LEADER

LW 360 (S1 version)

DIGITAL TUNER MEASURING SYSTEM

INSTRUCTION MANUAL

LEADER
ELECTRONIC MEASURING INSTRUMENTS

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GENERAL SAFETY SUMMARY

■ To Avoid Personal Injury

It is recommended that only qualified personnel with technical knowledge use this instrument only after reading and fully understanding all functions of the instrument described this instruction manual.
This instrument is not designed and manufactured for consumers.
If you do not have enough knowledge on electricity, to avoid personal injury and prevent damage to this product, please be sure to use this product only under the supervision of an engineer who has sufficient knowledge about electronics.

■ Precautions on Contents

Should you find the contents in this manual and any of its technical terms confusing, please feel free to contact your local LEADER agent.

■ Symbols and Terms

Following terms and symbols indicate necessary warnings and cautions used in this manual and on the product are there for safe operation.

＜**Symbol**＞ 	The sections where this symbol is marked in this manual or instrument, if not correctly performed or practiced, could result in personal injury or cause serious danger to the instrument. Misuse could also produce unintentional movement to create an operational impediment on the instrument or other products that might be connected to it. Be sure to refer to the safety precautions in this manual to safely use the part of the instrument where the symbol is marked.
＜**Term**＞  **WARNING**	Warning statements identify warning conditions that if disregarded or not correctly performed or adhered to, could result in serious personal injury or even loss of life.
＜**Term**＞  **CAUTION**	Caution statements identify caution conditions that if disregarded or not correctly performed or adhered to, could result in personal injury or damage to the instrument.

GENERAL SAFETY SUMMARY

Review the following safety precautions to avoid operator's injury and loss of life and prevent damage and deterioration to this instrument. To avoid potential hazards, use this product as specified.

WARNING

■ Warnings on the Cases and Panels of the Instrument

Operator should not remove any cases or panel for any reasons. If you touch inside the instrument it could result personal shock or fire hazard. Refrain from spilling any liquid on or inserting anything flammables or piece of metal into the ventilation of the instrument. Such actions could cause fire, shock, malfunction and be an accident hazard while the power is on.

■ Warnings on Power Line

- **Make sure to connect only to the rated power line voltage. Excess voltage may cause fire.**
  Confirm the voltage of the commercial power line before connecting the AC power cord. The power frequency of the power line should be 50/60 Hz.

- **Warning on the Power Cord**
  Use only the optional power cord that is attached to this instrument. The use of the power cord other than that attached could cause fire hazard.
  If the attached cord is damaged stop using it and contact your local LEADER agent. Should you use a damaged cord, it could cause a shock or create a fire hazard. When you pull out the cord be sure to hold it by plug and pull from the socket not by holding the cord wire.

■ Warning on Fuse

When the fuse is melted the instrument stops operation. If the fuse melted, turn off the power switch and disconnect the power plug from the socket. If you change the fuse while the cord is connected to the socket, it could cause a shock hazard. Only use the specified type and rated current and voltage fuses.
If the cause for melting fuse is unclear or if you suspect there is damage to the instrument or if you have no proper fuse at hand please contact your local LEADER agent.

GENERAL SAFETY SUMMARY

WARNING

■ Warning on Installation Environments

● About the Operating Temperature Range

Operate the instrument between the temperature range of 0 to 40 °C. When option 70 is installed, the operating temperature must be between 5 to 40 °C. Operating the instrument at higher temperatures could cause a fire hazard.

Rapid changes of temperatures from cold to warm can create internal moisture or condensation and could damage the instrument. If there is a possibility of moisture condensation allow the instrument to sit for 30 minutes without the power on.

● About the Operating Humidity Range

Operating humidity range is ≤ 85 % RH.

Do not operate the instrument with wet hands. This could cause a shock and fire hazard.

● About the Operation in the Presence of Gasses

Operating the instrument in and near the presence or storage locations of flammable, explosive gasses or fumes could create an explosion and fire hazard. Do not operate the instrument anywhere near such environments.

● Avoid Insertions

Do not insert metals or flammable objects or drop liquid on or into the instrument. To do so could cause fire, shock, malfunction and create a dangerous accident hazard.

■ Warning while Operating

While operating the instrument if smoke, fire, or a bad smell occurs, turn off the instrument at once for it could cause a fire hazard. When such a case occurs, turn off the power switch and pull the plug of the cord from the plug socket. Contact your local LEADER agent after confirming there is no fire.

■ Warning about Ground

The instrument has a ground terminal to avoid electric shock hazard and to protect the instrument from damage. Ensure that the product is properly grounded for safe operation.

GENERAL SAFETY SUMMARY

CAUTION

■ Caution on Output Terminals

Do not supply external power to Output terminal, this could cause the instrument to malfunction.

■ Caution when Not Using the Instrument for a Long Time

Make sure to disconnect the power cord from the socket when you do not use the instrument for a long time.

Please conform to the above warnings and cautions for safe operation. There are cautions in each area of this instruction manual, so please conform to each caution. If you have any questions about this manual, please feel free to contact your local LEADER agent.

■ Calibration

This instrument is produced under the strictest quality controls at the factory, but accuracy may gradually deteriorate due to worn components.
Therefore, periodic calibration should be performed.
When service or calibration is required, contact your local LEADER agent.

■ Routine Maintenance

Remove the power cord plug from the socket when cleaning the instrument.
Avoid the use of thinner or benzene solvents for cleaning cases, panels and knobs since this might remove the paint or damage plastic surfaces.
Wipe cases, panels, and knobs lightly with a soft cloth damped with neutral detergent.
Do not allow water, detergent, or other foreign objects to enter the instrument while cleaning.
If a liquid or metal object enters the instrument, it can cause electric shock or fire.

1. INTRODUCTION

Thank you for purchasing LEADER's measuring instruments.
Please read this instruction manual carefully to ensure correct and safe operation.
If you have any difficulties or questions on how to use the instrument after you have read this manual, please feel free to contact your local LEADER agent.
After you have read the manual, keep the manual in a safe place for quick reference.

1.1 Scope of Warranty

This LEADER instrument has been manufactured under the strictest quality control guidelines. LEADER shall not be obligated to furnish free service during the warranty period under the following conditions.

1. Repair of malfunction or damages resulting from fire, natural calamity, or improper voltage applied by the user.
2. Repair of an instrument that has been improperly repaired, adjusted, or modified by personnel other than a factory-trained LEADER representative.
3. Repair of malfunctions or damages resulting from improper use.
4. Repair of malfunctions caused by devices other than this instrument.
5. Repair of malfunctions or damages without the presentation of a proof of purchase or receipt bill for the instrument.

1.2 Operating Precautions

WARNING

1.2.1 Line Voltage and Fuse

Confirm that the power line voltage is correct before connecting the power cord.
The voltage range and fuse rating are indicated on the rear panel.
The instrument must be connected to the rated line voltage and line frequency of 50 Hz to 60 Hz.
When replacing the fuse, turn the power switch off and disconnect the power cord from the outlet.

When replacing the fuse, use the correct fuse that matches the line voltage.

Voltage Range	Fuse Rating	LEADER Parts Number
90 to 250 V	2.5 A, time-lag	436 3585 013

CAUTION

1.2.2 Maximum Input Voltage

There is restriction when applying input signals.
Applying excessive voltage to the connector may result instrument damage.

Connector		Allowable Input Voltage
IF INPUT		2V (p-p
DET INPUT		300 mV
TUNER POWER connector	Vt IN	±400 mV
	AGC IN	30 V (DC)
	LOCK IN	5 V (DC)
	TU SET SENSOR	5 V (DC)

CAUTION

1.2.3 Reverse Voltage, Excessive Voltage

Do not apply external voltage to the output connectors.
If the cable touches such as DC power source, internal attenuator may be burned-out.

1.2.4 Backup of Flash Memory

This instrument retains the panel settings even when the power is turned off.
When the power is turned on again, the screen displays STEP1 of the same TUNER MODEL as the last time.
When the instrument is left for five years without supplying power, the stored data may be lost.

Notes on Backup Data
Data must be backed up properly since stored data may be lost or changed caused by incorrect operation, malfunction, or maintenance. A notepad may be helpful in some cases.

1.2.5 Installation

Do not use the instrument in the following environments.

- High temperature environments
  Do not place the instrument under direct sunlight or near a heater (e.g., stove). Do not move the instrument from cold to warm environment abruptly, it may cause condensation.
  Operating temperature range: 0 to 40 ˚C
  5 to 40 ˚C (When Option 70 is installed.)
- High humidity environments
  Do not place the instrument in the high humidity environment (e.g., bathroom, near a humidor).
  Operating humidity range: ≤85 % RH (without condensation)
- Dusty environments

1.2.6 Mechanical Shock

To prevent damage to the precise components used in this instrument, be careful not to expose the instrument to other forms of severe mechanical shock.

1.2.7 About Network

The remote control capability operation via the Ethernet is confirmed only under the local network environments; it is not guaranteed under other environments.

2. SPECIFICATIONS

2.1 Description

The LW 360 is a comprehensive measuring system that integrates the necessary functions for adjusting and testing electronic TV tuners.
It measures the electric characteristics of electronic TV tuners with high accuracy at high speeds and simultaneously displays the measured waveforms, measured values, and judgement results. A power supply for the TV tuner, IF detector, VSWR bridge, and PLL tuner control function are also contained in its compact case, reducing space consumption.
It inherits the design concepts of the conventional LW 347/348 and is fully compatible. Various functions have been enhanced such as expanded power supply terminals for tuners, increased current capacity, and expanded tuner control signals to support the next generation tuners.
In addition, improved interface for connecting external devices achieves high efficiency in production lines and enable the LW 360 to be used in a wide range of applications such as evaluation of tuners in the design and quality assurance departments.

2.2 Features

[Multi-Functionality and High Performance]

Support for VHF, UHF, CATV, and Digital TV Tuners

A wideband signal generator that can sweep from 25 to 1000 MHz covers from TV VHF/UHF up to CATV channels. In addition, the LW 360 supports IF input frequencies from 1 to 120 MHz which allows it to support low-frequency IF tuners and FM tuners. A digital synthesized generator for its RF signal source ensures highly stable waveform display and accurate data measurement.

Easy Editing and Data Evaluation with the Multi Screen Display

The XGA display enables clear 4 screen display. When editing the settings, the setting items of each measurement can be modified while monitoring the measured waveforms. The 4 screen waveform display shows up to 12 channels of measured waveforms simultaneously, which is convenient for tuner evaluation and data acquisition. The waveform colors are selectable.

Integration of Power Supplies for Tuners and Control Signals

The LW 360 can deliver Vt (tuning voltage), +B (four systems), AGC, AFT, and TU SW (three systems) as power supplies for driving the tuner. It is equipped with all the functions necessary for tuner operation such as voltage/current measurement of control outputs and PLL tuner control (supports I^2C, 3Wire, and CCB). The I^2C control signal supports up to 256 bytes enabling the LW 360 to be used in a wide range of applications such as controlling tuners with demodulation functionality.

Easy on the Viewer's Eyes

Digital processing provides flickerless display even for slow sweep measurements.

Durability, Safety, and Easy Maintenance

Durability and safety are improved, since there are no mechanical parts such as mechanical relays and hard disk drives used in the LW 360. In addition, maintenance is easy, because parts can be replaced in unit of blocks when problems occur.

[Suitable for Product Evaluation in Design and Quality Assurance Departments]

Powerful Data Acquisition Capability

Various data such as waveform data and measured results can be printed and saved to memory cards.
The support for Ethernet and RS-232C enables data and screen images to be transmitted to an external PC.
These features are convenient for the product evaluation and report generation in the design and quality assurance departments.

[Careful Consideration to Product Lines]

Compatibility with Conventional Models

Tuner model data created on the conventional LW 347/348 can be used on the LW 360 allowing effective use of past resources and smooth installation in production lines.
Moreover, the edit screens for setting items are also compatible. Users of LW 347/348 can easily edit setting items on the LW 360 without effort.

Centralized Management of Data

The tuner model data and measured data can be transferred to a host over an Ethernet network enabling centralized management of data.

2.3 Specifications

2.3.1 Measurement

(1) Standard Measurement Item 16 (Factory setting)

No.	Measured Item	Description of Measurement	Measured Range
01	PCS LEVEL	Specified point level from a peak of waveform Level ratio between specified points Peak point position of waveform	0 to -10 dB 0 to ±10 dB 0 to ±20 MHz
02	POWER GAIN	Gain from ANT Input to IF Output Attenuation from Peak point to fc ±20 MHz (with respect to the specified point)	0 to 70 dB 0 to -30 dB
03	AGC	Gain control by AGC voltage	0 to -70 dB
04	IMAGE	Level rejection of image frequency	-20 to -90 dB
05	ndB WIDTH	Bandwidth at ndB (-0.5 to -6 dB) against peak point	0 to 30 MHz
06	AFT	LO frequency control by AFT voltage	0 to ±20 MHz
07	VSWR	Standing wave voltage ratio by ANT input terminal	2 to 10
08	IF REJ	IF signal interference removal ratio from ANT input to IF output	-20 to -90 dB
09	+B DRIFT	LO frequency variation due to change of +B voltage	0 to ±20 MHz
10	GUARD BAND	Receiving frequency margine at lower Vt voltage and upper Vt voltage	0 to 30 MHz
11	PCS CHECK	Judgment of PCS level in a range of Vt or f	0 to -10 dB
12	TOTAL WAVE	Simultaneous measurement of PCS Level, Power Gain, VSWR	Each measure-ment/range
13	PCS/IMAGE	Simultaneous measurement of PCS Level and Image	Each measure-ment/range
14	AGC VOLT	Operating voltage of AGC loop of Tuner with IF	0 to 15 V
15	UHF PLL LOCK f	Error of Lock frequency of PLL Tuner	0 to ±999 kHz
16	N.F.	Relative NF value measurement by setting NF ENR value	2 to 15 dB

(2) User Defined Measurement Item

User can create in combination with setting item and operational measurement function.

(3) Setting Item

Setting RF Output Section: Setting sweep, RF output level, etc.
Setting Input Section: Setting IF input, detected signal input, etc.
Setting Tuner Control Section: Setting power supply, control output, and control pin measurement section for Tuner

Setting Marker

RF Marker:	Specifying frequency point of RF output
IF Marker:	Specifying frequency point of IF input

Selecting Operational Measurement Function:

	Selecting basic measurement methods shown below
Power Gain Measurement:	Measuring power gain and difference at specified point
Level Measurement:	Measuring level between specified marker points
Frequency Measurement:	Measuring frequency at specified marker point, difference between specified marker points
Voltage/Current Measurement:	Measuring voltage and current at Tuner control pin
VSWR Measurement:	Measuring return loss at specified marker point. VSWR or return loss value can be selected.
Channel Table:	Setting the channel table for the marker frequency setting

2.3.2 RF Signal Output Section

(1) Synthesized Sweep Signal Generator Section

Frequency Range:	25 to 1000 MHz (Image measurement: 1.15 GHz max.)
Sweep width:	0 to 975 MHz
Sweep time:	3.2 ms, 6.4 ms, 12.8 ms, selectable with program
Spurious:	≤ -30 dBc
Harmonics:	≤ -25 dBc
Sweep Mode:	Single (Independent measurement of the L, M, R) Dual (Simultaneous measurement of the L, R) Triple (Simultaneous measurement of the L, M, R) Selectable with program

(2) Output Section

Output Level:	0 dBm max.
Accuracy:	±1 dB (under 500 MHz, 25°C)
Output Flatness:	±20 MHz sweep: within±0.5 dB Over full sweep: within 3 dB
Attenuator:	0 to 70 dB, 1 dB step, programmable Accuracy: ± (0.5 dB +2%) (in 500 MHz, 25°C)
Output impedance:	75 Ω unbalanced
Output Connector:	BNC-J type

(3) Bridge for VSWR Measurement

Frequency Range:	25 to 1000 MHz
Built-in AMP:	40 dB
Directivity:	≥30 dB

2.3.3 Receiving Section

(1) IF Signal Input Section

Frequency Range:	Within 1 to 120 MHz, Within fc ±20 MHz fc range: 4 to 120 MHz
Input Level Range:	1 to 300 mVrms

Attenuator:	0 to 30 dB, 10 dB steps, setting with program
Auto-Tracking Function:	Available. It makes waveform display always in the center of sweep, though tuned frequency of tuner varies.
IF Signal Detector	
Frequency Range:	1 to 120 MHz
Polarity:	Positive
Output:	0 dBm input: 150 mV ±20%
Flatness:	fc ±20 MHz Sweep: within±0.3 dB
Input Impedance:	75 Ω
Input Connector:	BNC-J type

(2) Detection Signal Input Section

Input System:	5 systems (DET IN 1. 2. 3, Internal IF detection signal, Internal VSWR detection signal) selectable with program
Max. Input Voltage:	±400 mV (including superimposed DC)
Input Impedance:	1 MΩ
Input connector:	BNC-J type
Polarity Switch:	Positive & Negative, selectable with program
ARC Function:	Available. (ARC: Auto Response Control) Definite amplitude is always shown regardless input signal amplitude.
Input Level Range:	3 to 300 mVp-p (superimposed DC: ≤200 mV)
Display amplitude:	Displayed in 5 DIV
Control Accuracy:	≤ ±0.2 DIV

2.3.4 Tuner Control Section

(1) Power Supply for Tuner

[MB1] +B Voltage

Output Voltage Range:	0.0 to 13.5 V
Resolution:	0.1 V steps
Output Modes:	ON/OFF, selectable with program
Setting Accuracy:	Within ±50 mV of setting value
Maximum Load Current:	300 mA
Load Current GO/NO GO:	Upper and lower limits for each band can be set individually with program.
Setting Resolution:	1 mA
Output ON Delay:	0 to 999 ms
Short-Circuit Sensor:	ON/OFF, selectable with program

[MB2] +B Voltage

Output Voltage Range:	0.00 to 10.50 V
Resolution:	0.05 V steps
Output Modes:	ON/OFF, selectable with program
Setting Accuracy:	Within ±50 mV of setting value
Maximum Load Current:	300 mA

Load Current GO/NO GO:	Upper and lower limits for each band can be set individually with program.
Setting Resolution:	1 mA
Output ON Delay:	0 to 999 ms
Short-Circuit Sensor:	ON/OFF, selectable with program

[MB3] +B Voltage

Output Voltage Range:	1 to 6 V
Resolution:	0.05 V steps
Output Modes:	ON/OFF, selectable with program
Setting Accuracy:	Within ±50 mV of setting value
Maximum Load Current:	400 mA
Load Current GO/NO GO:	Upper and lower limits for each band can be set individually with program.
Setting Resolution:	1 mA
Output ON Delay:	0 to 999 ms
Short-Circuit Sensor:	ON/OFF, selectable with program
PLL Control Voltage	Setting voltage of MB3 controls the control voltage of PLL

[MB4] +B Voltage

Output Voltage Range:	1 to 6 V
Resolution:	0.05 V steps
Output Modes:	ON/OFF, selectable with program
Setting Accuracy:	Within ±50 mV of setting value
Maximum Load Current:	400 mA
Load Current GO/NO GO:	Upper and lower limits for each band can be set individually with program.
Setting Resolution:	1 mA
Output ON Delay:	0 to 999 ms
Short-Circuit Sensor:	ON/OFF, selectable with program

[Band Select]

Band:	BL, BM, BH, BU output connector, selectable with program
Output Mode:	GND, OPEN, MB1can be set with program.
Load Current GO/NO GO:	Upper and lower limits for each band can be set individually with program.
Setting Resolution:	1 mA

[AGC] AGC Voltage Output

Output Voltage Range:	0 to 15 V
Resolution:	0.1 V steps
Output Modes:	ON/OFF, selectable with program
Setting Accuracy:	Within ±50 mV of setting value
Maximum Load Current:	10 mA

Output ON Delay: 0 to 999 ms
Short-Circuit Sensor: ON/OFF, selectable with program

[AFT] AFT Voltage Output
Output Voltage Range: 0 to 15 V
Resolution: 0.1 V steps
Output Modes: ON/OFF, selectable with program
Setting Accuracy: Within ±50 mV of setting value
Maximum Load Current: 10 mA
Output ON Delay: 0 to 999 ms
Short-Circuit Sensor: ON/OFF, selectable with program

[Tuner SW 1, 2, 3] Control Terminal Drive
Output Voltage Range: 3 to 13.5 V
Resolution: 0.1 V steps
Output Modes: GND, OPEN, MB1 Output can be set with program.
Maximum Load Current: 300 mA
Output ON Delay: 0 to 999 ms
Short-Circuit Sensor: ON/OFF, selectable with program

[VT L, VT U] Tuning Voltage Vt Output
Output Voltage Range: 0 to 30 V
Resolution: 10 mV steps
Output Modes: ON/OFF, selectable with program
Setting: Upper and lower limits for voltage can be set with program (each L, M, R)
Setting Accuracy: Within ±20 mV of setting value (0 to 20 V)
Within ±0.1 % of setting value (20 to 30 V)
Continuos Variable Output: The output voltage can be changed between upper and lower limits with an external potentiometer.
Fixed Voltage Output: Available
Output ON Delay: 0 to 999 ms
Short-Circuit Sensor: ON/OFF, selectable with program

[PLL] PLL Control Fixed Output
Voltage: 28 to 33 V
Resolution: 0.1 V steps
Output Accuracy: Within ±0.1 V of setting value
Maximum Load Current: 20 mA

(2) Vt Auto Function
Operation: Automatically setting function of tuning voltage
Resolution: ≤ ±100 kHz

(3) PLL Tuner Frequency Control Output

Tuner:	PLL
Control Signal:	3 wire, I^2C, CCB
Settable Frequency:	0.001 to 1000 kHz
Setting Accuracy:	1 Hz

(4) Tuner Control Terminal Measurement Section

[Vt IN]

Input Voltage Range:	0 to 30 V
Input Impedance:	≥1 MΩ
Operation:	Measurement & judgment of Input voltage
Measuring Accuracy:	±30 mV (0 to 15 V), 0.2 % (15 to 30 V)

[AGC, AFT]

Connector:	Input or Output (automatically selected according to items measured)
Input Voltage Range:	0 to 15 V
Input Impedance:	≥1 MΩ
Operation:	Measurement & judgment of Input voltage
Measuring Accuracy:	± (0.2% + 30 mV)

[Lock IN]

Operation:	Detection of PLL Lock, Measurement/Judgment of Input Voltage

[Tuner Set Sensor]

Operation:	Outputs the Tuner Power (MB1 to MB4, Band, AGC, AFT, Vt) Voltage and tuner control signal by detecting Low level.

(5) Total Judgment Output

Output:	Total judgment output for all measurement items
Timing:	Outputs in All Scan mode
Output Level:	Low level for NOGO, High level for others
Output Connector:	Tuner Power connector (on the rear panel)

(6) Connector 24 pin Amphenol connector (on the rear panel)

2.3.5 Monitor Display

(1) Monitor (sold separately)

Display Output:	XGA compatible monitor (on the rear panel) 15 pin D-sub connector (3-lines, female)

(2) Display

Measurement waveform, Setting data, Marker, Measurement value, Judgement result, etc.

Display Color:	64

(3) Measurement Waveform

Number of Displayable Waveforms: Up to 3 channel x 3 waveforms x 4 screens simultaneously

Scale: 12 x 6 divisions or 12 x 12 divisions, ON/OFF selectable

(4) Marker Display

Marker Type:	RF, IF
IF marker:	Accuracy ≤ ±20 kHz (±20 MHz sweep)
IF maker frequency:	1 to 120 MHz, 5 kHz steps (1/7 MHz offset is possible.) (Within fc ±20MHz)
RF maker:	Accuracy ≤ ±50 kHz (±20 MHz sweep)
RF maker frequency:	30 to 1000 MHz, 1 kHz steps
Marker Point:	Up to 12 points of IF and RF markers

(5) GO/NO GO Judgment

Judgment Result Display:	In NOGO judgment mode, each measurement value is displayed in red.
Total Judgment Result Display:	Measurement screen frame is switched to green or red.

2.3.6 Measurement Condition Setting Method

Input Method:	Via IBM PC-AT compatible keyboard 101 or 106 for Japanese, PS/2, USB (sold separately)
Setting Method:	Screen editor
Number of Settable Models:	Up to 20
Number of Settable Steps:	Up to 99 steps per models
Setting Contents:	RF output control, tuner control, measurement parameter, display parameter, judgment parameter, etc.

Panel Control

Setting function:	Selects tuner model
Setting key:	UP, DOWN, SET

2.3.7 Remote Control

Controller:	Remote Controller LW 360-01 (Supplied as accessory)
Function:	Switches measurement steps, ALL SCAN, PROTECTOR OFF, VT voltage control, parameter remote (OP. 70)
Connector:	36 pin Amphenol connector (on the rear panel)

2.3.8 Memory Card Interface

Memory Card (sold separately):	Compact flash card (CFA TYPE-1)
Function:	Stores the measurement condition in external memory. Transfers the measurement condition to external equipment. Accumulates All Scan data. Stores the copy data of a display screen and the waveform data.

2.3.9 Printer Interface

All Scan Data Output:	Total judgment results of All Scan data MB1 to MB4, AGC, AFT voltage MB1 to MB4, Band current Measurement value and judgment results of each step Measurement Data Output Select: All data: Outputs all data NG data: Outputs data of NG item
Measurement Waveform Output:	Copies the screen of waveform displayed on the PC monitor.
Interface:	UNIX compatible
Connector:	25 pin D-sub connector (female) or USB connector

2.3.10 RS-232C Interface

All Scan Data Output:	Total judgment results of All Scan data MB1 to MB4, AGC, AFT voltage MB1 to MB4, Band current Measurement value and judgment results of each step Measurement Data Output Select: All Data: Outputs all data NG Data: Outputs data of NG item
Control:	Start of All Scan Output request of All Scan data Step switching Tuner model data request
Interface Specifications	
Baud rate:	9600 bps, etc.
Data format:	ASCII
Connector:	9 pin D-sub connector (male)

2.3.11 LAN Interface

Function:	Remote control, the data collection, and the tuner model transfer, etc. are performed according to an external computer.
Mode:	100BASE-TX/10BASE-T
Input/Output Connector:	RJ-45 1 connector

2.3.12 USB Interface

Type:	Compatible with USB Version 1.1
Function:	USB keyboard interface, printer interface.

2.3.13 General Specifications

(1) Environment Conditions

Operating Temperature:	0 to 40 °C
Operating Humidity:	≤85 % RH (without Condensation)
Spec-Guaranteed Temperature:	10 to 35 °C
Spec-Guaranteed Humidity:	≤85 % RH (without Condensation)
Operating Environment:	Indoor use
Operating Altitude:	up to 2000 m
Overvoltage Category:	Ⅱ
Pollution degree:	2

(2) Power Supply: AC 90 to 250 V (47 to 440 Hz)

(3) Power Consumption: 120 W max.

(4) Size/Weight: 426 (W)×150 (H)×450 (D) mm 13 kg

2.3.14 Accessories

Remote Controller [LW 360-01]..... 1
Size/Weight 150 (W)×40 (H)×135 (D) mm 400 g
Connection cable
BNC-BNC cable (75 Ω, 50 cm) for RF OUT / IF IN..... 2
Amphenol cable (24-pin, 2m) for tuner power..... 1
Amphenol cable (36-pin, 2m) for remote controller..... 1
UA Power code 1
PS/2 distribution cable 1
Instruction manual..... 1

2.3.15 Required equipment for use

(1) Monitor
XGA display monitor 1
Connection cable for Display Monitor 1

(2) Setting of measurement condition
Full Keyboard IBM PC-AT compatible (PS/2 or USB type) ... 1
106 or 101 keyboard 1
Mouse (PS/2 or USB type)..... 1

∗ The five equipment noted above are required. Procure a full keyboard and memory card as required when using more than one LW 360. Though, measurement conditions can be configured without a mouse, it is more convenient to use one.

(3) Memory for storing measurement conditions and screen images
Compact Flash Card CFA TYPE-1 (≥16 MB)

∗ Use FAT16 or FAT32 for the file system on the compact flash card.

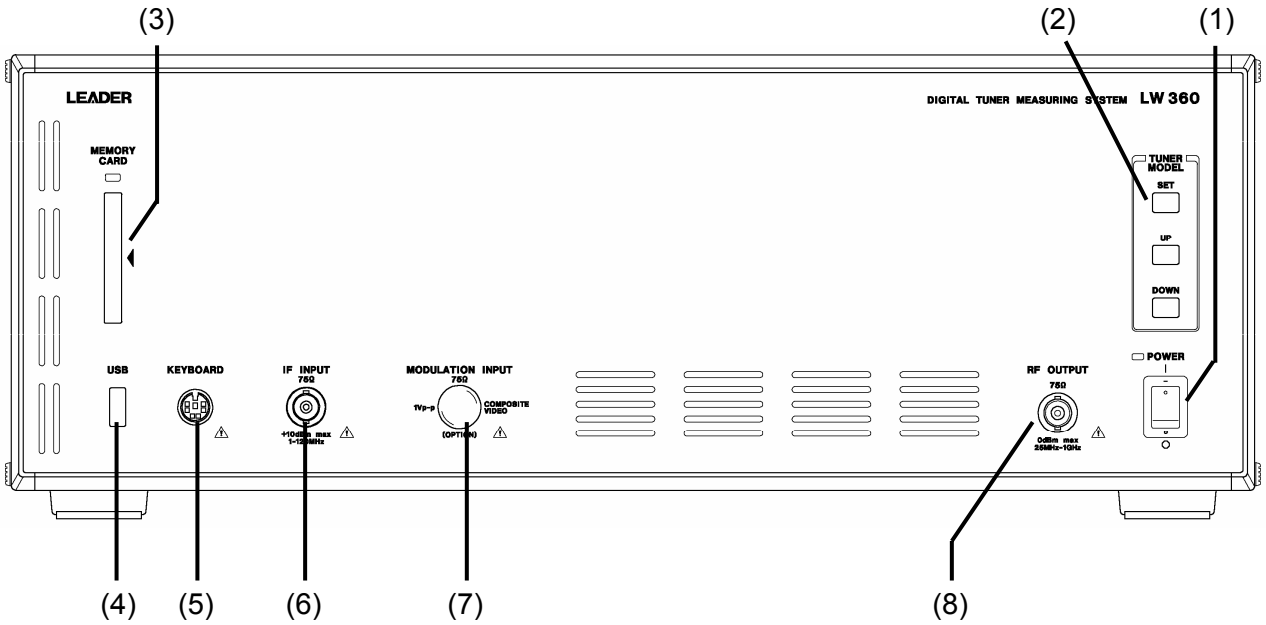
∗ Compact Flash Card is a registered trademark of SanDisk Corporation.

(4) Printer

Printer for screen image copy:	PM-A700 (EPSON) PIXUS, iP4100 (CANON) PSC 1315 (HP)
Printer cable:	USB or Parallel

3. PANEL DESCRIPTION

3.1 Front Panel



(1) Power switch

Lit Led indicates power on.

(2) Tuner Model switch

Selecting the tuner model file. Up to 20 models can be select. Use the Down and UP keys to select the model, then press the Set key to enter.

(3) Memory card

Use a Compact Flash Card to store measurement conditions, screen image, All Scan data. The access lamp in the upper part of the card slot lights while accessing the memory card.

(4) USB connector

A connector for connecting a USB keyboard or mouse.
It is used when setting the measurement conditions.

(5) Keyboard connector

Connect a PS/2 keyboard if you want to edit the measurement conditions with a keyboard. Do not connect or disconnect the PS/2 keyboard while the instrument is running. A mouse will not work even if you connect it to this connector. If you are using a PS/2 mouse, connect it to the connector on the rear panel.

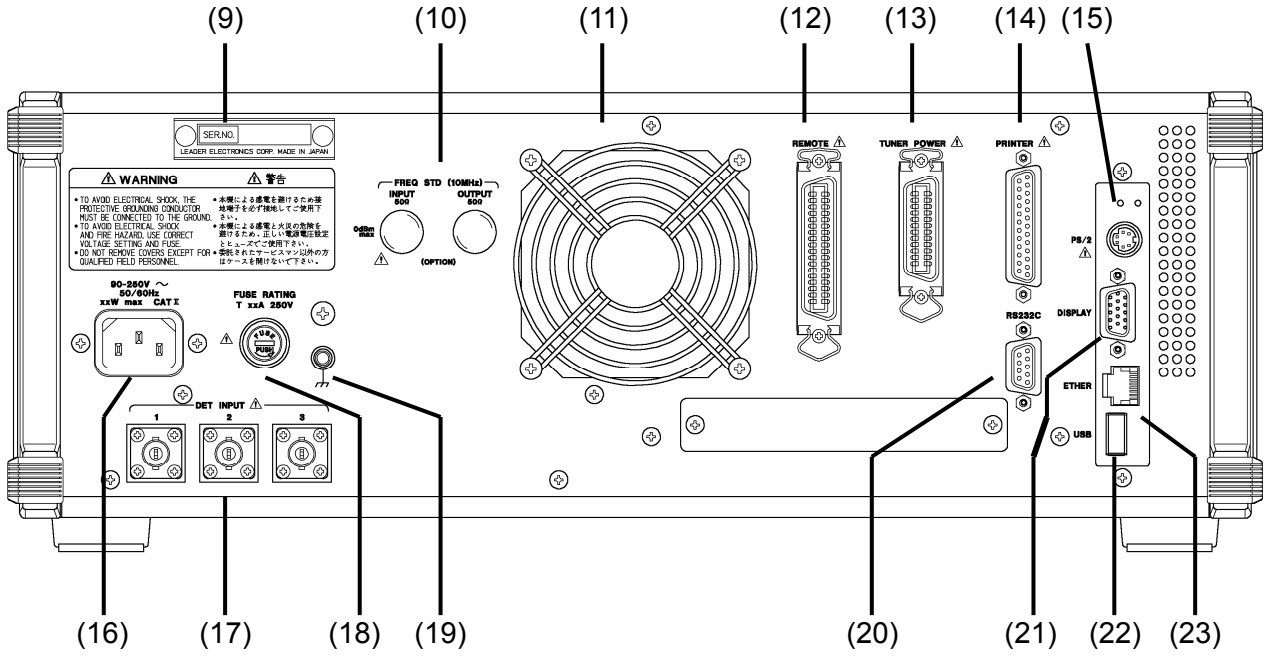
(6) IF input

Accepts IF signal output from a tuner. Input sensitivity is 1 to 300 mVrms.
Note: The IF signal should be input. Otherwise, auto tracking mode is disabled and the IF marker is not displayed.

(7) Connector for option Modulation Input
This connector is an option.

(8) RF output
Outputs RF sweep signal: 25 MHz to 1000 MHz.
Output impedance is 75 Ω.

3.2 Rear Panel



(9) Serial number plate
Instrument serial number.

(10) Connector for option FREQ STD (10 MHz)
This connector is an option.

(11) Cooling fan
Do not block airflow through the ventilation holes to prevent instrument damage due to overheating.

(12) Remote connector
The Step, All, Scan, Protector OFF, and electronic tuner tuning voltage (Vt) can be remotely controlled.
Connect the LW 360-01 Remote Controller or a test fixture.
For details, refer to section, 6.1.2 “Remote”.

(13) Tuner Power connector

Outputs following power source and signal to a tuner.

+B voltage
AGC voltage
Tuning voltage
PLL control signal
Test fixture selection voltage

Various input connectors for measurement.
For details, refer to section, 6.1.1 “Tuner Power”.

(14) Printer connector

To connect a printer conforming to Centronics standards.

(15) PS/2 connector

When editing the measurement conditions, connect a keyboard and mouse to this terminal through a PS/2 distribution cable that comes as an accessory.
If you do not use the distribution cable, the terminal works as a connector only for a mouse. Therefore, a keyboard does not operate.
If you are using only a PS/2 keyboard, connect it to the terminal on the front panel.

(16) AC Line 50/60 Hz

Power line inlet.
The voltage range should be rated value within ±10%. Exceeding -10% may result in improper operation; exceeding +10% may damage the instrument.
Confirm that the voltage range indicated on the rear panel.

(17) DET. IN 1, 2, 3

Accepts detected signal of the system to be measured.
Connect the detected signal from a tuner IF or TP and VSWR bridge.
The connector can be selected with program according to signal to be measured.

(18) Fuse

Rotating the cap counterclockwise can remove the fuse with the cap.
Use only the fuse of correct type and rating for replacement.
Refer to (1) “Power supply voltage” described in the Section 5.1 “Operating Precautions” for detail.

(19) GND terminal

Ground terminal connected to the chassis.

(20) RS-232C connector

To send data or to control the system.
A 9-pin D sub connector is used.
Use a cross cable to connect to a PC.

(21) XGA connector

To connect a XGA monitor to display measurement waveform and setting data.

(22) USB connector

A USB connector for connecting a keyboard, mouse, or printer.
Supports USB Version 1.1.

(23) LAN connector ETHER

The Ethernet connector is used to output measurement data and screen image or to control the system, etc.
Supports 100BASE-TX/10BASE-T.
Use a cross cable to connect to a PC.

4. BASIC OPERATION

4.1 System Configuration

(System Configuration Diagram Is Given in Figure 4-1.)

(1) RF Signal Output Section

- A highly accurate, digitally synthesized sweep signal generator.
- Built-in noise generator for NF measurement and bridge for VSWR measurement.

(2) IF Receiving Section

- Contains an IF signal input and three systems of detection input for measurement.

(3) Measurement/Display Section

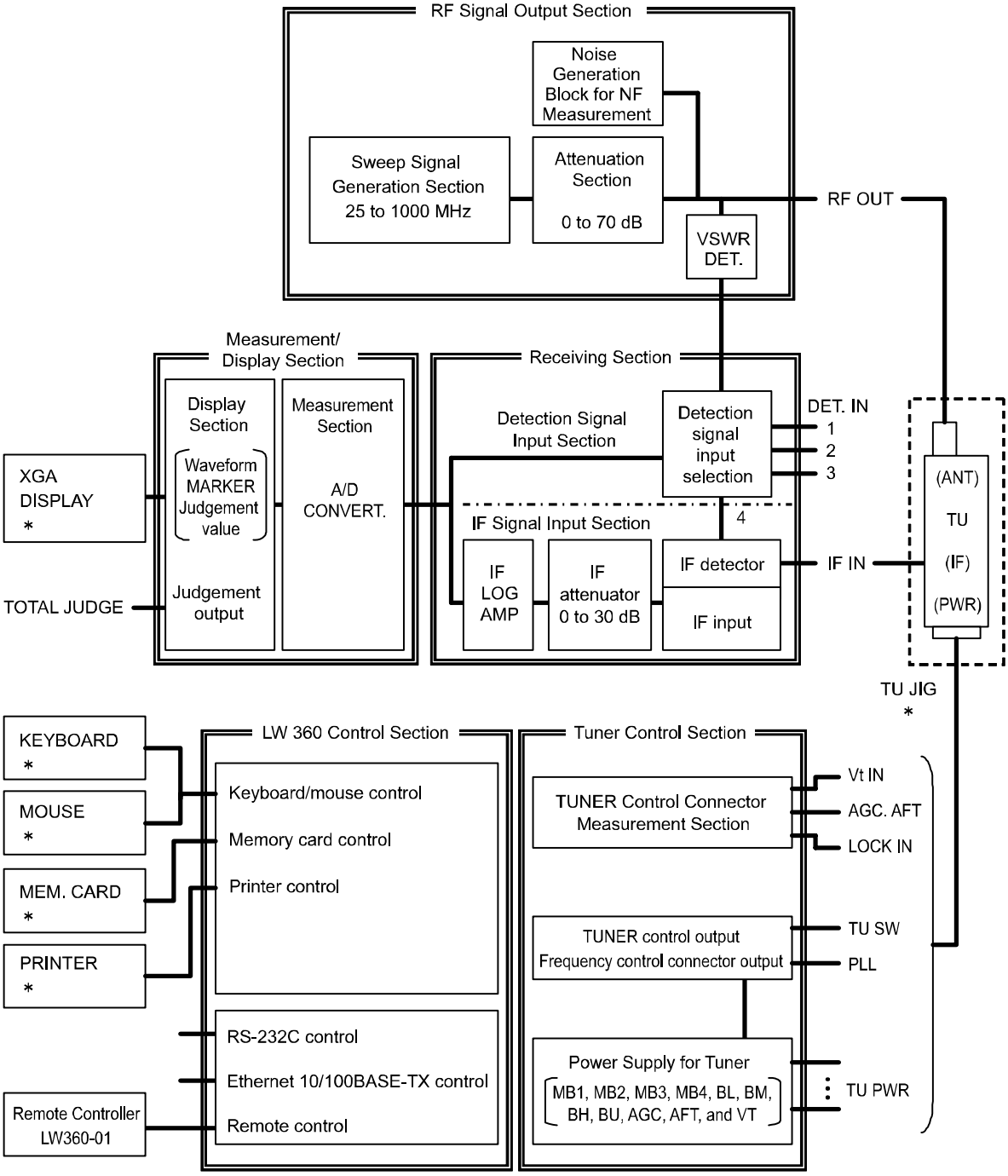
- Performs A/D conversion on the signal from the receiving section, and computes and displays measured values.
- Displays waveforms, data, and GO/NO-GO judgement according to the measurement conditions and GO/NO-GO judgement value specified by the control section.

(4) Tuner Control Section

- Performs control, power supply, and frequency settings that are necessary for making measurements.
- The frequency control supports PLL and Voltage synthesizer systems.
- A load current measurement function is included in the power supply.

(5) LW 360 Control Section

- Provides interfaces for a keyboard used to enter measurement conditions, a memory card used to store setting conditions, a remote controller that comes standard, etc.



* Asterisk marks indicated items that are not included in the system.
These items must be provided by the user.

Figure 4-1 System Configuration Diagram

4.2 Using the LW 360 for the First Time

4.2.1 Connection

(1) Basic Connections

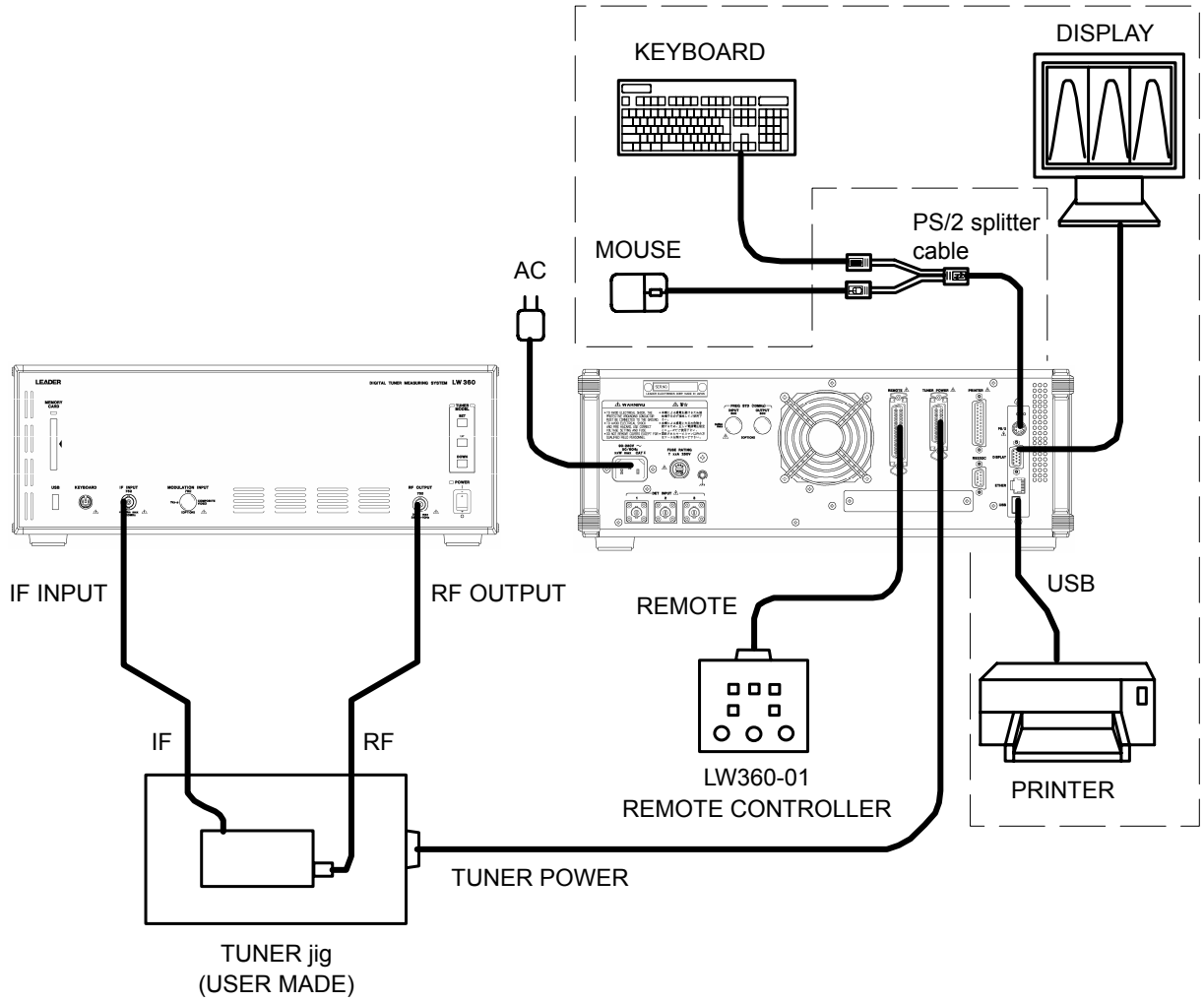


Figure 4-2 Basic Connections

The connection shown above is a basic connection. The items inside the dotted box [ ] are to be provided by the user.

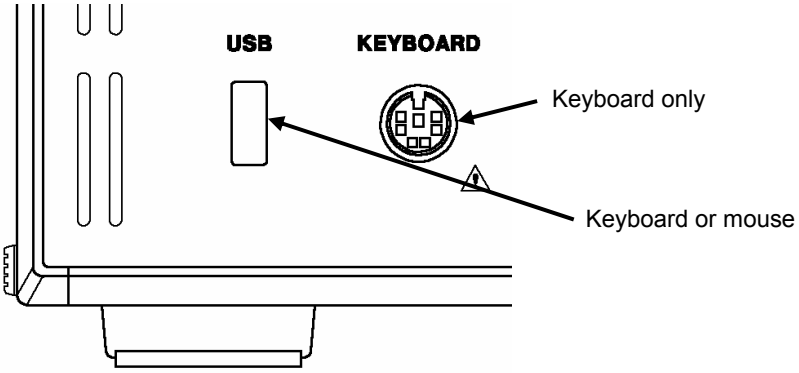
There are other ways to connect the keyboard, mouse, and printer. Please refer to the explanation in the following pages.

(2) Connecting a Keyboard and Mouse

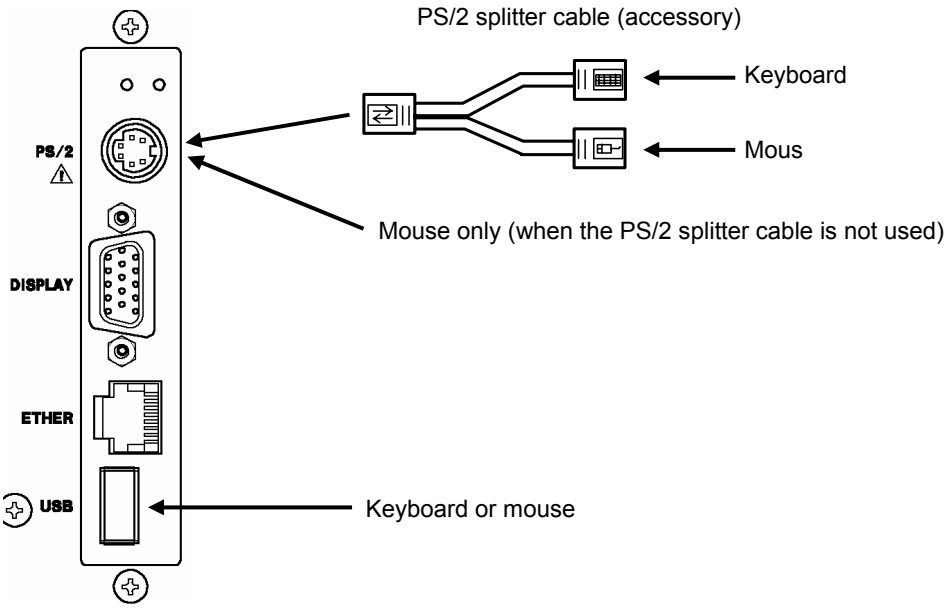
All editing operations can be carried out on the keyboard. However, a mouse can be used in conjunction with the keyboard to simplify the process. We recommend that you use a mouse if it is possible.

A PS/2 or USB keyboard or mouse can be used. The PS/2 and USB connectors are available on the front panel and rear panel. However, exercise caution, because their usage varies.

a) Front Panel



b) Rear Panel



∗ If you are using a keyboard with a USB HUB, you can connect a USB mouse to the HUB.

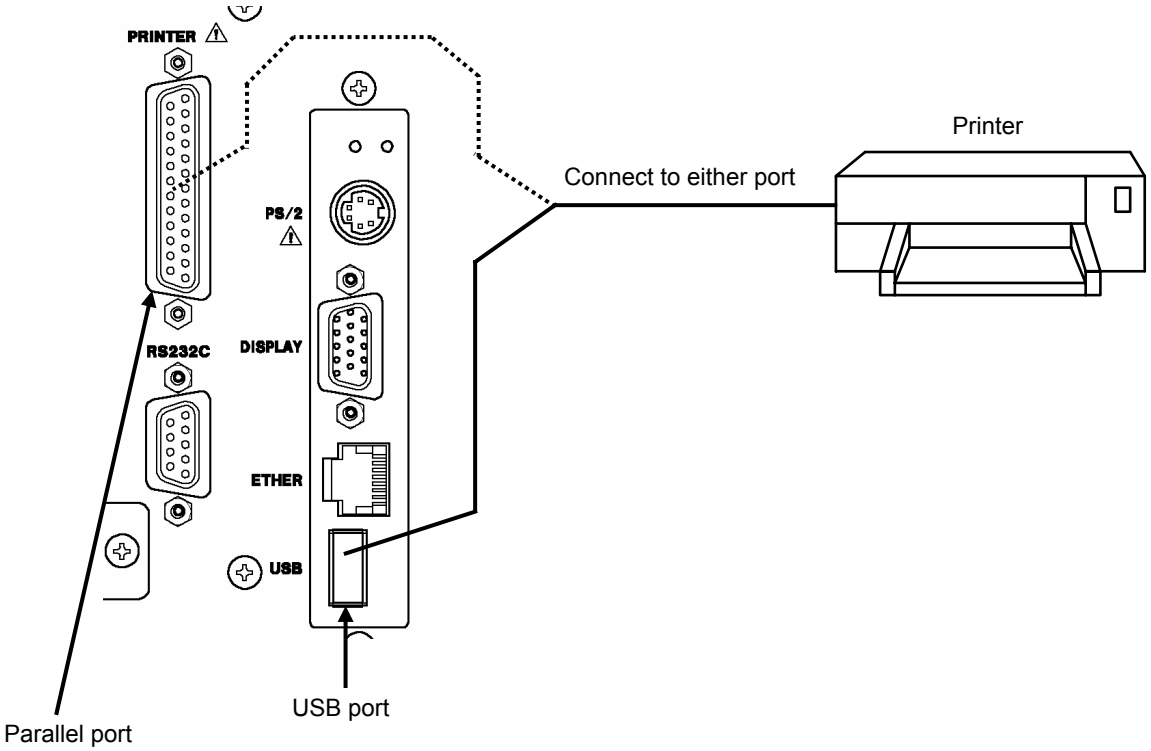
In this case, the keyboard and mouse can be used on either the USB port on the front panel or the USB port on the rear panel.

A USB keyboard and a PS/2 mouse (or a PS/2 keyboard and a USB mouse) can also be used.

In this case, follow the port specifications indicated above.

(3) Connecting the Printer

A printer with a parallel (Centronics) or USB interface can be used. Connect the printer to the parallel port (PRINTER) or USB port on the rear panel.

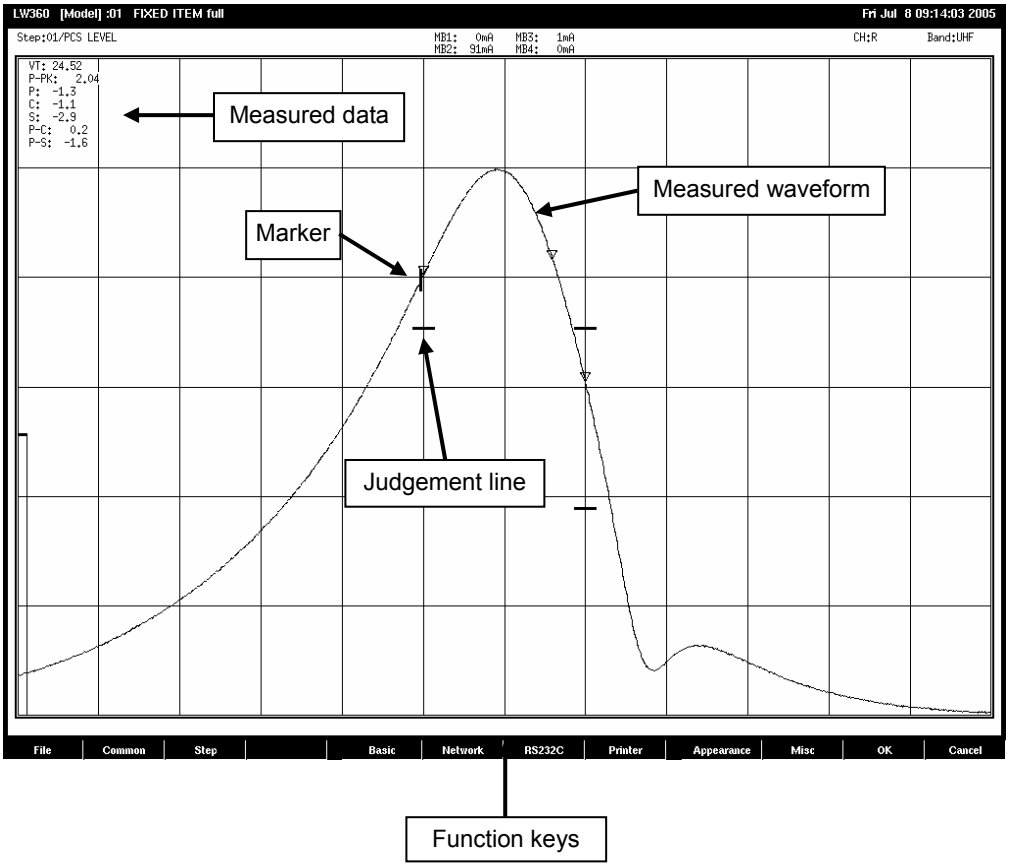


4.2.2 Screen Configuration

The LW 360 screen consists of a Wave screen that is used to display or measure waveforms, a File edit screen used to save Tuner Model, Channel Table, and other types of data, and an edit screen used to edit measurement conditions.
The edit screen consists of a Common edit screen and a Step edit screen.

(1) Wave Screen Configuration

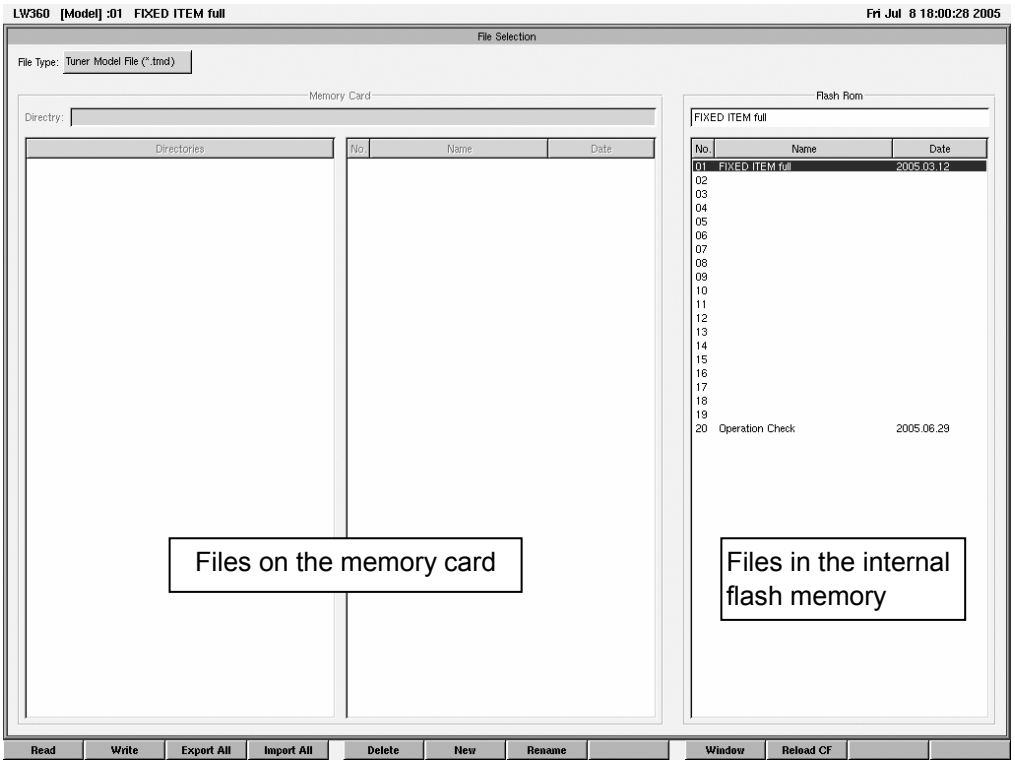
When the LW 360 is turned ON after entering basic settings, a Wave screen is displayed. This screen displays the measured waveform, measured data, and judgement lines of marker measurement. The function keys are used to enter system settings of the LW 360.



(2) File Screen

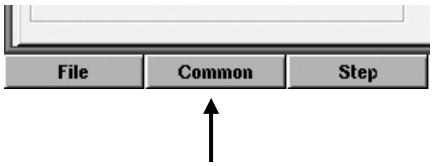
On the Wave screen, press the F1 (File) function key to display the File edit screen.

This screen is used to manage tuner model files, edit channel tables, manage PLL tables and user items, etc. This screen is also used to transfer data between the internal flash memory and memory card.



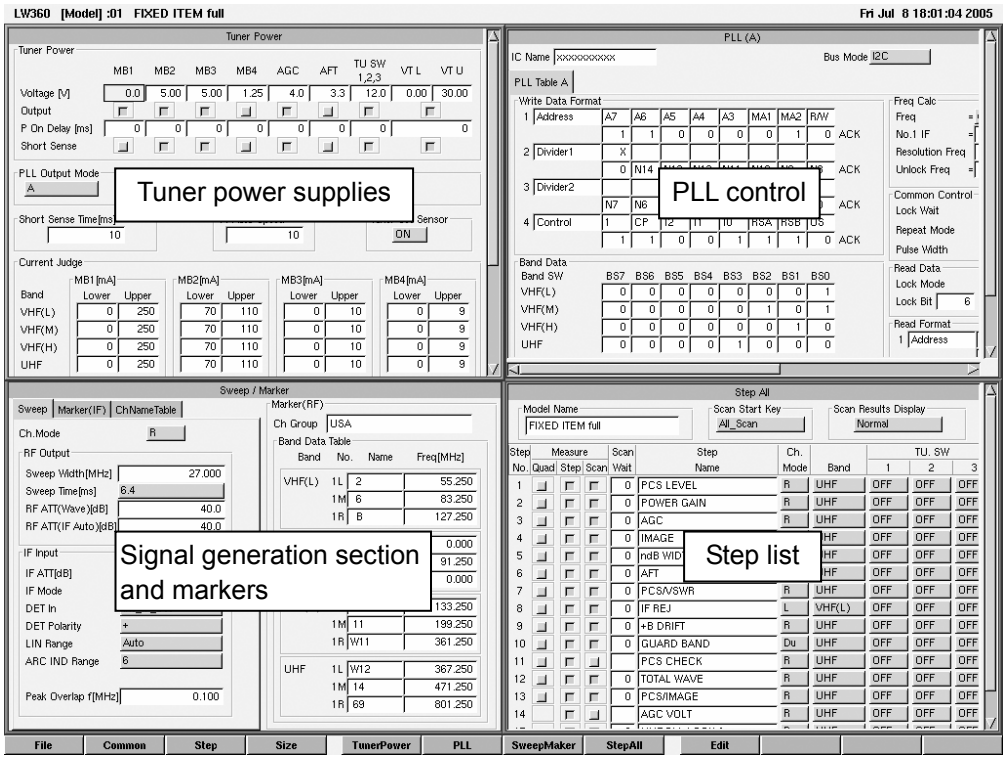
(3) Common Edit Screen

Press the F2 (Common) function key to display the Common edit screen.



This screen is used to enter settings common to each step in the tuner model. It is used to set the power supplies needed by the tuner, set the PLL control, set the signal generator and markers, and edit the step list.

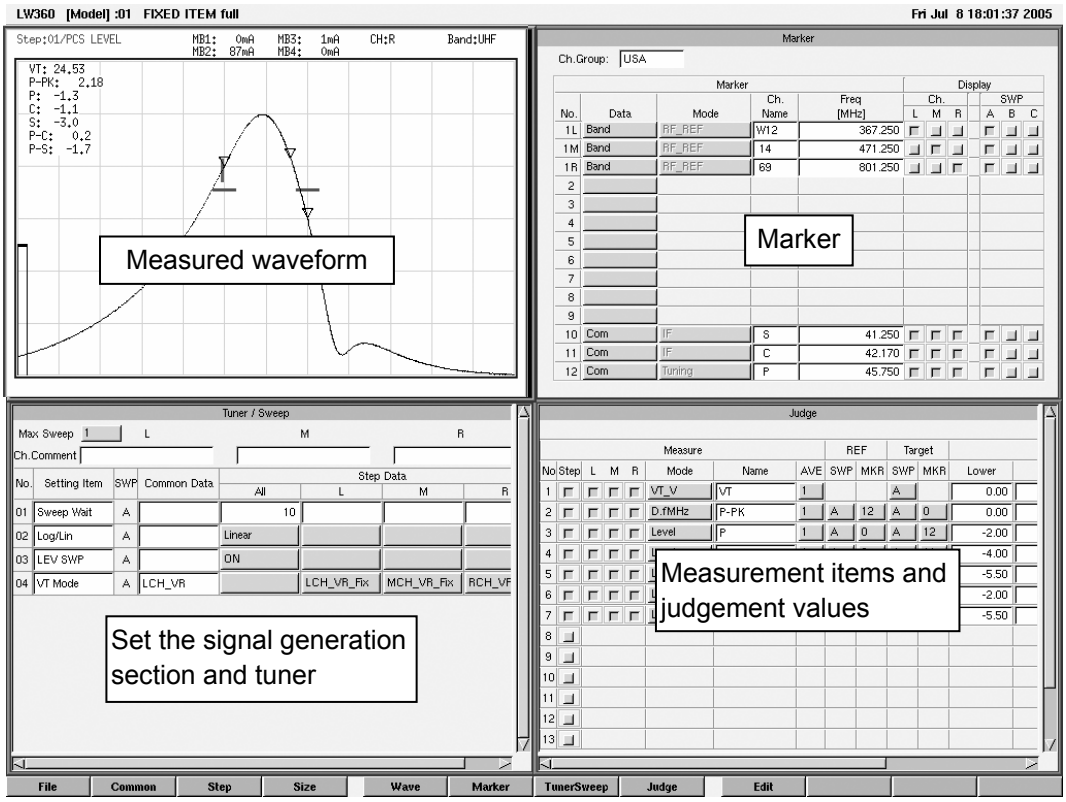
The settings entered on this screen are applied to all steps. However, if they are changed in the step, the settings specified in the step take precedence.



(4) Step Edit Screen

Press the F3 (Step) function key to display the Step edit screen.

This screen is used to edit the measurement conditions at the step level. It is used to set the sweep signal and tuner and edit the markers and judgement values. In addition, this screen enables you to edit the conditions while monitoring the measured waveform. The items that are changed are applied to the measured waveform in real-time.



4.2.3 Basic Operation

(1) Home Key

- Press the Home key to return to the Wave screen from any screen. If you press the Home key while you are editing a value or characters, they are cancelled.

(2) Selecting the Edit Screen and Moving the Cursor

a) Selecting the Edit Screen

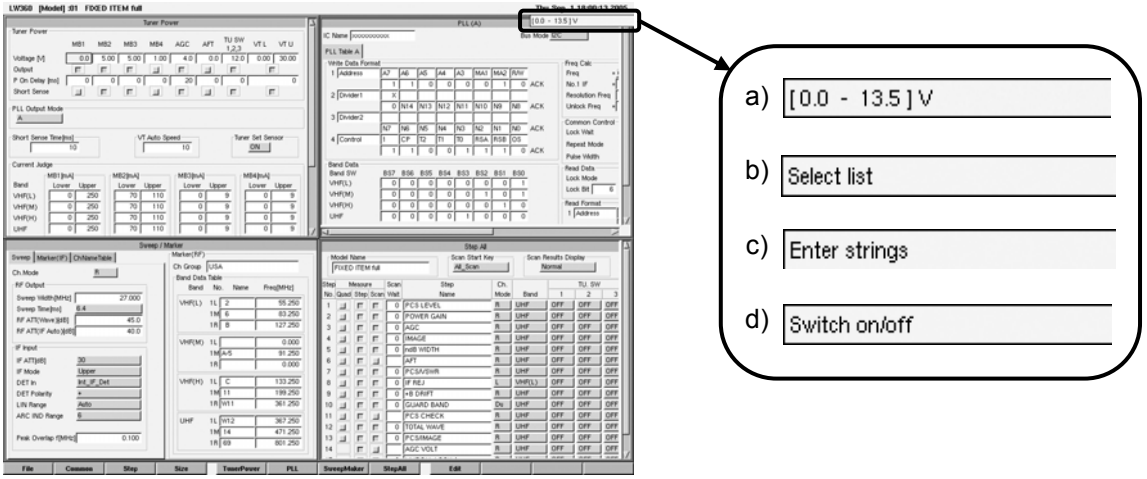
- To select the Common edit screen or Step edit screen, press an appropriate function key (F5 to F8) or move the pointer with the mouse to the desired screen or item and left-click it.

b) Moving the Cursor

• Move the cursor with the Tab, Shift + Tab, and arrow keys. You can also use the mouse to move the cursor directly to the desired screen.
If an item is selected, the area inside the frame turns light blue.

(3) Entering Setup Items

• Move the cursor to an setting item and press the End key to display an input guidance at the upper right of the screen.
The guidance varies depending on the selected item.



a) Value entry ([XXX - XXX])

• Displays the boundary values of the setting range.
• An arbitrary digit can be increased and decreased with the Ctrl key and the arrow key. (Ver 2.2 and later)

b) Select list

• Press the Space key or click the mouse to display a pull-down menu. Press the Enter key or left-click the mouse to confirm.

c) Enter strings

• Enter characters from the keyboard.
• About the following, there is a restriction in the letter that can be used.
File ·····PLL Table File, Item Table File, System Data File
Misc·····All Scan Log File Name, Screen Capture File Name
Input possible letter·····0 to 9, A to Z, a to z, !, +, -, ., =, @, _, ~

d) Switch on/off

• Turn the selection box ON/OFF. Press the Space or Enter key or left-click the mouse to confirm.

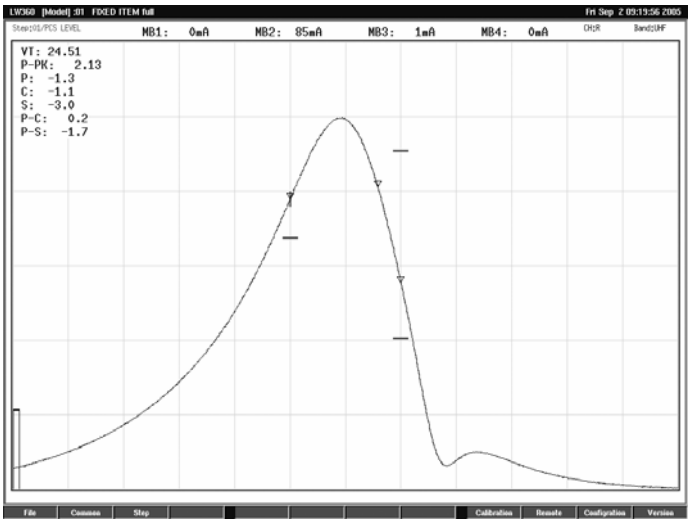
∗ Canceling entries

• To cancel a character or numeric entry, press Esc. The original display appears.

4.2.4 Basic Setup Procedure of Measurement Conditions

(1) Factory Default Settings

When the LW 360 is turned ON for the first time, the “FIXED ITEM full” Wave screen of Tuner Model No. 1 is displayed.



The default tuner model settings provided as reference assume the following tuner.

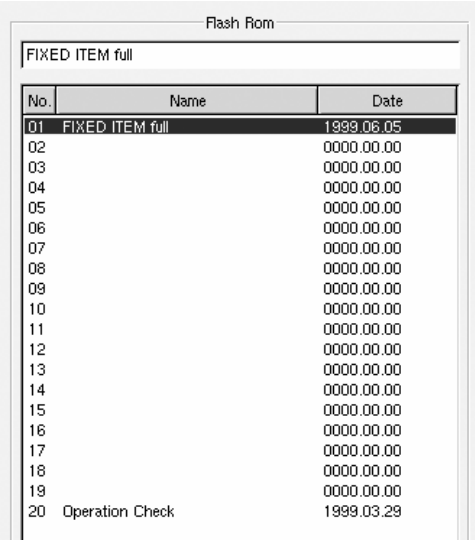
- Tuner type: PLL tuner for analog broadcasting
- Serial format: I^2C BUS, Resolution Freq: 62.5 kHz
- MB2: 5 V, AGC: 4 V, IF: 45.75 MHz

If the tuner specifications are the same as these setting conditions, a waveform similar to the figure above is displayed.

(2) Selecting the Tuner Model

a) Checking the Tuner Model

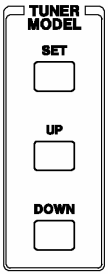
The following tuner model is registered by factory default. On the Wave screen shown above, press the F1 (File) key to display the File edit screen. You can check the tuner model on this screen.



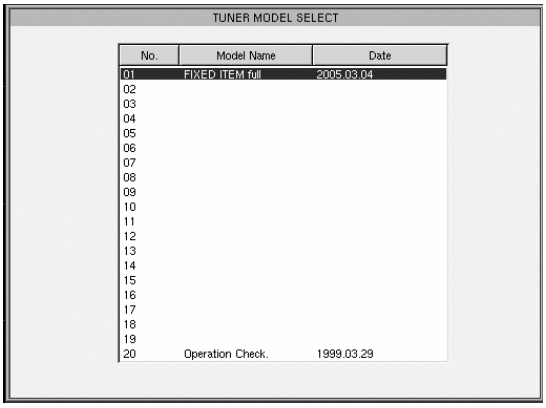
No.01 FIXED ITEM full
→ Sample program that performs basic measurement items.

No.20 Operation Check
→ A program used to check the LW 360 operation.

b) Selecting the Tuner Model from the Front Panel

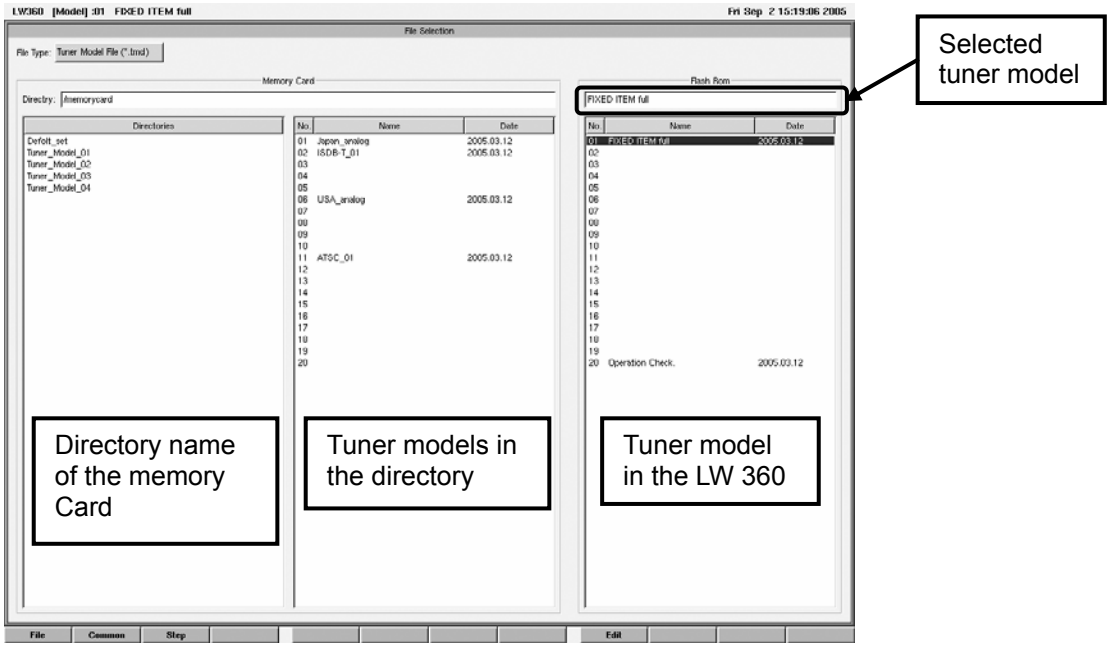


On the Wave screen, press one of the three keys on the front panel to display a screen shown on the right.
Move the cursor to the desired tuner model and press the SET key to select it.



- SET key: Loads the tuner model selected by the cursor.
- DOWN key: Moves the cursor to the next tuner model.
- UP key: Moves the cursor to the previous tuner model.

c) Selecting the Tuner Model from the File Edit Screen
On the Wave screen, press F1 (File) to display the File edit screen.



- The File edit screen consists of three areas. The left area displays the directory name of the external memory card. The center area displays the tuner models in a directory on the external memory card. The right area displays the tuner model in the internal flash memory of the LW 360.

Selection procedure
- First, press the Tab key to move the cursor to the desired area.
- Next, press the up and down arrow keys to move the cursor to the desired tuner model.
- Press F9 (Edit) followed by F1 (Read) to select the tuner model. The name of the selected tuner model is displayed at the top of the internal flash memory area.

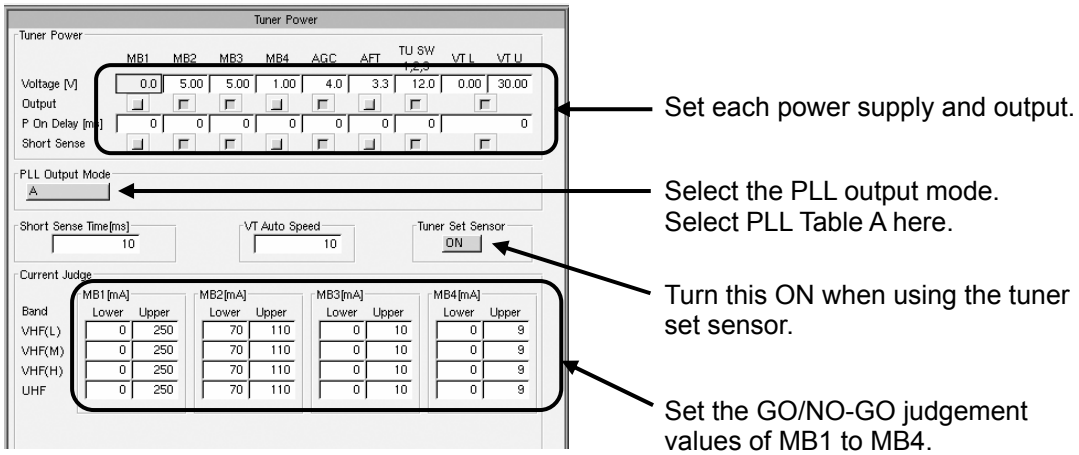
(3) Editing the Settings

• After selecting the tuner model, you edit the measurement conditions. This section explains the basic flow of the editing operation using the “FIXED ITEM full” settings that are provided by factory default. For details of each setting, see the explanation of the respective screen.

a) Setting the Tuner Power (Common Edit Screen)

Press F2 (Common) followed by F5 (Tuner Power) to activate the Tuner Power screen. You can also use the mouse to perform this task. To display the screen in full screen, press F4 (Size).

• Set the supplied power according to the tuner specifications and jig wiring.

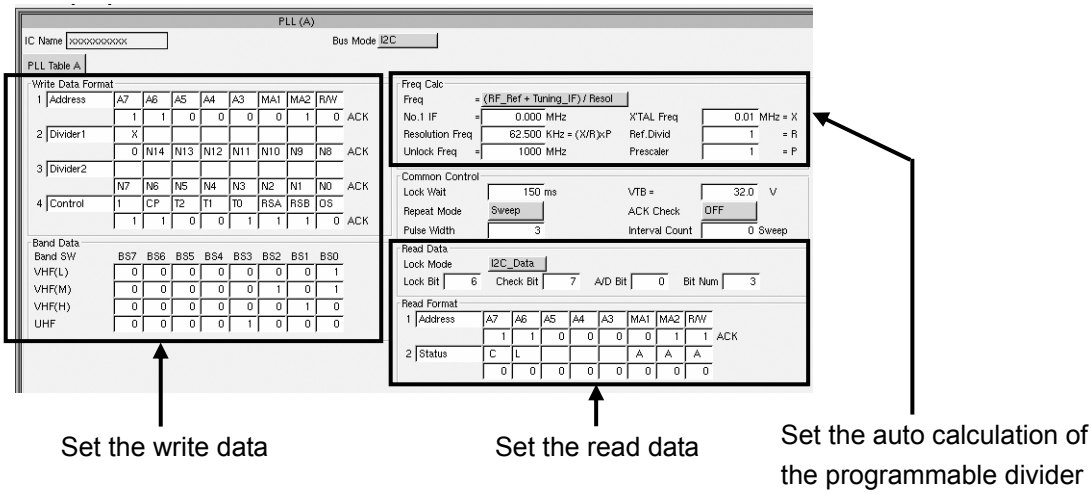


b) Setting the PLL (Common Edit Screen)

On the Common edit screen, press the F6 (PLL) key or click the PLL function key on the screen. The PLL screen is activated.

To display the screen in full screen, press F4 (Size).

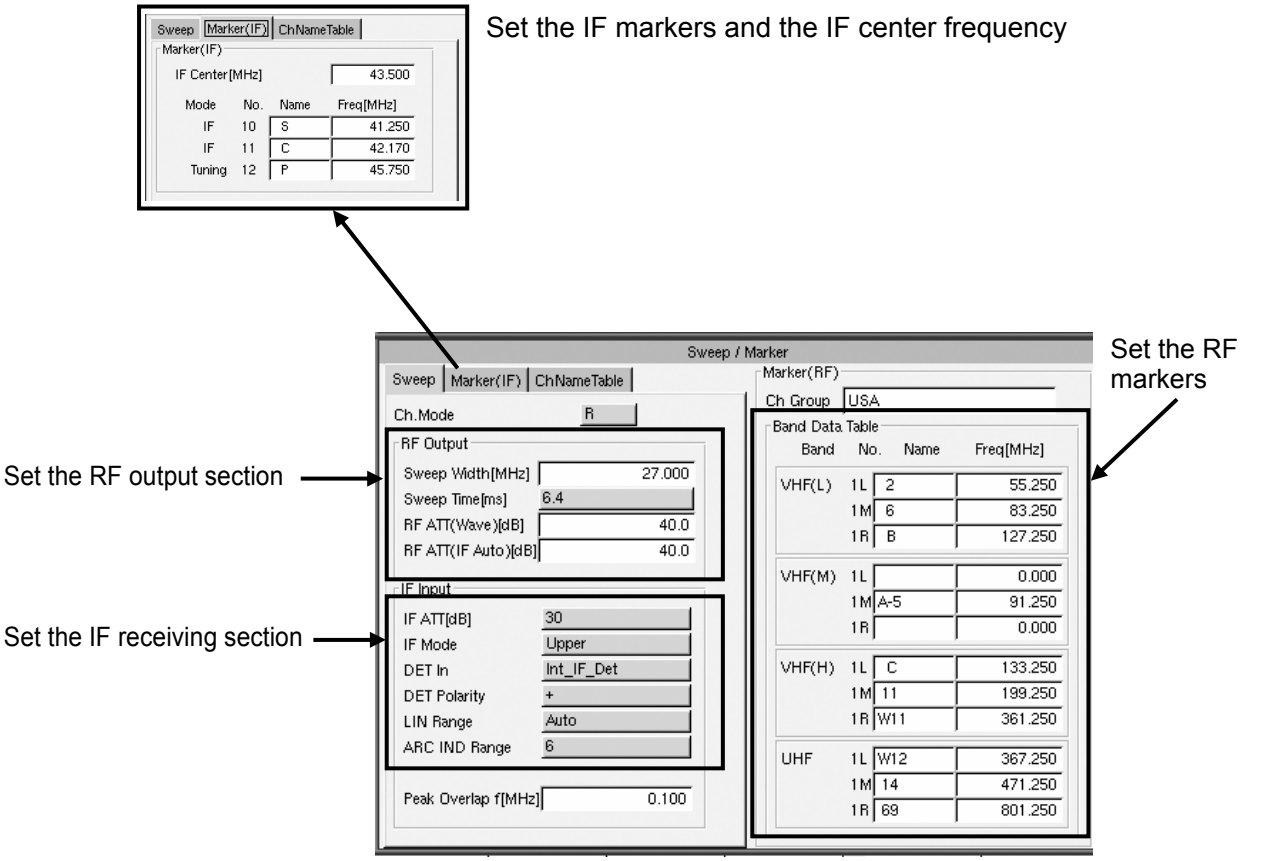
• Set each item according to the tuner specifications. In this example, the serial bus system uses the PLL table to set the I^2C.



c) Setting the Sweep/Marker (Common Edit Screen)

On the Common edit screen, press the F7 (Sweep Marker) key or click the Sweep Marker function key on the screen. The Sweep/Marker screen is activated.

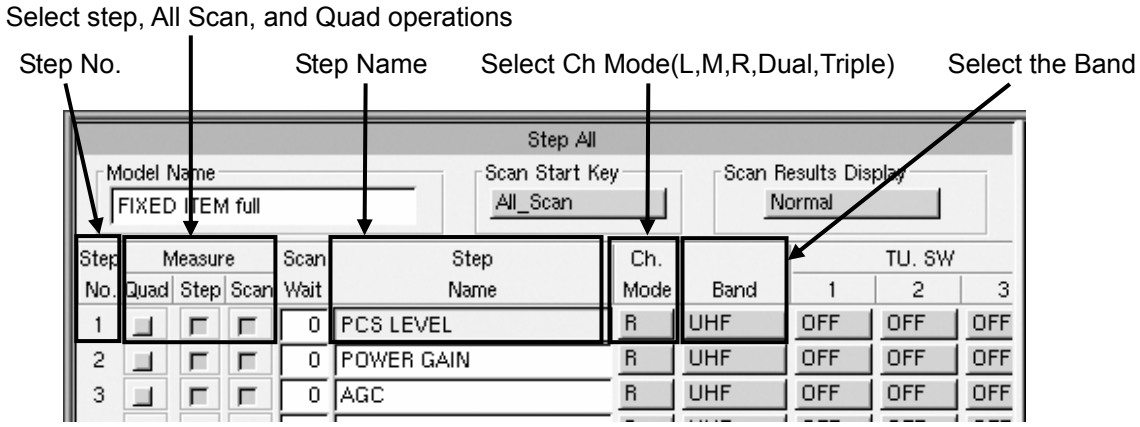
• Enter basic RF signal settings, IF receiving section settings, and RF and IF marker settings.



d) Setting the Step All Screen (Common Edit Screen)

The sweep/marker settings at step C) above are the last of the common settings. Next, enter settings at the step level.

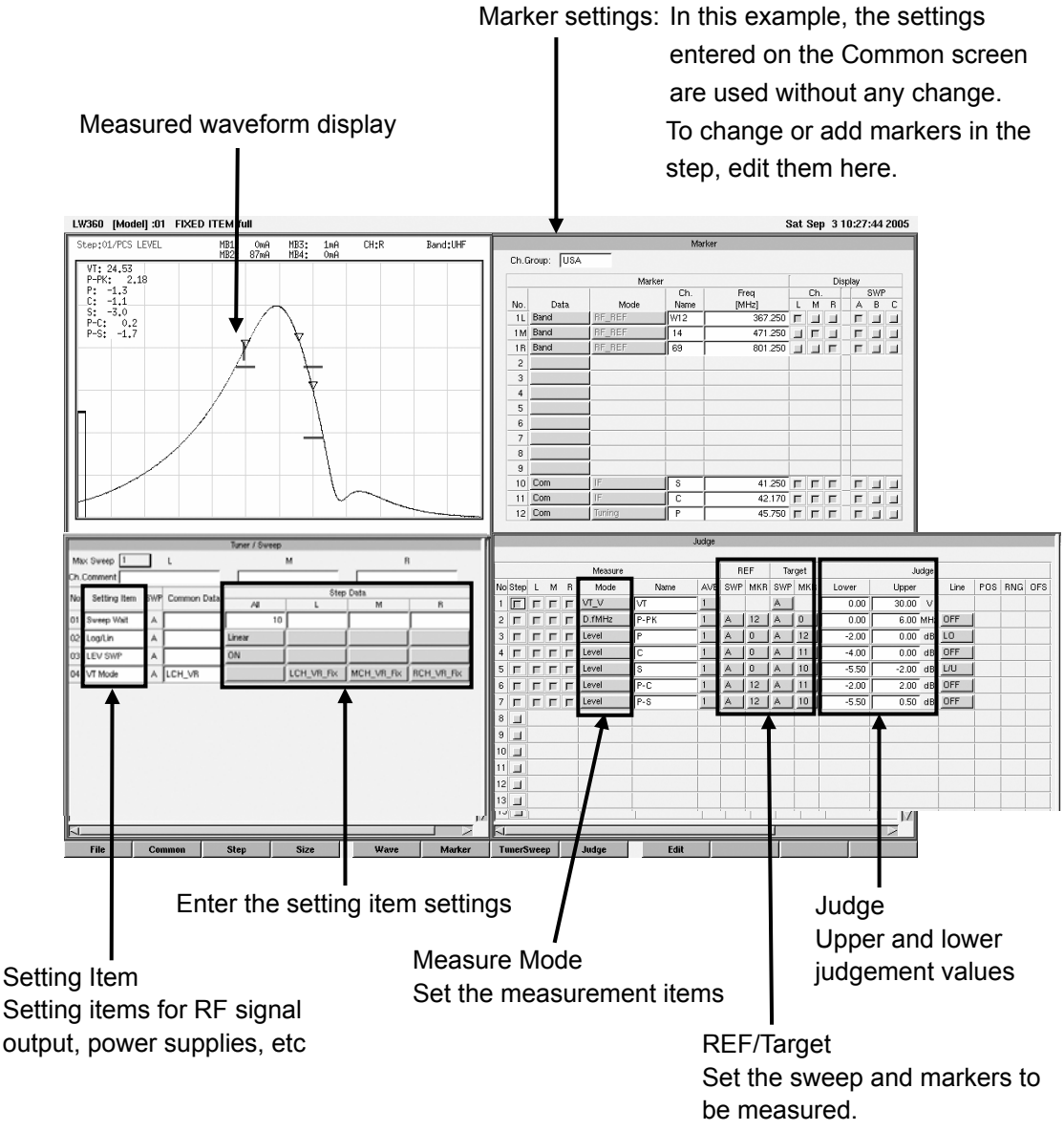
The Step All screen displays a list of measurement steps. This screen is used to set the Band, Channel Mode, Step Name, etc.



e) Editing Steps (Step Edit Screen)

After editing on the Common edit screen, edit the settings for each step. In each step, set the RF signal generation section, power supplies for the tuner, measurement items, etc.
The common settings are common to all steps. If you do not set the item in the step, the common setting is executed. Items specified in a step takes precedence over items specified in the Common settings.
This section briefly explains the settings in Step No. 01 PCS Level of the “FIXED ITEM full” tuner model.

Press the F3 (Step) key or click the Step function key to display a Step edit screen as shown below. To display an edit screen in full screen, activate the screen, and press F4 (Size).



- This concludes the basic flow of the setup operation. From this point, repeat the procedure of editing the steps for each measurement item to complete the program. In Step editing, you can create various setting patterns by combining the setting items, measurement mode, and sweep.

4.2.5 Using the Tuner Models Created on the LW 347/348

• Tuner models created on the conventional LW 347/348 can be used on the LW 360. The tuner models can basically be used without any change, but a portion of the settings must be added.
Refer to the description below.

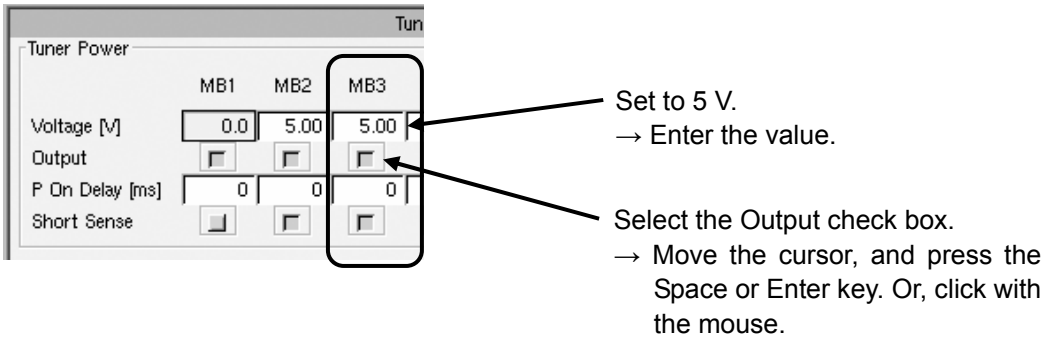
(1) Memory Card

• A PCMCIA card was used on the LW 347/348, but the LW 360 comes with a CF (CompactFlash) card slot. To transfer a tuner model created on the LW 347/348 using a memory card, copy the tuner model file to a CF card on your PC, and insert the card into the LW 360 card slot.
If you were using a CF card with a PC card adapter, the CF card can be used directly on the LW 360.

(2) Setting the PLL Control Voltage

• On the LW 347/348, the PLL control voltage was fixed to 5 V. However, the voltage is controlled with the newly added MB3 voltage on the LW 360. Because the MB3 function is not available on the LW 347/348, loading a tuner model file sets the MB3 value to the lowest setting of 1 V. Set this value to 5 V (if a different voltage is used such as 3.3 V on a special order model, set that voltage).

• Procedure
Press F2 (Common) followed by F5 (Tuner Power) or click Common followed by Tuner Power with the mouse.



• After setting MB3, save the tuner model file on the File edit screen.

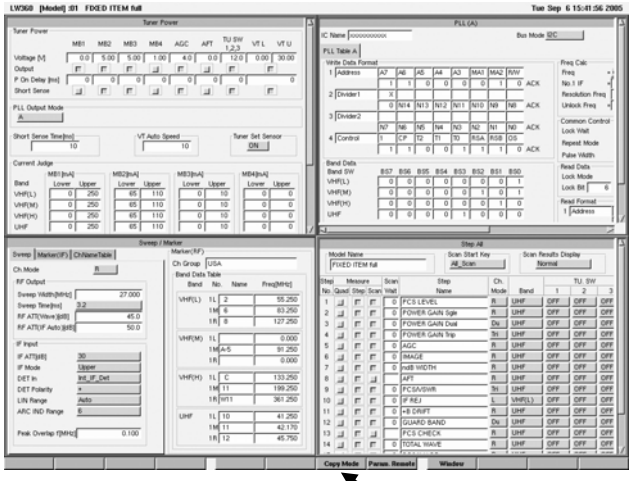
4.3 Basic Measurement (Using the FIXED ITEMs)

4.3.1 FIXED ITEMs

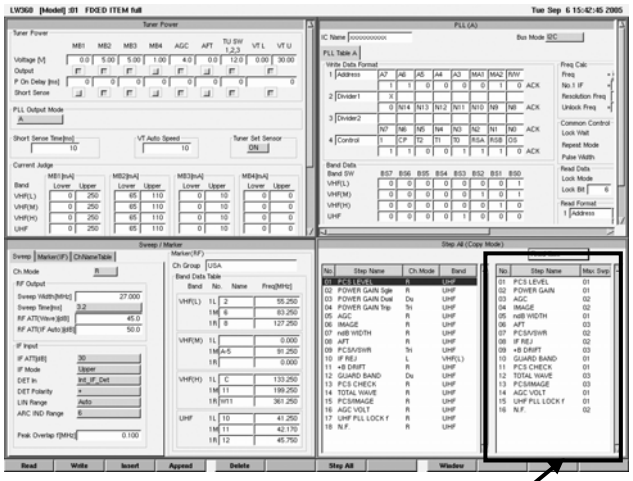
(1) FIXED ITEMs are 16 basic measurement items that are preset.
FIXED ITEMs are registered when the LW 360 is shipped from the factory. They cannot be added, deleted, or changed.
In addition, the settings may change when the firmware is updated.

(2) FIXED ITEMs are set to UHF, Single R^{CH} with a few exceptions.
In addition, some of the settings are specific to a tuner. They must be changed according to the tuner being measured.
Refer to sections 4.3.2 to 4.3.16.

(3) FIXED ITEMs are copied to steps on the Step All screen to be used.
After copying, the settings are changed to match the operating conditions.



a) On the Wave screen, press F2 (Common) to display the Common setting screen. Then, press F8 (Edit) to activate the Step All screen.
Next, press F9 (Edit) followed by F7 (Copy Mode) to display the Step All (Copy Mode) screen.



b) Move the cursor to the desired item in the FIXED ITEM list on the Step All (Copy Mode) screen. Press F1 (Read) to turn the cursor blue and read the required FIXED ITEM. Then, move the cursor to the Step area, and press F2 (Write) to copy the item to the specified step. (If you are using a mouse, clicking an item turns the cursor blue and automatically reads the settings. Use the keyboard to select the copy destination.)

c) Press F3 (Insert) to insert the recalled FIXED ITEM before the step where the cursor is positioned.
Press F4 (Append) to add the recalled FIXED ITEM after the last step.
Press F5 (Delete) to delete the step where the cursor is positioned.

(4) By factory default, Tuner Model No.1 contains all of the FIXED ITEMs as FIXED ITEM full.

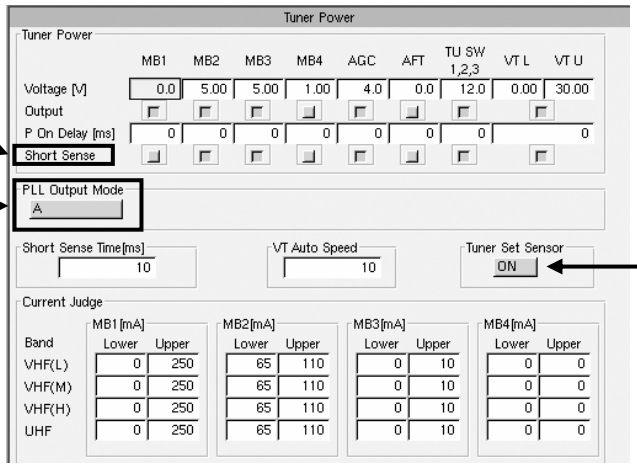
The program assumes that the tuner supports US CATV channels, 3Band, and PLL control (I^2C).

Change the settings according to the tuner being measured.

(5) Common Setting data of the FIXED ITEM full Tuner Model

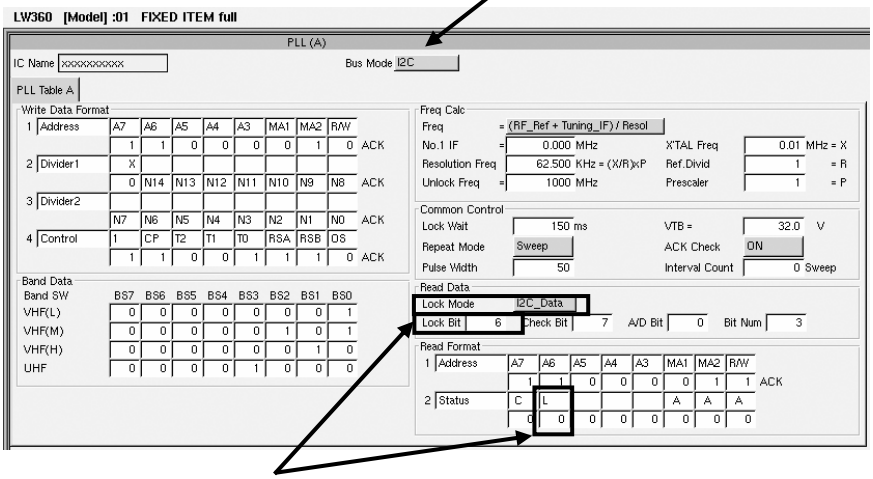
Set the short sensing of the tuner power supply connector

PLL tuner settings



The TU Set Sensor signal is enabled.

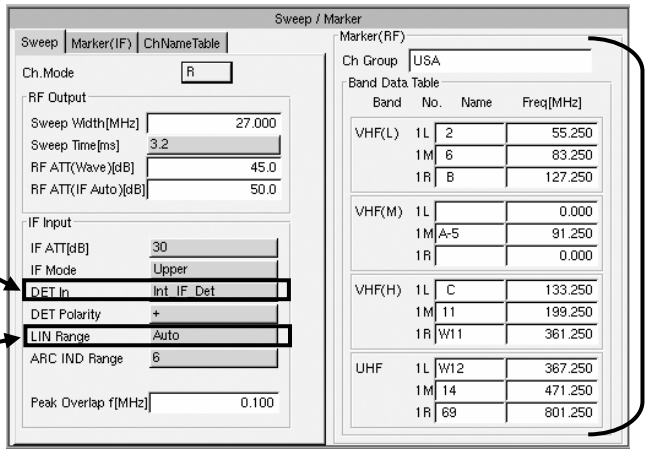
The bus mode of the PLL IC is I^2C.



Setting to monitor the tuner PLL Lock status

Internal detector enabled

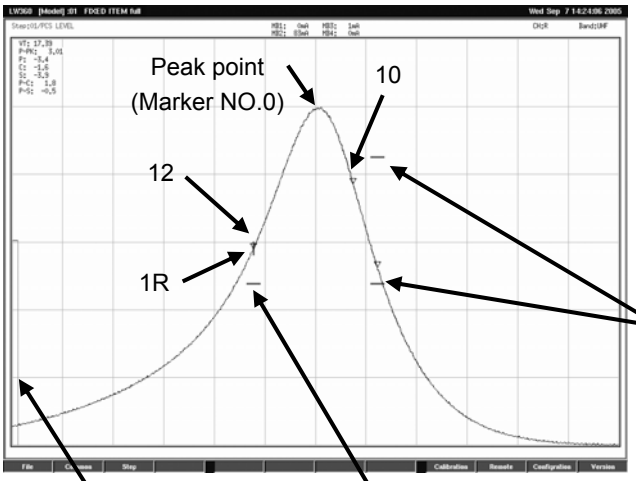
ARC ON setting



Frequency setting that includes USA CATV channels

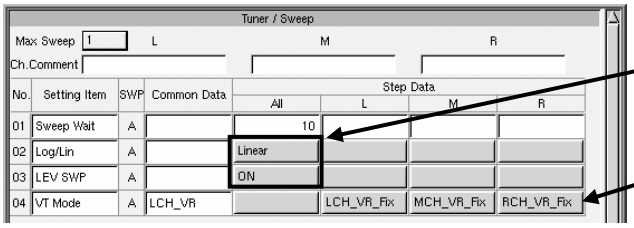
4.3.2 ITEM No.01 (PCS LEVEL)

This item measures and judges the level of the detected signal and the PCS marker points.



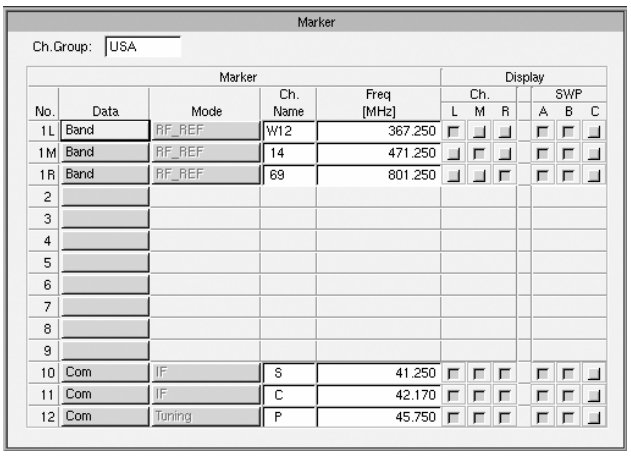
Wave screen
1R・・・RF marker NO.
10 to 12・・・IF marker NO.
ARC operation: ON
Because ARC IND RANG is 6 (32 mV/DIV), the detected signal is approximately 96 mV.

S measurement judge line (Upper and Lower)

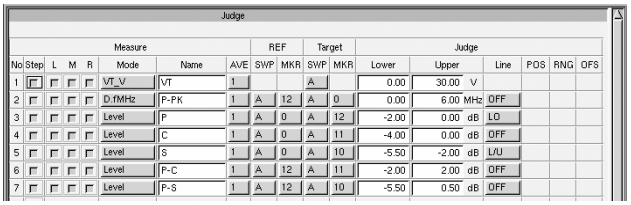


Tuner/Sweep screen
If Linear is specified, turn LEV SWP ON to perform level measurement.

V_T Mode is adjustable using a variable resistor.



Marker screen
Common settings are used without any change.

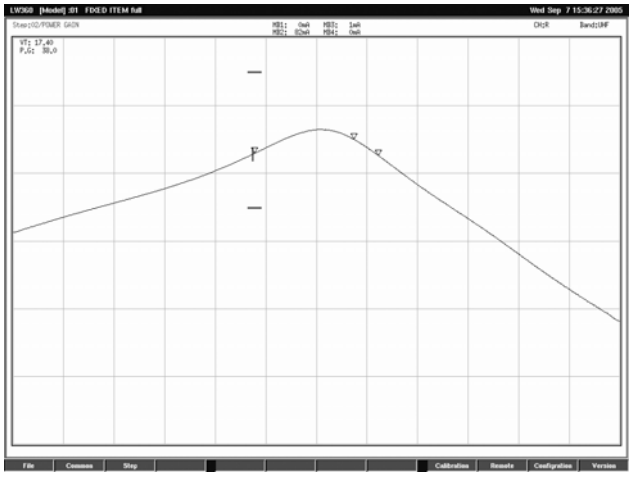


Judge screen
The following items are measured and judged.

- V_T output voltage
- Frequency difference between the P marker to the peak
- Level difference from the peak to the P, C, and S markers
- Level difference of the C and S markers with respect to the P marker

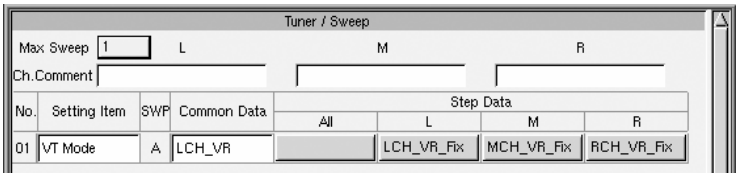
4.3.3 ITEM No.02 (POWER GAIN)

This item measures and judges the IF Log waveform and the power gain at the P marker from the ANT input to the IF output.



Wave screen

- The waveform is a basic waveform (factory default) when no settings are made. Log waveform.
- Power Gain has V_T and P.G measurement set on the Judge screen.
- Set the P.G.CAL value correctly.

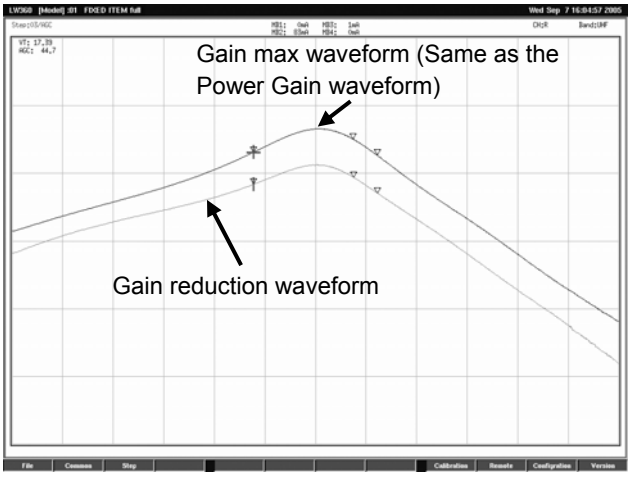


Tuner/Sweep screen

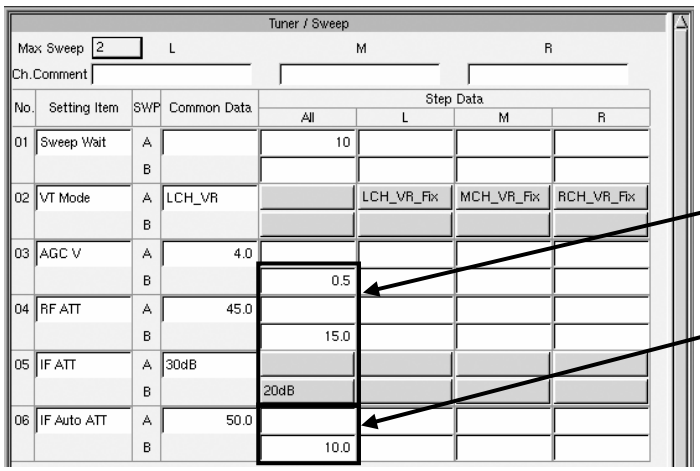
- V_T Mode is adjustable using a variable resistor.

4.3.4 ITEM No.03 (AGC)

This item measures and judges the IF Log waveform and the amount of reduction at the P marker by the AGC voltage



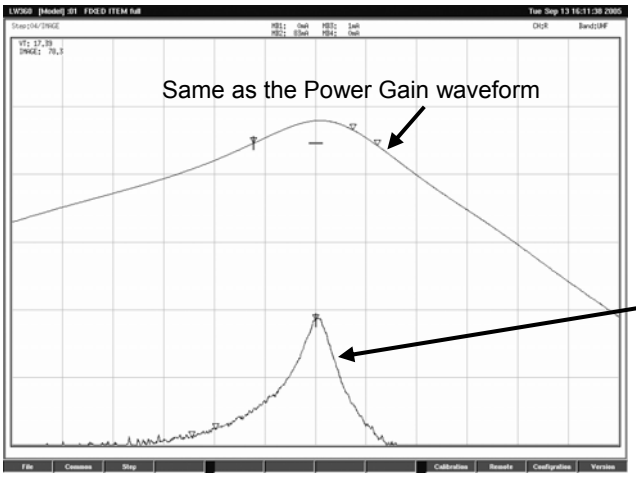
Wave screen
- Log waveform
- AGC has G.R measurement set on the Judge screen.
- Measurement is performed by adding the level difference of A/B including the RF ATT and IF ATT settings.



Tuner/Sweep screen
- Set the sweep to A/B (MAX Sweep: 2)
  - Sweep A・・・Gain max
  - Sweep B・・・Gain reduction
- Set the sweep B gain reduction. Set these to match the tuner.
- Set this item so that the IF marker on sweep B is not offset.

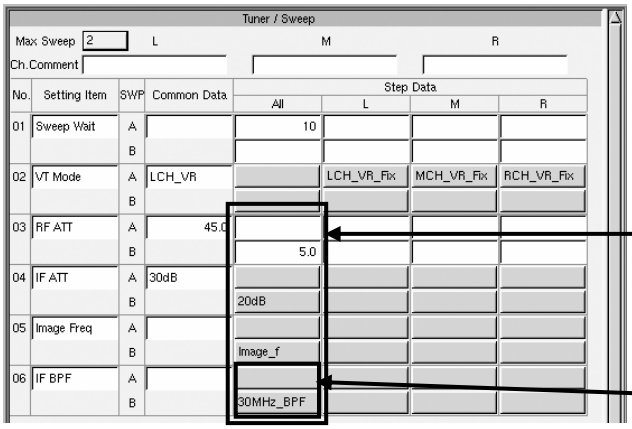
4.3.5 ITEM No.04 (IMAGE)

This item measures and judges the IF Log waveform and the level of rejection of the image at the P marker.



Wave screen
- Log waveform
- Image has G.R measurement set on the Judge screen.

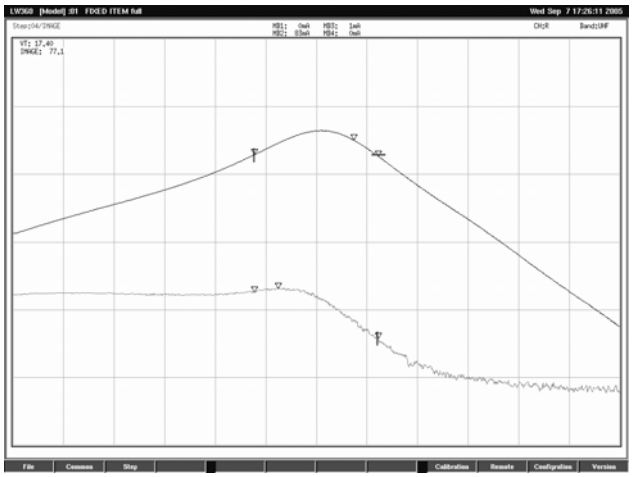
- Image measurement waveform
  The internal 30 MHz BPF appears.
  The IF BPF setting automatically sets the image frequency at the center frequency.



Tuner/Sweep screen
- Set the sweep to A/B
  (MAX Sweep: 2)
  Sweep A・・・Power Gain waveform
  Sweep B・・・Image waveform

- Set the sweep B image.
  Set RF ATT and IF ATT according to the level of rejection of the image.

- Set the IF BPF.

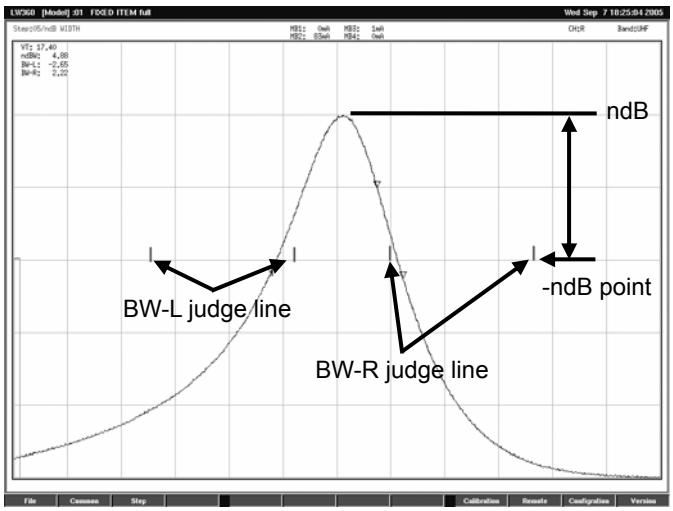


Wave screen (when IF BPF is set to through)
- The internal 30 MHz BPF is set to through, and the image waveform appears as-is.

- If the image waveform is hidden under noise, set the IF BPF (30 MHz BPF) to reduce the effects of noise.

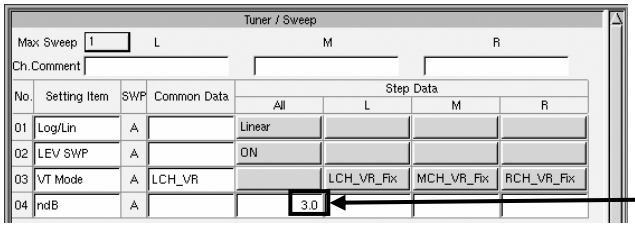
4.3.6 ITEM No.05 (ndB WIDTH)

This item measures and judges the detected signal and the bandwidth at the -3 dB point with respect to the peak.



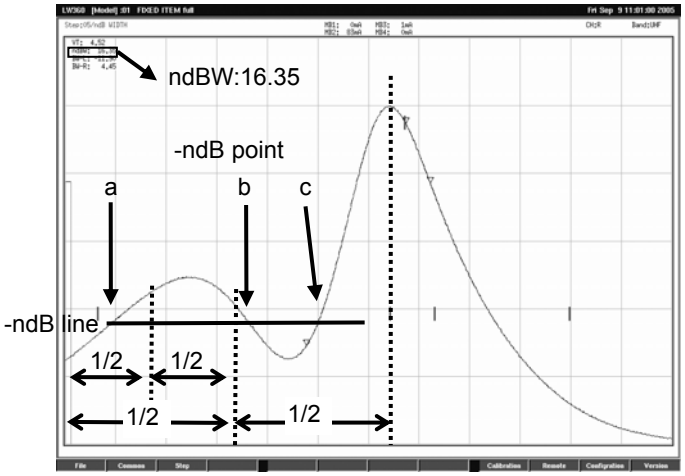
Wave screen

- The waveform is the same as PCS Level.
- ndB WIDTH has D.f MHz measurement set on the Judge screen.
- To reduce the measurement time, the -ndB point is searched by repeatedly dividing into halves the frequency areas left and right of the waveform peak point.

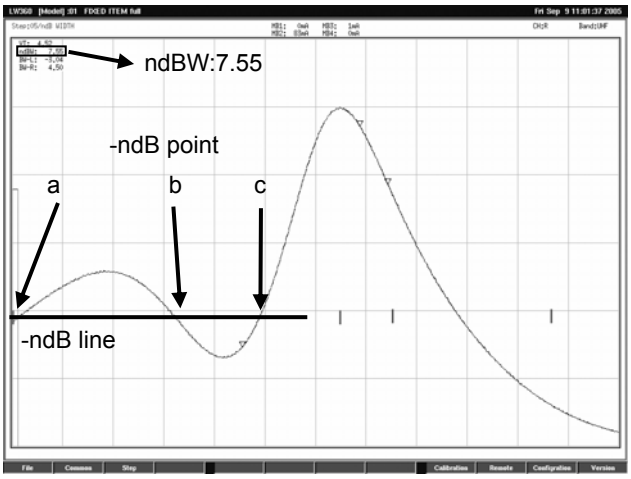


Tuner/Sweep screen

Set ndB to the value to be measured.



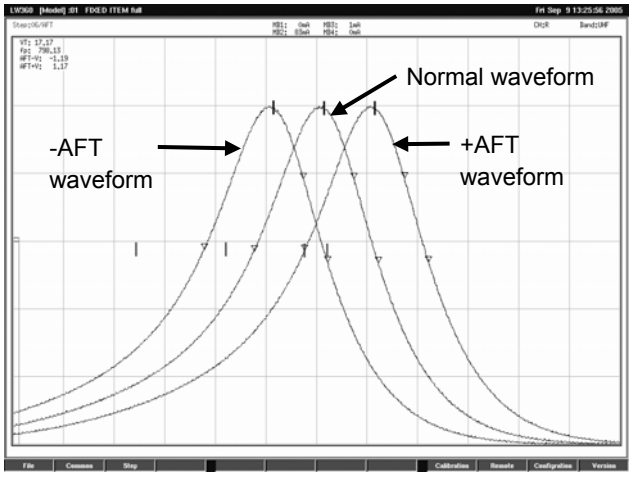
- This is an example when there is a dip in the waveform and several -ndB points exist (three in this case).
- In this case, the level at the half position of the frequency area left of the waveform peak is higher than -ndB. Therefore, the LW 360 determines that the -ndB point is at a lower frequency and searches for the half position of the frequency area left of the current position. This operation is repeated to arrive at the -ndB point.
  Therefore, the LW 360 measures point a in this example.



・To measure at point c, set the sweep width so that points a and b do not affect the measurement.
In this case, the sweep width is set narrower to avoid the effects of points a and b.
Thus, the ndBW changes from 16.35 to 7.55.
In this case, ndBW is decreased from 16.35 to 7.55 by narrowing the sweep width enabling measurement to be performed at point c.

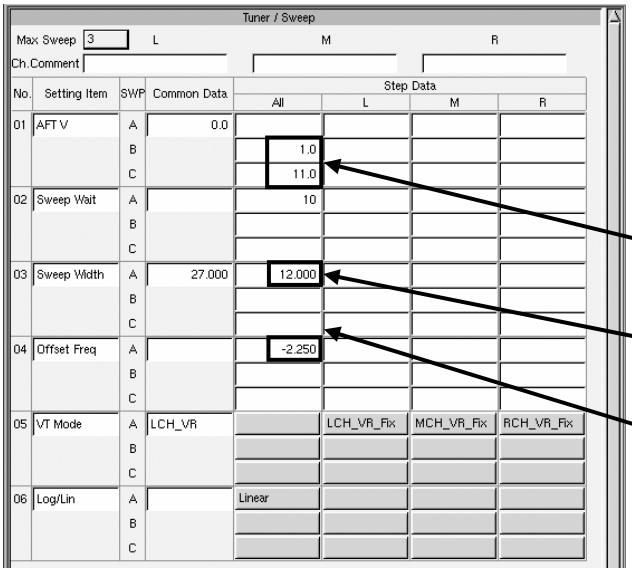
4.3.7 ITEM No.06 (AFT)

This item measures and judges the detected signal and the amount of local oscillator frequency control due by the AFT voltage.



Wave screen
・The waveform is the same as PCS Level. Monitors the change in the tuning frequency by the AFT voltage.

・AFT has D.f MHz measurement set on the Judge screen.



Tuner/Sweep screen
・Set the sweep to A/B/C (MAX Sweep: 3)
Sweep A・・・Normal waveform
Sweep B・・・-AFT voltage waveform
Sweep C・・・+AFT voltage waveform

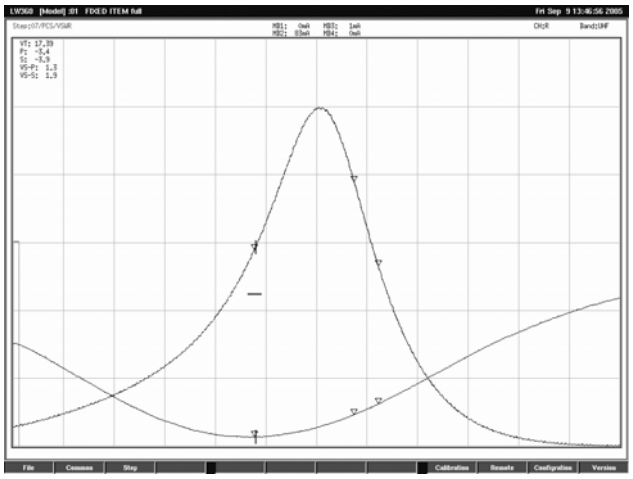
・Set the AFT voltage to match the tuner measurement specifications.

・Set the sweep width so that the waveforms can be viewed easily.

・Set this item so that the measurement reference of the normal waveform is at the center of the screen.
Because this is an IF marker, the value is given by
IF Center f(43.5MHz)-IF Tuning f(45.75MHz)=-2.25MHz

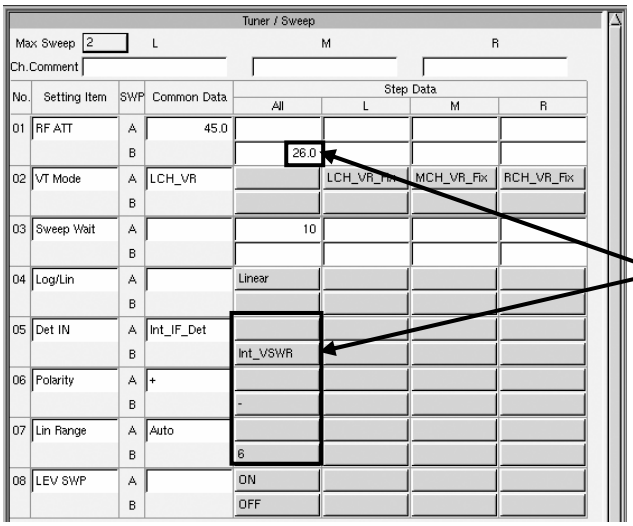
4.3.8 ITEM No.07 (PCS/VSWR)

This item measures and judges the detected signal, the levels at the peak and PS marker, and the voltage standing wave ratio (VSWR) of the ANT input connector.



Wave screen

- Two waveforms are displayed, PCS Level and VSWR.
- PCS/VSWR has Level and VSWR measurement set on the Judge screen.
- VSWR calibration is required with the measurement system such as a jig connected. (Remove the tuner.)
  Refer to section 7.1, “VSWR Calibration.”



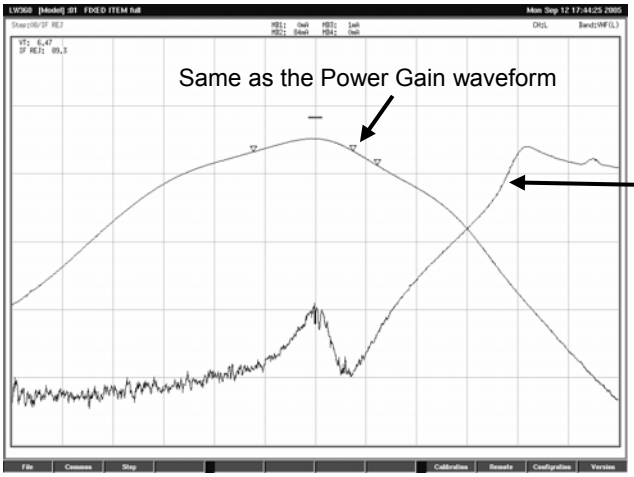
Tuner/Sweep screen

- Set the sweep to A/B
  (MAX Sweep: 2)
  Sweep A・・・PCS Level waveform
  Sweep B・・・VSWR waveform

- For sweep B, the internal VSWR bridge is enabled.
  When using an external VSWR, set each value to match the VSWR bridge being used.

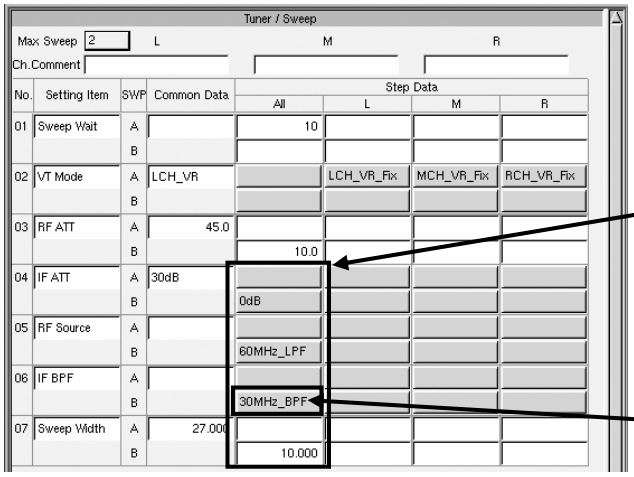
4.3.9 ITEM No.08 (IF REJ)

This item measures and judges the IF LOG waveform and the interference rejection ratio of the IF signal from the ANT input at marker P to the IF output (at the LO END CH of the VHF (L) band).



Wave screen
- LOG waveform
- IF REJ has G.R measurement set on the Judge screen.

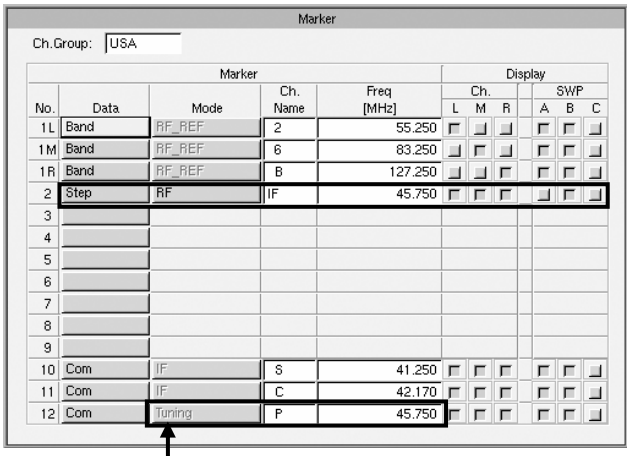
- IF REJ measurement waveform
  Setting RF Source to 60 MHz LPF (or 40 MHz LPF) enables manual sweep, and the center frequency is set to the frequency set by IF Tuning (Marker No. 12).



Tuner/Sweep screen
- Set the sweep to A/B
  (MAX Sweep: 2)
  Sweep A・・・Power Gain waveform
  Sweep B・・・IF REJ waveform

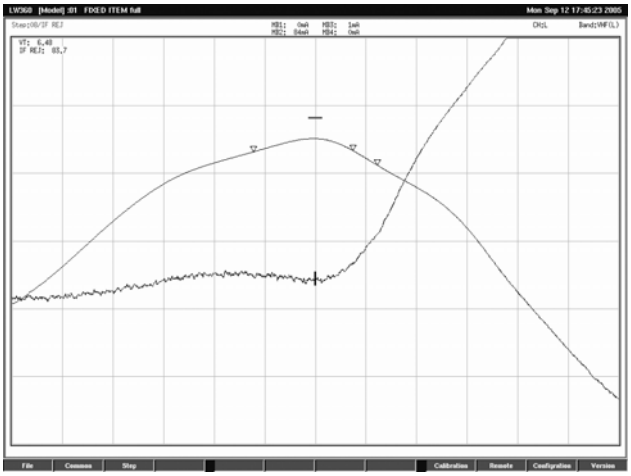
- Set the IF REJ for sweep B.
  Set RF ATT and IF ATT according to the level of rejection of IF REJ.
  Set the RF Source according to the frequency at the measurement point.

IF BPF is set to 30 MHz.



Marker screen
- Frequency at the measurement point
  30 to 40 MHz: 40 MHz LPF
  40 to 60 MHz: 60 MHz LPF

Center frequency of sweep B.
(When 60 MHz or 40 MHz LPF is specified)

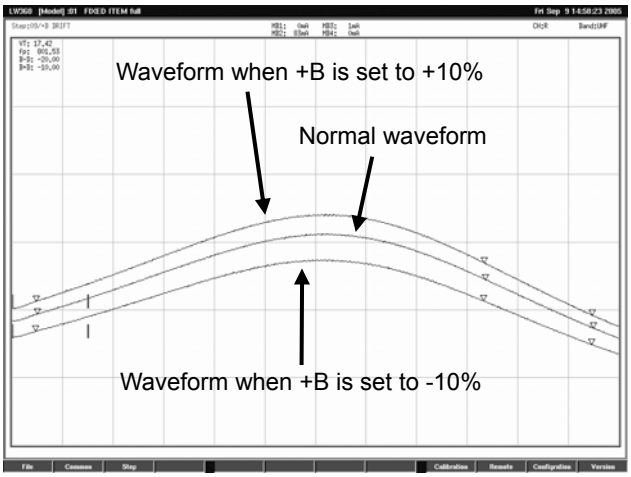


◎ Waveform when IF BPF is set to Through

・The level is raised due to the effects of the RF signal.

4.3.10 ITEM No.09 (+B DRIFT)

This item measures and judges the detected signal and the frequency drift of the local oscillator caused by the +B voltage.

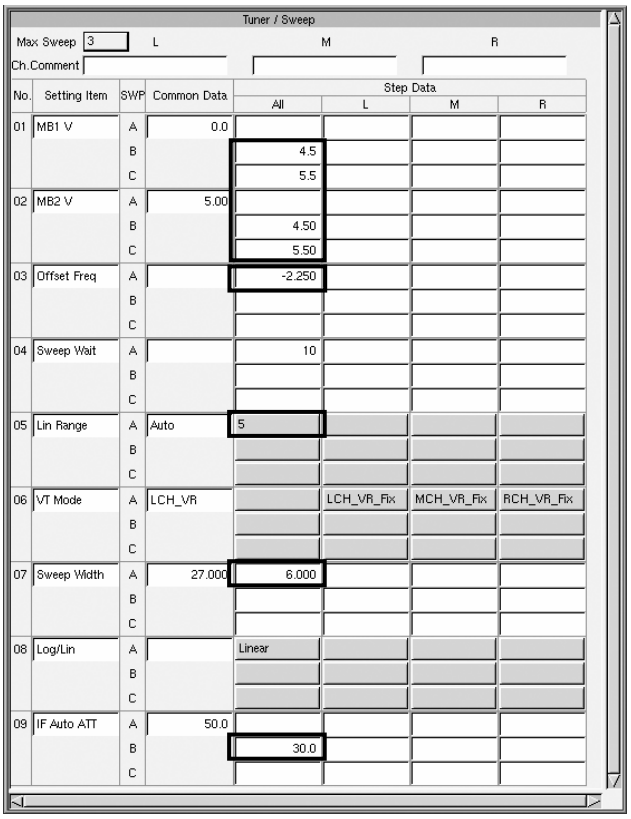


Wave screen

・The waveform is the same as PCS Level.

・Monitors the tuning frequency drift caused by the +B voltage.

・+B DRIFT has D.f kHz measurement set on the Judge screen.



Tuner/Sweep screen

- Set the sweep to A/B/C (MAX Sweep: 3)

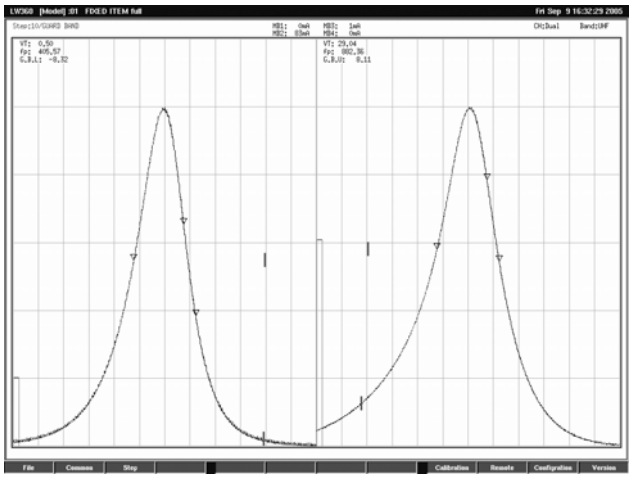
  Sweep A･･･Normal waveform
  Sweep B･･･+B waveform on the negative side
  Sweep C･･･+B waveform on the positive side

- Set the +B voltage to match the tuner measurement specifications.
- Set this item so that the measurement reference of the normal waveform is at the center of the screen.
- Set LIN Range so that the change in the waveform caused by the +B voltage can be seen.
- Set the sweep width so that the waveforms can be viewed easily.
  If set to 1.2 MHz, measurement can be performed at the minimum resolution of 1 kHz.
- Set this item so that the IF marker is not offset when the gain is small on the negative side of the +B voltage.

Waveform when LOG/LIN is set to LOG.
The waveform is the same as Power Gain.

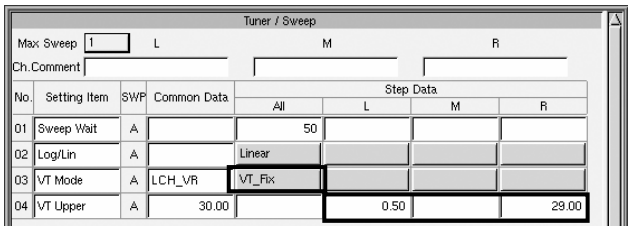
4.3.11 ITEM No.10 (GUARD BAND)

This item measures and judges the detected signal in Dual mode and the receiving frequency margin at the lower and upper V_T voltages.



Wave screen

・The waveform is the same as PCS Level.



Tuner/Sweep screen

・Set VT Mode to VT Fix.

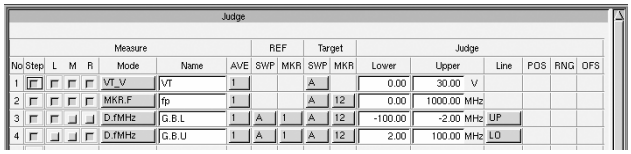
・Set the VT Upper voltage to match the measurement specifications of the tuner.

Normally, set as follows:

L CH: LO END

R CH: HI END

If V_T Lower is not set to 0 V on the Tuner Power screen, add the V_T Lower setting and set it to 0 V.



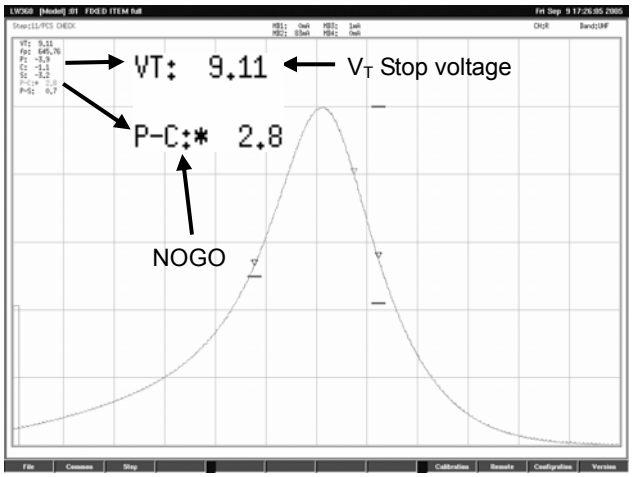
Judge screen

・No. 3 G.B.L measures the margin on the LO END (L CH).

・No. 4 G.B.U measures the margin on the HI END (R CH).

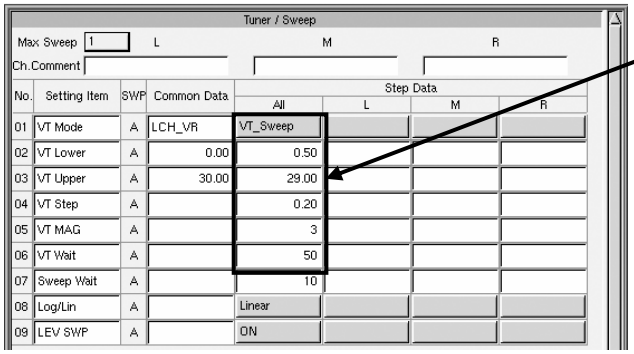
4.3.12 ITEM No.11 (PCS CHECK)

This item measures and judges the detected signal and the level at the PCS maker while automatically varying V_T from the specified Lower to Upper voltages at the specified step.



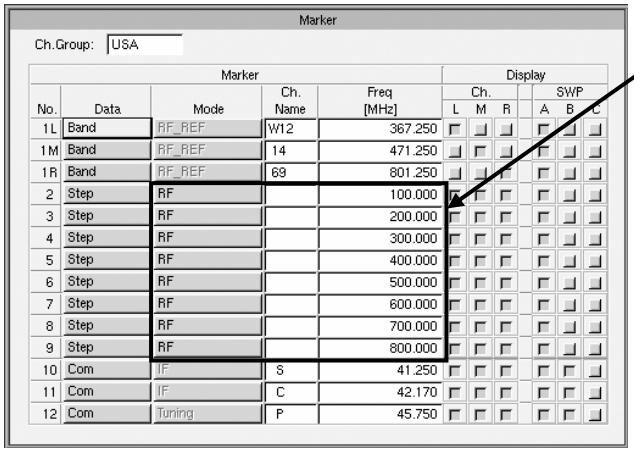
Wave screen

- The waveform is the same as PCS Level.
- The waveform when the P-C marker level is NOGO and the V_T sweep stopped. In this case, V_T = 9.11V.
- The same operation is carried out in other measurements if the V_T sweep is set.



Tuner/Sweep screen

- Settings for V_T sweep.
  In this case, the V_T wait is set to 50 ms, 0.5 V to 29 V is equally divided into three steps. The V_T voltage changes at the step voltages below.
  0.5 V to 10 V・・・0.2 V step
  10 V to 19.5 V・・・0.4 V step
  19.5 V to 29 V・・・0.6 V step

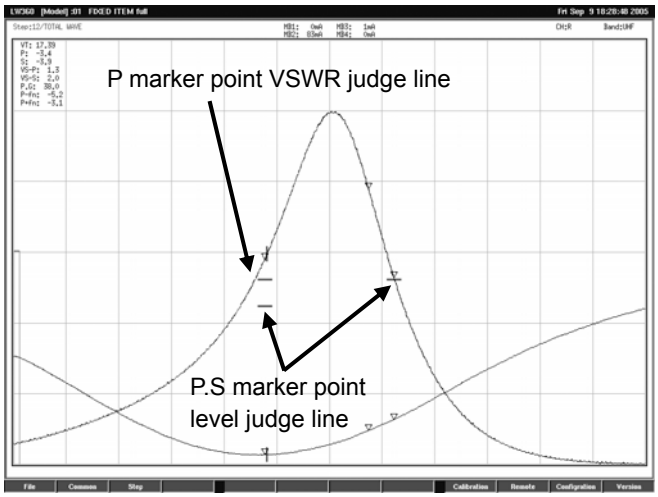


Marker screen

- RF marker frequencies are inserted at equally spaced intervals so that the change in the frequency can be checked. Change them as necessary.

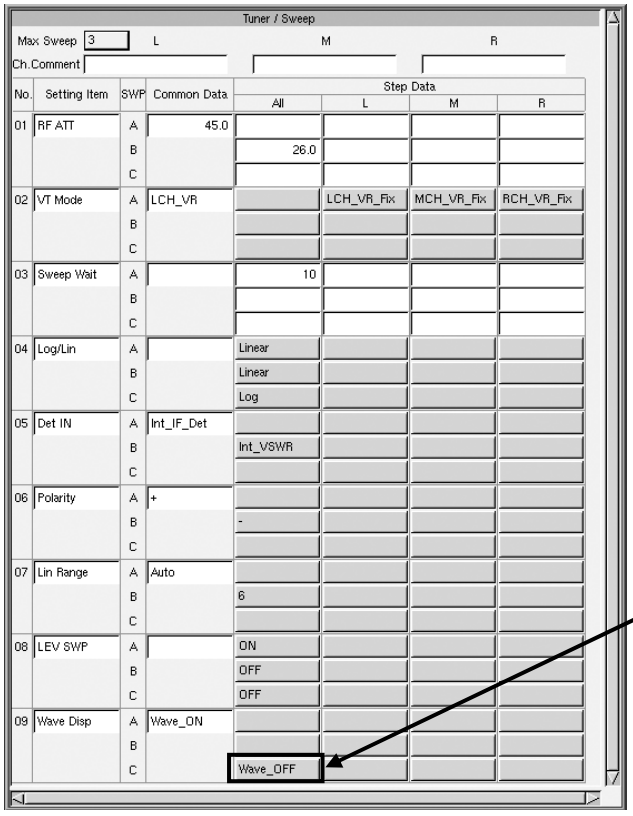
4.3.13 ITEM No.12 (TOTAL WAVE)

This item combines Item No. 07 (PCS/VSWR) and Item No. 02 (Power Gain) and adds the measurement and judgement of the attenuation level of the P-fn and P + fn points.



Wave screen

・The displayed waveform is the same as PCS/VSWR. However, the same measurement as Power Gain is performed in sweep C in which the waveform display is turned OFF.

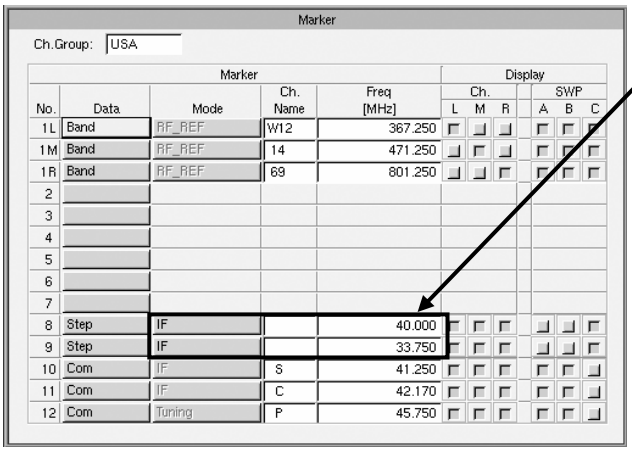


Tuner/Sweep screen

・Set the sweep to A/B/C (MAX Sweep: 3)

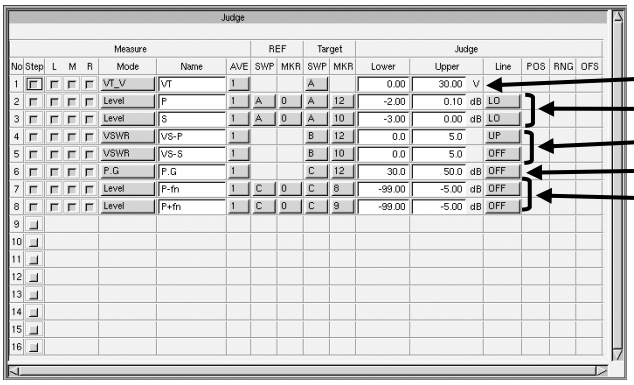
Sweep A・・・PCS Level waveform
Sweep B・・・VSWR waveform
Sweep C・・・Power Gain

The Power Gain waveform display of sweep C is set to OFF.



Marker screen

・Frequency settings of the -fn and +fn measurement points with respect to the IF P marker.
(For checking the levels along the slope)
Set using a value converted to IF frequency.
Set the frequency to match the tuner measurement specifications.

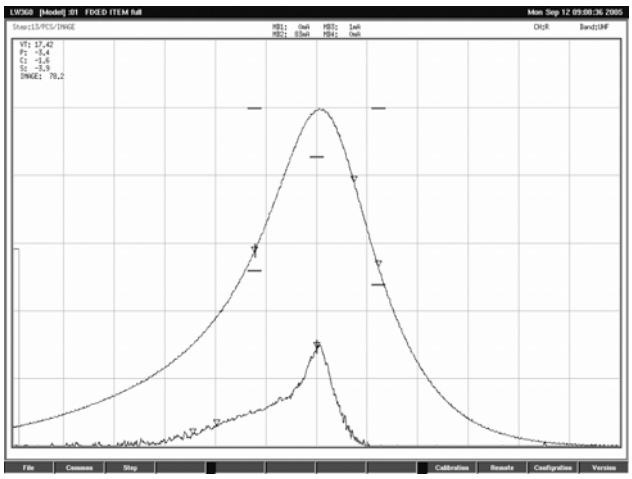


Judge screen

V_T voltage measurement
P and S level measurements
P and S VSWR measurements
Power gain measurement
Level measurement at P +/- fn points

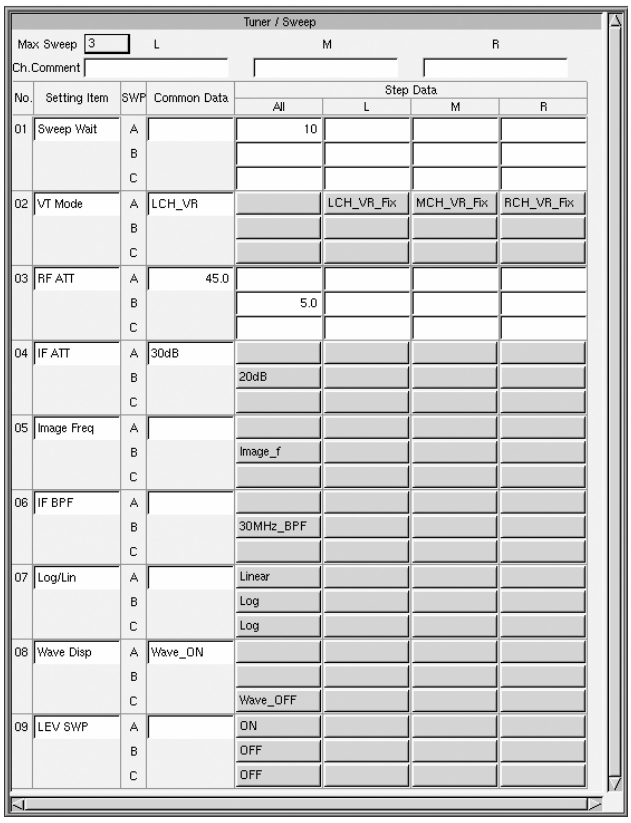
4.3.14 ITEM No.13 (PCS/IMAGE)

This item combines Item NO. 01 (PCS Level) and Item NO. 04 (Image).



Wave screen

- The displayed waveforms are PCS Level and Image waveforms. However, the Power Gain sweep used as a reference for the Image measurement is performed in sweep C in which the waveform display is turned OFF.
- The P.G measurement can be added on the Judge screen.



Tuner/Sweep screen

- Set the sweep to A/B/C (MAX Sweep: 3)
  - Sweep A・・・PCS Level waveform
  - Sweep B・・・Image waveform
  - Sweep C・・・Power Gain waveform
- For a description, see the PCS Level and Image sections.

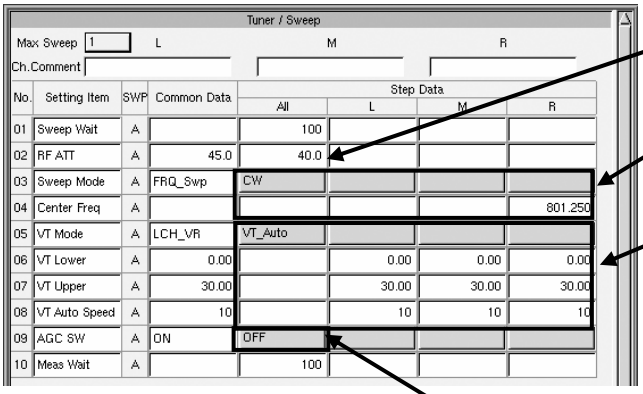
4.3.15 ITEM No.14 (AGC VOLT)

This item measures and judges the AGC control voltage when operating the AGC loop of a tuner with IF demodulation.

Wave screen

・No waveform is displayed.
The measured value is displayed
And judged.

・AGC Volt has AGC V measurement set on the Judge screen.



Tuner/Sweep screen

Set the attenuation to the specified signal level for AGC loop voltage measurement.

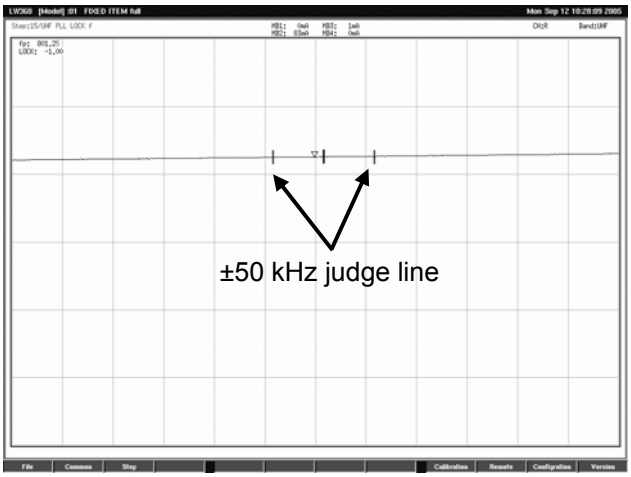
Set to the CW signal of the specified frequency.

V_T Auto operation settings.
Set the values so that stable operation is achieved at the specified frequency (RF REF frequency Marker No. 1 on the Marker screen). These value do not need to be specified, if PLL TU Mode is set to CH.CONT.
If CH.CONT is specified, add IF Auto Track and set it to Manual.

Sets pin 4 (AGC OUT/IN) of the Tuner Power connector to AGC IN.

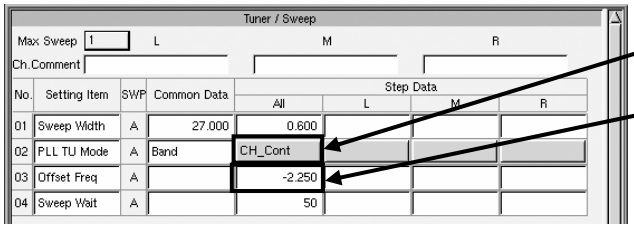
4.3.16 ITEM No.15 (UHF PLL LOCK f)

This item measures and judges the Log waveform and the PLL tuner lock frequency and error.



Wave screen

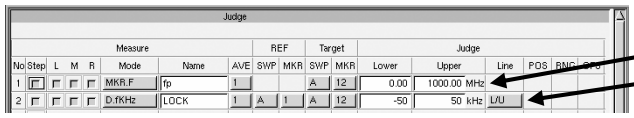
・Like the Power Gain waveform, the sweep width is reduced so that the frequency offset of the PLL lock can be easily seen.



Tuner/Sweep screen

・CH_Cont settings

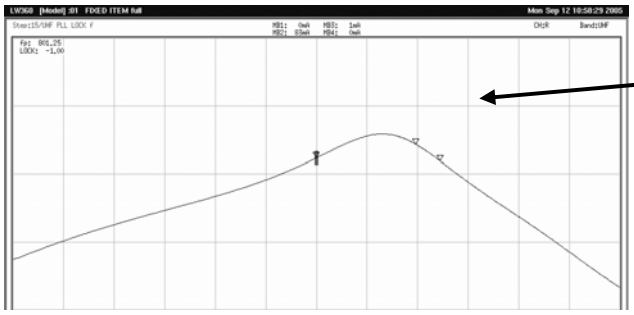
・To obtain an accurate frequency measurement, set the frequency so that the measurement point is at the center of the screen.



Judge screen

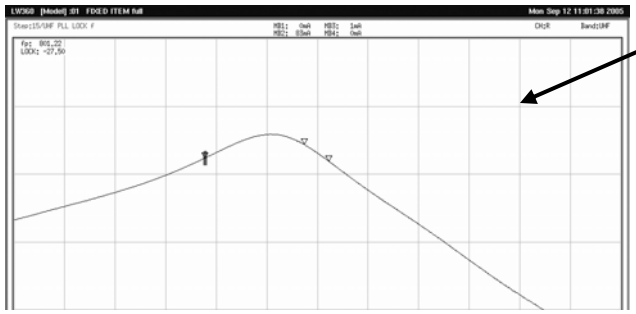
Turning frequency measurement

Frequency difference measurement (kHz)



◎ Difference in the frequency measurement accuracy

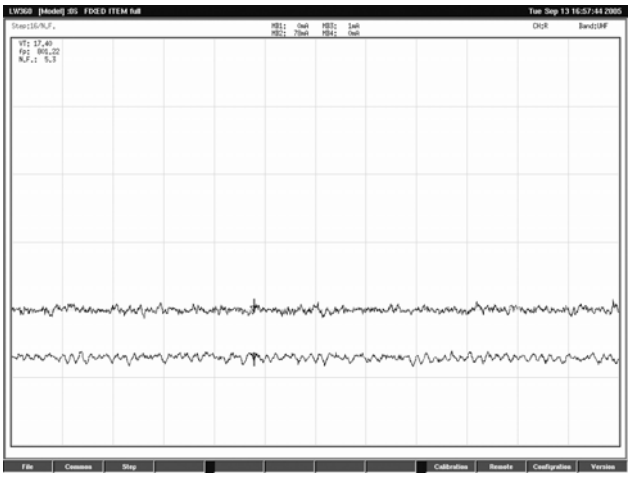
・Accurate measurement is obtained when the measurement point is at the center of the screen.



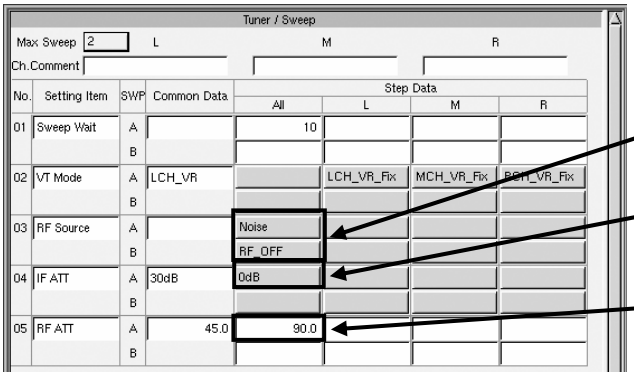
・When the measurement point is away from the center of the screen. (2.25 MHz)
In this case, a difference of 27.5 kHz appears.

4.3.17 ITEM No.16 (N.F.)

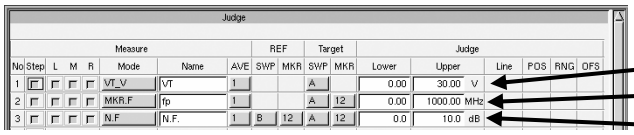
This item measures and judges the Log waveform and the relative NF value by setting the NF ENR value.



a) Wave screen
- Log waveform
- Noise signal ON/OFF waveform.
- Because this measurement is performed at an extremely small level, a shield is required to block external disturbance.
- Set the NF ENR value correctly. (Refer to section 7.3, “NF ENR Calibration.”)



Tuner/Sweep screen
- Set the sweep to A/B (MAX Sweep: 2)
  Sweep A・・・Noise signal ON
  Sweep B・・・Noise signal OFF
- Set the attenuation level according to the noise signal level.
- Set this attenuation to eliminate the effects from the sweep signal.



Judge screen
V_T voltage measurement
Tuning frequency measurement
NF measurement

b) Notes on Measuring NF

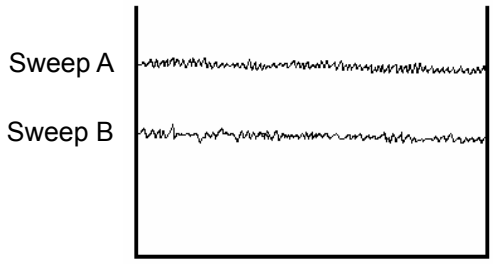
(1) The LW 360 has an internal noise source that can be used to output a noise signal from the RF Output connector when measuring NF. This enables the NF to be measured without changing the tuner connection. The LW 360 applies the tuner IF output signal to the IF Input for the cases when the noise signal is ON and OFF, measures the noise level, and determines the NF value through calculation (Y factor method).

(2) Because the output level of the noise source (ENR: Excess Noise Ratio) is not constant, the ENR value including the frequency response of the measuring system must be set for each measured frequency.

For the ENR calibration procedure, refer to section 7.3, “NF ENR Calibration.”

In addition, if you change the measuring system (items connected in the path between the output and the tuner ANT such as an impedance converter and cables), reset the NF ENR value to perform accurate measurements.

(3) Calculating the NF Value



N_A・・・Noise level when the noise source is ON

N_B・・・Noise level when the noise source is OFF

$$NF(dB) = ENR - 10\log\left\{10^{\left(\frac{N_A - N_B}{10}\right)} - 1\right\} \quad \cdots (4.1)$$

The LW 360 measures N_A and N_B and derives the NF value using equation 4.1.
Table 4-1 indicates the relationship between the (N_A-N_B) value and $10\ \log\left\{10^{\left(\frac{N_A - N_B}{10}\right)} - 1\right\}$.

Table 4-1

N_A-N_B	$10\ \log\left\{10^{\left(\frac{N_A - N_B}{10}\right)} - 1\right\}$	Difference for each (N_A-N_B) dB
10dB	9.542dB	
9	8.416	> 1.126 dB
8	7.251	> 1.165
7	6.033	> 1.218
6	4.744	> 1.289
5	3.349	> 1.395
4	1.795	> 1.554
3	-0.0206	> 1.8156
2	-2.329	> 2.3084
1	-5.868	> 3.539

As can be seen in Table 4-1, the amount of change in the NF value increases as the (N_A-N_B) value decreases.
This indicates that a small measurement error in N_A and N_B is magnified two or three times in terms of the error in the NF value.

Moreover, the measurement error of N_B increases as the N_B level approaches the noise floor of the LW 360.

(4) Therefore, the following points must be kept in mind to perform more accurate measurements.

・Keep (N_A-N_B) from becoming small.
Minimize the loss from the LW 360 output to the tuner ANT connector.

・Keep the N_B value away from the noise floor of the LW 360.
Minimize the loss from the tuner IF OUT to the LW 360 IF Input connector.

One method is to add a low-noise, high-dynamic, IF-band amplifier between the IF OUT of the IF detector and the IF Input connector of the LW 360, depending on the situation. However, the following conditions must be met. The measuring system must not saturate in other measurements (PCS level, P.G, AGC, Image, IF REJ, etc.) due to a large signal. The frequency flatness of the applicable IF must be adequate.

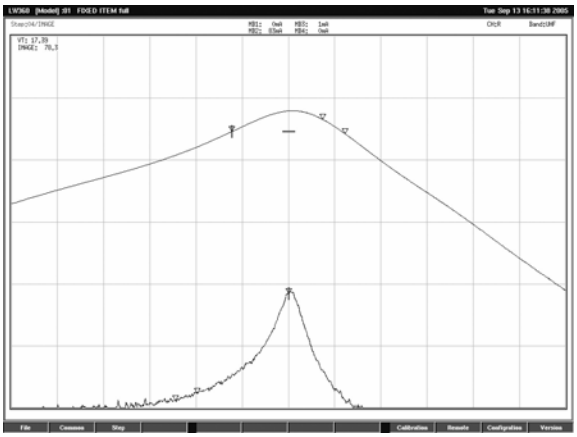
In addition, set the amplifier gain so that the smallest N_B level is approximately 10 dB greater than the noise floor of the LW 360 (including the IF-band amplifier).

4.3.18 ITEM No.16 (Application of FIXED ITEM)

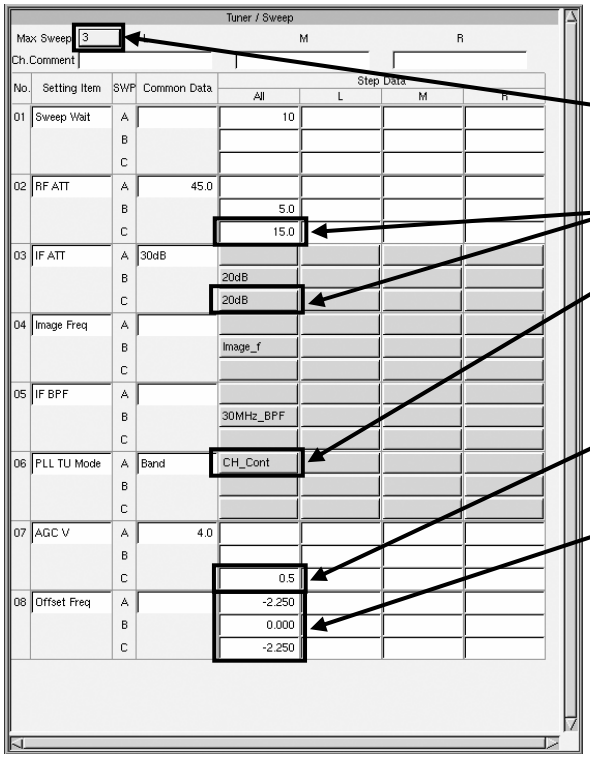
- If you adjust the tuner power, sweep/marker, and dedicated settings in each step to match the tuner being measured, the basic operations set in FIXED ITEMs can be checked.
- The LW 360 contains various other functions that are not used in FIXED ITEMs. By combining the setting items and measurement modes, you can create convenient and useful measurement items.
- Please create convenient measurement items that cuts down the test process according to the adjustment and test procedures given in sections 5.5 and 5.6.
- An application example derived from ITEM No.04 (IMAGE) is given below.

(1) PLL and PCS/PG/IM/AGC

Various functions are added to the IMG measurement of FIXED ITEM No. 4. PLL TU Mode is set to CH.CONT, and sweep A/B is expanded to sweep A/B/C. In sweep C, Gain reduction operation by the AGC voltage is carried out.



a) Wave screen (before the change)
First, read the IMG measurement from FIXED ITEMs.



b) Add settings that are necessary for the measurement on the Tuner/Sweep screen and remove unneeded settings.

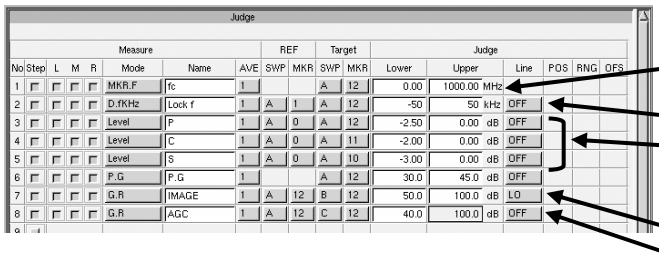
・Set MAX Sweep to 3 to enable sweep A, B, and C.

・Set the RF ATT and IF ATT for the AGC.

・Remove V_T Mode and set PLL TU MODE to CH_Cont to lock the PLL to MARKER 1R (801.25 MHz). The V_T output delivers the voltage set by VTB (32 V in this case).

・Add the AGC voltage setting of the AGC gain reduction measurement.

・ADD the Offset_Freq setting to bring the measurement point to the center of the screen in the PLL Lock frequency measurement.



c) Judge screen

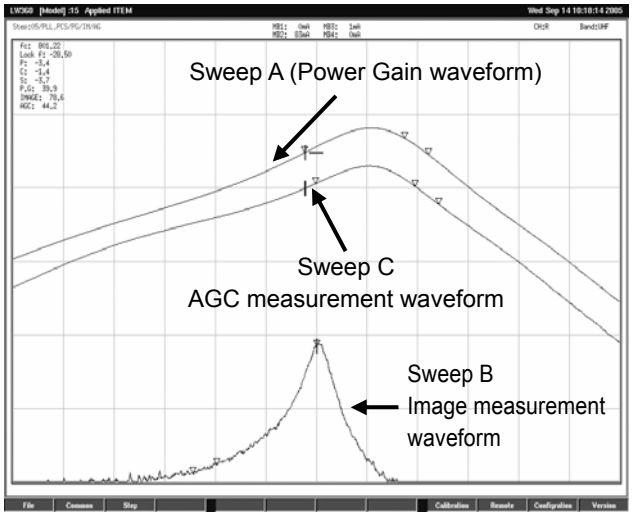
RF frequency measurement at the IF P marker

PLL Lock frequency error measurement

Level measurement of the PCS marker with respect to the peak (on the LOG waveform)

Image rejection measurement

AGC gain reduction measurement



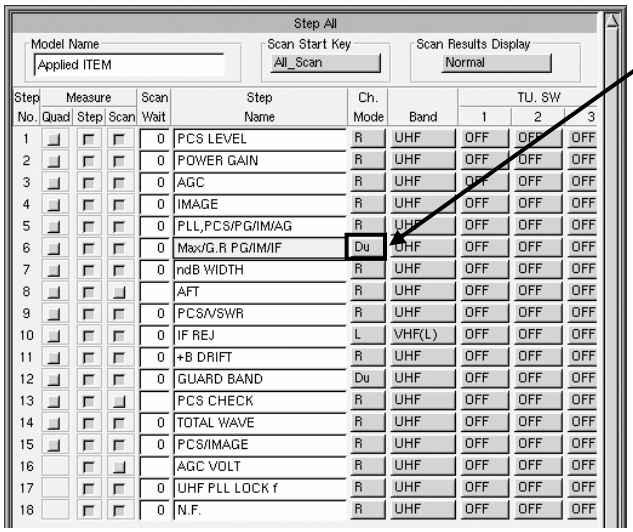
d) Wave screen (after the change)

This waveform appears after completing the settings of A) through C).

- Combined waveform of Image and AGC.
- Markers are unchanged from the common settings.

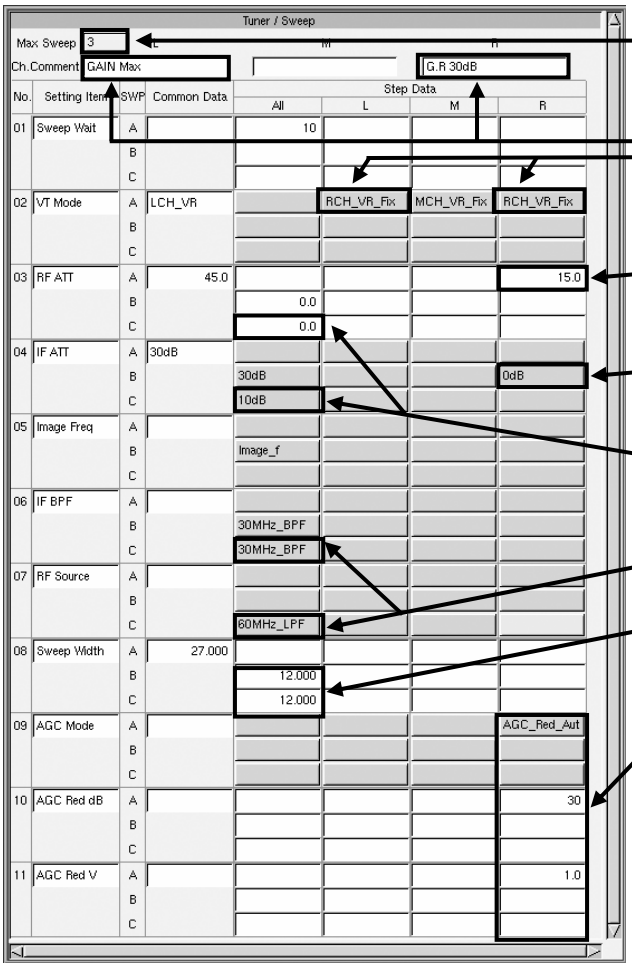
(2) Max/G.R PG/IM/IF

- Set CH Mode to Dual. Make a measurement at maximum gain on L^{CH} and a measurement at a gain reduction of 30 dB on R^{CH}.
  L^{CH} and R^{CH} are set to the same channel.
- Apply P.G, IF REJ, AGC Gain reduction voltage in the measurement.
- Like (1), read the IMG measurement from FIXED ITEMs.



a) Step All screen

Set the Ch. Mode to dual to use L^{CH} and R^{CH}.



b) Tuner/Sweep screen

・Set MAX Sweep to 3.

・Set the comment display.

・Control both L^{CH}/R^{CH} using the R^{CH} variable resistor.

・Reduce the RF ATT setting for the gain reduction amount (30 dB).

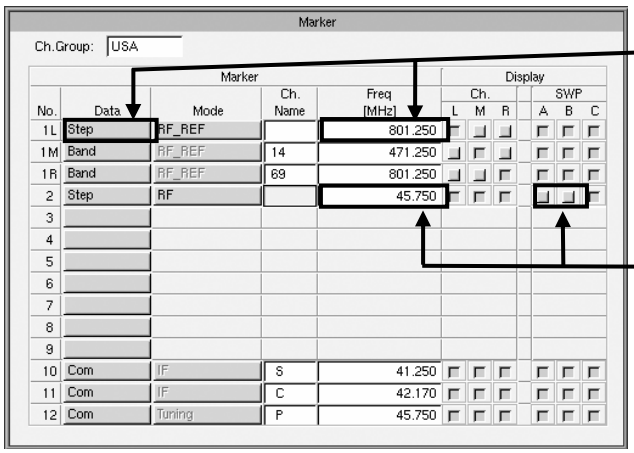
・Reduce the IF ATT setting for the Image side.

・Set the RF ATT and IF ATT for the IF REJ.

・Enter settings for IF REJ.

・Set the sweep width for the Image /IF REJ side.

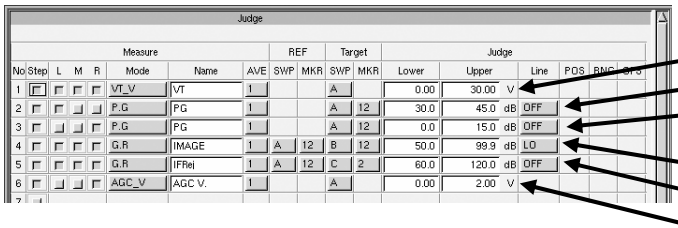
・AGC Gain RED Auto operation
Set to 30 dB.
(R^{CH} side only)



c) Marker screen

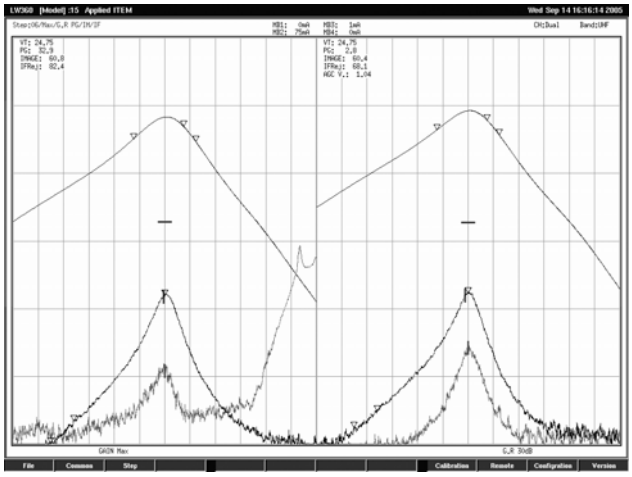
・Set to the same settings as R^{CH}.

・RF marker for IF REJ measurement
Turn OFF the display for sweep A and B.



d) Judge screen

- Tuning voltage measurement (V_T)
- P.G measurement for L^{CH} maximum gain
- P.G measurement for R^{CH} with G.R set to 30 dB
- Image measurement
- IF REJ measurement
- Measurement of the AGC voltage that is automatically set by the AGC Gain RED Auto operation.(R^{CH})



L^{CH} maximum gain measurement

Measurement for R^{CH} with gain reduction set to 30 dB

e) Wave screen

・This waveform appears after completing the settings of a) through e).

Sweep A: P.G measurement
Sweep B: Image measurement
Sweep C: IF REJ measurement

4.4 Key Points in the Settings

4.4.1 VT Auto Operation of the PLL Tuner

• The VT Auto operation may be unstable if the CR time constant at the VT (VTB) terminal on the PLL tuner large.

• If the operation is still unstable even after setting VT Auto Speed on each channel individually, a more stable operation can be achieved by setting PLL TU Mode to CH.CONT to lock each frequency through PLL control.

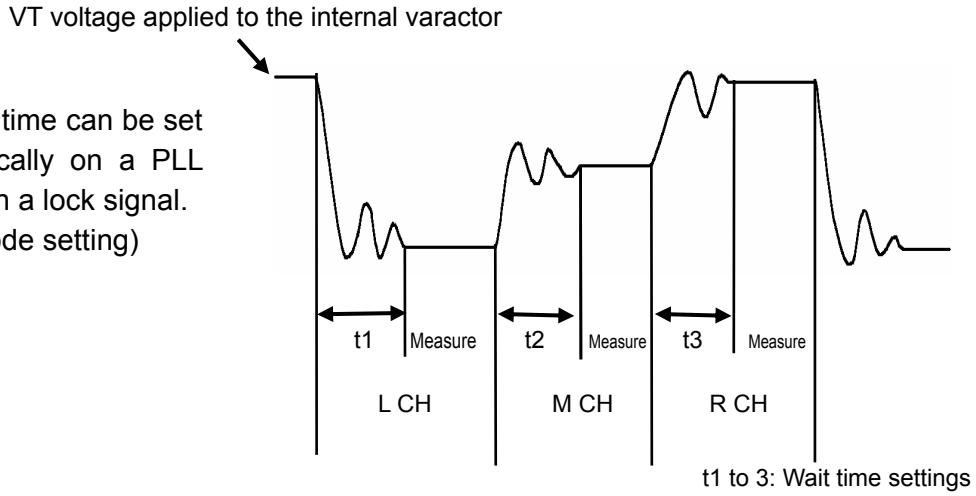
• Use the Lock signal from the PLL tuner (set the Lock Mode) to quickly start the sweep operation even in the Lock Wait time.
Difference Lock signals are used depending on the BUS MODE, I^2C and 3 Wire.
For details, refer to section 5.3.4, "PLL Table."

• For a PLL tuner without a Lock signal, add the Lock Wait and Sweep Wait setting items on the Tuner/Sweep screen, and set a wait time that enables stable measurements for each channel.

• Especially for Dual and Triple modes, the wait time must be matched for each channel.

[Example] When the PLL lock time is different for each channel

• The wait time can be set automatically on a PLL tuner with a lock signal. (Lock Mode setting)

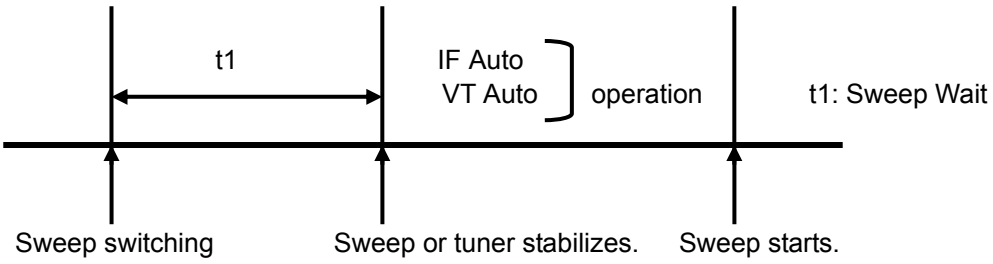


4.4.2 Setting Various Wait Times

• Various wait times can be set according to measurement purposes.
This section briefly explains them. For details, refer to the respective sections.

(1) Sweep Wait･･･ Set between 0 and 999 ms for each sweep.

• This item is used to set the wait time before starting the sweep operation in the following cases.
• When different frequencies are used for sweeps A, B, and C (for measuring Image, IF REJ, etc.), set the wait time until the sweep stabilizes. (10 ms typical)
• When different settings are used for sweeps A, B, and C (for measuring AGC, AFT, +B Drift, etc.), set the wait time until the tuner stabilizes.
• In Dual/Triple mode, set the wait time until the VT voltage is stabilizes.
• In VT AUTO mode, set wait time until the LW 360 sweeps the VT voltage.

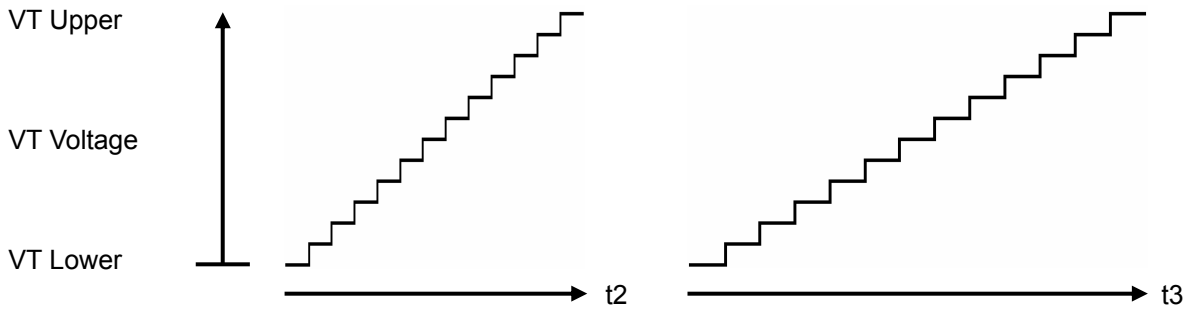


• In VT Sweep mode, set the wait time for switching the VT voltage at each step.

(2) VT Auto Speed･･･Set between -9 and 99 for each channel.

• In VT Auto mode, this item is used to set the time for changing the VT voltage.
The voltage basically switches in 10 mV steps. However, for settings -1 to -9, the step voltage is increased by 10 mV for each setting while keeping the speed at 0 to achieve faster operation.

[Example] -1: 20 mV steps, -9: 100 mV steps

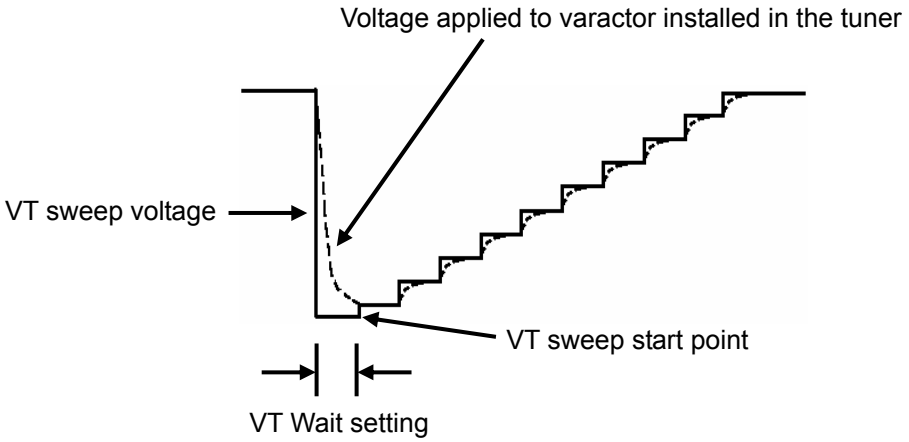


(3) Lock Wait･･･Set between 0 and 999 ms for each channel.

- This item is used to set the Lock wait time when in PLL TU Mode is set to CH. CONT.
- Set the maximum value of the tuner specifications on the Tuner Power or PLL Table screen.
  (A value given as Lock Up Time or something similar in the specifications.)
- When the Lock signal is output from the PLL tuner, setting the Lock Mode can reduce the wait time.
  For details, refer to section 5.3.4, "PLL Table."
- To change the Lock Wait time for each channel when the Lock signal is not output from the PLL tuner or cannot be used, add Lock Wait of Setting Item No. 21 on the Tuner/Sweep screen, and then enter the values.

(4) VT Wait･･･Set between 0 and 999 ms for each channel.

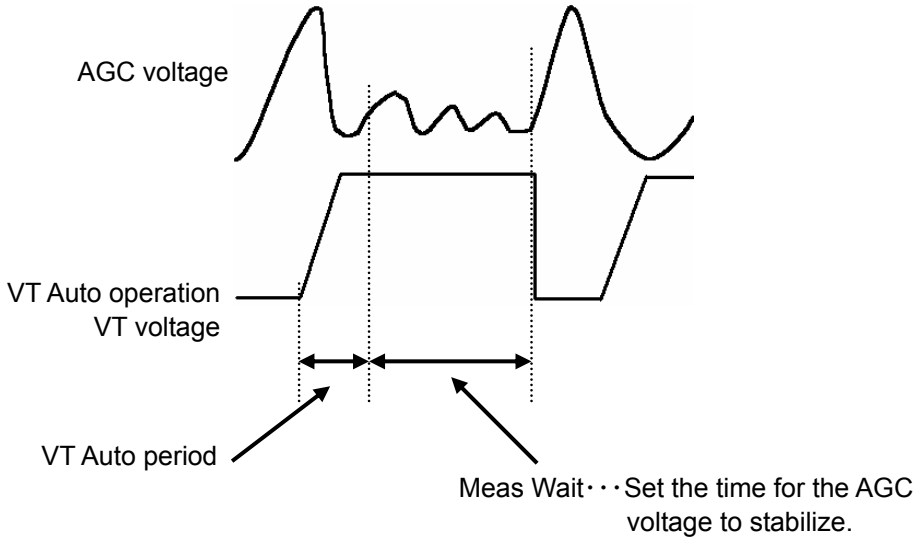
- This item is used to set the wait time before starting the VT sweep operation when VT Mode is set to VT Sweep.
- Use this setting when the CR time constant at the VT terminal of the tuner is large (especially, when performing VT Sweep when PLL TU Mode is set to Band).



- For details on the VT Sweep setting, refer to 5.5.2, “Description of Setting Items.”

(5) Meas Wait･･･Set between 0 and 999 ms for each sweep.

- This item is used to set the wait time before starting measurement after VT Auto and IF Auto operations are completed.
- Use this item to set the wait time if the level is not stable at the measurement point under test due to VT Auto operation such as when measuring AGC Volt.



(6) Scan Wait･･･Set between 0 and 999 ms for each step.

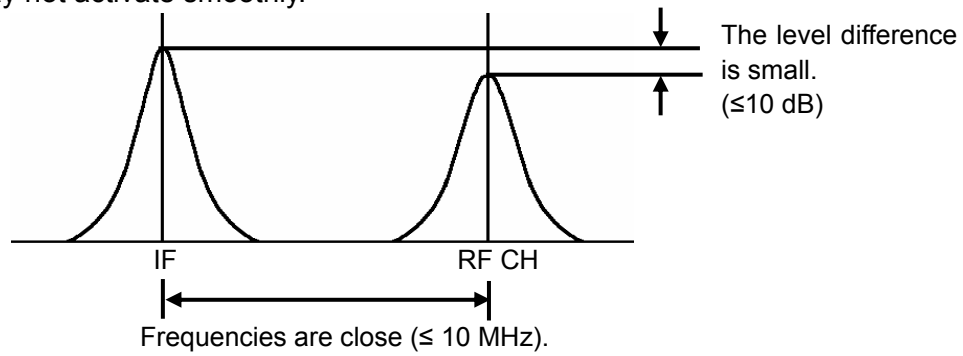
- This item is used to set the wait time until the switching jig stabilizes after switching the step.
- For details, refer to section 5.3.6, "Step All."

(7) Measure AVE･･･Set between 1 and 9 for each measurement item.

- This item is used to set the number of times to average the measured values for displaying.
- Set the number of times that produces a stable display when the measured values are unstable.
- In All Scan mode, measurements take longer, because the sweep operation is repeated the specified number of times.

4.4.3 Notes Regarding IF Auto

- If the leak of the RF signal component is large and the level difference with respect to the IF signal is small when receiving an RF channel that is close to the IF frequency, IF Auto may not activate smoothly.

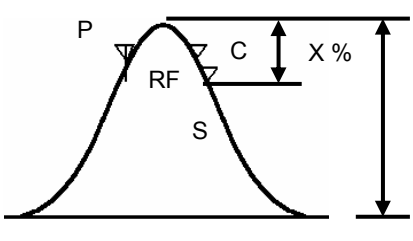


• This is because there is a possibility that the counter measuring the IF signal operates incorrectly. In such case, take measures such as inserting a bandpass filter in the IF output.

4.4.4 Level % Measurement

(1) Level %･･･Between 0 and 100% for each measurement item.

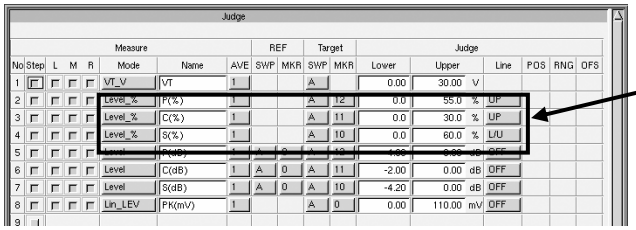
The amplitude ratio at each measurement point of LIN waveform (detected signal) is displayed with respect to the peak level (0%) in units of percentage (%). See the figure below.



The peak level is the reference.

• This function is dedicated for LIN, and used with Level sweep (LEV SWP setting item).

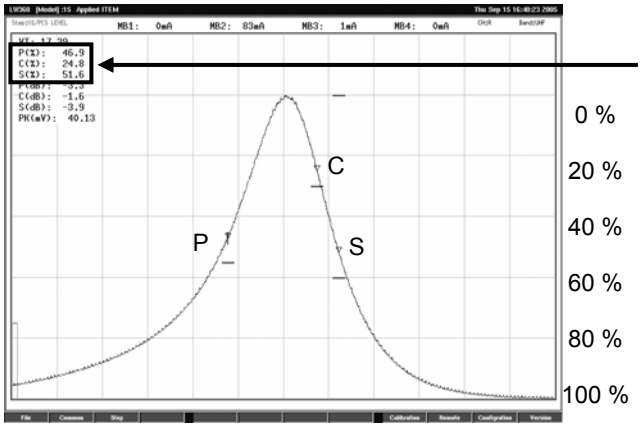
(2) Settings



Judge screen

Add Level _% and set the name, measurement point, and judgement values.

(3) Measurement Value Display and Notes



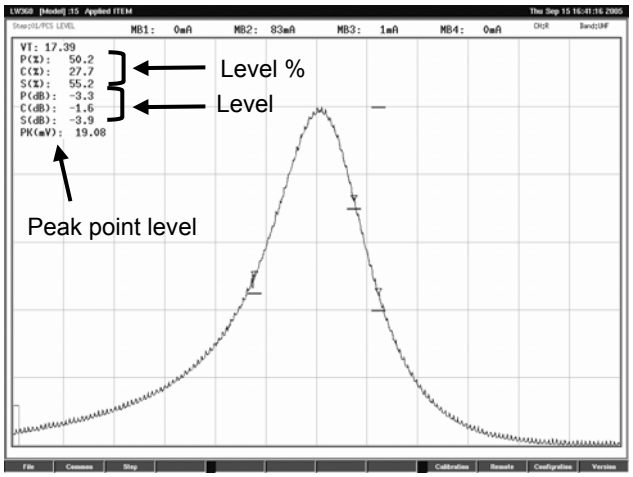
Wave screen

・Values are displayed in units of percentage (%).

・Since LIN Range is set to Auto (ARC), the scale is set to 20%/DIV.

(a) When the peak level is 40 mV

• Note that when a non-linear detector (generally square-law detector) is used, the measurement value depends on the detected level and detector type.

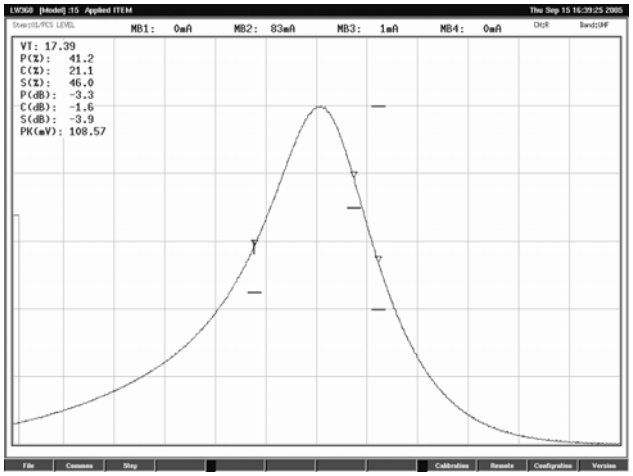


(b) When the peak level is 20 mV

・ Level % measures percentage, Level measures dB, and the peak point level is measured in mV.

・The three waveforms (a), (b), and (c) are displayed when the RF ATT is varied, and the peak level is set approximately to 20 mV, 40 mV, and 100 mV. As shown in the table, the measured values of Level % vary depending on the peak level, but the measured values of Level (dB) do not change.

Item \ Figure	(a)	(b)	(c)
Level at the peak point (mV)	40	20	100
RF_ATT (dB)	55	52	43
Level at point P (%)	46.9	50.2	41.2
Level at point C (%)	24.8	27.7	21.1
Level at point S (%)	51.6	55.2	46.0
Level at point P (dB)	-3.3	-3.3	-3.3
Level at point C (dB)	-1.6	-1.6	-1.6
Level at point S (dB)	-3.9	-3.9	-3.9



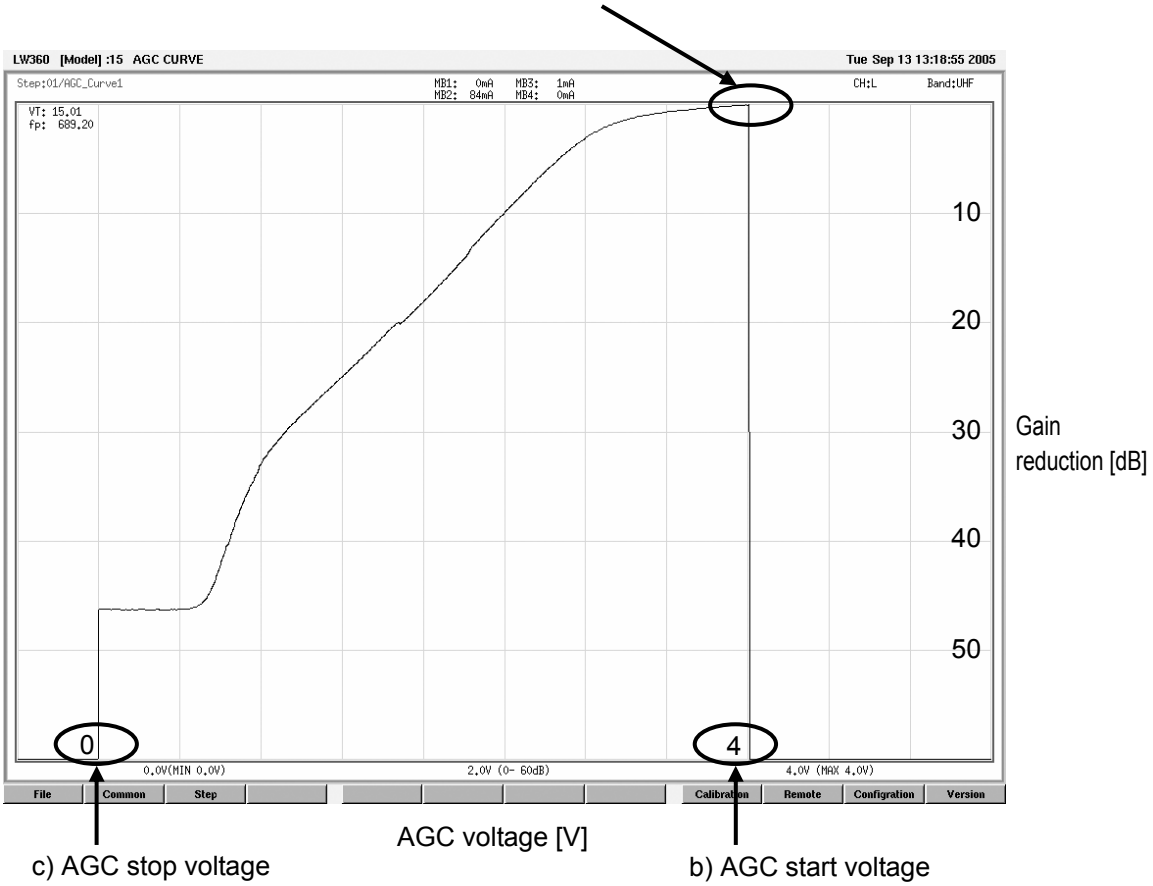
(c) When the peak level is 100 mV

4.5 Applied Measurements

4.5.1 AGC Curve

(1) Description

- This function displays the relationship between the AGC voltage and the power gain of the tuner.
- The range of AGC voltage to be varied can be set arbitrarily.
- The power gain at the AGC start voltage is set to 0 dB.



(2) Settings on the Tuner/Sweep Screen

Tuner / Sweep

Max Sweep 1 | L | M | R

Ch.Comment | Comment 1 | Comment 2 | Comment 3

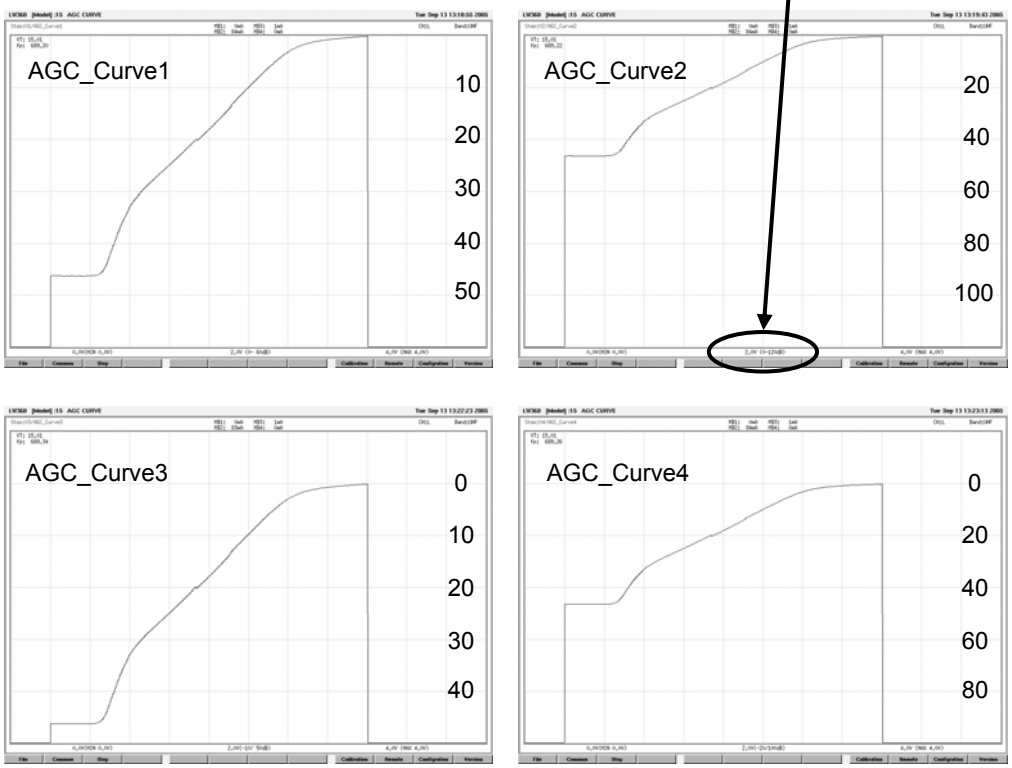
No.	Setting Item	SWP	Common Data	Step Data All	Step Data L	Step Data M	Step Data R
01	VT Mode	A	LCH_VR		LCH_VR_Fix	MCH_VR_Fix	RCH_VR_Fix
02	AGC Mode	A		AGC_Curve1			
03	AGC V	A	4.0	4.0			
04	AGC Red V	A		0.0			
05	Sweep Wait	A		5			
06	VT Wait	A		50			

a)
b)
c)
d)
e)

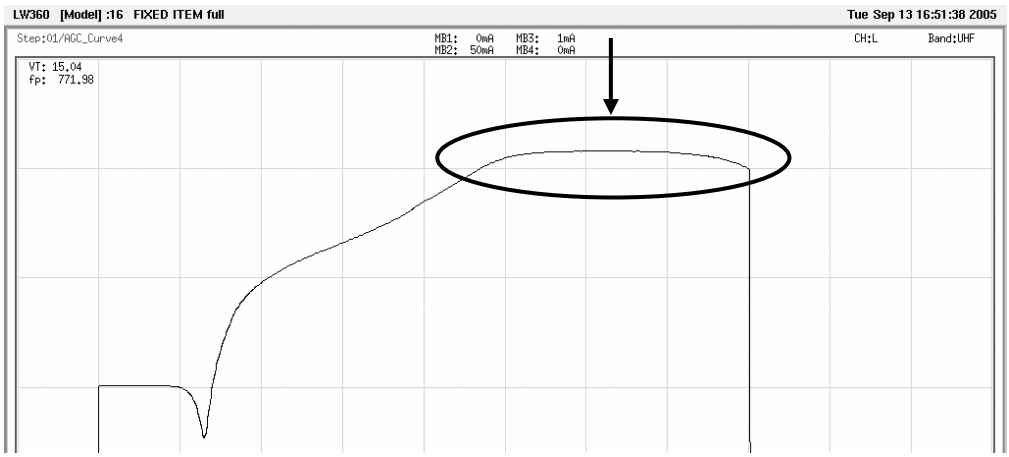
a) AGC Mode

• Select AGC_Curve 1 to 4 according to the gain reduction.

AGC Mode	Vertical Axis Range	Top Edge	Ch.Comment M Display
AGC_Curve1	10 dB/Div	0 dB	0- 60dB
AGC_Curve2	20 dB/Div	0 dB	0-120dB
AGC_Curve3	10 dB/Div	-10 dB	-10/ 50dB
AGC_Curve4	20 dB/Div	-20 dB	-20/100dB



• AGC_Curve 3 and 4 are used when monitoring waveforms whose reduction is on the negative side (gain is on the positive side) as shown below.

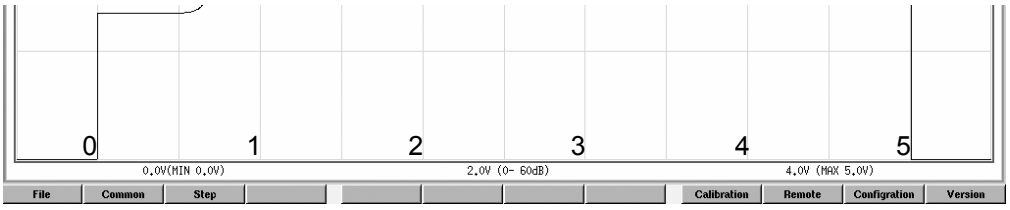


b) AGC V

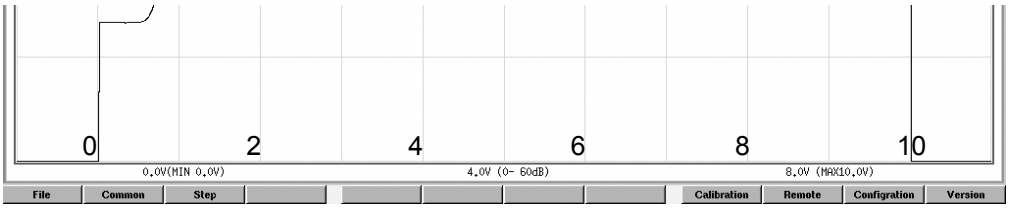
• Set the start voltage for varying the AGC. The AGC voltage scale automatically changes according to the setting as shown below.

AGC V	Horizontal Axis Range	Left Edge
0 to 5.0 V	0.5 V/Div	-0.5 V
5.1 to 10.0 V	1.0 V/Div	-1.0 V
10.1 to 15.0 V	1.5 V/Div	-1.5 V

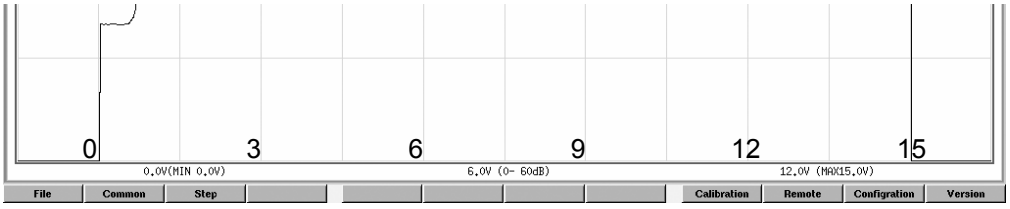
• When AGC V is 5 V



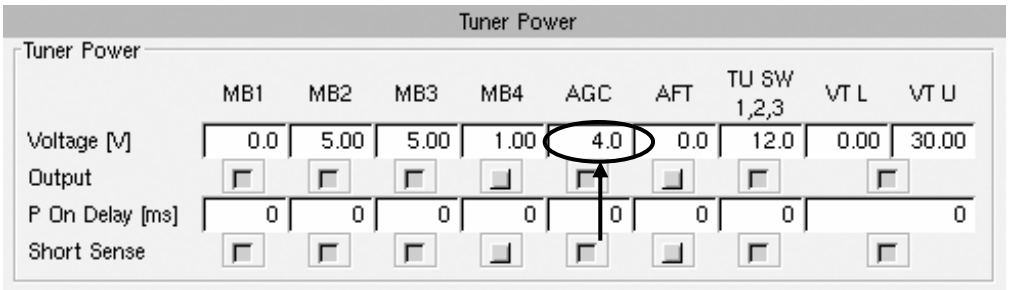
• When AGC V is 10 V



• When AGC V is 15 V



• If AGC V is not specified, it is set to the value specified on the Tuner Power screen (common setting).



c) AGC Red V

• Set the stop voltage for varying the AGC.

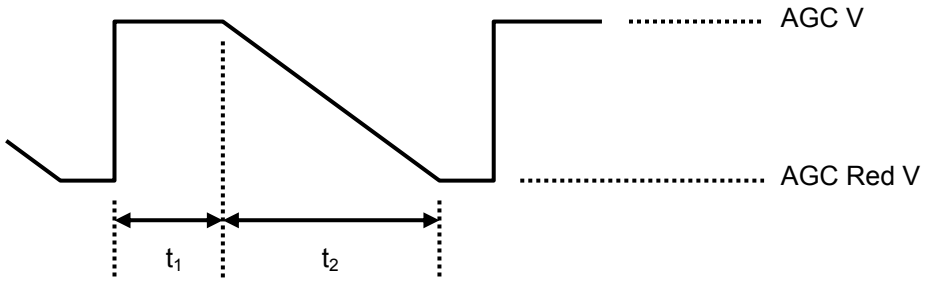
d) Sweep Wait

• Determine the variable speed of the AGC voltage (t_2) using the formula shown below.

• The voltage is changed at a constant interval of 1/10 the specified value.

$$\bullet\ t_2 \fallingdotseq \frac{\text{AGC V - AGC Red V}}{\text{variable voltage pitch}} \times \frac{\text{Sweep Wait}}{10}$$

AGC V	Variable Voltage Pitch
0 to 5.0 V	10 mV
5.1 to 10.0 V	20 mV
10.1 to 15.0 V	30 mV



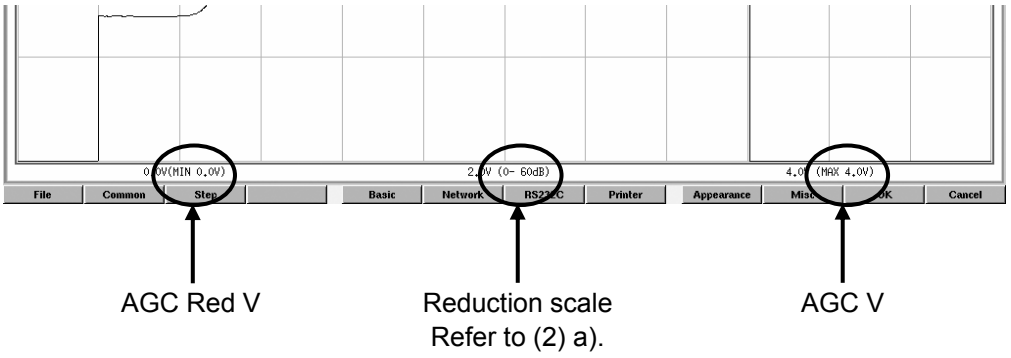
e) VT Wait

• Set the time before changing the AGC voltage (t_1).

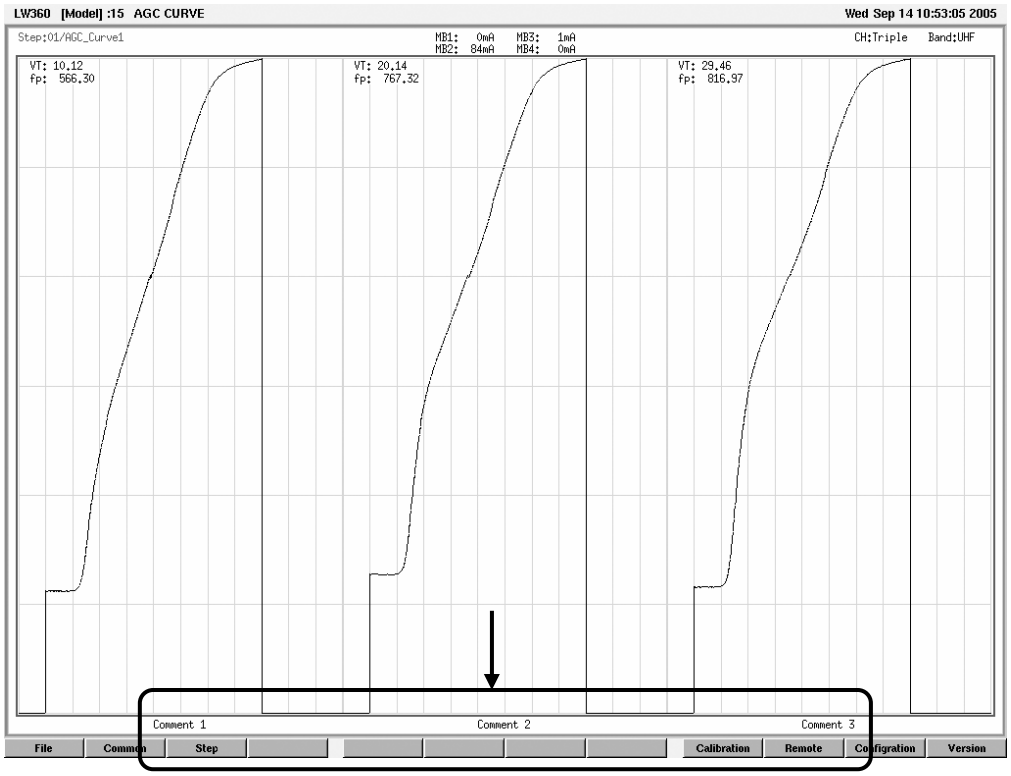
(3) Notes

a) Ch.Comment

• If Ch.Mode is set to Single, the Ch.Comment specified on the Tuner/Sweep screen is not displayed. Instead, the following comment is displayed automatically.



• When Ch.Mode is Dual or Triple, the Ch.Comment specified on the Tuner/Sweep screen is displayed.



b) Waveform

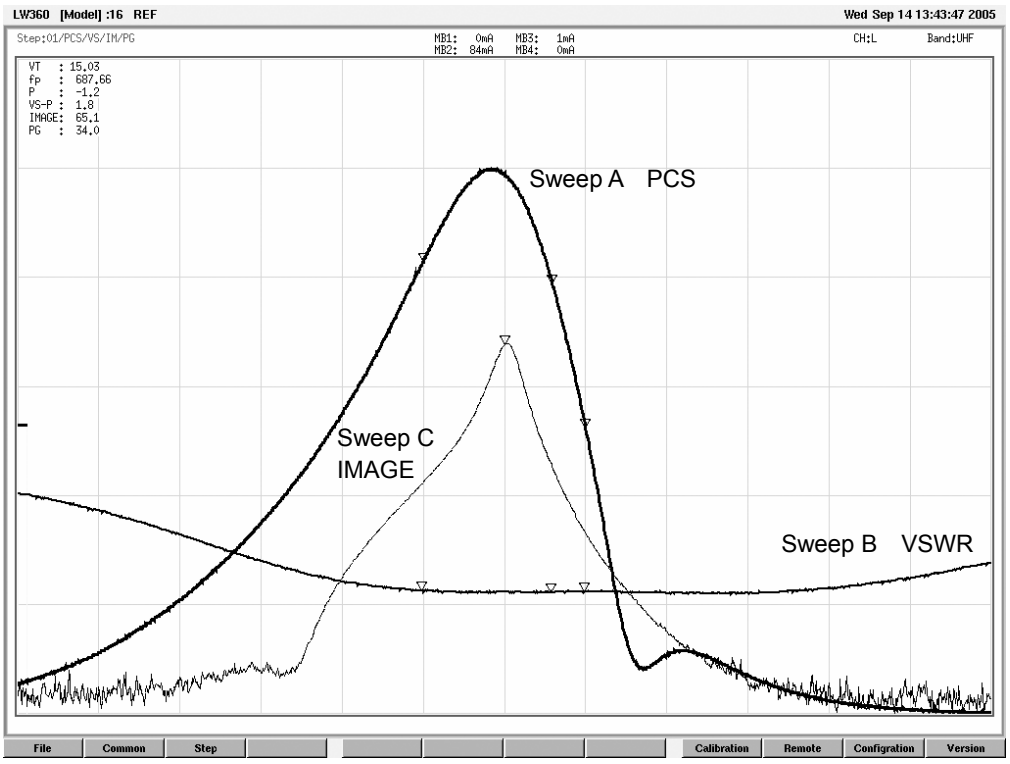
• Because the RF ATT and IF ATT are switched each time the AGC reduction changes by 20 dB, a bump may appear in the waveform due to error.

4.5.2 Measurement Using REF Sweep

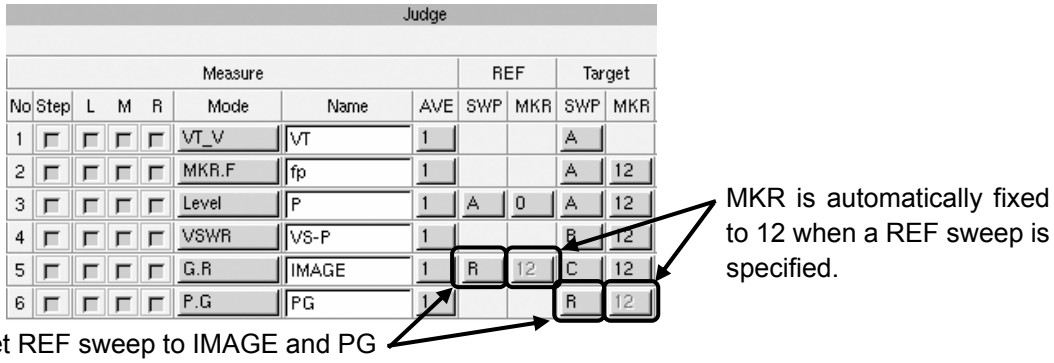
(1) Description

- REF sweep (R sweep) is used to measure the power gain of the tuning marker (Marker No. 12).
- The REF sweep can be added as one sweep to measure the power gain of the reference level for IMAGE, AGC, IF REJ measurements. This REF sweep enables measurements that require four sweeps.
- The REF sweep waveform cannot be displayed.
- As an example, the following measurement is explained.

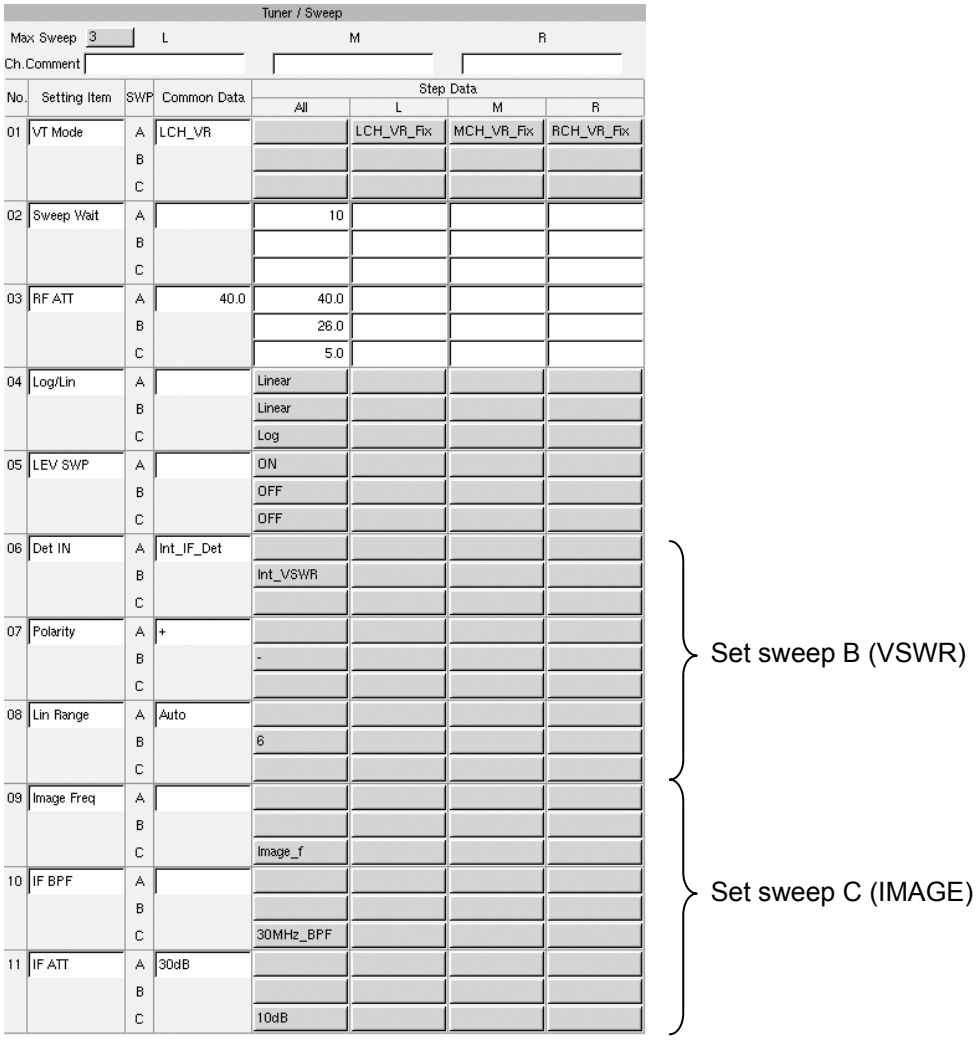
  Sweep A: PCS
  Sweep B: VSWR
  Sweep C: IMAGE
  Sweep R: POWER GAIN (the waveform is not displayed)



(2) Settings on the Judge Screen



(3) Settings on the Tuner/Sweep Screen



(4) Notes

• REF sweep can be specified on the following six measure modes on the Judge screen.

- P.G
- G.R
- Level (valid only in LOG mode)
- S_PGDEV
- A_PGDEV
- M_PGDEV

• The order of precedence of the AGC voltage and RF ATT settings of the REF sweep is shown below.

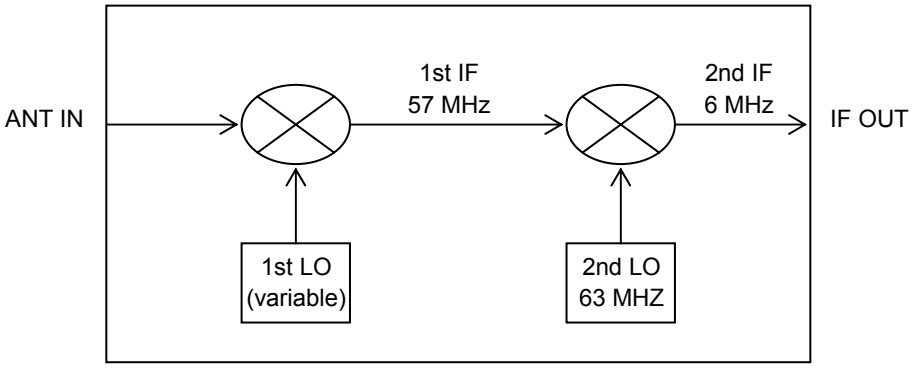
AGC voltage	1	Value specified by AGC Red dB on the Tuner/Sweep screen*
	2	Value specified by AGC_V on the parameter remote function*.
	3	Value specified by AGC on the Tuner Power screen
RF ATT	1	Value specified by RF ATT on the parameter remote function*.
	2	Value specified by RF ATT on the Sweep/Marker screen

∗ The first sweep that enters LOG operation among sweeps A, B, and C.

4.5.3 Measuring Double-Conversion Type Tuners

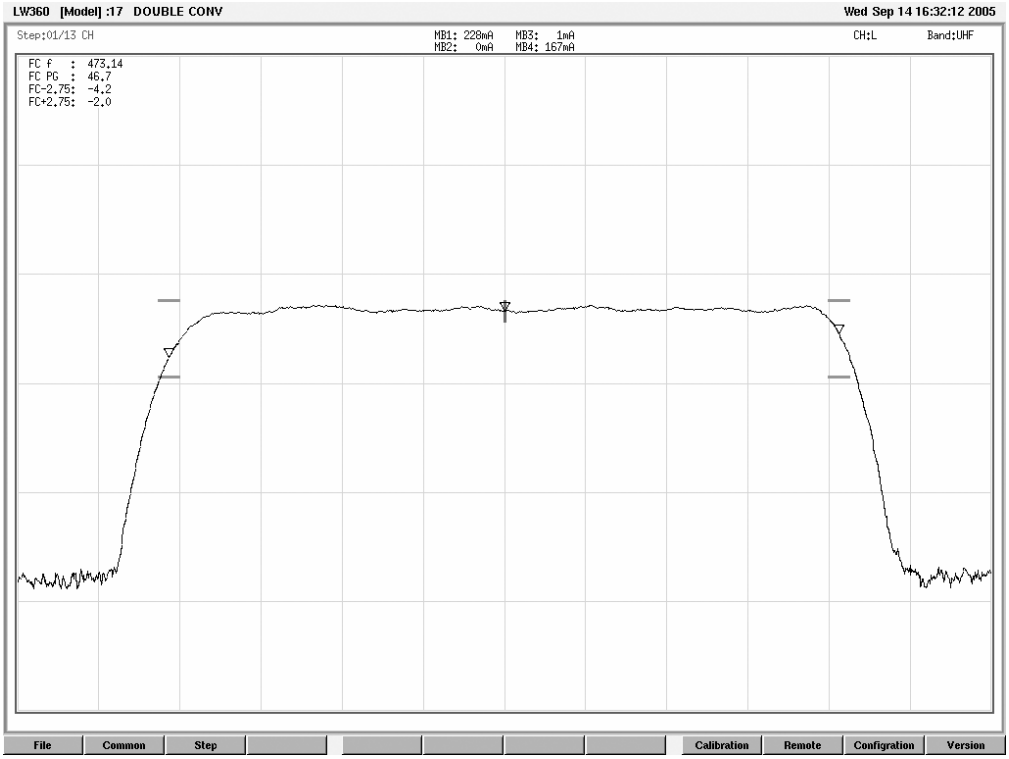
(1) Description

• As an example, this section explains the case when the 2nd IF waveform is measured for a double-conversion type tuner shown below.



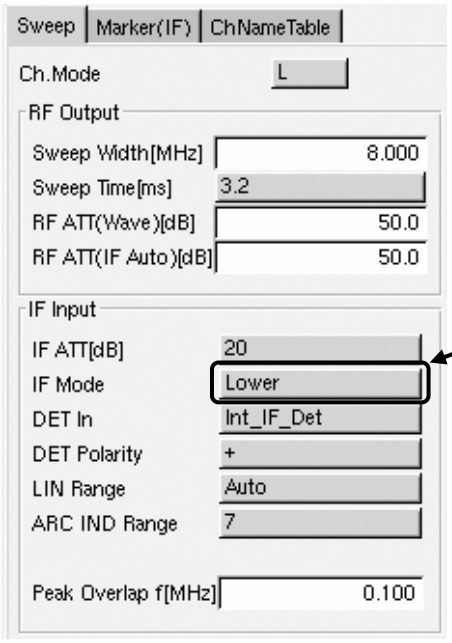
• In this example, channel 13 on a digital tuner is measured.

ANT IN = 473 + 1/7 = 473.143 MHz
1st LO = 530 + 1/7 = 530.143 MHz



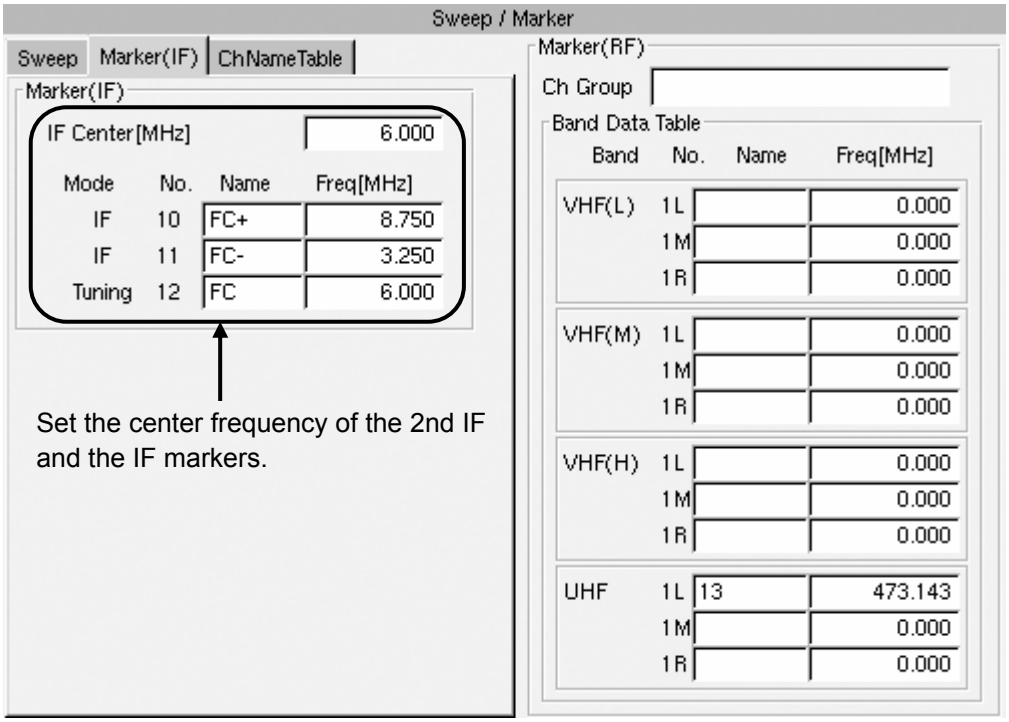
(2) Settings on the Sweep/Marker Screen

a) Sweep Screen



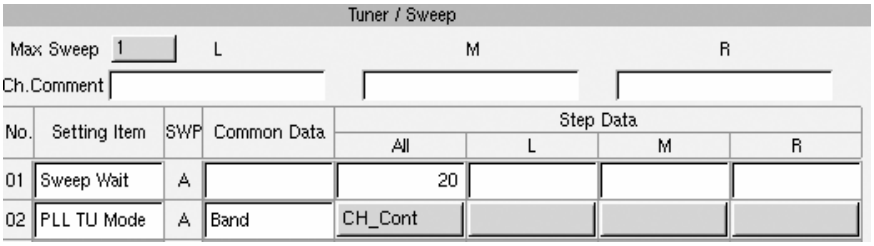
Select Lower, because the frequency direction of ANT IN and IF OUT is the same.

b) Marker Screen



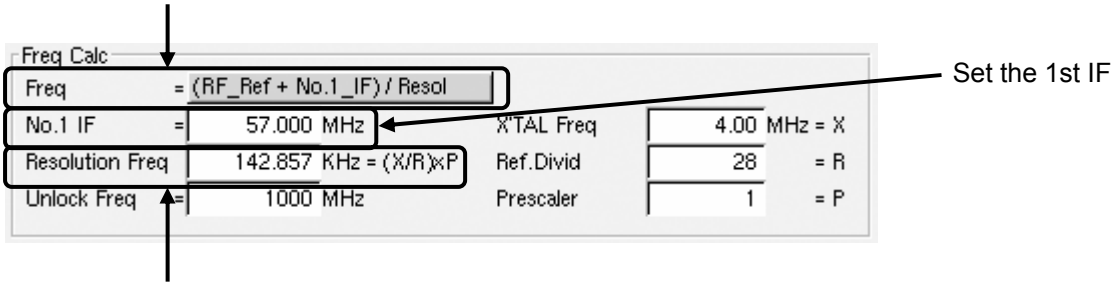
Set the center frequency of the 2nd IF and the IF markers.

(3) Settings on the Tuner/Sweep Screen



(4) Settings on the PLL Screen

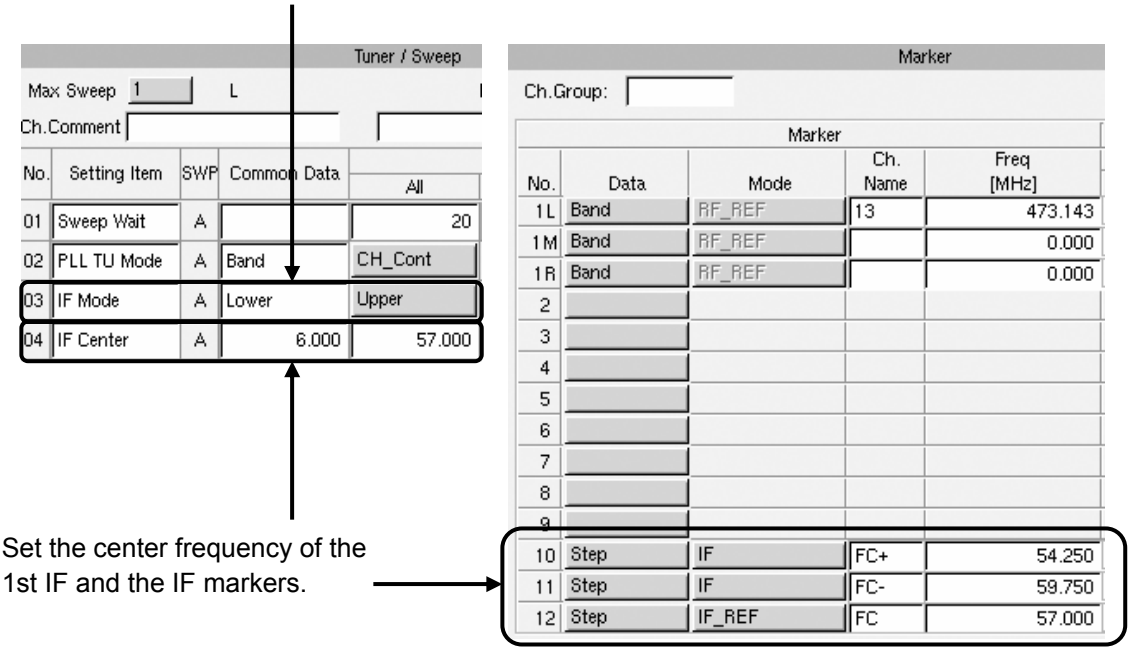
Since you are controlling the frequency of the 1st LO, select (RF_Ref+No.1_IF)/Resol.



• These values are used to automatically calculate Freq which is set to Divider or F of the PLL data.

(5) When Measuring the 1st IF

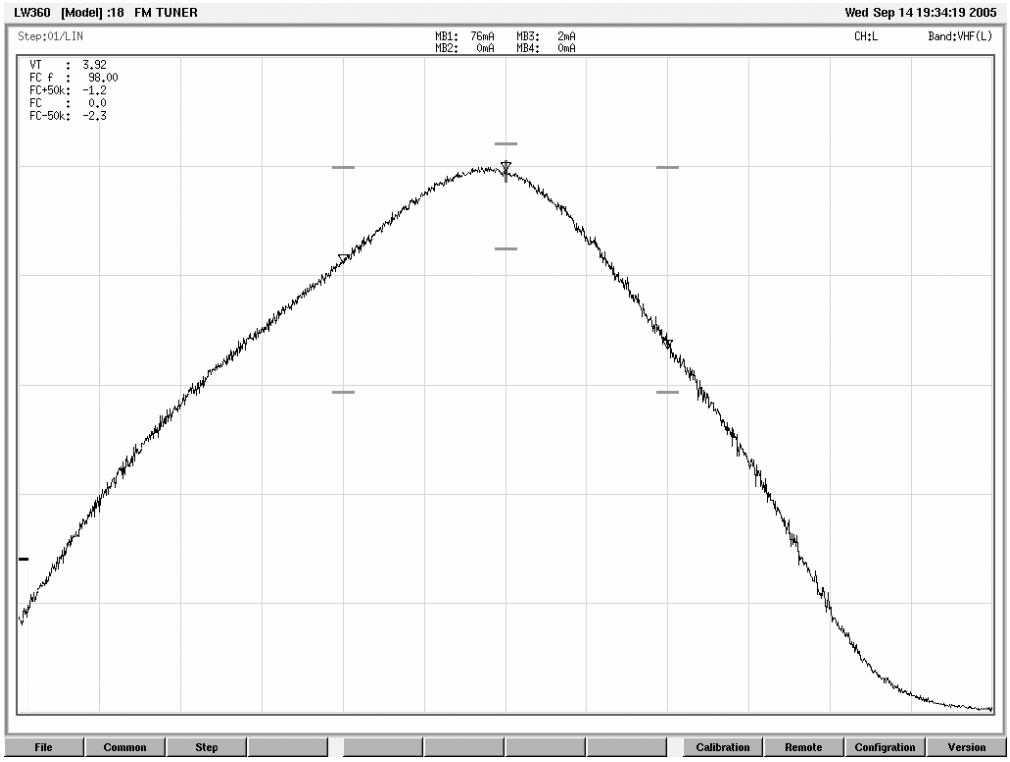
Select Upper, because the frequency direction of ANT IN and IF OUT is opposite.



4.5.4 Measuring an FM Tuner

(1) Description

• This section explains the measurement of an FM tuner.



(2) Settings on the Tuner/Sweep Screen

Tuner / Sweep

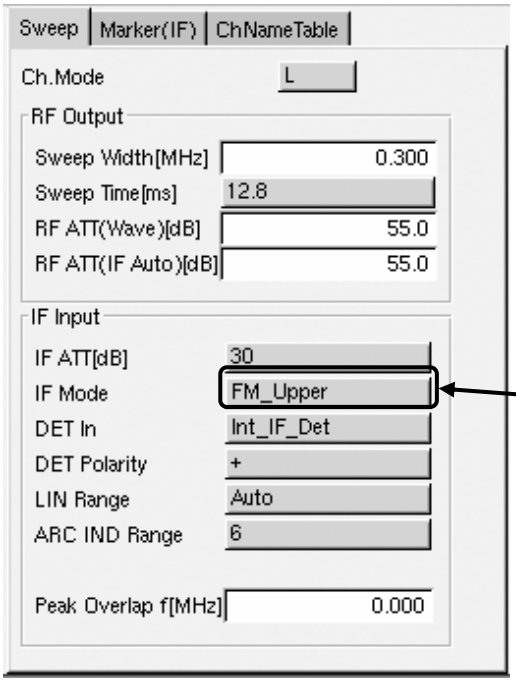
Max Sweep 1 L M R

Ch.Comment

No.	Setting Item	SWP	Common Data	Step Data All	L	M	R
01	Sweep Wait	A		10			
02	PLL TU Mode	A	Band	CH_Cont			
03	Log/Lin	A		Linear			
04	LEV SWP	A		ON			

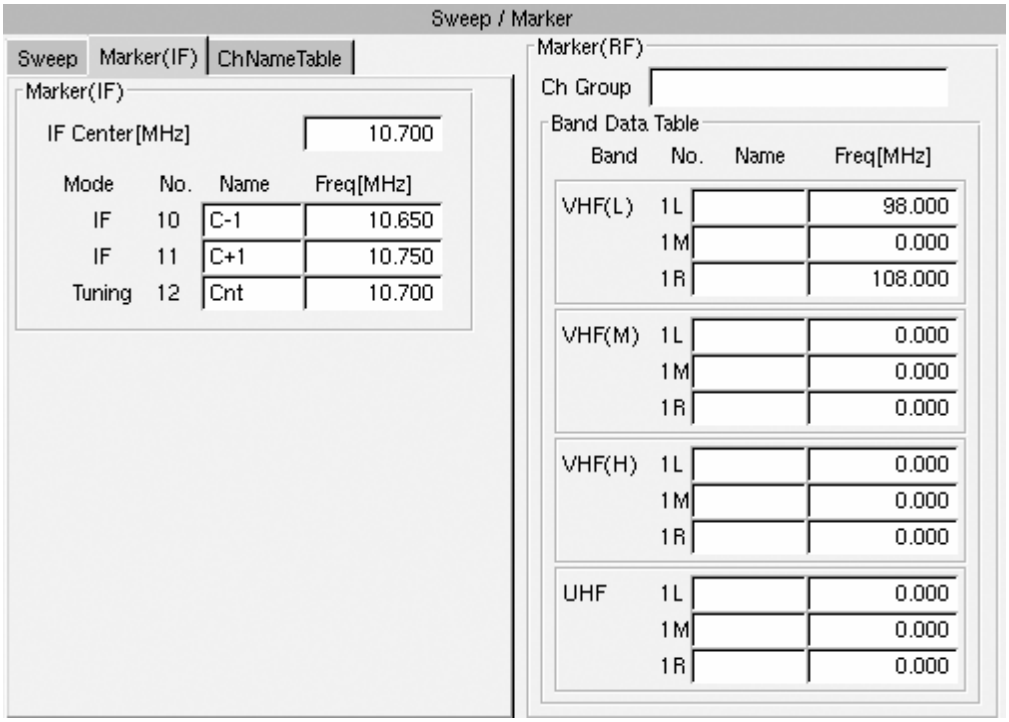
(3) Settings on the Sweep/Marker Screen

a) Sweep Screen



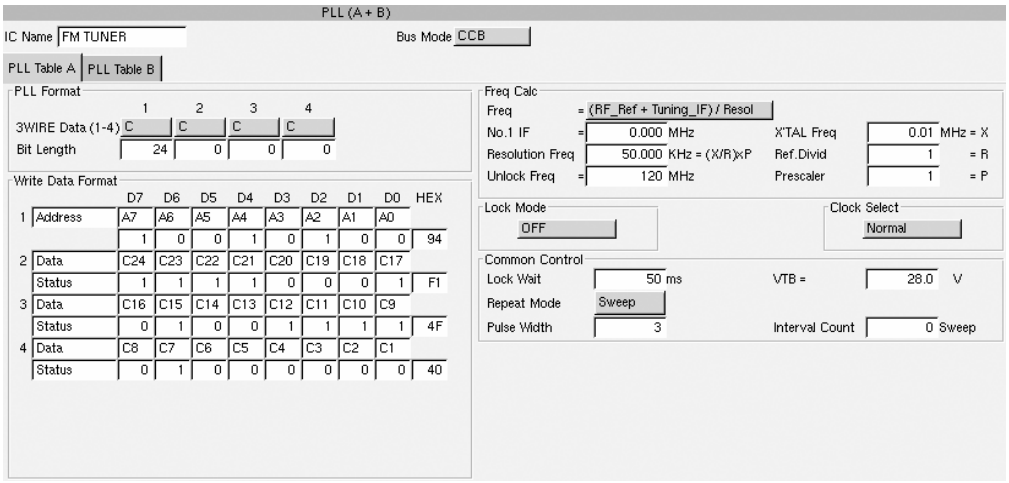
Select FM_Upper or FM_Lower when measuring an FM tuner.

b) Marker Screen

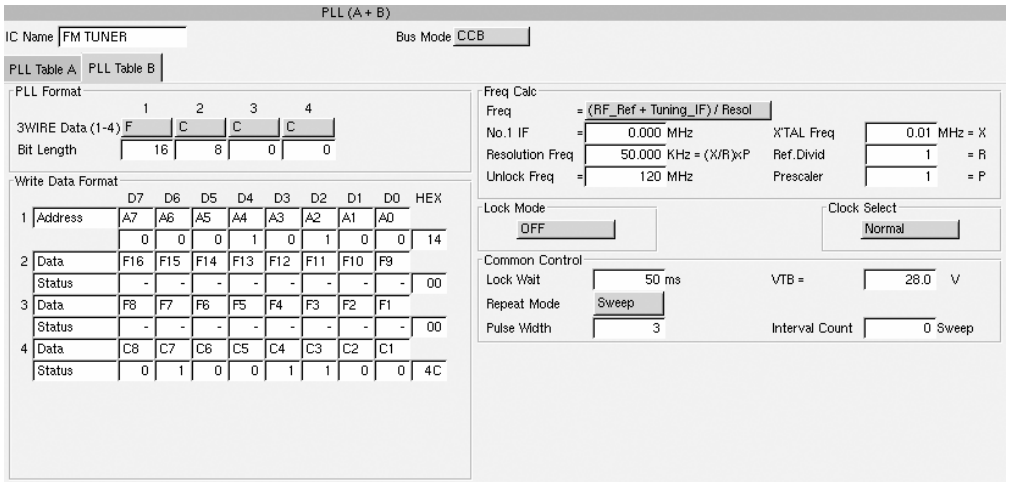


(4) Settings on the PLL Screen

a) PLL Table A Screen



b) PLL Table B Screen



4.5.5 Gain Deviation Measurement

(1) Description

• This section explains the six measurement modes below that measures the gain deviation.

Mode	Log / Lin	Measurement Item	Measurement Range	Max Hold	Remarks
S_PGDEV	Log	PG	Within step	Yes	
A_PGDEV	Log	PG	Between steps	Yes	
SLINDEV	Lin	Lin_LEV	Within step	Yes	
ALINDEV	Lin	Lin_LEV	Between steps	Yes	
M_PGDEV	Log	PG	Within step	No	With respect to Mch
MLINDEV	Lin	Lin_LEV	Within step	No	With respect to Mch

a) Log/Lin and Measurement Item

• There are two types of deviation measurement, Power Gain (Log) and Lin Level (Lin). The Lin Level measurement displays the input level by converting into dB. Perform linear calibration before making measurements. For details, refer to (2).

b) Measurement Range

• Within step mode measures the deviation within a single step such as between L, M, and R.
Since M_PGDEV and MLINDEV measure the deviation of Lch and Rch with respect to Mch, they are measured only in Triple mode.
For details, refer to (3).

• Between steps mode measures the deviation between step each time a step is transmitted.
For details, refer to (4).

c) Max Hold

• Items marked as Yes hold the deviation that is measured. The measured value can be reset using INC or DEC of step for within step measurement and the PROTECTOR OFF key on the remote controller or the Tuner Set Sensor for between step measurement.

(2) Linear Cal

• Linear calibration is carried out in order to convert the input level to dB and display the measured value in dB when measuring the Lin Level deviation.

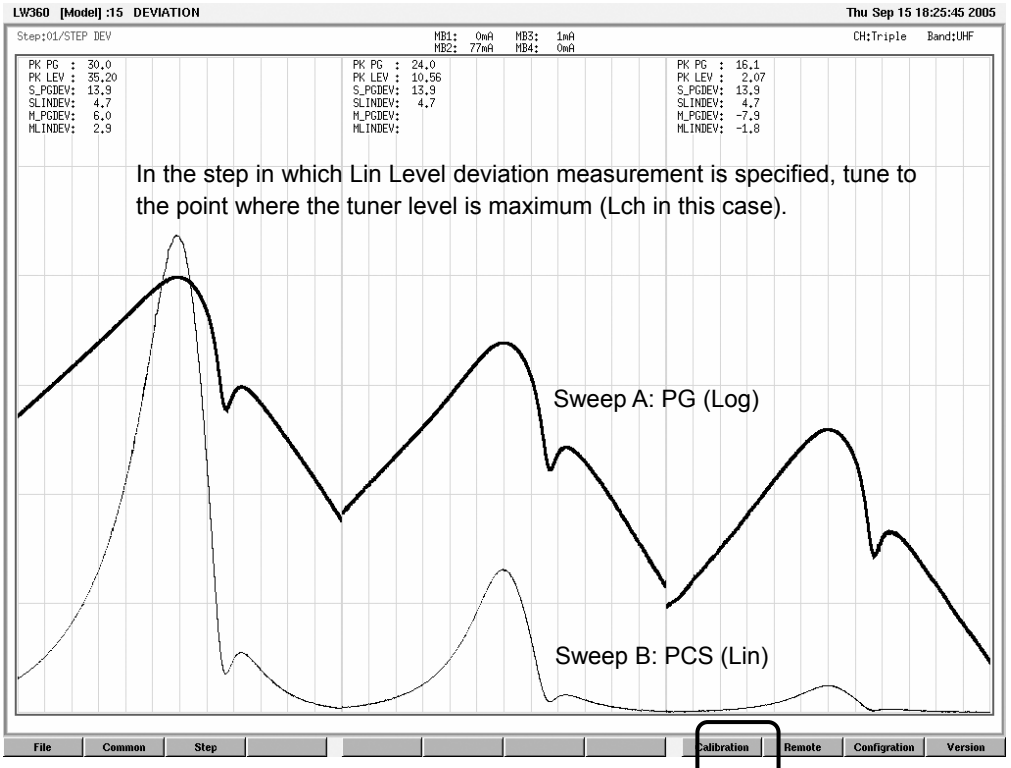
• Linear calibration is carried out at the maximum level of the tuner under test. Calibration is carried out in the +2 dB to -20 dB range with respect to this reference, and this range is the measurement range.

• In a multi-sweep step, linear calibration is carried out at the first sweep in which Lin Level deviation measurement is specified in the following order: Lch A, B, C, Mch A, B, C, Rch A, B, and C.

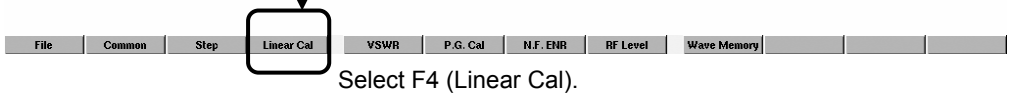
• Carry out calibration as needed when the tuner type, jig, detector, cable, or the main unit is replaced. In addition, calibrate periodically when using the system in the same setup over an extended period.

• One set of calibration values are stored in the LW 360.

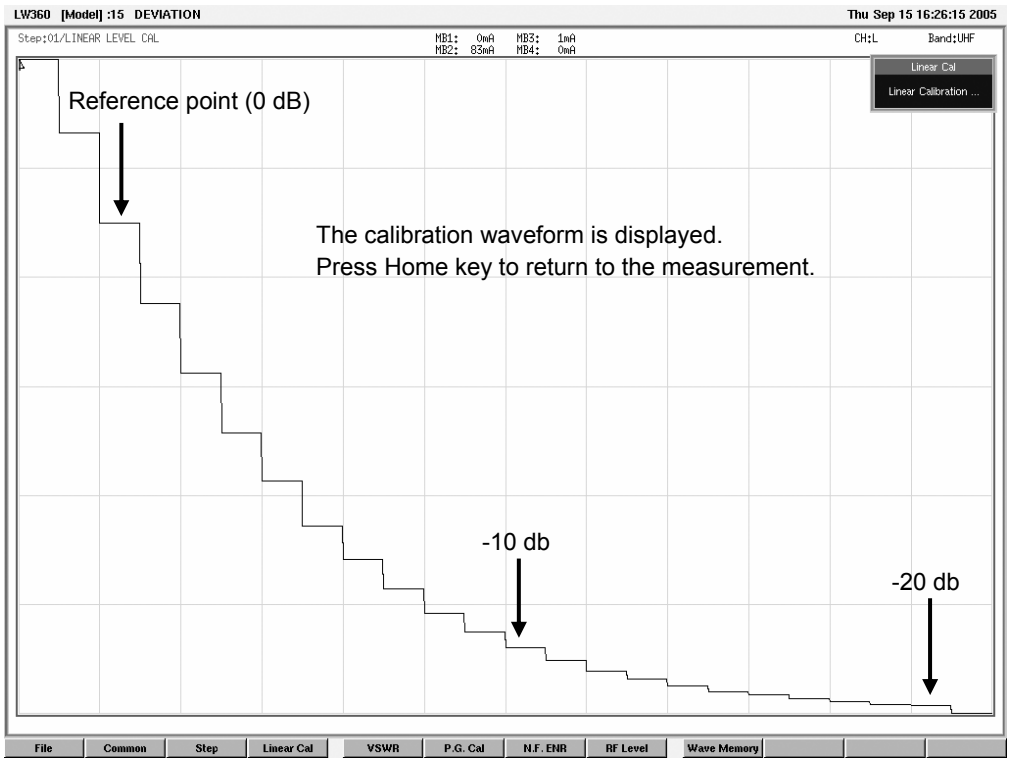
• The linear calibration procedure is given below.



Select F9 (Calibration).



Select F4 (Linear Cal).

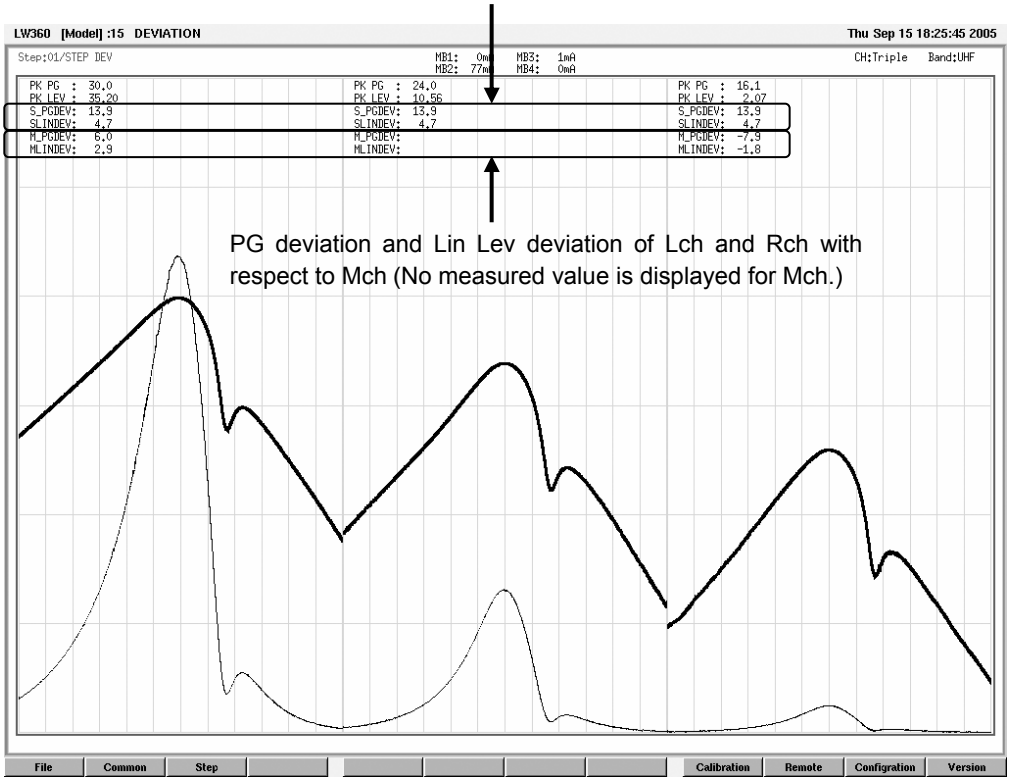


(3) Deviation Measurement within a Step

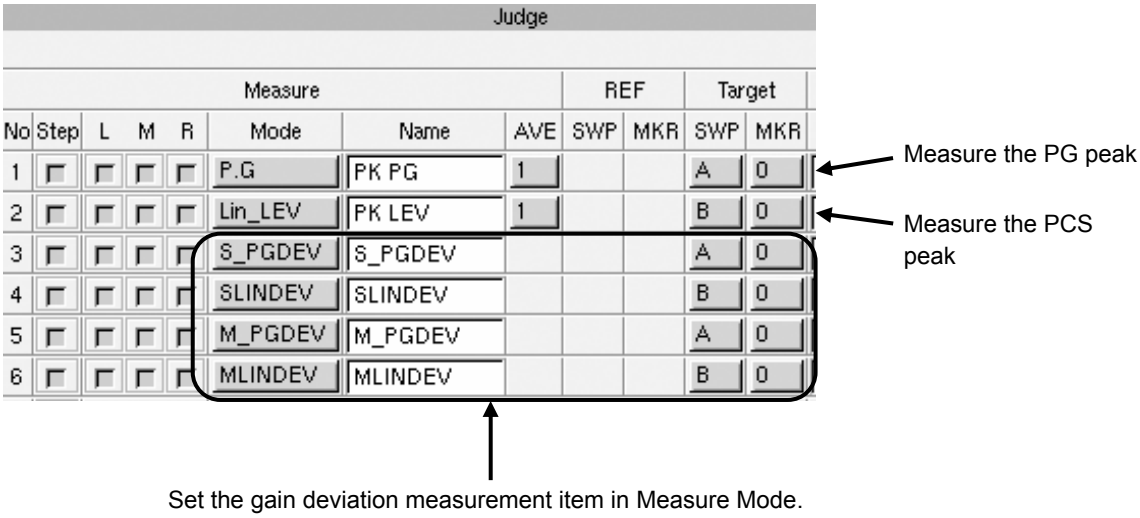
• Measure the linear deviation after carrying out linear calibration. The measured values are converted to dB and displayed.

a) Waveform

PG deviation and Lin Lev deviation for Lch, Mch, and Rch



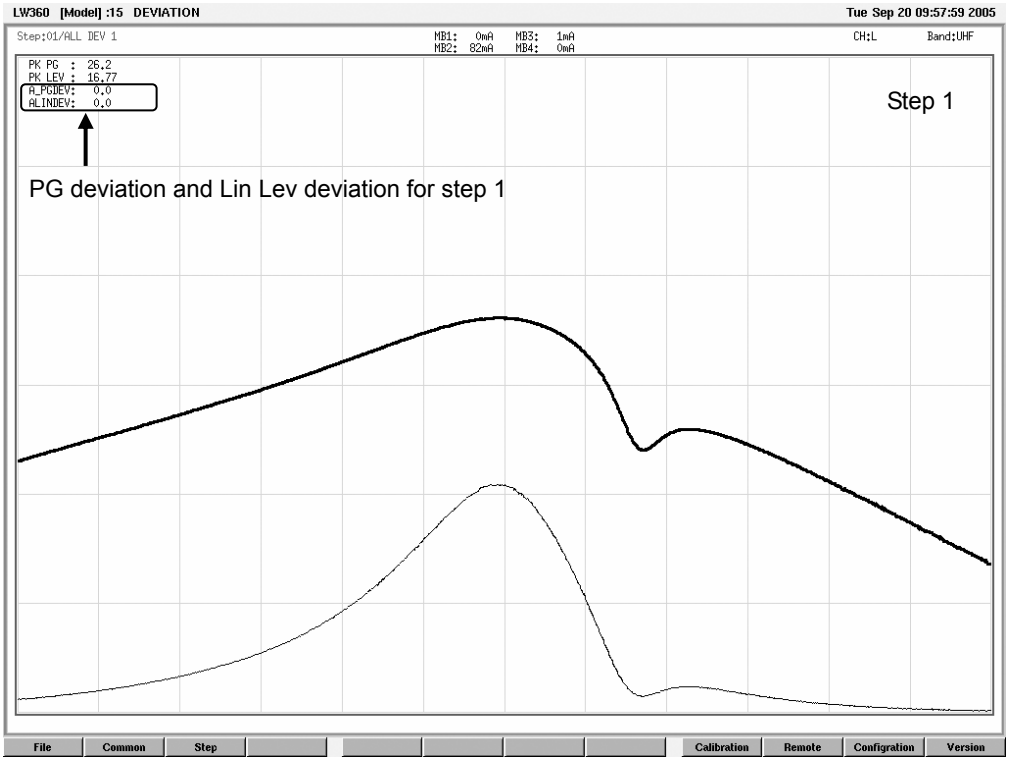
b) Settings on the Judge Screen

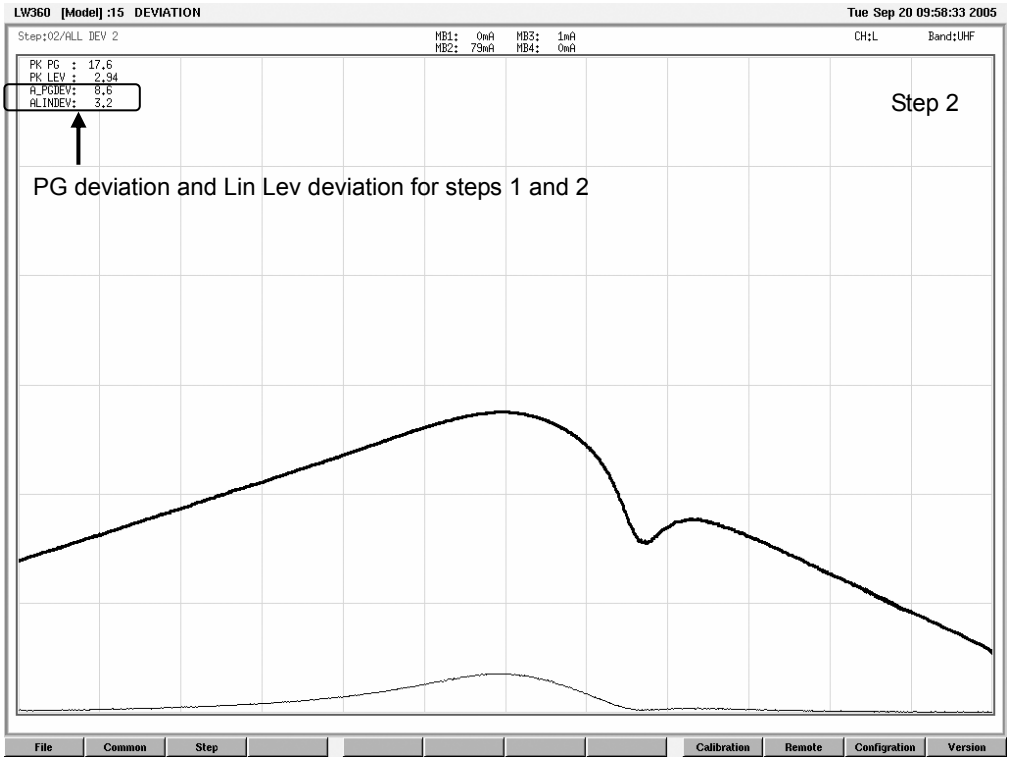


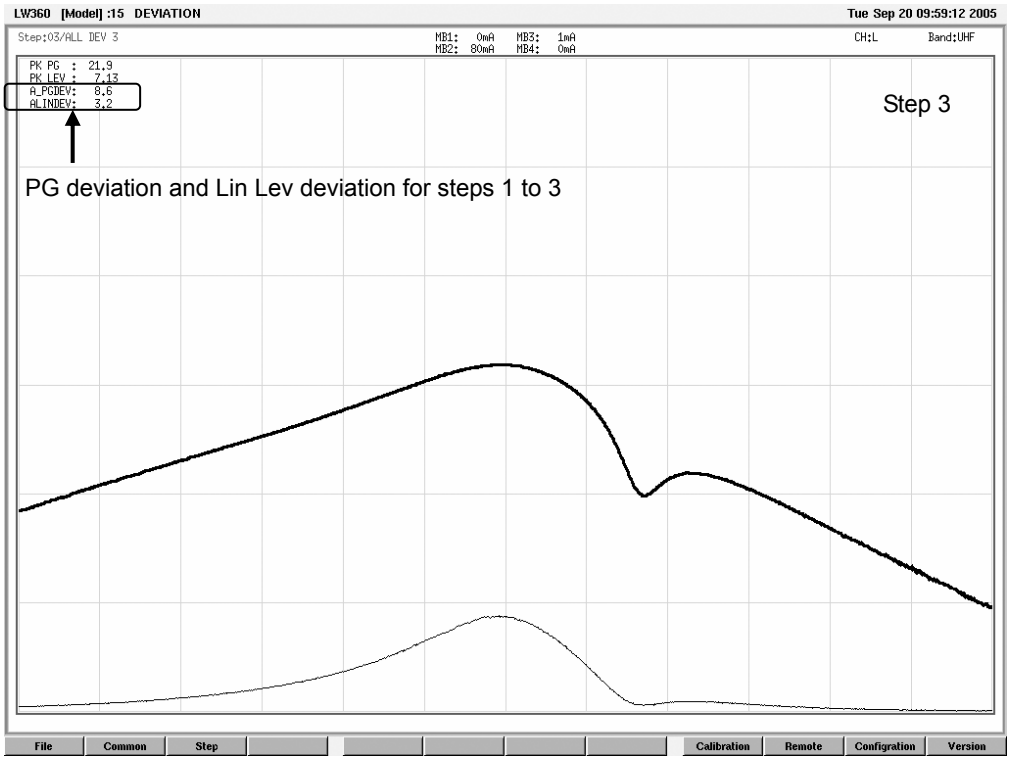
(4) Deviation Measurement between Steps

- Measure the linear deviation after carrying out linear calibration. The measured values are converted to dB and displayed.
- Each time a step is transmitted, the deviation between the steps up to that point can be measured.
- Reset the measured value using the PROTECTOR OFF key on the remote controller or Tuner Set Sensor.

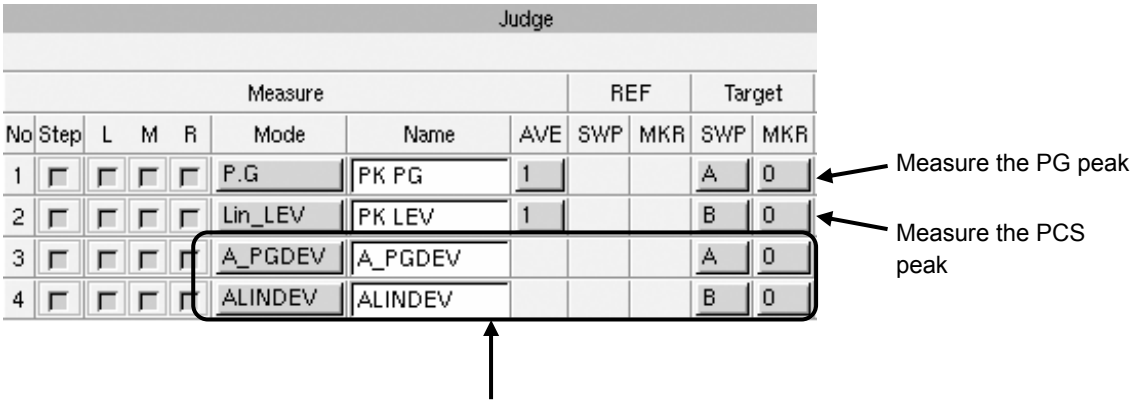
a) Waveform





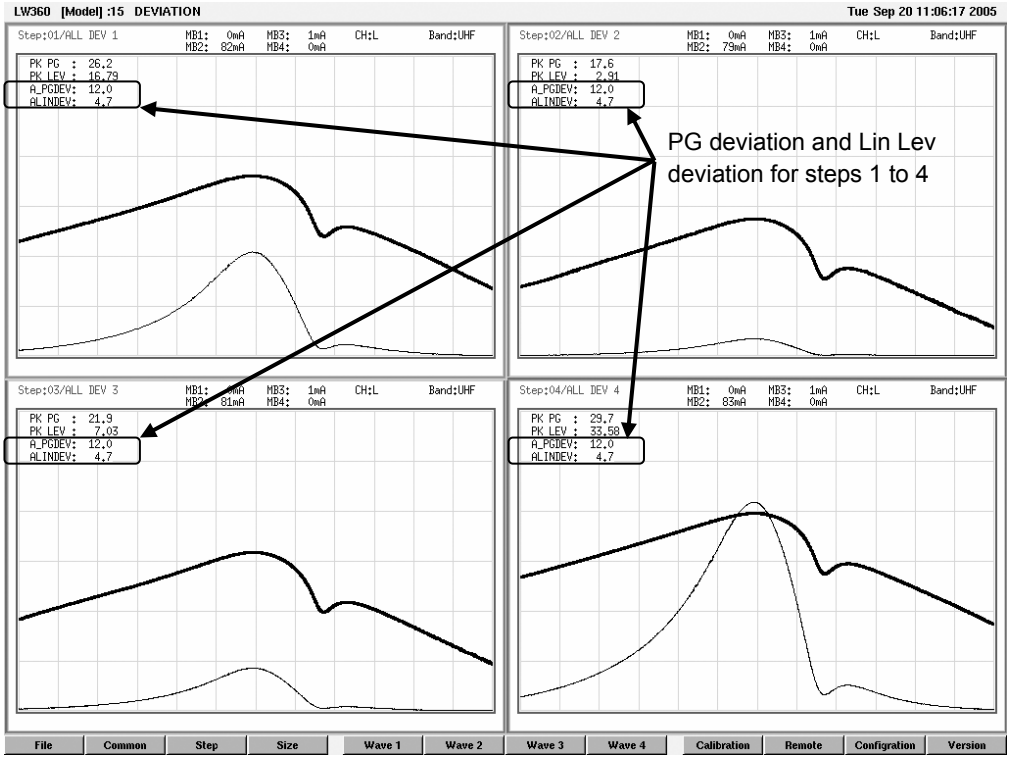


b) Settings on the Judge Screen

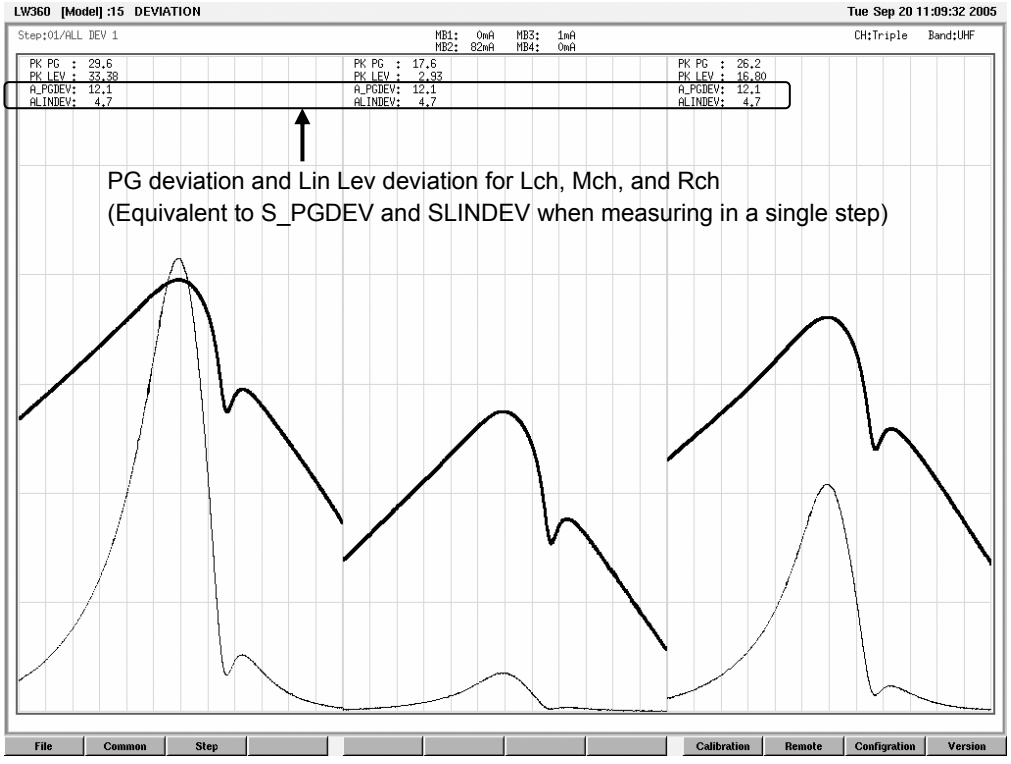


c) Notes

• On the Quad display, the difference between the maximum level and minimum level is displayed between the steps in which the gain deviation is specified. (In the figure below, the difference between step 2 and step 4 is displayed.)



• On the triple display, the difference between the maximum level and minimum level is displayed between the channels in which the gain deviation is specified. (In the figure below, the difference between Lch and Mch is displayed.)



4.5.6 Automatic Measurement

(1) Description

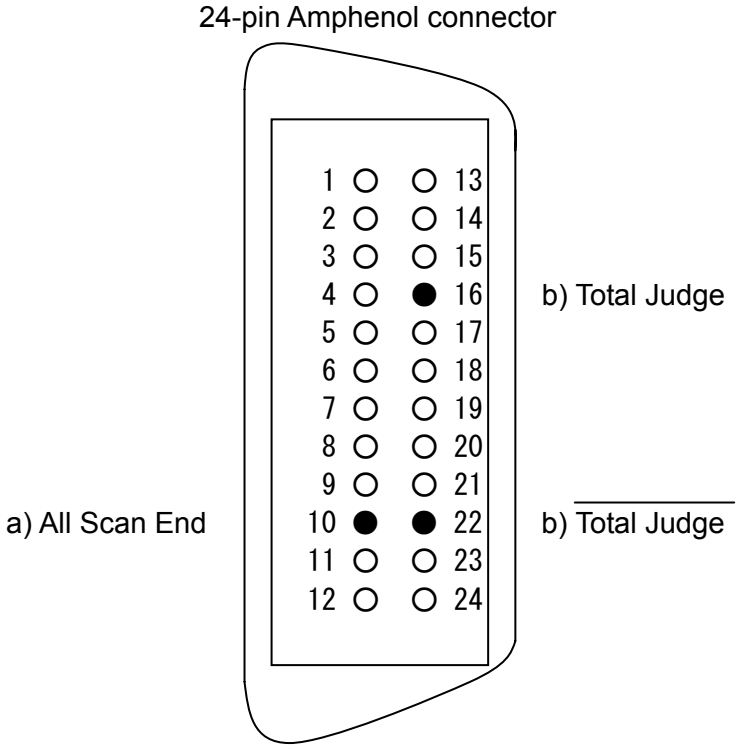
• This section describes the All Scan End and Total Judge pins of the Tuner Power connector on the rear panel.

a) All Scan End

• All Scan is Busy signal that is set to high level from the start to the end of the All Scan measurement.

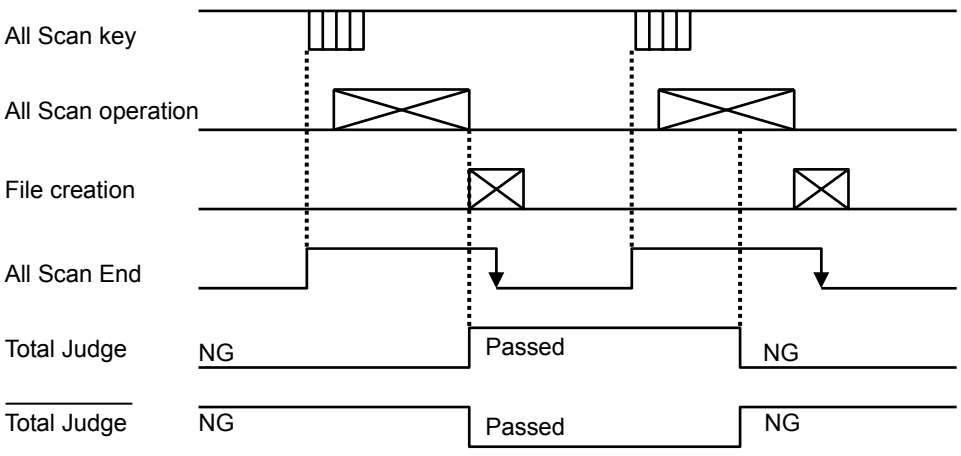
b) Total Judge

• Outputs the judgement result of All Scan. The pin is set to high level when the judgement is “Passed” and low level at the step in which the judgement is NG. This level is maintained until the judgement result of the next All Scan measurement.



(2) Timing Chart

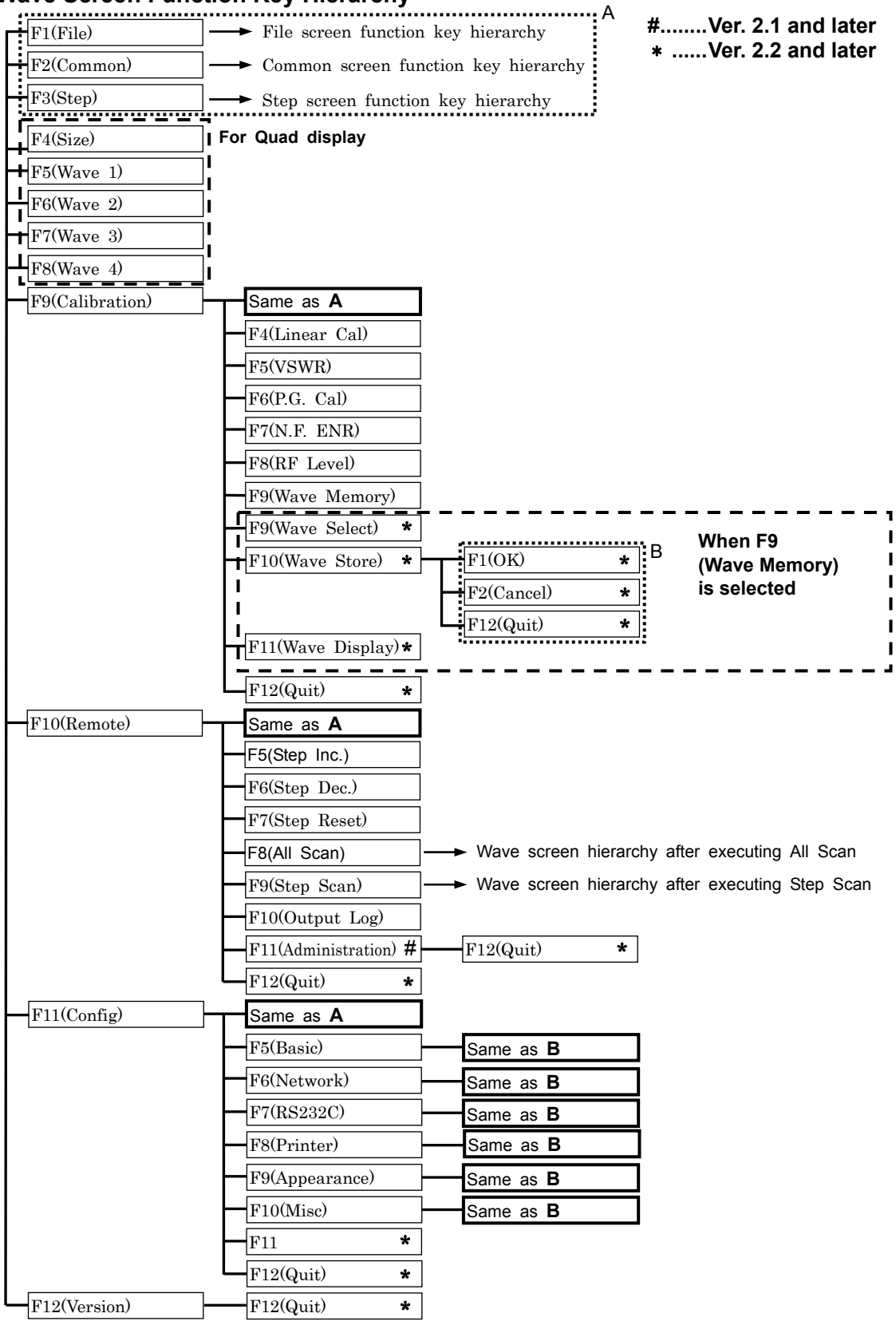
• Below is the timing chart when the result of the All Scan changes from “Passed” to NG.



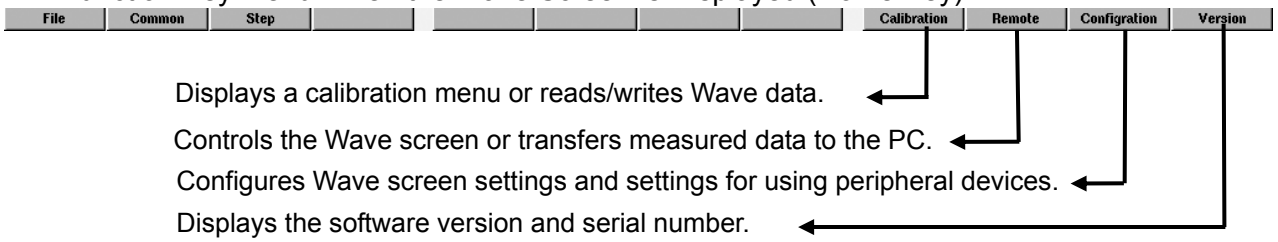
5. SCREEN CONFIGURATION AND EDIT

5.1 Wave screen

5.1.1 Wave Screen Function Key Hierarchy

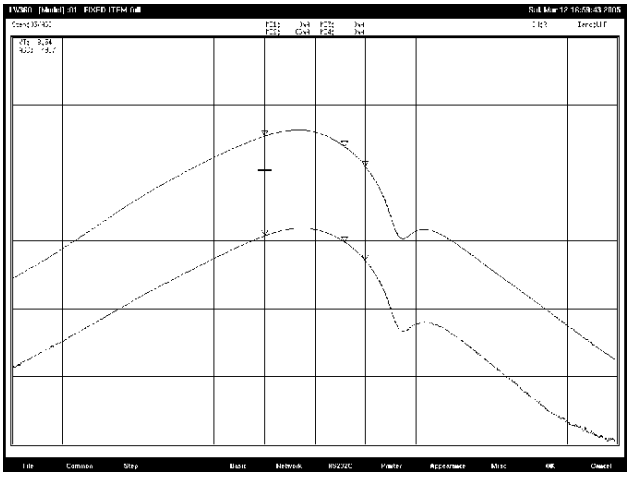


Function Key Menu When the Wave Screen Is Displayed (Home Key)



5.1.2 Full Screen Display

• The Wave screen can be displayed in full screen or quad screen.
Full screen displays the Wave screen on the entire screen.

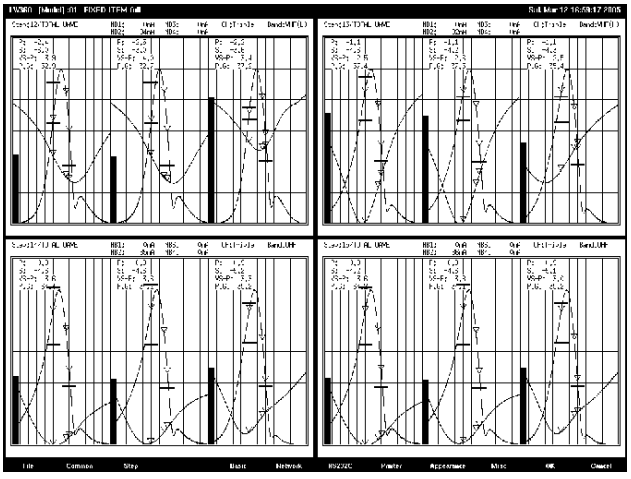


Full screen display

5.1.3 Quad Screen Display

• The quad screen displays four steps simultaneously.
• On the Wave screen, three channels, L, M, and R, can be displayed simultaneously for each step.
• Thus, when the quad screen is used, up to 12 channels can be displayed simultaneously.
• If a band is specified for each step, all bands can be displayed simultaneously.
• This function is useful for collecting data in design and quality assurance departments.

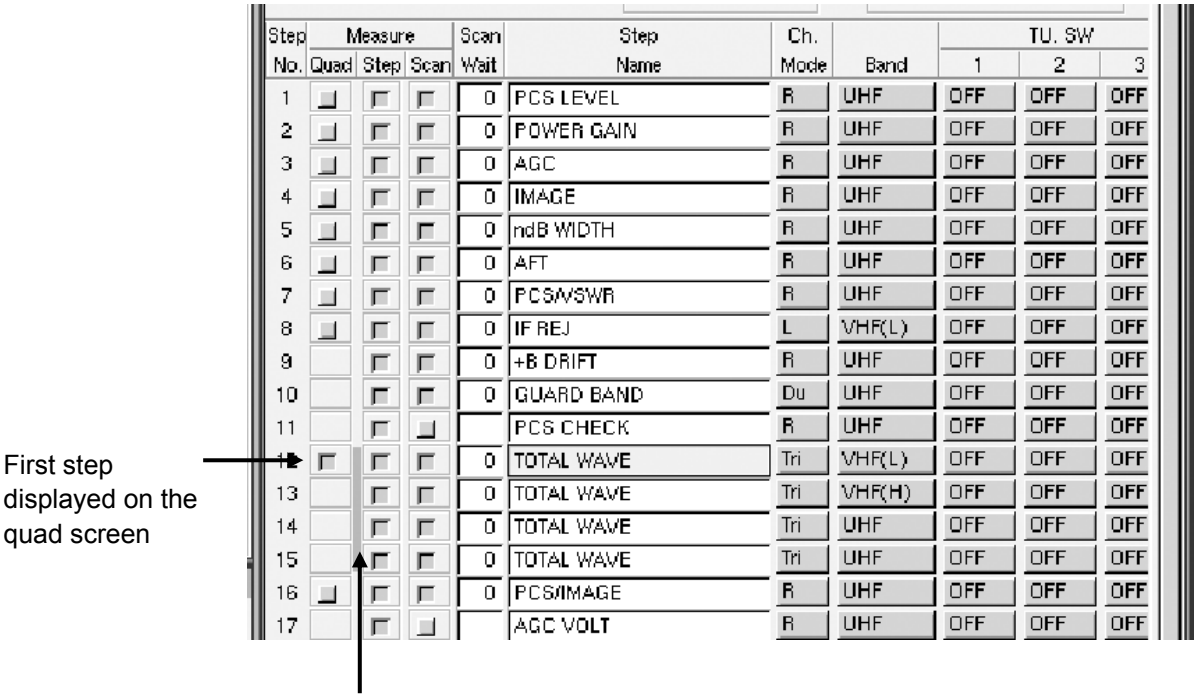
(1) Screen Display



Quad screen display

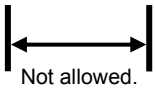
(2) Setting the Quad Screen Display

- Press F2 (Common) followed by F8 (Step.All). You can also click the function keys with the mouse.
- On the Step All screen, move the cursor to the check box of the first step you want to display on the quad screen under Measure → Quad and press the Space or Enter key. You can also click the check box with the mouse.
- Press Home key to simultaneously display the four steps from the selected step.



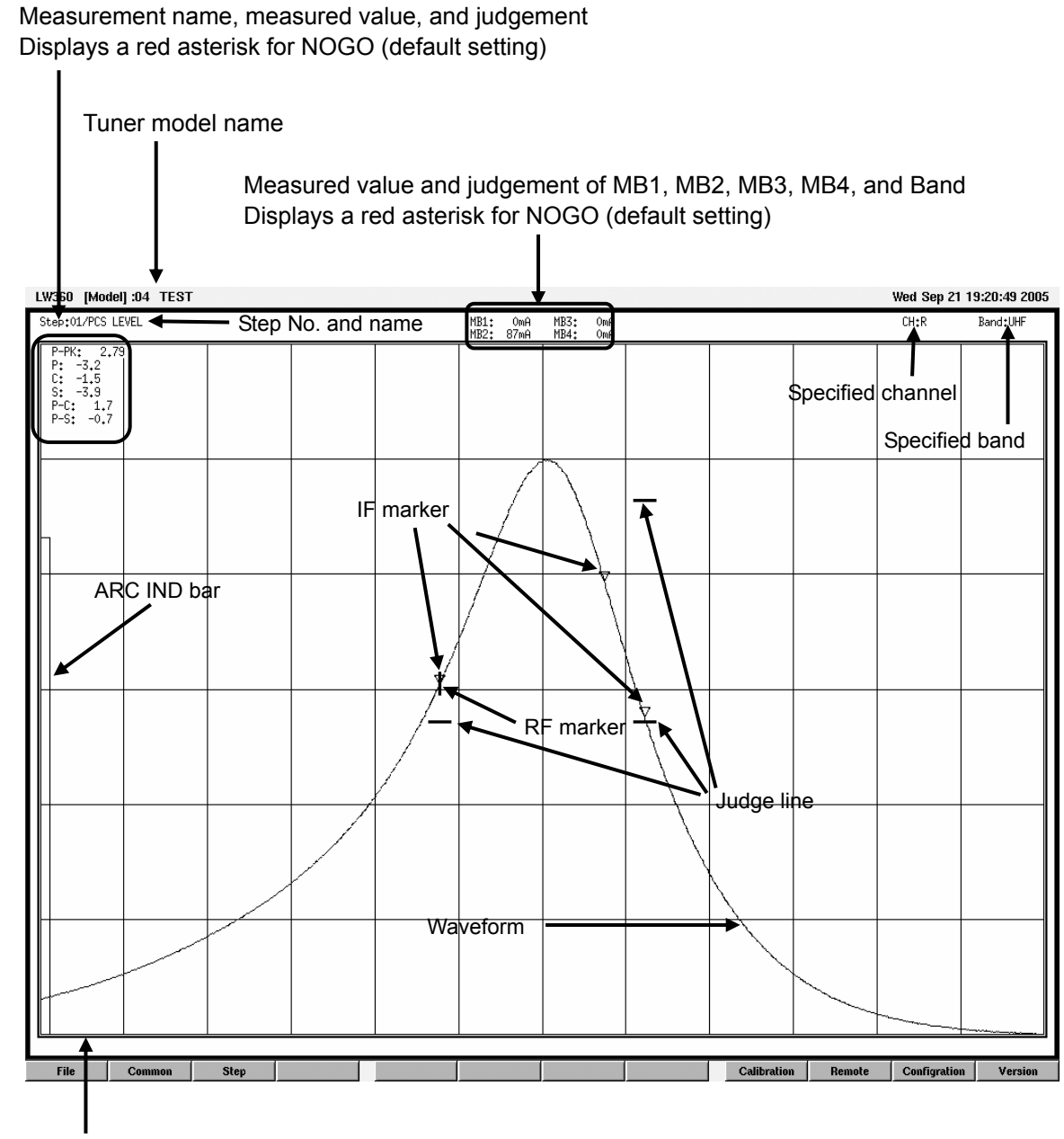
Step No.	Measure Quad	Measure Step	Measure Scan	Scan Wait	Step Name	Ch. Mode	Band	TU. SW 1	TU. SW 2	TU. SW 3
1	☑	☐	☐	0	PCS LEVEL	R	UHF	OFF	OFF	OFF
2	☑	☐	☐	0	POWER GAIN	R	UHF	OFF	OFF	OFF
3	☑	☐	☐	0	AGC	R	UHF	OFF	OFF	OFF
4	☑	☐	☐	0	IMAGE	R	UHF	OFF	OFF	OFF
5	☑	☐	☐	0	ndB WIDTH	R	UHF	OFF	OFF	OFF
6	☑	☐	☐	0	AFT	R	UHF	OFF	OFF	OFF
7	☑	☐	☐	0	PCS/VSWR	R	UHF	OFF	OFF	OFF
8	☑	☐	☐	0	IF REJ	L	VHF(L)	OFF	OFF	OFF
9	☐	☐	☐	0	+B DRIFT	R	UHF	OFF	OFF	OFF
10	☐	☐	☐	0	GUARD BAND	Du	UHF	OFF	OFF	OFF
11	☐	☐	☑		PCS CHECK	R	UHF	OFF	OFF	OFF
12	☑	☐	☐	0	TOTAL WAVE	Tri	VHF(L)	OFF	OFF	OFF
13	☐	☐	☐	0	TOTAL WAVE	Tri	VHF(H)	OFF	OFF	OFF
14	☐	☐	☐	0	TOTAL WAVE	Tri	UHF	OFF	OFF	OFF
15	☐	☐	☐	0	TOTAL WAVE	Tri	UHF	OFF	OFF	OFF
16	☑	☐	☐	0	PCS/IMAGE	R	UHF	OFF	OFF	OFF
17	☐	☐	☑		AGC VOLT	R	UHF	OFF	OFF	OFF

∗ The four steps must be consecutive in order for them to be displayed on the quad screen.
In addition, a step cannot be overlapped in different quad screen displays.
Example) Step No.2--No.3--No.4--No.5
No.4--No.5--No.6--No.7



5.1.4 Screen Display

(1) Wave Screen Configuration

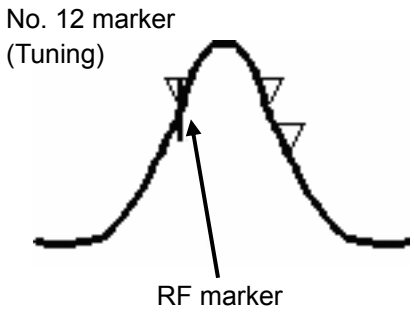


Outer frame indicates the total judgement for a step

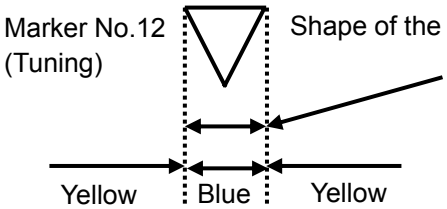
- GO: Green
- NOGO: Red
- During tuner power output OFF: White

(2) RF Marker Color Display

• The RF marker color is set to yellow by default (selectable), but it changes to blue (selectable since Ver. 2.2 and later) when it overlaps with the IF marker No. 12 (tuning).



• Range over which the RF marker turns blue

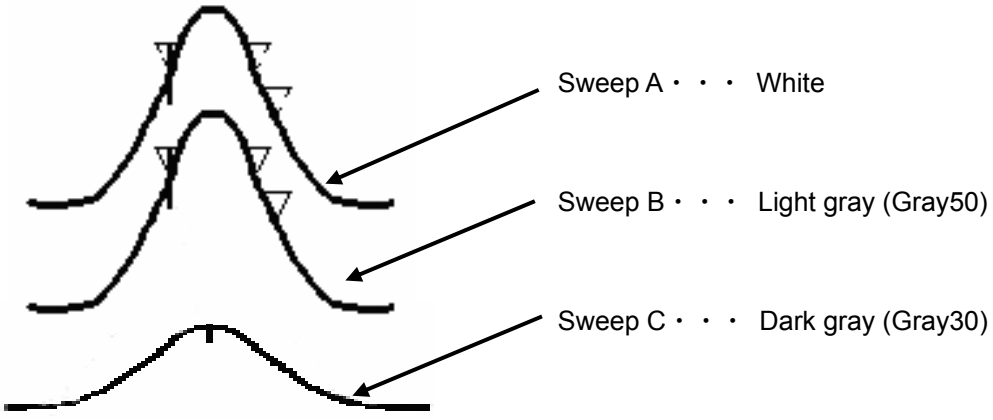


The range over which the RF marker turns blue (value converted frequency) varies depending on the sweep width and channel mode as shown in the table below.

Sweep Width / Ch.Mode	12 MHz	24 MHz	36 MHz
Single	±100 kHz	±200 kHz	±300 kHz
Dual	±200 kHz	±400 kHz	±600 kHz
Triple	±300 kHz	±600 kHz	±900 kHz

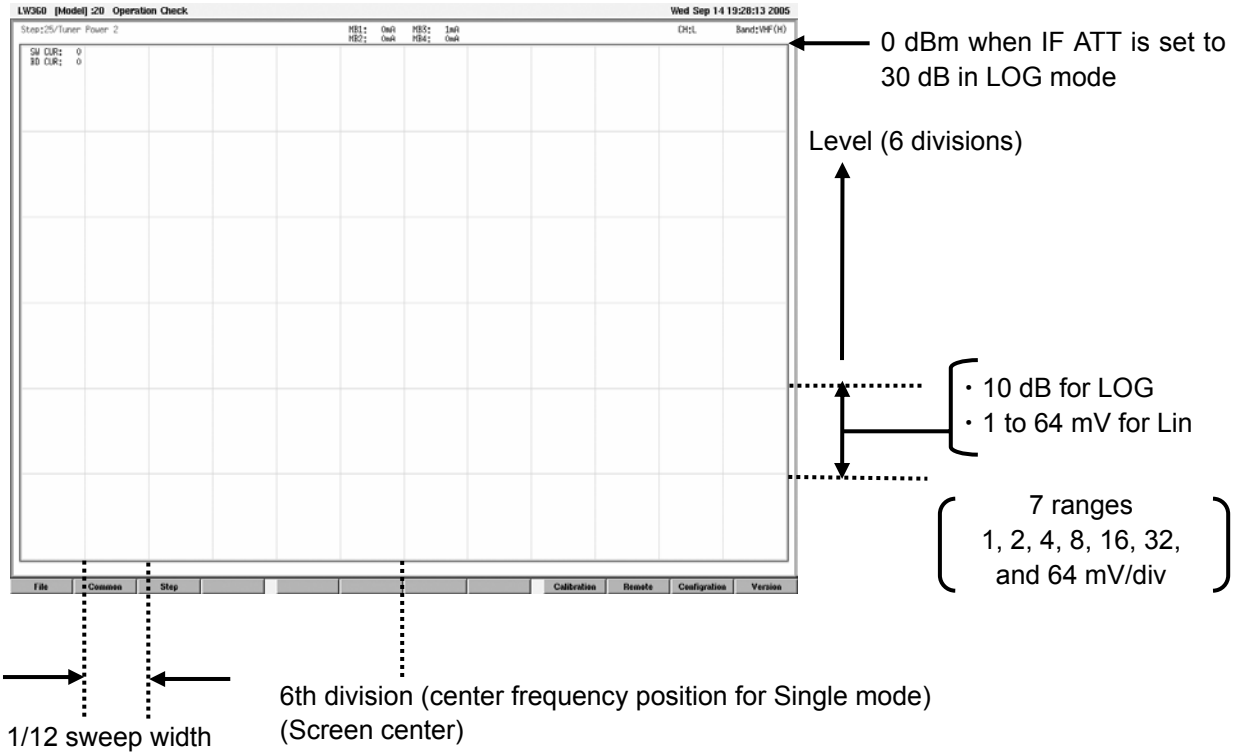
(3) Brightness of the Sweep Waveform

• You can select colors for sweeps A, B, and C to make the waveforms distinguishable. The figure below indicates the factory default colors.
For the procedure to select the color, refer to section 5.1.7, “Configuration (5) Appearance.”



(4) Display Grid Scale

• By default, the grid on the Wave screen is set to 12 divisions horizontal (frequency) and 6 divisions vertical (level).

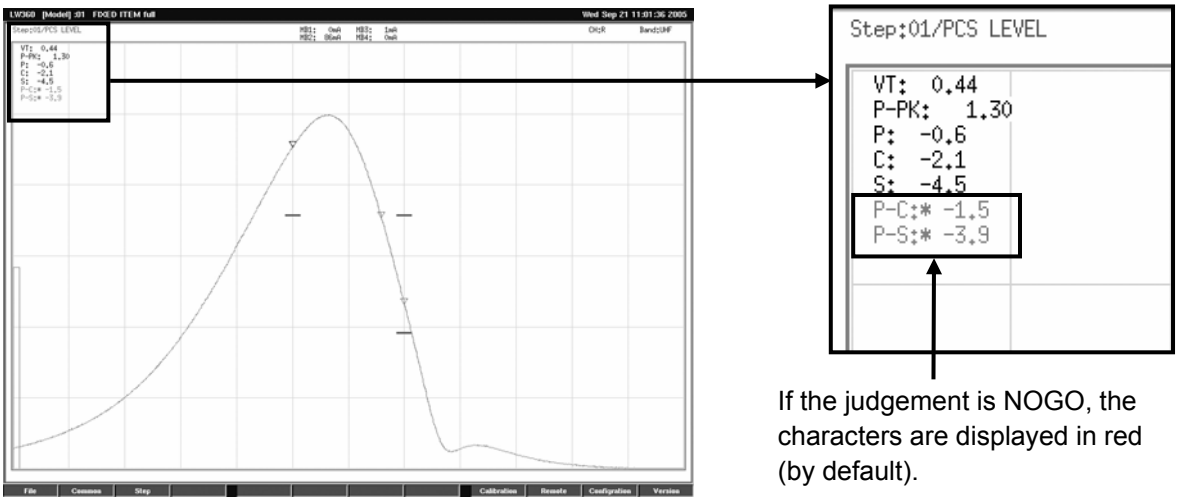


• The vertical (level) scale can be set to 12 divisions. The grid can also be turned OFF. (Refer to section 5.1.7, “Configuration (5) Appearance g).)

(5) Data Display and Judgement Result Display

a) Data Display

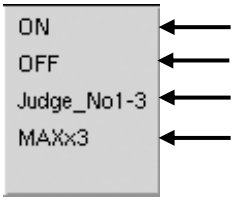
• The specified measured values are displayed on the Judge screen of the Step edit screen. If the judgement is NOGO, an asterisk is placed before the measured value, and the characters are displayed in red (by default). This color is selectable. (Refer to 5.1.7, “Configuration (5) Appearance.”)



b) Changing the Display Mode

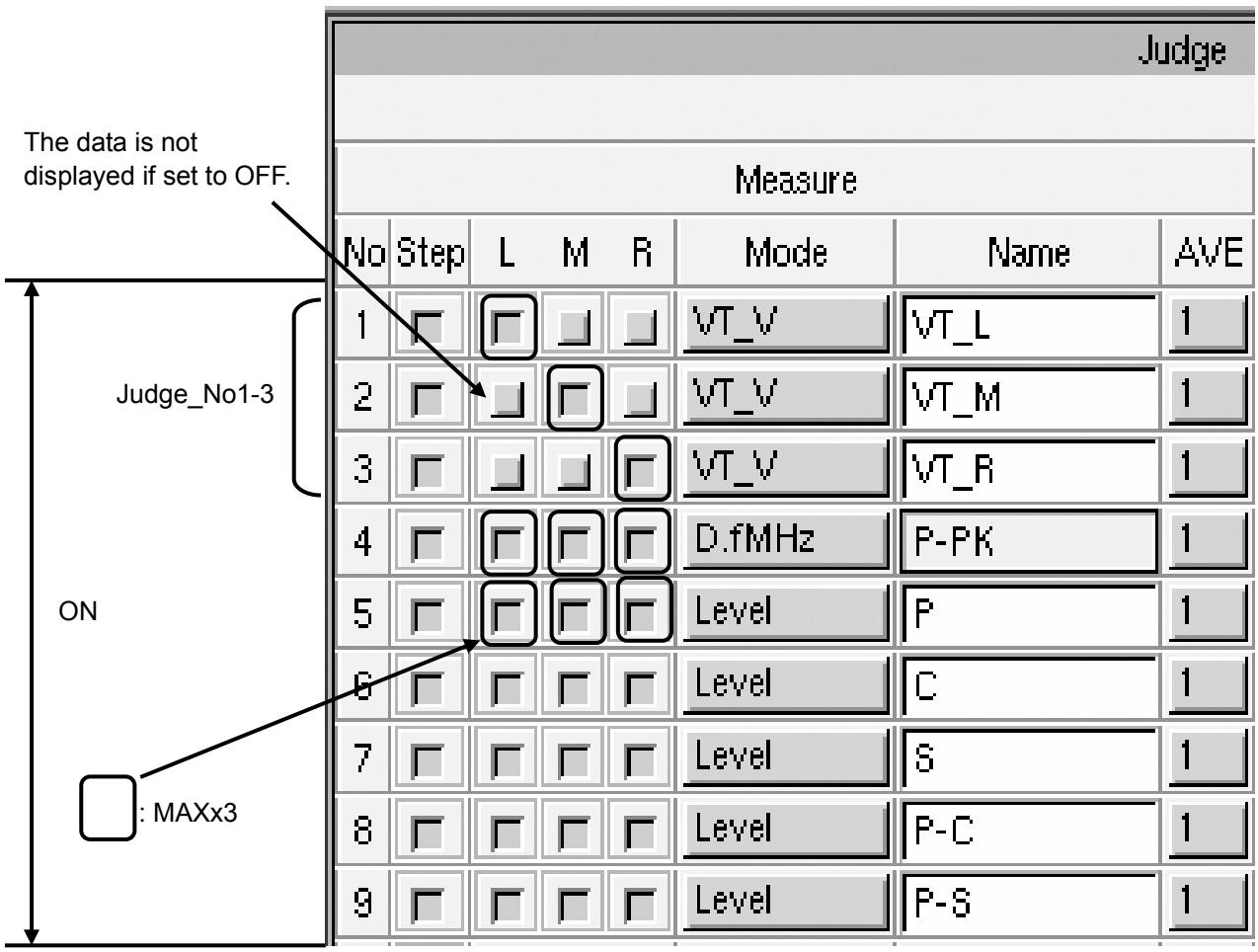
- The display mode of the measured data can be changed. Select the display mode as necessary.
- Press F3 (Step), F7 (Tuner Sweep), F9 (Edit), and F8 (Setting Item) or select the function keys with a mouse to display the Setting Item display.
- Select the Data Disp check box. Press F8 (Close) to return to the Tuner/Sweep screen.
- Move the cursor to Data Disp, and press the Space key or click the mouse.

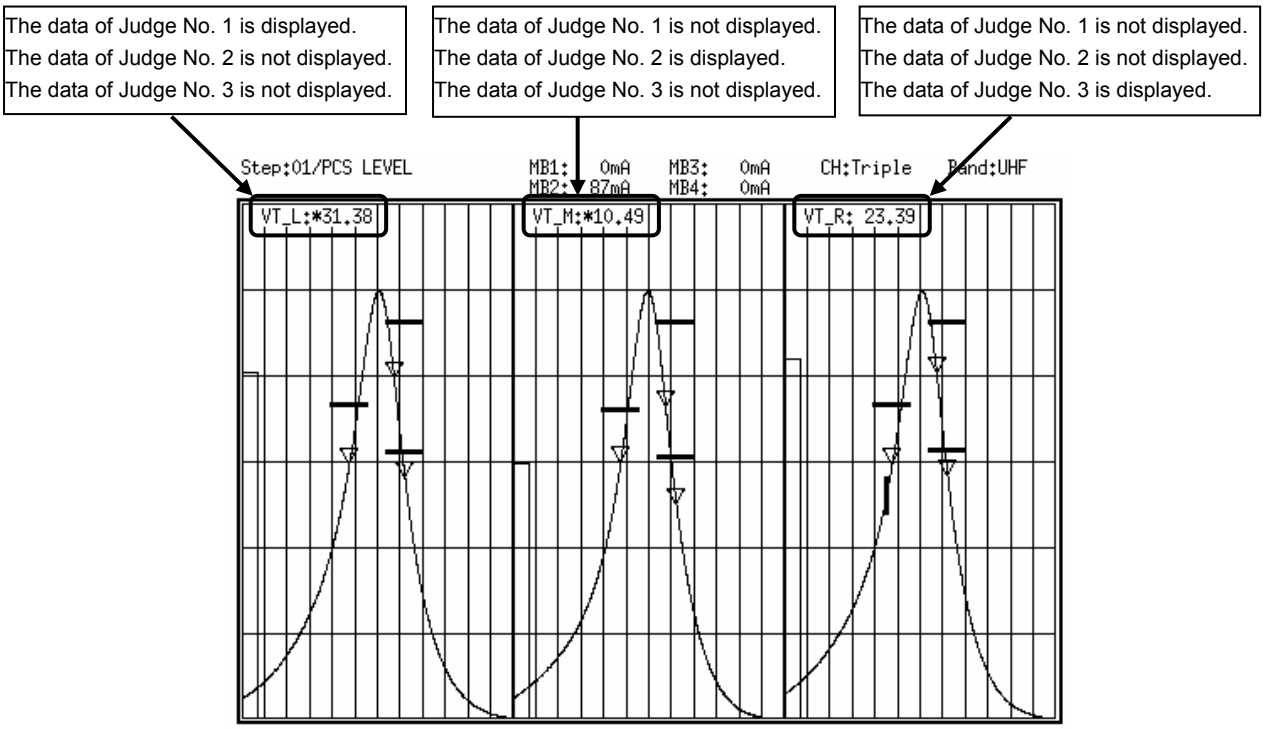
There are four selectable modes.



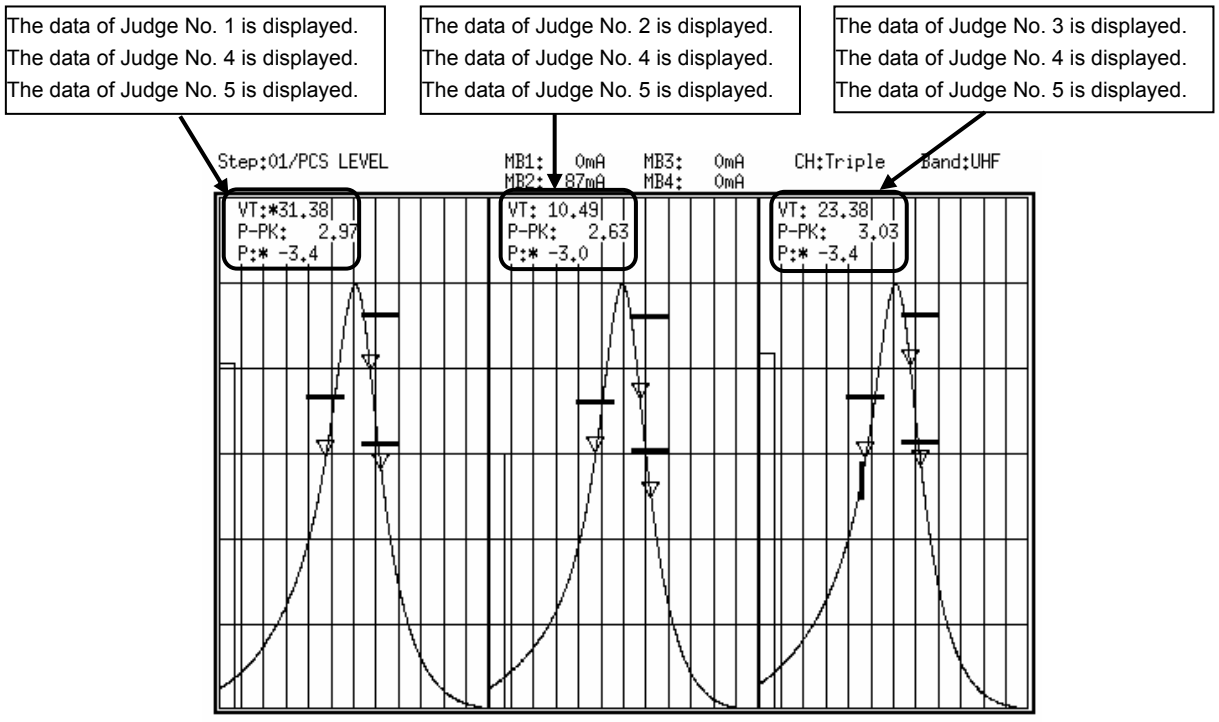
- ON ← Displays all measured values specified on the Judge screen.
- OFF ← Turns OFF the display.
- Judge_No1-3 ← Displays measurements No. 1 to 3 specified on the Judge screen.
- MAXx3 ← Displays the top three measurements of each channel specified on the Judge screen.

<Display example>





When set to Judge No.1-3



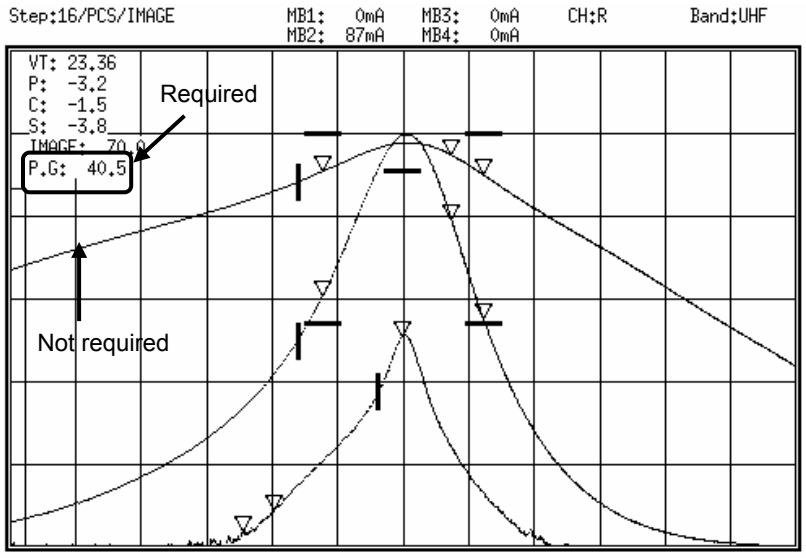
When set to MAXx3

(6) Turning the Waveform Display ON/OFF

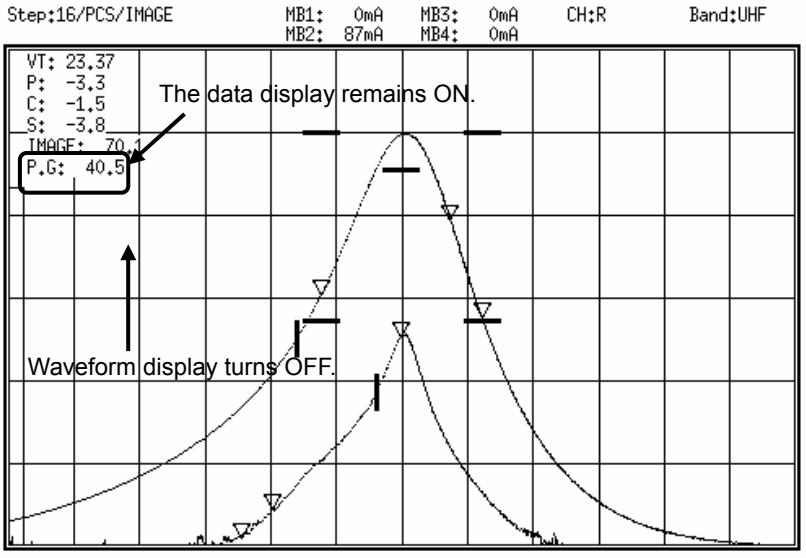
- If measurement is necessary but monitoring is not, the waveform display can be turned OFF.
  (Example: Power gain is measured during PCS/IMAGE measurement, but waveform is not required.)
- Press F3 (Step), F7 (Tuner Sweep), F9 (Edit), and F8 (Setting Item) or select the function keys with a mouse to display the Setting Item display.
- Select the Wave Disp check box. Press F8 (Close) to return to the Tuner/Sweep screen.
- Move the cursor to Wave Disp, and press the Space key or click the mouse.

Selection item

Wave_OFF	Hides the waveform display.
Wave_ON	Shows the waveform.



When set to Wave_ON

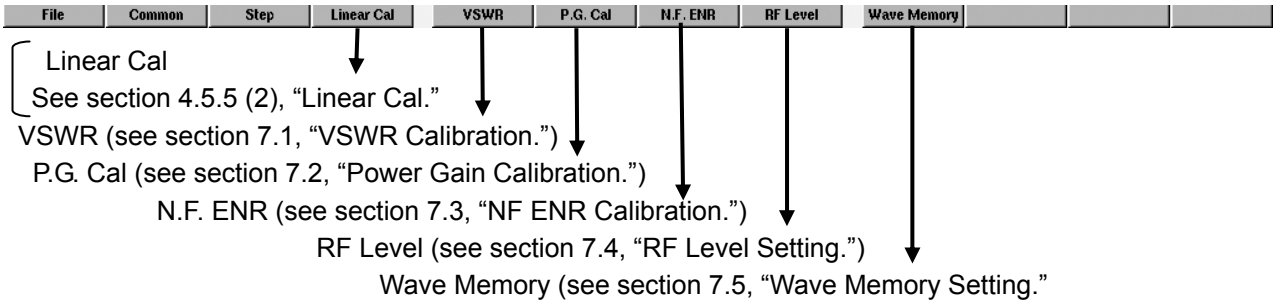


When set to Wave_OFF

5.1.5 Calibration (F9)

• Contains menus for the calibration of various measurements and waveform memory functions.

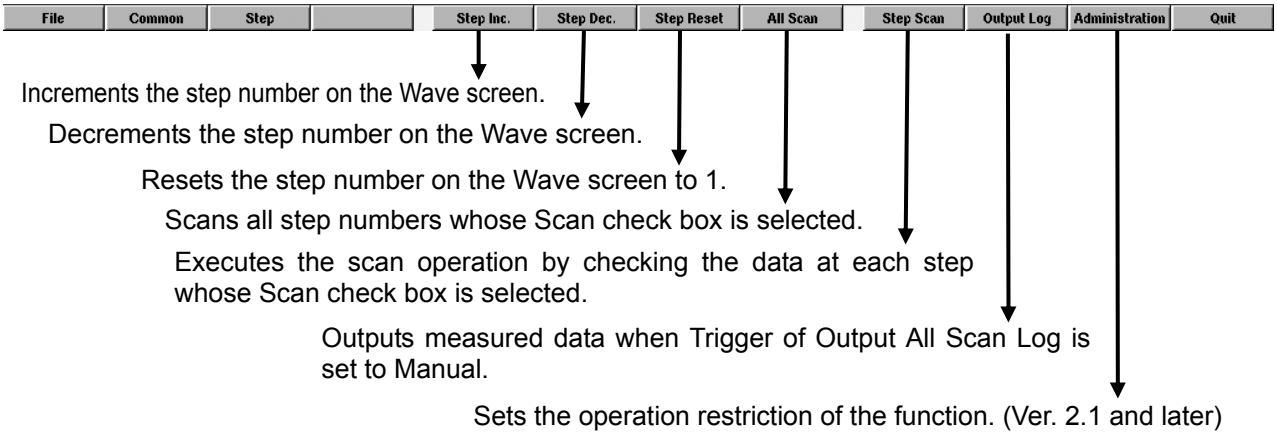
Calibration (Home → F9 (Calibration)) Function Menu



5.1.6 Remote (F10)

• The remote control function is assigned to this function key.

Remote (Home → F10 (Remote)) Function Menu



(1) Step Inc.

Increments the step number on the Waveform screen. (This is equivalent to the STEP INC button on the LW 360-01.)

(2) Step Dec.

Decrements the step number on the Wave screen. (This is equivalent to the STEP DEC button on the LW 360-01.)

(3) Step Reset

Resets the step number on the Wave screen to 1. (This is equivalent to the RESET button on the LW 360-01.)

(4) All Scan

Automatically scans all step numbers whose Scan check box is selected.
(This is equivalent to the ALL SCAN button on the LW 360-01.)

(5) Step Scan

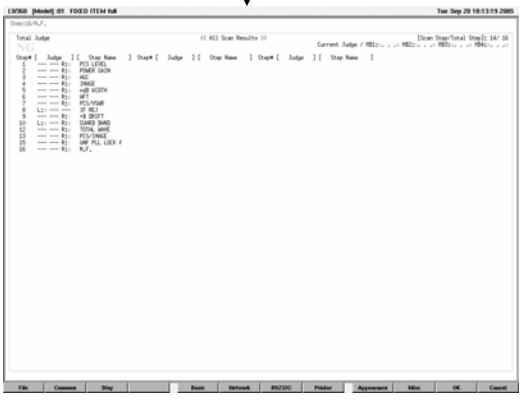
Executes the scan operation by checking the data at each step whose Scan check box is selected.

Setting the Conditions of the Output All Scan Log that can be used

- All Scan&Step All
- All Scan&Step NG
- Step All
- Step NG

"ALLSCAN executing..." is displayed.
The waveform is not displayed when step scan is being executed.

Press the Space or Enter key to advance the step.



The scan result is displayed after all steps are completed.

(6) Output Log

Outputs the both measured data of the scan and the present step when this key is pressed.

(When the trigger of F10 (Misc) Output All Scan Log is set to manual)

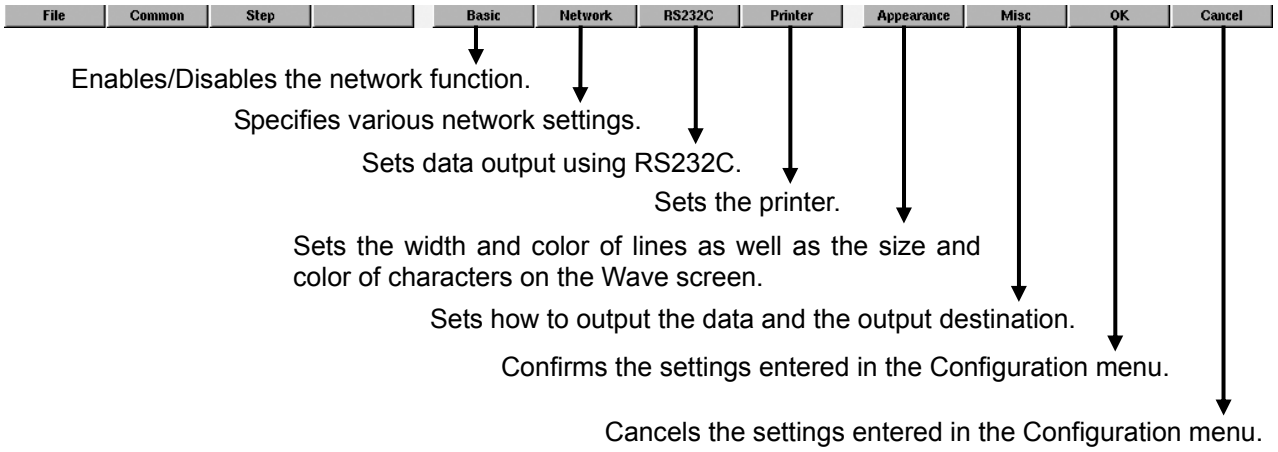
(7) Administration (Ver. 2.1 and later)

Set the operation restriction of the function.

5.1.7 Configuration (F11)

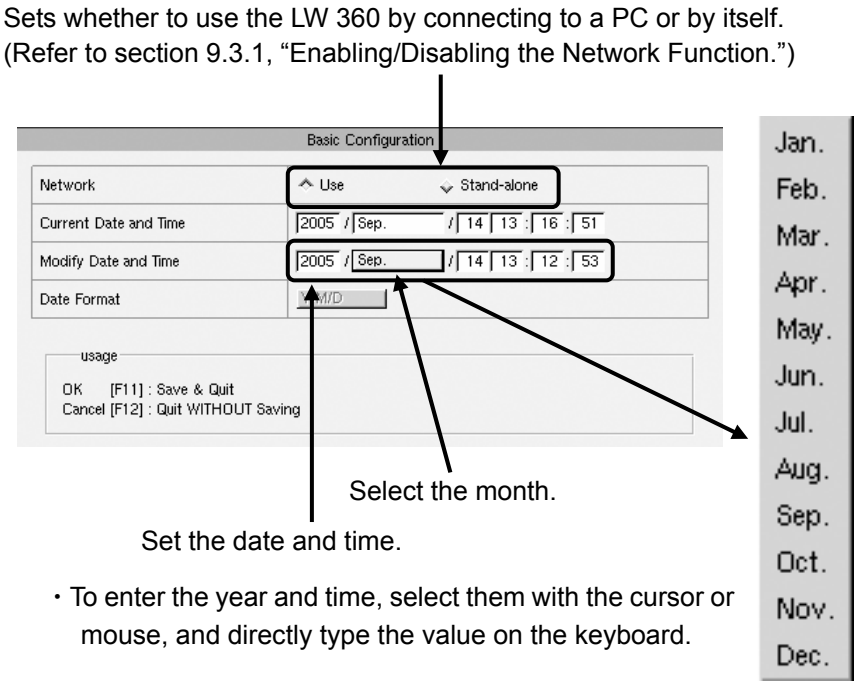
• Configures Wave screen settings and settings for using peripheral devices.

Configuration (Home → F11 (Configuration)) Function Menu



(1) Basic (F5)

Sets the date and time.



(2) Network (F6)

Sets DHCP, IP address, network address (subnet mask), gateway address, host name, and work group. (Refer to section 9.3.2, “Setting the Network.”

(3) RS232C (F7)

Sets the baud rate, character bits, stop bit, and parity bit of the RS232C. (Refer to section 10.2.3, “Setting the Communication Specifications.”)

(4) Printer (F8)

Sets the printer settings. (Refer to section 8.1.3, “Settings.”)

(5) Appearance (F9)

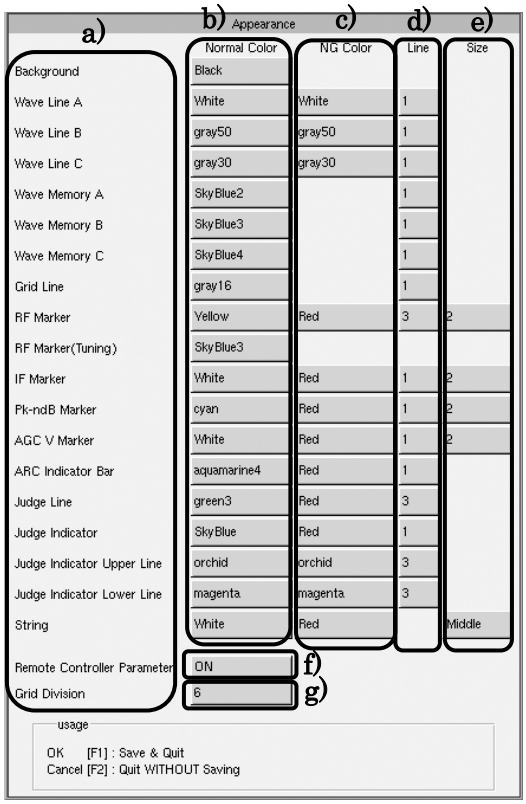
Sets the background color, the width and color of waveforms, and the size and color of the measured data on the Wave screen.

a) Setting Items

Background:	Wave screen background
Wave Line A:	Waveform of sweep A
Wave Line B:	Waveform of sweep B
Wave Line C:	Waveform of sweep C
Wave Memory A:	Waveform of sweep A in memory
Wave Memory B:	Waveform of sweep B in memory
Wave Memory C:	Waveform of sweep C in memory
Grid Line	
RF Marker:	RF Marker (Vertical line marker)
RF Marker (Tuning) (Ver. 2.2 and later):	RF Tuning Marker (Vertical line marker)
IF Marker:	IF Marker (Triangle marker)
Pk –ndB Marker (Ver. 2.2 and later):	RF Tuning Marker (Transverse triangle marker)
AGC V Marker (Ver. 2.2 and later):	AGC V Marker (Lozenge marker)
ARC Indicator Bar:	ARC bar graph
Judge Line	
Judge Indicator:	Judgement bar graph
Judge Indicator Upper Line:	Upper line of the judgement bar graph
Judge Indicator Lower Line:	Lower line of the judgement bar graph
String:	Character string data on the Wave screen
Remote Controller Parameter:	VR1, 2, 3 and ENC 1, 2, 3 of the LW 360-01
Grid Division:	Number of grids in vertical direction

Color type

White
Black
DimGray
gray16
gray30
gray50
Red
red1
red2
red3
red4
green3
blue
Yellow
orange
pink
SkyBlue
SkyBlue2
SkyBlue3
SkyBlue4
SeaGreen
magenta
orchid
purple
ivory
NavyBlue
cyan
aquamarine4
khaki
beige
brown
coral
maroon
violet
gold
chartreuse1

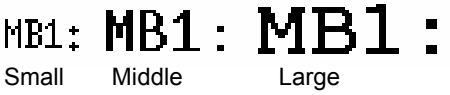


b) Select the color at Normal.

c) Select the color for NG judgement.

d) Select the thickness of a line.
(Three settings or five settings: 1 < 2 < 3 < 4 < 5)

e) Select the size.
(Three settings: 1 < 2 < 3, Small < Middle < Large)
Character size comparison



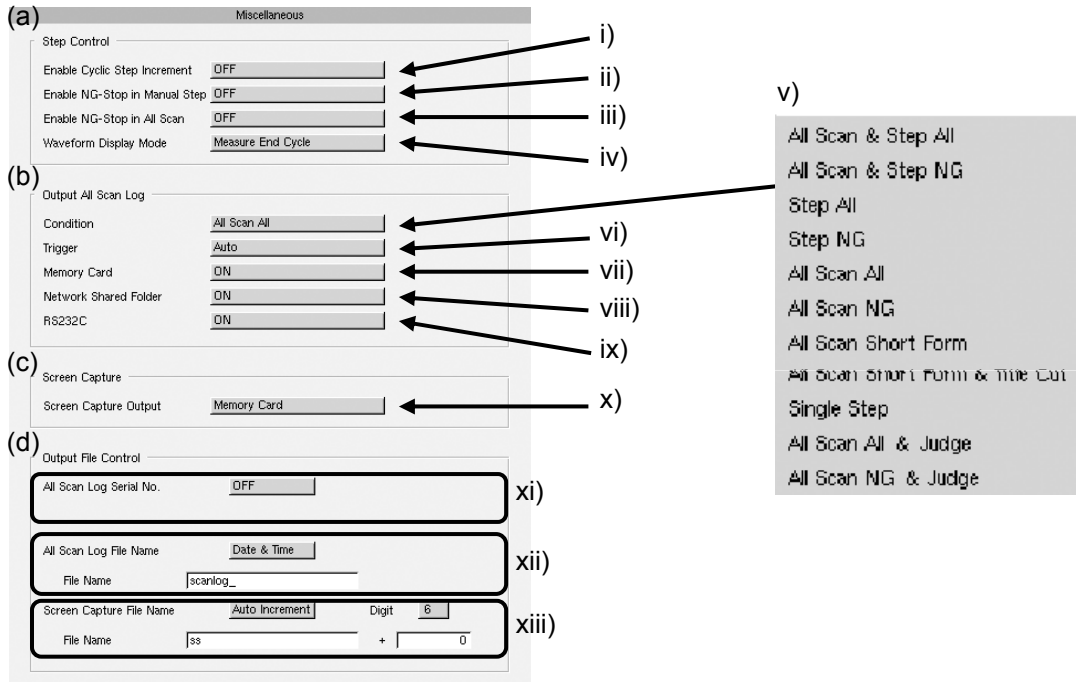
Small Middle Large

f) Turn the display ON/OFF when VR 1 ,2 ,3 and ENC 1, 2, 3 (see section 6.3.2, "Settings") of the LW 360 -01 (PARAMETER REMOTE) are configured.

g) Select the number of grid lines in vertical direction.
(Three settings are available: 0 for none, 6 for 6 grid lines, and 12 for 12 grid lines.)

(6) Misc (Miscellaneous) (F10)

Specifies settings concerning step operation, All Scan, and hard copy.



(a) Step Control

i) Enable Cyclic Step Increment

ON: This function repeats from the first step when the enabled steps are finished.

OFF: Stops at the last enabled step.

ii) Enable NG-Stop in Manual Step

ON: This function stops the operation from continuing to the next step when the measurement result is NOGO. If this happens, a message as shown in the following figure is displayed.

OFF: Continues the operation to the next step when the measurement result is NOGO.

iii) Enable NG-Stop in All Scan

ON: Aborts the All Scan operation when the judgement result of a step is NG.

OFF: Executes the All Scan operation till the end regardless of the judgement result.

iv) Waveform Display Mode (Ver 2.1 and later)

Measure End Cycle: A waveform is displayed when all sweeps (L, M, and R) are completed.

Sweep Cycle: A waveform is displayed when a sweep of each L, M and R is completed.

(b) Output All Scan Log

v) Condition

Sets the data output format.

(For details on each item, refer to section 10.3.1, "Output Data Types.")

vi) Trigger

Manual: Outputs the data manually. This is specified when using Step Scan.

Auto: Outputs the data automatically after the All Scan operation is completed.

(Only the title is output if the output data type is Step All, Step NG or Single Step.)

vii) Memory Card

ON: Enables the use of the CF card.

OFF: Disables the use of the CF card.

viii) Network Shared Folder

ON: Enables the network shared folder when connecting a PC to the LW 360.

OFF: Disables the network shared folder when not connecting a PC to the LW 360.

ix) RS232C

ON: Enables the RS-232C for outputting data.

OFF: Disables the RS-232C.

(c) Screen Capture

x) Screen Capture Output

Memory Card: Outputs the hard copy file to the CF card.

Network Shared Folder: Outputs the hard copy file to the network shared folder of a PC.

Printer: Prints the hard copy on a printer.

(d) Output File Control (Ver. 2.2 and later)

xi) All Scan Log Serial No.

Set the display method of the serial number of a tuner displayed in All Scan output data.

OFF: Not displayed

Fixed: A fixed name is displayed.

Auto Increment: A fixed name and a number are displayed.

xii) All Scan Log File Name

Set the output file name of All Scan data.

Auto Increment: A fixed name and a number are displayed.

Data & Time: Becomes a fixed name and date.

Fixed: Becomes a fixed name.

xiii) All Capture File Name

Set the output file name of a hard copy.

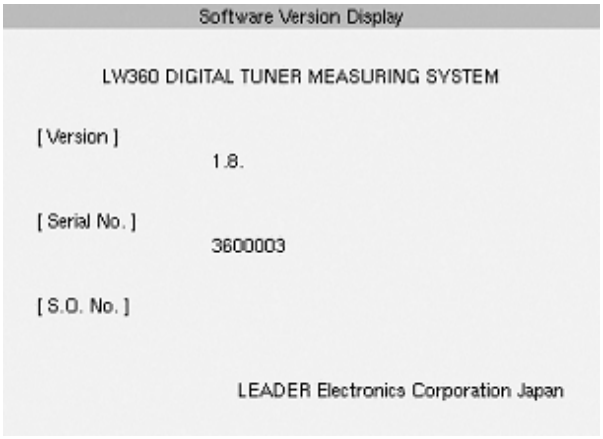
Auto Increment: A fixed name and a number are displayed.

Data & Time: Becomes a fixed name and date.

Fixed: Becomes a fixed name.

5.1.8 Version (F12)

Press Home followed by F12 (Version) to display the current firmware version and serial number.
(If a special-order function is added, S.O.No. is displayed.)



5.2 File Edit Screen

5.2.1 Managing the Files

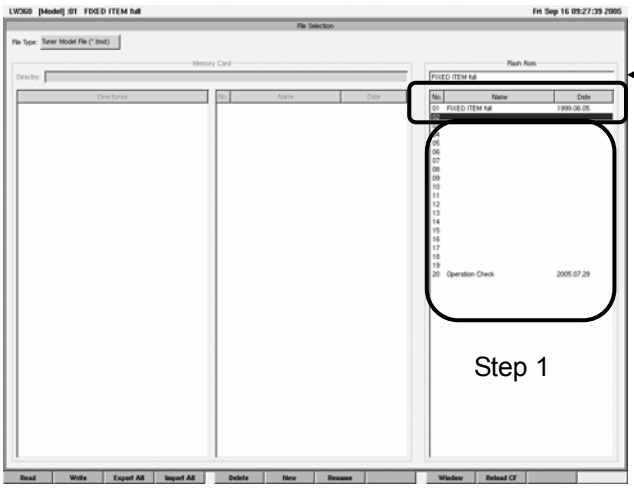
- This screen is used to manage the tuner model, channel name table, PLL table, item table, Wave Form (Ver. 2.1 and later), and System Data (Ver. 2.1 and later) files.
- The basic file operation is the same for the six files above.
- The files can be saved and loaded from the LW 360 or memory card.
- Press F1 (File) followed by F9 (Edit) to display the file operation function menu.

(1) Loading Files

a) Loading from the LW 360

[Step 1] Select the number of the file to be loaded using the cursor or mouse.

[Step 2] Press F1 (Read).



When the loading operation is complete, the file name is displayed in the file name box.

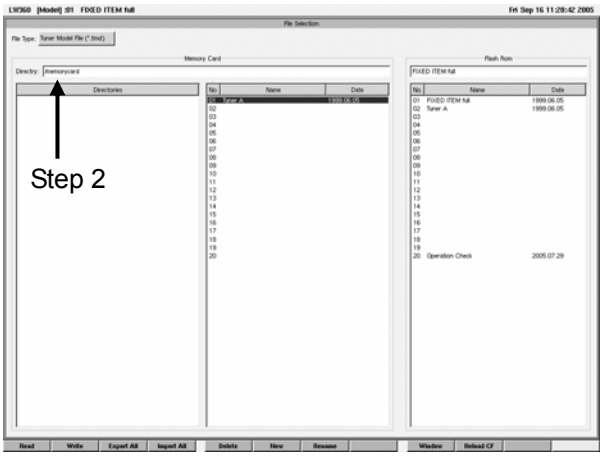
b) Loading from the Memory Card

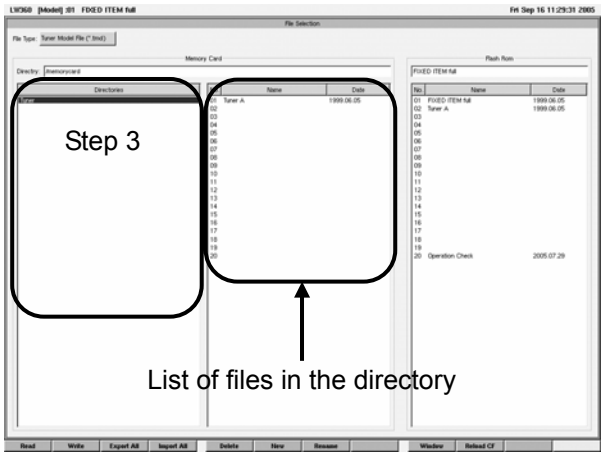
[Step 1] Insert a memory card into the LW 360.

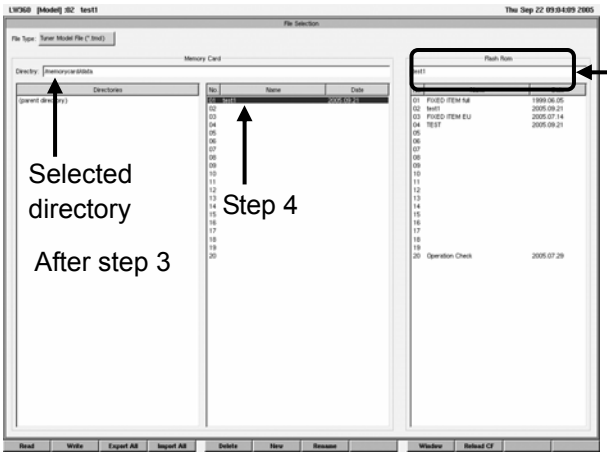
[Step 2] Press F10 (Reload_CF) to detect the memory card.
If Directory is set to /memorycard/, the card is already detected.
If you inserted the memory card on the Wave, Common, or Step screen, the memory card is automatically detected when switching to the File screen. Thus, the steps above are not necessary.

[Step 3] Select the directory.
- Use the mouse or the Tab key and up and down keys to move the cursor to the desired directory.
- Press F1 (Read) to select the directory. The files in the directory are displayed.

[Step 4] Move the cursor to the desired file, and press F1 (Read).







When the loading operation is complete, the file name is displayed in the file name box.

(2) Saving Files

a) Creating Files

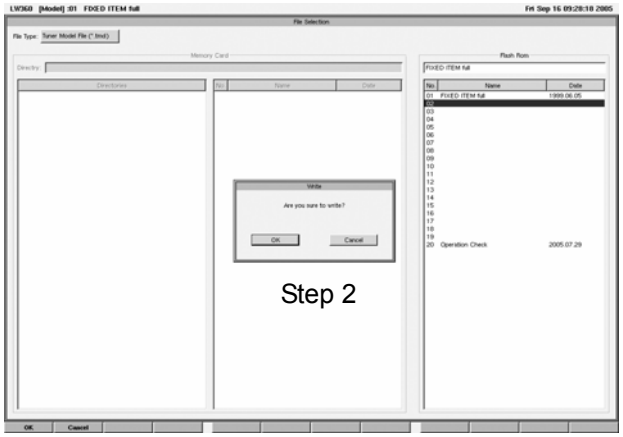
Saving to the LW 360

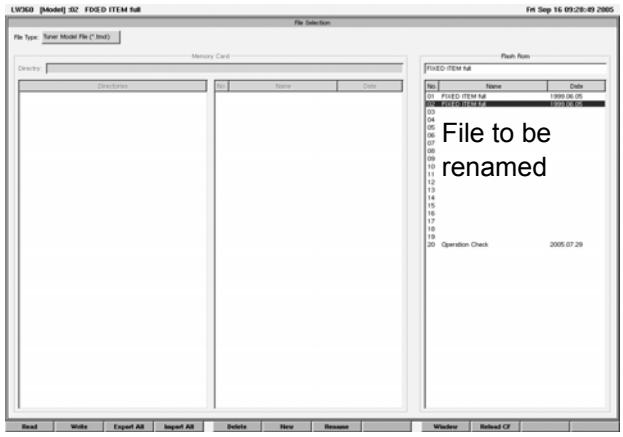
[Step 1] Select the number of the file to be saved using the cursor or mouse.

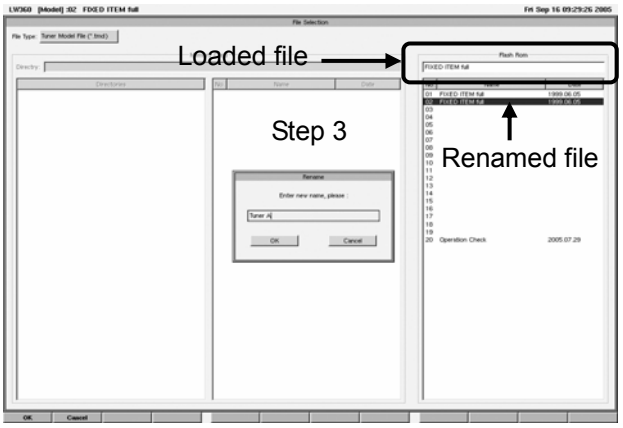
[Step 2] Press F2 (Write) to display a confirmation screen. Check the information, and press OK.
The file name is set to the name of the current loaded file.

Renaming the file

[Step 3] Press F7 (Rename) to display a screen for entering a new file name.
Enter the file name from the keyboard, and press OK.







b) Saving to the Memory Card

[Step 1] Insert a memory card into the LW 360.
(Have the memory card formatted on your PC in advance.)

[Step 2] Press F10 (Reload_CF) to detect the CF card.
If Directory is set to /memorycard/, the card is already detected.
If you inserted the memory card on the Wave, Common, or Step screen, the memory card is automatically detected when switching to the File screen. Thus, the steps above are not necessary.

Creating a Directory on the Memory Card

[Step 3] Press F6 (New) to display a directory name entry screen.
Enter the directory name, and press OK.

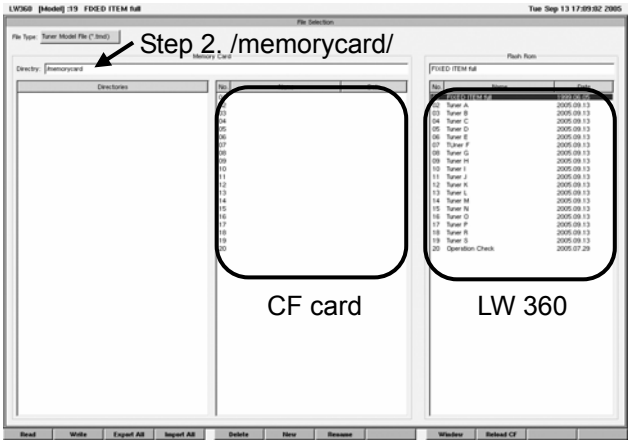
[Step 4] Move the cursor to the directory you created, and press F1 (Read).

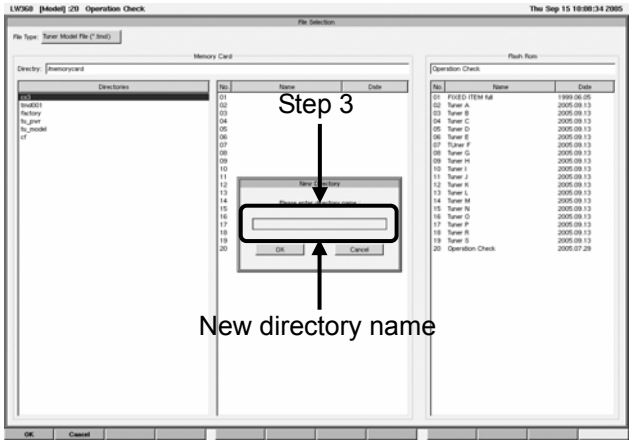
[Step 5] Select the number of the memory card on which to create the file using the cursor or mouse.

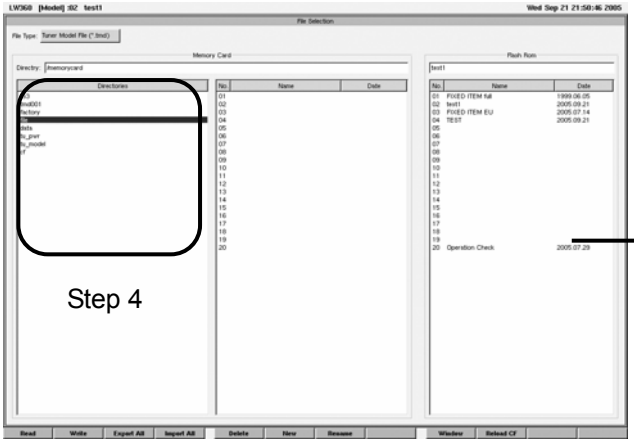
[Step 6] Press F2 (Write) to display a confirmation screen. Check the information, and press OK.

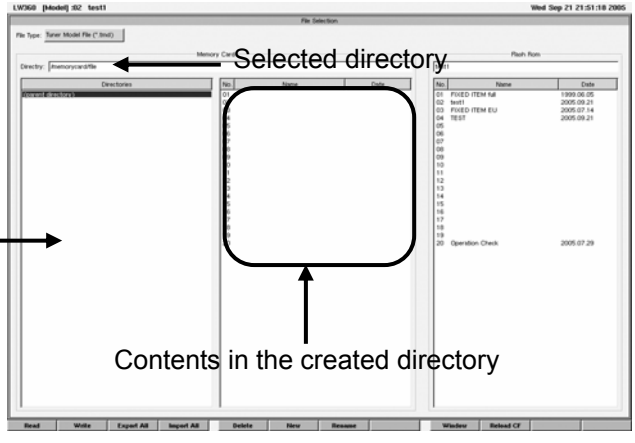
Renaming the file

[Step 7] Press F7 (Rename) to display a screen for entering a new file name.
Enter the file name from the keyboard, and press OK.



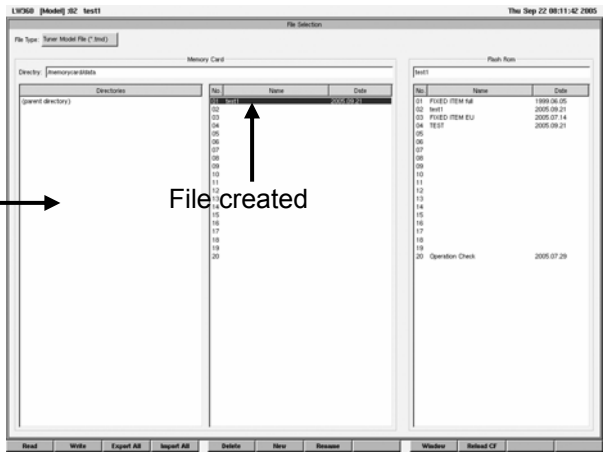




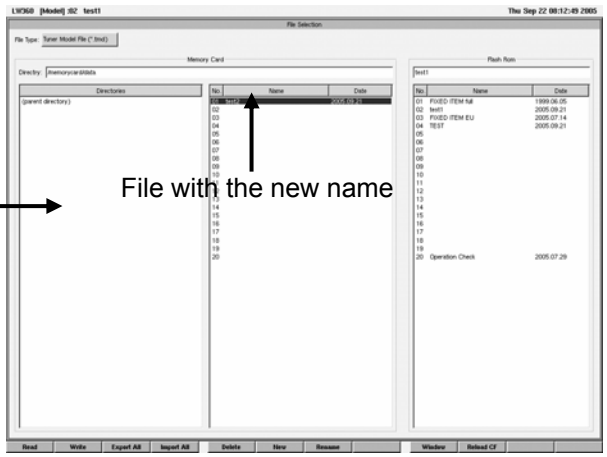



Step 5


Step 6


File created


Step 7
Enter the new file name


File with the new name

(3) Moving Files Collectively (Import All)

This function collectively moves files from the memory card to the flash memory in the LW 360.

This operation is possible only for tuner model and channel name table files.

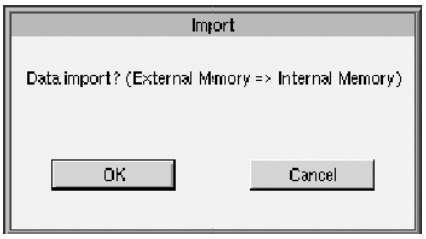
[Step 1] Insert a memory card into the LW 360.

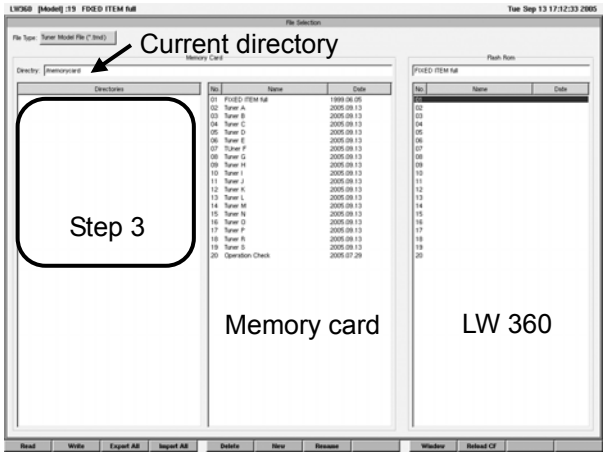
[Step 2] Press F10 (Reload_CF) to detect the memory card.
If Directory is set to /memorycard/, the card is already detected.
If you inserted the memory card on the Wave, Common, or Step screen, the memory card is automatically detected when switching to the File screen. Thus, the steps above are not necessary.

[Step 3] Select the directory.
- Use the mouse or the Tab key and up and down keys to move the cursor to the desired directory.
- Press F1 (Read) to select the directory. The files in the directory are displayed.

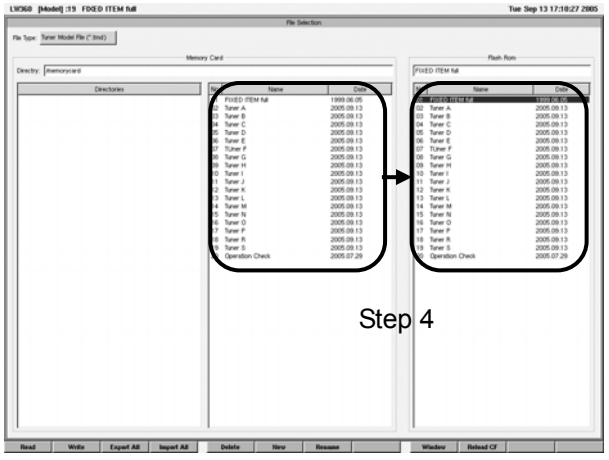
[Step 4] Press F4 (Import All) to display a confirmation screen.
Press OK to move the files.

Confirmation window





Before importing



After importing

(4) Moving Files Collectively (Export All)

This function collectively moves files from the flash memory in the LW 360 to the memory card.

This operation is possible only for tuner model and channel name table files.

[Step 1] Insert a memory card into the LW 360.

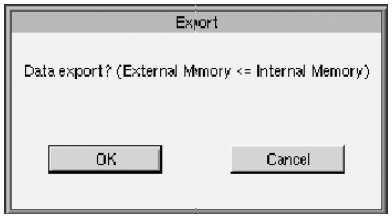
[Step 2] Press F10 (Reload_CF) to detect the memory card.

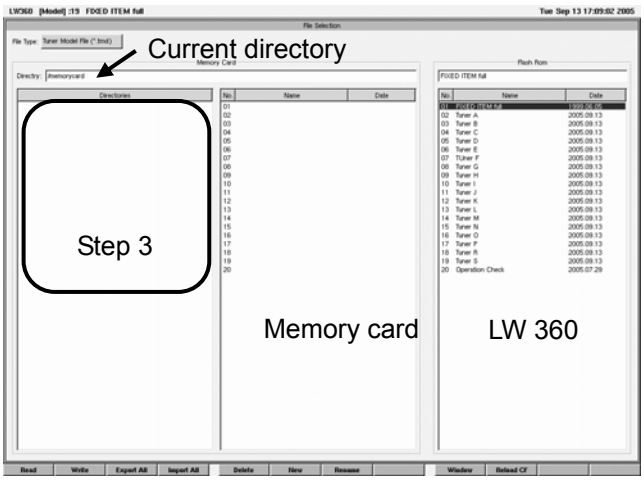
[Step 3] Select the directory.

- Use the mouse or the Tab key and up and down keys to move the cursor to the desired directory.
- Press F1 (Read) to select the directory. The files in the directory are displayed.

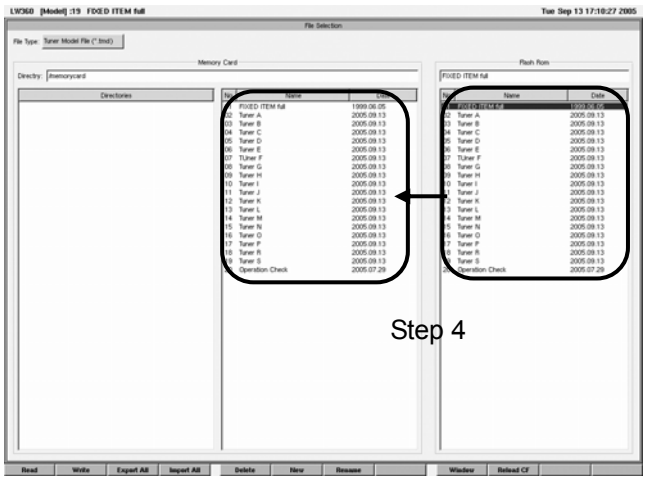
[Step 4] Press F3 (Export All) to display a confirmation screen.
Press OK to move the files.

Confirmation window





Before exporting



After exporting

(5) Copying Files

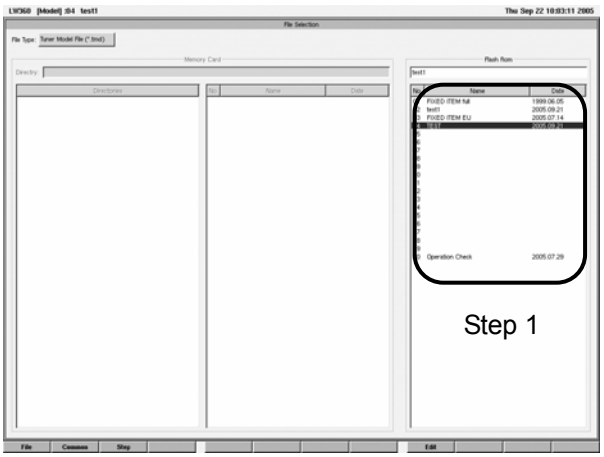
Files are copied by loading the files and writing them.

(6) Deleting Files

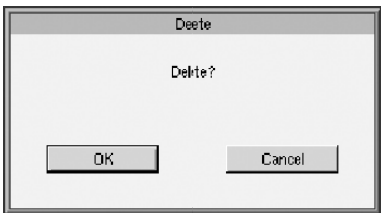
a) Deleting Files on the LW 360

[Step 1] Select the number of the file to be deleted using the cursor or mouse.

[Step 2] Press F5 (Delete). Confirm the displayed information, and press OK.



Step 2



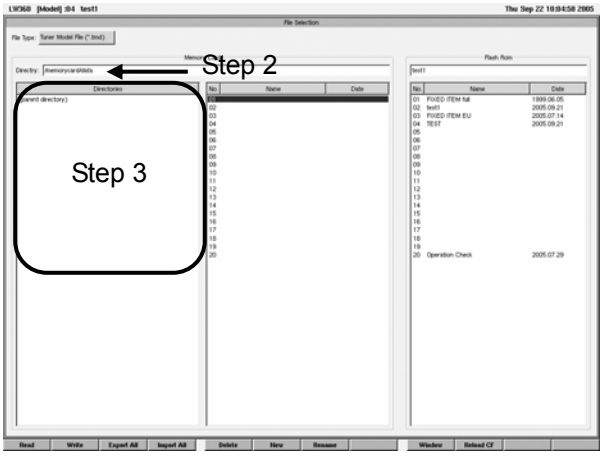
Deleting Files on the Memory Card

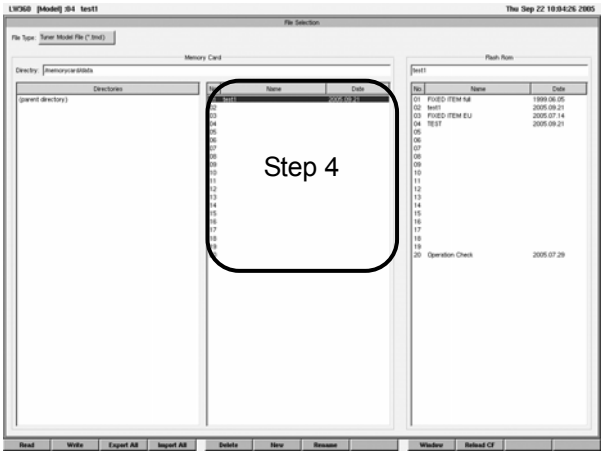
[Step 1] Insert a memory card into the LW 360.

[Step 2] Press F10 (Reload_CF) to detect the memory card.

[Step 3] Move the cursor to the desired directory, and press F1 (Read).

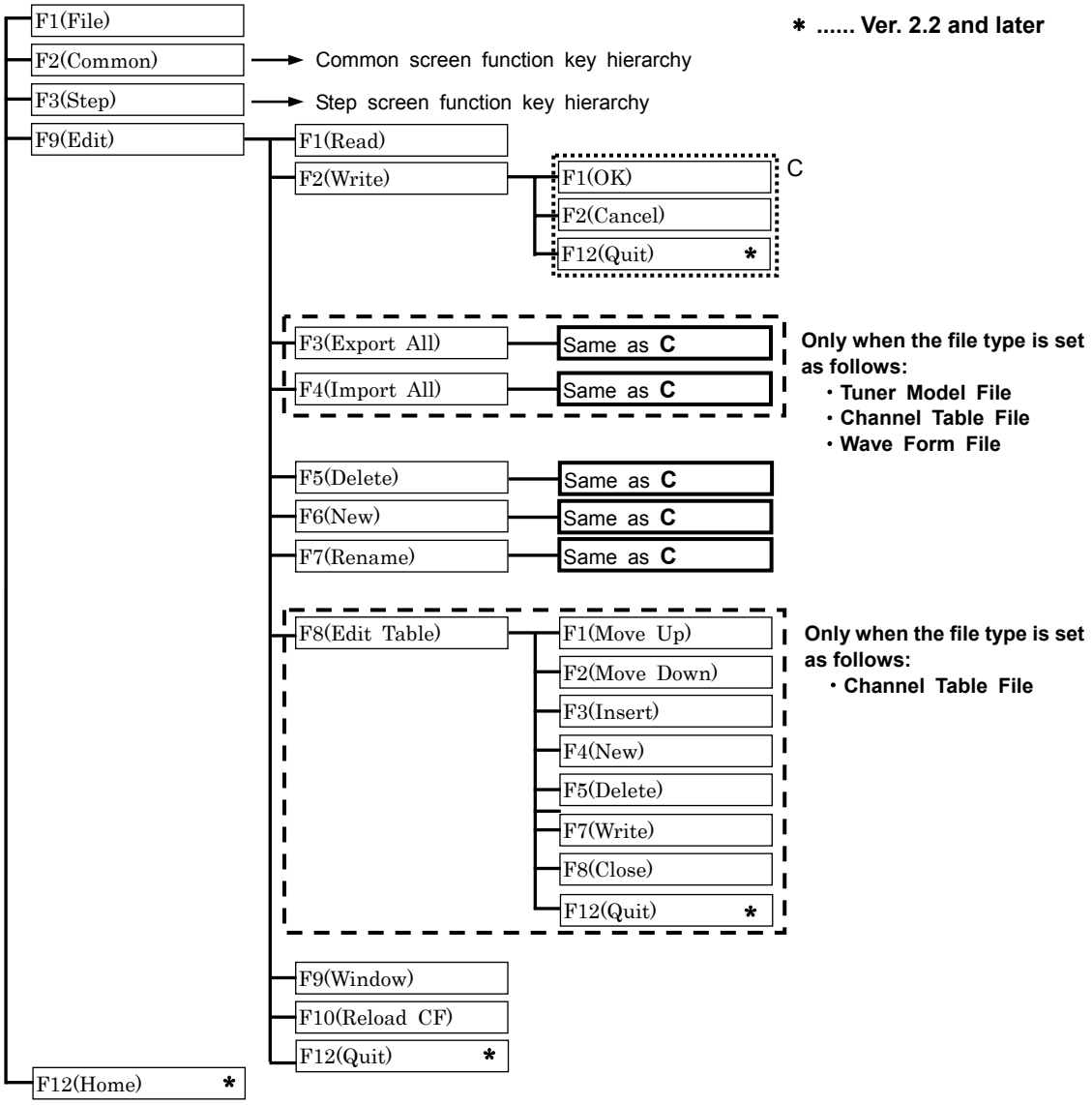
[Step 4] Select the number of the file you want to delete, and press F4 (Delete). Confirm the displayed information, and press OK.



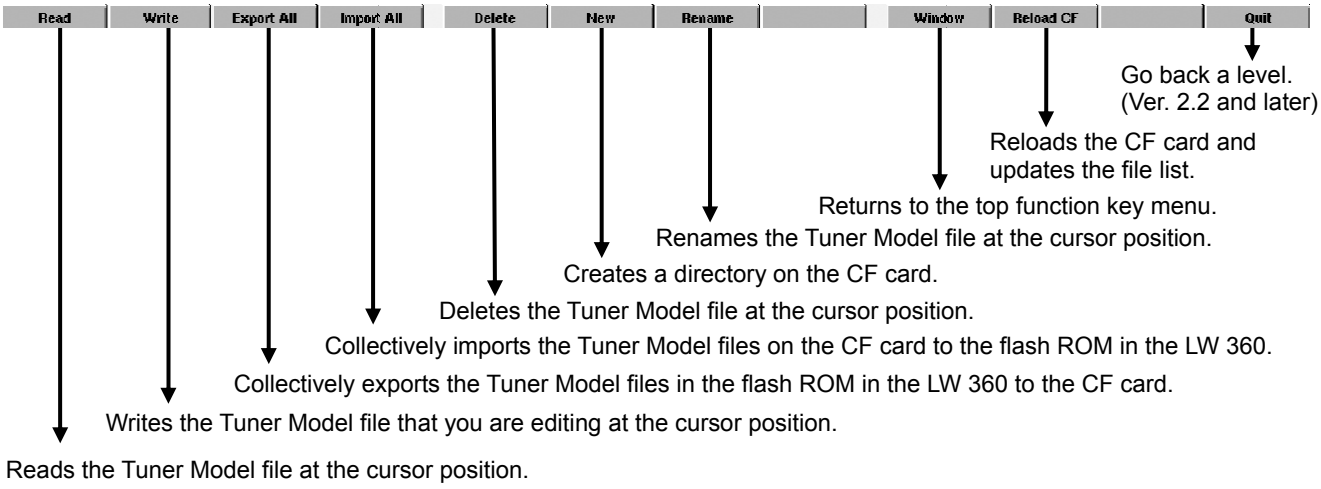


5.2.2 File Screen Function Key Hierarchy

• Displayed functions vary depending on the selective contents of File Type.



File → F9 (Edit) Function Menu

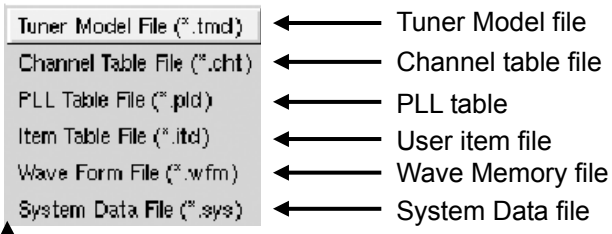


5.2.3 Tuner Model File

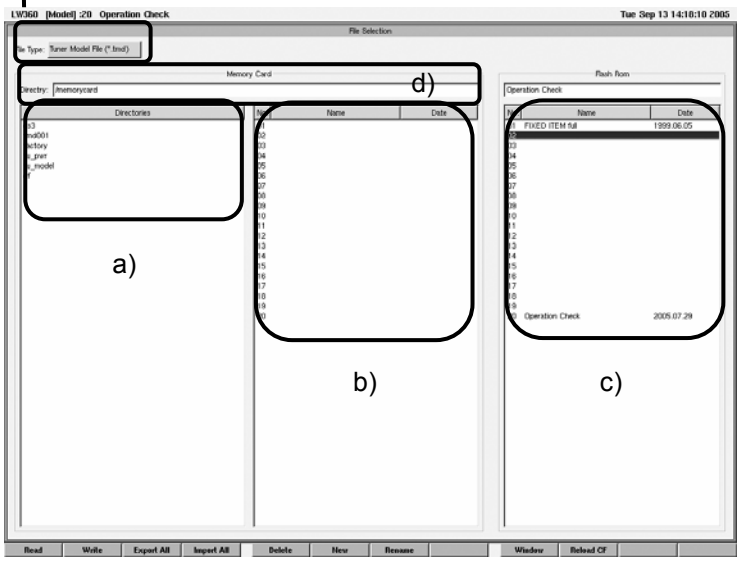
- The tuner model file is used to save or load tuner models.
- Up to 20 tuner models can be saved to the flash memory in the LW 360.
- Tuner models can also be saved to an external memory card.
- You can create a directory structure on the memory card.
- On a memory card, 20 tuner models can be saved to each directory.
- The number of directories you can create varies depending on the size of the CF card.

(1) File Type

Select Tuner Model File (*.tmd) using the Space and Enter keys or the mouse.



(2) File Selection



a) Displays the directories in the memory card.
Press F1 (Read) to move in the directory.

b) Displays the files in the directory on the memory card.

c) Displays the files in the flash memory in the LW 360.

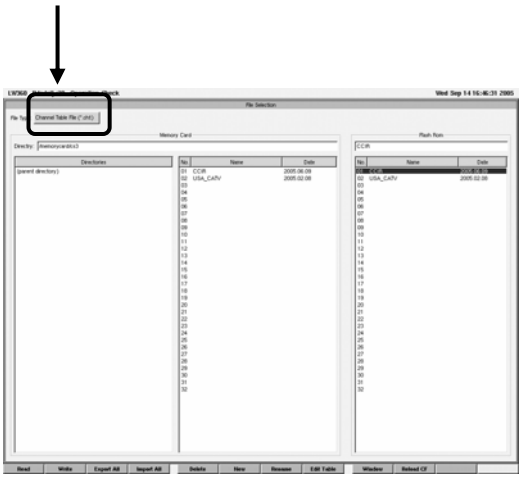
d) Displays the name of the directory on the memory card that is currently open.

5.2.4 Channel Table File

- The channel name table of the Sweep/Marker screen of the common screen.
- This file is used to set the marker frequency.
- You can set the channel number, frequency, and band for each country.
- It is convenient to save the file for each country.
- When setting the marker frequency, the frequency is automatically entered if you recall the required table and specify the channel.
- You can save 32 files to the flash memory in the LW 360. In addition, you can save 32 files in each directory on the memory card. The number of directories that you can create varies depending on the size of the memory card.
- The data of PLL (from CA1 to CA4) in PLL Table A and PLL (from CB1 to CB4) in PLL Table B can be set. This is effective only when having selected CH. No. by using Parameter Remote. (Ver. 2.1 and later)

(1) File Type

- Select Channel Table File (*.cht) using the Space and Enter keys or the mouse.



(2) Creating a New Channel Name Table

You can create and edit a channel name table.

[Step 1] Select Channel Table File (*.cht) for the file type using the Space and Enter keys or the mouse.

[Step 2] Select the number of the channel name table you want to create using the cursor or mouse.

[Step 3] Press F6 (New), enter the file name of the channel name table, and press OK.

[Step 4] Press F8 (Edit Table).

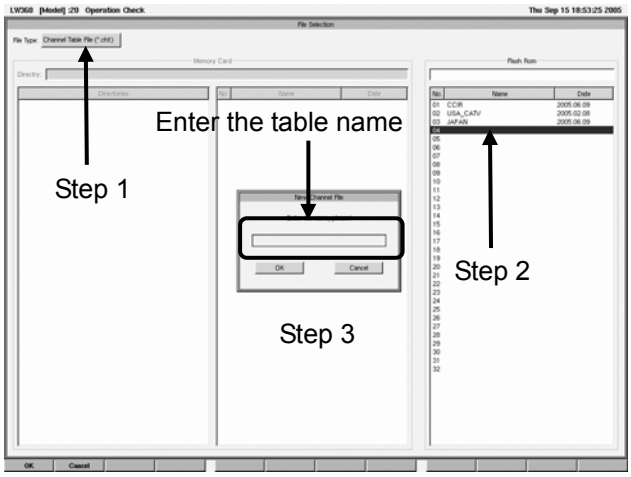
[Step 5] Press F4 (New) to create a new channel number.

[Step 6] Moves the cursor to Param1 or Param2 after setting the Ch Name, frequency and Band, and selects the parameter items.
Next, moves the cursor to Data1 or Data2, and sets the data.

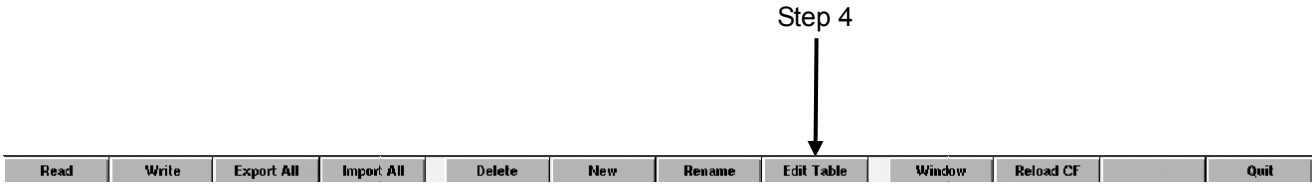
[Step 7] Repeat steps 5 and 6 to create the desired number of channels.

[Step 8] Press F7 (Write) to save the table.

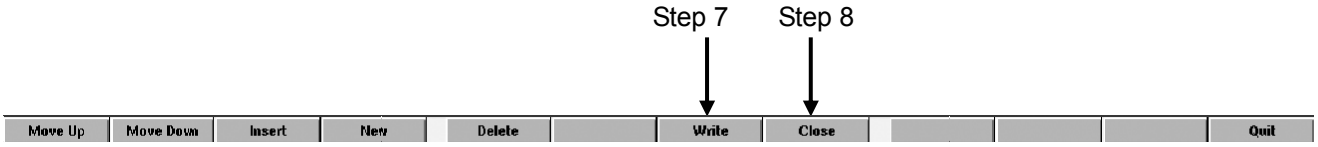
[Step 9] Press F8 (Close) to close the window.

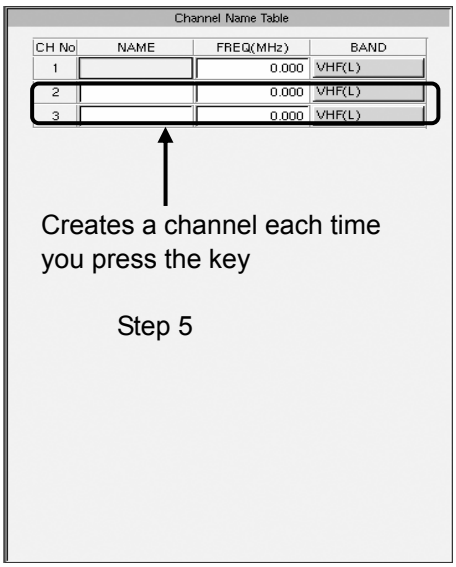


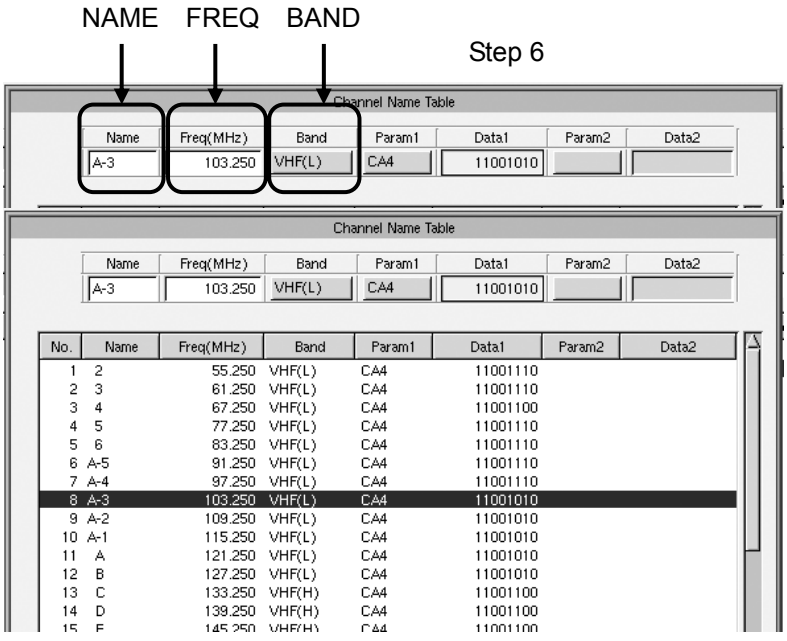
Ch Name Table Function Menu



Edit Table Function Menu





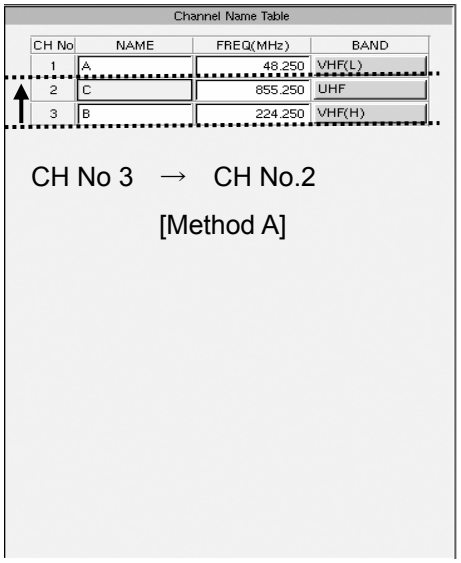


∗ Ver. 2.1 and later

(3) Editing the Channel Name Table

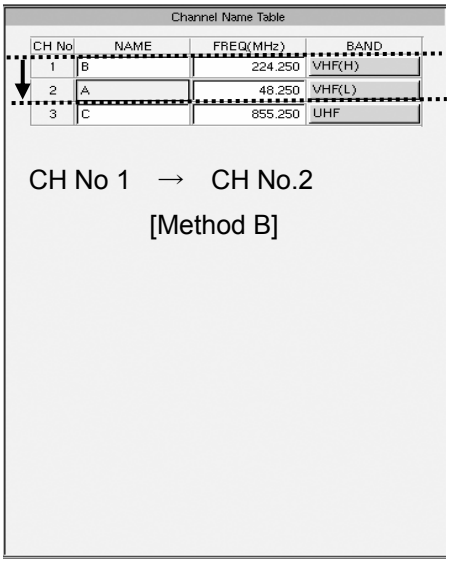
[Method A] Press F1 (Move Up) to move the cursor up (towards a smaller channel number).

[Method B] Press F2 (Move Down) to move the cursor down (towards a larger channel number).



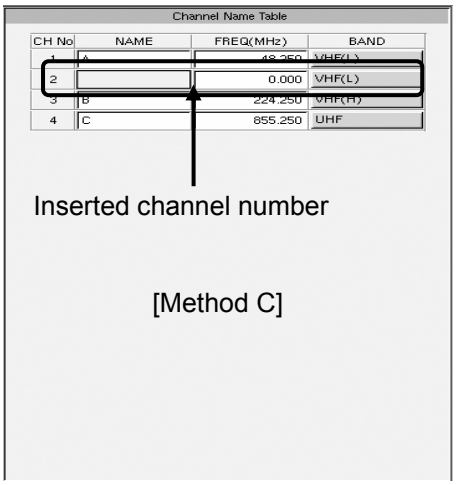
CH No 3 → CH No.2

[Method A]



CH No 1 → CH No.2

[Method B]



Inserted channel number

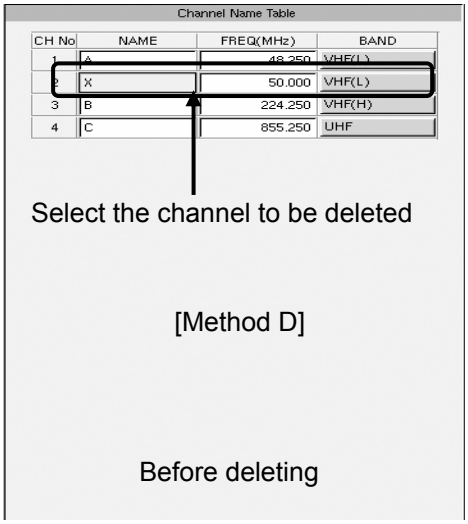
[Method C]

[Method C] Press F3 (Insert) to insert a new channel number before the current channel number.

[Method D] Select a channel number, and press F5 (Delete).

Press F7 (Write) to save the table.

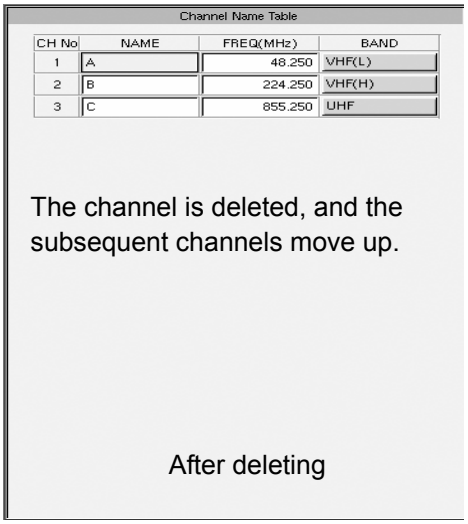
Press F8 (Close) to close the window.



Select the channel to be deleted

[Method D]

Before deleting



The channel is deleted, and the subsequent channels move up.

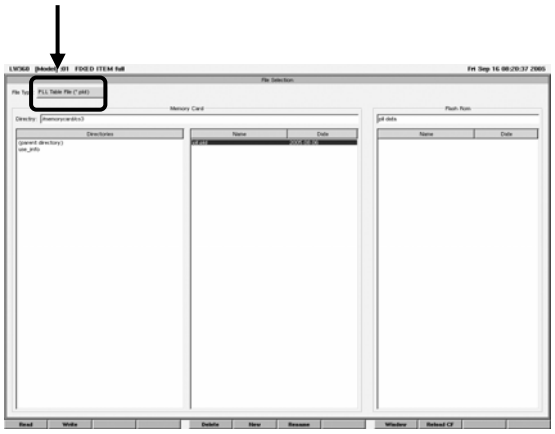
After deleting

5.2.5 PLL Table File

- The PLL table file contains a list of PLL items. Only a single PLL table file can be saved to the flash memory on the LW 360.
- If you want to save multiple list files, save them to the memory card.

(1) File Type

- Select PLL Table File (*.pld) using the Space and Enter keys or the mouse.



(2) Loading a File

a) Loading from the Flash Memory in the LW 360

- Since only one PLL table file can be saved to the flash memory of the LW 360, the file cannot be loaded using the F1 (Read) key.

b) Loading from a Memory Card

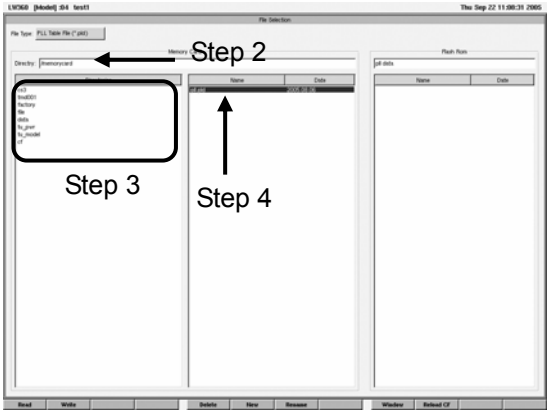
[Step 1] Insert a memory card into the LW 360.

[Step 2] Press F10 (Reload_CF) to detect the memory card.

[Step 3] Select the directory.

- Use the mouse or the Tab key and up and down keys to move the cursor to the desired directory.
- Press F1 (Read) to select the directory. The files in the directory are displayed.

[Step 4] Move the cursor to the desired file, and press F1 (Read).

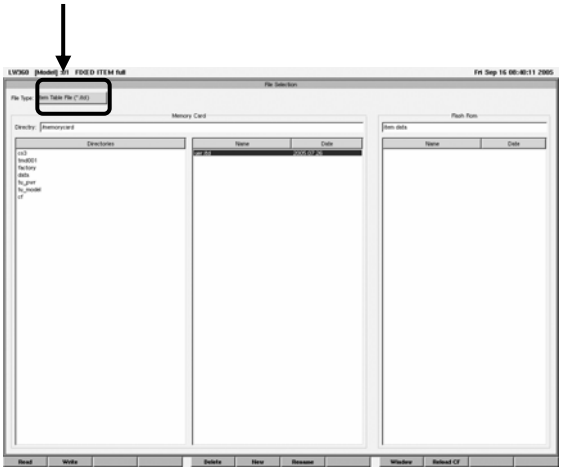


5.2.6 Item Table File

- The item table file stores the step settings that the user configured.
- Saving the common settings among different tuner models is convenient when creating new tuner models.

(1) File Type

- Select Item Table File (*.itd) using the Space and Enter keys or the mouse.



(2) Loading a File

a) Loading from the Flash Memory in the LW 360

Since only one item table file can be saved to the flash memory of the LW 360, the file cannot be loaded using the F1 (Read) key.

b) Loading from a Memory Card

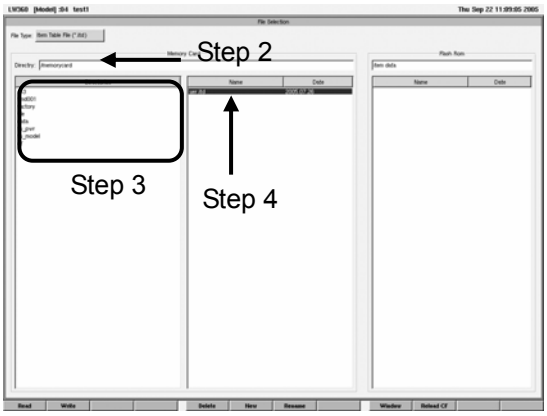
[Step 1] Insert a memory card into the LW 360.

[Step 2] Press F10 (Reload_CF) to detect the memory card.

[Step 3] Select the directory.

- Use the mouse or the Tab key and up and down keys to move the cursor to the desired directory.
- Press F1 (Read) to select the directory. The files in the directory are displayed.

[Step 4] Move the cursor to the desired file, and press F1 (Read).



5.2.7 Wave Form File (Ver. 2.1 and later)

• Edits the Wave Memory files.
• The CF card can save 40 wave forms per one directory.

5.2.8 System Data File (Ver. 2.1 and later)

• The files save the contents that are set by Config.

(1) Save contents

a) The setting to be saved

- F10 (Misc) Except Output File Control
- F9 (Appearance)
- F8 (Printer)
- F7 (RS232C)

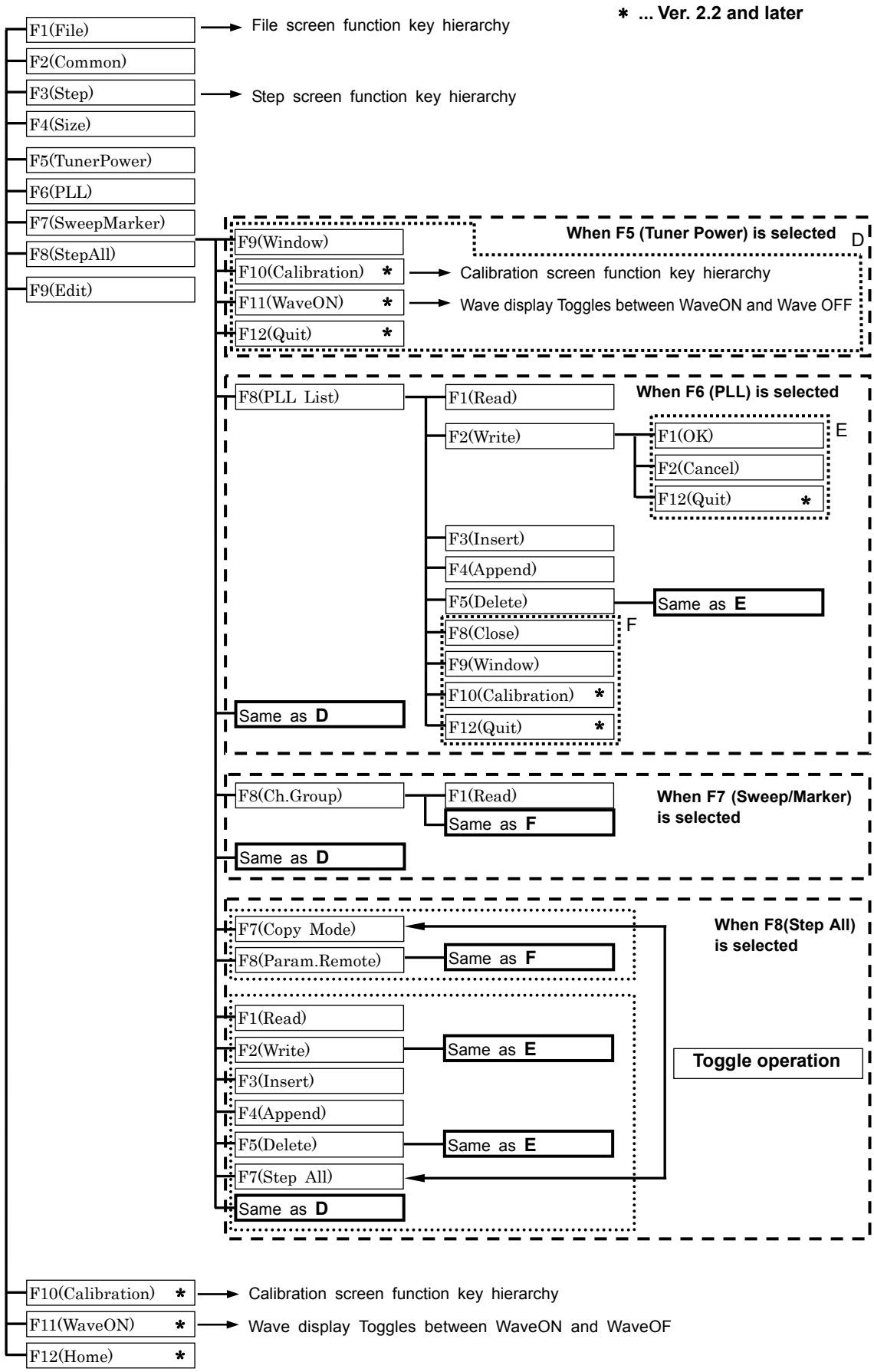
(2) The setting not to be saved

The following data cannot be saved since it is peculiar setting of the LW 360.

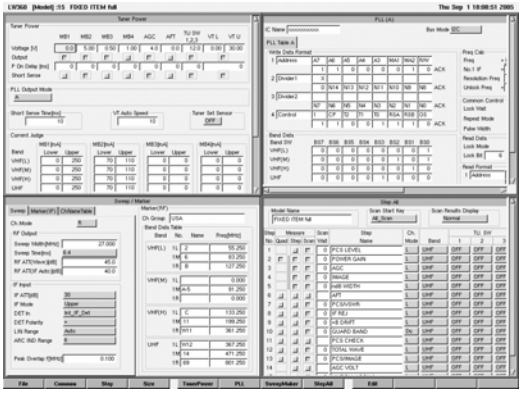
- F5 (Basic)
- F (Network)
- F10 (Misc) Output File Control

5.3 Common Edit Screen

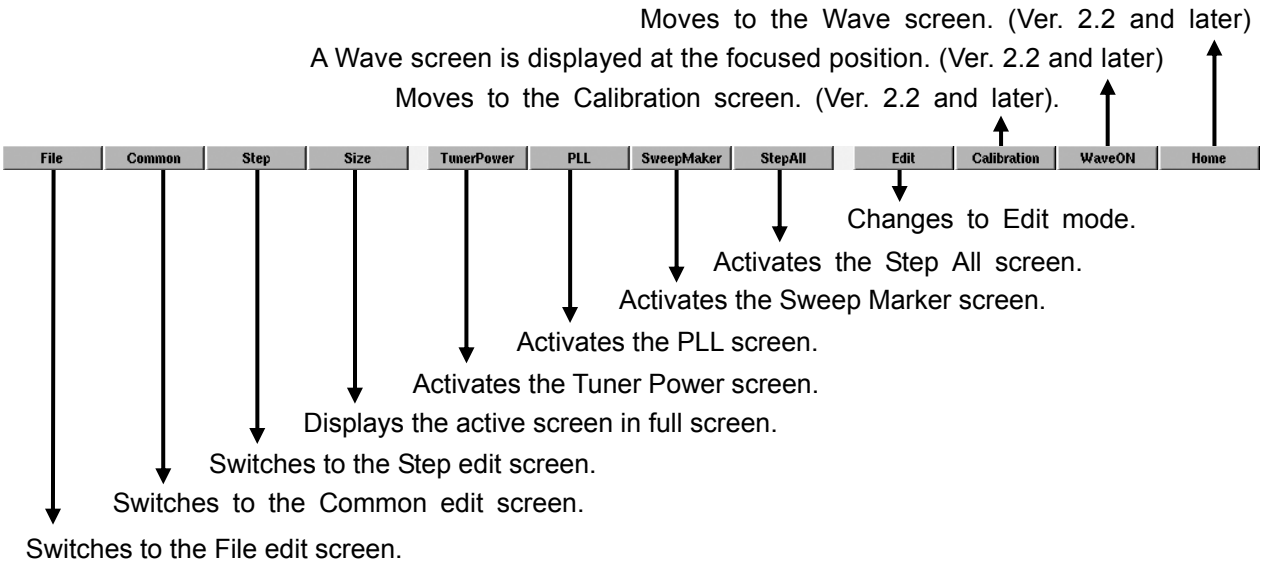
5.3.1 Common screen Function Key Hierarchy



• On the Wave screen, press F2 (Common) or use the mouse to select a function. The Common edit screen is displayed.

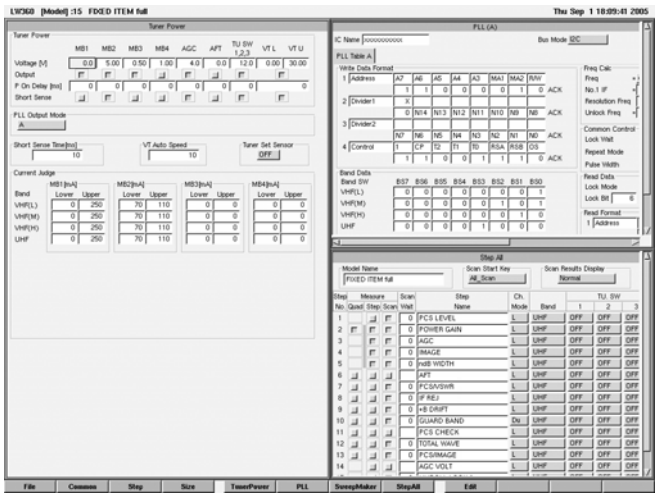


• Common edit screen function key structure



5.3.2 Operations and Settings on the Tuner Power Screen

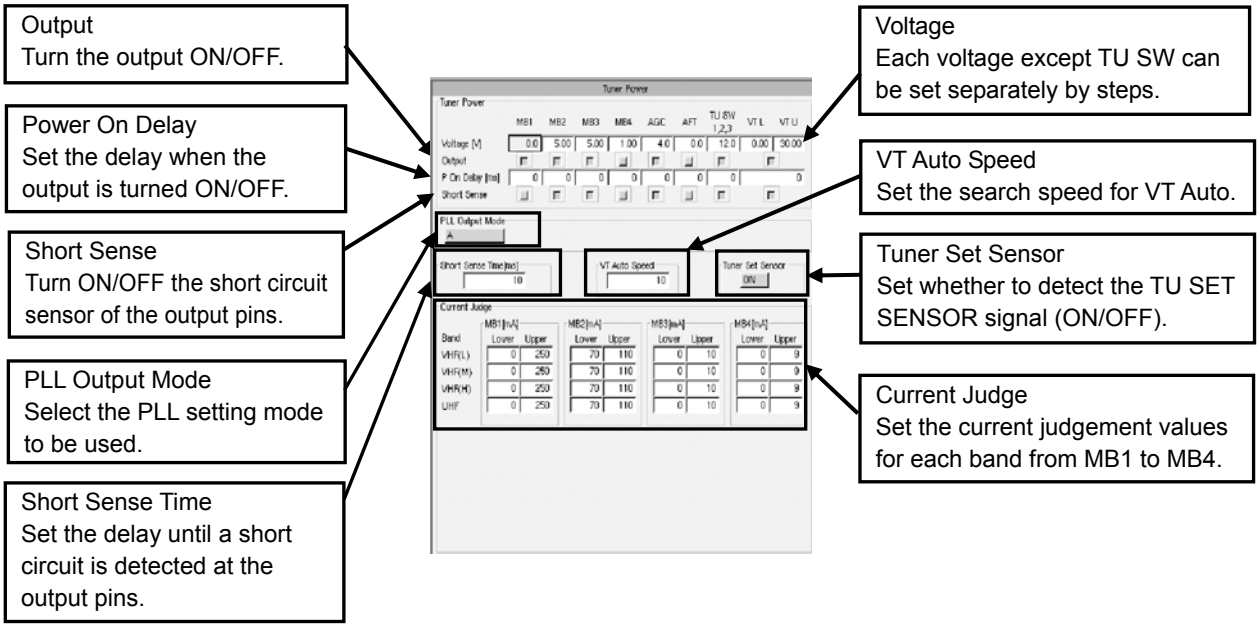
(1) Selecting the Tuner Power Screen



On the Common edit screen, press the F5 (TunerPower) key or click the Tuner Power function on the screen. The Tuner Power screen is activated.
Press the F4 (Size) key to display the entire window.

- The Tuner Power screen is used to enter basic settings according to the power supply specifications.
- There are two types of screens, one for PLL tuners and another for VT tuners.

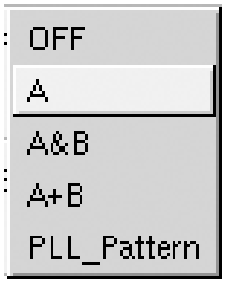
(2) Tuner Power Screen for PLL Tuners



a) Voltage output of TU SW 1, 2, and 3

- The voltage output must be set for each step on the Step All screen. Available settings are OFF, GND, and ON.
  - OFF ・・・High impedance
  - GND ・・・Transistor (open-collector) low level
  - ON ・・・Specified voltage output

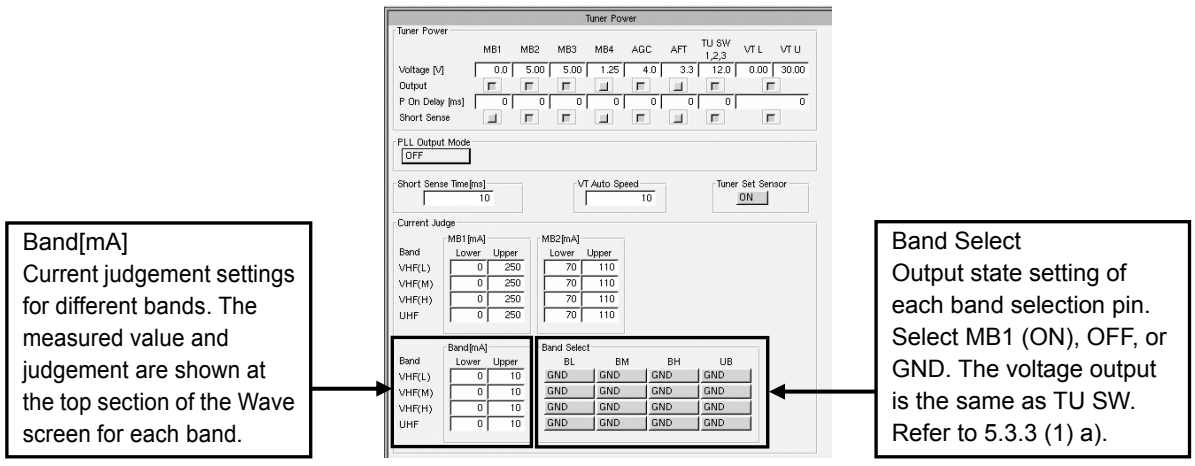
b) PLL Output Mode



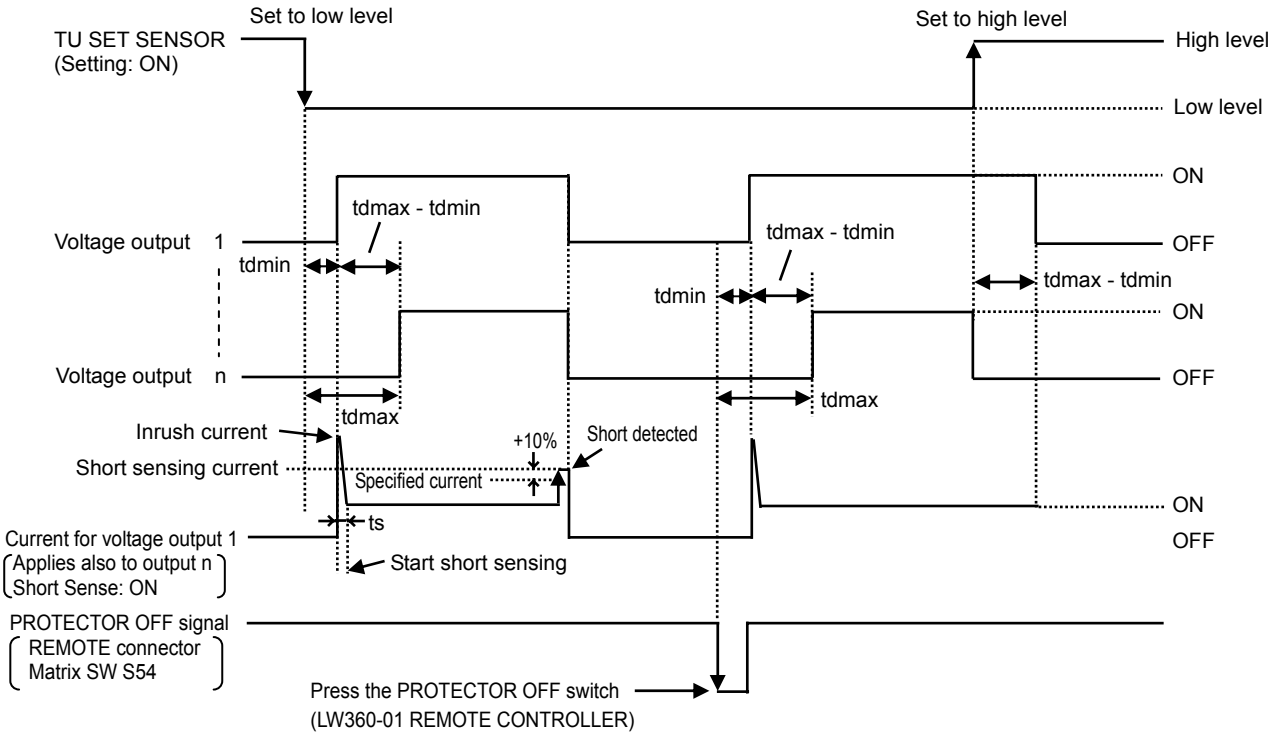
- Move the cursor to PLL Output Mode, and press the Space key or click the mouse to display a selection menu shown on the right.
- PLL Output Mode: OFF
  A setting for the VT tuner. The PLL setting screen becomes blank.
- PLL Output Mode: A
  Transmits only the data of PLL Table A. The I^2C data is fixed 5 bytes. This is used for general analog tuners, etc. Bus Mode supports I^2C, 3 Wire, and CCB systems.
- PLL Output Mode: A&B
  Transmits the data of PLL Table A followed by B. Data A and B is continuous without a stop condition or start condition in between the two. The number of output data bytes can be set in the range of 2 to 10 bytes. Bus Mode is dedicated to I^2C.
- PLL Output Mode: A+B
  Transmits two types of data, the data of PLL Table A followed by that of B. This is used for double-conversion type tuners with two PLL ICs. Bus Mode supports I^2C, 3 Wire, and CCB systems.
- PLL Output Mode: PLL_Pattern
  Up to 256 bytes of I^2C data can be set. This is used for tuners with large setting data such as a digital tuner with a demodulation IC. Bus Mode supports I^2C and 3 Wire systems.

(3) Tuner Power Screen for VT Tuners (PLL Output Mode: OFF)

- Set PLL Output Mode to OFF to enable TUNER POWER settings of VT tuners. In this case, MB3 and MB4 specified for PLL tuners cannot be used. Instead, BL and BM for the BAND switch are enabled. Pin 17 of the TUNER POWER connector on the rear panel is shared between BL and MB3; pin 18 is shared between BM and MB4. The output switches with the PLL Output Mode setting.
- The Tuner Power screen for VT tuners displays Current Judge only for MB1 and MB2 as shown below. Band current judgement and Band Select are added to the screen. The other setup is the same as PLL tuner.



(4) Power Supply Output ON/OFF Timing Chart

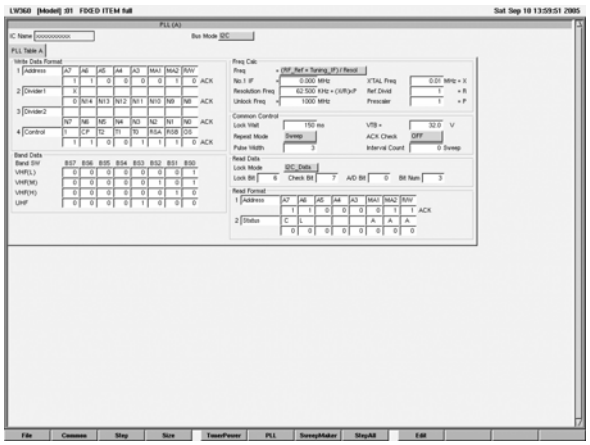


Power On Delay:	Set the delay in the range of td min to max for each voltage.
Short Sense:	ON (Short sensing is disabled when OFF is selected.)
Short Sense Time Lag:	ts setting (time until the inrush current subsides)
Tuner Set Sensor:	ON (If set to OFF, the output is delivered constantly regardless of the Tuner Set Sensor signal.)

- A short circuit is sensed at +10% or greater of the specified current for each voltage output.
- The REMOTE connector matrix switch can be used in place of a Tuner Set Sensor signal.
  S55: TU PWR START ····· Corresponds to low level
  S56: TU PWR RESET ····· Corresponds to high level

5.3.3 PLL Table

(1) Selecting the PLL Table Screen



- On the Common edit screen, press the F6 (PLL) key or click the PLL function on the screen. The PLL screen is activated. Press the F4 (Size) key to display the entire window.

- The following types of PLL Table screens are available.
  PLL (A) (Bus Mode:I^2C,3Wire,CCB)
  PLL (A&B) (Bus Mode: I^2C)
  PLL (A+B) (Bus Mode: I^2C,3Wire,CCB)

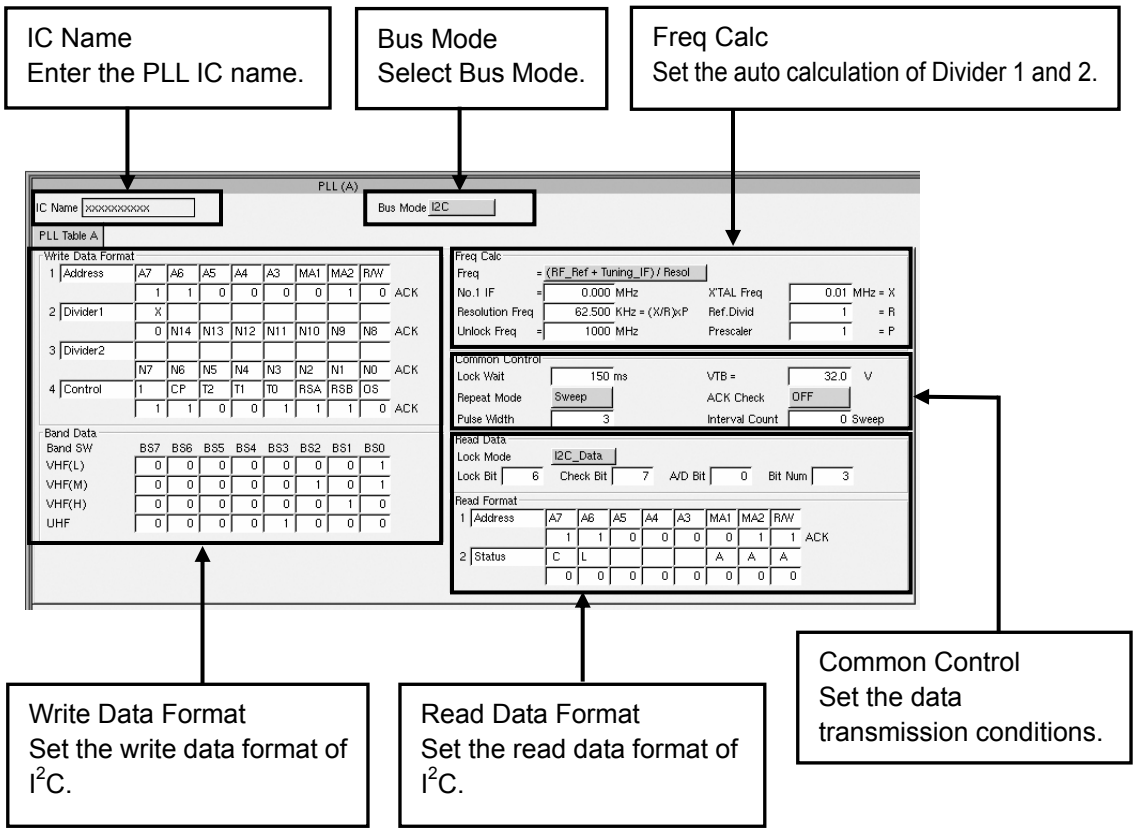
- Set the PLL screen according to the specifications of the tuner to be used.

(2) Bus Mode I^2C

a) Bus Mode Setting

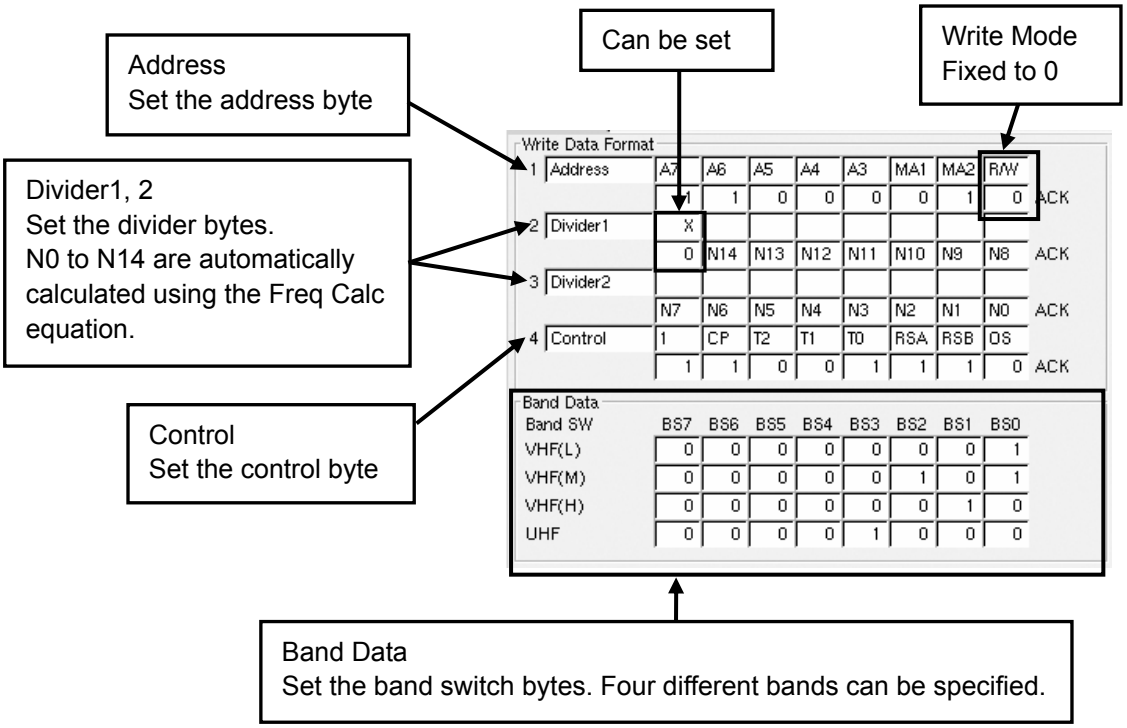
- Move the cursor to Bus Mode at the top center of the PLL screen, press the Space key to select it, and press the Enter key. You can also click the Bus Mode button with the mouse.

b) Screen Configuration (I^2C) of PLL (A)



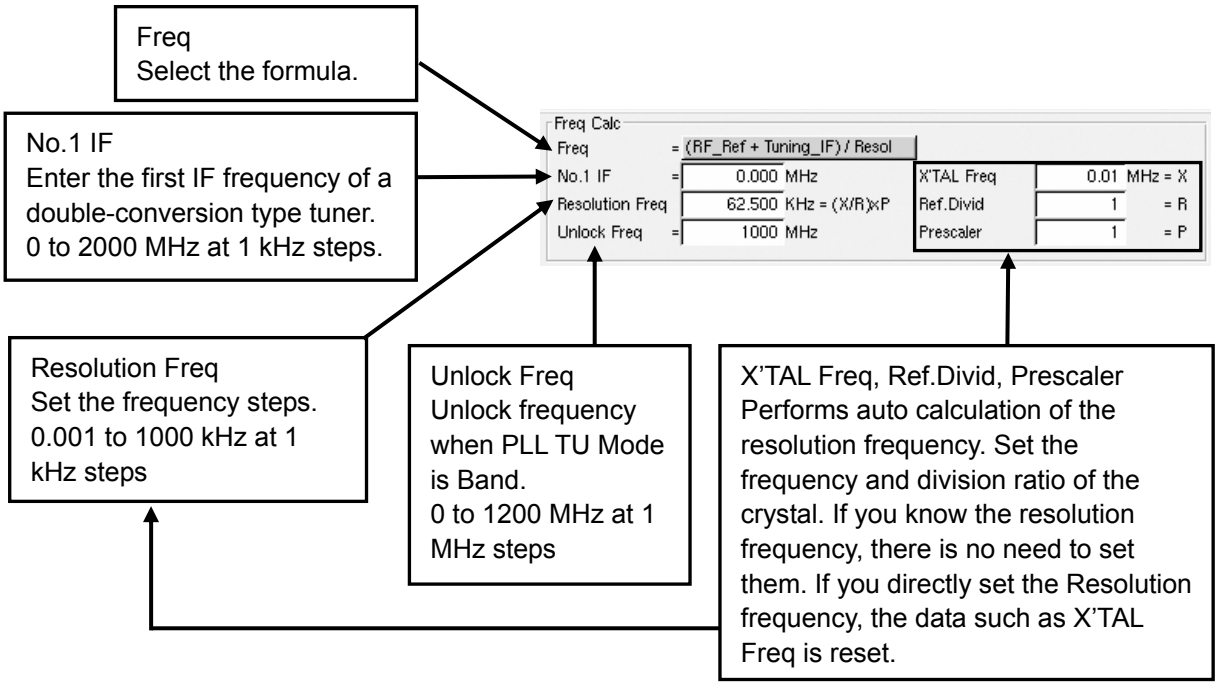
c) Write　Data Format

• Set the write data of the I^2C data. The address, Control, and Band SW bytes can be set individually in the step settings.

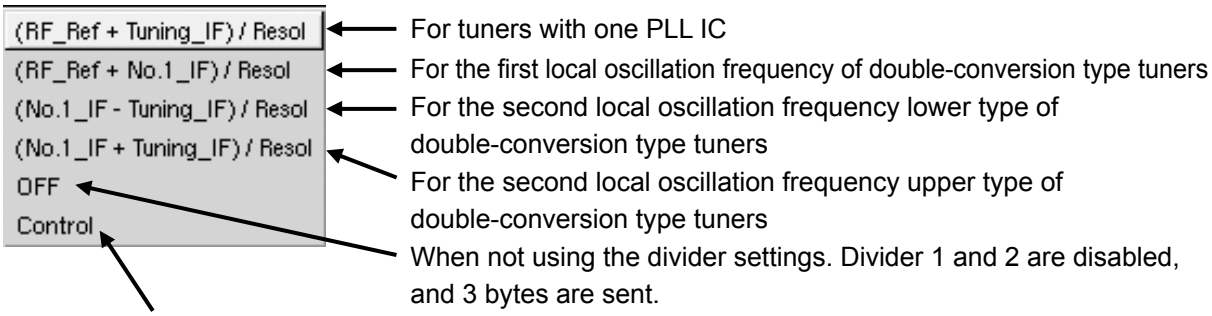


d) Freq Calc

• Set the auto calculating formula of the PLL IC programmable divider. The programmable divider is set to the frequency specified by the RF Ref Marker according to this auto calculation.



• Move the cursor to the Freq formula, and press the Space key or click the mouse to display a menu shown below. OFF and Control are available in addition to the four formulas.



• Unlock frequency is fixed to the frequency in which all the bits are when in the frequency calculation.

Example) When Resolution Freq = 31.25 kHz, 15 bits, and Tuning IF = 45.75 MHz

fmax = Resolution Freq × 32767 - Tuning IF

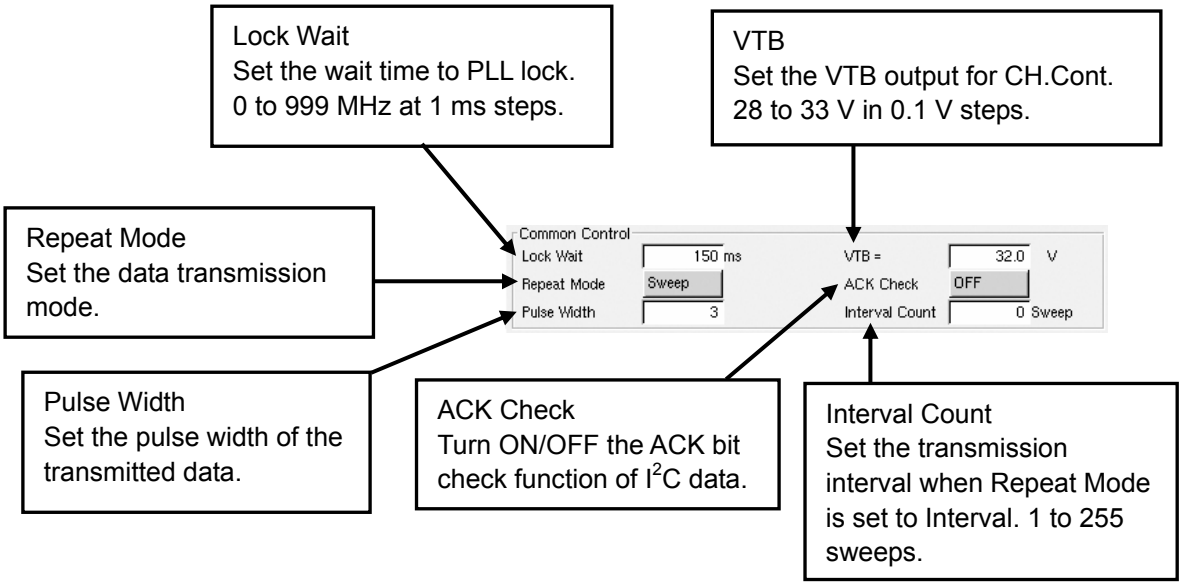
= 31.25 × 10E3 × 32767 - 45.75 × 10E6 = 978.219MHz

• X'TAL Freq・・・The frequency of the Ref CLK crystal of the PLL IC. 0.01 to 9.99 MHz at 10 kHz steps.

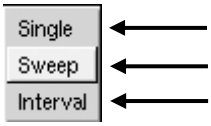
• Ref.Divid・・・The division ratio of the Ref CLK crystal of the PLL IC. 1 to 9999

• Prescaler・・・The division ratio of the prescaler for the main counter of the PLL IC. 1 to 99

e) Common Control



• Repeat Mode・・・Select the timing for sending the PLL control signal. Three modes are available: Single, Sweep, and Interval. Move the cursor to Repeat Mode, and press the Space key or click the mouse.



Send the signal only when switching the step
Send the signal each time the channel is swept
Send the signal every Interval Count of sweeps

• Pulse Width・・・Set the coefficient for varying the pulse width of the transmitted data. Set the smallest possible value that the PLL IC responds.

Pulse width per clock

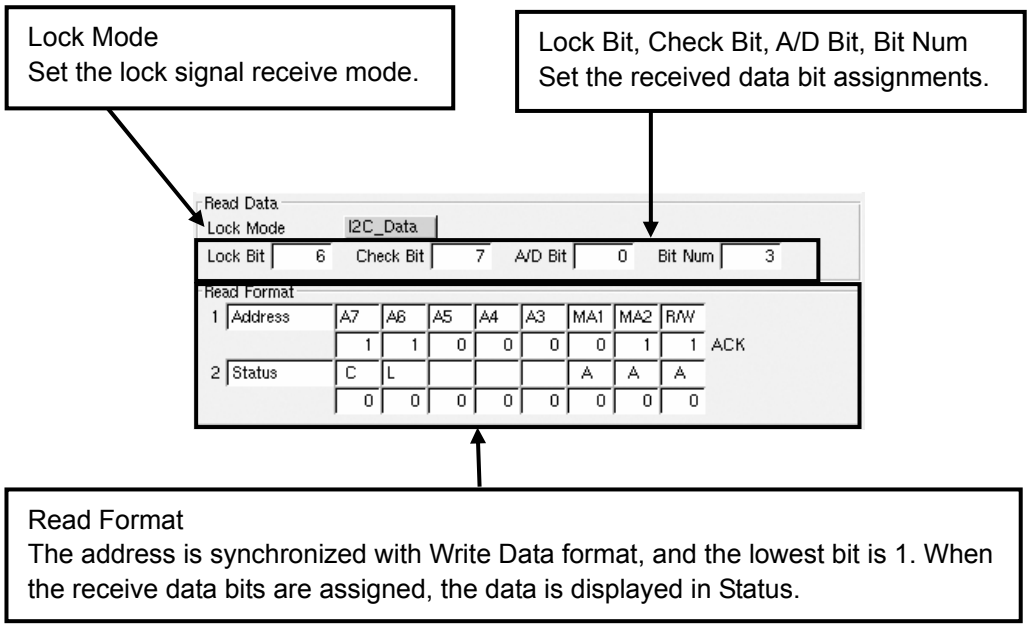
$40 + 9.8 \times n$ (μs) n: 0 to 255

The formula is different if PLL Pattern is used.

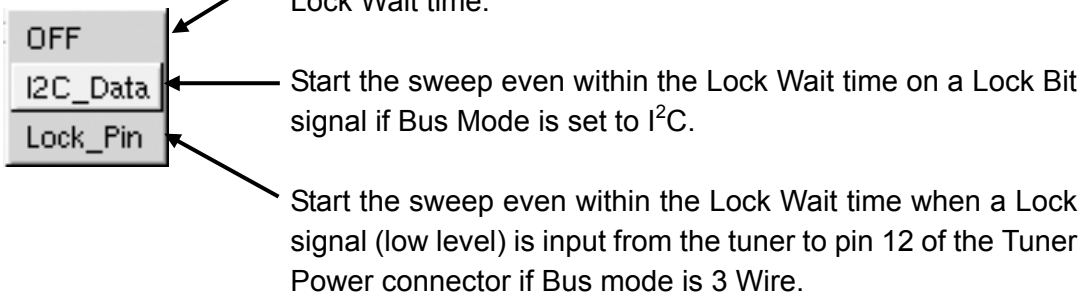
$1.4 \times n$ (μs) n:0 to 255

• ACK Check・・・This function stops sending the PLL control signal when the ACK bit data is set to high when Bus Mode is set to I^2C data.

f) Read Data, Read Format



• Lock Mode・・・Select the lock signal receive mode. Move the cursor to Lock Mode, and press the Space key or click the mouse.



• Lock Bit, Check Bit, A/D Bit, Bit Num
If Lock Mode is set to I^2C, assign the receive data bits. Bits are displays as follows: Lock Bit : L, Check Bit : C, A/D Bit, Bit Num : A. Set each bit according to the specifications of the PLL IC.

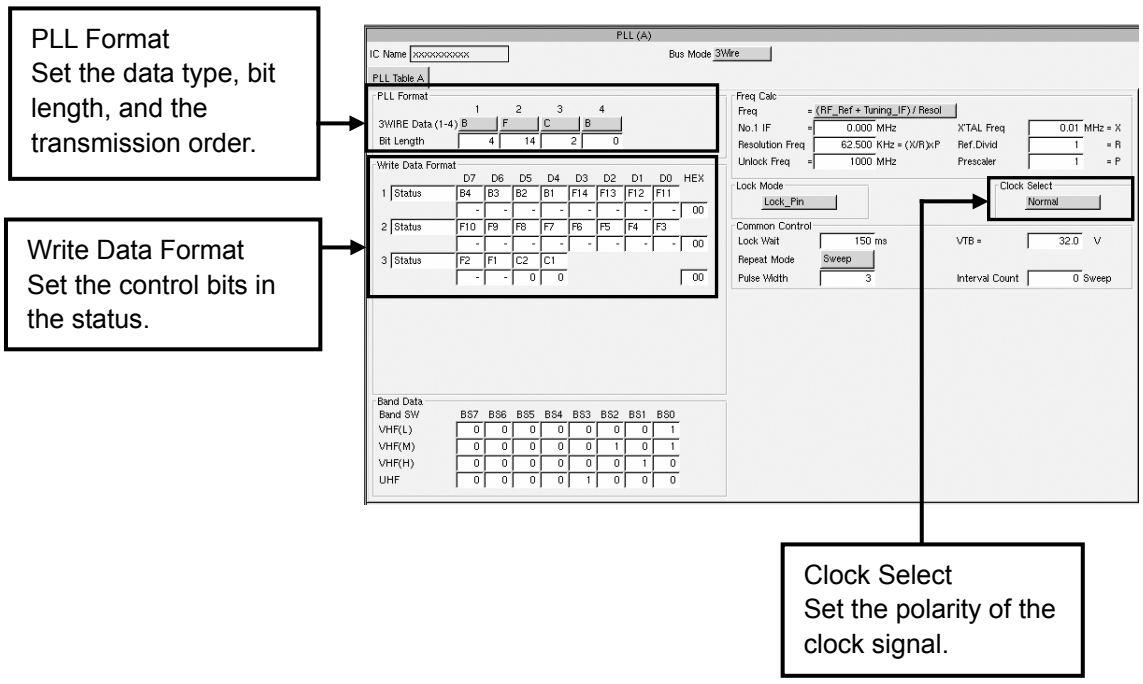
(3) Bus Mode 3Wire

a) Bus Mode Setting

• Move the cursor to Bus Mode at the top center of the PLL screen, press the Space key to select it, and press the Enter key. You can also click the Bus Mode button with the mouse.

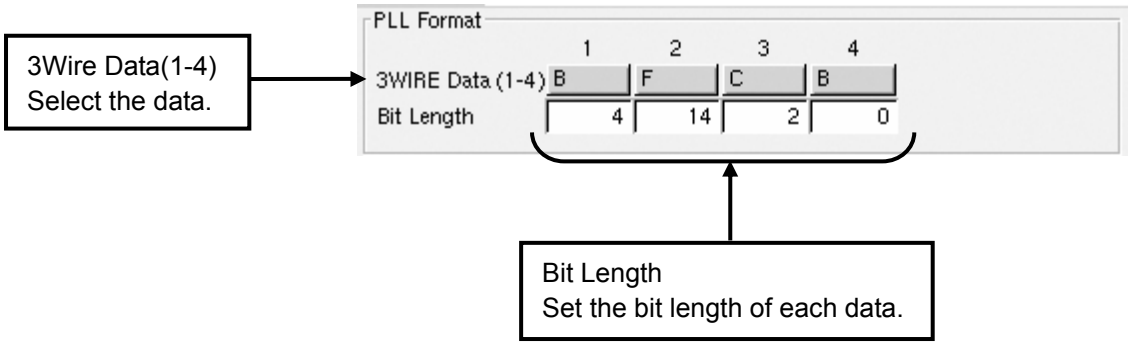
b) Screen Configuration (3 Wire) of PLL (A)

• The screen is the same as when Bus Mode is I^2C except PLL Format, Write Data Format, and Clock Select.

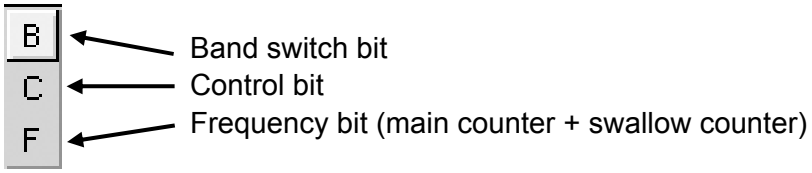


c) PLL Format

• Set the type and bit length in the order in which the 3 Wire data is to be sent. You can set up to 48 bits.

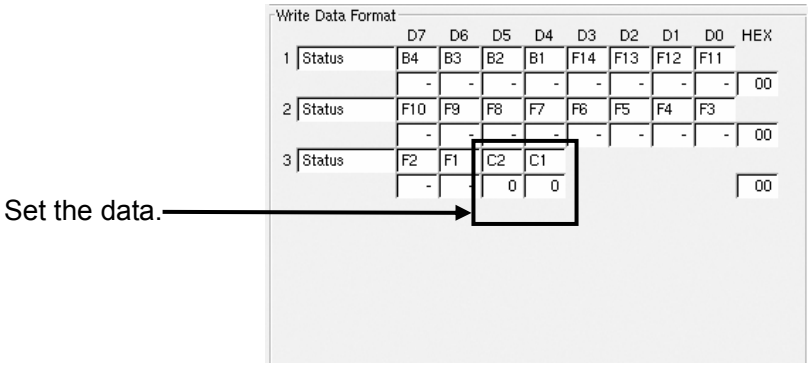


• 3Wire Data・・・Move the cursor to the data, and press the Space key or click the mouse.



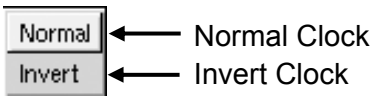
d) Write Data Format

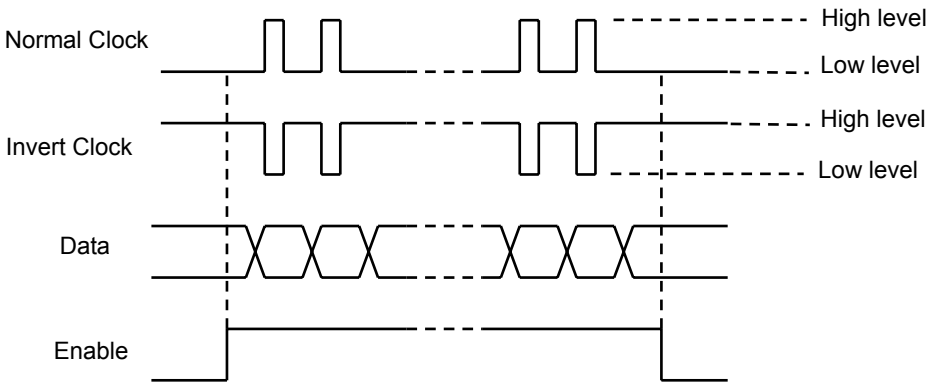
• Lists the bits set in 3WIRE Data. Set the control bits in the Status box.



e) Clock Select

• This function inverts the polarity of the clock signal when Bus Mode is set to 3 Wire. Move the cursor to Clock Select, and press the Space key or click the mouse.



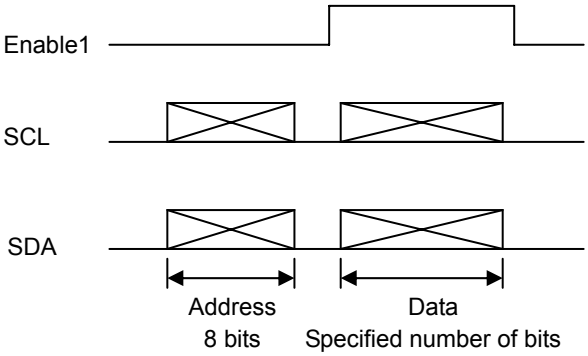


(4) Bus Mode　CCB

• CCB data can be sent to FM tuners. Set Bus Mode to CCB.

a) Features of the CCB Format

• In CCB format, Address data is sent before Enable. In addition, the LSB/MSB order of the frequency bits is reversed with respect to 3 Wire.



Frequency data (auto calculation)

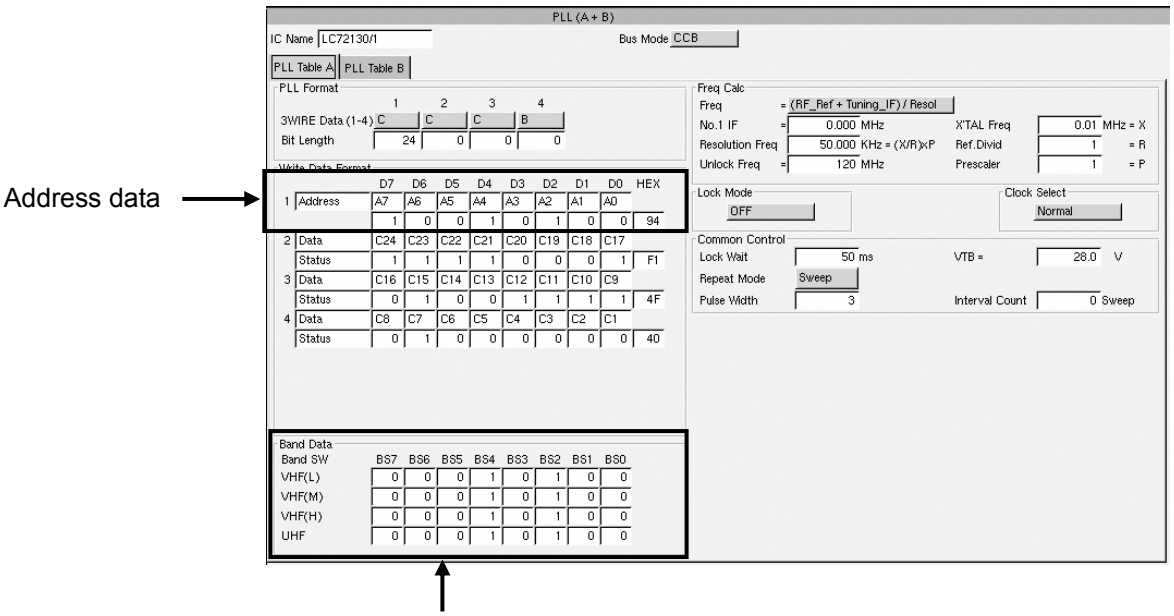
F16・・・LSB

F1 ・・・MSB

2	Data	F16	F15	F14	F13	F12	F11	F10	F9	
	Status	-	-	-	-	-	-	-	-	00
3	Data	F8	F7	F6	F5	F4	F3	F2	F1	
	Status	-	-	-	-	-	-	-	-	00

b) CCB Screen Configuration

• The setup procedure is the same as with 3 Wire.

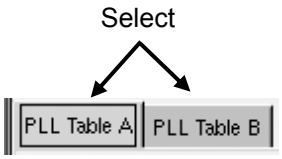


(5) PLL Output Mode A+B Settings

- This mode is used to control tuners with two PLL ICs.
- The PLL Table A and PLL Table B screens are used. The basic settings are the same as with PLL Table A.
- Available Bus Modes are I^2C, 3 Wire and CCB. This section explains the screen for I^2C.

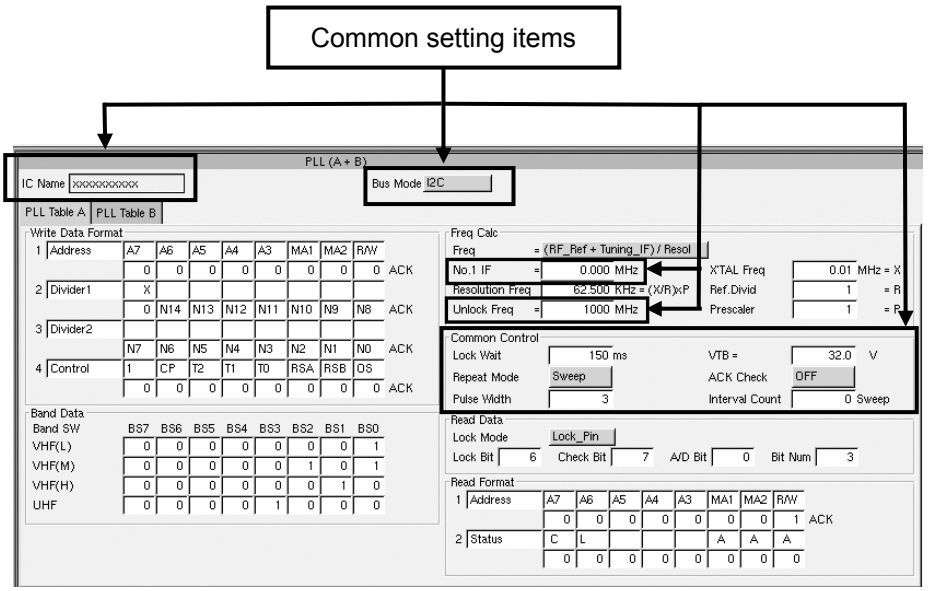
a) PLL Table A and B Selection

- Set PLL OUTPUT Mode on the Tuner Power screen to A+B.
- Press the F6 (PLL) key or use the mouse to activate the PLL (A+B) screen.
- Move the cursor to the PLL Table A or PLL Table B tab at the upper left of the screen, and select it using the Space key or the mouse.



b) Common Setting Items

- The screen configuration of PLL Table A and PLL Table B is common, and some items are shared between the two screens. Set these items in either screen.



c) Settings

- For items other than the common items above, set them according to each PLL IC. The data transmission order is A and then B.
- For A+B, a stop condition and start condition are inserted between A and B. If you wish to send a continuous signal for A and B, use PLL Output Mode A&B.

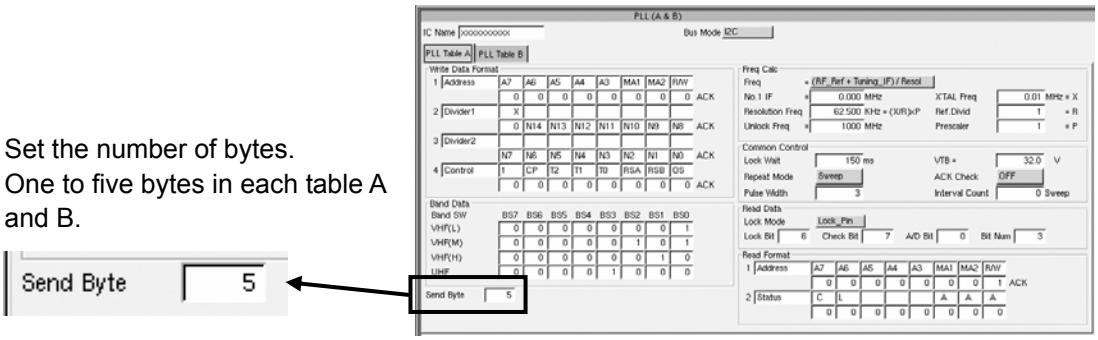
(6) PLL Output Mode A&B Settings

- This function sends PLL Table A and B continuously when PLL Output Mode is I^2C. Total continuous data of 2 to 10 bytes can be sent for PLL Table A and B.
- Variable range of PLL data bytes: One to five bytes in each table A and B. The specified number of bytes of A and B are sent continuously.
- The PLL Table A and PLL Table B screens are used. The basic settings are the same as with PLL Table A.
- Bus Mode is dedicated to I^2C.
- Set PLL OUTPUT Mode on the Tuner Power screen to A&B.

a) PLL Table A and PLL Table B Settings

- Setting the number of bytes

Set the number of bytes.
One to five bytes in each table A and B.



- Output in fixed format

One to five bytes can be set in PLL Table A and B. However, Divider 1 and 2 are set to fixed positions when they are used to automatically set the frequency. The Band SW byte is also set to a fixed position when it is used.

Divider1 and 2
Fixed to the 2nd and 3rd bytes.

Band SW
Fixed to the 5th byte.
Fixed to the 3rd byte if Freq is OFF.

PLL Table A | PLL Table B

Write Data Format

1	Address	A7	A6	A5	A4	A3	MA1	MA2	R/W	
		0	0	0	0	0	0	0	0	ACK
2	Divider1	X								
		0	N14	N13	N12	N11	N10	N9	N8	ACK
3	Divider2									
		N7	N6	N5	N4	N3	N2	N1	N0	ACK
4	Control	1	CP	T2	T1	T0	RSA	RSB	OS	
		0	0	0	0	0	0	0	0	ACK

Band Data

Band SW	BS7	BS6	BS5	BS4	BS3	BS2	BS1	BS0
VHF(L)	0	0	0	0	0	0	0	1
VHF(M)	0	0	0	0	0	1	0	1
VHF(H)	0	0	0	0	0	0	1	0
UHF	0	0	0	0	1	0	0	0

Send Byte 5

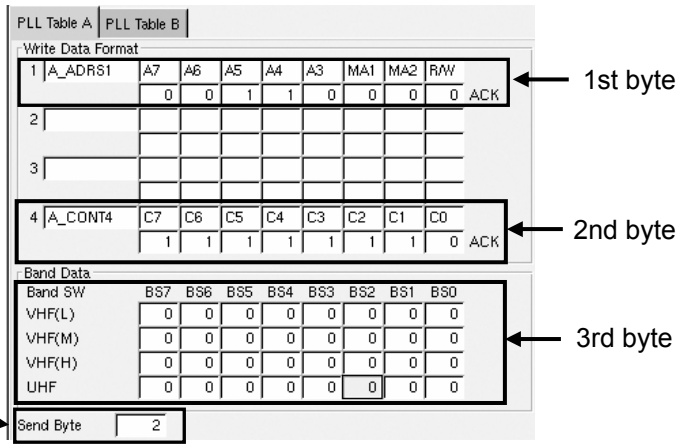
b) Example Using PLL Output Mode A&B

• In this example, two bytes are set in PLL Table A and five bytes are set in PLL Table B.

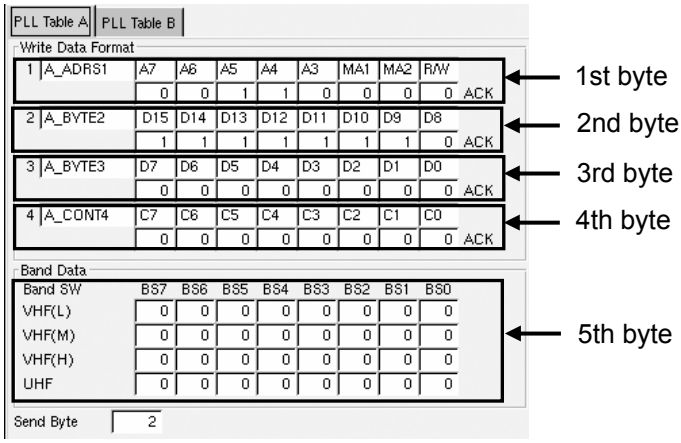
When Freq of Freq Calc is OFF

• When Freq of Freq Calc is OFF, only a maximum of three bytes can be set.
To set four or five bytes, set Freq to Control.

• Because two bytes are set in PLL Table A and five bytes are set in B, the total is seven bytes.



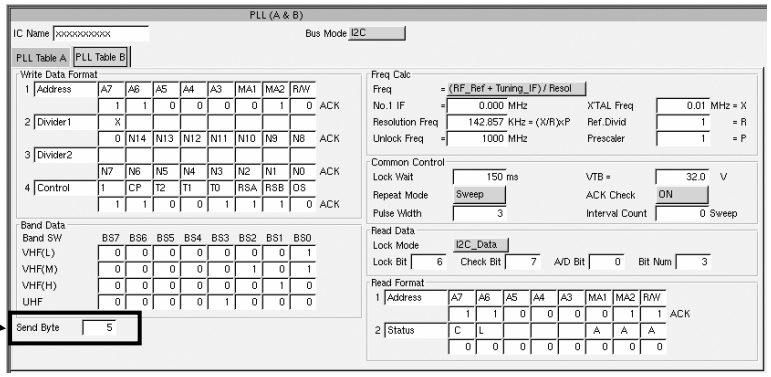
When Freq of Freq Calc is Control



PLL Table B Settings (When Using Auto Frequency Setting and Band SW)

• Set to the normal five bytes.
Set Send Byte to 5.

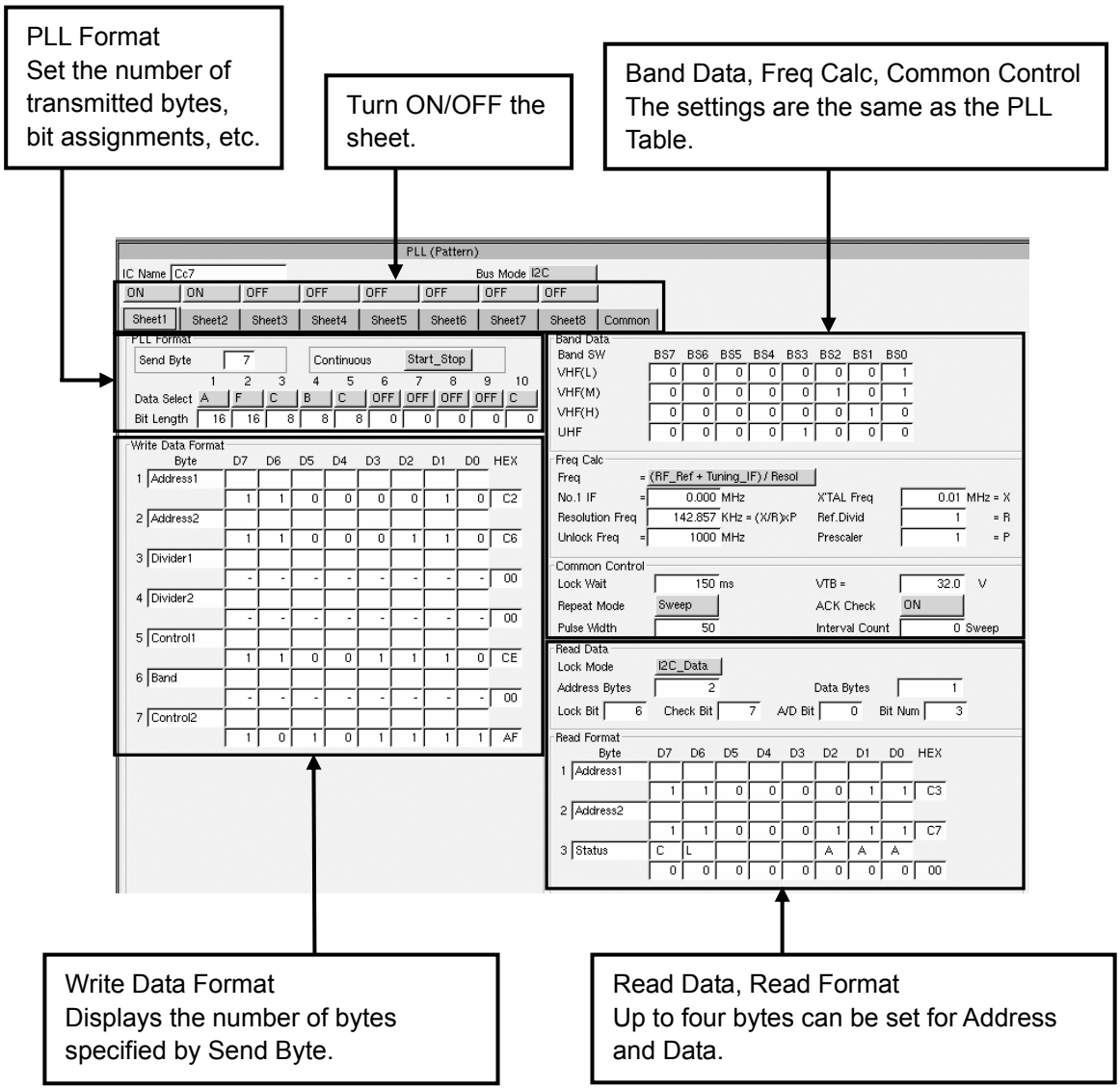
Set to 5 bytes.



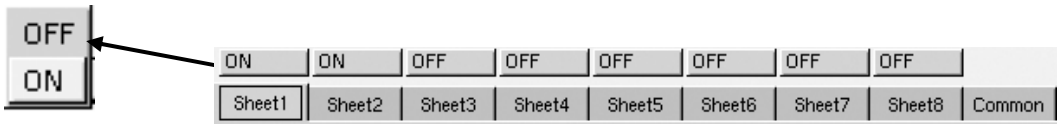
5.3.4 PLL Pattern

• The PLL Tables for I²C allowed up to 10 bytes to be set using 5 bytes for each table A and B. PLL Pattern allows up to 256 bytes to be set. One sheet consists of 32 bytes, and you can set up to eight sheets (256 bytes total).
PLL Pattern allows you to insert the automatically calculated Divider bytes and Band SW byte at arbitrary positions. In addition, the number of transmitted bytes can be varied for each step, and start condition and stop condition can be inserted at arbitrary positions.

(1) PLL Pattern Screen Configuration (When Bus Mode is I²C)



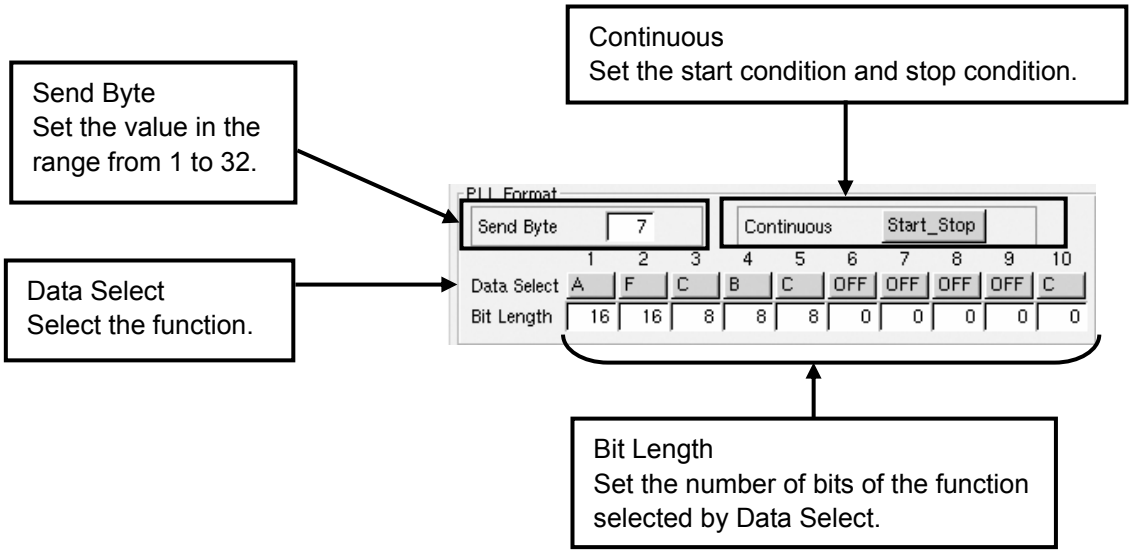
Turning ON/OFF the Sheet



• When using PLL Pattern, first select the sheets to be used. Move the cursor to button above the Sheet 1 to 8 tabs, and select it using the Space key or the mouse.

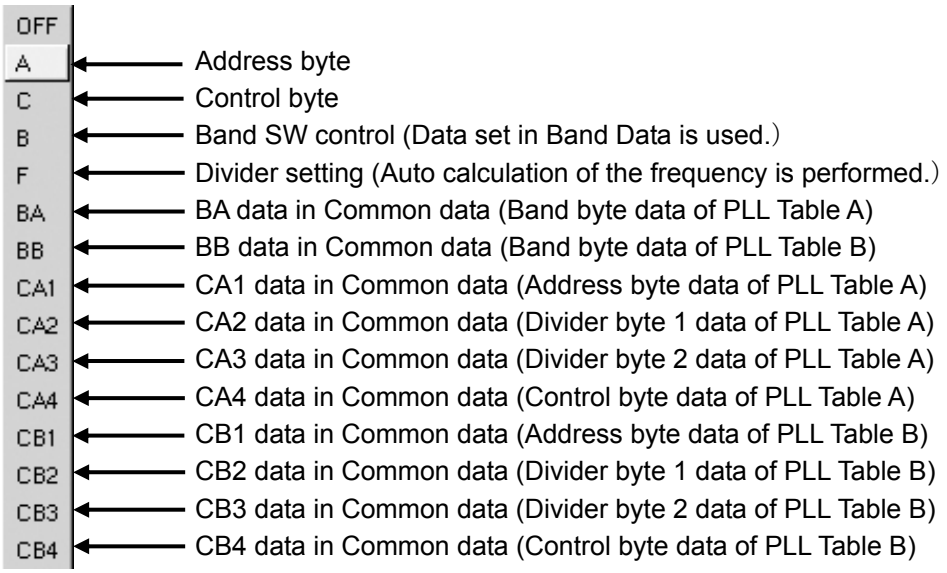
b) PLL Format

• Select a sheet. Then, set the number of bytes and bit assignments on the selected sheet.



• Data Select

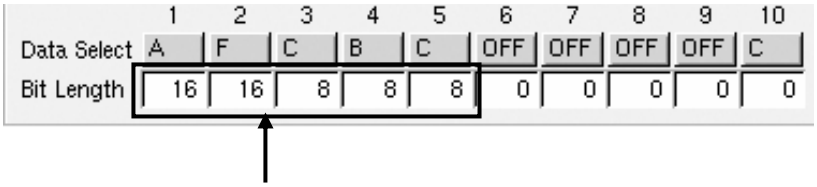
Set the data in the order in which the data is to be sent. Basically, the A, C, B, and F items can be used to set the data. If you wish to change the bit for each step, use BA1 and 2; CA1 to 4; and CB1 to 4. These use the data of the PLL Table as Common data and allow the bits to be changed with the Setting Item of Step. The data contents can be set on the Common sheet.



• Bit Length

Set the number of bits of the data item specified by Data Select. First, the number of bits of the number of bytes specified by Send Byte is set in the 10th C box. For example, if seven bytes is specified, the C box is set to 56 bits.

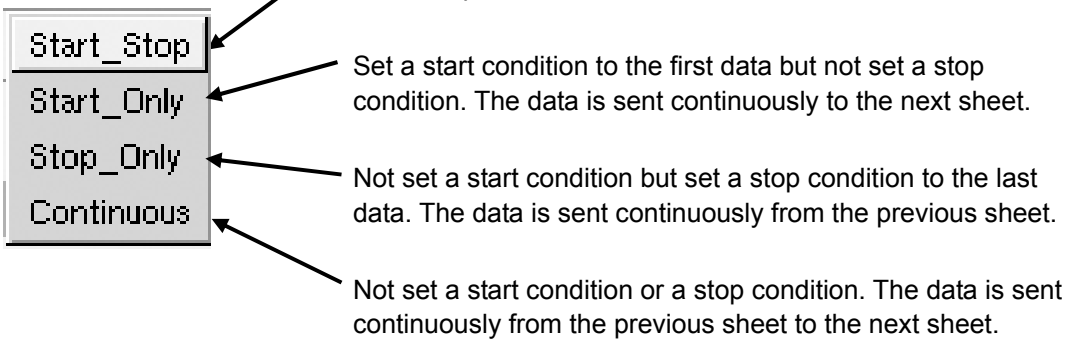
Set the number of bits in order from the first A (address byte). As you set the number of bits, the number of bits in the 10th box decreases accordingly. When all bits are set, the 10th box becomes 0.



Set the number of bits of each data item according to the specifications of the PLL IC.

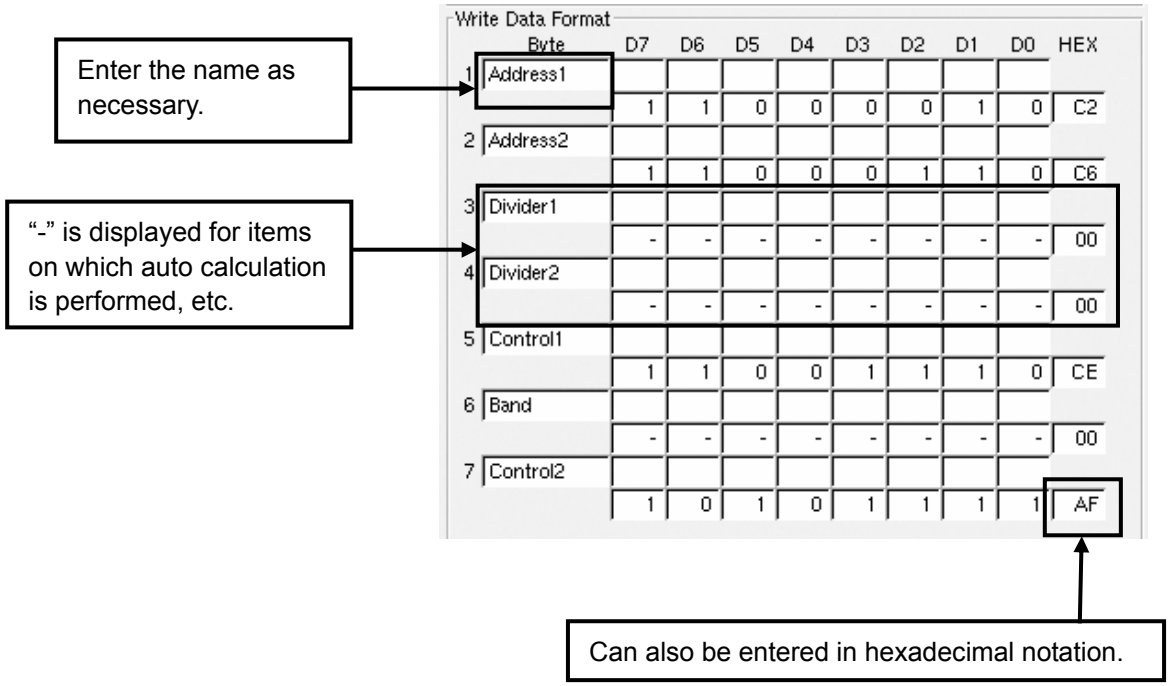
• Continuous

Set the start condition or stop condition for the data in the sheet. Move the cursor to Continuous, and press the Space key or click the mouse.



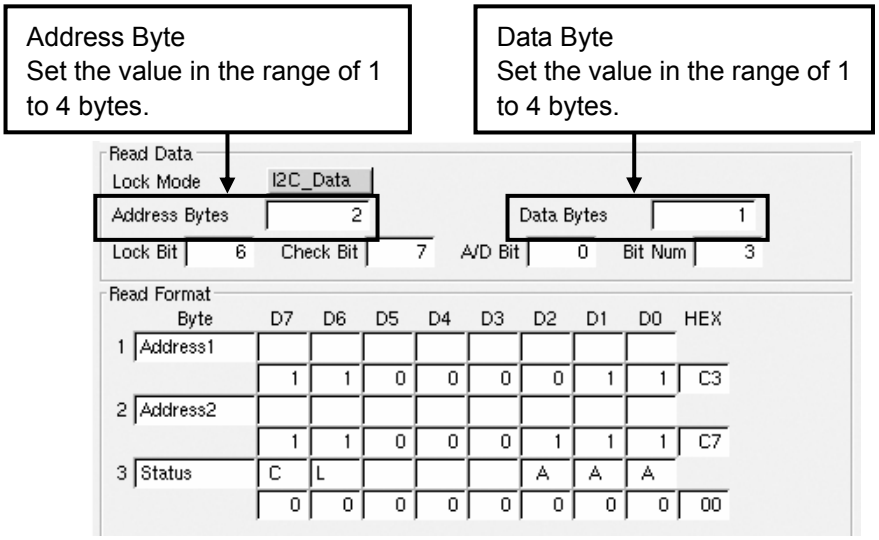
c) Write Data Format

- Set the write data format in the same manner as the PLL Table. The difference from the PLL Table is that there are no names displayed in the Byte boxes, because data items are set arbitrarily. As necessary, enter the name of the data according to the specifications of the PLL IC. In addition, enter the function name of each bit (CP0, CP1, etc.) as necessary.
- The data box displays "-" for data items that use auto calculation or refer to other data bytes (F, B, BB1, BB2, CA1 to 4, and CB1 to 4).
- The data can be set at the bit level, but it can also be entered in hexadecimal notation at the byte level.



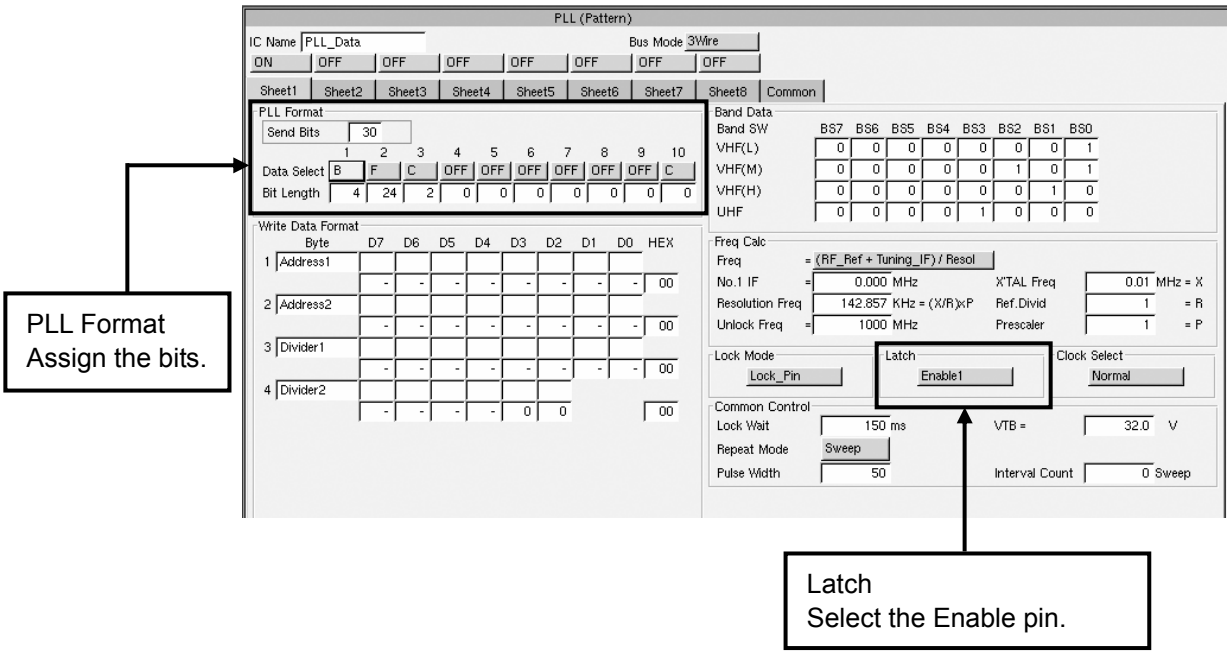
d) Read Data Format

- The read data format is basically the same as with the PLL Table. However, because the number of bytes can be varied as with Write Data, set the number of bits for each data item.



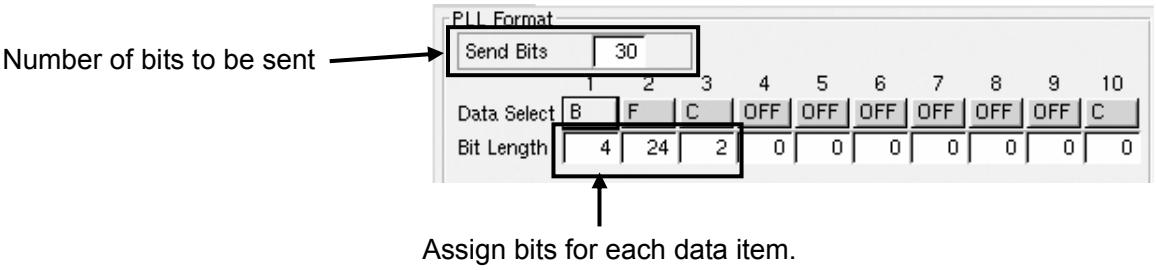
(2) PLL Pattern Screen Configuration (When Bus Mode is 3 Wire)

• PLL Pattern can be used with Bus Mode set to 3 Wire format. The PLL Table allows up to 48 bits of data, but PLL Pattern allows up to 256 bits per sheet.
However, the maximum number of bits for B (band bit) and F (frequency bit) are 8 and 24, respectively.



a) PLL Format

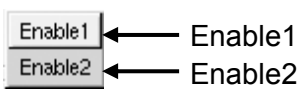
• Select the data item with Data Select, and set each bit. The total number of set bits is displayed in the Send Bits box.



• When A is set to Data Select, data will be transmitted forward of Enable.

b) Latch

• This function selects the pins for Enable1 (pin 15 of the TUNER POWER connector) and Enable2 (pin 23 of the TUNER POWER connector). Move the cursor to Latch, and press the Space key or click the mouse.

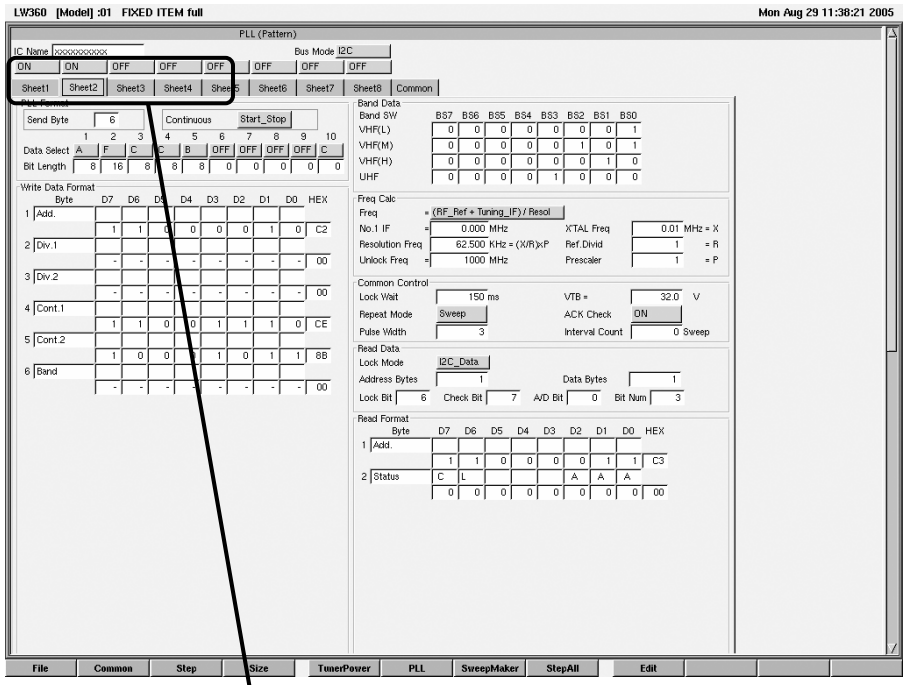


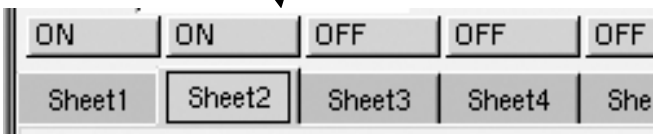
(3) Sheet Selection at the Step Level in PLL Pattern (When Bus Mode is I^2C)

- PLL Pattern generates up to 256 bytes of signals by using up to eight sheets with 32 bytes in each sheet. Each sheet can be used at the step level. This is convenient when you want to vary the number of transmitted bytes for each step or create data that is sent only when the power is turned ON.

a) Creating the Data

Set the necessary I^2C data in each sheet.



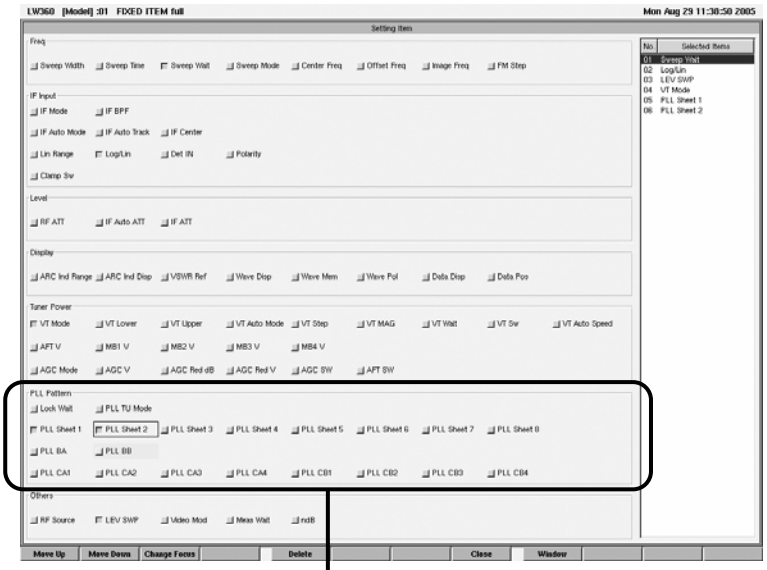


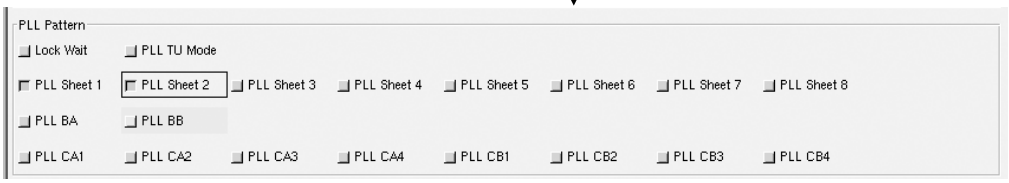
Turn the necessary sheets ON and set them.

b) Selecting the Setting Item

• When setting the PLL Pattern, the PLL items on the Setting Item screen are dedicated to the PLL Pattern as shown on the right.

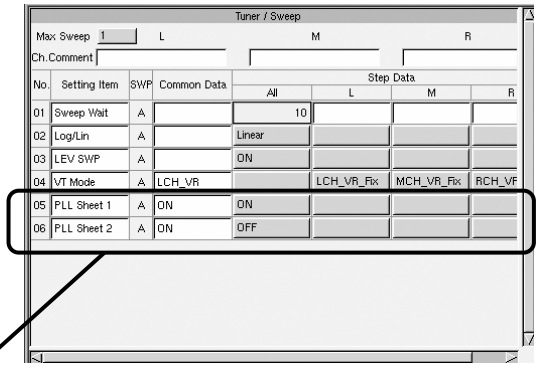
• From the sheets set in PLL Pattern, select the sheets you want to switch at each step.

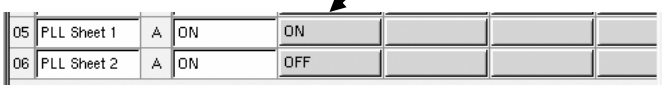




c) Selecting the Sheet

• Select the sheets specified in Setting Item.
To use the sheet as a step, select ON. Otherwise, select OFF. Note that because the sheets are set to ON in the Common settings, you can simply select only the sheets that are not used in steps (OFF setting).





5.3.5 Selecting, Saving, and Editing the PLL Item

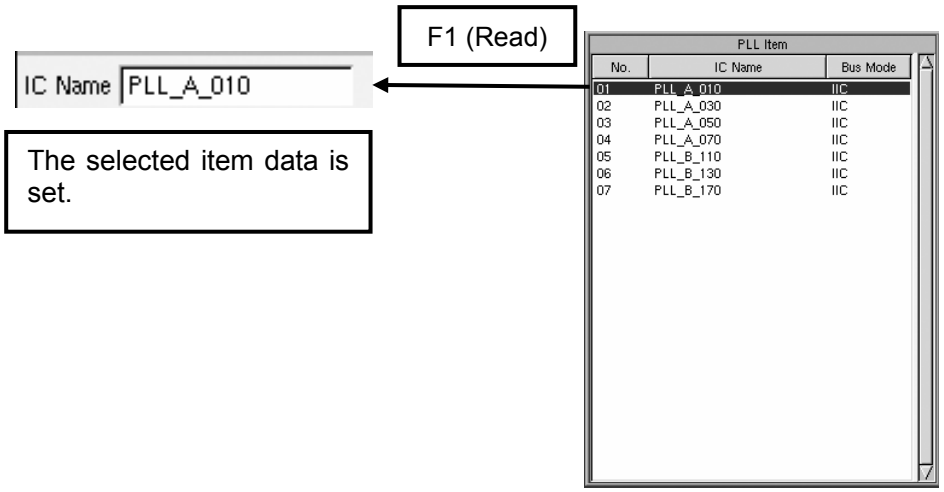
• PLL Item is a function that can store the PLL IC settings that are created using the PLL Table and PLL Pattern.
It is convenient to use the PLL item when creating a tuner model of a tuner that uses the same IC.
This list is stored in the LW 360, but it can also be saved to a memory card.

(1) Loading a PLL List

• With the PLL edit screen (PLL table or PLL pattern) selected, press or click F9 (Edit) followed by F8 (PLL LIST) to display the PLL List at the center of the screen.

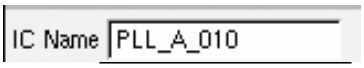
(2) Selecting an Item from the PLL List

• On the PLL List screen, move the cursor to the item (PLL IC data) you want to select.
• Press or click F1 (Read) to set the item (PLL IC) on the PLL screen.



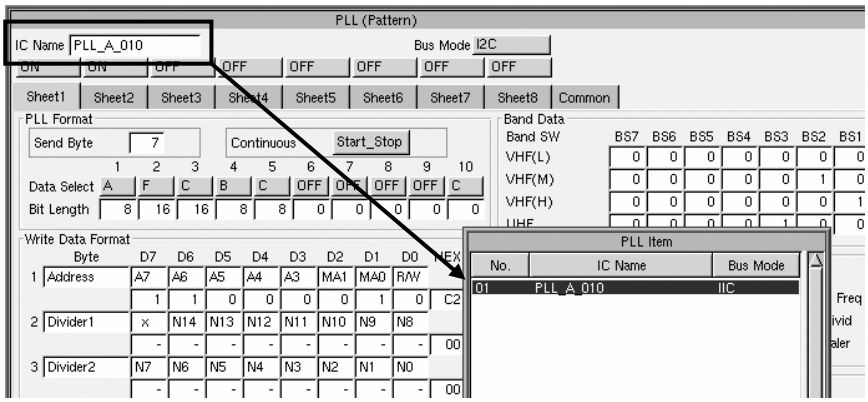
(3) Saving and Editing the PLL Item

a) When you create a new PLL Table or PLL Pattern, enter a name in IC Name (up to 10 characters).

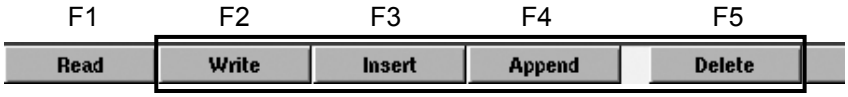


Up to 10 characters

b) Press or click F9 (Edit) followed by F8 (PLL List) to display the PLL Item.
Press or click F4 (Append) to add the item to the PLL Item.



c) Editing the PLL Item



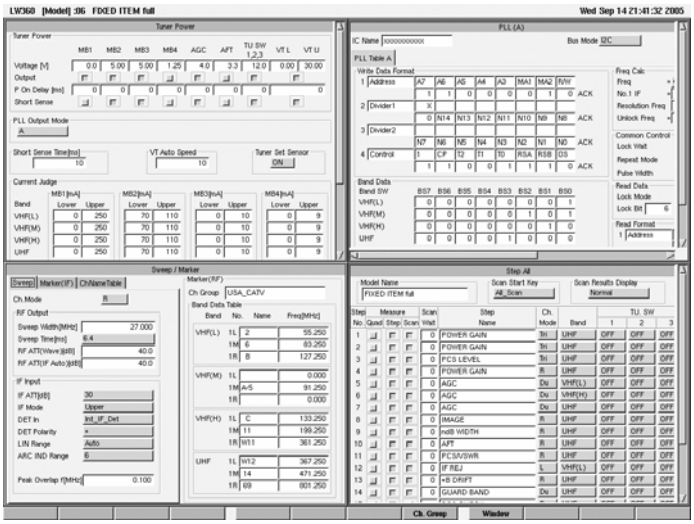
- F2 (Write) ・・Overwrites the item at the cursor position.
- F3 (Insert) ・・Inserts the item above the cursor position, and the subsequent item numbers are increased by 1.
- F4 (Append) ・・Adds the item to the end of the PLL Item list.
- F5 (Delete) ・・Deletes unneeded items.

(4) Saving to a Memory Card

- The PLL Item can be saved to a memory card (CF card). The File edit screen is used to save the PLL Item list as a single file. For the save and load operation, refer to section 5.2.5, "PLL Table File."

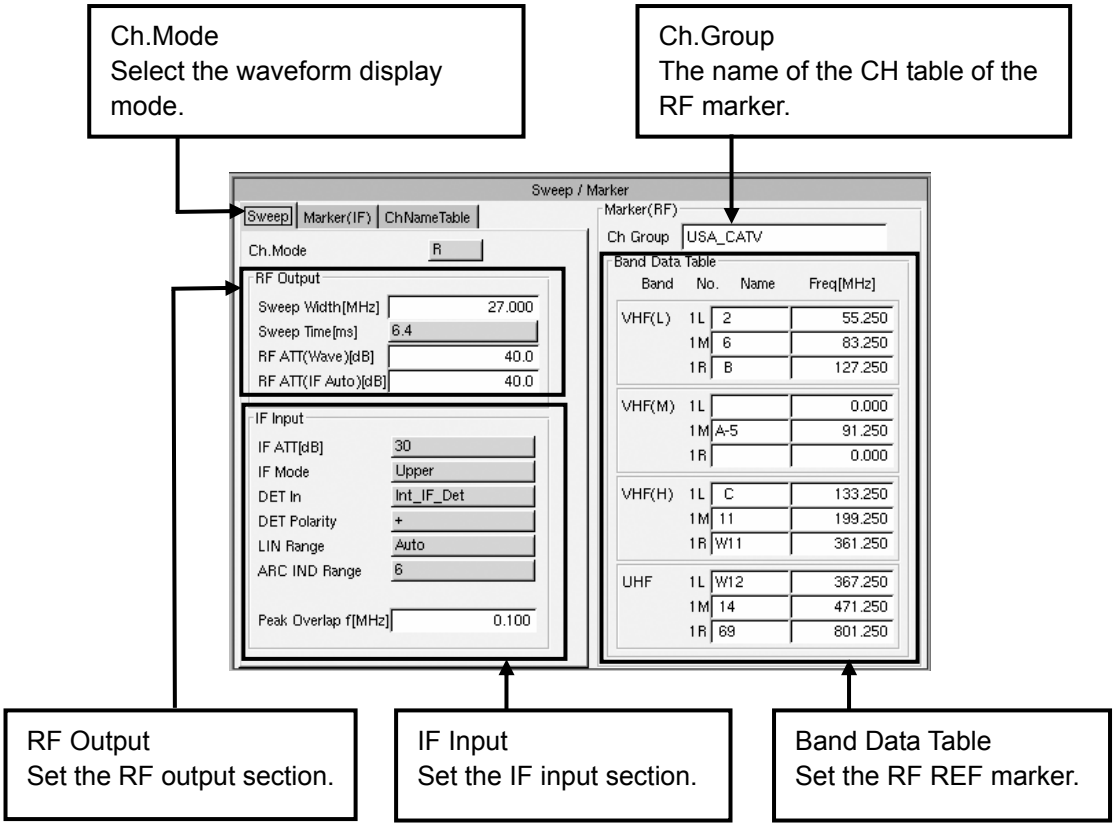
5.3.6 Operations and Settings on the Sweep/Marker Screen

(1) Selecting the Sweep/Marker Screen



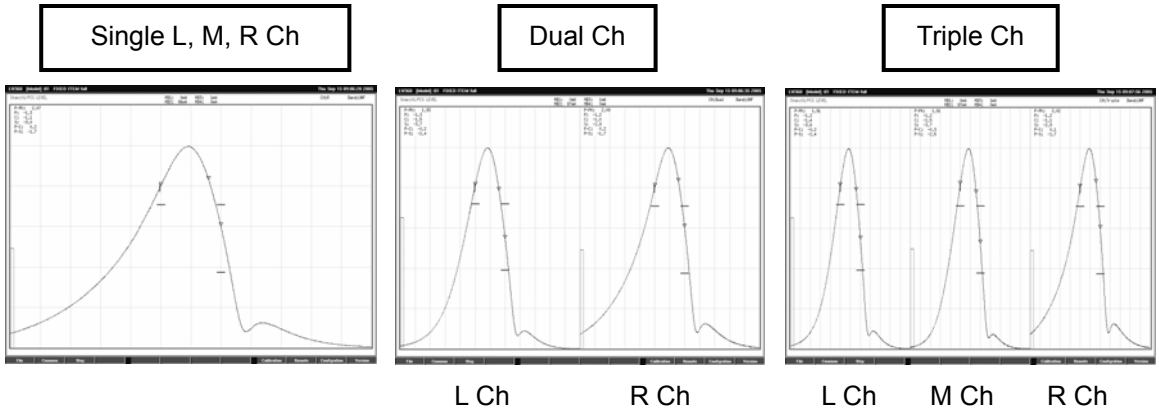
- On the Common edit screen, press the F7 (SweepMarker) key or click the PLL function on the screen. The Sweep/Marker screen is activated.

(2) Sweep/Marker Screen

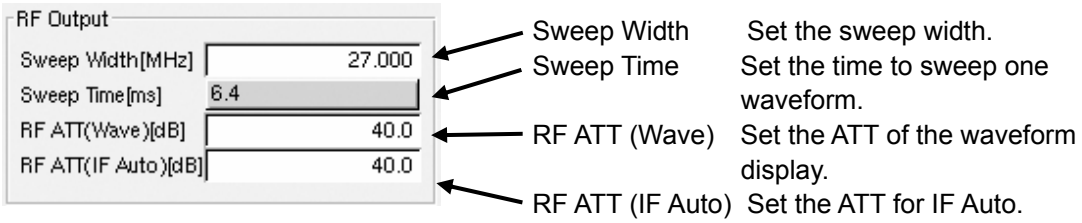


a) Ch.Mode

• Set the waveform display mode from five modes: Single L, M, and R; Dual; and Triple.



b) RF Output



• Sweep Width

Set the sweep width. 0.000 to 1000.000 MHz, 1 kHz steps. Move the cursor to Sweep Width, and set the value.

• Sweep Time

Set the time to sweep one waveform. The available settings are 3.2, 6.4, and 12.8 ms. Move the cursor to Sweep Time, and press the Space key or click the mouse. Set the sweep time by considering the time constant of the detector and the steepness of the detected signal .

• RF ATT（Wave）

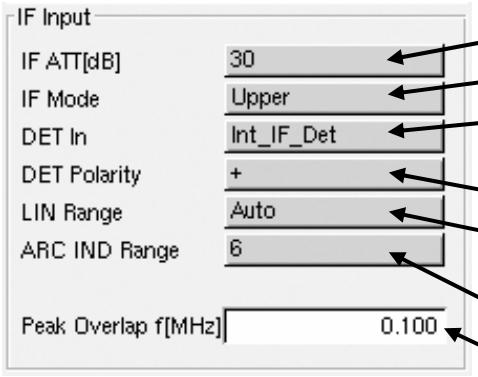
Set the RF output level of the waveform display. 0 to 90 dB in 1 dB steps. Set the level to match the maximum value of the power gain of the tuner. Normally, the level is set approximately equal to the power gain.

Example) If the maximum power gain is 40 dB, set RF ATT (Wave) to 40 dB.

• RF ATT (IF Auto)

Set the RF output level for performing IF auto tracking. 0 to 90 dB in 1 dB steps. Set the level approximately equal to the power gain of the tuner.

c) IF Input



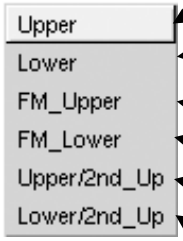
IF ATT Set the IF INPUT ATT.
IF Mode Select the type of tuner local frequency.
DET In Set the input connector for detecting the signal.
DET Polarity Set the polarity of the detector.
LIN Range Set the range of the linear measurement.
ARC IND Rang Set the ARC range.
Peak Overlap f Set the frequency span of the peak level measurement.

• IF ATT

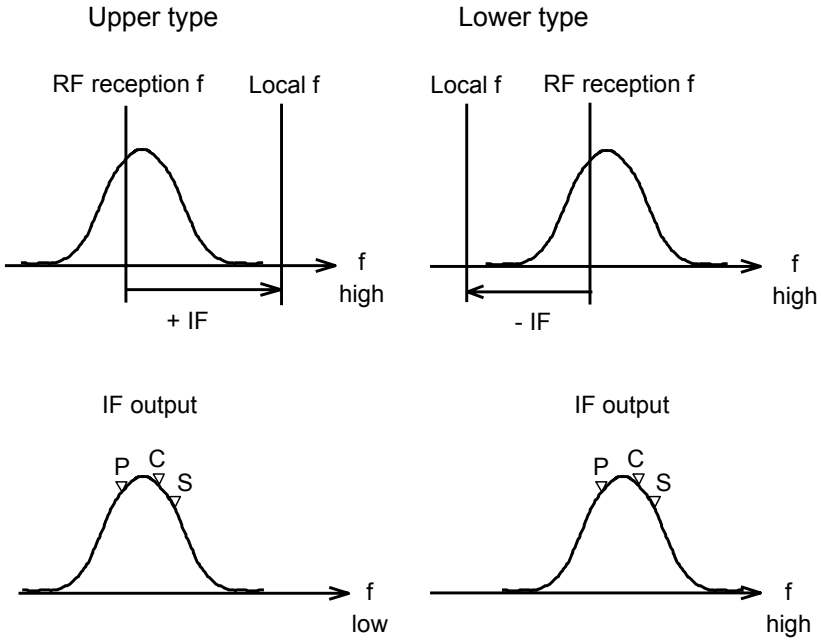
Set the ATT of the IF INPUT (IF receiving section). 0 to 30 dB in 10 dB steps. In normal measurements, set this value to 30 dB.

• IF Mode

Set the mode to match the type of tuner local frequency. Six modes are available. Move the cursor to IF Mode, and press the Space key or click the mouse.



Type in which the local frequency is higher than the RF reception frequency
Type in which the local frequency is lower than the RF reception frequency
Upper type for FM tuners
Lower type for FM tuners
Double-conversion type tuner in which both the 1st and 2nd local frequencies are of the upper type
Double-conversion type tuner in which the 1st local frequency is of the lower type and the 2nd local frequency is of the upper type

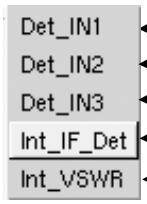


The IF output frequency is inverted.

VH and UHF of France, CATV converter, etc.

• DET In

Set the input connector for detecting the signal. Move the cursor to DET In, and press the Space key or click the mouse.



When connecting an external detector to DET IN 1 on the rear panel
When connecting an external detector to DET IN 2 on the rear panel
When connecting an external detector to DET IN 3 on the rear panel
When connecting the tuner IF to IF INPUT on the front panel
When measuring VSWR

• DET Polarity

Set the polarity of the detected signal specified in DET In. Select + when Int_IF_Det is selected. Select - when Int_VSWR is selected.

When DET IN 1, 2, or 3 is selected, select the polarity according to the detected signal to be input.

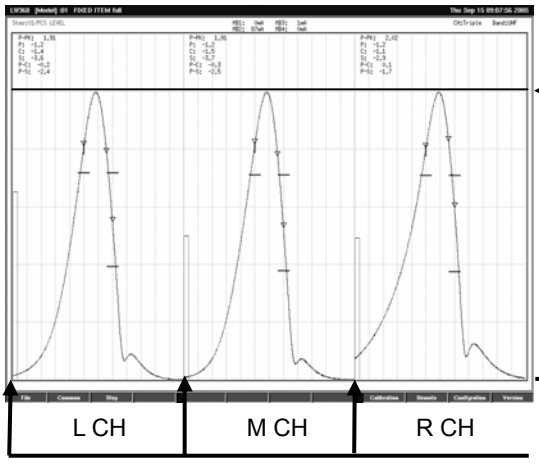
• LIN Range

Set the display level of the detected signal specified in DET In. Normally, set the level to Auto (ARC operation).

Move the cursor to LIN Range, and press the Space key or click the mouse. 1 to 7, and Auto.

To fix the range, select 1 (1 mV/div) to 7 (64 mV/div). The range doubles as the level is increased by 1 value.

ARC (Automatic Response Control) operation



Displays the detected signal level range between 2.34 and 320 mV in five divisions.

ARC IND bar: Indicates the detected signal level during ARC operation.

• ARC IND Range

Set the display range of the ARC IND bar when LIN Range is set to Auto. Set the range by considering the maximum value of the detected signal. The table below shows the maximum value of the detected signal when the ARC IND bar is set to 4 divisions maximum.

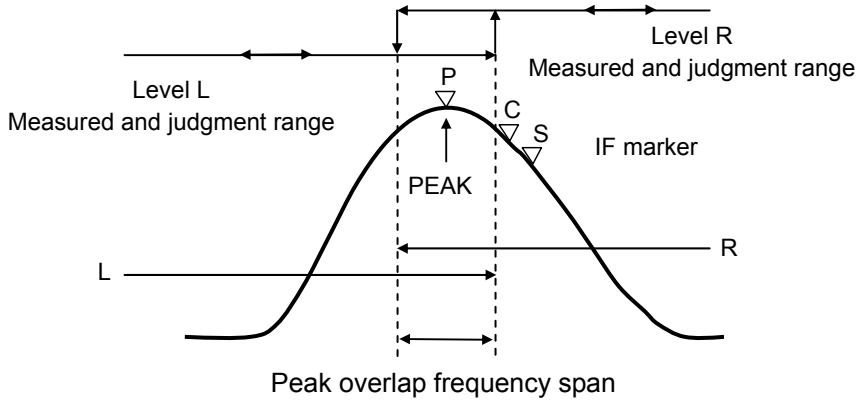
Range	mV/div	Level for 4 divisions
1	1	4 mV
2	2	8 mV
3	4	16 mV
4	8	32 mV
5	16	64 mV
6	32	128 mV
7	64	256 mV

• Peak Overlap f

Set the frequency span of the peak level when Measure Mode is set to Level_L and Level_R.

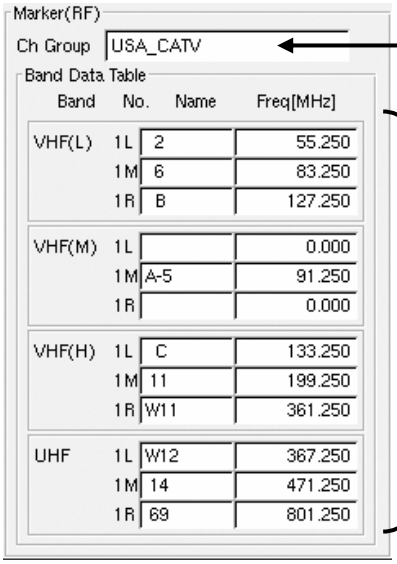
0.000 to 9.999 MHz, 1 kHz steps.

This function provides a span for detecting the peak frequency so that Level_L and Level_R are switched smoothly.



∗ Level_L and Level_R are measurement items that detect whether the IF P marker is to the left or right of the peak point and enable judgement to be performed using the respective value.

d) Marker (RF)



Displays the Ch Table name that is selected from Ch Group of the RF marker.

• Set the L, M, and R markers of each channel for each band.

1L: Low end channel of MKR No. 1 (for the L Ch)
1M: Middle channel of MKR No. 1 (for the M Ch)
1R: High end channel of MKR No. 1 (for the R Ch)

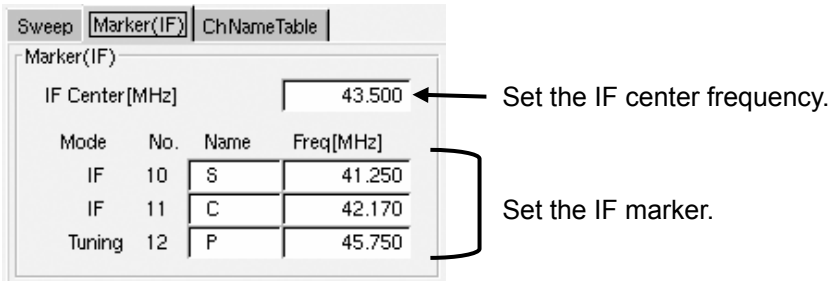
The frequencies specified here are used as the RF Ref Marker in the band specified in each step.This marker is the RF reference marker used for VT Auto or when PLL Tuning Mode is set to Ch.Cont.

• Enter the channel name in the Name box.Up to 3 characters.

• Set the channel frequency in the Freq box.

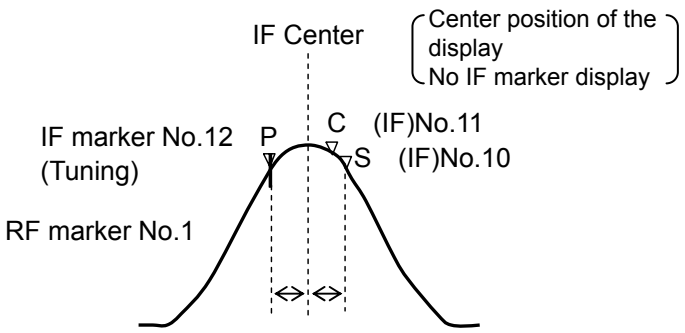
e) Marker(IF)

• Select the Marker (IF) tab at the upper left of the Sweep/Marker screen to display the IF marker and IF center frequency setting screen.



• IF Center

Set the center frequency of the waveform display. 4.000 to 120.000 MHz, 1 kHz steps. Normally, set the center frequency between P and S.



	P	S
JA	:(58.75+54.25)/2 = 56.5 MHz	
US	:(45.75+41.25)/2 = 43.5 MHz	
EU	:(38.9+33.4)/2 = 36.15 MHz	
CHINA	:(38.0+31.5)/2 = 34.75 MHz	

f) IF Marker, IF Name, and Freq

• Set the IF marker corresponding to the tuner IF. Enter the name using up to three characters. Set the frequency between 0.000 and 1000.000 MHz at 1 kHz steps.

• Normally, IF S marker and IF C marker are set to No. 10 and No. 11, respectively.

g) IF Marker (Tuning) Name and Freq

• Set the IF reference marker of the tuner. Enter the name using up to three characters. 0.000 to 1000.000 MHz, 1 kHz steps.

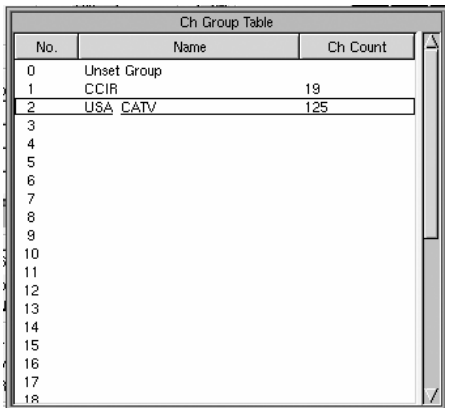
• Normally, set the IF P marker.

• The frequencies specified in f) and g) are automatically set to Marker No. 10 to 12 as IF and Tuning markers on the Marker screen at each step.

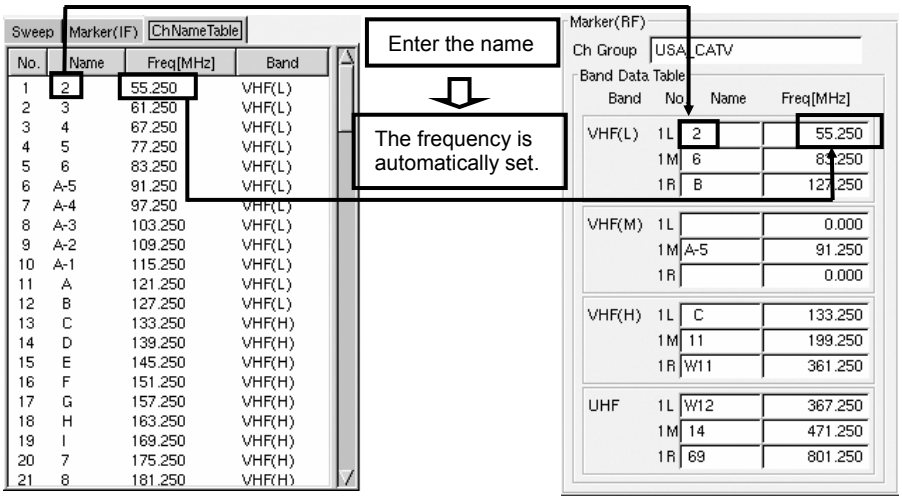
• The IF marker of Marker No. 12 is the IF reference marker for VT auto and when PLL TU Mode is set to CH_Cont.

h) Ch Name Table

- If Ch Name Table is used to set the marker, you can simply enter the Ch Name to automatically set the corresponding frequency.
  For details on creating and editing the Ch name table, see section 5.2.3, “Editing the Ch Table File.”
- Select the Ch Name Table tab at the upper left of the Sweep/Marker screen to display the Ch Name Table setting screen.
- Recalling the Ch Name Table
  Activate the Sweep/Marker screen, press or click F9 (Edit) followed by F8 (Ch.Group) to display the Ch Group Table at the center of the screen.
  Move the cursor to the file you want to recall, and press or click F1 (Read) to recall the Ch name table.

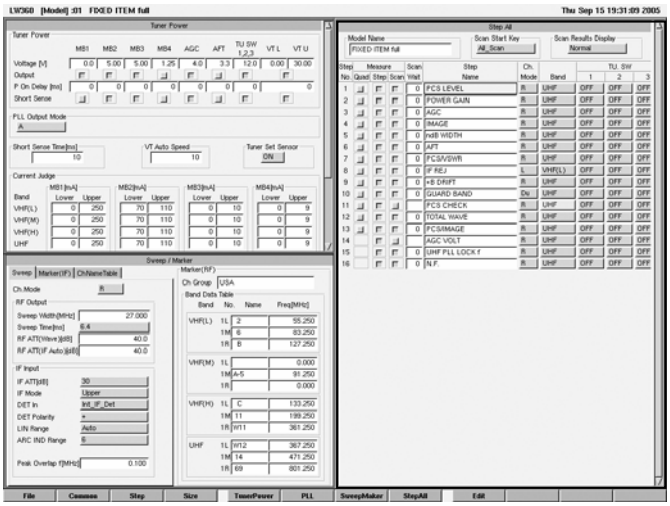


- By referring to the displayed Ch name table, set a name in the Marker (RF) Name box. The corresponding frequency is set in the Freq box.



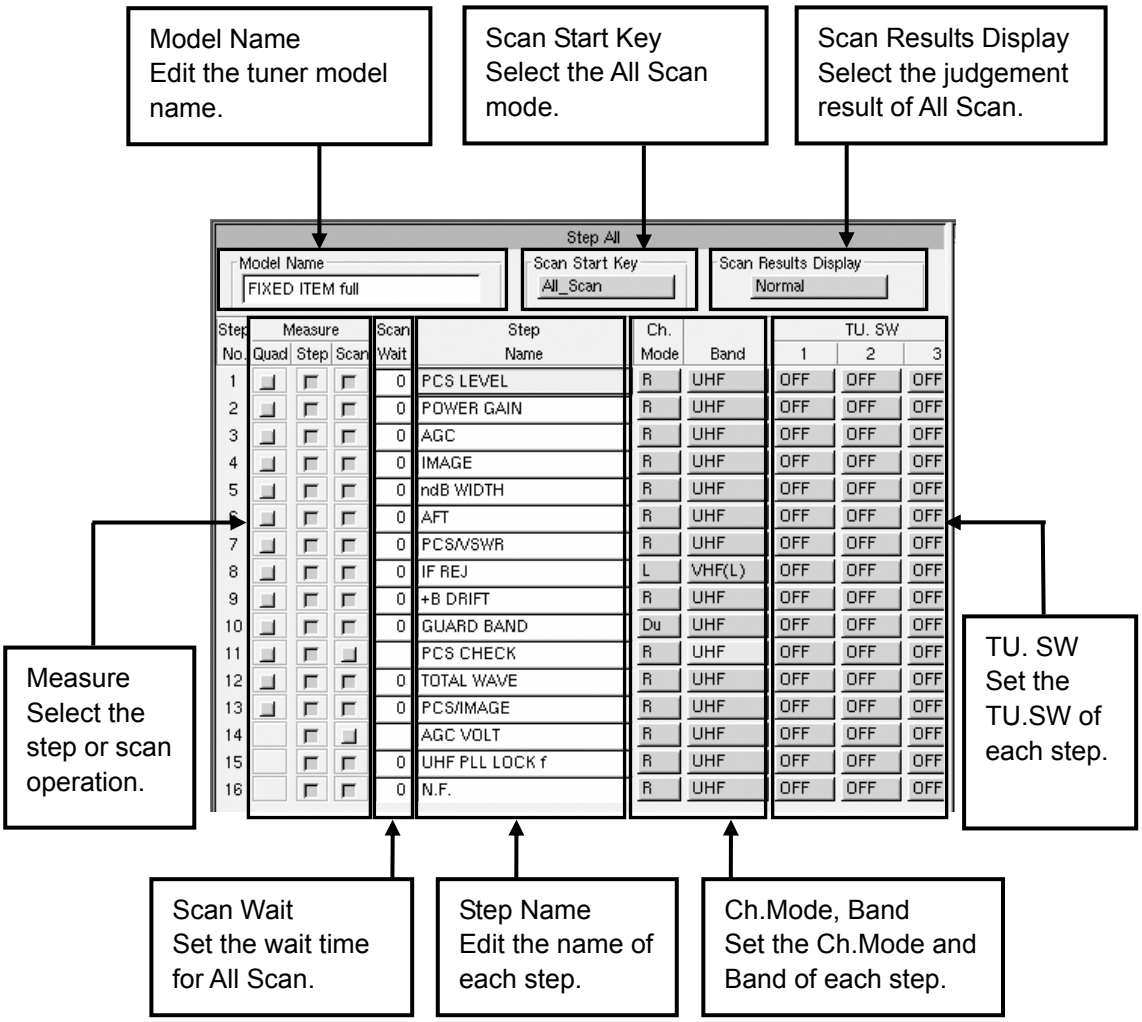
5.3.7 Operations and Settings on the Step All Screen

(1) Selecting the Step All Screen



- On the Common edit screen, press the F8 (Step All) key or click the Step All function on the screen. The Step All screen is activated.
  Press the F4 (Size) key to display the entire window.

(2) Functions of the Step All Screen

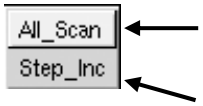


a) Model Name

• Edit the tuner model name using up to 16 characters. The name specified here is applied to the Tuner Model name on the File edit screen. After editing the name, save the file on the File edit screen.
The Tuner Model name can be edited also on the File edit screen.

b) Scan Start Key

• Select the scan mode. Move the cursor to Scan Start Key, and press the Space key or click the mouse.



Performs scan measurement on all steps that are selected for Scan under Measurement.
This function performs scan measurement on a portion of the steps.

c) Scan Results Display

• Select the display method of the All Scan judgement result. Move the cursor to Scan Results Display, and press the Space key or click the mouse.

The judgement of all Steps is displayed.
The judgement of NG Steps, measurement items, and measured values are displayed.
The judgement of all Steps, measurement items, setting values to judge, and measured values are displayed. (Ver. 2.2 and later)
The judegment of NG Steps, measurement items, setting values to judge, and measured values are displayed. (Ver. 2.2 and later)

d) Measure

• Three items, Quad, Step, and Scan, are available. Select the check boxes (red) for the items to be executed.
Move the cursor, and press the Space or Enter key or click the mouse to select the check box.

• Quad

Enable the quad screen display on the Wave screen. Select the first of the four consecutive steps to be displayed on the quad screen display. For the procedure, see section 5.1.2, “Quad Screen Display.”

• Step

Select the steps to be executed in Step operation. Steps that are checked are executed. Steps that are not checked are skipped to the next step.

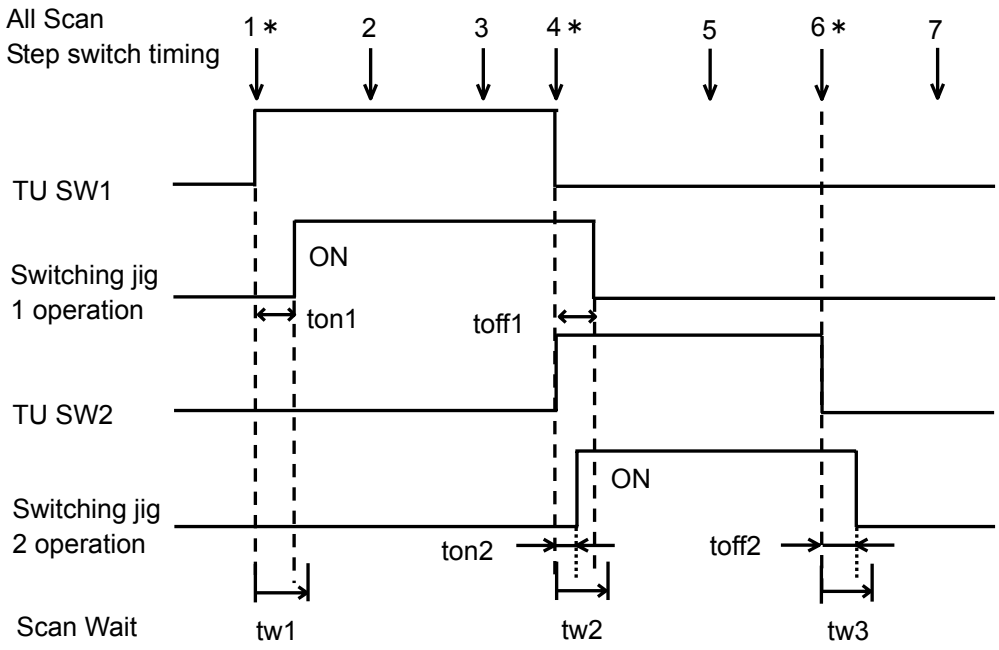
• Scan

Select the steps to be executed in All Scan or Step Scan operation. Steps that are checked are executed.
Steps that are not checked are skipped to the next step.

e) Scan Wait

• Set the wait time until the tuner switching jig or tuner response completes its operation when executing All Scan. 0 to 999 ms

• Operation timing example



Set the Scan Wait time to 1 ∗ , 4 ∗ , and 6* of the all scan step.

1 ∗ tw1 > ton1

4 ∗ tw2 > toff1 or ton2, whichever is greater

6 ∗ tw3 > toff2

When using switching jigs, the number of steps in which Scan Wait needs to be specified can be reduced by grouping the steps that are executed in All Scan for each switching jig. This reduces the time of the All Scan operation.

f) Step Name

• Enter the step name using up to 16 characters.

• The name entered here is displayed at the upper left of the Wave screen and Step edit screen.
It is also displayed on the All Scan result display and All Scan data output.

g) Ch.Mode, Band

• Ch.Mode
Set the waveform display mode. Move the cursor, and press the Space key or click the mouse to select.

L ← L Ch
M ← M Ch
R ← R Ch
Du ← Dual Ch (L,R Ch)
Tri ← Triple Ch (L,M,R Ch)

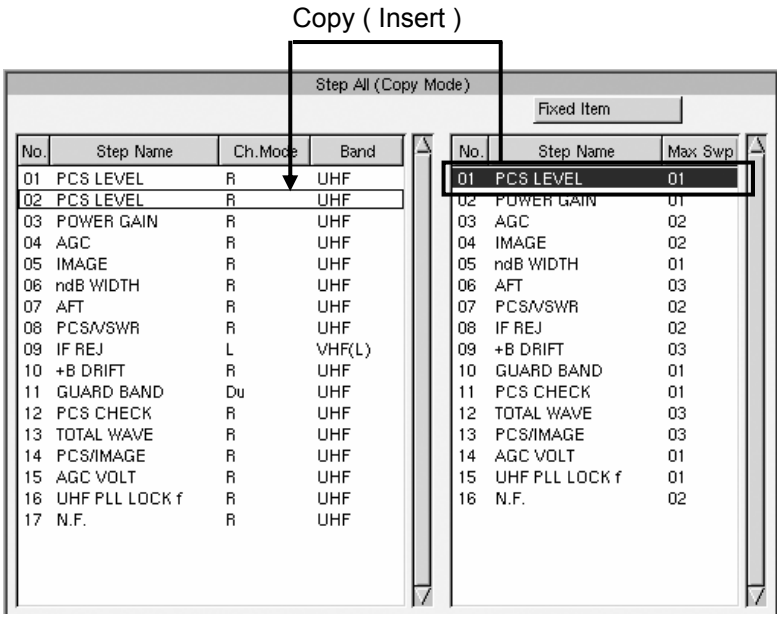
• Band
Select the tuner band. Move the cursor, and press the Space key or click the mouse to select.

h) TU. SW 1,2,3
• Set the type of switch control signal output of tuner jigs, etc. Move the cursor, and press the Space key or click the mouse to select.

GND ← Connect to GND of MOS FET
ON ← Voltage output specified by TU.SW 1, 2, and 3 on the Tuner Power screen
OFF ← Off state of the MOS FET and TR collector (high impedance)

(2) Editing Steps
a) Copying from Fixed Item
• Press F9 (Edit) followed by F7 (Copy Mode) or click the Edit function key followed by the Copy Mode function key to change the function key to edit mode and set the Step All screen to copy mode.
• A list of current steps is displayed on the left side, and a list of Fixed Items is displayed on the right side.
• Move the cursor to the item you want to copy from the Fixed Item list.
• Press F1 (Read) or click the Read function key to set the item to read condition. The item is displayed in blue.
• Next, move the cursor to a position in the left list where you want to copy the item, and press F2 (Write), F3 (Insert), or F4 (Append). The item is copied.

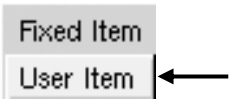
F2 (Write): Overwrites to the cursor position.
F3 (Insert): Inserts the item above the cursor.
F4 (Append): Adds the item after the very last step.
F5 (Delete): Deletes the item at the cursor position



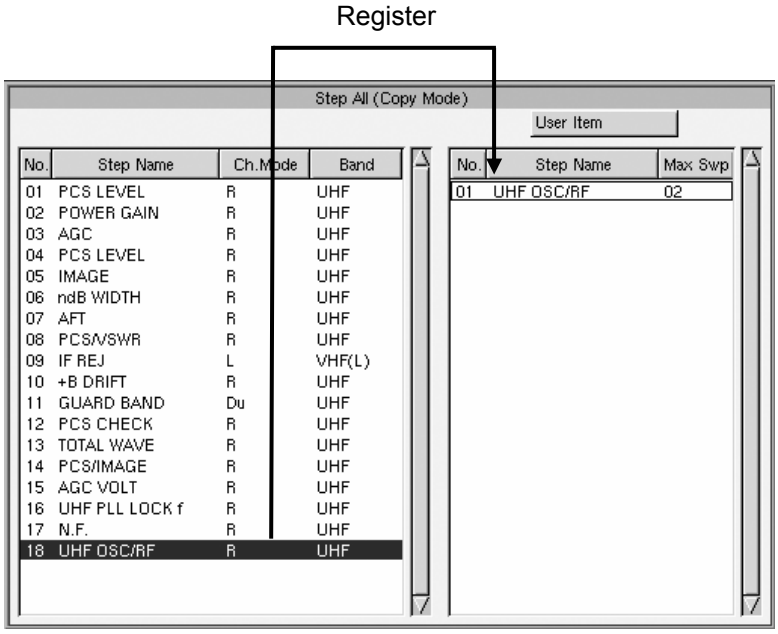
• Press F7 (Step All) to return to the Step All screen.

b) Registering to User Item

- Register new items that you create in User Item, and use them when creating another Tuner Model program.
- As with Fixed Item, press F9 (Edit) followed by F7 (Copy Mode) to enter edit mode.
- Move the cursor to Fixed Item at the upper right of the Step All (Copy Mode) screen, and select User Item with the Space key or mouse.



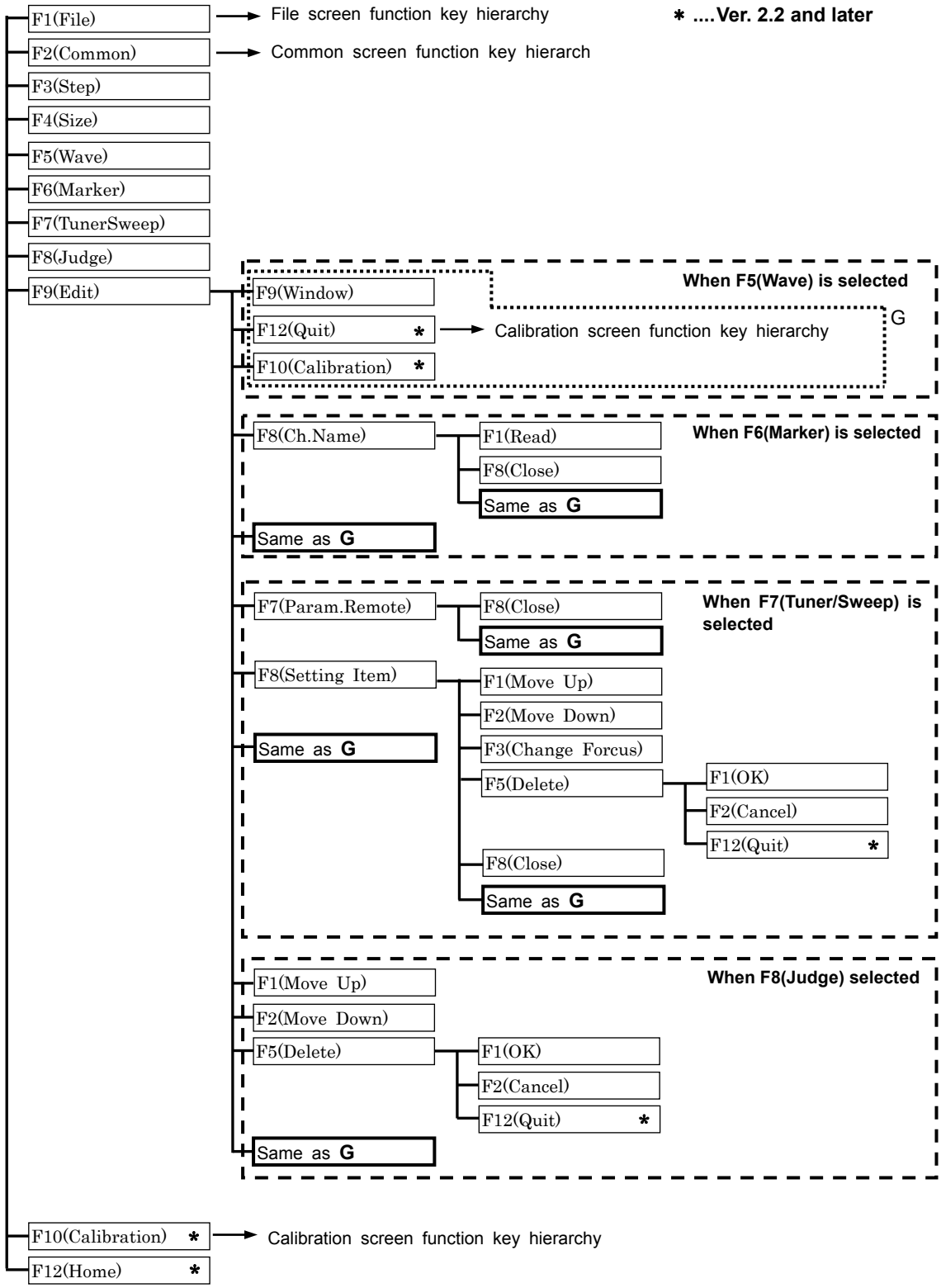
- Move the cursor to the item you want to copy from the Step All list.
- Press F1 (Read) or click the Read function key to set the item to read condition. The item is displayed in blue.
- Next, move the cursor to User Item (right side of the screen), and press F2 (Write), F3 (Insert), or F4 (Append). The item is registered.



- Press F7 (Step All) to return to the Step All screen.

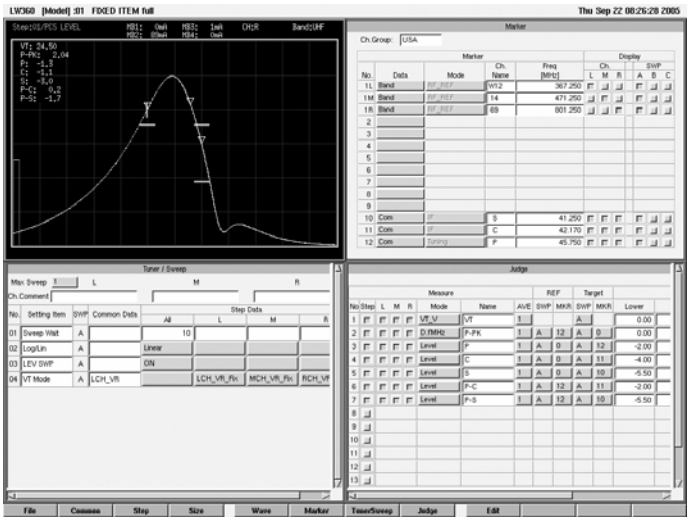
5.4 Step Edit Screen

5.4.1 Step Screen Function Key Hierarchy

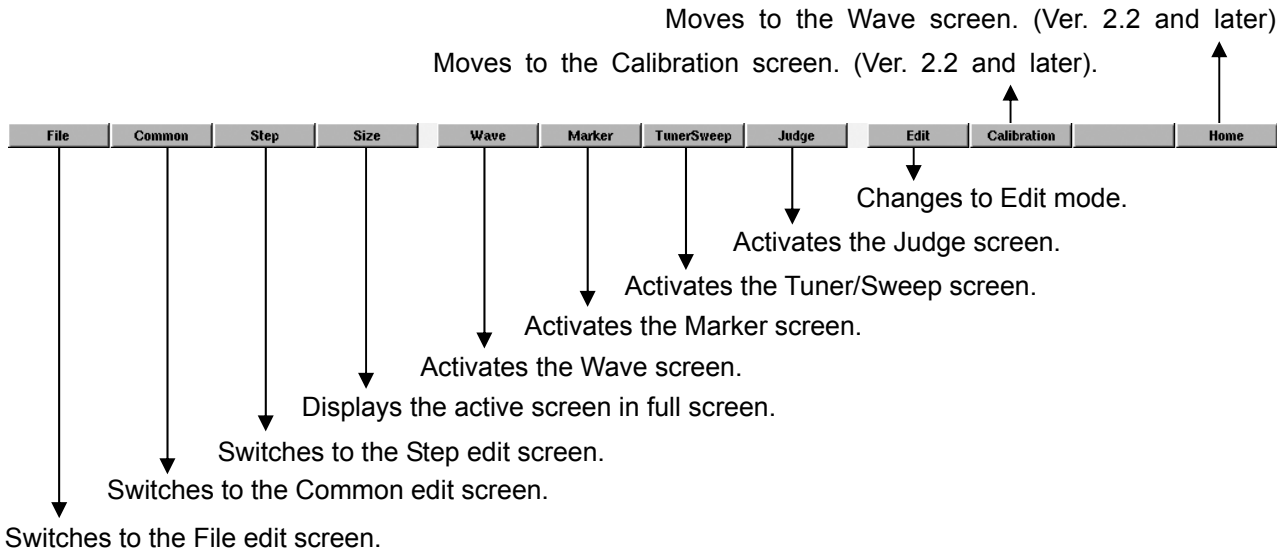


–

• On the Wave screen, press F3 (Step) or use the mouse to select a function. The Step edit screen is displayed.

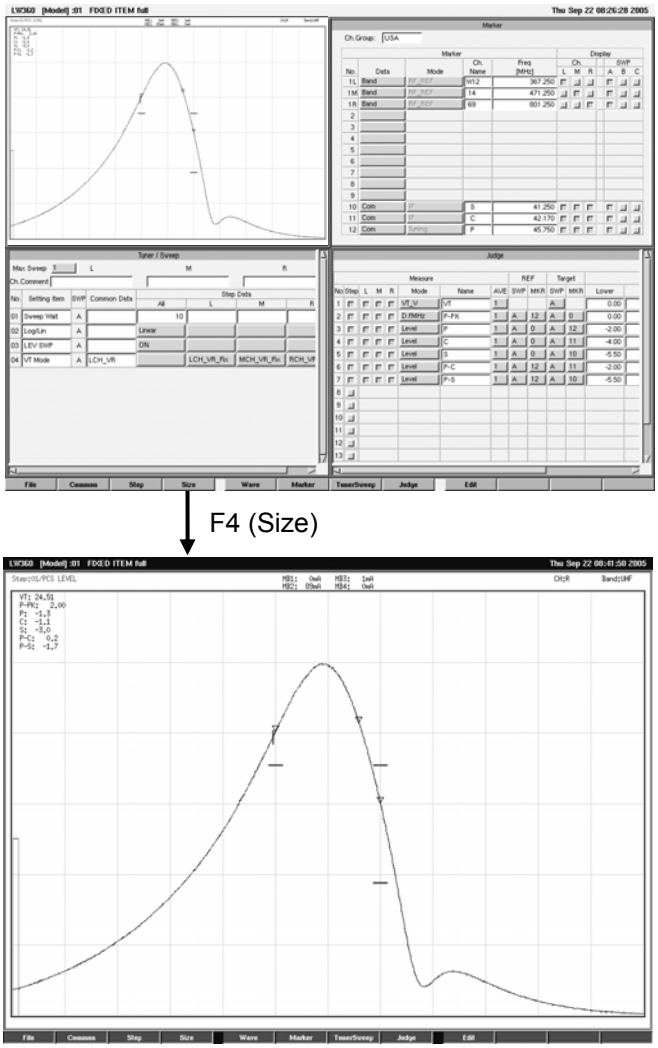


• Step edit screen function key structure



5.4.2 Wave Screen

(1) Wave Screen Selection



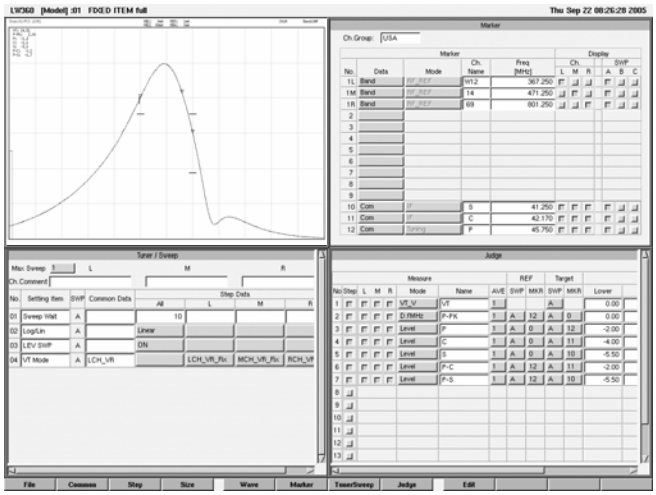
• On the Step edit screen, press the F5 (Wave) key or click the Wave function on the screen. The Wave screen is activated.
Press the F4 (Size) key to display the entire window.

(2) Notes when the Wave Screen Is Expanded

• If the Wave screen is expanded from the Step edit screen using the F4 (Size) key, the screen is expanded to the same size as the normal Wave screen displayed using the Home key. Note that normal measurement can be carried out on this screen, but functions available on the normal Wave screen (such as selecting the tuner model from the panel) cannot be used.
Use this screen only for viewing the screen in full screen. To measure using lines and so on, press the Home key to switch to the normal Wave screen.

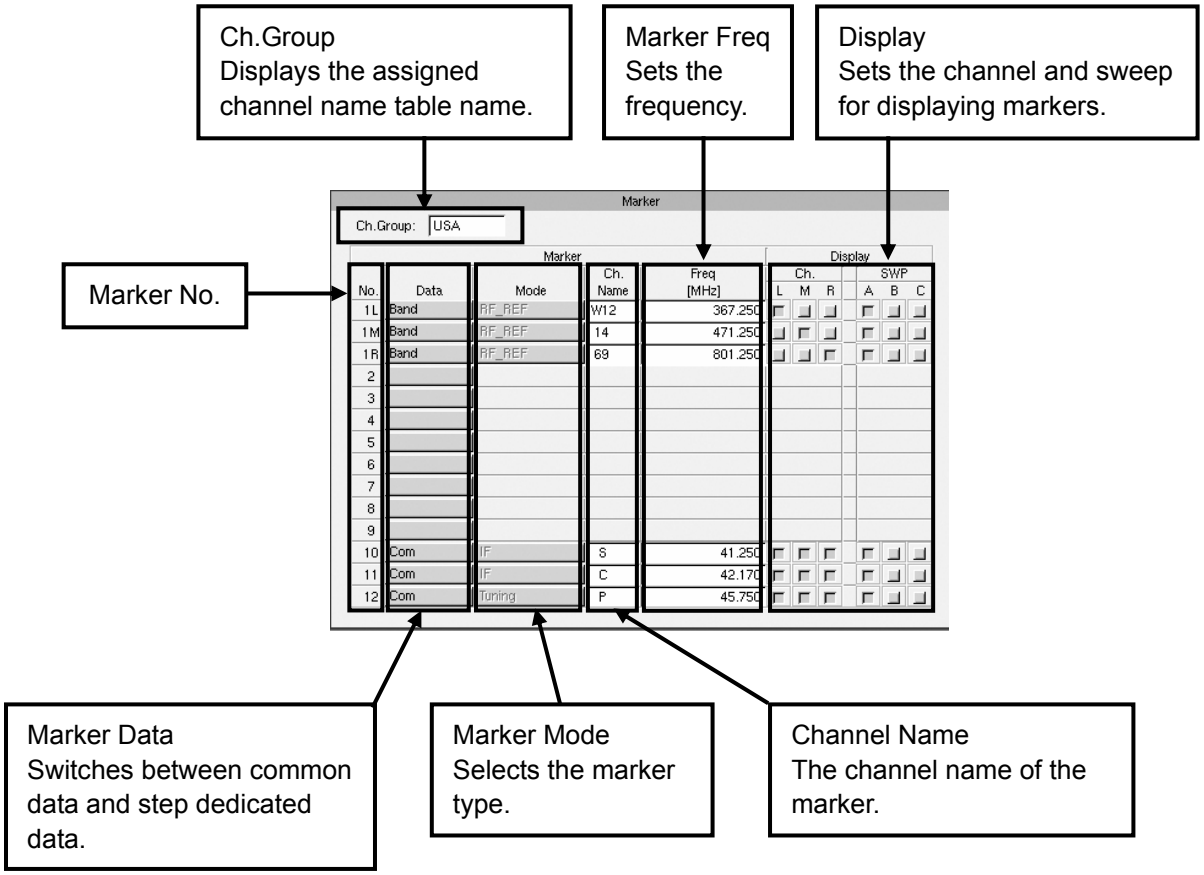
5.4.3 Operations and Settings on the Marker Screen

(1) Selecting the Marker Screen



- On the Step edit screen, press the F6 (Marker) key or click the Marker function on the screen. The Marker screen is activated.

(2) Marker Screen



a) Marker No.
- The measurement point marker on the Judge screen.
- No. 1L, 1M, and 1R are dedicated to RF markers.
- No. 10, 11, and 12 are dedicated to IF markers.
- Normally, data specified on the Sweep/Marker screen of the Common screen is automatically set.
- There are 12 RF/IF markers (No.1 to 12). However, there are four other markers for measurement that are not displayed.

  No.0 : Maximum level point of the measured waveform (peak point)
  No.13: -ndB point to the left of the peak point of the measured waveform
  No.14: -ndB point to the right of the peak point of the measured waveform
  No.15: Minimum level point of the measured waveform (bottom point)

b) Marker Data
- Sets whether to use the marker specified on the Common screen or make it dedicated to the step. Move the cursor, and press the Space key or click the mouse to select.
- When set to Band (RF marker) or Com (IF marker), you cannot move the cursor to the Data box.
  In addition, the name and frequency specified on the Common screen are automatically set.
- When set to Step, you can add or change the marker.

c) Marker Mode
- Sets the marker mode.
- RF ・・・ Set to RF marker.
  IF ・・・ Set to IF marker.
  OFF ・・・ Disables the frequency setting.
  AGC_V ・・・ Set to voltage marker only for AGC Curve. (Ver. 2.2 and later)
  Pk-ndB(L) ・・・ The marker of ndB is set to the left of the peak of the waveform. (Ver. 2.2 and later)
  Pk-ndB(R) ・・・ The marker of ndB is set to the right of the peak of the waveform. (Ver. 2.2 and later)

d) Marker Ch.Name
- If you set a Ch. Name Table name when setting a RF marker, the frequency is automatically set.
  When specifying a name, enter the name so that the first three characters match including spaces and upper and lower case.

e) Marker Freq (MHz)
- Sets the frequency.

  RF: 0.000 to 1200.000 MHz, 1 kHz steps
  IF: 0.000 to 1000.000 MHz, 1 kHz steps
  AGC_V: 0.0 to 15.0 V, 0.1 V steps (Ver. 2.2 and later)
  Pk-ndB(L): 0.0 to 99.9 dB, 0.1 dB steps (Ver. 2.2 and later)
  Pk-ndB(R): 0.0 to 99.9 dB, 0.1 dB steps (Ver. 2.2 and later)
- If a Ch. Name Table name is specified, the frequency cannot be changed.

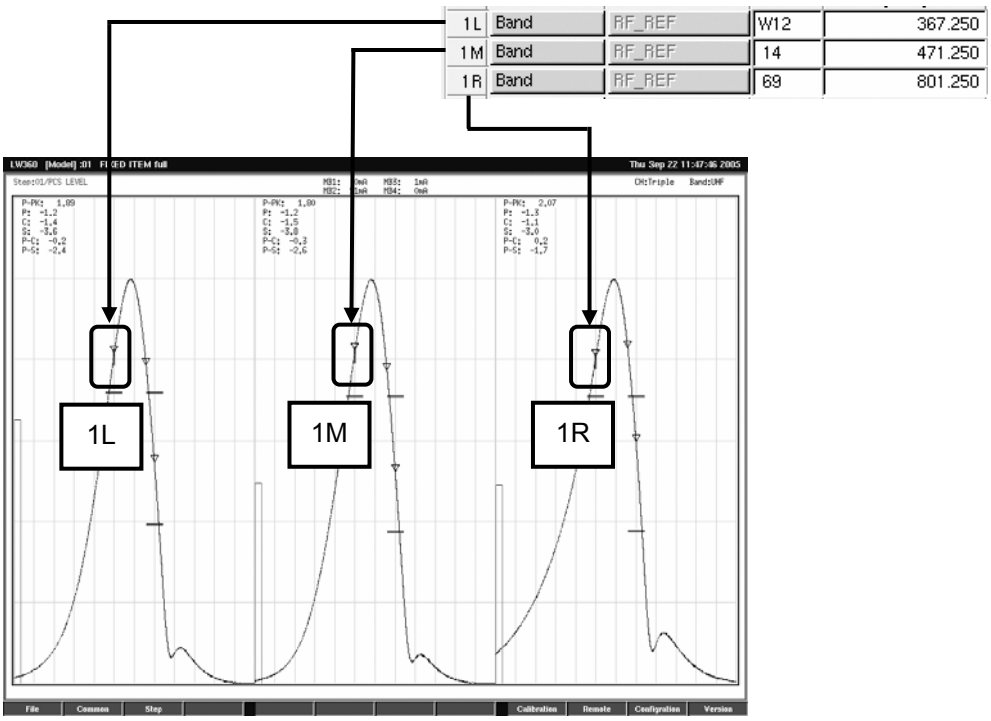
f) Display

- Turns ON/OFF the specified markers separately for each channel and each sweep. Select the check box using the Space and Enter keys or the mouse. The marker is ON and displayed when the check box is red.
- No. 1 marker consists of L, M, and R and is fixed.
- If all L, M, and R are turned OFF, the marker is turned OFF under Ch. (Ver. 2.3 and later)
- The area under SWP changes depending on the Max Sweep setting specified on the Tuner/Sweep screen.
  1: A only
  2: A and B
  3: All of A, B, and C

  If all A, B, and C are turned OFF, the marker is turned OFF.

(3) RF REF/Tuning Marker

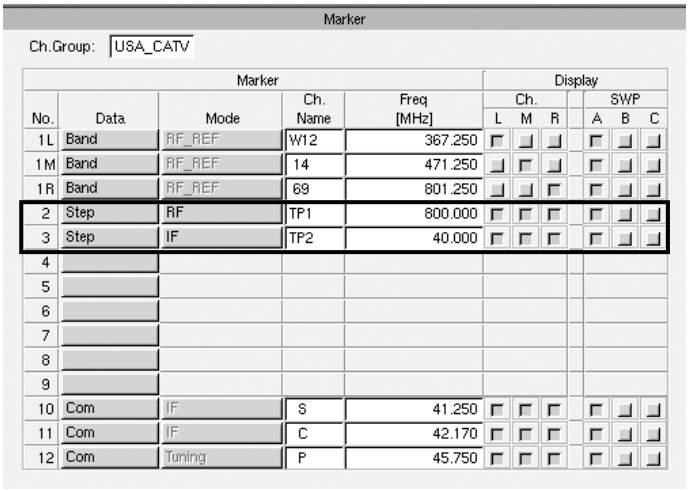
- These markers are reference markers for PLL control and VT Auto. L, M, and R channels tune to 1L, 1M, and 1R, respectively.



(4) Adding Markers

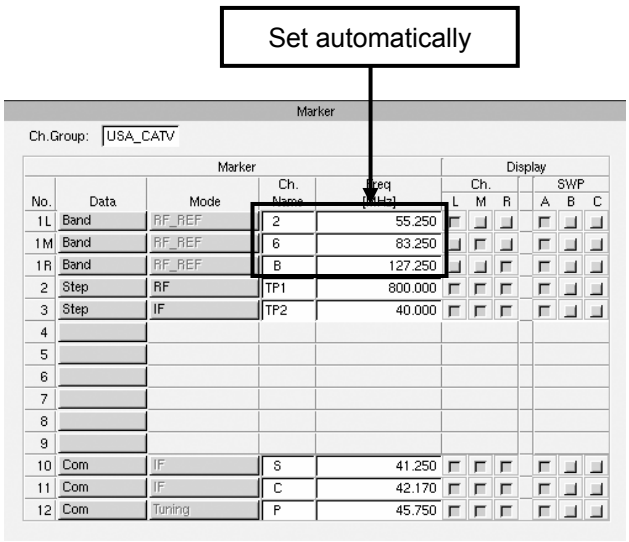
a) Setting Step Dedicated Markers

- Move the cursor to the Data button corresponding to the number you want to set the marker, and select Step using the Space key or mouse.
- Move the cursor to Mode, and select marker type.
- Set the channel or Freq. boxes to add the markers.



b) Auto Setting of Markers

- If you change the band on the Step All screen of the Common edit screen, the RF REF (No. 1L, 1M, and 1R) of the band is set automatically to the marker set on the Common edit screen.

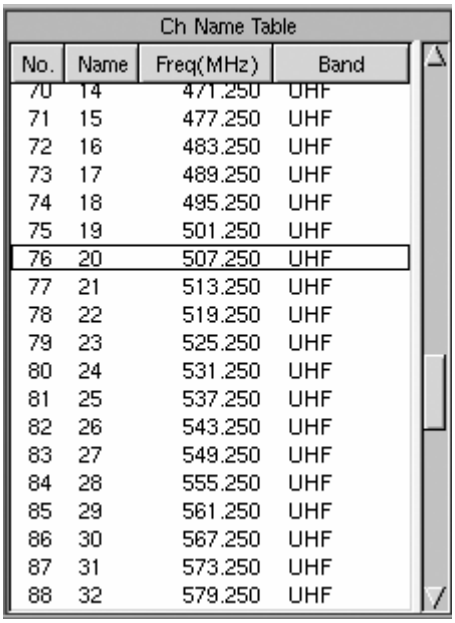


When Band is changed from UHF to VHF (L) in step a) above

(5) Setting RF Markers Using the Ch. Name Table

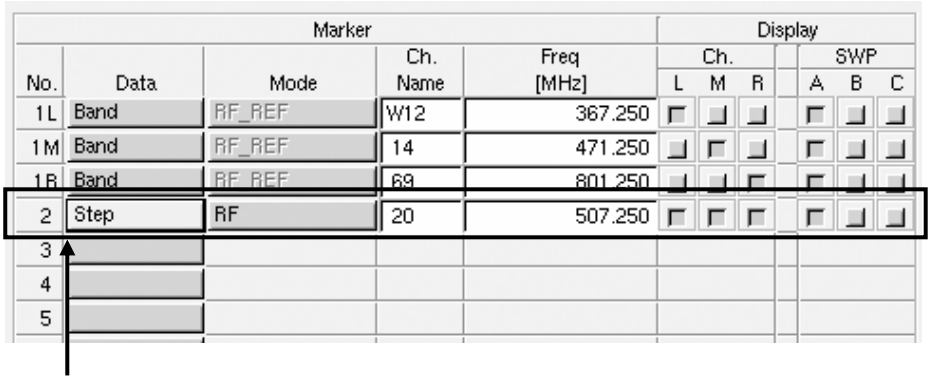
a) Displaying the Ch. Name Table

• Move the cursor to the position where the RF marker is to be added on the Marker screen.
Press or click F9 (Edit) followed by F8 (Ch. Name) to display the Ch. Name Table at the center of the screen. The table that is displayed corresponds to the Ch. Group that is specified on the Sweep/Marker screen of the Common edit screen.



• The Ch. Name Table is displayed at the center of the screen.
Use the up and down keys or the mouse to select the channel to be added.
If you are using only the keyboard, press the up and down keys to move the cursor, and press the Space or Enter key to confirm.
If you are using the mouse, click the channel to be added.

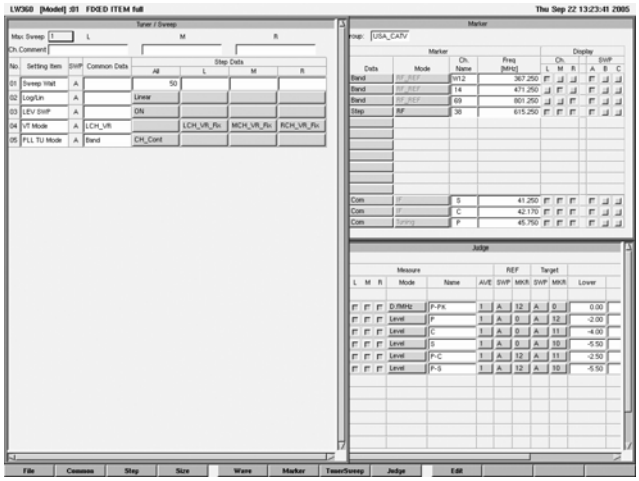
b) Adding RF Markers



The marker selected in the Ch. Name Table is entered.

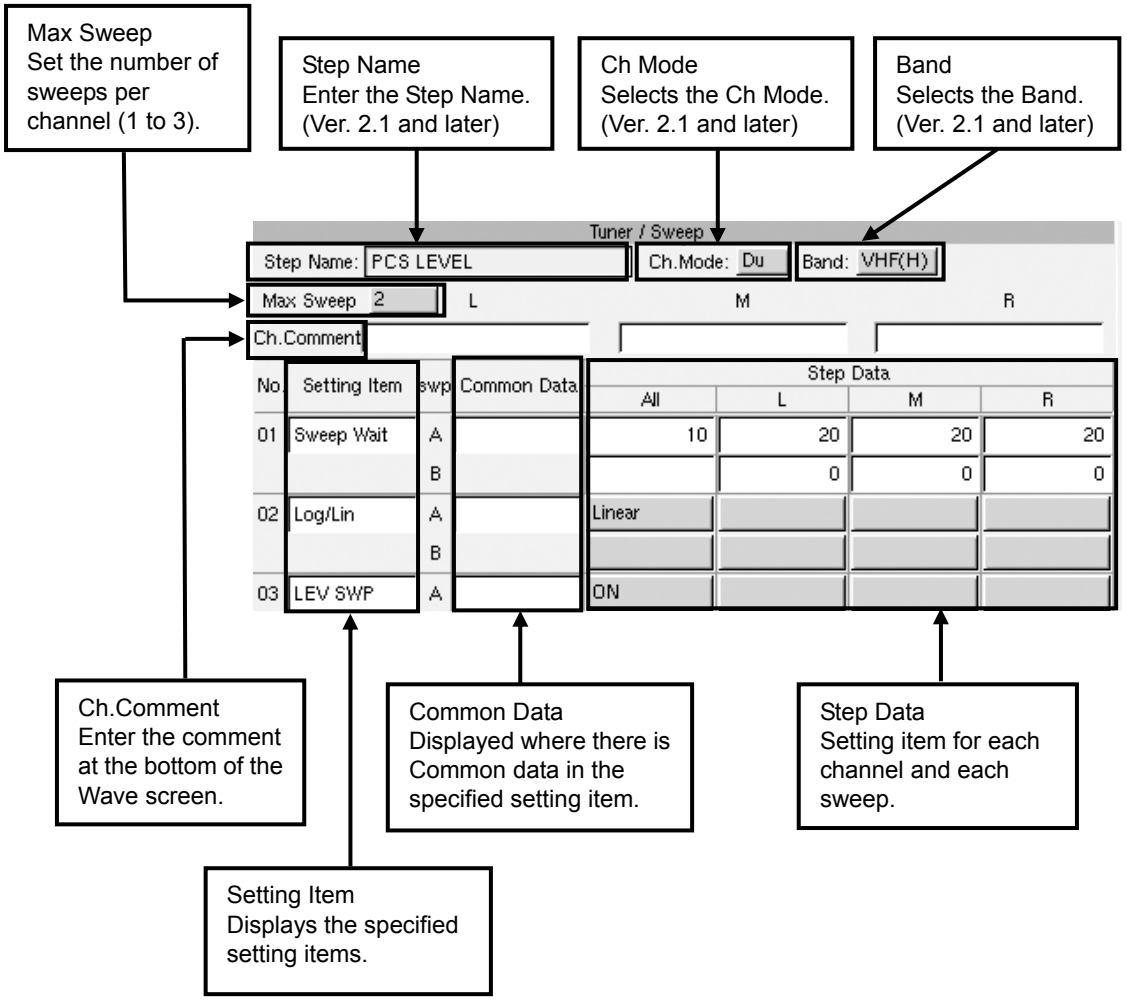
5.4.4 Operations and Settings on the Tuner/Sweep Screen

(1) Selecting the Tuner/Sweep Screen



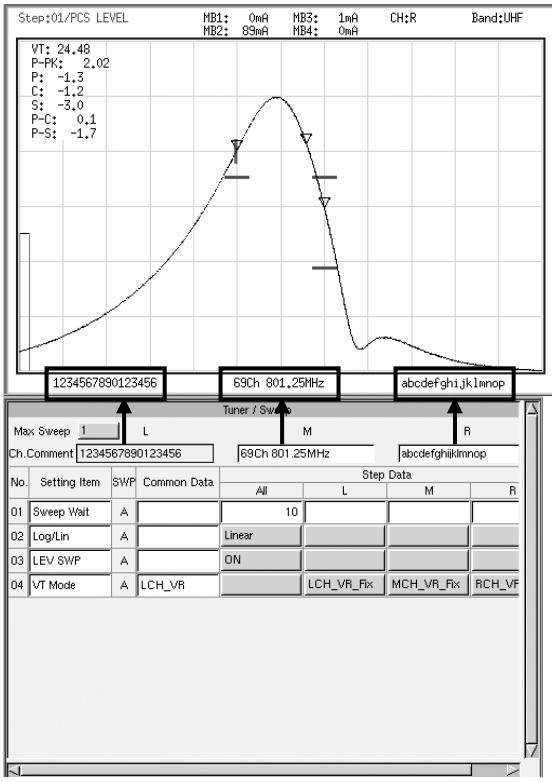
- On the Step edit screen, press the F7 (TunerSweep) key or click the TunerSweep function on the screen. The Tuner/Sweep screen is activated.
  Press the F4 (Size) key to display the entire window.

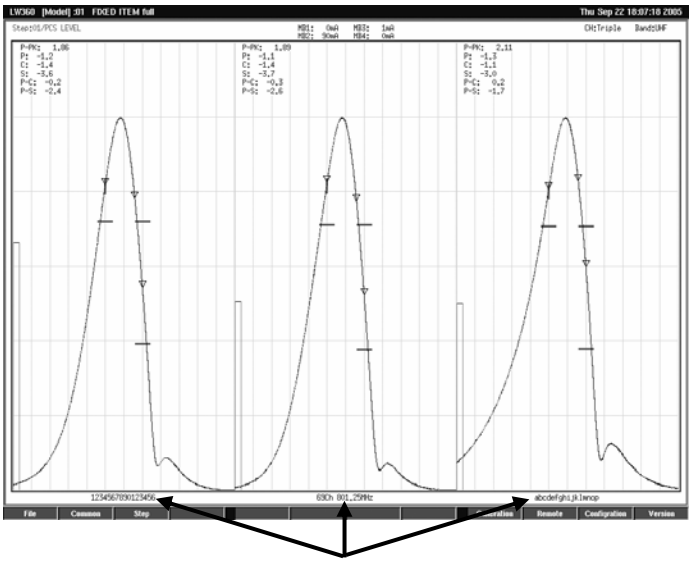
(2) Tuner/Sweep Screen



a) Ch. Comment

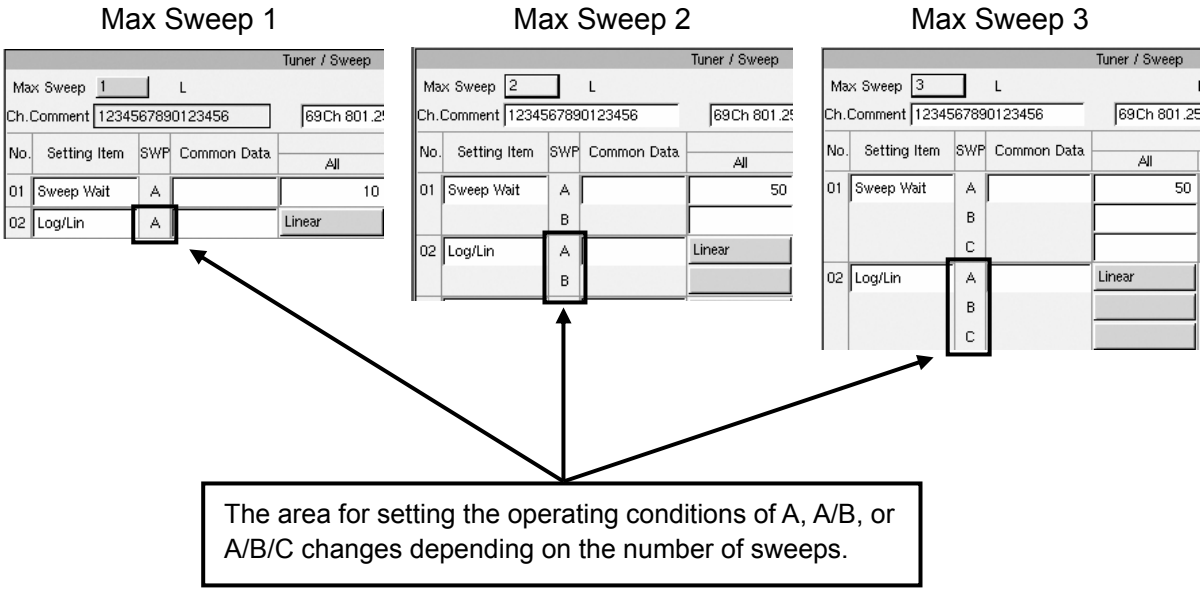
- Box for entering a comment that is displayed below the waveform display frame on the Wave screen. Up to three comments using up to 16 characters each can be entered.
- Move the cursor to Ch. Comment, and enter a comment. After entering the characters, press the Enter key.
  When the characters are entered, the comment is displayed below the waveform display frame on the Wave screen.
- The comment is displayed approximately at the center of each channel on the triple display. The display position is fixed.





Displayed approximately at the center of each channel

b) Max Sweep
- Set the number of sweeps per channel (1 to 3).
- Move the cursor, and press the Space or Enter key or click the mouse to select.
- When the Max Sweep value is entered, the area for setting the sweeps changes accordingly.



c) Setting Item
- Displays the specified setting items.
- Press or click F9 (Edit) followed by F8 (Setting Item) to add a setting item. For details on the setting items, see section 5.5, “Setting Items.”

d) Common Data
- Displays the basic data that is set on the Tuner Power and Sweep/Marker screens on the Common edit screen. Common data is not displayed for setting items that do not have common data except for a portion of the settings that have default settings.

e) Step Data
- Set the operating conditions independently.
- The condition can be set for each sweep (A, B, and C) on each channel (L, M, and R). If you want to set the same condition for all channels and all sweeps, set the condition in sweep A under All.

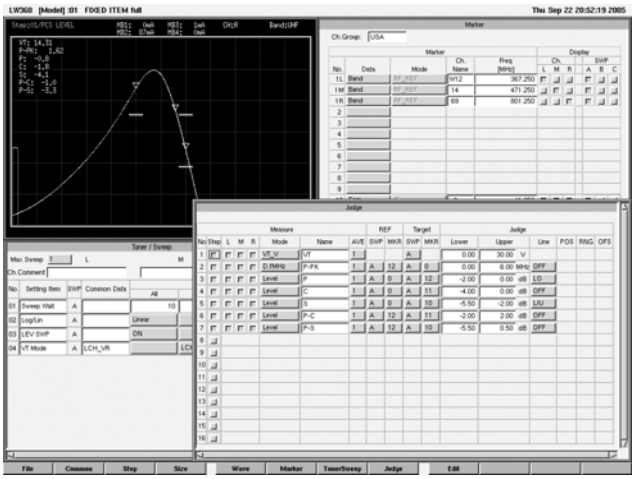
f) Step Name (Ver. 2.1 and later)
- Enter the Step Name. (Up to 16 characters)
- Also it can be set on the Step All screen.

g) Ch. Mode (Ver. 2.1 and later)
- Ch. Mode is selected from L, M, R, Du, and Tri.
- Also it can be set on the Step All screen.

h) Band (Ver. 2.1 and later)
- Band is selected from VHF(L), VHF(M), VHF(H), and UHF.
- Also it can be set on the Step All screen.

5.4.5 Operations and Settings on the Judge Screen

(1) Selecting the Judge Screen



- On the Step edit screen, press the F8 (Judge) key or click the Judge function on the screen. The Judge screen is activated.
  Press the F4 (Size) key to display the entire window.

(2) Judge Screen

Measure
Set the measure mode, measurement channel, etc.

REF,Target
Set the sweeps to be measured and markers.

Judge
Set the judge values and judge lines.

Judge

	Measure							REF		Target		Judge					
No	Step	L	M	R	Mode	Name	AVE	SWP	MKR	SWP	MKR	Lower	Upper	Line	POS	RNG	OFS
1					VT_V	VT	1			A		0.00	30.00 V				
2					D.fMHz	P-PK	1	A	12	A	0	0.00	6.00 MHz	OFF			
3					Level	P	1	A	0	A	12	-2.00	0.00 dB	LO			
4					Level	C	1	A	0	A	11	-4.00	0.00 dB	OFF			
5					Level	S	1	A	0	A	10	-5.50	-2.00 dB	L/U			
6					Level	P-C	1	A	12	A	11	-2.00	2.00 dB	OFF			
7					Level	P-S	1	A	12	A	10	-5.50	0.50 dB	OFF			
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	

a) Measure No.
- The measure number becomes the order of the measured values on the Wave screen.

b) Measure L, M, R
- Settings of the channels on which to perform measurements. Select the Ch check boxes (L, M, and R) to enable measurements. Move the cursor, and press the Space or Enter key or click the mouse to select.

Example)

Measure on L, M, and R channels

Measure only on the L channel

- If all of L, M, and R are turned OFF, the specified measure mode is skipped. (Ver. 2.3 and later)

c) Measure Step
- Used to add measurement items. Move the cursor, and select the step using the Space key or the mouse to enable the measurement.
- You can set up to 16 measurement items in a step.

d) Measure Mode
- Displays the current measure mode. To change the setting, move the cursor, and press the Space key or click the mouse to select from the menu. Press the Enter key or click the mouse to enter.
  For details on the measure mode, see section 5.6, “Measure Mode.”

e) Measure Name
- Enter the name for the measurement item. The name entered here is the name used on the measured value display on the Wave screen. If you do not enter a name, the name is not shown (only the measured value is displayed).
  Up to 10 characters can be entered.

f) Measure AVE
- Setting for averaging and displaying the measured values. Set the value in the range of 1 to 9. Set this value when the measured value is unstable and is difficult to read or when you need to insert a wait until the waveform stabilizes after switching the step during All Scan mode. The specified number of measured values will be averaged and displayed.

g) REF SWP , REF MKR , Target SWP , Target MKR
- Measurements are made basically within a channel at the points specified by the sweep (A to C) and marker (No. 0 to 15) and between two specified points. This area is used to set the sweeps and markers. If these settings are not necessary in the specified measure mode, this area shows blank.

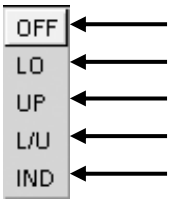
h) Judge Lower , Judge Upper
- Boxes used to enter judgement values for measurements. Move the cursor and enter the value. After moving the cursor, press the End key to display the selectable range at the upper right of the screen.
  GO/NOGO judgement is performed when you enter the Lower and Upper judge values for each measurement.

When the measured value goes outside the judgement limits, an asterisk is placed before the corresponding value on the Wave screen, and the value turns red. The waveform display frame also changes from green to red to indicate NOGO.

i) Judge Line

• Selects the judge lines to be displayed on the Wave screen for the marker point specified in Target MKR.

Move the cursor, and press the Space or Enter key or click the mouse to select. The button is not displayed for items that cannot display judge lines.

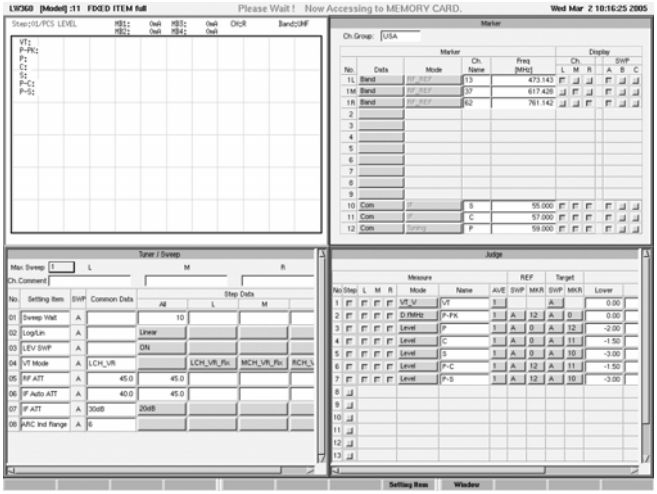


Does not display the judge lines.
Displays the lower judge line.
Displays the upper judge line.
Displays the lower and upper judge lines.
Displays the measured values using a bar graph. The judge line is displayed in the bar graph.

5.5 Setting Item (Setting Tuner/Sweep)

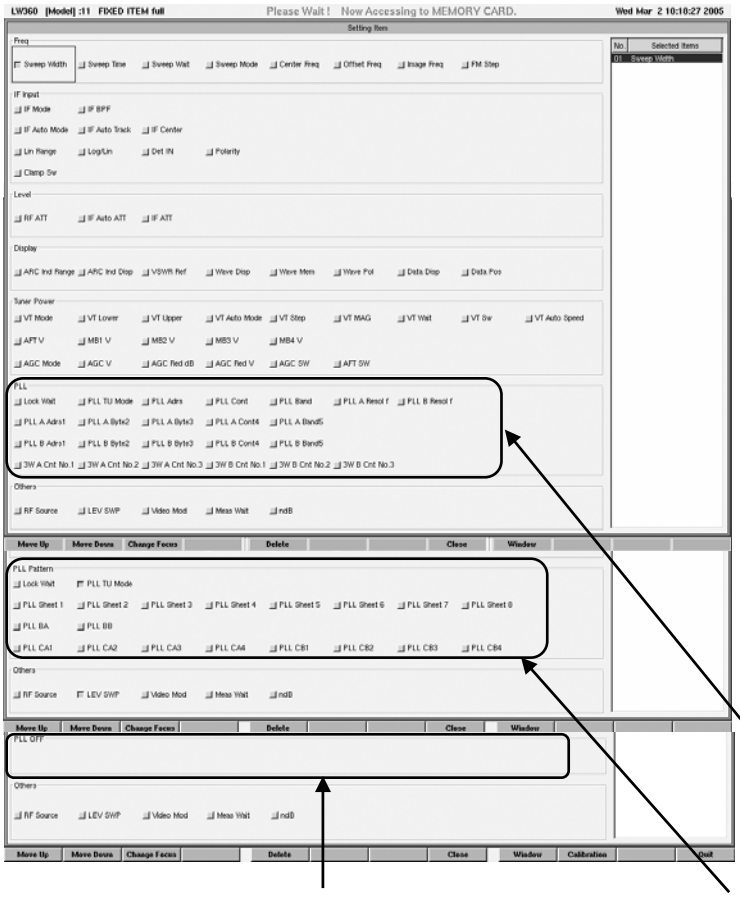
The Setting Item is used for setting the Tuner Power, Sweep and Marker.
Combining these settings can obtain various operating conditions.
The conditions can be stored as User Item and recalled when creating the Step for new Tuner Model.
This is also used for dedicated setting in Step.

5.5.1 Setting Item Selection Screen



- On the Wave screen, press the F3 [Step] key to display the Step setting screen. Then, press the F7 [Tuner/Sweep] key. You can also use the mouse to click the Tuner/Sweep screen on the Step setting screen.

- Press the F9 [Edit] key followed by the F8 [Setting Item] key to display the Setting Item screen.



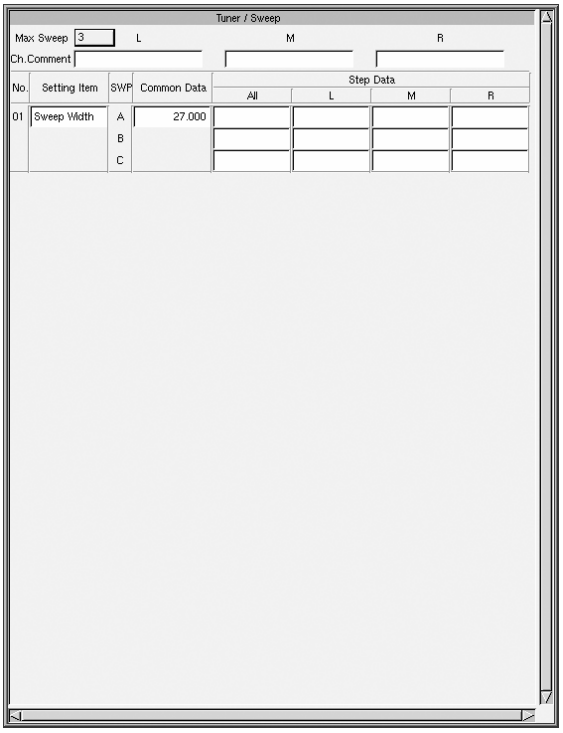
- Select the necessary item from the list on the Setting Item screen. Press the cursor keys to move the cursor and press the Enter key to select or deselect the item. If you are using the mouse, position the mouse cursor to the desired item and left-click to select or deselect the item.

- When the item is selected, the check box of the item turns red, and the item is added to the list on the right side of the Setting Item screen. The item is not selected when the check box is gray.

- After selecting the setting items, press the F8 [Close] key to return to the Tuner/Sweep screen.

When A, A&B or A+B is selected.

- The items displayed on the Setting Item selection screen are different according to the state of PLL Output Mode as shown above.



- Enter numeric value to All, L, M, and R of the Step Data columns.
- Enter numeric value for SWP columns A, B and C according to Max Sweep setting.
- Numeric value only entered to All:
  The L, M, and R values become the same value.
- Numeric value entered to L, M, and R:
  Values are dedicated for L, M, and R.
  This setting has priority over All and Common.
- Numeric value entered to A, B, or C:
  When numeric value is only entered to A, the B and C values become the same.
  When numeric value is only entered to B or C, the value is dedicated for B or C, and has priority over A.

Priority over numeric values entered

1. L, M, R CH
2. All
3. SWP A
4. Common

(I) Instance Priority Circle number indicates priority.

No.	Setting Item	SWP	Common Data	Step Data			
				All	L	M	R
01	Sweep Width	A	④	②	①	①	①
		B		②	①, ③	①, ③	①, ③
		C		②	①, ③	①, ③	①, ③

(II) Example (1) [ ] indicates numeric value entered.
( ) is automatically set according to the priority.

A	[20.000 MHz]		Common (20)	[1.000 MHz]	Common (20)
B		[10.000 MHz]	[5.000 MHz]	All (10)	All (10)
C			Common (20)	SWP A (1)	[2.000 MHz]

(III) Example (2)

A	[20.000 MHz]	[10.000 MHz]	All (10)	All (10)	All (10)
B			SWP A (10)	SWP A (10)	SWP A (10)
C			SWP A (10)	SWP A (10)	SWP A (10)

When A SWP is set to All, the same setting is made for B and C SWP.

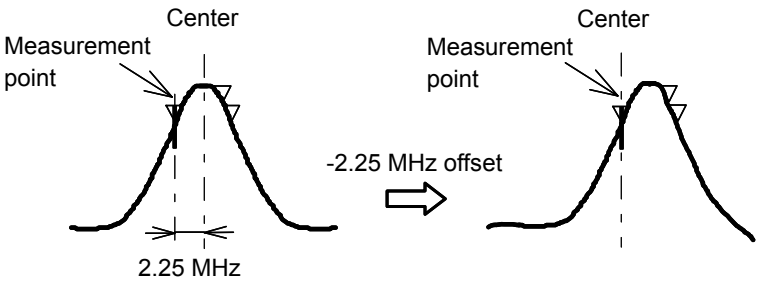
5.5.2 Description of Setting Item

(1) Freq

Type
- ○: Set with Common.
- △: Initial status.
- ☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
Sweep Width	○	0.000 to 1000.000 MHz, 1 kHz steps • This item is used to set sweep width.
Sweep Time	○	3.2, 6.4, 12.8 ms • This item is used to select sweep time. • If the waveform skews (differs from the waveform of the LSW-345B or MODEL 346B), select 3.2 ms. • If the waveform skews (differs from the waveform displayed in 5-ms sweep of the LSW-345B), select 6.4 ms.
Sweep Wait (0 ms)	△	0 to 999 ms, 1 ms steps • This item is used to set the wait time until sweep operation starts after VT is output. • In Dual or Triple sweep mode, consider the delay caused by the time constant of a tuner. Use this mode for time-consuming setting changes (e.g., AGC voltage) between A, B, and C sweeps.

Type
- ○: Set with Common.
- △: Initial status.
- ☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
Sweep Mode (FRQ SWP)	△	FRQ SWP, CW,FM SWP • Selects RF output signal Mode. • FRQ SWP Outputs swept signal. Use the Sweep Width to set the sweep width • CW Outputs CW. Use the Center FREQ to set the center frequency. Use this item together with IF Auto Track: Manual in the Setting Item. • FM SWP Outputs FM signal. The waveform is not displayed on the Display. The Single CH Mode can only be used. Set MAX Sweep: 1. Current cannot be measured. Set the Setting Item as follows. Sweep Width: FM deviation frequency IF Auto Track: Manual Center FREQ: Center frequency FM Step: Modulation frequency
Center FREQ (0 MHz)	△	0.000 to 1200.000 MHz, 1 kHz steps • This item is used to set sweep center frequency when IF Auto Track is set to Manual.
Offset FREQ (0 MHz)	△	-1000.000 to 1000.000 MHz, 1 kHz steps • This item is used to offset the waveform left or right from the specified center frequency when Auto or Manual in the IF Auto Track is selected. • When measuring the frequency at 1-kHz resolution, set the point at the screen center to obtain accurate results. 

Type
- ○: Set with Common.
- △: Initial status.
- ☆: Set when added.

<table>
<tr><th>Setting Item
(Initial Setting)</th><th>Type</th><th>Settable Range/Item Selected
Description of Setting Item</th></tr>
<tr><td>Image FREQ
(Normal)</td><td>△</td><td>Normal, Image f
• This item is used to select Image measurement.
• Normal
General measurement
• Image f
The sweep center frequency and marker frequency are automatically set to the image frequency.

IF Mode: Upper
Sweep center frequency: Add "2 x (IF Center)"
Setting Marker frequency: Add "2 x (Tuning IF)"

IF Mode: Lower
Subtract the frequency shown above.</td></tr>
<tr><td>FM Step
(1200)</td><td>△</td><td>0 to 1600
• This item is used to set FM modulation frequency.
• Modulated waveform is similar to a triangle wave.
$\text{FM Step} \fallingdotseq \left[\frac{600}{\text{fm}} - 0.084 \right] \times \frac{1}{\text{Sweep Time}}$
Where fm: modulation frequency

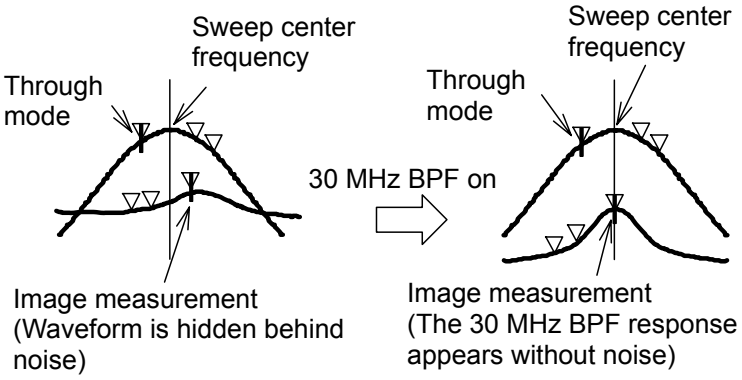
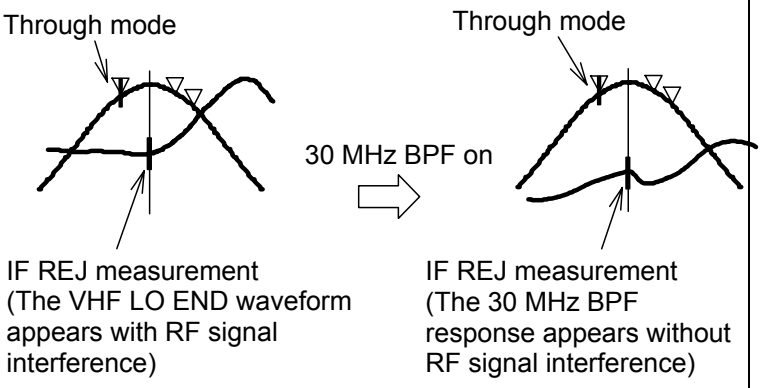
• Typical value of FM Step
<table>
<tr><th colspan="2">Modulation frequency</th><th>1 kHz</th><th>600Hz</th><th>400Hz</th><th>300Hz</th><th>200Hz</th></tr>
<tr><td rowspan="3">Sweep Time</td><td>3.2ms</td><td>161</td><td>286</td><td>443</td><td>599</td><td>911</td></tr>
<tr><td>6.4 ms</td><td>81</td><td>143</td><td>221</td><td>299</td><td>456</td></tr>
<tr><td>12.8 ms</td><td>40</td><td>72</td><td>111</td><td>150</td><td>228</td></tr>
</table>
</td></tr>
</table>

(2) IF Input

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
IF Mode	○	Upper, Lower, FM Upper, FM Lower, Upper/2nd_Up, Lower/2nd_Up • Set the mode to match the type of tuner local frequency. • Select the mode on whether the tuner local frequency is lower than or higher than the RF reception frequency. • Select the IF mode according to the direction of the frequency change of the tuner IF output (signal connected IF INPUT of the LW 360). Prevent the tuner from tuning to the image frequency. • Upper Type in which the local frequency is higher than the RF reception frequency and the direction of change in the RF reception frequency is opposite to the direction of change in the IF signal. • Lower Type in which the local frequency is lower than the RF reception frequency and the direction of change in the RF reception frequency is the same as the direction of change in the IF signal. • FM Upper Type in which the local frequency is higher than the RF reception frequency and the direction of change in the RF reception frequency is opposite to the direction of change in the IF signal for FM tuners. • FM Lower Type in which the local frequency is lower than the RF reception frequency and the direction of change in the RF reception frequency is in the same direction as the direction of change in the IF signal for FM tuners. • Upper/2nd_Up Double-conversion type tuners in which the 1st and 2nd local frequencies are of the upper type. • Lower/2nd_Up Double-conversion type tuners in which the 1st local frequency is of the lower type and the 2nd local frequency is of the upper type.

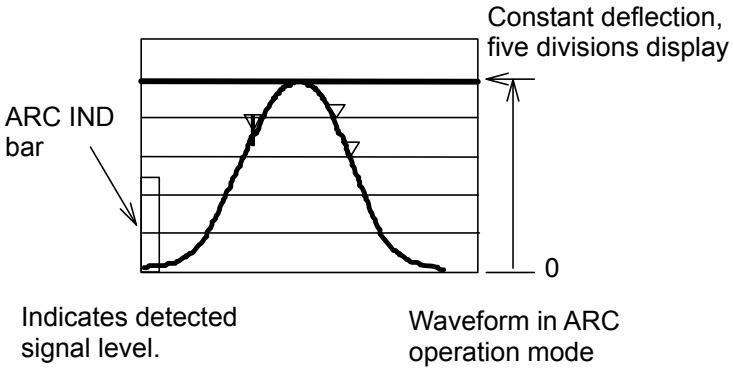
○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
IF BPF (Through)	△	Through, 30 MHz BPF • This item is used to select the 30 MHz BPF in the IF setting. (3 dB bandwidth: ≤1 MHz) • Through Use normally measurement Without filter • 30 MHz BPF Reduces interference and noise. Use this mode for measuring Image and IF REJ. • Image measurement The sweep center frequency (IF Center FREQ + IF Tuning FREQ) is added (IF Mode: Upper) or subtracted (IF Mode: Lower).  • IF REJ measurement 

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
IF Auto Mode (Normal)	△	Normal, A Sweep Only • This item is used to shorten the frequency measurement time before operating each sweep • Normal The IF Auto operates in each Sweep mode: A/B/C. Select this function when measuring a frequency variable range (e.g., AFC, +B Drift). • A Sweep Only Select this function when using the same tuning frequency in A/B/C Sweep mode. This function disables B/C Sweep to shorten the Sweep Wait time. No IF Auto ATT setting is required for a device that level is decreased in B/C Sweep mode.
IF Auto Track (Auto)	△	Auto, Manual • This item is used to select sweep center frequency setting method. • Auto Always displays the waveform at the screen center by detecting IF signal output from the tuner. • Manual Sweep operation performs based on the specified center frequency. This item is used to set the center frequency with the Center FREQ in the Setting Item.
IF Center	○	4.000 to 120.000 MHz • This item is used to set up IF Center (MHz) which has been set in a Sweep/Marker screen at each sweep.

○: Set with Common.
△: Initial status.
☆: Set when added.

<table>
<tr><th>Setting Item
(Initial Setting)</th><th>Type</th><th>Settable Range/Item Selected
Description of Setting Item</th></tr>
<tr><td>LIN Rage</td><td>○</td><td>1, 2, 3, 4, 5, 6, 7, Auto
• This item is used to select amplitude of the detected waveform.
• Each level to the next step (i.e., 1 to 7) is doubled as shown in Table below.
<table><tr><th></th><th></th><th>Level for 6-division display</th></tr><tr><td>1</td><td>1mV/Div</td><td>6mV</td></tr><tr><td>2</td><td>2</td><td>12</td></tr><tr><td>3</td><td>4</td><td>24</td></tr><tr><td>4</td><td>8</td><td>48</td></tr><tr><td>5</td><td>16</td><td>96</td></tr><tr><td>6</td><td>32</td><td>192</td></tr><tr><td>7</td><td>64</td><td>384</td></tr></table>• Selecting Auto enters Automatic Response Control (ARC) operation. The waveform is automatically displayed for five divisions when input signal level is between 2.34 mV and 320 mV. The ARC IND bar is displayed on the left side of the waveform.
  </td></tr>
<tr><td>LOG/LIN
(LOG)</td><td>△</td><td>LOG, Linear
• This item is used to select display method: LOG for IF signal, Linear for detected signal.
• LOG:
Select this item to measure a signal with large level difference (e.g., Power Gain, Image).
• Linear:
Select this item to measure detected waveform or detected waveform output from the VSWR bridge.</td></tr>
</table>

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
DET IN	○	INT IF DET, INT VSWR, DET IN 1, DET IN 2, DET IN 3 • This item is used to select destination of detected signal. • INT IF DET: The signal input to the IF Input is detected by using an internal detector. • INT VSWR: Input signal is detected by using an internal VSWR bridge. • DET IN 1 to 3: Input signal is detected by using an external detector or an external VSWR bridge. Select signals connected to the DET IN 1 to 3 connectors on the rear panel.
Polarity	○	+, - • This item is used to select polarity of detected signal. • Select + when INT IF DET is selected. • Select - when INT VSWR is selected. • When DET IN 1, 2, or 3 is selected, select the polarity according to each detected signal. • Incorrect polarity selection does not display the waveform.
Clamp SW (ON)	△	ON, OFF • Selects Clamp operation on/off. • ON Removes DC component to stabilize the base line displayed even when the DC component is superimposed on the detected signal. • OFF The base line moves according to the DC component superimposed on the detected signal (e.g., Local signal leak).

(3) Level

○: Set with Common.
△: Initial status.
☆: Set when added.

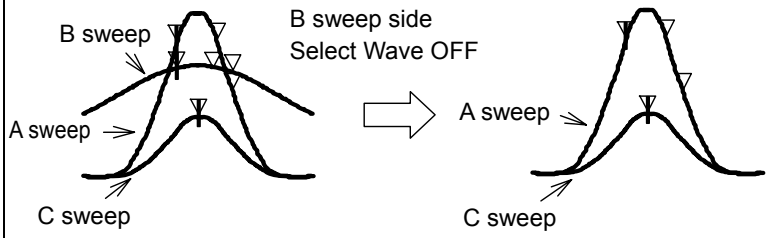
Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
RF ATT	○	0 to 90 dB,1 dB steps • This item is used to set P. ATT when observing waveforms Consider the tuner specifications (e.g., Gain) when setting the value.
IF Auto ATT	○	0 to 90 dB, 1 dB steps • This item is used to set P. ATT in IF Auto mode. Consider the tuner specifications (e.g., Gain, IF level) when setting the value.
IF ATT	○	30, 20, 10, 0 dB • This item is used to set attenuation of signal input from the IF IN connector • Select 30 dB in general. • When measuring low level signal (e.g., reduction waveform of AGC, rejection waveform of Image and IF REJ, noise figure), select suitable attenuation.

(4) Display

○: Set with Common.
△: Initial status.
☆: Set when added.

<table>
<tr><th>Setting Item
(Initial Setting)</th><th>Type</th><th>Settable Range/Item Selected
Description of Setting Item</th></tr>
<tr><td>ARC IND Range</td><td>○</td><td>1, 2, 3, 4, 5, 6, 7
• This item is used to select display range of the ARC IND bar when Auto in the LIN Range is selected.
Select the range for easy observation.
• Each level to the next step (i.e., 1 to 7) is double as shown in Table below. (same as the LIN Range)
<table>
<tr><th></th><th></th><th>Level for 6-division display</th></tr>
<tr><td>1</td><td>1mV/Div</td><td>6mV</td></tr>
<tr><td>2</td><td>2</td><td>12</td></tr>
<tr><td>3</td><td>4</td><td>24</td></tr>
<tr><td>4</td><td>8</td><td>48</td></tr>
<tr><td>5</td><td>16</td><td>96</td></tr>
<tr><td>6</td><td>32</td><td>192</td></tr>
<tr><td>7</td><td>64</td><td>384</td></tr>
</table></td></tr>
<tr><td>ARC_IND_DISP
(ON)</td><td>△</td><td>ON, OFF
• In Linear measurement mode, this item is used to delete the ARC IND bar when Auto is selected in the LIN Range.
• ON: Displays ARC IND bar.
• OFF: Deletes ARC IND bar.</td></tr>
<tr><td>VSWR REF
(OFF)</td><td>△</td><td>OFF, 2 to 9
• This item is used to display the amplitude of the VSWR measurement waveform by calculating the VSWR value settings equivalent to the 5 DIV.
• OFF: Shows a normal VSWR waveform display.
• 2 to 9: Shows a VSWR value at calculated display.</td></tr>
</table>

○: Set with Common.
△: Initial status.
☆: Set when added.

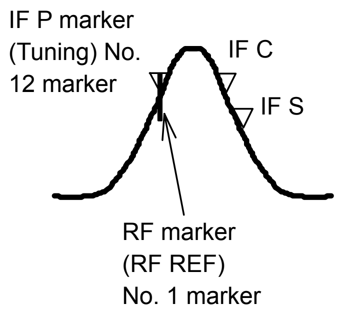
Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
Wave DISP (Wave DISP)	△	Wave ON, Wave OFF • This item is used only for the measurement and selects OFF to erase the waveform that is not used for observation. • Wave ON: Displays all waveforms being set. • Wave OFF: Erases selected waveform. Example of PCS/Image  B sweep: Set as a comparision signal in Image measurement Erasing the B sweep can easily observe the desired waveform.
Wave MEM	☆	0 to 40 (Version 2.0 or before: 0 to 20) • This item is used to display the stored waveform on the Display. • Set the desired waveform stored as standard to each sweep. The waveform is displayed in blue on the Display. Use this waveform as a reference. • This setting can also be performed while observing the waveform on the [WAVE] screen. The Setting Item is also automatically set. • When 0 is set, it becomes OFF.
Wave POL (Normal)	△	Normal, Reverse • This item is used to select a display direction of a waveform. • Normal: Normal state. Baseline positions at the lower end. • Reverse: Baseline positions to the top. A reverse of a waveform.
Data DISP (ON)	△	ON, OFF, Judge No. 1 to 3 • This item is used to select the display method of measurement data displayed at the upper left of [WAVE] screen. This setting cannot be selected in L/M/R CH and A/B/C sweep modes and becomes the setting of each Step. ON: Displays measurement data. OFF: Erases measurement data. Judge No. 1 to 3: Displays only No. 1 to 3 data of Judgement. MAX x3: The number of three higher ranks by Judgement settings is displayed.

○: Set with Common.
△: Initial status.
☆: Set when added.

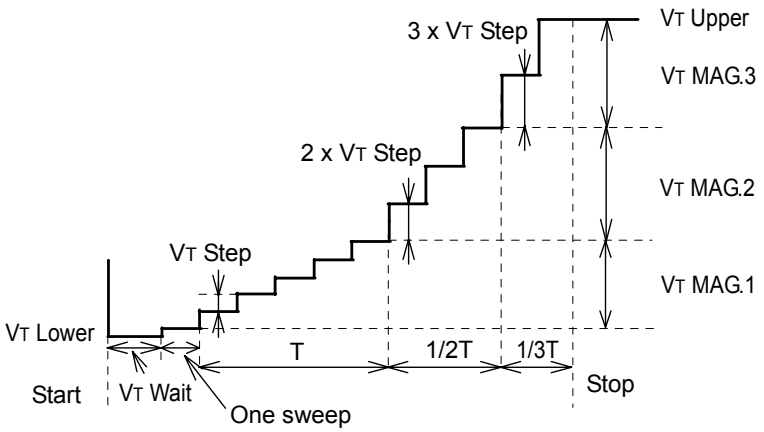
Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
Data POS (Normal)	△	Normal, Reverse • This item is used to select a display position of a measured data. • Normal: Normal state. Displays from the top in order. • Reverse: Displays the measured date from the lower end to top in order.
CH. Name Disp (OFF) (Ver. 2.1 and later)	△	OFF, ON • Ch. Name and Band are displayed at lower left of the screen when having set CH. NO. with Parameter Remote. • When having not set Parameter Remote, Ch. Name of RF Ref Marker is displayed. (Only setting by A sweep)
Log Scale (10 dB/Div) (Ver. 2.1 and later)	△	1 dB/Div, 2dB/Div, 5dB/Div, 10 dB/Div • When Log is measured, the amount of levels per 1 Div is selected. In Lin measurement, it becomes invalid. • A setting value is displayed at the lower right of the screen when setting it. However, when 10 dB/Div and Log Offset dB are 0 dB, it does not display. • When AGC_Curve2 or 4 is selected with AGC Mode, an actual scale doubles to the setting value.
Log Offset dB (0.0 dB) (Ver. 2.1 and later)	△	0.0 to 50.0 dB • When Log is measured, the offset level of the grid uppermost part is set. In Lin measurement, it becomes invalid. • A setting value is displayed at the lower right of the screen when setting it. • However, when 0.0 dB and Log Scale are both 10 dB/Div, it does not display.
dB Indicator (OFF) (Ver. 2.2 and later)	△	OFF, 1 dB, 0.5 dB • When Lin measurement is performed, the interval from the waveform peak to 10dB is displayed in the logarithm scale. Two kinds of scales of 1dB and 0.5dB can be selected. • This item is used together with turning ON LEV Swp.
dB Ind_Pos (Peak) (Ver. 2.2 and later)	△	Peak, A, B, C • Select the display position of dB Indicator. • Peak Waveform peak point • A A line at the screen center • B The center of the screen right half • C Screen right edge

(5) Tuner Power

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
VT Mode (LCH VR) Cont'd	△	LCH VR, MCH VR, RCH VR, VT FIX, LCH VR FIX, MCH VR FIX, RCH VR FIX, VT Auto, VT Sweep [Nine types selectable] • This item is used to select the method change VT output voltage. Setting only for A sweep LCH VR / MCH VR / RCH VR: These VT VRs are used to set the voltage to be output between VT Lower and VT Upper (entered by using the Setting Item) • VT FIX Fixed output voltage. Output voltage = VT Upper + (VT Lower X1/10) Set VT Lower Voltage to 0 V in general, then set the VT Upper to the desired voltage. LCH VR FIX / MCH VR FIX / RCH VR FIX: The sweep signal started by voltage set with VT VR of L, M, and R is output. Stable waveform is displayed since the VT voltage is fixed during sweep period. • VT Auto The VT voltage is automatically set for tuning a tuner to CH marker frequency set NO. 1 in the [Marker] screen. VT search voltage range is set by VT Lower and VT Upper. ◎ VT voltage is automatically set to match the markers No. 1 (RF REF) and No. 12 (Tuning). 

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
VT Mode (LCH VR)	△	• VT Sweep Step sweep is performed between the VT Lower and VT Upper. The level increases synchronized with the sweep. Set the step voltage by using the VT Step, VT MAG and VT Wait in the Setting Item. Sweep stops at the voltage when Step judgement NOGO  VT MAG: 3 selected
VT Lower	○	0.00 V to 30.00 V, 10 mV steps • This item is used to set the Lower voltage of the VT variable range.
VT Upper	○	0.00 V to 30.00 V, 10 mV steps • This item is used to set the Upper voltage of the VT variable range.
VT Auto Mode (Set_100 kHz)	△	Set 20 kHz, Set 50 kHz, Set 100 kHz • This item is used to shorten the VT Auto operation time. • Set 20 kHz Holds VT Auto operation until the specified frequency becomes within ±20 kHz. • Set 50 kHz The frequency is first measured. If the specified frequency is within ±50 kHz, VT Auto operation is canceled. • Set 100 kHz The frequency is first measured. If the specified frequency is within ±100 kHz, VT Auto operation is canceled.

○: Set with Common.
△: Initial status.
☆: Set when added.

<table>
<tr><th>Setting Item
(Initial Setting)</th><th>Type</th><th>Settable Range/Item Selected
Description of Setting Item</th></tr>
<tr><td>VT Step</td><td>☆</td><td>0.00 to 30.00 V, 0.01 V steps
• Select VT Sweep in the Setting Item: VT Mode, then enter data.
• Set the voltage to be added to VT voltage for every sweep.</td></tr>
<tr><td>VT MAG</td><td>☆</td><td>1 to 9
• To magnify the VT Step, select VT Sweep in the Setting Item: VT Mode, then enter data.
• By setting this item, VT Step voltage (described above) will be sloped.
Example:
When "n" is entered, voltage between VT Lower and VT Upper is divided into n-equal steps (VT Lower < VT Upper) and VT Step voltage (VTS) is multiplied by "n" when passing each step.
<table>
<tr><th>Step</th><th>Approx. Time</th><th>VT StepVoltage</th></tr>
<tr><td>1</td><td>T</td><td>1 x VTS</td></tr>
<tr><td>2</td><td>1/2T</td><td>2 x VTS</td></tr>
<tr><td>3</td><td>1/3T</td><td>3 x VTS</td></tr>
<tr><td>:</td><td>:</td><td>:</td></tr>
<tr><td>n-1</td><td>1/ (n-1) T</td><td>(n-1) x VTS</td></tr>
<tr><td>n</td><td>1/n T</td><td>n x VTS</td></tr>
</table>
• Set the voltage to obtain about an equal interval of frequencies according to the VT - f characteristics of the tuner.</td></tr>
<tr><td>VT Wait</td><td>☆</td><td>0 to 999 ms, 1 ms steps
• Set this item is required when VT Sweep in the Setting Item: VT Mode is selected.
• Use this item to set the wait time until VT Sweep operation starts.
• Set the time according to the time constant of the tuner VT connector.</td></tr>
<tr><td>VT SW
(ON)</td><td>○</td><td>ON, OFF
• This item is used to set VT Out (pin 1 of Tuner Power connector) off.
• ON: Outputs VT voltage.
• OFF: Sets VT voltage off.</td></tr>
</table>

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
VT Auto Speed	○	-9 to 99 • This item is used to set search speed of VT voltage in VT Auto operation. • Consider the time constant of VT connector and VT - f curve of the tuner when setting the speed. Set a larger value for a large time constant. Set a larger value for a gentle VT - f curve. (i.e., minor frequency variation against VT variation).
AFT V	○	0.0 to 15.0 V, 0.1 V steps • This item is used to set AFT output voltage. (Use this item for measuring AFT, etc.)
MB1 V	○	0.0 to 13.5 V, 0.1 V steps • This item is used to set MB1 output voltage. (Use this item for measuring +B Drift, etc.)
MB2 V	○	0.00 to 10.50 V, 0.05 V steps • This item is used to set MB2 output voltage. (Use this item for measuring +B Drift, etc.)
MB3 V	○	1.00 to 6.00V, 0.05 V steps • This item is used to set MB3 output voltage. (Use this item for measuring +B Drift, etc.)
MB4 V	○	1.00 to 6.00V, 0.05 V steps • This item is used to set MB4 output voltage. (Use this item for measuring +B Drift, etc.)

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
AGC Mode (Normal)	△	Normal, AGC RED Auto, AGC Curve 1, AGC Curve 2, AGC Curve 3, AGC Curve 4 • Select AGC voltage output Mode. • Normal Normal AGC voltage. • AGC Red Auto Activates automatic setting mode of AGC voltage to obtain the amount of specified AGC reduction. This setting is performed every five sweeps. Use this item together with RF ATT, AGC RED dB and AGC RED V in the Setting Item. If response speed is too slow when AGC voltage is varied, set the wait time by adding Setting Item of Sweep Wait. • AGC Curve 1 Displays AGC response curve by sweeping the AGC voltage. The level is indicated in 10 dB/DIV. The reference point is set to 0 dB (upper edge of the screen scales). Use this item together with Setting Item (i.e., AGC RED V, Sweep Wait, VT Wait). • AGC Curve 2 Same as the AGC Curve 1 except below. The level is indicated in 20 dB/DIV. • AGC Curve 3 When the Reduction becomes a minus side, the waveform is indicated by the display reference point that is lowered one-Division (1 scale). Also the level is indicated in 10 dB/DIV. • AGC Curve 4 Same as the AGC Curve 3 except below. The level is indicated in 20 dB/DIV.
AGC V	○	0.0 to 15.0 V, 0.1 V steps • This item is used to set AGC output voltage. (Use this item for measuring AGC reduction and performance under the specified AGC voltage.)

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
AGC RED dB	☆	0 to 50 dB, 1 dB steps • Setting Item: This item is used to set amount of AGC Reduction when you select AGC RED in AGC Mode.
AGC RED V	☆	0.0 to 15.0 V, 0.1 V steps • Set the voltage close to the AGC voltage that produces the specified AGC Reduction when you select AGC RED Auto in AGC Mode. This achieves stable and faster AGC RED Auto operation.

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
AGC SW	○	ON, OFF • This item is used to switch the Tuner Power AGC connector for output or input use. • ON: AGC voltage output connector. • OFF: AGC voltage input connector. Use this item to measure AGC voltage when operating a tuner in AGC loop operation. Use this item together with Sweep Mode (CW) and Center FREQ in the Setting Item. • Cannot be switch of ON, OFF in Step.
AFT SW	○	ON, OFF • This item is used to switch the Tuner Power AFT connector for output or input use. • ON: AFT voltage output connector. • OFF: AFT voltage input connector. Use this item to measure AFT voltage when operating a tuner in AFT loop operation. Use this item together with Sweep Mode (CW) and Center FREQ in the Setting Item. • Cannot be switch of ON, OFF in Step.

(6) PLL == When PLL Output Mode is OFF, A, A&B, A+B ==

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
Lock Wait	○	0 to 999 ms, 1 ms steps • This item is used to set Lock Time (i.e., between PLL-controlled signal output and with tuner locked to CH frequency) when measuring a PLL tuner. The sweep starts after Lock Wait time passes. (PLL TU Mode: CH CONT) • When Lock signal reception mode is selected, the sweep starts after the Lock signal is received (even during Lock Wait time). • When the PLL TU Mode is set to Band, the Lock Wait time becomes 0 ms regardless of setting value.
PLL TU Mode (Band)	△	Band, CH. CONT, OFF • This item is used to select frequency control method for PLL tuners. Only setting by A sweep. • Band Sets PLL-controlled CH frequency to Unlock status, then changes the tuning frequency with VT voltage. The CH frequency is sent in the Unlock FREQ. on the [Tuner Power] screen. • CH. CONT Sets PLL-controlled CH frequency to Lock status. The CH frequency is indicated in the NO. 1 RF REF in the [Marker] screen. The VT output is automatically switched to the voltage set by VTB. • OFF Sets PLL control data off. Operation is performed by using data sent in previous Step operation.
PLL ADRS	○	Eight bits binary code data • This item is used to change Address data in the PLL Table of PLL-controlled I^2C system. (Only setting by A sweep.)
PLL CONT	○	Eight bits binary code data • This item is used to change Control data in the PLL Table of PLL-controlled I^2C system. (Only setting by A sweep.)

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
PLL Band	○	Eight bits binary code data • This item is used to change Band data in the PLL Table of PLL-controlled. • Use this item when measuring a tuner in L, M and R CH mode with various BANDs. (Only setting by A sweep.)
PLL A Resol f	○	0.001 to 1000.000 kHz • This item is used to change Resolution FREQ in the PLL Table (A). (Only setting by A sweep.) • On the PLL table A and B, when PLL A Resol f and PLL B Resol f are set simultaneously, priority is given to PLL A Resol f.
PLL B Resol f	○	0.001 to 1000.000 kHz • This item is used to change Resolution FREQ in the PLL Table (B). (Only setting by A sweep.)
PLL A Adrs1 PLL A Byte2 PLL A Byte3 PLL A Cont4 PLL A Band5	○	8-bit binary code data • These items are used to set each byte in the PLL Table (A) of PLL-controlled I^2C system. (Only setting by A sweep.) • Priority is given to the items in this Setting Item when other single Setting Items (items such as PLL Adrs, PLL Cont, and PLL Band) and this Setting Item (items such as PLL Adrs1, PLL A Cont4, and PLL A Band5) are set simultaneously.
PLL B Adrs1 PLL B Byte2 PLL B Byte3 PLL B Cont4 PLL B Band5	○	8-bit binary code data • These items are used to set each byte in the PLL Table (B) of PLL-controlled I^2C system. (Only setting by A sweep.)

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
3W A CNT No. 1	○	8-bit binary code data • This item is used to set when changing the least significant 8 bits (C8 to C1) of the Control data in the PLL Table A of the PLL controlled 3 Wire and CCB systems. (Only setting by A sweep.)
3W A CNT No. 2	○	8-bit binary code data • This item is used to set when changing the Intermediate 8 bits (C16 to C9) of the Control data in the PLL Table A of the PLL controlled 3 Wire and CCB systems. (Only setting by A sweep.)
3W A CNT No. 3	○	8-bit binary code data • This item is used to set when changing the most significant 8 bits (C24 to C17) of the Control date in the PLL Table A of the PLL controlled 3 Wire and CCB systems. (Only setting by A sweep.)
3W B CNT No. 1	○	8-bit binary code data • This item is used to set when changing the least significant 8 bits (C8 to C1) of Control data in the PLL Table B of PLL-controlled 3 Wire and CCB systems. (Only setting by A sweep.)
3W B CNT No. 2	○	8-bit binary code data • This item is used to set when changing the Intermediate 8 bits (C16-C9) of the Control data in the PLL Table B of the PLL controlled 3 Wire and CCB systems. (Only setting by A sweep.)
3W B CNT No. 3	○	8-bit binary code data • This item is used to set when changing the most significant 8 bits (C24 to C17) of the Control date in the PLL Table B of the PLL controlled 3 Wire and CCB systems. (Only setting by A sweep.)

(7) PLL == When PLL Output Mode is PLL Pattern ==

∗ Lock Wait and PLL TU Mode are with the common in the case to select OFF, A, A&B and A+B.

○: Set with Common.
△: Initial status.
☆: Set when added.

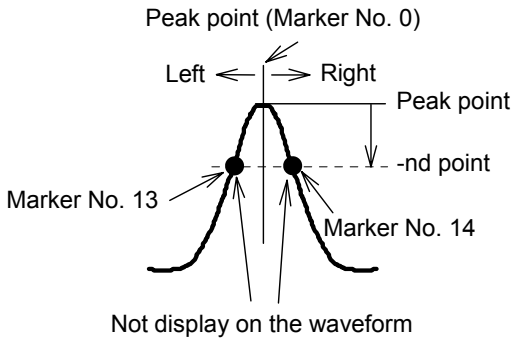
Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
PLL Sheet1 PLL Sheet2 PLL Sheet3 PLL Sheet4 PLL Sheet5 PLL Sheet6 PLL Sheet7 PLL Sheet8	○	OFF, ON • This item is used to set individually the ON/OFF of each sheet of the PLL (Pattern) (Only setting by A sweep.)
PLL BA	○	8-bit binary code data • This item is used to set individually the byte equivalent to the Band data portion of PLL Table (A) or Common Sheet. (Only setting by A sweep.)
PLL BB	○	8-bit binary code data • This item is used to set individually the byte equivalent to the Band data portion of PLL Table (B) or Common Sheet. (Only setting by A sweep.)
PLL CA1 PLL CA2 PLL CA3 PLL CA4	○	8-bit binary code data • This item is used to set individually each byte equivalent to the data portion of each item of CA of PLL Table (A) or Common Sheet. (Only setting by A sweep.) CA1 → Address CA2 → Divider1 CA3 → Divider2 CA4 → Control
PLL CB1 PLL CB2 PLL CB3 PLL CB4	○	8-bit binary code data • This item is used to set individually each byte equivalent to the data portion of each item of CB of PLL Table (A) or Common Sheet. (Only setting by A sweep.) CB1 → Address CB2 → Divider1 CB3 → Divider2 CB4 → Control

(8) Others

○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
RF Source (Normal)	△	Normal, Video MOD, Noise , 40 MHz LPF, 60 MHz LPF, RF OFF • This item is used to select output type of RF signal. • Normal Outputs general RF signal other than followings. • Video MOD ∗ Video MOD is a special order option. Outputs video carrier signal modulated by composite video signal input to the Modulation Input on the front panel. (Double side band modulation) Use this item together with Sweep Mode: CW, IF Auto Track: Manual, Center FREQ and Video MOD: - or+ in the Setting Item. • Noise This item outputs noise. The noise level (ENR) is about 16 dB. Use this item together with RF OFF (level off) for NF measurement. • 40 MHz LPF This item is used to reduce harmonic component on the signal source. Select this item when the IF signal is 40 MHz or lower for IF REJ measurement. The Manual sweep is automatically obtained by selecting this item and sweep center frequency becomes Tuning of IF frequency (No. 12 in the [Marker] screen). • 60 MHz LPF This item is used to reduce harmonic component of the signal source for IF REJ measurement. Refer to "40 MHz LPF" for operation. Use this item when IF signal is between 40 and 60 MHz. • RF OFF Sets RF signal off. Use this item together with [Noise] for NF measurement.

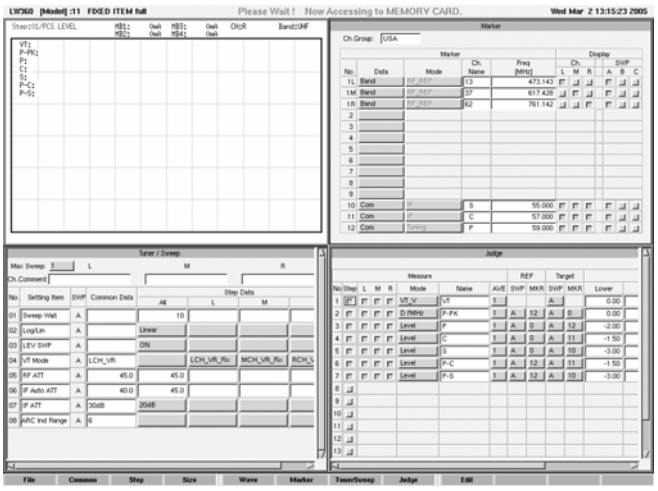
○: Set with Common.
△: Initial status.
☆: Set when added.

Setting Item (Initial Setting)	Type	Settable Range/Item Selected Description of Setting Item
LEV SWP (OFF)	△	OFF, ON • This item is used to measure level in unit of dB (Measure Mode: Level) in Linear (detected waveform) mode. • OFF Level Sweep is disabled. • ON Level Sweep is enabled. Linear level measurement can be performed in units of dB. The reference level can be varied between +2 dB and -13 dB with respect to the peak level. Measurement can be performed with respect to the reference level.
Video MOD ∗ Video MOD is a special order option	☆	-, + • This item is used to select the Video Modulation polarity. • - Negative modulation (sync signal level is the maximum carrier level). • + Positive modulation (100% white level is the maximum carrier level)
Meas Wait	☆	0 to 999 ms, 1 ms steps • This item is used to set a latency time till reaching the stabilization state of AGC voltage after VT Auto operation at AGC voltage measurement.
ndB	☆	0.5 to 9.9 dB, 0.1 dB steps • For n-dB-bandwidth measurement, select this item to set left and right markers at n dB point with respect to the peak of the waveform.  • For Linear (detected waveform), use this item together with LEV SWP in the Setting Item.

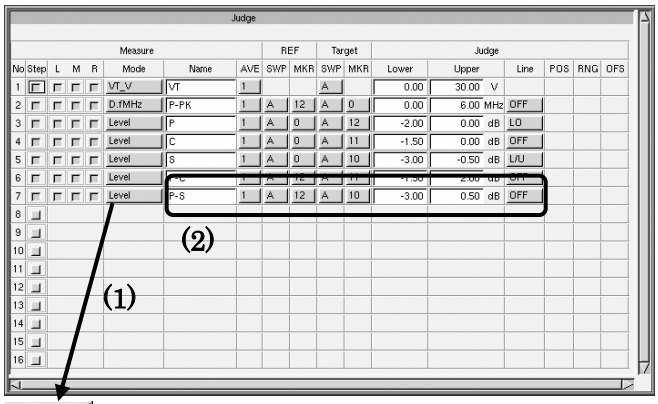
5.6 Measure Mode (Judge Setting)

Measure Mode specifies the setting for performing measurement and judgement.
Various measurements are possible through the combination with the setting item (Tuner/Sweep setting).

5.6.1 Measure Mode Selection Screen

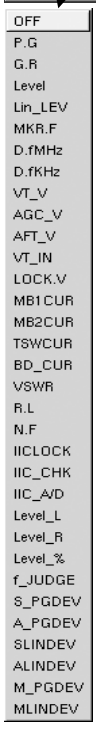


• On the Wave screen, press F3 (Step) followed by F8 (Judge) to display the Judge setup screen.



• Set the step to be used on the Judge screen.
(Use the keyboard or mouse to select or deselect.))

Step check box
Red: Selected
Gray: Not selected



(1) Select the item to be measured with the Mode button.
Press the up, down, and Space key to select the item from the list shown left.
You can also use the mouse to select the item.

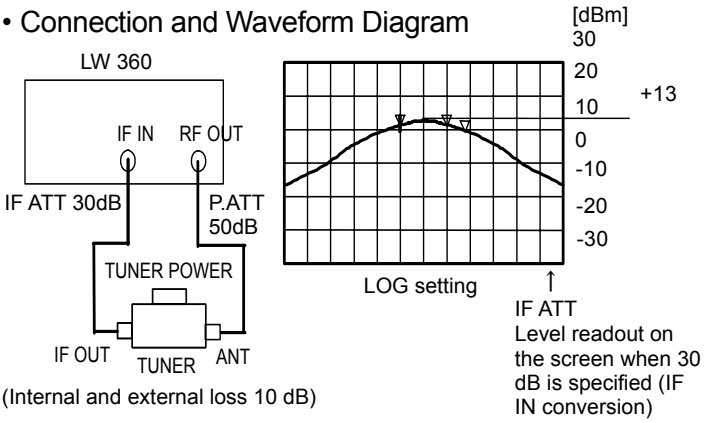
(2) Set the measurement channel, name, average count, measurement point, judge value, and judge line.

∗ Some items cannot be measured if the tuner power and sweep settings are not specified.

5.6.2 Measure Mode Description

The measurement range and the selectable range for judgement are not the same.

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
OFF	—	—	—	— • Turns OFF the measurement while retaining the settings.
P.G	—	○	○	-99.9 to 99.9 dB • Measures the power gain. Log setting only. Measures the gain of IF IN with respect to RF OUT of the LW 360. • The power gain from the tuner antenna to IF OUT can be measured by setting the P.G.Cal value. • The measurement is made on an absolute scale. Therefore, if the P.G.Cal value is not correct, the measured result will contain the corresponding amount of error. • Connection and Waveform Diagram  (Internal and external loss 10 dB) • Example of P.G. measurement (Readout on screen - IF ATT - RF OUT + internal and external loss) +13 - 30 - (-50) + 10 = 43 dB

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
G.R	○	○	○	-999.99 to 999.99 dB • Used to measure AGC reduction and Image/IF rejection. • These items can also be measured using Level (the next item), but the equation is reversed so that the measured value is positive. • Measures the level difference (reduction or rejection) between specified markers. Log setting only.
Level	○	○	○	-999.9 to 999.9 dB • Measures the level difference between the specified markers. • When set to linear measurement, use this mode in combination with the level sweep (Setting Item: LEV SWP). Used to measure the PCS level, etc. • When set to logarithmic measurement, the level difference on the log waveforms are measured. Used to measure P+/-fn, TRAP, etc.
Lin_LEV	—	○	○	0.00 to 999.99 mV • Measures the level at the specified marker point on the detected signal applied to the internal detector or Det_IN. Lin setting only. • DC voltage. Check the polarity setting of Det_IN for the polarity of the voltage. (The display always shows a positive value.)
MKR.F	—	○	—	00 to 1999.99 MHz • Measures the frequency at the specified marker point. • If an IF marker is specified, the frequency is converted into RF output frequency and displayed. • If the IF P marker is specified, the tune frequency is always displayed.
D.fMHz	○	○	○	-999.99 to 999.99 MHz • Measures the frequency difference between the specified markers. • Used to measure ndB Width, AFT, etc.

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
D.fkHz	○	○	○	-999.99 kHz to 999.99 kHz • Measures the frequency difference between the specified markers. • Used for measurements with small frequency difference such as +B Drift and PLL Lock. • To increase the measurement accuracy, use Setting Item: Offset so that the measurement point is at the center of the sweep.
VT_V	—	△	—	0.00 to 9.99 V • Measures the output voltage at the VT output pin (pin 1) of the Tuner Power connector.
AGC_V	—	△	—	0.00 to 99.99 V • Measures the voltage at the AGC OUT/IN pin (pin 4) of the Tuner Power connector. • Used to measure the AGC voltage when the AGC loop is activated on a tuner with IF. In this case, set the setting item AGC SW to OFF to switch to input. In addition, set the RF output signal to CW.
AFT_V	—	△	—	0.00 to 99.99 V • Measures the output voltage at the AFT OUT/IN pin (pin 5) of the Tuner Power connector. • Used to measure the AFT voltage when the AFT loop is activated on a tuner with IF. In this case, set the setting item AFT SW to OFF to switch to input. In addition, set the RF output signal to CW.
VT_IN	—	△	—	0.00 to 99.99 V • Measures the voltage at the VT_IN pin (pin 2) of the Tuner Power connector. • The measurement range is 0 to 32 V. • If the PLL tuner power has a VT output pin, connect it here to measure the VT voltage. • Can measure voltages other than VT as long as its range is 0 to 32 V.

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
LOCK.V	—	—	—	0.00 to 99.99 V • Measures the voltage at the $\overline{\text{LOCK\_IN}}$ pin (pin 12) of the Tuner Power connector. • The measurement range is 0 to 5 V. • If the PLL tuner has a PLL lock signal output pin, connect it here to judge the lock signal and measure the lock signal voltage. • Voltages other than the lock signal voltage can be measured as long as its range is 0 to 5 V. However, if lock mode is set to Lock_Pin in the PLL settings, the LW 360 judges the lock signal on the input voltage.
MB1CUR	—	△	—	0 to 999 mA • Measures the current flowing through the MB1 pin (pin 7) of the Tuner Power connector. • The current of sweep A is measured at all times and displayed at the top section of the Wave screen outside the frame. This mode is used to measure the current on the reduction side (sweep B or C) of the AGC measurement, etc. • This mode is used to make measurements on sweep B or C.
MB2CUR	—	△	—	0 to 999 mA • Measures the current flowing through the MB2 pin (pin 11) of the Tuner Power connector. • The current of sweep A is measured at all times and displayed at the top section of the Wave screen outside the frame. This mode is used to measure the current on the reduction side (sweep B or C) of the AGC measurement, etc. • This mode is used to make measurements on sweep B or C.

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
TSWCUR	—	△	—	0 to 999 mA • Measures the total current that flows through pin 8 (TU SW1), pin 9 (TU SW2), and pin 6 (TU SW3).
BD_CUR	—	△	—	0 to 999 mA • Measures the total current flowing through the BL, BM, BH, and BU pins (pins 17 to 20) of the Tuner Power connector. • For a VT tuner, the current of sweep A is measured at all times and displayed at the top section of the Wave screen outside the frame. This mode is used to measure the current on the reduction side (sweep B or C) of the AGC measurement, etc. • This mode is used to make measurements on sweep B or C. • This mode cannot be used for a PLL tuner, because the tuner does not output the band voltage.
VSWR	—	○	○	0.0 to 99.9 • Measures the VSWR at the specified marker point on the detected signal of the VSWR bridge. • Dedicated for VSWR measurement. • Perform VSWR calibration before making this measurement. • The VSWR value is obtained by performing the R.L measurement described next and calculating.
R.L	—	○	○	-99.9 to 99.9 dB • Measures the return loss at the specified marker point on the detected signal of the VSWR bridge. • Dedicated to return loss measurement. • Perform VSWR calibration before making this measurement.

Setting ○: Yes
△: Only for SWP
—: No

<table>
<tr><th rowspan="2">Measure Mode</th><th colspan="3">Setting</th><th rowspan="2">Selectable Judge Range
Measure Mode Description</th></tr>
<tr><th>REF.</th><th>Target</th><th>Line</th></tr>
<tr><td>N.F</td><td>○</td><td>○</td><td>—</td><td>0.0 to 99.9 dB

• Measures the noise figure.
• Set sweep A and B of setting item RF Source to Noise/RF OFF and use settings around RF ATT 90 dB and IF ATT 10 dB.
• The LW 360 measures the difference in the noise levels of sweep A and B and calculates the measured value (Y factor method).
• The NF ENR value must be specified.</td></tr>
<tr><td>IIC Lock</td><td>—</td><td>—</td><td>—</td><td>—
• Detects the lock signal using the read mode of the I^2C type PLL tuner.
• Indicates 1 for lock and 0 for unlock.
• Set the lock mode to IIC Data in the PLL settings and set the read data format according to the specifications.
• In PLL Table A and B, when Lock Mode is both set to IIC Data, Table A becomes effective.
In case of PLL Pattern, first Sheet becomes effective.</td></tr>
<tr><td>IIC CHK</td><td>—</td><td>△</td><td>—</td><td>0 to 1

• Judges the check bit using the read mode of the I^2C type PLL tuner.
• Set the read data format according to the specifications in the PLL settings.
• In PLL Table A and B, when Lock Mode is both set to IIC Data, Table A becomes effective.
In case of PLL Pattern, first Sheet becomes effective.</td></tr>
<tr><td>IIC A/D</td><td>—</td><td>△</td><td>—</td><td>0 to 7

• Judges the A/D output using the read mode of the I^2C type PLL tuner.
• The table below shows the relationship between the numeric display and the A/D bit output.
<table>
<tr><th>AD2</th><th>AD1</th><th>AD0</th><th>Numeric Display</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>2</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>3</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>4</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>5</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>6</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>7</td></tr>
</table>
• Set the read data format according to the specifications in the PLL settings.
• In PLL Table A and B, when Lock Mode is both set to IIC Data, Table A becomes effective.
In case of PLL Pattern, first Sheet becomes effective.</td></tr>
</table>

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
Level_L	○	○	○	-99.9 to 99.9dB • Measures the level difference between specified markers when the IF tuning marker (marker No. 12) is left of the waveform peak point. If the IF tuning marker is right of the peak point, measurement is aborted (nothing is displayed). • This mode is opposite of measure mode Level R. Use these two in pairs to make separate judgements for the case when the IF tuning marker (marker No. 12) is left and right of the waveform peak point. These two measurements make up a single measurement. • Set the setting items as follows: Log/Lin to Lin and LEV_SWP to ON. Set Peak Overlap f on the Sweep/Marker screen.
Level_R	○	○	○	-99.9 to 99.9dB • Measures the level difference between specified markers when the IF tuning marker (marker No. 12) is right of the waveform peak point. If the IF tuning marker is left of the peak point, measurement is aborted (nothing is displayed). • Other details are the same as Level_L.
Level_%	—	○	○	0.0 to 100.0% • Measures the amplitude ratio at each measurement point of linear waveform (detected signal) with respect to the peak level (0%) in percentage (%). • Lin setting only. Use setting item LEV_SWP.

Setting ○: Yes
△: Only for SWP
—: No

Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
F_JUDGE	—	—	—	000 to 999 MHz (first three characters in the Name box) • Set separate settings by dividing the judge value of each measurement item by the tuning frequency • Up to 16 settings can be specified including other measurement items. • The display box of the measured value, judge line, and measured value vary for each specified frequency. • Setting the switch frequency and name (Name box) XXX YYYYYY Set the name using 7 characters Set the frequency using the first three characters. Always enter a thee-digit number. The unit is MHz. • Hysteresis for switching from a higher frequency to a lower frequency can be specified at the switching point of the specified frequencies by setting Peak Overlap f on the Sweep/Marker screen (shared with measure mode Level_L and Level_R).
S_PGDEV	—	○	—	0.0 to 99.9 dB • Measures the power gain deviation within a single step. • Measures at each specified target marker point.
A_PGDEV	—	○	—	0.0 to 99.9dB • Measures the power gain deviation at all specified steps and target marker points.
SLINDEV	—	○	—	0.0 to 99.9 dB • Measures the linear level deviation for each target marker point within a single step. • Perform linear level calibration before making this measurement. This operation is for converting the linear input level to dB and displaying the measured value as dB difference. • Carry out the linear calibration at the maximum level of the tuner. • Calibrate when the tuner type, jig, and other parts are changed. • Calibrate as necessary when the same connection is used over a prolonged period.

Setting ○: Yes
△: Only for SWP
—: No

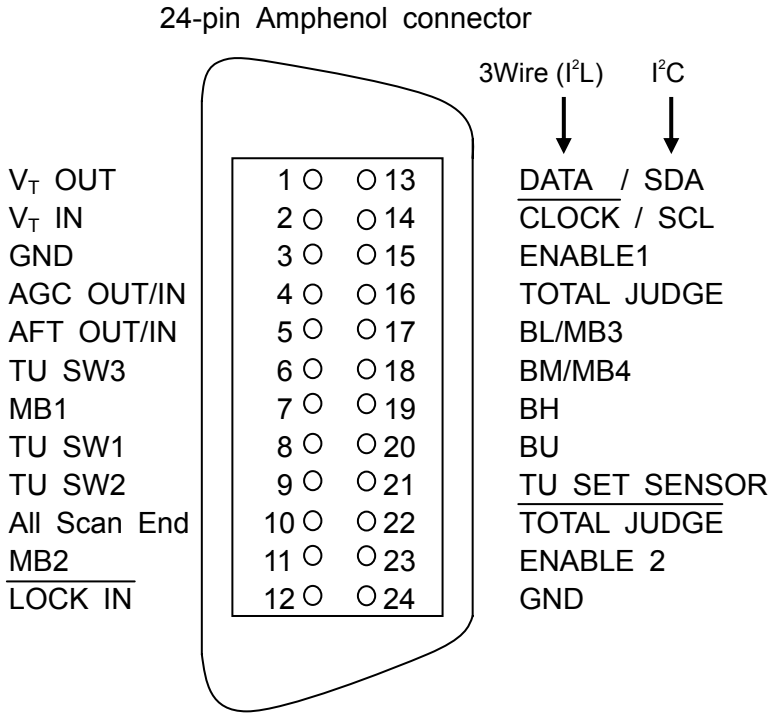
Measure Mode	Setting			Selectable Judge Range Measure Mode Description
	REF.	Target	Line	
ALINDEV	—	○	—	0.0 to 99.9 dB • Measures the linear level deviation at all specified steps and target marker points. • Carry out linear calibration as explained in SLINDEV before making the measurement. • Set the RF ATT values in all specified steps to the same value.
M_PGDEV	—	○	—	-99.9 to 99.9 dB • Measures the power gain deviation of the L and R channels with respect to the level of the M channel when the sweep mode is set to triple. • Measures the deviation at the specified target marker point. • This setting is valid only when the sweep mode is set to triple.
MLINDEV	—	○	—	-99.9 to 99.9 dB • Measures linear level deviation of the L and R channels with respect to the level of the M channel when the sweep mode is set to triple. • Measures the deviation at the specified target marker point. • Perform linear level calibration before making this measurement. • This setting is valid only when the sweep mode is set to triple.

6. REMOTE CONTROL

6.1 Remote Connector

6.1.1 TUNER POWER

(1) TUNER POWER Connector Pin Arrangement



(2) TUNER POWER Connector Specifications

Pin #	Name		Output Voltage	Specifications
1	VT	VT OUT	0 to 30 V	Set using the variable resistor within the limits specified by VT SET. Variable or fixed voltage specified by VT SET.
		VTB OUT	28 to 33 V	VTB output for PLL CH. CONT
2	VT IN		Input	Input for measurement when checking the tuning voltage of a PLL TU, etc. 0 to 30 V Z ≥1 MΩ
3	GND		0V	
4	AGC	OUT	0 to 15 V	Specified voltage output. 0.1 V steps. Voltage output specified by the step when measuring AGC.
		IN	Input	Input for measuring the AGC loop voltage.0 to 15 V. Switch type (setting).
5	AFT	OUT	0 to 15 V	Specified voltage output. 0.1 V steps. Voltage output specified by the step when measuring AFT.
		IN	Input	Input for measuring the AFT loop voltage.0 to 15 V. Switch type (setting).
6	TU SW3		0 to 13.5 V or GND,OPEN	Switch control signal output for tuner jig switcher, etc. Set the voltage output, GND or OPEN (Hi Z) for each step.
7	MB1		0 to 13.5 V	Specified voltage output. 0.1 V steps.
8	TU SW1		0 to 13.5 V or GND,OPEN	Switch control signal output for tuner jig switcher, etc. Set the voltage output, GND or OPEN (Hi Z) for each step.
9	TU SW2			
10	ALL SCAN END		TTL level	High level during All Scan operation.
11	MB2		0 to 10.5 V	Specified voltage output. 50 mV steps.
12	$\overline{\text{LOCK}}$ IN		Input TTL level	$\overline{\text{Lock}}$ signal input of the PLL tuner and voltage measurement input.
13	DATA/SDA		TTL level	Serial data bus for the PLL tuner. Set for each PLL IC. DATA, $\overline{\text{CLOCK}}$, and ENABLE1 are 3Wire system. SDA and SCL are I^2C system.
14	$\overline{\text{CLOCK}}$/SCL			
15	ENABLE 1			
16	TOTAL JUDGE		TTL level	Total judgement output for All Scan. GO: High level NOGO: Low level

Pin #	Name	Output Voltage	Specifications
17	BL	0 to 13.5 V (Same voltage as MB1) or GND,OPEN	BAND VL: Set ON (MB1 voltage output), GND, or OPEN (Hi Z) for each band. Output when PLL output mode is OFF.
	MB3	1 to 6 V	Specified voltage output. 50 mV steps. Amplitude voltage of the serial data for the PLL tuner.
18	BM	0 to 13.5 V (Same voltage as MB1) or GND,OPEN	BAND VM: Set ON (MB1 voltage output), GND, or OPEN (Hi Z) for each band Output when PLL output mode is OFF.
	MB4	1 to 6 V	Specified voltage output. 50 mV steps.
19	BH	0 to 13.5 V (Same voltage as MB1) or GND,OPEN	BAND VH: Set ON (MB1 voltage output), GND, or OPEN (Hi Z) for each band.
20	BU		BAND UHF: Set ON (MB1 voltage output), GND, or OPEN (Hi Z) for each band.
21	TU SET SENSOR	Input TTL level	Signal input used to turn ON/OFF the tuner power supply output. 5V max Low: ON High: OFF
22	$\overline{\text{TOTAL JUDGE}}$	TTL level	Inversion signal of pin 16, TOTAL JUDGE.
23	ENABLE 2	TTL level	Secondary enable signal for a PLL tuner and 3Wire system.
24	GND	0 V	

(3) TUNER POWER Connector Output Power Supply Specifications

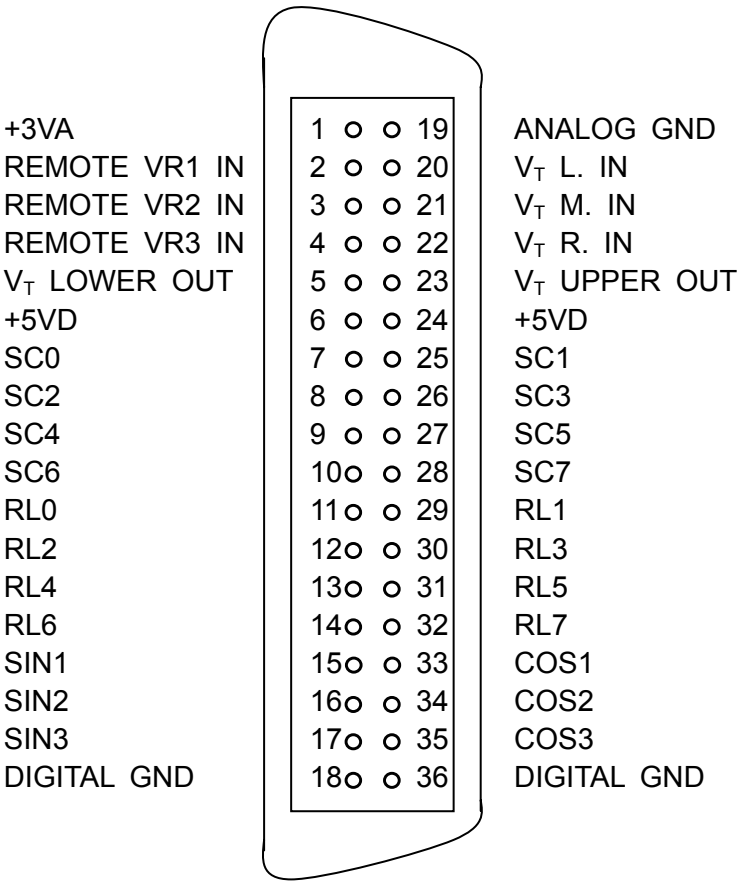
Power Supply	Voltage Range	Current Capacity	Specifications and Notes
MB1	0 to 13.5 V 0.1 V steps.	300 mA Total of BL, BM, BH, and BU outputs	・Voltage error: ±50 mV. ・Current measurement: 1 mA resolution. Error: ±(2 % + 2 mA) ・With a short detection function.
B_L, B_M, B_H, B_U	Select MB1, GND, or OPEN	Depends on MB1 10 mA	・Current measurement: 1 mA resolution. Error: ±(2 % + 2 mA) ・Uses a TR collector. VCES: 0.4 V or less. ・MOS FET and TR collector.
MB2	0 to 10.5 V 50 mV steps	300 mA	・Voltage error: ±50 mV. ・Current measurement: 1 mA resolution. Error: ±(2 % + 2 mA) ・With a short detection function.
MB3 MB4	1 to 6 V 50 mV steps.	400 mA	
TU SW1 TU SW2 TU SW3	0 to 13.5 V 0.1 V steps Select voltage output, GND, or OPEN	300 mA (total) 100 mA	・Total current can be measured. 1 mA resolution. ・Voltage error: ±50 mV. ・With short detection function. Voltage dropping type. (only during voltage output) ・MOS FET ・MOS FET and TR collector.
AGC	0 to 15 V 10 mV steps	10 mA	・Voltage error: ±50 mV. ・With a short detection function. ・Can be switched to input. ・Input impedance: 1 MΩ. ・Voltage measurement error: ±(0.2% + 30 mV).
AFT	0 to 15 V 0.1 V steps	10 mA	・Voltage error: ±50 mV. ・With a short detection function. ・Can be switched to input. ・Input impedance: 1 MΩ. ・Voltage measurement error: ±(0.2% + 30 mV).
V_T	0 to 30 V 10 mV steps	20 mA	・Voltage error: ±20 mV for 0 to 20 V ±0.1 % for 20 to 30 V ・Select variable output using variable resistors for setting the upper and lower limits or fixed output. ・Auto VT function. Accuracy: ±100 kHz. ・With a voltage judgement function. ・With a short detection function.
	VTB output 28 to 33 V 0.1 V steps		・Automatically switches the VT voltage to VTB when the PLL output mode is not OFF and PLL TU mode is CH_Cont.

• A short is detected when a current that exceeds the current capacity of each power supply + 10% flows.

6.1.2 REMOTE

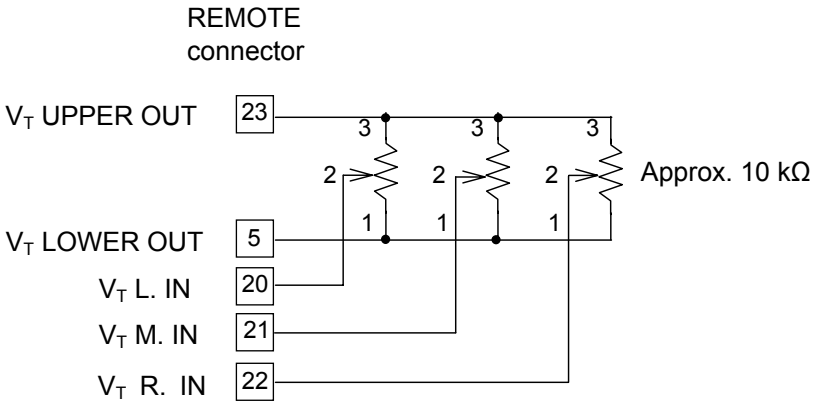
(1) Remote Connector Pin Arrangement

36-pin Amphenol connector



+3VA	20 mA max
+5VD	100 mA max
V_T LOWER OUT	10 mA max
V_T UPPER OUT	10 mA max

(2) Remotely Controlling V_T



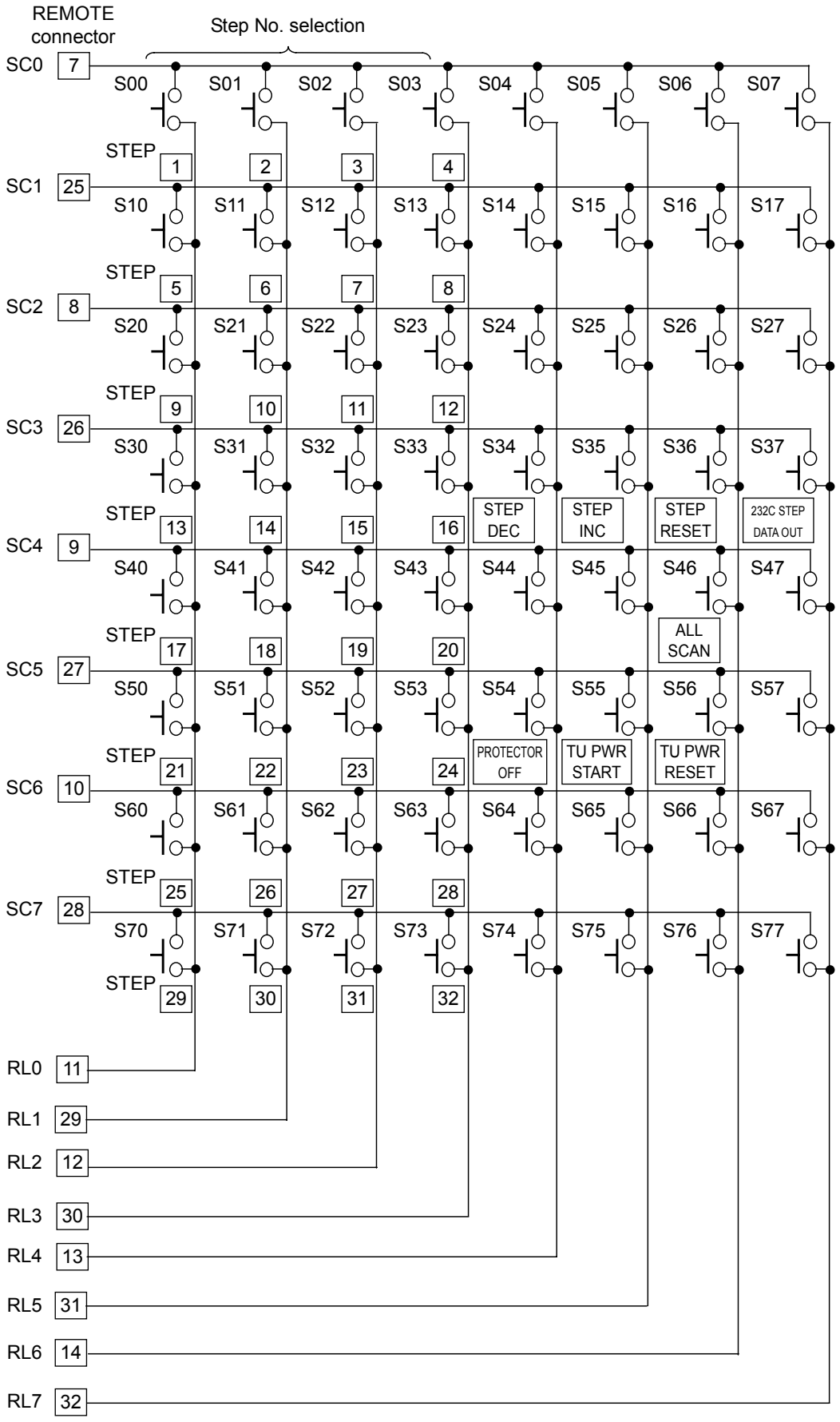
- If the variable resistor is wired as shown in the figure above, the V_T voltage increases as the variable resistor is turned clockwise.
  The assumption here is that the V_T LOWER voltage is less than the V_T UPPER voltage.

- The output voltages of V_T UPPER and V_T LOWER are voltages set by V_T SET (V) in the range of 0 to 30 V.
  The preset output voltage for each channel switches in sync with the switching of the channel.

- If you are using the auto V_T function or PLL CH CONT only, V_T remote is not necessary.

- Because the total output current of V_T LOWER OUT and V_T UPPER OUT is 10 mA maximum, be sure that the combined resistance of the variable resistors do not fall below 3 kΩ (9 kΩ each if the three variable resistors are of the same value).

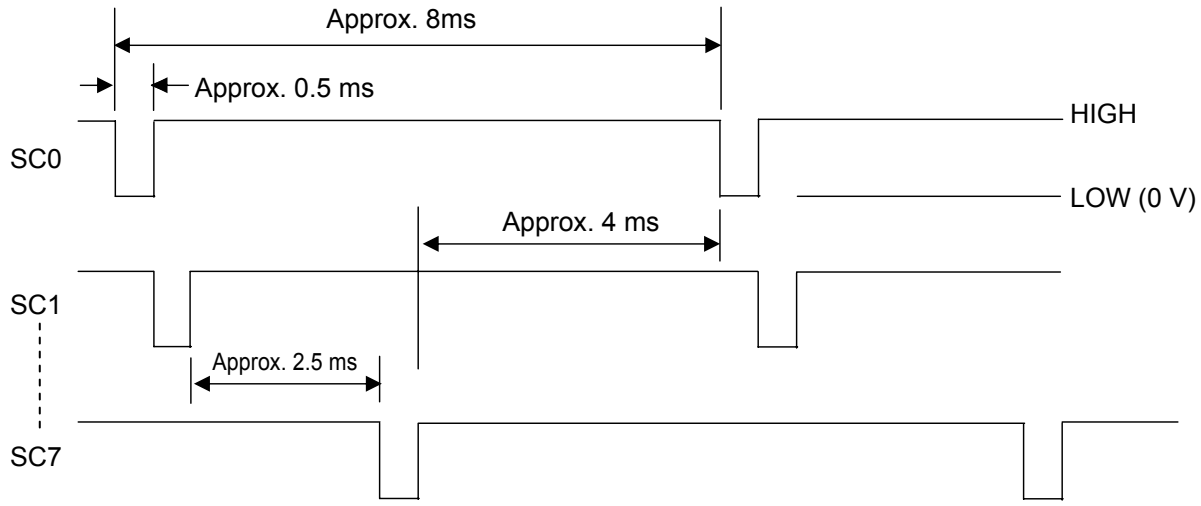
(3) Key Assignments



(4) Key Operation

• The keys are configured in a 8×8 matrix allowing 64 keys to be used.
SC0 to SC7 output timing signals for key control.

• RL0 to RL7 are input pins for the timing signals.
(Input setting of the I/O terminal, pulled up to +5 V through a 4.7-kΩ resistor)

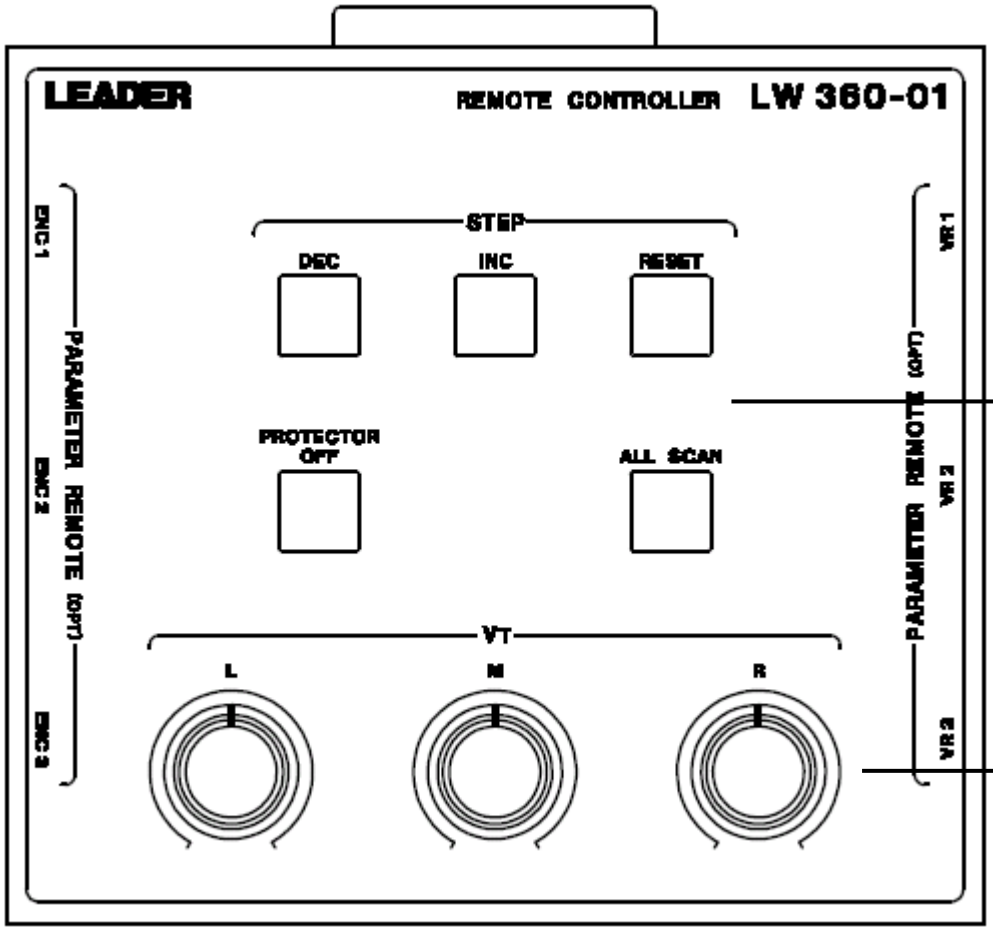


• The key is recognized in LOW level. When the key is pressed continuously, its key is only enabled and other keys are disabled.
Connect only desired keys.

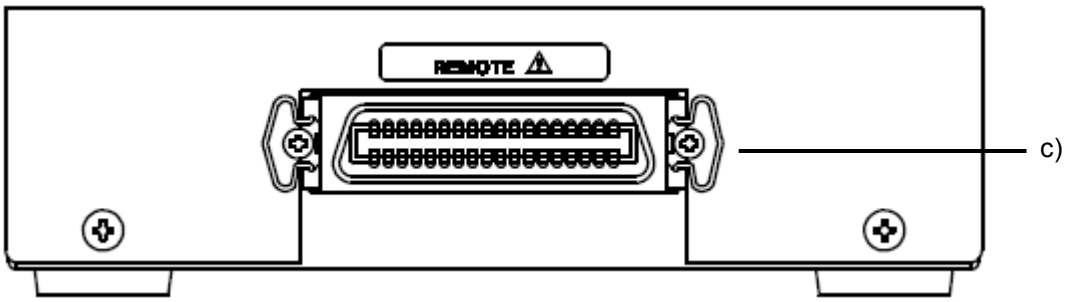
6.2 Remote Controller (LW 360-01)

6.2.1 Panel Diagram

(1) Top View



(2) Rear View



(3) Panel Description

a) Keys

Keys used to select steps, etc.

b) V_T

A knob used to vary the tuning voltage of the electronic tuner.

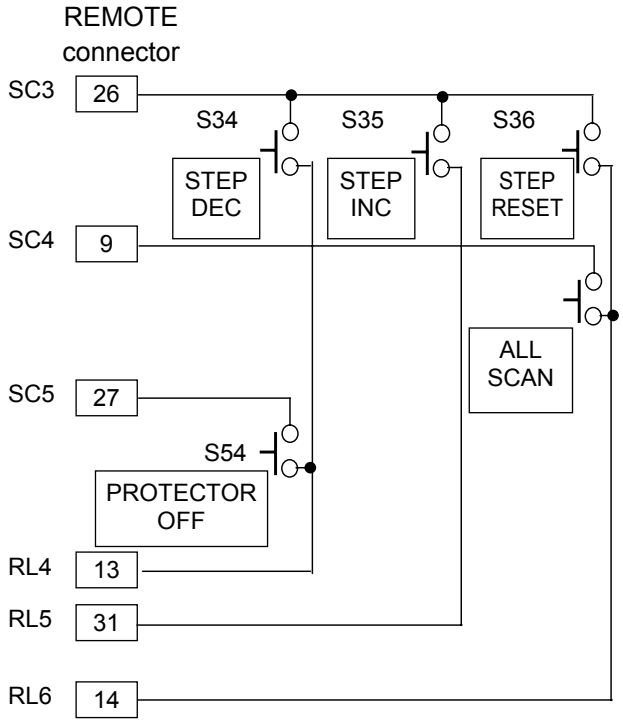
The knob specified by V_T mode is activated.

c) REMOTE

Connect to the REMOTE connector of the LW 360.

6.2.2 Key Operation

(1) Wiring Diagram



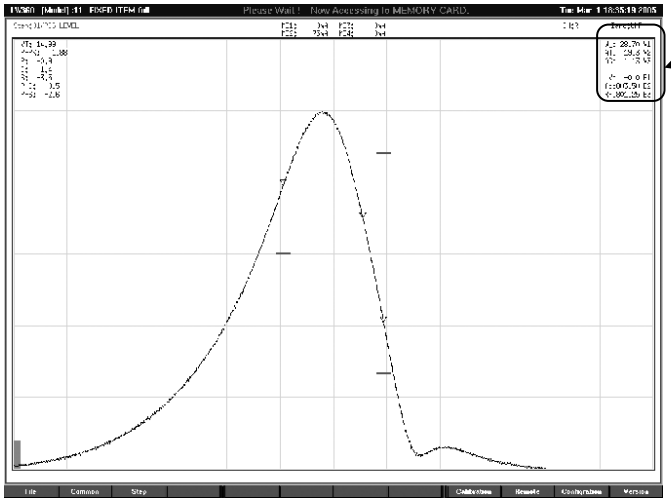
(2) Description of Operation

- STEP DEC····· Uses S34.
  Decrements the step number.
- STEP INC····· Uses S35.
  Increments the step number.
- STEP RESET····· Uses S36.
  Resets the step number.
- ALL SCAN····· Uses S46.
  Measures and judges all steps set to Scan operation.
- PROTECTOR OFF····· Uses S54.
  If the tuner power output is turned OFF due to a short detection, press this key to turn it back ON.

6.3 Parameter Remote (OP. 70)

- This function is used to remotely control twelve parameters (i.e., Center Freq, Sweep Width, RF Ref MARKER, RF ALC, P.ATT, MB1, MB2, AGC_V, CH. No*, Marker2*, Marker3* and Marker4*). You must order the Remote Controller with OPTION 70 or alter the LW 360-01 to use this function.

∗ The items with asterisk sign are added to the Firmware Version 2.1 and Later.



Displays the remote controllable parameters, values, and remote control numbers.

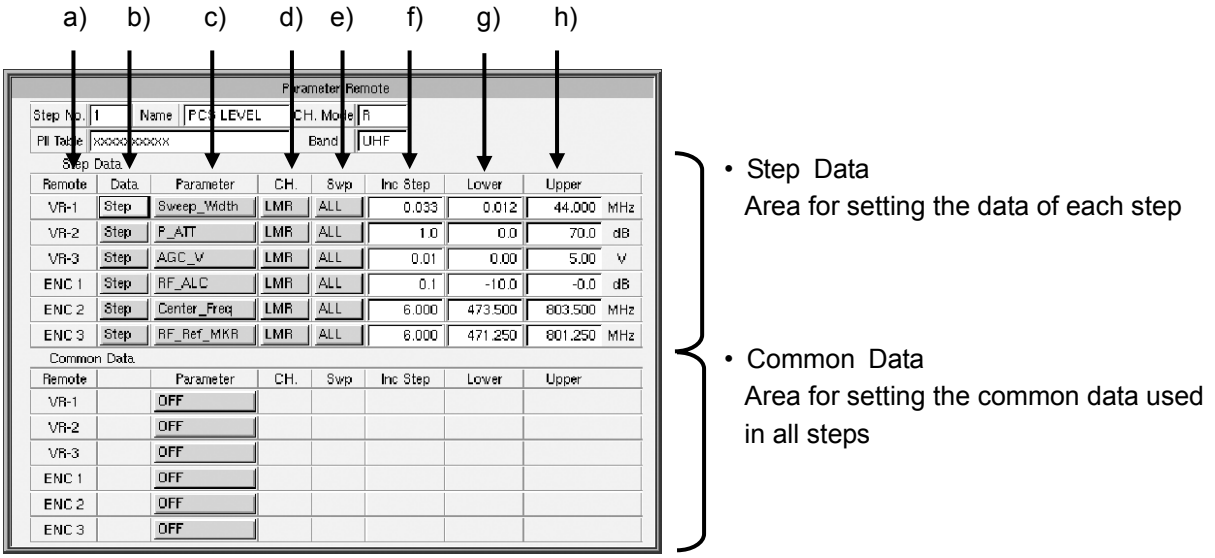
- Up to six parameters of each step can be controlled, three items using the variable resistors and three items using the encoder switches.
  A specific channel (L, M, or R) and a specific sweep (A, B, or C) can also be assigned.

- The parameter remote setting screen is set in the Step All screen or Tuner/Sweep. (only Step Data, and added to Version 2.2 and Later)

6.3.1 Description of the Parameter Remote Screen

To the Parameter Remote screen

Select the Step All screen from the Common screen. Press or click F8 (Param.Remote) to display the Parameter Remote screen.



(1) Remote
- Remote control number (VR-1 to 3, ENC 1 to 3).
- Enter settings for the variable resistor or encoder switch that you want to use.

(2) Data
- Select the data type, Step or Com.
- If set to Step, a dedicated operation is performed for each step number
- If set to Com, operation is performed by using data set in the Common Data area.

(3) Parameter
- Select the parameter to be remotely controlled among the twelve available parameters. (Version 2.0 or before: eight parameters)
- Press the Space key or click the button to display a menu containing the available parameters and select the desired parameter.
  Press the Enter key or click to enter.
- When using Center_Freq, set IF Auto Track to Manual on the Tuner/Sweep screen.

(4) CH.
- Select the channel to be remotely controlled (LMR, L, M, or R).
- The sweep to be remotely controlled can be selected in combination with the Swp selection.

(5) Swp
- Select the sweep to be remotely controlled (ALL, A, B, or C).

(6) Inc Step

• Select the resolution of the parameter to be remotely controlled.

• The resolutions of VR 1 to 3 are automatically set by the formula below.
(Upper value - Lower value)/1300
Fractional values smaller than the minimum resolution of each parameter are discarded and displayed.

• For ENC 1 to 3, each parameter can be set between the minimum resolution and maximum selectable value.

(7) Lower and Upper

• Set the lower and upper limits of the variable range for the parameters to be remotely controlled.

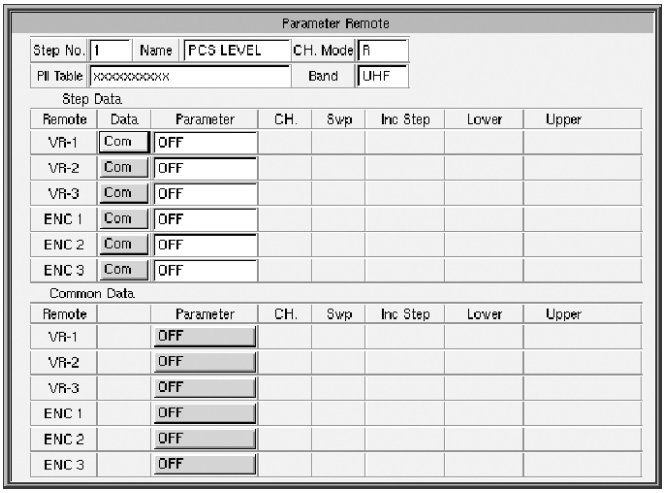
Abbreviation	Parameter	Min. Resolution	Selectable range	Unit
fc	Center_Freq	0.001	0.000 to 999.999	MHz
W_	Sweep_Width	0.001	0.000 to 999.999	MHz
RF	RF_Ref_MKR	0.001	0.000 to 999.999	MHz
LV	RF_ALC	0.1	-10.0 to 0.0	dB
AT	RF_ATT	1	0 to 90	dB
B1	MB1	0.1	0.0 to 13.5	V
B2	MB2	0.05	0.00 to 10.5	V
AG	AGC_V	0.01	0.00 to 15.00	V
＊ch	CH. No.	1	500	Ch
＊M2	Marker2	0.001	0.000 to 999.999	MHz
＊M3	Marker3	0.001	0.000 to 999.999	MHz
＊M4	Marker4	0.001	0.000 to 999.999	MHz

＊Version 2.1 and Later

6.3.2 Settings

(1) The specified parameters are displayed in the Step Data area, and the LW 360 operates using these settings. The settings on this screen takes precedence over the settings on the common and step edit screens.

(2) Initial Settings



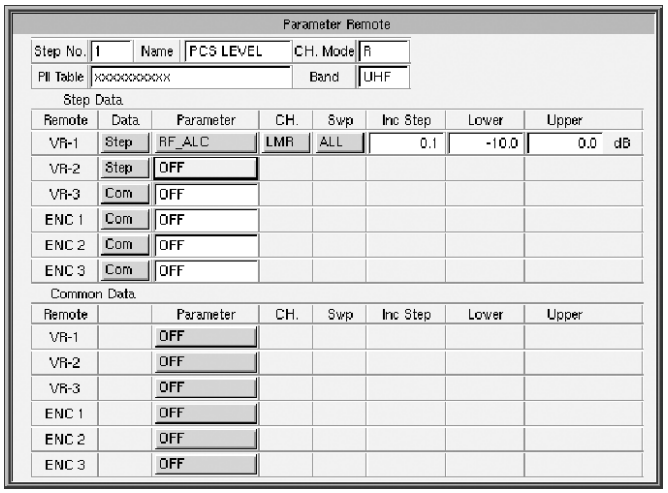
- Step Data area
  Data: Com
  Parameter: OFF

- Common Data area
  Parameter: OFF

- If you set data to the Common Data area in this condition, the common data is set to the Step Data area of all steps.

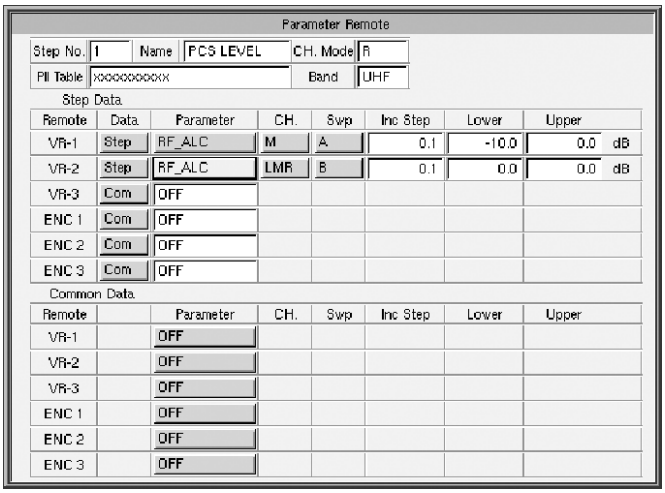
(3) Prohibited Settings

Identical Parameter, CH., and Swp settings cannot be set to two locations within the Step Data area or Common Data area.



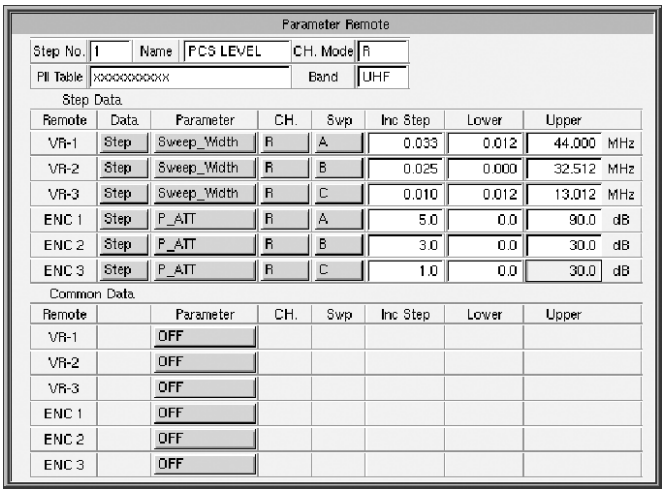
[Example 1]

CH.: LMR and Swp: ALL
If Parameter of VR-1 is set to RF_ALC and you try to set that of VR-2 also to RF_ALC, Parameter is set to OFF.



[Example 2]

• CH.: Other than LMR and Swp: Other than ALL
Parameter is entered, and CH. and Swp are automatically set to values that are not the same.

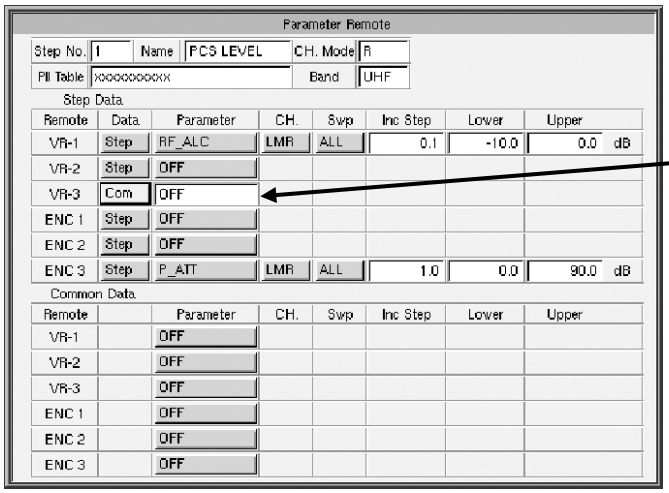


[Example 3]

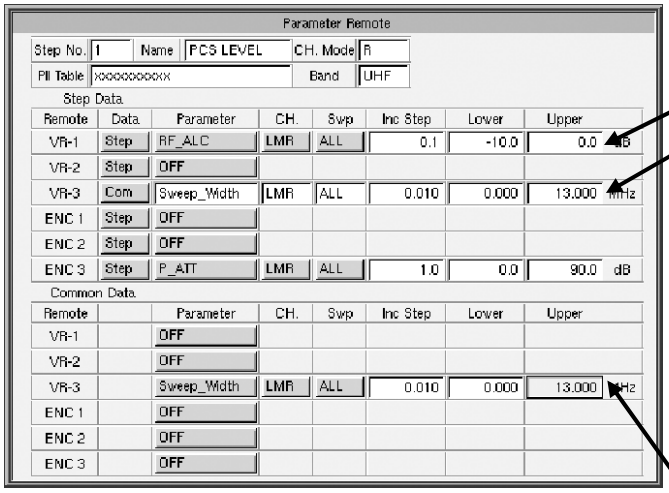
• CH.: R, Swp: A, B, and C
When set to Sweep_Width and P_ATT.

• Varied using VR1 to VR3
Sweep_Width of sweep A: 36 MHz
Sweep_Width of sweep B: 28 MHz
Sweep_Width of sweep C: 10 MHz
• Varied using ENC 1 to 3
P_ATT of sweep A: 40 dB
P_ATT of sweep B: 27 dB
P_ATT of sweep C: 27 dB

(4) Common Data Settings



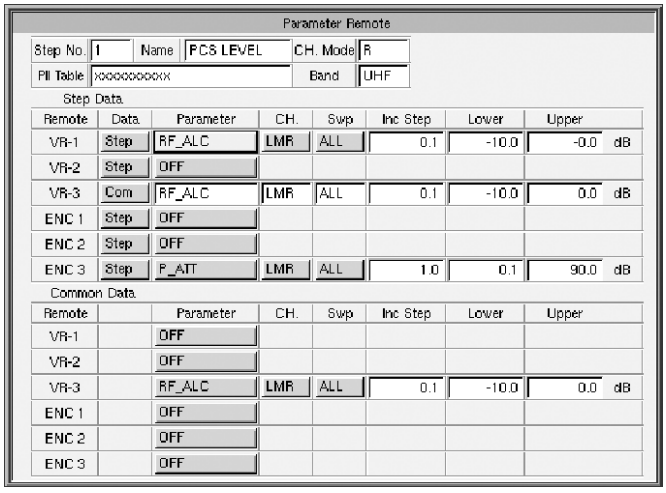
Data of VR-3 is set to Com.



Data set in the Step Data area
Data set in the Common Data area

When you set the VR-3 data, the VR-3 data in the Step Data area including that of other steps whose Data item is set to Com is automatically set using the settings in the Common Data area.

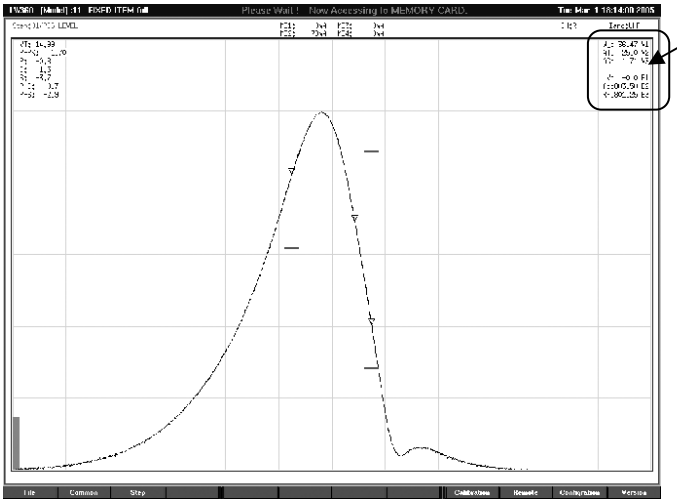
VR3 settings



Though the VR-1 settings set to Step and VR-3 settings set to Com are the same, the settings in the Common Data are set.

Because the priority order is ENC-3 to 1 and VR-3 to 1, the VR-1 settings (with lower priority) are displayed but not used. RF_ALC operates with the VR-3 settings.

6.3.3 Parameter Remote Display ON/OFF

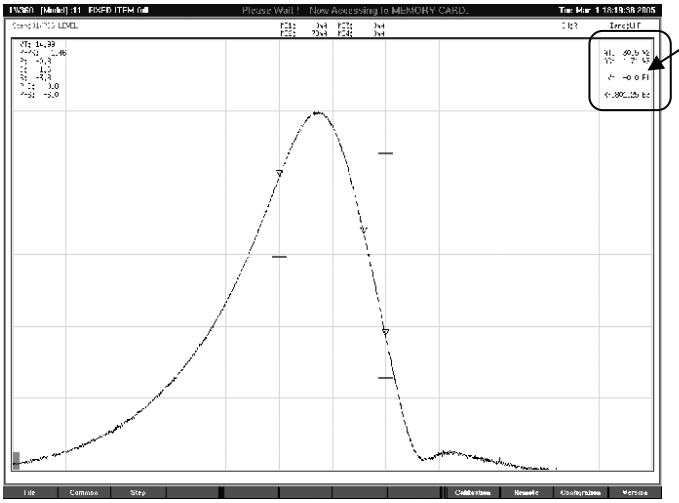


(1) Parameter display
(Example)
W_ : 36.47 V1
a) b) c)

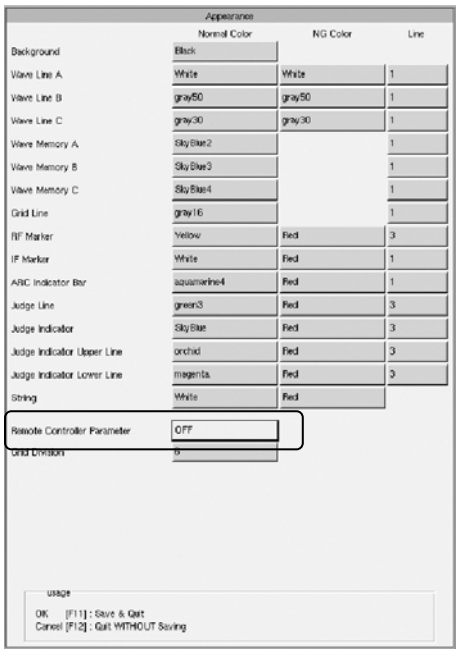
a) Parameter display.
Displayed using abbreviations.
Refer to “(7) Lower and Upper” in section 6.3.1.

b) Setting display

c) Remote number display
Vn···VR-1 to 3
En···ENC1 to 3



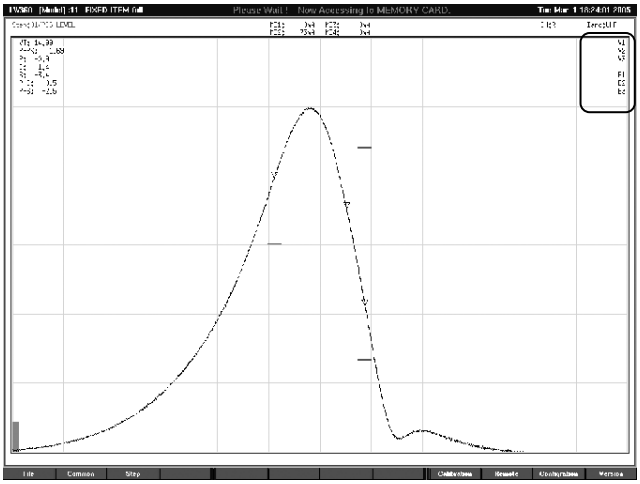
(2) Items whose Parameter is set to OFF are not displayed. In this example, VR-1 and ENC2 are turned OFF.
When all items are set to OFF, nothing is displayed.



(3) Display ON/OFF

On the Wave screen, press or click F11 (Configuration) followed by F9 (Appearance). The Appearance edit screen is displayed. The Remote Controller Parameter on this screen can be used to turn ON/OFF the parameter display.

After selecting ON or OFF, press F11 (OK).

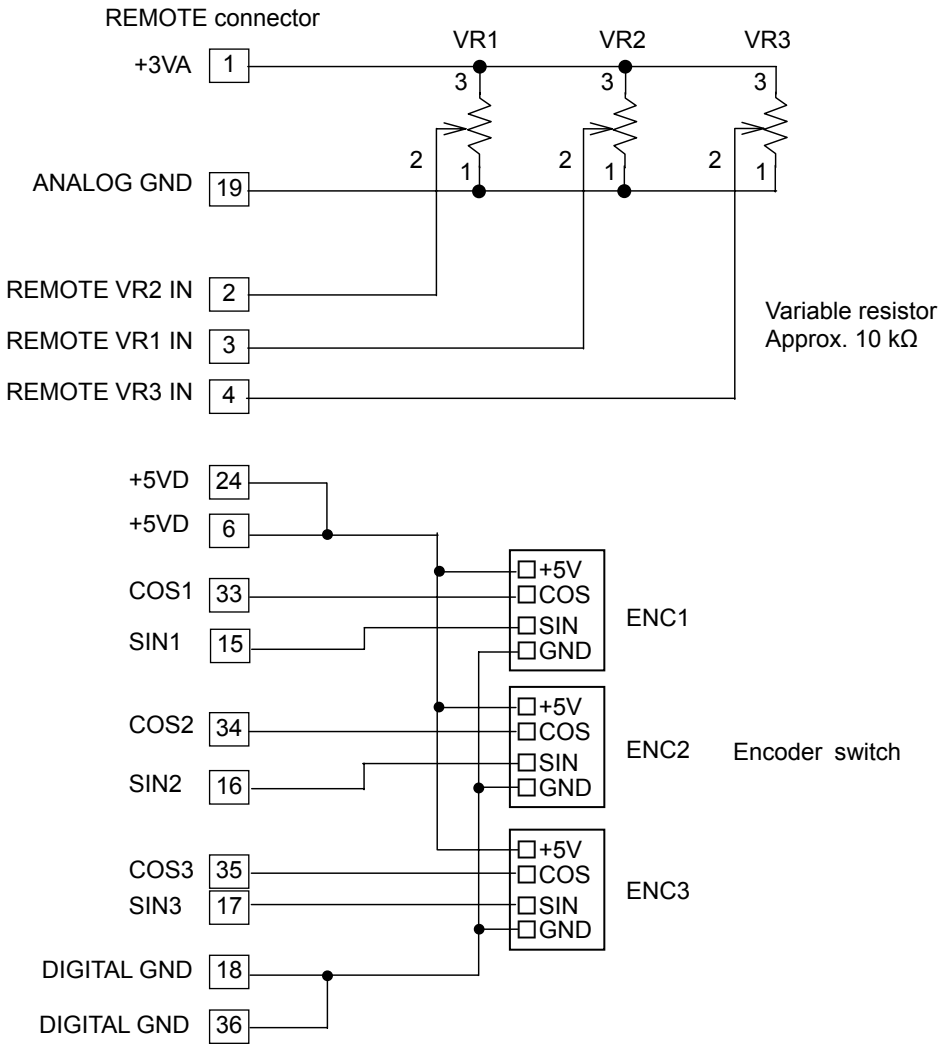


This example shows the screen when the Remote Controller Parameter is set to OFF.

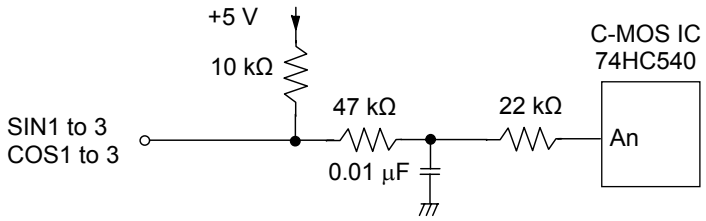
Select OFF when parameter display is not needed.

6.3.4 Remote Control Method

Refer to section 6.1.2, “Remote” and add the following circuits.



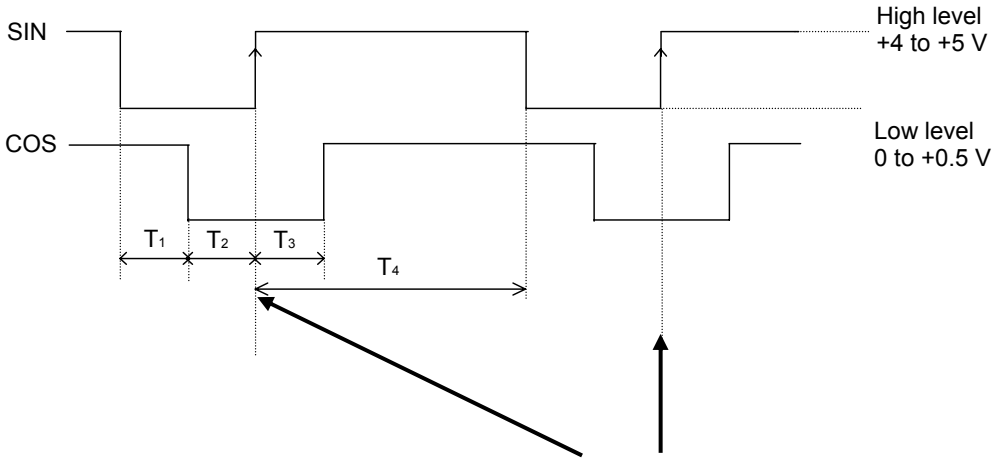
• The input circuit of signal input pins SIN1 to 3 and COS1 to 3 are shown below.



∗ A CR network is inserted to prevent chattering. If the amount of chattering is great, take other measures.

• Signal input to pins SIN1 to 3 and COS 1 to 3
The phase difference between signals input to SIN and COS pins should be as follows:

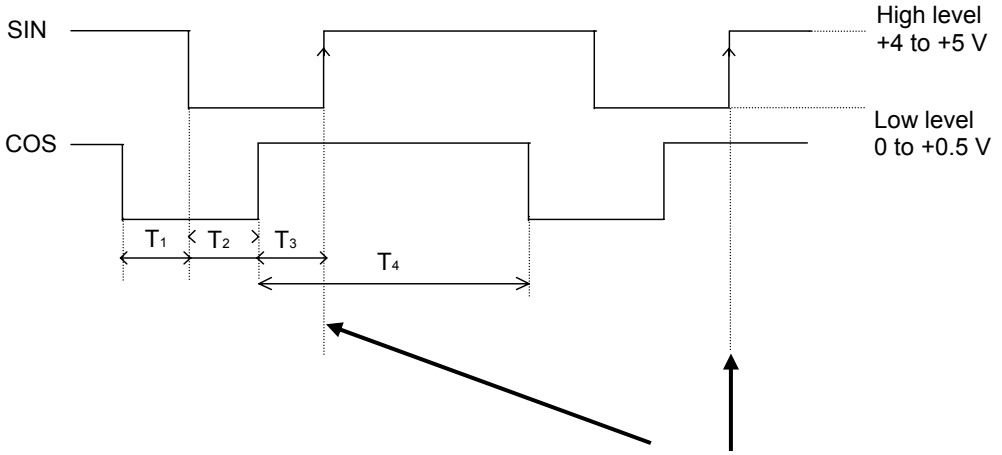
(1) Increasing the Value



$T_1 \geqq 0.5$ ms
$T_1 + T_2 \geqq 2$ ms
$T_2 + T_3 \geqq 2$ ms
$T_4 \geqq 4$ ms

If the COS signal level is low at the rising edge of SIN signal, the value is increased by Inc Step.

(2) Decreasing the Value



$T_1 \geqq 0.5$ ms
$T_1 + T_2 \geqq 2$ ms
$T_2 + T_3 \geqq 2$ ms
$T_4 \geqq 4$ ms

If the COS signal level is high at the rising edge of SIN signal, the value is decreased by Inc Step.

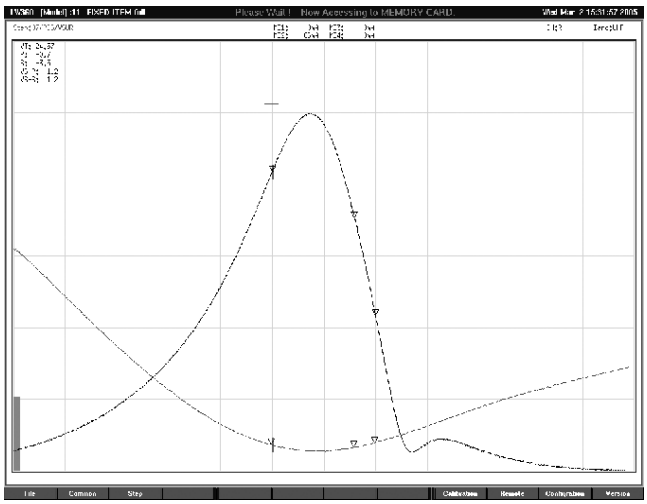
7. CALIBRATION

7.1 VSWR Calibration

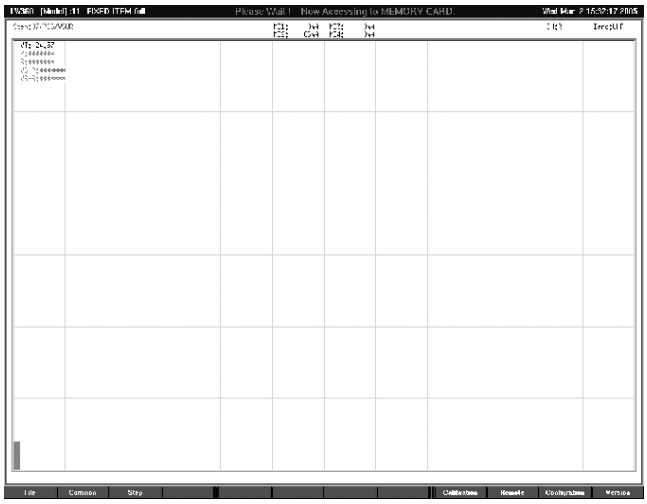
If you change the tuner jig, cable, connector, or the main unit when making VSWR measurements, perform calibration to achieve accurate measurements. Calibrate periodically when the same connection is used over a prolonged period.
The measured values will not be correct if you make measurements without calibration.
One set of calibration data is stored in the backup memory of the LW 360.

(1) Calibration Procedure

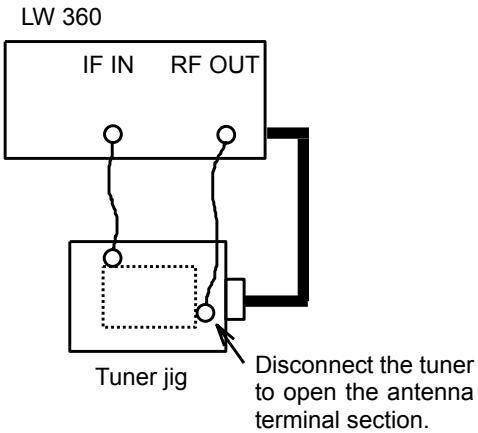
This section describes the procedure using the built-in VSWR bridge. However, the same procedure applies when using an external VSWR bridge. Select the step in which the VSWR measurement is set.

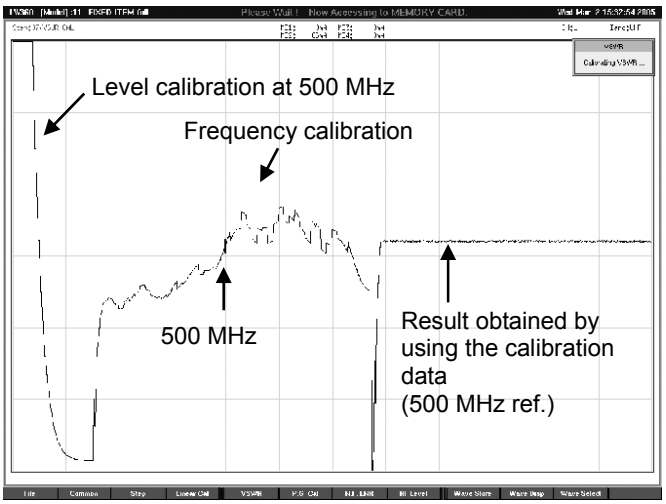


a) Measured using the factory calibration data (calibration with nothing connected to RF OUT)

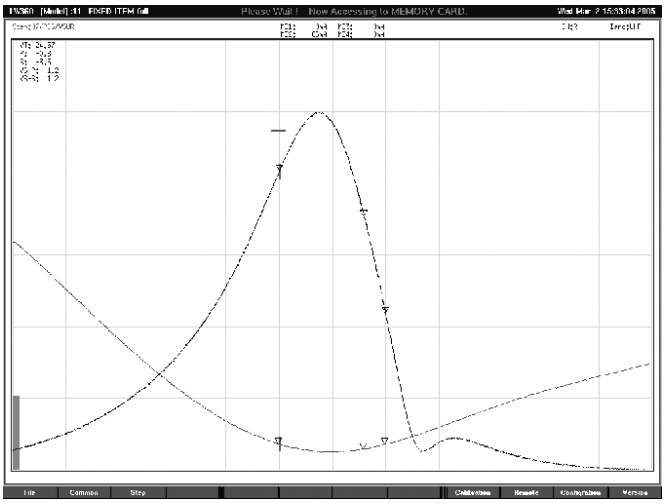


b) Disconnect the tuner from the tuner jig to open the antennal connector.





c) On the Wave screen, press F9 (Calibration) followed by F5 (VSWR) to calibrate the level and frequency characteristics and store the calibration data. The operation takes approximately 20 s.



d) Press Home to return to the Wave screen.

e) Connect the tuner to the tuner jig. The correct VSWR value and judge line are displayed.

(2) Measured Value

The VSWR is determined by measuring the return loss and making a calculation.

$$VSWR = \frac{1+\sqrt{10^{-\frac{xn}{10}}}}{1-\sqrt{10^{-\frac{xn}{10}}}}$$

xn: return loss

Return loss (dB)	20	15	10	8	6	4	3	2	1.5
VSWR	1.2	1.4	1.9	2.3	3.0	4.4	5.9	8.7	11.6

The VSWR increases as the return loss decreases.
When VSWR is large, the measurement error is also large accordingly.

7.2 Power Gain Calibration

The power gain is measured as an absolute value. To make accurate measurements, set the P. G. CAL value.

By default, the P. G. CAL value is set to 10 dB at 500 MHz as a basic setup.

(The P. G. CAL value set to 10 dB for all frequencies).

Accurate measurements can be obtained by correcting the frequency characteristics and loss of the RF output of the LW 360, cable, connector, turner jig, and so on by entering a P. G. CAL value for each measured frequency up to 20 (Version 2.0 or before: 10 points) points.

The P. G. CAL value is stored as data for each TUNER MODEL data.

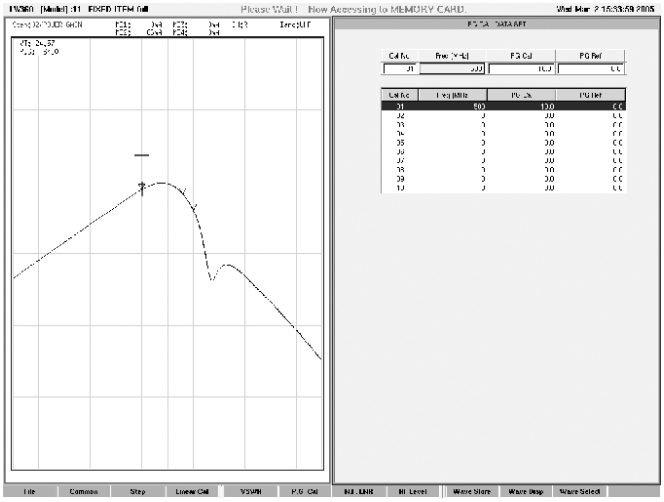
(You must store the data to the tuner model.)

For more accurate measurement, set the P. G. CAL value for each main unit (LW 360).

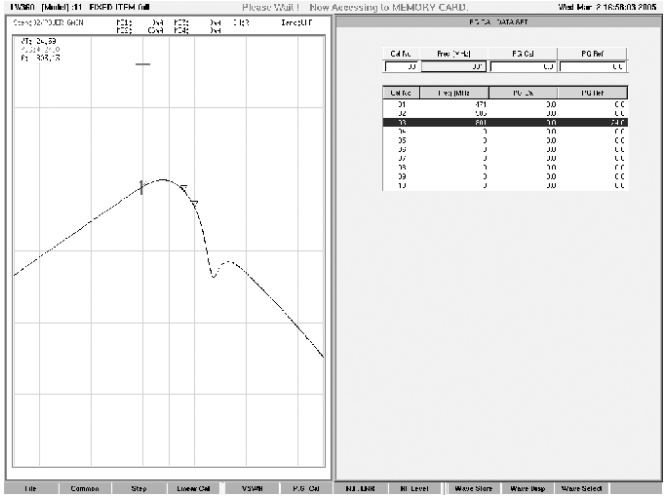
(1) Calibration Procedure

a) Connect the standard tuner (with known POWER GAIN data) to the tuner jig.

b) Select the power gain measurement step containing the frequency for setting the P. G. CAL value. When the tuner band differs, select the appropriate step of band. It is convenient to measure the frequency at the P. G. measurement marker point (set measure mode to MKR.F on the Judge screen).

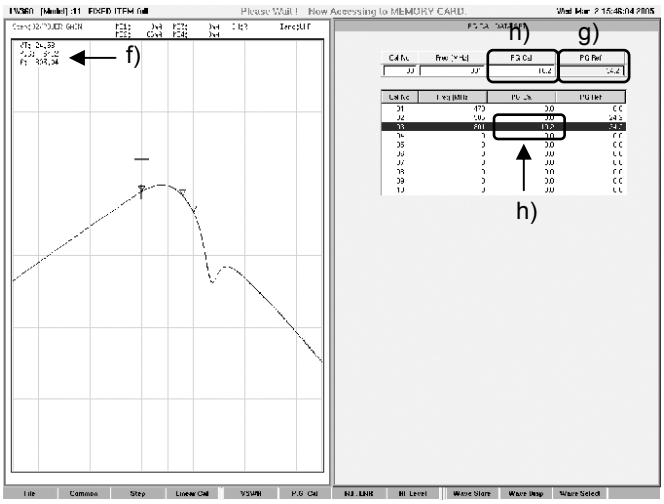


c) On the Wave screen, press F9 (Calibration) followed by F5 (P.G.Cal) to display the P.G.Cal screen.



d) Set the frequency for which to enter the P. G. CAL value. Enter the frequency using an integer in unit of MHz.

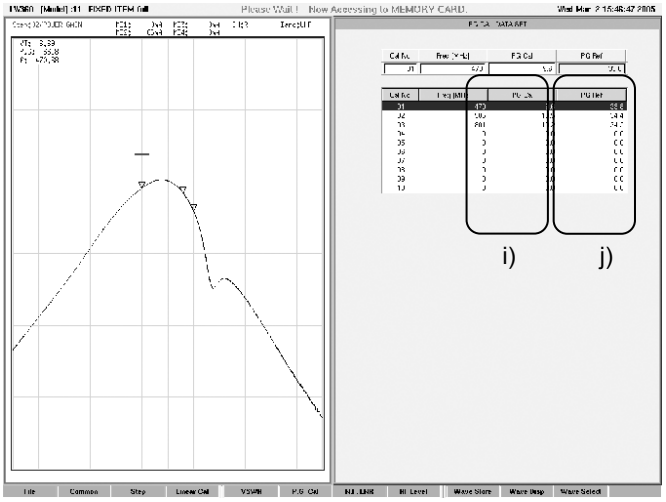
e) The data is displayed in the order of frequency, not in the order of entry.



f) Tune the tuner to the P. G. CAL frequency (within ±5 MHz).

g) Enter the tuner power gain value in PG Ref of the corresponding frequency.

h) The power gain value is set to the value specified in step g). The P. G. CAL value is also set.

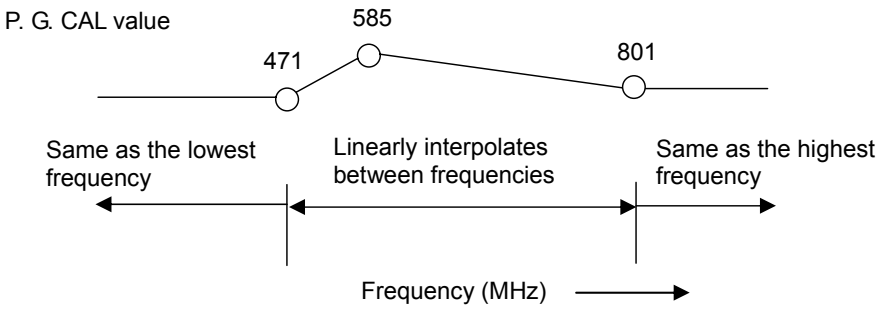


i) Set the P. G. CAL values for all frequencies by tuning the tuner, moving the cursor to the next frequency, and repeating steps g) and h). If the specified P. G. CAL value deviates more than 2 dB, check the measurement system for the cause of the deviation.

j) The P. G. Ref values for the tuned frequencies are retained until you exit the P. G. CAL screen. In addition, the value at the tuned frequencies is updated.

(2) P. G. CAL Values for Frequencies Other Than the Set Frequencies

The LW 360 derives P. G. CAL values between the set frequencies through interpolation at 2-MHz steps.



7.3 NF ENR Calibration

The noise source is not calibrated at the absolute value level. Therefore, NF ENR values including the frequency characteristics of the measurement system must be set for the NF measurement.

By default, the NF ENR value is set to 16 dB at 500 MHz.

Since the measurement level is extremely small, the measured value is easily affected by external conditions. If there are objects nearby that generate interference signals such as noise and pulse, measures must be taken such as shielding the system.

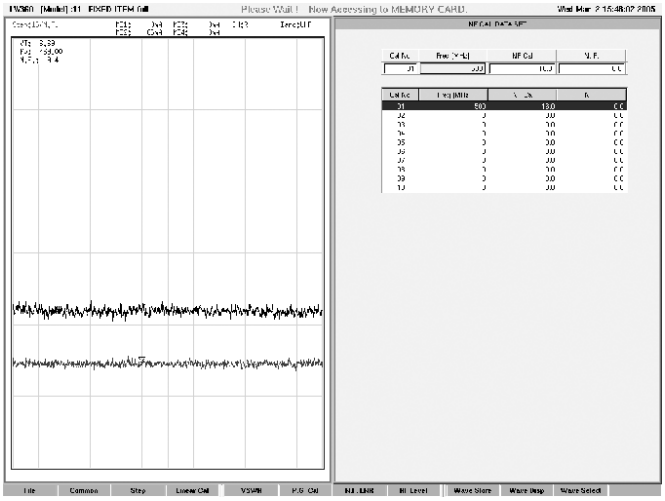
Set the NF ENR value for each LW 360 and store the data for each tuner model.

(1) Calibration Procedure

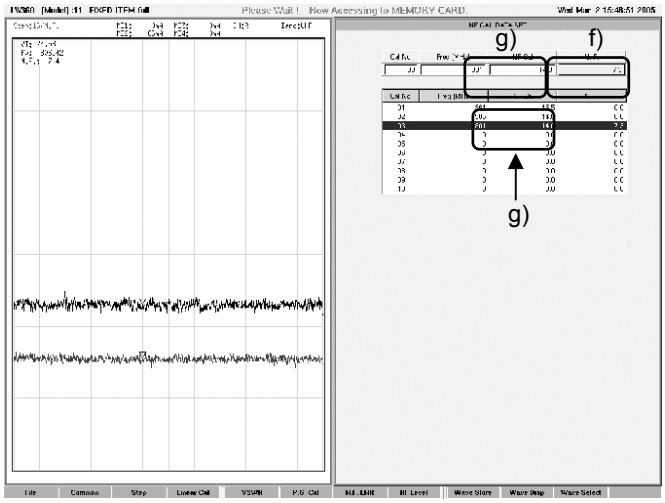
The basic procedure is the same as with the power gain calibration.

a) Connect the standard tuner (with known NF data) to the tuner jig.

b) Select the NF measurement step containing the frequency for setting the NF ENR value.



c) On the Wave screen, press F9 (Calibration) followed by F7 (N.F. ENR) to display the NF ENR screen.

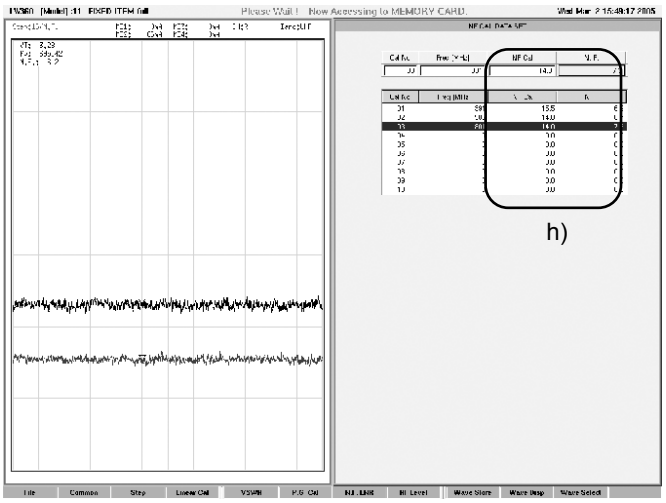


d) Set the frequency for which to enter the NF ENR value.

e) Tune the tuner to the NF ENR frequency (within ±5 MHz).

f) Enter the tuner NF value in N.F. of the corresponding frequency.

g) NF is set to the value specified in step f). The NF ENR value is also set.



h)

h) Set the NF ENR values for all frequencies by tuning the tuner, moving the cursor to the next frequency, and repeating steps f) and g). If the specified NF ENR value deviates more than 5 dB, check the measurement system for the cause of the deviation.

(2) NF ENR Values for Frequencies Other Than the Set Frequencies

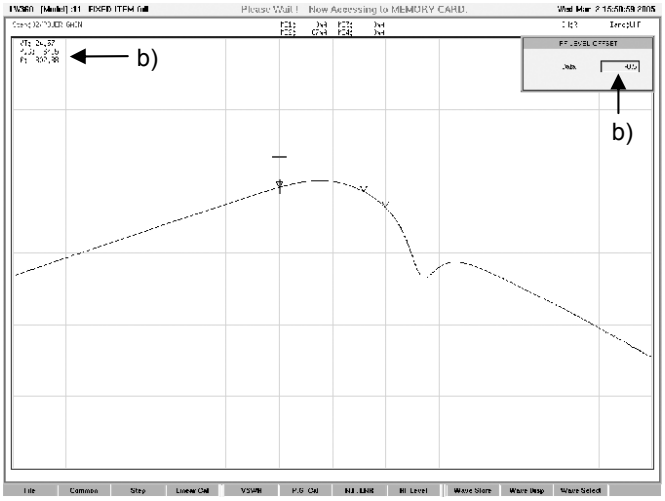
As with the P. G. CAL values, the LW 360 derives the values between the set frequencies through interpolation at 2-MHz steps.

7.4 Setting the RF Level

This function is used to align the differences in the output levels between LW 360s or the output level at a certain frequency. You can set the level in the range of ±3 dB in 0.1 dB steps. A single setting is available, and this setting changes the level at all frequencies. The value is stored in the backup memory of the LW 360.
When the RF level offset value is changed, the measured values of power gain and return loss values of VSWR measurement (the VSWR) change. Therefore, you must check the calibration values again.

• Setup Procedure
(Example) Changing the output level from -0.5 dB to 0 dBm

a) On the Wave screen, press F9 (Calibration) followed by F8 (RF Level) to display the RF LEVEL screen.

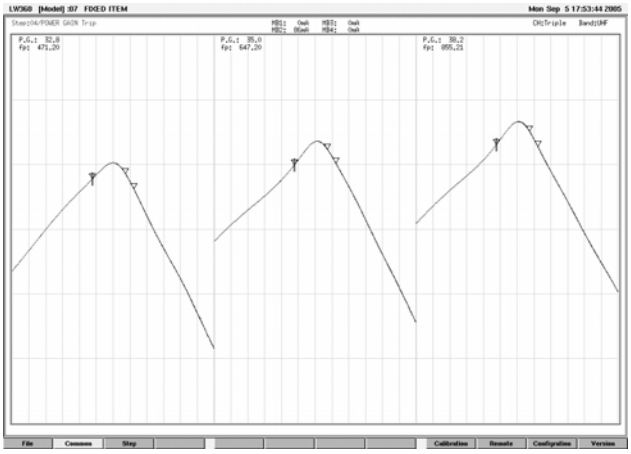


b) Type -0.5, and press the Enter key. The output level increases 0.5 dB. As a result, the measured value of power gain also increases 0.5 dB.

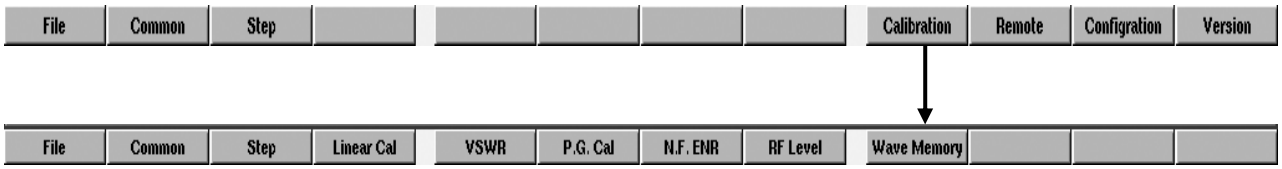
7.5 Wave Memory Settings

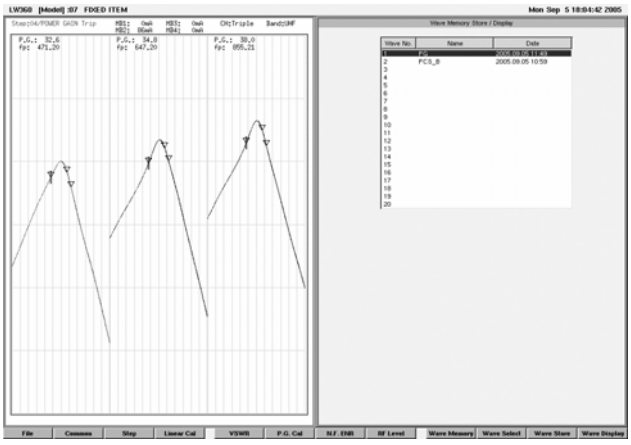
Up to 40 (Version 2.0 or before: 20 sweeps) sweep waveforms can be stored and recalled to the specified step.

(1) Storing Waveforms

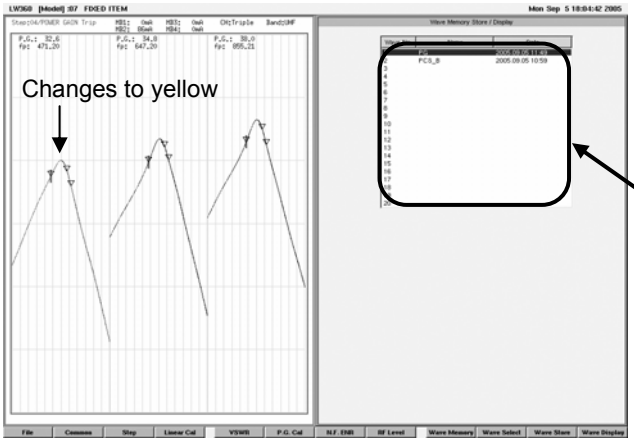


a) Display the waveform to be stored (select the step).

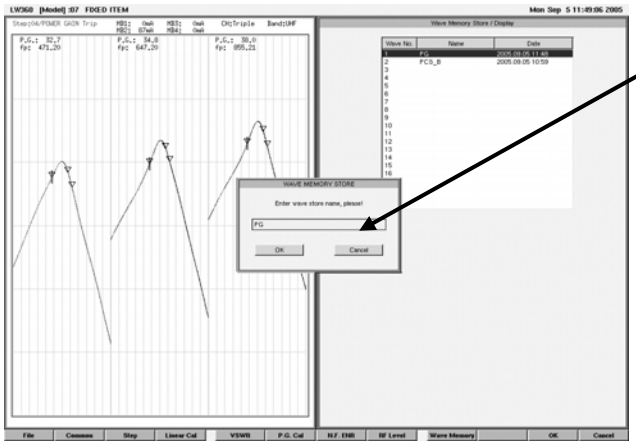




b) Press F9 (Calibration) followed by F9 (Wave Memory) to display the Wave Memory screen.

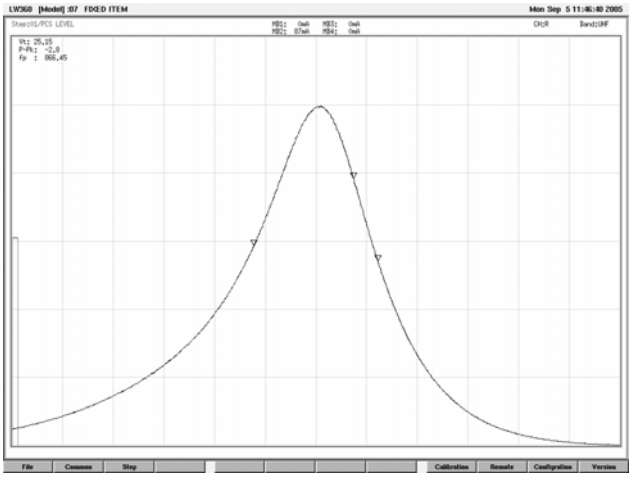


c) Press F9 (Wave Select) (Version 2.1 or before: F10 key) to select the waveform.
Then, the selected waveform turns yellow.
Press the ↑ and ↓ keys to select the memory No. (Wave No.).

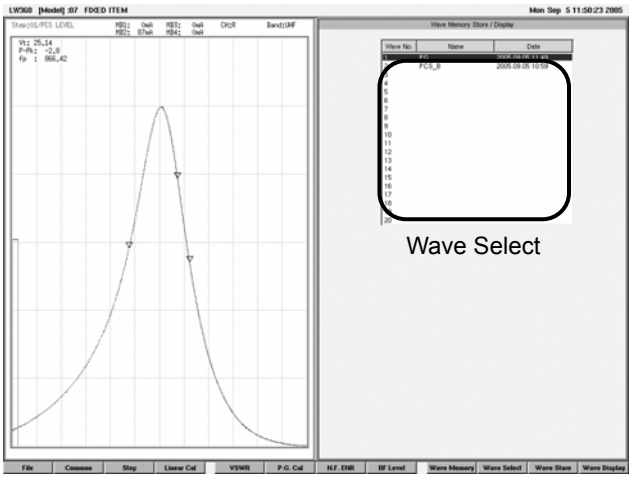


d) Press F10 (Wave Store) (Version 2.1 or before: F11 key). A window for entering the name appears. Press OK to be saved the waveform to the selected Wave No.
The date and time are automatically assigned.

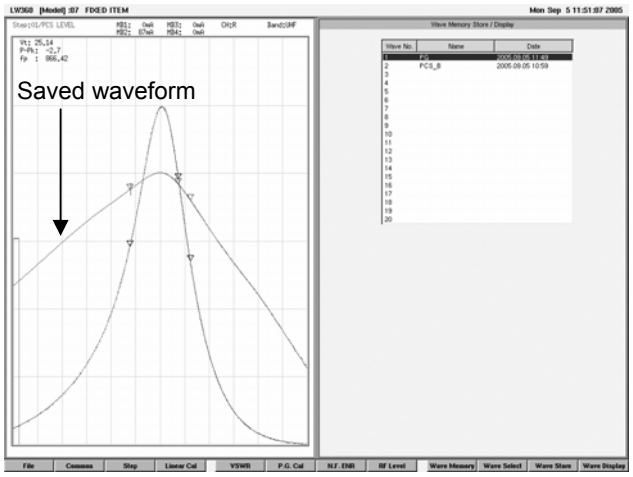
(2) Recalling Waveforms (method 1) (from Calibration)



a) Select the step you want to recall the stored waveform.

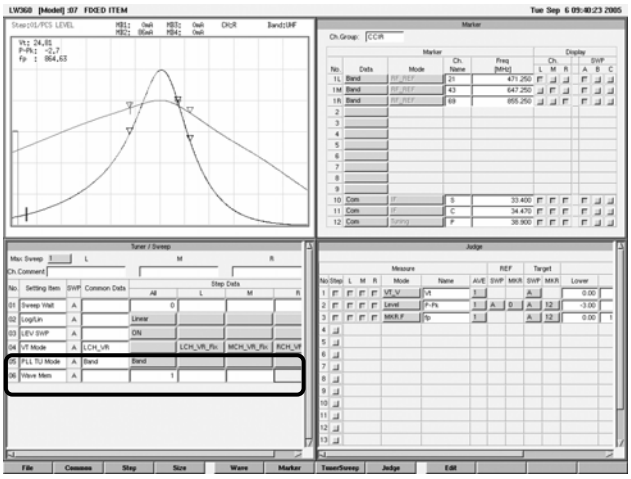


b) Press F9 (Calibration) followed by F9 (Wave Memory) to display the Wave Memory screen.
Press the ↑ and ↓ keys to select the Wave No. corresponding to the waveform you want to display.



c) Press F11 (Wave Display) (Version 2.1 or before: F12 key) to display the stored waveform.

(3) Recalling Waveforms (method 2) (from Tuner/Sweep screen)



a) Add setting item Wave Mem on the Tuner/Sweep screen. Type the Wave No. of the stored waveform in All or a channel (L, M, or R) to display the waveform. When No. 0 is entered, it becomes OFF.

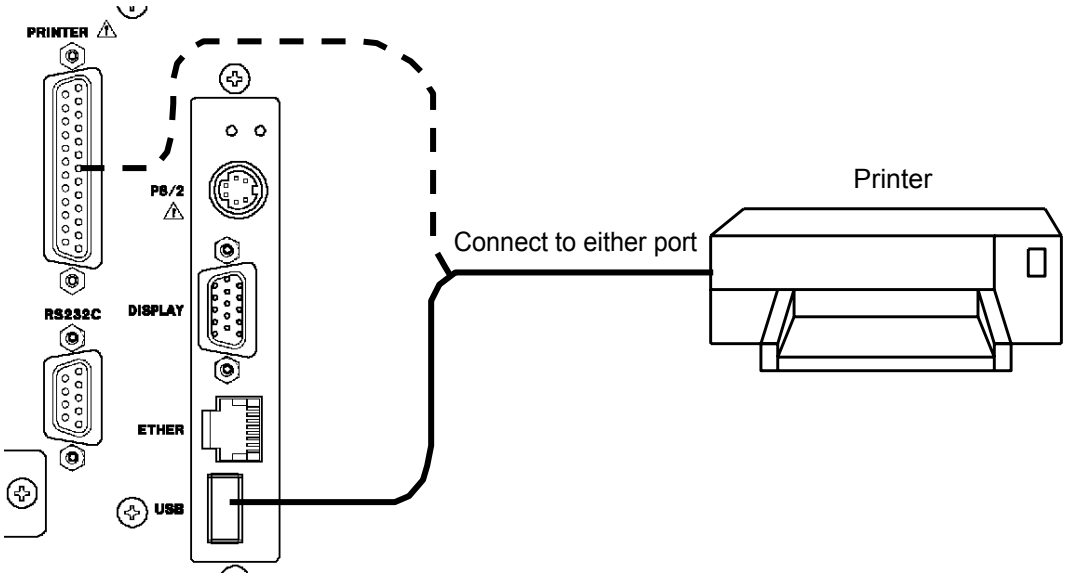
8. SCREEN IMAGE OUTPUT

The screen image on the LW 360 can be captured and output to a printer that connects to PCs, a memory card, etc. This function is useful in creating reports and collecting screen image data.

8.1 Using a Printer

8.1.1 Connecting a Printer

A printer with a parallel (Centronics) or USB interface can be used.
Connect the printer to the parallel port (PRINTER) or USB port on the rear panel.



8.1.2 Examples of Compatible Printers

- Printer drivers indicated below are installed in the LW 360. Printers listed below and their equivalents can be used.

(1) HP
- PSC 1315
- DeskJet Series CUPS V1.1
- New DeskJet Series CUPS V1.1
- PSC 1310 Foomatic/hpijs

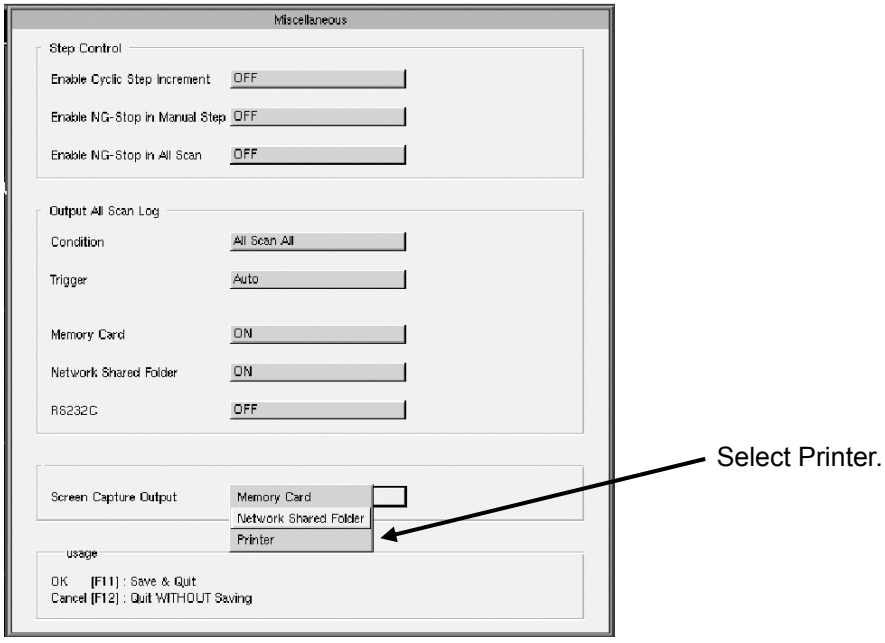
(2) Epson
- PM-A700
- PX-V500

(3) Canon
- PIXUS ip4100
- PIXUS 560i Ver.2.4
- PIXUS 860i Ver.2.4
- PIXUS 990i Ver.2.4

8.1.3 Settings

(1) Setting the Screen Output Port

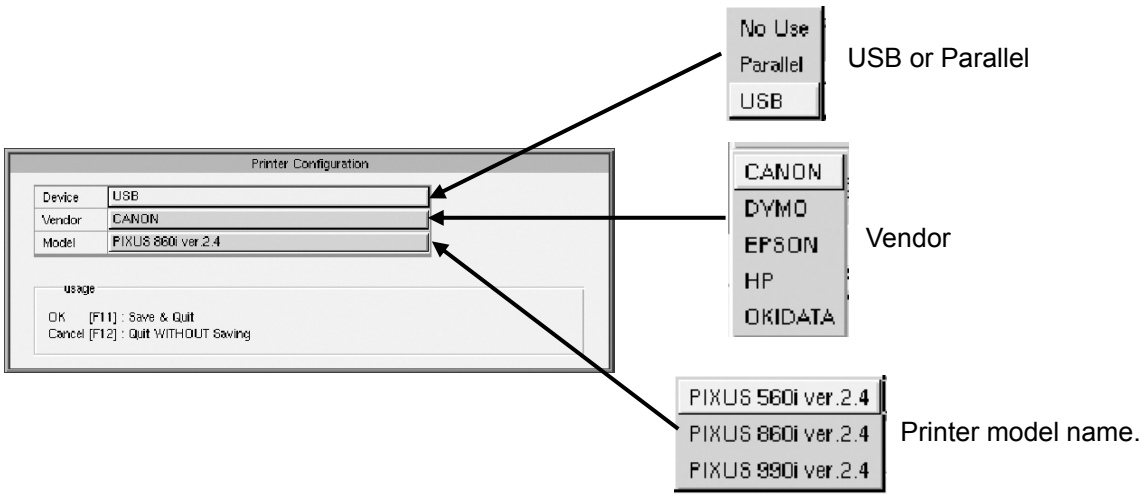
On the Wave screen, press or click F11 (Configuration) followed by F10 (Misc).
The Miscellaneous screen is displayed. Set Screen Capture Output to Printer using the Space key (Enter key to enter) or the mouse.



After selecting Printer, press F11 (OK).

(2) Setting the Printer Driver

In the above condition, press F8 (Printer).
The Printer Configuration screen is displayed. Set the printer interface, vendor, and printer model name using the Space key (Enter key to enter) or the mouse.



When you are done, press F11 (OK).

8.1.4 Printing the Screen Image

• Press Print Screen to send the data to the printer. A  mark (red) is displayed at the upper left of the screen while the data is being sent.

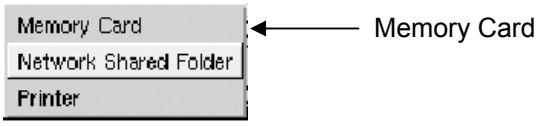
• The printout time varies depending on the printer type.

8.2 Outputting the Screen Image to the Memory Card

8.2.1 Settings

(1) Inserting the Memory Card
Insert the CompactFlash card in the memory card slot on the panel.

(2) Setting the Screen Output Port
On the Wave screen, press or click F11 (Configuration) followed by F10 (Misc).
The Miscellaneous screen is displayed. Set Screen Capture Output to Memory Card using the Space key (Enter key to enter) or the mouse.



8.2.2 Outputting the Screen Image to the Memory Card

• Press Print Screen to send the data to the memory card. A  mark (red) is displayed at the upper left of the screen while the data is being sent.

• It takes approximately 40 s to send one screen. The time varies depending on the screen type.

8.3 Outputting the Screen Image via the LAN Interface

• The screen image data can be output via the Ethernet interface. For details, see chapter 9, “LAN INTERFACE.”

9. LAN INTERFACE

9.1 LAN Interface Function

9.1.1 File Server (Network Shared Folder)

(1) The network shared folder in the LW 360 can be shared with a PC connected through a network.

(2) Windows Explorer can be used to carry out the following operations.
- Load and save data by drag & drop operation and copy and paste.
- Change the file name.

9.1.2 TELNET

The TELNET command “Syncfile” is used to load tuner model data into the LW 360.

9.2 Connection Procedure

Connect a 100BASE-TX STP cable to the Ethernet connector (ETHER).
Connection through a hub: Straight cable
One-to-one connection to a PC: Cross cable

∗ Configure the TCP/IP settings of the LW 360 according to your local network environment.

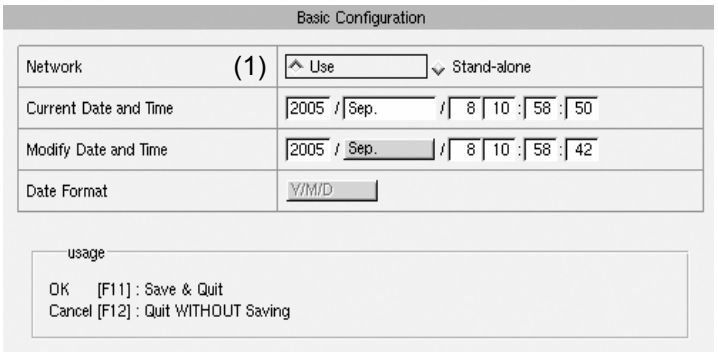
9.3 Settings on the LW 360

Setting items on the LW 360
- Basic Configuration
- Network Configuration
- Miscellaneous

∗ If you change the settings, reboot the LW 360 to activate the settings.

9.3.1 Enabling/Disabling the Network Function

On the Wave screen, press or click F11 (Configuration) followed by F5 (Basic). The Basic Configuration screen is displayed.



(1) To enable the network function, select Use for the Network item.

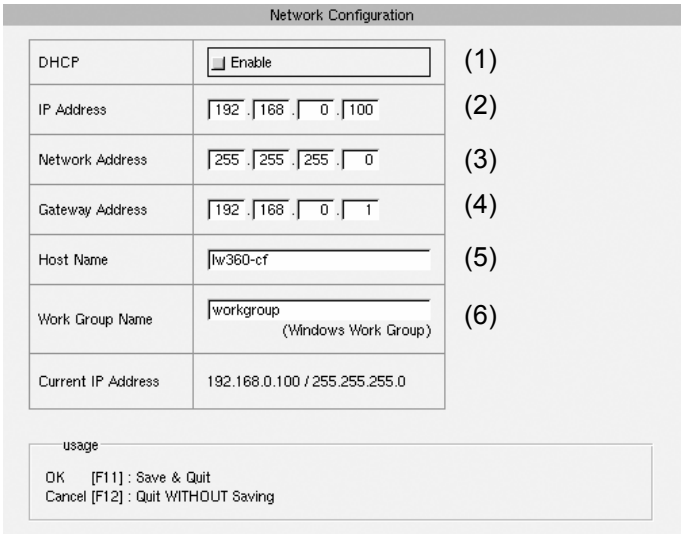
Network:	Use	Enable the network function
	Stand-alone	Disable the network function

(2) After changing the network function, press F11 (OK) to store the new setting in the LW 360.

∗ If you changed the network settings, reboot the LW 360.

9.3.2 Network Settings

On the Wave screen, press or click F11 (Configuration) followed by F6 (Network). The Network Configuration screen is displayed.



(1) DHCP

Select Enable to automatically obtain the IP address from the host.

If you select Enable, the following items are disabled, and you cannot set them.

- [IP Address]
- [Network Address (subnet mask)]
- [Gateway Address]

(2) IP Address

Set the IP address of the LW 360.

(3) Network address (Subnet Mask)

Set the mask used to specify the network address section and the host address section of the IP address.

(4) Gateway Address

Set the address of the router used to access outside the network.

(5) Host Name

The name of the LW 360 on the network. This name is used when opening the shared folder through the network.

(6) Work Group

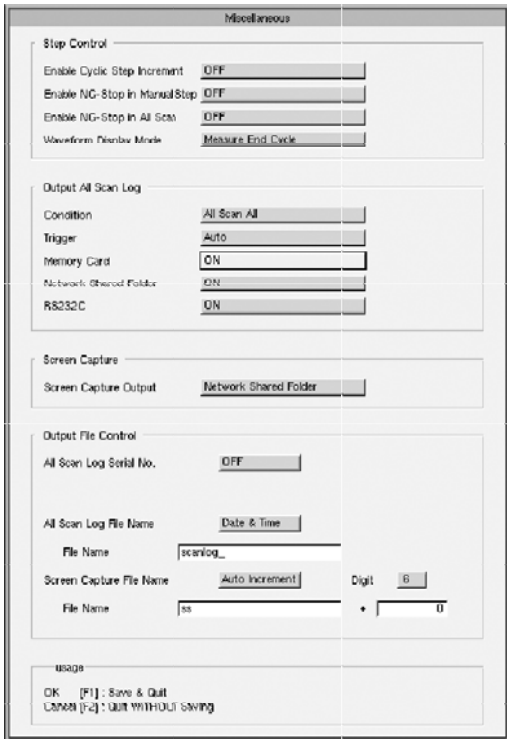
Set the work group name on the Windows network to match the PC to be connected.

(7) After changing the network settings, press or click F11 (OK) to store the new settings in the LW 360

(8) If you change the Use/Stand-alone setting of the network function, reboot the LW 360.

9.3.3 Setting Miscellaneous Items

On the Wave screen, press or click F11 (Configuration) followed by F10 (Misc). The Miscellaneous screen is displayed.



(1) Output All Scan Log / Network Shared Folder

Set the output to the network shared folder.

- When All Scan is complete
- Measured data output using F10 (Remote) / F10 (OutputLog)

Network Shared Folder: ON	Outputs the measured data above to the network shared folder.
Network Shared Folder: OFF	Does not output the measured data above to the network shared folder.

(2) Screen Capture Output

When Screen Capture Output is set to Network Shared Folder
Press PrintScreen to output the screen image to the network shared folder.

(3) After changing the Miscellaneous settings, press F1 (OK) (Version 2.1 or before: F11 key) to activate the settings.

9.4 Directory Structure of the Network Shared Folder

The directory structure of the network shared folder is as follows:

(1) public
- (2) config_current
- (3) config_update

(1) When the output is set to Network Shared Folder, the data is output in this directory.

(2) The image of the file saved in the flash ROM of the LW 360 output on the File edit screen.

(3) Write the setting file in this folder when sending the file to the Flash ROM of the LW 360. The TELNET command “syncfile” is used to load the data into the Flash ROM of the LW 360.

9.5 TELNET

(1) Login name: “lw360”

(2) Password: “lw360”

(3) Command

syncfile: Sends the tuner model file stored in config_update to the LW 360.

9.6 Output File

(1) Screen Capture Output

ss000000.bmp: The output file name is "ss" + "number"
The file name can change in the Misc screen. (Version 2.2 and later)

(2) Output All Scan Log

scanlog_20050310_180841.txt: The output file name is "scanlog_" + "date"
The file name can change in the Misc screen. (Version 2.2 and later)

9.7 Operation Example on Windows 2000

Windows Explorer is used to capture the LW 360 screen.

9.7.1 Capturing the Screen to the Network Shared Folder

The All Scan log output information can also be captured in a similar manner.

(1) Set the TCP/IP parameters of the LW 360 to match the network to which it is to be connected.

Network settings (TCP/IP, server name, work group, etc.)

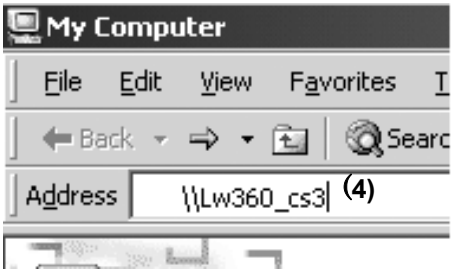
DHCP:	Disable
IP Address:	192.168.0.100
NetworkAddress:	255,255,255,0
GateWay Address:	192.168.0.1
HostName:	LW360_cs3
WorkGroup:	WORKGROUP

(2) If you changed the LW 360 settings, reboot the LW 360.

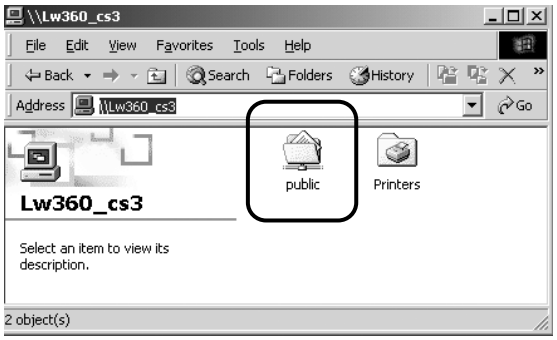
(3) Connect the LW 360 to a PC.

Connect a 100BASE-TX STP cable to the Ethernet connector. (Refer to section 9.2 for the cable types.)

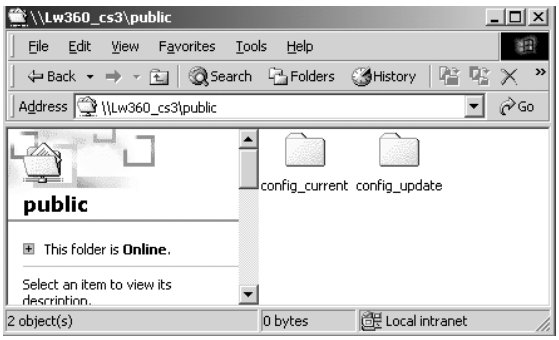
(4) Start Windows Explorer and enter the host name of the LW 360 in the Address bar.



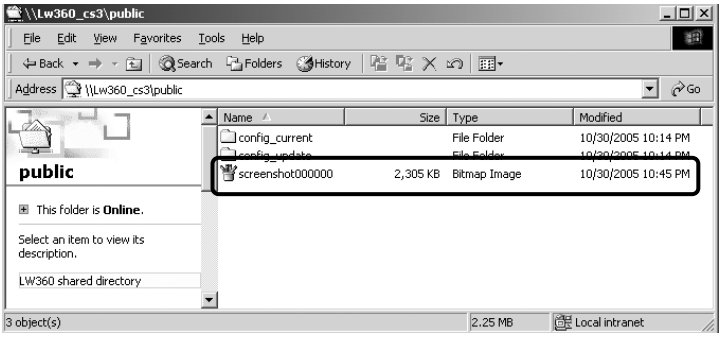
If the LW 360 cannot be found, use the search feature on the PC and directly search the IP address.
When the LW 360 is found, the following icon appears.



(5) Move to the public folder.
Double-click the public icon.



(6) Press PrintScreen. The captured screen is output to a file in the public folder.
If the output file does not appear, choose Refresh from the View menu.

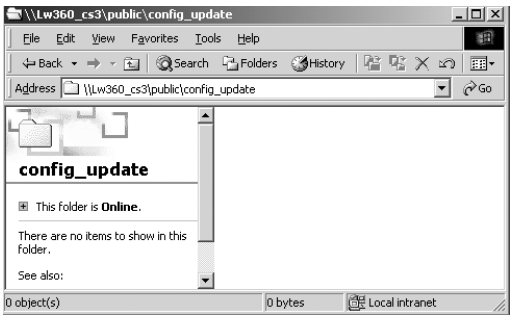


(7) To copy the file to the PC, drag the file.

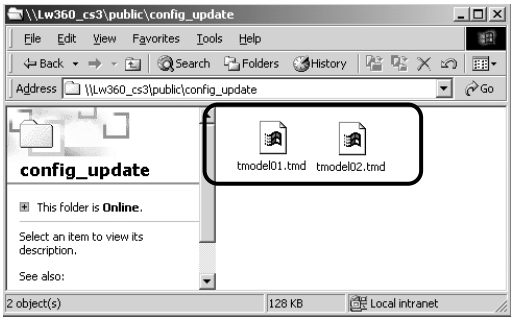
9.7.2 Sending the Tuner Model Data to the LW 360 Using the Network Shared Folder

(1) Carry out steps 1 to 6 in section 9.7.1 to open the public folder of the LW 360.

(2) Open the config_update folder, a dedicated folder for updating the tuner model data.



(3) Copy the tuner model data to be sent in the folder.
(Example: Update tuner model numbers 4 and 5.)



(4) Send a command to load the file using TELNET.
Start TELNET from the Start button on the task bar on Windows 2000.

① Click the Start button and select Run.
② When the IP address assigned to the LW 360 is 192.168.0.100
Type "TELNET 192.168.0.100" and click OK.
③ The PC is connected to the LW 360 via TELNET.

When the TELNET connection is established, "login:" appears on the screen. Type "lw360".
"Password:" appears. Enter "lw360".

＊The login name and password cannot be changed on the LW 360.

(5) When the password is accepted, "lw360$" appears.
Type in the command "syncfile."

(6) The LW 360 switches to the Wave screen.
The tuner model file displayed in step 3 is loaded into the LW 360 and deleted.

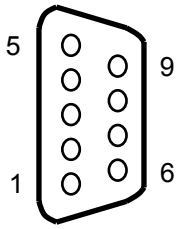
＊Windows is a registered trademark of Microsoft Corporation.
The operation of the LW 360 has been checked on Windows 2000 (SP2), but it may not operate depending on the PC environment.

10. RS-232C INTERFACE

The LW 360 is equipped with a RS-232C interface. The interface can be used to acquire All Scan data or tuner model data in the production line.

10.1 Pin Arrangement of the RS-232C Connector

D-sub 9 pin (male)



Pin #	Function	Signal Name	Direction
1 *			
2	Receive data	RXD	Input
3	Transmit data	TXD	Output
4 *			
5	Signal Ground	GND	— —
6 *			
7	Request to send	RTS	Output
8	Clear to send	CTS	Input
9 *			

* Not used

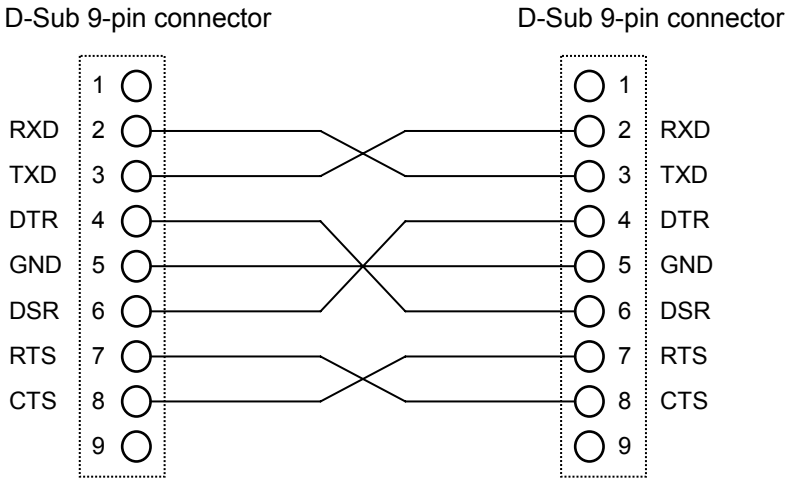
10.2 Communication Parameters and Communication Cable

10.2.1 Communication Specifications

- Baud rate: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200
- Stop bit: 1 or 2 bits
- Parity: None, odd, or even
- Data length: 7 or 8 bits
- CTS/RTS hardware flow control

10.2.2 Communication Cable

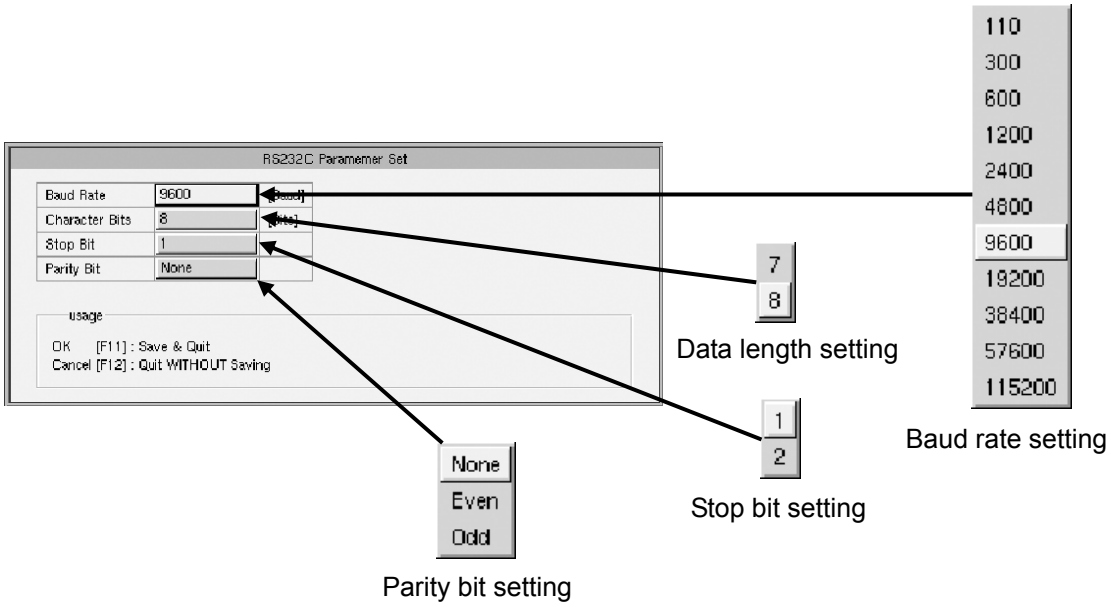
Use a cross cable with a D-Sub 9-pin connector.



10.2.3 Setting the Communication Parameters

(1) RS232C Parameter Set

On the Wave screen, press or click F11 (Configuration) followed by F7 (RS232C). The RS232C Parameter Set screen is displayed.



(2) Selecting Parameters

Use the up and down keys or the mouse to move the cursor to the parameter you want to change. Select with the Space key and enter with the Enter key. You can also left-click on the mouse to select and enter.

(3) When you are done setting the parameters, press F1 (OK) (Version 2.1 or before: F11 key) to confirm.

10.3 Data Output

10.3.1 Output Data Type

(1) All Scan & Step All
Outputs all the data measured using step and scan operation when All Scan is performed after measuring steps.

(2) All Scan & Step NG
Outputs only the steps whose judgement is NOGO in the measurement of (1).

(3) Step All
Outputs all the data measured using step operation.

(4) Step NG
Outputs only the steps whose judgement is NOGO in the measurement of (3).

(5) All Scan All
Outputs all the data measured using All Scan operation.

(6) All Scan NG
Outputs only the steps whose judgement is NOGO in the measurement of (5).

(7) All Scan Short Form
Outputs the All Scan All data with the sections without data (output as spaces) and the spaces between steps removed.

(8) All Scan Short Form & Title Cut
Outputs in the format of (7) with the title section (tuner model name, measured current of MB, etc.) removed.

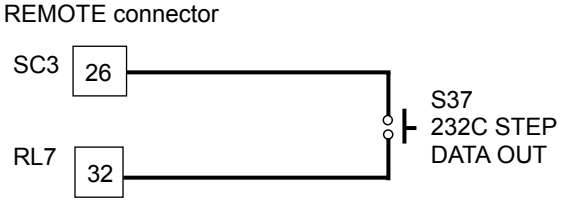
(9) Single Step (Version 2.2 and later)
The measurement data of Step being displayed presently is output.
When Quad is displayed, the measurement data of four Step is output.

10.3.2 Output Mode Type

(1) Manual

a) When the output data type is set to the formats below, the data can be output manually.
On the Wave screen, press or click F10 (Remote) and then F10 (Output Log) to output the data.
- All Scan & Step All
- All Scan & Step NG
- Step All
- Step NG
- Single Step (Version 2.2 and later)

b) The 232C STEP DATA OUT key is assigned to the matrix key of the REMOTE connector on the rear panel.
It can be used in the same manner as the key operation above.

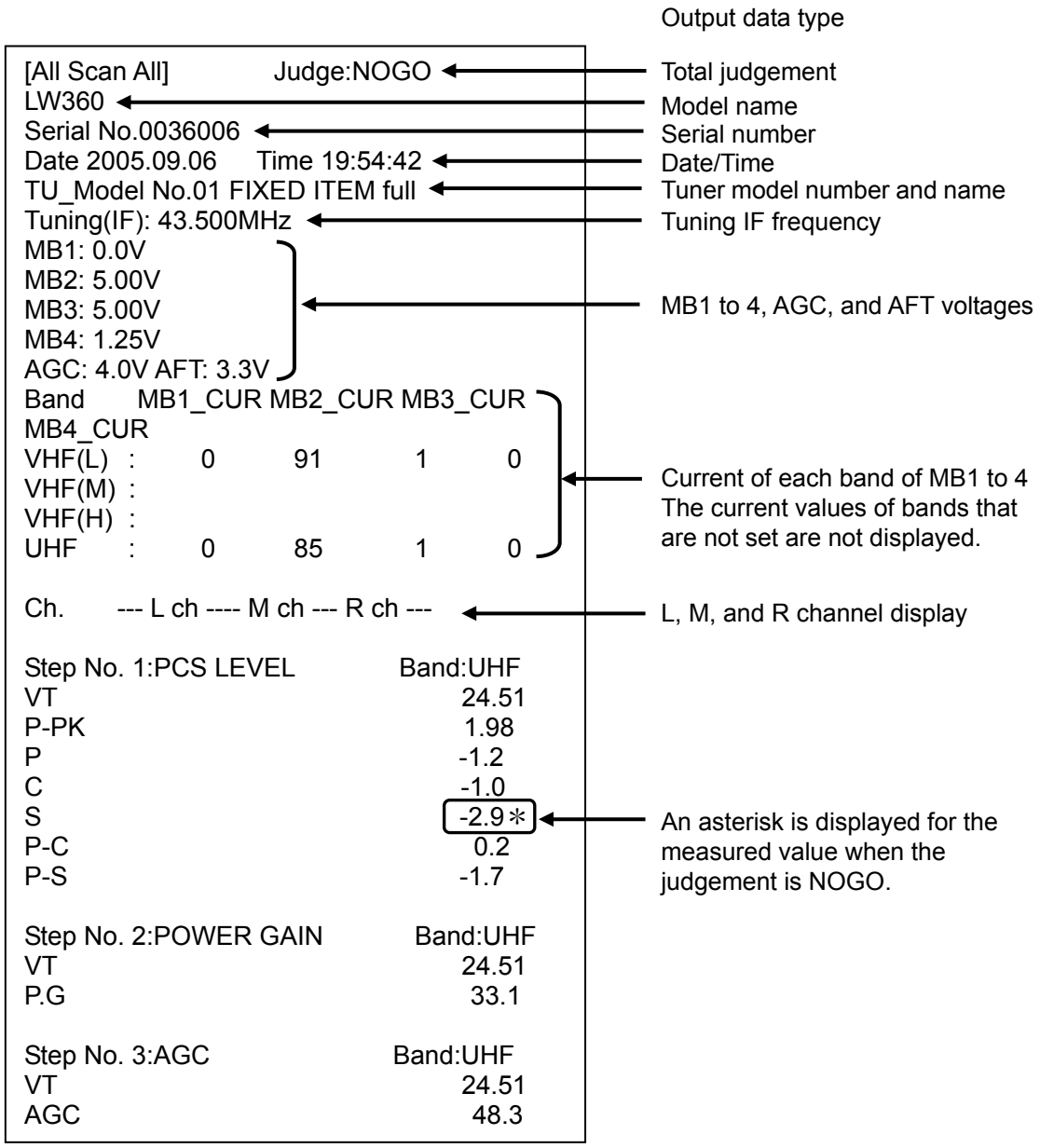


(2) Auto

When the output data type is set to the formats below, the data is output automatically after the All Scan operation.

- All Scan & Step All
- All Scan & Step NG
- All Scan All
- All Scan NG
- All Scan Short Form
- All Scan Short Form & Title Cut

10.3.3 Data Output Example (Data Output Mode: All Scan All)



10.4 External Control

Send the commands below on the Wave screen to carry out the corresponding operation.

Command	Description	Parameter
TMXX CR/LF	Set the tuner model number	01-20
STXX CR/LF	Set the step number	01-20
SC CR/LF	Start All Scan	
AS0 CR/LF	Request All Scan data output	
AS1 CR/LF	Request All Scan judgement result output	
TS0 CR/LF	Request tuner model data output	
CR CR/LF	Request to receive tuner model data	
TWXX CR/LF	Write the tuner model data	01-20

∗ The tuner model data is sent and received in ASCII-HEX format.

11. OPERATION CHECK PROCEDURE

The LW 360 comes with a program for self-checking the operation as Tuner Model No. 20 Operation Check.

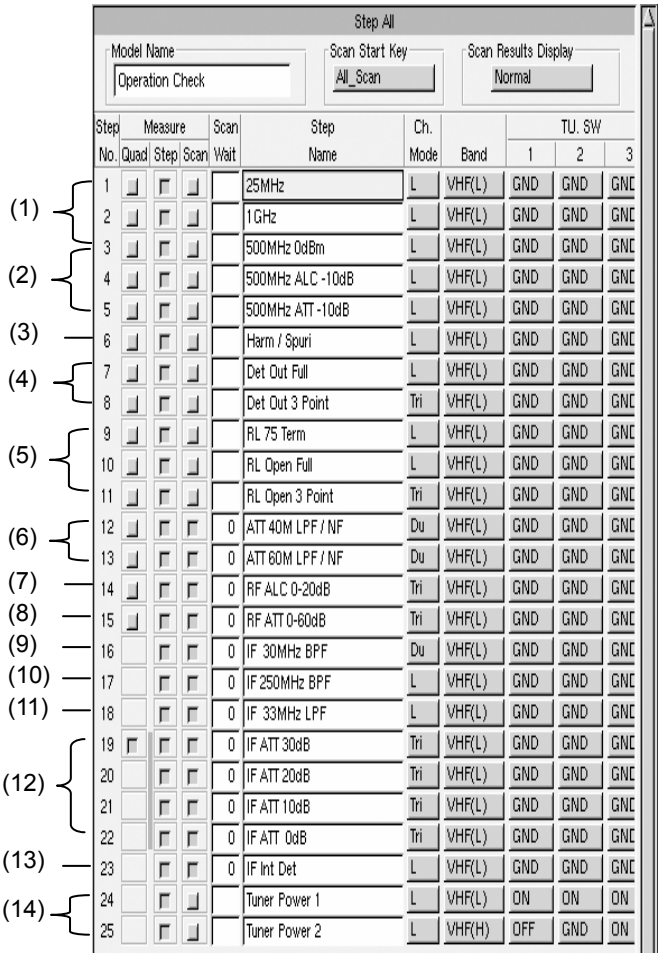
• Warm-up the LW 360 for at least 30 minutes before carrying out the operation check.

11.1 A List of Measuring Instruments Used

Name	Frequenc y Range	Other Specifications	Step Numbers Used
Frequency counter	≥ 1 GHz	Accuracy: ≤ 1 KHz	1 to 3
RF power meter	≥ 1 GHz	75 Ω. +10 to -20 dBm. Accuracy: ≤ 0.1 dB	3 to 5
Spectrum analyzer	≥ 1 GHz	75 Ω or 50 Ω (using a 75-to-50 Ω transformer) 0 to -70 dBm. Accuracy: ≤ 0.5 dB	6
75 Ω detector	≥ 1 GHz	75 Ω. Negative polarity (positive can also be used). Flatness: ≤ ±0.5 dB	7,8
75 Ω terminator	≥ 1 GHz	Return loss: ≥ 26 dB (VSWR 1.1)	9
Multimeter	≥ 1 GHz	Voltage: ≥ 33 V. Current: ≥ 400 mA.	24,25

11.2 A List of Program Operations

(1) Output frequency: 25 MHz, 500 MHz, and 1 GHz
(2) Output level at 500 MHz (three types)
(3) P. ATT: 0 to 70 dB. Variable attenuation. Signal quality (harmonic and spurious) and variable frequency.
(4) Output flatness using ±20 MHz sweep at three frequencies and full sweep
(5) VSWR calibration using full sweep and ±20 MHz sweep at three frequencies
(6) LPF, noise signal, and IF noise floor
(7) RF level control
(8) IF LOG characteristics
(9) BPF characteristics for measuring IF rejection and image rejection
(10) IF band characteristics
(11) IF band characteristics
(12) IF ATT: 30, 20, 10, and 0 dB
(13) Internal IF detector characteristics
(14) Tuner power output
(15) Judgement through All Scan

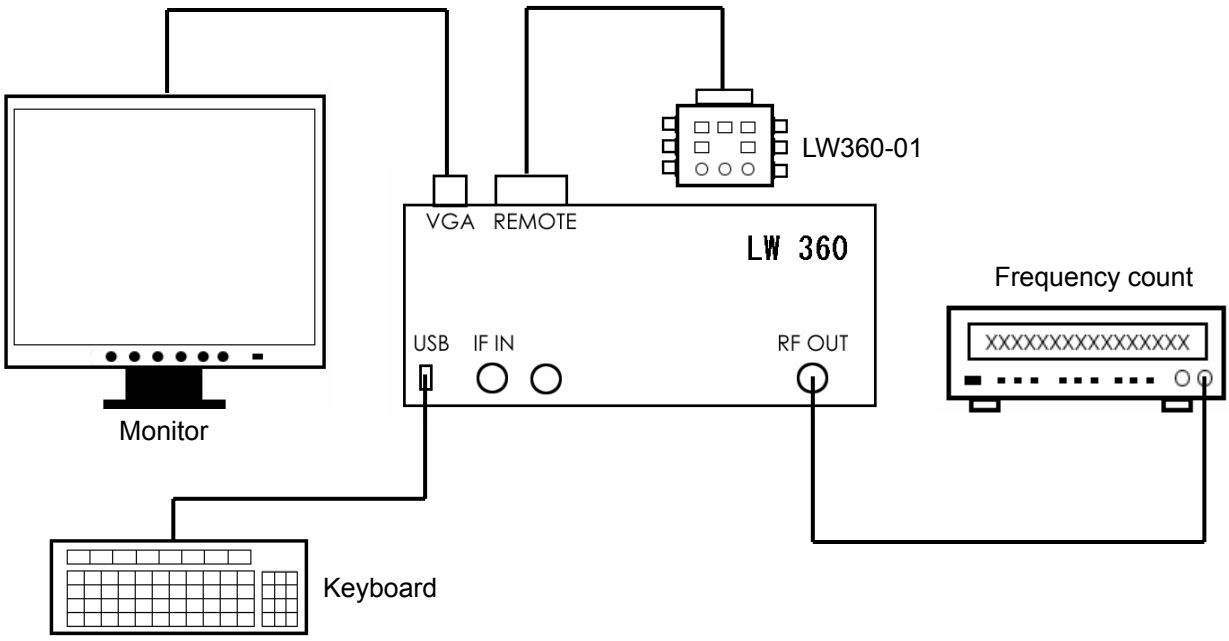


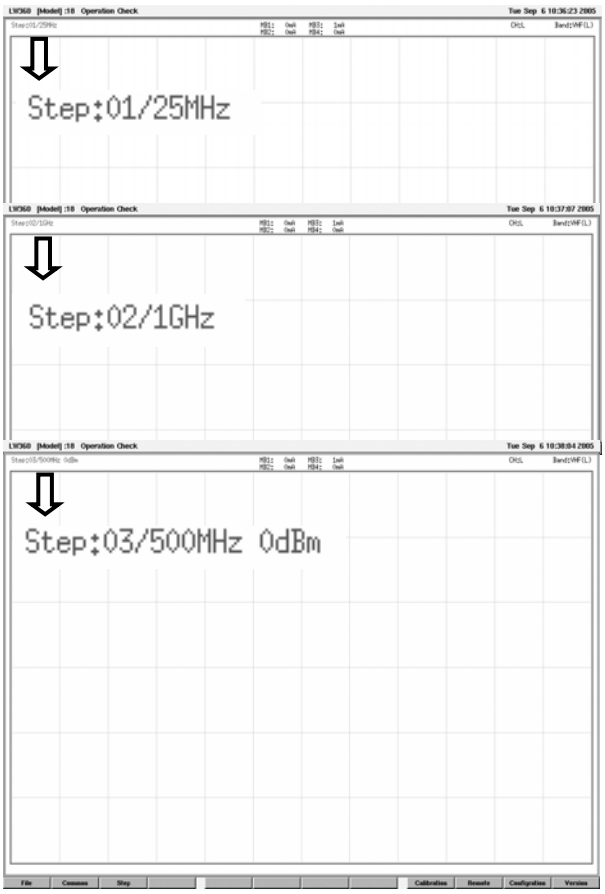
11.3 Operation Check

The measured values depend on the measuring instrument that you use. Perform checking by adding the accuracy of the measuring instrument.

(1) Output Frequency Steps 01 to 03

Basic connection diagram





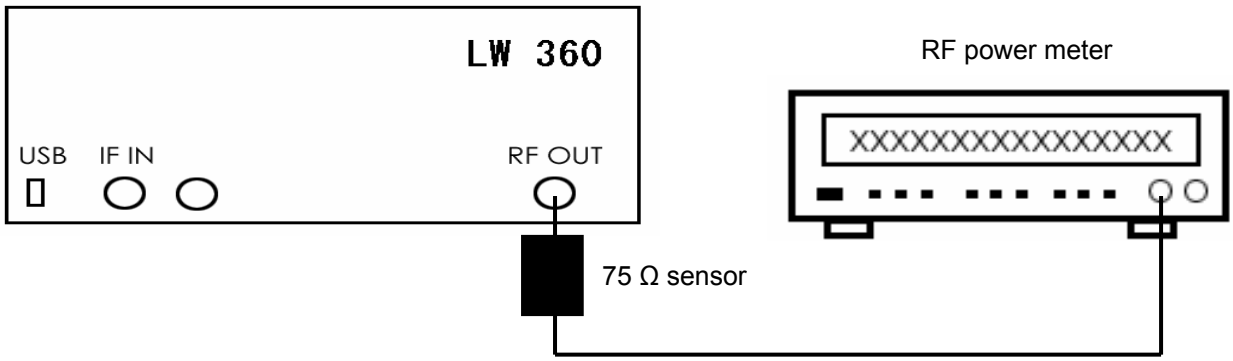
Output frequency

- Step 01
  25 MHz
- Step 02
  1 GHz
- Step 03
  500 MHz

≤ ±50 kHz

(2) Output Level Steps 03 to 05

Connection Diagram



• Connect a RF power meter.

• Perform the check of step 04 and step 05 with respect to step 03.

Output level: 500 MHz

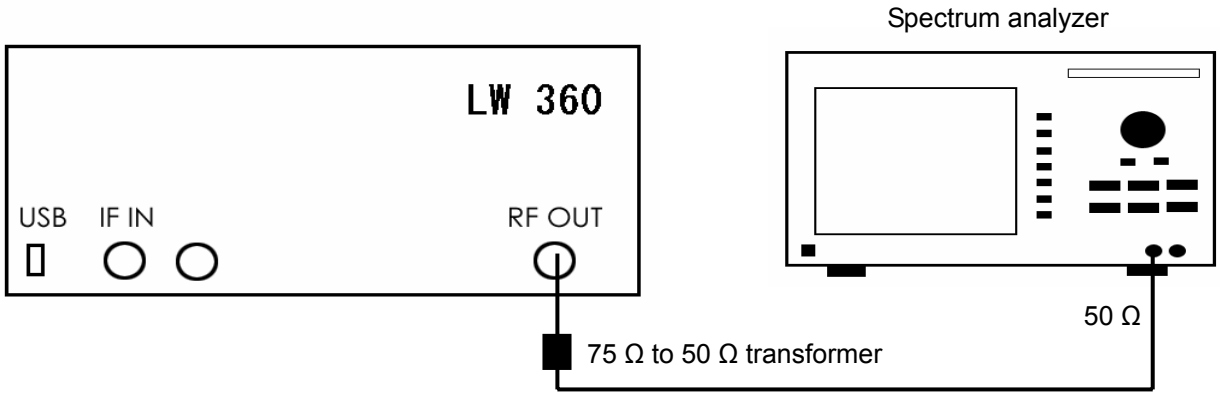
• Step 03
0 dBm ±1 dB

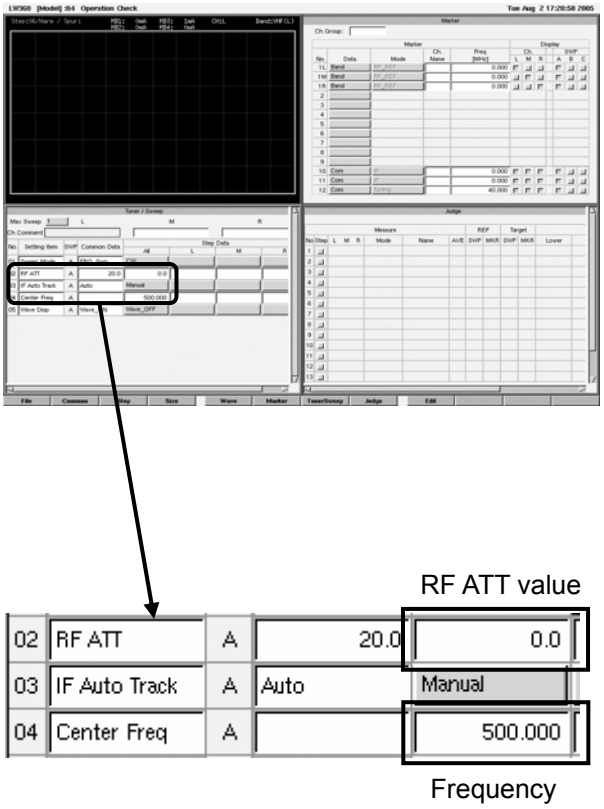
• Step 04 ALC –10 dB
-10±0.5 dB (with respect to the output of step 03)

• Step 05 ATT 10 dB
-10±0.7 dB (with respect to the output of Step 03)

(3) RF ATT and Signal Quality

Connection Diagram





- Connect a spectrum analyzer.
- On the Wave screen, press or click F3 (Step) followed by F7 (TunerSweep).
- Check the RF attenuator and harmonic spurious by changing the RF attenuator and center frequency values.

a) RF ATT 500 MHz

1 dB steps. Variable from 0 to 70 dB.
Accuracy (0.5 dB + 2%)

Example 10 dB: ≤ ±0.7 dB
70 dB: ≤ ±1.9 dB

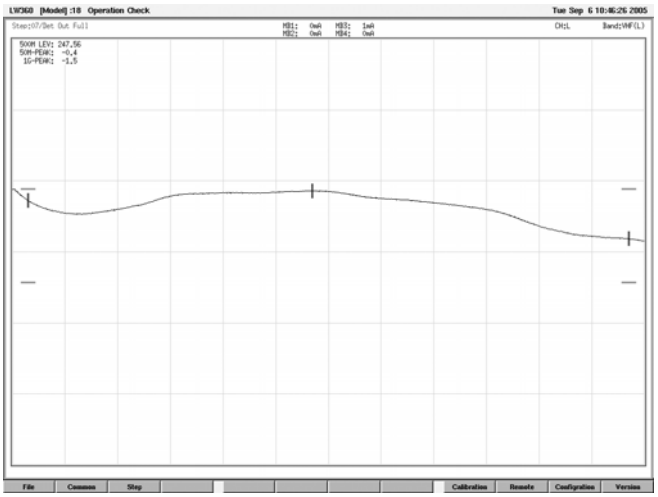
Reset to 0 dB after the check.

b) Signal quality 0 dB

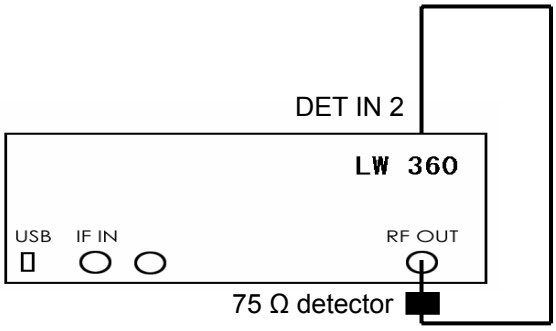
10 MHz steps. 30 to 1000 MHz.
(or 50 MHz or 100 MHz steps)

- Harmonic: ≤ -25 dBc
- Spurious: ≤ -30 dBc

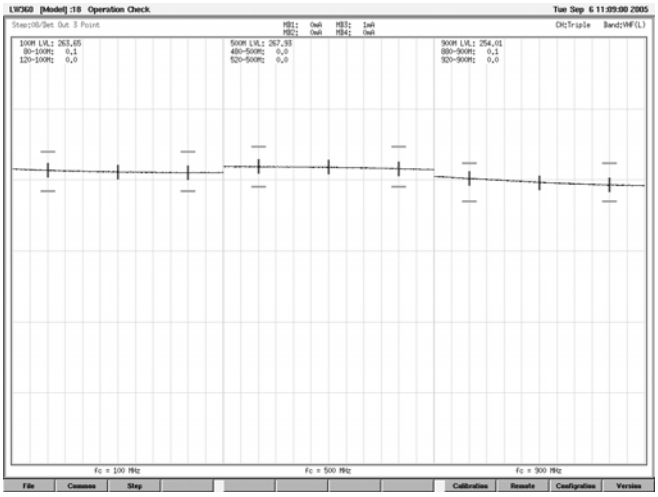
Reset to 500 MHz after the check.



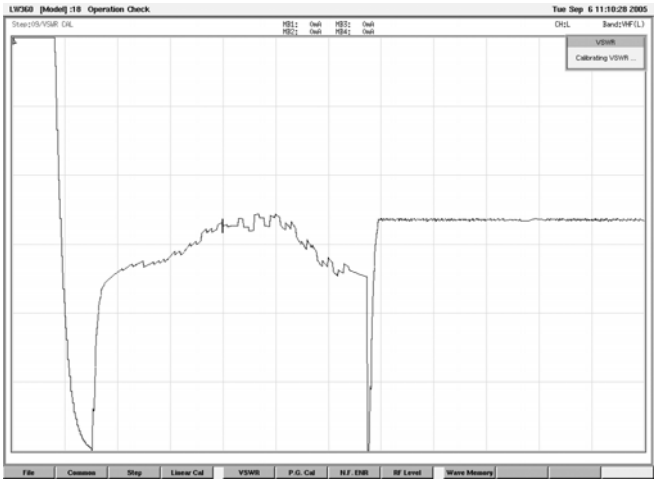
(4) Output Flatness Steps 07 and 08



Change the setting for positive polarity.
F3 (Step) → F7 (Tuner/Sweep) → Polarity



- Connect the RF OUT to DET IN2 on the rear panel.
- Step 07
  Output level: 0 dBm
  Full sweep
  ≤ 3 dB
- Step 08
  Output level: 0 dBm
  ±20 MHz sweep
  fc = 100, 500, and 900 MHz
  ≤ ±0.5 dB

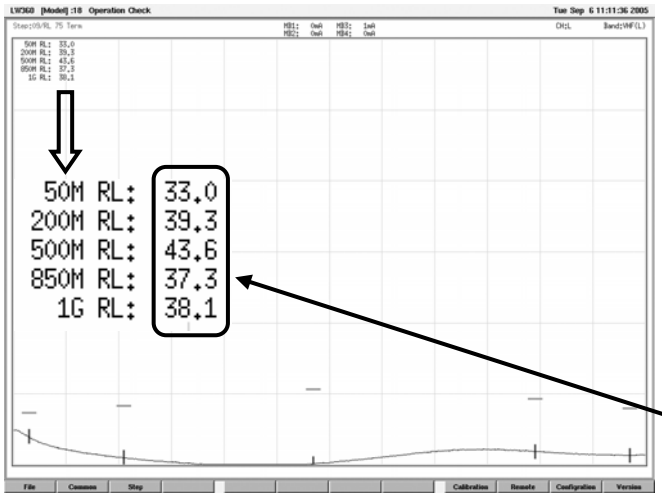


(5) VSWR Steps 09 to 11

Open

- Open RF OUT.
- Step 09

a) VSWR calibration
Home → F9 (Calibration) → F5 (VSWR) → Approx. 20s
After calibration, press the Home key to return to the normal Wave screen. Then, carry out the subsequent checks.

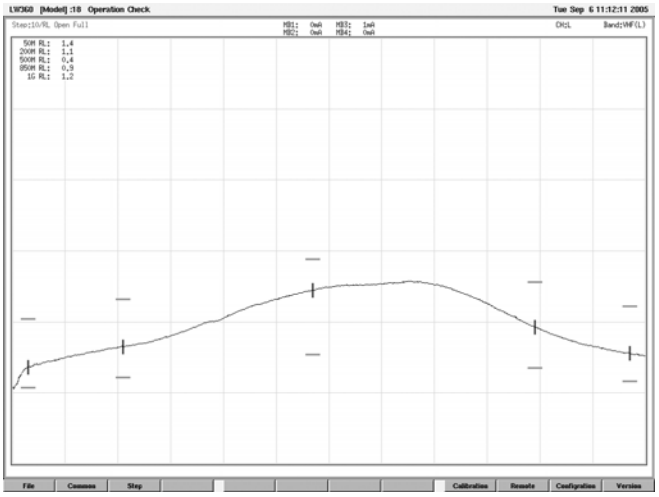


b) 75 Ω terminator return loss check

75 Ω terminator

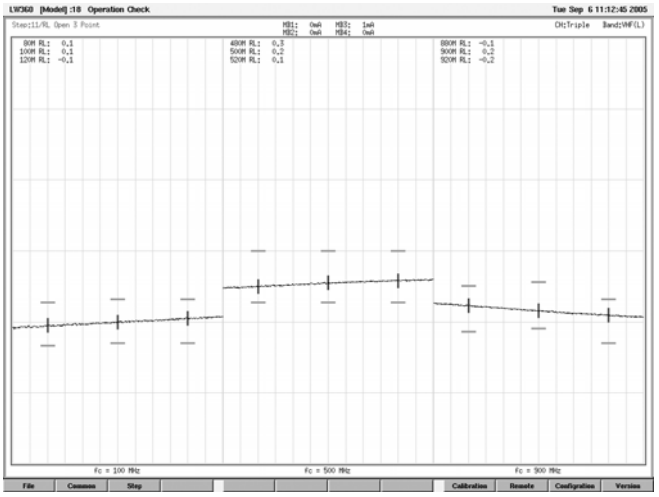
• Connect a 75 Ω terminator to RF OUT

≥ 30 dB

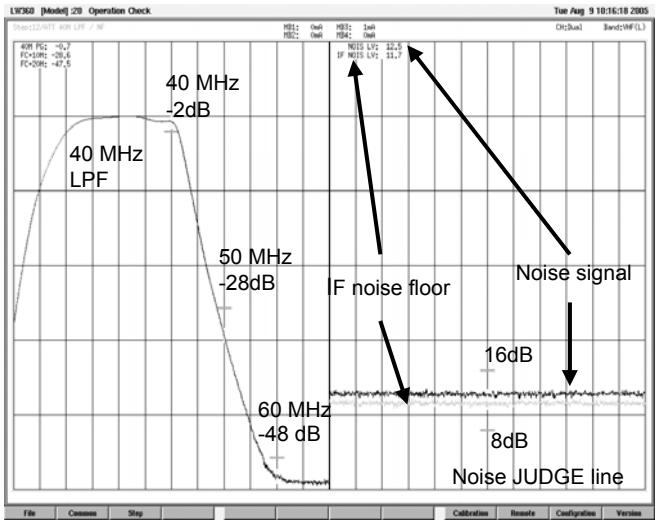


Open

• Step 10
Open return loss check error
Full sweep
-0.5 to 2.5 dB



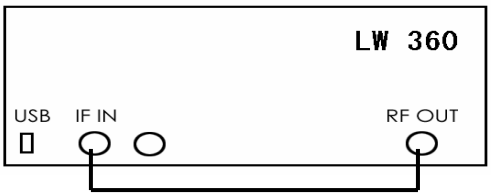
• Step 11
Open return loss check error
±20 MHz sweep
fc = 100, 500, and 900 MHz
≤ ±0.7 dB



(6) LPF, Noise Signal, and IF Noise Floor

Steps 12 and 13

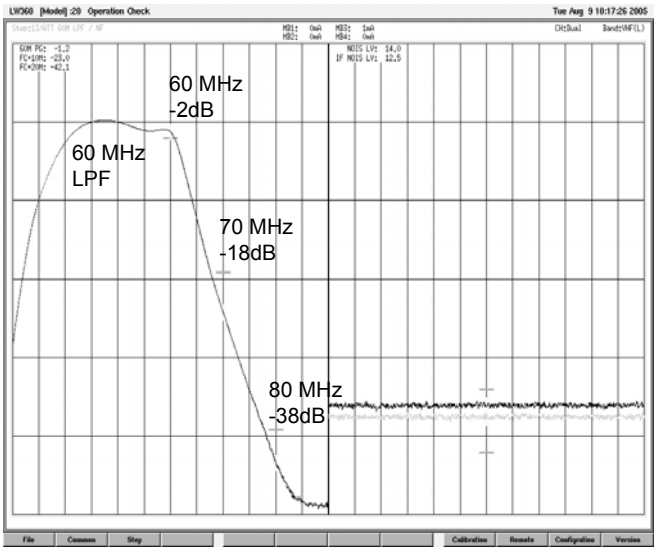
＊Connection for Step 12 and subsequent steps



3C2W 50cm

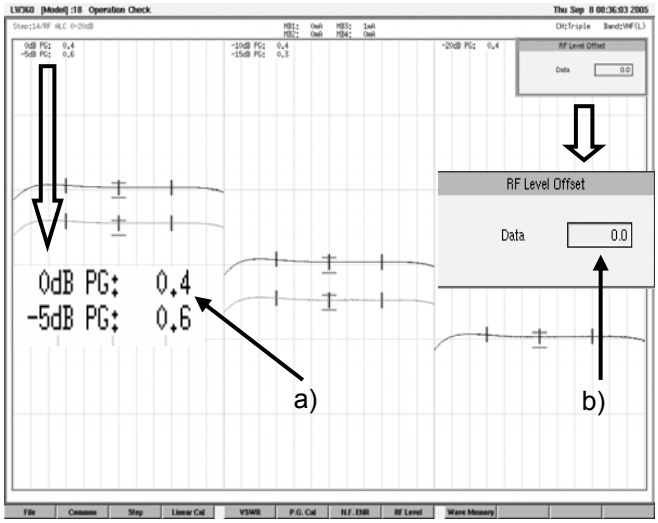
Step 12

- 40 MHz LPF check
  - 40 MHz: ≤ -2 dB
  - 50 MHz: ≥ -25 dB
  - 60 MHz: ≥ -45 dB
- Noise signal
  - 8 to 16 dB
- IF noise floor
  - ≤ 15 dB



Step 13

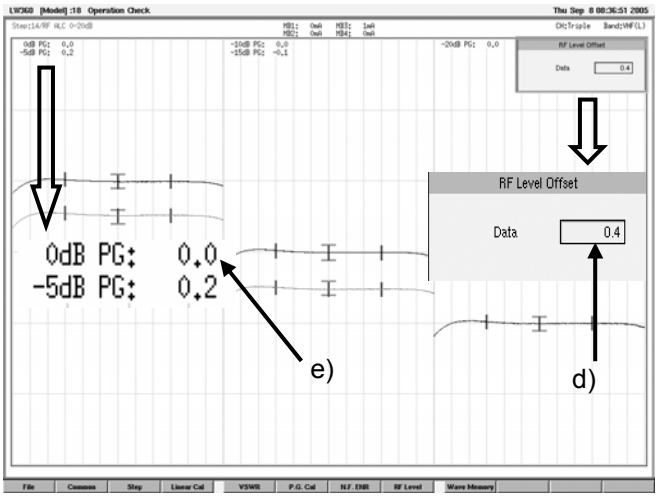
- 60 MHz LPF check
  - 60 MHz: ≤ -2 dB
  - 70 MHz: ≥ -18 dB
  - 80 MHz: ≥ -38 dB
- Noise signal
  - 8 to 16 dB
- IF noise floor
  - ≤ 15 dB



(7) RF Level Control Step 14

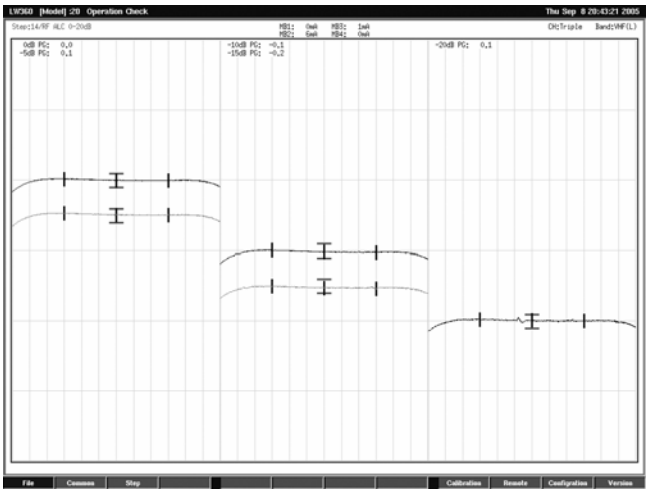
• First, set the level at 40 MHz.
Home → F9 (Calibration) → F8 (RF Level)

a) Read the measured value of 0dB PG. (Example: 0.4)
b) Read RF Level Offset data. (Example: 0.0)
c) Add a) and b). (Example: 0.4 + 0.0 = 0.4)

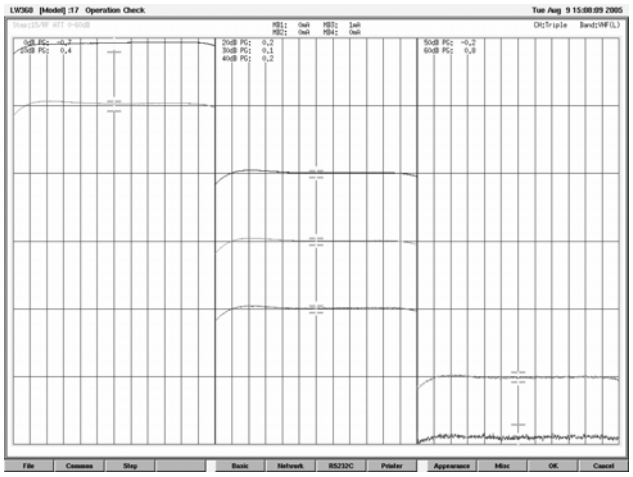


d) Type the value of c) in Data.
e) Check that the 0dB PG value is 0.0. (We change the value of data so that 0dB PG is 0.0.)
f) The Data value is within ±1 dB.

Press the Home key to return to the measurement screen.



• Step 14
RF Level control check
-5, -10, -15, and -20 dB
≤ 1 dB

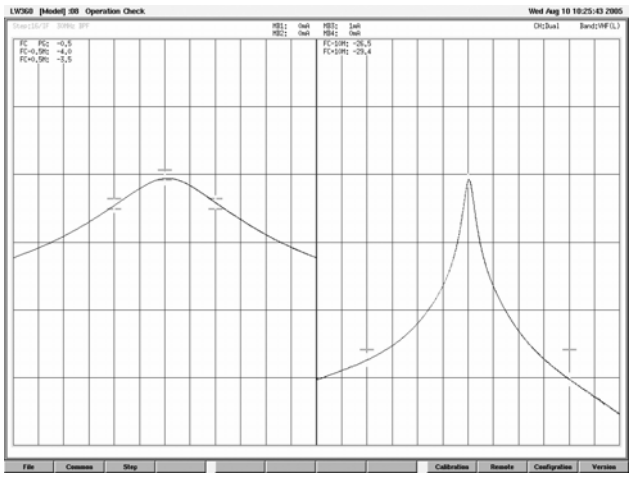


(8) IF LOG Characteristics Step 15

IF Center Freq: 40 MHz

IF LOG characteristics error

0 dB	-2.0 to 0 dB
-10 dB	-0.7 to 0.7 dB
-20 dB	-0.5 to 0.5 dB
-30 dB	-0.5 to 0.5 dB
-40 dB	-0.5 to 0.5 dB
-50 dB	-0.7 to 0.7 dB
-60 dB	0 to 3 dB

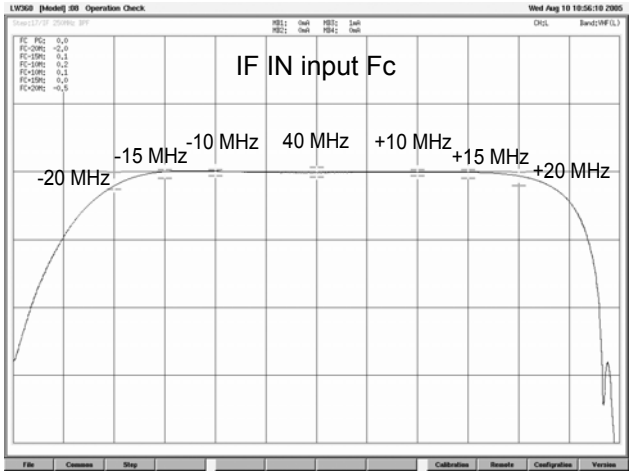


(9) BPF Characteristics of IF/IMAGE Rejection Step 16

IF Center Freq: 40 MHz

• Internal 30 MHz BPF

fc level	≤ ±0.7 dB
fc±0.5 MHz	-4.5 to -3.0 dB
fc±10 MHz	-40 to -25 dB

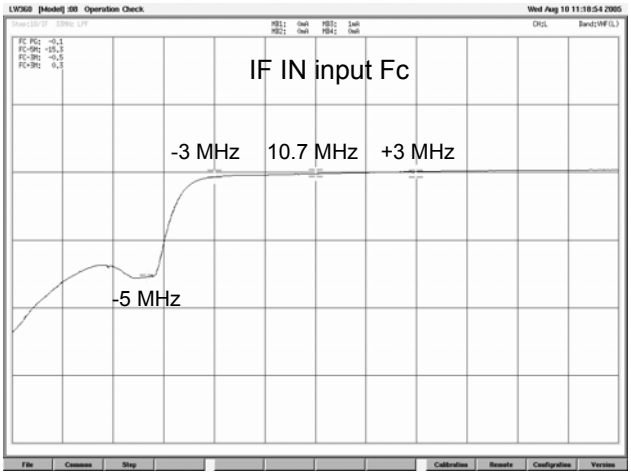


(10) IF Band Characteristics Step 17

IF Center Freq:40 MHz

IF band characteristics error

fc (40 MHz)	≤ ±0.7 dB
fc-20 MHz	-2.5 to 0 dB
fc±15 MHz	-0.9 to 0.4 dB
fc±10 MHz	-0.5 to 0.4 dB
fc+20 MHz	-2.0 to 0 dB

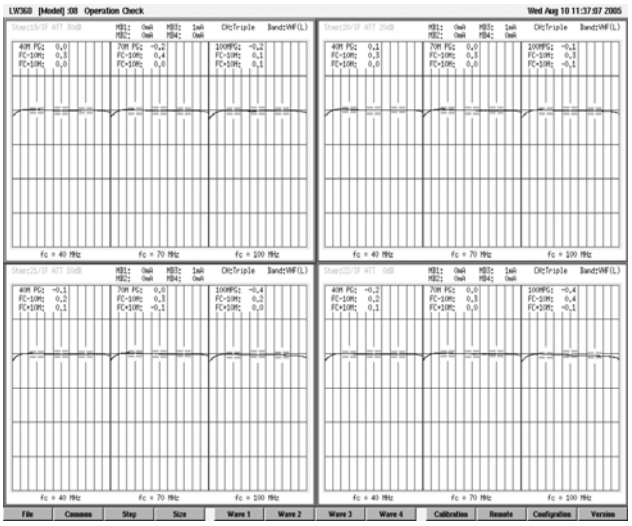


(11) IF Band Characteristics Step 18

IF Center Freq: 10.7 MHz

IF band characteristics error

fc (10.7 MHz)	-0.7 to 0.7 dB
fc-5 MHz	-50 to -15 dB
fc-3 MHz	-0.7 to 0.7 dB
fc+3 MHz	-0.7 to 0.7 dB



(12) IF ATT Steps 19 to 22

IF Center Freq: 40 MHz
70 MHz
100 MHz

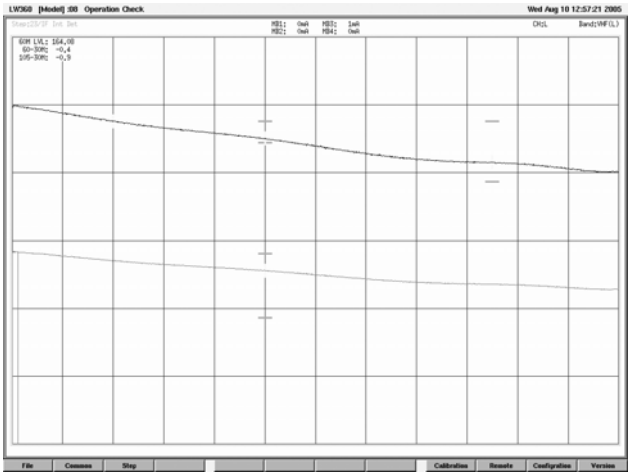
Check point: fc±10 MHz

- Step 19
  IF ATT 30 dB
- Step 20
  IF ATT 20 dB
- Step 21
  IF ATT 10 dB

fc ±0.8 dB
fc±10 MHz -0.7 to 0.7 dB

- Step 22
  IF ATT 0 dB

fc ±0.8 dB
fc±10 MHz 0.7 dB



(13) Internal IF Detector Characteristics

Step 23

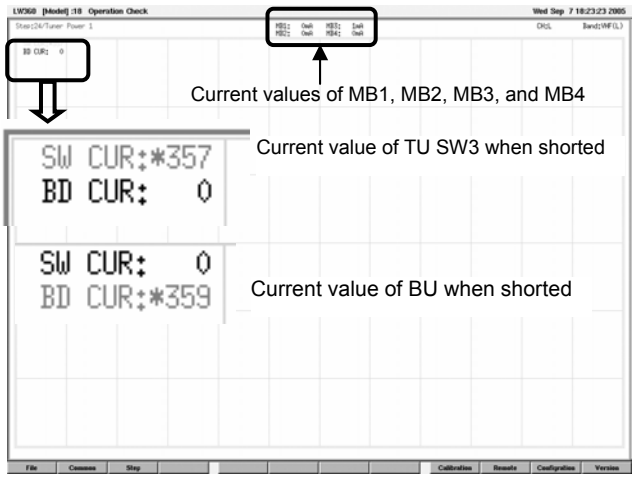
Sweep: 10 to 130 MHz

Output: 0 dBm

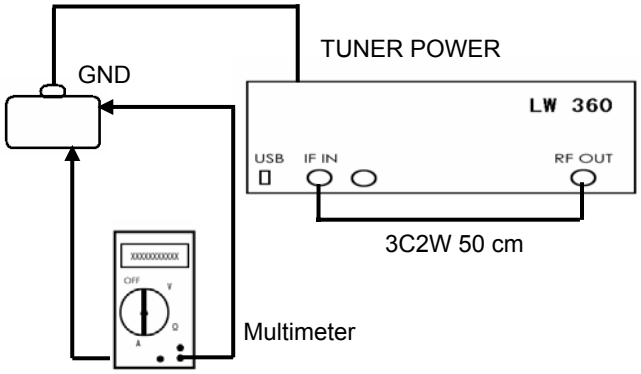
Detector level and flatness

60 MHz detector level: 120 to 180 mV

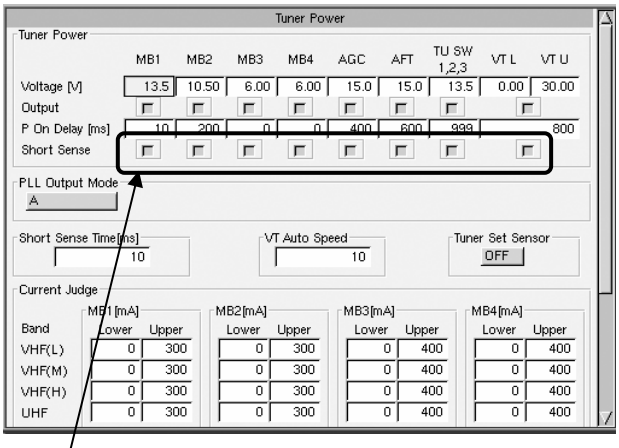
30 to 105 MHz flatness: ≤ -1.5 dB



(14) Tuner Power Output Steps 24 and 25



Pin E	Output	VHF(L)	VHF(H)
		STEP:24	STEP:25
1	VT	30.0	←
4	AGC	15.0	←
5	AFT	15.0	←
6	TU SW3	13.5	←
7	MB1	13.5	←
8	TU SW1	13.5	OFF
9	TU SW2	13.5	GND
11	MB2	10.5	←
17	BL/MB3	6.0	←
18	BM/MB4	6.0	←
19	BH	13.5	OFF
20	BU	13.5	GND
3,24	GND	GND	←
Short Sense		OFF	ON



Step 24 (1) Press the check button to make it gray.
Step 25 (1) Press the check button to make it red.

• Step 24

(1) Turn OFF the short detection.

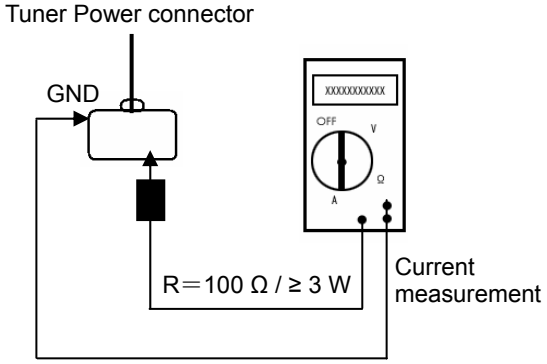
F2 (Common) → F5 (Tuner Power)

a) Voltage output

VT voltage: ≤ 30 V ± 30 mV

Other voltages: Output voltage ± 50 mV

b) Current measurement



Measure at pins MB1, MB2, MB3, MB4, BU, and TU SW3.

Difference between the multimeter indication and the displayed measured value

≤ (2 mA + 2%)

(Example) For 100 mA

Within 96 to 104 mA

c) Short Check

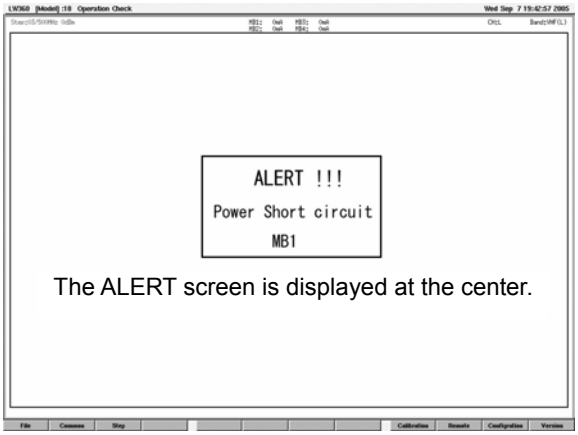
Short each pin (MB1, MB2, and TU SW3) and GND.

• Check that the short is not detected.

[Short current]

MB1, MB2, and TU SW3: ≥ 300 mA

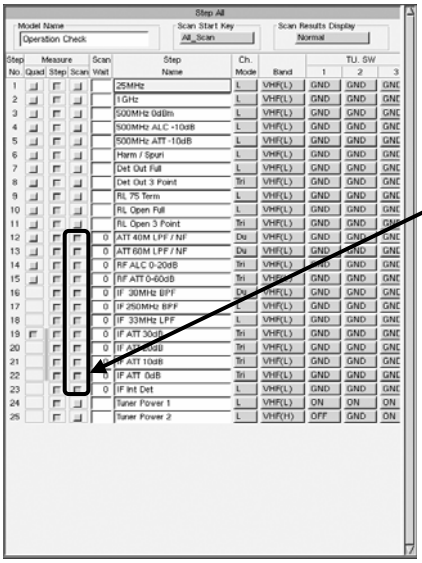
MB3 and MB4: ≥ 440 mA



The ALERT screen is displayed at the center.

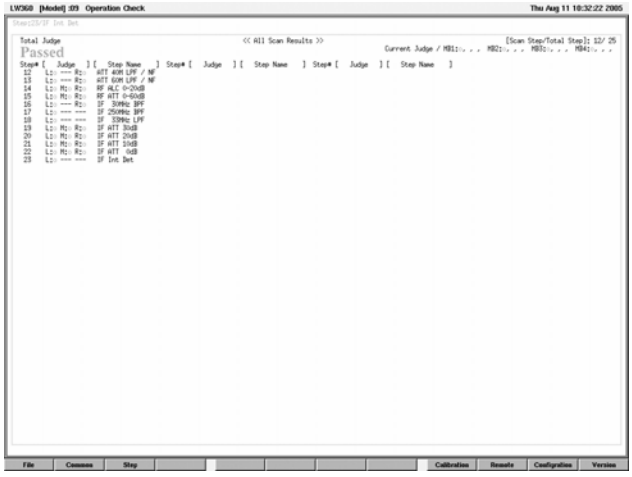
Step 25

- Press F2 (Common) followed by F5 (Tuner Power), and turn Short Sense ON.
- Short each pin (VT, AGC, AFT, TU SW3, MB1, MB2, MB3, MB4, and BH) and GND.
- Check that the short is detected, and the error is displayed.
- Check that when you press PROTECTOR OFF on the Remote Controller (LW 360-01), the LW 360 recovers at approximately 1 s.



(15) Judgement through All Scan

a) GO/NOGO judgement can be executed on the Step 12 to 23 items with All Scan.
- Turn ON Scan under Measure on the Step All screen.



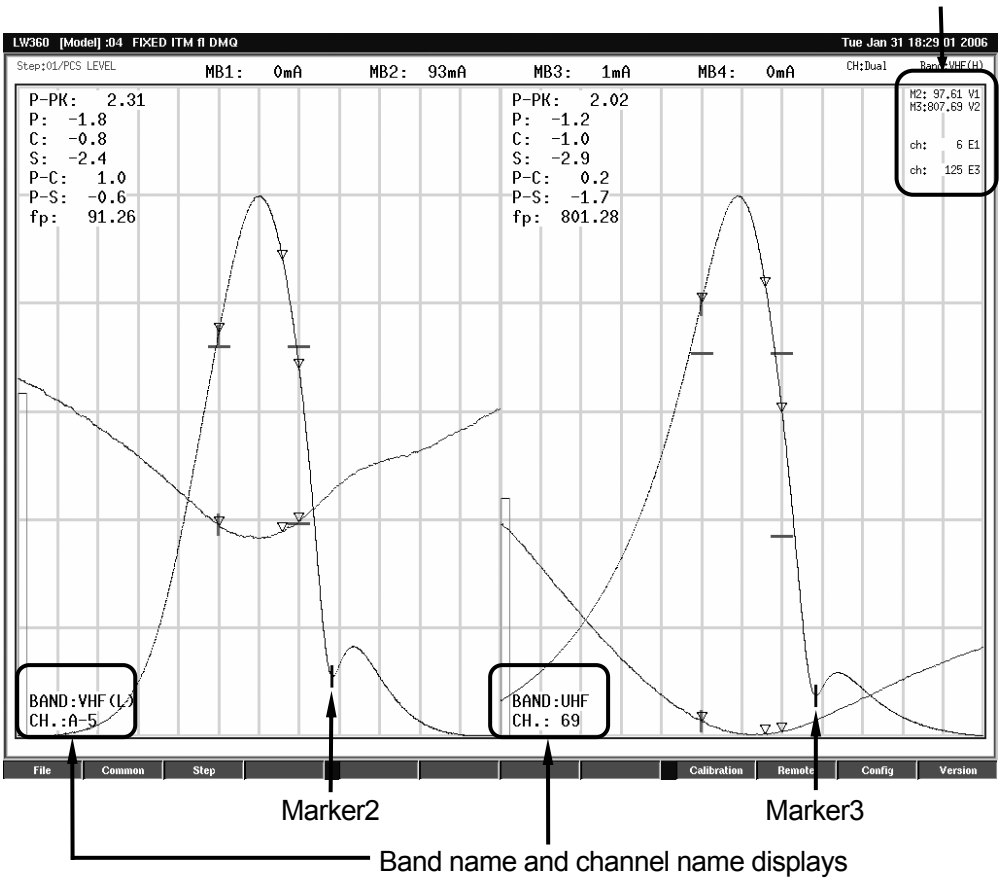
b) Press All Scan on the Remote Controller (LW 360-01). The judgement results are displayed in approximately 5 s.

After checking the operation above, reset the RF Level offset value specified in (7) RF Level Control (step 14) to the original value. (The value is normally 0.00.) In addition, carry out VSWR calibration before connecting the tuner jig and starting measurements.

12. FUNCTION ADDED BY UPDATING THE SOFTWARE

12.1 Version 2.1 and Later

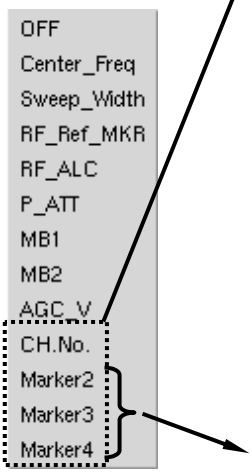
12.1.1 Addition of the Parameter Remote Function



(1) Additional Parameters

The following four parameters have been added to the parameter remote settings.

Abbreviation	Parameter	Minimum resolution	Selectable range	Unit
ch	Channel number	1	1 to 500	Ch
M2	Marker2	0.001	0.000 to 999.999	MHz
M3	Marker3	0.001	0.000 to 999.999	MHz
M4	Marker4	0.001	0.000 to 999.999	MHz



a) CH.No. (channel number)

You can set the channel number in the Channel Name Table stored in the File edit screen.

The channel number functions as a RF Ref MKR. In the past, the function for setting the RF Ref MKR using the parameter remote function could be used to vary the frequency step. The channel number can be used to monitor the waveform that is PLL locked at the channel level specified in the Channel Name Table.

The band and PLL data specified in the Channel Name Table are also active. Therefore, waveforms of all channels can be monitored on the same screen even if the band changes.

This is useful such as when checking all channels of a PLL tuner.

b) Marker2, 3, and 4

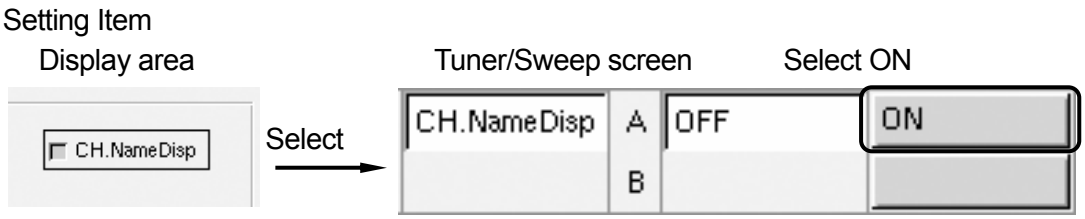
You can set frequencies of Marker 2, 3, and 4. You can vary the RF and IF Marker while performing IF auto tracking. In addition, the AGC voltage and the marker level from the peak can be varied (version 2.2 and later. See section 12.2.6.).

(2) Additional Setting Item (CH.Name Disp)

The channel name and band are displayed at the lower left of the screen when controlling the channel number using parameter remote.

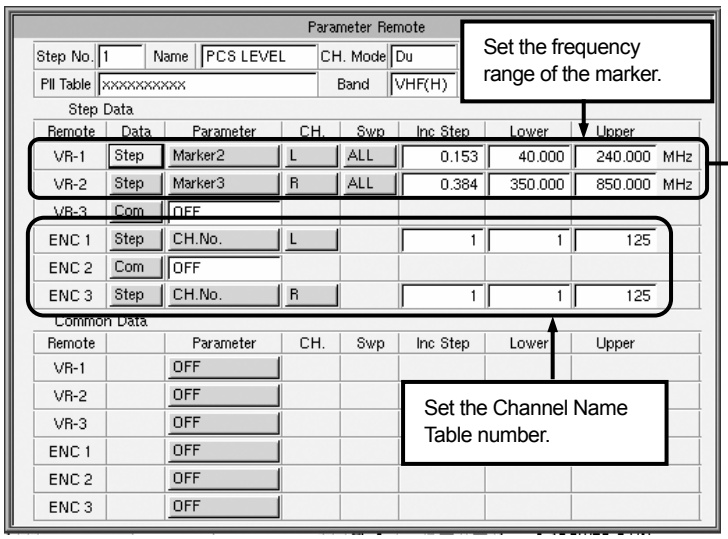
If parameter remote is not used, the channel name of the RF Ref Marker is displayed.

Set CH.Name.Disp only for sweep A.



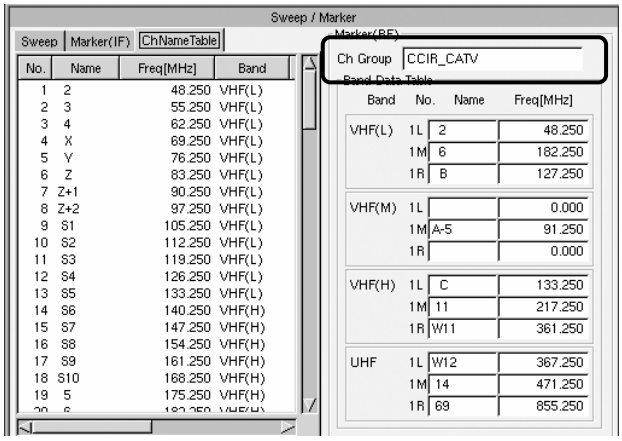
(3) Parameter Remote Setup Example

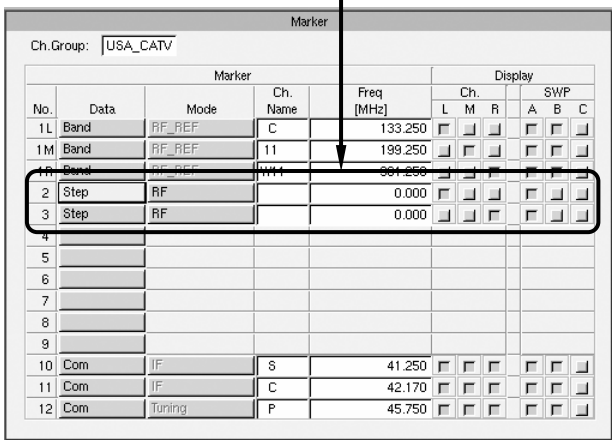
Set CH. Mode to Dual, set ENC1 and ENC3 to CH. No., and set VR-1 and VR-2 to Marker2 and Marker3, respectively.



If you specify CH.No., create a Channel Name Table and set Ch Group in the Sweep/Marker screen.

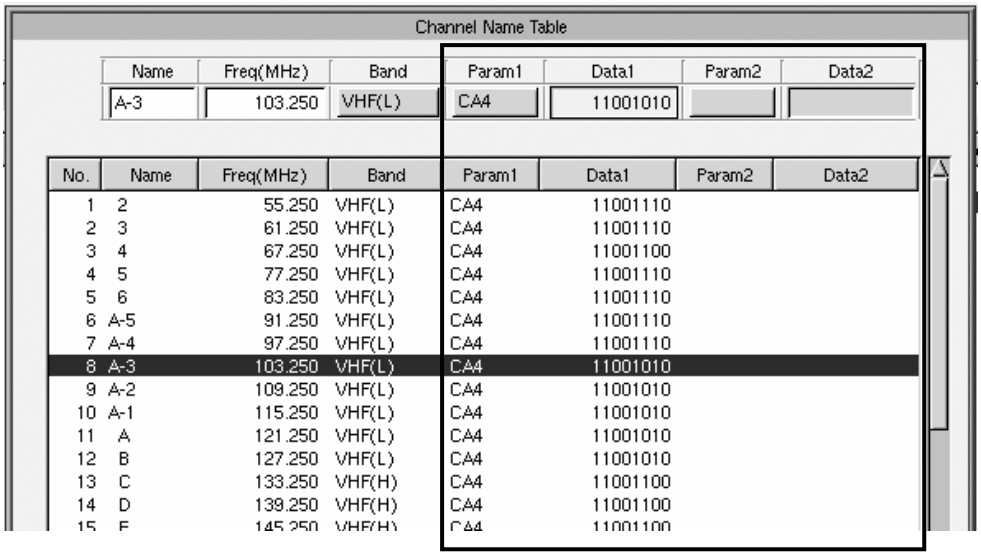
If you specify Marker 2 and 3, Set No. 2 and 3 of the Markers screen.





12.1.2 Additional Specifications to the Channel Name Table

The Channel Name Table was used as a reference to the marker frequency. However, items have been added to support parameter remote. The number of channels has also been expanded.

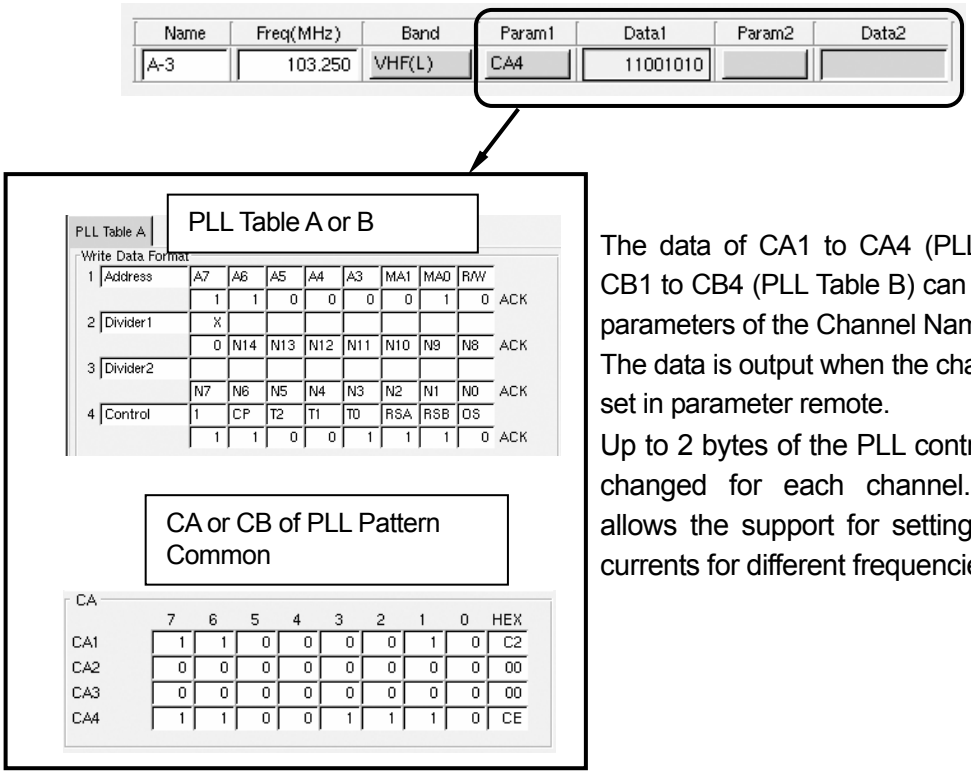


(1) Expansion of the Number of Channels

The channel numbers that can be registered in the Channel Name Table have been increased from 1 through 125 to 1 through 500.

You can set up to 500 channels.

(2) Additional Parameters



The data of CA1 to CA4 (PLL Table A) and CB1 to CB4 (PLL Table B) can be specified as parameters of the Channel Name Table.

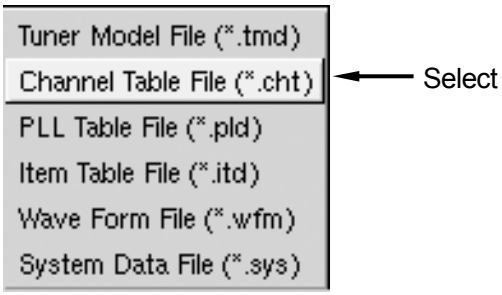
The data is output when the channel number is set in parameter remote.

Up to 2 bytes of the PLL control data can be changed for each channel. This feature allows the support for setting charge pump currents for different frequencies.

(3) Setup Example

a) Displaying the Channel Name Table

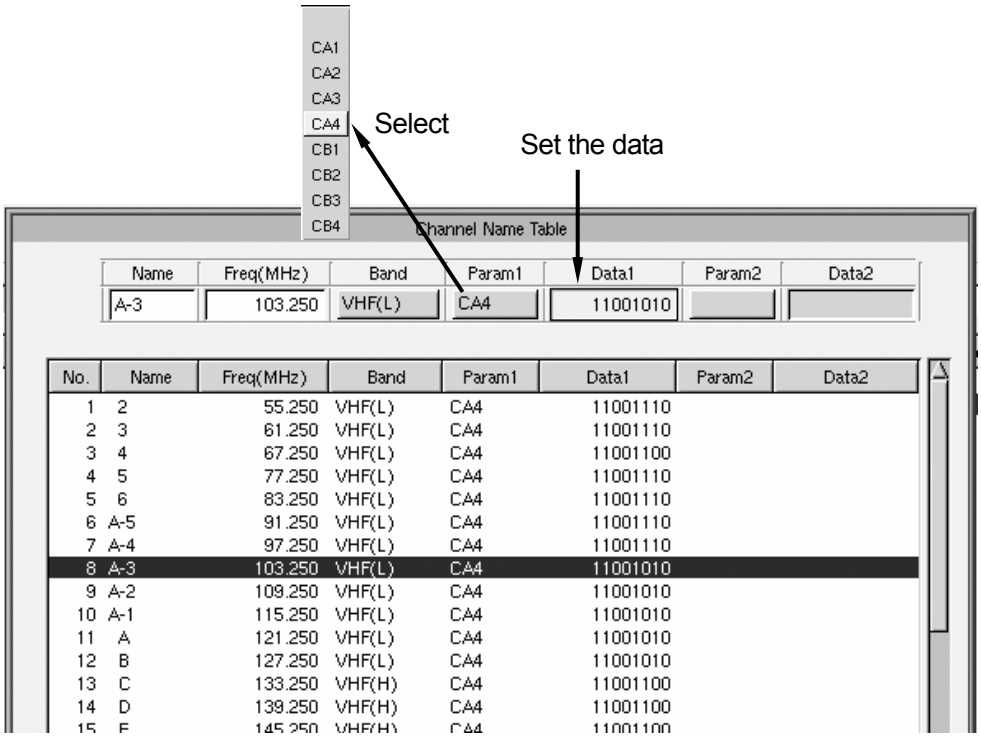
Press F1 (File) to display the File edit screen. Then, select Channel Table File using the Tab and Space keys or the mouse.



Select the desired file and press F9 (Edit) followed by F8 (Edit Table) to display the Channel Name Table.

b) Setting the Data

Set the name, frequency, and band. Move the cursor to Param1 or Param2 to select the parameter. Then, move the cursor to Data1 or Data2 to set the data.



(4) Parameter Data Priority

The added parameters can be used only when CH.No. is selected for parameter remote.

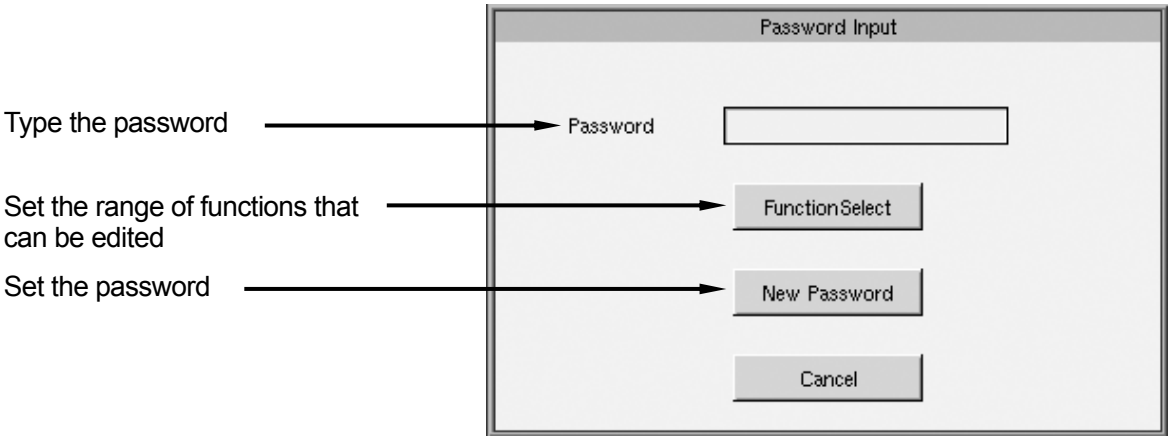
If CH.No. is selected for parameter remote, the data is applied at the highest priority. For normal measurements, the PLL data of Common is used.

12.1.3 Addition of the User Privilege Function

A user privilege function has been added to the Tuner Model settings.
The operation of the function is limited by setting up a password for changing the settings. The administrator of the password can limit the range of operations that other users can perform.

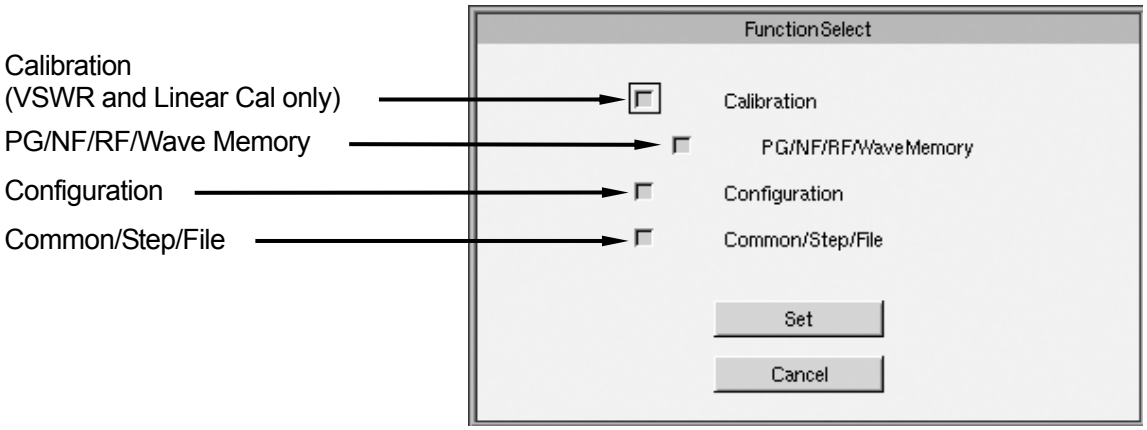
(1) Setup Procedure

From the Wave screen, press F10 (Remote) followed by F11 (Administration) to display the Password Input screen. Type the password and change the settings.



(2) Setting the Range of Functions That Can Be Edited

From the Password Input screen, select Function Select to display the Function Select screen. Set the range of functions that can be edited on this screen.



a) Calibration、PG/NF/RF/Wave Memory

Limits the calibration operation and setting. To use all the functions of F9 (Calibration), select both the Calibration and PG/NF/RF/Wave Memory check boxes. To use only the VSWR and Linear Cal, select only the Calibration check box.

b) Configuration

Limits the setting of the system data. Select the check box to use the functions of F11 (Configuration).

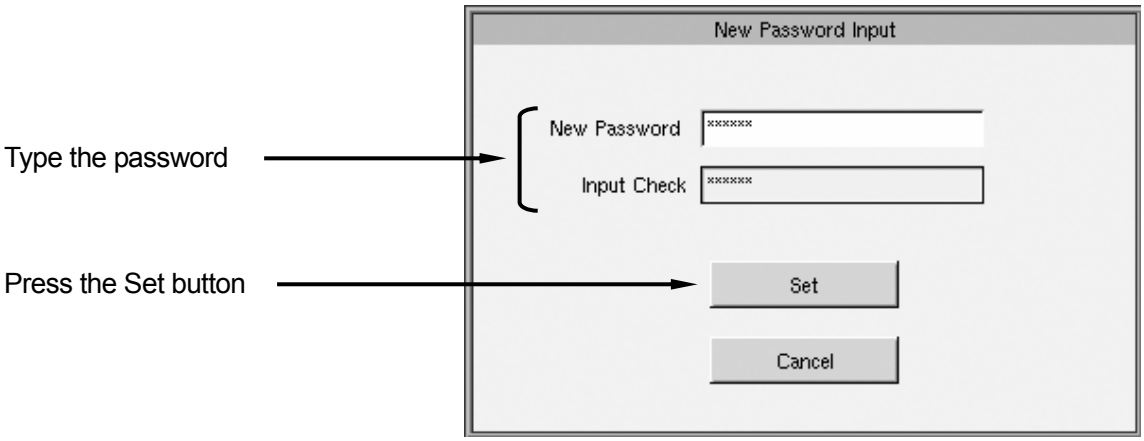
c) Common/Step/File
Limits the editing operations. Select the check box to use the functions of F1 (File), F2 (Common), and F3 (Step).

d) When the Check Boxes of All Functions Are Cleared
Prohibits all editing and calibrating operations. In this case, only F10 (Remote) and F12 (Version) can be used. To change other functions, enter the password and set the required functions of a) to c) above.

(3) Setting the Password

By factory default, no password is set. Thus, you can set the range of functions that can be edited (Function Select). If you set the password, you must enter the password to use the Function Select and New Password functions.

a) Setting a New Password
- From the Password Input screen, select New Password to display the New Password screen.
- Type the password in the New Password box, and type the same password again in Input Check for confirmation.
  The password characters that you type are displayed as asterisks.
- Type the password in the Input Check Box, and press the Enter key. Next, press the Set button to set the password.



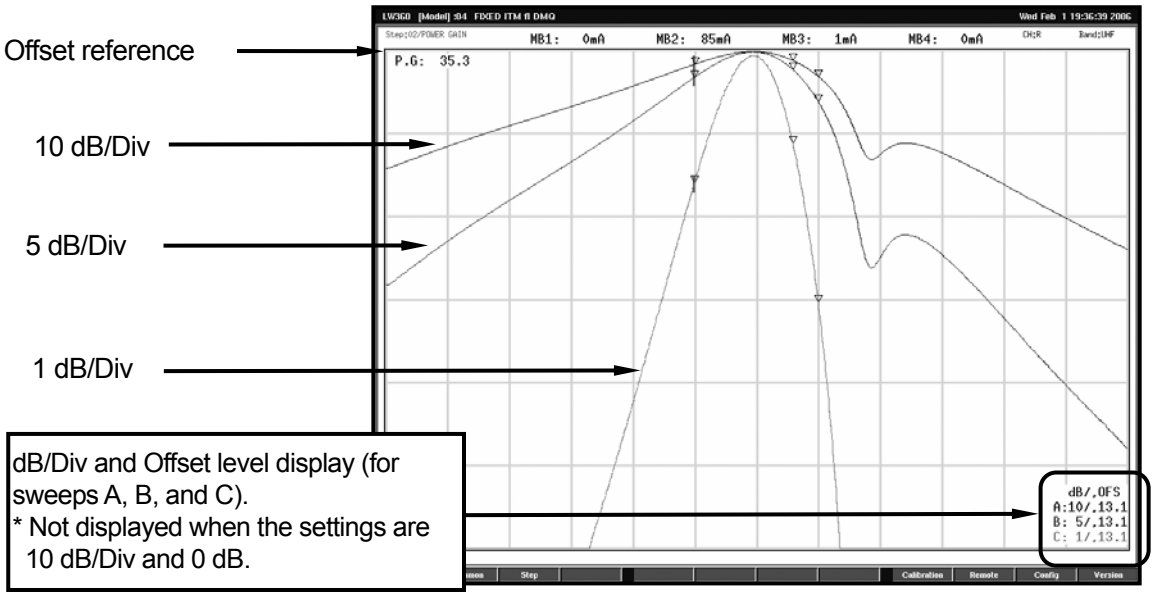
b) Typing the Password
- After you set the password, you need to enter the password for administration settings. Type the password in the Password Input screen.

(4) Password Management

It is your responsibility to manage the password. If you forget the password, contact your local Leader agent.

12.1.4 Switching of the LOG Measurement Scale

Previously, the level scale during LOG measurement was fixed to 10 dB. The scale can now be changed among 1, 2, 5, and 10 dB.



(1) Additional Setting Items (Log Scale and Log Offset dB)

a) Log Scale

Select the level per division. Select 1, 2, 5, or 10 dB. You can set a value for each channel (L, M, and R) and each sweep (A, B, and C).

b) Log Offset dB

Sets the offset level of the level reference (top section of the grid). The selectable range is 0 to 50 dB.

You can set a value for each channel (L, M, and R) and each sweep (A, B, and C).

The waveform peak overlaps with the reference position when the offset level is set to 0 dB in the following condition.

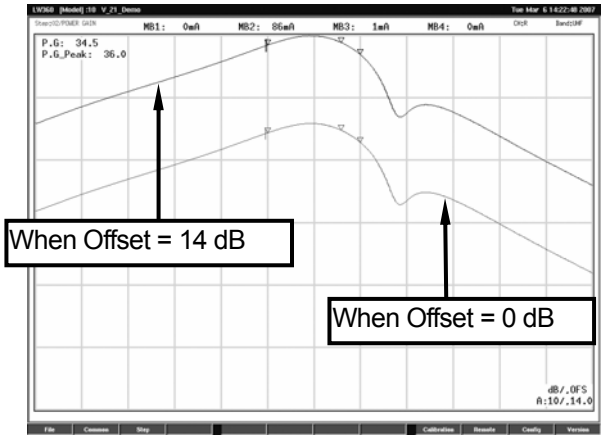
IF ATT	30 dB
RF ATT	0 dB
Power Gain	0 dB
P.G. Cal	0 dB

Normally, the RF ATT and P.G. Cal values as well as the tuner power gain are added. Thus, the offset level value varies depending on these settings and power gain.

The right figure shows the case when the peak P.G = 36 dB, RF ATT = 40 dB, IF ATT = 30 dB, and P.G. Cal = 10 dB.
If the offset level is set to 14 dB, the level matches that of the reference position. The setting for matching the offset level to the reference position can be determined by the following equation.

Offset(dB) = RF ATT + (IF ATT - 30)
- (P.G. - P.G. CAL)

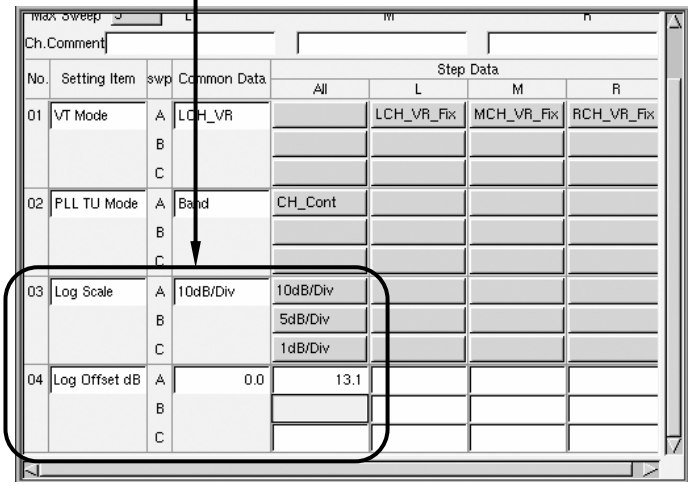
In actual use, set the level so that the waveform is displayed at the desired position.



(2) Setup Example

• Select Log Scale and Log Offset dB in the Display area of the Setting Item.

• Set the values in the Tuner/Sweep screen.
You can set a value for each channel and each sweep (A, B, and C).

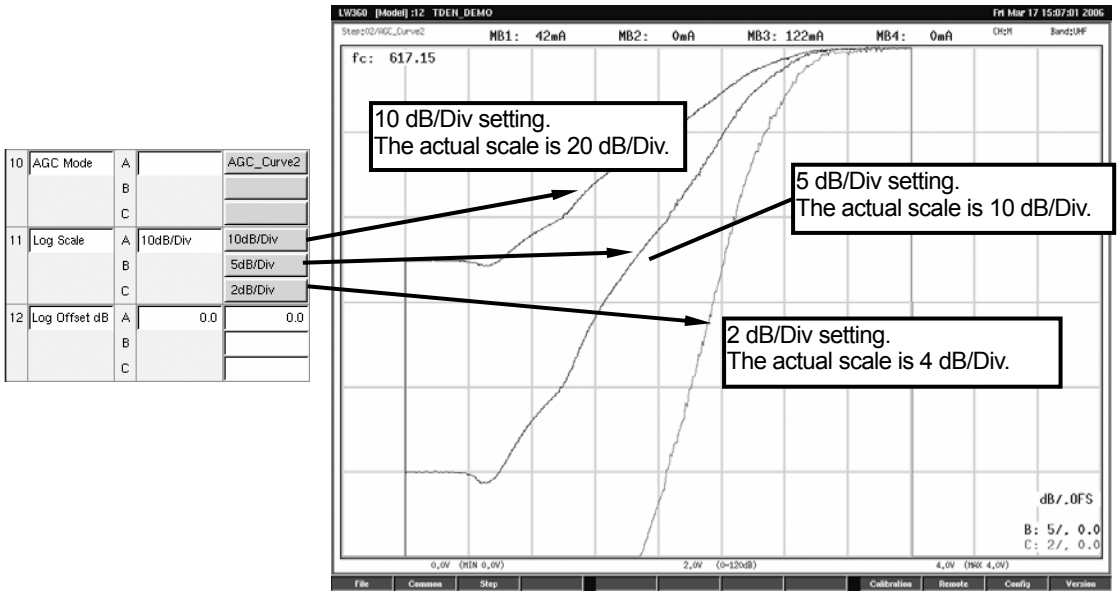


(3) Using Log Scale for AGC_Curve

The log scale is used when measuring Log waveforms. However, you must be careful when using the log scale when measuring AGC_Curve of AGC mode.

If you select AGC_Curve2 or AGC_Curve4, the scale is set to 20 dB/Div. If you set the log scale in this case, the actual scale is twice the specified value (10 dB/Div is actually 20 dB/Div, 5 dB/Div is actually 10 dB/Div, and so on).

• Example in which AGC_Curve2 is specified



12.1.5 Expansion of the Wave Memory Function

(1) Increase in the Number of Waveform Memories

The number of waveform memories has been increased from 20 to 40.

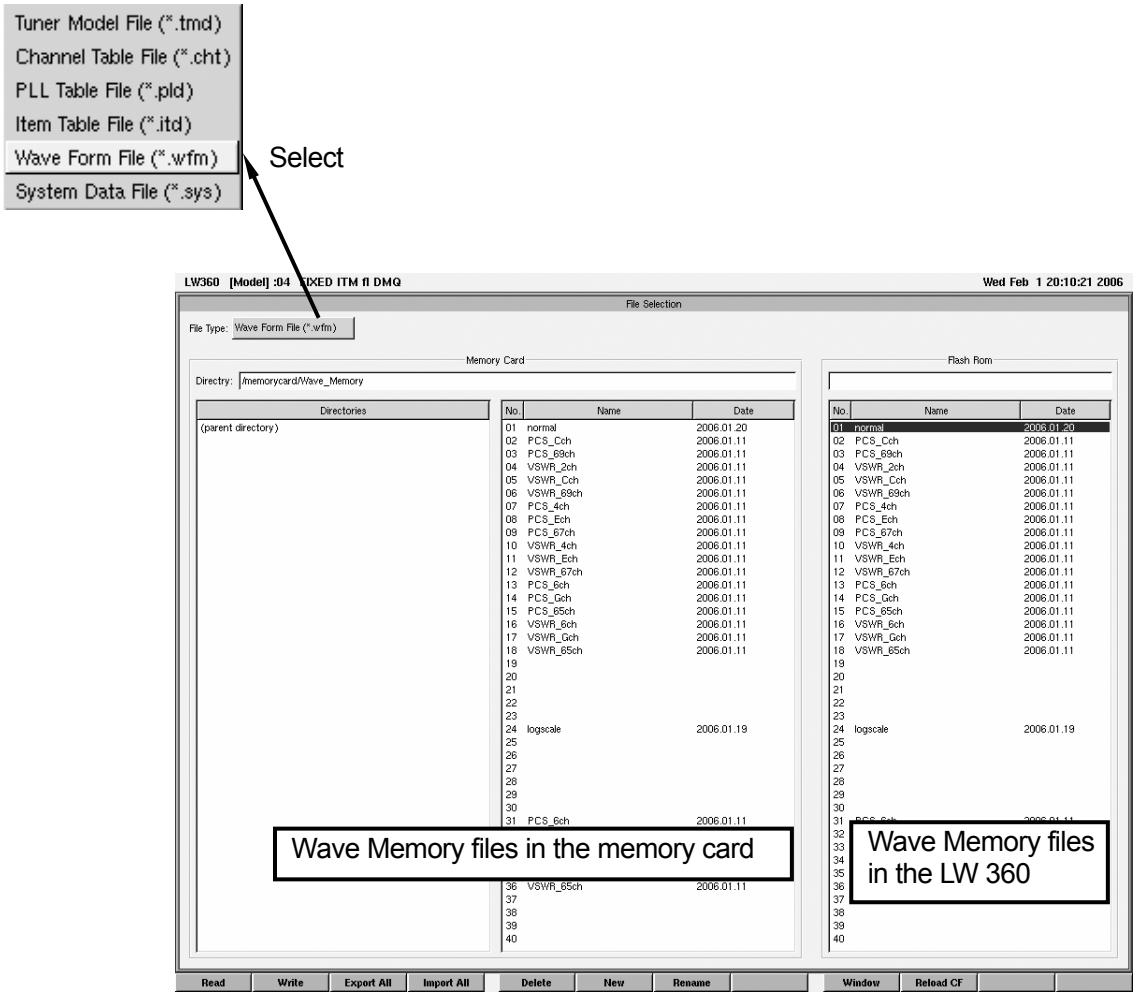
(2) Incorporation into the File System

The waveform memories can now be saved to a CF card or copied to other LW 360s through the File system.

You can edit the file by selecting Wave Form File from the File edit screen.

Each waveform is saved to a separate file. Up to 40 files can be save per directory.

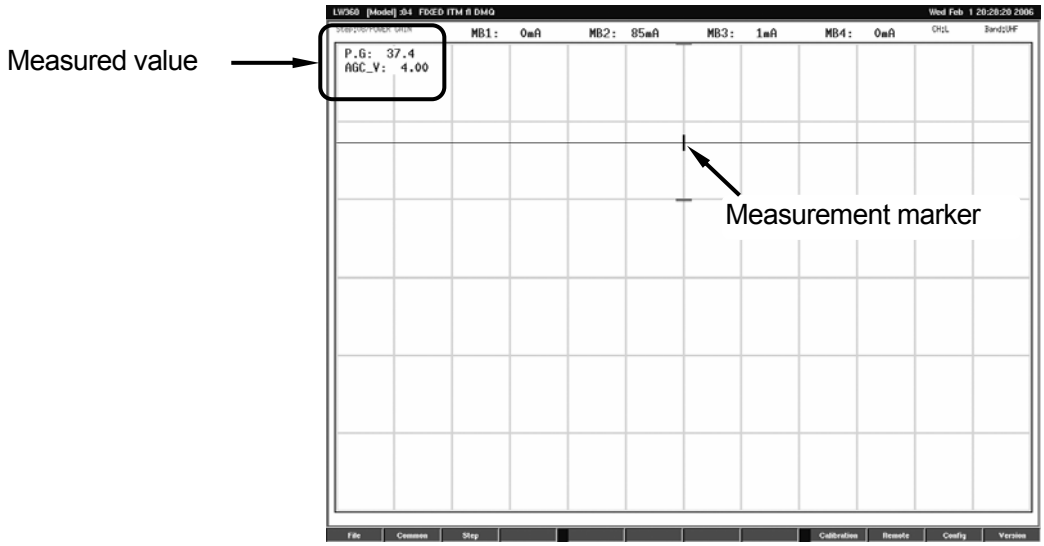
The method of editing the file is the same as with other files.



12.1.6 Additional Measurement Functions for CW

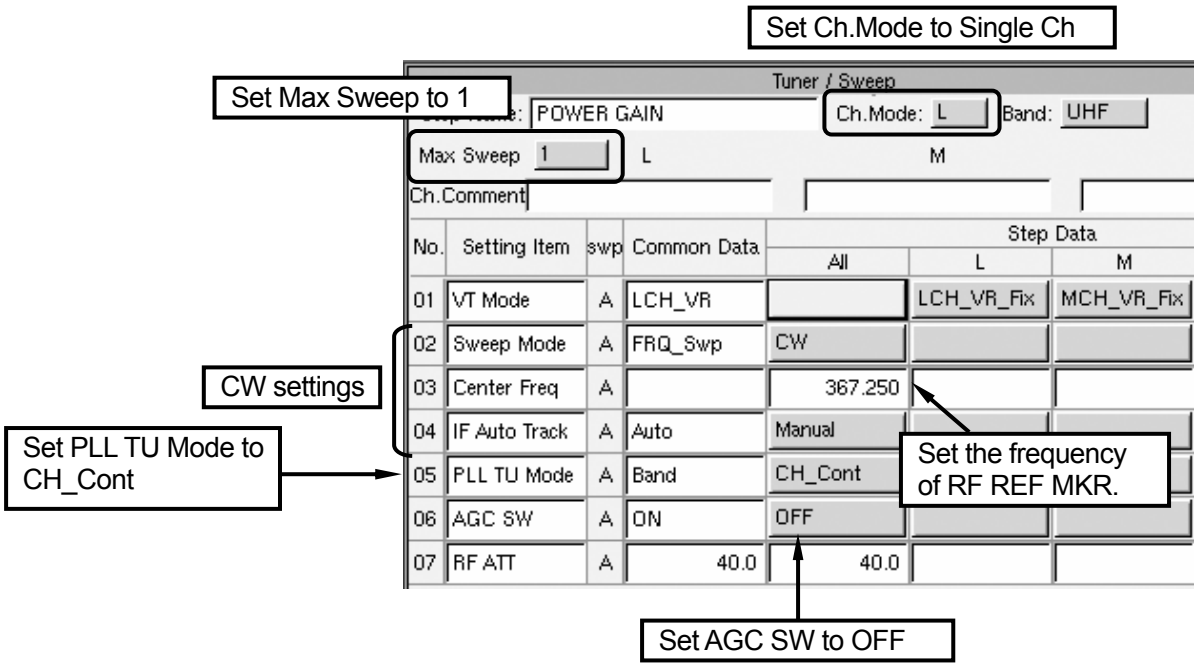
The power gain and AGC voltage can now be measured when the sweep mode is set to CW.

You can measure the power gain and AGC voltage that change according to the antenna input level when the AGC loop of the tuner is activated.



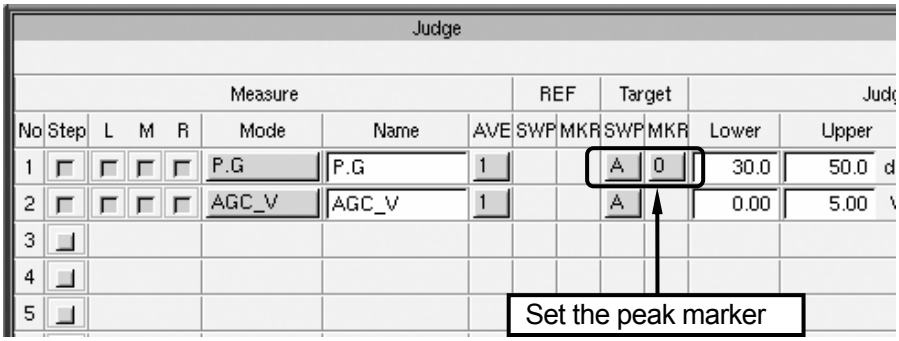
(1) Setup Example

a) Tuner/Sweep screen



- Because this setting does not allow IF Auto Tracking, the tuner PLL must be locked. Hence, set PLL TU Mode to CH_Cont.
- Set Max Sweep to 1, because measurement using multiple sweeps is not possible. In addition, set Ch.Mode to single sweep such as L, M, and R. Measurement is not possible for Dual and Triple.
- Set Center Freq of CW to the frequency of RF REF Marker (No. 1).

b) Judge Screen



- Because the frequency is a single frequency during CW measurement, the displayed waveform will be a line. Be sure to use the peak marker (marker number 0) to make measurements. The peak marker is displayed at the center of the waveform.

12.1.7 Addition of the System Data Copy Function

The Configuration items have been added to the File system. System settings such as the waveform color and All Scan settings can now be saved to a CF card or copied to other LW 360s.

(1) Stored Items

a) Settings That Can Be Stored

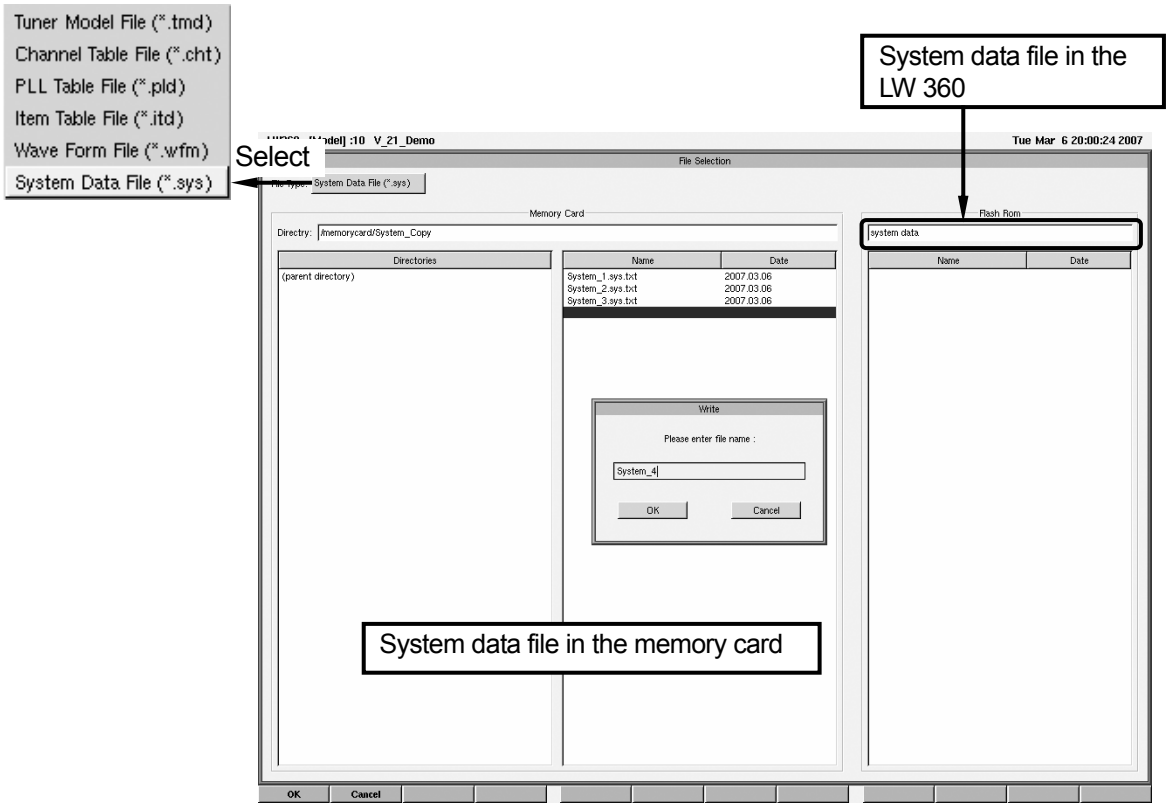
- F10 (Misc) setup data (excluding Output File Control. Version 2.2 and later)
- F9 (Appearance) setup data
- F8 (Printer) setup data
- F7 (RS232C) setup data

b) Data That Cannot Be Stored

The data below are specific to the LW 360 unit and cannot be copied externally.

- F5 (Basic) setup data
- F6 (Network) setup data
- F10 (Misc) setup data (Output File Control. Version 2.2 and later)

(2) Storage Procedure



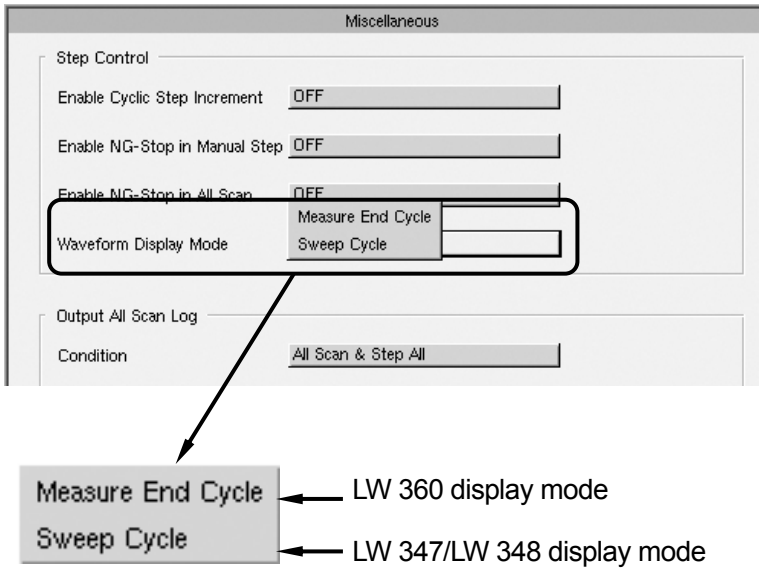
- Press F1 (File) to display the File edit screen. Then, select System Data File.
- Press F1 (Read) to read the directory of the destination memory card.
- Move the cursor to the file in which to save the data. To save to a new file, move the cursor below the last file in the list.
- Press F2 (Write) to save the data. For a new file, type the file name and press OK.
- To read a file from the memory card, select the file and press F1 (Read). Because only a single system data file can be stored in the LW 360, the file name on the Flash ROM is fixed to System Data.

12.1.8 Addition of Waveform Display Modes

A waveform display mode has been added. In addition to the display mode of the LW 360, the display mode of the LW 347/LW 348 (our predecessor model) is now selectable.

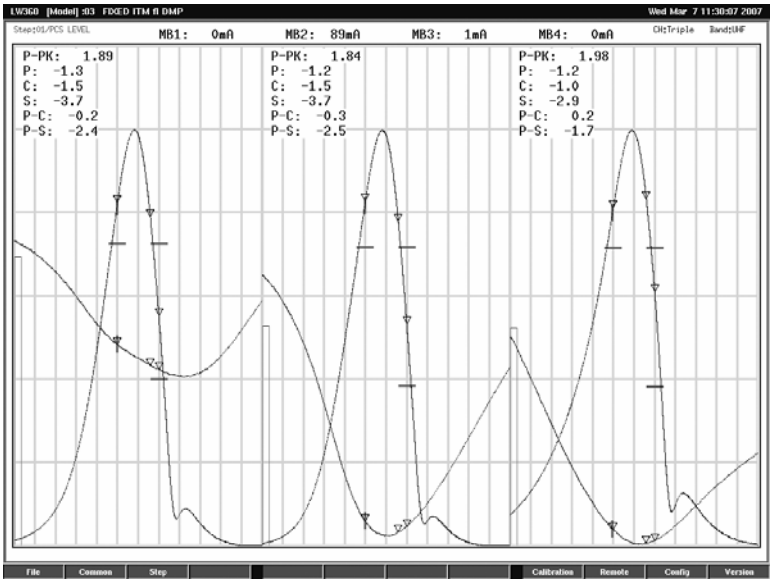
(1) Setup Procedure

- Press F11 (Config) followed by F10 (Misc) to display the Miscellaneous screen.
- Click the Waveform Display Mode button in the Step Control area and press Enter.



(2) Differences in the Display Modes

a) Display during Multiple Sweeps



- When measuring waveforms on L, M, and R (Triple) as shown above, the sweep is performed in the L, M, and R channel order. If sweeps A, B, and C are performed simultaneously on a channel, the sweep is performed in the following order: L channel A, B, C -> M channel A, B, C -> R channel A, B, and C. The calculation for the measured values is performed after each waveform sweep and shown on the display.

b) Differences in the Display Modes

The following two display modes are available.

Measure End Cycle

Sweep Cycle

- Measure End Cycle

  If the sweep is performed with Ch Mode set to Triple on the previous page, the sweep is performed in the L, M, and R order. However, the waveforms are displayed in the Wave screen at once after the last sweep is completed.

  This is the Measure End Cycle adopted by the LW 360.

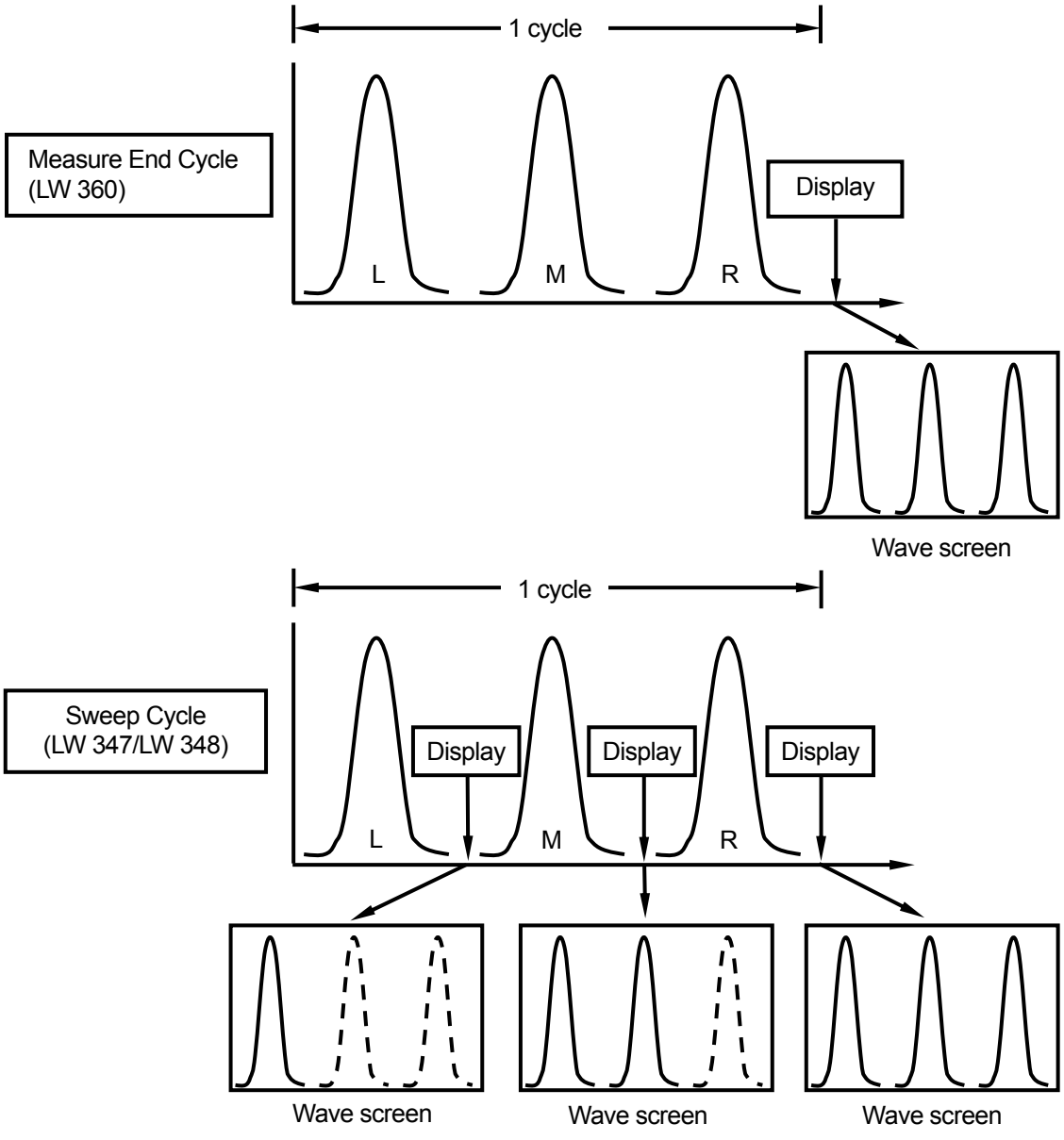
- Sweep Cycle

  This mode displays the waveform in the Wave screen when each sweep (L, M, and R) is completed.

  The predecessor model, LW 347/LW 348, employs this mode.

- Time of 1 Cycle

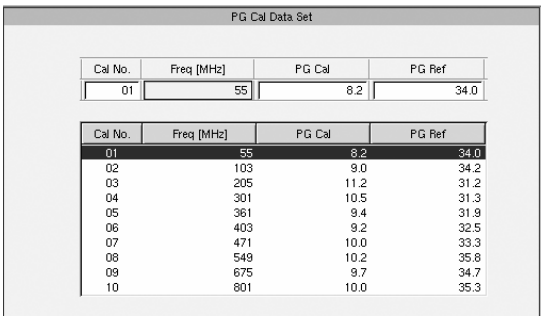
  In either mode, the time from when the sweep is started until the display is completed is the same.



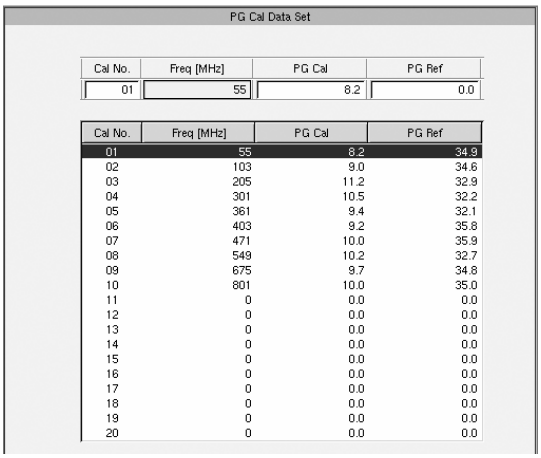
12.1.9 Expansion of the Number of P.G. Cal and NF ENR Values

The number of P.G. Cal and NF ENR values has been increased from 10 to 20. This allows calibration in more detail. If a tuner model created on an old version is recalled, up to 10 values are used.

Up to Ver.2.0



Ver.2.1 and later

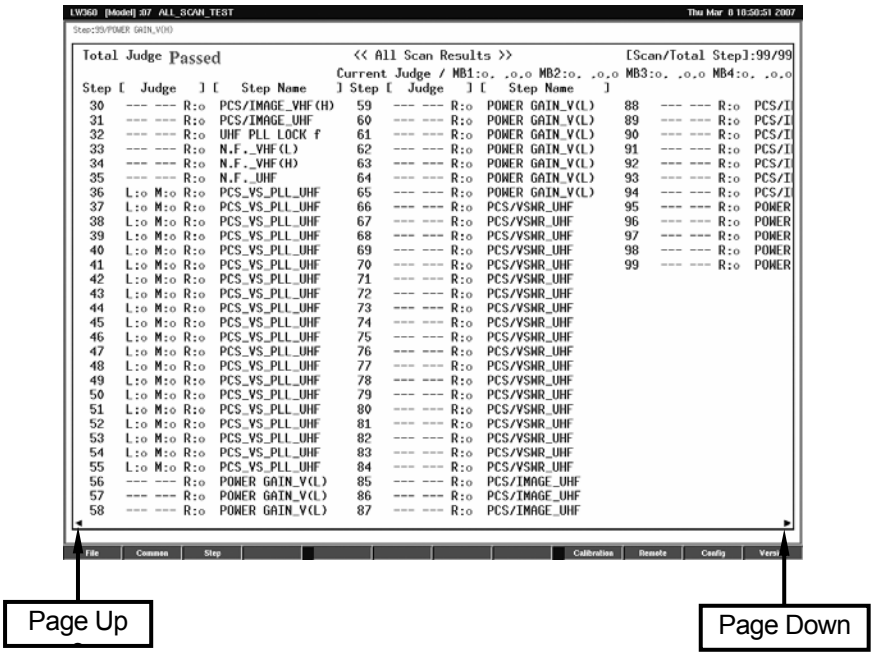


12.1.10 Software Improvement

(1) Character Size of the All Scan Result Display

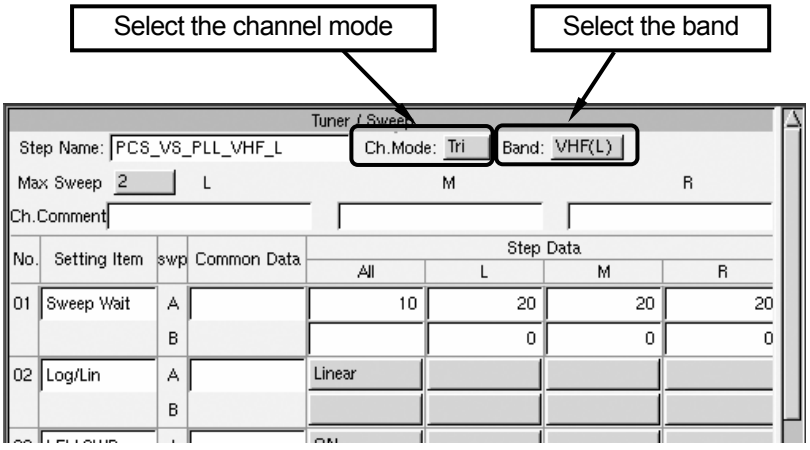
The character size of the All Scan result can now be changed according to the character size specified by changing F11 (Config) > F9 (Appearance) > String (measured data characters).

If increasing the character size causes the steps to overflow the screen, you can press Page Up and Page Down to scroll.



(2) Function for Setting Channel Mode and Band in the Step Edit Screen

The channel mode and band settings that were specified in the Step All screen of the Common edit screen can now be specified also in the Tuner/Sweep screen of the Step edit screen.



12.1.11 Changes and Additions to the Software

(1) Parameter Remote Function

a) Polarity of the Rotary Encoder

The polarity of the rotary recorder of the parameter remote has been inverted.
Increase counterclockwise to Increase clockwise

b) Variable Range Values

The upper and lower limits of the variable range setting can now be switched. This allows you to invert the polarity of the rotary encoder (increase counterclockwise) if you like.

(2) Change to the Mouse Pointer Position at Power On

The position of the mouse pointer that was shown in the center of the Wave screen at power-on has been changed to the upper right.

12.1.12 Software Fixes

(1) VSWR Ref

Fixed the problem that the VSWR Ref scale level and Judge line level were not matched.

(2) RF REF Marker of the Image Measurement Waveform

Fixed the problem that IF Tuning Freq × 2 were not added when the RF REF Marker frequency was measured using MKR. F during Image measurement.

(3) Step All Screen

Added the COM setting to channel mode in the Step All screen. Fixed so that the common setting specified in the Sweep/Marker screen can be used.

(4) Sweep/Marker Screen

Fixed the frequency resolution of IF Center from 0.002 MHz to 0.001 MHz.

(5) Appearance Setting

Fixed the problem that the frame line color of the judge indicator was set to the same color as the grid.

(6) All Scan Log

Fixed the problem that the IF Center frequency was displayed for the turning (IF) frequency in the All Scan Log output.

12.2 Version 2.2 and Later

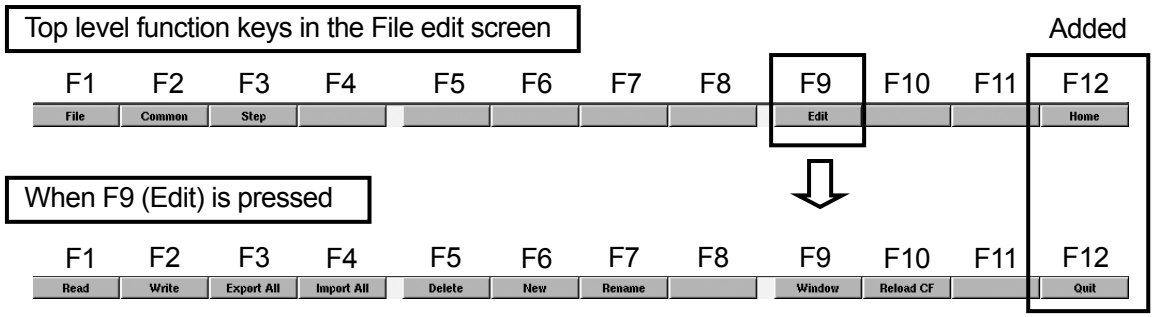
12.2.1 Changes to the Function Key Structure

In updating to version 2.2, the function key structure was changed to accommodate the new functions. Basically, the new functions have been assigned to unused function keys, but some function keys were modified to achieve consistency in the key procedure.

(1) Added Quit and Home Functions to the Function keys

The Quit key was assigned to F12 for all function key levels excluding the top level of the Wave screen. This key allows the function keys to be reverted back by one level. F12 in the File edit, Common, and Step edit screens has been set to the Home key. Pressing this function key switches the screen to the Wave screen. In the past, the Home key on the keyboard was used to switch to the Wave screen. Now, you can switch the screen using the mouse.

Example) When F9 (Edit) is pressed in the File edit screen

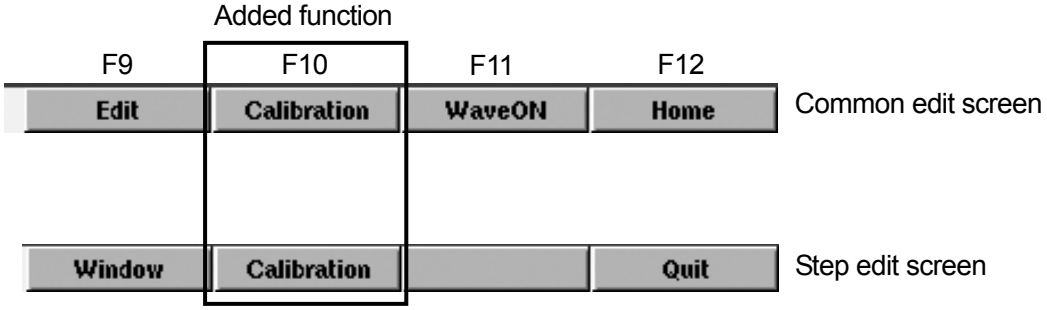


(2) Addition of the Calibration Key to the Edit Screen

A function has been added to allow you to move from the Common edit screen or Step edit screen directly to the Calibration screen. In the past, you had to return to the Wave screen once and move to the Calibration screen. This function key allows you to move to the Calibration screen in one key operation.

a) Setup

Press F10 (Calibration) in the Common edit screen or Step edit screen to move to the Calibration screen.



b) Notes

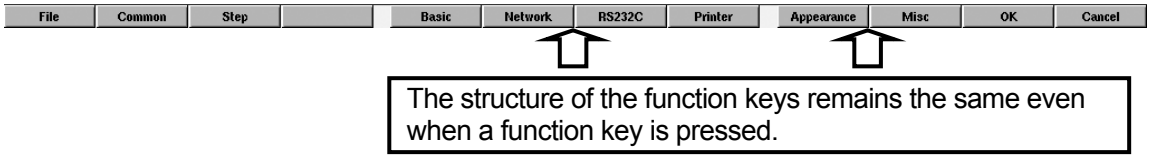
This function does not execute calibration in the edit screen but moves to the Calibration screen. To switch back to the edit screen, press F2 (Common) or F3 (Step).

(3) Hierarchical Changes in the Configuration Function Keys

The hierarchy of the functions of F11 (Config) has been rearranged. In addition, OK and Cancel in each screen were assigned to F11 (OK) and F12 (Cancel) up to version 2.1. However, to unify the keys with other OK and Cancel keys, they are now assigned to F1 (OK) and F2 (Cancel).

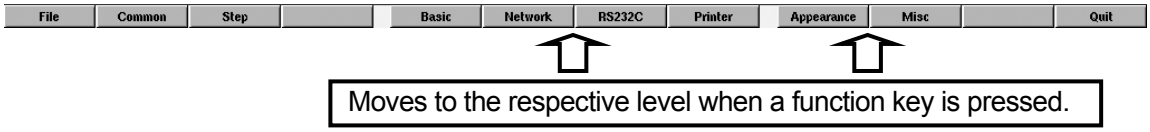
Before Ver.2.1

Function keys when F11 (Config) is pressed in the Wave screen

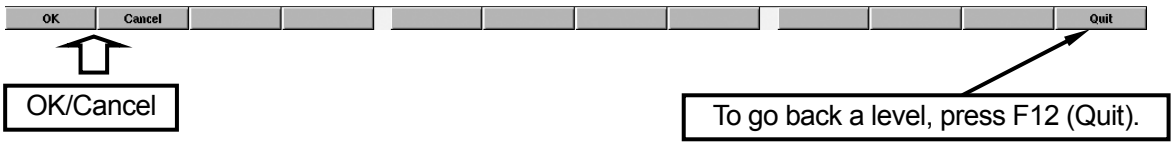


Ver.2.2 and later

Function keys when F11 (Config) is pressed in the Wave screen



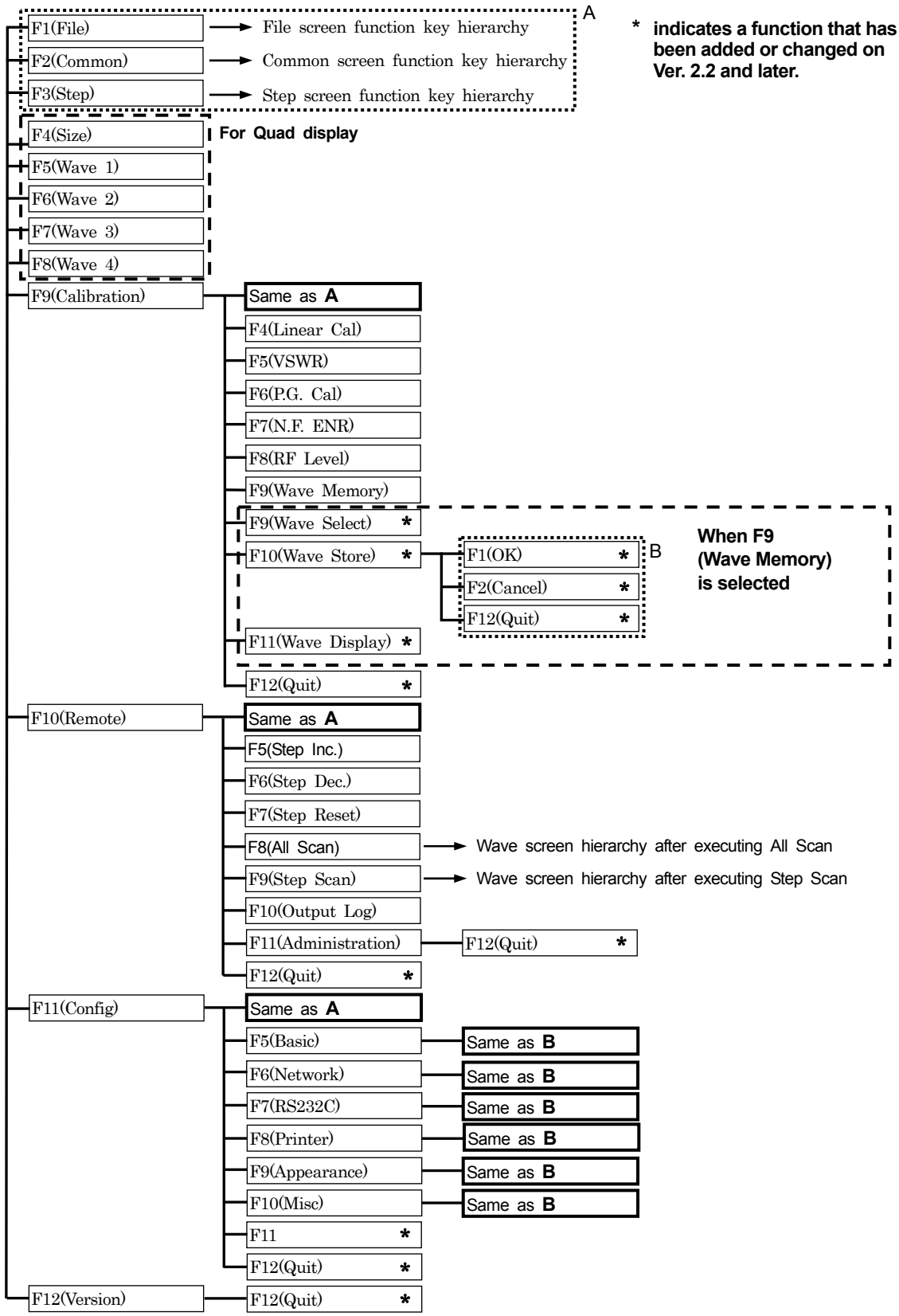
When any of the F5 to F10 key is pressed from the above condition



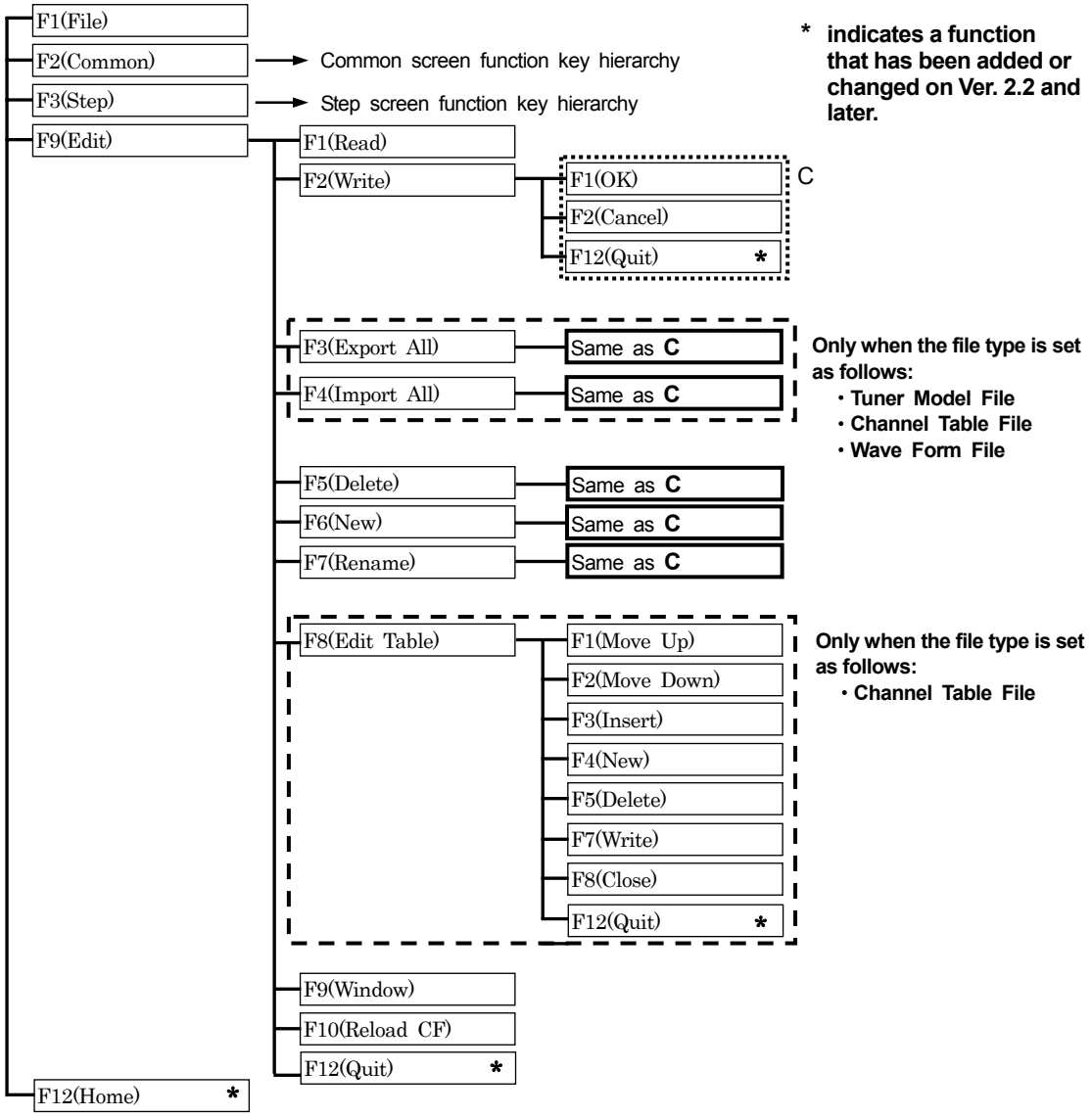
12.2.2 Function Key Hierarchy

The function key hierarchy for version 2.2 and later is given below.

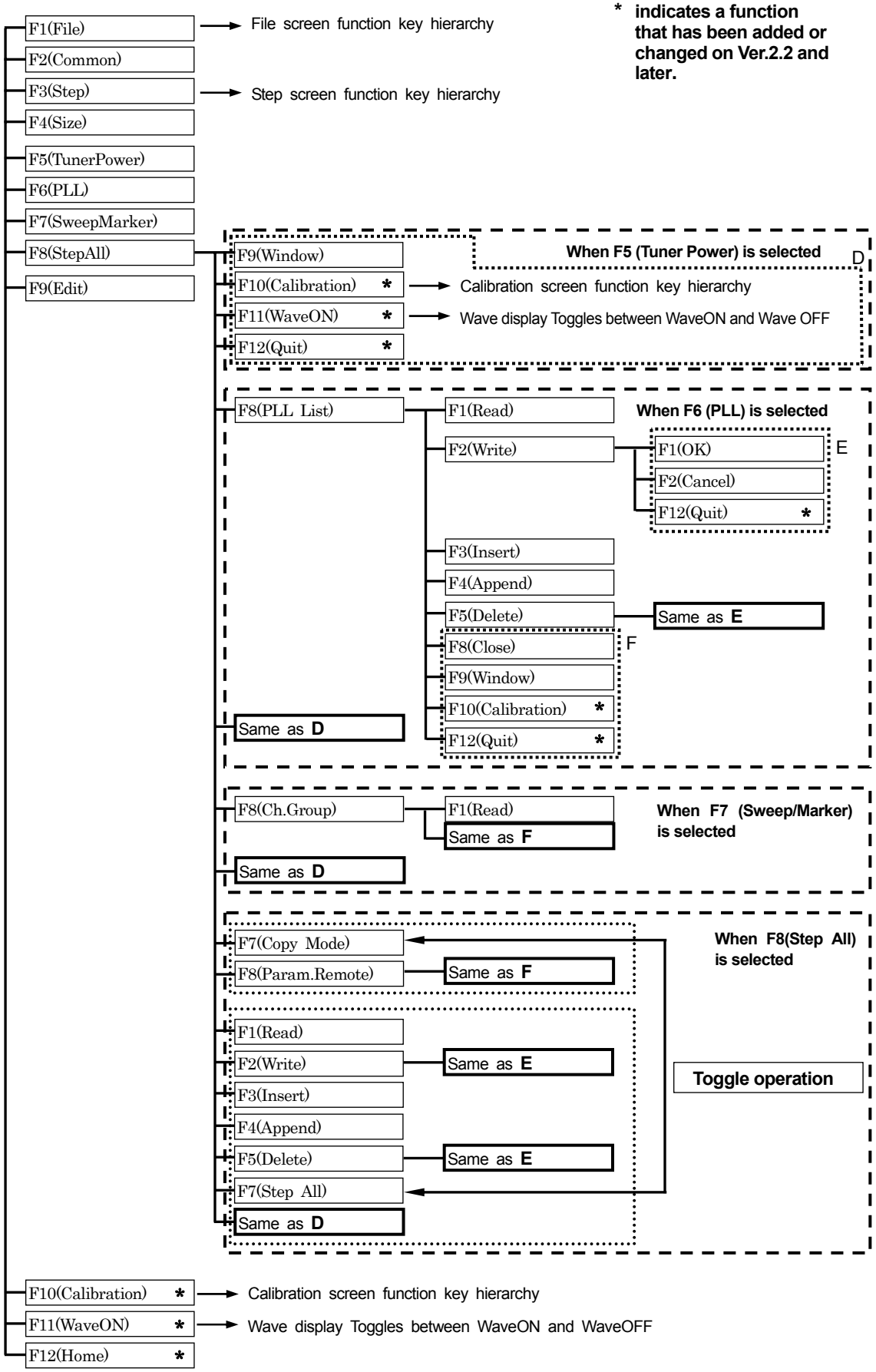
(1) Wave Screen Function Key Hierarchy



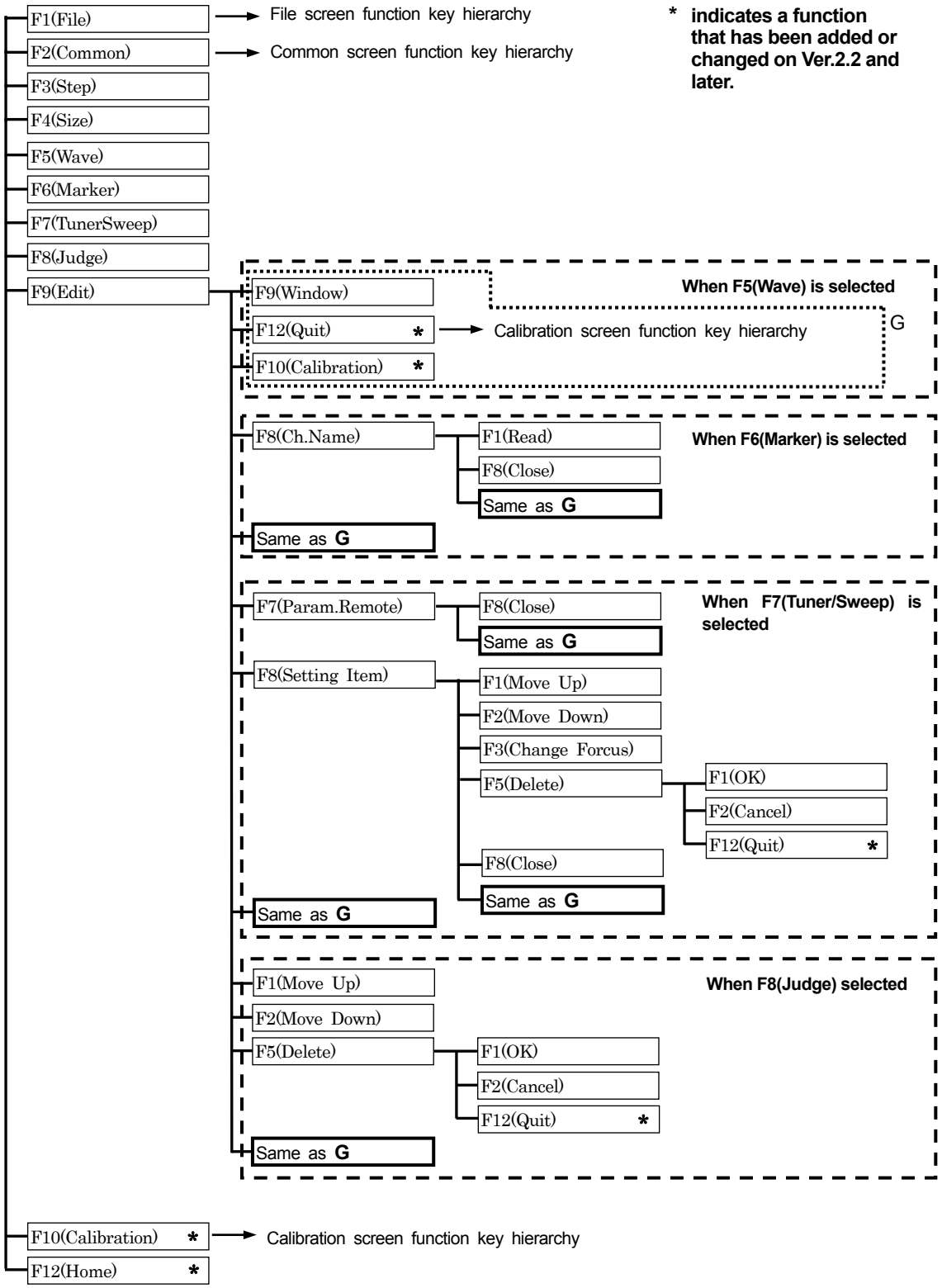
(2) File Edit Screen Function Key Hierarchy



(3) Common Edit Screen Function Key Hierarchy



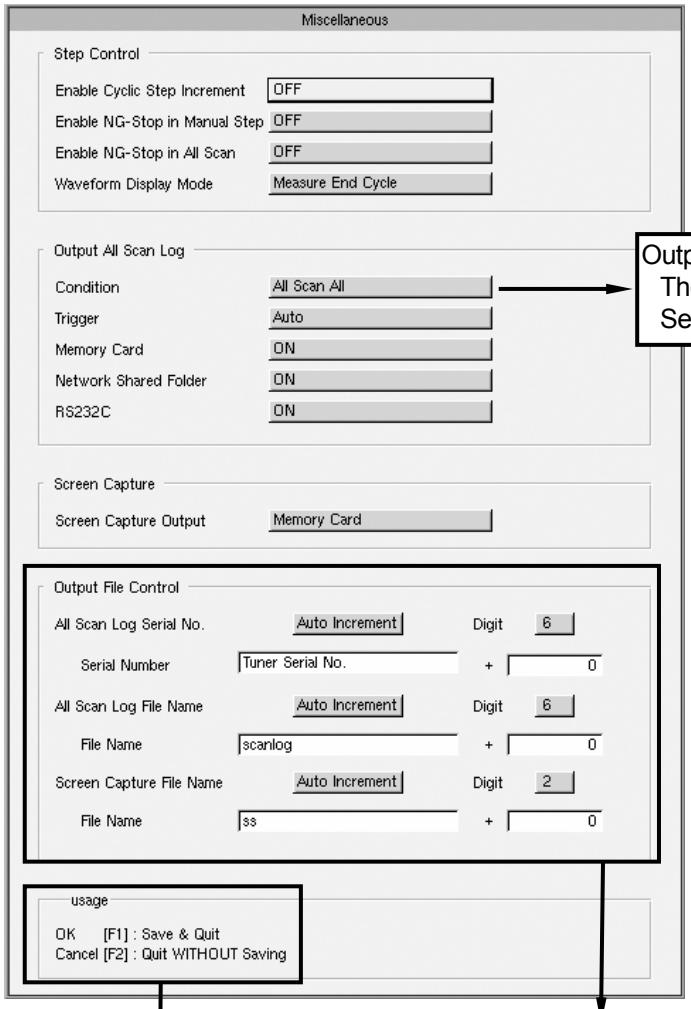
(4) Step Edit Screen Function Key Hierarchy



* **indicates a function that has been added or changed on Ver.2.2 and later.**

12.2.3 Changes to the Miscellaneous Screen

The Miscellaneous screen has been changed due to the addition of functions. For a description of how to use the new functions, see the section on the respective function. The Miscellaneous screen is displayed by pressing F11 (Config) followed by F10 (Misc).



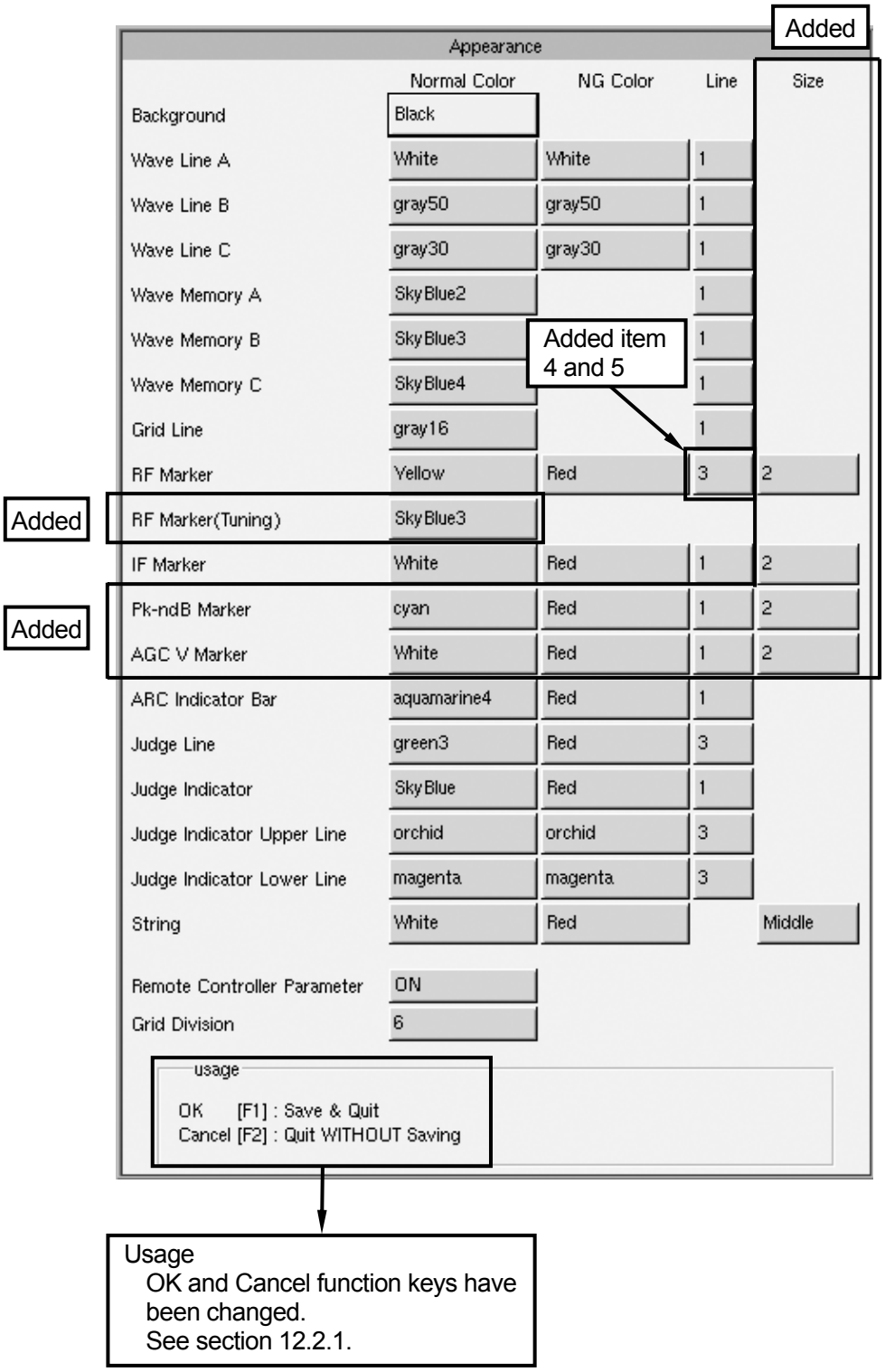
Output All Scan Log
The Condition setting has been added.
See section 12.2.12.

Usage
OK and Cancel function keys have been changed.
See section 12.2.1.

Output File Control
A function for displaying the output file name setting of the All Scan Log and screen copy and tuner unit number in All Scan log has been added.
See sections 12.2.9 to 11.

12.2.4 Changes to the Appearance Screen

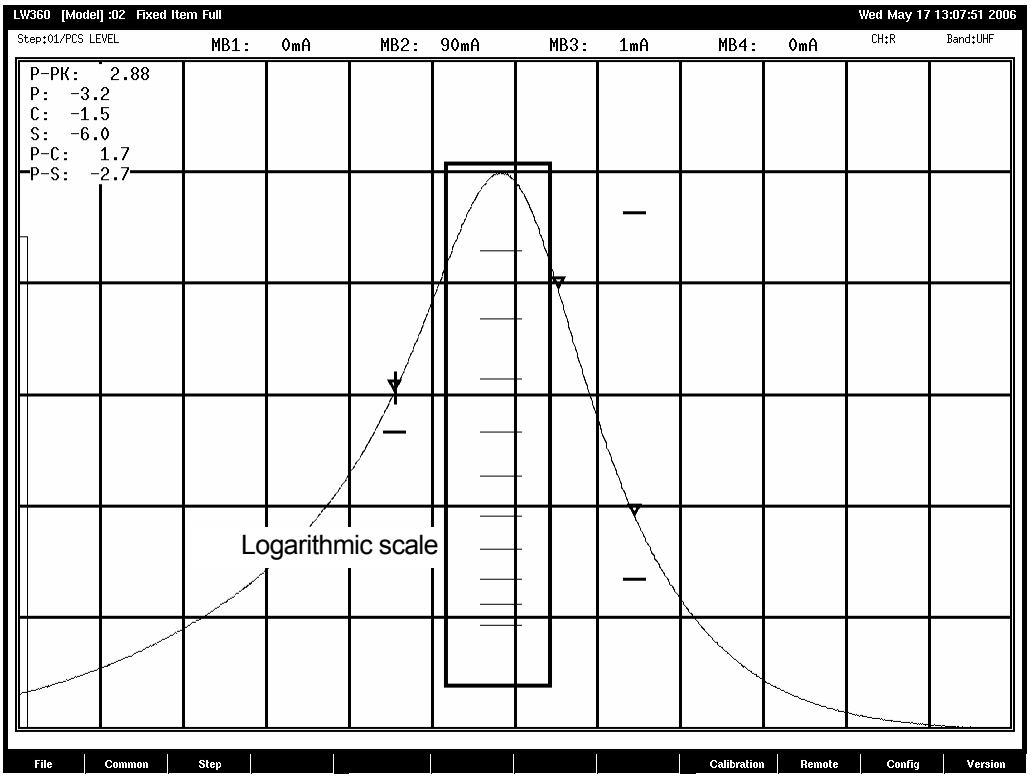
The size of various markers and the tuning color of the RF marker can be changed. See section 12.2.7.



12.2.5 Addition of the Logarithmic Scale Function of Linear Waveforms

A logarithmic scale can be added when measuring linear waveforms. The scale can be used for dB conversion estimation.

The range from the waveform peak to 10 dB is displayed.



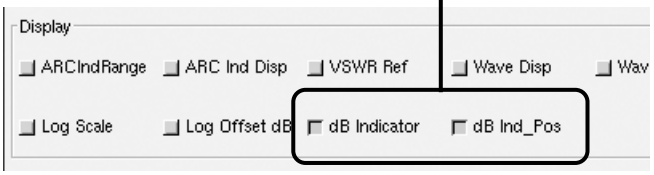
(1) Setup Procedure

a) Setting the Tuner/Sweep Screen

LEV SWP
Be sure to set the item to ON to use the logarithmic scale.

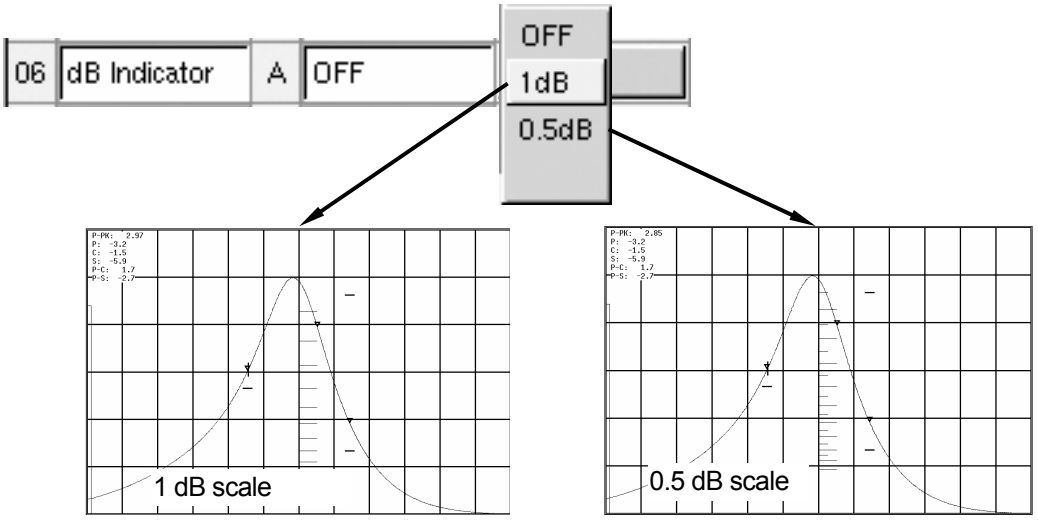
Setting Item
The dB Indicator and dB Ind_Pos of the Display area are added.

No.	Setting Item	swp	Common Data	Step Data All	Step Data L	
01	Sweep Wait	A		10		
02	Log/Lin	A		Linear		
03	LEV SWP	A		ON		
04	VT Mode	A	LCH_VR		LCH_VR_Fix	MCH
05	PLL TU Mode	A	Band	CH_Cont		
06	dB Indicator	A	OFF	1dB		
07	dB Ind_Pos	A	Peak	Peak		



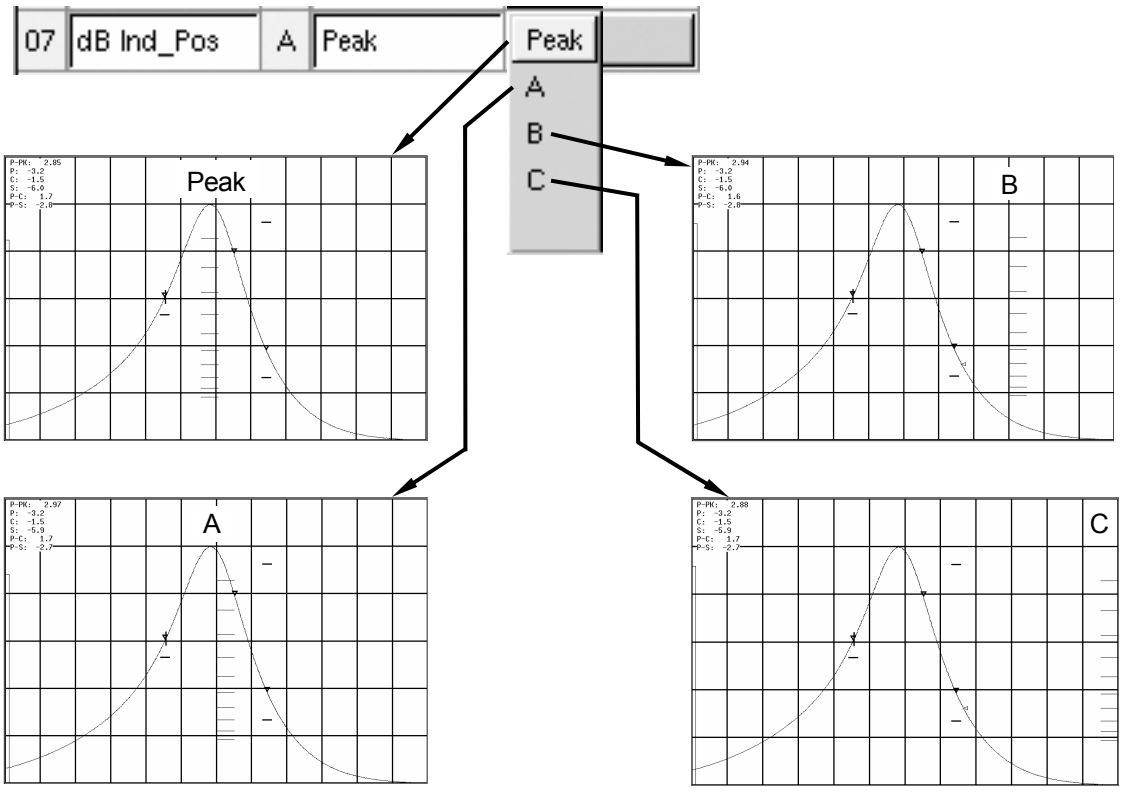
b) Display Scale Type

You can select two types of scales for the logarithmic scale: 1 dB or 0.5 dB.



c) Selecting the Scale Display Position

You can select the scale display position from Peak (waveform peak point), A (line at the center of the screen), B (center of the right half of the screen), and C (right side).



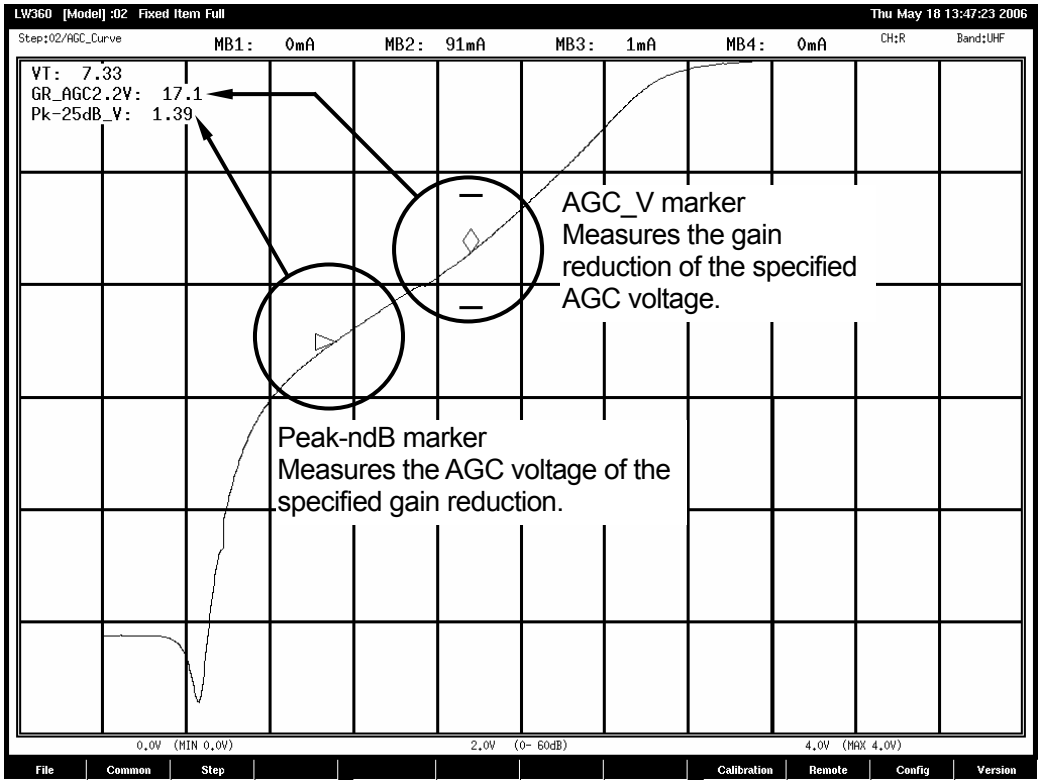
(2) Display When Using Dual or Triple

If the logarithmic scale is displayed when using Dual or Triple, the scale width is 1/2 or 1/3 the size as when Single is used.

12.2.6 Addition of the Marker Function for the AGC Curve

Markers can be set when measuring the AGC curve. This function is useful to analyze and acquire data on the AGC curve.

The RF/IF marker in normal waveform measurement is a frequency marker. However, the marker is a voltage marker on the AGC curve, because the parameter is voltage. The Peak-ndB marker has also been added for easy checking of the gain reduction.



(1) Addition of Markers

a) AGC_V Marker

A voltage marker dedicated to the AGC curve measurement. Measures the power gain or AGC gain reduction for the specified AGC voltage. The marker shape is a diamond.

AGC_V

b) Peak-ndB Marker

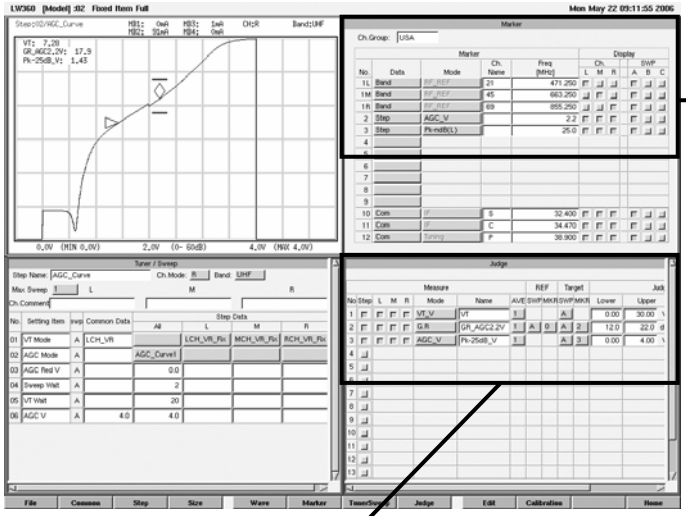
Pk-ndB(L) and Pk-ndB(R) are available. Each marker is used on either side (left or right) of the waveform peak.

Pk-ndB(L) is used for the AGC curve. The marker measures the AGC voltage when a gain reduction value is specified. In normal waveform measurement, independent gain difference settings can be assigned to the left and right markers with respect to the peak. The marker shape is an isosceles triangle facing sideways.

Pk-ndB(L)

Pk-ndB(R)

(2) Setup Example



• Judge Screen

Judge

	Measure						REF		Target		Judge			
No	Step	L	M	R	Mode	Name	AVE	SWP	MKR	SWP	MKR	Lower	Upper	Line	PO
1	☐	☐	☐	☐	VT_V	VT	1			A		0.00	30.00 V		
2	☐	☐	☐	☐	G.R	GR_AGC2.2V	1	A	0	A	2	12.0	22.0 dB	L/U	
3	☐	☐	☐	☐	AGC_V	Pk-25dB_V	1			A	3	0.00	4.00 V		
4	☐														
5	☐														
6	☐														

AGC gain reduction measurement setting
Measures the gain difference from the peak for AGC voltage of 2.2 V.

AGC voltage measurement setting
Measures the AGC voltage at 25 dB reduction from the peak.

• Marker Screen

Marker

Ch.Group: USA

	Marker				Display					
			Ch.	Freq	Ch.			SWP		
No.	Data	Mode	Name	[MHz]	L	M	R	A	B	C
1L	Band	RF_REF	21	471.250	☐	☐	☐	☐	☐	☐
1M	Band	RF_REF	45	663.250	☐	☐	☐	☐	☐	☐
1R	Band	RF_REF	69	855.250	☐	☐	☐	☐	☐	☐
2	Step	AGC_V		2.2	☐	☐	☐	☐	☐	☐
3	Step	Pk-ndB(L)		25.0	☐	☐	☐	☐	☐	☐
4										
5										

Set Marker2 to AGC_V and set Marker3 to Pk-ndB(L).

RF
IF
AGC_V
Pk-ndB(L)
Pk-ndB(R)
OFF

AGC_V marker (used for AGC_Curve)

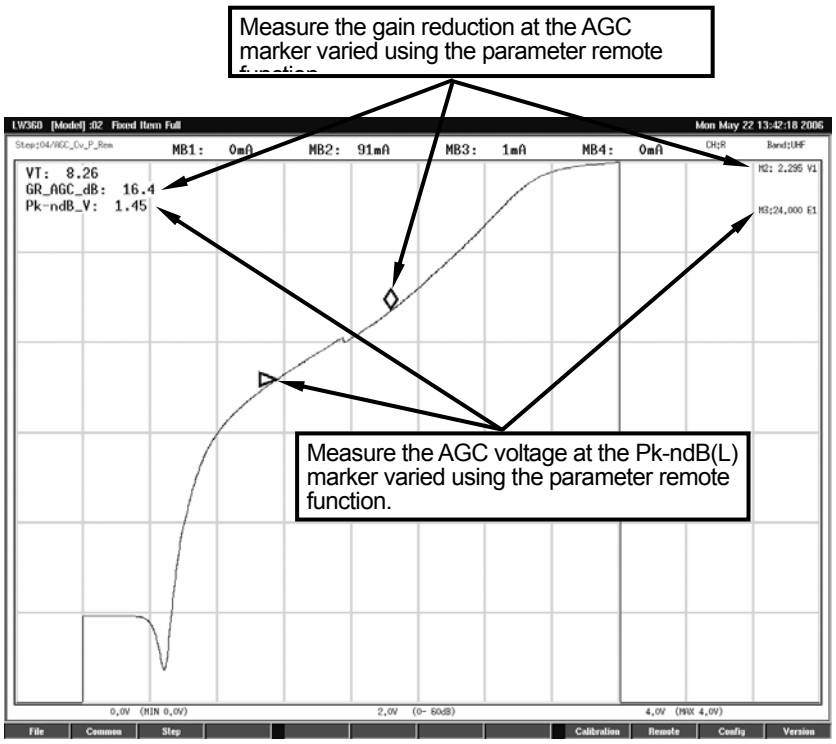
Peak-ndB(L) marker (used for AGC_Curve and normal waveform measurement)

Peak-ndB(R) marker (used for normal waveform measurement)

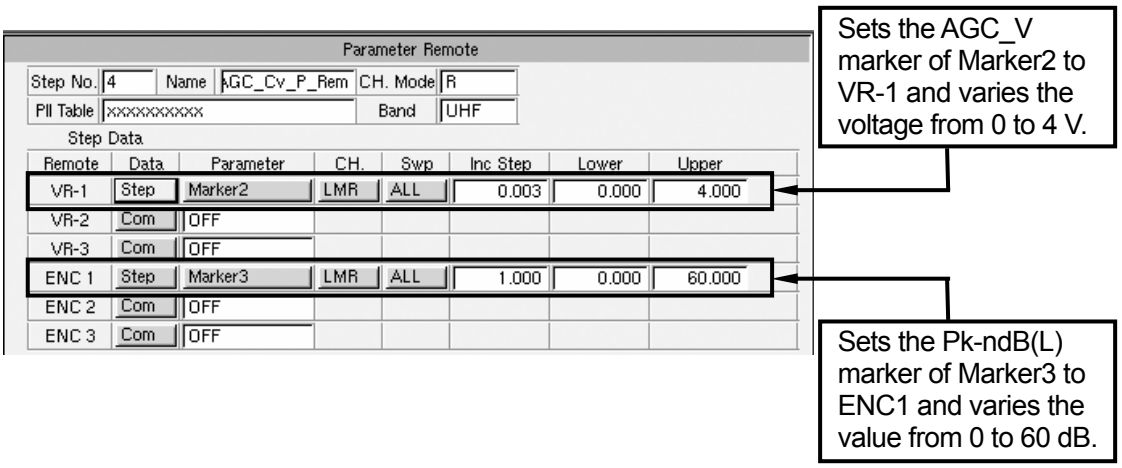
(3) Using Parameter Remote

The parameter remote function allows the marker to be moved smoothly to an arbitrary point.

a) Waveform Display When Using the Parameter Remote Function



b) Setup Example

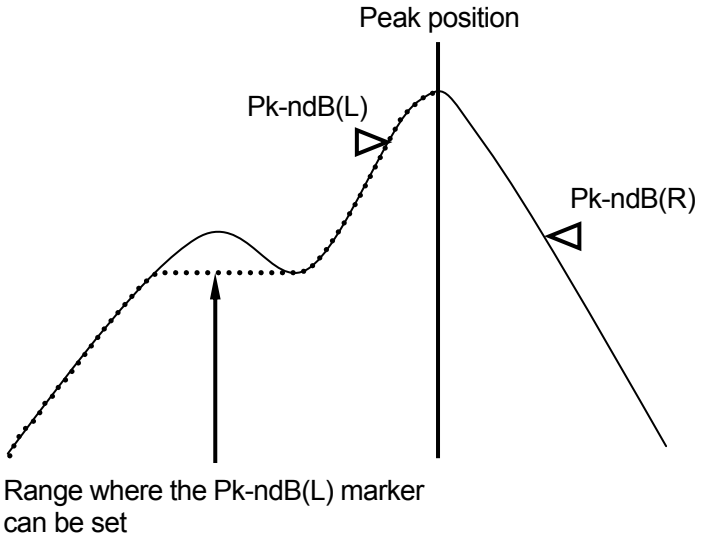


c) Parameter Remote Specifications When Using AGC_V or Pk-ndB Marker

Abbreviation	Parameter	Minimum Resolution	Selectable Range	Unit
M2	Marker2(AGC_V)	0.001	0.000 to 15.000	V
	Marker2(Pk-ndB)	0.001	0.000 to 99.900	dB
M3	Marker3(AGC_V)	0.001	0.000 to 15.000	V
	Marker3(Pk-ndB)	0.001	0.000 to 99.900	dB
M4	Marker4(AGC_V)	0.001	0.000 to 15.000	V
	Marker4(Pk-ndB)	0.001	0.000 to 99.900	dB

(4) Measurement of Pk-ndB(L) and (R) Markers

These markers can be set at an arbitrary gain position from the peak. However, if the waveform has a dip as shown below, the range of positions where the marker can be set from the peak is as shown by the dotted line.

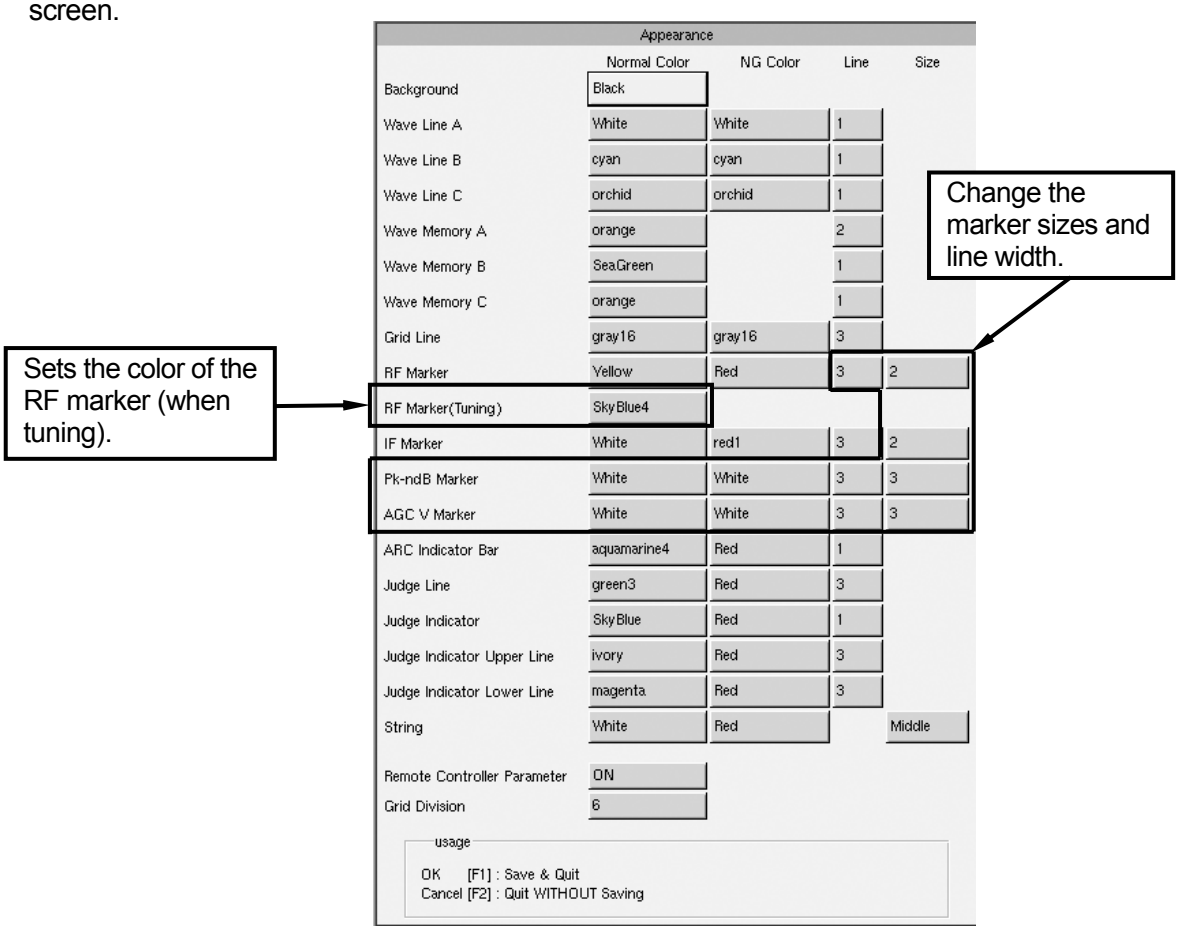


12.2.7 Addition of Functions for Changing the Marker Sizes and RF Marker Color

A function for changing the size of the RF, IF, AGC_V, and Pk-ndB markers has been added. The variable range of the line width of the RF marker has been expanded from 1 through 3 to 1 through 5. In addition, the color of the RF marker when it overlaps with the IF marker No.12 (Tuning) was blue. This color can now be changed.

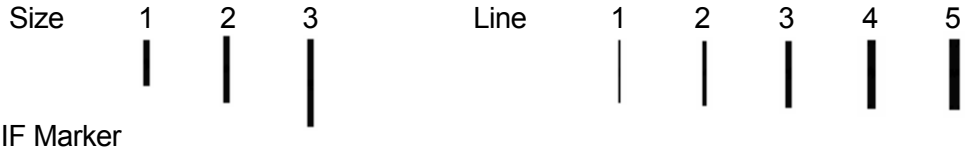
(1) Setup

Press F11 (Config) followed by F9 (Appearance) and change the settings in the Appearance screen.



(2) Marker Sizes and Line Width Comparison

a) RF Marker



b) IF Marker

c) AGC_V Marker

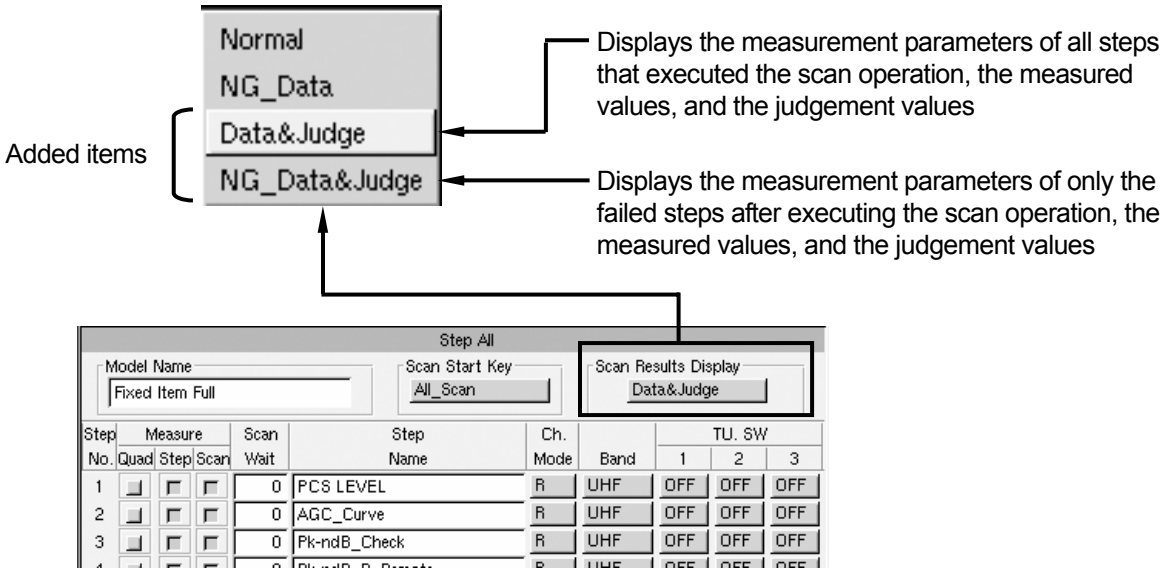
d) Pk-ndB Marker

12.2.8 Addition of a Function for Displaying the Upper and Lower Limits of Judgement in the All Scan Result

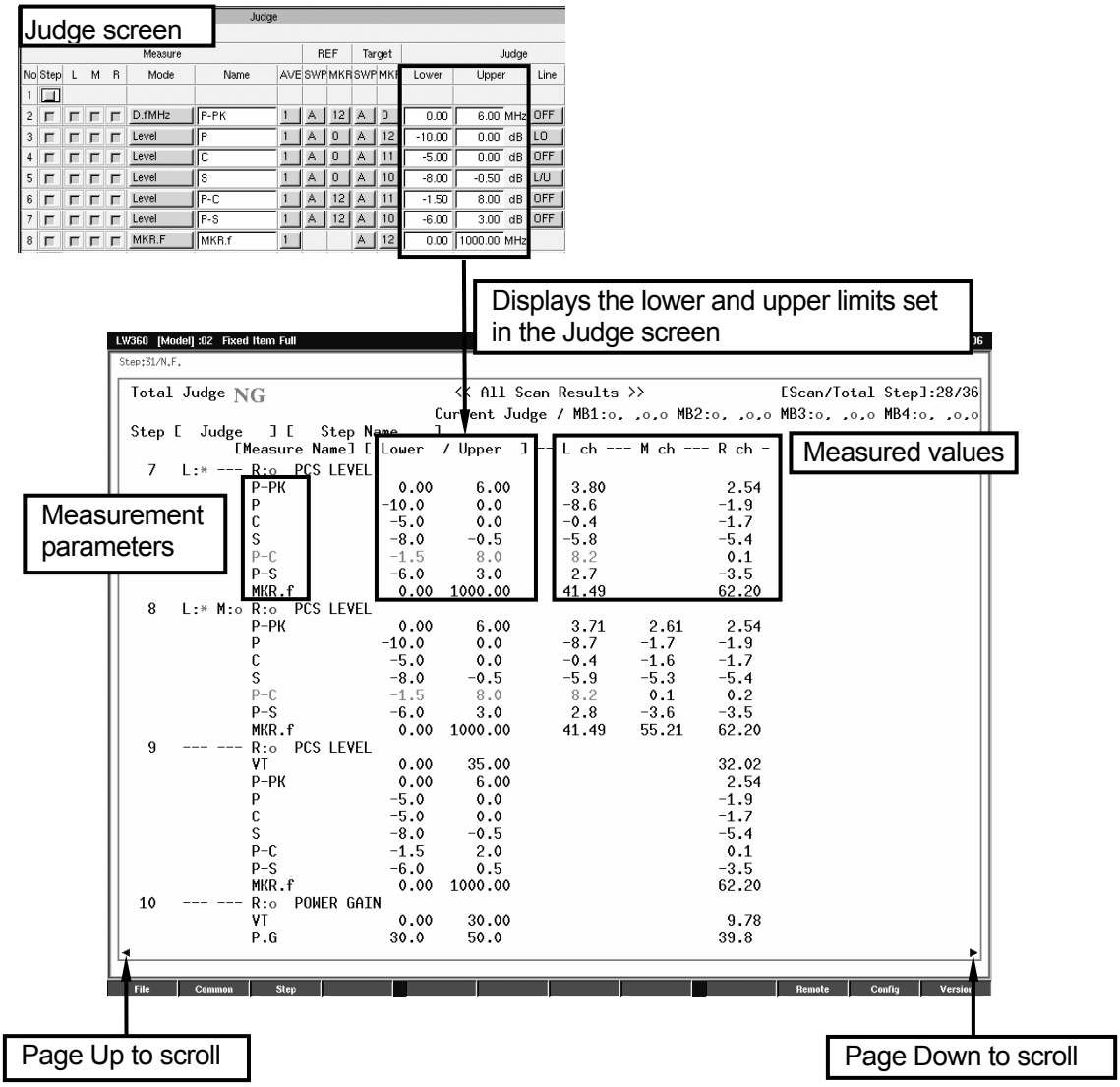
A function for displaying the upper and lower limits set in the Judge screen in the All Scan result display has been added.
This function is useful to check the data after All Scan.

(1) Setup

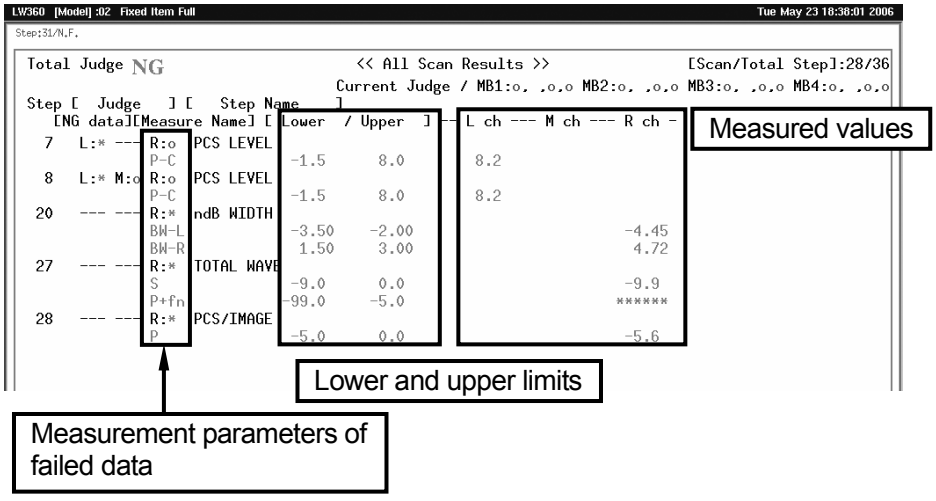
Items have been added to Scan Results Display in the Step All screen in the Common edit screen.
To display the data of all steps that executes the scan operation, select Data&Judge. To display only the failed items, select NG_Data&Judge.



(2) All Scan Result Screen When Data&Judge Is Selected

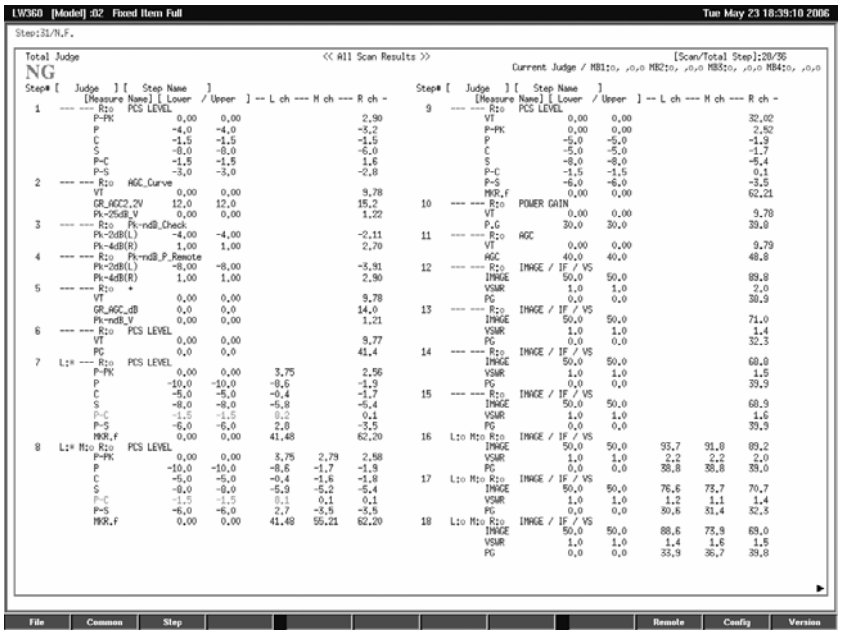


(3) All Scan Result Screen When NG_Data&Judge Is Selected

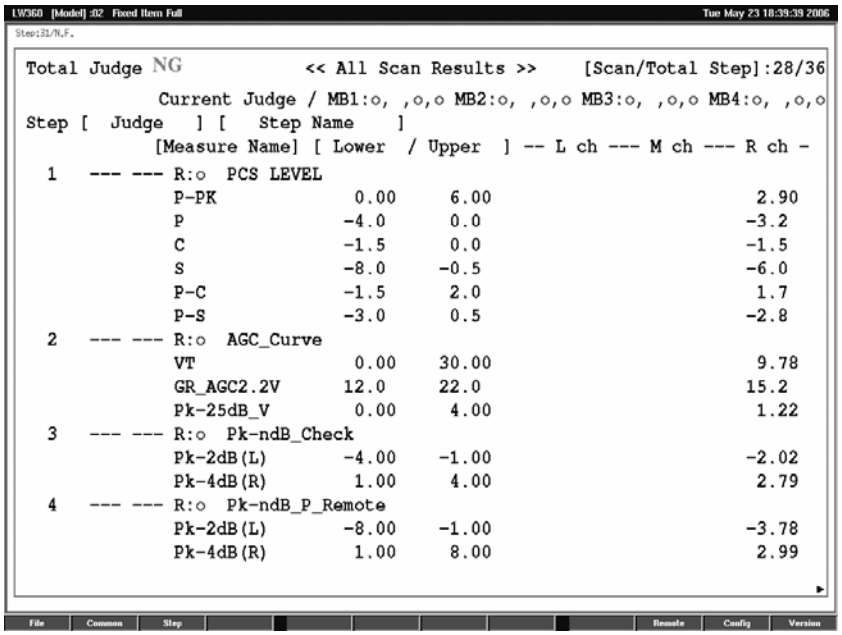


(4) Difference in the Display by Character Size

a) Display When the Character Size Is Small

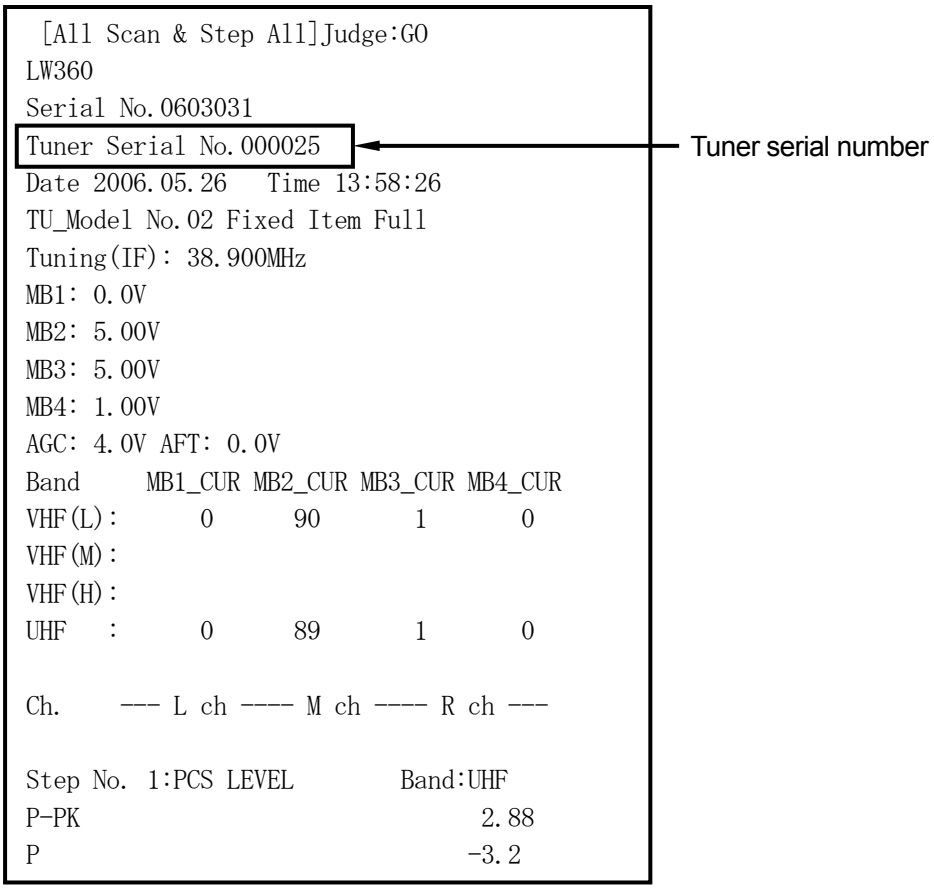


b) Display When the Character Size Is Large



12.2.9 Addition of a Function for Displaying the Tuner Serial Number in the All Scan Data

A function for displaying the tuner serial number in the All Scan output data has been added. This function is useful when attaching the data separately.



(1) Setting the Tuner Serial Number

You can set two types of tuner serial numbers.

a) Fixed Name

A fixed name is assigned. The same name is displayed each time All Scan is executed.

ABCDEFGHIJKLMNOP

Up to 16 characters

You can assign the fixed name using 16 alphanumeric characters.

b) Fixed Name + Number (Auto Increment)

The fixed name is the same as described above. The number section is incremented each time All Scan is executed.

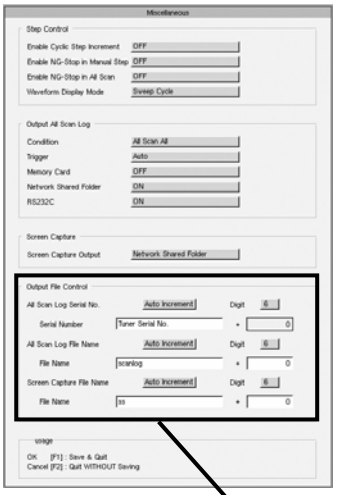
You can set up to 9 digits for the number.

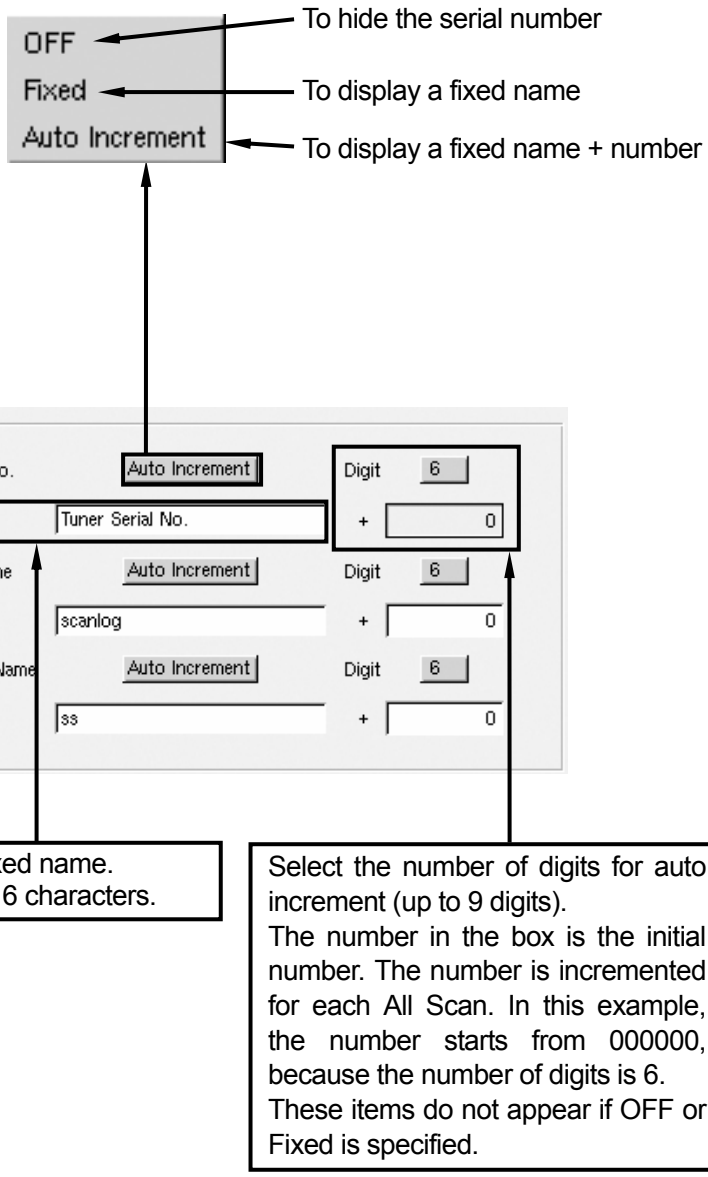
ABCDEFGHIJKLMNOP + 000000001

Up to 16 characters Up to 9 digits (incremented for each All Scan. The initial value can be set.)

(2) Setup

Press F11 (Config) followed by F10 (Misc) and set the items in the Miscellaneous screen.





12.2.10 Addition of a Function for Setting the All Scan Data Output File Name

A function for setting the output file name of the All Scan data has been added. This function is useful when editing the measured data.

(1) File Name Structure

The file name in the past was in the form "scanlog+date/time" as in scanlog_20060526_090310.txt. The file name can now be set as follows:

a) Fixed Name

A fixed file name is assigned. The data is overwritten to the same file each time All Scan is executed.

ABCDEFGHIJKLMNOP.txt
Up to 16 characters

You can assign the name using 16 alphanumeric characters. However, the following characters cannot be used.

SP " # $ % & ' ( ) * , / : ; < > ? [ ] ¥ ^ ` { } |

If you do not type any character, it is set to scanlog_.

b) Fixed Name + Date/Time

The date/time information is appended to the fixed name and saved as a file name. By default, the fixed name is set to scanlog_ (the same up to Ver. 2.1).

ABCDEFGHIJKLMNOP + 20060526 _ 090310.txt
Up to 16 characters — Date Time — Added automatically

The fixed name section can be assigned as described above.

c) Fixed Name + Number (Auto Increment)

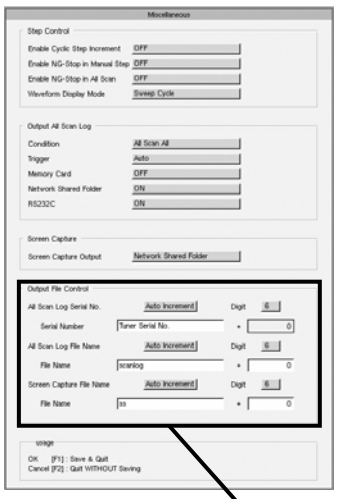
A number is appended to the fixed name and saved as a file name. The number is incremented each time All Scan is executed.

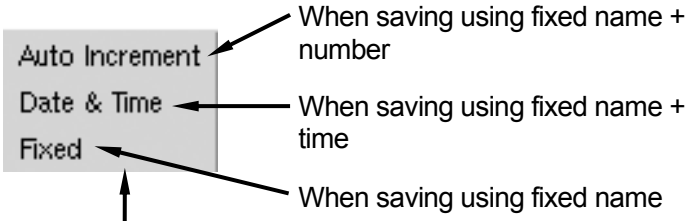
ABCDEFGHIJKLMNOP + 000000001.txt
Up to 16 characters — Up to 9 digits (incremented for each All Scan. The initial value can be set.)

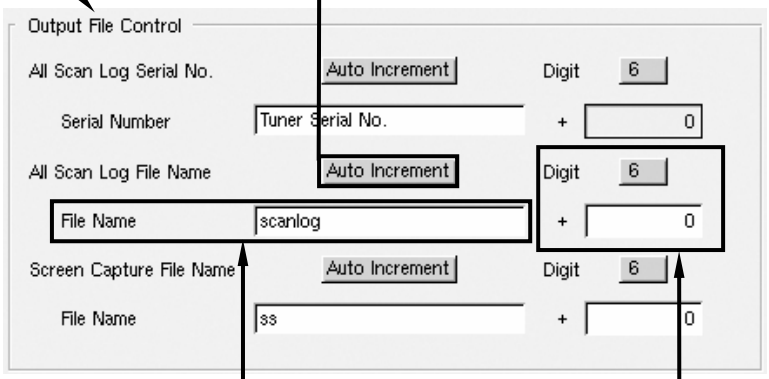
The fixed name section can be assigned as described above. You can set up to 9 digits for the number.

(2) Setup

Press F11 (Config) followed by F10 (Misc) and set the items in the Miscellaneous screen.







Type the fixed name.
Use up to 16 characters.

Select the number of digits for auto increment (up to 9 digits).
The number in the box is the initial number. The number is incremented for each All Scan. In this example, the number starts from 000000, because the number of digits is 6.
These items do not appear if Date & Time or Fixed is specified.

12.2.11 Addition of a Function for Setting the File Name to the Screen Image Hard Copy

A function for setting the output file name to the screen image hard copy has been added.

(1) File Name Structure

The file name in the past was in the form "ss+sequence number" as in ss000005.bmp. The file name can now be set as follows:

a) Fixed Name

A fixed file name is assigned. The data is overwritten to the same file each time a screen image hard copy is executed.

ABCDEFGHIJKLMNOP.bmp

Up to 16 characters

You can assign the name using 16 alphanumeric characters. However, the following characters cannot be used.

SP " # $ % & ' ( ) * , / : ; < > ? [ ] ¥ ^ ` { } |

If you do not type any character, it is set to ss_.

b) Fixed Name + Date/Time

The date/time information is appended to the fixed name and saved as a file name. By default, the fixed name is set to ss_ (the same up to Ver. 2.1).

ABCDEFGHIJKLMNOP + 20060526 _ 090310.bmp

Up to 16 characters — Date Time — Added automatically

The fixed name section can be assigned as described above.

c) Fixed Name + Number

A number is appended to the fixed name and saved as a file name. By default, the fixed name is set to ss_ (the same up to Ver. 2.1). The number is incremented each time a screen image hard copy is executed.

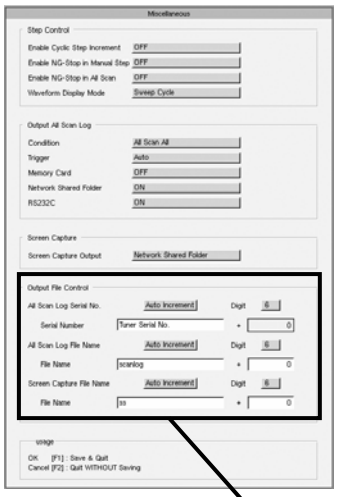
ABCDEFGHIJKLMNOP + 000000001.bmp

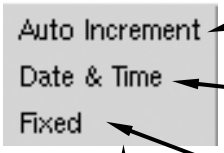
Up to 16 characters Up to 9 digits (incremented for each screen image hard copy.)

The fixed name section can be assigned as described above. You can set up to 9 digits for the number.

(2) Setup

Press F11 (Config) followed by F10 (Misc) and set the items in the Miscellaneous screen.

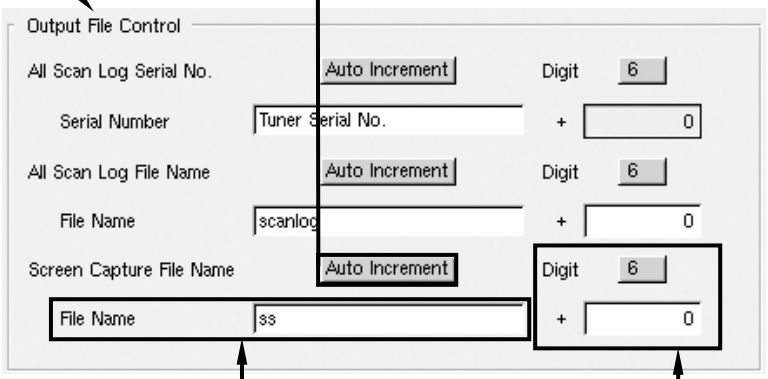




When saving using fixed name + number

When saving using fixed name + time

When saving using fixed name



Type the fixed name.
Use up to 16 characters.

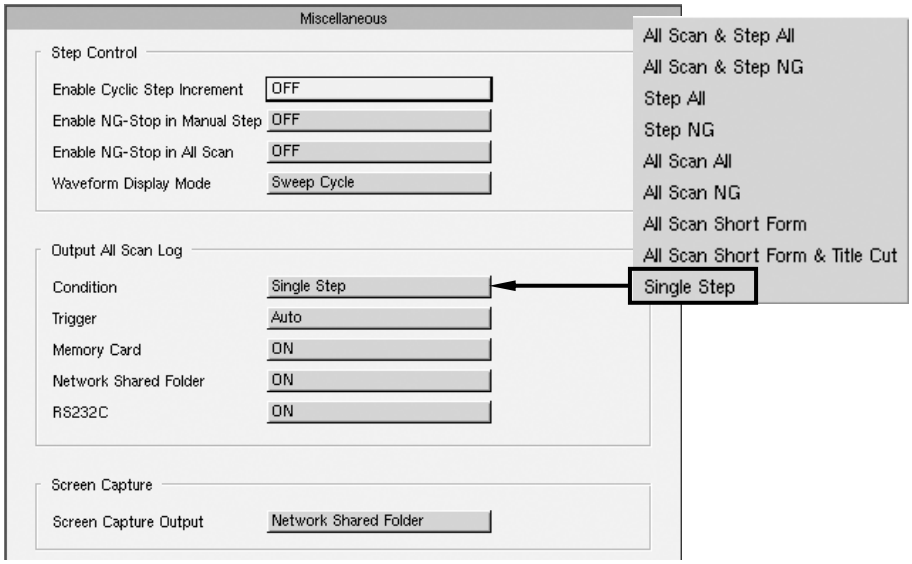
Select the number of digits for auto increment (up to 9 digits).
The number in the box is the initial number. The number is incremented for each screen image hard copy. In this example, the number starts from 000000, because the number of digits is 6.
These items do not appear if Date & Time or Fixed is specified.

12.2.12 Addition of a Data Output Command for Step Measurement

This function outputs only the measured data of the step that is being measured. A file is output by operating the function keys. The file is stored in the Network Shared Folder or the memory card in the same manner as All Scan. You can also request data output at the step level using a remote command. For Quad display, the data of the four steps being measured is output.

(1) Setup

Press F11 (Config) followed by F10 (Misc) and set the items in the Miscellaneous screen. Set Condition under Output All Scan to Single Step.



(2) Output Procedure

a) Data File Output Using Function Keys

On the Wave screen, press F10 (Remote) followed by F10 (Output Log) to output the file. You can also output the data to a file using the S37 matrix key (232C STEP DATA OUT) of the REMOTE connector on the rear panel.

b) Output Using a Remote Command

Send the AS0 CR/LF (All Scan data output request) via TELNET or RS232C to output the measured data.

(3) Output Example

a) For Step Output

```
[Single Step]
LW360
Serial No.0603031
Date 2006.06.01   Time 09:15:49
TU_Model No.02 Fixed Item Full
Band   MB1_CUR MB2_CUR MB3_CUR MB4_CUR
VHF(L):   0       83       1       0

Ch.     --- L ch ---- M ch ---- R ch ---

Step No. 8:PCS LEVEL          Band:VHF(L)
P-PK            3.78      2.67      2.58
P              -8.9      -1.7      -1.9
C              -0.3      -1.6      -1.8
S              -6.0      -5.4      -5.5
P-C             8.6       0.1       0.1
P-S             2.9      -3.6      -3.6
MKR.f         41.46     55.21     62.20
```

Measured data of a single step

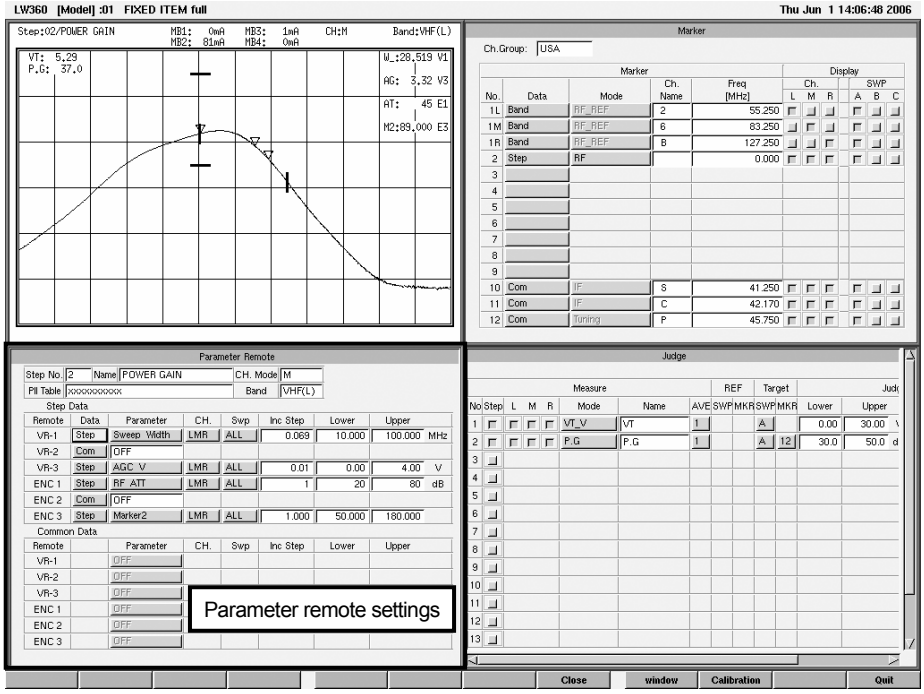
b) For Quad Output

```
[Single Step]
LW360
Serial No.0603031
Date 2006.06.01   Time 09:44:51
TU_Model No.02 Fixed Item Full
Band     MB1_CUR MB2_CUR MB3_CUR MB4_CUR
VHF(L):      0      83       1       0
VHF(H):      0      83       1       0
UHF   :      0      81       1       0

Ch.     --- L ch ---- M ch ---- R ch ---

Step No.16:IMAGE / IF / VS  Band:VHF(L)
IMAGE         92.0      91.4      89.0
VSWR           2.3       2.3       2.0
PG            39.0      39.0      39.1

Step No.17:IMAGE / IF / VS  Band:VHF(H)
IMAGE         78.0      74.7      71.2
VSWR           1.3       1.1       1.5
PG            30.6      31.4      32.3

Step No.18:IMAGE / IF / VS  Band:UHF
IMAGE         88.8      73.9      68.9
VSWR           1.5       1.6       1.5
PG            34.0      36.7      39.8

Step No.19:IMAGE / IF / VS  Band:UHF
IMAGE         88.8      73.8      68.8
VSWR           1.4       1.7       1.5
PG            33.8      36.6      39.7
```

Measured data of 4 steps

12.2.13 Addition of a Function for Setting the Parameter Remote Function from the Step Edit Screen

A function for editing the parameter remote settings from the Step edit screen has been added. You can specify the settings while viewing the waveform in steps.



(1) Setup

Press F7 (Tuner Sweep) in the Step edit screen and activate the Tuner/Sweep screen.
Press F9 (Edit) followed by F7 (Param.Remote) to display a parameter remote setup screen in the Tuner/Sweep screen position.

(2) Notes

- When setting the parameter remote function in the Step edit screen, you cannot set common data. To set the common data, set the parameter remote function from the Step All screen in the Common edit screen.
- If you activate another screen while setting the parameter remote function, the parameter remote screen automatically closes and returns to the Tuner/Sweep screen.

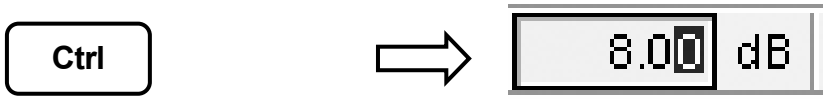
12.2.14 Addition of an Increment and Decrement Function for Values

A function for incrementing or decrementing values using the Ctrl, up, and down keys on the keyboard has been added. This function is useful when setting limits while viewing the waveform.

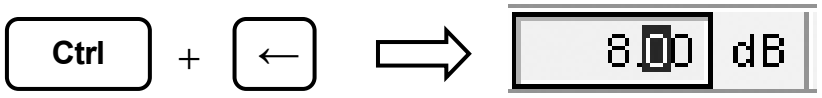
(1) Procedure

- Move the cursor to the item you wish to change the value.

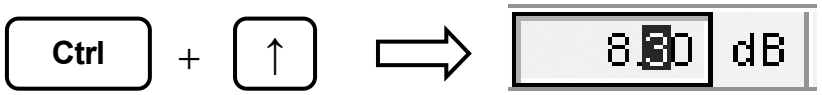
- Press the Ctrl key. The lowest digit is highlighted.



- While holding down the Ctrl key, press the ← or → key to move the highlighted digit.



- While holding down the Ctrl key, press the ↑ or ↓ key to increment or decrement the value.

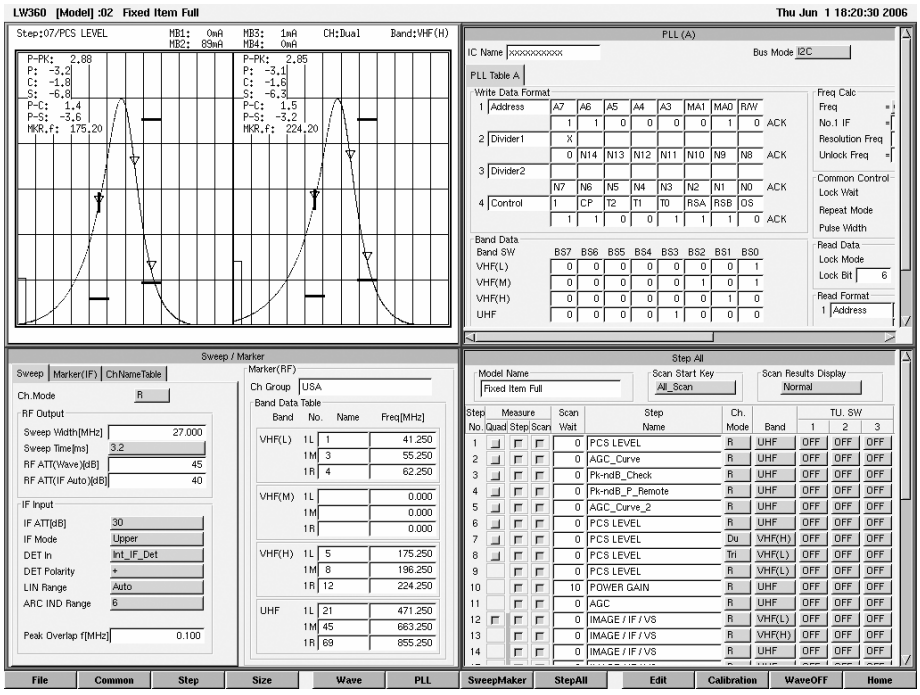


(2) Notes

- If you release the Ctrl key, you can no longer increment or decrement the value using the ↑ or ↓ key. However, if you do not move the cursor, the highlighted digit is maintained. Therefore, you can hold down the Ctrl key again to change the value.
- If you hold down the ↑ or ↓ key, the value of that digit is incremented or decremented continuously. If the limit is reached, the value is set to the limit value.

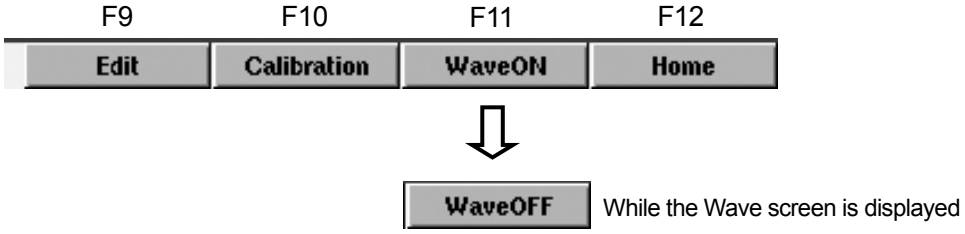
12.2.15 Addition of the Wave Display Function in the Common Edit Screen

A function for displaying the Wave screen in the Common edit screen has been added. You can view the waveform while you specify the common settings. You can display the Wave screen in an arbitrary position.



(1) Setup Procedure

- Press F11 (Wave ON) in the Common edit screen to display the Wave screen in the activated position. In the example above, the Wave screen is displayed in the Tuner Power screen position. The F11 function key displays Wave OFF while the Wave screen is displayed. Pressing this key closes the Wave screen and returns the original edit screen.



(2) Function

- If the Wave screen is displayed, All Scan can be executed in the same manner as the Step edit screen.
- If you switch the step in the Step All screen, the Wave screen also switches accordingly.
- Press F4 (Size) to expand to full screen.

12.2.16 Changes and Additions to the Software

- Changed a portion of the confirmation messages when writing or deleting files and the message box title.
- Changed so that the RF Level Offset value is backed up when the power is turned off.

12.2.17 Software Fixes

(1) Hard Copy
- Fixed a problem that the screen copy could not be saved to the memory card even though there was space left on the card.

(2) Guide Message
- Corrected a portion of the guide messages, value input range, and the number of significant digits.

(3) Parameter Remote
- Fixed a problem that caused the waveform to be unstable when AGC_V was set using the parameter remote function and AGC_Curve was set.
- Fixed a problem that the parameter remote settings of the measured values of the band current were not prioritized in the All Scan results when the channel was varied using the parameter remote function set to CH.No. and the band was different from the Step setting.

(4) When AGC Curve Is Set
- Fixed a problem that the maximum value of the comment area flickered when multiple sweeps (Max Sweep = 3) were specified.
- Fixed the problem that the waveform was unstable when multiple sweeps (Max Sweep = 3) were specified and the AGC voltage of sweeps B and C were varied.
- Fixed the software so that the settings of sweep A are displayed when multiple sweeps (Max Sweep = 3) are specified and AGC voltages of different voltage scale range are specified.
- Fixed a problem that the calculated value of the variable speed of the AGC voltage was different from that of the LW 347/LW 348.
- Fixed a problem that the band current value was sometimes not displayed when All Scan was executed only on the AGC curve step.

(5) Judgement Related Fixes
- Fixed a problem that the marker and judge line did not turn to the fail color even when the judgement of the measured value was fail for f_JUDGE.
- Fixed the software so that the number of significant digits of the limit setting is matched to the measurement resolution when setting the level.

(6) Appearance
- Fixed the problem that the line width of the Tuning Marker was displayed at 3 regardless of the RF Marker setting.

(7) PLL Related

• Corrected the A/D Bit Num setting and the Judge IIC_A/D limit setting for read data as follows:

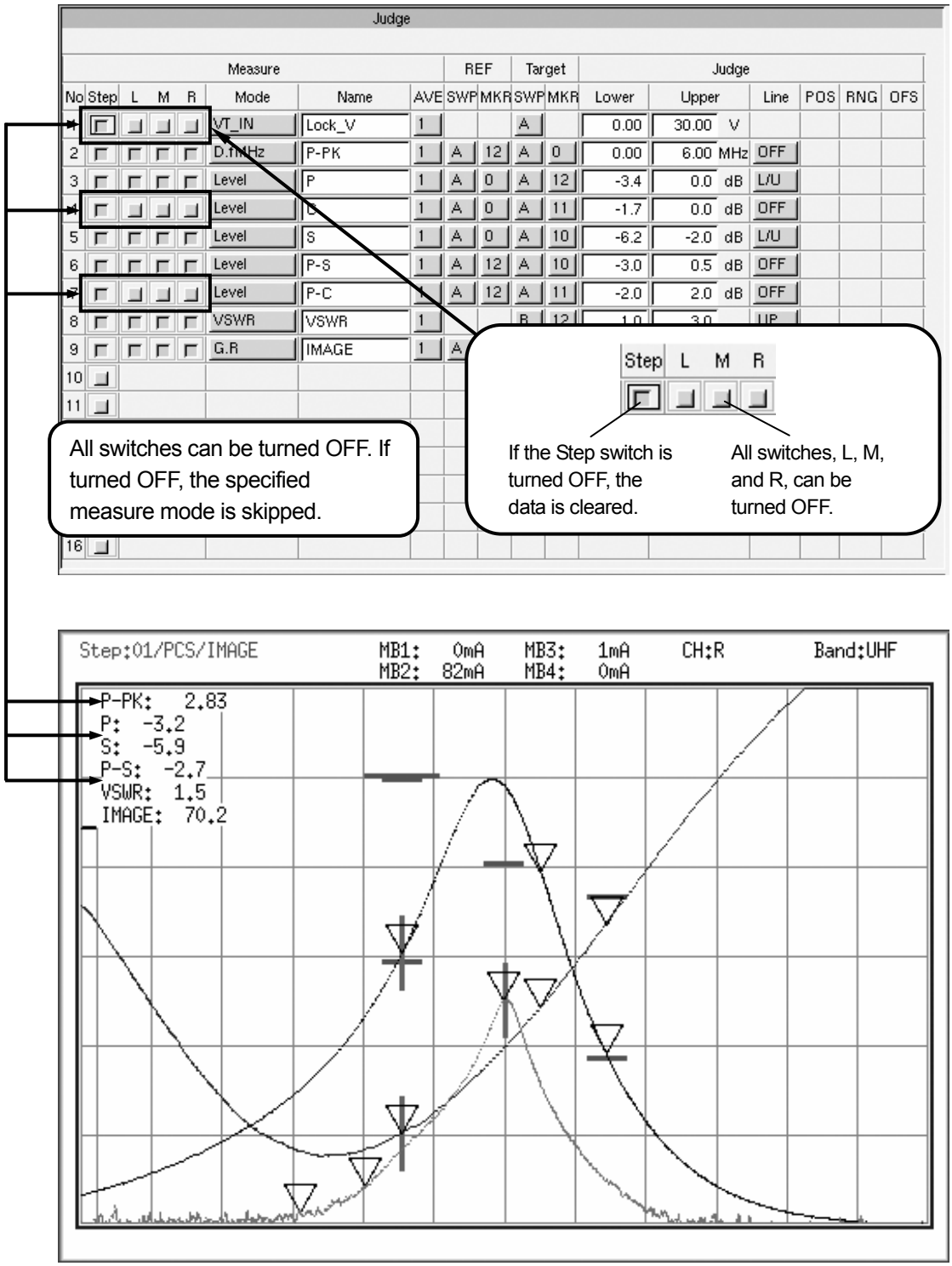
	Ver.2.1 or earlier	Ver.2.2 and later
PLL Table Bit Num	1 to 8	1 to 8
PLL Pattern Bit Num	1 to 32	1 to 12
Judge IIC_A/D	0 to 7	0 to 7999

12.3 Version 2.3 and Later

12.3.1 Addition of the Judge Item ON/OFF Function

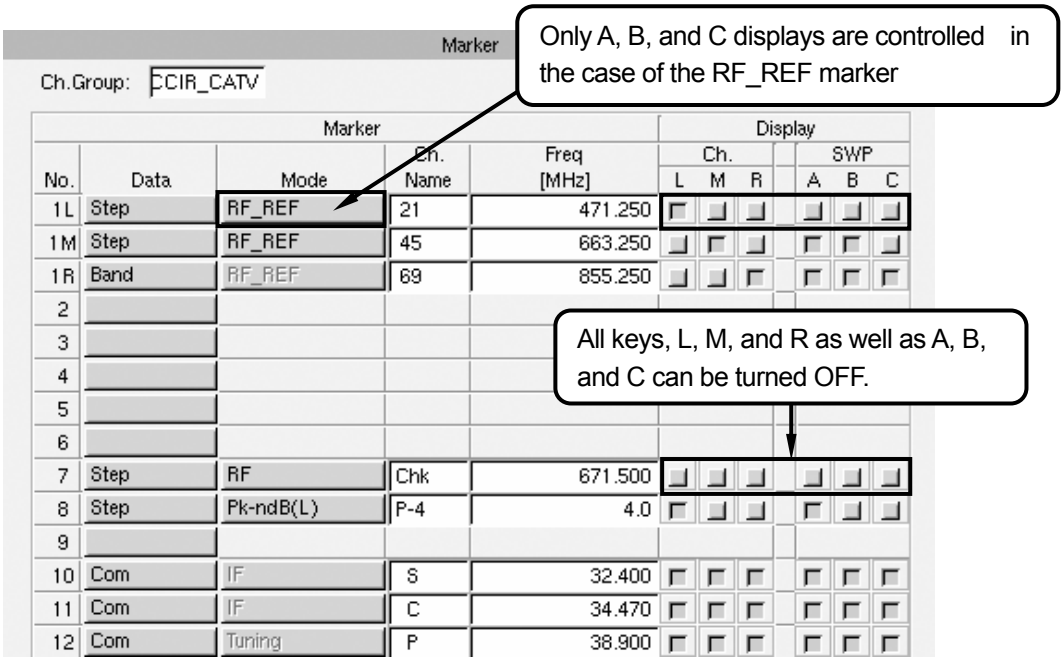
A function has been added that allows L, M, and R under Measure SW in the Judge screen to be turned all OFF.

This feature is convenient if you want to temporarily enable or disable the specified item.



12.3.2 Addition of the Marker ON/OFF Function

Like the Judge screen, a function has been added that allows all marker display switches to be turned all OFF. If Marker is set to Step, L, M, and R as well as A, B, and C can be turned all OFF. This feature is convenient if you want to temporarily enable or disable the specified marker.



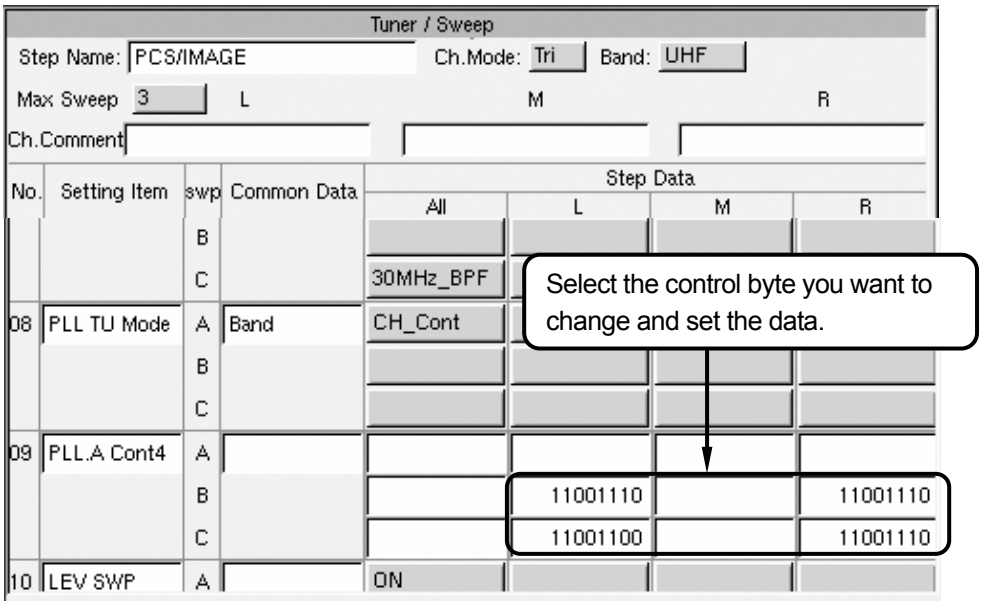
- This function can be used only if Data is Step. It cannot be used for Band and Com data.
- In the case of Marker No.1 (RF_REF), A, B, and C can be turned off using the switches, but the Ch switch cannot be turned OFF.

12.3.3 Addition of the Individual Setup Function for the B and C Sweep of the PLL Data

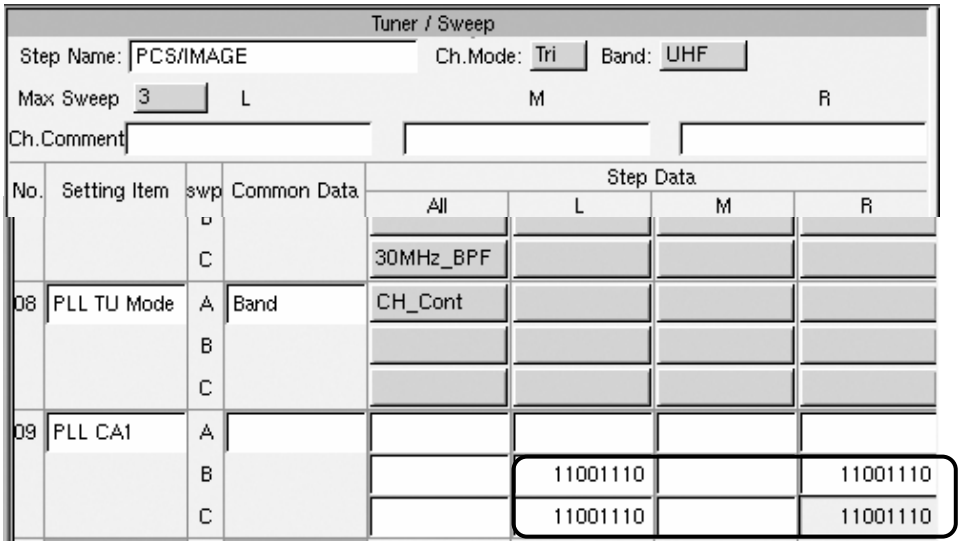
A function for setting the control byte data individually for the B and C sweeps has been added for the case when the bus mode of the PLL data is I^2C. This feature is convenient such as when you want to change the tuner settings within the same channel.

(1) Setup Procedure

When using the PLL Table



When using the PLL Pattern (when the control byte is set to CA1)

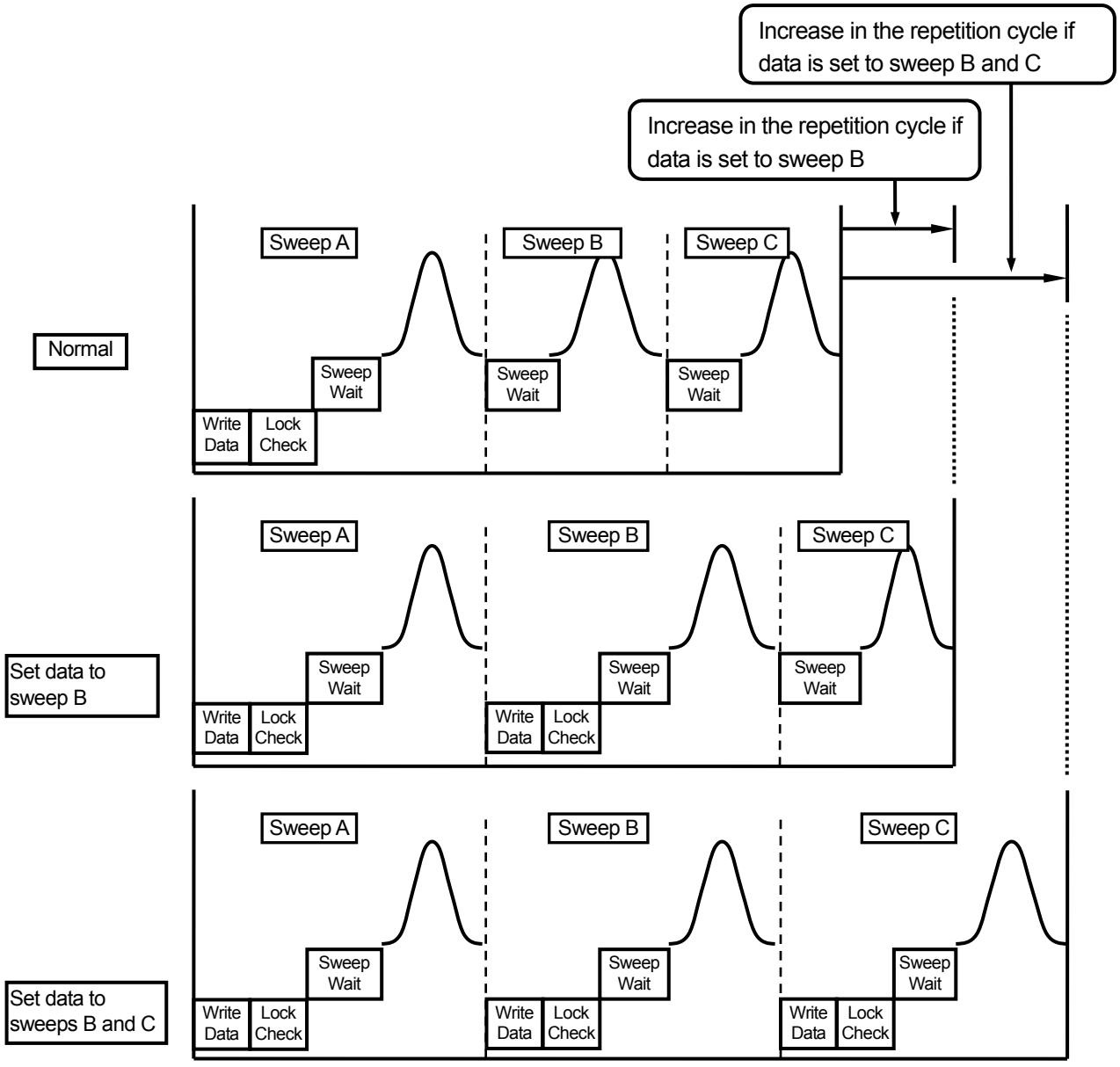


- Individual setting of the B and C sweeps is available only when the bus mode is I^2C. Do not specify this setting for 3Wire or CCB.
- This function assumes that the control byte is set individually for the B and C sweeps. However, you can set any of the data bytes. Note that if you change the data related to the frequency of the divider or band, the IF auto tracking may be lost preventing measurements.

(2) PLL Data Transmission Timing

Normally, the PLL data is sent at the beginning of a channel switch. Therefore, within the same channel, the PLL data is sent at the beginning of sweep A, and sweeps B and C uses the same data.

If you set the data to sweep B or C, the PLL data is sent before each sweep. Therefore, the repetition cycle is prolonged by the time needed to send the data.



∗ The figure above is the timing chart if Read Data is set on I^2C. If Read Data is not set (Lock Mode = OFF), Lock Wait is equal to the Lock Check time.

This cycle is for a single channel. The time is doubled for dual channel and tripled for triple channels.

12.3.4 Addition of Limit Information to the All Scan Result Output

In addition to the function that displays limit values in the All Scan result (version 2.2 and later), a function that displays the limit values in the All Scan Log output has been added. These values are useful as reference during data tabulation.

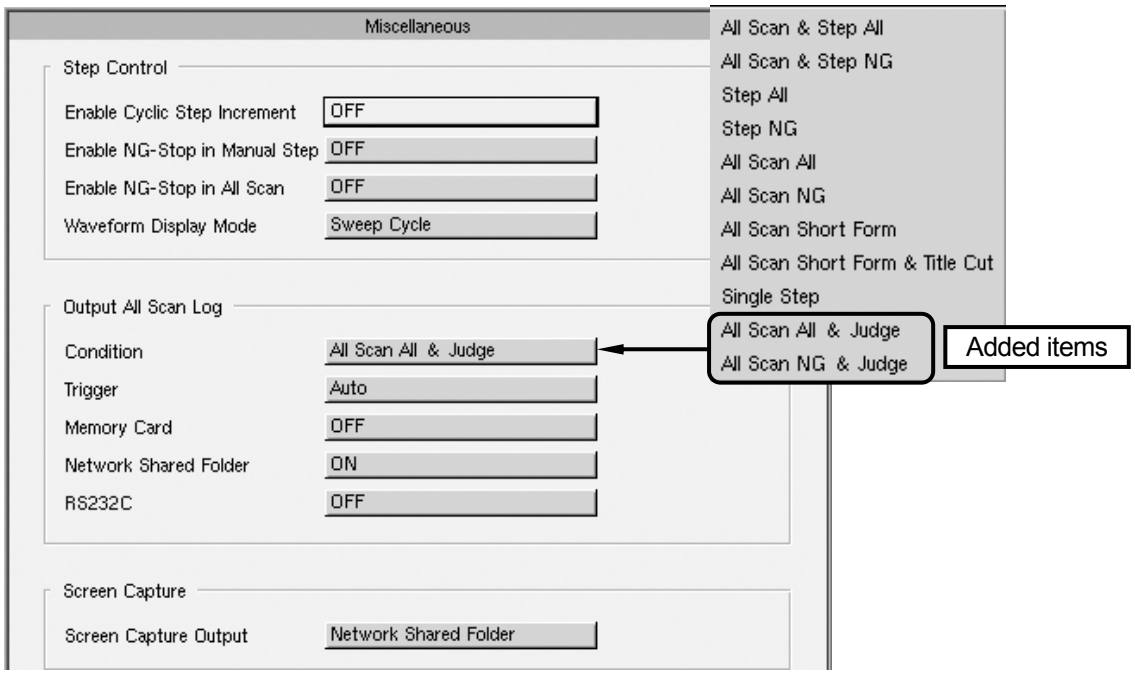
(1) Setup Procedure

Press F11 (Config) followed by F10 (Misc) to display the Miscellaneous screen.
The following two items have been added to Condition under Output All Scan Log.

All Scan All & Judge: Outputs the log by adding limit values to all the data measured using All Scan

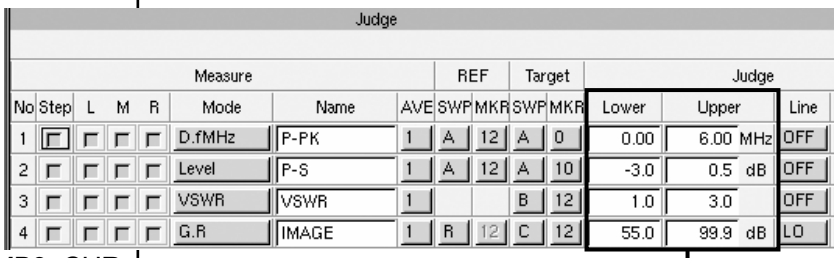
All Scan NG & Judge: Outputs the log by adding limit values to the step data for the data measured using All Scan judged as NOGO.

Select either of the settings above.



(2) Output Example (When All Scan All with Judge Is Selected)

```
[All Scan All&Judge]   Judge:NOGO
LW360
Serial No.0603031
Tuner Serial No.000333
Date 2006.12.04     Time 11:49:51
TU_Model No.05 Fixed Item Full
Tuning(IF): 38.900MHz
MB1: 0.0V
MB2: 5.00V
MB3: 5.00V
MB4: 1.00V
AGC: 4.0V AFT: 0.0V
Band          MB1_CUR  MB2_CUR  MB3_CUR
MB4_CUR
VHF(L):
VHF(M):
VHF(H):
UHF    :          0         86          1          0

Ch.       --- L ch ---- M ch ---- R ch ---

Step No. 1:PCS/IMAGE              Band:UHF
P-PK                2.74        2.88        2.92
   Judge L/U =      0.00   ,    6.00
P-S                -4.0*       -2.0        -2.8
   Judge L/U =     -3.0    ,    0.5
VSWR                1.4         1.5         1.5
   Judge L/U =      1.0    ,    3.0
IMAGE              89.8        74.5        70.2
   Judge L/U =     55.0    ,    99.9

Step No. 2:POWER GAIN             Band:UHF

P.G                                    43.0
    Judge L/U =    30.0    ,    50.0

Step No. 3:AGC                    Band:UHF
PG_Full          34.8                  41.2
    Judge L/U =    30.0    ,    50.0
PG_0.5V          -18.8
```



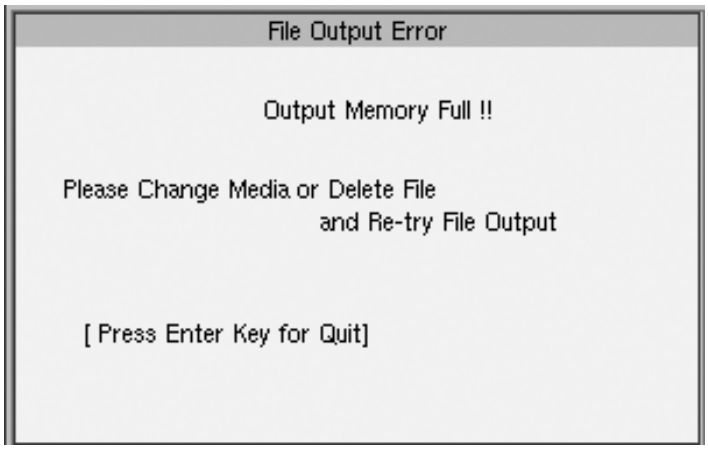
Displays the lower and upper limits set in the Judge screen below the measured value.

12.3.5 Software Improvement

(1) Memory Size Warning Display

A function has been added that displays a message if the memory size is exceeded when saving the Tuner Model, Screen Capture, All Scan Log, and the like to the network shared folder or memory card.

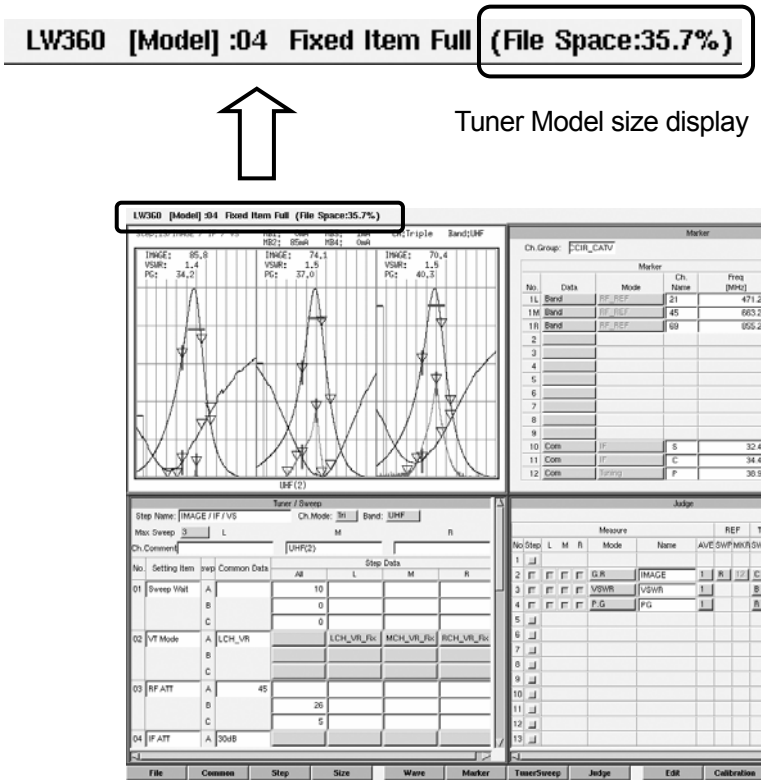
The following message appears.



If this message appears, no more files will be output to the memory. Free the memory space such as by deleting files from the network shared folder or replacing the memory card, and output the data again.

(2) Tuner Model Data Size Display

A function has been added that displays the size of the selected Tuner Model data. The size is displayed as a percentage of the full size single Tuner Model (64 KB). The size is displayed to the right of the Tuner Model name at the upper left of each screen.



The size display is updated when settings are changed on each screen as follows:

- File Edit Screen
  Updates the size display when the Tuner Model data is read.

- Common Edit Screen
  Updates the size display when the PLL pattern is changed, when the number of steps in Step All changes, or when the number of Parameter Remote data changes.

- Step Edit Screen
  Updates the size display when the number of Tuner/Sweep, Marker, Judge setup data changes or when the number of Parameter Remote data changes.

- Wave Screen
  Updates the size display when the Tuner Model is changes using the Panel key or the number of P.G.Cal or N.F.ENR data changes.

12.3.6 Changes and Additions to the Software

- If an item is selected in the Setting Item list of Tuner/Sweep and F9 (Window) or F12 (Quit) is used to return to the Tuner/Sweep screen instead of F8 (Close), the setting item was not added to the Tuner/Sweep screen. This has been changed so that it is added to the Tuner/Sweep screen.

12.3.7 Software Fixes

(1) Judge Related Fixes

- Fixed a problem that caused incorrect operation if Lch is not checked in f-JUDGE of Measure Mode.
- If f-JUDGE is specified and Line is set to IND, all judgement lines specified for each frequency were displayed. Fixed so that the display switches for each specified frequency.
- Fixed a problem that caused the Wave screen to appear after displaying the result if Judge is set to Rch and All Scan is executed in the Step edit screen.

(2) PLL Related Fixes

- Lock Wait was not applied in some cases if Lock Mode is set to OFF in the PLL Pattern. This has been fixed.

13. MAINTENANCE

The LW 360 is designed to operate stably under normal handling. If you have questions regarding calibration and service, contact your local LEADER agent.

■ Open Source

The LW 360 includes open source software licensed under the GNU General Public License (http://www.gnu.org/copyleft/gpl.html).

If you would like to obtain the source code according to the GNU General Public License, contact your local LEADER agent.

Notes

1. LEADER does not provide guarantees or support for GNU General Public License software.
2. Alterations and distribution of the program are under the customer's responsibility.
3. It is the customer's responsibility to pay the cost involved in delivering the program from LEADER to the customer.

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所含有毒有害物质信息

部件号码：LW 360

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产品适当使用后报废的方法请遵从电子信息产品的回收、再利用相关法令。
详细请咨询各级政府主管部门。

产品中有毒有害物质或元素的名称及含量

部件名称 Parts	有毒有害物质或元素 Hazardous Substances in each Part					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
实装基板	×	○	○	○	○	○
主体部	×	○	○	○	○	○
开关电源	×	○	○	○	○	○
风扇	×	○	○	○	○	○
线材料一套	○	○	○	○	○	○
外筐	○	○	○	○	○	○
附件	×	○	○	○	○	○
包装材	○	○	○	○	○	○
电池	○	○	○	○	○	○

备注）

○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006 规定的限量要求以下。

×：表示该有毒有害物质或元素至少在该部件的某一均质材料中的含量超出SJ/T11363-2006 标准规定的限量要求。

Ver.1

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