MX890120B
ISDB-T Signal Analysis
Software
Operation Manual

Sixth Edition

- **For safety and warning information, please read this manual before attempting to use the equipment.**
- **Additional safety and warning information is provided within the MS8901A Digital Broadcast Signal Analyzer Operation Manual Vol. 1 (Basic Operating Instructions). Please also refer to this document before using the equipment.**
- **Keep this manual with the equipment.**

ANRITSU CORPORATION

Document No.: M-W2312AE-6.0

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Ensure that you clearly understand the meanings of the symbols BEFORE using the equipment. Some or all of the following symbols may be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.

Symbols used in manual

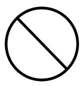
DANGER This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

WARNING This indicates a hazardous procedure that could result in serious injury or death if not performed properly.

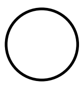
CAUTION This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

Safety Symbols Used on Equipment and in Manual

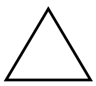
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE using the equipment.



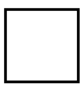
This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



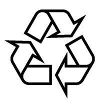
This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.

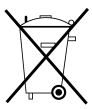


This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.





These indicate that the marked part should be recycled.

MX890120B
ISDB-T Signal Analysis Software
Operation Manual

8 February 2004 (First Edition)
1 April 2009 (Sixth Edition)

Equipment Certificate

Anritsu guarantees that this equipment was inspected at shipment and meets the published specifications.

Anritsu Warranty

- During the warranty period, Anritsu will repair or exchange this software free-of-charge if it proves defective when used as described in the operation manual.
- The warranty period is one year from the purchase date.
- The warranty period after repair or exchange will remain 1 year from the original purchase date, or 30 days from the date of repair or exchange, depending on whichever is longer.
- This warranty does not cover damage to this software caused by Acts of God, natural disasters, and misuse or mishandling by the customer.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

Anritsu Corporation Contact

In the event that this equipment malfunctions, contact an Anritsu Service and Sales office. Contact information can be found on the last page of the printed version of this manual, and is available in a separate file on the CD version.

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Anritsu affixes the CE Conformity marking on the following product(s) in accordance with the Council Directive 93/68/EEC to indicate that they conform to the EMC and LVD directive of the European Union (EU).

CE marking

1. Product Model

Software: MX890120B ISDB-T Signal Analysis Software

2. Applied Directive and Standards

When the MX890120B ISDB-T Signal Analysis Software is installed in the MS8901A, the applied directive and standards of this software conform to those of the MS8901A main frame.

PS: About main frame

Please contact Anritsu for the latest information on the main frame types that MX890120B can be used with.

C-tick Conformity Marking

Anritsu affixes the C-tick marking on the following product(s) in accordance with the regulation to indicate that they conform to the EMC framework of Australia/New Zealand.

C-tick marking

N274

1. Product Model

Software: MX890120B ISDB-T Signal Analysis Software

2. Applied Directive and Standards

When the MX890120B ISDB-T Signal Analysis Software is installed in the MS8901A, the applied directive and standards of this software conform to those of the MS8901A main frame.

PS: About main frame
Please contact Anritsu for the latest information on the main frame types that MX890120B can be used with.

Cautions against computer virus infection

- Copying files and data
  Only files that have been provided directly from Anritsu or generated using Anritsu equipment should be copied to the instrument.
  All other required files should be transferred by means of USB or CompactFlash media after undergoing a thorough virus check.
- Adding software
  Do not download or install software that has not been specifically recommended or licensed by Anritsu.
- Network connections
  Ensure that the network has sufficient anti-virus security protection in place.

Configuration of this Manual

This operation manual consists of the following chapters:

Chapter 1 Overview

This chapter describes a product overview and describes the product configuration and specifications of the MX890120B.

Chapter 2 Operation

This chapter describes the measuring instrument connection method, parameter settings and how to analyze the measured results.

Chapter 3 Remote Control

This chapter describes commands and simple program examples for remote control using GPIB.

Chapter 4 Performance Test

This chapter describes the measuring instruments required for executing a performance test, how to execute a performance test and pass-fail judgement criteria for test results.

When Upgrading from MX890120A/120A1/120A2/120B (Version 4.5 or before) to MX890120B

Note the following precautions when installing the MX890120B ISDB-T Signal Analysis Software.

(1) Overwrite the existing MX890120A/MX890120A1/MX890120A2/MS890120B (Version 4.5 or before) when installing the MX890120B. Otherwise, the MX890120B may not be recognized properly by the PC application Anritsu provides, when two or more MX890120x-series software has already been installed into the MS8901A. In this case, the operation of this software and PC application, after installing the MX890120B, is not guaranteed.

(2) Refer to Section 2.15, “Installing Measurement Software” when installing the MX890120B from the attached memory card.

Table 1 below shows the release notes for each measurement system software. Note that this table only lists the functions added to the MX890120B since the MX890120B supports all the functions of the MX890120A/120A1/120A2.

Table 1 Release Notes for Each System Software

Additional Functions		MX8901 20A	MX8901 20A1	MX8901 20A2	MX890120B Ver.4.2 or before	MX890120B Ver.4.3 Ver.4.4 Ver4.5	MX890120B Ver.4.6 or after
MER measurement	Equalizer switching function	–	–	–	✓	✓	✓
	Partial reception signal analysis function (one segment signal analysis)	–	–	–	✓	✓	✓
	Signal parameter automatic detection function	–	–	✓	✓	✓	✓
	Automatic level adjustment function based on MER	–	–	–	–	✓	✓
	Sub-carrier MER measurement function	–	–	–	–	✓	✓
CN measurement	C/N integration function	–	–	–	✓	✓	✓
RF/IF switch function		–	✓	✓	✓	✓	✓
Low IF/IQ unbalanced input (available when MS8901A-18 is installed)		–	–	–	✓	✓	✓
Revision of spectrum mask laws and ordinances		–	–	–	–	✓	✓
Upgrading the modulation frequency measurement accuracy (available when MS8901A-53 or 73 is installed)		–	–	–	–	✓	✓
30 dB Mask function is added to Station Power.		–	–	–	–	–	✓
BRAZIL Type	UHF (Brazil) is added to Channel Map.	–	–	–	–	–	✓
	Brazil is added to Spectrum Mask.	–	–	–	–	–	✓
	Filter characteristics file is added.	–	–	–	–	–	✓

✓: Available, –: Not Available

Table of Contents

Chapter 1 Overview

This chapter describes a product overview and describes the standard accessory configuration, application parts and specifications of the MX890120B ISDB-T Signal Analysis Software.

1.1 Product Overview

The MX890120B ISDB-T Signal Analysis Software is designed to be used in combination with the MS8901A Digital Broadcast Signal Analyzer.

Various types of signal analysis including MER measurement and constellation display for OFDM signals conforming to a digital terrestrial television system can be performed by installing the MX890120B in the MS8901A.

By using the MX890120B in combination with the spectrum analyzer function equipped in the MS8901A as standard, various measurements required to manufacture/maintain transmitters and repeaters for digital terrestrial broadcasting can be performed with a single MS8901A unit.

This operation manual explains only the functions offered by the MX890120B. Refer to the MS8901A Operation Manual for its functions, including the spectrum analyzer function.

1.2 Product Configuration

The following table shows the configuration of MX890120B standard accessories:

Table 1.2-1 Standard accessories

Item	Model name	Product name	Qty.
Software	MX890120B	ISDB-T Signal Analysis Software	1
Standard accessory		Memory card*	1
	W2312AE	Operation manual	1

*: ATA memory card, Compact Flash card or other available memory card of 20 MB or more.

Additional options for the low IF/IQ unbalanced analysis (MS8901A-18) and for upgrading the modulation frequency measurement accuracy (MS8901A-53, 73) are prepared to enhance the specific functions of this software. Refer to the Section of Unit Option of "MS8901A Digital Broadcast Signal Analyzer Operation Manual Vol.1", for details on the MS8901A additional options.

As to whether or not the additional options are installed, note that some figures on this manual abbreviate its detailed information.

1.2.1 Additional Option for the Low IF/IQ Unbalanced Analysis (MS8901A-18)

Low IF/IQ unbalanced analysis can be performed by this software by installing the MS8901A option MS8901A-18. For details of this function, refer to Section 2.11 "Low IF/IQ Unbalanced Input (MS8901A-18)."

1.2.2 Additional Option for Upgrading the Modulation Frequency Measurement Accuracy (MS8901A-53, 73)

Measurement accuracy and its resolution of the modulation frequency measurement are upgraded by installing the MS8901A option MS8901A-53 or MS8901A-73. For details of this function, refer to the table 1.4.1 and 1.4.2 at the Section 1.4 "Specifications".

With the measured result of the modulation frequency measurement (Modulation Analysis Screen), the user can know whether or not the measurement accuracy option of the modulation frequency is installed.

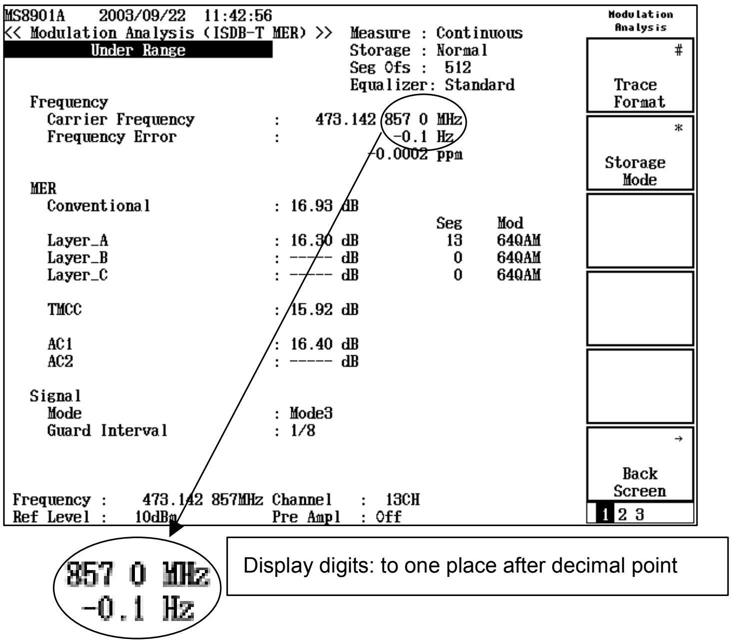


Figure 1.2.2-1 When the Option for Modulation Frequency Measurement Accuracy is not Installed

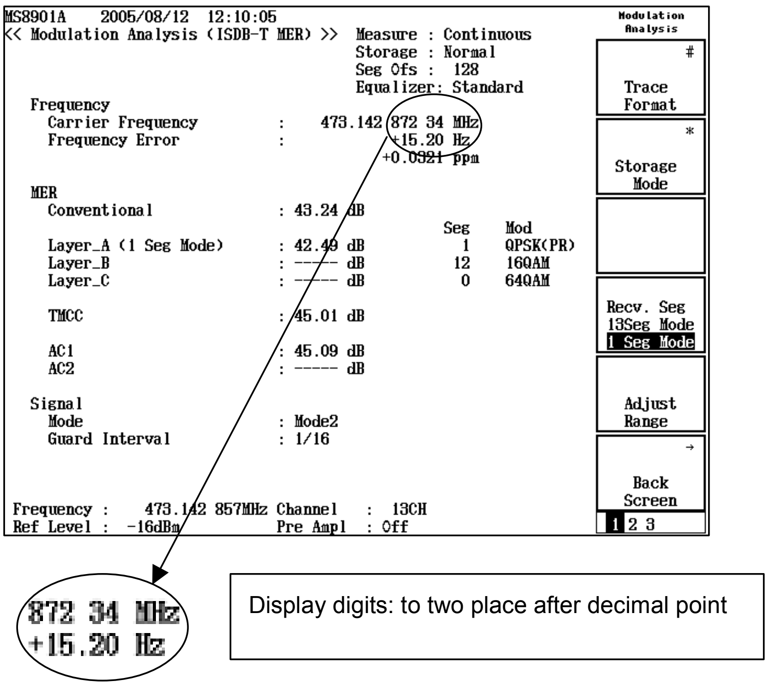


Figure 1.2.2-2 When the Option for the Modulation Frequeny Measurement Accuracy is Installed

1.3 Application Parts

The following application parts are available, sold separately.

Table 1.3-1 Application parts

Model name	Product name	Remarks
MX890110A	ISDB-T Field Measurement Software	
J0576D	Coaxial cord	N, 2 m
J0127C	Coaxial cord	BNC, 0.5 m
J0127A	Coaxial cord	BNC, 1 m
J0007	GPIB connection cable	1 m
J0008	GPIB connection cable	2 m
MP59B	50-Ω coaxial switch	DC to 3 GHz, manual switch
MN1607A	50-Ω coaxial switch	DC to 3 GHz, can be controlled externally
MP640A	Divider	DC to 1700 MHz
MP520A	CM directional coupler	25 to 500 MHz, 75 Ω
MP520B	CM directional coupler	25 to 1000 MHz, 75 Ω
MP520C	CM directional coupler	25 to 500 MHz, 50 Ω
MP520D	CM directional coupler	25 to 1000 MHz, 50 Ω
MP721A	Fixed attenuator	3 dB
MP721B	Fixed attenuator	6 dB
MP721C	Fixed attenuator	10 dB
MP721D	Fixed attenuator	20 dB
MP721E	Fixed attenuator	30 dB

When ordering parts, specify the model name, product name and quantity.

1.4 Specifications

The specifications of the MX890120B are shown in the table below. These specifications are based on when the MX890120B is installed in the MS8901A. For performance specifications, each value is assumed to be obtained by implementing calibration after 30-minute preheating under constant ambient temperature conditions.

Table 1.4-1 Specifications (Electrical performance (RF input))

Frequency	Setting range	When Interim-1 or Interim-2 is selected for Channel Map: 13 to 32 channels Nchannel center frequency of Interim-1 473 + (N – 13) × 6 + 0.142857 [MHz] Nchannel center frequency of Interim-2 473 + (N – 13) × 6 + 0.15 [MHz] When UHF is selected for Channel Map: 13 to 62 channels Nchannel center frequency of UHF 473 + (N – 13) × 6 + 0.142857 [MHz] (UHF) When General is selected for Channel Map: 32 to 3000 MHz, 1-Hz steps When IF Band is selected for Channel Map: 3.9 to 38 MHz, 1-Hz steps When VHF is selected for Channel Map: 1 to 12 channel Nchannel center frequency of VHF 1 ≤N ≤3 : 93 + (N – 1) × 6 + 0.142857 [MHz] 4 ≤N ≤7 : 173 + (N – 4) × 6 + 0.142857 [MHz] 8 ≤N ≤12 : 195 + (N – 8) × 6 + 0.142857 [MHz] When CATV is selected for Channel Map Channel: 13 to 63 When UHF (Brazil) is selected for Channel Map: 14 to 69 channel Nchannel center frequency for UHF (Brazil) 473＋(N – 14)×6＋0.142857 ［MHz］
	Offset frequency	0 to 12 GHz
	Spectrum reverse	When General or IF Band is selected for Channel Map: Can be selected from Normal or Reverse.

Table 1.4-1 Specifications (Electrical performance (RF input)) (Cont'd)

Level	Setting mode	Reference Setting: Inputs the reference level. Adjust Range: The MS8901A measures input power for all bandwidths to determine the reference level. Refer to MER: The MS8901A measures MER at the Adjust Range execution and sets reference level so that the measured result becomes optimal.
	Reference setting range	Pre-amplifier: Off +10 to –26 dBm Pre-amplifier: On –10 to –46 dBm
Signal information	Mode	Mode1, Mode2, Mode3
	Guard interval	1/4, 1/8, 1/16, 1/32
	Modulation system	64QAM, 16QAM, QPSK, DQPSK, 64QAM (PR), 16QAM (PR), QPSK (PR), DQPSK (PR) PR: Partial reception
	System	TV: Fixed input mode. Performs measurement with user setting values (frequency, channel, level, spectrum reverse.) TV-Auto Select: RF/IF input auto switching mode. Performs measurement for user setting value and IF (37.15 MHz, spectrum reverse) input signal; whichever has the higher level.
Modulation analysis	When an OFDM modulation signal conforming to ISDB-T is input for a waveform	
	Equalizer switch function	Switches operation mode corresponding to the signal frequency response. Standard: MX890120A/A1/A2 compatible mode Advanced: Field use mode
	Reception segment switch function	Switches the number of segments to be analyzed. 13 Seg: Receives and analyzes all segments. 1 Seg: Receives and analyzes one segment. Note that the following parameters are not measured (can be selected) when 1 Seg is set: • Mode 1 GI: All • Mode 2 GI: 1/16 and 1/32 • Mode 3 GI: 1/32
	Frequency range	32 to 1000 MHz
	Frequency lock range	±99 kHz
	Level range	+10 to –26 dBm (pre-amplifier: Off) –10 to –46 dBm (pre-amplifier: On)

Table 1.4-1 Specifications (Electrical performance (RF input)) (Cont'd)

Modulation analysis (Cont'd)	Frequency measurement accuracy	• When mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layers_A to _C: 64QAM, average count: 5, 13 segments; ±0.3 Hz + (reference frequency accuracy × measurement frequency) • When mode: Mode1, guard interval: 1/4, segmentation offset: 128, modulation system for all segments of Layers_A to _C: DQPSK, average count: 5, 13 segments; ±1.6 Hz + (reference frequency accuracy × measurement frequency) • When option: The MS8901A-53 or the MS8901A-73 is installed, mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layer_A to _C: 64 QAM, average count: 5, ±0.15 Hz + (reference frequency accuracy × measurement frequency) When average count: 40 in the above condition ±0.1 Hz + (reference frequency accuracy × measurement frequency)
	MER measurement item	Conventional (overall) Layer_A Layer_B Layer_C TMCC AC1 AC2
	Residual MER	Conventional value when mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layer_A to C: 64QAM, level: –20 dBm, Pre-amplifier: off, average count: 10, 13 segments; ≥44 dB (37.15 MHz, typical value) ≥42 dB (500 MHz, typical value)
	Constellation	Layer_A (64QAM, 16QAM, QPSK, DQPSK) Layer_B (64QAM, 16QAM, QPSK, DQPSK) Layer_C (64QAM, 16QAM, QPSK, DQPSK) TMCC (DBPSK) AC1 (DBPSK) AC2 (DBPSK) Marker function: I and Q values at the marker can be read. Note that when Advanced is selected for the Equalizer switch function, invalid values are included at the measurement point.

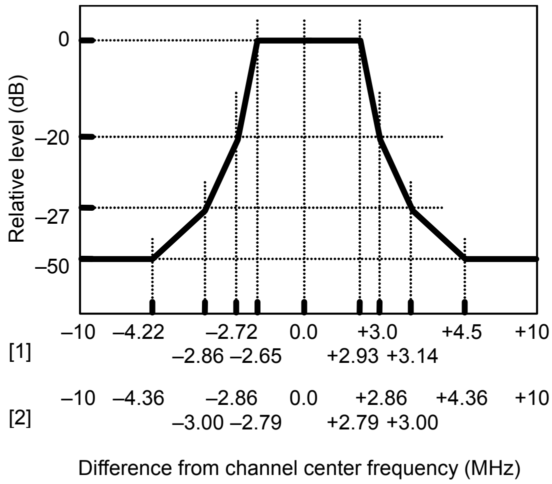
Table 1.4-1 Specifications (Cont'd)

<table>
<tr>
<td rowspan="3">Modulation analysis (Cont'd)</td>
<td>Frequency response</td>
<td>Displays assuming the average level of 5.57MHz bandwidth is 0 dB.
Level axis: ±2 dB, ±5 dB, ±10 dB, ±20 dB, ±50 dB
Marker function: Relative level and frequency at the marker can be read.
Correction: Frequency characteristic calibration can be performed using external signal source.
Display range: Depends on the reception segment switch function settings:
13 Seg: 5.57 MHz band (13 Segments)
1 Seg: 0.43 MHz band (1 Segment)
Note that these specifications apply when Standard is selected for the Equalizer switch function. When Advanced is selected for the Equalizer switch function, both ends of the frequency bandwidth are displayed as invalid values.</td>
</tr>
<tr>
<td>Segmentation offset</td>
<td>Specifies a position where analysis data is obtained within guard interval. The end of the guard interval is 0.
<table>
<tr><th>Guard interval / Mode</th><th>1/4</th><th>1/8</th><th>1/16</th><th>1/32</th></tr>
<tr><td>Mode1</td><td>0 to 512</td><td>0 to 256</td><td>0 to 128</td><td>0 to 64</td></tr>
<tr><td>Mode2</td><td>0 to 1024</td><td>0 to 512</td><td>0 to 256</td><td>0 to 128</td></tr>
</table>
</td>
</tr>
<tr>
<td>Signal parameter auto detection</td>
<td>Analyzes the signal input by user control (panel operation or remote control) to automatically detect the parameters required for modulation analysis.
Frequency lock range: ±99 kHz (typical value)
Mode, GI, TMCC information auto detection:
Analyzes the signal input by user control to automatically detect and set the mode, guard interval and TMCC information.
TMCC information auto detection:
Analyzes the signal input by user control to automatically detect and set the TMCC information.</td>
</tr>
</table>

Table 1.4-1 Specifications (Cont'd)

Modulation analysis (Cont'd)	Sub-carrier MER	Displays MER of all sub-carriers, which exist in the bandwidth. MER axis: 20 dB, 30 dB, 40 dB, 50dB and 60 dB Magnify Window: Enables to enlarge the selected segment Worst Envelope Line: Displays the worst value of the sub-carrier MER as the line graph. Non-display or display can be selected. Marker Function: Enables to read MER and frequency with marker. Can select the current value or the worst value Peak Display: Enables to read the MER and frequency of the worst value. Can set the full screen, enlarged screen and non-display. Threshold Setting: Recognizes the sub-carrier worse than the threshold value set by MER Setting Range: 0 to 30 dB (based on the Conventional MER value) Display Range: there are two settings of the reception segment switching function 13 Seg: 5.57 MHz bandwidth (13 Segment) 1 Seg: 0.43 MHz bandwidth (1 Segment) All the above are based on the condition when Standard is selected with Equalizer switching function. When Advanced is selected with the equalizer switching function, both ends of the frequency bandwidth are displayed as invalid
C/N	For CW (continuous wave)	
	Frequency range	32 to 1000 MHz (except IF Band)
	Offset frequency	100 Hz to 10 MHz
	C/N value	−40 to −140 dBc/Hz
	Residual C/N	When 500 MHz, −10 dBm; ≤−95 dBc/Hz (1-kHz offset) ≤−108 dBc/Hz (10-kHz offset) ≤−118 dBc/Hz (100-kHz offset)
	Frequency measurement accuracy	When input level: +10 to −20 dBm (pre-amplifier: Off) or −10 to −40 dBm (pre-amplifier: On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (reference frequency accuracy × measurement frequency)
	Display resolution	0.01 Hz
	Marker function	Offset frequency and C/N value at the marker can be read.

Table 1.4-1 Specifications (Cont'd)

<table>
<tr><td rowspan="2">C/N
(Cont'd)</td><td>Level range</td><td>+10 to –20 dBm (pre-amplifier: Off)
–10 to –40 dBm (pre-amplifier: On)</td></tr>
<tr><td>C/N integration function</td><td>Calculates C/N integral value for the specified range.
C/N integral display range: 0 to –99.9 dBc
C/N integral setting range: 100 Hz to 10 MHz, 1-Hz steps
The frequencies of the integral start/stop points must be different.</td></tr>
<tr><td rowspan="12">Spectrum mask</td><td colspan="2">Measurement can be set with three methods</td></tr>
<tr><td colspan="2">Type A: Channel number for measurement is fixed to 1 channel.</td></tr>
<tr><td>Frequency</td><td>32 to 2990 MHz (other than IF Band)</td></tr>
<tr><td>Mask type</td><td>Transmission, User-1, User-2</td></tr>
<tr><td>Mask break point</td><td>Transmission: Conforms to the transmission spectrum mask described in the "ARIB STD B31" (version 1.5).


Notes: [1] When Channel Map is set to other than General (except IF Band)
[2] When Channel Map is set to General
User-1, User-2: Any break point can be set up to 50 points</td></tr>
<tr><td>Pass-fail judgment</td><td>Performs pass-fail judgment. Judged as "Fail" when the spectrum waveform exceeds the mask line. 0-dB line is not included in the criteria.</td></tr>
<tr><td>Marker function</td><td>Normal marker: Waveform frequency and relative level at the marker can be read.
Delta marker: Frequency difference and relative level difference between any two points can be read.</td></tr>
<tr><td>Occupied frequency bandwidth measurement</td><td>Measures the bandwidth, where 99 % of total power of 20 MHz span is included. 1 kHz resolution.</td></tr>
<tr><td>Level range</td><td>When frequency is from 32 to 1000 MHz:
+10 to –22 dBm (pre-amplifier: Off) (Frequency: 32 to 1000 MHz)
–10 to –42 dBm (pre-amplifier: On) (Frequency: 32 to 1000 MHz)</td></tr>
<tr><td>Spectrum mask line recall</td><td>Recalls the spectrum mask line by using a remote control command.</td></tr>
</table>

Table 1.4-1 Specifications (Cont'd)

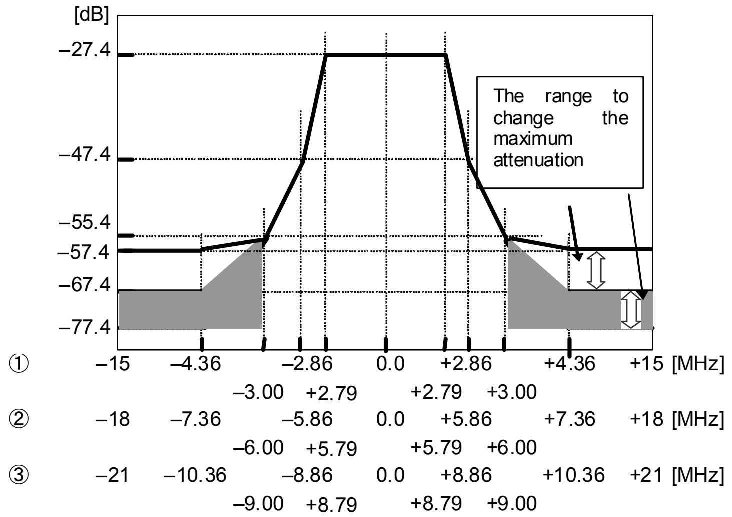
Spectrum mask (Cont'd)	Type B: Channel number for measurement is three at maximum. Frequency measurement width (Span) is 30 MHz (±15 MHz) at 1 channel measurement,	
	Frequency	32 to 2985 MHz (other than IF Band) at 1 channel measurement However, when several waves are measured, the frequency range for measurement should not exceed over 3 GHz.
	Mask type	Transmission, User-1, User-2
	Frequency channel	1 to 3 channel. However, several waves are limited to the adjacent continuous wave.
	Station power	Selection of station power: High/Low/30dB Mask • High: When the average power of the transmission or relay station is more than 2.5 W • Low: When the average power of the transmission or relay station is less than or equal to 2.5 W • 30dB Mask: When the average power of the transmission or relay station is less than 0.25 W.
	Average power Setting Range (Average Power)	0.25 to 2.5 [W] Only when the station power is selected to Low 0.025 to 0.249 [W] Only when the station power is 30 dB Mask.
	Mask break point	Transmission: Conforms to the transmission spectrum mask described in the Investigation Report from Spurious Committee  Notes: [1] When the number of Channel is set to 1: Center frequency = set frequency [2] When the number of Channel is set to 2: Center frequency = Set frequency + 3 [MHz] [3] When the number of Channel is set to 3: Center frequency = Set frequency + 6 [MHz] User-1, User-2: Any arbitrary breakpoint can be set up to 50 points

Table 1.4-1 Specifications (Cont'd)

Spectrum mask (Cont'd)	Maximum attenuation	When station power is high: –77.4 [dB] When station power is low: $0.25\ W < P \le 2.5\ W$: – (73.4 + 10 logP) [dB] $P \le 0.25\ W$: –67.4 [dB] The value is gained, depending on the Average Power P[W]. When station power is 30 dB Mask, depending on the Average Power P [W], $0.025\ W \leqq P < 0.25\ W$: – (73.4 + 10 logP) [dB] $P \leqq 0.025\ W$: –57.4 [dB]
	Frequency measurement width (SPAN)	Channel Number = 1: 30 (±15) [MHz] Channel Number = 2: 36 (±18) [MHz] Channel Number = 3: 42 (±21) [MHz]
	Pass-fail judgment	Performs pass-fail judgment. Judged as "Fail" when the spectrum waveform exceeds the mask line. –27.4 dB line is not included in the criteria.
	Marker function	Normal marker: Reads the frequency and relative level of the wave with marker Delta marker: Reads the difference of frequency and that of relative level between arbitrary 2 points
	Occupied frequency bandwidth measurement	Measures the bandwidth occupying 99 % within the whole bandwidth power of 30 MHz span. Resolution: 1 kHz Display: Only at 1 channel measurement
	Level range	+10 to –22 dBm (Preamplifier: Off) (Frequency 32 to 1000 MHz) –10 to –42 dBm (Preamplifier: On) (Frequency 32 to 1000 MHz)
	Mask line recall	Recalls the spectrum mask line by using a remote control command.
	Brazil: Channel number for measurement is fixed to 1 channel.	
	Frequency	32 to 2985 MHz (other than IFBand)
	Mask type	Transmission, User-1, User-2
	Station power	Selects the station power: Critical/Sub-Critical/Non-Critical.

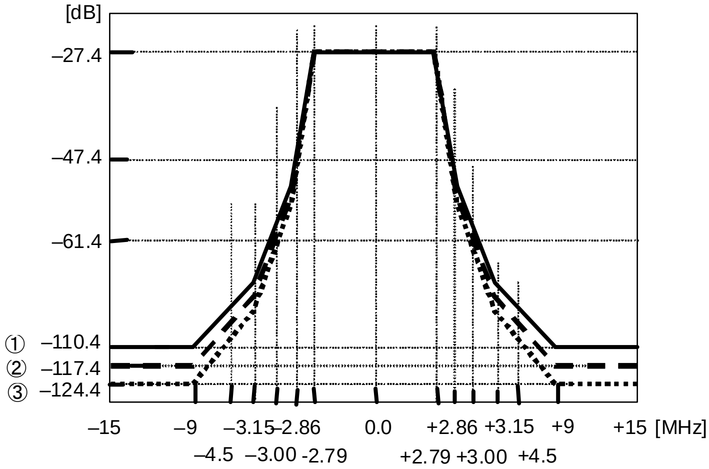
	Mask break point	Transmission: Conforms to "ABNT NBR 15601: 2007."  Notes:[1] When Station Power is Non Critical: The maximum attenuation = −110.4 [dB]. [2] When Station Power is Sub Critical: The maximum attenuation = −117.4 [dB]. [3] When Station Power is Critical: The maximum attenuation = −124.4 [dB]. User-1, User-2: Up to 50 break points can be set.
	Marker function	Normal marker: Reads the frequency and relative level of the waveform with marker. Delta marker: Reads the difference of frequency and relative level difference between any 2 points. Marker trace: Reads a mask line.
	Pass-fail judgment	Performs pass-fail judgment. Judged as "Fail" when the spectrum waveform exceeds the mask line. –27.4 dB line is not included in the criteria.
	Level range	+10 to –22 dBm (Preamplifier: Off) (Frequency 32 to 1000 MHz) –10 to –42 dBm (Preamplifier: On) (Frequency 32 to 1000 MHz)
	Mask line recall	Recalls the spectrum mask line by using a remote control command.
	Filter characteristics file selection	Default, User-1, User-2, User-3
Frequency counter	For CW (continuous wave)	
	Frequency range	3.9 to 1000 MHz
	Frequency measurement accuracy	When input level: +10 to –20 dBm (pre-amplifier: Off) or –10 to –40 dBm (pre-amplifier: On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (reference frequency accuracy × measurement frequency)
	Display resolution	0.01 Hz

Table 1.4-1 Specifications (Cont'd)

<table>
<tr><td rowspan="6">Storage mode</td><td colspan="2">For modulation analysis, C/N and frequency counter</td></tr>
<tr><td>Normal</td><td>Displays measured results every time.</td></tr>
<tr><td>Average</td><td>Displays average for the set number of measured results. However, overwrites every 5 times for constellation.
Average count: 2 to 100
Display method:
Every: Displays every measured result being averaged.
Once: Updates display after averaging the set number of measured results.</td></tr>
<tr><td>MaxHold</td><td>Displays the maximum value among the measured results up to the latest one.
However, the minimum value is displayed for the MER value.
Frequency is determined by the absolute value of the difference.
Constellation display is overwritten every 5 times. The display of the sub-carrier MER waveform is same as Normal.</td></tr>
<tr><td>OverWrite</td><td>Waveform display is overwritten without clearing the past measured results. Numeric values are displayed each time same as Normal display.</td></tr>
<tr><td>Moving Average</td><td>Displays the moving average for the set number of measured results. However, overwrites every 5 times for constellation.
Invalid during C/N measurement.
Average count: 2 to 100
Display method:
Every: Displays every measured result being averaged.
Once: Updates display after averaging the set number of measured results.</td></tr>
<tr><td rowspan="6">RF/IF auto switch mode</td><td>Measurement target</td><td>User setting value (RF) and preset value (IF)</td></tr>
<tr><td>Preset value</td><td>As IF, Channel Map is 37.15 MHz when General is set, spectrum reverse</td></tr>
<tr><td>User setting items</td><td>RF: Channel Map/frequency/offset frequency/reference setting
IF: Reference setting</td></tr>
<tr><td>Measurement target display</td><td>RF: RF measurement
IF: IF measurement
No Measure: Not measured</td></tr>
<tr><td>Switch status display</td><td>(No display): Normal
Signal Loss: No signal
Signal Abnormal: Signal error</td></tr>
<tr><td>Storage status display</td><td>(No display): Normal
Changed: Input is switched when storage mode is set to Average or Moving Average.</td></tr>
</table>

Table 1.4-2 Specifications (Electrical specifications (IQ input) – When the MS8901A-18 installed)

Input format	Low IF, IQ Unbalanced selectable When Low IF is selected, only the I connector is valid (unbalanced input)	
Measurement item	Modulation analysis only	
Function, performance	(Function and performance equivalent to modulation analysis when RF is input) • Equalizer function • Reception segment switch function • Constellation • Frequency characteristics • Segmentation offset • Signal parameter automatic detection • Sub-carrier MER	
Frequency setting range	250 kHz to 5 MHz, 1 Hz steps	
Impedance	1 MΩ (parallel capacity < 100 pF) or 50 Ω selectable	
Input level range	0.1 to 1.0 Vpp (unbalanced input, via input pin) DC connection or AC connection selectable	
Modulation analysis	When one OFDM modulation signal wave conforming to ISDB-T is input	
	Frequency lock range	±99 kHz
	Frequency measurement accuracy	(When 1 Seg is selected for reception segment switch function) • When Terminal: Low IF-DC or IQ-DC selected, Impedance: 50 Ω, Mode: Mode3, Guard interval: 1/8, Segmentation offset: 512, Modulation mode: 64QAM partial reception signal, Input level: 0.1 Vrms, Average count: 5 times for 1 Seg signal. ±0.3 Hz + (reference frequency accuracy × measurement frequency) • When option: The MS8901A-53 or the MS8901A-73 is installed, Impedance: 50 Ω, Mode: Mode3, Guard interval: 1/8, Segmentation offset: 512, Modulation system: 64 QAM partial reception signal, Input level: 0.1 Vrms, Average count: 5 times for 1 Seg signal. ±0.15 Hz + (reference frequency accuracy × measurement frequency) When average count: 40 in the above condition, ±0.1 Hz + (reference frequency accuracy × measurement frequency)

Table 1.4-2 Specifications (Electrical specifications (IQ input) – When the MS8901A-18 installed) (Cont’d)

Modulation analysis (Cont’d)	MER measurement item	Conventional (total) Layer_A Layer_B Layer_C TMCC AC1 AC2
	Residual MER	(When 1 Seg is selected for reception segment switch function) Conventional value when Terminal: Low IF-DC or IQ-DC selected, Impedance: 50 Ω, Mode: Mode3, Guard interval: 1/8, Segmentation offset: 512, Modulation mode: 64QAM partial reception signal, Input level: 0.1 Vrms, Average count: 10 times for 1 Seg signal. ≥50 dB (507.9 kHz typical value) 507.9 kHz: Frequency of 1/16 of FFT clock (512/63 MHz)

Chapter 2 Operations

This chapter describes parameter setting and measurement methods.

2.1 Preparing for Measurement

2.1.1 Panel description

The front panel key names required for reading this Operations Manual and the numerical value input method are described before explaining operations.

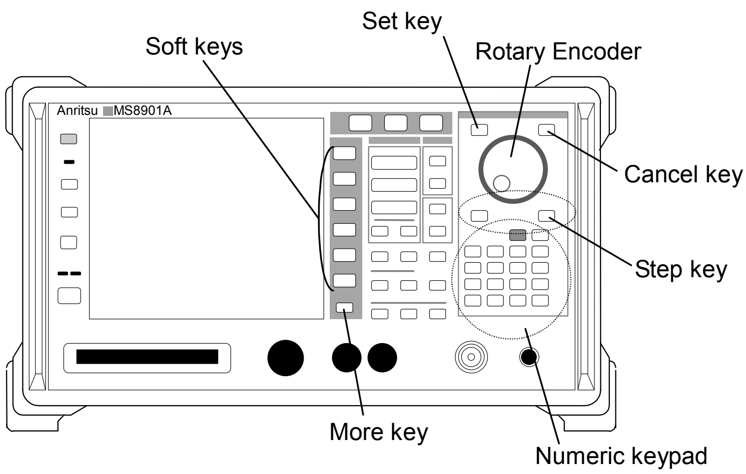


Figure 2.1.1-1 Front panel

(1) Cursor:

The cursor is expressed as a reverse display on the screen and indicates items that can be input. The cursor is moved with the Step key or the Rotary Encoder.

```
MS8901A   2000/04/01  12:34:56
<< Setup Common Parameter (ISDB-T MER) >>

  System                        :  [TV   ]
  Terminal                      :  [RF                  ]

  Frequency
    Channel Map                 :  [Interim-1(1/7MHz shift)]
    Channel / Frequency         :  [ 13CH]
```

Figure 2.1.1-2 Cursor

(2) Step key:

The Step key moves the cursor. The cursor moves up by pressing the up arrow key (↑). The cursor moves down by pressing the down arrow key (↓).

In addition, the input numerical values and selected items can be changed when the Set key is pressed so that the cursor item can be input.

(3) Rotary Encoder:

The Rotary Encoder moves the cursor. The cursor moves down by turning the Rotary Encoder to the right. The cursor moves up by turning the Rotary Encoder to the left.

In addition, the input numerical values and selected items can be changed when the Set key is pressed so that the cursor item can be input.

(4) Set key:

Press the Set key to set numerical value inputs of cursor items. Press the Set key after inputs are finished to set the input.

(5) Cancel key (Cancel):

Values during input are disabled where the Set key is pressed and items are in an input state.

(6) Numeric keypad:

The numeric keypad is used to input numerical values directly where the Set key is pressed and items are in an input state. Press a unit key for these items or the Set key after inputting the numerical values to set the input.

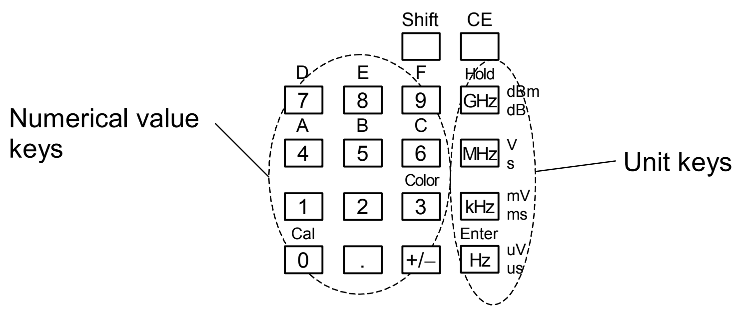


Figure 2.1.1-3 Numeric keypad

(7) Soft key:

The soft key function changes according to the displayed screen. Each key function is displayed on the screen at the left side of the keys.

Operations when the soft key is pressed differ according to type. Key operations are distinguished according to the symbols on the upper right of the screen where key functions are displayed.

(a)　No mark

The soft key with nothing in the upper right is executed as is when the key is pressed. For example, when the ±2 dB key (F1) in the Vertical Scale menu on the Freq Response screen is pressed, the vertical axis range of the frequency response graph on screen changes to ±2 dB.

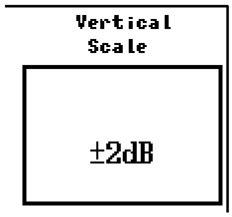


Figure 2.1.1-4　±2 dB key

(b)　Arrow (→)

Press a soft key with an arrow (→) on the upper right to change the screen display. For example, the screen changes from the Setup Common Parameter screen to the Modulation Analysis screen when the Modulation Analysis key (F1) on the Setup Common Parameter screen is pressed.

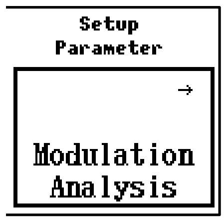


Figure 2.1.1-5　Modulation Analysis key

(c)　Sharp (#)

A soft key with a sharp (#) on the upper right requires numerical value inputs or item selection from the list displayed. Pressing such a key opens a pop-up window to input numerical values or select items from the list.

When the Trace Format key (F1) on the Signal Analysis screen is pressed, for example, the pop-up window opens on the right side of the Trace Format key to select the result display method (Trace Format).

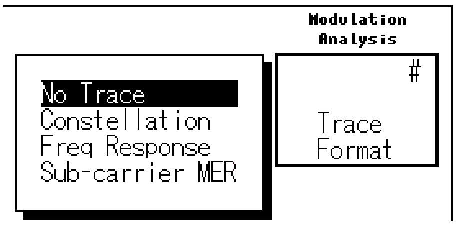


Figure 2.1.1-6 Trace Format key

When the Segmentation Offset key (F4) on the Signal Analysis screen is pressed, the pop-up window opens on the right side of the Segmentation Offset key to input numerical values.

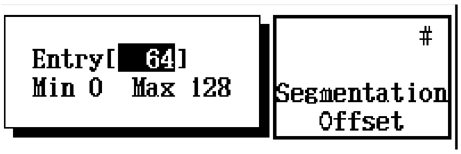


Figure 2.1.1-7 Segmentation Offset key

(d) Asterisk (*)

A soft key with an asterisk (*) on the upper right has a sub-menu. Press such a key to change the soft key contents.

For example, when the Storage Mode key (F2) on the Signal Analysis screen is pressed, the soft key contents change to those for selecting Storage mode types.

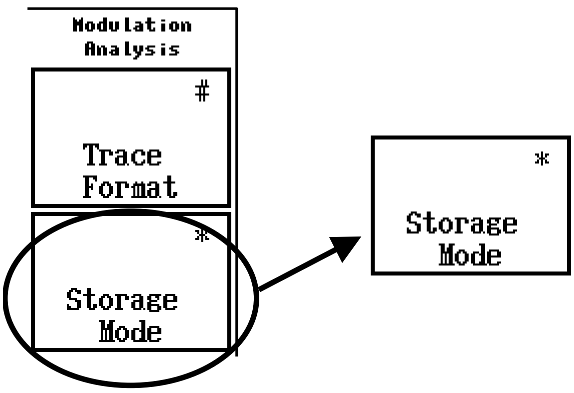


Figure 2.1.1-8 Storage Mode key

(8) More key:

The More key switches the soft key page. The pages of the currently displayed soft key are displayed on the left of the More key, and the current page is reverse displayed. Press the More key to switch (toggle) the page.

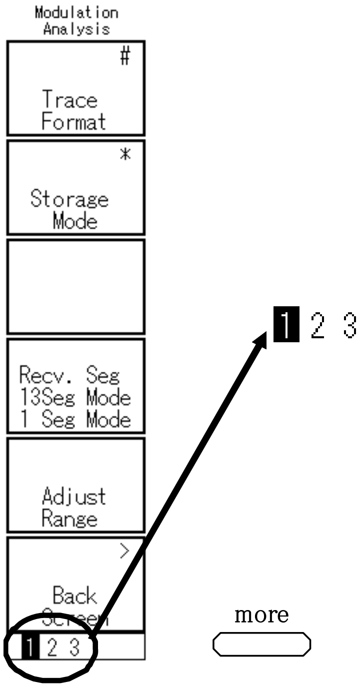


Figure 2.1.1-9　More key

2.1.2 Input method

Follow the procedure shown below to input numerical values or select items. The Setup Common Parameter screen is used in this example.

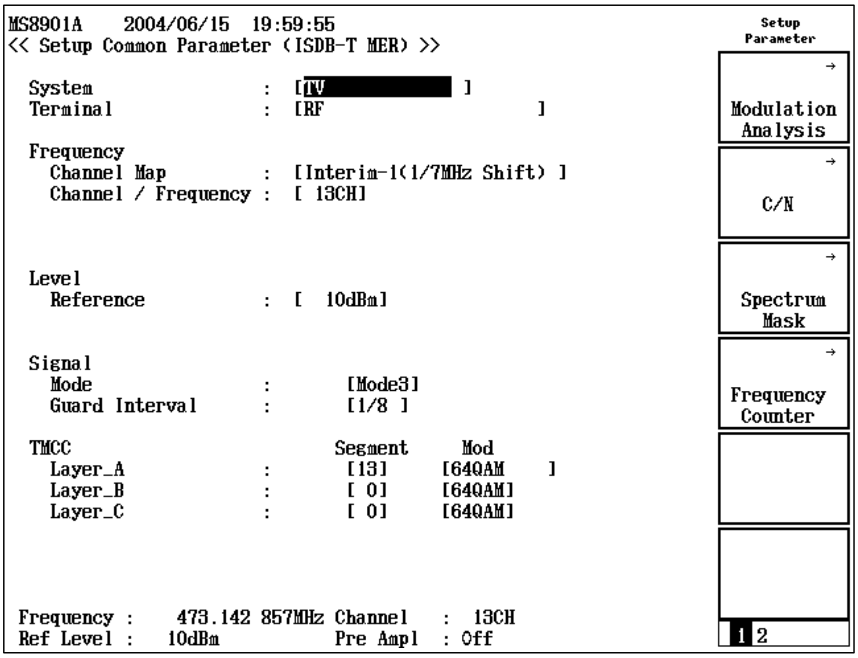


Figure 2.1.2-1 Setup Common Parameter screen as example

<Procedure>

1. Move the cursor to the target item using the Step key or the Rotary Encoder. Items that can be input are indicated by brackets [ ].

   Figure 2.1.2-2 (a) shows a numerical value input example, and (b) shows an item selection example. Move the cursor to Level Reference for (a), and Signal Mode for (b).

```
Level
  Reference             :  [    0dBm]
```

(a) For numerical value input

```
Signal
  Mode                 :        [Mode2]
  Guard Interval       :        [1/8  ]
```

(b) For item selection

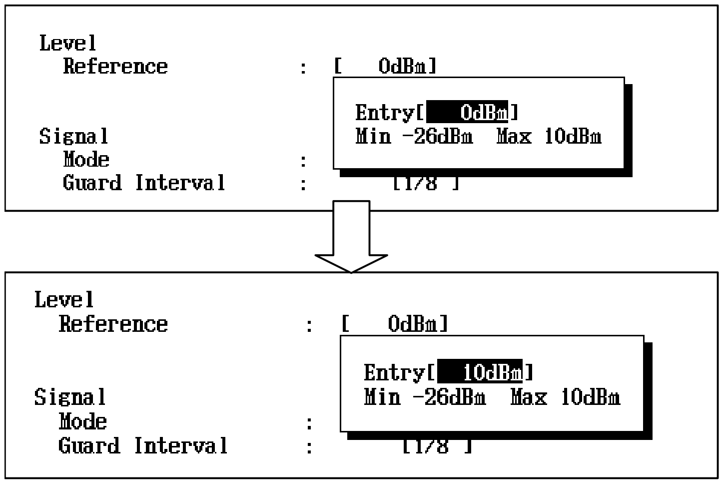
Figure 2.1.2-2 Moving the cursor

2. Press the Set key.
3. A small pop-up window opens on the screen.
   Numeric values can be input directly for items such as the frequency by using the numeric keypad.
   Any input values can be changed in the minimum steps determined for the corresponding item by using the Step key or Rotary Encoder.

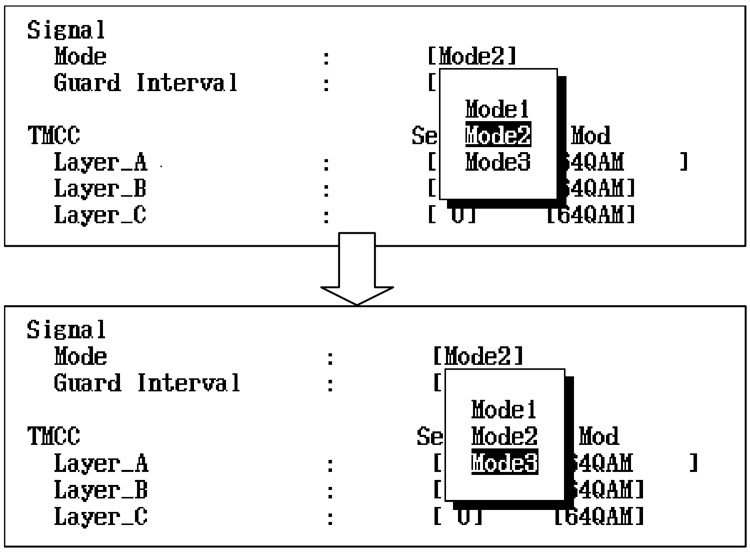
   Figure 2.1.2-3 (a) shows a numerical value input example where Level Reference is changed from 0 dBm to 10 dBm.

   A candidate item is selected by using the Step key or Rotary Encoder from a group of items whereby one candidate item is selected from a number of candidates such as mode settings.

   Figure 2.1.2-3 (b) shows an item selection example where Mode is changed from Mode2 to Mode3.



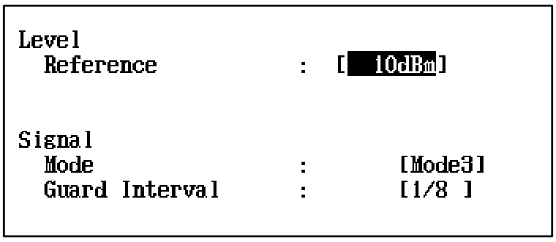
(a) Numerical value input pop-up window



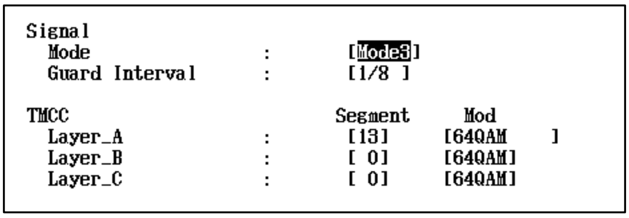
(b) Item selection pop-up window

Figure 2.1.2-3 Pop-up window

4. Press the Set key again to determine the input values. Figure 2.1.2-4 (a) shows a numerical value input example, and (b) shows an item selection example.



(a) For numerical value input



(b) For item selection

Figure 2.1.2-4 Determining input

5. Press the Cancel key during input to disable numerical values input or selected items and end the process.

2.1.3 Calibration

It takes approximately 30 minutes after power is added to the MS8901A for the internal circuit to stabilize. Internal circuit attenuation and gain vary when the ambient temperature changes at this time even after pre-heating is completed. These must be corrected before the measurement starts in order to demonstrate the performance as prescribed in the specifications. These operations are called Calibration.

Execute calibration in the following cases:

1. Before starting measurement after power supply has been supplied and pre-heating is finished.
2. When the ambient temperature fluctuates.

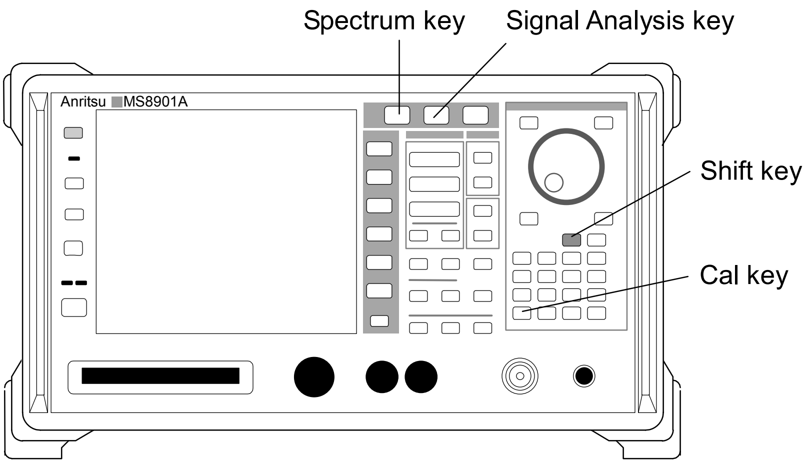


Figure 2.1.3-1 Front panel keys used in calibration

<Procedure>

1. Calibration is performed in the Spectrum Analyzer mode of the MS8901A. Press the Spectrum key on the front panel (see Figure 2.1.3-1).

   The screen is then displayed as shown in Figure 2-1.3-2 below.

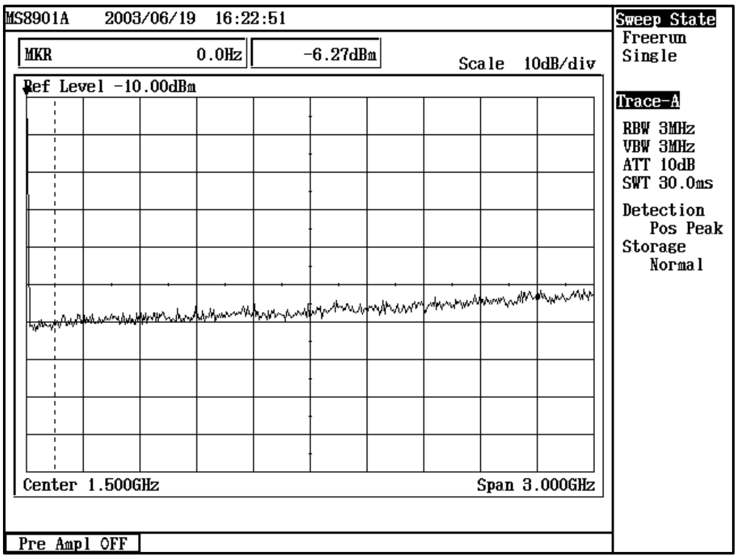


Figure 2.1.3-2 Spectrum Analysis screen

2. Press the Shift key and then press the Cal key after shifting to the Spectrum Analyzer mode (the Shift key lamp lights up when the Shift key is pressed). The soft key menu contents will change to Calibration item selection. Press the All Cal soft key (F1) to execute calibration.

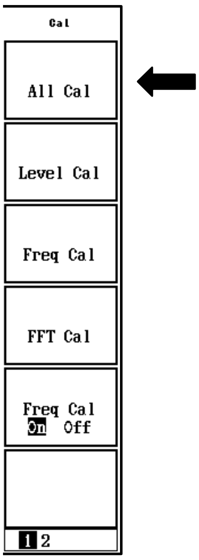


Figure 2.1.3-3 Calibration soft keys

Calibration will take approximately 5 minutes. Press the Signal Analysis key on the front panel after calibration is completed to return to the Signal Analysis Mode.

2.1.4 Switching systems

The MS8901A provides the spectrum analyzer functions as standard while also achieving signal analysis functions by installing optional software including the MX890120B.
Up to three types of application software can be installed. For example, install the MX890110A ISDB-T Field Measurement Software together with the MX890120B to perform measurement using one instrument required with ISDB-T such as modulation analysis, field strength measurement and delay profile measurement.

Press the System key on the front panel with the Signal Analysis screen displayed (the Signal Analysis key is pressed) to switch (toggle) the application software.

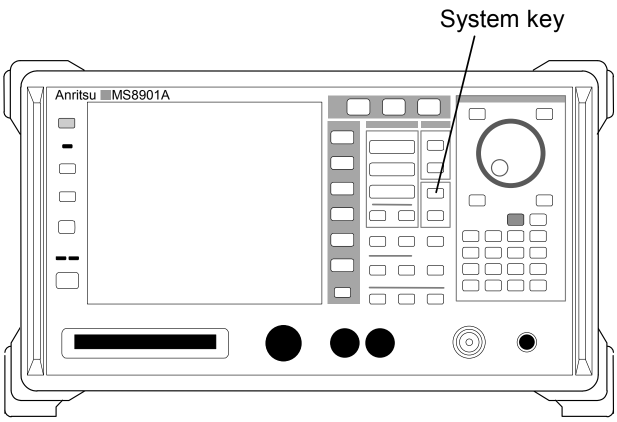


Figure 2.1.4-1 System key

The soft key menu contents change. The application software currently installed is displayed in soft keys. Press the key for the software to be executed.

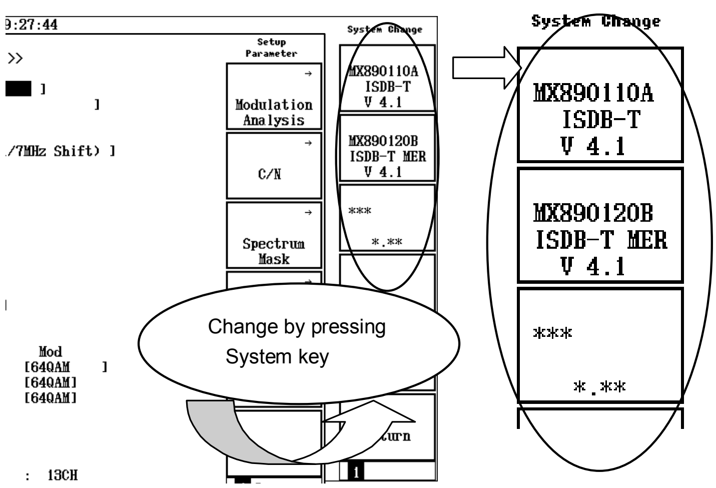


Figure 2.1.4-2 Soft key menu for system selection

2.2 Setting Measurement Parameters

This section describes setting the measurement parameters required for measuring signals with the MS8901A. Measurement parameters are set in the Setup Common Parameter screen or each measurement screen. Press the Signal Analysis key on the front panel or press the Back Screen soft key (F6) at each measurement screen to display the Setup Common Parameter screen.

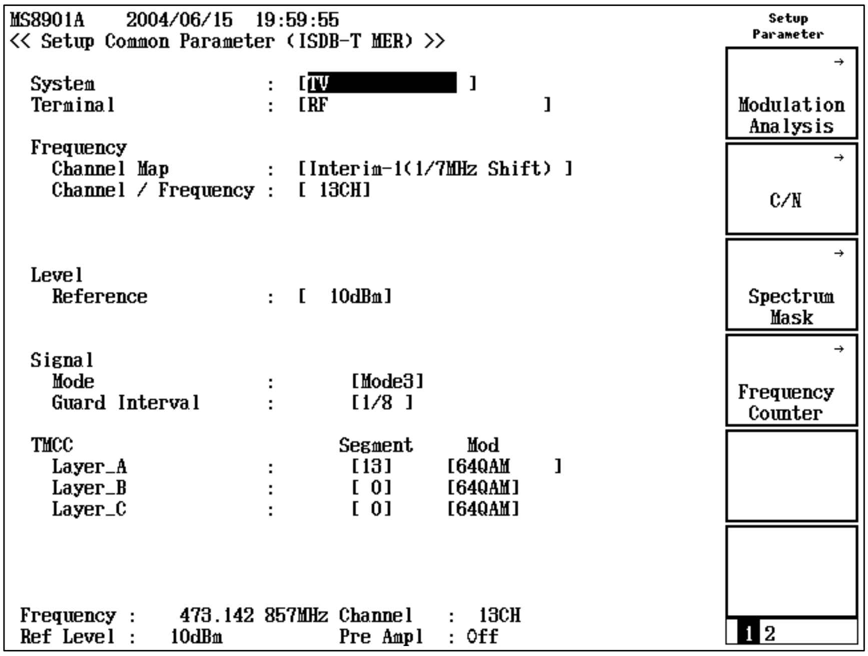


Figure 2.2-1 Setup Common Parameter screen

2.2.1 System

This item enables/disables the RF/IF switch function. Refer to Section 2.8 “RF/IF Switch Function” for details of the RF/IF switch function.
The RF/IF switch function is assumed to be disabled (System = TV) in this section.

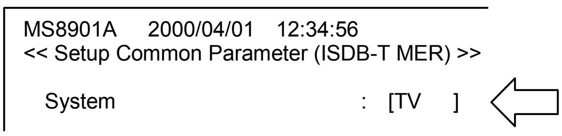


Figure 2.2.1-1 System item

2.2.2 Terminal

Set the input connector used for measurement. When the MS8901A-18 (Low IF/IQ unbalanced input) option is not installed, only RF input is set. When the option is installed, analysis using the IQ connector is enabled and the impedance setting is enabled. For details, refer to Section 2.11.3 “Terminal & Impedance.”

```
Terminal                         : [RF                  ]
```

Figure 2.2.2-1 Terminal setting

2.2.3 Frequencies and Channels

Set the carrier frequency (Frequency) or channels (Channel) for the signals to be measured. Valid only when RF input is selected for the terminal.

First, select a frequency map with the Channel Map item. The following five frequency maps can be selected.

(1) Interim-1

Channels 13 to 32 that conform to digital terrestrial television systems. The channel center frequency deviates at the high channels only 1/7 MHz from the center frequency of the active analog television channel plan.

The relationship between channel numbers and frequencies is as shown in Table 2.2.3-1.

Interim-1 and Interim-2 are set so as to conform to Channel Map for the test broadcast operated by the Telecommunication Advancement Organization of Japan (TAO).

(2) Interim-2

Channels 13 to 32 that conform to digital terrestrial television systems. The channel center frequency deviates at the high channels only 0.15 MHz from the center frequency of the active analog television channel plan.

The relationship between channel numbers and frequencies is as shown in Table 2.2.3-2.

(3) VHF

The channel center frequency deviates at the high channels only 1/7 MHz from the center frequency of the active analog television channel plan. The relationship between channel numbers and frequencies is as shown in Table 2.2.3-3.

(4) UHF

Channels 13 to 62 that conform to the ARIB STD-B31 digital terrestrial television transmission system. The channel center frequency deviates at the high channels only 1/7 MHz from the center frequency of the active analog television channel plan.
The relationship between channel numbers and frequencies is as shown in Table 2.2.3-4.

(5) CATV

The channel center frequency deviates at the high channels only 1/7 MHz from the center frequency of the active CATV channel plan. The relationship between channel numbers and frequencies is as shown in Table 2.2.3-5.

(6) General

Arbitrary frequencies in 1 Hz units from 32 to 3000 MHz.

(7) IF Band

Arbitrary frequencies in 1 Hz units from 3.9 to 38 MHz. For example, set the IF Band to 4 MHz for test evaluation of IC chips on an amplifier or tuner.
A different hardware control method from that of other frequency maps is employed for IF Band to enable measurement at a lower frequency. Therefore, the performance limit of the MER measurement value may be lower than that of other frequency maps.

(8) UHF (Brazil)

Channels 14 to 69 that conform to the ABNT NBR.
The relationship between channel number and frequency is shown in Table 2.2.3-6.

Table 2.2.3-1 Relationship between Interim-1 channels and transmission bandwidth center frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
13	473.142 857	23	533.142 857
14	479.142 857	24	539.142 857
15	485.142 857	25	545.142 857
16	491.142 857	26	551.142 857
17	497.142 857	27	557.142 857
18	503.142 857	28	563.142 857
19	509.142 857	29	569.142 857
20	515.142 857	30	575.142 857
21	521.142 857	31	581.142 857
22	527.142 857	32	587.142 857

Table 2.2.3-2 Relationship between Interim-2 channels and transmission bandwidth center frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
13	473.15	23	533.15
14	479.15	24	539.15
15	485.15	25	545.15
16	491.15	26	551.15
17	497.15	27	557.15
18	503.15	28	563.15
19	509.15	29	569.15
20	515.15	30	575.15
21	521.15	31	581.15
22	527.15	32	587.15

Table 2.2.3-3 Relationship between VHF channel and transmission bandwidth center frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	93.142 857	7	191.142 857
2	99.142 857	8	195.142 857
3	105.142 857	9	201.142 857
4	173.142 857	10	207.142 857
5	179.142 857	11	213.142 857
6	185.142 857	12	219.142 857

Table 2.2.3-4 Relationship between UHF channels and center frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
13	473.142 857	38	623.142 857
14	479.142 857	39	629.142 857
15	485.142 857	40	635.142 857
16	491.142 857	41	641.142 857
17	497.142 857	42	647.142 857
18	503.142 857	43	653.142 857
19	509.142 857	44	659.142 857
20	515.142 857	45	665.142 857
21	521.142 857	46	671.142 857
22	527.142 857	47	677.142 857
23	533.142 857	48	683.142 857
24	539.142 857	49	689.142 857
25	545.142 857	50	695.142 857
26	551.142 857	51	701.142 857
27	557.142 857	52	707.142 857
28	563.142 857	53	713.142 857
29	569.142 857	54	719.142 857
30	575.142 857	55	725.142 857
31	581.142 857	56	731.142 857
32	587.142 857	57	737.142 857
33	593.142 857	58	743.142 857
34	599.142 857	59	749.142 857
35	605.142 857	60	755.142 857
36	611.142 857	61	761.142 857
37	617.142 857	62	767.142 857

Table 2.2.3-5 Relationship between CATV channels and frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
13	111142 857	38	315.142 857
14	117.142 857	39	321.142 857
15	123.142 857	40	327.142 857
16	129.142 857	41	333.142 857
17	135.142 857	42	339.142 857
18	141.142 857	43	345.142 857
19	147.142 857	44	351.142 857
20	153.142 857	45	357.142 857
21	159.142 857	46	363.142 857
22	167.142 857	47	369.142 857
23	225.142 857	48	375.142 857
24	231.142 857	49	381.142 857
25	237.142 857	50	387.142 857
26	243.142 857	51	393.142 857
27	249.142 857	52	399.142 857
28	255.142 857	53	405.142 857
29	261.142 857	54	411.142 857
30	267.142 857	55	417.142 857
31	273.142 857	56	423.142 857
32	279.142 857	57	429.142 857
33	285.142 857	58	435.142 857
34	291.142 857	59	441.142 857
35	297.142 857	60	447.142 857
36	303.142 857	61	453.142 857
37	309.142 857	62	459.142 857
		63	465.142 857

Table 2.2.3-6 Relationship between UHF (Brazil) channels and center frequencies

Channel	Frequency (MHz)	Channel	Frequency (MHz)
14	473. 142 857	42	641. 142 857
15	479. 142 857	43	647. 142 857
16	485. 142 857	44	653. 142 857
17	491. 142 857	45	659. 142 857
18	497. 142 857	46	665. 142 857
19	503. 142 857	47	671. 142 857
20	509. 142 857	48	677. 142 857
21	515. 142 857	49	683. 142 857
22	521. 142 857	50	689. 142 857
23	527. 142 857	51	695. 142 857
24	533. 142 857	52	701. 142 857
25	539. 142 857	53	707. 142 857
26	545. 142 857	54	713. 142 857
27	551. 142 857	55	719. 142 857
28	557. 142 857	56	725. 142 857
29	563. 142 857	57	731. 142 857
30	569. 142 857	58	737. 142 857
31	575. 142 857	59	743. 142 857
32	581. 142 857	60	749. 142 857
33	587. 142 857	61	755. 142 857
34	593. 142 857	62	761. 142 857
35	599. 142 857	63	767. 142 857
36	605. 142 857	64	773. 142 857
37	611. 142 857	65	779. 142 857
38	617. 142 857	66	785. 142 857
39	623. 142 857	67	791. 142 857
40	629. 142 857	68	797. 142 857
41	635. 142 857	69	803. 142 857

Next, set the frequency or channel in the Channel/Frequency item. When Interim-1 or Interim-2 is selected for the Channel Map, specify a channel for 13 to 32.

When VHF is selected for the Channel Map, specify a channel number for 1 to 12.

When UHF is selected for the Channel Map, specify a channel number for 13 to 62.

When CATV is selected for the Channel Map, specify a channel number for 13 to 63.

When UHF (Brazil) is selected for the Channel Map, specify a channel number for 14 to 69.
When General is selected for the Channel Map, set the frequency for 32 to 3000 MHz in 1 Hz units.
When IF Band is selected for the Channel Map, set the frequency for 3.9 to 38 MHz in 1 Hz units.

```
Frequency
   Channel Map              :  [UHF                    ]
   Channel / Frequency      :  [ 13CH]
```

Figure 2.2.3-1 Channel settings

```
Frequency
   Channel Map              :  [General                ]
   Channel / Frequency      :  [       500.000 000MHz]
   Offset Frequency         :  [          0.000 000MHz]
   Spectrum                 :  [Normal]
```

Figure 2.2.3-2 Frequency settings

The frequency and channel can also be set from the Freq/Channel key on the front panel.

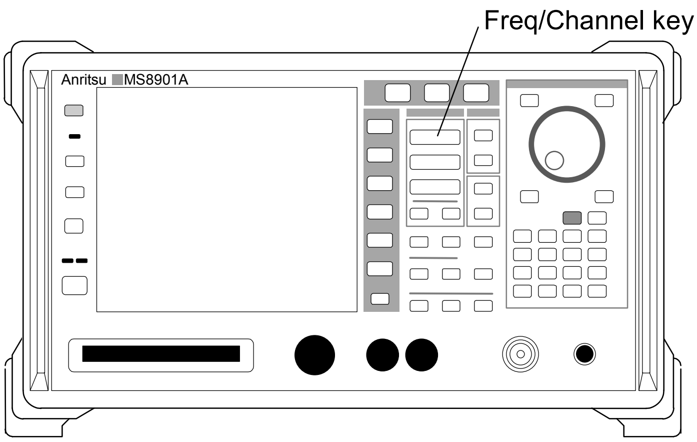


Figure 2.2.3-3 Freq/Channel key

Pressing the Freq/Channel key switches soft key contents. Press the Frequency soft key (F2) or Channel soft key (F1) to display the pop-up window and set the frequency or channel. Pressing the Channel Map key (F4) changes each item of Channel Map.

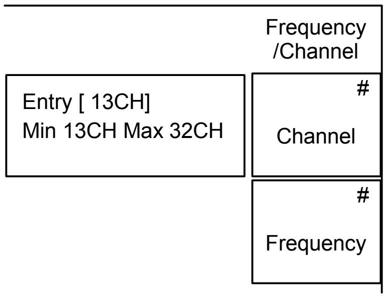


Figure 2.2.3-4 Setting from Freq/Channel key

2.2.4 Offset Frequency

The offset frequency can be set by the Offset Frequency item when General or IF Band is selected for Channel Map.

The offset frequency can be set from 0.000000 to 12000.000000 MHz. When the offset frequency is set, it is added to the measured frequency result and displayed on the Modulation Analysis screen or C/N screen.

```
Frequency
  Channel Map              :  [ General              ]
  Channel / Frequency      :  [      500.000 000MHz]
  Offset Frequency         :  [     8000.000 000MHz]
  Spectrum                 :  [Normal]
```

Figure 2.2.4-1 Offset Frequency settings

The MS8901A cannot handle the RF signal frequency exceeding 3 GHz such as when analyzing the ISDB-T signals on the microwave line.
The RF signal must be converted up to a frequency that the MS8901A can handle by using an external frequency converter at this time. Setting the difference between the RF signal frequency and the frequency of the signal to be input to the MS8901A to the offset frequency enables to display the measured frequency results as an RF signal value.

For example, when 500 MHz is set to Frequency and 10000 MHz to Offset Frequency, 10500 MHz (500 MHz + 10000 MHz) is displayed for the frequency on the lower of the screen while the frequency difference shows the value from 10500 MHz.

```
Frequency   : 105000.000 000MHz
                                    Pre Ampl   : Off
```

Figure 2.2.4-2 Display when Offset Frequency is set

2.2.5 Spectrum

The spectrum for 37.15-MHz IF signals in digital broadcast equipment is reversed with respect to final RF frequency signals. In addition, the IF signal spectrum will still be reversed when the LO signal frequency is set higher than the RF signal frequency even when the frequency is down-converted using an external frequency converter. Set Spectrum when analyzing the signal where the spectrum is reversed.

Normal: Analyzes the signal with normal spectrum.
Reverse: Analyzes the signal with reversed spectrum.

```
Frequency
  Channel Map                 : [ General              ]
  Channel / Frequency         : [     500.000 000MHz]
  Offset Frequency            : [    8000.000 000MHz]
  Spectrum                    : [Normal]
```

Figure 2.2.5-1 Spectrum reverse settings

The spectrum reverse can be set only when the channel map is General or IF Band.

2.2.6 Level

When RF input is selected for the terminal, the input signal level can be set. There are two methods for setting the input signal level Also the user can choose whether or not to refer to the modulation error ratio (MER) when adjusting the range automatically. Press the Level Cont key (F4), one of the soft key on the second page of Setup Common Parameter screen. Pressing the key toggles back and forth between Ref Setting and Adjust Range.

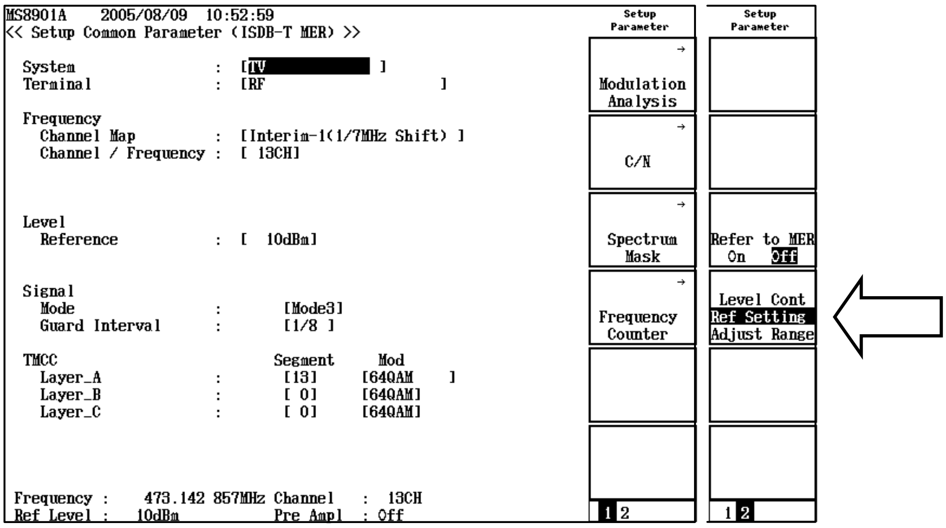


Figure 2.2.6-1 Level Cont key

To change the setting of the auto range adjustment by the modulation error ratio, press the Refer to MER key (F3), which is the soft key on the 2nd page. Pressing the key toggles on and off.

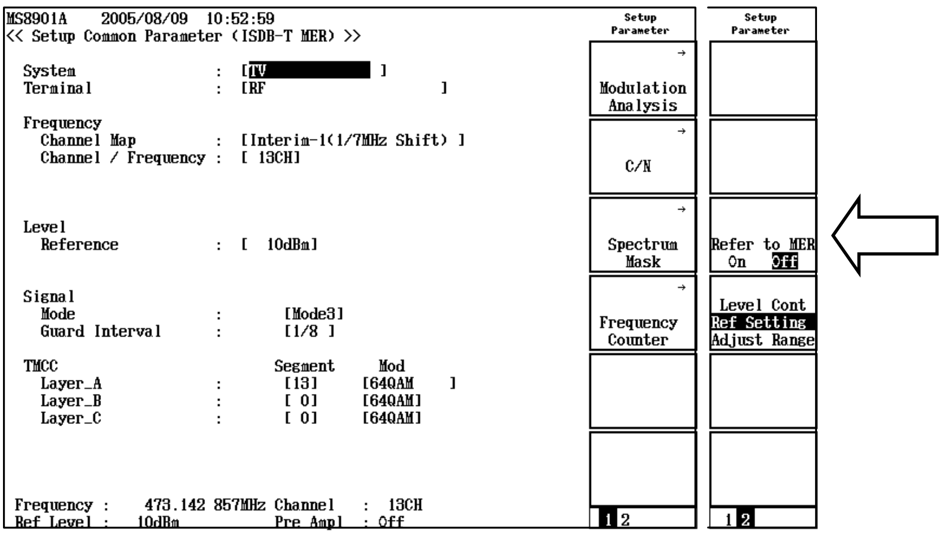


Figure 2.2.6-2 Refer to MER key

- Auto range adjustment (Adjust Range):
  Press the Level Cont soft key (F4) to set Adjust Range. The MS8901A measures the input level up to 3 GHz and automatically sets the optimum range. It is used for measurement in an environment where interfere waves exist, such as field tests.

Note:

Only Ref Setting is available when the frequency map is IF Band.

- Reference level setting (Ref Setting)
  Pressing the Level Cont key (F4) sets RefSetting. This can be set by hand on the front panel. It is used when the signal level is known beforehand such as a transmitter test. The initial state is Ref Setting.

- Auto range adjustment by the modulation error ratio (Refer to MER)
  This function is valid only on the Modulation Analysis screen. Press the Refer to MER (F3) key to switch to Off state. When executing Adjust Range with Refer to MER set to Off, the MS8901A itself the measures the input level up to 3 GHz to set the optimal range automatically. When executing Adjust Range with Refer to MER set to On the MS8901A itself measures the input level up to 3 GHz and detects the optimal ranges automatically. After it, Mode, Guard Interval, TMCC for the input level is automatically detected and then the modulation error ratio of the set frequency and channel is automatically measured. After measurement, the reference level is set, in which the modulation error ratio becomes the most adequate. This is very useful when an unwanted wave influences highly (e.g., field measurement).

  When the environment for measurement is not stable, the operation might be also unstable, too, when Adjust Range is executed with Refer to MER set to On. In this case, adjust the range by hand or execute Adjust Range again after setting Refer to MER to Off state. The initial state is set to Off.

(1) Reference level setting (Ref Setting)

Input the signal level to input from the screen as the reference level.

Preamplifier Off: –26 to +10 dBm

Preamplifier On: –46 to –10 dBm

Figure 2.2.6-3 Reference level setting

The reference level can be set from the Amplitude key on the front panel. Press the Amplitude key to change the soft key menu content, and a pop-up window opens on the left of the Ref Level soft key (F1). Set the reference level here.

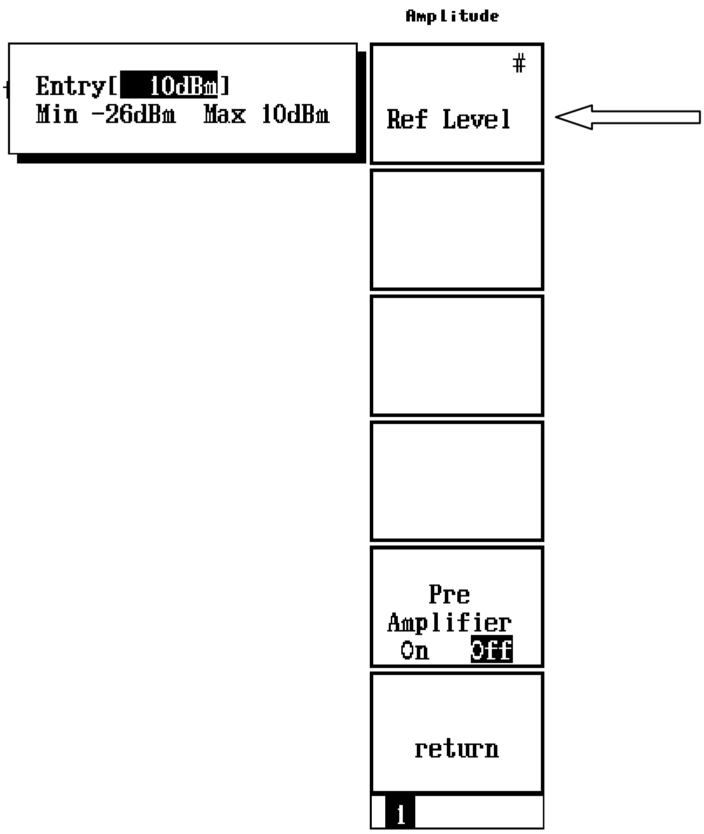


Figure 2.2.6-4 Settings using Amplitude key

Note:

When the Adjust Range is selected as the level setting (Level Cont), there is no need to set the reference level. The following input method is to be abbreviated.

(a) The setting item for Reference Level is not displayed on the Setup Common Parameter screen.

(b) Even pressing Amplitude key does not display the Ref Level key (F1).

(2) Auto range adjustment (Adjust Range)

When the Adjust Range is selected, the Adjust Range soft key (F5) is displayed in the soft key menu of each measurement screen (Signal Analysis, C/N, Spectrum Mask, and Frequency Counter screens). When the Adjust Range soft key (F5) is pressed, the MS8901A automatically measures the signal levels within the full bandwidth (up to 3 GHz) to set the internal range to the optimum condition.

This function takes approximately two seconds.

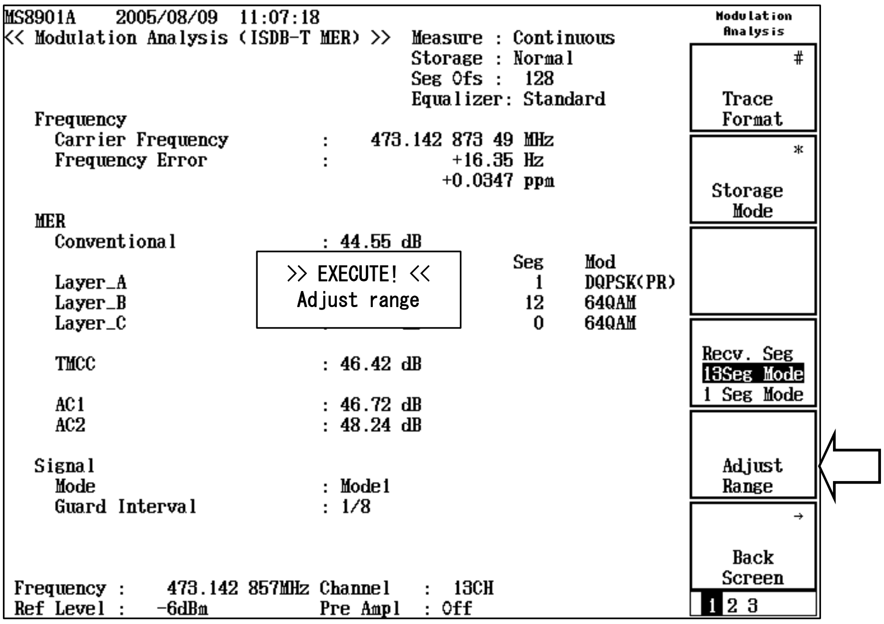


Figure 2.2.6-5 Adjust Range key and screen during Auto Range adjustment

Pressing the Adjust Range key displayed by the Amplitude key on the front panel, can set the range automatically. However, pressing the Amplitude key on the Setup Common Parameter screen does not display the Adjust Range key.

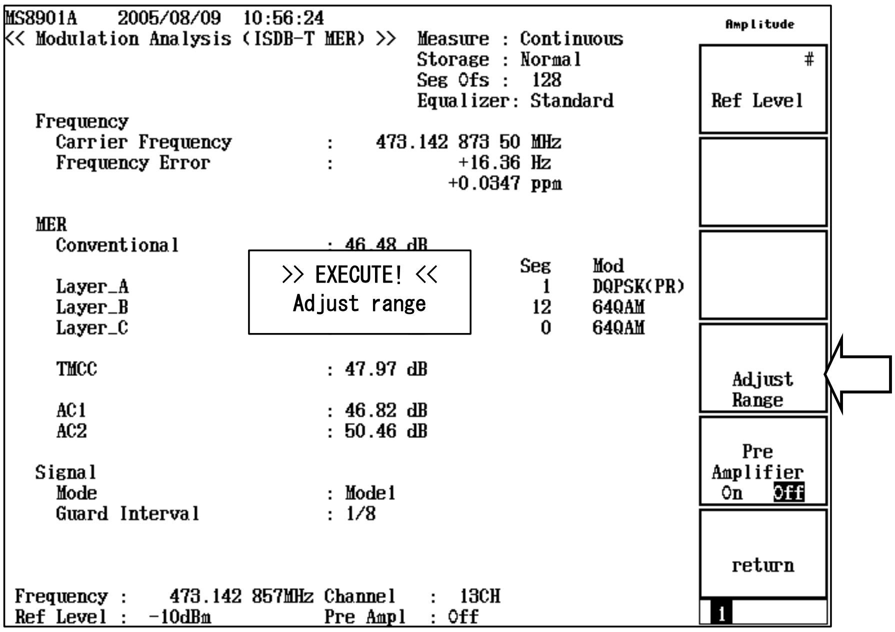


Figure 2.2.6-6 Adjust range key displayed on the amplitude key menu

When Adjust Range is selected as the level setting (Level Cont), Adjust Range is automatically executed every time the screen is switched to each measurement setting screen from the Setup Common Parameter screen or the Spectrum Analyzer mode.

Note:

Range is not automatically adjusted when Channel Map is IF Band.

(3) Auto range adjustment by the modulation error ratio (Refer to MER)

When measuring the modulation error ratio (MER) at the environment like field, where the unwanted wave is high, set the Refer to MER (Refer to the Modulation Error Ratio) to On.

If there is no unwanted wave or it is relatively low, set the Refer to MER to off.

When pressing the Adjust Range key on the MER screen with Refer to MER On, the MS8901A automatically measures the signal level within the full bandwidth (up to 3 GHz) to set the internal range to the optimal status.

Next, after detecting Mode (2.2.7), Guard Interval (2.2.8), and TMCC (2.2.9), the modulation error ratio of the set channel is automatically measured. After it, the reference level is set in which MER becomes the most adequate.

This function takes approximately 15 to 25 seconds.

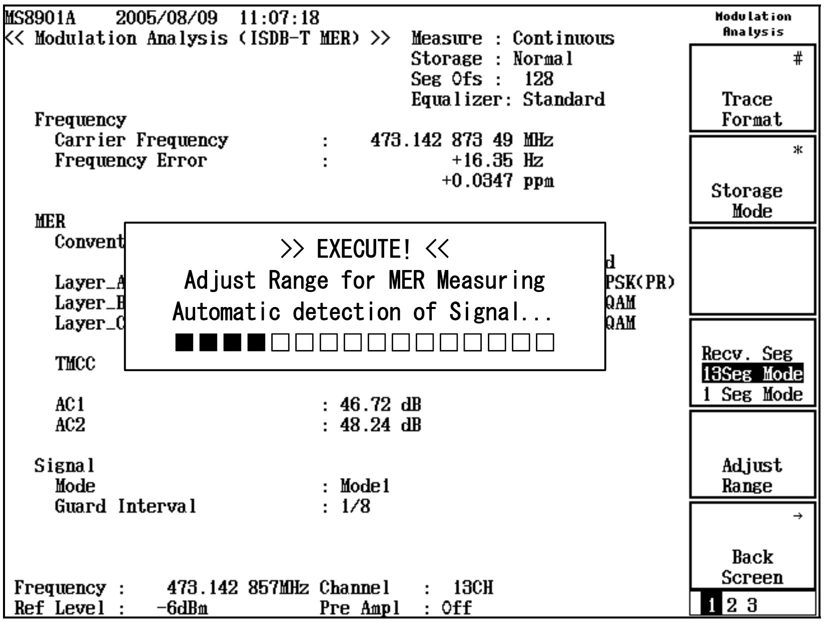


Figure 2.2.6-7 Automatic detection (auto range adjustment by the modulcation error ratio)

Note:

When detecting the different parameter from the content of the current Setup Common Parameter (code ratio and time interleave are count out, for they are not included within the setting content of this software) after the automatic detection of Mode, Guard Interval and TMCC, the Modulation Analysis screen is automatically switched to No Trace screen. If the parameter is found to be the same with the current setting content, the screen is not changed.

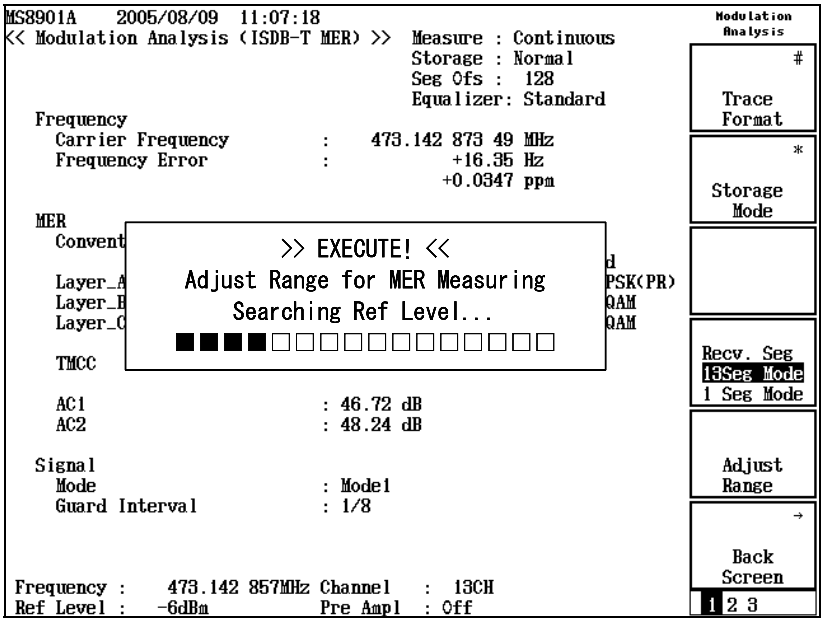


Figure 2.2.6-8 Modulation error ratio is being measured (auto range adjustment by the modulation error ratio)

When the Adjust Range is selected as the Level Cont, including the setting of the reference of the modulation error ratio (Refer to MER), the Adjust Range referring to MER is automatically executed at the switch to the Modulation Analysis screen from the Setup Common Parameter screen or to the Modulation Analysis screen from the spectrum analyzer mode.

(4) Input level status display

An indicator that identifies where actual input levels are not appropriate for the input level set appears in the upper left of the screen. The measured results may not be correct when this indicator appears. Reset the reference level or execute the auto range adjustment.

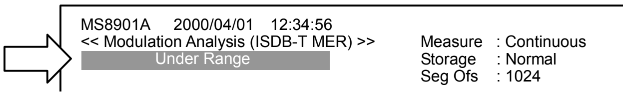


Figure 2.2.6-9 Under Range Indicator

(a) Level Over

An indicator appears when the input level exceeds +10 dBm while the pre-amplifier is set to Off. Internal circuits of the MS8901A may be damaged at further input levels. Lower the input level immediately.

(b) Over Range

The input level is too high against the range currently set. Execute the auto range adjustment.

(c) Over Range (Preamp Saturated)

This is displayed when the preamplifier is on and the level of the received signal gets higher than the uppermost limit of the currently set range. Executing the Adjust Range in this state can perform the measurement. However, it is only enlarging the input attenuator, which is in the runup to the preamplifier, and as a result does not lead to the internal setting to perform the function. For the setting to utilize the function, set the preamplifier off and execute Adjust Range. Refer to Section 2.2.10 “Preamplifier”, for details on the preamplifier setting.

(d) Level Under

This is displayed when a signal lower than the rated input level is input. Raise the input signal level. Terminal is displayed as other than RF.

(e) Under Range

The current reference level might be influenced by the noise floor of the measurement instrument. Execute the Adjust Range. When executing the Modulation Error Ratio in an environment including the unwanted wave like a field, set the Refer to MER to On state and execute the Adjust Range again.

If the Under Range is displayed again after the Adjust Range execution, switch the preamplifier to On state if it is Off state. And execute the Adjust Range again.

If the Under Range is still displayed, it might be that the range is set to the minimum level or the measurement level reaches to the limit by the unwanted wave. Make sure of the existence or nonexistence of the unwanted wave at the MS8901A spectrum analyzer mode. If necessary, use the band pass filter.

Refer to the following section of "Under Range", for details on this.

(f) Carrier Unlock

Mode (2.2.7), Guard Interval (2.2.8) and TMCC (2.2.9), all of which are set to the MS8901A do not correspond with the input signal. Detect the signal parameter automatically. Refer to Section 2.10 "Signal Parameter Automatic Detection Function".

Under Range:

Under range display shows that there is a possibility that the noise floor of the measurement instrument influences on the measurement value at the signal level to input. Under Range function brings to notice there is a possibility that the specifications might not be satisfied and this does not immediately mean the aberrance.

When executing the Adjust Range in an environment including the unwanted wave, the Under Range does not sometimes do a bunk. This is to avoid the distortion of the instrument by the unwanted wave.

When measuring the Modulation Analysis, the most optimal modulation error ratio (MER) becomes the measurement bound of this instrument. And this optimal MER is gained when the Refer to MER is On or the reference level is set by hand power.

If the measurement bound matters, remove the unwanted wave beforehand using the appropriate band path filter.

2.2.7 Mode

Set the input signal mode (Mode). Select from the following modes.

- Mode1
- Mode2
- Mode3

```
Signal
  Mode                         :  [Mode1]
  Guard Interval               :  [1/4 ]
```

Figure 2.2.7-1 Mode settings

2.2.8 Guard Interval

Set the guard interval for the input signal (Guard Interval). Select from the following.

- 1/4
- 1/8
- 1/16
- 1/32

```
Signal
  Mode                         :  [Mode1]
  Guard Interval               :  [1/4 ]
```

Figure 2.2.8-1 Guard Interval settings

2.2.9 TMCC

Set the TMCC information of the input signal.
Transmission and Multiplexing Configuration Control (TMCC) is a signal used for transmitting control data. The number of segments (Segment) and modulation system (Mod) at each layer from Layer A to Layer C are set here.
The total number of segments from Layer A to Layer C must be 13. When the input value total is over 13, the number of segments is automatically changed from Layer_A, Layer_B and Layer_C in this order.
For example, when the number of segments of Layer_A is 10, Layer_B is 1 and Layer_C is 2, if the number of segments of Layer_C is changed to 7, that of the Layer_A is automatically changed to 5 and that of Layer_B remains the same (1).
The total number of segments is automatically adjusted as above so that it is always 13.

Select the modulation system from the following.
64QAM
16QAM
QPSK
DQPSK
64QAM (PR)
16QAM (PR)
QPSK (PR)
DQPSK (PR)

The PR here is an abbreviation of Partial Reception. Make sure to select PR items when Partial Reception signals are added to Layer A. The number of segments at Layer A automatically becomes one at this time.

```
TMCC                        Segment      Mod
  Layer_A              :    [13]        [64QAM       ]
  Layer_B              :    [ 0]        [64QAM]
  Layer_C              :    [ 0]        [64QAM]
```

Figure 2.2.9-1 TMCC settings

2.2.10 Preamplifier

A pre-amplifier is built into the RF input portion as standard with the MS8901A. Set the pre-amplifier to On when the input signal level is low to enhance the MS8901A's NF (Noise Figure) to enable low level measurements.

Press the Amplitude key on the front panel to change the soft key contents. Then press the Preamplifier soft key (F5) to set the pre-amplifier On/Off.

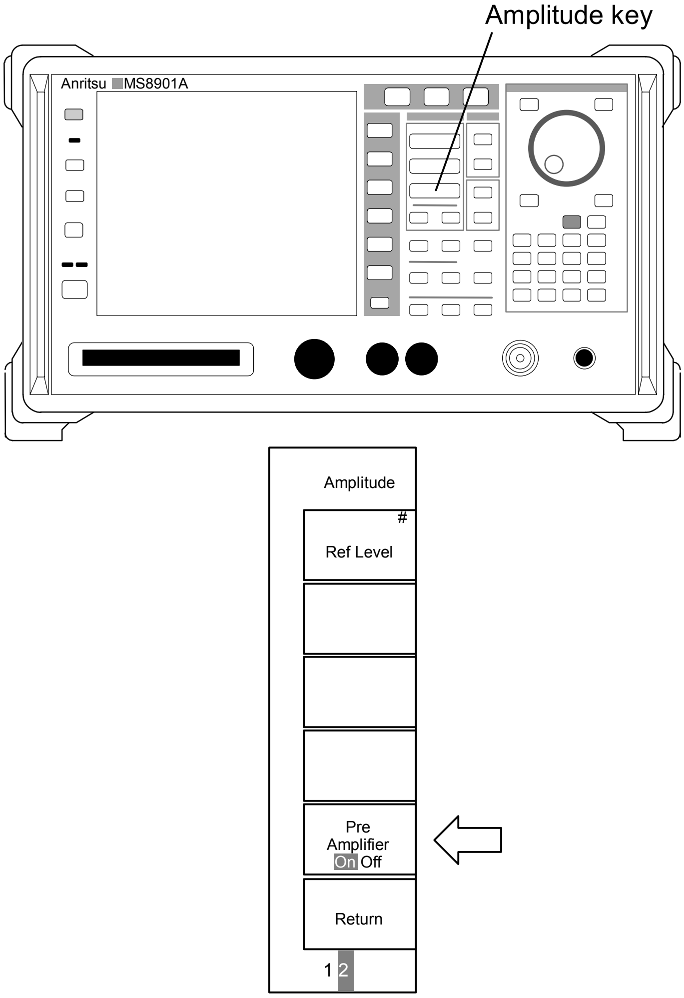


Figure 2.2.10-1 Preamplifier control

Note:

Values for maximum RF input level (the level when the MS8901A is not damaged) differ depending on the pre-amplifier On/Off setting.

Preamp Off: +30 dBm
Preamp On: +10 dBm

For example, there is a risk of damaging the MS8901A interior if the pre-amplifier is set to On when +20 dBm is input with the pre-amplifier Off. Note the input level when setting the pre-amplifier On/Off while signals are input.

2.2.11 Measurement mode

Measurement mode refers to the frequency how often measured results should be updated. There are two measurement modes provided: continuous mode (Continuous) and single mode (Single).

The measurement mode is set on a measurement screen.

(1) Continuous mode (Continuous)
Measurements are conducted and display is updated continuously.
Press the Shift key and Single key (panel key) in succession to switch to the continuous mode. “Measure: Continuous” will appear in the upper part of the screen.
This mode should be used for normal measurement.

(2) Single mode (Single)
Executes measurement only once and stops when the measurement ends. Press the Single key on the panel to switch to the single mode. The message “Measure: Single” is displayed on the upper part of the screen. After the measurement is finished, press the Single key to execute the measurement again. The single mode should be used when updating the screen during time-consuming process such as copying a screen.

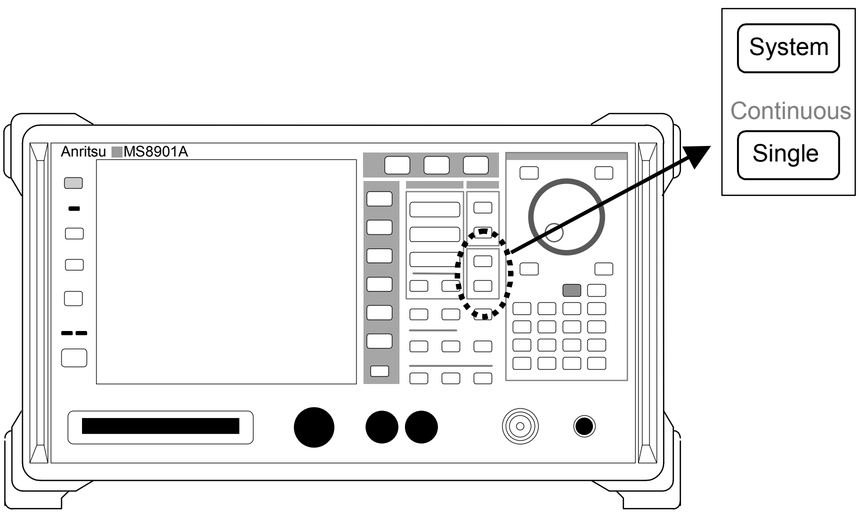


Figure 2.2.11-1 Single key and Continuous key

When the Storage Mode is set to Average, the measurement mode automatically switches to the Single mode. The measurement operation stops when measurement is performed for the number set in Average Count. “Measure: Single” on the upper right of the screen is not displayed and goes blank at this time.
Refer to Section 2.7 “Storage Mode” for details.

2.2.12 Initialization (Preset)

Initialization restores the measurement parameters to the values at factory shipment. It is executed when the measurement parameter settings are unknown.

Press the Preset key on the upper left of the front panel to execute initialization.

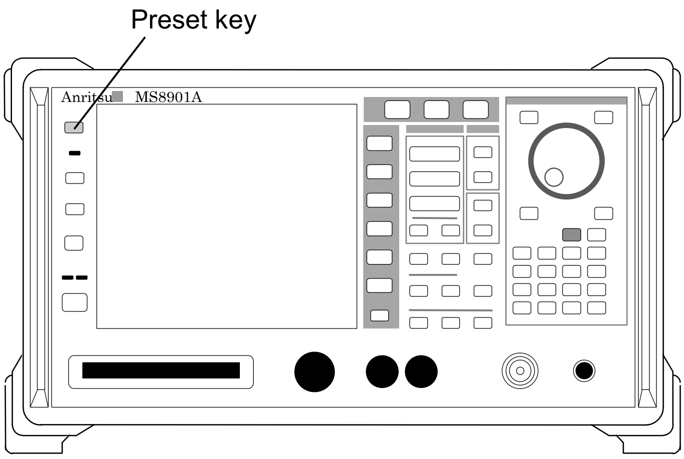


Figure 2.2.12-1 Preset key

Measurement parameters are set to the following values after initialization. The Setup Common Parameter screen is displayed after initialization.

Table 2.2.12-1 Setup Common Parameter screen default

Item	Default
System	TV
Terminal	RF
Impedance*	50 Ω
Channel Map	Interim-1
Channel & Frequency	13CH
Offset Frequency	0 Hz
Spectrum	Normal
Level Cont	Ref Setting
Refer to MER	Off
Reference Level	+10 dBm
Mode	Mode3
Guard Interval	1/8
Layer A Segment	13
Mod	64 QAM
Layer B Segment	0
Mod	64 QAM
Layer C Segment	0
Mod	64 QAM
Preamplifier	Off

*: Not displayed when Terminal = RF.

Table 2.2.12-2 Modulation Analysis screen default

Item	Default
Trace Format	No Trace
Storage Mode	Normal
Amount of Count	5
Refresh Interval	Every
Segmentation Offset	512
Section	Layer_A
Recv. Seg	13 Seg Mode
Equalizer	Standard
Auto. Det. from Seg	0
Correction	Off
Ampl Vertical Scale	±20 dB
MER Vertical Scale	50 dB
Threshold Offset	20.00 dB
Worst Envelope	Off
Marker Trace	Current
Peak Search	13 Segment

Table 2.2.12-3 C/N screen default

Item	Default
Integral Mode	Off
Integral Start	1.000 kHz
Integral Stop	1000.000 kHz
Storage Mode	Normal
Amount of Count	5
Refresh Interval	Every

Table 2.2.12-4 Spectrum Mask screen default

Item	Default
Mask	Transmission
Equipment Standard	Type A
Station Power	High
Average Power	2.50 W
Number of Channel	1
Filter Default	Default
Last Result	On
Uncorrection Result	Off
Filter Data	Off
Marker Trace	Last Result

Table 2.2.12-5 Frequency Counter screen default

Item	Default
Storage Mode	Normal
Amount of Count	5
Refresh Interval	Every

Table 2.2.12-6 Other default

Item	Default
Measurement Mode	Continuous

2.3 Modulation Analysis

Signals that conform to the ISDB-T can be analyzed for the following four items:

- Frequency
- MER
- Constellation
- Frequency response
- Sub-carrier MER

Press the Modulation Analysis soft key (F1) on the Setup Common Parameter screen to move to the Modulation Analysis screen to perform signal analysis.

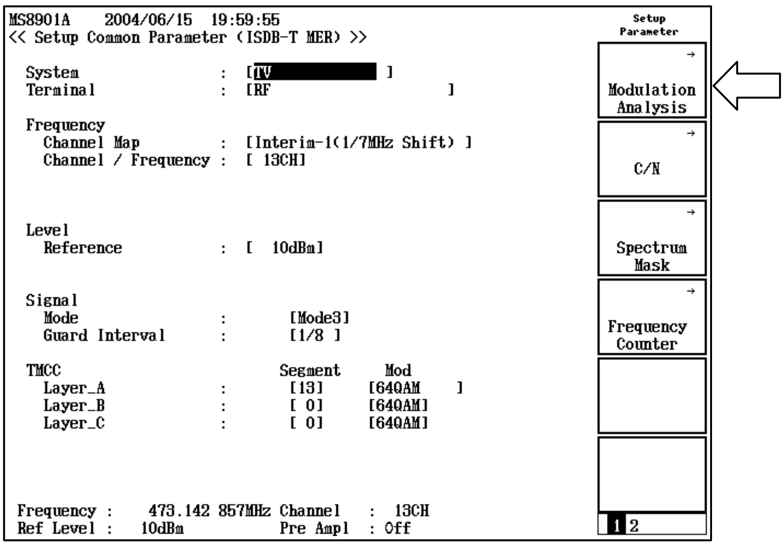


Figure 2.3-1 Setup Common Parameter screen

The Signal Analysis screen can be switched to four types of analysis results screens with the Trace Format soft key (F1).

Note:

Freq Response measurement cannot be performed when DQPSK is selected for the modulation system.

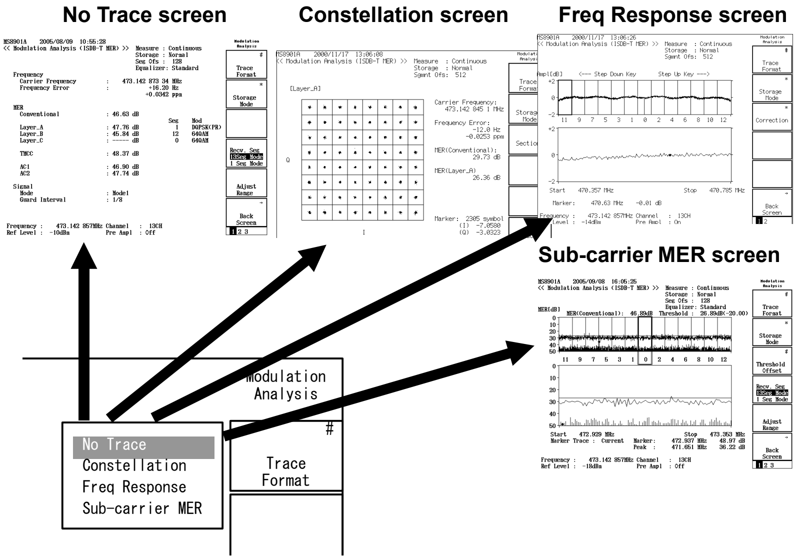


Figure 2.3-2 Switching to the Signal Analysis screen

2.3.1 Frequency and MER measurement (No Trace screen)

The carrier frequency and Modulation Error Ratio (MER) of signals that conform to the ISDB-T are measured in the No Trace screen.
MER is an index for expressing the effect of noise and distortions contained in demodulation signals comprehensively.
The MER permits equivalent C/N ratios to be estimated.

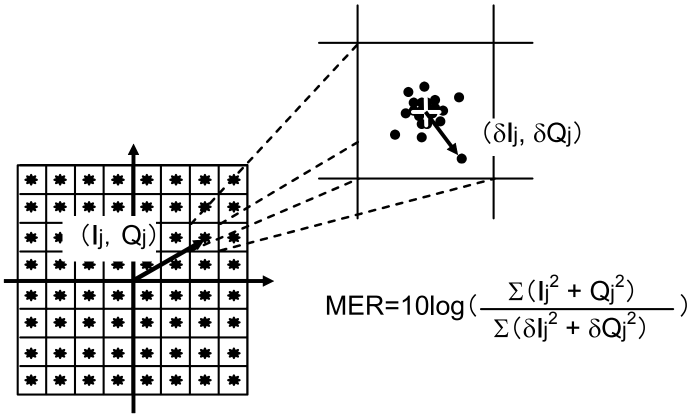


Figure 2.3.1-1 Definition of MER

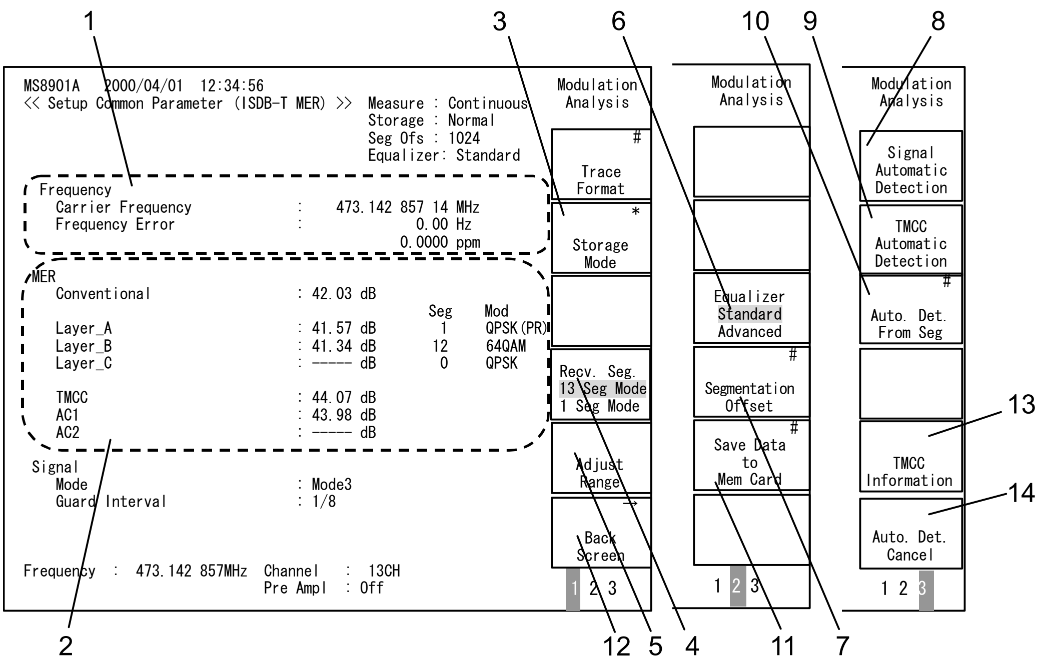


Figure 2.3.1-2 No Trace screen

1: Frequency measurement
The carrier frequency for OFDM-modulated signals that conforms to ISDB-T is measured. When the offset frequency is set, the carrier frequency added with the set offset frequency is displayed.
The difference between the measured frequency and the set frequency (frequency displayed at the bottom of the screen) is displayed as a Frequency Error.

Note:

Offset frequency additions are only the simple adding of setting values. The correct value may not be shown when there are frequency errors in the LO signal sources of the frequency converter.

While the frequency measurement function allows differences in the carrier frequency of up to ±99 kHz to be tracked, the frequency differences beyond that cannot be measured. The message "Carrier Unlock" is displayed in the upper left of the screen when the carrier frequency difference exceeds ±300 Hz.

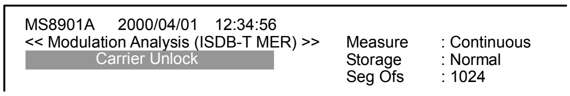


Figure 2.3.1-3 Carrier Unlock display

Note:

While a certain degree of locking is available for carrier frequency differences as described in the above with the frequency measurement function, lock functions are not performed on FFT sample clock frequency differences.

2: MER measurement
The OFDM signal conforming to ISDB-T possesses a layered structure for setting modulation systems individually per layer. The MER values can be measured for each layer here as a result. In addition, the MER values are measured individually for TMCC, AC and other information carriers as they employ independent modulation systems.

Conventional:
MER value that synthesizes all sub-carriers (Data carrier for each layer, TMCC, AC, SP, CP)
This is the total value where weight is given to the MER values from Layer A to Layer C and for TMCC and AC using the number of sub-carriers.

Layer_A:
MER value at Layer A

Layer_B:
MER value at Layer B. The Segment Number for Layer B must be set to at least one in order to measure this value.

Layer_C:
MER value at Layer C. The Segment Number for Layer C must be set to at least one in order to measure this value.

TMCC:
MER value of the TMCC signal.

AC1:
MER value of the AC1 signal.

AC2:
MER value of the AC2 signal. The DQPSK must be set to the modulation system of at least one layer from Layer A to Layer C in order for this value to be measured.

3: Storage Mode
This parameter sets the methods for displaying the measured results on the screen. Average, Max Hold, Over Write and other modes can be set. Refer to Section 2.7 “Storage Mode” for details.

4: Receive of Segment
This parameter switches the partial reception signal analysis function described in Section 2.3.5 “Partial reception signal analysis (Recv. Seg).”

5: Adjust Range
This parameter performs hardware settings appropriate for the RF signal level. During execution, the Adjust Range execution window opens and other processing is disabled. This parameter cannot be executed when other than RF is selected as Terminal.

6: Equalizer
This parameter switches the Equalizer setting between Advanced and Standard. Measurement is performed again after switching. The setting is toggled by pressing the function menu key. The selected item (Advanced/Standard) is shown in reverse display.
When Equalizer is set to Advanced, MER measurement can be easily performed under conditions where the frequency response varies significantly such as in a multipath environment. However, the Advanced setting may handle the measurement data at both ends of frequency as invalid values during calculation. Refer to Section 1.4 “Specifications” for details. It is recommended to set Equalizer to Standard when the measurement environment is stable.

7: Segmentation Offset
This parameter specifies the position where the signal is recalled within the OFDM symbol. Refer to Section 2.3.6 “Segmentation Offset” for details.

8: Signal Automatic Detection
This parameter automatically detects Mode, Guard Interval and TMCC of the input signal. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

9: TMCC Automatic Detection
This parameter automatically detects TMCC of the input signal. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

10: Automatic Detection segment position setting
This parameter sets which segment’s TMCC is to be used for automatic TMCC detection of the input signal. The set segment position is used from the next automatic TMCC detection. When Receive of Segment (partial reception) is set to 1 Seg Mode, the segment position cannot be changed. In this case, the function menu key appears in outline characters indicating that it is disabled. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

11: Save Data to Mem Card
This parameter saves the measured results as numerical value data to the memory card. Refer to Section 2.12.2 “Saving numerical value data” for details.

12: Back Screen
This parameter returns to the Setup Common Parameter screen where measurement parameters are set.

13: TMCC Information
This parameter detects TMCC information of the input signal.
Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

14: Auto. Det. Cancel
This parameter stops detection during execution of an automatic detection function such as Signal Automatic Detection or TMCC Automatic Detection, and performs signal analysis with the parameters currently set. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

2.3.2 Constellation measurement (Constellation screen)

The constellation is used to express the symbol position of demodulated signals diagrammatically. View this constellation to study the signal purity or the cause of failures that occur.

The MER is the numerical value converted from this constellation.

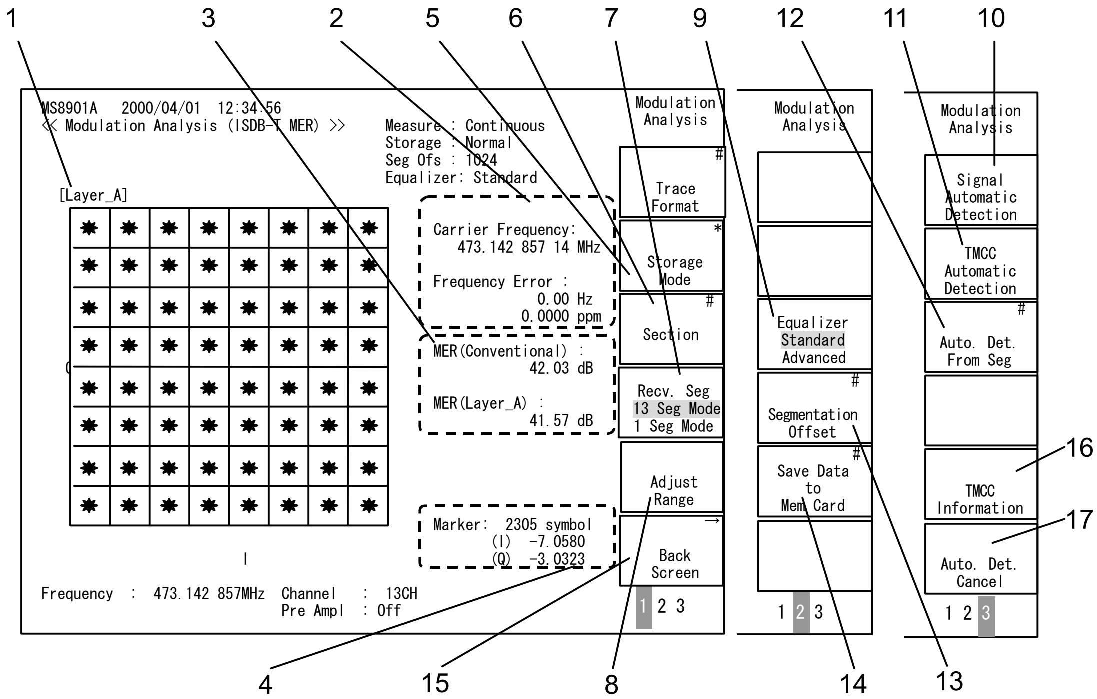


Figure 2.3.2-1 Constellation screen

1: Constellation
Constellation type (section) currently displayed. Refer to 6: Section below for details.
The Conventional constellation cannot be displayed.

2: Frequency measurement
This parameter measures the carrier frequency. This is identical to the frequency displayed on the No Trace screen.

3: MER measurement
This parameter measures the Conventional MER and the MER for sections currently displayed. This is identical to the MER displayed on the No Trace screen.

4: Marker

The I and Q values for each symbol on the Constellation can be recalled with the marker.

The marker is expressed in a red colored diamond shape on the Constellation screen. It can be moved by using the Rotary Encoder.

In addition, any symbol numbers can be input directly for reading the I and Q values at these positions. Press the Marker key on the front panel. A pop-up window will open to input the number of symbols.

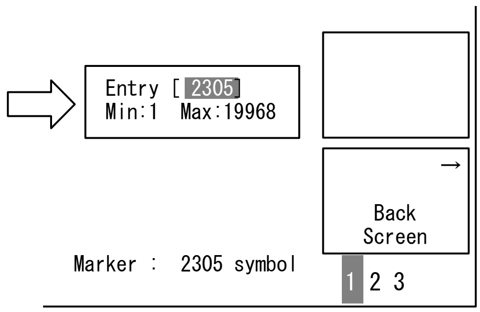


Figure 2.3.2-2 Input the number of marker symbols

Four OFDM data are loaded in one measurement for analysis with Signal Analysis. For example, 19968 symbol data exist in total with Mode3. Symbol numbers are allocated automatically from the lower frequencies of recalled data. Note that the correspondence between the symbol number and frequency in each OFDM symbol is reversed (higher frequency first) when the spectrum reverse setting is Reverse.

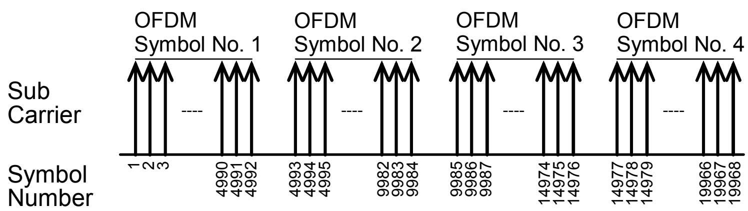


Figure 2.3.2-3 Marker symbol number

5: Storage Mode

This parameter sets the methods for displaying the measured results on the screen. Average, Max Hold, Over Write and other modes can be set. Refer to Section 2.7 “Storage Mode” for details.

6: Section
Constellation types (sections) to be displayed are selected. A Constellation type selected here is shown in 1: Constellation.
Press the Section key (F3). A pop-up window is opened to select the constellation type from among these. Refer to Section 2.3.1 "Frequency and MER measurement (No Trace screen)" for the selectable constellation types.

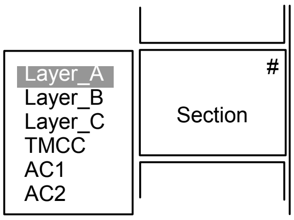


Figure 2.3.2-4 Section key

7: Receive of Segment
This parameter switches the partial reception signal analysis function described in Section 2.3.5 "Partial reception signal analysis (Recv. Seg)."

8: Adjust Range
This parameter performs hardware settings appropriate for the RF signal level. During execution, the Adjust Range execution window opens and other processing is disabled. This parameter cannot be executed when other than RF is selected as Terminal.

9: Equalizer
This parameter switches the Equalizer setting between Advanced and Standard. Refer to "6. Equalizer" in Section 2.3.1 "Frequency and MER measurement (No Trace screen)" for details.

10: Signal Automatic Detection
This parameter automatically detects Mode, Guard Interval and TMCC of the input signal. Refer to Section 2.10 "Signal Parameter Automatic Detection Function" for details.

11: TMCC Automatic Detection
This parameter automatically detects TMCC of the input signal. Refer to Section 2.10 "Signal Parameter Automatic Detection Function" for details.

12: Automatic Detection segment position setting
Sets which segment's TMCC is to be used for automatic TMCC detection of the input signal. Refer to "10. Automatic Detection segment position setting" in Section 2.3.1 "Frequency and MER measurement (No Trace screen)" for details.

13: Segmentation Offset

This parameter specifies the position where the signal is recalled within the OFDM symbol. Refer to Section 2.3.6 “Segmentation Offset” for details.

14: Save Data to Mem Card

This parameter saves the measured results as numerical value data to the memory card. Refer to Section 2.12.2 “Saving numerical value data” for details.

15: Back Screen

This parameter returns to the Setup Common Parameter screen where measurement parameters are set.

16: TMCC Information

This parameter detects TMCC information of the input signal.

Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

17: Auto. Det. Cancel

This parameter stops detection during execution of an automatic detection function such as Signal Automatic Detection or TMCC Automatic Detection, and performs signal analysis with the parameters currently set. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

2.3.3 Frequency Response (Freq Response screen)

The frequency responses within the 5.6 MHz band are displayed by using the CP and SP signals.

Note:

Freq Response measurement cannot be performed when DQPSK is selected for the modulation system of any layer.

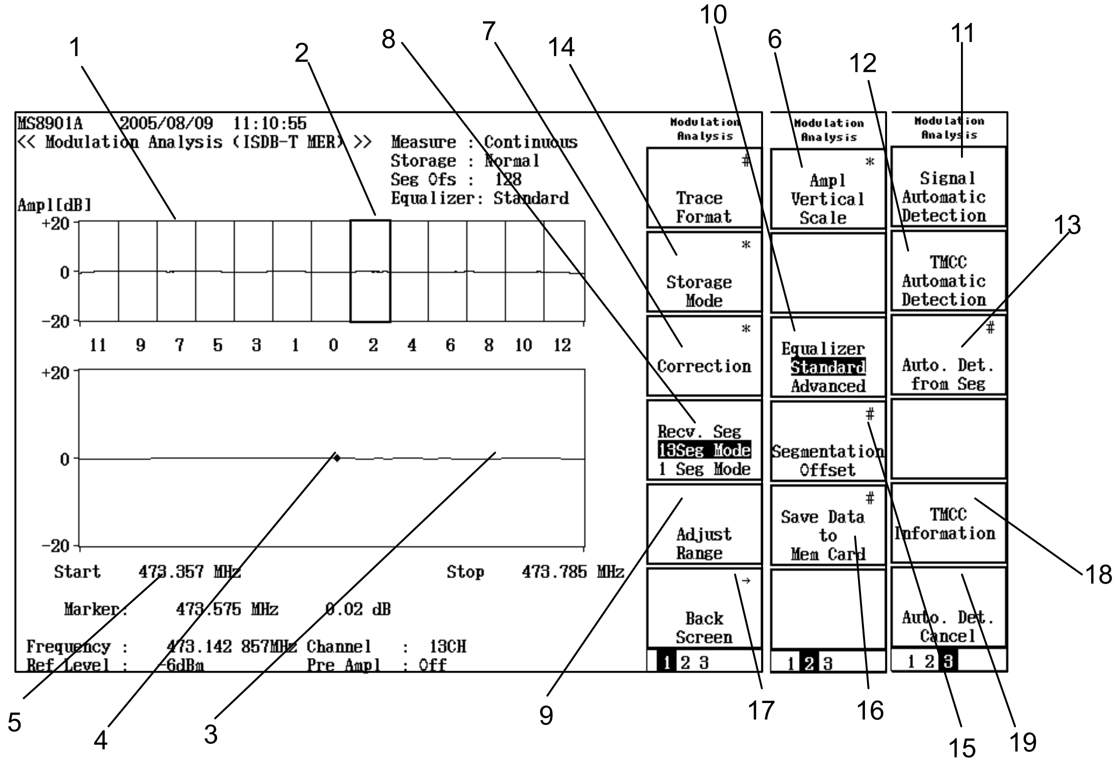


Figure 2.3.3-1 Freq Response screen

1: Full frequency response display
This parameter displays the frequency response in the 5.6 MHz band. The frequency responses are displayed in relative values, assuming the average power for the entire band as 0 dB. The horizontal axis is the segment number.

2: Magnify window
This parameter magnifies the segment of this window and displays it to the bottom of the screen. This magnify window can be moved horizontally using the Step key on the front panel.

3: Magnify display for frequency response
This parameter magnifies the position where the magnify window is located for display.

4: Marker
The marker point is where the diamond shape in the magnify window is located. The frequency and relative level at the marker position are magnified and displayed to the lower part of the screen.
The marker can be moved horizontally using the Rotary Encoder on the front panel.

5: Frequency and relative level at marker position
The frequency and relative level at the marker point are displayed.
The frequency is displayed in absolute values. The relative level is based assuming the power in 5.6-MHz band as 0 dB.

6: Ampl Vertical Scale
This parameter sets the displays range of the relative level axis (vertical axis) from ±2 dB to ±50 dB.
Press the Ampl Vertical Scale key (F1) located on page 2 of the soft key menu to change the soft key contents to a list of vertical scales. Select from among these.

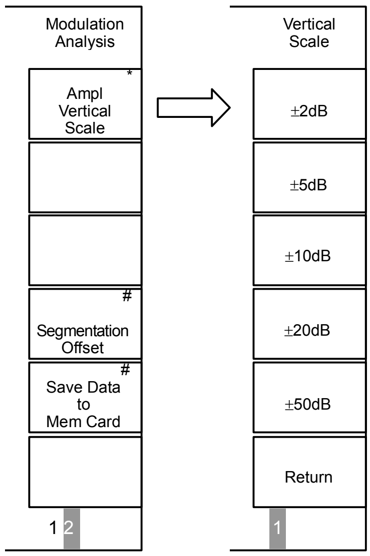


Figure 2.3.3-2 Relative level axis settings

7: Correction

Frequency response can be corrected with an external signal source. A method of use similar to the Network Analyzer is available.

Press the Correction soft key (F3) to change the soft key contents.

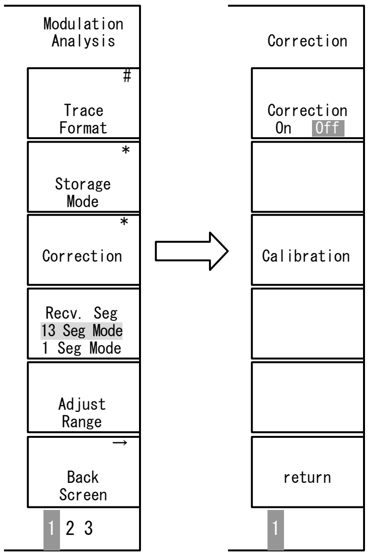


Figure 2.3.3-3 Frequency response correction

Calibration:

Pressing this key loads the frequency response data currently being measured, sets Correction On and starts measurement again.

Data loaded by Calibration is kept while the power is supplied to the MS8901A (data is erased when power is shut off).

Correction On/Off:

Controls whether frequency response correction functions are executed with data loaded by Calibration.

Press this key to switch (toggle) On/Off.

When Correction is set to On, “Cal” or “Uncal” is displayed at the upper left of the screen. “Uncal” indicates that correction has failed. In addition, this indication may change when the setting for after executing Calibration has changed.

When the settings for Receive of Segment and Equalizer are not changed after executing Calibration, “Cal” is displayed indicating that the correction value is valid. If the setting for Receive of Segment or Equalizer is changed after executing Calibration, or Calibration has not been executed, “Uncal” is displayed. However, if Receive of Segment is set to 13 segments when Calibration is executed, frequency response data in a sufficient range has already fetched, so even if the setting is changed to 1 segment, “Cal” is therefore displayed instead of “Uncal”.

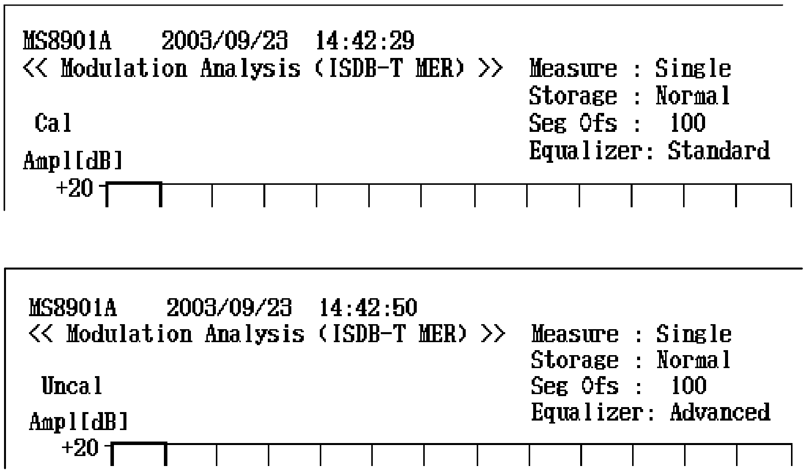


Figure 2.3.3-4 Valid (Cal)/invalid (Uncal) display for correction

8: Receive of Segment
This parameter switches the partial reception signal analysis function described in Section 2.3.5 “Partial reception signal analysis (Recv. Seg).”

9: Adjust Range
This parameter performs hardware settings appropriate for the RF signal level. During execution, the Adjust Range execution window opens and other processing is disabled. This parameter cannot be executed when other than RF is selected as Terminal.

10: Equalizer
This parameter switches the Equalizer setting between Advanced and Standard. Refer to “6. Equalizer” in Section 2.3.1 “Frequency and MER measurement (No Trace screen)” for details.

11: Signal Automatic Detection
This parameter automatically detects Mode, Guard Interval and TMCC of the input signal. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

12: TMCC Automatic Detection
This parameter automatically detects TMCC of the input signal. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

13: Automatic Detection segment position setting
This parameter sets which segment’s TMCC is to be used for automatic TMCC detection of the input signal. Refer to “10. Automatic Detection segment position setting” in Section 2.3.1 “Frequency and MER measurement (No Trace screen)” for details.

14: Storage Mode

This parameter sets the methods for displaying the measured results on the screen. Average, Max Hold, Over Write and other modes can be set. Refer to Section 2.7 “Storage Mode” for details.

15: Segmentation Offset

This parameter specifies the position where the signal is recalled within one OFDM symbol. Refer to Section 2.3.6 “Segmentation Offset” for details.

16: Save Data to Mem Card

This parameter saves constellation I and Q data to the memory card. Refer to Section 2.12.2 “Saving numerical value data” for details.

17: Back Screen

This parameter returns to the Setup Common Parameter screen where measurement parameters are set.

18: TMCC Information

This parameter detects TMCC information of the input signal.

Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

19: Auto. Det. Cancel

This parameter stops detection during execution of an automatic detection function such as Signal Automatic Detection or TMCC Automatic Detection, and performs signal analysis with the parameters currently set. Refer to Section 2.10 “Signal Parameter Automatic Detection Function” for details.

2.3.4 Sub-Carrier MER Screen

Sub-carrier MER existing within the 5.6 MHz bandwidth is displayed by bar chart.

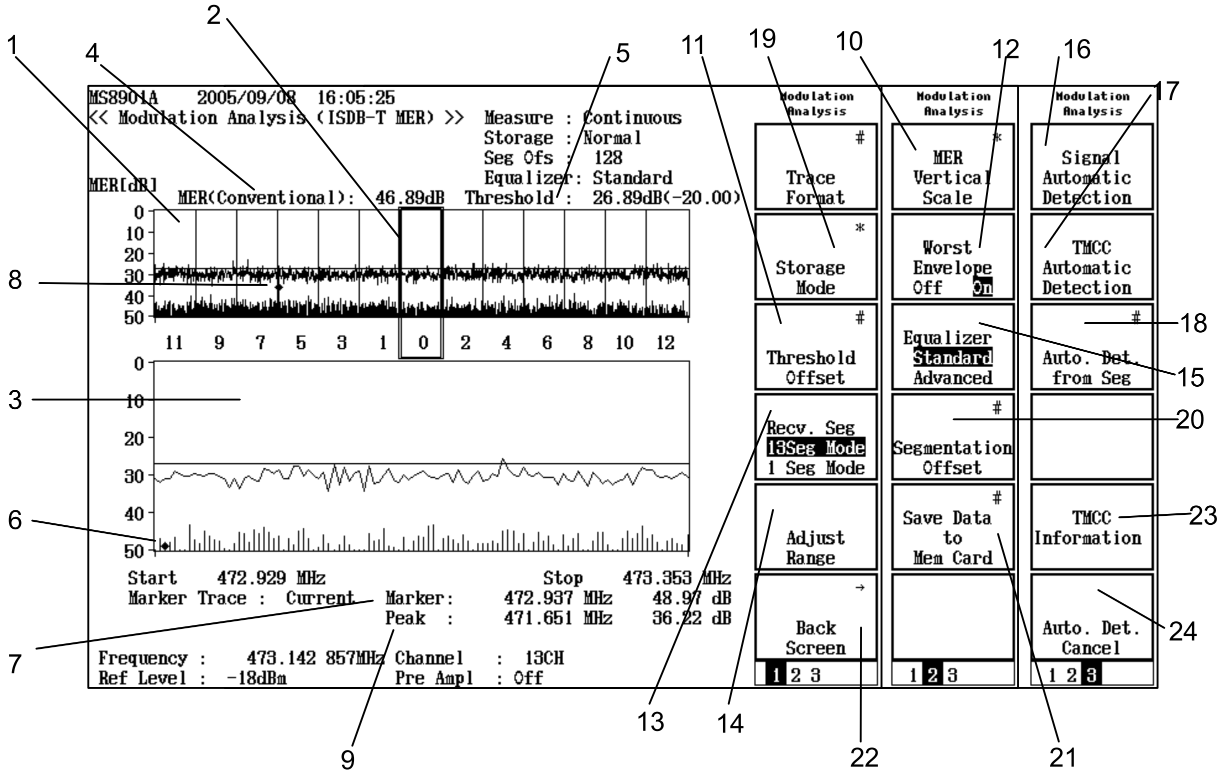


Figure 2.3.4-1 Sub-carrier MER screen

1: Full display of the sub-carrier MER

Sub-carrier MER within 5.6 MHz band is displayed by bar chart. The top line is displayed in the absolute value, which is fixed to 0 dB. The horizontal axis is the segment number.

If the Worst Envelope is On, the worst value of the measured sub-carrier MER is displayed in line graph. The display range of the horizontal and vertical axis are displayed in bar chart.

2: Magnify window

This parameter magnifies the segment with this window to display on the lower side of the screen. This magnify window can be moved horizontally using the Step key on the front panel.

3: Enlarged display of sub-carrier MER

This parameter magnifies the segment at the specified position where the magnify window exists. If the Worst Envelope is On, the measured sub-carrier MER is displayed in the line graph. The display range of the horizontal and vertical axis are the same with the ones for the bar-chart display.

4: MER (Conventional)

This parameter measures the Conventional MER. This conventional MER is the same one with the MER displayed on the No Trace screen.

5: Threshold

This parameter sets the threshold for the sub-carrier MER. This parameter displays the sub-carrier worse than the threshold in a different color within the bar graph. MER threshold is the value in which the value of Threshold Offset at 11 is subtracted from that of the Conventional MER.

6: Marker

The rhomboid point on the enlarged display is the marker point. The marker follows the waveform, but the waveform to follow can be chosen between the waveform of the bar chart and the one of the line graph.

Press the Marker key on the front panel and the Marker Trace key (F2) continuously on the marker menu to open the pop-up window. At this point, choose the waveform to follow for the marker.

(a) Current

The marker follows the waveform of the bar chart of the sub-carrier MER.

(b) Worst

The marker follows the line graph of the sub-carrier MER. However, if the line graph is not displayed, this is not selectable.

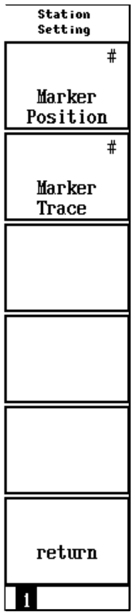


Figure 2.3.4-2 Marker menu (Sub-carrier MER screen)

Set the marker position by using the Marker Position key on the Marker menu or by moving the rotary encoder on the front panel horizontally.

7: Frequency and MER of the marker point

This parameter displays the marker point frequency and MER. Frequency and MER are displayed in absolute value.

8: Peak

The peak point is the rhombic point displayed in a different color from marker. The peak follows the waveform just as the marker, but cannot be moved. This is to show only the worst value of the waveform MER at the bar chart as the peak point.

Change over the specification of the following.

Press the Peak Search key on the front panel and then select the peak operation of the Peak Search menu.

(a) 13 Segment

This parameter displays the worst value of the waveform MER of the bar graph as peak. However, if the partial reception signal analysis is 1 Seg Mode, this cannot be selectable. Refer to Section 2.3.5 “Partial reception signal analysis”, for details on the signal analysis.

(b) Worst

This parameter shows the worst value of the waveform MER on the enlarged display.

(c) Off

This parameter hides the peak point.

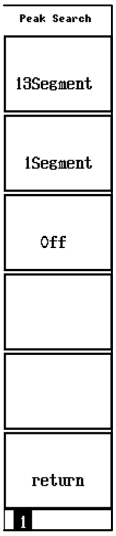


Figure 2.3.4-3 Peak Search menu (Sub-carrier MER screen)

9: Frequency and MER of the peak position

This parameter displays the frequency and MER of the peak point. Both are displayed in absolute value. When hiding the peak point, *** is displayed.

10: MER vertical scale

This parameter sets the display range of the MER axis (vertical axis) and changes the range of 20 to 60 dB. When pressing the MER Vertical Scale key (F1) on the second page of the soft key, the content of the soft key is changed. Select the display range.

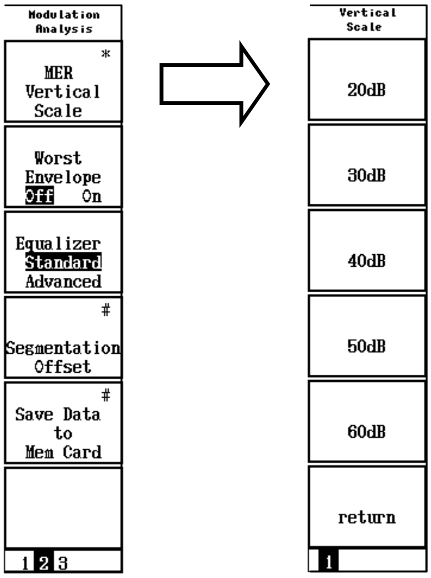


Figure 2.3.4-4 MER axis setting

11: Threshold Offset

This parameter sets the Threshold Offset. The range can be changed between 0 to 30 dB. When pressing the Threshold Offset key (F3) on the first page of the soft key, the pop-up window appears. Input the threshold offset in dB unit (input up to two decimal points).

This parameter sets the threshold as the normal measurement data on the sub-carrier MER screen and also modifies the color of the waveform of the bar chart when there is the sub-carrier worse than the threshold. Though the threshold is based on the Conventional MER, general versatility is enhanced by making the arbitrary value as the threshold offset.

When MER is worsened by the intermissive occurrence of the unwanted wave, of which level is lower than the expectant wave, this is useful to specify the unwanted frequency.

12: Worst Envelope

This parameter displays or hides the Worst Envelope line (Worst Envelope). On the sub-carrier MER screen, the worst value of the measured sub-carrier MER can be displayed as the line graph. This Worst Envelope line updates the value smaller than the one which has been already held, basing on the Current, the waveform of the normal measured data. And this operates as if to hold the storage mode as Max Hold.

As to the normal measurement data on the sub-carrier MER screen, the MS8901A operates as normal, though the storage mode is held as maximum (Max Hold). Refer to Section, “2.7 Storage Mode”.

Use the Worst Envelope line to assume the occurrence feature of the disturbing wave, by comparing between the current measured result and the time-series measured result.

13: Receive of Segment

This function is useful to switch the signal analysis function of the partial reception signal described at the Section 2.3.5 “Partial Reception Signal Analysis (Recv. Seg) ”.

14: Adjust Range

This parameter sets the hardware suited to the RF signal level. This parameter displays the window to show the Adjust Range is in execution and does not accept any other processing during execution. When other than RF is selected as Terminal, this Adjust Range is not executed.

15: Equalizer

This parameter switches the Advanced /Standard of the equalizer. Refer to “6. Euqalizer” in Section 2.3.1 “Frequency and MER measurement (No trace screen)”.

16: Signal Automatic Detection

This parameter detects the Mode, Guard Interval and TMCC of the input signal automatically. Refer to Section 2.10 “Automatic Detection of the Signal Parameter”.

17: TMCC Automatic Detection

This parameter detects the TMCC input signal automatically. Refer to Section 2.10 “Signal Parameter Automatic Detection Function”.

18: Setting of Automatic Detection Segment Position

This parameter decides which segment TMCC is used to detect TMCC automatically. Refer to “10. Automatic Detection Segment Position Setting ” in Section 2.3.1 “Frequency and MER measurement”.

19: Storage Mode

This parameter sets average, Max hold and overwriting of the measured result. Refer to Section 2.7 “Storage Mode”.

20: Segmentation Offset

This parameter specifies the position to hew out the signal among the IOFDM symbols. Refer to Section 2.3.6 “Segmentation Offset”.

21: Save Data to Mem Card

This parameter saves the I, Q data of the constellation to memory card. Refer to Section 2.12.2 “Saving numerical value data”.

22: Back Screen

This parameter returns to the Setup Common parameter to set the measurement parameter.

23: TMCC Information

This parameter detects the TMCC information of the input signal. Refer to Section 2.10 “Signal Parameter Automatic Detection Function”.

24: Auto. Det. Cancel

This parameter terminates the detection while the automatic detection function is executed such as Signal Automatic Detection and TMCC Automatic Detection and executes the signal analysis, keeping the current parameter as it is. Refer to Section 2.10 “Signal Parameter Automatic Detection Function”.

2.3.5 Partial reception signal analysis (Recv. Seg)

Signal analysis (frequency measurement and MER measurement) can be performed for all 13 segments (13 Seg Mode) or one of the segments (1 Seg Mode).

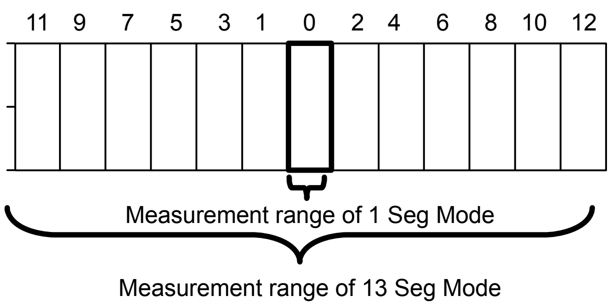


Figure 2.3.5-1 Partial reception

Toggle between the modes from the function menu. Reverse display indicates the selected mode.

1 Seg Mode can be set only when Mod of Layer_A is set to QPSK (PR), 16QAM (PR), 64QAM (PR) or DQPSK (PR). With settings other than the above, the function menu appears in outline characters indicating that it is disabled.

When 1 Seg Mode is selected, Trace screens change as shown below.

(1) On the No Trace screen, Layer_B and C become “----” (dashes).

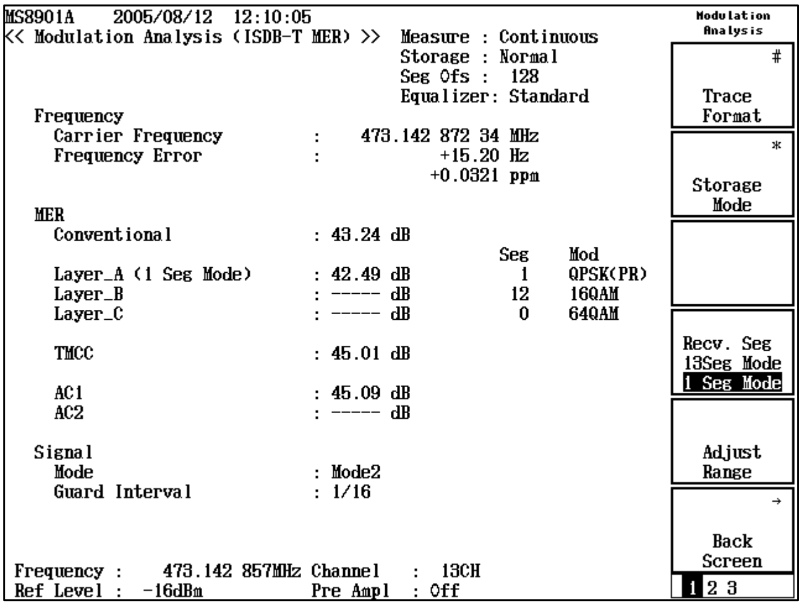


Figure 2.3.5-2 No Trace screen – partial reception

(2) On the Constellation screen, the Section key item includes only Layer_A, TMCC, AC1 and AC2.

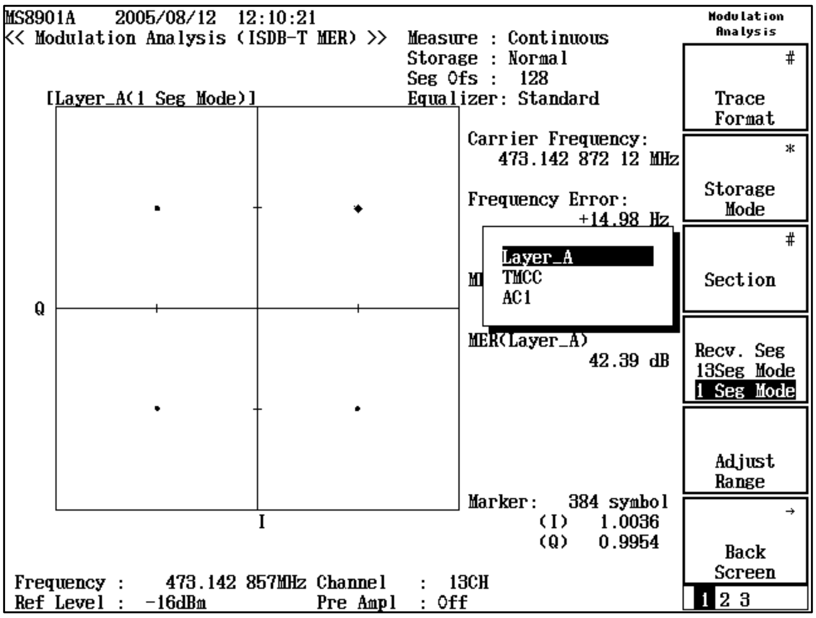


Figure 2.3.5-3 Constellation screen – partial reception

(3) On the Freq Response screen, only 1 Seg is available as a measurement target. Segments therefore cannot be moved by pressing the ∧ or ∨ hard keys.

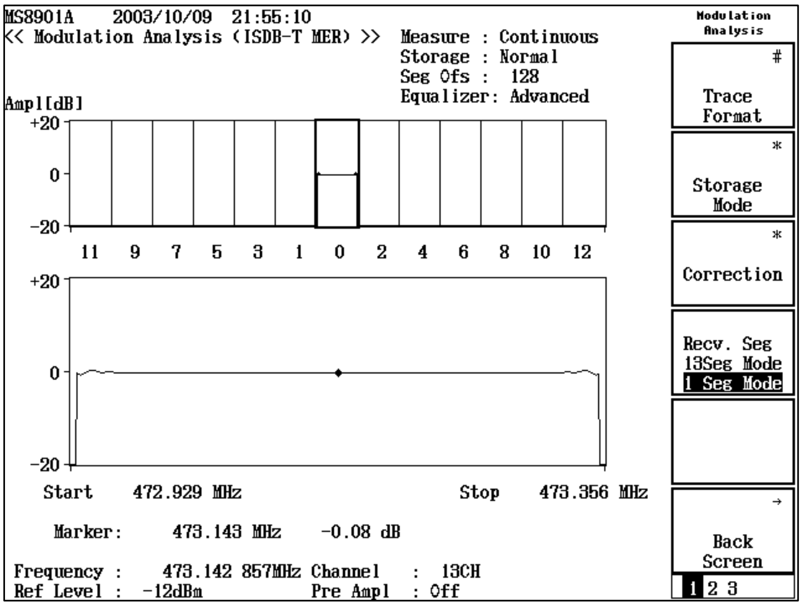


Figure 2.3.5-4 Freq Response screen – partial reception

(4) Pressing the key of ∧ and ∨ on the Sub-carrier MER screen cannot move the segment, for the measuring object is only 1 Seg. 13 Segment cannot be selected by Peak Search function.

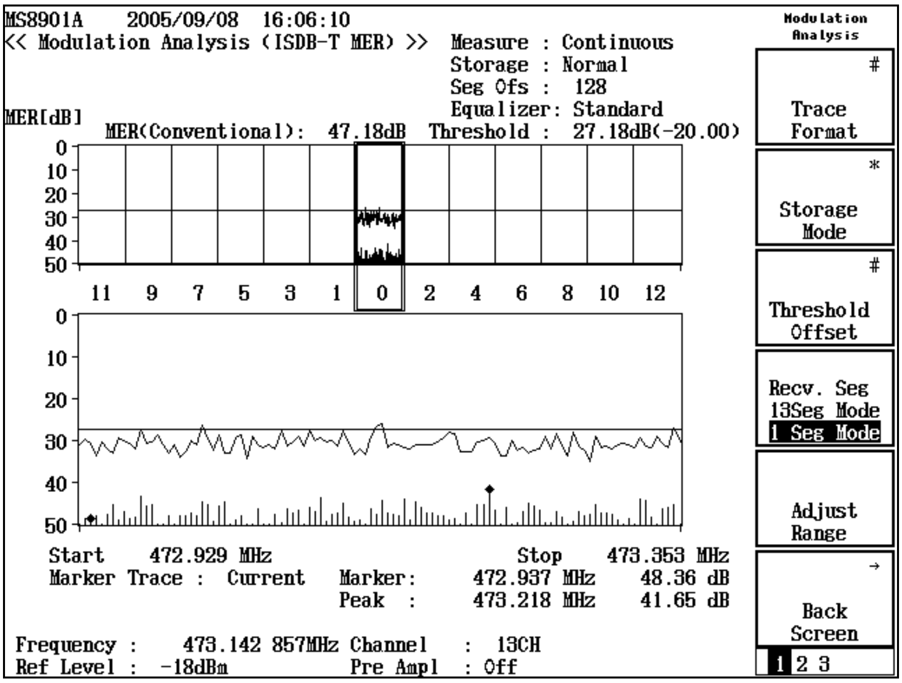


Figure 2.3.5-5 Sub-carrier MER screen at the partical reception

2.3.6 Segmentation Offset

A guard band is provided for OFDM that conform to ISDB-T before each OFDM symbol to increase tolerance under multipath environments. Segmentation offset refers to specifying where one OFDM symbol length should be recalled from, including this guard interval.
Measured results may be improved by changing the segmentation offset under multipath environments.

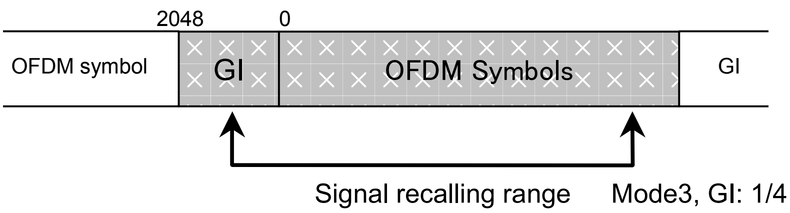


Figure 2.3.6-1 Segmentation offset

Numbers are assigned with segmentation offset whereby the last of the guard interval is set to 0. The maximum segmentation offset is set according to the mode and guard interval as shown in Table 2.3.6-1.

Table 2.3.6-1 Segmentation offset range

Mode \ Guard interval	1/4	1/8	1/16	1/32
Mode1	0 to 512	0 to 256	0 to 128	0 to 64
Mode2	0 to 1024	0 to 512	0 to 256	0 to 128
Mode3	0 to 2048	0 to 1024	0 to 512	0 to 256

The initial segmentation offset is located at the center of the guard interval.

2.4 C/N Measurement (C/N Screen)

Phase noise such as signal source and VCO is measured.
This measurement differs from the MER and Constellation measurement as it is performed on CW (continuous wave).

Note:

C/N measurement cannot be performed when frequency map is IF Band.

2.4.1 C/N measurement

Press the C/N soft key on the Setup Common Parameter screen. The screen changes to the C/N measurement screen.

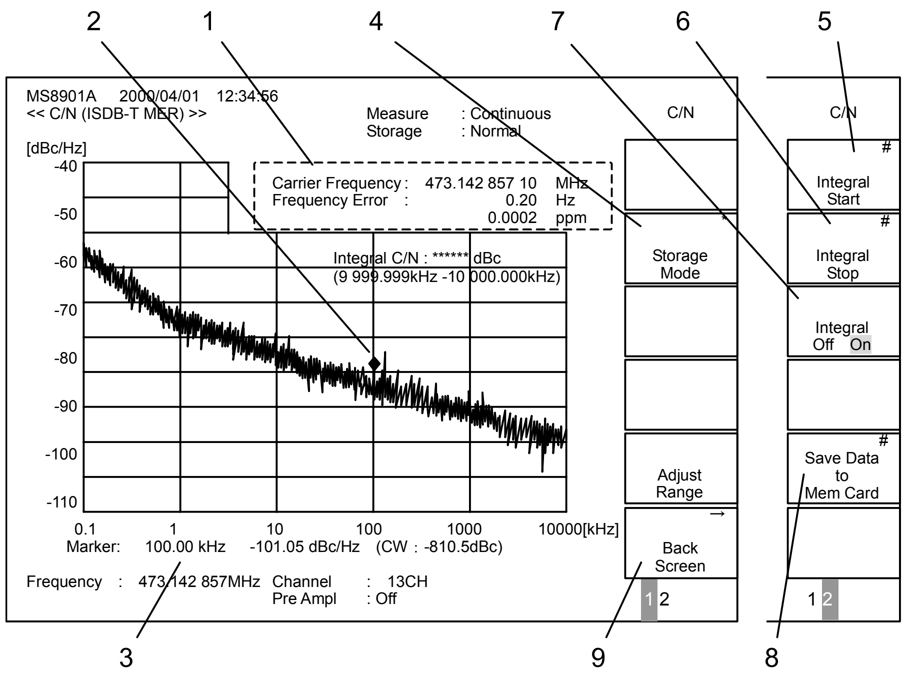


Figure 2.4.1-1 C/N measurement screen

1: Frequency measurement:
Measures the CW frequency.
When the offset frequency is set, the measured result (CW frequency) added with the set offset frequency is displayed.
The difference between the measured frequency and the set frequency (frequency displayed at the bottom of the screen) is displayed as a Frequency Error.

Note:

Offset frequency additions are only the simple adding of setting values. The correct value may not be shown when there are frequency errors in the Local signal sources of the frequency converter.

2: Marker
The marker is a diamond shaped point for recalling C/N values. The offset frequency and C/N value at the marker position are displayed at the bottom of the screen. The marker can be moved using the Rotary Encoder.

3: Offset frequency and C/N value
The offset frequency and C/N value at the marker position.

The value of "CW: ***dBc" in the parentheses is the D/U ratio for spurious signals. For the noise component, only levels where the FFT sample frequency is converted to 1 Hz bands are extracted. The unwanted signals are also calculated in the same way, thus they are not displayed correctly on the waveform at this time.

"CW:***dBc" is, therefore, provided to display the D/U ratio for such unwanted signals correctly.

4: Storage Mode
This parameter sets the methods for displaying the measured results on the screen. Average, Max Hold, Over Write and other modes can be set. Refer to Section 2.7 "Storage Mode" for details.

5: Integral Start
This parameter sets the start frequency position of the integration range. The setting range is within the horizontal axis frequency range of the C/N graph on screen (0.100 to 9999.999 kHz). However, the range cannot exceed the stop frequency position (Integral Stop).
Integral Start can be set only by inputting a numeric value from the numeric keypad (cannot be input by using step keys or the Rotary Encoder). The minimum unit is 1 Hz.

6: Integral Stop
This parameter sets the stop frequency position of the integration range. The setting range is within the horizontal axis frequency range of the C/N graph on screen (0.101 to 10000.000 kHz). However, the range cannot exceed the start frequency position (Integral Start).
The rest is the same as the start frequency position (Integral Start).

7: Integral

This parameter toggles Integral Mode On/Off. When Integral Mode is On, the integration results are displayed. The integration result range that can be output is from –99.99 to 0.00 dBc.

8: Save Data to Mem Card

This parameter saves C/N measured results to the memory card as numerical value data. Refer to Section 2.12 “Saving Measurement Data” for details.

9: Back Screen

This parameter returns to the Setup Common Parameter screen where measurement parameters are set.

2.5 Spectrum Mask

Performs input signal spectrum measurement in order to check whether the spectrum conforms to the specifications of the Equipment Standard. Arbitrary masks can also be set for measurement.

Note:

This measurement cannot be performed when Channel Map is IF Band.

The Equipment Standard indicates the transmission spectrum mask described in “ARIB STD-B31”and “ABNT NBR 15601.”
The MX890120B can measure in three types for pass-fail judgment of the transmission spectrum mask that conforms to the Equipment Standard.

1: Type A

This type A conforms to the specification of the ARIB STD-B31 1.5 version. And the measurement only for 1 channel is performed at this type. The frequency measurement width (Span) is 20 MHz (±10 MHz). And this type canonicalizes the whole spectrum waveform so that the top line of the spectrum mask comes to be 0.00 dB. Both ends of the mask line are relative level, which are declined by 50 dB from the top line.

2: Type B

This type B conforms to the specification of the ARIB STD-B31 revision. ARIB STD-B31 conforms to the spectrum mask measurement described at the investigation report from the Spurious Committee (Document of the Ministry of Internal Affairs and Communication: 29 November 2004). At type B, the measurement of up to three channels is performed. When measuring the 1 channel, the frequency measurement width (Span) is 30 MHz (±15 MHz), and it is increased by 6 MHz every time 1 channel is added.

This function canonicalizes the whole spectrum waveform so that the top line of the spectrum mask is –27.40 dB.

Both ends of the mask line is –50 dB as the reset. By inputting the transmitter output power of the transmitter and relay station, this type judges pass or fail, searching for the appropriate mask line automatically among the range of –50 to –30 dB.

3: Brazil

Brazil conforms to the specification of the ABNT NBR 15601 revision. This type measures only for one channel.

The frequency measurement width (Span) is 30 MHz (±15 MHz).

This type canonicalizes the whole spectrum waveform so that the top line of the spectrum mask comes to be –27.40 dB.
This type judges pass or fail, setting the appropriate mask line from the station power matching the transmit output power of the transmitter and relay station.

2.5.1 Spectrum mask measurement

Press the Spectrum Mask soft key on the Setup Common Parameter screen. The screen switches to the spectrum mask measurement screen.

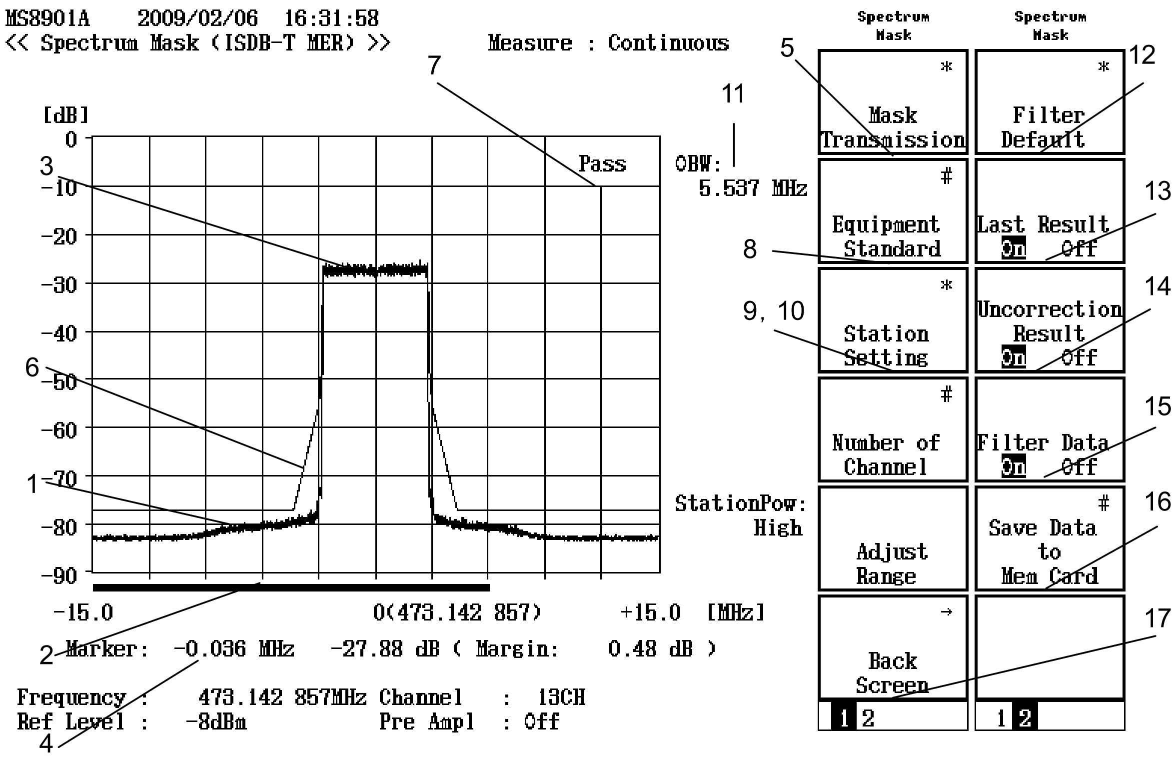


Figure 2.5.1-1 Spectrum Mask screen

1. Spectrum waveform
   This parameter displays the measured spectrum waveform and spectrum mask line. Spectrum is measured under the following conditions prescribed in the transmission spectrum mask specifications in "ARIB STD-B31"and "ABNT NBR 15601."

RBW:	10 kHz
VBW:	300 Hz
Span:	(1) 20 MHz * ARIB STD-B31 1.5 version
	(2) 30 MHz/36 MHz/42 MHz

* ARIB STD-B31 revision conformed to the spectrum mask measurement of the investigation report from Spurious Committee (document of the Ministry of Internal Affairs and Communications 29, November 2004)

(3) 30 MHz

* ABNT NBR 15601

The frequency measurement width (Span) is determined by the Equipment Standard and the number of channel.

(a) When the Equipment Standard is type A

Span is 20 MHz. This type measures one of the set channel, regardless of the setting of the channel number when the type A is the Equipment Standard before revision.

The center frequency of the frequency axis becomes the center frequency when channel map is Interim-1, Interim-2, UHF, or UHF (Brazil). For example, it becomes 473 MHz at 13 ch. This frequency is displayed in parentheses indicated. When Channel Map is set to General, the set frequency becomes directly the center frequency without any change.

(b) When the Equipment Standard is type B and channel number is only 1

Span is 30 MHz and this type measures only one channel.

When the center frequency of the frequency axis is channel set frequency when channel map is interim-1, interim-2, UHF, or UHF (Brazil). For example, it becomes 473.142857 MHz at 13 ch when Channel Map is set to UHF. When Channel Map is set to General, the set frequency becomes directly the center frequency without any change.

In both cases, the frequency is displayed in parentheses indicated.

(c) When the Equipment Standard is type B and channel number is 2

Span is 36 MHz and this type measures two channels. The left channel becomes the channel specified by channel or frequency.

The center frequency of the frequency axis is the value in which 3 MHz is added to the set frequency of the channel, when channel map is Interim-1, Interim-2, UHF, or UHF (Brazil). For example, it becomes 476.142857 MHz at 13 ch when Channel Map is set to UHF. When Channel Map is set to General, the center frequency is the value in which 3 MHz is added to the set frequency. In both cases, the frequency is displayed in parentheses indicated.

(d) When the Equipment Standard is type B and channel number is 3

Span is 42 MHz and this type measures three channels. The leftmost channel is the channel specified by channel or frequency.

The center frequency of the frequency axis is the value in which 6 MHz is added to the channel set frequency, when channel map is Interim-1, Interim-2, UHF, or UHF (Brazil). For example, it becomes 479.142857 MHz at 13 ch when Channel Map is set to UHF. When channel Map is set to General, the center frequency is the value in which 6 MHz id added to the set frequency. In both cases, the frequency is displayed in parentheses indicated

(e) When the Equipment Standard is Brazil

Span is 30 MHz and this type measures one channel. The center frequency of the frequency axis corresponds to the channel frequency when Channel Map is Interim-1, Interim-2, UHF, or UHF (Brazil). For example, when Channel Map is UHF (Brazil), it becomes 473.142857 MHz at 14 ch. When Channel Map is General, the set frequency becomes the center frequency. In both cases, the frequency is displayed within parenthesis. As a measurement result, the spectrum waveform after filter correction (Last Result), the spectrum waveform before filter correction (Uncorrection Result), and the filter characteristics mask line (Filter Data) are displayed.

2. Sweep progress indicating bar
   It takes approximately about 20 to 80 seconds for one spectrum waveform measurement (When the Equipment Standard is Type B and the number of channel is 3). The progress of the measurement is displayed on this bar indicator. Start from the left edge of the indicator part of the spectrum waveform. One measurement ends when the right edge is reached.

3. Marker
   The marker is a diamond shaped point where spectrum waveforms are recalled. The frequency and relative level at the marker position are displayed at the bottom of the screen. The marker can be moved using the Rotary Encoder.

   For Brazil type, you can switch the waveform display using the Marker Trace setting.

4. Frequency and relative level
   These are the frequency and the relative level at the marker position of the spectrum waveform.

5. Mask Transmission
   This parameter selects the spectrum mask. Press the Mask Transmission soft key (F1). The soft key contents are changed to those where mask specifications are selected.

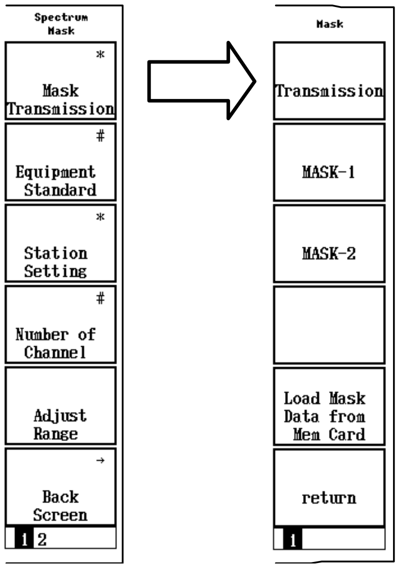


Figure 2.5.1-2 Spectrum mask selection

The names of masks selected are displayed in the soft keys. User-1 and User-2 are not displayed when spectrum mask data is not recalled to the MS8901A.

Transmission:

This is the transmission spectrum mask prescribed in the transmission spectrum mask specifications in “ARIB STD-B31” and “ABNT NBR 15601." There are three types of the Equipment Standard for the mask specifications: type A, type B, and Brazil are shown below respectively.

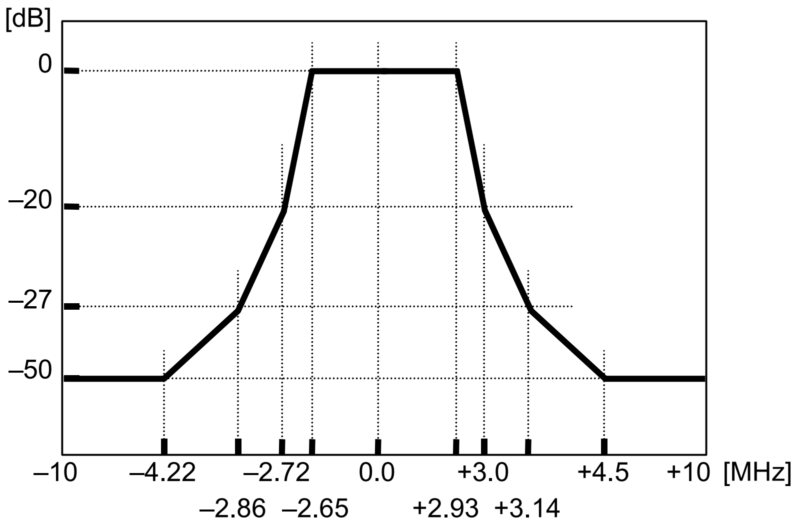


Figure 2.5.1-3 Transmission Spectrum Mask (Equipment Standard: Type A)

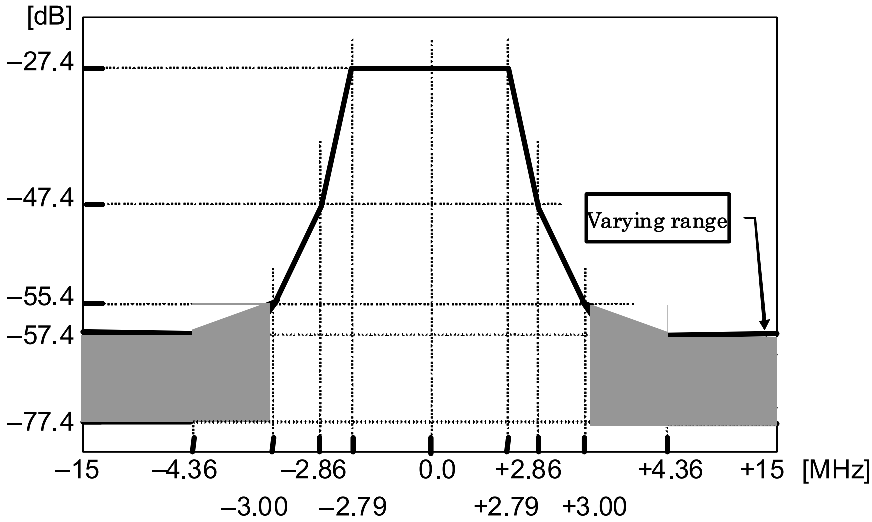


Figure 2.5.1-4 Transmission Spectrum Mask (Equipment Standard: Type B)

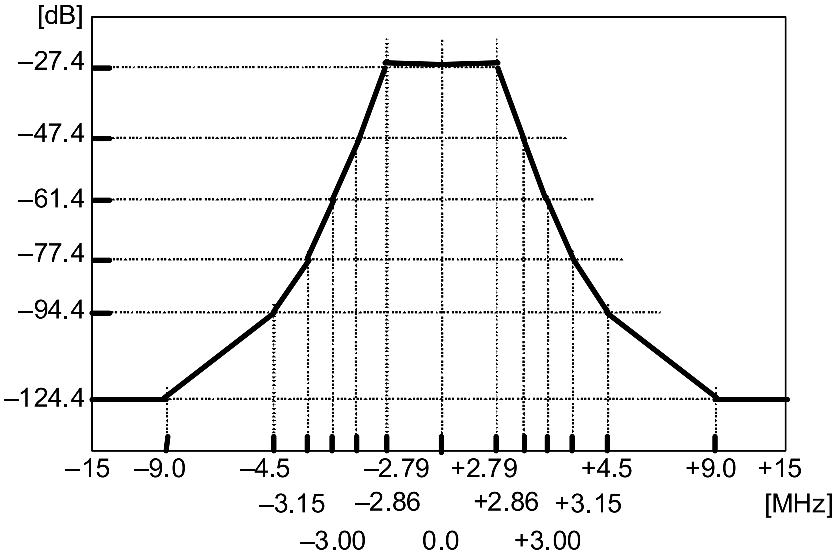


Figure 2.5.1-5 Transmission Spectrum Mask
(Equipment Standard: Type Brazil, Station Power: Critical)

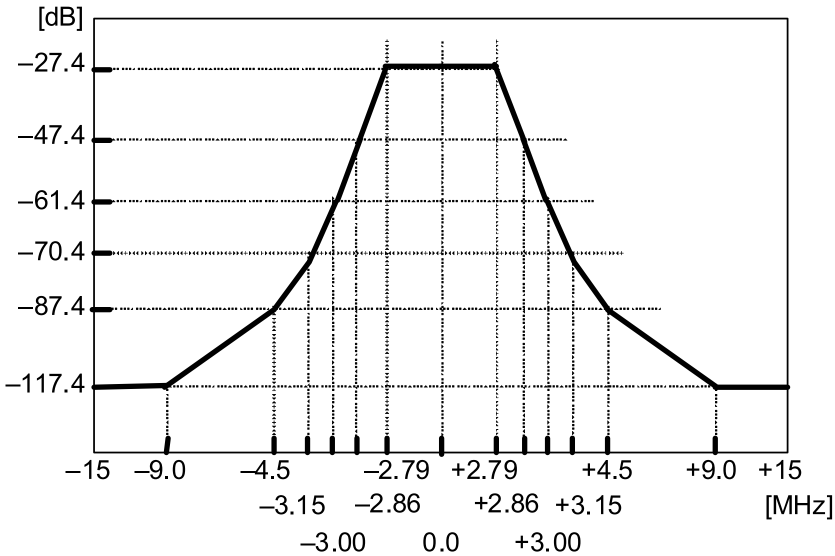


Figure 2.5.1-6 Transmission Spectrum Mask
(Equipment Standard: Brazil, Station Power: Sub-Critical)

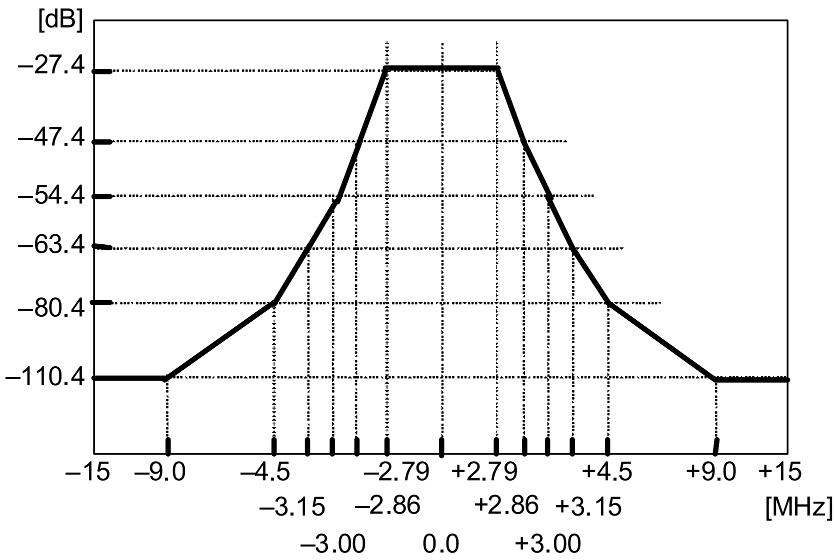


Figure 2.5.1-7 Transmission Spectrum Mask (Equipment Standard: Brazil, Station Power: Non-Critical)

When the Equipment Standard is type A, the transmission spectrum mask makes the 0.0 MHz frequency axis as the channel center frequency. About 1/7 MHz displacement from the center frequency of the transmission band.

When the Equipment Standard is type B, the transmission spectrum mask adds the 1/7 MHz compensation and the mask becomes axi-symmetrical based on 0.0 MHz. Therefore, there is no displacement. Both ends of the mask vary, depending on the value of the station power and average power.

When the Equipment Standard is Brazil, the transmission spectrum mask adds the 1/7 MHz compensation and the mask becomes axi-symmetrical based on 0.0 MHz. Therefore, there is no displacement. Both ends of the mask vary, depending on the value of the station power.

User-1 and User-2:

Two arbitrary spectrum masks can be set. These soft keys cannot be displayed when the spectrum mask line is not recalled within the MS8901A. Refer to Section 2.5.2 "Recalling spectrum mask line" for the method to load spectrum mask lines.

Besides, when the Equipment Standard is type B or Brazil and the arbitrary spectrum mask is used, both of the station power and average power cannot be set.

6. Spectrum mask
   The spectrum mask selected in 5: Mask Transmission is displayed on the spectrum waveform.
   The position relationship of the spectrum mask and spectrum mask waveform is adjusted so that the top line of the spectrum mask (the range of 0 dB or –27.4 dB) matches the average of the parts corresponding to the spectrum waveform.

Note:

When the Equipment Standard is type A, the top line is 0 dB. And it is –27.4 dB at type B or Brazil.

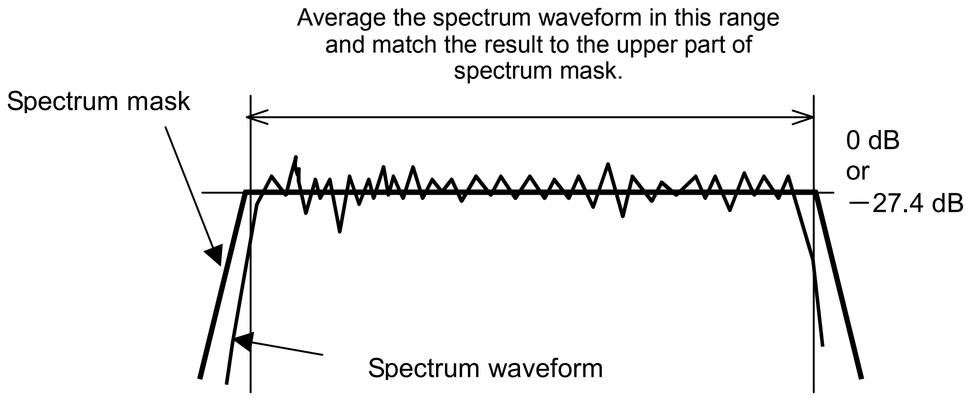


Figure 2.5.1-8 Spectrum mask and spectrum waveform alignment

7. Pass-fail judgment

Judges whether the measured spectrum waveform is in the spectrum mask. It is judged to have passed when the relative level of the spectrum waveform does not exceed the spectrum mask. It is also judged to have passed when the spectrum waveform overlaps on the spectrum mask. Note that the top line of the spectrum mask is not included in this judgment.

At Brazil, pass-fail judgment is performed for the spectrum waveform after filter correction (Last Result). The pass-fail judgment result is displayed even when the spectrum waveform display after filter correction is set to Off.

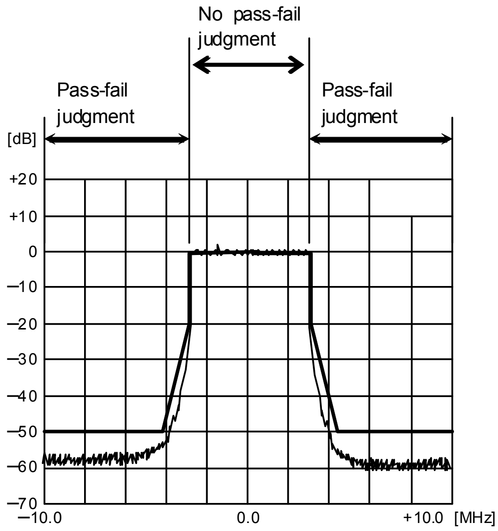


Figure 2.5.1-9 Spectrum mask pass fail judgment range (Equipment Standard: Type A)

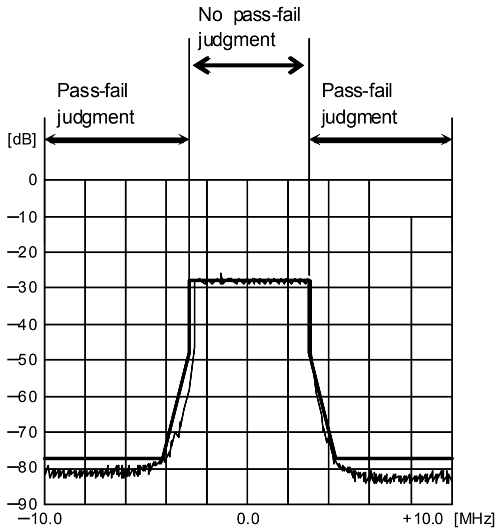


Figure 2.5.1-10 Spectrum mask pass fail judgment range

(Equipment Standard: Type B, Number of channel: 1)

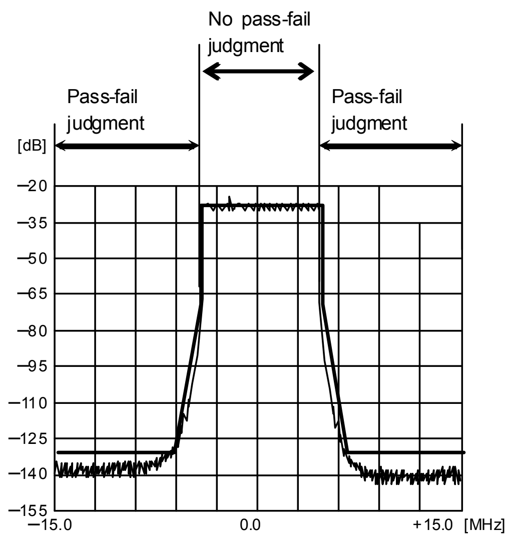


Figure 2.5.1-11 Spectrum mask pass fail judgment range (Equipment Standard: Brazil)

Note:

While the spectrum mask should apply only to the distorted components according to the transmission spectrum mask specifications in "ARIB STD-B31" and "ABNT NBR 15601," any spectrum waveform exceeding the spectrum mask is judged as "Fail" in this pass-fail judgment regardless of whether it is distorted component or spurious. Final pass-fail judgment should be determined based on observation made by the operator.

8. Equipment Standard

   This parameter switches to type A, type B, or Brazil of the Equipment Standard. At switching, the measurement is performed again. When pressing the Equipment Standard (F2) of the function menu, the pop up window appears. Select the type of the Equipment Standard.

   Refer to "1. Spectrum Waveform", "5. Mask Transmission" "6. Spectrum Mask" and "7. Pass-fail judgment" on this paragraph.

9. Station Power

   This parameter switches between High, Low, and 30 dB Mask of the station power when the Equipment Standard is type B. This parameter switches between Critical, Sub-Critical, and Non-Critical of the station power when the Equipment Standard is Brazil. Measurement is not performed again after switching. Only pass-fail judgment described in "7. Pass-fail judgment" is performed.

When pressing the Station Setting (F3) on the first page of soft key, menu key content is changed. Press the Station Power (F1) to set the toggle. The selected High/Low item displays in a reverse way.

When the Equipment Standard is Type A, station setting menu is not opened, which sets the station power and average power. In this case, the characters on the function menu key turn out to be white and this key becomes invalid.

When the Equipment Standard is Brazil, the average power cannot be set. In this case, the characters of the function menu key display in white and this key becomes invalid.

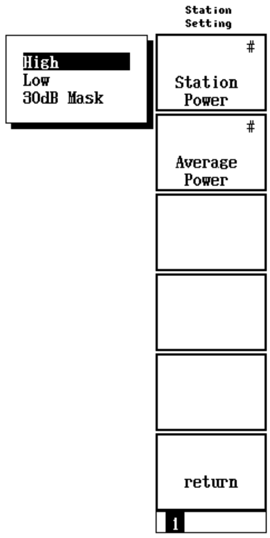


Figure 2.5.1-12 Station Power (Type B)

When Mask is User-1 or User-2 and also the Equipment Standard is type A, setting of the station power does not influence the Spectrum Mask measurement.

When specifying the Mask Transmission and setting the station power to High with the Equipment Standard type B, both ends' level of the spectrum mask is fixed to –77.4 dB.

When specifying the Mask Transmission and setting the station power to Low with the Equipment Standard type B, both ends' level of the spectrum mask is varied among the range of –67.4 to –77.4 dB.

When specifying Mask Transmission and setting the station power to 30 dB Mask with the Equipment Standard type B, both end's level of the spectrum mask is varied among the range of –57.4 to –67.4. Refer to “10. Average Power” for details.

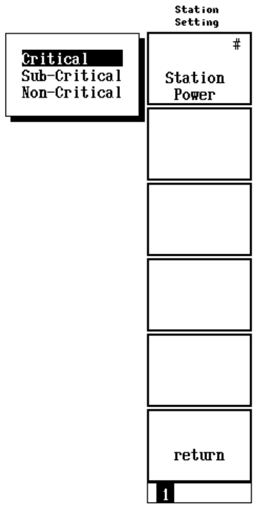


Figure 2.5.1-13 Station Power (Brazil)

If Mask Transmission is specified, the Equipment Standard is Brazil, and the station power is set to Critical, the levels at both ends of the spectrum mask are fixed to –124.4 dB.
If Mask Transmission is specified, the Equipment Standard is Brazil, and the station power is set to Sub-Critical, the levels at both ends of the spectrum mask are fixed to –117.4 dB.
If Mask Transmission is specified, the Equipment Standard is Brazil, and the station power is set to Non-Critical, the levels at both ends of the spectrum mask are fixed to –110.4 dB.

When measuring the spectrum mask of which average of the transmitter output power of the transmission and relay station exceeds over 2.50 W, set the station power to High. If the average transmitter output power is from 0.25 W to 2.50 W, set the station power to Low. If the average transmitter output power is less than 0.25 W, set the station power to 30 dB Mask.

10. Average Power

This parameter sets the average power. Even if modifying the setting, the measurement is not performed again and only the pass-fail judgment described in "7. Pass-fail judgment" is performed. When pressing the Station Setting (F3) on the first page of soft key, menu key content is changed. When pressing the Average Power (F2), the pop-up window appears on the screen. Input the average of the transmitter output power of the transmission or relay station in W unit (Input up to two decimal points). (Up to two digits following the decimal point are valid if the station power is Low, and up to three digits following the decimal point are valid if the station power is 30 dB Mask.)

If the station power is High, Critical, Sub-Critical, or Non-Critical, the average power cannot be changed. In this case, the entry field for Average Power is highlighted, indicating that this function key is not available.

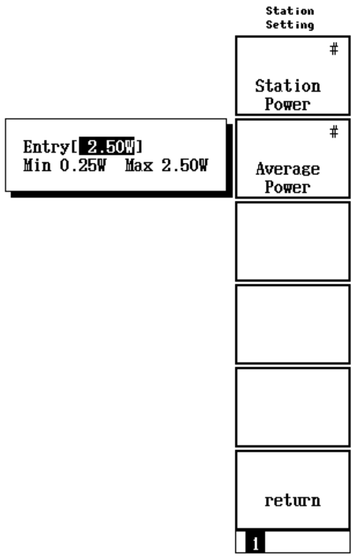


Figure 2.5.1-14 Average Power

The average power setting does not affect the Spectrum Mask measurement in the following cases:

When Mask is User-1 or User-2 with the type A Equipment Standard

When Mask is User-1 or User-2 with the station power set to High and the type B Equipment Standard

When Mask is User-1 or User-2 with the Brazil Equipment Standard

If the average power is changed while Mask Transmission is specified, the Equipment Standard is type B, and the station power is Low or 30 dB Mask, the levels at both ends of the spectrum mask change depending on the new average power.

If the station power is Low and the average power is from 0.25 W to 2.50 W, the levels at both ends of the spectrum mask are calculated using the following expression:

$$-(73.4 + 10\ \mathrm{Log}(\ [\text{Average Power}]))$$

If the station power is Low and the average power is 2.50 W, the levels at both ends of the spectrum mask are –77.4 dB (the default).

If the station power is Low and the average power is 0.25 W, the levels at both ends of the spectrum mask are –67.4 dB.

If the average power is changed while mask Transmission is specified, the Equipment Standard is type B, and the station power is 30 dB Mask, the levels at both ends of the spectrum mask change depending on the new average power

If the station power is 30 dB Mask and the average power is less than 0.25 W and equal to or greater than 0.025 W, the levels at both ends of the spectrum mask are calculated using the following expression:

(73.4 + 10 Log([Average Power]))

If the station power is 30 dB Mask and the average power is 0.025 W, the levels at both ends of the spectrum mask are –57.4 dB.

11. Occupied Frequency Bandwidth

    This parameter measures the occupied frequency bandwidth for spectrum waveforms, which includes 99 % of all power within the measurement band.

12. Filter

    This parameter modifies filter characteristics and loads a filter characteristics file. Valid only if Equipment Standard is Brazil.
    Select a filter characteristics file. Press the Filter Default key (F1) after pressing the More soft key. The soft keys change to those for selecting the filter.

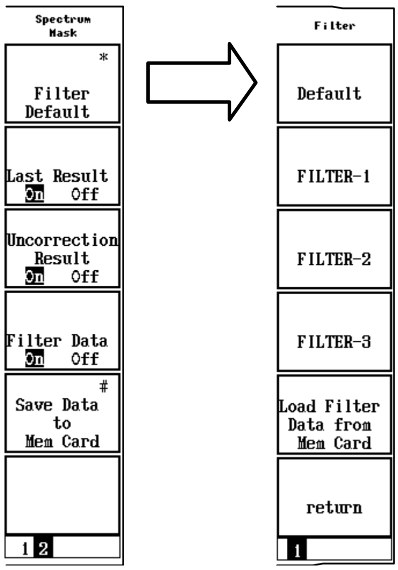


Figure 2.5.1-15 Filter characteristics file selection

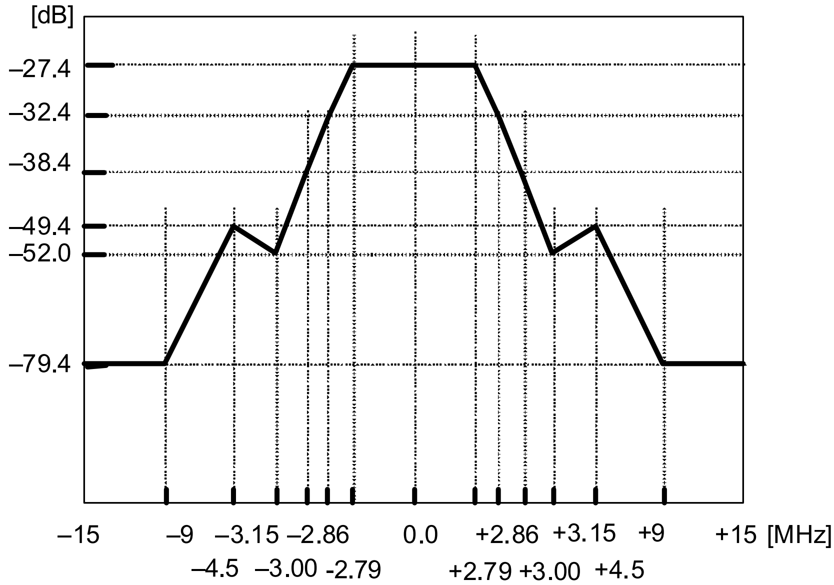


Figure 2.5.1-16 Example of the Filter Characteristics Waveform Data

Default

Filter characteristics waveform data is created using the fixed filter. The fixed filter contains filter data used to convert a waveform that complies with the ISDB-T Standards, which do not use a filter, to a waveform that complies with the Brazil Standards. If an ISDB-T Standard compliant waveform is input, it is converted to a Brazil Standard compliant waveform, and filter characteristics waveform data attenuated by about 5 dB is created.

User-1, User-2, User-3

Any three filter characteristics files can be set up. These soft keys are not displayed when the filter characteristics file is not loaded in the MS8901A. Refer to Section 2.5.4 "Loading Filter Characteristics file" for the method of loading the filter characteristics file.

13. Last Result

This parameter switches between showing and hiding the waveform after filter correction.

Valid only when the Equipment Standard is Brazil. Refer to Section 2.5.5 "Switching Waveform Display" for details.

14. Uncorrection Result

This parameter switches between showing and hiding the waveform without filter correction.

Valid only when the Equipment Standard is Brazil.

Refer to Section 2.5.5 "Switching Waveform Display" for details.

15. Filter Data

    This parameter switches between showing and hiding the waveform for filter characteristics data.

    Valid only when the Equipment Standard is Brazil.

    Refer to Section 2.5.5 “Switching Waveform Display” for details.

16. Save Data to Mem Card

    This parameter saves the spectrum waveform and the numerical value data of the spectrum waveform to the memory card. Refer to Section 2.12 “Saving Measurement Data” for details.

17. Back Screen

    This parameter returns to the Setup Common Parameter screen where measurement parameter is set.

When the RF/IF switching function is enabled, the measurement is performed in accordance with the Channel Map mode of the measurement target signal (RF/IF).

2.5.2 Recalling spectrum mask line

Two types of arbitrary spectrum masks can be set. The following are outlines of the two settings procedures.

<Procedure>

(a) When using a memory card:

Create spectrum mask line data with a Text Editor or Excel on a PC.

↓

Write created data to a memory card.

↓

Insert the memory card to the MS8901A then read the spectrum mask line data.

(b) When using a remote control command:

Create spectrum mask line data with a Text Editor or Excel on a PC.

↓

Transfer the created data to the MS8901A by a remote control command.

(a1) and (b1). Create spectrum mask line data

Create spectrum mask line data using a Text Editor or Excel.

The spectrum mask line data structure is as shown below:

Spectrum mask title
Data count
Frequency 1, relative value 1
Frequency 2, relative value 2
Frequency 3, relative value 3
: :

- The spectrum mask title can use up to ten alphanumeric characters. The title is displayed in the soft key menu on the screen. Commas (,) cannot be used in the title.
- Two to fifty data are available.
- Note that the frequency and the relative level differ, depending on the Equipment Standard setting.
- When the Equipment Standard is type A

  The frequency range: –10 to +10 MHz

  The relative level range: 0.00 to –60.00 dB
- When the Equipment Standard is type B

  The frequency range: –21 to +21 MHz

  The relative level range: –27.40 to –90.00 dB
- When the Equipment Standard is Brazil

  The frequency range: –15 to +15 MHz

  The relative level range: –27.40 to –155.00 dB
- Align the frequency values in ascending order. If they are aligned in the wrong order, an error may occur. It can be set up to two decimal points in MHz unit.
- The relative level can be set up to two decimal points in dB unit.
- Make sure to set so that at least one top line exists in each spectrum mask line data. The top line is used for positioning with the spectrum waveform. An error occurs in reading when two or more top lines exist in the spectrum mask.
- Top line: 0.00 dB when the Equipment Standard is type A

  –27.40 dB when the Equipment Standard is type B or Brazil.

The following example show writing examples for the spectrum mask line data using a using a Text Editor or Excel, each in case of when the Equipment Standard is type A, B, and Brazil.

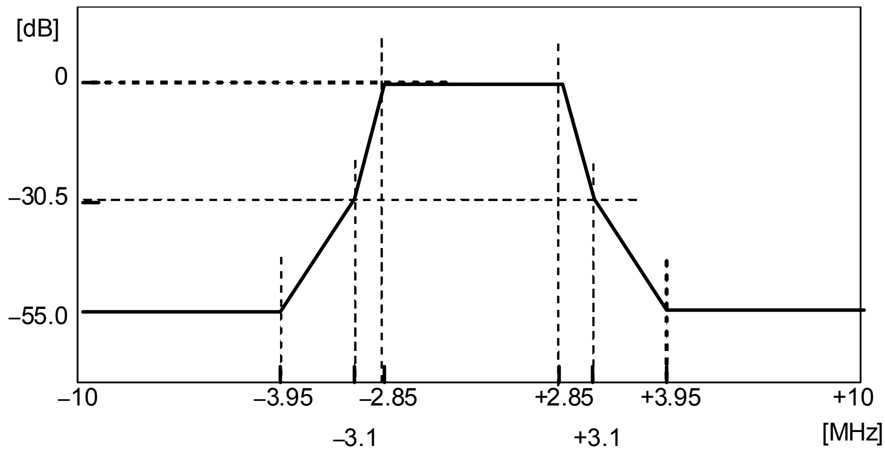


Figure 2.5.2-1 Example of spectrum mask (Equipment Standard: Type A)

```
MASK-1,
8,
-10.00, -55.00
-3.95, -55.00
-3.10, -30.50
-2.85, 0.00
2.85, 0.00
3.10, -30.50
3.95, -55.00
10.00, -55.00
```

Figure 2.5.2-2 Example of writing spectrum mask data with a Text Editor

A1	▼	=	
	A	B	C
1	MASK-1		
2	8		
3	–10.00	–55.00	
4	–3.95	–55.00	
5	–3.10	–30.50	
6	–2.85	0.00	
7	2.85	0.00	
8	3.10	–30.50	
9	3.95	–55.00	
10	10.00	–55.00	
11			

Figure 2.5.2-3 Example of writing spectrum mask data with Excel

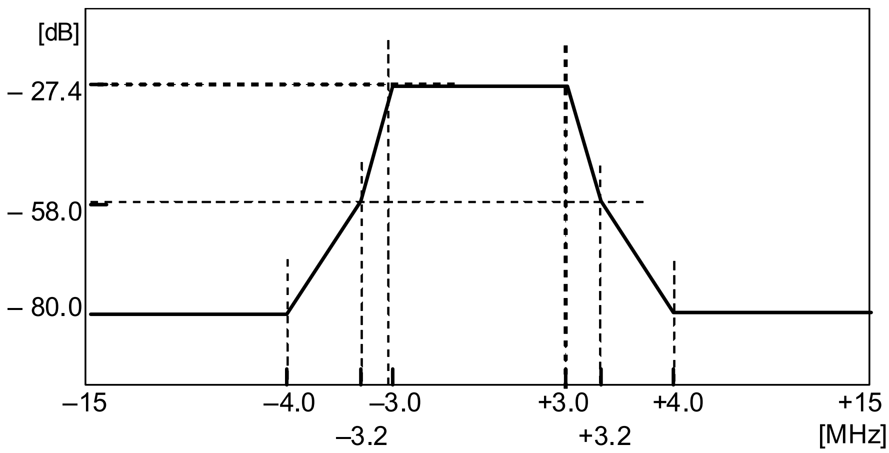


Figure 2.5.2-4 Example of spectrum mask (Equipment Standard: Type B)

```
MASK-1NEW,
8,
-15.00, -80.00
-4.00, -80.00
-3.20, -58.00
-3.00, -27.40
3.00, -27.40
3.20, -58.00
4.00, -80.00
15.00, -80.00
```

Figure 2.5.2-5 Example when the spectrum mask data is written with the text editor (Equipment Standard: Type B)

A1	▼	=	
	A	B	C
1	MASK-1NEW		
2	8		
3	–15.00	–80.00	
4	–4.00	–80.00	
5	–3.20	–58.00	
6	–3.00	–27.40	
7	3.00	–27.40	
8	3.20	–58.00	
9	4.00	–80.00	
10	15.00	–80.00	
11			

Figure 2.5.2-6 Example when the spectrum mask data is written with the text editor (Equipment Standard: Type B)

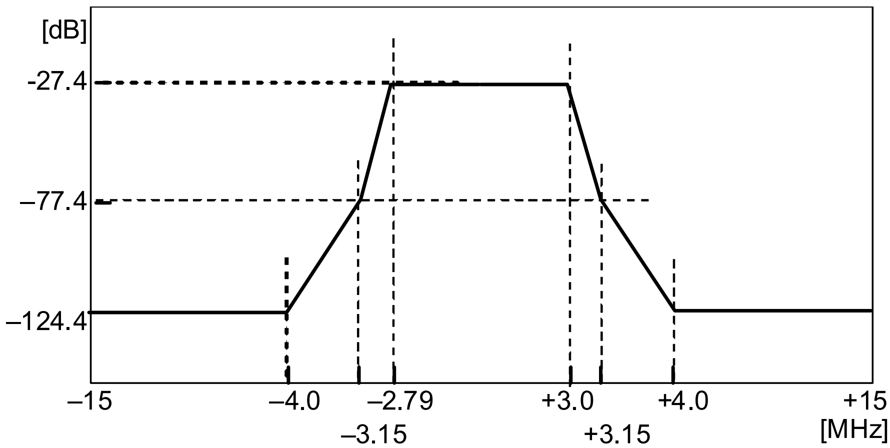


Figure 2.5.2-7 Example of spectrum mask (Equipment Standard: Brazil)

```
MASK-1BRA,
8,
-15.00, -124.4
-4.00, -124.4
-3.15, -77.4
-2.79, -27.4
2.79, -27.4
3.15, -77.4
4.00, -124.4
15.00, -124.4
```

Figure 2.5.2-8 Example when the spectrum mask data is written with the text editor (Equipment Standard: Brazil)

A1 ▼	=		
	A	B	C
1	MASK-1BRA		
2	8		
3	–15.00	–124.4	
4	–4.00	–124.4	
5	–3.15	–77.4	
6	–2.79	–27.40	
7	2.79	–27.40	
8	3.15	–77.4	
9	4.00	–124.4	
10	15.00	–124.4	
11			

Figure 2.5.2-9 Example when the spectrum mask data is written with the text editor (Equipment Standard: Brazil)

(a2) Write the data to a memory card (when using a memory card)

Save the data created using a text editor or Excel using one of the following file names:

spmask1.csv or spmask2.csv

spmask1.csv is downloaded to User-1 and spmask2.csv to User-2 as shown in Figure 2.5.1-2.

The first character string ("MASK-1"in Figure 2.5.2-2 "Example of writing spectrum mask data with a text editor") is displayed on the function key.

Write the files to a memory card. Write these files to the root directory in the memory card.

(a3) Load the spectrum mask data to the MS8901A (when using a memory card)

Insert the memory card in which the spectrum mask data (spmask1.scv file) is written into the MS8901A. The memory card can be inserted/removed while the power is supplied to the MS8901A.

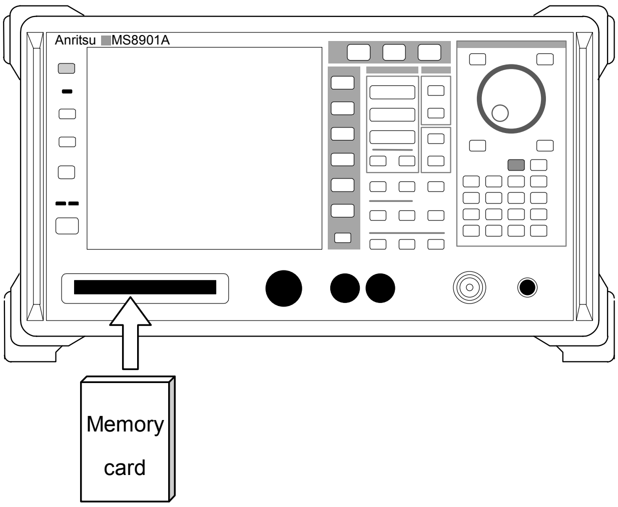


Figure 2.5.2-10 Insertion of memory card to the MS8901A

Press the Mask Transmission soft key (F1) on the first page of the soft key menu on the Spectrum Mask screen, and then press the Load Mask Data from Mem Card soft key (F5). The spectrum mask data in the memory card is written to the MS8901A.

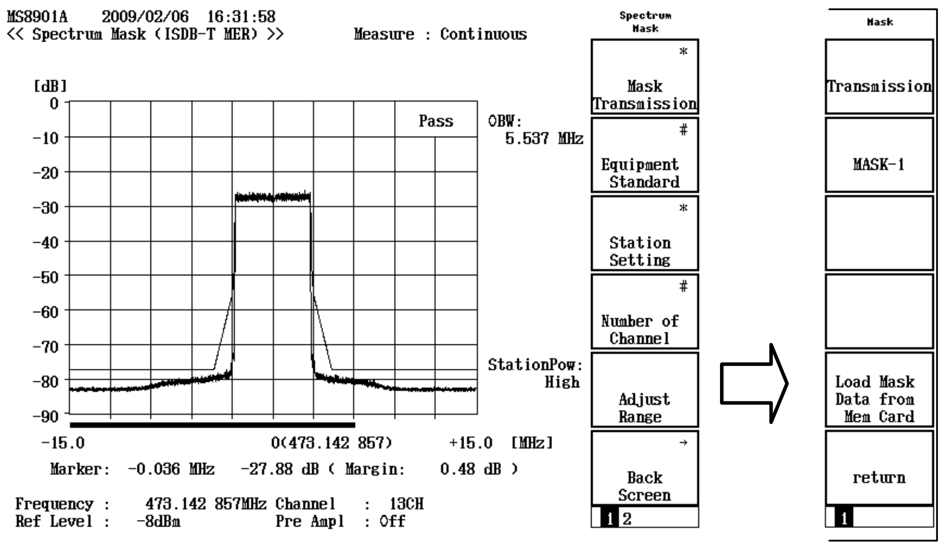


Figure 2.5.2-11 Loading spectrum mask data

MASK-1 is displayed on the F2 function key after the spmask1.csv file is loaded.

The range of the relative level and the frequency of the transmission spectrum mask changes, depending on the setting of the Equipment Standard. When loading, make sure of the type of the Equipment Standard and change the setting beforehand. Refer to (a1) or (b1), for details on the range.

(b2) Transfer the spectrum mask line data to the MS8901A by a remote control command (when using a remote control command)

Convert the data created using a Text Editor or Excel to the format of the remote control command MASKFIT, and then transfer it to the MS8901A. Refer to Section 3 “Remote Control” for detailed information on the MASKFIT command.

Figure 2.5.2-9 shows an example when transmitting the spectrum mask line data created using a Text Editor to the MS8901A by a remote control command.

```
MASK-1,
8,
-10.00, -55.00
-3.95, -55.00
-3.10, -30.50
-2.85, 0.00
2.85, 0.00
3.10, -30.50
3.95, -55.00
10.00, -55.00
```

```
MASKFIT 1, MASK-1,8,-10.00,-55.00,-3.95,-55.00,-3.10,-30.50,-2.85,0.00,2.85,0.00,3.10,-30.50,3.95,-55.00,10.00,-55.00
```

Figure 2.5.2-12 Conversion from spectrum mask line data created using a Text Editor to remote control command (Equipment Standard: Type A)

```
MASK-1NEW,
8,
-15.00, -80.00
-4.00, -80.00
-3.20, -58.00
-3.00, -27.40
3.00, -27.40
3.20, -58.50
4.00, -80.00
15.00, -80.00
```

↓

```
MASKFIT 1, MASK-1NEW,8,-15,-80,-4,-80,-3.2,-58,-3,-27.4,3,-27.4,3.2,-58,4,-80,15,-80
```

Figure 2.5.2-13 Conversion from spectrum mask line data created using a Text Editor to remote control command (Equipment Standard: Type B)

```
MASK-1BRA,
8,
-15.00, -124.4
-9.00, -124.4
-3.15, -77.4
-2.79, -27.4
2.79, -27.4
3.15, -77.4
9.00, -124.4
15.00, -124.4
```

↓

```
MASKFIT 1, MASK-1BRA,8, -15, -124.4,-9.00, -124.4,-3.15, -77.4,-2.79,-27.4,2.79…
```

Figure 2.5.2-14 Conversion from spectrum mask line data created using a Text Editor to remote control command (Equipment Standard: Brazil)

2.5.3 Marker

Marker function can be used for reading levels and frequencies of the spectrum wave.
The following three marker functions are provided:

(1) Normal marker:
This is displayed with a diamond shape on the screen. The level of and the frequency at the marker position are displayed.
The levels within the frequency range that matches the spectrum mask 0-dB line are averaged and aligned to 0 dB.
Frequency is displayed assuming the center frequency of the displayed band as 0 Hz.

(2) Delta marker:
The relative level and relative frequency for two points on the spectrum wave are displayed. Press the Delta Marker soft key when the normal marker is displayed to switch the normal marker position to the reference position, which is shown in the outlined diamond shape. The relative level and relative frequency between the delta marker and the reference position are displayed.

(3) Marker Trace:
This parameter switches the types of waveform that the marker traces. This parameter can be specified only when the Equipment Standard is Brazil. Refer to Section 2.5.6 “Marker Trace” for details.

Press the Marker key on the front panel to switch between normal/delta markers, and marker trace. The soft key menu contents change to those for marker type selection. Switch between the normal/delta markers and marker trace with the soft key. The marker can be moved by turning the Rotary Encoder.

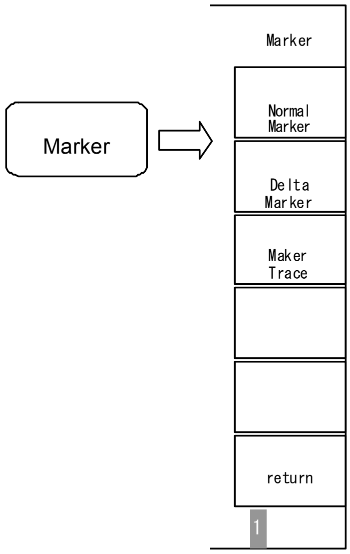


Figure 2.5.3-1 Marker type selection

2.5.4 Loading Filter Characteristics File

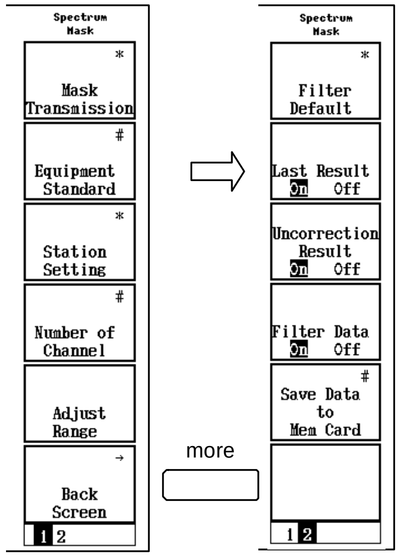


Figure 2.5.4-1 Filter setting selection

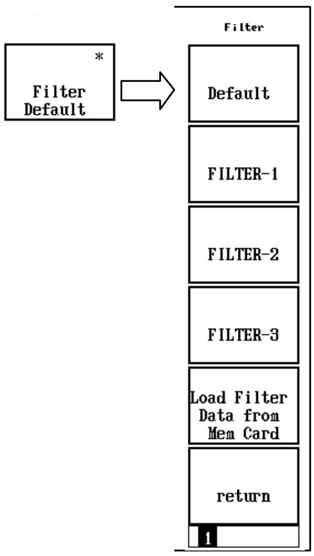


Figure 2.5.4-2 Filter Data selection

Filtering can be used to correct the spectrum mask waveform.
During filtering, the filter characteristics file can be loaded to display the spectrum waveform after attenuating the measurement data.

To specify the filter setting, press the More key on the Spectrum Mask screen, and then select Filter Transmission (F1). The soft key menu switches to the filter setting menu. One fixed filter (the default) and three user-specified filters (User-1, User-2, and User-3) can be specified in the filter characteristics by using the soft key. Filtering can be set up when the Equipment Standard is Brazil. Filtering cannot be set up when the Equipment Standard is type A or type B.

＜Procedure＞

Create filter characteristics file data using a text editor or Excel.

↓

Write the data to a memory card.

↓

Insert the memory card into the MS8901A, and then load the filter characteristics file data.

(1) Creating the filter characteristics file

Create the filter characteristics file. Use a text editor or Excel. The structure of the filter characteristics file is as follows.

```
The title of the filter characteristics file
The number of data items
The number of break points
Frequency 1, filter frequency
characteristics 1
Frequency 2, filter frequency
characteristics 2
Frequency 3, filter frequency
characteristics 3
    :                :
```

Figure 2.5.4-3 Characteristics File Structure

- The filter characteristics file title can include up to ten alphanumeric characters. The title is displayed in the soft key menu on the screen. Commas (,) cannot be used in the title.
- 2 to 100 data items are available.
- The setting range for the frequency is −15 to+15 MHz, and the setting range for the filter frequency characteristics is −0.00 to −127.6 dB.
- Sort the frequency values in ascending order. If they are sorted in the wrong order, an error may occur
- This parameter can include up to two digits following the decimal point and is specified in MHz.
- The filter frequency characteristics can include up to two digits following the decimal point and are specified in dB.
- The top line is 0.00 dB. Note that the setting value is multiplied by −27.4 dB and displayed on the screen.

As a detailed example, filter characteristics file data created using a text editor or Excel is shown below.

using a text editor

A1	▼	=	
	A	B	C
1	Filter-1		
2	8		
3	–15.00	–57.60	
4	–4.00	–57.60	
5	–3.50	–27.60	
6	–3.00	0.00	
7	3.00	0.00	
8	3.50	–27.60	
9	4.00	–57.60	
10	15.00	–57.60	
11			

Figure 2.5.4-5 Example of writing filter characteristics file mask data using Excel

(2) Write data to a memory card

Save the data created using a text editor or Excel using one of the following file names:

Filter1.csv, Filter2.csv, or Filter3.csv

Filter1.csv is downloaded to User-1, Filter2.csv to User-2, and Filter3.csv to User-3 as shown in Figure 2.5.4-2.

The first character string ("Filter-1" in Figure 2.5.4-3 "Example of writing filter characteristics file with a Text Editor") is displayed on the function key.

Write the files to a memory card. Write these files to the root directory in the memory card.

Example: When the memory card is set to Drive E: "E:\Filter1.csv"

Be sure to select the CSV format when writing with Excel.

(3) Load the filter characteristics file to the MS8901A.

Insert the memory card in which the filter characteristics file (Filter1.csv) is written into the MS8901A. The memory card can be inserted or removed while the MS8901A is on. Refer to the following procedure for details about loading the filter characteristics file from the memory card.

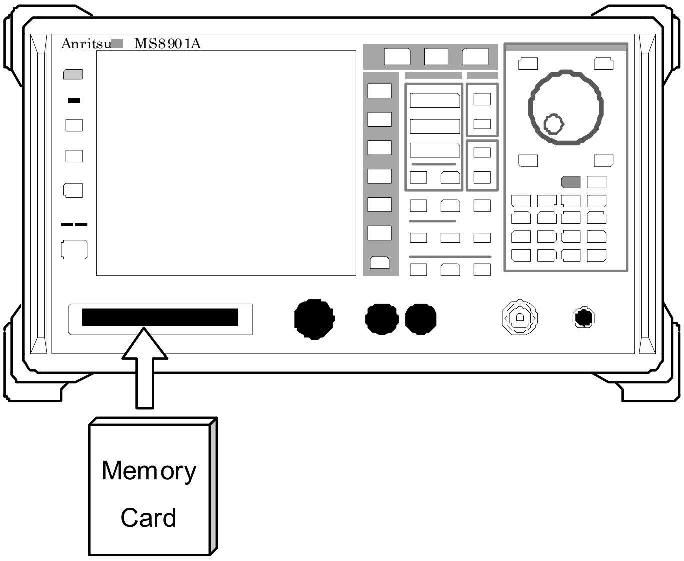


Figure 2.5.4-6 Insertion of memory card to the MS8901A

1. Insert the memory card into the MS8901A.
2. Press the More key on the Spectrum Mask screen to switch the menu bar.
3. Press the Filter Default key (F1), and then open the Filter menu.
4. Pressing Load Filter Data from Mem Card (F5) loads the filter characteristics file in the memory card automatically to the MS8901A.

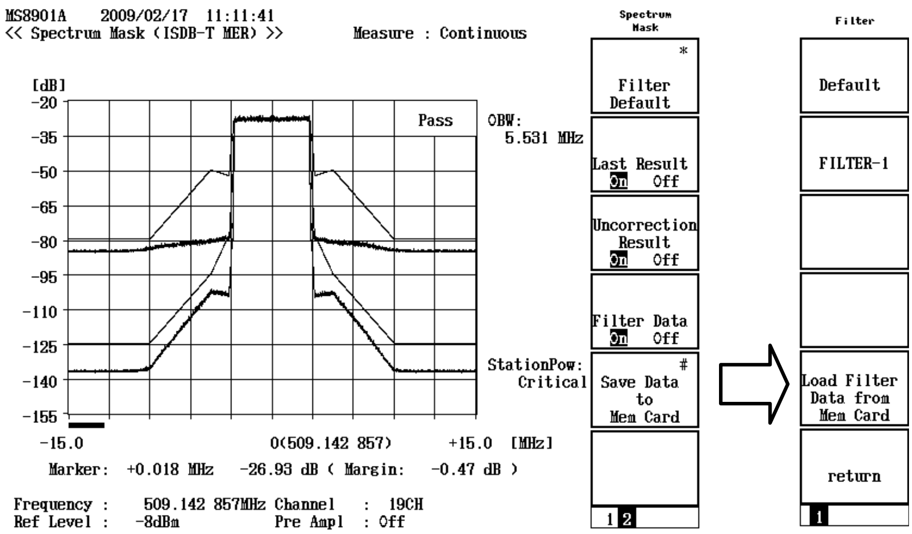


Figure 2.5.4-7 Recalling filter characteristics file

When the Filter1.csv file is loaded, the function menu of F2 (Filter-1) key is output.

Before loading the file, determine which standard corresponds to the data and change the Equipment Standard setting. Refer to "(1) Creating the filter characteristics file" for details about the range.

2.5.5 Showing/hiding waveform

When the Equipment Standard is changed to Brazil, the waveform data can be switched between being shown and hidden.

To switch whether the waveform is displayed, press the More key on the Spectrum Mask screen, which changes the menu key contents. Pressing the F2 to F4 keys can show or hide the waveform.

The F2 key can show and hide the spectrum waveform data (Last Result) after filter correction.
The F3 key can show and hide the spectrum waveform data before filter correction (Uncorrection Result).
The F4 key can show and hide the filter characteristics data (Filter Data).
Note, however, that it is not possible to hide all the spectrum waveform data.

Pass-fail judgment is performed for the spectrum waveform after filter correction (Last Result). The result of pass-fail judgment is displayed even when the spectrum waveform after filter correction is hidden.

Each waveform data line is colored. The spectrum waveform data for Last Result is yellow, that for Uncorrection Result is gray, and that for Filter Data is green.

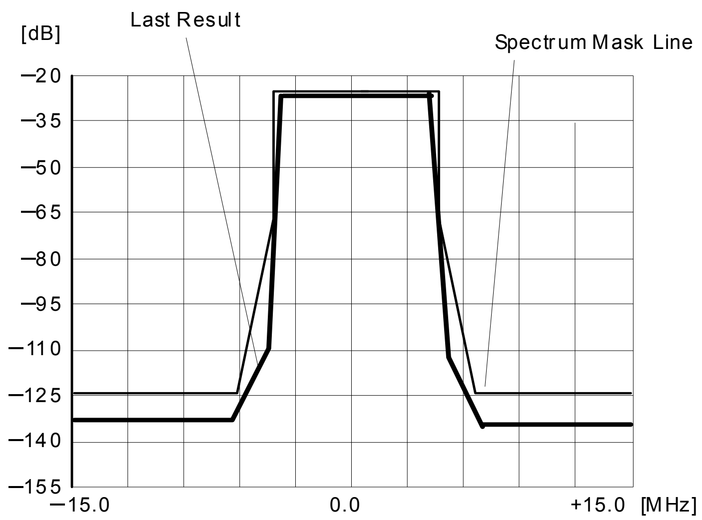


Table 2.5.5-1 Displayed waveform when Last Result is displayed, Uncorrection Result is hidden, and Filter Data is hidden

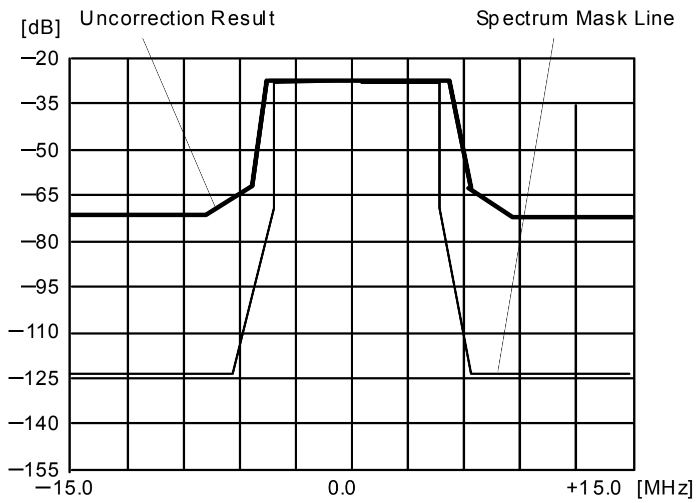


Table 2.5.5-2 Displayed waveform when Last Result is hidden, Uncorrection Result is displayed, and Filter Data is hidden

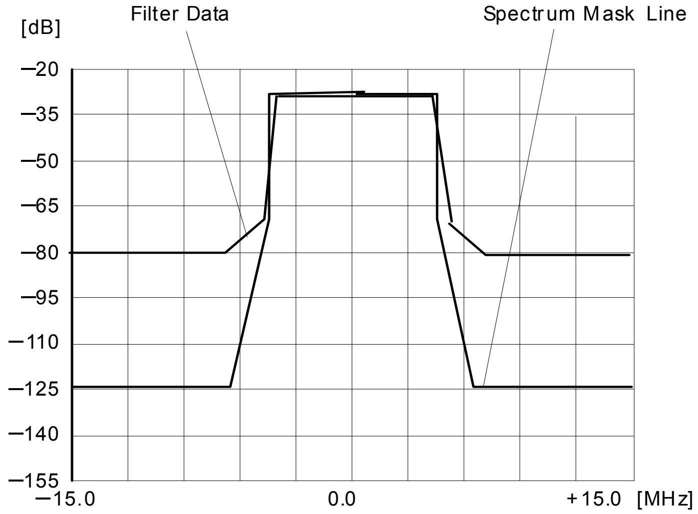


Table 2.5.5-3 Displayed waveform when Last Result is hidden, Uncorrection Result is hidden, and Filter Data is displayed

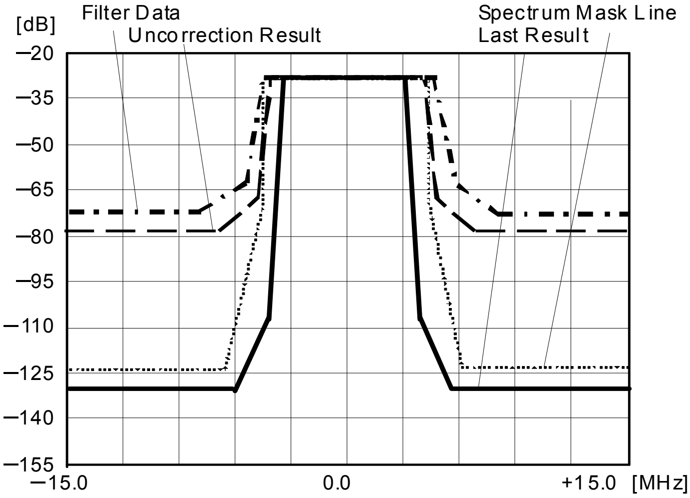


Table 2.5.5-4 Displayed waveform when Last Result, Uncorrection Result, and Filter Data are displayed

2.5.6 Marker Trace

The waveform that displays the marker can be switched when the Equipment Standard is Brazil. Refer to Section 2.5.3 "Marker" for how to specify the marker.

When the Equipment Standard is type A or B, the spectrum mask is not affected.

Press the Marker key on the front panel, and then select the Marker Trace key (F3) in the Marker menu to open the selection screen.

Select which waveform the marker follows.

The marker can be set up only for a displayed waveform, as described in Section 2.5.5 "Switching Display."

(a) Last Result

The marker is set to the waveform data after filter correction.

(b) Uncorrection Result

The marker is set to the waveform data before filter correction.

(c) Filter Data

The marker is set to the filter characteristics waveform data. Margin is not displayed when Filter Data is selected.

The appropriate marker trace target is selected when the specified waveform is shown or hidden after specifying a value for Marker Trace.

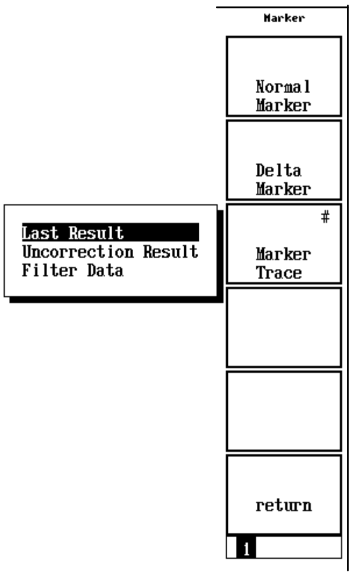


Table 2.5.6-1 Marker specification screen

2.6 Frequency Counter Measurement (Frequency Counter Screen)

Frequency measurements for FFT sample clocks, etc., are performed. This measurement differs from the MER and Constellation measurement as it measures CW.

Note:

This measurement cannot be performed when System is TV auto Select.

2.6.1 Frequency counter measurement

Press the Frequency Counter soft key on the Setup Common Parameter screen. The screen switches to the Frequency Counter screen.

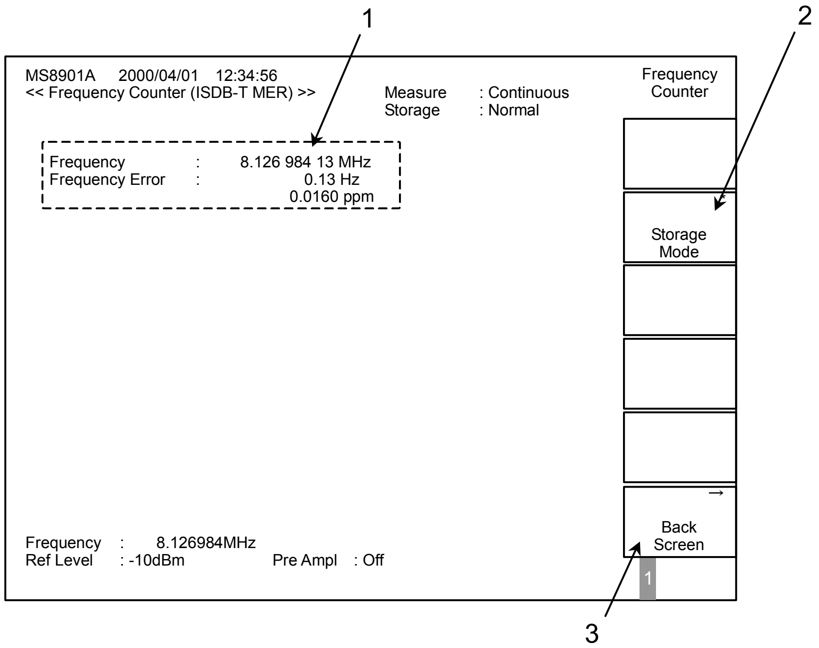


Figure 2.6.1-1 Frequency Counter screen

1: Frequency measurement

Measures the CW frequency.

When the offset frequency is set, the measured result (CW frequency) added with the set offset frequency is displayed.

The difference between the measured frequency and the set frequency (frequency displayed at the bottom of the screen) is displayed as a Frequency Error.

Note:

When the FFT sample frequency theoretical value of 512/63 MHz = 8.126984127 … MHz is measured, the frequency error result becomes 0.13 Hz because the minimum resolution for frequency settings is 1 Hz units. (Note that the 0.01 Hz digit may deviate ±0.01 Hz from the estimated limit).

Offset frequency additions are only the simple adding of setting values. The correct value may not be shown when there are frequency errors in the Local signal sources of the frequency converter.

The detection levels drops and Under Range is displayed on the screen if the frequency of the signal to be measured greatly deviates from the set frequency.

When the frequency error exceeds ±15000 Hz, it falls outside the measurement range and *** is displayed on the screen.

2: Storage Mode
Sets the methods for displaying the measured results on the screen. Average, Max Hold, Over Write and other modes can be set. Refer to Section 2.7 “Storage Mode” for details.

3: Back Screen
Returns to the Setup Common Parameter screen where measurement parameters are set.

2.7 Storage Mode

Each measured results are displayed as is for normal measurement. When the input signal status has deteriorated or for long-term status monitoring, however, it may be required to average the measured results or to hold the measured result on the screen. Select the optimum storage mode at this time.

The following five storage mode types are available.

- Normal
- Average
- Moving Avg
- Max Hold
- Over Write

These storage mode settings can be set for the Signal Analysis, C/N, and Frequency Counter screens.

The storage mode settings cannot be performed on the Spectrum Mask screen.

<Procedure>

1. Press the Storage Mode soft key (F2) on each measurement screen.
2. When the soft key menu changes, press the Mode soft key (F1).
3. A pop-up window for storage mode selection opens. Select a storage mode from this window.

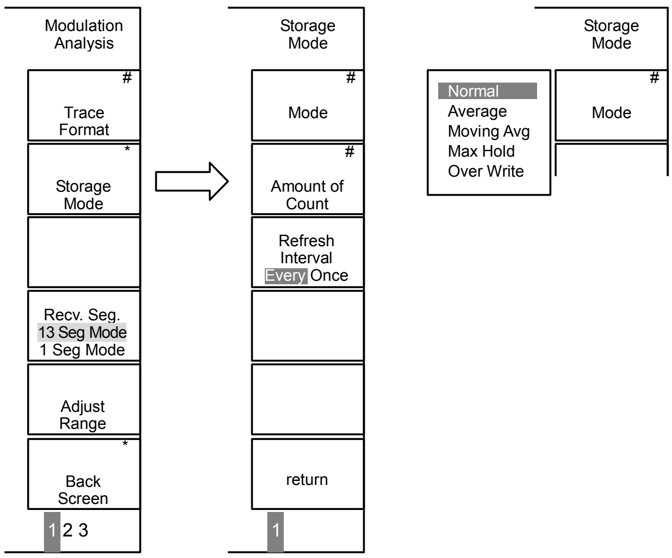


Figure 2.7-1 Storage mode selection

2.7.1 Normal

The measured results are displayed on the screen for each measurement. Perform normal measurement in this mode.

2.7.2 Average

The results of measurement for specified numbers (times) are averaged and displayed.

Note that the waveform display in the Constellation screen is updated every five measurements. When the set average count is 6 or more, therefore, the previous five measured results are always averaged and updated. This updating operation is the same as that of moving average described in Section 2.7.3 “Moving Avg.”

- Set average count (Amount of Count)
  Set the average count in the following procedure:

<Procedure>

1. Press the Storage Mode soft key (F2) on each measurement screen.
2. When the soft key menu changes, press the Amount of Count soft key (F2).
3. A pop-up window for setting the average count opens. Enter the average count in this window.

The average count can be set from 2 to 100.

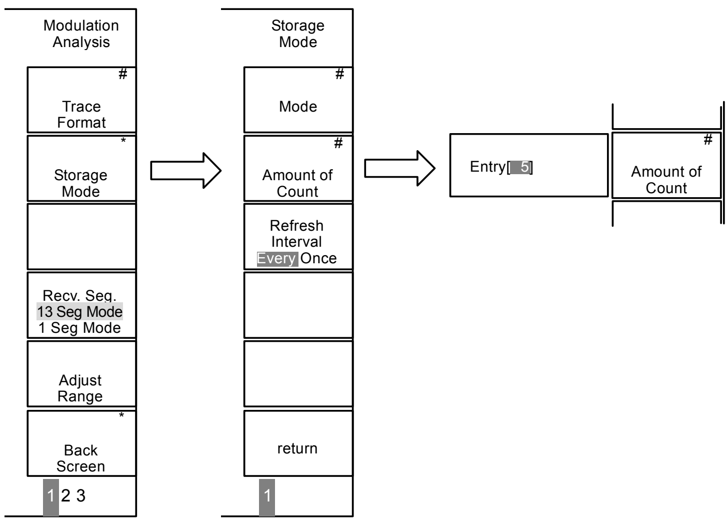


Figure 2.7.2-1 Setting average count (Amount of Count)

Note:

Measured results in dB units are converted to linear values before averaging.

- Set screen update method (Refresh Interval)

  Set the display method for the screen during averaging operations. The following two settings are possible:

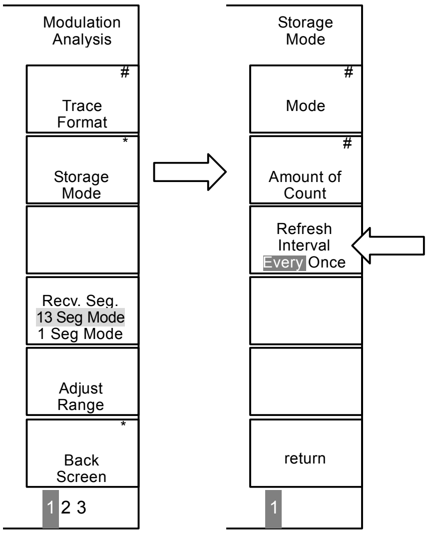


Figure 2.7.2-2 Setting screen update method (Refresh Interval)

(1) Every

This parameter displays the measured results during averaging (averaging result for the current measurement count).

(2) Once

This parameter displays the measured results on the screen after averaging is complete, without updating the waveform display during averaging.

The measurement mode switches to the Single mode automatically when the Storage Mode is set to Average.

The measurement operation stops when measurement of the number set by the average count has been performed. In this event, “Measure: Single” on the upper right of the screen becomes a blank space. Press the Single key on the front panel to execute averaging again.

2.7.3 Moving Avg

The results of measurement for specified number are averaged and displayed.

Moving Avg (moving average) differs from "Average" in Section 2.7.2 above in that only the results of measurement previously performed for the specified numbers are averaged and displayed. The measurement continues with Moving Avg even when the specified number of measurement is finished, while averaging in Section 2.7.2 "Average" ends the measurement.

Instantaneous measured value	[1]	[2]	[3]	[4]	[5]
Moving Avg	[1]	$\frac{([1]+[2])}{2}$	$\frac{([1]+[2]+[3])}{3}$	$\frac{([2]+[3]+[4])}{3}$	$\frac{([3]+[4]+[5])}{3}$
Average			$\frac{([1]+[2]+[3])}{3}$		

Set the measurement mode to Continuous for Moving Avg. When the measurement mode is Single, the averaging operation is the same as that in Average.

Moving Avg can only be set for the Modulation Analysis screen.

The waveform display in the Constellation screen is the same as that in the Average mode.
The waveform display in the Freq Response and Sub-carrier MER screen is the same as that in the Normal mode.

2.7.4 Max Hold

The measured results and the currently displayed value are compared, and the larger one is remained for display.

For MER, however, a smaller value is held since the larger MER values, the poorer the performance. For Frequency Error, which may have both positive and negative values, a larger absolute value is held.

The maximum value of each measurement point remains and is displayed in the waveform display on the Freq Response screen and C/N screen. The waveform display in the Constellation screen is the same as that in the Average mode.

The waveform display in the Sub-carrier MER screen is the same as that in the Normal mode. A minimum value of MER is always held as the waveform of the Worst Envelope line graph.

2.7.5 Over Write

Measured results are overwritten.
This function is available only for the waveform display in the Constellation, Freq Response, SUB carrier MER and C/N screens.

For the numerical value display, the measured result is updated and displayed for each measurement in the same manner with the Normal mode.

2.8 RF/IF Switch Function

RF/IF switch function detects the levels of both the RF signal (set frequency beforehand) and IF signal (37.15 MHz) at the beginning of measurement to perform measurement for the signal whose level is higher. The measurement target signal type (RF/IF) of this switch processing and its status (Normal/No signal/Abnormal) are also output.

When measurements (modulation analysis (MER) measurement, CN measurement and Spectrum Mask measurement) are complete and the results are displayed, the target signal type and status of automatic switch processing are output on the screen.

The RF/IF switch function is enabled when System is set to TV Auto Select.

When System is set to TV, the RF/IF switch function is disabled.

The explanation in this section assumes that System is set to TV Auto Select.

2.8.1 Setting Measurement Parameters

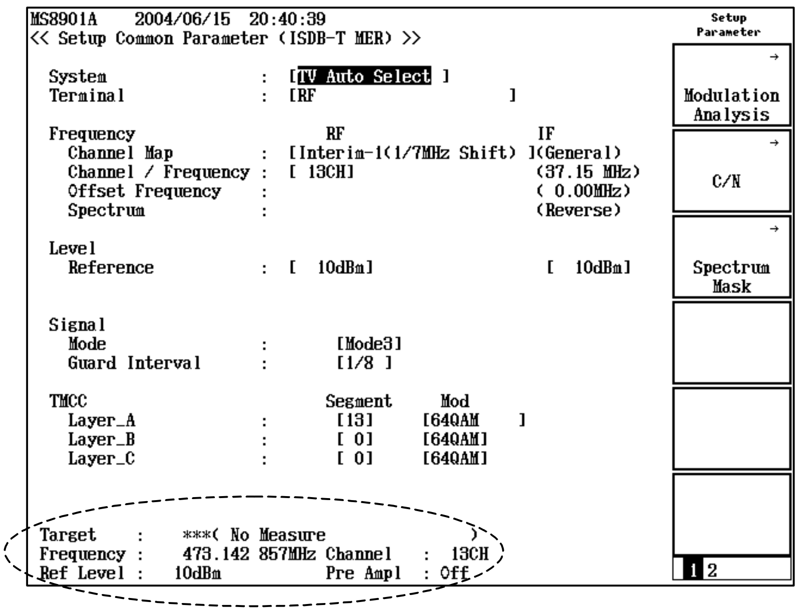


Figure 2.8.1-1 Setup Common Parameter screen (RF/IF switch function enabled)

The part enclosed in the dotted lines in the above figure shows the result of RF/IF switch processing. Refer to Section 2.8.2 “System” for details.

2.8.2 System

This item enables/disables the RF/IF switch function.

MS8901A 2000/04/01 12:34:56
<< Setup Common Parameter (ISDB-T MER) >>

System : [TV Auto Select]

Figure 2.8.2-1 System item

The difference between TV and TV Auto Select is shown below:

TV
Set to disable the RF/IF switch function. Select this to perform measurement only for the RF signal or IF signal. Normally use this setting.

TV Auto Select
Set to enable the RF/IF switch function. Select this to perform measurement by switching between RF and IF signals depending on the input status. Use this setting when the RF and IF signals to be input to the MX8901A are selected by using a switch.

2.8.3 Terminal

When TV Auto Select is set as System, the terminal is fixed to RF input regardless of whether the MS8901A-18 (Low IF/IQ unbalanced input) option is installed or not.

2.8.4 Frequencies and Channels

Set the frequency allocation (Channel Map) and carrier frequency (Frequency) or channels (Channel) for the signals to be measured.

The Channel Map setting on the RF side is the same as that when the RF/IF switch function is disabled (System = TV). The Channel Map setting on the IF side is fixed to General.

Frequency			
Channel Map	:	[Interim-1(1/7MHz Shift)]	(General)
Channel / Frequency	:	[13 CH]	(37.15 MHz)
Offset Frequency	:		(0.00 MHz)
Spectrum	:		(Reverse)

Figure 2.8.4-1 Channel Map setting (when RF/IF switch function enabled)

The Carrier frequency (Frequency) or channels (Channel) setting on the RF side is the same as that when the RF/IF switch function is disabled (System = TV). The Carrier frequency setting on the IF side is fixed to 37.15 MHz.

Frequency			
Channel Map	:	[Interim-1(1/7MHz Shift)]	(General)
Channel / Frequency	:	[13 CH]	(37.15 MHz)
Offset Frequency	:		(0.00 MHz)
Spectrum	:		(Reverse)

Figure 2.8.4-2 Carrier frequency setting (when RF/IF switch function enabled)

2.8.5 Offset Frequency

Offset Frequency can be set when General or IF Band is selected for frequency allocation (Channel Map).

The Offset Frequency setting on the RF side is the same as that when the RF/IF switch function is disabled (System = TV).

The Offset Frequency setting on the IF side is fixed to 0.00 MHz.

Frequency			
Channel Map	:	[Interim-1(1/7MHz Shift)]	(General)
Channel / Frequency	:	[13 CH]	(37.15 MHz)
Offset Frequency	:		(0.00 MHz)
Spectrum	:		(Reverse)

Figure 2.8.5-1 Offset Frequency setting (when RF/IF switch function enabled)

2.8.6 Spectrum

The spectrum for IF signals at 37.15 MHz is reversed with respect to the final RF frequency signals. In addition, the IF signal spectrum will still be reversed when the LO signal frequency is set higher than the RF signal frequency even when the frequency is down-converted using an external frequency converter. Set Spectrum when analyzing a signal with the spectrum reversed.

The Spectrum setting on the RF side is the same as that when the RF/IF switch function is disabled (System = TV).

The Spectrum setting on the IF side is fixed to Reverse.

Frequency			
Channel Map	:	[Interim-1(1/7MHz Shift)]	(General)
Channel / Frequency	:	[13 CH]	(37.15 MHz)
Offset Frequency	:		(0.00 MHz)
Spectrum	:		(Reverse)

Figure 2.8.6-1 Spectrum reverse settings (when RF/IF switch function enabled)

2.8.7 Level

There are two methods for setting the input signal level. When the RF/IF switch function is enabled (System = TV Auto Select), the setting method of auto range adjustment (Adjust Range) is changed.

- Reference level setting (Ref Setting):
  This sets the input level from the front panel. It is used when the signal level is known beforehand such as in a transmitter test.

- Auto range adjustment (Adjust Range):
  Press the AGC key (F5) to set AGC On. Since the RF/IF switch function includes level adjustment processing, the auto range adjustment function (Adjust Range) cannot be used when the RF/IF switch function is disabled (System = TV). The Level Cont key (F4) is therefore also disabled.
  This function detects the level of the measurement target signal at each measurement and automatically switches the attenuator to perform measurement (the reference set value is ignored). However, this function does not switch the pre-amplifier On/Off. Note that this function is executed normally when only one wave signal is input at a time.

(1) Reference level setting (Ref Setting)

The signal level to be input is input from the screen as the reference level.

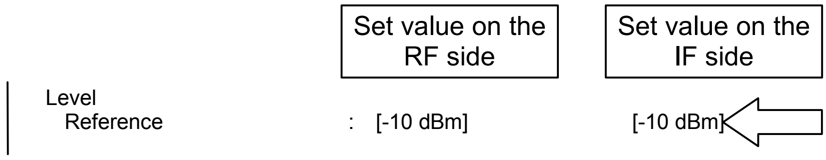


Figure 2.8.7-1 Reference level settings (when RF/IF switch function enabled)

The reference level can also be set from the Amplitude key on the front panel. Press the Amplitude key to change the soft key menu contents; a pop-up window opens on the left of the Ref Level soft key (F1). Set the reference level here.

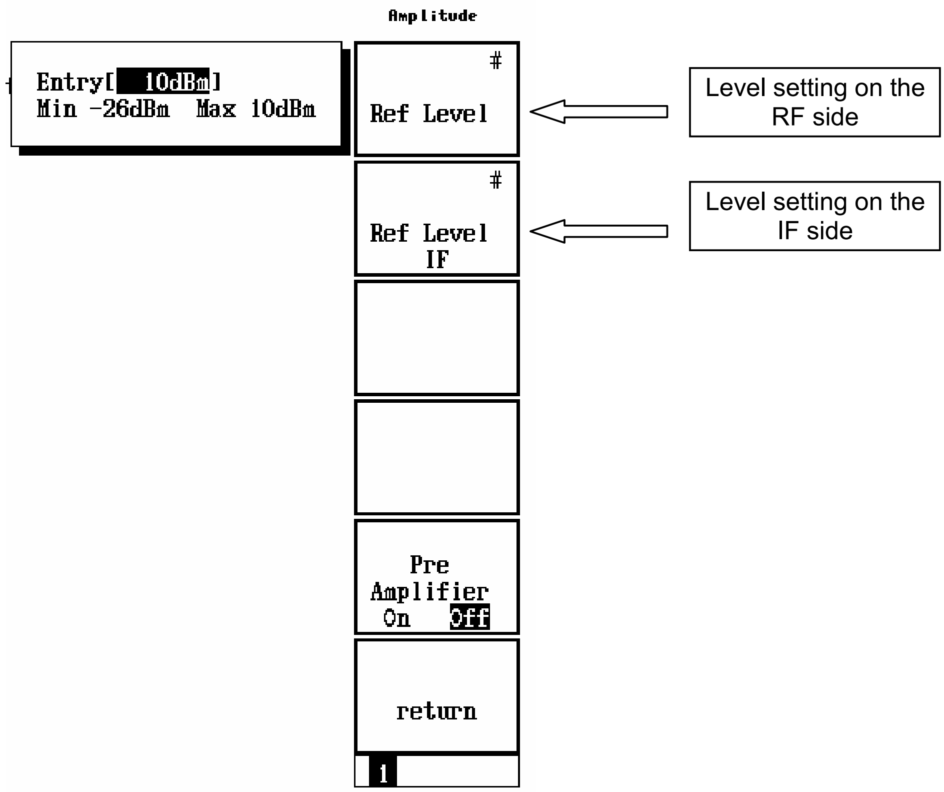


Figure 2.8.7-2 Settings using Amplitude key (when RF/IF switch function enabled)

(2) Auto range adjustment

AGC is initially set to Off. To change the input level setting method, press the AGC key (F5) on the second page of the soft key menu. Off and On are toggled when the AGC key is pressed. Note that Level Cont is fixed to Ref Setting when TV Auto Select is set.

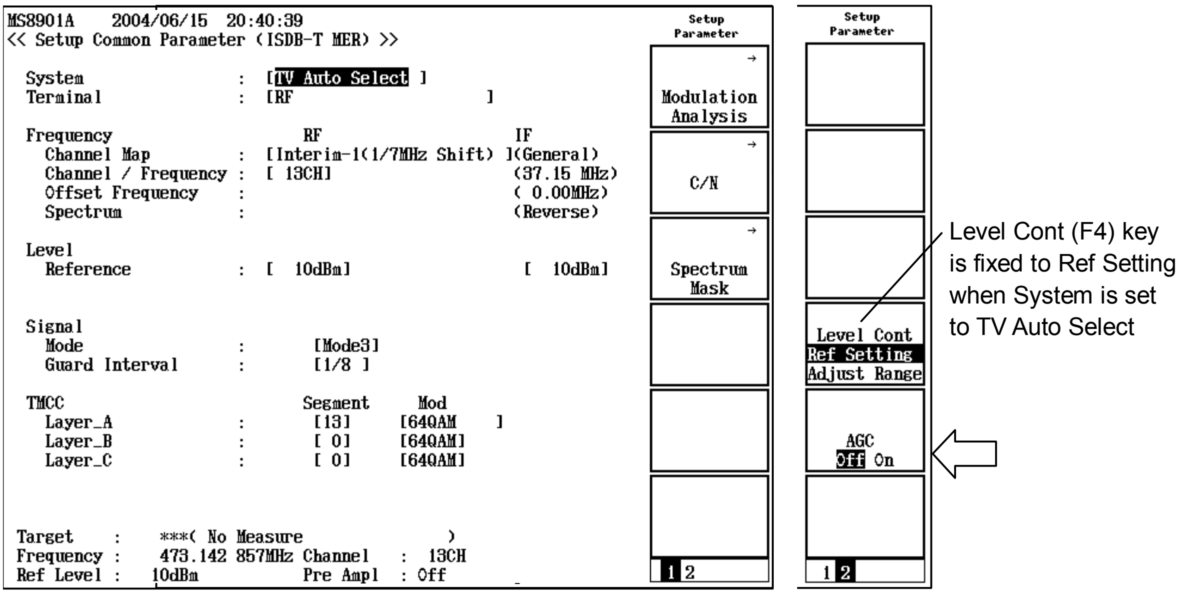


Figure 2.8.7-3 Level Cont key (when RF/IF switch function enabled)

(3) Input level status display

The interface is the same as that when the RF/IF switch function is disabled (System = TV). Refer to (3) in Section 2.2.6 “Level” for details.

2.8.8 Mode

Set the input signal mode (Mode). Mode settings on both the RF and IF sides are the same as those when the RF/IF switch function is disabled (System = TV). Refer to Section 2.2.7 “Mode” for details.

2.8.9 Guard Interval

Set the guard interval for the input signal (Guard Interval). Guard interval settings on both the RF and IF sides are the same as those when the RF/IF switch function is disabled (System = TV). Refer to Section 2.2.8 “Guard Interval” for details.

2.8.10 TMCC

Set the TMCC information of the input signal. TMCC settings on both the RF and IF sides are the same as those when the RF/IF switch function is disabled (System = TV). Refer to Section 2.2.9 “TMCC” for details.

2.8.11 Preamplifier

A pre-amplifier is built into the RF input portion as standard with the MS8901A. Set the pre-amplifier to On when the input signal level is low to enhance the MS8901A's NF (Noise Figure) to enable low-level measurements.

Press the Amplitude key on the front panel to change the soft key contents. Then press the Preamplifier soft key (F5) to set the pre-amplifier On/Off.

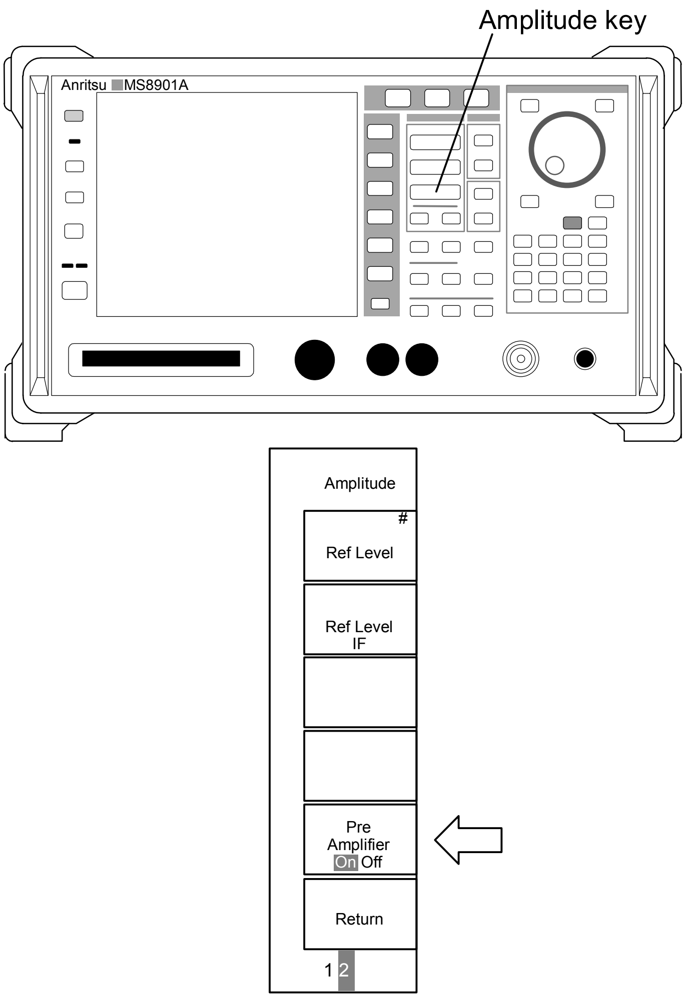


Figure 2.8.11-1 Pre-amplifier control

Note:

The maximum input level value (the upper level limit when the MS8901A is not damaged) varies depending on pre-amplifier On/Off.

Preamp Off: +30 dBm
Preamp On: +10 dBm

For example, there is a risk of damaging the MS8901A interior if the pre-amplifier is set to On when +20 dBm is input with the pre-amplifier Off. Note the input level when setting the pre-amplifier On/Off while signals are input. The maximum input level shown above will apply regardless of the Ref Level and Ref Level IF settings.

2.8.12 Measurement mode

Measurement mode refers to how often the measured results should be updated. There are two measurement modes provided: continuous mode (Continuous) and single mode (Single). The measurement mode setting is the same as that when the RF/IF switch function is disabled (System = TV). Refer to Section 2.2.11 “Measurement mode” for details.

2.8.13 Initialization (Preset)

The initialization method and initial values are the same as those when the RF/IF switch function is disabled (System = TV). Refer to Section 2.2.12 “Initialization (Preset)” for details.

2.8.14 Measurement screens (Modulation Analysis, C/N, Spectrum Mask)

The measured results are displayed on each measurement screen and the Setup Common Parameter screen.

(Example) Modulation Analysis screen (Trace Format is set to No Trace)

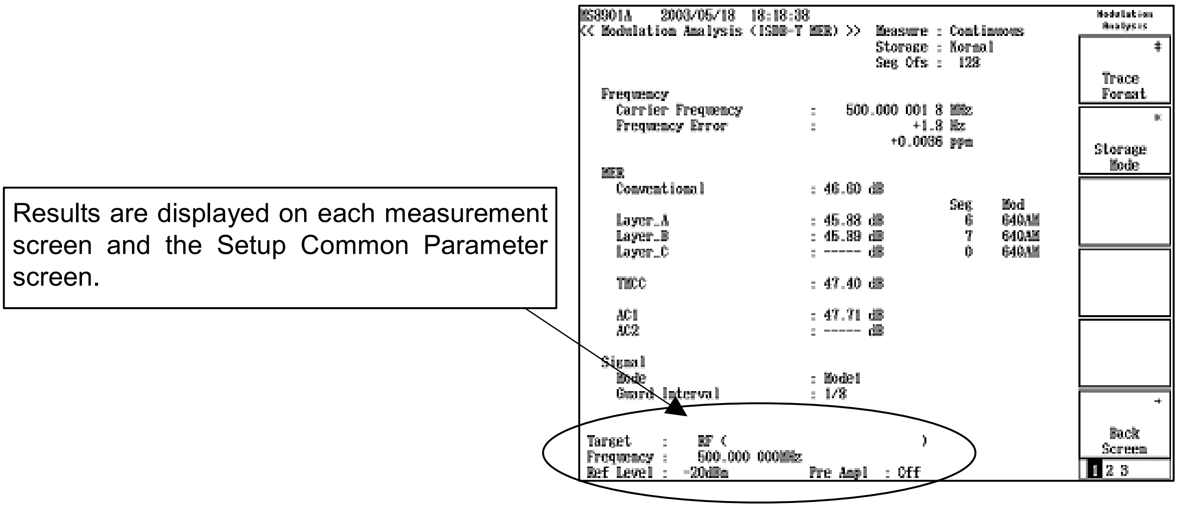


Figure 2.8.14-1 Measured results display on Modulation Analysis screen

- Measured results display details (common to all screens)

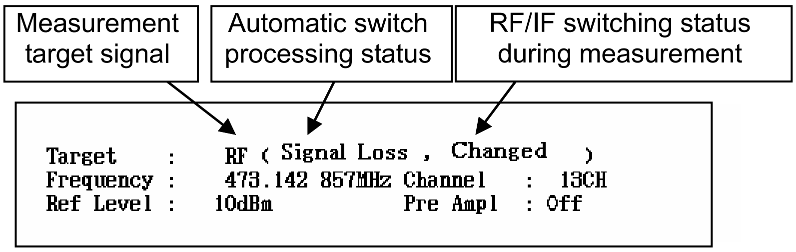


Figure 2.8.14-2 RF/IF measured results display

Measurement target signal

Shows the type of the measurement target signal.

RF : Indicates that the RF signal is the measurement target.

IF : Indicates that the IF signal is the measurement target.

*** : Indicates that the measurement target is not determined.

Automatic switch processing status

(No display) : Nothing is displayed when the input signal is normal.
No Measure : Not measured (from start to end of measurement)
Signal Loss : No input signal
Signal Abnormal : The number of attenuator switching exceeds the limit when determining the measurement target. Measurement is stopped after this is displayed.

Restarting measurement after stop

After measurement has stopped, it can be restarted by performing a measurement start operation (for example, by pressing the Single key). Refer to Section 2.9 "Measurement Stop when RF/IF Switch Function Enabled" for details.

RF/IF switching status during measurement

Changed : Storage Mode (Average or Moving Avg) is selected, or the measurement target (RF/IF) is switched during measurement.
When storage mode is Moving Avg during modulation analysis measurement, this display is cleared when measurements are performed the number of times set by Amount Of Count after the measurement target (RF/IF) is switched.
* This is not displayed on the Spectrum Mask screen since the Storage Mode function is not available.

(No display) : Nothing is displayed when the measurement target is not switched.

2.8.15 Spectrum Mask measurement

Performs measurement with frequency allocation (Channel Map) mode set for the measurement target (RF/IF). Refer to Section 2.5 "Spectrum Mask" for details.

2.8.16 Saving measurement data

The method of saving measurement data when the RF/IF switch function is enabled (System = TV Auto Select) is the same as that when the RF/IF switch function is disabled (System = TV). Refer to Section 2.12 "Saving Measurement Data" for details.

2.9 Measurement Stop when RF/IF Switch Function Enabled

Measurement may stop when the RF/IF switch function is enabled (System = TV Auto Select). This section describes the measurement stop conditions, reasons, mechanism and countermeasures.

2.9.1 Measurement stop conditions

- While the RF/IF switch function is enabled, the input level is higher than the reference setting (Over Range).
- While the RF/IF switch function is enabled, an OFDM signal is input as the target signal for CN measurement (even when the input level is the same as the reference setting).

Measurement may stop especially when setting the reference close to the input level (where Over Range likely occur) to obtain the best MER value.

2.9.2 Measurement stop criteria

When measurement stops, "Signal Abnormal" (RF/IF switch function status) appears at the bottom of the screen. You can ascertain whether the measurement is stopped by checking this status display.

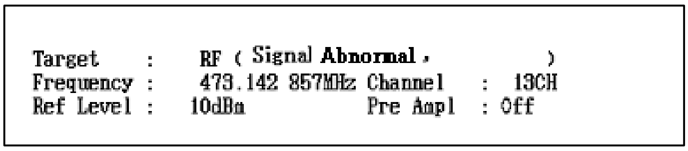


Figure 2.9.2-1 RF/IF measured results display

2.9.3 Measurement stop mechanism

When the RF/IF switch function is enabled, it measures the RF/IF levels at each measurement.

When measuring the levels of both RF and IF, the MS8901A checks if the internal AD converter is saturated to measure the levels accurately. If the AD converter is saturated, the MS8901A switches its internal attenuator to the one with the higher value. Then the MS8901A sets the attenuator depending on reference setting again and performs measurement.

It follows that when the input signal level is higher than that of the reference setting, attenuator switching occurs frequently. For CN measurement, the hardware settings are performed assuming a CW (continuous wave) signal as the input signal. If an OFDM signal is input accidentally, the same phenomenon may therefore occur even if the input signal level is equal to the set reference value.

Level control of the MS8901A is performed by a mechanical attenuator. To keep the attenuators from being applied with excessive load when the above phenomenon occurs frequently, the attenuator switch frequency is monitored by software to stop measurement when the set threshold is exceeded.

2.9.4 Restarting measurement after stop

After measurement has been stopped, it can be restarted by performing a measurement start operation (by pressing the Single key or issuing a remote command for measurement start).

2.9.5 Countermeasures to measurement stop

Prevent or handle measurement stop as shown below.

<Preventing measurement stop>

- Adjust the reference setting in advance.

<Handling measurement stop>

- Restart measurement. Refer to Section 2.9.4 “Restarting measurement after stop” for details.
- Check the automatic switch processing status displayed on each measurement screen to confirm the input signal status.

2.10 Signal Parameter Automatic Detection Function

The signal parameter automatic detection function analyzes the input signal to automatically set the mode, guard interval and TMCC information (modulation system and number of segments for each layer) of the input signal.

Automatic detection is executed on the signal analysis (Modulation Analysis) screen. Then signal analysis (frequency, MER, constellation, frequency response) is performed with the detected parameters.

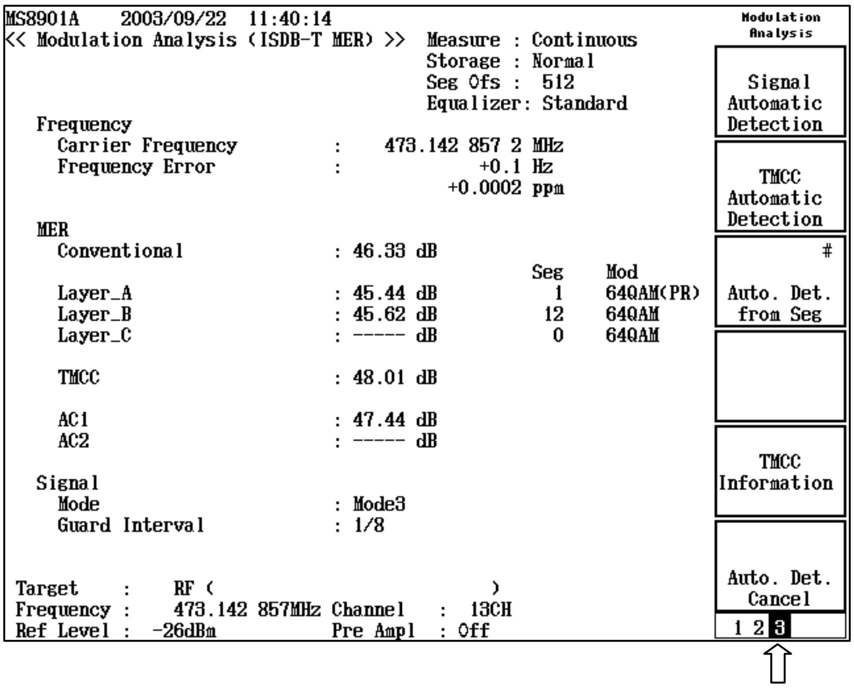


Figure 2.10-1 Modulation Analysis screen (when third menu page open)

2.10.1 Automatic detection operation

Execute automatic detection from the third page of the signal analysis (Modulation Analysis) menu.

The following two levels are available for automatic signal parameter detection.

- One for detecting mode, guard interval and TMCC information (modulation system and number of segments for each layer)
- One for detecting TMCC information (modulation system and number of segments for each layer)

Use the appropriate one of these two detection levels as follows:

- When the measurement environment varies significantly, such as in field tests, perform automatic detection in "mode, guard interval and TMCC information" mode at system startup and at the specified interval. After that, perform automatic detection in "TMCC information only" mode as necessary.
- In a measurement environment within a limited area, such as R&D or production lines, the mode and guard interval will not vary so much. Perform automatic detection in "TMCC information only" mode.

(1) Executing automatic detection
Follow the procedure shown below to execute automatic detection of signal parameters.

<Procedure>

1. Set the measurement channel or frequency on the Setup Common Parameter screen.
2. Set the reference level.
3. Move to signal analysis (Modulation Analysis).
4. Press the More key twice to display the third page of the menu.
5. Press the Auto. Det. from Seg (F3) key to select the measurement target segment (segment No.: 0 to 12, initial value: 0).
6. Press the Signal Automatic Detection (F1) key. Automatic detection of the signal parameters is executed.

After detection is complete, signal analysis measurement is performed with the parameters detected automatically.

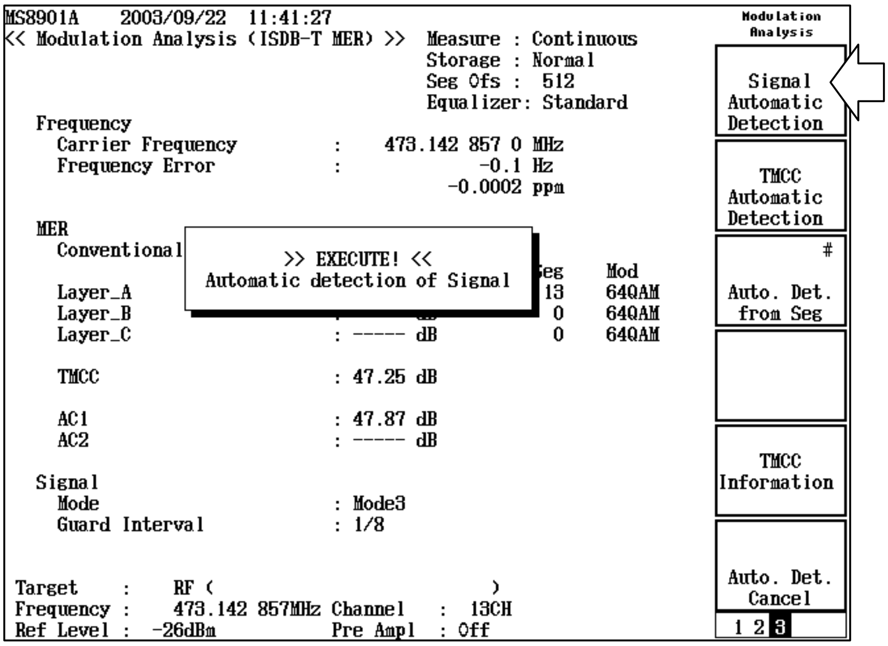


Figure 2.10.1-1 Executing automatic detection of signal parameters

When performing automatic detection for TMCC information only, press the TMCC Automatic Detection (F2) key in Step 3. above.

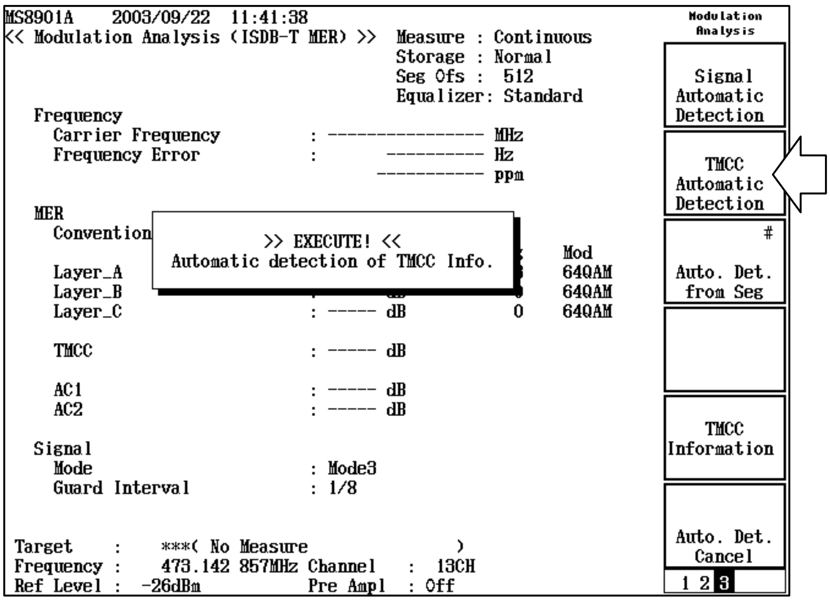


Figure 2.10.1-2 Executing automatic detection of TMCC

Note:

After automatic detection, the MS8901A checks whether or not the detected Mode, Guard Interval, modulation system and segment number for each layer are different from the current setting. If the setting is different, the screen automatically shifts to the No Trace screen, Code Rate for each layer and Time Interleave are not checked.

(2) Operation during automatic detection

Executing automatic detection opens the message window shown below. Operations except the Auto. Det. Cancel (F6) key and the Preset key are disabled while this message is displayed.

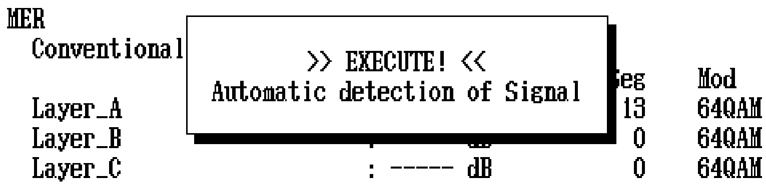


Figure 2.10.1-3 Display during automatic detection of signal parameters

Figure 2.10.1-4 Display during automatic detection of TMCC

Pressing the Auto. Det. Cancel (F6) key during detection stops automatic detection and performs signal analysis with the current parameters. Pressing the Preset key during detection stops automatic detection, initializes all parameters and returns to the Setup Common Parameter screen.

(3) Display after automatic detection

One of the following four is returned as the detection status:

- Normal
- Detect bit error
- Detection Failed
- TMCC Illegal

Details of each status are shown below.

Normal

The message window displayed after automatic detection varies depending on the automatic detection result. The messages displayed when the detected parameters are the same as/different from those before detection after automatic detection has been completed normally are shown below.

Figure 2.10.1-5 When the parameters are not changed

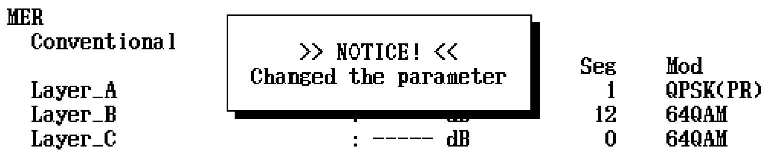


Figure 2.10.1-6 When the parameters are changed

Detect bit error

A parity bit is added to the bit string of the TMCC signal. The MX890120B performs a parity check during automatic detection. When a parity error is detected in the check, the messages shown below are displayed. In the same way as when detection was completed normally, the messages displayed vary depending on whether the detected parameters are the same as/different from those before detection as shown below.

Figure 2.10.1-7 When the parameters are not changed

Figure 2.10.1-8 When the parameters are changed

Note:

Even when an error is detected in the parity check, the detected parameters are reflected in the settings.

Detection Failed

When automatic detection has failed, the message shown below is displayed.

Figure 2.10.1-9 When automatic detection failed

Possible causes of automatic detection failure are listed below:

- Input level is inappropriate (too high or too low against the set reference level)
- Frequency settings including frequency allocation (Channel Map), frequency, channel and offset frequency are inappropriate for the input signal.
- Spectrum reverse setting is inappropriate for the input signal (not detected).

In addition, the signal quality may cause automatic detection failure as shown below:

- Too noisy to detect TMCC
- TMCC information bit string contains reserved information (for example, bit string of modulation system: 100 to 110).

TMCC Illegal

When the TMCC information is illegal, the message shown below is displayed.

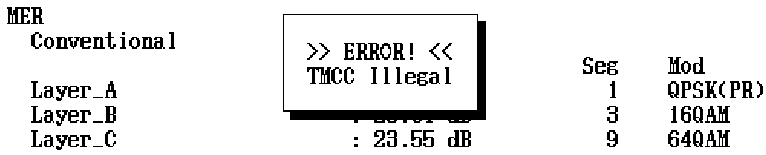


Figure 2.10.1-10 When TMCC information is illegal

Possible causes of illegal TMCC information are listed below:

- TMCC Current information does not conform to “TMCC information” in the “ARIB STD-B31” and “ABNT NBR 15601.”

  (Example) When bits that cannot be assigned according to the standards, such as reserve (101 to 110), are set for the code rate (B_{31} to B_{33}) that is Layer A transmission parameter information of the TMCC Current information.

Reference:

The detected TMCC information bit string (203 bits) can be viewed via a remote command. For details, refer to Section 3.2 “Device Message.”

2.10.2 Confirming detected parameters

The automatically detected parameters can be confirmed on all analysis results screens of signal analysis (Modulation Analysis).

On the No Trace screen, detected parameters (mode, guard interval and TMCC information) are displayed on the measured results screen.

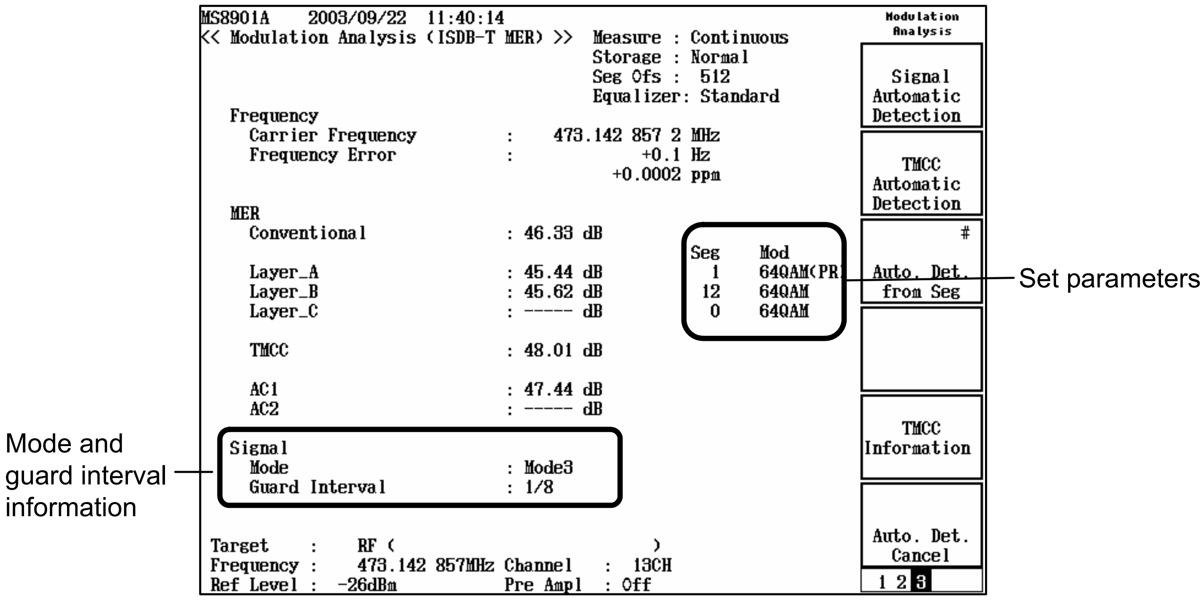


Figure 2.10.2-1 Detected parameters display

Pressing the TMCC Information (F5) key on all analysis results screens (No Trace, Constellation or Freq Response) opens the detection results window.

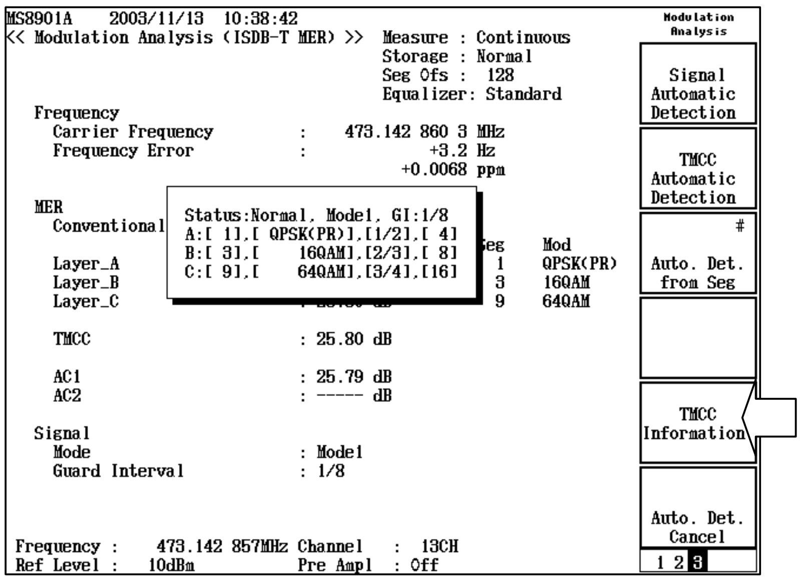


Figure 2.10.2-2 Detection results window on the Constellation screen

The detection results window parameters are described below:

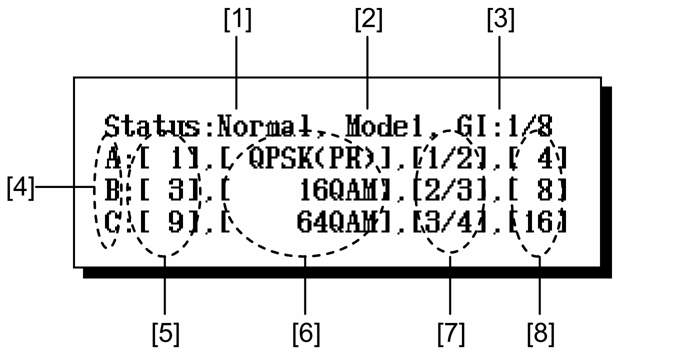


Figure 2.10.2-3 Detection results window details

[1] Status

Displays the automatic detection results status. The display contents are shown below:

Detection completed normally	: "Normal"
Parity check error	: "Detect bit error"
Detection failed	: "Detection Failed"
Illegal TMCC	: "TMCC Illegal"

[2] Mode

Displays the mode.

[3] Guard Interval

Displays the guard interval.

[4] Layer

Displays the layer.

[5] Segment

Displays the number of segments for each layer.

[6] Modulation

Displays the modulation system for each layer.

[7] Code Rate

Displays the coding ratio for each layer from the following five:
1/2, 2/3, 3/4, 5/6, 7/8

[8] Time Interleave

Displays the interleave length for each layer. This depends on the mode.

Mode1: 0, 4, 8, 16
Mode2: 0, 2, 4, 8
Mode3: 0, 1, 2, 4

However, information [4] thru [8] is shown as follows according to the TMCC information settings.

Reserved : "***"

Layer not used : "---"

TMCC information can be displayed even when the automatic detection result status is "Detection Failed" or "TMCC Illegal". However, the detection results are not reflected on the measurement screens.

Pressing the TMCC Information(F5) key without performing automatic detection causes the detection results window shown in Figure 2.10.2-4 to be displayed.

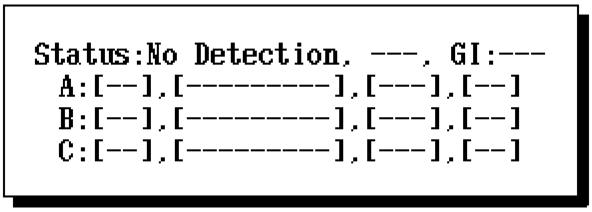


Figure 2.10.2-4 Detection results window (no detection performed)

2.10.3 Specifying segment for automatic detection (Auto. Det. from Seg)

The segment used for automatic detection can be specified from all analysis results screens of signal analysis (Modulation Analysis).

Specify the segment number by using the Auto. Det. from Seg (F3) soft key. Perform this setting before executing automatic detection to perform measurement with the segment specified.

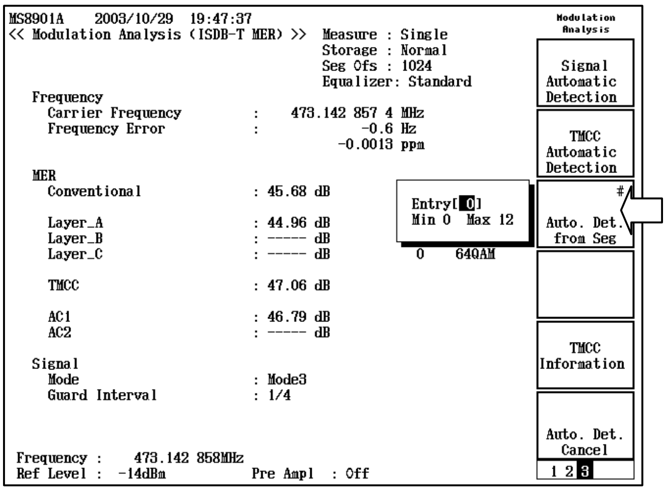


Figure 2.10.3-1 Specifying automatic detection segment on NoTrace screen

2.10.4 Canceling automatic detection (Auto. Det. Cancel)

Automatic detection can be canceled from all analysis results screens of signal analysis (Modulation Analysis).

While executing automatic detection, the window shown below is displayed. Key operations during detection are limited to pressing the Preset key or Auto. Det. Cancel (F6) key. Pressing the Auto. Det. Cancel (F6) soft key closes the window without changing parameters before detection.

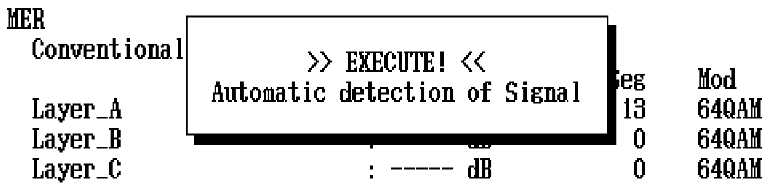


Figure 2.10.4-1 Display during automatic detection of signal parameters

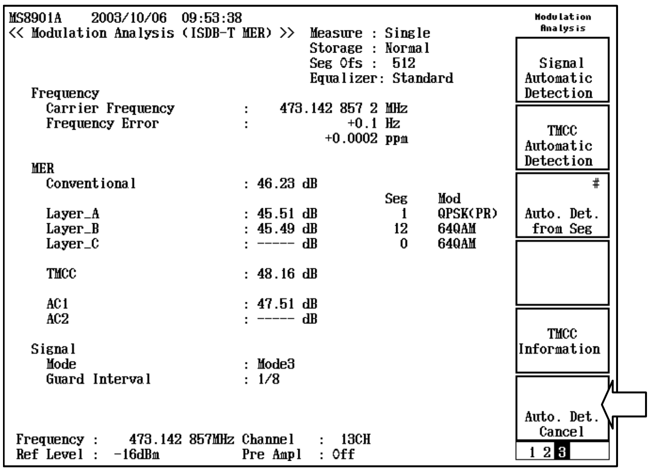


Figure 2.10.4-2 Canceling automatic detection of signal parameters

2.11 Low IF/IQ Unbalanced Input (MS8901A-18)

Low IF/IQ unbalanced input is an option function that can be used by installing the main unit option MS8901A-18. To use this function, the MS8901A-18 and MX890120B are necessary.

By using this function, measurement at a low frequency band (250 kHz to 5 MHz), called Low IF, and IQ analysis (unbalanced input) are enabled. Use the IQ connectors on the front panel as the input pins.

To use this function, select Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC as Terminal of Setup Common Parameter. Only modulation analysis can be measured when Low IF or IQ is selected. C/N measurement, Spectrum Mask measurement, and Frequency Counter measurement cannot be performed.

Table 2.11-1 Measurement items for each Terminal

Terminal selection	RF	Low IF-DC Low IF-AC	IQ-DC IQ-AC
Modulation Analysis	✓	✓	✓
C/N	✓*	–	–
Spectrum Mask	✓*	–	–
Frequency Counter	✓	–	–

*: Enabled only when Channel Map is other than IF Band.

This function in invalid when System = TV Auto Select is set.

This section describes the case when Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal.

2.11.1 Setting measurement parameter

Settings of the measurement parameters required for this function are described below.

The measurement parameters are set on the Setup Common Parameter screen or the measurement screen. To display this screen, press the Signal Analysis key on the front panel or click the Back Screen key (F6) of the soft keys in each measurement screen.

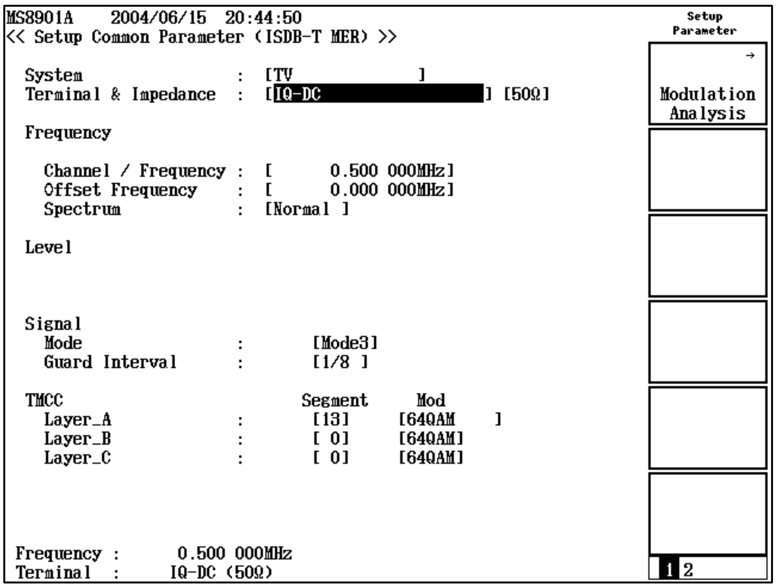


Figure 2.11.1-1 Setup Common Parameter screen

2.11.2 System

Set System = TV. This function cannot be used when System = TV Auto Select.

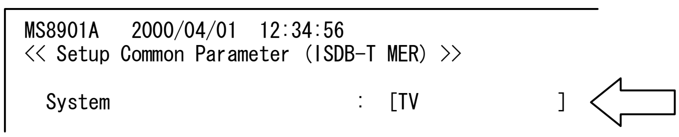


Figure 2.11.2-1 System display

2.11.3 Terminal & impedance

Select the Terminal from the following.

- Low IF-DC (I-Connector)
- Low IF-AC (I-Connector)
- IQ-DC
- IQ-AC

Use the I connector on the front panel to perform Low IF analysis (the Q connector is not used). Use the I and Q connectors to perform IQ analysis.

Either DC connection or AC connection is selectable for the measurement signal. When using DC connection, select Low IF-DC or IQ-DC; when using AC connection, select Low IF-AC or IQ-AC.

After Terminal above is selected, the impedance setting, 50 Ω or 1 MΩ, is enabled.

```
Terminal & Impedance  :  [IQ-DC                ] [50Ω]
```

Figure 2.11.3-1 Terminal & Impedance setting

Note:

When RF is selected as Terminal, impedance setting is not possible.

2.11.4 Channel/Frequency

When Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal, the frequency allocation (Channel Map) of the signal to be measured is not displayed. Set the carrier frequency (Frequency) of the signal to be measured.

The setting range of the frequency is 250 kHz to 5 MHz (1 Hz resolution). The initial value is 500 kHz.

```
Frequency

  Channel / Frequency          :  [      0.500 000 MHz]
  Offset Frequency             :  [      0.000 000 MHz]
  Spectrum                     :  [Normal]
```

Figure 2.11.4-1 Channel/Frequency setting

Signal Abnormal may be lit depending on the set frequency. It indicates that measurement may not be correctly performed because the signal loops at a 0 frequency.

2.11.5 Offset Frequency

When Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal, Offset Frequency can be set. This is the same as when General or IF Band is selected in the frequency allocation setting (Channel Map). For details, refer to Section 2.2.4 "Offset frequency."

2.11.6 Spectrum

To input a signal whose spectrum is inverted, perform the spectrum inversion setting. For the spectrum inversion, refer to Section 2.2.5 "Spectrum."

Reference:

When measuring using IQ-DC or IQ-AC as Terminal, a negative frequency can be represented. This software analyzes the signals assuming that all the signals are positive frequency. A negative frequency signal can be measured by inputting the I and Q input signals to the Q and I input connectors respectively. Note with caution, however, that the spectrum is inverted and the sign of the frequency result is reversed.

```
Frequency

  Channel / Frequency         :  [      0.500 000MHz]
  Offset Frequency            :  [      0.000 000MHz]
  Spectrum                    :  [Normal]
```

Figure 2.11.6-1 Spectrum setting

2.11.7 Level

When Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal, settings related to the level, the reference level setting (Ref Setting) and automatic range adjustment (Adjust Range) cannot be performed.

This function can be measured without setting the level. However, input the signal to the I and Q connectors on the front panel within the input level range (0.1 to 1.0 Vpp).

2.11.8 Mode

Set the input signal mode. For details, refer to Section 2.2.7 “Mode.”

2.11.9 Guard Interval

Set the input signal guard interval. For details, refer to Section 2.2.8 “Guard Interval.”

2.11.10 TMCC

Set the TMCC information of the input signal. For details, refer to Section 2.2.9 “TMCC.”

2.11.11 Preamplifier

When Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal, the preamplifier cannot be set. The Amplitude key on the front panel is disabled.

2.11.12 Measurement mode

Measurement mode refers to how often measured results should be updated. There are two measurement modes provided: continuous mode (Continuous) and single mode (Single). For details, refer to 2.2.11 “Measurement mode.”

2.11.13 Initialization (Preset)

The initialization method and the initial value are the same as when RF is selected as Terminal. For details, refer to Section 2.2.12 “Initialization (Preset).”

2.11.14 Setting list

Functions available for each Terminal and functions to which restrictions are applied are listed below.

Table 2.11.14-1 List of Setup Common Parameter screen settings

		RF	Low IF-DC Low IF-AC	IQ-DC IQ-AC
System	TV	✓	✓	✓
	TV Auto	✓	–	–
Terminal	RF	✓	–	–
	Low IF-DC	–	✓	–
	Low IF-AC	–	✓	–
	IQ-DC	–	–	✓
	IQ-AC	–	–	✓
Impedance		–	✓	✓
Channel Map		✓	–	–
Channel/Frequency		✓	✓	✓
Offset Frequency		✓	✓	✓
Spectrum		✓	✓	✓
Level		Arbitrary	–	–
Signal		✓	✓	✓
TMCC		✓	✓	✓
AGC On/Off (function key)		✓	–	–
Preamplifier (function key)		✓	–	–
Amplitude key		✓	–	–

2.11.15 Modulation Analysis

When Low IF-DC, Low IF-AC, IQ-DC, or IQ-AC is selected as Terminal, the same functions as those of RF input are enabled. For details, refer to Section 2.3 “Signal Analysis”. However, the functions shown in Table 2.11.14-1 cannot be used as an overall function.

Note:

Frequency setting when switching 1 Seg/13 Seg

When 13 Seg is selected by the 1 Seg/13 Seg switching function, “Signal Abnormal” may appears flashing on the screen depending on the set frequency. It indicates that measurement may not be correctly performed because the signal loops at a 0 frequency. For details of the partial reception signal, refer to Section 2.3.5 “Partial reception signal analysis (Recv. Seg).”

2.11.16 Saving measurement data

The method of saving the measurement data is the same as when RF is selected as Terminal. For details, refer to Section 2.12 “Saving Measurement Data”.

2.12 Saving Measurement Data

The MX890120B can save measured results to a memory card. The data can be loaded to a PC for analysis at a later time.

The following two saving methods are available:

- Saves the screen image as a BMP file.
- Saves measured results to a file as numerical value data.

The memory card is used as the media for storing the files. The ATA and compact flash cards are supported. Insert the memory card into the card insertion slot on the front panel of the MS8901A.

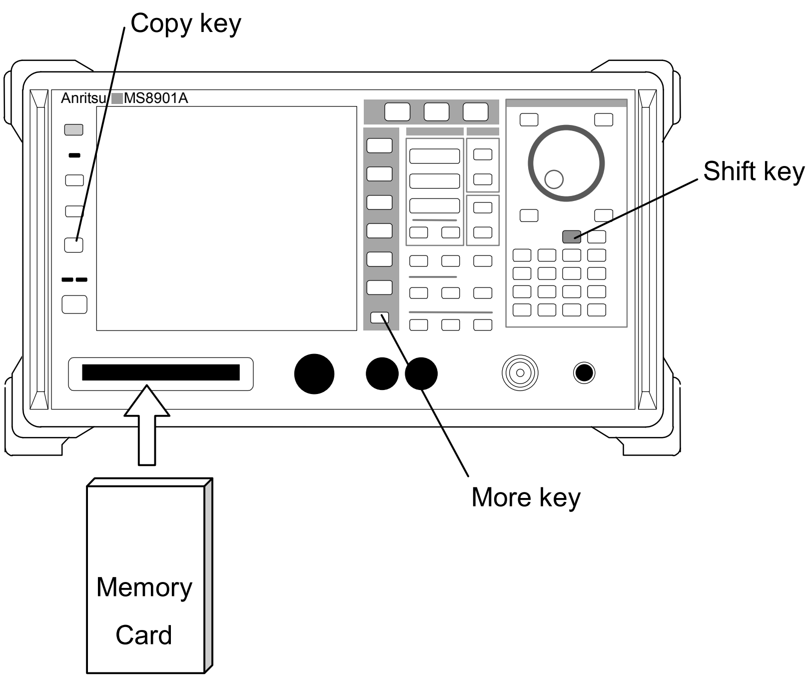


Figure 2.12-1 Memory card insertion

Note:

It takes several seconds for the MS8901A to identify the memory card when it is inserted. Wait approximately 5 seconds before saving screens or numerical value data.

2.12.1 Saving screen

The contents displayed on the MS8901A LCD screen are saved as a BMP file to the memory card.

Perform environmental settings for saving before saving the screen.

(1) Select save destination

Saving a screen can be performed simply by pressing the Copy key on the front panel. Since the Copy key supports outputs to the memory card and outputs to a printer, set the memory card as the saving destination first.

<Procedure>

1. Press the Shift key on the front panel then the Copy key (the Shift key lamp lights up when the Shift key is pressed).
2. The soft key menu changes to the menu for copy environmental settings use.
3. Press the Copy to Printer/BMP File soft key (F1) and select BMP File. This key performs toggle operations. Press it to switch between the Printer and BMP File. The selected item is highlighted.

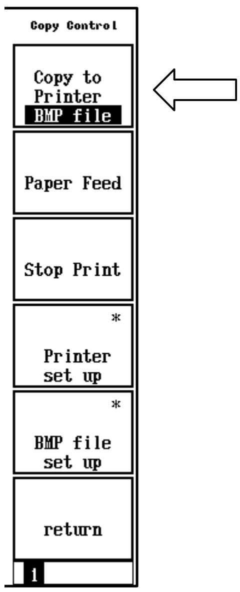


Figure 2.12.1-1 Copy environmental settings menu

(2) Set screen color

The screen to be saved can be saved with a color screen as viewed. It can also be saved with a monochrome screen.

Approximately 300 KB of memory capacity are needed for one color screen and approximately 40 KB are needed for one monochrome screen.

<Procedure>

1. Press the Shift key on the front panel then the Copy key (the Shift key lamp lights up when the Shift key is pressed).
2. The soft key menu changes to the menu for copy environmental settings use.
3. Press the BMP file set up soft key (F5). The soft key menu contents change.
4. Select either Color (F1) or Monochrome (F2).

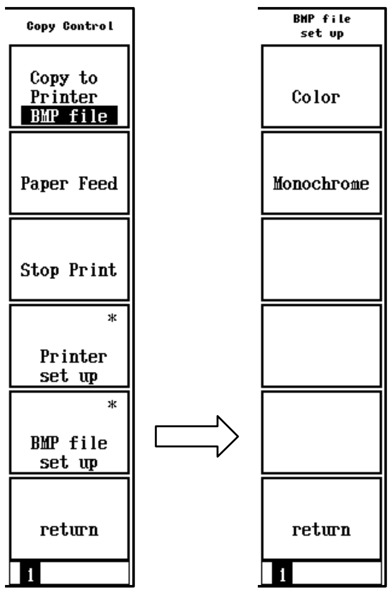


Figure 2.12.1-2 Saving screen color settings

(3) Save screen

The screen can be saved by pressing the Copy key on the front panel. When the Copy key is pressed, the screen is saved to the memory card in several seconds. The file name is displayed on the screen when the saving has completed successfully.

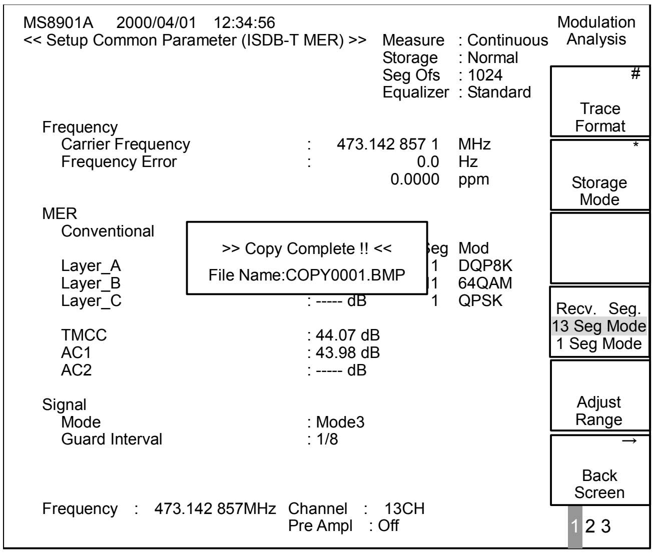


Figure 2.12.1-3 Screen at save completion

The file name format is “COPY****.BMP”. Numbers are assigned automatically to the **** part, from 0000 to 9999. This number cannot be set randomly.

The screen image is not copied if there are more than 10,000 COPY data.

The file is saved to the directory in the memory card as follows:
“MS8901A\COPY\COPY****.BMP”

2.12.2 Saving numerical value data

Measured results for constellations, frequency responses, etc. are saved to the memory card as numerical value data.
The numerical values are saved in a CSV file format, where the numerical values are delimited by commas (,). Detailed analysis is enabled using the tabulating calculation software on a PC such as Excel.

Note:

Numeric value data cannot be saved in the Frequency Counter screen.

- Press the More key on the front panel at each measurement screen to display the second page of the soft key menu.
- Press the Save Data to Mem Card soft key (F5).
- A pop-up window will open, asking whether to save. Move the Cursor to Yes (reverse display) if saving, then press the Set key on the front panel.

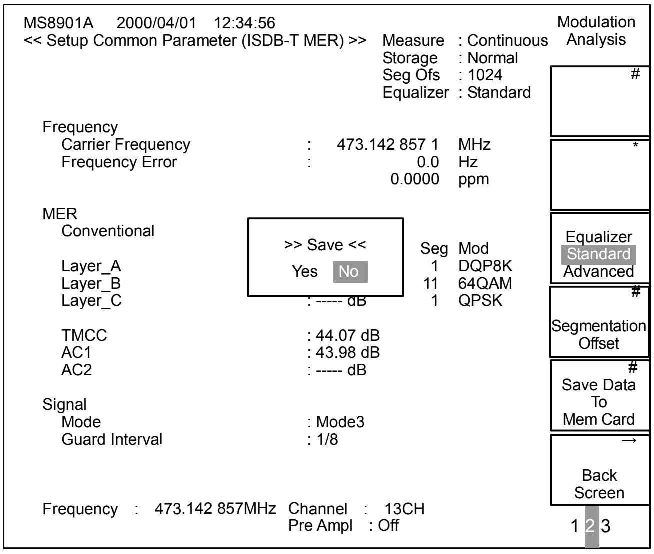


Figure 2.12.2-1 Saving numerical value data

- The numerical value data is saved to the memory card in several seconds to several tens of seconds. The file name is displayed on the screen when the saving has completed successfully.

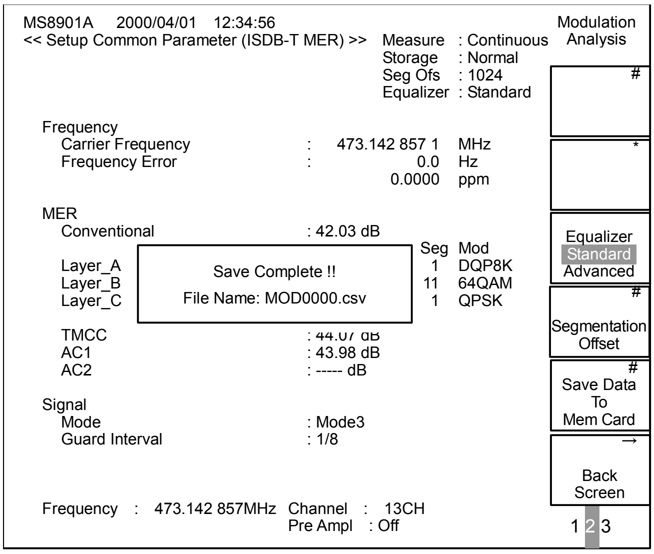


Figure 2.12.2-2 End of numerical value data save

The file is saved with the name "###****.csv." The ### parts express the types of saving data as follows:

MOD: MER, constellation, or frequency responses data
CN: C/N data
MASK: Spectrum mask data

Note:

There is no saving data type provided for the Frequency Counter screen because numeric value data cannot be saved in the Frequency Counter screen.

Numbers are assigned automatically to the **** part, from 000 to 999. Basically, this number cannot be set randomly, but can be specified by remote control. Refer to Section 3 "Remote Control" for details.

No more data files can be saved if there are more than 1,000 result data files.

The files are saved to the directory in the memory card as follows:
MS8901A\ISDBT20B\MOD\MOD****.csv
MS8901A\ISDBT20B\CN\CN****.csv
MS8901A\ISDBT20B\MASK\MASK****.csv
The file contents are classified into the common setting parameter and the specific measured results data for each.

- Common data (example)

DATE,	2000/04/01
TIME,	12:31:00
TITLE,	Tokyo pilot
SYSTEM,	TV
TERMINAL,	RF
CHANNEL MAP,	INTERIM-1
CHANNEL,	13
FREQUENCY,	473142857
FREQUENCY OFFSET,	0
REVERSE SPECTRUM,	NRM
REFERENCE LEVEL,	–20
PREAMP,	OFF
MODE,	3
GUARD INTERVAL,	1PER8
LAYER A SEG,	3
LAYER A MOD,	64 QAM
LAYER B SEG,	5
LAYER B MOD,	16 QAM
LAYER C SEG,	5
LAYER C MOD,	QPSK
LEVEL CONT,	REF SETTING
STORAGE MODE,	NORMAL
AMOUNT OF COUNT,	10

Notes:

1. CHANNEL is not displayed when CHANNEL MAP is set to GENERAL.
2. FREQUENCY, FREQUENCY OFFSET and REVERSE SPECTRUM are not displayed when CHANNEL MAP is set to INTERIM-1, INTERIM-2, UHF, or UHF (Brazil).
3. REFERENCE LEVEL is not displayed when LEVEL CONT is set to ADJUST RANGE.
4. Tabs have been inserted for easy understanding in the above description; however, no tabs are inserted in the actual description.

- Specific data on No Trace screen (example)

REFER TO MER,	OFF
EQUALIZER,	STD
RECV.SEG,	13SEG
AUTO DET.SEGMENT,	0
SEGMENTATION OFFSET,	1024
CARRIER FREQUENCY,	473143527.12
FREQ ERROR (Hz),	2.32
FREQ ERROR (ppm),	0.031
MER (CONVENTIONAL),	38.21
MER (LAYER A),	38.21
MER (LAYER B),	37.81
MER (LAYER C),	37.23
MER (TMCC),	38.21
MER (AC1),	40.32
MER (AC2),	40.57

- Specific data on Constellation screen (example)

REFER TO MER,	OFF	
EQUALIZER,	STD	
RECV.SEG,	13SEG	
AUTO DET.SEGMENT,	0	
SEGMENTATION OFFSET,	1024	
CARRIER FREQUENCY,	473143527.12	
FREQ ERROR (Hz),	2.32	
FREQ ERROR (ppm),	0.031	
SECTION,	LAYER_A	
MER (CONVENTIONAL),	38.21	
MER,	39.21	
DATA COUNT,	2231	
SYMBOLS,	I,	Q
0,	0.1546,	0.2533
1,	1.2547,	–3.2214
:	:	:
:	:	:

- Specific data on frequency response screen (example)

REFER TO MER,	OFF
EQUALIZER,	STD
RECV.SEG,	13SEG
AUTO DET.SEGMENT,	0
SEGMENTATION OFFSET,	1024
CORRECTION,	OFF
DATA COUNT,	2231
FREQ [Hz],	AMPL [dB]
515150000,	–2.32
515470000,	–2.35
:	:
:	:

- Specific data on sub-carrier MER screen (example)

REFER TO MER,	OFF
EQUALIZER,	STD
RECV.SEG,	13SEG
AUTO DET.SEGMENT,	0
SEGMENTATION OFFSET,	1024
MER (CONVENTIONAL),	45.0
THRESHOLD OFFSET,	20.0
MER VERTICAL SCALE,	50
WORST ENVELOPE,	OFF
DATA COUNT,	5616
FREQ [Hz]	MER [dB]
515150000,	45.550000
515470000,	44.990000
:	:
:	:

- Specific data on C/N screen (example)

CARRIER FREQUENCY,	473143527.12	
FREQ ERROR (Hz),	2.32	
FREQ ERROR (ppm),	0.031	
DATA COUNT,	2231	
INTEGRAL (dBc),	–32.58	
INTEGRAL RANGE (kHz),	23.05, 482.11	
OFFSET FREQ [Hz],	C/N [dBc/Hz],	CW [dBc]
100,	–51.3,	–31.3
120,	–51.9,	–31.9
:	:	:
:	:	:

- Specific data on Spectrum Mask screen (example)

MASK NAME,	TRANSMISSION
EQUIPMENT STANDARD,	NEW
STATION POWER,	HIGH
AVERAGE POWER,	1.25
NUMBER OF CHANNEL,	3
RESULT,	PASS
DATA COUNT,	2231
OBW,	5.535
*	

* When the Equipment Standard is not Brazil

FREQ [Hz],	LEVEL[dB],	MASK [dB]
−15000000,	−52.38,	−50.00
−14996000,	−57.82,	−50.00
:	:	:
:	:	:

* When the Equipment Standard is Brazil.

FREQ[Hz],	LAST[dB],	MASK[dB],	UNCORRECTION[dB],	FILTER[dB]
−15000000,	−52.38,	−50.00	−52.32	−30.48
−14996000,	−57.82,	−50.00	−57.82	−28.58
:	:	:	:	:
:	:	:	:	:

Notes:

1. The following parameters have been added to the MX890120B, compared with conventional products such as the MX890120A:
   - EQUALIZER
     - RECV. SEG
     - AUTO DET.SEGMENT
     - REFER TO MER
     - THRESHOLD OFFSET
     - MER VERTICAL SCALE
     - WORST ENVELOPE
     - EQUIPMENT STANDARD
     - STATION POWER
     - AVERAGE POWER
     - NUMBER OF CHANNEL
     - FILTER NAME
     - LAST RESULT
     - CORRECTION RESULT
     - FILTER DATA
     - TRACE MODE

2. When the Equipment Standard is type A, only commas (,) can be specified for the STATION POWER parameter.
3. When the Equipment Standard is type A or Brazil, only commas (,) can be specified as the values for AVERAGE POWER and NUMBER OF CHANNEL.
4. When the Equipment Standard is type A or B, only commas (,) can be specified for the FILTER NAME, LAST RESULT, CORRECTION RESULT, FILTER DATA, and TRACE MODE parameters.
5. The numeric data cannot be saved on the frequency counter screen.

Tabs have been inserted for easy understanding in the above examples. However, no tabs are inserted in the actual code.

2.13 Saving/Recalling Measurement Parameters (Save/Recall)

The MS8901A can save and load (recall) the measurement parameter settings to/from a memory card.
Insert a memory card into the MS8901A Memory Card insertion slot before saving and recalling. The memory card can be inserted/removed while the power is supplied to the MS8901A.
Do not insert or remove the memory card while saving or recalling.

Note:

Incompatible with conventional products such as the MX890120A.

2.13.1 Saving measurement parameters (Save)

Press the Shift key then press the Save key on the front panel.

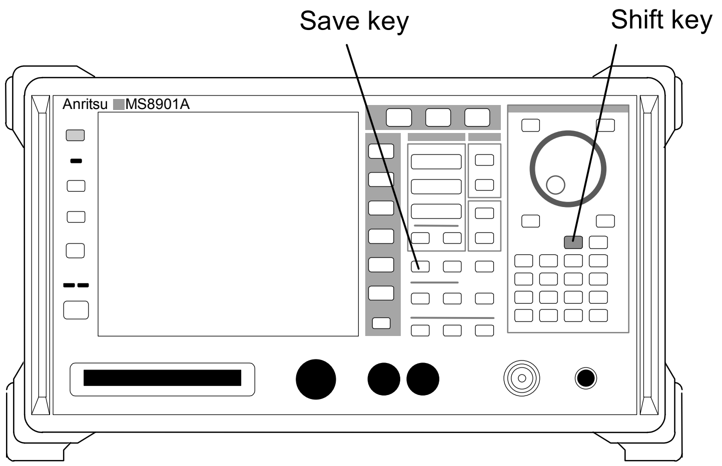


Figure 2.13.1-1 Save key

The soft key menu contents are changed for saving.

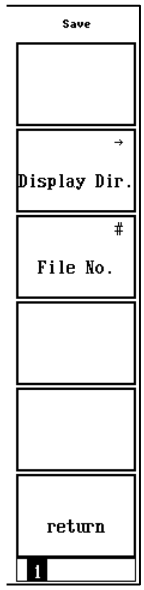


Figure 2.13.1-2　Save soft key

Up to one hundred setting conditions (files) can be saved to one memory card. Files are saved in file numbers that range from 0 to 99. In addition, alphabetic and numeric file names can be added as warranted and processed to write-protect.

Perform the following procedure to save a file by specifying a file number directly without adding a file name.

<Procedure>

1. Press the File No. soft key (F3). A pop-up window opens.
2. Enter a file number. Another pop-up window opens for confirming whether this input will be saved.
3. Confirm the file number then select “Yes.”

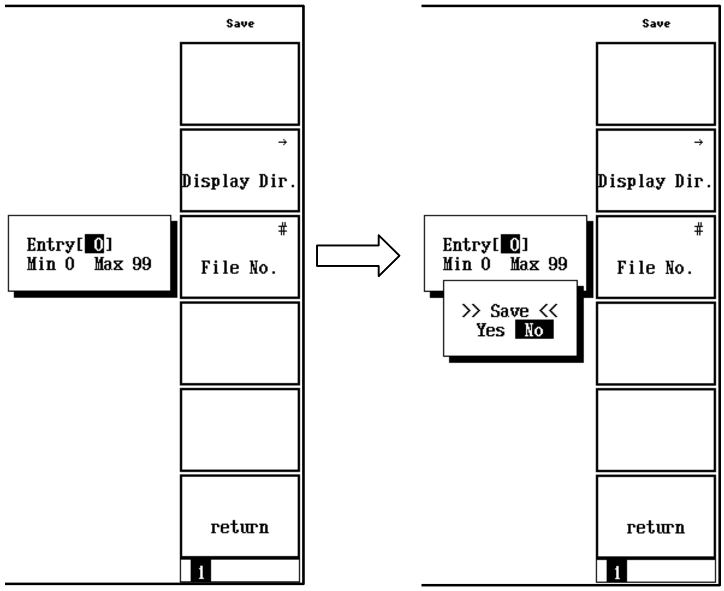


Figure 2.13.1-3 Inputting file numbers directly and saving

Press the Display Dir. soft key (F2) when adding file names to files or when write-protecting.

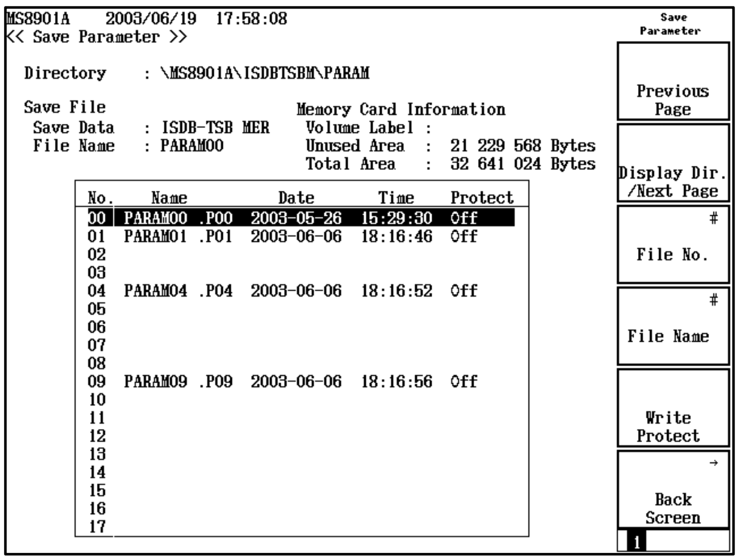


Figure 2.13.1-4 Save screen

(1) Previous Page
The number of files that can be saved is one hundred (100) in total. Eighteen files can be displayed per screen thus all one hundred are displayed on six separate pages. Press the Previous Page soft (F1) key to switch to the previous page.

(2) Display Dir./Next Page
Press the Display Dir./Next Page soft key (F2) to switch to the next page.

(3) File No.
Perform the following procedure to save a file by specifying a file number.

<Procedure>

1. Press the File No. soft key (F3). A pop-up window for entering a file number opens.
2. Enter a file number and press the Set key on the front panel.
3. Reconfirm the file number entered, then move the cursor to Yes in the >>Save<< confirmation pop-up window when confirmation is complete, and press the Set key on the front panel to finish saving.

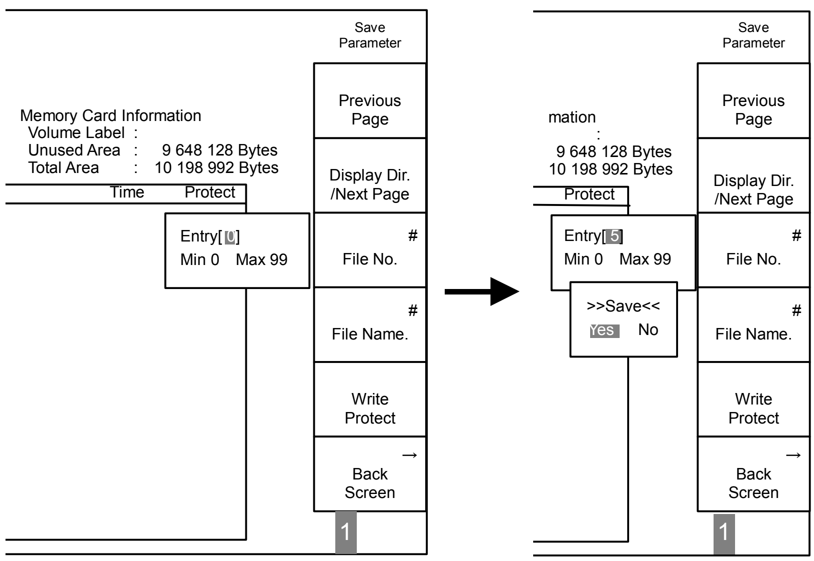


Figure 2.13.1-5 Saving by specifying file number

There are 100 file numbers that range from 0 to 99.
File names with "PARAM**" (** are file numbers) are added when saved to new file numbers. In addition, contents that are saved are overwritten when saved to file numbers where files already exist. File names stay as they are in this event.

(4) File Name

Perform the following procedure to save a file by adding a name.

<Procedure>

1. Move the cursor (highlighted) in the file number list to the number of the file to be saved.
2. Press the File Name soft key (F4) to open a pop-up window for entering a file name.
3. Enter the file name, and then press the Set key on the front panel.
4. Reconfirm the file name entered, then move the cursor to Yes in the >>Save<< confirmation pop-up window when confirmation is complete, and press the Set key on the front panel to finish saving.

Character inputs at pop-up window

Rotary Encoder:	Moves the cursor located in the character list.
Step key:	Moves the cursor located in the file name input window.
BS key:	Deletes one character immediately before the cursor located in the file name input window.
Enter key:	Inserts the character on the cursor located in the character list to immediately before the cursor in the file name input window.

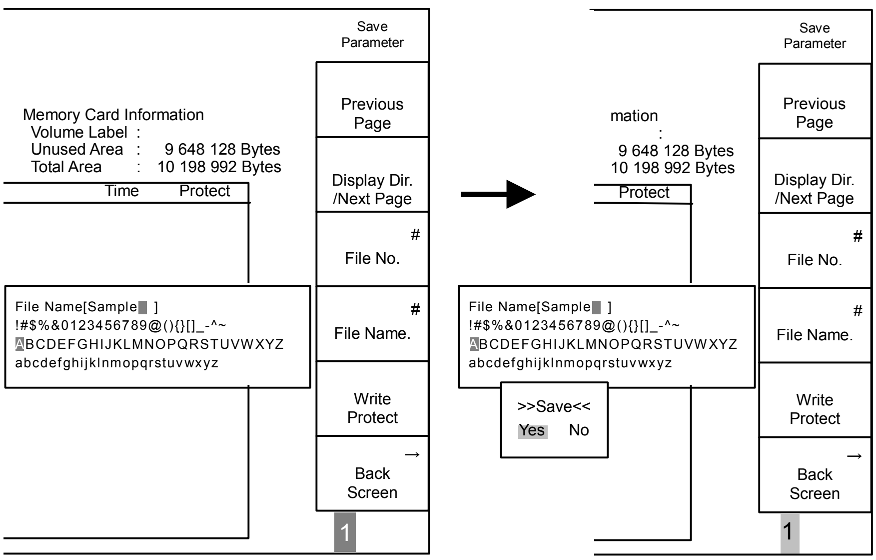


Figure 2.13.1-6 Saving with file names

Up to eight characters can be input for file names.

(5) Write Protect

Write-protects files.

Move the cursor in the file number list to the file to be protected. Press the Write Protect soft key. The Protect column located at the right edge of the file list will change from Off to On which will enable write-protect.

No.	Name	Date	Time	Protect
00	PARAM00 .P00	2003-05-26	15:29:30	On
01	PARAM01 .P01	2003-06-06	18:16:46	Off
02				
03				
04	PARAM04 .P04	2003-06-06	18:16:52	Off
05				
06				

Figure 2.13.1-7　Write-protect

Move the cursor onto this file when releasing it from write-protect then press the Write Protect soft key (F5).

2.13.2 Recalling measurement parameters (Recall)

Insert a memory card into the Memory Card insertion slot.
Press the Recall key on the front panel.

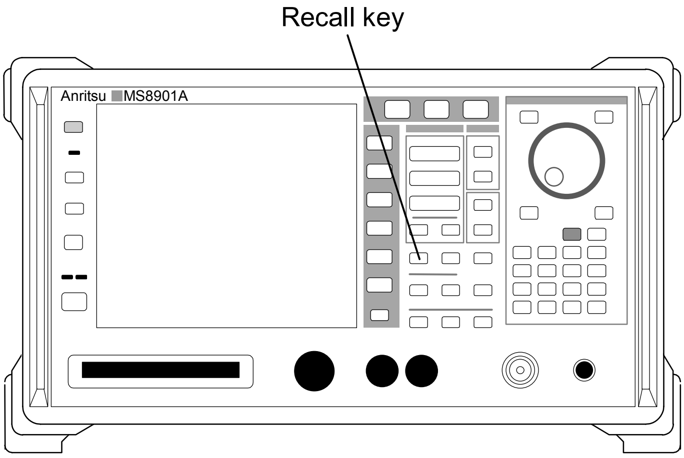


Figure 2.13.2-1 Recall key

The soft key menu contents are changed for recalling.

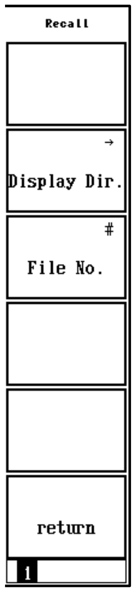


Figure 2.13.2-2 Recall soft key

Up to one hundred setting conditions (saved files) can be saved to one memory card.

Perform the following procedure when the file number to be recalled is known without having to check the file name.

<Procedure>

1. Press the File No. soft key (F3). A pop-up window opens.
2. Enter a file number. Another pop-up window opens for confirming whether this input will be recalled.
3. Confirm the file number then select “Yes.”

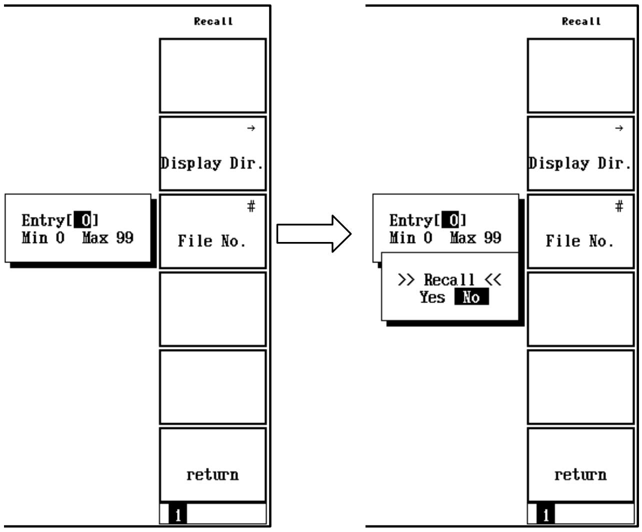


Figure 2.13.2-3 Direct recall by specifying file number

Press the Display Dir. soft key (F2) to view the list of saved files.

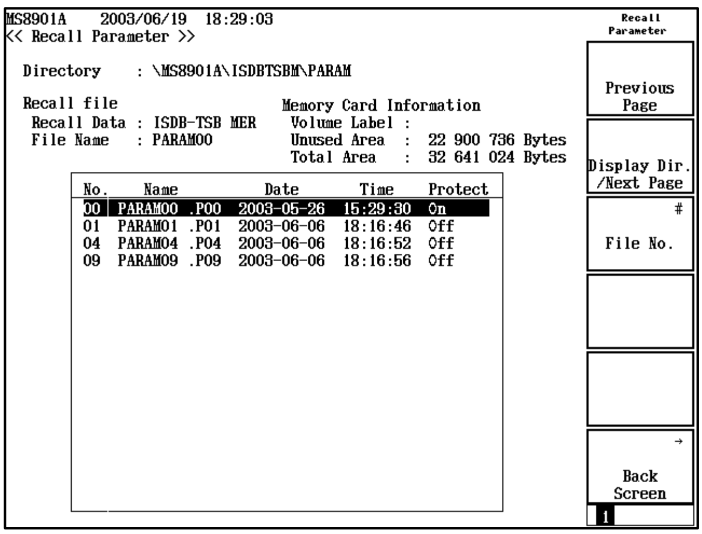


Figure 2.13.2-4 Recall screen

(1) Previous Page
The number of files that can be saved is one hundred in total. Twenty-five files can be displayed per screen thus all one hundred are displayed on four separate pages. Press the Previous Page soft key (F1) to switch to the previous page.

(2) Display Dir./Next Page
Press the Display Dir./Next Page soft key (F2) to switch to the next page.

(3) File No.
Perform the following procedure to recall a file by specifying a file number.

<Procedure>

1. Press the File No. soft key (F3). A pop-up window for entering a file number opens. Enter the file number to be recalled from the file list on the screen.
2. Reconfirm the file number entered, then move the cursor to Yes in the >>Recall<< confirmation pop-up window when confirmation is complete, and press the Set key on the front panel to finish recalling.

2.14 Screen Color Layout

The color for each part of the MX890120B ISDB-T Signal Analysis Software screen can be changed to any color. Press the Shift key then the Color key on the front panel to change the color layout. The soft key menu changes for color layout selection.

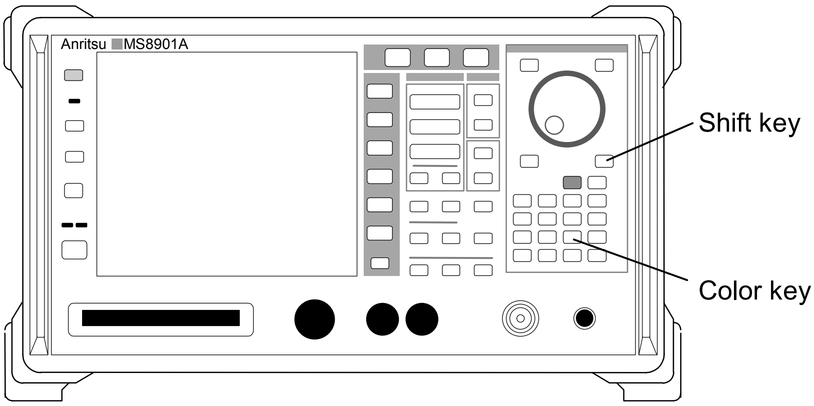


Figure 2.14-1 Shift key and Color key

2.14.1 Fixed pattern color layout

The MS8901A has four fixed color layout patterns. Press the soft key for each color layout. Note that the color layout from Color Pattern 1 to Color Pattern 4 cannot be changed.

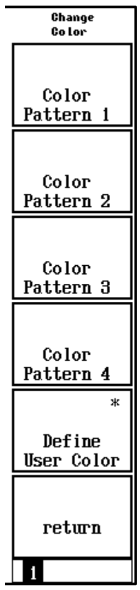


Figure 2.14.1-1 Fixed pattern soft key

Color Pattern 1: Blue background color and yellow character color layout

Color Pattern 2: Green background color and white character color layout

Color Pattern 3: Purple background color and yellow character layout

Color Pattern 4: Black background color, white character and waveform color layout. Suitable for photography, others.

2.14.2 User defined color layout

There is one pattern where the user can freely set the color layout. Press the Define User Color soft key (F5).

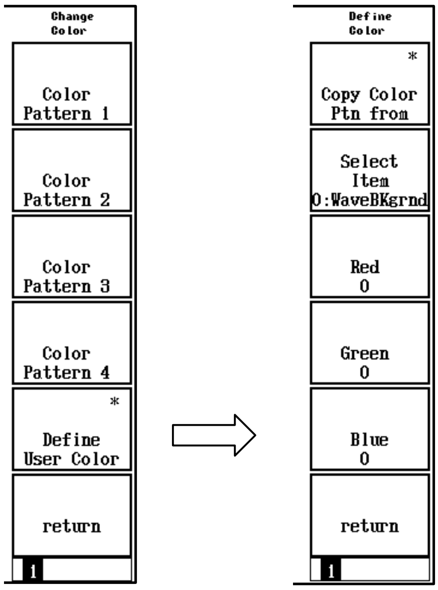


Figure 2.14.2-1 User definition soft key

(1) Copy Color Ptn from

The fixed pattern color layout is copied to the user-defined color layout. Press the Copy Color Ptn from soft key (F1) to change the soft key menu to Color Pattern 1 through Color Pattern 4. Press a soft key corresponding to the color layout pattern to be copied.

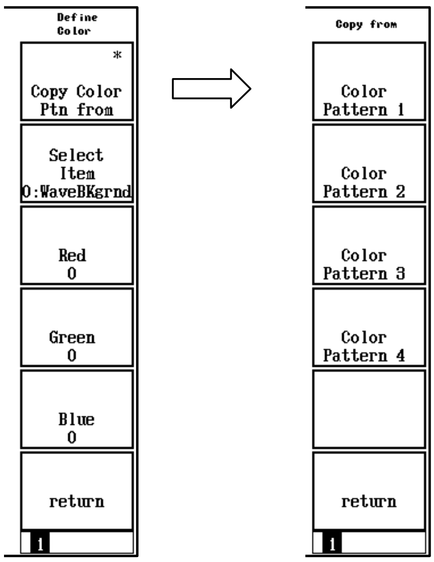


Figure 2.14.2-2 Soft key used to copy color layout from fixed pattern

(2) Select Item

Press the Select Item soft key (F2) to select the part where the color in the screen is changed. The name of the part where this color is changed is displayed to the bottom of the Select Item soft key (F2). It changes periodically when the Select Item soft key (F2) is pressed.

Table 2.14.2-1 Color layout item number and location on screen

<table>
<tr><th rowspan="2">Item No.</th><th colspan="5">Screen</th></tr>
<tr><th>Setup Common Parameter</th><th>Modulation Analysis</th><th>C/N</th><th>Spectrum Mask</th><th>Frequency Counter</th></tr>
<tr><td>0:WaveBKgnd</td><td>------</td><td colspan="3">Waveform display part background</td><td>------</td></tr>
<tr><td>1:Scale1</td><td>------</td><td>Magnify window (Sub-carrier MER)</td><td colspan="3">------</td></tr>
<tr><td>2:Scale2</td><td>------</td><td colspan="3">Subsidiary scale line of graph</td><td>------</td></tr>
<tr><td>3:Scale3</td><td>------</td><td colspan="2">Frame outline of waveform display part</td><td>Frame outline of waveform display part Bar display indicating measurement progress</td><td>------</td></tr>
<tr><td>4:Wave1</td><td>------</td><td colspan="3">Waveform</td><td>------</td></tr>
<tr><td>5:Wave2</td><td>------</td><td colspan="3">Waveform (for Over Write)</td><td>------</td></tr>
<tr><td>6:Wave3</td><td>------</td><td colspan="3">Waveform (for Over Write)</td><td>------</td></tr>
<tr><td>7:Wave4</td><td>------</td><td colspan="3">Waveform (for Over Write)</td><td>------</td></tr>
<tr><td>8:Wave5</td><td>------</td><td colspan="2">Waveform (for Over Write)</td><td>Waveform(Last Result)</td><td>------</td></tr>
<tr><td>9:Wave6</td><td colspan="3">------</td><td>Mask line</td><td>------</td></tr>
<tr><td>10:Wave7</td><td>------</td><td>Worst Envelope</td><td></td><td>Waveform (Filter Data)</td><td>------</td></tr>
<tr><td>11:Wave8</td><td>------</td><td>Sub-carrier exceeding over the threshold</td><td colspan="3">------</td></tr>
<tr><td>12:Wave9</td><td>------</td><td>Threshold line</td><td></td><td>Waveform (Uncorrection Result)</td><td>------</td></tr>
<tr><td>13:WaveA</td><td colspan="3">------</td><td>Delta marker</td><td>------</td></tr>
<tr><td>14:Text1</td><td colspan="5">Character, numerical value</td></tr>
<tr><td>15:Text2</td><td colspan="3">------</td><td>Pass/Fail display</td><td>------</td></tr>
<tr><td>16:Text3</td><td colspan="5">Status display on 2 lines at bottom of screen</td></tr>
<tr><td>17:Text4</td><td>------</td><td colspan="4">Level Over, Over Range, Level Under, Under Range, Carrier Unlocked, Signal Abnormal</td></tr>
<tr><td>18:Text5</td><td colspan="5">------</td></tr>
<tr><td>19:Zone</td><td>------</td><td>Magnify window (Freq Response)</td><td colspan="3">------</td></tr>
<tr><td>20:Marker</td><td>------</td><td colspan="3">Marker point</td><td>------</td></tr>
<tr><td>21:FKeyBKGnd</td><td colspan="5">Soft key surface and background</td></tr>
<tr><td>22:FKHilite</td><td colspan="5">Soft key frame highlighted portion</td></tr>
<tr><td>23:FK Shadow</td><td colspan="5">Soft key frame dark portion</td></tr>
<tr><td>24:FKey Text</td><td colspan="5">Soft key character</td></tr>
<tr><td>25:FKey Text2</td><td colspan="5">Inactive soft key highlighted character</td></tr>
<tr><td>26:FKey Text3</td><td colspan="5">Inactive soft key dark character</td></tr>
<tr><td>27:Window BG</td><td colspan="5">Pop-up window background</td></tr>
<tr><td>28:WinShadow</td><td colspan="5">Pop-up window shadow</td></tr>
<tr><td>29:WindowTxt</td><td colspan="5">Pop-up window character</td></tr>
<tr><td>30:</td><td colspan="5">------</td></tr>
</table>

31:	------
32:BKground	Screen background

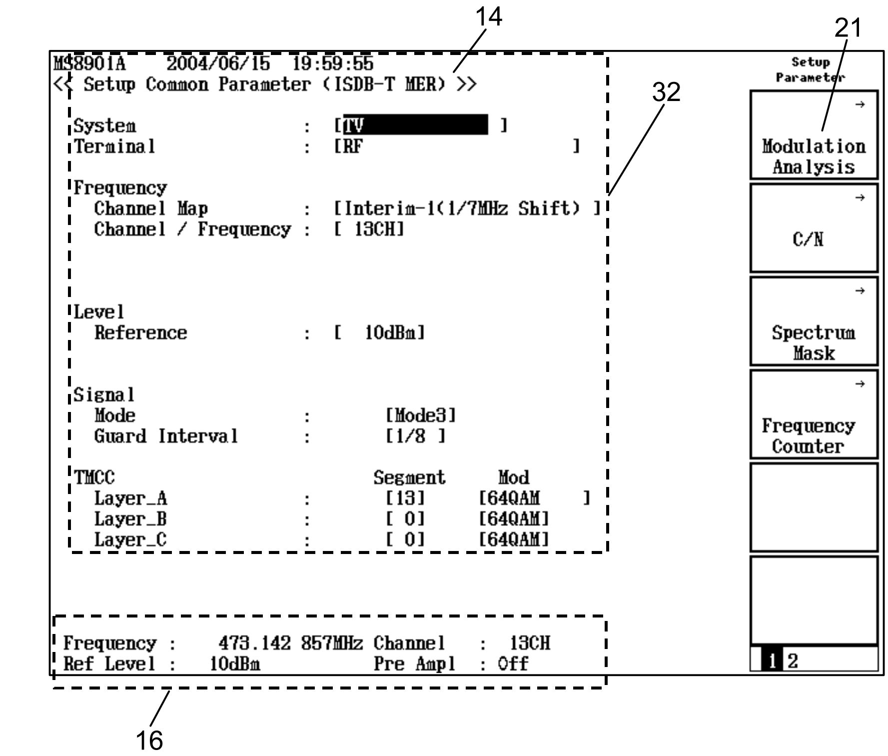


Figure 2.14.2-3 Setup Common Parameter screen color layout

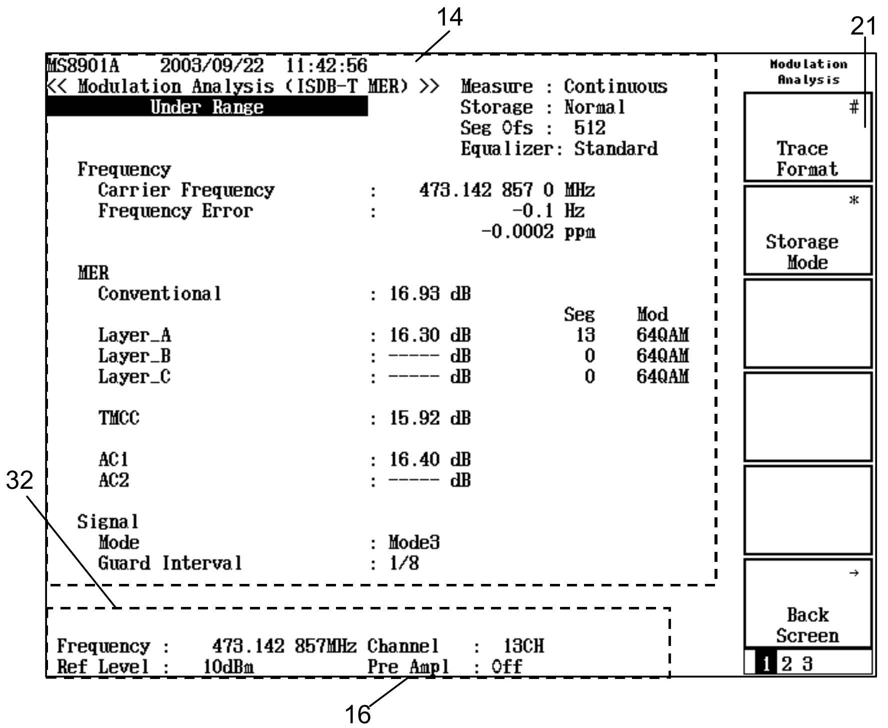


Figure 2.14.2-4 No Trace screen color layout

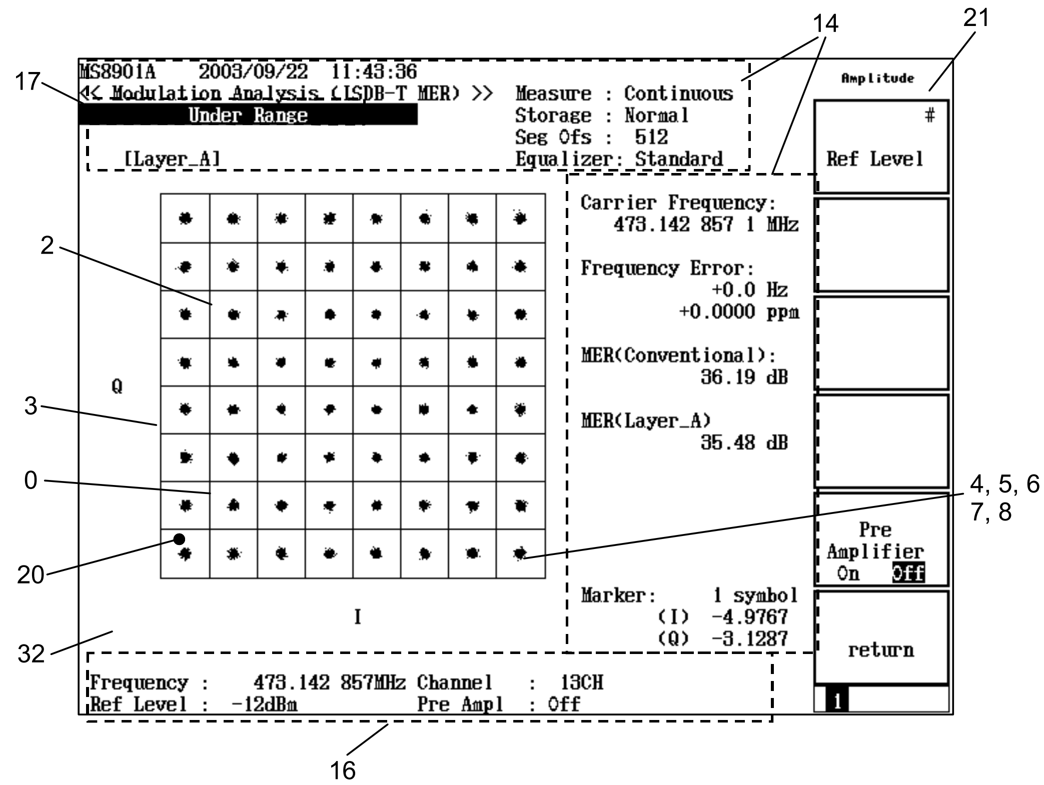


Figure 2.14.2-5 Constellation screen color layout

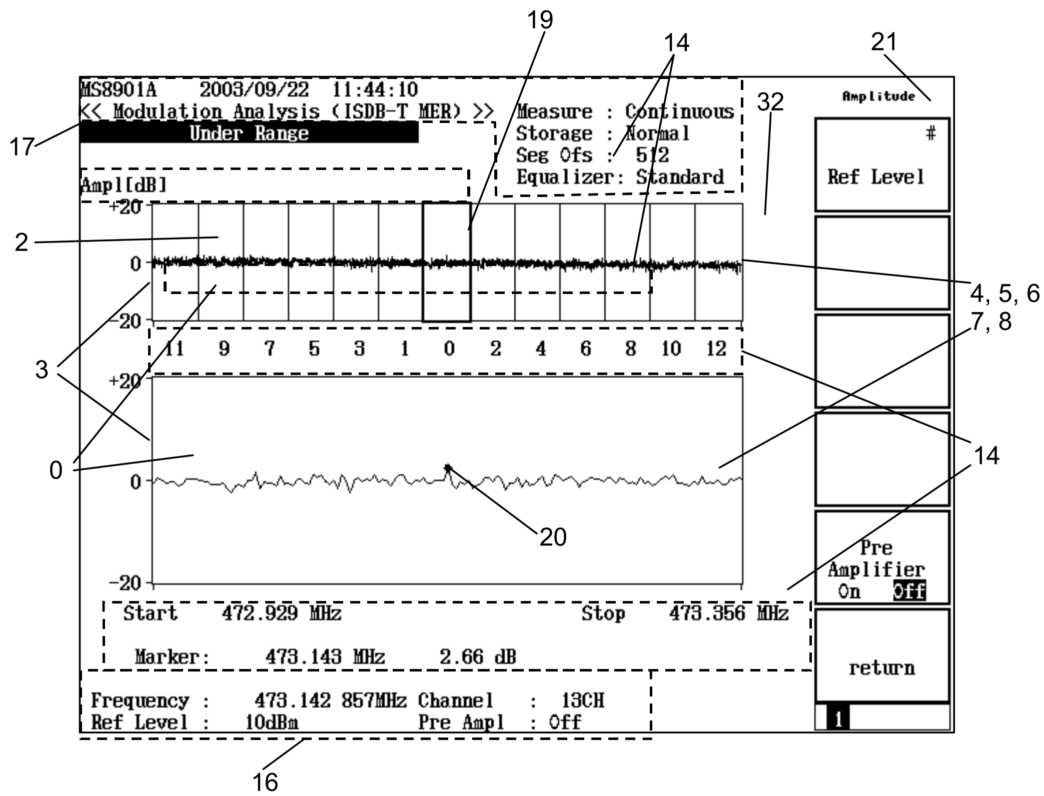


Figure 2.14.2-6 Freq Response screen color layout

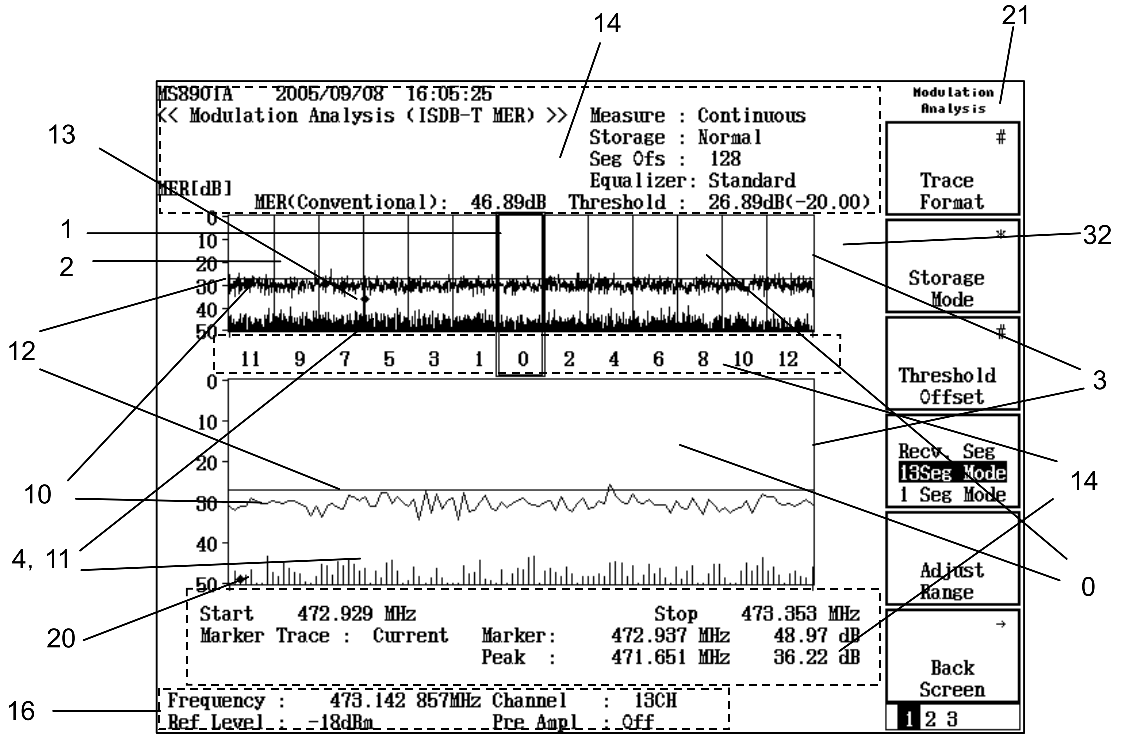


Figure 2.14.2-7 Sub-carrier MER color layout

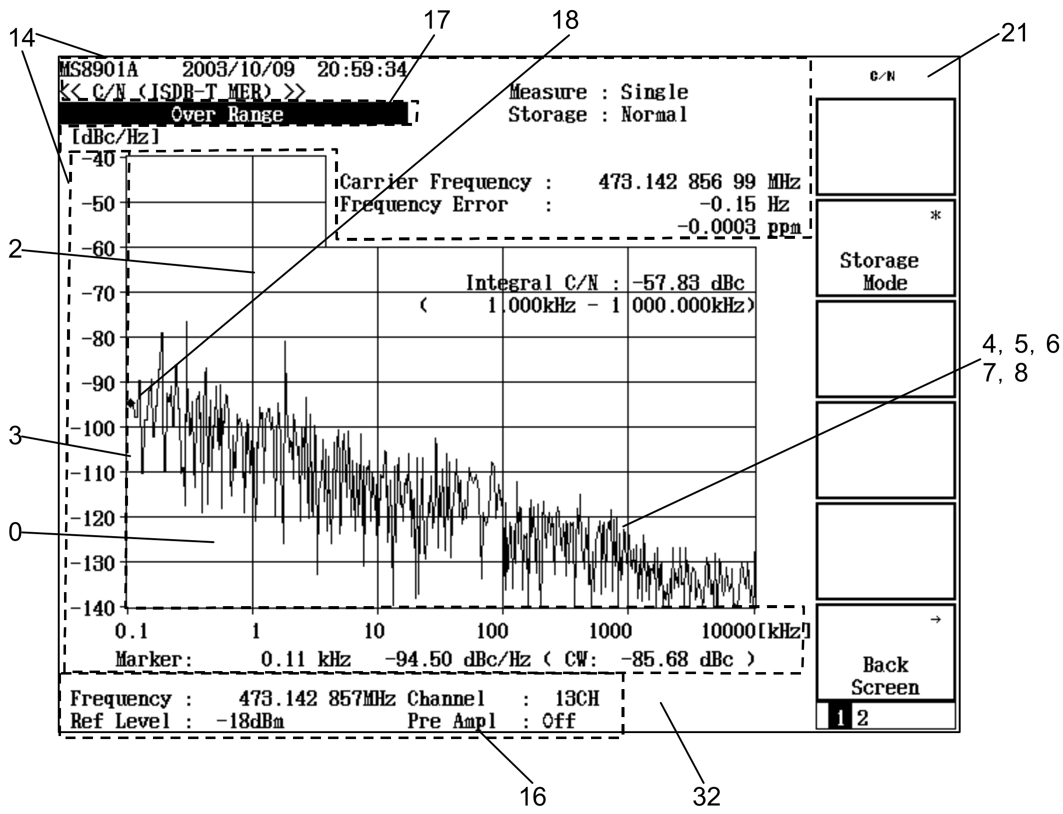


Figure 2.14.2-8 C/N screen color layout

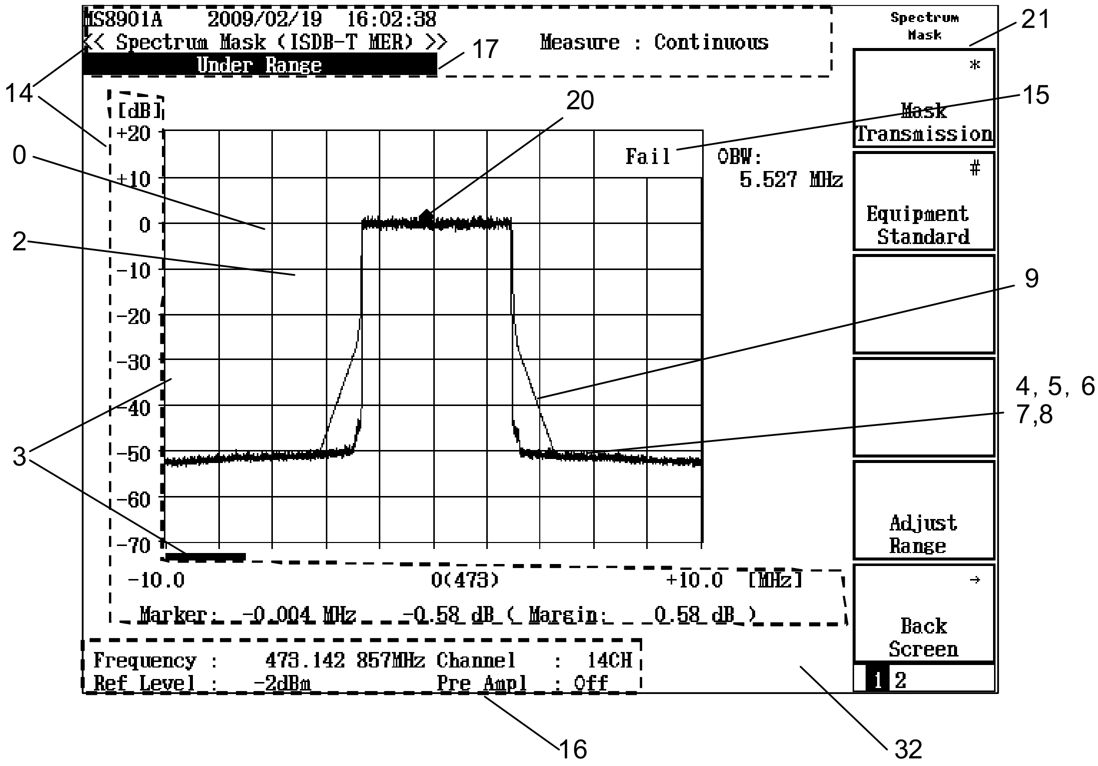


Figure 2.14.2-9 Spectrum Mask screen color layout (Type A, Type B)

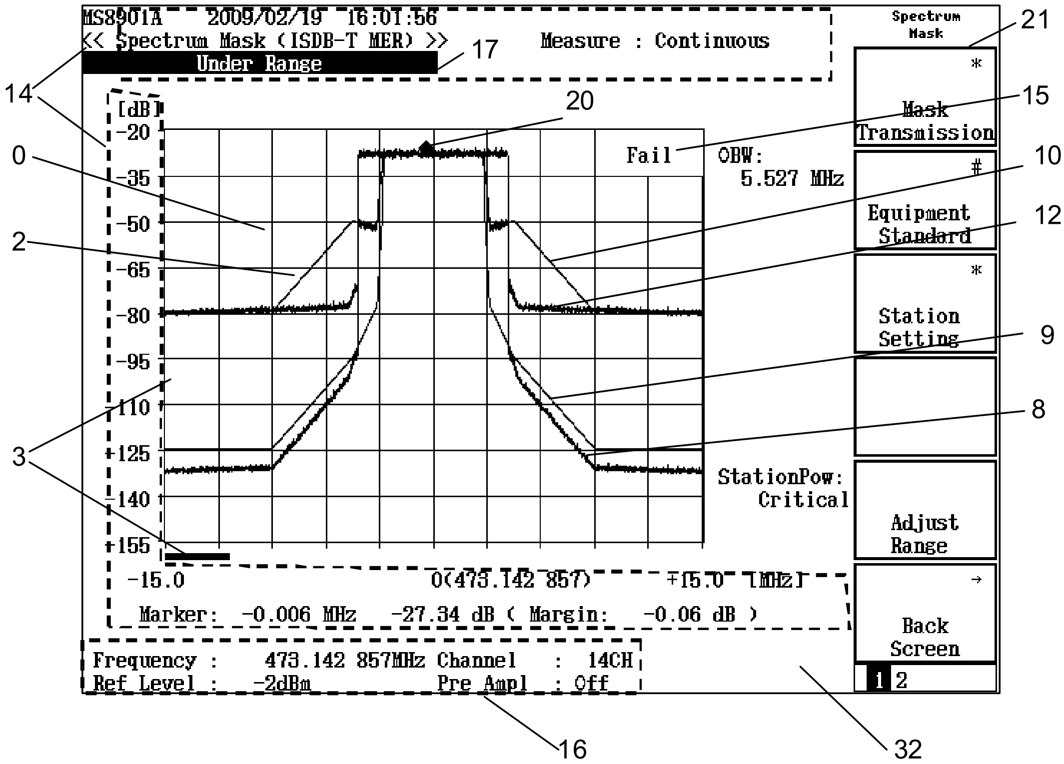


Figure 2.14.2-10 Spectrum Mask screen color layout (Brazil)

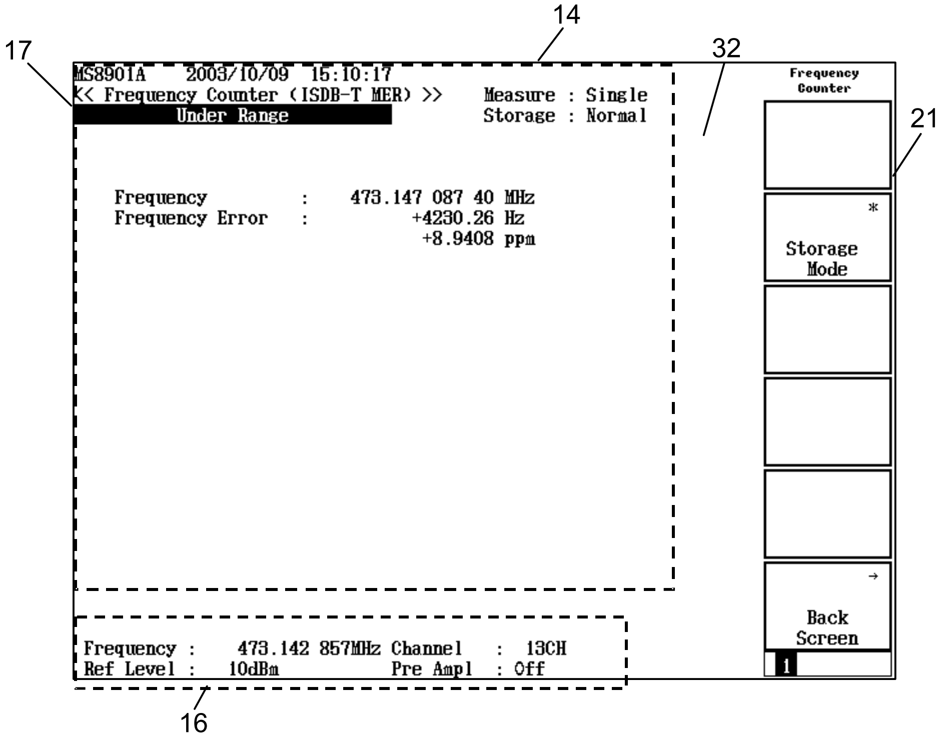


Figure 2.14.2-11 Frequency Counter screen color layout

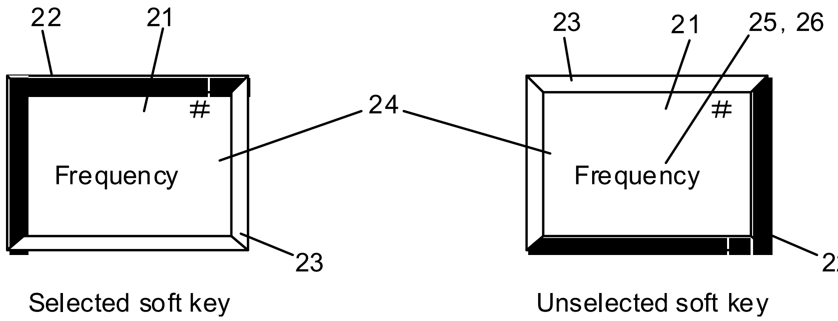


Figure 2.14.2-12 Pop-up window color layout

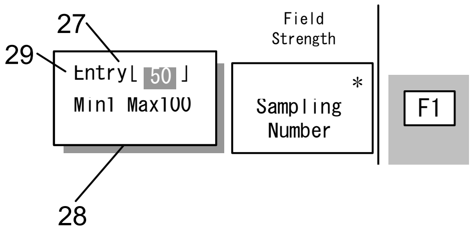


Figure 2.14.2-13 Soft key color layout

(3) Red: Green: Blue:
Set the color of the item selected with Select Item key. Color settings are made by entering red, green and blue tones (primary colors) with numerical values. Each color has 0 to 15 tones, thus a total of 4096 color tones can be set.
Typical tones and examples of color are shown in Table 2.14.2-2.

Table 2.14.2-2 Tone and color combinations

Red (F3)	Green (F4)	Blue (F5)	Color
0	0	0	Black
0	0	15	Blue
0	15	0	Green
0	15	15	Light blue
15	0	0	Red
15	0	15	Purple
15	15	0	Yellow
15	15	15	White

2.15 Installing Measurement Software

This section describes the procedure for installing the software required to use the MS8901A in the Signal Analysis mode.

<Procedure>

1. Insert the memory card containing the measurement software into the slot.
2. Press the Config key to display the Config screen.
3. Press the System Install key (F4) to display the System Install screen shown below.

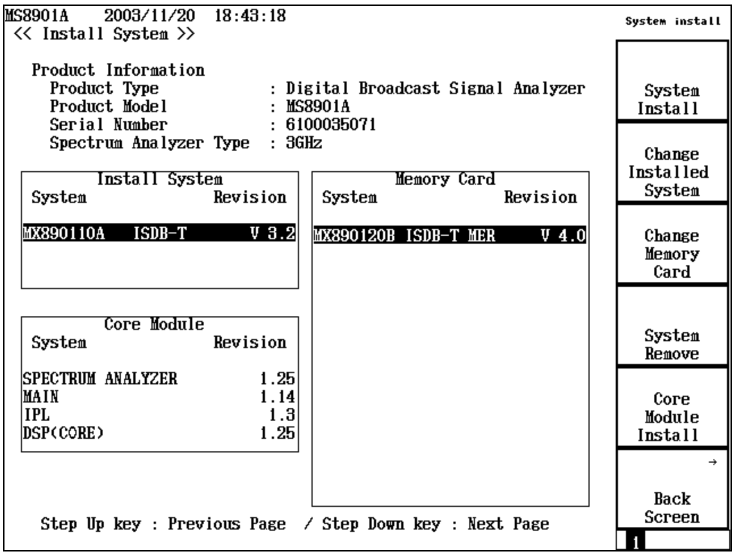


Figure 2.15-1 System Install screen

4. Press the Change Installed System key (F2) to activate the Install System box.
5. Select the installation destination of the new measurement system by using the Rotary Encoder.
6. Press the Change Memory Card key (F3) to activate the Memory Card box.
7. Select the new measurement system by using the Rotary Encoder.
8. Press the System Install key (F1) to install the new system.
9. A confirmation window opens. Move the cursor to [Yes] by using the Rotary Encoder.
10. Press the Set key to start installation.

Chapter 3 Remote Control

This chapter describes how to remotely control the ISDB-T signal analysis function of the MS8901A Digital Broadcast Signal Analyzer with the MX890120B ISDB-T Signal Analysis Software installed, via the GPIB interface.

Refer to the MS8901A Operation Manual vol.3 for how to control the spectrum analyzer function of the MS8901A.

3.1 Connection and Setting

The GPIB/RS232C/ETHERNET*1 is used for remote control of the MS8901A.

This section describes the interface connection method and setting method. For details of the connection method, refer to Section 2 “Connection Method” in the MS8901A Operation Manual Vol. 3.

*1: To use the ETHERNET interface, the MS8901A-09 ETHERNET interface option is required.

3.1.1 GPIB

Connect and set GPIB using the following procedure.

<Procedure>

1. Connect the GPIB connector on the rear panel of the MS8901A to the GPIB connector of the external controller using the GPIB cable.

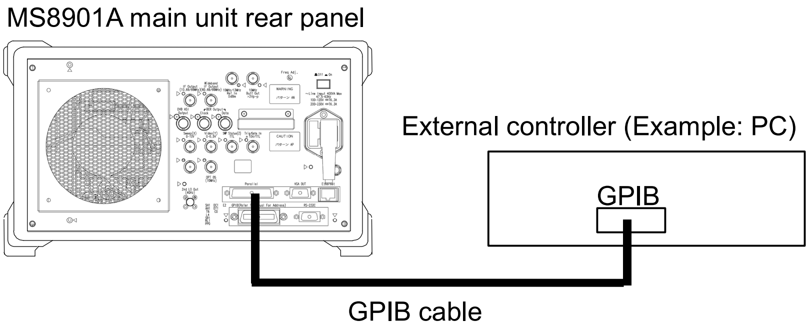


Figure 3.1.1-1 GPIB connection configuration

2. Press the Config key on the front panel.

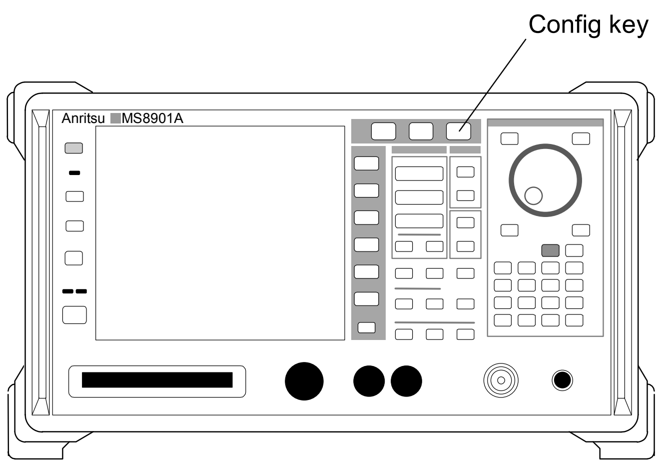


Figure 3.1.1-2 Config key

3. After switching to the Configuration screen, click the Interface key of the soft keys. Move the cursor to the Interface Connect to Controller item shown in the top half of the screen and set GPIB.

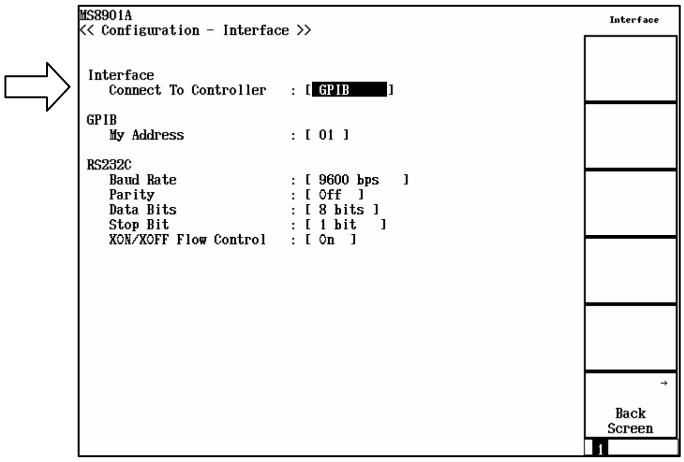


Figure 3.1.1-3 Interface setting

4. Set the GPIB address.

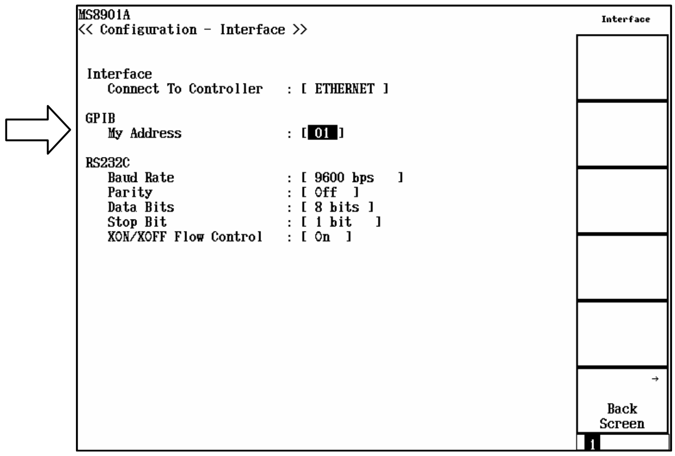


Figure 3.1.1-4 GPIB address setting

Table 3.1.1-1 GPIB communication conditions

Setting item	Set value
My address	0 to 30

3.1.2 RS-232C

Connect and set the RS-232C using the following procedure.

<Procedure>

1. Connect the RS-232C connector (D-sub, 9-pin, male) on the rear panel of the MS8901A to the RS-232C connector of the external controller using the RS-232C cross cable.

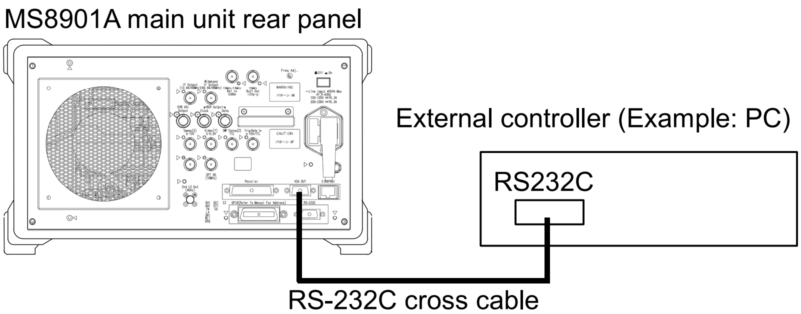


Figure 3.1.2-1 RS-232C connection configuration

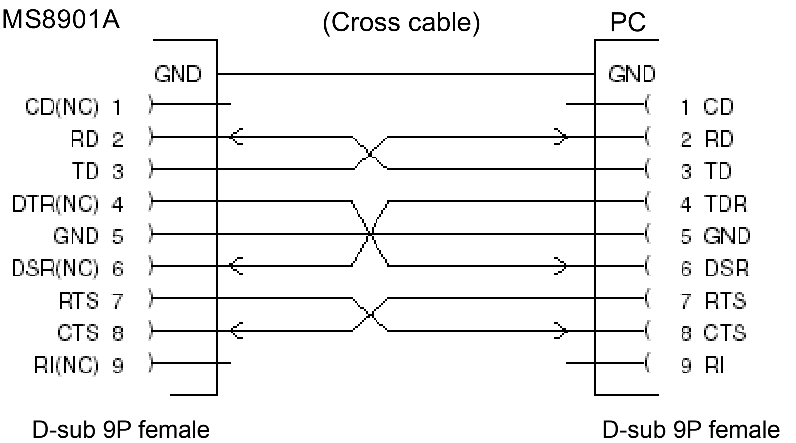


Figure 3.1.2-2 RS-232C cross cable connection

2. Press the Config key on the front panel.

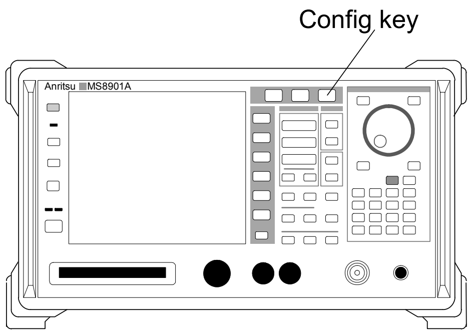


Figure 3.1.2-3 Config key

3. After switching to the Configuration screen, click the Interface key of the soft keys. Move the cursor to the Interface Connect to Controller item shown in the top half of the screen and set RS-232C.

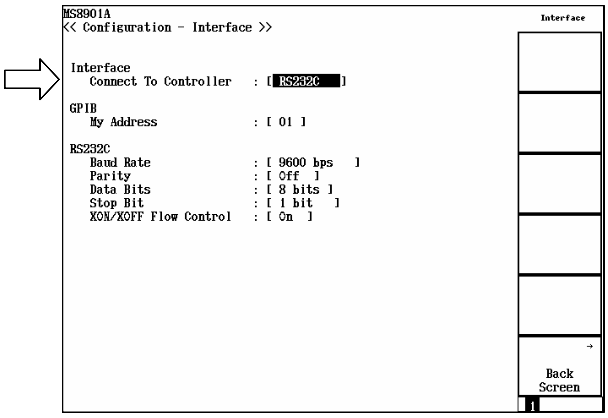


Figure 3.1.2-4 Interface setting

4. Set the RS-232C communication conditions.

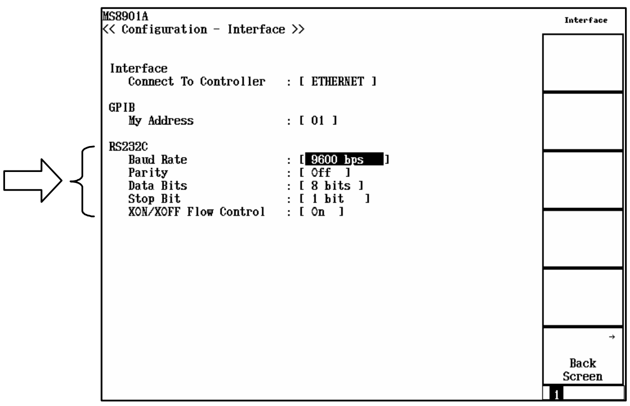


Figure 3.1.2-5 RS-232C communication condition setting

Table 3.1.2-1 RS232C communication conditions

Setting item	Set value
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 (bps)
Parity	Even, Odd, Off (none)
Data Bit	7 bits, 8 bits
Stop Bit	1 bit, 2 bits
XON/XOFF Flow Control	On

3.1.3 ETHERNET

Connect and set ETHERNET in the following procedure.

Note:

To use the ETHERNET interface, the MS8901A-09 ETHERNET option is necessary.

<Procedure>

1. Connect the ETHERNET connector (RJ-45) on the rear panel of the MS8901A to the ETHERNET connector of the external controller via the HUB and using the ETHERNET straight cable. When using the ETHERNET cross cable, directly connect the MS8901A to the external controller without HUB.

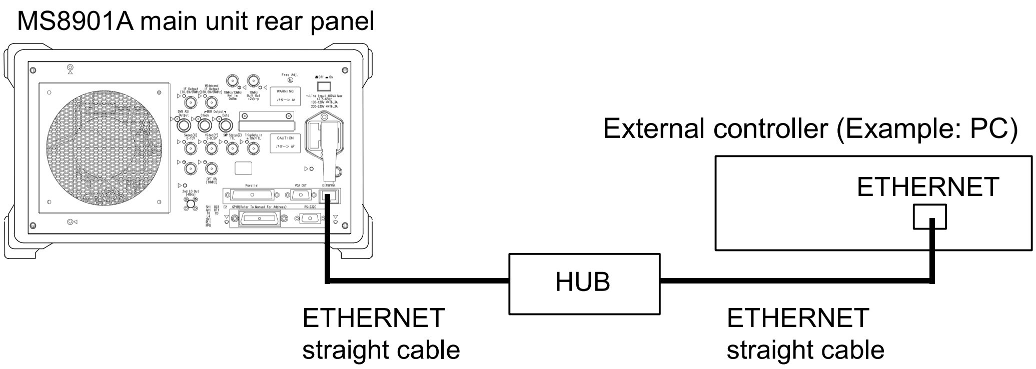


Figure 3.1.3-1 ETHERNET connection example (using straight cable)

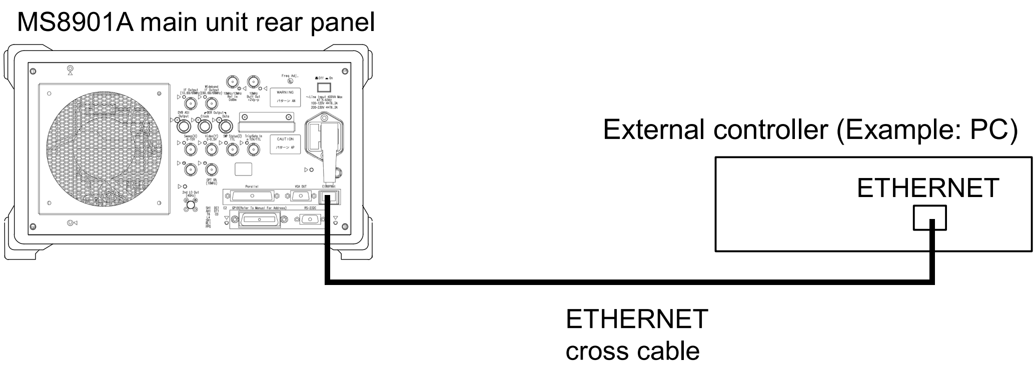


Figure 3.1.3-2 ETHERNET connection example (using cross cable)

2. Press the Config key on the front panel.

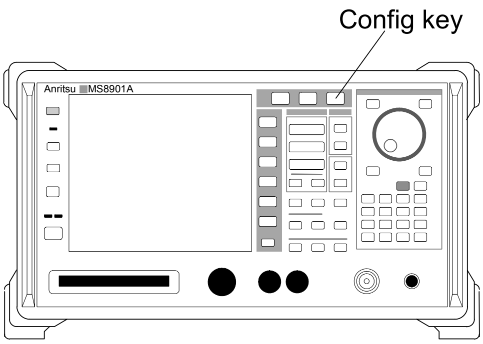


Figure 3.1.3-3 Config key

3. After switching to the Configuration screen, click the Interface key of the soft keys. Move the cursor to the Interface Connect to Controller item shown in the top half of the screen and set ETHERNET.

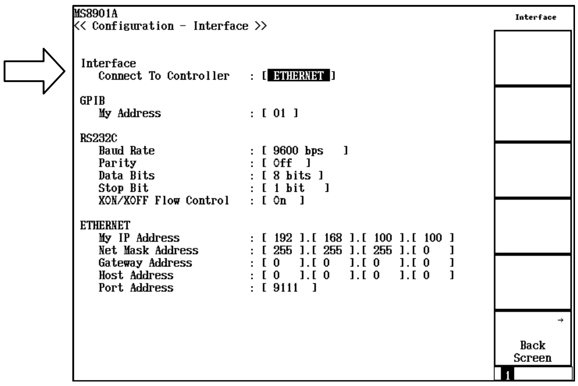


Figure 3.1.3-4 Interface setting

4. Set the ETHERNET communication conditions.

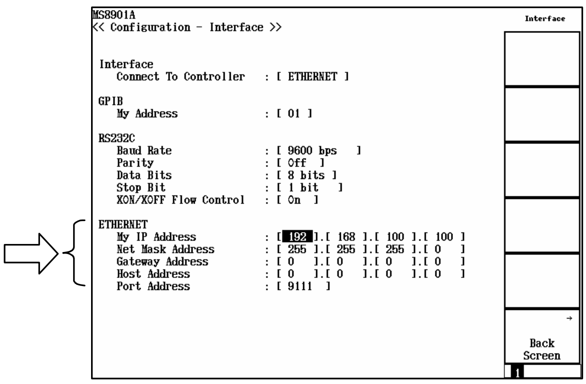


Figure 3.1.3-5 ETHERNET communication condition setting

Table 3.1.3-1 ETHERNET communication conditions

Set items	Set value	Remark
My IP Address	0.0.0.0 to 255.255.255.255	IP address
Net Mask Address	0.0.0.0 to 255.255.255.255	Net mask
Gateway Address	0.0.0.0 to 255.255.255.255	Gateway address (when 0.0.0.0: No gateway is set)
Host Address	0.0.0.0 to 255.255.255.255	Communication partner address (when 0.0.0.0: Communication partner is not set)
Port Address	3000 to 30000	Port number for socket communication

Note:

For the values required for the ETHERNET setting, contact the administrator of your network.

5. Restart the MS8901A.

Note:

If the set value of ETHERNET is changed, it is valid only after restarting the MS8901A.

3.2 Device Messages

Switching Screen Hierarchy

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Measurement mode	Spectrum Analyzer	PNLMDΔSPECT	PNLMD?	SPECT	Note 3
	Signal Analysis	PNLMDΔSYSTEM	PNLMD?	SYSTEM	
	Configuration	PNLMDΔCONFIG	PNLMD?	CONFIG	
System selection (System)	System1	SYS 1	SYS?	1	Note 3
	System2	SYS 2	SYS?	2	
	System3	SYS 3	SYS?	3	
Screen transition within signal analysis mode	Setup Common Parameter	DSPLΔSETCOM	DSPL?	SETCOM	Notes 1, 4, 5
	Modulation Analyzer	DSPLΔMODANAL	DSPL?	MODANAL	
	C/N	DSPLΔCN	DSPL?	CN	
	Spectrum Mask	DSPLΔMASK	DSPL?	MASK	
	Frequency Counter	DSPLΔFREQCNT	DSPL?	FREQCNT	
	Back Screen	BS	---	---	Note 4
	Setup Common Parameter	MEASΔSETCOM	MEAS?	SETCOM	Notes 2, 4, 5
	Modulation Analyzer	MEASΔMODANAL	MEAS?	MODANAL	
	C/N	MEASΔCN	MEAS?	CN	
	Spectrum Mask	MEASΔMASK	MEAS?	MASK	
	Frequency Counter	MEASΔFREQCNT	MEAS?	FREQCNT	

Notes:

1. Screen transition only. Adjust_Range and measurement are not performed.
2. Measurement is started after changing the screen, in the same way as the key operation from the front panel.
3. Available in all measurement modes.
4. Available when the measurement mode is set to Signal Analysis.
5. When other than RF is set as Terminal, C/N, Spectrum Mask, and Frequency Counter cannot be measured.

*: Δ in the table above indicates a space.

Setup Common Parameters

The commands in the table below are enabled when the measurement mode is Signal Analysis. Detailed information on each function is described in Section 2, “Operations.”

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
System setting (System)	System	ISDBTSYSΔTV	ISDBTSYS?	TV	When System = TV Auto Select, Terminal is fixed to RF.
		ISDBTSYSΔTVAUTO		TVAUTO	
Input connector (Terminal)	RF	ISDBTTERMΔRF	ISDBTTERM?	RF	
	Low IF-DC	ISDBTTERM ΔLOWIFDC		LOWIFDC	Note 6
	Low IF-AC	ISDBTTERM ΔLOWIFAC		LOWIFAC	Note 6
	IQ-DC	ISDBTTERM ΔIQDC		IQDC	Note 6
	IQ-AC	ISDBTTERM ΔIQAC		IQAC	Note 6
Impedance (Impedance)	50 Ω	TERMINZ Δ50	TERMINZ?	50	Note 6
	1 MΩ	TERMINZ Δ1M		1M	
Frequency allocation (Channel Map)	Interim-1	CHASSIGNΔINTERIM1	CHASSIGN?	INTERIM1	1/7-MHz shift Frequency setting: 13 to 32 channels Note 7
	Interim-2	CHASSIGNΔINTERIM2	CHASSIGN?	INTERIM2	0.15-MHz shift Frequency setting: 13 to 32 channels Note 7
	UHF	CHASSIGNΔUHF	CHASSIGN?	UHF	1/7-MHz shift Frequency setting: 13 to 62 channels Note 7
	General	CHASSIGNΔGENERAL	CHASSIGN?	GENERAL	Frequency setting: 32 to 3000 MHz Note 7
	IF Band	CHASSIGNΔIFBAND	CHASSIGN?	IFBAND	Frequency setting: 3.9 to 38 MHz Note 7
	VHF	CHASSIGNΔVHF	CHASSIGN?	VHF	1/7 MHz shift Frequency setting: 1 to 12 channels Note 7

Setup Common Parameters (cont'd)

Parameter: Function	Parameter: Control Item	Program Msg.	Query Msg.	Response Msg.	Remark
Frequency allocation (Channel Map) (Cont'd)	CATV	CHASSIGNΔCATV	CHASSIGN?	CATV	1/7 MHz shift Frequency setting: 13 to 63 channels Note 7
	UHF_BRAZIL	CHASSIGNΔ UHF_BRAZIL		UHF _BRAAZIL	1/7 MHz shift Frequency setting: 14 to 69 channels Note 7
Channel	Channel	CHANΔn	CHAN?	n	n: 1 to 69 (Unit: channel) Note 7, Note 8
Frequency	Frequency	FREQΔf	FREQ?	f	3.9 to 3000 MHz, Note 8
Frequency with offset	Frequency with Offset	---	OFFREQ?	f	Unit: Hz
Offset Frequency	Offset Frequency	FREQOFSΔf	FRQOFS?	f	0 to 12 GHz, Note 8
Frequency allocation (Channel Map IF)	General	---	CHASSIGNIF?	GENERAL	GENERAL (fixed)
Frequency (IF)	Frequency IF	---	FREQIF?	f	f: 37.15 MHz (fixed)
Frequency with Offset (IF)	Frequency with Offset IF	---	OFFREQIF?	f	f: 37.15 MHz (fixed)
Offset Frequency (IF)	Offset Frequency IF	---	FREQOFSIF?	f	f: 0 Hz (fixed)
Spectrum inversion (Spectrum)	Normal	RVSSPECTΔNRM	RVSSPECT?	NRM	Can be set when Channel Map = General or IFBand, or when Terminal is other than RF.
	Reverse	RVSSPECTΔRVS	RVSSPECT?	RVS	
Spectrum inversion (Spectrum IF)	Reverse IF	---	RVSSPECTIF?	RVS	RVS (fixed)
Reference Level	Ref Level	RFLVLΔ1	RFLVL?	1	Note 9
Reference Level (Reference Level.IF)	Ref level IF	RFLVLIFΔ1	RFLVLIF?	1	Note 9 Can be set only when System is set to TV Auto Select.
Mode (Transmission Mode)	MODE1	TRNSMODEΔ1	TRNSMODE?	1	
	MODE2	TRNSMODEΔ2	TRNSMODE?	2	
	MODE3	TRNSMODEΔ3	TRNSMODE?	3	
Guard interval	1/4	GINTERVΔ1PER4	GINTERV?	1PER4	
	1/8	GINTERVΔ1PER8	GINTERV?	1PER8	
	1/16	GINTERVΔ1PER16	GINTERV?	1PER16	
	1/32	GINTERVΔ1PER32	GINTERV?	1PER32	

Setup Common Parameters (cont'd)

Parameter: Function	Parameter: Control Item	Program Msg.	Query Msg.	Response Msg.	Remark
Segment		SEGMENT△n1,n2,n3	SEGMENT?	n1,n2,n3	Note 10
Modulation System (Modulation)		SEGMOD△a1,a2,a3	SEGMOD?	a1,a2,a3	Note 11
Level control method (Level Control)	Ref Setting	LVLCTRL△REF	LVLCTRL?	REF	
	Adjust Range	LVLCTRL△ADJ	LVLCTRL?	ADJ	"ADJ" cannot be set when System is set to TV Auto Select or Channel Map is IFBand. Note 7
Auto range adjustment by the modulation error ratio (Refer to MER)	On	REFMER△ON	REFMER?	ON	Cannot be set when System is set to TV Auto Select or Channel Map is IFBand. Note 7
	Off	REFMER△OFF	REFMER?	OFF	
Preamplifier	On	PREAMP△ON	PREAMP?	ON	Note 7
	Off	PREAMP△OFF	PREAMP?	OFF	Note 7
AGC	On	AGC△ON	AGC?	ON	Can be set only when System is set to TV Auto Select.
	Off	AGC△OFF		OFF	
Measurement target signal	Target	---	TARGET?	***	Fixed to RF when System is set to TV.
				RF	
				IF	
Measurement target signal status	Target Status	---	TGETSTAT?	NOMEAS	Fixed to NOMEAS when System is set to TV.
				NORM	
				SIGLOSS	
				ABNORM	
Measurement target signal change	Target Change	---	TGETCHANGE?	NOCHANGED	Fixed to NO-CHANGED when System is set to TV.
				CHANGED	
Guard Interval	1/4	GINTERV △1PER4	GINTERV?	1PER4	
	1/8	GINTERV △1PER8	GINTERV?	1PER8	
Ref level reconfiguration (Refer to MER)	On	REFMER ON	REFMER?	ON	
	Off	REFMER OFF	REFMER?	OFF	

Notes:

6. Setting Terminal = other than RF is possible only when the MS8901A-18 (Low IF/IQ unbalanced input) option is installed. If the setting is performed without this option installed, the message “Valid only when Low IF Option is enable” is displayed.

7. This command can be set only when Terminal = RF with the MS8901A-18 installed.

8. Hz applies when the unit is omitted. The following units can be used:
   HZ (Hz), KHZ (kHz), MHZ (MHz), GHZ (GHz)

   Only Channel can be set when Channel Map is Interim-1, Interim-2 ,VHF, UHF, CATV, and UHF (Brazil). Frequency can be set when Channel Map is IF Band or General.

   The settable channel range varies depending on the Channel Map setting.

   Type of Channel Map and n: The channel range is as follows.

Channel Map	n:Channel range
VHF	1 to 12
UHF	13 to 62
CATV	13 to 63
Interim-1	13 to 32
Interim-2	13 to 32
UHF (Brazil)	14 to 69

   When the MS8901A-18 is installed, this command can be set if Terminal is other than RF.

9. dBm applies when the unit is omitted. Only DBM (dBm) is available as the unit in this event.

   When pre-amplifier is Off: –26 to 10 dBm
   When pre-amplifier is On: –46 to –10 dBm

10. n1 = Number of segments for Layer_A
    n2 = Number of segments for Layer_B
    n3 = Number of segments for Layer_C

    n1 + n2 + n3 = 13

11. a1 = Modulation system for Layer_A
    a2 = Modulation system for Layer_B
    a3 = Modulation system for Layer_C

Select one of the following modulation systems:

PR64QAM (64QAM modulation for partial reception)
PR16QAM (16QAM modulation for partial reception)
PRQPSK (QPSK modulation for partial reception)
PRDQPSK (DQPSK modulation for partial reception)
(Cannot be set when Trace Format = Freq Response.)
64QAM (64QAM modulation)
16QAM (16QAM modulation)
QPSK (QPSK modulation)
DQPSK (DQPSK modulation)
(Cannot be set when Trace Format = Freq Response.)

Modulation Analysis

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Measurement screen selection (Trace Format)	No Trace	TRFORMΔNON	TRFORM?	NON	
	Constellation	TRFORMΔCONSTEL	TRFORM?	CONSTEL	
	Freq Response	TRFORMΔFRESP	TRFORM?	FRESP	Note 11
	Sub-carrier MER	TRFORMΔSUBCARR	TRFORM?	SUBCARR	
Partial reception (Receive of Segments)	Receive of ALL Seg. (13)	RECVSEGΔ13SEG	RECVSEG?	13SEG	Note 12
	Receive of 1 Seg (Mobile Profile)	RECVSEGΔ1SEG	RECVSEG?	1SEG	
Storage mode	Normal	STRG_MODΔNRM	STRG_MOD?	NRM	
	Average	STRG_MODΔAVG	STRG_MOD?	AVG	
	Moving Avg	STRG_MODΔMVAVG	STRG_MOD?	MVAVG	
	Max Hold	STRG_MODΔMAX	STRG_MOD?	MAX	
	Over write	STRG_MODΔOVER	STRG_MOD?	OVER	
Averaging count (Amount of Count)		CNT_MODΔn	CNT_MOD?	n	n: 2 to 100
Refresh interval	Every	INTVAL_MODΔEVERY	INTVAL_MOD?	EVERY	
	Once	INTVAL_MODΔONCE	INTVAL_MOD?	ONCE	
Constellation section (Section)	Layer_A	MODSECΔLAYERA	MODSEC?	LAYERA	
	Layer_B	MODSECΔLAYERB	MODSEC?	LAYERB	
	Layer_C	MODSECΔLAYERC	MODSEC?	LAYERC	
	TMCC	MODSECΔTMCC	MODSEC?	TMCC	
	AC1	MODSECΔAC1	MODSEC?	AC1	
	AC2	MODSECΔAC2	MODSEC?	AC2	
Multipath Equalizer	Advanced	EQZΔADV	EQZ?	ADV	
	Standard	EQZΔSTD	EQZ?	STD	
Segmentation offset		SEGOFSΔn	SEGOFS?	n	Refer to Table 2.3.5-1 in Section 2.3.5 “Segmentation Offset.”
Automatic range adjustment (Adjust Range)		ADJRNG	---	---	Disabled when ISDBTSystem is TVAUTO, or Channel Map is IFBand. Note 7
Correction	On	BNDCORRΔON	BNDCORR?	ON	
	Off	BNDCORRΔOFF	BNDCORR?	OFF	
Frequency response correction (Calibration)		BNDCAL	---	---	

Modulation Analysis (cont'd)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Vertical scale of frequency response (Vertical Scale)	±2 dB	VSCALE_AMPΔ2	VSCALE_AMP?	2	
	±5 dB	VSCALE_AMPΔ5	VSCALE_AMP?	5	
	±10 dB	VSCALE_AMPΔ10	VSCALE_AMP?	10	
	±20 dB	VSCALE_AMPΔ20	VSCALE_AMP?	20	
	±50 dB	VSCALE_AMPΔ50	VSCALE_AMP?	50	
Vertical scale of sub-carrier MER (Vertical Scale)	20 dB	VSCALE_MERΔ20	VSCALE_MER?	20	
	30 dB	VSCALE_MERΔ30	VSCALE_MER?	30	
	40 dB	VSCALE_MERΔ40	VSCALE_MER?	40	
	50 dB	VSCALE_MERΔ50	VSCALE_MER?	50	
	60 dB	VSCALE_MERΔ60	VSCALE_MER?	60	
MER threshold offset (MER Threshold Offset)		MERTHRΔl	MERTHR?	l	l:0.00 to 30.00
Display or non-display of worst envelope line (WORST ENVE-LOPE)	Display	WSTENVΔON	WSTENV?	ON	
	Non-display	WSTENVΔOFF	WSTENV?	OFF	
Automatic signal detection (Signal Automatic Detection)		SIGAUTODET	---	---	Notes 16, 19
TMCC signal detection (TMCC Automatic Detection)		TMCCAUTODET	---	---	Notes 16, 19
Cancellation of automatic detection (Detection Cancel)		DETCANCEL	---	---	Note 19
Automatic detection status (Detection Status)		---	DETSTAT?	n	See Note 17 for n.
TMCC information bit (TMCC Information)	Bit string	---	TMCCINFO?	s	See Note 18 for s.
	Mode	---	TMCCINFO? ΔTRNSMODE	a	Note 21
	Guard Interval	---	TMCCINFO? ΔGINTERV	b	Note 21
	Segment	---	TMCCINFO? ΔSEGMENT	c1, c2, c3	Note 21
	Modulation	---	TMCCINFO? ΔSEGMOD	d1, d2, d3	Note 21
	Coding ratio	---	TMCCINFO? ΔSEGCR	e1, e2, e3	Note 21

Modulation Analysis (cont'd)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
TMCC information bit (TMCC Information) (Cont'd)	Interleave length	---	TMCCINFO? ΔSEGINTLEV	f1, f2, f3	
Specification of segment for automatic detection (Auto. Det. from Seg)		AUTODETSEGΔn	AUTODETSEG?	n	n: Segment number, 0 to 12
Marker position on constellation		MKP_MODΔs	MKP_MOD?	s	s: Number of symbols Note 20 Can be set when the measurement screen is Constellation
I and Q at marker position on constellation	I	---	MKL_MOD?ΔI	i	
	Q	---	MKL_MOD?ΔQ	q	
	I and Q	---	MKL_MOD?	i,q	
Magnify window position for frequency response		FRESPZONEΔn	FRESPZONE?	n	n: Number of segments, 0 to 12 Can be set when the measurement screen is Freq Response
Marker position for frequency response		MKP_FREΔp	MKP_FRE?	p	p: Number of horizontal points, 0 to 431 Can be set when the measurement screen is Freq Response
Marker value for frequency response		---	MKL_FRE?ΔAMP	a	Unit: dB
Marker trace status	Normal data	MKMODEΔCURR	MKMODE?	CURR	
	Worst envelope line	MKMODEΔWORST	MKMODE?	WORST	Note: 22
Magnify window position of sub-carrier MER		SUBCARRZONEΔn	SUBCARRZONE?	n	Can be set when the measurement screen is sub-carrier MER n: Segment number 0 to 12

Modulation Analysis (cont'd)

Parameter: Function	Parameter: Control Item	Program Msg.	Query Msg.	Response Msg.	Remark
Marker position of sub-carrier MER		MKP_SUBCARRΔp	MKP_SUBCARR?	p	Can be set when the measurement screen is sub-carrier MER p: Number of horizontal points Note 23
Marker value of sub-carrier MER		---	MKL_SUBCARR?	l	Unit: dB
Peak search setting	Whole waveform	PKS_SUBCARRΔON, 13	PKS_SUBCARR?	ON, 13	Note 24
	Magnify waveform	PKS_SUBCARRΔON, 1	PKS_SUBCARR?	ON, 1	
	Peak search Off	PKS_SUBCARRΔOFF	PKS_SUBCARR?	OFF	
Frequency value of the peak position		---	PKF_SUBCARR?	f	Unit: Hz
Level value of the peak position		---	PKL_SUBCARR?	l	Unit: dB
Carrier frequency		---	CARRF?	f	Unit: Hz (One decimal point)
			CARRFHR?	f	Unit: Hz (Two decimal points) Note 26
Carrier frequency error		---	CARRFERR?	f	Unit: Hz (One decimal point)
			CARRFERRHR?	f	Unit: Hz (Two decimal points) Note 26
		---	CARRFERR?ΔHZ	f	Unit: Hz (One decimal point)
			CARRFERRHR?ΔHZ	f	Unit: Hz (Two decimal points) Note 26
		---	CARRFERR?ΔPPM	f	Unit: ppm, 5 digits of integer part displayed

Modulation Analysis (cont’d)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Carrier frequency error (Cont’d)			CARRFERRHV?ΔPPM	f	Unit: ppm, 6 digits of integer part displayed Note 27
			CARRFERRHR?ΔPPM	f	Unit: ppm, 6 digits of integer part displayed Note 26, 27
MER measured result	All	---	MER?ΔALL	a,b,c,d,e,f,g	Note 13
	Conventional	---	MER?ΔCONV	a	
	Layer_A	---	MER?ΔLAYERA	b	
	Layer_B	---	MER?ΔLAYERB	c	
	Layer_C	---	MER?ΔLAYERC	d	
	TMCC	---	MER?ΔTMCC	e	
	AC1	---	MER?ΔAC1	f	
	AC2	---	MER?ΔAC2	g	
Measurement target signal (Target)		---	TARGET?	***	Fixed to RF when System is set to TV.
				RF	
				IF	
Measurement target signal status (Target Status)		---	TGETSTAT?	NOMEAS	Fixed to NOMEAS when System is set to TV.
				NORM	
				SIGLOSS	
				ABNORM	
Measurement target change (Target Change)		---	TGETCHANGE?	NOCHANGED	Fixed to NOCHANGED when System is set to TV.
				CHANGED	
Constellation data readout		---	XMC?Δt,a,b,d	k,k, ...	Note 14, 49
Frequency response data readout		---	XMAMP?Δb,d	k,k, ...	Note 15, 49
Sub-carrier MER data readout		---	XMSUBCARR?Δb,d	k,k, ...	Note 25, 49
Worst envelope line of sub-carrier MER data readout		---	XMWSTENV?Δb,d	k,k, ...	Note 25, 49
Saving data to memory card	Automatic number assignment	MODSV	---	---	
	Specified number	MODSVΔn	---	---	n: 0 to 999

Notes:

12. "RECVSEG 1SEG" is valid only when Layer-A Mod is set to partial reception (PR)

13. Argument types:

    a: Conventional
    b: Layer_A
    c: Layer_B
    d: Layer_C
    e: TMCC
    f: AC1
    g: AC2
    Resolution: 0.01 (in dB units)
    "***" (three asterisks) will be returned when a measured value is not displayed.

14. t = Section type

    LAYERA (Layer_A)
    LAYERB (Layer_B)
    LAYERC (Layer_C) TMCC (TMCC)
    AC1 (AC1)
    AC2 (AC2)

    a = Data type

    0 (I) or
    1 (Q)

    b = First symbol point where data readout starts
    d = Number of symbols

    Refer to the maximum symbol number of Note 20. The maximum symbol number is the upper limit of the data to be readout. For example: At Mode3, AC1 symbol data is 416 by the following formula.

    416 = {(8 carriers) × (segment number for each layer: 13) × 4}

    When reading out all the data of I component, the formula comes to be "XMC?ΔAC1,0,1,416". And when it is Q component, the formula comes to be "XMC?ΔAC1,1,1,416".

15. b = First frequency axis point where data readout starts

    (0 to 5617)

    d = Number of points

16. Remote control messages act as follows during automatic detection.
    - When DETCANCEL is received, automatic detection is stopped.
    - When DETSTAT? is received, the value shown in Note 17 corresponding to the automatic detection status is returned.
    - When *RST is received, detection is stopped and initialization is performed.
    - When a query command for a parameter is received, the set value for the parameter is returned as the response.
    - When a query command for measured results on the Modulation Analysis screen is received, "***" is returned.
    - When a query command for measured results on other than the Modulation Analysis screen is received, the previous measured result (or "***" if measurement is not performed) is returned.
    - Other messages are ignored.
    - As a result of the automatic detection (Adjust Range is included when Refer to MER is On), the selection of the measured screen (Trace Format) is automatically switched to No Trace, after Mode, Guard Interval, modulation system and segment number for each layer are modified.

17. 0: Completed normally
    2: Detection failed
    3: Parity check error
    4: Invalid TMCC
    9: Not detected or under detection

18. The TMCC bit string (203 bits excluding differential reference) is converted to a hexadecimal number and returned as a character string (51 characters).
    The output format is shown below.

B_1-B_{11}	B_{12}-B_{27}	B_{28}-B_{43}	------	B_{172}-B_{187}	B_{188}-B_{203}
7FF	FFFF	FFFF	------	FFFF	FFFF

When TMCCINFO? is received when detection is not performed or is under execution, the response becomes "***" (three asterisks).

19. Can be executed only on a measurement screen.

20. The number of symbols varies depending on the mode or modulation system.
Synchronized segment (when modulation system is not DQPSK or DQPSK(PR))

Mode	Data carrier	AC1	TMCC
Mode1	96	2	1
Mode2	192	4	2
Mode3	384	8	4

Differential segment (when modulation system is DQPSK or DQPSK(PR))

Mode	Data carrier	AC1	AC2	TMCC
Mode1	96	2	4	5
Mode2	192	4	9	10
Mode3	384	8	19	20

The maximum number of symbols for data carrier is:
(Number of carriers) × (Number of segments in the layer) ×4

The maximum number of symbols for other cases is:
{(Number of carriers in synchronized segment) × (Number of synchronized segments)
+ (Number of carriers in differential segment) × (Number of differential segments)} × 4

Note that the sum of the number of synchronized segments and the number of differential segments is 13.

21. The response message is a value obtained by TMCC automatic detection.
    a: Mode
    b: Guard Interval
    c1: Segment in Layer A
    c2: Segment in Layer B
    c3: Segment in Layer C
    d1: Modulation in Layer A
    d2: Modulation in Layer B
    d3: Modulation in Layer C
    e1: Coding ratio in Layer A
    e2: Coding ratio in Layer B
    e3: Coding ratio in Layer C

Range of coding ratio: 1/2, 2/3, 3/4, 5/6, 7/8
    f1: Interleave length in Layer A
    f2: Interleave length in Layer B
    f3: Interleave length in Layer C

Range of interleave length (selectable value varies depending on mode):

Mode1	Mode2	Mode3
0, 4, 8, 16	0, 2, 4, 8	0, 1, 2, 4

The following response messages can be returned depending on the layer status:
    Layer not used: "---"
    Reserved: "***"

22. "MKMODE∆WORST" is valid only when Worst Envelope is On.

23. Horizontal point number at marker shift depends on Mode on the sub-carrier MER screen.

Mode 1	Mode 2	Mode 3
0 to 107	0 to 215	0 to 431

24. When Receive of Segments is 1 Segment, "PKS_SUBCARR∆ON, 13" is invalid.

25.b = First frequency axis point to readout the data. (0 to 5617 at max)

d = point number

Refer to the point number at the horizontal axis of Note 23. The upper threshold is the data, in which the number of horizontal points is multiplied by 13 and 1 is added.

For example: At Mode3, all the data number of sub-carrier MER is equal to 5617, which is gained by the following formula:

{(432 point) × (segment number of layer:13) + 1}

When reading out all the data of the normal sub-carrier MER ,issue the command of "XMSUBCARR?Δ0,5617".

26.This command is valid only when the MS8901A-53 or MS8901A-73 (upgrading of the modulation frequency measurement accuracy) option is installed. When reading out without the option installed, the message of "Valid only when Mod.Freq.Measurement Ext-Option is enable" is displayed.

27.The difference between "CARRFERRHV?ΔPPM" and "CARRFERRHR?ΔPPM" is as follows.

(a) "…HV?" uses the measured result of the 0.1 Hz resolution frequency error to convert the frequency error into ppm unit.

(b) "…HR?" is valid only when the MS8901A-53 or MS8901A-73 (upgrading of the modulation frequency measurement accuracy) option is installed. The measured result of the 0.01 Hz resolution frequency error is used to convert the frequency error into ppm unit. Example of when frequency error is 0.04 Hz.

In case of (a), the frequency error is treated as the 0.1 Hz resolution here and the error is rounded to 0.0 Hz. The value converted into the ppm unit, is to be + 0.0000 ppm.

In case of (b), the frequency error is 0.04 Hz to be treated and the value converted into ppm unit is to be output.

49. Response is in binary format when binary format is specified as format of response data by the BIN command.

Refer to the response message format in Chapter 3 “Device Message Format” in the MS8901A Operation Manual Vol.3.

C/N (Note 5)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Storage mode	Normal	STRG_CN ΔNRM	STRG_CN?	NRM	
	Average	STRG_CNΔAVG	STRG_CN?	AVG	
	Max Hold	STRG_CNΔMAX	STRG_CN?	MAX	
	Over write	STRG_CN ΔOVER	STRG_CN?	OVER	
Averaging count (Amount of Count)		CNT_CNΔn	CNT_CN?	n	n: 2 to 100
Refresh interval	Every	INTVAL_CN ΔEVERY	INTVAL_CN?	EVERY	
	Once	INTVAL_CN ΔONCE	INTVAL_CN?	ONCE	
Automatic range adjustment (Adjust Range)		ADJRNG	---	---	Disabled when ISDBTSystem is TVAUTO
Integral value measurement range (Integral Range)		INTG_RNGΔn,m	INTG_RNG?	n,m	n and m indicate frequency (kHz) Resolution: 0.001, n< m n: 0.100 to 999.999 kHz m: 0.101 to 100000.000 kHz
Integral value measurement function (Integral Setting)	On	INTGΔON	INTG?	ON	
	Off	INTGΔOFF	INTG?	OFF	
Marker position		MKP_CNΔp	MKP_CN?	p	p: Number of horizontal points, 0 to 483
C/N value at marker position		---	MKL_CN?	l	Unit: dBc/Hz
C/N value at specified offset frequency		---	MKL_CN?Δf	l	Unit: dBc/Hz f: Offset frequency * Relative frequency from the marker position
CW value at marker position		---	MKLCW?	l	Unit: dBc
CW value at specified offset frequency		---	MKLCW?Δf	l	Unit: dBc f: Offset frequency * Relative frequency from the marker position
Carrier frequency		---	CARRF_CN?	f	0.1-Hz resolution

C/N (Note 5)

<table>
<tr><th colspan="2">Parameter</th><th rowspan="2">Program Msg.</th><th rowspan="2">Query Msg.</th><th rowspan="2">Response Msg.</th><th rowspan="2">Remark</th></tr>
<tr><th>Function</th><th>Control Item</th></tr>
<tr><td rowspan="3">Carrier frequency error</td><td></td><td>---</td><td>CARRFERR_CN?</td><td>f</td><td>0.1-Hz resolution</td></tr>
<tr><td></td><td>---</td><td>CARRFERR_CN?ΔHZ</td><td>f</td><td>0.1-Hz resolution</td></tr>
<tr><td></td><td>---</td><td>CARRFERR_CN?ΔPPM</td><td>p</td><td>Unit: ppm</td></tr>
<tr><td>High-resolution carrier frequency (Carrier Frequency High Resolution)</td><td></td><td>---</td><td>CARRFHR_CN?</td><td>f</td><td>0.01-Hz resolution
Note 28</td></tr>
<tr><td rowspan="3">High-resolution carrier frequency error (Carrier Frequency Error High Resolution)</td><td></td><td>---</td><td>CARRFERRHR_CN?</td><td>f</td><td>0.01-Hz resolution
Note 28</td></tr>
<tr><td></td><td>---</td><td>CARRFERRHR_CN?ΔHZ</td><td>f</td><td>0.01-Hz resolution
Note 28</td></tr>
<tr><td></td><td>---</td><td>CARRFERRHR_CN?ΔPPM</td><td>p</td><td>Unit: ppm</td></tr>
<tr><td>Integration results (Integral Result)</td><td></td><td>---</td><td>INTGRSLT?</td><td>l</td><td>Unit: dBc</td></tr>
<tr><td>Measurement target signal</td><td>Target</td><td>---</td><td>TARGET?</td><td>***
RF
IF</td><td>Fixed to RF when System is set to TV.</td></tr>
<tr><td>Measurement target signal status</td><td>Target Status</td><td>---</td><td>TGETSTAT?</td><td>NOMEAS
NORM
SIGLOSS
ABNORM</td><td>Fixed to NOMEAS when System is set to TV.</td></tr>
<tr><td>Measurement target change</td><td>Target Change</td><td>---</td><td>TGETCHANGE?</td><td>NOCHANGED
CHANGED</td><td>Fixed to NO-CHANGED when System is set to TV.</td></tr>
<tr><td rowspan="3">C/N data readout</td><td>Specified point</td><td>---</td><td>XMCN?Δp,d</td><td>l,l, ...</td><td>Note 29, 49</td></tr>
<tr><td rowspan="2">Specified frequency</td><td>---</td><td>XMCNF_HZ?Δp,d</td><td>f,l, ...</td><td>Note 30, 49</td></tr>
<tr><td>---</td><td>XMCNF?Δp,d</td><td>f,l, ...</td><td>Note 31, 49</td></tr>
<tr><td rowspan="2">Saving data to memory card</td><td>Automatic number assignment</td><td>CNSV</td><td>---</td><td>---</td><td></td></tr>
<tr><td>Number assignment</td><td>CNSVΔn</td><td>---</td><td>---</td><td>n: 0 to 999</td></tr>
</table>

Notes:

28. Performs measurement with one-tenth calculation resolution of that for existing command.

29. p = Starting point of data readout on the horizontal axis (0 to 483)
    d = Number of data
    l = Level

30. p = Starting frequency of data readout on the horizontal axis (unit: Hz)
    d = Number of data
    l = Level (unit: dBc/Hz)
    f = Frequency (unit: Hz)

31. p = Starting frequency of data readout on the horizontal axis (in Hz units)
    d = Number of data
    l = Level (unit: dBc/Hz)
    f = Frequency (unit: 10 Hz)

Spectrum Mask (Note 5)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Status of Mask Check	Complete	---	MASK_STS?	0	
	Now Execute		MASK_STS?	1	
Judgment results	Pass	---	MASK_CHECK?	PASS	
	Fail	---	MASK_CHECK?	FAIL	
Occupied frequency bandwidth		---	OBW?	f	Unit: Hz
Mask selection	Transmission	SPMASK∆TRANS	SPMASK?	TRANS	
	User-1	SPMASK∆USER1	SPMASK?	USER1	
	User-2	SPMASK∆USER2	SPMASK?	USER2	
Mask data load (from memory card)		SPMASKLD	---	---	
Mask data read/write (using command)		MASKFIT∆n,s,c,f(1),l(1), ...f(c),l(c)	MASKFIT?∆n	s,c,f(1),l(1), ...f(c),l(c)	Note 32
Marker mode	Normal	MKR_MASK∆NRM	MKR_MASK?	NRM	
	Delta	MKR_MASK∆DELTA	MKR_MASK?	DELTA	
Equipment Standard	Type A	SPMASK_STD∆TYPEA	SPMASK_STD?	TYPEA	
	Type B	SPMASK_STD∆TYPEB	SPMASK_STD?	TYPEB	
	Brazil	SPMASK_BRAZIL	SPMASK_STD?	BRAZIL	
Station Power (Type B)	High	STTNTYP∆HIGH	STTNTYP?	HIGH	Note 33
	Low	STTNTYP∆LOW	STTNTYP?	LOW	Note 33
	30dB Mask	STTNTYP ∆30DB_MASK	STTNTYP?	30DB_ MASK	Note 33
Station Power (Brazil)	Critical	STTNTYP∆CRTICAL	STTNTYP?	CRITICAL	Note 34
	Sub-Critical	STTNTYP ∆SUBCRITICAL	STTNTYP?	SUB CRITICAL	Note 34
	Non-Critical	STTNTYP ∆NONCRITICAL	STTNTYP?	NON CRITICAL	Note 34
Average Power		STTNPOW∆w	STTNPOW?	w	w: Transmitter When the station power is Low output power (unit: w) 0.25 to 2.50v When the station power is 30dB Mask Output Power (unit: w) 0.025 to 0.249 Cannot be set when the station power is High Note 33, 35

Number of channel to measure (Number of Channel)		NUMCHΔn	NUMCH?	n	n: 1 to 3 Note 33,36
Marker position		MKP_MASKΔp	MKP_MASK?	p	p: Number of horizontal points, 0 to 5000
Spectrum waveform at marker position	Level	---	MKL_MASK?	l	Unit: dB
	Frequency	---	MKL_MASK?Δf	l	Unit: dB f: Relative frequency (Unit: Hz) Marker position is not related Note 36
Margin at marker position		---	MKMRGN_MASK?	l	Unit: dB

Spectrum Mask (Cont'd)

Parameter: Function	Parameter: Control Item	Program Msg.	Query Msg.	Response Msg.	Remark
Automatic range adjustment (Adjust Range)		ADJRNG	---	---	Disabled when ISDBTSystem is TVAUTO
Measurement target signal	Target	---	TARGET?	*** RF IF	Fixed to RF when System is set to TV.
Measurement target signal status	Target Status	---	TGETSTAT?	NOMEAS NORM SIGLOSS ABNORM	Fixed to NOMEAS when System is set to TV.
Measurement target change	Target Change	---	TGETCHANGE?	NOCHANGED CHANGED	Fixed to NO-CHANGED when System is set to TV.
Spectrum waveform data readout	Specified point	---	XMM? Δp, d	l, l, ····	Note 37, 38, 49
		---	XMM_LAST? Δp,d	l, l, ····	Note 37, 39, 49 Waveform data after Filter correction
		---	XMM_UNCORR? Δ p,d	l, l, ····	Note 37, 39, 49 Waveform data before Filter correction
		---	XMM_FILTER? Δp,d	l, l, ····	Note 37, 39, 49 Filter characteristics data
	Specified frequency	---	XMMF?Δp,d	f,l, ...	Note 38, 40, 49
		---	XMMF_LAST? Δp,d	f, l, ····	Note 39, 40, 49 Waveform data after Filter correction
		---	XMMF_ UNCORR?Δp,d	f, l, ····	Note 39, 40, 49 Waveform data before Filter correction
		---	XMMF_ FILTER?Δp,d	f, l, ····	Note 39, 40, 49 Filter characteristics data
Saving data to memory card	Automatic number assignment	MASKSV	---	---	
	Specified number	MASKSVΔn	---	---	n: 0 to 999

Filter characteristics file selection	Default	MASKFILTER△ DEFAULT	MASKFILTER?	DEFAULT	Note 34
	User-1	MASKFILTER△USER1	MASKFILTER?	USER1	Note 34
	User-2	MASKFILTER△USER2	MASKFILTER?	USER2	Note 34
	User-3	MASKFILTER△USER3	MASKFILTER?	USER3	Note 34
Loading Filter Data File		MASK FILTERLD	---	---	Note 34
Displaying/Not Displaying the spectrum waveform after correction (Last Result)	On	LASTRSLT △ON	LASTRSLT?	ON	Note 34,41
	Off	LASTRSLT △OFF	LASTRSLT?	OFF	Note 34,41
Displaying/Not Displaying the spectrum waveform before correction (Uncorrection Result)	On	UNCORRRSLT△ON	UNCORRRSLT?	ON	Note 34,41
	Off	UNCORRRSLT△OFF	UNCORRRSLT?	OFF	Note 34,41
Displaying/Not Displaying filter characteristics waveform (Filter Data)	On	FILTERDATA△ON	FILTERDATA?	ON	Note 34,41
	Off	FILTERDATA △OFF	FILTERDATA?	OFF	Note 34,41
Selecting where to trace the marker (Marker Trace)	Last Result	MKTRACE_MASK△ LAST	MKTRACE_MASK?	LAST	Note 34,42
	Uncorrection Result	MKTRACE_MASK△ UNCORR	MKTRACE_MASK?	UNCORR	Note 34,42
	Filter Data	MKTRACE_MASK△ FILTER	MKTRACE_MASK?	FILTER	Note 34,42

Notes:

32. The mask table data can be registered by using a remote programming command. Use a remote query command to read out the mask table contents.
    The remote program command format is shown below.
    MASKFIT n,s,c,f(1),l(1), ... ,f(c),l(c)
    n: 1 (User-1) or 2 (User-2)
    *0 (Transmission) cannot be specified.
    s: Mask title (up to 10 characters)
    c: Number of break points (2 to 50)
    f(1-c): Frequency (MHz) at each break point. Specify as many as the number of break points (c).
    l(1-c): Relative level (dB) at each break point. Specify as many as the number of break points (c).
    When specifying the top line for the relative level, it is assumed that there is only one horizontal line.

Horizontal line level: 0.0 dB when Equipment Standard is Type A

–27.4 dB when Equipment Standard is Type B

The format for a remote query command and its response message are shown below.
MASKFIT? n <Query>
s,c,f(1),l(1), ... ,f(c),l(c) <Response>
n: 0 (Transmission), 1 (User-1) or 2 (User-2)
s: Mask title. "TRNS" is output when n=0.
c: Number of break points
f(1-c): Frequency (MHz) at each break point. Specify as many as the number of break points (c).
l(1-c): Relative level (dB) at each break point. Specify as many as the number of break points (c).
When the currently selected mask table is changed, Pass/Fail judgment is performed again.
The valid range to set the frequency and relative level changes, depending on the Equipment Standard.
Type A: Frequency range ± 10 MHz, relative level 0.0 dB to –60 dB
Type B: Frequency range ± 21 MHz, relative level –27.4 dB to –90.0 dB
Brazil: Frequency range ± 15 MHz, relative level –27.4 dB to –155.0 dB

33. Valid only when Equipment Standard is Type B. This parameter cannot be set when Equipment Standard is Type A or Brazil. But only Query is valid.

34. Valid only when Equipment Standard is Brazil. This parameter cannot be set when Equipment Standard is Type A or Type B. But only Query is valid.
35. When Station Power is Low or 30dB Mask. This parameter cannot be set when Station Power is High. But only Query is valid.
36. When Equipment Standard is Type A, the frequency range to measure is ± 10 MHz. When Equipment Standard is Type B and the channel number to measure is 1, the frequency range to measure is ± 15 MHz. Hereafter, every time 1 channel increases, the frequency range is enlarged by ＋6 MHz at Type B. When Equipment Standard is Brazil, the frequency range to measure is ± 15 MHz.
37. p = Starting point of data readout on the horizontal axis (0 to 5000)
    d = Number of data
    l = Level
38. Valid when Equipment Standard is Type A or Type B. Query is invalid when the Equipment Standard is Brazil.
39. Valid only when Equipment Standard is Brazil. Query is invalid when the Equipment Standard is Type A or Type B.
40. p = Starting frequency of data readout on the horizontal axis
    d = Number of data
    l = Level
    f = Frequency
41. At least one of the waveform display settings for Last Result, Uncorrection Results, and Filter Data must be enabled.
42. Hidden waveforms cannot be specified as the marker trace target.

Frequency Counter (Notes 5, 43)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Storage mode	Normal	STRG_FCNTΔNRM	STRG_FCNT?	NRM	
	Average	STRG_FCNTΔAVG	STRG_FCNT?	AVG	
	Max Hold	STRG_FCNTΔMAX	STRG_FCNT?	MAX	
Averaging count (Amount of Count)		CNT_FCNTΔn	CNT_FCNT?	n	n: 2 to 100
Refresh interval	Every	INTVAL_FCNTΔEVERY	INTVAL_FCNT?	EVERY	
	Once	INTVAL_FCNTΔONCE	INTVAL_FCNT?	ONCE	
Automatic range adjustment (Adjust Range)		ADJRNG	---	---	Disabled when Channel Map is IFBand.
Frequency		---	CARRF_FCNT?	f	Unit: Hz
Frequency error		---	CARRFERR_FCNT?	f	Unit: Hz
		---	CARRFERR_FCNT? ΔHZ	f	Unit: Hz
		---	CARRFERR_FCNT? ΔPPM	p	Unit: ppm

Note:

43. Measurement cannot be performed when System is set to TV Auto Select.

Saving/Recalling

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Saving setting parameters to memory card		SVMΔn	---	---	n: 0 to 99
Recalling setting parameters from memory card		RCMΔn	---	---	n: 0 to 99

Color Layout (disabled when measurement mode is set to Configuration)

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Color pattern selection	Pattern 1	COLORPTNΔCOLOR1	COLORPTN?	COLOR1	
	Pattern 2	COLORPTNΔCOLOR2	COLORPTN?	COLOR2	
	Pattern 3	COLORPTNΔCOLOR3	COLORPTN?	COLOR3	
	Pattern 4	COLORPTNΔCOLOR4	COLORPTN?	COLOR4	
	User Pattern	COLORPTNΔUSERCOLOR	COLORPTN?	USERCOLOR	
Color pattern copy	Pattern 1	COPYCOLORΔCOLOR1	---	---	
	Pattern 2	COPYCOLORΔCOLOR2	---	---	
	Pattern 3	COPYCOLORΔCOLOR3	---	---	
	Pattern 4	COPYCOLORΔCOLOR4	---	---	
User color definition		COLORDEFΔn,r,g,b	COLORDEF?Δn	r,g,b	Note 44

Note:

44. n: Frame number
    r: Value for red (0 to 15)
    g: Value for green (0 to 15)
    b: Value for blue (0 to 15)

Other items

Parameter		Program Msg.	Query Msg.	Response Msg.	Remark
Function	Control Item				
Initialization		PRE	---	---	Note 45
		INI	---	---	
		IP	---	---	
Measurement execution	Single measurement	SNGLS	---	---	Notes 46, 45
		SWP	---	---	Notes 47, 45
		TS	---	---	
		*TRG	---	---	
	Continuous measurement	CONTS	---	---	Note 45
Measurement status	End	---	SWP?	SWPΔ0	
	Measurement in progress	---	SWP?	SWPΔ1	
Measured result		---	MSTAT?	n	Note 48
Error message window deletion		HOLD	---	---	

Notes:

45. Refer to Section 8 in the MS8901A Operation Manual Vol. 3 for command details.

46. The next command is immediately executed.

47. The next command is not executed until measurement is complete.

48. Value of n:

    0: Normal end
    1: Level Over
    2: Over Range
    3: Under Range
    4: Signal Abnormal
    5: Symbol Unlocked
    6: Not used
    7: Carrier Unlocked
    8: Measurement timeout
    9: Not used or measurement in progress

3.3 GPIB Sample Program

This section describes examples of programs for remotely controlling the ISDB-T signal analysis function of the MX890120B using GPIB commands.

Use of the following environment is assumed: an IBM-PC/AT compatible with National Instruments AT-GPIB/TNT for Windows 2000/XP incorporated, and Microsoft Visual Basic.

For detailed information on GPIB and how to control the Spectrum Analyzer function of the MS8901A, refer to the MS8901A Operation Manual.

Add Vbib-32.bas and Niglobal.bas provided with the NI-488.2 driver as the standard module when creating a Visual Basic project in the sample program.

3.3.1 Reading measurement parameters

This section provides an example of a program used to read the parameters set on the MX8901A, including the frequency or channel, and to save them to a file.

Note:

Refer to Section 3.3.6 “Sample program for common functions” for the ReadData function.

Main procedure (measure):

```
Public Sub MeasParamRead()
    ‘Define variables
    Dim strChannelMap As String
    Dim strChannel As String
    Dim strFreq As String
    Dim strOffsetFreq As String
    Dim strSpectrum As String
    Dim strRefLevel As String
    Dim strMode As String
    Dim strGuardInterval As String
    Dim strSegment As String
    Dim strModulation As String
    Dim strPreamp As String
    ‘**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd As Integer
    Dim strListenTerm As String

    ‘Set board
    intBoardNo = 0

    ‘Set address
    intAddr = 1
    intSubAddr = 0

    ‘Set terminator
    strListenTerm = vbCrLf
```

```
'Initialize GPIB
Call ibrsc(intBoardNo, 1)
Call ibsre(intBoardNo, 1)
Call SendIFC(intBoardNo)
Call ibdev(intBoardNo, intAddr, intSubAddr, T30s, DABend, _
 Asc(strListenTerm), intUd)

'Open file destination
Open "C:\My Documents\Param.txt" For Output As #1

'Read out channel map and save it to the file
Call ibwrt(intUd, "CHASSIGN?")
Call ReadData(intBoardNo, intAddr, strChannelMap, _
 Asc(strListenTerm))
Print #1, "Channel Map :"; strChannelMap

'Read out channel and save it to the file
Call ibwrt(intUd, "CHAN?")
Call ReadData(intBoardNo, intAddr, strChannel, _
 Asc(strListenTerm))
Print #1, "Channel :"; strChannel

'Read out frequency and save it to the file
Call ibwrt(intUd, "FREQ?")
Call ReadData(intBoardNo, intAddr, strFreq, _
 Asc(strListenTerm))
Print #1, "Frequency(Hz) :"; strFreq

'Read out offset frequency and save it to the file
Call ibwrt(intUd, "FREQOFS?")
Call ReadData(intBoardNo, intAddr, strOffsetFreq, _
 Asc(strListenTerm))
Print #1, "Offset Frequency(Hz) :"; strOffsetFreq

'Read out spectrum and save it to the file
Call ibwrt(intUd, "RVSSPECT?")
Call ReadData(intBoardNo, intAddr, strSpectrum, _
 Asc(strListenTerm))
Print #1, "Spectrum :"; strSpectrum
```

```
    'Read out reference level and save it to the file
    Call ibwrt(intUd, "RFLVL?")
    Call ReadData(intBoardNo, intAddr, strRefLevel, _
     Asc(strListenTerm))
    Print #1, "Reference Level :"; strRefLevel

    'Read out mode and save it to the file
    Call ibwrt(intUd, "TRNSMODE?")
    Call ReadData(intBoardNo, intAddr, strMode, _
     Asc(strListenTerm))
    Print #1, "Mode :"; strMode

    'Read out guard interval and save it to the file
    Call ibwrt(intUd, "GINTERV?")
    Call ReadData(intBoardNo, intAddr, strGuardInterval, _
     Asc(strListenTerm))
    Print #1, "Guard Interval :"; strGuardInterval

    'Read out number of segments and save it to the file
    Call ibwrt(intUd, "SEGMENT?")
    Call ReadData(intBoardNo, intAddr, strSegment, _
     Asc(strListenTerm))
    Print #1, "Segment(A,B,C) :"; strSegment

    'Read out modulation system and save it to the file
    Call ibwrt(intUd, "SEGMOD?")
    Call ReadData(intBoardNo, intAddr, strModulation, _
     Asc(strListenTerm))
    Print #1, "Modulation(A,B,C) :"; strModulation

    'Read out pre-amplifier and save it to the file
    Call ibwrt(intUd, "PREAMP?")
    Call ReadData(intBoardNo, intAddr, strPreamp, _
     Asc(strListenTerm))
    Print #1, "Preamp :"; strPreamp

    'Close the file
    Close
End Sub
```

3.3.2 Measuring MER

The Conventional MER and the frequency are measured continuously. While saving the measured results in a file, the minimum and maximum values of MER and the frequency error are displayed on the screen.
Set the measurement parameter values as shown below:

(1) When RF is selected for Terminal

- Input connector (Terminal) : RF
- Channel Map : Interim-1
- Channel : 13ch
- Reference Level : –20 dBm
- MODE : MODE3
- Guard Interval : 1/4
- Layer_A : 64QAM, 13 segments
- Layer_B : 64QAM, 0 segments
- Layer_C : 64QAM, 0 segments

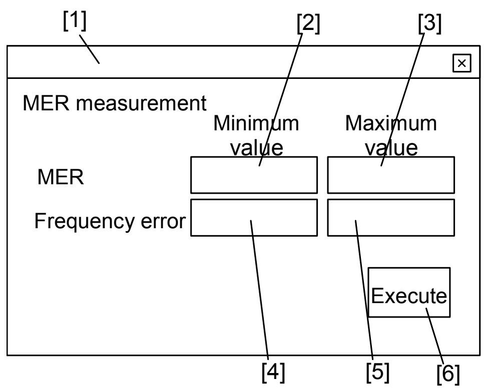


Figure 3.3.2-1 MER measurement – Frame screen

[1]: Frame
Object name: frmMER

[2]: TextBox
Object name: txtMinMER

[3]: TextBox
Object name: txtMaxMER

[4]: TextBox
Object name: txtMinFreqErr

[5]: TextBox
Object name: txtMaxFreqErr

[6]: CommandButton
Object name: btnExecute
Caption: Execute

Procedure:

```
Private Sub btnExecute_Click()
    If frmMER.btnExecute.Caption = "Execute" Then
        frmMER.btnExecute.Caption = "Stop"
        Call MerMeasure
    Else
        frmMER.btnExecute.Enabled = False
        frmMER.btnExecute.Caption = "Execute"
    End If
End Sub
```

Note:

Refer to Section 3.3.6 "Sample program for common functions" for the ReadData function.

Main procedure (measure):

```
Public Sub MerMeasure()
    'Define variables
    Dim intCount As Integer
    Dim intFlag As Integer
    Dim sngData(100) As Single
    Dim sngMER As Single
    Dim sngMaxMER As Single
    Dim sngMinMER As Single
    Dim sngFreqError As Single
    Dim sngMaxFreqError As Single
    Dim sngMinFreqError As Single
    Dim sngFreq As Double
    '**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd As Integer
    Dim strListenTerm As String
    Dim strTemp As String

    'Set board
    intBoardNo = 0

    'Set address
    intAddr = 1
    intSubAddr = 0
```

```
'Set terminator
strListenTerm = vbCrLf

'Initialize GPIB
Call ibrsc(intBoardNo, 1)
Call ibsre(intBoardNo, 1)
Call SendIFC(intBoardNo)
Call ibdev(intBoardNo, intAddr, intSubAddr, T30s, DABend, _
Asc(strListenTerm), intUd)

'Sets initial maximum/minimum values
sngMaxMER = 0
sngMinMER = 100
sngMaxFreqError = –10000
sngMinFreqError = 10000

'Select signal analysis mode
Call ibwrt(intUd, "PNLMD SYSTEM")

'Execute initialization
Call ibwrt(intUd, "PRE")

'Set input connector to RF
Call ibwrt(intUd, "ISDBTTERM RF")

'Set channel map to Interim1
Call ibwrt(intUd, "CHASSIGN INTERIM1")

'Set channel to 13
Call ibwrt(intUd, "CHAN 13")

'Set level control method to Ref_Setting
Call ibwrt(intUd, "LVLCTRL REF")

'Set reference level to –20 dBm
Call ibwrt(intUd, "RFLVL –20")

'Set mode to MODE3
Call ibwrt(intUd, "TRNSMODE 3")

'Set guard interval to 1/4
Call ibwrt(intUd, "GINTERV 1PER4")
```

```
'Set modulation system to 64QAM and set number of segments to 13
Call ibwrt(intUd, "SEGMENT 13,0,0")
Call ibwrt(intUd, "SEGMOD 64QAM,64QAM,64QAM")

'Move to Modulation Analysis screen
Call ibwrt(intUd, "DSPL MODANAL")

'Move to No Trace screen on Modulation Analysis screen
Call ibwrt(intUd, "TRFORM NON")

'Open file destination
Open "C:\My Documents\MER.txt" For Output As #1

'Measurement loop
Do
    'Single measurement
    Call ibwrt(intUd, "SWP")

    'Obtain MER (Conventional)
    Call ibwrt(intUd, "MER? CONV")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngMER = Val(strTemp)

    'Obtain frequency
    Call ibwrt(intUd, "CARRF?")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngFreq = Val(strTemp))

    'Obtain frequency error
    Call ibwrt(intUd, "CARRFERR? HZ")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngFreqError = Val(strTemp))

    'Write date, time and measured results to the file
    Print #1, Date;",";Time; ","; Format(sngFreq, "#.0"); ","; _
        Format(sngMER, "#.00")

    'Find out the maximum value
    If sngMER > sngMaxMER Then
        sngMaxMER = sngMER
```

```
        End If
        If sngFreqError > sngMaxFreqError Then
            sngMaxFreqError = sngFreqError
        End If

        'Find out the minimum value
        If sngMER < sngMinMER Then
            sngMinMER = sngMER
        End If
        If sngFreqError < sngMinFreqError Then
            sngMinFreqError = sngFreqError
        End If

        'Display maximum/minimum values on screen
        frmMER.txtMaxMER.Text = sngMaxMER
        frmMER.txtMinMER.Text = sngMinMER
        frmMER.txtMaxFreqErr.Text = sngMaxFreqError
        frmMER.txtMinFreqErr.Text = sngMinFreqError

        'Confirm if the stop button has been pressed
        DoEvents
        If frmMER.btnExecute.Enabled = False Then Exit Do


    Loop

    'Close the file
    Close

End Sub
```

(2) When IQ-DC is selected for Terminal (with MS8901A-18 installed)

- Input connector (Terminal) : IQ-DC
- Impedance : 50 Ω
- Frequency : 500 kHz
- MODE : MODE3
- Guard Interval : 1/4
- Layer_A : 64QAM (PR), 1 segment
- Layer_B : 64QAM, 12 segments
- Layer_C : 64QAM, 0 segment

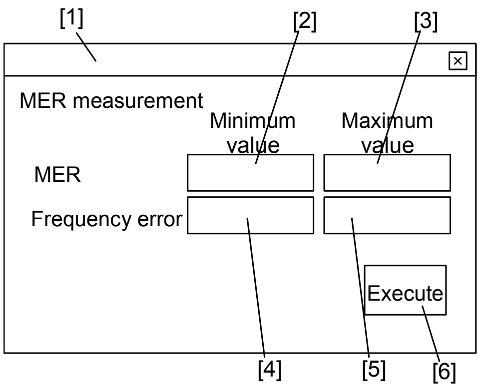


Figure 3.3.2-2 MER measurement – Frame screen

[1]: Frame
Object name: frmMER

[2]: TextBox
Object name: txtMinMER

[3]: TextBox
Object name: txtMaxMER

[4]: TextBox
Object name: txtMinFreqErr

[5]: TextBox
Object name: txtMaxFreqErr

[6]: CommandButton
Object name: btnExecute
Caption: Execution

Procedure:
```
Private Sub btnExecute_Click()
    If frmMER.btnExecute.Caption = "Execution" Then
        frmMER.btnExecute.Caption = "Stop"
        Call MerMeasure
    Else
        frmMER.btnExecute.Enabled = False
        frmMER.btnExecute.Caption = "Stop"
    End If
End Sub
```

Note:

Refer to Section 3.3.6 “Sample program for common functions” for the ReadData function.

Main procedure:
```
Public Sub MerMeasure()
    'Variable definition
    Dim intCount As Integer
    Dim intFlag As Integer
    Dim sngData(100) As Single
    Dim sngMER As Single
    Dim sngMaxMER As Single
    Dim sngMinMER As Single
    Dim sngFreqError As Single
    Dim sngMaxFreqError As Single
    Dim sngMinFreqError As Single
    Dim sngFreq As Double
    '**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd     As Integer
    Dim strListenTerm As String
    Dim strTemp As String

    'Set board
    intBoardNo = 0

    'Set address
    intAddr = 1
    intSubAddr = 0
```

```
'Set terminator
strListenTerm = vbCrLf

'Initialize GPIB
Call ibrsc(intBoardNo, 1)
Call ibsre(intBoardNo, 1)
Call SendIFC(intBoardNo)
Call ibdev(intBoardNo, intAddr, intSubAddr, T30s, DABend, _
Asc(strListenTerm), intUd)

'Set max. and min. initial values
sngMaxMER = 0
sngMinMER = 100
sngMaxFreqError = –10000
sngMinFreqError = 10000

'Select signal analysis mode
Call ibwrt(intUd, "PNLMD SYSTEM")

'Initialization
Call ibwrt(intUd, "PRE")

'Set input connector to IQ-DC
Call ibwrt(intUd, "ISDBTTERM IQDC")

'Set impedance to 50 Ω
Call ibwrt(intUd, "TERMINZ 50")

'Set frequency to 500 kHz
Call ibwrt(intUd, "FREQ 500KHz")

'Set mode to MODE3
Call ibwrt(intUd, "TRNSMODE 3")

'Set guard interval to 1/4
Call ibwrt(intUd, "GINTERV 1PER4")

'Set modulation mode to partial reception 64QAM, and number
 of segments to 1,12,0
Call ibwrt(intUd, "SEGMENT 1,12,0")
Call ibwrt(intUd, "SEGMOD PR64QAM,64QAM,64QAM")

'Shift to Modulation Analysis screen
Call ibwrt(intUd, "DSPL MODANAL")
```

```
'Set to partial reception (1 segment)
Call ibwrt(intUd, "RECVSEG 1SEG")

'Shift to No Trace screen of Modulation Analysis
Call ibwrt(intUd, "TRFORM NON")

'Open file saving destination
Open "CMy DocumentsMER.txt" For Output As #1

'Measurement loop
Do
    '1 measurement
    Call ibwrt(intUd, "SWP")

    'Obtain MER(Conventional)
    Call ibwrt(intUd, "MER? CONV")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngMER = Val(strTemp)

    'Obtain frequency
    Call ibwrt(intUd, "CARRF?")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngFreq = Val(strTemp)

    'Obtain the frequency error
    Call ibwrt(intUd, "CARRFERR? HZ")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc(strListenTerm))
    sngFreqError = Val(strTemp)
    'Write date and measured result to file
    Print #1, Date; ","; Time; ","; Format(sngFreq, "#.0"); ","; _
        Format(sngMER, "#.00")

    'Search the maximum value
    If sngMER > sngMaxMER Then
        sngMaxMER = sngMER
    End If
    If sngFreqError > sngMaxFreqError Then
        sngMaxFreqError = sngFreqError
    End If
```

```
            'Search the minimum value
            If sngMER < sngMinMER Then
                sngMinMER = sngMER
            End If
            If sngFreqError < sngMinFreqError Then
                sngMinFreqError = sngFreqError
            End If

            'Display the maximum and minimum values in the screen
            frmMer.txtMaxMER.Text = sngMaxMER
            frmMer.txtMinMER.Text = sngMinMER
            frmMer.txtMaxFreqErr.Text = sngMaxFreqError
            frmMer.txtMinFreqErr.Text = sngMinFreqError

            'Check if the Stop button is pressed
            DoEvents
            If frmMer.btnExecute.Enabled = False Then Exit Do

        Loop

        'Close file
        Close

    End Sub
```

3.3.3 Measuring constellation

The constellation I and Q values are read out and the I and Q data is saved to a file while displaying the constellation on the screen.
The reception signal is assumed to be as shown below:

Modulation mode	: MODE1
Guard interval	: 1/4
Layer_A	: 64QAM, 13 segments

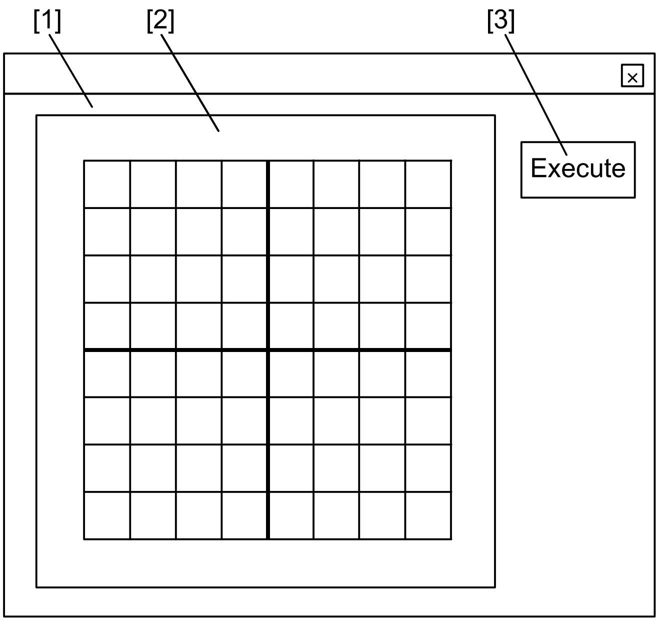


Figure 3.3.3-1 Constellation measurement – Frame screen

[1]: Frame
Object name: frmConstellation

[2]: PictureBox
Object name: picGraph
Height: 6000
ScaleHeight: 20
ScaleLeft: –10
ScaleTop: –10
ScaleWidth: 20
Width: 6000

[3]: CommandButton
Object name: btnExecute
Caption: Execute

Procedure:

```
Public Sub btnExecute_Click()
    frmConstellation.btnExecute.Enabled = False
    Call ConstellationMeasure
End Sub
```

Note:

Refer to Section 3.3.6 “Sample program for common functions” for the ReadData function.

Main procedure:

```
Public Sub ConstellationMeasure()
    ‘Define variables
    Dim intN As Integer
    Dim sngI(5000) As Single
    Dim sngQ(5000) As Single
    ‘**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd As Integer
    Dim strListenTerm As String
    Dim strTemp As String

    ‘Set board
    intBoardNo = 0

    ‘Set address
    intAddr = 1
    intSubAddr = 0

    ‘Set terminator
    strListenTerm = vbCrLf

    ‘Initialize GPIB
    Call ibrsc(intBoardNo, 1)
    Call ibsre(intBoardNo, 1)
    Call SendIFC(intBoardNo)
    Call ibdev(intBoardNo, intAddr, intSubAddr, T30s, DABend, _
        Asc(strListenTerm), intUd)
```

```
'Initialize graph screen
frmConstellation.picGraph.Cls

'Open file destination
Open "C:\My Documents\Constellation.txt" For Output As
#1

'Loop for reading I,Q data
For intN = 1 To 4992
  DoEvents
   'Read out constellation waveform data (I, Q)
   Call ibwrt(intUd, "XMC? LAYERA,0," + Str(intN) + ",1")
   Call ReadData(intBoardNo, intAddr, strTemp, _
       Asc(strListenTerm))
   sngI(intN) = Val(strTemp)
   Call ibwrt(intUd, "XMC? LAYERA,1," + Str(intN) + ",1")
   Call ReadData(intBoardNo, intAddr, strTemp, _
       Asc(strListenTerm))
   sngQ(intN) = Val(strTemp)

   'Write point number, I data and Q data to the file
   Print #1, intN; ","; sngI(intN); ","; sngQ(intN)

   'Write constellation waveform data to graph screen
   frmConstellation.picGraph.Circle (sngI(intN),
   -sngQ(intN)), 0.01
Next intN

'Close the file
Close

'Enable the Execute button
frmConstellation.btnExecute.Enabled = True

End Sub
```

3.3.4 C/N measurement

Enter the carrier frequency to be measured in [2] in Figure 3.3.4-1 below. The C/N measured results at offset frequencies of 1 kHz, 10 kHz and 100 kHz are displayed on the screen by averaging the measured results for 100 measurements.

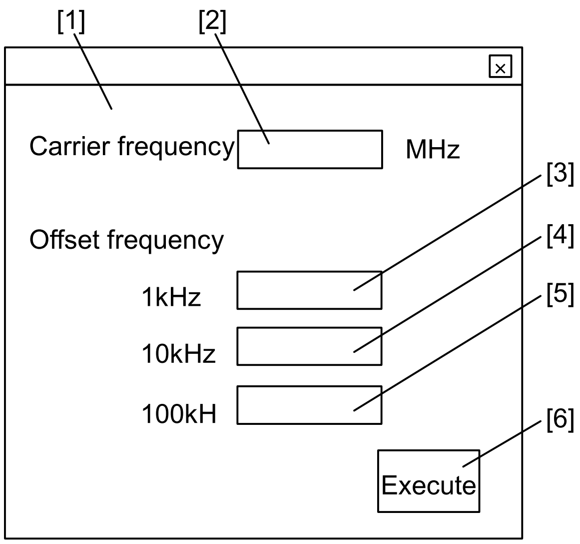


Figure 3.3.4-1 C/N measurement – Frame screen

[1]: Frame
Object name: frmCN

[2]: TextBox
Object name: txtFreq

[3]: TextBox
Object name: txtCN1kHz

[4]: TextBox
Object name: txtCN10kHz

[5]: TextBox
Object name: txtCN100kHz

[6]: CommandButton
Object name: btnExecute
Caption: Execute

Procedure:

```
Private Sub btnExecute_Click()
    frmCN.btnExecute.Enabled = False
    Call CNMeasure
End Sub
```

Note:

Refer to Section 3.3.6 “Sample program for common functions” for the ReadData and Wait_delay functions.

Main procedure:

```
Public Sub CNMeasure()
    'Define variables
    Dim intCount As Integer
    Dim sngData(100) As Single
    Dim intFlag As Integer
    Dim strFreq As String
    Dim sngCN1kHz As Single
    Dim sngCN10kHz As Single
    Dim sngCN100kHz As Single
    '**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd As Integer
    Dim strListenTerm As String
    Dim strTemp As String

    'Set board
    intBoardNo = 0

    'Set address
    intAddr = 1
    intSubAddr = 0

    'Set terminator
    strListenTerm = vbCrLf
```

```
'Initialize GPIB
Call ibrsc(intBoardNo, 1)
Call ibsre(intBoardNo, 1)
Call SendIFC(intBoardNo)
Call ibdev(intBoardNo, intAddr, intSubAddr, TNONE,_
    DABend, Asc(strListenTerm), intUd)

'Initialize MS8901A
Call ibwrt(intUd, "PRE")

'Select Channel Map
Call ibwrt(intUd, "CHASSIGN GENERAL")

'Select C/N measurement screen
Call ibwrt(intUd, "DSPL CN")

'Set reference level to –20 dBm
Call ibwrt(intUd, "RFLVL –20")

'Set storage mode to average
Call ibwrt(intUd, "STRG_CN AVG")

'Set averaging count to 100
Call ibwrt(intUd, "CNT_CN 100")

'Read out set frequency
strFreq = frmCN.txtFreq.Text

'Set frequency on MS8901A
Call ibwrt(intUd, "FREQ " + strFreq + "MHZ")

'Single measurement
Call ibwrt(intUd, "SWP")

'Wait measurement completion in 1-sec steps
Do
Wait_delay (1#)
    Call ibwrt(intUd, "SWP?")
    Call ReadData(intBoardNo. intAddr, strTemp, _
       Asc(strListenTerm))
Loop While strTemp <> "SWP 0"
```

```
    'Read out C/N
    Call ibwrt(intUd, "MKL_CN? 1000")
    Call ReadData(intBoardNo, intAddr, strTemp, _
    Asc (strListenTerm))
    frmCN.txtCN1kHz.Text = strTemp
    Call ibwrt(intUd, "MKL_CN? 10000")
    Call ReadData(intBoardNo, intAddr, strTemp, _
    Asc (strListenTerm))
    frmCN.txtCN10kHz.Text = strTemp
    Call ibwrt(intUd, "MKL_CN? 100000")
    Call ReadData(intBoardNo, intAddr, strTemp, _
    Asc (strListenTerm))
    frmCN.txtCN100kHz.Text = strTemp

    'Enable the Execute button
    frmCN.btnExecute.Enabled = True

End Sub
```

3.3.5 Spectrum mask measurement

The occupied frequency and judgement result are read and displayed on the screen.

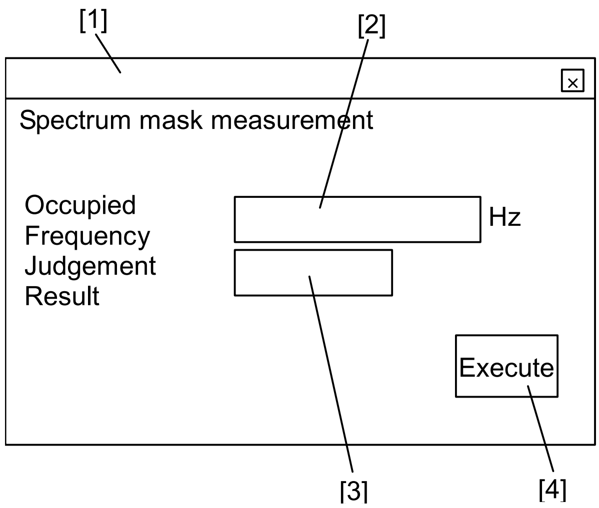


Figure 3.3.5-1 Spectrum mask measurement – Frame screen

[1]: Frame
Object name: frmSpectrummask

[2]: TextBox
Object name: txtOBW

[3]: TextBox
Object name: txtCheckmask

[4]: CommandButton
Object name: btnExecute
Caption: Execute

Procedure:

```
Public Sub btnExecute_Click()
    frmSpectrummask Enabled = False
    Call SpectrummaskMeasure
End Sub
```

Note:

Refer to Section 3.3.6 “Sample program for common functions” for the ReadData and Wait_delay functions.

Main procedure:

```
Public Sub SpectrummaskMeasure()
    'Define variables
    Dim intMASK_STS As Integer
    '**
    Dim intBoardNo As Integer
    Dim intAddr As Integer
    Dim intSubAddr As Integer
    Dim intUd As Integer
    Dim strListenTerm As String
    Dim strTemp As String

    'Set board
    intBoardNo = 0

    'Set address
    intAddr = 1
    intSubAddr = 0

    'Set terminator
    strListenTerm = vbCrLf

    'Initialize GPIB
    Call ibrsc(intBoardNo, 1)
    Call ibsre(intBoardNo, 1)
    Call SendIFC(intBoardNo)
    Call ibdev(intBoardNo, intAddr, intSubAddr, T30s, DABend,
    _Asc(strListenTerm), intUd)

    'Initialize MS8901A
    Call ibwrt(intUd, "PRE")

    'Select Spectrum Mask measurement screen
    Call ibwrt(intUd, "DSPL MASK")

    'Select MASK line
    Call ibwrt(intUd, "SPMASK TRANS")

    'Single measurement
    Call ibwrt(intUd, "SINGLS")
```

```
    'Wait measurement completion in 1-sec steps
    Do
    Wait_delay (1#)
        Call ibwrt(intUd, "SWP?")
        Call ReadData(intBoardNo. intAddr, strTemp, _
            Asc(strListenTerm))
    Loop While strTemp <> "SWP 0"

    'Wait measurement completion in 1/5-sec steps
    Do
    Wait_delay (1#)
        Call ibwrt(intUd, "MASK_STS?")
        Call ReadData(intBoardNo. intAddr, strTemp, _
            Asc(strListenTerm))
        intMASK_STS = Val(strTemp)
    Loop While intMASK_STS <> 0

    'Obtain occupied frequency bandwidth
    Call ibwrt(intUd, "OBW?")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc (strListenTerm))
    frmSpectrummask.txtOBW.Text = strTemp

    'Obtain judgement result
    Call ibwrt(intUd, "MASK_CHECK?")
    Call ReadData(intBoardNo, intAddr, strTemp, _
        Asc (strListenTerm))
    frmSpectrummask.txtCheckmask.Text = strTemp

End Sub
```

3.3.6 Sample program for common functions

This section provides a program example of the common functions used in the sample programs in Section 3.3.1 "Reading measurement parameters" through 3.3.5 "Spectrum mask measurement."

ibdev( ) and Receive() are functions provided by the NI-488.2 driver. Refer to the online manual provided by National Instruments for details of these functions.

```
Subroutine (ReadData):
    Sub ReadData(ByVal ud As Integer, ByVal addr As Integer, _
        buf As String, ByVal term As Integer)
        Dim intJc As Integer
        Dim intIc As Integer

        buf = Space(255)'Space compensation

        Call Receive(ud, addr, buf, term)

        intJc = InStr(buf, vbLf)      'LF detection point
        intIc = InStr(buf, vbCrLf)  'CR/LF detection point
        If intIc% <> 0 Then
            'Processing for CR/LF detection
            If intIc < intJc Then
                buf = Mid$(buf, 1, intIc% - 1)
            Else
                buf = Mid$(buf, 1, intJc% - 1)
            End If
        If intJc% <> 0 Then
            'Processing for LF detection
            buf = Mid$(buf, 1, intJc% - 1)
            Else
                'Processing for EOI only
                buf = Mid$(buf, 1, ibcntl)
            End If
    End Sub
```

Subroutine (Wait_delay):

```
Public Function Wait_delay(PauseTime As Single)
    Dim Start, Finish
    Start = Timer                 'Sets interruption start time
    Finish = Start + PauseTime    'Sets interruption end time
    Do While Timer < Finish
        DoEvents                  'Transfers the control to an-
                                  other process
    Loop
End Function
```

3.4 ETHERNET Sample Program

This section provides examples of programs for remotely controlling the ISDB-T signal analysis function of the MX890120B via ETHERNET.

Use of the following environment is assumed: an IBM-PC/AT compatible with ETHERNET card incorporated, and Microsoft Visual Basic.

For details of the ETHERNET card, refer to the operation manual of the ETHERNET manufacturer.

For how to control the Spectrum Analyzer function of the MS8901A, refer to the MS8901A Operation Manual.

3.4.1 Measuring constellation

The constellation I and Q values are read out and the I and Q data is saved to a file while displaying the constellation on the screen.

The following is assumed in this sample program.

- IBM-PC/AT compatible side IP address : 192.168.100.123
- MS8901A side IP address : 192.168.100.100
- MS8901A side port number : 9111

The reception signal is assumed to be as shown below:

Modulation mode	: MODE1
Guard interval	: 1/4
Layer_A	: 64QAM, 13 segments

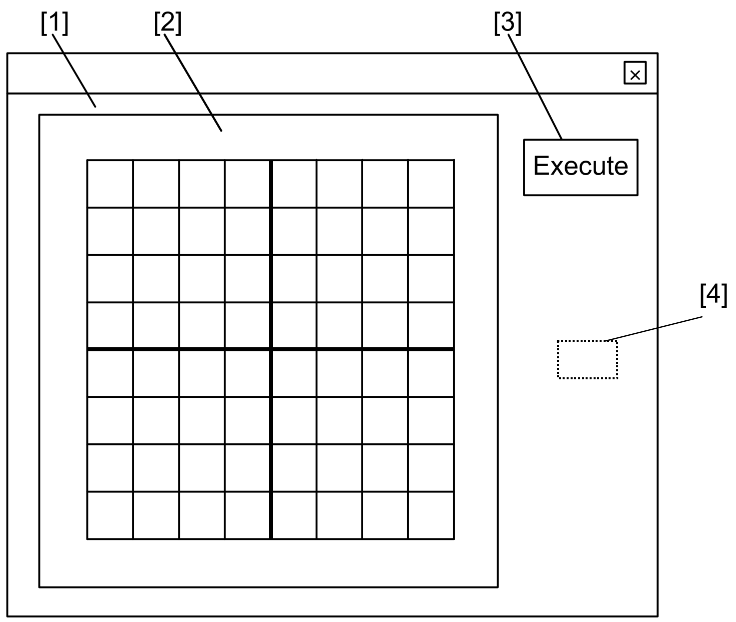


Figure 3.4.1-1 Constellation measurement – Frame screen

[1]: Frame
Object name: frmConstellation

[2]: PictureBox
Object name: picGraph
Height: 6000
ScaleHeight: 20
ScaleLeft: –10
ScaleTop: –10
ScaleWidth: 20
Width: 6000

[3]: CommandButton
Object name: btnExecute
Caption: Execute

[4]: Winsock
Object name: WinsockConstellation

```
'Procedure:
Public WaitConnectFlg As Boolean      ‘Connection wait flag
Public SendFlg As Boolean             ‘Transmission end flag
Public RcvData As String              ‘Reception data buffer

Public Sub btnExecute_Click()
    frmConstellationSocket.btnExecute.Enabled = False
    Call ConstellationMeasure
 End Sub

 ‘Event processing when connection established
 Private Sub WinsockConstellation_Connect()
         ‘Set connection wait flag
         WaitConnectFlg = True
 End Sub

 ‘Event processing on data reception
 Private Sub WinsockConstellation_DataArrival( _
             ByVal bytesTotal As Long)
         ‘Read reception data to reception data buffer
         WinsockConstellation.GetData RcvData, vbByte
 End Sub

 ‘Event processing on data transmission end
 Private Sub WinsockConstellation_SendComplete()
         ‘Set transmission end flag
         SendFlg = True
 End Sub

'Main procedure:
Public Sub ConstellationMeasure()
    'Variable definition
    Dim intN As Integer
    Dim sngI(5000) As Single
    Dim sngQ(5000) As Single
    '**
    Dim strListenTerm As String
    Dim strTemp As String

    'Set IP address and port number
    frmConstellationSocket.WinsockConstellation.RemoteHost _
     = "192.168.100.100"
    frmConstellationSocket.WinsockConstellation.RemotePort = 9111
```

```
    'Set terminator
    strListenTerm = vbCrLf

    'Establish connection
    frmConstellationSocket.WaitConnectFlg = False
                                'Clear connection wait flag
    frmConstellationSocket.WinsockConstellation.Connect
    Call WaitConnection         'Wait connection

    'Initialize graph screen
    frmConstellationSocket.picGraph.Cls

    'Open file saving destination
    Open "C:\My Documents\Constellation.txt" For Output As #1

    'Loop for reading I and Q data
    For intN = 1 To 4992
        DoEvents
        'Read constellation waveform data (I, Q)
        SendDataSocket "XMC? LAYERA,0," + Str(intN) + ",1"
        Call ReadDataSocket (strTemp, Asc(strListenTerm))
        sngI(intN) = Val(strTemp)
        SendDataSocket "XMC? LAYERA,1," + Str(intN) + ",1"
        Call ReadDataSocket (strTemp,Asc(strListenTerm))
        sngQ(intN) = Val(strTemp)

        'Write point number and I, Q data to file
        Print #1, intN; ","; sngI(intN); ","; sngQ(intN)

        'Write constellation waveform data to graph screen
        frmConstellationSocket.picGraph.Circle (sngI(intN), _
          -sngQ(intN)), 0.01
    Next intN

    'Close file
    Close

    'Enable the Execution button
    frmConstellationSocket.btnExecute.Enabled = True

End Sub

 'Subroutine:
```

```
'Process wait connection
Sub WaitConnection()
        Do
                DoEvents
        Loop Until frmConstellationSocket.WaitConnectFlg = True
End Sub


'Transmit data
Sub SendDataSocket(buf As String)
        frmConstellationSocket.RcvData = ""     'Clear reception buffer
        frmConstellationSocket.SendFlg = False 'Clear transmission
end flag
        'Transmit data
        frmConstellationSocket.WinsockConstellation.SendData buf
& _
           strListenTerm

        'Wait transmission end
        Do
                DoEvents
        Loop Until frmConstellationSocket.SendFlg = True

End Sub

'Receive data
Sub ReadDataSocket(buf As String, ByVal term As Integer)
        Dim intJc As Integer

        buf = "" 'Clear buffer


        'Read receive data
        Do
                'Process data reception wait
                Do
                        DoEvents
                Loop Until frmConstellationSocket.RcvData <> ""
                buf = buf & frmConstellationSocket.RcvData
                frmConstellationSocket.RcvData = ""   'Clear reception buffer

                'Detect if up to the terminator is read
                intJc = InStr(buf, vbLf)     'LF detection position
```

```
        If intJc <> 0 Then
            Exit Do
        End If
    Loop

    'Delete terminator
    intJc = InStr(buf, vbLf)          'LF detection position
    If intJc <> 0 Then                'Processing at LF detection
        buf = Mid$(buf, 1, intJc% - 1)
    End If

End Sub
```

3.5 RS-232C Sample Program

This section provides an example of a program for remotely controlling the ISDB-T signal analysis function of the MX890120B using RS-232C.

Use of the following environment is assumed: an IBM-PC/AT compatible with an RS-232C port, and Microsoft Visual Basic.

Refer to the MS890120B Operation Manual, for how to control the Spectrum Analyzer function of the MS8901A.

3.5.1 Measuring constellation

The constellation I and Q values are read out and the I and Q data are saved to a file while the constellation is displayed on the screen.

The following parameters are assumed in this sample program.

- RS-232C on IBM-PC/AT compatible: CommPort1
- RS-232C on MS8901A

Baud Rate:	9600 bps
Parity:	Off
Data Bits:	8 bits
Stop Bit:	1 bit
XON/XOFF Flow Control:	On

The reception signal is assumed to be as shown below:

- Modulation mode: MODE1
- Guard Interval: 1/4
- Layer-A: 64QAM, 13 segment

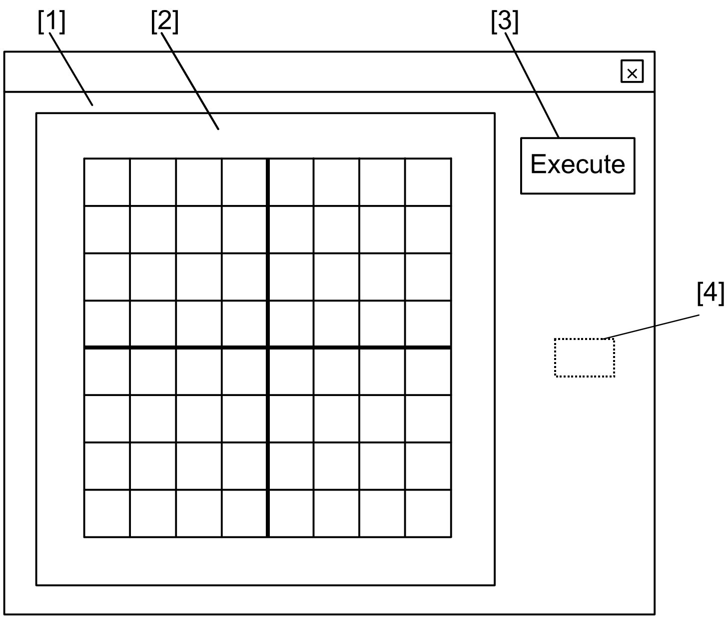


Figure 3.5.1-1 Constellation measurement – Frame screen

[1]: Frame
Object name: frmConstellation

[2]: PictureBox
Object name: picGraph
Height: 6000
ScaleHeight: 20
ScaleLeft: –10
ScaleTop: –10
ScaleWidth: 20
Width: 6000

[3]: CommandButton
Object name: btnExecute
Caption: Execute

[4]: Winsock
Object name: WinsockConstellation
CommPort: 1

```
Public strListenTerm As String
Public Sub ConstellationMeasureSerial()
'Define variables
Dim intN As Integer
Dim sngI(5000) As Single
Dim sngQ(5000) As Single
'**
Dim strTemp As String
```

```
    'Set terminator
    strListenTerm = vbLf

    'Initialize RS-232C
    frmConstellationSerial.MSCommConstellation.Settings = _
  "9600,N,8,1"
    frmConstellationSerial.MSCommConstellation.Handshaking   =
    _
  comXOnXoff
    frmConstellationSerial.MSCommConstellation.RTSEnable     =
    True
    frmConstellationSerial.MSCommConstellation.PortOpen = True

'Initialize graph screen
frmConstellationSerial.picGraph.Cls

'Open the file destination
Open "C:\My Documents\Constellation.txt" For Output As #1

'Loop for reading I, Q data
For intN = 1 To 4992
DoEvents
'Read out constellation waveform data (I, Q)
SendDataSerial "XMC? LAYERA,0," + Str(intN) + ",1"
Call ReadDataSerial(strTemp, Asc(strListenTerm))
sngI(intN) = Val(strTemp)
SendDataSerial "XMC? LAYERA,1," + Str(intN) + ",1"
Call ReadDataSerial(strTemp, Asc(strListenTerm))
sngQ(intN) = Val(strTemp)

'Write point number, I data and Q data to the file
Print #1, intN; ","; sngI(intN); ","; sngQ(intN)

 'Write constellation waveform data to graph screen
frmConstellationSerial.picGraph.Circle (sngI(intN), _
 -sngQ(intN)), 0.01
Next intN

'Close the file
Close

   'Close the port
   frmConstellationSerial.MSCommConstellation.PortOpen = False
```

```
'Enable the Execute button
frmConstellationSerial.btnExecute.Enabled = True

End Sub
Sub SendDataSerial(buf As String)
    frmConstellationSerial.MSCommConstellation.InBufferCount = 0
    _
'Clear reception buffer
    'Transmit data
    frmConstellationSerial.MSCommConstellation.Output = buf & _
    strListenTerm
End Sub
Function ReadDataSerial(buf As String, ByVal term As Integer) _
As String
    Dim intJc As Integer
    buf = "" 'Clear buffer
    'Read receive data
    Do
    'Process data reception wait
        Do
            buf = _
    buf & frmConstellationSerial.MSCommConstellation.Input
            DoEvents
        Loop Until _
    frmConstellationSerial.MSCommConstellation.InBufferCount = 0
            'Detect if up to the terminator is read
            intJc = InStr(buf, strListenTerm) 'LF detection position
            If intJc <> 0 Then
                Exit Do
            End If
        Loop
        'Delete terminator
        intJc = InStr(buf, strListenTerm) 'LF Detection position
        If intJc <> 0 Then 'Processing at LF detection
            buf = Mid$(buf, 1, intJc% - 1)
        End If
    End Function
```

Chapter 4 Performance Test

This chapter describes the performance test for the ISDB-T signal analysis function of the MS8901A Digital Broadcast Signal Analyzer in which the MX890120B ISDB-T Signal Analysis Software is installed.
Refer to the MS8901A Operation Manual for the performance test procedures of the spectrum analyzer function.

4.1 When Performance Test Is Required

The performance test is carried out as part of preventive maintenance against performance deterioration when the MX890120B ISDB-T Signal Analysis Software is installed in the MS8901A Digital Broadcast Signal Analyzer. It should be performed in the incoming acceptance inspection and regular inspection of the MS8901A + MX890120B, and to check the performance following repairs.

Be sure to regularly implement performance test items deemed important as preventive maintenance. Regular tests are recommended to be carried out about once or twice a year.

Check the following performance test items:
- Frequency measurement accuracy (modulation wave)
- Frequency lock range
- Residual C/N
- Frequency measurement accuracy (CW)
- Frequency measurement accuracy (modulation wave) with MS8901A-18 installed
- Frequency lock range with MS8901A-18 installed

If you find an item that does not meet the specifications during the performance test, please contact your local Anritsu Sales Representative or Service Center.

4.2 List of Equipment for Performance Test

Test item	Name	Recommended model	Required performance
Frequency measurement accuracy (modulation wave)	Digital Broadcast Signal Generator	MG8940A	Output frequency 30 MHz to 1 GHz, conforming to the ISDB-T standards
	Power Meter	ML2437A	Input/output frequency: 30 to 200 MHz
	Power Sensor	MA2422A	Thermal sensor
	Amplifier	A3000-2-M	Input/output frequency: 30 to 200 MHz, 20 dB
	3 dB Fixed Attenuator	MP721A	Input impedance: 50 Ω
Frequency lock range	Digital Broadcast Signal Generator	MG8940A	Output frequency 30 MHz to 1 GHz, conforming to the ISDB-T standards
	Power Meter	ML2437A	Input/output frequency: 30 to 200 MHz
	Power Sensor	MA2422A	Thermal sensor
Residual C/N	Signal Generator	MG3633A	Output frequency: 32 to 2700 MHz, –138 dBc/Hz
Frequency measurement accuracy (CW)	Signal Generator	MG3633A	Output frequency: 32 to 2700 MHz, –138 dBc/Hz
Frequency measurement accuracy (modulation wave) with MS8901A-18 installed	Arbitrary wave-form generator	AWG420	IQ output band 25 MHz or higher
Frequency lock range with MS8901A-18 installed	Arbitrary wave-form generator	AWG420	IQ output band 25 MHz or higher

Note:

When using the arbitrary waveform generator, the clock accuracy may be insufficient. In this case, it is recommended to use the following as the FFT clock generation source.

Device name	Recommended model
Signal generator	MG3633A

4.3 Performance Test

Warm up the DUT and measuring equipment for at least 30 minutes unless otherwise specified. We recommend that you observe the following points to ensure maximum measurement accuracy:

- Carry out the test at room temperature
- Minimize AC voltage fluctuation
- Eliminate effects from noise, vibration, dust, humidity or other problems

4.3.1 Frequency measurement accuracy (modulation wave)

(1) Specifications

- Frequency: 32 to 1000 [MHz]
- Level range: +10 to 26 dBm (pre-amplifier: Off)
  –46 to –10 dBm (pre-amplifier: On)

When one wave of the OFDM modulation signal that conforms to ISDB-T is input:

- Measurement target signal 1
  ± 0.15 Hz + (Reference frequency accuracy × Set frequency) when average count is 5 under the following conditions:

  ± 0.1 Hz + (Reference frequency accuracy × Set frequency) when average count is 40 under the following conditions:

  Mode: Mode3, Guard interval: 1/8, Segmentation offset: 512, Modulation system for all segments of Layers_A to C: 64QAM

- Measurement target signal 2
  ±1.6 Hz + (Reference frequency accuracy × Set frequency) under the following conditions:

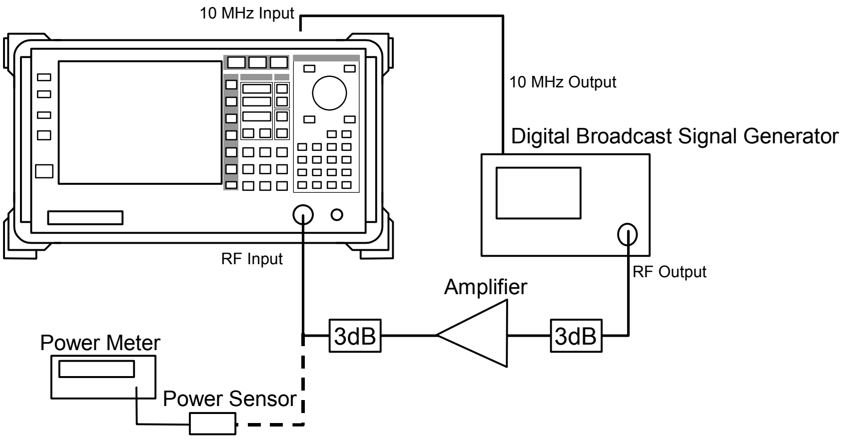
  Mode: Mode1, Guard interval: 1/4, Segmentation offset: 128, Modulation system for all segments of Layers_A to C: DQPSK, Average count: 5

(2) Measuring instruments used in testing

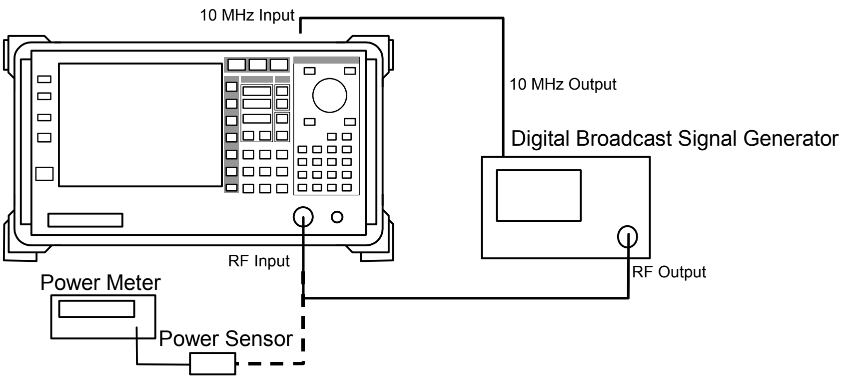
Name	Recommended model
Digital Broadcast Signal Generator	MG8940A
Power Meter	ML2437A
Power Sensor	MA2422A
Amplifier	A3000-2-M
3 dB Fixed Attenuator	MP721A

(3) Setup

When pre-amplifier: Off



When pre-amplifier: On



(4) Test procedure

Step	Operation
1.	Initialize the Digital Broadcast Signal Generator. Then set as follows: Frequency: 32 MHz Modulation mode: Mode3 Guard interval: 1/8 Modulation system: 64QAM, 13 segments
2.	Initialize the MS8901A. Then set as follows: Channel map: General Frequency: 32 MHz Level control: Ref Setting Reference level: +10 dBm Modulation mode: Mode3 Guard interval: 1/8 Modulation system: 64QAM, 13 segments No Trace screen Pre-amplifier: Off Segmentation offset: 512 Storage mode: Average Average count: 5 Recv. Seg: 13 Seg
3.	Connect the 3 dB fixed attenuator on the amplifier output side to the power sensor. Adjust the output level of the Digital Broadcast Signal Generator so that the output level becomes +10 dBm. This setting level is Po [dBm].
4.	Connect the 3 dB fixed attenuator to the MS8901A.
5.	Press the Single key on the MS8901A to perform Frequency Error (Hz) measurement.
6.	Set the level of the Digital Broadcast Signal Generator to Po – 36[dBm] (–26 dBm at MS8901A input.)
7.	Set the reference level of the MS8901A to –26 dBm. Press the Single key to perform Frequency Error (Hz) measurement.
8.	Repeat Steps 1 through 7 to perform measurements for the parameter sets described in (5). Remove the 3 dB fixed attenuator and amplifier when the pre-amplifier is On.

(5) Measured results

- Measurement target signal 1, Pre-amplifier: Off, Mode: Mode3, Segmentation offset: 512, Modulation system: 64QAM, Storage mode: Average, Average count: 5

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	+10	–0.15	–0.14		0.14	0.15	0.01
2	32	–26	–0.15	–0.14		0.14	0.15	0.01
3	500	+10	–0.15	–0.14		0.14	0.15	0.01
4	500	–26	–0.15	–0.14		0.14	0.15	0.01
5	1000	+10	–0.15	–0.14		0.14	0.15	0.01
6	1000	–26	–0.15	–0.14		0.14	0.15	0.01

- Measurement target signal 1, Pre-amplifier: Off, Mode: Mode3, Segmentation offset: 512, Modulation system: 64 QAM, Storage mode: Average, Average Count: 40

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	+10	–0.10	–0.09		0.09	0.10	0.01
2	32	–26	–0.10	–0.09		0.09	0.10	0.01
3	500	+10	–0.10	–0.09		0.09	0.10	0.01
4	500	–26	–0.10	–0.09		0.09	0.10	0.01
5	1000	+10	–0.10	–0.09		0.09	0.10	0.01
6	1000	–26	–0.10	–0.09		0.09	0.10	0.01

- Measurement target signal 2, Pre-amplifier: Off, Mode: Mode1, Segmentation offset: 128, Modulation system: DQPSK, Storage mode: Average, Average count: 5

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	+10	–1.6	–1.5		1.5	1.6	0.1
2	32	–26	–1.6	–1.5		1.5	1.6	0.1
3	500	+10	–1.6	–1.5		1.5	1.6	0.1
4	500	–26	–1.6	–1.5		1.5	1.6	0.1
5	1000	+10	–1.6	–1.5		1.5	1.6	0.1
6	1000	–26	–1.6	–1.5		1.5	1.6	0.1

- Measurement target signal 1, Pre-amplifier: On, Mode: Mode3, Segmentation offset: 512, Modulation system: 64 QAM, Storage mode: Average, Average Count: 5

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	–10	–0.15	–0.14		0.14	0.15	0.01
2	32	–46	–0.15	–0.14		0.14	0.15	0.01
3	500	–10	–0.15	–0.14		0.14	0.15	0.01
4	500	–46	–0.15	–0.14		0.14	0.15	0.01
5	1000	–10	–0.15	–0.14		0.14	0.15	0.01
6	1000	–46	–0.15	–0.14		0.14	0.15	0.01

- Measurement target signal 1, Pre-amplifier: On, Mode: Mode3, Segmentation offset: 512, Modulation system: 64 QAM, Storage mode: Average, Average count: 40

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	–10	–0.10	–0.09		0.09	0.10	0.01
2	32	–46	–0.10	–0.09		0.09	0.10	0.01
3	500	–10	–0.10	–0.09		0.09	0.10	0.01
4	500	–46	–0.10	–0.09		0.09	0.10	0.01
5	1000	–10	–0.10	–0.09		0.09	0.10	0.01
6	1000	–46	–0.10	–0.09		0.09	0.10	0.01

- Measurement target signal 2, Pre-amplifier: On, Mode: Mode1, Segmentation offset: 128, Modulation system: DQPSK, Storage mode: Average, Average count: 5

No.	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	–10	–1.6	–1.5		1.5	1.6	0.1
2	32	–46	–1.6	–1.5		1.5	1.6	0.1
3	500	–10	–1.6	–1.5		1.5	1.6	0.1
4	500	–46	–1.6	–1.5		1.5	1.6	0.1
5	1000	–10	–1.6	–1.5		1.5	1.6	0.1
6	1000	–46	–1.6	–1.5		1.5	1.6	0.1

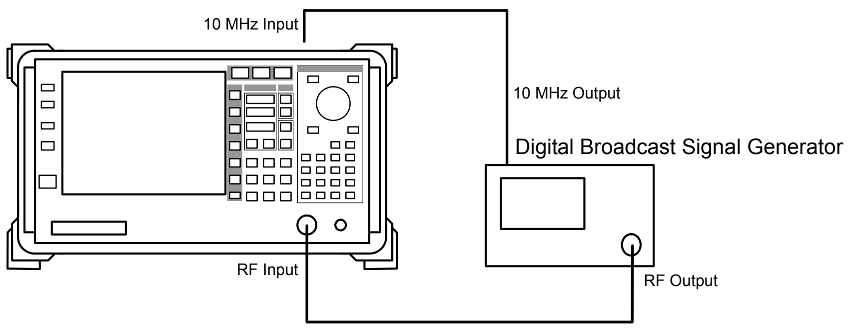
4.3.2 Frequency lock range

(1) Specifications
±99 kHz

(2) Measuring instruments used in testing

Name	Recommended model
Digital Broadcast Signal Generator	MG8940A

(3) Setup



(4) Test procedure

Step	Operation
1.	Initialize the Digital Broadcast Signal Generator. Then set as follows: Frequency: 32 MHz Level: –20 dBm Modulation mode: Mode3 Guard interval: 1/8 Modulation system: 64QAM, 13 segments
2.	Initialize the MS8901A. Then set as follows: Channel map: General Frequency: 32 MHz Level control: Ref Setting Reference level: –20 dBm Modulation mode: Mode3 Guard interval: 1/8 Modulation system: 64QAM, 13 segments No Trace screen Pre-amplifier: Off Segmentation offset: 512 Storage mode: Average Average count: 5 Recv. Seg: 13 Seg
3.	Set the frequency of the Digital Broadcast Signal Generator to 32 MHz + 99 kHz.
4.	Press the Single key on the MS8901A to perform measurement once. Confirm that Frequency Error is within the specification.
5.	Set the average count to 40 times on the Modulation Analysis screen of MS8901A and then press the Single key to perform measurement once. Confirm that Frequency Error is within the specification. ∗ This confirmation is unnecessary when the Mode is set to Mode1.
6.	Set the frequency of the Digital Broadcast Signal Generator to 32 MHz - 99 kHz.
7.	Set the average count to 5 times on the Modulation Analysis screen of MS8901A and then press the Single key on the MS8901A to perform measurement once. Confirm that Frequency Error is within the specification.
8.	Set the average count to 40 times on the Modulation Analysis screen of MS8901A and then press the Single key to perform measurement once. Confirm that Frequency Error is within the specification. * This confirmation is unnecessary when the Mode is set to Mode1.

Step	Operation
9.	Change the setting of the Digital Broadcast Signal Generator and MS8901A for measurement target signal 2 (see 4.3.1 (5) Specifications above), then repeat Steps 1 through 8 above to perform measurement in the same way.

(5) Measured results

No.	Measurement target signal	Frequency	Average count	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	1	32 MHz + 99 kHz	5	–0.15	–0.14		0.14	0.15	0.01
2	1	32 MHz + 99 kHz	40	–0.10	–0.09		0.09	0.10	0.01
3	1	32 MHz – 99 kHz	5	–0.15	–0.14		0.14	0.15	0.01
4	1	32 MHz – 99 kHz	40	–0.10	–0.09		0.09	0.10	0.01
5	2	32 MHz + 99 kHz	5	–1.6	–1.5		1.5	1.6	0.1
6	2	32 MHz – 99 kHz	5	–1.6	–1.5		1.5	1.6	0.1

- Measurement target signal 1
  Mode: Mode3, Guard Interval: 1/8, Segmentation offset: 512, Modulation system of all the segments among Layer_A to C: 64 QAM
- Measurement target signal 2
  Mode: Mode1, Guard Interval: 1/4, Segmentation offset: 128, Modula tion system of all the segments among Layer_A to C: DQPSK

4.3.3 Residual C/N

(1) Specifications

When CW, frequency: 500 MHz, level: –10 dBm:

≤ –95 dBc/Hz (1-kHz offset)

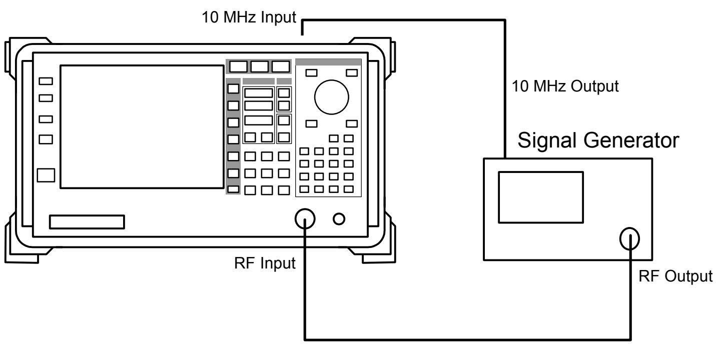
≤ –108 dBc/Hz (10-kHz offset)

≤ –118 dBc/Hz (100-kHz offset)

(2) Measuring instruments used in testing

Name	Recommended model
Signal Generator	MG3633A

(3) Setup



(4) Test procedure

Step	Operation
1.	Initialize the Signal Generator. Then set as follows: Frequency: 500 MHz Level: –10 dBm
2.	Initialize the MS8901A. Then set as follows: Channel map: General Frequency: 500 MHz Level control: Ref Setting Reference level: –10 dBm C/N screen Pre-amplifier: Off Storage mode: Average Average count: 100
3.	Press the Single key on the MS8901A to perform measurement. Then read the C/N values at a 1-kHz, 10-kHz and 100-kHz offset by using the marker.

(5) Measured results

No.	Offset frequency (kHz)	Measured value (dBc/Hz)	Upper effective limit (dBc/Hz)	Upper limit of specification (dBc/Hz)	Guard band (Hz)
1	1		–95.1	–95	0.1
2	10		–108.1	–108	0.1
3	100		–118.1	–118	0.1

4.3.4 Frequency measurement accuracy (CW)

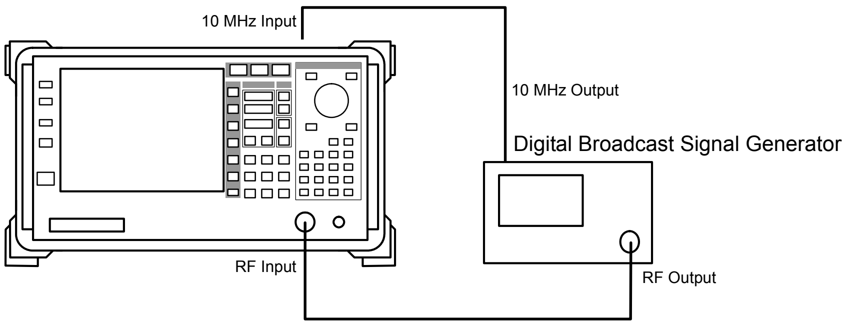
(1) Specifications

±0.1 Hz + (Reference frequency accuracy × Measurement frequency)

(2) Measuring instruments used in testing

Name	Recommended model
Signal Generator	MG3633A

(3) Setup



(4) Test procedure

Step	Operation
1.	Initialize the Signal Generator. Then set as follows: Frequency: 32 MHz Level: –10 dBm
2.	Initialize the MS8901A. Then set as follows: Channel map: General Frequency: 32 MHz Level control: Ref Setting Reference level: –10 dBm C/N screen Pre-amplifier: Off Storage mode: Average Average count: 5
3.	Press the Single key on the MS8901A to perform measurement and read Frequency Error.
4.	Perform measurements for the parameter sets described in (5).

(5) Measured results

No.	Frequency (MHz)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	32	–0.1	–0.08		+0.08	+0.1	0.02
2	500	–0.1	–0.08		+0.08	+0.1	0.02
3	1000	–0.1	–0.08		+0.08	+0.1	0.02

4.3.5 Frequency measurement accuracy (modulation wave) with MS8901A-18 installed

(1) Specifications

- Frequency: 250 to 5000 [kHz]
  When one wave of an OFDM modulation signal that conforms to ISDB-T is input:
- Measurement target signal:
  Terminal: Low IF-DC or IQ-DC, Impedance: 50 Ω, Mode: Mode3, Guard interval: 1/8, Segmentation offset: 512, Modulation system for partial reception signal: 64QAM, Input level: 0.1 Vrms

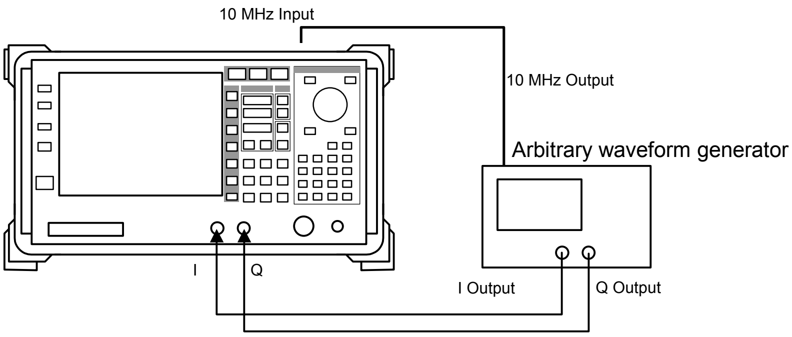
  ± 0.15 Hz + (reference frequency accuracy × Measurement frequency) when average count is 5 times

  ± 0.1 Hz + (reference frequency accuracy × Measurement frequency) when average count is 40 times

(2) Measuring instruments used in testing

Name	Recommended model
Arbitrary waveform generator	AWG420 (manufactured by Tektronix)

(3) Setup



(4) Test procedure

Step	Operation
1.	Create the waveform data to generate the IQ signal of the measurement target signal that conforms to ISDB-T and load it to the arbitrary waveform generator.
2.	Initialize the MS8901A. Then set as follows: Terminal: Low IF-DC Impedance: 50 Ω Frequency: 500 kHz Mode: Mode3 Guard interval: 1/8 TMCC Layer_A Segment: 1 Layer_A Mod: 64QAM (PR) Layer_B Segment: 12 Layer_B Mod: 64QAM Layer_C Segment: 0 Layer_C Mod: 64QAM Modulation Analysis screen Recv. Seg: 1 Seg Mode Storage mode Average Average count 5 Press the Single key of MS8901A to perform measurement. Read Frequency Error.
3.	Change the Terminal setting to IQ-DC, and perform measurement repeating Step 2 above.
4.	Perform measurements for the parameter sets described in 4.3.5 (5) Specification in the way of Step 1 through 3 above.

(5) Measured results

Mode: Mode3, Segmentation offset: 512, Modulation system: 64QAM, Storage mode: Average, Average count: 5 times

No.	Terminal	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	Low IF-DC	–0.15	–0.14		0.14	0.15	0.01
2	IQ-DC	–0.15	–0.14		0.14	0.15	0.01

Mode: Mode3, Segmentation offset: 512, Modulation system: 64QAM, Storage mode: Average, Average count: 40 times

No.	Terminal	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	Low IF-DC	–0.10	–0.09		0.09	0.10	0.01
2	IQ-DC	–0.10	–0.09		0.09	0.10	0.01

4.3.6 Frequency lock range with MS8901A-18 installed

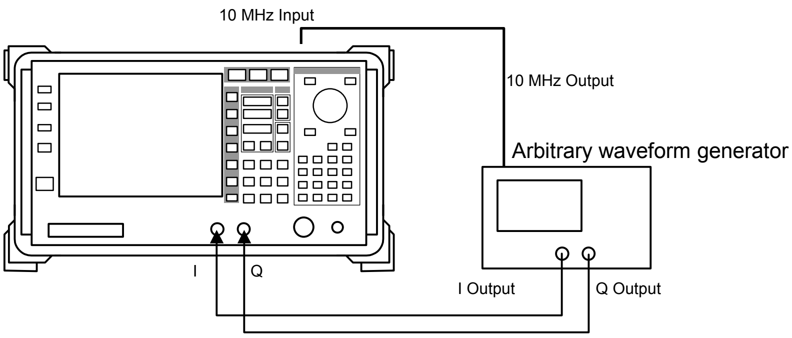
(1) Specifications

±99 kHz

(2) Measuring instruments used in testing

Name	Recommended model
Arbitrary waveform generator	AWG420 (manufactured by Tektronix)

(3) Setup



(4) Test procedure

Step	Operation
1.	Create the waveform data to generate the IQ signal of the measurement target signal that conforms to ISDB-T and load it to the arbitrary waveform generator.
2.	Initialize the MS8901A. Then set as follows: Terminal: Low IF-DC Impedance: 50 Ω Frequency: 500 kHz Mode: Mode3 Guard interval: 1/8 TMCC Layer_A Segment: 1 Layer_A Mod: 64QAM (PR) Layer_B Segment: 12 Layer_B Mod: 64QAM Layer_C Segment: 0 Layer_C Mod: 64QAM Modulation Analysis screen Recv. Seg: 1 Seg Mode Storage mode Average Storage count 5
3.	Set the MS8901A frequency to 500 kHz + 99 kHz.
4.	Press the Single key of the MS8901A to perform measurement. Read Frequency Error.
5.	Set the MS8901A frequency to 500 kHz – 99 kHz.
6.	Press the Single key of the MS8901A to perform measurement. Read Frequency Error.
7.	Change the average count to 40 times on the MS8901A Modulation Analysis screen, repeating Step 3 through 6 above.
8.	Change the Terminal setting to IQ-DC, and perform measurement repeating Step 3 through 7 above.

(5) Measured results

No.	Terminal	Fre-quency (kHz)	Aver-age count)	Lower limit of speci-fica-tion (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)
1	Low IF-DC	500 – 99	5	–0.15	–0.14		0.14	0.15	0.01
2	Low IF-DC	500 + 99	5	–0.15	–0.14		0.14	0.15	0.01
3	Low IF-DC	500 – 99	40	–0.10	–0.09		0.09	0.10	0.01
4	Low IF-DC	500 + 99	40	–0.10	–0.09		0.09	0.10	0.01
5	IQ-DC	500 – 99	5	–0.15	–0.14		0.14	0.15	0.01
6	IQ-DC	500 – 99	5	–0.15	–0.14		0.14	0.15	0.01
7	IQ-DC	500 + 99	40	–0.10	–0.09		0.09	0.10	0.01
8	IQ-DC	500 + 99	40	–0.10	–0.09		0.09	0.10	0.01

Appendix A Performance Test Results Sheet

Test site	______	Report No.	______
	______	Date	______
	______	Test supervisor	______

Equipment name

	MS8901A Digital Broadcast Signal Analyzer	Ambient temperature	°C
	MX890120B ISDB-T Signal Analysis Software	Relative humidity	%
Serial No.	______	Atmospheric pressure	hPa

Note:

Frequency measurement (modulation wave)

No.	Average	Preamplifier	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specifi-cation (Hz)	Guard band (Hz)	Judge-ment
1	5	Off	32	+10	–0.15	–0.14		0.15	0.14	0.01	
2	5	Off	32	–26	–0.15	–0.14		0.15	0.14	0.01	
3	5	Off	500	+10	–0.15	–0.14		0.15	0.14	0.01	
4	5	Off	500	–26	–0.15	–0.14		0.15	0.14	0.01	
5	5	Off	1000	+10	–0.15	–0.14		0.15	014	0.01	
6	5	Off	1000	–26	–0.15	–0.14		0.15	0.14	0.01	
7	5	On	32	–10	–0.15	–0.14		0.15	0.14	0.01	
8	5	On	32	–46	–0.15	–0.14		0.15	0.14	0.01	
9	5	On	500	–10	–0.15	–0.14		0.15	0.14	0.01	
10	5	On	500	–46	–0.15	–0.14		0.15	0.14	0.01	
11	5	On	1000	–10	–0.15	–0.14		0.15	0.14	0.01	
12	5	On	1000	–46	–0.15	–0.14		0.15	0.14	0.01	
13	40	Off	32	+10	–0.10	–0.09		0.10	0.09	0.01	
14	40	Off	32	–26	–0.10	–0.09		0.10	0.09	0.01	
15	40	Off	500	+10	–0.10	–0.09		0.10	0.09	0.01	
16	40	Off	500	–26	–0.10	–0.09		0.10	0.09	0.01	
17	40	Off	1000	+10	–0.10	–0.09		0.10	0.09	0.01	
18	40	Off	1000	–26	–0.10	–0.09		0.10	0.09	0.01	
19	40	On	32	–10	–0.10	–0.09		0.10	0.09	0.01	
20	40	On	32	–46	–0.10	–0.09		0.10	0.09	0.01	
21	40	On	500	–10	–0.10	–0.09		0.10	0.09	0.01	
22	40	On	500	–46	–0.10	–0.09		0.10	0.09	0.01	
23	40	On	1000	–10	–0.10	–0.09		0.10	0.09	0.01	
24	40	On	1000	–46	–0.10	–0.09		0.10	0.09	0.01	

Frequency measurement (modulation wave), Mode: Mode1, Modulation system: DQPSK

No.	Average	Preamplifier	Frequency (MHz)	Level (dBm)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)	Judgement
1	5	Off	32	+10	–1.6	–1.5		1.5	1.6	0.1	
2	5	Off	32	–26	–1.6	–1.5		1.5	1.6	0.1	
3	5	Off	500	+10	–1.6	–1.5		1.5	1.6	0.1	
4	5	Off	500	–26	–1.6	–1.5		1.5	1.6	0.1	
5	5	Off	1000	+10	–1.6	–1.5		1.5	1.6	0.1	
6	5	Off	1000	–26	–1.6	–1.5		1.5	1.6	0.1	
7	5	On	32	–10	–1.6	–1.5		1.5	1.6	0.1	
8	5	On	32	–46	–1.6	–1.5		1.5	1.6	0.1	
9	5	On	500	–10	–1.6	–1.5		1.5	1.6	0.1	
10	5	On	500	–46	–1.6	–1.5		1.5	1.6	0.1	
11	5	On	1000	–10	–1.6	–1.5		1.5	1.6	0.1	
12	5	On	1000	–46	–1.6	–1.5		1.5	1.6	0.1	

Frequency lock range, Mode: Mode3, Guard Interval: 1/8 for number 1 to 4
Mode: Mode1, Guard Interval: 1/4 for number 5 and 6

No.	Frequency	Average count	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)	Judgment
1	32 MHz + 99 kHz	5	–0.1.5	–0.14		0.14	0.15	0.01	
2	32 MHz + 99 kHz	40	–0.1.0	–0.09		0.09	0.10	0.01	
3	32 MHz – 99 kHz	5	–0.1.5	–0.14		0.14	0.15	0.01	
4	32 MHz – 99 kHz	40	–0.1.0	–0.09		0.09	0.10	0.01	
5	32 MHz + 99 kHz	5	–1.6	–1.5		1.5	1.6	0.1	
6	32 MHz – 99 kHz	5	–1.6	–1.5		1.5	1.6	0.1	

Residual C/N

No.	Offset frequency (kHz)	Measured value (dBc/Hz)	Upper effective limit (dBc/Hz)	Upper limit of specification (dBc/Hz)	Guard band (dB)	Judgment
1	1		–95.1	–95	0.1	
2	10		–108.1	–108	0.1	
3	100		–118.1	–118	0.1	

Frequency measurement (CW)

No.	Frequency (MHz)	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)	Judgment
1	32	−0.2	−0.1		+0.1	+0.2	0.1	
2	500	−0.2	−0.1		+0.1	+0.2	0.1	
3	1000	−0.2	−0.1		+0.1	+0.2	0.1	

Frequency measurement (modulation wave) with MS8901A-18 installed, Mode: Mode3, Modulation system: 64QAM

No.	Average count	Terminal	Impedance	Lower limit of specification (Hz)	Lower effective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specification (Hz)	Guard band (Hz)	Judgement
1	5	Low IF-DC	50 Ω	–0.15	–0.14		015	0.14	0.01	
2	5	IQ-DC	50 Ω	–0.15	–0.14		0.15	0.14	0.01	
3	40	Low IF-DC	50 Ω	–0.10	–0.09		0.10	0.09	0.01	
4	40	IQ-DC	50 Ω	–0.10	–0.09		0.10	0.09	0.01	

Frequency lock range with MS8901A-18 installed, Average count: 5 for number 1, 2, 5 and 6, Average count: 40 for number 3, 4, 7 and 8

No.	Frequency	Terminal	Im-pedance	Lower limit of specifica-tion (Hz)	Lower ef-fective limit (Hz)	Measured value (Hz)	Upper effective limit (Hz)	Upper limit of specifi-cation (Hz)	Guard band (Hz)	Judge-ment
1	500 – 99	Low IF-DC	50 Ω	–0.15	–0.14		0.14	0.15	0.01	
2	500 + 99	Low IF-DC	50 Ω	–0.15	–0.14		0.14	0.15	0.01	
3	500 – 99	Low IF-DC	50 Ω	–0.10	–0.09		0.09	0.10	0.01	
4	500 + 99	Low IF-DC	50 Ω	–0.10	–0.09		0.09	0.10	0.01	
5	500 – 99	IQ-DC	50 Ω	–0.15	–0.14		0.14	0.15	0.01	
6	500 + 99	IQ-DC	50 Ω	–0.15	–0.14		0.14	0.15	0.01	
7	500 – 99	IQ-DC	50 Ω	–0.10	–0.09		0.09	0.10	0.01	
8	500 + 99	IQ-DC	50 Ω	–0.10	–0.09		0.09	0.10	0.01	

Numeric and symbol

A

C

E

F

G

I

L

M

N