Product Brochure

Anritsu

MS8901A

Digital Broadcast Signal Analyzer
9 kHz to 3 GHz

Fusion of RF Microwave and DSP Technologies

MS8901A Digital Broadcast Signal Analyzer analyzes the signals very accurately, in the various kinds of fields like development and manufacturing field or maintenance field to manage service area or transmission station. MS8901A is equipped with spectrum analyzer of highly dynamic-range. This analyzer is realized to analyze broad band vector signal, by using the frequency converter with superior SSB phase noise characteristic, in conjunction with frequency characteristic. Up to three signal analyzing software can be installed into the platform, which can analyze the digital terrestrial broadcasting signals.

MS8901A

Digital Broadcast Signal Analyzer

9 kHz to 3 GHz

Excellent Basic Performance

SSB Phase Noise Characteristics of High Purity

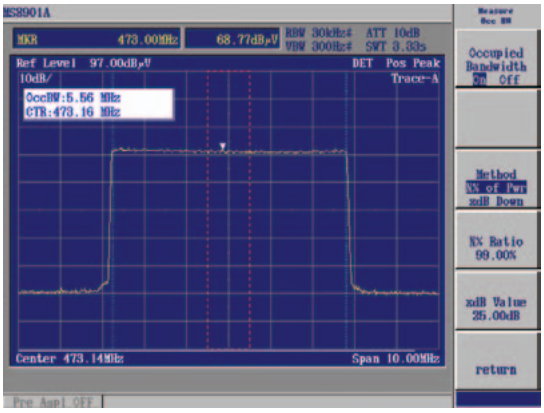
MS8901A uses the synthesizer, of which SSB phase noise characteristic is –95 dBc/Hz (1 kHz offset typ.) and –108 dBc/Hz (10 kHz offset) as local signal source. The performance of the frequency converter, which is an important component for the signal analysis of the digital broadcasting, is highly improved.

IF-stage SAW Filter

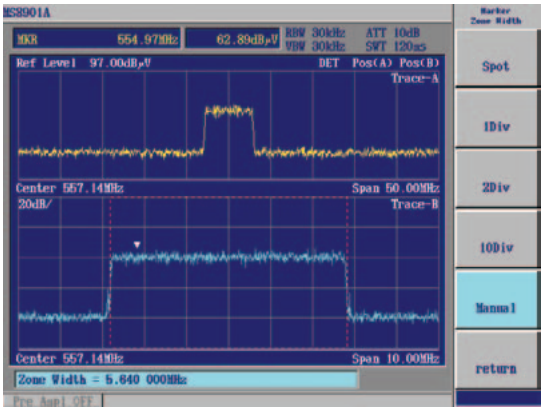
To assure high channel selectivity for field measurement, the MS8901A has a SAW filter at the IF processing stage.
The combination of SAW filter and digital filter at the DSP stage offers greatly improved selectivity.

High-performance Spectrum Analyzer

MS8901A includes the spectrum analyzer as standard equipment. This analyzer features various display screens and major functions, which enables to measure frequency counter, occupied bandwidth, and channel power.



Measurement of Occupied Bandwidth



Double-screen Display

Dynamic Range

When analyzing the digital broadcasting signal, lower level of noise floor characteristic is required for the nonlinear components like mixer or preamplifier used for the frequency converter.
The frequency converter included within MS8901A is equipped with spectrum analyzer and vector signal analyzer, both of which is highly dynamic range.
Together with this, this frequency converter compresses 1 dB gain within +3 dBm and includes –148 dBm/Hz floor noise (–163 dBm/Hz at preamplifier).

High-level DSP Technology

The MS8901A uses high-performance digital signal processing functions with a 14 bit A/D converter to assure superior analog front-end performance.

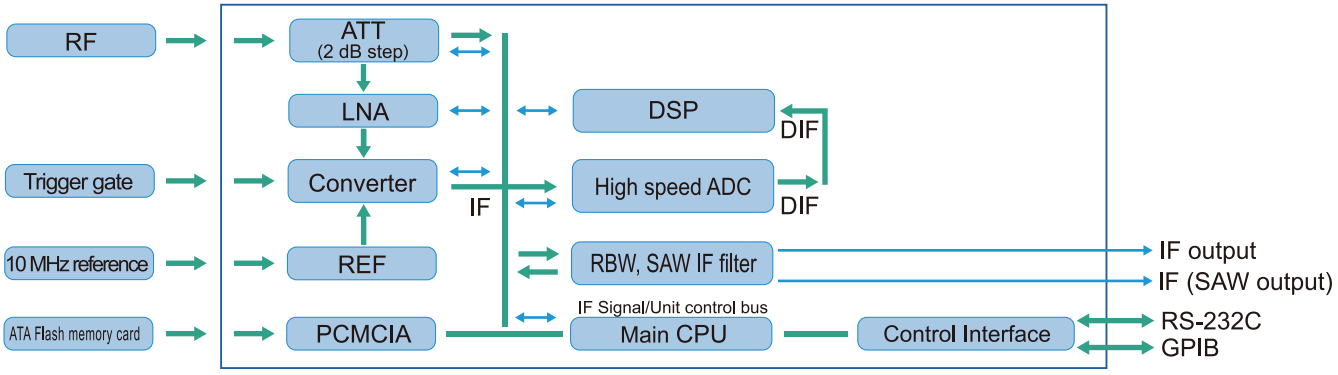
Speeds-up System and Device Production Lines

The fast, 20-times-a-second refresh rate of the spectrum analyzer plus 120 bps GPIB interface supports faster measurement with higher production efficiency on system and device production lines.

All-in-One

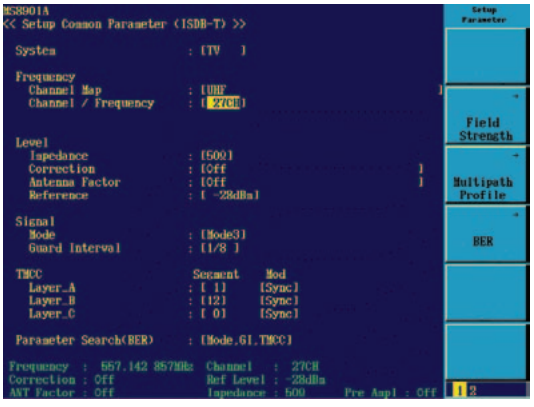
Two Functions in One Unit

The MS8901A Digital Broadcast Signal Analyzer combines a spectrum analyzer and vector signal analyzer in a convenient modular platform supporting all the functions needed for measuring digital broadcast signals. The efficient system bus linking each module supports a system-independent platform.



Easy-to-Navigate User Interface

Parameter for each digital broadcasting system is arranged, according to each function. Complicated operation is unnecessary and the user can switch to the desired measurement status easily. Color VGA is employed to show the detailed waveform beautifully in the measurement screen. RGB connector of rear panel can be used to take out the measurement screen and this screen is to be displayed on the monitor.



Set-up Screen

System Upgrade

The MS8901A is easily tailored to each broadcast system by installing measurement software with functions matching the system requirements.

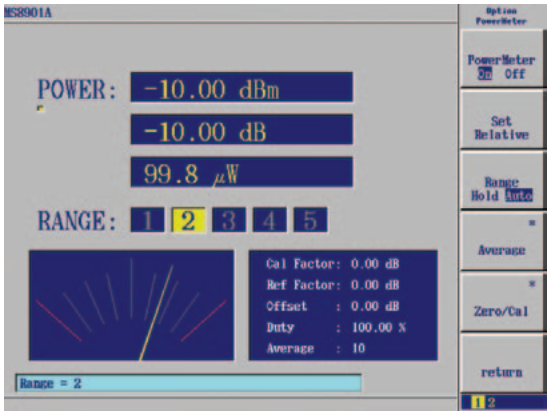
PCMCIA Card Slot

For the external memory interface, the ATA flash memory card is employed. The measurement data or the parameter setting status in the field can be saved on a flash card.
The measurement screen can be saved as bit map file in monochrome or color optionally and used to make reports.
Measurement data can be saved as CSV format file, too.

Power Measurement of High Accuracy

Power Meter Function (Option)

MS8901A includes the power meter function which enables to measure up to 32 GHz. Only by installing the power sensor to the front connector, high-accurate power measurement is realized.

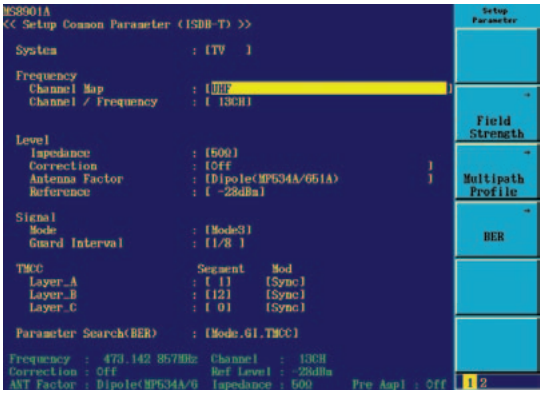


Power Measurement

MX890110A ISDB-T Field Test Software

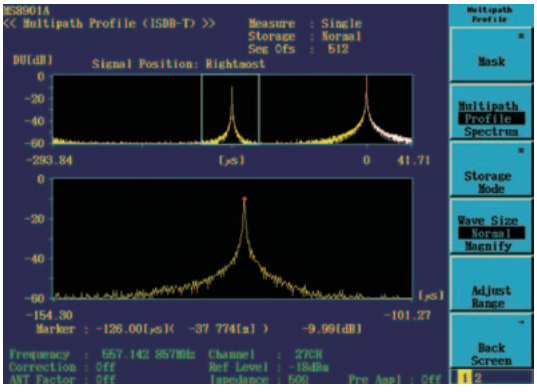
For SFN Field Maintenance

SFN measurements include not only field strength measurement for general-purpose field maintenance but also essential delay profile measurements. The MX890110A ISDB-T Field Test Software is an all-in-one measurement solution for field maintenance of ISDB-T service networks. Installing it in the MS8901A supports transmitter and repeater measurements when used in combination with the spectrum analyzer functions.



Delay Profile Measurement

Delay profiles are easily measured to assure monitoring of multipath effects caused by changes in ground geography. Moreover, in an SFN environment, sometimes the delay wave appears before the wanted wave (pre-ghosting); these pre-ghosting faults can be analyzed in the actual field environment, helping optimize the repeater, etc., installation location design.



Repeater Bypass Echo Analysis

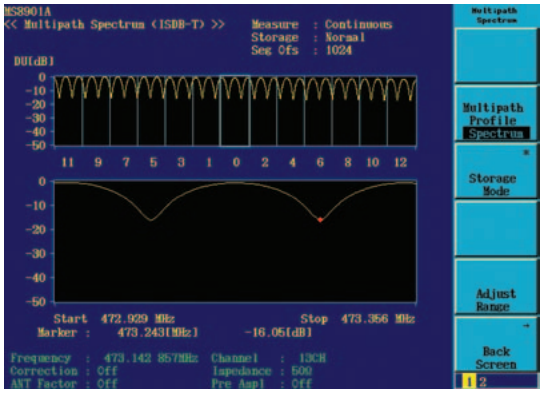
To assure that SFN network repeaters use the same frequency at the input and output sides, the repeater output is bypassed to the input side to generate echo. The echo can be analyzed using the delay profile measurement function because the same characteristics as the delay profile are displayed.

Precision Field Strength Measurement

The built-in SAW filter and DSP technology used in the MS8901A support high-accuracy measurement of the field strength of all segments in one channel as well as just the one segment. Using DSP, the on-air ISDB-T 5.57 MHz band power can be measured with high accuracy. Furthermore, the antenna factor can be calibrated (frequency data set via ATA flash-memory card) and displayed as dBμV/m. The measured level is displayed as a power graph, supporting antenna angle adjustment, etc.

Multipath Analysis in Frequency Domain

The multipath spectrum measurement function measures the frequency selectivity fading caused by multipaths. This is very useful when managing severe delays at SFN repeater send time adjustment, etc.



For ISDB-T SFN Installation and Field Maintenance Repeater Bypass Canceller Operation Test

When a canceller is used to suppress repeater bypass, the frequency ripple generated by echo becomes flat. The multipath spectrum measurement function can be used to accurately measure how much the ripple is improved.

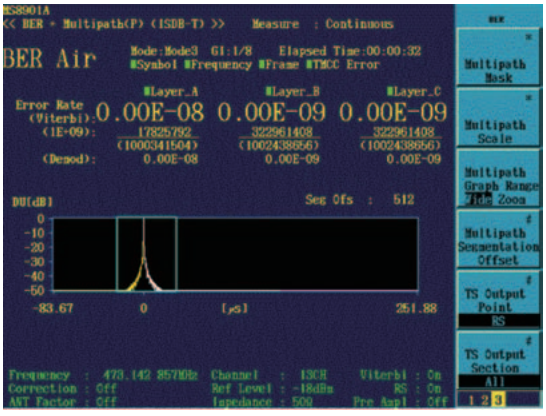
MU890100A ISDB-T Demodulation Unit

Installing the MU890100A ISDB-T Demodulation Unit in the MS8901A supports real-time demodulation of terrestrial digital signals when used in combination with the MX890110A ISDB-T Field Test Software. This is a powerful tool supporting BER evaluation of on-air and pseudorandom signals as well as service area inspection and Rx tuner evaluations for monitoring video and audio. The Rx signal can be analyzed and evaluated from various perspectives by simultaneously measuring and displaying the BER, delay profile and field strength for each layer supporting BER, delay profile and field strength measurement.

Field Strength and Delay Profile can be Measured as well as BER Measurement

Parameter for each digital broadcasting system is arranged, according to each function. Complicated operation is unnecessary and the user can switch to the desired measurement status easily. Color VGA is employed to show the detailed waveform beautifully in the measurement screen. RGB connector of rear panel can be used to take out the measurement screen and this screen is to be displayed on the monitor.

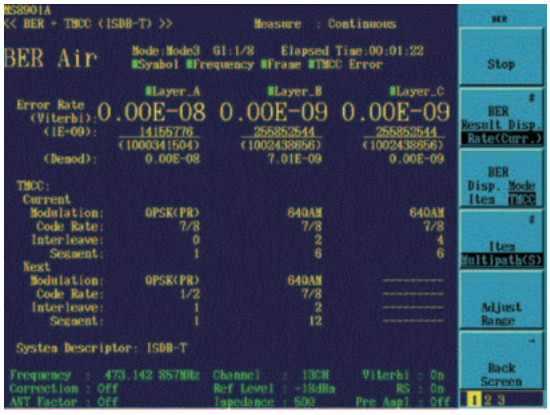
BER (Count) + Field Strength



BER (Rate) + Delay Profile

Transmission Parameter Monitor Function

From the received signal, Mode, GI and transmission parameter for each layer (TMCC) can be extracted and then monitored.
TMCC information includes the current parameter and next one at a time.



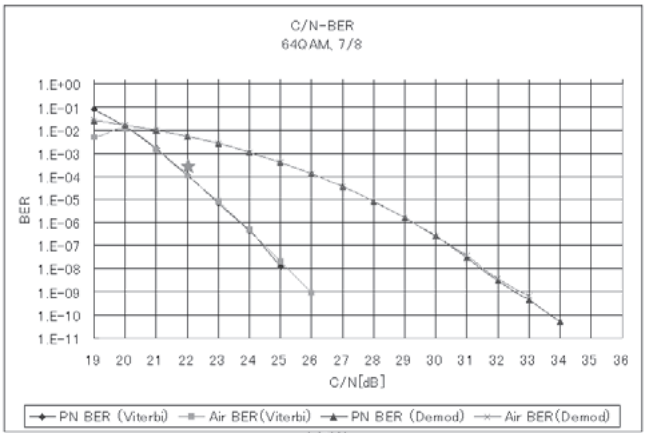
BER (Count) + Field Strength

External TS Output Function

With this external TS output function, demodulated MPEG-TS signal can be output to the external instrument through DVB-ASI interface. By connecting MPEG decoder and image monitor as the external instrument, real-time image and sound can be monitored. Besides, the layer of the output signal can be selected.

Note: This instrument does not include the scramble

BER Measurement Result Example



MX890120B ISDB-T Signal Analysis Software

All-in-one for Broadcast Equipment Measurements

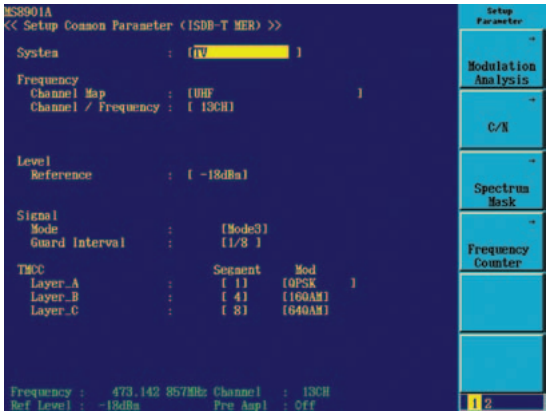
The MX890120B ISDB-T Signal Analysis Software is application software for the MS8901A. Installing it in the MS8901A supports the MER measurements needed for manufacturing and maintaining ISDB-T terrestrial digital transmitters and repeaters, as well as for signal analysis using constellation displays, etc. In addition, when used with the MS8901A spectrum analyzer function, it supports the many measurements needed for manufacturing inspection and operation of transmitters and repeaters.

MS8901A + MX890120B Measurement Items

Frequency error, signal strength, occupied bandwidth, spectrum mask, spurious, phase noise characteristics, amplitude frequency measurement, IM measurement, MER measurement, constellation monitoring, delay profile (requires MX890110A).

Constellation Monitoring

The constellation for each layer can be displayed according to the each layer segment specifications at the TMCC setting of the Setup Parameter screen.
Extremely fast measurement is achieved using high-speed DSP. As shown in the following diagram, all ISDB-T modulations can be analyzed and data signals such as TMCC and AC can be displayed as a constellation to evaluate fault locations.

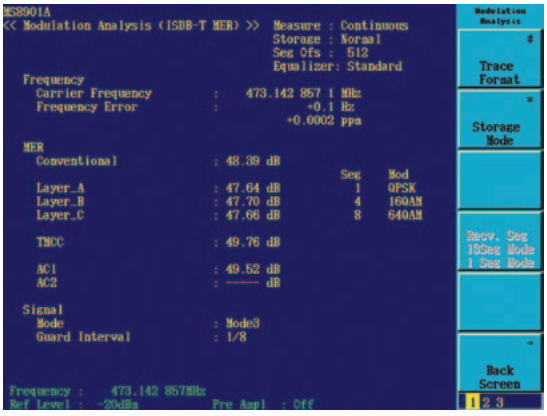


Modulation Frequency Measurement

The center carrier frequency and frequency error of the 5.57 MHz OFDM modulation signal can be measured with a high accuracy of ±0.15 Hz (Mode 3, 64QAM). In addition, the frequency range from 32 MHz to 1 GHz covers the entire spectrum from the public (nominal) IF (37.15 MHz) to all UHF channels.

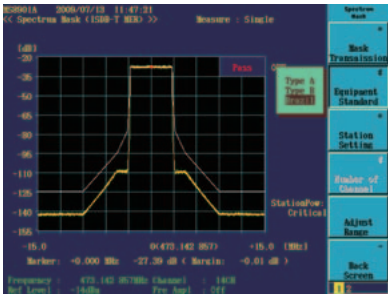
MER (Modulation Error Ratio) Measurement Function

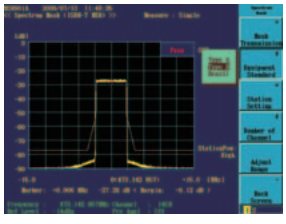
The Modulation Error Ratio (MER) is defined as the ratio of the vector error power converted from the ideal constellation point to the power of the ideal constellation point. MER is used by the European DVB standard as an index of the OFDM modulation signal quality. The MX890120B supports MER measurement for all modulation signals, as well as simultaneous MER measurement for each layer and MER measurement for data signals, such as TMCC and AC.

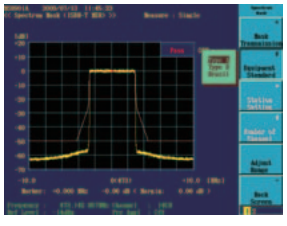


Spectrum Mask Conformance Test

Compliance with the Tx spectrum mask standardized by laws governing radio installations can be checked automatically. In addition, any spectrum mask standard line can be set in three ways.







Complete ISDB-T Signal Analysis Functions

Equalizer Operation Switching Function

The modulation analysis mode can be switched between the Standard mode, which is compatible with the previous MX890120A, and the Advanced mode. The Advanced mode is best for field use in a multipath environment and supports constellation and MER analysis. Even in a multipath environment like that in Figure 2, the waveform behavior can be confirmed using both MER analysis, like in Figure 1, as well as constellation monitoring, making it a useful field troubleshooting tool.

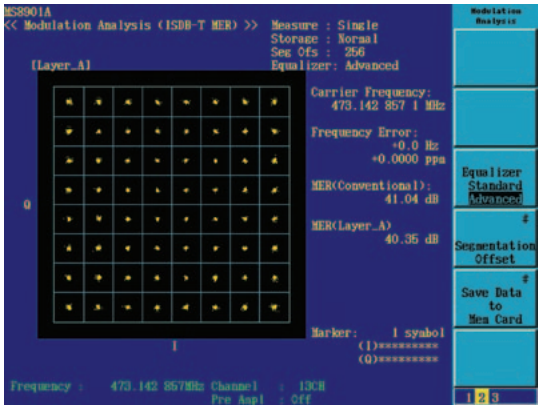


Figure 1 Advanced Mode: Constellation Monitor Screen

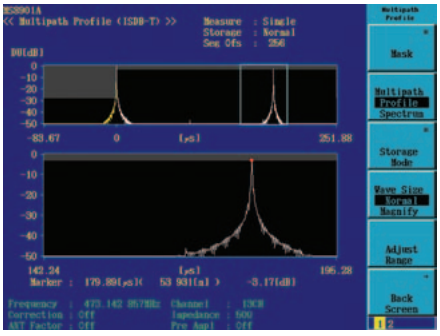
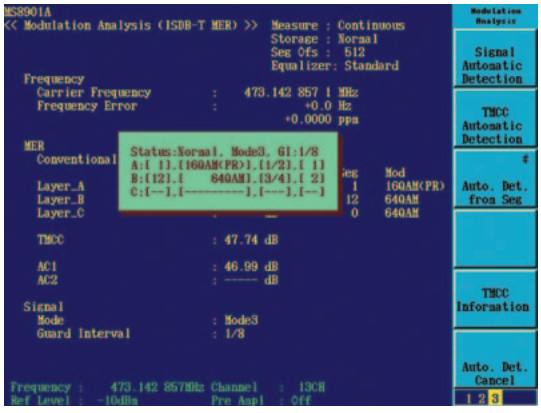


Figure 2 Delay profile measurement screen using MX890110A ISDB-T Field Test Software

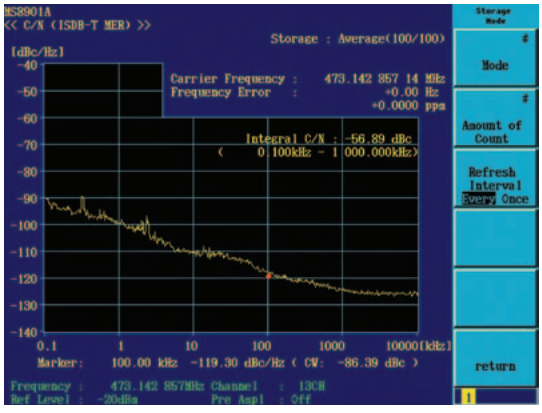
Transmission Parameter Detection Function

Inputting the input signal frequency (channel) at ISDB-T signal analysis allows one-touch detection and setting of transmission parameters (Mode, GI, TMCC data).



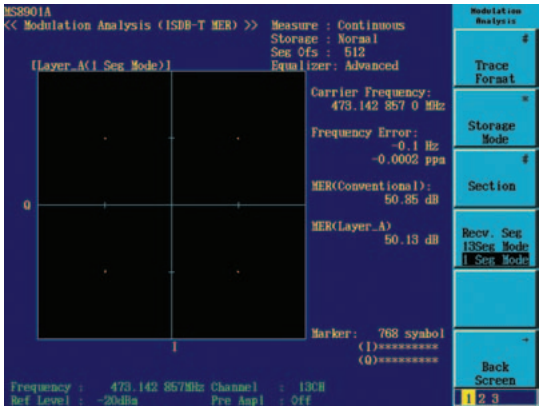
C/N, C/N Integer Function

The integrated results for any range of C/N curve described in the specification like JEITA transmitter handbook, etc., can be calculated and displayed using this function.



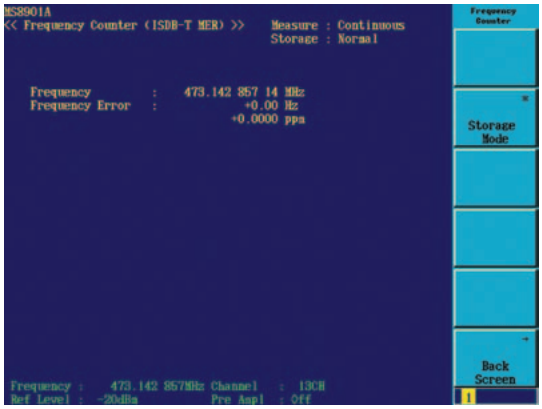
One Segment Analysis Function

The only one segment of the ISDB-T signal can be measured to display the constellation and perform MER analysis.



Frequency Counter Functions

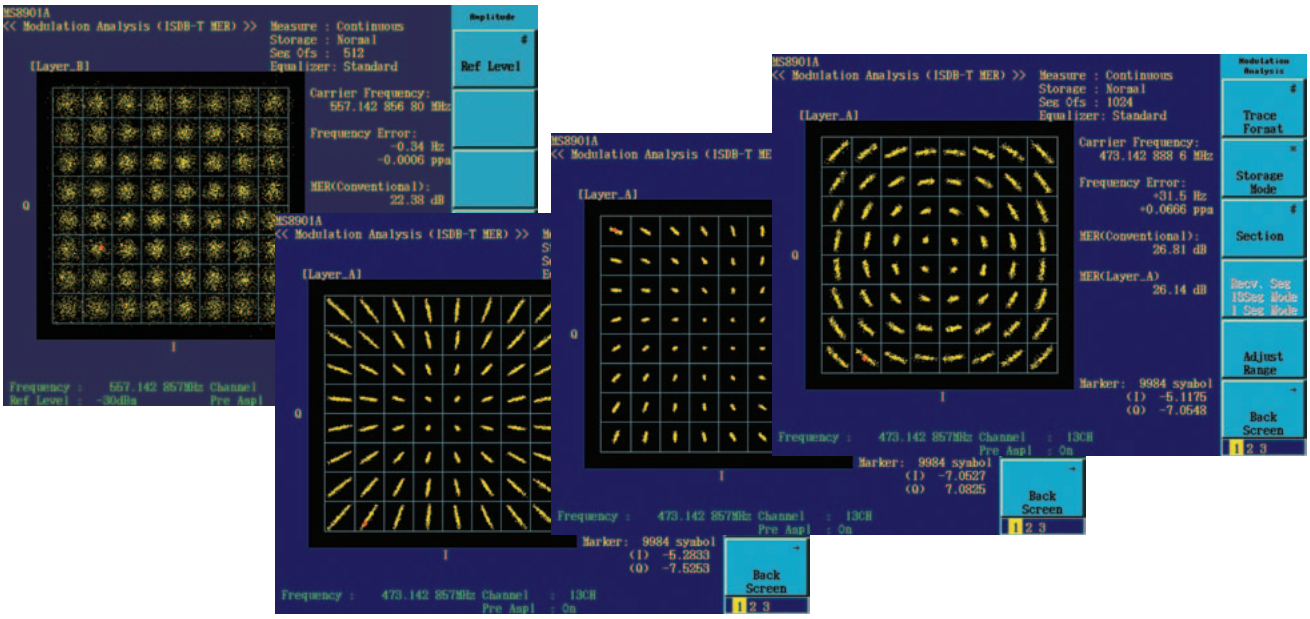
The frequency counter function can be used to measure the continuous waveform over a range of 3.9 MHz to 1000 MHz at a display resolution of 0.01 Hz.



For R&D and Design Ranging from ISDB Devices to STB

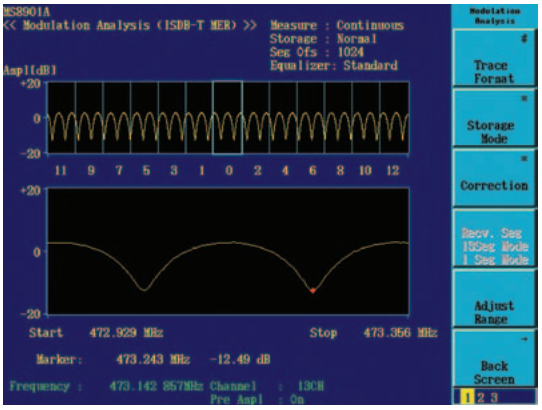
Constellation Monitor Function

The constellation monitor function is a useful tool for troubleshooting faults based on their behavior. In addition, the MER measurement function is useful for managing MER and easy determination of aging of device and CN.



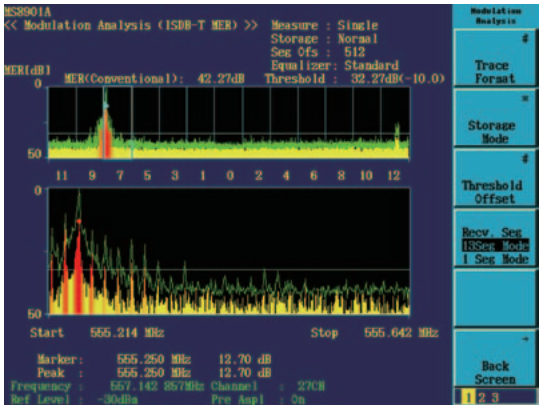
Frequency Characteristics Measurement

This function displays the 5.57 MHz in-band frequency characteristics using SP and CP in the OFDM modulation signal. The in-service frequency characteristics of transmitters and repeaters can be monitored using the modulation signal. Moreover, since there is a correction function, combination with a digital broadcast signal generator supports simple measurement of frequency characteristics like using a network analyzer. After the MS8901A and digital broadcast signal generator have been calibrated while directly linked and the frequency characteristics have been flattened, the 5.57 MHz band frequency characteristics of a device inserted between them can be measured.



OFDM In-band Interference Analysis (Sub-carrier MER measurement)

Signals (such as interference) hidden in the ISDB-T signal band can be analyzed for each sub-carrier. This is useful for field analysis of waveform quality, and in-circuit crosstalk or interference.



Specifications

• MS8901A Digital Broadcast Signal Analyzer

Except were noted otherwise, specified values were obtained after warming up the equipment for 30 minutes at a constant ambient temperature and then performing calibration. The typical values are given for reference, and are not guaranteed.

Frequency	Frequency range	9 kHz to 3.0 GHz
	Setting frequency resolution	Minimum 1 Hz
	Frequency read out accuracy	± (frequency readout x reference frequency accuracy + span × span accuracy + resolution bandwidth × 0.15 + 10 Hz)
	Marker frequency readout accuracy	Normal: Same as frequency readout accuracy Delta: Same as frequency span accuracy
	Frequency counter	Resolution: 1, 10, 100 Hz, 1 kHz Accuracy: ± (frequency readout × reference frequency accuracy + 1 LSD + 2 Hz) (S/N ≥20 dB)
	Frequency span	Setting range: 0 Hz, 1 kHz to 3.1 GHz Accuracy: ±1.0%
	Resolution bandwidth (3 dB BW) (RBW)	Setting range: 300 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 20 MHz (manually or automatically settable according to frequency span) Bandwidth accuracy: ±20% (RBW = 300 Hz to 10 MHz), ±40% (RBW = 20 MHz) Selectivity (60 dB: 3 dB): ≤15:1
	Video bandwidth (VBW)	1 Hz to 3 MHz (1-3 sequence), Off (manually or automatically settable according to resolution bandwidth)
	Signal purity	Noise side bands: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Reference oscillator	Frequency: 10 MHz Aging rate: ≤2 × 10^{-8}/day , ≤1 × 10^{-7}/year (referred to frequency after 24 hours warm-up) Temperature characteristics: ±5 × 10^{-8} (0˚ to 50˚C, referred to frequency at 25˚C)
Amplitude	Level measurement	Measuring range Average noise level to +30 dBm (preamplifier Off) Average noise level to +10 dBm (preamplifier On) Maximum input level +30 dBm (CW average power, input attenuator: 10 dB, preamplifier Off), ±0 V (DC) +10 dBm (CW average power, preamplifier Off) Average noise level: Preamplifier On ≤–139 dBm + 2 × f [GHz] dB (1 MHz to 2.5 GHz) Preamplifier Off ≤–124 dBm + 2 × f [GHz] dB (1 MHz to 2.5 GHz) ≤–120 dBm + 2 × f [GHz] dB (2.5 GHz to 3 GHz) (input attenuator: 0 dB, RBW: 300 Hz, VBW: 1 Hz) Residual response: ≤–100 dBm (1 MHz to 3.0 GHz) (input attenuator: 0 dB, input: 50Ω termination)
	Reference level	Setting range Preamplifier Off Log scale: –100 to +40 dBm or equivalent level Linear scale: 2.24 µV to 22.4 V Preamplifier On Log scale: –120 to +10 dBm or equivalent level Linear scale: 0.224 µV to 707 mV Unit Log scale: dBm, dBµV, dBmV, dBµV (emf), W, dBµV/m Linear scale: V Reference level accuracy: Preamplifier Off ±0.75 dB (+0.1 to +30 dBm), ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) Preamplifier On ±0.75 dB (–19.9 to +10 dBm), ±0.9 dB (–69.9 to –20 dBm), ±1.1 dB (–89.9 to –70 dBm) ∗After calibration, at 50 MHz frequency, span 1 MHz (when input attenuator, resolution bandwidth, video bandwidth, and sweep time set to AUTO) Resolution bandwidth switching uncertainly: ±0.3 dB (300 Hz to 5 MHz), ±0.5 dB (10 MHz, 20 MHz) ∗After calibration, referenced to resolution bandwidth 3 kHz Input attenuator (input attenuator) Setting range: 0 to 62 dB, 2 dB step (manually or automatically settable according to reference level) Switching uncertainly: Preamplifier Off ±0.3 dB (10 to 50 dB), ±0.5 dB (52 to 62 dB) ∗After calibration, referenced to input attenuator 10 dB Preamplifier On ±0.5 dB (10 to 50 dB), ±1.0 dB (52 to 62 dB) ∗After calibration, referenced to input attenuator 10 dB Input attenuator switching mode: 2, 10 dB step mode

Frequency	Frequency response	Referred to 50 MHz frequency, input attenuator 10 dB, temperature 18˚ to 28˚C ±0.6 dB (preamplifier Off) ±1.0 dB (preamplifier On) Referred to 50 MHz frequency, input attenuator 10 to 62 dB ±1.0 dB (preamplifier Off) ±2.0 dB (preamplifier On)
	Scale fidelity	Scale: 10 div Log scale: 10, 5, 2, 1 dB/div Linear scale: 10, 5, 2, 1%/div Linearity (after calibration) Preamplifier Off Log scale: ±0.4 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW ≤1 kHz) Linear scale: ±4% of reference level Preamplifier On Log scale: ±0.5 dB (0 to –20 dB, RBW ≤1 kHz), ±1.0 dB (0 to –60 dB, RBW ≤1 kHz), ±1.5 dB (0 to –75 dB, RBW ≤1 kHz) Linear scale: ±5% of reference level Marker level resolution Log scale: 0.01 dB Linear scale: 0.02% of reference level
	Spurious response	2nd harmonic distortion: ≤–60 dBc (10 MHz to 200 MHz, mixer input level –30 dBm) ≤–72 dBc (0.2 GHz to 0.85 GHz, mixer input level –30 dBm) ≤–70 dBc (0.85 GHz to 1.5 GHz, mixer input level –30 dBm) 3rd order intermodulation distortion: ≤–70 dBc (10 MHz to 100 MHz), –85 dBc (0.1 GHz to 3.0 GHz) *Frequency reference of two signal: ≥50 kHz, mixer input level –30 dBm Image response: ≤–70 dBc
	1 dB gain compression	At mixer input level Preamplifier Off ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz) Preamplifier On ≥–35 dBm (≥100 MHz)
	Maximum dynamic range	1 dB gain compression vs. Averaging noise level 124 dB – 2f [GHz] dB (≥100 MHz)
Frequency domain	Frequency response	In frequency sweep Setting range: 10 ms to 1000 s (manual settable, or automatically settable according to span, resolution bandwidth, video bandwidth) Setting resolution: 5 ms (10 ms to 1 s), most significant 3-digits (≥1 s) Accuracy: ±3%
	Sweep mode	Continuous, Single
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Line, Ext (±10 V), Ext (TTL)
	Gate mode	Off, Random sweep mode Gate delay: 0 µs to 65.5 ms, resolution 1 µs Gate length: 2 µs to 65.5 ms, resolution 1 µs Gate end: Internal/External
	Zone sweep	Sweeps only in frequency range indicated by zone marker
	Tracking sweep	Sweeps while tracking peak points within zone marker (zone sweep also possible)
Time domain	Sweep time	Setting range: 1 µs to 1000 s Setting resolution: 1, 2, 5 sequence (1 µs to 50 µs), 100 µs (100 µs to 4.9 ms), 5 ms (5 ms to 1 s), Most significant 3-digits (>1 s) Accuracy: ±1%
	Trigger switch	Freerun, Triggered
	Trigger source	Wide IF Video, Video, Line, Ext (±10 V), Ext (TTL)
	Trigger delay	Pre-trigger: Display waveform before triggering Setting range: – (time span) to 0 s Setting resolution: bigger value between (time span)/500 ns or 100 ns Post-trigger: Display waveform before triggering Setting range: 0 µs to 65.5 ms Setting resolution: 100 ns (sweep time ≤4.9 ms), 1 µs (sweep time ≥5 ms)

Function	Numbers of point	501,1001 points
	Detection mode	Normal, Positive Peak, Negative Peak, Sample, Average Normal: Simultaneously displays max. and min. points between sample points Positive Peak: Displays max. points between sample points Negative Peak: Displays min. points between sample points Sample: Displays momentary value at sample points Average: Displays average value between sample points
	Display function	Trace-A, Trace-B, Trace-Time, Trace-A/B, Trace-A/BG, Trace-A/Time
	Trace calculation	A → B, B → A, A ↔ B, A + B → A, A – B → A, A – B + DL → A
	Storage function	Normal, Max Hold, Min Hold, Average, Linear Average, Cumulative, Over Write
	Signal search	Auto Tune, Peak → CF, Peak → REF, Scroll
	Zone marker	Normal, Delta
	Marker function	Marker → CF, Marker → REF, Marker → CF Step Size, ΔMarker → Span, Zone → Span
	Peak search	Peak, Next Peak, Min Dip, Next Dip, Next Right Peak, Next Left Peak
	Multi marker	Number of points: 10 max. (Highest 10, Harmonics, Manual Set)
	Measurement function	Noise power: dBm/Hz, dBm/CH, dBV/$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: power N% method, X dB Down method Adjacent channel leakage power: 2 channels × 2, graphic display Average power of burst signal: average power in designate time range of time domain waveform Channel power: dBm/Hz, dBm, dBμV, dBμV (emf), dBmV, dBμV/m Template comparison measurement: upper/lower limits × each 2 (time domain) MASK: upper/lower limits × each 2 (time domain)
	Correction	The user can correct frequency response optionally, max. 150 points
General specification	Display	Color TFT-LCD, Size: VGA 17 cm (6.5" Type), 4096 colors (RGB, 16-scale settable)
	Hard copy	Display data can be hard-copied via the parallel interface (model corresponded to PCL Level 3 or less, ESC/P-J83 or J84)
	PC card interface	PC-ATA card or Compact Flash card (3.3 V/5 V) can be accessed Function: Save/recall measurement settings and waveform data, Save bitmap files of waveform display Connector: PC Card Type I or Type II
	RS-232C	Can be controlled as device from external controller (excluding power switch) Baud rate: 1200, 2400, 4800, 9600, 19.2 k, 38.4 k, 56 k, 115 kbps Connector: D-Sub 9 pins, plug
	GPIB	Function: Meets to IEEE488.2 Can be controlled as device from external controller (excluding power switch) Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
	Parallel interface	Based on centronics, output printing data to printer Connector: D-Sub 25 pins, jack
	Input connector	N-type connector, jack 50Ω, VSWR: 1.5 typ. (input attenuator 10 dB)
	IF output	BNC, 50Ω nominal value Frequency: 10.69 MHz/66 MHz Output level: –10 dBm typ. (frequency 100 MHz, at upper edge of display scale)
	Wideband IF output	BNC, 50Ω nominal value Frequency: 60.69 MHz/66 MHz Gain: 0 dB typ. (frequency 100 MHz, input attenuator 0 dB)
	Video output (Y)	BNC, 75Ω nominal value Output level: 0 to 0.5 V ±0.1 V (log scale), 0 to 0.4 V ±0.1 V (linear scale) (frequency 100 MHz, at upper edge of display scales)
	Video output	Analog RGB, Connector: D-Sub 15 pins, jack
	External reference signal input	BNC connector, Frequency: 10 MHz ±10 Hz, 13 MHz ±13 Hz, Level: ≥0 dBm (50Ω termination)
	Buffered output	BNC connector, Frequency: 10 MHz, Output level: 2 to 5 Vp-p (200Ω termination)
	Sweep output (X)	BNC connector Output level: 0 to 10 V ±1 V (100kΩ termination, from left edge to right edge in display scale, single sweep)
	Sweep status output (Z)	BNC connector, Output level: TTL (when sweeping, at low level)
	Probe source	4-pin connector, +12 V, –12 V, each ±10%, each max 110 mA
	Trig/Gate input	BNC connector Input level: ±10 V (0.1 V resolution), or TTL level
Others	Dimension	320 (W) × 177 (H) × 411 (D) mm (exclude handle, legs, front cover, fan cover)
	Mass	≤16 kg (nominal value)
	Power supply (operating range)	85 V(ac) to 132 V(ac), 170 V(ac) to 250 V(ac) (automatic voltage change), 47.5 Hz to 63 Hz, ≤400 VA
	Temperature range	Operating: 0˚ to +50˚C, ≤RH85%, Storage: –20˚ to +60˚C
	EMC	EN61326-1, EN61000-3-2
	LVD	EN61010-1

∗ Typical value and nominal value are reference data, so that not warrant them as spec.

• **Option**

Option 01: Precision Frequency Reference Oscillator

Frequency	10 MHz
Aging rate	≤5 × 10^{-10}/day (referred to frequency after 24 hours warm-up)
Temperature stability	≤5 × 10^{-10} (0˚ to 50˚C, referenced to frequency at 25˚C)
Warm-up time within ≤5 × 10^{-8}	7 minutes typ. (at 25˚C)

Option 02: Narrow Resolution Bandwidth

Resolution bandwidth	Setting range: 1 Hz to 1 kHz (1-3 sequence) Switching uncertainly: ±0.5 dB ∗Reference to RBW 3 kHz (analog) Resolution bandwidth accuracy: ±10% (RBW = 30 Hz, 300 Hz) ±10% typ. (RBW = 1, 3, 10, 100 Hz, 1 kHz) Selectivity (60 dB: 3 dB): ≤5: 1
Span	Minimum span setting: 100 Hz
Average noise level	At Input attenuator: 0 dB, RBW: 1 Hz, Preamplifier Off ≤–146.3 dBm + 1.5 × f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–144.3 dBm + 1.5 × f [GHz] dB (typ.) (2.5 GHz to 3 GHz)

Option 04: Digital Resolution Bandwidth

Resolution bandwidth	Setting Range: 10 Hz to 1 MHz (1-3 sequence) Resolution Bandwidth Accuracy: ±10% (RBW ≥100 Hz), ±10% (RBW ≤30 Hz, typ.) Resolution Bandwidth Selectivity: ≤5:1 (RBW ≥100 Hz), ≤5:1 (RBW ≤30 Hz, typ.) Resolution Switching Deviation: ±0.5 dB (Referenced to RBW = 3 kHz)
Detection mode	Normal, Positive Peak, Negative Peak, Sample, RMS RMS: Displays RMS Value between sample points
Span	Setting Range: Minimum 1 kHz
Detection mode	At Input attenuator: 0 dB, RBW: 10 Hz Preamplifier Off ≤–134.5 dBm + 1.5 × f [GHz] dB (typ.) (1 MHz to 2.5 GHz) ≤–130.5 dBm + 1.5 × f [GHz] dB (typ.) (2.5 GHz to 3 GHz)

Option 09: Ethernet Interface

Function	Controlled by the external computer (Except power switch)
Connector	10BASE-T

Option 18: Low IF/IQ Unbalance Input

Refer to next page.

Option 21: Power Meter (Option 41 is an option retrofit)

Outline	High accuracy electric power measurement in frequency range of 100 kHz to 32 GHz can be performed.
Frequency range	100 kHz to 32 GHz
Level range	–10 to +20 dBm
Conformity power sensor	MA4601A, MA4701A, MA4703A, MA4705A
Readout	Selection of W, dBm, and dB (Relative) is possible. Digital 4 figure display, 20% of over range
Power range	4 range/10 dB step (The measurement level range is indicated to the standard of Power sensor.)
Change of range	Automatic, Manual (A setup to ranges arbitrary regardless of Range hold and Input level is possible.)
Equipment accuracy	±0.7% (W mode) ±0.03 dB (dBm mode, dB (Relative) mode) ∗If ZERO ADJ key is pushed, it will adjust to a zero point automatically.
Zero set	±0.5% of full scale typical. (100 µW range of the highest sensitivity)
Zero movement between ranges	±0.2% of full scale (It is 100 µW range of the highest sensitivity and is after zero set.)
Oscillator for calibration	Frequency: 50 MHz Level: 1 mW ±1.2% (For one year) Averaging: Setting is possible in four stages in sample rate time.

Option 34: 4 GHz LO Output

Frequency	4 GHz
Frequency accuracy	± (4 GHz × Reference frequency accuracy) ±1 Hz
Output Level	–10 dBm (typ.)
Spurious	≤–40 dBc (typ.)

Option 46: Auto Power Recovery

Outline	Cancels the power switch on front panel and automatically recovers to power-on after power failure.

∗ This equipment enters the standby state when the line has to be disconnected and reconnected, because power switch on front panel doesn't have latch function.
If this equipment is built into remote systems, please install this option.

Option 47: Rack Mount (IEC)

Outline	Attachment of rack mount which meets IEC spec The standard tilt handle is eliminated when rack mount kit is attached.

Option 48: Rack Mount (JIS)

Outline	Attachment of rack mount which meets JIS spec The standard tilt handle is eliminated when rack mount kit is attached.

Option 53: High Accuracy Modulation Frequency Measurement (Option 73 retrofit)

Outline	Measures the center frequency of the OFDM modulation wave of the software sold separately (MX890120B) with high accuracy.
Frequency display	Displays the measured result of the center frequency in 0.01 Hz unit. (0.1 Hz, heretofore)
Frequency accuracy	Refer to the Section 1.2 "Product Configuration" and 1.4 "Specifications" of the Operation Manual MX890120B for details on the Specifications of the frequency accuracy.

• Option 18: Low IF/IQ Unbalance Input

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	1MΩ (parallel capacity <100 pF) or 50Ω selectable	
Input level range	0.1 to 1.0 Vp-p (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: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation mode: 64QAM partial reception signal Input level: 0.1 V (rms) 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: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation system: 64QAM partial reception signal Input level: 0.1 V (rms) Average count: 5 times for 1 Seg ±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 (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: 50Ω Mode: Mode3 Guard interval: 1/8 Segmentation offset: 512 Modulation mode: 64QAM partial reception signal In-put level: 0.1 V (rms) Average count: 10 times for 1 Seg signal. ≥50 dB (507.9 kHz typ.) 507.9 kHz: Frequency of 1/16 of FFT clock (512 MHz/63 MHz)

• MX890110A ISDB-T Field Test Software (MU890100A ISDB-T Demodulation Unit)

The specifications of the MX890110A Field Test Software shown in the table below.
These specifications are based on when the MX890110A is installed in the MS8901A. For performance specifications, each value is assumed to be obtained from measurement by implementing calibration after 30 minute preheating under constant ambient temperature conditions and then executing Adjust Range immediately before measurement.

Frequency	Channel Map	The following frequencies can be set according to the item selected for Channel Map: • General: A frequency from 32 MHz to 1000 MHz can be set in steps of 1 Hz • Interim-1: A frequency calculated from the following expression with N = 13 to 32 (channels) can be set. 473 + (N–13) × 6 + 0.142857 MHz • Interim-2: A frequency calculated from the following expression with N = 13 to 32 (channels) can be set. 473 + (N–13) × 6 + 0.15 MHz • VHF: A frequency calculated from the following expression with N = 1 to 12 (channels) can be set. 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 • UHF: A frequency calculated from the following expression with N = 13 to 62 (channels) can be set. 473 + (N–13) × 6 + 0.142857 MHz • CATV: A frequency calculated from the following expression with N = 13 to 63 (channels) can be set. 13 ≤N ≤21: 111 + (N–13) × 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤N ≤63: 225 + (N–23) × 6 + 0.142857 MHz • UHF (Brazil): A frequency calculated from the following expression with N = 14 to 69 (channels) can be set. 473 + (N–14) × 6 + 0.142857 MHz
	Spectrum direction (only when Channel Map is set to General)	Normal and Reverse can be selected for the spectrum direction based on the Spectrum setting.
Level	The reference level setting method can be switched between the manual setting by a user (Ref Setting) and the automatic setting (Adjust Range).	
	Reference level (Ref setting)	Preamplifier Off: –28 to +10 dBm (setting resolution: 2 dB) Preamplifier On: –48 to –10 dBm (setting resolution: 2 dB)
	Adjust range	This is a function used to set the reference level automatically. The reference level is determined by measuring the input power for the full frequency band.
	Refer to BER	The MS8901A measures BER for each layer at the Adjust Range execution and sets the reference level so that the measured result becomes optimal. (This function is valid when the MU890100A ISDB-T demodulation unit is installed and also the measurement is carried out on the BER screen)
Receiver performance (Valid for measurement on the Field strength screen when Channel Map is not set to General.)	Detuning characteristics	Attenuation with preamplifier Off, input attenuator 0 dB, 101 dBμV (emf) input: OFDM signal conforming to ISDB-T ≥35 dBc (±6 MHz offset), ≥50 dBc (±12 MHz offset) CW signal ≥46 dBc (–3.25 MHz offset), ≥54 dBc (–7.75 MHz offset), ≥46 dBc (+4.25 MHz offset), ≥54 dBc (+8.75 MHz offset)
	2-tone 3rd-order intermodulation distortion	Preamplifier Off, input attenuator 0 dB, CW signal, 93 dBμV (emf) input, 2-tone signal frequency difference 6 MHz: ≤–56 dBc Preamplifier On, input attenuator 0 dB, CW signal, 73 dBμV (emf) input, 2-tone signal frequency difference 6 MHz: ≤–53 dBc
	1 dB gain compression	Preamplifier Off, input attenuator 0 dB, OFDM signal conforming to ISDB-T: ≥107 dBμV (emf) Preamplifier On, input attenuator 0 dB, OFDM signal conforming to ISDB-T: ≥78 dBμV (emf)
Field strength (Valid when Channel Map is not set to General.)	For J1032 UHF bandpass filter input when the supplied 30 cm coaxial cable and J1032 UHF bandpass filter are connected to the RF input connector (The loss is automatically corrected only for 5.57 MHz band when Channel Map is set to Interim-1 or Interim-2.) At RF input connector end when Channel Map is set to UHF, VHF, or CATV.	
	Voltage measurement	Range: 43 to 123 dBμV (emf) (preamplifier Off), 27 to 103 dBμV (emf) (preamplifier On) Accuracy: ±2 dB (average value from sampling count of 100) Resolution: 0.01 dB Noise floor: ≤35 dBμV (emf) (preamplifier Off), ≤19 dBμV (emf) (preamplifier On) (At RF input terminal, average value from sampling count of 100)
	Field strength measurement	Range: Voltage measurement range + cable loss + antenna factor (The cable loss and antenna factor can be corrected by the Correction function and Antenna Factor function respectively.) Unit: dBμV/m Sampling count: 1 to 100 points Display system Instantaneous value: Displays instantaneous field strength Maximum value: Displays the maximum field strength for the number of measurement samples Minimum value: Displays the minimum field strength for the number of measurement samples Average value: Displays the average field strength for the number of measurement samples Bar graph: Displays the instantaneous field strength on a bar graph Display system for 1-segment measurement Displays the field strength of the central one segment (0.43 MHz bandwidth). Displays simultaneously with 13 segments' field strength Bar graph: Displays the instantaneous field strength of the central one segment. Displays simultaneously with that of 13 segments Relative value: Displays the theoretical figure calculated from the 13-segments' field strength and the relative value from the 1-segment field strength

<table>
<tr><td colspan="2">Channel power</td><td>Displays the voltage and power (5.57 MHz bandwidth) from RF input connector
Unit: W, dBm, dBmV, dBµV, dBµV(emf)
Range: –70 to +10 dBm (Preamplifier Off, typ.), –86 to –10 dBm (Preamplifier On, typ.)
Display system for 1-segment measurement:
Displays the channel power of the central 1 segment (0.43 MHz bandwidth)
Displays simultaneously with the 13 segments' channel power</td></tr>
<tr><td rowspan="11">Delay profile</td><td colspan="2">Measurement using a signal conforming to the Digital Terrestrial Broadcasting system</td></tr>
<tr><td>Mode</td><td>Mode1, Mode2, Mode3</td></tr>
<tr><td>Guard interval</td><td>1/4, 1/8, 1/16, 1/32</td></tr>
<tr><td>TMCC</td><td><table><tr><th></th><th>Segment</th><th>Modulation</th></tr><tr><td>Layer A</td><td>1 to 13</td><td>Sync/Diff</td></tr><tr><td>Layer B</td><td>1 to 12</td><td>Sync/Diff</td></tr><tr><td>Layer C</td><td>1 to 11</td><td>Sync/Diff</td></tr></table>• Total number of segments for Layer A to Layer C is 13
• The number of segments for Layer C is automatically set to the value calculated from the following expression: 13 – (segments for Layer A) – (segments for Layer B)
• Sync: Synchronous modulation
• Diff: Differential modulation</td></tr>
<tr><td>Mode, GI auto setting</td><td>Sets the mode and guard interval automatically by analyzing an input signal</td></tr>
<tr><td>D/U</td><td>Display range: –60 to 0 dB
Can be switched among –20, –30, –40, –50, –60
Marker resolution: 0.01 dB
D/U accuracy
Input signal:
RF input level: 63 dBµV (emf) or greater (Preamplifier Off), 43 dBµV(emf) or greater (Preamplifier On)
Modulation system: Synchronous modulation (for all segments), By using a 2-wave evaluation signal with the averaging count of 10:
±2 dB (–3 dB ≥D/U >–20 dB)
±3 dB (–20 dB ≥D/U >–30 dB)
Evaluation signals (delay time/level):
Path1: 0 s/0 dB, Path2: 0.95 GI/–3 dB
Path1: 0 s/0 dB, Path2: 1.48 µs/–3 dB
Path1: 0 s/0 dB, Path2: 0.95 GI/–20 dB
Path1: 0 s/0 dB, Path2: 3.69 µs/–20 dB
Path1: 0 s/0 dB, Path2: 0.95 GI/–30 dB
Path1: 0 s/0 dB, Path2: 6.27 µs/–30 dB</td></tr>
<tr><td>Delay time</td><td>Display range:
Fixes the screen display range/ can switch to the variable
• Fixing the range
– (1/12 of valid symbol length) to (1/4 of valid symbol length)
• Varies the range: 5 types of display range can be selected
– (2/48 of valid symbol length) to (14/48 of valid symbol length)
– (5/48 of valid symbol length) to (11/48 of valid symbol length)
– (8/48 of valid symbol length) to (8/48 of valid symbol length)
– (11/48 of valid symbol length) to (5/48 of valid symbol length)
– (14/48 of valid symbol length) to (2/48 of valid symbol length)
Valid range: 0 µs to Guard interval length
Marker resolution: 0.123 µs</td></tr>
<tr><td>Display method</td><td>Entire display: Displays all measured results of delay profile
Magnified display: Magnifies a part of Entire display.
(Two scaling factors can be selected in the Delay Profile screen.)</td></tr>
<tr><td>Marker</td><td>D/U ratio and delay time can be read using a marker in Magnified display
A delta marker is available</td></tr>
<tr><td>Mask</td><td>A standard line can be displayed on the Delay Profile display screen
0 µs or shorter: –28 dB
From 0 µs to Guard interval length:–3 dB
Guard interval length or longer: –28 dB</td></tr>
<tr><td>Relative level</td><td>Display range: –60 to 0 dB
Can be switched among –20, –30, –40, –50, –60
Marker resolution: 0.01 dB</td></tr>
<tr><td>Frequency</td><td>Display range: ±2.79 MHz
Marker resolution: 1 kHz</td></tr>
<tr><td>Display method</td><td>Entire display: Displays all measured results of multipath spectrum
Magnified display: Magnifies a part of Entire display</td></tr>
<tr><td>Marker</td><td>Frequency and relative level can be read using a marker in Magnified display.</td></tr>
<tr><td>Average (on the Delay Profile screen only)</td><td>Times: 2 to 100
Method
LOG: Averages the D/U value and relative level value in dB units.
LIN: Converts the D/U value and relative level value once to a antilog value for averaging.</td></tr>
</table>

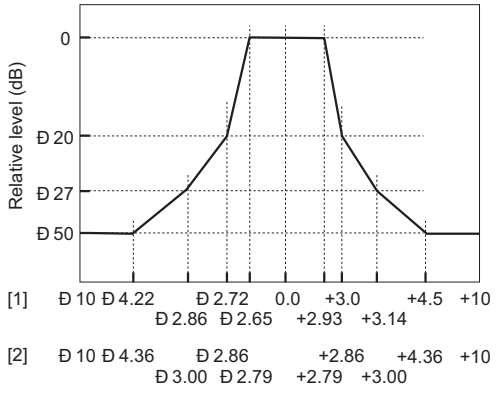
Level correction	Antenna factor	Type: Corr-1 to Corr-5, OFF No. of points: Up to 150 points Type: Dipole (MP534A/MP651A), Log-1 (MP635A), Log-2 (MP666A), User-1 to User-4, OFF No. of points: Up to 150 points
	Impedance switch	50Ω 75Ω: The insertion loss of the MA1621A impedance converter is automatically corrected.
BER measurement (Valid when MU890100A ISDB-T demodulation unit is installed)	Measurement using a signal conforming to the Digital Terrestrial Broadcasting system	
	BER mode	Can be switched between PN and Air.
	BER measurement	Two measurement functions of PN BER measurement and Air BER measurement are available. • PN BER: Possible only when the measurement target is PN. • Air BER: Possible even if the measurement target is not PN, such as an actual image. The following selections are available when measuring. • The BER measurement mode can be selected from the single mode (Single) and continuous mode (Continuous). • The BER measurement result display method can be selected from the following according to the combination of Rate/Count and Current/Last: Rate (Current), Rate (Last), Count (Current), Count (Last) PN BER measurement BER measurement is performed using a PN pattern. • Target data: Can be selected from After demodulation, After Viterbi decoder, and After RS decoder. • PN pattern: Can be selected from PN9, PN15, and PN23. • Range: Can be set by measuring time (1 to 359999 s (= 99 h 59 m 59 s), in steps of 1 s) • Result display: Can be switched between Rate and Count. • BER output: The measurement target data can be out-put. In this event, the target layer can be selected from A, B, and C. Air BER measurement BER measurement is performed by actual broadcasting. • Target data: Can be selected from After Viterbi decoder (BER measurement after demodulation) and After RS (BER measurement after Viterbi decoder). • Measuring bits: 1e5, 1e6, 1e7, 1e8, 1e9, 1e10 • TS output: The measurement target data can be output with the packet length of 188 bytes, regardless of the target data type. In this event, the target layer can be selected from A, B, C, and All.
	Transmission parameter automatic search	The target items for the transmission parameter automatic search function can be selected from the following: • Mode, GI, TMCC: The mode, guard interval, and TMCC are automatically searched. • TMCC: The TMCC is automatically searched.
	TMCC information monitor	The information of the following items can be automatically obtained and displayed from the received signals. • System identification: ISDB-T (TV)/ISDB-TSB (radio) • Transmission parameter switching index: 1 to 15 frames before switching/normal value • Emergency alarm broadcasting start flag: Emergency alarm (starting is controlled)/ None (starting is not controlled) • Partial reception flag (TV): PR (partial reception)/None • Format identification flag (radio): 1 segment/3 segments • Carrier modulation system (for each layer): DQPSK/QPSK/16QAM • Convolution code ratio (for each layer): 1/2, 2/3, 3/4, 5/6, 7/8 • Interleave length (for each layer): 0, 4, 8, 16 (Mode1) 0, 2, 4, 8 (Mode2) 0, 1, 2, 4 (Mode3) • Number of segments (for each layer): 1 to 13, unused (TV)
	Status display	Synchronization The status of the following synchronization is displayed in green (synchronized) and red (not synchronized): • Symbol synchronization: Synchronized (green)/not synchronized (red) • Frequency synchronization: Synchronized (green)/not synchronized (red) • Frame synchronization: Synchronized (green)/not synchronized (red) TMCC error The TMCC error status is displayed in green (no error) and red (error). Green (no error)/Red (error) PN synchronization (for PN BER measurement only) The PN synchronization status is displayed in green (synchronized) and red (not synchronized). When PN was once not synchronized but now synchronized, it is displayed in yellow. Error for each layer The BER measurement status for each layer (A/B/C) is displayed in green (no error), red (error), and yellow (currently no error but an error existed before).
	Buzzer	This is a function to alarm the status change from green/yellow to red by beeping.
	Output connector	The following two outputs are exclusive according to the BER Mode (PN BER measurement/Air BER measurement). BER output Output for external BER measurement Two types of signals Data (Pos/Neg switch) and Clock (Rise/Fall switch) can be output. Connector: BNC-J Impedance: 75Ω Output level: 0 to 5 V (typ.) DVB-ASI output Connector used to input TS data after demodulation to an external MPEG decoder, etc. Connector: BNC-J Impedance: 75Ω Output level: 800 mVp-p (typ.)

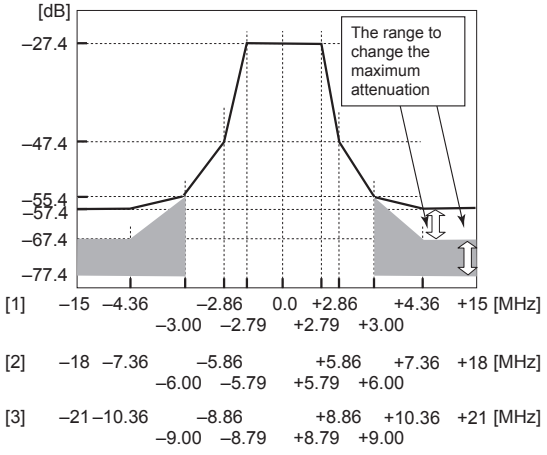
• MX890120B ISDB-T Signal Analysis Software

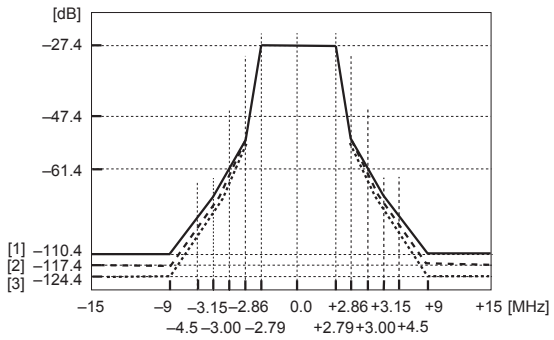
The specifications of the MX890120B are shown in the table below. These specifications are based on when the MX890120B is installed in the MS8901A. For performance specifications, each value is assumed to be obtained by implementing calibration after 30 minute preheating under constant ambient temperature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

Frequency	Setting range	When Interim-1 or Interim-2 is selected for Channel Map: 13 to 32 channels When UHF is selected for Channel Map: 13 to 62 channels Center frequency of transmission bandwidth for N channels: 473 + (N–13) × 6 + 0.142857 MHz (Interim-1, UHF) 473 + (N–13) × 6 + 0.15 MHz (Interim-2) General is selected for Channel Map: 32 MHz to 3000 MHz, 1 Hz steps IF Band is selected for Channel Map: 3.9 MHz to 38 MHz, 1 Hz steps VHF is selected for Channel Map: 1 to 12 channels Nch 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 CATV is selected for Channel Map: 13 to 63 channels Nch center frequency for CATV 13 ≤N ≤21: 111 + (N–13) × 6 + 0.142857 MHz N = 22: 167.142857 MHz 23 ≤N ≤63: 225 + (N–23) × 6 + 0.142857 MHz UHF (Brazil) is selected for Channel Map: 14 to 69 channels Nch 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.
Level	Setting mode	Reference setting: Inputs the reference level. Adjust range: The MS8901A measures input power for all bandwidth 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	–26 to +10 dBm (Preamplifier Off) –46 to –10 dBm (Preamplifier On)
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. 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 MHz to 1000 MHz
	Frequency lock range	±99 kHz
	Level range	–26 to +10 dBm (Preamplifier Off), –46 to –10 dBm (Preamplifier On)
	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, when mode: Mode3, guard interval: 1/8, segmentation offset: 512, modulation system for all segments of Layer_A to _C: 64QAM, 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)

<table>
<tr><td rowspan="6">Modulation analysis</td><td>MER measurement item</td><td>Conventional (overall), Layer_A, Layer_B, Layer_C, TMCC, AC1, AC2</td></tr>
<tr><td>Residual MER</td><td>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, Preamplifier Off, average count: 10, 13 segments;
≥44 dB (37.15 MHz, typ.)
≥42 dB (500 MHz, typ.)</td></tr>
<tr><td>Constellation</td><td>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 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>Frequency response</td><td>Displays assuming the average level of 5.57 MHz bandwidth is 0 dB.
Level axis: ±2, ±5, ±10, ±20, ±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>1/62</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>
<tr><td>Mode3</td><td>0 to 2048</td><td>0 to 1024</td><td>0 to 512</td><td>0 to 256</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 (typ.)
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>
<tr><td>Sub-carrier MER</td><td>Displays MER of all sub-carriers, which exist in the bandwidth.
MER axis: 20, 30, 40, 50, 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.
Maker Function: Enables to read MER and frequency with maker 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</td></tr>
</table>

C/N	For CW (continuous wave)	
	Frequency range	32 MHz to 1000 MHz (except IF Band)
	Offset frequency	100 Hz to 10 MHz
	C/N value	–140 to –40 dBc/Hz
	Residual C/N	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	Input level: –20 to +10 dBm (Preamplifier Off) or –40 to –10 dBm (Preamplifier 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.
	Level range	–20 to +10 dBm (Preamplifier Off), –40 to –10 dBm (Preamplifier On)
	C/N integration function	Calculates C/N integral value for the specified range. C/N integral display range: –99.9 to 0 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.
Spectrum mask	Measurement can be set with two methods	
	Type A: Only 1 channel is fixed for the measurement channel numbers	
	Frequency	32 MHz to 2990 MHz (except IF Band)
	Mask type	Transmission, User-1, User-2
	Mask break point	Transmission: Conforms to the transmission spectrum mask described in the “ARIB STD B31” (version 1.5).  **Difference from channel center frequency (MHz)** Notes: [1] When Channel Map is set to other than General (except IF Band) [2] When Channel Map is set to General
	Pass/Fail judgment	Performs Pass/Fail judgment. Judged as “Fail” when the spectrum waveform exceeds the mask line. 0 dB line is not included in the criteria.
	Marker function	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.
	Occupied frequency bandwidth measurement	Measures the bandwidth, where 99% of total power of 20 MHz span is included. 1 kHz resolution.
	Level range	When frequency is from 32 MHz to 1000 MHz: –22 to +10 dBm (Preamplifier Off) (Frequency: 32 MHz to 1000 MHz) –42 to –10 dBm (Preamplifier On) (Frequency: 32 MHz to 1000 MHz)
	Spectrum mask line recall	Recalls the spectrum mask line by using a remote control command.

Spectrum mask	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 MHz to 2985 MHz (except 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/30 dB 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 • 30 dB 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 W to 2.5 W Only when the station power is selected to Low 0.025 W 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
	Maximum attenuation	When station power is high: –77.4 dB When station power is low: 0.25 W <P ≤2.5 W: – (73.4 + 10 logP) dB P ≤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 ≤P <0.25 W: – (73.4 + 10 logP) dB P ≤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. Display: Only at 1 channel measurement Resolution: 1 kHz Display: Only at 1 channel measurement
	Level range	–22 to +10 dBm (Preamplifier Off) (Frequency 32 MHz to 1000 MHz) –42 to –10 dBm (Preamplifier On) (Frequency 32 MHz to 1000 MHz)
	Mask line recall	Recalls the spectrum mask line by using a remote control command.

Spectrum mask	Brazil: Channel number for measurement is fixed to 1 channel.	
	Frequency	32 MHz to 2985 MHz (other than IF Band)
	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	–22 to +10 dBm (Preamplifier: Off) (Frequency 32 MHz to 1000 MHz) –42 to –10 dBm (Preamplifier: On) (Frequency 32 MHz 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 MHz to 1000 MHz
	Frequency measurement accuracy	When input level: –20 to +10 dBm (Preamplifier Off) or –40 to –10 dBm (Preamplifier On), for input signal of ±1 kHz from the set frequency, average count: 5; ±0.1 Hz + (reference frequency accuracy x measurement frequency)
	Display resolution	0.01 Hz
Storage mode	For modulation analysis, C/N and frequency counter	
	Normal	Displays measured results every time.
	Average	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.
	Max. hold	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.
	Overwrite	Waveform display is overwritten without clearing the past measured results. Numeric values are displayed each time same as Normal display.
	Moving average	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.
RF/IF auto switch mode	Measurement target	User setting value (RF) and preset value (IF)
	Preset value	As IF, Channel Map is 37.15 MHz when General is set, spectrum reverse
	User setting items	RF: Channel Map/frequency/offset frequency/reference setting IF: Reference setting
	Measurement target display	RF: RF measurement, IF: IF measurement No Measure: Not measured
	Switch status display	(No display): Normal, Signal Loss: No signal, Signal Abnormal: Signal error
	Storage status display	(No display): Normal, Changed: Input is switched when storage mode is set to Average or Moving Average.

Ordering Information

Please specify the model/order number, name and quantity when ordering.
The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

• MS8901A

Model/Order No.	Name	
	Main frame	
MS8901A	Digital Broadcast Signal Analyzer	
	Standard accessories	
J0017F	Power Code, 2.6 m:	1 pc
J0266	Adapter (tripolar/dipolar conversion):	1 pc
J0996B	RS232C Cable:	1 pc
F0014	Fuse, 6.3 A:	1 pc
B0329G	Front Cover for 3/4 MW 4U:	1 pc
MA1621A	50Ω to 75Ω Impedance Transformer:	1 pc
W1717AE	MS8901A Operation Manual Vol. 1 (Basic Operation):	1 copy
W1782AE	MS8901A Operation Manual Vol. 2 (Panel Operation):	1 copy
W1783AE	MS8901A Operation Manual Vol. 3 (Programming):	1 copy
MX268001A	File Transfer Utility:	1 pc
	Option	
MS8901A-01	Precision Frequency Reference (Aging Rate: 5×10^{-10}/day)	
MS8901A-02	Narrow Resolution Bandwidths (FFT) (1 Hz to 1 kHz)	
MS8901A-04	Digital Resolution Bandwidth (10 Hz to 1 MHz, RMS Detection Function)	
MS8901A-09	Ethernet Interface (10BASE-T)	
MS8901A-18	Low IF/IQ Unbalanced Input	
MS8901A-21	Power Meter	
MS8901A-34	4 GHz LO Output	
MS8901A-41	Power Meter Retrofit	
MS8901A-46	Auto Power Recovery	
MS8901A-47	Rack-mount (IEC) without Handles	
MS8901A-48	Rack-mount (JIS) without Handles	
MS8901A-53	High Accuracy Modulation Frequency Measurement (Option 73 retrofit)	
MU890100A	ISDB-T Demodulation Unit*1	
	Measurement software	
MX890110A	ISDB-T Field Test Software (Attached to J1032 UHF Band Pass Filter)	
MX890120B	ISDB-T Signal Analysis Software	

Model/Order No.	Name
	Application parts
J0576D	Coaxial Cord, 2 m (N-P/ 5D-2W/ N-P)
J0127C	Coaxial Cord, 0.5 m (BNC-P, RG-58A/U, BNC-P)
J0127A	Coaxial Cord, 1 m (BNC-P, RG-58A/ U, BNC-P)
J0007	408JE-104 GP-IB Cable (1 m)
J0008	GPIB Cable, 2 m
J1032	UHF Bandwidth Pass Filter (460 MHz to 600 MHz)
MP59B	50Ω Coaxial Switching Unit (DC to 3 GHz, Manual Switch)
MP640A	Branch (DC to 1700 MHz, 50Ω)
MP520C	CM Directional Coupler (25 MHz to 500 MHz, 50Ω)
MP520D	CM Directional Coupler (100 MHz to 1700 MHz, 50Ω)
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)
MP534A	Dipole Antenna (25 MHz to 520 MHz)
MP651A	Dipole Antenna (470 MHz to 1700 MHz)
MP635A	Log Periodic Antenna (80 MHz to 1000 MHz)
MP666A	Log Periodic Antenna (200 MHz to 2000 MHz)
MB9A	Tripod (for MP666A, MP651AB, MP534A/B)
MB19A	Tripod (for MP635A, MP666A, with pole)
B0452A	Hard Carrying Case with Caster
MA4701A	Power Sensor (10 MHz to 18 GHz, –30 to +20 dBm, N connector)
MA4703A	Power Sensor (50 MHz to 26.5 GHz, –30 to +20 dBm, SMA connector)
MA4705A	Power Sensor (50 MHz to 32 GHz, –30 to +20 dBm, SMA connector)
J0370A	Sensor Connecting Code, 1.5 m

• MX890110A

Model/Order No.	Name	
	Measurement software	
MX890110A	ISDB-T Field Test Software	
	Standard accessories	
J1032	UHF Band Pass Filter (460 MHz to 600 MHz):	1 pc
J0576E	Coaxial Cord, 30 cm (N-P/5D2W/N-P):	1 pc
Z0808	ANR-CFX00T64 (P) (Memory Card)*2:	1 pc
W1718AE	MX890110A Operation Manual:	1 copy
	Option	
MU890100A	ISDB-T Demodulation Unit*1	

• MX890120B

Model/Order No.	Name	
	Measurement software	
MX890120B	ISDB-T Signal Analysis Software	
	Standard accessories	
Z0808	ANR-CFX00T64 (P) (Memory Card)*2:	1 pc
W2312AE	MX890120B Operation Manual:	1 copy
	Option	
MX890110A	ISDB-T Field Test Software*3	

∗1: MX890110A is necessary.

∗2: Means ATA memory card, CompactFlash card or gettable memory card with a minimum size of 20 MB.

∗3: This software can be used at the same time with MX890120B.

Anritsu

Specifications are subject to change without notice.

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Catalog No. MS8901A-E-A-1-(3.00) Printed in Japan 19/NOV/2012 ddch/CDT