DIGITAL MOBILE COMMUNICATIONS MEASURING INSTRUMENTS

Mobile communication measurement equipment

(example of an application; various other types of measurement equipment are also available)

Type of measurement equipment	Communication system																		Anritsu model	Equipment to be measured										
	Digital																	Analog		Mobile equipment				Base station						
	8PSK	GMSK		GFSK		π/4 DQPSK				CDMA			π/4 DQPSK			M-16QAM													
	Europe etc.							USA				Japan																		
	EDGE	GSM	PCN (DCS1800)	CT2	DECT	TFTS	TETRA	NADC	PACS	WCPE	CDMA (IS-95)	CDMA (ARIB STD-T53)	W-CDMA	PDC	PHS	RCR STD-39	DMCA			Transmitter	Receiver	Signalling	Maintenance, troubleshooting	Transmitter	Receiver	Signalling	Construction, maintenance	Service areas	Entrance circuitry	Parts
Radio communication analyzer		√	√					√			√	√		√	√			√	MT8801C	√	√	√	√	√	√					√
													√						MT8820A	√	√	√	√							√
Digital mobile radio transmitter tester	√	√											√						MS8608A/8609A	√				√			√			√
		√	√	√	√	√	√	√	√	√				√	√	√	√		MS8604A	√				√			√			√
Time-domain-capable spectrum analyzer		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	MS2661B/C, MS2663C, MS2665C, MS2667C, MS2668C	√	√			√	√		√	√		√
	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	MS2683A	√	√		√	√	√		√	√		√
Digital modulation signal generator													√						MG3681A		√		√		√		√			√
		√	√	√	√	√	√	√	√	√	√	√		√	√	*	*		MG3670B/C, MG3671A/B		√		√		√		√			√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	*	*		MG3672A		√		√		√		√			√
		√	√	√	√	√	√	√	√	√				√	√				MG3660A		√		√		√		√	√		√
Signalling tester														√					MD1620B			√	√							
															√				MD1620C*			√	√			√				
													√						MD8480A			√	√							
Radio communication test system												√	√		√	√			ME7812 series	√	√	√	√							
Error rate tester		√	√	√	√	√	√	√	√	√				√	√	√	√		MP1201C		√				√		√		√	√
		√	√	√	√	√	√	√	√	√				√	√	√	√		MD6420A		√				√		√		√	
Signal generator		√		√			√	√								√		√	MG3641A		√				√		√	√		√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	MG3642A		√				√		√	√		√
		√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	MG3633A		√				√		√			√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	68000C, 69000B		√				√		√		√	√
Power meter		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	ML2437A/2438A	√				√			√			√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	ML2407A/2408A	√				√			√			√
Frequency counter		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	MF2400B series	√				√			√			√
Measuring receiver														√			√	√	ML5655C								√	√		
		√															√	√	ML524B*								√	√		
Site master		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	S331B								√			
Network analyzer		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	54100A series								√			√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	MS4630B	√	√			√	√					√
		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	37200C series	√	√			√	√					√
Area tester													√						ML8720B								√	√		

*: Custom-made product

For product ordering information, see pages 4 – 10

DIGITAL MOBILE RADIO TRANSMITTER TESTER

MS8609A

9 kHz to 13.2 GHz

Measures Wide-Band Signals up to IMT-2000 2 Mbit/s

NEW

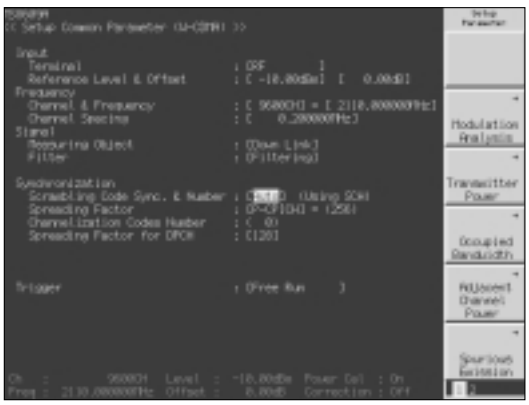
CE GPIB

The MS8609A is a transmitter tester equipped with an internal spectrum analyzer, a modulation analyzer and a power meter. One tester covers the development, manufacturing of base stations, mobile stations to construction, maintenance of base stations.
The spectrum analyzer has resolution bandwidths up to 20 MHz, meaning that it can readily support measurement of a 2 Mbit/s (16 Mcps) wide-band signal for IMT-2000.
The modulation analyzer realizes all Vector Signal Analysis (VSA) functions through high-speed DSP. The power sensor can perform highly accurate power measurements of ±0.4 dB by using an amorphous power sensor.
Up to three dedicated measurement software options (such as W-CDMA and GSM/EDGE) can be installed simultaneously. Input signals can be selected from either RF or I/Q inputs. For I/Q signals, balanced or unbalanced input can also be selected.
It is equipped with GPIB, RS-232C and 10 Base-T (optional) interfaces for remote measurement. High-speed GPIB data transmission of 120 kbyte/s enables high-speed measurement on the manufacturing line. The monitor uses an easy-to-see 6.5 type TFT color LCD.

MX860901B W-CDMA Measurement Software

• Parameter setup

The measurement parameters such as modulation accuracy and code domain power are set on the screen shown below.
Measurement are simply performed via a soft-key menu after setting the measurement parameters.



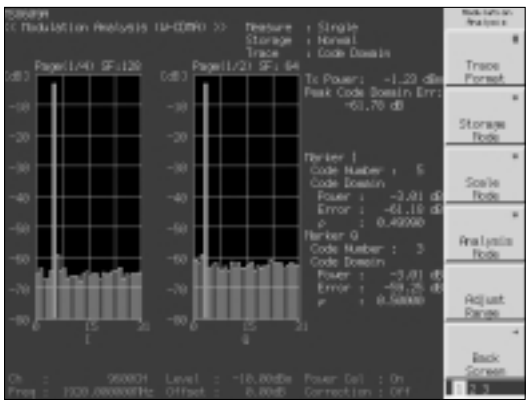
• Base station code domain power

Only 3 seconds are required for measurement. Either automatic detection of scrambling code from SCH, or specification of scrambling code can be selected.

• Modulation accuracy measurement

The modulation accuracy of base station and mobile equipment can be measured and modulation analysis of multiple waveforms can be performed. The residual vector error (rms) accuracy is high (1%, typical).

• Mobile terminal code domain power
Displays the code domain power measurement results of phase I and phase Q, separately. Either synchronization with DPCCH or specification of spreading factor and code can be selected.



• I/Q level measurement
Measures and displays each I and Q input voltage (rms, p-p value). dBmV or mV units are selectable.

• Spectrum analyzer function
This analyzer has a wide dynamic range and various useful measurement functions.

• Power meter function
The built-in power meter uses the amorphous power sensor and the measurement accuracy is very high (±0.4 dB).

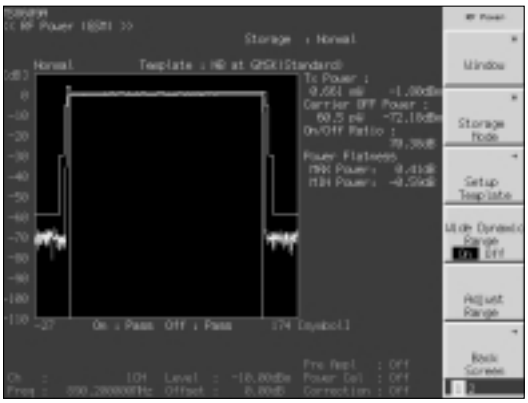
• Demodulation data monitoring
After de-spreading, up to 10 frames of I/Q data can be evaluated with external application software. (Sample soft-ware can be provided.)

MX860902A GSM Measurement Software

• Parameter setup
The measurement parameters such as GMSK modulation of GSM and 8PSK modulation of EDGE are set on the screen shown below. Measurement are simply performed via a soft-key menu after setting the measurement parameters.

• Modulation accuracy measurement
The modulation accuracy is high. (The residual phase error of GMSK modulation: rms, < 0.5° and residual EVM of 8PSK modulation: rms, < 1.0%)

• Transmitter power measurement
The screen displays the amplitude waveforms with horizontal axis a symbol, vertical axis a level and the template simultaneously.

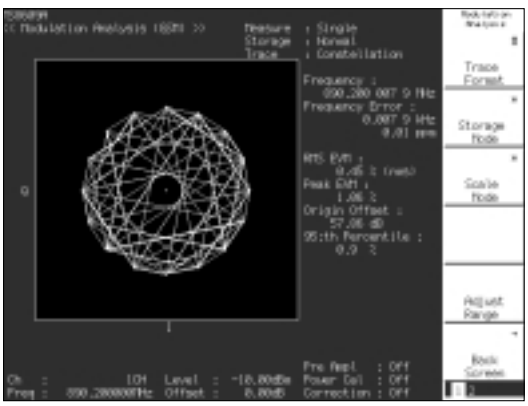


• Trellis display function
The screen displays the trellis and the modulation accuracy result simultaneously.

• Output RF spectrum measurement
The output RF spectrum measurement can be performed at high speed and simply.

• Spurious measurement
Spurious measurement has three kinds of method: Sweep, Search, and Spot. These can be selected depending on the usage.

• EDGE constellation display
The following screen represents constellation display through the filter of the EDGE constellation display of the GSM standard. And the screen represents constellation display of the 8PSK modulation through Nyquist filter and Gaussian inverse correction filter.



For product ordering information, see pages 4 – 10

Specifications

• **MS8609A**

Frequency range		9 kHz to 13.2 GHz
Max. input level		+20 dBm (100 mW), continuous average power
Input impedance		Power meter 50 Ω, VSWR: ≤1.3 (30 MHz to 3 GHz) Except power meter 50 Ω, VSWR: ≤1.5 (input attenuator: ≥4 dB, ≤3 GHz)/≤2.3 (input attenuator: ≥10 dB, >3 GHz)
Input connector		N-type
Reference oscillator		Frequency: 10 MHz Starting characteristics: ≤5 x 10^{-8}/day (after 10 minute warm-up, compared to frequency after 24 hour warm-up) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ±5 x 10^{-8} (0˚ to 50˚C, compared to frequency at 25˚C)
Power meter		Frequency range: 30 MHz to 3 GHz Level range: –20 to +20 dBm Measurement accuracy (after zero calibration): ±10%
Spectrum analyzer	Frequency	Frequency setting Setting range: 9 kHz to 13.2 GHz, Pre-selector range: 3.15 to 13.2 GHz (Band 1 and 2) Frequency accuracy Accuracy: ± (display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 0.15 + 10 x N Hz) Normal marker: Same as display frequency accuracy Delta marker: Same as span accuracy Frequency span setting range: 0 Hz, 5 kHz to 13.2 GHz Span accuracy: ±1.0% (at single band sweep, number of data points: 1001) RBW (resolution bandwidth) Setting range: 300 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 20 MHz (Band 0) Accuracy: ±20% (300 Hz to 10 MHz), ±40% (20 MHz) Selectivity (60 dB: 3 dB): ≤15:1 VBW (video bandwidth): 1 Hz to 3 MHz (1-3 sequence), off Sideband noise: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Amplitude	Maximum input level Continuous average power: +20 dBm, DC voltage: 0 V Average noise level (RBW: 300 Hz, VBW: 1 Hz): [Without Option 08] ≤–124 dBm + 1.5 x f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + 1.5 x f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤–107 dBm (7.7 to 13.2 GHz, Band 2) [With Option 08] ≤–122 dBm + 1.8 x f [GHz] dB (1 MHz to 2.5 GHz, Band 0) ≤–120 dBm + 1.8 x f [GHz] dB (2.5 to 3.2 GHz, Band 0) ≤–116 dBm (3.15 to 7.8 GHz, Band 1) ≤–107 dBm (7.7 to 13.2 GHz, Band 2) Residual response: ≤–100 dBm (1 MHz to 3.2 GHz, Band 0), ≤–90 dBm (3.15 to 7.8 GHz, Band 1) Reference level Setting range: –100 to +30 dBm Accuracy: ±0.75 dB (+0.1 to 20 dBm), ±0.5 dB (–49.9 to 0 dBm), ±0.75 dB (–69.9 to –50 dBm), ±1.5 dB (–80 to –70 dBm) ∗After calibration, frequency: 50 MHz, span: 1 MHz (Input attenuator, RBW, VBW and sweep time are set to AUTO.) Input attenuator: 0 to 62 dB (2 dB steps) Frequency response: ±0.6 dB (9 kHz to 3.2 GHz, Band 0), ±1.5 dB (3.15 to 7.8 GHz, Band 1[*1]), ±2.0 dB (7.7 to 13.2 GHz, Band 2[*1]) Log linearity: ±0.4 dB (0 to –20 dB, RBW: ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW: ≤1 kHz) 2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz), ≤–75 dBc (200 to 850 MHz, Band 0), ≤–70 dBc (0.85 to 1.6 GHz, Band 0), ≤–90 dBc (1.6 to 6.6 GHz, Band 1 and 2) Two-tone 3rd order distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 3.2 GHz), ≤–80 dBc (3.15 to 7.8 GHz), ≤–75 dBc (7.7 to 13.2 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm 1 dB gain compression: ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz, Band 0), ≥–3 dBm (≥3150 MHz, Band 1 and 2)
	Sweep	Setting range: 10 ms to 1000 s (frequency axis sweep), 1 µs to 1000 s (time axis sweep) Trigger switch: Free-run, triggered Trigger source: Wide IF video, Line, External (TTL level), External (±10 V) Trigger delay Pre-trigger range: –time span to 0 s Resolution: time span/500 or 100 ns whichever is larger. Post trigger: 0 µs to 65.5 ms Resolution: 100 ns (sweep time: ≤4.9 ms), 1 µs (sweep time: ≥5 ms) Gate sweep mode Gate delay range: 0 to 65.5 ms (resolution: 1 µs), Gate length range: 2 µs to 65.5 ms (resolution: 1 µs)

Continued on next page

Spectrum analyzer	Functions	Number of data points: 501, 1001 Detection modes: Normal, Positive peak, Negative peak, Sample, Average, rms (Option 04) Display functions: Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time Storage functions: Normal, View, Max hold, Min hold, Average, Linear average, Cumulative, Overwrite Markers Signal search: Auto tune, Peak → CF, Peak → Ref, Scroll Zone markers: Normal, Delta Marker function: Marker → CF, Marker → Ref, Marker → CF step size, Δ marker → Span, Zone → Span Peak search: Peak, Next peak, Min dip, Next dip Multi-marker: 10 max. Measurements Noise power: dBm/Hz, dBm/ch, dBμ$\sqrt{Hz}$ C/N: dBc/Hz, dBc/ch Occupied bandwidth: Power N% method, X-dB down method Adjacent channel power Reference measurement: Total power, reference level, in-band method Display methods: Channel specified display (3 channels x 2), graphic display Average power of burst signal: Average power within specified time range of time domain waveform Template comparison measurement (time sweep): Upper limit x 2, lower limit x 2 Mask measurement (frequency sweep): Upper limit x 2, lower limit x 2
Others		Display: Color TFT-LCD, VGA 6.5 type Hard copy: Hard copy of screen via parallel interface (ESC/P compatible printer) Memory card interface: ATA flash card (3.3/5V) GPIB: Can be controlled from external controller (except power switch) when specified as device Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Parallel interface: Centronics printer I/F, D-sub 25-pin connector (female) Video output: Analog RGB output, D-sub 15-pin connector (female)
Dimensions and mass		320 (W) x 177 (H) x 411 (D) mm (except handle, feet, front cover and fan cover), ≤16 kg (nominal)
Power		100 to 120/200 to 240 Vac (–15/+10%, max. voltage: 250 V, automatic voltage selection), 47.5 to 63 Hz, ≤400 VA
Operating temperature and humidity		0˚ to 50˚C, ≤85% (no condensation)
EMC		EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)
LVD		EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: Reference frequency: 50 MHz, input attenuator: 10 dB, 18˚ to 28˚C

• MX860901B W-CDMA Measurement Software

Guaranteed specifications after Adjust Range and Power Calibration keys pressed

Modulation/frequency measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (average power, pre-amplifier: off), –80 to +10 dBm (average power, pre-amplifier: on[*1]) Carrier frequency accuracy: ±(reference oscillator accuracy + 10 Hz) ∗Input level: ≥–30 dBm (pre-amplifier: off), ≥–40 dBm (pre-amplifier: on[*1]),1 code channel Modulation accuracy (residual vector error): <2% (rms) ∗Input level: ≥–30 dBm (pre-amplifier: off), ≥–40 dBm (pre-amplifier: on[*1]), 1 code channel Origin offset accuracy: ±0.5 dB ∗Input level: ≥–30 dBm (pre-amplifier: off), ≥–40 dBm (pre-amplifier: on[*1]), 1 code channel, relative to signal with origin offset of –30 dBc Waveform display (for one-channel to multi-channel) Constellation display, vector error vs. chip, phase error vs. chip, amplitude error vs. chip
Code domain analysis	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (average power, pre-amplifier: off), –80 to +10 dBm (average power, pre-amplifier: on[*1]) Code domain power accuracy: ±0.1 dB (code power: ≥–10 dBc), ±0.3 dB (code power: ≥–25 dBc) ∗Input level: ≥–10 dBm (pre-amplifier: off), ≥–20 dBm (pre-amplifier: on[*1]) Code domain error Residual error: <–50 dB Accuracy: ±0.5 dB (error: relative to signal with origin offset of –30 dBc) ∗Input level: ≥–10 dBm (pre-amplifier: off); ≥–20 dBm (pre-amplifier: on[*1]), spread factor: 512 (down-link)/256 (up-link) Display Function: Code domain power, code domain error Spread factor: 4 to 256 (up-link)/4 to 512 (down-link), spread factor auto detection function, I/Q separately at up-link
Amplitude measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –60 to +20 dBm (average power, pre-amplifier: off), –80 to +10 dBm (average power, pre-amplifier: on[*1]) Transmitter power measurement Measurement range: –20 to +20 dBm (average power, pre-amplifier: off), –20 to +10 dBm (average power, pre-amplifier: on[*1]) ∗Auto calibrated at internal power meter Accuracy: ±0.4% Power measurement linearity: ±0.2 dB (0 to –40 dB) ∗Input level: ≥–10 dBm (pre-amplifier: off); ≥–20 dBm (pre-amplifier: on[*1]), after the range adjusted, with the reference level setting unchanged Filter selection function: Power measurement through RRC (α= 0.22) filter Transmitter power control measurement function: Relative power per slot, NO/GO evaluation
Occupied bandwidth measurement	Frequency range: 50 MHz to 3 GHz Input level: –60 to +20 dBm (average power, pre-amplifier: off), –80 to +10 dBm (average power, pre-amplifier: on[*1]) Measurement method Sweep method: Displays result after signal measured with sweep spectrum analyzer FFT method: Displays result after FFT

Continued on next page

Adjacent channel power measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (Option 08) Input level: –10 to +20 dBm (average power, pre-amplifier: off) Measurement method Sweep method (all): Calculates and displays result after signal measured with sweep spectrum analyzer Sweep method (separate): Calculates and displays power after each adjacent channel measured with sweep spectrum analyzer Filter method: Measures and displays power of adjacent channels after passing via built-in receiving filters (RRC: α = 0.22) Measurement range Input level: ≥0 dBm (filter method, wide dynamic range mode) Code channel (1 code): ≥55 dBc (5 MHz offset), ≥62 dBc (10 MHz offset) Code channel (16 multi-code): ≥50 dBc (5 MHz offset), ≥60 dBc (10 MHz offset, without Option 08) Input level: ≥–10 dBm (filter method, wide dynamic range mode) Code channel (1 code): 55 dBc (5 MHz offset, typical), 62 dBc (10 MHz offset, typical) Code channel (16 multi-code): 50 dBc (5 MHz offset, typical), 60 dBc (10 MHz offset, typical)
Spurious measurement	Measurement frequency: 9 kHz to 12.75 GHz (except within carrier frequency ±50 MHz) Input level (transmitter power): 0 to +20 dBm (average power, pre-amplifier: off) Measurement method Sweep method: Sweeps the specified range of frequency using the spectrum analyzer, and then detects and displays the peak value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Spot method: Measures the specified frequency with time domain from the spectrum analyzer and then displays the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Search method: Sweeps the specified frequency range using the spectrum analyzer to detect the peak value, then measures the frequency using the time domain to display the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Measurement range[*2]: ≥79 dB (RBW: 1 kHz, 9 to 150 kHz, Band 0) ≥79 dB (RBW: 10 kHz, 150 kHz to 30 MHz, Band 0) ≥79 dB (RBW: 100 kHz, 30 to 1000 MHz, Band 0) ≥76 –f [GHz] dB (RBW: 1 MHz, 1 to 3.15 GHz, Band 0) ≥76 dB (RBW: 1 MHz, 3.15 to 7.8 GHz, Band 1) ∗Carrier frequency: 1.8 to 2.2 GHz
I/Q signal	Input: Balanced, unbalanced Input impedance: 1 MΩ (parallel capacity: <100 pF), 50 Ω Balanced input Differential voltage: 0.1 to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, code domain power, amplitude, occupied bandwidth (FFT method), I/Q level Residual vector error: <2% (rms) ∗Input level: ≥0.1 V (rms), DC coupling I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When the CW signal is inputted to I and Q input terminals, measures and displays the phase difference between I- and Q-phase signals.

∗1: Can be set when MS8609A-08 option is installed in the main unit.
∗2: When carrier frequency is in a 2030.354 to 2200 MHz range, spurious will be generated at the frequency below.
f (spurious) = f (input) –2030.345 MHz

• MX860902A GSM Measurement Software

Guaranteed specifications after Adjust Range and Power Calibration keys pressed

Modulation/frequency measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –40 to +20 dBm (burst average power, pre-amplifier: off), –60 to +10 dBm (burst average power, pre-amplifier: on[*1]) Carrier frequency accuracy: ± (reference oscillator accuracy + 10 Hz) ∗Input level (burst average power): ≥–30 dBm (pre-amplifier: off), ≥–40 dBm (pre-amplifier: on[*1]) Residual phase error (GMSK modulation): <0.5 deg (rms), <2.0 deg (peak) ∗Input level (burst average power): ≥–30 dBm (pre-amplifier: off), ≥–40 dBm (pre-amplifier: on[*1]) Residual EVM (8PSK modulation): <1% (rms) Waveform display: Trellis (GMSK modulation), eye pattern, EVM vs. bit (8PSK modulation), phase vs. bit, amplitude vs. bit, I/Q diagram
Amplitude measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –40 to +20 dBm (burst average power, pre-amplifier: off), –60 to +10 dBm (burst average power, pre-amplifier: on[*1]) Transmitter power measurement (auto calibrated at internal power meter) Measurement range: –10 to +20 dBm (burst average power), –10 to +10 dBm (burst average power, pre-amplifier: on[*1]) Accuracy: ±0.4 dB Power measurement linearity: ±0.2 dB (0 to –30 dBm) ∗Input level (burst average power): ≥–10 dBm (pre-amplifier: off); ≥–20 dBm (pre-amplifier: on[*1]), without changing the reference level setting after range optimization Carrier-off power measurement range Input level (burst average power): ≥–10 dBm (pre-amplifier: off), ≥–20 dBm (pre-amplifier: on[*1]) Normal mode: ≥60 dB (compared with burst average power) Wide dynamic range mode: ≥80 dB (compared with 10 mW of burst average power) ∗Measurement limit is decided by average nose level (≤–70 dBm, 50 MHz to 2.7 GHz). Rise/fall characteristics: Display rising/falling edges while synchronizing to modulation data of signal data to be measured. Standard line display possible (measured by 1 MHz bandwidth). NO/GO judgment function

Continued on next page

Output RF spectrum measurement	Frequency range: 100 MHz to 2.7 GHz Input level: –10 to +20 dBm (burst average power, pre-amplifier: off), –20 to +10 dBm (burst average power, pre-amplifier: on[*1]) Modulation portion measurement range: ≥60 dB (≥200 kHz offset), ≥68 dB (≥250 kHz offset) ∗CW signal, RBW: 30 kHz (<1.8 MHz offset), RBW: 100 kHz (≤1.8 MHz offset) Transient portion measurement range: ≥63 dB (CW, ≥400 kHz offset)
Spurious measurement	Measurement frequency: 100 kHz to 12.75 GHz (except within carrier frequency ±50 MHz) Input level (transmitter power): 0 to +20 dBm (burst average power, pre-amplifier: off) Measurement method Sweep method: Sweeps the specified range of frequency using the spectrum analyzer, and then detects and displays the peak value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Spot method: Measures the specified frequency with time domain from the spectrum analyzer and then displays the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Search method: Sweeps the specified frequency range using the spectrum analyzer to detect the peak value, then measures the frequency using the time domain to display the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Measurement range: ≥72 dB (RBW: 10 kHz, 100 kHz to 50 MHz, Band 0) ≥72 dB (RBW: 100 kHz, 50 to 500 MHz, Band 0) ≥66 –f [GHz] dB (RBW: 3 MHz, 0.5 to 3.15 GHz, Band 0, except harmonic frequency) ≥66 dB (RBW: 3 MHz, 3.15 to 7.8 GHz, Band 1) ∗Carrier frequency: 0.8 to 1 GHz, 1.8 to 2 GHz
I/Q signal	Input: Balanced, unbalanced Input impedance: 1 MΩ (parallel capacity: <100 pF), 50 Ω Balanced input Differential voltage: 0.1 to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, I/Q level Modulation accuracy Residual phase error: <0.5 deg (rms), DC coupling Residual EVM: <1.0% (rms), DC coupling ∗Input level: ≥0.1 V (rms), 18˚ to 28˚C I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When the CW signal is inputted to I and Q input terminals, measures and displays the phase difference between I- and Q-phase signals.

∗1: Can be set when MS8609A-08 option is installed in the main unit.

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MS8609A	Digital Mobile Radio Transmitter Tester	
	Standard accessories	
	Power cord, 2.6 m:	1 pc
J0996	RS-232C cable:	1 pc
JT32MA3-NT1	PC-ATA card (32 MB):	1 pc
F0014	Fuse, 6.3 A:	1 pc
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
MX268001A	File Transfer Utility:	1 pc
W1709AE	MS8608A/8609A operation manual (Vol. 1):	1 copy
W1744AE	MS8608A/8609A operation manual (Vol. 2):	1 copy
W1745AE	MS8608A/8609A operation manual (Vol. 3):	1 copy
	Options	
MS8609A-01	Precision frequency reference (aging rate: 5 x 10^{-10}/day)	
MS8609A-04	Digital resolution bandwidth	
MS8609A-05	Rubidium reference oscillator	
MS8609A-08	Pre-amplifier	
MS8609A-09	Ethernet interface	
MS8609A-35	7.9 GHz frequency extension	
MS8609A-46	Auto-power recovery	
MS8609A-47	Rack mount without handle (JIS)	
MS8609A-48	Rack mount without handle (IEC)	

Model/Order No.	Name
	Measurement software
MX860901B	W-CDMA Measurement Software
MX860902A	GSM Measurement Software
W1746AE	MX860801B/860901B operation manual
W1795AE	MX860802A/860902A operation manual
	Optional accessories
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m
J0127C	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 0.5 m
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
MA1612A	Four-Point Junction Pad (5 to 3000 MHz)
J0395	High-power fixed attenuator (30 dB, 30 W, DC to 8 GHz)
B0472	High-power fixed attenuator (30 dB, 100 W, DC to 18 GHz)
B0452A	Hard carrying case (with casters)
B0452B	Hard carrying case (without casters)
B0329G	Front cover (3/4 MW4U)
B0488	Rear panel protective pad
	Maintenance service
MS8609A-90	Extension service 3 years
MS8609A-91	Extension service 5 years

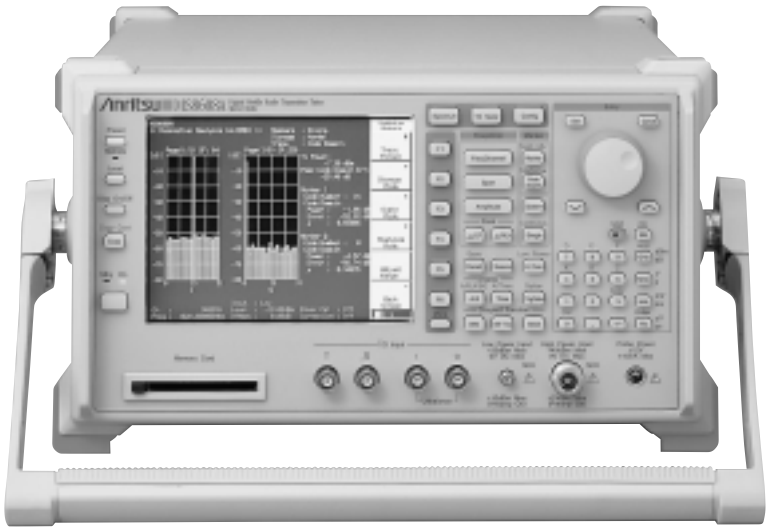
For product ordering information, see pages 4 – 10

DIGITAL MOBILE RADIO TRANSMITTER TESTER

MS8608A

9 kHz to 7.8 GHz

Transmitter Tester for W-CDMA 3GPP Specification



CE GPIB

The MS8608A is a transmitter tester equipped with an internal spectrum analyzer, a modulation analyzer and a power meter. One tester covers the development to manufacturing of base stations, mobile stations and devices.
The spectrum analyzer has resolution bandwidths up to 20 MHz, meaning that it can readily support measurement of a 2 Mbit/s (16 Mcps) wide-band signal for IMT-2000.
The modulation analyzer realizes all Vector Signal Analysis (VSA) functions through high-speed DSP processing.
The power sensor can perform highly accurate power measurements of ±0.4 dB by using an amorphous power sensor.
Up to three dedicated measurement software options (such as W-CDMA and GSM/EDGE) can be installed simultaneously.
Input signals can be selected from either RF or I/Q inputs. For I/Q signals, balanced or unbalanced input can also be selected.
It is equipped with GPIB, RS-232C and 10 Base-T (optional) interfaces for remote measurement. High-speed GPIB data transmission of 120 kbyte/s enables high-speed measurement on the manufacturing line. The monitor uses an easy-to-see 6.5 type TFT color LCD.

Feature

• Broadband signal support (up to IMT-2000 2 Mbit/s)

MX860801B W-CDMA Measurement Software

• Parameter setup

The measurement parameters such as modulation accuracy and code domain power, etc. are set on the screen shown below.
Measurement are simply performed via a soft-key menu after setting the measurement parameters.

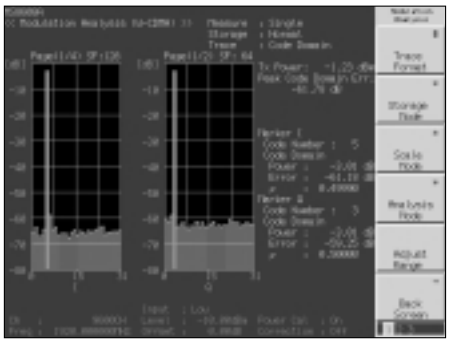
• Base station code domain power

Only 3 seconds are required for measurement. Either automatic detection of scrambling code from SCH, or specification of scrambling code can be selected.

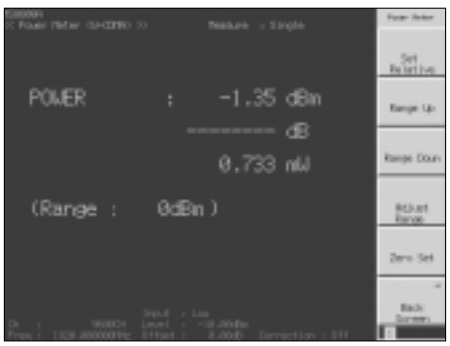
• Modulation accuracy measurement

The modulation accuracy of base station and mobile equipment can be measured and modulation analysis of multiple waveforms can be performed. The residual EVM (rms) accuracy is high (1%, typical).

• Mobile terminal code domain power
Displays the code domain power measurement results of phase I and phase Q, separately. Either synchronization with DPCCH or specification of spreading factor and code can be selected.



• Power meter function
The built-in power meter uses the amorphous power sensor and the measurement accuracy is very high (±0.4 dB).



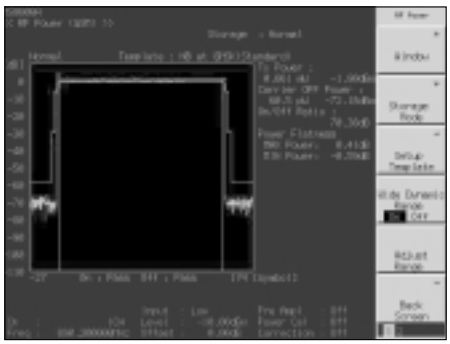
• Demodulation data monitoring
After de-spreading, up to 10 frames of I/Q data can be evaluated with external application software (Sample software can be provided).

MX860802A GSM Measurement Software

• Parameter setup
The measurement parameters such as GMSK modulation of GSM and 8PSK modulation of EDGE are set on the screen.
Measurement are simply performed via a soft-key menu after setting the measurement parameters.

• Modulation accuracy measurement
The modulation accuracy is high. (The residual phase error of GMSK modulation: rms, <0.5° and residual EVM of 8PSK modulation: rms, <1.0%)

• Transmitter power measurement
The screen displays the amplitude waveforms with horizontal axis a symbol, vertical axis a level and the template simultaneously.

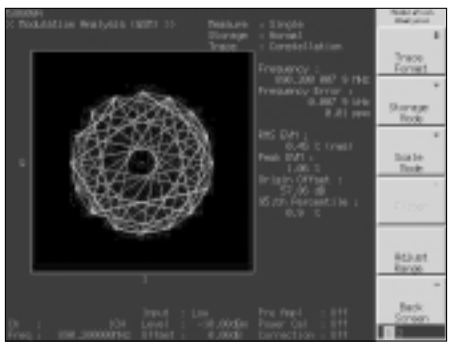


• Trellis display function
The screen displays the trellis and the modulation accuracy result simultaneously.

• Output RF spectrum measurement
The output RF spectrum measurement can be performed at high speed and simply.

• Spurious measurement
Spurious measurement has three kinds of method: Sweep, Search, and Spot. These can be selected depending on the usage.

• EDGE constellation display
The following screen represents constellation display of the 8PSK modulation through Nyquist filter and Gaussian inverse correction filter.



Specifications

• MS8608A

Frequency range	9 kHz to 7.8 GHz, 9 kHz to 7.9 GHz (with option 35)
Max. input level	High-power input: +40 dBm (10 W), Low-power input: +20 dBm (100 mW)
Input impedance	High-power input 50 Ω, VSWR: ≤1.2 (≤3 GHz)/≤1.3 (>3 GHz) Low-power input Power meter: 50 Ω, VSWR: ≤1.3 (≤3 GHz) Except power meter: 50 Ω, VSWR: ≤1.5 (≤3 GHz)/≤2.0 (>3 GHz) ∗Input attenuator: ≥4 dB
Input connector	N-type (high-power input), SMA-type (low-power input), BNC-type (I/Q input)
I/Q input	Input: Balanced, unbalanced Input impedance: 1MΩ (parallel capacitance: <100 pF), 50 Ω Balanced input Differential Voltage: 0.1 to 1V(p-p), In-phase voltage ±2.5 V Unbalanced input: 0.1 to 1V(p-p), AC/DC switchable

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Reference oscillator		Frequency: 10 MHz Starting characteristics: ≤5 x 10^{-8} (compared to frequency after 24 hour warm-up characteristics after 10 minute warm-up) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (compared to frequency after 24 hour warm-up) Temperature characteristics: ≤5 x 10^{-8}/day (0˚ to 50˚C, compared to frequency at 25˚C)
Power meter		Frequency range: 30 MHz to 3 GHz Level range: 0 to +40 dBm (high-power input), –20 to +20 dBm (low-power input) Measurement accuracy (after zero calibration): ±10%
Spectrum analyzer	Frequency	Frequency setting Setting range: 9 kHz to 3.2 GHz (Band: 0), 3.15 to 7.8 GHz (Band: 1) ∗Setting resolution: 1 Hz Pre-selector range: 3.15 to 7.8 GHz (Band: 1) Frequency accuracy Display accuracy: ± (display frequency x reference frequency accuracy + span x span accuracy + resolution bandwidth x 0.15 + 10 Hz) Normal marker: Same as display frequency accuracy Delta marker: Same as span accuracy Frequency span setting range: 0 Hz, 5 kHz to 7.8 GHz Span accuracy: ±1.0% (at single band sweep) RBW (resolution bandwidth) Setting range: 300 Hz to 3 MHz (1-3 sequence), 5 MHz, 10 MHz, 20 MHz (Band 0) Accuracy: ±20% (300 Hz to 10 MHz) Selectivity (60 dB: 3 dB): ≤15:1 VBW (video bandwidth): 1 Hz to 3 MHz (1-3 sequence), off Sideband noise: ≤–108 dBc/Hz (1 GHz, 10 kHz offset), ≤–120 dBc/Hz (1 GHz, 100 kHz offset)
	Amplitude	Maximum input level Continuous average power: +40 dBm (high-power input), +20 dBm (low-power input) DC voltage: 0 V Average noise level (at RBW: 300 Hz, VBW: 10 Hz): [Without Option 08] ≤–104 dBm + 1.5 f [GHz] dB (high-power input, 1 MHz to 2.5 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 1.5 f [GHz] dB (high-power input, 2.5 to 3.2 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 0.8 f [GHz] dB (high-power input, 3.15 to 7.8 GHz, Band 1, input attenuator: 20 dB) [With Option 08] ≤–102 dBm + 1.8 f [GHz] dB (high-power input, 1 MHz to 2.5 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 1.8 f [GHz] dB (high-power input, 2.5 to 3.2 GHz, Band 0, input attenuator: 20 dB) ≤–100 dBm + 0.8 f [GHz] dB (high-power input, 3.15 to 7.8 GHz, Band 1, input attenuator: 20 dB) [Without Option 08] ≤–124 dBm + 1.5 f [GHz] dB (low-power input, 1 MHz to 2.5 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 1.5 f [GHz] dB (low-power input, 2.5 to 3.2 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 0.8 f [GHz] dB (low-power input, 3.15 to 7.8 GHz, Band 1, input attenuator: 0 dB) [With Option 08] ≤–122 dBm + 1.8 [GHz] dB (low-power input, 1 MHz to 2.5 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 1.8 f [GHz] dB (low-power input, 2.5 to 3.2 GHz, Band 0, input attenuator: 0 dB) ≤–120 dBm + 0.8 f [GHz] dB (low-power input, 3.15 to 7.8 GHz, Band 1, input attenuator: 0 dB) Residual response: ≤–80 dBm (high-power input, 1 MHz to 3.2 GHz, input attenuator: 20 dB) ≤–70 dBm (high-power input, 3.15 to 7.8 GHz, input attenuator: 20 dB) ≤–100 dBm (low-power input, 1 MHz to 3.2 GHz, input attenuator: 0 dB) ≤–90 dBm (low-power input, 3.15 to 7.8 GHz, input attenuator: 0 dB) Reference level Setting range: –80 to +50 dBm (high-power input), –100 to +30 dBm (low-power input) Accuracy (high-power input, after calibration): ±0.5 dB (–29.9 to +20 dBm), ±0.75 dB (–49.9 to –30 dBm, +20.1 to +40 dBm), ±1.5 dB (–60 to –50 dBm) Accuracy (low-power input, after calibration): ±0.5 dB (–49.9 to +0 dBm), ±0.75 dB (–69.9 to –50 dBm, +0.1 to +20 dBm), ±1.5 dB (–80 to –70 dBm) ∗Frequency: 50 MHz, span: 1 MHz (Input attenuator, RBW, VBW and sweep time are set to AUTO.) RBW switching uncertainty: ±0.3 dB (300 Hz to 5 MHz, referenced to RBW: 3 kHz) Input attenuator: 20 to 82 dB (high-power input), 0 to 62 dB (low-power input), 2 dB steps Frequency response: ±0.6 dB (9 kHz to 3.2 GHz, Band 0), ±1.0 dB (3.15 to 7.8 GHz, Band 1) ∗Referenced to 50 MHz, input attenuator: 30 dB (high power input)/10 dB (low power input), 18˚ to 28˚C Log linearity: ±0.5 dB (0 to –20 dB, RBW: ≤1 kHz), ±1.0 dB (0 to –90 dB, RBW: ≤1 kHz) 2nd harmonic distortion: ≤–60 dBc (10 to 200 MHz, Band 0, mixer input: –30 dBm) ≤–75 dBc (200 to 850 MHz, Band 0, mixer input: –30 dBm) ≤–70 dBc (0.85 to 1.6 GHz, Band 0, mixer input: –30 dBm) ≤–90 dBc (1.6 to 3.9 GHz, Band 1, mixer input: –10 dBm) Two tone 3rd order intermodulation distortion: ≤–70 dBc (10 to 100 MHz), ≤–85 dBc (0.1 to 7.8 GHz) ∗Frequency difference of two signals: ≥50 kHz, mixer input: –30 dBm 1 dB gain compression: ≥0 dBm (≥100 MHz), ≥+3 dBm (≥500 MHz)

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Spectrum analyzer	Sweep	Setting range: 10 ms to 1000 s (frequency axis sweep), 1 µs to 1000 s (time axis sweep) Trigger switch: Free-run, triggered Trigger source: Wide IF video, video, external (TTL level), external (±10 V), line Trigger delay Pre-trigger range: –time span to 0 s Resolution: time span/500 or 100 ns whichever is lager. Post trigger: 0 µs to 65.5 ms, Resolution: 100 ns (sweep time: ≤4.9 ms), 1 µs (sweep time: ≥5 ms) Gate sweep mode Gate delay range: 0 to 65.5 ms (resolution: 1 µs) Gate length range: 2 µs to 65.5 ms (resolution: 1 µs)
	Functions	Number of data points: 501 Detection modes: Normal, Positive peak, Negative peak, Sample, Average, rms (option 04) Display functions: Trace A, Trace B, Trace A/B, Trace A/BG, Trace A/Time Storage functions: Normal, View, Max hold, Min hold, Average, Cumulative, Overwrite Markers Signal search: Auto tune, Peak → CF, Peak → Ref, Scroll Zone markers: Normal, Delta Marker function: Marker → CF, Marker → Ref, Marker → CF step size, Δ marker → Span, Zone → Span Peak search: Peak, Next peak, Min dip, Next dip Multi-marker: 10 max. Measurements Noise power: dBm/Hz, dBm/ch, dBµV/$\sqrt{\text{Hz}}$ C/N: dBc/Hz, dBc/CH Occupied bandwidth: Power N% method, X-dB down method Adjacent channel power Reference measurement: Total power, reference level, in-band method Display methods: Channel specified display (3 channels x 2), graphic display Average power of burst signal: Average power within specified time range of time domain waveform Template comparison measurement (time sweep): Upper limit x 2, lower limit x 2 Mask measurement (frequency sweep): Upper limit x 2, lower limit x 2
Others		Display: Color TFT-LCD, VGA 6.5 type Hard copy: Hard copy of screen via parallel interface (ESC/P compatible printer) Memory card interface: ATA Flash card (3.3/5 V) GPIB: Can be controlled from external controller (except power switch) when specified as device Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2 Parallel interface: Centronics printer I/F, D-sub 25-pin connector (female) Video output: Analog RGB output, D-sub 15-pin connector (female)
Dimensions and mass		320 (W) x 177 (H) x 411 (D) mm (except handle, feet, front cover and fan cover), ≤16 kg (nominal)
Power		100 to 120/200 to 240 Vac (–15%/+10%, max. voltage: 250 V, automatic voltage selection), 47.5 to 63 Hz, ≤400 VA
Operating temperature and humidity		0˚ to 50˚C, ≤85% (no condensating)
EMC		EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326 (1997/A1: 1998 (Annex A)
LVD		EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

• MX860801B W-CDMA measurement software

Guaranteed specifications after Adjust Range and Power Calibration keys pressed

Modulation/frequency measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (with option 08) Input level: –40 to +40 dBm (average power, high-power input), –60 to +20 dBm (average power, low-power input), –80 to +10 dBm (average power, low-power input, pre-amplifier: on[*1]) Carrier frequency accuracy: ± (reference oscillator accuracy + 10 Hz) *Input level: ≥–10 dBm (high-power input), ≥–30 dBm (low-power input), ≥–40 dBm (low-power input, pre-amplifier: on[*1]), at 1 code channel Modulation accuracy (residual EVM): <2% (rms) *Input level: ≥–10 dBm (high-power input), ≥–30 dBm (low-power input), ≥–40 dBm (low-power input, pre-amplifier: on[*1]), at 1 code channel Origin offset accuracy: ±0.5 dB *Input level: ≥–10 dBm (high-power input), ≥–30 dBm (low-power input), at 1 code channel, relative to signal with origin offset of –30 dBc Waveform display (for 1 CH to multi-channel) Constellation display, EVM vs. chip, amplitude error vs. chip, phase error vs. chip
Code domain analysis	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (with option 08) Input level: –40 to +40 dBm (average power, high-power input), –60 to +20 dBm (average power, low-power input), –80 to +10 dBm (average power, low-power input, pre-amplifier: on[*1]) Code domain power measurement accuracy: ±0.1 dB (code power: ≥–10 dBc), ±0.3 dB (code power: ≥–25 dBc) *Input level: ≥+10 dBm (high-power input), ≥–10 dBm (low-power input), ≥–20 dBm (pre-amplifier: on[*1]) Code domain error measurement Residual error: <–50 dB, Measurement accuracy: ±0.5 dB (at error of –30 dBc) *Input level: ≥+10 dBm (high-power input), ≥–10 dBm (low-power input), ≥–20 dBm (pre-amplifier: on[*1]), spread factor: 512 (down-link)/256 (up-link) Display function: Code domain power, code domain error Spread factor: 4 to 256 (up-link)/4 to 512 (down-link), I/Q separately displayed at up-link

Continued on next page

Amplitude measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (with option 08) Input level: –40 to +40 dBm (average power, high-power input), –60 to +20 dBm (average power, low-power input), –80 to +10 dBm (average power, low-power input, pre-amplifier: on[*1]) Transmitter power measurement Measurement range: 0 to +40 dBm (average power, high-power input), –20 to +20 dBm (average power, low-power input), –20 to + 10 dBm (average power, low-power input, pre-amplifier: on[*1]) Accuracy: ±0.4 dB (calibrated at internal power meter) Power measurement linearity: ±0.2 dB (0 to –40 dB) ∗Input level: ≥+10 dBm (high-power input), ≥–10 dBm (low-power input), ≥–20 dBm (pre-amplifier: on[*1]) , after the range adjusted, with the reference level setting unchanged Filter selection function: Power measurement through RRC (α = 0.22) filter Transmitter power control measurement function: Relative power per slot, NO/GO evaluation
Occupied bandwidth measurement	Frequency range: 50 MHz to 3 GHz Input level: –40 to +40 dBm (average power, high-power input), –60 to +20 dBm (average power, low-power input), –80 to +10 dBm (average power, low-power input, pre-amplifier: on[*1]) Sweep mode: Displays result after signal measured with sweep spectrum analyzer FFT mode: Displays result after FFT
Adjacent channel power measurement	Frequency range: 50 MHz to 3 GHz, 50 MHz to 2.3 GHz (with option 08) Input level: +10 to +40 dBm (average power, high-power input), –10 to +20 dBm (average power, low-power input) Sweep method (all): Calculates and displays result after signal measured with sweep spectrum analyzer Sweep method (separate): Calculates and displays power after each adjacent channel measured with sweep spectrum analyzer Filter method: Measures and displays power of adjacent channels after passing via built-in receiving filters (RRC: α = 0.22) Measurement range Input level: +20 to +40 dBm (high-power input), 0 to +20 dBm (low-power input) ≥55 dBc (5 MHz offset), ≥62 dBc (10 MHz offset) ∗Filter method, wide dynamic range mode, 1 code channel ≥50 dBc (5 MHz offset), ≥60 dBc (10 MHz offset) ∗At 16 multi-code channel Input level: +10 to +40 dBm (high-power input), –10 to +20 dBm (low-power input) 55 dBc (5 MHz offset), 62 dBc (10 MHz offset) ∗Filter method, wide dynamic range mode, 1 code channel (typical) 50 dBc (5 MHz offset), 60 dBc (10 MHz offset) ∗At 16 multi-code channel (typical)
Spurious measurement	Measurement frequency: 9 kHz to 7.8 GHz (except within carrier frequency ±50 MHz) Input level (transmitter power): +20 to +40 dBm (average power, high-power input), 0 to +20 dBm (average power, low-power input) Measurement method [Sweep method] Sweeps the specified range of frequency using the spectrum analyzer, and then detects and displays the peak value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average [Spot method] Measures the specified frequency with time domain from the spectrum analyzer and then displays the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average [Search method] Sweeps the specified frequency range using the spectrum analyzer to detect the peak value, then measures the frequency using the time domain to display the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Measurement range[*2] [Carrier frequency: 1.8 to 2.2 GHz] ≥79 dB (RBW: 1 kHz, 9 to 150 kHz, Band 0), ≥79 dB (RBW: 10 kHz, 150 kHz to 30 MHz, Band 0), ≥79 dB (RBW: 100 kHz, 30 to 1000 MHz, Band 0) [Normal mode] ≥76 –f [GHz] dB (RBW: 1 MHz, 1 to 3.15 GHz, Band 0), ≥76 dB (RBW: 1 MHz, 3.15 to 7.8 GHz, Band 1) [Spurious mode (with option 03)] ≥76 dB (RBW: 1 MHz, 1.6 to 7.8 GHz, Band 1)
I/Q signal	Input: Balanced, unbalanced Input impedance: 1 MΩ (parallel capacity: <100 pF), 50 Ω Balanced input Differential voltage: 0.1 to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, code domain power, amplitude, occupied bandwidth (FFT method), I/Q level Residual vector error: <2% (rms) ∗Input level: ≥0.1 V (rms), DC coupling I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When the CW signal is inputted to I and Q input terminals, measures and displays the phase difference between I- and Q-phase signals.

∗1: Can be set when MS8608A-08 option is installed in the main frame.
∗2: When carrier frequency is in a 2030.354 to 2200 MHz range, spurious will be generated at the frequency below.
f (spurious) = f (input) – 2030.345 MHz

• MX860802A GSM measurement software
Guaranteed specifications after Adjust Range and Power Calibration keys pressed

Modulation/frequency measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –20 to +40 dBm (average power within burst, high-power input) –40 to +20 dBm (average power within burst, low-power input) –60 to +10 dBm (average power within burst, low-power input, pre-amplifier: on[*1]) Carrier frequency accuracy: ±(reference oscillator accuracy + 10 Hz) ∗Input level (average power within burst: ≥–10 dBm (high-power input): ≥–30 dBm (low-power input), ≥–40 dBm (low-power input, pre-amplifier: on[*1]) Residual phase error (GMSK modulation): <0.5° (rms), <2.0° (peak) ∗Input level (average power within burst): ≥–10 dBm (high-power input), ≥–30 dBm (low-power input), ≥–40 dBm (low-power input, pre-amplifier: on[*1]) Residual EVM (8PSK modulation): <1% (rms) Waveform display: Trellis (GMSK modulation), eye pattern, EVM vs. bit (8PSK modulation), phase vs. bit, amplitude vs. symbol, I/Q diagram
Amplitude measurement	Frequency range: 50 MHz to 2.7 GHz Input level: –20 to +40 dBm (average power within burst, high-power input) –40 to +20 dBm (average power within burst, low-power input) –60 to +10 dBm (average power within burst, , low-power input, pre-amplifier: on[*1]) Transmitter power measurement (auto calibrated at internal power meter) Measurement range: +10 to +40 dBm (average power within burst, high-power input) –10 to +20 dBm (average power within burst, low-power input) –10 to +10 dBm (average power within burst, low-power input, pre-amplifier: on[*1]) Accuracy: ±0.4 dB Power measurement linearity: ±0.2 dB (0 to –30 dBm) ∗Input level (average power within burst): +10 dBm (high-power input), ≥–10 dBm (low-power input), ≥–20 dBm (low-power input, pre-amplifier: on[*1]), without changing the reference level setting after range optimization Carrier-off power measurement range [Input level (average power within burst)] +10 dBm (high-power input), ≥–10 dBm (low-power input), ≥–20 dBm (low-power input, pre-amplifier: on[*1]) [Normal mode] ≥60 dB (compared with average power within burst) [Wide dynamic range mode] ≥80 dB (high-power input: 1 W, compared with 10 mW of average power within burst, low-power input) ∗Measurement limit is decided by average nose level (≤50 dBm, 50 MHz to 2.7 GHz). Rise/fall characteristics: Display rising/falling edges while synchronizing to modulation data of signal data to be measured. Standard line display possible (measured by 1 MHz bandwidth). NO/GO judgement function
Output RF spectrum measurement	Frequency range: 100 MHz to 2.7 GHz Input level: +10 to +40 dBm (average power within burst, high-power input) –10 to +20 dBm (average power within burst, low-power input) –20 to +10 dBm (average power within burst, low-power input, pre-amplifier: on[*1]) Modulation portion measurement range: ≥60 dB (≥200 kHz offset), ≥68 dB (≥250 kHz offset) ∗CW signal, RBW: 30 kHz (<1.8 MHz offset), RBW: 100 kHz (≥1.8 MHz offset) Transient portion measurement range: ≥63 dB (CW, ≥400 kHz offset)
Spurious measurement	Measurement frequency: 100 kHz to 7.8 GHz (except within carrier frequency ±50 MHz) Input level (transmitter power): +20 to +40 dBm (average power within burst, high-power input) 0 to +20 dBm (average power within burst, low-power input) Measurement method [Sweep method] Sweeps the specified range of frequency using the spectrum analyzer, and then detects and displays the peak value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average [Spot method] Measures the specified frequency with time domain from the spectrum analyzer and then displays the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average [Search method] Sweeps the specified frequency range using the spectrum analyzer to detect the peak value, then measures the frequency using the time domain to display the average value. Calculates the rate for transmission power value and displays it as power rate. Waveform detection mode: average Measurement range [Carrier frequency: 0.8 to 1 GHz, 1.8 to 2 GHz] ≥72 dB (RBW: 10 kHz, 100 kHz to 50 MHz, Band 0), ≥72 dB (RBW: 100 kHz, 50 to 500 MHz, Band 0) [Normal mode] ≥66 –f [GHz] dB (RBW: 3 MHz, 0.5 to 3.15 GHz, Band 0, except harmonic frequency) ≥66 dB (RBW: 3 MHz, 3.15 to 7.8 GHz, Band 1) [Spurious mode (with option 03)] ≥66 dB (RBW: 3 MHz, 1.6 to 7.8 GHz, Band 1)

Continued on next page

I/Q signal	Input: Balanced, unbalanced Input impedance: 1 MΩ (parallel capacity: <100 pF), 50 Ω Balanced input Differential voltage: 0.1 to 1 V (p-p), In-phase voltage: ±2.5 V Unbalanced input: 0.1 to 1 V (p-p), AC/DC switchable Measurement items: Modulation accuracy, I/Q level Modulation accuracy Residual phase error: <0.5˚ (rms), DC coupling Residual EVM: <1.0% (rms), DC coupling ∗Input level: ≥0.1 V (rms), 18˚ to 28˚C I/Q level measurement: Measures and displays each I, Q input voltage (rms, p-p) I/Q phase difference measurement: When the CW signal is inputted to I and Q input terminals, measures and displays the phase difference between I- and Q-phase signals.

∗1: Can be set when MS8608A-08 option is installed in the main frame.

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Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MS8608A	Digital Mobile Radio Transmitter Tester	
	Standard accessories	
	Power cord, 2.6 m:	1 pc
J0996B	RS-232C cable:	1 pc
JT32MA3-NT1	PC-ATA card (32 MB):	1 pc
F0014	Fuse, 6.3 A:	1 pc
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
MX268001A	File transfer utility:	1 pc
W1709AE	MS8608A/8609A operation manual (Vol. 1):	1 copy
W1744AE	MS8608A/8609A operation manual (Vol. 2):	1 copy
W1745AE	MS8608A/8609A operation manual (Vol. 3):	1 copy
	Options	
MS8608A-01	Precision frequency reference (aging rate: 5 x 10^{-10}/day)	
MS8608A-03	Extension of pre-selector lower limit (to 1.6 GHz)	
MS8608A-04	Digital resolution bandwidth	
MS8608A-05	Rubidium reference oscillator	
MS8608A-08	Pre-amplifier (100 kHz to 3 GHz)	
MS8608A-09	Ethernet interface	
MS8608A-35	7.9 GHz frequency extension	
MS8608A-46	Auto-power recovery	
MS8608A-47	Rack mount without handle (IEC)	
MS8608A-48	Rack mount without handle (JIS)	
	Measurement software	
MX860801B	W-CDMA Measurement Software	
MX860802A	GSM Measurement Software	
W1746AE	MX860801B/860901B operation manual	
W1795AE	MX860802A/860902A operation manual	
	Optional accessories	
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m	
J0127C	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 0.5 m	
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m	
MA1612A	Four-Way Junction Pad (5 to 3000 MHz)	
J0395	High-power fixed attenuator (30 dB, 30 W, DC to 8 GHz)	
B0472	High-power fixed attenuator (30 dB, 100 W, DC to 18 GHz)	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0452A	Hard carrying case (with casters)	
B0452B	Hard carrying case (without casters)	
B0329G	Front cover (3/4MW4U)	
B0488	Rear panel protective pad	
	Maintenance service	
MS8608A-90	Extension service 3 years	
MS8608A-91	Extension service 5 years	

DIGITAL MOBILE RADIO TRANSMITTER TESTER

MS8604A

100 Hz to 8.5 GHz

For Mobile Communications Systems Worldwide

PTA GPIB

The MS8604A offers full test performance in a single unit capable of evaluating the major characteristics of transmitters used in digital mobile communication worldwide. Applicable systems are PDC, PHS, NADC, digital MCA, GSM, DCS1800 (PCN), CT2, DECT, WCPE, PACS, RCR STD-39 and TETRA. In addition, the MS8604A has GMSK and p/4 DQPSK universal analysis functions for analysis of the GMSK and p/4 DQPSK modulation signal. It covers frequencies from 100 Hz to 8.5 GHz and measures spurious emissions over a broad frequency range. It can also measure RF signals directly up to 10 W (average burst power), and baseband devices can be evaluated using its I/Q signal input function (option). The MS8604A is ideal for high-speed measurement of carrier frequency, modulation accuracy, antenna power, leakage power during carrier-off, transmission ramp-up and ramp-down power, and occupied bandwidth (adjacent channel power, spurious emissions, and signal transmission rate)* of digital mobile transmitters. In addition to measurements conforming to EIA/TIA, ETSI, RCR, and MKK standards, DSP (digital signal processing) and high-speed measurement functions based on a unique measurement algorithm combine to greatly reduce the time required for manufacturing and inspecting transmitters. PTA functions enabling free programming of test procedures are provided as a standard feature.

*: Measurement items depend on the measurement software. For details, refer to the specifications.

Features

- Major transmitter functions evaluated by a single system
- Compatible with NADC, PDC, PHS, Digital MCA, GSM, DCS1800 (PCN), CT2, DECT, WCPE, PACS, RCR STD-39 TETRA systems, and GMSK and π/4 DQPSK universal measurement (measurement software can be installed as an option)
- High-speed measurement (under 1 second for modulation-accuracy measurements)
- Input up to 10 W (internal 20 dB attenuator and power meter for high power levels)

Measurement example

• Quick configuration for different communication systems

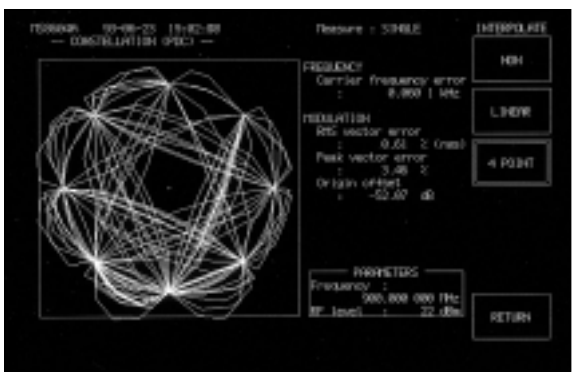
Optional measurement software can be installed in the MS8604A. When these options are chosen, the communication system can be selected by pressing a single key.

• One-touch selection of measurement items

Measurement items can be selected by pressing a single key. The input connector (RF/IQ), maximum input power, and type of signal for measurement (uplink/downlink, channel number/frequency, frequency steps, synchronizing words) can be preset. In particular, synchronizing words can be predefined to any value. Measurement can be performed in either the single-measurement mode (one measurement performed each time key pressed) or in the automatic continuous repeat mode.

• Measurement of frequency, modulation accuracy

Frequency and modulation accuracy (vector error, phase error) can be measured. The numerical display and modulation waveform (constellation etc.) are displayed simultaneously, providing an accurate visual representation of the modulation waveform.



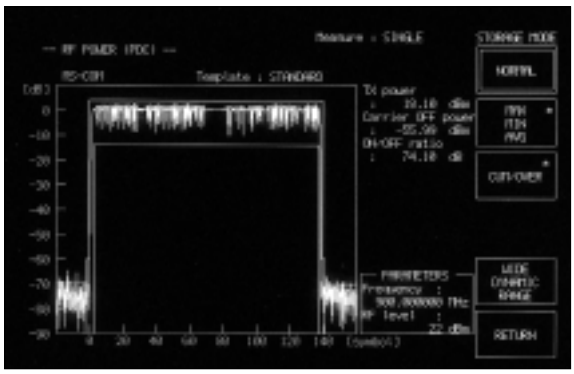
For product ordering information, see pages 4 – 10

• Direct measurement with broadband power sensor
The tester has a high-performance power meter comparable to the Anritsu ML4803A. A broadband amorphous-element power sensor is coupled directly for high-precision measurement.

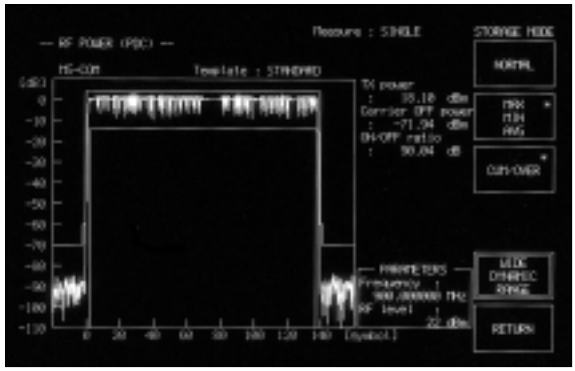
• Internal calibration signal
An internal 1 mW calibration signal is provided for calibrating the sensitivity of the power sensor automatically by pressing the CAL ADJUST key.

• High-power measurements
Antenna power up to 10 W max (burst average power) can be measured directly using the internal high-power attenuator. This high-power attenuator is pre-calibrated for accurate measurement of transmitter power levels.

• Measurement of antenna power and leakage power during carrier-off
At measurement of burst signal antenna power, the power-on intervals are auto-detected based on the modulated wave, so an external synchronization trigger is not needed. In addition, the average power during power-on intervals is automatically matched to a template value, simplifying measurement automation. Any template can be set, and three types can be stored. The leakage power during carrier-off can be measured as either an absolute value or as an on/off ratio. When the carrier-off power is low, measurements can be performed in a wide-dynamic-range mode (during single-mode measurements with synchronizing word).



Normal mode (PDC)



Wide dynamic range mode (PDC)

• Application software
The application software extends the analysis function of the MS8604A by using PTA (Personal Test Automation) functions. The application software provides sophisticated analysis of digital modulation signals. The MX3512A uses π/4 DQPSK analysis software. The MX3513A uses M16QAM analysis software. The MX3518A/3519A/3520A are adjacent channel power and spurious measurement software for GSM, DCS1800 (PCM), DECT, and CT2 systems.

Applicable system	Measurement software	Application software (supplied by PMC)
PDC	Option 11	MX3512A
PHS	Option 12	
NADC	Option 13	
Digital MCA	Option 14	MX3513A
GSM	Option 15	MX3518A
DCS1800 (PCN)		
DECT		MX3519A
CT2		MX3520A
General-purpose GMSK		–
WCPE	Option 16	–
RCR STD-39		
PACS		
TETRA		
General-purpose π/4 DQPSK		

Specifications

• MS8604A

General	Frequency range	100 Hz to 8.5 GHz
	Max. input level (continuous wave average power)	+40 dBm (10 W)
	Reference oscillator	Frequency: 10 MHz Starting characteristics: ≤5 x 10^{-8}/day (option: ≤2 x 10^{-8}/day after 30 min. warm-up) *After 10 min. of warm-up, compared to the frequency after 24-hour warm-up Aging rate: ≤2 x 10^{-8}/day (option: ≤5 x 10^{-9}/day), ≤1 x 10^{-7}/year (option: ≤5 x 10^{-8}/year) *Compared to the frequency after 24-hour warm-up Temperature characteristics: 5 x 10^{-8} (option: 3 x 10^{-8}) *0° to 50°C, relative to the frequency at 25°C
Spectrum analyzer	Frequency	Setting range: 100 Hz to 8.5 GHz (resolution: 1 Hz), 0 to 2 GHz (freq. band: 0), 1.7 to 7.5 GHz (freq. band: 1–), 6.5 to 8.5 GHz (freq. band: 1+) Preselector range: 1.7 to 8.5 GHz (bands: 1–/1+) Display accuracy: ± (display freq. x reference freq. accuracy + span x span accuracy) Span Setting range: 0 Hz, 100 Hz to 8.5 GHz Accuracy: ±2.5% (span ≥1 kHz), ±5% (100 Hz ≤span <1 kHz) RBW Setting range: 10 Hz to 3 MHz (3 dB), 1-3 sequence Accuracy: ±20% Selectivity (60/3 dB); ≤15:1 (100 kHz to 3 MHz), ≤12:1 (10 Hz to 30 kHz) VBW: 1 Hz to 3 MHz, off, 1-3 sequence Signal purity (SSB, 1 MHz to 4 GHz): ≤–100 dBc/Hz (10 kHz offset), ≤–115 dBc/Hz (50 kHz offset), ≤–120 dBc/Hz (100 kHz offset)

Continued on next page

Spectrum analyzer	Amplitude	Level measurement	Level measuring range: Average noise level to +40 dBm Average noise level: ≤–112 dBm (10 MHz to 8.5 GHz, RBW 10 Hz, VBW 1 Hz, input att. setting 20 dB) Residual response: ≤–75 dBm (1 MHz to 8.5 GHz, input att. setting 20 dB)
		Reference level	Setting range: –80 to +40 dBm Accuracy: ±0.5 dB (–30 to +20 dBm), ±0.75 dB (–40 to –30 dBm, +20 to +40 dBm), ±1.5 dB (–60 to –40 dBm) *After calibration and at freq. 100 MHz, span ≤2 MHz, and in auto mode for input att., RBW, VBW and sweep time settings RBW switching error (after calibration): ±0.3 dB (RBW: ≤300 kHz), ±0.7 dB (RBW: ≥1 MHz) LOG/LIN switching error: ±0.3 dB (after calibration) Input attenuator Setting range: 20 to 75 dB in 5 dB steps Switching error: ±0.3 dB (referred to input att. 30 dB, at 100 MHz)
		Frequency response	±0.5 dB (100 MHz to 2 GHz, band: 0), ±1 dB (1.7 to 8.5 GHz, bands: 1–/1+) *Referred to at 100 MHz, input att. 30 dB, temperature 18° to 28°C (after tuning preselector at bands 1–/1+)
		Linearity (after calibration)	LOG: ±0.3 dB (0 to –20 dB, RBW: ≤1 MHz), ±1 dB (0 to –60 dB, RBW: ≤100 kHz), ±1.5 dB (0 to –80 dB, RBW: ≤10 kHz) LIN: ±5% (to reference level)
		Dynamic range	2nd harmonics: ≤–70 dBc (5 to 800 MHz, band: 0, mixer input level: –30 dBm), ≤–80 dBc (800 to 850 MHz, band: 0, mixer input level: –30 dBm), ≤–90 dBc (850 MHz to 2.1 GHz, bands: 1–, mixer input level: –10 dBm) Two-signal third-order intermodulation distortion: ≤–70 dBc (10 to 50 MHz), ≤–85 dBc (50 MHz to 2.1 GHz) *Frequency difference between two signals ≥50 kHz, mixer input level: –30 dBm
		Spurious	Image response: ≤–70 dBc Multiple-response: ≤–70 dBc (bands: 1–/1+)
		Sweep	Sweep time Setting range: 20 ms to 1000 s (TRACE-FREQ., data points: NORMAL), 50 ms to 1000 s at other conditions Accuracy: ±10% (20 ms to 200 s), ±15% (200 to 1000 s) Sweep mode: CONTINUOUS, SINGLE Trigger: FREE RUN, TRIGGERED Trigger source: VIDEO, LINE, EXT (±10 V), EXT (TTL) Gate mode (OFF, random sweep mode) GATE DELAY: 0 to 65.5 ms (in 1 µs steps) GATE LENGTH: 20 µs to 65.5 ms (in 1 µs steps, GATE END: INT) GATE END: INT/EXT
		Time domain waveform display	Sweep time: 50, 100 to 900 µs (data point: NORMAL, One most significant digit can be set.) 1 ms to 1000 s (data point: NORMAL, Two most significant digits can be set.) 100, 200 to 800 µs (data point: DOUBLE, One most significant digit can be set as even number.) 1 ms to 1000 s (data point: DOUBLE, Two most significant digits can be set as even number.) Delay time Pre-trigger: –time span to 0 s (in 1 point steps) Post trigger: 0 to 65.5 ms (in 1 µs steps) Amplitude display resolution: 50 µs to 49 ms, 10 bits (0.1% of full scale) 50 ms to 1000 s, 14 bits (0.01% of full scale)
		Detection mode	POS PEAK, SAMPLE, NEG PEAK
		Number of points	NORMAL: 501 points, DOUBLE: 1002 points
		AM/FM demodulation	Demodulated waveform display and monitoring demodulated audio signal with internal speaker
		Auxiliary inputs/ outputs	IF output 21.4 MHz: –10 dBm ±2 dB (at top of screen, with output terminated by 50 Ω terminator), BNC connector Y output: 0 to 0.5 V ±0.1 V (at range between top and bottom of screen, LOG: 10 dB/div., LIN: 10%/div., 100 MHz and with output terminated by 75 Ω terminator), BNC connector External trigger input Input 1: Max. ±10 V (in 0.1 V steps, rising/falling edges selectable and pulse width ≥10 µs), BNC connector Input 2: TTL level (rising/falling edges selectable and pulse width ≥10 µs), BNC connector
Power meter	Frequency range		100 kHz to 5.5 GHz
	Level range		–20 to +20 dBm
	Instrumentation accuracy		±0.5%
	Zero set		±0.5% of full scale at most sensitive range (100 µW range)
	Zero shift between ranges		±0.2% of full scale zero setting at most sensitive range
	Calibration oscillator		Freq: 50 MHz, Output: 1.00 mW, Accuracy: ±1.2%
	Applicable power sensor		MA4601A

Continued on next page

Others	Display		640 x 400 dot, 9-inch EL
	Inputs/outputs on rear panel		Reference input: 10 MHz ±10 Hz, 2 to 5 Vp-p, ≥50 Ω, BNC connector Reference buffer output: 10 MHz, 2 to 3 Vp-p (with the output terminated by 200 Ω terminator), BNC connector Separate video output: Compatible with 8-pin DIN connector
	External memory		One slot for can be connected.
	Save/recall		Internal memory (4 sets of spectrum and Tx test conditions), can save/recall setting conditions at external memory (PMC)
	Direct plotting		Can hard-copy screen via GPIB 2
	External control	GPIB 1 (IEEE 488.2)	As device controlled by host, all functions except power switch Controls other instruments as controller using PTA SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0 (C1, C2, C3 and C24 with PTA)
		GPIB 2 (IEEE 488.1)	Controls other instruments as controller SH1, AH1, T6, L4, SR0, RL0, PP0, DC0, DT0, C1, C2, C3, C4, C28
		I/O port	Output port A/B: 8-bit (TTL level), Input/Output port C/D: 4-bit (TTL level), Exclusive port: 3-bit (TTL level) Control signal: 4 (TTL level), +5 V output: Max. 50 mA
		RS-232C (Option 02)	Controls other instruments as controller
	PTA	Language	PTL: High level language interpreter based on BASIC
		Programming	Using external keyboard
		Program memory	On PMC or FD Upload/download from/to PC
		Programming capacity	900 KB
Operating temperature			0° to 50°C
Power			85 to 132/170 to 250 Vac, 47.5 to 63 Hz, ≤500 VA
Dimensions and mass			426 (W) x 221.5 (H) x 451 (D) mm, ≤27 kg

• Option 11: Measurement software (for PDC)

The following specifications are guaranteed if the internal level is optimized using the auto range of the MS8604A calibration function.

Modulation/ frequency measurement	Frequency range	400 kHz to 2.1 GHz
	Input level	–10 to +40 dBm (average power of burst signal) *When using the low power input connector, measurement to levels 20 dB lower than the above values is possible.
	Frequency accuracy	± (accuracy of reference oscillator +1 Hz)
	Modulation accuracy	± (2% of indicated value +0.5%)
	Origin offset accuracy	±0.5 dB to signal level of –30 dBc
	Transmission rate accuracy	±1 ppm
	Measuring range of transmission rate	42 kbps ±100 ppm
	Waveform display	Constellation display
	Measurement time	≤1 s(except transmission rate measurement), ≤3 s(transmission rate measurement)
Amplitude measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Transmission power accuracy	±10% (using high power input after calibration with MA4601A Power Sensor)
	Carrier-off power	Measurement range in Normal mode: ≥65 dB (to average power of burst signal) Average noise level in Wide dynamic range mode: ≤–60 dBm (100 MHz ≤frequency ≤2.1 GHz) *Measurement range is ≥95 dB for 3 W input level of average power of burst signal.
	Rise/fall edge characteristic	Display rising/falling edges while synchronizing with modulation characteristics data of measured signal
	Measurement time	≤1 s
	Impedance	50 Ω (VSWR: ≤1.2)
Occupied bandwidth measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Standard mode (spectrum analyzer mode)	Measurement: Displays results of occupied bandwidth measurement after measuring signal with spectrum analyzer Measurement time: Approx. 12 s in full rate when number of data points set to Normal
	High-speed mode	Measurement: Displays results of occupied bandwidth measurement after FFT of measured signal Measurement time: ≤1 s

Continued on next page

Adjacent channel power	Frequency range	100 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Measurement	Standard mode: Displays results of leakage power of adjacent channel measurement after measuring signal with spectrum analyzer; measurement time: approx. 13 s when number of data points set to Normal-All High-speed mode: Displays results of leakage power of adjacent channel measured after passing signal through internal root-Nyquist filter; measurement time: ≤1.5 s
	Measurement range	Standard mode: ≥60 dB (50 kHz offset), ≥65 dB (100 kHz offset) High-speed mode: ≥60 dB (50 kHz offset), ≥65 dB (100 kHz offset) *Ratio of average power of burst signal to average value of leakage power of adjacent channel at burst-on time
Spurious measurement	Frequency range	10 MHz to 8.5 GHz (except frequency range ±1 MHz of carrier frequency)
	Input level range (transmission power)	+10 to +40 dBm (average power of burst signal)
	Measurement range	≥65 dB (10 MHz to 1.7 GHz), ≥75 dB (1.7 to 8.5 GHz) *At carrier frequency range 800 MHz to 1.7 GHz
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

• Option 12: Measurement software (for PHS)

The following specifications are guaranteed if the internal level is optimized using the auto range of the MS8604A calibration function.

Modulation/ frequency measurement	Frequency range	10 MHz to 2.1 GHz
	Input level	–10 to +40 dBm (average power of burst signal) *When using the low power input connector, measurement to levels 20 dB lower than the above values is possible.
	Frequency accuracy	± (accuracy of reference oscillator +10 Hz)
	Modulation accuracy	± (2% of indicated value +0.7%)
	Origin offset accuracy	±0.5 dB to signal level of –30 dBc
	Transmission rate accuracy	±1 ppm
	Measuring range of transmission rate	384 kbps ±100 ppm
	Waveform display	Constellation display
	Measurement time	≤1 s (except transmission rate measurement), ≤2 s (transmission rate measurement)
Amplitude measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Transmission power accuracy	±10% (using high power input after calibration with MA4601A Power Sensor)
	Carrier-off power	Measurement range in Normal mode: ≥55 dB (to average power of burst signal) Average noise level in Wide dynamic range mode: ≤–50 dBm (100 MHz ≤frequency ≤2.1 GHz) *Measurement range is ≥69 dB for 80 mW input level of average power of burst signal.
	Rise/fall edge characteristics	Display rising/falling edges while synchronizing with modulation data of measured signal
	Measurement time	≤1 s
	Impedance	50 Ω (VSWR: ≤1.2)
Occupied bandwidth measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Standard mode (spectrum analyzer mode)	Measurement: Displays results of occupied bandwidth measurement after measuring signal with spectrum analyzer Measurement time: Approx. 4 s when number of data points of spectrum analyzer set to Normal
	High-speed mode	Measurement: Displays results of occupied bandwidth measurement after FFT of measured signal Measurement time: ≤1 s
Adjacent channel power	Frequency range	100 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Measurement	Standard mode: Displays results of leakage power of adjacent channel measurement after measuring signal with spectrum analyzer; measurement time: approx. 5 s when number of data points set to Normal-All High-speed mode: Displays results of leakage power of adjacent channel measured after passing signal through internal root-Nyquist filter; measurement time: ≤1.5 s
	Measurement range	Standard mode: ≥60 dB (600 kHz offset), ≥60 dB (900 kHz offset) High-speed mode: ≥60 dB (600 kHz offset), ≥60 dB (900 kHz offset) *Ratio of average power of burst signal to average value of leakage power of adjacent channel at burst-on time
Spurious measurement	Frequency range	10 MHz to 8.5 GHz (except frequency range ±50 MHz of carrier frequency)
	Input level range (transmission power)	+10 to +40 dBm (average power of burst signal)
	Measurement range	≥60 dB (10 MHz to 1.7 GHz), ≥70 dB (1.7 to 8.5 GHz) *At carrier frequency range 800 MHz to 2 GHz
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

For product ordering information, see pages 4 –10

• Option 13: Measurement software (for NADC)

The following specifications are guaranteed optimizing the internal level using the auto range of the MS8604A calibration function.

Modulation/ frequency measurement	Frequency range	400 kHz to 2.1 GHz
	Input level	–10 to +40 dBm (burst average power) *When using the low power-input connector, measurement to levels 20 dB lower than the above values is possible.
	Frequency accuracy	± (accuracy of reference oscillator +1 Hz)
	Modulation accuracy	± (2% of indicated value +0.5%)
	Origin offset accuracy	±0.5 dB to signal level of –30 dBc
	Transmission rate accuracy	±1 ppm
	Measuring range of transmission rate	48.6 kbps ±100 ppm
	Waveform display	Constellation display
	Measurement time	≤1 s (except transmission rate measurement), ≤3 s (transmission rate measurement)
Amplitude measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Transmission power accuracy	±10% (using high-power input after calibration with MA4601A Power Sensor)
	Carrier-off power	Measurement range in Normal mode: ≥65 dB (to average power of burst signal) Average noise level in Wide dynamic range mode: ≤–60 dBm (100 MHz ≤frequency ≤2.1 GHz) *Measurement range is ≥96 dB for +36 dBm input level of average power of burst signal.
	Rise/fall edge characteristics	Display rising/falling edges while synchronizing with modulation data of measured signal
	Measurement time	≤1 s
	Impedance	50 Ω (VSWR: ≤1.2)
Occupied bandwidth measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Standard mode (spectrum analyzer mode)	Measurement: Displays results of occupied bandwidth measurement after measuring signal with spectrum analyzer Measurement time: Approx. 12 s in full rate when number of data points set to Normal
	High-speed mode	Measurement: Displays results of occupied bandwidth measurement after FFT of measured signal Measurement time: ≤1 s
Adjacent channel power	Frequency range	100 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Measurement	Standard mode: Displays results of leakage power of adjacent channel measurement after measuring signal with spectrum analyzer; measurement time: approx. 13 s when number of data points set to Normal-All High-speed mode: Displays results of leakage power of adjacent channel measured after passing signal through internal root-Nyquist filter; measurement time: ≤2 s
	Measurement range	High-speed mode: ≥30 dB (30 kHz offset), ≥60 dB (60 kHz offset), ≥65 dB (90 kHz offset) *Ratio of average power of burst signal to average value of leakage power of adjacent channel at burst-on time
Spurious measurement	Frequency range	10 MHz to 8.5 GHz (except frequency range ±1 MHz of carrier frequency)
	Input level range (transmission power)	+10 to +40 dBm (average power of burst signal)
	Measurement range	≥65 dB(10 MHz to 1.7 GHz), ≥75 dB (1.7 to 8.5 GHz) *At carrier frequency range 800 MHz to 1.7 GHz
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

• Option 14: Digital MCA measurement software (for Digital MCA)

The following specifications are guaranteed if the internal level is optimized using the auto range of the MS8604A calibration function.

Maximum input level		10 W (average power), 50 W (peak power: ≤1 ms)
Modulation/ frequency measurement	Frequency range	400 kHz to 2.1 GHz
	Input level range	–10 to +40 dBm (average power of burst signal) *When using the low power input connector, measurement to levels 20 dB lower than the above is possible.
	Carrier frequency (phase trace method)	Accuracy: ± (accuracy of reference oscillator +5 Hz)
	Modulation accuracy	Accuracy: ±3% (normal slot), ±4% (sub slot)
	Transmission rate	Range: ±100 ppm, Accuracy: ±2 ppm (normal slot)
	Waveform display	Constellation display
	Measurement time	≤2 s (except transmission rate measurement), ≤10 s (transmission rate measurement)
Amplitude measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Antenna power measurement	Accuracy: ±10% (using high power input connector after calibration with MA4601A Power Sensor)
	Leakage power at carrier-off	Measurement range in Normal mode: ≤55 dB Average noise level in Wide dynamic range mode: ≤–60 dBm (100 MHz ≤frequency ≤2.1 GHz)
	Amplitude waveform display	Displays amplitude waveform while synchronizing with modulation data (synchronous symbol) of measured signal Display time: 108 ms (displays frame), 18 ms (displays slot), 3.6 ms (displays rising/falling)
	Measurement time	≤2 s
	Impedance	50 Ω, VSWR: ≤1.2

Continued on next page

Occupied frequency bandwidth measurement	Frequency range	10 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm (average power of burst signal)
	Measurement method	Standard mode: Displays results of occupied bandwidth measurement after measuring signal with spectrum analyzer; measurement time: approx. 50 s High speed mode: Displays results of occupied bandwidth measurement after FFT of measured signal; measurement time: ≤1 s
Adjacent channel power	Frequency range	100 MHz to 2.1 GHz
	Input level range	+10 to +40 dBm
	Measurement method	Standard mode: Displays results of leakage power of adjacent channel measurement after measuring signal with spectrum analyzer; measurement time: approx. 50 s High speed mode: Displays results of leakage power of adjacent channel measurement after measuring signal passed through internal filter (bandwidth: 18 kHz); measurement time: ≤2 s
	Measurement range	High-speed mode: Ratio of average power of burst signal to value of leakage power of adjacent channel at burst-on time ≤58 dB (standard mode, high speed mode)
Spurious measurement	Frequency range	10 MHz to 8.5 GHz (except frequency range ±1 MHz of carrier frequency)
	Input level range (transmission power)	+10 to +40 dBm (burst average power)
	Measurement range	≤65 dB (10 MHz to 1.7 GHz), ≤75 dB (1.7 to 8.5 GHz) ∗For carrier frequency range 850 MHz to 1.7 GHz
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

• Option 15: Measurement software (for GMSK)

The following specifications are guaranteed if the internal level is optimized using the auto range of the MS8604A calibration function.

Maximum input level		+40 dBm
General GMSK	Frequency	10 MHz to 3 GHz
	Input level	–10 to +40 dBm (high power input), –30 to +20 dBm (low power input)
	Setting	Bit rate: 100 bps to 1.25 Mbps (resolution: 0.1 bps) BT: 0.2 to 1.0 (bit rate: 100 bps to 160 kbps), 0.2 to 0.5 (bit rate: 160 kbps to 1.25 Mbps) Analysis bit number: 50 to 1000 bits Frame length: Analysis bit number – 4000 bits (continuous signal), (analysis bit number x 2) – 4000 bits (burst signal) Measurement signal: Continuous signal, burst signal
	Modulation/frequency measurement (phase trace method)	Measurement item: Carrier frequency, phase error Waveform display: Eye pattern, trellis, phase error vs. bit number, amplitude error vs. bit number, I/Q diagram
	Amplitude measurement	Measurement item: Transmission power (average power of burst signal) Waveform: Displays amplitude waveform while synchronizing with modulation data (rise/fall, slot, and frame changeable) Impedance: 50 Ω, VSWR: ≤1.2 (high power input connector)
	FM deviation measurement	Measurement item: Maximum frequency deviation Waveform: FM demodulation waveform (continuous demodulation or eye pattern changeable), display range = standard frequency deviation x 2
	Occupied bandwidth measurement	Displays results of occupied bandwidth measurement (99%) after FFT of measurement signal
GSM, DCS1800 (PCN)	Modulation/frequency measurement (phase trace method)	Frequency: 10 MHz to 2.1 GHz Input level: –10 to +40 dBm (high power input), –30 to +20 dBm (low power input) Carrier frequency measurement accuracy: ±(reference oscillator accuracy +10 Hz) Phase error measurement (residual phase error): ≤0.5° rms, ≤2° peak Waveform display: Eye pattern, trellis, phase error vs. bit number, amplitude error vs. bit number, I/Q diagram Measurement time: ≤1 s (measured at mobile station), ≤1 s (measured at base station)
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) ∗After calibration using MA4601A Power Sensor, at high power input connector; linearity: +0.3 dB (at 0 to –30 dB) Leakage power during carrier-off Measurement range in Normal mode: ≥55 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–50 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤1 s (measured at mobile station), ≤2 s (measured at base station)
	FM deviation measurement	Same as general GMSK measurement
	Occupied bandwidth measurement	Same as general GMSK measurement
	Output RF spectrum	Available, combined with the MX3518A
	Spurious emissions	Available, combined with the MX3518A

Continued on next page

DECT	Modulation/frequency measurement (phase trace method)	Same as general GMSK measurement
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector; input level: ≥+15 dBm Leakage power during carrier-off Measurement range in Normal mode: ≥50 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–45 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤2 s (except for double slot measurement)
	FM deviation measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Maximum frequency deviation: Measurement of section specified by marker Residual FM: ≤±5 kHz peak Average frequency measurement: Measurement of section specified by marker Waveform: FM demodulation waveform (continuous demodulation or eye pattern changeable) Measurement time: ≤2 s (except for double slot measurement)
	Occupied bandwidth Measurement	Same as general GMSK measurement
	Emissions due to modulation	Available, combined with the MX3519A
	Emissions due to transmitter transients	Available, combined with the MX9516A
	Spurious emissions	Available, combined with the MX9516A
CT2	Modulation/frequency measurement (phase trace method)	Same as general GMSK measurement
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector Leakage power during carrier-off Measurement range in Normal mode: ≥60 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–50 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤1 s (except for multiplex-3 measurement)
	FM deviation measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Maximum frequency deviation: Measurement of section specified by marker Residual FM: ≤±200 Hz peak (10 MHz ≤frequency ≤2.1 GHz) Average frequency measurement: Measurement of section specified by marker Waveform: FM demodulation waveform (continuous demodulation or eye pattern changeable) Measurement time: ≤1 s (except for multiplex-3 measurement)
	Occupied bandwidth measurement	Same as general GMSK measurement
	Adjacent channel power	Available, combined with the MX3520A
	Out of band power arising from transmitter transients	Available, combined with the MX3520A
	Spurious emissions	Available, combined with the MX3520A
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

• Option 16: Measurement software (for π/4 DQPSK)

The following specifications are guaranteed if the internal level is optimized using the auto range of the MS8604A calibration function.

Maximum input level		+40 dBm
General-purpose π/4 DQPSK	Frequency	10 MHz to 4 GHz
	Input level	–10 to +40 dBm (high power input), –30 to +20 dBm (low power input)
	Setting	Symbol rate: 1 to 600 k symbol/s (2 to 1200 kb/s), setting resolution: 0.1 symbol/s α (roll-off factor): 0.2 to 1.0 (symbol rate: 1 to 320 k symbol/s), 0.2 to 0.5 (symbol rate: 320 to 600 k symbol/s), setting resolution: 0.01 Number of analysis symbols: 48 to 1000 symbols Frame length: Number of analysis symbols — 5800 symbols (continuous signal), (number of analysis symbols x 2) — 5800 symbols (burst signal) Measurement signal: Continuous signal, burst signal
	Modulation/frequency measurement (phase trace method)	Measurement item: Carrier frequency, modulation accuracy Waveform: Displays constellation, eye pattern, vectors error vs. symbol number, phase error vs. symbol number, amplitude error vs. symbol number
	Amplitude measurement	Measurement item: Transmission power (average power of burst signal) Waveform: Displays amplitude waveform while synchronizing with modulation data (rise/fall, slot, and frame changeable) Impedance: 50 Ω, VSWR; ≤1.2 (high power input connector)
	Occupied bandwidth measurement	Displays results of occupied bandwidth measurement (99%) after FFT of measurement signal

Continued on next page

WCPE	Modulation/frequency measurement (phase trace method)	Frequency: 10 MHz to 2.1 GHz Input level: 0 to +40 dBm (high power input), –20 to +20 dBm (low power input) Carrier frequency measurement accuracy: ±(reference oscillator accuracy +10 Hz) Modulation accuracy (residual vector error): ≤1%rms, ≤3%peak Waveform: Displays constellation, eye pattern, vectors error vs. symbol number, phase error vs. symbol number, amplitude error vs. symbol number Measurement time: ≤2 s
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +15 to +40 dBm (high power input), –5 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector Leakage power during carrier-off Measurement range in Normal mode: ≥55 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–50 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤2 s
	Occupied bandwidth measurement	Same as general-purpose π/4 DQPSK measurement
RCR STD-39 (π/4 DQPSK digital mobile communication system for public works)	Modulation/frequency measurement (phase trace method)	Frequency: 400 kHz to 2.1 GHz Input level: –10 to +40 dBm (high power input), –30 to +20 dBm (low power input) Carrier frequency measurement accuracy: ±(reference oscillator accuracy +1 Hz) Modulation accuracy (residual vector error): ≤0.5%rms, ≤2%peak Waveform: Displays constellation, eye pattern, vectors error vs. symbol number, phase error vs. symbol number, amplitude error vs. symbol number Measurement time: ≤1 s
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector Leakage power during carrier-off Measurement range in Normal mode: ≥65 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–60 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤1 s
	Occupied bandwidth measurement	Same as general-purpose π/4 DQPSK measurement
PACS	Modulation/frequency measurement (phase trace method)	Frequency: 10 MHz to 2.1 GHz Input level: –10 to +40 dBm (high power input), –30 to +20 dBm (low power input) Carrier frequency measurement accuracy: ±(reference oscillator accuracy +10 Hz) Modulation accuracy (residual vector error): ≤1%rms, ≤3%peak Waveform: Displays constellation, eye pattern, vectors error vs. symbol number, phase error vs. symbol number, amplitude error vs. symbol number Measurement time: ≤1 s
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector Leakage power during carrier-off Measurement range in Normal mode: ≥55 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–50 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data and CRC data (mobile station measurement) Measurement time: ≤1 s
	Occupied bandwidth measurement	Same as general-purpose π/4 DQPSK measurement
TETRA	Modulation/frequency measurement (phase trace method)	Frequency: 400 kHz to 2.1 GHz Input level: –10 to +40 dBm (high power input), –30 to +20 dBm (low power input) Carrier frequency measurement accuracy:±(reference oscillator accuracy +1 Hz) Modulation accuracy (residual vector error): ≤0.5%rms/≤2%peak (symbol time), ≤0.7%rms/≤3%peak (1/2 symbol time) Waveform: Displays constellation, eye pattern, vectors error vs. symbol number, phase error vs. symbol number, amplitude error vs. symbol number Measurement time: ≤1 s
	Amplitude measurement	Frequency: 10 MHz to 2.1 GHz Input level: +10 to +40 dBm (high power input), –10 to +20 dBm (low power input) Transmission power measurement accuracy: ±0.4 dB (±10%) *After calibration using MA4601A Power Sensor, at high power input connector Leakage power during carrier-off Measurement range in Normal mode: ≥65 dB (ratio between transmission power and average noise level) Average noise level in Wide dynamic range mode: ≤–60 dBm (100 MHz ≤frequency ≤2.1 GHz, at high power input) Waveform: Displays amplitude waveform while synchronizing with modulation data Measurement time: ≤1 s
	Occupied bandwidth measurement	Same as general-purpose π/4 DQPSK measurement
I/Q input (Option 03)		Input level range: 0.3 to 1.5 Vp-p Input impedance: 5 kΩ, AC/DC coupling (switchable) Measurement items: Modulation, amplitude, occupied bandwidth

For product ordering information, see pages 4 – 10

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
	Main frame
MS8604A	Digital Mobile Radio Transmitter Tester
	Standard accessories
J0114A	Coaxial cord, UG-21D/U · RG-9A/U · UG-21D/U, 1 m: 1 pc
	Power cord, 2.5 m: 1 pc
P0005	PMC (32 KB): 1 pc
MA4601A	Power Sensor: 1 pc
J0370N	Power sensor connector cable, 0.5 m: 1 pc
F0014	Fuse, 6.3 A: 2 pcs
W0682AE	MS8604A operation manual: 1 copy
	Options
MS8604A-01	Reference quartz oscillator (aging rate: ≤5 x 10^{-9}/day)
MS8604A-02	RS-232C interface (for external control)
MS8604A-03	I/Q input
MS8604A-11	Measurement software Ver. 3 (PDC, added to the MS8604A firmware at the factory)
MS8604A-12	Measurement software Ver. 3 (PHS, added to the MS8604A firmware at the factory)
MS8604A-13	Measurement software Ver. 3 (NADC, added to the MS8604A firmware at the factory)
MS8604A-14	Measurement software Ver. 2 (Digital MCA, added to the MS8604A firmware at the factory)
MS8604A-15	Measurement software Ver. 2 (GMSK, added to the MS8604A firmware at the factory)
MS8604A-16	Measurement software (π/4 DQPSK, added to the MS8604A firmware at the factory)
W0722AE	Measurement software operation manual (supplied with Option 14)
W0876AE	Measurement software operation manual (supplied with Option 15)
W0973AE	Measurement software operation manual (supplied with Option 16)

Previously-purchased MS8604A measurement software options (Option 11, Option 12, Option 13, Option 14 and Option 15) can be upgraded to the latest version (with fee). For details, please contact your sales representative.

Model/Order No.	Name
	Application software (supplied with PMC)
MX3512A	π/4 DQPSK Analysis Software (for MS8604A-11/12/13)
MX3513A	Digital MCA Analysis Software (for MS8604A-14)
MX3518A	GSM Application Software (for MS8604A-15)
MX3519A	DECT Application Software (for MS8604A-15)
MX3520A	CT2 Application Software (for MS8604A-15)
	Peripheral equipments and parts
MC3305A	JIS Type PTA Keyboard
MC3306A	ASCII Type PTA Keyboard
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
P0006	PMC, 64 KB
P0007	PMC, 128 KB
P0008	PMC, 256 KB
P0009	PMC, 512 KB
MA4001A	Range Calibrator
MP59B	50 Ω Coaxial Switch (DC to 3 GHz, 50 Ω)
MP640A	Branch (DC to 1.7 GHz, 40 dB)
MP654A	Directional Coupler (0.8 to 3 GHz, 30 dB)
MP520C	CM Directional Coupler (25 to 500 MHz, 50 Ω, N type)
MP520D	CM Directional Coupler (100 to 1700 MHz, 50 Ω, N type)
J0395	Fixed attenuator for high-power (30 dB, 30 W, DC to 8 GHz)
J0055	Coaxial adapter (NC-P · BNC-J)
562	DC block (10 MHz to 12.4 GHz, NARDA product)
B0329D	Protective cover
B0331D	Front handle kit (2 pcs/set)
B0332	Joint plate (4 pcs/set)
B0333D	Rack mount kit
B0334D	Hard carrying case (with protective cover and casters)

DIGITAL MODULATION SIGNAL GENERATOR

MG3681A

250 kHz to 3 GHz

W-CDMA Device, Mobile Equipment, Base Station Test

CE GPIB

The MG3681A is a high performance digital modulation signal generator that incorporates a broadband vector modulator. It generates the complex high-accuracy signals required for research and development to mass-production of digital mobile communication systems and related devices.
It has a frequency range of 250 kHz to 3 GHz, covering the frequency bands of all major mobile communications systems. In addition, it uses quadrature vector modulation to provide high-quality frequency characteristics, distortion characteristics, and S/N ratio. It can perform accurate sensitivity tests of receivers in high-speed modulation communication systems, as well as test transmitter adjacent-channel power characteristics.
Expansion options such as the MU368040A CDMA Modulation Unit, which generates modulation signals for W-CDMA communication systems, can be installed in the seven expansion slots. Various modulation signal waveforms can be generated with the expansion units and associated software.
The MG3681A also has superior AM and FM analog modulation functions for testing conventional analog communications systems. Its high signal purity and various functions such as memory and sweep capabilities are useful in general-purpose signal generation applications.

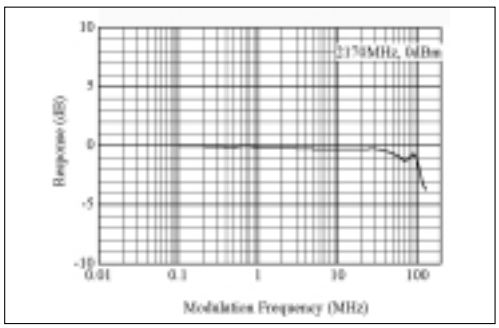
Features

- Comprehensive expandability
- Excellent analog performance

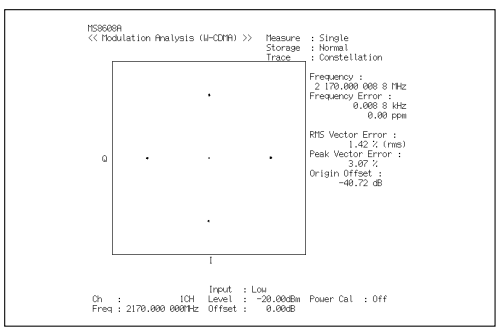
Performance and functions

• Broadband vector modulation

The modulation frequency response of ±3 dB at the modulation frequency from DC to 30 MHz is achievable by the high-speed base band signal processor and broadband quadrature modulator. The MG3681A provides broadband vector modulation for W-CDMA and other high-speed data communication systems. Accurate broadband vector modulation is also available by using the external I/Q signals as well as internal modulation using the optional digital modulation unit installed.



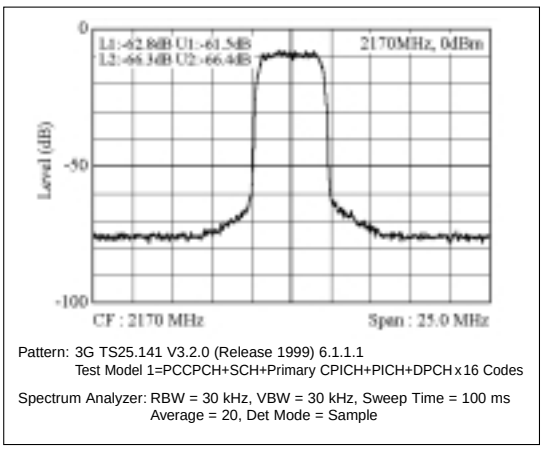
Vector modulation frequency response



Vector modulation accuracy

For product ordering information, see pages 4 – 10

• Excellent adjacent channel power characteristics
Adjacent channel power characteristic is important for evaluating devices and radio receivers. The MG3681A provides excellent adjacent channel power characteristics by using a proven circuit configuration. It offers excellent rejection of adjacent channel signals, such as –68 dBc/ 3.84 MHz (1 code, typical) for adjacent channel and –75 dBc/3.84 MHz (1 code, typical) for 1st alternate channel. This makes the MG3681A an excellent choice for evaluating intermodulation distortion of power amplifiers.



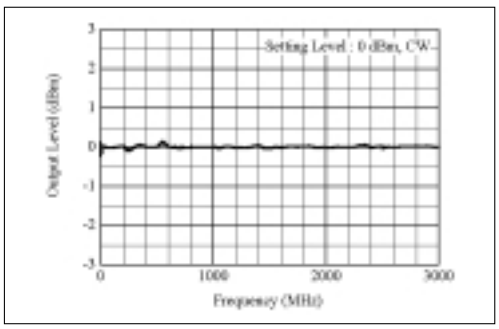
Pattern: 3G TS25.141 V3.2.0 (Release 1999) 6.1.1.1
Test Model 1=PCCPCH+SCH+Primary CPICH+PICH+DPCH x 16 Codes

Spectrum Analyzer: RBW = 30 kHz, VBW = 30 kHz, Sweep Time = 100 ms
Average = 20, Det Mode = Sample

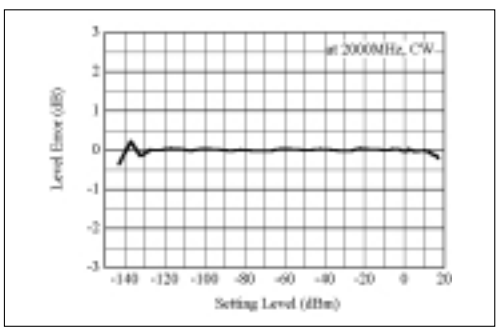
Adjacent channel power characteristic (16 code multiwave)

• High-resolution output level setting of 0.01 dB
The output level can be set with 0.01 dB resolution across the entire level range. This is useful for device tests, level calibration of power meter etc., requiring precise level settings.

• Excellent level accuracy
Even low levels can be output with high accuracy due to use of a high-precision, high-reliability step attenuator and high-speed level calibration method. As a result, highly sensitive receivers can be measured accurately.

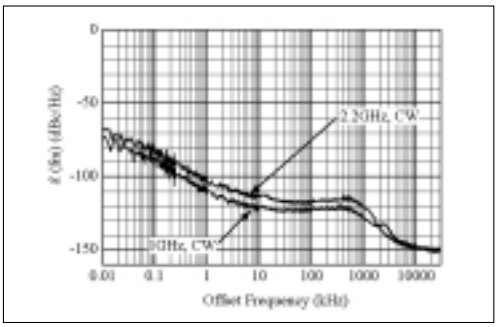


Output level frequency response



Output level accuracy

• Excellent noise characteristics
The MG3681A can be used for interference testing of radio receivers and as sources of various local oscillator and reference signals.



SSB phase noise characteristics

• Compatibility with W-CDMA systems
The MG3681A can generate up-link and down-link signals with the W-CDMA modulation standard corresponding to 3GPP (FDD) with the installation of the MX368041A W-CDMA Software and the MU368040A CDMA Modulation Unit.

Connection with mobile equipment and base stations
For down-link simulation, the MG3681A outputs P-CCPCH, P-SCH and S-SCH to synchronize with mobile equipment for up to three base stations simultaneously. It incorporates an external trigger to control the generation timing of the CDMA modulation waveform for base-station connection tests.

Optional filter factor
The baseband filter can be switched between Nyquist and root-Nyquist, and the roll-off ratio can be set between 0.10 and 1.00 in step of 0.01.

Modulation data downloading
Modulation can be performed using the data downloaded by the MX368041A W-CDMA Software. In addition, the symbol data downloaded before diffusion can be used to generate channel formats such as DPCH and PRACH when physical format specification changes occur. It also allows insertion of special test patterns and bit errors. The waveform data can also be downloaded after diffusion to control the crest factors of multiple waves.

Power control function
Using the externally inputted TTL level signals, the channel power can be controlled in 1 dB and 1 slot steps. In addition, the internal program function enables the code power to be programmed for every slot in each channel at the maximum period of 64 slots. This is useful for checking the power control function.

Multiwaves generation
The channels that can be set, such as channelization codes and code power, can be increased up to 12 waveforms. The stored waveform table function enables the generation of multiple waveforms up to 512 channels (at Phase 1). In multiwave mode, MG3681A can generate signals with ratios of peak power to average power of up to 18 dB (except base band filtering effect).

Supports chip rates up to 16.5 Mcps
The MG3681A can output a CDMA modulation waveform whose diffusion and modulation methods are in accordance with 3GPP standard at the chip rate of 1.6 to 16.5 Mcps (set resolution: 1 cps)

Specifications

• MG3681A main frame

<table>
<tr><td rowspan="6">Frequency</td><td>Range</td><td>250 kHz to 3000 MHz, Resolution: 0.01 Hz</td></tr>
<tr><td>Accuracy</td><td>Depends on installed reference oscillator, Reference frequency accuracy: ± (5% of FM setting deviation + 5 Hz) for frequency modulation</td></tr>
<tr><td>Internal reference oscillator</td><td>Aging rate: ±1 x 10^{-6}/year, Temperature stability: ±1 x 10^{-6} (0˚ to 50˚C)*1</td></tr>
<tr><td>External reference input</td><td>10 MHz/13 MHz auto-switching, ±10 ppm, ≥0.7 V(p-p)/50 Ω (AC coupled), BNC connector (rear panel)</td></tr>
<tr><td>Buffer output</td><td>10 MHz, TTL level (DC coupled), BNC connector (rear panel)</td></tr>
<tr><td>Switching time</td><td>≤20 ms (response time from final command to ±500 Hz of set frequency on GPIB at CW, ALC on, except when setting frequency is crossing over 600 MHz and 1010 MHz)</td></tr>
<tr><td rowspan="7">Output level</td><td>Range</td><td>–143 to +13 dBm (settable range: –143 to +17 dBm)</td></tr>
<tr><td>Unit</td><td>dBm, W, dBμV, V (dBμV, V selected terminate/open voltage display)</td></tr>
<tr><td>Resolution</td><td>0.01 dB (dBm, dBμV units), 3 digit (W, V units)</td></tr>
<tr><td>Frequency response</td><td>±1 dB (CW, ALC on, 0 dBm)</td></tr>
<tr><td>Accuracy</td><td>CW, ALC on
<table>
<tr><th>Level \ Frequency</th><th>≤1 GHz</th><th>>1 GHz</th></tr>
<tr><td>≤+13 dBm, ≥–127 dBm</td><td>±1 dB</td><td>±2 dB</td></tr>
<tr><td><–127 dBm</td><td>±2 dB</td><td>±3 dB</td></tr>
</table></td></tr>
<tr><td>Output connector</td><td>50 Ω, N-type connector (front panel)</td></tr>
<tr><td>Switching time</td><td>≤50 ms (normal mode), ≤100 ms (safety mode), ≤10 ms (continuous mode)
*Response time from final command to ±0.5 dB of final level on GPIB at CW, ALC on</td></tr>
<tr><td>Special setting mode</td><td>Continuous mode:
Level continuously adjustable in set value range of ±10 dB (dBm, dBμV units only)
For vector modulation by optional digital modulation unit, continuous mode variance depends on modulation setting
Safety mode: Mechanical attenuator decreases level to prevent generation of high-level signal spikes</td></tr>
<tr><td>ALC mode</td><td>ALC on
Usage: Continuous wave or pulse modulation wave (burst wave) with RF On time of 10 μs or more
ALC time constant: Auto, 500 ns, 2.4 μs, 5 μs, 24 μs, 50 μs, 240 μs, 500 μs selectable
At Auto, automatically selected depending on frequency, AM and vector modulation [when digital modulation unit (option) is used]
The ALC time constant is automatically selected, depending on the set frequency, regardless of the time constant selected on the front panel
ALC off
Usage: Pulse modulation wave (burst wave) whose RF on time is less than 10 μs
Restrict item: Without AM
ALC calibration: Automatic during ALC Calibration operation and at frequency/level setting change</td></tr>
<tr><td rowspan="2">Signal purity</td><td>Spurious</td><td>Harmonics: <–30 dBc
Non harmonic:
<table>
<tr><th>Frequency</th><th>15 kHz to 300 MHz offset</th><th>>300 MHz offset</th><th>Fixed frequency spurious</th></tr>
<tr><td>≤2500 MHz</td><td><–60 dBc</td><td><–30 dBc</td><td>–50 dBc (660, 1320 MHz)</td></tr>
<tr><td>>2500 MHz</td><td colspan="2"><–30 dBc</td><td>–</td></tr>
</table>
Those related power: <–40 dBc *CW, ≤0 dBm</td></tr>
<tr><td>SSB phase noise</td><td><–118 dBc/Hz (≥10 MHz, ≤1010 MHz), <–112 dBc/Hz (>1010 MHz) *At CW, 20 kHz offset</td></tr>
<tr><td rowspan="4">AM</td><td>Range</td><td>0 to 100% (cannot set internal/external modulation independently), Resolution: 0.1%</td></tr>
<tr><td>Modulation frequency response</td><td>≤0 dBm, ALC on, in band of ±1.5 dB based on modulation frequency of 1 kHz
<table>
<tr><th rowspan="3">Frequency</th><th rowspan="3">Lower limit frequency</th><th colspan="3">Upper limit frequency</th></tr>
<tr><th colspan="2">Vector modulation and wideband AM off</th><th>Vector modulation or wideband AM on</th></tr>
<tr><th>AM: 30%</th><th>AM: 80%</th><th>AM: 30%</th></tr>
<tr><td>≥0.4 MHz, <2 MHz</td><td rowspan="3">DC (Internal modulation, External modulation DC coupled), 20 Hz (External modulation AC coupled)</td><td>3 kHz</td><td>1 kHz</td><td rowspan="3">1 kHz</td></tr>
<tr><td>≥2 MHz, <10 MHz</td><td>10 kHz</td><td>10 kHz</td></tr>
<tr><td>≥10 MHz</td><td>10 kHz</td><td>10 kHz</td></tr>
</table></td></tr>
<tr><td>Internal modulation</td><td>Depends on AF synthesizer (Option 21)</td></tr>
<tr><td>External modulation</td><td>2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)</td></tr>
<tr><td>Modulation signal polarity</td><td>Positive/negative switchable</td></tr>
<tr><td rowspan="5">FM</td><td>Range</td><td>0 to 1000 kHz (≥10 MHz, ≤1010 MHz), 0 to 2000 kHz (>1010 MHz)
*Cannot set internal/external modulation independently.</td></tr>
<tr><td>Resolution</td><td>10 Hz (0 to 10 kHz deviation), 100 Hz (10.1 to 100 kHz deviation), 1 kHz (101 to 1000 kHz deviation), 10 kHz (1010 to 2000 kHz deviation)</td></tr>
<tr><td>Modulation frequency response</td><td>DC to 20 kHz (internal modulation, external modulation DC coupled), 20 Hz to 20 kHz (external modulation AC coupled)
*In band of ±1 dB based on modulation frequency of 1 kHz</td></tr>
<tr><td>Internal modulation</td><td>Depends on AF synthesizer (Option 21)</td></tr>
<tr><td>External modulation</td><td>2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)</td></tr>
<tr><td>Modulation signal polarity</td><td>Positive/negative switchable</td></tr>
</table>

Continued on next page

For product ordering information, see pages 4 –10

øM	Range	0 to 6.28 rad (≥10 MHz, ≤1010 MHz), 0 to 12.56 rad (>1010 MHz) ∗Cannot set internal/external modulation independently.
	Unit	rad, deg
	Resolution	rad unit: 0.01 rad, deg unit: 1 deg
	Modulation frequency response	DC to 20 kHz (internal modulation, external modulation DC coupled), 20 Hz to 20 kHz (external modulation AC coupled) ∗In band of ±1 dB based on modulation frequency of 1 kHz
	Internal modulation	Depends on AF synthesizer (Option 21)
	External modulation	2 V(p-p) approx., 600 Ω, AC/DC coupled switchable, BNC connector (front panel)
	Modulation signal polarity	Positive/negative switchable
Wideband AM	Modulation frequency response	DC to 15 MHz (±2 dB bandwidth), DC to 30 MHz (±3 dB bandwidth) ∗External modulation, input level: 0.9 V(p-p), ≥100 MHz, ≤0 dBm, modulation frequency of 1 kHz
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	≤1 V(p-p), 50 Ω, BNC connector (front panel), sensitivity: 1 V(p-p) = 100%
Pulse modulation	On/off ratio	>60 dB
	Rise/fall time	<100 ns (external modulation)
	Minimum pulse width	<500 ns (external modulation)
	Pulse repetition frequency	DC to 1 MHz (external modulation, ALC off)
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	TTL level, positive logic, 50 Ω, BNC connector (front panel)
Vector modulation	Modulation frequency response	DC to 15 MHz (±2 dB bandwidth), DC to 30 MHz (±3 dB bandwidth) ∗External modulation, input level: 0.5 V(rms), ≥100 MHz, ≤0 dBm, modulation frequency of 1 kHz
	Vector error	≤2.5%(rms) ∗External modulation, input level: 0.5 V(rms), ≥100 MHz, ≤0 dBm, 3.84 Msps QPSK modulation
	Internal modulation	Depends on installed digital modulation unit (option)
	External modulation	$\sqrt{(I^2+Q^2)}$ = 0.5 V(rms), I/Q = ±1.5V(peak), 50 Ω, BNC connector (front panel)
	Quadrature degree adjustment function	Adjustment range: ≥±1 deg
	I/Q change	I, Q signal changeable (RF spectrum invert)
Simultaneous modulation		Modulation depth and deviation same for combinations below: AM (internal/external), FM (internal/external), øM (internal/external) Frequency and waveform of modulation signal source same for combinations below: AM (internal)/FM (internal), AM (internal)/øM (internal) Simultaneous modulation impossible as below: FM/øM, wideband AM/vector modulation, vector (internal)/Vector (external) modulation
AF signal output		Depends on AF synthesizer (Option 21)
I/Q signal output*2	Output level	Depends on installed digital modulation unit (option)
	Signal source	Depends on installed digital modulation unit (option)
	Output connector	50 Ω, BNC connector (front panel)
Memory function	Basic parameter memory	512 sets of frequency and level
	All parameter memory	All parameters including 100 sets maximum of analog modulation and digital modulation units (option)
Sweep function	Sweep parameter	Basic parameter memory address
	Sweep pattern	Start address → stop address
	Sweep time	1 ms to 600 s (per memory; memory recall time restricts lower limit, resolution: 1 ms)
	Sweep mode	Auto (repetition sweep), single (single sweep)
Special display	Relative display	Frequency, output level (dBm, dBμV units only)
	Offset display	Frequency (offset range: –3 to +3 GHz), output level (offset range: –55 to +55 dB, dBm, dBμV units only)
Display	Size	7.2 inch, 480 x 640 dots, color D-STN
	On/off setting	Panel display on/off
Backup function		All items reset at power-on except following: Input data contents, remote condition, contents of GPIB data being transferred, RPP operation condition, screen condition, main function selections
Panel lock function	Panel lock	Disable operation of all keys except front panel power key, panel lock key, local key and contrast key
	Knob hold	Disable rotary knob on front panel operation
External interface	GPIB	Controls all functions except power key, local key and contrast key Connector: rear panel
	PC card	Memory card (memory backup, screen hard copy) Connector: JEIDA Ver 4/4.1 PCMCIA Rel 2.0, 1 slot (rear panel)
	Trigger	Executes item specified by command-input signals (3 bits) from following items: Frequency step-up/step-down, output level step-up/step-down, basic parameter recall address up/down, output level on/off Interface: TTL level Connector: D-sub 9-pin, female (rear panel)
Reverse power protection		≤50 W (≤1 GHz), ≤25 W (>1 GHz), ±50 V (DC)
Power		AC 100 to 120/200 to 240 V (–15/+10%, 250 V max, automatic selection), 47.5 to 63 Hz, ≤300 VA
Temperature		Operating: 0˚ to 50˚C, Storage: –20˚ to 60˚C

Continued on next page

Dimensions and mass	426 (W) x 177 (H) x 451 (D) mm, ≤25 kg (excluding option)
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

∗1: Aging rates down to 5 x 10^{-10}/day are available as reference crystal oscillator (MG3681A Option 01/02).
∗2: Possible to expand the function with MG3681A Option 11

• Options

Option 01 (Reference crystal oscillator)	Frequency: 10 MHz Aging rate: ±5 x 10^{-9}/day Start-up characteristics: 1 x 10^{-7} (After 10 min, compared to frequency after 24 h warm-up) Temperature stability: ±3 x 10^{-8} (0˚ to 50˚C)
Option 02 (Reference crystal oscillator)	Frequency: 10 MHz Aging rate: ±5 x 10^{-10}/day Start-up characteristics: 1 x 10^{-7} (After 10 min, compared to frequency after 24 h warm-up) Temperature stability: ±5 x 10^{-9} (0 to 50˚C)
Option 11 (Additional function of I/Q output)	Functions: Adds level, offset setting, and differential output functions to I/Q output Level Range: 80 to 120% of nominal level, Resolution: 0.1% ∗2 sets of I/$\overline{I}$ and Q/$\overline{Q}$ set independently, 50 Ω termination Offset Range: –0.5 to +1.5 V, Resolution: 0.5 mV ∗4 sets of I, $\overline{I}$, Q, $\overline{Q}$ set independently, 50 Ω termination Quadrature degree variable function Range: ±5 deg, Resolution: 0.5 deg Differential output: I, Q signals (Using front I/Q input connector) Signal source: Depends on installed digital modulation unit (option) Output connector: 50 Ω, BNC connector (front panel)
Option 21 (AF synthesizer)	Frequency: 0.01 Hz to 400 kHz, Resolution: 0.01 Hz, Accuracy : same as reference oscillator Waveform: Sine, triangular, square, sawtooth Frequency response: ±1 dB [sine wave, level: 2 V(p-p), offset: 0 V, 600 Ω termination, reference to 1 kHz, 10 Hz to 100 kHz] Harmonics: ≤–50 dB [sine wave, level: 2 V(p-p), offset: 0 V, 600 Ω termination, 1 kHz] Level Range: 0 to 4 V(p-p), Resolution: 1 mV(p-p), Accuracy: ± [8% of set level + 2 mV(p-p)] ∗600 Ω termination Offset Range: –2 to +2 V, Resolution: 1 mV, Accuracy: ± (8% of set level + 2 mV) ∗600 Ω termination Output connector: 600 Ω, BNC connector (front panel)

• MU368040A CDMA Modulation Unit (incorporated in the MG3681A)

Usable Software	MX368041A W-CDMA Software
Occupied slot number	2 slots
Firmware back up size	CDMA: 2 Mbyte, DSP: 2 Mbyte, FPGA: 4 Mbyte
Mass	700 g
EMC	Same as MG3681A
LVD	Same as MG3681A

• MX368041A W-CDMA Software (with MG3681A and MU368040A)

System		W-CDMA (FDD)
Spreading method		Direct sequence
Modulation method		Up-link: BPSK (data), HPSK (spreading) Down-link: QPSK (data), QPSK (spreading)
W-CDMA phase		Phase 1, 2, 3 (Phase 2, 3: only for the chip rate)
Channel number		Phase 1: 1 to 512, Phase 2: 1 to 1024, Phase 3: 1 to 2048
Spreading factor		Phase 1: 1 to 512, Phase 2: 1 to 1024, Phase 3: 1 to 2048
Chip rate		Phase 1: 1.6 to 4.125 Mcps, Phase 2: 3.2 to 8.25 Mcps, Phase 3: 6.4 to 16.5 Mcps
Symbol rate		Chip rate/spreading factor
Data rate accuracy		Depends on installed reference oscillator in the MG3680 series or depends on external reference oscillator
Filter mode		ACP (preference to the Adjacent Channel Power ratio), EVM (preference to the Error Vector Magnitude)
Base band filter		Nyquist or Root Nyquist, Roll off ratio: 0.1 to 1.0, Resolution: 0.01
Editable code number		1 to 12 (for the settings after spreading process)
Down-loaded data	Symbol data code number	2 code max. (The available number of external physical data codes that can be downloaded. When the multi-code function is used, the total number is 9 codes.)
	Symbol data length	4 M symbol/1 code (without power sequence), 1 M symbol/1 code (with power sequence)
	Wave data length	Arbitrary wave form data: 512 k word x 2 ch (1 word = 16 bit)
Internal real-time coding channels		P-CCPCH (base station simulation)

Continued on next page

Spreading code	Base station simulation	Channelization code: Editable for the each 1 to 12 channels Code: OVSF Setting range: 0 to (spreading factor – 1) Scrambling code*1 Code: Gold sequence Scrambling code number setting: 00000 h to 3FFFF h Scrambling code initial phase setting: 00000 h to 3FFFF h Scrambling code Q-phase offset setting: 00000 h to 3FFFF h Scrambling code period: 00001 h to 40000 h
	Mobile station simulation	Channelization code: Editable for the each 1 to 12 channels Code: OVSF Setting rage: 0 to (spreading factor – 1) Scrambling code*1 Long Code: Gold sequence (HPSK or QPSK) Scrambling code number setting: 00000 h to 1FFFFFF h Scrambling code period setting: 0000001 h to 2000000 h Short*2 Code: 256 chips sync short scrambling sequence Scrambling code number setting: 000000 h to FFFFFF h
Internal generating data		Pseudo-random pattern (PN 9, PN 15, PN 23), arbitrary 16 bit repeat pattern (CH11, 12 : Variable repeat pattern of max. 32 bit)
Code domain power		–40 to 0 dB, off, resolution: 0.1 dB
Power control	Internal program function	Programmable each channel's slot power, period: 2 to 64 slot, resolution: 1 dB
	External control function	Control the arbitrary code power synchronizing with the slot timing by the external input signal (TTL), resolution: 1 dB
Offset		The frame timing offset from the scrambling code's first phase (resolution: 1 symbol) The offset of the each scrambling code's phase (resolution: 1 chip)
I/Q phase		Symbol point of the I/Q output: 0, π/4 rad
Aux. signal	Input signals	Data: Physical layer (before the spreading) data input (serial). Frame Clock/Trig: External frame sync. signal input (adjustable the trigger delay) Power Control: External power control input (1 dB step power control of any 1 code) Ref. Clock: Sync. input signal for base-band clock (chip rate x 2^n) *n: phase 1 = 0 to 2, Phase 2 = 0 to 1, Phase 3 = 0 Input connector: TTL, BNC connector (front panel)
	Output signals	Data Clock: Sync. output signal for data output Data: Symbol data output before spreading Symbol Clock: Symbol clock output Ref. Clock: Base-band clock (chip rate x 2^n) *n: Phase 1 = 0 to 3, Phase 2 = 0 to 2, Phase 3 = 0 to 1 Frame Clock: Pulse output of frame period Slot Clock: Pulse output of time slot period Code: Exclusive OR data, channelization code and scrambling code Output connector: TTL, BNC connector (rear panel)
I/Q signal	Output level	$\sqrt{(I^2+Q^2)}$ = 0.200 V(rms) *Maximum code number : 1, filter mode: EVM, 50 Ω termination, connector: BNC connector (front panel)
	Vector error	≤3%(rms) *Chip rate: 3.84 Mcps, maximum code number: 1, filter mode: EVM, 18˚ to 35˚C
RF signal	Frequency rage	10 to 3000 MHz
	Output power rage	–143 to +5 dBm (maximum code number: 1 to 7), –143 to +4 dBm (maximum code number: 8 to 12), –143 to +3 dBm (maximum code number: 13 to 15), –143 to +2.14 dBm (maximum code number: 16 to 19), –143 to +2 dBm (maximum code number: 20 to 31), –143 to +1 dBm (maximum code number: 32 to 50), –143 to 0 dBm (maximum code number: ≥51)
	Continuous mode range	–10 to +8 dB (maximum code number: except 16 to 19), –10 to +7.14 dB (maximum code number: 16 to 19)
	Burst on/off ratio	>60 dB (1.9 to 2.3 GHz)
	Vector error	≤2%(rms) *1.9 to 2.3 GHz, 0 dBm, chip rate: 3.84 Mcps, maximum code number: 1, filter mode: EVM
	Carrier leak	≤–30 dBc (≤0 dBm, 18˚ to 35˚C, 1.9 to 2.3 GHz)
	Image rejection	≤–40 dBc (≤0 dBm, after calibration, 1.9 to 2.3 GHz)
	Level accuracy	Level accuracy of CW ±1.2 dB (1.9 to 2.3 GHz, chip rate: 3.84 Mcps, maximum code number: 1, scrambling code: on, power control function: off)
	Adjacent channel power ratio	–64 dBc/3.84 MHz (5 MHz offset), –71 dBc/3.84 MHz (10 MHz offset), –68 dBc/3.84 MHz (typical, 5 MHz offset), –75 dBc/3.84 MHz (typical, 10 MHz offset) *1.9 to 2.3 GHz, –3 dBm, maximum code number: 1, filter mode: ACP, 18˚ to 35˚C, by spectrum analyzer with RMS detector
	Spurious	<–60 dBc (1.9 to 2.3 GHz, chip rate: 3.84 Mcps, maximum code number: 1, filter mode: ACP)
Necessary firmware back up size		CDMA: 300 kbyte, DSP: 250 kbyte, FPGA: 100 kbyte

*1: Equipped with three generators, selectable each channel or off. The start timing of each generator can set with 1 chip resolution.
*2: Only one selectable from three scrambling code generator

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MG3681A	Digital Modulation Signal Generator	
	Standard accessories	
	Power cord, 2.6 m:	1 pc
B0325	GPIB connector shield cap:	1 pc
F0014	Fuse, 6.3 A:	2 pcs
W1708AE	MG3681A operation manual:	1 copy
	Options	
MG3681A-01	Reference oscillator (aging rate: 5 x 10^{-9}/day)	
MG3681A-02	Reference oscillator (aging rate: 5 x 10^{-10}/day)	
MG3681A-11	Additional function of I/Q output (level and offset setting, differential output)	
MG3681A-21	AF synthesizer (0.01 Hz to 400 kHz, resolution: 0.01 Hz)	
	Maintenance service	
MG3681A-90	Extension service 3 years	
MG3681A-91	Extension service 5 years	
	Expansion units	
MU368010A	TDMA Modulation Unit*1,*2	
MU368040A	CDMA Modulation Unit*1,*2	
MU368060A	AWGN Unit*1	
	Standard accessories	
W1835AE	MU368010A operation manual:	1 copy
W1758AE	MU368040A operation manual:	1 copy
W1955AE	MU368060A operation manual:	1 copy
	Maintenance service	
MU368010A-90	Extension service 3 years	
MU368010A-91	Extension service 5 years	
MU368040A-90	Extension service 3 years	
MU368040A-91	Extension service 5 years	
MU368060A-90	Extension service 3 years	
MU368060A-91	Extension service 5 years	
	Softwares*1	
MX368011A	PDC Software (for MU368010A)	
MX368012A	GSM Device Test Software (for MU368010A)	
MX368041A	W-CDMA Software (for MU368040A)	
MX368042A	IS-95 Device Test Software (for MU368040A)	
	Standard accessories	
W1836AE	MX368011A operation manual:	1 copy
W1837AE	MX368012A operation manual:	1 copy
W1759AE	MX368041A operation manual:	1 copy
W1838AE	MX368042A operation manual:	1 copy
	Optional accessories	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m	
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m	
J0127C	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 0.5 m	
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0329C	Front cover (1MW4U)	
B0331C	Front handle (2 pcs/set)	
B0332	Joint plate (4 pcs/set)	
B0333C	Rack mount kit	
B0334C	Carrying case (Hard type, with front cover and casters)	

∗1: For the details of expansion units and software, refer to the each catalog.
∗2: The software is required to use the MU368010A/368040A

For product ordering information, see pages 4 – 10

DIGITAL MODULATION SIGNAL GENERATOR

MG3670B/C, MG3671A/B, MG3672A

300 kHz to 2.25/2.75 GHz

For Measuring Signals of Digital Mobile Communication Systems in North America, Europe and Japan

GPIB

The MG3670B/C, MG3671A/B and MG3672A are digital modulation signal generators equipped with a high-performance quadrature modulator. They output the signals needed to develop, test, and evaluate digital mobile communications equipment and related devices with expansion units.

The MG3670B/C operates from 300 kHz to 2.25 MHz; the MG3671A/B and MG3672A operate 300 to 2.75 MHz. Both provide a stable and precise output as well as spectrum purity up to +13 dBm, even with modulation. In addition to testing receiver sensitivity and excess input, they can be used for testing IF stage performance and for evaluating device quality. A CMOS-level mode is provided for I/Q signal input. The input frequency band covers the CDMA spread spectrum band, expanding the range of applications.

The MG3670C/3671B/3672A can be expanded by rear panel extension connectors to use for auxiliary signal output functions special to communication system. MG3670B/C, MG3671A/B and MG3672A can be used in combination with up to eight modulation units and a burst function unit simultaneously.

The MG0301C/0302A/0305A/0307A/0311A modulation units have a continuous data generator capable of generating arbitrarily-programmable data signals and ITU-T specification PN9/15 stage PRBS signals. They also have band-limiting filters and can output I/Q baseband signals.

The MG0303A Burst Function Unit uses the frame and slot configuration stipulated by various communication systems and has a modulation pattern generator function and a function for ramp control of carrier burst signals. It can also handle data editing and scrambling.

The MG0310A Modulation Unit generates SS + QPSK/OQPSK modulated (1.2288 Mcps) I/Q baseband signals, supporting the CDMA system (TIA/EIA/IS-95) used in US Digital Cellular Systems and the US Personal Communications Service (PCS).

Anritsu-developed DSP and ASIC technology is used in the MG0310A to achieve superior waveform quality factor (ρ) and spurious emission characteristics. Channel multiplexed signals are supported for both forward and reverse links. With two MG0310A units mounted in the MG3670C/3671B/3672A, all the test signals required to conform to TIA/EIA/IS-95, -97, and -98 can be generated. Simultaneous outputs from the rear extension connectors using long and short codes, etc., support a wide range of applications including RF related tests, IF stage performance tests, and device and module quality evaluation. (Option 25 is required to install the MG0310A in the MG3670B/3671A. The auxiliary signal output function is not installed, so long/short codes cannot be output.)

The MG0312A QPSK Modulation Unit generates QPSK/OQPSK modulated I/Q baseband signals at 8 high-speed bit rates between 500 kbps and 2.4576 Mbps. Built-in modulation data includes PN7/PN9/PN15/PN23 pseudorandom patterns. Use over a wide range is supported by multiple baseband filters and the Phase Encoding function, which allows modulation data to be voluntarily phase mapped onto a constellation. At the 2.4576 Mbps rate, the evaluation of transmission section devices and modules can be performed such as RF power amplifier for CDMA mobile stations.

Communication systems	Units	
PHS, PDC, PDC_H, NADC, TFTS	MG0301C π/4 DQPSK Modulation Unit	MG0303B Burst Function Unit
GSM, PCN (DCS1800), CT2	MG0302A GMSK Modulation Unit	
DECT	MG0305A GFSK Modulation Unit	
PACS, WCPE, PHS	MG0307A π/4 DQPSK Modulation Unit	
TETRA	MG0311A π/4 DQPSK Modulation Unit	
IS-95	MG0310A CDMA Modulation Unit*1	
	MG0312A QPSK Modulation Unit	

*1 MG3670B, MG3671A: Requires Option 25

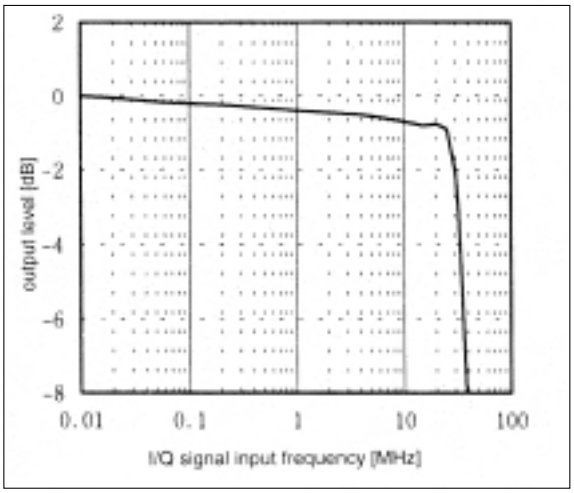
Features

- Compatible with communication system measurement signals of Japan, North America and Europe
- High modulation accuracy (≤1.8% rms vector error)
- Outputs modulation signals suited to each communication system
- Internal pattern generator with data-editing and scrambling functions
- Outputs IS-95 channel multiplex signal
- Wide range (30 MHz, 3 dB) I/Q Input (only for MG3672A)

Basic performance

• I/Q input supporting wide range of applications (only for MG3672A)

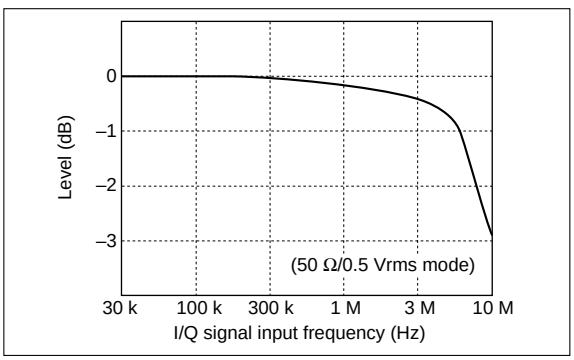
The MG3672A is equipped with wide-band I/Q input from DC to 30 MHz (3 dB) so that wide-band quadrature modulation can be performed. This ensures that the MG3672A will remain fully compatible with communication systems for which band expansion is planned in the future.



Frequency response for I/Q external modulation (typical values)

• I/Q signal I/O over broad frequency range (only for MG3670B/C, MG3671A/B)

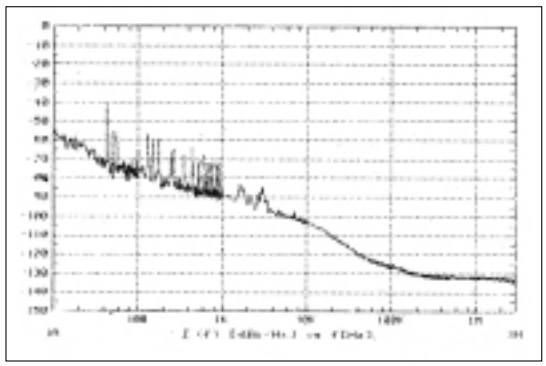
A quadrature modulator is built in, and external I/Q signals can be input to enable use with a variety of digital modulation modes, including QPSK, 8PSK, and M16QAM. The modulation band for I/Q input signals is broad, covering the CDMA spread spectrum bandwidth. Further, by adding an expansion unit, I/Q signal output can be obtained from the internal data generator. Either 50 Ω or CMOS-level compatibility can be selected for I/Q signals. Functions for adjusting the level balance, offset, and phase are also provided for greater utility in evaluating modulators/demodulators and other devices.



Frequency response for I/Q external modulation (typical values)

• Excellent spectral purity

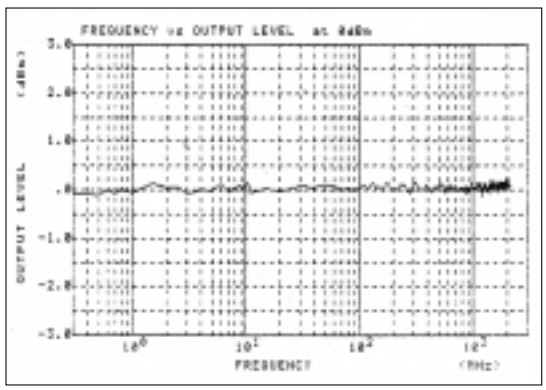
The SSB phase noise characteristic is an excellent –120 dBc/Hz or less (100 kHz offset). The adjacent channel power characteristic excels as the interference signal source during modulation.



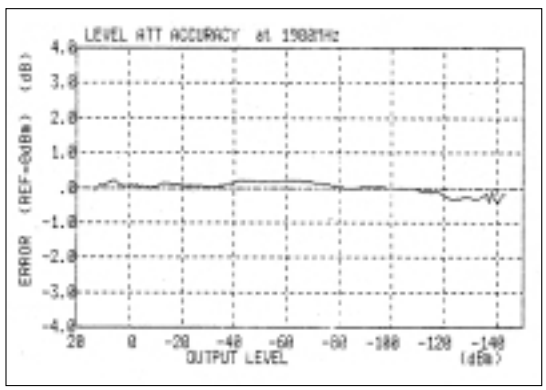
SSB phase noise at 1.9 GHz

• Large output level

Through use of new AGC circuitry, the MG3670B/C, MG3671A/B, and MG3672A produce a highly precise output at levels down to –143 dBm with stable frequency characteristics, not only for output of unmodulated signals but also with π/4 DQPSK modulation accompanied by amplitude fluctuations and when outputting burst signals. The MG3670B/C, MG3671A/B and MG3672A can generate a high output level of up to +13 dBm over a broad range of frequencies, so amplifiers are not needed even when testing receivers for excess input and in testing other devices.



Output level frequency characteristics



Output level accuracy at 1.9 GHz

• High modulation accuracy

A vector error of less than 1.8%rms is assured for output levels up to +5 dBm over the entire operating frequency range. This high modulation accuracy is also achieved when the expansion units are used. Even when the MG0301C and MG0303B units are installed and π/4 DQPSK modulation burst signals are generated, the vector error is less than 1.8%rms. The MG3670B/C, MG3671A/B and MG3672A enable measurement and quality evaluation of receivers and other devices with more than adequate precision.

For product ordering information, see pages 4 – 10

Functions and performances with expansion unit

• Frame structure and data

TDMA

The MG0303B incorporates TDMA frames for various kinds of communication systems, as well as modulation patterns for each time slot. Modulation patterns for device evaluation and for up/down communication channels are provided and are output at the timing required by the system. Hence the MG3670B/C, MG3671A/B, and MG3672A can generate the burst signals needed to measure various digital communication systems.

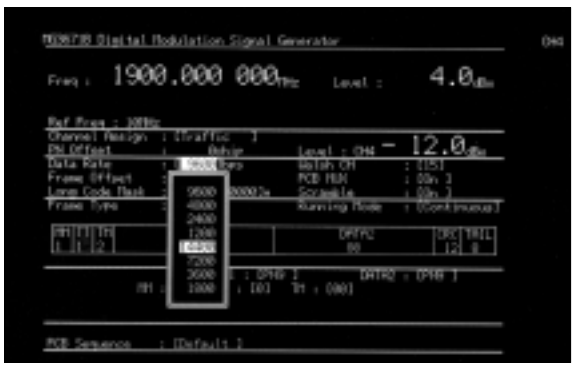
Time slots specified for different communication systems can be selected freely. There is considerable freedom in choosing the modulation pattern within slots; either a PN9 or PN15 TCH segment can be chosen, and part of the data outside the TCH segment can be edited. The pattern memory function can be used to store and recall patterns. A data scrambling function is provided as standard, and any initial code can be set permitting more sophisticated evaluations and diagnostics using the MG3670B/C, MG3671A/B and MG3672A as a supposed base station and mobile equipment.

The internal modulation pattern can also be driven by an external clock, so margin tests can be conducted by varying the clock pulse.

Pattern edit display

CDMA

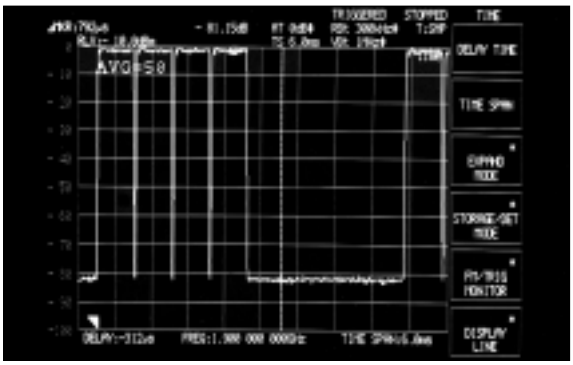
MG0310A has various TIA/EIA/IS-95 frame formats and encoder functions built-in for each channel type. For example, frame format of signalling, communication, and Multiplex Option 1 are provided to support Rate Set 1 (1200 ... 9600 bps) and Rate Set 2 (1800 ... 14400 bps) for the Traffic Channel. In combination with the Burst Randomizer function, this allows system support at all rates, even for reverse links. For internal data you can select either a PN7, 9, or 15 pseudo-random pattern, or a user settable 16-bit data repeating pattern, all fully editable. Operation can be from internal RAM user-definable sequence data or from external serial data.



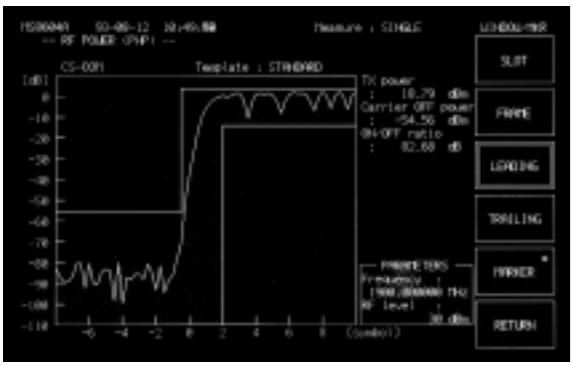
Pattern setting display

• Excellent leakage power characteristics during carrier-off

The rising and falling edges of burst signals have a gentle waveform with a duration equivalent to two symbols, and the leakage power during carrier-off characteristics are excellent.



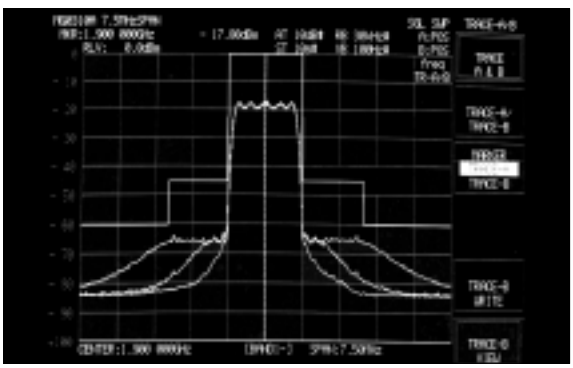
PHS



Slot rise time waveform

• Superior spurious emission characteristics

Spurious emissions are guaranteed to be lower than –60 dBc (±900 kHz detuning, 30 kHz bandwidth) and –70 dBc (±1.98 MHz detuning, 30 kHz bandwidth) with MG0310A installed in the MG3670C/3671B/3672A mainframe (for output level: 0 dBm, baseband filter: SPEC 2). Using this baseband filter gives a waveform quality factor (ρ) of 0.999 or better. This filter conforms to IS-95, providing 3-step switching. Selecting the best step for each evaluation item gives even higher performance. This excellent basic performance in a standard digital modulation signal generator makes it the ideal choice for the development and manufacture of digital mobile wireless equipment and related devices/modules.



Modulation spectrum
(with MG0310A installed in the MG3670C/3671B/3672A)

Specifications (refer to the MG3670B/C, MG3671A/B, and MG3672A data sheet for more details)

• MG3670B/C, MG3671A/B, and MG3672A Digital Modulation Signal Generator

Carrier frequency	Frequency range	300 kHz to 2250 MHz (MG3670B/C), 300 kHz to 2750 MHz (MG3671A/B and MG3672A)		
	Accuracy	Depends on installed reference oscillator*1		
	Internal reference oscillator	Frequency: 10 MHz Start-up characteristics: ≤1 x 10^{-7}/day (after 30 min. warm-up), ≤5 x 10^{-8}/day (after 60 min. warm-up) Aging rate: ≤2 x 10^{-8}/day (after 24 h warm-up) Temperature characteristics: ≤±5 x 10^{-8} (0˚ to 50˚C)		
	External reference input	10 MHz or 13 MHz (±10 ppm), 2 to 5 Vp-p, BNC connector (rear panel)		
	Reference output	10 MHz, 2 to 5 Vp-p, BNC connector (rear panel)		
Output	Level range*2	–143 to +13 dBm (resolution: 0.1 dB)		
	Frequency response	≤±1 dB (at 0 dBm output)		
	Level accuracy*2	Output level/frequency	≤1000 MHz	>1000 MHz
		–33 to +13 dBm	±1 dB	±2 dB
		–123 to –33.1 dBm	±1.5 dB	±2 dB
		–136 to –123.1 dBm	±3 dB	±4 dB
	Impedance	50 Ω, N-type connector		
	Continuously variable level*2	Continuously variable output over 20 dB range (+8 to –12 dB) in 0.1 dB steps within upper and lower limits of any output level		
	Level unit	dBm, dBμ, μV, mV, V (dBμ, μV, mV, V selected terminate/open voltage display)		
	Interference radiation	≤1 μV ∗Measured 25 mm from cabinet (except rear panel) with two-turn 25 mm diameter loop antenna, terminated with 50 Ω load, ≤+5 dBm output, CW		
Signal purity	Spurious (at ≤+5 dBm output)	≤–65 dBc (≥100 kHz offset, ≤±100 MHz bandwidth), ≤–50 dBc (≥100 kHz offset, full band), ≤–40 dBc [≥2.65 GHz, spurious at 5.4–Fout (carrier frequency) GHz], ≤–30 dBc (harmonics)		
	SSB phase noise	≤–120 dBc/Hz (100 kHz offset, CW)		
Digital modulation	Internal modulation	Depends on installed modulation unit (MG0301C/0302A/0305A/0307A/0310A/0311A/0312A)		
	External modulation	For MG3670B/C, MG3671A/B Any modulation using I/Q input signal Input frequency: DC to 1.2 MHz*3 Input level: $\sqrt{I^2 \pm Q^2}$ ≤0.5 Vrms, BNC connector ∗I/Q ≤1.5 Vp-p (50 Ω), I/Q ≤10% to 100% of 1.5 Vp-p (CMOS) Vector error: ≤1.8%rms (I/Q input level: 1 Vrms/50 Ω, at ≤+5 dBm output) For MG3672A 50 Ω input Input frequency: DC to 30 MHz (BW: 3 dB, 18˚ to 30˚C), Input level: $\sqrt{I^2 \pm Q^2}$ ≤1.0 Vrms, I/Q ≤1.5 Vp-p CMOS input Input frequency: DC to 1.2 MHz, Input level: $\sqrt{I^2 \pm Q^2}$ ≤1.0 Vrms, I/Q ≤1.5 Vp-p		
	I/Q output	Outputs I/Q signal at internal modulation (MG0301C/0302A/0305A/0307A/0310A/0311A/0312A installed)		
Pulse modulation	Input	TTL level, BNC connector, polarity selectable		
	On/off ratio	≥40 dB (at ≥0 dBm output)		
	Transition time	≤2 μs, minimum pulse width: 10 μs		
Memory function	Frequency memory	1000 carrier frequencies (save and recall)		
	Parameter memory	100 panel settings (save and recall)		
Other functions	Relative display	Carrier frequency, output level		
	I/Q signal adjustment	Variable offset, balance, phase (only output) of I/Q input/output signal (DC to 1.2 MHz)		
	Backup	Last settings stored at power-off		
	Reverse power protection	Maximum reverse input power: 50 W (<1000 MHz), 25 W (≥1000 MHz), ±50 Vdc		
	GPIB	All functions except power switch and panel lock switch controlled Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2		
Operating temperature		0˚ to 50˚C		
Power		100 to 120/200 to 240 Vac (switchable), 47.5 to 63 Hz, ≤550 VA		
Dimensions and mass		(426±5) W x (221.5±4) H x (451±5) D mm, ≤27 kg		

∗1: Internal reference oscillator accuracy: 2 x 10^{-8}/day (23˚ ±5˚C), calibrated after 24 h operation
∗2: Depended on the specifications of each units when MG0310A unit are installed.
∗3: Refer to the “Frequency response for I/Q external modulation (typical value)” on page 217 for the input frequency range. Typical values are given for reference only to assist in the use of this instrument, and are not guaranteed specifications.

For product ordering information, see pages 4 –10

• MG0301C π/4 DQPSK Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system	PDC, PDC_H, PHS, NADC, TFTS
Modulation system	π/4 DQPSK
Vector error	I/Q signal: ≤1.5%rms (at 50 Ω output), RF signal: ≤1.8%rms (at ≤+5 dBm output)
Internal modulation data	Pseudorandom pattern: PN15, PN9 Free 4-bit repetition pattern (ex: 1010, 1111)
External modulation data	DATA CLOCK: Covering ±5% of bit rate DATA: Digital data synchronized with DATA CLOCK SYMBOL CLOCK: Clock specified by DATA synchronized with DATA CLOCK TTL level, BNC connector, polarity selectable
I/Q signal output	Selectable 50 Ω or CMOS (600 Ω), BNC connector 50 Ω setting [modulation data: 0000 (TFTS: 1111)]: 1 Vp-p ±2% (MG3670A/B/C, MG3671A/B), 2 Vp-p ±2% (MG3672A) CMOS setting [modulation data: 0000 (TFTS: 1111)] Variable in 10% steps over range of 10% to 100% of 1 Vp-p ±2%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3670A/B/C, MG3671A/B) Variable in 10% steps over range of 10% to 100% of 2 Vp-p ±2%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3672A)
PDC, PDC_H	Carrier frequency range: 300 kHz to 2250 MHz*1 (incorporated in the MG3670B/C), 300 kHz to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 42 kbps Baseband filter: Root Nyquist (α = 0.5), Nyquist (α = 0.5)
PHS	Carrier frequency range: 1 to 2250 MHz*1 (incorporated in the MG3670B/C), 1 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 384 kbps Baseband filter: Root Nyquist (α = 0.5), Nyquist (α = 0.5) Adjacent channel power ratio: ≤–74 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)*2
NADC	Carrier frequency range: 300 kHz to 2250 MHz*1 (incorporated in the MG3670B/C), 300 kHz to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 48.6 kbps Baseband filter: Root Nyquist (α = 0.35), Nyquist (α = 0.35)
TFTS	Carrier frequency range: 300 kHz to 2250 MHz*1 (incorporated in the MG3670B/C), 300 kHz to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 44.2 kbps Baseband filter: Root Nyquist (α = 0.4), Nyquist (α = 0.4)

∗1: The upper frequency is limited by the specifications of the main frame in which this unit is installed.
∗2: Applicable when this unit is installed in MG3670B/C, MG3671A/B and MG3672A. Not applicable when this unit is installed in MG3670A.

• MG0302A GMSK Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system	GSM, DCS1800 (PCN), CT2
Modulation system	GMSK
Phase error	I/Q signal: ≤1° rms, ≤3° peak (at 1 Vrms/50 Ω output, 25° ±5°C, after 30 min. warm-up) ≤2° rms, ≤5° peak (at 1 Vrms/50 Ω output) RF signal: ≤1° rms, ≤3° peak (at ≤+5 dBm output, 25° ±5°C, after 30 min. warm-up) ≤2° rms, ≤5° peak (at ≤+5 dBm output)
Internal modulation data	Pseudorandom pattern: PN15, PN9, free 4-bit repetition pattern (ex: 1010, 1111)
External modulation data	DATA CLOCK: Covering ±5% of bit rate, DATA: Digital data synchronized with DATA CLOCK ∗TTL level, BNC connector, polarity selectable
I/Q signal output	Selectable 50 Ω or CMOS (600 Ω), BNC connector 50 Ω setting (modulation data: 0000): 1 Vp-p ±2% (MG3670A/B/C, MG3671A/B), 2 Vp-p ±2% (MG3672A) CMOS setting (modulation data: 0000) Variable in 10% steps over range of 10% to 100% of 1 Vp-p ±2%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3670A/B/C, MG3671A/B), Variable in 10% steps over range of 10% to 100% of 2 Vp-p ±2%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3672A)
GSM/PCN (DCS1800)	Carrier wave frequency range: 1 to 2250 MHz*1 (incorporated in the MG3670B/C), 1 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 270.833 kbps Baseband filter: Gaussian filter BbT = 0.3
CT2	Carrier wave frequency range: 300 kHz to 2250 MHz*1(incorporated in the MG3670B/C), 300 kHz to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 72 kbps Baseband filter: Gaussian filter BbT = 0.5

∗1: The upper frequency is limited by the specifications of the mainframe in which this unit is installed.

• MG0305A GFSK Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system	DECT
Modulation system	GFSK
Vector error	I/Q signal: ≤12 kHz (at 1 Vrms/50 Ω output), RF signal: ≤12 kHz (at ≤+5 dBm output, modulation data: FFFF)
Internal modulation data	Pseudo-random pattern: PN15/PN9, Free 16-bit repetition pattern (ex: 0F0F, 00FF)
External modulation data	DATA CLOCK: Covering ±5% of bit rate, DATA: Digital data synchronized with DATA CLOCK ∗TTL level, BNC connector, polarity selectable
I/Q signal output	Selectable 50 Ω or CMOS (600 Ω), BNC connector 50 Ω setting (modulation data: 0000): 1 Vp-p ±6% (MG3670A/B/C, MG3671A/B), 2 Vp-p ±6% (MG3672A) CMOS setting (modulation data: 0000) Variable in 10% steps over range of 10% to 100% of 1 Vp-p ±6%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3670A/B/C, MG3671A/B), Variable in 10% steps over range of 10% to 100% of 2 Vp-p ±6%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3672A)
Phase polarity	Polarity reversal of frequency deviation during modulation is possible.
DECT	Carrier frequency range: 5 to 2250 MHz[*1] (incorporated in the MG3670B/C), 5 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 1152 kbps Deviation ratio: 70% (202 kHz), 90% (259 kHz), 100% (288 kHz), 140% (403 kHz), at BbT=0.5 Baseband filter: Gaussian filter BbT = 0.4, 0.5, 0.6, at deviation ratio = 100%

∗1: The upper frequency is limited by the specifications of the mainframe in which this unit is installed.

• MG0307A π/4 DQPSK Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system	PACS, WCPE, PHS
Modulation system	π/4 DQPSK
Vector error	I/Q signal: ≤1.5%rms (at 1 Vrms/50 Ω output), RF signal: ≤1.8%rms (at ≤+5 dBm output)
Internal data mode	Pseudo-random pattern: PN15, PN9 Free 16-bit repetition pattern (ex: 0F0F, 00FF): WCPE Free 4-bit repetition pattern (ex: 0101, 0011): PACS, PHS
External data mode	DATA CLOCK: Covering ±5% of bit rate DATA: Digital data synchronized with DATA CLOCK SYMBOL CLOCK: Clock specified by DATA synchronized with DATA CLOCK TTL level, BNC connector, polarity selectable
I/Q signal output	Selectable 50 Ω or CMOS (600 Ω), BNC connector 50 Ω setting (modulation data: 0000): 1 Vp-p ±5% (MG3670A/B/C, MG3671A/B), 2 Vp-p ±5% (MG3672A) CMOS setting (modulation data: 0000) Variable in 10% steps over range of 10% to 100% of 1 Vp-p ±5%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3670A/B/C, MG3671A/B), Variable in 10% steps over range of 10% to 100% of 2 Vp-p ±5%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3672A)
Phase encode function	Invertible phase polarity at modulation
PACS	Carrier frequency range: 1 to 2250 MHz[*1] (incorporated in the MG3670B/C), 1 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 384 kbps Baseband filter: Root Nyquist (α = 0.5), Nyquist (α = 0.5)
WCPE	Carrier frequency range: 5 to 2250 MHz[*1] (incorporated in the MG3670B/C), 5 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 1152 kbps Baseband filter: Root Nyquist (α = 0.5), Nyquist (α = 0.5)
PHS	Carrier frequency range: 1 to 2250 MHz[*1] (incorporated in the MG3670B/C), 1 to 2750 MHz (incorporated in the MG3671A/B and MG3672A) Bit rate: 384 kbps Baseband filter: Root Nyquist (α = 0.5), Nyquist (α = 0.5) Adjacent channel power ratio: ≤–74 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)[*2]

∗1: The upper frequency is limited by the specifications of the mainframe in which this unit is installed.
∗2: Applicable when this unit is installed in MG3670B/C, MG3671A/B and MG3672A. Not applicable when this unit is installed in MG3670A.

For product ordering information, see pages 4 –10

• MG0311A π/4 DQPSK Modulation Unit (incorporated in MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system	TETRA
Modulation system	π/4 DQPSK
Vector error	I/Q signal: ≤1.5%rms (at 50 Ω output); RF signal: ≤1.8%rms (at ≤+5 dBm output)
Internal modulation data	Pseudo-random pattern: PN15/PN9, Free 4-bit repetition pattern (ex: 0101, 0011)
External modulation data	DATA CLOCK: Covering ±5% of bit rate DATA: Digital data synchronized with DATA CLOCK SYMBOL CLOCK: Clock specified by DATA synchronized with DATA CLOCK ∗TTL level, BNC connector, polarity selectable
I/Q signal output	Selectable 50 Ω or CMOS (600 Ω), BNC connector 50 Ω setting (modulation data: 0000): 1 Vp-p ±5% (MG3670A/B/C, MG3671A/B), 2 Vp-p ±5% (MG3672A) CMOS setting (modulation data: 0000) Variable in 10% steps over range of 10% to 100% of 1 Vp-p ±5%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3670A/B/C, MG3671A/B), Variable in 10% steps over range of 10% to 100% of 2 Vp-p ±5%, variable offset voltage: 0 to 4 V in 1 mV steps (MG3672A)
Phase encode function	Invertible phase change polarity at modulation
TETRA	Carrier frequency range: 300 kHz to 2250 MHz[*1] (incorporated in MG3670B/C), 300 kHz to 2750 MHz (incorporated in MG3671A/B and MG3672A) Bit rate: 36 kbps Baseband filter: Root Nyquist (α = 0.35), Nyquist (α = 0.35) Adjacent channel leakage power ratio[*2]: ≤–48 dB (25 kHz offset, ±9 kHz band), ≤–67 dB (50 kHz offset, ±9 kHz band)

∗1: The upper frequency is limited by the specifications of the mainframe in which this unit is installed.
∗2: Also applicable when this unit is installed in the MG3670A with option 11 (low adjustment channel leakage power). This unit can not be installed in the MG3670A without option 11.

• MG0303B Burst Function Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)

Applicable communication system		PDC, PDC_H, PHS, NADC, TFTS (with MG0301C) GSM, PCN (DCS1800), CT2 (with MG0302A) DECT (with MG0305A) PACS, WCPE, PHS (with MG0307A) TETRA (with MG0311A)
Modulation signal	Internal data mode	TDMA framing specified for each system; modulation in each time slot using any internal modulation data
	Internal data	Pseudo-random pattern: PN15/PN9[*1] (for device) Specified pattern based on communication channel format specified for each system: Up/down communication channel, VOX signal control TCH section consists of pseudo-random pattern PN15/PN9[*1]
	External data mode	DATA CLOCK: Covering ±5% of bit rate DATA: Digital data synchronized with DATA CLOCK SYMBOL CLOCK: Clock specified by DATA synchronized with DATA CLOCK BURST GATE: Burst signal synchronized with DATA CLOCK (on: ≥14 symbols, off: ≥8 symbols) TTL level, BNC connector, polarity selectable
Burst trigger input		Burst wave output synchronized with trigger input signal of burst repetition rate (frame cycle) at internal modulation Input period: ≤burst repetition rate ±1 symbol [PDC, PDC_H, PHS, NADC, GSM, PCN (DCS1800), CT2, DECT, PACS, WCPE, TETRA], ≤burst repetition rate ±1/2 symbol (TFTS) TTL level, BNC connector (rear panel), polarity selectable
Control signal output	Burst trigger output	Outputs 1-symbol wide pulse at same cycle as burst waveform output at internal modulation TTL level, BNC connector (rear panel), polarity selectable
	Pattern sync output	Following outputs selectable at internal modulation PN CLOCK: Data clock corresponding to pseudo-random pattern part PN GATE: Gate signal corresponding to pseudo-random pattern part RF GATE: Signal for controlling pulse modulator in accordance with burst signal output TTL level, BNC connector (rear panel)
	Burst gate output	Outputs gate signal corresponding to burst waveform output at internal modulation TTL level, BNC connector (rear panel), polarity selectable
RF output	Burst on/off ratio	≥80 dB (+5 dBm output, PDC, PDC_H, NADC, CT2, TFTS, TETRA), ≥75 dB (+5 dBm output, PHS, GSM, PCN, PACS), ≥70 dB (+5 dBm output, DECT, WCPE)
	Rise/fall time	Equivalent to 2 symbols
Memory (pattern memory)		Max. 100 patterns/system (save and recall of internal modulation pattern data)
NADC	Burst repetition rate	20 ms
	Slot configuration	For device, up/down communication channel
	Output slot select	On/off selectable for any slots of slot 0 to slot 2 (excluding all slots off)
	Edit function	SYNC/SACCH/CDVCC: Any data, DATA: PN9, PN15[*1] selectable

Continued on next page

PDC PDC_H	Burst repetition rate	20 ms (PPC), 40 ms (PDC_H)
	Slot configuration	For device, up/down communication channel, up VOX control
	Output slot select	On/off selectable for any slots of slot 0 to slot 2 (PDC)/slot 5 (PDC_H) ∗excluding all slots off
	Edit function	SW/CC/SACCH: Any data, TCH: PN9, PN15*1 selectable
	Scramble function	TCH + SF + SACCH scramble on/off, any scramble code setting
PHS	Burst repetition rate	5 ms
	Slot configuration	For device, up/down communication channel, VOX control
	Output slot select	On/off selectable for any slots of slot 1 to slot 4 (excluding all slots off)
	Edit function	UW/SA: Any data, TCH: PN9, PN15*1 selectable
	Scramble function	TCH + CRC, scramble and secret scramble on/off, any scramble code setting
	Adjacent channel power leakage ratio	≤–74 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)*2
TFTS	Burst repetition rate	80 ms
	Slot configuration	For device, up/down communication channel
	Output slot select	On/off selectable for any slots of slot 0 to slot 16 (Device/UP TCH: Slots 16 is off at all time, excluding all slots off)
	Edit function	S: Any data, DATA: PN9, PN15*1 selectable
GSM, PCN (DCS1800)	Burst repetition rate	4.615 ms
	Slot configuration	For device, normal burst (communication channel)
	Output slot select	On/off selectable for any slots of slot 0 to slot 7 (excluding all slots off)
	Edit function	TS: Any data, E: PN9, PN15*1 selectable
CT2	Burst repetition rate	2 ms
	Slot configuration	Up/down communication channel (MUX 1.2, MUX 1.4, MUX 2)
	Edit function	D, B, Da, Db, CHM/SYNC data selectable
	Scramble function	B scramble on/off, any scramble code setting
DECT	Burst repetition rate	10 ms
	Slot configuration	For device, up/down communication channel
	Output slot select	Full slot: Slot 0 to slot 11 (down channel), slot 12 to slot 23 (up channel) Half slot: Slot 0-0 to slot 11-1 (down channel), slot 12-0 to slot 23-1 (up channel) Double slot: Slot 0 to slot 10 (down channel), slot 12 to slot 22 (up channel) ∗On/off selectable for any slots (excluding all slots off)
	Edit function	S, H, T: Any data D: PN15/PN9*1, all-0 or all-1 selectable (for device evaluation) D: PN15/PN9*1, TEST or REP-8 bits any data selectable (for communication channel)
PACS	Burst repetition rate	2.5 ms
	Slot configuration	For device, up/down communication channel
	Output slot select	On/off selectable for any slots of slot 0 to slot 7 (excluding all slots off)
	Edit function	PN: PN9, PN15*1 selectable (for device), DE/SC/R/SYC/PCC: Any data, FC: PN9*1, PN15*1, all-0 or all-1 selectable (PN15 selectable only for 1 slot)
WCPE	Burst repetition rate	10 ms
	Slot configuration	For device, up/down communication channel
	Output slot select	Full slot: Slot 0 to slot 11 (down), slot 12 to slot 23 (up); Half slot: Slot 0-0 to slot 11-1 (down), slot 12-0 to slot 23-1 (up); Double slot: Slot 0 to slot 10 (down), slot 12 to slot 22 (up) ∗On/off selectable for any slots (excluding all slots off)
	Edit function	S/H/T: Any data D: PN9*1, PN15*1, all-0 or all-1 selectable (for device) D: PN9*1, PN15*1, TEST or REP 8-bits any data selectable (for communication channel)
PHS	Burst repetition rate	5 ms
	Slot configuration	For device, up/down communication channel, VOX control, sync burst
	Output slot select	On/off selectable for any slots of slot 1 to slot 4 (excluding all slots off)
	Edit function	UW/SA etc.: Any data, TCH: PN9, PN15*1 selectable
	Scramble function	TCH + CRC, scramble on/off, any scramble code setting
	Adjacent channel leakage power ratio	≤–74 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)*2
TETRA	Burst repetition rate	V + D mode: 1.02; Excluding CH13, 255 to 30000 symbols; CH13 PDO mode: 1.00; Excluding CH14, 126 to 30000 symbols; CH14
	Burst pattern	Following channel types selectable V + D mode: CH1, CH2, CH3, CH4, CH13; Downlink, CH7, CH8, CH9, CH10, CH11; Uplink PDO mode: CH5, CH6, CH14; Downlink, CH12; Uplink
	Slot configuration	V + D mode: DEVICE, NORMAL, SYNC; Downlink, DEVICE NORMAL, CONTROL; Uplink PDO mode: NORMAL, SYNC; Downlink, START, EVEN, ODD, END; Uplink
	Output slot select	V + D mode: On/off selectable for any slots of slot 1 to slot 4 (excluding CH13 and all slots off) Frame 1 to Frame 17 set to the same values PDO mode: Variable slot numbers of slot 1 to slot 150 (excluding CH14)

Continued on next page

TETRA	Edit function	V + D mode: Downlink NORMAL; Any SB, SSB, NTS field data SYNC; Any FC, SSB1, STS, SBB, SB2 field data Uplink NORMAL; Any SB, NTS field data CONTROL; Any SCB, ETS field data PDO mode: Downlink SYNC; Any FC, SB, STS field data NORMAL; Any SB, NTS field data Uplink START; Any ETS, SB field data, R bit Length EVEN; Any NTS field data
	Scramble function	Any scramble code setting

∗1: The pseudorandom pattern in each slot has a different phase, and its pattern is continuous within the data field of slots.
∗2: Applicable when this unit is installed in MG3670B/C, MG3671A/B, and MG3672A. Not applicable when this unit is installed in MG3670A.

• MG0310A CDMA Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)∗1

Carrier frequency range		4 kHz to 2250 MHz (MG3670B/C), 4 kHz to 2750 MHz (MG3671A/B and MG3672A)
RF output level		–143 to +8 dBm, 0.1 dB steps (1 channel only on, PCB MUX must be off when traffic present) –143 to +4 dBm, 0.1 dB steps (multiplex channel) Frequency response, level accuracy: Depends on main frame (after level calibration)
Supported systems		IS-95: US Digital Cellular System
Modulation format		Forward link: SS + QPSK; Reverse link: SS + OQPSK
Chip rate		1.2288 Mcps
Baseband filters		IS-95 recommended filters: SPEC 1, SPEC 2, SPEC 3, SPEC 1 + EQ, SPEC 2 + EQ, SPEC 3 + EQ Nyquist filters: α = 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5 Root Nyquist filters: α = 0.2, 0.25, 0.3, 0.35, 0.4, 0.45, 0.5
Forward link	Multiplex channels	Channels 1 to 5
	Supported channels	CH 1: Current Pilot, Off CH 2 to CH 5: Nth Pilot, Sync, Paging, Traffic, OCNS, Off (Sync available for 1 selected channel only, all channels cannot be turned off simultaneously.)
	Spread code	Walsh code + Short code
	Walsh code	Point: 0, Sync: 32, Paging: 1 to 7, Traffic: 8 to 31/33 to 63, OCNS: 0 to 63 (Except for Pilot code, same code number cannot be set for multiple channels.)
	Short code offset	0 to 3276 chips in 64 chip steps (for Current Pilot), 1 chip steps (for Nth Pilot)
	Data rate	Sync 1200 bps, Paging: 4800/9600 bps, OCNS: 19200 sps, Traffic: 1200/2400/4800/9600 bps, 1800/3600/7200/14400 bps (Single channel selection only, except for 9600/14400 bps)
	Channel level	(RF output level + upper limit for each no. of multiplex channels) to –20 dB in 0.1 dB steps Upper limit for each no. of multiplex channels: –3 dB (2 channels), –5 dB (3 channels), –6 dB (4 channels), –7 dB (5 channels) ∗Level is set automatically for channel with highest CH number, user setting not possible.
	Scramble function	Long code scramble on/off (for Paging/Traffic/OCNS)
	PCB MUX function	Power control bit transmission on/off (for Traffic) PCB data: Selectable 256 bit data repeating pattern
	Long code mask	42 bits can be set by user in each channel (scramble On, PCB MUX On)
Reverse link	Multiplex channels	Channels 1 to 4
	Supported channels	CH 1: Traffic, Access, Interfered CH 2 to CH 4: Traffic, Access, Interfered, Off
	Spread code	Long code + short code
	Long code mask	42 bits can be set by user in each channel.
	Data rates	Access: 4800 bps, Interfered: 28800 sps Traffic: 1200/2400/4800/9600 bps, 1800/3600/7200/14400 bps (For CH1 only on, except for 9600/14400 bps)
	Channel level	(RF output level + upper limit for each no. of multiplex channels) to –15 dB in 0.1 dB steps, Upper limit for each No. of multiplex channels: 0 dB (2 channels), 2 dB (3 channels), –3 dB (4 channels) CH 1 is fixed on upper limit, user setting not possible.
	Power monitor function	CH 1 to CH 4 composite output level, CH 2 to CH 4 composite output level (N), S/N ratio of CH 1 output level (S), CH 1 Eb/N (Multiplex channel only)
Frame offset		0 to 15 power control group (PCG) in 1 PCG steps
Internal frame structure		Frame formats for all channel types specified by IS-95
Internal modulation data		Pseudo-random patterns: PN7, PN9, PN15 Fixed pattern: User settable 16 bit data repeating pattern Sequence data: User can set sequence data in internal RAM (2048 bits x 7 blocks) as repeating pattern of 1 to 8192 frames.
External modulation data		Using internal time reference clock Data Clock: Data rate clock synched to Ref Clock and Frame Clock Data: Digital data synched to Data Clock ESTM Clock: 0.5 pulse/s clock synched to Ref Clock and Data Clock Frame Clock: Channel frame clock synched to Ref Clock and ESTM Clock BNC connector, TTL level, polarity switchable Using external time reference clock Ref Clock: ±2% of 19.6608, 9.8304, 4.9152, 2.4576 or 1.2288 MHz Data: Digital data synched to Data Clock ESTM Clock: 0.5 pulse/s clock synched to Ref Clock and Data Clock Frame Clock: Channel frame clock synched to Ref Clock and ESTM Clock BNC connector, TTL level, polarity switchable
I/Q signal output		50 Ω or CMOS (600 Ω), BNC connector

Continued on next page

Modulation accuracy (VEM), Waveform quality (ρ)	≤0 dBm output, CH1 only on, level control program function Off VEM ≤2.5%rms, ρ ≤0.9992 (With SPEC 1 baseband filter) VEM ≤3.5%rms, ρ ≤0.999 (With SPEC 2 baseband filter) VEM ≤9.7%rms, ρ ≤0.99 (With SPEC 3 baseband filter) VEM ≤3.0%rms (With Nyquist/Root Nyquist baseband filter)
Spurious emissions	0 dBm output, 30 kHz bandwidth (Forward link/Reverse link, Default)

Baseband filter \ Offset frequency	≥750 kHz	≥900 kHz	≥1.98 MHz
SPEC 1 + EQ/SPEC 1	≤–45 dBc	≤–55 dBc	≤–60 dBc
SPEC 2 + EQ/SPEC 2		≤–60 dBc	≤–70 dBc
SPEC 3 + EQ/SPEC 3		≤–65 dBc	≤–75 dBc

Level control program function	Variable level in 1 dB steps from RF output level to 0 to –20 dB range in 1.25 ms units (program interval: 800 ms)
Control signal I/O	Long code trigger input, ESTM output, ESTM alignment output, data output, data clock output, frame clock output, time reference clock output, TTL level, BNC connector (rear panel)
Auxiliary signal outputs*2	Long code, short code I/Q: TTL level, BNC connector (rear panel) Long code trigger, 26.7 ms clock, 80 ms clock,TTL level, D-sub connector (rear panel)

∗1: This expansion unit cannot be mounted in the MG3670A mainframe.
∗2: MG3670B/3671A can mount MG0310A fitted with Option 25, but in this case the auxiliary signal output function is not available.

• MG0312A QPSK Modulation Unit (incorporated in the MG3670B/C, MG3671A/B and MG3672A)*1

Carrier frequency range	10 to 2250 MHz (MG3670B/C), 10 to 2750 MHz (MG3671A/B and MG3672A)
RF output level	–143 to +8 dBm, 0.1 dB steps
Continuously variable level range	Variable in steps of 0.1 dB in a range of 12 dB (+8 to –4 dB) from any RF output level to the upper or lower limit level.
Modulation system	QPSK, OQPSK
Bit rate	0.5, 0.512, 1.0, 1.024, 1.5, 2.0, 2.048, 2.4576 Mbps
Baseband filters	FIR filter*2: FIR 1, FIR 2, FIR 3 (at a bit rate of 2.4576 Mbps) Root Nyquist: α = 0.3, 0.4, 0.5 (operable at all bit rates) Nyquist: α = 0.2, 0.3, 0.4, 0.5 (operable at all bit rates)
Vector error (RF output)	≤1.8%rms (bit rate: ≤1.5 Mbps), ≤3%rms (bit rate: ≥2 Mbps, Nyquist/Root Nyquist filters), ≤2.2%rms*3 (bit rate: 2.4576 Mbps, FIR 1 filter), ≤3%rms*3 (bit rate: 2.4576 Mbps, FIR 2 filter), ≤10%rms*3 (bit rate: 2.4576 Mbps, FIR 3 filter) ∗At ≤0 dBm output
Internal modulation data	Pseudo-random patterns: PN7, PN9, PN15, PN23 Fixed pattern: Iteration of any 16-bit data (Example: $2D2D_H$)
External modulation data	DATA CLOCK: ±5% of the bit rate DATA: Digital data synchronized with the data clock SYMBOL CLOCK: Symbol definition clock synchronized with the data clock (BNC connector, TTL level, polarity selectable)
I/Q signal output	Selectable between 50 Ω or CMOS (600 Ω), BNC connector
Phase encoding function	The phase mapping of data on a constellation can be set.
Spurious emissions	At 2.4576 Mbps bit rate, 0 dBm output level, 30 kHz bandwidth

Baseband filter \ Offset frequency	≥900 kHz	≥1.98 MHz
FIR 1	≤–55 dBc	≤–60 dBc
FIR 2, Nyquist α = 0.2	≤–55 dBc	≤–70 dBc
FIR 3	≤–60 dBc	≤–75 dBc

∗1: This expansion unit cannot be mounted in the MG3670A mainframe.
Please consult your sales representative regarding the addition of expansion units to previously purchased MG3670A-11 mainframes.
∗2: Finite Impulse Response filter conforming to the TIA/EIA/IS-95 specifications
∗3: The waveform quality ρ conforming to the TIA/EIA/IS-95 specifications is ≥0.9995 (FIR 1), ≥0.999 (FIR 2), ≥0.99 (FIR 3).

• Options

Model	Start-up characteristics	Aging rate	Temperature characteristic (0˚ to 50˚C)
MG3670/3671/3672 Option 01	7×10^{-8}/day (after 30 min. warm-up) 3×10^{-8}/day (after 60 min. warm-up)	5×10^{-9}/day (after 24-h warm-up)	$\pm 5 \times 10^{-8}$
MG3670/3671/3672 Option 02	2×10^{-8}/day (after 60 min. warm-up)	2×10^{-9}/day (after 24-h warm-up)	$\pm 1.5 \times 10^{-8}$
MG3670/3671/3672 Option 03	–	5×10^{-10}/day (after 48-h warm-up)	$\pm 5 \times 10^{-9}$
MG3670B Option 20	RF off release function (When RF is off, level display and level setting is enabled.)		
MG0301C Option 22	PHS LCCH super frame control pattern function (artificial base station signal output for field strength measurement: A PS connection test is impossible.)		
MG0302A Option 23	CT2 MUX3 control pattern function		
MG3670B/3671A Option 25	Format upgrade (enables MG0310A to be used in MG3670B/3671A)		

For product ordering information, see pages 4 –10

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Mainframe	
MG3670B	Digital Modulation Signal Generator	
MG3670C	Digital Modulation Signal Generator	
MG3671A	Digital Modulation Signal Generator	
MG3671B	Digital Modulation Signal Generator	
MG3672A	Digital Modulation Signal Generator	
	Expansion units (factory installed)	
MG0301C	π/4 DQPSK Modulation Unit (for PDC, PDC_H, PHS, NADC and TFTS communication systems)	
MG0302A	GMSK Modulation Unit [for GSM, PCN (DCS1800), and CT2 communication systems]	
MG0303B	Burst Function Unit [for PDC, PDC_H, PHS, NADC, TFTS, GSM, PCN (DCS1800), CT2, DECT, PACS and WCPE communication systems]	
MG0305A	GFSK Modulation Unit (for DECT communication system)	
MG0307A	π/4 DQPSK Modulation Unit (for PACS, WCPE, PHS communication systems)	
MG0310A	CDMA Modulation Unit (for IS-95 communication system)	
MG0311A	π/4 DQPSK Modulation Unit (for TETRA communication system)	
MG0312A	QPSK Modulation Unit	
	Standard accessories (for mainframe)	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m:	2 pcs
	Power cord, 2.5 m:	1 pc
B0325	Shielded cover for GPIB:	1 pc
F0014	Fuse, 6.3 A (for 100 Vac power supply):	2 pcs
F0012	Fuse, 3.15 A (for 200 Vac power supply):	2 pcs
W0869AE	MG3670B/C operation manual (supplied with MG3670B/C):	1 copy
W0932AE	MG3671A/B operation manual (supplied with MG3671A/B):	1 copy
W1462AE	MG3672A operation manual (supplied with MG3672A):	1 copy
	Standard accessories (for expansion units)	
W0872AE	MG0301C/0303B operation manual (supplied with MG0301C):	1 copy
W0691AE	MG0302A/0303B operation manual (supplied with MG0302A):	1 copy
W0851AE	MG0305A/0303B operation manual (supplied with MG0305A):	1 copy
W0949AE	MG0307A/0303B operation manual (supplied with MG0307A):	1 copy
W1183AE	MG0310A operation manual (supplied with MG0310A):	1 copy
B0405A	Exchange sheet for front panel (supplied with MG0310A):	1 pc
B0406A	Exchange sheet for real panel (supplied with MG0310A):	1 pc
W1050AE	MG0312A operation manual (supplied with MG0310A):	1 copy

For additional units and version upgrades, consult your Anritsu sales representative.

Model/Order No.	Name
	Options (for mainframe)
MG3670/3671/3672-01	Reference oscillator
MG3670/3671/3672-02	Reference oscillator
MG3670/3671/3672-03	Reference oscillator
MG3670-20	RF off release function
MG3670B/3671A-25	Format upgrade
	Options (for expansion units)
MG0301C-22	PHS LCCH super frame control pattern
MG0302A-23	CT2 MUX3 control pattern
	Optional accessories
J0127C	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 0.5 m
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m
J0004	Coaxial adapter (N-P · SMA-J)
J0007	GPIB cable, 1 m
J0008	GPIB cable, 2 m
B0329D	Protective cover
B0331D	Front handle kit (2 pcs/set)
B0332	Joint plate (4 pcs/set)
B0333D	Rack mount kit
B0334D	Carrying case (with casters and protective cover)
	Optional equipment
MS8604A	Digital Mobile Radio Transmitter Tester
MT8801C	Radio Communication Analyzer
MD1620B	Signalling Tester [PDC 800 MHz, PDC 1.5 GHz (MD1620B-01)]
MD1620C	Signalling Tester (PHS 1.9 GHz)
MD6420A	Data Transmission Analyzer
MP1201C	Error Rate Tester
MS2683A	Spectrum Analyzer

DIGITAL MODULATION SIGNAL GENERATOR

MG3660A

300 kHz to 2.75 GHz

Economy Version of MG3671A with Same Basic Features

GPIB

The MG3660A has all the basic functions of the higher-level MG3670B/C, MG3671A/B, and identical GPIB and front-panel operation. In addition, the same expansion units can be used.

- The MG3660A is an economic version of the MG3671A/B with the same basic features.

Specifications

Carrier frequency	Frequency range	300 kHz to 2750 MHz		
	Accuracy	Depends on installed reference oscillator*1		
	Internal reference oscillator	Frequency: 10 MHz Start-up characteristics: ≤1 x 10^{-7}/day (after 30-min. warm-up), ≤5 x 10^{-8}/day (after 60-min. warm-up) Aging rate: ≤2 x 10^{-8}/day (after 24-h warm-up) Temperature characteristics: ≤±5 x 10^{-8} (0° to 50°C)		
	External reference input	10 MHz or 13 MHz (±10 ppm), 2 to 5 Vp-p, BNC connector (rear panel)		
	Reference output	10 MHz, 2 to 5 Vp-p, BNC connector (rear panel)		
Output	Level range	–143 to +13 dBm (resolution: 0.1 dB)		
	Frequency response	Within +1 dB (at 0 dBm output)		
	Level accuracy	Output level/frequency	≤1000 MHz	>1000 MHz
		–33 to +13 dBm	±1 dB	±2 dB
		–123 to –33.1 dBm	±1.5 dB	±2 dB
		–136 to –123.1 dBm	±3 dB	±4 dB
	Impedance	50 Ω, N-type connector		
	Continuously-variable level	Continuously-variable output over 20 dB range (+8 to –12 dB) in 0.1 dB steps within upper and lower limits of any output level		
	Level unit	dBm, dBμ, μV, mV, V (dB μ, μV, mV, V selected terminate/open voltage display)		
	Interference radiation	≤1 μV *measured 25 mm from cabinet (except rear panel) with two-turn 25 mm diameter loop antenna, terminated with 50 Ω load, ≤+5 dBm output, carrier wave		
Signal purity	Spurious	≤–65 dBc (≥100 kHz offset, ±100 MHz bandwidth) ≤–50 dBc (≥100 kHz offset, full band) ≤–40 dBc [spurious of (5.4 – Fout) GHz at ≥2.65 GHz] ≤–30 dBc (harmonics)		
	SSB phase noise	≤–116 dBc/Hz (100 kHz offset, CW)		

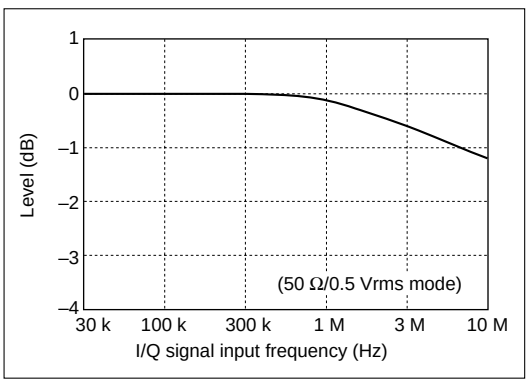
Continued on next page

For product ordering information, see pages 4 – 10

Digital modulation	Internal modulation	Depends on installed modulation unit (MG0301C, MG0302A, MG0305A, MG0307A, MG0311A)
	External modulation	Any modulation using I/Q input signal Input frequency: DC to 1.2 MHz*2 Input level: $\sqrt{I^2 + Q^2}$≤0.5 Vrms, BNC connector *I/Q : ≤1.5 Vp-p (50 Ω), I/Q: ≤10% to 100% of 1.5 Vp-p (CMOS) Vector error: ≤2.5%rms (I/Q input level: 0.5Vrms/50 Ω, at ≤+5 dBm output)
	I/Q output	Outputs I/Q signal at internal modulation (MG0301C, MG0302A, MG0305A, MG0307A, or MG0311A installed)
Pulse modulation	Input	TTL level, BNC connector, polarity selectable
	On/off ratio	≥40 dB (at ≥0 dBm output)
	Transition time	≤2 µs, minimum pulse width: 10 µs
Memory function	Frequency memory	1000 carrier frequencies (save and recall)
	Parameter memory	100 panel settings (save and recall)
Other functions	Relative display	Carrier frequency, output level
	I/Q signal adjustment	Offset, balance, phase (only output) of I/Q input/output signal
	Backup	Last settings stored at power-off
	Reverse power protection	Maximum reverse input power: 50 W (<1000 MHz), 25 W (≥1000 MHz), ±50 V (DC)
	GPIB	All functions except power switch and panel lock switch controlled Interface function: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT0, C0, E2
Operating temperature		0° to 50°C
Power		85 to 132/170 to 250 Vac (automatically selected), 47.5 to 63 Hz, ≤350 VA
Dimensions and mass		426 ±5 (W) x 221.5 ±4 (H) x 451 ±5 (D) mm, ≤23 kg

*1: Internal reference oscillator accuracy: 2 x 10^{-8}/day (23° ±5°C), calibrated after 24-h operation

*2: Refer to the "frequency response for I/Q external modulation (typical value)" shown below for the input frequency range. Typical value are given for reference only to assist in using this instrument, and are not guaranteed specifications.



• Expansion units

The MG3660A expansion units can be used with the MG3670B/C, MG3671A/B. For the specifications, refer to page 248. However, when an expansion unit is mounted in the MG3660A, the specifications change as shown below.

MG0301C π/4 DQPSK Modulation Unit

Vector error	RF signal: ≤2.5%rms (+5 dBm output)
PHS, PDC_H, NADC, TFTS	Carrier frequency: 300 kHz to 2750 MHz
PHS	Carrier frequency: 1 to 2750 MHz Adjacent channel leakage power ratio: ≤–69 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)

MG0302A GMSK Modulation Unit

GSM, PCN (DCS1800)	Carrier frequency: 1 to 2750 MHz
CT2	Carrier frequency: 300 kHz to 2750 MHz

MG0303B Burst Function Unit

RF output	Burst on/off ratio: ≥75 dB (+5 dBm output, PDC, PDC_H, NADC, TFTS, TETRA, CT2)
PHS	Adjacent channel leakage power ratio: ≤–69 dB (600/900 kHz offset, ±96kHz band, ≥10 MHz)

MG0305A GFSK Modulation Unit

Vector error	RF signal: ≤18 kHz (≤+5 dBm output)
DECT	Carrier frequency: 5 to 2750 MHz

MG0307A π/4 DQPSK Modulation Unit

Vector error	RF signal: ≤2.5%rms (≤+5 dBm output, modulation data FFFF)
PACS, WCPE	Carrier frequency: 1 to 2750 MHz
PHS	Carrier frequency: 1 to 2750 MHz Adjacent channel leakage power ratio: ≤–69 dB (600/900 kHz offset, ±96 kHz band, ≥10 MHz)

MG0311A π/4 DQPSK Modulation Unit

Vector error	RF signal: ≤2.5%rms (≤+5 dBm output)
TETRA	Carrier frequency: 300 kHz to 2750 MHz Adjacent channel leakage power ratio: ≤–45 dB (25 kHz offset, ±9 kHz band) ≤–62 dB (50 kHz offset, ±9 kHz band)

Ordering information

Please specify model/order number, name, and quantity when ordering.

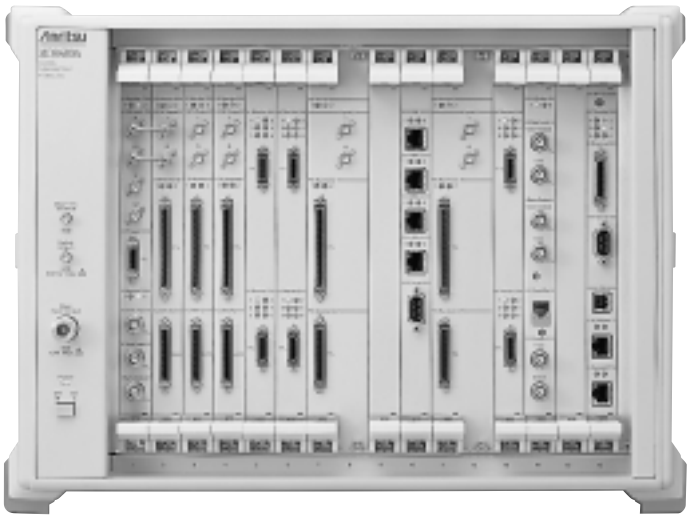
Model/Order No.	Name	
	Main frame	
MG3660A	Digital Modulation Signal Generator	
	Expansion units (factory installed)	
MG0301C	π/4 DQPSK Modulation Unit	
MG0302A	GMSK Modulation Unit	
MG0303B	Burst Function Unit	
MG0305A	GFSK Modulation Unit	
MG0307A	π/4 DQPSK Modulation Unit	
MG0311A	π/4 DQPSK Modulation Unit	
	Standard accessories (for main frame)	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
J0127A	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 1 m:	2 pcs
	Power cord, 2.5 m:	1 pc
B0325	Shielded cover for GPIB:	1 pc
F0013	Fuse, 5 A:	2 pcs
W1005AE	MG3660A operation manual:	1 copy
	Standard accessories (for expansion units)	
W0872AE	MG0301C/0303B operation manual (supplied with MG0301C):	1 copy
W0691AE	MG0302A/0303B operation manual (supplied with MG0302A):	1 copy
W0851AE	MG0305A/0303B operation manual (supplied with MG0305A):	1 copy
W0949AE	MG0307A/0303B operation manual (supplied with MG0307A):	1 copy
W1042AE	MG0311A/0303B operation manual (supplied with MG0311A):	1 copy
	Options (for main frame)	
MG3660A-01	Reference oscillator (aging rate: 5 x 10^{-9}/day)	
MG3660A-02	Reference oscillator (aging rate: 2 x 10^{-9}/day)	
MG3660A-03	Reference oscillator (aging rate: 5 x 10^{-10}/day)	
	Optional accessories	
J0127C	Coaxial cord (BNC-P · RG-58A/U · BNC-P), 0.5 m	
J0003A	Coaxial cord (SMA-P · 3D-2W · SMA-P), 1 m	
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m	
J0004	Coaxial adapter (N-P · SMA-J)	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0329D	Protective cover	
B0331D	Front handle kit (2 pcs/set)	
B0332	Joint plate (4 pcs/set)	
B0333D	Rack mount kit	
B0334D	Carrying case (with casters and protective cover)	
	Optional equipment	
MS8604A	Digital Mobile Radio Transmitter Tester	
MD1620B	Signalling Tester	
MD1620C	Signalling Tester	
MD6420A	Data Transmission Analyzer	
MP1201C	Error Rate Tester	
MS2683A	Spectrum Analyzer	

For product ordering information, see pages 4 – 10

W-CDMA SIGNALLING TESTER
MD8480A

For the Development of W-CDMA Mobile Stations

NEW



CE GPIB

The MD8480A has a full lineup of advanced functions for testing third-generation W-CDMA mobile stations. Its air interface meets the 3GPP specifications, and it can be used as a base station simulator. The test functions include mobile station modulation and demodulation processing, protocol sequence tests such as location registration, origination, termination, handover (option), disconnection from mobile station/network, various applications such as voice and packet communications as well as communications between two mobile stations.
In summary, the MD8480A is the ideal instrument for developing 3G W-CDMA mobile stations and application software.

Features

- Modulation/demodulation tests for W-CDMA mobile station
- Protocol sequence tests for W-CDMA mobile station
- Flexible settings of test parameters and sequences for protocol sequences
- Voice and packet communications test, and communications testing between two mobile stations

Measurement example

• Modulation/demodulation function tests
In the modulation test, fixed-pattern or PN9 data is output from the mobile station modulation section and compared with the obtained demodulation result on the trace screen of the MD8480A. It is also possible to simultaneously measure BLER and BER (BER requires external BER counter). In addition, the received signal timing error can also be displayed.
In the demodulation test, fixed-pattern or PN9 data is output from the MD8480A and compared with the modulation signal from the mobile station.

• Protocol sequence test
The test items include broadcast information transmission location registration, mobile station origination/termination, disconnection from mobile station/network, and handover (option). In addition, any parameter and sequence can be defined and quasi-normal tests and SMS test are also supported. Furthermore, data communications between the mobile station and MD8480A can be monitored simultaneously. These functions are ideal for efficient troubleshooting and testing the mobile station protocol sequence.

Application tests

• AMR voice test
A handset is connected to the MD8480A to perform a voice test between the mobile station and MD8480A.

• User data test
Any data can be inserted into the DTCH being transmitted and the demodulated DTCH data is output externally. This is an effective method for measuring error rate.

• IP packet test
A PC with 10Base-T connection is connected to the MD8480A to test the IP protocol data communications.

• PPP packet test (option)
A PC with RS-232C is connected to the MD8480A to test the PPP protocol data communications. PPP is the internet dial-up connection protocol.

• PPP test (built-in server)
This is another PPP protocol test in which the PPP protocol stack is executed by the MD8480A that acts as the PPP terminal. The PC functions as the Ethernet medium and performs IP level communications. High-speed Ethernet communications at 384 kbps are supported.

• ISDN test (option)
A videophone, etc., is connected to the MD8480A to test the video and audio communications between the mobile station and MD8480A.

• Communications between two mobile stations test
Two MD8480A are connected by a 10Base-T Ethernet connection to test communications between two mobile stations.

Specifications

General	Frequency range	Tx: 2110 to 2170 MHz, Rx: 1920 to 1980 MHz
	I/O connector	Main N-type, Impedance: 50 Ω, VSWR: ≤1.3 Downlink SMA-type, Impedance: 50 Ω, VSWR: ≤2.0 Uplink SMA type, Impedance: 50 Ω, VSWR: ≤2.0
	Reference oscillator	Frequency: 10 MHz Startup characteristics: ≤5 x 10^{-8}/day (10 minutes after power-on, reference to 24 hours after power-on) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (reference to 24 hours after power-on) Temperature characteristics: ≤5 x 10^{-8} (0˚ to 50˚C, reference to 25˚C) External reference input: 10 MHz, 2 to 5 Vp-p
Transmitter	Frequency	Range: 2110 to 2170 MHz (200 kHz steps)
	Output level	Maximum output level Main: –25 dBm (each channel), –15 dBm (overall) Downlink: –10 dBm (each channel), 0 dBm (overall) Setting resolution: 0.1 dB Accuracy: ±1.5 dB
	Spreading	Codes: Scrambling, channelization, synchronization Chip rate: 3.84 MHz
	Modulation	Method: QPSK Modulation band limit: Root Nyquist filter (a= 0.22) EVM: ≤10% rms
	AWGN	Setting resolution: 0.1 dB
Receiver	Frequency	Range: 1920 to 1980 MHz, Step: 200 kHz
	Input level	Range: –30 to +40 dBm (main), –50 to +20 dBm (uplink)
	Sync.	Rake receive: None, Capture range: ±200 chip (DPCCH), ±100 chip (preamble)
Power		100 to 120/200 to 240 Vac (250 V max.), automatic switching, 47.5 to 63 Hz, ≤430 VA
Ambient temperature		0˚ to +50˚C (operating), –40˚ to +70˚C (storage)
Dimensions and mass		426 (W) x 310 (H) x 500 (D) mm, ≤35 kg
EMC		EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A)
LVD		EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

Option functions

Additional function	MU848057A	MU848058A	MU848055A	MU848053A	MD8480A-01	MX848001A-01	MX848041A-01	MX848041A
2BS soft handover	√	√						
3BS soft handover	√	√*1						
ISDN			√					
Tx diversity (1RF OUT)	√	√*1				√	√*2	
Tx diversity (2RF OUT)	√	√*1		√	√	√	√*2	
Hard handover	√	√*1		√	√			
Ciphering								√

∗1: Requires two equipment sets
∗2: Requires when using both MX848001A-01 and MX848041A

The options are all shared functions.
- Requires MD8480A + MU848057A + MU848058A + MU848058A for 3BS soft handover function
  This configuration also supports 2BS soft handover function.
- Requires MD8480A + MU848057A + MU848058A + MU848058A + MD8480A-01 + MX848001A-01 for Tx Diversity (2RF OUT)
  This configuration also supports the 2BS soft handover function, 3BS soft handover function, Tx diversity (1RF OUT) function and hard handover.

For product ordering information, see pages 4 –10

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MD8480A	W-CDMA Signalling Tester	
	Unit (incorporated in the main frame)	
MU848051A	CPU:	1 pc
MU848052A	Frame Decoder:	1 pc
MU848053A	Rx Baseband:	1 pc
MU848056A	Voice Codec:	1 pc
MU848057A	Frame Coder:	1 pc
MU848058A	Tx Baseband:	1 pc
MU848059A	Timing Generator:	1 pc
	Standard accessories	
MX848000A	W-CDMA Signalling Tester Control software:	1 pc
MX848001A	W-CDMA Signalling Tester Firmware:	1 pc
MX848002A	W-CDMA Signalling Tester FPGA:	1 pc
MX848003A	W-CDMA Signalling Tester ISDN/PPP:	1 pc
J0892	10Base-T cross cable, 5 m:	1 pc
G0091	Monitor board:	2 pcs
J1005	Monitor cable, 80-pin:	1 pc
J1006	Monitor cable, 20/50-pin:	1 pc
	Power cord, 2.6 m:	1 pc
J0127F	Coaxial cord (BNC-P · RG58A/U · BNC-P), 1 m:	1 pc
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
J1010	U-link:	2 pcs
J1007	RS-232C cable (cross), 2 m:	1 pc
F0014	Fuse, 6.3 A:	2 pcs
W1945AE	MD8480A operation manual (CD-ROM):	1 pc
A0010	Blank board (at option uninstalled):	8 pcs
	Option units	
MU848053A	Rx Baseband	
MU848055A	ISDN	
MU848057A	Frame Coder	
MU848058A	Tx Baseband	
MD8480A-01	Additional RF unit	
	Software	
MX848001A-01	W-CDMA signalling tester Tx diversity	
MX848041A	W-CDMA Signalling Tester Ciphering	
MX848041A-01	Tx Diversity for Ciphering	
	Peripherals	
G0082	Personal computer*1 (for control)	
Z0430	Microsoft Visual C++ V6.0*2 (standard edition)	

∗1 OS: Windows 95/98/ME/2000, Windows NT4.0 Workstation
CPU: 200 MHz or better with minimum of 32 MB of memory and 10Base-T and RS-232C interfaces (D-Sub 9pin) and CD-ROM drive.

∗2 Microsoft Visual C++ Version 6.0 is a registered trademark of Microsoft Corporation in USA and other countries.

SIGNALLING TESTER
MD1620B
PDC 800 MHz, PDC 1.5 GHz (Option 01)

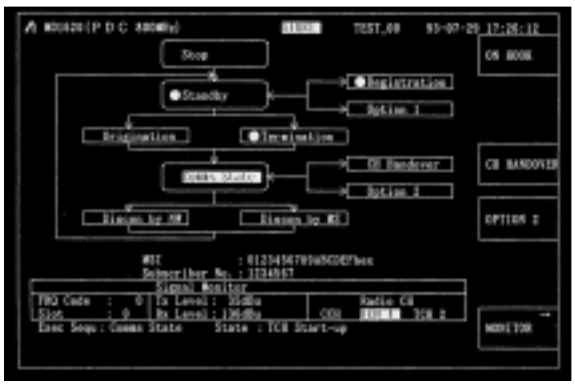
For Testing General Operations and Functions of PDC Terminals

GPIB

The MD1620B has all functions which are necessary for operation tests and function tests of mobile stations for PDC system for a 800 MHz band (1.5 GHz band: Option 01). It has an air-interface based on RCR STD-27C and works as a simulator for the base station.
The MD1620B can test sequences, such as standby, location registration, call initiated/call present, channel handover, disconnection by the network end, and disconnection by the mobile station. It also provides many measurement and test functions, such as time alignment and handover time measuring function, real-time display of information reported from the mobile station during communications with the base station, and controls to the mobile station.
The MD1620B is the best choice for connection tests at the last stage of production lines and for function tests at the development stage.
With the MS8604A Digital Mobile Radio Transmitter Tester and the MG3670B/C, MG3671A/B, and MG3660A Digital Modulation Signal Generator, measuring systems for digital cellular systems can be easily constructed.

Features
- Can set parameters and sequences used for sequence tests
- Can test layer 3 semi normal sequences
- Can do real-time measurements of time alignment and handover time
- Can easily create digital cellular measuring systems
- Provides easy-to-use operation system by windows and menu selections

Measurement example
• By pressing a key once the sequence measurement starts
By pressing the Start key once, the screen display changes to the sequence monitor screen, and the sequence test starts automatically. The test item under measurement is displayed in a reverse-display mode, and a position displayed in a reverse-mode moves as the test is proceeding.
Each result of the test is indicated with a mark ("•" or "X").
For example, • Registration is displayed when the location registration sequence is performed correctly, and X Registration when errors are detected during the location registration sequence test.
When a series of the sequence tests are completed and all the items are displayed with "•" marks, an operator knows at a glance that the mobile station under test has passed.



Sequence monitor

• Real-time display of time alignment and handover time
The conditions of the mobile station under test are displayed in real-time on the monitor screen of the execution condition.
And also, the MD1620B can control time alignment (TA) and transmitting power (POW) to the mobile station.

Execution condition monitor

For product ordering information, see pages 4 – 10

• Can freely set the parameters of the control channel and the traffic channels

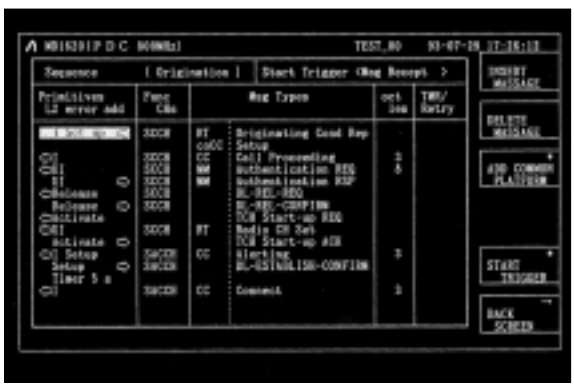
A control channel that the MD1620B sends out as a simulator of the base station and broadcast information are set on the control channel setting screen and traffic channels are set on the traffic channel setting screen. For channel handover during communications, the test is performed by alternatively switching the traffic channel 1 and the traffic channel 2.

Control channel setting

Traffic channel setting

• Can freely set layer 3 sequences

Sequences used for location registration, call initiated/call present, channel handover, disconnection by the mobile station, and disconnection by the network end can be freely changed. Also, information elements included in each message can be freely set.
Moreover, the tester can set arbitrary sequences to Option 01 and Option 02 and be used for testing of RT sequence during communications and semi-normal sequence.



Sequence setting

Specifications

Tx	Frequency range	810 to 826 MHz, 1477 to 1501 MHz (Option 01), 860 to 898 MHz (Option 03), 834 to 843 MHz (Option 06)
	Frequency setting interval	25 kHz steps
	Number of carriers	2
	Transmission level range	13 to 83 dBμV*1/carrier
	Transmission level accuracy	±2 dB (24 to 83 dBμV) at 25° ±5°C
Rx	Frequency range	940 to 956 MHz, 1429 to 1453 MHz (Option 01), 915 to 940 MHz (Option 03), 889 to 898 MHz (Option 06)
	Frequency setting interval	25 kHz steps
	Number of carrier	1
	Receiving level range	77 to 149 dBμV*1
	Receiving error rate	BER ≤1 x 10^{-6} at 77 dBμV
Reference oscillator	Frequency	10 MHz
	Stability	Aging rate: 2 x 10^{-8}/day, 2 x 10^{-7}/year Temperature characteristic: ±5 x 10^{-8} (relative to 25°C)
	External reference input signal	10 MHz, 2 to 5 Vp-p
External control		GPIB: SH1, SR1, DC1, C0, AH1, RL1, DT0, T5, PP0, L4 RS232C bit rate: 600, 1200, 2400, 4800 bps
Floppy		3.5-inch floppy disk, MS-DOS*2 format 2DD format: 720 KB (when formatted) 2HD format: 1.2 MB (when formatted)
Power		85 to 132 Vac, 47.5 to 63 Hz, ≤230 VA
Temperature range		0° to 50°C (5° to 45°C when using a floppy)
Dimensions and mass		426 (W) x 221.5 (H) x 451 (D) mm, ≤20 kg

*1: 0 dB μV = –113 dBm
*2: MS-DOS is a registered trademark of Microsoft Corporation.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MD1620B	Signalling Tester	
	Standard accessories	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	2 pcs
F0012	Fuse, 3.15 A:	2 pcs
	Power cord, 2.5 m:	1 pc
Z0244A	System disc (3.5-inch):	1 pc
Z0244B	System disc for back-up (3.5-inch):	1 pc
Z0244C	Software disc for test (3.5-inch):	1 pc
W0685AE	MD1620B operation manual:	1 copy
	Options	
MD1620B-01	PDC 1.5 GHz	
MD1620B-03	PDC 800 MHz band frequency extend option	
MD1620B-06	PDC 800 MHz 3 band extend option	
MD1620B-13	Trace function	
	Optional accessories	
CU10NA3S-C	Circulator (810 to 956 MHz, TDK)	
CU111A3N-C	Circulator (1429 to 1513 MHz, TDK)	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
J0324	RS232C cable, 3 m	
B0329D	Cover	
B0331D	Front handle (2 pcs/set)	
B0332	Joint plate (4 pcs/set)	
B0333D	Rack mount kit	
B0334D	Carrying case (with a cover and casters)	

Notes:
- The MD1620B is developed according to RCR STD-27C. However, test sequences for Appendix 1 (authentication and encryption) is not provided.
- When connecting the MD1620B to a MS with a cable or antennas, a circulator optionally provided is necessary.
- Optional trace function stored on a system disk can be used only with the MD1620B having the same serial number as the number indicated on the system disk.

SIGNALLING TESTER
MD1620C
PHS 1.9 GHz

For Testing General Operations and Functions of PHS Terminals

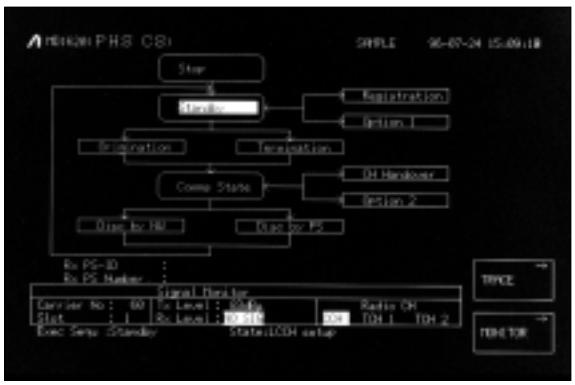
Custom-made product

GPIB

The MD1620C has all the functions needed for operation tests and function tests of CS/PS for PHSs. The MD1620C has an air-interface according to RCR STD-28 and can be used as a PS/CS simulator. Control sequences, such as standby, registration, origination, termination, CH handover, disconnection-by-CS, and disconnection-by-PS can be tested.
The MD1620C is the best choice for connection tests at the last stage of production lines of PS/CS and for function tests at the development stage. With the MS8604A Digital Mobile Radio Transmitter Tester and the MG3670B/3671A/3660A Digital Modulation Signal Generator, measuring systems for PHS systems can be constructed easily.

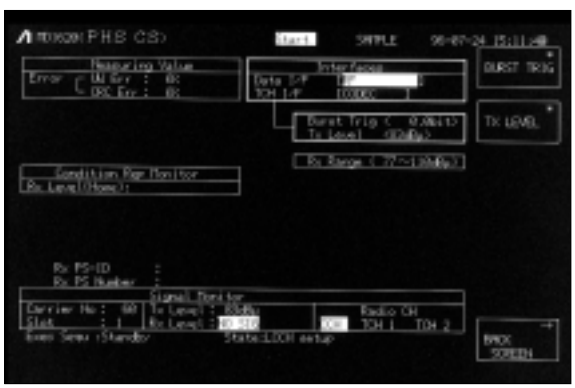
Features
- The MD1620C has a built-in CODEC, and communication tests between the simulator and a CS/PS are possible using a hand-set supplied as a standard accessory.
- Parameters and optional sequences for tests can be freely defined.
- Layer-3 sequences can be freely defined and layer 3 semi-normal sequence tests are possible.
- Defined sequences and parameters can be stored on a 3.5 inch floppy disk.
- Easy-to-use operation system by windows and menu selection method

Measurement example
• Sequence test starts at a stroke of a key
By pressing the Start key on the front panel, the screen changes to the sequence monitor screen, and the sequence test starts. Execution conditions and test results of the sequence test are displayed as a flowchart. The test sequence under execution is indicated with a cursor in a reverse display mode, shown in the figure top right, and the cursor moves to next test sequence as the test proceeds.
Sequence test results are indicated with a mark ("•" or "X"). For example, when the registration sequence is performed correctly, the "•" mark is displayed on its left side, and the "X" mark is displayed when an error is detected. When the sequence test ends and each sequence is displayed with the "•" mark, an operator knows at a glance that a DUT is OK.



Sequence monitor screen (CS simulation mode)

• Real-time display of slot error rates and a receiving level
The MD1620C displays slot error rates and a receiving level (the transmission level from a PS) in real time. By turning a rotary knob on the front panel, a transmission level can be continuously varied.



Execution condition monitor screen (CS simulation mode)

For product ordering information, see pages 4 – 10

• Control signals of up-link and down-link can be displayed by using a trace function provided as an option.

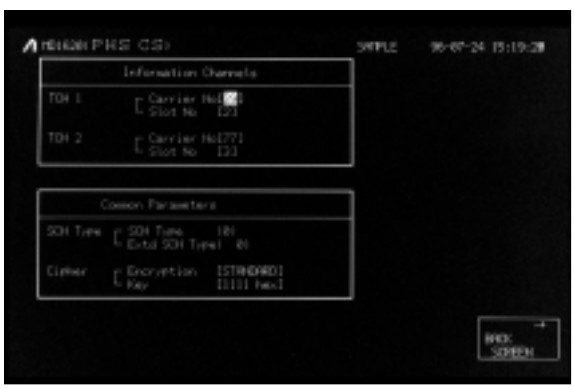
By using the trace function, up-link and down-link control signals sent or received by PS or CS during a sequence test are stored in built-in memories and are displayed after the sequence test ends. Max. 100 steps back from the test end are displayed in layer 2 and layer 3 levels and with elapsed time in 10 ms steps. This function allows engineers to find out the cause(s) when errors occurred during the sequence test and is indispensable to software debug and tests.

Trace screen (CS simulation mode)

• Can freely set parameters of the control/communication CH

When being used as a CS simulator, a control CH and broadcasting information that the MD1620C sends can be set at the control CH setting screen and communications CH can be set at the communication CH screen. Handover test during communications can be performed by alternating a communication CH 1 and a communication CH 2.

Control CH setting screen (CS simulation mode)



Communication CH setting screen (CS simulation mode)

• Can be freely defined layer 3 sequences

Basic test sequences, such as registration, origination, termination, handover, disconnection by CS, and disconnection by PS are stored on a 3.5-inch floppy disk supplied as a standard accessary. In addition, sequences according to user's applications can be defined by modifying the basic test sequences or adding messages to the sequence, and parameters in messages can be set freely. By defining arbitrary sequences in Option 01 and Option 02, sequence tests for supplement service and semi-normal sequence can be done.

Sequence setting screen (CS simulation mode: origination sequence)

• Parameters and sequences defined can be stored on a 3.5-inch floppy disk.

Parameters and test sequences defined can be stored as a file on a floppy disk (up to 100 files can be stored). Trace data resulting from using the trace function can be also stored on a floppy disk.

File management screen

Specifications

Tx	Frequency range	1895.15 to 1917.95 MHz
	Frequency setting interval	300 kHz steps
	Number of carriers	2 carriers
	Transmission level range	13 to 83 dBμV*1 per carrier
	Transmission level accuracy	±2 dB (24 to 83 dBμV) at 25° ±5°C
Rx	Frequency range	1895.15 to 1917.95 MHz
	Frequency setting interval	300 kHz steps
	Number of carriers	1 carrier
	Receiving level range	77 to 149 dBμV*1
	Receiving error rate	BER ≤1 x 10^{-8} at 77 dBμV
Reference oscillator	Frequency range	10 MHz
	Stability	Aging rate: 2 x 10^{-8}/day, 2 x 10^{-7} year Temperature characteristics: ±5 x 10^{-8} (referred at 25°C)
	External reference input signal	10 MHz, TTL level
External control		GPIB: SH1, SR1, DC1, C0, AH1, RL1, DT0, T5, PP0, L4 RS-232C bit rate: 600, 1200, 2400, 4800 bps
Floppy		3.5-inch floppy disk, MS-DOS*2 format 2DD format: 720 KB (when formatted) 2HD format: 1.2 MB (when formatted)
Power		85 to 132/170 to 250 Vac, 47.5 to 63 Hz, ≤230 VA
Dimensions and mass		426 (W) x 221.5 (H) x 451 (D) mm, ≤20 kg

∗1: 0 dBμV = –113 dBm
∗2: MS-DOS is a registered trademark of Microsoft Corporation.

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MD1620C	Signalling Tester (Custom-made product)	
	Standard accessories	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	2 pcs
F0012	Fuse, 3.15 A:	2 pcs
	Power cord, 2.5 m:	1 pc
Z0252A	System disk (3.5-inch):	1 pc
Z0252B	System disk for back-up (3.5-inch):	1 pc
Z0252C	Disk for calibration (3.5-inch):	1 pc
G0057	Hand-set	1 pc
W0778AE	MD1620C operation manual:	1 copy
	Option	
MD1620C-13	Trace function	
MD1620C-15	Frequency expansion	
	Optional accessories	
CU111A3N-C	Circulator (1895 to 1918 MHz, TDK product)	
J0657	Adapter (N-P · SMA-J)	
J0658	Adapter (SMA-P · SMA-J), L-type	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
J0324	RS-232C cable, 3 m	
B0329D	Cover	
B0331D	Front handle (2 pcs/set)	
B0332	Joint plate (4 pcs/set)	
B0333D	Rack mount kit	
B0334D	Hard carrying case (with covers and casters)	

Notes:
- The MD1620C is developed according to RCR STD-28. However, test sequences for Appendix 1 (authentication) and Appendix 2 (subscriber data write-in) are not provided.
- When connecting the MD1620C to a PS or a CS with a cable or antennas, a circulator optionally provided is necessary.
- Optional trace function stored on a system disk can be used only with the MD1620C having the same serial number as the number indicated on the system disk.

For product ordering information, see pages 4 – 10

Bluetooth™ TEST SET
MT8850A
2.4 GHz Reference *Bluetooth* Transceiver

Test Bluetooth Modules and Products with a Bluetooth Interface

NEW

Bluetooth CE

The MT8850A is Anritsu's entrant into the fast-growing *Bluetooth* world of wireless communications for mobile PCs, mobile phones and other portable devices. The MT8850A *Bluetooth* Test Set measures the radio performance of *Bluetooth* modules and Bluetooth products – quickly and at low cost.

Features

- **Fast**

The rapid "Quick Test" measurement script is pre-configured for ease of operation. Production test scripts can run in as little as 10 seconds, measuring power, frequency, modulation and receiver sensitivity (BER).

- **One touch testing**

Once the MT8850A has been configured, each device is tested with a single keystroke. Press RUN to initiate a link, activate a test mode, perform the measurement, and report the results.

- **Authoritative**

Tests are made exactly as defined in the *Bluetooth* RF Test Specification. All measurements are traceable to National Standards so that you can be totally confident in both your production testing and design proving.

- **Reference *Bluetooth* transceiver**

A custom designed transceiver offers 1 kHz frequency accuracy at the start of any packet, and it is in full compliance with the requirements for the "Dirty Transmitter" for true receiver sensitivity measurements. In addition to the standard dirty transmitter table, you can define customized stress conditions with user-settable values of Carrier Frequency Offset Modulation Index, Symbol Timing Error, and simulated carrier frequency drift.

- **Remote control**

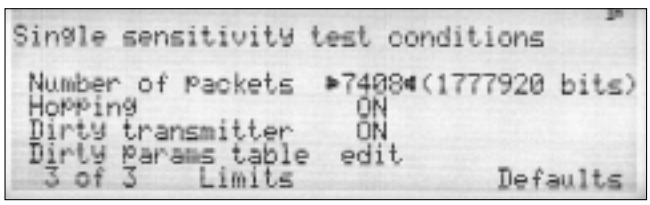
Both GPIB and RS 232 interfaces are offered as standard. Creating test programs has been simplified by the MT8850A's capability for initiating a test using a single command and then having results returned in a single string.

- **Small size and weight**

MT8850A takes up minimal space in your test system, thanks to its half-rack size and light weight. Where *Bluetooth* interfaces are being introduced into existing products, the disturbance to the test system is minimized.

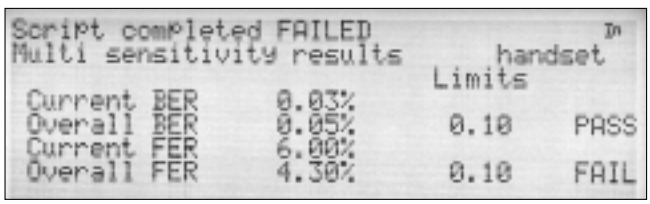
- **Editing tests**

Define your own test scripts for customizing test measurements to your specific requirements. Each test can be enabled or disabled and within any other test; parameters, such as hopping, and can be enabled or disabled; the number of measured packets can be defined and the specific test frequencies initiated.



- **Single test mode**

A single test can be run continuously. This allows, for example, the BER of a link to be monitored as additional interfering *Bluetooth* devices are activated or the distance between the EUT and the MT8850A is increased.



- **Making a link**

The BT address can be entered manually using the keypad, or it can be discovered and selected using Inquiry via the GPIB or RS 232 interface, or it can be read through the EUT HCI interface (RS 232). Once the EUT BT address is known a *Bluetooth* link is established using Paging. This process typically takes 200 ms.

- **Field upgradeable**

The *Bluetooth* protocol stack is held in FPGA so that future versions of the core *Bluetooth* specification can be installed locally. The instrument's main program is held in flash memory; consequently, product enhancements can be downloaded in the field.

• Design proving
Because measurements are made in accordance with the *Bluetooth* RF Test Specification, the MT8850A is the ideal instrument for pre-conformance testing and design proving. The MT8850A lets you gain confidence in your product before submitting it to a *Bluetooth* Qualification Test Facility for approval. For the TX output spectrum and spurious emissions tests, the MT8850A can establish a BT link and set the EUT to transmit the appropriate DH1 packets at a fixed frequency _ just add an Anritsu MS2661C or MS2665C Spectrum Analyzer to your test system.

• BlueSuite support software
A complementary BlueSuite software package gives PC control of the MT8850A for advanced design proving measurements on *Bluetooth* radios. Use BlueSuite to view burst power profiles, modulation eye diagrams, display graphs of the output power of the 79 frequencies and many other advanced diagnostic tools.

Specifications

Output power	General	MT8850A measures average and peak power according to the *Bluetooth* RF Test Specification measurement of output power is made with the EUT in test mode, loopback enabled and hopping on. MT8850A transmits the longest supported packets and longest supported payload length with a PRBS 9 payload. Power is measured at three defined frequencies. MT8850A identifies the position of p0 and measures the power of every bit in the packet.	
	Link conditions	Hopping	ON
		Test mode	ON
		Loopback	Loopback only
		Payload	PRBS 9
		Packet type	Longest supported
	Measurement	Supported measurements	Average power, peak power
		Number of measurement frequencies	Three, default to qualification specification or user defined
		Measurement range	+22 dBm to -35 dBm average power (+23 dBm peak power)
		Resolution	0.1 dB
		Accuracy	+20 dBm to -35 dBm, ±1 dB +22 dBm to +20 dBm, ±1.5 dB
Power control	General	MT8850A measures power control according to the Bluetooth RF Test Specification. Measurement of power control is made with the EUT in test mode, loopback enabled, and hopping off. MT8850A transmits DH1 packets, with a PRBS 9 payload. Power control is measured at three defined frequencies. MT8850A uses standard LMP commands to set the EUT power. MT8850A identifies the position of p0 and measures the power of every bit in the packet.	
	Link conditions	Hopping	OFF
		Test mode	ON
		Loopback	Loopback only
		Payload	PRBS 9
		Packet type	DH1
	Measurement	Supported measurements	Average power at each power step, step size
		Number of measurement frequencies	Three, default to qualification specification or user defined
		Measurement range	+22 dBm to -35 dBm average power (+23 dBm peak power)
		Resolution	0.1 dB
		Accuracy	+20 dBm to -35 dBm, ±1 dB +22 dBm to +20 dBm, ±1.5 dB
Modulation characteristics	General	MT8850A measures modulation characteristics according to the Bluetooth RF Test Specification. Measurement of modulation characteristics is made with the EUT in test mode, loopback enabled, and hopping off. MT8850A transmits longest supported packets with the defined payload to the EUT. Modulation characteristics are measured at three defined frequencies.	
	Link conditions	Hopping	OFF
		Test mode	ON
		Loopback	Loopback or TX mode
		Payload	11110000 and 10101010
		Packet type	Longest supported
	Measurement	Supported measurements	Frequency deviation. Δf1max, Δf2max, Δf1avg, Δf2avg and (Δf2avg/Δf1avg)
		Number of measurement frequencies	Three, default to qualification specification or user defined
		RF input measurement range	+20 dBm to -35 dBm
		Deviation measurement range	0 Hz to 350 kHz peak
		Deviation resolution	1 kHz
		Accuracy	1 kHz

Continued on next page

Initial carrier frequency tolerance	General	MT8850A measures initial carrier frequency tolerance according to the *Bluetooth* RF Test specification. Measurement of initial carrier frequency is made with the EUT in test mode, TX mode and hopping on and/or off. MT8850A transmits DH1 packets, with a PRBS 9 payload. Initial carrier frequency is measured at three defined frequencies. MT8850A identifies the position of p0 and measures the average frequency of the 4 preamble bits.	
	Link conditions	Hopping	OFF and ON
		Test mode	ON
		Loopback	Loopback or TX mode
		Payload	PRBS 9
		Packet type	DH1
	Measurement	Supported measurements	Initial carrier frequency error
		Number of measurement frequencies	Three; default to qualification specification or user defined
		RF input measurement range	+20 dBm to -35 dBm
		Initial frequency error measurement range	0 Hz to ±150 kHz
		Frequency resolution	1 kHz
		Accuracy	1 kHz
Carrier frequency drift	General	MT8850A measures carrier frequency drift according to the *Bluetooth* RF Test Specification Measurement of frequency drift is made with the EUT in test mode, with either loopback or transmitter test mode enabled. EUT transmits longest supported packets with a 10101010 payload to the EUT. Measurements are made with hopping off and then with hopping on. Frequency drift is measured at three defined frequencies with hopping off and every frequency with hopping on.	
	Link conditions	Hopping	OFF and ON
		Test mode	ON
		Loopback	Loopback or TX mode
		Payload	10101010
		Packet type	All supported packet lengths
	Measurement	Supported measurements	Carrier frequency drift
		Number of measurement frequencies	Three with hopping off then every frequency with hopping on
		RF input measurement range	+20 dBm to -35 dBm
		Frequency drift measurement range	0 Hz to 200 kHz, and > 2000/50 µs
		Frequency resolution	1 kHz
		Accuracy	1 kHz
Sensitivity - single slot packets	General	MT8850A measures single slot sensitivity according to the *Bluetooth* RF Test Specification. BER and FER are measured with the EUT in test mode and loopback on. MT8850A transmits DH1 packets, with a PRBS 9 payload to the EUT. The user can select to run the measurement with hopping on or off. Dirty transmitter conditions as defined in the *Bluetooth* test specifications can be enabled.	
	Link conditions	Hopping	OFF or ON, user selectable
		Test mode	ON
		Loopback	ON
		Payload	PRBS 9
		Packet type	DH1
		Dirty transmitter (as defined in RF test spec)	ON or OFF, user selectable

Continued on next page

<table>
<tr><td rowspan="15">Sensitivity - single slot packets</td><td rowspan="15">Measurement</td><td>Supported measurements</td><td colspan="4">BER, total number of bit errors and FER</td></tr>
<tr><td>Number of measurement frequencies</td><td colspan="4">Three with hopping off, or hopping on</td></tr>
<tr><td>Number of measured bits</td><td colspan="4">1 to 32,768 packets (216 to 7,077,888 bits)</td></tr>
<tr><td>MT8850A transmitter output range</td><td colspan="4">0 dBm to -80 dBm, resolution 0.1 dB</td></tr>
<tr><td>BER/FER measurement range</td><td colspan="4">0.00% to 100%</td></tr>
<tr><td>BER/FER resolution</td><td colspan="4">0.01%</td></tr>
<tr><td rowspan="14">Dirty transmitter specification</td><td colspan="4">MT8850A transmits the first 20 ms with the first set of measurement conditions, the second 20 ms with the second set of measurement conditions up to the tenth set of conditions. The cycle is then repeated until the test is complete.</td></tr>
<tr><td>Measurement conditions</td><td>Carrier frequency offset</td><td>Modulation index</td><td>Symbol</td></tr>
<tr><td>1</td><td>75 kHz</td><td>0.28</td><td>-20 ppm</td></tr>
<tr><td>2</td><td>14 kHz</td><td>0.30</td><td>-20 ppm</td></tr>
<tr><td>3</td><td>-2 kHz</td><td>0.29</td><td>+20 ppm</td></tr>
<tr><td>4</td><td>1 kHz</td><td>0.32</td><td>+20 ppm</td></tr>
<tr><td>5</td><td>39 kHz</td><td>0.33</td><td>20 ppm</td></tr>
<tr><td>6</td><td>0 kHz</td><td>0.34</td><td>-20 ppm</td></tr>
<tr><td>7</td><td>-42 kHz</td><td>0.29</td><td>-20 ppm</td></tr>
<tr><td>8</td><td>74 kHz</td><td>0.31</td><td>-20 ppm</td></tr>
<tr><td>9</td><td>-19 kHz</td><td>0.28</td><td>-20 ppm</td></tr>
<tr><td>10</td><td>-75 kHz</td><td>0.35</td><td>+20 ppm</td></tr>
<tr><td colspan="4">In addition to the above measurement conditions, MT8850A transmits with a sine wave, frequency modulation, with a deviation of ±25 kHz. rate 1.6 kHz, synchronized to zero phase at the packet start.</td></tr>
<tr><td>Dirty transmitter user control</td><td colspan="3">Any entry in the dirty transmitter table can be edited within the following ranges:
• Carrier frequency offset: 0 Hz to 100 kHz, 1 kHz resolution
• Modulation index 0.25 to 0.38, 0.01 resolution
• Symbol timing error: 0 ppm, +20 ppm or 20 ppm</td></tr>
<tr><td rowspan="15">Sensitivity - multi-slot packets</td><td>General</td><td colspan="4">MT8850A measures multi-slot sensitivity according to the Bluetooth RF Test Specification. BER and FER are measured with the EUT in test mode and loopback on. MT8850A transmits DH5 packets (or DH3 packets if DH5 not supported by EUT), with a PRBS 9 payload to the EUT. The user can select to run the measurement with hopping on or off. Dirty transmitter conditions as defined in the Bluetooth test specifications can be enabled.</td></tr>
<tr><td rowspan="6">Link conditions</td><td>Hopping</td><td colspan="4">OFF or ON, user selectable</td></tr>
<tr><td>Test mode</td><td colspan="4">ON</td></tr>
<tr><td>Loopback</td><td colspan="4">ON</td></tr>
<tr><td>Payload</td><td colspan="4">PRBS 9</td></tr>
<tr><td>Packet type</td><td colspan="4">DH5 (or DH3 packets if DH5 not supported by EUT)</td></tr>
<tr><td>Dirty transmitter
(as defined in RF test spec)</td><td colspan="4">ON or OFF, user selectable measurement</td></tr>
<tr><td rowspan="8">Measurement</td><td>Supported measurements</td><td colspan="4">BER, total number of bit errors and FER</td></tr>
<tr><td>Number of measurement frequencies</td><td colspan="4">Three with hopping off, or hopping on</td></tr>
<tr><td>Number of measured bits</td><td colspan="4">1 to 32,768 packets (for DH3, 1,464 to 47,972,352 bits), (for DH5, 2,712 to 88,866,816 bits)</td></tr>
<tr><td>MT8850A transmitter output range</td><td colspan="4">0 dBm to -80 dBm, 0.1 dB resolution</td></tr>
<tr><td>BER/FER measurement range</td><td colspan="4">0.00% to 100%</td></tr>
<tr><td>BER/FER resolution</td><td colspan="4">0.01%</td></tr>
<tr><td>Dirty transmitter specification</td><td colspan="4">As for single-slot sensitivity section except; in addition to the measurement condition table, MT8850A transmits with a sine wave, frequency modulation, with a deviation of ±40 kHz, rate 500 Hz (3 slots) or 300 Hz (5 slots), synchronized to zero phase at the packet start.</td></tr>
</table>

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Maximum input level	General	MT8850A measures BER and FER at the EUT maximum input level according to the *Bluetooth* RF Test Specification. Measurement is made with the EUT in test mode, loopback enabled, and hopping off. MT8850A transmits the DH1 packets with a PRBS 9 payload. The MT8850A transmitter level is set so that the EUT receiver input level is -20 dBm. BER and FER are measured at three defined frequencies.	
	Link conditions	Hopping	OFF
		Test mode	ON
		Loopback	ON
		Payload	PRBS 9
		Packet type	DH1
	Measurement	Supported measurements	BER and FER for -20 dBm at receiver input
		Number of measurement frequencies	Three, default to qualification specification or user defined
		Number of measured bits	1 to 32,768 packets (216 - 7,077,888 bits)
		Transmitter power settable range	0 dBm to -80 dBm
		Resolution	0.1 dB
EUT control interface		Provides HCI commands to EUT through a standard RS 232 interface. Interface meets requirements of *Bluetooth* V1.1 specification for HCI UART transport layer. Cable supplied.	
Frequency standard		Frequency	10 MHz
		Accuracy	±0.5 ppm at 25ºC
		Temperature Stability	±0.5 ppm, -10ºC to +85ºC
		Aging (1st year)	±1.0 ppm
		Aging (over 10 years)	±2.5 ppm, including year 1
Rear panel connectors		External frequency standard input	Rear panel BNC socket, 50 Ω 1 volt
		Output 1	TTL high when MT8850A TX on
		Output 2	TTL high when MT8850A RX active
		Input 1	For service use only
GPIB		IEE 488.2 Offers full instrument control as standard. User can also read the 4 x over-sampled magnitude and frequency values of each data bit in the last measured packet	
RS 232		RS 232 interface offering full instrument control as standard	
Power requirements		Supply	85 to 264 Volts AC 47 to 63 Hz 150 VA MAX
Environmental		Operating temperature	5 to +40ºC
		Operating humidity	20% to 75%
		Safety	Complies with IEC 1010-1
		EMC	Conforms to the protection requirements of EEC Council Directive 89/336/EEC.
Size and weight		Dimensions	216.5 mm x 88 mm x 380 mm
		Weight	<3.45 kg

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MT8850A signal generator		
Frequency	Frequency range	2.40 to 2.5 GHz
	Frequency resolution	1 kHz
	Frequency accuracy	As frequency standard ± 25 Hz
	Settling time (when hopping)	<160 µs to ± 75 kHz during the establishing of a link. When a link has been established and the EUT been placed into test mode, the MT8850A transmitter is pre-tuned to ±1 kHz of the nominal channel frequency at the beginning of its data burst for both fixed frequency or hopping measurements.
Level	Amplitude range	0 dBm to -80 dBm
	Amplitude accuracy	±1 dB
	Amplitude resolution	±0.1 dB
	Output impedance	50 Ω (nominal)
	Output VSWR	1.5:1 (typically 1.3) Adjacent channels 3 or higher -40 dBc
	Spurious	30 MHz to 1 GHz; -36 dBc 1 GHz to 12 GHz; -30 dBc 1.8 GHz to 1.9 GHz; -47 dBc 5.15 GHz to, 5.3 GHz; -47 dBc or -80 dBm, whichever is greater
Modulation	Modulation	GFSK
	Modulation index	Variable, 0.25 to 0.38 (125 kHz to 190 kHz)
	Mod index resolution	0.01
	Mod index accuracy	1 kHz
	Baseband filter	BT=0.5
MT8850A measuring receiver		
Frequency	Range	2.40 to 2.5 GHz
	Resolution	1 kHz
	Settling time	<160 µs to 75 kHz during the establishment of a link. When a link has been established and the EUT has been placed into test mode, the MT8850A receiver is pre-tuned to ±1 kHz of the nominal channel frequency.
	Accuracy	As frequency standard ±25 Hz
	Measurement channel bandwidth	3 MHz
Level	Range Power measurement accuracy	+22 dBm to -35 dBm average power ±1 dB (+20 dBm to -35 dBm)
	Input VSWR	1.5:1
	Damage level	+25 dBm
	Resolution	0.1 dB
Modulation	Modulation	GFSK
	Deviation measurement range	0 to 350 kHz peak
	Accuracy	1 kHz

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name
MT8850A	*Bluetooth* Test Set **Included accessories** Power cord for destination country Operation manual RS232 cable for firmware update Remote control programming manual Certificate of calibration EUT control interface lead (RS232)

Model/Order No.	Name
	Options and accessories
MT8850A-01	Rack mount kit, single unit
MT8850A-03	Rack mount kit, side by side
MT8850A-06	rear mount RF and EUT connectors
MT8850A-10	*Bluetooth* antenna and adapter
MT8850A-20	Spare EUT control interface lead (RS 232)
MT8850A-30	Extra Operation and Remote control programming manual
D41310	Soft carry case
760-209	Hard transit case

For product ordering information, see pages 4 –10

RADIO COMMUNICATION ANALYZER
MT8820A
30 MHz to 2.7 GHz

Supports Third Generation W-CDMA

NEW

CE GPIB

The MT8820A hardware platform covers a frequency range of 30 MHz to 2.7 GHz.
When dedicated measurement software and hardware (options) are installed, this single platform supports evaluation of all the main transmission/reception test items for W-CDMA terminals.
Advanced DSP and parallel measurement technologies dramatically reduce wireless manufacturing and inspection test times. Furthermore, several measurement items can be selected freely for batch measurement.
A one-touch operation also allows for each selected batch measurement item to be executed repeatedly for a designated number of times. Pass/fail evaluation of the main measurement items including transmission frequency, modulation accuracy, output power, adjacent channel power, occupied frequency bandwidth, BER, etc., can be performed easily and quickly.
The built-in GPIB interface enables the MT8820A to be integrated into automated production lines as well as to configure an automated test system for after-sales maintenance.

Tests	3GPP TS34.121	Test items
Transmitter tests	5.2	Max. peak transmission power
	5.3	Frequency error
	5.4.3	Min. transmission power
	5.5.1	Transmission off power
	5.8	Occupied frequency bandwidth (OBW)
	5.9	Spectrum radiation mask
	5.10	Adjacent channel power ratio (ACLR)
	5.13.1	Error vector amplitude (EVM)
	5.13.2	Peak code domain error
Receiver tests	6.2	Reference sensitivity level
	6.3	Max. peak input level

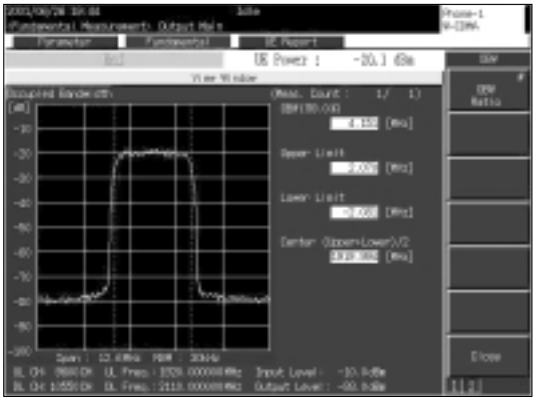
W-CDMA measurement functions
(Using Option 01 and W-CDMA measurement software)

• Transmitter tests

Output power
This test measures the output power of the W-CDMA terminal with the power controlled to maximum, minimum and any other power. When the number of measurements is set to two or more, the max., mean, and min. values of the result are displayed, providing evaluation of the terminal randomness. This repeat measurement function is also supported for other measurements.

Frequency error
This test measures the frequency error of the W-CDMA terminal. The absolute error (kHz) and relative error (ppm) can be measured and displayed simultaneously.

Occupied frequency bandwidth
This test measures the occupied frequency bandwidth of the W-CDMA terminal. The ratio of the frequency band to the total power can be changed in the range of 80.0% to 99.9%.



Spectrum emission mask
This function performs pass/fail evaluation of the W-CDMA terminal spectrum emission mask. Frequency components are checked within ±12.5 MHz of the center frequency that are exceeding the specified limits of the 3GPP standards.

Adjacent channel power
This test measures the adjacent channel power of the W-CDMA terminal. The leakage power at points ±5 and ±10 MHz from the center frequency can be measured at high speed using an advanced measurement algorithm.

Modulation analysis
This test performs modulation analysis of the W-CDMA terminal. In addition to the error vector magnitude (EVM) specified in the 3GPP measurement items, the phase error, amplitude error and origin offset can also be measured.

Peak code domain error
The test measures the peak code domain error of the W-CDMA terminal.

• Down link RF signal generation function
The relative level of each of the CPICH*1, P-CCPCH*2, SCH*3, PICH*4, DPCH*5, S-CCPCH*6, and AICH*7 code channels can be set in the range of –30.0 to 0.0 dB. In addition, OCNS*8 and AWGN*9 are also provided, making it possible to generate any down link modulation signal required for transmitter and receiver tests. The RF output level can be set in 0.1 dB steps across a range of –140 to –10 dBm (MAIN I/O connectors)

*1: Common Pilot Channel, *2: Primary Common Control Physical Channel, *3: Synchronization Channel, *4: Paging Indicator Channel, *5: Dedicated Physical Channel, *6: Secondary Common Control Physical Channel, *7: Acquisition Indication Channel, *8: Orthogonal Channel Noise Simulator, *9: Additive White Gaussian Noise

• Receiver tests

Bit error rate measurement
Bit error rate can be measured by the loopback method specified in the 3GPP standards. In addition, bit error rate can also be measured by directly inputting the demodulated data and clock signals from a PDC terminal when the PDC terminal test is executed. Either PN9 or PN15 can be selected as the data pattern that is inserted in the down link RF signal.

• Call processing function

Connection tests
Various connection tests such as registration, origination, termination, disconnection from terminal, disconnection from network, etc., can be performed by using the call processing function. In addition, the voice signal from the terminal can be echoed-back during conversation to perform a simple voice communications test.

Measurement results batch read command
All the results of a single batch measurement can be read using the ALLMEAS command. Specific measurement results can be selected and reported by specifying the measurement items, for example ALLMEAS MOD (for modulation analysis). The load on the GPIB bus of both the MT8820A and the host PC has been lightened by reducing the number of GPIB commands to increase throughput. Moreover, the number of steps in the control program has been reduced, making it easy to understand and easy to write comprehensive remote control programs.

For product ordering information, see pages 4 – 10

Specifications

• MT8820A (main frame)

General	Frequency range: 30 to 2700 MHz Max. input level: +35 dBm (MAIN 1) MAIN 1 I/O Impedance: 50 Ω VSWR: ≤1.2 (<1.6 GHz), ≤1.25 (1.6 to 2.2 GHz), ≤1.3 (>2.2 GHz) Connector: N type AUX 1 output Impedance: 50 Ω VSWR: ≤1.3 (at SG Output level: ≤–10 dBm) Connector: SMA type Reference oscillator Frequency: 10 MHz Level: TTL Startup characteristics: ≤±5 x 10^{-8} (at 10 min after startup referenced to frequency 24 h after startup) Aging rate: ≤±2 x 10^{-8}/day, ≤±1 x 10^{-7}/year (referenced to frequency 24 h after startup) Temperature characteristics: ≤±5 x 10^{-8} Connector: BNC type External reference input Frequency: 10 MHz or 13 MHz (±1 ppm) Level: ≥0 dBm Impedance: 50 Ω Connector: BNC type
RF signal generator	Frequency Frequency range: 30 to 2700 MHz (setting range: 0.4 to 2700 MHz) Setting resolution: 1 Hz Accuracy: Due to reference oscillator accuracy Output level Level range: –140 to –10 dBm (MAIN 1), –130 to 0 dBm (AUX 1) Resolution: 0.1 dB Accuracy: ±1.0 dB (–120 to –10 dBm, MAIN 1, after calibration), ±1.0 dB (–110 to 0 dBm, AUX 1, after calibration) Signal purity Non-harmonic spurious: ≤–50 dBc (offset frequency: ≥100 kHz), ≤–40 dBc [spurious of (4.8 –Fout) GHz at ≥2.1 GHz] Harmonics: ≤–25 dBc Uninterrupted level variation Variable range: 0 to –30 dB Setting resolution: 1 dB
Others	Display: Color 8.4" TFT LCD, 640 x 480 dots External control GPIB: Control from external host with main unit as device (excluding some functions such as power-on), no external device control Interface functions: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2
Power supply	100 to 120/200 to 240 Vac (–15/+15%, 250 V max.), 47.5 to 63 Hz, ≤300 VA (with Option 01)
Dimensions and mass	426 (W) x 221.5 (H) x 498 (D) mm (excluding projections), ≤23 kg
Environmental conditions	Operating temperature and humidity: 0˚ to +50˚C, ≤95% (no condensation) Storage temperature and humidity: –20˚ to +60˚C, ≤95% (no condensation) EMC: EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class A), EN61326: 1997/A1: 1998 (Annex A) LVD: EN61010-1: 1993/A2: 1995 (Installation Category Ⅱ, Pollution degree 2)

• Option 01 (W-CDMA measurement hardware), MX882000A W-CDMA Measurement Software

Modulation analysis	Frequency: 300 to 2200 MHz Input level: –30 to +35 dBm (MAIN) Carrier frequency accuracy: Reference oscillator accuracy + 10 Hz Modulation accuracy (residual vector error): ≤2.5% (at input of 1-DPCCH and 1-DPDCH)
RF power	Frequency: 300 to 2200 MHz Input level: –65 to +35 dBm (MAIN) Measurement accuracy: ±0.5 dB (–25 to +35 dBm), ±0.7 dB (–55 to –25 dBm), ±0.9 dB (–65 to –55 dBm) ∗After calibration Linearity: ±0.2 dB (–40 to 0 dB, ≥–55 dBm), ±0.4 dB (–40 to 0 dB, ≥–65 dBm) Measurement object: DPCH, PRACH
Occupied bandwidth	Frequency: 300 to 2200 MHz Input level: –10 to +35 dBm (MAIN)
Adjacent channel power	Frequency: 300 to 2200 MHz Input level: –10 to +35 dBm (MAIN) Measurement points: ±5 MHz, ±10 MHz Measurement range: ≥50 dB (at ±5 MHz), ≥55 dB (at ±10 MHz)
RF signal generator	Output frequency: 300 to 2200 MHz (1 Hz step) Channel level (CPICH, P-CCPCH, SCH, PICH, DPCH, S-CCPCH, AICH): Off, –30.0 to 0.0 dB [0.1dB step, relative level for Ior (total level)] Channel level (OCNS): Off, Auto-setting Channel level accuracy: ±0.2 dB (relative level accuracy for Ior) AWGN level: Off, –20 to +5 dB (0.1 dB step) AWGN level accuracy: ±0.2 dB (relative level accuracy for Ior)
Bit error rate measurement	Functions: Insert PN9 or PN15 pattern in DTCH Measurement items: BER Measurement objective: Loop-back data imposed in up-channel, serial data input from rear-panel call processing I/O port
Call processing	Origination control: Registration, origination, disconnection from network, disconnection from mobile station (executes each processing based on 3GPP standards and performs pass/fail judgment) Mobile station control: Output level, loop-back (executes each mobile function control based on 3GPP standards)

Ordering information

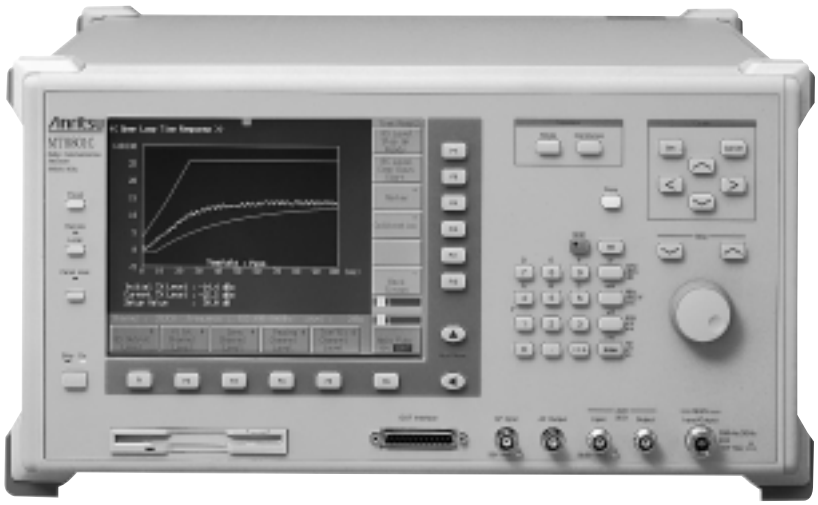
Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MT8820A	Radio Communication Analyzer	
	Standard accessories	
J0576B	Coaxial cord (N-P · 5D-2W · N-P), 1 m:	1 pc
	Power cord, 2.6 m:	1 pc
HB288064C5	Compact flash card:	1 pc
CA68ADP	PC card adapter:	1 pc
W1940AE	MT8820A operation manual (CD-ROM):	1 copy
	Options	
MT8820A-01	W-CDMA Measurement Hardware	
MX882000A	W-CDMA Measurement Software (requires MT8820A-01)	
	Application parts	
J0576D	Coaxial cord (N-P · 5D-2W · N-P), 2 m	
J0127A	Coaxial cord (BNC-P · RG58A/U · BNC-P), 1 m	
J0127C	Coaxial cord (BNC-P · RG58A/U · BNC-P), 0.5 m	
J0007	GPIB connection cable, 1 m	
J0008	GPIB connection cable, 2 m	
MN8110A	I/O Adapter (for call processing I/O)	
B0332	Extender boards (4 pcs/set)	
B0333G	Rack mount kit	
B0499	Carrying case (hard type with protective cover and casters)	
B0499B	Carrying case (hard type with protective cover but no casters)	

For product ordering information, see pages 4 – 10

RADIO COMMUNICATION ANALYZER
MT8801C
300 kHz to 3 GHz

Support for CDMA, GSM, DECT, IS-136A, PDC and PHS



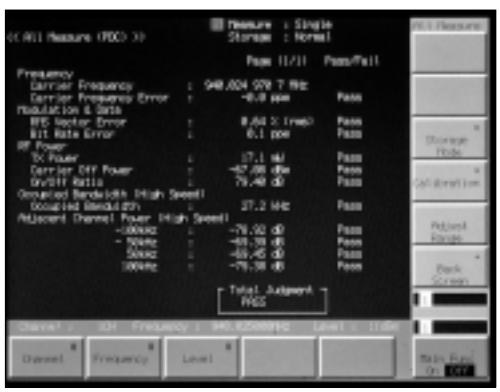
CE GPIB

Every major radio communication system in the world including AMPS/PCS1900, GSM400/900/1800/1900, GPRS, HSCSD, DECT, IS-136A, PDC, and PHS can be evaluated using just one MT8801C Radio Communication Analyzer, covering the 300 kHz to 3 GHz frequency band in one hardware platform, and the dedicated measurement software options. The call processing test and sensitivity test using the loopback method are possible for GSM/DCS1800/PCS1900, CDMA, IS-136A and DECT. In addition, connection testing as well as send testing while communicating, are also possible for PDC and PHS measurement by using the call processing function, and the PDC uplink RCH can be monitored (RSSI, estimated error rate) too. FM radio transmission/reception tests are simplified by using the optional analog measurement function, and the optional spectrum analyzer function covering 10 MHz to 3 GHz is very useful for maintaining as well as measuring spurious near carrier on production lines. GPIB and RS-232C interfaces are standard, so MT8801C can be incorporated easily into automated production lines or on-site automated testing systems.
The time required for testing equipment on production lines is greatly reduced using the high-speed adjacent channel power and occupied bandwidth measurement functions based on Anritsu's proprietary measurement algorithm and DSP (Digital Signal Processing). Furthermore, major transmission test items such as transmission frequency, modulation accuracy (phase error), transmission power, rise/fall characteristics of burst wave, adjacent channel power, etc. can be measured and judged pass/fail for the limit value of each item.

Features
- 1 unit for GSM, DECT, IS-136A, PDC and PHS systems
- All basic transmission and reception measurements performed by 1 unit

System type	Measurement software option	Description
IS-136A	MX880113A	Tx and Rx measurements of IS-136A mobile stations including call processing (requires option 01)
AMPS PCS1900	MX880114A	Tx and Rx measurements of AMPS analog mobile stations and PCS1900 digital mobile telephones including call processing (requires option 01)
GSM400/ 900/1800/ 1900	MX880115A	Tx and Rx measurements of GSM and advanced GSM mobile stations including call processing and multiple timeslot measurements
PDC	MX880116A	Tx and Rx measurements of PDC mobile stations including call processing
	MX880131A	Tx and Rx measurements of PDC mobile stations
PHS	MX880117A	Tx and Rx measurements of PHS mobile stations including call processing
	MX880132A	Tx and Rx measurements of PHS base stations and mobile stations
DECT	MX880118A	Tx and Rx measurements both portable part and fixed part for DECT including call processing (requires option 07)
GSM	Option 11	Audio test of GSM mobile stations including call processing (requires MX880115A and option 01)
CDMA	Option 12	Tx and Rx measurements of mobile stations including call processing (requires option 01)

Transmission test
• Batch measurements of transmission test items
Only about 1 second is required to measure all major transmission test items, including frequency, modulation accuracy, origin offset, transmission rate, transmission power, leakage power during carrier-off, rise/fall edge characteristics, occupied bandwidth, and adjacent channel power. Pass/fail decisions for limit value of each test item can also be displayed.



Example of linked send measurement items (PDC)

• Calibration functions
A built-in thermocouple power sensor is used for calibration, providing accurate measurement of absolute values such as average power within burst signal and leakage power during carrier-off. There is no need for other instruments; just one press of the CAL key during measurement performs calibration.

• Wide-band power meter
The power meter with built-in thermocouple power sensor can accurately measure power between 0 and +40 dBm.

• Modulation analysis
The user can display the waveform as either frequency deviation, eye diagram or constellation diagram to easily show any irregularities in the modulation.

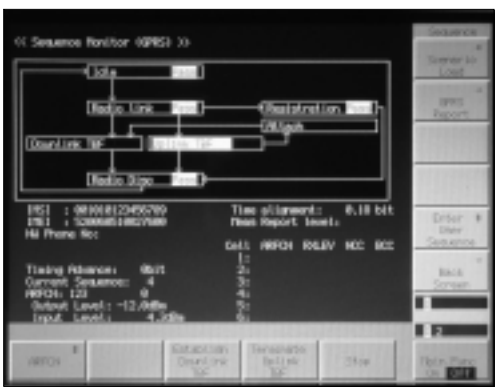
• Measurement of antenna power rise/fall edge characteristics
Antenna power rise/fall edge characteristics can be measured simultaneously with antenna power measurements. In addition, the marker points can be moved and the power can be read directly with 1/10 symbol resolution.

• Adjacent channel power measurement
The MT8801C can measure adjacent channel power for each communication system at high speed.

• Receiver sensitivity measurement
This function displays the error count and error rate in the RF input or DATA/CLOCK input measured signal.

Bit error rate measurement (IS-136A)

• Call processing function
The MT8801C acts as a pseudo base station permitting to judge pass/fail for registration, origination, termination, communication, handover (PHS: TCH switching type only), disconnection from network, and disconnection from mobile station at the sequence monitor screen.



Sequence monitor display (GSMGPRS)

Analog measurement

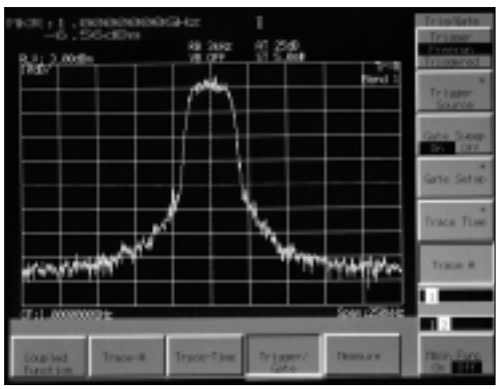
• Analog measurement function (Option 01)
The MT8801C has general analog measurement functions too. Efficient FM TX/RX testing is made easy by built-in signal generator, AF oscillator, RF analyzer (power meter, frequency counter, FM measurement) and audio analyzer functions. This function is especially useful for the IS-136A analog test.

• Transmission measurement
Characteristics such as frequency, power, and frequency deviation can be measured easily.

• Reception measurement
An FM modulated signal is output to permit measurement of the frequency and level of the AF signal from a receiver, as well as SINAD and distortion.

Spectrum analysis

• Spectrum analyzer function (Option 07)
The spectrum analyzer with synthesized local oscillator covers a frequency range of 10 MHz to 3 GHz with a resolution of 1 Hz. In addition to a C/N of –115 dBc (100 kHz offset), the RBW can be set to 300 Hz to 1 MHz, the VBW to 3 to 100 kHz, and the sweep time in the frequency domain to 100 ms to 1000 s (1 ms to 1000 s in time domain). The total level accuracy is an astonishing ±1.5 dB due to the analyzer's excellent linearity and the level calibration function. Moreover, the average noise level is just –85 dBm max (at 10 MHz to 1 GHz), and the secondary harmonic distortion is –60 dB max (100 MHz to 1.5 GHz).



IS-136A modulated wave measurement

Options

• Option 04: AF low impedance output
This option converts the output impedance of the AF oscillator of the Option 01 analog measurement to low impedance. It permits direct driving of an external speaker connected to the AF output connector.

• Option 11: GSM audio test
When using with the MX880115A GSM Measurement Software, speech Tx/Rx characteristics can be measured in accordance with GSM Rec. RPE LTP (Full Rate Speech CODEC).
The audio signal generated by the MT8801C is digitally processed and ideal audio signal is sent. In addition, this option can also be used to digitally process an audio signal sent from a GSM terminal for high-reliability and high-accuracy measurement.

• Option 12: CDMA measurement
The Option 12 can measure the following systems; USA 800-MHz cellular band (TIA/EIA/IS-95A standard), USA 1.9 GHz PCS band (ANSI J-STD-008 standard), Japan 800-MHz cellular band (ARIB STD-T53 standard).
The CDMA and analog dual mode standardized in the IS-95A standard are supported.

For product ordering information, see pages 4 – 10

Specifications

• MT8801C

Frequency range	300 kHz to 3 GHz
Maximum input level	+40 dBm (10 W, MAIN connector), +20 dBm (100 mW, AUX connector)
Input/output connector	MAIN I/O connector Impedance: 50 Ω, N-type VSWR: ≤1.2 (≤2.2 GHz), ≤1.3 (>2.2 GHz) AUX input/output connector: TNC-type
Reference oscillator	Frequency: 10 MHz Starting characteristics: ≤5 x 10^{-8}/day (after 10 minutes of warm-up, referred to frequency after 24 hours warm-up) Aging rate: ≤2 x 10^{-8}/day, ≤1 x 10^{-7}/year (referred to frequency after 24 hours warm-up) Temperature characteristics: ≤5 x 10^{-8} (0˚ to 50˚C, referred to frequency at 25˚C) External standard input: 10 MHz or 13 MHz (±1 ppm), input level: 2 to 5 Vp-p
Power meter	Frequency range: 300 kHz to 3 GHz Level range: 0 to +40 dBm, –10 to +40 dBm (CDMA measurement) Level accuracy: ±10% (0 to +40 dBm, after zero point calibration), ±10% (–10 to +40 dBm, 18˚ to 28˚C, at average value, after zero point calibration)
Signal generator	Frequency Range: 300 kHz to 3 GHz Resolution: 1 Hz Accuracy: Reference frequency accuracy ±100 mHz Output level Level range (no modulation or analog modulation): –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Level accuracy: ±1 dB (10 MHz to 2.2 GHz, ≥–123 dBm, 18˚ to 28˚C), ±3 dB (10 MHz to 2.2 GHz, ≥–133 dBm), ±2 dB (>2.2 GHz, ≥–123 dBm, 18˚ to 28˚C), ±4 dB (>2.2 GHz, ≥–133 dBm) Radiated interference: 1 µV/50 Ω (carrier frequency measured, 25 mm from front panel with two-turn 25 mm diameter loop antenna) Signal purity Spurious: ≤–50 dBc (at CW, offset frequency 100 kHz to ≤50 MHz; where carrier frequency: other than 1300 MHz to 1400 MHz and 2000 MHz to 2100 MHz), ≤–40 dBc (for all band) Harmonics: ≤–25 dBc (at CW)
Others	Display: Color TFT-LCD, 7.8 inch, 640 x 480 dots Hard copy: Enables data hard copy of the display through a parallel interface (applicable only for EPSON VP series or equivalent) GPIB: This equipment is specified as a device, can be controlled from external controller (excluding power switch and FD ejection key). No controller function Interface: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0, E2) Parallel Conform to the Centronics. Outputs printing data to printer. Data line exclusive for output: 8 Control line: 4 (BUSY, $\overline{\text{DTSB}}$, $\overline{\text{ERROR}}$, PE) Connectors: D-sub 25 pins, female (equivalent to the connector of IBM-PC/AT built-in printer) RS-232C: All functions except power switch controlled by external controller (baud rate: 1200, 2400, 4800, 9600 bps)
Dimensions and mass	426 (W) x 221.5 (H) x 451 (D) mm, ≤22 kg
Power	100 to 120/200 to 240 Vac (automatic voltage switch system), 47.5 to 63 Hz, ≤300 VA
Operating temperature	0˚ to 50˚C
EMC	EN61326: 1997/A1, 1998 (Class A) EN61000-3-2: 1995/A2, 1998 (Class A) EN61326: 1997/A1, 1998 (Annex A)
LVD	EN610101-1: 1993/A2, 1995 (Installation Category Ⅱ, Pollution degree 2)

• Option 01: Analog measurement

RF signal generator	Frequency range: 10 MHz to 3 GHz Output level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) FM deviation: 0 to 40 kHz (resolution: 10 Hz) Accuracy: Set value ±5% ±1 digit (internal modulation frequency: 1 kHz, excluding residual FM) Internal modulation: 20 Hz to 20 kHz External modulation: 20 Hz to 20 kHz (limited to 1Vpeak into 600 Ω) Flatness: ±0.5 dB (referenced to 1 kHz between 0.3 to 3 kHz with 4 kHz deviation) ±1 dB (referenced to 1 kHz between 20 Hz to 20 kHz with 4 kHz deviation) Distortion: ≤–50 dB (internal modulation frequency: 1 kHz, demodulation bandwidth: 0.3 to 3 kHz, frequency deviation: 5 kHz)
AF Generator	Frequency range: 20 Hz to 20 kHz, Setting resolution: 0.1 Hz, Accuracy: Same as reference oscillator Output Level range: 0.1 mVrms to 3.0 Vrms (EMF, MAIN output impedance: 600 Ω) 0.1 mVrms to 0.3 Vrms (EMF, MAIN output impedance: 50 Ω) Setting resolution: 1 µV (output level: <4 mV), 10 µV (output level: <40 mV) 100 µV (output level: <0.4 V), 1 mV (output level: ≤3 V) Accuracy (bandwidth: <30 kHz) Unbalanced output: ±0.5 dB (frequency: 1 kHz, output level: ≥1 mV), ±1 dB (frequency: 20 Hz to 20 kHz, output level: ≥1 mV) Floating output: ±2 dB (frequency: 1 kHz, output level: ≥1 mV) Output impedance MAIN output: 600 Ω, 50 Ω selectable (unbalanced, BNC connector) DUT interface microphone output: 600 Ω, floating Distortion: <–50 dBc (bandwidth: <30 kHz, frequency: 1 kHz, output level: 1 V) <–45 dBc (bandwidth: <30 kHz, frequency: 20 Hz to 20 kHz, output level: 1 V) Noise generator: White noise passed through a weighting filter (conforming to ITU-T Rec. G.227)

Continued on next page

Transmission measurement	RF power meter	Frequency range: 300 kHz to 3 GHz Input range: 0 to +40 dBm (MAIN connector) Accuracy: ±10% (after zero calibration)
	IF level meter	Frequency range: 10 MHz to 3 GHz Input range: 0 to +40 dBm (MAIN connector) Accuracy: ≤10% (after calibration with internal RF power meter) Linearity: ±0.3 dB (0 to –30 dB)
	Frequency counter	Frequency range: 10 MHz to 3 GHz Input level range: –15 to +40 dBm (MAIN connector), –40 to +20 dBm (AUX connector) Resolution: 1 Hz Accuracy: ±(reference oscillator accuracy + 10 Hz) Method: IF frequency counting (bandwidth: ±30 kHz)
	Modulation	FM Frequency range: 10 MHz to 3 GHz Input level range: –15 to +40 dBm (MAIN connector), –40 to +20 dBm (AUX connector) Filters (3 dB cut-off frequency): HPF (300 Hz, 50 kHz), LPF (3 kHz, 15 kHz) Deviation: 0 to 20 kHz Demodulation frequency: 20 Hz to 20 kHz Accuracy: 1% + residual FM (demodulation frequency: 1 kHz) Frequency response: ±0.5 dB (referenced to 1 kHz) Residual FM: 8 Hz-rms (demodulation frequency: 0.3 to 3 kHz) Distortion: 0.3% (modulation frequency: 1 kHz, demodulation bandwidth: 0.3 to 3 kHz) øM Frequency range: 10 MHz to 3 GHz Input level range: –15 to +40 dBm (MAIN connector), –40 to +20 dBm (AUX connector) Filters (3 dB cut-off frequency): HPF (300 Hz, 50 kHz), LPF (3 kHz, 15 kHz) Deviation: 0 to 10 rad Demodulation frequency: 300 Hz to 3 kHz Accuracy: 1% + residual øM (modulation frequency: 1 kHz) Frequency response: ±0.5 dB (referenced to 1 kHz) Residual øM: 0.01 rad-rms (demodulation bandwidth: 0.3 to 3 kHz) Distortion: 0.5% (modulation frequency: 1 kHz, demodulation bandwidth: 0.3 to 3 kHz, deviation: 5 rad) FM demodulation output Deviation: 0 to 40 kHz (4/40 kHz range selectable) Demodulation frequency range: 50 Hz to 10 kHz Output level: 4 Vpeak (EMF, at full-scale range) Output impedance: 600 Ω Frequency response: ±1 dB Distortion: 1% (FM frequency: 1 kHz, demodulation bandwidth: 0.3 to 3 kHz, frequency deviation: 4 kHz) Filters (3 dB cut-off frequency): HPF (300 Hz), LPF (3 kHz) De-emphasis: 750 µs
Audio analyzer		Input impedance: 600 Ω/100 kΩ selectable (unbalanced, BNC connector) Bandpass filter HPF: 400 Hz (for tone rejection) De-emphasis: 750 µs Weighting filter: ITU-T P.53, C-MESSAGE AF Level meter Frequency range: 30 Hz to 20 kHz Level range: 1 mVrms to 30 Vrms Accuracy: ±0.5 dB AF frequency counter Frequency range: 30 Hz to 20 kHz Level range: 30 mVrms to 30 Vrms Accuracy: ±0.1 Hz Distortion meter Frequency range: 100 Hz to 5 kHz Level range: 30 mVrms to 30 Vrms Accuracy: ±1 dB (frequency: 1 kHz, distortion factor: 1%)
Mass		≤500 g

• Option 04: AF low impedance output

AF oscillator	Output impedance*1: ≤1 Ω (MAIN connector, unbalanced, BNC connector) Maximum output current: ≥100 mApeak (MAIN connector) Waveform distortion: –50 dBc (band: <30 kHz, 1 kHz, output level: 0.3 V), –45 dBc (band: <30 kHz, 20 Hz to 20 kHz, output level: 0.3 V)

*1: <1 Ω fixed (can not exchange to 50/600 Ω)

For product ordering information, see pages 4 – 10

• Option 07: Spectrum analyzer

Frequency	Band Band 0: 0 Hz to 3 GHz, Band 1: 10 MHz to 3 GHz; HPF: On/off switchable (Band 1, 1.6 to 3 GHz) Setting range 0 to 3 GHz (Band: 0), 10 MHz to 3 GHz (Band: 1); Resolution: 1 Hz Display accuracy: ± (display frequency x reference frequency accuracy + span x span accuracy) Marker frequency accuracy Normal marker: Same as display frequency accuracy; Delta marker: Same as span accuracy Span setting range: 0 Hz or 10 kHz to 3 GHz (Band: 0), 0 Hz or 10 kHz to 2.99 GHz (Band: 1) Span accuracy: ±2.5% Resolution bandwidth Setting range: 300 Hz to 1 MHz (3 dB BW, 1-3 sequence) Accuracy: ±2% (300 Hz to 300 kHz), ±10% (1 MHz) Selectivity (60 dB:3 dB): ≤5:1 Video bandwidth: 3 Hz to 100 kHz (1-3 sequence) or through ∗Setting range is limited by resolution bandwidth. Sideband noise: ≤–95 dBc/Hz (1 GHz, 10 kHz offset), ≤–115 dBc/Hz (1 GHz, 100 kHz offset)
Amplitude (band 1)	Maximum input level Continuous average power: +40 dBm (MAIN connector), +20 dBm (AUX connector) DC voltage: 0 V Average noise level (resolution bandwidth: 1 kHz, video bandwidth: 10 Hz) ≤–90 dBm (10 MHz to 2.2 GHz), ≤–85 dBm (>2.2 GHz) ∗MAIN connector input, input attenuator: 20 dB ≤–110 dBm (10 MHz to 2.2 GHz), ≤–105 dBm (>2.2 GHz) ∗AUX connector input, input attenuator: 0 dB Residual response: ≤–70 dBm (MAIN connector, input attenuator: 20 dB), ≤–90 dBm (AUX connector, input attenuator: 0 dB) Level accuracy ±1.5 dB (MAIN connector, reference level: +10.1 to +40 dBm, at 0 to –50 dB of reference level) ±1.5 dB (AUX connector, reference level: –9.9 to +20 dBm, at 0 to –50 dB of reference level) Reference Level Setting range: ≤–60 to +50 dBm (MAIN connector), ≤–80 to +30 dBm (AUX connector) Setting resolution: 0.1 dB Accuracy: ±0.5 dB (MAIN connector, +10.1 to +40 dBm), ±1.0 dB (MAIN connector, –60 to +10 dBm), ±0.5 dB (AUX connector, –9.9 to +20 dBm), ±1.0 dB (AUX connector, –80 to –10 dBm) ∗After calibration, frequency: 100 MHz, span: 2 MHz; Input attenuator, resolution bandwidth, video bandwidth, sweep time are AUTO.) Resolution bandwidth switching deviation: ±0.1 dB (resolution bandwidth reference: 3 kHz) Frequency characteristics: ±0.5 dB [100 MHz reference, input attenuation: 30 dB (10 dB for AUX input), 18˚ to 28˚C] Log linearity: ±0.5 dB (0 to –50 dB, resolution bandwidth: ≤1 MHz), ±1.0 dB (0 to –70 dB, resolution bandwidth: ≤30 kHz), ±1.0 dB (0 to –80 dB, resolution bandwidth: ≤1 kHz) ∗10 MHz to 2.2 GHz, reference level: ≥0 dBm (MAIN connector)/≥–20 dBm (AUX connector) Spurious (2nd harmonic distortion): ≤–55 dBc (10 to 100 MHz), ≤–60 dBc (100 to 1500 MHz) ∗Mixer input: –30 dBm
Sweep	Sweep time: 100 ms to 1000 s (frequency domain sweep), 100 ms to 1000 s (time domain sweep, resolution bandwidth: ≤1 kHz) 10 ms to 1000 s (time domain sweep, resolution bandwidth: 3 to 10 kHz), 1 ms to 1000 s (time domain sweep, resolution bandwidth: ≥30 kHz) Trigger switch: FREERUN, TRIGGERED Trigger source: WIDE IF VIDEO (3 dB bandwidth: ≥20 MHz, trigger slope: RISE/FALL), EXT (trigger: TTL level, trigger slope: RISE/FALL) Trigger delay Range: 0 µs to 100 ms, Resolution: 2 µs Gate sweep Displays spectrum of input signal at specified gate on frequency domain display Gate delay: 2 µs to 100 ms from trigger start point (resolution: 2 µs) Gate width: 2 µs to 100 ms from gate delay point (resolution: 2 µs)
Functions	Marker functions Signal search: PEAK → CF, PEAK → REF Zero marker: NORMAL, DELTA Marker function: MARKER → CF, MARKER → REF, ZONE → SPAN Peak search: PEAK, NEXT PEAK, NEXT RIGHT PEAK, NEXT LEFT PEAK Measurement function Noise power: dBm/Hz, dBm/ch C/N: dBc/Hz, dBc/ch Occupied bandwidth: N% of power method, X-dB down method Adjacent channel power: Reference total power method, reference level method, channel designate display (2 channels x 2), graphic display Average power within a burst: Average power of time domain waveform within specified time
Others	Number of data point: 501 points Detector mode POS PEAK: Displays max. point between sample points, NEGATIVE PEAK: Displays min. point between sample points, SAMPLE: Displays momentary value at sample points Display memory TRACE A: Displays frequency spectrum, TRACE B: Displays frequency spectrum, Trace time: Displays time domain waveform at center frequency Storage function: NORMAL, VIEW, MAX HOLD, MIN HOLD, AVERAGE, CUMULATIVE, OVER WRITE

• Option 11: GSM audio test

Tx measurement	Decoding characteristics	Frequency range: 50 Hz to 4 kHz Level range: 0 to 3.2768 V Accuracy: ±1 Hz (500 Hz to 2 kHz)
	AF oscillator	Frequency range: 50 Hz to 20 kHz (setting resolution: 50 Hz) Accuracy: Same as reference oscillator Output level range: 50 mVrms to 3 Vrms (EMF) ∗Setting resolution: 0.1 mV Accuracy (bandwidth: <30 kHz) Unbalanced output: ±0.5 dB (1 kHz, ≥1 mV), ±1 dB (20 Hz to 20 kHz, ≥1 mV) Floating output: ±2 dB (1 kHz, ≥1 mV) Output impedance Main output: 600 Ω, 50 Ω (unbalanced, BNC connector) Microphone input: 600 Ω (floating, DUT interface) Waveform distortion (bandwidth: <30 kHz): <–50 dBc (1 kHz, 1 Vrms), <–45 dBc (20 Hz to 20 kHz, 1 Vrms)
Rx measurement	Coded signal	Frequency range: 50 Hz to 4 kHz (setting resolution: 50 Hz) Level range: 0 to 2.2 V (setting resolution: 0.1 mV)
	AF level measurement	Frequency range: 30 Hz to 20 kHz Level range: 1 mVrms to 30 Vrms Accuracy: ±0.5 dB
	AF frequency measurement	Frequency range: 30 Hz to 20 kHz Level range: 30 mVrms to 30 Vrms Accuracy: ±0.1 Hz

• Option 12: CDMA measurement

Signal generator	Frequency range IS-95A: 869.01 to 893.97 MHz (30 kHz step) J-STD-008: 1930.00 to 1989.95 MHz (50 kHz step) ARIB STD-T53: 832.0125 to 833.9875 MHz, 843.0125 to 845.9875 MHz, 860.0125 to 869.9875 MHz (12.5 kHz step) KORER-PCS: 1805.05 to 1870.00 MHz (50 kHz step) Level setting range: –133 to –18 dBm (Main connector, AWGN off), –133 to +2 dBm (AUX connector, AWGN off) –133 to –24 dBm (Main connector, AWGN on), –133 to –4 dBm (AUX connector, AWGN on) Relative level accuracy: ±0.2/20 dB (Relative level accuracy at level change in time response of open-loop power control 18˚ to 28˚C) Waveform quality: >0.99 (pilot channel: 0 dB) Channel level accuracy: ±0.2 dB (relative level accuracy between any 2 channels) AWGN level accuracy: ±0.2 dB (relative level for forward traffic channel)
Reception measurement	FER measurement: FER measurement value, error frame number, test frame number, reliability limit (pass/fail)
Transmission measurement	Frequency range IS-95A: 824.01 to 848.97 MHz (30 kHz step) J-STD-008: 1850.00 to 1909.95 MHz (50 kHz step) ARIB STD-T53: 887.0125 to 888.9875 MHz, 898.0125 to 900.9875 MHz, 915.0125 to 924.9875 MHz (12.5 kHz step) KORER-PCS: 1715.05 to 1780.00 MHz (50 kHz step) Modulation analysis Level range: –20 to +40 dBm (average power within a burst, main connector only) Waveform quality measurement range: 0.9 to 1.0 Measurement error: ±0.003 (after executing adjust range) Residual vector error: <5% (after executing adjust range) Power measurement (IF level meter) Measurement range: –50 to +40 dBm Measurement accuracy: ±0.4 dB (0 to +40 dBm, after executing power meter calibration) ±0.4 dB (–10 to +40 dBm, after executing power meter calibration, 18˚ to 28˚C) ±0.7 dB (–10 to +40 dBm, after executing internal oscillator calibration, 18˚ to 28˚C) Linearity: ±0.1 dB (0 to –10 dB), ±0.2 dB (–10 to –20 dB), ±0.5 dB (–20 to –40 dB) ∗Referred to reference level: ≥–10 dBm Input connector: Main connector only Occupied bandwidth measurement Level range: 0 to +40 dBm (average power within a burst, MAIN connector), –20 to +20 dBm (average power within a burst, AUX connector) Spurious close to the carrier measurement Level range: 0 to +40 dBm (average power within a burst, MAIN connector), –20 to +20 dBm (average power within a burst, AUX connector) Measurement range: ≥50 dB (900 kHz offset), ≥60 dB (1.98 MHz offset) Spurious measurement Level range: 0 to +40 dBm (average power within a burst, MAIN connector), –20 to +20 dBm (average power within a burst, AUX connector) Measurement range: ≥60 dB
Call processing	Functions: Registration, origination, termination, conversation, loopback, hard handoff, disconnection from network, disconnection from mobile station, CDMA → analog handoff (IS-95A), soft handoff (MX880201A-01), softer handoff (MX880201A-01) Protocol: IS-95A (CDMA, analog), J-STD-008, ARIB STD-T53

For product ordering information, see pages 4 – 10

• MX880113A IS-136A Measurement Software (extracts)

Transmission measurement	Digital	Frequency/modulation measurement Frequency range: 10 MHz to 2.2 GHz Modulation accuracy: ± (2% of indicated value + 0.5%) Amplitude measurement Input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmitter power accuracy: ±10% (MAIN connector, after calibration) Adjacent channel power measurement Measurement range: ≥30 dB (30 kHz offset), ≥60 dB (60 kHz offset), ≥65 dB (90 kHz offset) Batch measurement functions Measurement time: ≤1.5 s (amplitude measurement in normal mode)
	Analog	Same as Option 01
Reception measurement	Digital	Signal generator Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation accuracy: ≤3%rms Error rate measurement Measurement pattern: PN9 (measures TCH data of up communication burst at RF input) Number of measurement bits: 1 to 99999999
	Analog	Same as Option 01
Call processing		Pass/fail judgement of registration, origination, termination communication, handoff, disconnection from network, disconnection from mobile station

• MX880114A AMPS/PCS1900 Measurement Software (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Residual phase error accuracy: ≤0.5° rms, ≤2° peak
	Amplitude measurement	Input level range: –5 to +40 dBm (average power within burst, MAIN connector) Calibration input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmission power accuracy: ±0.4 dB (+10 to +40 dBm), ±0.7 dBm (–5 to +40 dBm) ∗MAIN connector, after calibration by using built-in power meter with same Tx reference level as calibration
	Output RF spectrum measurement	Modulation portion measurement range: ≥50 dB (200 kHz offset), ≥66 dB (250 kHz offset) Transition portion measurement range: ≥57 dB (400 kHz offset)
	All measurement items	Measurement time: ≤2.0 s (amplitude measurement: normal mode, except MS report measurement)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Phase error: ≤1° rms, ≤4° peak
	Error rate measurement	Measurement pattern: 10 test patterns selectable Number of measurement samples: 1 to 99999999 (FER, CIb, CII)
Call processing		Pass/fail judgement of registration, origination, termination, communication, hand-over, disconnection from network, disconnection from mobile station
Analog measurement		Same as Option 01 for AMPS

• MX880115A GSM Measurement Software (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Residual phase error accuracy: ≤0.5° rms, ≤2° peak
	Amplitude measurement	Input level range: –5 to +40 dBm (average power within burst, MAIN connector) Calibration input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmission power accuracy: ±0.4 dB (+10 to +40 dBm), ±0.7 dBm (–5 to +40 dBm) ∗MAIN connector, after calibration by using built-in power meter with same Tx reference level as calibration
	Output RF spectrum measurement	Modulation portion measurement range: ≥50 dB (200 kHz offset), ≥66 dB (250 kHz offset) Transition portion measurement range: ≥57 dB (400 kHz offset)
	All measurement items	Measurement time: ≤2.0 s (amplitude measurement: normal mode, except MS report measurement)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Phase error: ≤1° rms, ≤4° peak
	Error rate measurement	Measurement pattern: 10 test patterns selectable Number of measurement samples: 1 to 99999999 (FER/CRC, CIb, CII, FAST)
Call processing		Pass/fail judgement of registration, origination, termination, communication, hand-over, disconnection from network, disconnection from mobile station
Analog measurement		Same as Option 01 for AMPS

• MX880116A PDC Measurement Software with Call Processing (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Modulation accuracy: ±(2% of indicated value + 0.5%)
	Amplitude measurement	Input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmitter power accuracy: ±10% (MAIN connector, after calibration by using built-in power meter)
	Adjacent channel power measurement	Measurement range: ≥60 dB (50 kHz offset), ≥65 dB (100 kHz offset)
	Batch measurement functions	Measurement time: ≤1.5 s (amplitude measurement in normal mode; occupied bandwidth and adjacent channel power measurement on high-speed mode)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation accuracy: ≤3%rms
	Error rate measurement	Measurement pattern: PN9, PN15 Number of measurement bits: 10^2, 10^3, 2556, 10^4, 10^5, 10^6, ∞
Call processing		Pass/fail judgement of registration, origination, termination, communication, hand-over, disconnection from network, disconnection from mobile station

• MX880117A PHS Measurement Software with Call Processing (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Modulation accuracy: ±(2% of indicated value + 0.7%)
	Amplitude measurement	Input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmitter power accuracy: ±10% (MAIN connector, after calibration by using built-in power meter, at +10 to +40 dBm)
	Adjacent channel power measurement	Measurement range: ≥60 dB (600 kHz offset), ≥65 dB (900 kHz offset)
	Batch measurement functions	Measurement time: ≤1.5 s (amplitude measurement in normal mode; occupied bandwidth and adjacent channel power measurement on high-speed mode)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation accuracy: ≤3%rms
	Error rate measurement	Measurement pattern: PN9, PN15 Number of measurement bits: 10^2, 10^3, 2556, 10^4, 10^5, 10^6, ∞
Call processing		Pass/fail judgement of registration, origination, termination, communication, hand-over, disconnection from network, disconnection from mobile station

• MX880118A DECT Measurement Software (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz, RF carrier accuracy: ±250 Hz + reference oscillator accuracy, Frequency drift measurement accuracy: ±250 Hz, Modulation measurement accuracy: ±10 kHz
	Amplitude measurement	Input level range: –5 to +40 dBm (MAIN connector) Calibration input level range: +15 to +40 dBm (MAIN connector) Transmitter power accuracy: ±0.4 dB (+15 to +40 dBm), ±0.7 dB (–5 to +15 dBm) ∗MAIN connector, after calibration by using built-in power meter
	Adjacent channel power measurement	Emission due to modulation: –8 dBm/160 µW at M ±1, –30 dBm/1 µW at M ±2, –44 dBm/40 nW at M ±3, –47 dBm/20 nW at M ±4 and M ±5 Emission due to transmitter transient: –6 dBm/250 µW at M ±1, –13 dBm/40 µW at M ±2, –23 dBm/4 µW at M ±3, –30 dBm/1 µW at M ±4 and M ±5
	All measurement items	Frequency, deviation, frequency drift, Tx power, carrier-off power, template pass/fail, timing, adjacent channel emission
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation error: ≤±8% (at 288 kHz deviation, frequency 10 MHz to 2.2 GHz)
	Error rate measurement	Modes: FER, BER (Quick Mode), BER (Full Mode) Measurement pattern: 0000111100001111, 0011001100110011, 0101010101010101, 1010 64 x 1 64 x 0 1010, pseudo-random (D-M2), ETSI patterns Number of measurement bits: 1 to 99000 k
Call processing		Bearer setup, bearer release, hand-over, loopback

• MX880131A PDC Measurement Software (extracts)

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Modulation accuracy: ± (2% of indicated value + 0.5%)
	Amplitude measurement	Input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmitter power accuracy: ±10% (MAIN connector, after calibration by using built-in power meter)
	Adjacent channel power measurement	Measurement range: ≥60 dB (50 kHz offset), ≥65 dB (100 kHz offset)
	Batch measurement functions	Measurement time: ≤1.5 s (amplitude measurement in normal mode; occupied bandwidth and adjacent channel power measurement on high-speed mode)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation accuracy: ≤3%rms
	Error rate measurement	Measurement pattern: PN9, PN15 Number of measurement bits: 10^2, 10^3, 2556, 10^4, 10^5, 10^6, ∞

For product ordering information, see pages 4 – 10

• **MX880132A PHS Measurement Software (extracts)**

Transmission measurement	Frequency/modulation measurement	Frequency range: 10 MHz to 2.2 GHz Modulation accuracy: ± (2% of indicated value + 0.7%)
	Amplitude measurement	Input level range: +10 to +40 dBm (average power within burst, MAIN connector) Transmitter power accuracy: ±10% (MAIN connector, after calibration by using built-in power meter)
	Adjacent channel power measurement	Measurement range: ≥60 dB (600 kHz offset), ≥65 dB (900 kHz offset)
	Batch measurement functions	Measurement time: ≤1.5 s (amplitude measurement in normal mode; occupied bandwidth and adjacent channel power measurement on high-speed mode)
Reception measurement	Signal generator	Frequency range: 10 MHz to 3 GHz Level range: –133 to –13 dBm (MAIN connector), –133 to +7 dBm (AUX connector) Modulation accuracy: ≤3%rms
	Error rate measurement	Measurement pattern: PN9, PN15 Number of measurement bits: 10^2, 10^3, 2556, 10^4, 10^5, 10^6, ∞

4

Ordering information

Please specify model/order number, name, and quantity when ordering.

Model/Order No.	Name	
	Main frame	
MT8801C	Radio Communication Analyzer	
	Standard accessories	
J0576B	Coaxial cord (N-P · 5D-2W · P), 1 m:	1 pc
J0768	Coaxial adaptor (N-J · NC-P):	2 pcs
	Power cord:	1 pc
F0014	Fuse, 6.3 A:	2 pcs
	Options[*1]	
MT8801C-01	Analog Measurement	
MT8801C-04	AF Low Impedance Output (requires Option 01)	
MT8801C-07	Spectrum Analyzer	
MT8801C-11	GSM Audio Test (requires MX880115A and Option 01)	
MT8801C-12	CDMA Measurement (requires Option 01)	
MX880113A	IS-136A Measurement Software (requires Option 01)	
MX880114A	AMPS/PCS1900 Measurement Software (requires Option 01)	
MX880115A	GSM Measurement Software	
MX880116A	PDC Measurement Software with Call Processing	
MX880117A	PHS Measurement Software with Call Processing	
MX880118A	DECT Measurement Software (requires Option 07)	
MX880131A	PDC Measurement Software	
MX880132A	PHS Measurement Software	
MX880201A-01	Soft Handoff (for CDMA, requires Option 12)	
	Peripherals	
MS8604A	Digital Mobile Radio Transmitter Tester	
MD6420A	Data Transmission Analyzer	
MS2683A	Spectrum Analyzer	
MG3672A	Digital Modulation Signal Generator	
	Optional accessories	
J0127C	Coaxial cord (BNC-P · G-58A/U · NC-P), 0.5 m	
J0769	Coaxial adapter (BNC-J · NC-P)	
J0040	Coaxial adapter (N-P · NC-J)	
MA1612A	Four-Point Junction Pad	
J0395	Fixed attenuator for high power (30 dB, 30 W, dc to 9 GHz)	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0329D	Front cover (1MW 5U)	
B0331D	Front handle kit (2 pcs/set)	
B0332	Joint plate (4 pcs/set)	
B0333D	Rack mount kit	
B0334D	Carrying case (hard type, with protective cover and casters)	
J0742A	RS-232C cable (for PC-98 PC, D-sub 25-pin), 1 m	
J0743A	RS-232C cable (for DOS/V PC, D-sub 9-pin), 1 m	

*1: Installed in Anritsu. It can be retrofitted to an already purchased MT8801C. For details, contact your Anritsu sales representative.

W-CDMA AREA TESTER
ML8720B
2110 to 2200 MHz

For W-CDMA Base Station Area Investigation and Maintenance

NEW

The ML8720B is used for investigation and maintenance to evaluate the radio wave propagation characteristics in the area of a W-CDMA base station. When it is connected to a GPS receiver, the measured data can be correlated with positioning information (latitude and longitude).
The measurement items include functions for measuring the RSCP*1, Ec/No*2 and SIR*3, which is used to evaluate the strength of the radio wave received from each base station; and the delay profile, which is used to evaluate the delay characteristics of the radio wave caused by multipath propagation.
There are two measurement modes: the unspecified base station measurement mode, and the specified base station measurement mode. The CPICH*4 from the base station is measured in both cases. In the unspecified base station measurement mode, measurement is performed without knowing the base station scrambling code.
In the specified base station measurement mode, measurement is performed using the known base station scrambling code.
*1: Received Signal Code Power
*2: Ratio of desired receive power per chip to receive power density in band
*3: Signal Interference Ratio
*4: Common Pilot Channel

• High-speed and high-accuracy area analysis
RSCP, Ec/No and SIR can be measured at 30 cm intervals (at specified base station and single-channel measurement) while travelling at 100 km/h in a monitoring vehicle to provide fast and accurate area analysis.

• Correlation with GPS positioning data
The measured data can be correlated with GPS positioning data (latitude and longitude) and saved to a memory card. In addition, the measured data and positioning information can be downloaded at real time to an external PC via the RS-232C interface.

• High-accuracy measurement using diversity function
When used in combination with the optional diversity function, even higher-accuracy measurements, such as CPICH transmit diversity format and receive antenna diversity can be performed.

• Master/slave mode
In addition to stand-alone measurement using a single unit, several ML8720B units can be connected as one master and several slaves, permitting parallel master/slave measurements. A separate measurement channel can be specified for each ML8720B to greatly reduce the initial code detection time.

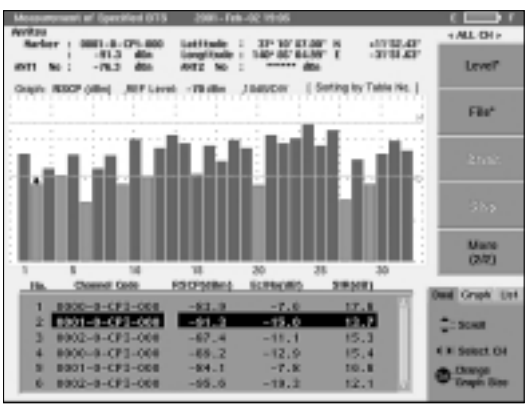
• Handy type
At only 4 kg, the ML8720B is easily portable for both outside and inside work. And the large 8.4" color LCD is easy to view.

• 3-hour battery operation
The lithium-ion battery pack provides more than 3 hours of operation and a spare battery pack solves even long-term measurement problems.

• Large-capacity memory cards
Large amounts of measured data can be saved to large-capacity flash-memory cards (256 MB max.).

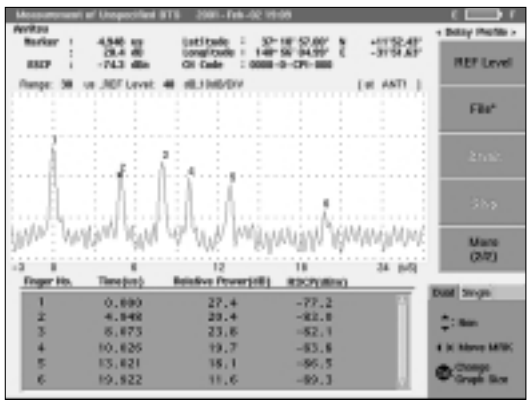
Measurement examples

• Channel display
The measurement results for all the receive channels (32 max.) can be displayed simultaneously as a graph and as data. Additionally, it is possible to set measurement interval and to select the cumulative processing (max., min., median, average) for the internally accumulated data in the set measurement interval.

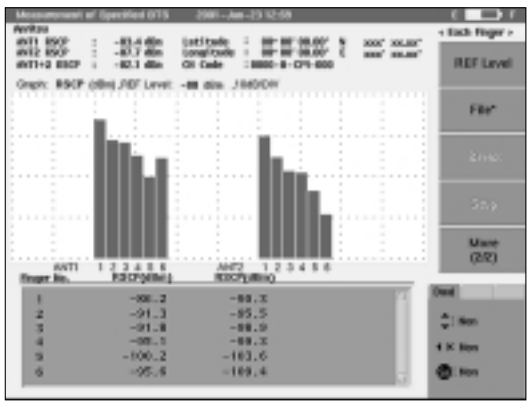


For product ordering information, see pages 4 – 10

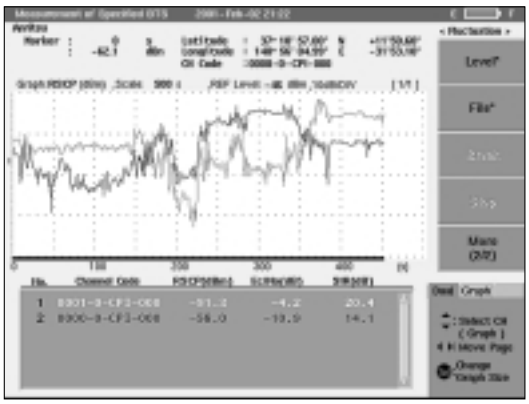
• Delay profile display
This displays the delay profile for one selected channel and the multipath can be confirmed visually. In addition, time or distance range can be selected for the horizontal axis.



• Finger display
This displays the measured data for one selected channel path (finger).
When the diversity option is installed, the RSCP for up to 12 paths can be evaluated simultaneously.



• Time/Distance variation display
A time/distance variation of the RSCP, Ec/No and SIR are displayed. The time variation can be measured in 10 ms intervals for 10 ms to 500 s and the max., min., median or average value of the cumulative totals can be displayed. The distance variation can be measured using the vehicle wheel pulse (external trigger) for 1 to 500 pulses and the max., min., median or average value of cumulative totals can be displayed.



Specifications

Frequency range	2110 to 2200 MHz
Input impedance	50 Ω (SMA-type connector)
Frequency setting resolution	200 kHz (W-CDMA measurement mode), 1 kHz (spectrum monitor mode)
Reference oscillator	Aging rate: ±1 x 10^{-6}/year
Receive signals	P-CPICH, S-CPICH
Power measurement	Measurement range W-CDMA measurement mode: –117 to –33 dBm Spectrum monitor mode: –123 to –33 dBm Resolution: 0.1 dB Display units: dBm, dBμV, dBμV/m (spectrum monitor mode) Accuracy: ±2 dB (RSCP) Average noise level (spectrum monitor mode): ≤–127 dBm (RBW: 4 kHz) SIR Accuracy: ±3 dB (at dynamic range: –100 to –40 dBm, SIR: 5 to 20 dB) Dynamic characteristics: RSCP, SIR measurement at 0 to 100 km/h (averaged distance: 50 m)
Measurement items	Specified base station, unspecified base station, spectrum monitor
Base station measurement	Measurement items: Received signal code power (RSCP), ratio of desired receive power per chip to receive power density (Ec/No), signal interference ratio (SIR) Measurement modes: Time variation (internal trigger) distance variation (external trigger) Sampling interval: 10 ms min. (at 1 channel measurement) Measurement channels: 32 max. Sync acquisition time: 600 ms x the number of search channel Data processing method: Average, median, max., min., 10%, 20%, 30%, 40%, 60%, 70%, 80%, 90% Measurement displays: All channel, delay profile, each finger, fluctuation (fluctuation is only for specification base station measurement)
Spectrum monitor function	Frequency span: 4 MHz, 90 MHz Resolution bandwidth: 4 kHz

Continued on next page

Other functions	Master/slave function: Daisy chain of multiple ML8720B, parallel measurement GPS connection: Supports NMEA-0183 format Remote control: Via RS-232C File I/O: Read measurement conditions, output measured results file Diversity function: Transmit diversity, receive antenna diversity (Option 01)
Interface	IF output: ≥10 dBμV (190 MHz), BNC connector External reference input: 2 to 5 Vp-p (10 MHz), BNC connector External trigger input: 1.5 Vdc ±(2 to 13 Vp-p), BNC connector Sync output: TTL level, BNC connector RS-232C-1: For external computer (max. 115.2 kbps), D-sub 9-pin connector RS-232C-2: For GPS (supports NMEA-0183 format), mini-DIN 8-pin connector Printer: 8-bit parallel I/F (conform to Centronics), D-sub 25-pin connector Keyboard: Mini-DIN 6-pin connector External monitor: VGA, mini-DIN 10-pin connector
Storage media	FDD (3.5", 2HD), ATA flash card
Display	640 x 480 dots, 8.4" color LCD
Environment conditions	Temperature and humidity: 0˚ to +40˚C/≤85% (operating), —25˚ to +60˚C/≤85% (storage) Vibration: MIL-T-28800E Class 3 Drop test: 76 cm drop (Bellcore standard) EMC: EN61326 (1997/A1, 1998) Class A, EN61000-3-2 (1995/A2, 1998) Class A, EN61326 (1997/A1, 1998) Annex A LVD: EN61010-1 (1993/A2, 1995) Installation Category Ⅱ, Pollution degree 2
Power	10 to 26.4 Vdc 100 to 240 Vac, 50/60 Hz (with AC adapter) Battery: Z0404A Lithium Ion Battery Pack Power consumption: 35 W max., 20 W (typical), 30 W (typical with Option 01) Battery continuous operation time: 3 h (typical), 2 h (typical with Option 01)
Dimensions and mass	290 (W) x 194 (H) x 78 (D) mm, ≤4 kg (with battery pack) 290 (W) x 194 (H) x 123 (D) mm, ≤5 kg (with Option 01 and battery pack)

Ordering information

Please specify model/order number, name and quantity when ordering.

Model/Order No.	Name	
	Main frame	
ML8720B	W-CDMA Area Tester	
	Standard accessories	
W1893AE	ML8720B operation manual:	1 copy
Z0404A	Lithium Ion Battery Pack:	1 pc
J1069	AC adapter:	1 pc
	Power cord:	1 pc
Z0402A	Protective cover:	1 pc
Z0403A	Belt with hook:	1 pc
Z0516	Antenna:	1 pc
Z0517	Antenna mount (with 5 m cable):	1 pc
	Option	
ML8720B-01	Diversity function	
	Maintenance service	
ML8720B-90	Extension service 3 years	
ML8720B-91	Extension service 5 years	
ML8720B-96	Extension service 3 years (with Option 01)	
ML8720B-97	Extension service 5 years (with Option 01)	
	Application parts	
JT128MA3-NT1	PC-ATA card (128 MB)	
JT256MA3-NT1	PC-ATA card (256 MB)	
Z0436	Hard carrying case	
Z0435	Soft carrying case [430 (W) x 300 (H) x 170 (D) mm]	
B0442	Soft carrying case [440 (W) x 310 (H) x 110 (D) mm]	
Z0526	Case for installation (for main frame)	
J0127D	BNC cable (for external trigger connection)	
J0654A	Serial interface cable (for connecting IBM-PC/AT)	
J0977	Serial interface cable (for connecting GPS)	
J0978	VGA conversion cable (for connecting external monitor)	

For product ordering information, see pages 4 –10

RADIO COMMUNICATION TEST SYSTEM
ME7812 Series

Low-Cost Automatic Test System for cdmaOne/PDC/PHS Mobile Stations

GPIB

The ME7812 series test system is for automatic testing of cdmaOne mobile station for both the Japanese ARIB system and the North-American IS-95 system and PDC/PHS mobile stations. It can also be used for testing dual mode stations of the North-American AMPS (analog) and cdmaOne.
The test method can be selected from the IS-95A, J-STD-008, ARIB STD-T53 KOREA-PCS (cdmaOne), RCR STD-27 (PDC) and RCR STD-28 (PHS) standards, the TELEC Technical Standard Conformity Certification, and a high-speed method.
A full range of options permits the test system to be configured for both production lines and specific applications. A personal computer running Windows 98 can be used as a system controller.

Models	Application systems
ME7812A	cdmaOne
ME7812B	cdmaOne, PDC
ME7812C	cdmaOne, PHS
ME7812D	cdmaOne, PDC, PHS
ME7812E	PDC
ME7812F	PHS
ME7812G	PDC, PHS

Features

- Standards-based measurement
- Easy-to-understand GUI operations and help guide

Functions and performance

• LAN connection, data collection and system management
A network of plural test systems can be constructed easily using the Windows 98 Network Drive Assignment function. The test conditions and data can be saved into a server*1. In addition, network construction services are supported.
*1: Requires LAN card in PC

• Automatic correction of frequency characteristics
The I/O frequency characteristics of the test system with the options must be corrected. The MX781250A Level Correction Software measures the correction data automatically. Maintenance and periodical updates are made easily using these corrected frequency characteristic values. I/O level errors can be detected by comparing the current and previous corrected values.

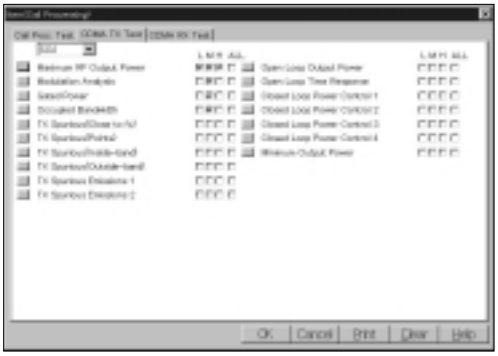
• Switching unit for continuous tests
The ME7411A Switching Unit for Transceiver Continuous Test is used for testing two mobile stations alternately. It eliminates the time required to change mobile stations, allowing continuous testing*2.
*2: The ME7410A or ME7413A switches the RF signals.

• Compact high-performance coaxial switch
The ME7413A Coaxial Switch can be connected directly to the RF I/O connector of the MT8801B/C and MT8802A. It is especially suitable for maintenance of mobile stations. The power is supplied and controlled from the controller.

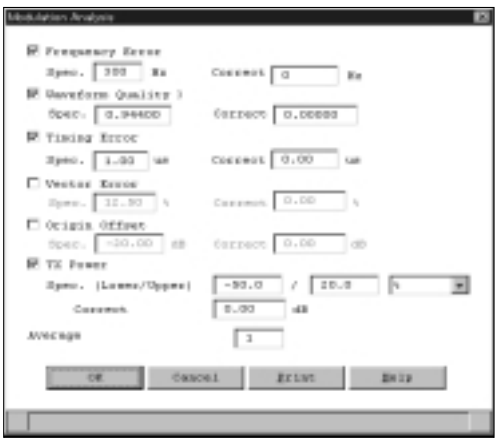
• For maintenance of mobile stations
Call processing allows PDC, PHS, and cdmaOne mobile stations to be tested in the actual operation conditions (communication mode). Communication test is also possible.

• High-speed measurement
TELEC Technical Standard Conformity Test items, such as frequency, transmission rates, antenna power, carrier-off leakage power, occupied bandwidth, adjacent channel power, spurious emissions and radiated spurious emissions can be measured for PDC/PHS in less than 30 seconds.

• Test by call processing or test mode control
Any frequency channel (L, M, H, ALL) can be selected for each test item of call processing or test mode control. The selected items can be tested continuously.



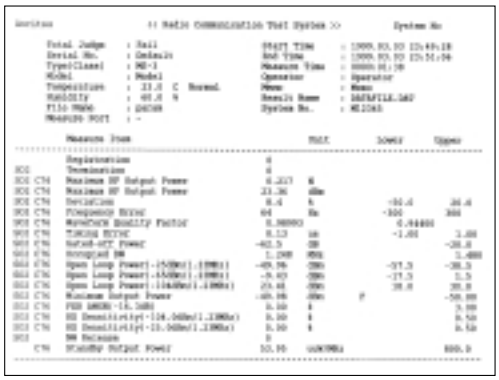
• Flexible tests with various parameters
Specifications and average, etc., parameters can be set for each test item, providing optimum test conditions suitable for the mobile station model or test purpose.



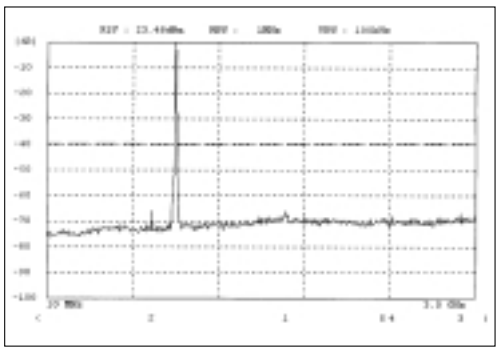
• Free choice of system components
System components can be chosen to match the required functions. For example, a signal generator can be chosen for 3-signal application.

• Help guide
A help guide supports the software products. Either Japanese help guide or the English help guide (only for cdmaOne) can be selected at installation.

• Example of test data output



Data printout



Graphical data printout

Only cdmaOne graphical data can be saved on disk.

For product ordering information, see pages 4 – 10

Test items (For system construction, please refer to the individual data sheet.)

• **ME7812A/B/C/D**

Measurement items	System	cdmaOne		
	Options	Standard	Option 03/13	Option 04
CDMA TX tests	Maximum RF output power	●		
	Frequency error	●		
	Waveform quality factor	●		
	Transmit time error	●		
	Gated output power	◆		
	Occupied bandwidth	●		
	TX spurious (close to fc) at maximum RF output power	●		
	TX spurious (points) at maximum RF output power	●		
	TX spurious (inside-band) at maximum RF output power		●	
	TX spurious (outside-band) at maximum RF output power		●	
	TX spurious emissions		●	
	Open loop output power	■		
	Time response of open loop power control	■		
	Range of closed loop power control	■		
	Minimum controlled output power	●		
	Stand-by output power	■		
	Access probe output power	■		
CDMA RX tests	Demodulation of forward traffic channel in AWGN	■		
	Receiver sensitivity and dynamic range	■		
	Single tone desensitization			■
	Intermodulation spurious response attenuation			■
	RX spurious emissions		●	
Analog TX tests	RF frequency error	◆		
	RF output power	◆		
	Compressor	◆		
	Transmit electrical audio response	◆		
	Modulation deviation limiting	◆		
	SAT	◆		
	SA	◆		
	FM hum and noise	◆		
	Modulation distortion	◆		
Analog RX tests	RF sensitivity	◆		
	RSSI	◆		
	Electrical audio frequency response	◆		
	Audio muting	◆		
	Expander	◆		
	Hum and noise	◆		
	Audio harmonic distortion	◆		
Call processing test	CDMA origination and termination	■		
	Voice test	■		
	CDMA-to-analog hand-off	■		
	Analog origination/release	■		
DC test*1	Current consumption	●		

● : Tests with call processing and test mode control
■ : Test with call processing
◆ : Test with test mode control
*1: A DC power supply and a multimeter are required.

• **ME7812B/D/E/G**

Measurement items	System	PDC					
	Software	MX781217A (with processing)			MX781232A		
	Options	Standard	Option 03/13	Option 04	Standard	Option 03/13	Option 04
TX tests	Frequency error	●			◆		
	Modulation accuracy	●			◆		
	Transmission rate	●			◆		
	Antenna power deviation	●			◆		
	Leakage power during carrier-off	●			◆		
	Burst transmission transient response characteristics	●			◆		
	Occupied bandwidth	●	●		◆	◆	
	Adjacent channel power	●	●		◆	◆	
	Transmission timing	■			◆		
	Spurious emission strength		●			◆	
	Transmission intermodulation			◆*2			◆*2
	Transmission output control characteristics	●			◆		
	Time alignment	■					
RX tests	Receiver sensitivity	◆			◆		
	Bit error rate floor characteristics	◆			◆		
	Interference level			◆			◆
	Adjacent channel selectivity			◆			◆
	Intermodulation characteristics			◆			◆
	Spurious sensitivity			◆			◆
	Receiver level detection	●			◆		
	Network quality detection	●			◆		
	Secondary emission strength		◆			◆	
Call processing test	Origination/termination disconnection	■					
	Voice test	■					
DC test*1	Current consumption	●			◆		

● : Tests with call processing and test mode control
■ : Test with call processing
◆ : Test with test mode control
*1: A DC power supply and a multimeter are required.
*2: ME7410A-03 and ME7812B/C/D-03 are required.

For product ordering information, see pages 4 – 10

• **ME7812C/D/F/G**

Measurement items	System	PHS					
	Software	MX781217A (with processing)			MX781232A		
	Options	Standard	Option 03/13	Option 04	Standard	Option 03/13	Option 04
TX tests	Frequency error	●			◆		
	Modulation accuracy	●			◆		
	Transmission rate	●			◆		
	Antenna power deviation	●			◆		
	Leakage power during carrier-off	●*2			◆*2	◆	
	Burst transmission transient response characteristics	●			◆		
	Occupied bandwidth	●	●		◆	◆	
	Adjacent channel power	●	●		◆	◆	
	Transmission timing	■			◆*4		
	Spurious emission strength		●			◆	
	Transmission intermodulation			◆*3			◆*3
	Transmission output control characteristics	◆			◆		
	2 signal 3rd order distortion					◆*4	
RX tests	Receiver sensitivity	◆			◆		
	Bit error rate floor characteristics	◆			◆		
	Interference level			◆			◆
	Adjacent channel selectivity			◆			◆
	Intermodulation characteristics			◆			◆
	Spurious sensitivity			◆			◆
	Receiver level detection	◆			◆		
	Network quality detection						
	Secondary emission strength		◆			◆	
Call processing test	Origination/termination disconnection	■					
	Voice test	■					
DC test*1	Current consumption	●			◆		

● : Tests with call processing and test mode control
■ : Test with call processing
◆ : Test with test mode control
∗1: A DC power supply and a multimeter are required.
∗2: High-speed method only
∗3: ME7410A-03 and ME7812B/C/D-03 are required.
∗4: PHS base station (CS) test only

W-CDMA Virtual Signaling Tester (VST), MX785101A,

W-CDMA Protocol Test System (PTS) MX785201A

The MX785101A VST (Virtual Signaling Tester) and MX785201A PTS (Protocol Test System) is a family of test and verification tools from Anritsu for next generation wireless products. They have been developed to provide the test support today's research and development engineers need to successfully meet demanding performance and time to market targets.
They provide a common user interface thus reducing operator learn time as development progresses and migrates over the range of Anritsu's 3G development tools.
In addition, test procedures generated for the PTS can be run on the VST and vice versa. This enables test procedures to be developed very early in the development cycle and to evolve as the user equipment evolves. A substantial saving in the investment in development of test procedures can be realized.

Features

- W-CDMA protocol test capability
- 3GPP Standard compliant development tool
- Common user interface across Anritsu development tools
- Comprehensive on-line help
- Environment supporting TTCN test case execution
- TTCN test procedure library available
- Re-use of test cases on VST (Virtual Signaling Tester) and PTS (Protocol Test System)

MX785201A

The MX785201A PTS software is combined with the MD8480A W-CDMA Signaling Tester to make a system providing an environment to exercise Layer 3 and Layer 2 signaling protocols defined within the Third Generation Partnership Project (3GPP).
The PTS and VST software component runs on a Windows 95/NT™ PC. They execute TestStand™ test sequences made up of calls into a library of TTCN test cases through which can be defined:

- Sequences of layer 3 messages and expected responses
- Layer 3 to layer 2 service primitives to trigger specific layer 2 procedures, or to configure layer 2 operation
- Layer 3 to layer 1 service primitives to configure and initiate layer 1 operation
- Service primitives to and from user provided code modules for UE control

The layer 2 protocol stack and layer 3 test tools are functionally equivalent to those used in the Anritsu VST (Virtual Signaling Tester). An application-programming interface (API) to enable user generated C-language test scenarios to be executed is available for the PTS.

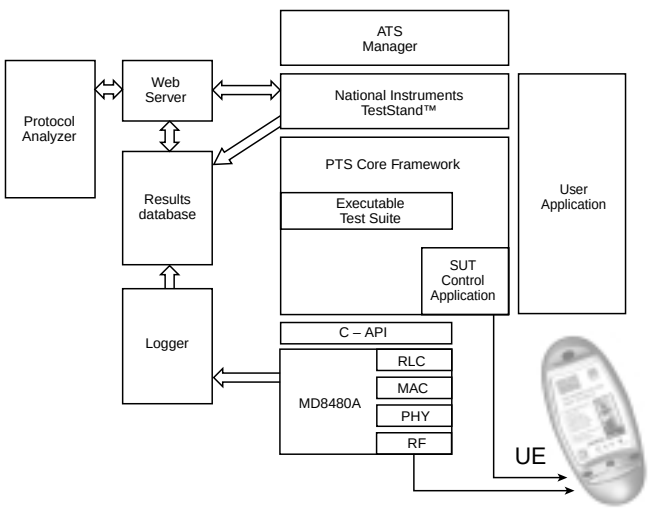
MX785101A

The MX785101A VST software provides an environment to exercise Layer 3 and Layer 2 signaling protocols defined within the Third Generation Partnership Project (3GPP). When linked to the customer's signaling protocol development environment, Layer 3 and Layer 2 Test Procedures running on the VST platform enable verification and subsequent validation of the signaling protocol Software Under Test.
The VST executes on a standard Windows PC. The SUT (Software Under Test) may reside on any machine that can be connected via a TCP/IP port to the Windows PC running the VST. In order to interface to the VST, the User Equipment (UE) abstract layer 1 and UE adapter software components are required for the Software Under Test. The VST Network (NW) abstract layer 1 and adapter components can be used as a starting point to develop these components. The Abstract Layer 1 has also been developed in such a way that users can easily customize it in order to simulate specific features of the air interface.

Evolution with 3GPP

The capability of the VST & PTS will evolve and additional capability added in-line with the 3GPP specifications. When available, the PTS will run the 3GPP Conformance Test Suite as defined in TS34.123.
In addition, the Protocol Test System will support the layer 1 and layer 2 parameter sets defined in the 3GPP specifications TS34.108.

System overview



PTS Core Software

For product ordering information, see pages 4 –10

ATS manager

The ATS Manager provides a user interface which allows configuration of the MX785201A PTS, launch of the test sequencer tool to select and execute pre-prepared Layer 3 and Layer 2 Test Procedures and browse the results of the Test Procedures using the Protocol Analyzer.

Protocol Analyzer

All Layer 3, Layer 2 and Layer 1 message exchanges between the MX785201A PTS and the System Under Test are logged. These messages are decoded to show the name and content of each field and displayed using the Protocol Analyzer. Raw captured data is displayed in hexadecimal format.

National Instruments TestStand™

The MX785201A PTS uses the National Instruments TestStand™ run-time engine as a high level sequencing tool. The TestStand™ development system is used to create test sequences.

C-API

As an alternative language to develop Layer 3 and Layer 2 Test Procedures, a 'C' based Application Programmer's Interface (C-API) is included in the form of a DLL.

Executable test suite

Layer 3 and Layer 2 test cases are implemented using TTCN (Tree and Tabular Combined Notation). Created TTCN tests are compiled to an Executable Test Suite (ETS) which interfaces to the MX785201A PTS via the GCI Management Interface and the GCI Operational Interface. These provide an open, standardized interface to TTCN based executable test suites. The MX785201A PTS has been developed to work with the Telelogic Test Suite TTCN Browser tool.
The GCI framework provided by the MX785201A PTS provides support for a number of Test Suite Operations (TSOs) and also Protocol Implementation Conformance Statement (PICS/PIXIT).

Codec

The ETS is supported by a codec capable of encoding and decoding Radio Resource Control (RRC), Non Access Stratum (NAS) and lower layer configuration data.

Thin RRC

A thin RRC is provided to load NAS messages into RRC direct transfer messages and unload NAS messages from RRC direct transfer messages transparently.

SUT Control Application

The MX785201A PTS frame-work provides an API to support automatically communicating with the UE to replace keyboard or internal (to UE) signals.

Logger and Results Database

The logger captures data from the majority of components in the system and stores it in the Results Database. This data is used by the Protocol Analyzer to create message sequence charts and display decoded messages.

RLC and MAC

RLC and MAC layers conforming to the 3GPP specifications TS25.322 Radio Link Control Protocol Specification and TS25.321 Medium Access Control Specification are supplied as part of MD8480A.

TE (Terminal Equipment)

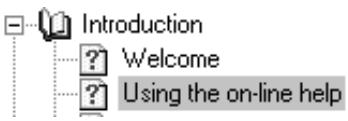
The TE is an optional software component available as part of the MD8480A in the MX785201A PTS. It supports a number of features including voice AMR 12.2K Codec, ISDN, IP and PPP.

Layer 1

The MX785201A PTS provides a physical layer 1 through the MD8480A that can communicate with a terminal.

Simple installation

The distribution software set is provided on CD-ROM with a self-contained installation program.
The installation process is straightforward and the user is guided through the process using self-explanatory prompts. The PTS Quick Start Guide details the installation procedure and information about the hardware setup requirements.



Libraries available

Integration libraries

Integration libraries provide a proven set of test scripts that have been tested on real terminals. These test cases take the user through specific milestones (e.g. RRC Connection, location update, voice call, etc.) and provide a straightforward method for testing of terminals during the integration process. They provide a step by step test approach to prove functionality in a UE.

Executable TTCN Integration Library

The Test Procedures are 3GPP compliant and are designed to be customized to the particular needs of an Integration environment. The PTS Integration Library provides TestStand‘ Sequences in an executable form of the TTCN test cases. National Instruments TestStand™ is required to implement these cases.
TTCN Integration Library Source Code
This Library includes the source code for the Test Procedures and TestStand‘ sequences included in MX785201A-30. This will allow more experienced users to make changes to the parameters in order to test more specific details of the terminal deisgn.

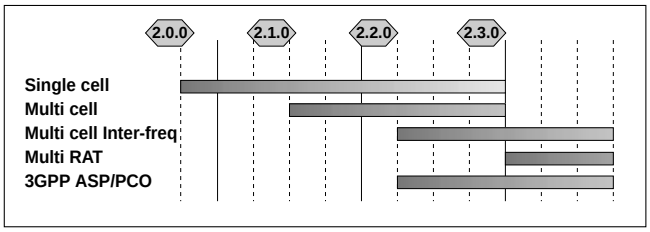
R&D libraries

R&D libraries provide more flexible test capability and allow experienced designers to exercise their terminals beyond the requirements of 3GPP. These libraries will become available in executable form and as source code as the standards eveolve.

Conformance libraries

These libraries currently are being written by 3GPP and when they are available they will be the authority for 3GPP conformance. These libraries are expected to change as the 3GPP specifications are refined. Anritsu will provide the latest versions available and for those users within the support scheme, the libraries will be updated regularly.

The PTS is intended to evolve along with 3GPP specifications and terminal capability. Version 2.0 is planned to evolve as shown in the timeline below.



Ordering information

Please specify model/order number, name and quantity when ordering.
For full information please request the MX785101A or MX785201A data sheet.

Model/Order No.	Name
MX785101A	VST Core Software Single Cell ETS Framework
	Libraries
MX785101A-30	Executable TTCN Integration Library
MX785101A-31	TTCN Integration Library Source Code
Note:	*For latest information on options and libraries available, please refer to your local Anritsu sales office*
	Support
MX785101A-01	National Instruments TestStand™
MX785101A-20	Software Update and Maintenance Contract
MX785101A-21	Training Course (2 days)
MX785101A-22	Premium Support (per day)
MX785101A-23	Installation & Commissioning (1 day)

Model/Order No.	Name
MX785201A	PTS Core Software Single Cell ETS Framework
	Options
MX785201A-30	Executable TTCN Integration Library
MX785201A-31	TTCN Integration Library Source Code
Note:	*For latest information on options and libraries available, please refer to your local Anritsu sales office*
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MX785201A-01	National Instruments TestStand™
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MX785201A-23	Installation & Commissioning (1 day)

For product ordering information, see pages 4 –10

MEASURING RECEIVER
ML5655C
1.4 to 1.55 GHz

For Measuring Field Strength of Digital Cellular Phones and MCA Systems

GPIB
OPTION

Recent radio communication systems such as the Personal Digital Cellular and MCA require high-speed and multichannel field strength measurements. The ML5655C Measuring Receivers meet these requirements and can be used as part of a mobile system for measuring radio wave propagation characteristics.

Applications
- Automatic radio wave propagation measurement system
- Radio wave propagation characteristics measurement system

Features
- 1 ms sampling rate
- 10%, 50%, 90% values calculation
- Measuring transmitter spurious, and measuring low-level signals in R&D and production
- Portable design

ERROR RATE TESTER
MP1201C
40 Hz to 1.2 MHz

For R&D, Manufacturing and Maintenance of Digital Systems

The MP1201C is a compact, easy-to-use tester operating at a clock frequency of 40 Hz to 1.2 MHz. It is composed of a separate transmitter and receiver; the transmitter sends an M-series pseudo-random signal similar to that of an actual circuit, and the receiver displays the error rate of measured signals using LEDs. A GPIB is provided as standard equipment. In addition to measuring the reception sensitivity of digital radio systems and the bit error rate of digital transmission systems, the MP1201C is ideal for systems R&D, manufacturing, and maintenance.

Features
- Bit error rate and error pulse count measurement
- Pseudo-random (PN9, PN15) and fixed (1010‥) pattern measurement
- Error insertion
- Auto sync on/off
- Printer output