NETWORK ANALYZER
MS4661A/E, MS4662A
100 kHz to 3 GHz

For Measuring Transmission/Reflection and S-Parameter

Custom-made product

CE PTA GPIB

The MS4661A/E include a built-in transmission/reflection measurement test set (bridge), making them ideal for measuring antennas and passive devices (filters, attenuators, switches, cables) where the input and output impedances are nearly equal. The MS4662A also has an S-parameter test set. In addition to measuring active devices with different input and output characteristics (such as amplifiers), it measures forward and reverse direction characteristics with a single connection. You can choose the model best suited to your application. The MS4661A and MS4662A has color LCD displays, while the MS4661E has an EL display (monochrome).

The high-speed synthesizer and DSP (digital signal processor) permit measurements at 400 µs/point (or 600 µs/point using two-port calibration), with sweep times approximating real-time measurement. Post-measurement data analysis is facilitated by unique functions such as limit tests, 3 dB bandwidth searches, and ripple searches for device evaluation and pass/fail identification. With PTA (Personal Test Automation) capability as standard, it is easy to configure ATE (Automated Test Equipment) systems.

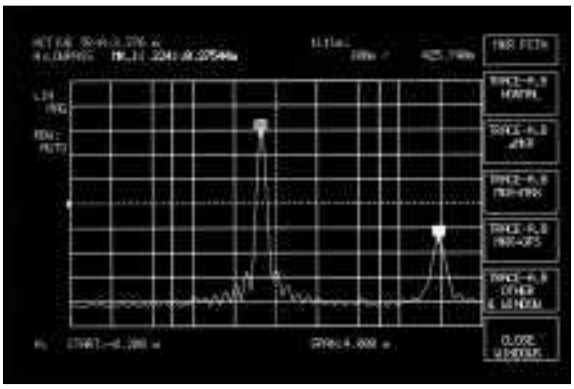
Features

- Built-in transmission/reflection measurement, and S-parameter test set
- Full range of limit test functions for real-time pass/fail testing
- One-touch measurement of each characteristic using target data search function
- Time domain analysis

Application examples

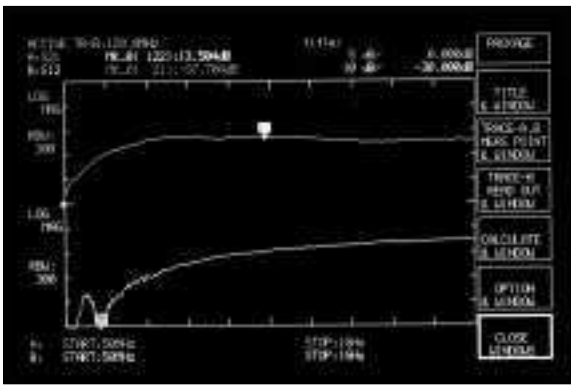
- **Measurement of cable fault locations**

Time-domain function permits measurement of distances to cable faults and impedance mismatch points.

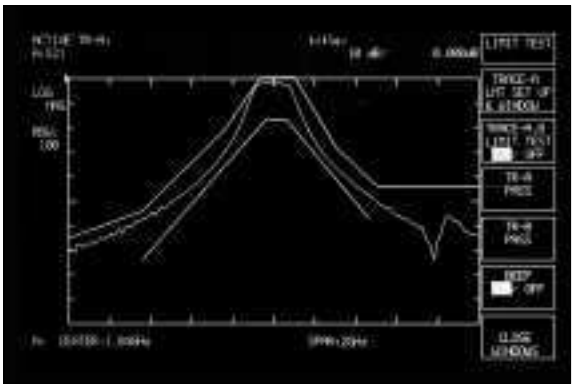


- **Simultaneous measurement of amplifier forward/reverse direction transmission (MS4662A)**

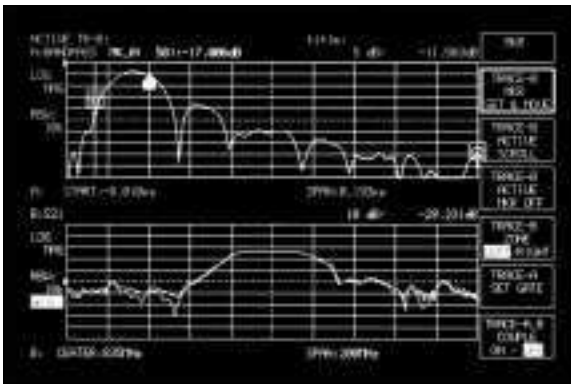
The S-parameter test set in the MS4662A allows you simultaneous measurement of forward and reverse direction device characteristics.



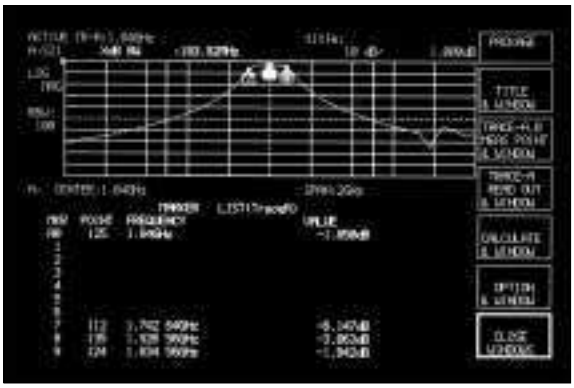
• Filter pass/fail judgment using limit tests
The segment limit test permits pass/fail testing for complex characteristics with subtle fluctuations in slope not detected as ripples.



• SAW filter measurement with time gate function
Time domain gate function is very useful for eliminating test fixture leakage signals.



• Filter analysis using target data search
This function is useful in filter 3 dB bandwidth measurements and ripple searches.



Specifications

Model		MS4661A/E	MS4662A
Measurement	Measurement items	S parameter: S_{11}, S_{21} Level characteristics: R, TA, TB Group delay characteristics: GPDLY (any aperture) Time domain characteristics: displays impulse and step response of above characteristics	S parameter: S_{11}, S_{21}, S_{12}, S_{22} Level characteristics: R, TA, TB Time domain characteristics: displays impulse and step response of above characteristics
	Display	1 to 2 screens (front/back, split)	
	Display format	S_{11}: LOG MAG, PHASE, LIN MAG, REAL IMAG, POLAR (M/P), VSWR, IMPD (Z∠PHASE, Q/D, R_S/C_S, L_S, R+jX), ADMT (Y∠PHASE, Q/D, R_P/C_P, L_P, G+jB) S_{21}: LOG MAG, PHASE, LIN MAG, REAL IMAG, POLAR (M/P), HSDLY GPDLY: REAL LEVEL: LOG MAG Time domain (band pass, low pass, impulse/step response): LOG MAG, PHASE, LIN MAG, REAL, IMAG	S_{11}/S_{22}: LOG MAG, PHASE, LIN MAG, REAL IMAG, POLAR (M/P), VSWR, IMPD (Z∠PHASE, Q/D, R_S/C_S, L_S, R+jX), ADMT (Y∠PHASE, Q/D, R_P/C_P, L_P, G+jB) S_{21}/S_{12}: LOG MAG, PHASE, LIN MAG, REAL IMAG, POLAR (M/P), HSDLY LEVEL: LOG MAG Time domain (band pass, low pass, impulse/step response): LOG MAG, PHASE, LIN MAG, REAL, IMAG
Frequency	Range	100 kHz to 3 GHz	
	Resolution	Minimum resolution: 0.1 Hz	
	Frequency accuracy	Same as internal reference oscillator	
	Internal reference oscillator	Standard Aging rate: ≤±1 x 10^{-6}/day (compared to after 15 minutes warm-up) Temperature characteristics: ≤±5 x 10^{-6}(0˚ to 50˚C) Option 01 Aging rate: ≤±2 x 10^{-8}/day (compared to after 24 hours warm-up) Temperature characteristics: ≤±5 x 10^{-8}(0˚ to 50˚C)	

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<table>
<tr><th colspan="2">Model</th><th>MS4661A/E</th><th>MS4662A</th></tr>
<tr><td rowspan="4">Test port output characteristics</td><td>Impedance</td><td colspan="2">50 Ω</td></tr>
<tr><td>Output level</td><td>Range: –10 to +10 dBm
Accuracy: ≤±1.0 dB (100 MHz, 0 dBm)
Linearity: ≤±0.5 dB (–10 to +10dBm, compared to 100 MHz/0 dBm)
Resolution: 0.01 dB
Output level deviation: Compared to 100 MHz/0 dBm
<table>
<tr><th>Frequency</th><th>Deviation</th></tr>
<tr><td>100 to 500 kHz</td><td>–0.5 to +2.5 dB</td></tr>
<tr><td>500 kHz to 2 GHz</td><td>–1.5 to +1.5 dB</td></tr>
<tr><td>2 to 3 GHz</td><td>–2.0 to +2.0 dB</td></tr>
</table></td><td>Range: –70 to +10 dBm
Accuracy: ≤±1.0 dB (100 MHz, 0 dBm)
Linearity: ≤±0.5 dB (–10 to +8 dBm, compared to 100 MHz/0 dBm)
Resolution: 0.01 dB
Output level deviation: Compared to 100 MHz/0 dBm
<table>
<tr><th>Frequency</th><th>Deviation</th></tr>
<tr><td>100 to 500 kHz</td><td>–0.5 to +2.5 dB</td></tr>
<tr><td>500 kHz to 2 GHz</td><td>–1.5 to +1.5 dB</td></tr>
<tr><td>2 to 3 GHz</td><td>–2.0 to +2.0 dB</td></tr>
</table></td></tr>
<tr><td>Signal purity</td><td colspan="2">SSB phase noise (offset frequency: 10 kHz):
–90 dBc/Hz (100 kHz to 80 MHz), –85 dBc/Hz (80 MHz to 1 GHz), –80 dBc/Hz (1 to 3 GHz)
Non-harmonic spurious: ≤–30 dBc (output level: 0 dBm)
Harmonic distortion: ≤–25 dBc (output level: 0 dBm)</td></tr>
<tr><td>Test port connector</td><td>N-J</td><td>GPC-7</td></tr>
<tr><td rowspan="5">Test port input characteristics</td><td>Frequency</td><td colspan="2">100 kHz to 3 GHz</td></tr>
<tr><td>RBW</td><td colspan="2">3 Hz to 10 kHz (1-3 sequence), AUTO (auto-setting with sweep time)</td></tr>
<tr><td>Maximum input level</td><td>0 dBm (DC couple)</td><td>+20 dBm, DC ±40 V (AC couple)</td></tr>
<tr><td>Average noise level</td><td>Measurement of transmission characteristics (S_{21}, TB):
<–90 dBm (100 kHz to 80 MHz, RBW: 1 kHz),
<–80 dBm (80 MHz to 3 GHz, RBW: 1 kHz)
Measurement of reflection characteristics (S_{11}, TA):
<–70 dBm (100 kHz to 80 MHz, RBW: 1 kHz),
<–60 dBm (80 MHz to 3 GHz, RBW: 1 kHz)</td><td><–90 dBm (100 kHz to 80 MHz, RBW: 1 kHz)
<–80 dBm (80 MHz to 3 GHz, RBW: 1 kHz)</td></tr>
<tr><td>Test port attenuator</td><td>–</td><td>0 dB, 20 dB (switching error: ±1 dB)</td></tr>
<tr><td>Crosstalk</td><td colspan="2">>90 dB (100 kHz to 1 GHz)*, >80 dB (1 to 3 GHz)* *Improved to >105 dB by calibration</td></tr>
<tr><td rowspan="3">Magnitude measurement</td><td>Measurement range</td><td colspan="2">≥100 dB (resolution: 0.001 dB)</td></tr>
<tr><td>Display resolution</td><td colspan="2">0.01 dB/div to 50 dB/div (1-2-5 sequence)</td></tr>
<tr><td>Dynamic accuracy</td><td colspan="2">Measurement accuracy
Compared to –10 dBm at test port level, RBW: 10 Hz)
<table>
<tr><th rowspan="2">Test port level (input)</th><th colspan="2">Measurement accuracy</th></tr>
<tr><th>≤1.0 GHz</th><th>>1.0 GHz</th></tr>
<tr><td>+10 to 0 dB</td><td>±0.30 dB</td><td>±0.30 dB</td></tr>
<tr><td>0 to –40 dB</td><td>±0.05 dB</td><td>±0.05 dB</td></tr>
<tr><td>–40 to –50 dB</td><td>±0.05 dB</td><td>±0.10 dB</td></tr>
<tr><td>–50 to –60 dB</td><td>±0.10 dB</td><td>±0.30 dB</td></tr>
<tr><td>–60 to –70 dB</td><td>±0.30 dB</td><td>±1.20 dB</td></tr>
<tr><td>–70 to –80 dB</td><td>±1.20 dB</td><td>±4.00 dB</td></tr>
<tr><td>–80 to –90 dB</td><td>±4.00 dB</td><td>–</td></tr>
</table></td></tr>
<tr><td rowspan="3">Phase measurement</td><td>Measurement range</td><td colspan="2">±180˚(resolution: 0.001˚)</td></tr>
<tr><td>Display resolution</td><td colspan="2">0.01˚/div to 50˚/div (1-2-5 sequence)</td></tr>
<tr><td>Dynamic accuracy</td><td colspan="2">Measurement accuracy
Compared to –10 dBm at test port level, RBW: 10 Hz)
<table>
<tr><th rowspan="2">Test port level (input)</th><th colspan="2">Measurement accuracy</th></tr>
<tr><th>≤1.0 GHz</th><th>>1.0 GHz</th></tr>
<tr><td>10 to 0 dB</td><td>±6.0˚</td><td>±6.0˚</td></tr>
<tr><td>0 to –40 dB</td><td>±0.3˚</td><td>±0.3˚</td></tr>
<tr><td>–40 to –50 dB</td><td>±0.3˚</td><td>±0.8˚</td></tr>
<tr><td>–50 to –60 dB</td><td>±0.8˚</td><td>±2.0˚</td></tr>
<tr><td>–60 to –70 dB</td><td>±2.0˚</td><td>±6.0˚</td></tr>
<tr><td>–70 to –80 dB</td><td>±6.0˚</td><td>±20˚</td></tr>
<tr><td>–80 to –90 dB</td><td>±20˚</td><td>–</td></tr>
</table></td></tr>
<tr><td rowspan="3">Group delay measurement</td><td rowspan="2">Measurement range</td><td>Aperture frequency fixed mode (GPDLY): delay range (DRG); 40 ns to 400 ms (1-2-4 sequence, aperture frequency = 0.4/DRG)
Aperture frequency free mode (GPDLY): 1 Hz (correspond to 400 ms) to 400 MHz (correspond to 1 ns)</td><td>–</td></tr>
<tr><td colspan="2">High-speed mode (HSDLY): τ = Δθ/(360 x aperture frequency)
[Δθ: phase measurement range, aperture frequency = SPAN x smoothing aperture (%). Smoothing aperture can be set between 20 to 2/MEP x 100 (%).]</td></tr>
<tr><td>Resolution</td><td colspan="2">2.78 x 10^{-5}/aperture frequency, DRG/14400 when set by DRG</td></tr>
<tr><td>Dynamic accuracy</td><td colspan="2">Phase measurement dynamic accuracy/(360 x aperture frequency)</td></tr>
</table>

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Model		MS4661A/E	MS4662A
TD measurement	Input waveform analysis	Impulse/step response	
	Filtering	Band pass (LOG/LIN MAG, PHASE, REAL, IMAG), low pass (LOG/LIN MAG, PHASE, REAL, IMAG)	
	Time domain range	$\frac{\text{(numbers of measuring points in frequency domain } -1)}{\text{Frequency span width (GHz)}}$ [ns]	
	Range resolution	Time span/(number of measuring points – 1)	
	Windows	RECTANGULAR, NOMINAL, LOW SIDELOBE, MIN SIDELOBE	
	Gating	Frequency response of specified range measurable after gate specification in time-domain	
Sweep	Frequency sweep	LIN: CENTER/SPAN, START/STOP, LOG: START/STOP	
	Level sweep	LIN: START/STOP/STEP	
	Sweep time	10 ms to 27.5 h (differs with measurement items, number of measuring points, RBW, display condition)	
	Number of measuring points	11, 21, 51, 101, 251, 501, 1001 points (display: 501 points)	
	Sweep function	Sweep range: Full, part, listed-frequency Sweep control: REPEAT, SINGLE, STOP/CONT	
Marker	Multi-marker	Up to 10 independent markers set for each trace (independent/linked setting possible)	
	Frequency marker	Marker position settable at frequency	
	Marker function	NORMAL MKR, ΔMKR, 0 MKR, MKR → MAX, MKR → MIN, MKR → CF, ΔMKR → SPAN, MKR → OFFSET, MKR → +PEAK, MKR → –PEAK, MKR TRACK +PEAK, MKR TRACK –PEAK	
	Target data search	OFF, MIN, MAX, P-P, MEAN, σ, 1st +PEAK, 1st –PEAK, NEXT +PEAK, NEXT –PEAK, 1 dB COMP, XdB BW, XdB FREQ, Ripple 1, Ripple 2, Ripple 3, Ripple 4	
Calibration method		Frequency response, 1-port OSL, 1-pass 2-ports	Frequency response, 1-port OSL, full 2-ports, 1-path 2-ports
Reference plane extend		Electrical length can be corrected. Range: 0 to ±999999.9999999 m, Resolution: 100 nm	
Display	Display	MS4661A: 640 x 400 dots, 8.9 inch color LCD MS4661E: 640 x 400 dots, 8.9 inch EL	640 x 400 dots, 8.9 inch color LCD
	Calculation	Complex number input/output of (+, –, x, ÷), SUM, DIFF, conjugate complex number operation	
	Auto-scale	A/B trace independently settable	
	Time display	Year, month, date, time (display and settable)	
Hard copy		Video plotter: Hard copy at video plotter using separate video output Direct plot: Hard copy at printer or plotter (HP-GL, GP-GL) via GPIB	
Data storage		Following data saved to or recalled from PMC or floppy disk (external FDD required): Measurement condition/ calibration data (max. 10 items), PTA application program	
Measurement data memory		Following measurement data saved as display and complex data in same memory as measurement setup, etc.: Trace A memory (XMA), trace B memory (XMB), trace A sub-memory (SMA), trace B sub-memory (SMB)	
Internal computer		PTA	
Auxiliary input and output		Reference oscillator input: 10 MHz ±10 Hz, TTL level, BNC-J connector Reference oscillator buffer output: 10 MHz, TTL level, BNC-J connector GPIB: meets IEEE-488 (24-pole connector) I/O ports: PTA-α parallel input/output Module bus: for external module control Video output: separate video output (DIN-type, 8-pole), digital RBG output (Dsub-type, 9-pole)	
Power		85 to 132 Vac/170 to 250 Vac, ≤220 VA	
Dimensions and mass		426 (W) x 222 (H) x 450 (D) mm, ≤24 kg	
Operating temperature range		0˚ to 50˚C	
EMC*1		EN55011: 1991, Group 1, Class A EN50082-1: 1992	
Safety		EN61010-1: 1993 (Installation Category II, Pollution Degree II)	

*1: Electromagnetic Compatibility

Test port characteristics

• Test port characteristics (pre-calibration)

Model	MS4661A/E	MS4662A
Directivity*1	>30 dB (300 kHz to 3 GHz), >22 dB (100 to 300 kHz)	
Source match	>15 dB (300 kHz to 1.5 GHz) >10 dB (100 kHz to 3 GHz)	>10 dB (300 kHz to 1.5 GHz) >8 dB (100 kHz to 3 GHz)
Load match	>25 dB (300 kHz to 1.5 GHz) >22 dB (100 kHz to 3 GHz)	>15 dB (300 kHz to 1.5 GHz) >10 dB (100 kHz to 3 GHz)
Transmission frequency response	<2 dB (300 kHz to 80 MHz), <5 dB (100 kHz to 3 GHz)	
Reflection frequency response	<2 dB (300 kHz to 80 MHz), <5 dB (100 kHz to 3 GHz)	
Crosstalk	>90 dB (100 kHz to 1 GHz), >80 dB (1 to 3 GHz)	

*1: 23˚ to 35˚C

• **Test port characteristics (typical values after 2-port OSL calibration*2)**

Model	MS4661A/E*3	MS4662A
Connector	N	3.5 mm (SMA)
Directivity	>38 dB	>38 dB
Source match	>35 dB	>35 dB
Load match	>25 dB (300 kHz to 1.5 GHz) >22 dB (100 kHz to 3 GHz)	>35 dB
Transmission frequency response	±0.02 dB	±0.02 dB
Reflection frequency response	±0.02 dB	±0.02 dB
Crosstalk	>105 dB	>105 dB

*2: Typical values are for reference, they are not guaranteed.
*3: 1-pass 2-port calibration

Ordering information

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

Model/Order No.	Name	
	Main frame	
MS4661A*	Network Analyzer (color LCD, built-in bridge)	
MS4661E*	Network Analyzer (EL display, built-in bridge)	
MS4662A*	Network Analyzer (color LCD, built-in S-parameter)	
	Standard accessories	
E001	Power cord, 2.5 m:	1 pc
F0014	Fuse, 6.3 A:	1 pc
F0043	Fuse, 1 A (MS4662A only):	2 pcs
Z0280A	List band (MS4662A only):	1 pc
W0996AE	MS4661A/E operation manual (MS4661A/E only):	1 copy
W0997AE	MS4662A operation manual (MS4662A only):	1 copy
W0998AE	GPIB operation manual:	1 copy
W0999AE	PTA operation manual:	1 copy
	Option	
MS4661/4662-01	High stability reference oscillator (aging rate: ≤±2 x 10^{-8}/day)	
	Optional accessories	
3750	SMA/3.5 mm calibration kit (open, short, termination, 7 mm-3.5 adapter)	
3751	7 mm calibration kit (open, short, termination)	
3753	50 Ω, N-type calibration kit (open, short, termination, 7 mm-N adapter)	
3753-75	75 Ω, N-type calibration kit (open, short, termination, N-N adapter)	
J0629	Test port cable (GPC-7 at both ends, 60 cm)	
J0729A	Test port cable (N-M at both ends, 60 cm)	
J0730A	Test port cable (3.5 mm-M at both ends, 60 cm)	
34AS50	Adapter (GPC-7 • WSMA-M)	
34ASF50	Adapter (GPC-7 • WSMA-F)	
34AN50	Adapter (GPC-7 • N-M)	
34ANF50	Adapter (GPC-7 • N-F)	
1091-26	Adapter (N-M • SMA-M)	
1091-27	Adapter (N-M • SMA-F)	
1091-80	Adapter (N-F • SMA-M)	
1091-81	Adapter (N-F • SMA-F)	
K220	Adapter (K-M • K-M, SMA compatible)	
K222	Adapter (K-F • K-F, SMA compatible)	
K224	Adapter (K-M • K-F, SMA compatible)	
12N75B	Matching pad (50 Ω → 75 Ω, N-M • N-M)	
P0005	Memory card (32 KB SRAM)	
P0006	Memory card (64 KB SRAM)	
P0007	Memory card (128 KB SRAM)	
P0008	Memory card (256 KB SRAM)	
P0009	Memory card (512 KB SRAM)	
MC3305A	JIS Type PTA Keyboard	
MC3306A	ASCII Type PTA Keyboard	
J0007	GPIB cable, 1 m	
J0008	GPIB cable, 2 m	
B0329D	Front cover (1MW 5U)	
B0333D	Rack mount kit	
B0334D	Carrying case (hard type)	
	Peripheral instruments	
VP870	Printer (GPIB, EPSON)	

*: Custom-made product

For product ordering information, see pages 4-7.