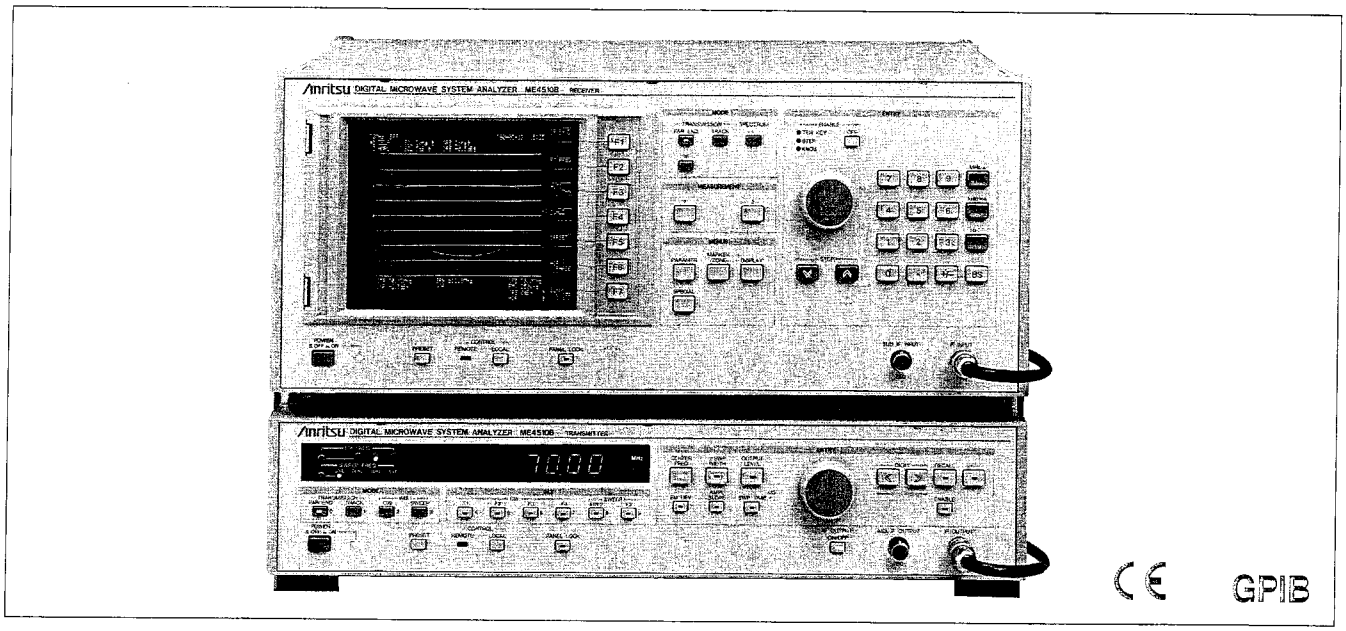
DIGITAL MICROWAVE SYSTEM ANALYZER
ME4510B



The ME4510B (DMSA) is used to evaluate large-capacity digital microwave links and characterize the equipment used in such links by measuring the IF transmission band characteristics and the amplitude linearity of such equipment. When links are being constructed, the propagation delay time difference between the main route and the subroute can be measured. The ME4510B outputs a four-tone signal for the measurement of amplitude linearity through intermodulation. The ME4510B can also measure IF spectrums.

Since the ME4510B transmitter and receiver operate separately, far-end measurements can be performed with a single receiver-transmitter set.

Measurement Items

Delay/amplitude characteristics, two route propagation delay time differences, third-order intermodulation distortions, spectrum analysis, return loss.

Features

• Digital microwave link delay and amplitude characteristics

Depending on the link capacity, either a 70 MHz or a 140 MHz IF band can be used for a digital microwave link. The ME4510B can be used to evaluate both of these bands. In addition, since the ME4510B has the FM and sweep frequencies listed in the transmitter specifications shown on page 401, both the far-end measurement of IF band delay and amplitude characteristics can be made when the ME4510B is used in combination with the ME453/538 series MSA.

• Space diversity propagation delay time difference

When installing link the propagation time for the space diversity (SD) main route and subroute must be matched. The ME4510B has two 1-channel input terminals to measure the main input signal lead/lag time relative to the secondary input signal.

A frequency modulated signal is used for the measurement. The ME4510B receiver demodulates the two modulated signals that are received from the two input terminals and then calculates the space diversity propagation delay time difference from the phase difference of these two demodulated signals.

The adjustment of the space diversity also very easy since the difference of the two routes can be directly shown in the electrical length calculated from the delay time difference.

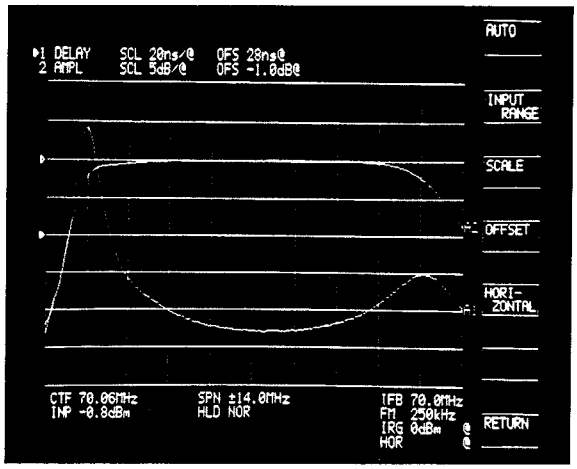
• A four-tone signal can be used to measure the third-order harmonic intermodulation distortions.

Large-capacity digital microwave links use quadrature amplitude modulation in which the signal amplitude and phase change simultaneously.Since the linearity of the amplitude for a transmission path affects the amplitude component of the signal, it is critical to measure and characterize the third-order harmonic intermodulation distortions. The ME4510B applies a four-tone signal to the transmission path and then measures the third-order harmonic intermodulation distortions that are generated by this signal with the spectrum function.

Example of display screen

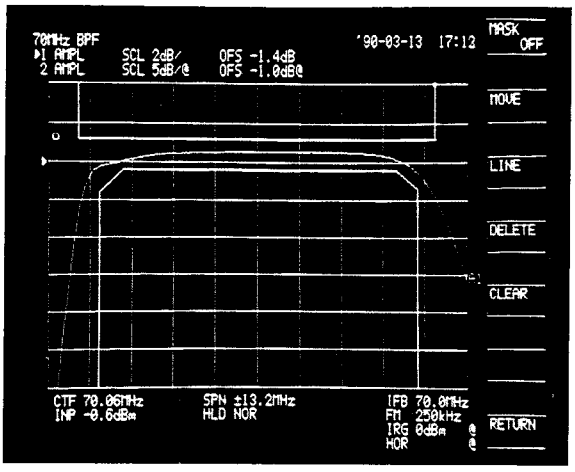
• Automatic setting

Measurement is very simple and easy because the input level range, CRT scale sensitivity, and measured trace position are set automatically according to the input levels and peak-to-peak deviations of the signals that are to be displayed on the measurement trace.



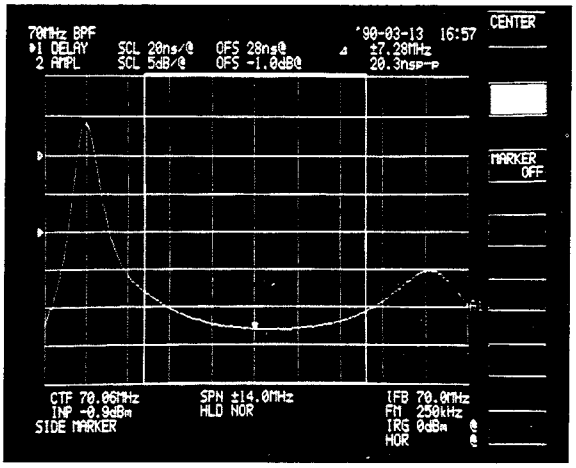
• Displaying specification lines

Specification lines can be input and displayed so that a GO/NO GO judgement can be easily made. Up to 10 sets of specification lines can be stored in and recalled from memory. So that a specification line may be re-used at a later time.



• Displaying data values by means of the markers

The maximum deviation of a measured trace (amplitude and delay characteristics) can be read by means of side markers.



Functions

• Memory

Measurement conditions, measured traces, and specification line data can be stored in memory. The memory is backed-up by a battery so that, after the measurement conditions have been set, measurements can again be performed under the same conditions simply by recalling the stored data.

• Remote-control via an RS-232C interface (option)

The transmitter and receiver have optional RS-232C interfaces, which can be used to remotely control the ME4510B from the far end station.

• Direct print out of the CRT screen

The measurement parameters and results on the display screen can be output directly to a printer without using a controller, so that a measurement data record can be easily and accurately created. Display screen print out controlled by means of a function key.

	Recommended model
Plotter	7470A (HP), 7475A (HP)
Printer	FP-850 (Epson), 2225A (HP), 2227A (HP)

Major specifications

• Overall (Transmitter and Receiver)

End-to-end measurement	Frequency range	70 ±25 MHz (70 MHz band), 140 ±60 MHz (140 MHz band)
	Amplitude characteristics	Measurement range: 0 to 40 dB Display sensitivity: 0.05 to 5 dB/div (1-2-5 sequence) Internal deviation: ≤0.1 dB (70 ±25 MHz), ≤0.3 dB (140 ±60 MHz) ⋆Input level at 0 dBm
	Delay characteristics	Measurement range: 0 to 400 ns Display sensitivity: 0.1 to 50 ns/div (1-2-5 sequence) Internal deviation1⋆1: ≤0.5 ns (70 ±25 MHz), ≤1 ns (140 ±60 MHz) Noise⋆1: 0.2 ns-rms
	Delay time difference between 2 propagation routes	Measurement range: – 200 to +200 ns Display sensitivity: 0.5 to 50 ns/div (1-2-5 sequence) Internal deviation⋆1: ≤0.5 ns (70 ±25 MHz), ≤1 ns (140 ±60 MHz) Noise⋆1: 0.5 ns-rms
	Return loss measurement	Measurement range: 10 to 50 dB (However, measurement accuracy depends on return loss bridge used.) Display sensitivity: 1 dB/div, 2 dB/div, 5 dB/div Internal deviation: 0.5 dB (45 ±95 MHz), 1 dB (80 ±200 MHz) ⋆Return loss bridge deviation omitted.

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Loop-back measurement	Amplitude characteristics	Measurement range: 10 to 40 dB Display sensitivity: 0.05 to 5 dB/div (1-2-5 sequence) Internal deviation: 0.3 dB (10 to 45 MHz), 0.4 dB (45 to 200 MHz), 0.8 dB (200 to 300 MHz) *Input level at 0 dBm
	Delay characteristics	Measurement range: –200 to +200 ns Display sensitivity: 0.1 to 50 ns/div (1-2-5 sequence) Internal deviation*1: ≤0.5 ns (45 to 95 MHz), ≤1 ns (80 to 200 MHz) Noise*1: 0.5 ns-rms
General		Input/output connector: BNC (SP-type connector also available. Please specify when ordering.) Power: *2Vac $^{+10}_{-15}$ %, 50/60 Hz, ≤320 VA (Transmitter: ≤110 VA, Receiver: ≤210 VA) Operating temperature range: 0° to 50°C Dimensions and mass: 426 (W) x 177 (H) x 351 (D) mm, ≤17.5 kg (Receiver) 426 (W) x 88 (H) x 351 (D) mm, ≤9.5 kg (Transmitter) EMC*3: EN55011 (1991, Group 1, Class A), EN50082-1 (1992) Safety: EN61010-1; 1993 (Installation Category II, Pollution Degree II)

*1: At FM frequency: 250 kHz, FM deviation: 200 kHz-rms
*2: Specify a nominal line voltage between 100 and 240 V when ordering. Maximum operation voltage is 250 V.
*3: Electromagnetic Compatibility

• Receiver

End-to-end measurement	Frequency range	70 ±25 MHz (70 MHz band), 140 ±60 MHz (140 MHz band)
	IF input	Level range: –30 to +20 dBm Level display: 3 digits on CRT (resolution: 0.1 dB) Level display accuracy: ±0.5 dB (at 70/140 MHz, 0 dBm) Input signal sweep width: ±(0.5 to 25) MHz [70 MHz band], ± (0.2 to 60) MHz [140 MHz band] Impedance: 75 Ω, Return loss: 26 dB (at 0 dBm)
	Frequency marker	Center marker Frequency range: 45 to 95 MHz (70 MHz band), 80 to 200 MHz (140 MHz band) Display resolution: 10 kHz Frequency accuracy: ±500 kHz (at ±1 MHz input signal sweep width) Side marker Frequency range: ± (0 to 25) MHz [70 MHz band], ± (0 to 60) MHz [140 MHz band] Display resolution: 10 kHz [at ± (0 to 9.99) MHz], 100 kHz [at ± (10 to 60) MHz] Frequency accuracy: ± (5% of sweep width +100 kHz)
	Demodulation of FM	FM signal frequency to be demodulated

a			b			c		
P1	P2	P3	P1	P2	P3	P1	P2	P3
66.667 kHz	200 kHz	400 kHz	92.539 kHz	277.778 kHz	555.556 kHz	83.333 kHz	250 kHz	500 kHz

		Delay characteristics measurement range: 50 to 500 kHz-rms
	Auxiliary IF input	Input level: –30 to +20 dBm (on 2 route propagation delay time measurement), –60 to –20 dBm (on return loss measurement) Impedance: 75 Ω Return loss: ≥20 dB at 0 dBm
	Screen horizontal axis phase adjustment	LINE: 0 to 360°, AUTO: ≥10°
	Trace blanking	Fly back time blanking of measured trace possible
	Normalizing function	Averaging, A–B, display hold
Spectrum measurement	Center frequency	Range: 10 kHz to 300 MHz Display resolution: 1/100 of span (/div) or 0.1 kHz, whichever is greater. Display accuracy: ± (E +5% of full frequency +10% of resolution bandwidth) *Where, E = 3 kHz (span: 1 to 200 kHz/div) or E = 30 kHz (span: 210 kHz/div to 30 MHz/div) Settings: Ten key pad, unit key, rotary knob, step key
	Frequency span	Measurement range/resolution

Frequency span	Resolution
10 to 200 kHz/div	1 kHz
210 kHz/div to 2 MHz/div	10 kHz
2.1 to 20 MHz/div	100 kHz
21 to 30 MHz/div	1 MHz

- Besides shown on the left, 0 Hz setting also possible for ten key pad.
- 10 kHz/div to 30 MHz/div is for step key setting. (1-2-5 sequence, 30 MHz/div)

		Display accuracy: ±5% (5 to 30 MHz/div), ±10% (10 kHz to 4.9 MHz/div) Settings: Ten key pad, unit key, rotary knob, step key
	Start/stop frequency	Setting range: 10 kHz to 300 MHz Display resolution: 1/100 of span (/div) or 0.1 kHz, whichever is greater Display accuracy: ± (center frequency display accuracy +10% of full frequency span) Settings: Ten key pad, unit key, step key

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Spectrum measurement	Zero marker	NORMAL: Indicates marker frequency and spectrum level DELTA (Δ): Indicates frequency and level differences between two markers ZONE→PEAK: Center of ZONE marker moves to trace peak, and indicates its frequency and level ZONE→CENTER: Sets center frequency to that indicated as the marker frequency ZONE→OFFSET: Sets offset level to that indicated by the marker Marker indication accuracy: ± (5% of full frequency span +10% of resolution bandwidth +E) *Where E = 3 kHz (span: 10 to 200 kHz/div) or E = 30 kHz (span: 210 kHz/div to 30 MHz/div) Display resolution: Frequency; 1/100 of span (/div) or 0.1 kHz whichever is greater, level; 0.1 dB
	Resolution bandwidth setting range (3 dB bandwidth)	100 Hz to 300 kHz (1-3-10 sequence)
	Amplitude	Measurement range: –110 to +20 dBm CRT display: Vertical axis; 8 div (uppermost scale line used as reference level) Scale: 10 dB/div (0 to –70 dB from reference level), 5 dB/div (0 to –40 dB from reference level), 2 dB/div (0 to –16 dB from reference level), 1 dB/div (0 to –8 dB from reference level)
	Input attenuator setting range	0 to 55 dB, 5 steps (manually or automatically set according to reference level)
	Frequency response	3 dB (input attenuator 0 dB, 100 kHz to 300 MHz)
	2nd harmonic distortion	≤–65 dB (45 to 150 MHz, when input level – input attenuator loss = –35 dBm)
	Two signal 3rd intermodulation distortion	≤–65 dB (input frequency: 45 to 200 MHz, when input level – input attenuator loss = –35 dBm)
	Video bandwidth	100 Hz to 300 kHz, 1-3-10 sequence (manually or automatically set according to resolution bandwidth)
	Sweep time	10 ms/div to 10 s/div (manually or automatically set according to frequency span, resolution bandwidth or video bandwidth)
	Sweep trigger	FREE, RUN ,LINE, VIDEO
	Normalizer function	Averaging, MAX HOLD, A–B
Loop-back measurement	Frequency range	10 to 300 MHz
	Input level range	– 30 to +20 dBm
	Marker	Type: NORMAL, DELTA, ZERO→PEAK, ZERO→CENTER Marker frequency accuracy: ±(5% of full frequency span + E) *Where E = 20 kHz (span: 10 to 200 kHz/div), or E = 200 kHz (span: 210 kHz/div to 30 MHz/div) Display resolution Frequency: 1/100 of frequency span (/div), or 0.1 kHz whichever is greater Level: 1/10 of scale (/div), or values shown below; Amplitude characteristics: Minimum 0.01 dB, Delay characteristics: Minimum 0.01 ns
	Demodulation of FM	Demodulation signal frequency: Same as those of end-to-end measurement Delay characteristics measurement range: 50 to 500 kHz-rms
	Normalizer function	Averaging A–B
Other functions		Mask (specification line) display: Specification lines can be set and displayed on CRT screen. Measurement condition memory: Up to ten sets of measurement conditions can be saved and recalled. Screen graphic memory: Up to 30 sets of graphic information (title, measurement conditions, measured trace) can be saved and recalled. Mask memory: Up to 10 sets of mask data can be saved and recalled. Hard copy: Screen graphic information can be output to external printer via GPIB (talk only mode) Title display: Title of up to 38 characters can be set and display on CRT screen. Time display: Year, month, day hour, minutes can be displayed on CRT screen. CRT brightness adjustment: CRT brightness setting possible External control: GPIB (IEEE488). All functions can be controlled except power switch and horizontal axis phase adjustment.

• Transmitter

IF signal	Frequency	Range: 45 to 200 MHz Display: Digital 5 digits, LED (resolution: 10 kHz) Accuracy: ± (20 kHz +0.1% of sweep width)
	IF sweep width	Range: ± (0 to 25) MHz [center frequency: 70 MHz], ± (0 to 60) MHz [center frequency: 140 MHz] Display: Digital 3 digits, LED, Display resolution; 10 kHz [± (0 to 9.99) MHz] or 100 kHz [± (10 to 60) MHz] Accuracy: ±5%
	Output level	Range: –50 to 10 dBm Display: Digital 3 digits, LED (resolution: 0.1 dB) Accuracy: ±0.3 dB (70/140 MHz, at 0 dBm output)
	Amplitude deviation compensation	± (0 to 0.1) dB/10 MHz sweep width (at 0 dBm output)
	Harmonics	≤–30 dB (at +10 dBm output)
	Output impedance	75 Ω, ≥26 dB (at 0 dBm output)
	Sweep signal	Frequency: AC mains frequency, 70 Hz, 18 Hz, external signal frequency (18 to 70 MHz) Display: LED Frequency accuracy: ±10% Waveform: sinusoidal
	Frequency modulation	Modulation frequency a: P1 66.667 kHz, P2 200 kHz, P3 400 kHz b: P1 92.593 kHz, P2 277.778 kHz, P3 555.556 kHz c: P1 83.333 kHz, P2 250 kHz, P3 500 kHz Frequency accuracy: ±1 x 10^{-5} Deviation: 0 to 995 kHz-rms Display: Digital 3 digits, LED, Resolution: 1 kHz (at 0 to 99 kHz-rms) or 5 kHz (at 100 to 995 kHz-rms)

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IM3 measurement signal	Output signal	Up to 4 simultaneous signal output possible
	Frequency	Range: 55 to 85 MHz (70 MHz band), 110 to 170 MHz (140 MHz band) Display: Digital 5 digits, LED (resolution: 10 kHz) Accuracy: ±5 x 10^{-5}
	Output level	Range: –60 to +0 dBm (per single wave) Display: Digital 3 digits, LED (resolution: 0.1 dB) Accuracy: ±1.0 dB (at 0 dBm) Level adjustment: Greater than the range of ±2.5 dB (Each signal level can be adjusted separately)
	Spurious	Harmonics: ≤–50 dB (for a output signal, at 0 dBm) IM3 spurious: ≤–60 dB (two output signal at 0 dBm, frequency interval: ≥1 MHz)
	Digital sweep	Output signal: Two sweep signal, one fixed frequency signal (adjustable frequency) Center frequency Range: 55 to 85 MHz (70 MHz band), 110 to 170 MHz (140 MHz band) Display: Digital 5 digits, LED (resolution: 10 kHz) Sweep width Range: ± (0 to 15) MHz [70 MHz band], ± (0 to 30) MHz [140 MHz band] Display: Digital 3 digits, LED (resolution: 100 kHz) Frequency difference between two signals: 0 to 5.0 MHz (resolution: 100 kHz)
	Output impedance	75 Ω, return loss: ≥20 dB (at –10 dBm)
Loop-back measurement signal	Frequency range	10 to 300 MHz
	Output level	Range: –50 to +10 dBm Display level: Digital 3 digits, LED Resolution: 0.1 dB Accuracy: ±1 dB (70/140 MHz, at 0 dBm output)
	Harmonics	≤–30 dB (10 to 200 MHz), ≤–26 dB (200 to 300 MHz)
	Frequency modulation	Same as those of IF sweep signal frequency modulation function
	Output impedance	75 Ω, return loss (at 0 dBm output): ≥26 dB (10 to 200 MHz); ≥20 dB (200 to 300 MHz)
Other functions		Measurement condition memory: Up to 10 sets of measurement conditions can be saved and recalled. External control: GPIB (IEEE488). All functions of panel settings except power switch can be controlled.

Ordering information

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

Model/Order No.	Name	
ME4510B*1	**Main frame** Digital Microwave System Analyzer	
	Standard accessories	
J0082A*2	Coaxial cord, SP-3CP•3C-2WS•SP-3CP (for SP connector), 2 m:	2 pcs
J0092C*2	Coaxial cord, BNC-P62ø•3C-2W•BNC-P (for BNC-P connector), 2 m:	2 pcs
J0093A	Coaxial cord, BNC-P•RG-55/U•BNC-P, 0.5 m:	1 pc
J0134	Power cord, 2.5 m (one each for Transmitter and Receiver):	2 pcs
F0013	Fuse, 5 A:	2 pcs
F0011	Fuse, 2 A:	2 pcs
F0049	Fuse, 8 A:	1 pc
F0046	Fuse, 3.15 A:	1 pc
F0045	Fuse, 2 A:	2 pcs
F0043	Fuse, 1 A:	1 pc
W0637AE	ME4510B operation manual:	1 copy
	Options	
ME4510B-01	RS-232C interface (factory assembly required)	
	Optional accessories	
MA2510A/B	IF Return Loss Bridge (A: BNC, B: SP) *Bridge balance: ≥54 dB (45 to 190 MHz)	
MA1513A/B	20 dB Return Loss Termination (A: BNC, B: SP)	
MB23A	Portable Test Rack	
MB24A	Portable Test Rack	
B0018	Front cover (for Transmitter)	
B0020	Front cover (for Receiver)	
B0029	Stacking feet	
B0163	Soft carrying case *Front cover (B0018 or B0020) is needed.	
Z0175	ME4510B service kit	

*1: Standard input/output connector: BNC, (SP-type connector is available.)
*2: Either one is attached according to the main frame connector type.