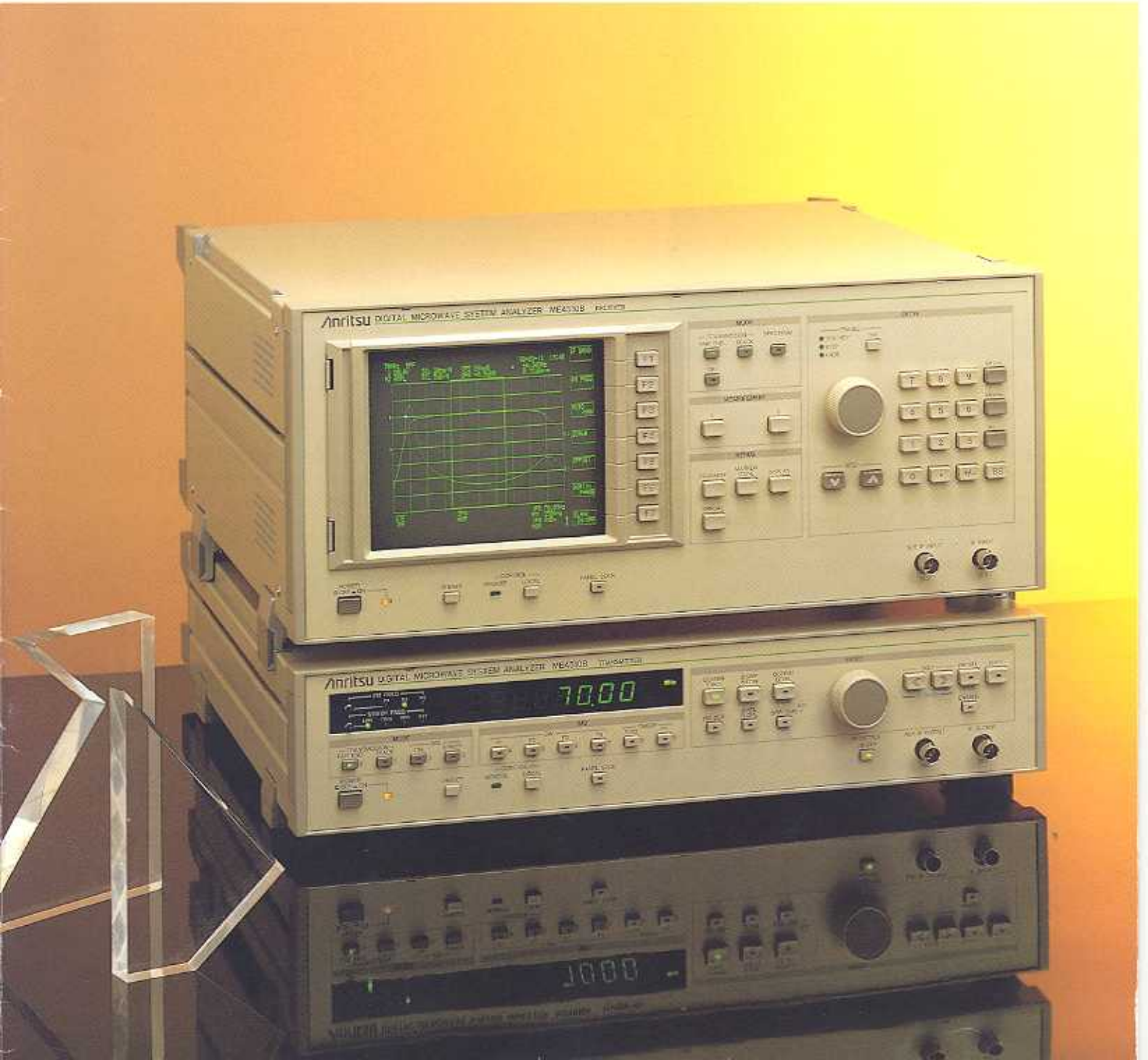
Anritsu

Digital Microwave System Analyzer

ME4510B



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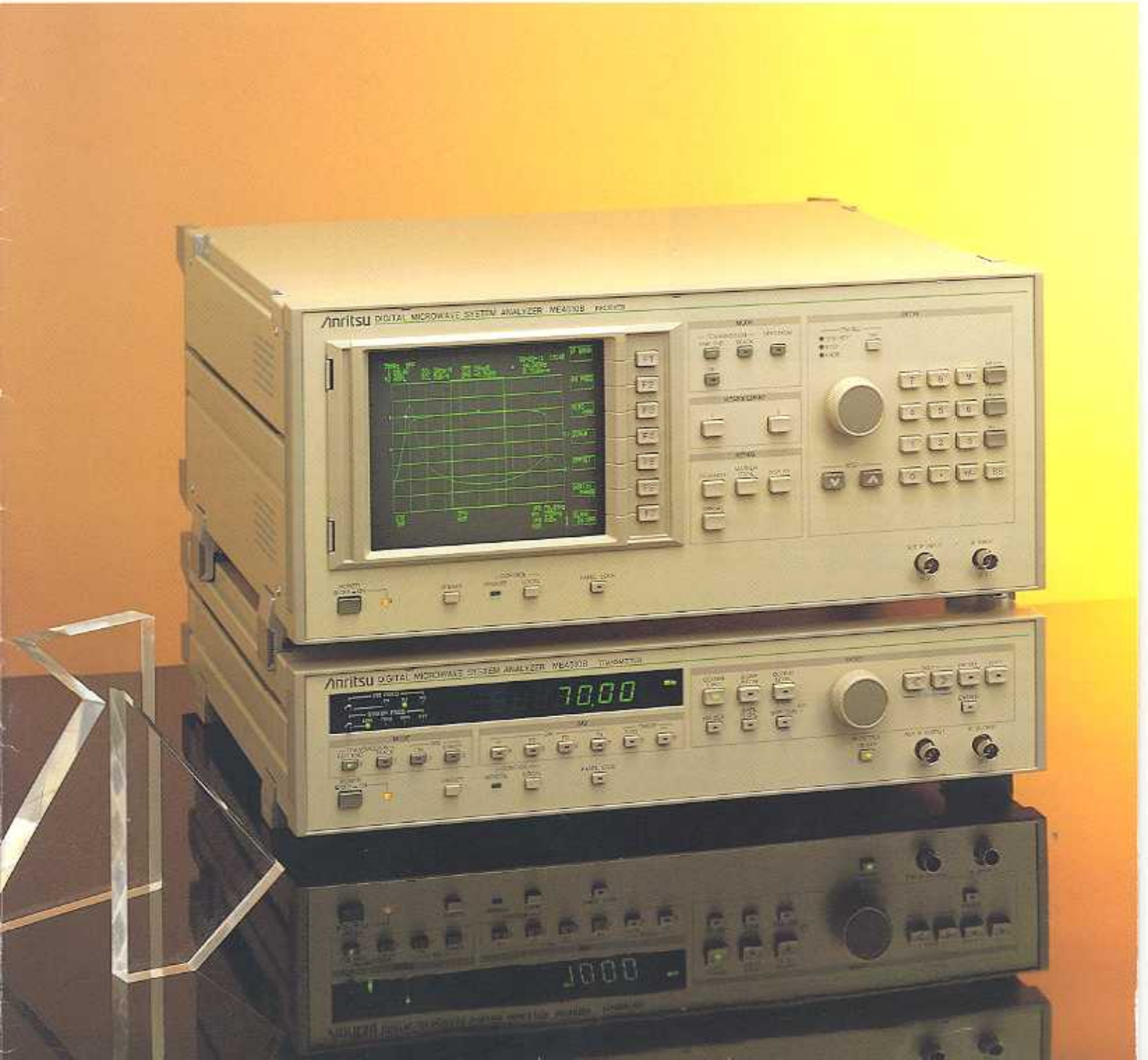


General

The ME4510B Digital Microwave System Analyzer (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.

Today, quadrature amplitude modulation methods such as 16QAM and 64QAM are used in large-capacity digital microwave links.
These multi-level modulation systems are thought to improve the spectral efficiency.

If the amplitude or delay characteristics of a large-capacity digital microwave link which uses quadrature amplitude modulation are poor, then distortion in the digital microwave transmission signals will not only cause interference between codes but will also cause code errors to occur. Therefore, these transmission characteristics must be completely equalized by acculately adjusting them during calibration measurement before the system is put into normal use.

The ME4510B DMSA outputs a four tone signal for the measurement of amplitude linearity through intermodulation distortion. The ME4510B can also measure IF spectrums.

Applications

The ME4510B can be used in the installation, maintenance and manufacturing digital microwave links. Specifically, the ME4510B can be used to evaluate the following digital microwave link characteristics:

- Overall quality of transmission links
  The far-end delay and amplitude characteristics between terminal stations can be measured.
  Since the DMSA transmitter and receiver operate separately, far-end measurements can be performed with a single set of receiver and transmitter.
- Space diversity;
  When links are being constructed, the propagation delay time difference between the main route and the subroute can be measured.

The RF band can be measured with an optional UP/DOWN converter.

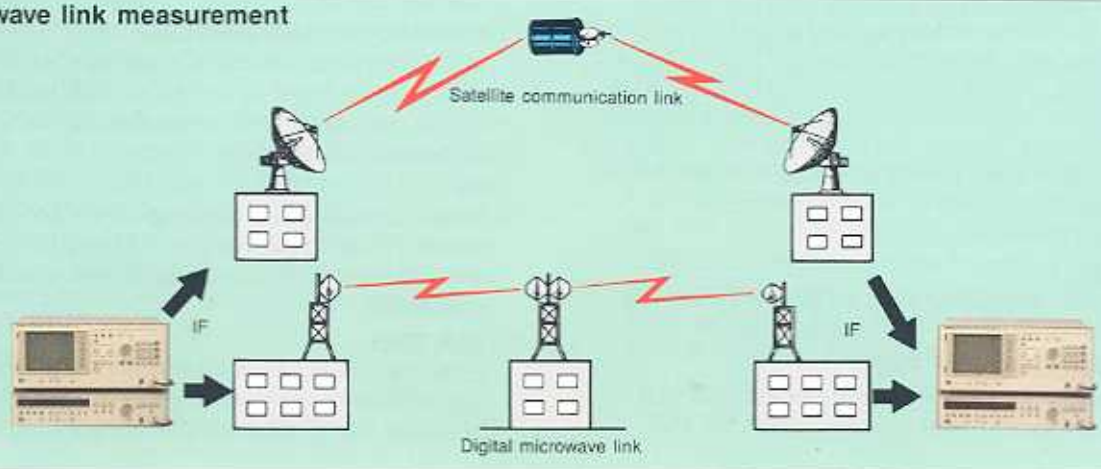
Measurement Items

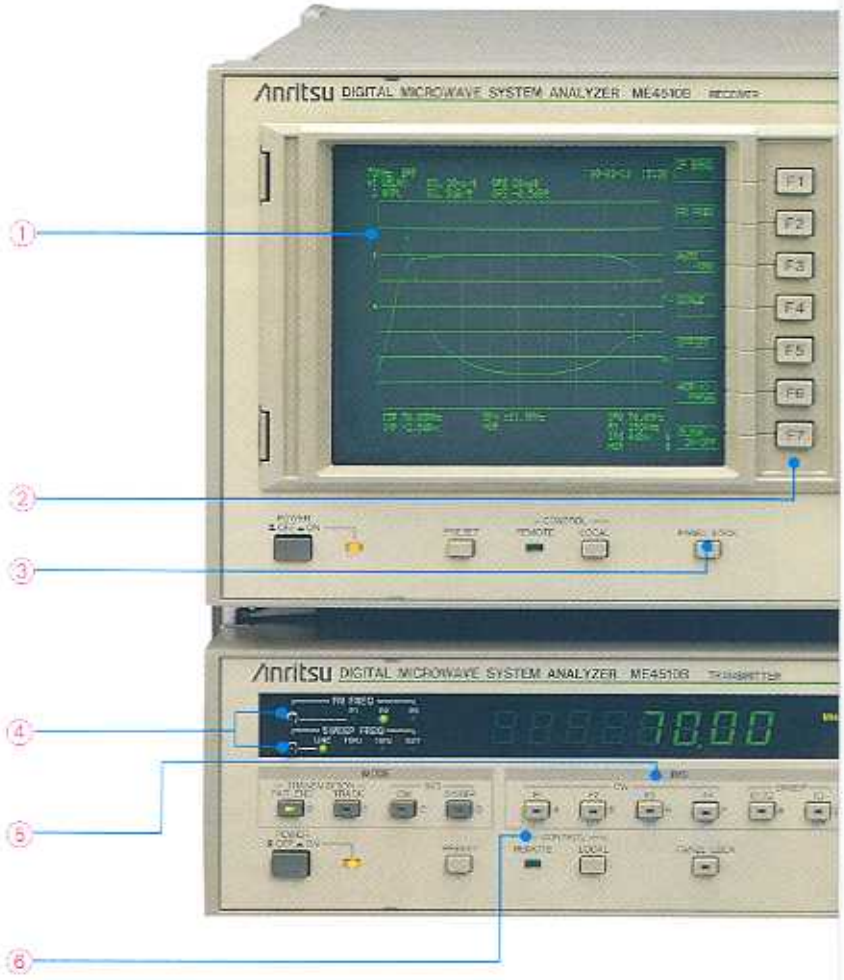
- Delay characteristics
- Amplitude characteristics
- Two-route propagation delay time differences
- Third-order harmonic intermodulation distortions
- Spectrum analysis
- Return loss

Features

- Both 70 MHz and 140 MHz bands can be measured.
- In combination with the conventional ME453/538 series MSA instruments, both the IF band delay and the amplitude characteristics can be measured.
- The GP-IB is a standard feature for both the transmitter and receiver.
- The measurement conditions, measured screen images, and specification line data can be stored in battery-powered memory.
- All measurement information is displayed on the CRT.
- Both noise reduction of measured screen images and display for subtraction of two images can be performed.
- The user specified limit lines, title, and time can be displayed on the CRT.
- CRT screen images can be printed out directly by means of a function key.
- The transmitter and receiver can be externally controlled via an optional RS-232C interface.

Microwave link measurement





ME4510B Digital Microwave System Analyzer Panel controls

① **CRT**
Displays measurement information including the measurement conditions, measurement trace, graticule, markers, date and title on the CRT. Screen images can be output directly to an external printer. The brightness of each display item can be adjusted independently.

② **Easy Operation Using Soft Keys**
The functions performed by the soft keys change with each measurement menu that is selected. These measurement menus include functions which set the value of measurement parameters, display the data markers, select the method of data processing and transfer measurement data to and from memory. So the ME4510B is easy to use.

③ **PANEL LOCK**
Disables the panel keys so that they will not unintentionally set to a different value.

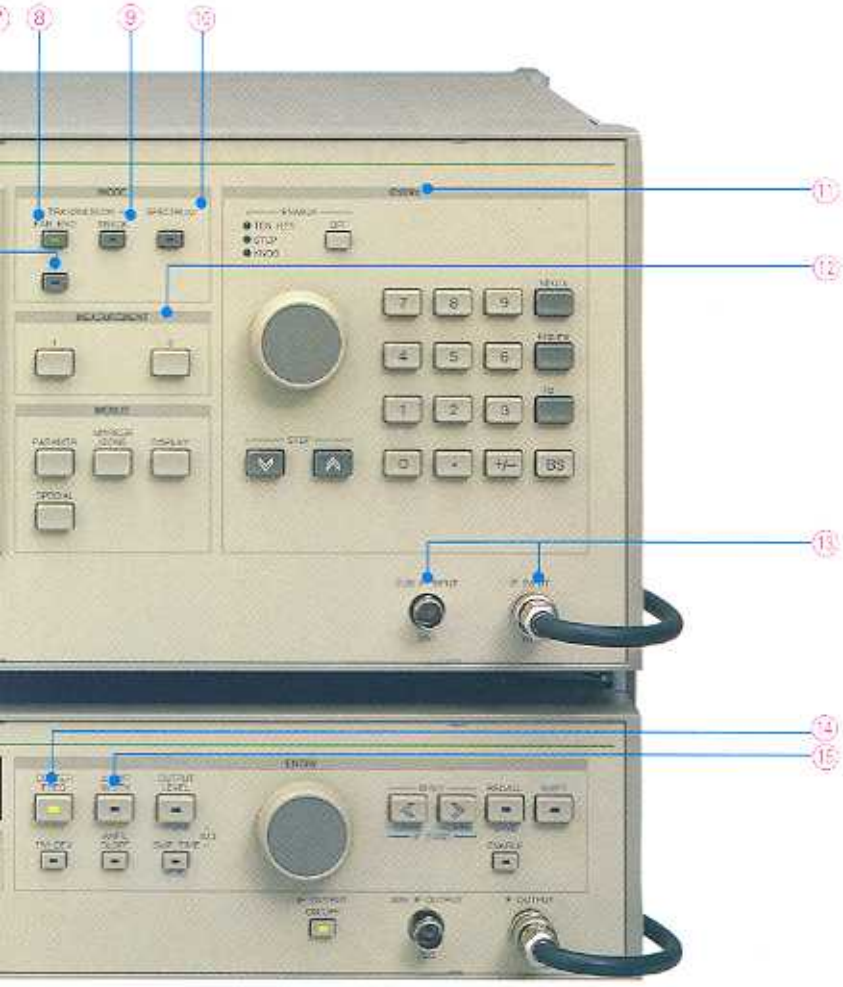
④ **FM FREQ/SWEEP FREQ**
Provides the nine FM frequencies and four sweep modes most typically used, so that almost all terrestrial/satellite microwave communication links can be evaluated.

⑤ **IM3**
The IM3 measurement mode includes two sub-modes. In the first sub-mode a signal with up to four CW tones is generated. In the second sub-mode, a signal that consists of three tones is generated. Two of these tones are swept frequency signals that have a constant frequency difference, while the third tone is a fixed frequency signal.

⑥ **CONTROL-REMOTE/LOCAL**
Measured data can be output from or control data can be input to the ME4510B via either the GP-IB (standard feature) or the RS-232C (optional) interface.

⑦ **RF**
When used with an optional UP/DOWN converter, RF (microwave) band amplitude, delay and return loss characteristics can also be measured.

⑧ **FAR END**
Enables far-end measurement of the characteristics of the microwave transmission link that exists between the IF input of the transmitting station



and the IF output of the receiving station. Signals used to measure the IF amplitude/delay characteristics are compatible with Anritsu's ME453/538 series MSA; therefore, far-end measurements are possible when the ME4510B is used in combination with the ME453/538 series MSA.

⑨ **TRACK**
When the transmitter and receiver are connected together, the ME4510B works as a scalar network analyzer.
The amplitude, delay and return loss characteristics of IF equipment can be measured.

⑩ **SPECTRUM**
Provides the same set of functions as a 10 kHz to 300 MHz spectrum analyzer. Amplitude linearity characteristics can be determined from the IM3 (the third-order intermodulation distortion of the two signals) and the transmitter multi-tone signals. Adjacent channel signal leak and interference signals can be quantified with the SPECTRUM function.

⑪ **ENTRY**
Numerical data can be entered into the ME4510B by one of three methods: directly through the numerical key pad, incrementally through the increase/decrease data step key size, or continuously via the adjustable knob. The method of entry for specific instrument setting is indicated by an LED so that instrument settings can be set efficiently.

⑫ **MEASUREMENT (Two trace display)**
Two measurement items can be displayed with two separate traces. Trace 1 can display the amplitude, delay or delay difference; trace 2 can display the amplitude or return loss.

⑬ **IF INPUT/SUB IF INPUT**
Theses two input terminals are used for direct measurements of space diversity propagation delay time difference.

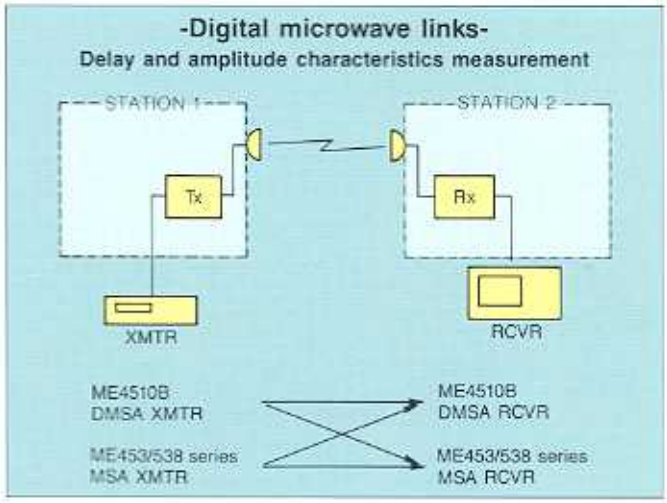
⑭ **Accurately controlable CENTER FREQ**
Frequency synthesizer circuitry is used to stabilize and accurately control the center frequency.

⑮ **±SWEEEP WIDTH (Wide band)**
Wide sweep bands of ±25 MHz for the 70 MHz band and ±60 MHz for the 140 MHz band allow a wide range of measurement.

- **Digital microwave link delay and amplitude characteristics can be measured.**

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 DMSA can be used to evaluate both of these bands. In addition, since the ME4510B can measure the FM and sweep frequencies that are listed in the table below, 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.

Mode	FM frequency	Sweep frequency	Main application
a	66.667 kHz 220 kHz 400 kHz	Power line frequency	Terrestrial microwave links
b	92.593 kHz 277.778 kHz 555.556 kHz	18 Hz	Satellite microwave links
c	83.333 kHz 250 kHz 500 kHz	Power line frequency or 70 Hz	Terrestrial microwave links



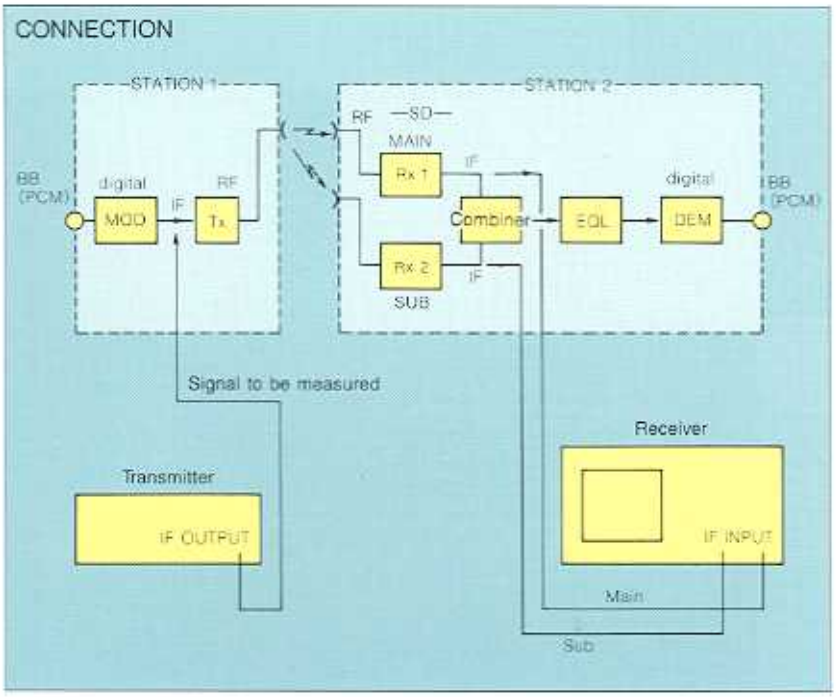
- **Space diversity propagation delay time difference can be measured.**

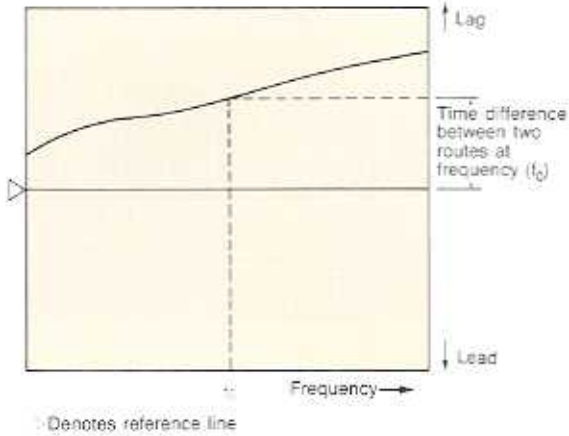
When installing a microwave link the propagation time for the space diversity (SD) main route and sub-route must be matched.

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





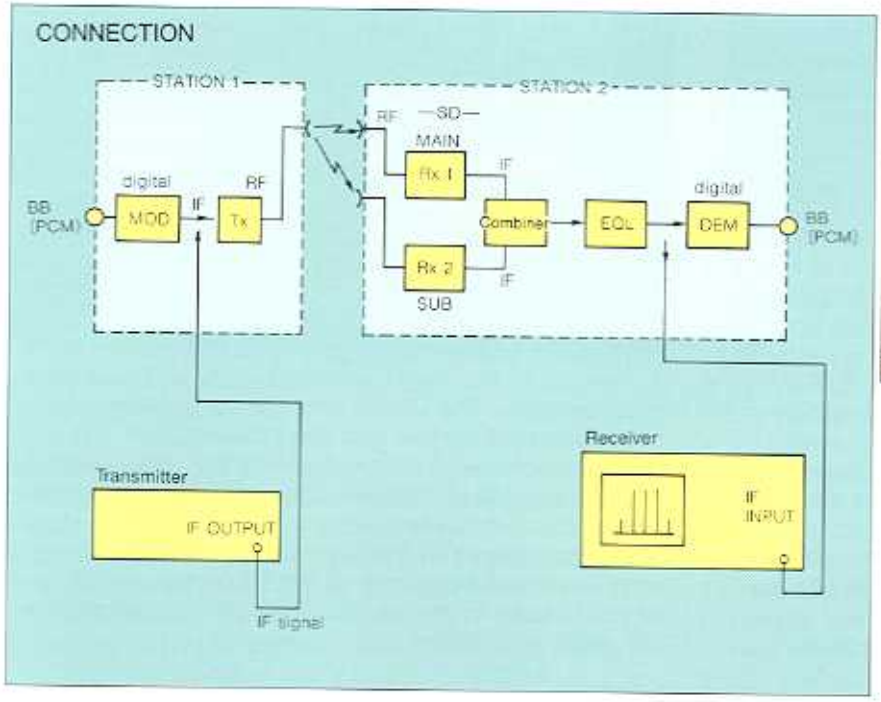
• A four-tone signal can be used to measure the third-order harmonic intermodulation distortions

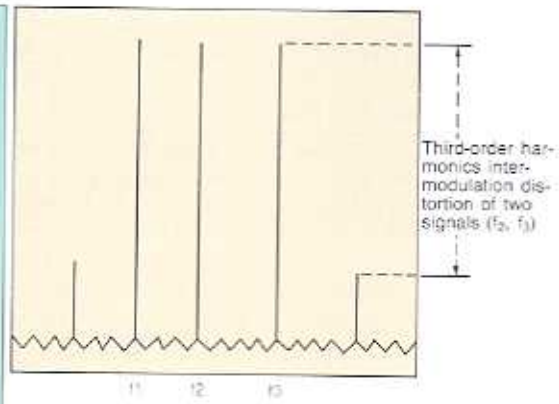
Large-capacity digital microwave links use quadrature amplitude modulation in which the signal amplitude and phase change simultaneously.
Since the linearity of the amplitude for a transmission path affects the amplitude component of the signal, it is critical to measure and characterize the third-order harmonic intermodulation distortions.

The DMSA applies a four-tone signal (f_1, f_2, f_3, and f_4) to the transmission path and then measures the third-order harmonic intermodulation distortions which are generated by this signal with the spectrum function.

Distortion components = $2 \times f_1 - f_2$, $2 \times f_2 - f_3$, $2 \times f_3 - f_4$, $2 \times f_4 - f_1$, ... Others

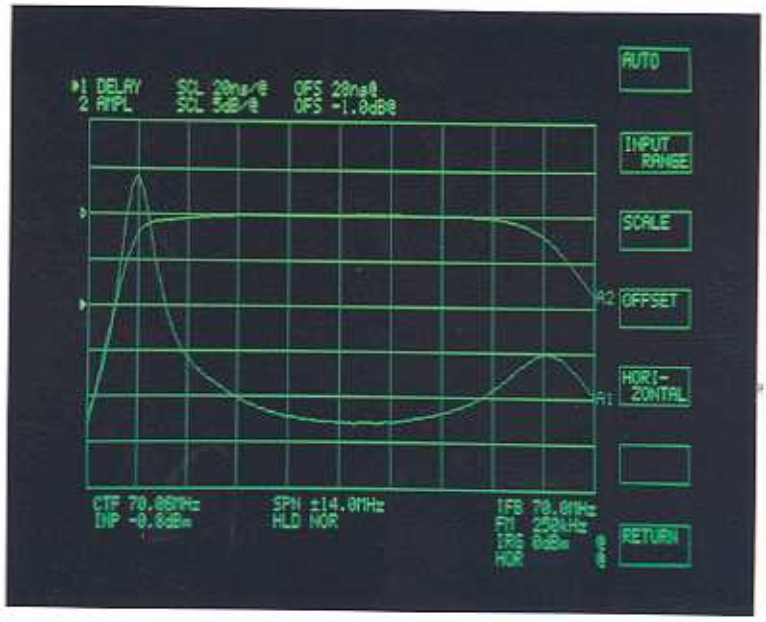
Note: The ME4510B1 output is limited to a maximum of 3 tones.





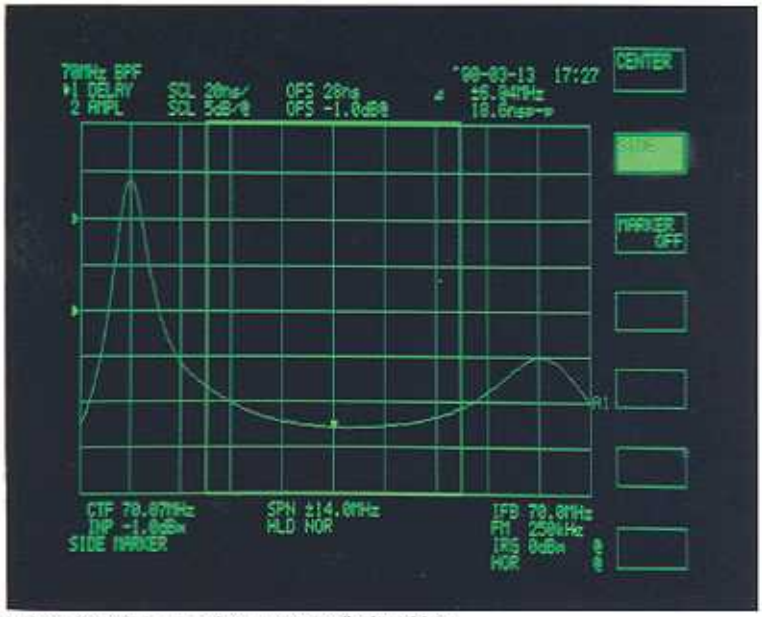
• Automatic setting

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 data values by means of the markers**

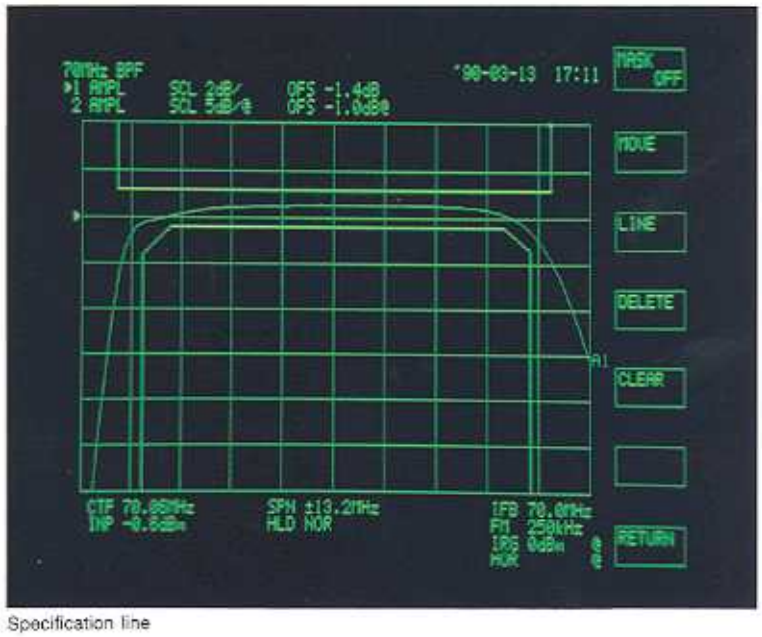
The maximum deviation of a measured trace (amplitude and delay characteristics) can be read by means of side markers.



Maximum deviation and frequency are displayed here

- **Displaying specification lines**

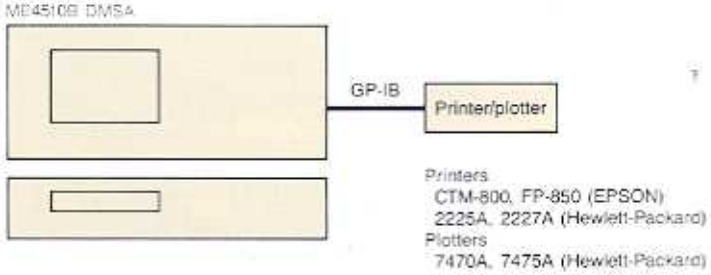
Specification lines can be input and displayed so that a GO/NO GO judgement can be easily made.
Up to 10 sets of specification lines can be stored in and recalled from memory. So that a specification line may be re-used at a later time.



Specification line

- **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 is controlled by means of a function key.



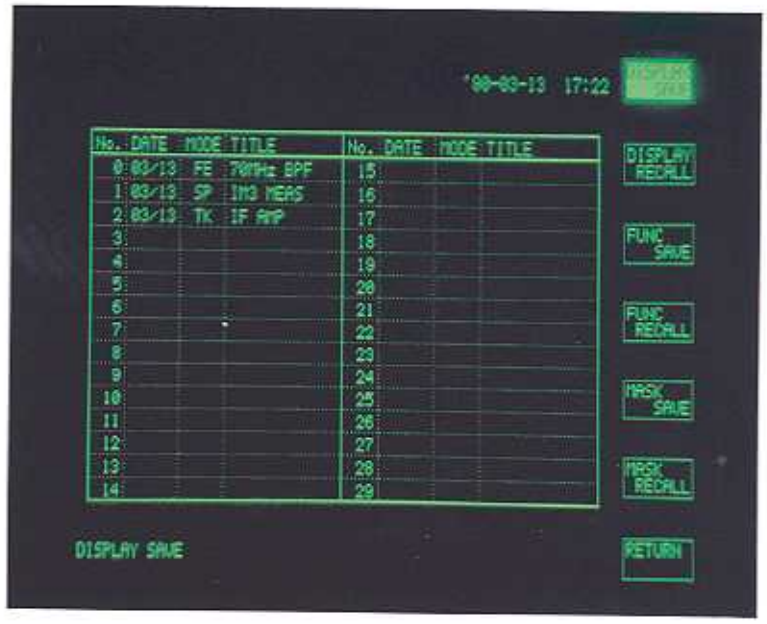
• **Memory**

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.

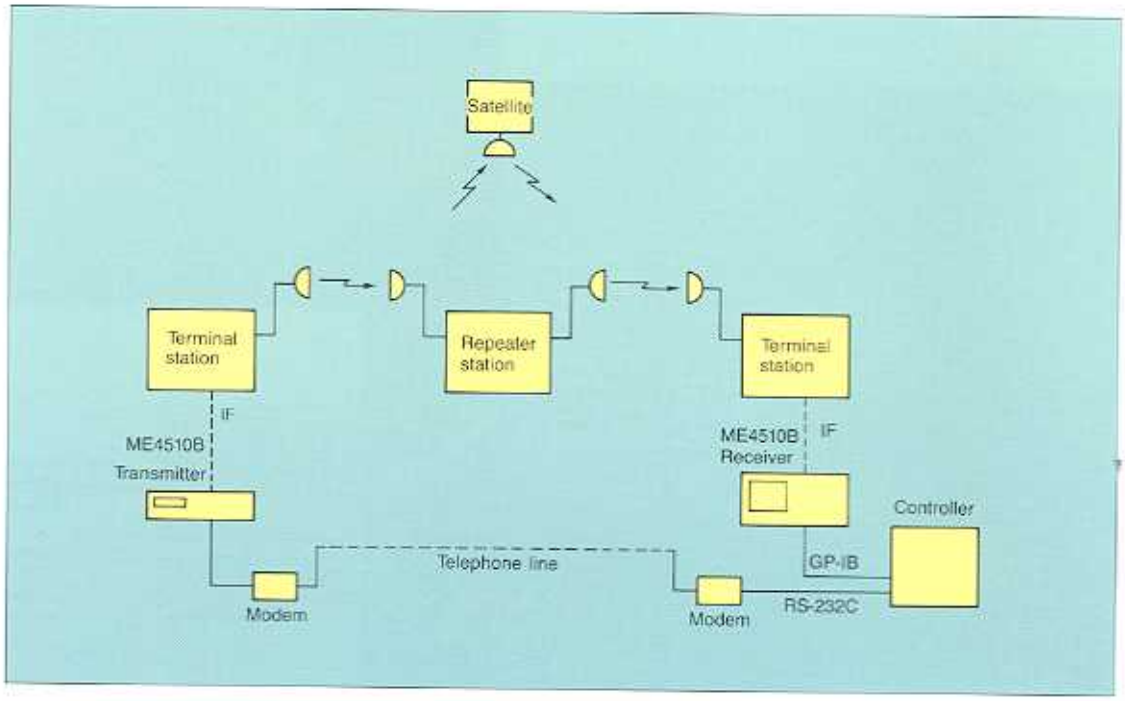
Memory Types and Memory Storage Capacity

	Item	Memory storage capacity
RCVR	Measurement conditions	10 sets
	Measured images	30 screens
	Specification lines	10 sets
XMTR	Measurement conditions	10 sets



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

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



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 dB/div 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 deviation	≦0.5 ns (70 ±25 MHz), ≦1 ns (140 ±60 MHz)
		Noise	0.2 ns-rms (at FM freq.: 250 kHz, FM deviation: 200 kHz-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	≦0.5 ns (70 ±25 MHz), ≦1 ns (140 ±60 MHz)
		Noise	0.5 ns-rms (at FM freq.: 250 kHz, FM deviation: 200 kHz-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 to 95 MHz), 1 dB (80 to 200 MHz) *Return loss bridge deviation omitted.
Loop-back measurement	Amplitude characteristics	Measurement range	0 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	≦0.5 ns (45 to 95 MHz), ≦1 ns (80 to 200 MHz)
		Noise	0.5 ns-rms (at FM freq.: 0 kHz, FM deviation: 200 kHz-rms)

• 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 0/140 MHz, 0 dBm)
		Input signal sweep width	±(0.5 to 25) MHz [70 MHz band], ±(0.2 to 60) MHz [140 MHz band]
		Impedance	75Ω, 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 ±49.99) MHz], 100 kHz [at ±(50 to 60) MHz] Frequency accuracy: ±(5% of sweep width +100 kHz)
	Demodulation of FM	FM Signal frequency to be demodulated	
		Delay characteristic measurement range	50 to 500 kHz-rms

a			b			c		
P1	P2	P3	P1	P2	P3	P1	P2	P3
66.667kHz	200kHz	400kHz	92.593kHz	277.778kHz	555.556kHz	83.333kHz	250kHz	500kHz

End-to-end measurement

Auxiliary IF input	Input level ragne	−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
AUTO function	Input level range	−20 to +20 dBm, 10 dB step [Optimum ranges are selected automatically at AUTO mode]
	Scale sensitivity	Measurement item scale sensitivities are as shown below. (However, optimum range is selected automatically at AUTO mode).

Range No.	Delay characteristis	Amplitude chracteristics	Delay time difference between 2 propagation routes	Return Loss
1	(0.1) ns/div	—	—	—
2	(0.2)	—	—	—
3	0.5	(0.05) dB/div	0.5 ns/div	—
4	1	(0.1)	1	—
5	2	0.2	2	—
6	5	0.5	5	—
7	10	1	10	1 dB/div
8	20	2	20	2
9	50	5	50	5

Values in parentheses "( )" cannot be set at AUTO mode.

Offset — Measurement item offset ranges are as shown below. (Optimum offset values are set at AUTO mode.)

	Delay characteristics	Amplitude characteristics	Delay time difference between 2 propagation routes	Return loss
Range	−200 to +200 ns	−30 to +10 dB	−100 to +100 ns	10 to 50 dB
Min. display resolution	0.1 ns	0.01 dB	0.1 ns	1 dB

	Sweep signal	LINE: Synchronized with AC mains frequency AUTO: Synchronized with input signal frequency (Frequency range: 18 to 70 Hz)
Normalizing function	Averaging	Displays measured trace averaged for every sweep (Averaging figure: 2 to 1000)
	Arithmetic operation	A−B→A (Displays difference between traces A and B) A→B (Stores measured trace A in memory B)
	Display hold	Holds measured trace still

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 span +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

Spectrum measurement	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
	Zone 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	Average noise level to +20 dBm
		CRT display	Vertical axis: 8 div (Uppermost scale line used as refference 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 responce		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	Starts with its own timing
		LINE	Starts synchronizing with AC mains frequency
		VIDEO	Starts synchronizing with video signal
	NORMALIZER function	Averaging	Displays measured trace A after averaging
		MAX HOLD	Displays maximum value by every sweep
		A−B	Displays difference between traces A and B

<table>
<tr><td rowspan="15">Loop-back measurement</td><td colspan="2">Frequency range</td><td>10 to 300 MHz</td></tr>
<tr><td colspan="2">Input level range</td><td>−30 to +20 dBm</td></tr>
<tr><td rowspan="6">Marker</td><td>NORMAL</td><td>Displays marker point frequency and level</td></tr>
<tr><td>DELTA</td><td>Displays frequency difference and level difference between two markers</td></tr>
<tr><td>ZONE→PEAK</td><td>Marker moves to peak point, and displays its frequency and level.</td></tr>
<tr><td>ZONE→CENTER</td><td>Marker frequency indication coincides with center frequency.</td></tr>
<tr><td>Marker frequency accuracy</td><td>± (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)</td></tr>
<tr><td>Display resolution</td><td>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</td></tr>
<tr><td rowspan="2">Demodulation of FM</td><td>Demodulation signal frequency</td><td>Same as those of end-to-end measurement</td></tr>
<tr><td>Delay characteristics measurement range</td><td>50 to 500 kHz-rms</td></tr>
<tr><td rowspan="3">AUTO function</td><td>Input level range</td><td>−20 to +20 dBm, 10 dB steps (Optimum range is selected automatically according to the input level)</td></tr>
<tr><td>Scale sensitivity</td><td>Each measurement item sensitivity are as shown below. (Optimum value is automatically set according to the measured trace offset value.)
<table>
<tr><th>Range No.</th><th>Group delay characteristics</th><th>Amplitude characteristics</th></tr>
<tr><td>1</td><td>(0.1) ns/div</td><td>—</td></tr>
<tr><td>2</td><td>(0.2)</td><td>—</td></tr>
<tr><td>3</td><td>0.5</td><td>(0.05) dB/div</td></tr>
<tr><td>4</td><td>1</td><td>0.1</td></tr>
<tr><td>5</td><td>2</td><td>0.2</td></tr>
<tr><td>6</td><td>5</td><td>0.5</td></tr>
<tr><td>7</td><td>10</td><td>1</td></tr>
<tr><td>8</td><td>20</td><td>2</td></tr>
<tr><td>9</td><td>50</td><td>5</td></tr>
</table>
• Values in parenthese "( )" cannot be set at AUTO mode.</td></tr>
<tr><td>Offset</td><td>Each measurement item offset value range are as shown below. (Optimum offset value is set automatically according to the measured trace offset value.)
<table>
<tr><th></th><th>Group delay characteristics</th><th>Amplitude characteristics</th></tr>
<tr><td>Range</td><td>−200 to 200 ns</td><td>−30 to +10 dB</td></tr>
<tr><td>Display resolution</td><td>0.1 ns</td><td>0.01 dB</td></tr>
</table></td></tr>
<tr><td rowspan="2">Normalizer function</td><td>Averaging</td><td>Displays measured trace after averaging by every sweep (averaging figure: 2 to 1000).</td></tr>
<tr><td>A — B</td><td>Displays difference between measured traces A and B.</td></tr>
<tr><td rowspan="8">Other functions</td><td colspan="2">Mask (specification line) display</td><td>Specification lines can be set and displayed on CRT screen.</td></tr>
<tr><td colspan="2">Measurement condition memory</td><td>Up to ten sets of measurement conditions can be saved and recalled.</td></tr>
<tr><td colspan="2">Screen graphic memory</td><td>Up to 30 sets of graphic information (Title, measurement conditions, measured trace) can be saved and recalled.</td></tr>
<tr><td colspan="2">Mask memory</td><td>Up to 10 sets of mask data can be saved and recalled.</td></tr>
<tr><td colspan="2">Hard copy</td><td>Screen graphic information can be output to external printer. Via GP-IB (Talk only mode)</td></tr>
<tr><td colspan="2">Title display</td><td>Title of up to 38 characters can be set and displayed on CRT screen.</td></tr>
<tr><td colspan="2">Time display</td><td>Year, month, day, hour, minutes can be displayed on CRT screen.</td></tr>
<tr><td colspan="2">CRT blightness adjustment</td><td>CRT blightness setting possible.</td></tr>
<tr><td colspan="2">External control</td><td>GP-IB (IEEE488). All functions can be controlled except power switch and horizontal axis phase adjustment.</td></tr>
</table>

• Transmitter

<table>
<tr><td rowspan="16">IF signal</td><td rowspan="3">Frequency</td><td>Range</td><td>45 to 200 MHz</td></tr>
<tr><td>Display</td><td>Digital 5 digits, LED (resolution: 10 kHz)</td></tr>
<tr><td>Accuracy</td><td>±(20 kHz +0.1% of sweep width)</td></tr>
<tr><td rowspan="3">IF sweep width</td><td>Range</td><td>±(0 to 25) MHz [Center frequency: 70 MHz], ±(0 to 60) MHz [Center frequency: 140 MHz]</td></tr>
<tr><td>Display</td><td>Digital 3 digits, LED. Display resolution: 10 kHz [±(0 to 9.99) MHz] or 100 kHz [±(10 to 60) MHz]</td></tr>
<tr><td>Accuracy</td><td>±5%</td></tr>
<tr><td rowspan="3">Output level</td><td>Range</td><td>−50 to 10 dBm</td></tr>
<tr><td>Display</td><td>Digital 3 digits, LED (Resolution: 0.1 dB)</td></tr>
<tr><td>Accuracy</td><td>±0.3 dB (70/140 MHz, at 0 dBm output)</td></tr>
<tr><td colspan="2">Amplitude deviation compensation</td><td>±(0 to 0.1) dB/10 MHz sweep width (at 0 dBm output)</td></tr>
<tr><td colspan="2">Harmonics</td><td>≦ −30 dB (at +10 dBm output)</td></tr>
<tr><td colspan="2">Output impedance</td><td>75Ω, ≧26 dB (at 0 dBm output)</td></tr>
<tr><td rowspan="4">Sweep signal</td><td>Frequency</td><td>AC mains frequency, 70 Hz, 16 Hz, external signal frequency (16 to 70 Hz)</td></tr>
<tr><td>Display</td><td>LED</td></tr>
<tr><td>Frequency accuracy</td><td>±10%</td></tr>
<tr><td>Waveform</td><td>Sinusoidal</td></tr>
<tr><td rowspan="4">Frequency modulation</td><td>Modulation frequency</td><td><table><tr><td></td><td>a</td><td>b</td><td>c</td></tr><tr><td>P1</td><td>66.667 kHz</td><td>92.593 kHz</td><td>83.333 kHz</td></tr><tr><td>P2</td><td>220 kHz</td><td>277.778 kHz</td><td>250 kHz</td></tr><tr><td>P3</td><td>400 kHz</td><td>555.556 kHz</td><td>500 kHz</td></tr></table></td></tr>
<tr><td>Frequency accuracy</td><td>$\pm 1 \times 10^{-5}$</td></tr>
<tr><td>Deviation</td><td>0 to 995 kHz-rms</td></tr>
<tr><td>Display</td><td>Digital 3 digits, LED. Resolution: 1 kHz (at 0 to 99 kHz-rms) or 5 kHz (at 100 to 995 kHz-rms)</td></tr>
<tr><td rowspan="3">Auxiliary IF sweep signal</td><td colspan="2">Frequency</td><td>Same as that of IF sweep signal</td></tr>
<tr><td colspan="2">Output level</td><td>≧ −15 dBm (IF output level at 0 dBm)</td></tr>
<tr><td colspan="2">Output impedance</td><td>75Ω, return loss: ≧20 dB</td></tr>
<tr><td rowspan="10">IM3 measurement signal</td><td colspan="2">Output signal</td><td>Up to 4 simultaneous signal output possible*1</td></tr>
<tr><td rowspan="3">Frequency</td><td>Range</td><td>55 to 65 MHz (70 MHz band), 110 to 170 MHz (140 MHz band)</td></tr>
<tr><td>Display</td><td>Digital 5 digits, LED (Resolution: 10 kHz)</td></tr>
<tr><td>Accuracy</td><td>$\pm 5 \times 10^{-5}$</td></tr>
<tr><td rowspan="4">Output level</td><td>Range</td><td>−60 to +0 dBm (per single wave)</td></tr>
<tr><td>Display</td><td>Digital 3 digits, LED (Resolution: 0.1 dB)</td></tr>
<tr><td>Accuracy</td><td>±1.0 dB (at 0 dBm)</td></tr>
<tr><td>Level adjustment</td><td>Greater than the range of ±2.5 dB (Each signal level can be adjusted separately)</td></tr>
<tr><td rowspan="2">Spurious</td><td>Harmonics</td><td>≦ −50 dB (for a output signal, at 0 dBm)</td></tr>
<tr><td>IM3 suprious</td><td>≦ −60 dB (two output signal at 0 dBm, frequency interval: ≧1 MHz)</td></tr>
</table>

*1 The ME4810B1 output is limited to a maximum of 3 tones.

IM3 measurement signal	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 digit, 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)
		Sweep step	101 steps
		Sweep time	1 to 10 s
		Sweep waveform	Sawtooth wave
	Output impedance		75Ω, 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		75Ω, 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.
	Releasing IF center frequency lock		Can release digital AFC of IF center frequency
	External control		GP-IB (IEEE488). All functions of panel settings except power switch can be controlled.
Overall specifications	Input/output connector		BNC (SP-type connector also available. Please specify when ordering.)
	Power		* Vac +10/−15%, 50/60 Hz, ≦320 VA (Transmitter: ≦110 VA, Receiver: ≦210 VA)
	Ambient temperature, rated range of use		0° to 50°C
	Dimensions and weight		177H × 426W × 351D mm, <17.5 kg (Receiver) 88H × 426W × 351D mm, < 9 kg (Transmitter)

* Specify a nominal line voltage between 100 and 240 V when ordering. Maximum operation voltage is 250 V.