

MICROWAVE SYSTEM ANALYZER

ME453K/L/M, ME538K/L/M

70 MHz band

70/140 MHz band



GP-1B
OPTION

Custom-made product

The ME453 and ME538 series are used to measure the transmission line characteristics in the BB and IF bands in terrestrial microwave radio relay systems and in satellite communication systems. The above types of transmission distortion can be measured and analyzed with them. They have been designed with special emphasis on measurement items, performance, functions, precision and size so that they can be used for all types of microwave radio relay systems, such as FDM-FM relay systems, high-efficiency large-capacity digital microwave radio relay systems, and INTELSAT and other satellite communications systems. Unique special innovations contribute greatly to improving handling ease. To improve operational ease, a number of internal controls are used and some measurements are automatic.

Furthermore, the measuring parameters and measured values are displayed digitally, so even when one of these analyzers is used for the first time, results can be obtained quickly and accurately.

The IF and BB frequencies must coincide for remote testing with other models or instruments of other manufacturers. This condition can be met quite easily by selecting the appropriate model from this particular series.

Multiplexed telephone, TV, PCM and data communications signals are mostly transmitted through microwave radio relay systems. However, when linear distortion (amplitude distortion, phase distortion) or non-linear distortion (which causes problems, particularly with analog signal transmission) is present in the transmission line, distortion noise is generated in the telephone transmission, clarity and color uniformity are lost with TV transmission and intersymbol interference between codes originating in the waveform distortion results in digital transmission. It is therefore necessary to measure the distortion in these transmission lines and to equalize it sufficiently.

Measurement items

- Group delay characteristics
- Linearity and sensitivity in modulators and demodulators
- Differential gain characteristics
- Differential phase characteristics
- IF and BB band amplitude response
- IF and BB band return loss
- Frequency deviation (or spectrum)
- AM/PM conversion coefficient
- DC characteristics
- IF/BB band power, gam, loss
- IF band frequency

Applications

The ME453 and ME538 can be used in the construction, maintenance, or research and development of digital microwave systems and of satellite

and terrestrial radio relay systems with BB and IF capability. The measurement item relating to the various circuit parts are listed below.

- **Modulators and demodulators:**
Linearity, sensitivity, group delay characteristics, differential gain, differential phase, IF and BB band amplitude characteristics
- **Repeater IF sections and overall links:**
Group delay characteristics, differential gain, differential phase, IF and BB band amplitude characteristics
- **Others:**
IF/BB impedance, power, gain, AM/PM conversion coefficient.
The transmitter and receiver are designed to operate independently so that end-to-end measurement can be conducted with a single analyzer.
RF band measurements can be conducted by connecting an up/down converter to this analyzer.

Functions

- **LED readout of transmitter settings**
For IF and BB measurements, the transmitter settings are shown with unmistakable clarity by the front-panel LED display, so you can read deviation, sweep width and center frequency at a glance.
- **Automatic receiver settings and display**
Deviation, IF level, BB frequency and level—all are automatically selected and displayed by this receiver. Calibration and attenuation are also automatic.
- **Automatic display of units**
Both sensitivity and units are displayed automatically for all measurements, so readings are fast and unmistakably accurate.
- **All measurements shown on the CRT and large LED displays**
Measurement parameters and results are displayed on the CRT in alphanumeric form together with the signal trace. They are also displayed simultaneously on the large, easy-to-read LED display.
- **Signal averaging for noisy traces**
Internal normalizing circuitry allows you to average traces for removing the noise component—as in the measurement of a satellite system, for example.
- **BB to BB amplitude measurement (optional)**
An extremely flat baseband sweep generator and detector give you the end-to-end, BB to BB amplitude response measurements so necessary for maintenance of telephone and TV links. The CRT X-axis is a logarithmic frequency scale. Markers are at 60, 100 and 300 kHz, and 1, 3, 10 and 15 MHz.

MICROWAVE MEASURING INSTRUMENTS

Receiver GP-IB and direct plotting functions (Option)

The receiver is computer controllable via the GP-IB which is usable with either plotters or personal computers. This function enables measured data to be sent to a personal computer for data processing.

The direct plotter function allows CRT displayed data (measured parameters and displayed signal) to be directly printed out on either a plotter or a dot matrix printer.

Specifications

IF band measurement

Measurements	Models	ME453K/L/M		ME538K/L/M		
		70 MHz Band		140 MHz Band		
Amplitude (IF INPUT terminal)	Inherent slope	±0.05 dB/±25 MHz		±0.05 dB/±25 MHz, ±0.1 dB/±40 MHz, ±0.2 dB/±50 MHz		
	Measuring range	0 to 16 dB				
	Max. sensitivity	0.01 dB/div (Y2 display)				
	IF INPUT level	+ 10 to - 20 dBm				
Amplitude (RET. LOSS INPUT terminal)	Inherent slope	±1 dB				
	Measuring range	0 to 40 dB				
	Sensitivity	1 dB/div, 5 dB/div				
	INPUT level	- 60 to - 20 dBm				
Group delay	Inherent slope	0.3 ns/±15 MHz, 0.5 ns/±25 MHz	0.3 ns/±15 MHz, 0.5 ns/±25 MHz	0.3 ns/±20 MHz, 0.5 ns/±30 MHz, 1 ns/±50 MHz		
	Measuring range	0 to 400 ns				
	Max. sensitivity	0.1 ns/div (Y2 display)				
	Noise	0.05 ns/condition: f _M = 200 to 278 kHz, deviation: 200 kHz rms, using average function				
Linearity	Inherent slope	0.2%/±25 MHz	0.2%/±25 MHz	0.2%/±50 MHz		
	Measuring range	0 to 80%				
	Max. sensitivity	0.05%/div				
	Noise	0.01%/condition: f _M < 1 MHz, deviation: 200 kHz rms, using average function				
Differential phase	Inherent slope	0.3°/±15 MHz, 0.5°/±25 MHz	0.3°/±15 MHz, 0.5°/±25 MHz	0.3°/±20 MHz, 0.5°/±30 MHz, 0.8°/±50 MHz		
	Measuring range	0° to 40°				
	Max. sensitivity	0.2°/div				
	Noise	0.02°/condition: f _M = 5.6 MHz, deviation: 500 kHz rms, using average function				
Differential gain	Inherent slope*	0.2%/±15 MHz, 0.4%/±25 MHz	0.2%/±15 MHz, 0.4%/±25 MHz	0.3%/±20 MHz, 0.4%/±30 MHz, 0.6%/±50 MHz		
	Measuring range	0 to 80%				
	Max. sensitivity	0.05%/div				
	Noise	0.01%/condition: f _M = 5.6 MHz, deviation: 500 kHz rms, using average function				
IF return loss	Frequency range	70 ± 25 MHz	70 ± 25 MHz	140 ± 50 MHz		
	Measuring range	10 to 50 dB: Accuracy depends on the bridge used				
	Sensitivity	1 dB/div, 5 dB/div				
AM to PM conversion	Residual PM	0.3°/dB/±25 MHz	0.3°/dB/±25 MHz	0.3°/dB/±35 MHz		
	Measuring range	0.3°/dB to 16°/dB				
Spectrum	Center frequency	70 ± 20 MHz Auto tuning	70 ± 20 MHz Auto tuning	140 ± 30 MHz Auto tuning		
	Sweep width	Approx. ±700 kHz				
	Max. sensitivity	Detects 0.1 dB change of modulating signal at carrier zero point				
	Deviation	K: 340 kHz rms at 200 kHz, L: 472 kHz rms at 277.778 kHz, M: 425 kHz rms at 250 kHz				
	Measuring range	20 to 999 kHz rms at the built-in BB frequencies <8.2 MHz				
Deviation	Accuracy	10% at the built-in BB frequencies <8.2 MHz				
	Calibration	Deviation is calibrated by easy pushbutton operation. Accuracy reaches 1% theoretically at the specified modulation frequency and deviation (as measured by the Bessel zero method) shown below.				
		Model	MOD frequency	Key in factor		
		K	200 kHz	340 kHz rms		
L		277.778 kHz	472 kHz rms			
M	250 kHz	425 kHz rms				
Modulator sensitivity	Mod. signal level	- 50 to + 10 dBm				
	Deviation	Use the DEVIATION meter function or use the carrier zero deviation with the SPECTRUM function				
Demodulator sensitivity	IF signal	Calibrate the deviation with DEVIATION meter function or SPECTRUM function				
	Demo. BB level	- 50 to + 10 dBm				
Inherent noise (IF to IF)	Group delay	Linearity		Differential phase	Differential gain	
		66 to 93 kHz: 0.3 ns rms		0.05° rms	0.1% rms	
		200 to 278 kHz: 0.1 ns rms				
	400 to 556 kHz: 0.05 ns rms				Detection band: 3 kHz	
Deviation: 200 kHz rms, f _M < 1 MHz			Deviation: 500 kHz rms, f _M = 5.6 MHz			

* Specified frequency range = Carrier sweep width + 2 f_M

• BB (baseband) measurement

	Item	Inherent slope	Measuring range	Max. sensitivity	Noise
BB to BB measurements	Group delay	0.1 ns	0 to 400 ns	0.1 ns/div (at Y2)	0.2 ns
	Linearity	0.1%	0 to 80%	0.05%/div	0.05%
	Differential phase	0.1%	0° to 40°	0.2°/div	0.05°
	Differential gain	0.1%	0 to 80%	0.05%/div	0.05%
	Measuring condition	BB level: -30 dBm			
BB return loss	Frequency	Built-in BB frequency or BB amplitude option			
	Range	10 to 40 dB, 1 dB/div (BB amplitude option)			
BB amplitude (Option)	Frequency range: 60 kHz to 15 MHz, level: +10 to -50 dBm, inherent slope: ±0.5 dB/100 kHz to 13 MHz Measuring range: 0 to 8 dB, max. sensitivity: 0.1 dB/div				
DC input	Measuring range: 0 to ±400 mV, max. sensitivity: 1 mV/div				

• Receiver

IF input	Frequency range	70 MHz band: 45 to 95 MHz 140 MHz band: 90 to 190 MHz When BB frequency is 55.6 kHz (or 27.8 kHz). *1 70 MHz band: 60 to 80 MHz 140 MHz band: 130 to 150 MHz	Phase detector	Input frequency	The BB frequency (66.7 kHz to 12.39 MHz) is selected automatically.																																											
	Level range	+10 to -20 dBm		<table border="1"> <thead> <tr> <th></th> <th>K</th> <th>L</th> <th>M</th> </tr> </thead> <tbody> <tr> <td>f1</td> <td>66.667 kHz</td> <td>92.593 kHz</td> <td>83.333 kHz</td> </tr> <tr> <td>f2</td> <td>200 kHz</td> <td>277.778 kHz</td> <td>250 kHz</td> </tr> <tr> <td>f3</td> <td>400 kHz</td> <td>555.556 kHz</td> <td>500 kHz</td> </tr> <tr> <td>f4</td> <td colspan="3">2 MHz</td> </tr> <tr> <td>f5</td> <td colspan="3">3.58 MHz</td> </tr> <tr> <td>f6</td> <td colspan="3">4.43 MHz</td> </tr> <tr> <td>f7</td> <td colspan="3">5.6 MHz</td> </tr> <tr> <td>f8</td> <td colspan="3">8.2 MHz</td> </tr> <tr> <td>f9</td> <td colspan="3">12.39 MHz (ME538K/L/M)</td> </tr> <tr> <td>f10</td> <td colspan="3">55.556 kHz² (option)</td> </tr> </tbody> </table>		K	L	M	f1	66.667 kHz	92.593 kHz	83.333 kHz	f2	200 kHz	277.778 kHz	250 kHz	f3	400 kHz	555.556 kHz	500 kHz	f4	2 MHz			f5	3.58 MHz			f6	4.43 MHz			f7	5.6 MHz			f8	8.2 MHz			f9	12.39 MHz (ME538K/L/M)			f10	55.556 kHz ² (option)		
		K			L	M																																										
	f1	66.667 kHz			92.593 kHz	83.333 kHz																																										
f2	200 kHz	277.778 kHz	250 kHz																																													
f3	400 kHz	555.556 kHz	500 kHz																																													
f4	2 MHz																																															
f5	3.58 MHz																																															
f6	4.43 MHz																																															
f7	5.6 MHz																																															
f8	8.2 MHz																																															
f9	12.39 MHz (ME538K/L/M)																																															
f10	55.556 kHz ² (option)																																															
Level display	3-digit LED display Resolution: 0.1 dB	Capture range ±5 Hz (≤555.556 kHz) ±5 × 10 ⁻⁶ (≤12.39 MHz) ±1 Hz (≤55.556 kHz)																																														
Level accuracy	±0.3 dB at +4 dBm																																															
Impedance	75 Ω Return loss: >30 dB at +4 dBm	Slide marker Variable side markers: 70 ±25 MHz, 140 ±50 MHz																																														
Input frequency sweep width	±25 MHz/center frequency 70 MHz		Frequency display 4-digit LED display Resolution: 10 kHz Accuracy ±1 × 10 ⁻⁴ ±1 digit 2 MHz Comb + slide markers + Variable side markers																																													
Maximum sweep width	±50 MHz/center frequency 140 MHz	Counts the center frequency of the swept IF signal and CW-IF signal and displays it on the 5-digit LED display. The display to the LED display is made by selecting either the slide marker frequency or center frequency with a key																																														
Minimum sweep width	±10 MHz/center frequency 70/140 MHz		Frequency range 70 MHz band: 45 to 90 MHz 140 MHz band: 90 to 190 MHz Frequency display 4-digit LED display (ME453□) 5-digit LED display (ME538□) Resolution: 10 kHz Accuracy ±1 × 10 ⁻³ ±1 digit																																													
Demodulation	66.7, 80 kHz to 8.2 MHz BB frequency 55.6 kHz (or 27.8 kHz) is demodulated when sweep frequency is only 18 Hz. *1	Measuring range 70 MHz band: ±0.2 to ±25 MHz 140 MHz band: ±0.2 to ±50 MHz Resolution 0.2 to 9.99 MHz: 10 kHz 10 to 50 MHz: 100 kHz Accuracy ±5 × 10 ⁻² ±1 digit																																														
IF return loss input	The return loss input is used with the same frequency applied to IF INPUT to lock the AFC loop. Input level range -20 to -60 dBm Flatness ±1 dB/45 to 95 MHz ±1 dB/90 to 190 MHz Impedance 75 Ω Return loss: >28 dB		IF sweep width measurement Level -7 dBm, typical Impedance 75 Ω, nominal																																													
BB input (BB + sweep)	BB frequency range	66 kHz to 15 MHz and 55.6 kHz *1 (or 27.8 kHz)		Ext. sweep input (rear panel) Frequency 18 to 100 Hz Level 1 Vp-p Impedance >5kΩ																																												
	BB level range	+10 to -50 dBm																																														
	BB level display	3-digit LED display Resolution: 0.1 dB	X-Y recorder output (Option) Output X: 0 to 4 V Y: 0 to 4 V Pen lift: Open Pen down: Ground Sweep speed 20 s, 40 s, nominal																																													
	BB level accuracy	±0.3 dB at 0 dBm																																														
Impedance	75 Ω Return loss: >28 dB at 0 dBm frequency 66 kHz to 15 MHz																																															
Sweep frequency range	18 to 100 Hz																																															
Sweep voltage range	±50 mV to ±5 V																																															
X phase setting range	0° to 360°																																															

*1 Option 05: 55.6 kHz additional BB frequency
*2 27.8 kHz can be supplied if specified.

• Transmitter

IF output	Frequency range Center frequency Display	70 MHz band: 45 to 95 MHz 140 MHz band: 90 to 190 MHz 4-digit LED display (ME453□) 5-digit LED display (ME538□) Resolution: 10 kHz
	Frequency display Accuracy Stability	$\pm 1 \times 10^{-4} \pm 1$ digit/CW ± 100 kHz at 70 MHz ± 200 kHz at 140 MHz 5-hour after 1/2-hour warm-up
	Level range Level accuracy Harmonics Impedance	+ 10 to - 70 dBm (1 dB step attenuator) Continuously variable range: > ± 1 dB ± 0.3 dB at +4 dBm < -30 dB 75 fi Return loss: > 30 dB at +4 dBm
IF sweep width	Sweep width range Sweep width display Auto sweep reduct on	70 MHz band: 0 to ± 25 MHz 140 MHz band: 0 to ± 50 MHz 3-digit LED display Resolution: 0.1 MHz The sweep width is reduced by 2 x BB frequency $\pm 10\%$ when BB frequency > 1 MHz. This function can be reset with a switch.
FM deviation	Mod. frequency Deviation range Deviation display	Same as BB frequency (item 6) 5 to 1000 kHz rms 4-digit LED display Resolution: 1 kHz rms
AUX IF output	Frequency range Output level Level accuracy Impedance	Same as IF OUTPUT specification (item 1) -10 dBm < ± 1 dB 75 fi, nominal
Crystal output	Frequency Output level Level accuracy Impedance	70 MHz band: 70 MHz 140 MHz band: 140 MHz +5 dBm < ± 1 dB 75 fi, nominal

BB + sweep output	BB frequency			
		K	L	M
	f ₁	66.667 kHz	92.593 kHz	83.333 kHz
	f ₂	200 kHz	277.778 kHz	250 kHz
	f ₃	400 kHz	555.556 kHz	500 kHz
	f ₄	2 MHz	2.4 MHz	
	f ₅	3.58 MHz		
	f ₆	4.43 MHz		
	f ₇	5.6 MHz		
	f ₈	8.2 MHz		
f ₉	12.39 MHz (ME538K/L/M)			
f ₁₀	55.5556 kHz*	(Option)		
* Can be changed to 27.778 kHz if so specified. Option 05: 55.6 kHz additional BB frequency.				
BB frequency	± 5 Hz (≤ 555.556 kHz)			
Accuracy	$\pm 5 \times 10^{-6}$ (≤ 12.39 MHz) ± 1 Hz (≤ 55.5556 kHz)			
BB level	+ 10 to - 50 dBm A 10 dB step attenuator and 0 to - 10 dB continuously variable dial are provided for setting the level.			
BB level display	3-digit LED display Resolution: 0.1 dB			

(Contd.)	BB level accuracy BB harmonics BB impedance	± 0.3 dB at 0 dBm < -38 dB 75 fi Return loss: > 28 dB at - 10 dBm
BB + sweep output	Sweep frequency	Line (50/60 Hz), 70 Hz Option (select one frequency from 18 to 100 Hz) Ext. (18 to 100 Hz)
	Sweep level Sweep level display Sweep level accuracy Sweep harmonics	0 to 6.5 Vp-p/75 fi 3-digit LED display Resolution: 0.01 V $\pm 10\%$ at 6 Vp-p < - 35 dB
	Sweep output	Sweep level Sweep level display Sweep level accuracy
Ext. sweep input (rear panel)	Frequency Level Impedance	18 to 100 Hz 2 Vp-p 10 kfi, nominal
Ext. BB input (rear panel)	Frequency Level Impedance	80 kHz to 15 MHz - 7dBm 75 fi, nominal
BB sweeper (option)	Frequency range BB output level	60 kHz to 15 MHz + 10 dBm to - 50 dBm (10 dB step attenuator) Continuously variable range: 0 to - 10 dB
	BB level display Inherent slope	3-digit LED display Resolution: 0.1 dB ± 0.5 dB/100 kHz to 13 MHz The value of the sum of the receiver and transmitter
	Impedance	75 fi Return loss: > 28 dB at - 10dBm

Sweep frequency is automatically set to 18 Hz when f₁ is selected.

MICROWAVE MEASURING INSTRUMENTS

• Low BB frequency: 55.6 kHz or 27.8 kHz (Option)

Group delay	Inherent slope	70 ±10 MHz: 5 ns 140 ±10 MHz: 5 ns
	Measuring range	0 to 400 ns
	Max. sensitivity	2 ns/div
	Noise	1 ns
Linearity	Inherent slope	70 ±10 MHz: 0.5% 140 ±10 MHz: 0.5%
	Measuring range	0 to 80%
	Max. sensitivity	0.1%/div
	Noise	0.1%

With deviation 100 kHz rms and sweep frequency 18 Hz using average function

• General specifications

Input and output connector	BNC or SP connector Other type of connectors can be installed if requested by the user: e.g., Siemens Small, Weco 560A or equivalent.
Power	260 VA Transmitter: 85 VA Receiver: 175 VA From AC 100 V to AC 250 V, at the request of the user. Tolerance ±10%
Ambient temperature, rated range of use	0° to 50°C
Dimensions and mass	Receiver: 177H x 426W x 450D mm, < 18.5 kg Transmitter: 133H x 426W x 450D mm, < 13.5 kg

Ordering information

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

Model/Order No.	Name	Remarks		
		IF bands	BB	Std. I/O connector
	Main frame			
ME453K	Microwave System Analyzer	70 MHz	200kHz	SP
ME453L	Microwave System Analyzer	70 MHz	278 kHz	BNC
ME453M	Microwave System Analyzer	70 MHz	250 kHz	BNC
ME538K	Microwave System Analyzer	70/140 MHz	200 kHz	SP
ME538L	Microwave System Analyzer	70/140 MHz	278 kHz	BNC
ME538M	Microwave System Analyzer	70/140 MHz	200 kHz	BNC
	Standard accessories			
J0082A	Coaxial Cord, 2 m:	3 pcs	SP-3CP•3C-2WS•SP-3CP for SP connector	(Either one is attached)
J0092C	Coaxial Cord, 2 m:	3 pcs	BNC-P620•3C-2W•BNC-P620 for BNC connector	
J0134	Power Cord, 2.5 m:	2 pcs	One each for transmitter and receiver	
B0019	Front Cover:	1 pc	For transmitter	
B0020	Front Cover:	1 pc	For receiver	
F0023	Fuse, 3.15 A:	2 pcs	MF51NN250V3.15AAC05	
F0022	Fuse, 2 A:	2 pcs	MF51NN250V2AAC05	
F0045	Fuse, 2 A:	4 pcs	MF51NN250V2ADC01	
W0094CE	ME453K/L/M, ME538K/L/M Operation and Service Manual:	1 copy		
	Options		Processed at factory	
MSA-01	BB Amplitude Measurement			
MSA-02	X-Y Recorder Output			
MSA-03	Sweeper Frequency Added		Specify one frequency from 18 to 100 Hz	
MSA-04	Receiver GP-IB, Direct Plotting of CRT Output			
MSA-05	55.6 kHz BB Frequency Added		Change to 27.8 kHz possible, option 03 (18 Hz) is required.	
	Optional accessories			
MR55A1	IF Return Loss Bridge		Connector: SP or BNC	
MR43A	BB Return Loss Bridge		Connector: SP or BNC	
	Peripherals			
MB23A	Portable Test Rack		Tilt angle	
MB24A	Portable Test Rack		Horizontally fixed	