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CREATIVE & UNIQUE

MICROWAVE

VSWR BRIDGE

MVS300

- *Frequency range: 5 to 3000MHz*
- *Directivity: more than 40dB*
- *Internal 50Ω reference*
- *Maximum input power: 1.5W*
- *The frequency characteristics of VSWR can be easily observed by using Spectrum analyzer with TG MSA338TG.*

SPECIFICATIONS

Frequency range	5 to 3000MHz
Directivity	more than 40dB@50 to 3000MHz more than 25dB@5 to 50MHz
Return loss	more than 20dB@SOURCE port more than 25dB@DUT port more than 10dB@REFLECTED port
Insertion loss	less than 7dB@SOURCE to DUT less than 8dB@DUT to REFLECTED
Open/short ratio	within ±1dB
Connectors	SMA(J) (for any port)
Maximum input power	1.5W@CW ※Don't supply DC voltage to any port.
Operating temperature	−10 to 85℃ (Guaranteed at 10 to 50℃)
Operating humidity	less than 85℃/80%RH (Guaranteed at less than 50℃/80%)
Storage temperature	−55 to 125℃、less than 125℃/70%RH
Dimensions	50(W)×31(H)×114(D)mm (exclude projections and rubber foot)
Weight	approx. 240g
Standard accessory	Operating manual

Options

SMA(P)/SMA(P)	Coaxial cable (50cm)	MC301
SMA(P)/SMA(P)	Coaxial cable (1m)	MC302
SMA(P)/SMA(P)	Coaxial cable (1.5m)	MC303
SMA(P)/N(P)	Coaxial cable (20cm)	MC305
SMA(P)/BNC(P)	Coaxial cable (20cm)	MC307

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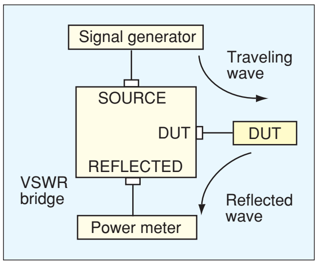
Outline of VSWR bridge

The VSWR bridge is used to evaluate the matching at input/output of electronic parts, circuits and equipment such as filter, amplifier and antenna. The matching can be evaluated by the measurement of VSWR. The VSWR bridge is also called the Return Loss bridge because it directly measures the return loss.

The sine wave (traveling wave) from the signal generator is supplied to the device under test (DUT) through SOURCE port and DUT port of the VSWR bridge. The reflected wave generated at the input of DUT is supplied to the power meter or the spectrum analyzer through DUT port and REFLECTED port.



The 0dB calibration of the return loss is done by opening DUT port. In the state in which DUT port is opened, the whole power is reflected at this port and then output to REFLECTED port. The insertion loss from SOURCE port to DUT port and from DUT port to REFLECTED port is theoretically 6dB respectively. Therefore, if −10dBm signal is supplied to SOURCE port under the condition of DUT port: open, REFLECTED port outputs −22dBm (actually −22 to −25dBm). The measured value Po (dBm) of the power meter at this time is 0dB of the returm loss. And if the measured value of the power meter is Px (dBm) after the connection of DUT, the return loss is calculated as follows;

$$\text{Return loss RL} = \text{Po} - \text{Px (dB)}$$

Conversion from return loss to VSWR

The VSWR bridge measures the power reflected by DUT, in short the return loss. When DUT port is open or short, the power measured at this time is 0dB of the return loss because the whole power is reflected. On the other hand, the standing wave is generated by the traveling wave supplied to DUT and the reflected wave reflected by DUT. And VSWR is calculated from the ratio of the maximum value Vmax and the minimum value Vmin of the standing wave.

$$\text{VSWR} = \text{Vmax}/\text{Vmin}$$

Because it's very difficult to measure Vmax and Vmin, the return loss is actually measured and then this value is converted into VSWR. If the return loss is assumed to RL, the conversion expression is as follows.

$$\text{VSWR} = \frac{10^{(RL/20)}+1}{10^{(RL/20)}-1}$$

And the conversion table is shown below.

RETURN LOSS	VSWR	RETURN LOSS	VSWR
3dB	5.85	13dB	1.58
4dB	4.42	14dB	1.50
5dB	3.57	15dB	1.43
6dB	3.01	16dB	1.38
7dB	2.61	17dB	1.33
8dB	2.32	18dB	1.29
9dB	2.10	19dB	1.25
10dB	1.92	20dB	1.22
11dB	1.78	25dB	1.12
12dB	1.67	30dB	1.07

Return loss measurement by MSA338TG

VSWR or the return loss can be measured by the signal generator and the power meter. However, a lot of time and labor, by which the frequency of the signal generator is changed little by little and the reading value of the power meter is plotted one by one, are needed to observe the curve of the frequency characteristics.

Then,the frequency characteristics curve of the return loss can be easily observed by using Spectrum analyzer with TG MSA338TG. Fig.1 shows how to connect MSA338TG and MVS300. The coaxial cable MC301 of an option is recommended as the cables connecting TG OUT and SOURCE port,and RF INPUT and REFLECTED port. The frequency bandwidth of MC301 is 10GHz.

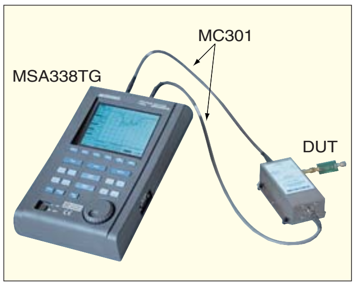


Fig.1 Connection for measurement

Moreover, the power supplied to DUT is −16 to −17 dBm because the output level of MSA338TG is −10dBm and the insertion loss from SOURCE port to DUT port of MVS300 is 6dB (less than 7dB at spec). If the power supplied to DUT is too high, the fixed attenuator should be inserted between TG OUT and SOURCE port.

The amplitude compensation(the frequency characteristics of the amplitude axis is compensated to be flat) of VSWR bridge and MSA338TG and 0dB calibration of the return loss can be easily done by using the NORMALIZE function of MSA338TG. Only DUT port is opened from the connection of Fig.1. In a word, nothing is connected to DUT port. If MSA338TG is set to T.G.: ON under this state, the screen shown in Fig.2 appears. The broken line displayed 1 div lower from the reference level is the normalization level.

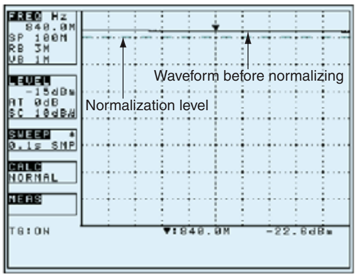


Fig.2 Before normalizing

When NORM (normalization) is set to ON under this state, the output level of REFLECTED port is compensated to the normalization level as shown in Fig.3. This normalization level is the position of 0dB return loss.

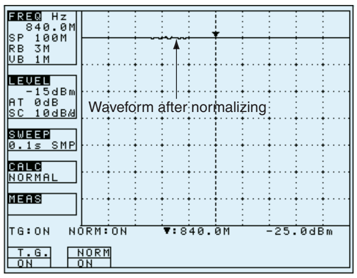


Fig.3 After normalizing

After then, the frequency characteristics curve is observed as shown in Fig.4 when DUT is connected to DUT port. Of course, the measurement value of the return loss can be directly read from the data of marker.

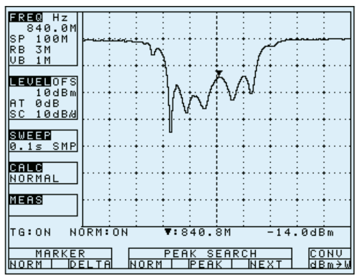


Fig.4 Waveform of return loss

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