NETWORK ANALYZER
54100A series
1 MHz to 110 GHz

CE GPIB

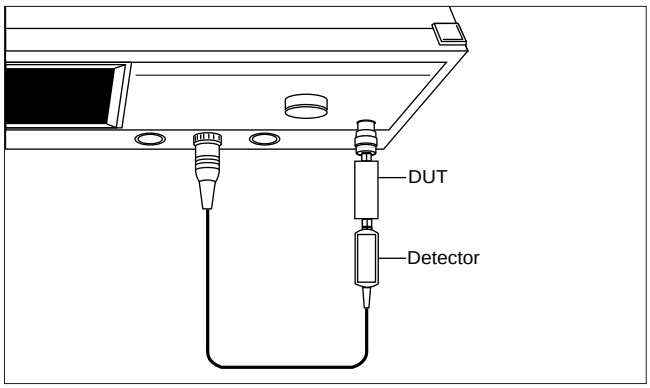
54100A series Network Analyzers provide characterization of devices such as amplifiers, antennas, attenuators, adapters, RF bridges, duplexers, couplers, attenuators, cables, waveguide transmission lines, isolators, circulators, mixers, receivers, transceivers, up/down converters, multiplexers, power dividers, VCOs, switches, and filters.
Advanced hardware and software features speed productivity and improve accuracy. Speed tuning processes with automated bandwidth search functions. Fast recall mode quickly steps through test procedures and sophisticated limit line controls quickly identify conformance to specifications.
Low source harmonics and high directivity SWR autotesters assure accuracy.

Features

- Fast, accurate measurement of transmission, return loss, precision return loss, SWR, group delay, absolute power, and distance-to-fault
- Crystal-based source for exceptional stability and accuracy
- Built-in automation features including distance-to-fault
- Built-in floppy disk drive
- Rugged, reliable chassis

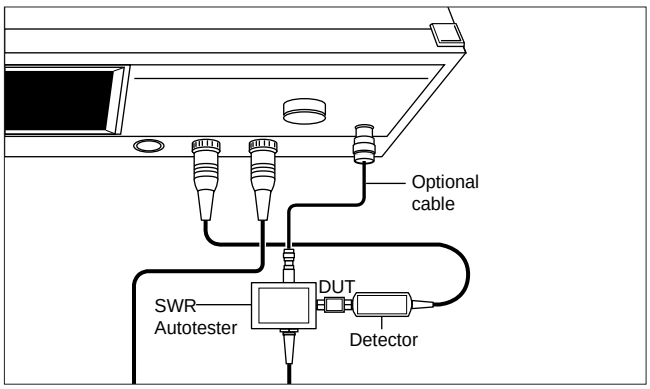
- **Transmission gain (loss), group delay and power measurements**

The basic configuration requires a single detector. For very low transmission loss devices (<0.25 dB), a second detector should be used to monitor any source power variations.

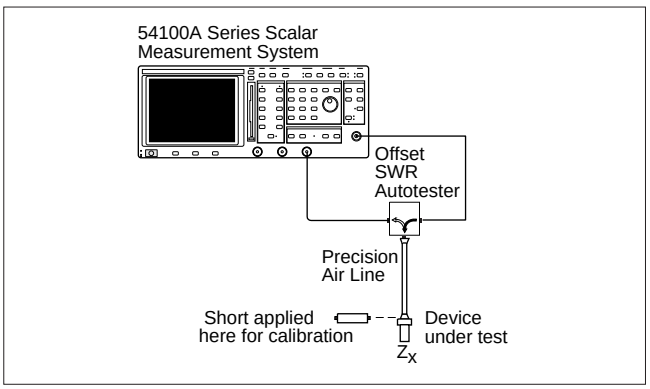


- **Transmission and return loss (or SWR)**

Return loss or Standing Wave Ratio (SWR) measurements require a high directivity SWR autotester to separate the incident signal from the RF sweep source and reflected signal from the device under test. The configuration below will simultaneously display transmission and return loss characteristics.

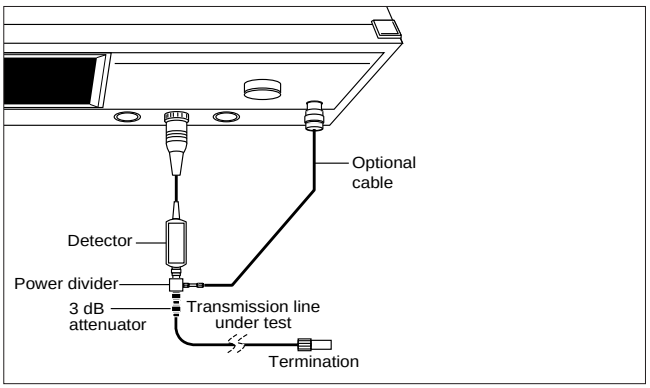


• Adapters, attenuators, terminations, couplers, RF bridges
The 54100A series precision return loss mode measures high return loss devices accurately traceable to NIST. The measurement system uses an offset SWR autotester and a precision airline - a physical impedance standard. Additionally, by exchanging the offset SWR autotester with a 20 dB offset termination, the directivity of couplers and RF bridges is displayed directly on the 54100A.



Distance-to-fault

The 54100A's optional distance-to-fault software accurately verifies transmission line and antenna system performance during installation, link/site commissioning, and at regular maintenance intervals. Transmission lines are typically the most common failure point in an antenna system. Finding the problem connectors, cables and antennas before a complete failure saves down-time, and expense.
Faulty antenna systems and transmission lines are easily diagnosed. A wide variety of coaxial and waveguide types are supported with standard catalog components.



Common causes of antenna feed problems

• Cable and waveguide problems
Cable discontinuities
Moisture
Braid wire ground shield fault (appears as a notch filter)
Damaged/cut ground shields
Dielectric fault or narrowed dielectric diameter
Fasteners pinch cables

• Connector problems
Corroded connectors
Low quality connectors
Connector pin offset (poor mating contact)

• Antenna problems
Antenna out of specification
Antenna storm/shipping damage

Performance

• Preventing "ghost" faults
The 54100A uses a low harmonic source and high performance anti-aliasing software to prevent the display of false or "ghost" transmission line faults. This is a common problem when the end of the DUT is unterminated or damaged.
Anritsu's precision components and low harmonic sources prevent "ghost" faults, assuring accurate, repeatable results.

• High dynamic range
The 54100A distance-to-fault software optimizes sensitivity and accuracy. For example, a precision termination is used during calibration to achieve industry leading dynamic range. If the termination is not of high quality, it will reflect some of the source energy rather than absorb it –causing errors in the measurement process.
The use of a specialized discrete fourier transform rather than a more common fast fourier transform also improves low level sensitivity. Low source harmonics also ensure that fault indications are actual transmission line not re-reflections of source harmonic energy.

Relative group delay

Optional relative group delay software identifies signal distortion caused by bandpass devices such as filters, receivers, power amplifiers, and up/down converters. Group delay is a key cause of high Bit Error Rate (BER). Group delay is important for 1) CDMA and spread spectrum communications 2) phase array radars 3) high capacity satellite and terrestrial microwave links, 4) PAL and HDTV television components and other RF systems sensitive to phase distortion.
The 54100A saves time and expense by eliminating several pieces of expensive test equipment – combining the capabilities into a single, low cost test station. Manufacturing processes save re-test/re-tuning time by utilizing a single 54100A instead of two separate tuning stations – one for scalar transmission and return loss and the other for relative phase group delay. Furthermore, the 54100A can accurately test frequency conversion devices without the wideband reference converters required with vector network analyzers or microwave system analyzers.

Convertible SWR autotester

Convertible SWR autotesters reduce capital equipment and maintenance costs. A single convertible SWR autotester accurately measures the return loss or SWR of devices with SMA, 3.5 mm, or K connectors. Six interchangeable test port heads (male and female for each connector standard) are precision tuned to the convertible SWR autotester's internal bridge circuit.

The 560-98C50 Convertible SWR Autotester improves test accuracy and reduces maintenance cost without using error prone test port adapters or connector savers.

The inexpensive test port heads save repair and calibration costs because they are interchangeable.

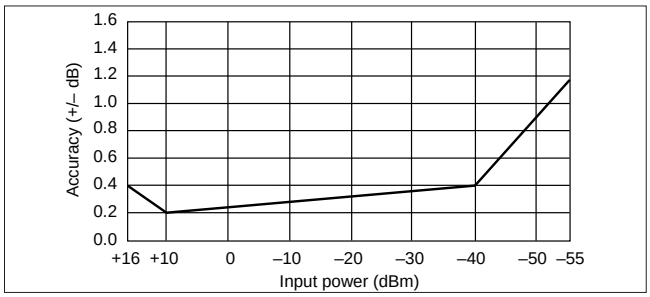
Measurement accuracy

• Transmission loss or gain measurement accuracy

Uncertainties from the frequency response of components are automatically subtracted from test data during the path calibration procedure. Overall accuracy is then:

Channel accuracy
+ Mismatch uncertainty
+ Distortion from source harmonics
Transmission measurement accuracy

Effects of source, test device, SWR autotester, and detector mismatch can be significant. This mismatch uncertainty is minimized by the exceptionally low reflection characteristics of Anritsu's detectors, sources, and SWR autotesters. Anritsu's ultra low source harmonics maximize the accuracy.



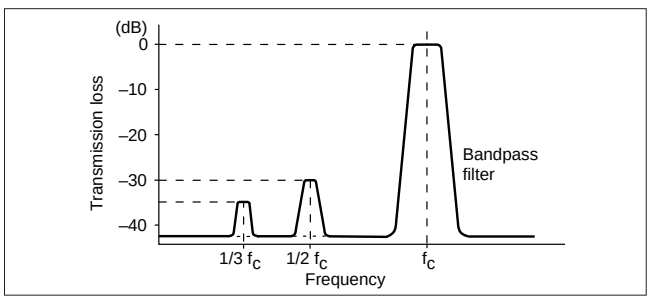
Channel accuracy (25˚C)

• Distortion from source harmonics

Poor source harmonics cause large measurement errors. If the sweep range is set wide enough, at some point during the sweep, the harmonic will pass through the filter's pass band. Since the transmission detector is a broadband diode, the harmonic's signal power is measured. Thus, the analyzer displays the response of the harmonic in addition to the fundamental sweep frequency.

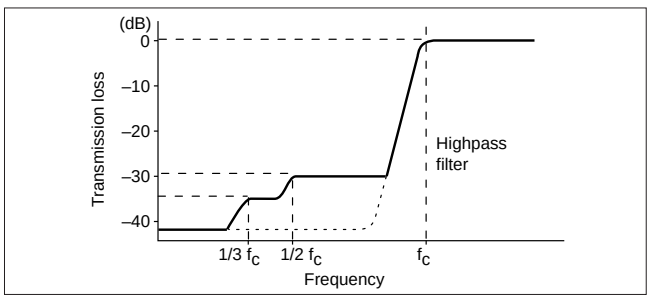
• Bandpass filter, distortion from source harmonics

If the source has a –30 dBc second harmonic and a –35 dBc third harmonic, at the beginning of the sweep, the harmonics pass through the filter's passband.



• Highpass filter, distortion from source harmonics

A highpass (or wide bandpass) filter responds similarly to the bandpass filter, except the presence of the harmonic in the filter's pass band limits the useful dynamic range of the analyzer.



Return loss measurement accuracy

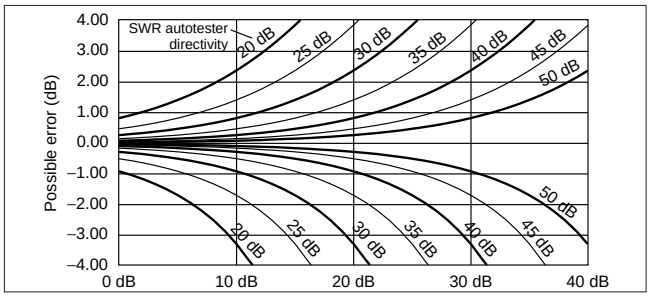
Uncertainties resulting from SWR autotester and source frequency response and from system open and short characteristics are subtracted automatically from test data. Overall accuracy is then:

Channel accuracy
+ Autotester accuracy
+ Distortion from source harmonics
Return loss measurement accuracy

Autotester accuracy is composed of error due to directivity and error due to test port match. Unless the DUT has very poor return loss (high SWR), test port match will be negligible. When an adapter is used at the test port, use effective directivity to determine possible errors.

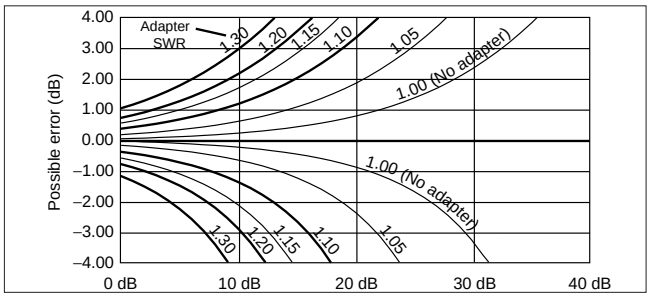
• Return loss accuracy due to directivity

Improved directivity decreases SWR (or return loss) measurement errors. The chart below identifies maximum error due to directivity.



• Return loss accuracy due to effective directivity

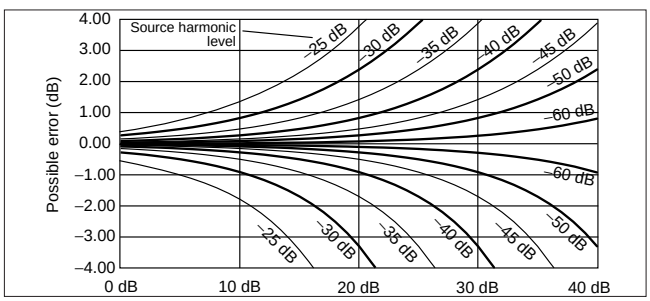
Effective directivity is the reduction to directivity due to a test port adapter's SWR performance. Adapters severely degrade measurement directivity. The chart below shows the maximum degradation to a 40 dB directivity SWR autotester caused by test port adapters of varying quality.



• Return loss accuracy due to source harmonics

Source harmonics are a significant source of return loss measurement uncertainty when testing banded devices such as filters, receivers, transmitters, power amplifiers, and antennas.

In many cases, the harmonic errors are larger than uncertainty due to directivity, which is typically assumed to be the largest uncertainty factor.



This chart assumes full reflections of a single source harmonic at the DUT input. Multiple harmonics can cause additional measurement uncertainty.

Specifications

Analyzer	Measurement modes	Transmission (dB), return loss (dB), SWR (linear SWR), optional group delay (ns), power (dBm) precision return loss (dB) and optional distance-to-fault
	Dynamic range	–55 to +16 dBm, autozeroing with DC detection
	Inputs	Three, two standard inputs, A and B, with optional third reference channel, R (Option 5)
	Display channels	Two channels are used to select and simultaneously display any two inputs from A, B, or R. The inputs can also be displayed as ratios A/R or B/R.
	Scale resolution	0.1 to 10 dB(m) per division in 0.1 dB steps
	Cursor functions	Searches for trace maximum, minimum, dB level, dB bandwidth, next marker and active marker
	Averaging	2, 4, 8, 16, 32, 64, 128, or 256
	Limit lines	Two limit lines, either single value or multi level segmented, for each trace. Segmented lines may be made from up to 10 individually editable segments.
	Auto-zero	Performs an AC modulation cycle and low level calibration during sweeper retrace
	Save/Recall	Thirteen sets of front panel set-ups and thirteen sets of trace memory can be stored in non-volatile instrument memory.
	Trace mask	A swept frequency measurement can be stored to a graticule trace mask for visual comparison to later measurements.
	Disk drive	Built-in 3.5 inch, 1.44 MB floppy disk drive
	Autosave	Automatically increments the trace data file name and reference number during successive data storage operations to the DOS disk
Source	Frequency range	1 MHz to 110 GHz, model dependent
	Alternate sweep	Sweeps alternately between frequency ranges set differently for channel 1 and channel 2
	CW	Provides single frequency output (both channels turned off)
	Frequency resolution	RF Models (54107A, 54109A, 54111A): 10 kHz, Microwave models: 100 kHz
	Output power	Maximum guaranteed levelled output power is model dependent.
	Reverse power protection	Up to 5 Watts. Limited to 1 Watt with attenuator option
Application function	Min/Max hold	Save the minimum and maximum values of successive sweeps or the combination of the two
	Cursor functions	Automatic cursor search updates the bandwidth, minimum, or maximum levels of the displayed trace.
	Compression test automation	Determines the gain compression point over the operating frequency range of an amplifier by successively incrementing the source power and measuring the amount of compression until a preset “X” dB limit is exceeded.
	Self test	Performs a self test every time power is applied or when SELF TEST pushbutton is pressed. If an error is detected, a diagnostic code appears, identifying the cause and location of the error.
General	Operating temperature	0˚ to +50˚C
	Power	115 V $^{+10}_{-20}$ %, 230 V $^{+10}_{-20}$ %, 48 to 400 Hz, 300 VA
	Mass	18 kg (39 lb.)
	Printer	Parallel printer interface is compatible with the Canon BJ30, BJ200e, and most Epson FX-compatible printers.
	Transit case	Hard shell case with custom foam inserts, PN: 760-183
	EMC	Meets European community requirements for CE marking

Ordering information

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

Model/Order No.	Name
	Main frame
54107A	Scalar Measurement System (0.001 to 1.5 GHz)
54109A	Scalar Measurement System (0.001 to 2.2 GHz)
54111A	Scalar Measurement System (0.001 to 3.0 GHz)
54117A	Scalar Measurement System (0.01 to 8.6 GHz)
54119A	Scalar Measurement System (2 to 8.6 GHz)
54128A	Scalar Measurement System (8 to 12.4 GHz)
54130A	Scalar Measurement System (12.4 to 20 GHz)
54131A	Scalar Measurement System (10 to 16 GHz)
54136A	Scalar Measurement System (17 to 26.5 GHz)
54137A	Scalar Measurement System (2 to 20 GHz)
54147A	Scalar Measurement System (0.01 to 20 GHz)
54154A	Scalar Measurement System (2 to 32 GHz)
54161A	Scalar Measurement System (2 to 40 GHz)
54163A	Scalar Measurement System (0.01 to 32 GHz)
54169A	Scalar Measurement System (0.01 to 40 GHz)
54177A	Scalar Measurement System (0.01 to 50 GHz)

Model/Order No.	Name
	Options
Option 1	Rack mounting with slides
Option 2	70 dB RF step attenuator
Option 2A	70 dB, 20 GHz MW step attenuator
Option 2B	70 dB, 26.5 GHz MW step attenuator
Option 2C	70 dB, 40 GHz MW step attenuator
Option 2D	70 dB, 50 GHz MW step attenuator
Option 4	75 Ω source output (available to 3.0 GHz)
Option 5	Add reference channel
Option 6	Add external levelling
Option 7	Internal distance-to-fault software
Option 8	Internal relative group delay software
Option 12	Add front panel cover
Option 13	Add front mounted handles
Option 16	+15 V DC supply for millimeter wave source modules (available with <20 GHz models only)
Option 25	Maintenance manual
Option 26	Extra operation and GPIB programming manual
Option 33	Canon printer