Adams Russell
MICRO-TEL DIVISION

1295

.01-54 GHz
PRECISION ATTENUATION
MEASUREMENT RECEIVER

FEATURES

- .01-18 GHz Standard
- Expandable to 54 GHz with Options
- Fundamental LO Performance to 54 GHz
- Over 100 dB Display Range
- .001 dB Resolution to 80 dB
- .01 dB Resolution to 100 dB
- NBS Traceable
- Digital Averaging
- GPIB—all Controls
- Positive Electro-Mechanical AFC
- Simple Calibration
- Accessory Frequency Synthesizer
- Measures Relative Noise

DESCRIPTION

The 1295 Receiver is a completely self-contained instrument for precise manual or computer-controlled measurement of relative signal levels. Primary applications are measurement of output attenuators of signal generators as well as other fixed and variable devices whose insertion loss must be known accurately up to 100 dB.

The receiver can be manually tuned near the frequency of the signal source whereupon the electro-mechanical AFC will takeover and complete the tuning cycle. Also the unique AFC eliminates the retuning normally associated with the connect-disconnect cycle of many attenuation measurements. Alternately, with an IEEE-488 Bus Controller, programming sets the receiver slightly higher than the desired frequency and tunes downward until frequency lock is attained.

A third method is to employ a synthesized source and to control the 1295 Receiver with the Micro-Tel FS-1000 Frequency Synthesizer. Manually or under IEEE-488 Bus Control, source and receiver will track precisely, in increments as small as 100 Hz from .01-18 GHz and 10 KHz from 18-54 GHz.

An internal switch can modulate an external 30 MHz noise source, as from a mixer output signal, whereupon the 1295 Receiver will measure noise ratios in accordance with USAF Tech Order 33K4-4-1-2.

The digital level display has a resolution of .001 dB up to 80 dB (.01 dB to 100 dB) and incorporates selectable digital averaging for improved accuracy and meaningful resolution. The two amplitude levels associated with attenuation measurements are determined automatically in both manual and computer-controlled modes, digitally stored, and the difference displayed by a convenient, internal "scratch pad calculator".

The internal CRT displays the IF signal and serves as a convenient tuning aid for manual operation and to verify proper operation in all modes.

The 1295 Receiver covers 2 to 18 GHz with fundamental frequency YIG-tuned local oscillators and .01 to 2 GHz with an internal up-converter. The receiver also contains a single input connector, internal mixers, a unique adjustable precision IF attenuator, 30 MHz IF amplifier, and associated digital circuitry and display.

18-54 GHz EXTERNAL MIXER-MULTIPLIERS

The basic Receiver covers .01 to 18 GHz and added coverage from 18 to 26 GHz, 26 to 40 GHz and 40 to 54 GHz is provided by three optional, external, mixer assemblies with waveguide inputs. The special mixer multipliers are driven by the lower frequency local oscillators to provide the equivalent performance of fundamental mixing while offering synthesized frequency control (with the FS-1000 Frequency Synthesizer) to 54 GHz.

An AFC error signal is applied to the frequency tuning control through a positive electro-mechanical servo system which automatically zeros the AFC error voltage.

The 30 MHz IF attenuator covers 110 dB in 10 dB steps. Each step is independently adjustable to .01 dB from the front panel by reference to a customer-supplied, external, 30 MHz precision attenuator. The IF attenuator cycles automatically to maintain the output level of the IF amplifier within one of two 13 dB segments. The IF amplifier drives a bolometer and the operator may select either of the two segments to optimize either accuracy or dynamic range. Maximum accuracy is provided over a 80 dB range with .001 dB resolution; above 80 dB resolution is reduced to .01 dB.

The bolometer output is digitized and averaged over selectable periods of one to four seconds. The averaged output is combined with the attenuator step to provide an attenuation value display from 0.000 to 123.00 dB.

The IF amplifier in the 1295 has selectable bandwidths of 15, 100, and 500 kHz. The 100 kHz bandwidth is most commonly employed; 15 kHz utilizes the stability of synthesized operation to improve sensitivity and measuring range. The 500 kHz bandwidth is provided to accomodate less than normal frequency stable signal sources.

When a signal is received, the relative amplitude is automatically displayed. The operator depresses the buttons marked "LEVEL—STORE—DIFF" whereupon, the display reads 0.000. A subsequent change in RF attenuation is displayed directly in dB.

For a second measurement, the operator can reverse the procedure by again depressing the three buttons, remove the device under test, and again read the attenuation level directly in dB. This automation, in manual operation, significantly reduces test time and the need for skilled operators.

EXTERNAL MIXERS
(Options 1 and 2)

SPECIFICATIONS

Measurment Accuracy (based on slow averaging and 100 kHz bandwidth):

.01-18 GHz

Attenuation Range	Accuracy	Maximum Error	RF Input	Sensitivity Setting
0 - 70 dB	±(0.02 dB + 0.02 dB/10 dB)	±0.16 dB	-10 to -80 dBm	LO
0 - 85 dB	±(0.05 dB + 0.02 dB/10 dB)	±0.21 dB	-10 to -95 dBm	HI
0 - 95 dB	±(0.10 dB + 0.02 dB/10 dB)	±0.28 dB	-10 to -105 dBm	HI
0 -100 dB	±(0.20 dB + 0.02 dB/10 dB)	±0.40 dB	- 5 to -105 dBm	HI

18-54 GHz

Attenuation Range	Accuracy	Maximum Error	RF Input	Sensitivity Setting
0 - 50 dB	±(0.02 dB + 0.02 dB/10 dB)	±0.12 dB	-25 to -75 dBm	LO
0 - 65 dB	±(0.05 dB + 0.02 dB/10 dB)	±0.17 dB	-25 to -90 dBm	HI
0 - 75 dB	±(0.10 dB + 0.02 dB/10 dB)	±0.24 dB	-25 to -100 dBm	HI
0 - 80 dB	±(0.20 dB + 0.02 dB/10 dB)	±0.36 dB	-20 to -100 dBm	HI

Measurement Stability... ±.010 dB/minute @ IF after 1 hour warm-up, LO Sens., Slow Avg.

Frequency Display: ..... 5-digit LED, 1 MHz resolution.
Display Accuracy: ..... .01-2 GHz ±1% of frequency, ±20 MHz.
2-54 GHz ±1% of frequency.
IF Attenuator: ..... 0-110 dB in 10 dB steps. Automatic or manual operation. Each step adjustable to ±.01 dB of external reference attenuator.
IF Input: ..... 30 MHz
IF Bandwidth: ..... 15, 100 and 500 kHz, nominal.
IF Linear Range: ..... 30 dB nominal.
Digital Averaging: ..... 1 or 4 seconds per reading, selectable.
Reference Signal: ..... 30 MHz ±7.5 kHz, 0-50 degrees C. +17 dBm min. at rear panel.
LO Sample: (4): ..... -10 dBm minimum, 2-18 GHz
Phase Lock Input: ..... 1.7 MHz per volt, nominal.
CRT Display: ..... Displays 1 kHz swept IF output signal.
AFC: ..... Electro-mechanical. Operates to minimum measurement level.
FM Tolerance: ..... Approximates selected IF bandwidth.
IEEE-488 Bus: ..... Rear panel input. Controls all measurement functions plus tuning and data readout.
Frequency Acquisition: ..... Automatic. Capture range programmable.
Power Requirements: ..... 115/230 Vac ±10%, 50-400 Hz, 50 watts max.
Temperature: ..... Operating: +15 to +35°C.
Non-Operating: -15 to +85°C
Construction: ..... Solid state except for CRT.
Size: ..... 5¼ x 17 x 18 inches, Rack mount optional.
Weight: ..... 38 pounds, nominal, excluding options.

NOTES:

(1) The 30 MHz input may be switched at a 1000 Hz rate for measurement of noise sources.

(2) A 4 dB pad is internally connected to the 2-18 GHz mixer. This may be removed for increased sensitivity but higher SWR.

(3) Sensitivity is the signal level at which the "low level" light extinguishes.

(4) In the .01-2 GHz band, the LO sample is 2330 MHz above the input signal frequency. The 2330 MHz second local oscillator may be phase-locked to a 5 MHz reference having 0 dBm level.

SPECIFICATIONS

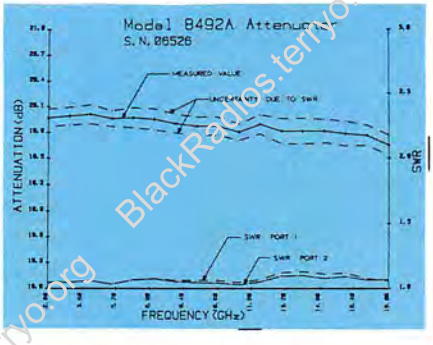
Frequency Range:	.01 to 54 GHz
Frequency Bands (Standard):	.01-2 GHz, 2-4 GHz, 4-8 GHz, 8-12 GHz and 12-18 GHz.
(Optional):	18-26.5 GHz (Option 1) 26-40 GHz (Option 2) 40-54 GHz (Option 5)
Inputs: (Standard):	30 MHz (Type "N") (1) .01-18 GHz (Type "N")
(Option 1):	18-26.5 GHz (UG-595/U, WR 42)
(Option 2):	26.5-40 GHz (UG-599/U, WR 28)
(Option 5):	40-54 GHz (UG-383/U modified, WR 19)
Input SWR: (2)	2:1, maximum
Sensitivity in 100 kHz bandwidth (3)	-103 dBm, .01 to 18 GHz -100 dBm, 18 to 40 GHz -90 dBm, 40 to 54 GHz
Maximum Input Signal:	+20 dBm without damage
Measurement Range:	100 dB minimum, .01-18 GHz 80 dB minimum, 18-40 GHz 70 dB minimum, 40-54 GHz
Measurement Resolution:	0.001 dB (0-80 dB) 0.01 dB (80-100 dB)

COMPUTER OPERATION

Any IEEE-488 Bus controlled signal source can be used with the 1295 Receiver for automated computer control. A positive, fast acting, digital AFC, controlled by the computer, permits use of the 100 kHz bandwidth. For even faster, more positive operation, a synthesized signal source plus an FS-1000 Frequency Synthesizer in conjunction with the 1295 Receiver can be employed. This is the system shown in the above photograph which includes the Micro-Tel SG-811 Signal Generator and covers .01 to 18 GHz. Coverage from 18 to 54 GHz can be provided by adding the ME-811 Series Frequency Extenders to the SG-811 and Options 1, 2 and 5 to the 1295 Receiver.

The computer-controlled system also provides a convenient method to measure and record mismatch uncertainty. Mismatch uncertainty due to the VSWR of the device-under-test, as well as associated components, is frequently greater than the instrumentation error (see Measurement Accuracy). For example, a 20 dB attenuator with a VSWR of 1.2 at each port, has a measurement uncertainty of 0.2 dB when inserted between a source with a VSWR of 1.1 and a load with a VSWR of 1.2.

Portion of Computer Printout for a 20 dB Attenuator.



The same attenuator showing measured valued, SWR, and uncertainty due to mismatch displayed on an associated chart recorder. Total time – 5 minutes.

IF ATTENUATOR CALIBRATION AND SELF-TEST

The internal 30 MHz precision IF attenuators in the 1295 Receiver can be calibrated in about 20 minutes employing an external reference attenuator. An amplitude stable 30 MHz reference oscillator is provided as a convenient source for the calibration procedure with a customer-supplied external reference attenuator.

This reference oscillator provides a convenient means for the operator to periodically verify the calibration of the IF attenuator steps by connecting it to the 30 MHz input through a variable attenuator. Stepping manually, each position can be verified by comparison to the bolometer.

ORDERING INFORMATION (Please see latest price list.)

1295 **Precision Attenuation Measurement Receiver** .01-18 GHz	☐ Option R	Rack Mount
	☐ Option 1	Adds 18-26 GHz Coverage
	☐ Option 2	Adds 26-40 GHz Coverage
	☐ Option 4	30 MHz IF Output
	☐ Option 5	Adds 40-54 GHz Coverage
	☐ C-1000	Fiberglass Carrying Case
SG-811B **Microwave Signal Generator** .01 to 18 GHz, 15 mw output	See individual Data Sheet	
FS-1000 **Frequency Synthesizer** .01 to 18 GHz (to 54 GHz with ME-211)	See individual Data Sheet	
AMS-1295 **Automatic Measurement System** (.01 to 18 GHz, up to 54 GHz with Extenders)	Composed of: 1295 Receiver SG-811 Signal Generator (2) FS-1000 Frequency Synthesizer System Controller and Software	
Signal Generator Calibration System	Composed of: 1295 Receiver, FS-1000 Frequency Counter / Synthesizer, System Software and Customer Furnished Power Meter, Modulation Meter and System Controller.	

WARRANTY

All Micro-Tel products are unconditionally warranted for a period of one year except for physical damage, provided the equipment is returned to the plant in Hunt Valley.

DISCLAIMER

Micro-Tel produces computer-controlled systems to support the Test and Measurement industry and the surveillance market as well. Demonstration software is produced to support these systems and is provided at no cost to our customers. This software is supplied to assist our customers in developing their own software. Micro-Tel does not warrant the software to meet any specific needs or requirements and is not responsible for improving existing software.

MICRO-TEL DIVISION
ADAMS-RUSSELL ELECTRONICS CO., INC.
10713 Gilroy Road / Hunt Valley, Maryland 21030 / (301) 771-0077
FAX: (301) 771-6025 / TLX 87442