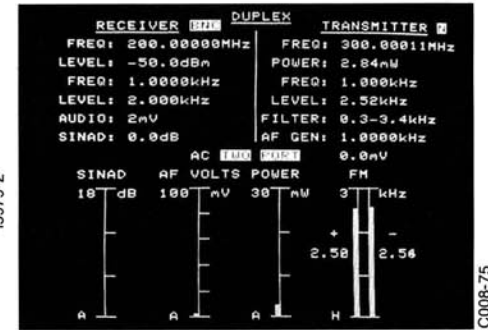


Radio Communications Test Sets

2955A/2955R



relating to a particular test, and a direct indication of controls in use. Setting up the instrument for a particular test involves selection of the appropriate colour identified keys in a logical left-to-right sequence. As the operator selects the required keys, the screen indicates the test mode selected and highlights the function accessed in reverse screen video. This informs the operator which frequency or level parameter is then available for control.



CONTROLS AND INDICATIONS

Setting of specific test channel frequencies, modulating levels and output levels etc. is via a numeric key pad. However, for convenience and speed of operation, three variable controls are provided. Programmable incremental keys for frequency and level allow the operator to define any INC/DECrement size, within the range and resolution of the test set. This facility enables rapid channel stepping for checking of multi-channel radios, and simplifies receiver bandwidth and AGC testing. For tests requiring fine adjustments of frequency or level, such as squelch threshold measurements or sub-audible tone deviation settings, a rotary variable control is available.

Large Clear Display

The CRT display provides the flexibility for measurements to be presented in digital form for precise unambiguous readings, from which a hard-copy printout can be obtained. It also allows measured information to be presented in analog bar chart form, which is convenient for providing adjustments such as simple peaking indications. Comparative measurements between positive and negative peak deviation are available to check modulation symmetry.

In transmitter, receiver and audio test modes, a digital storage scope facility is provided. When testing transmitters, the scope's vertical scale is directly calibrated for modulation measurements: a single shot facility allows the user to measure peak-to-peak modulation. This peak hold function is invaluable for setting the modulation limiter circuits in the radio, and for ensuring that maximum permissible deviation is not exceeded.

- Comprehensive testing facilities for AM/FM/ØM transceivers to 1000 MHz
- Sensitive receiver for off-air transmitter monitoring with 2955R
- Full duplex facility tests radio telephones and cross-band repeaters
- Sequential and revertive tones, DTMF and DCS encoders/decoders
- Menu driven CRT display with 26 stores for recall of standard settings
- Precision digital readouts and auto-ranging bar charts for rapid testing
- Built-in self test and operator guide
- System checking of simplex transceivers in less than 3 seconds
- Operation from any standard a.c. supply up to 400 Hz or vehicle supply
- Digital scope with single shot for peak modulation setting
- GPIB or RS232 for full instrument control
- High stability OCXO fitted as standard

The 2955 series Radio Communications Test Sets combine all the instruments required for transceiver testing within a single unit. Designed for bench and mobile field service applications in maintenance workshops, the instruments are lightweight, portable and may be operated from all standard AC supplies, or vehicle supplies.

Comprehensive facilities are provided for testing all types of AM, FM and ØM mobile radio equipment, including low-power hand portables and mobiles using selective calling, full duplex radio telephones, digital pocket pagers, base station and repeater equipment.

Major users include mobile radio manufacturers, providers of mobile radio telephone networks, service maintenance workshops, commercial and public service organisations, and the military.

Comprehensive Measurements

The 2955A comprises 19 instrument functions for transceiver testing: RF power meter, RF frequency meter, modulation

meter, RF signal generator, dual AF signal generators, AF frequency meter, AF voltmeter, 1 kHz AF distortion meter, S/N and SINAD meter, sequential tones encoder/decoder, DTMF encoder/decoder, digitally coded squelch (DCS) encoder/decoder, POCSAG digital pager encoder and digital oscilloscope. This comprehensive instrument also functions well as a low-cost ATE system, or as a set of general-purpose test equipment for production, service or laboratory use.

The 2955R includes a sensitive, selective input for measurement of signals as low as 1 µV, in addition to all the facilities of 2955A.

Simple Set-Up

Operation of the test set is by keys, which configure the instrument functions to test either a transmitter and receiver together in full duplex mode, or independently for simplex or semi-duplex operation. A large CRT display provides the operator with all generated and measured information

TRANSMITTER TEST (MODE = TX TEST)

When measuring a transmitter in the frequency range 1.5 MHz to 1000 MHz, the modulation meter automatically tunes to the incoming signal frequency in typically less than 3 seconds, providing the user with analog and digital readouts of all parameters. This avoids the operator having to set up the transmitter frequency. The screen indicates transmitter frequency, power, modulation frequency, modulation level and transmitter distortion.

All measurement scales are auto-ranging, thus preventing the likelihood of accidental damage due to excessive input levels. Best instrument measurement accuracy is assured because manual range selection is avoided: a range hold is available where automatic ranging is not required. These facilities cut service test time dramatically.

150 W Power Handling

RF power measurement range is 0.05 mW to 75 W continuous rating, catering for low-power portables and base station transmitters. Power readings in dBm or Watts are available. High-power transmitters of up to 150 W may be measured for short intervals. A thermal sensor warns the operator if the load gets too hot, by flashing a screen message to REMOVE RF INPUT. A short interval later, an additional two-tone audible alarm is given in case the operator's attention has been diverted from the screen.

To facilitate a number of maximum power measurements, without having to wait for the power load to cool, a HOLD DISPLAY key is provided. This enables the user to freeze the entire screen display after the readings have stabilised, allowing all the transmitter measurements and settings to be read off, with the transmitter de-keyed. A hard-copy printout of all the digital information contained in RX, TX, DUPLEX, AF TEST and Directional Power meter screens can be obtained using a GPIB or RS232 printer. The optional 24 column ticket printer fits into the instrument's lid for storage.

SSB Testing

RF frequency counter resolution is selectable as either 1 Hz or 10 Hz, enabling tests of SSB systems. A two-tone modulating signal may be applied to a SSB transmitter to check for linearity; the carrier waveform may be observed at the IF output socket on the rear of the instrument. This facility also allows future expansion in capability to meet the needs of emerging radio telephone networks.

Testing simplex radios is simplified by using the RX = TX key. This pre-sets the RF signal generator to the same frequency as the transmitter, saving the operator the task of entering the channel frequency in receive

test mode. The INC/DEC keys may be used to offset the generator frequency for channel-to-channel operation or for semi-duplex tests.

DUPLEX TEST (MODE = DUPLEX TEST)

Full duplex testing of radio telephones is possible with all necessary parameters for both the transmitter and receiver displayed simultaneously on the CRT screen. The frequency and level of the RF and AF signal generators may be independently controlled from the instrument key pad or varied using the rotary control.

Any Duplex Offset

A unique feature is that the modulation meter is independent of the RF signal generator, so there is no restriction to the total frequency offset between transmitter and receiver test. This means that, in addition to measuring standard duplex systems, cross-band repeaters, and repeater systems using mixed AM and FM equipment can be tested.

RECEIVER TEST (MODE = RX TEST)

In the receiver test mode, standard default settings of the RF and AF signal generators are provided. The RF signal generator level is set to -100 dBm and the AF signal generator frequency to 1 kHz. Modulation can be set to any default value for FM, \emptyset M and AM testing within the default limits.

This facility is provided so that the minimum amount of user interaction is required to perform a simple system check after switch on. If the RF signal generator frequency has been pre-set using the RX=TX key and the radio being tested is simplex, then no further instrument settings are required. For a functioning receiver, audio output will be present from the receiver under test.

Noise And Distortion

Dedicated keys allow the user to select either signal-to-noise (S/N), SINAD or distortion test. All readings are displayed numerically on the CRT screen and as auto-ranging bar charts for maximum user convenience.

RF output level accuracy is specified to be within ± 2 dB over the attenuator range of +5 dBm to -127 dBm, and includes the effects of temperature, from 0° to +50°C, making the signal generator one of the most accurate available in a test set for the maintenance user.

Comprehensive modulation control is provided by using the INC/DECrement keys or rotary control. The generator may be internally or externally modulated to produce AM, FM or \emptyset M signals. The external modulation input can be used for dual tone inputs such as DTMF tones, or for FFSK/FSK modulation.

AUDIO TEST (MODE = RX TEST, FUNCTION = AF GEN)

The audio generator function provides access to the 2 audio generators, AF voltmeter and digital oscilloscope. The audio generators provide a choice of sine, square, triangular, and saw-tooth waveforms. Tone generation is available providing CCIR, ZVEI, DZVEI, EEA, EIA, or USER DEFINED tones, and separately DTMF generation and decoding. The AF input socket has a nominal input impedance of 1 M Ω , making it compatible with standard probes.

TONES ENCODER/DECODER

The 2955 series provides a very comprehensive analog and digital tones encoder/decoder facility for testing selective circuits in mobile radios and digital pagers. Sequential tone standards are available to the user from a screen menu. In addition, a USER DEFINED mode allows 15 different tone frequencies to be defined.

Provision is made to send a sequence of up to 33 tones in any standard, either as a single burst, tone step or as continuous cycles for receiver testing. Frequencies may be shifted from nominal up to $\pm 9\%$ in 1% steps for tolerance checking of receiver decoders. Any one of the sequence tones can be extended. Sub audible tones (CTCSS) and two tone operation are also available.

Standard Tones

Decoded tones are compared with standard frequencies held in memory. If each tone is within the standard limits, the tone number, frequency and percentage error is displayed. Sub audible tones are measured directly in the transmitter test mode by the audio frequency counter with the 300 Hz low pass filter selected: this allows measurement even in the presence of modulation. For applications requiring encoding and decoding of complex or non standard tones systems, and EXTERNAL MODulation input and AF DEMODulation output are provided.

Revertive tone systems can be tested. Up to 11 tones can be programmed for transmit; with decoding and display of up to 11 revertive tones from the unit under test.

DTMF messages can be sent and received, and displayed on the screen. Digitally coded squelch (DCS) can be generated, with the capability to program the DCS 3 digit code, digital bit rate, modulation level, and signal polarity. DCS transmissions can be received, decoded, and the waveforms displayed with the correct code highlighted from all possible codes.

2955A/2955R



Pager Testing

POCSAG digitally coded pagers can be tested with control of the pager frequency, bit rate, deviation and identity code. Transmission of either an alert signal only, a numeric message or an alpha-numeric message is available. A facility to insert errors into the 32 bit address to test the units error correction capability is provided.

TRANSMITTER MONITOR (MODE = Tx MON)

Off-air measurements of a transmitter station can be made by the 2955R when Tx MONitor mode is selected. A selective, sensitive receiver with 1 μ V sensitivity covering the range 100 kHz to 1 GHz, is available to demodulate an off-air signal. Calibrated signal strength is displayed in μ V, mV, dB μ V or dBm up to a level of 140 mV. Carrier frequency is measured and displayed as an offset from the ideal. Modulation level, frequency and distortion are also displayed, both as readings and as bar charts.

Off -Air Testing

In use the 2955R is connected to a suitable antenna or the telescopic antenna supplied. The readings are then presented in a similar way to the normal transmitter test screen. The increment keys may be used to alter the carrier frequency, such as for channel steps, and the variable control is available for fine tuning.

The audio generators are available for exciting the transmitter, typically over a land line to a remote base station. Other applications include the use of a probe (see 52388-900D) for fault finding and aligning receiver circuits such as mixers, IF amplifiers and filters. Being hi-impedance, the loading on the circuit in question can be minimised.

The demodulated signal can be monitored on the built-in loudspeaker and on the storage oscilloscope display. If desired an external loudspeaker or a headset can also be used. To cater for different modulation types, two receiver bandwidths are available, 12 kHz for narrowband speech and 180 kHz for data and broadcast signals. The normal transmitter tones decoding facilities are

available to permit tests on remote base station calling tones.

Using the microphone interface accessory and microphone (54432-013E and 54412-020Y) it is possible to use the 2955R in a 'talk-through' mode as a low power transceiver for testing mobile equipment whilst in service. This allows instructions to be given to the radio operator and for comments to be returned. In this way large fleets can be quickly tested, with minimum disruption to users.

NON-VOLATILE MEMORY

26 non-volatile stores are provided, each capable of retaining indefinitely a complete front panel set-up, with instant recall whenever required. One additional storage location (00) provides power fail back-up so that the last group of front panel settings is restored after an AC power or battery supply failure. A facility is provided to lock the stores to prevent accidental erasure.

PROGRAMMABLE OPERATION

Full instrument control is provided via the GPIB or RS232 interfaces, and adds further versatility for automatic testing, and computer-assisted manual testing. A write-to-screen capability enables the CRT to be used for operator instructions and for simple straight line graphics. Specification tests can be carried out using the upper half of the screen, whilst the lower half is used for drawing limit bar charts and writing text.

LOW COST-OF-OWNERSHIP

Instrument lifetime is a significant factor in cost-of-ownership, and the 2955 series include a number of features to reduce calibration costs, reduce down-time and help eliminate expensive repairs. Visual and audible warnings are given when excess power is dissipated in the power load, and if a transmitter with an output power of up to 50 W is accidentally connected to the BNC-RF connector, a relay opens the signal path thus protecting the instrument.

Simple Servicing

A built-in self test facility identifies faulty sections either to major module level or group of components, so reducing the mean time to repair. Instrument down-time is further reduced by modular construction, which simplifies the service of faulty modules. The Test Set has only six p.c.b.'s plugging into a mother board, a plug-in RF tray, an attenuator block, a receiver module (in the 2955R) and a power load. These are easily removed for replacement or further test.

Routine calibration needs have been kept to a minimum, and calibration factors stored in non-volatile memory may be accessed with a secure access code from the front

panel key buttons, or via the GPIB, permitting rapid recalibration.

A 3 year unconditional warranty is provided in many territories.

VERSIONS AND ACCESSORIES

Accessories are available to provide comprehensive cellular radio test facilities for NMT, AMPS, Radiocomm 2000 and TACS. Band III and similar trunked radio system test facilities are also available.

Other accessories are described later in this document.

SPECIFICATION

RF SIGNAL GENERATOR

FREQUENCY

Range

0.4 MHz to 1000 MHz (usable to 1060 MHz).

Resolution

50 Hz up to 530 MHz. 100 Hz up to 1000 MHz.

Indication

9 digit display.

Setting

Via keyboard entry. Step change variation by INC/DEC keys and rotary control.

Accuracy

As internal standard.

OUTPUT LEVEL

Range

Rx Mode: -135 dBm to -15 dBm (0.04 μ V to 40 mV), N-type socket selected. -115 dBm to 5 dBm (0.4 μ V to 400 mV), BNC socket selected.
One Port Duplex Mode: -140 dBm to -21.5 dBm, (0.0224 μ V to 18.85 mV).
Two Port Duplex Mode: -115 dBm to -15 dBm (0.04 μ V to 40 mV).

Resolution

0.1 dB.

Indication

4 digits with units μ V, mV, dBm, dB μ V. PD/EMF selection as appropriate.

Setting

Via keyboard entry. Step change variation by INC/DEC keys and rotary control.

Accuracy

± 2 dB for levels above -127 dBm, (± 1.8 dB from +18 to +28°C)

SPECTRAL PURITY

Residual FM

Less than 23 Hz up to 520 MHz, typ. 15 Hz, less than 45 Hz up to 1000 MHz, typ. 30 Hz. Measured in 300 Hz to 3.4 kHz bandwidth.

Residual AM

<0.5%, 300 Hz to 3.4 kHz bandwidth.

Harmonics

Less than -20 dBc up to 1.5 MHz, -25 dBc up to 250 MHz, -20 dBc up to 1000 MHz.

Sub-harmonics

None up to 530 MHz, less than -25 dBc to 1000 MHz.

Spurious signals

For carrier frequencies up to 88 MHz: Less than -45 dBc up to 110 MHz, less than -35 dBc above 110 MHz.

For carrier frequencies up to 1000 MHz: Less than -60 dBc.

Signal/noise at 20 kHz offset

Less than -106 dBc/Hz up to 500 MHz, less than -100 dBc/Hz to 1000 MHz.

RF leakage

Less than 0.2 μ V PD generated in a 50 Ω load by a 2-turn 25 mm loop as near as 25 mm to the case of the instrument with the output set to less than -40 dBm and the output terminated in a 50 Ω sealed load.

Protection

50 W reverse power trip, automatically resets on removal of power input (BNC socket). Visual alarm warning (REMOVE RF INPUT) and audible alarm provided for added protection.

OUTPUT IMPEDANCE

50 Ω nominal.

VSWR

Less than 1.2 to 500 MHz, less than 1.35 to 1000 MHz (N-type), less than 2.2 to 1000 MHz (BNC).

MODULATION

AMPLITUDE MODULATION

INTERNAL

CW range

1.5 to 400 MHz, usable from 400 kHz to 500 MHz.

Mod. depth range

0 to 99%.

Resolution

1%.

Indication

2 digits.

Mod. frequency range

20 Hz to 20 kHz.

Setting

Via keyboard entry. Step change variation by INC/DEC keys and rotary control.

Accuracy

$\pm 7\%$ of setting ± 1 digit at 1 kHz. $\pm 10\%$ of setting ± 1 digit, 50 Hz to 5 kHz up to 70% AM. $\pm 15\%$ of setting ± 1 digit, 50 Hz to 15 kHz up to 85% AM.

EXTERNAL

As internal plus:

Input impedance

1 M Ω in parallel with approximately 40pF.

Sensitivity

1.0 V p-p for 30% AM at 1 kHz $\pm 15\%$ reading $\pm 1\%$ AM.

AM distortion

Less than 2% distortion at 1 kHz with 30% AM. (300 Hz to 3.4 kHz bandwidth).

FREQUENCY MODULATION

INTERNAL

CW range

0.4 to 1000 MHz (usable to 1060 MHz).

Mod. deviation range

0 to 25 kHz.

Resolution

25 Hz (<6.25 kHz dev.). 100 Hz (<25 kHz dev.).

Indication

4 digits.

Mod. frequency range

20 Hz to 20 kHz.

Setting

Via keyboard entry. Step change variation by INC/DEC keys and rotary control.

Accuracy

$\pm 7\%$ ± 10 Hz at 1 kHz. $\pm 10\%$ from 50 Hz to 15 kHz.

EXTERNAL

As internal plus:

Input impedance

1 M Ω in parallel with approximately 40pF.

Mod. deviation range

0 to 30 kHz.

Sensitivity

1 V p-p for 5 kHz deviation: $\pm 10\%$ at 1 kHz.

Mod. frequency range

1 Hz to 50 kHz.

FM distortion

Less than 1% distortion at 1 kHz with 5 kHz deviation (300 Hz to 3.4 kHz bandwidth).

PHASE MODULATION

INTERNAL

CW range

0.4 to 1000 MHz.

Modulation range

0 to 10 rads.

Resolution

0.025 rads, up to 6.3 rads. 0.1 rads, above 6.3 rads.

Indication

3 digits.

Mod. frequency range

300 Hz to 3.4 kHz.

Setting

Via keyboard entry. Step change variation by INC/DEC keys and rotary control.

Accuracy

$\pm 8\%$ at 1 kHz, $\pm 11\%$ from 300 Hz to 3.4 kHz.

DM distortion

Less than 2% at 1 kHz with 5 rads (300 Hz to 3.4 kHz bandwidth).

EXTERNAL

As internal plus:

Input impedance

1 M Ω in parallel with approximately 40pF.

Sensitivity

1 V p-p for 5 rads. $\pm 12\%$ at 12 kHz.

DUAL AUDIO GENERATOR

OUTPUT IMPEDANCE

Less than 5 Ω nominal.

WAVEFORM SHAPE

Sine, square, triangle, saw-tooth.

FREQUENCY

Range

10 Hz to 20 kHz.

Resolution

0.1 Hz (10 Hz to 3.25 kHz). 1 Hz (3.25 kHz to 20 kHz).

Indication

5 digits.

Setting

Via keyboard, and with rotary control for step change variation.

Accuracy

± 0.01 Hz from 10 Hz to 100 Hz. ± 0.1 Hz from 100 Hz to 20 kHz.

Distortion

Less than 0.5% at 1 kHz (sine), less than 1% from 50 Hz to 15 kHz (sine).

Residual noise

Less than 0.1 mV RMS in a psophometric bandwidth.

DC offset

Less than 10 mV DC.

OUTPUT LEVEL (EMF)

Range

0.1 mV to 4.095 V RMS (sine and square). 0.1 mV to 4.095 V peak (triangle and sawtooth).

Accuracy

$\pm 5\%$ ± 1 digit, 50 Hz to 15 kHz.

Setting

0.1 mV steps (0.1 mV to 409.5 mV). 1 mV steps (409.5 mV to 4.095 V).

RF RECEIVER

Range

100 kHz to 1000 MHz (usable to 1060 MHz).

Sensitivity

1 μ V for 10 dB SINAD in 12 kHz bandwidth typical from 1 MHz to 1000 MHz for 3.5 kHz deviation.

Linearity Response

Typically ± 6 dB level accuracy at 100 MHz with reference to -60 dBm, over range -87 dBm to -24 dBm (10 μ V to 14 mV) BNC -67 dBm to -4 dBm (100 μ V to 140 mV) N type.

Maximum Input

-24 dBm (14 mV) for 11 dB SINAD in 12 kHz bandwidth from 100 kHz to 1000 MHz (BNC).

Image Response

0 dB at 42.8 MHz of RF input.

Squelch

A manual squelch control is provided with a variable threshold.

RF FREQUENCY METER

Range

1.5 MHz to 1000 MHz (usable to 1060 MHz).

Resolution

1 Hz or 10 Hz to 200 MHz, 10 Hz from 200 MHz to 1000 MHz.

Typ. acquisition

Up to 200 MHz, 100 ms, with 10 Hz resolution; 1 s with 1 Hz resolution. Up to 1000 MHz, 400 ms, 10 Hz resolution only.

Sensitivity

Input to type-N socket; 5 mW (0.5 V), TX mode selected. 20 mW (1 V), one/two port duplex. BNC input; 1 μ V with TX MOD selected (2955R). 0.05 mW (50 mV).

Accuracy

As internal standard ± 1 digit.

RF POWER METER

Range

0.05 mW to 150 W.

Input to type-N socket: 50 mW to 75 W continuous, TX Mode selected. 100 mW to 75 W continuous in single port duplex mode. (150 W max. for typically 2 minutes at 25°C continuous). End of safe working is indicated by screen warning "REMOVE RF INPUT" and audible alarm.

Input to BNC socket: Usable 0.05 mW to 1.0 W.

Measurement Units

Watts or dBm.

Frequency range

As RF Frequency Meter.

Resolution

1% full-scale.

Indication

2/3 digits and analog display.

Setting

Automatic ranging on scales 0 to 30, 0 to 100, 0 to 300 mW, 0 to 1, 0 to 3, 0 to 10, 0 to 30, 0 to 100 W and 0 to 300 W.

Accuracy

$\pm 10\%$ ± 1 digit up to 500 MHz, $\pm 15\%$ ± 1 digit up to 960 MHz, $\pm 20\%$ ± 1 digit up to 1000 MHz. $\pm 20\%$ typ. BNC socket.

VSWR

Less than 1.2 to 500 MHz, less than 1.35 to 1000 MHz (N-type). Less than 2.2 to 1000 MHz (BNC).

MODULATION METER

Manual-tune

Provides frequency offset indication from carrier. 3 Digits and decimal point indicate most significant positive or negative error.

Auto-tune

Provides measurement and simultaneous display of RF frequency, power, modulation frequency and level, and 1 kHz demod. distortion.

Acquisition

Less than 3 seconds at 10 Hz resolution.

Frequency range

As RF Frequency Meter.

Sensitivity

As RF Frequency Meter.

AF filters

The following filters are available: Bandpass — 300 Hz to 3.4 kHz, Low pass — 300 Hz, Low pass — 15 kHz.

AMPLITUDE MODULATION

CW range

1.5 MHz to 400 MHz.

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Modulation range

Manual-tune mode: 0 to 100% up to 400 MHz.
Auto-tune mode: 0 to 90% up to 100 MHz. 0 to 80% up to 400 MHz. Auto ranging (bar chart), 0 to 10, 0 to 30, 0 to 100% depth.

Resolution

1% AM.

Indication

2 digits and \pm peak analog display.

Accuracy

$\pm 5\%$ ± 1 digit at 1 kHz, $\pm 8.5\%$ ± 1 digit from 50 Hz to 10 kHz.

Mod. frequency range

10 Hz to 15 kHz.

Demod. distortion

Less than 2% above 21 MHz; Less than 5% below 21 MHz; measured in a 300 Hz to 3.4 kHz filter and 30% AM at 1 kHz.

Residual AM

<1% at frequency meter sensitivities .6 dB.

FREQUENCY MODULATION

Modulation range

0 to 25 kHz. Automatic ranging (bar chart), 0 to 1, 0 to 3, 0 to 10, 0 to 30 kHz.

Resolution

10 Hz up to 2.5 kHz deviation. 1% up to 25 kHz deviation.

Indication

3 digits and \pm peak analog display.

Accuracy

$\pm 5\%$ ± 1 digit at 1 kHz, $\pm 7.5\%$ over range 50 Hz to 10 kHz.

Mod. frequency range

10 Hz to 15 kHz.

Demod. distortion

Less than 1.5% at 5 kHz deviation and 1 kHz modulation frequency in a 300 Hz to 3.4 kHz bandwidth.

Residual FM

Less than 23 Hz RMS up to 500 MHz, typ. 15 Hz. Less than 45 Hz RMS up to 1000 MHz, typ. 30 Hz. For inputs above 20 mW/0.2 mW (N/BNC), measured in a 300 Hz to 3.4 kHz bandwidth.

PHASE MODULATION

Modulation range

0 to 10 radians. Automatic ranging (bar chart), 0 to 1, 0 to 3 and 0 to 10 radians.

Resolution

1% or 0.01 radians.

Indication

3 digits and \pm peak analog display.

Accuracy

$\pm 5\%$ ± 1 digit at 1 kHz, $\pm 7.5\%$ ± 1 digit from 0.3 to 3.4 kHz w.r.t. 750 μ s de-emphasis.

Mod. frequency range

300 Hz to 3.4 kHz. Phase de-modulation is obtained using 750 μ s de-emphasis.

Demod. distortion

Less than 2% at 5 rads. modulated by 1 kHz measured in 300 Hz to 3.4 kHz bandwidth.

SINAD METER/SIN METER

Frequency

1 KHz.

Range

0 to 18 dB, 0 to 50 dB (SINAD). 0 to 30, 0 to 100 dB (S/N).

Resolution

0.1 dB.

Indication

3 digits plus analog display.

Accuracy

± 1 dB.

Sensitivity

50 mV (100 mV for 40 dB SINAD/S/N).

DISTORTION METER

Frequency

1 kHz.

Range

0 to 10%, 0 to 30% distortion.

Resolution

0.1% distortion.

Indication

3 digits plus analog display.

Accuracy

$\pm 5\%$ of reading $\pm 0.5\%$ distortion.

Sensitivity

50 mV (100 mV for 1% distortion).

AF LEVEL METER

Features

AC, DC, or AC measurements.

Input impedance

1 M Ω in parallel with approximately 40pF.

Frequency range

20 Hz to 50 kHz (or d.c.).

Level range

0 to 100 mV, 0 to 300 mV, 0 to 1, 0 to 3, 0 to 10, 0 to 30 and 0 to 100 V.

Resolution

1 mV on 1% dependent on range.

Indication

3 digits plus analog display.

Accuracy

$\pm 3\%$ ± 3 mV ± 1 digit (50 Hz to 20 kHz or D.C.).

Frequency response

Switchable: bandpass 0.3 to 3.4 kHz, low pass 300 Hz or 50 kHz, external filter.

AF FREQUENCY METER

Range

20 Hz to 20 kHz.

Resolution

0.1 Hz/1 Hz.

Indication

3, 4 or 5 digits.

Accuracy

As internal standard ± 1 digit ± 0.1 Hz or 0.02% (whichever is greater).

Sensitivity

50 mV.

INTERNAL FREQUENCY STANDARD

OCXO

Oven controlled crystal oscillator, nominal frequency 10MHz.

Temperature coefficient

Less than ± 5 parts in 10^8 from 0 to 50°C; Less than 4 parts in 10^9 /°C from 50 to 70°C.

Ageing rate

Less than ± 5 parts in 10^8 /month, ± 2 parts in 10^7 /year after 1 month's continuous use.

Short-term stability

Less than ± 1 part in 10^9 , RMS frequency error over a 1 s period.

Retrace error

Less than ± 2 parts in 10^7 over 24 hours, at constant temperature and after 25 minutes warm-up.

EXTERNAL FREQUENCY STANDARD INPUT

Frequency

1 MHz.

Level

100 mV to 3 V RMS.

Impedance

10 k Ω in parallel with 100 pF approximately.

DIGITAL STORAGE OSCILLOSCOPE

Features

Single or repetitive sweep, available in TX, RX and Audio Test modes (Tx MON on 2955R), calibrated for AM, FM and Ω M.

Frequency range

DC to 50 kHz (from 3 Hz on AC).

Voltage range

10 mV/div to 20 V/div in a 1-2-5 sequence.

Accuracy

$\pm 5\%$.

FM ranges

± 30 , 15, 6, 3, 1.5 kHz deviation at $\pm 10\%$ accuracy.

Ω M ranges

± 15 , 7.5, 3, 1.5 rad at $\pm 10\%$ accuracy.

AM ranges

20, 10, 5% /div. at $\pm 10\%$ accuracy.

Sweep rates

100 μ s/div to 5 s/div in 1-2-5 sequence, accuracy locked to internal standard.

Trigger

Repetitive or single-shot storage.

SELDCALL ENCODER/DECODER

Functions

Encodes 33 tones, decodes up to 33 tones in a CCIR, ZVEI, DZVEI, EEA, EIA or USER DEFINED tone sequence.

Tone encoder facilities

Send continuous, burst, single step, extend any tone, null, repeat or frequency shift up to $\pm 9\%$ in 1% steps.

Tone decoder facilities

Displays tone number, frequency and percentage error. Screen indicates null tones (using CRT) and annotates out of limit frequencies for ease of identification.

User defined

Allows definition of up to 15 tones. Frequency range 300 Hz to 3.4 kHz, duration 20 ms to 1.2 s (decode); 20 Hz to 20 kHz, duration 10 ms to 999 ms (encode). Frequencies are stored in non-volatile memory.

Tones in audio mode

Tones encode and decode facility available using AFGEN output and AF input BNC sockets.

Revertive tones

Available in Receive Test Mode, tones are sent to the radio and the 2955A awaits a response.

ADDITIONAL FEATURES

IF OUTPUT SOCKET

Frequency

110 kHz nominal.

Level

Minimum 180 mV.

Impedance

50 Ω , minimum load 5 k Ω .

Bandwidth

50 kHz to 350 kHz.

DEMODULATION OUTPUT SOCKET

Level

400 mV p-p for ± 1 kHz deviation $\pm 10\%$.

Impedance

10 k Ω nominal.

Bandwidth

Either 300 — 3.4 kHz, 15 kHz or 300 Hz LP.

EXTERNAL MODULATION

In RX TEST MODE, the 2955 series can be configured to measure the modulation at the EXT MOD INPUT. Adjustment will provide the desired modulation level.

ACCESSORY SOCKET

Pins 3, 4, 5, 6 accessory control. Pin 2, +12 V, 100 mA max. Pin 7, AF output, 1 W into 8 Ω . Pin 1, pulse output available under GPIB control, approximately 600 ns.

DTMF ENCODE/DECODER

Provides DTMF encoder and decoder under Tones menu. Tone duration and intertone gaps may be varied from 10 to 999 ms in 1 ms steps.

PAGER TESTER

Encoding of POCSAG code CCIR No. 1 Rec. 584. Bit rate 400 — 1500 bits/s, deviation 0 — 25 kHz. Allows entry of Radio Identity Code (RIC), 4 addresses, 2 preset numeric messages, 4 alphanumeric messages and insertion of bit errors. A data Invert facility is provided.

DCS ENCODER

Digitally Coded Squelch encoder, allows entry of Bit rate 100 — 200 bits/s, deviation 0 — 25 kHz. Polarity, normal or inverted, RIC 3 digit code.

DCS DECODER

Displays bit rate, deviation, polarity and all possible codes.

SPECIAL KEY FUNCTIONS

RX = TX FREQ

Presets the RF signal generator frequency to the measured frequency in TX mode and Duplex mode.

Hold Display

Freezes instrument settings and readings, facilitating high RF power measurements and hard copy printout of TX, RX, Duplex, TX monitor or AF test screens.

INC/DEC

Available in TX, RX, Duplex, TX monitor and AF test modes for defining frequency or level increments of the AF and RF signal generators. Any step size setting within the range and resolution of the test set is permissible.

Store/Recall

26 non-volatile stores (01 to 26) are provided, each capable of retaining all front panel settings for up to 10 years.

Recall 00

An additional store (00) is provided to retain the last test set-up, in the event of a power fail.

Help

Provides access to SELF TEST, stores lock, RF meter resolution, SINAD or S/N default values, external attenuator offset, variable default deviation, 2955/2955A emulation, default AF filter, Rx/Tx mod. type lock, USA/Europe tone standard selection, and user help for Tx, Rx, Duplex and AF test modes.

Hold range

The displayed bar chart can be held, ie no autoranging, by use of the scope pushbuttons.

Audible output

For listening to demod output and received audio.

Two tone modulation

In transmit mode, two tones are available under tones menu. In receiver mode, external modulation inputs add to internal modulation.

GENERAL

POWER REQUIREMENTS

Rated supply voltage

105-120 V AC, 210-240 V AC, all $\pm 10\%$.

Supply frequency range

45 Hz-440 Hz.

Maximum consumption

100 VA.

DC supply voltage

11-32 V DC.

DC supply consumption

Less than 60 W (2955A). Less than 70 W (2955R).

GPIB INTERFACE

All functions except the supply switch are remotely programmable.

Capabilities

Complies with the requirements of EEC Directive IEEE 488-1978 and IEC Publication 625-1: SH1, AH1, T5, L4, SR1, RL1, PP0, DT1, E1.

RADIO FREQUENCY INTERFERENCE

Conforms with the requirements of EEC Directive 76/889 as to limits of RF interference. Complies with VDE 0871, limit value Class B, as specified in General Licence Vfg 1046/ 1984.

SAFETY

Complies with IEC 348.

RATED RANGE OF USE

0 to 50°C.

LIMIT RANGE OF OPERATION

0 to 55°C.

CONDITIONS OF STORAGE AND TRANSPORT

Temperature

-40 to +70°C.

Humidity

Up to 90% humidity.

Altitude

Up to 2500 m (pressurized freight at 27 kPa differential, i.e. 3.9 lbf/in²).

DIMENSIONS AND WEIGHT

| Height | Width | Depth |
|--------|-----------------|-----------------|
| 175 mm | 345 mm | 460 mm |
| 6.9 in | 13.6 in | 18.1 in |
| Weight | 15.5 kg (2955A) | 16.8 kg (2955R) |
| | 34 lb | 37 lb. |

VERSIONS AND ACCESSORIES

When ordering please quote eight digit code numbers.

| Ordering numbers | Versions of Radio Communication Test Set |
|------------------|--|
| 2955A | |
| 52955-911J | Radio Communication Test Set with GPIB fitted |
| 52955-910L | Radio Communication Test Set with GPIB fitted |
| 52955-912F | Radio Communication Test Set with RS232 fitted. |
| 52995-326F | Radio Communication Test Set with GPIB fitted (French Language Version). |
| 52995-327G | Radio Communication Test Set with GPIB fitted (Spanish Language Version). |
| 2955R | |
| 52955-321U | Radio Communication Test Set with Sensitive Receiver and GPIB fitted. |
| 52955-331V | Radio Communication Test Set with Sensitive Receiver and RS232 fitted. |
| 52995-328V | Radio Communication Test Set with Sensitive Receiver and GPIB fitted (French Language Version). |
| 52995-329S | Radio Communication Test Set with Sensitive Receiver and GPIB fitted (Spanish Language Version). |
| | Supplied accessories |
| 43129-003W | AC Supply Lead. |
| 46881-952B | Operating Manual. |
| 46881-953K | Programming Manual. |
| 46881-986A | Introductory Guide. |
| 41690-411S | Front Cover (Stowage). |
| 43130-119U | DC Supply Lead. |
| 54421-001N | BNC Telescopic Antenna (2955R only). |
| | Optional accessories |
| 54415-005E | Multi-system Adapter. |
| 46884-101J | NMT 450/900. Country Variants Cellular Software. |
| 46884-102F | AMPS/E-AMPS Cellular Software. |
| 46884-103G | TACS/E-TACS Cellular Software. |
| 46884-104V | Radiocomm 2000 Cellular Software. |
| 46884-105S | Band III Trunked Radio Software. |
| 54421-003J | Directional Power Head 25 MHz-1000 MHz. |
| 54421-002L | Directional Power Head 1 MHz-50 MHz. |
| 54462-023W | Battery Pack with built-in D.C. Input Fast Charger. |
| 54211-001D | Printer 24 Column with Paper & Ribbon. |
| 46883-877P | Printer Ribbon & Paper Kit. |
| 54411-052M | 600 Ω Balanced Interface with 20 dB Attenuator. |
| 54499-042L | CCITT Psophometric Filter. |
| 54499-043J | CMESS Psophometric Filter. |
| 43129-189U | GPIB Lead (used with 24 Column Printer.) |
| 54433-002Y | GPIB Interface. |
| 54433-004L | RS232 Interface. |
| 54451-163Y | IF Injector Probe 470 kHz. |
| 54451-164N | IF Injector Probe 10.7 MHz. |
| 54451-165L | IF Injector Probe 455 kHz. |
| 54127-304C | Rack Mounting Kit (19"). |
| 54431-023A | 20 dB AF Attenuator. |
| 54150-022P | Viewing Hood. |
| 46662-192W | Transit Case. |
| 46662-432V | Soft Carrying Case. |
| 54111-053C | Impedance Matching Unit. |
| 54432-012H | Microphone Interface Unit. |
| 54412-020Y | Microphone. |
| 54432-012H | Wideband RF Amplifier 100 Hz-500 MHz. |
| 54491-325H | 150 Hz Bandstop Filter. |
| 46881-954A | Service Manual. |

(Contact Marconi Instruments for further optional accessories)