Wireless

2968 TETRA Radio Test Set

The IFR 2968 TETRA Radio Test Set for comprehensive terminal and base station testing

- TETRA terminal and base station test options
- Trunked Mode and optional Direct Mode
- Simplex and Duplex operation
- Group, Individual, Phone and Emergency call types
- Direct or Hook signalling
- TIPv3 compliant
- ETSI EN 300 394-1 transmitter and receiver measurements
- TETRA Test (TT) registration and TT loopback BER testing
- T1 test signal generation and T1 loopback and BER testing
- Auto-test mode for fast terminal testing
- Audio loopback testing for voice or tones
- Multi-standard platform
- Optional TETRALOG protocol analysis
- Full span spectrum analyzer and tracking generator
- Audio FFT analysis

The IFR 2968 TETRA Radio Test Set is a single box solution for testing TETRA radio terminals and / or base stations and has been designed to offer maximum flexibility to satisfy applications in design, manufacturing and radio maintenance. The test set provides all the necessary signalling to control a TETRA radio and then make measurements of key transmitter and receiver RF and audio parameters. Measurements are performed accurately with speed and ease.

TETRA Measurements

Transmitter measurements performed on terminals and base stations include burst power, power profile, frame alignment (burst timing error), frequency error, modulation accuracy (EVM) and residual carrier. All are performed in accordance with ETSI EN 300 394-1. These parameters are measured for each of the different TETRA burst types and displayed numerically on a summary screen as well as a graphical bar chart. Individual parameters are supported by dedicated graphical displays to aid design engineering or fault diagnosis. Demodulated symbol data for captured bursts can be displayed or output for offline storage or analysis.

The IFR 2968 is able to perform TETRA receiver sensitivity measurements by various means depending upon the capability of the radio under test. TETRA terminals supporting TT loopback can be automatically tested by allowing the 2968 to control test mode registration and RF loopback during which BER, MER and RBER parameters can be measured. Terminals supporting T1 test mode can be tested for BER using T1 loopback; MER and BER may be measured by the terminal under test using the T1 signals generated by the 2968. The T1 signal types supported include TCH/7.2 type 1, TCH/2.4 type 4 and SCH/F type 2. Receiver sensitivity (SINAD, Distortion) may also be tested by recovering and analyzing audio signals from the terminal using the array of standard audio analysis features of the tester. The 2968 provides the necessary RF stimulus modulated with a digitized encoded audio tone, silence or ‘talkback’.

For base station testing the 2968 supports synchronization either to the downlink signal generated by the base station or to a synchronization pulse output from the base station. The RF T1 Test signal
generated in the test set (TCH/7.2 type 7) stimulates the base station receiver to enable internal BER measurement.

**Network Simulation**

The IFR 2968 is highly configurable to enable it to emulate a wide variety of different TETRA networks, such that a terminal under test recognizes the IFR 2968 as the network for which it is configured. Functional tests provide an essential check for terminals before they are deployed into a TETRA network or when returning to active service after repair.

- The various TETRA RF channel plans are all supported together with user defined or NO PLAN options making the 2968 suitable for use wherever TETRA systems are deployed.
- TX slot selection and RF power control modes are made user definable to improve versatility.
- Group attachment, detachment and modification functions are supported for up to 40 different groups. Displayed GSSI information makes it simple for users to verify that terminals are correctly configured for the target user.
- SDS-TL text messages (up to 120 characters) can be sent or received by the test set using either TETRA or GSM message coding schemes. Sent messages can be time stamped and received messages can be displayed with destination SSI and ESN. When requested the tester provides a message received response to the terminal.

**Call Processing Functions**

The 2968 supports all the necessary call processing functions required for terminal testing. These include registration, de-registration to / from a network, mobile originated and mobile terminated call set-up and clear down. Supported call types include individual, group, telephone, emergency and user defined. An audio loopback (talk-back) feature is provided to enable simple end to end testing. In talkback received audio from the terminal microphone is received, time delayed, then re-transmitted to the terminal from the 2968 and output from the terminal loudspeaker.

**Auto-test**

Pre-defined auto-test sequences are provided to enable fast and simple testing of terminals in repair organizations. Test sequences can be selected to perform comprehensive signalling and RF measurement or protocol only tests to verify functionality only. User defined test sequences can be configured via the front panel in which up to 6 different call setup and clear down scenarios can be specified. This allows terminals supporting different modes of operation to be fully tested. TT loopback can also be incorporated within an automated test program enabling simple and repeatable Go / No Go testing of terminals.

**TIP V3 Compatibility**

Call processing functions are performed in accordance with the TETRA MoU TETRA Interoperability Profile version 3. This ensures that the IFR 2968 is able to test all similarly conforming TETRA terminals.

**Direct Mode Operation (DMO) option 32**

DMO functionality includes signalling verification as well as transmitter measurement capability. The 2968 displays the mobile’s ITSI as well as other call setup parameters such as call type and encryption status in much the same way as for normal Mobile Test trunked mode operation (option 30).

**Operation**

The IFR 2968 can be manually operated or incorporated into an automated test system and controlled via RS-232 or GPIB. Manual control is via front panel hard and soft-keys used in conjunction with a monochrome CRT. A VGA compatible monitor may be connected in which case display information is presented in color. RF input/output ports to the test set are selectable as either single port or dual port duplex. The two RF inputs provide the flexibility to connect the 2968 directly to high power signal sources up to 150 W or to low level signals during off air analysis. Single port operation is ideal for terminal testing whereas dual port configuration is ideal for base station testing where the TX and RX ports are independent.

**TETRALOG (Refer to separate data sheet 46891/117 for detail)**

As an optional accessory to the 2968, a software application can be provided for use in conjunction with a PC operating in Windows™. This application captures and displays decoded protocol messages that are exchanged between the radio test set and the TETRA terminal to aid the testing of the terminal protocol during development or interoperability testing. These messages can be displayed with varying degrees of detail from LMAC (layer 2.1) to CMCE and MM (layer 3.2).

**Standard Features**

The basic 2968 platform is provided with a comprehensive range of standard features including.

- Fully featured full span spectrum analyzer and variable level offset tracking generator for signal measurement, alignment, filter / amplifier and mixer response measurements.
- FFT analyzer for fast and high resolution audio measurements.
- Variable frequency SINAD and distortion measurement for customized applications.
- Wide range of audio filters for versatile audio characterization.
- Comprehensive audio generator with up to 6 sources enabling complex signalling.
- Broad band and selective power meters to enable measurement of total transmitted power or channel power.
- Built in multi-meter.

**Options**

The 2968 may be configured with any combination of available system options. All supported standards can co-exist on the same platform. This makes the 2968 ideal for repair workshops where mixed product is supported.

In addition to the various TETRA terminal and base station radio options, MPT1327/1343 trunking, GSM, TACS, AMPS, NMT and SSB system options are also available.
GSM (900 MHz) Option 21

This option, compatible with GSM Phase 2, allows control and measurement of GSM 900 MHz mobile terminals. The option is designed to enable radio alignment and test during radio repair.

For more information on other system options refer to product specification literature 2965, 2967 available from www.ifrsys.com

Support

The 2968 is supplied with a standard 2 year warranty with an optional extension to 3 years and a recommended calibration interval of 2 years.

Upgrade of functionality is through software download which can be performed in the field by Aeroflex support personnel or at any of Aeroflex’s approved service centers.

The 2968 is supported by a component level service manual which is backed up by factory run training courses arranged on demand. On-site service training or user training can be supplied by arrangement.

### SPECIFICATION

#### GENERAL INFORMATION

Certain characteristics are shown as typical. These provide additional information for use in applying the instrument but they are unwarranted.

#### TETRA SIGNAL GENERATOR

##### FREQUENCY

**Range**

10 MHz to 1 GHz, useable to 1.15 GHz

**Resolution**

1 Hz

**Indication**

4 digit display (channel number) in SYSTEMS mode

10 digit display (Hz) in Duplex mode

**Setting**

SYSTEMS mode: Channel number and frequency plan or direct entry in MHz

Other modes: Keyboard entry (Hz), delta increment/ decrement function and rotary variable control

**Accuracy**

As frequency standard

##### OUTPUT LEVEL

**Range**

One-port Dx modes:

N-Type socket: -135 dBm to -50 dBm

TNC socket: -135 dBm to -30 dBm

Rx Test and two-port Dx modes:

N-Type socket: -135 dBm to -40 dBm

TNC socket: -135 dBm to -20 dBm

**Resolution**

0.1 dB

**Indication**

4 digits plus sign (dBm)

#### TETRA MODULATION

**Modulation Type**

$\pi/4$ DQPSK

**Modulation Rate**

18 k symbols/sec

**Modulation Filter**

Root Nyquist, $\alpha = 0.35$

**Vector Error**

<3% RMS

<6% peak

**Residual Carrier Power**

<-35 dBc

**Data**

T1 test signals (in accordance with ETS 300 394-1)

- T1 type 1 (TCH/7.2 downlink)
- T1 type 2 (SCH/F downlink)
- T1 type 4 (TCH/2.4 downlink)
- T1 type 7 (TCH/7.2 uplink)
- Control Channel (MCCH)

#### TETRA RECEIVER MEASUREMENTS

**BER Testing**

T1 type 1 (TCH/7.2) BER

TCH/S Class 0 BER

TCH/S Class 1 BER

TCH/S Class 2 BER

TCH/S Class 0 RBER

TCH/S Class 1 RBER

TCH/S MER
Traffic Channel (TCH/S):  
Talkback  
Silence  
1 kHz test tone  
0.153 PRBS

**TETRA TRANSMITTER MEASUREMENTS**

**Frequency Range**  
10 MHz to 1 GHz

**Dynamic Range**  
0 dBm to +52 dBm

**Burst Types Measured - Base Station Test**  
NDB - Normal Down Link (cont.) using TS1 or TS2  
SB - Synchronization Burst (cont.)  
NDB - Normal Down Link (discont.) using TS1 or TS2  
SB - Synchronization Burst (discont.)

**Burst Types Measured - Direct Mode Mobile Test**  
DNB - Direct mode Normal Burst using TS1 or TS2  
DSB - Direct mode Synchronization Burst  
DSB - Direct mode Synchronization Burst (cont.)

**Burst Types Measured - Mobile Test**  
CB - Control Burst (Half Slot discontinuous)  
NUB - Normal Uplink Burst (discont.) TS1 or TS2  
NUB - Normal Uplink Burst (cont.) TS1 or TS2

**RF RELATIVE FREQUENCY ERROR METER**  
Mobiles test mode only  
Frequency Error Range  
±500 Hz

**Burst Types Measured**  
CB, NUB (discont.), NUB (cont.)

**Resolution**  
10 Hz

**Indication**  
3 digits and bar chart with peak hold

**Accuracy**  
±15 Hz

**RF ABSOLUTE FREQUENCY ERROR METER**  
Base Station and Direct Mode test modes only  
Frequency Error Range  
±500 Hz

**Resolution**  
0.1 Hz

**Indication**  
3 digits and bar chart with peak hold

**Accuracy**  
±15 Hz + frequency standard accuracy

**TETRA RF POWER METER**  
Power Measurement  
Average power during one burst measured at the symbol points measured through a TETRA filter (Root Nyquist α = 0.35) averaged over n bursts (selectable between n = 1 to n = 250)

**Indication Units**  
dBm / Watts

**Resolution**  
0.1 dB

**Indication**  
3 digits and bar chart with peak hold

**Accuracy**  
±0.6 dB for temperatures in the range 15 to 35°C  
See also under Environmental - User Calibration

**BURST TIMING ERROR**  
Range  
±510 symbols

**Resolution**  
0.01 symbols

**Indication**  
5 digits

**Accuracy**  
±0.05 symbols

**TETRA MODULATION ANALYZER**  
Modulation Error Range  
20% RMS Vector error  
40% Peak Vector error  
20% Residual Carrier

**Resolution**  
0.25%

**Indication**  
4 digits and bar chart with peak hold  
Vector Error profile

**Accuracy**  
±0.5% at 10% error

**GRAPHICAL DISPLAYS**

**RF POWER PROFILE**

**Vertical Scale**  
10 dB/div or 3 dB/div

**Burst Type (Selectable)**  
BS, MS and DM-MS (Discontinuous only)

**Power Measurement**  
Measured through TETRA filter  
Referenced (0 dB) to average power

**Power Profile Dynamic Range**  
50 dB

**Indication**  
Power profile against TETRA template

**Display**  
Complete Burst  
Ramp Up/Ramp Down
Accuracy
±0.6 dB at symbol points for levels greater than -10 dB

CONSTELLATION DIAGRAM
Amplitude and phase at the symbol point measured over all symbols of the burst (SN₀ ~ SNₘₐₓ) measured through TETRA filter

Display Features
Normal/Expanded

Display Mode
Single/Continuous
Refresh/Persistence/Accumulate

PHASE TRAJECTORY DIAGRAM
Amplitude and phase continuously measured over all symbols of the burst (SN₀ ~ SNₘₐₓ) through TETRA filter

Display Features
Normal/Expanded

Display Mode
Single/Continuous
Refresh/Accumulate

VECTOR ANALYSIS DISPLAYS
Vector error, magnitude error and phase error displays
Amplitude error and Phase error Continuous measured over all symbols of the burst (SN₀ ~ SNₘₐₓ) through TETRA filter

Display Features
Normal/Expanded

Display Mode
Single/Continuous

RF ANALOG SIGNAL GENERATOR
AS TETRA GENERATOR EXCEPTION FOR:

Frequency Range
100 kHz to 1 GHz, useable 90 kHz to 1.15 GHz

OUTPUT LEVEL

Range
One-port Dx modes:
N-Type socket: -135 dBm -40 dBm
TNC socket: -115 dBm -20 dBm
Rx Test and two-port Dx modes:
N-Type socket: -135 dBm -10 dBm (-20 dBm with AM)
TNC socket: -115 dBm +10 dBm (0 dBm with AM)

Indication
4 digits plus sign (dBm, dBµV, µV, µV PD/EMF)

SPECTRAL PURITY
Residual FM (CCITT weighted)
15 to 35°C
Less than 6 Hz RMS up to 575 MHz
Less than 12 Hz RMS up to 1 GHz

Residual AM (CCITT weighted)
Less than 0.05% RMS

Harmonics
Better than -30 dBc for levels up to +7 dBm (TNC)
Better than -30 dBc for levels up to -13 dBm (N-Type)

Spurious signals
Better than -45 dBc for carrier frequencies from 100 kHz to 36 MHz
Better than -50 dBc for carrier frequencies above 36 MHz

SSB Phase Noise (20 kHz offset)
Better than -114 dBc/Hz up to 575 MHz
Better than -108 dBc/Hz up to 1 GHz

AMPLITUDE MODULATION – INTERNAL
Frequency Range
100 kHz to 400 MHz, useable to 1.15 GHz

AM Depth Range
0 to 99%

Resolution
0.1%

Indication
3 digits

Setting
Keyboard entry, delta increment/decrement function and rotary variable control

Accuracy (up to 85% AM)
±4% of setting ±1 digit for modulation frequency 1 kHz
±6% of setting ±1 digit for modulation frequencies from 30 Hz to 10 kHz
±8% of setting ±1 digit for modulation frequencies from 10 kHz to 20 kHz

Distortion
Less than 1% at 1 kHz for modulation depths up to 30%, CCITT weighted
Less than 2% for modulation frequencies from 100 Hz to 20 kHz and depths up to 85%

Modulation Frequency
Range: 20 Hz to 15 kHz for carrier frequencies up to 36 MHz; 20 Hz to 20 kHz for carrier frequencies up to 400 MHz
Resolution: 0.1 Hz below 10 kHz; 1 Hz below 20 kHz

AMPLITUDE MODULATION – EXTERNAL
Input impedance
Nominally 1 MΩ in parallel with 100 pF

Frequency Range
As internal AM

Modulation Frequency Range
As internal AM with AC or DC coupling

Accuracy
As internal ±2%

Input Sensitivity
1 VRMS for indicated modulation depth

FREQUENCY MODULATION – INTERNAL
Frequency Range
100 kHz to 1 GHz, useable 90 kHz to 1.15 GHz
**Maximum Deviation**

![Maximum Deviation Diagram]

**Indication**

4 digits

**Setting**

Keyboard entry, delta increment/decrement function and rotary variable control

**Accuracy**

±3% ±1 digit at 1 kHz over the range 15 to 35°C (0.1% per °C outside this range)

±3% ±1 digit (typ) for mod frequencies from 20 Hz to 5 kHz

±7% ±1 digit (typ) for mod frequencies from 5 kHz to 20 kHz

±10% ±1 digit (typ) for mod frequencies from 20 kHz to 75 kHz

**Distortion**

Less than 0.5% for modulation frequencies from 250 Hz to 5 kHz (for deviation 1 kHz to 800 kHz)

Less than 1% for modulation frequencies from 50 Hz to 20 kHz (for deviation 1 kHz to 800 kHz)

**Resolution**

0.1 Hz

**FREQUENCY MODULATION – EXTERNAL**

**Input Impedance**

Nominally 1 MΩ in parallel with 100 pF

**Frequency Range**

As internal FM

**Maximum Deviation**

![Maximum Deviation Diagram]

**Input Sensitivity**

2.828 V pk-pk for indicated deviation

**Accuracy**

As internal ±2% for frequencies up to 20 kHz

**PHASE MODULATION – INTERNAL**

**Frequency Range**

100 kHz to 1 GHz, usable to 1.15 GHz

**Indication**

4 digits

**Setting**

Keyboard entry, delta increment/decrement function and rotary variable control

**Accuracy**

±5% ±1 digit for modulation frequencies from 250 Hz to 3.4 kHz, over the range 15 to 35°C (0.1% per °C outside this range)

**Distortion**

Less than 1% for modulation frequencies from 250 Hz to 5 kHz (for deviation 1 rad to 160 rads)

**Modulation Frequency Range**

Range: 250 Hz to 5 kHz

**Resolution**

0.1 Hz

**PHASE MODULATION – EXTERNAL**

**Input Impedance**

Nominally 1 MΩ in parallel with 100 pF

**Frequency Range**

As internal phase modulation

**Modulation Frequency Range**

250 Hz to 5 kHz

**Input Sensitivity**

2.828 V pk-pk for indicated deviation

**Accuracy**

As internal ±2%

**INTERNAL MODULATION AND AUDIO SOURCES**

Up to 6 tone sources can be assigned as 3 modulation generators and 3 audio tone generators.

**Modulation Modes**

Internal generators may be assigned to AM, FM, Φ M.

**AUDIO VOLTMETER**

**Input Impedance**

Nominally 1 MΩ in parallel with 100 pF

**Frequency Range**

DC and 20 Hz to 500 kHz

AC only 20 Hz to 500 kHz

Polarized DC less than 10 Hz
Level Ranges
0 to 10, 0 to 30, 0 to 100, 0 to 300 mV, 0 to 1, 0 to 3, 0 to 10, 0 to 30 V RMS reading (auto-ranging or fixed)

Level Indication
4 digits and bar chart with peak hold

Level Accuracy (DC Coupled) (^a)
±2% of reading ±1 mV ± resolution, DC and 100 Hz to 20 kHz
±4% of reading ±1 mV ± resolution, 40 Hz to 100 kHz

Level Accuracy (AC Coupled) (^a)
±2% of reading ±1 mV, ± resolution 150 Hz to 20 kHz
±4% of reading ±1 mV, ± resolution 100 Hz to 100 kHz

Residual Noise
100 µV RMS CCITT weighted

AUDIO FREQUENCY METER

Range
10 Hz to 500 kHz

Resolution
0.1 Hz from 10 Hz to 5 kHz
1 Hz from 5 kHz to 50 kHz
10 Hz from 50 kHz to 500 kHz

Indication
6 digits

Accuracy
As frequency standard ±1 digit ± resolution

Sensitivity
On bar chart greater than 25% FSD (DC coupled)

AUDIO SINAD METER

Frequency
1 kHz default. User selectable up to 20 kHz

SINAD Range
5 to 50 dB

Resolution
0.1 dB for readings less than 20 dB
0.2 dB for readings less than 25 dB

Indication
3 digits and bar chart with peak hold

Accuracy (bandpass filter selected)
±0.5 dB ± resolution

Sensitivity
100 mV for 46 dB SINAD

AUDIO DISTORTION METER

Frequency
1 kHz default. User selectable up to 20 kHz

Distortion Range
0 to 100%

Resolution
0.1% distortion for readings greater than 1%
0.2% distortion for readings less than 1%

Indication
3 digits and bar chart with peak hold

Accuracy
±5% of reading ± resolution (bandpass filter selected)

Sensitivity
100 mV for 0.5% distortion

S/N RANGE

S/N Range
0 to 100 dB

Resolution
0.1 dB for readings less than 50 dB
0.2 dB for readings less than 70 dB

Indication
3 digits and bar chart with peak hold

Accuracy
±0.5 dB ± resolution

Sensitivity
2 V for 60 dB, 200 mV for 40 dB

AUDIO OSCILLOSCOPE

Operating Modes
Single or Repetitive sweep

Frequency Range
DC to 500 kHz
10 Hz to 500 kHz (AC coupled)

Glitch Catching
1 µs minimum

Voltage Ranges
2 mV/div to 20 V/div in a 1, 2, 5 sequence

Voltage Accuracy
±5% of full scale

Timebase
5 µs/div to 10 s/div in a 1, 2, 5 sequence

Timebase Accuracy
As frequency standard

Trigger Mode
Auto-trigger

Marker Indication
Level: M1-M2, M2-M1
Time: M1-M2, M2-M1

Graticule
10 Horizontal by 8 Vertical divisions
Can be magnified to full screen
**Audio FFT Analyzer**

**Span Widths**
50 Hz to 50 kHz in a 5, 10, 25 sequence
Above 40 kHz signals are attenuated by 80 dB/octave.

**Graticule**
10 Horizontal by 8 Vertical divisions
Can be magnified to full screen

**Level Reference (top of screen)**
10 mV to 20 V in a 1, 2, 5 sequence

**Level Accuracy**
±0.3 dB 100 Hz to 15 kHz; typically ±1 dB 40 Hz to 40 kHz

**Vertical Scaling**
1, 2, 5, 10 dB/div

**Dynamic Range**
60 dB

**Max hold facility**

**Audio Sweep facility**
DC to 20 kHz
Marker Indication
Level: M1, M2, M1-M2
Frequency: M1, M2, M1-M2

**Audio Bar Charts**
Displays: AF voltage, SINAD, Distortion, S/N
Vertical Resolution: 1% of full scale
Ranging: Auto-ranging, range hold or manual selection (up/down), 1, 3, 10 sequence with hysteresis
With peak hold facility.

**Audio and Modulation Filters**
300 Hz Lowpass (+0.1 dB less than 150 Hz, ±0.2 dB, 150-200 Hz relative to 100 Hz)
300 Hz to 3.4 kHz Bandpass (±0.4 dB, 400-2100 Hz relative to 1 kHz)
5 kHz Lowpass (+0.3 dB at <3 kHz relative to 1 kHz)
20 kHz Lowpass (±0.3 dB at <12 kHz, typically -0.9 dB at <15 kHz and -3 dB at 20 kHz relative to 1 kHz)
CCITT Psophometric
C-MESSAGE
See also under Environmental - User Calibration.

**Multimeter**

**Input Terminals**
3 x 4 mm, ‘Volt/Ohm’, ‘Current’ and ‘Common’

**Maximum Input Voltage**
300 V (CAT II) with respect to instrument chassis

**Accuracy specifications apply with a maximum common mode voltage of 25 V**

**Voltmeter**

**Voltage Range**
0 to 300 V, 0 to 30 V, 0 to 3 V, 0 to 300 mV, Terminals, ‘Volt/Ohm’ and ‘Common’, maximum crest factor 3:1 at range full scale

**Frequency Range**
Polarized DC or 40 Hz to 1 kHz

**Input Impedance**
Nominal 6 MΩ in parallel with 100 pF

**Resolution**
0.1% of FSD

**Accuracy**
DC: ±3% of reading ±2 mV ±1 digit
AC + DC: ±3% of reading ±3 mV ±1 digit
See also under Environmental/User Calibration.

**Indication**
3 digits and barchart with peak hold

**Ammeter**

**Current Range**
0 to 1 A and 0 to 10 A

**Frequency Range**
Polarized DC or 40 Hz to 1 kHz

**Resolution**
1 mA below 1 A; 10 mA below 10 A

**Accuracy**
DC: ±5% of reading ±50 mA ±1 digit
AC + DC: ±5% of reading ±150 mA ±1 digit

**Indication**
3 digits and barchart with peak hold

**Resistance Meter**

**Resistance Ranges**
100 Ω, 1 kΩ, 10 kΩ, 100 kΩ, 1 MΩ

**Resolution**
1 Ω below 1 kΩ or 3 digits

**Accuracy**
±5% of reading ±1 Ω ±1 digit
Continuity Test continuous tone if reading is less than 10 Ω

**Indication**
4 digits and bar chart with peak hold

**RF Frequency Meter**

**Range**
100 kHz to 1 GHz

**Resolution**
1 Hz or 10 Hz selectable

**Indication**
Up to 10 digits

**Accuracy**
As Frequency Standard ±2 Hz ± resolution

**Dynamic Range (Auto-tuned)**
As RF Power Meter (broadband)
**RF POWER METER (BROADBAND)**

**Frequency Range**
100 kHz to 1 GHz

**Dynamic Range (Auto-tuned)**
10 mW to 150 W (N-Type), 100 µW to 0.5 W (TNC)

**Power Reading**
True mean power

**Indication Units**
Watts

**Resolution**
Better than 1%

**Indication**
3 digits and barchart with peak hold

**Accuracy**

- 100 kHz to 500 MHz:
  - ±7.5% (0.3 dB), 0.1 W to 50 W (N-Type)
  - ±10% (0.4 dB), 20 mW to 150 W (N-Type)
  - ±12% (0.5 dB), 200 µW to 50 mW (TNC)

- 500 MHz to 1 GHz:
  - ±12% (0.5 dB), 20 mW to 150 W (N-Type)
  - ±15% (0.6 dB), 200 µW to 50 mW (TNC)

- 100 kHz to 1 GHz:
  - ±7.5% (0.3 dB), 0.1 W to 50 W (N-Type)
  - ±10% (0.4 dB)

1 mW to 50 mW (TNC) for ambient temperatures in the range 15°C to 35°C

See also under Environmental - User Calibration.

**Maximum Safe Continuous Rating**
N-Type: 50 W
TNC: 0.5 W; overload protected to 10 W

**Intermittent Rating**
N-Type: 150 W for limited periods, typically 2 minutes at 20°C. Typical off to on ratio is 6:1. Overload indicated by audible and visual warning.

**RF POWER METER (SELECTIVE)**

**Frequency Range**
100 kHz to 1 GHz

**IF Bandwidth**
300 Hz to 30 kHz in a 1, 3, 10 sequence and 110 kHz, 280 kHz and 3 MHz

**Dynamic Range (Manually tuned)**
0 dBm to +50 dBm (110 kHz IF bandwidth) (N-Type)
-90 dBm to +20 dBm (110 kHz IF bandwidth) (TNC)

**Power Reading**
Average

**Indication Units**
dBm

**Resolution**
0.1 dB

**Indication**
3 digits + barchart with peak hold

**Accuracy**

- ±2.5 dB N-Type & TNC (typical)

See also under Environmental - User Calibration.

**RF SPECTRUM ANALYZER**

**Frequency Range:**
100 kHz to 1 GHz, useable from 30 kHz to 1.05 GHz

**Spans**
500 Hz/div to 100 MHz/div, in a 1, 2, 5 sequence

**Resolution Bandwidth**
300 Hz to 300 kHz in a 1, 3, 10 sequence and 3 MHz (automatically selected according to span and manually selectable)

Video bandwidth – fixed at 3 kHz

**Filter Shape**
Nominally 3 dB/60 dB, 1:11 (300 Hz to 30 kHz bandwidth)

**Reference Level (top of screen)**
-100 dBm to +70 dBm

**On Screen Dynamic Range**
80 dB

**Vertical Resolution**
0.5 dB on 10 dB/div, 0.05 dB on 1 dB/div

**Level Accuracy**

- ±2.5 dB (typical)

See also under Environmental - User Calibration.

**Intermodulation Distortion**
Less than 80 dB for 2 signals on screen at reference level

**Phase Noise (typically)**
-70 dBc / Hz at ±100 Hz from signal
-75 dBc / Hz at ±1 kHz from signal
-85 dBc / Hz at ±10 kHz from signal
-100 dBc / Hz at ±100 kHz from signal

**Sweep Speeds**
Optimum sweep speed selected according to span and resolution bandwidth

**Modes**
Single sweep and continuous

**Graticule**
10 horizontal by 8 vertical divisions

**Display Features**
Normal/Expanded
Markers
M1 and M2

Indication
Level: M1, M2, M1-M2
Frequency: M1, M2, M1-M2

TRACKING GENERATOR
Available in RF TEST mode

Frequency Range
100 kHz to 1 GHz

Level Range
-135 dBm to +13 dBm

Offset Tracking
Allows testing of mixers, IFs, fundamental and 2nd harmonic analysis (up, down, ×2, ÷2)

MODULATION ANALYZER

Dynamic Range (Auto-tuned)
As RF Power Meter (Broadband)

Sensitivity (Manual tuned)
N-Type -30 dBm (110 kHz IF bandwidth)
TNC -50 dBm (110 kHz IF bandwidth)
TNC (off-air test mode) -101 dBm (2 μV 10 dB SINAD in 30 kHz IF bandwidth and CCITT weighting)

Demodulation
Accuracy maintained on signals greater than -60 dBm

Receiver Bandwidths
300 Hz to 30 kHz in a 1, 3, 10 sequence and 110 kHz, 280 kHz and 3 MHz

Demodulation Filters
As audio analyzer plus 5 kHz lowpass (±0.3 dB at less than 3.4 kHz relative to 1 kHz)

Audio Output
Available in to an internal loudspeaker, demodulated output or accessory socket for external loudspeaker or headphones

Switching Speed
Nominally less than 1 ms channel to channel up to 50 MHz apart, settling to within 1 kHz of final frequency

Demodulated Output
Nominal output impedance less than 10 Ω. Output voltage is range dependent (2 V peak at top of range).

Squelch
A manual squelch control is provided with a variable threshold.

AMPLITUDE MODULATION

Frequency Range
100 kHz to 1 GHz

Modulation Frequency Range
20 Hz to 20 kHz

AM Depth Range
0 to 99.9%

Resolution
0.1% AM

Indication
3 digits and bar chart with peak hold

Accuracy (up to 85% AM)
±3% of reading, ±1% AM, 250 Hz to 5 kHz
Typically ±5% of reading, ±1% AM, 50 Hz to 15 kHz

Demodulation Distortion
Less than 1% at 1 kHz, CCITT weighted

Residual AM
Less than 0.1% AM, CCITT weighted

FREQUENCY MODULATION

Frequency Range
1 MHz to 1 GHz

Modulation Frequency Range
20 Hz to 20 kHz

Deviation Range
0 to 100 kHz

Resolution
10 Hz below 10 kHz deviation; 100 Hz below 100 kHz deviation

Indication
3 digits and bar chart with peak hold

Accuracy
±3% ± resolution for mod frequency of 1 kHz
±5% ± resolution for mod frequencies from 100 Hz to 15 kHz

Demodulation Distortion
Less than 0.5% at 1 kHz, CCITT weighted

Residual FM
Less than 25 Hz RMS CCITT weighted

PHASE MODULATION

Frequency Range
1 MHz to 1 GHz

Modulation Frequency Range
250 Hz to 5 kHz

Deviation Range
0 to 20 rads

Resolution
0.01 rads

Indication
3 digits and bar chart with peak hold

Accuracy
±5% ± resolution

Demodulation Distortion
Less than 0.5% at 1 kHz, CCITT weighted
**AUDIO GENERATORS**

See section on modulation generators for interaction of audio and modulation generators.

**FREQUENCY**

*RANGE*

1 Hz to 20 kHz AF Gens 1, 2 & 3 or 1 Hz to 100 kHz AF Gen 4

**SETTING**

Keyboard entry, delta increment/decrement function and rotary control

**INDICATION**

6 digits

**RESOLUTION**

0.1 Hz

**ACCURACY**

As frequency standard

**LEVEL**

*Range*

0.1 mV to 5 V RMS (maximum AF output 7 V peak, all generators combined)

*SETTING*

Keyboard entry, delta increment/decrement function and rotary control

**INDICATION**

4 digits

**RESOLUTION**

0.1 mV

**ACCURACY**

±3% ±1 digit, 250 Hz to 5 kHz
±5% ±1 digit, 10 Hz to 20 kHz
±10% ±1 digit, 20 kHz to 75 kHz

**Output Impedance**

Nominally 5 Ω

**Protection**

Maximum applied voltage 50 V

**SIGNAL PURITY**

**Distortion**

Less than 0.5% at 1 kHz measured in a 30 kHz bandwidth
Less than 1% from 20 Hz to 20 kHz measured in an 80 kHz bandwidth
Typically 0.1% for levels greater than 100 mV

**Residual Noise**

Less than 50 µV RMS (CCITT weighted)

**DC Offset**

Less than 10 mV

**SIGNALLING ENCODER/DECODER**

**Sequential tones functions**

Encodes and decodes up to 40 tones
CCIR, ZVEI, DZVEI, EEA, EIA or user defined
Any of the tones may be extended
Continuous, burst and single step modes available

**User defined tones**

Up to three frequency plans may be defined and stored within the 2968 for sequential tones.
Any of the standard tone frequency plans may be copied to user defined and modified.
Tone length 10 ms to 1 s
Extended tone length 100 ms to 10 s

**CTCSS tones mode**

Standard tone frequencies may be selected from a menu.

**DTMF Encoder/Decode**

Generation and decode of DTMF tones, displaying Hi/Lo frequencies, frequency error, timing information and twist

**DCS Encode/Decode**

Generation and decoding of digitally coded squelch

**POCSAG generator**

Generation of POCSAG code CCIR No.1
Rec 584. Bit rates from 400 to 9600 bit/s.

**AUDIO MONITOR**

Audio and demodulation signals may be monitored via the internal loudspeaker or via the accessory socket output or BNC socket on the rear panel.

**GENERAL FEATURES**

**INTERFACES**

Keyboard and Display
Logical color coded keyboard with bright high resolution CRT

**GPIB**

Full control of all major instrument functions via the GPIB interface
Flexibility is further enhanced by Aeroflex’s implementation of IEEE-488.2.

**Capability**

Complies with the following subsets as defined in IEEE-488.1-1978:-
SH1, AH1, T5, TE0, L4, LEO, SR1, RL1, PP0, DC1, DT1, C1, E1

**Serial**

Serial interface is provided for connection of RS-232 for instrument remote control. 9 Way socket. Control language is based on IEEE P1174.

**Parallel**

Connector 25 way female D-Type. Provides graphics screen dump. A selection of printer drivers are included.

**Accessory Socket**

Allows the connection of various optional accessories.
With suitable adapters is compatible with most 2955 series accessories.

**Memory Card**

Meets PCMCIA2/JEIDA – 4 standard. The memory card facility allows the storage of test results and set-ups.

**Video Output**

Color, compatible with most VGA monitors. 15 way Sub Miniature D Type.
**FREQUENCY STANDARD**

*Internal Frequency Standard Output*

**Frequency**
10 MHz

**Level**
Nominally 2 V pk-pk

**Output Impedance**
Nominally 50 Ω

**Temperature Stability**
Better than 5 in 10^8, 5 to 50°C

**Ageing Rate**
Better than 1 in 10^7 per year, after 1 month continuous use

**Warm-Up Time**
Less than 10 minutes to within 2 in 10^7 at 20°C

*External Frequency Standard Input*

**Frequencies**
1, 2, 5 and 10 MHz

**Level**
Greater than 2 V pk-pk

**Input Impedance**
Nominally 1 MΩ in parallel with 40 pF

**POWER REQUIREMENTS**

**AC supply**

**Voltage**
100 - 240 V~ (Limit 88 - 264 V~)

**Supply frequency**
50 - 60 Hz (Limit 45 - 66 Hz)

**Power**
Nominally 135 W, 260 W maximum

**CALIBRATION INTERVAL**
2 years

**ELECTROMAGNETIC COMPATIBILITY**

Conforms with the protection requirements of the EEC Council Directive 89/336/EEC. Conforms with the limits specified in the following standards:
IEC/EN61326-1:1997, RF Emission Class B, Immunity Table 1, Performance Criteria B

**SAFETY**

Conforms with the requirements of EEC Council Directive 73/23/EEC (as amended) and the product safety standard IEC / EN 61010-1:2001 + C1:2002 + C2:2003 for Class 1 portable equipment, for use in a Pollution Degree 2 environment. The instrument is designed to be operated from an Installation Category 2 supply.

**ENVIRONMENTAL**

**Rated Range Of Use**
0 to 50°C and up to 95% relative humidity at 40°C

**User Calibration**

User calibrations are provided to maintain high accuracy for any ambient temperature (e.g. in ATE racks or in field measurements). Having allowed the instrument to stabilize, running the user calibrations optimizes the performance at that temperature.

A change in temperature of 5°C from the calibration temperature affects readings as below. These figures are provided as a guide to typical performance. Typical variations are as follows for a 5°C change in temperature.

- Power Meter: Burst 0.5 dB
- Broadband 2%
- Selective 0.5 dB
- Spectrum Analyzer Level: 0.5 dB
- Audio Analyzer & Modulation Filters:
  - Audio Voltage 0.4%
  - Demod depth & deviation 0.4%
- Multimeter: Voltage 0.5%
- Current 0.5%

**STORAGE AND TRANSPORT**

**Temperature**
-40 to +70°C

**Altitude**
Up to 2500 m (pressurized freight at 27 kPa differential)

**INTERNAL TEST SOFTWARE**

**OPTION 10 NMT CELLULAR SOFTWARE**

NMT450  NMT900

Benelux  NMTF
Austria  Spain
Malaysia  Indonesia
Saudi 1  Saudi 2
Thailand  Oman
Tunisia  Hungary
Poland  Russia
Czech  Bulgaria
Slovenia  Turkey

USER DEFINED NMT

**OPTION 11 AMPS CELLULAR SOFTWARE**

E-AMPS  N-AMPS

USER DEFINED AMPS

**OPTION 12 TACS CELLULAR SOFTWARE**

E-TACS  TACS-2
C-TACS I  C-TACS II
J-TACS  N-TACS

USER DEFINED TACS

**OPTION 13 MPT1327 TRUNKING SOFTWARE**

Band III  JRC
UK Water  Hong Kong
Auto-net  AMT
Madeira  NL-TRAXYS
NZ MPT1327  PH-INDO

USER DEFINED MPT

**OPTION 14 PMRTEST SOFTWARE**

USER DEFINED PMR for FM radios

**OPTION 21 GSM (900 MHz) DIGITAL CELLULAR SOFTWARE**

GSM Phase 1 and 2
**TETRA OPTIONS**

**OPTION 30 TETRA MOBILE OPTION**

**OPTION 31 TETRA BASE STATION OPTION**

**OPTION 32 TETRA DIRECT MODE OPTION**

**GENERAL FEATURES (SYSTEMS)**

Channel Plans:
- TETRA 380 (0 Hz or 12.5 kHz offset)
- TETRA 410 (0 Hz, -6.25 kHz or 12.5 kHz offset)
- TETRA 450 (0 Hz or 12.5 kHz offset)
- TETRA 800 (0 Hz or 12.5 kHz offset)
- TETRA 870 (0 Hz or 12.5 kHz offset)
- USER DEFINED TETRA
  - No plan

Test Modes
- Manual Test/Auto Test

**Manual Test Signalling Functions (TETRA Mobile)**

Registration (Location Update, all types)
- SSI, ITSI

Test Mode Registration
- TEI, Power Class, Receiver Class

De-Registration

Individual call (private call)
- Mobile Originated (MO) and Mobile Terminated (MT)
- Simplex and Duplex
- Hook Signalling and Direct Setup
- Calling Party SSI (MT)
- Called Party SSI (MO)
- Priority
- Modification by Called Party (MT)
- Rejection by Called Party (MT)
- Transmit Request and Transmission ceased
- Cleardown from Mobile or from Test Set

Group Attachment
- Selected Group
- No Group
- Multiple Groups (up to 40 with Class of Usage)
- Command Registration with Group Report

Group Call
- Mobile Originated (MO) and Mobile Terminated (MT)
- Priority
- Calling Party SSI (MT)
- Called GSSI (MO)
- Transmit Request and Transmission ceased
- Cleardown from Mobile or from Test Set
- Automatic cleardown on hang timer expiry

Phone Call
- Mobile Originated (MO) and Mobile Terminated (MT)
- Priority
- Calling Party SSI (MT) / Called Party SSI (MO)
- Calling Party ESN (MT) / Called Party ESN (MO)
- CLIP/CLIR
- DTMF Overdial
- Cleardown from Mobile or from Test Set

Emergency Call
- Group/Individual
- Simplex/Duplex
- Hook Signalling/Direct Setup

Calling Party SSI (MT) / Called Party SSI (MO)
- Clear from Mobile or Test Set

User Defined Call (MT)
- Group/Individual
- Simplex/Duplex
- Hook Signalling/Direct Setup
- Priority
- Calling Party SSI
- Calling Party ESN
- CLIP/CLIR

Cell-Reselection
- Undeclared
- Unannounced
- Announced Type 3
- Announced Type 2
- Call Restoration
- Neighbor Cell Broadcast

Short Data Service
- Mobile Originated and Mobile Terminated
- SDS Types 1,2,3,4
- SDS-TL Text Messages 7-bit & 8-bit coding Time stamp
- SDS-TL Short Reports
- SDS-TL User Applications (hex data)
- Status (Acknowledged)
- Destination SSI & ESN (MO)

Call Control (simplex calls)
- Message Trunking
- Transmission Trunking
- Transmission by 2968:
  - Timed
  - Continuous
- No transmission

Power Control
- Open Loop
- Closed Loop

RF Loopback Control
- TT Loopback (BER)
- TT Loopback (RBER/MER)
- T1 Loopback (BER)

**Manual Test Signalling Function**

(TETRA DIRECT MODE)

Group Call
- Mobile Originated (MO)
- Priority
- Calling Party ITSI
- Called GSSI
- Power Class
- Power Control Flag
- Clear from Mobile

Auto-Test Programs

<table>
<thead>
<tr>
<th>TETRA MS</th>
<th>GSM</th>
<th>Analog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call Processing Only</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Call and RF Testing</td>
<td>–</td>
<td>√</td>
</tr>
<tr>
<td>Brief Testing</td>
<td>–</td>
<td>√</td>
</tr>
<tr>
<td>Comprehensive Testing</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>User Defined Test</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>
Digital Parametric Auto-Test Routines

<table>
<thead>
<tr>
<th>TETRA MS</th>
<th>GSM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx Timing</td>
<td>✓</td>
</tr>
<tr>
<td>Tx Power Level</td>
<td>✓</td>
</tr>
<tr>
<td>Tx Power Profile</td>
<td>✓</td>
</tr>
<tr>
<td>Tx Frequency</td>
<td>✓</td>
</tr>
<tr>
<td>Tx RMS Vector/Phase Error</td>
<td>✓</td>
</tr>
<tr>
<td>Tx Peak Vector/Phase Error</td>
<td>✓</td>
</tr>
<tr>
<td>Tx Residual carrier</td>
<td>✓</td>
</tr>
<tr>
<td>Rx BER Class 0/1/2</td>
<td>✓</td>
</tr>
<tr>
<td>Rx RBER Class 0/1</td>
<td>✓</td>
</tr>
<tr>
<td>Rx BER Class I/II</td>
<td>–</td>
</tr>
<tr>
<td>Rx RBER Class I/II</td>
<td>–</td>
</tr>
<tr>
<td>Rx Frame/Message Erasure</td>
<td>✓</td>
</tr>
<tr>
<td>Rx Sensitivity</td>
<td>–</td>
</tr>
<tr>
<td>Rx RSSI Report</td>
<td>–</td>
</tr>
</tbody>
</table>

Analog Parametric Auto-Test Routines

| AF Frequency | AF Level |
| FM Deviation | Mod Frequency |
| Rx Distortion | Rx Expansion |
| Rx Sensitivity | Rx SINAD |
| Rx S/N | Tx Compression |
| Tx Distortion | Tx Frequency |
| Tx Level | Tx Power Level |
| Tx Limiting | Tx Mod Level |
| Tx Noise | Tx SINAD |
| Tx S/N | SAT Deviation |
| SAT Frequency | ST Duration |
| ST Frequency | ST Deviation |
| Data Deviation | DSAT Deviation |

Signalling Auto-Test Routines

Registration/Roaming Update
Test Mode registration (TETRA)
Place Call
Clear From Mobile- TETRA has six configurable call setup and clear-
down tests -MO/MT/GROUP/PRIVATE/PHONE
Page/Call Mobile-Handoff (Not TETRA)
Clear From Land
Speech Quality
Hook Flash (Not GSM/TETRA)
DTMF Decode (Not GSM/TETRA)
Data Performance (Not GSM/TETRA)
PTT On
PTT Off
Auto-Test Pause Modes
Pause Manual Only
Pause On Failure
Pause Always

Dimensions and Weight

Excluding handle, feet and covers:

<table>
<thead>
<tr>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.77 mm (6.9 in)</td>
<td>370 mm (14.5 in)</td>
<td>540 mm (21.2 in)</td>
</tr>
</tbody>
</table>

Including handle, feet and covers:

<table>
<thead>
<tr>
<th>Height</th>
<th>Width</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.03 mm (7.9 in)</td>
<td>420 mm (16.5 in)</td>
<td>600 mm (23.6 in)</td>
</tr>
</tbody>
</table>

Weight

Less than 19.5 kg (42.9 lb)

VERSIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering Numbers

Versions

2968 TETRA Radio Test Set
Must be ordered with Option 30, 31 or 32

TETRA Options

Option 30 TETRA Mobile Option
Option 31 TETRA Base Station Option
Option 32 TETRA Direct Mode Option

System Options

Option 09 SSB Receiver Option
Option 10 NMT Cellular Radio Option
Option 11 AMPS Cellular Radio Option (including N-AMPS)
Option 12 TACS Cellular Radio Option (including N-TACS)
Option 13 MPT 1327/MPT 1343 Trunked Radio Option
Option 14 PMRTEST for AM/FM/ΦM radios
Option 21 GSM (900 MHz) Digital Cellular
Option 22 Mobile Tuning Range Test

Language Options

Option 01 French Language Version
Option 02 Spanish Language Version
Option 03 German Language Version

Note:
Default language selection is English.
TETRA system Options 30, 31 and 32 are available in English only.

General Options

W3 3 year warranty

Supplied with

AC supply lead
Operating and programming manuals
Multimeter test lead kit

TETRA Applications

81514 TETRALOG MS Protocol Analyzer
Refer to datasheet 46891/117 (requires Option 30)
## Accessories

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>54421/001</td>
<td>BNC Telescopic antenna</td>
</tr>
<tr>
<td>54431/023</td>
<td>20 dB AF attenuator (BNC)</td>
</tr>
<tr>
<td>54112/157</td>
<td>Soft Carrying Case</td>
</tr>
<tr>
<td>54212/001</td>
<td>GSM Phase 2 Plug-In TEST SIM</td>
</tr>
<tr>
<td>54212/002</td>
<td>GSM Phase 2 Full Size TEST SIM</td>
</tr>
<tr>
<td>54127/310</td>
<td>Rack Mounting Kit</td>
</tr>
<tr>
<td>59000/189</td>
<td>Memory Card (128 K)</td>
</tr>
<tr>
<td>54411/052</td>
<td>600 Ω interface and 20 dB AF attenuator (Note 1)</td>
</tr>
<tr>
<td>46884/645</td>
<td>Accessory socket adapter (for use with 2955 acces-sories)</td>
</tr>
<tr>
<td>46884/646</td>
<td>Accessory Socket ‘Y’ adapter</td>
</tr>
<tr>
<td>46884/560</td>
<td>Parallel Printer Interface Cable</td>
</tr>
<tr>
<td>46884/649</td>
<td>Serial port to PC Cable (25 way)</td>
</tr>
<tr>
<td>46884/650</td>
<td>Serial port to PC Cable (9 way)</td>
</tr>
<tr>
<td>43129/189</td>
<td>GPIB Cable</td>
</tr>
<tr>
<td>43130/596</td>
<td>Coaxial cable N-Type(m) to TNC(m) (double screened)</td>
</tr>
<tr>
<td>54311/095</td>
<td>Coaxial cable N-Type(m) to N-Type(m) (1 meter)</td>
</tr>
<tr>
<td>54311/071</td>
<td>TNC(m) to BNC(f) Adapter</td>
</tr>
<tr>
<td>54311/092</td>
<td>N-Type(m) to BNC(f) Adapter</td>
</tr>
<tr>
<td>52388/900</td>
<td>1 GHz Active Probe</td>
</tr>
<tr>
<td>54441/012</td>
<td>Power supply for probe 52388-900</td>
</tr>
<tr>
<td>46880/080</td>
<td>Service Manual</td>
</tr>
</tbody>
</table>

*Note 1 – requires 46884-645 Accessory socket adapter*

### NOTES

- At low modulation levels the residual AM/FM may become significant.
- At low audio levels the residual noise may become significant.
- Audio and Modulation filter passband errors not included.
- Typical performance figures are non-warranted.
- Refer to USER CALIBRATION section.
- Either 3 modulation plus 3 audio generators up to 20 kHz or 1 modulation or 1 audio generator to 100 kHz.
- Cell re-selection functions require two test sets and a power splitter.
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