Wireless
3900 Series Analog and Digital Radio Test Platform

The 3900 Series is the latest Radio Test Solution from Aeroflex for engineering, production and field service applications. The instrument provides a comprehensive range of general purpose analog measurement facilities as well as advanced digital test options for P25, TETRA and HPD systems.

Standard features include:

- Full AM and FM test capabilities
- Channel spectrum analyzer
- Full Span spectrum analyzer to 2.7 GHz (3902)
- Dual-Channel Oscilloscope to 4 MHz
- Full audio analysis for AF level, frequency, SINAD and distortion measurements
- Full RF parametric tests for power, frequency error, deviation (FM), modulation index (AM)
- Three high accuracy audio modulators/function generators
- Three high accuracy audio baseband generators
- DTMF and DCS generators NEW!
- FM pre-emphasis and de-emphasis 50 µs, 75 µs and 750 µs for true audio performance analysis
- Color codes Pass/Fail meter functions for fast test capabilities

The digital architecture of the 3900 Series delivers faster, accurate and more repeatable measurements than any of its predecessors and provides for future technology enhancements as new digital technology becomes available.

Combining the power of an onboard PC with a 30 GB hard-drive and Linux OS, the 3900 Series also supports USB mouse and keyboard interfaces.
interface for very easy operation as well as almost unlimited save/recall setups, saving time and effort.

The 3900 Series features easy to read meters with Pass/Fail color coding for instant Go/NoGo testing. With these easy to configure meters, the user can set up unique Pass/Fail parameters for each radio type that is being tested. When used with the save/recall locations, this allows for instant recall of the test parameters so semi-technical or non-technical individuals can simply key the radio and test. The meters will display "Green" for good, "Red" for high and "Blue" for low. A quick glance and the operator will know that the radio is within established test parameters.

The 3900 Series provides a flexible platform for almost any application. Each of the modes of operations can be enhanced with optional applications and features. In addition, optional system personalities allow the 3900 Series to be completely reconfigured "on the fly" to provide advanced tests for analog and digital systems.

**High Performance Standard Features:**

**Wide Frequency Range:** The 3900 Series includes two variants. The 3901 provides continuous frequency coverage from 10 MHz (usable down to 100 kHz) to 1 GHz while the 3902 extends the maximum frequency to 2.7 GHz.

**Broadband RF Power:** Direct input of signal power of up to 125 W is supported, making the 3900 Series compatible with virtually all practical requirements for mobile terminal and base station test.

**Inband Low Level RF Power Measurements:** For sensitive measurement, e.g. off-air analysis, a low power input is provided via the antenna input port. This low level input gives the user the ability to measure an off the air signal as low as -100 dBm or -115 dBm with the internal pre-amp selected.

**High Stability Time Base:** With a 0.01 ppm OCXO frequency standard, the 3900 series provides ultra-reliable RF frequency measurements.

**0.6 dB Accurate (Typical) RF Generators:** Level accuracy is important in determining today's receiver performance in design, manufacturing and field service environments. With a 1 dB (0.6 dB typical) level accuracy on the RF output ports, the 3900 Series provides consistent results in testing receiver parameters.

**Full Span Spectrum Analyzer:** View signals from 1 MHz to 1 GHz with the 3901 or to a full 2.7 GHz with the 3902. This full band analyzer provides plenty of range to view harmonics and other spurious emissions in and out of band.

**Wide Band Channel Analyzer:** The channel analyzer makes it possible to monitor a 5 MHz spectral window around the carrier while simultaneously demodulating the signal. This allows the spectrum around the carrier to be analyzed while the device under test is participating in a call.

**Dual-Channel 4 MHz Oscilloscope:** High performance base band analysis of audio and digital signals can be performed easily and accurately.

**High Performance Audio Features:** With high accuracy audio generators from 1 mV to 8 V rms, the 3900 Series provides level accuracy to ± 1% of the setting. The audio generator frequency ranges from 20 Hz to 40 kHz with 50 ppm accuracy (10 ppm typical) and 0.1 Hz resolution provides solid audio performance for audio testing. The AF Counter features full range from 20 Hz to 20 kHz.

**Speed:** Measurement speed is directly related to processing power and internal communications. The 3900 Series digital architecture utilizes a mixture of powerful digital signal processors and programmable logic. Coupled to the use of a compact PCI backplane capable of delivering peak rates of >100 Mbytes/s, this ensures that the instrument has the power to acquire, synchronize and process data, producing measurement results to the user with the minimum of delay.

**Input and Output Capability:** The 3900 Series provides a high degree of connectivity. Instrument remote control for automated testing is provided using GPIB and supports connection to a remote server via Ethernet. Connection of printers and other peripherals is supported including keyboard, mouse and external monitor connection to provide expansion of the instrument user interface. Triggering and synchronization interfaces are provided for measurement, along with configurable single-port and dual-port duplex RF input/output and analog audio/modulation I/O.

**Ease of Use:** Whether using the 3900 Series manually, remotely or in Auto-Test II mode, the user interface is intuitive, logical and accessible. The instrument uses a tiled graphical display, which can be controlled by the front panel keypad or an external mouse. Tiles can be viewed in their full-detail maximized state or the minimized state which shows key details and allows active tiles to be viewed at the same time for maximum information display.
The color display produces a bright and sharp daylight readable image that can be output to an external monitor. Color coded fields are used to simplify testing and graphical traces utilize color to clearly identify limit line and measurement traces.

Remote Control: The 3900 Series supports remote control via GPIB for automated test system control. A VXI pnp VISA driver allows easy test system integration of the 3900 Series. In addition to a native 3900 command set, the 3900 Series also supports commands for the HP/Agilent 8920B that allows migration from the 8920B to the 3900 extremely easy.

Remote Operation: Use of the 3900 Series Ethernet connection permits remote operation from anywhere in the world making it possible to download new software or remotely interrogate instrument status. With an internal VNC server, users can install VNC software on their PC and remotely operate the front panel of the 3900 from virtually anywhere on the planet. All that is needed is the ability to access the unit’s IP address.

Cost of Ownership: To manage through life costs, the 3900 Series comes with a standard 2-year warranty. Users can also purchase a 36 or 60 month warranty period extension with or without scheduled calibration. On request Aeroflex can provide customized premium warranty support designed around your specific needs.

Optional Application Software and Special Features Enhance Test Capabilities

Site Monitoring

The 3900 Series brings impressive new capabilities to site monitoring applications. With 390XOPT051, the user now has the ability to leave the 3900 on-site while the unit provides automated data logging of the site’s effective receiver sensitivity. When connected to a good documented receiver (a “golden” radio), the 3900 Series will automatically calculate the Effective Receiver Sensitivity (ERS) at a predetermined interval (example: every 10 seconds) over a specified time (example: log ERS for 72 hours). As these measurements are taken, a min/average/max SINAD is displayed and the data is logged to the 3900’s internal hard-drive. Spectral information is also optionally logged with each measurement to help locate and track sources of interference. This gives the system engineer a valuable tool in determining site location performance and system RF boundaries. The 3900 Series provides the user with the ability to recall the ERS point at given intervals, as well as spectral data at each of the sample points to view interferes that may be present at one particular time, but not another (for example: 2AM).

IQ Gen Modulation

IQCreator™ is an Aeroflex developed PC based software utility that gives the user the ability to develop their own waveforms to use as the modulation source. Since the waveforms are defined by I and Q, virtually any type of complex digital modulation format can be created. Once the IQ waveform is created it can easily be uploaded to the 3900 and used as the modulation source in the Analog Duplex System.

Harmonics and Spurious

A new option for the 3900 Series is the ability to quickly and accurately measure the harmonics and spurious of the transmitter of a radio. The fundamental frequency is automatically detected and measured and then the second and third harmonics are measured and compared. In addition, the spurious signals that are higher than the configured level are identified and displayed.

Audio Analyzer

With 390XOPT055, the 3900 Series provides audio spectral analysis of the recovered audio signal, either from the audio inputs or from the demodulated RF signal. This feature allows users to view frequency amplitude in relation to other audio frequencies, and to isolate problems such as noise in audio circuits.

Tracking Generator

Now available as an option to the spectrum analyzer, the 3900 Series tracking generator allows the user to look at the response of a duplexer, filter bank or other RF device on the spectrum analyzer. When used with the optional return loss bridge (AC4105), the spectrum analyzer/tracking generator can measure the return loss of an antenna or cable (see screen below).
OPTIONAL SYSTEM PERSONALITIES

With analog duplex featured as standard, the 3900 Series can support a number of optional test systems installed concurrently. Personalities include TETRA digital trunked radio systems for mobile terminal and base station testing, TETRA direct mode, HPD® (High Performance Data) and APCO P25 Conventional.

HPD® OPERATION

- Generate/receive HPD signals
- Modulation - 64QAM, 16QAM and QPSK
- Transmitter parameters including signal power, frequency error, EVM,
- Symbol clock error, RX BER, burst timing error and occupied bandwidth.
- I & Q modulation analysis including constellation and trajectory plots of the data symbols, synch and pilot bits.
- Display of Min/Max and average as specified by the number of bursts.
- Pass/Fail indication using color codes meters.

Aeroflex has developed this test mode for Motorola to address the need for testing their high performance packet data operation on both mobiles and base stations in the 700 and 800 MHz bands. HPD® systems operate within the normal 25 kHz mobile radio bandwidth. The 3900 HPD® options 390XOPT300 and 390XOPT301 provide users with the ability to test High Performance Data systems. HPD® can be configured for two modes of operation. When configured to operate in BR Mode the test set simulates base radio operation and is used to test the functionality of Motorola Base Repeaters (BR). More advanced test features are available with 390XOPT301 including:

- Received Data Stream Logger. Logs the data portion of the HPD® signal and displays it in hex.
- RX Time Display. Shows Frequency Error, Power and Symbol Clock error over time.
- HPD® Magnitude/Phase Estimation. Displays magnitude and phase fluctuations of the received signal.
- Eye Diagram and I/Q over time displays
- Power Profile. Shows the power over time and in a burst (TDMA transmission).
- Power Ramps. Shows the power up and power down portion of the TDMA burst.

P25 Conventional Operation

- P25 C4FM error meter.
- Eye Diagram showing transitional diagram and points to the C4FM frequency states.
- Constellation Plot.
- Power, frequency error and TX BER meters
- Full TIA/EIA-102 test patterns (STD1011, CAL, SILENCE, LDU1 trigger, etc.) as specified by TIA-EIA-102-CAAA-A
The 3900 Series P25 Conventional Option provides test features for testing P25 radios and systems. Included is the ability to transmit P25 C4FM standard waveforms and analyze P25 received waveforms. The analysis of the received waveforms includes the ability to perform RF and modulation parametric tests. This option, 390XOPT200, provides the first implementation of P25 on the 3900 Series and provides the basic parametric analysis of the P25 signal.

### Example of P25 Conventional Tiles

- Generate/Analyze TETRA RF signals
- Base Station and Mobile Station testing plus testing with test signal T1
- Transmit parameter measurements including power, frequency error, EVM and burst timing
- TETRA RF power meter and burst power analysis up to 125 W
- Modulation analysis with I/Q constellation and trajectory display
- Receiver Bit Error Rate (BER) and Message Error Rate (MER) measurements
- Pass/Fail indication using color coded meters
- TETRA protocol analyzer/simulator
- Data display mode
- Time stamped protocol history
- New option for testing Direct Mode Operation (DMO)

### Example of TETRA MS Tiles

For TETRA applications, the 3900 Series is the successor to the Aeroflex 2968 TETRA Radio Test Set, the established industry standard for TETRA R&D, manufacturing, application development and service operations. Building upon the experience gained over many years of TETRA test, the 3900 Series with the TETRA options provides the world's best solution for testing TETRA radios. TETRA system options provide signaling and physical layer measurement requirements for testing TETRA radio equipment. Measurements are made in accordance with ETSI EN 300 394-1 for on channel transmitter and receiver parameters. Signaling functions support TIP (Tetra Interoperability Profile) compliant TETRA radios, thus ensuring optimum compatibility with TETRA equipment from various suppliers. Whatever the device under test, the TETRA system options have the flexibility to measure the various burst types specified by the TETRA standard including normal bursts, control bursts and synchronization bursts. The 3900 Series offers high speed measurement capabilities to expedite production testing. As a direct benefit of high power signal processing capacity, TETRA measurements are performed nearly 9 times faster than its predecessor.

### TETRA Trajectory Tile Maximized

Call Processing Highlights

The 3900 Series can be freely configured to emulate a TETRA network by selection of the appropriate channel plan, country code, network code, color code, etc. Once configured, registration, group attachment and TETRA call types including group call, private call, emergency call, telephone call and user defined call can all be tested. SDS messages (types 1 to 4 and SDS-TL) can be sent or received. The 3900 Series TETRA system option displays a range of mobile reported information relating to registration, group attachment, test mode, call type, called party, status messages, text messages, and DTMF digits dialed.
Protocol History Maximized Tile

TETRA Test Mode T1 and T1 Loopback

The TETRA MS and TETRA BS options provide various T1 test signals as defined in ETSI EN 300 394-1, for performing manual testing of TETRA base station and mobile stations receivers. The test signal T1 in the MS T1 application provides control information to the mobile to aid testing e.g. burst type, max, TX power, loopback commands. These T1 test signals can be used by the mobile in a test mode to output received demodulated data to a test interface for external processing of receiver Bit Error Rate (BER). Alternatively, the mobile can be commanded by the test signal T1 to loop back the received data to the 3900 Series which can then perform BER/MER/PUEM measurement. In the BS T1 application, the 3900 Series also supports T1 loopback BER/MER/PUEM measurements for base stations.

TETRA Test (TT) Protocol Support

The TETRA MS option provides support for the TETRA Test (TT) protocol as defined in ETSI EN 300 394-1. The TT protocol allows the mobile to be tested in a loopback mode whereby the mobiles BER, MER, and RBER can all be reported.

Audio Testing

Subjective audio testing is supported for simplex and duplex calls. Audio spoken into the mobile’s microphone is received and stored by the test set, which then re-transmits the speech so that it is replayed through the mobile’s speaker or ear piece with 2 seconds delay added, thus providing an end-to-end audio quality test.

Direct Mode Functionality

The 3900 Series also supports the testing of Direct Mode Operation. The 3900 Series can initiate or receive calls from a mobile that is operating in direct mode and then make transmitter measurements such as power, frequency error and modulation accuracy. The operation and graphical displays are very similar to the normal TETRA operation.

TETRA Energy Economy Mode

This optional mode of operation provides protocol signaling to control a mobile’s energy economy mode from "Stay alive" through energy groups EG1 (shortest sleep) to EG7 (longest sleep) and is used in conjunction with the comprehensive signaling capabilities already within the TETRA MS option. This operation enables developers, operators and users to configure battery test scenarios to simulate particular operational conditions. It gives them the testing flexibility to characterize the expected battery life performance in its intended operational use on the network.

AUTO-TEST II

- Develop automated tests for AM/FM and P25 systems
- Design your own Graphical User Interface
- Uses TCL/TK scripting language
- Utilizes the full set of 3900 RCI commands

Available now as a new option for the 3900 Series is the Auto-Test II operation. Providing the ultimate in flexibility, this option gives the user the ability to control the operation of 3900 using the TCL/TK scripting language. The control of the functions of the 3900 is performed through the use of RCI commands, which are sent as part of the TCL/TK program developed by the user.

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**SPECIFICATION**

**RF SIGNAL GENERATOR**

**FREQUENCY**

**Range**
- 10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
- 10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

**Resolution**
- 1 Hz

**Accuracy**
- Frequency standard ±1 count

**OUTPUT LEVEL**

**Range**
- T/R Port: -130.0 to -30.0 dBm
- Duplex: -130.0 to +10.0 dBm (+10 dBm max for CW or FM; 0 dBm max for complex modulation)

**Resolution**
- 0.1 dB

**Accuracy (for level > -110 dBm)**
- T/R port: ±1.0 dB (Typical better than ±0.6 dB)
- GEN port: ±1.0 dB (Typical better than ±0.6 dB)
**SPECTRAL PURITY**

Residual FM  
<15 Hz (300 Hz to 3 kHz bandwidth)

Residual AM  
<0.1% RMS (300 Hz to 3 kHz bandwidth)

Harmonics  
<-34 dBC (Typically -40 dBC, RF level set at +10 dBm)

Non-Harmonics  
<-55 dBC (all freq. except crossovers)

Phase Noise  
<-93 dBC/Hz (20 kHz offset, RF <1.05 GHz)

<-90 dBC/Hz (20 kHz offset, RF >1.05 to 2.7 GHz)

**MODULATION**

**INTERNAL FM**

RF Range  
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

Deviation  
±0.001 to ±150 kHz, OFF

Accuracy  
3% (From ±1 kHz to ±100 kHz deviation, 20 Hz to 15 kHz rate)

Resolution  
1 Hz

Deviation Rate  
20 Hz to 15 kHz

Waveform  
Sine, Square, Triangle, Ramp, Digital Coded Squelch, DTMF

THD  
<1% (1 kHz rate, 6 kHz deviation, 300 Hz to 3 kHz BW)

**INTERNAL AM**

RF Range  
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

Modulation Range  
0 to 100%

Accuracy  
1% (Modulation from 10 to 90%)

Resolution  
0.1%

Rate  
20 Hz to 15 kHz

Waveform  
Sine, Square, Triangle, Ramp, Digital Coded Squelch, DTMF

**SINGLE-SIDEBAND (SSB)**

RF Range  
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

Modulation Selection  
Upper SideBand (USB) or Lower SideBand (LSB)

Modulation Range  
0 to 100%

Resolution  
0.1%

Rate  
300 kHz to 3 kHz

Waveform  
Sine, Square, Triangle, Ramp, Digital Coded Squelch

**EXTERNAL AM/FM/SSB**

**AUDIO INPUTS**  
With 1 Vrms, AM/FM/SSB have same characteristics as internal sources, ±10% of indicated setting. (Audio 1 or Audio 2 input from 20 Hz to 15 kHz, 300 Hz to 3 kHz SSB).

**MICROPHONE INPUT**  
With 50 mVrms, AM/FM/SSB have same characteristics as internal sources, ±10% of indicated setting. (MIC Input from 100 Hz to 15 kHz).

**INTERNAL I-Q (OPTIONAL)**

RF Range  
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

Modulation  
IQCreator® file downloads for custom I-Q modulation

**RF RECEIVE MEASUREMENTS**

RF RECEIVER  
FREQUENCY  
Range  
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

SENSITIVITY  
<-100 dBM (10 dB SINAD, FM, 25 kHz, 1 kHz rate, 6 kHz FM deviation, 300 Hz to 3.4 kHz IF filter, pre-amp OFF)

<-113 dBM (10 dB SINAD, FM, 25 kHz, 1 kHz rate, 6 kHz FM deviation, 300 Hz to 3.4 kHz AF filter, pre-amp ON)

SELECTIVITY  
IF Bandwidth  
6.25, 8.33, 10, 12.5, 25, 30, 100, 300 kHz filters
**DEMOD OUTPUT LEVEL**

**FM**
2.5 Vrms ±10% (for deviation ±½ of selected BW; 25 kHz BW same output level as 30 kHz BW)

**AM**
3.0 Vrms ±10% (for 100% AM)

**RF COUNTER**

**FREQUENCY**

**Range**
- 10 MHz to 1.05 GHz (3901) (Usable from 100 kHz, auto-tune)
- 10 MHz to 2.7 GHz (3902) (Usable from 100 kHz, auto-tune)

**Resolution**
- 1 Hz

**Accuracy**
- Frequency standard ±1 count

**Level (Range)**
- T/R port: -10 to +50 dBm (Find level is selectable)
- ANT port: -60 to +10 dBm (Find level is selectable)

**RF POWER METER (BROAD BAND)**

**FREQUENCY**

**Range**
- 10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
- 10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

**Level**
- 100 mW to 125 W (Usable from 10 mW)

**Resolution**
- 4 digits for W or 0.1 dB

**Accuracy**
- 10%, ±1 digit

**Power Measurement Range**
- T/R port: 100 mW to 125 W (25% on/off ratio)

**RF POWER METER (IN BAND)**

**FREQUENCY**

**Range**
- 10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
- 10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

**Level**
- T/R port: -60 to +51 dBm

**FM DEVIATION METER**

**Range**
- 0 to 150 kHz

**Scales**
- 1 to 200 kHz in a 1, 2, 5 sequence, plus auto-scale

**Resolution**
- 10 Hz

**Accuracy**
- ±3% plus source residual, ±1 count (1 to 150 kHz FM deviation, IF BW set appropriately for the received modulation BW)

**RF CHARACTERISTICS**

**Input RF**
- 10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
- 10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

**RF Level**
- T/R port: -10 to +50 dBm
- ANT port: -80 to +10 dBm

**FM CHARACTERISTICS**

**Rate**
- 20 Hz to 20 kHz (IF BW set appropriately for the received modulation)
RF Range
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

RF Level
T/R port: -10 to +50 dBm
ANT port: -80 to +10 dBm

AM Meter
Range
0 to 100%
Scales
1 to 100% in a 1, 2, 5 sequence, plus auto-scale
Resolution
0.1%
Accuracy
±3 % + source residual, ±1 count (30 to 90% AM, IF BW set appropriately for the received modulation BW)

AM Characteristics
Rate
20 Hz to 15 kHz (IF BW set appropriately for the received modulation BW)
RF Range
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)
RF Level
T/R port: -10 to +50 dBm
ANT port: -80 to +10 dBm

Audio Function Generator(s)
Up to 3 function generators can be combined into 1 output signal.
Waveshapes
Sine, Square, Triangle, Ramp, Digital Coded Squelch, DTMF

Frequency
Range
Sine: 20 Hz to 40 kHz (usable 1 Hz to 40 kHz)
Square, Triangle and Ramp: 20 Hz to 4 kHz (usable 1 Hz to 15 kHz)
Resolution
0.1 Hz
Accuracy
±50 ppm ±1 count max, ±10 ppm typical

Level (Sine)
Range
1 mV to 5 V RMS into a 10 kΩ load
Resolution
0.1 mV

Audio and Modulation Measurements
AF Counter
Range
20 Hz to 20 kHz (usable from 10 Hz)
Resolution
0.1 Hz
Accuracy
±50 ppm max, ±1 count, ±10 ppm typical
Waveshape
Sine or square

Signal Characteristics
Level
10 mV to 5 Vrms (Audio 1 or Audio 2)
Impedance
600 Ω or Hi-Z (Hi-Z is ~10 kΩ)
600 Ω balanced (Audio 1 and 2)

AF Level Meter
Input
Audio 1 or 2
Range
0 to 8 Vrms
Resolution
1 mV (Unbalanced)
0.1 dB (600 Ω Balanced)
Scales
20 mV to 5 V in a 1, 2, 5 sequence, plus auto-scale
Frequency
20 Hz to 20 kHz
Accuracy
5% (Unbalanced, Hi-Z, 300 to 3 kHz, 0.1 to 5 Vrms)

SINAD Meter
Range
0 to 60 dB
Resolution
0.01 dB
Accuracy
±1 dB, ±1 count (SINAD ≥ 3 dB, ≤40 dB, 5 kHz LP AF filter)
SIGNAL CHARACTERISTICS

Signal Frequency
300 Hz to 5 kHz (Entry Range - 0 Hz to 24,000 Hz)

Signal Level
0.1 to 8 Vrms
Audio 1 or 2 (600 Ω or Hi-Z)
Audio 1 and 2 (600 Ω balanced)

DISTORTION METER

Range
0.0% to 100.0%

Resolution
0.1%

Accuracy
<±0.5% (Distortion 1% to 10%, 5 kHz LP AF filter)
<±1.0% (Distortion 10% to 20%, 5 kHz LP AF filter)

SIGNAL CHARACTERISTICS

Signal Frequency
300 Hz to 5 kHz (Entry Range - 0 Hz to 24,000 Hz)

Audio Input Signal Level (Mode 1)
0.1 to 5 Vrms
Audio 1 or 2 (600 Ω or Hi-Z)
Audio 1 and 2 (600 Ω balanced)

RF Level (FM Demod)
T/R Port: -10 to +50 dBm
ANT Port: -80 to +10 dBm

RF Level Input (Mode 2)
T/R Port: -10 to +50 dBm
ANT Port: -80 to +10 dBm

AUDIO FILTERS (CHARACTERISTIC RESPONSE)

Filter Type Ripple -1 dB -60 dB
NONE No Filter <±0.2 dB, above 20 Hz 20 kHz 24 kHz
300 Hz Low-Pass <0.2 dB, above 20 Hz 400 Hz 800 Hz
5 kHz Low-Pass <0.2 dB, above 20 Hz 5 kHz 5.4 kHz
15 kHz Low-Pass <±0.2 dB, above 20 Hz 16.5 kHz 18 kHz
20 kHz Low-Pass <±0.2 dB, above 20 Hz 20 kHz 21 kHz
0.3 to 3.4 kHz Band-Pass <0.2 dB 200 Hz / 3.7 kHz 80 Hz / 4.4 kHz
0.3 to 5 kHz Band-Pass <0.2 dB 200 Hz / 5 kHz 80 Hz / 5.4 kHz
0.3 to 15 kHz Band-Pass <±0.2 dB 200 Hz / 16.5 kHz 80 Hz / 18 kHz
0.3 to 20 kHz Band-Pass <±0.2 dB 200 Hz / 20 kHz 80 Hz / 21 kHz
PSOPH Band-Pass Per PSOPH Spec Per PSOPH Spec Per PSOPH Spec
PSOPH/CCITT Band-Pass Per CCITT Spec Per CCITT Spec Per CCITT Spec
300 Hz High-Pass <0.2 dB 200 Hz / 80 Hz

Audio 1 or 2 (600 Ω or Hi-Z)
Audio 1 and 2 (600 Ω Balanced)

RF SPECTRUM ANALYZER

FREQUENCY

Range
10 MHz to 1.05 GHz (3901) (Usable from 100 kHz)
10 MHz to 2.7 GHz (3902) (Usable from 100 kHz)

Resolution
1 Hz

Frequency Accuracy
Same as frequency standard
Span
Span mode: start/stop, center/span and zero span
Span width: 2 kHz to full span

Display Accuracy
Span accuracy + frequency accuracy + 50% of RBW

Span Range
Selection list is 2 kHz to full span in 1, 2, 5 sequence, plus zero span (Span may be entered numerically down to 1 Hz resolution)

Span Accuracy
±1% of span width

Marker Accuracy
±1% of span width

LEVEL
Ref Level Range
T/R port: -50 to +50 dBm
ANT port: -90 to +10 dBm

Vertical Scales
1, 2, 5, 10 dB/division

Reference Level Resolution
0.1 dB

Ref Level Units
dBm, dBµV, dBmV

Dynamic Range
70 dB (Antenna, no attenuation, ref level -30 dBm, 30 kHz RBW)

Bandwidth Switching Error
±1 dB (After normalize)

Log Linearity
±1 dB

Accuracy
±1 dB (Input signal -10 dB from ref level, normalized, preamp off)

Attenuator Selections
0 to 50 dB of attenuation, controlled by changing the ref level

3rd Order Intermodulation
-60 dBc (Input level of -30 dBm, ref level at -20 dBm)

Harmonic Spurious
-55 dBc (Input level of -30 dBm, ref level at -20 dBm)

Non-Harmonic Spurious
-60 dBc (Input level of -30 dBm, ref level at -20 dBm)

Displayed Average Noise Level (DANL)
-125 dBm (Typical, 300 Hz RBW, ANT port terminated, 20 sweep average)

RESOLUTION BANDWIDTH
RBW Selections
300 Hz, 3 kHz, 30 kHz, 60 kHz, 300 kHz, 6 MHz

RBW 60 dB/3 dB Filter Shape
>10:1

Selectivity - Filter Shape
60 dB/3 dB ratio better than 10:1

Accuracy
±10% of RBW for 3 kHz, 30 kHz, 60 kHz, 300 kHz
-10% / +25% of RBW for 6 MHz
±20% of RBW for 300 Hz

Bandwidth Switching Error
±1 dB

VIDEO BANDWIDTH
10 Hz to 1 MHz in a 1, 3, 10 sequence, plus NONE

Sweep
Frequency Sweep Time
100 mS to 100 S in 1 ms increments

Zero Span Sweep Time
50 mS to 100 S in 1 ms increments

Sweep Trigger Source
Internal and external

Trigger Modes
Continuous (repeat), single (single-shot)

FUNCTION/FEATURE
Display Modes
Live, average, max hold

Averages
1 to 100

MARKERS
Track
Frequencies (or time) and amplitudes

Number of Markers
2

Marker Functions
Marker to peak
Marker to next right/left
Marker to minimum
Marker to ref level
Marker to center frequency
Marker sets span
Marker sets vertical scale (zero span only)

TRACKING GENERATOR

TRACKING GENERATOR OUTPUT

Refer to RF SIGNAL GENERATOR section for:
Frequency range and accuracy
Output level range, resolution and accuracy at center frequency
Spectral purity
CENTER FREQUENCY, SPAN, SWEEP TIME
Same as Spectrum Analyzer

TRACKING GENERATOR CONTROLS
Output port selection
RF level
Reference cal

OSCILLOSCOPE

DISPLAY
Traces
2
Trace Types
Live, captured, accumulated
Markers
2
Marker Functions
Time with amplitude, deviation or %depth
Delta marker (including $1/\Delta t$, e.g. Hz)

VERTICAL
3 dB Bandwidth
16 MHz
Frequency Range
DC to 4 MHz (40 MS/s sampling rate)
Input Range
0 to 100 Vpeak
Scales
2 mV to 20 V/division in a 1, 2, 5 sequence (8(h) x 10 (w) graticule display)
Accuracy
5% of full scale (DC to 1 MHz)
10% of full scale (1 to 4 MHz)
Resolution
Better than 1% of full scale
Coupling
DC, AC, GND

HORIZONTAL
Sweep Factors
1 µSec to 1 Sec/division in a 1, 2, 5 sequence
Accuracy
>1.5% of full scale
Resolution
>1% of full scale
Input Impedance
1 MΩ, 20 pF

TRIGGER
Trigger Source
Trace A, trace B, EXT, (or trace C with no CH1 or CH2 Input)
Trigger Edge
Rising/falling
Trigger Mode
Auto/normal
Continuous/single shot
External Trigger Level
Hi-Z BNC input on the rear panel of the unit
Adjustable from -5 to +5 V

FREQUENCY STANDARD I/O

INTERNAL FREQUENCY STANDARD OUTPUT (OCXO)
Frequency
10 MHz (nominal)
Output Level
1 Vpp (nominal) into 50 Ω
Temperature Stability (0 to 50 degrees C)
±0.01 ppm
Aging Rate
±0.1 ppm/year after 1 month continuous use
Warm Up Time
Less than 5 min. to ±0.02 ppm

EXTERNAL FREQUENCY INPUT
Frequency
10 MHz
Input Level
1 to 5 Vpp for sine waves
3.3/5 V TTL for square waves
Connector
BNC socket (10 kΩ Input/50 Ω Output)

AUDIO SPECTRUM ANALYZER (OPTIONAL)

FREQUENCY
Range
Start and Stop Frequency - 0 Hz to 24,000 Hz
Resolution
1 Hz
Accuracy
±50 ppm, ±10 ppm Typical
Span
2 kHz minimum to 24 kHz maximum
**LEVEL**

*Vertical Scales*
1, 2, 5, 10, 20 dB per division

*Reference Level*
0 dB Full Scale (dBr)

*Dynamic Range*
Greater than 120 dB

*Accuracy*
±1 dB from 300 Hz to 15 kHz

**MARKERS**

*Number of Markers*
2

**HARMONICS AND SPURIOUS (OPTIONAL)**

*HARMONIC LEVEL*

*Range*
0 to -60 dBC

*Resolution*
0.1

*Accuracy*
Same as spectrum analyzer

*SPURIOUS LEVEL*

*Range*
0 to -60 dBC

*Resolution*
0.1

*Accuracy*
Same as spectrum analyzer

**INPUT/OUTPUT CONNECTORS**

*ANT (RF INPUT)*

*Connector Type*
TNC

*Function*
Receiver input (input port)

*Impedance*
50 Ω (nominal)

*VSWR (with Att ≤10 dB):*
Better than 1.44:1 (RF freq. <1.05 GHz)
Better than 1.58:1 (RF freq. >1.05 GHz to <2.7 GHz)

*Input Protection*
10 W with warning above +17 dBm (Remove power immediately when alarm sounds)

*GEN (RF OUTPUT)*

*Connector Type*
TNC

*Function*
Generator high-level output (output connector)

*Impedance*
50 Ω (nominal)

*VSWR (with level <0 dBm):*
Better than 1.7:1 (RF freq. <1.05 GHz)
Better than 1.9:1 (RF freq. >1.05 GHz to <2.7 GHz)

*Input Protection*
10 W with warning above +23 dBm (Remove power immediately when alarm sounds)

*T/R (RF INPUT/OUTPUT)*

*Connector Type*
Type N

*Function*
RF power input, generator low-level output (input/output connector)

*Impedance*
50 Ω (nominal)

*VSWR*
Better than 1.2:1 (RF freq. <1.05 GHz)
Better than 1.3:1 (RF freq. >1.05 GHz to <2.7 GHz)

*Input Protection*
200 W with warning above 135 W or power termination temp >100°C. Recommend max of 30 s ON and minimum of 2 min OFF for power levels above 50 W. (Remove power immediately when alarm sounds)

*GPIB*

*Connector Type*
24 pin IEEE

*Function*
IEEE-488.1-1997

*ETHERNET*

*Connector Type*
8 Position, RJ-45 100/10 Mbit/s

*Function*
10/100 Base-T network connection

*VIDEO*

*Connector Type*
15-pin, D-sub, VGA

*Function*
VGA for external monitor

*MIC/ACCESSORY*

*Connector Type*
8 position, female DIN

*Function*
Microphone connection, modulation input, demod output
PARALLEL PORT
Connector Type
25 position, female D-sub
Function
Printer interface

USB
Connector Type
Twin USB standard connection
Function
USB Version 1.1 interface

PS/2 INTERFACE
Connector Type
Dual-PS/2 connectors
Function
Keyboard interface

TEST PORT
Connector Type
15 position, female 3 tier D-sub
Function
Programmable I/O and voltage output (optional interface)

POWER REQUIREMENTS
AC
Voltage
100 V to 120 VAC @ 60 Hz
220 V to 240 VAC @ 50 Hz

Power Consumption
Nominally 120 W (200 W Max)

Mains Supply Voltage Fluctuations
<10% of the nominal voltage

Fuse Requirements
3 A, 250 V, Type F

ENVIRONMENTAL
OPERATING TEMPERATURE
0 to 50°C (Tested in accordance with MIL-PRF-28800F Class 3)

WARM-UP TIME
15 minutes

STORAGE TEMPERATURE
-40 to 71°C (Tested in accordance with MIL-PRF-28800F Class 3)

RELATIVE HUMIDITY
80% up to 31°C decreasingly linearly to 50% at 40°C (Tested in accordance with MIL-PRF-28800F Class 3)

ALTITUDE
4,000 m (13,123 ft) (MIL-PRF-28800F Class 3)

SHOCK AND VIBRATIONS
30 G Shock (functional shock)
5-500 Hz random vibrations (Tested in accordance with MIL-PRF-28800F Class 3)

USE
Pollution degree 2

RELIABILITY
> 8,000 hour calculated MTBF

SAFETY STANDARDS
UL 61010B-1
EN 61010-1
CSA C22.2 No. 61010-1

DIMENSIONS AND WEIGHT
Height
Width
Depth
19.7 cm (7.75")
35.6 cm (14")
52.0 cm (20.5")

Weight
16.5 kg (36.8 lbs.)

SYSTEM CONFIGURATION
The following information is provided to help the user understand what instruments are available on the 3900 Digital Radio Test Set.

AVAILABLE 3900 SYSTEMS
TETRA SYSTEMS (All TETRA systems are optional)
Available Options
- Option 110 - TETRA MS (Mobile Station) and TETRA MS T1 - Compatible with software versions 1.0 and higher
- Option 111 - TETRA BS (Base Station) and TETRA BS T1 - Compatible with software versions 1.0 and higher
- Option 112 - TETRA DM (Direct Mode) A - Compatible with software versions 1.2 or higher

ANALOG SYSTEMS (Analog functions are provided as standard, but have options available under analog configuration.)
- Option 051 - Remote Site Monitoring Application - Compatible with software versions 1.1 and higher

TETRA CHANNEL PLANS AND SIGNALLING
Channel Plans
- TETRA 380-400 (0 Hz or 12.5 kHz offset)
- TETRA 410-430 (0 Hz, -6.25 kHz or 12.5 kHz offset)
- TETRA 450-470 (0 Hz or 12.5 kHz offset)
- TETRA 805-870 (0 Hz or 12.5 kHz offset)
- TETRA 870-921 (0 Hz or 12.5 kHz offset)
- No plan
- User defined

System Identity
Mobile Country Code, MCC
Mobile Network Code, MNC
Base Color Code, BCC
Location Area Code, LA

Test Modes
Manual test/Auto-Test MS (see Auto-Test)
Manual Test Signaling Functions (TETRA MS mode only)
Protocol functions are compatible with TIP compliant mobiles.
Mobile parameter control for SSI, GSSI, power class, receiver class
Registration, test mode registration and de-registration
Private (individual) call, group call, phone call, emergency call, user
defined call (mobile terminated)
Call timer and trunking type selection
Cell-re-selection (requires two test sets and a power splitter)
Short data service
Status message and SDS types 1 to 4 call control (simplex calls)
Power control
Frequency control
Frequency handoff
RF loopback control (TT)
Display of mobile information
Demodulated and channel decoded data
Protocol history display
Subjective mobile audio tests
Talk back, silence and test tone (1 kHz digitally encoded)

TETRA MEASUREMENTS

TETRA RECEIVER MEASUREMENTS
TETRA MS T1 mode, TETRA MS mode, TETRA BS T1 mode (T1 loop-
back, TT loopback BER, MER, PUEM, RBER, with pre-set/user defined
limit checking, subjective audio testing, (TETRA MS mode), audio
talk-back, test tone, silence)
BER Testing (TETRA MS T1 mode)
BER, MER and PUEM
BER Testing (TETRA MS mode)
BER, RBER and MER
BER Testing (TETRA BS T1 mode)
BER, MER and PUEM
SINAD Meter
Same as platform specifications. Not available in direct mode (DM)

TETRA TRANSMITTER MEASUREMENTS
RF power, RF power profile, burst timing, error vector magnitude, frequency
error, residual carrier each with pre-set/user defined result limit checking
Input Range
T/R: -40 dBm to + 40 dBm
Ant: -80 dBm to 0 dBm
Burst Types
MS: Control Burst (CB), Normal Uplink Burst (NUB)
BS: Normal Downlink Burst (TS1+2, TS1, and TS2),
Synchronization Burst, PRBS with no training sequence

TETRA RF POWER METER
Average power across the useful part of the burst measured at the
symbol points through a TETRA filter. Results available for avg, max
and min for a sample of up to 250 bursts

Units
dBm/W
Resolution
0.1 dB / 1 mW
Indication
Numerical value, bar chart and progress indicator
Accuracy
±1.0 dB (±0.6 dB typical)
Level Offset Range
±40.0 dB

TETRA RF POWER PROFILE
(see graphical displays)
BURST TIMING ERROR (MS/MS T1 ONLY)
Timing error relative to downlink results available for avg, max, min and
worst case for a sample of up to 250 bursts
Range
±510.00 symbols
Indication
Numerical value, bar chart and progress indicator
Accuracy
±0.05 symbols
Timing offset range
±999.99 symbols

MODULATION ACCURACY
Modulation accuracy measures the displacement of symbol points from
their ideal position. Results available for avg, and max for a sample of
up to 250 bursts
Modulation Error Range
20.0% RMS vector error
40.0% Peak vector error
20.0% Residual carrier
Indication
Numerical value, bar chart and progress indicator
Accuracy
±0.5% at 10% error
FREQUENCY ERROR
Frequency error is the error relative to the expected frequency.
Results available for avg., max, min and worst case for a sample of up
to 250 bursts
Frequency Error Range
±500.0 Hz
Indication
Numerical value, bar chart and progress indicator
Accuracy
±15 Hz + frequency standard accuracy

For the very latest specifications visit www.aeroflex.com
GRAPHICAL DISPLAYS

BAR CHARTS

Display of average, max, min and worst case values as appropriate with progress bar. Bar chart is color coded to indicate pass, fail low, fail high or accumulating.

POWER PROFILE DISPLAY

Display of power versus time for a complete burst or ramp up/ramp down intervals measured at the symbol points and displayed relative to a TETRA mask (TETRA limits or user defined) with pass/fail indication. Measured through a TETRA filter referenced (0 dB) to average power. Displayed profile and pass/fail indication are available as the average for a sample of up to 250 bursts. (N.B. multiple burst averaging is NOT available for the other graphical displays, only for the power profile).

Power Profile Dynamic Range

70 dB

Vertical Scale

20 dB/div or 0.1 dB/div in 1, 2, 5 steps

Accuracy

±1.0 dB (±0.6 dB typical) at symbol points for levels greater than -10 dB

CONSTELLATION DISPLAY

Polar display of amplitude versus phase at the symbol point measured over all symbols (SN0 ~ SN max) through a TETRA filter. Also available as a rotated constellation display where all symbol point values are mapped to a single constellation point.

PHASE TRAJECTORY DISPLAY

Polar display of amplitude versus phase continuously measured over the duration (SN0 ~ SN max) through a TETRA filter.

VECTOR ANALYSIS DISPLAYS

Vector error (%), magnitude error (%) and phase error (degrees) measured at symbol points (SN0 ~ SN max) through a TETRA filter.

Vertical Scaling

Vector error 0.1 %/div to 20 %/div in 1, 2, 5 steps
Phase error ±0.1 °/div to ±20 °/div in 1, 2, 5 steps
Magnitude error ±0.1 %/div to ±20 %/div in 1, 2, 5 steps

Display Features

Optimized, maximized
Trace re-fresh or accumulate
Limit lines/checking

Display Mode

Single/repeat

Symbol Markers

Mkr 1 and Mkr 2 plus Mkr Delta, coupled/uncoupled (not available on phase trajectory and constellation displays)

TETRA SIGNAL GENERATOR

Specification as per platform specification unless otherwise stated

TETRA MODULATION

π/4 DQPSK, 18 k symbols/sec, TETRA filter, (RRC with <= 0.35)

Level

T/R Port -130 dBm to -40 dBm
Gen Port -130.0 dBm to 0 dBm

Accuracy

±1.0 dB

Vector Error

<3% RMS
<6% peak

Residual Carrier Power

<-35 dBc

Data TETRA MS mode

Main Control Channel (MCCH) Traffic Channel (TCH/S) containing silence or 1 kHz tone or talk-back, Fast Associated Control Channel (FACCH)

Data TETRA MS T1 mode

T1 test signals (in accordance with ETSI EN 300 394-1) T1 type 1 (TCH/7.2), T1 type 2 (SCH/F), T1 type 3 (BSCH + SCH/H), T1 type 4 (TCH/2.4), T1 type 15 (TCH/S), T1 type 17 (TCH/4.8)

Data TETRA BS T1 mode

T1 test signals (in accordance with ETSI EN 300 394-1) T1 type 7 (TCH/7.2), T1 type 8 (SCH/F), T1 type 9 (STCH + STCH UL), T1 type 10 (TCH/2.4), 18 Frame PRBS, Framed PRBS, Unframed PRBS

BS T1 Synchronization Mode

Pulse or Auto

GENERAL FEATURES

LCD DISPLAY Screen Size

6.4 in diagonal
162.6 mm diagonal

Active Area

129.6 mm (h) x 97.44 mm (v)
5.1 in (h) x 3.8 in (v)

Resolution

640 x 480 pixels

Disk storage

3.5 inch floppy disk
Internal 30 GByte hard disk available for user storage
**VERSIONS AND ACCESSORIES**

When ordering please quote the full ordering number information.

<table>
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<th>Ordering Numbers</th>
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<td>IFR3901</td>
<td>Advanced Radio Test System - 1 GHz</td>
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<tr>
<td>IFR3902</td>
<td>Advanced Radio Test System - 2.7 GHz</td>
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**Supplied with**

Operating and Programming Manual (CD ROM)
AC Supply Lead

**Options**

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<td>Remote Site Monitoring application</td>
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<td>390XOPT055</td>
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<td>390XOPT059</td>
<td>Auto-Test II Analog</td>
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<td>390XOPT060</td>
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<td>390XOPT061</td>
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<td>390XOPT110</td>
<td>TETRA MS (Mobile Station)</td>
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<td>390XOPT111</td>
<td>TETRA BS (Base Station)</td>
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<td>390XOPT112</td>
<td>TETRA DM (Direct Mode)</td>
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<td>390XOPT114</td>
<td>TETRA Energy Economy Mode</td>
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<td>390XOPT200</td>
<td>P25 Conventional Operation Mode</td>
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<tr>
<td>390XOPT300</td>
<td>HPD® Testing Option</td>
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<tr>
<td>390XOPT301</td>
<td>HPD® Advanced Analysis Package</td>
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**Accessories for 390X**

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<td>AC25012</td>
<td>Case, Soft Padded Carrying</td>
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<td>AC25013</td>
<td>Kit, 10/20 dB Pads, TNC</td>
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<td>AC25014</td>
<td>Scope Probe Kit</td>
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<tr>
<td>AC25023</td>
<td>Front/Rear Cover</td>
</tr>
<tr>
<td>AC25027</td>
<td>TNC To BNC Adapter</td>
</tr>
<tr>
<td>AC25029</td>
<td>Accessory Pouch</td>
</tr>
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<td>AC25036</td>
<td>DC to AC Converter, 12 VDC to 110-120 VAC</td>
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<tr>
<td>AC25042</td>
<td>HF Antenna</td>
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<tr>
<td>AC25043</td>
<td>UHF Antenna</td>
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<tr>
<td>AC25044</td>
<td>800 MHz Antenna</td>
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<tr>
<td>AC25045</td>
<td>VHF Antenna</td>
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<tr>
<td>AC4105</td>
<td>Return Loss Bridge (1.3 GHz)</td>
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<tr>
<td>CALFB390X</td>
<td>Calibration Certificate</td>
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<tr>
<td>AC8645</td>
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</table>

**Extended Standard Warranties for 390X**

- W390X/203 Extended Standard Warranty 36 Months
- W390X/205 Extended Standard Warranty 60 months

**Extended Standard Warranties with Calibration for 390X**

- W390X/203C Extended Warranty 36 Months with scheduled calibration
- W390X/205C Extended Warranty 60 Months with scheduled calibration

**Enhanced Standard Warranty for 390X**

- W390X/201 Enhanced Standard Warranty

Maximum span width limited to 5 MHz when in channel analyzer mode.
Option 114 TETRA Energy Economy Mode requires option 110 TETRA MS.
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