VIAVI Solutions

VIAVI
3920B

Analog and Digital Radio Test Platform

Featuring improved RF signal generator phase noise performance

The 3920B. The most advanced radio test solution from VIAVI Solutions for engineering, production and field service applications. The 3920B features an improvement to the RF signal generator phase noise specification of −110 dBc/Hz at 10 kHz offset. The instrument provides a comprehensive range of general purpose analog measurement facilities as well as advanced digital test options. The 3920B includes many standard features as well as a host of optional test capabilities and digital personalities.

Features

- 1 GHz frequency range
- High performance FM / AM / SSB analog duplex test capabilities
- Sensitive receiver with built-in pre-amp for off air measurements
- Color coded pass / fail results
- -140 dBm (typical) DANL spectrum analyzer with eight markers
- Dual-Channel oscilloscope to 4 MHz
- Full audio analysis for AF level, frequency, SINAD, and distortion measurements
- Three high accuracy audio modulators / function generators
- Three high accuracy audio baseband generators
- Tone encode and decode functionality including DTMF, DCS, tone remote, 2-tone sequential and 5/6-tone
- GPIB, Ethernet, USB, and RS-232 interfaces
- HP / Agilent 8920B remote emulation

The 3920B also includes many optional features including:

- 2.7 GHz frequency range extension

- Harmonics and spurious measurements

- Tracking generator

- Audio spectrum analyzer and audio tracking generator (used for analog simulcast alignment)

- IQ generator for use with IQCreator®

- P25 conventional operation with advanced parametric / protocol analysis

- P25 trunking operation

- LSM generate and receive analysis

- P25 Phase II TDMA physical layer transmitter and receiver testing

- Off Air Monitor for P25 message logging – protocol analysis tool

- P25 AES encryption

- SmartZone™ and SMARTNET™ trunking

- DMR (MOTOTRBO™) mobile and repeater tests

- TETRA mobile, base station, and DMO tests

- HPD (High Performance Data) base and mobile simulation

- NXDN™, dPMR™, and ARIB T98

Automatic test and alignment options include:

- Motorola ASTRO®, ASTRO® 25, and APX™ series radios

- EF Johnson ES and VP600 series radios

- BK DPHX5102S and KNG series radios

- TIA / EIA-603 FM land mobile radio test software

- MOTOTRBO radios

- L3Harris P7300, P5500, XL-200P, and XG series

- Kenwood P25 TK-5X10, 5X20, and NXDN series radios

- ICOM P25 and NXDN series radios

- DMR Repeaters

The one test set for all your narrowbanding test needs!

With the largest selection of digital radio options of any radio test set, the 3920B will meet all of your narrowbanding test needs, both now and in the future. The software defined digital architecture of the 3920B provides for future technology enhancements as new digital technology becomes available. You can easily perform software updates in the field, making additions of new software features and options as simple as plugging in a USB flash memory drive.
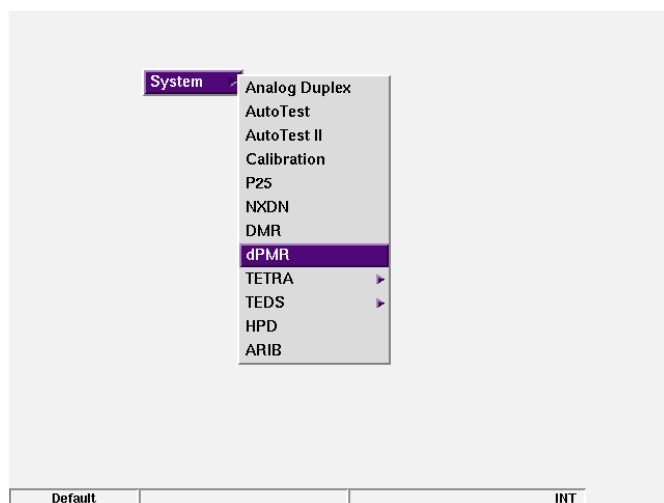

Figure 1. Menu of Radio Test Systems in the 3920B

Ease of Use

Combining the power of an onboard PC with a 30 GB hard-drive and Linux OS, the 3920B can support USB mouse and keyboard interface for very easy operation as well as almost unlimited save / recall setups, saving time and effort. Multiple methods of controlling the 3920B include the front panel keys, using a mouse and keyboard, or through a VNC application on your PC, touch-screen tablet or mobile phone.

Ease of Test

To make you more productive, the 3920B is not only simple to use but has features that makes testing a radio quick and repeatable. The 3920B features easy-to-read meters with pass/fail color coding for instant Go / NoGo testing. With these easy-to-configure meters, you can set up unique pass / fail parameters for each radio type that you are testing. 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.
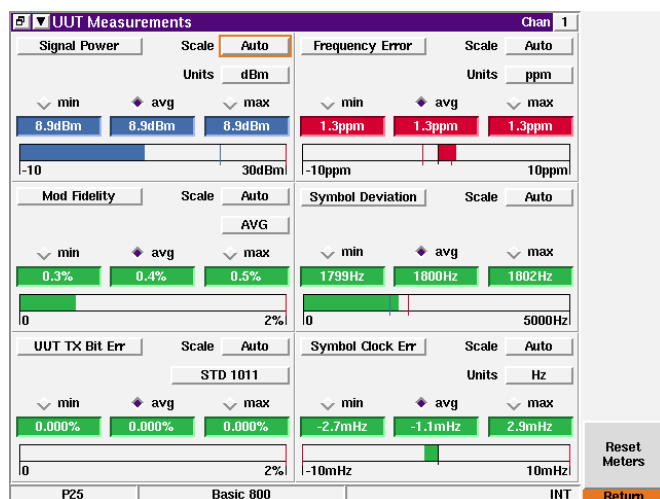

Figure 2. P25 UUT Measurements Tile Maximized, Showing Green, Red, and Blue Indications

High Performance

Measurement speed is directly related to processing power and internal communications. The 3920B 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 MB, this ensure that the instrument has the power to acquire, synchronize, and process data, producing measurement results to the user with the minimum of delay.

Accurate Testing

Time Base

With a 0.01 ppm OCXO frequency standard, the 3920B provides ultra-reliable RF frequency measurements. For even more stability, the 3920B provides an external frequency reference input.

Generator

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 3920B provides consistent results in testing receiver parameters.

Receiver

For sensitive measurement, e.g. off-air analysis, a lower power input 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. Direct input of signal power of up to 125 W is supported, making the 3920B compatible with virtually all practical requirements for mobile terminal and base station test.

Audio

With high accuracy generators from 1 mV to 8 V rms, the 3920B provides level accuracy to ±1% of the setting. The audio generator frequency ranges from 20 Hz to 40 kHz and 0.1 Hz resolution provides solid audio performance for audio testing. The AF Counter features full range from 20 Hz to 20 kHz.

Automatic Testing

The Auto-Test environment provides you with the capability to turn the 3920B into a stand-alone ATE test environment. With the built-in PC running your test script, or one of our available automatic test and alignment applications, the 3920B can be conformed to your exact testing needs. Available with the Auto-Test option for the 3920B are a selection of applications covering many of the latest digital radios. With these applications, you can automatically test and align the transmitter / receiver of a radio in as little as five minutes.
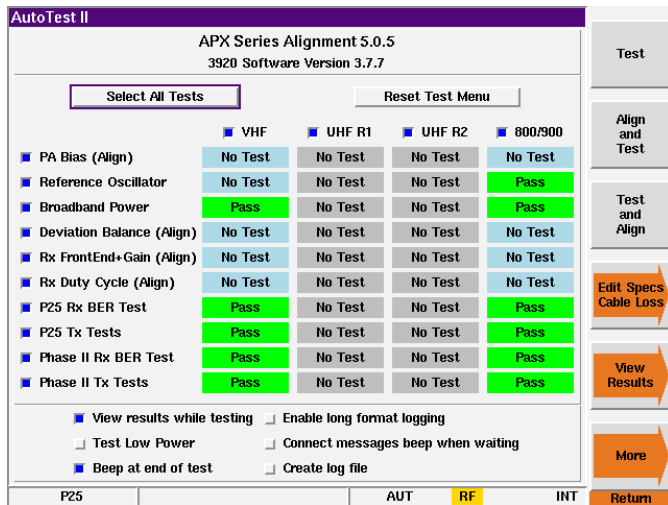
Figure 3. Motorola APX Radio Alignment

More automatic test and alignment options are being added all the time. For the latest selection of scripts for the 3920B, go to the 3920B product page on www. viavisolutions.com/3920B and click on the 3920B Radio Test Set Scripts link in the Product Directory.

3920B Standard Features

FM / AM / SSB Analog Duplex operation: The 3920B features advanced RF testing capabilities for FM / AM / SSB radio transmitters and receivers. The features for analog duplex testing are:

- 1 GHz frequency range for transmitter and receiver (2.6 GHz optional)

- Three modulation sources

- Three audio sources

- DTMF encode and decode

- DCS encode and decode

- 2-tone sequential and tone remote encode and decode

- Tone sequential encode operation that includes up to 40 tones, user defined pause, tone frequency shift, all standard tone sequential codes and two USER defined sequential codes

- Tone sequential decode that can decode according to standard tone protocols or according to user defined tone protocol

- Channel analyzer that can simultaneously display the RF spectrum while demodulating received signal

- Meters for measuring RF Power, Modulation, Frequency Offset, Distortion, Audio Level, SINAD, SNR, and Hum and Noise
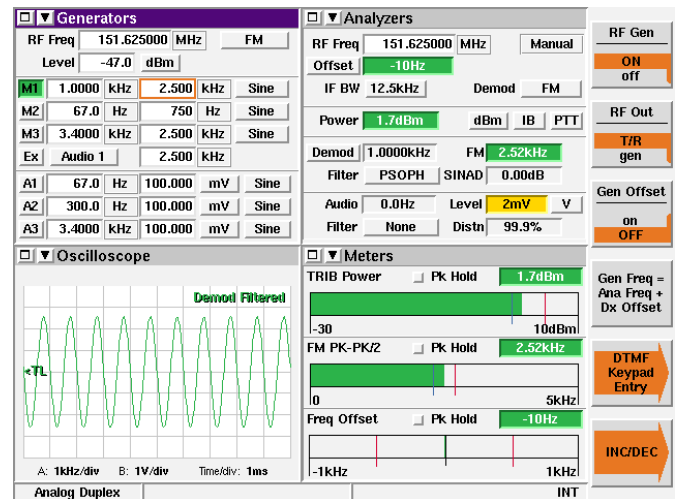
- Dual Channel 4 MHz Oscilloscope

Figure 4. Analog Duplex Screen

Full Span Spectrum Analyzer

View signals from 1 MHz to 1 GHz with the 3920B or to a full 2.7 GHz with the frequency extended option. With a DANL of -140 dBm (300 Hz RBW with pre-amp enabled), the 3920B provides high performance spectrum analysis. This full band analyzer provides plenty of range to view harmonics and other spurious emissions in and out of band.
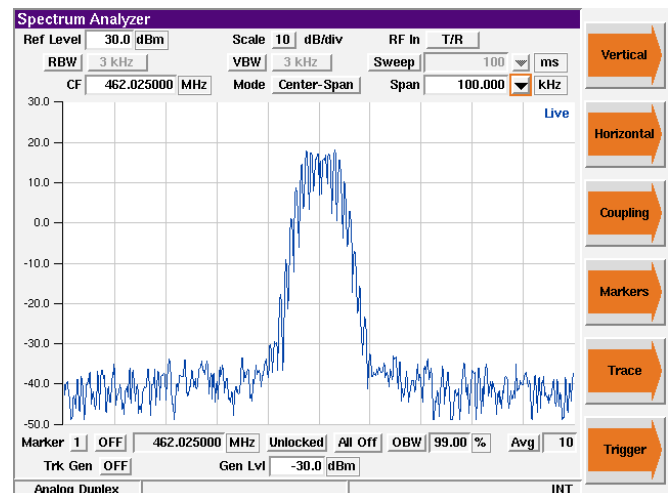

Figure 5. Spectrum Analyzer

Digital Multimeter

Now standard for the 3920B is the Digital Multimeter. The Digital Multimeter comes with three new ports on the front panel used for measuring AC / DC volts, AC / DC amps, and OHMS.

Remote Control

The 3920B supports remote control via GPIB for automated test system control. A VSI pnp VISA driver allows easy test system integration of the 3920B. In addition to a native 3920B command set, the 3920B also supports commands for the HP / Agilent 8920B that allows migration from the 8920B to the 3920B extremely easy.

Remote Operation

Use of the 3920B 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 or Tablet PC and remotely operate the front panel of the 3920B from virtually anywhere on the planet. All that is needed is the ability to access the unit's IP address.

Optional Test Capabilities

Site Monitoring Application (390XOPT051)

The 3920B brings impressive new capabilities to site monitoring applications. With option 390XOPT051, the user now has the ability to leave the 3920B 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 3920B 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 3920B'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.

IQ Gen Modulation (390XOPT054)

IQCreator is an Aeroflex (now VIAVI) 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. With the IQ Gen Modulation options, once the IQ waveform is created, it can easily be uploaded to the 3920B and used as the modulation source in the Analog Duplex System.

Audio Analyzer (390XOPT055)

With 390XOPT055, the 3920B 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. With a frequency range of 1 Hz to 24 kHz, the audio analyzer covers more than the full audio frequency range of mobiles and hand-helds. In addition, there are two markers, plus a peak hold and average function. The user can also capture traces that can be stored and then recalled later for use as a comparison with a live trace. A tracking generator option (390XOPT210) is also available as an add-on to the audio analyzer.
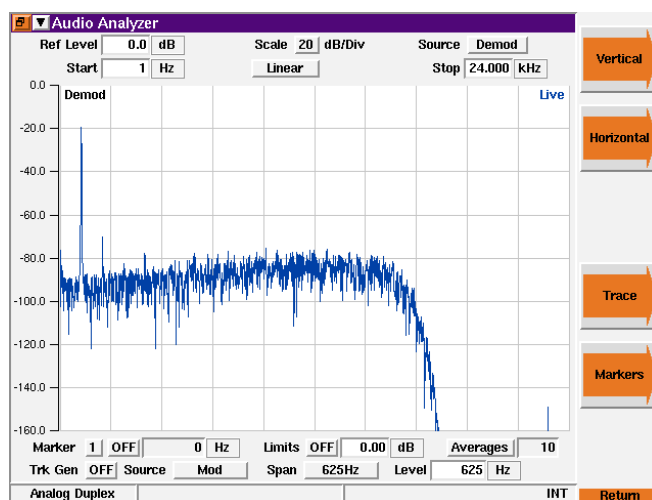

Figure 6. Audio Analyzer

2.7 GHz Frequency Range (390XOPT058)

The 3920B comes standard with a generate and receive frequency range of 10 MHz (100 kHz usable) to 1.05 GHz. This option will extend the range to 2.7 GHz.

Harmonics and Spurious (390XOPT060)

The ability to quickly and accurately measure the harmonics and spurious of the transmitter of a radio is the function of 390XOPT060. The fundamental frequency is automatically detected and measured, and 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. The frequency and level of the fundamental, as well as the harmonics and spurs, are then displayed. This option makes finding the harmonics and spurious transmitter very simple. Simply connect the transmitter of the radio to the 3920B, key the radio, and press Start.
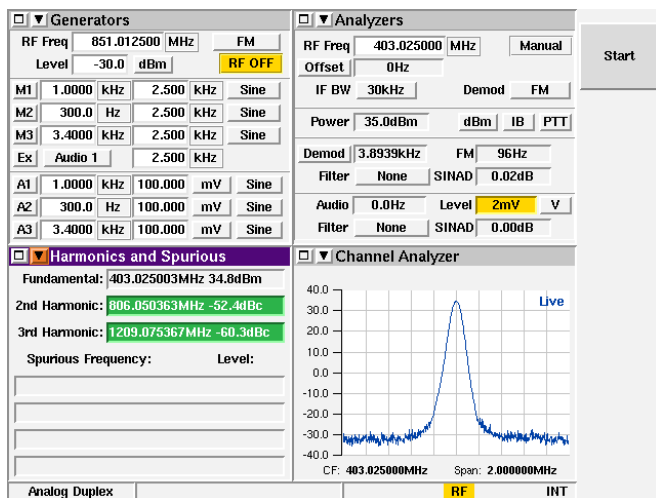

Figure 7. Harmonics and Spurious

Tracking Generator (390XOPT061)

A full featured spectrum analyzer is standard on all 3920Bs. Available as an option to the spectrum analyzer, the 3920B tracking generator allows the user to look at the response of a duplexer, filter bank or other RF device on the spectrum analyzer. This option greatly simplifies the often laborious process of checking or changing the tuning of a duplexer. When used with the optional return loss bridge (AC4105), the spectrum analyzer / tracking generator can measure the return loss of an antenna or cable.
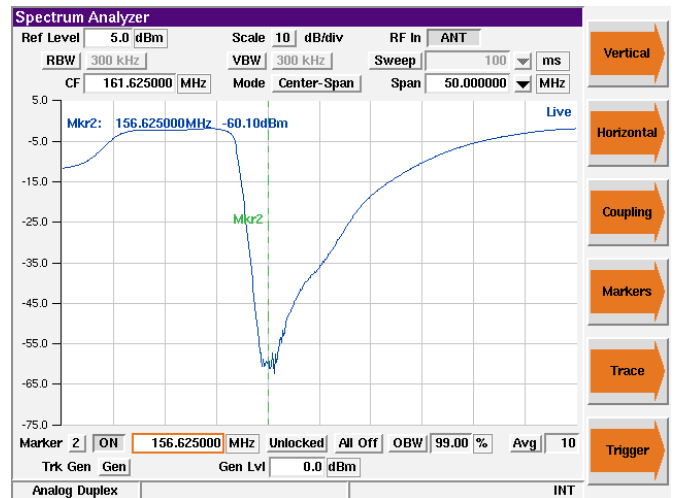

Figure 8. Spectrum Analyzer with Tracking Generator

Power Between Markers (390XOPT064)

Also available as an option, the power between markers option provides a measurement of the amount of power between the spectrum analyzer markers. With this feature, the user can set the position of two markers on the spectrum analyzer and then measure the amount of power in the bandwidth selected with those markers. This will enable the user to determine the amount of power in an adjacent channel or in the center channel.

POCSAG (390XOPT067)

The user can now test and verify the operation of both POCSAG transmitters and receivers. When this option is enabled, there are two new tiles available from the tile drop down arrows. This adds the following capability:

POCSAG Encode

• Send Alphanumeric or Numeric POCSAG formatted pages

• Select any rate from 400 to 4800 Hz

• Select deviation from 0 to 50.000 Hz

• Pick from a selection of canned messages or create a custom message

• Select RIC (Radio Identification Code) of encoded message, or send to a range of RIC's

POCSAG Decode

• Select Decode Format – either Automatic, Alphanumeric or Numeric

- Select Decode Filter – decode all messages or only messages to a user selectable RIC

- Select Normal or Inverted Polarity for decoding

- Displays deviation and rate of decoded message

- Displays the RIC and the type bits (two bits) of the decoded messages as well as the message

Chinese GUI (390XOPT090)

This option enables the selection of either Chinese or English as the language for the graphical user interface for the Analog Duplex system. When enabled, a selection is added to the utilities screen that allows the user to choose between English or Chinese character display in the Audio Duplex system.
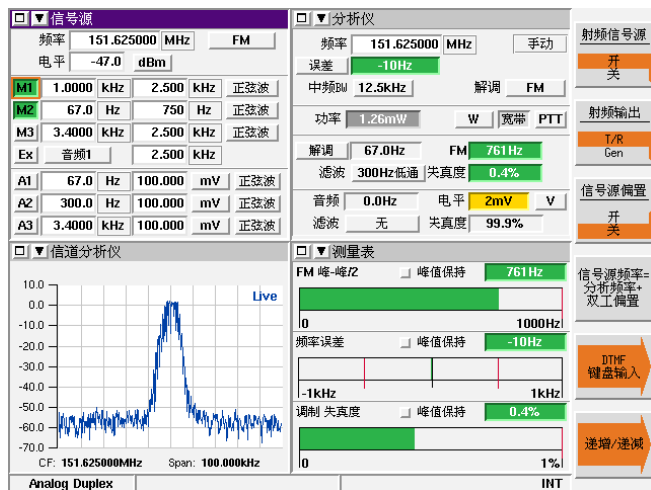

Figure 9. Illustration of Chinese GUI

Optional System Personalities

In addition to the Analog Duplex system, the 3920B can support a number of optional test systems or personalities, installed concurrently. Personalities include:

- TETRA digital trunked radio systems for mobile station and base station testing

- TETRA direct mode testing

- APCO P25 conventional and trunked radios

- APCO P25 Phase II TDMA

- SmartZone and SMARTNET

- DMR (Digital Mobile Radio)

- NXDN

- HPD (High Performance Data)

- dPMR (digital Private Mobile Radio)

- ARIB T98 (Digital Convenience Radio Equipment For Simplified Service)

P25 Conventional Operation (390XOPT200)

The 3920B P25 Conventional Option provides test features for testing P25 radios and systems. Featured is the ability to transmit P25 C4FM standard waveforms and analyze P25 received waveforms. The analysis of the received waveforms consists of the ability to perform RF and modulation parametric tests. The vocoder enables the user to perform, transmit and receive audio testing. Included in this option is the capability to:

- Measure C4FM modulation fidelity and symbol deviation

- Measure power, frequency error and TX BER

- Measure symbol clock error

- Measure RX BER

- Display eye diagram of C4FM demodulation

- Display constellation plot of C4FM symbols

- Display C4FM symbol deviation distribution plot

- Transmit full TIA/EIA-102 test patterns (STD1011, CAL, SILENCE, STD511, etc) as specified by TIA/EIA-102.CAAA-C

- Transmit and receive live audio using the vocoder

- Transmit stored speech patterns

- Decode voice channel header and link control messages

- Encode link control messages
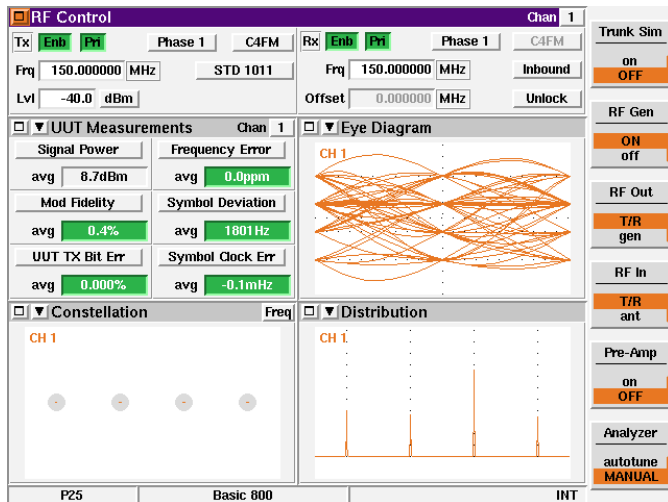
- Perform DES encryption

Figure 10. P25 Conventional

P25 Trunking Operation VHF / UHF / 700 / 800 MHz (390XOPT201)

To further enhance P25 operation, the addition of the P25 trunking option allows simulation of a P25 control channel in any frequency band. Channel plans may be configured to test virtually any P25 trunked system. A simulator tile logs the messages sent by the radio under test and allows the 3920B to simulate a virtual mobile, configured to talk to the radio under test. This option enables the user to originate a group call to the radio under test or make a group call from the radio under test to the 3920B. In addition, the user can have multiple radios register and affiliate with the 3920B and then originate calls from one radio to the other radios.

Figure 11. P25 Trunking Simulation

LSM Generate and Receive / Analysis (390XOPT204)

In addition to the standard P25 modulation, also available on the 3920B, is the capability to generate and receive Linear Simulcast Modulation (LSM). This option, available as an extension of P25 conventional operation, enables measurements that are specific to LSM. It also adds a graphical analysis of the demodulated LSM signal that is normally only found in vector signal analyzers. Since LSM is a complex type modulation, this plot shows the inphase versus quadature phase (I versus Q) of the demodulated LSM signal. In addition, this option adds Error Vector Magnitude to the selection of measurements available from the UUT Measurements tile.
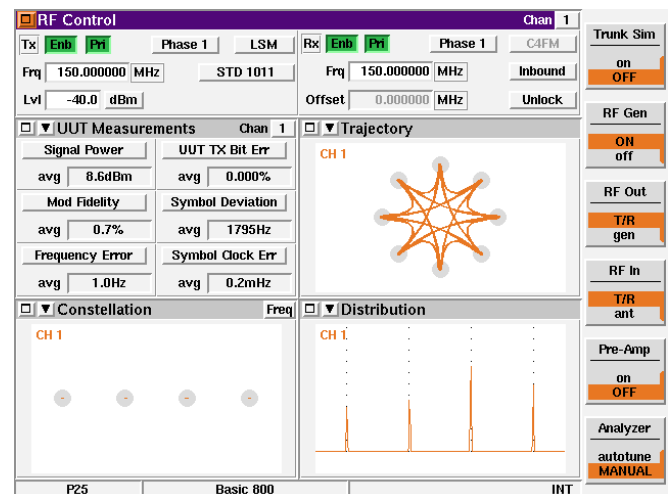

Figure 12. LSM Signal Analysis Screen

P25 Control Channel Logger Option (390XOPT206)

This option provides the user a tool to perform advanced protocol analysis on both control channel and voice channel data. With this option, the user can log P25 data by streaming the received data in real time from the Ethernet port to a PC. This data is logged in an XML format so that the user can easily view the data using a text editor or use an external program to perform further analysis on the data. This data can be logged at three different levels ranging from the raw data symbols up through decoded data. The data is time-stamped on a frame by frame basis. In addition to being able to log data, the user can also send data to the 3920B to be transmitted, making the 3920B into a completely user defined data modem for P25.

SmartZone and SMARTNET (390XOPT207)

This option provides support for Motorola ASTRO SmartZone and SMARTNET systems, including support for rebanded channels in the 800 MHz band.

KVL Keyloader Option (390XOPT209)

This option provides an interface to the KVL Keyloader enabling the user to be able to directly enter keys into the 3920B using a KVL-3000+.

Analog Simulcast Option (390XOPT210)

This option is an extension to the Audio Analyzer option and acts as a tracking generator for the audio analyzer. This feature is designed primarily for use in characterizing the performance of Motorola Analog Simulcast systems and enables detailed alignment of the 0-100 Hz band. In addition, this option allows for extended characterization of audio circuits from 0-10 kHz.

Explicit Mode Trunking (390XOPT212)

The advanced form of frequency channel assignment known as Explicit Messaging is supported by adding option 390XOPT212 to the P25 Trunking Operation VHF / UHF / 700 / 800 MHz option. The explicit mode of operation assigns the actual channel / frequency over the air by providing the exact TX and RX frequency assignments directly to the radio.

Unit to Unit Call (390XOPT213)

This option adds capability of testing the unit to unit call functionality of a mobile station to the P25 trunking option. The user can either originate a unit to unit call from the mobile station or from the test set.

Adjacent Channel Broadcast Message (390XOPT214)

This option adds the adjacent status broadcast message to the control channel messages transmitted by the 3920B. This will enable the user to test the capability of the mobile station to operate correctly in the presence of this message. The purpose of this message is to inform mobile stations of the presence and status of sites adjacent to this particular site.

Secondary Control Channel Broadcast Message (390XOPT215)

This option adds the secondary control channel broadcast message to the control channel messages transmitted by the 3920B. This will enable the user to test the capability of the mobile station to operate correctly in the presence of this message. This message is used to inform mobile stations of other control channels or other potential backup control channels at this site.

P25 Phase II Two-Slot TDMA (Time Division Multiple Access) Physical Layer (390XOPT220)

One of the newest features of the 3920B is the capability to test P25 Phase II TDMA operation of both base stations and mobile stations. With this option, the 3920B can measure and analyze the different modulations used for both the outbound and inbound signals used in P25 Phase II. With the modulation for Phase II being completely different from Phase I C4FM modulation, this option is critical for radio technicians, designers, or anyone involved with the roll-out of P25 Phase II systems. Included with this option are the following features:

- H-CPM (inbound modulation) modulation and demodulation
- H-CPM eye diagram, distribution plots, and constellation
- H-DQPSK (outbound modulation) modulation and demodulation
- H-DQPSK eye diagram, distribution plot, and constellation
- Generation of all H-CPM standard patterns
- Generation of all H-DQPSK standard patterns
- UUT measurements for Phase II including modulation fidelity, symbol deviation, symbol clock error, frequency error, power and TX Bit Error
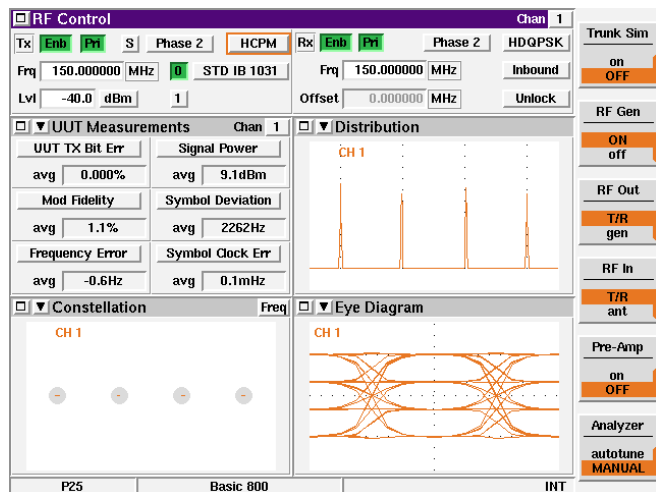
Figure 13. P25 Phase II

Off Air Monitor Software for P25 Message Logging - Protocol Analysis Tool (390XOPT230)

The VIAVI Solutions 3920B P25 Off Air Monitor (OAM) is used to capture and view APCO P25 messages sent over the air. The OAM can receive and demodulate P25 RF signalling, decode P25 messages and log these messages to a file for later viewing. Both trunked (control and traffic) and conventional channels are supported, allowing network engineers to:

- Verify compliance to P25 standards

- Troubleshoot existing P25 systems

- Analyze third party signalling

This option is a PC application that uses the data from option 390XOPT206 to perform an advanced decoded display and log of the XML data streams from multiple P25 channels. This provides the user with the data to perform a complete analysis of all channels of a P25 trunked system.

P25 AES Encryption (390XOPT240)

With the addition of this option, the 3920B supports P25 encryption formats and manual key entry for systems that employ DES OFB Type III (included in 390XOPT200) or AES Encryption (390XOPT240). These options allow decoding of encrypted voice frames to verify encrypted channel performance. Encryption keys may be loaded manually using either the front panel or external keypad or with option 390XOPT209, keys may be loaded with the Project 25 Key Fill Device (KFD)

interface protocol. Additionally, keys may be loaded using KVL ASN mode of operation found in KVL-3000 and older model key loaders from Motorola.

X2-TDMA Test Suite (390XOPT219)

Available for testing X2-TDMA test systems, this option is available through Motorola only.

X2-TDMA Mobile Emulator (390XOPT245)

This option enables the testing of X2-TDMA base stations. This option is available through Motorola only.

P25 Performance Test Triggers (390XOPT260)

In order to perform the P25 Performance Tests required by the TIA 102-CAAA standard, the 3920B has the capability with this option of generating trigger signals. This Sync I/O port on the rear panel of the 3920B is used to source this trigger. The output trigger signal is generated when any of the following occur.

- Switching between the STD SILENCE pattern and the STD 1011 pattern

- Switching between the STD BUSY pattern and the STD IDLE pattern

- Enabling the STD LDU1 pattern

- Enabling the STD LDU2 pattern

- During trunking simulation at each slot boundary

- During trunking simulation, when a Channel Grant message is transmitted

X2-TDMA Advance Test Suite (390XOPT261)

This option combines 390XOPT216 and 390XOPT245.

Motorola HPD Testing Option (390XOPT300)

- Generate / receive HPD signals

- Modulation – 64QAM, 16QAM and QPSK (inbound and outbound)

- 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, sync and pilot bits

- Display of Min / Max and average as specified by the number of bursts

- Pass / Fail indication using color code meters

VIAVI Solutions 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 3920B HPD options 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 HPD Mobile Subscriber Units (MSU). When configured to operate in MSU Mode, the test set simulates Mobile Subscriber Unit operation and is used to test the functionality of Motorola Base Repeaters (BR).
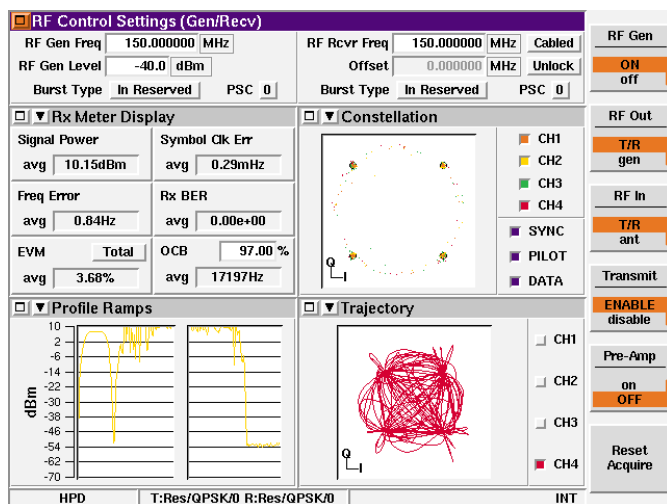

Figure 14. Example of HPD Tiles

Motorola HPD Advanced Analysis Package (390XOPT301)

More advanced 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.

Motorola HPD Testing Suite (390XOPT302)

This option combines 390XOPT300 and 390XOPT301.

DMR (390XOPT400)

Add advanced testing capability to DMR (Digital Mobile Radio) with 390XOPT400. This option enables the 3920B Digital Radio Test Platform to test and align a wide range of DMR repeaters and mobile stations. DMR radio technology is a digital radio format offering advanced communications features specified by the ETSI technical standard ETSI TS 102-361-1. Capabilities of the 3920B include:

- Generate and receive DMR modulated signals

- Measure FSK error and magnitude error

- Measure symbol deviation

- Measure symbol clock error

- Measure slot power

- Distribution plot of symbol deviation

- Eye diagram of FSK demodulation

- Power profile of burst and of burst ramp up / ramp down

- Transmit and receive live audio using the vocoder

- Transmit stored speech patterns

- Test duplex or simplex mobiles

- Wake-up burst for testing repeaters

- Synchronize with repeaters

- BER testing

- Encode color code and call ID

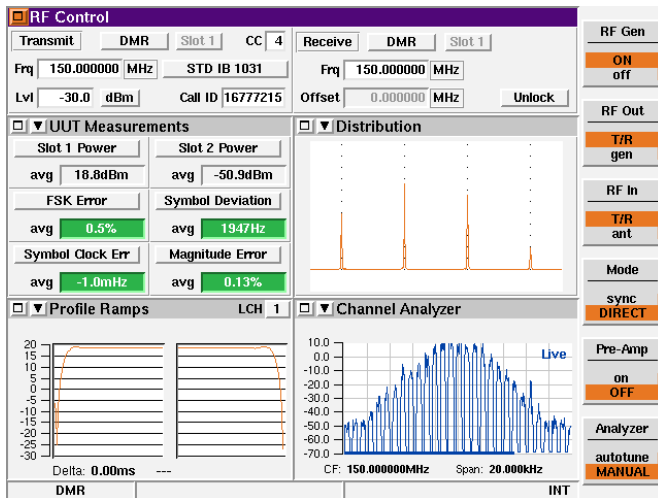- Decode color code, unit ID and call ID

Figure 15. Example of DMR Tiles

DMR XML Channel Logger Option (390XOPT402)

With this option, the user can now capture and log to a file (on a PC connected to the 3920B through a LAN) the raw data that is transmitted by a mobile station or repeater. The data is formatted using XML, so that it can be decoded with an external program (developed by the user) or viewed with a text editor. This is perfect for the engineer performing development work or the test engineer in the field that needs to capture the data being transmitted by a repeater or subscriber unit. The data is captured by connecting a PC to the 3920B through an Ethernet crossover cable. Using the PC application, "DMR XML channel logger for 3920", the user can both log DMR XML data and send XML files that can control the data being transmitted by the 3920B.

dPMR (390XOPT420)

dPMR is an ETSI standard specified in ETSI TS 102 658. This option adds advanced testing capabilities that conform to the requirements of this ETSI standard. The transmitter tests include power, frequency error, FSK error, symbol deviation and symbol clock error. This option also provides several graphical screens that provide more insight into the accuracy of the dPMR modulation.

NXDN (390XOPT440)

Add advanced testing capability for NXDN with 390XOPT440. This option enables the 3920B Digital Radio Test Platform to perform a variety of Transmitter

and Receiver tests on any NXDN radio. Transmitter measurements include:

- Signal power

- Frequency error

- FSK error

- Symbol deviation

- TX BER

- Symbol clock error

The system supports both 4800 and 9600 baud systems. The 3920B can also analyze the modulation as an eye diagram, symbol distribution plot and a symbol constellation plot. A power over time graph can be used to diagnose power-related issues.
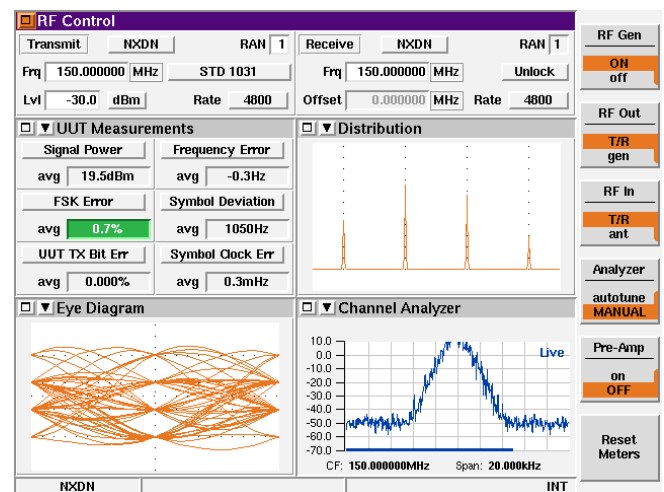
Figure 16. Example of NXDN Tiles

The 3920B NXDN Option supports receiver testing with a variety of signal generation patterns.

- STD 1031 (1031 Hz pattern)

- STD CAL (1031 Hz pattern with 5% BER)

- STD 511 (PN9 bit sequence)

- STD INTFR (PN15 bit sequence)

ARIB STD T98 (390XOPT460)

The option provides testing for mobile stations that conform to the ARIB T98 standard. This testing is similar to dPMR and NXDN.

TETRA

- Mobile station testing with test signal T1 (390XOPT110)

- Base station testing with test signal T1 (390XOPT111)

- 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

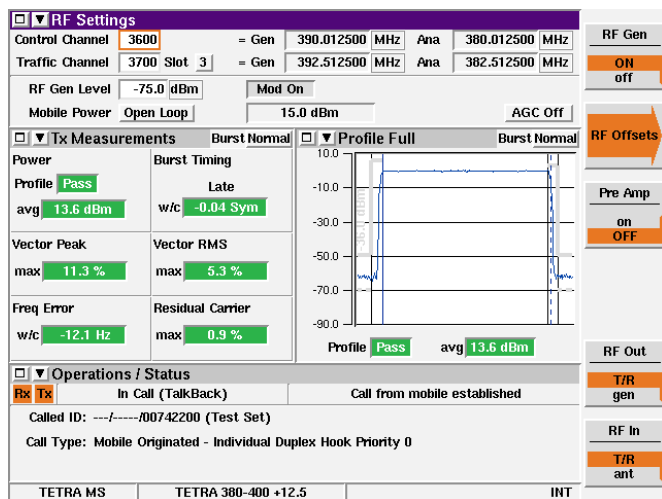- Option for testing Direct Mode Operation (DMO)

Figure 17. Example of TETRA MS Tiles

For TETRA applications, the 3920B is the successor to the 2968 TETRA Radio Test Set. The 2968 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 3920B with the TETRA options provides the world's best solution for testing TETRA radios. TETRA system options provide signalling 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. Signalling 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 3920B offers high speed measurement capabilities to expedite production testing. As a direct benefit of high power signal processing capacity, TETRA measurements are performed nearly nine times faster than its predecessor.
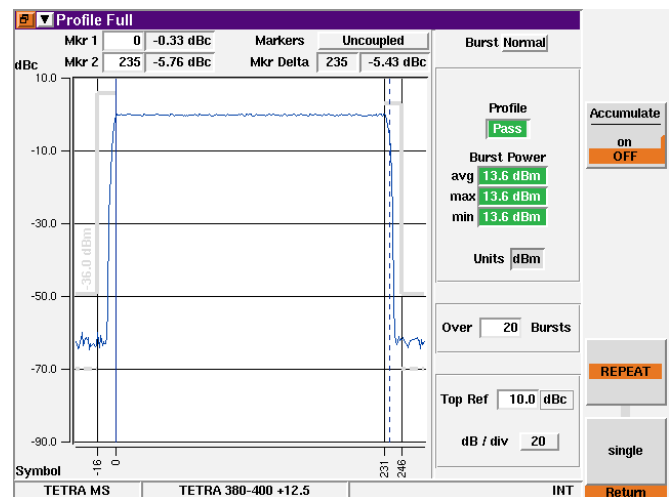

Figure 18. Profile Full Tile Maximized TETRA
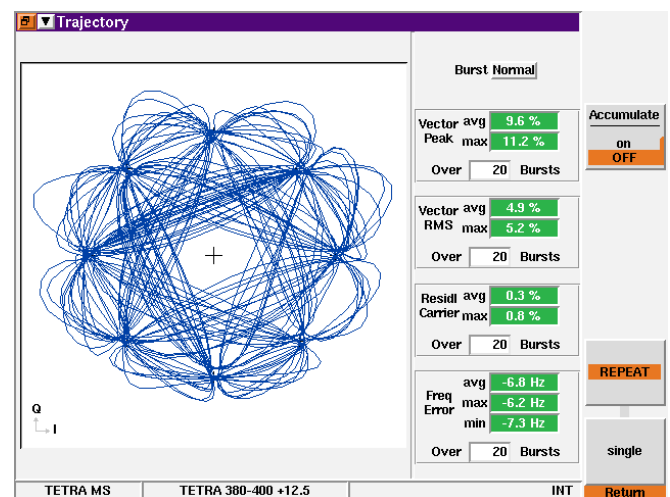

Figure 19. Trajectory Tile Maximized

Call Processing Highlights

The 3920B 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 3920B 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.
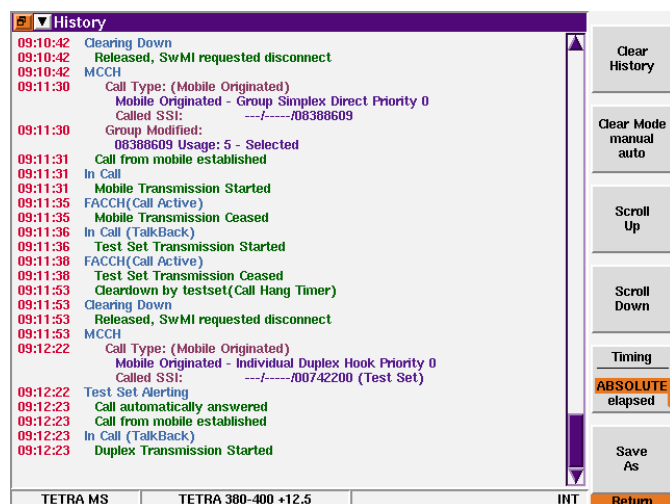

Figure 20. Protocol History Maximized Tile

TETRA Test Mode T1 and T1 Loopback

The TETRA MS and TETRA BS options provides 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 3920B, which can then perform BER / MER / PUEM measurement. In the BS T1 application, the 3920B 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 BER 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 two seconds delay added, thus, providing an end-to-end audio quality test.

Direct Mode Functionality (390XOPT112)

The 3920B also supports the testing of Direct Mode Operation. The 3920B 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 (390XOPT114)

This optional mode of operation provides protocol signalling 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 signalling 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

Available as an option for the 3920B is the Auto-Test operation. Providing the ultimate in flexibility, this option gives you the ability to control the operation of the 3920B using the TCL scripting language. You control the functions of the 3920B through the use of RCI commands, which are sent as part of the TCL program.

- Develop your own automated tests for any system in the 3920B

- Design your own Graphical User Interface Uses TCL scripting language
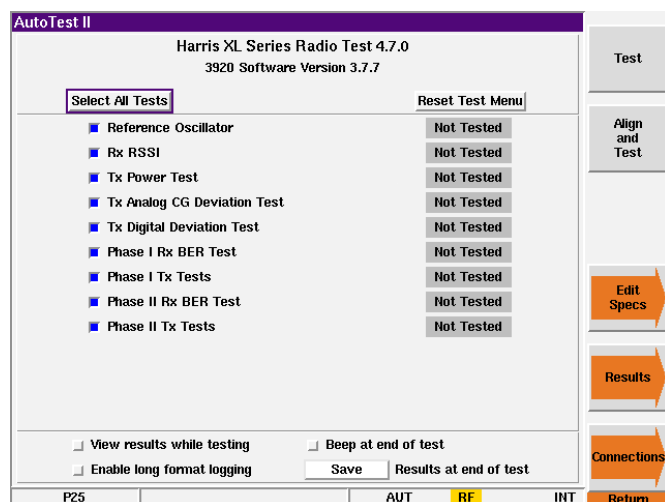
• Utilizes the full set of 3920B RCI Commands

Figure 21. Example of Auto-Test Display

Auto-Test is also the environment for running the auto alignment options. Auto alignment is available for several manufacturers' radios, and more are being added all the time. The Auto-Test Programming Environment is available for all of the systems in the 3920B:

• Analog duplex (390XOPT059)

• TETRA (390XOPT115)

• P25 radio systems (390XOPT218)

• HPD radio systems (390XOPT303)

• DMR radio systems (390XOPT401)

• dPMR radio systems (390XOPT421)

• NXDN radio systems (390XOPT441)

• ARIB T98 radio systems (390XOPT461)

Auto-Test / Alignment

Validate radios faster than ever with ease. Connect the test cables, press "Test and Align" and you are free to do more important things. The Auto-Test / Alignment applications are self-contained within the 3920B and automatically perform the functions of radio alignment and verification to ensure optimal radio performance. These applications can test and align radios in as little as five minutes.

Alignments	Performance Tests
Reference oscillator	P25 modulation fidelity
Power	P25 symbol deviation
Deviation balance	P25 RX BER
Front end alignment	

Motorola ASTRO 25 Series Auto-Test / Alignment (390XOPT600)

This package provides support for the following radios: XTS®5000, XTS2500, XTS1500, XTS4000, MT 1500, PM1500™, SSE 5000, ASTRO XLT-5000, ASTRO XTL-2500, ASTRO XTL-1500, and Astro Spectra Plus. Requires 390XOPT200 and 390XOPT218.

Motorola ASTRO Series Auto-Test / Alignment (390XOPT601)

This option (390XOPT600) provides the functionality for the following radios: XTS3000, ASTRO Saber, ASTRO Spectra. Requires 390XOPT200 and 390XOPT218.

Motorola ASTRO 25 Series XTL Power Auto-Test / Alignment (390XOPT602)

Option 390XOPT602 adds the capability of full power alignment. This option includes all current bias adjustments, power characterization, and current limit settings for the XTL-5000, XTL-2500, XTL-1500, and PM1500. Typical alignment time is less than four minutes for a full power characterization alignment. Requires 390XOPT200, 390XOPT218, 390XOPT053, AC24011, and 390XOPT600.

TIA / EIA-603 FM Land Mobile Test (390XOPT603)

This application is self-contained within the 3920B and automatically performs the test functions as prescribed by the EIA / TIA-603 standards for testing any FM Land Mobile Radio. Configure up to 30 channels with independent test customization for each channel.

Motorola APX Series Auto-Test / Alignment (390XOPT604)

This option allows test and alignment of APX Series radios. The application can perform a full alignment on the single or dual band radios. Analog alignments and digital performance tests will ensure the radio has maximum coverage area.

EF Johnson ES Series Auto-Test / Alignment (390XOPT606)

This option adds the capability to complete a fully automatic alignment on EF Johnson P25 radios. The option has the same features as option 390XOPT600, but for EF Johnson P25 radios.

BK DPHX5102X Series Auto-Test / Alignment (390XOPT607)

This option adds the capability to complete a fully automatic alignment on BK DPHX5102X radios.

Kenwood P25 TK-5X10G Series Radio Auto-Test / Alignment (390XOPT608)

This package provides support for the following radios: TK-5210G, TK-5310G, TK-5410, TK-5710BG / HBG, TK-5810BG / HBG, TK5910B. This option adds the capability to perform a fully automatic test and alignment on Kenwood P25 TK-5X10G Series radios. This option includes all the tests and alignments required by the Kenwood P25 TK-5X10G Series radios including power, frequency, mod balance, deviation, squelch, and many others. To ensure optimum P25 operation, this application includes P25 performance testing.

MOTOTRBO Series Auto-Test / Alignment (390XOPT610)

This option adds the capability to complete a fully automatic test and alignment on MOTOTRBO Series radios. This option is compatible with all MOTOTRBO XPR™ Series radios and support for new MOTOTRBO Series radios will be added in the future. This option includes the following tests and alignments:

- Rx Front End Filter
- Rx Rated Volume
- Rx Front End Gain and Atten
- Rx BER
- Tx Ref Oscillator
- Tx Power
- Tx Modulation Balance
- Tx BER
- Tx FSK Error

- Tx Magnitude Error
- Tx Symbol Deviation

DMR Repeater Auto-Test (390XOPT626)

With the DMR repeater Auto-Test, the 3920B can automatically perform the key transmitter and receiver tests for DMR repeaters. This test does not require the DMR repeater to be in any special test mode but can quickly make these measurements on any channel programmed into the repeater. The user simply indicates the frequencies that the repeater is using from the auto-test setup screen, and then can initiate the test and walk away. The testing is all performed automatically.

ICOM P25 and NXDN Radio Auto-Test / Alignment

VIAVI and ICOM worked together to develop Auto-Test applications to support over 200 models of ICOM P25 and NXDN radios. The P25 option is 390XOPT605 and the NXDN option is 390XOPT632.

Hytera DMR Series Radios Auto-Test / Alignment (390XOPT628)

This option adds the capability to complete a fully automatic alignment on the following DMR portable radios: PD702, PD782, PD792, PD882, HD702, HD782, HD795, SD982, X1e, and X1p.

L3Harris P25 Series Radios Auto-Test / Alignment

This option performs Auto-Test and alignment on L3Harris P25 Radios. Option 390XOPT616 includes L3Harris P7300, M7300, P5500, and XG Series. Option 390XOPT637 includes the very popular L3Harris XL-200P.

Ordering Information

Versions and Options

Order Number	Description
91164	3920B Analog and Digital Radio Test Platform
Standard Accessories	
Front / Rear Cover	
Adapter (BNC-F to TNC-M x2)	
Adapter (N-M to BNC-F)	
AC Line Cord	
Antenna (BNC) (450 MHz)	
Antenna (BNC) (800 MHz)	
Antenna (BNC) (150 MHz)	
112265	3920B Digital Radio Test Set FAA
88459	3920N Digital Radio Test Set
89871	3920N Test Accessory Kit
Options	
83352	390XOPT051 Site Monitoring Applications
83353	390XOPT054 IQ Gen Modulation
83354	390XOPT055 Audio Analyzer
83368	390XOPT210 Analog Simulcast Option (Requires Opt055)
83390	392XOPT058 2.7 GHz Frequeny Range Extension Option
83356	390XOPT060 Harmonics & Spurious Measurements
83357	390XOPT061 Tracking Generator
83358	390XOPT064 Analog Duplex Power Between Markers
92573	390XOPT067 POCSAG
83359	390XOPT110 TETRA MS (Mobile Station Testing)
83362	390XOPT114 TETRA Energy Economy Mode (Requires Opt110)
83360	390XOPT111 TETRA BS (Base Station Testing)
83361	390XOPT112 TETRA DM (Direct Mode Testing)
83363	390XOPT200 P25 Conventional Operation (with DES OFB Type III)

83364	390XOPT201 P25 Trunking Operation VHF / UHF / 700 / 800 MHz (Requires Opt200)
83369	390XOPT212 Explicit Mode Trunking (UHF / VHF only) (Requires Opt201)
83370	390XOPT213 Unit to Unit Call (Requires Opt212)
83371	390XOPT214 Adjacent Channel Broadcast Message (Requires Opt201)
83372	390XOPT215 Secondary Control Channel Broadcast Message (Requires Opt201)
84412	390XOPT260 P25 Performance Test Triggers (Requires Opt200 and Opt201)
83365	390XOPT204 LSM Generate and Receive / Analysis (Requires Opt200)
83366	390XOPT206 P25 Control Channel Logger Option (Requires Opt200)
82566	390XOPT230 Off Air Monitor Software for P25 Message Logging - Protocol Analysis Tool (Requires Opt206)
83367	390XOPT207 SMARTNET / SmartZone Option (Requires Opt200)
62377	390XOPT209 KVL 3000 & 4000 Keyloader Option (Requires Opt200)
90532	390XOPT220 Phase 2 Two-Slot Time Division Multiple Access Physical Layer (Requires Opt200)
67444	390XOPT240 P25 AES Encryption (Requires Opt200)
83378	390XOPT250 Occupied Bandwidth for P25 (Requires Opt200)
83383	390XOPT400 DMR (MOTOTRBO) ETSI 102-361
84413	390XOPT402 DMR XML Channel Logger Option (Requires Opt400)
84414	390XOPT420 dPMR - ETSI 102-658
90533	390XOPT422 dPMR Control Channel Logger Option (Requires Opt420)
84416	390XOPT440 NXDN
104218	390XOPT442 NXDN XML Channel Logger (Requires Opt440)
84418	390XOPT460 ARIB T98
140219	390XOPT462 ARIB T98 Channel Logger (Requires Opt460)

Auto-Test and Alignments

Analog Radios

83355	390XOPT059 Auto-Test II Environment for Analog Radio Systems
83387	390XOPT603 TIA / EIA-603 FM Land Mobile Test Software (Requires Opt059)
138575	390XOPT624 Collins Aerospace 721S Blade Auto-Test (Requires Opt059, 061)

TETRA Radios

85543	390XOPT115 Auto-Test II Environment for TETRA Radio Systems
90676	390XOPT611 Motorola TETRA MS Auto-Test Software - Includes Opt054 as standard (Requires Opt110, 115)
90943	390XOPT621 Motorola TETRA MTS (Requires Opt115, 111)

P25 Radios

83373	390XOPT218 Auto-Test II Environment for P25 Radio Systems (Requires Opt200)
87371	390XOPT607 BK Technologies DPHX5102X Series Auto-Test and Alignment Software (Requires Opt218, 061)
91956	390XOPT627 BK Technologies KNG Command Series Auto-Test and Alignment; Portables Only (Requires Opt218, 061)
139148	390XOPT636 BK Technologies KNG S-Series (Portables only) Auto-Test and Alignment (Requires Opt218, 061)
87372	390XOPT606 EFJohnson ES Series Auto-Test and Alignment Software (Requires Opt218, 061)
112997	390XOPT633 EFJohnson Viking Series Auto-Test and Alignment Software (Requires Opt218, 061)
90966	390XOPT616 L3Harris P25 Series Auto-Test and Alignment Software (Requires Opt218, 061)
91955	390XOPT625 L3Harris P25 ADVANCED Series Auto-Test and Alignment Software (Requires Opt616)
140637	390XOPT637 L3Harris XL Series Auto-Test and Alignment Software (Requires Opt218, 061)

87370	390XOPT605 Icom P25 Auto-Test and Alignment Software (Requires Opt218, 061)
90946	390XOPT608 Kenwood 5x10 Series Auto-Test and Alignment Software (Requires Opt218, 061)
91959	390XOPT630 Kenwood 5x20 Series Auto-Test and Alignment Software (Requires Opt218, 061)
141437	390XOPT641 Kenwood Viking 5/6/7000 Series Auto-Test and Alignment Software (Requires Opt218, 061)
83385	390XOPT600 Motorola ASTRO 25 XTS / XTL Series Auto-Test and Alignment Software (Requires Opt218, 061)
84422	390XOPT602 Motorola ASTRO 25 Series XTL Power Auto-Test and Alignment Software (Requires Opt600 & 112277)
83386	390XOPT601 Motorola ASTRO (XTS-3000) Series Auto-Test and Alignment Software (Requires Opt21, 061)
84421	390XOPT604 Motorola APX Series Auto-Test and Alignment Software (Requires Opt218, 061 & 112277)
140545	390XOPT644 Motorola APX 8000 Series Auto-Test and Alignment Software (Requires Opt604)
140899	390XOPT645 Motorola APX "B" Series Auto-Test and Alignment Software (Requires Opt604)
390XOPT646	390XOPT646 Motorola APX NEXT™ Series Auto-Test and Alignment Software (Requires 604)
91958	390XOPT629 Tait P25 Series Auto-Test ONLY (Requires Opt218, 061)

DMR Radios

83384	390XOPT401 Auto-Test II Environment for DMR Radio Systems (Requires Opt400)
91705	390XOPT626 DMR Repeater Auto-Test Software (Requires Opt401, 061)
91957	390XOPT628 Hytera DMR Series Auto-Test and Alignment Software (Requires Opt401, 061)
141994	390XOPT642 Hytera DMR Repeater Auto-Test (Requires Opt628)

89818	390XOPT610 Motorola MOTOTRBO Radio Series Auto-Test and Alignment Software (Requires Opt401, 061 & 112277)
141377	390XOPT639 Tait DMR Series Auto-Test ONLY (Requires Opt400, 401, 061)

dPMR Radios

84415	390XOPT421 Auto-Test II Environment for dPMR Radio Systems (Requires Opt420)

NXDN Radios

84417	390XOPT441 Auto-Test for NXDN Radio Systems (Requires Opt440)
112987	390XOPT632 Icom NXDN Series Auto-Test (Requires Opt441, 061)
91960	390XOPT631 Kenwood NEXEDGE Series Auto-Test and Alignment Software (Requires Opt441, 061)

ARIB T98 Radios

84419	390XOPT461 Auto-Test II Environment for ARIB T98 Radio Systems (Requires Opt460)

Multi-Protocol Radios

141378	390XOPT640 Kenwood NX–3000 / 5000 Series Auto-Test and Alignment Software (Requires Opt200 / 218, Opt400 / 401 and / or Opt440 / 441 depending on radio digital technology selected)

Languages

84410	390XOPT090 3920 Chinese GUI

Optional Accessories

89243	Case, Hard Transit with Wheels (Pelican)
10225	Case, Soft Padded Carrying
10228	3920 Accessory Pouch
63936	DMM Test Leads (Category 3 Rated)
112277	10 Amp Current Shunt (0.01 Ohm)
90323	3920 5U Rack Mount Kit
90322	3920 6U Rack Mount Kit
67442	Kit, 10 / 20 dB Pads, TNC
67411	Scope Probe Kit
10456	3920 Front / Rear Cover

63928	DC to AC Converter, 12 VDC to 110-120 VAC
9149	Antenna (BNC) (50 MHz)
82556	Attenuator (6 dB / 150 Watts), 1.5 GHz
82557	Attenuator (10 dB / 150 Watts), 1.5 GHz
58520	50 Ohm 250 Watt 5 GHz Termination
140309	3920 Return Loss Bridge Kit
64009	3920 Microphone
63351	RF Cable for AutoAlignment (COAX ASSY, RG223, 36.0, BNC, M, ST / BNC, M, ST)
63927	Survey Technologies Inc (STI) Site Survey Package (Software & GPS Antenna)

Extended Warranties

84349	3920 1 Year Extended Hardware Warranty + ANSI No-Cert Calibrations
84350	3920 1 Year Extended Hardware Warranty + Certified Calibrations
89738	3920 2 Year Extended Hardware Warranty + ANSI No-Cert Calibrations
89741	3920 2 Year Extended Hardware Warranty + Certified Calibrations
84351	3920 3 Year Extended Hardware Warranty + ANSI No-Cert Calibrations
84352	3920 3 Year Extended Hardware Warranty + Certified Calibrations

Calibration Certificates

83482	CALFB392X 3920 Calibration Certificate (ISO 9001)