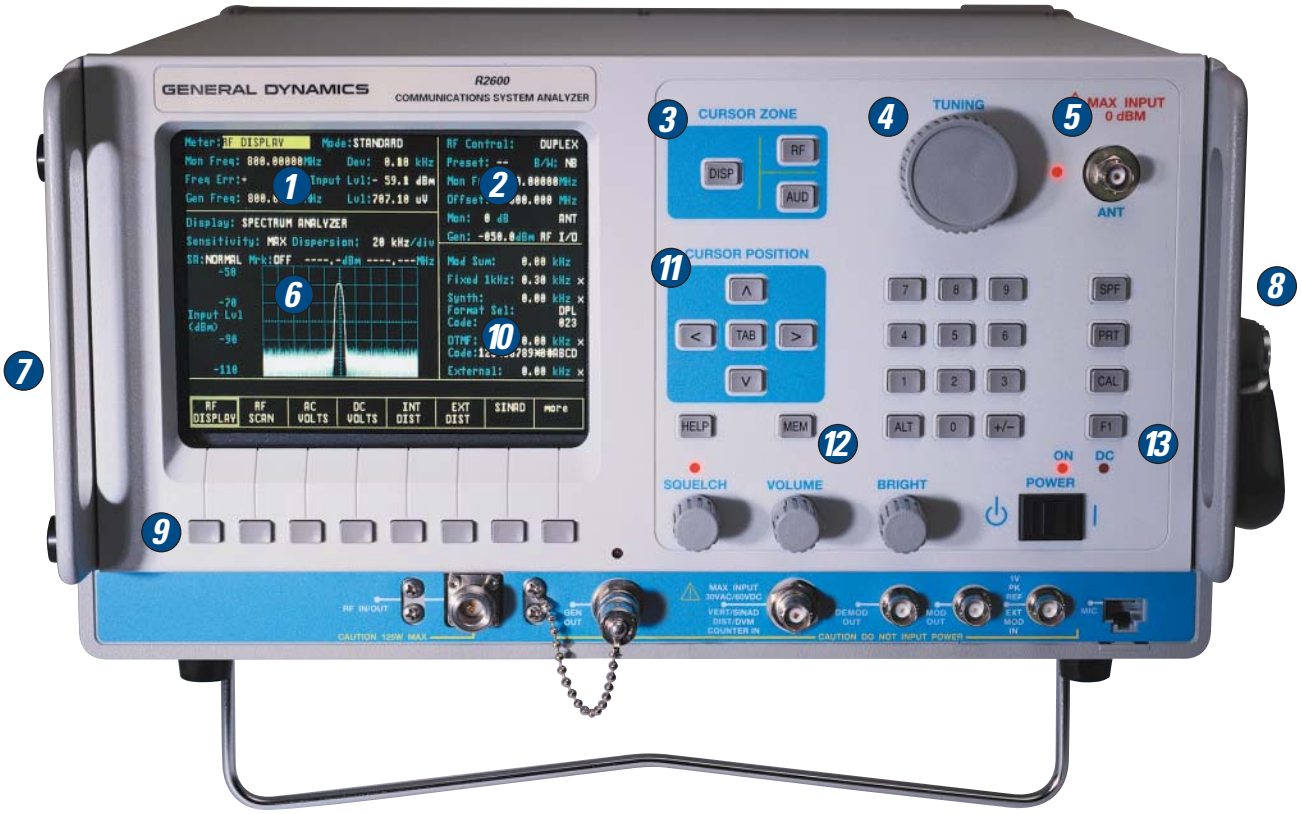
Communications System Analyzers

R2600 Series, including R2600, R2625 and R2670

If you maintain, repair, calibrate, or design radio communications equipment, the R2600 family of Communications System Analyzers has a solution for you. Rugged enough to withstand heavy field use, the R2600 is designed to help you save time and work more efficiently. This platform is available in three models, each tailored to its own set of testing requirements.

GENERAL DYNAMICS
Decision Systems

R2600 Series Communications System Analyzers



Features/Benefits

1) Display Zone for presentation of test data and waveforms
2) RF Control Zone for selecting RF test conditions
3) Cursor Zone keys provide simple, one-button access to any zone
4) Tuning Knob for quick and easy changes of numeric entries: Digital precision with an analog feel
5) Off-the-air antenna port for sensitive receiver measurements
6) Color LCD
7) VGA output port
8) High speed serial port for remote control operation and flash software update capability
9) User-friendly, soft-touch keys for feature selection
10) Audio Control Zone for setting modulation conditions
11) Cursor position keys allow instant cursor movement within a zone
12) Memory recall for up to 30 channels including automatic scanning plus optional 15 user-programmable test setups
13) One-button access to special functions

With the functionality of more than a dozen separate test instruments, the R2600 family of Communications System Analyzers is your total radio test solution. It's light and rugged enough to take to the field, yet powerful enough to service radios on your bench. The R2600 family is a preferred choice of radio servicers worldwide.

The R2600 Series: The test solution for conventional two-way systems, APCO™ Project 25 (Project 25) conventional and trunked, SMARTNET/ SmartZone™, ASTRO™, SECURENET™, and more.

The R2600 family of Communications System Analyzers performs tests normally associated with these instruments:

- RF Signal Generator
- Sensitive Measurement Receiver
- Spectrum Analyzer
- Full Band Duplex Offset Generator
- Frequency Counter
- AC/DC Voltmeter
- 50 kHz Oscilloscope
- RF Wattmeter
- Signal Strength Meter
- Frequency Error Meter
- SINAD Meter
- Distortion Meter
- Sweep Generator
- Audio Generator
- Modulation Analyzer
- Signaling Simulator
- RF Scan/Counter

Optional in R2600 & R2625; standard in R2670:

- Cable Fault Locator
- Tracking Generator
- Programmable Test Set-Ups
- High Performance Spectrum Analyzer with Markers

R2600 – For Conventional Radio and Base Station Service

If you service conventional two-way systems, the value-packed R2600 is the product for you.

Because of its unique design, the R2600 allows you to perform numerous complex functions with the same piece of equipment. This "one-box" design is especially useful in remote sites or where use of multiple pieces of heavy equipment is impractical – or impossible.

R2670 – Expandable Platform for Digital, Trunked, and Secure Testing

In addition to having all the capabilities found in the R2600, the R2670 FDMA digital Communications System Analyzer is a special digital hardware platform that allows customized configuration to include multiple test capabilities in one convenient package.

The R2670 includes as standard features:

- Tracking Generator
- Cable Fault Testing
- High Performance Spectrum Analyzer with Markers
- Programmable Test Set-Up Memory

R2670 OPTIONAL test capabilities:

- SMARTNET/SmartZone Type I, I EP II, II
- Project 25 Standard Conventional (IMBE) and Encrypted
- ASTRO Conventional (VSELP) and Encrypted
- ASTRO (VSELP/IMBE) Trunking
- SECURENET Secure Voice
- Project 25 Trunking

R2625 – Economical Project 25 Solution

The most cost-effective Project 25 test solution on the market, the R2625 is specifically configured for the needs of those servicing Project 25 along with conventional two-way analog systems.

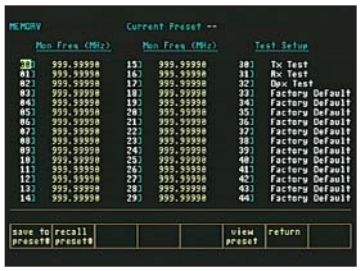
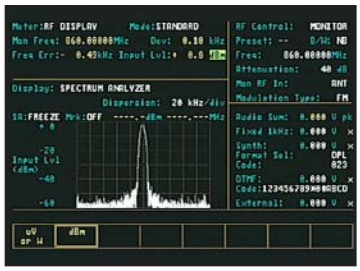
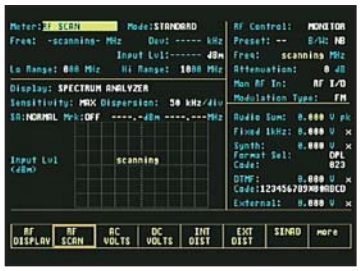
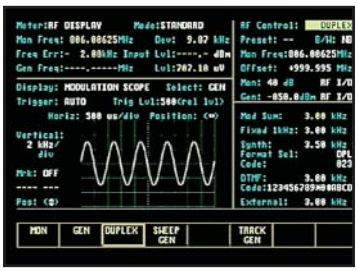
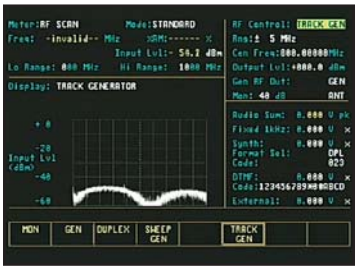
In addition to all of the test capabilities of the R2600, the R2625 contains Project 25 diagnostic test capability, and can be optionally expanded to include the following:

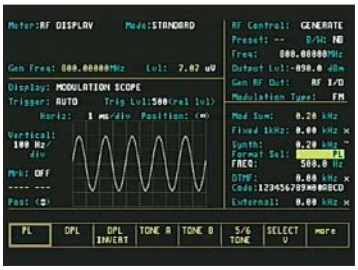
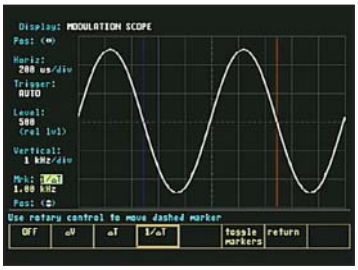
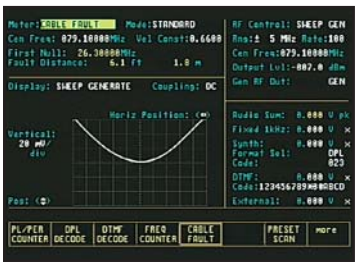
- Tracking Generator
- Cable Fault Testing
- High Performance Spectrum Analyzer with Markers
- Programmable Test Set-Up Memory
- Project 25 Compatible Type III Encryption (AES, DES-OFB, DES-XL, DVP-XL, DVI-XL)
- Project 25 Trunking

For your radio communication testing needs, the R2600 family includes a solution for you.

Standard System Features

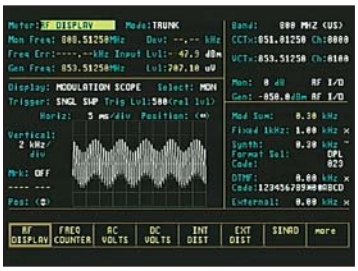
Feature	Description	Benefits
Spectrum Analyzer	The built-in Spectrum Analyzer will display a window of RF spectrum anywhere within the 400 kHz to 1 GHz operating range of the unit. The EXPAND softkey enlarges the display to fill the LCD and retains dispersion and center frequency control. The optional High Performance spectrum analyzer (standard on R2670) adds Marker functions for more precise measurements of level and frequency (both absolute and delta). Included with the marker functions are additional dispersion selections – up to 10 MHz per division, plus the additional freeze, peak hold, and max hold features.	The ability to observe the spectrum display for detailed analysis through the use of multiple Markers provides a significant advantage. The tuning knob retains control of the center frequency even in the EXPAND mode to perform fast sweeps or fine tuning. This allows you to quickly locate and identify signal carriers.
Terminated RF Wattmeter	RF power anywhere in the operating range of 400 kHz to 1GHz is automatically measured by the Communications System Analyzer when tuned to that frequency. The built-in RF load dissipates up to 125 watts for one minute. If a high power transmitter should be keyed into the unit for any longer, the LCD changes to read "WARNING RF OVERLOAD," thus warning the technician to un-key.	This feature provides calibrated RF power measurements eliminating the need for a separate wattmeter. The LCD also displays frequency error and modulation level readings simultaneously.

Feature	Description	Benefits
Programmable Test Memory 	**Channel Presets** – The unit has 30 memory locations which can be used to store preset channel information. Channels can readily be selected individually or automatically scanned over a user-defined range. **Programmable Test Setups (standard in R2670; optional in R2600 and R2625)** – You can easily program and store up to 15 of the most commonly used test configurations, including all test conditions, measurement display formats, and levels. These memory settings operate independently of the channel presets.	**Channel Presets** – This feature allows quick access to frequently used channel location information to speed testing. Scanning allows automatic monitoring and measurement of activity on channels of interest. **Programmable Test Setups (standard in R2670; optional in R2600 and R2625)** – You can significantly reduce the number of key presses required to set up more commonly used test configurations, greatly increasing your efficiency while promoting uniform test procedures. You can also assign a custom name to the configuration for easy recall.
Relative Signal Strength Meter 	In addition to reading frequency error and modulation, a digital readout relative signal strength meter has been included. Sensitivity is specified to -100 dBm at the antenna port for FM signals and extends up to 125 watts at the RF I/O port. The LCD display will automatically convert to a terminating "watts" display as the level increases.	This feature, in conjunction with an external antenna, allows remote monitoring of distant transmitters to check for antenna, transmission line or P.A. problems. Many users also find this feature convenient in performing propagation studies to identify weak coverage areas.
RF Scan/RF Counter Function 	RF Scan operates in the monitor mode and provides a function similar to a 1 GHz counter. This feature automatically scans a user-defined frequency range and locks on the applied signal. Any RF carrier above 20 MHz can be located within 5 seconds and the reception displayed with digital readouts.	This feature allows convenient and immediate verification of the programming of a multi-channel radio. By automatically tuning the analyzer's receiver to the detected carrier, immediate measurement data can be taken without having to enter new frequency data via the keyboard.
Duplex 	Full output level control from -130 dBm to 0 dBm over the entire range of the instrument is available from the RF I/O port (-130 dBm up to -50 dBm) and the generator port (-80 dBm to 0 dBm). Variable offsets from 0 to ±999.995 MHz in 5 kHz steps are keypad-selectable.	The duplex generator provides enhanced capability to service equipment, such as repeaters and full duplex radios. Full RF level control, as well as full internal and external modulation capability allows receiver desensitization and transmitter tests to be performed simultaneously through one port, if desired. The wide offset range extends the functionality to include cross band repeater systems, as well as enhanced receiver and transmitter troubleshooting capabilities.
Tracking Generator (standard in R2670; optional in R2600 and R2625) 	The combining of the capabilities of the sweep generator and the spectrum analyzer into a Tracking Generator function allows the user to view the performance characteristics of many RF filter devices. Display range is operator selectable from a 200 kHz window up to a 50 MHz window anywhere in the 400 kHz to 1GHz spectrum.	Diagnosis and adjustment of critical receiver front ends, IFs, helical filters, cavities, combiners and duplexers can be made in a few minutes, quickly and easily with the flexibility of a tracking generator at your fingertips.

Feature	Description	Benefits
Signaling Simulator: Encoder and Decoder 	The System Analyzer includes the capability of encoding and decoding PRIVATE LINE (PL), DIGITAL PRIVATE LINE (DPL), and single tone sequences as well as multi-tone sequences including DTMF signals, 5/6 tone paging, Select V and up to 20 sequential tones. Decoding displays include tone frequencies and time durations of the individual tones. The unit can also encode tone remote signaling.	The signaling capability of the unit reaches a broader range of service applications with its decode capability. This gives you a more flexible test instrument which aids in servicing paging equipment and specialized signaling encoders, as well as mobile, portable and other radio products. The signaling simulator can perform a full system check-out faster, with more accuracy than ever before.
General Purpose & Modulation Oscilloscope 	The oscilloscope has a 50 kHz bandwidth for audio waveform analysis. The display can be triggered over the full screen range to a fixed reference level. Triggering in both automatic and normal modes is provided for synchronizing the horizontal timebase to the vertical input signal. Internal or external inputs allow observation of both generated and monitored modulation signals. Softkeys provide for an enlarged full screen display. The optional High Performance Spectrum Analyzer (standard on R2670) adds Marker functions for more precise measurements of Voltage, Frequency, and Period.	Recovered audio or internally produced audio can be displayed visually for deviation measurements. Additionally, detection of an asymmetric modulation or audio distortion can be achieved with waveform analysis. With internal and external triggering and a freeze display single sweep, this unit duplicates many features of more expensive scopes. The markers allow detailed analysis to measure waveforms displayed on the LCD. The EXPAND function provides an enlarged, easy to interpret view of the signal for quick analysis.
AM, FM Signal Generator	When the GENERATE mode is selected, the RF modulation method, carrier frequency, bandwidth, composite audio modulation, and RF signal level output are displayed on the LCD.	In addition to reducing receiver test time, this flexible, self-calibrating signal generator is complemented by the simultaneous display of all necessary control information.
Off-the-Air Sensitive Receiver	The 2 microvolt sensitivity of the unit is available through the antenna port. This allows off-the-air monitoring of remote transmitters operating up to 1 GHz. Variable squelch aids in picking up weak signals but can be set tighter to ensure the proper S/N ratio for measurement accuracy.	This feature reduces service costs by enabling frequent preventive maintenance parameter checks for system degradation or interference identification without leaving the shop.
Electronic Software Updates	High-Speed serial port and flashable memory permit programming firmware updates from an external PC.	Quick and easy access to future software updates.
Cable Fault (standard in R2670; optional in R2600 and R2625) 	Cable fault and length are RF measurement features which help the technician isolate cable defects. Supported by on-screen prompts and user-selectable Help messages, you can quickly set up and accurately determine the distance to a fault on a coaxial cable. The distance to fault (or cable length) is computed and displayed in feet or metric units.	Cable fault locating techniques are mandatory for site servicing, where visual inspection is not practical, safe, or effective in detecting hidden or cold-flow damage. The semi-automatic operation of the cable faultfinder precludes the use of mathematical formulas and manual calculations, maximizing your on-site productivity.
RS-232/Serial Interface (standard) **IEEE-488-2 Interface (optional)**	A full bi-directional RS232 port is standard and includes the capability to respond to serial input command vocabulary and return measurement results as a serial output stream. Included are user-selectable baud rates (up to 115.2 Kbps) and start, stop and parity bit selection. In addition, this dual function port can drive a serial printer to print out data and graphic displays. The optional IEEE remote interface option contains the necessary hardware and software for IEEE-488.2.	If you have large volume repetitive testing requirements, this feature allows you to write your own programs to reduce test time costs. Printed results can be used as part of the service shop's internal quality control system and can be used to demonstrate performance to the radio equipment user.

SMARTNET/SmartZone Option

(Available on R2670 only)

Feature	Description	Benefits
Dynamic Call Testing of Subscriber Radios 	This feature tests Motorola compatible Type I, Type II, SmartZone and ASTRO IMBE/VSELP trunked mobile and portable radio units under actual signaling conditions. This is achieved by simulating the function of the trunked fixed-end equipment. The radio access control channel is provided to perform initial registration. A thermometer-style graphic indicator shows call progression as it directs the radio to a traffic channel for parametric measurements and voice testing. Radio-initiated or system-initiated tests can be performed in either the phone interconnect or dispatch call modes. Dynamic Call Testing allows you to test auto affiliation for SMARTZONE systems. An additional RF synthesizer provides simultaneous control and traffic channels, operator selectable over the entire band of allowable channels. This option also allows you to exit from the main testing screen while a call is in process to access the other diagnostic screens.	You can verify both radio system compatibility and basic functionality without using valuable airtime for testing. This feature also allows you to test in areas that are beyond the range of an actual system. By obtaining precise measurements of radio performance data, you can be sure that your system is operating with the proper margin. This feature ensures compatibility with SMARTZONE system operation. The simultaneous control channel allows you to redirect a radio to the traffic channel upon temporary loss of signal. Testing all channels within a band also helps you ensure adequate performance margin. This feature affords you greater diagnostic capability to ensure proper radio operation.
Closed Cover Measurements 	Transmitter power, frequency and deviation are measured within the dynamic calling mode and displayed on the signaling screen all with a single RF connection to the radio. Additional measurements can be made on other screens while the simulated “live” call is maintained. Radio ID information is decoded in either hex or decimal format.	You can verify radio specification performance and programming quickly and easily without opening or removing the radio to activate a special test mode.
Dedicated Trunking Screens 	Conveniently accessed, dedicated test screens can be set up as a start-up default condition or a programmable test set-up. Dedicated Trunking test screens are windowed with RF and Modulation control screens to simultaneously display test results along with their test conditions. A single system configuration screen for Type I systems provides non-volatile storage of up to ten fleet maps.	This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance.

Project 25 Conventional Test Option

(Standard in R2625; optional in R2670; not available in R2600)

Feature	Description	Benefits
Voice Mode System Testing 	This feature provides Project 25 compatible FDMA Digital C4FM modulation and demodulation with vocoding and embedded data testing. Generate and monitor modes support actual functional voice testing. Within the voice mode, embedded data can be encoded and decoded for either subscriber or fixed site radio equipment.	This feature allows you to verify operation and system compatibility under actual operating conditions for increased confidence of proper system performance.
Bit Error Rate (BER) Testing 	BER testing can be performed on radios that support BER test capability. The R2670/R2625 in Project 25-mode can generate RF transmissions modulated with either a 1011Hz tone test pattern or a calibration test pattern (generates 5% BER) for UUT BER measurement. The units will compute a BER when a 1011 Hz tone test pattern is received.	This testing provides an accurate, quantitative measurement of modulation quality and overall system performance.
Dedicated Test Screens 	Conveniently accessed, dedicated test screens allow the user to specify Link Control and Low Speed Data information contained within Voice Frames and to specify status symbol value. Input parameters can be defined as default values, or uniquely specified by the user.	This feature makes testing easier, more efficient and robust by allowing operator specified values to be tested.

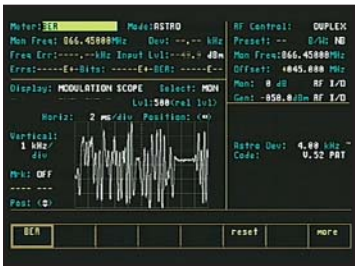
Project 25 Trunking Test Option

(Optional in R2625 and R2670; not available in R2600)

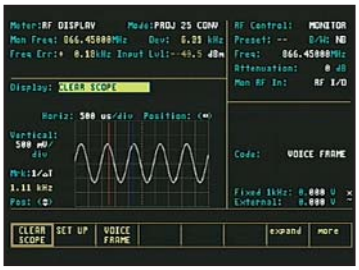
Feature	Description	Benefits
Dynamic Call Testing of Subscriber Radios 	Project 25 compatible FDMA Digital C4FM modulation and demodulation on trunked channels allows testing of radio registration process and ability to receive call alert indication. These features also permit testing of trunked radio capabilities such as a transition to a traffic channel from a control channel, quality of radio-transmitted signal, as well as voice quality.	The operator can verify both radio system compatibility and functionality without having to rely on an actual system for confirmation. In addition, precise radio performance and programming data ensure operation within appropriate system performance specifications.
Closed Cover Measurements	Measurements can be made while a simulated 'live' call is maintained with the radio under test.	This affords the user greater diagnostic capability to ensure proper radio operation with just a single RF connection to the radio.
Full Duplex Test of Base Station Repeaters 	Project 25 compatible FDMA digital C4FM modulation of 1011 Hz test pattern with simultaneous C4FM/LSM demodulation of voice. Performs average power level measurements under actual operating conditions, with a selectable averaging interval.	This feature allows the operator to monitor transmitter power levels under traffic conditions for both C4FM and LSM modulated signals while verifying receipt and transmit of the C4FM modulated 1011 Hz test pattern.
Bit Error Rate (BER) Testing 	BER testing can be performed on base stations and repeaters which support BER test capability. The R2670 and R2625 in Project 25 trunking mode can monitor RF transmissions modulated with a V.52 BER test pattern.	This testing provides an accurate, quantitative measurement of modulation quality and system performance.

ASTRO Test Option

(Optional in R2670; not available in R2600 and R2625)

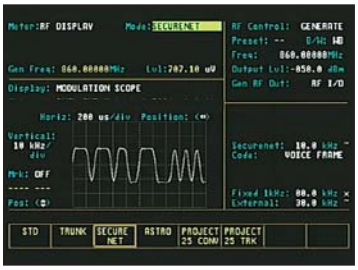
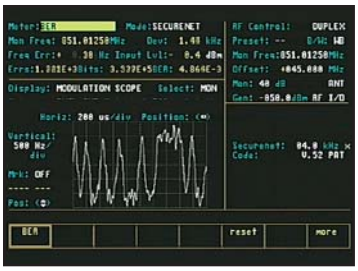
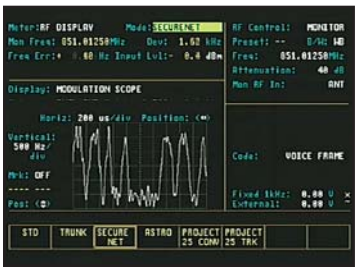
Feature	Description	Benefits
Voice Mode System Testing 	This feature provides ASTRO compatible FDMA Digital C4FM modulation and demodulation with vocoding and embedded data testing. Generate and monitor modes support actual functional voice testing. Within the voice mode, embedded data can be encoded and decoded for either subscriber or fixed site radio equipment.	This feature allows you to verify operation and system compatibility under actual operating conditions for increased confidence of proper system performance.
Bit Error Rate (BER) Testing 	BER testing can be performed on radios that support BER test capability. The R2670 in ASTRO mode can generate or monitor RF transmissions modulated with a V.52 BER test pattern.	This testing provides an accurate quantitative measurement of modulation quality and overall system performance. The Duplex mode supports loop-back testing.
Dedicated Test Screens 	Conveniently accessed, dedicated test screens can be set up as a start-up default condition or as a programmable test set-up. Dedicated ASTRO test screens are windowed with RF and Modulation control screens to simultaneously display test results along with their test conditions. While in ASTRO mode, standard diagnostic test screens can be easily accessed.	This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance margin.

Project 25, ASTRO and SECURENET Common Features

Feature	Description	Benefits
Encryption Test Option 	Voice and embedded data encode and decode testing can also be done in the encrypted mode using either test keys, which are permanently stored in the R2670, or actual customer-selected keys which can be loaded into the unit using a compatible key loader.	This feature allows verification of the proper operation and system compatibility using actual encryption algorithms.
Baseband Audio Scope Display 	This display provides a clear graphic image of the audio baseband, signal-selectable at either the vocoder input in generate mode or the vocoder output in monitor mode.	This feature provides greater assurance of proper system operation through its graphic display of voice or tone modulation.

SECURENET Test Option

Available only in R2670

Feature	Description	Benefits
Voice Mode System Testing 	Voice mode system testing provides SECURENET-compatible modulation and demodulation with vocoding. Generate and monitor modes support functional voice testing in the encrypted mode using either test keys stored in the R2670, or customer-selected keys provided by a separate DX key loader. The R2670 also emulates an AX, BX, or CX key loader, which can be used to download test keys to a compatible radio.	This feature allows verification of the proper operation and system compatibility using actual encryption algorithms.
Bit Error Rate (BER) Testing 	BER can be measured using the built-in V.52 test pattern generator. This standard, non-encrypted pattern can be used to either modulate the Generator or inject into a radio or system under test via the baseband output. This BER pattern can then be recovered from the radio system either through the analyzer's receiver or from its baseband input to perform a closed loop BER test. The BER test is also available in the unit's Duplex mode.	This testing provides an accurate, quantitative measurement of modulation quality and overall system performance. Loop-back testing is supported while operating in Duplex mode.
Dedicated Test Screens 	Conveniently accessed, dedicated test screens can be set up as a start-up default condition or a programmable test set-up. Dedicated SECURENET test screens are windowed with RF and Modulation control screens to simultaneously display test results along with their test conditions. While in SECURENET mode, standard diagnostic test screens can be readily accessed.	This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance margin.

Specifications

OPERATING/DISPLAY MODES

AM/FM Monitor	Cable Fault Locator
AM/FM Generate	Frequency Counter
Audio Synthesizer	Digital Voltmeter
Spectrum Analyzer	Wattmeter
Duplex Generator	Oscilloscope
Sweep Generator	Signal Strength Meter
Tracking Generator	SINAD/Distortion Meter

RF SIGNAL GENERATOR

FREQUENCY	
Range:	400 kHz to 1 GHz
Resolution:	50 Hz
Accuracy:	Refer to Accuracy of Master Oscillator
Stabilization Time:	.1 Second
OUTPUT	
Range FM:	-130 dBm to 0 dBm
Range AM:	-130 dBm to -3 dBm
Accuracy:	±2 dB, -80 dBm to -130 dBM, RF I/O Port ±4 dB, >3 MHz, all other levels and ports.
SWEEP GENERATOR	
Range:	400 kHz to 1 GHz
Resolution:	50 Hz
Output:	-130 dBm to 0 dBm
Sweep Width:	Selectable up to ±5 MHz of center freq.
Scope Coupling:	Synchronized scope trace to the sweep signal
Accuracy:	Same as Signal Generator
DUPLEX GENERATOR	
Range:	400 kHz to 1 GHz
Receiver Resolution:	50 Hz
Output:	-130 dBm to 0 dBm
Frequency Offset	0 MHz to ±999.995 MHz in 5 kHz steps
Accuracy:	Same as Signal Generator
SPECTRAL PURITY	
Spurious:	-35 dBc within ±20 MHz of selected carrier frequency. Additional fixed spurs at an absolute level of <-90 dBm at harmonic frequencies of 5 MHz. These can affect level and modulation measurements when operated at low levels at or very near these specific frequencies.)
Harmonics:	-20 dBc
FM MODULATION	
Deviation:	99.5 kHz
Accuracy:	5% of setting ±25 Hz @ 1 kHz (NB) 5% of setting ±250 Hz @ 1 kHz (WB)
Residual FM:	20 Hz max @ 300 Hz to 3 kHz
Frequency Range:	5 Hz to 20 kHz
AM MODULATION	
Range:	0 to 90%
Resolution:	1% of modulation
Residual AM:	1.0% max @ 300 to 3 kHz
Frequency Range:	100 Hz to 10 kHz
PHASE MODULATION	**(Optional)**
Range:	0.5 to 10 radians
Accuracy:	±8% at 1 kHz
Resolution:	.1 radians (.01 below 2.00 radians)
Frequency Range:	300 to 3000 Hz

AUDIO MODULATION SYNTHESIZER

Modulation Types:	1 kHz tone, PRIVATE LINE, DIGITAL PRIVATE LINE, Single Tone, DTMF, Two-Tone Paging, 5/6 Tone Paging, International Select V, 20 Tone General Sequence, Tone Remote Control, External inputs from both a supplied microphone and BNC input.
Mod Output Amplitude Flatness:	5 Hz to 20 kHz ± 1 dB
Mod Output Level:	Programmable to ± 7.95 v peak
Mod Output Impedance:	100 ohms nominal
1 kHz Tone Distortion:	Not to exceed 1% THD

Audio Modulation Synthesizer (Cont.)

External Modulation Inputs:	Front panel microphone and a BNC jack are summed.
BNC Input Impedance:	600 ohms nominal
Microphone Supplied:	HMN-1056D
Microphone Input Conditioning:	Internal audio limiting providing IDC and pre-emphasis.

RF RECEIVER

FREQUENCY	
Range:	400 kHz to 1 GHz
Resolution:	50 Hz
Accuracy:	Refer to Accuracy of Master Oscillator
Spurious Response:	40 dB typical
SENSITIVITY (Above 10 MHz)	
Narrowband FM:	2.0 uV for 10 dB EIA SINAD
Wideband FM:	10 uV for 10 dB EIA SINAD
AM:	10 uV for 10 dB EIA SINAD
FREQUENCY ERROR METER	
Type of Display:	Autoranging
Resolution:	1 Hz
FM DEVIATION MEASUREMENT	
Demod Range:	Up to ±5 kHz in Narrowband Up to ±75 kHz in Wideband
Accuracy:	±5% plus peak residual FM
Frequency Response:	Selectable per the following: Low Pass Filters 300 Hz, 3 kHz, 20 kHz High Pass Filters 5 Hz, 300 Hz, 3 kHz
Demodulated Output Level:	0.8 V peak per 1 kHz peak Deviation in Narrowband and per 10 kHz Deviation in Wideband
Demodulation Output Impedance:	100 ohms nominal
Deviation Alarm:	Audible, set via keypad in 100 Hz increments
AM MODULATION MEASUREMENTS	
Demodulation Range:	0 to 100%
Accuracy:	±5% for levels below 80%
Frequency Response:	Selectable per the following: Low Pass Filters 300 Hz, 3 kHz, 20 kHz High Pass Filters 5 Hz, 300 Hz, 3 kHz
Demodulated Output Level:	0.8 V peak per 10% AM modulation
Output Impedance:	100 ohms nominal
PHASE DEMODULATION MEASUREMENTS	**(Optional)**
Demod Range:	Narrowband = 1 radian Wideband = 10 radians
Accuracy/ Frequency Response:	±5% at 1 kHz, ±7.5% 300 Hz to 3.5 kHz with de-emphasis filter cornered at 100 Hz
Output Impedance:	100 ohms nominal

TRUNKING (OPTIONAL FEATURE)

Signaling Types:	SMARTNET, SmartZone (Type I, Type I EP II, Type II), ASTRO (VSELP/IMBE). ASTRO testing in the Trunked mode is limited to functional verification of operation on a traffic channel. More detailed testing of Data, BER and Encryption are done in conventional mode through use of the ASTRO diagnostic options.
Call Sequence Tests:	Dispatch Phone Interconnect Call Alert Failsoft

Trunking (Cont.)

Trunking Test Parameter Entries:	(Dependent on Test Selection) Signaling Type Call Sequence System ID Size Code Connect Tone Frequency Band Control and Traffic Channel (by frequency and channel number)
Test Measurement Display:	Call Sequence Status Indicator Radio ID (Hex or Decimal) Call Type RF Performance Data (via exit to standard screens)
Radio ID Decoding:	Type I: Fleet, Sub-fleet & Unit ID Type II: Talk Group, Unit ID
Smart Zone Test Support:	Auto affiliation test
Frequency Bands:	851-870 MHz, 866-870 MHz Split Channel 935-941 MHz, 850-860 MHz JSMR 403-522 MHz UHF, 132-175 MHz VHF
Generate Deviation Selection:	1.2 kHz, 2.4 kHz, 3.125 kHz
Type I System Configuration Storage:	Non-volatile storage of up to 10 fleet maps with alpha numeric entries
Channel Plan Entry for VHF/UHF:	Separate transmitter and receiver start-and-end frequency for three blocks. Independent channel spacing for each block.

DIAGNOSTIC OPTIONS

Project 25 Conventional (Optional Feature)

Voice Testing:	Project 25-compatible IMBE vocoder for both generator and receiver provides functional voice testing capability via internal speaker and microphone accessory. Scope display of voice waveform can also be selected.
EMBEDDED SIGNALING Encode Capability:	Link Control Field (LCF) Low Speed Data (LSD) Key ID Network ID Status Symbol
Encode Operator Entry:	A default configuration can be selected or a detailed special screen can be accessed for customized programming.
Decoding Operation:	A dedicated screen may be selected to display and decode the same data as described in the encode section. The unit can also buffer 30 frames of data on a first-in/first-out basis with the capability to selectively recall any of the stored frames to the screen.
BER Capability:	Compute BER from received non-encrypted 1011 Hz tone test pattern. Generate non-encrypted 1011 Hz tone test pattern or a calibration test pattern (generates 4.977% BER)for UUT BER calculation with Project 25 test mode.
Encryption Capability:	AES, DES-OFB, DVP-XL, DES-XL, DVI-XL. For each of these algorithms, the unit can accept customer keys from Motorola external key loaders (DX compatible). A single side connector is provided for key loading.
Generate Capability:	Project 25 Standard Voice Frames containing both IMBE vocoded voice and embedded signaling, a standard 1011 Hz tone test pattern, a calibration test pattern and a standard silence test pattern.
Monitor Capability:	Either Project 25 Standard Voice Frames containing IMBE vocoded voice and embedded signaling or a standard 1011 Hz tone test pattern.

Project 25 Trunking (Optional Feature)

Call Sequence Tests:	Registration/Call Alert Dispatch Voice
Project 25 Trunking Test Parameter Entries:	WACN ID, System ID, WUID (or UID), WGID (or GID), RFSS ID, Site ID, IDEN_UP
Test measurement display:	Call sequence status indicator WACN ID, System ID, UID, GID, WUID, WGID
Frequency Bands:	800MHz – 851.00625MHz – 876.59375MHz) with a -45Mhz offset. Channel plan #1. 700MHz – 762.00625MHz – 787.59375MHz) with a +30MHz offset. Channel plan #2. UHF/VHF – User-defined channel plan. The channel plan range is 1 thru 16. This can also be used to define non-standard 700MHz channel plans.
Generate Deviation Selection:	0.00kHz – 5.00kHz
Base Station Tests:	Full duplex modulation of 1011 Hz test pattern with simultaneous C4FM/LSM demodulation of voice. Also includes an averaging wattmeter with selectable period (.09 sec to 4.32 sec) and an accuracy of ±15%. Input range is from .5 watts to 125 watts peak.
BER Capability:	Free running, unframed V.52 pseudo random non-encrypted sequence. Measurement range from 0 to 20% bit errors.

ASTRO (Optional Feature)

Voice Testing:	ASTRO -compatible vocoder for both generator and receiver provides functional voice testing capability via internal speaker and microphone accessory. Scope display of voice waveform can also be selected.
EMBEDDED SIGNALING Encode Capability:	Link Control Field (LCF) Presentation Address (PA) Key ID Network ID Busy Bits
Encode Operator Entry:	A default configuration can be selected or a detailed special screen can be accessed for customized programming.
Decoding Operation:	A dedicated screen may be selected to display and decode the same data as described in the encode section. The unit can also buffer 30 frames of data on a first-in/first-out basis with the capability to selectively recall any of the stored frames to the screen.
BER Capability:	Free running, unframed V.52 pseudo random non-encrypted sequence compatible with ASTRO test mode. Measurement range from 0 to 20% bit errors.
Encryption Capability:	DVP-XL, DES-XL, DVI-XL. For each of these algorithms, the unit can accept customer keys from Motorola external key loaders (DX Compatible). ASTRO single key software encryption is also supported. A single side connector is provided for key loading.
Generate Capability:	ASTRO Voice Frames containing both VSELP vocoded voice and embedded signaling or an unframed V.52 pseudo random non-encrypted sequence.
Monitor Capability:	ASTRO Voice Frames containing both VSELP vocoded voice and embedded signaling or an unframed V.52 pseudo random non-encrypted sequence.
Duplex Capability:	An unframed V.52 pseudo random non-encrypted sequence.

SECURENET (Optional Feature)

Voice Testing:	SECURENET compatible vocoder for both generator and receiver provides functional voice testing capability via internal speaker and microphone accessory. Scope display of voice waveform can also be selected.
Encryption Capability:	DVP-XL, DES, DES-XL, DVI-XL For each of these algorithms, the unit can emulate an AX, BX or CX-type key loader to load test keys to a compatible radio. It can accept actual keys from Motorola external key loaders. A single side connector is provided for key loading.
End of Message Test:	The signaling tone that terminates a SECURENET transmission can be detected and displayed to the operator.
BER Capability:	Free running, unframed V.52 pseudo random non-encrypted sequence. Measurement range from 0 to 20% bit errors.

INTERFACE PORTS

Printer/Remote Control:	RS-232 DB25 (female)
Color Monitor:	Standard 15 pin VGA

METERING & MEASUREMENT

SPECTRUM ANALYZER	
Frequency Range:	400 kHz to 1 GHz
Dispersion:	Selectable from keypad, as follows: 200 kHz window - (20 kHz per division) 500 kHz window - (50 kHz per division) 1 MHz window - (100 kHz per division) 2 MHz window - (200 kHz per division) 5 MHz window - (500 kHz per division) 10 MHz window - (1 MHz per division) 20 MHz window - (2 MHz per division)* 50 MHz window - (5 MHz per division)* 100 MHz window - (10 MHz per division)*
Dynamic Range:	60 dB
Bandwidth:	Automatically selected: 6 kHz - (100 kHz per division & below) 30 kHz - (200 kHz per division & above)
Display Range:	+50 to -95 dBm
Modes:	Freeze, Max Hold, Peak Hold, Average*
Markers:	Delta or Absolute Level and Frequency*
SIGNAL STRENGTH INDICATOR	
Range:	400 KHz to 1 GHz
Accuracy:	±4 dB, >3 MHz
Sensitivity:	-100 dBm (antenna port rating)
WATTMETER (RF I/O PORT)	
Frequency Range:	400 KHz to 1 GHz
Measurement Range:	.1 watt to 125 watts
Input Impedance:	50 ohms with maximum VSWR of 1.5:1
Accuracy:	±10%, >3 MHz
Protection:	Over temperature alarms
TRACKING GENERATOR*	
Frequency Range:	400 kHz to 1 GHz
Tracking Display Sweep Range:	200 kHz window - (20 kHz per division) 500 kHz window - (50 kHz per division) 1 MHz window - (100 kHz per division) 2 MHz window - (200 kHz per division) 5 MHz window - (500 kHz per division) 10 MHz window - (1 MHz per division) 20 MHz window - (2 MHz per division) 50 MHz window - (5 MHz per division)
Display Range:	0 to -80 dBm
CABLE FAULT*	
Method:	Standing Wave Analysis
Measure:	Fault distance, cable length
Reading:	Feet and meters
Accuracy:	±10%

Metering & Measurement (Cont.)

OSCILLOSCOPE	
Display Size:	6.4 in (17 cm) diagonal
Frequency Response:	0 to 50 kHz
Vertical Input Ranges:	Selectable per the following: 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1v, 2v, 5v, 10v per division
Accuracy:	5% of full scale all ranges
Sweep Ranges:	Selectable per the following: 20 usec, 50 usec, 100 usec, 200 usec, 500 usec, 1 msec, 2 msec, 5 msec, 10 msec, 20 msec, 50 msec, 100 msec, 200 msec, 500 msec, 1 sec per division
Trigger:	Automatic, normal, and single sweep
Markers:	Delta Voltage, Delta Frequency, Delta Period*
DIGITAL VOLTMETER	
Meter Type:	RMS
Frequency Range:	DC plus AC of 50 Hz to 20 kHz
DC Voltage Ranges:	1.0 V, 10.0 V, 100.0 V full scale
Accuracy:	1% full scale ±1 least significant digit
AC Voltage Ranges:	1.0 V, 10.0 V, 70.0 V full scale
Accuracy:	5% full scale ±1 least significant digit
Freq. Response:	3 dB end points @ 50 Hz and 20 kHz
FREQUENCY COUNTER	
Frequency Range:	5 Hz to 500 kHz plus Auto Tune
Period Counter Range:	5 Hz to 20 kHz
Input Level:	0.1 v RMS minimum input level
Resolution:	0.1 Hz, 1 Hz and 10 Hz varying by frequency range
Auto Tune:	Monitor mode, 20 MHz to 1 GHz, unit will scan and find signals greater than -30 dBm
Accuracy:	See **TIME BASE**
SINAD/DISTORTION METER	
Input Level:	0.1 V to 10 V RMS
SINAD Accuracy:	±1 dB at 12 dB SINAD
Distortion Range:	1% to 20%
Distortion Accuracy:	±0.5% of distortion or ±10% of reading whichever is greater
Optional:	C-Message Filter; CCITT Filter w/ 600 ohm switchable load
TONE SEQUENCE DECODE	
Modulation types:	PRIVATE LINE, DIGITAL PRIVATE LINE, Single Tone, DTMF, Two-Tone Paging, 5/6 Tone Paging, International Select V, 20 Tone General Sequence.
Frequency Accuracy:	±3% from 300 Hz to 3 kHz
Duration Accuracy:	±12 msec for tones greater than 30 msec and 300 Hz

RS232 PORT
Bi-directional port provided with capability to respond to serial input command vocabulary to activate standard functions and return measured results. Baud rates to 115.2 Kbps with selectable start, stop and parity bits.

TIME BASE:	Aging .5 ppm/yr, Temperature .05 ppm

POWER & ENVIRONMENT

AC:	100 to 130 VRMS or 200 to 260 VRMS @ 50 Hz to 440 Hz
DC:	+11 to +16 VDC (10A Fused)
Battery Option:	13.6 V, 50 minutes typical
Dimensions:	8.5" high x 16" wide x 17" deep (21.6 cm x 40.7 cm wide x 43.2 cm) excluding accessories, battery pack and cover
Weight:	28.5 lbs., base unit without cover, options or accessories
Temperature:	0° C to +50° C (operating) -40° C to +85° C (storage)

*optional in R2600 and R2625; standard in R2670

Model Nomenclature and Ordering Guide

Base Models:

R2600D	Standard Unit for general purpose 2-way testing
R2625B	Standard Unit configured for Project 25 Test Capability
R2670B	Enhanced Standard Unit for ASTRO, Project 25, SMARTNET/SmartZone, and/or SECURENET test options

Options Matrix (Order as additional Line items with base Model)

Standard Options		Model Availability			
Description	**Part Number**	**R2600**	**R2625**	**R2670**	**Notes**
Tracking Generator	RLN5069	Optional	Optional	**Standard**	
Cable Fault	RLN4306	Optional	Optional	**Standard**	Includes RF Detector Probe and 'T'
Hi Performance Spectrum Analyzer with Markers	RLN4423	Optional	Optional	**Standard**	
Programmable Test Setup Memory	RLN4485	Optional	Optional	**Standard**	
IEEE 488.2 Remote Interface	RLN4329	Optional	Optional	Optional	
C-Message Filter with 600 ohm load	RLN4034	Optional	Optional	Optional	
CCITT Filter with 600 ohm load	RLN4361	Optional	Optional	Optional	
Phase Mod/Demod	RLN4484	Optional	Optional	Optional	
Analog Trunking Options – Select Only One					
SMARTNET/SmartZone	RLN4498	NA	NA	Optional	
SMARTNET/SmartZone with ASTRO trunking	RLN4497	NA	NA	Optional	VSELP/IMBE Compatible
Diagnostic Test Options	**Order CM701 plus desired transmission format(s) and applicable encryption**				
Conventional Hardware Module	CM701	NA	NA	Optional	
Transmission Formats – Select any combination					**Must also include CM701**
Securenet	CM711	NA	NA	Optional	Requires Compatible Encryption Option
ASTRO	CM712	NA	NA	Optional	VSELP Vocoder
Project 25	CM713	NA	Standard	Optional	IMBE Vocoder
Project 25 Trunking	CM714	NA	Optional	Optional	Support for 9600 Baud CC trunking and OBT
Encryption Options – Select any combination					
DES-OFB	CM702	NA	Optional	Optional	Compatible w/Project 25
AES	CM707	NA	Optional	Optional	Compatible w/Project 25
DES, DES-XL	CM708	NA	Optional	Optional	Compatible w/Project 25, ASTRO, SECURENET
DVP-XL	CM709	NA	Optional	Optional	Compatible w/Project 25, ASTRO, SECURENET
DVI-XL	CM710	NA	Optional	Optional	Compatible w/Project 25, ASTRO, SECURENET
Accessories Supplied – May also be ordered separately					
Oscilloscope Probe	RTL4011A	*	*	*	
BNC to N Adapter	5884300A98	*	*	*	
DC Power Connection Kit	RPX4097A	*	*	*	
Telescoping Antenna	RTA4000A	*	*	*	
Microphone	HMN1056D	*	*	*	
Signal Generator Termination (50 ohm)	5880386B73	*	*	*	
Operators Manual		*6880386B72	*6880309J83	*6880309F17	
Power Cord	3080397A62	*	*	*	
Spare RF Fuses	GG6530277C002	*	*	*	
BNC RF 'T'	0982578B01			*	Required for cable fault testing
RF Detector Probe	RLN4748A			*	Required for cable fault testing
Additional Accessories – Order Separately					
Battery Pack	RPN4000A				Affixes to back of unit
Canvas Carrying Case	1580357B77				Protects unit when used in the field
Hard sided transit case	A001				Shipping protection
Hard sided transit case w/wheels	A002				Shipping protection
Isolation transformer for baseband output	0180302E83				Isolate output signal from chassis ground
Isolation transformer for baseband input	0180302E82				Isolate input signal from chassis ground
RF Detector probe with 50 ohm termination	5880345B96				
Programmers Reference Manual	6880309E55				Includes RS232 and IEEE 488.2
Service Manual on CD	RLN5237A				

NA – Option Not Available
****Accessory Included with model***

Service, maintenance and technical support

For support on General Dynamics test equipment contact:

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