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
C4 Systems
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.

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 family has a solution for your radio communication testing needs

**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. And now, the R2600 comes standard with a high performance spectrum analyzer with markers, freeze, peak hold and max hold features.

**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 comes standard with DES-OFB Project 25 compatible Type III encryption. The R2625 also contains Project 25 diagnostic test capability, and can be optionally expanded to include the following:
- Tracking Generator
- Cable Fault Testing
- Programmable Test Set-Up Memory
- Project 25 Compatible Type III Encryption (AES, DES-XL, DVP-XL, DVI-XL)
- Project 25 Trunking
- Automated Test and Alignment

**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

**Automated Test and Alignment**
AutoTest is an automated test and alignment software application that runs on a standard PC. The PC automatically controls both the radio and the systems analyzer to alleviate most operator intervention. AutoTest performs all recommended factory alignment procedures, in addition to critical transmitter and receiver performance tests – in a fraction of the time it takes to perform manually.

*P25 conventional equipped R2670*
## Standard System Features

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<thead>
<tr>
<th>Feature</th>
<th>Description</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>High Performance Spectrum Analyzer</td>
<td>The built-in High Performance 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 High Performance Spectrum Analyzer 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.</td>
<td>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.</td>
</tr>
<tr>
<td>Terminated RF Wattmeter</td>
<td>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.</td>
<td>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.</td>
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## Standard System Features – continued

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<tr>
<td><strong>Programmable Test Memory</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Relative Signal Strength Meter</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>RF Scan/RF Counter Function</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Duplex</strong></td>
<td>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 2.5 kHz steps are keypad-selectable.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Tracking Generator (standard in R2670; optional in R2600 and R2625)</strong></td>
<td>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.</td>
<td>Diagnosis and adjustment of critical receiver front ends, IFs, helical filters, cavities, combiners and duplexer can be made in a few minutes, quickly and easily with the flexibility of a tracking generator at your fingertips.</td>
</tr>
<tr>
<td>Feature</td>
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<tr>
<td><strong>Signaling Simulator:</strong>  <strong>Encoder and Decoder</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>General Purpose &amp; Modulation Oscilloscope</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>AM, FM Signal Generator</strong></td>
<td>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.</td>
<td>In addition to reducing receiver test time, this flexible, self-calibrating signal generator is complemented by the simultaneous display of all necessary control information.</td>
</tr>
<tr>
<td><strong>Off-the-Air Sensitive Receiver</strong></td>
<td>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.</td>
<td>This feature reduces service costs by enabling frequent preventive maintenance parameter checks for system degradation or interference identification without leaving the shop.</td>
</tr>
<tr>
<td><strong>Electronic Software Updates</strong></td>
<td>High-Speed serial port and flashable memory permit programming firmware updates from an external PC.</td>
<td>Quick and easy access to future software updates.</td>
</tr>
<tr>
<td><strong>Cable Fault</strong> (standard in R2670; optional in R2600 and R2625)</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>RS-232/Serial Interface</strong> (standard) IEEE-488-2 Interface (optional)</td>
<td>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.</td>
<td>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.</td>
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## SMARTNET/SmartZone Option

(Available on R2670 only)

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<tr>
<th>Feature</th>
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<tbody>
<tr>
<td><strong>Dynamic Call Testing of Subscriber Radios</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Closed Cover Measurements</strong></td>
<td>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 &quot;live&quot; call is maintained. Radio ID information is decoded in either hex or decimal format.</td>
<td>You can verify radio specification performance and programming quickly and easily without opening or removing the radio to activate a special test mode.</td>
</tr>
<tr>
<td><strong>Dedicated Trunking Screens</strong></td>
<td>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.</td>
<td>This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance.</td>
</tr>
</tbody>
</table>
## Project 25 Conventional Test Option

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

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<tr>
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<tbody>
<tr>
<td><strong>Voice Mode System Testing</strong></td>
<td>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.</td>
<td>This feature allows you to verify operation and system compatibility under actual operating conditions for increased confidence of proper system performance.</td>
</tr>
<tr>
<td><strong>Bit Error Rate (BER) Testing</strong></td>
<td>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.</td>
<td>This testing provides an accurate, quantitative measurement of modulation quality and overall system performance.</td>
</tr>
<tr>
<td><strong>Dedicated Test Screens</strong></td>
<td>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.</td>
<td>This feature makes testing easier, more efficient and robust by allowing operator specified values to be tested.</td>
</tr>
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</table>
### Project 25 Trunking Test Option

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

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<tr>
<td><strong>Dynamic Call Testing of</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Subscriber Radios</strong></td>
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<tr>
<td><strong>Closed Cover Measurements</strong></td>
<td>Measurements can be made while a simulated 'live' call is maintained with the radio under test.</td>
<td>This affords the user greater diagnostic capability to ensure proper radio operation with just a single RF connection to the radio.</td>
</tr>
<tr>
<td><strong>Full Duplex Test of Base</strong></td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Station Repeaters</strong></td>
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<tr>
<td><strong>Bit Error Rate (BER) Testing</strong></td>
<td>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.</td>
<td>This testing provides an accurate, quantitative measurement of modulation quality and system performance.</td>
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</table>
### ASTRO Test Option
(Optional in R2670; not available in R2600 and R2625)

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<tbody>
<tr>
<td><strong>Voice Mode System Testing</strong></td>
<td>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.</td>
<td>This feature allows you to verify operation and system compatibility under actual operating conditions for increased confidence of proper system performance.</td>
</tr>
<tr>
<td><strong>Bit Error Rate (BER) Testing</strong></td>
<td>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.</td>
<td>This testing provides an accurate quantitative measurement of modulation quality and overall system performance. The Duplex mode supports loop-back testing.</td>
</tr>
<tr>
<td><strong>Dedicated Test Screens</strong></td>
<td>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.</td>
<td>This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance margin.</td>
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### Project 25, ASTRO and SECURENET Common Features

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<tr>
<td><strong>Encryption Test Option</strong></td>
<td>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.</td>
<td>This feature allows verification of the proper operation and system compatibility using actual encryption algorithms.</td>
</tr>
<tr>
<td><strong>Baseband Audio Scope Display</strong></td>
<td>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.</td>
<td>This feature provides greater assurance of proper system operation through its graphic display of voice or tone modulation.</td>
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## SECURENET Test Option

Available only in R2670

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<tr>
<td><strong>Voice Mode System Testing</strong></td>
<td>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.</td>
<td>This feature allows verification of the proper operation and system compatibility using actual encryption algorithms.</td>
</tr>
<tr>
<td><strong>Bit Error Rate (BER) Testing</strong></td>
<td>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.</td>
<td>This testing provides an accurate, quantitative measurement of modulation quality and overall system performance. Loop-back testing is supported while operating in Duplex mode.</td>
</tr>
<tr>
<td><strong>Dedicated Test Screens</strong></td>
<td>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.</td>
<td>This feature makes testing easier and more efficient. It also provides quantitative RF measurements to ensure proper system performance margin.</td>
</tr>
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</table>

### Specifications
**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

**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

**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 and pre-emphasis.
- Harmonics: -20 dBc

**FM MODULATION**
- Deviation: 99.5 kHz
- Accuracy: 5% of setting ±25 Hz @ 1 kHz (NB)
- 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
- Frequency Range: 300 to 3000 Hz

**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
- Accuracy: ±5% plus peak residual FM
- Frequency Response: Selectable per the following: 300 Hz, 3 kHz, 20 kHz
- Output Level: 0.8 V peak per 1 kHz peak Deviation in Narrowband and per 10 kHz Deviation in Wideband
- Demodulation: 5 Hz, 300 Hz, 3 kHz
- 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: 300 Hz, 3 kHz, 20 kHz
- Output Level: 0.8 V peak per 10% AM modulation
- Output Impedance: 100 ohms nominal

**PHASE MODULATION MEASUREMENTS**
- Demod Range: Narrowband = 1 radian
- Output Impedance: 100 ohms nominal
- Accuracy: ±5% at 1 kHz, ±7.5% 300 Hz to 3.5 kHz with de-emphasis filter cornered at 100 Hz

**TRUNKING (OPTIONAL FEATURE)**

**Signalizing Types:** SMARTNET, SmartZone (Type I, Type I EP II, Type III), ASTRO (VSELPI/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, False Call Alert.
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
  - 850-868 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-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

- **Test Measurement Display:** Call sequence status indicator
  - WACN ID, System ID, UID, GID, WUID, GUID

- **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:** 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, DVE-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 dBm
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 μsec, 50 μsec, 100 μsec, 200 μsec, 500 μsec, 1 μsec, 2 μsec, 5 μsec, 10 μsec, 20 μsec, 50 μsec, 100 μsec, 200 μsec, 500 μsec, 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
AC Voltage Ranges: 1.0 V, 10.0 V, 100.0 V full scale
DC 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
Period Counter: 5 Hz to 50 kHz plus Auto Tune
Range: 5 Hz to 20 kHz
Input Level: 0.1 v RMS minimum input level
Resolution: 0.1 Hz, 1 Hz and 10 Hz
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

TONE SEQUENCE DECODE
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 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)
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, including DES-OFB encryption
- 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)**

<table>
<thead>
<tr>
<th>Standard Options</th>
<th>Model Availability</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tracking Generator</strong></td>
<td>RLN5069</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Cable Fault</strong></td>
<td>RLN4308</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Programmable Test Setup Memory</strong></td>
<td>RLN4485</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>IEEE 488.2 Remote Interface</strong></td>
<td>RLN4329</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>C-Message Filter with 600 ohm load</strong></td>
<td>RLN4034</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>CCITT Filter with 600 ohm load</strong></td>
<td>RLN4361</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Phase Mod/Demod</strong></td>
<td>RLN4484</td>
<td>Optional</td>
</tr>
</tbody>
</table>

**Analog Trunking Options – Select Only One**
- SMARTNET/SmartZone with ASTRO trunking
  - RLN4498: NA NA Optional
  - 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**
- Securenet: CM711 NA NA Optional Requires Compatible Encryption Option
- ASTRO: CM712 NA NA Optional VSELP Vocoder
- Project 25 with DES-OFB encryption: CM713 NA Standard Optional IMBE Vocoder Support for 9600 Baud CC trunking and OBT. Requires CM713
- Project 25 Trunking: CM714 NA Optional Optional

**Encryption Options – Select any combination**
- 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: 5884900A98 + + *
- DC Power Connection Kit: RXP4907A * + *
- Telescoping Antenna: TSBN * + *
- 90 Degree BNC for Antenna: M55339/14-003 + + *
- Microphone: HMN1056D + + *
- Signal Generator Termination (50 ohm): 5880386B73 + + *
- Operators Manual (on CD): *6880386B72 *6880386B73 *6880386B74
- 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
- Isolation transformer for baseband input: 0180302E82 Isolate input signal from chassis ground
- RF Detector probe with 50 ohm termination: 5880345B96 from chassis ground
- Programmers Reference Manual: 6880309E55 Includes RS232 and IEEE 488.2
- Service Manual on CD: RLN5237A

*Accessory Included with model*

**NA – Option Not Available**
Service, maintenance and technical support

For support on General Dynamics test equipment contact:

**United States and Canada:**
Motorola Test Equipment Service Center
2216 Galvin Drive
Elgin, IL 60123
Phone: 800-323-6967

**Europe, the Middle East, and Africa:**
Motorola Test Equipment Service Center
Heinrich-Hertz Strasse 1
65232 Taunusstein-Neuhof
Phone: +49-6128-700

**Asia and the Pacific Rim (excluding Japan):**
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Fax: +61-3-9847-7755

Service is also available in other areas around the world. Please contact your local General Dynamics sales or service representative for the facility nearest you.