FREEDOM

COMMUNICATIONS SYSTEM ANALYZER FAMILY

NOW PART OF ASTRONICS TEST SYSTEMS

OUR TRADITION OF INNOVATION

Our heritage in LMR test equipment dates to the late 1970's and the first all-in-one radio test solution: The R2001. From then to now, our products have been the unquestioned benchmark in LMR test equipment. The R2600 series, introduced in 1989, was the industry standard for nearly a quarter-century. We followed up a few years later with the R2670 - the first test set supporting APCO Project 16 and Project 25. And in 2004, we invented the concept of automated radio testing and alignment with our revolutionary "AutoTune" option for Motorola radios.

In 2009, we introduced the first portable, software-defined LMR test set - the R8000, now in its third generation. In 2016 we achieved another industry first with the R8100, the only full-featured communications analyzer with an internal battery. We followed this up with the R8600 Radio Test Hub in 2017. The R8600 is the only test instrument designed for the rigors of a 24/7 radio production environment.

In 2019 FREEDOM introduced the most transformative product the industry has ever seen: The R9000 6GHz Communications System Analyzer. The R9000 provides the full capabilities of an LMR service monitor but also includes a Vector Network Analyzer and the RF bandwidth to support the FirstNet nationwide public safety LTE network. With the R9000, FREEDOM ushers in The New World of Communications Test Equipment.

1979
The R2001 – the industry's first LMR service monitor – is introduced

1989
R2600 - 2nd generation platform – is introduced

1992
R2670A introduced. The R2670 was the first analyzer to test both APCO Project 16 and Project 25.

2000
R2670B introduced – the first analyzer with full color LCD display.

2004
"AutoTest" – The first automated test and alignment software for LMR radios – is introduced.

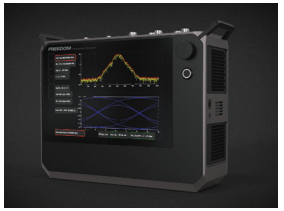
2009
R8000A introduced – The first fully portable, software-defined LMR test set.

2012
R8000B introduced. The first LMR service monitor with lab grade spectral purity.

2016
R8000C and R8100 Introduced. R8100 is the first full features LMR service monitor with an internal battery

2017
R8600 Introduced. The first LMR test set designed for 24/7 manufacturing operation.

2018
Process Automation Toolkit Introduced. The first product to bring customized automated testing to non-programmers.

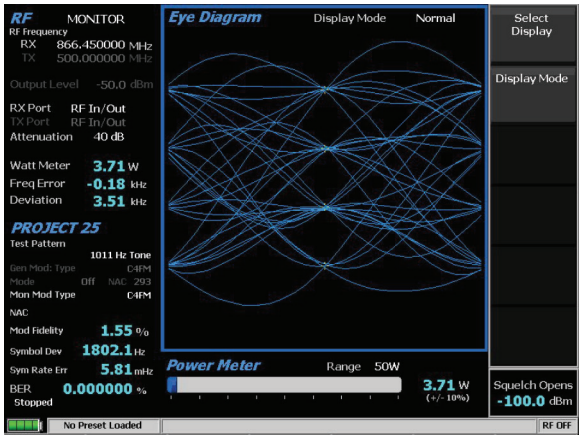


2019
R9000 introduced: the first LTE capable radio test instrument Includes 6GHz capability, multitouch display and standard VNA

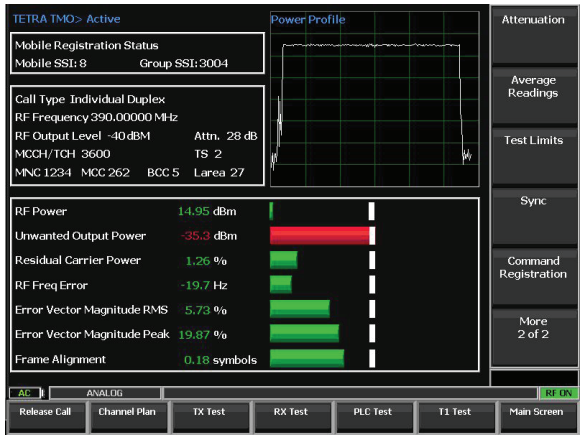
THE R8100 AND R8000:
THE ONLY CHOICE FOR DIGITAL LMR TESTING AND ANALYSIS

The R8000 and R8100 comprehensively support every major LMR protocol. Our test suites for both P25 Phase 1 and 2 are fully compliant with the TIA/EIA specification and employ every modulation and test pattern called out in the specification. And our P25 Phase 1 trunking option allows the test set to emulate a base station and trunking controller.

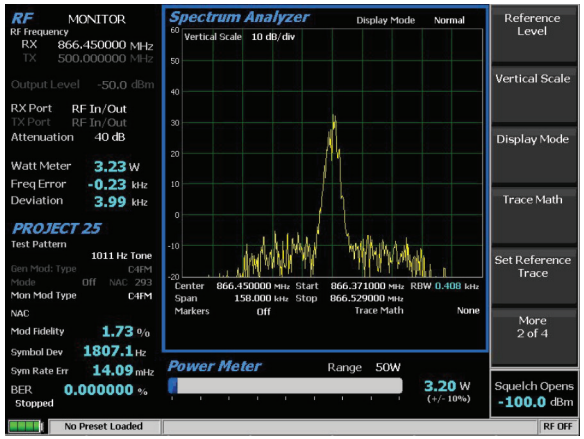
Our analyzers also lead the way in testing the new 6.25kHz and 6.25kHz channel equivalent technologies. Our NXDN™ and DMR test modes fully conform to the applicable specifications. NXDN "Type C" Trunking simulates the functions of an NXDN central controller. Comprehensive TETRA and dPMR test options are also offered.



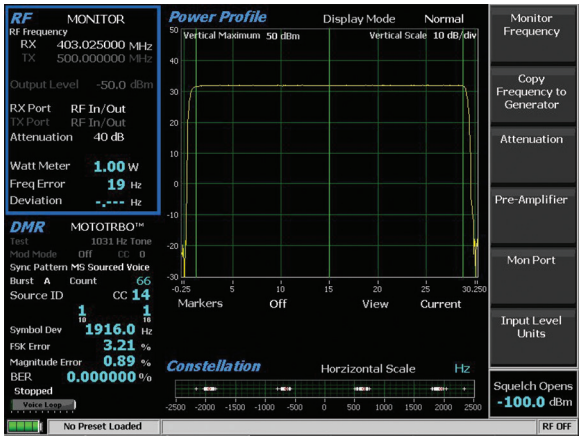
APCO P25 Phase1 Eye Diagram



TETRA TMO



APCO P25 Phase 1 Trunking



DMR Power Profile

APCO P25
THE INDUSTRY'S MOST COMPREHENSIVE TEST SOLUTION

Whether your system is P25 Phase 1 conventional, Phase 1 trunked, or Phase 2, FREEDOM has the total solution. Our P25 options generate and receive every test pattern called out in the P25 standard. Hear recovered audio with our Phase 1 vocoder option. Choose from multiple available graphical displays: eye diagram, distribution plot, constellation or power profile Includes the most complete set of P25 measurements available in the market: Frequency Error, Deviation, Power Level, Modulation Fidelity, Symbol Rate, Symbol Deviation, and more.

Our P25 Trunking option simulates a trunking controller with all the control and voice channel protocols needed for P25 radio service. All standard-compliant test patterns for Bit Error Rate (BER) testing are included, as are all compliant modulations.

TETRA
UNPARALLELED TEST CAPABILITY FOR EVERY TETRA FORMAT

FREEDOM analyzers boast an unparalleled suite of test capabilities: TMO and DMO subscriber testing, comprehensive T1 testing and base station monitoring. Whether you are monitoring system performance or doing maintenance and repair of TETRA handsets, FREEDOM has a test option that meets your needs. Red/Green Pass/Fail bars provide quick visual confirmation that all radio parameters are within specifications. Our TMO test option measures RF Power, Unwanted Output Power, Residual Carrier Power, Frequency Error, EVM (RMS and Peak), Frame Alignment and much more.

DMR/NXDN

For nearly 10 years FREEDOM has offered the most complete set of tests available for the rapidly growing DMR and NXDN technologies.

Our DMR option tests any repeater or handset compliant with the ETSI DMR Tier 2 conventional radio transmission protocol. Available graphical displays include spectrum analyzer, power profile and constellation. Bit Error Rate (BER) tests can also be run using manufacturer provided radio programming software.

Our DMR repeater test option enables the technician to test a live repeater without putting the repeater in test mode, eliminating the need to take down the system for maintenance.

Our NXDN option provides a suite of test functions compliant with the NXDN Common Air Interface (CAI) standard. These include power, Frequency Error, Symbol Deviation, Modulation Fidelity (FSK Error), Radio Access Number (RAN), audio/test patterns, and Bit Error Rate (BER). The option also features an Eye Diagram with graphical representation of the NXDN signal.

Also available is an NXDN Type C Trunking option that simulates the functions of an NXDN central controller.

FREEDOM's proprietary Voice Loopback function enables verification of a radio's end-to-end operation and operates with both DMR and NXDN test options.

POSITIVE TRAIN CONTROL (PTC)

FREEDOM is the only test equipment manufacturer offering test solutions for both major PTC protocols: PTC-ACSES used by commuter railroads and PTC-ITCR used by long-haul carriers.

Working with radio manufacturers, we have developed an extensive portfolio of tests to measure the integrity of signals generated and received by PTC radios.

For more detail about testing PTC radios, visit
www.ptcradiotest.com

AutoTune™
AUTOMATED RADIO TEST AND ALIGNMENT

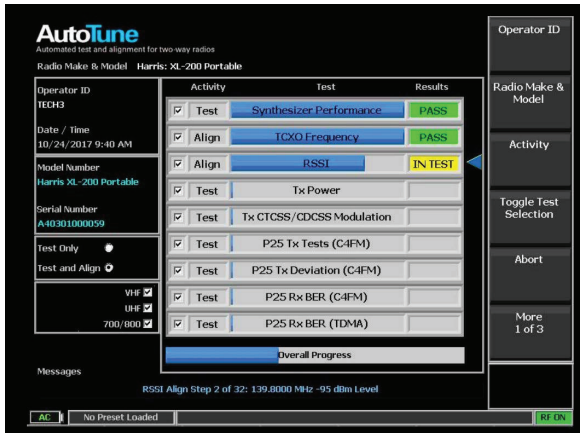
Our AutoTune option performs all recommended factory test and alignment procedures in a fraction of the time needed to perform them manually. Just select your radio model and connect as shown on the unit, choose the tests and alignments you wish to perform, then enter your operator ID and press the “start button.”

AutoTune is available for every major LMR radio brand

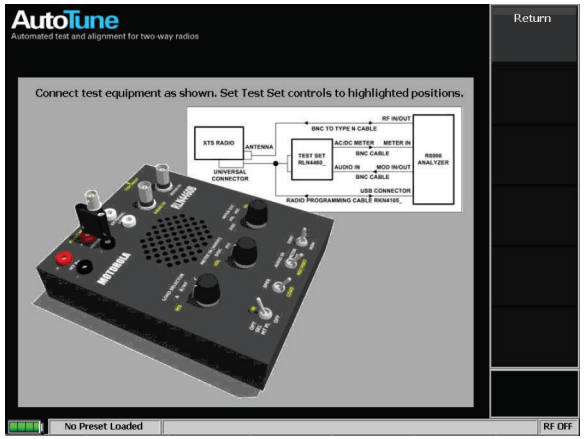
BENEFITS

- Test time reduced by over 80%
- Consistent manufacturer specified alignments among radios
- Accurate and repeatable test results
- Comprehensive test reports show before & after readings, time, date and operator identification
- Pass/Fail indicators flag radio defects
- Little or no technical expertise required
- Results are stored on the unit and can be exported to a USB drive for analysis with PC spreadsheet software

The test set automatically reads key radio information such as model number and serial number, and makes the measurements and alignments needed to bring the radio within factory specifications. Within minutes you have a complete record of your test session stored on the unit in comma delimited form for quick and easy recall. Over time you will build a complete test history for every radio – ideal for large fleets with formal Preventative Maintenance programs. Test reports can be conveniently viewed on the unit or exported for further analysis using spreadsheets and other data manipulation programs.



Harris XL-200P AutoTune Status Screen



XTS AutoTune Setup Diagram

PROCESS AUTOMATION TOOLKIT ("PAT")
THE NEXT FRONTIER IN AUTOMATED RADIO TESTING

FREEDOM's revolutionary Process Automation Toolkit, or PAT, transforms radio service and brings automated testing within the reach of every technician. With PAT, virtually every function of the R8100/R8000 analyzer can be incorporated into a test script using a simple point-and-click interface. Test modes, functions and protocols can be automated with a few mouse clicks!

No longer does automated radio testing require a dedicated prorgammer with in-depth knowledge of a particular programming language. PAT allows you to create and store virtually any test script in a few minutes and execute the test in seconds.

Scripts can be concatenated and decision operators such as IF/THEN/ELSE, GOTO, <>, etc. can be used to easily create pass/fail thresholds and repeat loops.

THE R8600
RADIO TEST HUB

The R8600 Radio Test Hub is designed to meet the demanding requirements of RF production environments. Able to withstand 150 Watts of continuous RF power input, the R8600 was explicitly engineered to provide a cost-effective solution for 24/7 manufacturing use. Once deployed, it requires minimal operator intervention beyond making the physical RF connections.

The Radio Test Hub provides reliable, cost-effective, easy-to-operate testing for manufacturers of LMR radios and other RF devices. It is also ideal for other customers with intense automated testing requirements.

It operates without an embedded display to make efficient use of manufacturing rack space in an ATE environment, and features an expansive suite of scripting options including our proprietary Process Automation Toolkit (PAT) feature and our Remote Front Panel application.

Powered by our Software Defined Radio architecture, the R8600 is ideal as both an upgrade to enable testing of modern digital radio technologies and for the production of analog radios and RF devices.

Two units can fit side-by-side in a standard 19" rack. The units stand less than 4RU high.

Key R8600 Specifications:

Weight:	18 lbs.
Dimensions:	6.2" H x 8.7" W x 17.3" D
Operating Temperature:	0º to 50ºC
Shock and Vibration Rating:	MIL-PRF-28800F, Class 3
TCP/IP Command Methods:	TCP/IP Command Methods: Process Automation Toolkit (PAT) 8920 Emulation R8000 scripting language Remote control utility (provided)
RF Input:	RF Input 150W continuous (24/7)
Timebase Stability:	Aging: ±0.1ppm / year Temperature:±0.01ppm
Frequency Range:	250kHz - 1GHz; Optional to 3GHz
Displayed Average Noise Floor:	-140dBm
Residual FM:	Residual FM: 4Hz, 300Hz to 3kHz (<1GHz) 5Hz, 300Hz to 3 kHz (> 1GHz)
Power Meter Range:	0.1W - 150W across all frequencies
Warranty:	3 Years

ACCESSORIES INCLUDED WITH EVERY UNIT:

- Antenna
- Microphone
- Oscilloscope Probe
- Power Cord & AC Adapter
- Internal Lithium Ion Battery (R8100 only)
- 24V Car Plug Adapter

ADDITIONAL ACCESSORIES SOLD SEPARATELY:

- R8-SC Soft carrying case
- R8-GC Protective Glove Case
- R8-TGC Transit Case With Foam Molding for Glove Case.
- BATT8100 Spare internal battery for R8100
- CHRG8100 Charger for R8100 battery
- R8-VSWR Bridge Kit
- R8-FT7 Field Test 7 Coverage Mapping Kit

Transit case with wheels

Soft carrying case

Spare internal battery and charger for R8100

VSWR Bridge Kit

THE R9000
THE NEW WORLD OF COMMUNICATIONS TEST EQUIPMENT

We invented the LMR test set and have led the way in new technology for the industry every step of the way. FREEDOM continues that tradition with the introduction of our **R9000 6GHz LTE-Ready Communications System Analyzer.**

With a standard Vector Network Analyzer (VNA), real-time Spectrum Analyzer, color multi touch display, 6GHz frequency range and full suite of LMR test capabilities, the R9000 represents a quantum leap in communications testing. The R9000 is the only LMR test instrument with the ability to process the instantaneous signal bandwidth required for LTE/FirstNet.

The R9000 is available in both top and front connector access configurations.

Key Features:

- 6GHz Frequency Range
- Fully portable (less than 17 pounds) targeting better than 4 hour battery life
- Full-color multi-touch display
- LTE capable (25MHz instantaneous bandwidth; 160MHz in future releases)
- Vector Network Analyzer (VNA)
- Interference Analyzer
- Industry-best spectral purity (-110 dBc/Hz @20khz offset)
- Configurable connector access (front and top access models available)

Basic Options:

- Frequency Range from 10MHz to 6GHz.
- Analog modulation and demodulation (AM, FM and Single SideBand).
- 50 W continuous input power and up to 150W peak input power.
- Output level to -130 dBm
- Spectrum Analyzer
- Signal Generator
- Oscilloscope
- Vector Network Analyzer
- Integrated Audio Generators
- I/Q Recorder and Playback
- Audio Quality Tests (SINAD, THD)

Options:

- All major digital LMR protocols: P25 Phases 1 &2, TETRA, DMR, NXDN and dPMR
- Interference Analyzer
- LTE test options
- AutoTunes: Test and Alignment

ORDERING INFORMATION:

MODEL	DESCRIPTION MODEL
R8100	Ultra-Portable Communications System Analyzer
R8000C	Communications System Analyzer, 1GHz
R8000C-1GHz Premier	1 GHz Premier Package w/ highlighted options
R8000C-3GHz Premier	3 GHz Premier Package w/ highlighted options

Data Sheets including specifications can be found at www.freedomcte.com

PART NUMBER	DESCRIPTION	R8100	R8000C	R8000C 1GHZ PREMIER	R8000C 3GHZ PREMIER	R8600
R8-TG	Tracking Generator	✓	Optional	✓	✓	Optional
R8-CF	Cable Fault Locator	✓	Optional	✓	✓	Optional
R8-ESA	Dual Display/Enhanced Spectrum Analyzer	✓	Optional	✓	✓	Optional
R8-REMOTE	Remote Front Panel	Optional	Optional	✓	✓	✓
R8-PAT	Process Automation Toolkit	Optional	Optional	Optional	Optional	✓
R8-3G	3GHz Capability	Optional	Optional	Optional	✓	Optional
R8-DMR	DMR Test	Optional	Optional	Optional	Optional	Optional
R8-P25	P25 Phase 1 Test	Optional	Optional	Optional	Optional	Optional
R8-P25TRNK	P25 Phase 1 Trunking Test	Optional	Optional	Optional	Optional	Optional
R8-P25_VOC	P25 Phase 1 Vocoder	Optional	Optional	Optional	Optional	Optional
R8-P25_II	P25 Phase 2 Test	Optional	Optional	Optional	Optional	Optional
R8-NXDN	NXDN Test	Optional	Optional	Optional	Optional	Optional
R8-NXDNTYPC	NXDN Type C Trunking Test	Optional	Optional	Optional	Optional	Optional
R8-TETRA_TMO	TETRA TMO Subscriber Test	Optional	Optional	Optional	Optional	Optional
R8-TETRA_DMO	TETRA DMO Subscriber Test	Optional	Optional	Optional	Optional	Optional
R8-TETRA_BST1	TETRA Base Station T1 Test	Optional	Optional	Optional	Optional	Optional
R8-TETRA_BSM	TETRA Base Station Monitoring	Optional	Optional	Optional	Optional	Optional
R8-DPMR	dPMR Test	Optional	Optional	Optional	Optional	Optional
R8-PTC-ITCR	PTC Test Option	Optional	Optional	Optional	Optional	Optional
R8-AT_XTS	AutoTune for Motorola XTS2500/5000	Optional	Optional	Optional	Optional	Optional
R8-AT_XTL	AutoTune for Motorola XTL Series Mobiles	Optional	Optional	Optional	Optional	Optional
R8-AT_APX	AutoTune for Motorola APX Mobiles & Portables	Optional	Optional	Optional	Optional	Optional
R8-APX_8000	AutoTune for Motorola APX8000/8500	Optional	Optional	Optional	Optional	Optional
R8-AT_TRBO	AutoTune for MOTOTRBO Mobiles & Portables	Optional	Optional	Optional	Optional	Optional
R8-AT_KWNX	AutoTune for Kenwood NX Series	Optional	Optional	Optional		Optional
R8-AT_XG75	AutoTune for Harris XG-75 Mobiles & Portables	Optional	Optional	Optional	Optional	Optional
R8-AT_XM100	AutoTune for Harris XM100 Radios	Optional	Optional	Optional	Optional	Optional
R8-AT_XL200	AutoTune for Harrix XL200 Radios	Optional	Optional	Optional	Optional	Optional
R8-AT_HYTERA	AutoTune for Hytera DMR Radios	Optional	Optional	Optional	Optional	Optional
BATT8100	Internal Lithium Ion Battery	✓	N/A	N/A	N/A	N/A
BATT8000	Battery Kit, Li-Ion with R8-HC	N/A	Optional	Optional	Optional	N/A
BATT- BP90	Spare Battery for R8000	N/A	Optional	Optional	Optional	N/A
CHRG8100	Charger for R8100 Battery	Optional	N/A	N/A	N/A	N/A
202907-01	External Lithium Ion Battery (North America)	N/A	Optional	Optional	Optional	N/A
202908-01	External Lithium Ion Battery (International)	N/A	Optional	Optional	Optional	N/A
R8-VSWR	VSWR Bridge Kit	Optional	Optional	Optional	Optional	Optional
R8-FT7	“Field Test 7” Coverage Mapping Kit	Optional	Optional	Optional	Optional	Optional
R8-GC	Protective "Glove Case" for R8100 or R8000	Optional	Optional	Optional	Optional	N/A
R8-HC	Protective “Glove Case” for R8000 Only	Optional	Optional	Optional	Optional	N/A
R8-SC	Soft Carrying Case	Optional	Optional	✓	✓	Optional
R8-TGC	Transit Case With Foam Molding For Glove Case	Optional	Optional	Optional	Optional	N/A
	Foreign Language Soft-key Support	✓	N/A	N/A	N/A	N/A
	MIL-PRF-28800F Class 3 Shock & Vibration Rating	✓	N/A	N/A	N/A	N/A
	Color Enhanced Display	✓	N/A	N/A	N/A	N/A
	Data Entry Capable Tuning Knob	✓	N/A	N/A	N/A	N/A
	Scalable Power Meter Bar Graphs	✓	N/A	N/A	N/A	N/A
R8-3Y	3 Year Service Plan (incl. 2 annual calibrations)	Optional	Optional	✓	Optional	Optional
R8-5Y	5 Year Service Plan (incl. 4 annual calibrations)	Optional	Optional	Optional	Optional	Optional

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ASTRONICS
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