Brochure

OneAdvisor 800 Wireless

All-in-One Installation
and Maintenance Test
Solution for GSM and
GSM-R network operation

The VIAVI OneAdvisor 800 is designed to help Railway Operators verify and troubleshoot radio access networks, such as GSM for Railway (GSM-R/ERTMS) for proper deployment and effective operation quickly and easily.

OneAdvisor 800 leverages a multi-functional, modular architecture that allows users the flexibility to address many test applications and different user groups, including:

- Traditional Radio sites; cover all test scenarios of any radio site including transmission lines, coaxial cable, antennas, fiber end-face inspection and fiber characterization
- GSM and GSM-R Signal Analysis, Ethernet testing, RF and EMF analysis – 4G and 5G are also supported, which will prove invaluable supporting testing of the upcoming Future Railway Mobile Communication System (FRMCS)

Key Test Functions Include:

- 100 MHz real-time persistence spectrum (9 kHz to 6 GHz)

- Over-the-Air RF spectrum, spectrogram, and persistence spectrum testing with 72 hr logging capability to effectively characterize intermittent interference signals

- Channel Scanner with route map to track RSSI and coverage of multiple carriers with different technologies

- Automatic Interference location finder when paired with the VIAVI InterferenceAdvisor®

- Interference hunting with triangulation when paired with the VIAVI AntennaAdvisor®

- Cable and antenna reflection tests, distance-to-fault, and cable loss

- 2-Port transmission mode for tuning of filters and duplexers

- Terminating and through type RF power sensor

- Optional fiber inspection and fiber validation including OTDR testing

OneAdvisor 800
Cable and Antenna Analysis

OneAdvisor 800
Realtime Persistence Spectrum
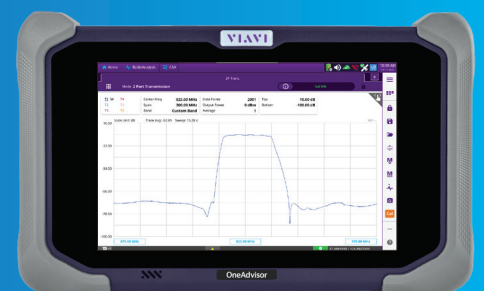
OneAdvisor 800
Two-Port Transmission

OneAdvisor 800 Expanded View with
Full-size Module

OneAdvisor 800 Expanded View with
Full-size and Half-size Modules

GSM and GSM-R Signal Analysis

The Global System for Mobile Communications (GSM) is a digital cellular standard that uses Time Division Multiple Access (TDMA) multiplexing scheme and Gaussian Minimum Shift Keying (GMSK) modulation.

VIAVI OneAdvisor 800 signal analyzer performs measurements using the methods and limits as defined in the 3GPP TS 51.021 Base Station System (BSS) equipment specification: Radio Aspects V8.9.0 (2003-06) and 3GPP TS 45.005 Radio Transmission and Reception (version 12.5.0, release 12) for GSM/GSM-R systems.

This instrument provides the following measurement functions for the validation of a GSM/GSM-R system:

- RF Analysis
    - Spectrum Analysis
    - Channel Power
    - Occupied Bandwidth
    - Spectrum Emission Mask (SEM)
    - Output RF Spectrum
    - Spurious Emissions
- Signal Analysis
    - Constellation
    - Power vs. Time (Slot)
    - Power vs. Time (Frame)
- Over The Air (OTA)
    - Channel Scanner
    - Frequency Scanner
    - Multipath Profile
    - Modulation Analyzer

The Over-the-Air (OTA) Analyzer function provides OTA measurements to quickly perform base station characterization. This measurement capability is especially useful for testing cell sites without interrupting service on those that are not easily accessible.

The Pass/Fail indicator helps you to determine base station performance easily.
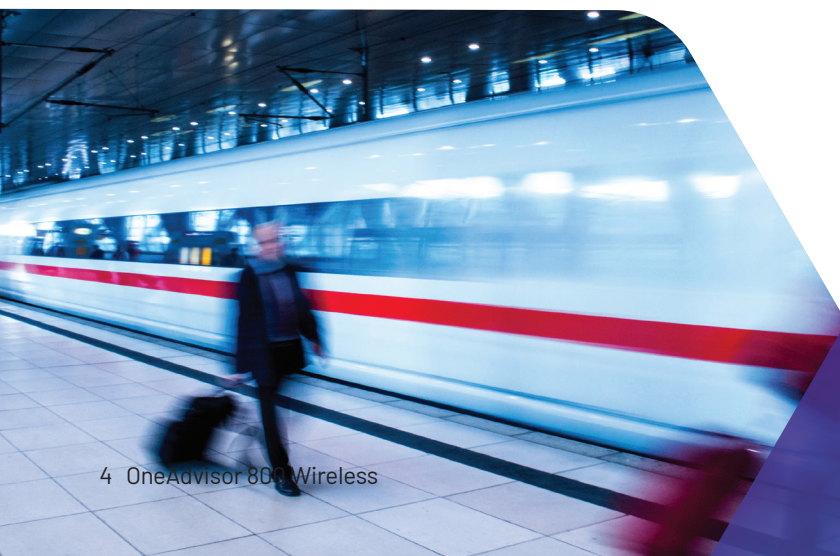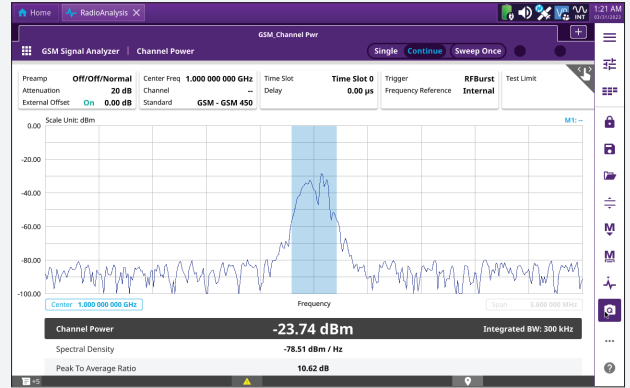
Channel Power and Occupied Bandwidth

Channel Power measures in-channel power of GSM/GSM-R systems. GSM uses dynamic power control to ensure that each link is maintained with minimum power. This gives two fundamental benefits: overall system interference is kept to a minimum and, in the case of mobile stations, battery life is maximized.

The Channel Power measurement determines the average power of an RF signal burst at or above a specified threshold value. The threshold value may be absolute, or relative to the peak value of the signal.

The purpose of the Channel Power measurement is to determine the power delivered to the antenna system on the RF channel under test. The instrument acquires a GSM/GSM-R signal in the time domain. The average power level above the threshold is then computed and displayed.


The Occupied Bandwidth is calculated as the bandwidth containing 99% of the transmitted power.

• Channel power measures the average power in a GSM frame in the frequency specified.
• Out of specification power indicates system faults.
• Channel power is expressed in dBm and Power spectral density in dBm/Hz.

Spectrum Emission Measurement

The measurement conditions for radiated and conducted spurious are specified separately in 3GPP TS 51.010 and 3GPP TS 51.02x series. In this measurement, the spurious transmissions (whether modulated or unmodulated) and the switching transients are specified together by measuring the peak power in a given bandwidth at various frequencies. The bandwidth is increased as the frequency offset between the measurement frequency and, either the carrier, or the edge of the MS or BTS transmit band, increases.
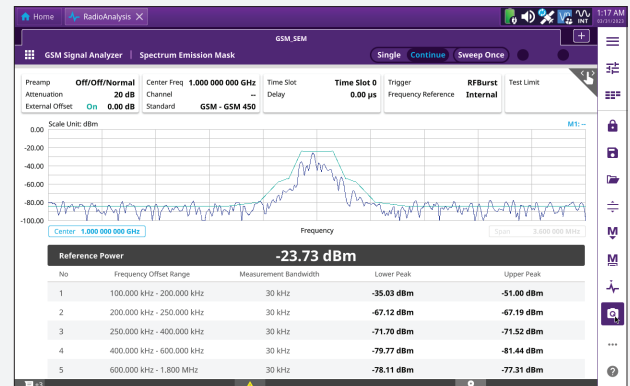

The effect for spurious signals of widening the measurement bandwidth is to reduce the allowed total spurious energy per MHz. The effect for switching transients is to effectively reduce the allowed level of the switching transients (the peak level of a switching transient increases by 6 dB for each doubling of the measurement bandwidth).

Constellation (Frequency and Phase Error)

Phase and frequency error are the measurements of modulation quality for GSM. Since GSM/GSM-R uses relative phase to transmit information, the phase and frequency accuracy of the transmitter are critical to the system performance and ultimately transmission coverage.

The phase error of the signal is measured by computing the difference between the phase of the transmitted signal and the phase of a theoretical signal. The VIAVI OneAdvisor 800 samples the transmitter output in order to capture the actual phase trajectory. This is then demodulated, and the ideal phase trajectory is mathematically derived. The error signal is obtained by subtracting one from the other.
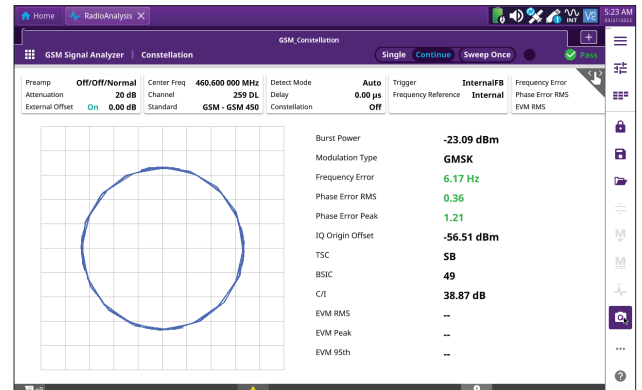
This measurement displays the frequency and phase errors numerically and graphically, showing the binary representation of the demodulated data bits in terms of Phase Error (RMS and Peak), Modulation Type, C/I, Frequency Error, TSC, Burst Power, I/Q Origin Offset and BSIC (Base Transceiver Station Identity Code), including EVM (RMS, Peak and 95th percentile).
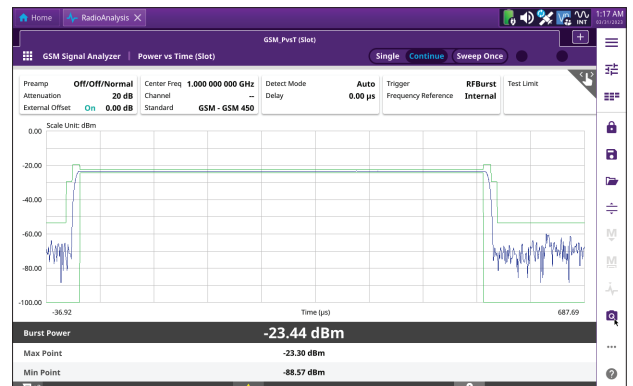
Power vs. Time (Slot and Frame)

Power vs. Time (P vs.T) measures the mean transmit power during the "useful part" of GSM bursts and verifies that the power ramp fits within the defined mask. It also lets you view the rise, fall, and "useful part" of the GSM burst.

GSM/GSM-R is a Time Division Multiple Access (TDMA) scheme with eight time slots, or bursts, per RF channel and by using the "Multi-Slot" function, up to eight slots in a frame can be viewed at one time.
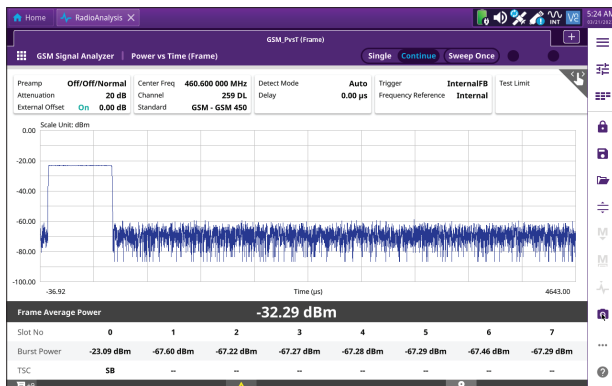

Power vs. Time Measurement (Frame view)

Power vs. Time Measurement (Slot view)

If the burst does not occur at exactly the right time, or if the burst is irregular, then other adjacent timeslots can experience interference. Because of this, the industry standards specify a tight mask for the fit of the TDMA burst.

OTA Channel Scanner and Frequency Scanner

The VIAVI OneAdvisor 800 supports a GSM Over the Air (OTA) measurement function to display channel power and related information up to 128 GSM down link signals, configured either by channel number or by channel center frequency values. This channel scanner can quickly identify improper power levels that affect network performance.

The transmitter performance can be made on a base station from the convenience of your vehicle without taking the base station out of service.
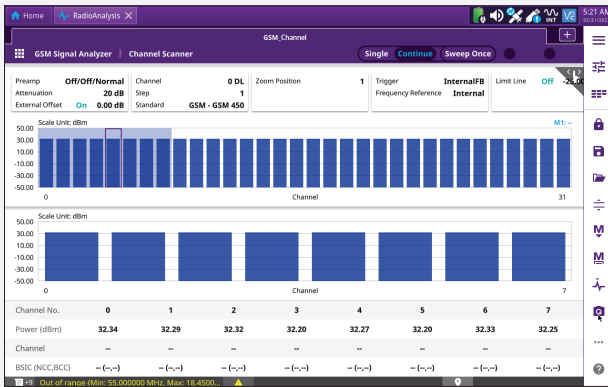
GSM OTA Channel Scanner
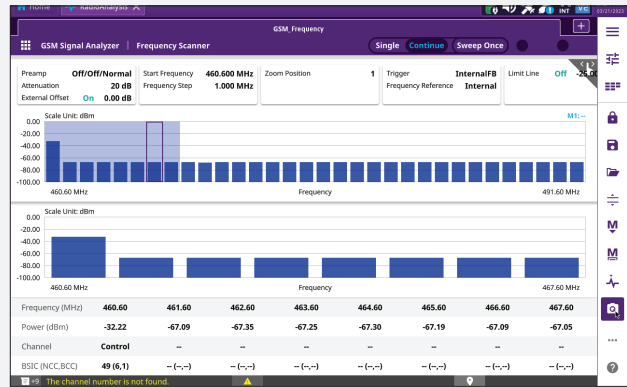
GSM OTA Channel Scanner

OTA Multipath Profile

The Multipath Profile enables the user to determine any RF environmental conditions of the testing area. The multipath profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings or being refracted through the atmosphere, differently from the main signal path.
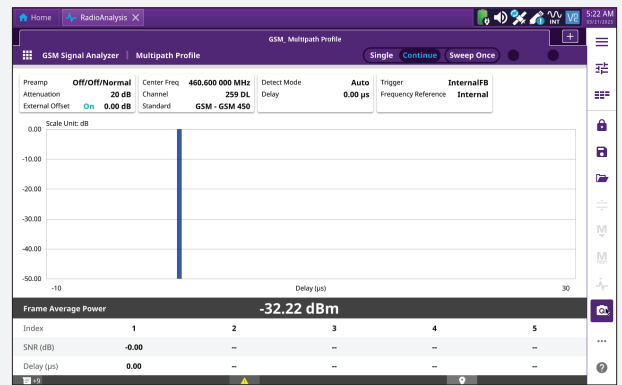
GSM OTA Multipath Profile

OTA Modulation Analyzer

The Modulation Analyzer provides a summary view with performance metrics for a given BSIC channel, including power variation over time of the Frame Average Power and C/I (Carrier over Interference ratio) values, to identify any potential issues of a GSM/GSM-R transmission system in case of suspecting variations of performance over extended periods of time.
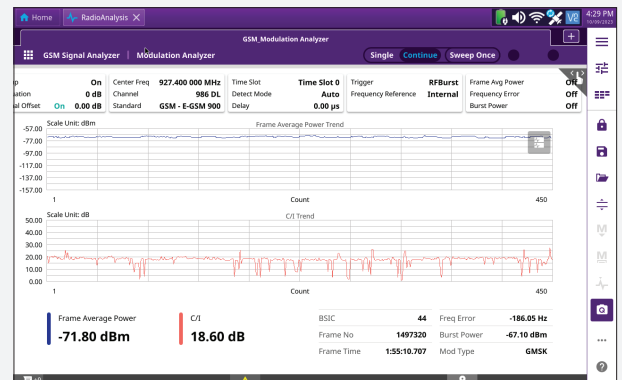

GSM OTA Modulation Analyzer

Real-Time Persistence Spectrum

OneAdvisor 800 real-time spectrum analysis (RTSA) performs persistence power measurements through a defined frequency range in high speed.

RTSA provides a comprehensive view of intermittent signals for a fast characterization of wireless signals and the identification of intermittent interference signals through its 2D and 3D spectrogram measurements that characterize signals in power, frequency, and time.
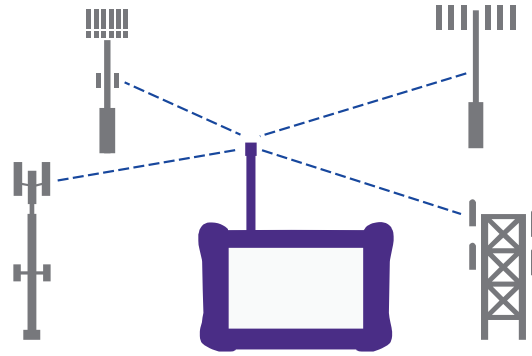
OneAdvisor 800 Real-time Spectrum Analysis – Persistent Spectrum
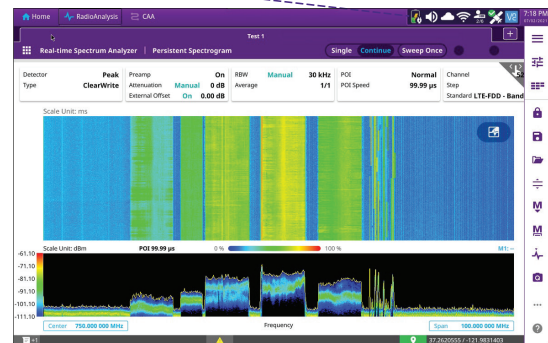
OneAdvisor 800 Real-Time Spectrum Analysis – Persistent Spectrogram

OneAdvisor 800 real-time spectrum analysis is ideal to properly characterize signals that have different communication profiles in time-domain, such as time division duplex (TDD) transmissions which in the same frequency channel allocates different timeslots for uplink and downlink signals which may be the case of GSM and GSM-R channels when using a combination of TDMA and FDMA transmission modes for user separation.

It also provides the ability to quickly identify the presence and location of all sorts of interfering signals, including those intermittent along with spurious and harmonics of any nature, due to its 100MHz of instantaneous analysis bandwidth.

VIAVI offers the possibility to log and save RF traces for extended periods of time that can be played back using a replay function in the instrument itself or post-processed offline using the OneViewer analysis and reporting software utility tool, which is Windows based.

Channel Scanner

The fast evolution of wireless technologies results in a coexistence of multiple wireless service offerings from different technologies including cellular and non-cellular.

A channel scanner is a spectrum analysis-based feature and is commonly used to scan the signal strength of various commercially available wireless channels.
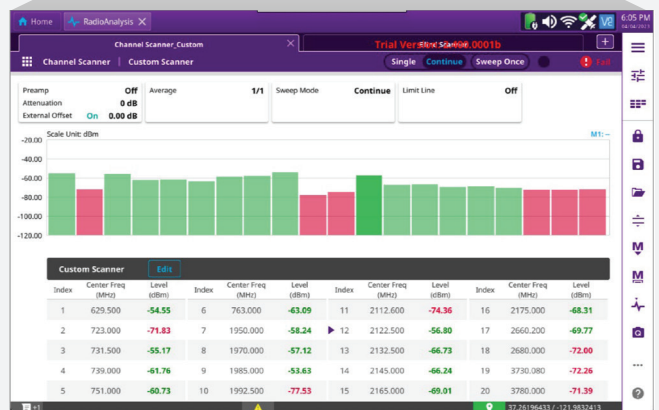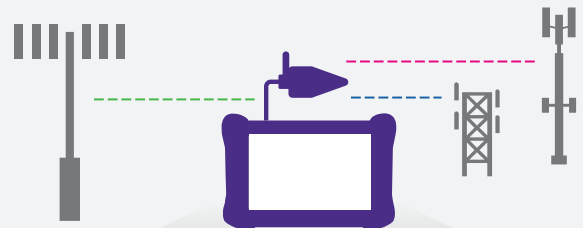
Key Scanner measurement functions:

• Channel Scanner

• Frequency Scanner

• Customer Scanner

• Route Map

Scanners

Depending on the allocation status of carriers to measure, user can choose one of the following and track the RSSI of multiple carriers up to 20.

• Channel Scanner allows user can track multiple carriers which are allocated with equal channel spacing and carrier bandwidth.

• Frequency Scanner allows user can track multiple carriers which are allocated with equal frequency spacing and carrier bandwidth

• Custom Scanner allows user can track multiple carriers which are allocated arbitrarily frequency steps and have different carrier bandwidth. It is useful for multi-tech network environment.

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OneAdvisor 800 Channel Scanner – Custom Scanner

Radio Access Outdoor Coverage and Route Map

Route Map allows to plot the RSSIs of each channel achieved with a custom scanner function on the map.

By displaying the measurement results in different colors according to the intensity of the RSSI, a user can easily compare the coverage for each carrier at each location. Full down key allows to check RSSI of multiple carriers at once and also can change the top three carrier as needed.

The VIAVI OneAdvisor 800 is equipped with route map test functions that perform coverage testing in real-time, by plotting signal strength, with different color schemes based on the received power level, in a geographical map obtaining location from GPS. The resulting route map shows coverage levels and dead-zones or areas with no impairments, such as call drops. This can be helpful for testing along rail track routes with poor QoS.

Coverage test data can be saved as comma separated files for post-processing analysis and also as a mapping test result in graphical format.

Radio Access Indoor Coverage

Indoor coverage can be affected by many factors, including reflections and attenuation caused by building materials including concrete walls, steel, and reflective windows, as well as for potential interfering signals that collide with signals of small cells or customer premise equipment.

Therefore, it is essential in the deployment of indoor networks to verify the spectrum is clear, verifying no other signals are present, avoiding service quality impairments; and subsequently the network is not causing interference to other networks.

The VIAVI OneAdvisor 800 can perform indoor coverage mapping in two different modes to obtain location and availability for indoor networks when testing coverage around train stations or test labs:

• Manual geo-location, assisted by user intervention selecting the physical location.

• Automatic geo-location, assisted by NEON Tracker and NEON Signal Mapper.
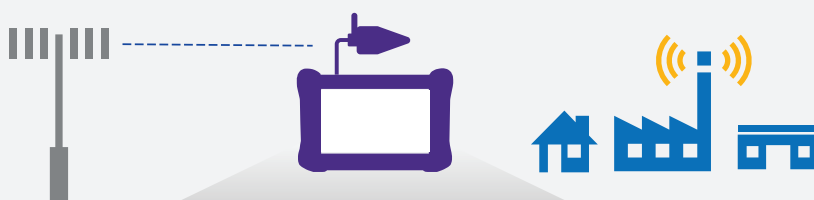
Wireless Interference Analysis

OneAdvisor 800 Interference Analyzer functions provides the most comprehensive measurement techniques to effectively identify, characterize and locate interfering signals.

Key interference analysis measurement functions:

• Received Signal Strength Indicator (RSSI)

• Interference Finder

• Radar Chart

• Interference Hunting

Received Signal Strength Indicator (RSSI)

RSSI performs a multi-signal measurement (up to 6 simultaneously signals) in time, assessing the power-level variations of interference signals over time. In RSSI measurements power limits can be set for audible alarms and increase alarm counters every time a signal exceeds the defined limit line. For long-term analysis, the spectrogram and RSSI measurements can be saved into an external USB memory for post-analysis.
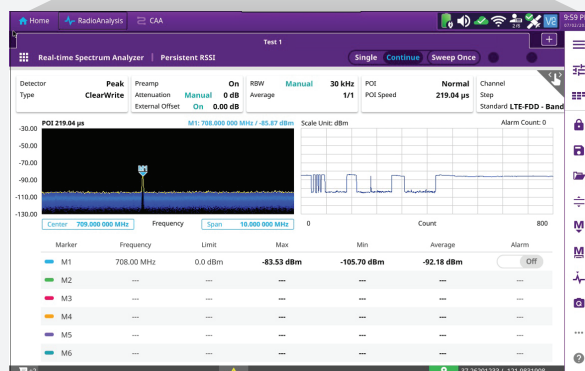
OneAdvisor 800 Interference Analysis – RSSI

Interference Finder

Interference Finder is an automatic triangulation algorithm performed by the OneAdvisor 800 that uses GPS to extract geo-coordinates in multiple test points to locate the source of interference.

The interference finder automatically calculates the interference locations using an inscribed or circumscribed area based on the measured intersection points.

OneAdvisor 800 Interference Analysis – Interference Finder

Radar Chart

The radar chart works with the AntennaAdvisor handle to detect the direction the interfering signal is coming from. The AA handle has a built-in gyro sensor that detects the azimuth the antenna is scanning. By linking the measured signal strength and the azimuth of the YAGI antenna and displaying the interference signal strength on the radar chart, field engineer can easily isolate the direction of the interference signal. At a crowded downtown or in a shopping mall area where vehicles are not available, interference hunting should be carried out on foot and radar chart help you to find the interference source quickly and accurately.
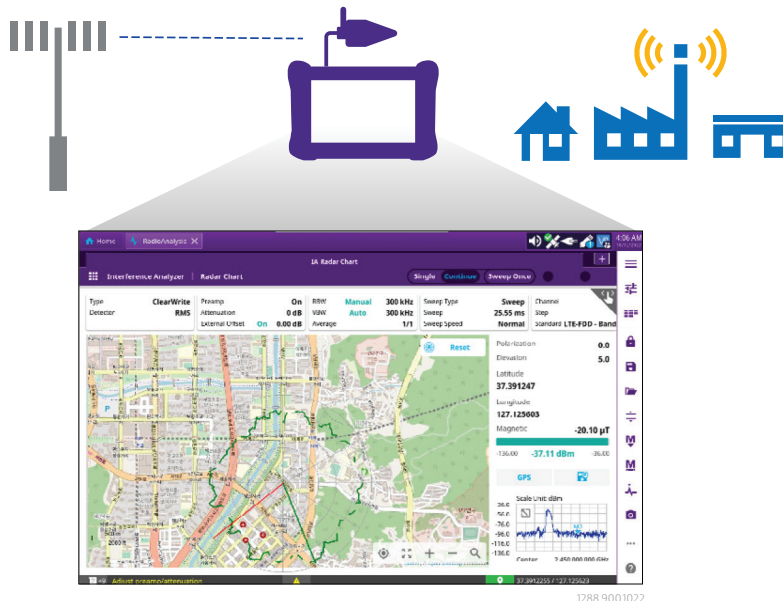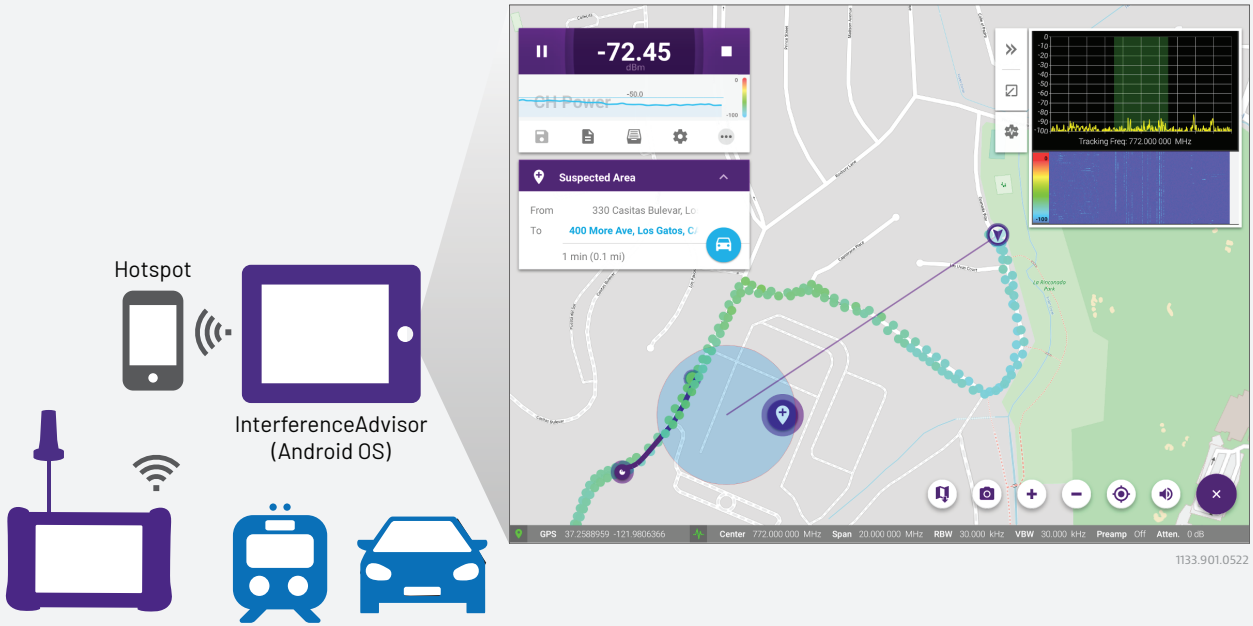

OneAdvisor 800 Interference Analysis – Radar Chart

Interference Hunting

InterferenceAdvisor is a fully automated RF interference hunting solution. Easy to set up and simple to use, it allows one RF engineer to identify and locate an interference source in just hours, simply by following voice prompts on a familiar map-style application on an Android tablet.

The InterferenceAdvisor software communicates with OneAdvisor 800 to retrieve RF power measurements (Peak, RSSI, Channel) and creating a power heat-map during a drive test, and automatically detects the area of incidence with the highest presence of interference, giving optional navigation instructions to the detected location of interference.

Hotspot

InterferenceAdvisor
(Android OS)

InterferenceAdvisor – Heat Map

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Cable and Antenna Analysis

OneAdvisor 800 can be equipped with a Cable and Antenna Analyzer module allowing RF technicians to verification the connectivity between the radio and antennas which are RF devices such as cables, jumpers, filters and duplexer, and the antenna, including:

• Return Loss and VSWR

• Distance to Fault

• Cable Loss

OneAdvisor 800 user-friendly GUI with intuitive PASS/FAIL results instantly identifies problems and enables technicians to easily determine if the radio site meets the coaxial transmission specifications.
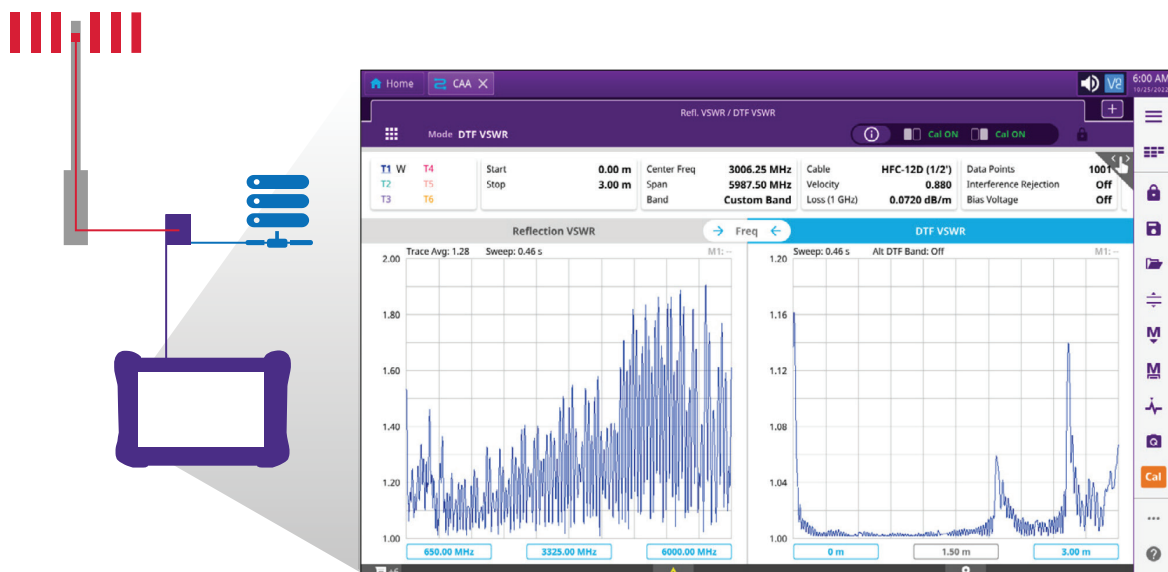
OneAdvisor 800 Cable and Antenna Analysis – VSWR

Easy Multi Band Antenna Testing

The larger display also allows for multiple pass/fail zones, this is especially useful when testing modern multiband antenna's commonly used in public safety vehicle installs.

OneAdvisor 800 Cable and Antenna Analysis – Zoom

Test Process Automation with Job Manager and StrataSync

VIAVI Test Process Automation allows RF technicians to perform installation and maintenance tests with confidence:

- In accordance with mobile operator's test criteria
- Covering all radio types and topologies
- Automatically uploading test results to the StrataSync cloud with simple PASS/FAIL indicator

Job Manager

The VIAVI Job Manager automates test processes, offering mobile network operations and construction teams a self-guided test solution, improving efficiency in the field for radio site installation and maintenance.

Job Manager's automates the entire process ensuring the proper test sequence is executed according to mobile operator's requirements, configuration test time is minimized, and results are consistent and consolidated.
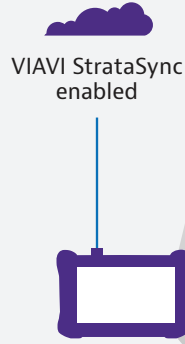

OneAdvisor 800 Job Manager

StrataSync™

VIAVI StrataSync is a cloud-hosted system that provides a centralized management of test solutions including test set management, test configurations, data management, and test results.

StrataSync is designed to eliminate email dispatches, manual test procedures, manual report consolidation, test solution availability and test devices that need calibration.

VIAVI StrataSync enabled

StrataSync – Asset Management

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Faster Work Speed

Eliminate wasted time trying to remember which tests to run and how to run them

Greater Consistency

Drive consistent, repeatable results, regardless of technician skill or experience

Lower Training Costs

New technicians get up to speed quickly with easy-to-follow prompts

Peace of Mind

Test results automatically saved to StrataSync cloud

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The OneAdvisor 800 is an invaluable tool for testing railway networks during conception (test labs), deployment and acceptance, as well as for easy troubleshooting in active networks.

VIAVI just celebrated its centenary and this is one of the most widely used pieces of test equipment trusted and used by mobile network operators all over the world. Please get in touch with your local representative and find out how VIAVI can help you.

VIAVI Solutions

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