Keysight

T3100S Series NFC Test Systems

Test systems for NFC, EMV and contactless device testing

Technical Overview



The Keysight Technologies T3100S Series includes:

- T3111S NFC conformance test system
- T3121S NFC R&D test system
- T1141A NFC test set
- T1142A automatic positioning robot

KEYSIGHT TECHNOLOGIES

Unlocking Measurement Insights

The Keysight Technologies, Inc. T3100S Series NFC test systems are the essential tools for testing NFC and contactless payment devices. From chipsets to cards, terminals, and mobile devices, T3100S Series test systems cover all product development phases from R&D to pre-conformance and final certification.

Each of the T3100S Series systems is built around the Keysight T1141A NFC Test Set. Capable of supporting Analog RF and Digital Protocol Testing, the T1141A combines the functions needed to test NFC devices:

- Scripted card and terminal emulation
- Arbitrary waveform generation
- Powerful waveform, logic, protocol, and voltage analysis

The Keysight T3121S NFC R&D Test System combines the T1141A with a PC-hosted virtual front panel application.

The Keysight T3111S NFC Conformance Test System can be configured as a superset of the T3121S by adding a Test Manager software application, and hosting an expandable range of standards-based test suites covering:

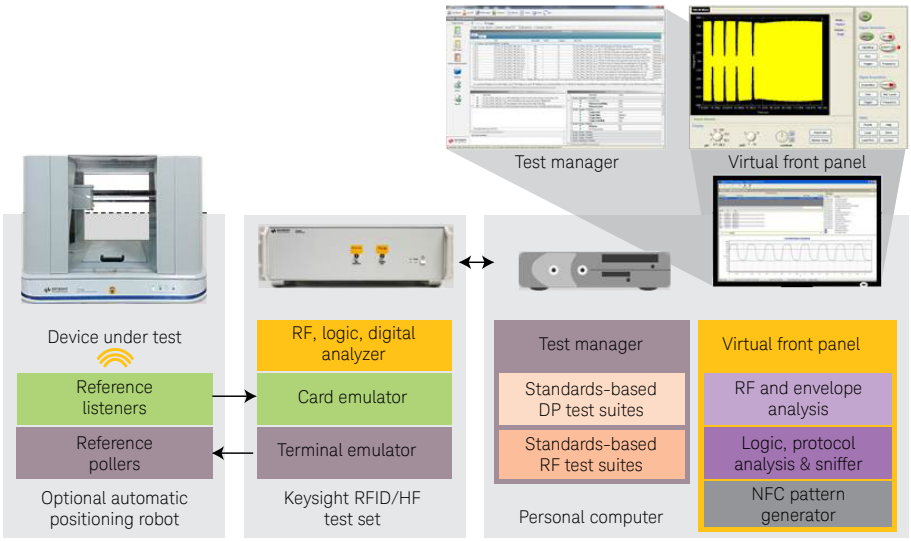
- EMV™ Level 1 PICC/Mobile and PCD Digital Protocol
- NFC Forum Digital Protocol and Analog RF
- NFC Forum LLCP and SNEP
- ISO 14443 and 18092 NFC Digital Protocol and Analog RF
- ISO 15693 and 18000-3 RFID HF Analog RF

The T3111S Test System can be expanded with specialized EMV test accessories and software applications from FIME to cover EMV Level 1 PICC/Mobile and PCD analog RF testing (**www.keysight.com/find/FIME**).

When combined with the T3111S, the optional Keysight T1142A Automatic Positioning Robot enables accurate and repeatable antenna positioning.



The integrated T1141A NFC Test Set forms the core of the T3111S and T3121S systems.



T3100S Test System components.

Test Manager

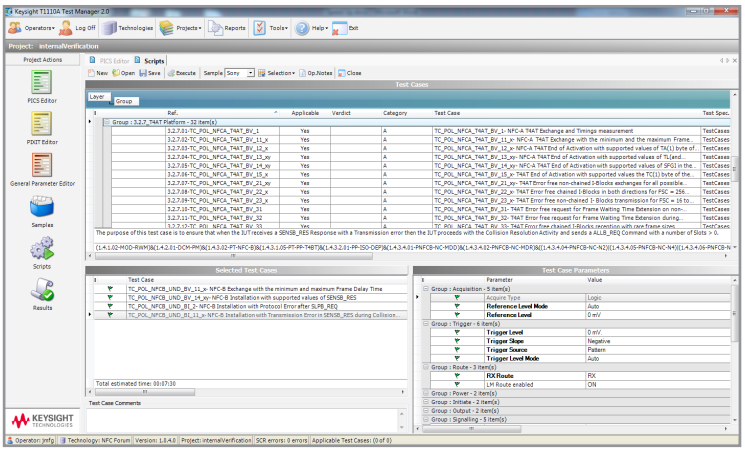
The Test Manager automates and controls test suite execution and report generation. The intuitive and powerful graphical user interface includes:

- Technology manager to select and load standards-based test suites
- Project manager to create, edit, save, and recall test campaigns with customized ICS, IXIT, device-under-test (DUT) information and test case selections
- Sequencer to select and execute individual tests or test campaigns
- Results analyzer to save and review test logs and statistics

Powerful utilities allow test projects to be migrated forward as test suite software is modified to support test case standards updates.

Test parameter defaults are set to support pre-conformance and conformance testing, with many parameters, including additional setting flexibility.

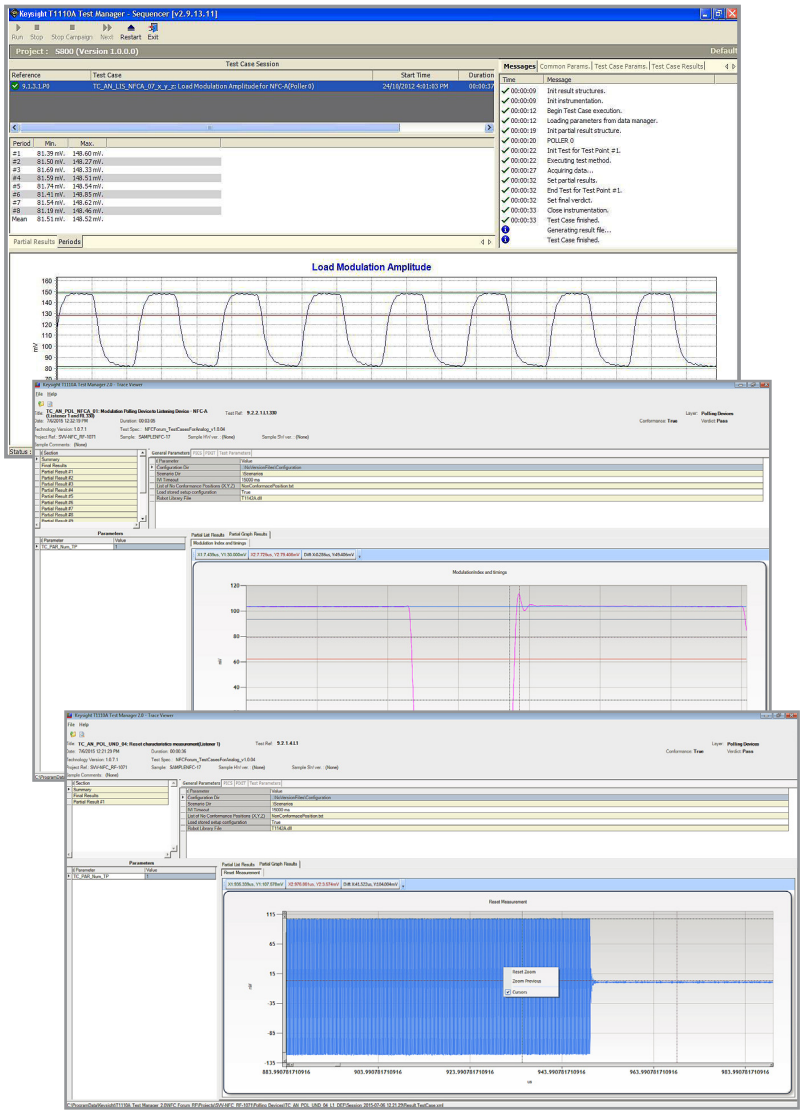
By using the Test Manager Remote feature, users can access the T3111S system and execute test cases remotely.



Test Manager user interface

Results Analysis

Comprehensive test reports and logs allow users to review and analyze results from automated testing sessions. Captured results can also be visualized with the Virtual Front Panel software application.



Test manager sequencer

Validated Test Suites

Regular software updates ensure that test suites are maintained in alignment with evolving industry standards. Keysight is a member of the NFC Forum and has been recognized by EMVCo as a test tool provider.

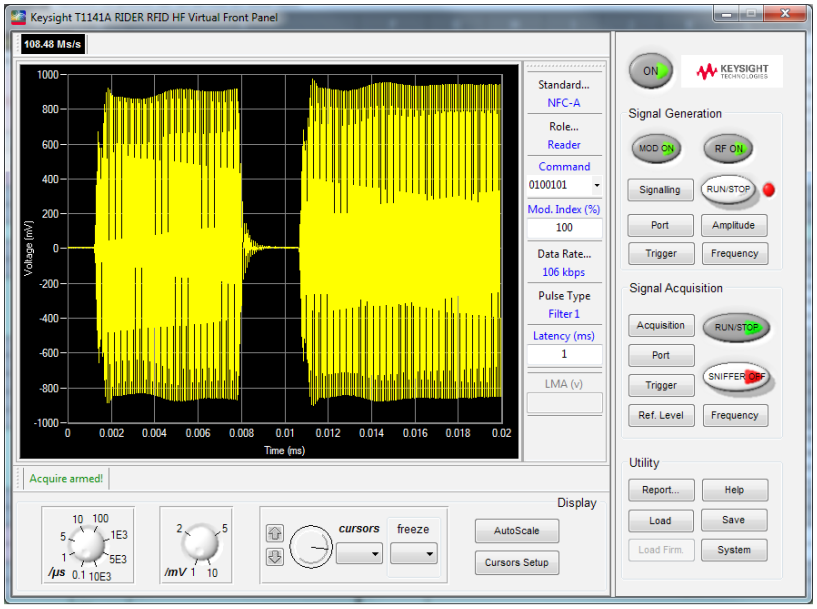
T3111S NFC Forum test suites have been validated by the NFC Forum. At the date of publishing, EMV Level 1 PICC/Mobile Digital Protocol and EMV Level 1 PCD Digital Protocol test suites have been validated for test spec versions 2.3.1a and 2.5.

Virtual Front Panel

Available with the T3121S and T3111S systems, the Virtual Front Panel software application provides a powerful and intuitive graphical user interface for analog RF and digital protocol testing. The Virtual Front Panel can be used as an NFC device emulator or analyzer supporting NFC Forum and ISO standards. While working with the Virtual Panel, different operation modes can be selected. The analog RF Virtual Front Panel displays waveform and envelope traces captured by the T1141A test set. The digital protocol Virtual Front Panel displays logic-level traces and binary protocol decodes captured by the T1141A. In each operating mode, users are able to send message sequences to the device under test to stimulate responses for capture.

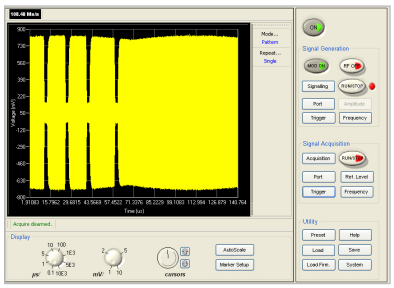
The Virtual Front Panel enables hands-on interactive testing. The tool also allows users to display waveforms, logic traces, and protocol logs saved when running automated campaigns within the Test Manager. A sniffer function allows the recording of real terminal-card protocol communication exchanges. Curser and zooming functions enable users to perform detailed investigation of captured voltage and logic waveforms.

In addition to providing an interactive graphical user interface, the Virtual Front Panel includes a programming API enabling integration with user-developed software and systems.

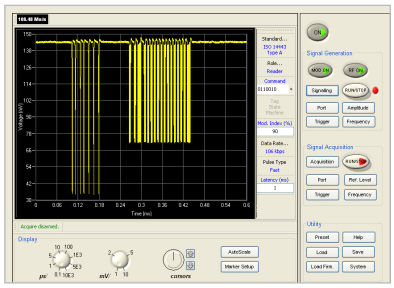


R&D Virtual Front Panel software user interface

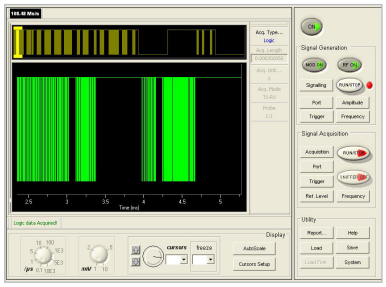
Virtual Front Panel display modes:



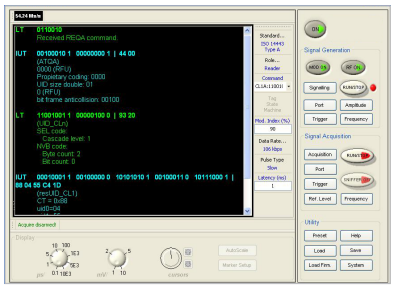
Waveform type



Envelope type



Logical type



Protocol type

Automatic Positioning Robot

The T1142A Automatic Positioning Robot ensures exact antenna positioning when testing NFC and EMV device RF analog performance. Robot-mounted antennas are reliably and repeatability moved under test case control to each specified position. Users can select standards-based or customized antenna measurement positions. The robot:

- Meets NFC Forum Analog RF test requirements
- Includes laser-assisted sample detection and location
- Has positioning accuracy better than ± 0.25 mm (typical)
- Has a large operating volume, supporting device weights up to 10 kg
- Has a user calibration kit available (sold separately)
- Includes non-metallic construction with three-axis, independent movement



T1142A Automatic Positioning Robot

TCI II Antenna

Keysight offers a complete sets of test antennas portfolio, including those recommended by NFC Forum, ISO or EMVCO (through FIME) for Analog testing.

For Digital tests, Keysight offers a combo design that enable hands-off digital testing. The main features of the Keysight TCI II antenna are:

- Software utility to find sweet test point
- Automatic switch Poll/Listen Mode
- Selectable RL values for Listen Mode
- Ready to operate with T1142A Automatic Positioning Robot

Worldwide Technical Support

Each T3100S system is configured with a Software and Technical Support Contract (STSC). Renewed annually, the STSC enables users to download and install regular software and firmware updates including system usability enhancements and test case standards updates.

Enhanced technical support is provided by local and factory-based NFC test experts.

System Components

T1141A NFC Test Set



Control PC [1]

- Desktop PC loaded with Windows 7 (64-bit)
- Keyboard, mouse, and 19-inch widescreen LED/LCD monitor



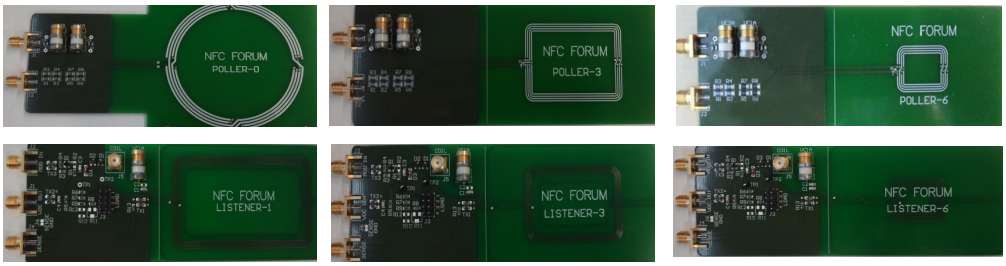
Keysight's NFC universal test antenna

- Test coil interface (TCI)



NFC Forum reference interfaces

- 3 poller
- 3 listener



ISO 10373-6 test interfaces including

- PCD test assembly
- Calibration coil
- Reference PICC

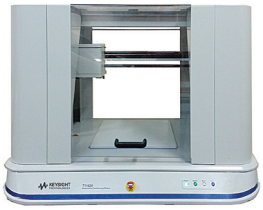


ISO 10373-7 test interfaces including

- VCD antenna and sense coils
- Calibration coil
- Reference VICC



T1142A Automatic Positioning Robot



1. PC, operating system, and monitor details subject to change without notice. PC images courtesy of Dell Inc.

T1141A NFC Test Set Specifications

Technical specifications

RF generator specifications LP (TX/RX) front panel and MP rear panel BNC ports	
Frequency range	10 to 20 MHz
Nominal output impedance	50 Ω
Nominal level setting resolution	< 0.04%
Typical carrier frequency accuracy	< 2 Hz from 11 to 20 MHz
LP (TX/RX) front panel	
Nominal level range	–5 to +25 dBm
Typical absolute level accuracy	± 1.5 dB from 11 to 20 MHz and –1 to 25 dBm
MP rear panel	
Nominal level range	+6 to +35 dBm
Typical absolute level accuracy	± 1.5 dB from 11 to 17 MHz and 8 to 36 dBm
Load modulator specifications LM rear panel port	
Nominal output impedance	50 Ω
Nominal level range	0 to 5 V rms
RF analyzer specifications LP (TX/RX) front panel BNC port	
Frequency range	10 to 20 MHz
Nominal input impedance	50 Ω
Nominal level range	0 to 20 dBm
Damage level	0 Vdc or 5 V peak
Typical absolute level accuracy	± 1 dB at 13.56 MHz and 0 to 20 dBm
RF analyzer specifications CC (RX) front panel and SC rear panel BNC ports	
Frequency range	10 to 20 MHz
Nominal input impedance	50 Ω or 1 M Ω switchable
Nominal level range	1 mV to 700 mV rms
Damage level	± 2.5 V peak
Typical absolute level accuracy	± 5% from 50 to 700 mV rms and 11 to 20 MHz
Typical level measurement linearity	± 2% from 12 to 700 mV rms and 13.56 MHz
Nominal residual reading for 0V input	< 3.5 mV rms
Nominal frequency measurement accuracy	< 10 Hz
DC voltmeter	
Nominal input impedance	> 10 MΩ
Nominal level range	0 to 10 Vdc
Damage level	12 Vdc
Typical absolute level accuracy	± 1.59% from 0 to 10 Vdc

T1141A NFC Test Set Specifications (continued)

Technical specifications (continued)

Nominal performance with Keysight antennas	
ISO 10373-6 test assemblies	Nominal output field range: 0.1 to 2 A/m with LP (TX/RX) front panel output 0.25 to 7.75 A/m with MP rear panel output Nominal output field resolution: 0.02 A/m with LP (TX/RX) front panel output 0.06 A/m with MP rear panel output
Keysight test coil interface	Nominal output field range: 0.5 to- 3 A/m with LP (TX/RX) front panel output Nominal output field resolution: 0.05 A/m with LP (TX/RX) front panel output
Output and reception uncertainties	
	Compliant with NFC Forum requirements for test tools [1]

Processing parameters

Maximum sampling rate	108.48 Msps
ADC resolution	14 bits
DAC resolution	16 bits

Signaling parameters

Standards supported	EMVCo Level 1 NFC Forum Digital Protocol NFC Forum Analog RF NFC Forum LLCP NFC Forum SNEP	ISO/IEC 14443 (Type A and Type B) ISO/IEC 18092 ISO/IEC 15693 ISO/IEC 18000-3 (Mode 1)
Modulation supported	ASK Load modulation BPSK	
Modulation index	ASK 1 to 100% (adjustable)	
Bit rate	106 to 848 kbps	

General specifications

Dimensions (W x H x D)	456 x 155 x 363 mm
Weight	8.6 Kg

Environmental and safety

Supply voltage range	100 to 120 VAC and 200 to 240 VAC
Supply frequency range	50 Hz (220 V range) and 60 Hz (110 V range)
Operating temperature	10 to 35° C
Storage temperature	–20 to +60° C
Humidity	20 to 80%
Calibration	1 year



T1141A NFC test set (front and rear panels)

1. Uncertainties requirements defined at NFC Analog RF Test Specifications.

T1142A Automatic Positioning Robot Specifications

General specifications

Control interfaces	
Serial	1 x USB connection
Power supply	
External power supply	24 V 100 to 240 V, 50 to 60 Hz
Power consumption	80 W
Dimensions (W x H x D)	1100 x 800 x 800 mm
Storage ranges	
Temperature	–20 to 80 °C
Humidity	20 to 90% non condensing
Operation ranges	
Temperature	15 to 30 °C
Humidity	20 to 90% non condensing
EMC	IEC-61326
Electrical safety	IEC 61010-1
Recommended calibration interval	1 year

Performance features

Speed	
X axis	44 mm/s
Y axis	19 mm/s
Z axis	19 mm/s
Threads per mm	
X axis	32
Y axis	32
Z axis	800
Precision (positioning within the NFC Forum defined test volume)	±0.26 mm; *±0.15 mm typical*
Effective operation volume (W x H x D)	350 x 320 x 320 mm
Free guard area [1]	> 150 mm
Maximum DUT dimensions allowed	645 x 320 x 645 mm
Maximum DUT weight allowed	10 kg
Warm up time	N/A

1. Distance from reference antenna to any disturbing elements.

Ordering Information

Following tables described options for these available products:

- T3111S NFC Conformance Test System is the Keysight platform for NFC and RFID HF conformance testing of contactless devices.
- T3121S NFC R&D Test System is the Keysight platform for NFC and RFID HF R&D testing of contactless devices.
- T1142A Automatic Positioning Robot

T3111S hardware options

Option	Description
T3111S-H01	NFC test set, PC, and Test Manager 2.0 license

T3111S test antennas

Option	Description
T3111S-SH1	ISO 10373-6 test assemblies
T3111S-RH1	ISO 10373-7 test assemblies
T3111S-CH1	NFC Forum reference test assemblies
T3111S-CH3	Keysight TCI II NFC universal test antenna
T3111S-CH4	Antenna Kit of NFC Forum Poller 0 and NFC Forum Listener

T3111S software options

NFC Forum conformance test cases packages

Option	Description
T3111S-C01	NFC Forum Analog RF test suite
T3111S-C02	NFC Forum Digital Protocol test suite
T3111S-C03	NFC Forum LLCP test suite
T3111S-C04	NFC Forum SNEP test suite

EMV™ Level 1 test suites

Option	Description
T3111S-V01	EMV PICC and Mobile L1 Digital protocol test suite
T3111S-V02	EMV PCD L1 Digital Protocol test suite

ISO NFC conformance test cases packages

Option	Description
T3111S-S01	ISO Analog RF test suites (ISO 14443 and 18092)
T3111S-S02	ISO Digital Protocol test suites (ISO 14443 and 18092)

ISO RFID HF conformance test cases packages

Option	Description
T3111S-R01	RFID HF Analog RF test suites (ISO 15693 and 18000-3)

R/D software options

Option	Description
T3111S-D01	Analog RF Virtual Front Panel (NFC, ISO, and RFID HF)
T3111S-D02	Digital Protocol Virtual Front Panel (NFC, ISO, and RFID HF)

Ordering Information

T3111S software options (continued)

Calibration

Option	Description
T3111S-1AC	Accredited calibration certificate

T3111S support options

Option	Description
T3100SC	NFC test system support

T3121 hardware options

Option	Description
T3121S-H01	NFC test set and virtual panel R/D software platform

T3121 software options

NFC R/D options

Option	Description
T3121S-D01	NFC R/D RF tester
T3121S-D02	NFC R/D protocol analyzer

ISO RFID HF R/D options

Option	Description
T3121S-D41	ISO RFID HF R/D RF tester
T3121S-D42	ISO RFID HF R/D protocol analyzer

NFC/ISO RFID HF protocol sniffer

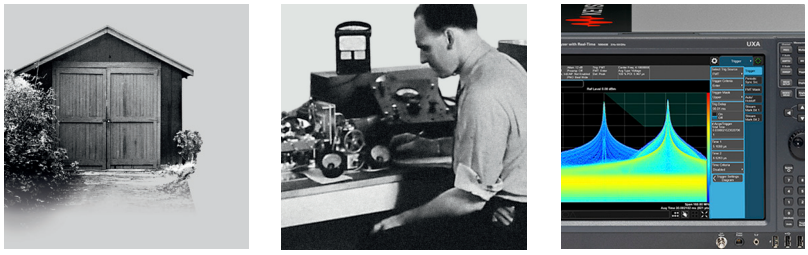
Option	Description
T3121S-D81	NFC/ISO RFID HF protocol sniffer

T1142A options

Option	Description
T1142A-F01	Automatic Positioning Robot with fixed head and three axis of movement
T1142A-C01	Calibration kit for T1142A
T1142A-C02	Holder kit for EMV test equipment

From Hewlett-Packard through Agilent to Keysight

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Other Keysight Test Systems

Keysight test systems portfolio offers a broad range of wireless technologies testing solutions, including:

- *Bluetooth®*
- LTE
- UMTS
- GSM, GPRS, EDGE

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Unlocking Measurement Insights

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