

JD747A

RF Analyzer

Introduction

The RF Analyzer JD747A is an ideal tool for installation and maintenance of cellular base stations.

The JD747A combines the functionality of spectrum analysis, cable and antenna analysis, and power measurements, covering all the measurements required for test, acceptance and troubleshooting the physical layer of cellular networks.

The JD747A is equipped with one-button standards based measurements for wireless signals and offers the full scope of common performance measurements of BTS antenna systems.

Equipped with optional power sensors, the JD747A becomes a highly accurate RF power meter with no additional cost. In addition, the JD747A provides an interference analysis function to find intermittent interfering signals using a spectrogram display, signal strength meter and signal ID capability.

The JD747A has a standard built-in preamplifier that together with the interference analysis option provides the ability to identify and locate interfering signals as low as -155 dBm.

The standard features of the JD747A include the following:

- Spectrum Analyzer: 100 kHz to 4 GHz
- Cable and Antenna Analyzer: 5 MHz to 4 GHz
- Power Meter: 10 MHz to 4 GHz

The JD747A was designed with a flexible platform that can support any of the following functions.

- Interference Analysis
- Channel Scanner
- GPS receiver
- 2 port transmission measurements
- Built-In Bias Tee
- CW signal generator

The JD747A is the ideal field testing solution that combines portability, due to its lightweight design and battery extended operation, and performance, with its multifunction capability.

The JD747A has a strong enclosure design for harsh environments, and its backlight key panel makes nocturnal maintenance tasks possible.



JD747A – RF Analyzer



JD747A – Backlight Panel

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Features

Easy User Interface

The JD747A has a consistent and intuitive interface through its multiple functions providing a common menu structure that is easy to use.

The JD747A has a built-in help capability which guides users through each measurement task.

A screenshot of any functions can be saved as a graphic file for report generation and traces can be saved for post-analysis process into the instrument's internal memory or external USB memory device. The stored data can be easily transferred to a PC using the USB 10/100 Ethernet ports.

For file name editing, a rotary knob is integrated with an enter button providing convenience to choose and select alphanumeric characters easily.



Field Useable Design

The JD747A is compact and lightweight especially convenient for users performing field measurements.

Its bright 8" color display provides visibility in daylight. And its backlight keys provide visibility on the dark.

The JD747A has an operating temperature range from -10 to 55 Celsius; and its connector bay support was designed to protect the instrument's connectors from drops or other external impacts exceeding the MIL-PRF-28800F class 2 specification.

The instrument's internal battery provide up to 3 hours of continuous operation. When extended operation is necessary, a secondary battery can be installed in seconds. Alternatively, it is equipped with DC adapters for vehicles and AC adapters for standard line power.

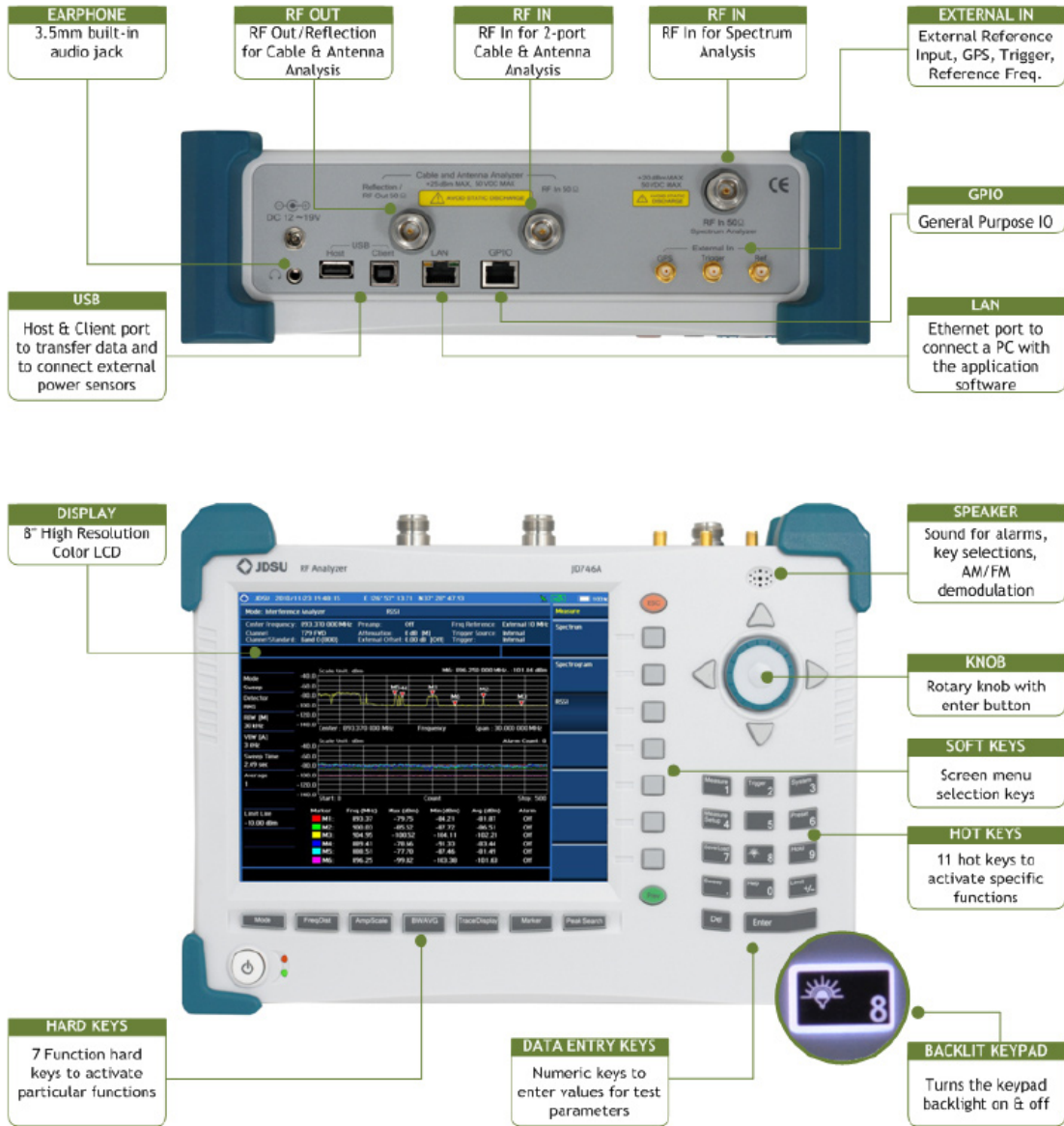
Convenience is absolutely necessary in the field. The JD746A is equipped with powerful one button measurements for channel power, occupied bandwidth, spectrum emission mask, adjacent channel power ratio and spurious emissions.

Multi language user interface

The instrument's architecture allows the graphical user interface to adapt into different languages, permitting localization around the world.

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Integrated Functionality



Integrated Functionality

Spectrum Analyzer

100 kHz to 4 GHz	Locates and identifies various signals over a frequency range up to 4 GHz.
Built in Pre-amplifier	Detects signal as low as -155 dBm with phase noise -90 dBc/Hz at 30 kHz offset and measurement accuracy better than 1 dB.
Zero Span with Gate Sweep	Triggers pulse or burst signal such as WiMAX, GSM, and TD-SCDMA.

Cable and Antenna Analyzer

5 MHz to 4 GHz	Provides cable and antenna characterization for proper power transfer from the radio to the antenna.
Reflection-VSWR/ Return Loss DTF – VSRW/Return Loss Cable Loss Smith Chart 1 Port Phase	Locates failure points for an effective troubleshooting. Verifies cable conformance specifications.

Power Meter	Integrated power meter eliminates the need of a separate instrument and provides power measurement with or without power sensors.
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2 Port Transmission Measurements (Option 001) Insertion Gain/Loss 2 Port Phase	Performance verification of passive and active devices such as filters and amplifiers.
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Bias Tee (option 002)	Supplies up to 32 VDC built-in bias to active devices, such as amplifiers.
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CW Signal Generator (option 003)	Provides a sine wave or continuous wave (CW) source allowing measurements such as repeater's isolation.
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GPS Receiver and Antenna (option 010)	Provides geographical location and highly accurate frequency and time base enabling precise frequency and phase measurements.
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Interference Analyzer (option 011)	Provides the parameters of spectrogram and a multi-signal RSSI required to properly monitor, identify and located interference signals. In addition to its capability of generating variable audible tones accordingly to the signal strength.
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Channel Scanner (option 012)	Intuitive graphical representation of the signal's power for each of the 20 user-definable carriers (frequency or channels) allowing a fast identification of improper power levels.
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Spectrum Analyzer

The JD747A has a general purpose spectrum analyzer which is the most flexible test tool for RF analysis including spectrum monitoring and analysis. The spectrum analysis function provides the capability of one-button standards based power measurements for wireless signals.

- Channel Power
- Occupied Bandwidth
- Spectrum Emission Mask
- Adjacent Channel Power
- Spurious Emissions
- Field Strength

Specifications

The JD747A has one of the best sensitivity and selectivity specifications. With its built-in preamplifier, measurements can be done as low as -155 dBm with a 1 Hz RBW.

Its low SSB phase noise allows detecting very low level spurs or noise signals which are close to the carrier. Its narrow (1 Hz) bandwidth ensures the identification of signals that are very close in frequency.

In addition, the narrow RBW means that the displayed noise level can be reduced, improving sensitivity. Its Auto Sweep time and Auto RBW/VBW allows an easy set up for a fast sweep time while ensuring accurate measurements.

- Frequency Range: 100 kHz to 4 GHz
- DANL (RBW 1 Hz, $1 \text{ GHz} < f_c < 2 \text{ GHz}$)
 -140 dBm
 -155 dBm with preamp
- Sweep Time
10 ms to 1000 s
6 μ s to 200 s in zero span
- RBW: 1 Hz to 3 MHz
- VBW: 1 Hz to 3 MHz
- SSB Phase Noise
 -90 dBc/Hz @ 30 kHz
 -95 dBc/Hz @ 100 kHz
 -102 dBc/Hz @ 1 MHz

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Capabilities

- Built-in Preamplifier
- Zero Span with Gated Sweep
- AM/FM Audio Demodulation

Multiple Detectors

- Normal
- RMS
- Sample
- Negative
- Peak

Advanced Marker

- Frequency counter
- Noise marker

Limit Line

Up to 6 markers and 6 traces

Measurements

Channel power measures the power level, spectral density and peak to average ratio (PAR) of the signal in a specified channel bandwidth, showing a “Pass” or “Fail” condition according to the defined power.



Channel Power

Occupied bandwidth measures the frequency bandwidth that contains the specified percentage of the power, the total integrated power and the occupied power, showing a “Pass” or “Fail” condition according to the defined bandwidth.



Occupied Bandwidth

Adjacent channel power (ACP) measures the amount of interference, or power, in an adjacent frequency channels and its ratios, showing a “Pass” or “Fail” condition according to the defined test condition.



Adjacent Channel Power

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Spectrum emission mask (SEM) compares the total power level within the defined carrier bandwidth and offset frequencies according to the defined mask limits with "Pass" or "Fail" result.



Spectrum Emission Mask

Spurious Emissions identifies and determines the power level of spurious emissions in certain frequency bands, showing a "Pass" or "Fail" condition according to the defined mask limits.



Spurious Emissions

Field Strength offers quick and convenient field strength measurement and analysis with the userdefinable user-definable multi segment line. The field strength measurement is easy to make once the antenna factors are specified in the analyzer.

AM/FM audio demodulation allows an easy identification of interfering signals. The AM/FM signal can be demodulated into the instrument's built-in speaker or through a headset.

Spectrum Analyzer can be simultaneously operated with CW Signal Generator (option 003). It is easily fulfilling the guideline of >100 dB required for repeater and antenna isolation measurement.

Cable and Antenna Analyzer

The JD747A Cable and Antenna Analyzer performs cable and antenna measurements for the verification of base station's infrastructure including feed-lines, connectors, antennas, cables, jumpers, amplifiers, and filters.

The JD747A distance-to-fault (DTF) function is capable of locating transmission problems up to 1,500 m (4,921 ft), at a measurements speed of 1.65 ms/data.

The JD747A offers a superior analysis tools including a trace overlay feature allowing a comparison analysis of up to 6 traces, and supporting up to 6 individual markers allocated to any trace.

In addition, it includes a user-configurable marker bands enabling visual identification of uplink and downlink frequencies for compliance verification with a single measurement trace.

Capabilities

Reflection

- VSWR
- Return Loss

DTF

- VSWR
- Return Loss

Cable Loss (1 port)

1 Port Phase

Smith Chart

2 Port Transmission Measurements (Option 001)

Insertion

- Loss
- High Gain
- Low Gain

2 Port Phase

Measurements

Reflection measures the complete cell-site transmission line impedance performance across the frequency range of interest in Voltage Standing Wave Ratio (VSWR) or Return Loss.



Reflection Return Loss

Cable loss (1 port) measures the signal loss through a cable or other devices over a defined frequency range. It is sufficient to connect one end of the cable to the base station analyzer measurement port. The other end of the cable is terminated with a short or left open.



Cable Loss (1 port)

Distance-to-Fault (DTF) measures fault locations in the transmission system of the cell-site indicating signal discontinuities in VSWR or Return Loss. Use this measurement to precisely pinpoint the location of damaged or degraded antennas, connectors, amplifiers, filters and duplexers, etc.



DTF-Return Loss

Smith Charts and Phase measures impedance and phase for proper tuning of RF devices.

Smith charts can be used to display impedance matching characteristics in cable and antenna system as well as filter and duplexers devices.



Smith Chart

1 Port Phase measures S11 phase in order to tune antennas and phase match cables.



1-Port Phase

Optional 2 port transmission measurements (option 001) which are insertion gain/loss and 2 port phase provide real vector network analysis. Matching and transmission characteristics of filter and amplifiers can be determined quickly and highly accuracy.

Insertion Gain/Loss measures the characteristics of passive and active devices such as filters, jumpers, splitters, and amplifiers as well as verifies antenna isolation or sector to sector isolation.

2 Port Phase measures S21 phase in order to characterise transmitted device.

The optional built-in bias tee (option 002) supplies power to active devices through the instrument's RF-In port eliminating the need of an external power supplies.



Insertion Loss

Power Meter

The JD747A performs two different methods of power measurement; the first is an internal power measurement for standard power testing without the assistance of external power sensors and the second is interfacing with an external power sensor for high accuracy power measurements.

Internal Power Measurement	External Power Measurement	
Frequency Range	Terminating Power Sensor	Directional (Through Line) Power Sensor
• 10 MHz to 4 GHz	JD732A	JD731A/JD733A
Dynamic Range	• Average Power	• Forward Average Power
• -120 to +20 dBm	JD734A	• Forward Peak Power
Measurement Type	• Peak Power	• Reverse Average Power
• RMS	JD736A	• Power
• Peak	• Average and Peak Power	• VSWR

The JD747A Power Meter function also provides a Pass/Fail condition with user-definable limits. The test results are displayed in dBm and Watts. The power measurement can be set as an absolute measurement displayed in dBm or as a relative measurement displayed in dB.

The JD747A displays the power level in two formats, as a real-time power level value in an analog meter, and as a power level trend through time in a histogram chart.

For high-precision power measurements the JD747A interface with external power sensors through a USB connection. There are two types of power sensors:

- **Termination power:** Power sensor JD732A, JD734A, or JD736B. For out-of-service testing.
- **Directional power or through line:** Power sensors JD731A or JD733A. Having the advantage to perform in-service power testing.



Internal Power Measurement



External Power Measurement



Interference Analyzer

The JD747A Interference Analyzer (option 11) is the most effective way to locate and identify periodic or intermittent RF interferences. The presence of interference signals are derived from licensed or unlicensed transmitters of many kinds causing dropped calls and poor quality service.

Measurements

The **Spectrum Analyzer** with an audible indicator is especially useful during the process of locating the interferer source with a directional antenna.

The **audible tone** is proportional to the signal power strength. In addition a built-in AM/FM audio demodulator it provides a convenient identification of AM/FM signals.

Interference ID allows an automatic classification of the interfering signal providing a list of possible signal types corresponding to the signal selected.

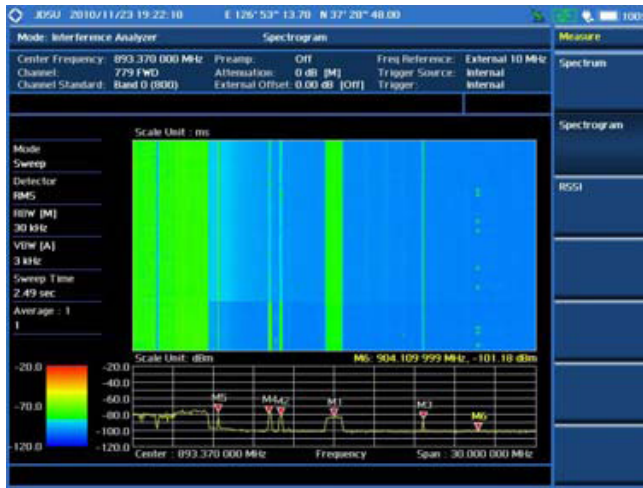


The **spectrogram** captures spectrum activity over time indicating the power levels of the spectrum with different color identification.

The spectrogram is an effective measurement to identify periodic or intermittent signals. Postprocessing analysis can be done for each measurement over time using a time cursor.

For long-term analysis the spectrogram can be automatically saved into an external USB memory.

Post-analysis can be done with the application software JDViewer.



Spectrogram

Received Signal Strength Indicator (RSSI) is a multiple signal tracking metric that is particularly useful for measuring power level variations over time.

The RSSI measurement also allows the assignment of power limit lines for each signal generating an audible alarm and increasing an alarm counter every time any signal goes beyond the limit line.

For long-term analysis the RSSI measurement can be automatically saved into an external USB memory. Post-analysis can be done with the application software JDViewer.



Received Signal Strength Indicator

Channel Scanner

The JD747A Channel Scanner function (option 12) is capable of measuring up to 20 independent channels, of any cellular technology, at any frequency or channel.

The channel scanner function provides a simple view of the power level of each signal type.



Channel Scanner

GPS Receiver And Antenna

The JD747A GPS Receiver and Antenna (option 10) provides positioning information (latitude, longitude and altitude), as well as timing for highly accurate frequency measurement, allowing an independent verification of base station timing.



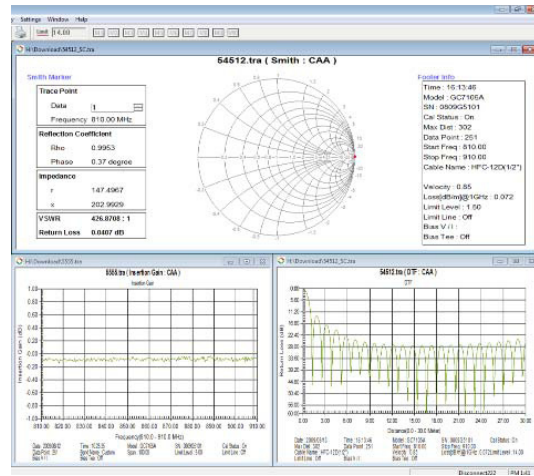
JD747A with GPS Antenna

Application Software

The JD747A communicates with the PC application software JDViewer to retrieve measurements and perform post-processing analysis and reporting.

Features

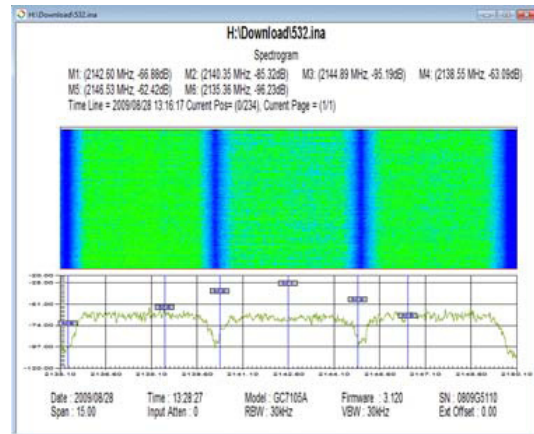
- Communicates with the JD747A via LAN or USB.
- Retrieves measured or saved measurements.
- Exports measurement results.
- Generates and prints configurable reports.
- Edits measurement charts.
- Creates a composite file of multiple spectrogram traces.
- Analyzes measurement results allowing the assignment of multiple markers and limit lines.
- Creates user defined settings for channel power, occupied BW, spectrum emission mask, and adjacent channel power measurements.
- Registers or edits user definable cable types into the instrument's custom cable lists.
- Registers or edits user definable frequency bands into the instrument's custom bands lists.
- Creates or edits multi-segment lines for insertion gain and loss measurements.
- Superimposes up to 4 traces on one measurement graph.



JDViewer, VSWR, DTF, Smith Chart



JDViewer Spectrum, Spectrogram and RSSI



JDViewer Spectrogram

LTE-FDD Signal Analyzer

General Parameters

Frequency range	Band 1 to 14, 17 to 26	
Input signal level	-40 to +20 dBm	
Channel power accuracy	±1.0 dB (typical)	
Supported bandwidths	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, and 20 MHz	
Frequency error	±10 Hz + ref freq accuracy	99% confidence level
Residual EVM (RMS)	2.0% (typical)	Data EVM

Measurements

	Option 028		Option 048
Channel power	I/Q diagram	I/Q origin offset	ID scanner (up to 6)
Channel power	RB power	EVM RMS, peak	RSRP/RSRQ dominance
Spectral density	Modulation format	Data EVM RMS, peak	S-SS RSSI dominance
Peak to average power	I/Q origin offset	Cell, group, sector ID	S-SS Ec/Io dominance
Occupied bandwidth	EVM RMS, EVM peak	Time alignment error	Cell, group, sector ID
Occupied bandwidth	Control channel	Time alignment error trend	RSRP/RSRQ
Integrated power	Control channel summary	Time alignment error	RS-SINR/S-SS RSSI
Occupied power	(P-SS, S-SS, PBCH, PCFICH, PHICH, PDCCH, RS, MBSFN*)	RS power difference	P-SS/S-SS Power
Spectrum emission mask	EVM, relative or absolute	Antenna 0 RS power	S-SS Ec/Io
Reference power	power, modulation type	Antenna 0 RS EVM	Multipath profile
Peak level at defined range	Each control channels'	Antenna 1 RS power	Cell, group, sector ID
ACLR	I/Q diagram	Antenna 1 RS EVM	Ant 0 RS Ec/Io, delay
Reference power	Modulation format	Cell, group, sector ID	Ant 1 RS Ec/Io, delay
Abs power at defined range	Frequency error	Data allocation map	Ant 0 Sync Ec/Io, delay
Rel power at defined range	I/Q origin offset	Data allocation vs frame	Ant 1 Sync Ec/Io, Delay
Multi-ACLR	EVM RMS, EVM peak	Resource block power	Control channel
Lowest reference power	Subframe	OFDM symbol power	RS power trend
Highest reference power	MBSFN*	Data utilization	Cell, group, sector ID
Abs power at defined range	Subframe summary table	Data allocation vs subframe	Control channel table
Rel power at defined range	(P-SS, S-SS, PBCH, PCFICH, PHICH, PDCCH, RS, MBSFN*, PDSCH/Data*)	Resource block power	(P-SS, S-SS, PBCH, PCFICH, RS 0, RS 1)
Spurious emissions	QPSK, PDSCH/Data* 16 QAM, PDSCH/Data* 64 QAM)	Data utilization	Absolute power
Peak frequency at defined range	EVM, relative or absolute power, modulation type	Auto measure	Relative power
Peak level at defined range	Subframe power	Channel power	EVM RSM, phase
Power vs. time (frame)	OFDM symbol power	Occupied bandwidth	Frequency error
Frame average power	Frequency, time error	Spectrum emission mask	Time alignment error
Subframe power	Data EVM RMS, peak	ACLR	Time offset
First slot power	RS EVM RMS, peak	Multi-ACLR	Datagram
Second slot power	Cell, group, sector ID	Spurious emission mask	Datagram
Cell ID, I/Q origin offset	Frame	Frame average power	Resource block power
Time offset	MBSFN*	Time alignment error	Data utilization
Constellation	Frame summary table	Frequency error	Route Map
MBSFN*	(P-SS, S-SS, PBCH, PCFICH, PHICH, PDCCH, RS, MBSFN*, PDSCH/Data*)	MBSFN*	RSRP
RS TX power	QPSK, PDSCH/Data* 16 QAM, PDSCH/Data* 64 QAM)	PDSCH/Data* QPSK EVM	RSRQ
PDSCH/Data* QPSK EVM	EVM, relative or absolute power, modulation type	PDSCH/Data* 16 QAM EVM	RS-SINR
PDSCH/Data* 16 QAM EVM	Frame average power	PDSCH/Data* 64 QAM EVM	S-SS RSSI
PDSCH/Data* 64 QAM EVM	OFDM symbol power	Data EVM RMS, peak	P-SS, S-SS power
Data EVM RMS	Frequency error	RS, P-SS, S-SS EVM	S-SS Ec/Io
Data EVM peak	Time error	RS, P-SS, S-SS power	
Frequency error	Data channel	PBCH power	
Time error	MBSFN*	Subframe power	
Data channel	Resource block power	OFDM power	
MBSFN*	OFDM symbol power	Time error	
Resource block power	Frequency error	I/Q origin offset	
		Power statistics CCDF	

Longitude, latitude, and satellite in all screens

* Measurement is performed when MBMS is enabled.

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Ordering information**JD747A RF Analyzer**

Spectrum Analyzer	100 kHz to 4 GHz	
Cable and Antenna Analyzer ¹	5 MHz to 4 GHz	
RF Power Meter	10 MHz to 4 GHz	Internal mode

Options

NOTE: Upgrade options for the JD747A use the designation JD747AU before the respective last three digit option number.

JD747A001	2 Port Transmission Measurements ²
JD747A002	Bias Tee ³
JD747A003	CW Signal Generator
JD747A010	GPS Receiver and Antenna
JD747A011	Interference Analyzer ^{4,5}
JD747A012	Channel Scanner

¹Requires Calibration Kit

²Requires Dual port Calibration Kit

³Requires JD747A001

⁴Highly recommends adding JD747A010

⁵Highly recommends adding G70005035x and/or G70005036x

Standard Accessories

G710550322	AC/DC Power Adapter ⁶
G710550335	Cross LAN Cable (1.5 m) ⁶
GC73050515	USB A to B Cable (1.8 m) ⁶
GC72450518	> 1 G Byte USB Memory ⁶
G710550325	Rechargeable Lithium Ion Battery ⁶
G710550323	Automotive Cigarette Lighter 12 VDC Adapter ⁶
JD747A361	JD747A User's Manual and Application Software – CD

⁶Standard accessories can be purchased separately.

Optional Power Sensors

JD731A	Directional power sensor (peak and average power) Frequency: 300 to 3.8 GHz Power: Average 0.15 to 150 W, Peak 4 to 400 W
JD733A	Directional power sensor (peak and average power) Frequency: 150 MHz to 3.5 GHz Power: Average/Peak 0.1 to 50 W
JD732A	Terminating power sensor (average power) Frequency: 20 MHz to 3.8 GHz Power: -30 to 20 dBm
JD734A	Terminating power sensor (peak power) Frequency: 20 MHz to 3.8 GHz Power: -30 to 20 dBm
JD736A	Terminating power sensor (peak and average power) Frequency: 20 MHz to 3.8 GHz Power: -30 to 20 dBm

Ordering information**Optional Calibration Kits**

JD72450509	One port N type Calibration Kit Open/Short/Load N(m), 40 dB, 4 GHz, 50 Ω
JD72450510	One port DIN type Calibration Kit Open/Short/Load DIN(m), 40 dB, 4 GHz, 50 Ω
JD71050507	Dual port N type Calibration Kit, 50 Ω – Open/Short/Load N(m), 40 dB, 4 GHz, 50 Ω – Two Adapters N(f) to N(f), DC to 4 GHz, 50 Ω – Two 1 m (3.28 ft) RF Test Cables, N(m) to N(m), DC to 4 GHz, 50 Ω
JD71050508	Dual port DIN type Calibration Kit 50 Ω – Open/Short/Load DIN(m), 40 dB, 4 GHz, 50 Ω – Two 1m (3.28 ft) RF Test Cables, N(m) to N(m), DC to 4 GHz, 50 Ω – Adapter N(f) to DIN(f), DC to 4GHz, 50 Ω – Adapter N(f) to DIN(m), DC to 4 GHz, 50 Ω – Adapter DIN(f) to DIN(f), DC to 4 GHz, 50 Ω – Adapter DIN(m) to DIN(m), DC to 4 GHz, 50 Ω

Optional RF Cables

G710050531	1.5 m (4.92 ft) RF Cable DC to 18 GHz N(m)-N(f), 50 Ω
G710050532	3.0 m (9.84 ft) RF Cable DC to 18 GHz N(m)-N(f), 50 Ω

Optional Omni Antennas

G700050351	RF Omni Antenna 400 MHz to 450 MHz
G700050352	RF Omni Antenna 450 MHz to 500 MHz
G700050353	RF Omni Antenna 806 MHz to 896 MHz
G700050354	RF Omni Antenna 870 MHz to 960 MHz
G700050355	RF Omni Antenna 1710 MHz to 2170 MHz

Optional Yaggi Antennas

G700050364	RF Yaggi Antenna 806 MHz to 896 MHz
G700050365	RF Yaggi Antenna 866 MHz to 960 MHz
G700050363	RF Yaggi Antenna 1750 MHz to 2390 MHz

Optional Adapters

G710050571	Adapter N(m) to DIN(f), DC to 4 GHz, 50 Ω
G710050572	Adapter DIN(m) to DIN(m), DC to 4 GHz, 50 Ω
G710050573	Adapter N(m) to SMA(f), DC to 18 GHz, 50 Ω
G710050574	Adapter N(m) to BNC(f), DC to 1.5 GHz, 50 Ω
G710050575	Adapter N(f) to N(f), DC to 4 GHz, 50 Ω
G710050576	Adapter N(m) to DIN(m), DC to 4 GHz, 50 Ω
G710050577	Adapter N(f) to DIN(f), DC to 4GHz, 50 Ω
G710050578	Adapter N(f) to DIN(m), DC to 4 GHz, 50 Ω
G710050579	Adapter DIN(f) to DIN(f), DC to 4 GHz, 50 Ω