Keysight Technologies
CMMB
X-Series Measurement Application
N6158A & W6158A

Technical Overview

KEYSIGHT TECHNOLOGIES

Introduction

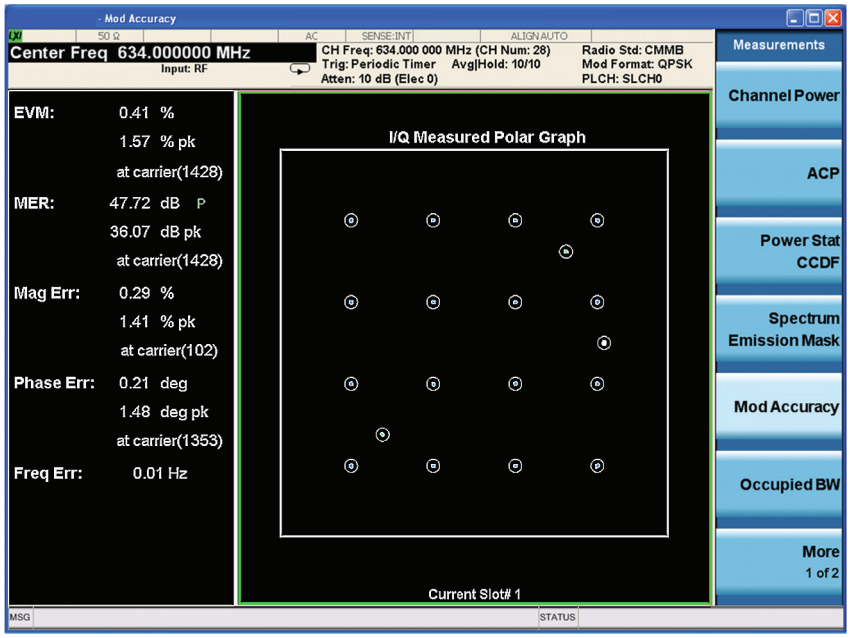
- Measure CMMB transmitters, exciters, modulators, gap-fillers, tuners, or amplifiers performance
- Perform one-button tests with CMMB standard compliant pass/fail limit
- Use hardkey/softkey manual user interface or SCPI remote user interface
- Leverage built-in, context-sensitive help
- Move the application between X-Series signal analyzers with transportable licensing

CMMB Measurement Application

The CMMB measurement application provides one-button standard-based power and modulation analysis capabilities to help your design, evaluation and manufacturing of CMMB modulators, transmitters, amplifiers, tuners and gap-fillers/repeaters. With the optional analog baseband IQ inputs in the PXA or MXA signal analyzer, it can also provide the flexibility of measuring signal quality and modulation accuracy with the RF input or analog IQ input.

Key parameter setup

- Device type: Transmitter/exciter
- Measurement type: PLCH/timeslot/frame
- Modulation format: BPSK/QPSK/16QAM
- Trigger mode: External trigger, periodic timer, free run
- Input: RF or analog IQ (only available in the N9030A PXA or N9020A MXA) for signal quality and modulation accuracy measurements



The CMMB measurement application is just one in a common library of more than 25 measurement applications in the Keysight Technologies, Inc. X-Series, an evolutionary approach to signal analysis that spans instrumentation, measurements, and software. The X-Series analyzers, with upgradeable CPU, memory, disk drives, and I/O ports, enable you to keep your test assets current and extend instrument longevity. Proven algorithms, 100% code-compatibility, and a common UI across the X-Series create a consistent measurement framework for signal analysis that ensures repeatable results and measurement integrity so you can leverage your test system software through all phases of product development. In addition to fixed, perpetual licenses for our X-Series measurement applications, we also offer transportable licenses which can increase the value of your investment by allowing to you transport the application to multiple X-Series analyzers.

CMMB Standards Overview

China multimedia mobile broadcasting (CMMB) is a mobile digital video standard developed in China by the State Administration of Radio, Film, and Television. Announced in 2006, CMMB network has been deployed in more than hundreds of cities in China.

The core part of CMMB is satellite and terrestrial interactive multi-service infrastructure (STiMi). It uses both satellite and terrestrial signals to obtain effective coverage both in densely populated cities and in sparsely populated rural areas. CMMB system supports single-frequency network (SFN) and multiple-frequency network (MFN).

CMMB physical layer can support N (1~39) data streams at the same time (Fig 1). Each data stream is configurable on channel coding, constellation and timeslots allocation. That means CMMB signal can broadcast up to 39 services (e.g., SDTV, HDTV), giving each service different error protections.

The CMMB broadcasting system uses physical logical channels (PLCH) to transmit the upper-layer services. The allocation of PLCH is shown in Fig 2. The PLCHs include one control logical channel (CLCH) and 1~39 service logical channels (SLCH). CLCH contains CMMB broadcast system control information and occupies only time slot 0. SLCH can be configured to contain one or more time slots to transmit one broadcasting service.

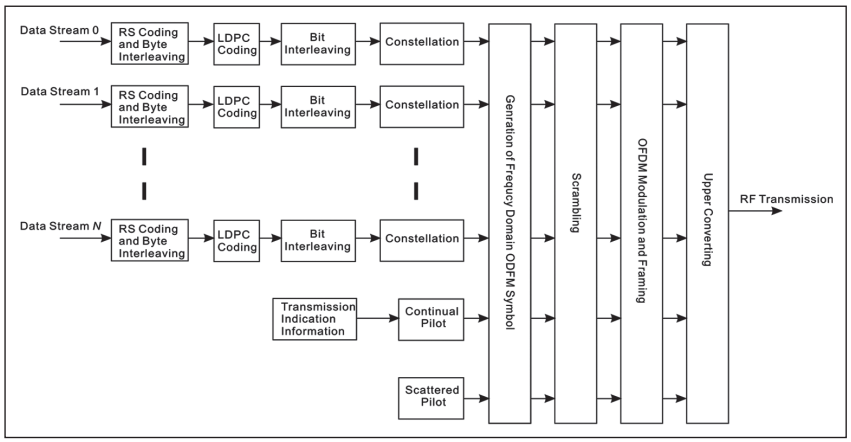


Figure 1. The block diagram of CMMB system

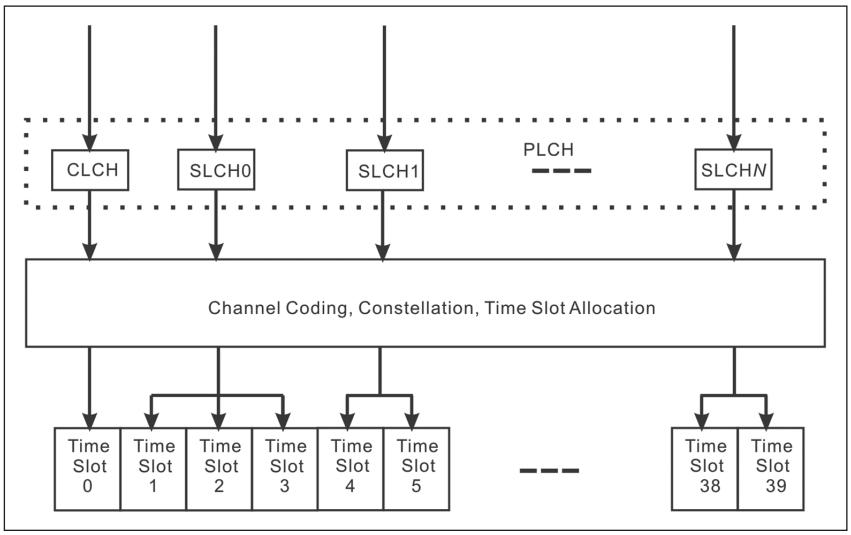


Figure 2. CMMB PLCH

RF Transmitter Tests

The RF transmitter test requirements for CMMB transmitter and exciter are defined in GD/J020-2008 technical specification and methods of measurement for mobile multimedia broadcasting transmitters and technical specification and method of measurement for mobile multimedia broadcasting exciters (draft) standards. Table 1 shows RF transmitter and exciter tests defined by the specs along with the corresponding measurements provided by the CMMB measurement application.

Table 1. Required RF transmitter and exciter measurements and the corresponding measurements in N/W6158A and other modes

Test item	GD/J020-2008 (For transmitter measurement)	Test specification (For exciter measurement)	N/W6158A CMMB measurement application
Frequency adjustable step	•	•	Spectrum analyzer mode (marker counter function)
Frequency stability	•	•	Spectrum analyzer mode (marker counter function)
Frequency accuracy	•	•	Spectrum analyzer mode (marker counter function)
RF power		•	Channel power (RF spectrum view)
RF power stability	•	•	Channel power (RF spectrum view)
RF effective bandwidth		•	Spectrum analyzer mode (marker counter)
Shoulder attenuation	•	•	Channel power (shoulder attenuation view)
In-band spectrum flatness	•	•	Modulation accuracy (spectral flatness view)
Spectrum mask	•		Channel power (spectrum mask view) or spectrum emission mask
Useless power in adjacent channel	•	•	ACP
Power outside adjacent channel	•	•	ACP
Phase noise	•	•	N/W9068A phase noise measurement application
Peak-to-average power ratio		•	Power stat CCDF
Modulation error ratio	•	•	Modulation accuracy (result metrics view)

Measurement details

Measurements as defined by the CMMB standard, as well as a wide range of additional measurements and analysis tools, are available with a press of a button (Table 2). These measurements are fully remote controllable via the IEC/IEEE bus or LAN, using SCPI commands.

Analog baseband measurements are available on the PXA or MXA signal analyzer equipped with BBIQ hardware. Supported baseband measurements include all of the modulation quality plus I/Q waveform and CCDF measurements.

Table 2. One-button measurements provided by the CMMB measurement application

Technology	**CMMB**
Measurement application	N6158A, W6158A
X-Series signal analyzer	**PXA, MXA, EXA, CXA**
Measurements	Channel power RF spectrum Shoulder attenuation
	Adjacent channel power
	Spectrum emission mask
	Power statistic CCDF
	Occupied bandwidth
	Monitor spectrum
	IQ waveform
	Modulation accuracy RMS EVM (%) Peak EVM (%) Position of peak EVM RMS MER (dB) Peak MER (dB) Position of peak MER RMS mag error (%) Peak mag error (%) Position of peak mag error RMS phase error (deg) Peak phase error (deg) Position of peak phase error Frequency error (Hz) Tx power (dBm) Quadrature error (deg) Amplitude imbalance (%) Timing skew (s) Trigger difference (s) MER/EVM vs. subcarriers/frequency Amplitude vs. subcarriers (dB) Phase vs. subcarriers (deg) Group delay vs. subcarriers (ns) Channel impulse response (dB) MER vs. timeslot (dB) MER of data (dB) MER of continual pilot (dB) MER of scatter pilot (dB) In-band spectrum ripple Amax-Ac (dB) In-band spectrum ripple Amin-Ac (dB) Region index Transmitter index

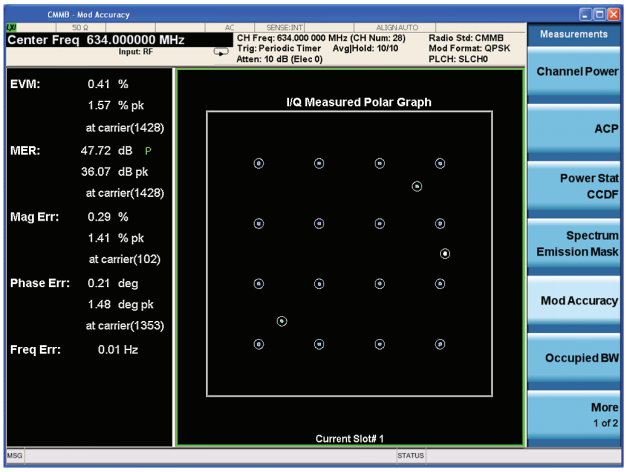


Figure 3. CMMB constellation and MER results

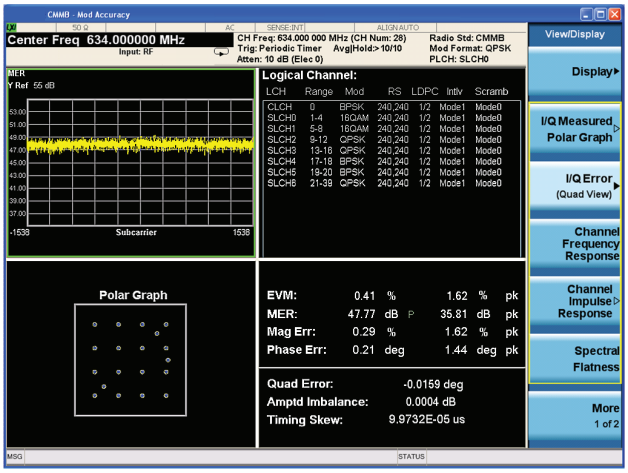


Figure 4. CMMB IQ quad view

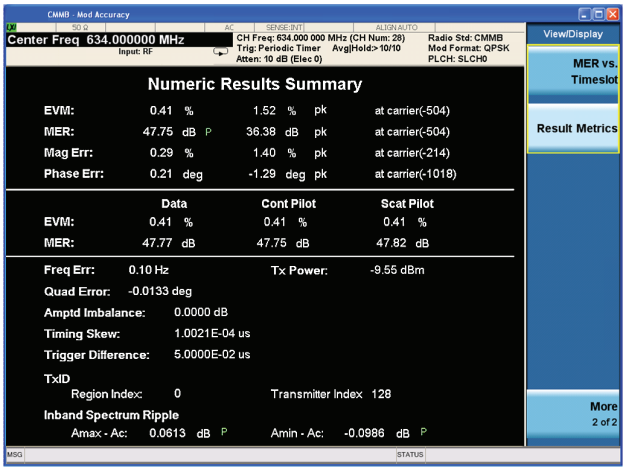


Figure 5. CMMB result metrics

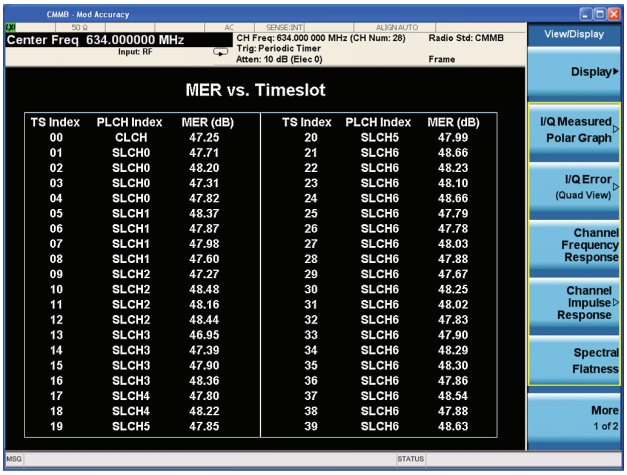


Figure 6. CMMB MER vs. timeslot

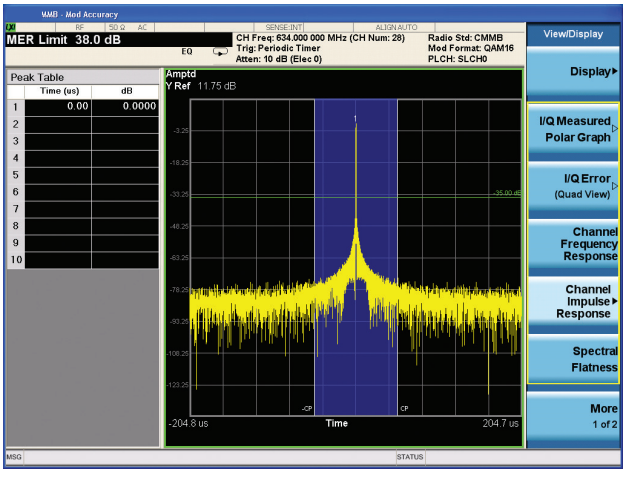


Figure 7. CMMB channel impulse response view

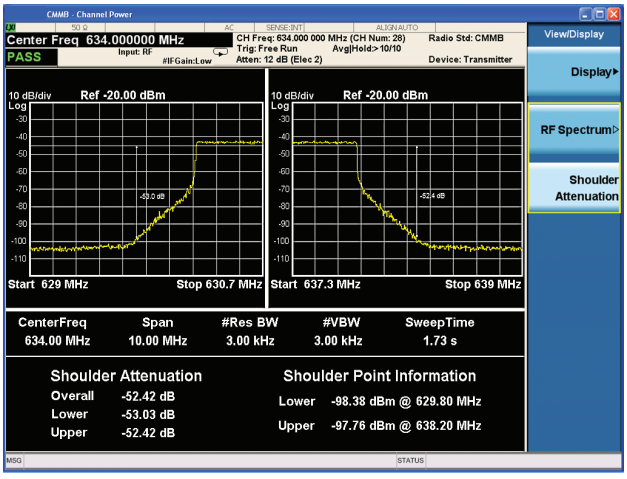


Figure 8. CMMB shoulder attenuation

Key Specifications

Definitions

- Specifications describe the performance of parameters covered by the product warranty.
- 95th percentile values indicate the breadth of the population (≈2σ) of performance tolerances expected to be met in 95% of cases with a 95% confidence. These values are not covered by the product warranty.
- Typical values are designated with the abbreviation "typ." These are performance beyond specification that 80% of the units exhibit with a 95% confidence. These values are not covered by the product warranty.
- Nominal values are designated with the abbreviation "nom." These values indicate expected performance, or describe product performance that is useful in the application of the product, but is not covered by the product warranty.
- PXA specifications apply to analyzers with frequency options of 526 and lower. For analyzers with higher frequency options, specifications are not warranted but performance will nominally be close to that shown in this section.

Note: Data subject to change

Performance specifications

Description	PXA	MXA	EXA	CXA
Channel power				
7.512 MHz integration bandwidth	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)
Absolute power accuracy				
20 to 30 °C	± 0.61 (± 0.19 dB 95%)	± 0.82 dB (± 0.23 dB 95%)	± 0.94 dB (± 0.27 dB 95%)	± 1.33 dB (± 0.61 dB 95%)
Measurement floor	–85.7 dBm	–82.7 dBm	–78.7 dBm	–75.7 dBm
Channel power with shoulder attenuation view				
7.512 MHz integration bandwidth	ML[1] = –14.0 dBm (nom)	ML[1] = –16.0 dBm (nom)	ML[1] = –16.0 dBm (nom)	ML[1] = –15.0 dBm (nom)
Dynamic range, relative				
Offset freq				
4.2 MHz	98.4 dB (103.7 dB typ)	92.2 dB (98.5 typ)	86.9 dB (94.0 dB typ)	84.5 dB (91.7 dB typ)
Power statistics CCDF				
Minimum power at RF input	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)
Histogram resolution	0.01 dB	0.01 dB	0.01 dB	0.01 dB
Adjacent channel power				
Minimum power at RF input; 0 to 55 °C	–36 dBm (nom)	–36 dBm (nom)	–36 dBm (nom)	–36 dBm (nom)
ACPR accuracy		7.512 MHz noise bandwidth, method = IBW		
Offset freq				
8 MHz	± 0.18 dB	± 0.44 dB	± 0.93 dB	± 1.54 dB

1. ML (mixer level) is RF input power minus attenuation.

Performance specifications (continued)

Description	PXA	MXA	EXA	CXA
Spectrum emission mask	**8 MHz integration bandwidth, RBW = 3.9 kHz**			
4.2 MHz offset				
Dynamic range, relative	98.4 dB (103.7 dB typ)	92.2 dB (98.5 dB typ)	86.9 dB (94.0 dB typ)	84.5 dB (91.7 dB typ)
Sensitivity, absolute	–114.5 dBm (–118.5 dBm typ)	–110.5 dBm (–115.5 dBm typ)	–105.5 dBm (–111.5 dBm typ)	–102.5 dBm (–108.5 dBm typ)
Accuracy				
Relative	± 0.10 dB	± 0.18 dB	± 0.18 dB	± 0.27 dB
Absolute, 20 to 30 °C	± 0.62 dB (± 0.20 dB 95%)	± 0.88 dB (± 0.23 dB 95%)	± 1.05 dB (± 0.31 dB 95%)	± 1.53 dB (± 0.64 dB 95%)
10.0 MHz offset				
Dynamic range, relative	100.8 dB (106.2 dB typ)	94.6 dB (100.6 dB typ)	89.3 dB (96.0 dB typ)	87.2 dB (95.0 dB typ)
Sensitivity, absolute	–114.5 dBm (–118.5 dBm typ)	–110.5 dBm (–115.5 dBm typ)	–105.5 dBm (–111.5 dBm typ)	–102.5 dBm (–108.5 dBm typ)
Accuracy				
Relative	± 0.12 dB	± 0.21 dB	± 0.21 dB	± 0.36 dB
Absolute	± 0.62 dB (± 0.20 dB 95%)	± 0.88 dB (± 0.23 dB 95%)	± 1.05 dB (± 0.31 dB 95%)	± 1.53 dB (± 0.64 dB 95%)
Modulation analysis				
ML[1] = –20 dBm, 20 to 30 °C	CLCH + SLCH0, CLCH: Timeslot 0, LDPC 1/2, Reed Solomon code (240,240), Interleaver mode 1, Modulation type BPSK SLCH0: Timeslot 1-39, LDPC 1/2, Reed Solomon code (240,240), Interleaving mode 1, Modulation type 16QAM			
EVM	EQ Off			
Operating range	0 to 16%	0 to 16%	0 to 16%	0 to 16% (nom)
Floor	0.39%	0.54%	0.70%	0.70% (nom)
Accuracy				
from 0.4%/0.54%/0.7% (PXA/MXA/EXA) to 1.0%	± 0.20%	± 0.30%	± 0.30%	
from 1.0% to 2.0%	± 0.10%	± 0.20%	± 0.30%	
from 2.0% to 16.0%	± 0.40%	± 0.40%	± 0.40%	
MER	EQ Off			
Operating range	≥ 16 dB	≥ 16 dB	≥ 16 dB	≥ 16 dB (nom)
Floor	48 dB	45 dB	43 dB	43 dB (nom)
Accuracy				
from 39 to 48 dB/45 dB/43 dB (PXA/MXA/EXA)	± 2.83 dB	± 2.78 dB	± 2.93 dB	
from 34 to 39 dB	± 0.50 dB	± 0.89 dB	± 1.41 dB	
from 16 to 34 dB	± 0.23 dB	± 0.34 dB	± 0.52 dB	
Frequency error[2]				
Range	–20 to 20 kHz	–20 to 20 kHz	–20 to 20 kHz	–20 to 20 kHz
Accuracy	±1 Hz + tfa[3]	±1 Hz + tfa[3]	±1 Hz + tfa[3]	±1 Hz + tfa[3]
Quad error range	–5 to 5 deg	–5 to 5 deg	–5 to 5 deg	–5 to 5 deg
Amplitude imbalance range	–1 to +1 dB	–1 to +1 dB	–1 to +1 dB	–1 to +1 dB

1. *ML (mixer level) is RF input power minus attenuation.*
2. *The accuracy specification applies at the EVM = 1%.*
3. *tfa = transmitter frequency × frequency reference accuracy.*

Ordering Information

Software licensing and configuration

Choose from two license types:

– **Fixed, perpetual license:**
This allows you to run the application in the X-Series analyzer in which it is initially installed.

– **Transportable, perpetual license:**
This allows you to run the application in the X-Series analyzer in which it is initially installed, plus it may be transferred from one X-Series analyzer to another.

The table below contains information on our fixed, perpetual licenses. For more information, please visit the product web pages.

N6158A & W6158A CMMB X-Series measurement application

Description	Model-Option		Additional information
	PXA, MXA, EXA	CXA	
CMMB	N6158A-2FP	W6158A-2FP	

For a complete list of specifications refer to the appropriate specifications guide.

PXA: www.keysight.com/find/pxa_specifications

MXA: www.keysight.com/find/mxa_specifications

EXA: www.keysight.com/find/exa_specifications

CXA: www.keysight.com/find/cxa_specifications

Hardware configuration

N9030A PXA signal analyzer

Description	Model-Option	Additional information
Analog baseband IQ (BBIQ) inputs	N9030A-BBA	Required for analog baseband measurement
3.6, 8.4, 13.6, 26.5, 42.98, 44 or 50 GHz frequency range	N9030A-503, -508, -513, -526, -543, -544 or -550	One required
Precision frequency reference	N9030A-PFR	Recommended
Electronic attenuator, 3.6 GHz	N9030A-EA3	Recommended
Preamplifier, 3.6, 8.4, 13.6, 26.5, 42.98, 44 or 50 GHz	N9030A-P03, -P08, -P13, -P26, -P43, -P44 or P50	One recommended
Analysis bandwidth to 25, 40, or 160 MHz	N9030A-B25, -B40, or -B1X	One optional

N9020A MXA signal analyzer

Description	Model-Option	Additional information
3.6, 8.4, 13.6, or 26.5 GHz frequency range	N9020A-503, -508, -513, or -526	One required
Analog baseband IQ (BBIQ) inputs	N9020A-BBA	Required for analog baseband measurement
Precision frequency reference	N9020A-PFR	Recommended
Electronic attenuator, 3.6 GHz	N9020A-EA3	Recommended
Preamplifier, 3.6, 8.4, 13.6, or 26.5 GHz	N9020A-P03, -P08, -P13, or -P26	One recommended
Analysis bandwidth to 25 or 40 MHz	N9020A-B25, -B40	One optional

N9010A EXA signal analyzer

Description	Model-Option	Additional information
3.6, 7.0, 13.6, or 26.5 GHz frequency range	N9010A-503, -507, -513, or -526	One required
Precision frequency reference	N9010A-PFR	Recommended
Fine step attenuator	N9010A-FSA	Recommended
Electronic attenuator, 3.6 GHz	N9010A-EA3	Recommended
Preamplifier, 3.6 or 7.0 GHz	N9010A-P03 or -P07	One recommended
Analysis bandwidth to 25 or 40 MHz	N9010A-B25, -B40	One optional

N9000A CXA signal analyzer

Description	Model-Option	Additional information
3.0, 7.5, 13.6, or 26.5 GHz frequency range	N9000A-503, -507, -513, or -526	One required
Precision frequency reference	N9000A-PFR	Recommended
Analysis bandwidth to 25 MHz	N9000A-B25	Optional
Tracking generator, 9 kHz to 3GHz or 6 GHz	N9000A-T03 or T06	One optional
Fine step attenuator	N9000A-FSA	Recommended
Preamplifier, 3.0, 7.5, 13.6, or 26.5 GHz	N9000A-P03, -P07, -P13, or -P26	One recommended
Wideband IF output	N9000A-CR3	Optional

Related Literature

N6158A and W6158A CMMB Measurement Application, Demonstration Guide, Literature Number 5990-5934EN
N6158A & W6158A CMMB Measurement Application, Measurement Guide, Part number N6158-90002
N6158A & W6158A CMMB Measurement Application, User's and Programmer's Reference, Part Number N6158-90001

Web

Product page:
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