Keysight N6149A
iDEN/WiDEN/MotoTalk
X-Series Measurement Application

Technical Overview

– Measure iDEN/WiDEN/MotoTalk transmitter performance, including WiDEN multi-carrier base transceiver stations with multiple slot formats

– Supports measurements of BS (outbound) and MS (inbound)

– Perform one-button transmitter tests with pass/fail limit per iDEN standard

– Use hardkey/softkey manual user interface or SCPI remote user interface

– Leverage built-in context sensitive help

– Move application between X-Series signal analyzers with transportable licensing

KEYSIGHT
TECHNOLOGIES

iDEN/WiDEN/MotoTalk Measurement Application

The N6149A iDEN/WiDEN/MotoTalk measurement application for the X-Series signal analyzers (PXA, MXA and EXA) provides one-button, standard-based power and modulation analysis capabilities to help your design, evaluation, and manufacturing of iDEN radios, transmitters, amplifiers, tuners, and filters/repeaters.

The iDEN/WiDEN/MotoTalk measurement application is just one in a common library of more than 25 advanced 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. You can further extend your test assets by transporting applications across multiple X-Series analyzers.

Try Before You Buy!

Free 14-day trials of X-Series advanced measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license on-line today:
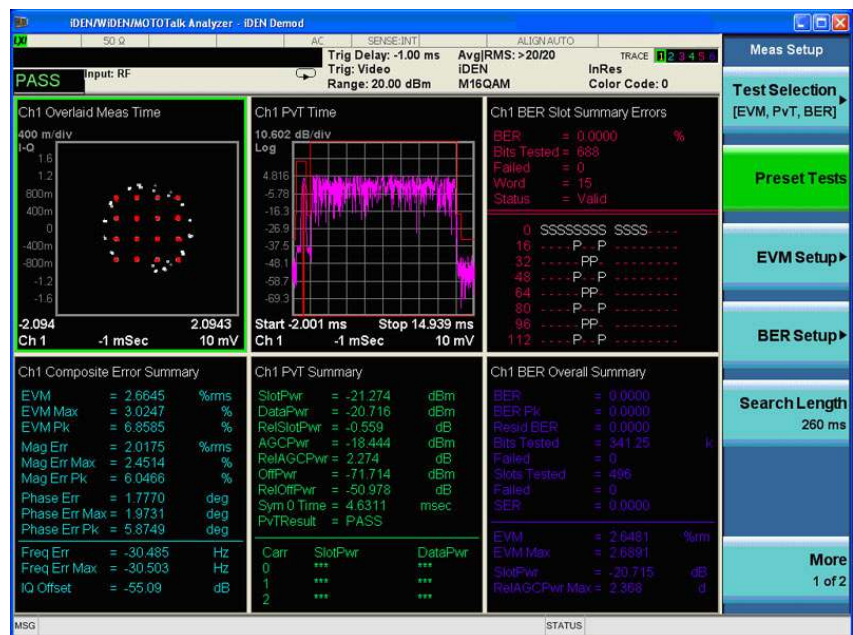
www.keysight.com/find/X-Series_trial

Figure 1. N6149A iDEN demodulation measurement

iDEN/WiDEN/MotoTalk Technology Overview

iDEN technology (Integrated Digital Enhanced Network) was developed by Motorola, Inc. The iDEN standard combines four communication technologies into a single network: radio, telephone, messaging, and data communications capabilities. The basic mode of operation in the iDEN system is Time Division Multiple Access (TDMA). The modulation for iDEN is called multiple carrier-QAM (M-QAM). The modulated signal consists of four frequency division multiplexed sub-channels, each carrying a M-ary_QAM signal, such as a 16QAM or 64QAM signal. The sub-channel approach allows you to use a lower symbol rate which provides resistance to time dispersion.

Fixed Network Equipment (FNE): the land-based side of the iDEN RF interface

Full slot: a full 15 ms slot

Inbound: from Subscriber Unit to FNE

Outbound: from FNE to Subscriber Unit

WiDEN (Wideband iDEN) is similar to iDEN Enhanced 6:1 format in the following ways:

— Both slot formats use the same symbol mapping.

— Both slot formats use the same sync and pilot definitions.

— Both slot formats use the same BER test sequence. However, in WiDEN the same sequence of BER words is transmitted on all active carriers. However, the sequence starting point is offset from carrier to carrier. For example, when four carriers are transmitted the

sequence transmitted on each carrier is offset by four words from the previous carrier. In this case, the BER word sequence transmitted in four active slots (possibly separated by inactive slots) would be:

Carrier 0 word sequence: 0, 1, 2, 3
Carrier 1 word sequence: 4, 5, 6, 7
Carrier 2 word sequence: 8, 9, a, b
Carrier 3 word sequence: c, d, e, f
— Both slot formats are 15 ms long.

WiDEN is dissimilar to iDEN Enhanced 6:1 format in the following ways:

— WiDEN allows one to four 25 kHz carriers.

— WiDEN allows arbitrary slots within a frame to be active.

— The training sequence is different between the two slot formats.

— The training waveform is DC centered with respect to the com-

posite signal and may or may not be present. For WiDEN, this means that the training waveform is often not centered with respect to any given carrier.

— WiDEN adds an SGC pulse for the benefit of the base station at a point in time where there is no data or any other information being transmitted by the mobile. WiDEN can simultaneously transmit up to four carriers at 25 kHz spacing.

You can perform WiDEN signal analysis under any of the allowed carrier combinations. When multiple carriers are present, all carriers will be analyzed at the same time.

There are five distinct carrier configurations for WiDEN inbound signals. These configurations are shown in Figure 2.
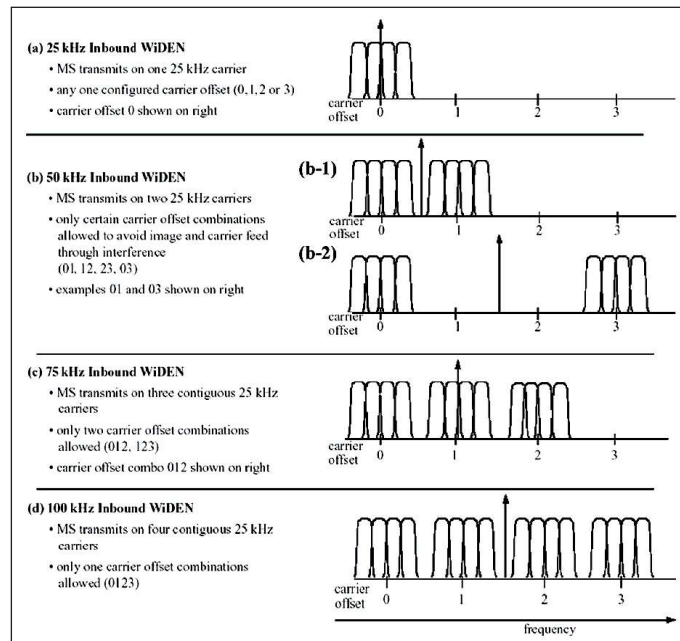

Figure 2. WiDEN inbound carrier configurations

MotoTalk supports mobile-to-mobile communications between a pair or group of MotoTalk radios on a single logical channel in simplex fashion (walkie-talkie).

MotoTalk uses orthogonal, continuous-phase, 8-level Frequency Shift Keying (8-FSK) modulation format. A Gaussian pre-modulation filter is applied to the baseband symbols to reduce adjacent channel splatter. In addition, an envelope windowing function is applied to each slot, so that the slot begins and ends with smooth transitions.

Because MotoTalk is deployed in the 900 MHz Industrial, Scientific, and Medical (ISM) band, frequency hopping rules governed by FCC regulations are followed. The highlights are as follows:

– A pseudorandom sequence is employed for frequency selection, and each burst is sent on a different frequency.

– Preamble and Sync Slot Bursts are ALWAYS sent in the same order and on the same frequencies each time. There are three of each, and they are always the first six bursts of any transmission.

– The traffic bursts are carried on frequencies determined by the pseudorandom sequence, and the first traffic burst always picks up the sequence where the final burst of that transmitter's previous transmission left off. The seed sent in the Sync Slot ID Block points to the position in the sequence of the first burst of the upcoming sequence.

– In order to ensure uniform distribution of frequencies for voice mode, the pseudorandom sequence generator reduces the likelihood of selecting the Preamble/Sync-Slot frequencies during short transmissions or the early portion of long transmissions.

– A similar process is used in data mode, but the weighting factor is different for selecting Preamble/Sync frequencies during traffic since data transmissions are always the same length.

RF Transmitter Tests

With the X-Series signal analyzers and the iDEN/WiDEN/MotoTalk measurement application, you can perform RF transmitter measurements on BTS and mobile devices in time, frequency and modulation domains. Measure iDEN and WiDEN signals as well as MotoTalk signals with 4QAM/16QAM/64QAM modulation formats.

Table 1. One-button measurements provided by the N6149A measurement application

| Technology	iDEN	WiDEN	MotoTalk
X-Series measurement application	N6149A	N6149A	N6149A
X-Series signal analyzer	PXA, MXA, EXA	PXA, MXA, EXA	PXA, MXA, EXA
Measurements			
Modulation quality			
RMS EVM	●	●	●
Peak EVM	●	●	●
Max EVM	●	●	
Magnitude error	●	●	
Peak magnitude error	●	●	
Max magnitude error	●	●	
Phase error	●	●	
Freq error	●	●	
I/Q offset	●	●	
Constellation diagram		●	
Burst power			●
Slot power			●
Slot # analyzed			●
Power			
Reference power	●	●	
Adjacent power	●	●	
Occupied bandwidth	●	●	
Power vs. Time (PvT)			
PvT mask	●	●	
Symbol time	●	●	
Power: slot, data, relative	●	●	
Sub-channel slot/data pwr		●	
Bit Error Rate (BER)			
EVM	●	●	
Max EVM	●	●	
Slot power	●	●	
Max power	●	●	
Displayed symbols	●	●	
BER %	●	●	
BER tested, failed, status	●	●	
BER peak	●	●	
Slots tested, failed	●	●	
Slot Error Rate (SER)	●	●	
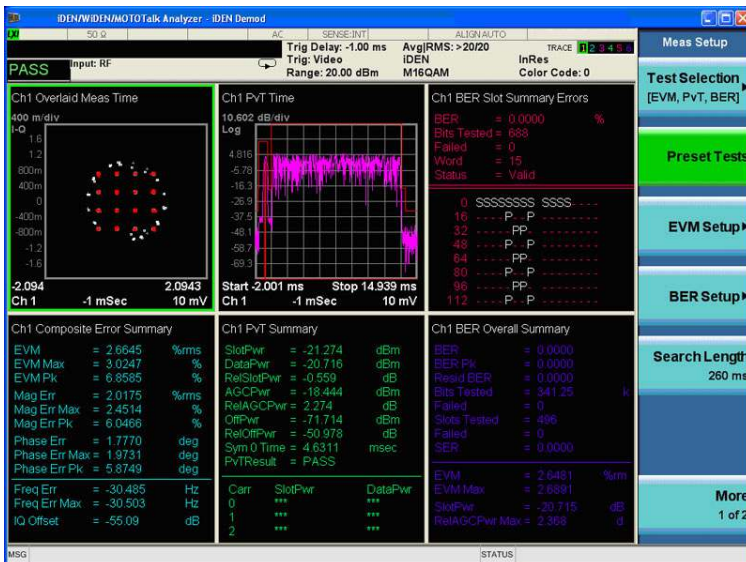
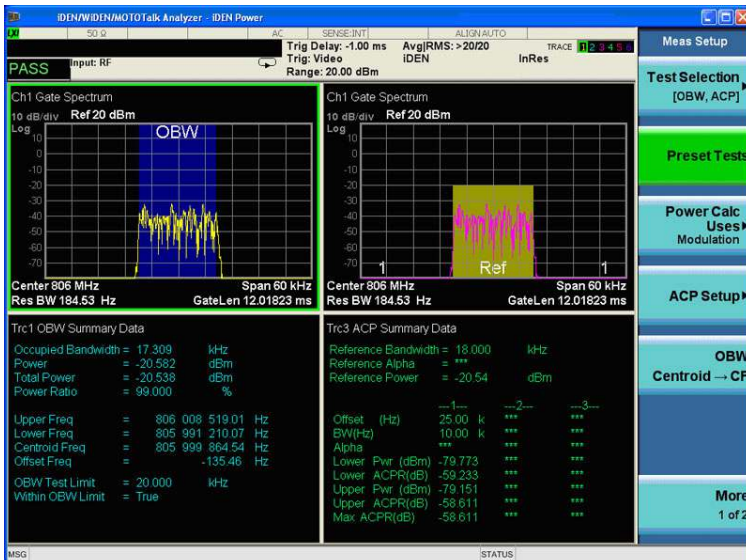Figure 3. N6149A iDEN demodulation measurement

Figure 4. N6149A iDEN power and frequency measurements
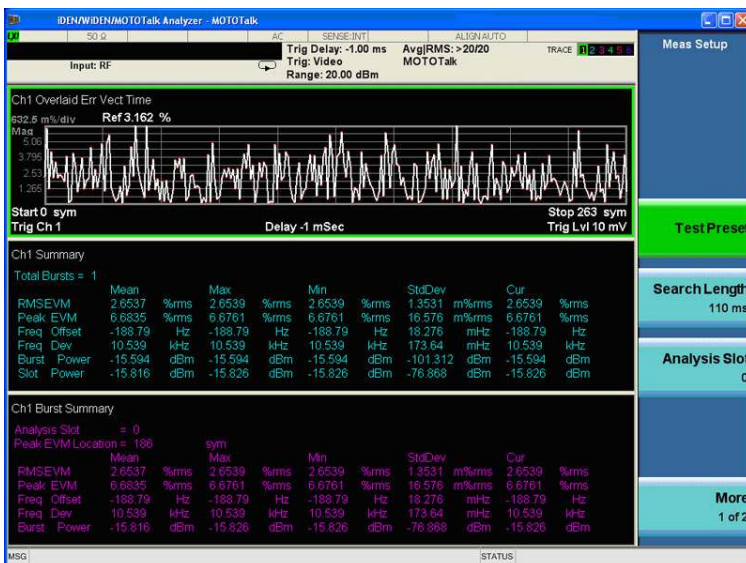

Figure 5. N6149A MotoTalk measurement

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Key Specifications

Definitions (Data and specifications are subject to change)

– 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.

Performance specifications

Description	Specifications	Supplemental information
iDEN Demod		
ML = –20 dBm 0 to 50 °C		RF input power range is accordingly determined to meet mixer level
iDEN composite EVM floor (The EVM floor is derived for signal power –20 dBm. The signal is iDEN Inbound Full Reserved.)		2.4% (nominal, PXA/MXA) 2.4% (nominal, EXA)
MotoTalk		
ML = –20 dBm 0 to 50 °C		RF input power range is accordingly determined to meet Mixer level
Composite EVM floor (The EVM floor is derived for signal power –20 dBm.)		1.3% (nominal, PXA/MXA) 1.4% (nominal, EXA)

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

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 (PXA/MXA/EXA).

Try Before You Buy!

Free 14-day trials of X-Series advanced measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license on-line today:

www.keysight.com/find/X-Series_trial

N6149A iDEN/WiDEN/MotoTalk measurement application

Model-option	Description	Notes
N6149A-2FP	iDEN/WiDEN/MotoTalk measurement application, fixed perpetual license	
N6149A-2TP	iDEN/WiDEN/MotoTalk measurement application, transportable perpetual license	

Hardware configurations

N9030A PXA signal analyzer

Model-option	Description	Notes
N9030A-503, -508, -513 or -526	3.6, 8.4, 13.6, or 26.5 GHz frequency range	One required
N9030A-PFR	Precision frequency reference	Recommended
N9030A-EA3	Electronic attenuator, 3.6 GHz	Recommended
N9030A-P03, -P08, -P13 or -P26	Preamplifier, 3.6, 8.4, 13.6 or 26.5 GHz	One recommended

N9020A MXA signal analyzer

Model-option	Description	Notes
N9020A-503, -508, -513 or -526	3.6, 8.4, 13.6, or 26.5 GHz frequency range	One required
N9020A-PFR	Precision frequency reference	Recommended
N9020A-EA3	Electronic attenuator, 3.6 GHz	Recommended
N9020A-P03, -P08, -P13 or -P26	Preamplifier, 3.6, 8.4, 13.6 or 26.5 GHz	One recommended

N9010A EXA signal analyzer

Model-option	Description	Notes
N9010A-503, -507, -513 or -526	3.6, 7.0, 13.6, or 26.5 GHz frequency range	One required
N9010A-PFR	Precision frequency reference	Recommended
N9010A-FSA	Fine step attenuator	Recommended
N9010A-EA3	Electronic attenuator, 3.6 GHz	Recommended
N9010A-P03, -P07	Preamplifier, 3.6 or 7.0 GHz	One recommended

Additional Resources

Literature

N6149A iDEN/WiDEN/MotoTalk, Self-Guided Demonstration, literature number 5990-6793EN

N6149A iDEN/WiDEN/MotoTalk, Measurement Guide, part number N6149-90002

N6149A iDEN/WiDEN/MotoTalk, User's and Programmer's Reference Guide, part number N6149-90001
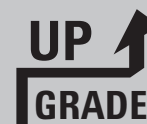
Web

Product pages:
www.keysight.com/find/N6149A

X-Series advanced measurement applications:
www.keysight.com/find/X-Series_apps

X-Series signal analyzers:
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