Keysight Technologies
DVB-T/H with T2
X-Series Measurement Application
N6153A & W6153A

Technical Overview

KEYSIGHT TECHNOLOGIES

Introduction

- DVB-T/H/T2 RF transmitters, modulators, gap-fillers, tuners, or amplifiers measurements
- Single frequency network measurement (supports pre-, post-, 0 dB, and out-of-GI echo scenarios)
- Auto-detect demodulation parameters from TPS decoding of DVB-T/H or from L1-Signalling of DVB-T2
- DVB-T2 supports both single PLP and multi-PLP modes as well as SISO and MISO measurements
- One-button tests with pass/fail limit per DVB-T, DVB-H, and DVB-T2 standards
- Hardkey/softkey manual user interface or SCPI remote control
- Built-in, context-sensitive help
- Transportable license between X-Series signal analyzers

DVB-T/H with T2 Measurement Application

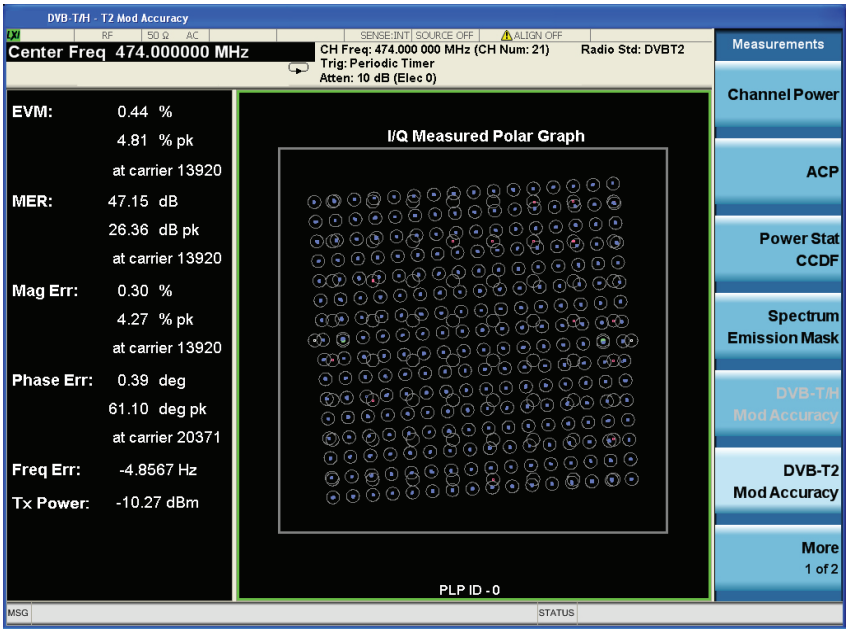
The Keysight Technologies, Inc. N/W6153A measurement application provides one-button, standards-based power and modulation analysis capabilities to help you with designing, evaluating, and manufacturing DVB-T/H/T2 modulators, transmitters, amplifiers, tuners, and gap-fillers/repeaters. Optional analog baseband IQ inputs in the PXA or MXA signal analyzer provide you the flexibility to measure signal quality and modulation accuracy with RF input or analog IQ input.

The N/W6153A measurement application is just one in a common library of more than 25 measurement applications in the Keysight X-Series. The Keysight X-Series is 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.

Key parameter setup

- Radio standard: DVB-T, DVB-H, and DVB-T2 (versions 1.1.1 and 1.2.1) Channel bandwidth: 5/6/7 /8 MHz in DVB-T/H; 1.7/5/6/7 /8/10 MHz in DVB-T2
- FFT Mode: 2K/8K in DVB-T, 2K/4K/8K in DVB-H, 1k/2K/4K/8K/16K/32K in DVB-T2
- Modulation: QPSK/16QAM/64QAM in DVB-T/H; QPSK,16/64/256QAM in DVB-T2
- Input: RF or analog IQ (available in the PXA or MXA) for signal quality and modulation accuracy measurements



DVB-T/H Standards Overview

Digital video broadcasting-terrestrial/handheld (DVB-T/H) is the European-based consortium standard for broadcast transmission of digital terrestrial/handheld television.

DVB-T

DVB-T is a flexible system that allows networks to be designed for the delivery of compressed digital audio, video, and other data in an MPEG transport stream using OFDM modulation with concatenated channel coding (i.e. COFDM). It is the most widely adopted digital terrestrial television broadcasting standard in the world and is deployed in more than 30 countries.

In DVB-T, the use of OFDM modulation with appropriate guard interval allows optimal tradeoff between network topology and frequency efficiency. The capacity for hierarchical modulation can enable two completely separate data streams to transmit in a single signal which can be used to trade off bit rate versus ruggedness. DVB-T has the following technical characteristics that make it a very flexible system.

DVB-H

DVB-H is an extension of the DVB-T standard, which takes into account the handheld receiver's specific properties such as the small size, light weight, portability, and battery operation.

DVB-H uses a time slicing technique which results in a large battery power saving effect, and introduces a multi-protocol encapsulation forward error correction (MPE-FEC) scheme for reliable transmission in poor signal reception conditions. A transmission mode of 4k is defined in DVB-H to offer a tradeoff between the transmission cell size and mobile reception capabilities.

The complexity of the DVB-T/H standards demands flexibility and excellent modulation analysis for system development and evaluation.

DVB-T2

The DVB-T2 standard, defined in ETSI EN 302 755, is an extension of the existing DVB-T standard, aiming to provide a minimum of 30% capacity increase over the DVB-T, improving single-frequency-network (SFN) performance, service specific robustness, better error correction ability, and bandwidth and frequency flexibility.

A new technology, called Rotated Constellation, is used and provides significant additional robustness in difficult channels. DVB-T2 defines two modes: Mode A (single PLP) and Mode B (multi-PLPs). A multi-PLPs mechanism is provided to separately adjust the robustness of each delivery service within a channel to meet the required reception conditions. Furthermore, a receiver can save power by decoding only a single service rather than the entire multiplex of service.

Table 1. Key parameters in DVB-T, DVB-H, and DVB-T2 standards

	DVB-T	DVB-H	DVB-T2
Frequency	VHF-III (170 to 230 MHz) UHF-IV/V (470 to 862 MHz)	VHF-III (170 to 230 MHz) UHF-IV/V (470 to 862 MHz) L (1.452 to 1.492 GHz)	VHF-III (170 to 230 MHz) UHF-IV/V (470 to 862 MHz)
Bandwidth	5, 6, 7, 8 MHz	5, 6, 7, 8 MHz	1.7, 5, 6, 7, 8, 10 MHz
Modulation	OFDM	OFDM	OFDM
FFT size	2K, 8K	2K, 4K, 8K	1K, 2K, 4K, 8K, 16K, 32K
Modulation format	QPSK/16QAM/64QAM	QPSK/16QAM/64QAM	QPSK,16/64/256QAM
Guard interval	1 /4, 1 /8, 1/16, 1/32	1 /4, 1 /8, 1/16, 1/32	1 /4, 19/256, 1 /8, 19/128, 1/16, 1/32, 1/128
FEC	Convolution + Reed Solomon 1 /2, 2/3, 3 /4, 5/6, 7 /8	Convolution + Reed Solomon 1 /2, 2/3, 3 /4, 5/6, 7 /8, and MPE-FEC	LDPC+BCH 1 /2, 3/5/, 2/3, 3 /4, 4/5, 5/6
Constellation rotation	No	No	Yes
MIMO Support	SISO	SISO	SISO, MISO
Stream	MPEG-2 TS	DVB-IPDC and MPEG-2 TS	TS, GSE, GCS, or GFPS
Bit rate	4.976 ~ 31.668 Mb/s	4.976 ~ 31.668 Mb/s	Up to 50.34 Mb/s
Other		Time slicing	

Transmitter Tests

The RF transmitter test requirements for DVB standards are defined in the ETSI TR 101 290 standard. Table 2 shows the required base station RF transmitter tests along with the corresponding measurement applications.

Table 2. Required RF transmitter measurements and the corresponding measurements in N/W6153A

ETSI TR101 290 v.1.2.1 Paragraph #	Transmitter test	N/W6153A DVB-T/H with T2 measurement application
9.1.1	RF frequency accuracy (precision)	Spectrum analyzer mode (marker counter function)
9.1.2	RF channel width (sampling frequency accuracy)	Spectrum analyzer mode (marker counter function)
9.1.3	Symbol length measurement at RF (guard interval verification)	Spectrum analyzer mode (marker counter function)
9.2	Selectivity	Modulation accuracy (BER view)
9.4	Phase noise of local oscillators (LO)	N/W9068A phase noise measurement application
9.5	RF/IF signal power	Channel power
9.7	RF and IF spectrum	Monitor spectrum
9.8	Receiver sensitivity/dynamic range for a Gaussian channel	Modulation accuracy (BER view)
9.9	Equivalent noise degradation (END)	Modulation accuracy (BER view)
9.9.1	Equivalent noise floor (ENF)	Modulation accuracy (BER view)
9.10	Linearity characterization (shoulder attenuation)	Channel power (shoulder attenuation view)
9.12	Coherent interferer	Spectrum analyzer mode
9.13	BER vs C/N ratio by variation of transmitter power	Modulation accuracy (BER view)
9.14	BER vs C/N ratio by variation of Gaussian noise power	Modulation accuracy (BER view)
9.15	BER before Viterbi (inner) decoder	Modulation accuracy (BER view)
9.16	BER before RS (outer) decoder	Modulation accuracy (BER view)
9.17	BER after RS (outer) decoder	Modulation accuracy (BER view)
9.18.1	I/Q analysis definition	NA
9.18.2	Modulation error ratio	Modulation accuracy (result metrics view)
9.18.3	System target error	NA
9.18.4	Carrier suppression	Modulation accuracy (result metrics view)
9.18.5	Amplitude imbalance	Modulation accuracy (result metrics view)
9.18.6	Quadrature error	Modulation accuracy (result metrics view)
9.18.7	Phase jitter	Modulation accuracy (result metrics view)

Measurement details

All of the RF transmitter measurements as defined by the DVB-T/H/T2 standard, as well as a wide range of additional measurements and analysis tools, are available with the press of a button (Table 3). 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, power stat CCDF, and IQ waveform measurements.

Table 3. One-button measurements provided by the N/W6153A measurement application

Technology	DVB-T/H	DVB-T2
Measurements		
Channel power	●	●
Shoulder attenuation	●	●
Spectrum mask with analog TV in adjacent channel	●	●
Adjacent channel power	●	●
Spectrum emission mask	●	●
Power statistic CCDF	●	●
Spurious emission	●	●
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)	●	●
Clock error (Hz)	●	●
Tx power (dBm)	●	●
Amplitude Imbalance	●	●
Quadrature error (deg)	●	●
Phase jitter (rad)	●	●
Carrier suppression (dB)	●	
SNR (dB)	●	
TPS power ratio (dB)	●	
Data power ratio (dB)	●	
MER/EVM vs. subcarriers/frequency	●	
MER of data (dB)	●	●
MER of pilot/TPS (dB)	●	●
MER of P2 Pilot/L1-Pre/L1-Post/Cont	●	
Pilot/Scat Pilot/FC Pilot		●
Amplitude vs. subcarriers (dB)	●	●
Phase vs. subcarriers (deg)	●	●
Group delay vs. subcarriers (ns)	●	●
Channel impulse response (dB)	●	●
Single frequency network (SFN) test	●	●
(pre-, post-, and 0 dB echo)	●	●
BER results	●	●
TPS decoding	●	
L1 signalling		●
MER monitor	●	●
MER vs. PLP		●
MISO Support		●

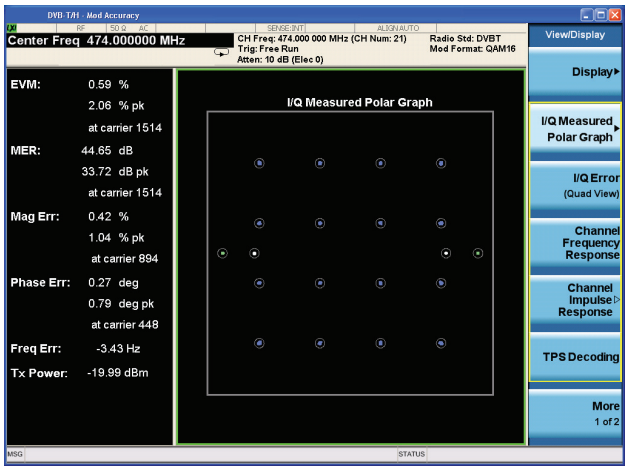


Figure 1. DVB-T/H constellation and MER results

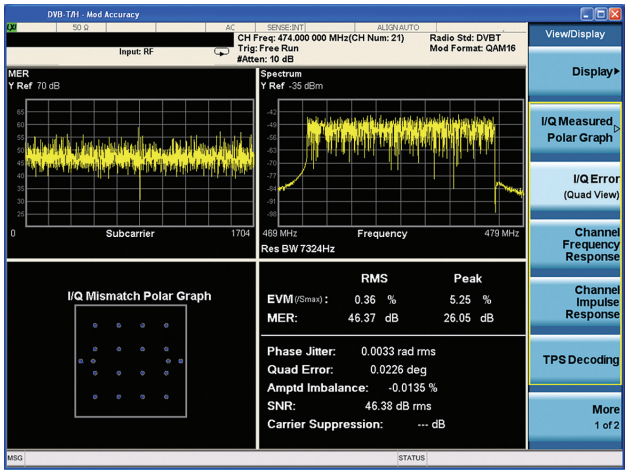


Figure 2. DVB-T/H IQ error (quad view)

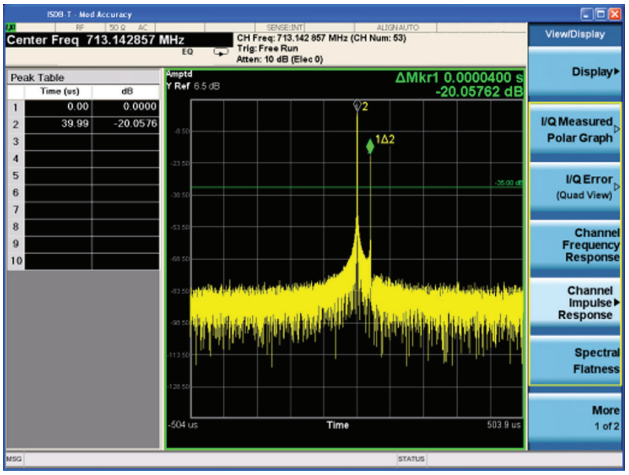


Figure 3. DVB-T/H channel impulse response with peak table

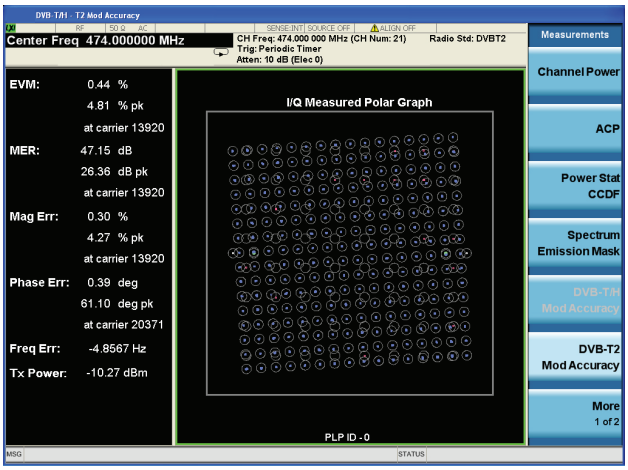


Figure 4. DVB-T2 constellation and MER result view

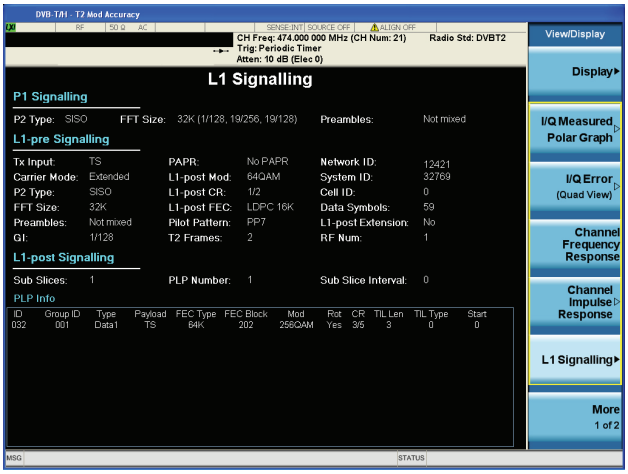


Figure 5. DVB-T2 L1 signaling view

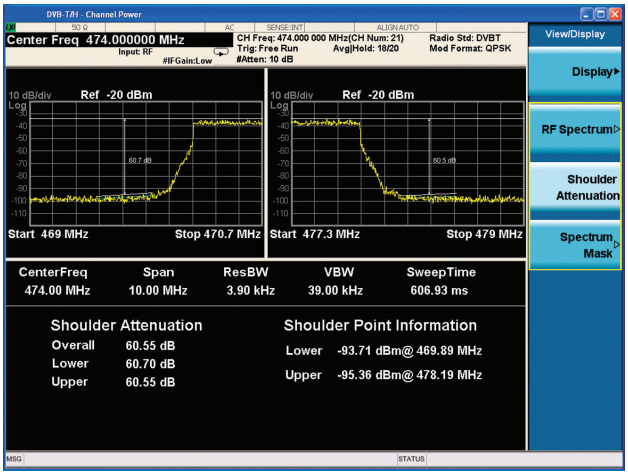


Figure 6. DVB-T/H shoulder attenuation

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

Description	PXA	MXA	EXA	CXA
Channel power				
5.60 MHz integration bandwidth	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)	–50 dBm (nom)
Absolute power accuracy 20 to 30 °C	± 0.61 dB (± 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	–85.9 dBm	–82.9 dBm	–78.9 dBm	–75.9 dBm
Channel power with shoulder attenuation view				
5.60 MHz integration bandwidth	ML[1] = –15.0 dBm (nom)	ML[1] = –16.0 dBm (nom)	ML[1] = –16.0 dBm (nom)	ML[1] = –15.0 dBm (nom)
Dynamic range, relative Offset frequency 7.61/ 2 MHz	97.8 dB	92.2 dB	86.9 dB	84.6 dB
+ 500 kHz	(102.8 dB typ)	(98.5 dB typ)	(94.0 dB typ)	(91.8 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	7.61 MHz noise bandwidth, method = IBW			
Offset frequency 8 MHz	± 0.20 dB	± 0.44 dB	± 0.94 dB	± 1.42 dB
Spectrum emission mask	8 MHz integration bandwidth, RBW = 3.9 kHz			
4.0 MHz offset				
Dynamic range, relative	97.8 dB (102.8 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 dB (–118.5 dBm typ)	–110.5 dB (–115.5 dBm typ)	–105.5 dB (–111.5 dBm typ)	–102.5 dB (–108.5 dBm typ)

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

Description	PXA	MXA	EXA	CXA
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	100.2 dB (105.1 dB typ)	94.5 dB (100.5 dB typ)	89.2 dB (95.9 dB typ)	87.1 dB (94.9 dB typ)
Sensitivity, absolute	–114.5 dB (–118.5 dBm typ)	–110.5 dB (–115.5 dBm typ)	–105.5 dB (–111.5 dBm typ)	–102.5 dB (–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%)
Spurious emission				
Mixer level	2 dBm	3 dBm	3 dBm	–3 dBm
Dynamic range, relative				
RBW = 3.9 kHz	114.2 dB (118.2 dB typ)	106.0 dB (111.0 dB typ)	102.5 dB (107.8 dB typ)	92.8 dB (95.4 dB typ)
RBW = 1009 kHz	100.1 dB (104.1 dB typ)	91.9 dB (96.9 dB typ)	88.5 dB (93.7 dB typ)	78.7 dB (81.3 dB typ)
Sensitivity, absolute	–90.4 dB (–94.4 dBm nom)	–86.4 dB (–91.4 dBm nom)	–81.4 dB (–87.4 dBm nom)	–78.4 dB (–84.4 dBm nom)
Accuracy, absolute				
20 Hz to 3.6 GHz	0.19 dB (95%)	0.29 dB (95%)	0.38 dB (95%)	
3.5 to 8.4 GHz	1.08 dB (95%)	1.17 dB (95%)	1.22 dB (95%)	
8.3 to 13.6 GHz	1.48 dB (95%)	1.54 dB (95%)	1.59 dB (95%)	
100 kHz to 3.0 GHz				0.81 dB (95%)
3.0 to 7.5 GHz				1.80 dB (95%)
DVB-T/H modulation accuracy	DVB-T 64QAM EVM, ML[1] = –20 dBm, 20 to 30 °C			
EVM				
Operating range	0 to 8%	0 to 8%	0 to 8%	0 to 8% (nom)
Floor	0.30% (EQ ON) 0.32% (EQ OFF)	0.52% (EQ ON) 0.56% (EQ OFF)	0.64% (EQ ON) 0.73% (EQ OFF)	0.64% (EQ ON, nom) 0.73% (EQ OFF, nom)
Accuracy				
From 0.35/0.66/0.70% (PXA/MXA/EXA) to 1.2%	± 0.20%	± 0.20%	± 0.30%	
From 1.2 to 2.0%	± 0.10%	± 0.20%	± 0.20%	
From 2.0 to 8.0%	± 0.20%	± 0.20%	± 0.20%	
MER				
Operating range	≥ 22 dB	≥ 22 dB	≥ 22 dB	≥ 22 dB (nom)
Floor	51 dB (EQ On) 50 dB (EQ Off)	46 dB (EQ On) 45 dB (EQ Off)	44 dB (EQ On) 43 dB (EQ Off)	44 dB (EQ On, nom) 43 dB (EQ Off, nom)
Accuracy				
From 38 to 49 dB/44 dB/43 dB (PXA/MXA/EXA)	± 2.64 dB	± 2.20 dB	± 2.62 dB	
From 34 to 38 dB	± 0.36 dB	± 0.69 dB	± 1.02 dB	
From 22 to 34 dB	± 0.25 dB	± 0.36 dB	± 0.48 dB	
Frequency error[2]				
Range	–100 to 100 kHz	–100 to 100 kHz	–100 to 100 kHz	–100 to 100 kHz (nom)
Accuracy	± 10 Hz + tfa[3]	± 10 Hz + tfa[3]	± 10 Hz + tfa[3]	± 10 Hz + tfa[3] (nom)

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*

Description	PXA	MXA	EXA	CXA
Phase jitter				
Range	0 to 0.0349 rad	0 to 0.0349 rad	0 to 0.0349 rad	0 to 0.0349 rad (nom)
Resolution	0.0001 rad	0.0001 rad	0.0001 rad	0.0001 rad (nom)
Quad error				
Range	–4 to 5 deg	–4 to 5 deg	–4 to 5 deg	–4 to 5 deg (nom)
Accuracy	± 0.090 deg	± 0.090 deg	± 0.090 deg	± 0.090 deg (nom)
Amplitude imbalance				
Range	–5 to 5%	–5 to 5%	–5 to 5%	–5 to 5% (nom)
Accuracy	± 0.45%	± 0.45%	± 0.50%	± 0.50% (nom)
BER before Viterbi				
Range	0 to 1.0×10^{-1}	0 to 1.0×10^{-1}	0 to 1.0×10^{-1}	0 to 1.0×10^{-1} (nom)
BER before Reed-Solomn				
Range	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3} (nom)
BER after Reed-Solomn				
Range	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3} (nom)
Channel impulse response (also called echo pattern)	(a) Selectable center and time/div (b) Scale type by Time or Distance (c) Results sorted by Amplitude or Time/Distance (d) Default echo search limit –35 dB and adjustable (e) Adjustable FFT Start Position (0/8 to 8/8 GI), and MER metric displayed on the top of the view can be used as the criteria to tune the FFT window (f) Support pre-echo, post-echo, 0 dB echo and out-of-GI echo scenarios (time range supports up to one OFDM symbol length Tu with Decoding On) (h) Cell ID (hex/dec) display			
DVB-T2 modulation accuracy	DVB-T2 single PLP, 32K FFT, 256QAM, constellation rotation yes, ML[1] = –20 dBm, 20 to 30 °C			
EVM				
Operating range	0 to 6%	0 to 6%	0 to 6%	0 to 6% (nom)
Floor	0.27% (EQ Off)	0.58% (EQ Off)	0.72% (EQ Off)	0.72% (EQ Off, nom)
MER				
Operating range	≥ 24 dB	≥ 24 dB	≥ 24 dB	≥ 24 dB (nom)
Floor	51 dB (EQ Off)	45 dB (EQ Off)	43 dB (EQ Off)	43 dB (EQ Off, nom)
Frequency error[2]				
Range	–380 kHz to 380 kHz	–380 kHz to 380 kHz	–380 kHz to 380 kHz	–380 kHz to 380 kHz (nom)
Accuracy	± 1 Hz + tfa[3]	± 1 Hz + tfa[3]	± 1 Hz + tfa[3]	± 1 Hz + tfa[3] (nom)
Clock error[2]				
Range	–20 Hz to 20 Hz	–20 Hz to 20 Hz	–20 Hz to 20 Hz	–20 Hz to 20 Hz (nom)
Accuracy	± 1 Hz + tfa[3]	± 1 Hz + tfa[3]	± 1 Hz + tfa[3]	± 1 Hz + tfa[3] (nom)
Quad error				
Range	–5 deg to 5 deg	–5 deg to 5 deg	–5 deg to 5 deg	–5 deg to 5 deg (nom)
Amplitude imbalance				
Range	–1 to +1 dB	–1 to +1 dB	–1 to +1 dB	–1 to +1 dB (nom)
BER before LDPC				
Range	0 to 1.0×10^{-1}	0 to 1.0×10^{-1}	0 to 1.0×10^{-1}	0 to 1.0×10^{-1} (nom)
BER before BCH				
Range	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3} (nom)
BER after BCH				
Range	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3}	0 to 1.0×10^{-3} (nom)
Packet error rate				
Range	0 to 1.0	0 to 1.0	0 to 1.0	0 to 1.0 (nom)

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*

Description	PXA	MXA	EXA	CXA
LDPC itineration times				
Data	0 to 100	0 to 100	0 to 100	0 to 100 (nom)
L1-pre	0 to 100	0 to 100	0 to 100	0 to 100 (nom)
L1-post	0 to 100	0 to 100	0 to 100	0 to 100 (nom)
MISO Tx1 only	Measurements same as SISO			
MISO Tx2 only	Measurements same as SISO			
MISO Tx1+Tx	(a) Combined data MER/EVM (rms) (b) Combined L1-pre EVM/MER (rms) (c) Combined L1-post EVM/MER (rms) (d) Combined BER result (e) Combined data per PLP (MER rms, EVM rms, Magnitude Error rms, Phase Error rms) (f) Channel frequency response (Tx1) (g) Channel frequency response (Tx2) (h) Frequency error (Hz) (i) Clock error (Hz) (j) Tx power (dBm)			
Channel impulse response (SISO-SFN and MISO-SFN echo pattern)	(a) Selectable center and time/div (b) Scale type by Time or Distance (c) Results sorted by Amplitude or Time/Distance (d) Default echo search limit –35 dB and adjustable (e) Adjustable FFT Start Position (0/8 to 8/8 GI), and MER metric displayed on the top of the view can be used as the criteria to tune the FFT window (f) Support pre-echo, post-echo, 0 dB echo and out-of-GI echo scenarios (g) Cell ID (hex/dec) display (h) Adjustable echo display, from MISO Tx1 group, or from MISO Tx2 group, or from MISO Tx1+Tx2 (dual trace, relative amplitude and delay display between Tx1 group and Tx2 group)			

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

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.

N6153A & W6153A DVB-T/H with T2 X-Series measurement application

Description	Model-Option		Additional information
	PXA, MXA, EXA	CXA	
DVB-T/H	N6153A-2FP	W6153A-2FP	
DVB-T2	N6153A-3FP	W6153A-3FP	

Hardware configurations

N9030A PXA signal analyzer

Description	Model-Option	Additional information
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
Analog baseband IQ (BBIQ) inputs	N9030A-BBA	Required for analog baseband measurement
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
Wideband IF output	N9030A-CR3	Optional
Programmable IF output	N9030A-CRP	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
Dual-core, high-performance processor, removable SSD	N9020A-PC4	Recommended for faster MER/BER
Digital processor with 2 GB capture memory	N9020A-DP2	Optional for faster MER/BER
Analysis bandwidth to 25 or 40 MHz	N9020A-B25 or B40	One optional
Wideband IF output	N9020A-CR3	Optional
Programmable IF output	N9020A-CRP	Optional

N9010A EXA signal analyzer

Description	Model-Option	Additional information
3.6, 7.0, 13.6, 26.5, 32, or 44 GHz frequency range	N9010A-503, -507, -513, -526, -523, -544	One required
Precision frequency reference	N9010A-PFR	Recommended
Electronic attenuator, 3.6 GHz	N9010A-EA3	Recommended
Preamplifier, 3.6 or 7.0 GHz	N9010A-P03 or P07	One recommended
Dual-core, high-performance processor, removable SSD	N9010A-PC4	Recommended for faster MER/BER
Digital processor with 2 GB capture memory	N9010A-DP2	Optional for faster MER/BER
Analysis bandwidth to 25 MHz or 40 MHz	N9010A-B25 or B40	One optional
Wideband IF output	N9010A-CR3	Optional
Programmable IF output	N9010A-CRP	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
Fine step attenuator	N9000A-FSA	Recommended
Precision frequency reference	N9000A-PFR	Recommended
Preamplifier, 3.0, 7.5, 13.6, or 26.5 GHz	N9000A-P03 or -P07, -P13 or -P26	One recommended
Tracking generator of 9 kHz to 3 GHz or 6 GHz	N9000A-T03 or T06	One optional
Analysis bandwidth to 25 MHz	N9000A-B25	Optional
Wideband IF output	N9000A-CR3	Optional

Related Literature

N6153A & W6153A DVB-T/H with T2 Measurement Application, Demonstration Guide, literature number 5990-5931EN
N6153A & W6153A DVB-T/H with T2 Measurement Application, Measurement Guide, Part number N6153-90002
N6153A & W6153A DVB-T/H with T2 Measurement Application, User's and Programmer's Reference, Part number N6153-90001

Web

Product page:
www.keysight.com/find/N6153A and www.keysight.com/find/W6153A

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

X-Series signal analyzers:
www.keysight.com/find/X-Series

Application pages:
www.keysight.com/find/digitalvideo

Digital video solution table:
www.keysight.com/find/digitalvideo_solution

myKeysight

myKeysight

www.keysight.com/find/mykeysight
A personalized view into the information most relevant to you.

www.lxistandard.org
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/go/quality
Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners
www.keysight.com/find/channelpartners
Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-09-04-14)

KEYSIGHT TECHNOLOGIES

Published in USA, August 3, 2014
5990-3569EN
www.keysight.com