

Keysight Technologies

ISDB-T/Tmm

X-Series Measurement Application

N6155A & W6155A

Technical Overview



Introduction

- Measure ISDB-T or ISDB-Tmm RF transmitter, modulator, gap-filler, tuner, or amplifier performance
- Auto-detect the ISDB-T demodulation parameters and display in the TMCC decoding view; auto-detect and show the ISDB-Tmm configuration by super segment
- Single frequency network measurement (supports pre-, post-, 0-dB, and out-of-GI echo scenarios)
- Show the AC (auxiliary channel) decoded bits in AC decoding results view
- Perform one-button tests with pass/fail limit per ISDB-T and ISDB-T_{SB} standards
- Use hardkey/softkey manual user interface or SCPI remote control
- Leverage built-in context sensitive help
- Move application between X-Series signal analyzers with transportable licensing

ISDB-T/Tmm Measurement Application

The ISDB-T/Tmm measurement application provides one-button, standard-based power and modulation analysis capabilities to help you with designing, evaluating, and manufacturing ISDB-T modulators, transmitters, amplifiers, tuners, and gap-fillers/repeaters. Used with the optional analog baseband IQ inputs in the PXA or MXA signal analyzer, it can provide you the flexibility of measuring signal quality and modulation accuracy with RF input or analog IQ input.

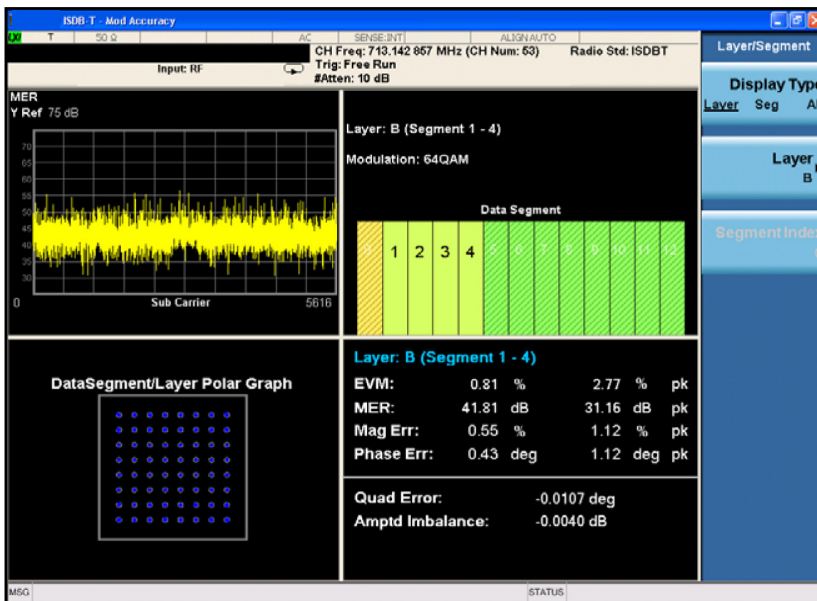
The ISDB-T/Tmm measurement application is just one in a common library of more than 25 measurement applications in the Keysight Technologies, Inc. X-Series, an evolutionary approach to signal analysis that spans instrumentation, measurements, and software.

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 you to transport the application to multiple X-Series analyzers.

Key parameter setup

- Radio standard: ISDB-T, or ISDB-T_{SB}, and ISDB-Tmm
- Channel bandwidth: 6/ 7/ 8 MHz for ISDB-T; 14.5 MHz for ISDB-Tmm
- Segment number: 13 segments for ISDB-T, 1 or 3 segments for ISDB-T_{SB}, 33 segments for ISDB-Tmm
- FFT mode: 2K, 4K or 8K
- Guard interval: 1/4, 1/8, 1/16, 1/32
- Partial reception: On/Off
- Modulation: QPSK/16QAM/64QAM
- Input: RF or analog IQ (only available in the N9030A PXA or N9020A MXA) for signal quality and modulation accuracy measurements



ISDB-T, ISDB-T_{SB}, and ISDB-Tmm Standards Overview

ISDB-T, ISDB-T_{SB} and ISDB-T_B

Integrated services digital broadcasting (ISDB) is a Japanese standard for digital television (DTV) and digital radio used by the country's radio and television stations. ISDB-T and ISDB-T_{SB} standards are the digital terrestrial broadcasting systems developed by Japan's Association of Radio Industries and Business (ARIB). ISDB-T, as a terrestrial broadcasting system, has also been adopted by Brazil, where it is called ISDB-T_B. ISDB-T and ISDB-T_B both use an identical physical layer. ISDB-T_{SB} is used for audio and data program transmissions. The system and specifications of ISDB-T_{SB} are similar to ISDB-T, except that the bandwidth is narrower and there are only one or three segments in the channel. Keysight's ISDB-T measurement application supports measurement on both ISDB-T and ISDB-T_{SB} standards.

ISDB-Tmm and AC

The new VHF band, 207.5 to 222 MHz, introduced in 2011, after the analog TV switch-off in Japan. The government announced that ISDB-Tmm (Terrestrial Mobile Multimedia) will be used for new multimedia service in this band. The ISDB-Tmm standard employs the concatenated transmission method which, combining blocks of the 13-segment (Type A) and the 1-segment (Type B), eliminates the need for a guard band, making it possible to apply it to various bandwidths. Figure 2 is an example of ISDB-Tmm frame structure consisting of two Type A super segments and one Type B super segment.

Auxiliary channel (AC) is used to convey additional information on modulation signal-transmission control, or earthquake alarm information. The earthquake information is transmitted using the AC of the center segment (segment No. 0).

Segment and layer in ISDB-T

ISDB-T supports hierarchical transmission by introducing hierarchical layers, which means different services such as HDTV, multi-channel SDTV, and data, can be transmitted in one frequency channel. There are 13 OFDM segments in the ISDB-T transmission channel. Each layer consists of one or more segments which have their own transmission parameters (such as the inner coding rate, modulation scheme, and time interleaving length). A maximum of three layers can be provided, defined as Layer A, B, and C.

Partial reception

ISDB-T also supports partial receptions. Partial reception refers to the segment at the center of the transmission system. The range of frequency interleaving can be limited within the segment, so that narrow band (1-seg) receiver can receive services contained in the center segment. The general concept of hierarchical transmission and partial reception is shown in Figure 1.

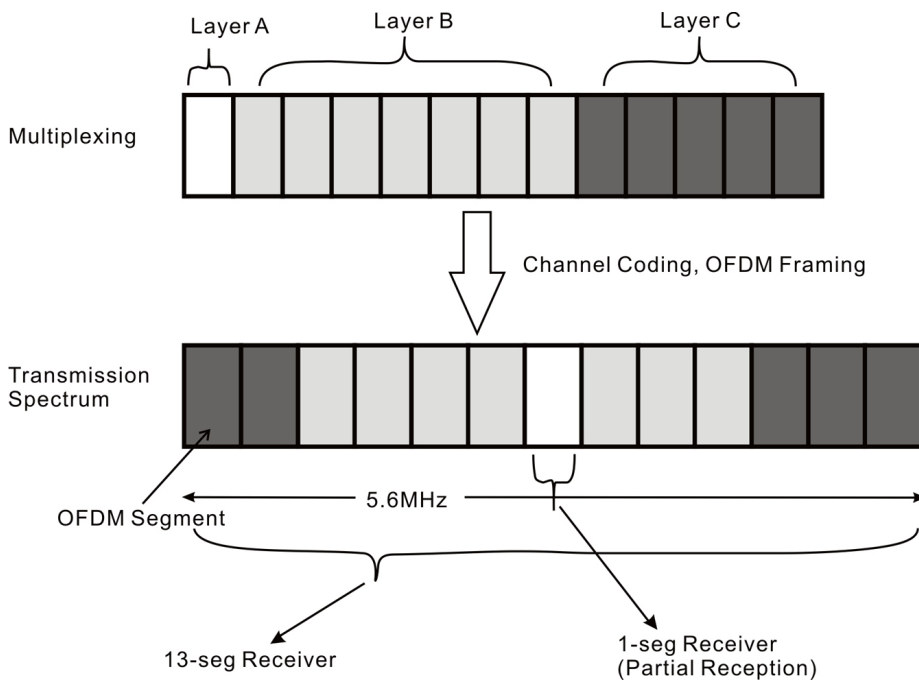


Figure 1. Hierarchical transmission and partial reception in ISDB-T

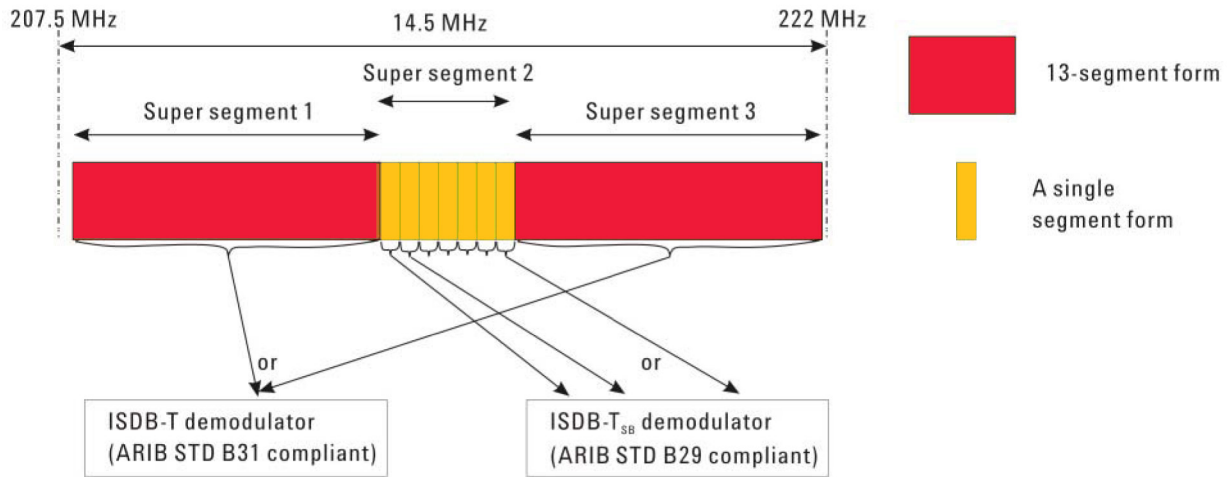


Figure 2. ISDB-Tmm frame configuration

Table 1. Key parameters in ISDB-T and ISDB-T_{sb} standards

| | ISDB-T | ISDB-T_{sb} | ISDB-Tmm |
|-------------------|---|---|--|
| Frequency | UHF 470 to 770 MHz | VHF/UHF | VHF: 207.5 to 222 MHz |
| Bandwidth | 6, 7, 8 MHz | 430 kHz for 1-segment and 1.3 MHz for 3-segments for 6 MHz system | 6 to 14.5 MHz |
| Segments | 13 segments | 1 or 3 segments | 13 to 33 segments |
| Modulation | OFDM | OFDM | OFDM |
| Mode | Mode 1 /2/3 | Mode 1 /2/3 | Mode 1 /2/3 |
| Modulation format | DQPSK/QPSK/16QAM/64QAM | DQPSK/QPSK/16QAM/64QAM | DQPSK/QPSK/16QAM/64QAM |
| Guard interval | 1 /4, 1 /8, 1/16, 1/32 | 1 /4, 1 /8, 1/16, 1/32 | 1 /4, 1 /8, 1/16, 1/32 |
| FEC | Inner coding: Convolution 1 /2, 2/3, 3 /4, 5/6, 7 /8 Outer coding: Reed Solomon (204, 188) | Inner coding: Convolution 1 /2, 2/3, 3 /4, 5/6, 7 /8 Outer coding: Reed Solomon (204, 188) | Inner coding: Convolution 1 /2, 2/3, 3 /4, 5/6, 7 /8 Outer coding: Reed Solomon (204,188) |
| Multiplexing | MPEG-2 TS | MPEG-2 TS | MPEG-2 TS |
| Video | MPEG-2 video or MPEG-4 AVC/H.264 (1-seg) | MPEG-2 video or MPEG-4 AVC/H.264 (1-seg) | MPEG-2 video or MPEG-4 AVC/H.264 (1-seg) |
| Audio | MPEG-2 audio (AAC) | MPEG-2 audio (AAC) | MPEG-2 audio (AAC) |
| Bit rate | 3.651 ~ 23.234 Mb/s | 0.280 ~ 1.787 Mb/s | |
| Other | Supports partial reception and AC | | |

Transmitter Tests

The RF transmitter test requirements for ISDB-T are defined in the JEITA handbook “Methods of Measurement for Digital Terrestrial Broadcasting Transmitters.” 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/W6155A

| JEITA handbook V2.2 Paragraph # | Transmitter test | N/W6155A ISDB-T measurement application |
|---------------------------------|--|---|
| 4.3.1 | Frequency deviation | Spectrum analyzer mode (marker counter function) |
| 4.3.2 | Signal power | Channel power |
| 4.3.3 | Occupied frequency bandwidth | Occupied bandwidth (BW) |
| 4.3.4 | Spectrum mask | Spectrum emission mask |
| 4.3.5 | Unwanted emissions | Spectrum analyzer mode (spurious emissions measurement) |
| 4.3.6 | IFFT sampling frequency deviation | Spectrum analyzer mode (marker counter function) |
| 4.3.7 | Phase noise | N/W9068A phase noise measurement application |
| 4.3.8 | Amplitude-frequency characteristics | Monitor spectrum measurement |
| 4.3.9 | Group delay characteristics | Mod accuracy (frequency response view) |
| 4.3.10 | Delay time | N/A |
| 4.3.11 | Intermodulation | Monitor spectrum measurement |
| 4.3.12 | Gaussian noise vs. BER | N/A |
| 4.3.13 | Input electric field strength vs. BER | N/A |
| 4.3.14 | Power consumption | N/A |
| 4.3.15 | Input signal | Mod accuracy (TMCC decoding view) |
| 4.3.17 | Output mismatching range | Spectrum analyzer mode |
| 4.3.18 | MER characteristics | Mod accuracy (result metrics view) |
| 4.3.19 | Actual viewing of and listening to video and sound | N/A |

Measurement Details

Most of the RF transmitter measurements as defined by the ISDB-T standard, as well as a wide range of additional measurements and analysis tools, are available with a 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 Keysight PXA or MXA signal analyzer equipped with BBIQ hardware. Supported baseband measurements include all of the modulation quality plus I/Q waveform measurements.

Table 3. One-button measurements provided by the N/W6155A measurement application

| Technology | ISDB-T | ISDB-T _{SB} | ISDB-Tmm |
|--|---------------------------------|---------------------------------|---------------------------------|
| Measurement application | N6155A-2FP, W6155A-2FP | N6155A-2FP, W6155A-2FP | N6155A-3FP, W6155A-3FP |
| X-Series analyzer | PXA, MXA, EXA, CXA ¹ | PXA, MXA, EXA, CXA ¹ | PXA, MXA, EXA, CXA ¹ |
| Measurements | | | |
| Channel power | | | |
| RF spectrum | ● | ● | ● |
| Shoulder attenuation | ● | ● | |
| Adjacent channel power | ● | ● | ● ² |
| Spectrum emission mask | ● | ● | ● ² |
| 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) | ● | ● | ● |
| Tx power (dBm) | ● | ● | ● |
| Quadrature error (deg) | ● | ● | ● |
| Amplitude imbalance (dB) | ● | ● | ● |
| In-band spectrum ripple | | | |
| Amx-Ac (dB) | ● | ● | ● |
| Amin-Ac (dB) | ● | ● | ● |
| MER/EVM vs. subcarriers/frequency | ● | ● | ● |
| MER by layer A/B/C (dB) | ● | ● | ● |
| MER by data, pilot, TMCC, and AC1 (dB) | ● | ● | ● |
| Amplitude vs. subcarriers (dB) | ● | ● | ● |
| Phase vs. subcarriers (deg) | ● | ● | ● |
| Group delay vs. subcarriers (ns) | ● | ● | ● |
| Spectral flatness (dB) | ● | ● | ● |
| TMCC decoding | ● | ● | ● |
| AC decoding | ● | ● | ● |
| ISDB-Tmm configuration | ● | ● | ● |
| Channel impulse response | ● | ● | ● |
| Single frequency network (SFN) test (Pre-echo, Post-echo, 0-dB echo, and out-of-GI echo) | ● | ● | ● |

1. N6155A operates in the PXA, MXA, and EXA signal analyzers. W6155A operates in the CXA signal analyzer.

2. This measurement in ISDB-Tmm mode requires manual configuration.

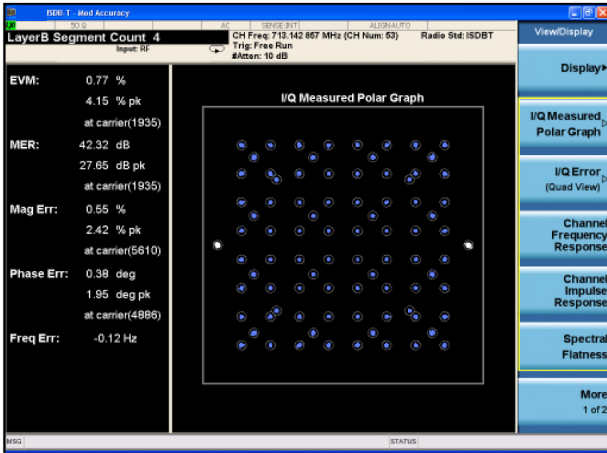


Figure 3. ISDB-T constellation and MER results

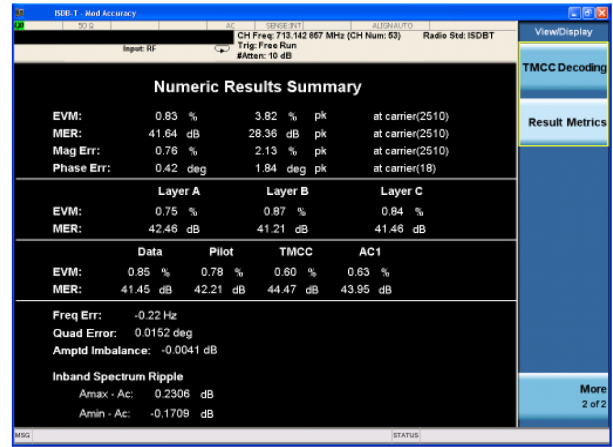


Figure 6. ISDB-T result metrics view

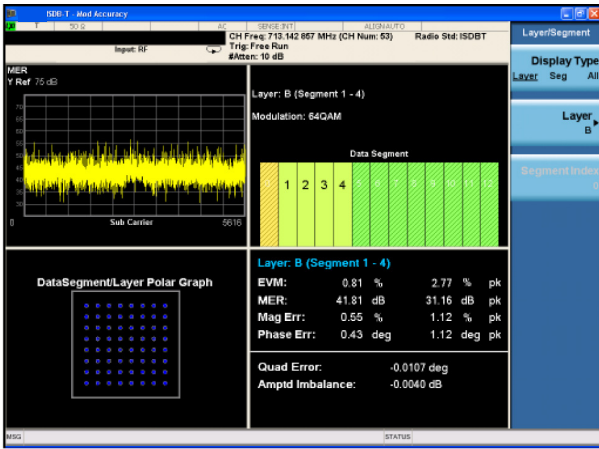


Figure 4. ISDB-T IQ quad view

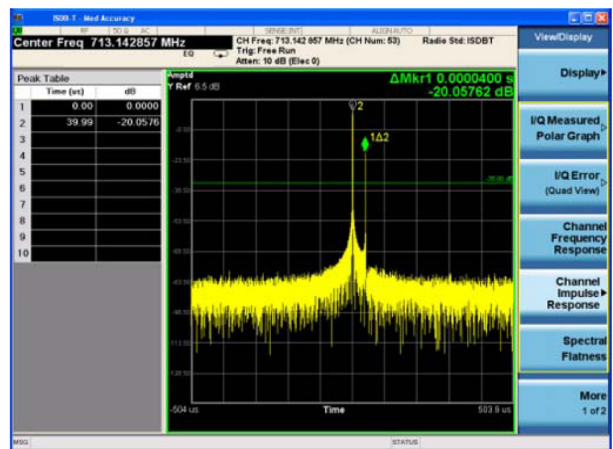


Figure 7. ISDB-T channel impulse response view

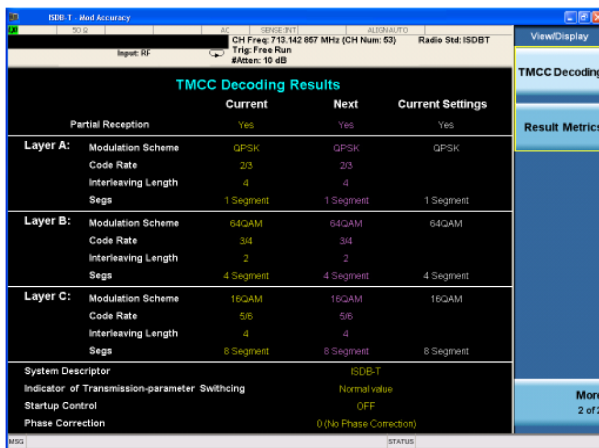


Figure 5. ISDB-T TMCC decoding view

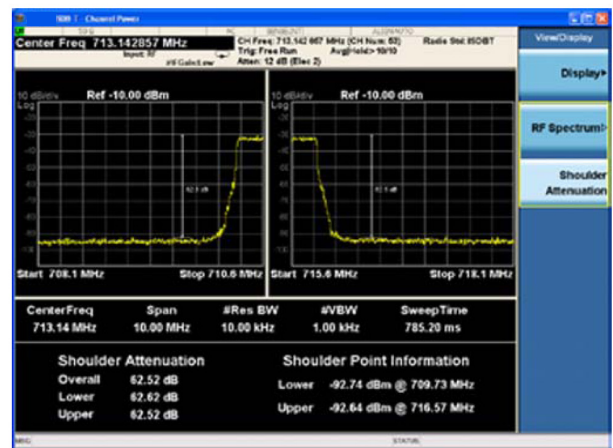


Figure 8. ISDB-T shoulder attenuation



Figure 9. ISDB-T AC decoding view

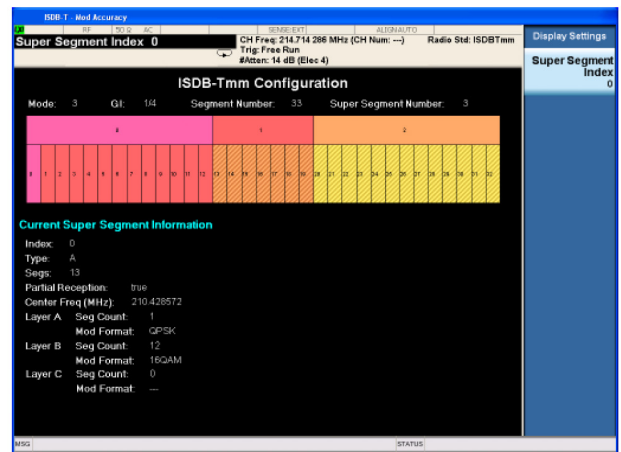


Figure 11. ISDB-Tmm configuration with Type A lowercase segments and super segment

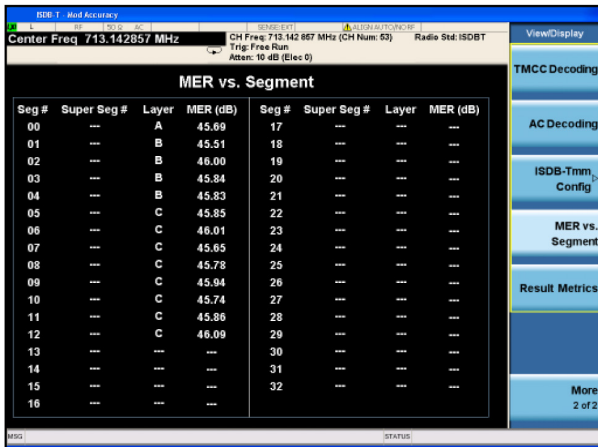


Figure 10. ISDB-Tmm MER vs. lowercase segments and super segment

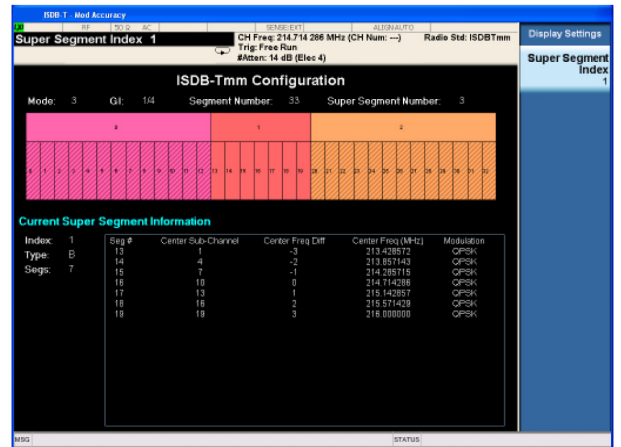


Figure 12. ISDB-Tmm configuration with Type B lowercase segments and super segment

Key Specifications

Definitions

- Specifications describe the performance of parameters covered by the product warranty.
- 95th percentile values indicate the breadth of the population ($\approx 2\sigma$) 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.

You Can Upgrade!

Options can be added after your initial purchase.

All of our X-Series application options are license-key upgradeable.



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 | -87.2 dBm | -84.2 dBm | -80.2 dBm | -77.2 dBm |
| Channel power with shoulder attenuation view | | | | |
| 5.60 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 frequency 3.4 MHz | 92.9 dB (98.7 dB typ) | 87.7 dB (94.1 dB typ) | 82.5 dB (89.6 dB typ) | 78.9 dB (86.6 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 | 5.60 MHz noise bandwidth, method = IBW | | | |
| Offset frequency 6 MHz | ± 0.16 dB | ± 0.38 dB | ± 0.81 dB | ± 1.20 dB |

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

| Description | PXA | MXA | EXA | CXA |
|---|--|-------------------------------|-------------------------------|------------------------------|
| Spectrum emission mask | Limit type: Manual; JEITA(ARIB-B31) according to $P \leq 0.025 \text{ W}$, $0.025 \text{ W} < P \leq 0.25 \text{ W}$, $0.25 \text{ W} < P \leq 2.5 \text{ W}$ or $P > 2.5 \text{ W}$: ABNT non-critical; ABNT sub-critical; ABNT-critical; ISDB-T _{SB} | | | |
| 3.0 MHz offset (RBW = 10 kHz) | | | | |
| Dynamic range, relative | 93.8 dB (99.1 dB typ) | 87.6 dB (93.9 dB typ) | 82.3 dB (89.5 dB typ) | 79.7 dB (86.4 dB typ) |
| Sensitivity, absolute | -110.5 dB (-114.5 dBm typ) | -106.5 dB (-111.5 dBm typ) | -101.5 dB (-107.5 dBm typ) | -98.5 dB (-104.5 dBm typ) |
| Accuracy | | | | |
| Relative | ± 0.08 dB | ± 0.16 dB | ± 0.16 dB | ± 0.23 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%) |
| 4.36 MHz offset (RBW = 10 kHz) | | | | |
| Dynamic range, relative | 94.2 dB (99.5 dB typ) | 88.1 dB (94.4 dB typ) | 82.8 dB (89.9 dB typ) | 80.4 dB (87.7 dB typ) |
| Sensitivity, absolute | -110.5 dB (-114.5 dBm typ) | -106.5 dB (-111.5 dBm typ) | -101.5 dB (-107.5 dBm typ) | -98.5 dB (-104.5 dBm typ) |
| Accuracy | | | | |
| Relative | ± 0.01 dB | ± 0.18 dB | ± 0.18 dB | ± 0.29 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%) |
| ISDB-T modulation accuracy | Segments = 13, mode 3, GI = 1/8, partial reception = off, layer A-C segment = 13, code rate = 3/4, time interleaving I = 2, modulation = 64QAM ML ¹ = -20 dBm, 20 to 30 °C | | | |
| EVM | | | | |
| Operating range | 0 to 8% | 0 to 8% | 0 to 8% | 0 to 8% |
| Floor | 0.36% (EQ OFF) | 0.66% (EQ OFF) | 0.80% (EQ OFF) | 0.99% (EQ Off) |
| Accuracy | | | | |
| from 0.40/0.66/0.80% (PXA/MXA/EXA) to 1.2% | ± 0.20% | ± 0.30% | ± 0.40% | |
| from 1.2 to 2.0% | ± 0.20% | ± 0.20% | ± 0.30% | |
| from 2.0 to 8.0% | ± 0.70% | ± 0.70% | ± 0.70% | |
| MER | | | | |
| Operating range | ≥ 22 dB | ≥ 22 dB | ≥ 22 dB | ≥ 22 dB |
| Floor | 49 dB (EQ Off) | 44 dB (EQ Off) | 42 dB (EQ Off) | 40.1 dB (EQ Off) |
| Accuracy | | | | |
| from 38 to 48 dB (PXA/MXA/EXA) | ± 2.54 dB | ± 2.68 dB | ± 3.00 dB | |
| from 34 to 38 dB | ± 0.67 dB | ± 1.16 dB | ± 1.52 dB | |
| from 22 to 34 dB | ± 0.61 dB | ± 0.73 dB | ± 0.85 dB | |
| Frequency error ² | | | | |
| Range | -100 to 100 kHz | -100 to 100 kHz | -100 to 100 kHz | -100 to 100 kHz |
| Accuracy | ± 10 Hz + tfa ³ | ± 10 Hz + tfa ³ | ± 10 Hz + tfa ³ | ± 10 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 |
| Channel impulse response (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 | | | |

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 |
|---|---|----------------------------|----------------------------|----------------------------|
| ISDB-Tmm mod accuracy | For ISDB-Tmm, Segments = 33, Mode 3, GI = 1/4, Super Segment #0 ISDB-T, Super Segment #1 six one-Segment, Super Segment #2 ISDB-T, ML ¹ = -23 dBm, 20 to 30 °C, CF ≤ 1 GHz | | | |
| EVM | EQ Off | EQ Off | EQ Off | EQ Off |
| Operating range | 0 to 25% | 0 to 25% | 0 to 25% | 0 to 25% |
| Floor | 0.32% | 0.51% | 0.68% | 0.99% |
| MER | EQ Off | EQ Off | EQ Off | EQ Off |
| Operating range | ≥12 dB | ≥12 dB | ≥12 dB | ≥12 dB |
| Floor | 50 dB | 46 dB | 44 dB | 40.1 dB |
| Frequency error ² | | | | |
| Range | -170 kHz to 170 kHz | -170 kHz to 170 kHz | -170 kHz to 170 kHz | -170 kHz to 170 kHz |
| Accuracy | ± 1 Hz + tfa ³ | ± 10 Hz + tfa ³ | ± 10 Hz + tfa ³ | ± 10 Hz + tfa ³ |
| Clock error ² | | | | |
| Accuracy | -100 Hz to 100 Hz | -100 Hz to 100 Hz | -100 Hz to 100 Hz | -100 Hz to 100 Hz |
| Range | ± 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 (nom) |
| Channel impulse response (SFN echo pattern) | Same as ISDB-T channel impulse response | | | |

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

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.

Try Before You Buy!

Free 30-day trials of X-Series measurement applications provide unrestricted use of each application's features and functionality on your X-Series analyzer. Redeem a trial license online today:

www.keysight.com/find/X-Series_trial

The table below contains information on our fixed, perpetual licenses.

For more information, please visit the product web pages.

N6155A & W6155A ISDB-T/Tmm X-Series measurement application

| Description | Model-Option | | Additional information |
|-------------|---------------|------------|------------------------|
| | PXA, MXA, EXA | CXA | |
| ISDB-T | N6155A-2FP | W6155A-2FP | |
| ISDB-T/Tmm | N6155A-3FP | W6155A-3FP | |

Hardware Configurations

N9030A PXA signal analyzer

| Description | Model-Option | Additional information |
|--|---|--|
| 3.6, 8.4, 13.6, 26.5, 43, 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, -544, or -550 | One recommended |
| Analysis bandwidth to 25, 40, or 160 MHz | N9030A-B25, -B40, or -B1X | One required for ISDB-Tmm |
| 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 |
| Analysis bandwidth to 25 or 40 MHz | N9020A-B25, -B40 | One required for ISDB-Tmm |
| 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, or 26.5 GHz frequency range | N9010A-503, -507, -513, or -526 | 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 |
| Analysis bandwidth to 25 or 40 MHz | N9010A-B25, -B40 | One required for ISDB-Tmm |
| 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 |
| Precision frequency reference | N9000A-PFR | Recommended |
| Analysis bandwidth to 25 MHz | N9000A-B25 | Required for ISDB-Tmm |
| Tracking generator, 9 kHz to 3 GHz 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 |
| Analysis bandwidth to 25 MHz | N9000A-B25 | Optional |
| Wideband IF output | N9000A-CR3 | Optional |

Related Literature

N6155A and W6155A ISDB-T Measurement Application, Demonstration Guide, literature number 5990-5932EN

N6155A & W6155A ISDB-T Measurement Application, Measurement Guide, Part number N6155-90002

N6155A & W6155A ISDB-T Measurement Application, User's and Programmer's Reference, Part number N6155-90001

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Product page:

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