

WJ5000A

WaveJudge wireless analyzer platform

Introduction

This data sheet describes the main specifications of the Keysight WJ5000A WaveJudge Wireless Analyzer platform.



General Characteristics

- Scalable architecture allowing up to 256 modules
- Flexible selection of modules including RF, synthesizer, DSP, and SSD memory
- Wideband RF from 380 MHz to 11.4 GHz with up to 800 MHz bandwidth
- Additional mmWave module for Frequency Range 2 (FR2) testing (up to 42.5 GHz)
- Wide dynamic range for use in the lab and in the field
- Coherent RF ports, up to 16 per set
- All transmission modes up to 8 layers
- Carrier Aggregation (CA) up to 8 Component Carriers (CC) with up to 800 MHz channels
- Real-time streaming analysis of unlimited devices under test for any length of time
- IQ storage in expandable SSD for minutes or hours
- Excellent close-in phase noise performance

Modulation formats

- OFDMA/SC-FDMA with BPSK
- QPSK
- 16QAM
- 64QAM
- 256QAM
- 1024QAM
- Zadoff-Chu

Traces

- Constellation
- 2D physical
- Time domain power
- EVM vs. subcarrier
- EVM vs. symbol time
- MIMO rank per subcarrier
- MIMO rank per symbol
- Throughput and BLER
- Spectral flatness (frequency domain)
- Amplitude flatness (time domain)
- CCDF, PAPR
- Spectral power
- Amplitude, phase, and frequency during synchronization signal
- Impulse response

Example statistics

- EVM
- Peak EVM
- EVM of reference signal
- Frequency error of carrier and sampling clock
- IQ offset
- CFI error rate
- Payload bits
- CRC
- TB count
- SINR, RSSI, RSRP, RSRQ
- RNTI
- MCS
- N resources
- Modulation type

Protocol analyzer decodes

- MAC
- RLC
- PDCP
- RRC
- NAS
- TCP/IP (Wireshark-supported decodes available)

General Specifications

The WJ5000A platform consists of a chassis and four modules. Combinations of RXJudge RF receiver modules, SynthJudge synthesizer modules, StoraJudge SSD storage modules, and IntelliJudge processing modules provide analysis of multiple technologies such as LTE, NB-IoT, eMTC, 5G NR, C-V2X, and Wi-Fi. Depending on the RXJudge modules used, each chassis supports up to 8 RF ports and up to 2 synthesizer modules.

Chassis specifications

Parameter	Specification	Conditions
Operating temperature range	0 °C to 55 °C	
Storage temperature range	-40 °C to 80 °C	
Dimensions	16.75 × 1.72 × 12 inches (width x height x depth)	
Calibration	Regular calibration is not required	
Power	12 V DC, 18.3 A	Converter to chassis
	110 or 240 V AC, 2.5 A, 50 or 60 Hz	AC to converter

Rear panel inputs and outputs

Port	Description	Connector type	Specification
GPS ANT IN	Input from a GPS antenna using an LNA	SMA female	0 to 5 V, 0.1 μA, 0.9 V low, 1.2 V high
PPS IN	Input for external precision time source	SMA female	1 pps, TTL signal level
PPS OUT	GPS pulse per second output derived from GPS signal received at the GPS ANT IN port	SMA female	1 pps, TTL signal level
SYNC OUT	Output to synchronize multiple chassis	RF twinax	
SYNC AUX OUT	Output to synchronize multiple chassis	RF twinax	
SYNC IN	Input to synchronize multiple chassis	RF twinax	
TRIGGER AUX IN	Input from a chassis analyzing 4G to synchronize with a chassis analyzing 5G	RF twinax	
DC IN	Input for external DC power		12 V DC, 18.3 A

StoraJudge IQ SSD Storage Module

Store up to 1 TB on the SSD. Use two SRIO to connect with other WaveJudge modules.

Front panel connections

Port	Description	Connector type	Specification
SRIO x2	Interconnection with other modules		20 Gb

IntelliJudge2 Module

Each module contains:

- Dual TM320C6670 multi-core DSP
- 4 GB DDR3 SDRAM
- Gen2 SRIO 8-port switch

Front panel connections

Port	Description	Connector type	Specification
SRIO	Interconnection with other modules		20 Gb
SFP	Connection to external PC	Ethernet	1 Gb

RXJudge 4-Port RF Receive Module Specifications

One or two RXJudge modules may be used in each WJ5000A chassis. Each RXJudge module has 4 RF ports. At least one input from a SynthJudge module is required for each RXJudge module.

Amplitude specifications

Parameter	Specification	Conditions
Maximum input level	≤ 22 dBm	
DANL	< -172 dB, <i>typical</i>	1024 pts, 10 MHz channel bandwidth (approx. 15 kHz RBW)
Measurement range	DANL to maximum input level	
Absolute amplitude accuracy	$< \pm 2.5$ dB, <i>typical</i>	
Relative amplitude accuracy	$< \pm 0.2$ dB, <i>typical</i>	Adjacent tones – 11 kHz
Attenuation	0 to 60 dB in 2 dB steps	
Variable gain	-35 to 25 dB, <i>typical</i>	At 2 GHz

Frequency specifications

Parameter	Specification	Conditions
Frequency range	380 MHz to 6 GHz	From synthesizer input
Center frequency resolution	1 Hz	
Maximum instantaneous bandwidth	40 MHz	

Sampling specifications

Parameter	Specification	Conditions
A/D bits	16 bits	
A/D clock (sampling frequency)	90 MHz	
Second harmonic distortion	< -70 dBc, <i>typical</i>	
Third harmonic distortion	< -70 dBc, <i>typical</i>	
Two-tone intermodulation	< -80 dBc, <i>typical</i>	
Sample frequency set (Fs)	1 to 45 MHz	Optimized for channel bandwidth
Sample frequency set accuracy	10 Hz, <i>typical</i>	

Front panel inputs

Input port	Description	Connector type	Specification
CH 0	RF input port 1	SMA female	50 ohm
CH 1	RF input port 2	SMA female	50 ohm
CH 2	RF input port 3	SMA female	50 ohm
CH 3	RF input port 4	SMA female	50 ohm
SYNTH 1 IN	Synthesizer input for CH 0 and CH 1	MCX female	50 ohm, AC coupled
SYNTH 2 IN	Synthesizer input for CH 2 and CH 3	MCX female	50 ohm, AC coupled

Example measured performance

Parameter	Measured performance	Conditions
EVM noise level	-98.1 dBm	10 MHz LTE channel
PHY estimator noise	2 dB	10 MHz LTE channel
Actual noise floor	-100.1 dBm	10 MHz LTE channel
Theoretical noise floor	-104 dBm	10 MHz LTE channel
Noise figure	3.9 dB	10 MHz LTE channel with 0 dB attenuation

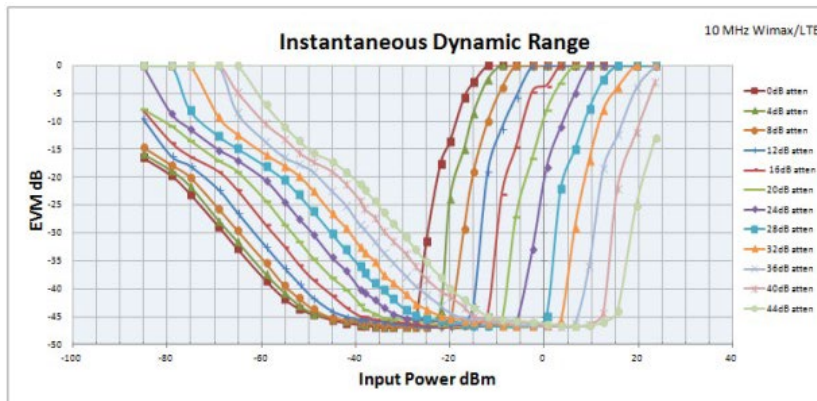


Figure 1. Example of measured instantaneous dynamic range for a 10 MHz LTE channel

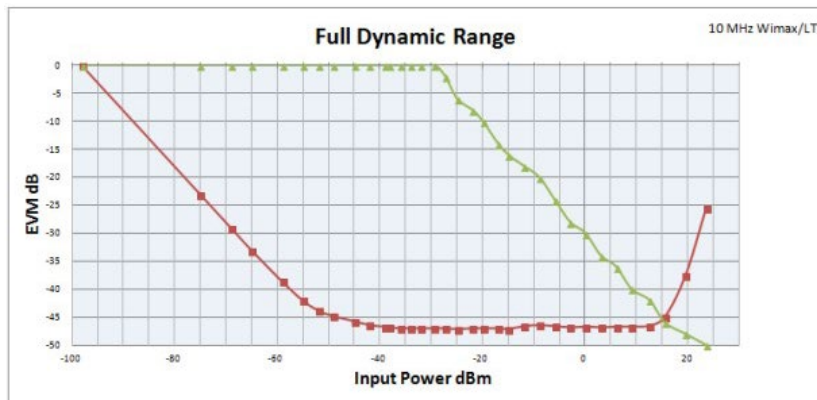


Figure 2. Example of measured full dynamic range for a 10 MHz LTE channel

SynthJudge 2-OXCO Clock Module Specifications

SynthJudge modules provide the frequency reference for RXJudge modules using the FREQ 1/2 input ports on the RXJudge module. The SynthJudge module may be in a different chassis than the RXJudge module. Optionally, an external reference may be applied at the REF IN port instead of the SynthJudge OCXO.

Frequency specifications

Parameter	Specification	Conditions
Carrier frequency range	380 MHz to 6 GHz	
Center frequency resolution	4 Hz	
Carrier frequency calibration accuracy	$< \pm 1 \text{ ppm} \pm 4 \text{ Hz}$, typical	
Single-sideband phase noise	$< -96 \text{ dBc/Hz}$, typical	1 kHz offset, normalized to 2 GHz
	$< -106 \text{ dBc/Hz}$, typical	10 kHz offset, normalized to 2 GHz
	$< -111 \text{ dBc/Hz}$, typical	100 kHz offset, normalized to 2 GHz
	$< -121 \text{ dBc/Hz}$, typical	1 MHz offset, normalized to 2 GHz
OCXO reference frequency	100 MHz	
OCXO temperature stability	$< \pm 50 \text{ ppb}$, typical	0 to 50 °C
OCXO aging	$< \pm 500 \text{ ppb}$, typical	Over 1 year
	$< \pm 3 \text{ ppm}$, typical	Over 10 years
OCXO calibration accuracy	$< \pm 1 \text{ ppm}$, typical	
OCXO frequency accuracy	$< \pm (\text{time since last adjustment} \times \text{aging rate}) + \text{temperature stability} + \text{calibration accuracy}$, typical	
External reference input frequency	10	
External reference input level	0.8 to 3.3 V p-p	

Front panel inputs and outputs

Port	Description	Connector type	Specification
REF IN	Optional external 10 MHz reference input	MCX female	50 ohm
FREQ 1 OUT	First set of four frequency clock outputs, simultaneous at the same frequency	MCX female	50 ohm
FREQ 2 OUT	Second set of four frequency clock outputs, simultaneous at the same frequency	MCX female	50 ohm

RXJudge Digital IF Module (800 MHz) Specifications

One or two RXJudge digital IF modules may be used in each WJ5000A chassis. Each RXJudge digital IF module has 1 RF port and a built-in synthesizer. RXJudge digital IF modules and RXJudge 4-port modules cannot coexist in the same chassis.

Amplitude specifications

Parameter	Specification	Conditions
Maximum input level	≤ 15 dBm	
Optimal measurement range	-32 to -2 dBm	
Trigger input level	0 to 3.3 V	Trigger level 1.2 V
Auxiliary trigger output	0 to 3.3 V, 50 mA	

Frequency specifications

Parameter	Specification	Conditions
Carrier frequency range	2 to 11.4 GHz	Including instantaneous bandwidth of ±400 MHz
Instantaneous bandwidth	800 MHz	
External reference input frequency	10 MHz	
External reference input level	0.8 to 1.8 V p-p	

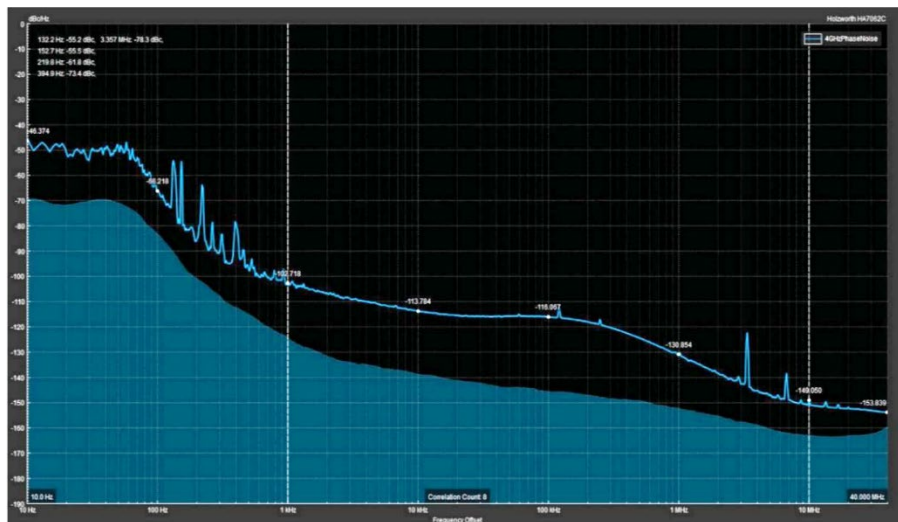


Figure 3. Example of typical phase noise performance at 4 GHz

Front panel inputs and outputs

Port	Description	Connector type	Specification
RF IN	RF input port	SMA female	300 ohm, AC coupled
mmWave	Power connection to optional WJ1000A mmWaveJudge for FR2 testing		
LO OUT	LO output to optional WJ1000A mmWaveJudge for FR2 testing	SMA female	50 ohm
REFCLK	Optional external 10 MHz reference input	SMA female	300 ohm, AC coupled
TRIG IN	Optional trigger input	SMA female	100 kohm, DC coupled
AUX OUT	Potential future use	SMA female	

Simplify Troubleshooting of RF and Signaling Issues

Keysight's WJ5000A WaveJudge Wireless Analyzer makes resolving RF and signaling issues easy.

- Unique solution for passive signal capture and analysis
- Real-time decoding of LTE, NB-IoT, and eMTC signals
- FR1 and FR2 with channel bandwidth up to 800 MHz
- Scalable ports per chassis

For more information, visit the following links.

[WJ5000A WaveJudge Wireless Analyzer Platform](#)

[SJ001A WaveJudge Wireless Analyzer Toolset](#)

[WJ001000A WaveJudge Wireless Analyzer software](#)

[WJ1000A mmWaveJudge Remote Receiver](#) (for extension to FR2)

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