DATA SHEET

E7760B with M1740A

mmWave 5G Non-Signaling Solution

Streamlined testing across any 3GPP mmWave band

Mobile operators around the world are accelerating 5G deployments to capture early market opportunities. As a result, wireless equipment manufacturers need to support a more rapid pace of development while addressing evolving 5G New Radio (NR) specifications.

Most 5G mobile devices operating in mmWave frequency spectrum rely on modules with highly integrated RFIC architectures. This requires new 5G designs to be verified across both intermediate frequencies (IF) and mmWave frequencies. Since 5G mmWave devices use phased-array antennas that lack connectorized ports, performance validation needs to take place in Over-the-Air (OTA) test environments. Creating and maintaining a calibrated system when using multiple platforms to perform measurements in OTA test environments can be challenging and lead to unreliable measurement results.

Keysight's mmWave 5G non-signaling solution enables validation of a broad range of 5G modules in OTA test environments. Its single wideband transceiver (E7760B) and remote radio head (M1740A) provide tunable access across four mmWave frequency bands.

Non-signaling test is useful for verification of baseband, IF, RF and mmWave modules before protocol firmware is added. Keysight's mmWave 5G non-signaling solution ensures a streamlined approach to reliably verify transmit and receive paths between IF and mmWave frequencies.

Figure 1: E7760B and M1740A for IF and mmWave 5G testing

Performance Characteristics

Definitions

Specification (spec)
The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range and after a 60-minute warm up period. Specifications are valid from 20 to 35 °C unless otherwise noted.

Typical (typ)
The characteristic performance, that 95 percent of the units exhibit with a 95 percent confidence level. This data, shown in Italics, is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 23 ± 5 °C).

Nominal (nom)
The mean or average characteristic performance, or the value of an attribute that is determined by design. This data is not warranted and is measured at room temperature (approximately 23 ± 5 °C).

Conditions

The specifications in this document apply to a single E7760B wideband transceiver connected to a single M1740A remote radio head (RRH).

mmWave Downconverter (Rx In) Performance Characteristics

Measured at the two RF Tx/Rx 1/2 input ports of the M1740A.

Frequency	Performance	Conditions
Frequency ranges	24.25 to 29.5 GHz, 37 to 43.5 GHz	
Bandwidth, maximum	800 MHz 1.4 GHz	24.25 to 29.5 GHz 37 to 43.5 GHz
Amplitude	**Performance**	**Conditions**
CW input level range	-70 to 10 dBm	
CW power level accuracy	< ±2.5 dB, nominal	-40 to 5 dBm 24.25 to 29.5 GHz 37 to 43.5 GHz
Maximum applied reverse power	20 dBm CW, 15 V DC	
Error Vector Magnitude (EVM)[1]	**Performance**	**Conditions**
100 MHz, 1 carrier, 256QAM	< -40 dB, nominal < -37 dB, nominal	28, 39 GHz 42 GHz -40 to 5 dBm input

[1] Performance characteristics above 40 GHz are valid for M1740A with serial numbers larger than US5848xxxx or MY5848xxxx.

mmWave Upconverter (Tx Out) Performance Characteristics

Measured from the two RF Tx/Rx 1/2 output ports of the M1740A.

Frequency	Performance	Conditions
Frequency ranges	24.25 to 29.5 GHz, 37 to 43.5 GHz	
Bandwidth, maximum	800 MHz 1.4 GHz	24.25 to 29.5 GHz 37 to 43.5 GHz
Amplitude	**Performance**	**Conditions**
CW output power range	-70 to 10 dBm	
Modulated output power range	-40 to 10 dBm	
CW power level accuracy	< ±2.5 dB, nominal	-40 to 10 dBm 24.25 to 29.5 GHz 37 to 43.5 GHz
Error Vector Magnitude (EVM)[2]	**Performance**	**Conditions**
100 MHz, 1 carrier, 256QAM	< -40 dB, nominal < -38 dB, nominal < -39 dB, nominal	28 GHz 39 GHz 42 GHz -5 dBm output

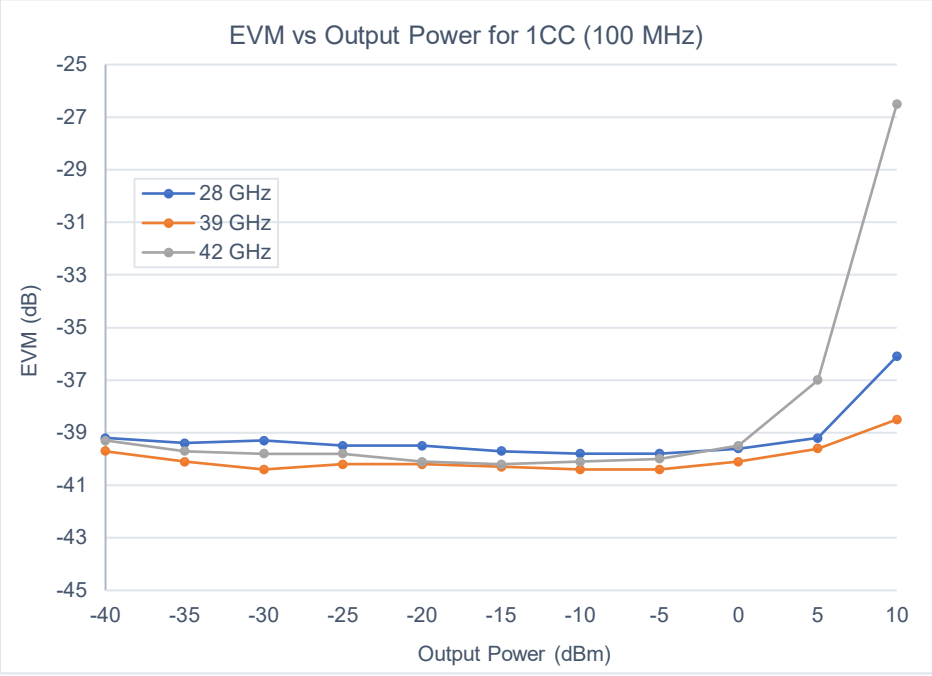

Figure 3: EVM vs. Output Power

[2] Performance characteristics above 40 GHz are valid for M1740A with serial numbers larger than US5848xxxx or MY5848xxxx.

IF Vector Signal Analyzer Performance Characteristics

Measured at the two IFIO1/2 input ports of the E7760B.

Frequency	Performance	Conditions
Frequency range	6 to 18 GHz	
Maximum bandwidth	1.4 GHz	
Amplitude	**Performance**	**Conditions**
CW input level range	-90 to 0 dBm	
Modulated input level range	-50 to 0 dBm	
CW absolute level accuracy	< ±1.0 dB, typical	-80 to 0 dBm input
CW amplitude linearity	< ±0.5 dB, nominal	
Carrier leakage	< -40 dBc, nominal	
Error Vector Magnitude (EVM)	**Performance**	**Conditions**
100 MHz, 1 carrier, 64QAM	< -40 dB, nominal	-40 to 0 dBm input

IF Vector Signal Generator Performance Characteristics

Measured from the two IFIO 1/2 output ports of the E7760B.

Frequency	Performance	Conditions
Frequency range	6 to 18 GHz	
Maximum bandwidth	1.4 GHz	
Amplitude	**Performance**	**Conditions**
CW input level range	-45 to 7 dBm	
Modulated output level range	-20 to 0 dBm	
CW absolute level accuracy	< ±1.0 dB, typical	
Carrier leakage	< -40 dBc, nominal	-20 to 0 dBm output

Error Vector Magnitude (EVM)	Performance	Conditions
100 MHz, 1 carrier, 256QAM	< -40 dB, nominal	-20 to -5 dBm output 6 to 18 GHz
	< -38 dB, nominal	0 dBm output 8 to 12 GHz

Internal Timebase Performance Characteristics

Aging Rate	Performance	Conditions
Daily	< ±5 ppb/day	After 72 hours of operation
Annually	< ±0.1 ppm/year	After 72 hours of operation
Cumulative	< ±0.6 ppm/10years	After 72 hours of operation
Temperature Effects	**Performance**	**Conditions**
20 to 30 ºC	< ±10 ppb	
Full operating range	< ±50 ppb	
Frequency Accuracy		
< ±[(time since last adjustment x aging rate) + temperature effects + calibration accuracy]		

External Reference Input Performance Characteristics

Aging Rate	Performance
Frequency	10 MHz
Lock range	±1 ppm
Amplitude	0 to 10 dBm

Instrument Performance Characteristics

General Attributes	Performance
Power consumption E7760B M1740A	 350 W with 100 to 120 V AC 34 W with 36 V DC
Dimensions (W x H x D) E7760B M1740A	 425 x 89x 559 mm, 46.7 x 3.5 x 22 inches 165 x 64 x 139 mm, 6.5 x 2.51 x 5.46 inches
Weight E7760B M1740A	 15 kg, 33 pounds 2.2 kg, 4.85 pounds
Operating temperature	10 to 40 ºC
Storage temperature	-40 to 70 ºC
Power requirements	100/120 V AC or 220/240 V AC, 50/60 Hz
Regulatory Information	**Performance**
EMC	Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): • IEC/EN 61326-1 • CISPR 11, Group 1, class A • AS/NZS CISPR 11 • ICES/NMB-001 This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada. South Korean Class A EMC declaration: This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference. 사 용 자 안 내 문 이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.
Safety	Complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity): • IEC/EN 61010-1 • Canada: CSA C22.2 No. 61010-1 • USA: UL std no. 61010-1

Acoustic statement	(European Machinery Directive) Acoustic noise emission LpA <70 dB Operator position Normal operation mode per ISO 7779

To find a current Declaration of Conformity for a specific Keysight product, go to:
http://www.keysight.com/go/conformity

Ordering Information

Product/Option	Description
E7760B	Wideband transceiver
E7760B-FB1	Frequency band, 24.25 to 29.5 GHz
E7760B-FB5	Frequency band, 37 to 40 GHz
E7760B-FB6	Frequency band, 40 to 43.5 GHz
E7760B-RF2	IF testing
E7760B-RF4	mmWave OTA
Software	**Description**
Y9085EM0E	5G NR non-signaling waveform and measurement application

Node-locked, floating (single site), transportable and USB portable license types are available. Twelve months of software support is included.

Hardware support, warranty, calibration and services are available. Please contact your sales representative for options and pricing.

Product/Option	Description
M1740A	mmWave transceiver for 5G
M1740A-CA4	RF cable N-SMA, 4m
M1740A-CB4	RF cable TNC-SMA, 4m

Hardware support, warranty, calibration and services are available. Please contact your sales representative for options and pricing.

Upgrades and Accessories

Product/Option	Description	Comments
E7760BK-FB1	Frequency band, 24.25 to 29.5 GHz	Add frequency band to existing E7760B
E7760BK-FB5	Frequency band, 37 to 40 GHz	Add frequency band to existing E7760B
E7760BK-FB6	Frequency band, 40 to 43.5 GHz	Add frequency band to existing E7760B
E7760BK-RF2	IF testing	Add IF testing to existing E7760B
M1740AU	mmWave transceiver for 5G	Add remote radio head to existing solution
M1740AU-CA4	RF cable N-SMA, 4m	Add or replace cable
M1740AU-CB4	RF cable TNC-SMA, 4m	Add or replace cable

Keysight 5G Solutions

Keysight's solutions span the entire 5G workflow. The E7760B wideband transceiver and M1740A mmWave transceiver for 5G are one solution of the mmWave 5G solutions.

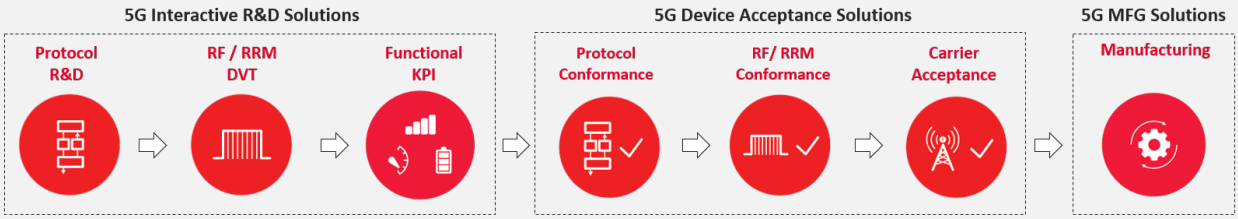

Figure 4: Workflow Solutions

For more information about Keysight's 5G solutions, visit www.keysight.com/find/5G.

For more information about Keysight's PathWave and automation of Keysight solutions, visit www.keysight.com/find/pathwave.

Additional information about the E7760B and the mmWave 5G non-signaling test solution is available at www.keysight.com/find/e7760b.

Additional information about the M1740A is available at www.keysight.com/find/m1740a.

Learn more at: www.keysight.com

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

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