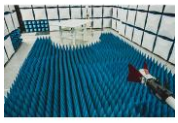
PCTEST
7185 Oakland Mills Road, Columbia, MD 21046 USA
Tel. 410.290.6652 / Fax 410.290.6654
http://www.pctest.com



MEASUREMENT REPORT
FCC Part 30 5G mmWave

Applicant Name:
Pivotal Commware
10801 120th Ave NE #200,
Kirkland, WA 98033
United States

Date of Testing:
6/29/2021-8/9/2021
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2106240071-02.2AUVU

FCC ID:	**2AUVU-P28SUHMGA1**
APPLICANT:	**Pivotal Commware**

Application Type:	Certification
Model:	PIV28SUHMGA1
EUT Type:	5G mmWave Repeater (Service Unit)
FCC Classification:	Part 30 Transportable Transmitter (5GT)
FCC Rule Part(s):	2, 30
Test Procedure(s):	ANSI C63.26-2015, KDB 842590 D01 v01r02, KDB 662911 D01 v02r01

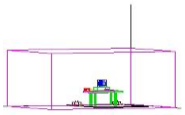
This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947. Test results reported herein relate only to the item(s) tested.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

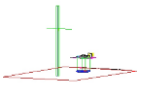
Randy Ortanez
President

ACCREDITED
CERT #2041.01

TABLE OF CONTENTS



MEASUREMENT REPORT
FCC Part 30



Band	Ant. Pol.	Bandwidth (MHz)	CCs Active	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
						Max. Power (W)	Max. Power (dBm)		
n261	H	50	1	30	27500 - 28350	2.545	34.06	46M0G7D	QPSK
n261	V	50	1	30	27500 - 28350	2.829	34.52	46M1G7D	QPSK
n261	V	50	1	30	27500 - 28350	2.370	33.75	46M1W7D	16QAM
n261	H	100	4	30	27500 - 28350	1.966	32.94	392MG7D	QPSK
n261	V	100	4	30	27500 - 28350	2.226	33.48	392MG7D	QPSK
n261	H	100	4	30	27500 - 28350	1.856	32.69	392MW7D	16QAM

EUT Overview

1.0 INTRODUCTION

1.1 Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada.

1.2 PCTEST Test Location

These measurement tests were conducted at the PCTEST facility located at 7185 Oakland Mills Road, Columbia, MD 21046. The measurement facility is compliant with the test site requirements specified in ANSI C63.4-2014.

1.3 Test Facility / Accreditations

Measurements were performed at PCTEST located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO/IEC 17025:2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.01 for Specific Absorption Rate (SAR), Hearing Aid Compatibility (HAC) testing, where applicable, and Electromagnetic Compatibility (EMC) testing for FCC and Innovation, Science, and Economic Development Canada rules.

- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC 17065-2012 by A2LA (Certificate number 2041.03) in all scopes of FCC Rules and ISED Standards (RSS).

- PCTEST facility is a registered (2451B) test laboratory with the site description on file with ISED.

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Pivotal Commware 5G mmWave Repeater (Service Unit) FCC ID: 2AUVU-P28SUHMGA1**. The test data contained in this report pertains only to the emissions due to the EUT's 5G mmWave function.

The EUT has an open-ended waveguide horn antenna for transmission of 5G mmWave signals. The antenna configuration is comprised of two separate linearly polarized antenna feeds - one for horizontally polarized transmission and one for vertically polarized transmission. These feeds are labelled as "Horizontal Downlink Antenna" (H-DL) and "Vertical Downlink Antenna" (V-DL), respectively.

The EUT supports any combination of bandwidths, number of carriers, and modulations as input signals. It will transmit all signals within the 5G NR n261 band that are received.

Test Device Serial No.: 00049, 00010

2.2 Device Capabilities

This device contains the following capabilities:

5G FR2 (mmWave), 2.4 GHz Wi-Fi, LTE Cat M1

2.3 Test Configuration

The EUT was tested per the guidance of ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated tests.

All testing was performed using a signal generator connected by a coaxial cable to the input port of the EUT via waveguide adapters. The signal generator was set to transmit a simulated a 5G mmWave NR signal in various sized bandwidth and modulations.

2.4 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and no modifications were made during testing.

2.5 Software/Firmware

The test was conducted with software version 1.5.0 installed on the EUT.

3.0 DESCRIPTION OF TESTS

3.1 Measurement Procedure

The measurement procedures described in the document titled "American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services" (ANSI C63.26-2015) was used in the measurement of the EUT. KDB 842590 D01 v01r02 was referenced for testing the EUT as well.

3.2 Radiated Power and Radiated Spurious Emissions

§30.202, §30.203

The radiated test facilities consisted of an indoor 3 meter anechoic chamber used for final measurements and exploratory measurements, when necessary for radiated emissions measurements in the spurious domain. The test site conforms to the site validation requirements of CISPR 16-1-4. The measurement area is contained within the anechoic chamber which is shielded from any ambient interference. Absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections for measurements above 1GHz. For measurements below 1GHz, the absorbers are removed. A raised turntable is used for radiated measurement. The turn table is a continuously rotatable, remote-controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane.

A positioner was used to manipulate the EUT through several positions in space by rotating about the roll axis as shown in the figure below. The positioner was mounted on top of a turntable bringing the total EUT height to 1.5m.

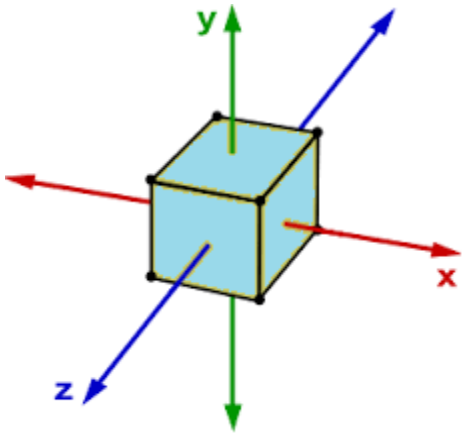


Figure 3-1. Rotation of the EUT Through Three Orthogonal Planes

The equipment under test was transmitting while connected to its patch or HBF antenna and is placed on a positioner. The measurement antenna is in the far field of the EUT per formula $2D^2/\lambda$ where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT. For radiated power and radiated spurious emission measurements, "D" is the largest dimension of the measurement antenna per KDB 842590 D01 v01r02. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning. It was determined that H=0 degree and V=90 degree are the worst case positions when the EUT was transmitting horizontally and vertically polarized beams, respectively.

The maximized power level is recorded using the spectrum analyzer's "Channel Power" function with the integration bandwidth set to the emissions' occupied bandwidth. The EIRP is calculated from the raw power level measured with the spectrum analyzer using the formulas shown below.

Effective Isotropic Radiated Power Sample Calculation

The measured e.i.r.p is converted to E-field in V/m. Then, the distance correction is applied before converting back to calculated e.i.r.p, as explained in KDB 971168 D01.

Field Strength [dBμV/m] = Measured Value [dBm] + AFCL [dB/m] + 107

= -34.06 dBm + (40.6dB/m + 8.49dB) + 107 = 122.03dBuV/m

= 10^(122.03/20)/1000000 = 1.26 V/m

e.i.r.p. [dBm] = 10 * log((E-Field*D_m)^2/30) + 30dB

= 10*log((1.26V/m * 1.00m)^2/30) + 30dB

= **17.24 dBm e.i.r.p.**

4.0 MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4-2014. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.13
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to an accredited ISO/IEC 17025 calibration facility. Measurements antennas used during testing were calibrated in accordance to the requirements of ANSI C63.5-2017.

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	ETS-001	EMC Cable and Switch System	3/2/2021	Annual	3/2/2022	ETS-001
-	AP2-001	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	AP2-001
-	AP2-002	EMC Cable and Switch System	3/4/2021	Annual	3/4/2022	AP2-002
Anritsu	MT8821C	Radio Communication Analyzer	4/30/2021	Annual	4/30/2022	6201524620
Megaphase	FAC mmWave	AP FAC mmWave 18ft 40GHz	3/3/2021	Annual	3/3/2022	20033003
Narda	180-442-KF	Wide Band Horn Antenna 18.0 - 40.0 GHz	9/14/2020	Annual	9/14/2021	2172481
OML Inc.	M19RH	WR-19 Horn Antenna, 24dBi, 40 to 60 GHz	12/30/2018	Biennial	12/30/2021	18073001
OML Inc.	M12RH	WR-12 Horn Antenna, 24dBi, 60 to 90 GHz	12/30/2018	Biennial	12/30/2021	18073001
OML Inc.	M08RH	WR-08 Horn Antenna, 24dBi, 90 to 140 GHz	12/30/2018	Biennial	12/30/2021	18073001
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/10/2020	Annual	8/10/2021	103200
Rohde & Schwarz	ESU40	EMI Test Receiver (40GHz)	5/25/2021	Annual	5/25/2022	100348
Rohde & Schwarz	ESW44	EMI Test Receiver 2Hz to 44 GHz	1/21/2021	Annual	1/21/2022	101716
Rohde & Schwarz	FSV40-N	Spectrum Analyzer	1/14/2021	Annual	1/14/2022	101814
Rohde & Schwarz	SMW200A	Vector Signal Generator	N/A			109456
Schwarzbeck	VULB9162	Bilog Antenna	4/17/2020	Biennial	4/17/2022	301
Sunol Science	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107
Virginia Diodes Inc	SAX411	SAX Module (40 - 60GHz)	2/24/2021	Annual	2/24/2022	SAX411
Virginia Diodes Inc	SAX252	SAX Module (60 - 90GHz)	2/24/2021	Annual	2/24/2022	SAX252
Virginia Diodes Inc	SAX253	SAX Module (90 - 140GHz)	2/24/2021	Annual	2/24/2022	SAX253

Table 5-1. Test Equipment

Notes:

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

6.0 SAMPLE CALCULATIONS

Emission Designator

QPSK Modulation

Emission Designator = 800MG7D

BW = 800 MHz
G = Phase Modulation
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

QAM Modulation

Emission Designator = 802MW7D

BW = 802 MHz
W = Amplitude/Angle Modulated
7 = Quantized/Digital Info
D = Data transmission, telemetry, telecommand

7.0 TEST RESULTS

7.1 Summary

Company Name: Pivotal Commware

FCC ID: 2AUVU-P28SUHMGA1

FCC Classification: Part 30 Transportable Transmitter (5GT)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	CONDUCTED	PASS	Section 7.2
2.1046	Conducted Power	N/A		PASS	Section 7.3
30.202(c)	Equivalent Isotropic Radiated Power	55dBm	RADIATED	PASS	Section 7.4
2.1051, 30.203	Spurious Emissions	-13dBm/MHz for all out-of-band emissions		PASS	Section 7.5
2.1051, 30.203	Out-of-Band Emissions at the Band Edge	-5dBm/MHz, from the band edge up to 10% of the channel bandwidth -13dBm/MHz, for all other out-of-band emissions		PASS	Section 7.6
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	Section 7.7

Table 7-1. Summary of Radiated Test Results

Notes:

1) Per 2.1057(a)(2), spurious emissions were investigated up to 100GHz.
2) Testing was completed with a signal generator creating a representative mmWave 5G NR signal, using DFT-s-OFDM scheme, various modulations including QPSK, and QAM, 120kHz subcarrier spacing, 50MHz-single carrier and 100MHz-four carrier bandwidths, and full and single resource block allocations.
3) The input signal was fed from the signal generator to the EUT via a coaxial cable and it was set at a level so as to produce the maximum output power of the AGC range.
4) Based upon investigations of all possible modulations, testing was mainly performed with QPSK modulation.
5) The EUT was fitted with a waveguide-to-coax adapter to facilitate conducted measurements.
6) Unless other wise specified, triggering from the signal generator was used in order to more accurately gate on the TDD signal with the analyzer.

7.2 Occupied Bandwidth

§2.1049

Test Overview

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. All modes of operation were investigated and the worst case configuration results are reported in this section.

Test Procedure Used

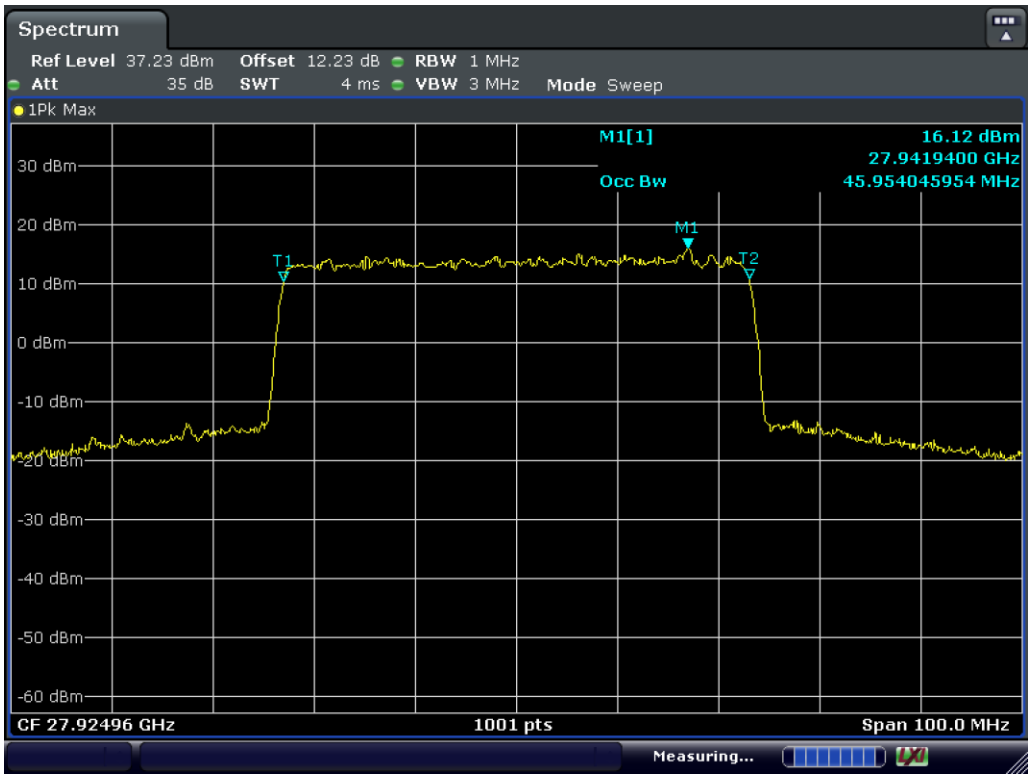
ANSI C63.26-2015 Section 5.4.3

Test Settings

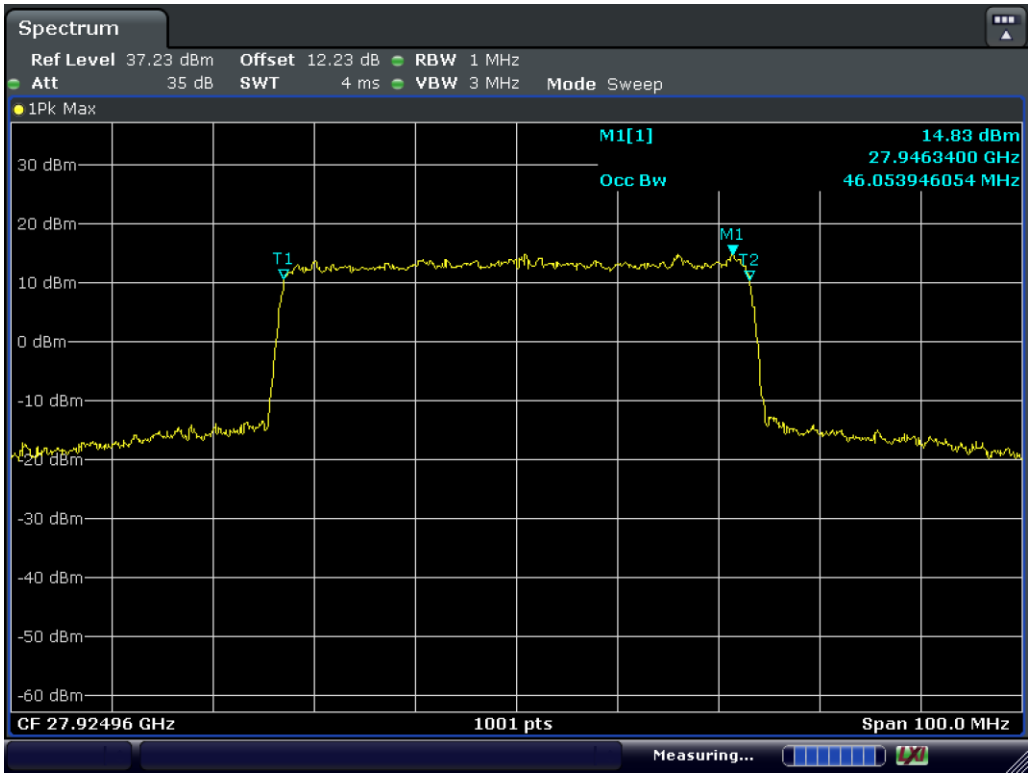
1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7.

Channel	Bandwidth [MHz]	CCs Active	Beam Pol	Modulation	OBW [MHz]
Mid	50	1	H	QPSK	45.95
			H	16QAM	46.05
			V	QPSK	46.05
			V	16QAM	46.05
	100	4	H	QPSK	391.61
			H	16QAM	390.61
			V	QPSK	391.61
			V	16QAM	391.61

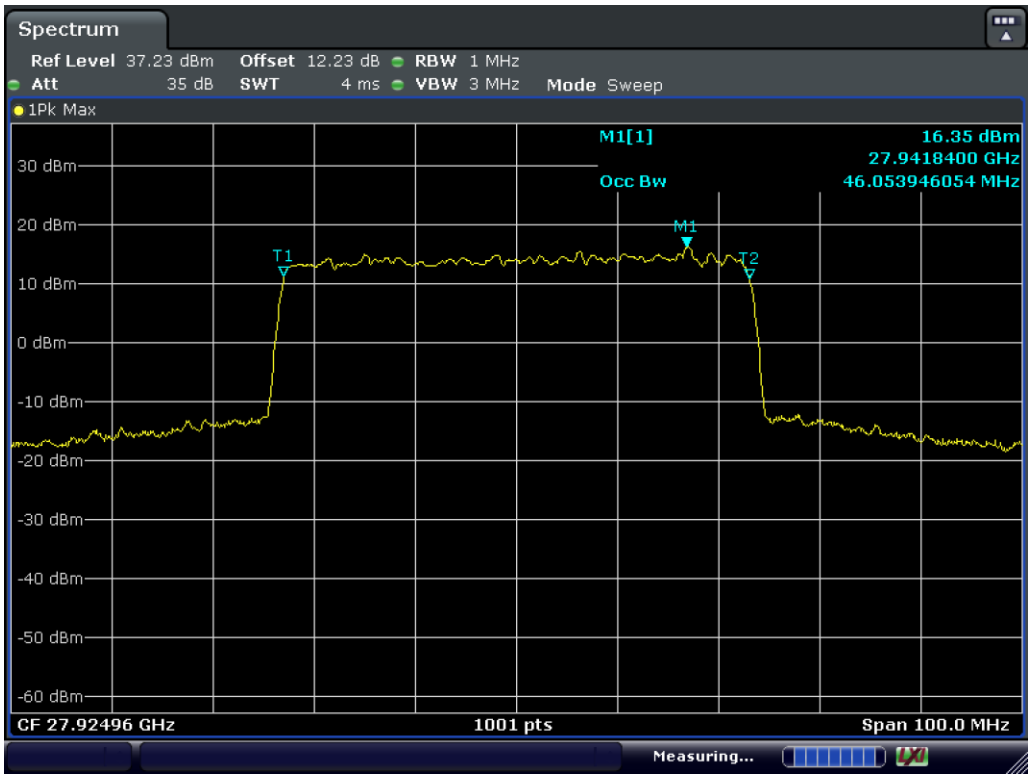
Table 7-2. Summary of Downlink Antenna Occupied Bandwidth – NR Band n261



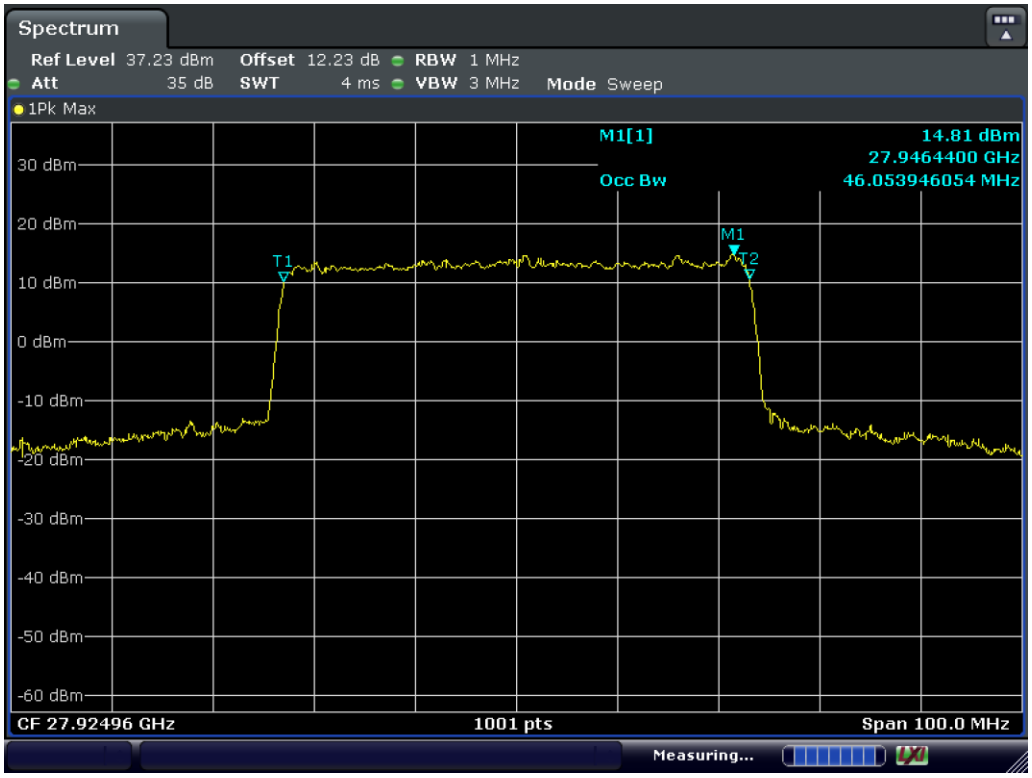
Plot 7-1. Occupied Bandwidth Plot (NR Band n261 - 50MHz QPSK - Mid Channel) – H-DL



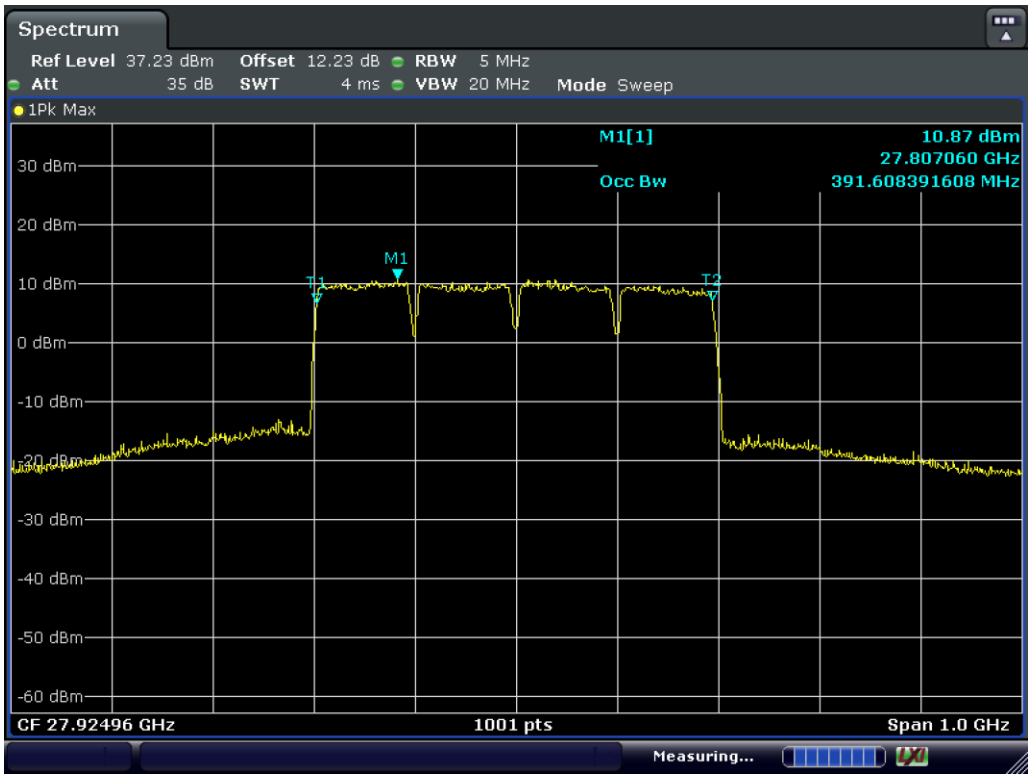
Plot 7-2. Occupied Bandwidth Plot (NR Band n261 - 50MHz 16QAM - Mid Channel) – H-DL



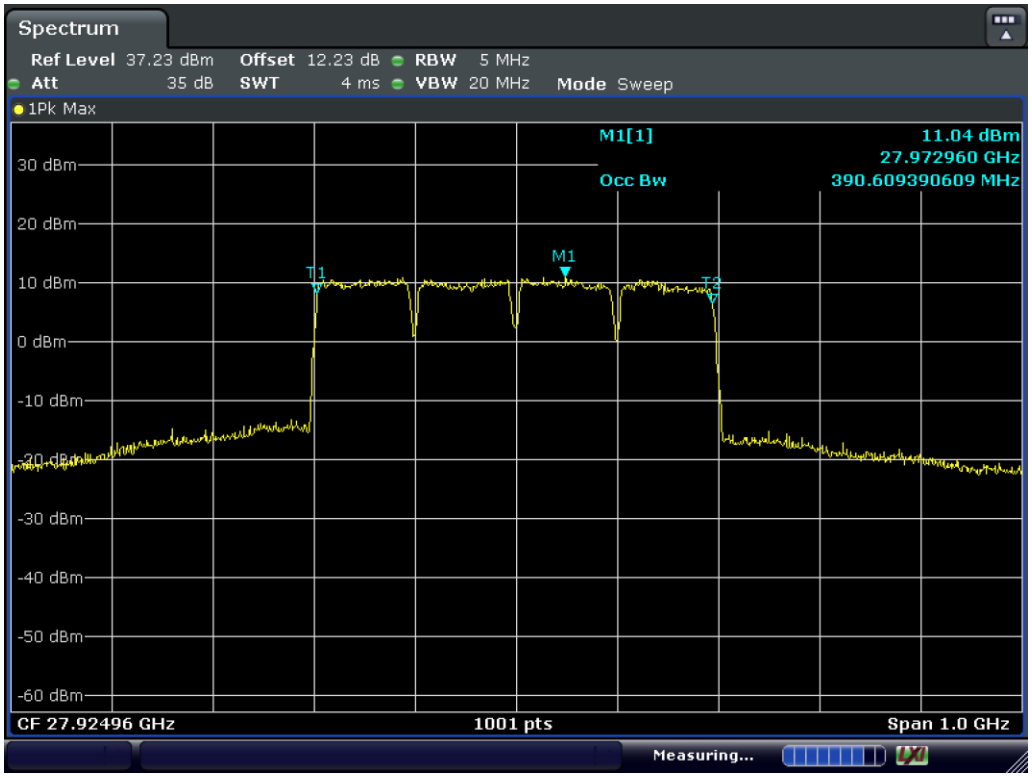
Plot 7-3. Occupied Bandwidth Plot (NR Band n261 - 50MHz QPSK - Mid Channel) – V-DL



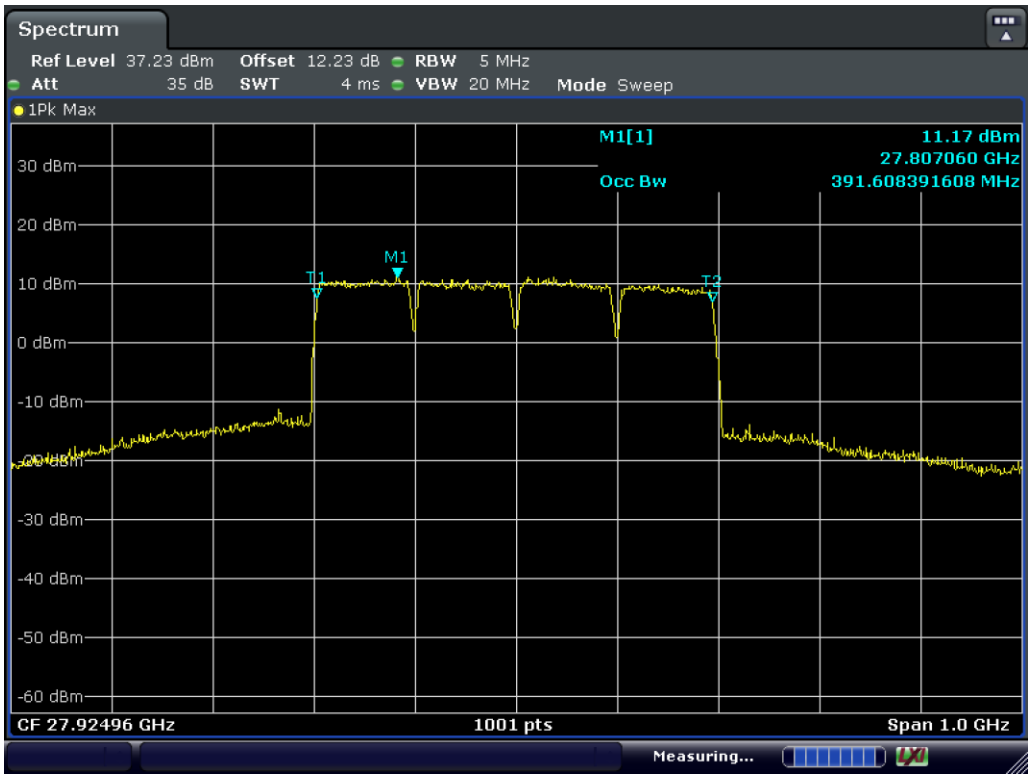
Plot 7-4. Occupied Bandwidth Plot (NR Band n261 - 50MHz 16QAM - Mid Channel) – V-DL



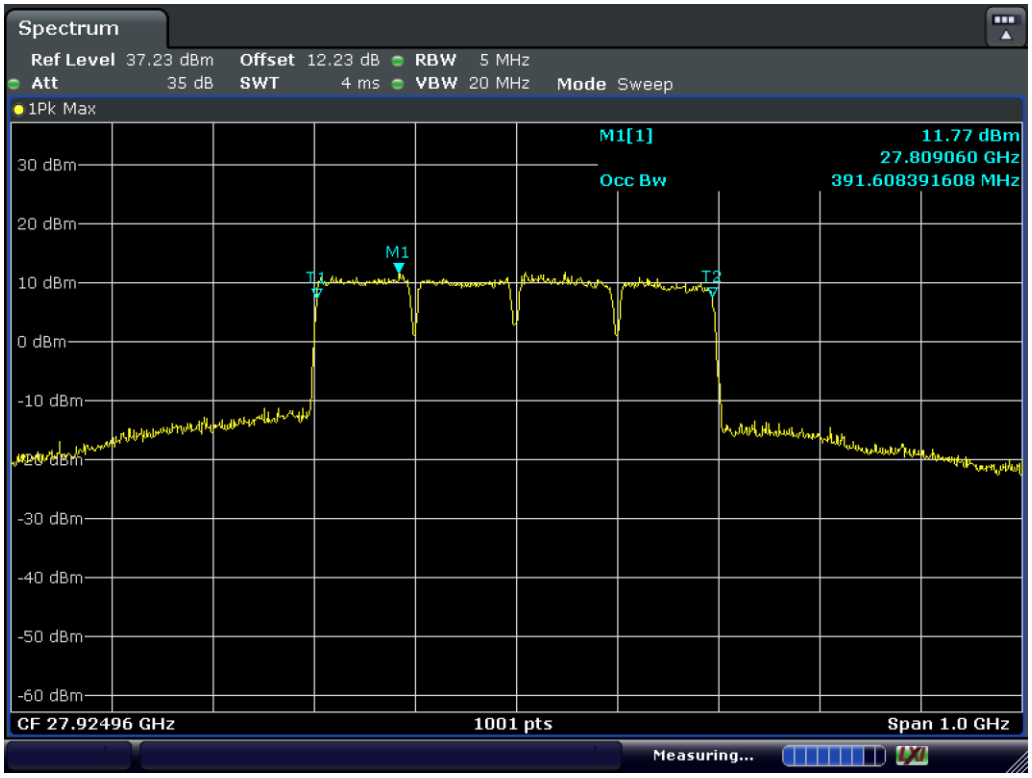
Plot 7-5. Occupied Bandwidth Plot (NR Band n261 - 100MHz 4CC QPSK - Mid Channel) – H-DL



Plot 7-6. Occupied Bandwidth Plot (NR Band n261 - 100MHz 4CC 16QAM - Mid Channel) – H-DL



Plot 7-7. Occupied Bandwidth Plot (NR Band n261 - 100MHz 4CC QPSK - Mid Channel) – V-DL



Plot 7-8. Occupied Bandwidth Plot (NR Band n261 - 100MHz 4CC 16QAM - Mid Channel) – V-DL

7.3 Conducted Power

§2.1046

Test Overview

A transmitter port of the EUT is connected to the input of a signal analyzer. A signal generator supplies a 5G NR signal directly into the input port of the device. All measurements are performed as RMS average measurements while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies.

Test Procedures Used

ANSI C63.26-2015 Section 5.2.4.4.1

Test Settings

1. Conducted power measurements are performed using the signal analyzer's "channel power" measurement capability.
2. Triggering was set to enable measurements only during full power bursts of the pulsed signal, with the sweep time set less than or equal to the transmission burst duration.
3. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
4. VBW ≥ 3 x RBW
5. Span = 2x to 3x the OBW
6. No. of sweep points ≥ 2 x span / RBW
7. Detector = RMS
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize.

Test Notes

1) The MIMO Conducted Power were calculated by using the "measure and sum the spectral maxima across the outputs" technique specified in Section 6.4.3.2.3 of ANSI C63.26-2015. The spectra were summed linearly and converted to dBm for comparison with the limit.

2) The MIMO Conducted Power shown below are mathematically summed conducted powers between measurements on H Beam and V Beam.

Sample MIMO Calculation:

Antenna 1 + Antenna 2 = MIMO

(21.32dBm + 21.39dBm) = (135.52mW + 137.72mW) =273.24mW = 24.37dBm

Center Frequency (MHz)	Ant.Pol.	Transmission Scheme	Modulation	Bandwidth (MHz)	# of Carriers (CCs)	No. RBs	Conducted Power (dBm)
27525.00	V	DFT-s-OFDM	QPSK	50	1	Full	19.50
27924.96	V	DFT-s-OFDM	QPSK	50	1	Full	19.91
28324.92	V	DFT-s-OFDM	QPSK	50	1	Full	19.84
27550.08	V	DFT-s-OFDM	QPSK	100	1	Full	19.12
27924.96	V	DFT-s-OFDM	QPSK	100	1	Full	19.00
28299.96	V	DFT-s-OFDM	QPSK	100	1	Full	18.92
27700.02	V	DFT-s-OFDM	QPSK	100	4	Full	16.94
27924.96	V	DFT-s-OFDM	QPSK	100	4	Full	16.88
28150.02	V	DFT-s-OFDM	QPSK	100	4	Full	16.80
27525.00	H	DFT-s-OFDM	QPSK	50	1	Full	19.74
27924.96	H	DFT-s-OFDM	QPSK	50	1	Full	19.81
28324.92	H	DFT-s-OFDM	QPSK	50	1	Full	19.79
27550.08	H	DFT-s-OFDM	QPSK	100	1	Full	18.90
27924.96	H	DFT-s-OFDM	QPSK	100	1	Full	19.08
28299.96	H	DFT-s-OFDM	QPSK	100	1	Full	19.04
27700.02	H	DFT-s-OFDM	QPSK	100	4	Full	16.89
27924.96	H	DFT-s-OFDM	QPSK	100	4	Full	16.96
28150.02	H	DFT-s-OFDM	QPSK	100	4	Full	17.02

Table 7-3. NR Band n261 - Conducted Power - SISO

Center Frequency (MHz)	Ant.Pol.	Transmission Scheme	Modulation	Bandwidth (MHz)	# of Carriers (CCs)	No. RBs	MIMO Conducted Power (dBm)
27525.00	MIMO	DFT-s-OFDM	QPSK	50	1	Full	22.63
27924.96	MIMO	DFT-s-OFDM	QPSK	50	1	Full	22.87
28324.92	MIMO	DFT-s-OFDM	QPSK	50	1	Full	22.83
27550.08	MIMO	DFT-s-OFDM	QPSK	100	1	Full	22.02
27924.96	MIMO	DFT-s-OFDM	QPSK	100	1	Full	22.05
28299.96	MIMO	DFT-s-OFDM	QPSK	100	1	Full	21.99
27700.02	MIMO	DFT-s-OFDM	QPSK	100	4	Full	19.93
27924.96	MIMO	DFT-s-OFDM	QPSK	100	4	Full	19.93
28150.02	MIMO	DFT-s-OFDM	QPSK	100	4	Full	19.92

Table 7-4. NR Band n261 - Conducted Power - MIMO

7.4 Equivalent Isotropic Radiated Power

§30.202(c)

Test Overview

Equivalent Isotropic Radiated Power (EIRP) measurements are performed using broadband horn antennas. All measurements are performed as RMS average measurements while the EUT is operating at the appropriate frequencies with the max power condition as specified by the AGC software of the EUT.

The average power of the sum of all antenna elements is limited to a maximum EIRP of +55 dBm.

Test Procedures Used

ANSI C63.26-2015 Section 5.2.4.4.1

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability.
2. Triggering was set to enable measurements only during full power bursts of the pulsed signal, with the sweep time set less than or equal to the transmission burst duration.
3. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
4. VBW ≥ 3 x RBW
5. Span = 2x to 3x the OBW
6. No. of sweep points ≥ 2 x span / RBW
7. Detector = RMS
8. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
9. Trace mode = trace averaging (RMS) over 100 sweeps
10. The trace was allowed to stabilize

Test Notes

1. The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below.
2. The input signal to the EUT was set in order to produce the max power allowed by the AGC software of the EUT.
3. EIRP measurements were taken in the far field.
4. The average EIRP reported below is calculated per section 5.2.7 of ANSI C63.26-2015 which states: EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in meters. The field strength E is calculated E (dBμV/m) = Spectrum Analyzer Channel Power Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107.

CCs active	Bandwidth [MHz]	Frequency [MHz]	Channel	Beam Pol	Modulation	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Azimuth Roll [degrees]	RB Size/Offset	EIRP [dBm]	Limit [dBm]	Margin [dB]
1	50	27525.00	Low	H	QPSK	H	1	1	Full	32.96	55.00	-22.04
		27525.00	Low	V	QPSK	V	0	0	Full	34.31	55.00	-20.69
		27924.96	Mid	H	QPSK	H	0	359	Full	33.50	55.00	-21.50
		27924.96	Mid	H	QPSK	H	0	359	1/16	30.49	55.00	-24.51
		27924.96	Mid	V	QPSK	V	0	0	Full	33.77	55.00	-21.23
		27924.96	Mid	V	QPSK	V	0	0	1/16	30.91	55.00	-24.09
		28324.92	High	H	QPSK	H	1	1	Full	34.06	55.00	-20.94
		28324.92	High	V	QPSK	V	0	0	Full	**34.52**	55.00	-20.48
		28324.92	High	V	16QAM	V	0	0	Full	33.75	55.00	-21.25

Table 7-5. EIRP - NR Band n261 - 50MHz Bandwidth 1CC

CCs active	Bandwidth [MHz]	Frequency [MHz]	Channel	Beam Pol	Modulation	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Azimuth Roll [degrees]	RB Size/Offset	EIRP [dBm]	Limit [dBm]	Margin [dB]
4	100	27700.02	Low	H	QPSK	H	1	1	Full	32.17	55.00	-22.83
		27700.02	Low	V	QPSK	V	0	0	Full	33.15	55.00	-21.85
		27924.96	Mid	H	QPSK	H	0	359	Full	32.46	55.00	-22.54
		27924.96	Mid	V	QPSK	V	0	0	Full	32.93	55.00	-22.07
		28150.02	High	H	QPSK	H	1	1	Full	32.94	55.00	-22.06
		28150.02	High	V	QPSK	V	0	0	Full	**33.48**	55.00	-21.52
		28150.02	High	H	16QAM	H	1	1	Full	32.69	55.00	-22.31

Table 7-6. EIRP - NR Band n261 - 100MHz Bandwidth 4CC

7.5 Radiated Spurious and Harmonic Emissions

§2.1051, §30.203

Test Overview

The spectrum is scanned from 30MHz to 100GHz. All out of band emissions are measured in a radiated test setup while the EUT is operating at the appropriate frequencies with the max power condition as specified by the AGC software of the EUT. All modulations were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

The conductive power or total radiated power of any emissions outside a licensee's frequency block shall be -13dBm/1MHz.

Test Procedure Used

ANSI C63.26-2015 Section 5.7.4

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 100 GHz. Several plots are used to show investigations in this entire span.
2. RBW = 100kHz for emissions below 1GHz and 1MHz for emissions above 1GHz.
3. VBW ≥ 3 x RBW
4. No. of sweep points > 2 x span / RBW
5. Trace / Detector =
    a. Average / RMS – for all emissions
    b. Max Hold / Peak – for emissions solely due to unlicensed transmitters (in addition to settings in 5a.)
6. For measurements made with Trace Averaging:
    a. These measurements were averaged over at least 100 traces.
    b. For signals with continuous operation, triggering was set to "free run" and the sweep time was set to "auto". For pulsed signals, triggering was set to enable measurements only during full power bursts with the sweep time set less than or equal to the transmission burst duration.
7. The trace was allowed to stabilize.

Test Notes

1) The EUT was tested in three orthogonal planes and in all possible test configurations and positioning. The worst case emissions are reported with the EUT positioning, modulations, RB sizes and offsets, and channel bandwidth configurations shown in the tables below. The worst case found was 50 MHz Bandwidth, QPSK Modulation, 1RB, and was tested as such.

2) All final radiated spurious emissions were measured as EIRP to compare with the §30.203 TRP limits.

3) The plots from 1-100GHz show corrected max hold EIRP levels. Plots below 1GHz show corrected max hold ERP levels. The corrected EIRP measurements reported in the following RSE tables are calculated per section 5.2.7 of ANSI C63.26-2015 which states: EIRP (dBm) = E (dBµV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in meters. The field strength E is calculated by: E (dBµV/m) = Spectrum Analyzer Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + Harmonic Mixer Conversion Loss (dB) + 107. The corrected ERP level is calculated as: ERP (dBm) = EIRP (dBm) – 2.15 dB.

4) All appropriate Antenna Factor and Cable Loss values have been applied in the spectrum analyzer for each measurement. For measurements > 40GHz, Harmonic Mixer Conversion Loss was also applied to the spectrum analyzer.

5) Emissions below 18GHz were measured at a 3 meter test distance, while emissions above 18GHz were measured at the appropriate far field distance. The far field of the mmWave signal is based on formula: R > 2D^2/wavelength, where D is the larger between the dimension of the measurement antenna and the transmitting antenna of the EUT.

6) All emissions from 30MHz - 40GHz were measured using a spectrum analyzer with an internal preamplifier. Emissions above 40GHz were measured using a harmonic mixer with the spectrum analyzer.

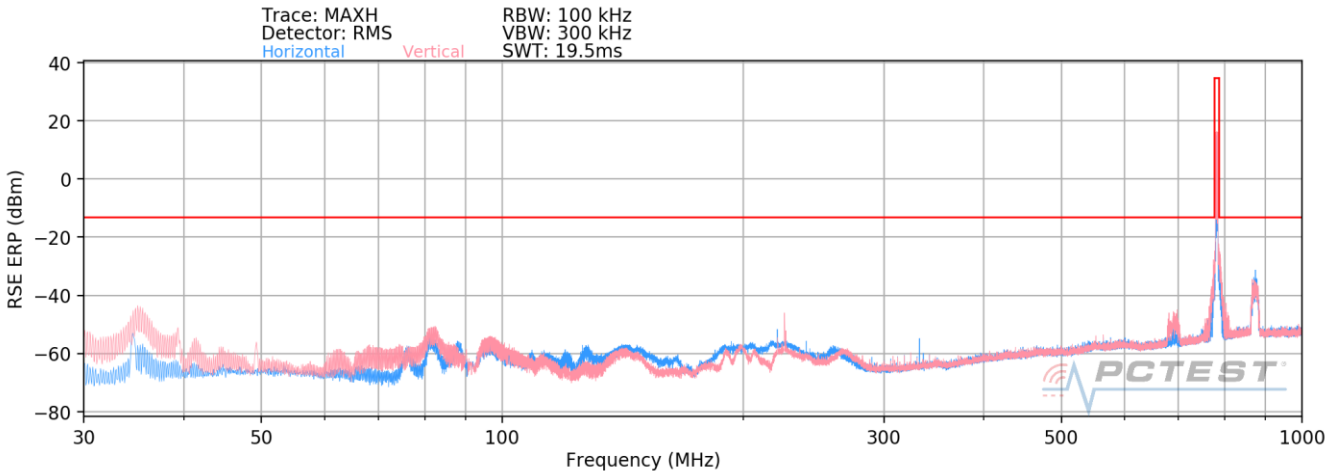
7) To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. Therefore, the EUT is simultaneously transmitting: the NR Band n261 mmWave signal, WLAN at 2437MHz in 802.11b mode, and an LTE Cat M1 B13/B4 signal.

8) The spectrum scan plots on the following pages are used for the purpose of signal identification. Each emission is subject to a unique limit based on the rule under which the transmitter operates. For instances where an emission is the product of co-located transmitters (i.e. an intermodulation product), the limit on that emission is the least stringent between the rule parts under which each transmitter operates.

9) The fundamental emissions from multiple co-located transmitters may appear on spectrum scan plots. These are not investigated as spurious emissions.

10) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

30MHz – 1GHz



Plot 7-9. Radiated Spurious Plot 30 MHz - 1 GHz (1CC QPSK Mid Channel V Beam) – B13

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
221.5	Mid	V	348	232	Avg / RMS	37.55	-57.71	-13.00	-44.71
691.0	Mid	V	152	161	Avg / RMS	42.03	-53.23	-13.00	-40.23
873.0	Mid	H	207	146	Avg / RMS	58.84	-36.42	-13.00	-23.42

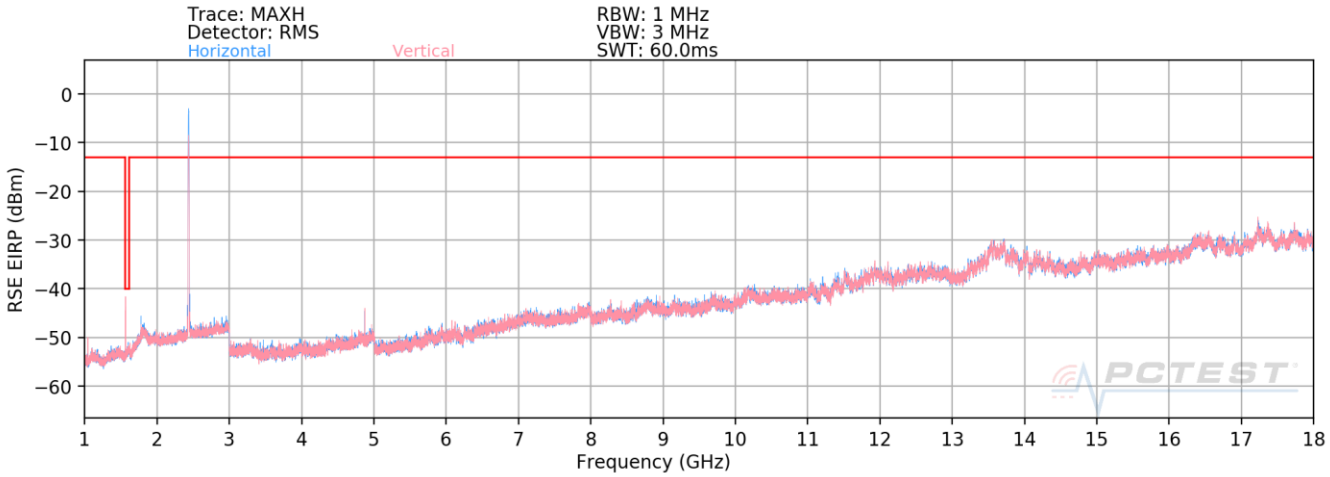
Table 7-7. Spurious Emissions Table (30MHz-1GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 3 meters.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B13 signal.

1 – 18GHz



Plot 7-10. Radiated Spurious Plot 1-18 GHz (1CC QPSK Mid Channel V Beam) - B13

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1564.0	Mid	V	163	218	Avg / RMS	50.91	-44.35	-40.00	-4.35
2346.0	Mid	V	207	260	Avg / RMS	41.42	-53.84	-13.00	-40.84
3128.0	Mid	V	-	-	Avg / RMS	34.59	-60.67	-13.00	-47.67
3910.0	Mid	V	-	-	Avg / RMS	33.58	-61.68	-13.00	-48.68
4874.0**	Mid	V	185	199	Avg / RMS	49.51	-45.75	-41.28	-4.47
4874.0**	Mid	V	185	199	Max / Peak	52.96	-42.30	-21.28	-21.02
7311.0**	Mid	V	-	-	Avg / RMS	38.81	-56.45	-41.28	-15.17
7311.0**	Mid	V	-	-	Max / Peak	48.75	-46.51	-21.28	-25.23

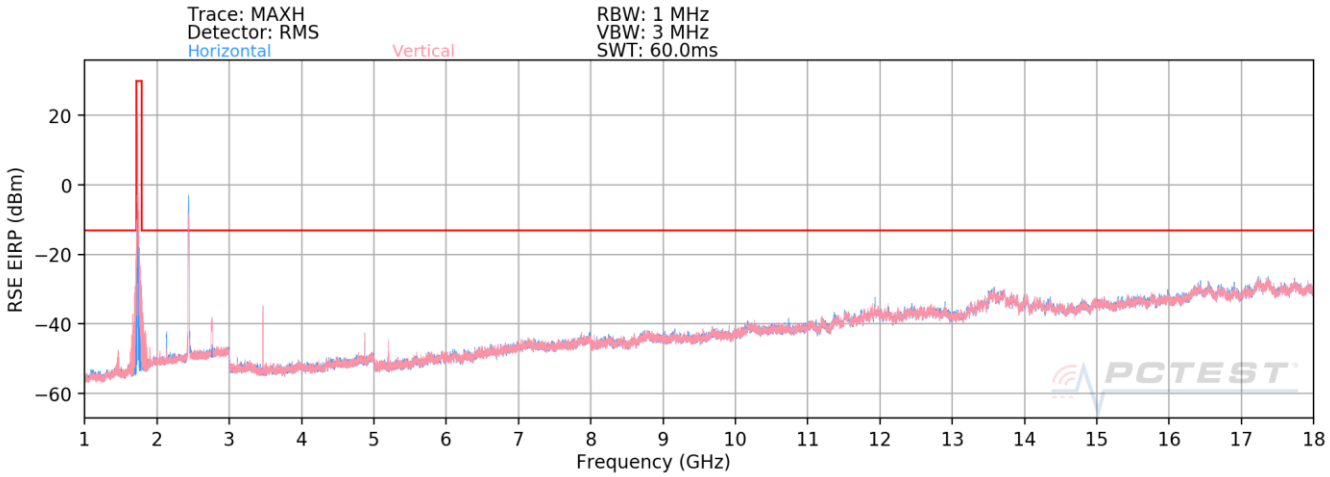
Table 7-8. Spurious Emissions Table (1GHz-18GHz) – B13

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 3 meters.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B13 signal.

3. Emissions denoted with ** are due solely to the WLAN transmitter. As such, they are subject to the spurious emission limits for unlicensed transmitters from FCC Part 15 Subpart C (§15.247). These limits have been converted from the given field strength values to an EIRP level for display in the table above.



Plot 7-11. Radiated Spurious Plot 1-18 GHz (1CC QPSK Mid Channel V Beam) – B4

Note: The emission at 2132.5 MHz is due to the downlink signal from the radio communication tester used to establish an LTE Cat M1 connection. As it did not originate from the EUT, it was not investigated as a spurious emission.

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1443.7	Mid	V	120	130	Avg / RMS	35.75	-59.51	-13.00	-46.51
2759.0	Mid	V	180	147	Avg / RMS	52.92	-42.34	-13.00	-29.34
3465.0	Mid	V	141	294	Avg / RMS	56.87	-38.39	-13.00	-25.39
4874.0**	Mid	V	184	199	Avg / RMS	49.38	-45.88	-41.28	-4.60
4874.0**	Mid	V	184	499	Max / Peak	52.57	-42.69	-21.28	-21.41
5197.5	Mid	V	227	114	Avg / RMS	47.79	-47.47	-13.00	-34.47
6930.0	Mid	V	236	158	Avg / RMS	44.37	-50.89	-13.00	-37.89
7311.0**	Mid	V	-	-	Avg / RMS	38.38	-56.88	-41.28	-15.60
7311.0**	Mid	V	-	-	Max / Peak	49.30	-45.96	-21.28	-24.68
8662.5	Mid	V	-	-	Avg / RMS	39.38	-55.88	-13.00	-42.88
10395.0	Mid	V	-	-	Avg / RMS	42.64	-52.62	-13.00	-39.62

Table 7-9. Spurious Emissions Table (1GHz-18GHz)

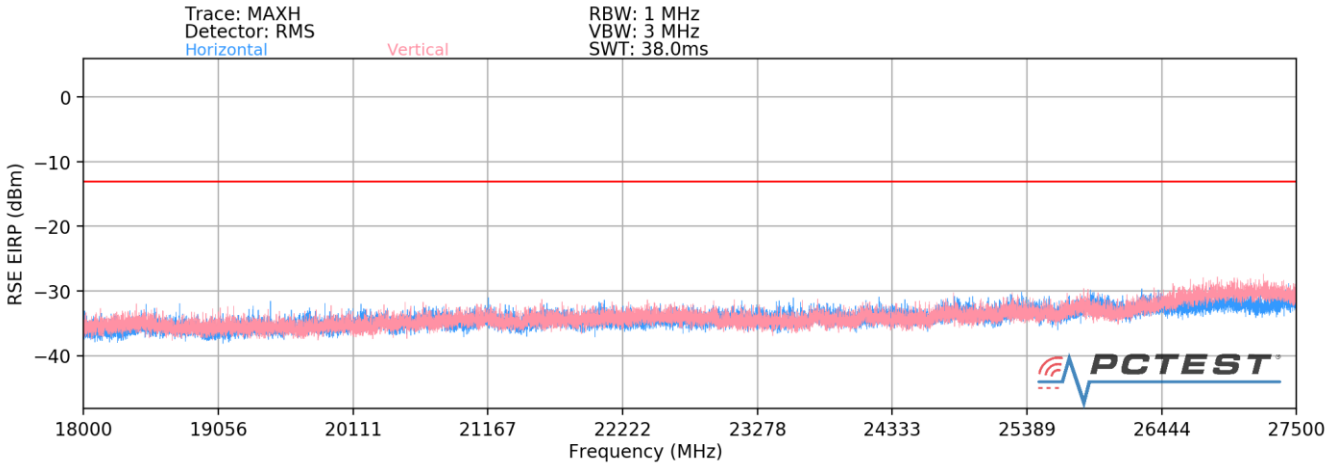
Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 3 meters.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

3. Emissions denoted with ** are due solely to the WLAN transmitter. As such, they are subject to the spurious emission limits for unlicensed transmitters from FCC Part 15 Subpart C (§15.247). These limits have been converted from the given field strength values to an EIRP level for display in the table above.

18 – 27.5GHz



Plot 7-12. Radiated Spurious Plot 18-27.5 GHz (1CC QPSK Mid Channel V Beam)

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
26636.2	Low	V	-	-	Avg / RMS	59.52	-35.74	-13.00	-22.74
27036.2	Mid	V	-	-	Avg / RMS	60.00	-35.26	-13.00	-22.26
27436.1	High	V	-	-	Avg / RMS	59.89	-35.37	-13.00	-22.37

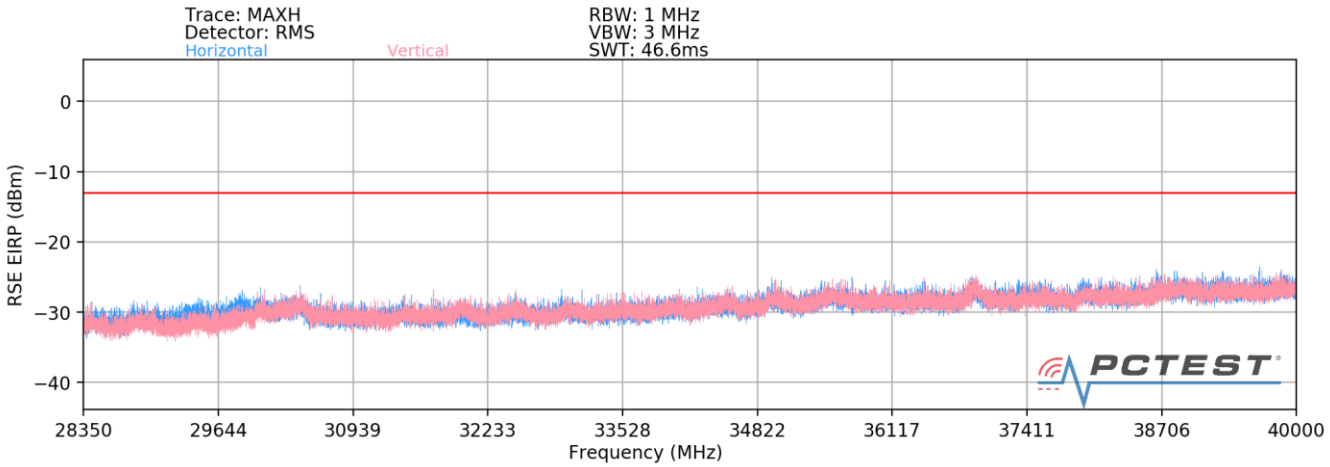
Table 7-10. Spurious Emissions Table (18-27.5GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 1 meter.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

28.35 – 40GHz



Plot 7-13. Radiated Spurious Plot 28.475-40 GHz (1CC QPSK Mid Channel V Beam)

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
29667.0	Low	V	-	-	Avg / RMS	59.55	-35.71	-13.00	-22.71
30066.9	Mid	V	-	-	Avg / RMS	60.43	-34.83	-13.00	-21.83
30466.9	High	V	-	-	Avg / RMS	60.78	-34.48	-13.00	-21.48

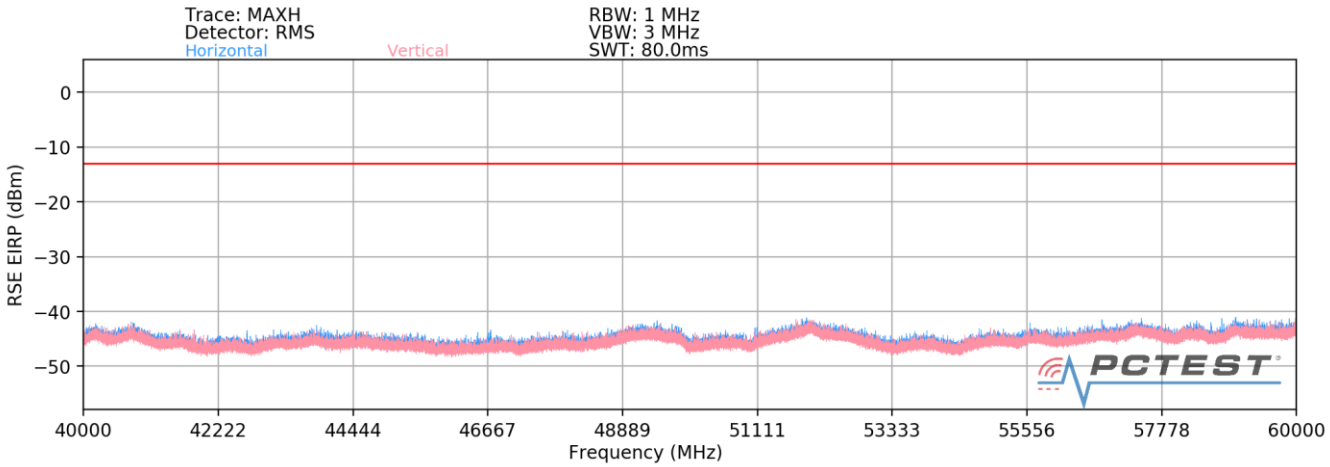
Table 7-11. Spurious Emissions Table (28.35-40 GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 1 meter.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

40 – 60GHz



Plot 7-14. Spurious Plot 40-60 GHz (1CC QPSK Mid Channel V Beam)

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
55050.0	Low	V	-	-	Avg / RMS	55.78	-39.48	-13.00	-26.48
55849.9	Mid	V	-	-	Avg / RMS	56.84	-38.42	-13.00	-25.42
56649.8	High	V	-	-	Avg / RMS	57.27	-37.99	-13.00	-24.99

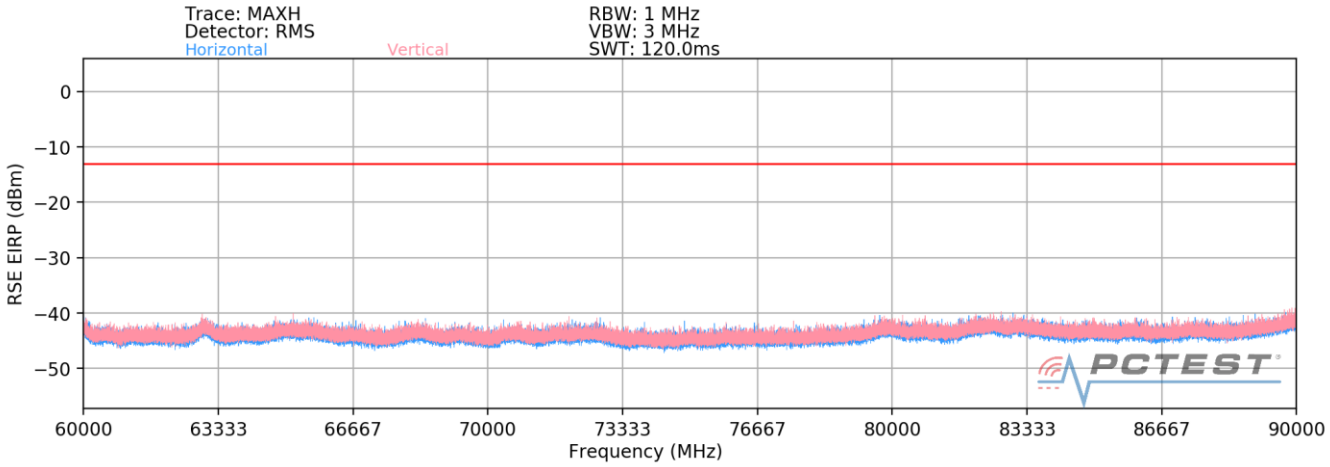
Table 7-12. Spurious Emissions Table (40 - 60GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 1.5 meters.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

60 – 90GHz



Plot 7-15. Radiated Spurious Plot 60-90 GHz (1CC QPSK Mid Channel V Beam)

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
82575.0	Low	V	-	-	Avg / RMS	55.53	-39.73	-13.00	-26.73
83774.9	Mid	V	-	-	Avg / RMS	55.55	-39.71	-13.00	-26.71
84974.8	High	V	-	-	Avg / RMS	55.23	-40.03	-13.00	-27.03

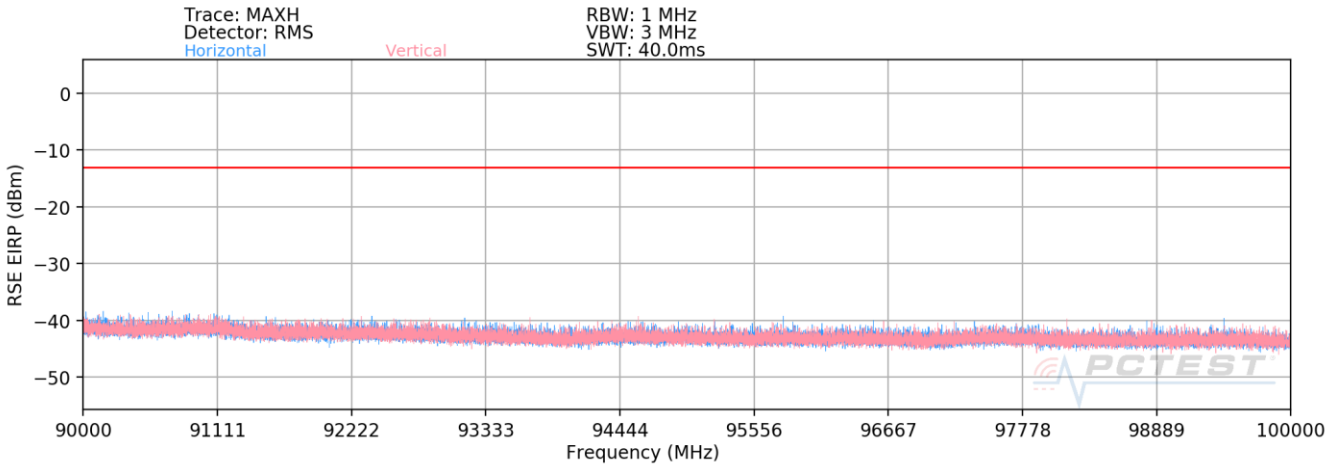
Table 7-13. Spurious Emissions Table (60-90GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 1 meter.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

90 – 100GHz



Plot 7-16. Radiated Spurious Plot 90-100 GHz (1CC QPSK Mid Channel V Beam)

Frequency [MHz]	n261 Channel	Ant. Pol. [H/V]	Turntable Azimuth [degrees]	Antenna Height [cm]	Trace / Detector	Field Strength [dBµV/m]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
96337.5	Low	V	-	-	Avg / RMS	55.90	-39.36	-13.00	-26.36
97737.4	Mid	V	-	-	Avg / RMS	55.59	-39.67	-13.00	-26.67
99137.2	High	V	-	-	Avg / RMS	55.70	-39.56	-13.00	-26.56

Table 7-14. Spurious Emissions Table (90-100GHz)

Notes

1. The RSE EIRP level is taken directly from the spectrum analyzer which includes the appropriate antenna factors, cable losses. Measurements were performed at a distance of 1 meter.

2. To cover the simultaneous transmissions, both the LTE module (FCC ID: 2AUVU-UBR410M) and WLAN module (FCC ID: Z64-WL18SBMOD) are set to transmit at the same time as the mmWave functionality of the host. EUT is transmitting WLAN at 2437MHz in 802.11b mode simultaneously with the LTE Cat M1 B4 signal.

7.6 Band Edge Emissions

§2.1051, §30.203

Test Overview

The EUT is made to transmit a representative mmWave signal via each antenna feed. All out of band emissions are then measured in a radiated setup while the EUT is operating at its maximum AGC level, at maximum power, and at the appropriate frequencies. All modes of operation were investigated and the worst case configuration results are reported in this section.

The minimum permissible attenuation level of any spurious emission is -13dBm/1MHz. However, in the bands immediately outside and adjacent to the licensee's frequency block, having a bandwidth equal to 10 percent of the channel bandwidth, the conductive power or the total radiated power of any emission shall be −5 dBm/MHz or lower.

Test Procedures Used

ANSI C63.26-2015 Sections 5 & 6.4
KDB 842590 D01 v01r02 Section 4.4

Test Settings

1. Start and stop frequency were set such that both upper and lower band edges are measured.
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 1MHz
4. VBW $\geq$ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Sweep Count = 1
8. Sweep time $\geq$ [10 × (number of points in sweep) × (transmission symbol period)]
9. Trigger = Free Run

Test Notes

1) Per ANSI C63.26-2015 Sections 5.2.4.5 & 5.2.4.4.2, the test settings above were applied to the spectrum analyzer to make band edge measurements of the constant duty cycle, broadband signal transmitted by the EUT.

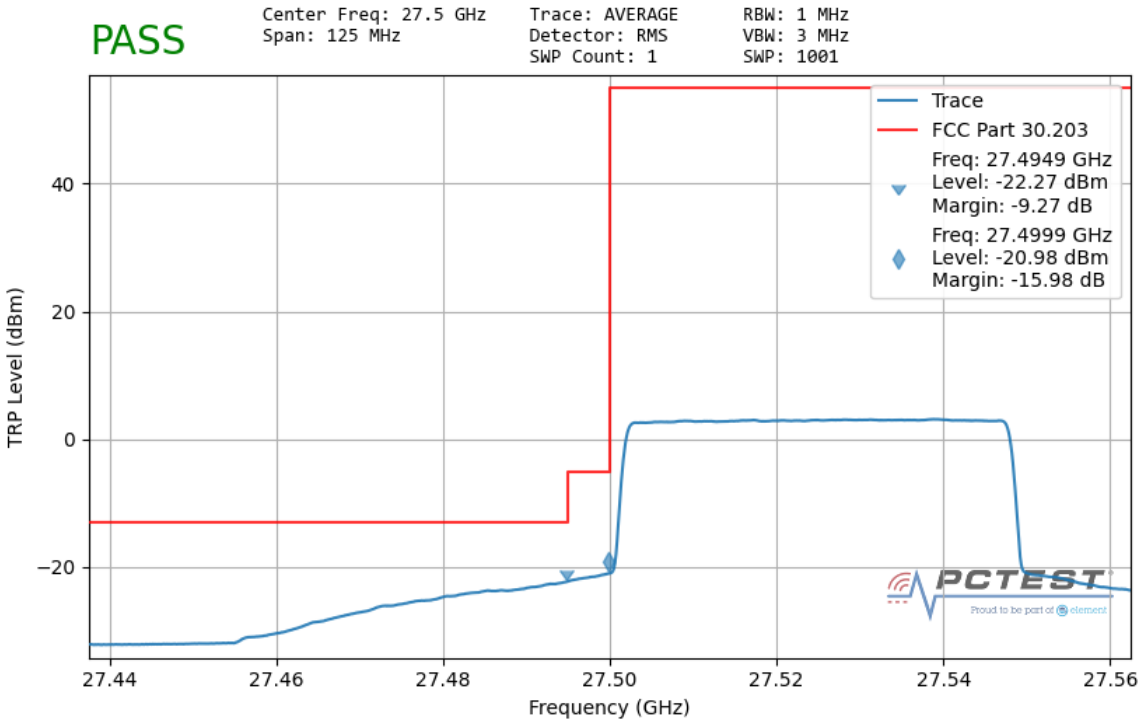
2) The transmission symbol period was calculated to be 8.33µs when the EUT was configured to transmit with a DFT-s-OFDM scheme and 120kHz subcarrier spacing (worst-case configuration).

3) The n261 mmWave TDD signal transmitted by the EUT had a 50% duty cycle.

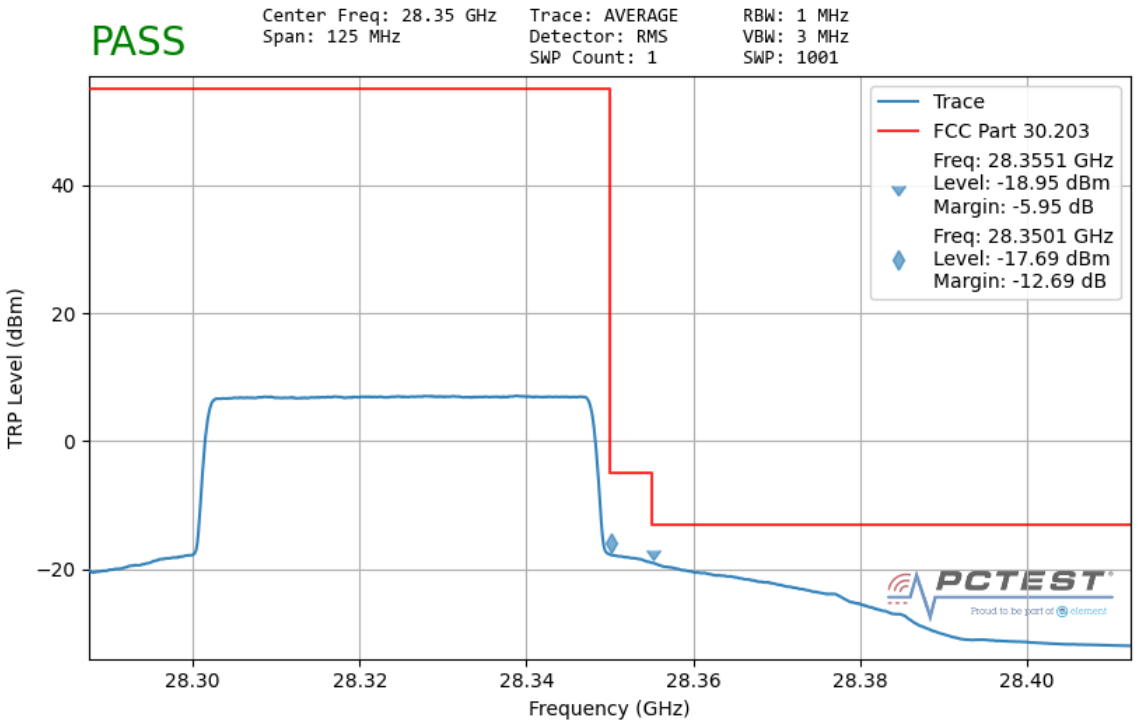
4) Band Edge emissions were measured at a 1 meter distance (in the far field).

5) The Total Radiated Power measurements shown in this section were performed in accordance with the guidance of Sections 4.4.2 & 4.4.3 of KDB 842590 D01 v01r02 for the *2-cut Method When Pattern Multiplication Is Not Applicable*.

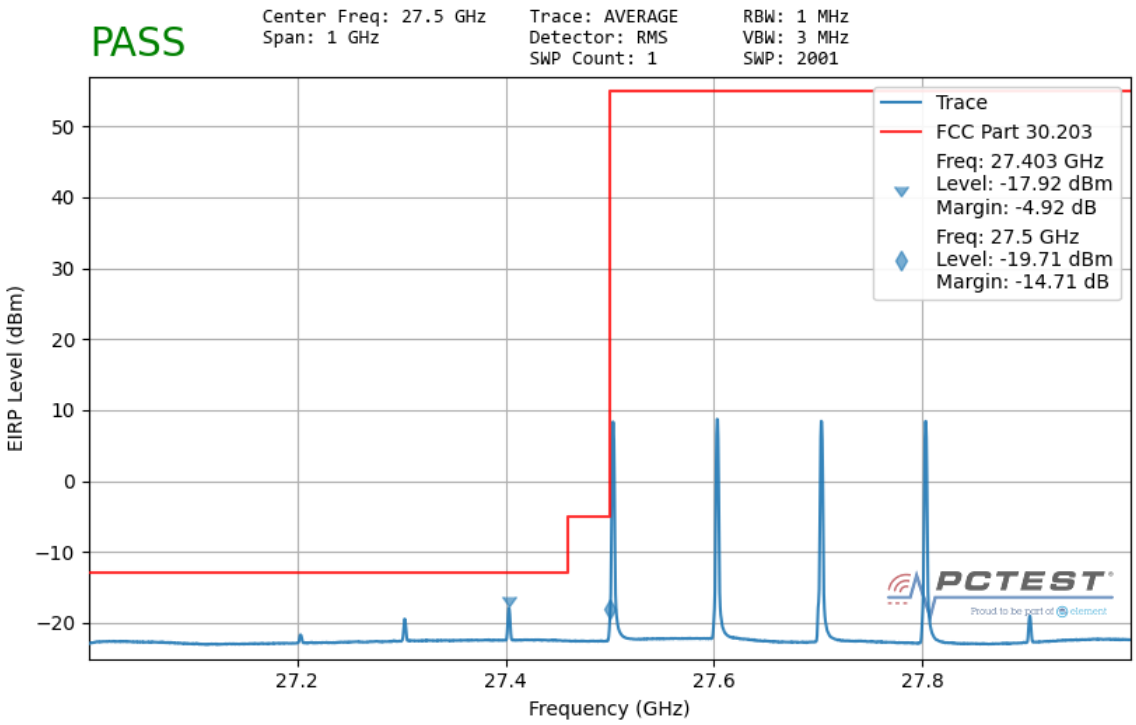
6) The following offsets & corrections were applied to the spectrum analyzer while taking band edge measurements:
    a. Per ANSI C63.26-2015 Section 5.2.4.4.2, an offset of 10log(1/duty cycle) was applied to compute the average emission level during continuous transmission.
    b. Corrections were applied for measurement antenna factor, cable loss, and far field measurement distance.
    c. Per KDB 842590 D01 v01r02 Section 4.4.3.3.2, an offset of 2 dB is applied to all TRP measurements since the 2-cut TRP plots shown in this section include measurements made in the Spurious Domain.



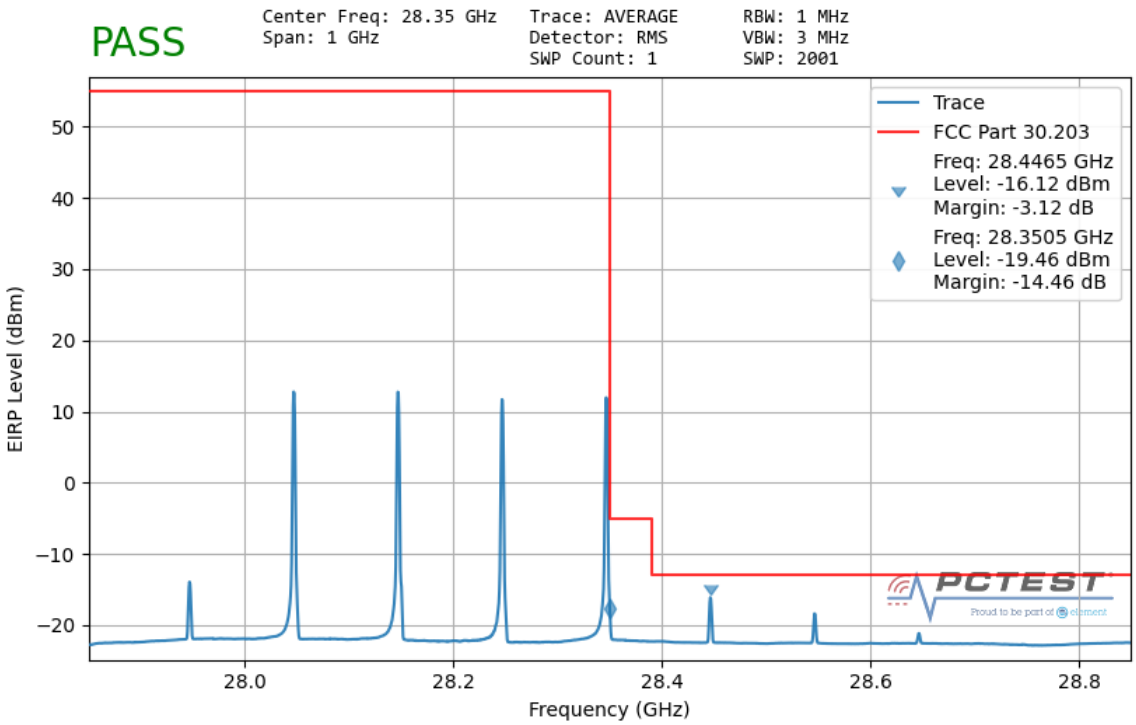
Plot 7-17. Lower Band Edge Plot – NR Band n261 (50MHz QPSK Full RB) – H-DL



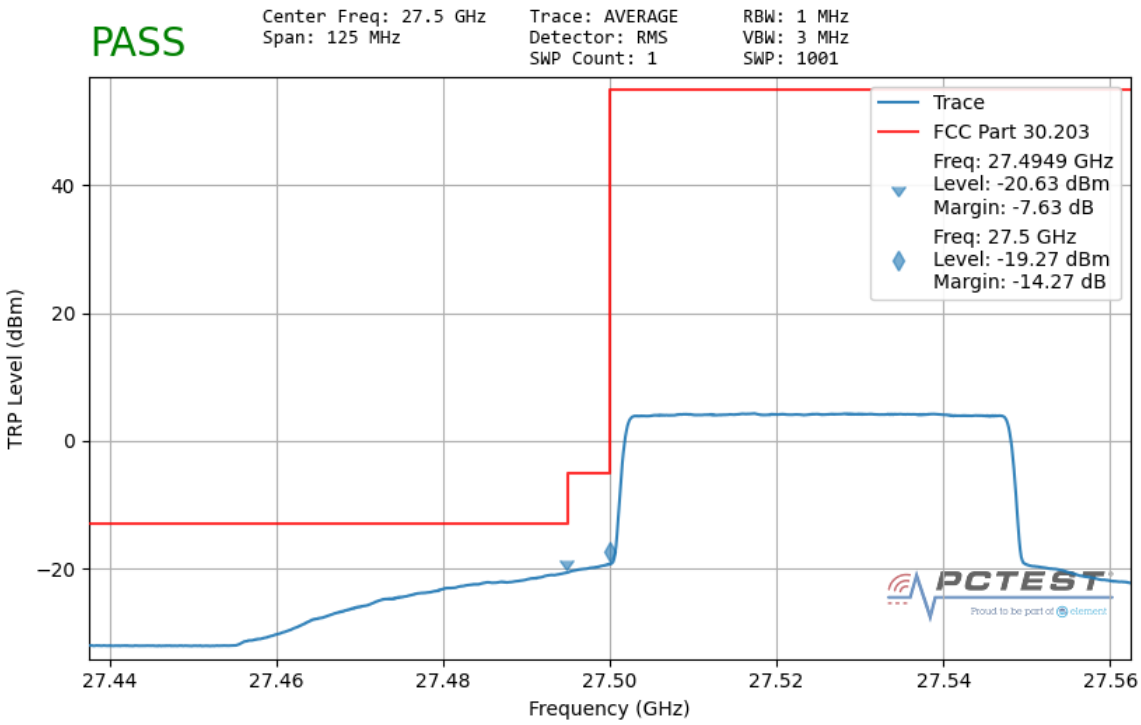
Plot 7-18. Upper Band Edge Plot – NR Band n261 (50MHz QPSK Full RB) – H-DL



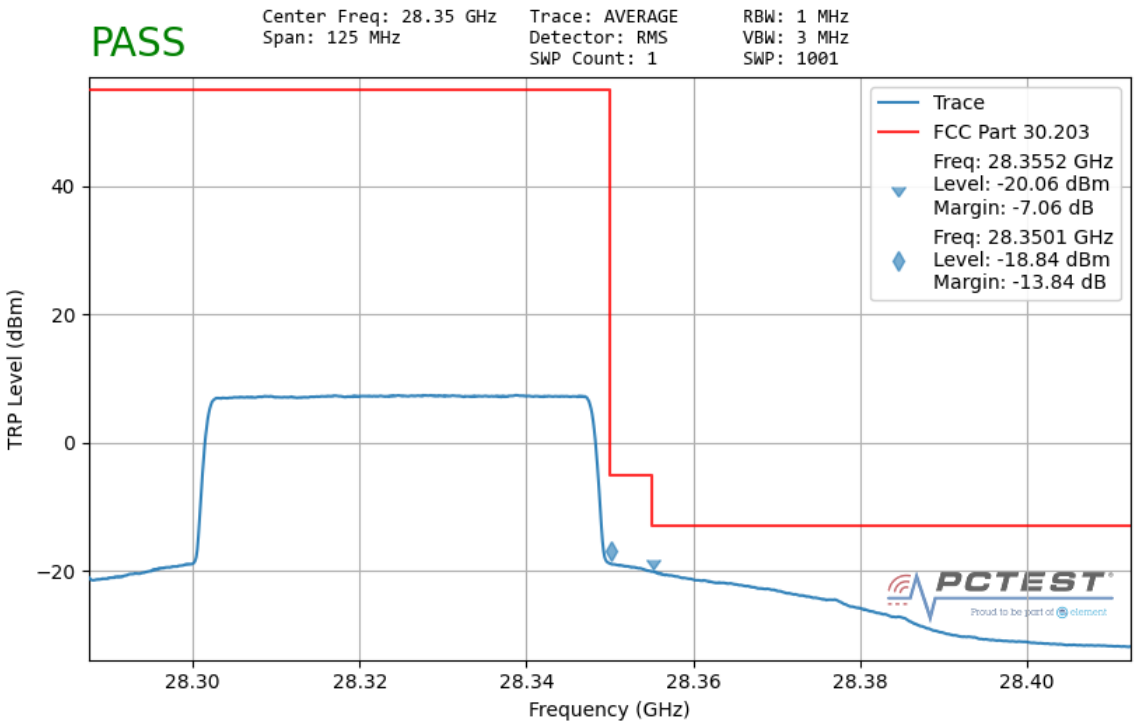
Plot 7-19. Lower Band Edge Plot – NR Band n261 (100MHz 4CC QPSK 1 RB) – H-DL



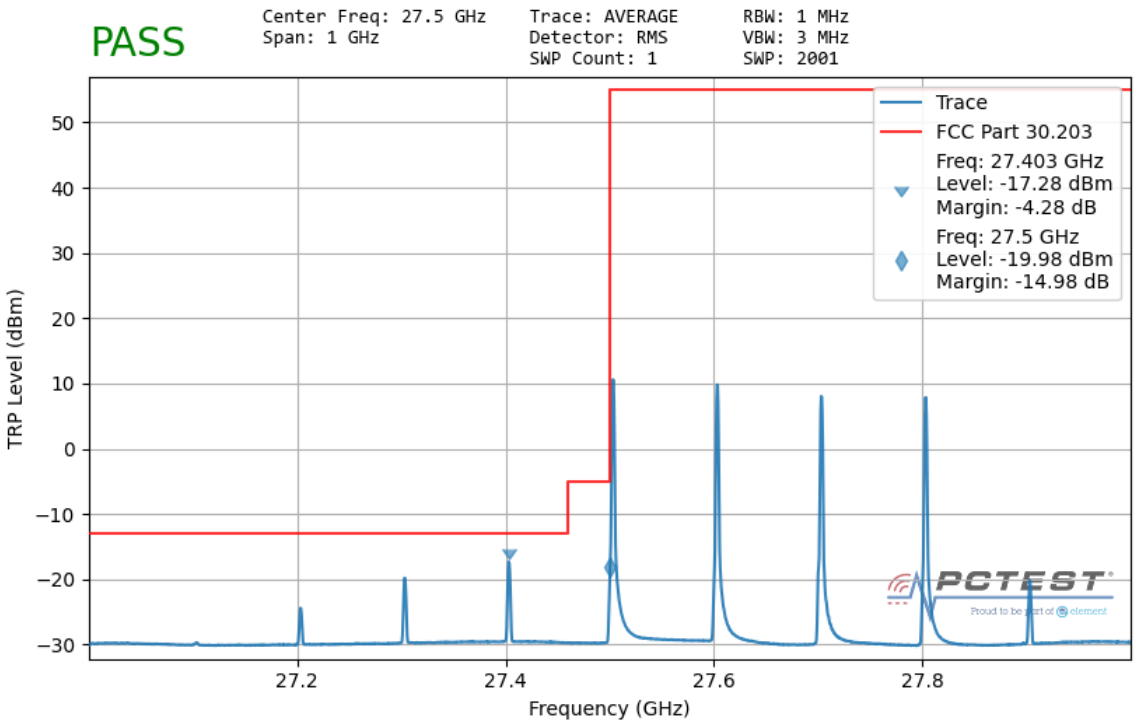
Plot 7-20. Upper Band Edge Plot – NR Band n261 (100MHz 4CC QPSK 1 RB) – H-DL



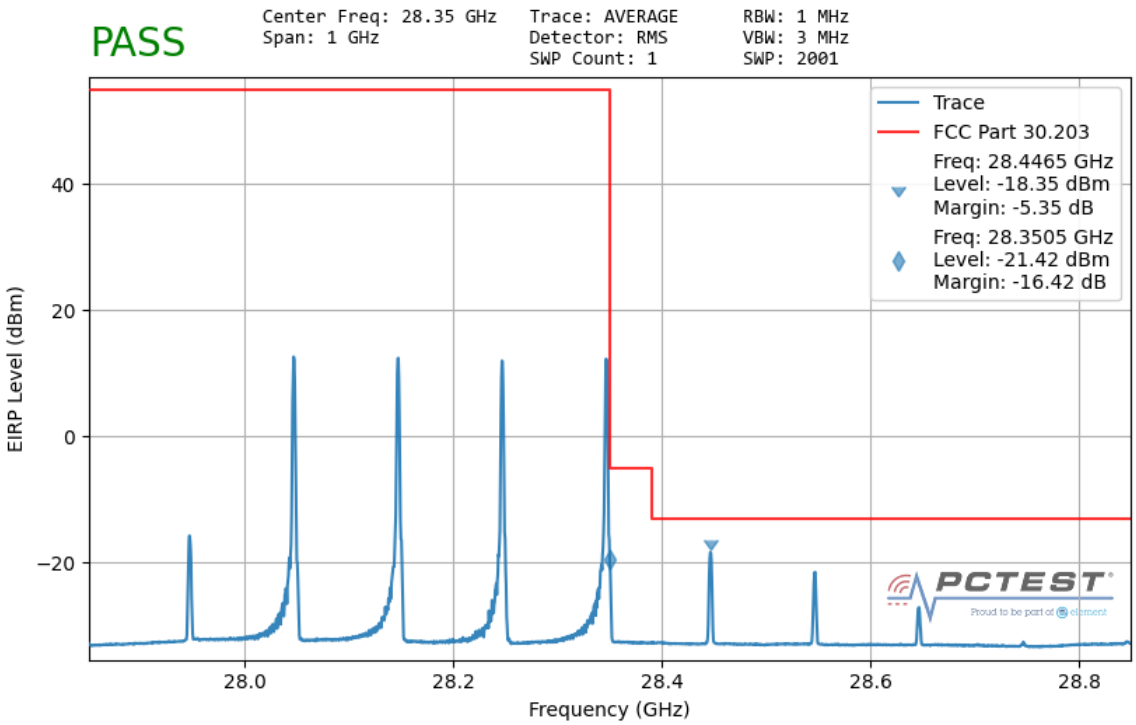
Plot 7-21. Lower Band Edge Plot – NR Band n261 (50MHz QPSK Full RB) – V-DL



Plot 7-22. Upper Band Edge Plot – NR Band n261 (50MHz QPSK Full RB) – V-DL



Plot 7-23. Lower Band Edge Plot – NR Band n261 (100MHz 4CC QPSK 1 RB) – V-DL



Plot 7-24. Upper Band Edge Plot – NR Band n261 (100MHz 4CC QPSK 1 RB) – V-DL

7.7 Frequency Stability / Temperature Variation

§2.1055

Test Overview and Limit

Frequency stability testing is performed in accordance with the guidelines of ANSI C63.26-2015. The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Test Procedure Used

ANSI C63.5-2015 Section 5.6

Test Settings

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a "standby" condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

Test Setup

The EUT was measured using horn antenna connected to a spectrum analyzer. The EUT was placed inside an environmental chamber. Using a foam plug, the horn antenna measured the frequency of the fundamental signal.

Test Notes

The Frequency Deviation column in the table below is the amount of deviation measured from the center frequency of the indicated Reference measurement.

Frequency Stability Measurements

§2.1055

OPERATING FREQUENCY:	27,924,960,000	Hz
REFERENCE VOLTAGE:	-48.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	-48.00	- 30	27,925,485,152	-27,964	-0.0001001
		- 20	27,925,558,666	-101,478	-0.0003634
		- 10	27,925,630,178	-172,990	-0.0006195
		0	27,925,531,908	-74,720	-0.0002676
		+ 10	27,925,420,683	36,505	0.0001307
		+ 20 (Ref)	27,925,457,188	0	0.0000000
		+ 30	27,925,320,209	136,979	0.0004905
		+ 40	27,925,388,176	69,012	0.0002471
		+ 50	27,925,370,004	87,184	0.0003122
85%	-40.80	+ 20	27,925,471,693	-14,505	-0.0000519
115%	-55.20	+ 20	27,925,476,089	-18,901	-0.0000677

Table 7-15. NR Band n261 - Frequency Stability Data

Note:

Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

Frequency Stability Measurements

§2.1055

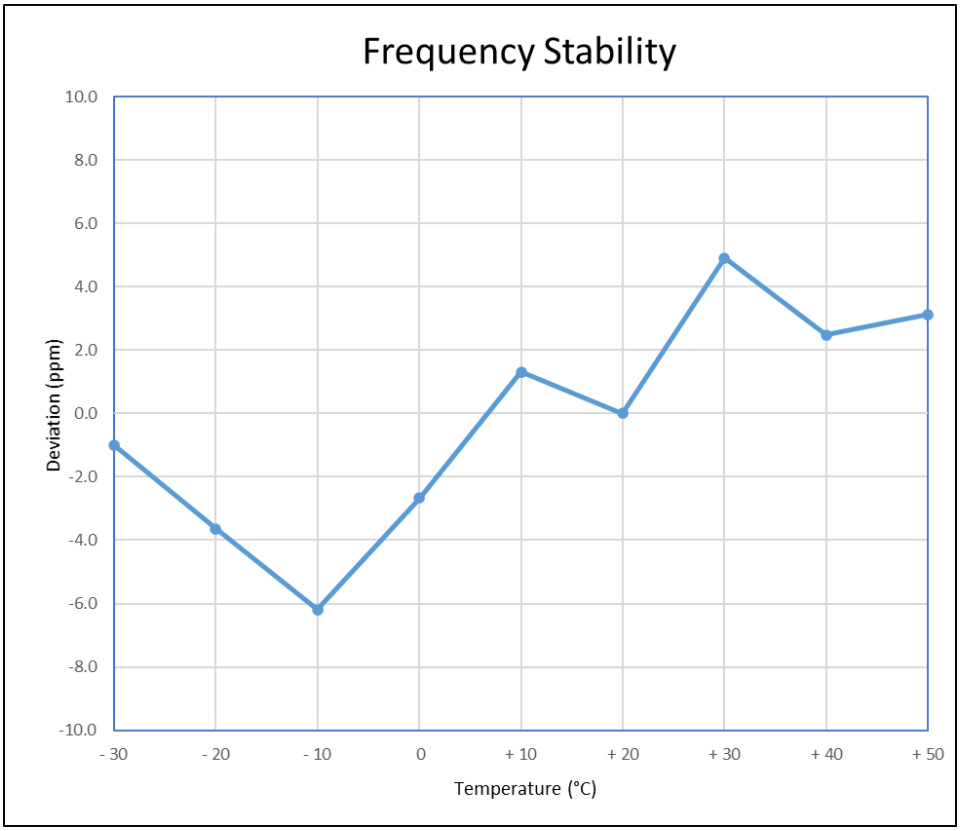


Figure 7-1. Frequency Stability Graph

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Pivotal Commware 5G mmWave Repeater (Service Unit) FCC ID: 2AUVU-P28SUHMGA1** complies with all the requirements of Part 30.

9.0 APPENDIX A

9.1 VDI Mixer Verification Certificate

Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902
Phone: 434-297-3257
Fax: 434-297-3258

Certificate of Conformance

To: PCTEST Engineering Laboratory
7185 Oakland Mills Road
Columbia, MD 21046
United States

From: Virginia Diodes, Inc
979 2nd St. SE
Suite 309
Charlottesville, VA 22902

Packing List No: 210608 **Today's Date:** 02/24/21
Shipping Date: 02/23/21 **PO Number:** 210119.DP1

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	RETEST-WR19SAX SAX 411	21036-01
1	EA	RETEST-WR12SAX SAX 252	21036-02
1	EA	RETEST-WR8.0SAX SAX 253	21036-03
1	EA	RETEST-WR5.1SAX SAX 254	21036-04

The VDI product(s) in this shipment meet(s) the guidelines for performance specifications established in accordance with the corresponding Purchase Order. Data presented in the User Guide, where applicable, has been obtained in accordance with VDI's Quality Management System. All instruments, used to obtain data, which require calibration have been calibrated with equipment traceable to the National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI).

Authorized Signature
Virginia Diodes, Inc

Page 1 of 1

9.2 Test Scope Accreditation

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

PCTEST ENGINEERING LABORATORY, LLC
7185 Oakland Mills Road
Columbia, MD 21046
Randy Ortanez Phone: 410 290 6652

ELECTRICAL[1]

Valid To: May 31, 2022 Certificate Number: 2041.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location listed above, ***as well as the two satellite laboratory locations listed below***, to perform the following Electromagnetic Compatibility, SAR, HAC, Telecommunications, OTA, Battery, RF, and Conformance and Protocol testing of wireless devices:

Test Technology:	**Test Method(s) [2]:**
Emissions Radiated and Conducted	CFR 47, FCC Parts 15B/C/D/E/F/G/H (using ANSI C63.4:2014, ANSI C63.10:2013, ANSI C63.17:2013, and FCC KDB 905462 D02 (v02)), 18 (using MP-5:1986); ANSI C63.10:2020; KDB 987594; ETSI TS 134 124 Universal Mobile Telecommunications System (UMTS); (3GPP TS 34.124); (3GPP TS38.124 NR; Electromagnetic Compatibility (EMC) Requirements for Mobile Terminals and Ancillary Equipment); ETSI TS 136 124 LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); (3GPP TS 36.124); ETSI TS 151 010-1 Digital Cellular Telecommunications System (Phase 2+) (GSM); 3GPP TS 51.010-1, Section 12 (Conducted and Radiated Spurious Emissions); EN55011; EN 55032; CNS 13438 (up to 6 GHz); AS/NZS CISPR 11; IEC/CISPR 11; CISPR 32; FCC OET/MP-5; ICES-003; KN 11; KN 32; VCCI V-3(2016.11); VCCI V-3 (2015.04); VCCI 32-1: VCCI-CISPR 32
Accessibility	CFR 47, FCC Part 14
Transmitter/Receiver	RSS 111; RSS 112; RSS 117; RSS 119; RSS 123; RSS 125; RSS 127; RSS 130; RSS 131; RSS 132; RSS 133; RSS 134; RSS 135; RSS 137; RSS 139; RSS 140; RSS 141; RSS 142; RSS 170; RSS 181; RSS 182; RSS 191; RSS 192; RSS 194; RSS 195; RSS 196; RSS 197; RSS 199; RSS 210; RSS 211; RSS 213; RSS 215; RSS 216; RSS 220; RSS 222; RSS 236; RSS 238; RSS 243; RSS 244; RSS 246; RSS 247; RSS 251; RSS 252; RSS 287; RSS 288; RSS 310; RSS Gen

Test Technology:	Test Method(s) [2]:
SAR/RF Exposure	IEEE 1528-2013; RSS 102 Issue 5 (2015); EN 50360-2017; EN 62209-1:2016; EN 62209-2:2010; IEC 62209-1 2nd Edition 2016; IEC 62209-2 2010; IEC PAS 63083-2017; EN 50566-2017; IEC 62209-2 AMD 1; Australian Communications Authority Radio Communications (Electromagnetic Radiation – Human Exposure) Standard 2014; FCC KDB 248227 D01; FCC KDB 447498 D01, D02, and D03; FCC KDB 615223 D01; FCC KDB 616217 D04; FCC KDB 643646 D01; FCC KDB 648474 D03 and D04; FCC KDB 680106 D01; FCC KDB 865664 D01 and D02; FCC KDB 941225 D01, D05, D05A, D06, and D07; EN 50401:2017; EN 50385:2017; IEC 62311:2008; IEC 62479:2010; EN 62479:2010; EN 50663:2017; EN 62311:2007; EN 62232:2017; IEC 62232:2017; IEEE C95.1-2005; IEEE C95.1-1992; IEEE C95.3-2002; RSS-102 (SAR. RF Exposure, NS), SPR-002; SPR-001; IEC TR 62630:2010; IEEE C95.3.1:2010; IEC TR 63170:2018; AS/NZS 2772.2:2016; IEC 62209-3: 2019; IEC 62209-3:2019; C95.1: 2019; ICNIRP (100KHz – 300 GHz): 2020; IEC 62311:2019; EN 62311:2020; IEC/IEEE 62209-1528:2020; RRA Public Notification 2018-18, December 7, 2018
Hearing Aid Compatibility	ANSI C63.19:2007; ANSI C63.19:2011; ANSI C63.19:2019; CTIA Test Plan for Hearing Aid Compatibility v.3.1.1 (2017); FCC KDB 285076, D01 & D02; RSS-HAC
United States Radio	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015); ANSI/TIA-603-D; TIA-102.CAAA-D; FCC KDB 935210 D03 (v04); FCC KDB 935210 D04 (v02); FCC KDB 935210 D05 (v01)
European Radio	ETSI EN 302 065-1 Version 2.1.1 (2016-11); ETSI EN 302 065-2 Version 2.1.1 (2016-11); ETSI EN 302 065-3 Version 2.1.1 (2016-11); ETSI EN 302 065-4 Version 1.1.1 (2016-11); ETSI EN 302 291-1 Version 1.1.1 (2005-07); ETSI EN 302 291-2 Version 1.1.1 (2005-07); ETSI EN 302 502 Version 2.1.3 (2017-07); ETSI EN 302 510-1 Version 1.1.1; ETSI EN 302 510-2 Version 1.1.1; ETSI EN 302 537 Version 2.1.1 (2016-10); ETSI EN 301 511 Version 12.5.1 (2017-03); ETSI EN 301 839 Version 2.1.1 (2016-04); ETSI EN 301 893 Version 2.1.1 (2017-05); ETSI EN 301 893 Version 1.8.1 (2015-03); ETSI EN 301 908-1 Version 13.1.1 (2019-11); ETSI EN 301 908-13 Version 13.1.1 (2019-11); ETSI EN 300 220-1 Version 3.1.1 (2017-02);

Test Technology:	Test Method(s) [2]:
European Radio (cont'd)	ETSI EN 300 220-2 Version 3.2.1 (2018-06); ETSI EN 300 328 Version 2.1.1 (2016-11); ETSI EN 300 328 Version 2.2.2 (2019-07); ETSI EN 300 330 Version 2.1.1 (2017-02); ETSI EN 300 440 Version 2. (22.1 (2018-07); ETSI EN 300 440-2 Version 1.4.1 (2010-08); KS X 3123, KS X 3142, KS X 3270, KS X 3271; LP0002; DGT LP0002;
Korean Radio	Regulations on Radio Equipment (MSIT Ordinance MSIT No. 63, Dec. 24, 2020); Unlicensed Radio Equipment Established Without Notice (MSIT Public Notification 2020-59, Oct. 16, 2020); Technical Requirements for the Human Protection against Electromagnetic Waves (MSIT Public Notification 2019-4, January 16, 2019); Equipment to be Subject of the Test Procedure for Electromagnetic Field Strength and Specific Absorption Rate (RRA Public Notification 2019-1, January 17, 2019); Technical Requirements for Radio Equipment for Telecommunication Services (RRA Public Notification 2019-9, June 3, 2019); Technical Requirements for Measurement and Test Procedure of Specific Absorption Rate (RRA Public Notification 2018-18, Dec 7, 2018); Technical Requirements for Measurement of Electromagnetic Field Strength (RRA Public Notification 2019-3, March 4, 2019)
Australia/New Zealand Radio	AS/NZS 4268:2017
Licensed Wireless Devices	ANSI C63.26:2015
Wired and Wireless Conformance	
5G NR	3GPP TS 38.508-1; 3GPP TS 38.508-2; 3GPP TS 38.521-1; 3GPP TS 38.521-2; 3GPP TS 38.521-3; 3GPP TS 38.521-4; 3GPP TS 38.522; 3GPP TS 38.523-1; 3GPP TS 38.523-2; 3GPP 38.523-3; 3GPP TS 38.533; VZW 5G NR FR2 RFOTA; VZW 5G Protocol Pre-Conformance (TS 38.523-1); VZW 5G NR FR1 Supp RF; VZW 5G NR RF Pre Conformance (TS 38.521-3); VZW 5G NR Radio Resource Management (RRM) Pre-Confromance (TS 38.533)

Test Technology:	Test Method(s) [2]:
LTE	3GPP TS 36.521-1; 3GPP TS 36.521-3; 3GPP TS 36.523-1; 3GPP 37.571-1; 3GPP 37.571-2; 3GPP TS 34.229; 3GPP Carrier Aggregation; PTCRB NAPRD.03; PTCRB PPMD; PTCRB Cat-M (per RFT132 eMTC); PVG.09 LTE Data Throughput & TR 37.901 Data Throughput Performance; PVG.04 PTCRB Radiated Spurious Emissions; Global Certification Forum (GCF-CC) Certification / LTE Field Test (TS.11) [3]; 3GPP Cat-NB & Cat-M; MetroPCS Lab Conformance; AT&T LTE Conformance; AT&T IoT Accelerator Conformance, 19263; VZW Lab Conformance; VZW Supl RF; VZW FR2 Supplementary RF, VZW FR1 Supplementary RF; VZW Supl Signaling Conformance; VZW Supl RRM; VZW LTE LBS Performance; VZW Safe for Network (SFN), VZW Phase 1, VZW Open Development and Field Interoperability Testing (FIT) [3]; VZW Network Extender; VZW PCO; VZW Data Retry; VZW Data Throughput; VZW SMS; VZW AT Commands; VZW CMAS; VZW eMBMS; VZW APN; VZW Cat-M VoLTE; Live Network Extender and Android Test Plan; Sprint LTE Test Plan; Sprint LTE Safe for Network (SFN); Sprint LTE Conformance; Sprint LTE IoT; Sprint Lab Conformance; USCC Lab Conformance; KDDI LTE Device Testing; SoftBank LTE Testing
WCDMA (UTRA)	3GPP TS 34.121-1; 3GPP TS 34.123-1; SoftBank Mobile WCDMA Testing
SVLTE / Multimode	CDMA-LTE Inter-RAT (iRAT); CDMA-LTE Inter-RAT SVD; SVLTE: 1x RF with LTE Data Cal; SVLTE: LTE RF with 1x Voice Call; SVD and SVLTE: LTE Data Throughput with 1x Voice Call; eHRPD; GMSS; SVD GMSS; E911 Data Call Processing; Stress Testing; RSSI for MM Devices; SVD Interband; LTE LBS Performance; VZW Multimode Supl Signaling; VZW Multimode SMS; VZW Multimode Data Retry
VoLTE	IMS VoIP; Rich Communication Services (RCS); VoLTE to 1xRTT Fallback for SVLTE (1xRTT Fallback); IMS Registration and Retry; ePDG Live Network; E911 for VoLTE; VZW hVoLTE; VZW VoIP and VT Performance; VZW Interband RRM and Protocol

Test Technology:	Test Method(s) [2]:
Carrier Aggregation	VZW Carrier Aggregation Supplementary RF; VZW Carrier Aggregation Data Throughout
UICC	USIM/USAT/CSIM/ISIM Interaction Test Plan (LTE/WCDMA/GSM/CDMA/MM); 3GPP TS 31.121; 3GPP TS 31.124; ETSI TS 102 230; SIM Application Interaction Test Plan; UICC USIM ISIM Electrical; UICC USIM ISIM Protocol (LTE/WCDMA/GSM/CDMA); SWP/HCI ETSI TS 102 694-1; ETSI TS 102 695-1
SunSpec Alliance	SunSpec – CSIP (Common Smart Inverter Profile) Conformance Test Procedures; SunSpec – Advanced Function Inverter Test Lab Specification; SunSpec – UL1741 Supplement SA/Rule 21 Implementation Guide; IEEE 2030.5-2018 Smart Energy Profile Application Protocol
CBRS (OnGo) / WInnForum	CBRS Alliance Certification Test Plan; WInnForum Conformance and Performance Test Technical Standards

[1] This accreditation covers testing performed at the main laboratory listed above, and the two satellite laboratories listed below:

PCTEST ENGINEERING LABORATORY, LLC.
7195 Oakland Mills Rd, Suite A
Columbia, MD 2016

Test Technology:	**Test Method(s) [2]:**
Wireless	3GPP2 C.S0011-C 20-Feb-2006 (TIA-98D/E/F) (*excluding Sections 3.2.1.3, 3.2.3.2, 3.3.3, 3.3.4, 3.3.5, 3.3.6, 3.4.6, 3.4.8, 3.4.10, 3.4.11, 3.4.12, 3.4.13, 3.7.2, 4.4.8, 4.4.9.2.1, 4.4.10, 4.4.11*); 3GPP2 C.S0043-0 24-Sep-2004 (TIA-1035); 3GPP2 C.S0036-0 11-Mar-2002 (TIA-916); 3GPP2 C.S0036-A 23-May-2011 (TIA-916-A); 3GPP2 C.S0037-0 19-Apr-2002 (TIA-918); 3GPP2 C.S0056-0 22-Jul-2005 (TIA-1042); 3GPP2 C.S0059-0 20-Aug-2008 (TIA-1038); 3GPP2 C.S0060-0 06-Dec-2005 (TIA-1044); 3GPP2 C.S0061-0 22-Jun-2005 (TIA-1045); 3GPP2 C.S0062-0 14-May-2007 (TIA-1046); 3GPP2 C.S0073-0 26-Sep-2005 (TIA-1084); 3GPP2 C.S0073-B 21-Aug-2009 (TIA n/a); 3GPP2 C.S0094-0 30-Oct-2008 (TIA-1157); CTIA Conformance Test Plan for CDMA Wireless Devices; GCF Certification Criteria 2 (CAG2) Test Plan; VZW Wireless Priority Services (WPS); VZW Safe for Network (SFN); VZW Open Development (OD) Device Specifications; VZW Location Based Services (LBS); VZW CMAS; VZW NBPCD; VZW Phase 1
EVDO	3GPP2 C.S0033-0 12-Dec-2003 (TIA-866); 3GPP2 C.S0033-A 14-Dec-2005 (TIA-866); 3GPP2 C.S0038-0 19-Apr-2002 (TIA-919); 3GPP2 C.S0038-A 26-Sep-2005 (TIA-919); 3GPP2 C.S0038-B 30-Mar-2009 (TIA n/a); 3GPP2 C.S0037-0 19-Apr-2002 (TIA-918); CTIA Conformance Test Plan for CDMA Wireless Devices; GCF Certification Criteria 2 (CAG2) Test Plan

Test Technology:	Test Method(s) [2]:
Emissions Radiated and Conducted	CFR 47, FCC Parts 15B/C/D/E/F/G/H (using ANSI C63.4:2014, ANSI C63.10:2020, ANSI C63.10:2013; ANSI C63.17:2013, FCC KDB 905462, and KDB 987594, 18 (using MP-5:1986); ANSI C63.10:2013; ETSI TS 134 124 Universal Mobile Telecommunications System (UMTS); (3GPP TS 34.124); ETSI TS 136 124 LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); (3GPP TS 36.124); (3GPP TS38.124 NR; Electromagnetic Compatibility (EMC) Requirements for Mobile Terminals and Ancillary Equipment); ETSI TS 151 010-1 Digital Cellular Telecommunications System (Phase 2+) (GSM); 3GPP TS 51.010-1, Section 12 (Conducted and Radiated Spurious Emissions); EN55011; EN 55032; CNS 13438 (up to 6 GHz); AS/NZS CISPR 11; IEC/CISPR 11; CISPR 32; FCC OET/MP-5; ICES-003; KN 11; KN 32; VCCI V-3(2016.11); VCCI V-3 (2015.04); VCCI 32-1: VCCI-CISPR 32
Accessibility	CFR 47, FCC Part 14
Transmitter/Receiver	RSS 111; RSS 112; RSS 117; RSS 119; RSS 123; RSS 125; RSS 127; RSS 130; RSS 131; RSS 132; RSS 133; RSS 134; RSS 135; RSS 137; RSS 139; RSS 140; RSS 141; RSS 142; RSS 170; RSS 181; RSS 182; RSS 191; RSS 192; RSS 194; RSS 195; RSS 196; RSS 197; RSS 199; RSS 210; RSS 211; RSS 213; RSS 215; RSS 216; RSS 220; RSS 222; RSS 236; RSS 238; RSS 243; RSS 244; RSS 246; RSS 247; RSS 251; RSS 252; RSS 287; RSS 288; RSS 310; RSS Gen
Hearing Aid Compatibility	ANSI C63.19:2007; ANSI C63.19:2011; ANSI C63.19:2019; CTIA Test Plan for Hearing Aid Compatibility v.3.1.1 (2017); FCC KDB 285076, D01 & D02; RSS-HAC
United States Radio	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015); FCC KDB 935210;
European Radio	ETSI EN 302 065-1 Version 2.1.1 (2016-11); ETSI EN 302 065-2 Version 2.1.1 (2016-11); ETSI EN 302 065-3 Version 2.1.1 (2016-11); ETSI EN 302 065-4 Version 1.1.1 (2016-11); ETSI EN 302 291-1 Version 1.1.1 (2005-07); ETSI EN 302 291-2 Version 1.1.1 (2005-07); ETSI EN 302 502 Version 2.1.3 (2017-07); ETSI EN 302 510-1 Version 1.1.1; ETSI EN 302 510-2 Version 1.1.1; ETSI EN 302 537 Version 2.1.1 (2016-10); ETSI EN 301 511 Version 12.5.1 (2017-03); ETSI EN 301 839 Version 2.1.1 (2016-04); ETSI EN 301 893 Version 2.1.1 (2017-05); ETSI EN 301 893 Version 1.8.1 (2015-03);

Test Technology:	Test Method(s) [2]:
European Radio (cont'd)	ETSI EN 301 908-1 Version 13.1.1 (2019-11); ETSI EN 301 908-13 Version 13.1.1 (2019-11); ETSI EN 300 220-1 Version 3.1.1 (2017-02); ETSI EN 300 220-2 Version 3.2.1 (2018-06); ETSI EN 300 328 Version 2.1.1 (2016-11); ETSI EN 300 328 Version 2.2.2 (2019-07); ETSI EN 300 330 Version 2.1.1 (2017-02); ETSI EN 300 440 Version 2. (22.1 (2018-07); ETSI EN 300 440-2 Version 1.4.1 (2010-08); KS X 3123, KS X 3142, KS X 3270, KS X 3271; LP0002; DGT LP0002;
Korean Radio	Regulations on Radio Equipment (MSIT Ordinance MSIT No. 1 July 26, 2017); Unlicensed Radio Equipment Established Without Notice (MSIT Public Notification 2019-105, December 23, 2019); Technical Requirements for the Human Protection against Electromagnetic Waves (MSIT Public Notification 2019-4, January 16, 2019); Equipment to be Subject of the Test Procedure for Electromagnetic Field Strength and Specific Absorption Rate (RRA Public Notification 2019-1, January 17, 2019); Technical Requirements for Radio Equipment for Telecommunication Services (RRA Public Notification 2019-9, June 3, 2019); Technical Requirements for Measurement of Electromagnetic Field Strength (RRA Public Notification 2019-3, March 4, 2019)
Australia/New Zealand Radio	AS/NZS 4268:2017
Licensed Wireless Devices	ANSI C63.26:2015

Test Technology:	Test Method(s) [2]:
OTA *OTA Anechoic Chambers*	CTIA Test Plan for Wireless Device Over-the-Air Performance for CDMA, 1xEVDO Rev0/A, GSM, GPRS, EGPRS, UMTS (W-CDMA), LTE, CDMA A-GPS, GSM A-GPS, UMTS WCDMA A-GPS; LTE A-GPS A-Glonass and SIB8 / SIB16; PTCRB NAPRD03; PTCRB PPMD; OTA Carrier Aggregation; OTA ECC Measurements; VZW OTA Radiated Performance for CDMA & LTE Multimode Devices; VZW Location Determination Test Plan; VZW LTE-LBS Performance Test Plan; SPRINT OTA Antenna Performance Test Plan; AT&T 13340 OTA; AT&T IoT Accelerator; USCC CDMA Over The Air Radiated Test Plan; USCC LTE Over The Air Radiated Test Plan; CTIA Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices (Wi-Fi Alliance); GSMA TS.24 Operator Acceptance Values for Device Antenna Performance; 3GPP TS 34.114 Technical Specification UE/MS OTA Antenna Performance; 3GPP TS 37.544 Technical Specification UTRA & E-UTRA UE OTA Antenna Performance
CTIA IoT Security	CTIA Cybersecurity Certification Test Plan for IoT Devices
SunSpec Alliance	SunSpec – CSIP (Common Smart Inverter Profile) Conformance Test Procedures; SunSpec – Advanced Function Inverter Test Lab Specification; SunSpec – UL1741 Supplement SA/Rule 21 Implementation Guide; IEEE 2030.5-2018 Smart Energy Profile Application Protocol
CBRS (OnGo) / WInnForum	CBRS Alliance Certification Test Plan; WInnForum Conformance and Performance Test Technical Standards

PCTEST ENGINEERING LABORATORY, LLC.
9017-F/G Mendenhall Court
Columbia, MD 21045

Test Technology:	**Test Method(s) [2]:**
Battery Safety	IEEE 1725 Standard for Rechargeable Batteries for Cellular Telephones; CTIA Certification Requirements for Battery System Compliance to IEEE 1725; IEEE 1625 Standard for Rechargeable Batteries for Multi-Cell Mobile Computing Devices; CTIA Certification Requirements for Battery System Compliance to IEEE 1625; UL1642 Standard for Lithium Batteries; UL 2054 Household and Commercial Batteries; UL 62133; IEC 62133 Secondary Cells and Batteries containing Alkaline or other Non-Acid Electrolytes – Safety Requirements for Portable Sealed Secondary Cells & Batteries made from them, for use in Portable Applications
UNDOT Battery Transportation Safety	United Nations Document ST/SG/AC.10/11/Section 38.3 Recommendations on the Transport of Dangerous Goods; Manual of Tests and Criteria; IEC 62281 – Safety of Primary and Secondary Lithium Cells and Batteries During Transport Altitude Simulation Temperature Cycling Mechanical Shock Vibration Short Circuit Overcharge Impact/Crush Forced Discharge
Aerospace Battery Performance and Safety	NASA Specification for Acceptance Testing of Commercial Lithium Ion Cell Lots Engineering Directorate Propulsion & Power Division, EP-WI-031
Hardware Reliability	CTIA Device Hardware Reliability Test Plan
Determining Battery Life	CTIA Battery Life Test Plan
Safety Requirement for Portable Sealed Secondary Cells	IEC 62133; EN 62133

Test Technology:	Test Method(s) [2]:
CEC: Energy Efficient Battery Charger System	Uniform Test Method for Measuring the Energy Consumption of Battery Chargers
Immunity	EN/IEC 61000-4-2

3801 E. Plano Parkway, Ste 150
Plano, TX 75074

Test Technology:	Test Method(s) [2]:
Radiated Emissions (10 Meter Test Distance) (Frequency Range, 30 MHz – 1 GHz)	CFR 47, FCC Parts 15B (using ANSI C63.4:2014) EN55011; EN 55032; CNS 13438 (up to 6 GHz); AS/NZS CISPR 11; IEC/CISPR 11; CISPR 32; FCC OET/MP-5; ICES-003; KN 11; KN 32; VCCI V-3(2016.11); VCCI V-3 (2015.04); VCCI 32-1: VCCI-CISPR 32

[2] When the date, revision or edition of a test method standard is not identified on the scope of accreditation, the laboratory is expected to be using the current version within one year of the date of publication, per part C., Section 1 of A2LA *R101 - General Requirements - Accreditation of ISO-IEC 17025 Laboratories*.

[3] This laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these tests.

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[4]:

Rule Subpart/Technology	Test Method	Maximum Frequency
Unintentional Radiators Part 15B	ANSI C63.4:2014	40000 MHz
Industrial, Scientific, and Medical Equipment Part 18	FCC MP-5 (February 1986)	333000 MHz
Intentional Radiators Part 15C	ANSI C63.10:2013	333000 MHz
Unlicensed Personal Communication Systems Devices Part 15D	ANSI C63.17:2013	20000 MHz
U-NIII without DFS Intentional Radiators Part 15E	ANSI C63.10:2013	40000 MHz

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[4]:

Rule Subpart/Technology	Test Method	Maximum Frequency
U-NIII with DFS Intentional Radiators Part 15E	FCC KDB 905462 D02 (v02)	40000 MHz
UWB Intentional Radiators Part 15F	ANSI C63.10:2013	200000 MHz
BPL Intentional Radiators Part 15G	ANSI C63.10:2013	40000 MHz
White Space Device Intentional Radiators Part 15H	ANSI C63.10:2013	40000 MHz
Commercial Mobile Services (FCC Licensed Radio Service Equipment) Parts 22 (cellular), 24, 25 (below 3 GHz), and 27	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	333000 MHz
General Mobile Radio Services (FCC Licensed Radio Service Equipment) Parts 22 (non-cellular), 90 (below 3 GHz), 95, 97 (below 3 GHz), and 101 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	333000 MHz
Citizens Broadband Radio Services (FCC Licensed Radio Service Equipment) Part 96	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	333000 MHz
Maritime and Aviation Radio Services Parts 80 and 87	ANSI/TIA-603-E; ANSI C63.26:2015	333000 MHz
Microwave and Millimeter Bands Radio Services Parts 25, 30, 74, 90 (M, DSRC, Y, Z), 95 (M and L), and 101	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	333000 MHz
Broadcast Radio Services Parts 73 and 74 (below 3 GHz)	ANSI/TIA-603-E; TIA-102.CAAA-E; ANSI C63.26:2015	333000 MHz
RF Exposure Devices Subject to SAR Requirements	IEEE Std 1528:2013	6000 MHz
Hearing Aid Compatibility Part 20 (HAC for Commercial Mobile Services)	ANSI C63.19:2011	6000 MHz

Testing Activities Performed in Support of FCC Declaration of Conformity and Certification in Accordance with 47 Code of Federal Regulations and FCC KDB 974614, Appendix A, Table A.1[4]:

Rule Subpart/Technology	Test Method	Maximum Frequency
Signal Boosters Part 20 (Wideband Consumer Signal Boosters, Provider-specific signal boosters, and Industrial Signal Boosters) Section 90.219	ANSI C63.26:2015	333000 MHz

[4]Accreditation does not imply acceptance to the FCC equipment authorization program. Please see the FCC website (https://apps.fcc.gov/oetcf/eas/) for a listing of FCC approved laboratories.