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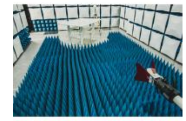

MEASUREMENT REPORT
FCC Part 30 5G mmWave

Applicant Name:
Samsung Electronics Co., Ltd.
129, Samsung-ro,
Yeongtong-gu, Suwon-si
Gyeonggi-do, 16677, Korea

Date of Testing:
8/22 - 9/2/2020
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2007010102-04-R1.A3L

FCC ID:	**A3LSMH303V**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-H303V
EUT Type:	Outdoor Customer Premises Equipment (CPE)
FCC Classification:	Part 30 Transportable Transmitter (5GT)
FCC Rule Part(s):	30
Test Procedure(s):	ANSI C63.26-2015, KDB 971168 D01 v03r01, KDB 842590 D01 v01r01

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.

This revised Test Report (S/N: 1M2007010102-04-R1.A3L) supersedes and replaces the previously issued test report (S/N: 1M2007010102-04.A3L) on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

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

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Mode	Transmission Scheme	Bandwidth (MHz)	CCs Active	Band	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
							Max. Power (W)	Max. Power (dBm)		
MIMO	CP-OFDM	100	1	n261	30	27500 - 28350	6.776	38.31	93M2G7D	QPSK
MIMO	CP-OFDM	100	1	n261	30	27500 - 28350	6.918	38.40	93M4W7D	16QAM
MIMO	CP-OFDM	100	1	n261	30	27500 - 28350	4.966	36.96	93M7W7D	64QAM
2Tx	DFT-s-OFDM	100	1	n261	30	27500 - 28350	23.878	43.78	90M7G7D	π/2 BPSK
2Tx	DFT-s-OFDM	100	1	n261	30	27500 - 28350	24.044	43.81	93M2G7D	QPSK
2Tx	DFT-s-OFDM	100	1	n261	30	27500 - 28350	18.967	42.78	93M4W7D	16QAM
2Tx	DFT-s-OFDM	100	1	n261	30	27500 - 28350	15.171	41.81	93M7W7D	64QAM
MIMO	CP-OFDM	50	1	n261	30	27500 - 28350	7.079	38.50	45M3G7D	QPSK
MIMO	CP-OFDM	50	1	n261	30	27500 - 28350	7.047	38.48	45M4W7D	16QAM
MIMO	CP-OFDM	50	1	n261	30	27500 - 28350	4.508	36.54	45M2W7D	64QAM
2Tx	DFT-s-OFDM	50	1	n261	30	27500 - 28350	24.210	43.84	45M4G7D	π/2 BPSK
2Tx	DFT-s-OFDM	50	1	n261	30	27500 - 28350	23.988	43.80	45M3G7D	QPSK
2Tx	DFT-s-OFDM	50	1	n261	30	27500 - 28350	16.711	42.23	45M4W7D	16QAM
2Tx	DFT-s-OFDM	50	1	n261	30	27500 - 28350	13.804	41.40	45M2W7D	64QAM

EUT Overview (Band n261)

Mode	Transmission Scheme	Bandwidth (MHz)	CCs Active	Band	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
							Max. Power (W)	Max. Power (dBm)		
MIMO	CP-OFDM	100	1	n260	30	37000 - 40000	5.047	37.03	93M5G7D	QPSK
MIMO	CP-OFDM	100	1	n260	30	37000 - 40000	5.309	37.25	93M2W7D	16QAM
MIMO	CP-OFDM	100	1	n260	30	37000 - 40000	4.699	36.72	93M1W7D	64QAM
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	21.330	43.29	91M3G7D	π/2 BPSK
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	21.330	43.29	93M5G7D	QPSK
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	20.941	43.21	93M2W7D	16QAM
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	16.866	42.27	93M1W7D	64QAM
MIMO	CP-OFDM	50	1	n260	30	37000 - 40000	5.000	36.99	45M4G7D	QPSK
MIMO	CP-OFDM	50	1	n260	30	37000 - 40000	5.023	37.01	45M5W7D	16QAM
MIMO	CP-OFDM	50	1	n260	30	37000 - 40000	4.477	36.51	45M3W7D	64QAM
2Tx	DFT-s-OFDM	50	1	n260	30	37000 - 40000	20.845	43.19	45M5G7D	π/2 BPSK
2Tx	DFT-s-OFDM	50	1	n260	30	37000 - 40000	21.281	43.28	45M4G7D	QPSK
2Tx	DFT-s-OFDM	50	1	n260	30	37000 - 40000	20.512	43.12	45M5W7D	16QAM
2Tx	DFT-s-OFDM	50	1	n260	30	37000 - 40000	16.331	42.13	45M3W7D	64QAM

EUT Overview (Band n260)

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 Engineering Laboratory, Inc. 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 Engineering Lab located in Columbia, MD 21046, U.S.A.

- PCTEST is an ISO 17025-2005 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 **Samsung Outdoor Customer Premises Equipment (CPE) FCC ID: A3LSMH303V**. The test data contained in this report pertains only to the emissions due to the EUT's 5G mmWave function.

The EUT supports both 50MHz bandwidth and 100MHz bandwidth. The EUT supports a subcarrier spacing (SCS) of 120kHz with two transmission schemes, CP-OFDM and DFT-s-OFDM, with π/2 BPSK, QPSK, 16-QAM, and 64-QAM modulations. Different Beam IDs are supported, each corresponding to a different position in space for each antenna. During testing, FTM (Factory Test Mode) was used to operate the transmitter. MIMO operation was achieved by enabling two Beam IDs at the same time: one is from the list of H Beam IDs and other is from the list of V Beam IDs.

Test Device Serial No.: 13812, 14141

2.2 Device Capabilities

This device contains the following capabilities:

Multi-band LTE, 5G NR (n5, n66, n2, n261, n260), Bluetooth (LE)

2.3 Test Configuration

The EUT was tested per the guidance of KDB 842590 D01 v01r01 and ANSI C63.26-2015. See Section 7.0 of this test report for a description of the radiated tests.

EIRP Simulation data for all Beam IDs was used to determine the worst case Beam ID for SISO operation and Beam ID pair for MIMO operation. These Beam ID's were used for final measurements.

All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation.

2.4 EMI Suppression Device(s)/Modifications

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

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) and the guidance provided in KDB 842590 D01 v01r01 were used in the measurement of the EUT.

3.2 Radiated Power and Radiated Spurious Emissions

§30.202, §30.203

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary for radiated emissions measurements in the spurious domain. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. The test site inside the chamber is a 6m x 5.2m elliptical, obstruction-free area in accordance with Figure 5.7 of Clause 5 in ANSI C63.4-2014. 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. An 80cm tall test table made of Styrodur is placed on top of the turn table. A Styrodur pedestal is placed on top of the test table to bring the total table height to 1.5m for measurements above 1GHz.

Radiated power (EIRP) measurements were performed in a full anechoic chamber (FAC) conforming to the site validation requirements of CISPR 16-1-4. Radiated spurious emission measurements from 30MHz - 18GHz were performed in a semi anechoic chamber (SAC) conforming to the site validation requirements of CISPR 16-1-4. 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.

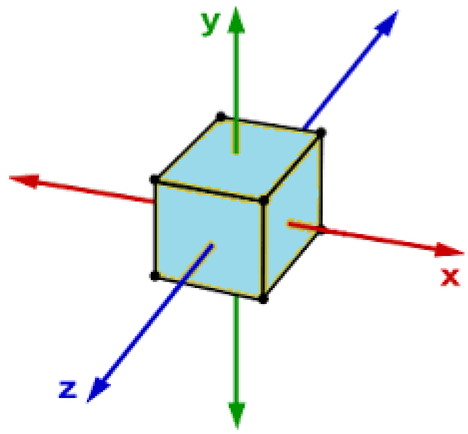


Figure 3-1. Rotation of the EUT Through Three Orthogonal Planes

The equipment under test was transmitting while connected to its integral antenna and is placed on a turntable. 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. In this case, "D" is the largest dimension of the measurement antenna. The EUT is manipulated through all orthogonal planes representative of its typical use to achieve the highest reading on the receive spectrum analyzer.

Frequency Range (GHz)	Wavelength(cm)	Far Field Distance (m)	Measurement Distance (m)
18-40	0.749	0.54	1.00
40-60	0.500	1.39	1.50
60-90	0.333	0.91	1.00
90-140	0.214	0.58	1.00
140-200	0.150	0.39	1.00

Table 3-1. Far-Field Distance & Measurment Distance per Frequency Range

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 “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

= - 32.74 dBm + (40.7dB/m + 8.78dB) + 107 = 123.74dBuV/m

= 10^(123.74/20)/1000000 = 1.54 V/m

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

= 10*log((1.54V/m * 1.00m)^2/30) + 30dB

= 18.98 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
Agilent	N9030A	PXA Signal Analyzer (44GHz)	8/17/2020	Annual	8/17/2021	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Emco	3115	Horn Antenna (1-18GHz)	6/18/2020	Biennial	6/18/2022	9704-5182
OML Inc.	M05HWA	140 - 220GHz Mixer/Antenna	10/31/2019	Annual	10/31/2020	G00228-2
OML, Inc.	M08HWA	90 - 140GHz Mixer/Antenna	10/31/2019	Annual	10/31/2020	F00228-1
OML, Inc.	M12HWA	60 - 90GHz Mixer/Antenna	10/31/2019	Annual	10/31/2020	E00228-1
OML, Inc.	M19HWA	40 - 60GHz Mixer/Antenna	10/31/2019	Annual	10/31/2020	U00228-1
OML, Inc.	M28HWA	26 - 40GHz Mixer/Antenna	10/31/2019	Annual	10/31/2020	Ka00310-1
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/10/2020	Annual	2/10/2021	102134
Sunol Science	JB5	Bi-Log Antenna (30M - 5GHz)	7/27/2020	Biennial	7/27/2022	A051107
Virginia Diodes Inc	SAX252	SAX Module (60 - 90GHz)	9/30/2019	Annual	9/30/2020	SAX252
Virginia Diodes Inc	SAX253	SAX Module (90 - 140GHz)	9/30/2019	Annual	9/30/2020	SAX253
Virginia Diodes Inc	SAX254	SAX Module (140 - 220GHz)	9/30/2019	Annual	9/30/2020	SAX254
Virginia Diodes Inc	SAX411	SAX Module (40 - 60GHz)	10/2/2019	Annual	10/2/2020	SAX411

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: Samsung Electronics Co., Ltd.

FCC ID: A3LSMH303V

FCC Classification: Part 30 Transportable Transmitter (5GT)

Mode(s): TDD

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1049	Occupied Bandwidth	N/A	RADIATED	PASS	Section 7.2
2.1046, 30.202	Equivalent Isotropic Radiated Power Density	75dBm/100MHz		PASS	Section 7.3
2.1051, 30.203	Spurious Emissions	-13dBm/MHz for all out-of-band emissions		PASS	Section 7.4
2.1051, 30.203	Out-of-Band Emissions at the Band Edge	-13dBm/MHz for all out-of-band emissions, -5dBm/MHz from the band edge up to 10% of the channel BW		PASS	Section 7.5
2.1055	Frequency Stability	Fundamental emissions stay within authorized frequency block		PASS	Section 7.6

Table 7-1. Summary of Radiated Test Results

Notes:

1) All modes of operation and modulations were investigated. The test results shown in the following sections represent the worst case emissions.
2) Per 2.1057(a)(2), spurious emissions were investigated up to 100GHz for n261 and up to 200GHz for n260.
3) The radiated RF output power and all out-of-band emissions in the spurious domain are evaluated to the EIRP limits.
4) “CC” refers to “Component Carriers”.
5) Beam IDs were chosed based on which Beam ID produces the highest EIRP during EIRP simulation.
6) All testing was performed using FTM (Factory Test Mode) software at continuous Tx operation (100% duty cycle).
7) The CP-OFDM and DFT-s-OFDM transmission schemes were investigated fully for each test type and only the worst case data is included.
8) The test data in this test report shows that 8 RB configuration is the lowest RB configuration. Per specification in 3GPP, all RB configurations lower than 8 RB show an MPR of 10dB. Due to this reason, the 8 RB configuration is the one that represents the lowest RB configuration with the worst case emissions..

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
KDB 842590 D01 v01r01 Section 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

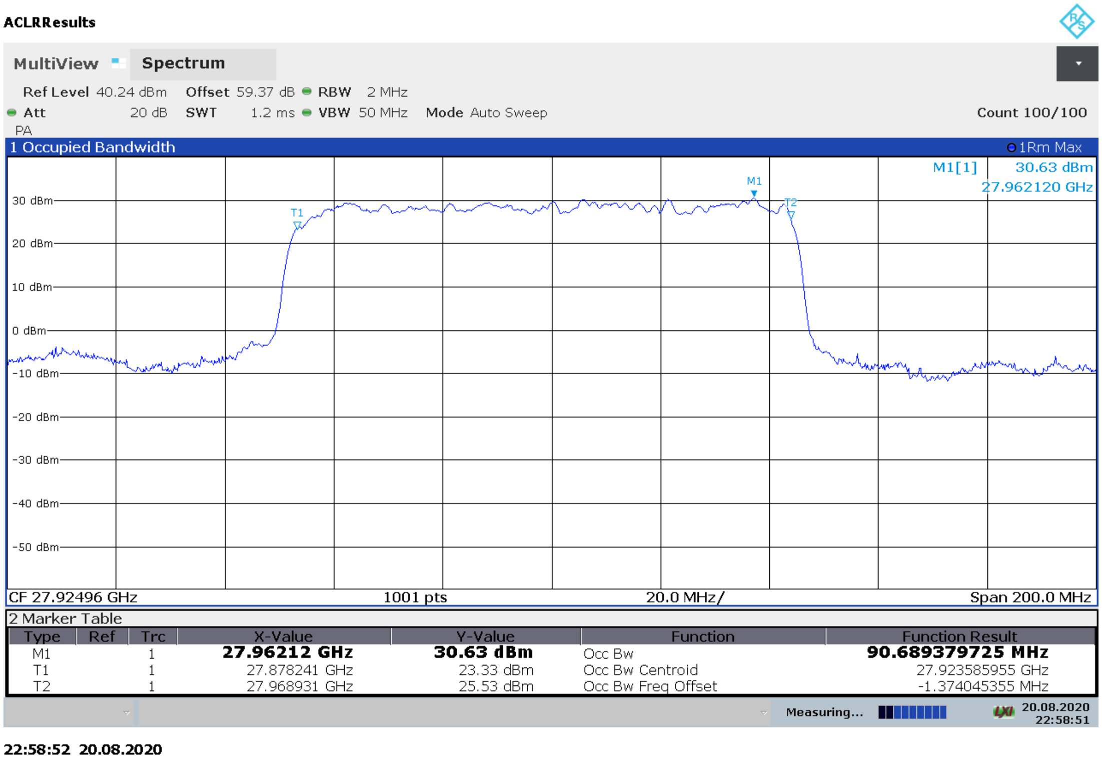
Test Notes

1. The EUT supports CP-OFDM and DFT-s-OFDM. OBW was measured for both waveforms and the worst case has been included in the report.
2. Due to similar antenna performance from both patch antennas, the Occupied Bandwidth was only measured on one antenna for each band.

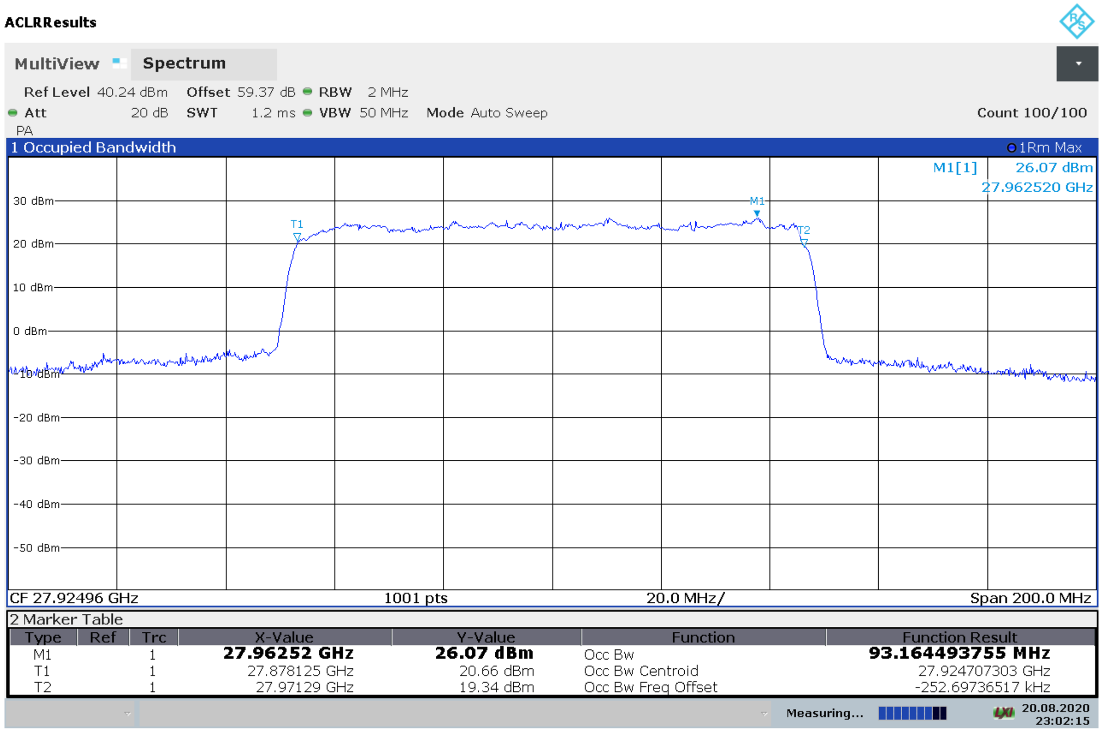
Band n261

Channel	Bandwidth	CCs Active	Transmission Scheme	Modulation	OBW [MHz]
Mid	100	1	DFT-s-OFDM	π/2 BPSK	90.69
			CP-OFDM	QPSK	93.16
			CP-OFDM	16QAM	93.39
			CP-OFDM	64QAM	93.69
	50	1	DFT-s-OFDM	π/2 BPSK	45.37
			CP-OFDM	QPSK	45.33
			DFT-s-OFDM	16QAM	45.38
			CP-OFDM	64QAM	45.20

Table 7-2. Summary of Occupied Bandwidths (n261)



Plot 7-1. Occupied Bandwidth Plot (100MHz-1CC – π/2 BPSK – Mid Channel)



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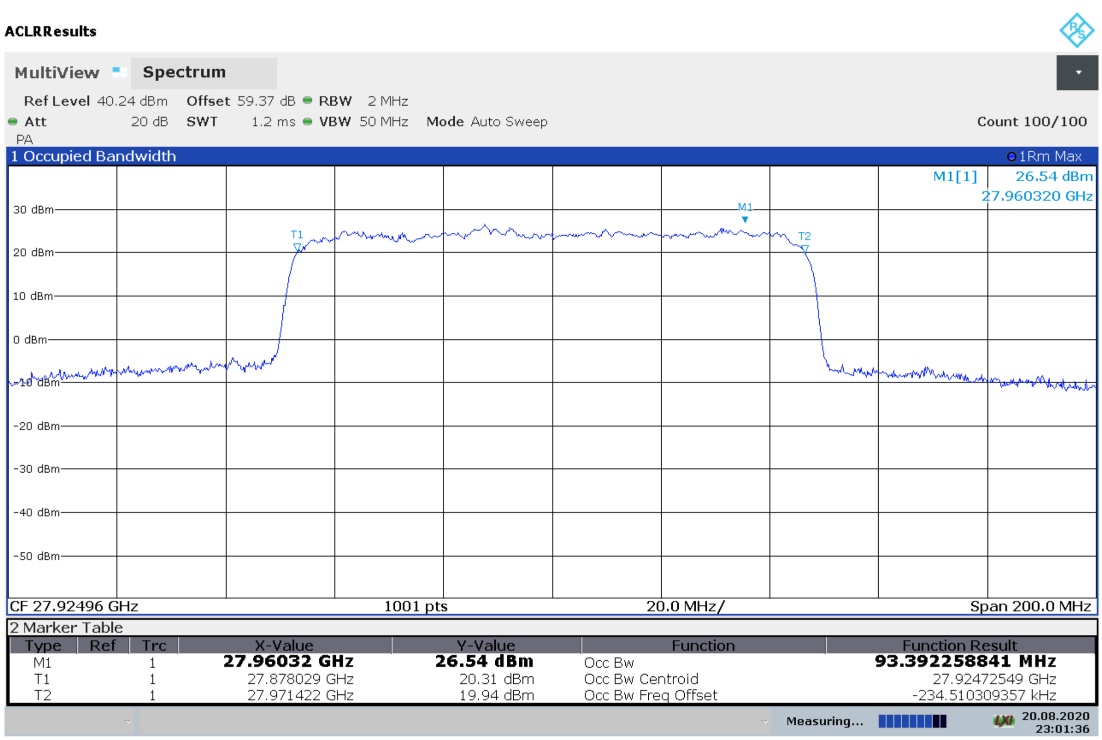
Plot 7-2. Occupied Bandwidth Plot (100MHz-1CC – QPSK – Mid Channel)



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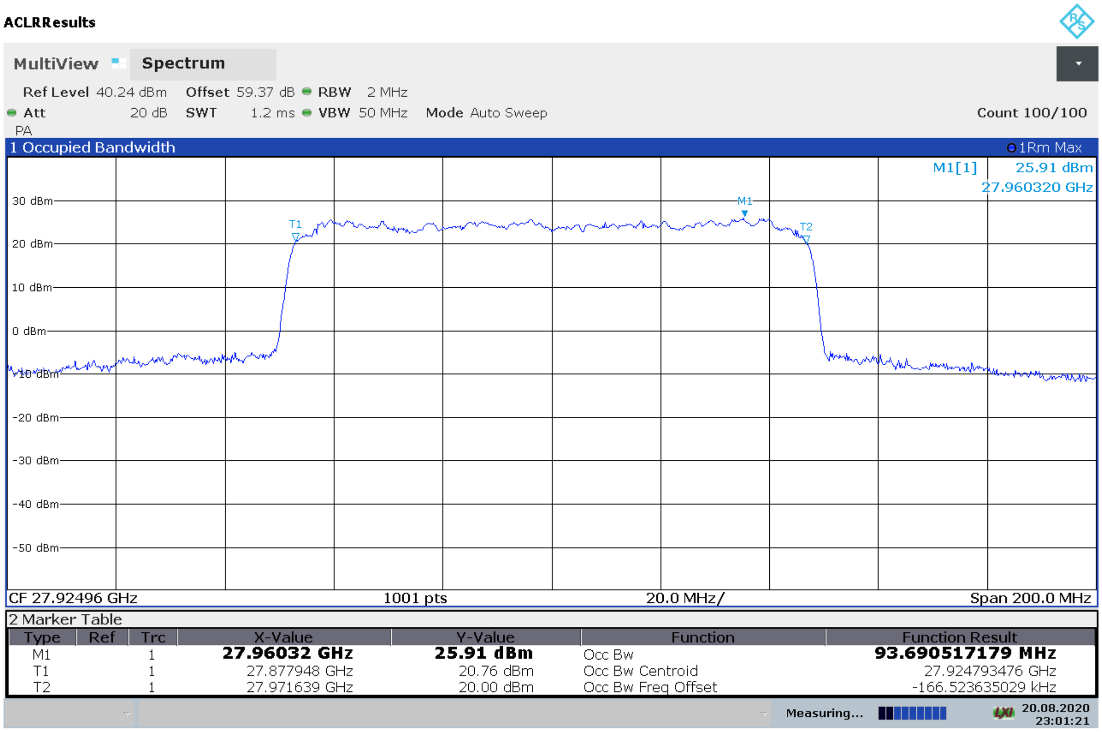
Plot 7-3. Occupied Bandwidth Plot (100MHz-1CC – 16QAM – Mid Channel)



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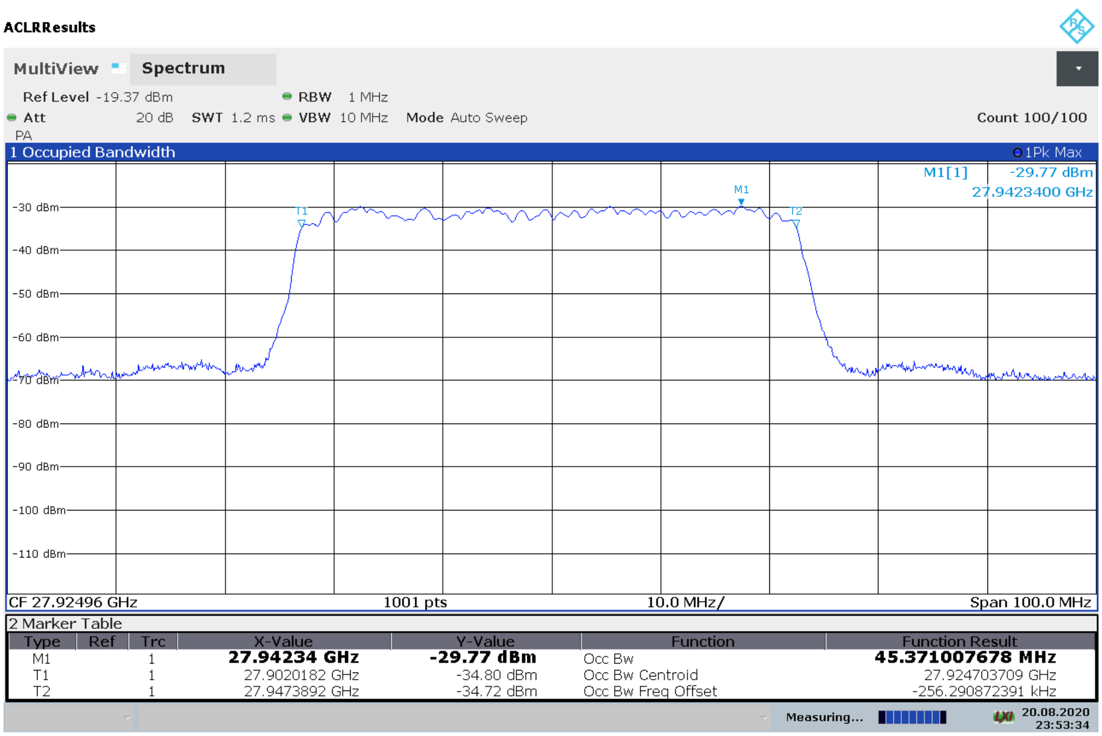
Plot 7-4. Occupied Bandwidth Plot (100MHz-1CC – 64QAM – Mid Channel)



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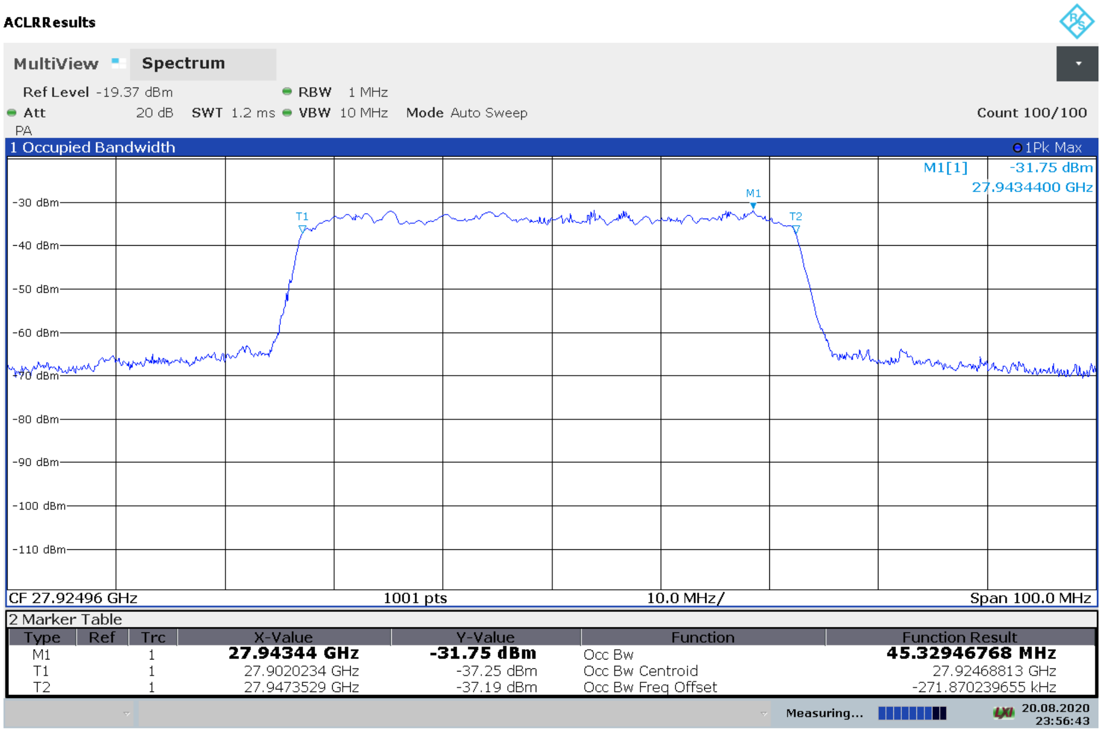
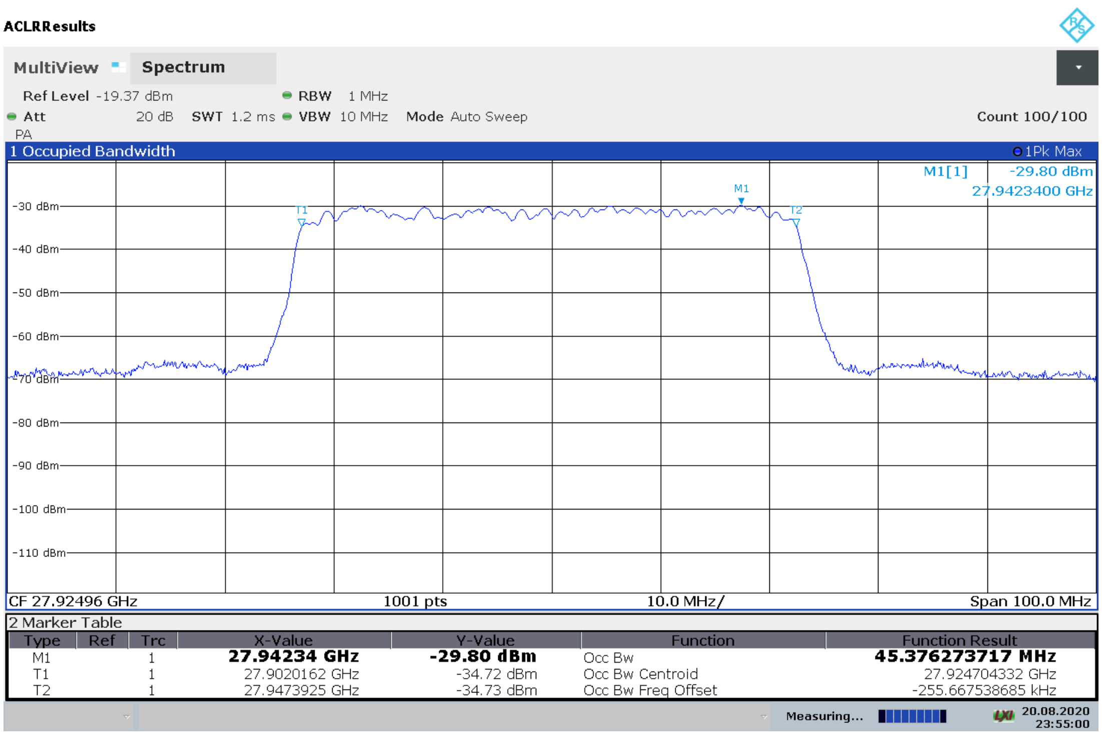
Plot 7-5. Occupied Bandwidth Plot (50MHz-1CC – π/2 BPSK – Mid Channel)



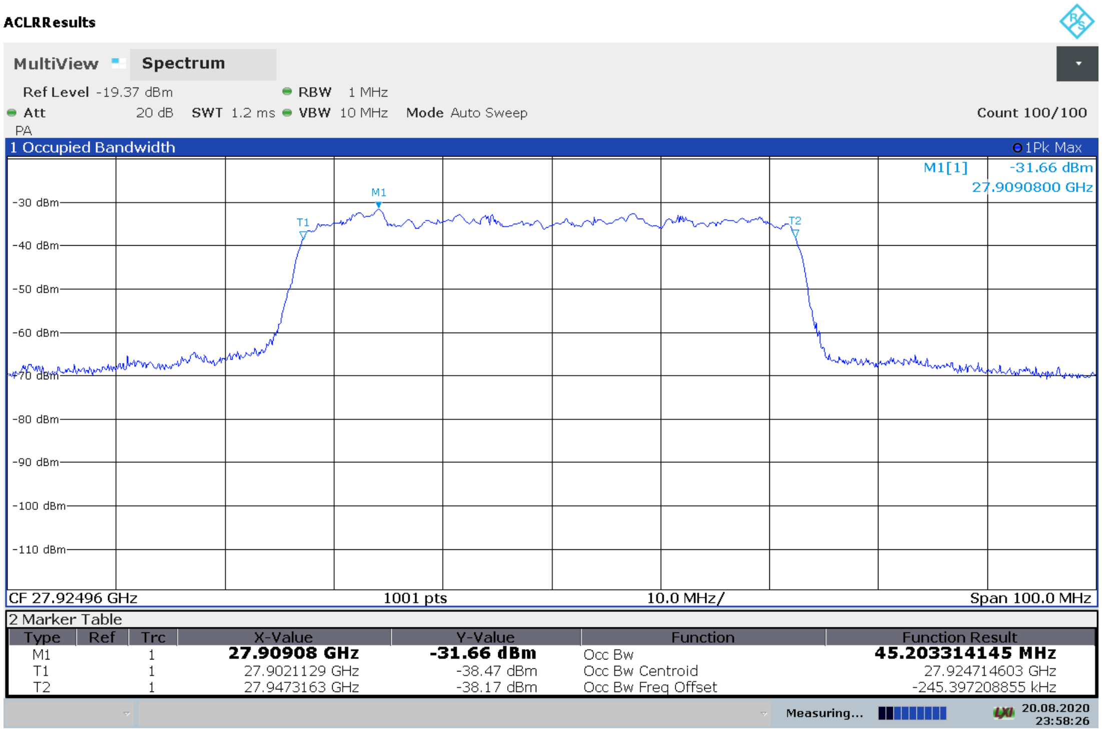
23:56:44 20.08.2020

Plot 7-6. Occupied Bandwidth Plot (50MHz-1CC – QPSK – Mid Channel)



23:55:01 20.08.2020

Plot 7-7. Occupied Bandwidth Plot (50MHz-1CC – 16QAM – Mid Channel)



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**27.90908 GHz**	**-31.66 dBm**	Occ Bw	**45.203314145 MHz**
T1		1	27.9021129 GHz	-38.47 dBm	Occ Bw Centroid	27.924714603 GHz
T2		1	27.9473163 GHz	-38.17 dBm	Occ Bw Freq Offset	-245.397208855 kHz

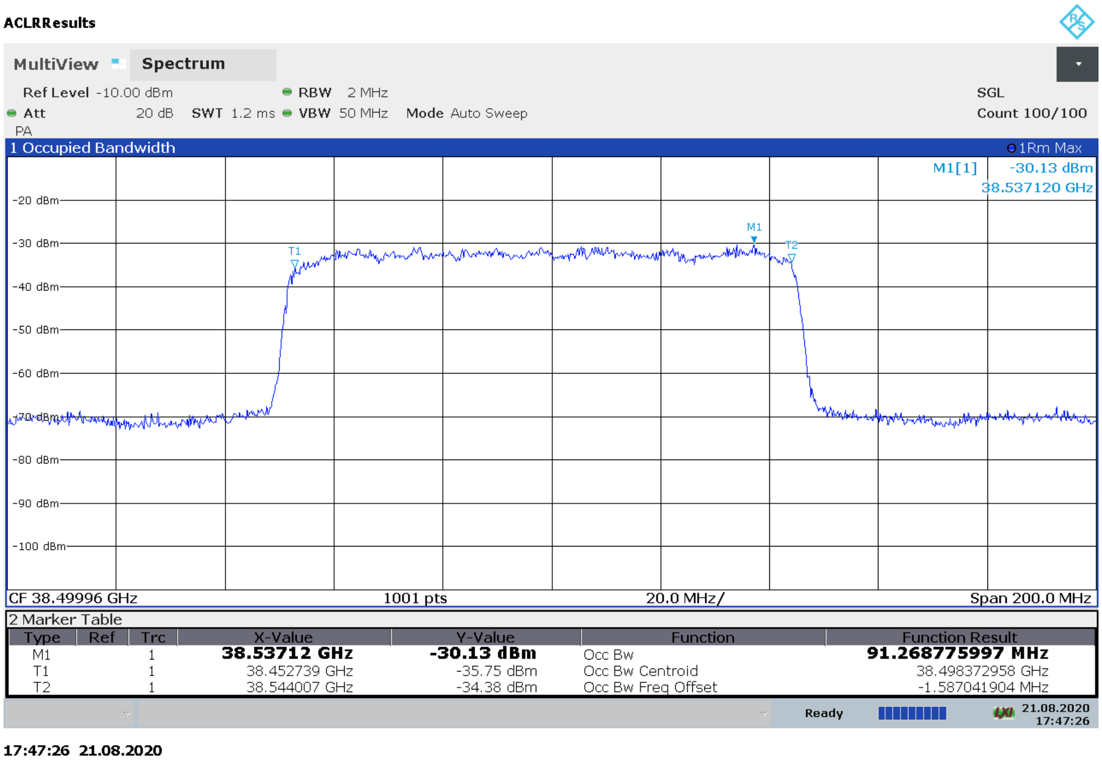
23:58:27 20.08.2020

Plot 7-8. Occupied Bandwidth Plot (50MHz-1CC – 64QAM – Mid Channel)

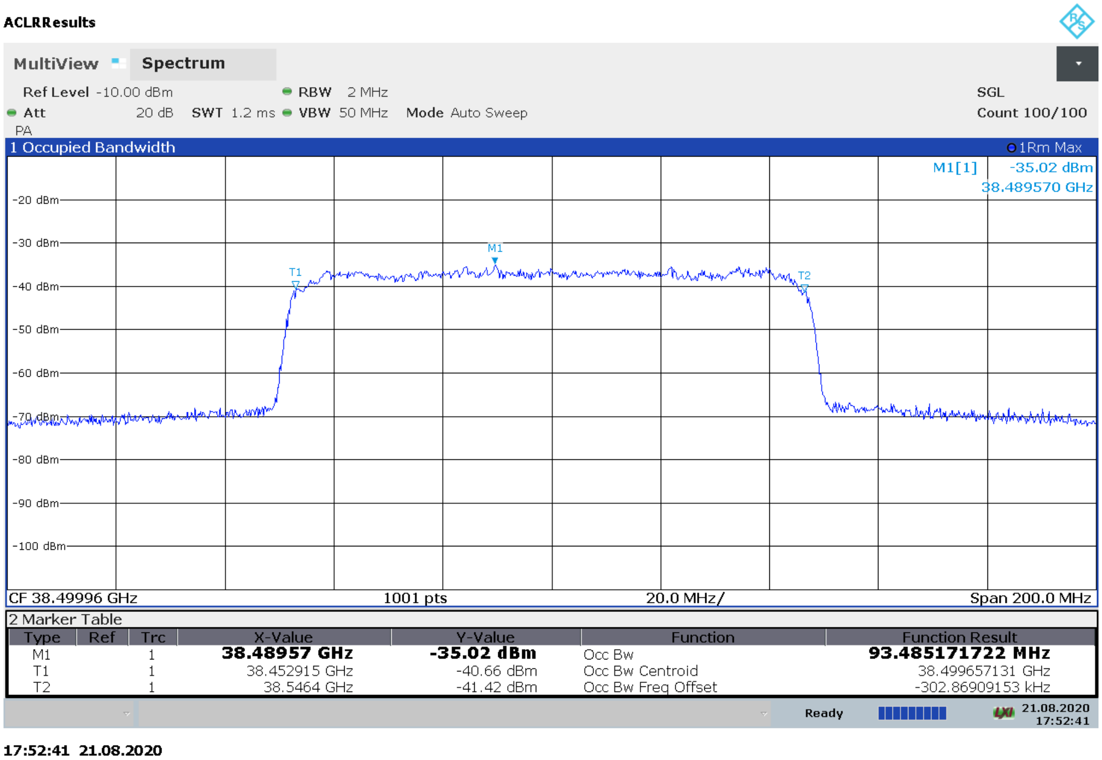
Band n260

Channel	Bandwidth	CCs Active	Transmission Scheme	Modulation	OBW [MHz]
Mid	100	1	DFT-s-OFDM	π/2 BPSK	91.27
			CP-OFDM	QPSK	93.49
			CP-OFDM	16QAM	93.18
			CP-OFDM	64QAM	93.09
	50	1	DFT-s-OFDM	π/2 BPSK	45.46
			CP-OFDM	QPSK	45.37
			CP-OFDM	16QAM	45.47
			CP-OFDM	64QAM	45.32

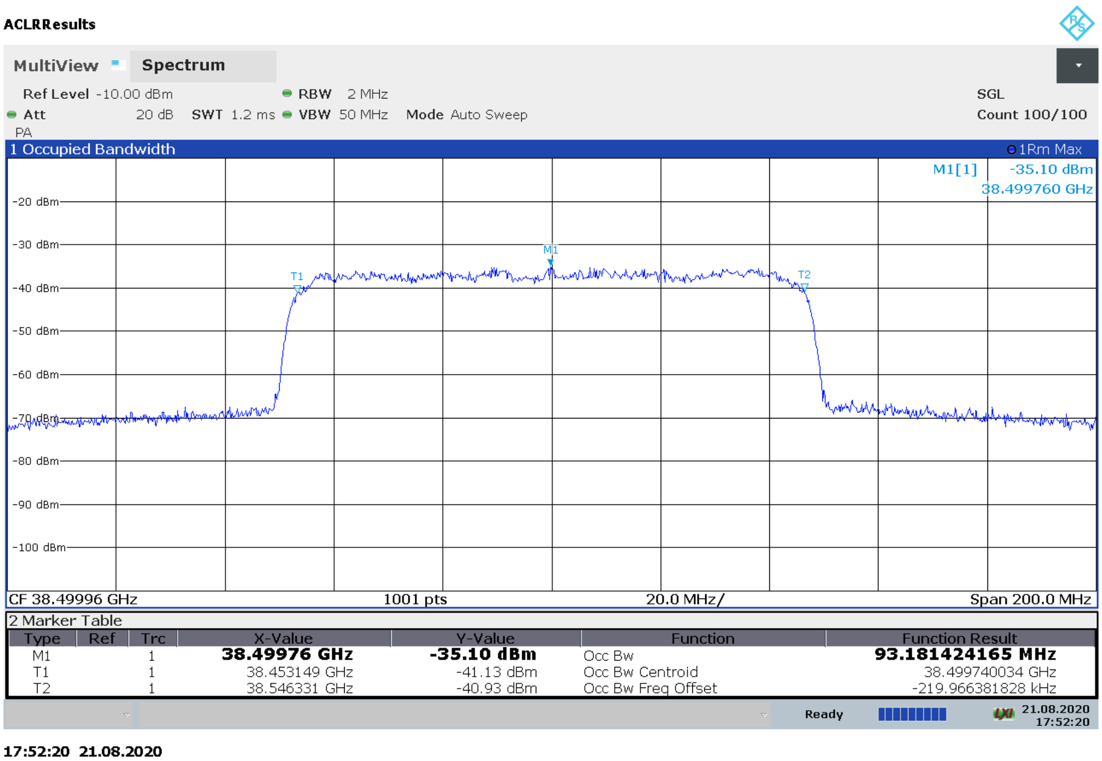
Table 7-3. Summary of Occupied Bandwidths (n260)



Plot 7-9. Occupied Bandwidth Plot (100MHz-1CC – π/2 BPSK – Mid Channel)

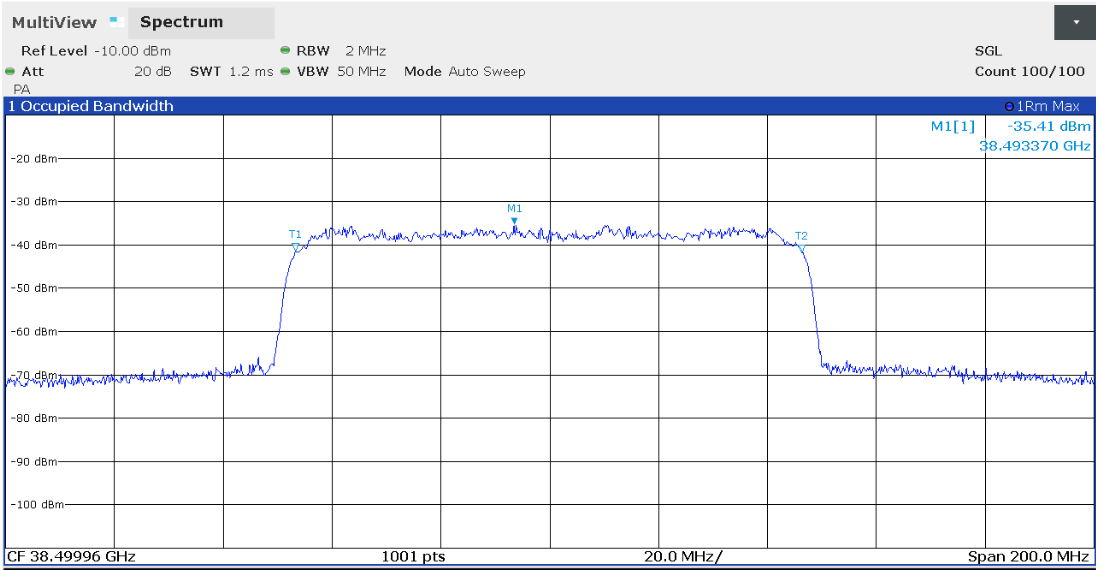


Plot 7-10. Occupied Bandwidth Plot (100MHz-1CC – QPSK – Mid Channel)



Plot 7-11. Occupied Bandwidth Plot (100MHz-1CC – 16QAM – Mid Channel)

ACLRResults



2 Marker Table

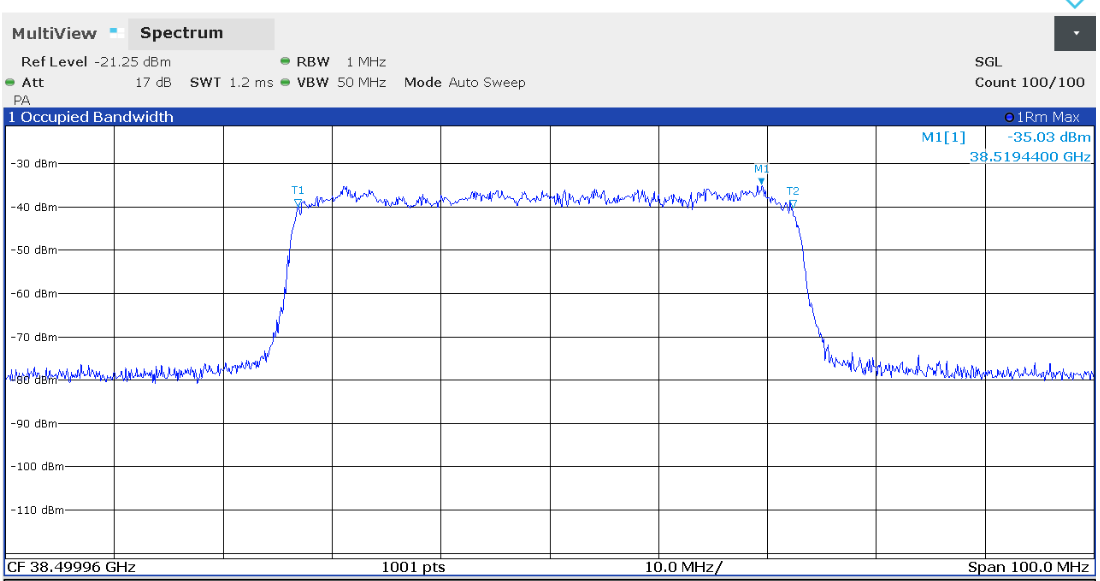
Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**38.49337 GHz**	**-35.41 dBm**	Occ Bw	**93.092232129 MHz**
T1		1	38.4532 GHz	-41.47 dBm	Occ Bw Centroid	38.499746603 GHz
T2		1	38.546293 GHz	-41.79 dBm	Occ Bw Freq Offset	-213.397294403 kHz

Ready 21.08.2020 17:51:53

17:51:53 21.08.2020

Plot 7-12. Occupied Bandwidth Plot (100MHz-1CC – 64QAM – Mid Channel)

ACLRResults



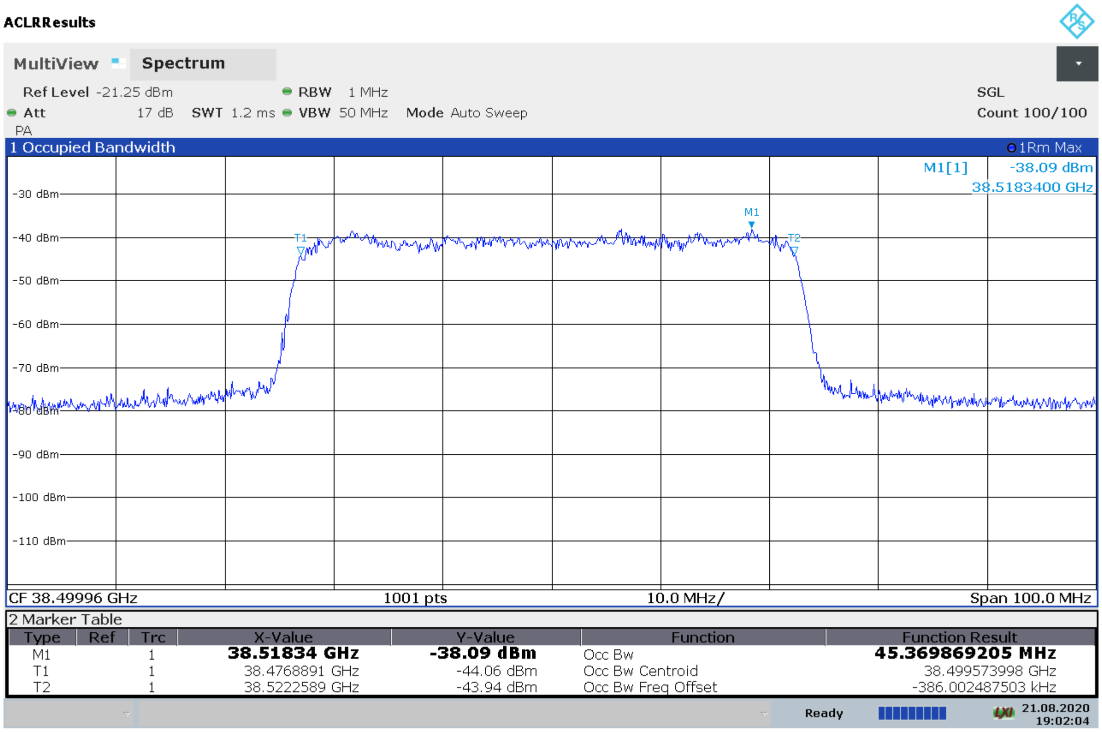
2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**38.51944 GHz**	**-35.03 dBm**	Occ Bw	**45.463903799 MHz**
T1		1	38.476817 GHz	-39.96 dBm	Occ Bw Centroid	38.49954897 GHz
T2		1	38.5222809 GHz	-40.32 dBm	Occ Bw Freq Offset	-411.030083466 kHz

Ready 21.08.2020 18:58:53

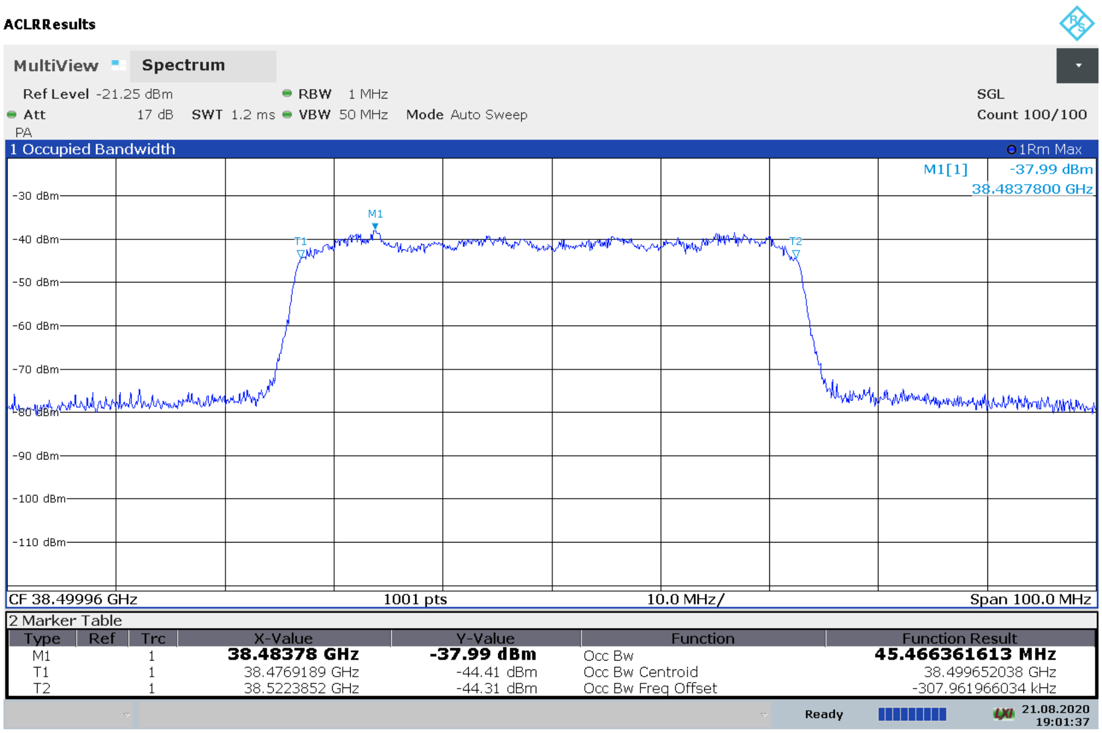
18:58:53 21.08.2020

Plot 7-13. Occupied Bandwidth Plot (50MHz-1CC – π/2 BPSK – Mid Channel)



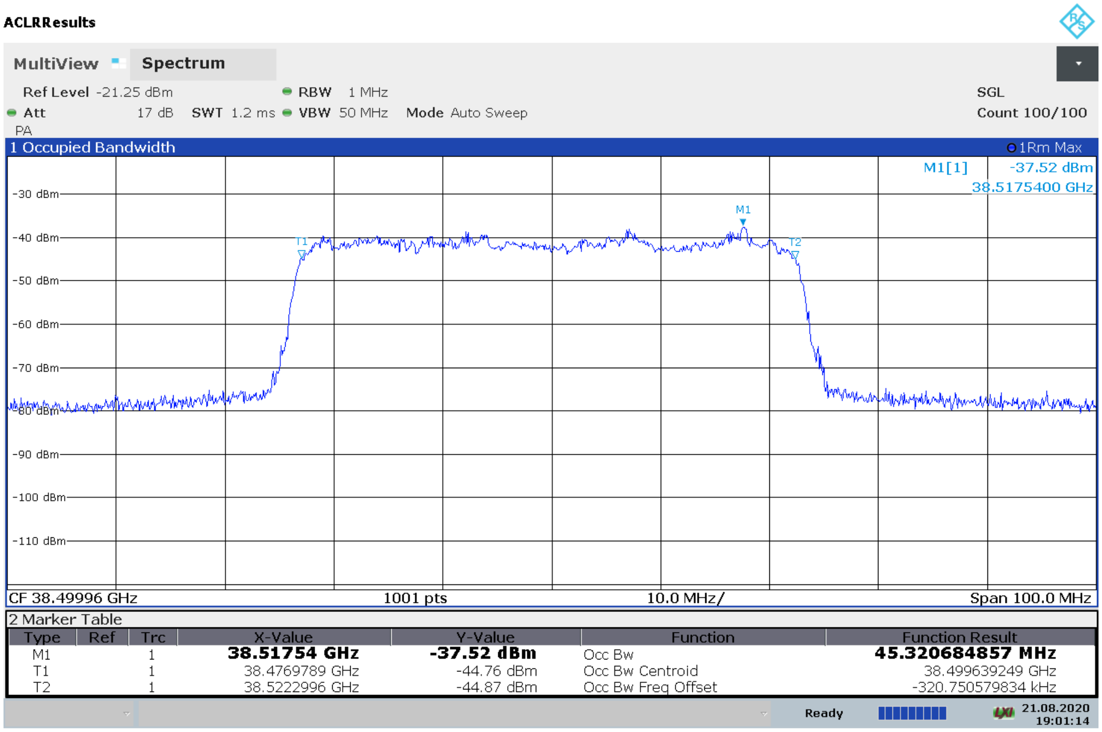
19:02:04 21.08.2020

Plot 7-14. Occupied Bandwidth Plot (50MHz-1CC – QPSK – Mid Channel)



19:01:38 21.08.2020

Plot 7-15. Occupied Bandwidth Plot (50MHz-1CC – 16QAM – Mid Channel)



19:01:15 21.08.2020

Plot 7-16. Occupied Bandwidth Plot (50MHz-1CC – 64QAM – Mid Channel)

7.3 Equivalent Isotropic Radiated Power
§30.202

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 its maximum duty cycle, at maximum power, and at the appropriate frequencies.

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
KDB 842590 D01 v01r01 Section 4.2

Test Settings

1. Radiated power measurements are performed using the signal analyzer's "channel power" measurement capability for signals with continuous operation.
2. RBW = 1 – 5% of the expected OBW, not to exceed 1MHz
3. VBW ≥ 3 x RBW
4. Span = 2x to 3x the OBW
5. No. of sweep points ≥ 2 x span / RBW
6. Detector = RMS
7. The integration bandwidth was roughly set equal to the measured OBW of the signal for signals with continuous operation.
8. Trace mode = trace averaging (RMS) over 100 sweeps
9. 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. Both H-Beam and V-Beam were investigated and the worst-case measurements were reported below.

2) Elements within the same antenna array are correlated to produce beamforming array gain. Antenna arrays cannot be correlated with another antenna array. During testing, only one antenna array was active.

3) EIRP measurements were taken at 1m test distance.

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 m. The field strength E is calculated E (dBμV/m) = Spectrum Analyzer Channel Power Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + 107.

5) Radiated power levels are investigated while the receive antenna was rotated through all angles to determine the worst case polarization/positioning.

6) This device supports transmission of H-polarized and V-polarized beams from the antenna array in both CP-OFDM and DFT-s-OFDM transmission schemes. SISO and MIMO operation is also supported for some configurations. As part of the testing, all modes are investigated fully on the channel showing the highest simulated EIRP using QPSK modulation. The configuration that shows the highest measured EIRP was then used to determine the EIRP for the low and high channels and for the additional modulations.

7) Per 30.202(a), the limit for 50MHz limit operation is reduced by 3dB to 72dBm/100MHz

Band n261

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Bean ID	RB Size/Offset	EIRP [dBm]	Limit [dBm/100MHz]	Margin [dBm/100MHz]
1	27550.08	Low	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/22	43.15	75.00	-31.85
	27924.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/22	42.98	75.00	-32.02
	28299.96	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	147+19	8/29	43.78	75.00	-31.22
	28299.96	High	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/22	**43.81**	75.00	-31.19
	28299.96	High	DFT-s-OFDM	16QAM	H + V	2Tx	147+19	8/22	42.78	75.00	-32.22
	28299.96	High	DFT-s-OFDM	64QAM	H + V	2Tx	147+19	8/22	41.81	75.00	-33.19
	28299.96	High	CP-OFDM	QPSK	H + V	MIMO	147+19	8/29	38.31	75.00	-36.69

Table 7-4. EIRP Data (Band n261 - 100MHz-1CC)

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Bean ID	RB Size/Offset	EIRP [dBm]	Limit [dBm/100MHz]	Margin [dBm/100MHz]
1	27525.00	Low	QPSK	QPSK	H + V	2Tx	147+19	8/12	43.80	72.00	-28.20
	27924.96	Mid	QPSK	QPSK	H + V	2Tx	147+19	8/12	42.63	72.00	-29.37
	28324.92	High	π/2 BPSK	π/2 BPSK	H + V	2Tx	147+19	8/12	**43.84**	72.00	-28.16
	28324.92	High	QPSK	QPSK	H + V	2Tx	147+19	8/12	43.80	72.00	-28.20
	28324.92	High	16QAM	16QAM	H + V	2Tx	147+19	8/12	42.20	72.00	-29.80
	28324.92	High	64QAM	64QAM	H + V	2Tx	147+19	8/12	41.40	72.00	-30.60
	28324.92	High	QPSK	QPSK	H + V	MIMO	147+19	8/12	**38.50**	72.00	-33.50

Table 7-5. EIRP Data (Band n261 - 50MHz-1CC)

Band n260

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Bean ID	RB Size/Offset	EIRP [dBm]	Limit [dBm/100MHz]	Margin [dBm/100MHz]
1	37050.00	Low	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/29	40.91	75.00	-34.09
	38499.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/35	42.34	75.00	-32.66
	39949.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	147+19	8/35	**43.29**	75.00	-31.71
	39949.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/22	43.29	75.00	-31.71
	39949.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	147+19	8/22	43.21	75.00	-31.79
	39949.92	High	DFT-s-OFDM	64QAM	H + V	2Tx	147+19	8/35	42.27	75.00	-32.73
	39949.92	High	CP-OFDM	QPSK	H + V	MIMO	147+19	8/22	37.03	75.00	-37.97

Table 7-6. EIRP Data (Band n260 - 100MHz-1CC)

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Bean ID	RB Size/Offset	EIRP [dBm]	Limit [dBm/100MHz]	Margin [dBm/100MHz]
1	37051.80	Low	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/12	40.76	72.00	-31.24
	38498.88	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/12	42.28	72.00	-29.72
	39949.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	147+19	8/12	43.19	72.00	-28.81
	39949.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	147+19	8/12	**43.28**	72.00	-28.72
	39949.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	147+19	8/12	43.12	72.00	-28.88
	39949.92	High	DFT-s-OFDM	64QAM	H + V	2Tx	147+19	8/12	42.13	72.00	-29.87
	39949.92	High	CP-OFDM	QPSK	H + V	MIMO	147+19	8/12	36.99	72.00	-35.01

Table 7-7. EIRP Data (Band n260 - 50MHz-1CC)

7.4 Radiated Spurious and Harmonic Emissions

§2.1051, §30.203

Test Overview

The spectrum is scanned from 30MHz to 100GHz for n261 and from 30MHz to 200GHz for n260. All out of band emissions are measured in a radiated test setup while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. 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
KDB 842590 D01 v01r01 Section 4.4.2 and Section 4.4.3

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 100 GHz for n261 and 200GHz for n260. Several plots are used to show investigations in this entire span.
2. Detector = RMS
3. Trace mode = trace average
4. Sweep time = auto couple
5. Number of sweep points ≥ 2 x Span/RBW
6. The trace was allowed to stabilize
7. RBW = 1MHz, VBW = 3MHz

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

3) Elements within the same antenna array are correlated to produce beamforming array gain. Antenna arrays cannot be correlated with another antenna array. During testing, only one antenna array was active.

4) The plots from 1-200GHz show corrected average EIRP levels. 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 m. The field strength E is calculated E (dBμV/m) = Spectrum Analyzer Level (dBm) + Antenna Factor (dB/m) + Cable Loss (dB) + Harmonic Mixer Conversion Loss (dB) + 107. All appropriate Antenna Factor and Cable Loss 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. In this case, D is the largest dimension of the measurement antenna.

Frequency Range (GHz)	Wavelength(cm)	Far Field Distance (m)	Measurement Distance (m)
18-40	0.749	0.54	1.00
40-60	0.500	1.39	1.50
60-90	0.333	0.91	1.00
90-140	0.214	0.58	1.00
140-200	0.150	0.39	1.00

Table 7-8. Far-Field Distance & Measurement Distance per Frequency Range

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

7) All RSE's were measured with 1CC. It was determined that adding more CC's causes the overall amplitude of just 1CC to decrease, therefore, 1CC is the worst case for the purposes of spurious emissions measurements.

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

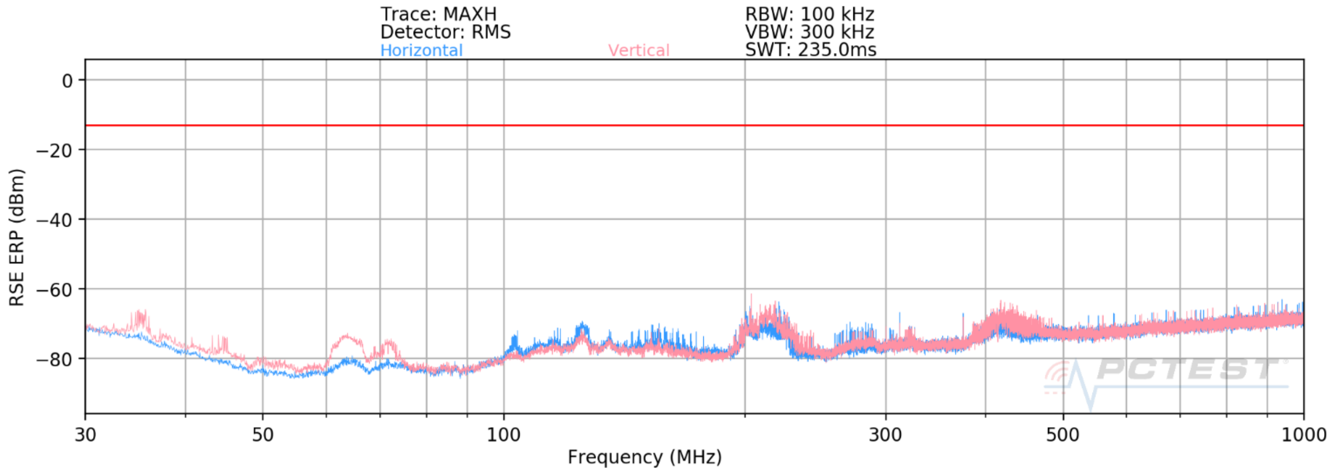
9) All RSE's were investigated in EN-DC mode and with 802.11 chipset active. It was determined that there is no new emission introduced by EN-DC mode, or the 802.11 chipset. For EN-DC mode, n261 uses LTE B2, B5, B13, B48, and B66, and n260 uses LTE B2, B5, B13, B48, and B66.

10) There was no discernible difference in the spurious emission levels when using different LTE anchor bands. Thus, LTE Band 2 was used as a representative anchor band for EN-DC investigations.

11) All modes of operation were investigated for RSE and the 2Tx mode was the worst case.

Band n261

30MHz - 1GHz



Plot 7-17. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

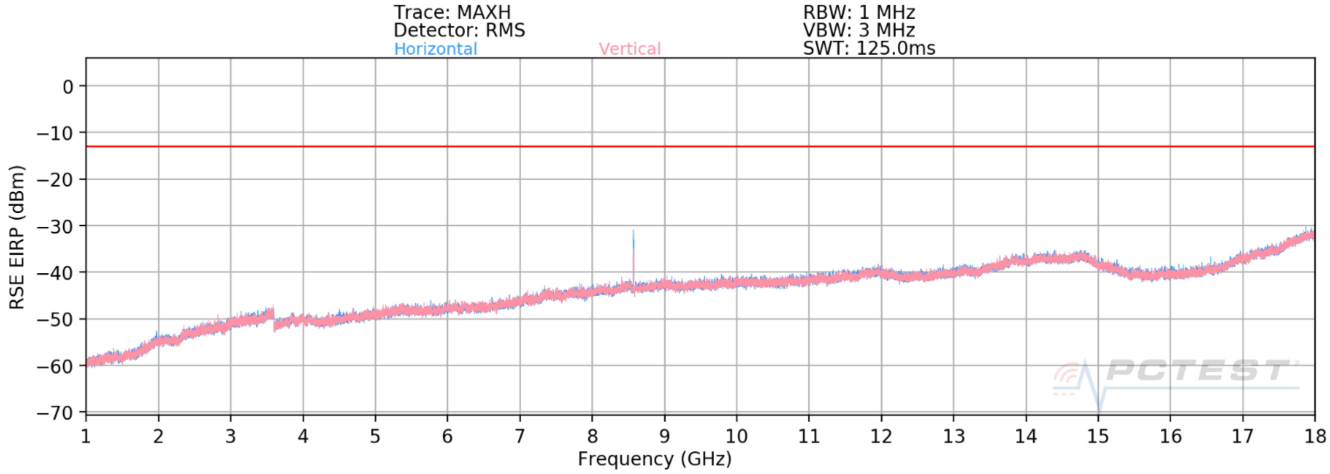
Frequency [MHz]	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
63.24	50	H + V	QPSK	V	191	126	-69.32	-13.00	-56.32
124.58	50	H + V	QPSK	H	281	314	-72.26	-13.00	-59.26
212.27	50	H + V	QPSK	V	144	182	-64.53	-13.00	-51.53
312.48	50	H + V	QPSK	V	104	110	-68.51	-13.00	-55.51
375.00	50	H + V	QPSK	V	165	124	-66.65	-13.00	-53.65
430.03	50	H + V	QPSK	V	278	132	-70.19	-13.00	-57.19

Table 7-9. 2Tx -Spurious Emissions Table (30MHz - 1GHz)

<u>Notes</u>

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

1GHz - 18GHz



Plot 7-18. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

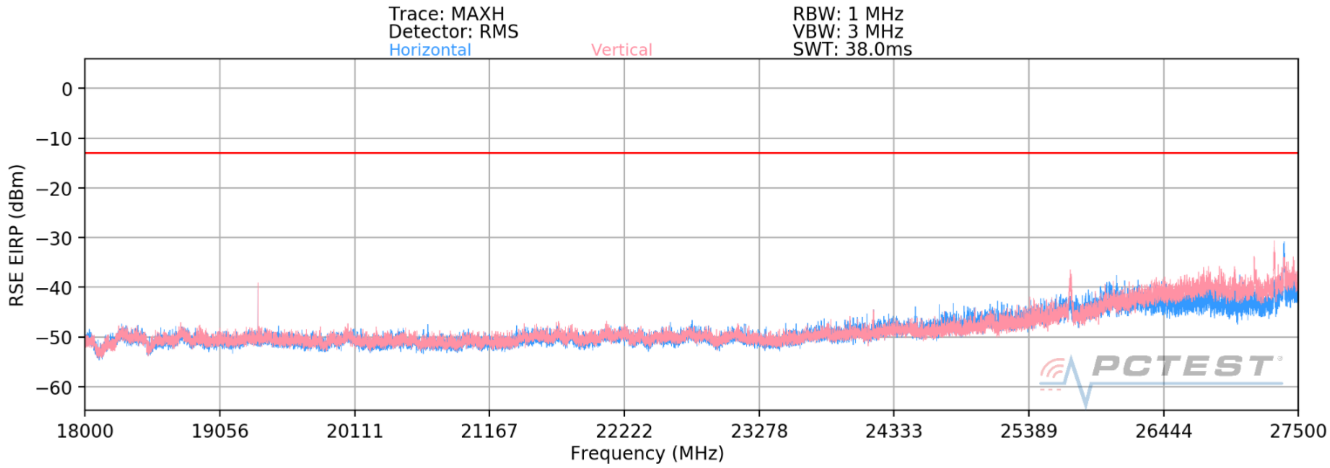
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
8806.86	Low	50	H + V	QPSK	143	-32.97	-13.00	-19.97
8575.00	Mid	50	H + V	QPSK	213	-30.10	-13.00	-17.10
8975.26	High	50	H + V	QPSK	152	-27.73	-13.00	-14.73

Table 7-10. 2Tx -Spurious Emissions Table (1GHz - 18GHz)

Notes

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

18GHz - 27.5GHz



Plot 7-19. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor B2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

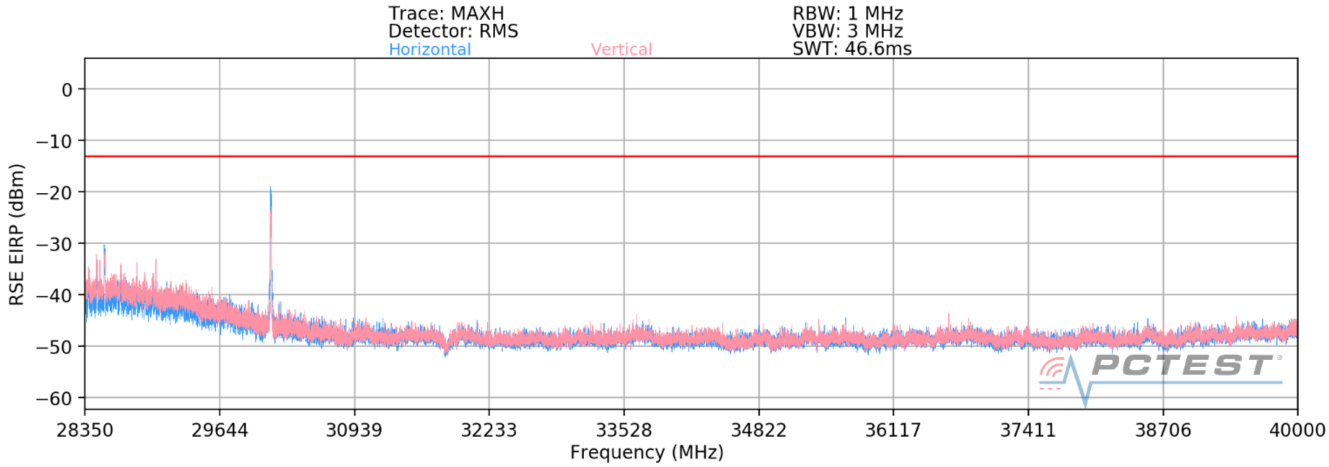
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
18713.00	Low	50	H + V	QPSK	150	-53.19	-13.00	-40.19
19353.00	Mid	50	H + V	QPSK	150	-48.61	-13.00	-35.61
19353.00	High	50	H + V	QPSK	150	-49.34	-13.00	-36.34
27214.00	Low	50	H + V	QPSK	150	-39.38	-13.00	-26.38
27392.00	Mid	50	H + V	QPSK	150	-40.14	-13.00	-27.14
27326.25	High	50	H + V	QPSK	150	-45.44	-13.00	-32.44

Table 7-11. 2Tx -Spurious Emissions Table (18GHz - 27.5GHz)

<u>Notes</u>

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

28.35GHz - 40GHz



Plot 7-20. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor B2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

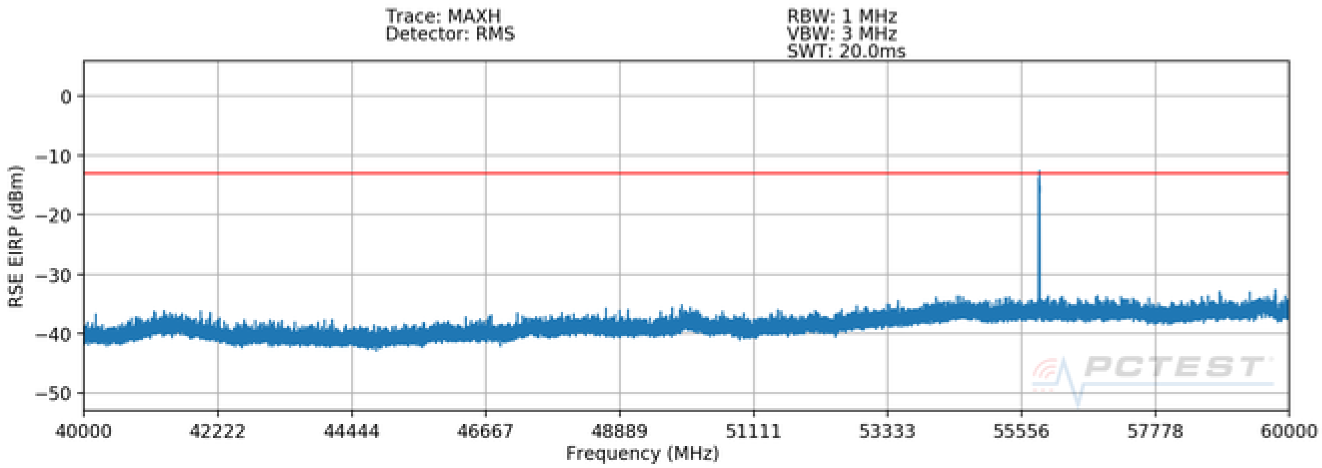
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
28620.00	Low	50	H + V	QPSK	150	-33.37	-13.00	-20.37
28453.41	Mid	50	H + V	QPSK	150	-40.77	-13.00	-27.77
28627.59	High	50	H + V	QPSK	150	-46.16	-13.00	-33.16
29712.76	Low	50	H + V	QPSK	150	-54.70	-13.00	-41.70
30133.28	Mid	50	H + V	QPSK	150	-26.19	-13.00	-13.19
29740.00	High	50	H + V	QPSK	150	-34.87	-13.00	-21.87

Table 7-12. 2Tx -Spurious Emissions Table (28.35GHz - 40GHz)

Notes

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

40GHz - 60GHz



Plot 7-21. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor B2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1.5 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

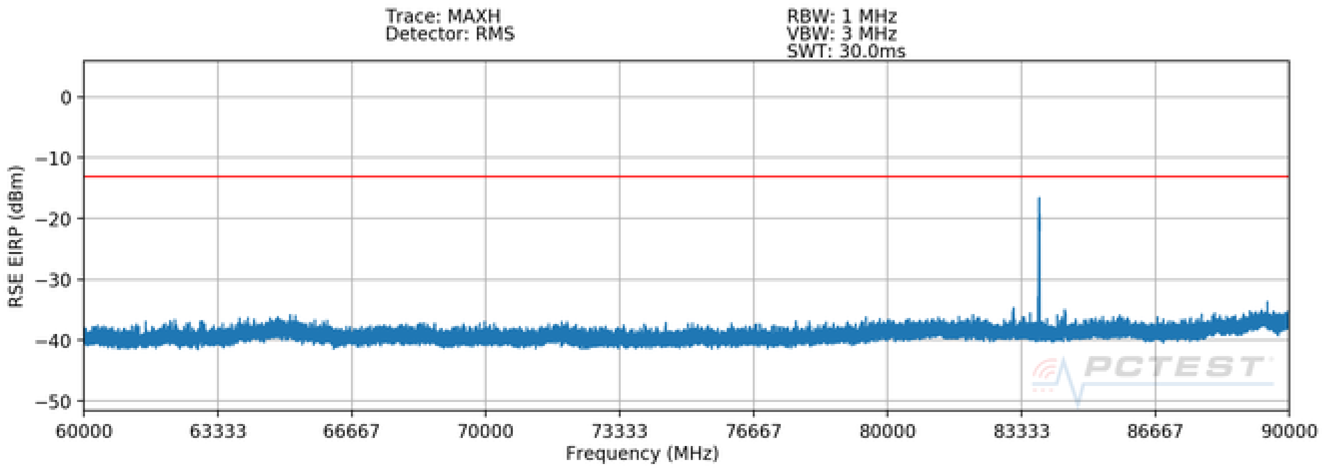
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
55050.75	Low	50	H + V	QPSK	333	-22.78	-13.00	-9.78
55847.94	Mid	50	H + V	QPSK	335	-19.07	-13.00	-6.07
56650.77	High	50	H + V	QPSK	10	-22.67	-13.00	-9.67

Table 7-13. 2Tx -Spurious Emissions Table (40GHz - 60GHz)

Notes

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

60GHz - 90GHz



Plot 7-22. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor B2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

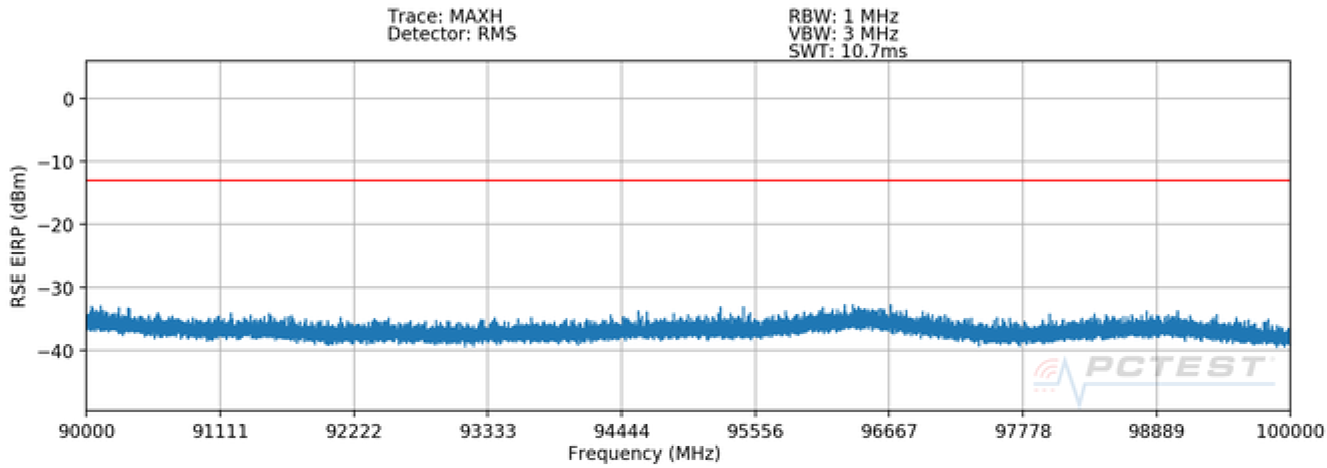
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
82572.63	Low	50	H + V	QPSK	299	-23.67	-13.00	-10.67
83773.64	Mid	50	H + V	QPSK	299	-22.19	-13.00	-9.19
84973.89	High	50	H + V	QPSK	301	-24.34	-13.00	-11.34

Table 7-14. 2Tx -Spurious Emissions Table (60GHz - 90GHz)

Notes

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

90GHz - 100GHz



Plot 7-23. n261 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor B2)

Spurious Emissions EIRP Sample Calculation (n261)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
110106.75	Low	50	H + V	QPSK	164	-45.02	-13.00	-32.02
111700.11	Mid	50	H + V	QPSK	8	-46.07	-13.00	-33.07
113292.21	High	50	H + V	QPSK	128	-45.51	-13.00	-32.51

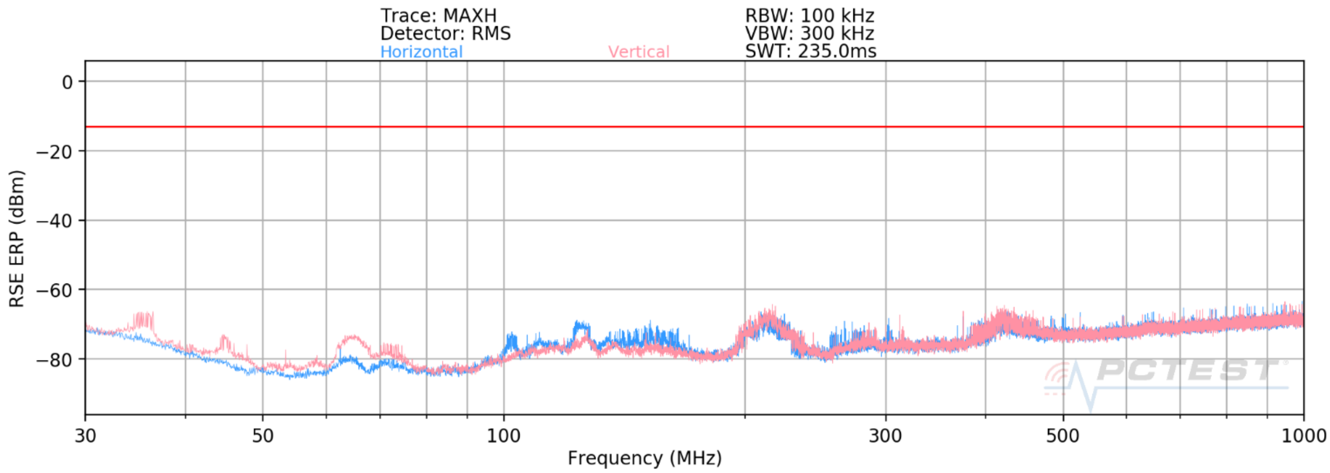
Table 7-15. 2Tx -Spurious Emissions Table (90GHz - 100GHz)

Notes

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

Band n260

30MHz - 1GHz



Plot 7-24. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

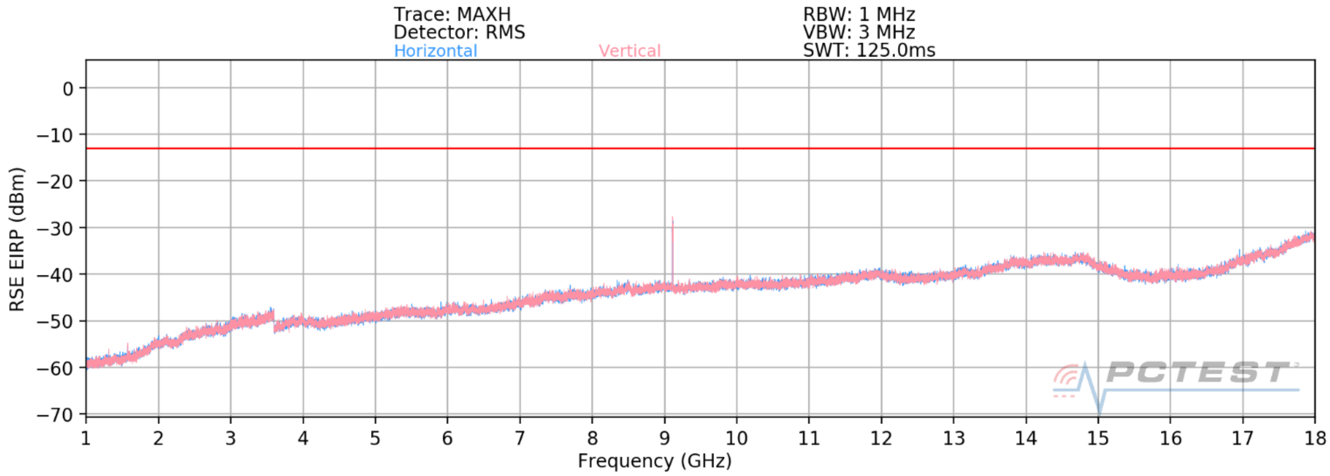
Frequency [MHz]	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
38.41	50	H + V	QPSK	V	245	114	-68.50	-13.00	-55.50
67.45	50	H + V	QPSK	V	155	193	-70.83	-13.00	-57.83
123.08	50	H + V	QPSK	H	89	194	-70.30	-13.00	-57.30
213.71	50	H + V	QPSK	V	154	185	-62.47	-13.00	-49.47
312.48	50	H + V	QPSK	V	160	121	-68.24	-13.00	-55.24
385.40	50	H + V	QPSK	V	118	124	-72.08	-13.00	-59.08

Table 7-16. 2Tx - Spurious Emissions Table (30MHz - 1GHz)

Notes

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

1GHz - 18GHz



Plot 7-25. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 3 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

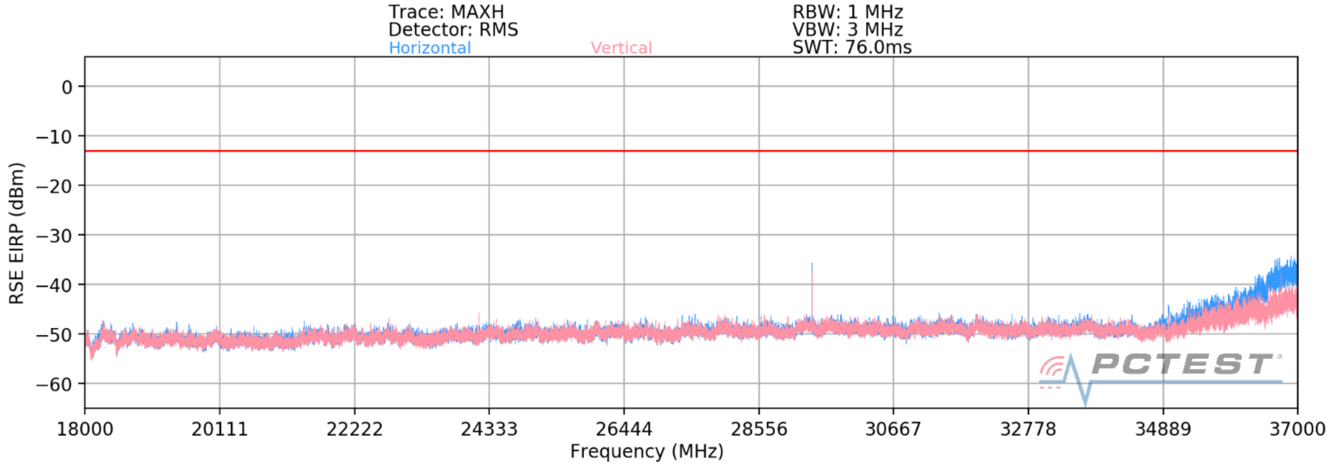
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
8399.74	Low	50	H + V	QPSK	V	172	192	-25.11	-13.00	-12.11
9109.05	Mid	50	H + V	QPSK	V	148	185	-26.26	-13.00	-13.26
9157.29	High	50	H + V	QPSK	V	157	181	-20.95	-13.00	-7.95

Table 7-17. 2Tx -Spurious Emissions Table (1GHz - 18GHz)

<u>Notes</u>

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

18GHz – 37GHz



Plot 7-26. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8

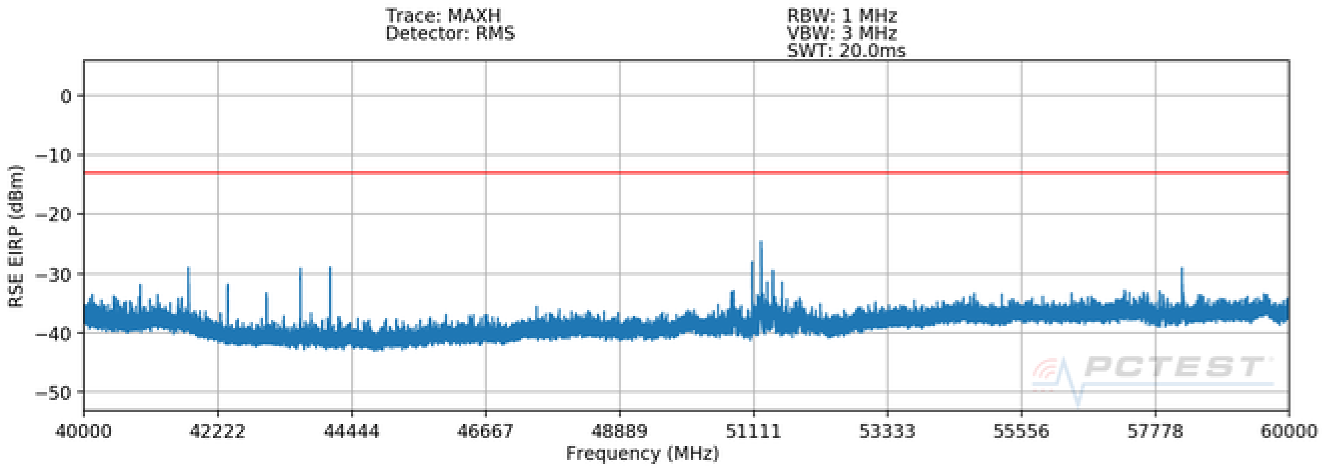
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
28620	Low	50	H + V	QPSK	H	150	15	-44.49	-13.00	-31.49
29388	Mid	50	H + V	QPSK	H	150	92	-39.63	-13.00	-26.63
30822	High	50	H + V	QPSK	H	150	15	-38.55	-13.00	-25.55

Table 7-18. 2Tx -Spurious Emissions Table (18GHz – 37GHz)

Notes

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

40GHz - 60GHz



Plot 7-27. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1.5 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

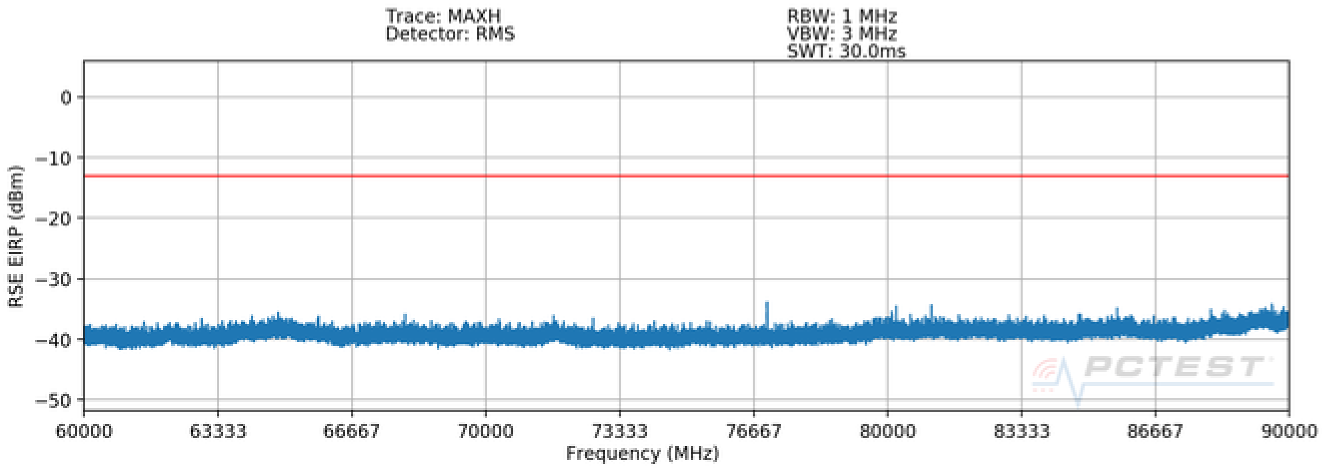
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
42931.20	Low	50	H + V	QPSK	14	-20.30	-13.00	-7.30
44083.15	Mid	50	H + V	QPSK	19	-31.31	-13.00	-18.31
40527.59	High	50	H + V	QPSK	352	-23.59	-13.00	-10.59
59435.30	Low	50	H + V	QPSK	355	-31.09	-13.00	-18.09
51234.71	Mid	50	H + V	QPSK	354	-32.20	-13.00	-19.20
53044.44	High	50	H + V	QPSK	356	-31.00	-13.00	-18.00

Table 7-19. 2Tx -Spurious Emissions Table (40GHz - 60GHz)

Notes

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

60GHz - 90GHz



Plot 7-28. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

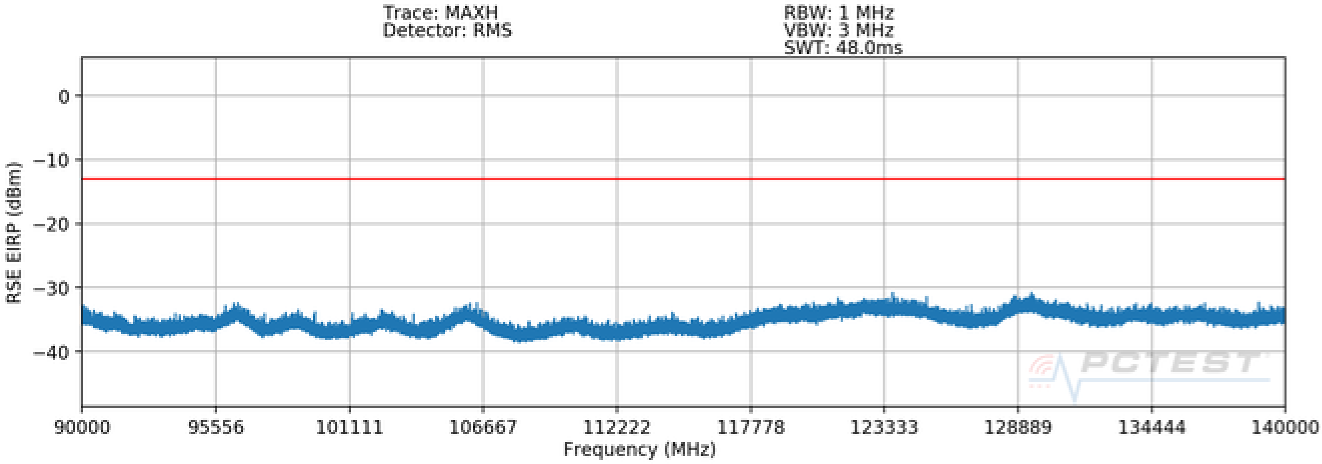
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
74048.70	Low	50	H + V	QPSK	341	-47.06	-13.00	-34.06
76999.14	Mid	50	H + V	QPSK	45	-45.19	-13.00	-32.19
79948.77	High	50	H + V	QPSK	298	-46.08	-13.00	-33.08

Table 7-20. 2Tx -Spurious Emissions Table (60GHz - 90GHz)

Notes

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

90GHz - 140GHz



Plot 7-29. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Spurious Emissions EIRP Sample Calculation (n260)

The raw radiated spurious level is converted to field strength in dBuV/m. Then, the RSE EIRP level is calculated by applying the additional factors shown below for a test distance of 1 meter.

RSE EIRP (dBm) = Analyzer Level (dBm) + 107 + AFCL (dB/m) + 20Log(Dm) – 104.8 + Harmonic Mixer Conversion Loss [dB]

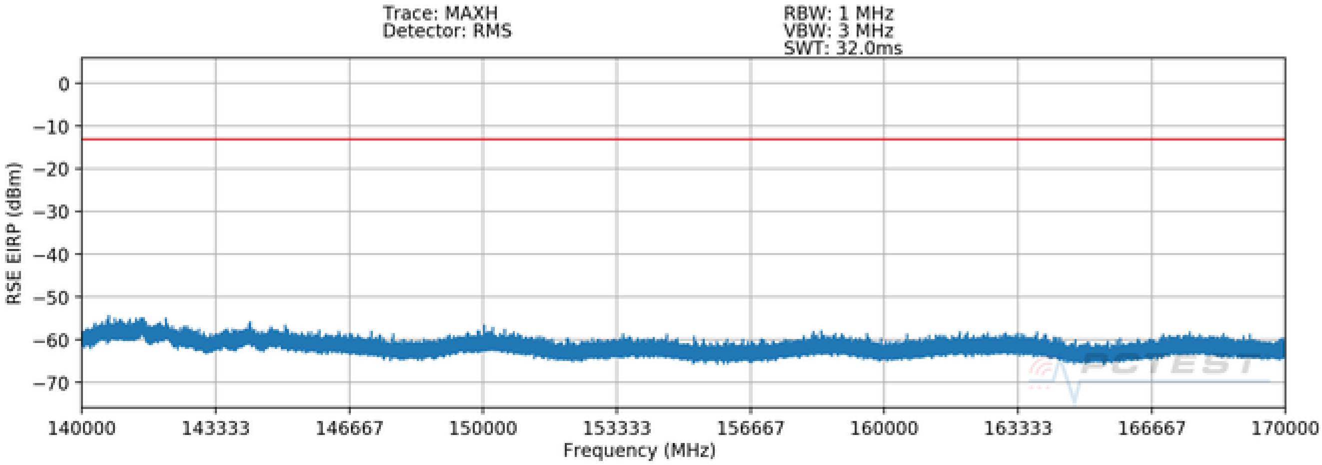
Frequency [MHz]	Channel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
111064.59	Low	50	H + V	QPSK	23	-45.56	-13.00	-32.56
115497.20	Mid	50	H + V	QPSK	355	-43.78	-13.00	-30.78
119925.15	High	50	H + V	QPSK	326	-43.36	-13.00	-30.36

Table 7-21. 2Tx -Spurious Emissions Table (90GHz - 140GHz)

Notes

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

140GHz - 170GHz

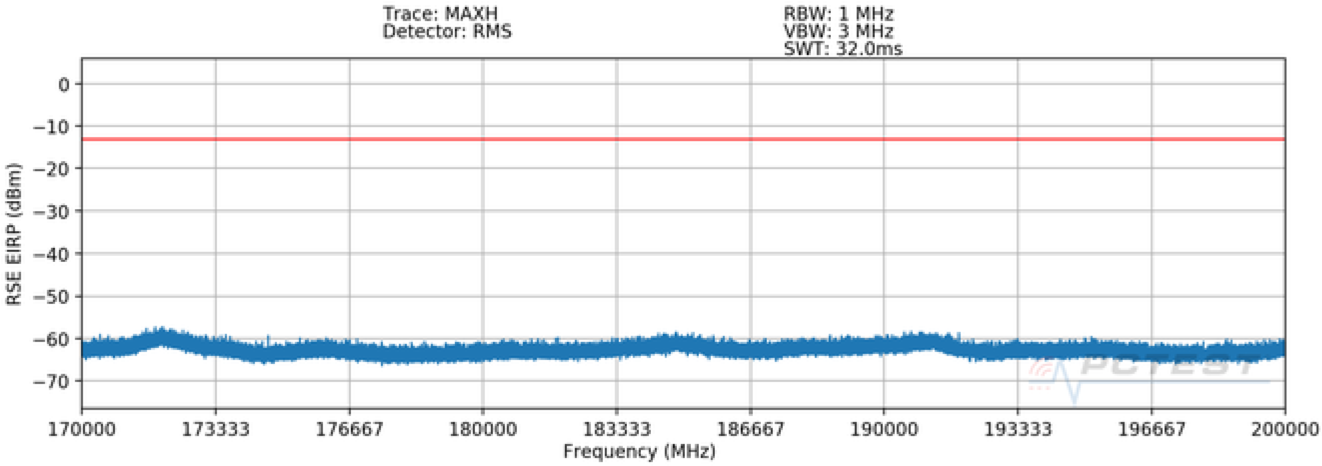


Plot 7-30. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Notes

An RSE table for compliance in the 140 - 200GHz ranges is not included since the pre-scan shows all emissions are well below the limit.

170GHz - 200GHz



Plot 7-31. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Note: An RSE table for compliance in the 140 - 200GHz ranges is not included since the pre-scan shows all emissions are well below the limit.

7.5 Band Edge Emissions

§2.1051, §30.203

Test Overview

All out of band emissions are measured in a radiated setup while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. 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 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 Procedure Used

ANSI C63.26-2015 Section 5 and ANSI C63.26-2015 Section 6.4
KDB 842590 D01 v01r01 Section 4.4.2.5

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 ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = trace average
8. Sweep time = auto couple
9. 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.
2) Band Edge emissions were measured at a 1 meter distance.
3) The spectrum analyzer for each measurement shows an offset value that was determined using the measurement antenna factor, cable loss, far field measurement distance. A sample calculation is shown on the following page.
4) This device supports transmission of H-polarized and V-polarized beams from the antenna array in both CP-OFDM and DFT-s-OFDM transmission schemes. SISO and MIMO operation is also supported for some configurations. As part of the testing, all modes were fully investigated and only the worst case has been included in this report.
5) All combinations of 1CC were fully investigated, and only the worst case has been included in this report.

Sample Analyzer Offset Calculation (at 27.5GHz)

Measurement Antenna Factor = 40.70dB/m

Cable Loss = 8.82dB

Analyzer Offset (dB) = AF (dB/m) + CL (dB) + 107 + $20\log_{10}(D)$ – 104.8dB, where D = 1m

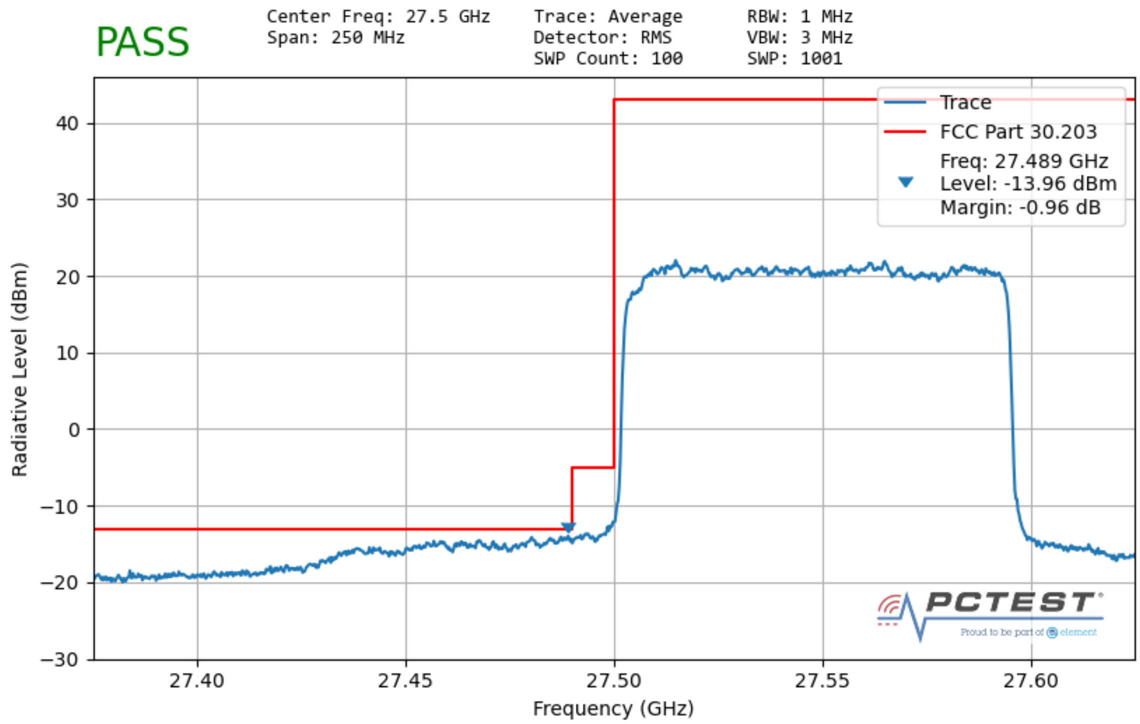
= 40.70dB/m + 8.82dB + 107 + $20\log_{10}(1m)$ – 104.8dB

= 51.72dB

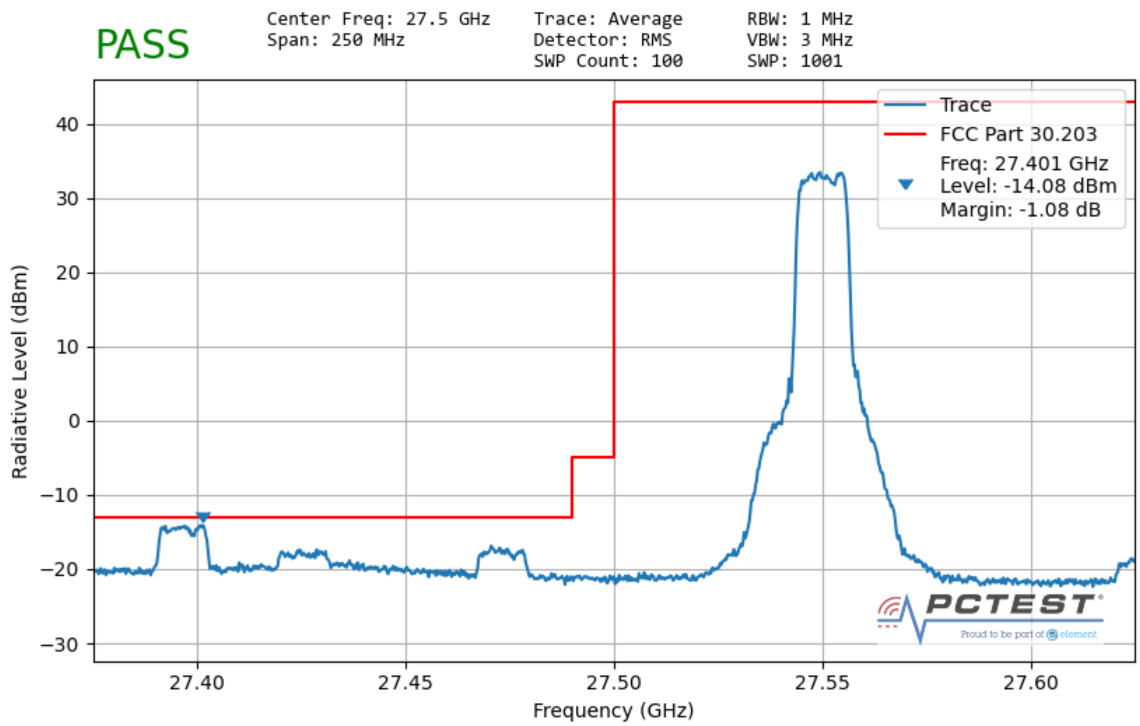
Note:

While it is allowed to use the antenna gain subtraction method in the band edge as it is defined in Part 30, the device meets the requirements via early exit condition as specified in KDB publication 842590 D01.

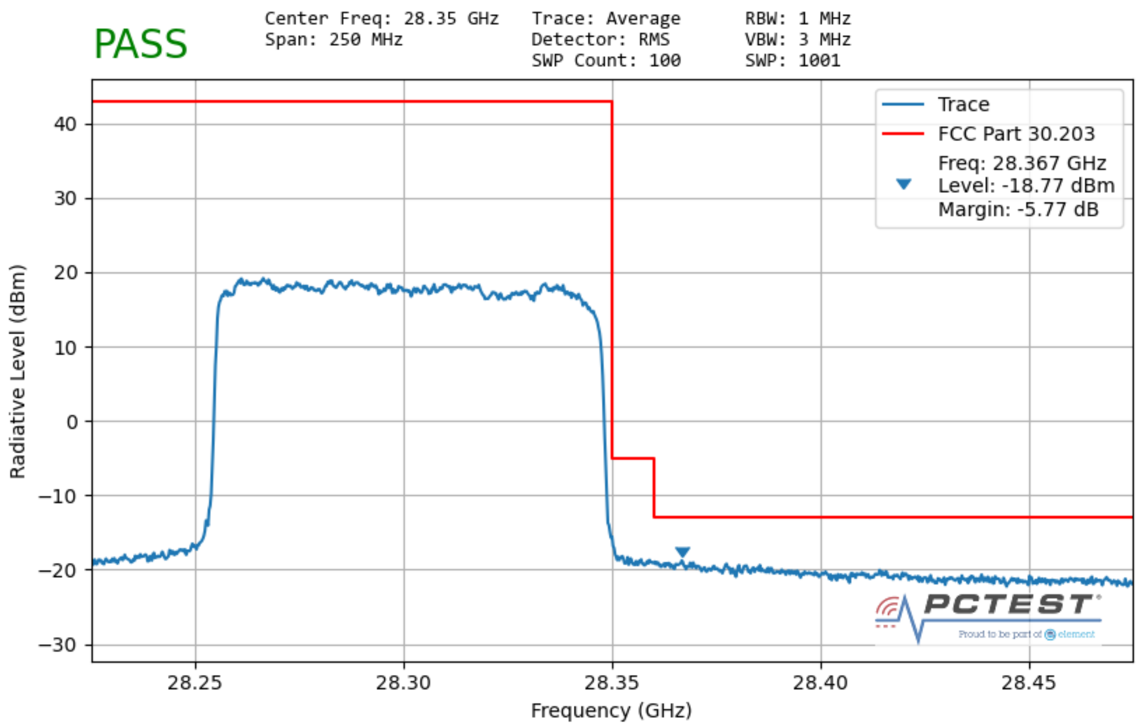
Band n261 – Worst-Case



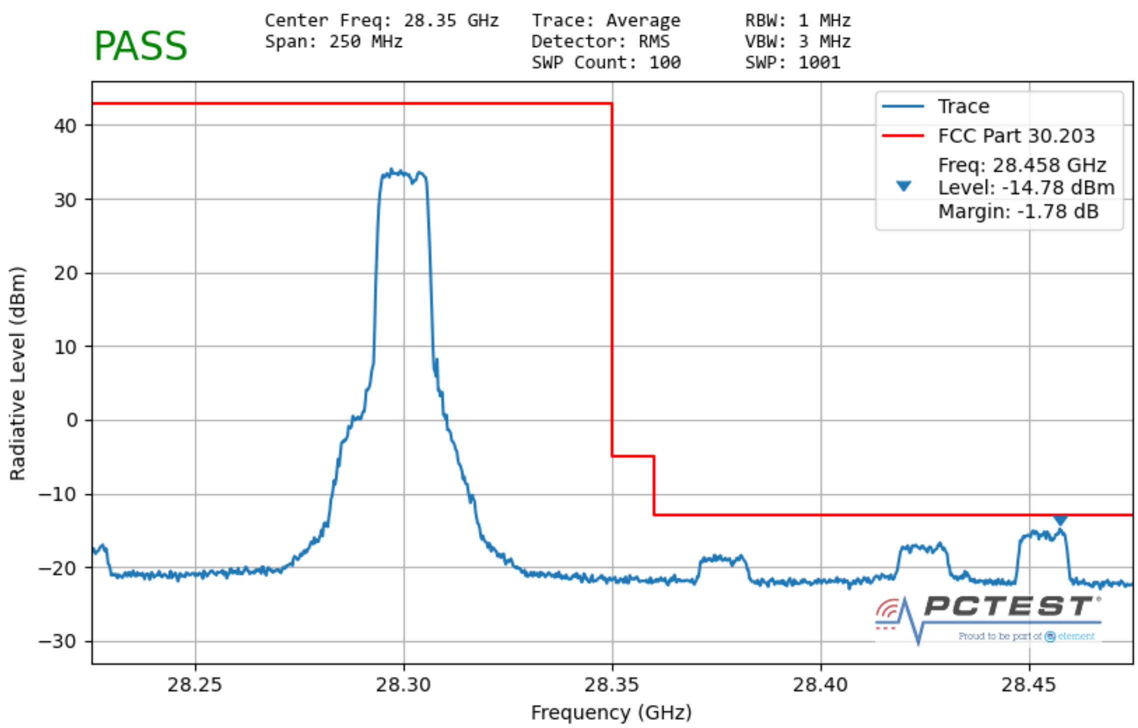
Plot 7-32. Lower Band Edge (100MHz-1CC – QPSK Full RB)



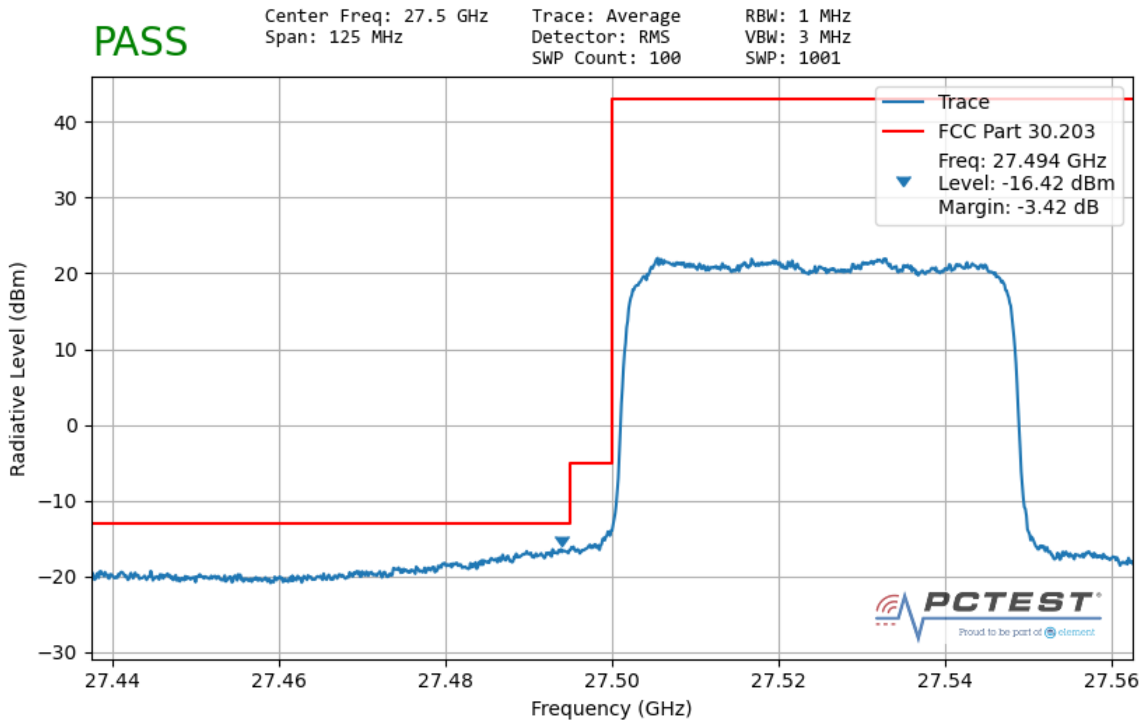
Plot 7-33. Lower Band Edge (100MHz-1CC – QPSK 8 RB)



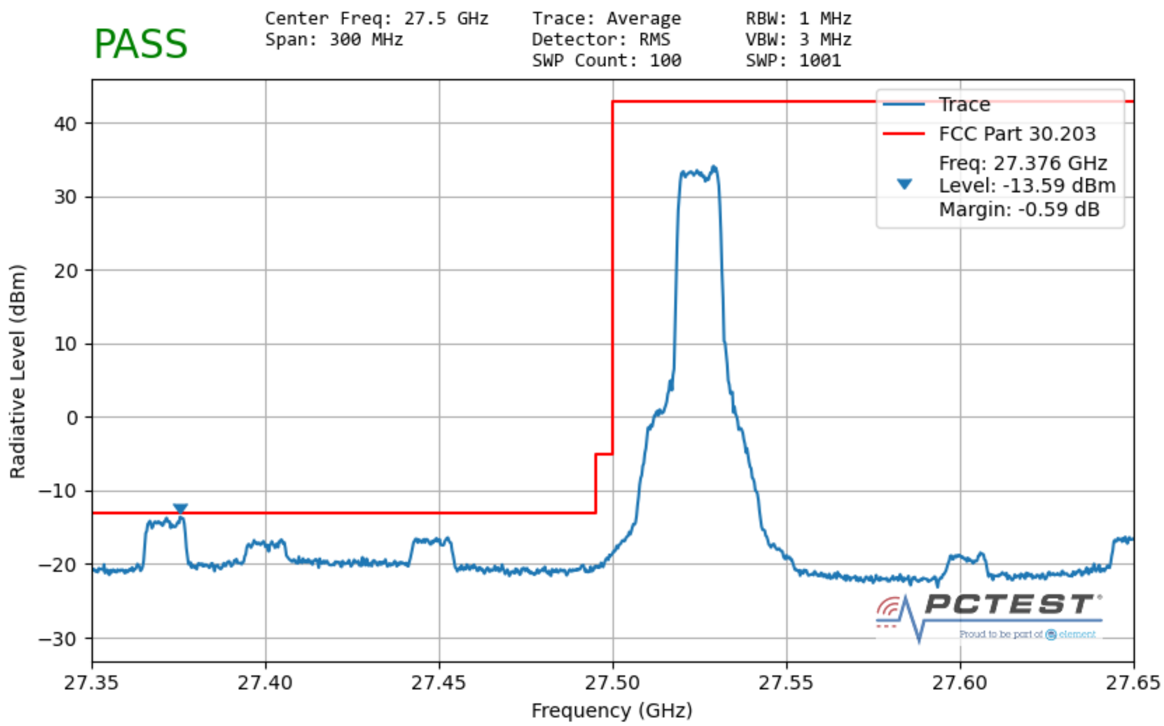
Plot 7-34. Upper Band Edge (100MHz-1CC – QPSK Full RB)



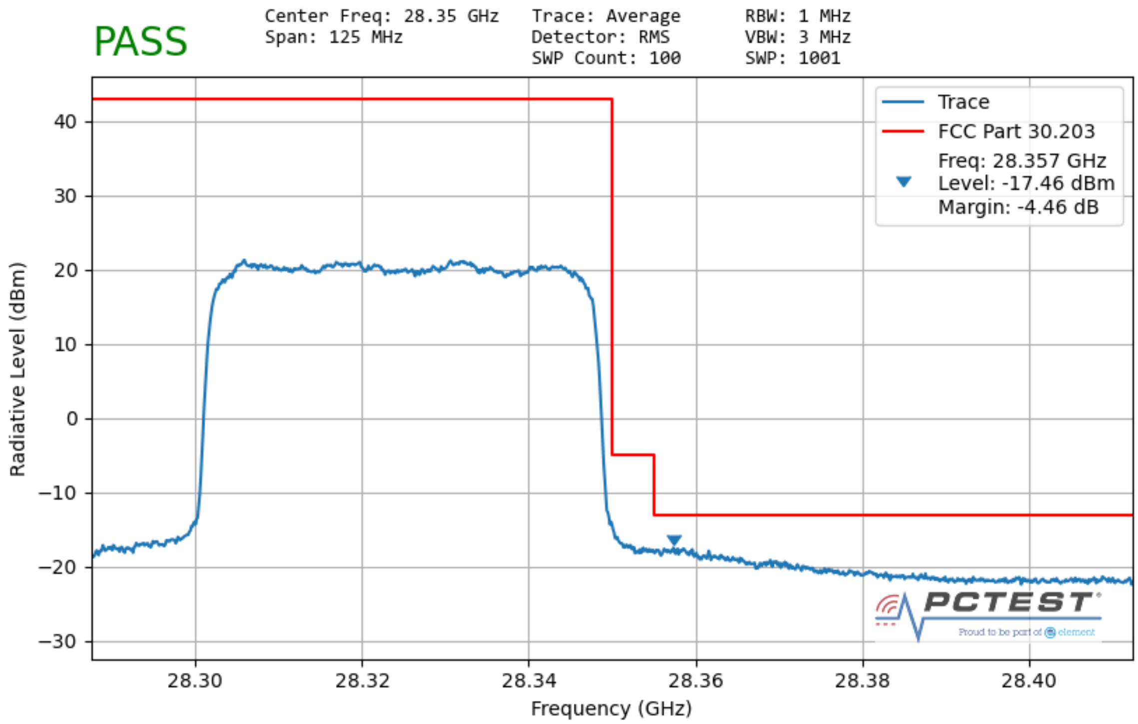
Plot 7-35. Upper Band Edge (100MHz-1CC – QPSK 8 RB)



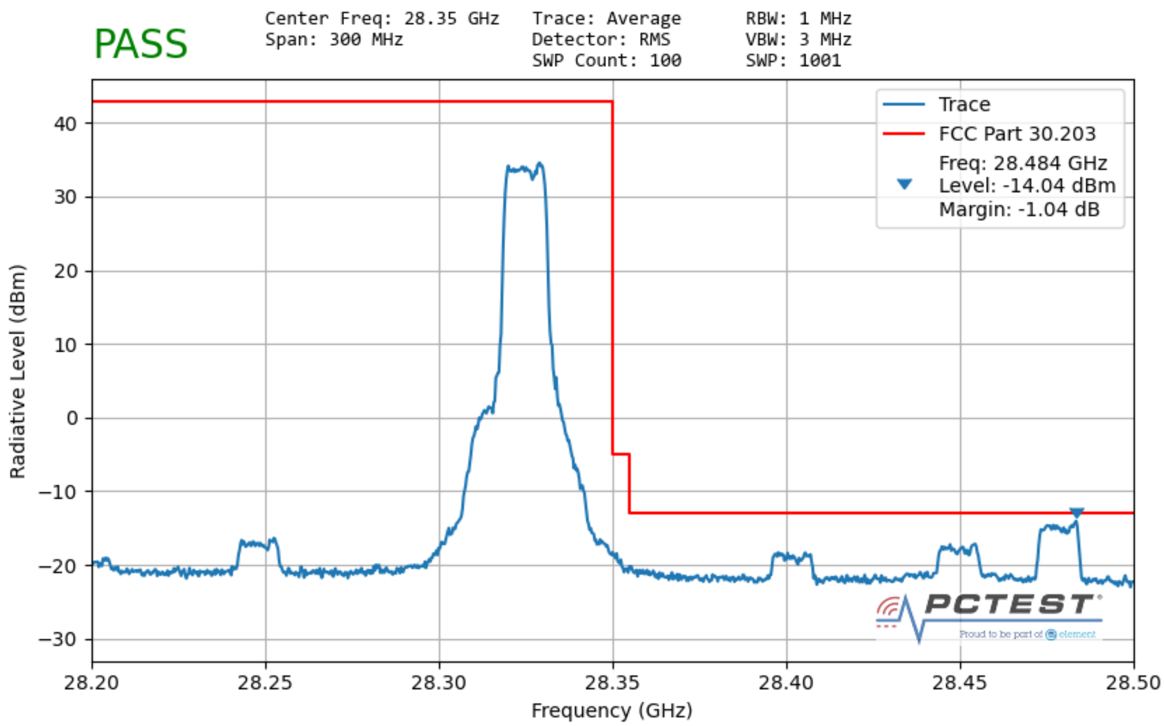
Plot 7-36. Lower Band Edge (50MHz-1CC – QPSK Full RB)



Plot 7-37. Lower Band Edge (50MHz-1CC – QPSK 8 RB)

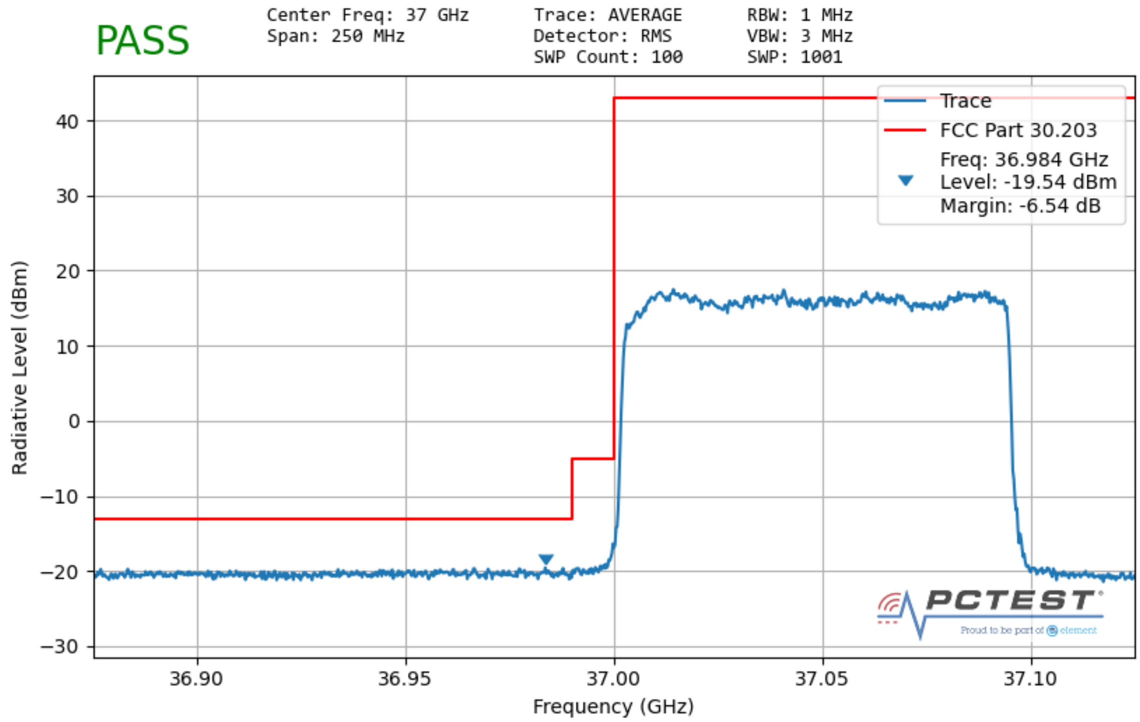


Plot 7-38. Upper Band Edge (50MHz-1CC – QPSK Full RB)

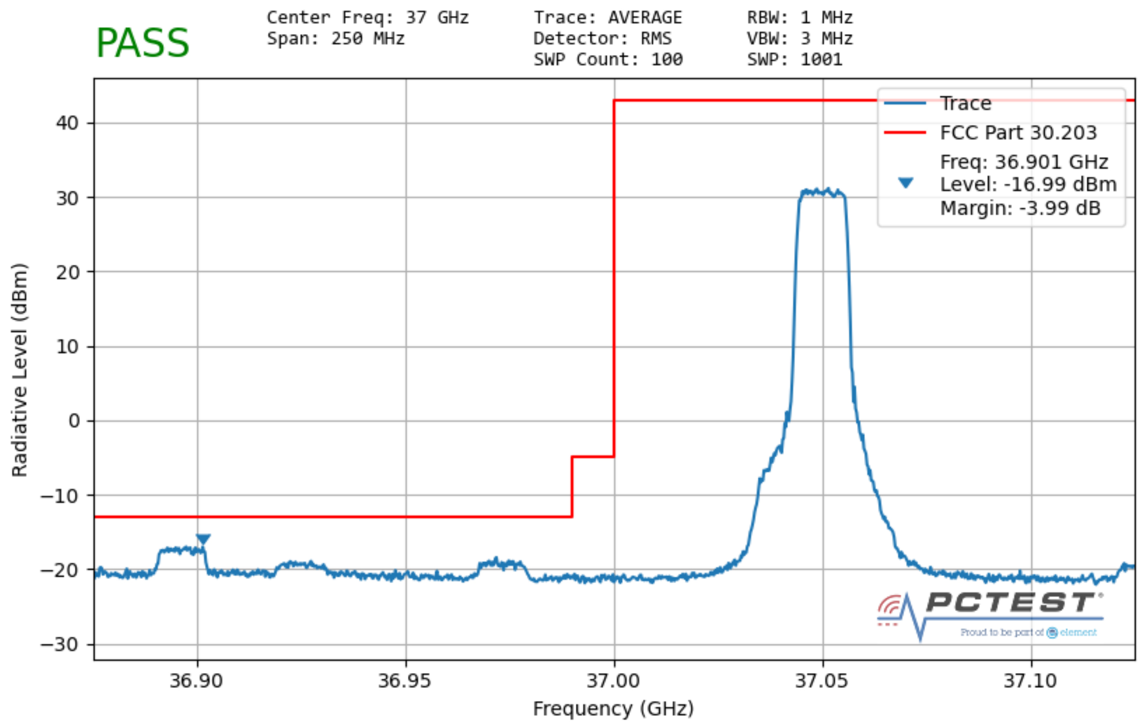


Plot 7-39. Upper Band Edge (50MHz-1CC – QPSK 8 RB)

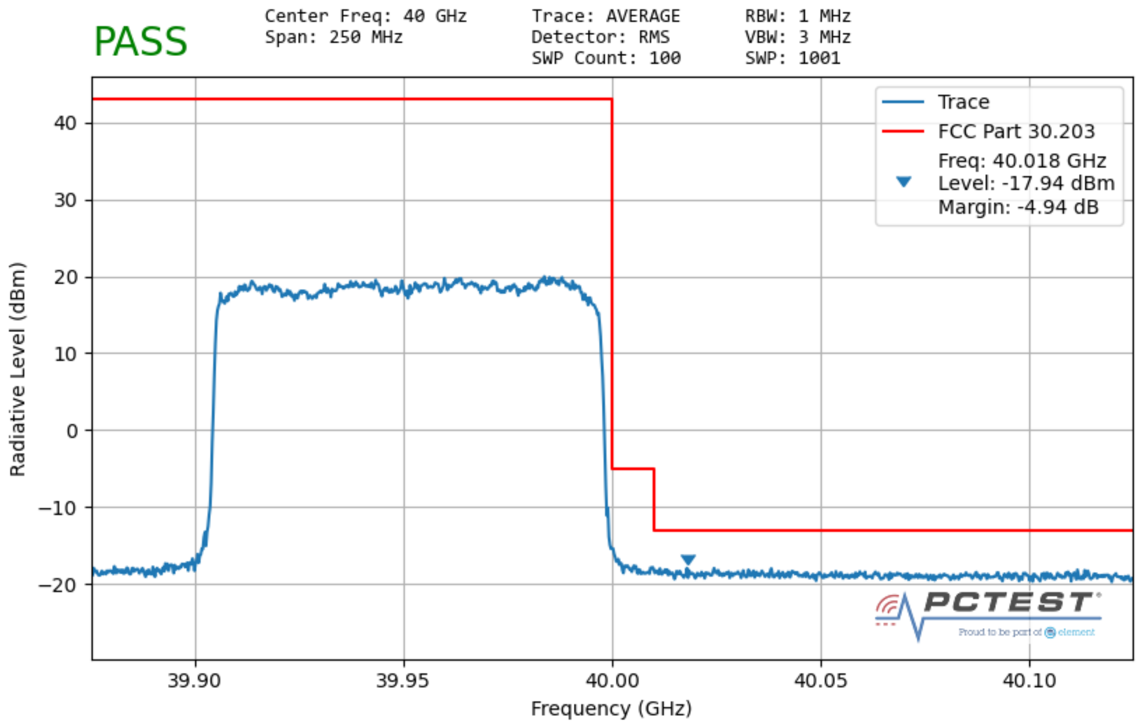
Band n261 – Worst Case



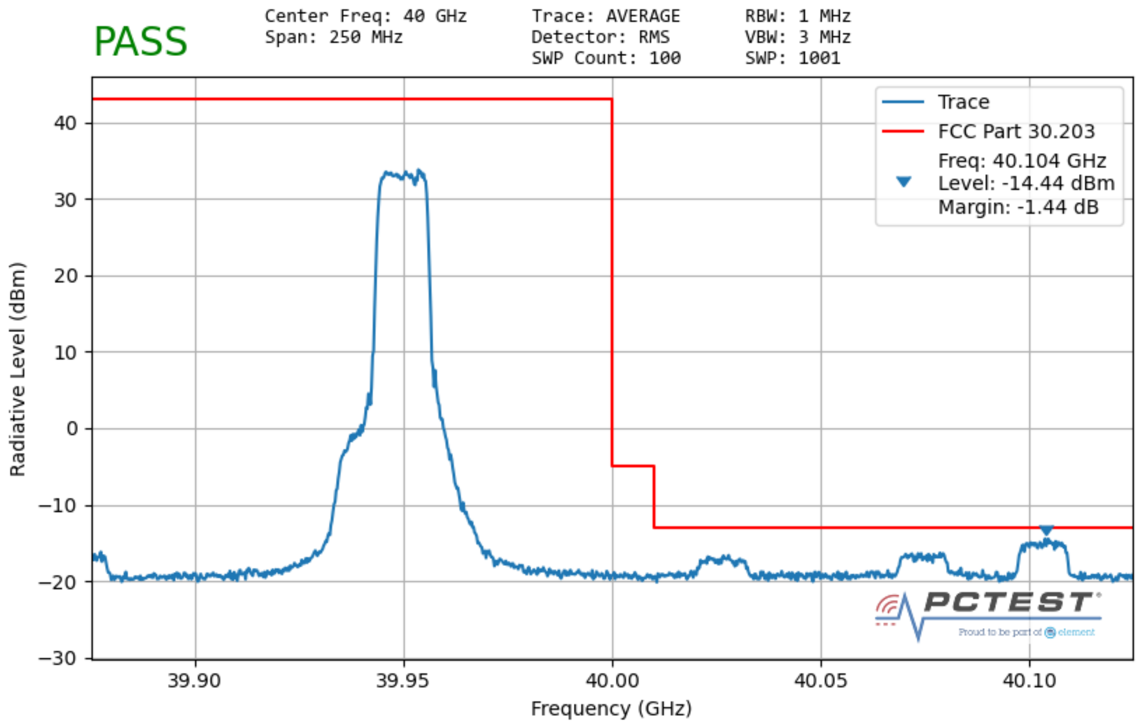
Plot 7-40. Lower Band Edge (100MHz-1CC – QPSK Full RB)



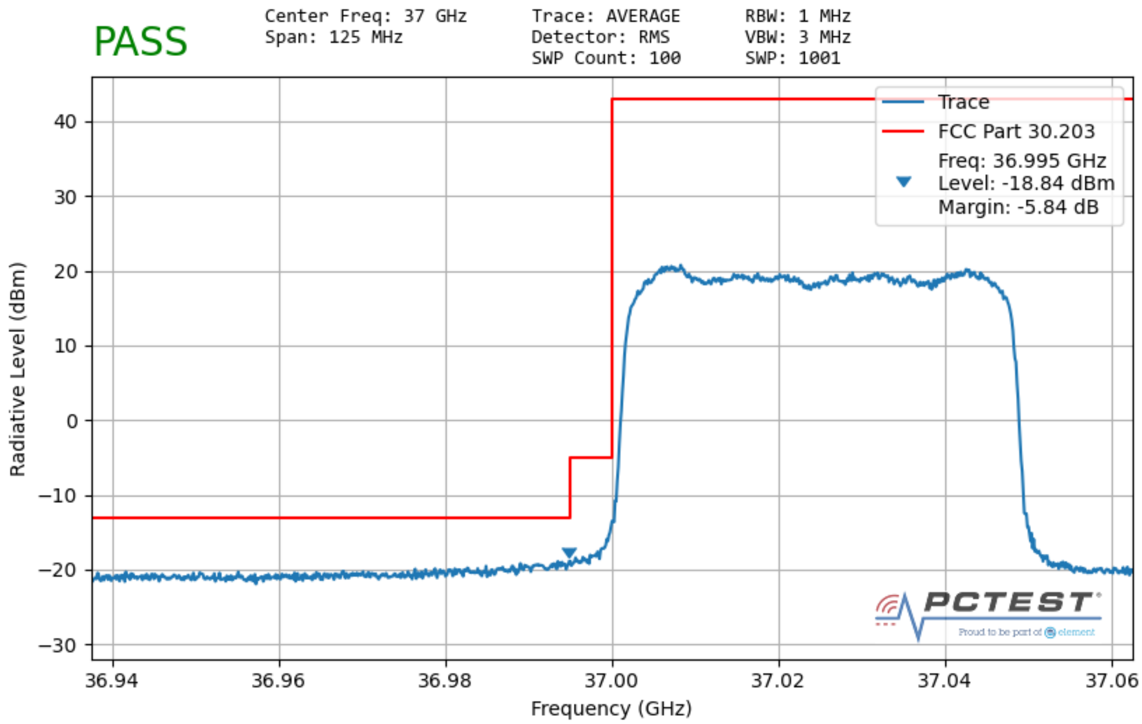
Plot 7-41. Lower Band Edge (100MHz-1CC – QPSK 8 RB)



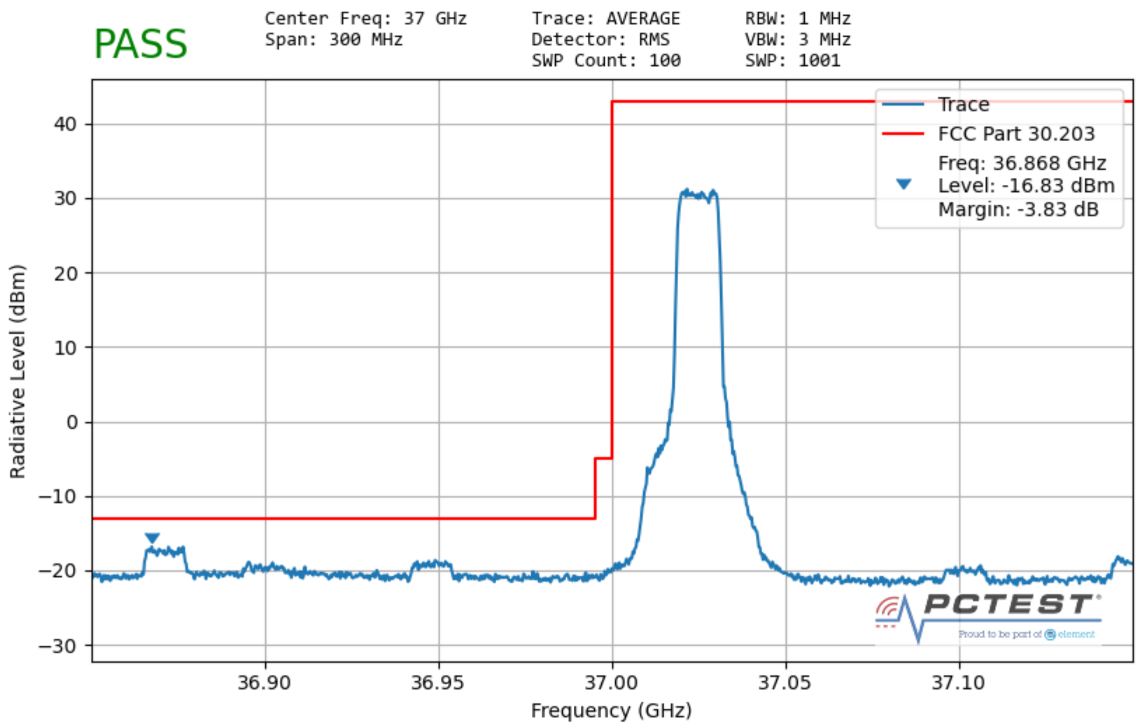
Plot 7-42. Upper Band Edge (100MHz-1CC – QPSK Full RB)



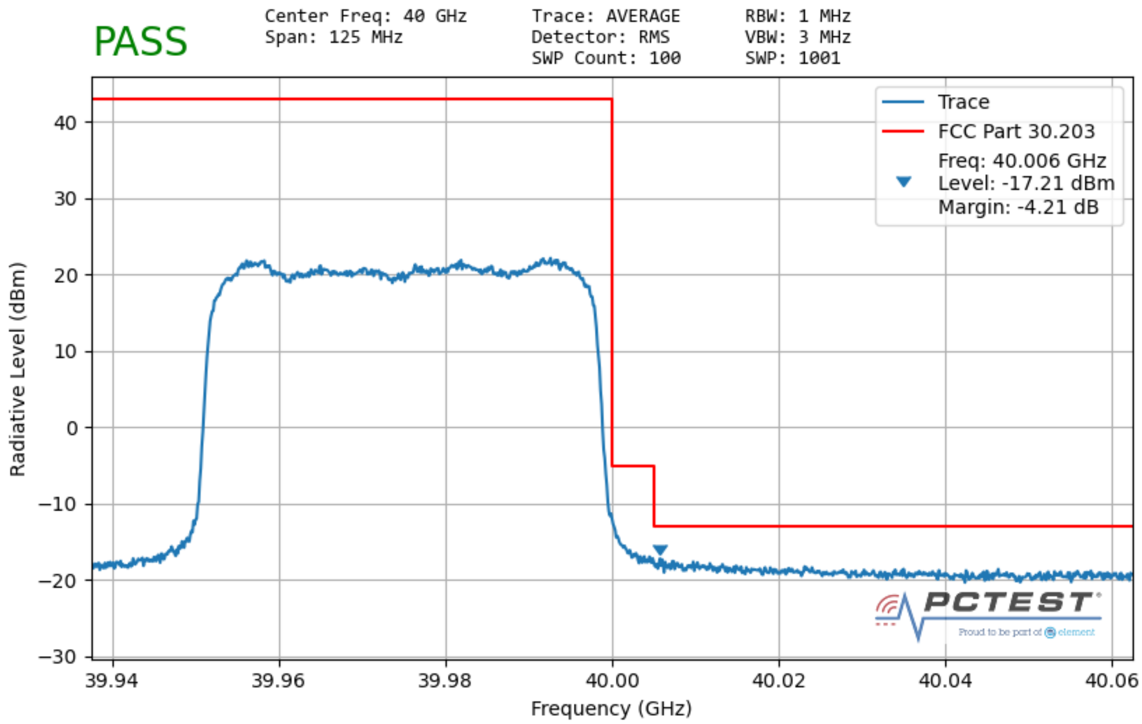
Plot 7-43. Upper Band Edge (100MHz-1CC – QPSK 8 RB)



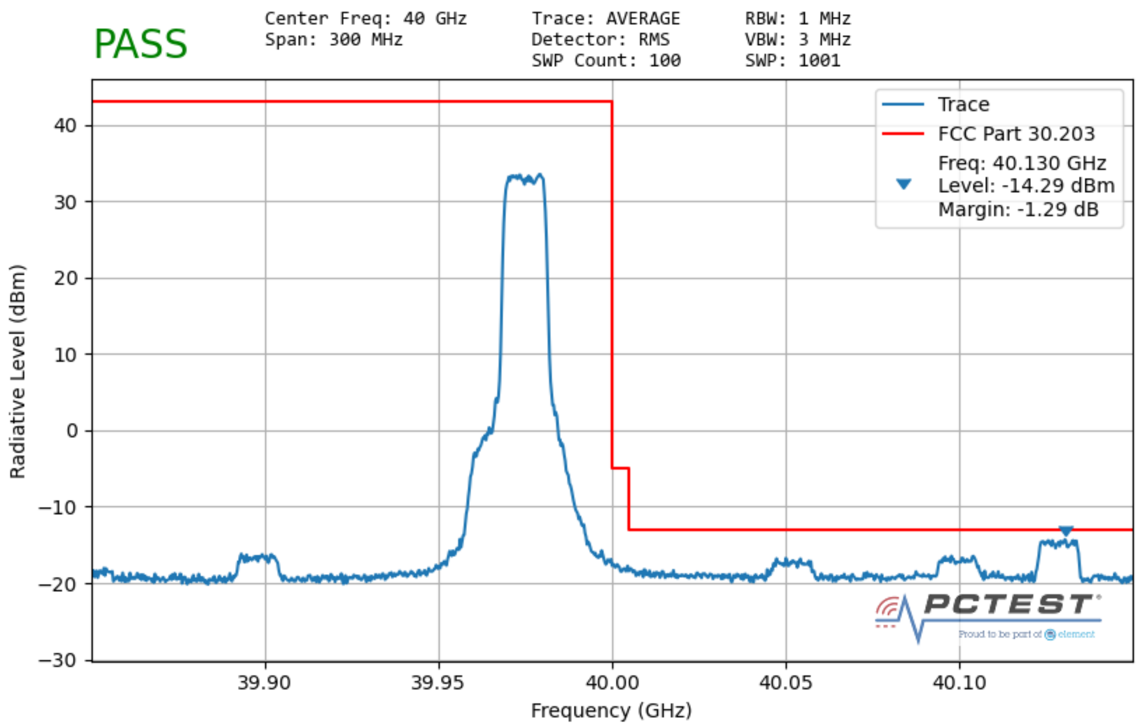
Plot 7-44. Lower Band Edge (50MHz-1CC – QPSK Full RB)



Plot 7-45. Lower Band Edge (50MHz-1CC – QPSK 8 RB)



Plot 7-46. Upper Band Edge (50MHz-1CC – QPSK Full RB)



Plot 7-47. Upper Band Edge (50MHz-1CC – QPSK 8 RB)

7.6 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
KDB 842590 D01 v01r01 Section 4.5

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 Reference measurement (first row).

Frequency Stability Measurements (Band n261)

§2.1055

OPERATING FREQUENCY:	27,922,080,000	Hz
CHANNEL:	2254091	
REFERENCE VOLTAGE:	56.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (^{o}C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	56.00	- 30	27,922,085,496	129,932	0.0004653
100 %		- 20	27,922,159,989	55,439	0.0001985
100 %		- 10	27,922,119,908	95,520	0.0003421
100 %		0	27,922,151,064	64,364	0.0002305
100 %		+ 10	27,922,109,601	105,827	0.0003790
100 %		+ 20	27,922,122,816	92,612	0.0003317
100 %		+ 30	27,922,007,827	207,601	0.0007435
100 %		+ 40	27,922,008,867	206,561	0.0007398
100 %		+ 50	27,922,012,890	202,538	0.0007254
85 %	47.60	+ 20	27,922,183,956	31,472	0.0001127
115 %	64.40	+ 20	27,922,163,896	-78,400	-0.0002808

Table 7-22. Frequency Stability Data (n261)

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 (Band n261)
§2.1055

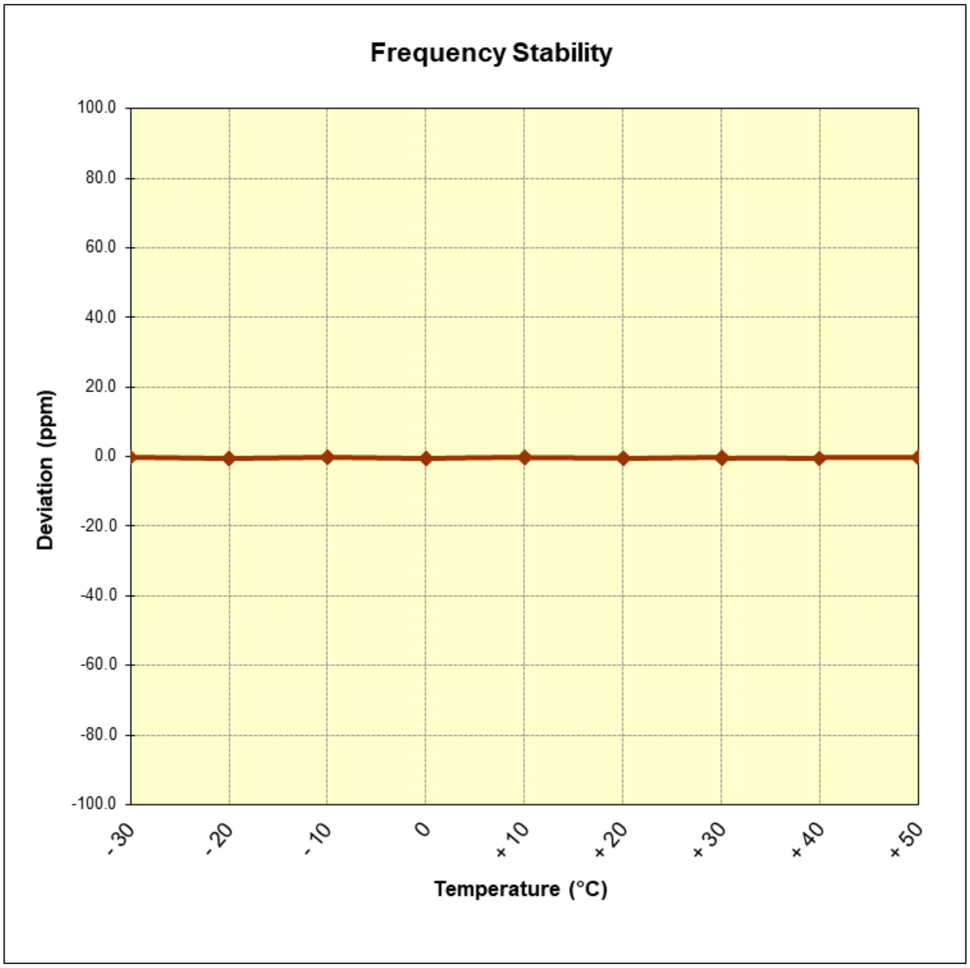


Figure 7-1. Frequency Stability Graph (n261)

Frequency Stability Measurements (Band n260)

§2.1055

OPERATING FREQUENCY:	38,495,520,000	Hz
CHANNEL:	2254091	
REFERENCE VOLTAGE:	56.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (^{o}C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	56.00	- 30	38,495,373,111	331,361	0.0008608
100 %		- 20	38,495,699,100	5,372	0.0000140
100 %		- 10	38,495,632,574	71,898	0.0001868
100 %		0	38,495,685,945	18,527	0.0000481
100 %		+ 10	38,495,725,088	-20,616	-0.0000536
100 %		+ 20	38,495,312,600	391,872	0.0010180
100 %		+ 30	38,495,337,051	367,421	0.0009545
100 %		+ 40	38,495,337,194	367,278	0.0009541
100 %		+ 50	38,495,396,726	307,746	0.0007994
85 %	47.60	+ 20	38,495,548,277	156,195	0.0004057
115 %	64.40	+ 20	38,495,358,401	14,710	0.0000382

Table 7-23. Frequency Stability Data (n260)

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 (Band n260)
§2.1055

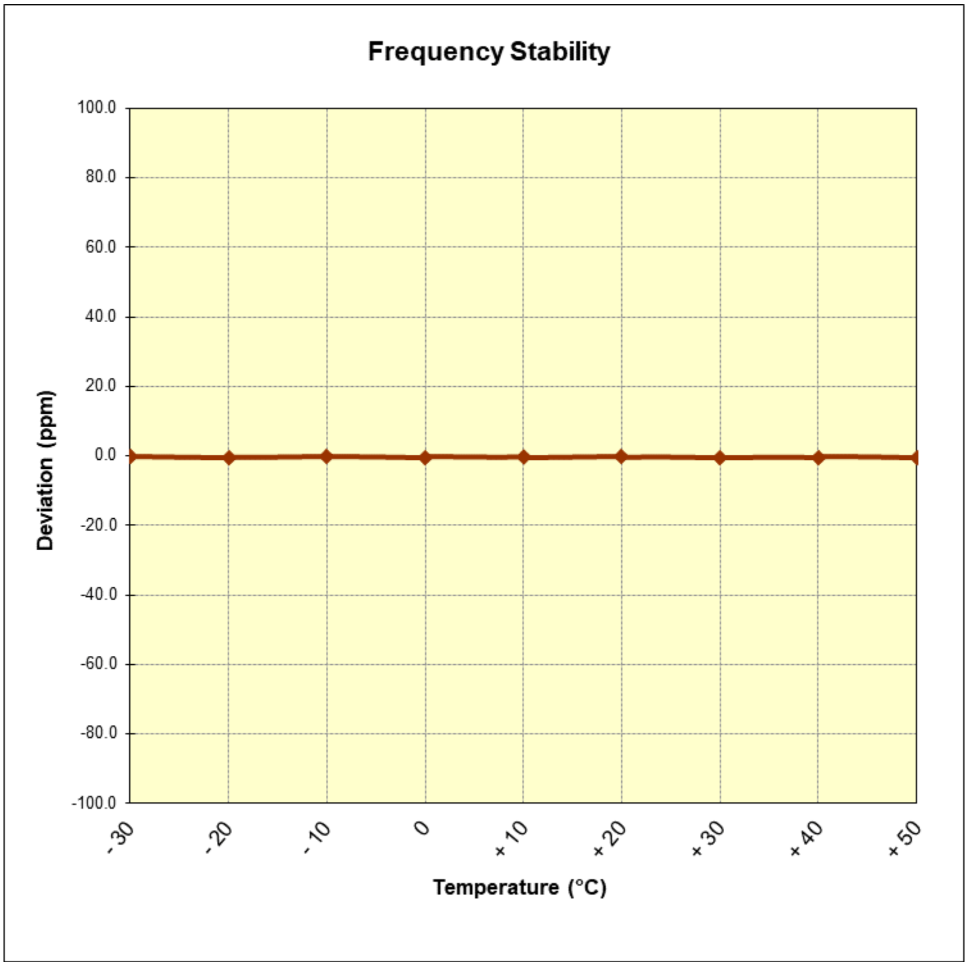


Figure 7-2. Frequency Stability Graph (n260)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Outdoor Customer Premises Equipment (CPE) FCC ID: A3LSMH303V** complies with all the requirements of Part 30.

9.0 APPENDIX A

9.1 VDI Mixer Verification Certificate

Virginia Diodes, Inc.

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: 193065 **Today's Date:** 10/02/19

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	VDIWR19.0SAX WR19SAX / SN: SAX 411	19329-01

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

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Virginia Diodes, Inc.

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: 193037
Shipping Date: 09/30/19
Today's Date: 09/30/19
PO Number: 190719.DP1R

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	SAX RETEST-WR12SAX WR12SAX / SN: SAX 252	19408-01
1	EA	SAX RETEST-WR8.0SAX WR8.0SAX / SN: SAX 253	19408-02
1	EA	SAX RETEST-WR5.1SAX WR5.1SAX / SN: SAX 254	19408-03

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

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