PCTEST
7185 Oakland Mills Road, Columbia, MD 21046 USA
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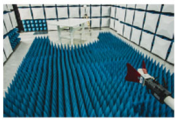

MEASUREMENT REPORT
FCC Part 30 5G mmWave

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

Date of Testing:
4/29 - 7/27/2020
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2004140062-05-R1.A3L

FCC ID:	**A3LSMH204V**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-H204V
EUT Type:	Indoor 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: 1M2004140062-05-R1.A3L) supersedes and replaces the previously issued test report (S/N: 1M2004140062-05.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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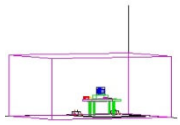
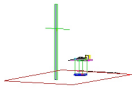


MEASUREMENT REPORT
FCC Part 30



Mode	Transmition Scheme	Bandwidth (MHz)	CCs Active	Band	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
							Max. Power (W)	Max. Power (dBm)		
SISO	DFT-s-OFDM	100	1	n261	30	27500 - 28350	17.498	42.43	92M7G7D	π/2 BPSK
SISO	DFT-s-OFDM	100	1	n261	30	27500 - 28350	25.674	44.09	94M9G7D	QPSK
SISO	DFT-s-OFDM	100	1	n261	30	27500 - 28350	10.605	40.25	94M9W7D	16QAM
SISO	DFT-s-OFDM	100	1	n261	30	27500 - 28350	16.014	42.04	95M0W7D	64QAM
2Tx	DFT-s-OFDM	100	1	n261	30	27500 - 28350	23.714	43.75	94M9G7D	QPSK
SISO	DFT-s-OFDM	50	1	n261	30	27500 - 28350	17.418	42.41	45M6G7D	π/2 BPSK
SISO	DFT-s-OFDM	50	1	n261	30	27500 - 28350	24.604	43.91	46M0G7D	QPSK
SISO	DFT-s-OFDM	50	1	n261	30	27500 - 28350	9.506	39.78	45M9W7D	16QAM
SISO	DFT-s-OFDM	50	1	n261	30	27500 - 28350	7.798	38.92	46M1W7D	64QAM
2Tx	DFT-s-OFDM	50	1	n261	30	27500 - 28350	22.751	43.57	46M0G7D	QPSK

EUT Overview (Band n261)

Mode	Transmition Scheme	Bandwidth (MHz)	CCs Active	Band	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
							Max. Power (W)	Max. Power (dBm)		
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	25.527	44.07	91M8G7D	π/2 BPSK
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	25.763	44.11	94M4G7D	QPSK
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	15.205	41.82	94M5W7D	16QAM
2Tx	DFT-s-OFDM	100	1	n260	30	37000 - 40000	12.162	40.85	94M5W7D	64QAM
SISO	DFT-s-OFDM	100	1	n260	30	37000 - 40000	23.878	43.78	94M4G7D	QPSK
SISO	DFT-s-OFDM	50	1	n260	30	37000 - 40000	20.230	43.06	45M4G7D	π/2 BPSK
SISO	DFT-s-OFDM	50	1	n260	30	37000 - 40000	25.293	44.03	46M0G7D	QPSK
SISO	DFT-s-OFDM	50	1	n260	30	37000 - 40000	9.550	39.80	45M8W7D	16QAM
SISO	DFT-s-OFDM	50	1	n260	30	37000 - 40000	7.709	38.87	45M9W7D	64QAM
2Tx	DFT-s-OFDM	50	1	n260	30	37000 - 40000	24.266	43.85	45M4G7D	π/2 BPSK

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 Indoor Customer Premises Equipment (CPE) FCC ID: A3LSMH204V**. 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.: 16619

2.2 Device Capabilities

This device contains the following capabilities:

Multi-band LTE, 5G NR (n5, n66, n2, n261, n260), 802.11b/g/n/ax WLAN, 802.11a/n/ac/ax UNII, 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.

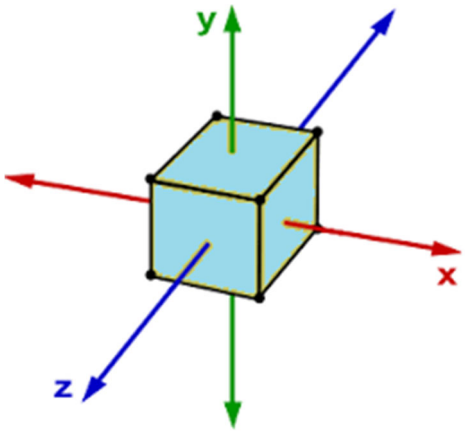


Figure 3-1. Rotation of the EUT Through Three Orthogonal Planes

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	50GHz PXA Signal Analyzer	11/22/2019	Annual	11/22/2020	US51350301
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2019	Biennial	10/10/2021	121034
Espec	ESX-2CA	Environmental Chamber	8/13/2019	Annual	8/13/2020	17620
ETS-Lindgren	3116C	DRG Horn Antenna	3/11/2019	Biennial	3/11/2021	218893
Keysight Technologies	N9030A	PXA Signal Analyzer	9/13/2019	Annual	9/13/2020	MY54490576
Rohde & Schwarz	180-442-KF	Horn (Small)	8/21/2018	Biennial	8/21/2020	U157403-01
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	2/10/2020	Annual	2/10/2021	102134
Rohde & Schwarz	TS-PR26	18-26.5 GHz Pre-Amplifier	11/1/2019	Annual	11/1/2020	100040
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	11/1/2019	Annual	11/1/2020	100037
Sunol	DRH-118	Horn Antenna (1-18GHz)	10/3/2019	Biennial	10/3/2021	A050307
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

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: A3LSMH204V

FCC Classification: Part 30 Mobile Transmitter (5GM)

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	55dBm		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

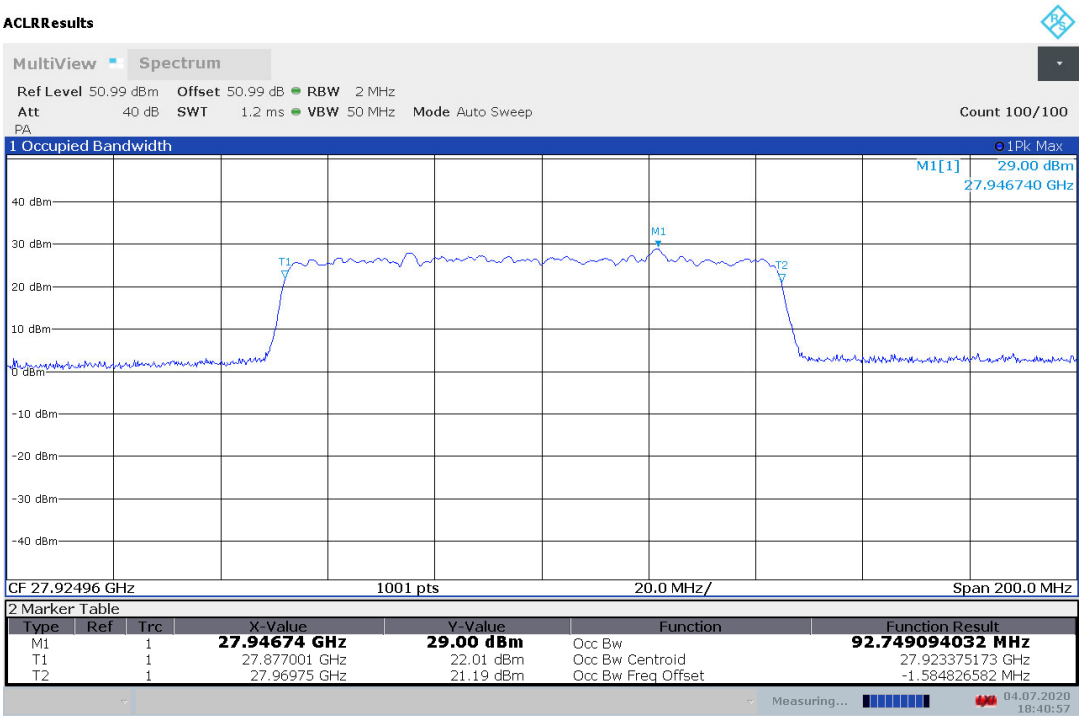
Test Notes

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	DFTs-s-OFDM	π/2 BPSK	92.75
			CP-OFDM	QPSK	94.91
			CP-OFDM	16QAM	94.87
			CP-OFDM	64QAM	94.97
	50	1	DFTs-s-OFDM	π/2 BPSK	45.57
			CP-OFDM	QPSK	46.01
			CP-OFDM	16QAM	45.89
			CP-OFDM	64QAM	46.11

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



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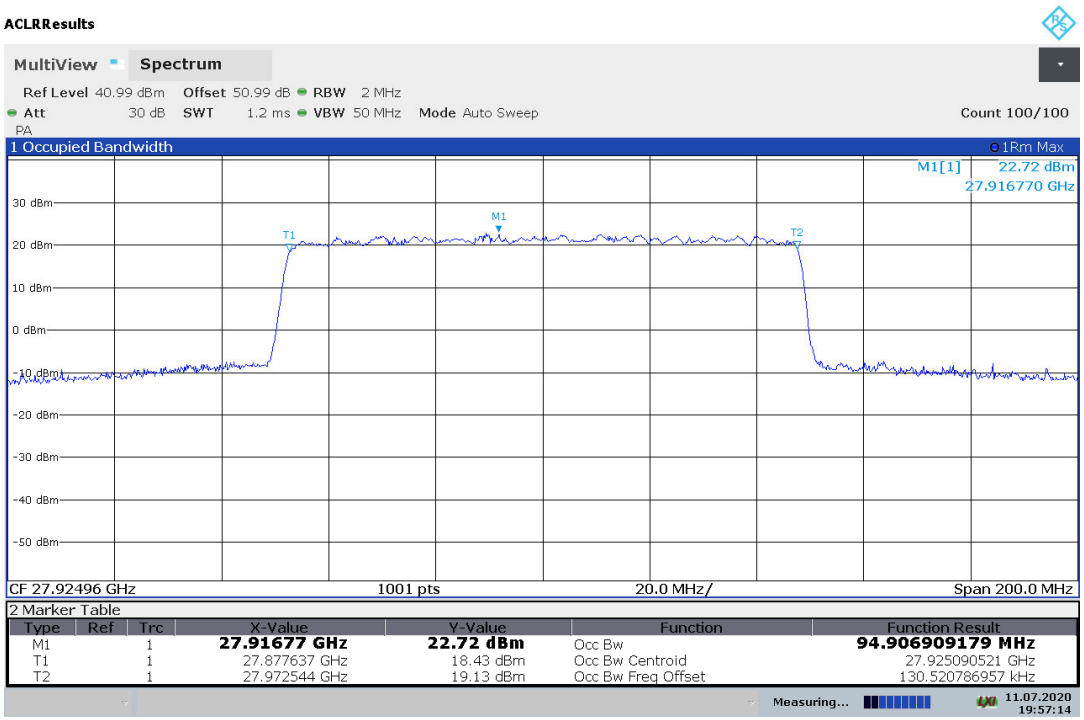
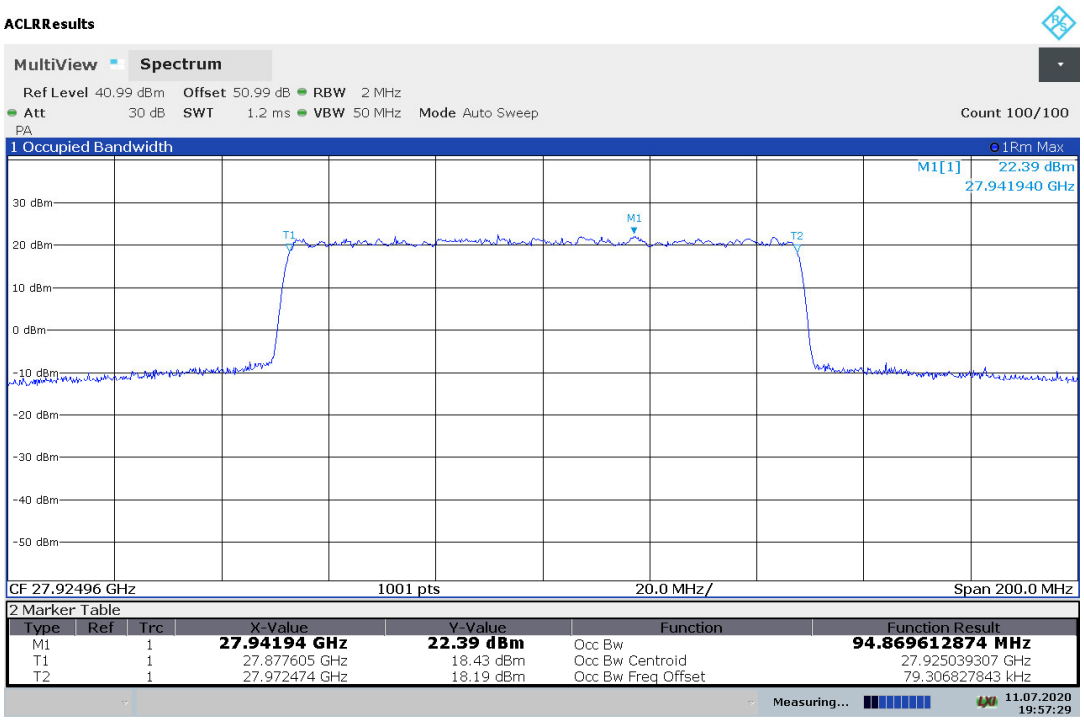
Plot 7-1. Occupied Bandwidth Plot (100MHz-1CC – π/2 BPSK – Mid Channel)



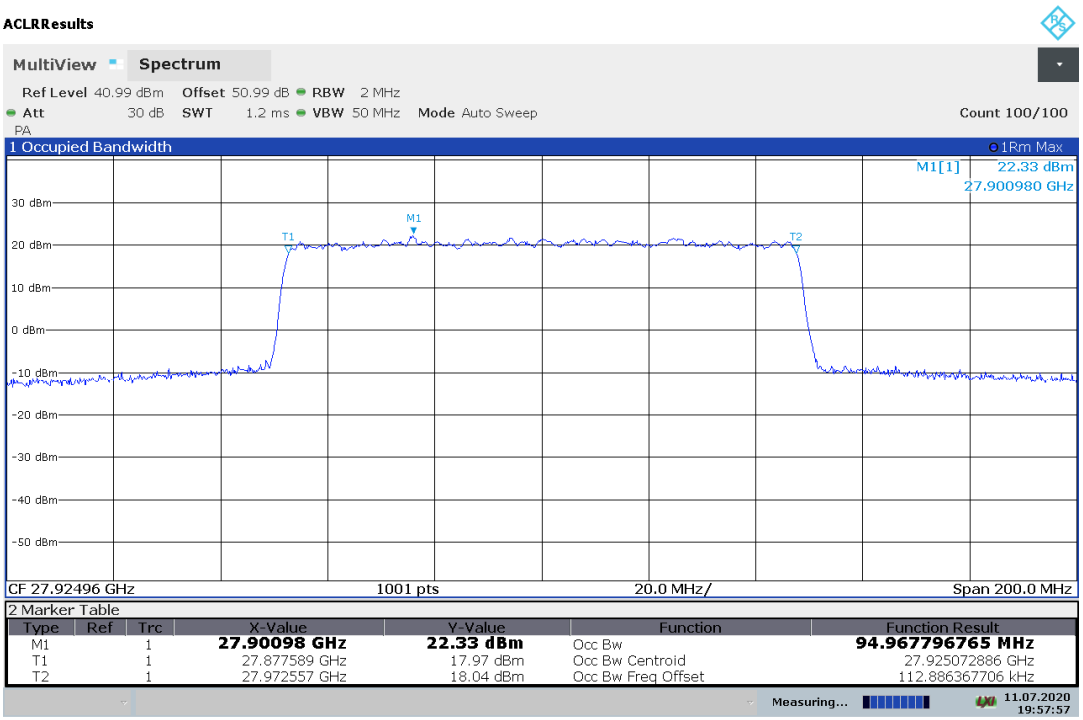
19:57:15 11.07.2020

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



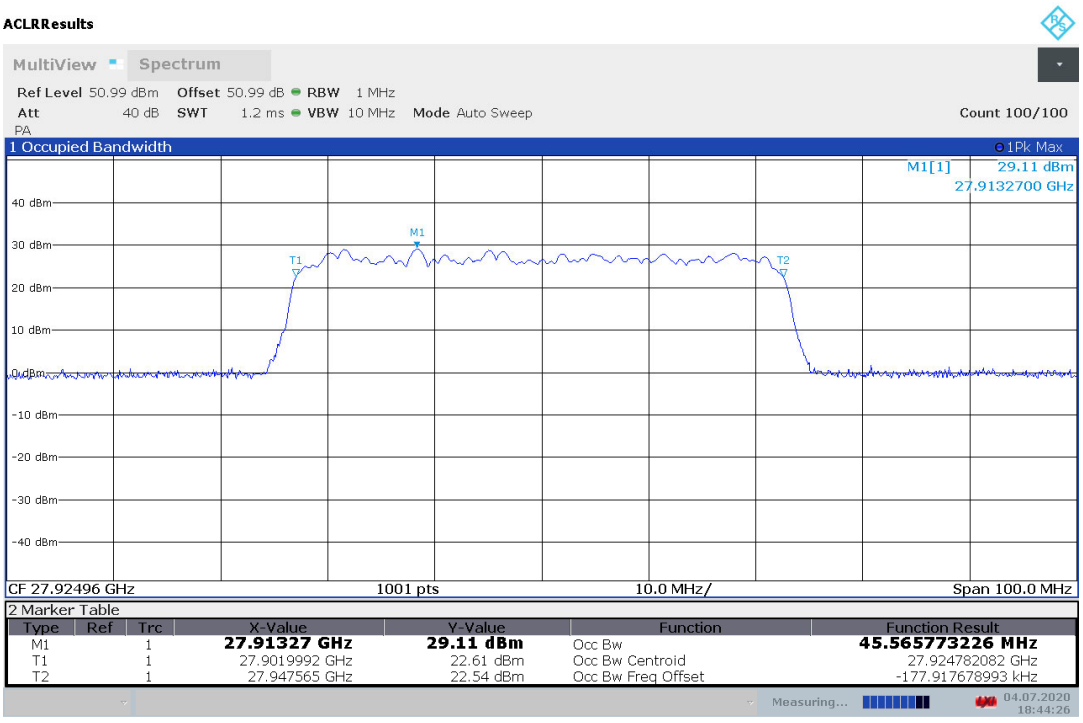
19:57:30 11.07.2020

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



19:57:58 11.07.2020

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



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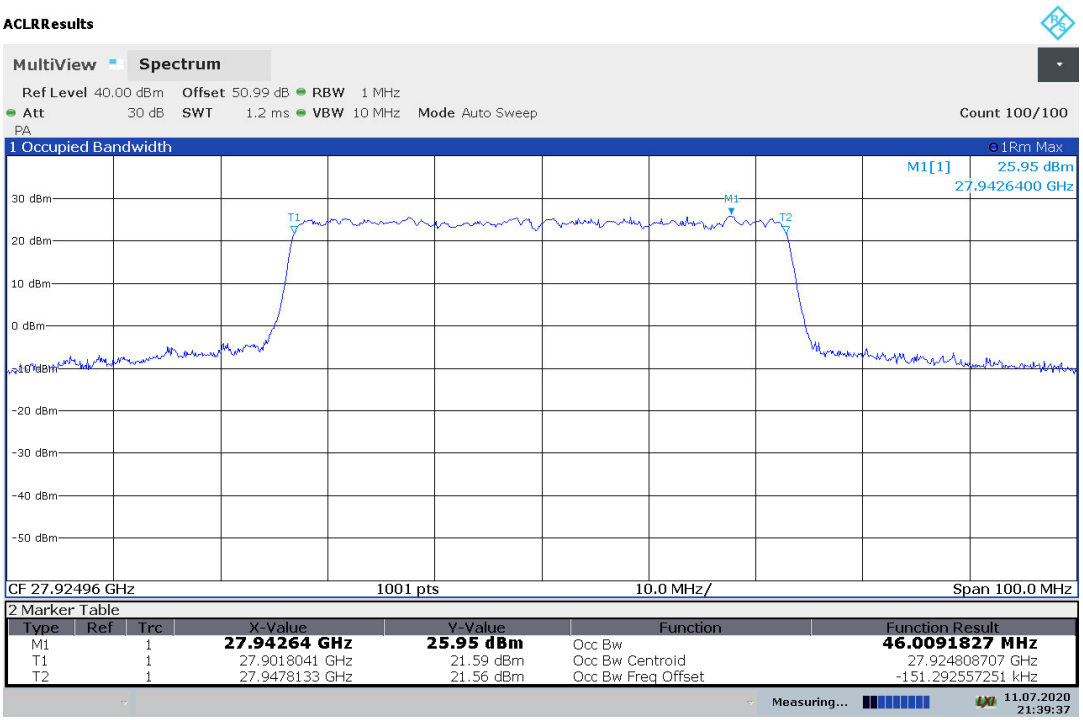
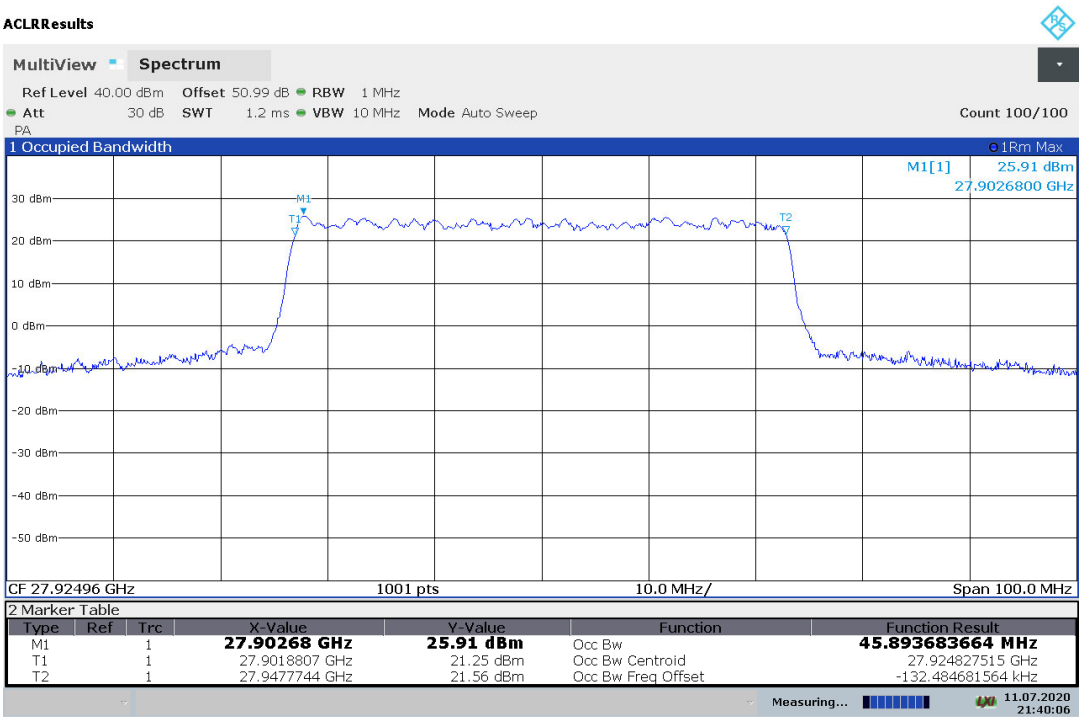
Plot 7-5. Occupied Bandwidth Plot (50MHz-1CC – π/2 BPSK – Mid Channel)



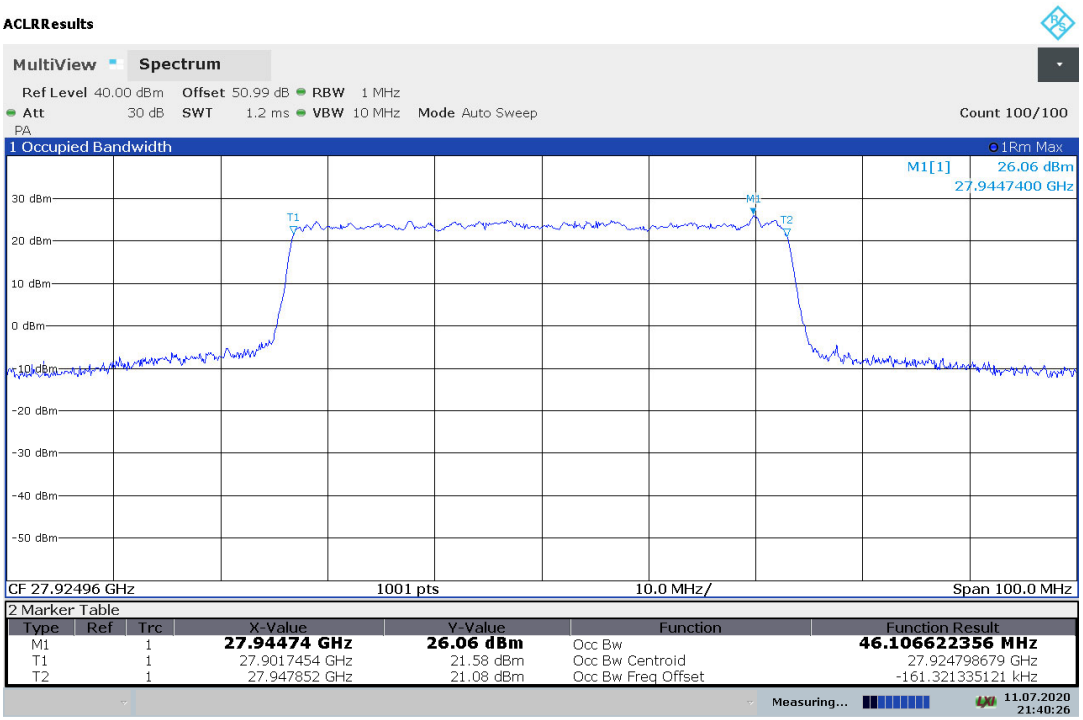
21:39:38 11.07.2020

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



21:40:06 11.07.2020

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



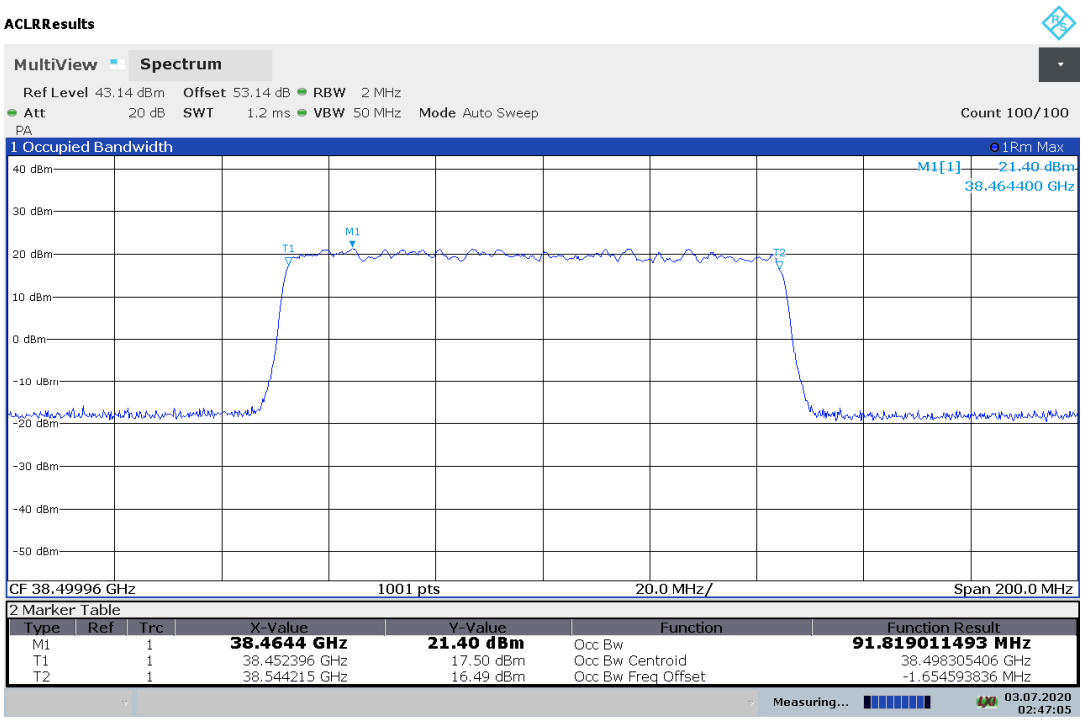
21:40:27 11.07.2020

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

Band n260

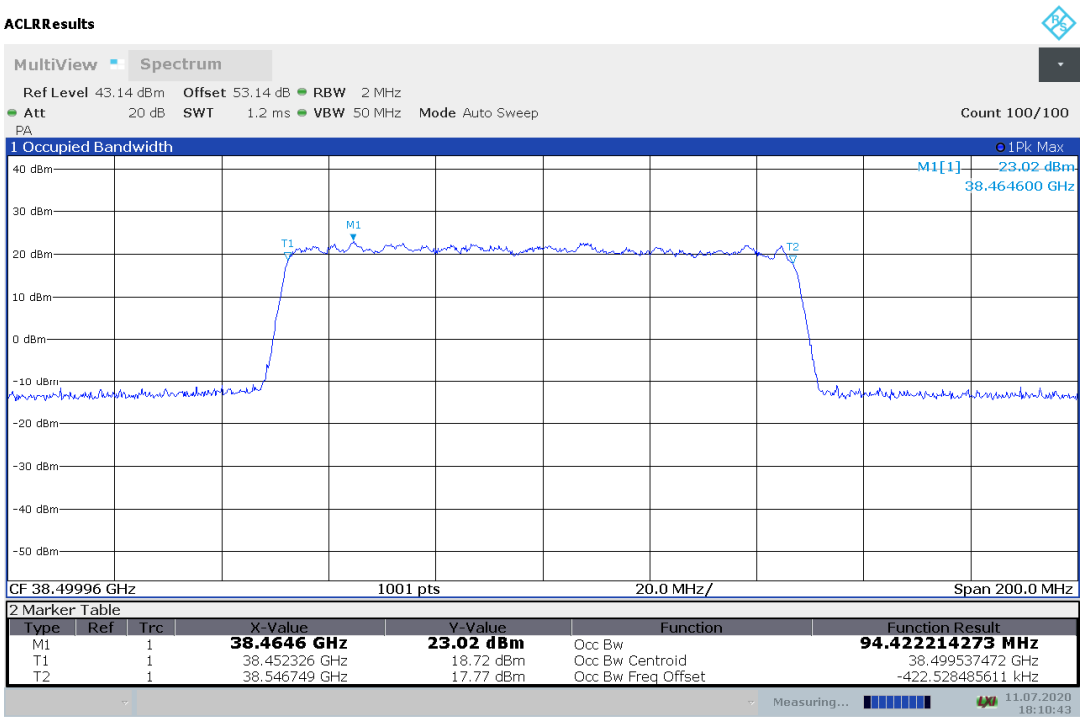
Channel	Bandwidth	CCs Active	Transmission Scheme	Modulation	OBW [MHz]
Mid	100	1	DFTs-s-OFDM	π/2 BPSK	91.82
			CP-OFDM	QPSK	94.42
			CP-OFDM	16QAM	94.53
			CP-OFDM	64QAM	94.52
	50	1	DFTs-s-OFDM	π/2 BPSK	45.39
			CP-OFDM	QPSK	45.95
			CP-OFDM	16QAM	45.82
			CP-OFDM	64QAM	45.89

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



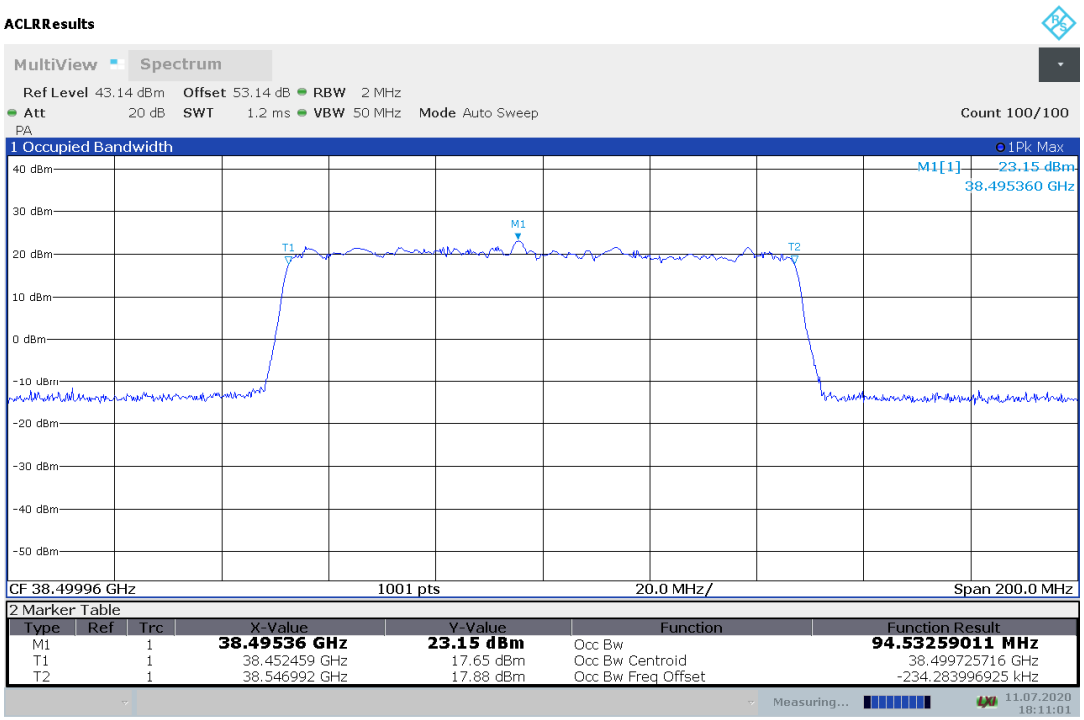
02:47:06 03.07.2020

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



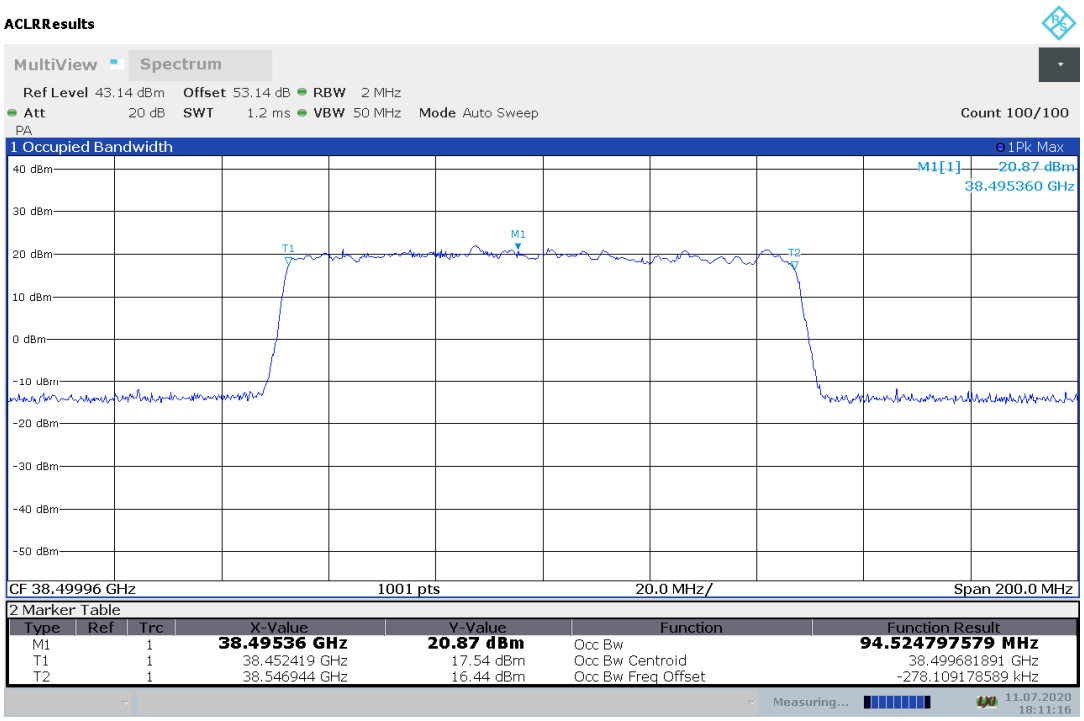
18:10:43 11.07.2020

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



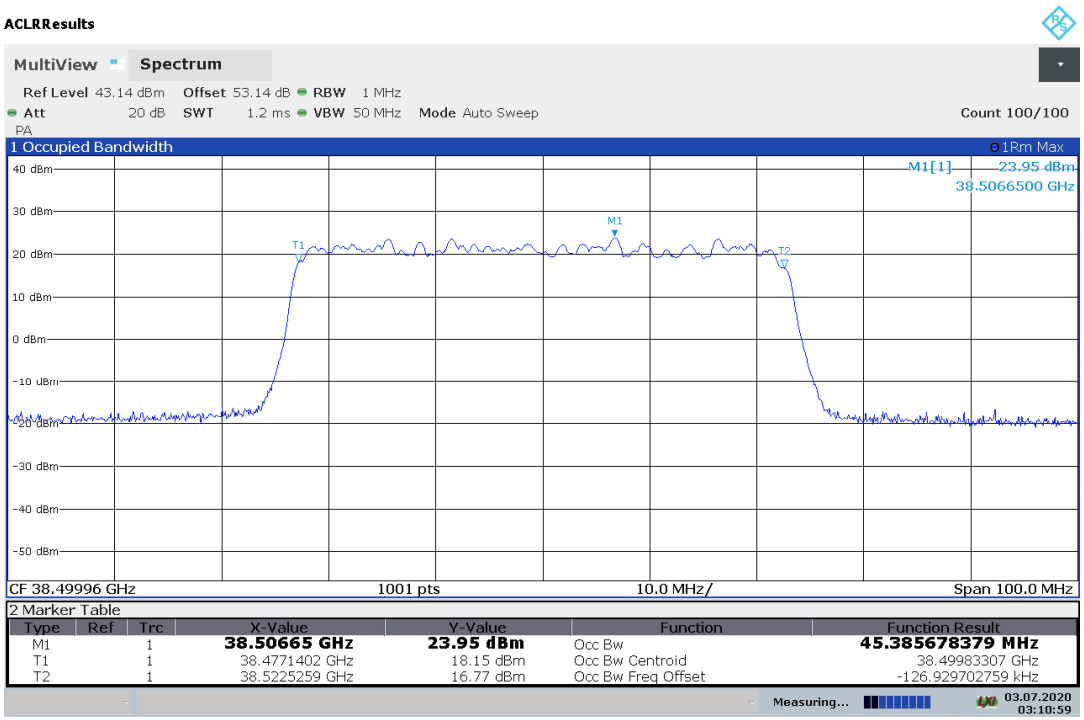
18:11:02 11.07.2020

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



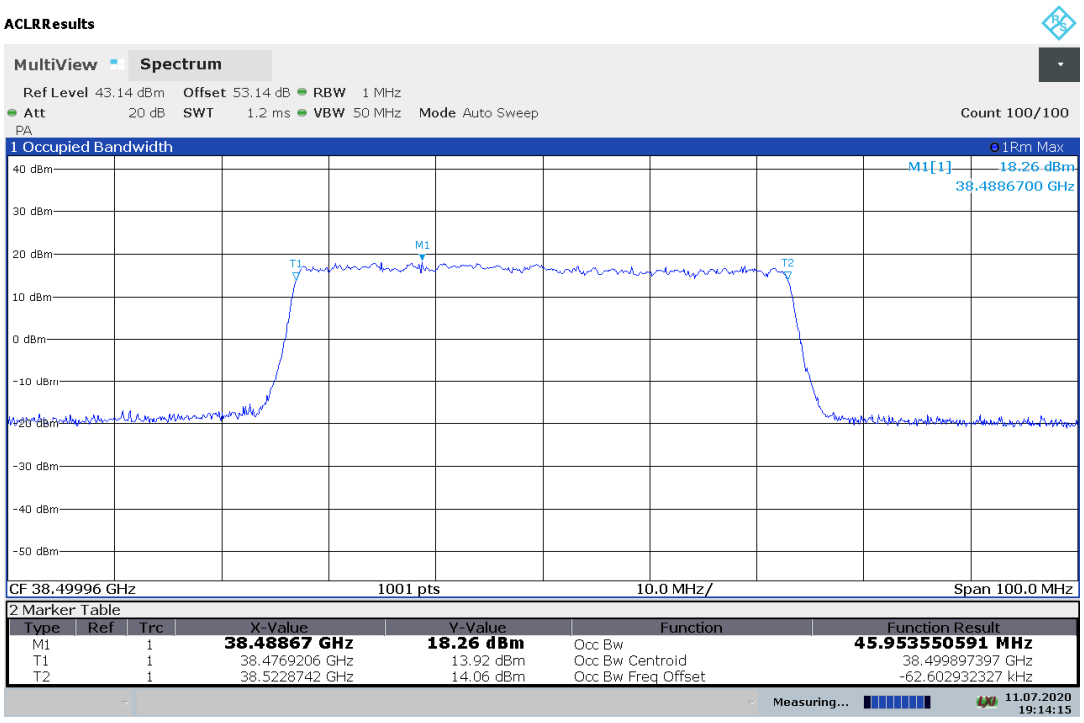
18:11:17 11.07.2020

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



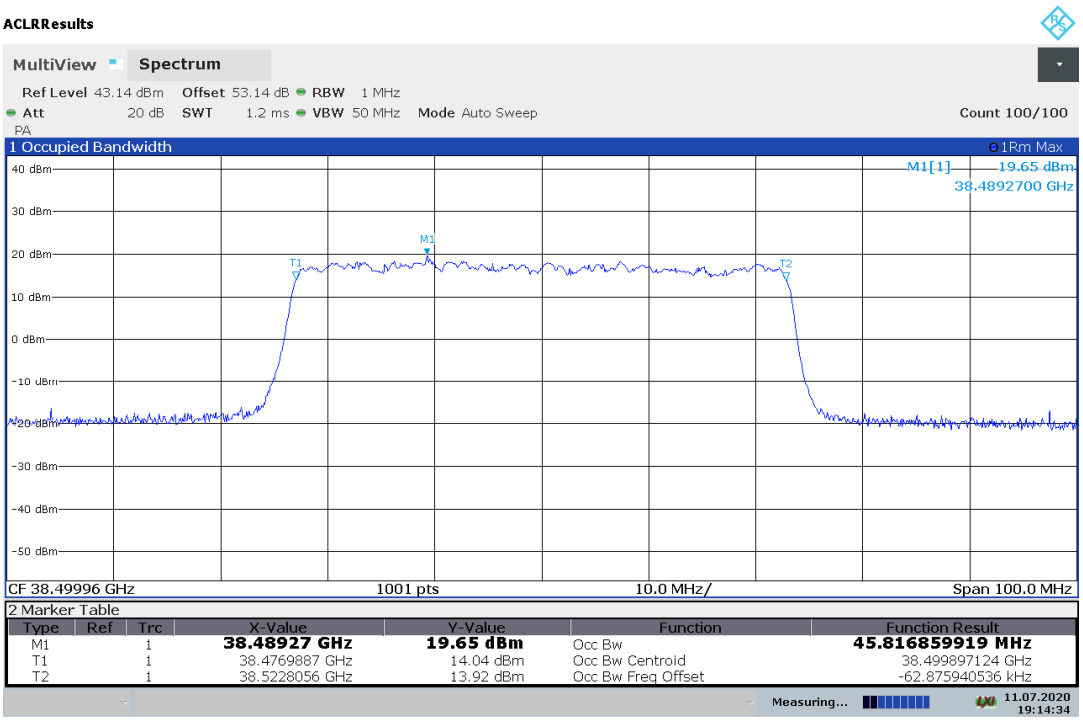
03:11:00 03.07.2020

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



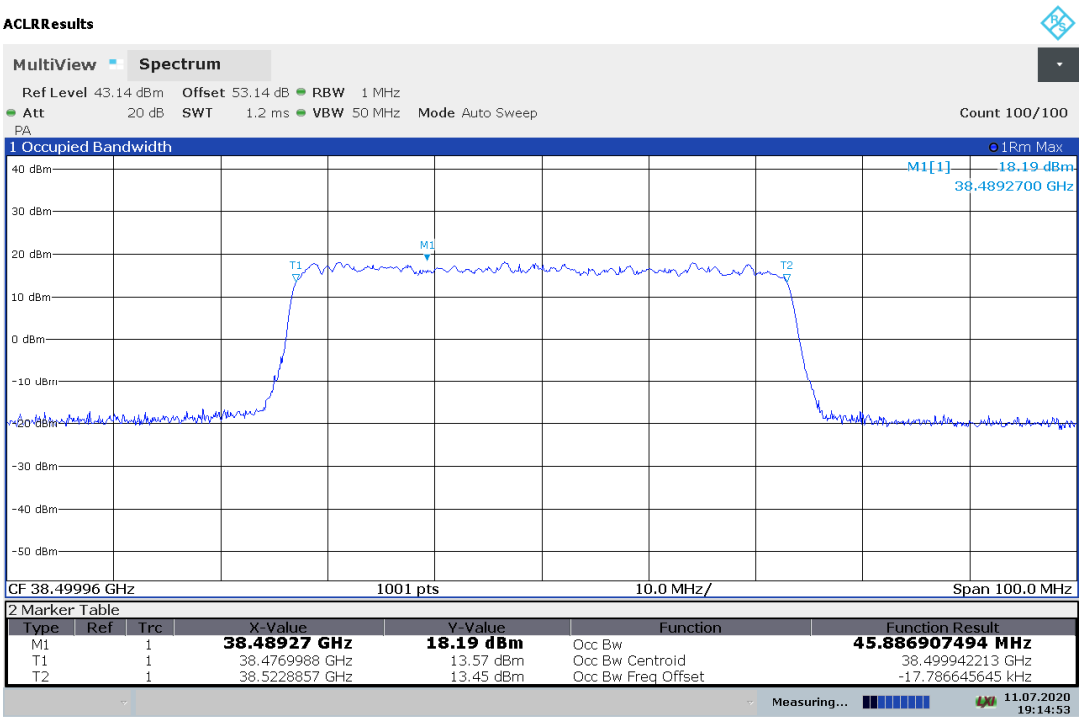
19:14:15 11.07.2020

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



19:14:34 11.07.2020

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



19:14:54 11.07.2020

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.

Band n261 Beam ID Configurations

CCs active	Mode	Beam Polarization	Beam ID
1	SISO	H	159
		V	20
	MIMO/2Tx	H	159
		V	31

Table 7-4. Worst Case Beam ID

Band n261

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	BeamID	Ant. Pol. [H/V]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	RB Size/Offset	EIRP [dBm]
1	27550.08	Low	DFT-s-OFDM	QPSK	H	SISO	20	V	32	205	8/29	43.77
	27550.08	Low	DFT-s-OFDM	QPSK	H+V	2Tx	159+31	H	26	203	8/35	43.75
	27924.96	Mid	DFT-s-OFDM	QPSK	H	SISO	159	V	36	206	8/22	**44.09**
	27924.96	Mid	DFT-s-OFDM	QPSK	V	SISO	20	V	330	173	8/22	43.46
	27924.96	Mid	CP-OFDM	QPSK	H+V	MIMO	159+31	H	32	199	8/29	41.95
	28299.96	High	DFT-s-OFDM	QPSK	H	SISO	159	V	33	203	8/22	43.78
	27924.96	Mid	DFT-s-OFDM	π/2 BPSK	H	SISO	159	V	36	206	8/29	**42.43**
	27924.96	Mid	DFT-s-OFDM	16QAM	H	SISO	159	V	36	206	8/22	**40.25**
	28299.96	High	DFT-s-OFDM	64QAM	V	SISO	20	V	325	173	8/35	**42.04**

Table 7-5. EIRP Data (Band n261 - 100MHz-1CC)

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	BeamID	Ant. Pol. [H/V]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	RB Size/Offset	EIRP [dBm]
1	27525.00	Low	DFT-s-OFDM	QPSK	H	SISO	159	V	37	209	8/12	**43.91**
	27525.00	Low	DFT-s-OFDM	QPSK	V	SISO	20	V	327	173	8/12	43.45
	27525.00	Low	DFT-s-OFDM	QPSK	H+V	2Tx	159+31	H	27	204	8/12	43.57
	27525.00	Low	CP-OFDM	QPSK	H+V	MIMO	159+31	H	36	199	8/12	42.57
	27924.96	Mid	DFT-s-OFDM	QPSK	V	SISO	20	V	325	172	8/12	43.64
	28324.92	High	DFT-s-OFDM	QPSK	V	SISO	20	V	330	173	8/12	41.79
	27924.96	Mid	DFT-s-OFDM	π/2 BPSK	V	SISO	20	V	325	172	8/12	**42.41**
	27924.96	Mid	DFT-s-OFDM	16QAM	H	SISO	159	V	36	205	8/12	**39.78**
	27924.96	Mid	DFT-s-OFDM	64QAM	H	SISO	159	V	36	205	8/12	**38.92**

Table 7-6. EIRP Data (Band n261 - 50MHz-1CC)

Band n260 Beam ID Configurations

CCs active	Mode	Beam Polarization	Beam ID
1	SISO	H	156
		V	19
	2Tx	H	153
		V	25
	MIMO	H	147
		V	19

Table 7-7. Worst Case Beam ID

Band n260

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	BeamID	Ant. Pol. [H/V]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	RB Size/Offset	EIRP [dBm]
1	37050.00	Low	DFT-s-OFDM	QPSK	H+V	2Tx	153+25	H	258	118	8/35	42.95
	38499.96	Mid	DFT-s-OFDM	QPSK	H+V	2Tx	153+25	H	250	178	8/22	43.98
	39966.24	High	DFT-s-OFDM	QPSK	H+V	2Tx	153+25	H	248	183	8/29	**44.11**
	39966.24	High	DFT-s-OFDM	QPSK	H	SISO	156	H	303	159	8/35	43.78
	39966.24	High	DFT-s-OFDM	QPSK	V	SISO	19	H	57	182	8/35	42.13
	39966.24	High	CP-OFDM	QPSK	H+V	MIMO	147+19	H	38	171	8/35	42.12
	39966.24	High	DFT-s-OFDM	π/2 BPSK	MIMO	2Tx	153+25	H	248	183	8/29	44.07
	39966.24	High	DFT-s-OFDM	16QAM	MIMO	2Tx	153+25	H	248	183	8/35	41.82
	39966.24	High	DFT-s-OFDM	64QAM	MIMO	2Tx	153+25	H	248	183	8/29	**40.85**

Table 7-8. EIRP Data (Band n260 - 100MHz-1CC)

CCs active	Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	BeamID	Ant. Pol. [H/V]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	RB Size/Offset	EIRP [dBm]
1	37051.80	Low	DFT-s-OFDM	QPSK	H	SISO	156	H	301	158	8/12	42.81
	38498.88	Mid	DFT-s-OFDM	QPSK	H	SISO	156	H	303	158	8/12	43.50
	39949.92	High	DFT-s-OFDM	QPSK	H	SISO	156	H	305	158	8/12	**44.03**
	39949.92	High	DFT-s-OFDM	QPSK	V	SISO	19	H	49	181	8/12	42.28
	39949.92	High	DFT-s-OFDM	π/2 BPSK	H+V	2Tx	153+25	H	249	289	8/12	43.85
	38499.96	High	CP-OFDM	QPSK	H+V	MIMO	147+19	H	27	173	8/12	42.61
	39949.92	High	DFT-s-OFDM	π/2 BPSK	H	SISO	156	H	305	158	8/12	**43.06**
	39949.92	High	DFT-s-OFDM	16QAM	H	SISO	156	H	305	158	8/12	**39.80**
	39949.92	High	DFT-s-OFDM	64QAM	H	SISO	156	H	305	158	8/12	**38.87**

Table 7-9. 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 7-10. 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.

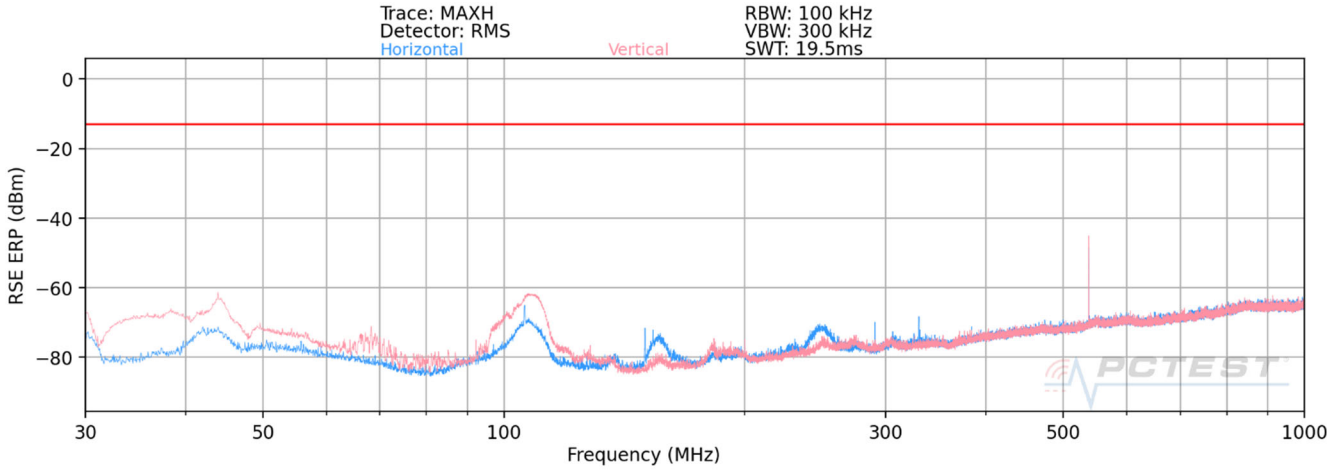
8) The "-" shown in the following RSE tables are used to denote a noise floor measurement.

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.

Band n261

30MHz - 1GHz



Plot 7-17. Ant 1- 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

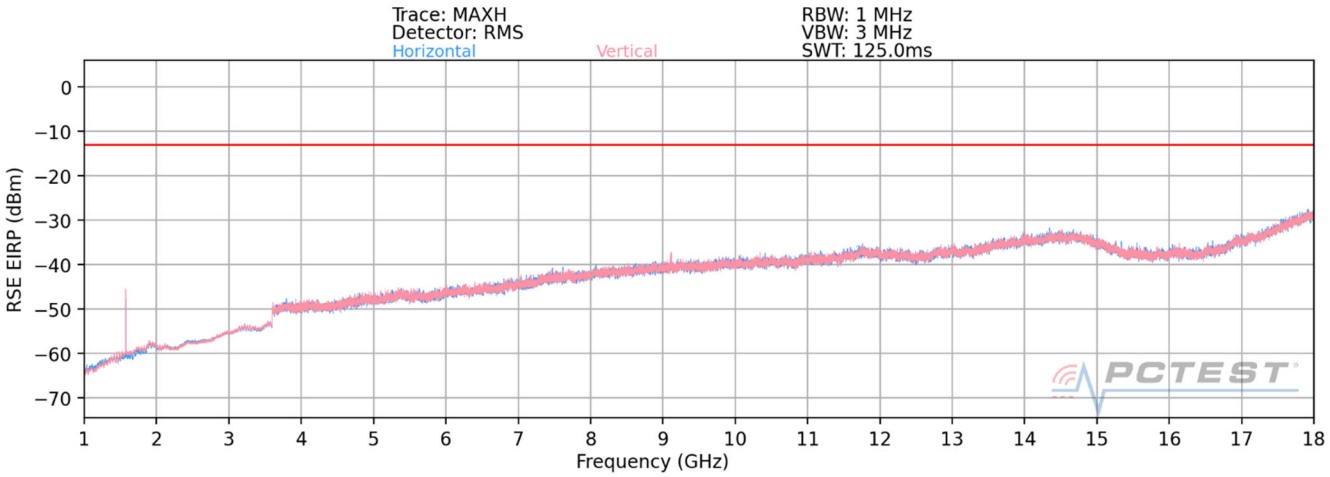
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
550.40	Low	50	H	QPSK	V	102	232	-45.08	-13.00	-32.08
550.40	Low	50	V	QPSK	V	10	181	-46.61	-13.00	-33.61
550.40	Low	50	H + V	QPSK	V	106	286	-39.69	-13.00	-26.69
537.60	Mid	50	H	QPSK	V	106	292	-42.06	-13.00	-29.06
537.60	Mid	50	V	QPSK	V	105	292	-42.30	-13.00	-29.30
537.61	Mid	50	H + V	QPSK	V	102	9	-38.96	-13.00	-25.96
537.60	High	50	H	QPSK	V	110	287	-41.76	-13.00	-28.76
537.60	High	50	V	QPSK	V	102	287	-39.72	-13.00	-26.72
537.61	High	50	H + V	QPSK	V	102	293	-39.96	-13.00	-26.96

Table 7-11. - SISO -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 7-18. Ant 1-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

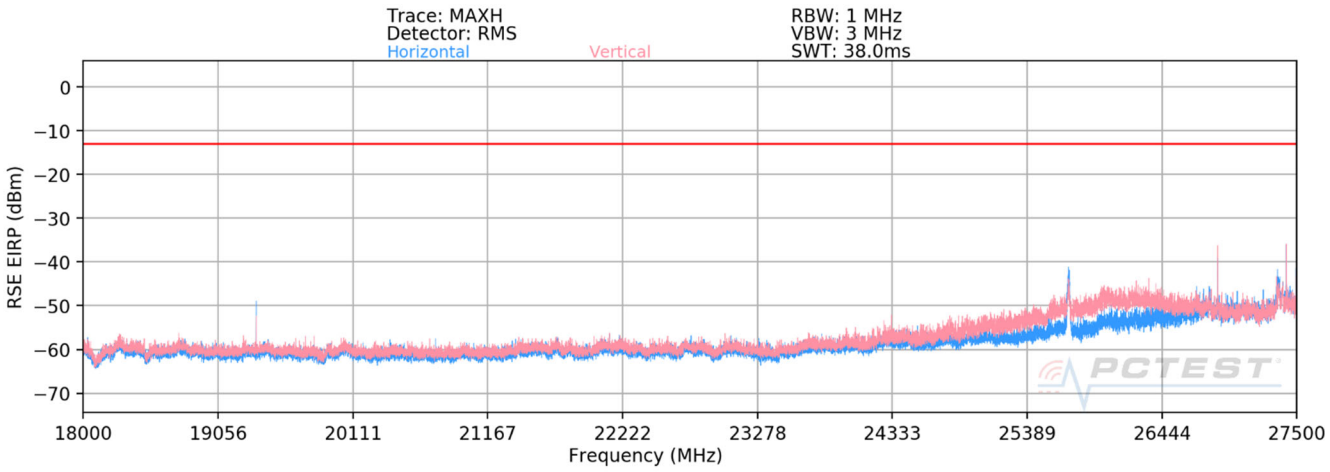
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1651.19	Low	50	H	QPSK	V	339	187	-67.61	-13.00	-54.61
1651.19	Low	50	V	QPSK	V	343	157	-68.74	-13.00	-55.74
1689.67	Low	50	H + V	QPSK	V	315	112	-58.20	-13.00	-45.20
1612.83	Mid	50	H	QPSK	V	340	117	-63.02	-13.00	-50.02
1612.80	Mid	50	V	QPSK	V	359	321	-64.90	-13.00	-51.90
1612.87	Mid	50	H + V	QPSK	V	340	112	-53.31	-13.00	-40.31
1612.81	High	50	H	QPSK	V	354	111	-62.46	-13.00	-49.46
1612.88	High	50	V	QPSK	V	328	111	-62.79	-13.00	-49.79
1612.77	High	50	H + V	QPSK	V	332	135	-56.67	-13.00	-43.67

Table 7-12. - SISO -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. Ant 1-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

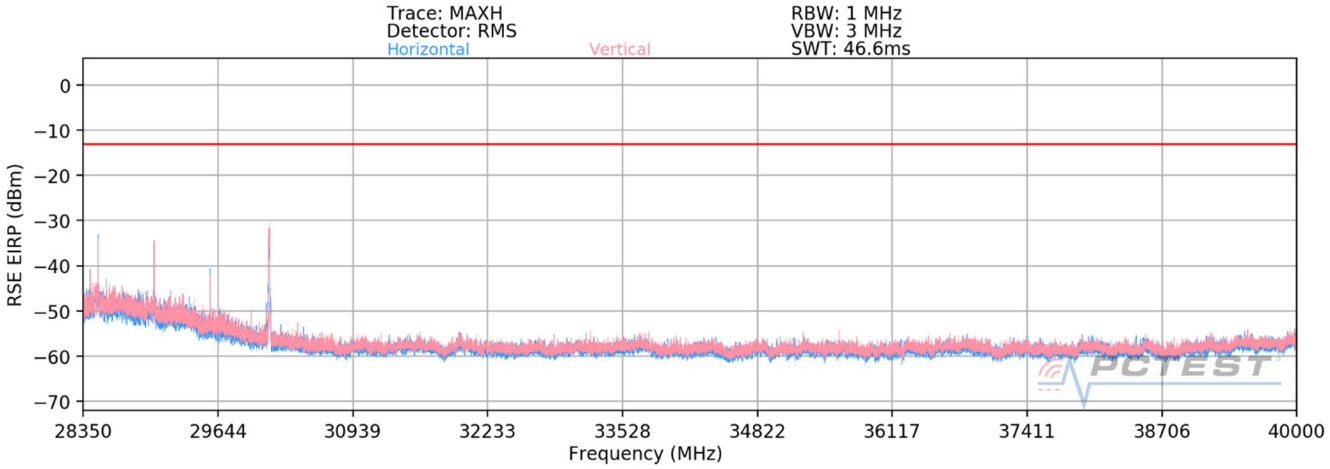
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
27367.59	Low	50	H	QPSK	V	150	95	-39.18	-13.00	-26.18
27367.58	Low	50	V	QPSK	V	150	84	-33.27	-13.00	-20.27
27367.63	Low	50	H + V	QPSK	V	150	93	-34.21	-13.00	-21.21
27379.04	Mid	50	H	QPSK	V	150	172	-46.80	-13.00	-33.80
27385.54	Mid	50	V	QPSK	V	150	122	-48.70	-13.00	-35.70
27899.10	Mid	50	H + V	QPSK	V	150	137	-50.45	-13.00	-37.45
27340.79	High	50	H	QPSK	V	150	114	-51.57	-13.00	-38.57
27340.77	High	50	V	QPSK	V	150	108	-49.80	-13.00	-36.80
27340.76	High	50	H + V	QPSK	V	150	171	-48.91	-13.00	-35.91

Table 7-13. - SISO -Spurious Emissions Table (18GHz - 27.5GHz)

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.

28.35GHz - 40GHz



Plot 7-20. Ant 1-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

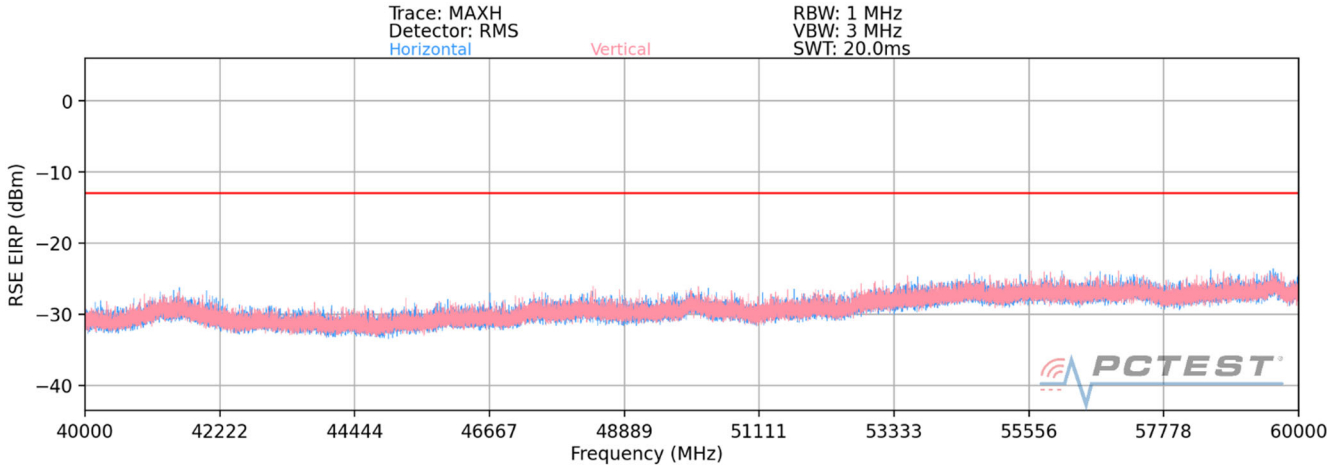
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
30272.48	Low	50	H	QPSK	H	150	96	-57.79	-13.00	-44.79
30272.36	Low	50	V	QPSK	V	150	108	-55.77	-13.00	-42.77
30272.95	Low	50	H + V	QPSK	V	150	208	-59.41	-13.00	-46.41
30132.52	Mid	50	H	QPSK	H	150	129	-37.53	-13.00	-24.53
30132.47	Mid	50	V	QPSK	V	150	87	-28.63	-13.00	-15.63
30134.10	Mid	50	H + V	QPSK	V	150	156	-34.53	-13.00	-21.53
30105.75	High	50	H	QPSK	H	150	50	-56.03	-13.00	-43.03
30105.87	High	50	V	QPSK	V	150	217	-56.05	-13.00	-43.05
30106.38	High	50	H + V	QPSK	V	150	214	-53.45	-13.00	-40.45

Table 7-14. - SISO -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. Ant 1-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]

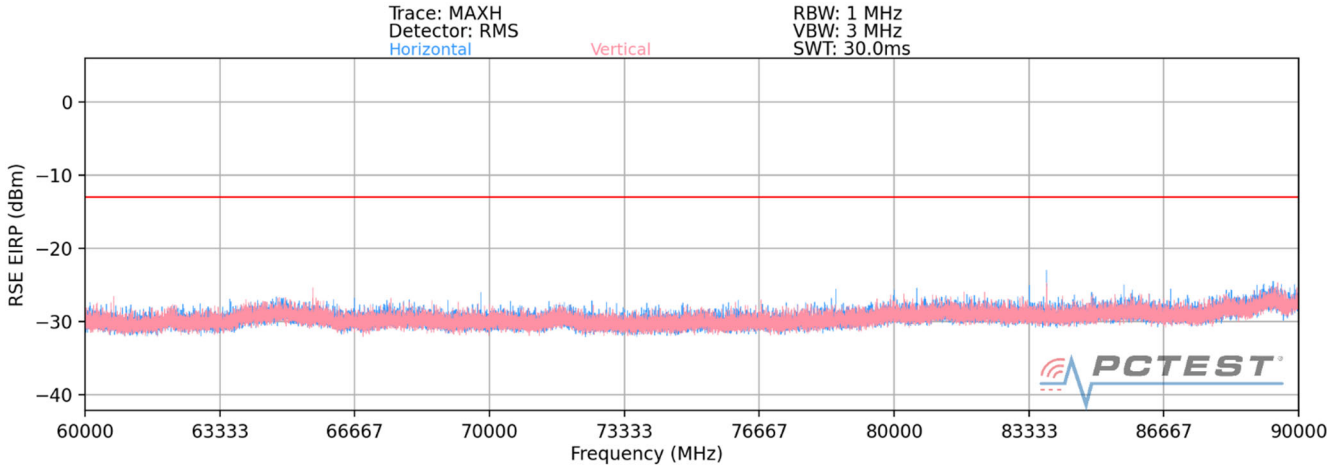
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
55050.63	Low	50	H	QPSK	V	201	163	-29.77	-13.00	-16.77
55050.03	Low	50	V	QPSK	V	359	232	-25.10	-13.00	-12.10
55050.09	Low	50	H + V	QPSK	V	110	191	-39.09	-13.00	-26.09
55851.63	Mid	50	H	QPSK	V	211	162	-29.99	-13.00	-16.99
55850.76	Mid	50	V	QPSK	V	0	149	-22.33	-13.00	-9.33
55849.74	Mid	50	H + V	QPSK	V	205	160	-24.52	-13.00	-11.52
56650.62	High	50	H	QPSK	V	15	217	-23.72	-13.00	-10.72
56650.47	High	50	V	QPSK	V	182	173	-26.41	-13.00	-13.41
56649.57	High	50	H + V	QPSK	V	15	214	-25.33	-13.00	-12.33

Table 7-15. - SISO -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. Ant 1-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]

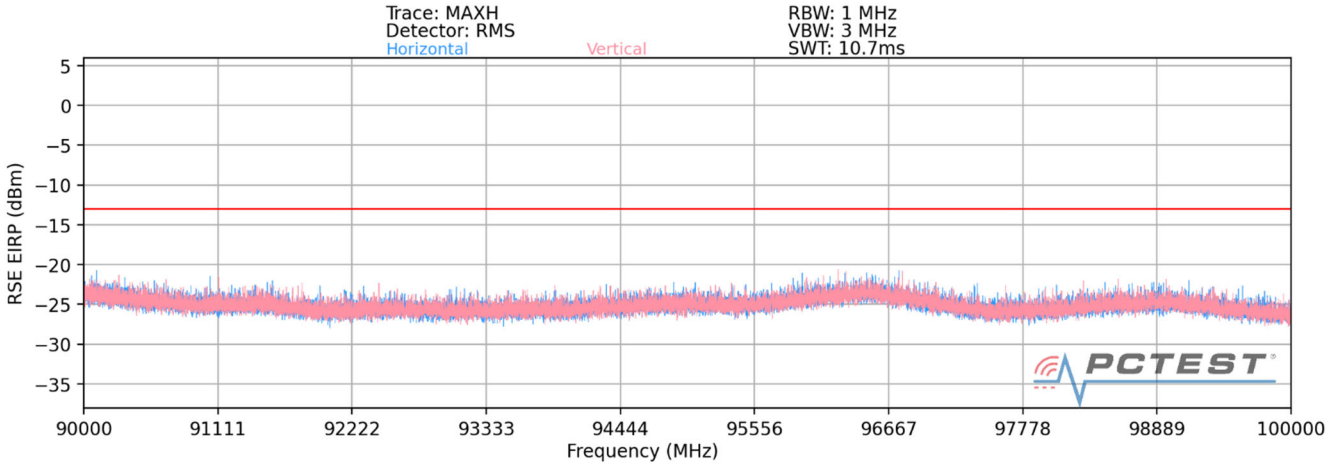
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
82573.83	Low	50	H	QPSK	H	121	139	-31.17	-13.00	-18.17
82573.98	Low	50	V	QPSK	V	3	219	-23.54	-13.00	-10.54
82575.00	Low	50	H + V	QPSK	H	163	214	-32.93	-13.00	-19.93
83771.66	Mid	50	H	QPSK	H	331	152	-28.69	-13.00	-15.69
83773.67	Mid	50	V	QPSK	V	3	222	-22.88	-13.00	-9.88
83775.53	Mid	50	H + V	QPSK	H	336	145	-33.24	-13.00	-20.24
849736.92	High	50	H	QPSK	H	131	195	-34.32	-13.00	-21.32
84972.93	High	50	V	QPSK	V	0	219	-32.38	-13.00	-19.38
84974.46	High	50	H + V	QPSK	H	337	147	-37.26	-13.00	-24.26

Table 7-16. - SISO -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. Ant 1-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	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
96248.50	Low	50	H	QPSK	H	-	-	-20.41	-13.00	-7.41
96266.15	Low	50	V	QPSK	H	-	-	-20.16	-13.00	-7.16
96230.15	Low	50	H + V	QPSK	H	-	-	-20.16	-13.00	-7.16
96248.18	Mid	50	H	QPSK	H	-	-	-20.50	-13.00	-7.50
96213.33	Mid	50	V	QPSK	H	-	-	-20.37	-13.00	-7.37
96214.61	Mid	50	H + V	QPSK	H	-	-	-20.50	-13.00	-7.50
96224.92	High	50	H	QPSK	H	-	-	-20.38	-13.00	-7.38
96248.42	High	50	V	QPSK	H	-	-	-20.30	-13.00	-7.30
96295.59	High	50	H + V	QPSK	H	-	-	-20.17	-13.00	-7.17

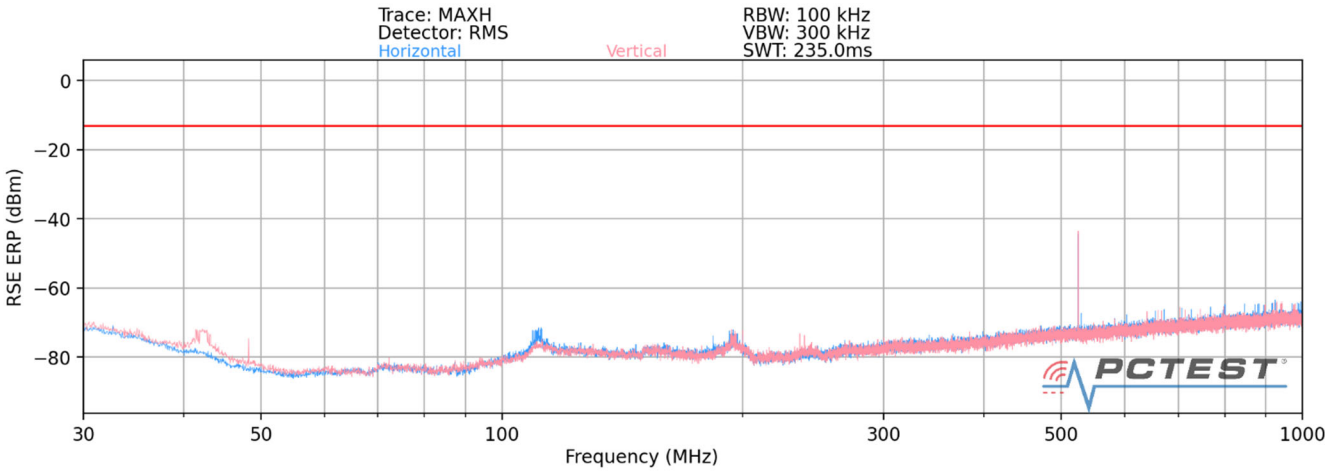
Table 7-17. - SISO -Spurious Emissions Table (90GHz - 100GHz)

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. Ant 1-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

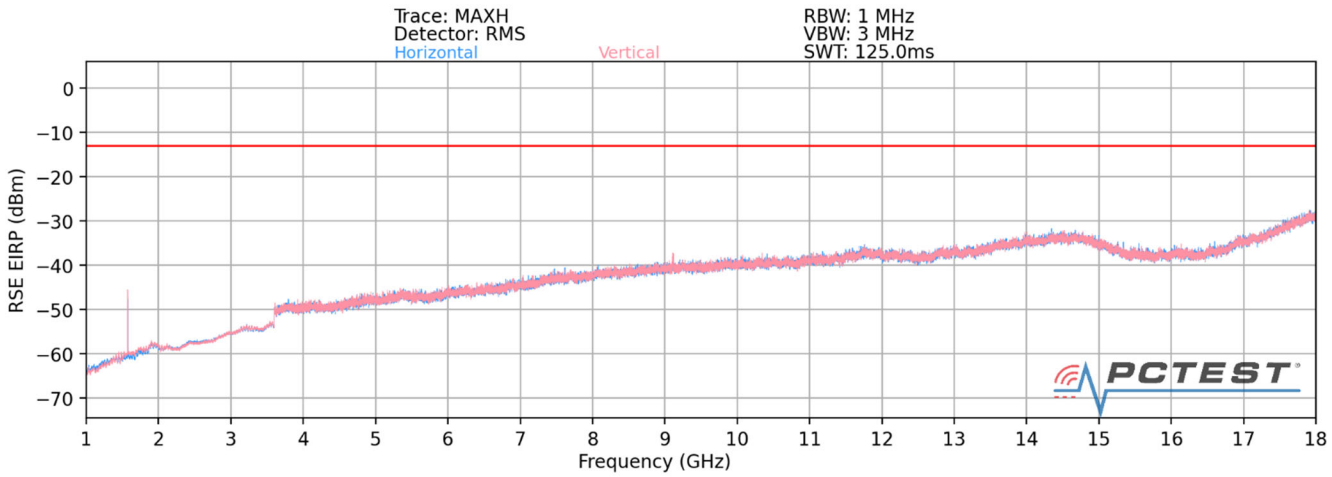
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
550.40	Low	50	H	QPSK	V	188	337	-45.84	-13.00	-32.84
550.40	Low	50	V	QPSK	V	102	38	-46.85	-13.00	-33.85
550.40	Low	50	H + V	QPSK	V	102	46	-44.60	-13.00	-31.60
524.79	Mid	50	H	QPSK	V	183	156	-36.90	-13.00	-23.90
524.80	Mid	50	V	QPSK	V	125	295	-36.38	-13.00	-23.38
524.80	Mid	50	H + V	QPSK	V	102	164	-38.92	-13.00	-25.92
550.40	High	50	H	QPSK	V	104	46	-44.62	-13.00	-31.62
550.40	High	50	V	QPSK	V	106	40	-46.21	-13.00	-33.21
550.40	High	50	H + V	QPSK	V	104	48	-49.38	-13.00	-36.38

Table 7-18. - MIMO -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. Ant 1-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

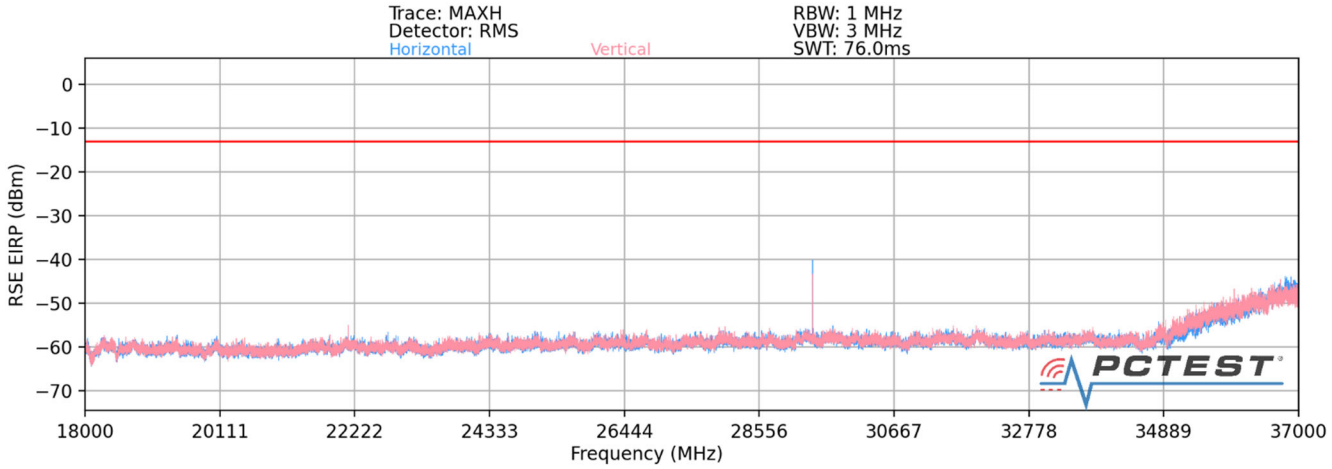
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
1651.18	Low	50	H	QPSK	V	121	354	-55.38	-13.00	-42.38
1651.13	Low	50	V	QPSK	V	116	323	-55.47	-13.00	-42.47
1651.23	Low	50	H + V	QPSK	V	305	40	-55.76	-13.00	-42.76
1574.40	Mid	50	H	QPSK	V	164	355	-44.05	-13.00	-31.05
1574.40	Mid	50	V	QPSK	V	113	352	-45.17	-13.00	-32.17
1574.40	Mid	50	H + V	QPSK	V	112	329	-45.31	-13.00	-32.31
1651.18	High	50	H	QPSK	V	111	2	-55.60	-13.00	-42.60
1651.08	High	50	V	QPSK	V	114	327	-55.90	-13.00	-42.90
1651.23	High	50	H + V	QPSK	V	115	339	-55.19	-13.00	-42.19

Table 7-19. - MIMO -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 – 37GHz



Plot 7-26. Ant 1-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

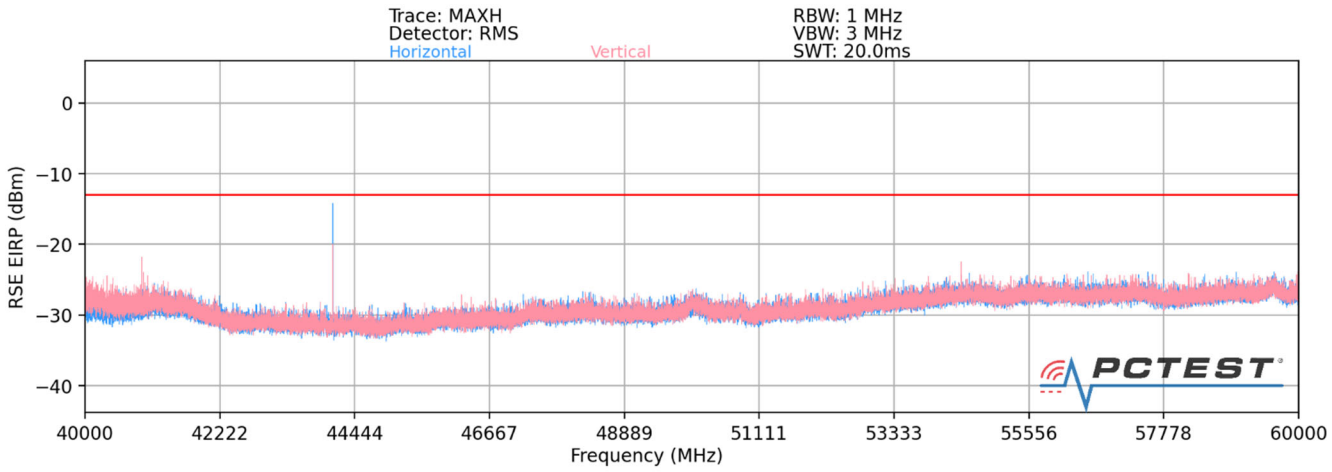
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Antenna Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
28620.63	Low	50	H	QPSK	H	150	231	-52.64	-13.00	-39.64
28620.63	Low	50	V	QPSK	H	150	104	-48.63	-13.00	-35.63
28620.75	Low	50	H + V	QPSK	H	150	272	-53.63	-13.00	-40.63
29388.68	Mid	50	H	QPSK	H	150	176	-45.75	-13.00	-32.75
29388.68	Mid	50	V	QPSK	H	150	170	-49.71	-13.00	-36.71
29388.68	Mid	50	H + V	QPSK	H	150	93	-38.55	-13.00	-25.55
29423.70	High	50	H	QPSK	H	150	46	-61.54	-13.00	-48.54
29423.67	High	50	V	QPSK	H	150	202	-58.81	-13.00	-45.81
29423.90	High	50	H + V	QPSK	H	150	57	-59.39	-13.00	-46.39

Table 7-20. - MIMO -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. Ant 1-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]

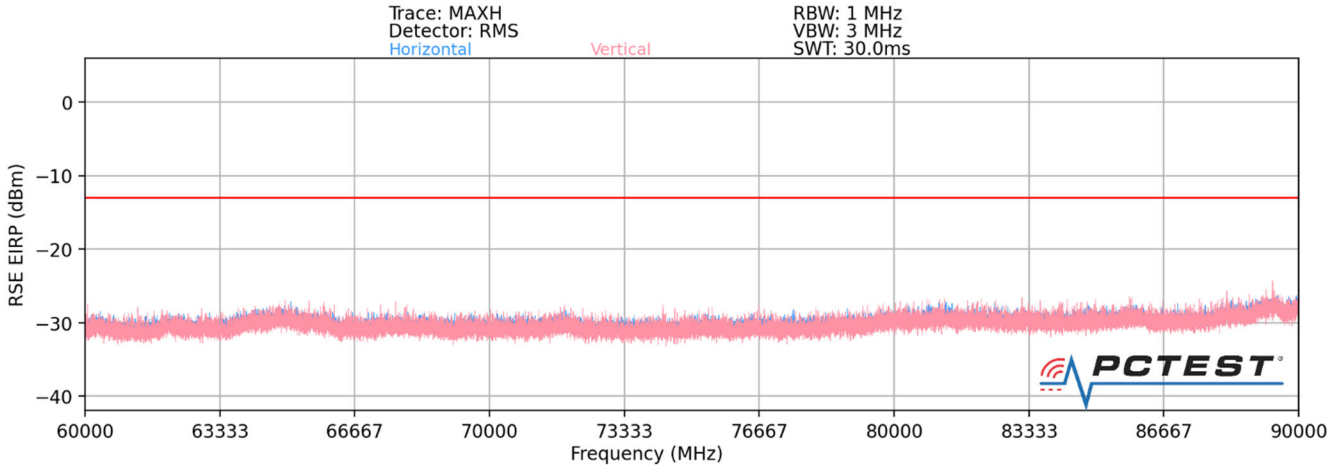
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
42931.25	Low	50	H	QPSK	V	340	211	-24.50	-13.00	-11.50
42931.15	Low	50	V	QPSK	V	311	181	-22.81	-13.00	-9.81
42931.59	Low	50	H + V	QPSK	H	301	219	-21.64	-13.00	-8.64
44083.31	Mid	50	H	QPSK	V	56	222	-29.25	-13.00	-16.25
44083.45	Mid	50	V	QPSK	V	358	222	-32.03	-13.00	-19.03
46233.70	High	50	H	QPSK	V	345	200	-32.33	-13.00	-19.33
44083.40	Mid	50	H + V	QPSK	H	83	229	-22.13	-13.00	-9.13
46233.50	High	50	V	QPSK	V	1	204	-30.46	-13.00	-17.46
46233.51	High	50	H + V	QPSK	H	12	189	-28.70	-13.00	-15.70

Table 7-21. - MIMO -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. Ant 1-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]

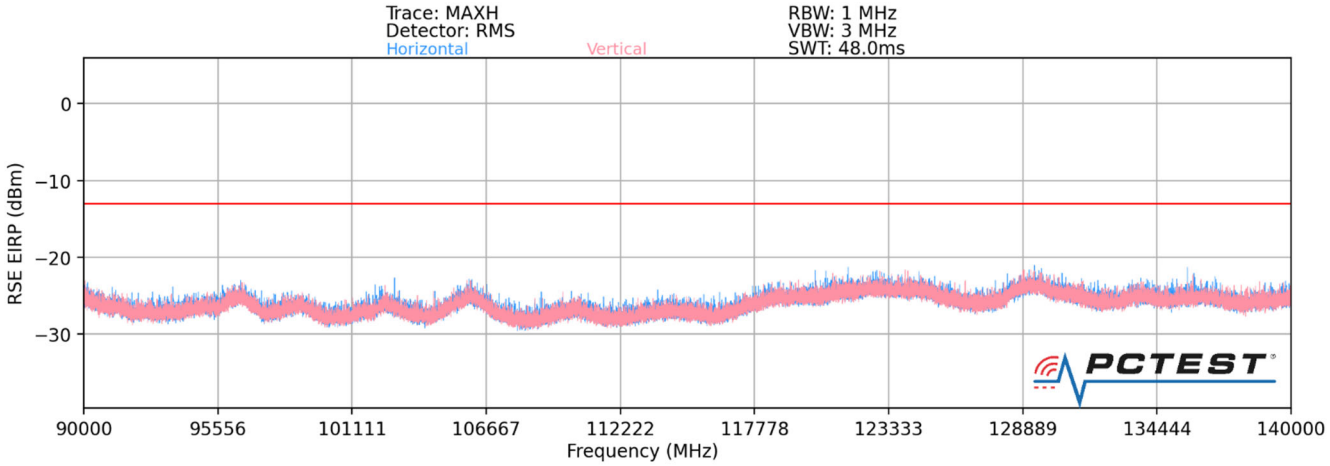
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
74065.29	Low	50	H	QPSK	H	245	315	-45.14	-13.00	-32.14
74056.17	Low	50	V	QPSK	H	0	148	-44.16	-13.00	-31.16
74051.07	Low	50	H + V	QPSK	H	243	300	-45.02	-13.00	-32.02
77001.51	Mid	50	H	QPSK	H	13	154	-45.41	-13.00	-32.41
77001.45	Mid	50	V	QPSK	H	155	176	-44.28	-13.00	-31.28
77001.39	Mid	50	H + V	QPSK	H	157	253	-45.03	-13.00	-32.03
79945.92	High	50	H	QPSK	H	162	212	-42.49	-13.00	-29.49
79952.25	High	50	V	QPSK	H	0	228	-42.92	-13.00	-29.92
79954.38	High	50	H + V	QPSK	H	348	321	-45.79	-13.00	-32.79

Table 7-22. - MIMO -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. Ant 1-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]

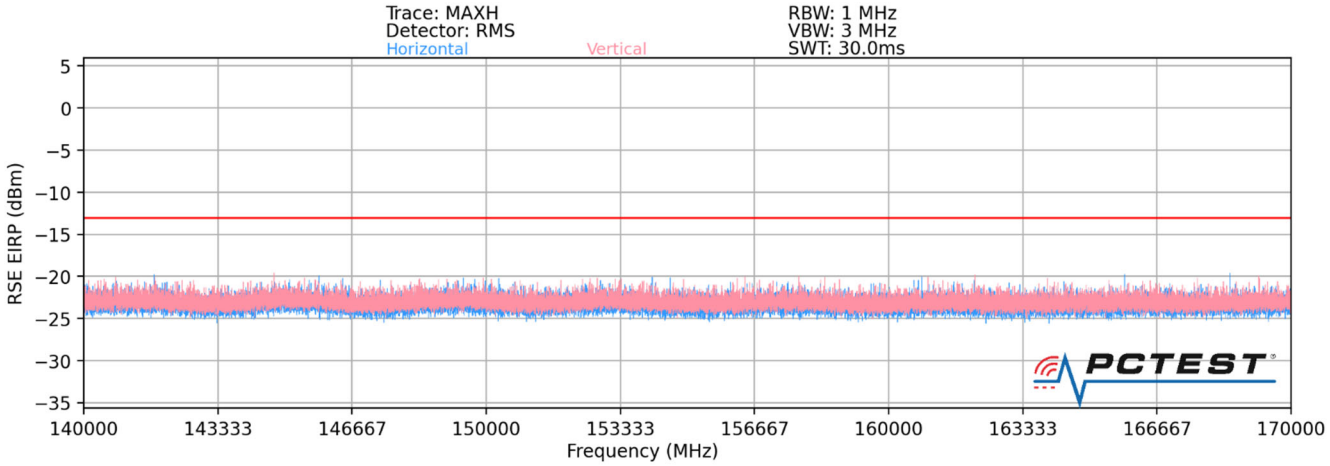
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
111074.10	Low	50	H	QPSK	H	-	-	-43.28	-13.00	-30.28
111080.16	Low	50	V	QPSK	H	-	-	-43.46	-13.00	-30.46
111090.42	Low	50	H + V	QPSK	H	-	-	-43.19	-13.00	-30.19
115503.20	Mid	50	H	QPSK	H	-	-	-43.03	-13.00	-30.03
115499.81	Mid	50	V	QPSK	H	-	-	-42.97	-13.00	-29.97
115497.02	Mid	50	H + V	QPSK	H	-	-	-43.18	-13.00	-30.18
119930.19	High	50	H	QPSK	H	-	-	-40.63	-13.00	-27.63
119929.47	High	50	V	QPSK	H	-	-	-40.68	-13.00	-27.68
119.916.33	High	50	H + V	QPSK	H	-	-	-41.00	-13.00	-28.00

Table 7-23. - MIMO -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. Ant 1-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]

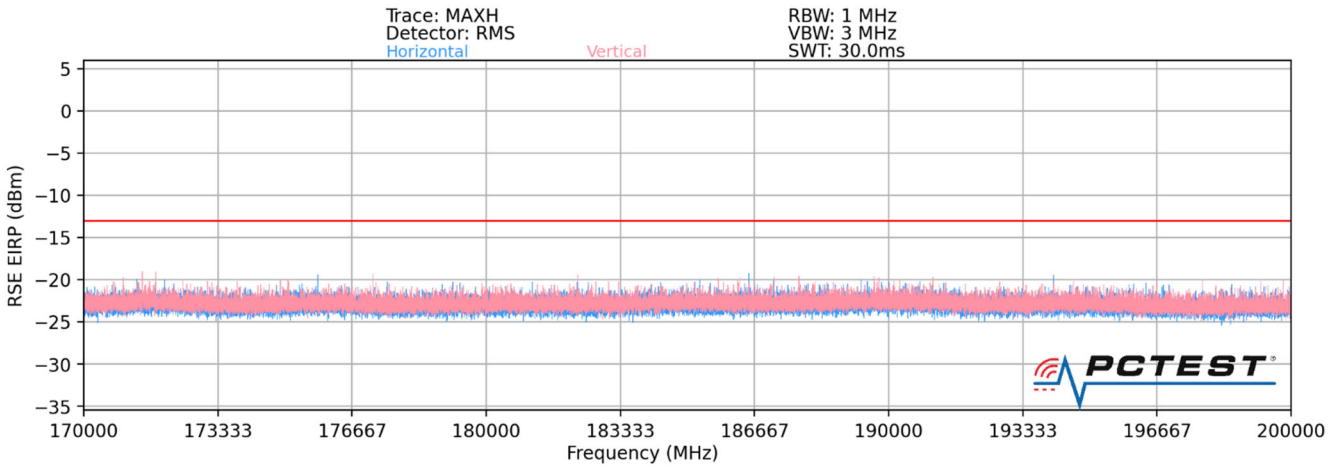
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
148089.12	Low	50	H	QPSK	V	-	-	-40.19	-13.00	-27.19
148116.27	Low	50	V	QPSK	V	-	-	-40.26	-13.00	-27.26
148110.36	Low	50	H + V	QPSK	V	-	-	-41.48	-13.00	-28.48
153991.02	Mid	50	H	QPSK	V	-	-	-39.93	-13.00	-26.93
153991.08	Mid	50	V	QPSK	V	-	-	-41.84	-13.00	-28.84
154005.42	Mid	50	H + V	QPSK	V	-	-	-40.99	-13.00	-27.99
159895.59	High	50	H	QPSK	V	-	-	-40.41	-13.00	-27.41
159899.52	High	50	V	QPSK	V	-	-	-40.47	-13.00	-27.47
159891.00	High	50	H + V	QPSK	V	-	-	-41.52	-13.00	-28.52

Table 7-24. - MIMO -Spurious Emissions Table (140GHz - 170GHz)

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.

170GHz - 200GHz



Plot 7-31. Ant 1-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	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Positioner Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
185114.76	Low	50	H	QPSK	H	-	-	-40.05	-13.00	-27.05
185139.99	Low	50	V	QPSK	H	-	-	-40.02	-13.00	-27.02
185119.47	Low	50	H + V	QPSK	H	-	-	-40.25	-13.00	-27.25
192500.93	Mid	50	H	QPSK	H	-	-	-40.36	-13.00	-27.36
192500.45	Mid	50	V	QPSK	H	-	-	-40.38	-13.00	-27.38
192493.91	Mid	50	H + V	QPSK	H	-	-	-40.91	-13.00	-27.91
199889.58	High	50	H	QPSK	H	-	-	-40.46	-13.00	-27.46
199871.73	High	50	V	QPSK	H	-	-	-40.28	-13.00	-27.28
199883.94	High	50	H + V	QPSK	H	-	-	-40.51	-13.00	-27.51

Table 7-25. - MIMO -Spurious Emissions Table (170GHz - 200GHz)

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.

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

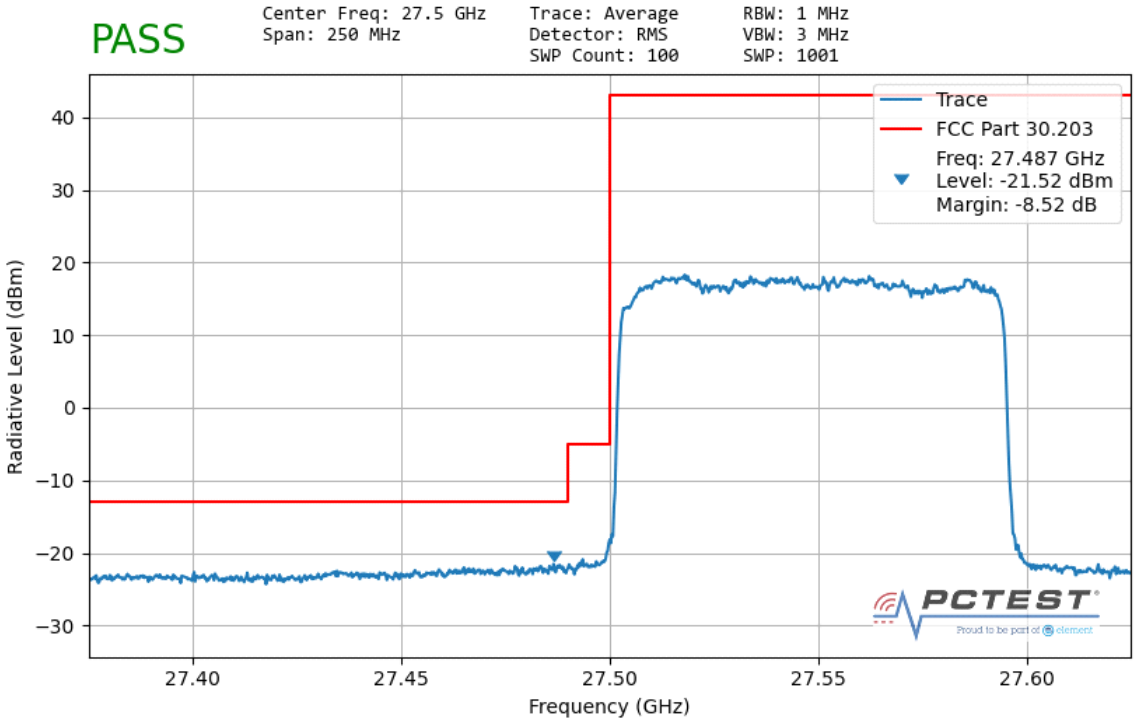
= 40.70dB/m + 8.82dB + 107 + $20\log_{10}(1m)$ – 104.8dB

= 51.72dB

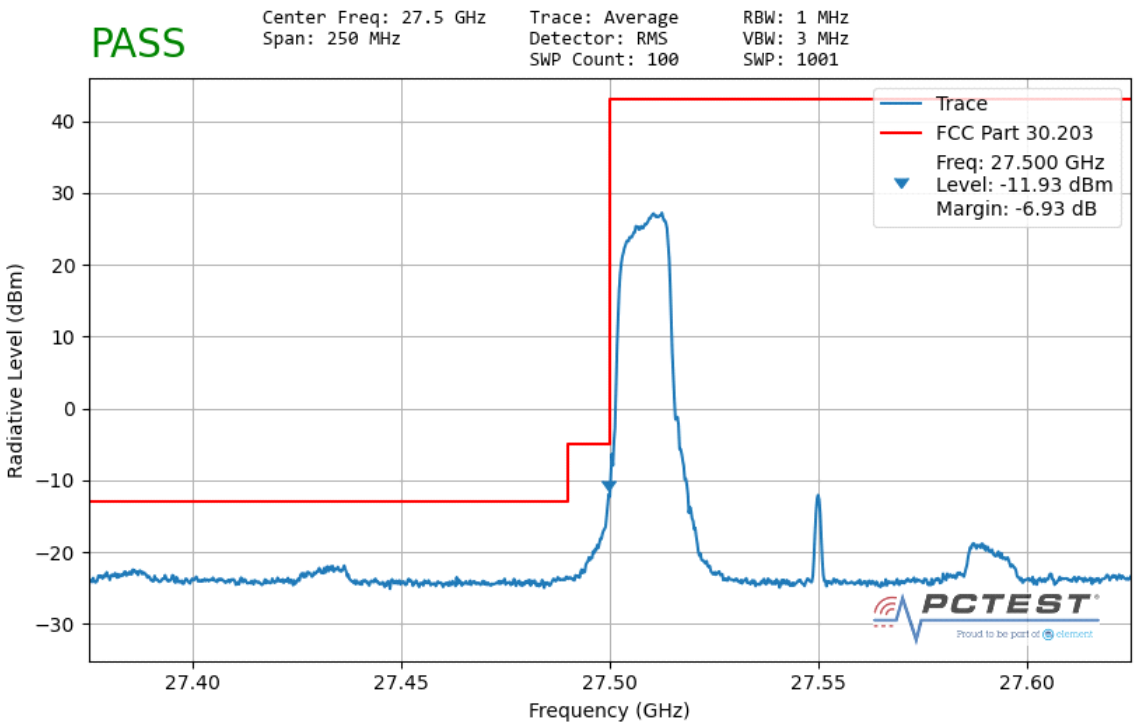
Note:

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.

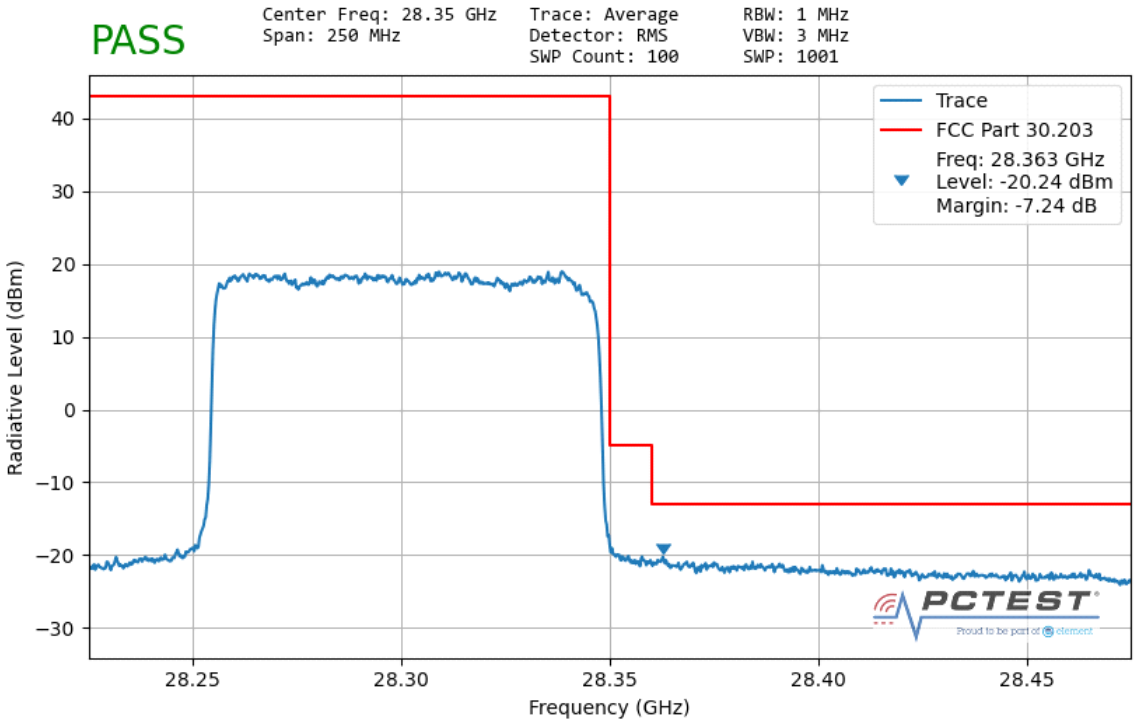
Band n261 – Worst-Case



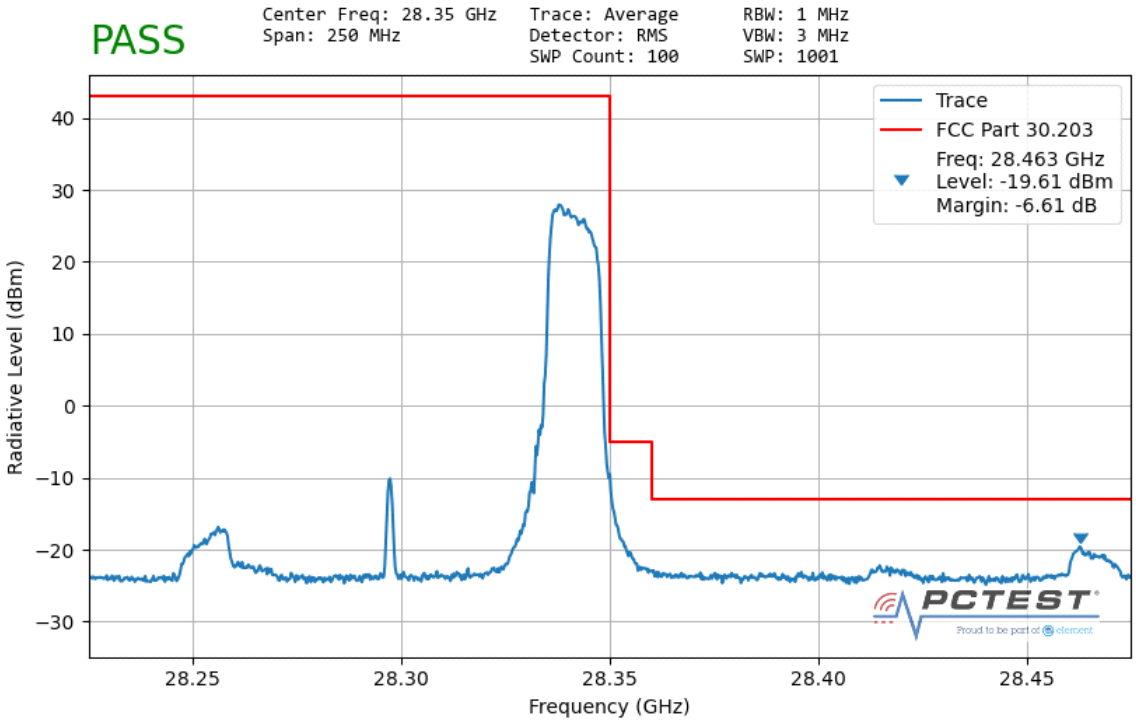
Plot 7-32. Lower Band Edge (100MHz-1CC – QPSK Full RB)



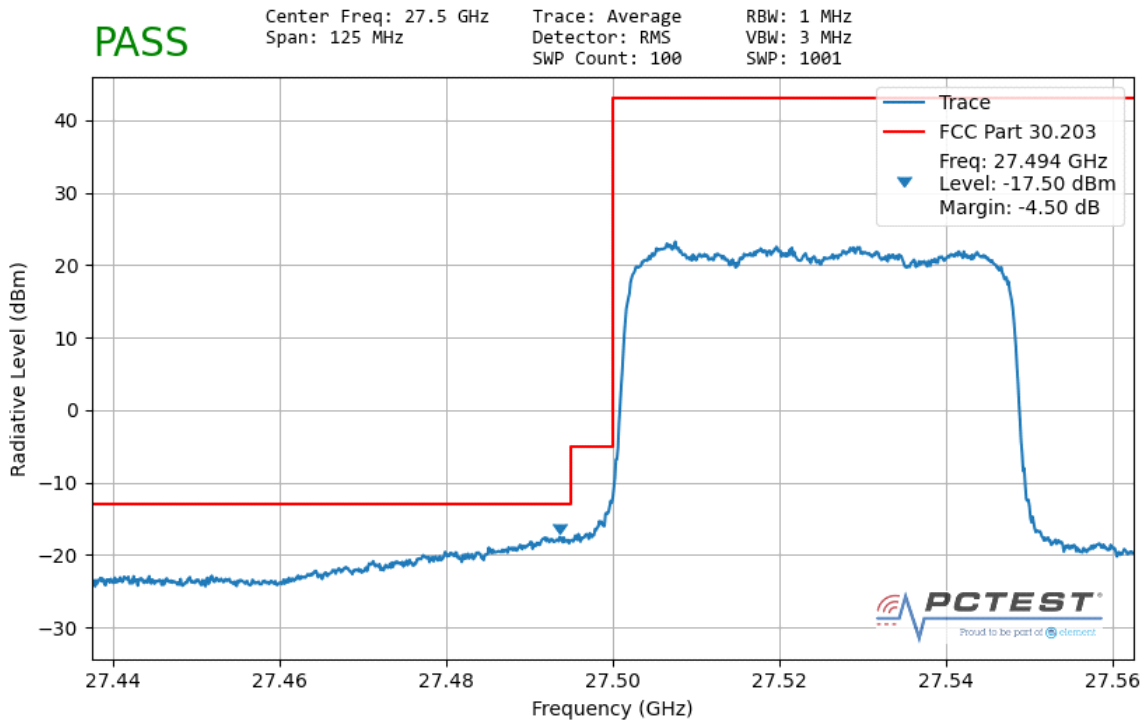
Plot 7-33. Lower Band Edge (100MHz-1CC – QPSK 8 RB)



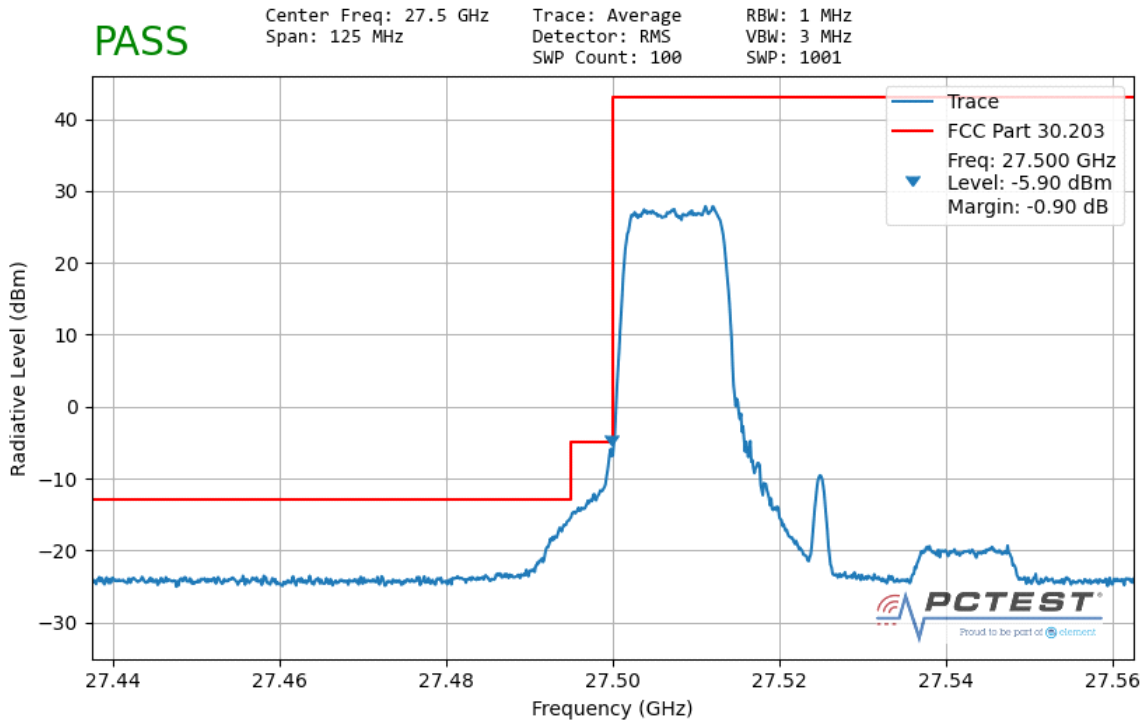
Plot 7-34. Upper Band Edge (100MHz-1CC – QPSK Full RB)



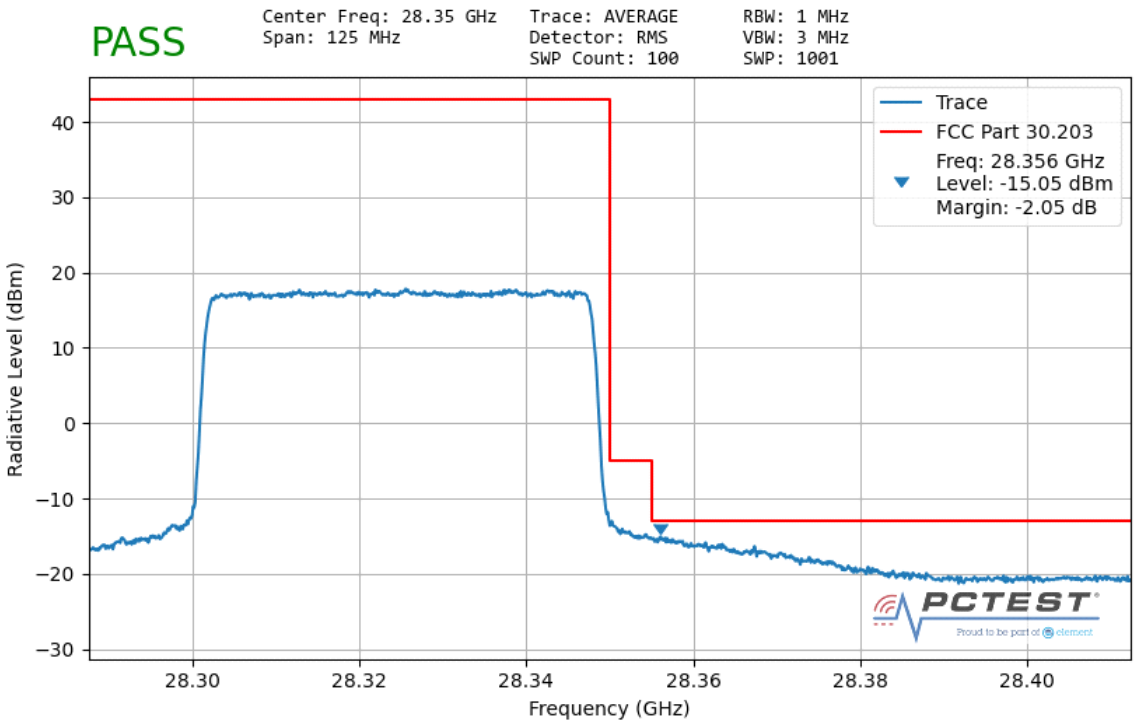
Plot 7-35. Upper Band Edge (100MHz-1CC – QPSK 8 RB)



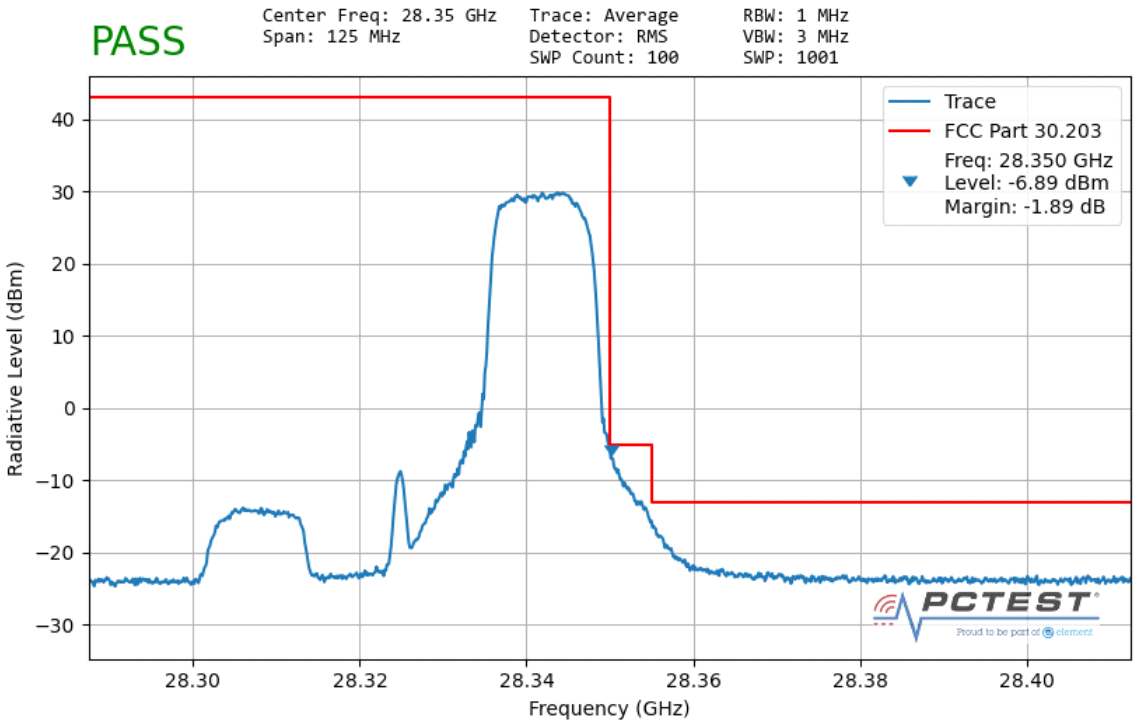
Plot 7-36. Lower Band Edge (50MHz-1CC – QPSK Full RB)



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

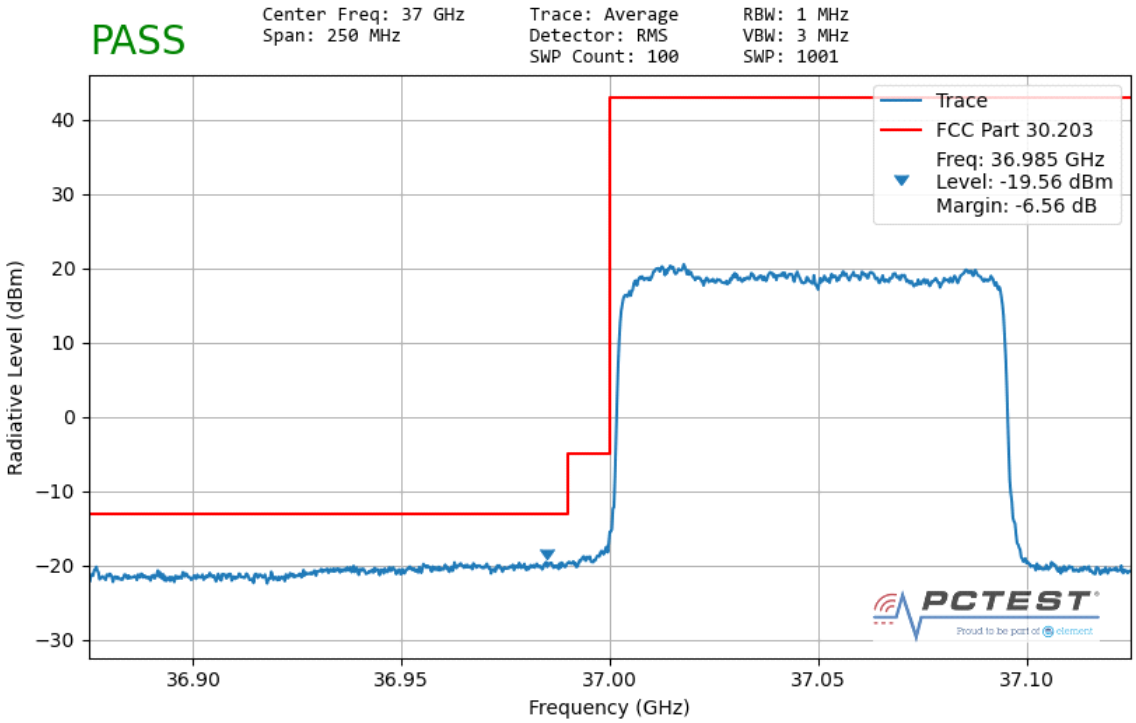


Plot 7-38. Upper Band Edge (50MHz-1CC – QPSK Full RB)

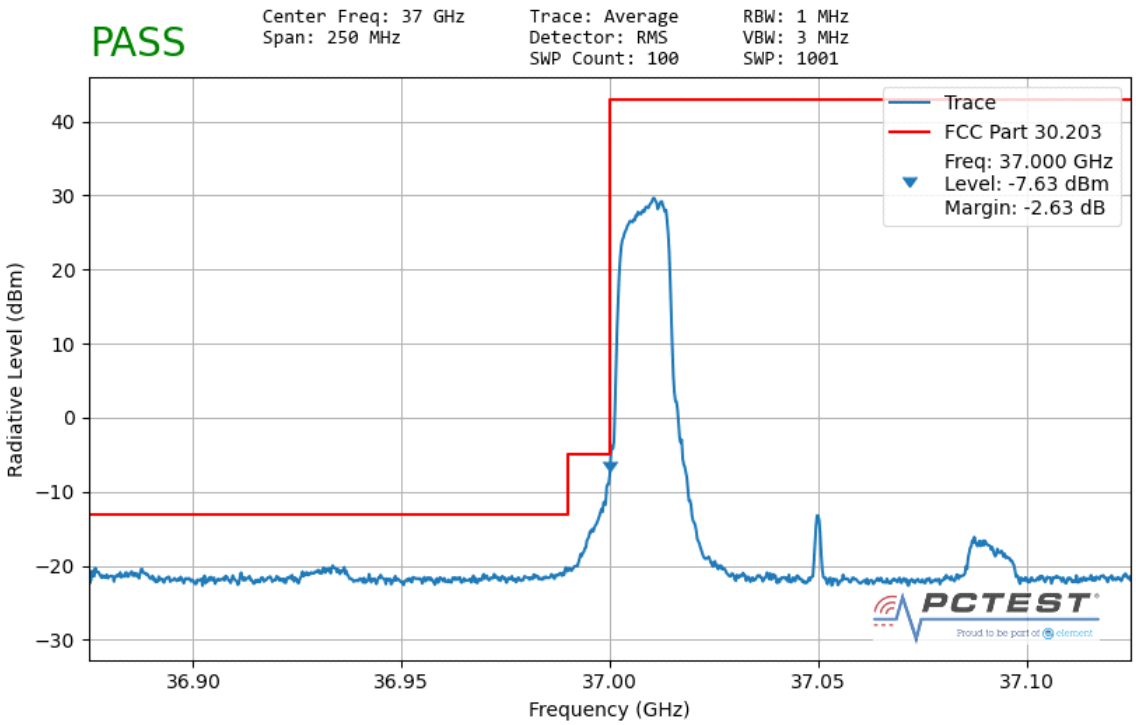


Plot 7-39. Upper Band Edge (50MHz-1CC – QPSK 8 RB)

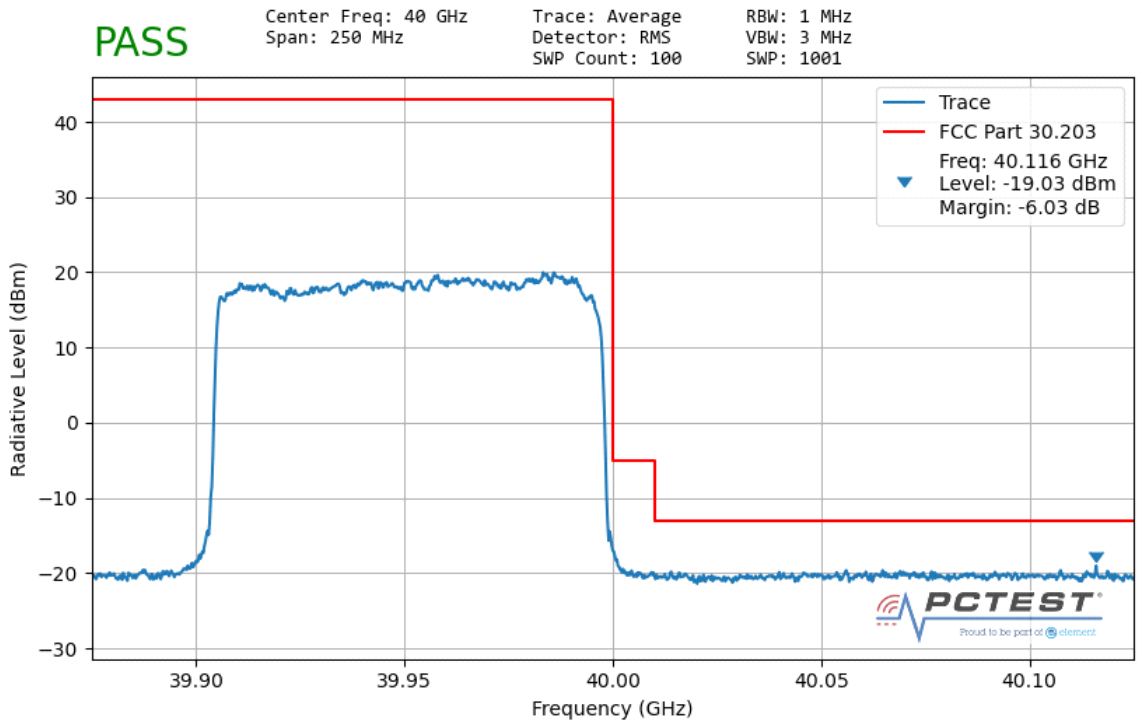
Band n260 – Worst Case



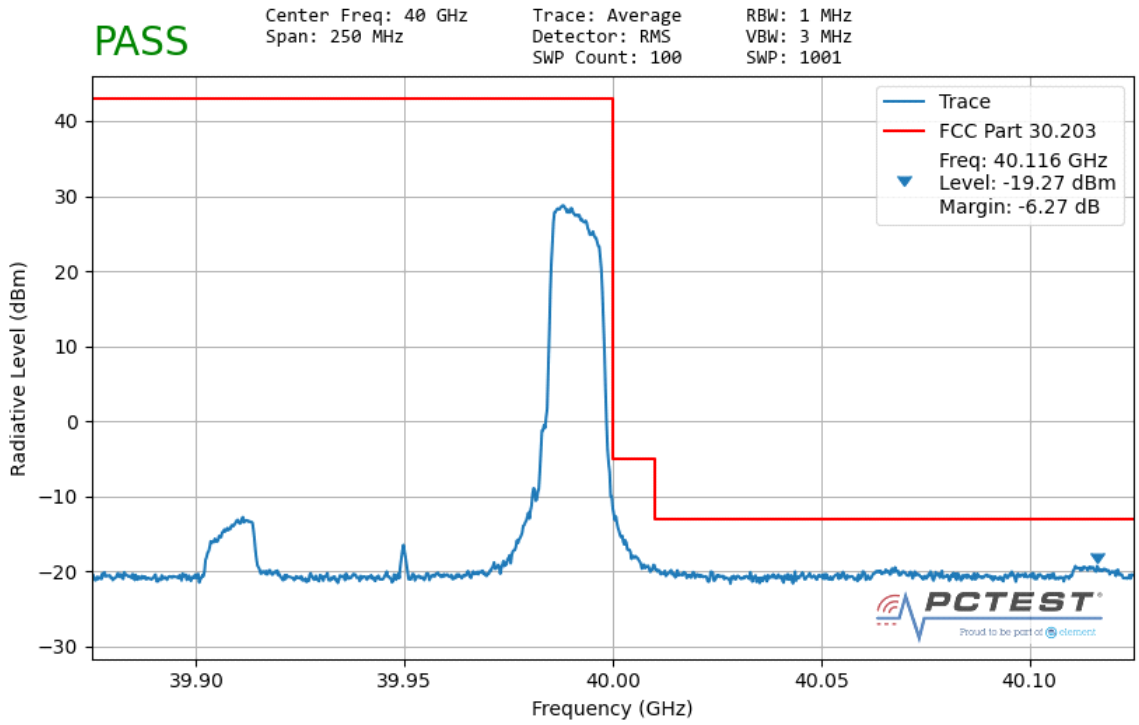
Plot 7-40. Lower Band Edge (100MHz-1CC – QPSK Full RB)



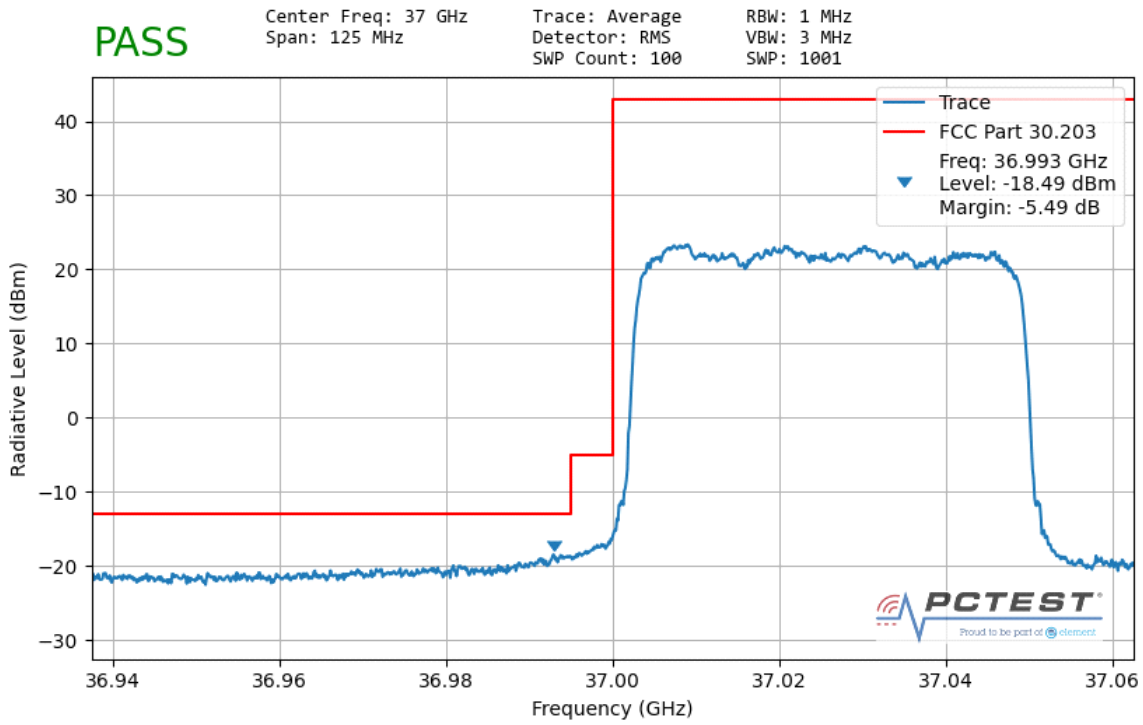
Plot 7-41. Lower Band Edge (100MHz-1CC – QPSK 8 RB)



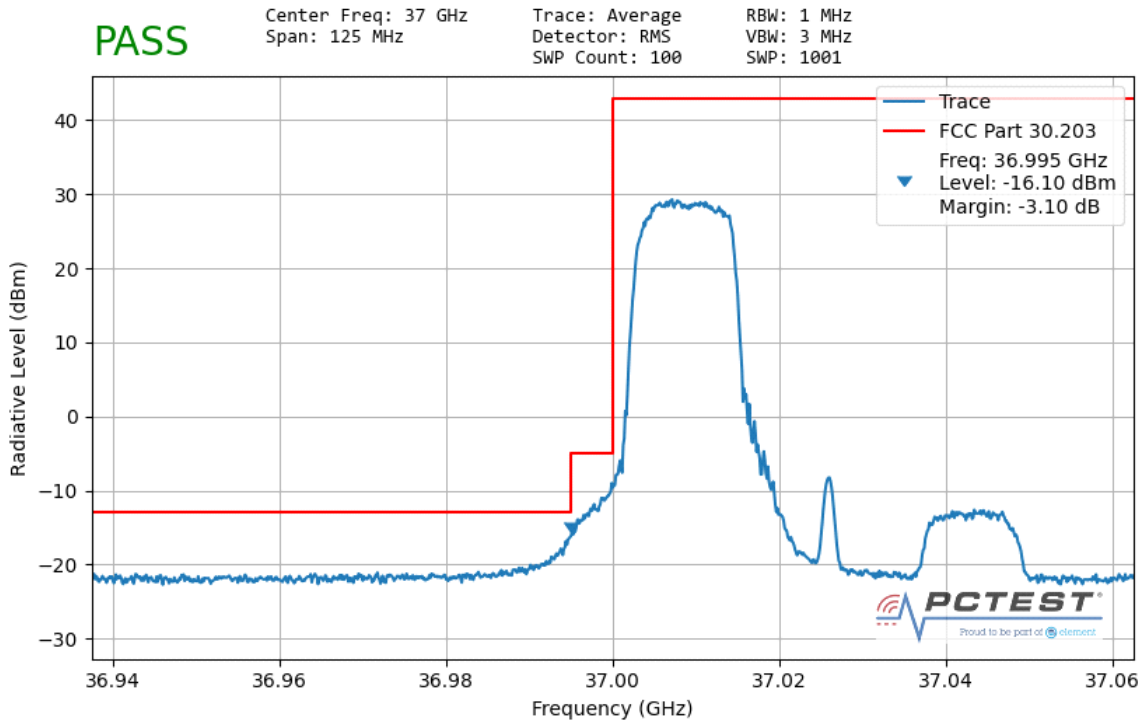
Plot 7-42. Upper Band Edge (100MHz-1CC – QPSK Full RB)



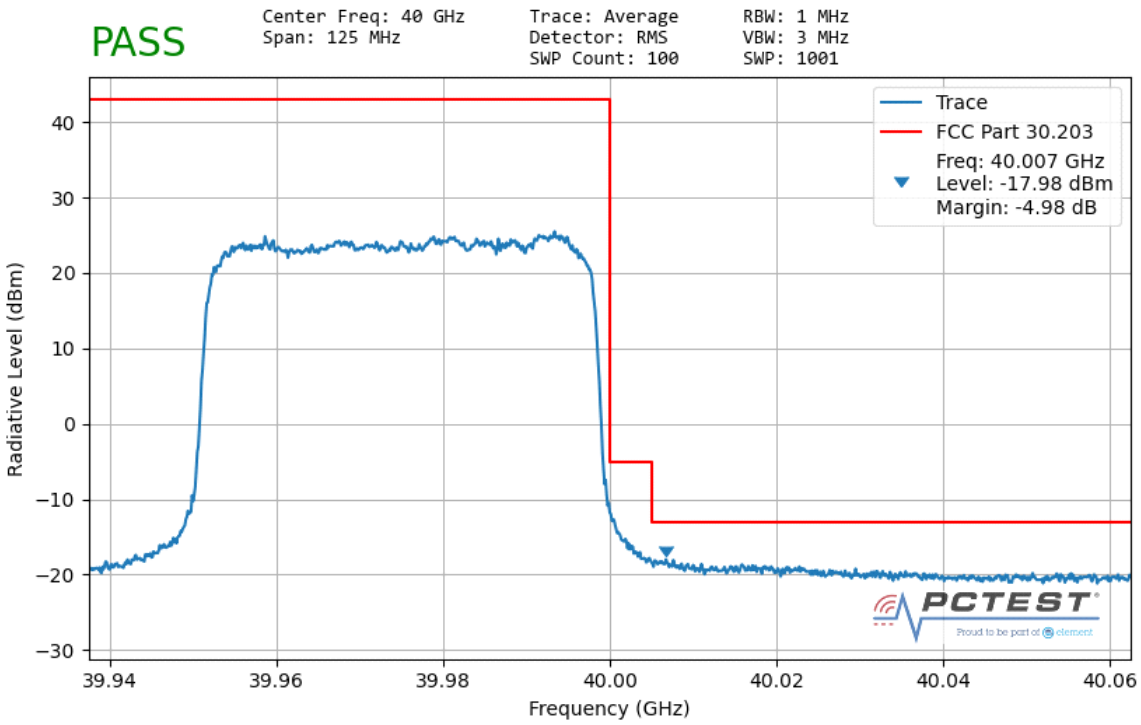
Plot 7-43. Upper Band Edge (100MHz-1CC – QPSK 8 RB)



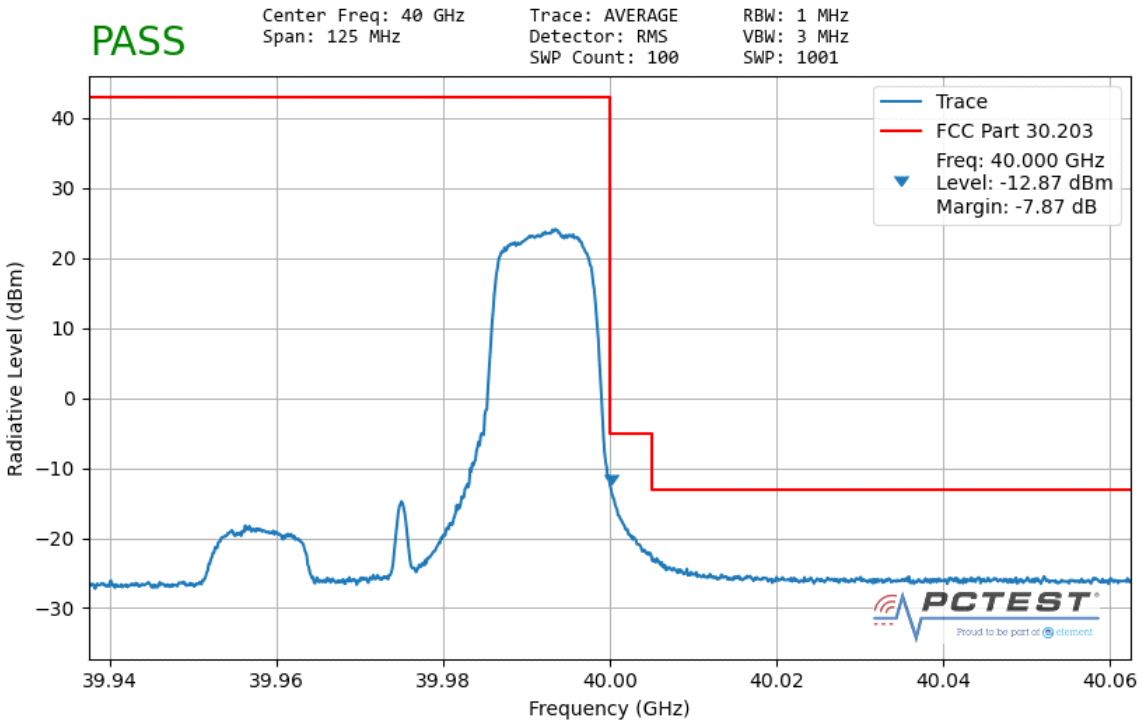
Plot 7-44. Lower Band Edge (50MHz-1CC – QPSK Full RB)



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:	20.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	20.00	+ 20 (Ref)	27,835,969,548	0	0.0000000
100 %		- 30	27,971,282,114	-135,312,566	-0.4846078
100 %		- 20	28,060,827,862	-224,858,314	-0.8053065
100 %		- 10	27,790,910,082	45,059,466	0.1613757
100 %		0	28,119,532,413	-283,562,865	-1.0155507
100 %		+ 10	27,677,553,350	158,416,198	0.5673510
100 %		+ 20	28,100,027,760	-264,058,212	-0.9456968
100 %		+ 30	27,966,948,708	-130,979,160	-0.4690881
100 %		+ 40	27,947,307,823	-111,338,275	-0.3987464
100 %		+ 50	27,840,683,458	-4,713,910	-0.0168824
85 %	17.00	+ 20	27,742,534,652	93,434,896	0.3346273

Table 7-26. 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

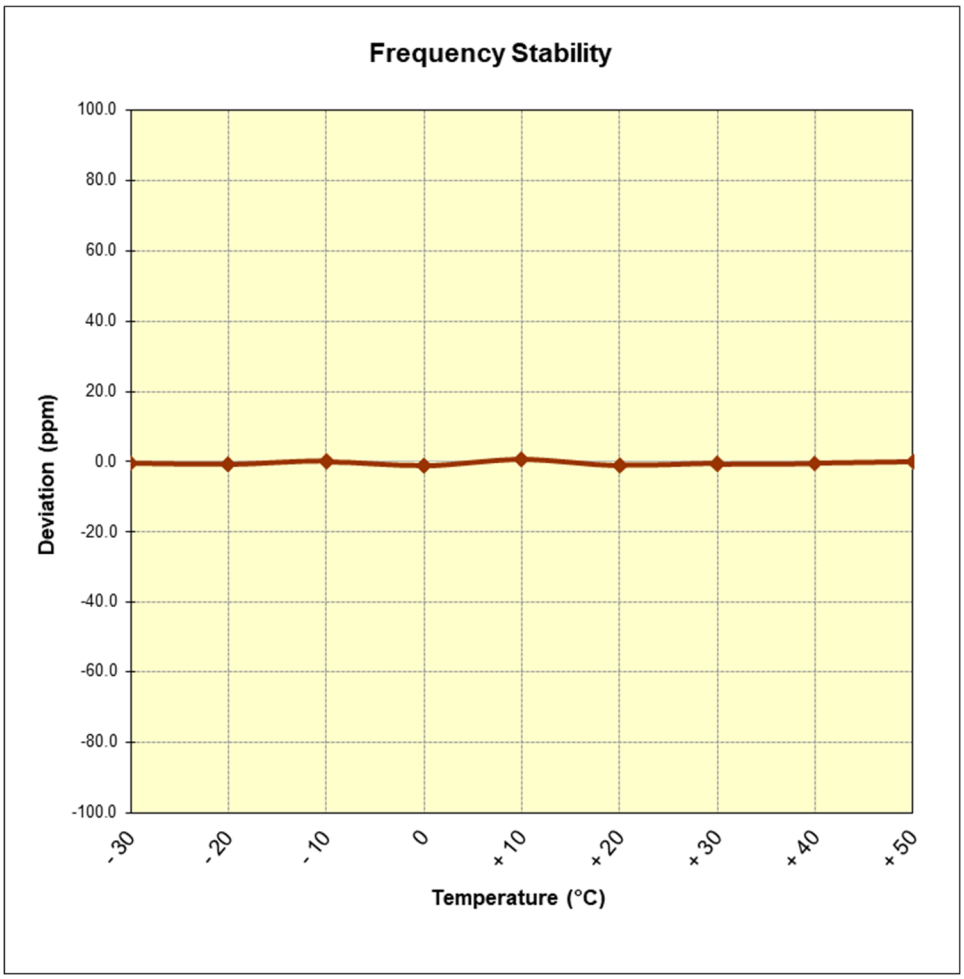


Figure 7-1. Frequency Stability Graph (n261)

Frequency Stability Measurements (Band n260)

§2.1055

OPERATING FREQUENCY:	38,495,520,000	Hz
CHANNEL:	2254091	
REFERENCE VOLTAGE:	20.00	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	20.00	+ 20 (Ref)	38,248,808,020	0	0.0000000
100 %		- 30	38,288,157,219	-39,349,199	-0.1022176
100 %		- 20	38,532,354,178	-283,546,158	-0.7365692
100 %		- 10	38,529,023,124	-280,215,104	-0.7279161
100 %		0	38,591,569,835	-342,761,815	-0.8903940
100 %		+ 10	38,364,694,856	-115,886,836	-0.3010398
100 %		+ 20	38,543,475,870	-294,667,850	-0.7654601
100 %		+ 30	38,655,256,103	-406,448,083	-1.0558322
100 %		+ 40	38,413,297,619	-164,489,599	-0.4272954
100 %		+ 50	38,657,684,251	-408,876,231	-1.0621398
85 %	17.00	+ 20	38,661,457,341	-412,649,321	-1.0719412

Table 7-27. 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

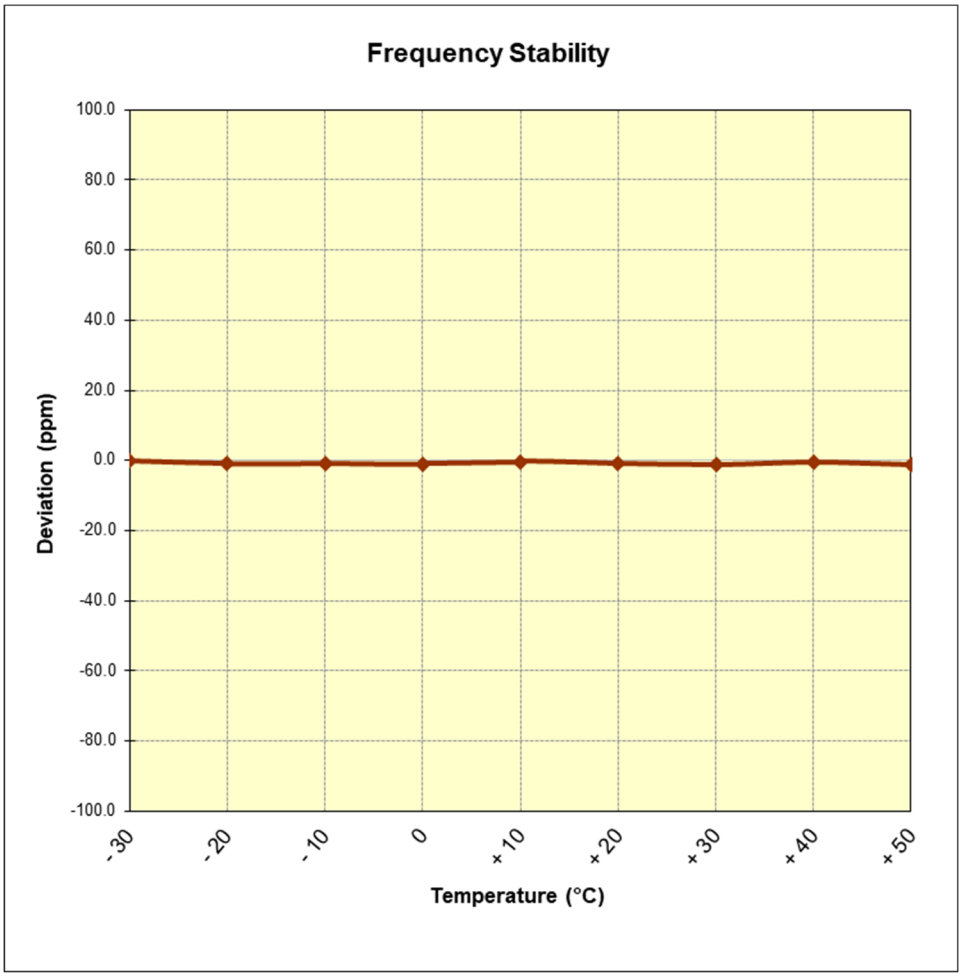


Figure 7-2. Frequency Stability Graph (n260)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung Indoor Customer Premises Equipment (CPE)**

FCC ID: A3LSMH204V 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: 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
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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