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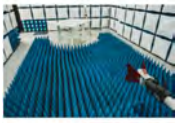

MEASUREMENT REPORT
FCC Part 30 5G mmWave

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

Date of Testing:
10/30 - 11/24/2020
Test Site/Location:
PCTEST Lab. Columbia, MD, USA
Test Report Serial No.:
1M2010290170-01.A3L

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

Application Type:	Class III Permissive Change
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
Class III Permissive Change:	Please see FCC change document
Original Grant Date:	9/21/2020

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

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

Randy Ortanez
President

ACCREDITED
CERT #2041.01

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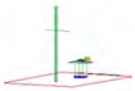
MEASUREMENT REPORT
FCC Part 30



Mode	Transmission Scheme	Bandwidth (MHz)	CCs Active	Band	FCC Rule Part	Tx Frequency (MHz)	EIRP		Emission Designator	Modulation
							Max. Power (W)	Max. Power (dBm)		
2Tx	DFTs-OFDM	100	1	n261	30	27500 - 28350	81.283	49.10	89M9G7D	π/2 BPSK
2Tx	DFTs-OFDM	100	1	n261	30	27500 - 28350	82.031	49.14	93M1G7D	QPSK
2Tx	DFTs-OFDM	100	1	n261	30	27500 - 28350	29.648	44.72	93M1W7D	16QAM
2Tx	DFTs-OFDM	100	1	n261	30	27500 - 28350	23.933	43.79	92M7W7D	64QAM
2Tx	DFTs-OFDM	100	2	n261	30	27500 - 28350	16.634	42.21	190MG7D	π/2 BPSK
2Tx	DFTs-OFDM	100	2	n261	30	27500 - 28350	15.031	41.77	191MG7D	QPSK
2Tx	DFTs-OFDM	100	2	n261	30	27500 - 28350	8.531	39.31	191MW7D	16QAM
2Tx	DFTs-OFDM	100	2	n261	30	27500 - 28350	8.531	39.31	191MW7D	64QAM
2Tx	DFTs-OFDM	50	1	n261	30	27500 - 28350	80.724	49.07	45M4G7D	π/2 BPSK
2Tx	DFTs-OFDM	50	1	n261	30	27500 - 28350	79.799	49.02	45M6G7D	QPSK
2Tx	DFTs-OFDM	50	1	n261	30	27500 - 28350	29.444	44.69	45M3W7D	16QAM
2Tx	DFTs-OFDM	50	1	n261	30	27500 - 28350	26.730	44.27	45M5W7D	64QAM
2Tx	DFTs-OFDM	50	2	n261	30	27500 - 28350	8.371	39.23	93M8G7D	π/2 BPSK
2Tx	DFTs-OFDM	50	2	n261	30	27500 - 28350	8.371	39.23	94M9G7D	QPSK
2Tx	DFTs-OFDM	50	2	n261	30	27500 - 28350	7.499	38.75	95M0W7D	16QAM
2Tx	DFTs-OFDM	50	2	n261	30	27500 - 28350	3.999	36.02	94M9W7D	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)		
2Tx	DFTs-OFDM	100	1	n260	30	37000 - 40000	70.307	48.47	90M7G7D	π/2 BPSK
2Tx	DFTs-OFDM	100	1	n260	30	37000 - 40000	69.984	48.45	93M4G7D	QPSK
2Tx	DFTs-OFDM	100	1	n260	30	37000 - 40000	26.485	44.23	93M4W7D	16QAM
2Tx	DFTs-OFDM	100	1	n260	30	37000 - 40000	22.182	43.46	93M4W7D	64QAM
2Tx	DFTs-OFDM	100	2	n260	30	37000 - 40000	13.397	41.27	189MG7D	π/2 BPSK
2Tx	DFTs-OFDM	100	2	n260	30	37000 - 40000	13.274	41.23	191MG7D	QPSK
2Tx	DFTs-OFDM	100	2	n260	30	37000 - 40000	13.183	41.20	192MW7D	16QAM
2Tx	DFTs-OFDM	100	2	n260	30	37000 - 40000	7.228	38.59	191MW7D	64QAM
2Tx	DFTs-OFDM	50	1	n260	30	37000 - 40000	72.788	48.62	45M4G7D	π/2 BPSK
2Tx	DFTs-OFDM	50	1	n260	30	37000 - 40000	74.111	48.70	45M4G7D	QPSK
2Tx	DFTs-OFDM	50	1	n260	30	37000 - 40000	29.107	44.64	45M3W7D	16QAM
2Tx	DFTs-OFDM	50	1	n260	30	37000 - 40000	22.594	43.54	45M3W7D	64QAM
2Tx	DFTs-OFDM	50	2	n260	30	37000 - 40000	8.956	39.52	93M9G7D	π/2 BPSK
2Tx	DFTs-OFDM	50	2	n260	30	37000 - 40000	6.929	38.41	94M7G7D	QPSK
2Tx	DFTs-OFDM	50	2	n260	30	37000 - 40000	6.934	38.41	95M0W7D	16QAM
2Tx	DFTs-OFDM	50	2	n260	30	37000 - 40000	3.767	35.76	94M9W7D	64QAM

EUT Overview (Band n260)

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

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

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

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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 up to 8CC for DL and 2CC for UL. For each CC, 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 and 2Tx 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.

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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.

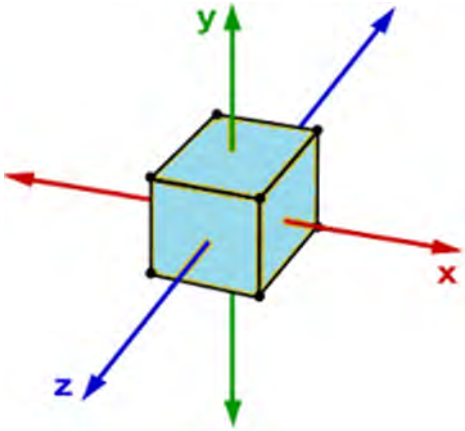

Figure 3-1. Rotation of the EUT Through Three Orthogonal Planes

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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.

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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

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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
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
Espec	ESX-2CA	Environmental Chamber	8/27/2020	Biennial	8/27/2022	17620
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	8/17/2020	Annual	8/17/2021	MY52350166
OML Inc.	M05RH	WR-08 Horn Antenna, 24dBi, 140 to 220 GHz	12/30/2018	Biennial	12/30/2020	G00228-2
OML Inc.	M08RH	WR-08 Horn Antenna, 24dBi, 90 to 140 GHz	12/30/2018	Biennial	12/30/2020	18073001
OML Inc.	M12RH	WR-12 Horn Antenna, 24dBi, 60 to 90 GHz	12/30/2018	Biennial	12/30/2020	18073001
OML Inc.	M19RH	WR-19 Horn Antenna, 24dBi, 40 to 60 GHz	12/30/2018	Biennial	12/30/2020	18073001
Rohde & Schwarz	180-442-KF	Horn (Small)	11/5/2020	Biennial	11/5/2022	U157403-01
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	7/15/2020	Annual	7/15/2021	100342
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/10/2020	Annual	8/10/2021	103200
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)	12/30/2019	Annual	12/30/2020	SAX252
Virginia Diodes Inc	SAX253	SAX Module (90 - 140GHz)	12/30/2019	Annual	12/30/2020	SAX253
Virginia Diodes Inc	SAX254	SAX Module (140 - 220GHz)	12/30/2019	Annual	12/30/2020	SAX254
Virginia Diodes Inc	SAX411	SAX Module (40 - 60GHz)	12/2/2019	Annual	12/2/2020	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.

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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

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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): mmWave NR

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

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..

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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

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.

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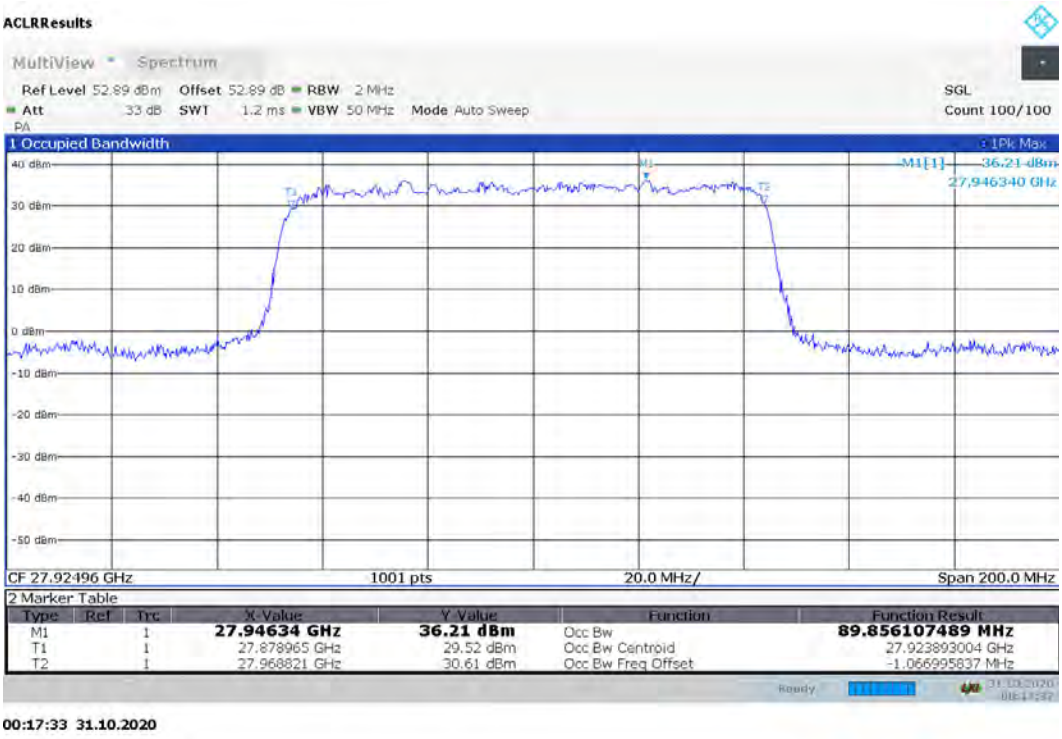
Band n261

Channel	Bandwidth	CCs Active	Modulation	OBW [MHz]
Mid	100	1	π/2 BPSK	89.86
			QPSK	93.08
			16QAM	93.15
			64QAM	92.69
		2	π/2 BPSK	189.76
			QPSK	190.88
			16QAM	191.07
			64QAM	190.65
	50	1	π/2 BPSK	45.43
			QPSK	45.58
			16QAM	45.33
			64QAM	45.46
		2	π/2 BPSK	93.76
			QPSK	94.90
			16QAM	94.96
			64QAM	94.92

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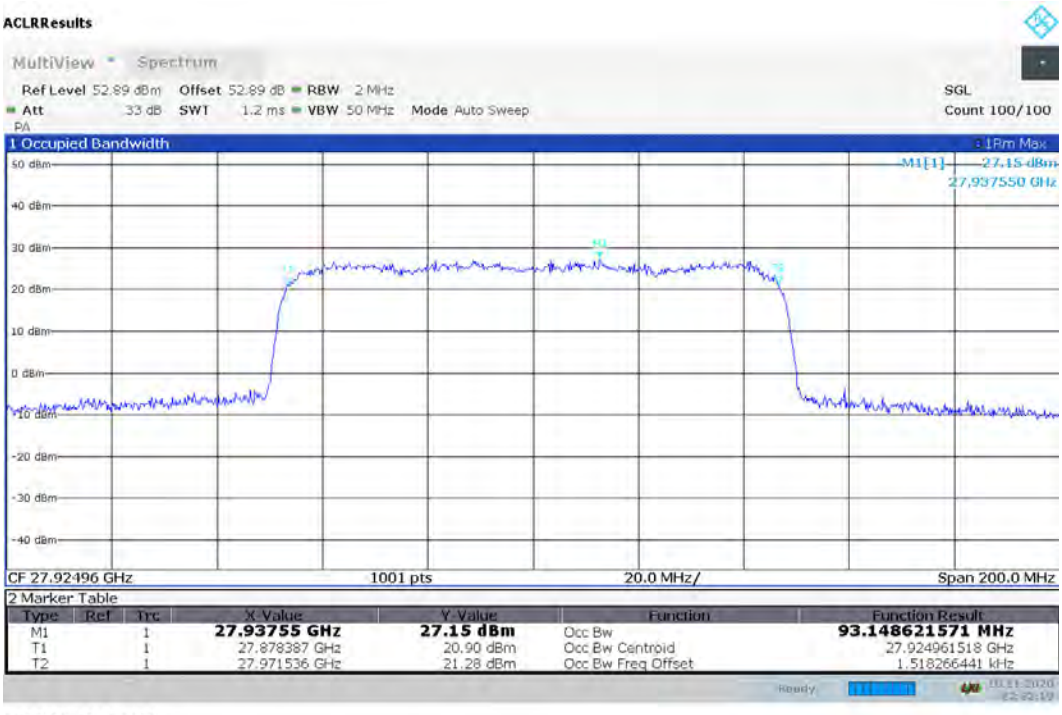
Plot 7-2. Occupied Bandwidth Plot (100MHz-1CC – QPSK – Mid Channel)



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

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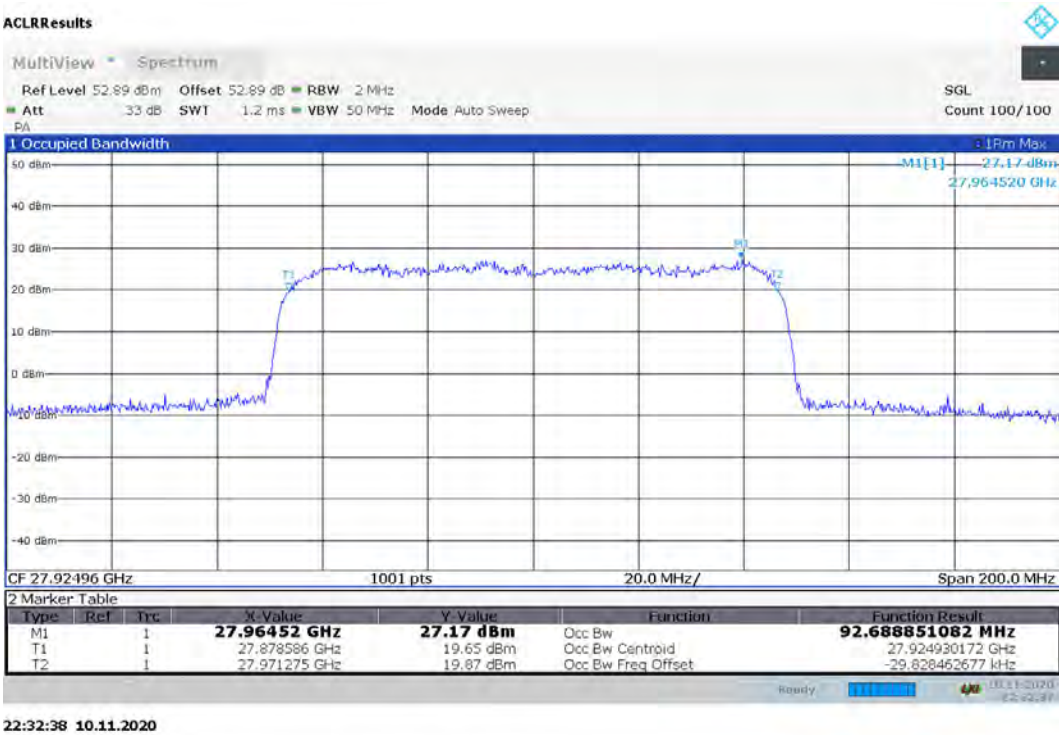

Plot 7-4. Occupied Bandwidth Plot (100MHz-1CC – 64QAM – Mid Channel)

Plot 7-5. Occupied Bandwidth Plot (100MHz-2CC – π/2 BPSK – Mid Channel)

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Plot 7-6. Occupied Bandwidth Plot (100MHz-2CC – QPSK – Mid Channel)

Plot 7-7. Occupied Bandwidth Plot (100MHz-2CC – 16QAM – Mid Channel)

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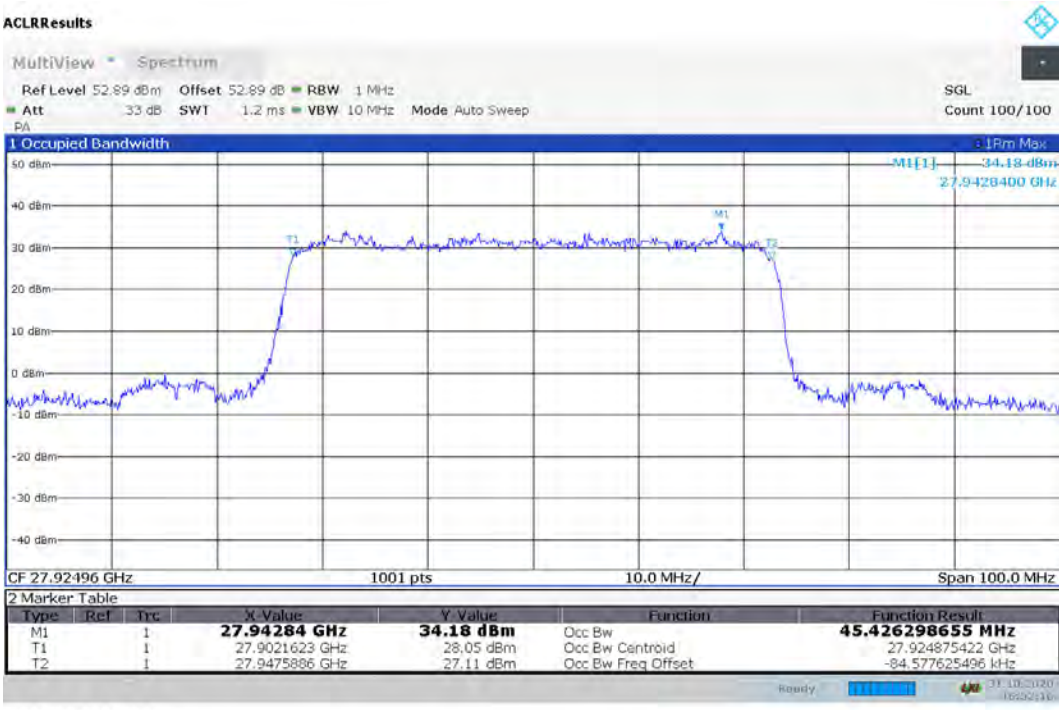
Plot 7-8. Occupied Bandwidth Plot (100MHz-2CC – 64QAM – Mid Channel)



Plot 7-9. Occupied Bandwidth Plot (50MHz-1CC – π/2 BPSK – Mid Channel)

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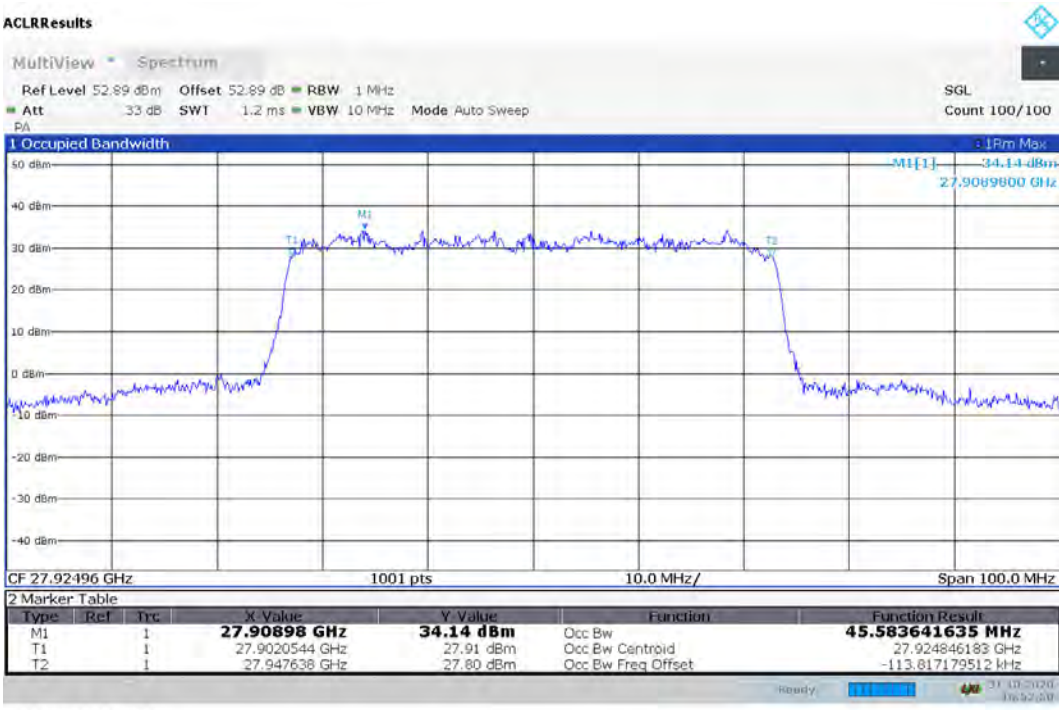

16:52:51 31.10.2020

Plot 7-10. Occupied Bandwidth Plot (50MHz-1CC – QPSK – Mid Channel)

22:34:00 10.11.2020

Plot 7-11. Occupied Bandwidth Plot (50MHz-1CC – 16QAM – Mid Channel)

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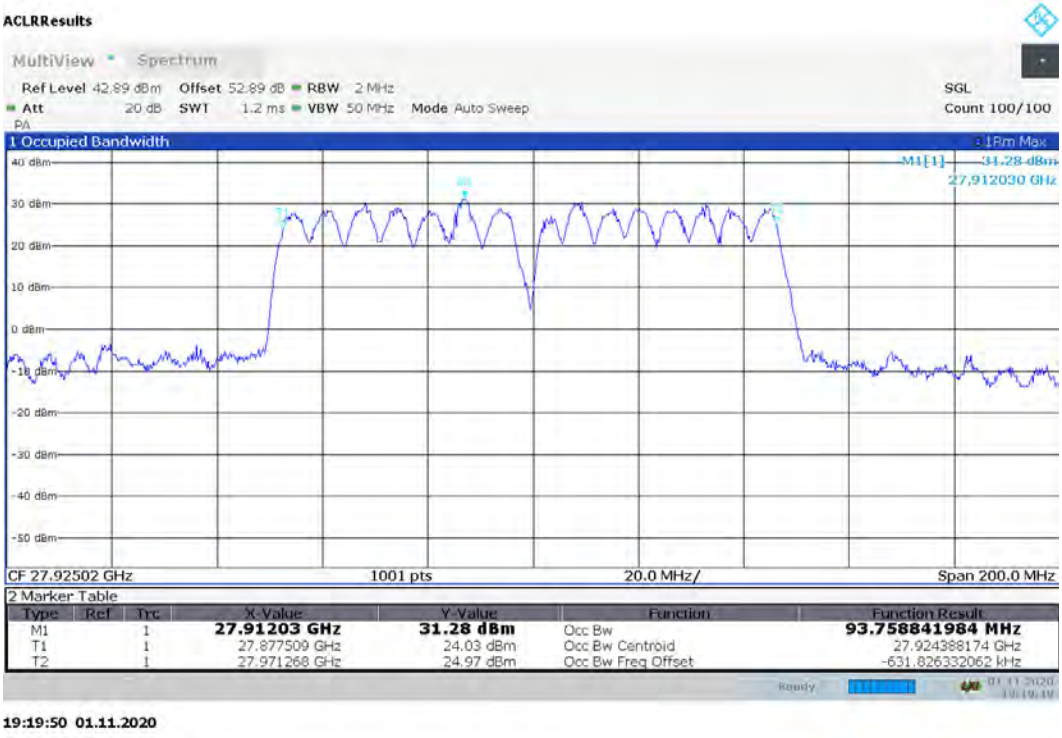
Plot 7-12. Occupied Bandwidth Plot (50MHz-1CC – 64QAM – Mid Channel)



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

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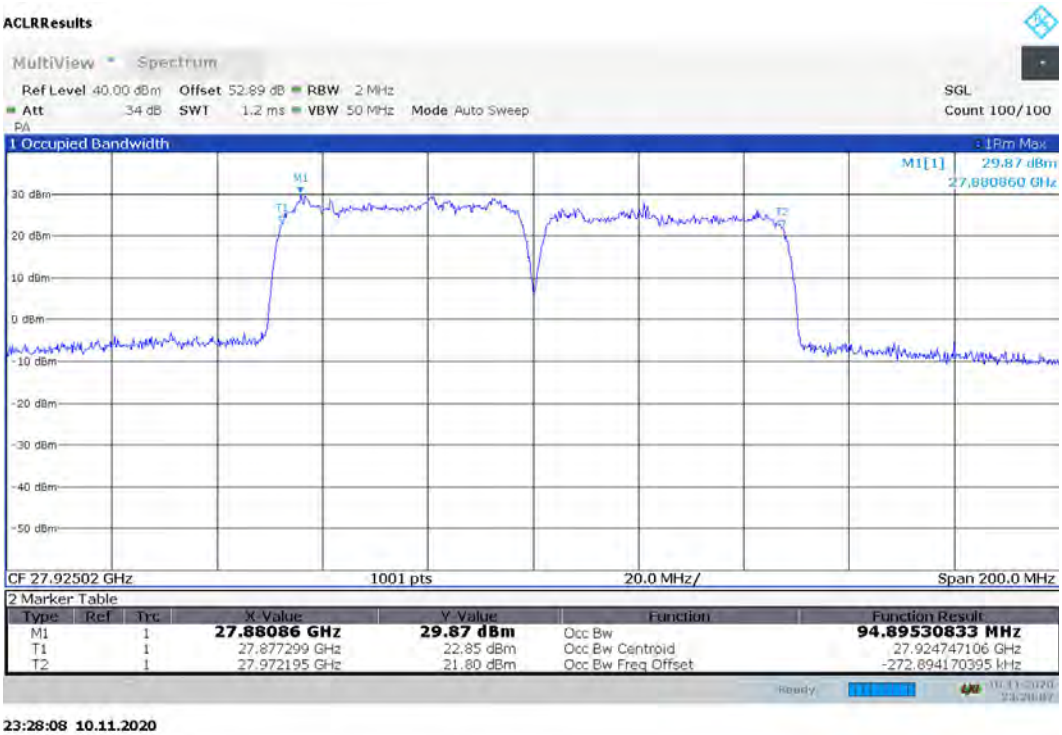
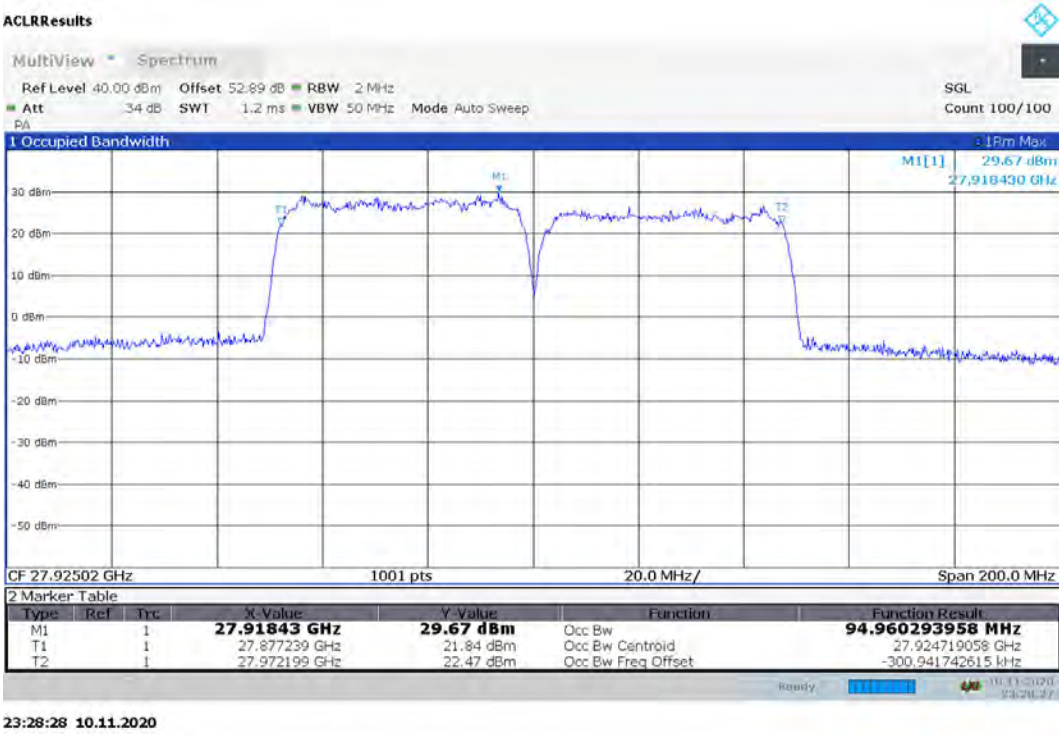


Plot 7-14. Occupied Bandwidth Plot (50MHz-2CC – QPSK – Mid Channel)



Plot 7-15. Occupied Bandwidth Plot (50MHz-2CC – 16QAM – Mid Channel)

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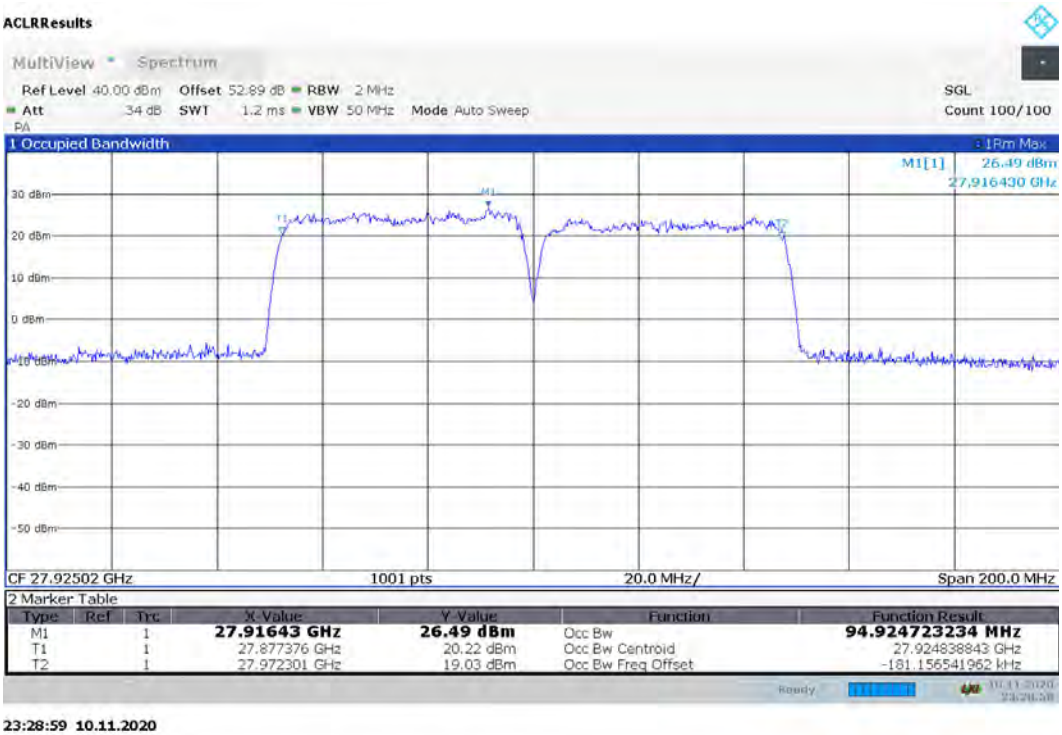

Plot 7-16. Occupied Bandwidth Plot (50MHz-2CC – 64QAM – Mid Channel)

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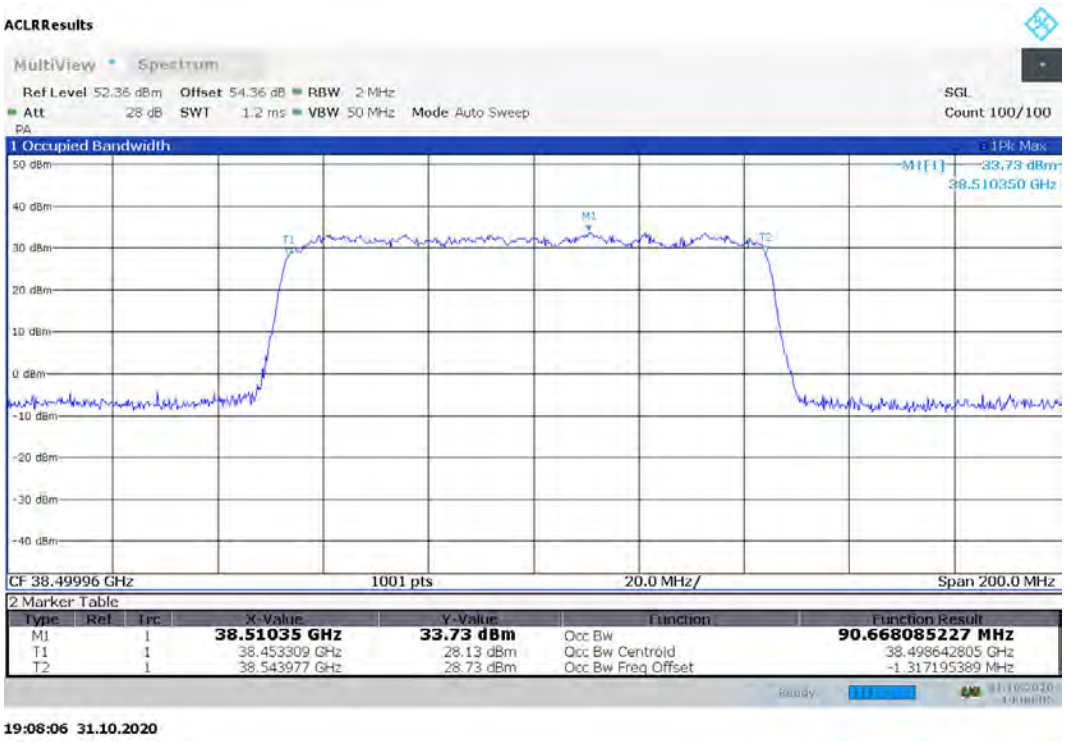
Band n260

Channel	Bandwidth	CCs Active	Modulation	OBW [MHz]
Mid	100	1	π/2 BPSK	90.67
			QPSK	93.36
			16QAM	93.41
			64QAM	93.45
		2	π/2 BPSK	189.43
			QPSK	191.21
			16QAM	191.54
			64QAM	190.98
	50	1	π/2 BPSK	45.39
			QPSK	45.44
			16QAM	45.28
			64QAM	45.31
		2	π/2 BPSK	93.88
			QPSK	94.70
			16QAM	95.00
			64QAM	94.94

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



Plot 7-17. Occupied Bandwidth Plot (100MHz-1CC – π/2 BPSK – Mid Channel)

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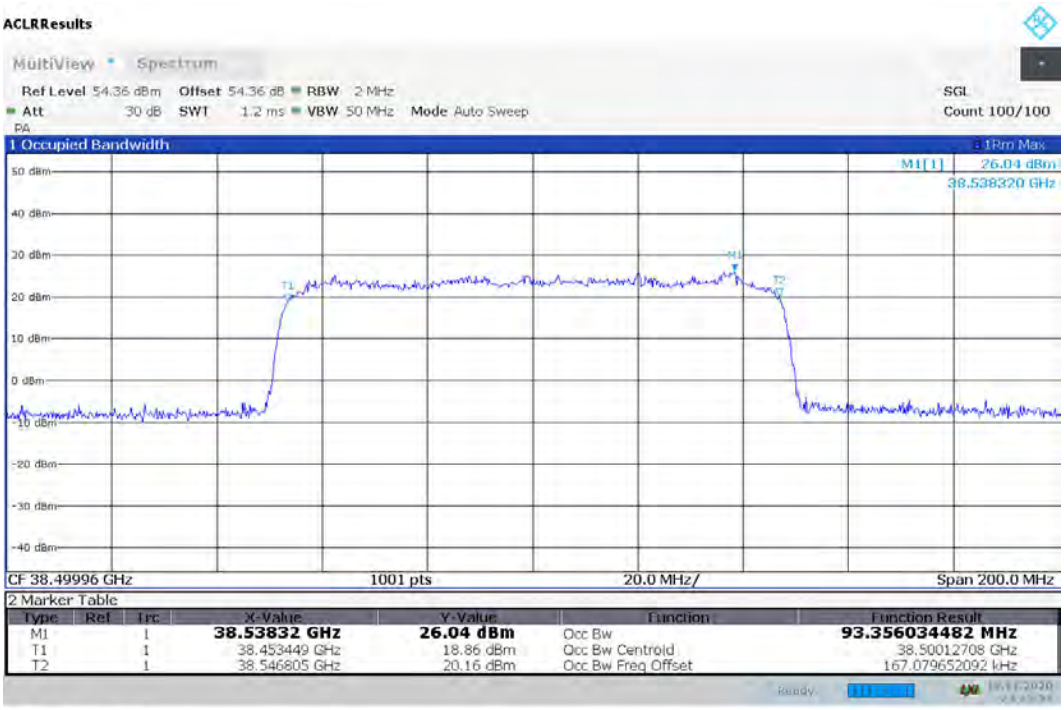
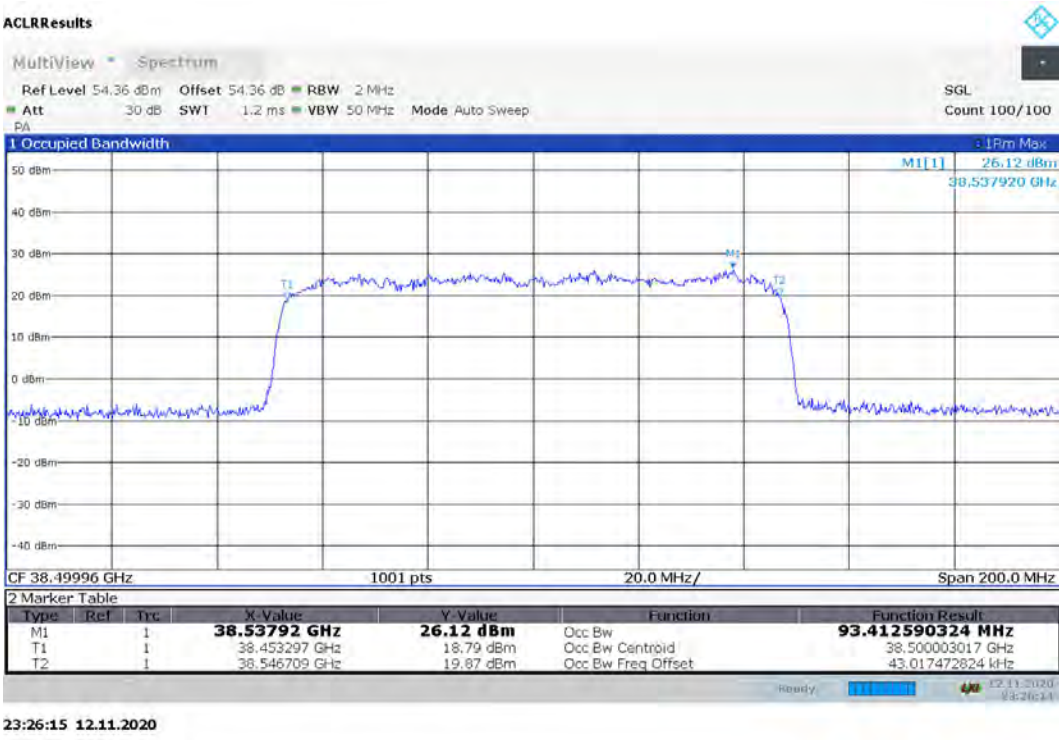


Plot 7-18. Occupied Bandwidth Plot (100MHz-1CC – QPSK – Mid Channel)



Plot 7-19. Occupied Bandwidth Plot (100MHz-1CC – 16QAM – Mid Channel)

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Plot 7-20. Occupied Bandwidth Plot (100MHz-1CC – 64QAM – Mid Channel)

Plot 7-21. Occupied Bandwidth Plot (100MHz-2CC – π/2 BPSK – Mid Channel)

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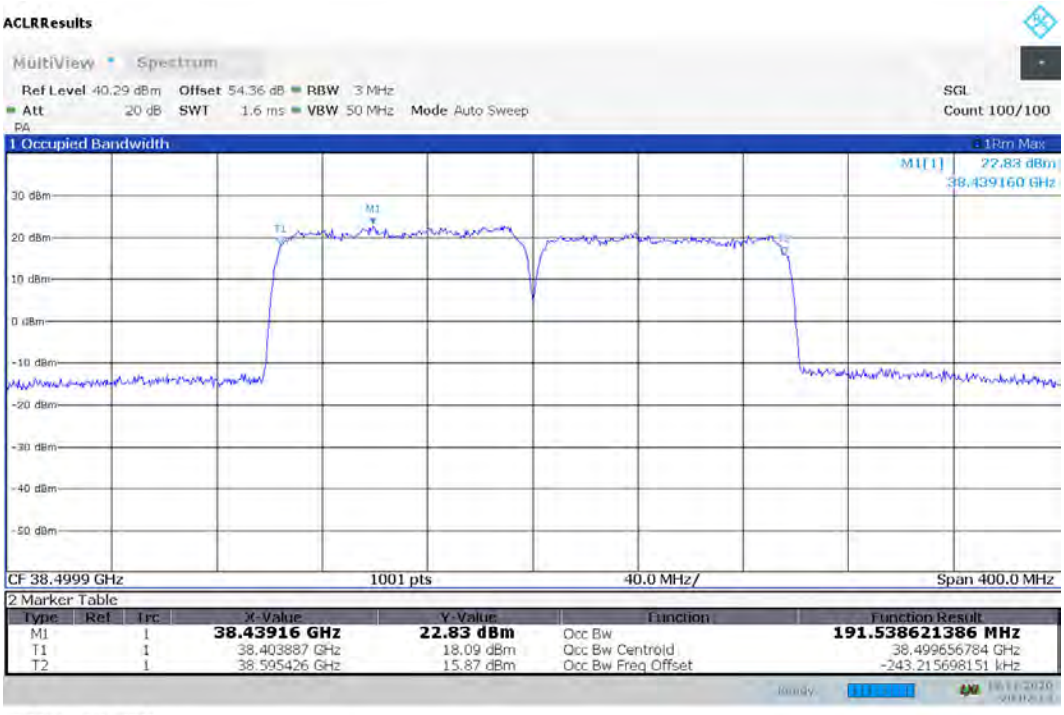
Plot 7-22. Occupied Bandwidth Plot (100MHz-2CC – QPSK – Mid Channel)



Plot 7-23. Occupied Bandwidth Plot (100MHz-2CC – 16QAM – Mid Channel)

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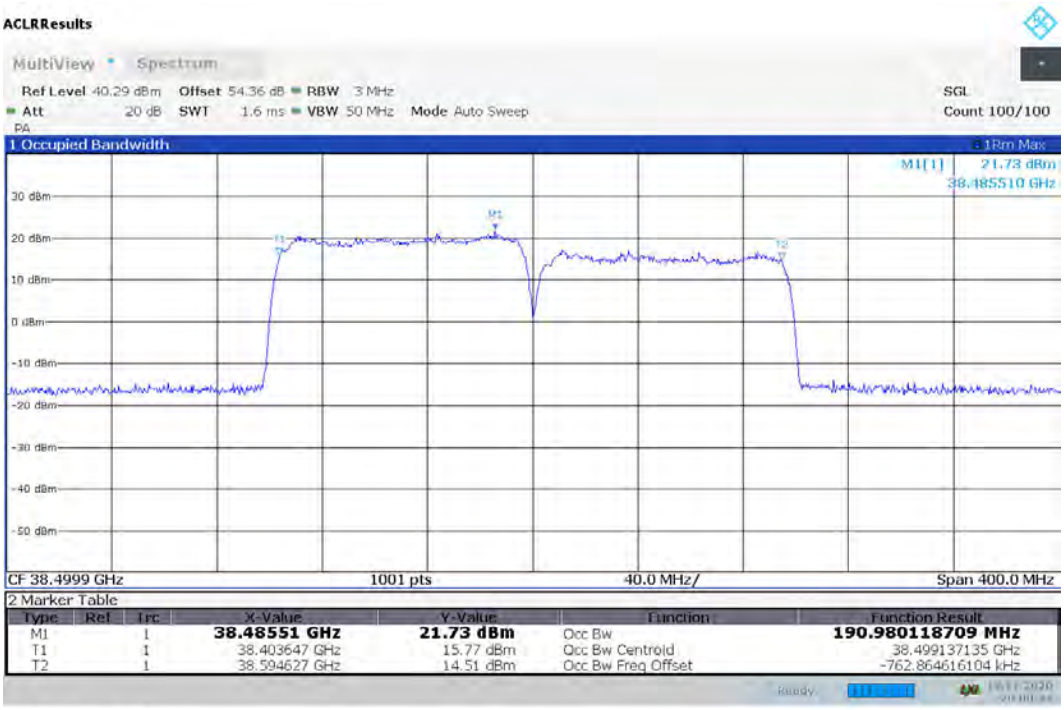
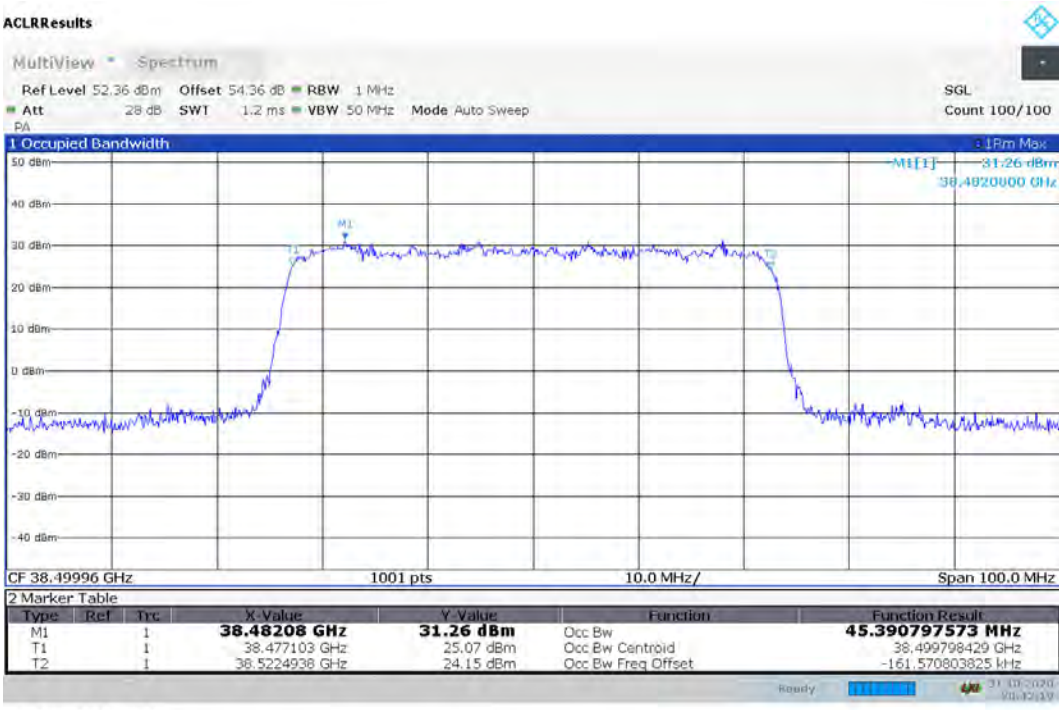


20:00:55 12.11.2020

Plot 7-24. Occupied Bandwidth Plot (100MHz-2CC – 64QAM – Mid Channel)



20:42:20 31.10.2020

Plot 7-25. Occupied Bandwidth Plot (50MHz-1CC – π/2 BPSK – Mid Channel)

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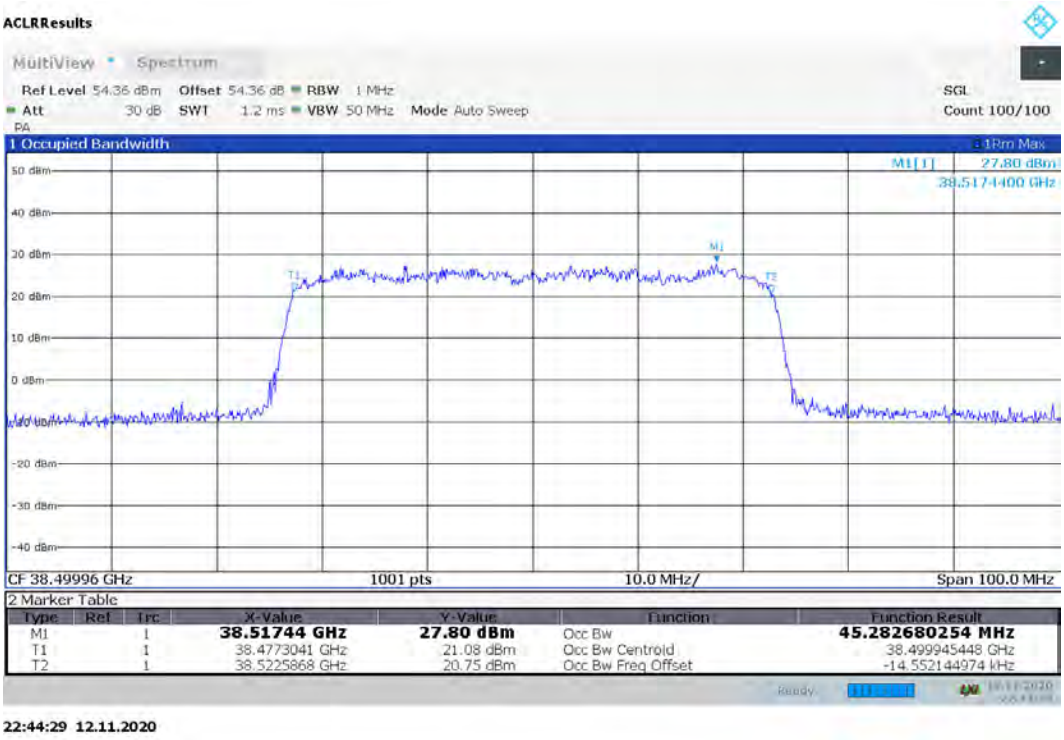
Plot 7-26. Occupied Bandwidth Plot (50MHz-1CC – QPSK – Mid Channel)



Plot 7-27. Occupied Bandwidth Plot (50MHz-1CC – 16QAM – Mid Channel)

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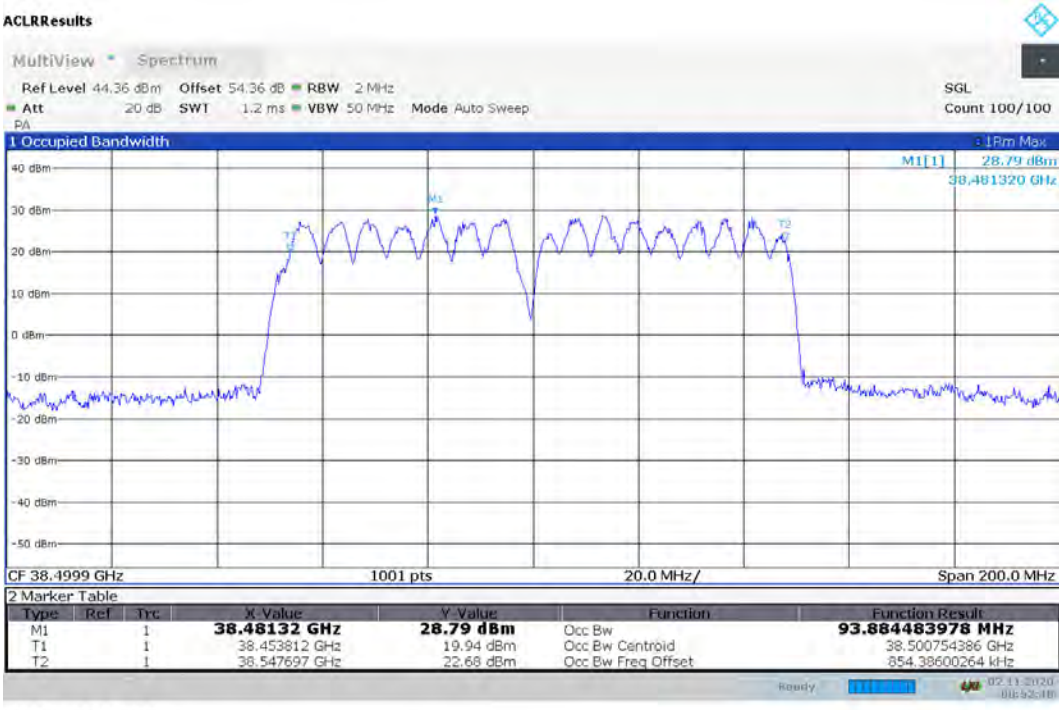
22:44:12 12.11.2020

Plot 7-28. Occupied Bandwidth Plot (50MHz-1CC – 64QAM – Mid Channel)



00:52:41 02.11.2020

Plot 7-29. Occupied Bandwidth Plot (50MHz-2CC – π/2 BPSK – Mid Channel)

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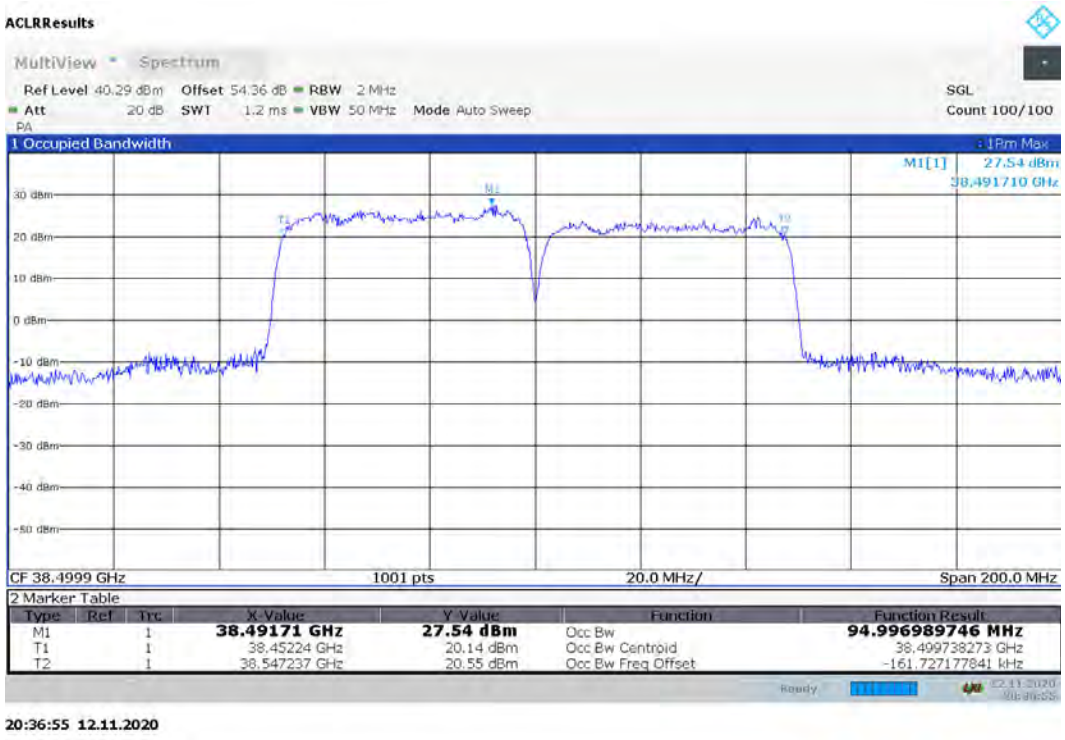
Plot 7-30. Occupied Bandwidth Plot (50MHz-2CC – QPSK – Mid Channel)



Plot 7-31. Occupied Bandwidth Plot (50MHz-2CC – 16QAM – Mid Channel)

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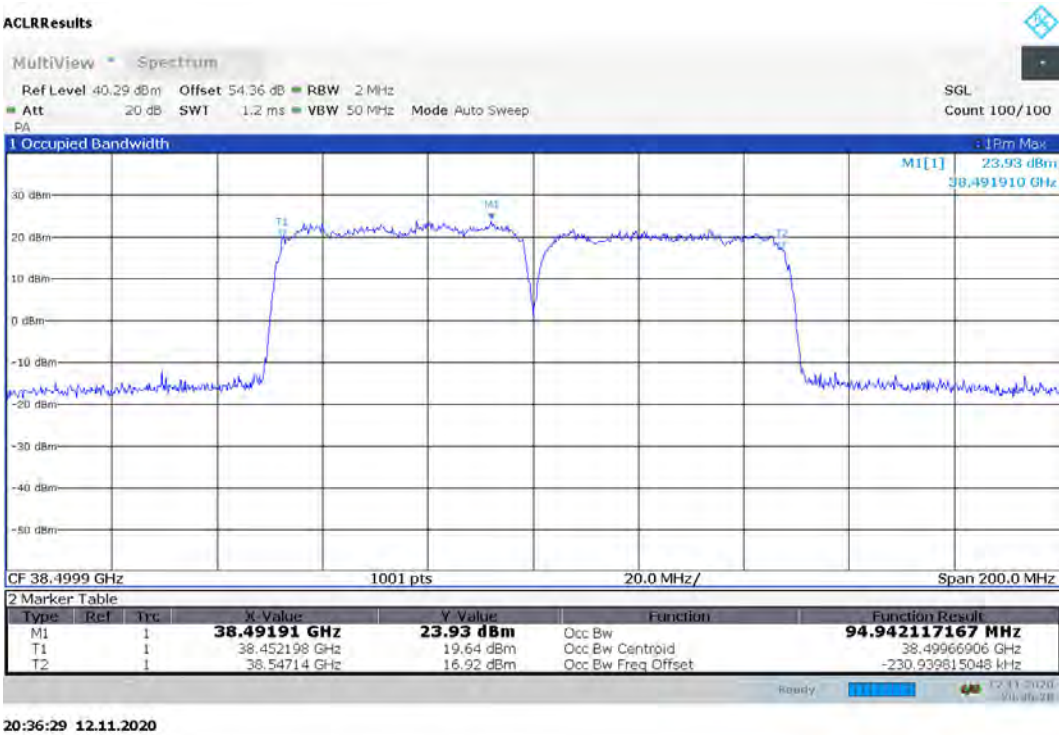

Plot 7-32. Occupied Bandwidth Plot (50MHz-2CC – 64QAM – Mid Channel)

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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 55dBm.

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

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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.

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Band n261

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
27550.08	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/35	48.20
27926.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/35	**49.14**
27924.96	Mid	DFT-s-OFDM	QPSK	H	SISO	319	8/35	44.45
27924.96	Mid	DFT-s-OFDM	QPSK	V	SISO	63	8/35	44.42
27926.96	Mid	CP-OFDM	QPSK	H + V	MIMO	319 + 63	8/35	39.64
27924.96	Mid	CP-OFDM	QPSK	H	SISO	319	8/35	39.70
27924.96	Mid	CP-OFDM	QPSK	V	SISO	63	8/35	39.47
27926.96	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/35	49.10
27926.96	Mid	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	8/35	**49.10**
27926.96	Mid	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	8/35	**44.72**
27926.96	Mid	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	8/35	**43.79**

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

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
27600.08	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	**41.77**
27600.08	Low	DFT-s-OFDM	QPSK	H	SISO	319	64/0	38.91
27600.08	Low	DFT-s-OFDM	QPSK	V	SISO	63	64/0	38.57
27600.08	Low	CP-OFDM	QPSK	H + V	MIMO	319 + 63	66/0	38.25
27600.08	Low	CP-OFDM	QPSK	H	SISO	319	66/0	39.00
27600.08	Low	CP-OFDM	QPSK	V	SISO	63	66/0	38.80
27926.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	41.00
28249.96	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	41.15
27600.08	Low	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	64/0	**42.21**
27600.08	Low	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	64/0	**39.31**
27600.08	Low	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	64/0	**39.31**

Table 7-5. EIRP Data (Band n261 - 100MHz-2CC)

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Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
27525.00	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	48.37
27924.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	48.56
28324.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	**49.02**
28324.92	High	DFT-s-OFDM	QPSK	H	SISO	319	8/12	43.92
28324.92	High	DFT-s-OFDM	QPSK	V	SISO	63	8/12	43.83
28324.92	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	8/12	39.26
28324.92	High	CP-OFDM	QPSK	H	SISO	319	8/12	39.17
28324.92	High	CP-OFDM	QPSK	V	SISO	63	8/12	39.24
28324.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	8/12	**49.07**
28324.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	8/12	**44.69**
28324.92	High	DFT-s-OFDM	64QAM	H + V	MIMO	319 + 63	8/12	**44.27**

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

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
27550.00	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	38.31
27924.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	38.18
28299.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	**39.23**
28324.92	High	DFT-s-OFDM	QPSK	H	SISO	319	32/0	37.42
28324.92	High	DFT-s-OFDM	QPSK	V	SISO	63	32/0	37.73
28324.92	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	32/0	37.88
28324.92	High	CP-OFDM	QPSK	H	SISO	319	32/0	37.78
28324.92	High	CP-OFDM	QPSK	V	SISO	63	32/0	37.86
28299.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	32/0	**39.23**
28299.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	32/0	**38.75**
28324.92	High	DFT-s-OFDM	64QAM	H + V	MIMO	319 + 63	32/0	**36.02**

Table 7-7. EIRP Data (Band n261 - 50MHz-2CC)

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Band n260

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
37050.00	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/22	47.69
38499.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/22	47.47
39949.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/35	**48.45**
39949.92	High	DFT-s-OFDM	QPSK	H	SISO	319	8/22	45.74
39949.92	High	DFT-s-OFDM	QPSK	V	SISO	63	8/35	45.47
39949.92	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	8/22	39.95
39949.92	High	CP-OFDM	QPSK	H	SISO	319	8/22	41.14
39949.92	High	CP-OFDM	QPSK	V	SISO	63	8/22	40.35
39949.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	8/35	**48.47**
39949.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	8/35	**44.23**
39949.92	High	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	8/35	**43.46**

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

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
37100.00	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	40.77
38499.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	39.97
39899.92	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	64/0	**41.23**
39899.92	High	DFT-s-OFDM	QPSK	H	SISO	319	64/0	39.00
39899.92	High	DFT-s-OFDM	QPSK	V	SISO	63	66/0	38.72
39899.92	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	66/0	36.21
39899.92	High	CP-OFDM	QPSK	H	SISO	319	64/0	39.10
39899.92	High	CP-OFDM	QPSK	V	SISO	63	66/0	38.73
39899.92	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	64/0	**41.27**
39899.92	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	64/0	**41.20**
39899.92	High	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	64/0	**38.59**

Table 7-9. EIRP Data (Band n260 - 100MHz-2CC)

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Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
37025.04	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	47.30
38499.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	47.02
39975.00	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	8/12	**48.70**
39975.00	High	DFT-s-OFDM	QPSK	H	SISO	319	8/12	46.15
39975.00	High	DFT-s-OFDM	QPSK	V	SISO	63	8/12	45.81
39975.00	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	8/12	39.66
39975.00	High	CP-OFDM	QPSK	H	SISO	319	8/12	41.49
39975.00	High	CP-OFDM	QPSK	V	SISO	63	8/12	41.04
39975.00	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	8/12	**48.62**
39975.00	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	8/12	**44.64**
39975.00	High	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	8/12	**43.54**

Table 7-10. EIRP Data (Band n260 - 50MHz-1CC)

Frequency [MHz]	Channel	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Beam ID	RB Size/Offset	EIRP [dBm]
37050.04	Low	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	38.00
38499.96	Mid	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	38.29
39950.00	High	DFT-s-OFDM	QPSK	H + V	2Tx	319 + 63	32/0	**38.41**
39950.00	High	DFT-s-OFDM	QPSK	H	SISO	319	32/0	39.14
39950.00	High	DFT-s-OFDM	QPSK	V	SISO	63	32/0	38.85
39950.00	High	CP-OFDM	QPSK	H + V	MIMO	319 + 63	32/0	36.63
39950.00	High	CP-OFDM	QPSK	H	SISO	319	32/0	39.29
39950.00	High	CP-OFDM	QPSK	V	SISO	63	32/0	38.89
39950.00	High	DFT-s-OFDM	π/2 BPSK	H + V	2Tx	319 + 63	32/0	**39.52**
39950.00	High	DFT-s-OFDM	16QAM	H + V	2Tx	319 + 63	32/0	**38.41**
39950.00	High	DFT-s-OFDM	64QAM	H + V	2Tx	319 + 63	32/0	**35.76**

Table 7-11. EIRP Data (Band n260 - 50MHz-2CC)

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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.

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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 7-12. 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.

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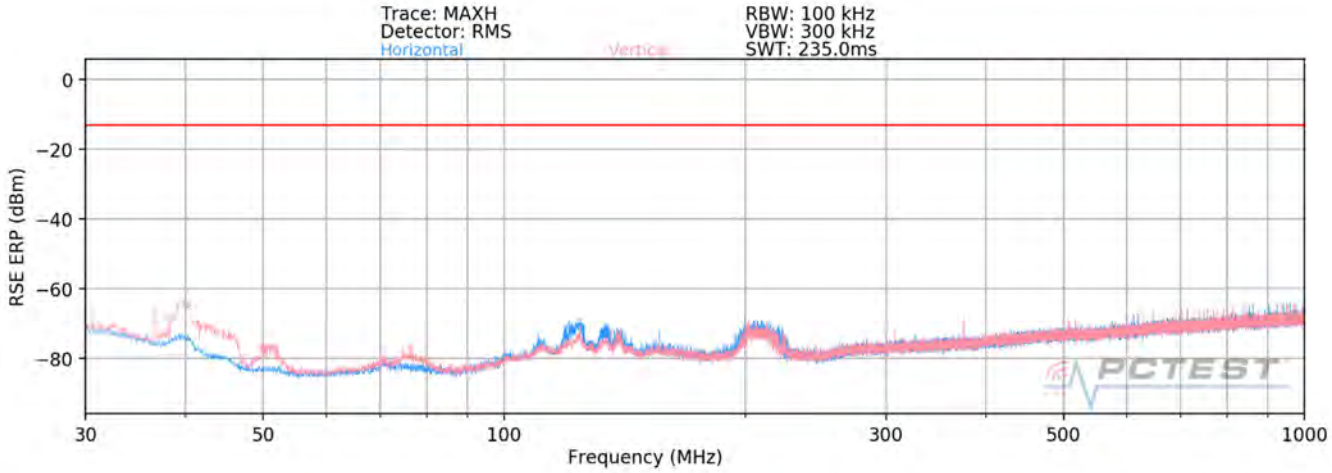
Band n261

30MHz - 1GHz



Plot 7-33. n261 Radiated Spurious Plot (1CC QPSK Mid Channel)

Note: A RSE table for compliance in the 30MHz - 1GHz ranges is not included since the pre-scan shows all emissions are well below the limit.

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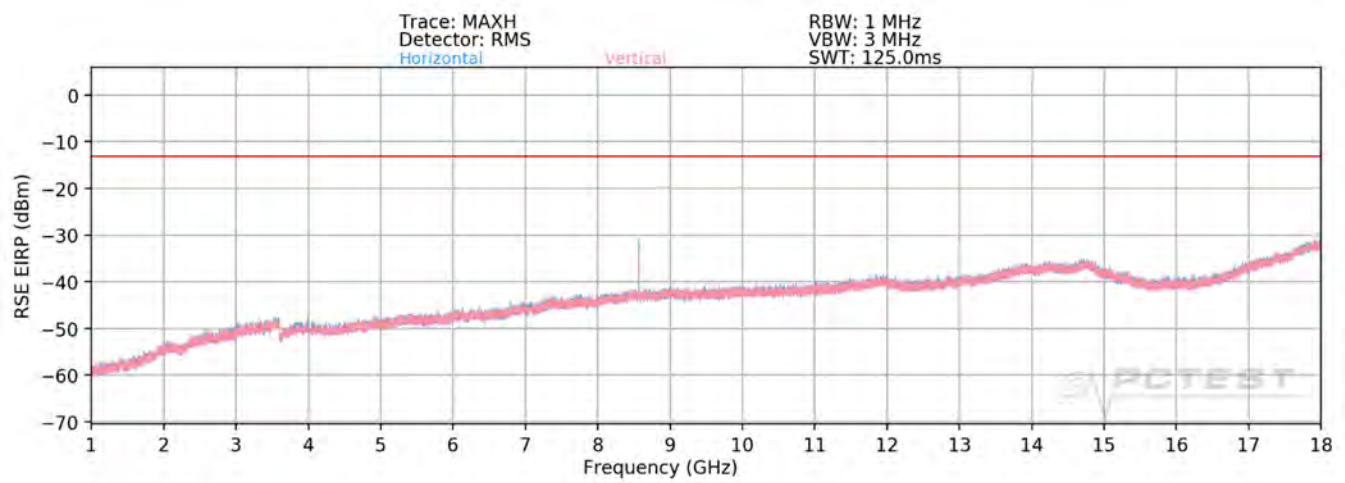
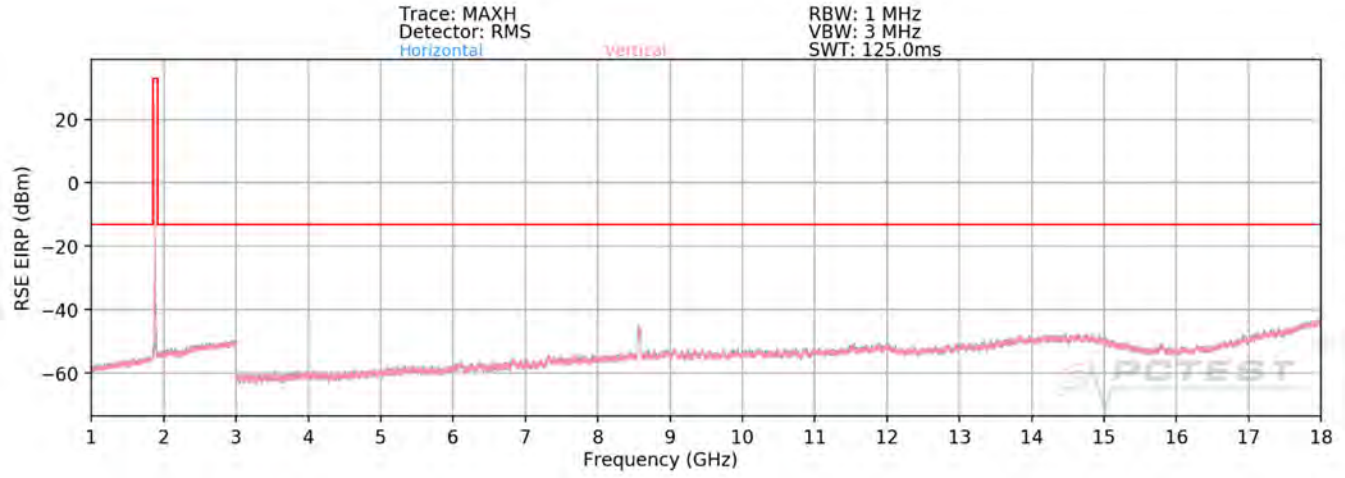
1GHz - 18GHz



Plot 7-34. n261 Radiated Spurious Plot (1CC QPSK Mid Channel)



Plot 7-35. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – EN-DC Anchor Band 2)

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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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
8398.64	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	154	-38.39	-13.00	-25.39
9105.51	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	151	-28.95	-13.00	-15.95
9146.40	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	151	-27.70	-13.00	-14.70

Table 7-13. n261 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.

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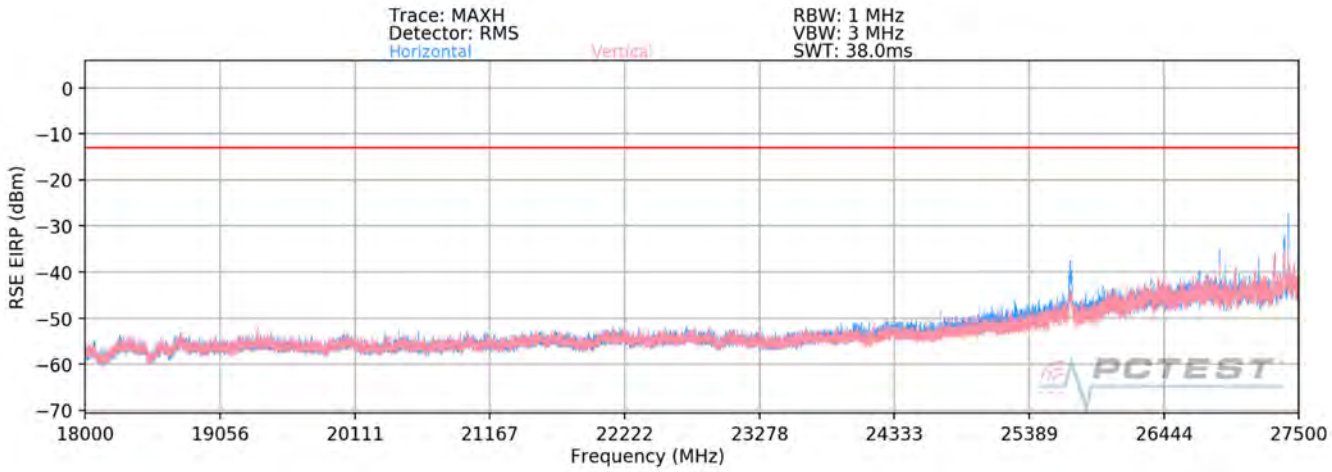
18GHz - 27.5GHz



Plot 7-36. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – 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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
26969.77	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	34	-22.38	-13.00	-9.38
27391.89	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	302	-31.10	-13.00	-18.10
26881.17	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	24	-29.35	-13.00	-16.35

Table 7-14. n261 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.

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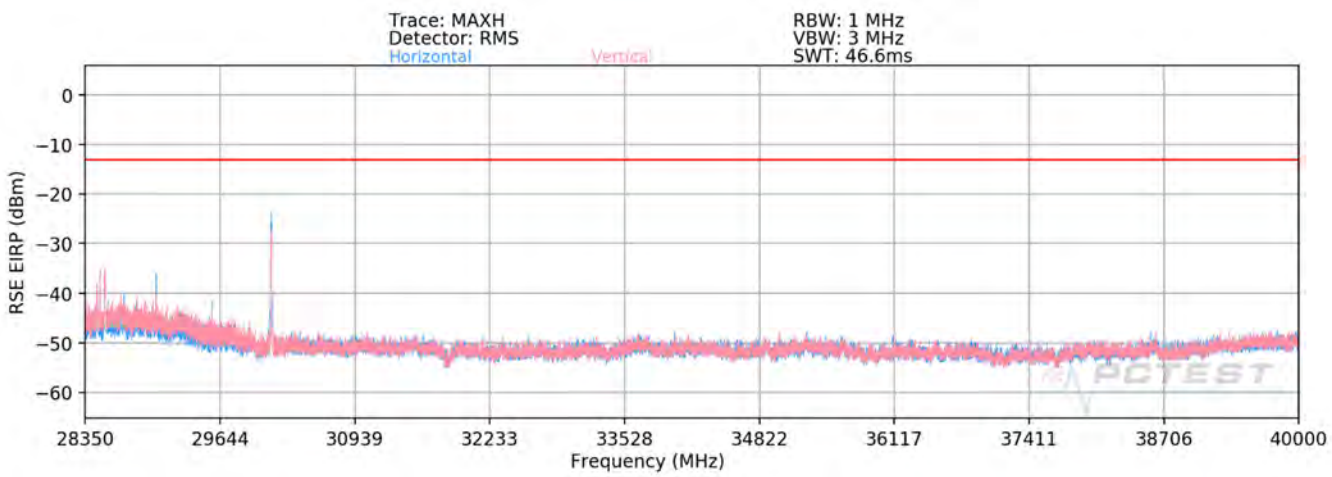
28.35GHz - 40GHz



Plot 7-37. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – 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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Mast Height [cm]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
28513.69	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	306	-20.30	-13.00	-7.30
30134.23	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	299	-26.54	-13.00	-13.54
28636.70	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	150	301	-27.87	-13.00	-14.87

Table 7-15. n261 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.

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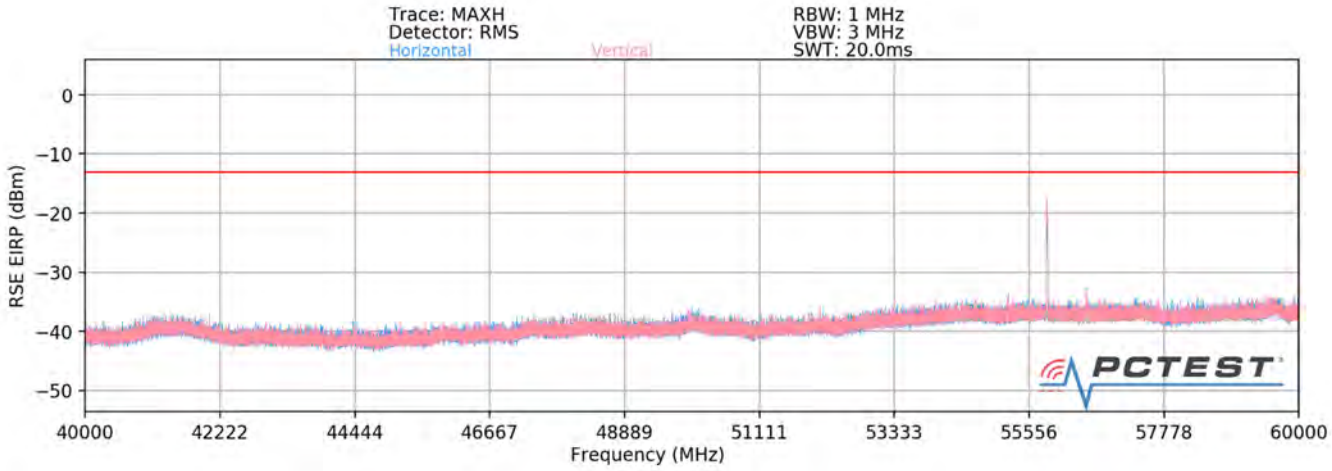
40GHz - 60GHz



Plot 7-38. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – 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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
55051.41	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	342	-28.13	-13.00	-15.13
55848.99	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	20	-18.18	-13.00	-5.18
56648.88	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	20	-27.28	-13.00	-14.28

Table 7-16. n261 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.

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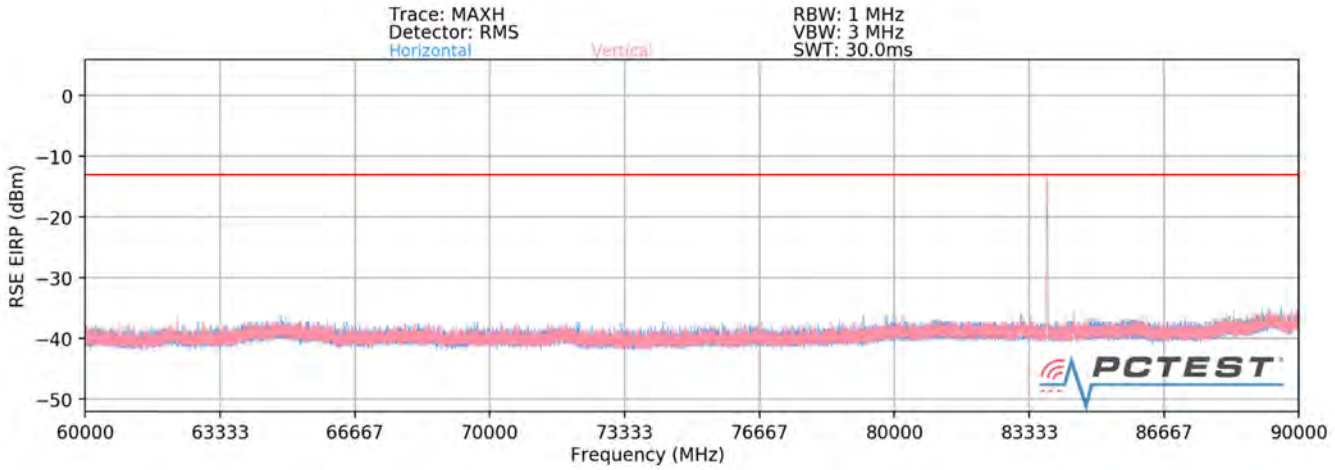
60GHz - 90GHz



Plot 7-39. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – 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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
82575.00	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	359	-23.01	-13.00	-10.01
83774.30	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	325	-18.22	-13.00	-5.22
84973.83	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	0	-16.97	-13.00	-3.97

Table 7-17. n261 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.

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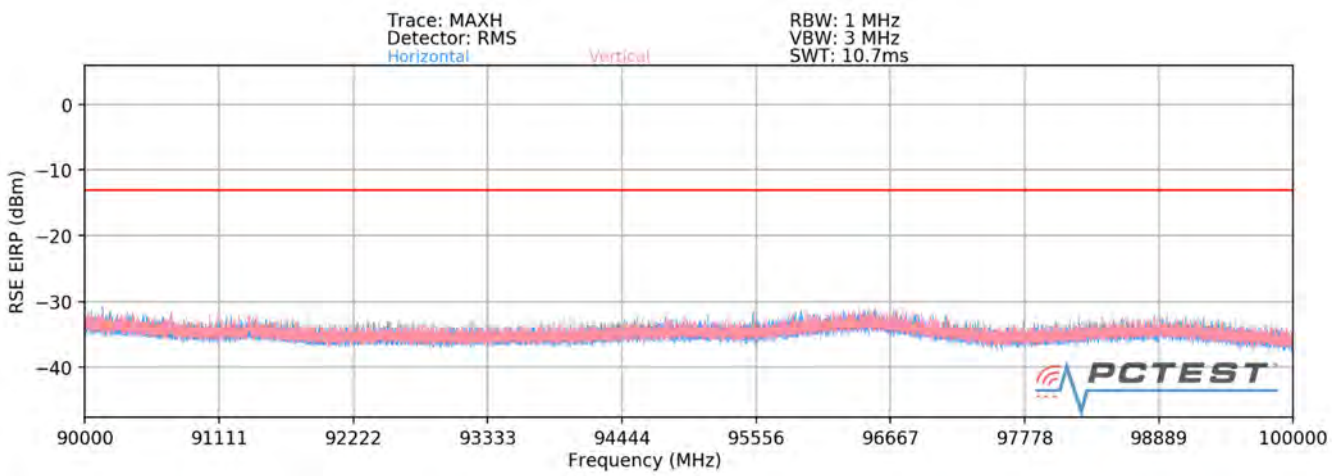
90GHz - 100GHz



Plot 7-40. n261 Radiated Spurious Plot (1CC QPSK Mid Channel – 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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
90038.00	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	-	-41.99	-13.00	-28.99
90046.70	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	-	-42.08	-13.00	-29.08
90035.20	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	-	-42.17	-13.00	-29.17

Table 7-18. n261 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.

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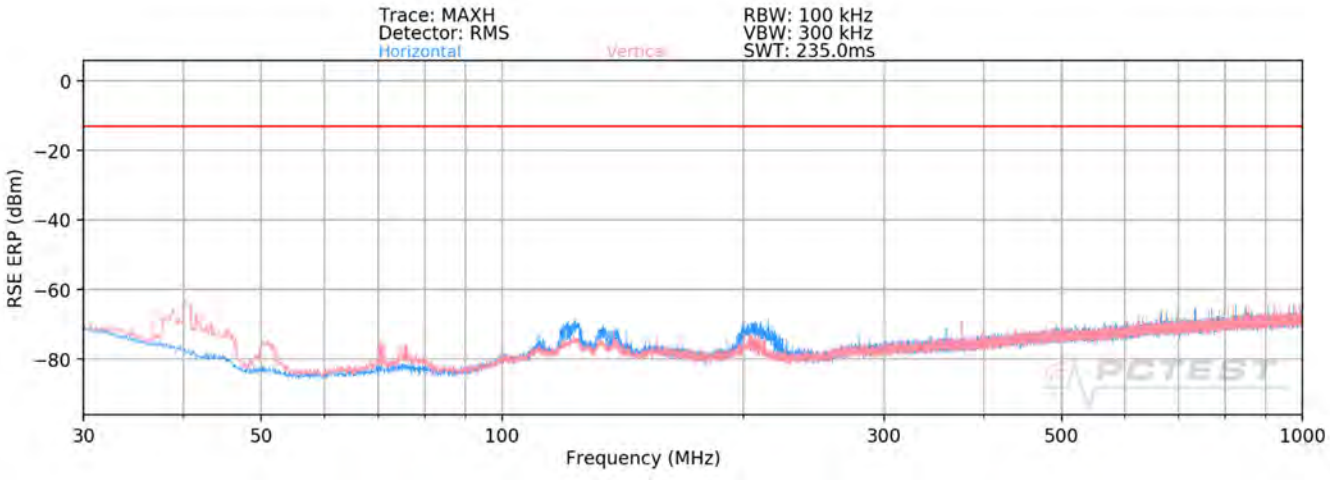
Band n260

30MHz - 1GHz



Plot 7-41. n260 Radiated Spurious Plot (1CC QPSK Mid Channel H Beam – EN-DC Anchor Band 2)

Note: A RSE table for compliance in the 30MHz - 1GHz ranges is not included since the pre-scan shows all emissions are well below the limit.

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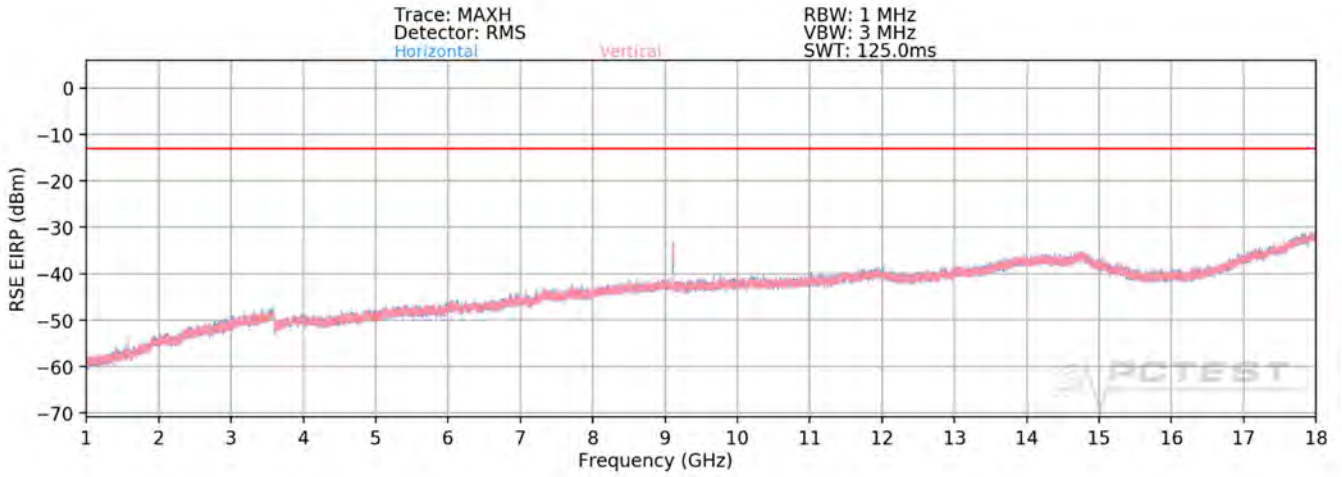
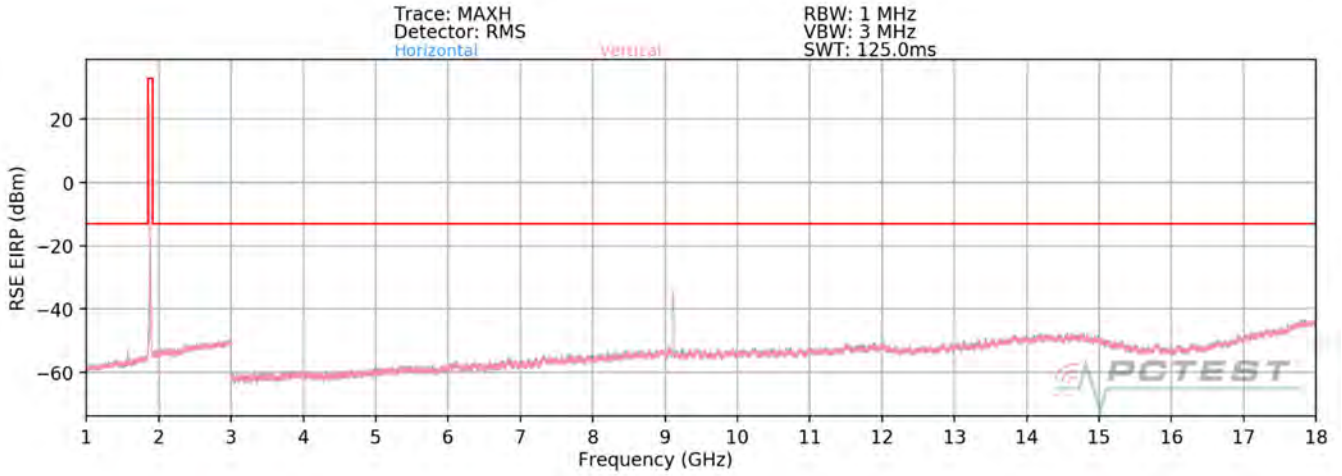
1GHz - 18GHz



Plot 7-42. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)



Plot 7-43. n260 Radiated Spurious Plot (1CC QPSK Mid Channel – EN-DC Anchor Band 2)

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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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
8398.64	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	154	-38.39	-13.00	-25.39
9105.51	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	151	-28.95	-13.00	-15.95
9146.40	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	151	-27.70	-13.00	-14.70

Table 7-19. n260 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.

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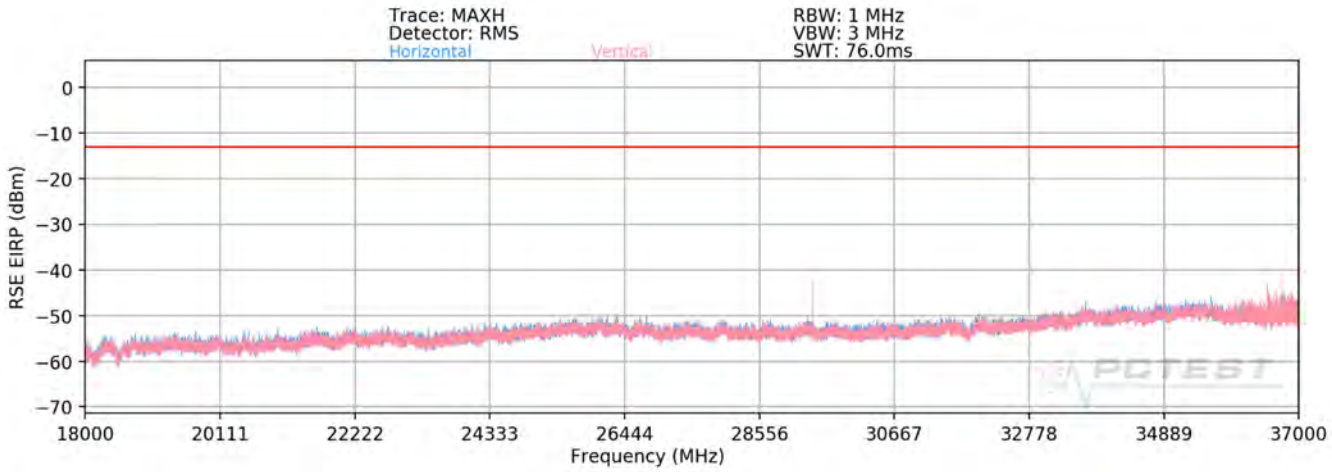
18GHz – 37GHz



Plot 7-44. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Mast Height [cm]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
29120.82	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-43.74	-13.00	-30.74
29389.17	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-43.83	-13.00	-30.83
29531.76	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-49.00	-13.00	-36.00
36476.80	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-36.63	-13.00	-23.63
36736.15	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-37.42	-13.00	-24.42
36876.87	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	150	-42.20	-13.00	-29.20

TaCWble 7-20. n260 Spurious Emissions Table (18GHz – 37GHz)

Notes

1. 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.
2. A RSE measurement for the emission ~29GHz was not included since it is well below the limit

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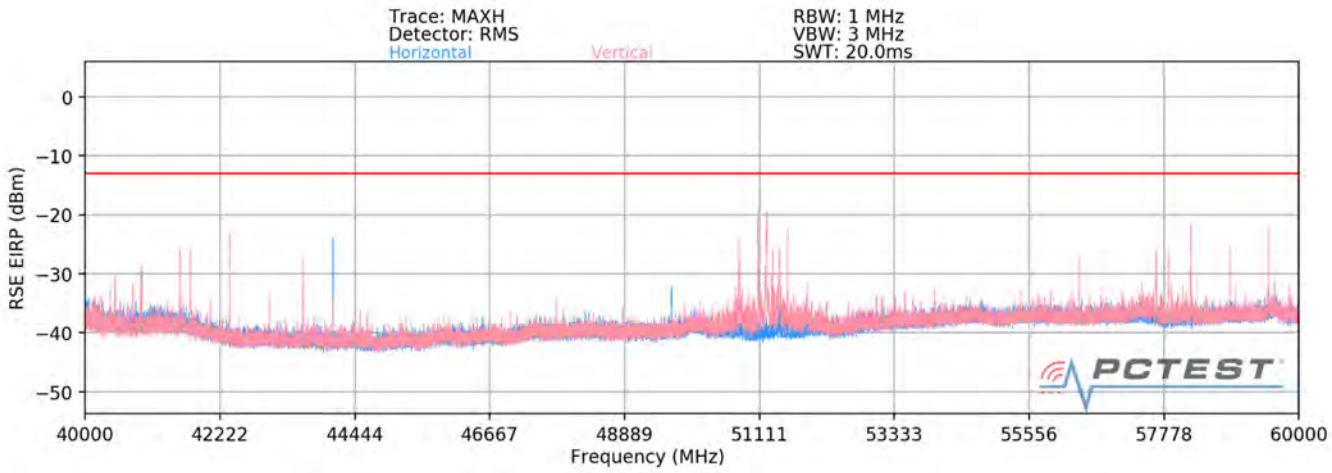
40GHz - 60GHz



Plot 7-45. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
49108.60	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	2	-25.40	-13.00	-12.40
51090.70	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	358	-25.67	-13.00	-12.67
49572.13	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	V	1	-18.40	-13.00	-5.40

Table 7-21. n260 Spurious Emissions Table (40GHz - 60GHz)

Notes

1. 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.
2. All emissions were investigated in this range of operation. Although the pre-scan plot shows the presence of many high level emissions, a closer investigation of these emissions confirmed that they are all much greater than 20dB below the limit

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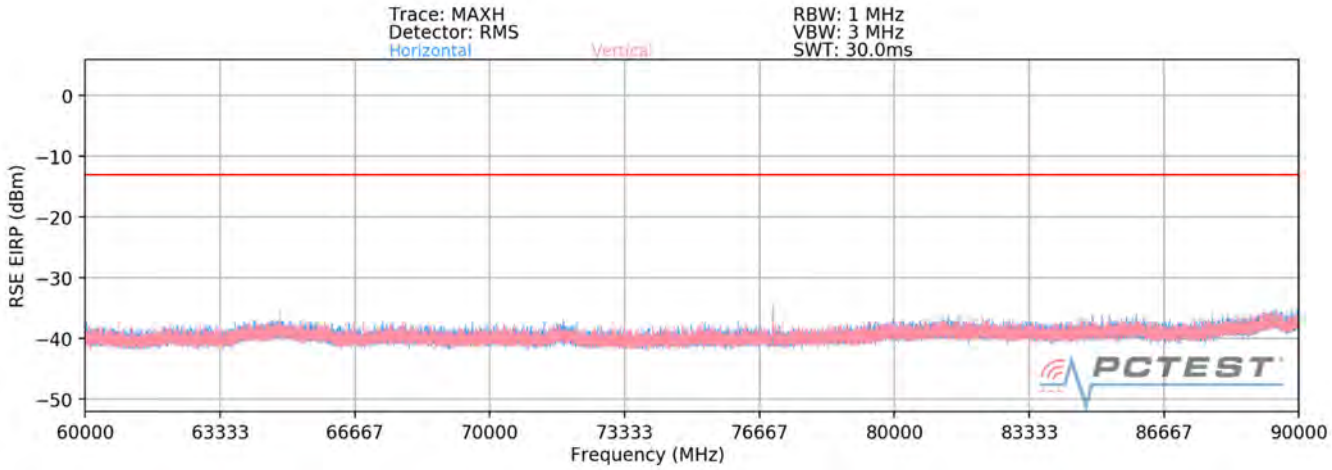
60GHz - 90GHz



Plot 7-46. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
74051.37	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	296	-42.42	-13.00	-29.42
77001.33	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	313	-36.41	-13.00	-23.41
79951.68	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	317	-36.65	-13.00	-23.65

Table 7-22. n260 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.

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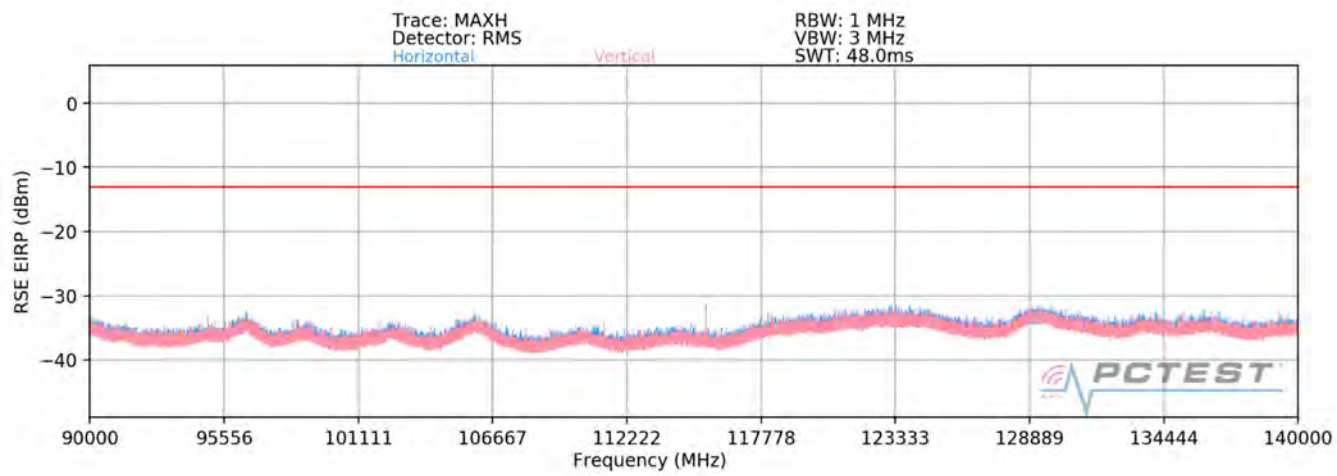
90GHz - 140GHz



Plot 7-47. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
111075.78	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	307	-41.36	-13.00	-28.36
115499.39	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	4	-36.86	-13.00	-23.86
119926.92	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	358	-40.41	-13.00	-27.41

Table 7-23. n260 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.

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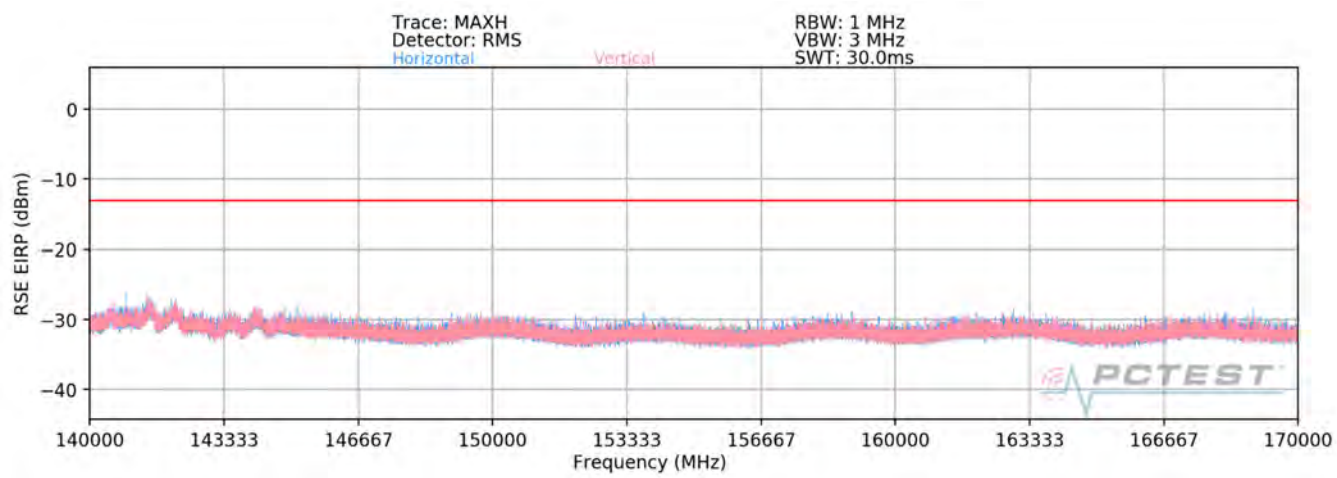
140GHz - 170GHz



Plot 7-48. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
148113.87	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-39.89	-13.00	-26.89
153990.81	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-38.20	-13.00	-25.20
159.895.44	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-38.17	-13.00	-25.17

Table 7-24. n260 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.

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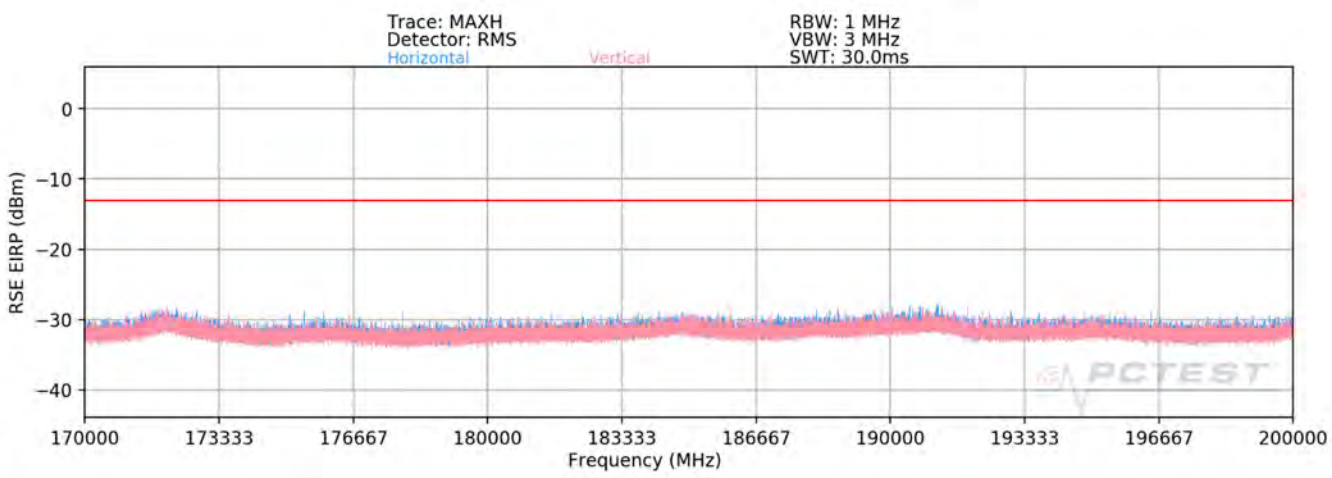
170GHz - 200GHz



Plot 7-49. n260 Radiated Spurious Plot (1CC QPSK Mid Channel)

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)	Transmission Scheme	Modulation	Beam Pol.	Ant. Div. Scheme	Antenna Polarization [H/V]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
185126.10	Low	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-39.60	-13.00	-26.60
192492.47	Mid	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-39.69	-13.00	-26.69
199866.06	High	50	DFT-s-OFDM	QPSK	H + V	2Tx	H	-	-40.93	-13.00	-27.93

Table 7-25. n260 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.

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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 4.4.2.2

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 and 2CC were fully investigated, and only the worst case has been included in this report.
6) Since some of the Band Edge EIRP measurements exceed the emssion limit, the TRP measurement was performed as the alternative method. The plots measured are TRP are labeled as “TRP” in the captions.

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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.

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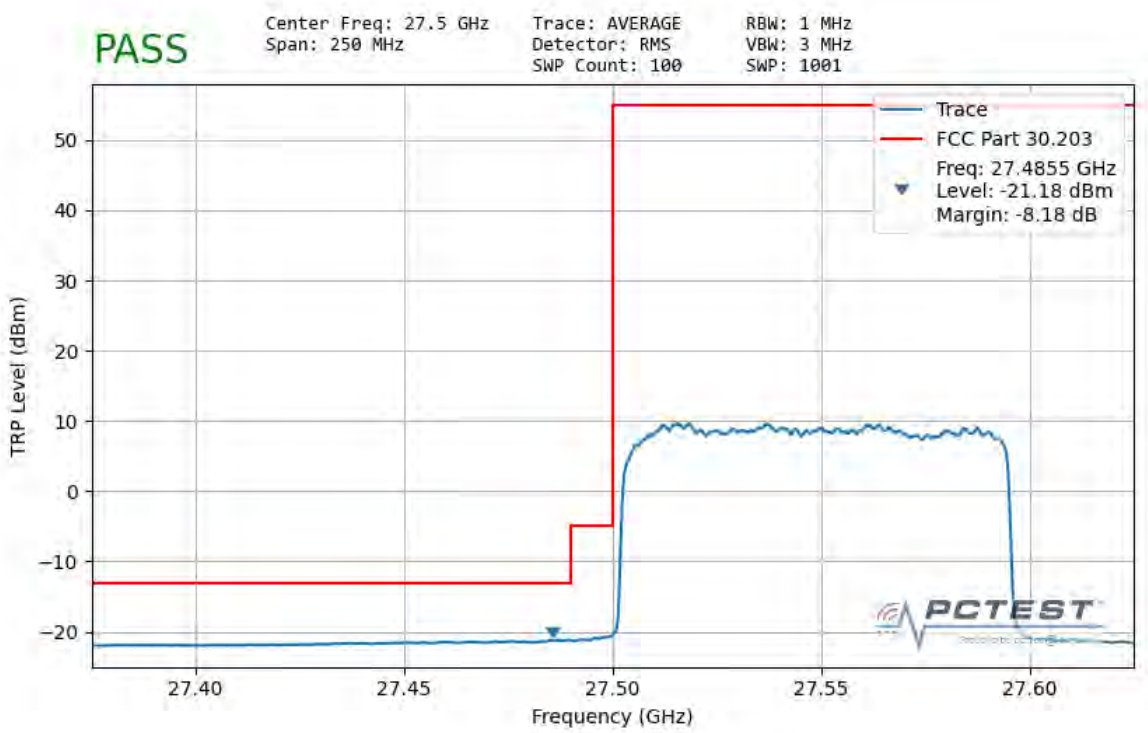
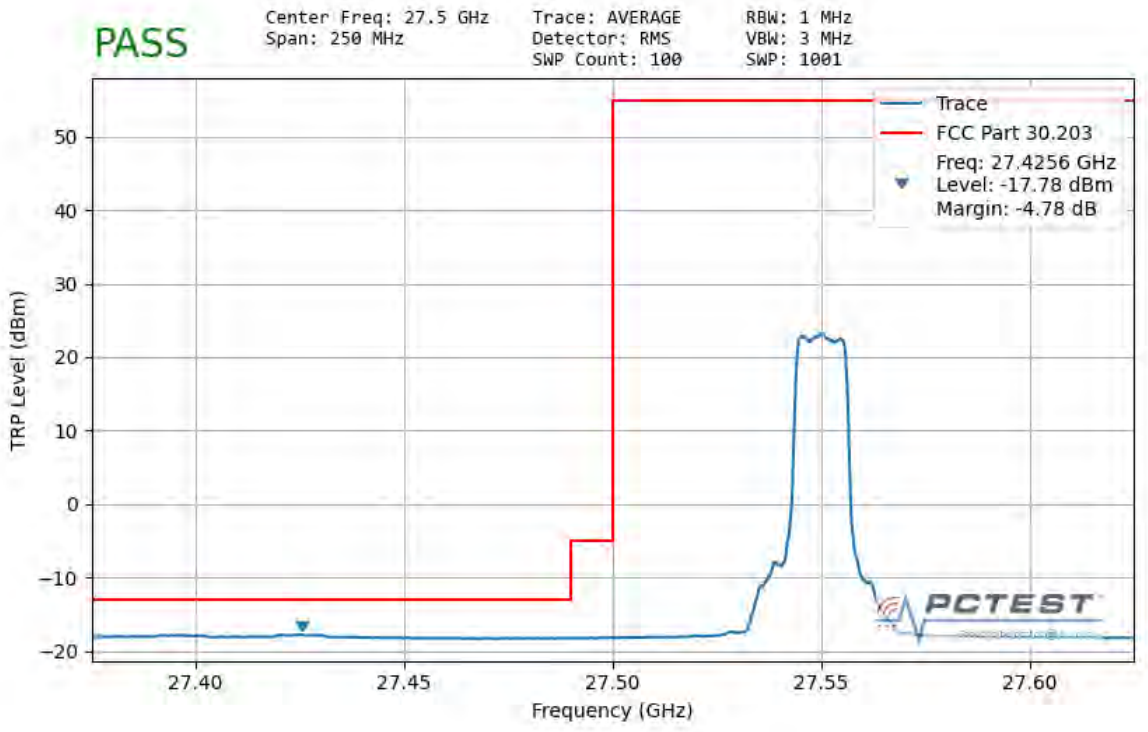
Band n261 – Worst-Case



Plot 7-50. Lower Band Edge in TRP (100MHz-1CC – QPSK Full RB)



Plot 7-51. Lower Band Edge in TRP (100MHz-1CC – π/2 BPSK 8 RB)

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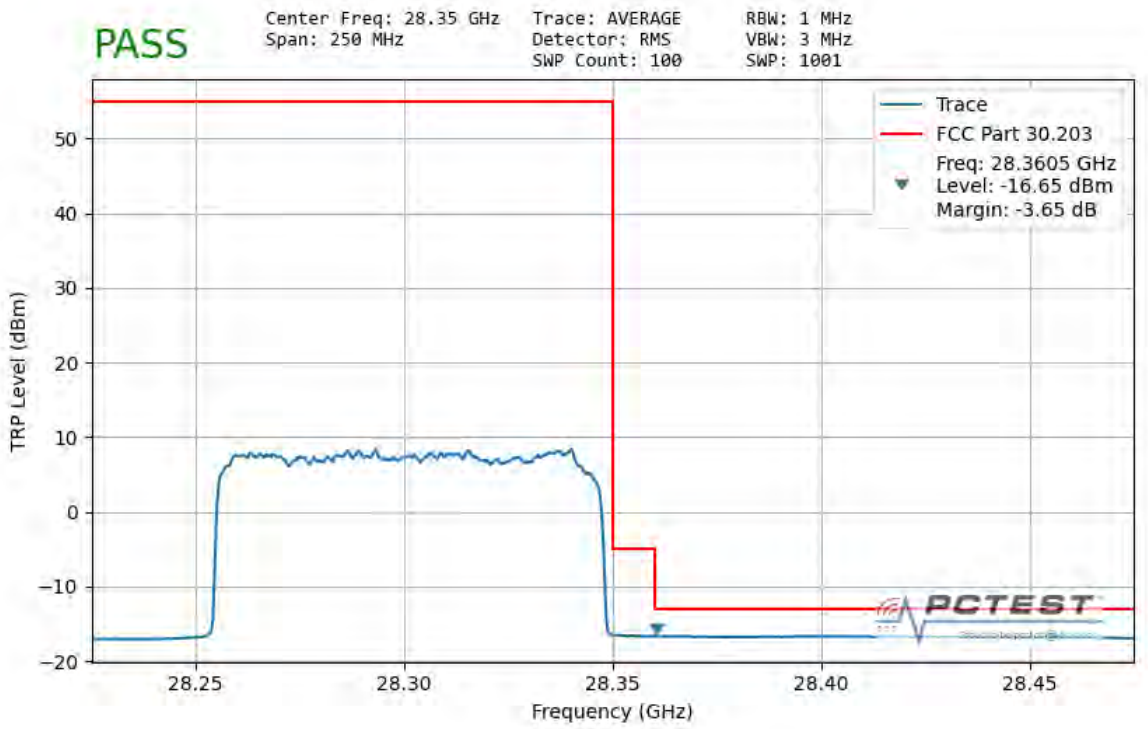
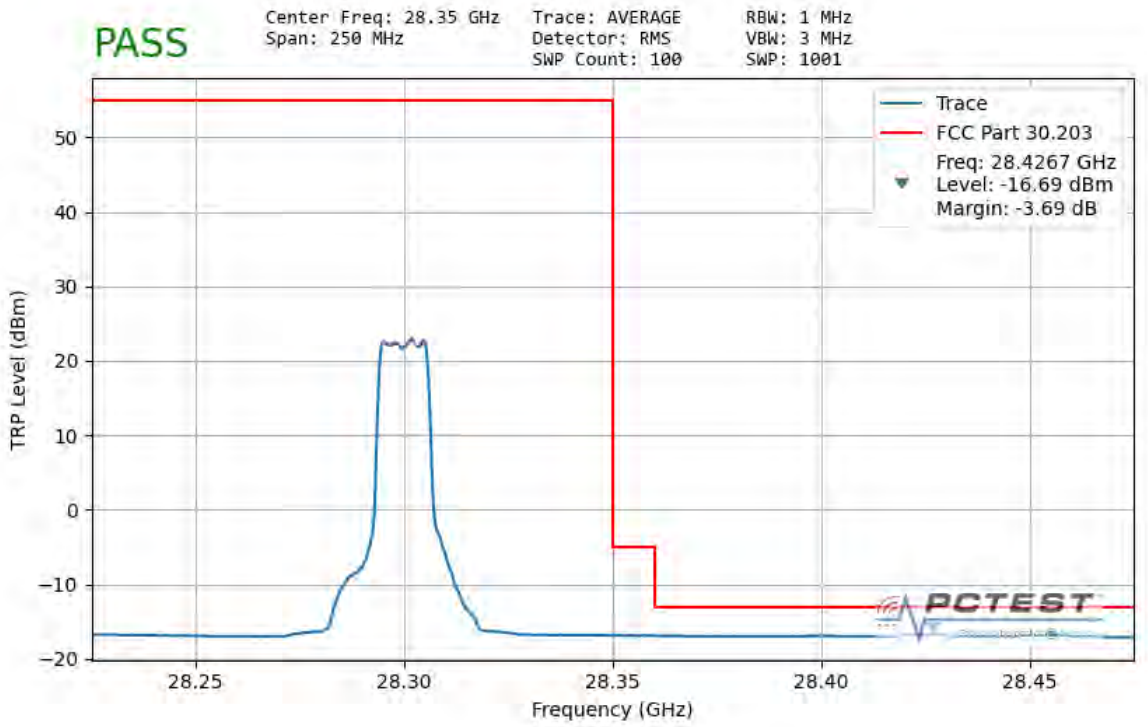


Plot 7-52. Upper Band Edge in TRP (100MHz-1CC – QPSK Full RB)



Plot 7-53. Upper Band Edge in TRP (100MHz-1CC – QPSK 8 RB)

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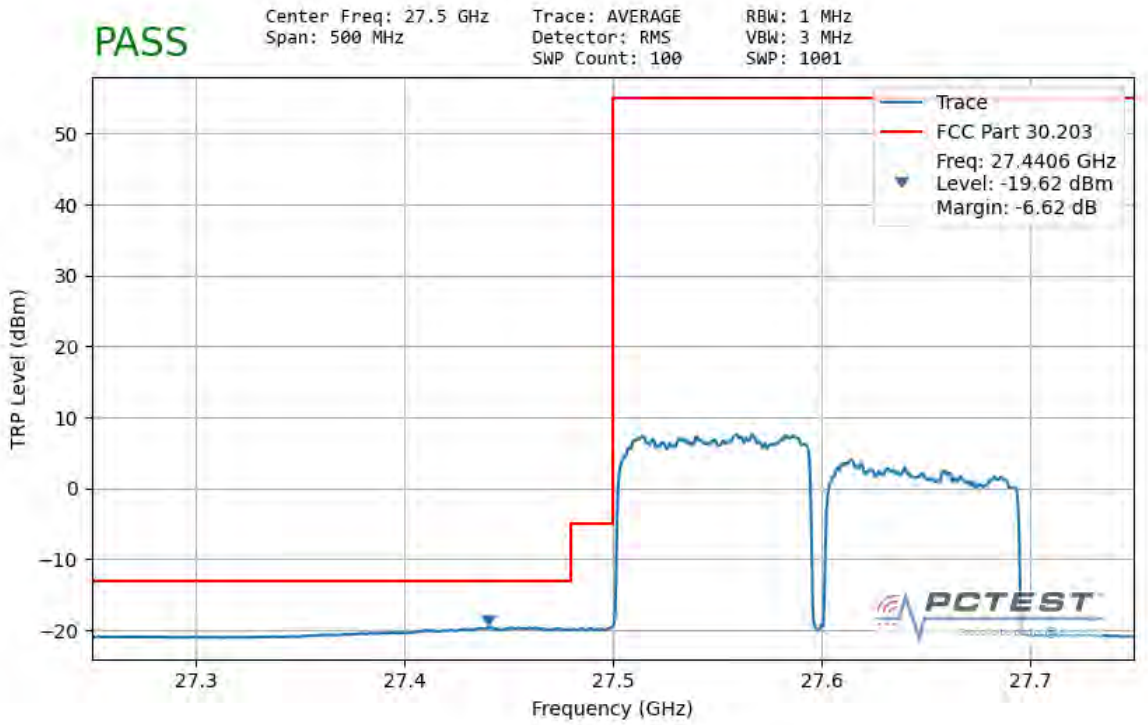
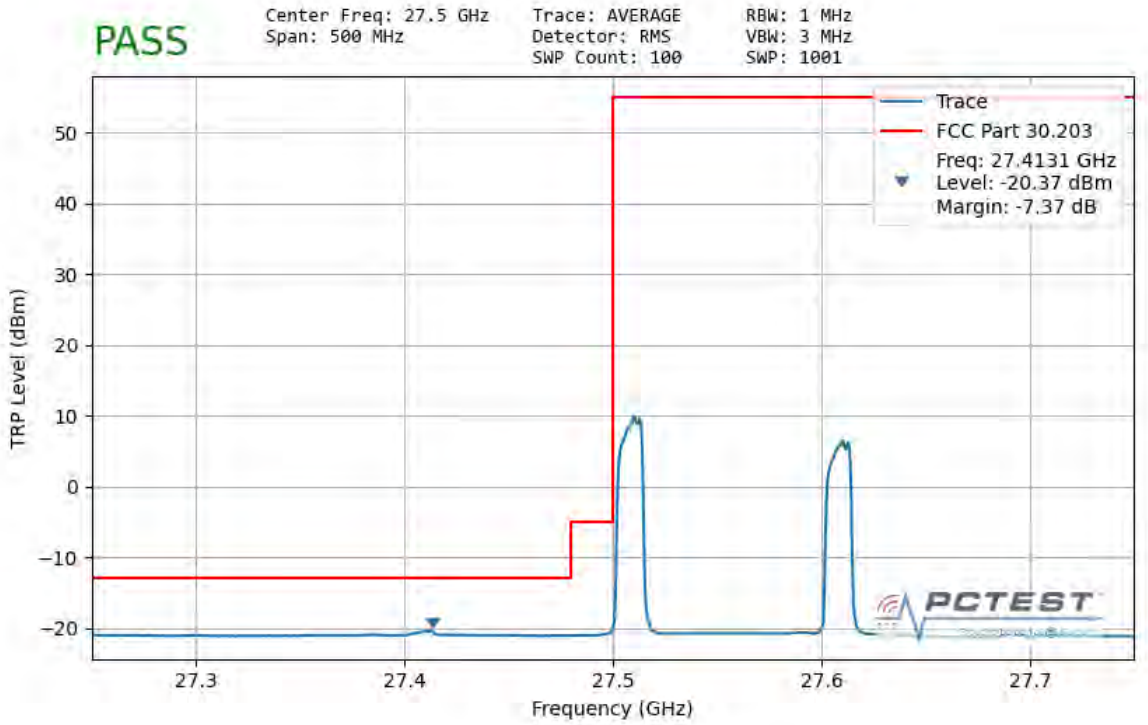


Plot 7-54. Lower Band Edge in TRP (100MHz-2CC – QPSK Full RB)



Plot 7-55. Lower Band Edge in TRP (100MHz-2CC – QPSK 8 RB)

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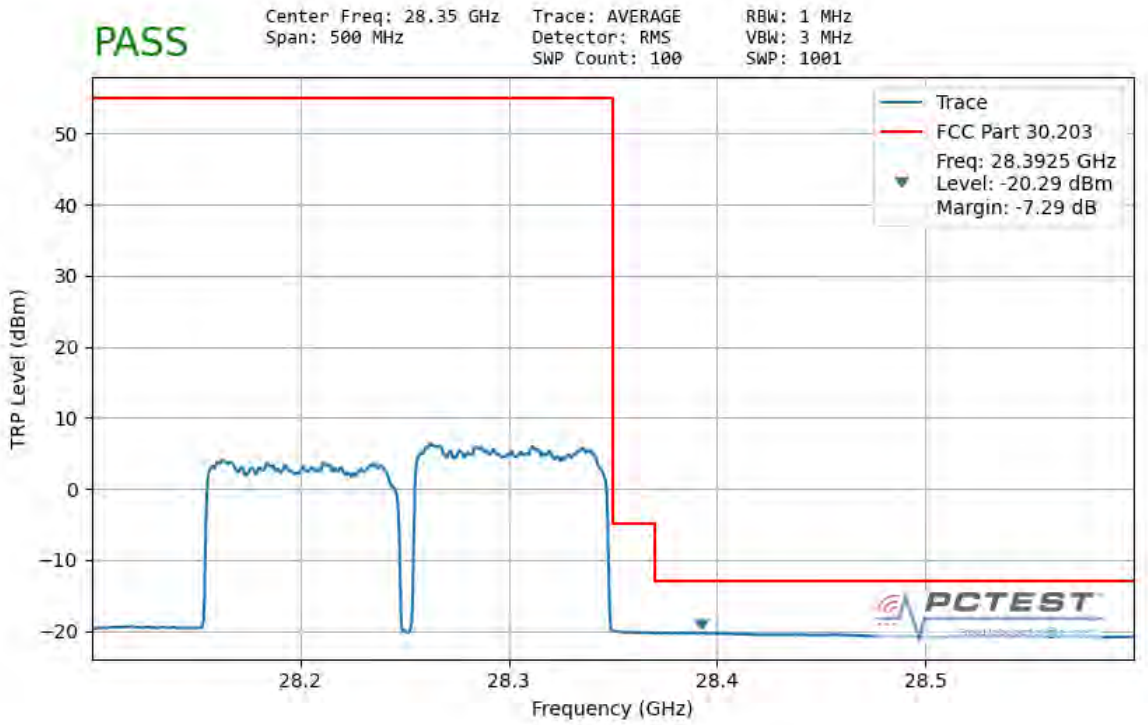
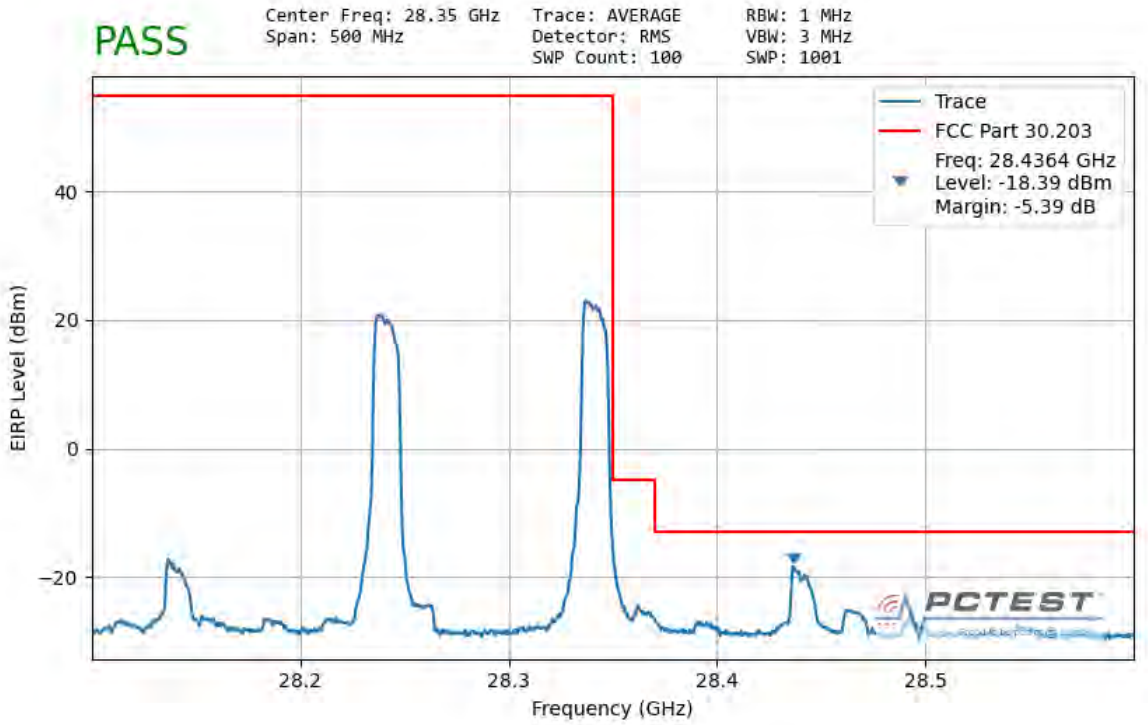


Plot 7-56. Upper Band Edge in TRP (100MHz-2CC – QPSK Full RB)



Plot 7-57. Upper Band Edge (100MHz-2CC – QPSK 8 RB)

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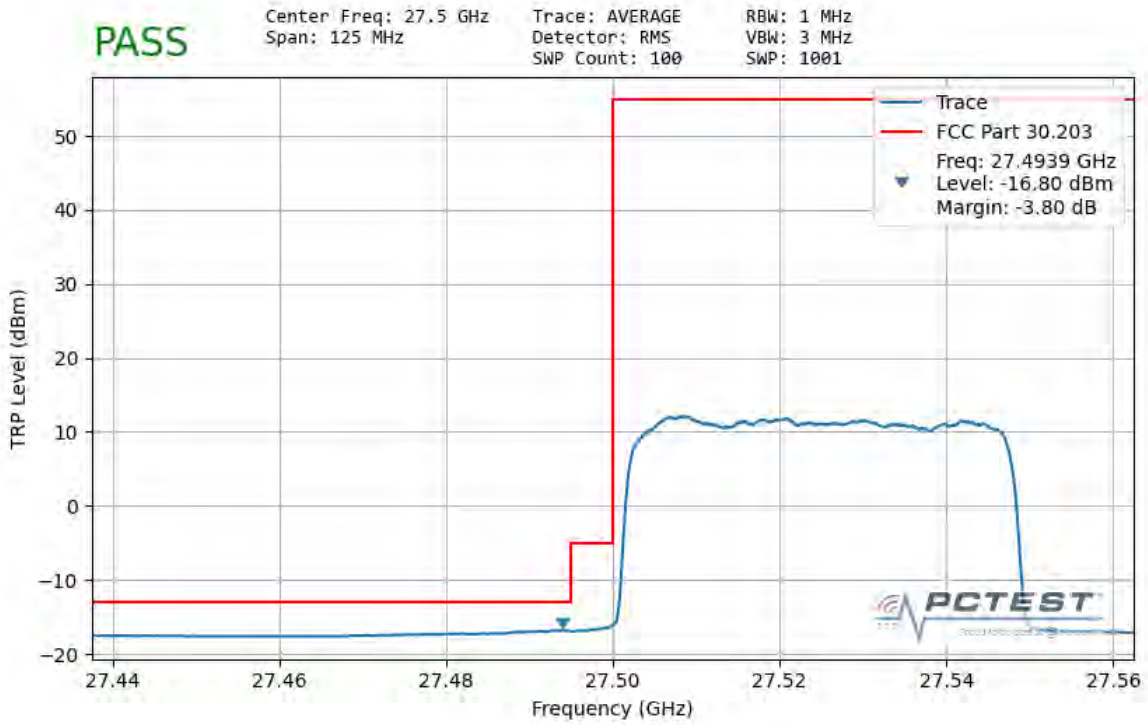
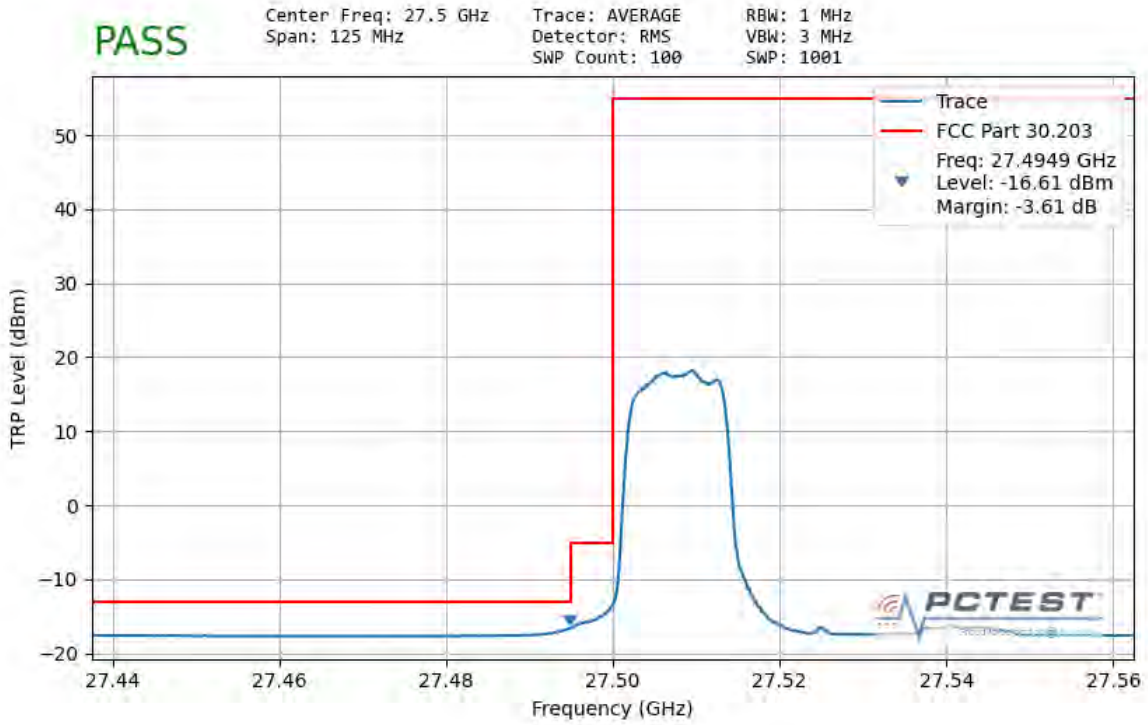


Plot 7-58. Lower Band Edge in TRP (50MHz-1CC – QPSK Full RB)



Plot 7-59. Lower Band Edge in TRP (50MHz-1CC – QPSK 8 RB)

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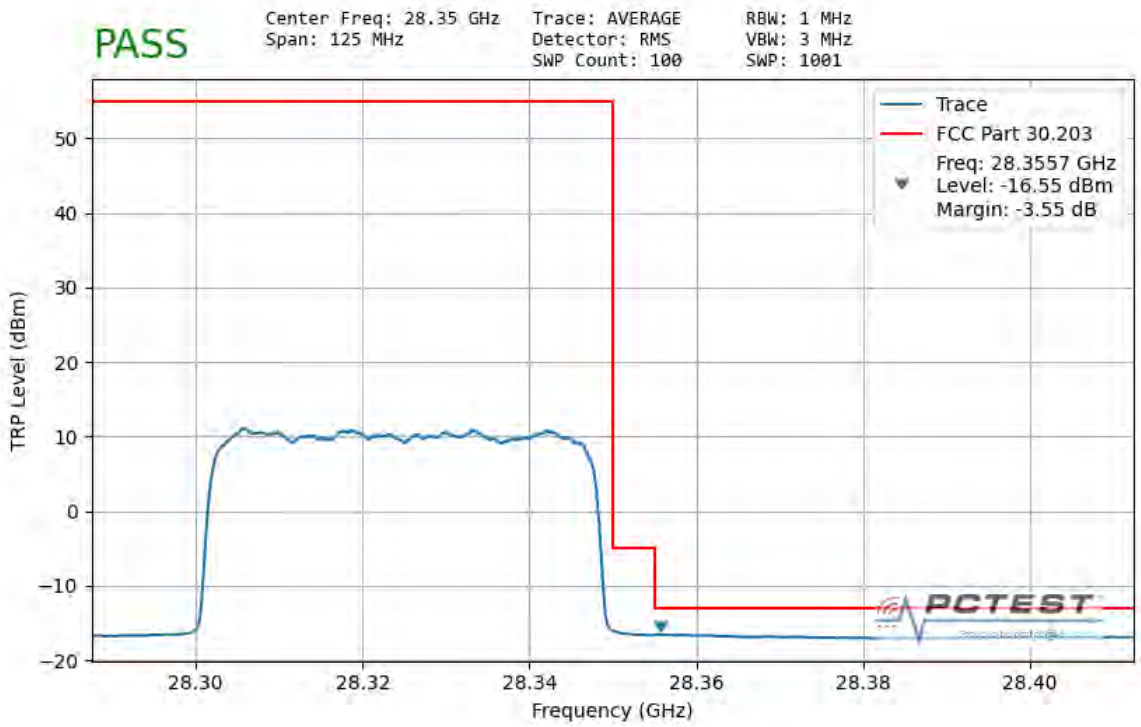
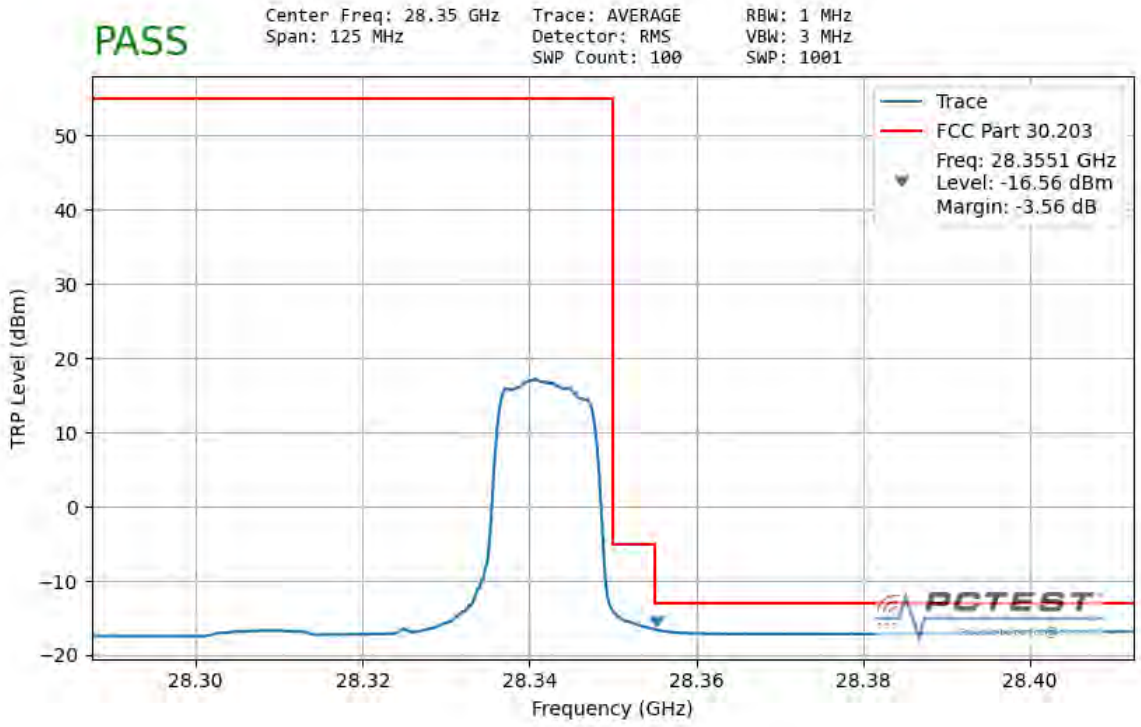


Plot 7-60. Upper Band Edge in TRP (50MHz-1CC – QPSK Full RB)



Plot 7-61. Upper Band Edge in TRP (50MHz-1CC – QPSK 8 RB)

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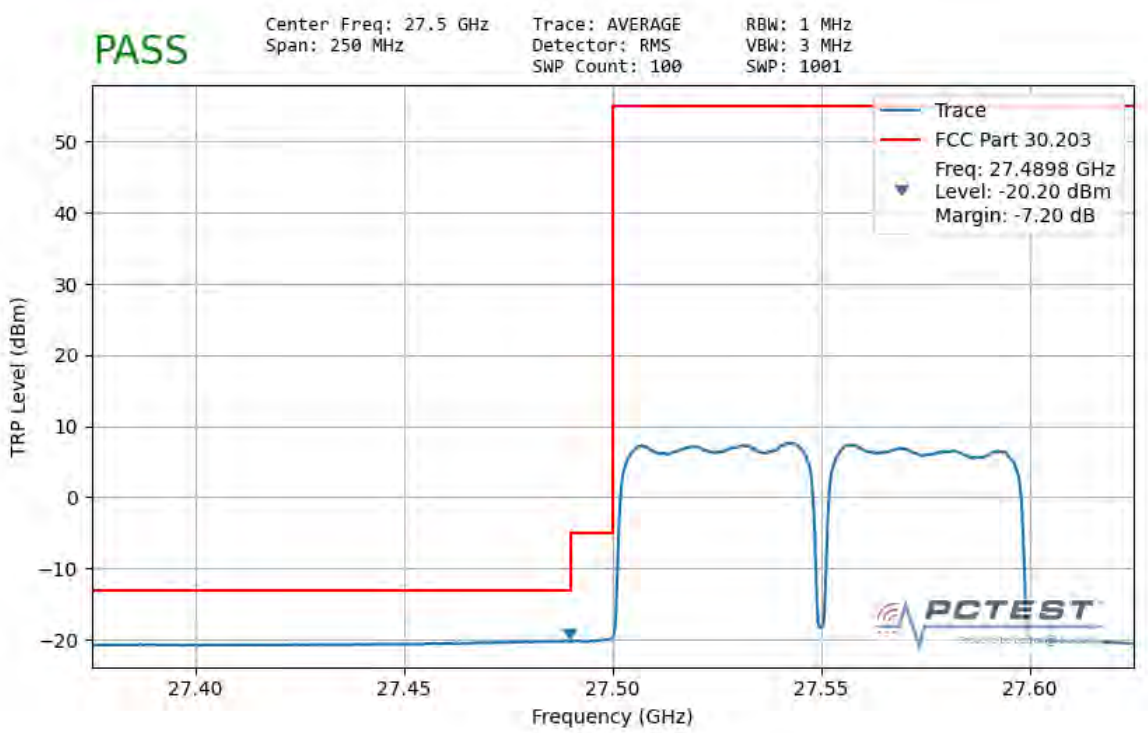
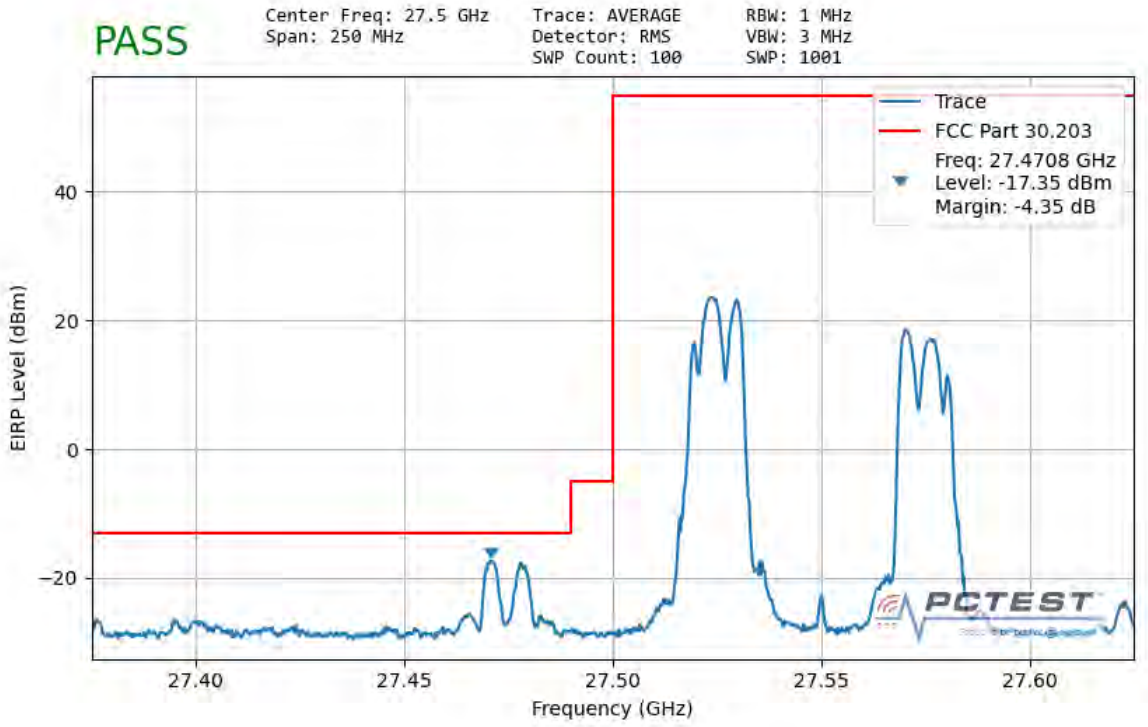


Plot 7-62. Lower Band Edge in TRP (50MHz-2CC – QPSK Full RB)



Plot 7-63. Lower Band Edge (50MHz-2CC – QPSK 8 RB)

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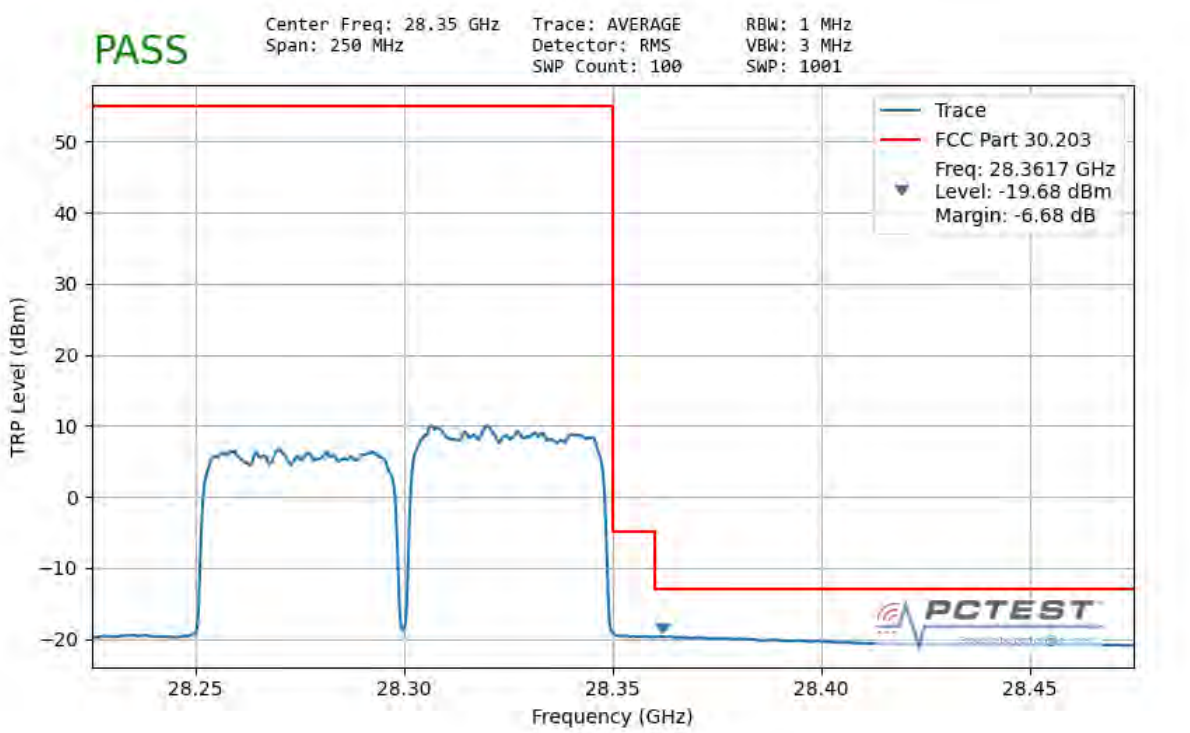
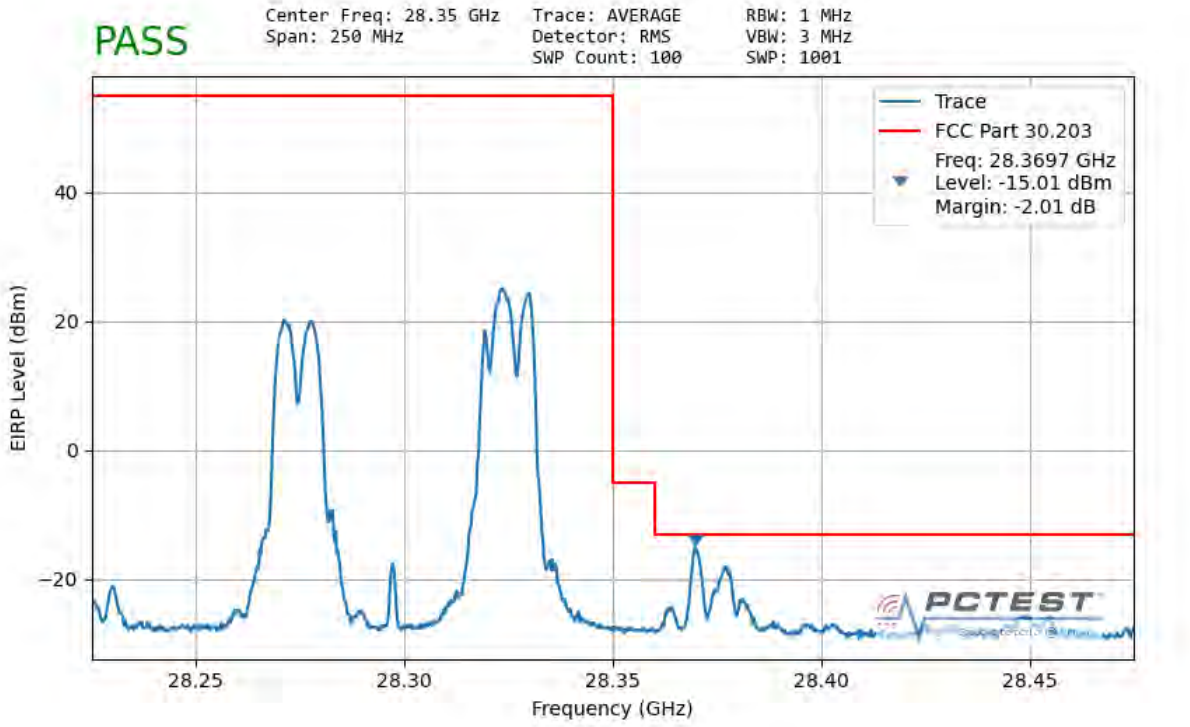


Plot 7-64. Upper Band Edge in TRP (50MHz-2CC – QPSK Full RB)



Plot 7-65. Upper Band Edge (50MHz-2CC – QPSK 8 RB)

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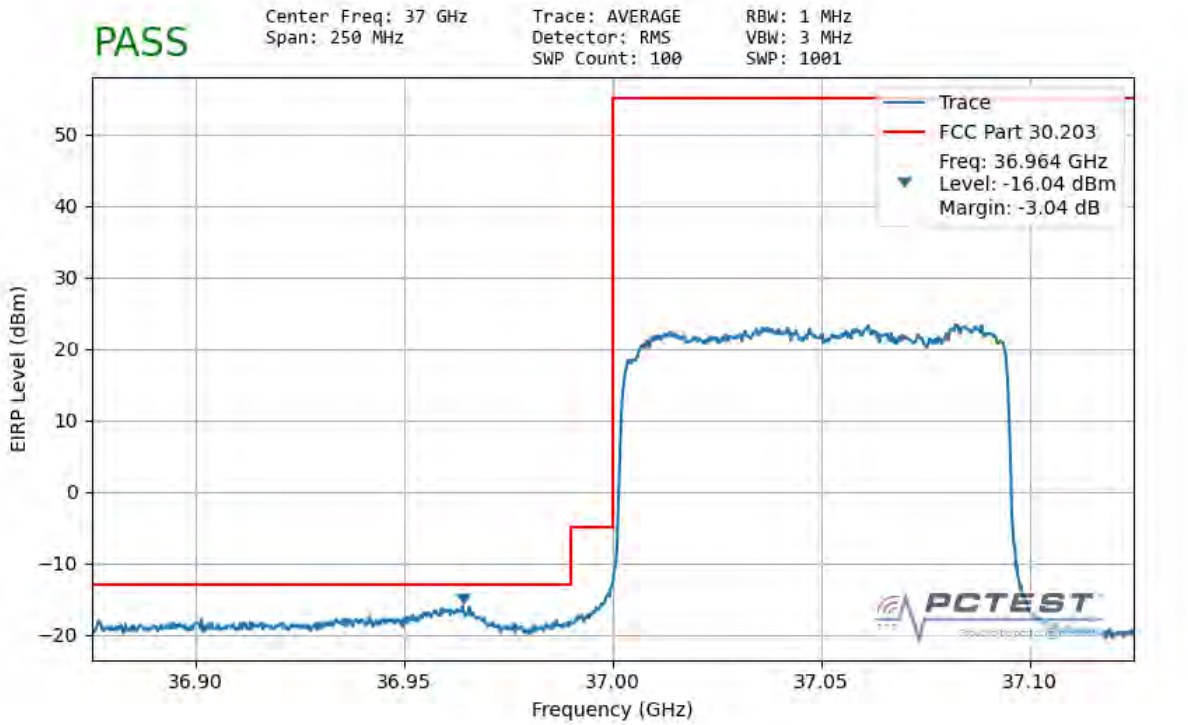
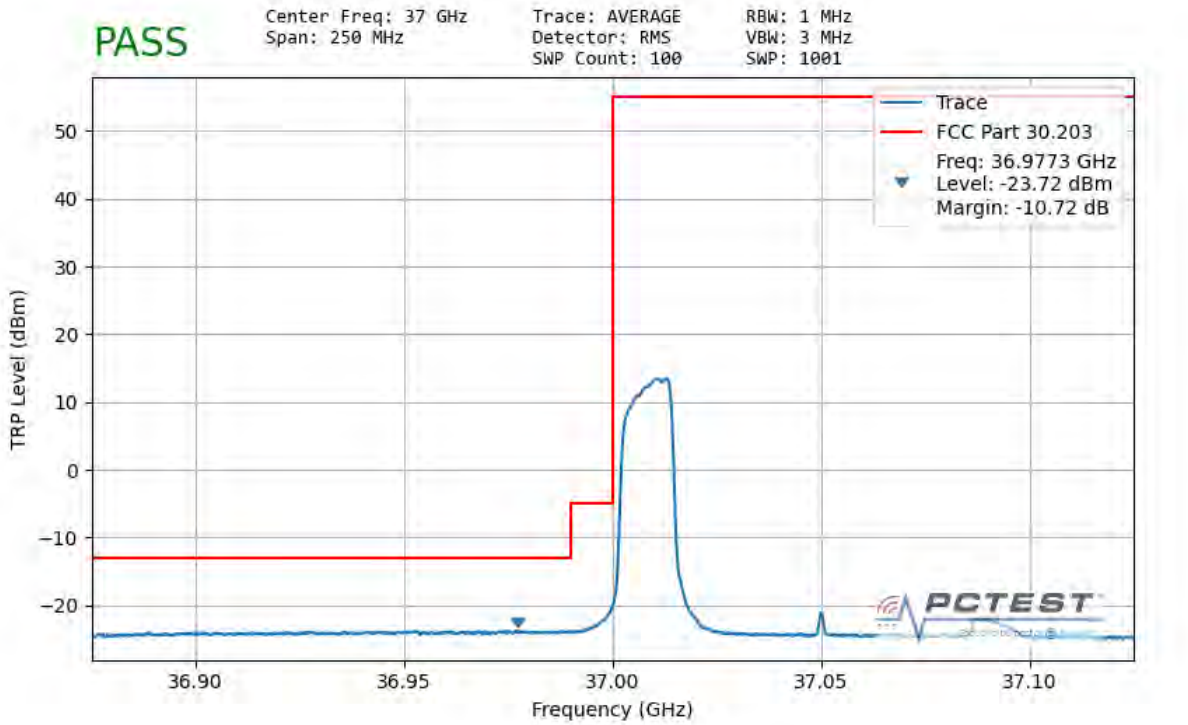
Band n260 – Worst Case



Plot 7-66. Lower Band Edge (100MHz-1CC – π/2 BPSK Full RB)



Plot 7-67. Lower Band Edge in TRP (100MHz-1CC – QPSK 8 RB)

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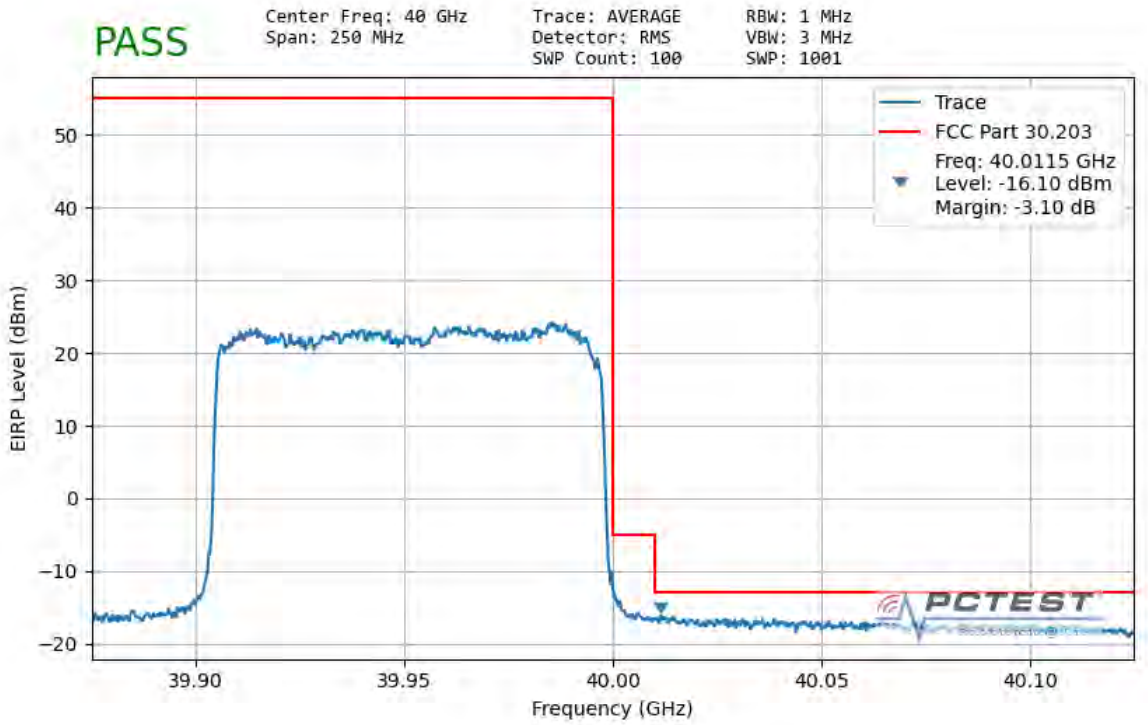
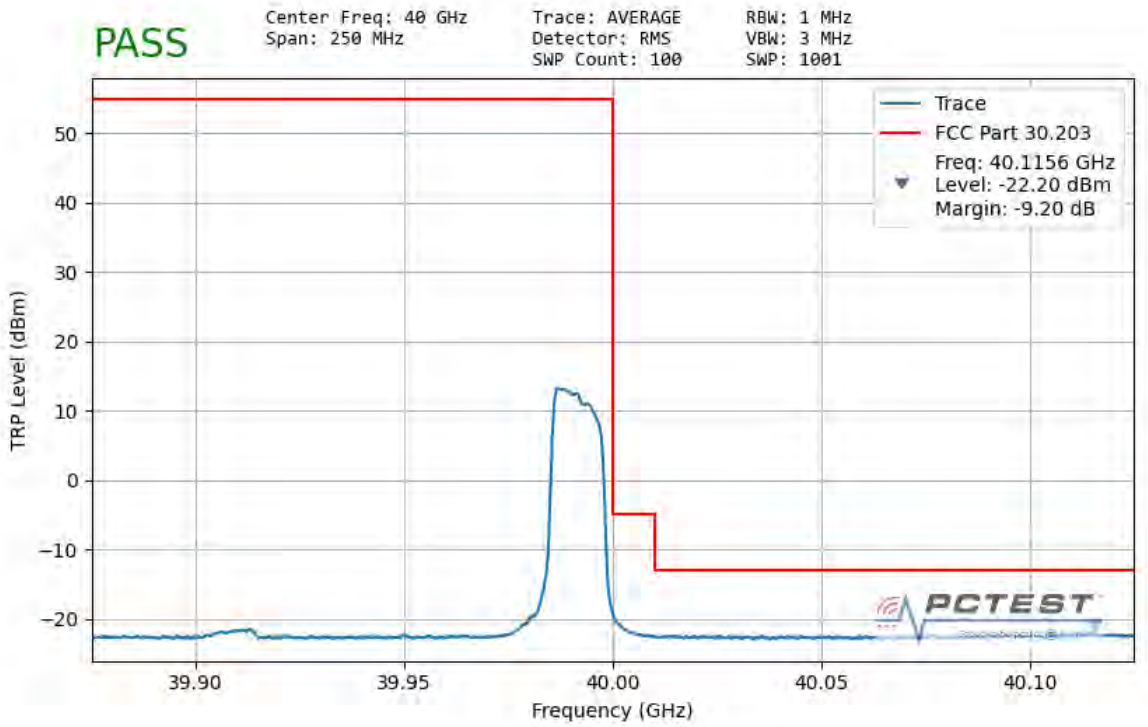


Plot 7-68. Upper Band Edge (100MHz-1CC – QPSK Full RB)



Plot 7-69. Upper Band Edge in TRP (100MHz-1CC – QPSK 8 RB)

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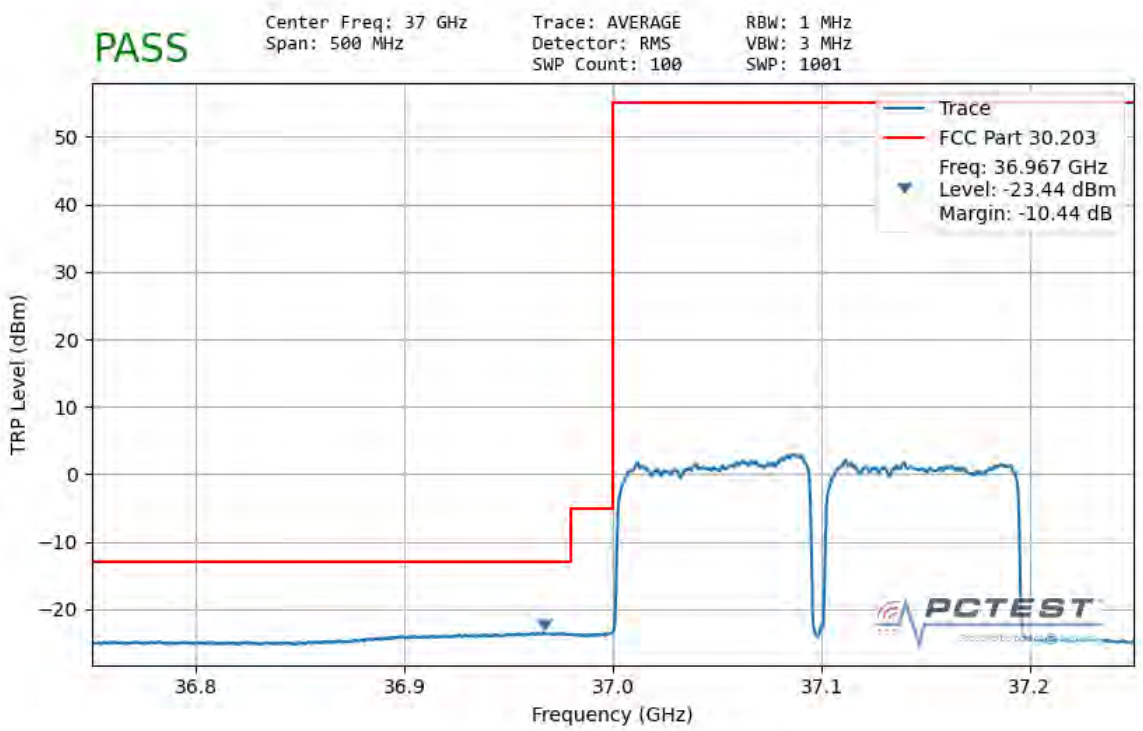
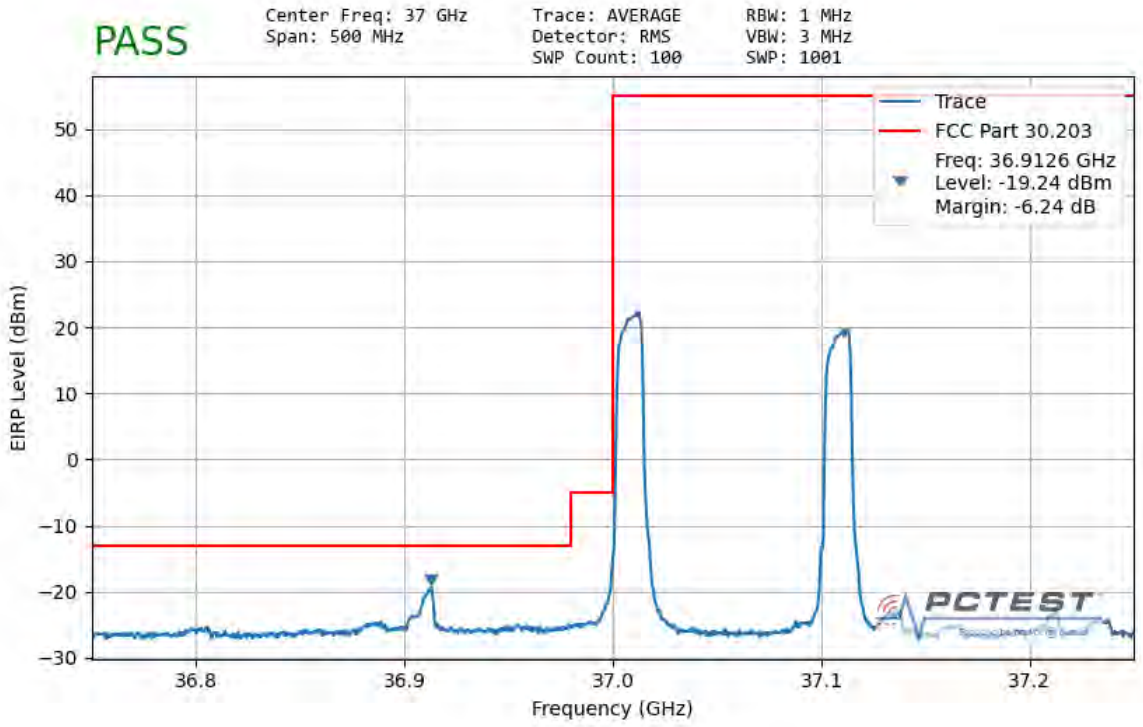


Plot 7-70. Lower Band Edge in TRP (100MHz-2CC – π/2 BPSK Full RB)



Plot 7-71. Lower Band Edge (100MHz-2CC – π/2 BPSK 8 RB)

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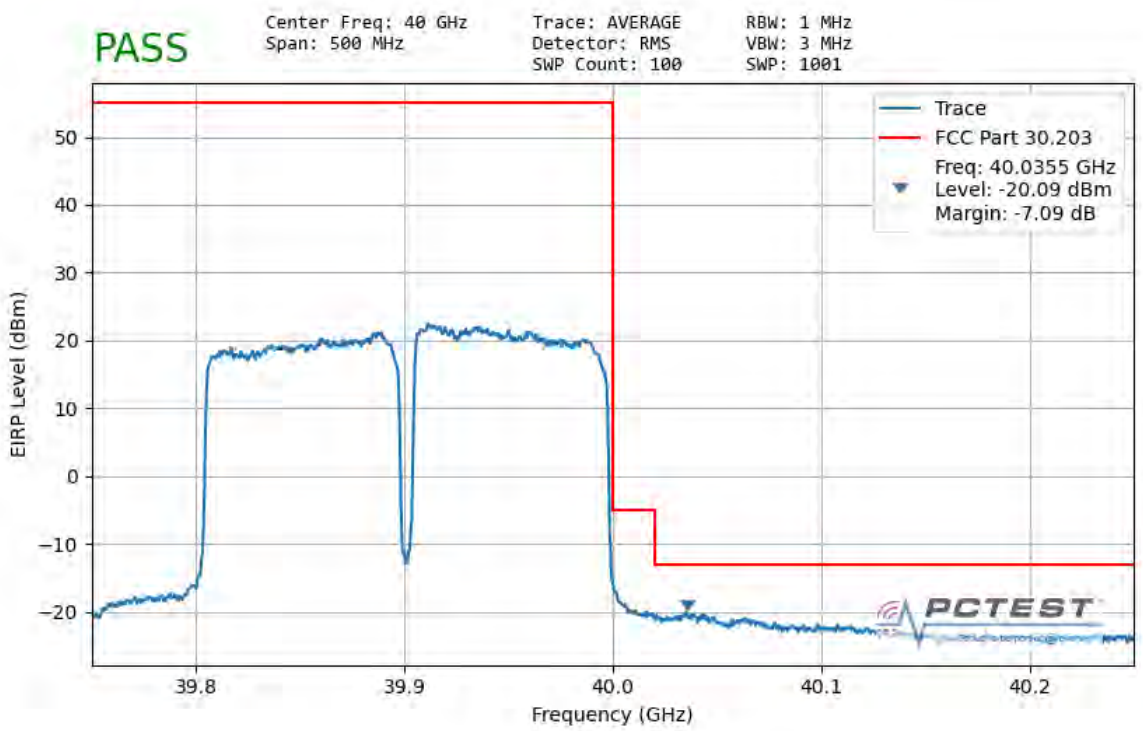
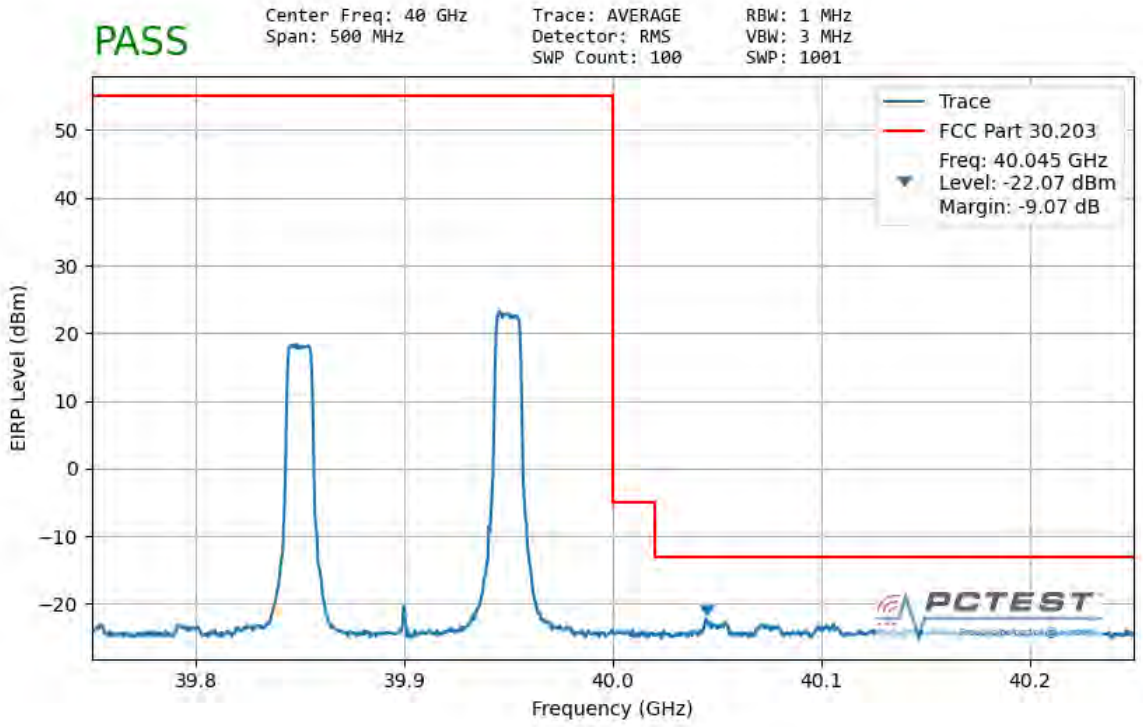


Plot 7-72. Upper Band Edge (100MHz-2CC – π/2 BPSK Full RB)



Plot 7-73. Upper Band Edge (100MHz-2CC – π/2 BPSK 8 RB)

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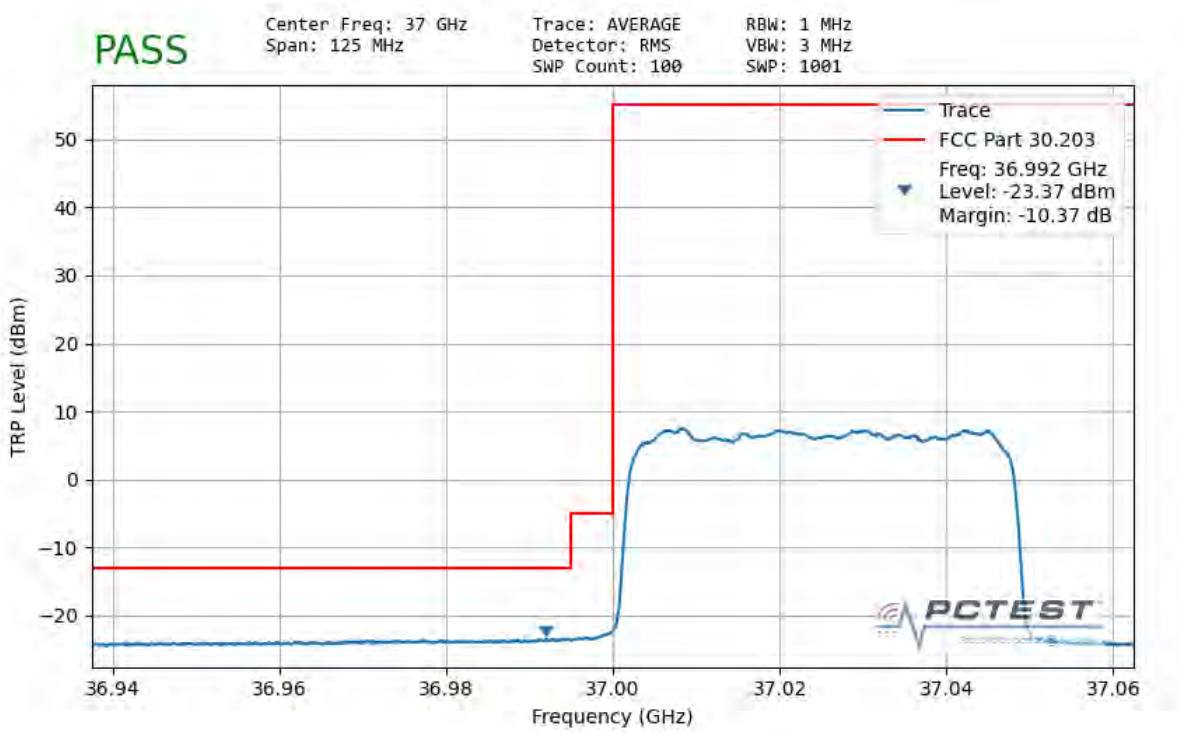
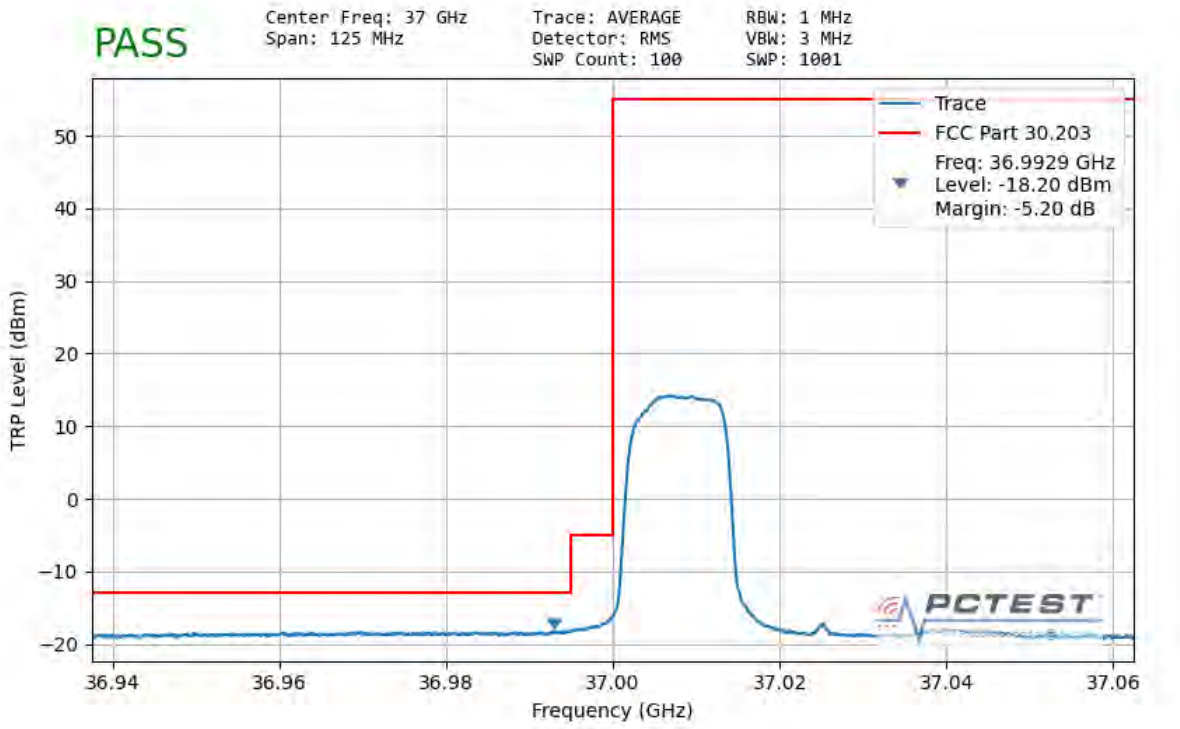


Plot 7-74. Lower Band Edge in TRP (50MHz-1CC – QPSK Full RB)



Plot 7-75. Lower Band Edge in TRP (50MHz-1CC – QPSK 8 RB)

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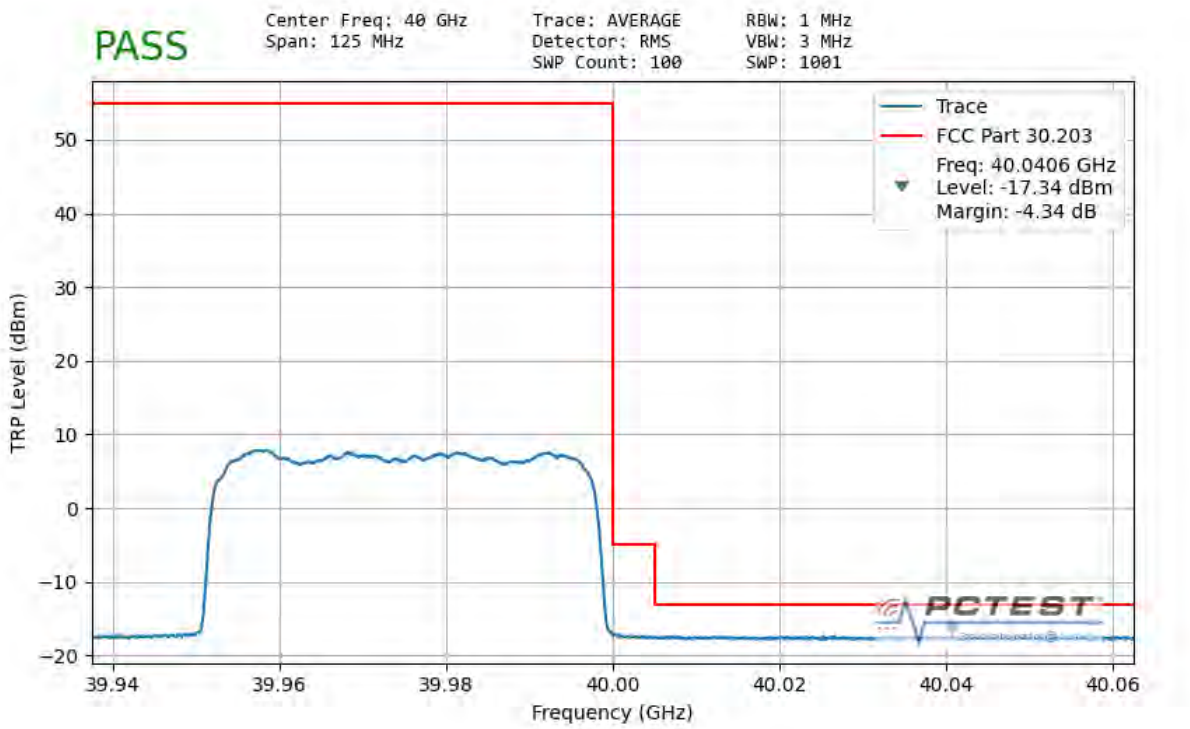
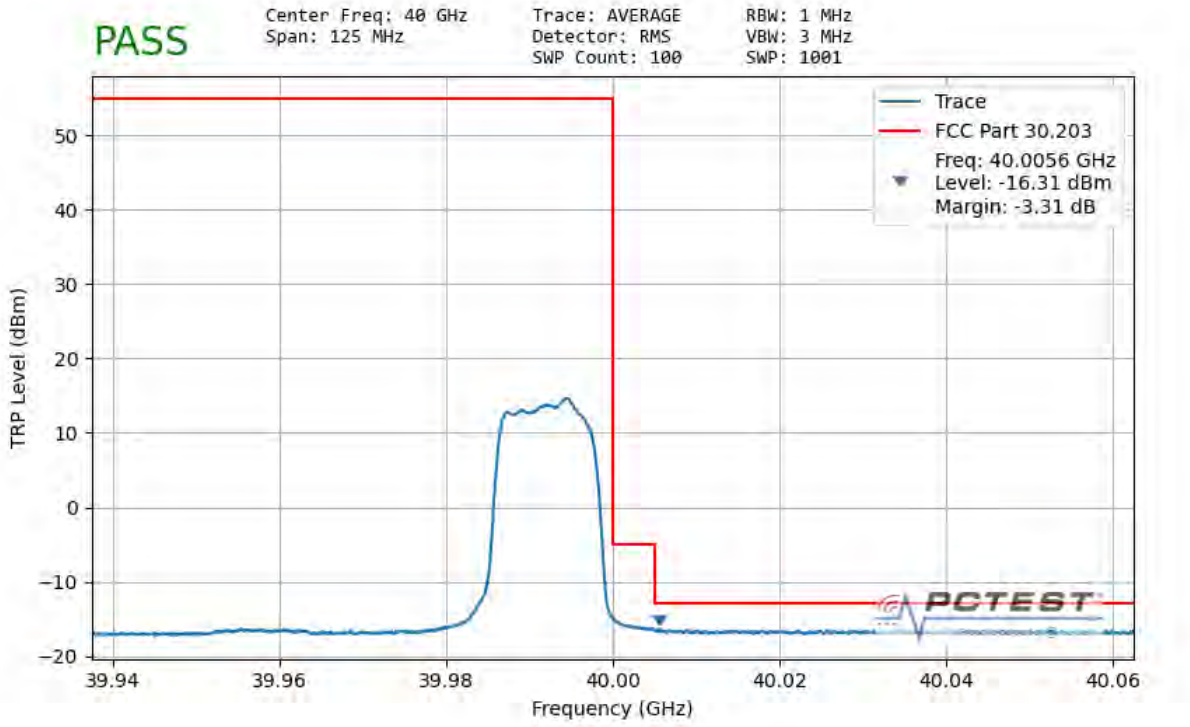


Plot 7-76. Upper Band Edge in TRP (50MHz-1CC – QPSK Full RB)



Plot 7-77. Upper Band Edge in TRP (50MHz-1CC – QPSK 8 RB)

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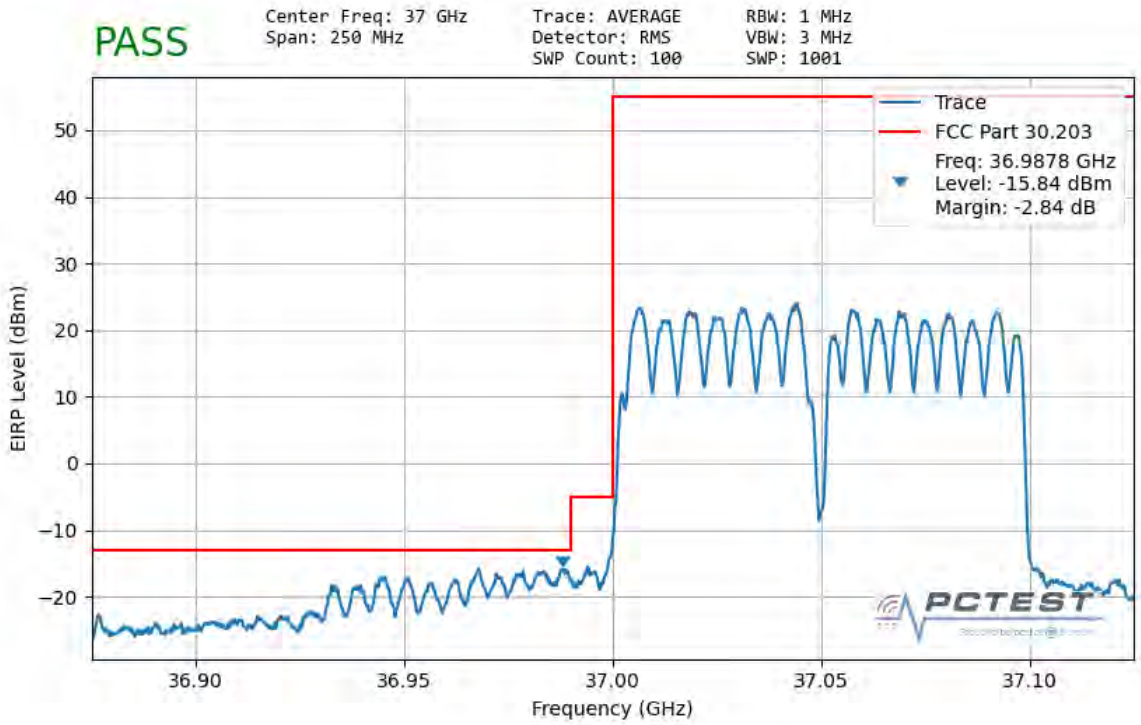
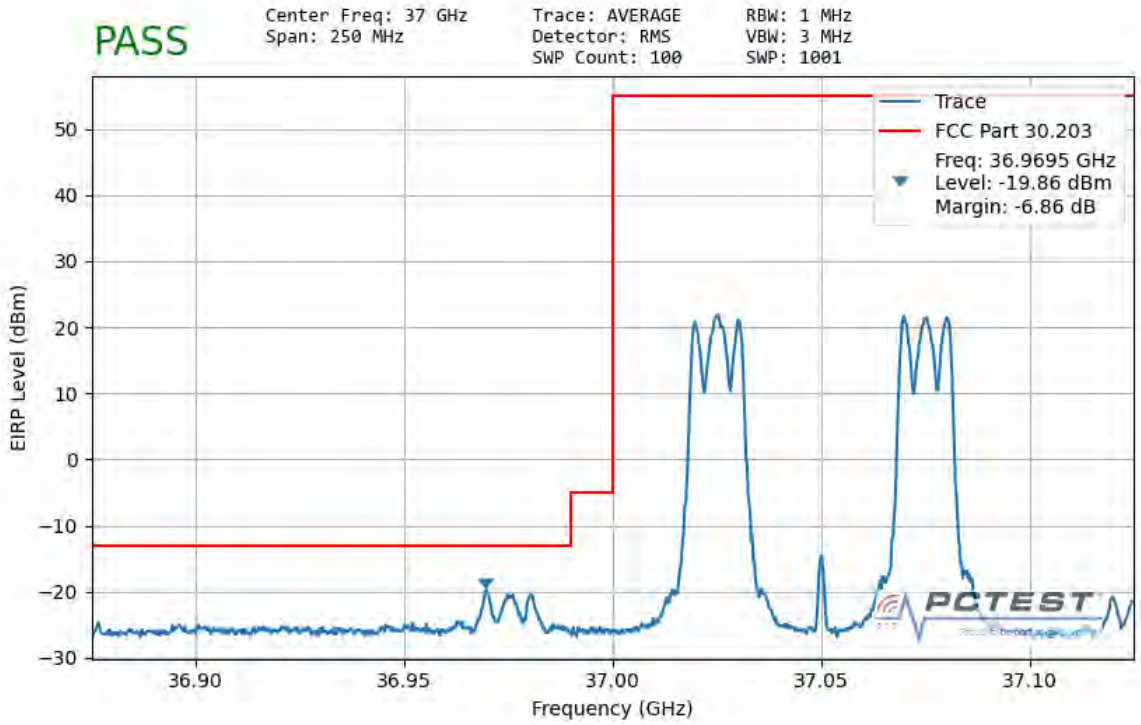


Plot 7-78. Lower Band Edge (50MHz-2CC – QPSK Full RB)



Plot 7-79. Lower Band Edge (50MHz-2CC – QPSK 8 RB)

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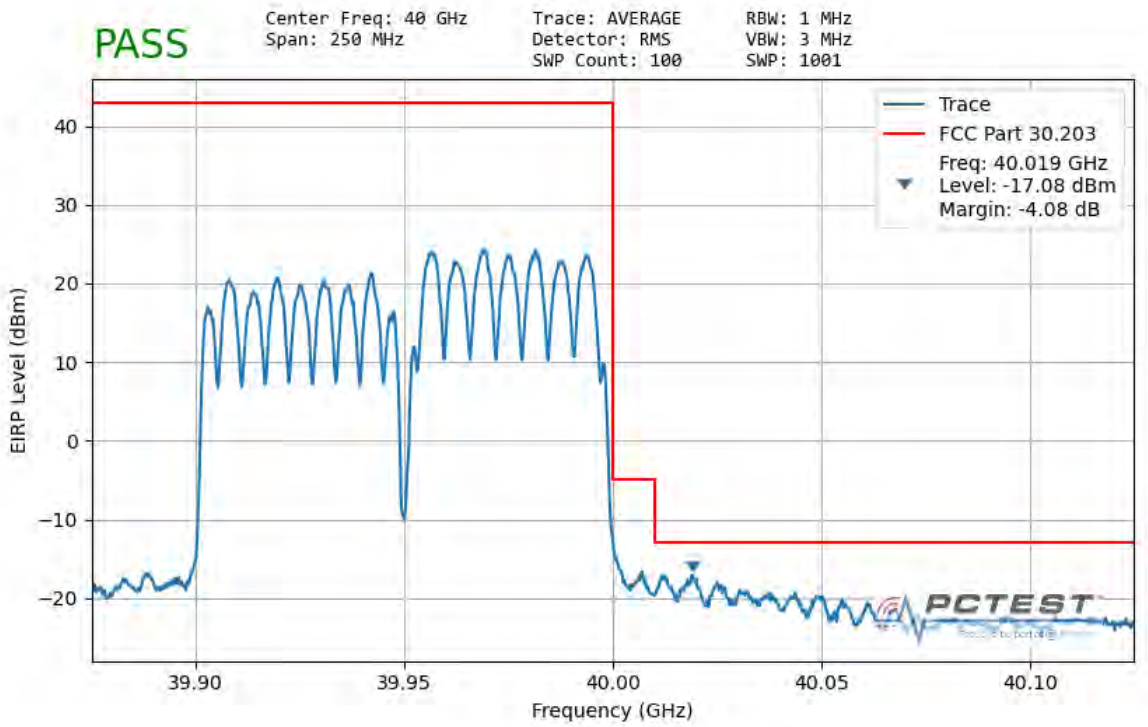
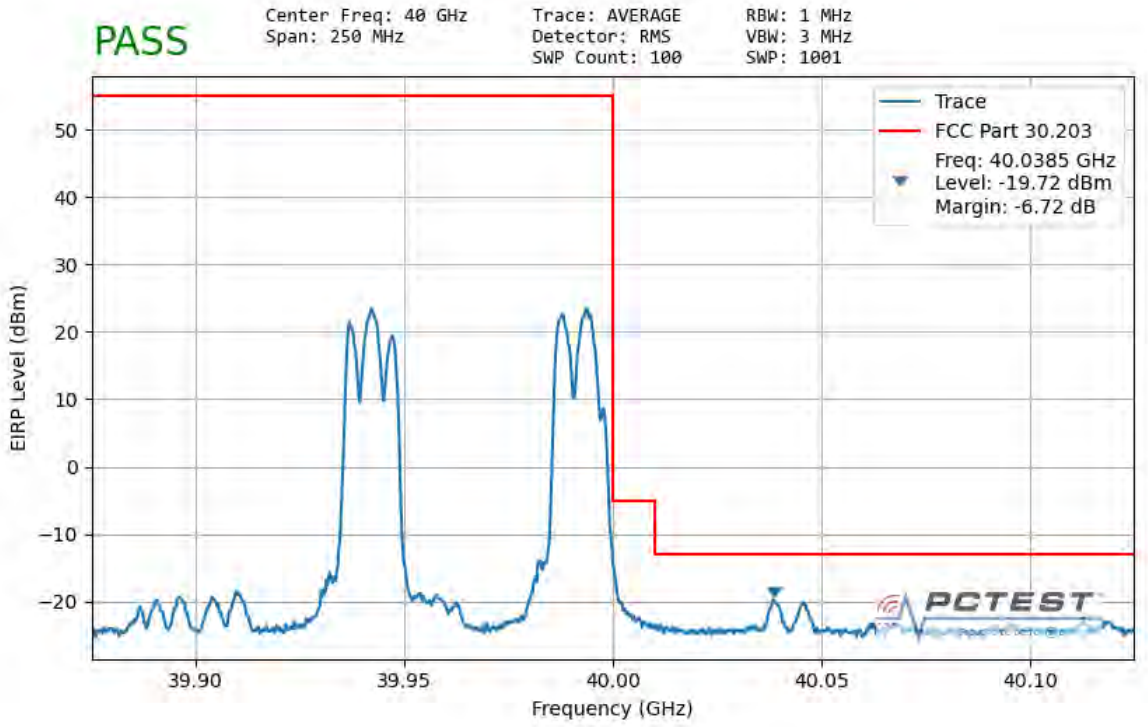


Plot 7-80. Upper Band Edge (50MHz-2CC – QPSK Full RB)



Plot 7-81. Upper Band Edge (50MHz-2CC – QPSK 8 RB)

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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.

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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).

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Virginia Diodes, Inc

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