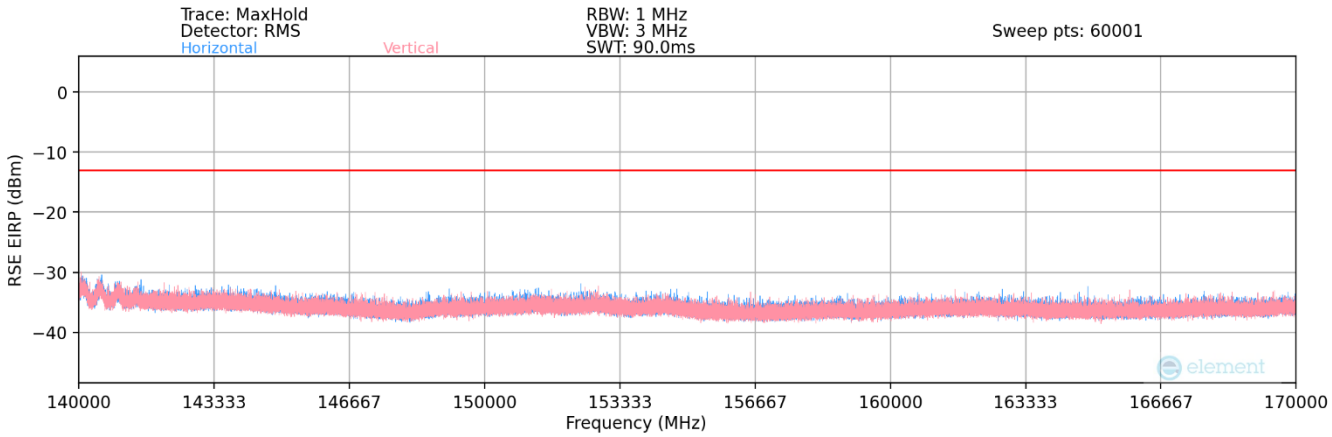
140GHz - 170GHz



Plot 7-165.n260 Radiated Spurious Plot

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]

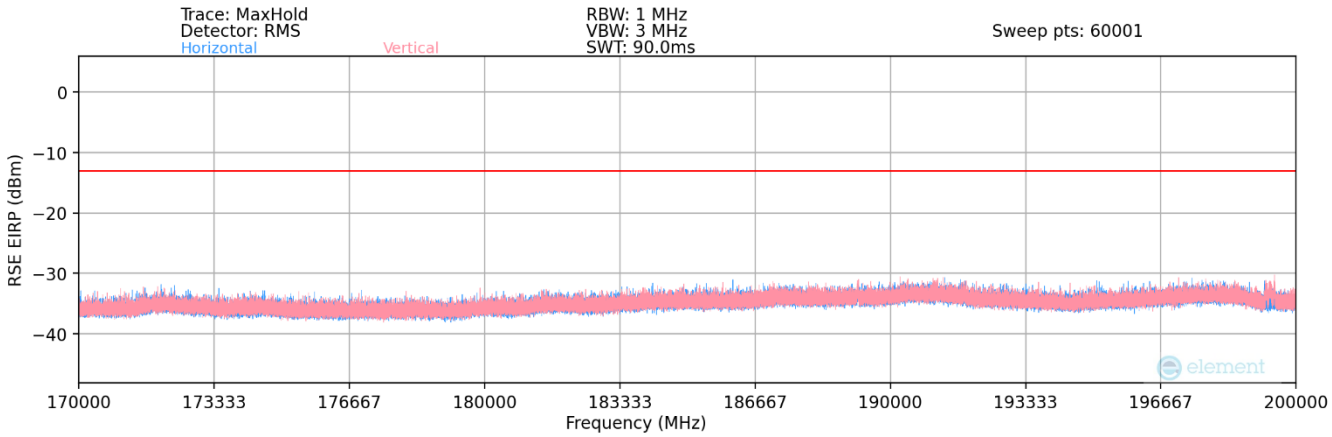
Frequency [MHz]	Channnel	Bandwidth (MHz)	EUT Beam Pol.	Modulation	Antenna Polarization [H/V]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
148107.13	Low	50	2Tx	QPSK	V	-	-	-38.92	-13.00	-25.92
154008.99	Mid	50	2Tx	QPSK	V	-	-	-37.80	-13.00	-24.80
159905.40	High	50	2Tx	QPSK	V	-	-	-38.83	-13.00	-25.83

Table 7-73.n260 Radiated 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 test distance of 1 meter.

170GHz - 200GHz



Plot 7-166.n260 Radiated Spurious Plot

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]	Positioner Roll [degrees]	Turntable Azimuth [degrees]	Spurious Emission Level [dBm]	Limit [dBm]	Margin [dB]
185124.82	Low	50	2Tx	QPSK	V	-	-	-39.21	-13.00	-26.21
192489.15	Mid	50	2Tx	QPSK	V	-	-	-38.94	-13.00	-25.94
199885.82	High	50	2Tx	QPSK	V	-	-	-39.38	-13.00	-26.38

Table 7-74.n260 Radiated 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 test 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 v01r02 Section 4.4.2.4

Test Settings

1. Start and stop frequency were set such that both upper and lower band edges are measured.
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 1MHz
4. VBW ≥ 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, 2CC, 3CC, and 4CC were fully investigated, and only the worst case has been included in this report.

6) Unless otherwise specified, the radiated band edge plots in this section display the worst case EIRP measurements for the indicated bandwidth−component carrier configuration.

7) The plots in this section that display Total Radiated Power (TRP) were obtained from measurements that were performed in accordance with the guidance of Section 4.4.2.4 of KDB 842590 D01 for the Spherical Method.

Sample Analyzer Offset Calculation (at 27.5GHz)

Measurement Antenna Factor = 46.85dB/m

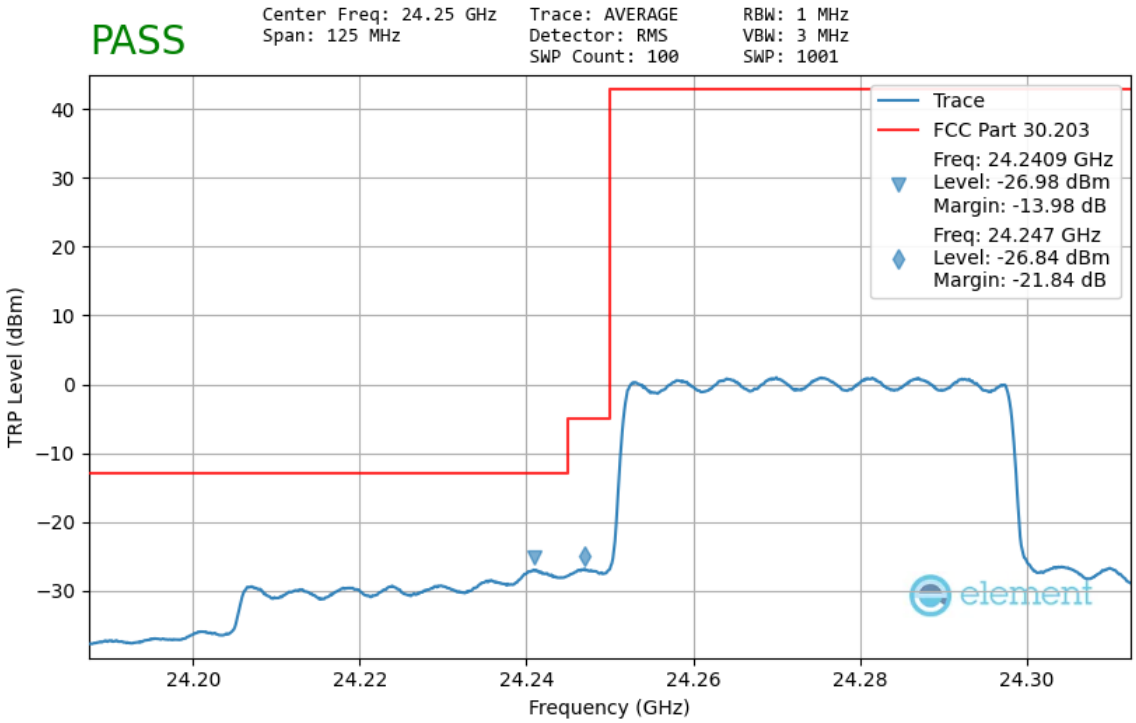
Cable Loss = 9.18dB

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

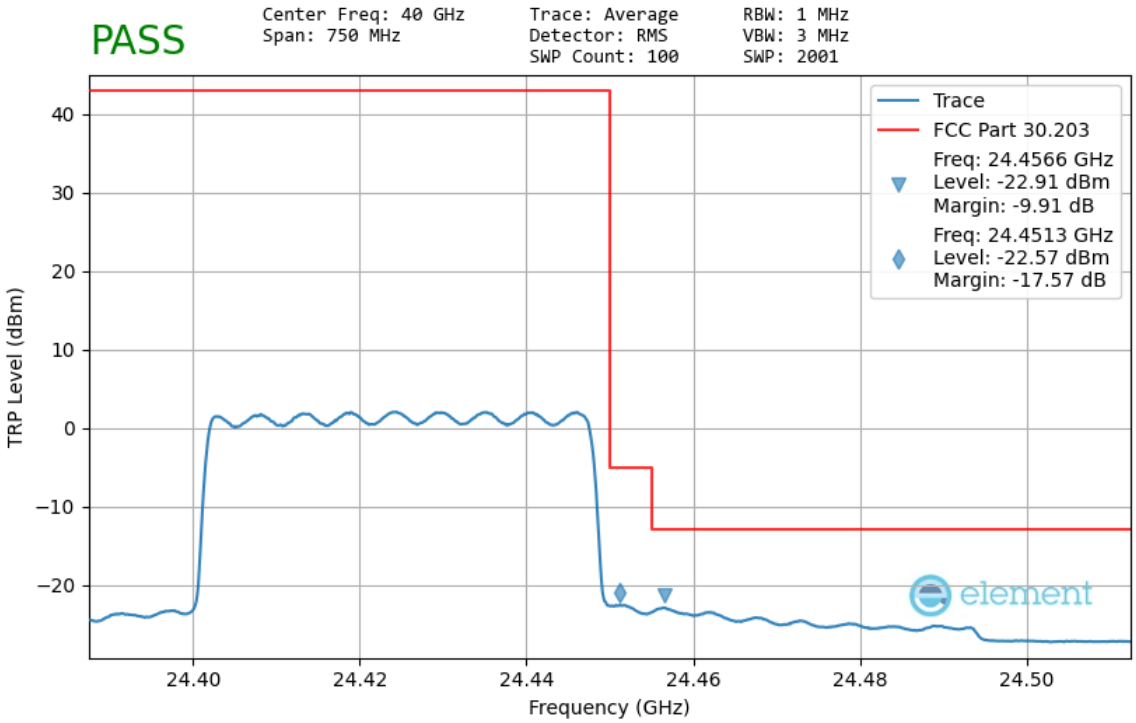
= 46.85dB/m + 9.18dB + 107 + $20\log_{10}(1m)$ – 104.8dB

= 58.23dB

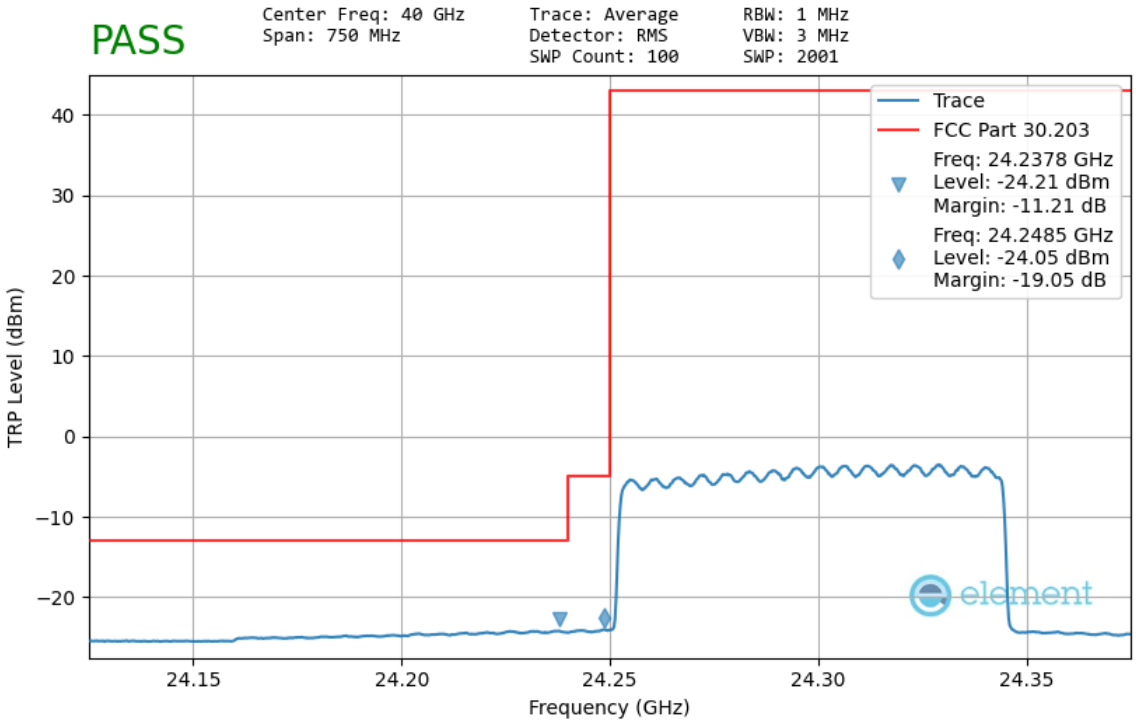
Band n258-R1 – Worst Case



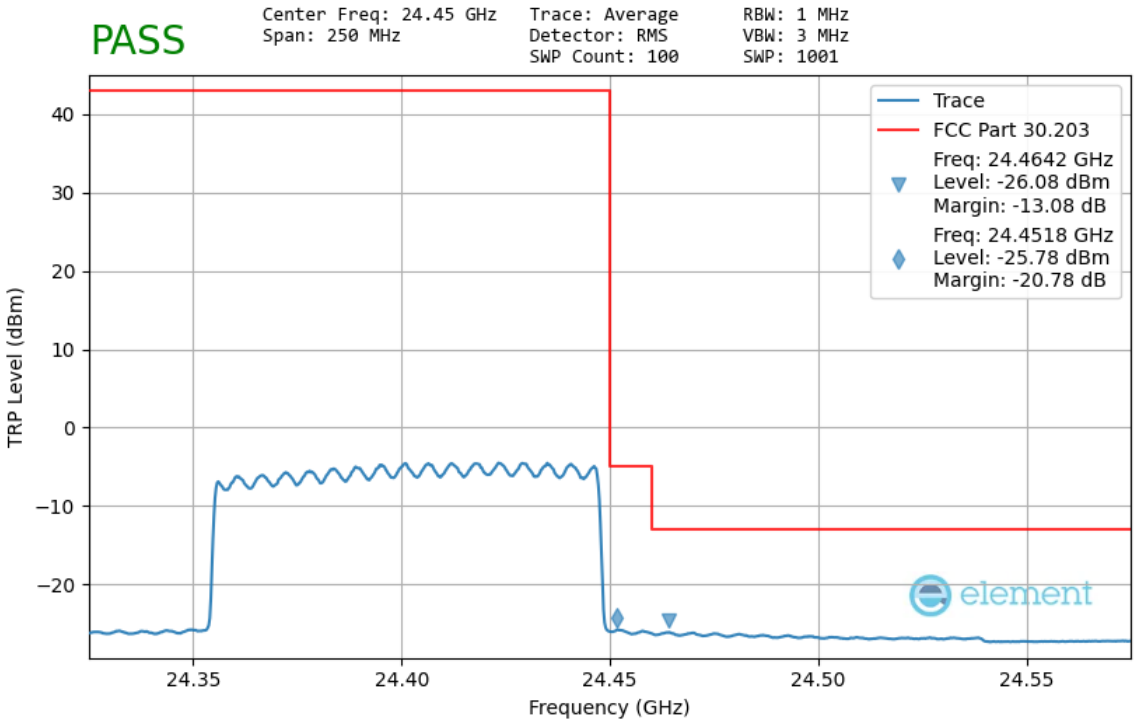
Plot 7-167.Ant 1 Lower Band Edge - TRP (50MHz-1CC – DFT-s -OFDM QPSK Full RB)



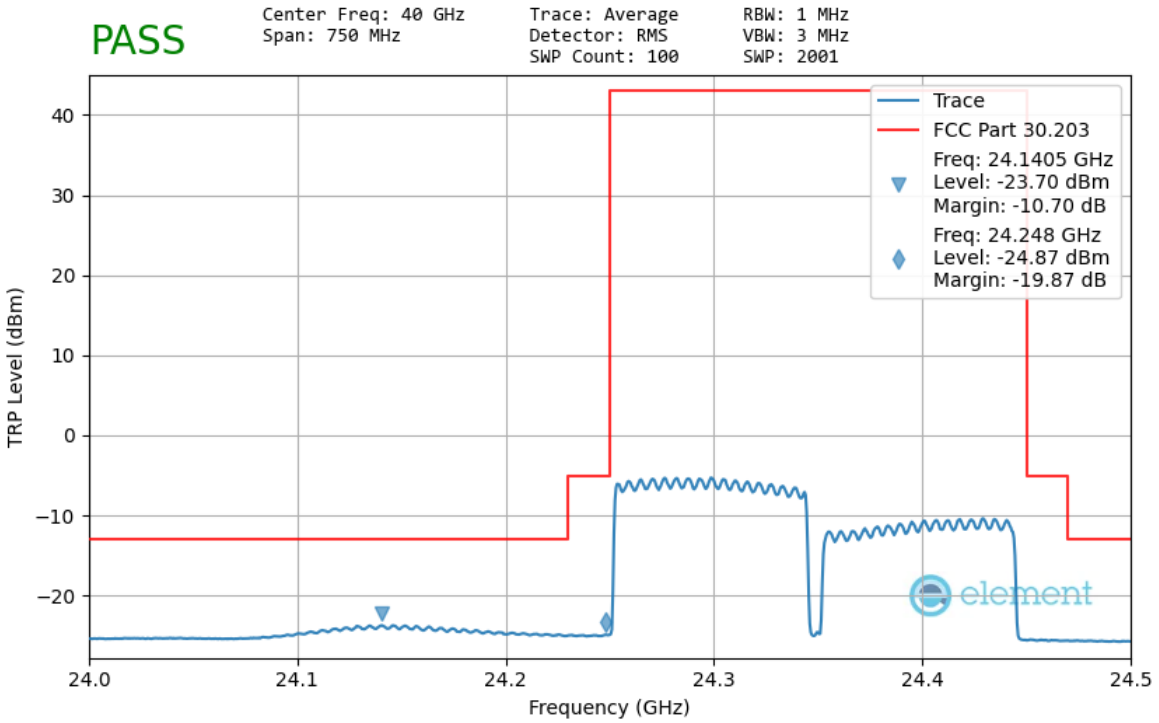
Plot 7-168. Ant 1 Upper Band Edge- TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



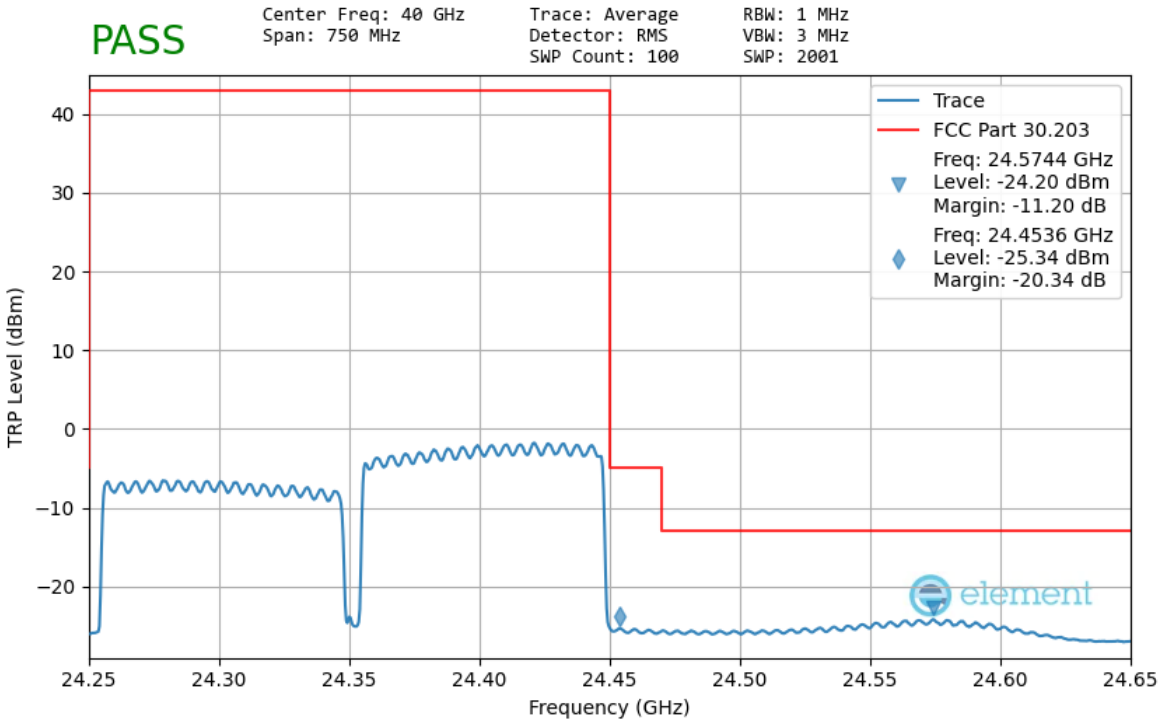
Plot 7-169.Ant 1 Lower Band Edge- TRP (100MHz-1CC – DFT-s -OFDM QPSK Full RB)



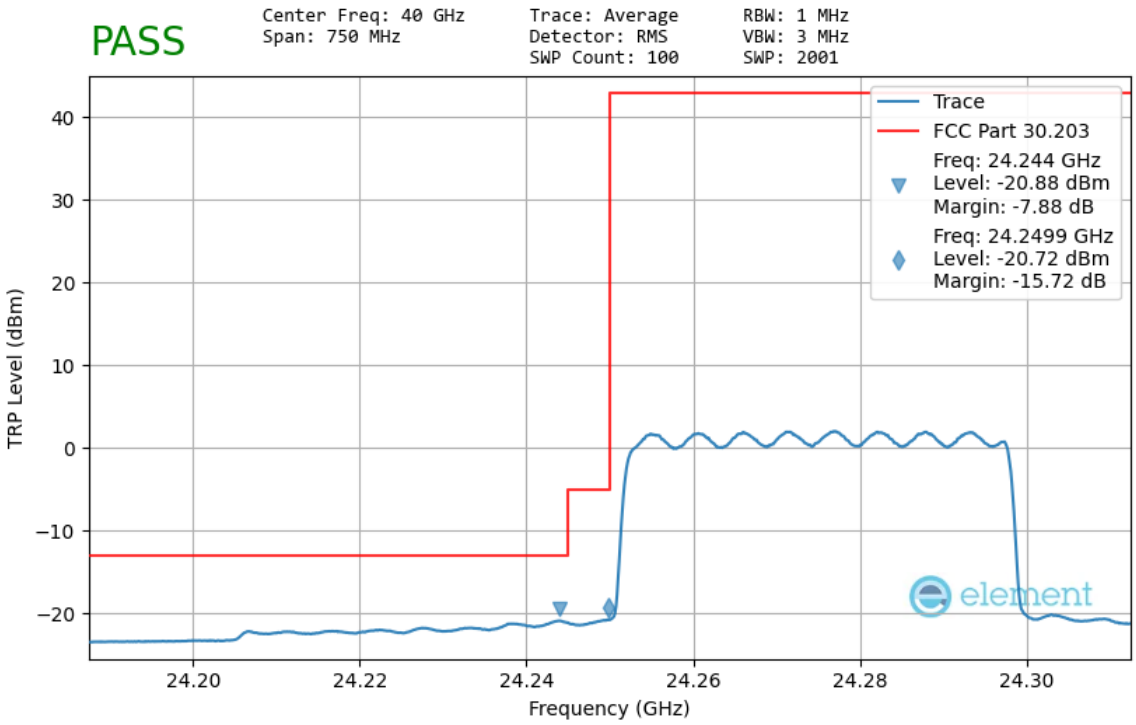
Plot 7-170.Ant 1 Upper Band Edge -TRP (100MHz-1CC – DFT-s-OFDM π/2 BPSK Full RB)



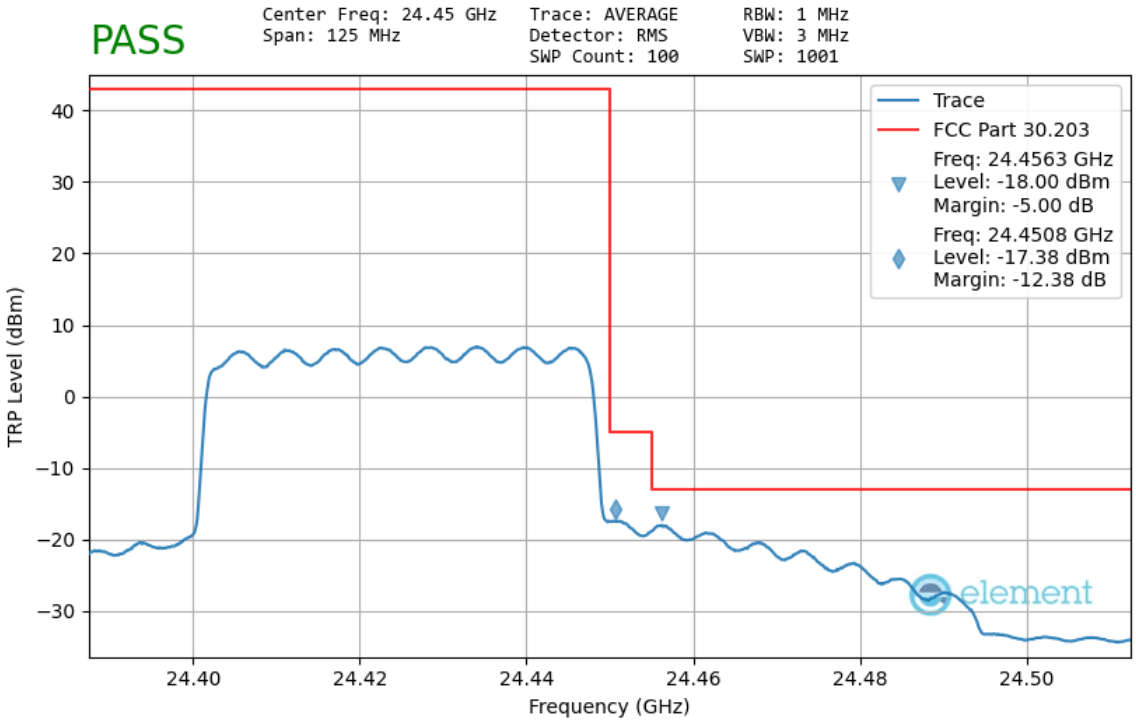
Plot 7-171.Ant 1 Lower Band Edge - TRP (100MHz-2CC DFT-s -OFDM QPSK Full RB)



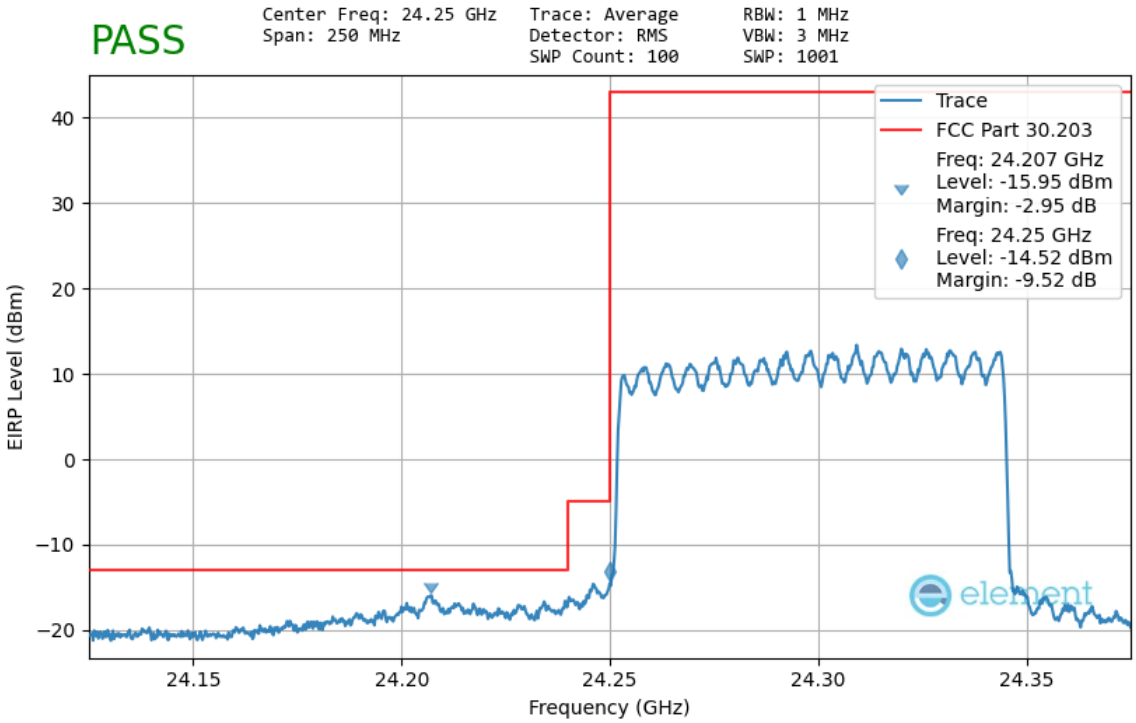
Plot 7-172.Ant 1 Upper Band Edge-TRP (100MHz-2CC – DFT-s -OFDM QPSK Full RB)



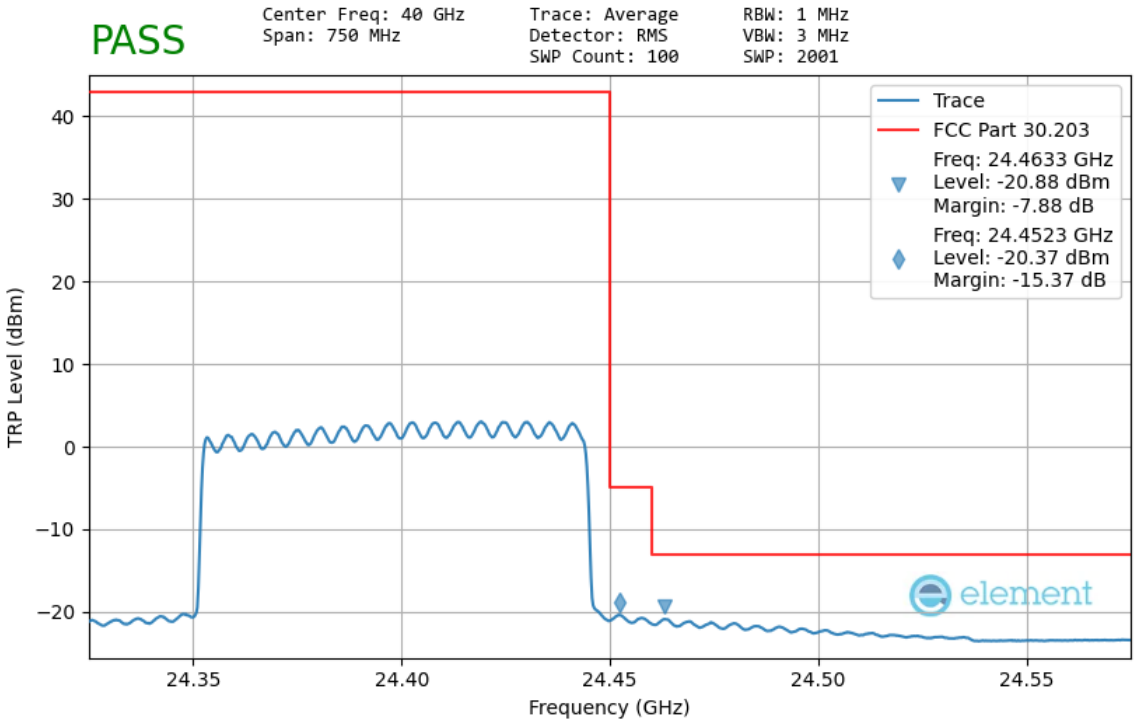
Plot 7-173.Ant 2 Lower Band Edge - TRP (50MHz-1CC – DFT-s -OFDM QPSK Full RB)



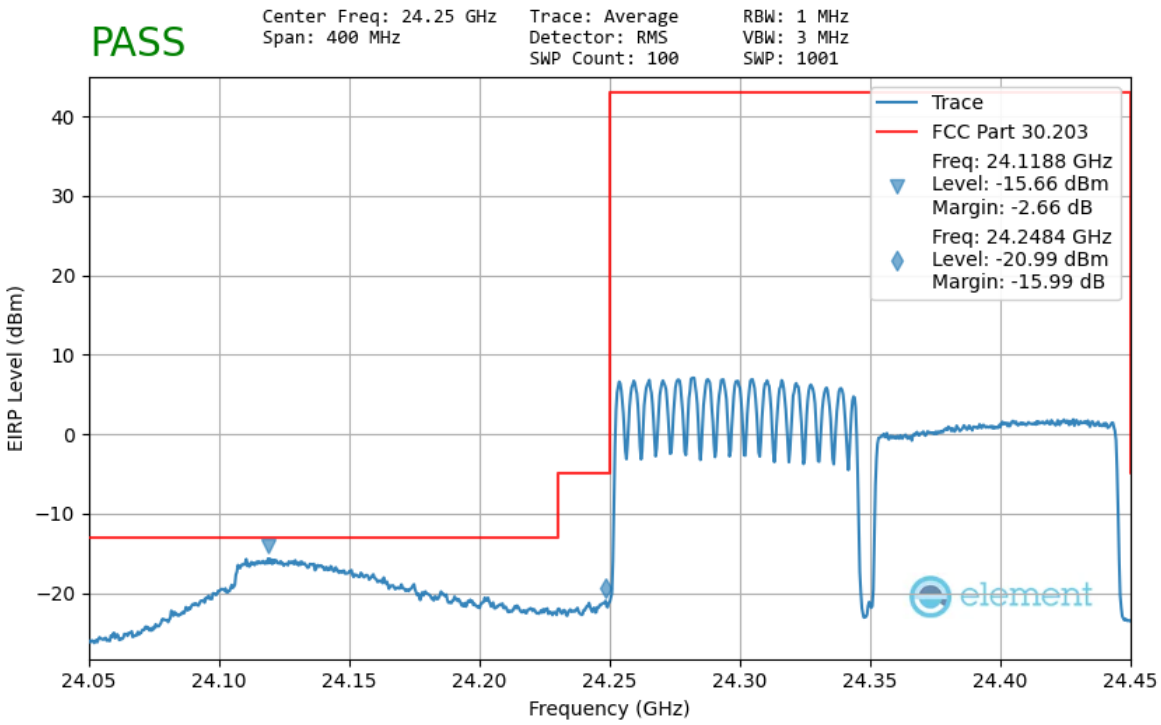
Plot 7-174. Ant 2 Upper Band Edge- TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



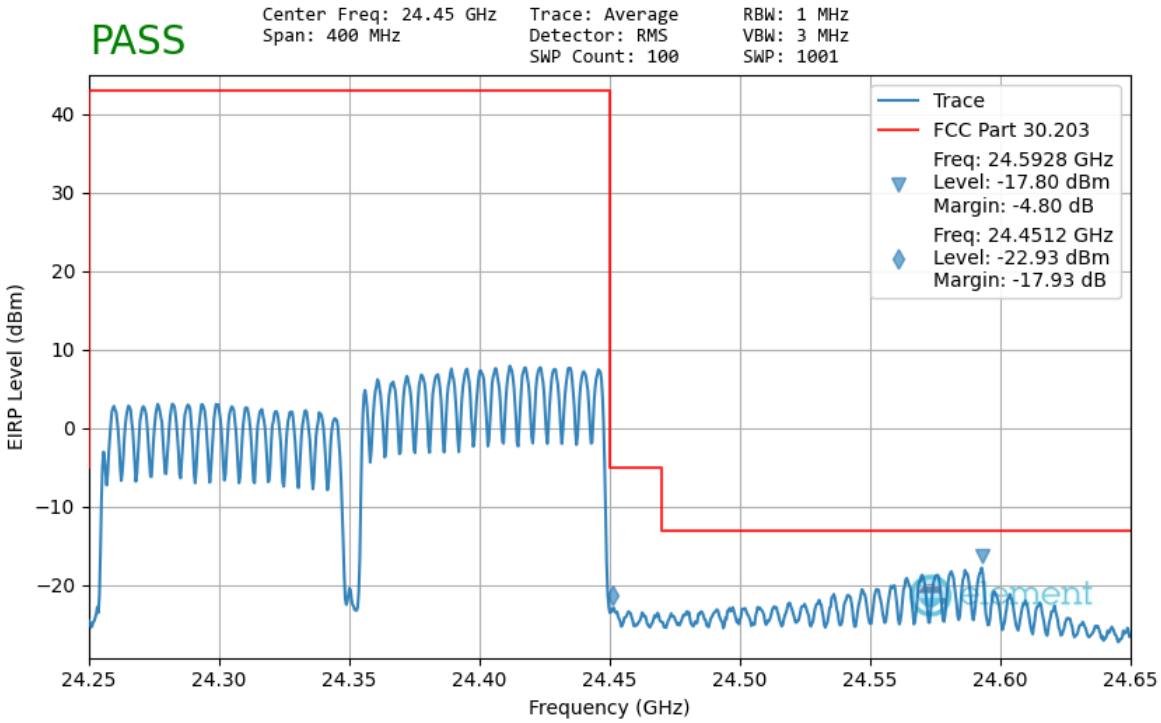
Plot 7-175.Ant 2 Lower Band Edge- (100MHz-1CC – DFT-s -OFDM QPSK Full RB)



Plot 7-176.Ant 2 Upper Band Edge -TRP (100MHz-1CC – DFT-s-OFDM QPSK Full RB)

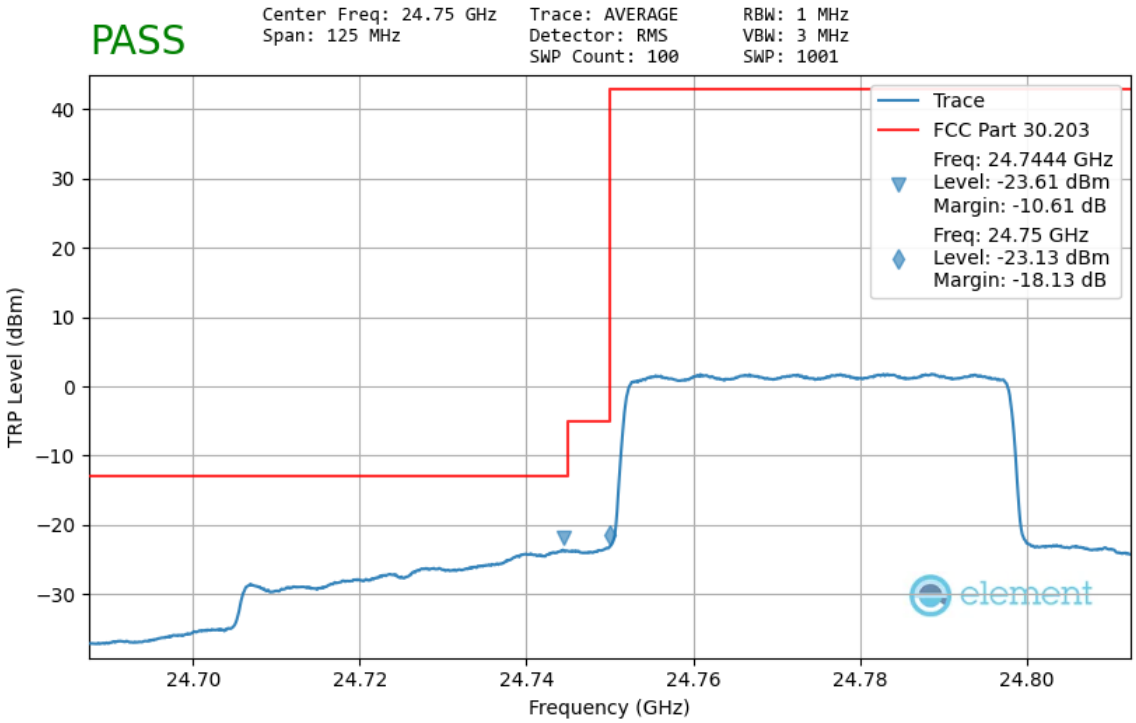


Plot 7-177.Ant 2 Lower Band Edge - (100MHz-2CC DFT-s -OFDM π/2 BPSK Full RB)

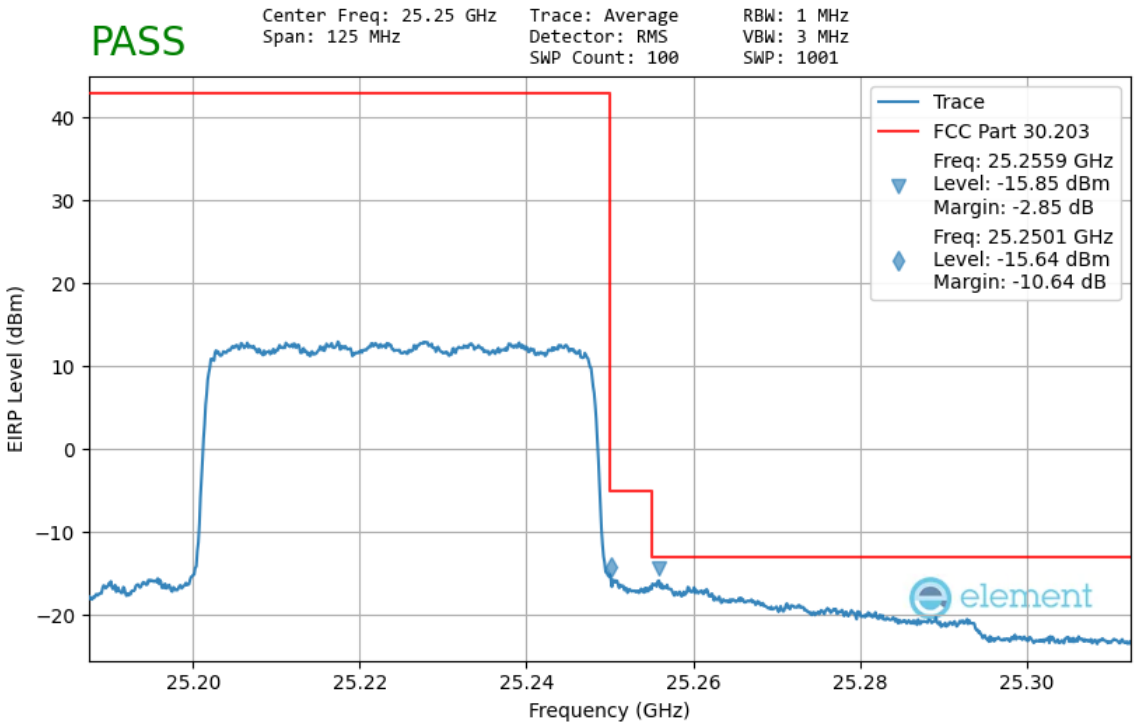


Plot 7-178.Ant 2 Upper Band Edge- (100MHz-2CC – DFT-s -OFDM π/2 BPSK Full RB)

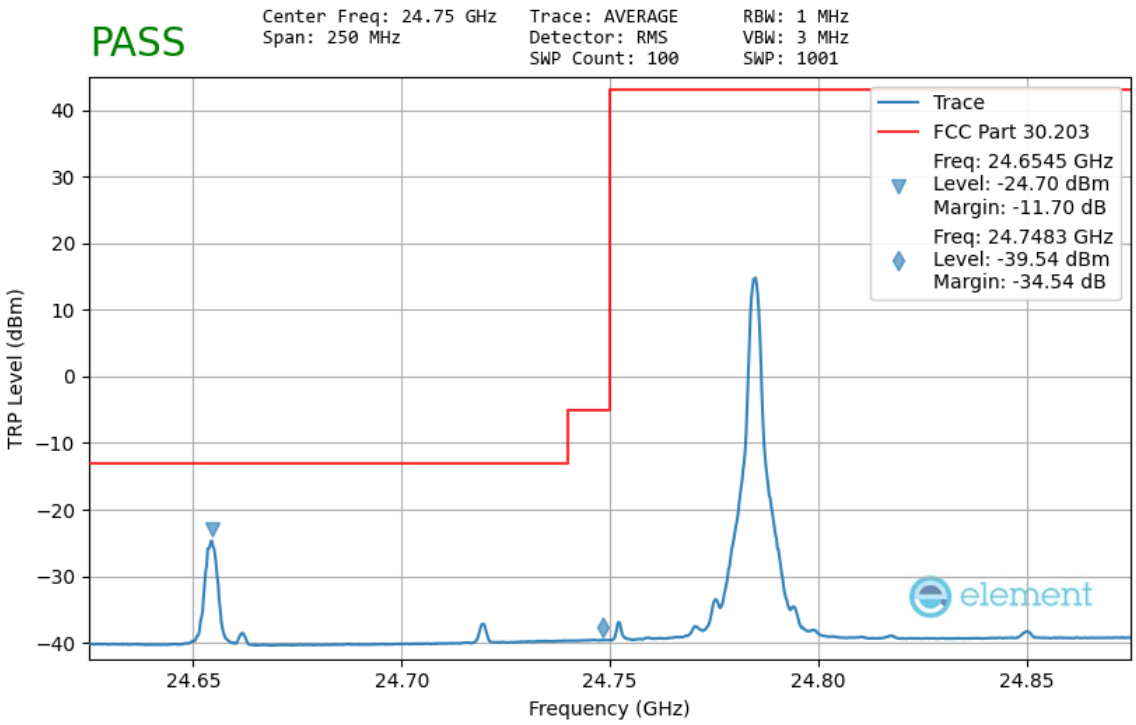
Band n258-R2 –Worst Case



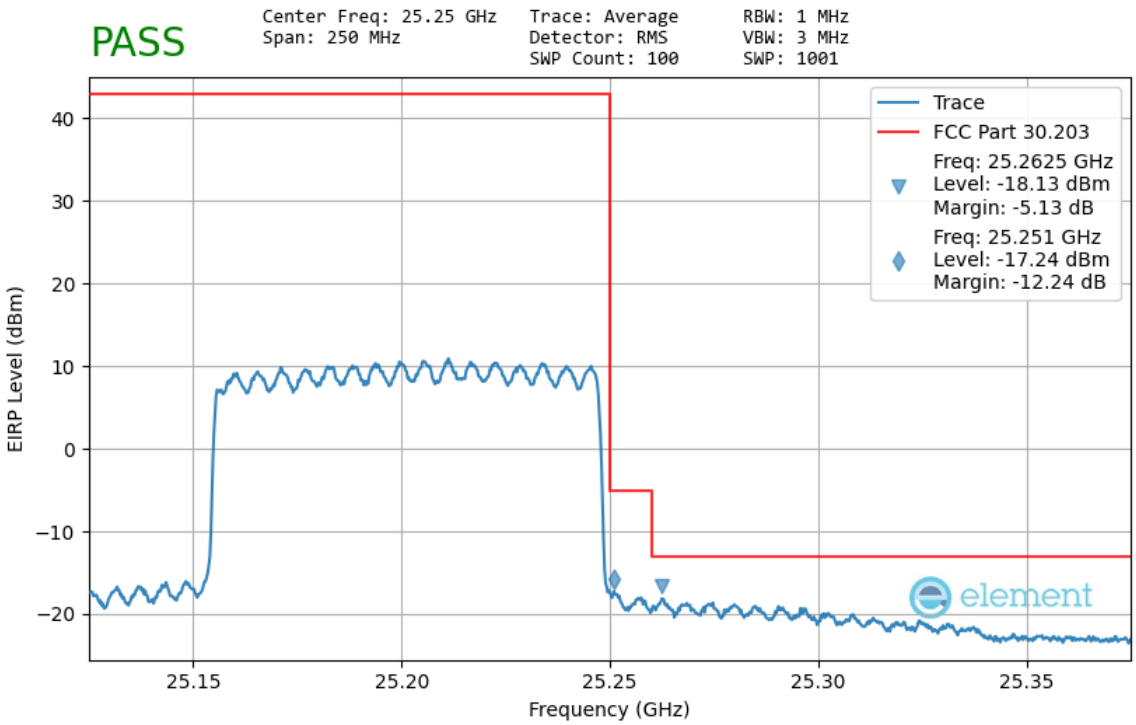
Plot 7-179. Ant 1 Lower Band Edge-TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



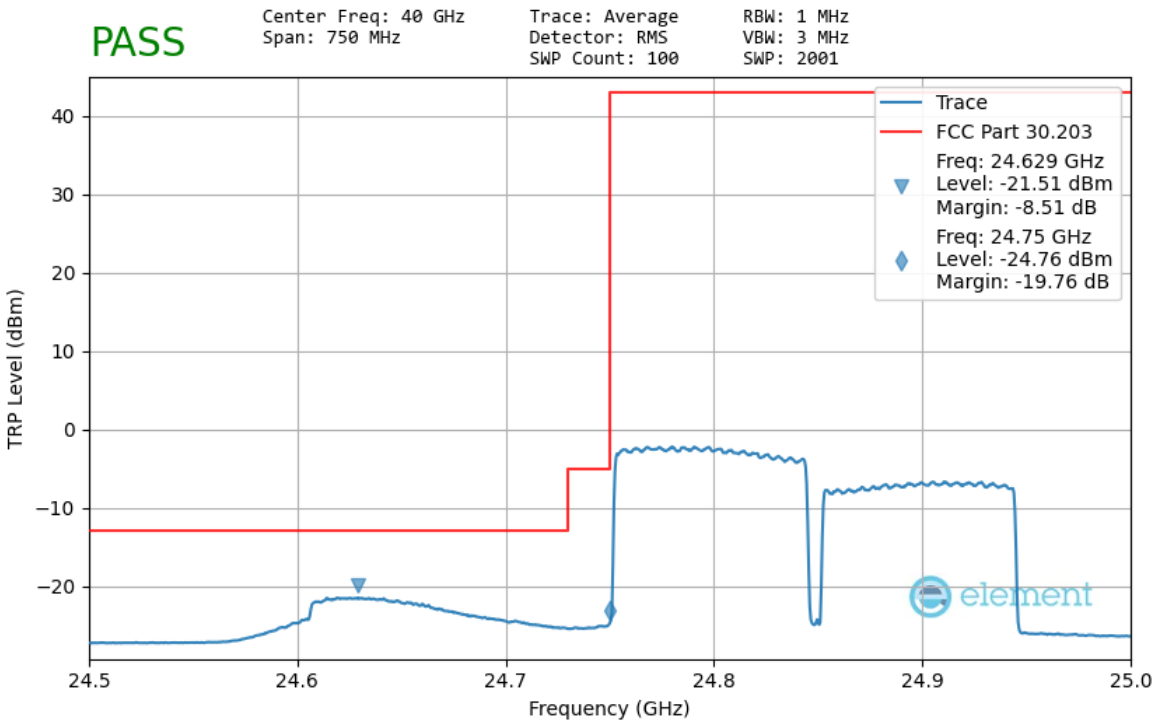
Plot 7-180.Ant 1 Upper Band Edge (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



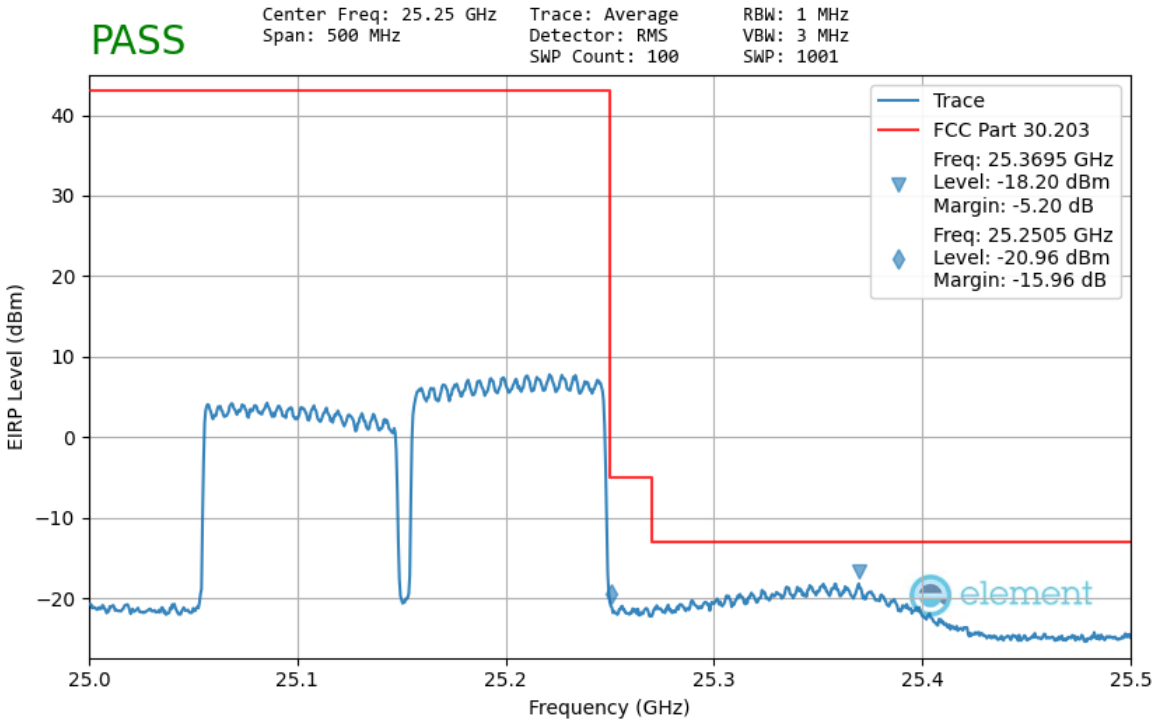
Plot 7-181.Ant 1 Lower Band Edge-TRP (100MHz-1CC – CP-OFDM QPSK 1 RB)



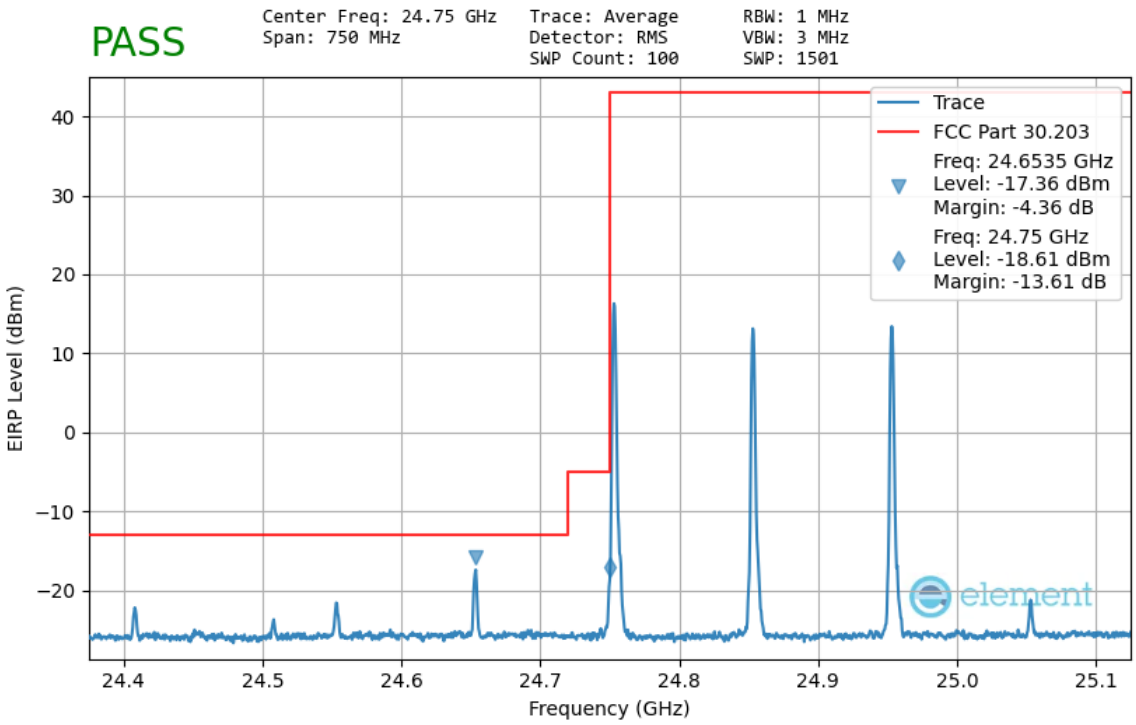
Plot 7-182.Ant 1 Upper Band Edge (100MHz-1CC – DFT-s-OFDM QPSK Full RB)



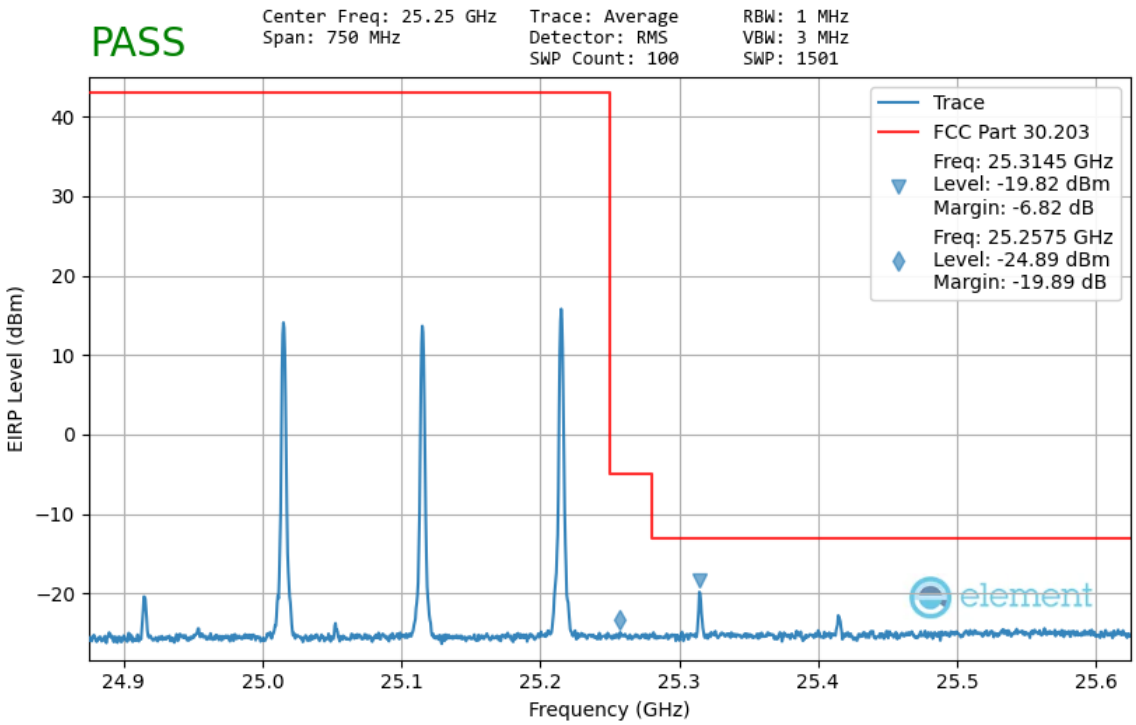
Plot 7-183.Ant 1 Lower Band Edge - TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



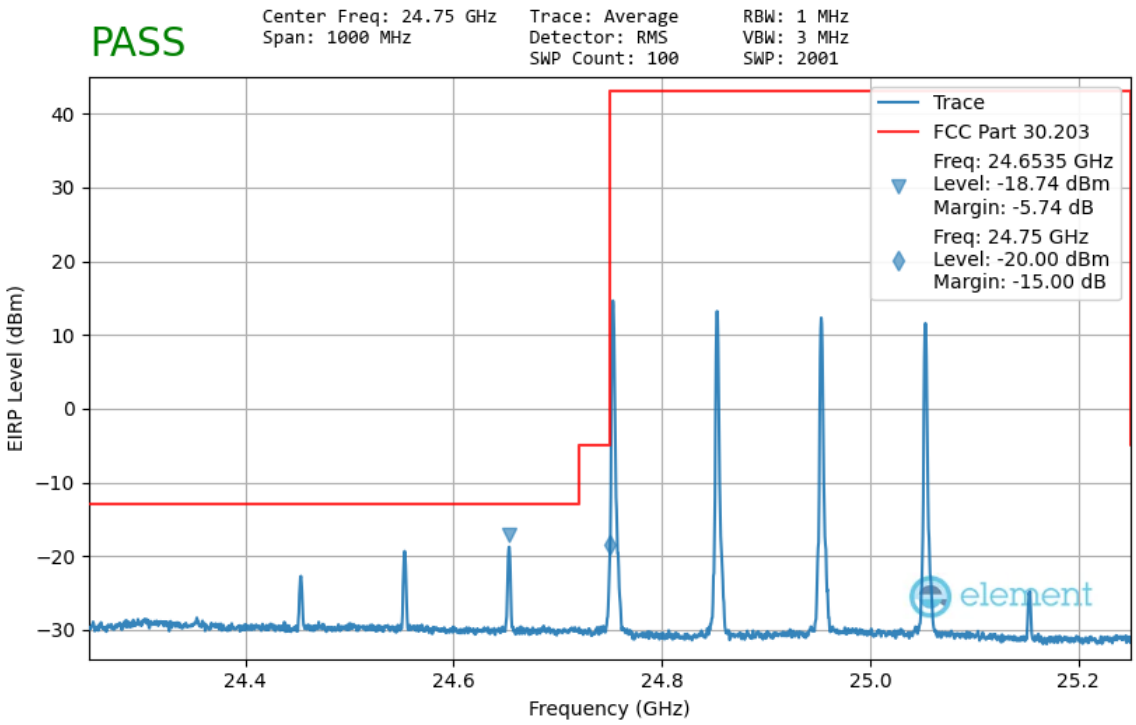
Plot 7-184.Ant 1 Upper Band Edge (100MHz-2CC – DFT-s-OFDM QPSK Full RB)



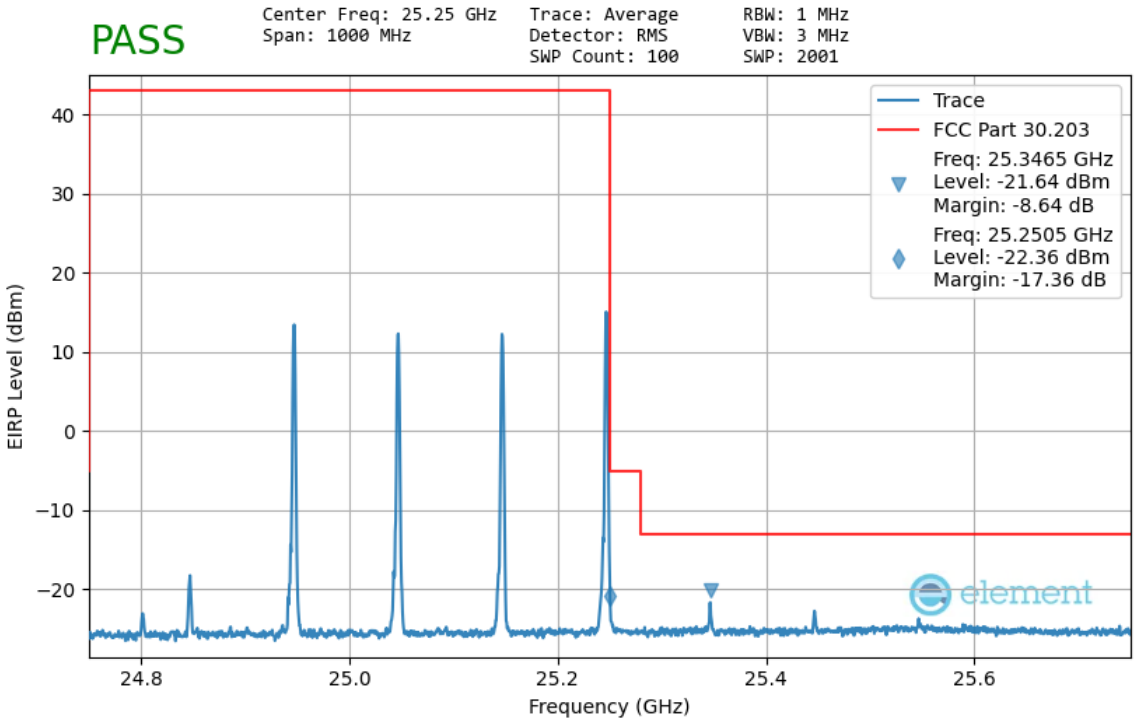
Plot 7-185.Ant 1 Lower Band Edge (100MHz-3CC – DFT-s-OFDM QPSK 1 RB)



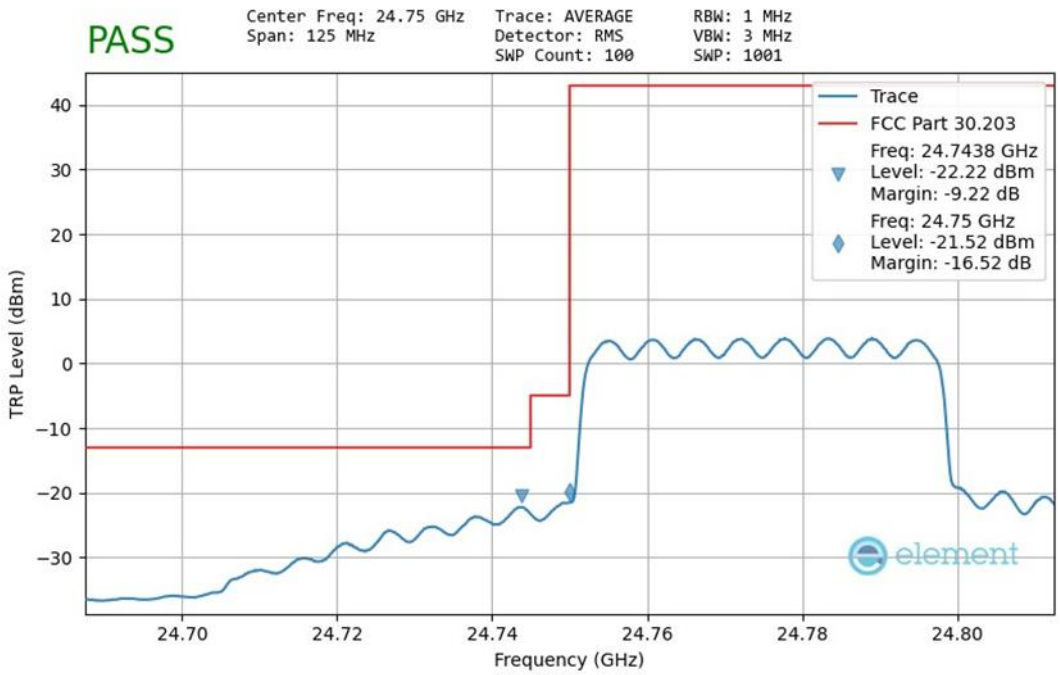
Plot 7-186.Ant 1 Upper Band Edge (100MHz-3CC – CP-OFDM QPSK 1 RB)



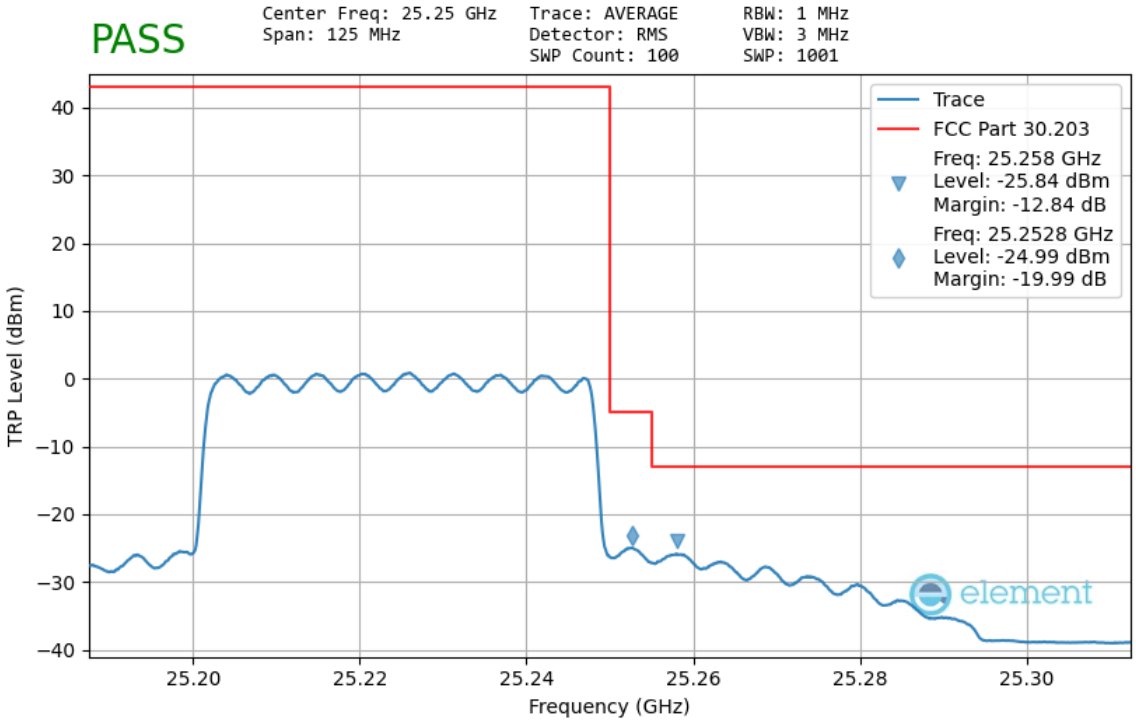
Plot 7-187.Ant 1 Lower Band Edge (100MHz-4CC – DFT-s-OFDM QPSK 1 RB)



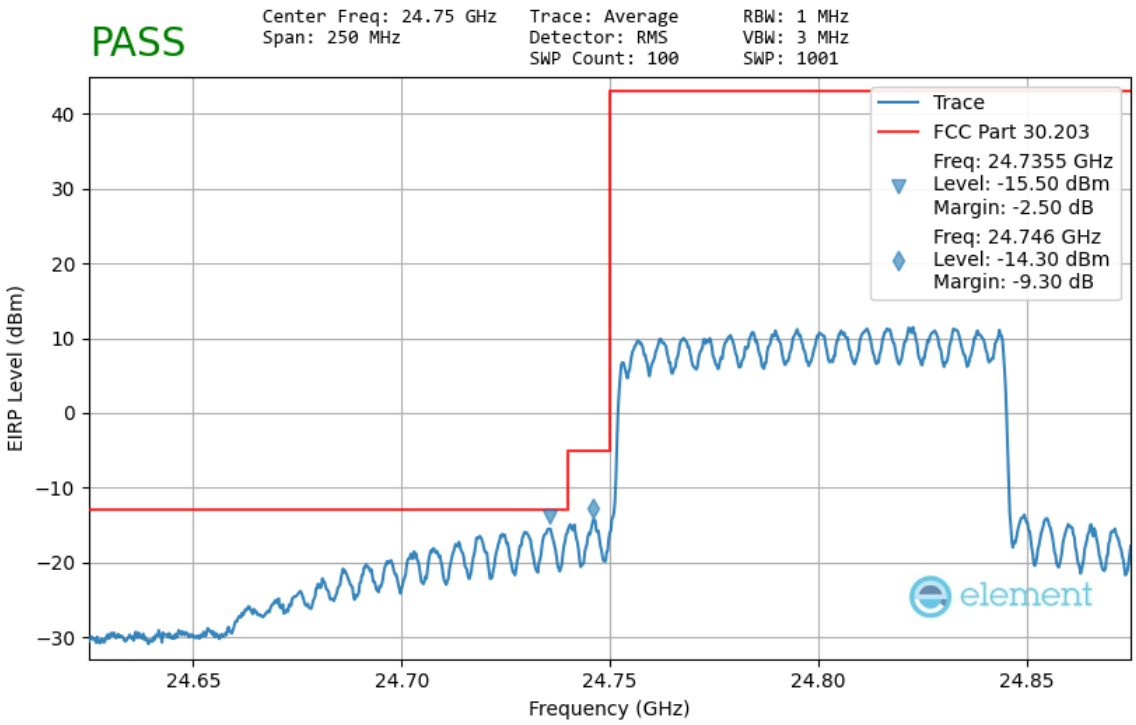
Plot 7-188.Ant 1 Upper Band Edge (100MHz-4CC – CP-OFDM QPSK 1 RB)



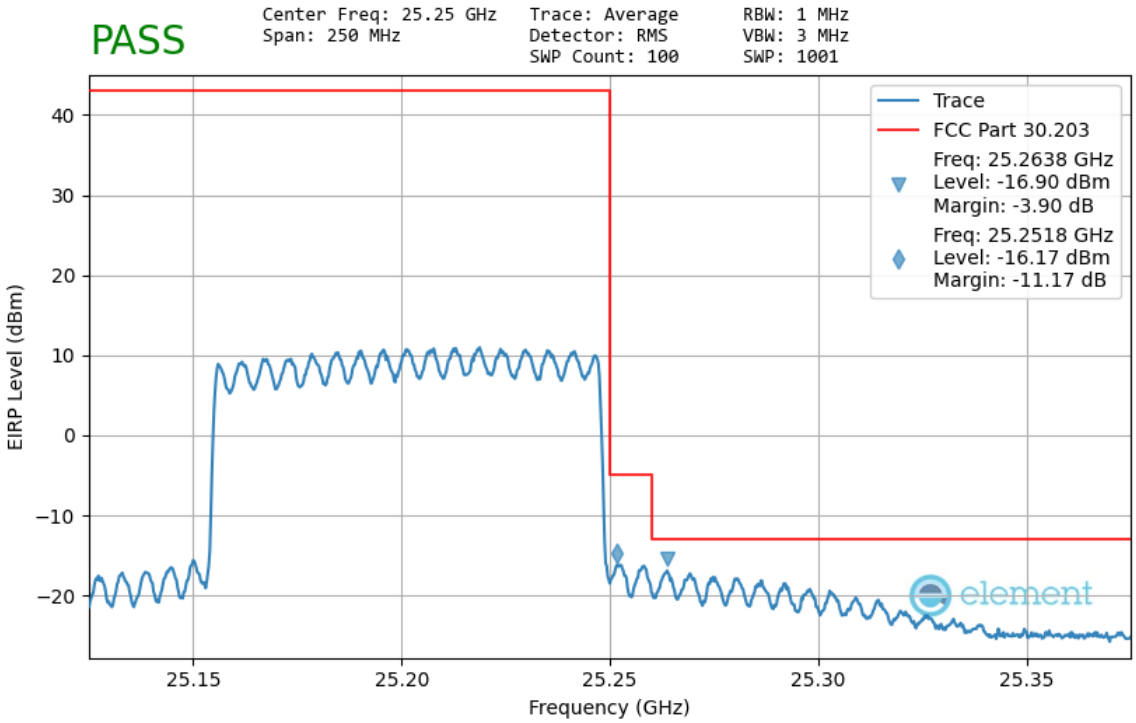
Plot 7-189. Ant 2 Lower Band Edge-TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



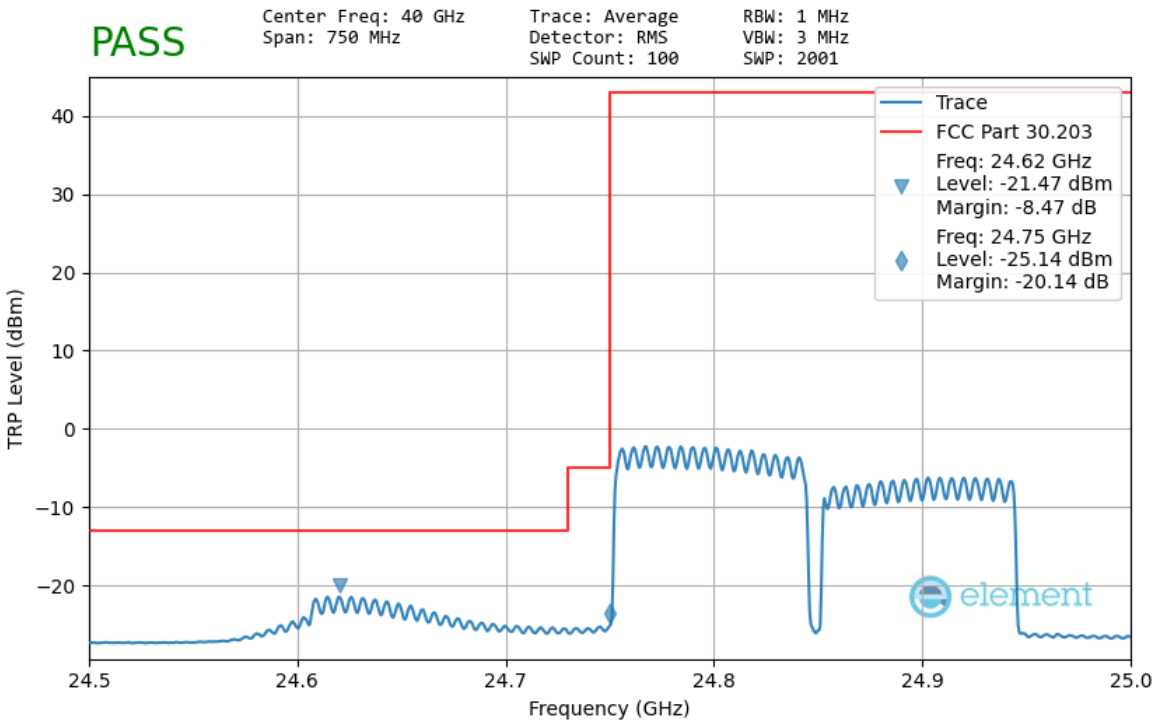
Plot 7-190.Ant 2 Upper Band Edge -TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



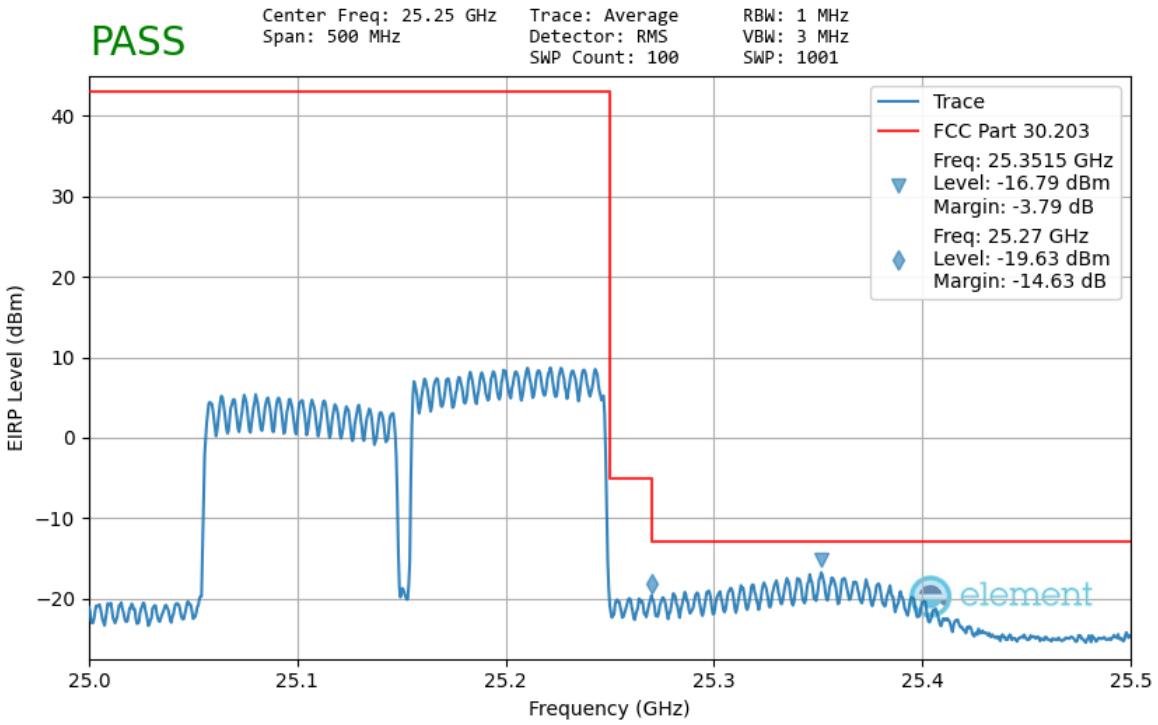
Plot 7-191.Ant 2 Lower Band Edge (100MHz-1CC – DFT-s -OFDM QPSK Full RB)



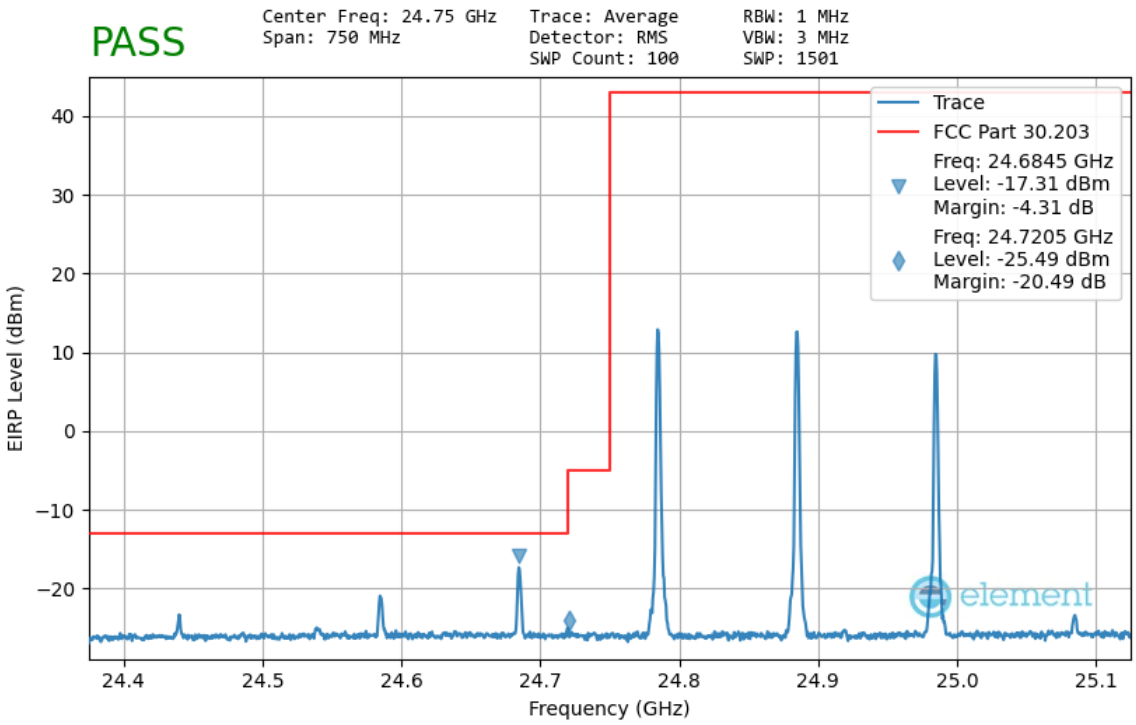
Plot 7-192.Ant 2 Upper Band Edge (100MHz-1CC – DFT-s-OFDM QPSK Full RB)



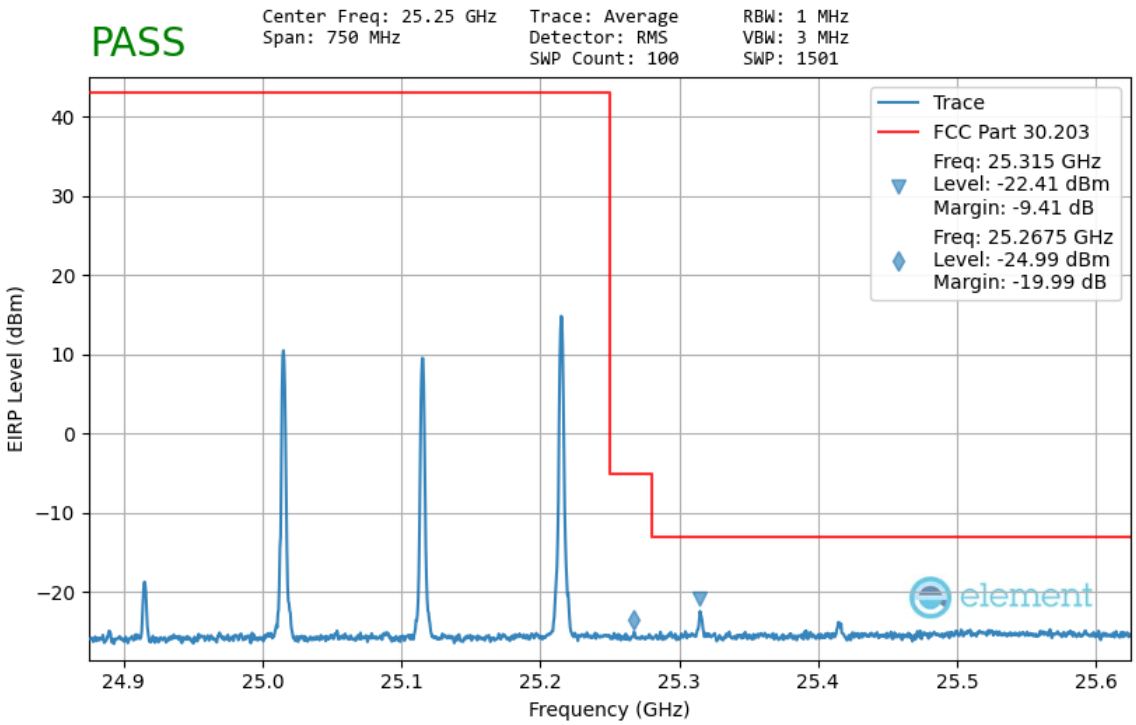
Plot 7-193.Ant 2 Lower Band Edge - TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



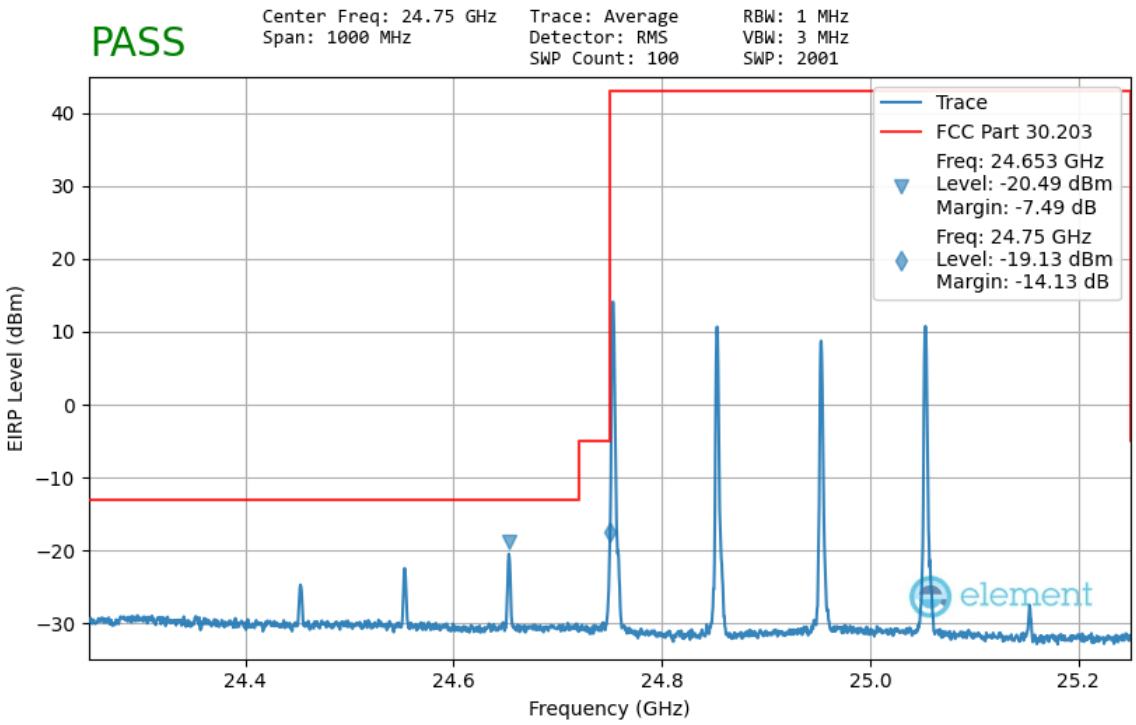
Plot 7-194.Ant 2 Upper Band Edge (100MHz-2CC – DFT-s-OFDM QPSK Full RB)



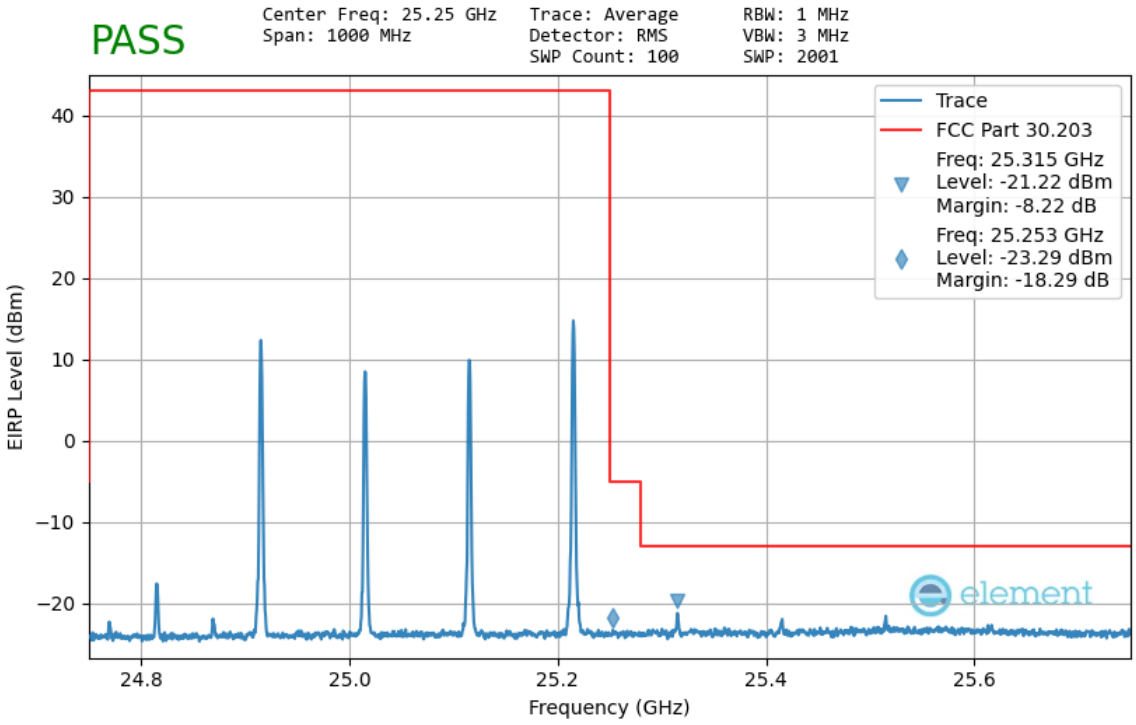
Plot 7-195.Ant 2 Lower Band Edge (100MHz-3CC – DFT-s-OFDM π/2 BPSK 1 RB)



Plot 7-196.Ant 2 Upper Band Edge (100MHz-3CC – CP-OFDM QPSK 1 RB)

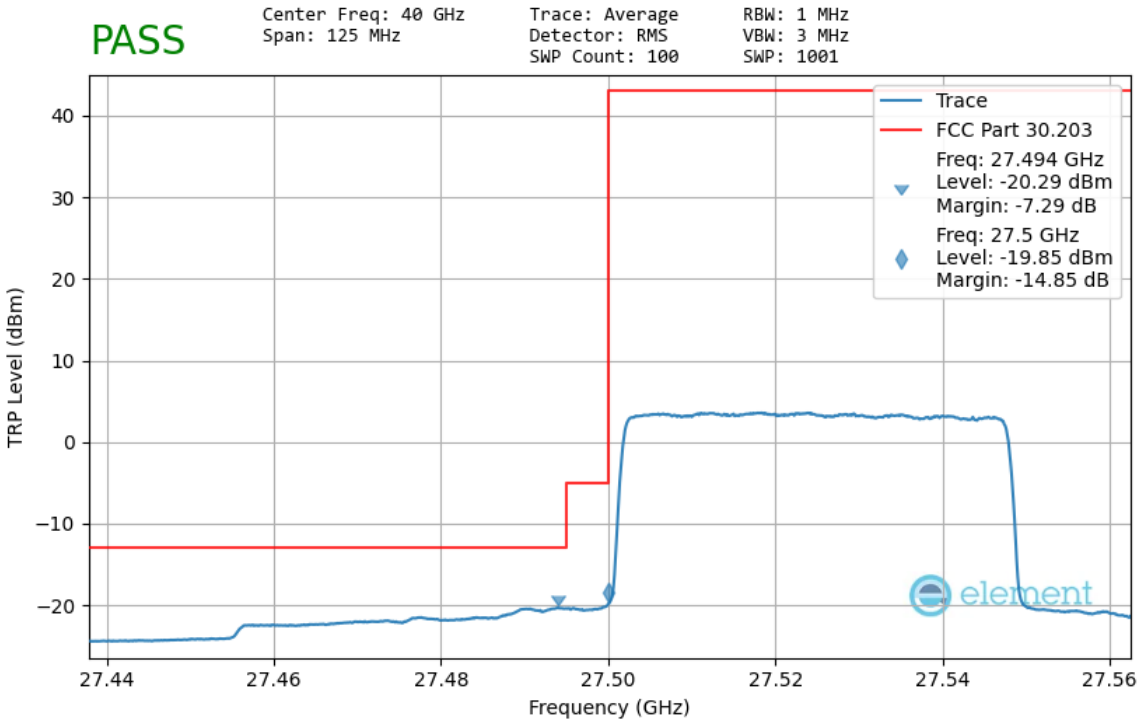


Plot 7-197.Ant 2 Lower Band Edge (100MHz-4CC – DFT-s-OFDM π/2 BPSK 1 RB)

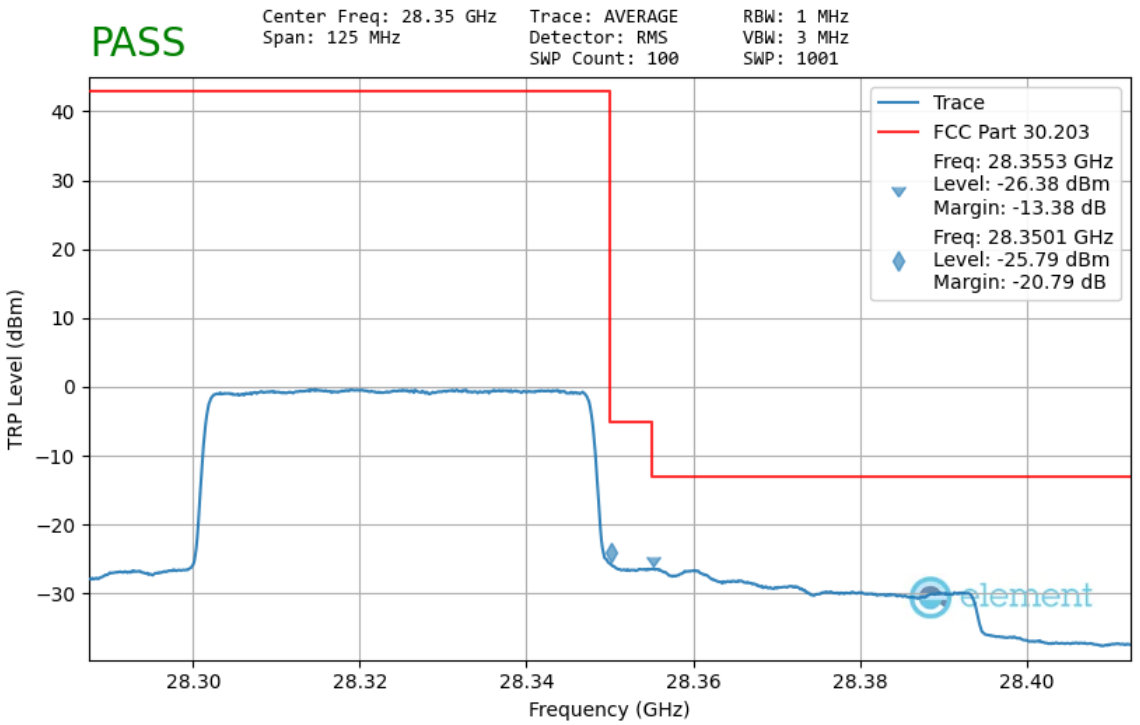


Plot 7-198.Ant 2 Upper Band Edge (100MHz-4CC – CP-OFDM QPSK 1 RB)

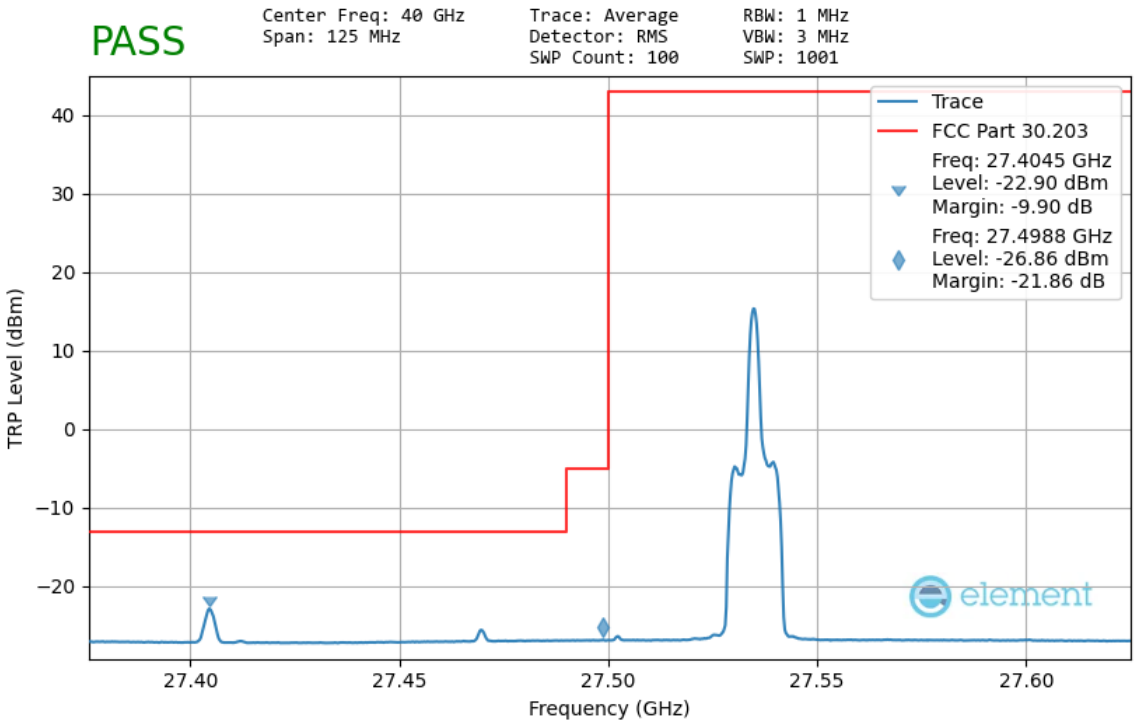
Band n261 – Worst Case



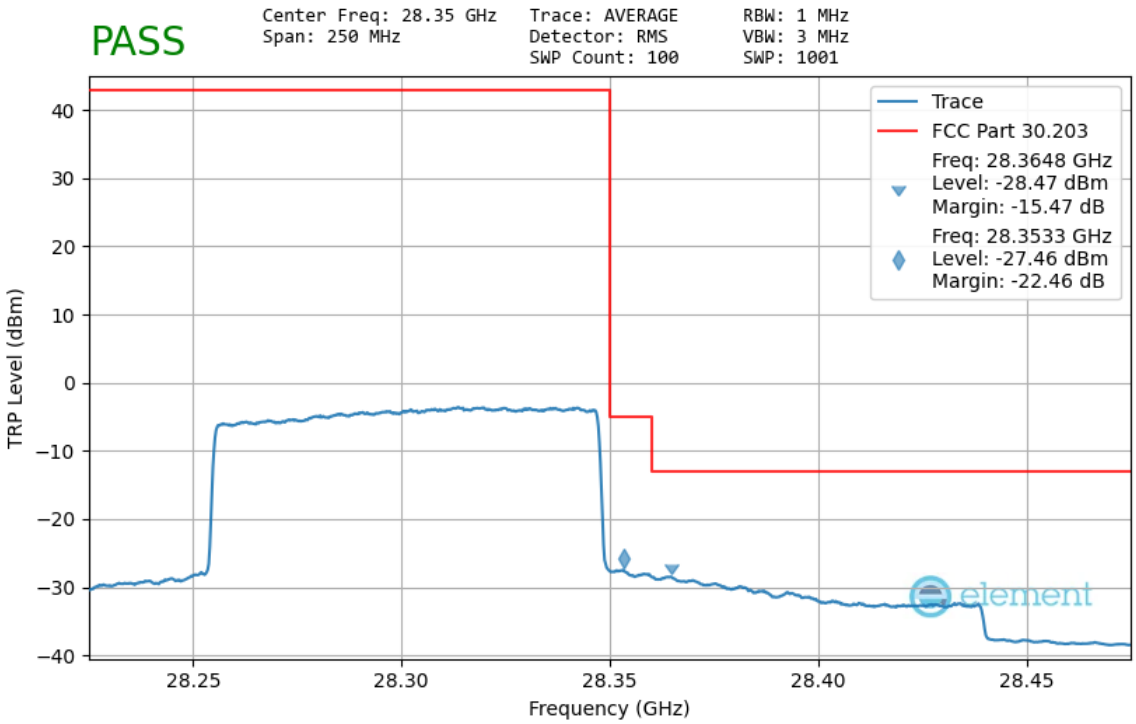
Plot 7-199. Ant 1 Lower Band Edge - TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



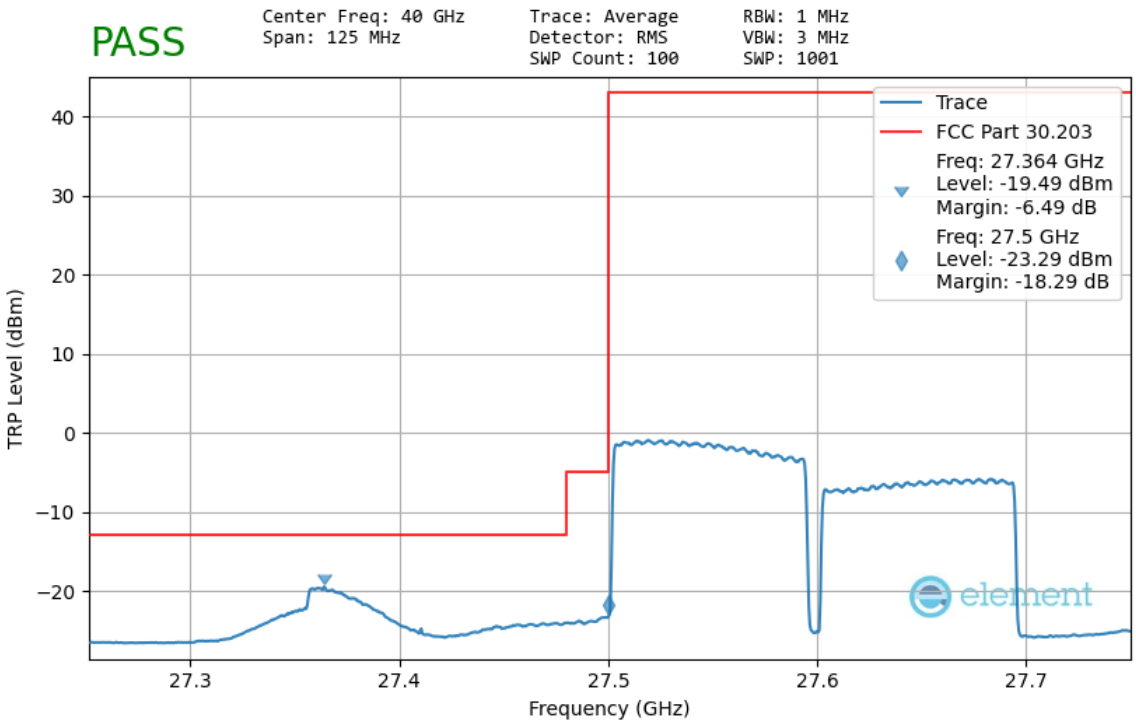
Plot 7-200.Ant 1 Upper Band Edge -TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



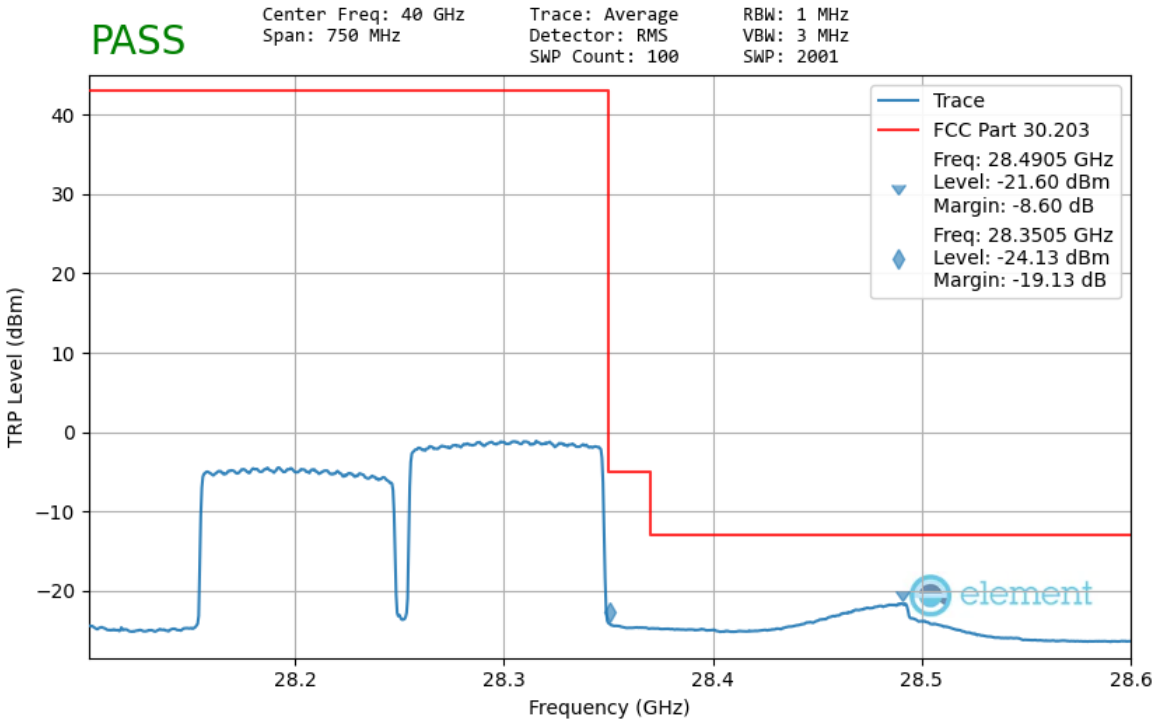
Plot 7-201.Ant 1 Lower Band Edge-TRP (100MHz-1CC – DFT-s-OFDM QPSK 1 RB)



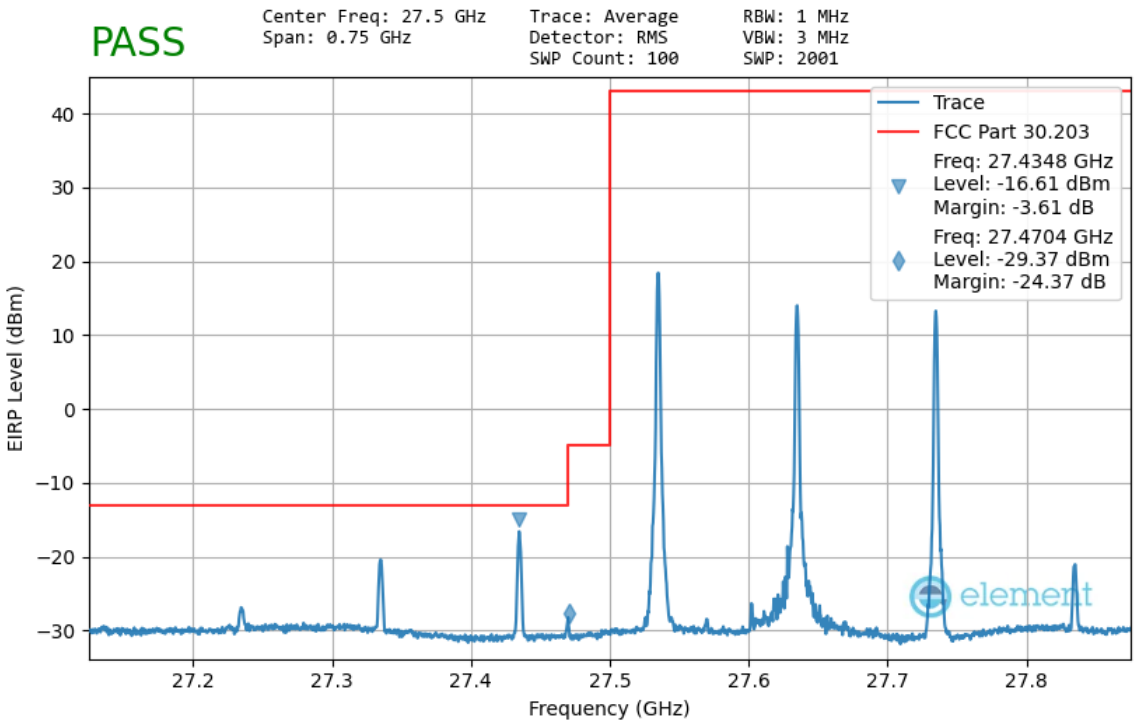
Plot 7-202.Ant 1 Upper Band Edge-TRP (100MHz-1CC – DFT-s-OFDM QPSK Full RB)



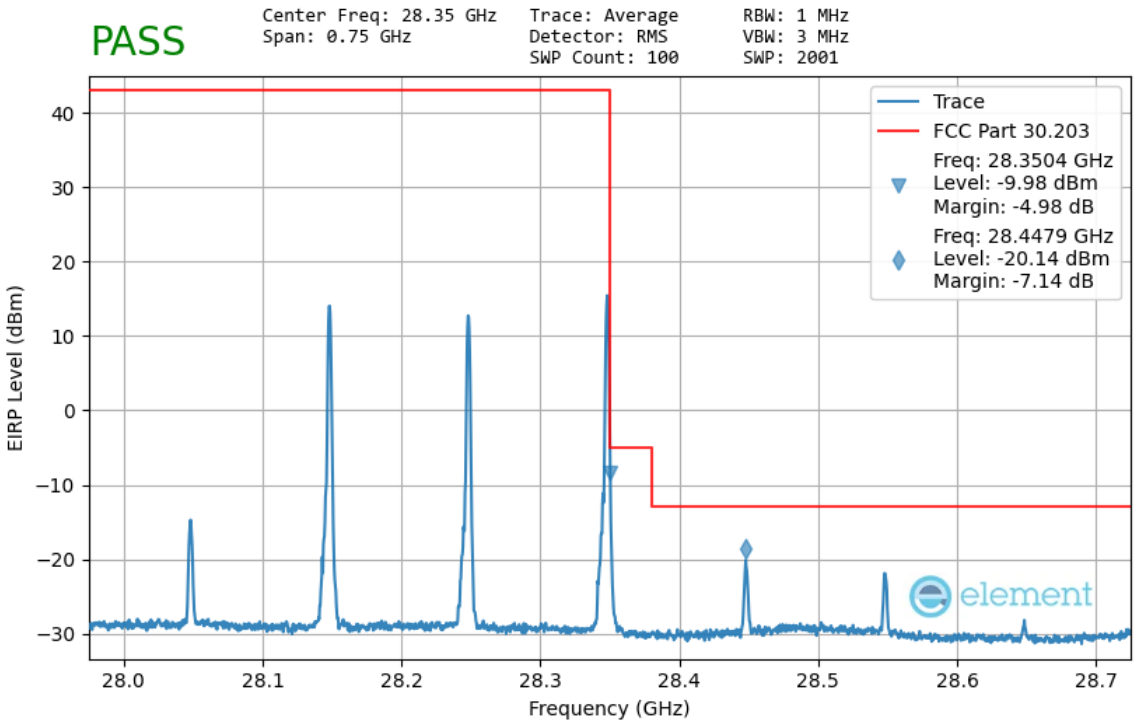
Plot 7-203.Ant 1 Lower Band Edge – TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



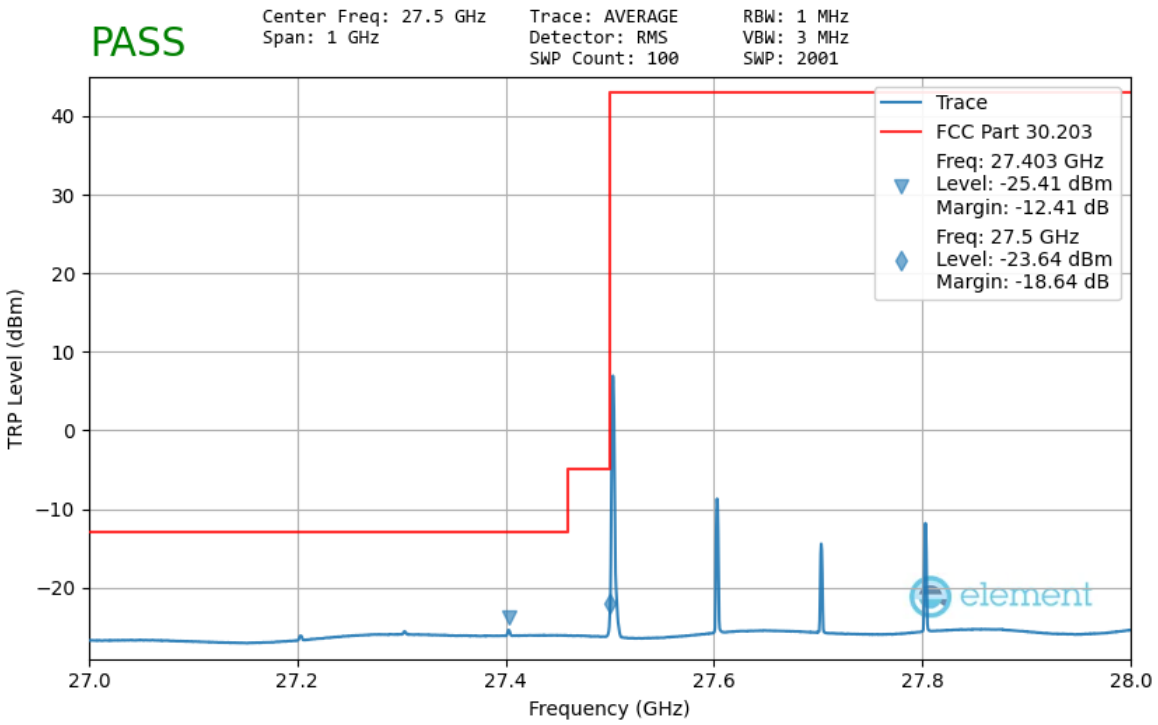
Plot 7-204.Ant 1 Upper Band Edge -TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



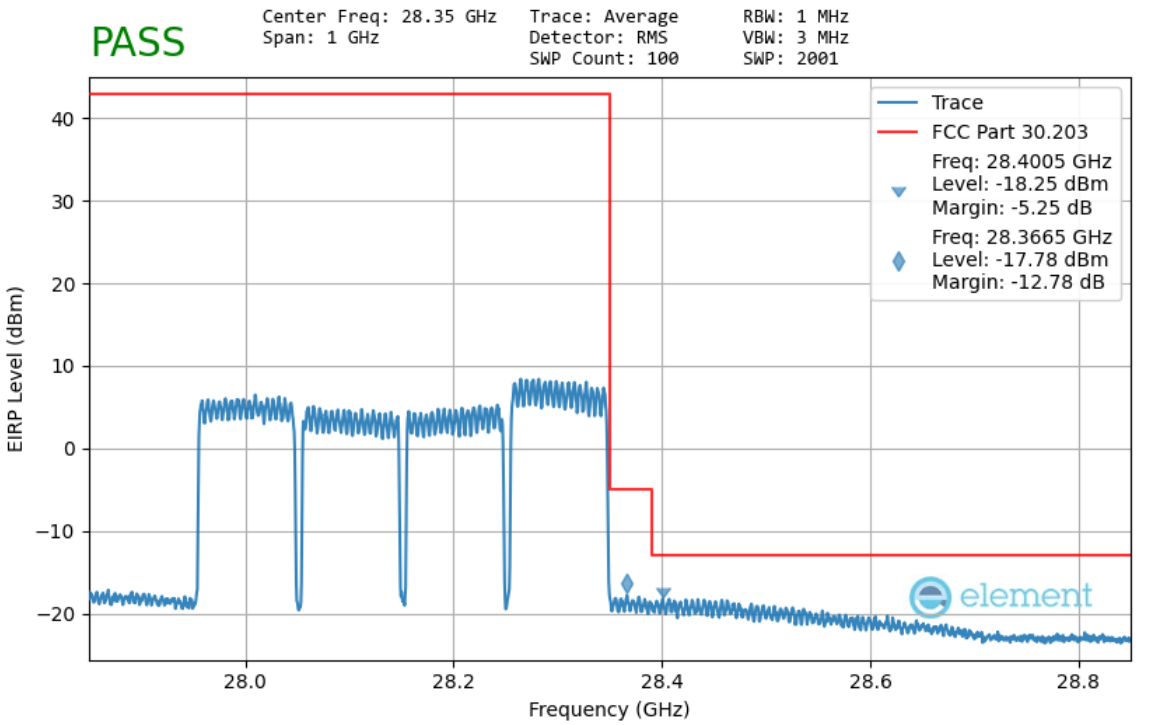
Plot 7-205.Ant 1 Lower Band Edge - (100MHz-3CC – DFT-s-OFDM QPSK 1 RB)



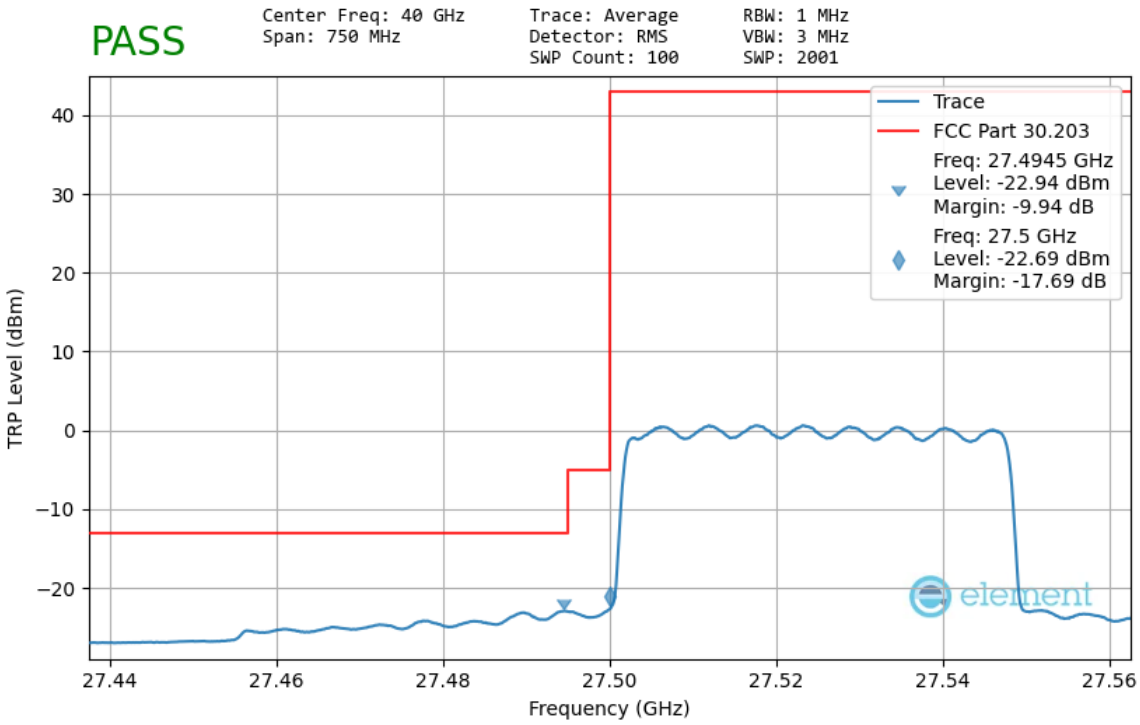
Plot 7-206.Ant 1 Upper Band Edge (100MHz-3CC – DFT-s-OFDM QPSK 1 RB)



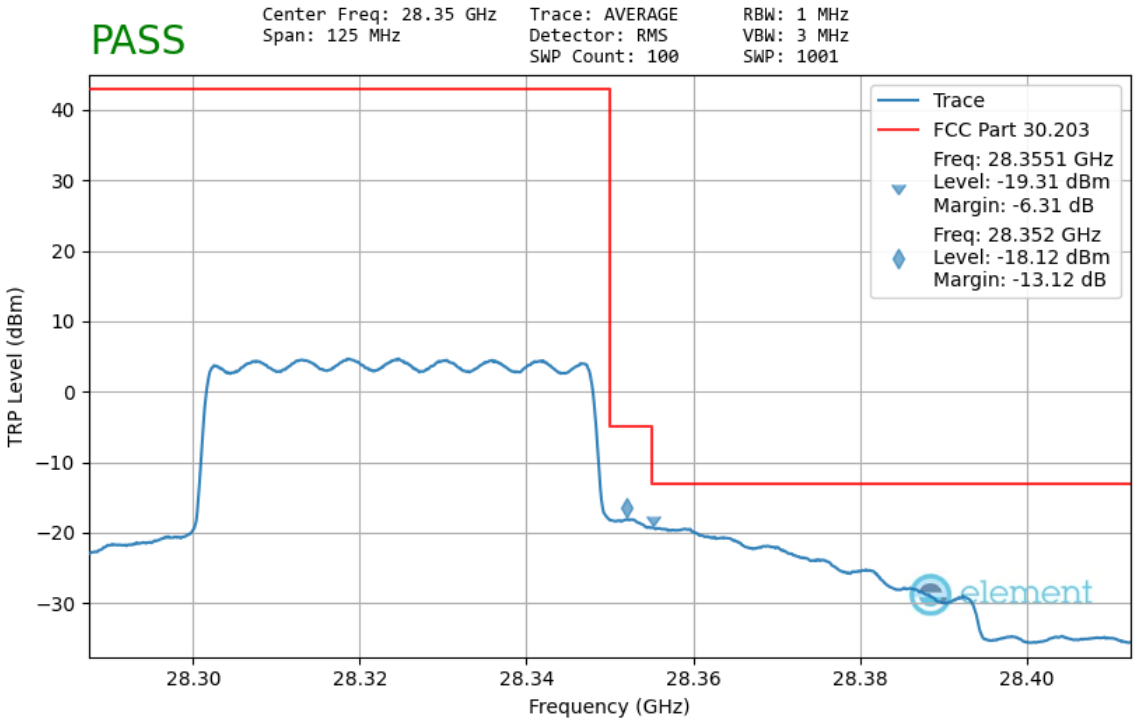
Plot 7-207.Ant 1 Lower Band Edge -TRP (100MHz-4CC – CP-OFDM QPSK 1 RB)



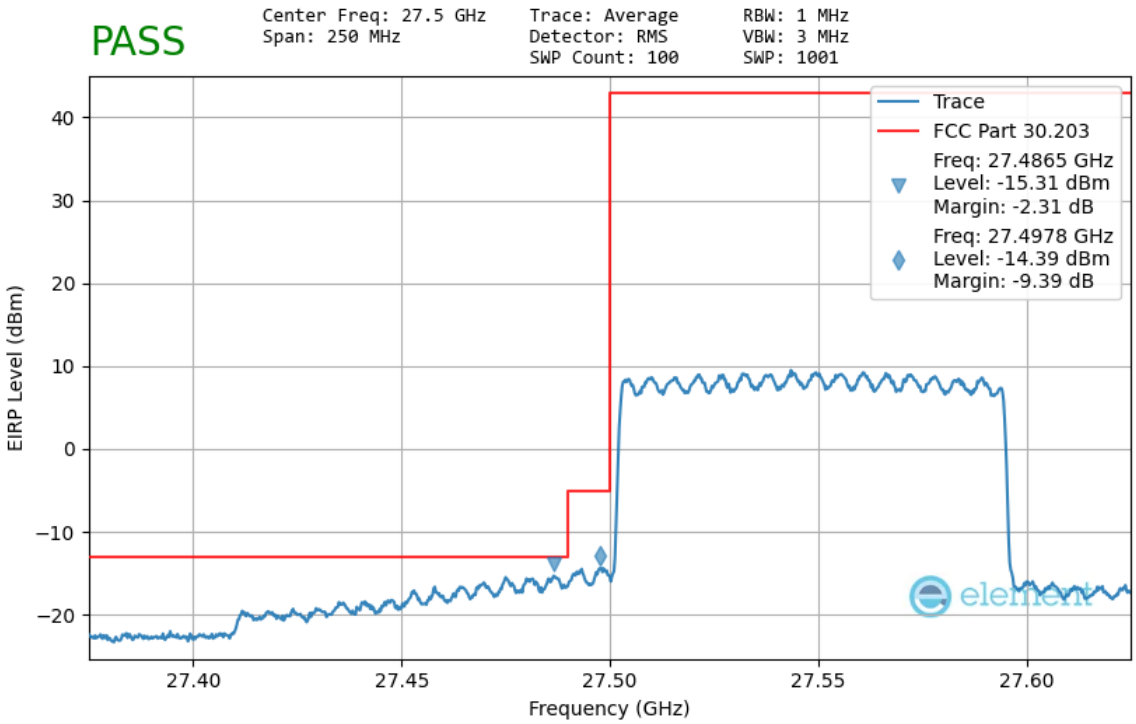
Plot 7-208.Ant 1 Upper Band Edge (100MHz-4CC – DFT-s-OFDM QPSK Full RB)



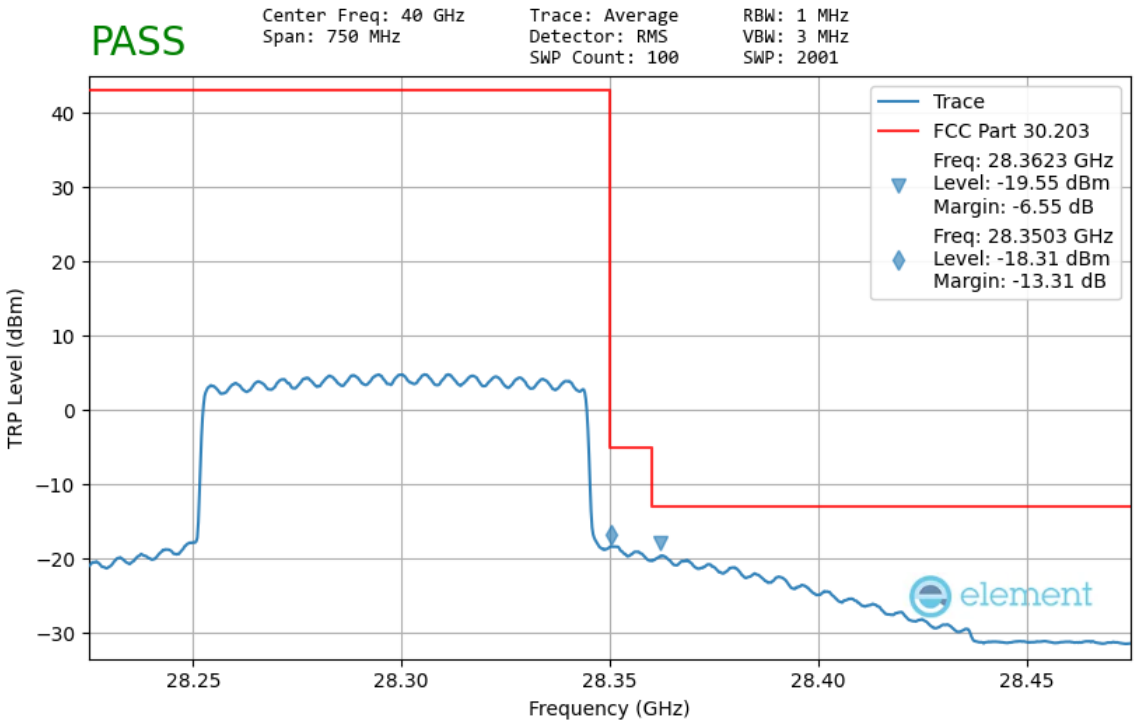
Plot 7-209. Ant 2 Lower Band Edge - TRP (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



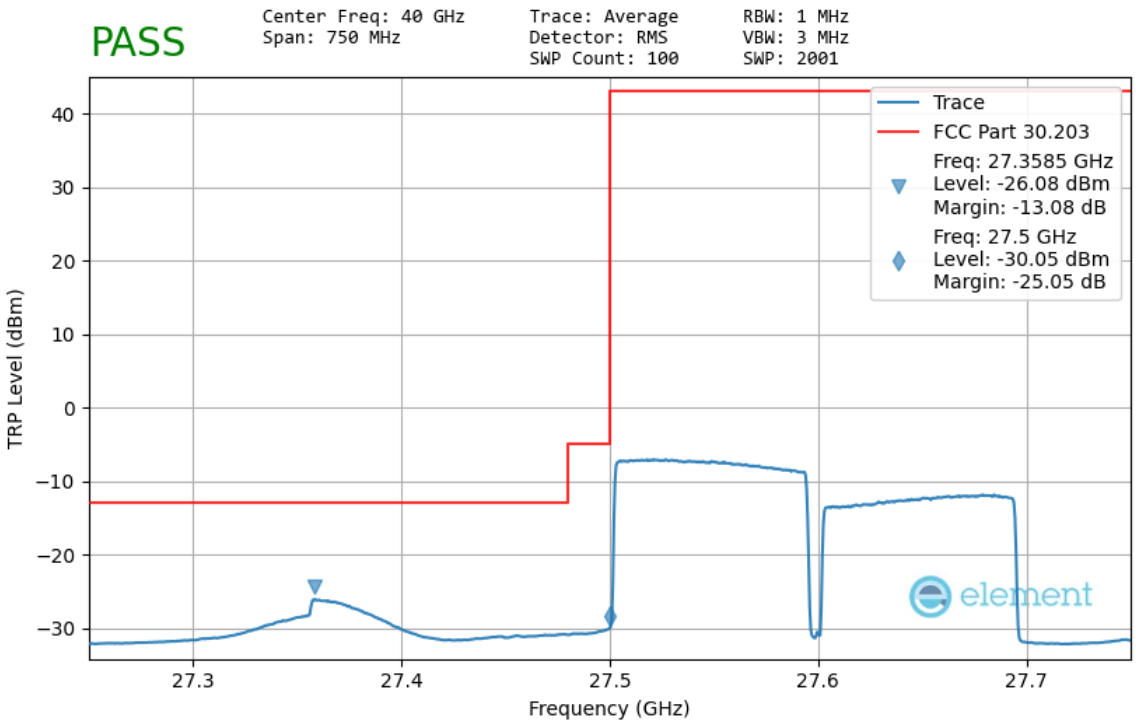
Plot 7-210.Ant 2 Upper Band Edge-TRP (50MHz-1CC – CP-OFDM QPSK Full RB)



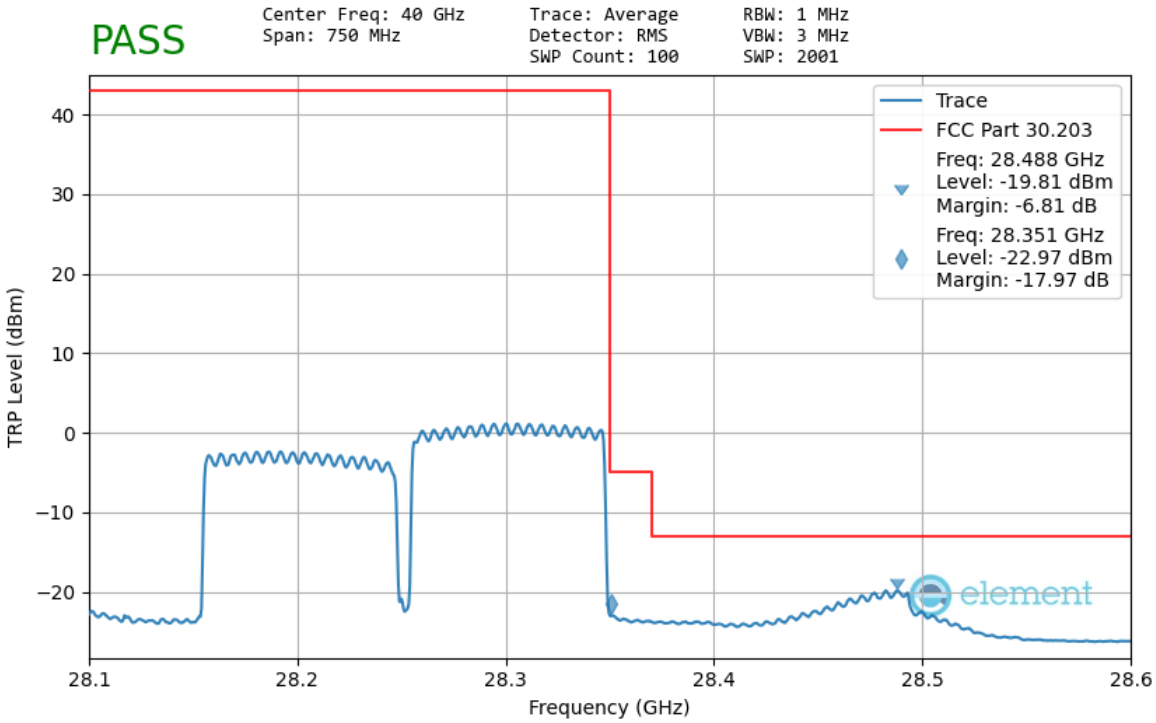
Plot 7-211.Ant 2 Lower Band Edge (100MHz-1CC – DFT-s-OFDM QPSK Full RB)



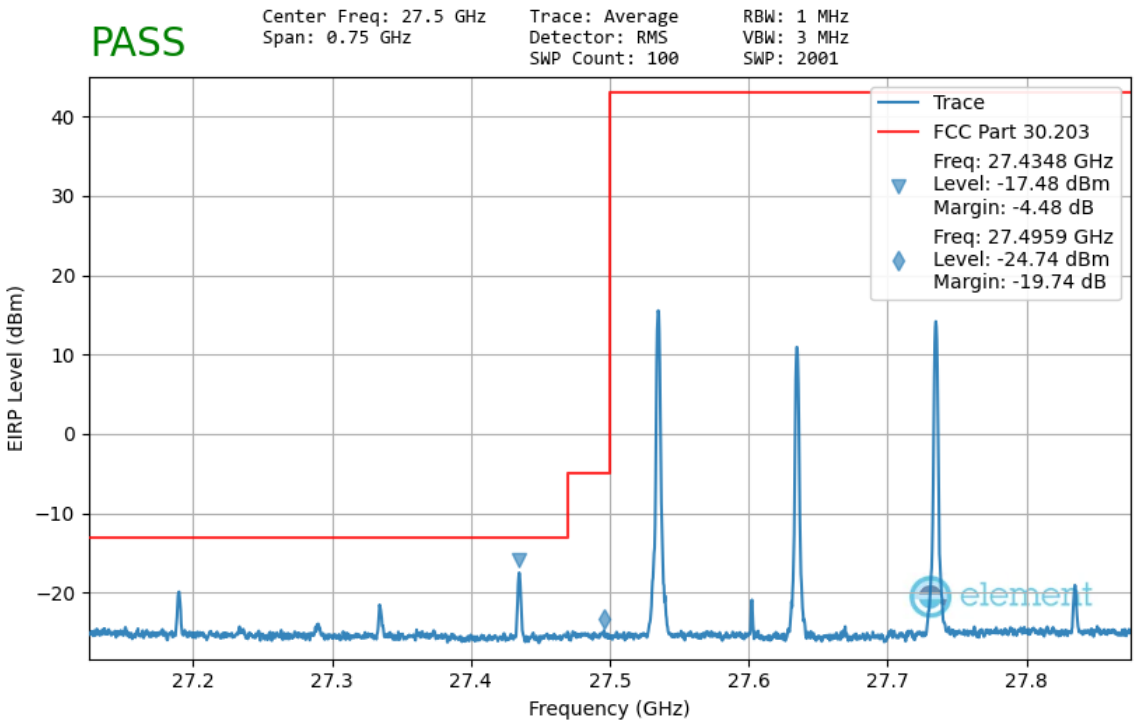
Plot 7-212.Ant 2 Upper Band Edge -TRP (100MHz-1CC – DFT-s-OFDM QPSK Full RB)



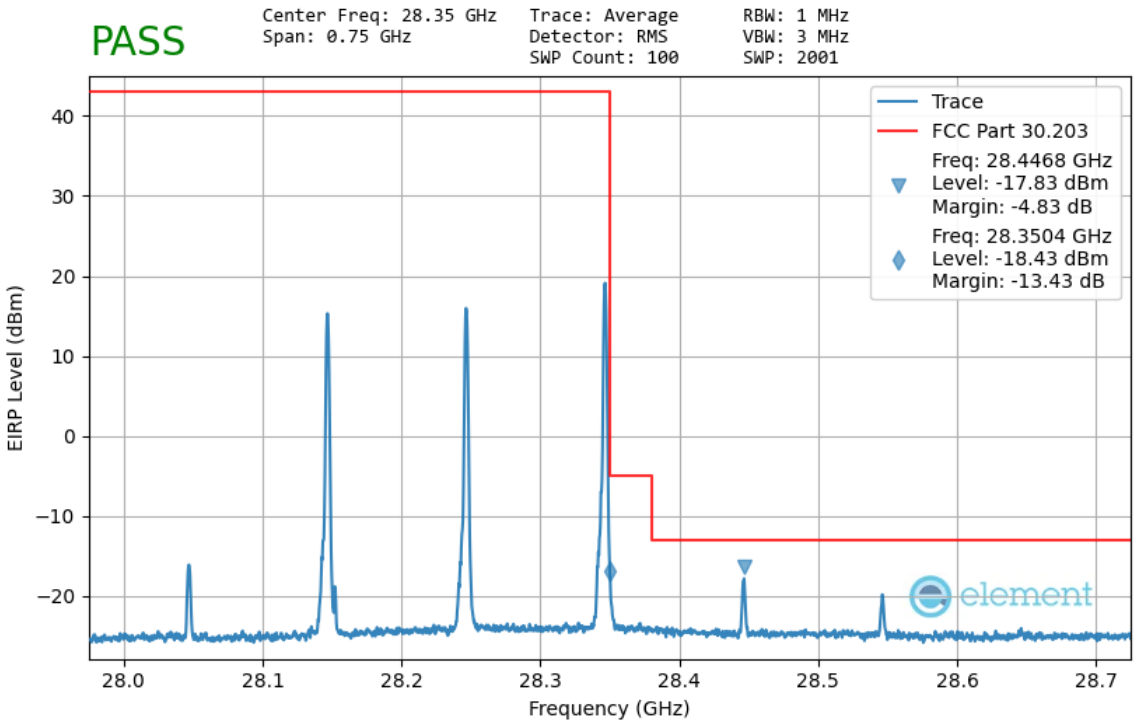
Plot 7-213.Ant 2 Lower Band Edge – TRP (100MHz-2CC – π/2 BPSK QPSK Full RB)



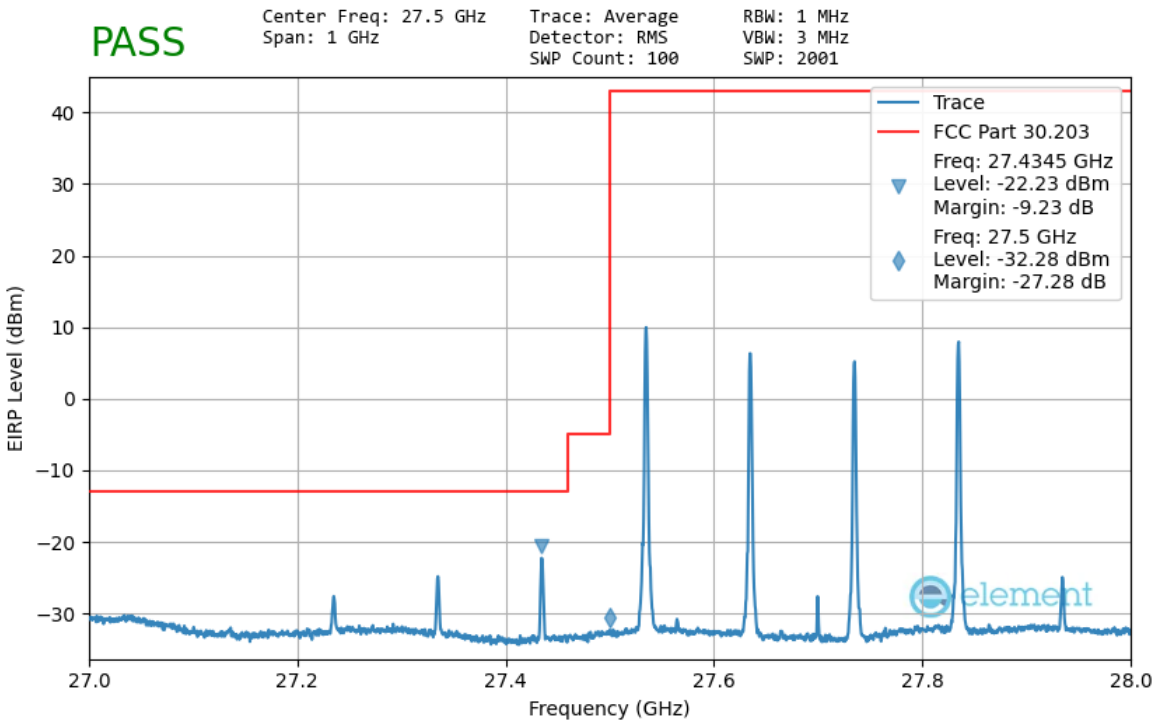
Plot 7-214.Ant 2 Upper Band Edge - TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



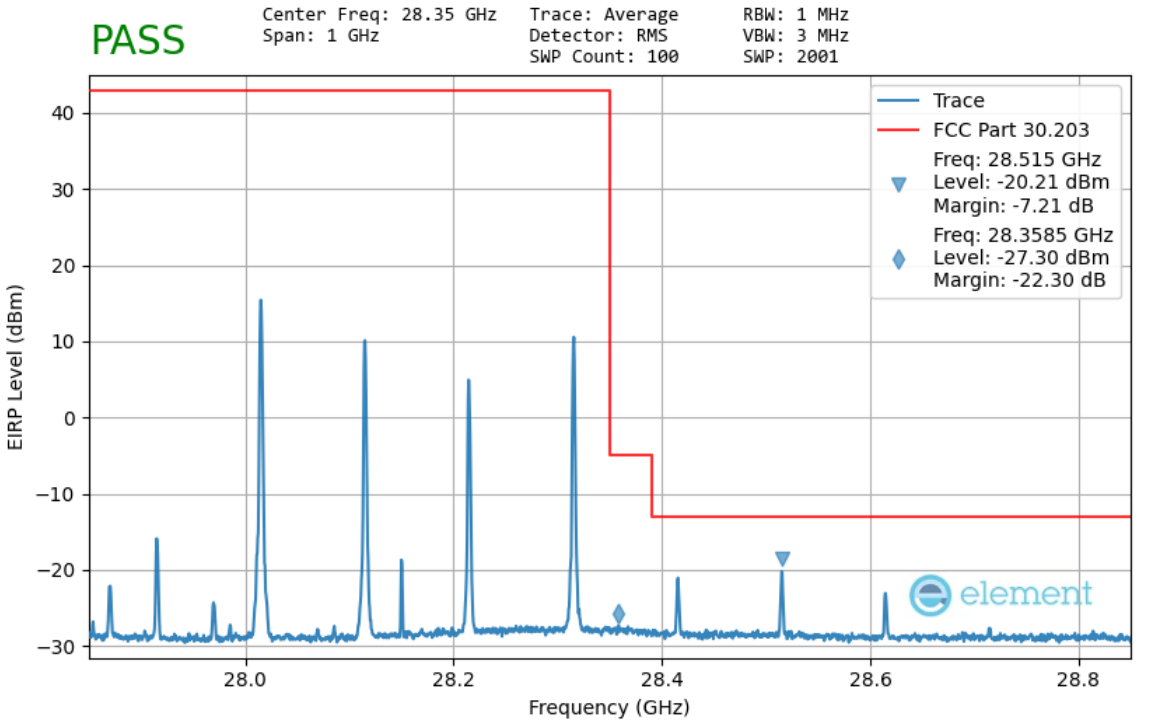
Plot 7-215.Ant 2 Lower Band Edge - (100MHz-3CC – DFT-s-OFDM π/2 BPSK 1 RB)



Plot 7-216.Ant 2 Upper Band Edge (100MHz-3CC – DFT-s-OFDM QPSK 1 RB)

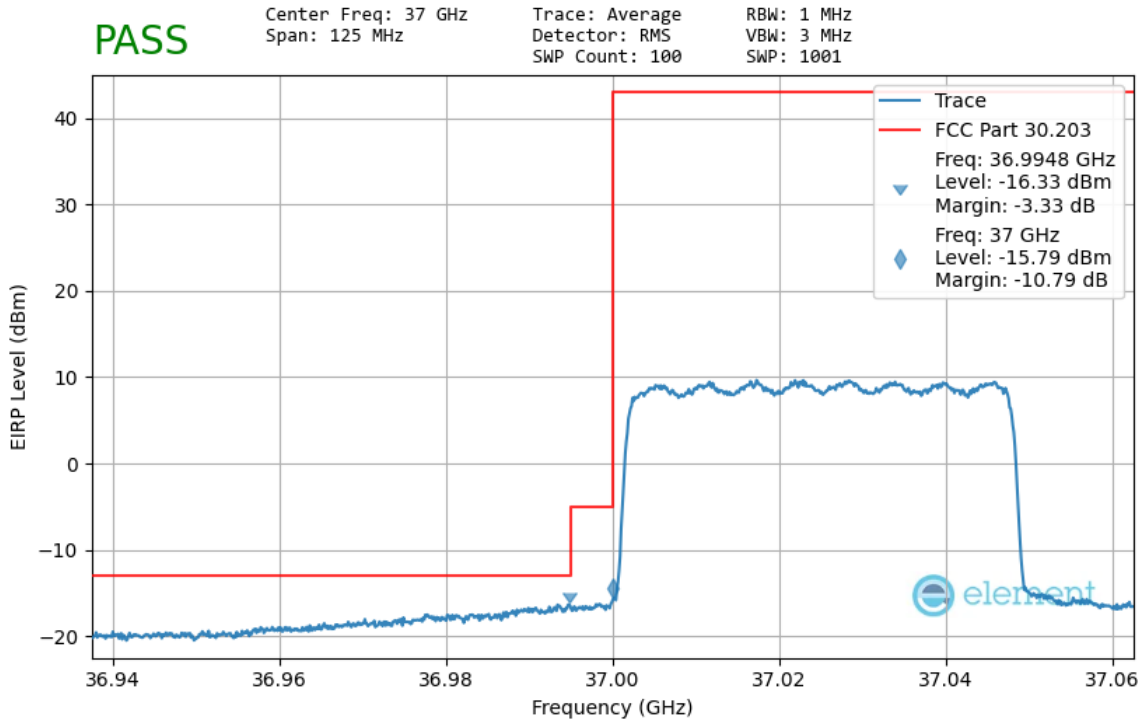


Plot 7-217.Ant 2 Lower Band Edge (100MHz-4CC – DFT-s-OFDM QPSK 1 RB)

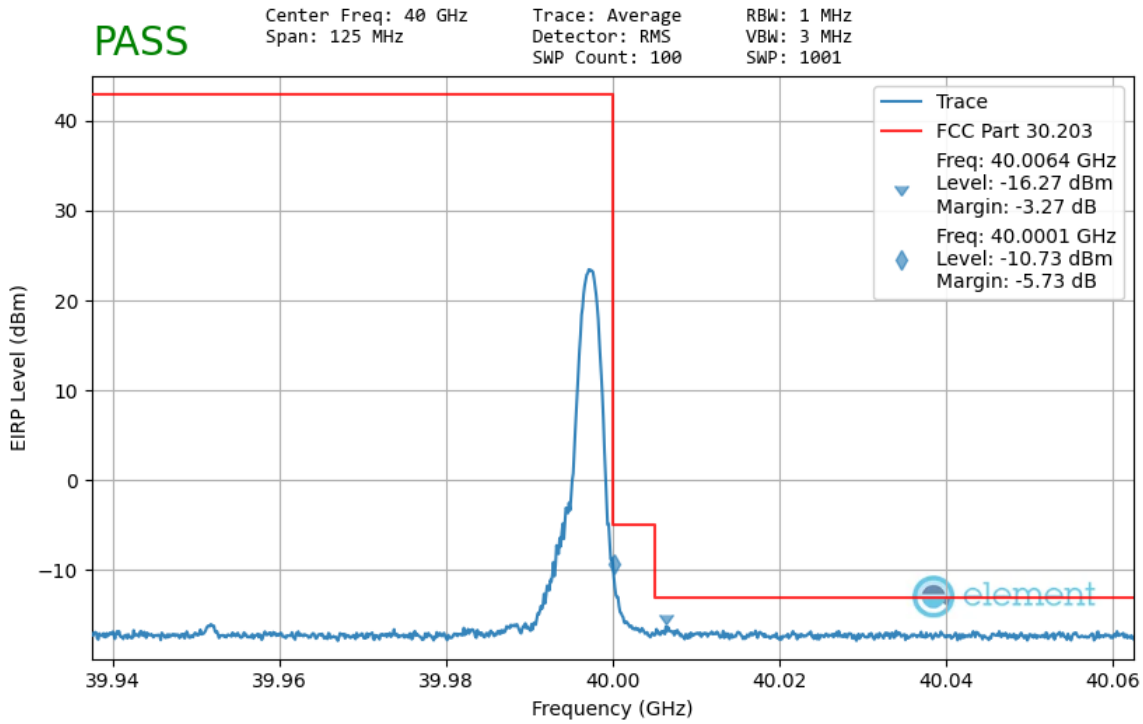


Plot 7-218.Ant 2 Upper Band Edge (100MHz-4CC – CP-OFDM QPSK 1 RB)

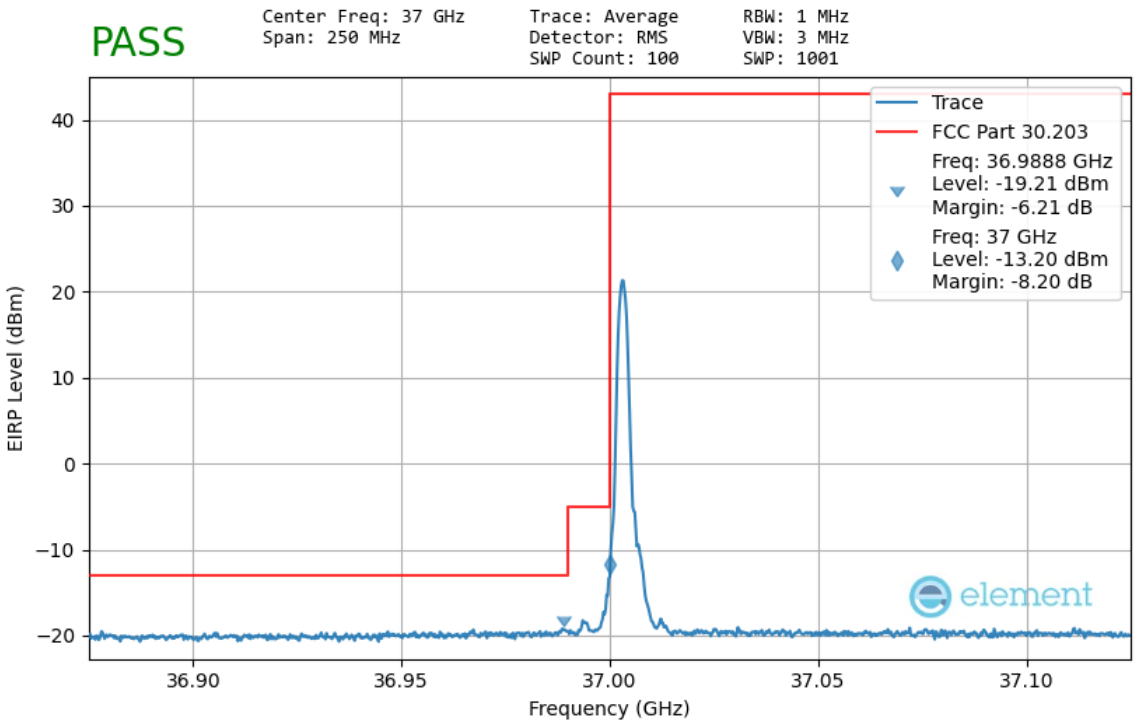
Band n260 – Worst Case



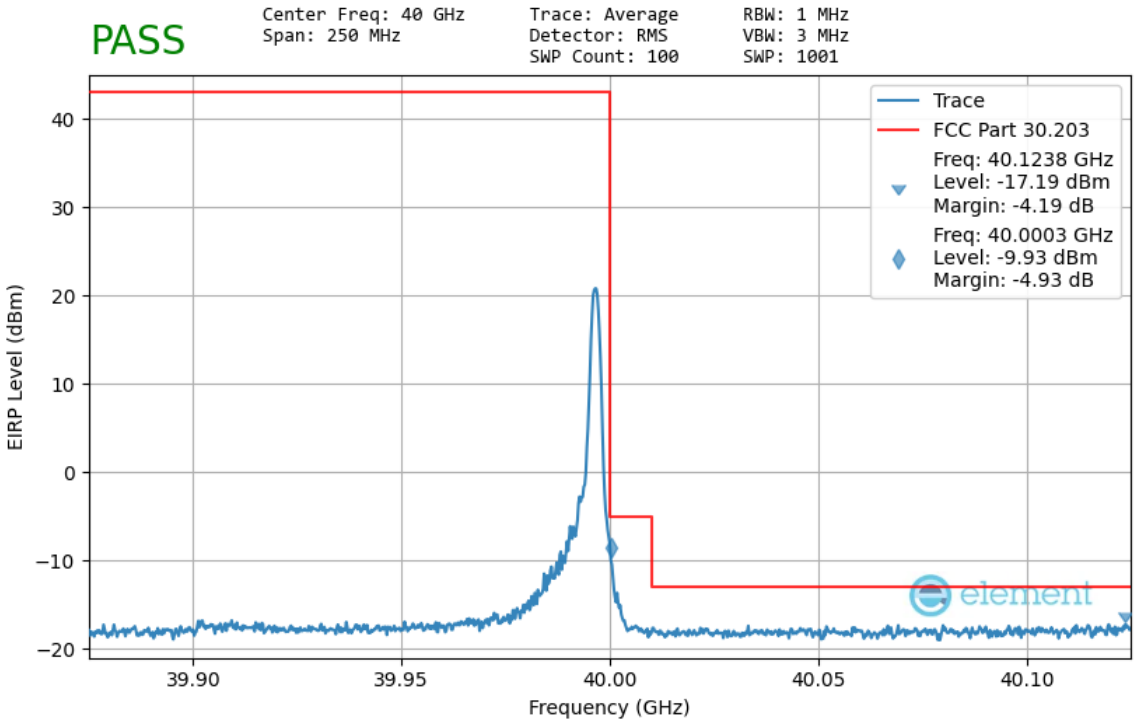
Plot 7-219.Ant 1 Lower Band Edge – (50MHz-1CC – DFT-s-OFDM QPSK Full RB)



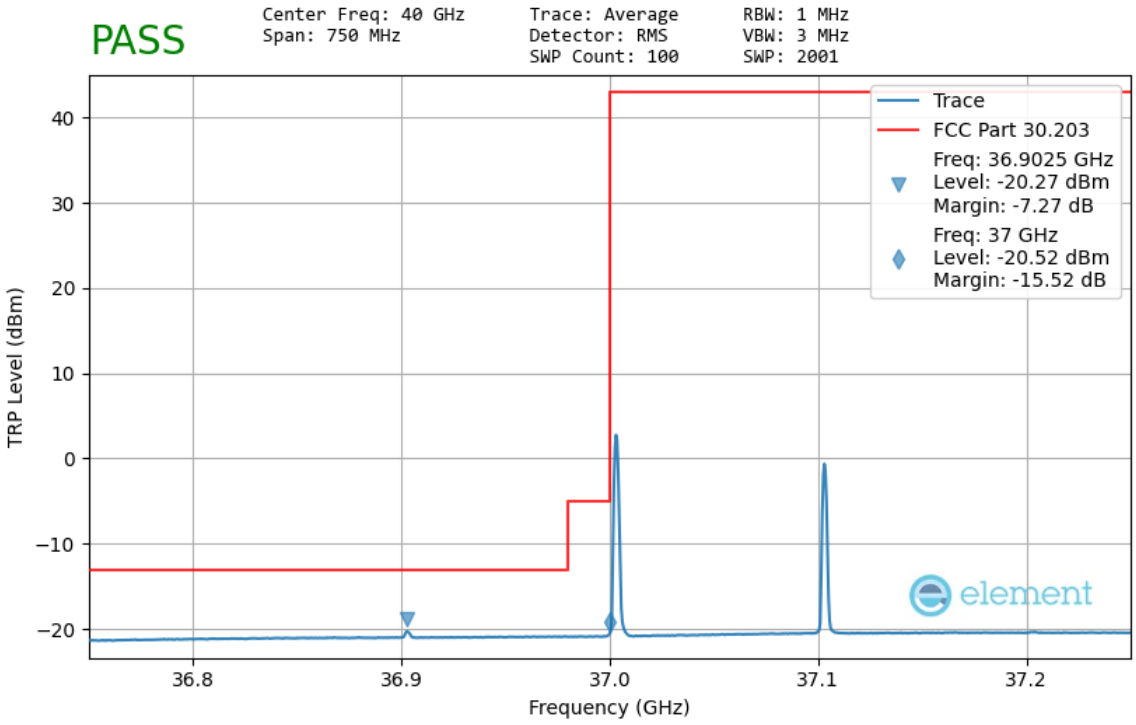
Plot 7-220.Ant 1 Upper Band Edge - (50MHz-1CC – DFT-s-OFDM π/2 BPSK 1 RB)



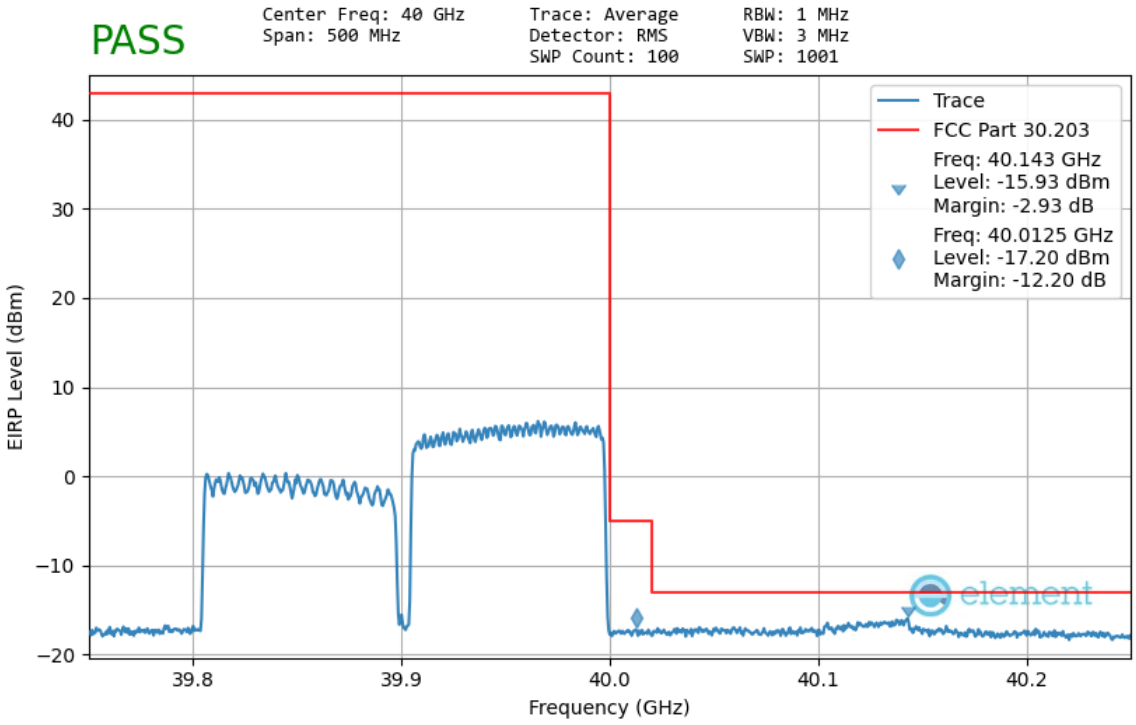
Plot 7-221.Ant 1 Lower Band Edge (100MHz-1CC – DFT-s-OFDM π/2 BPSK 1 RB)



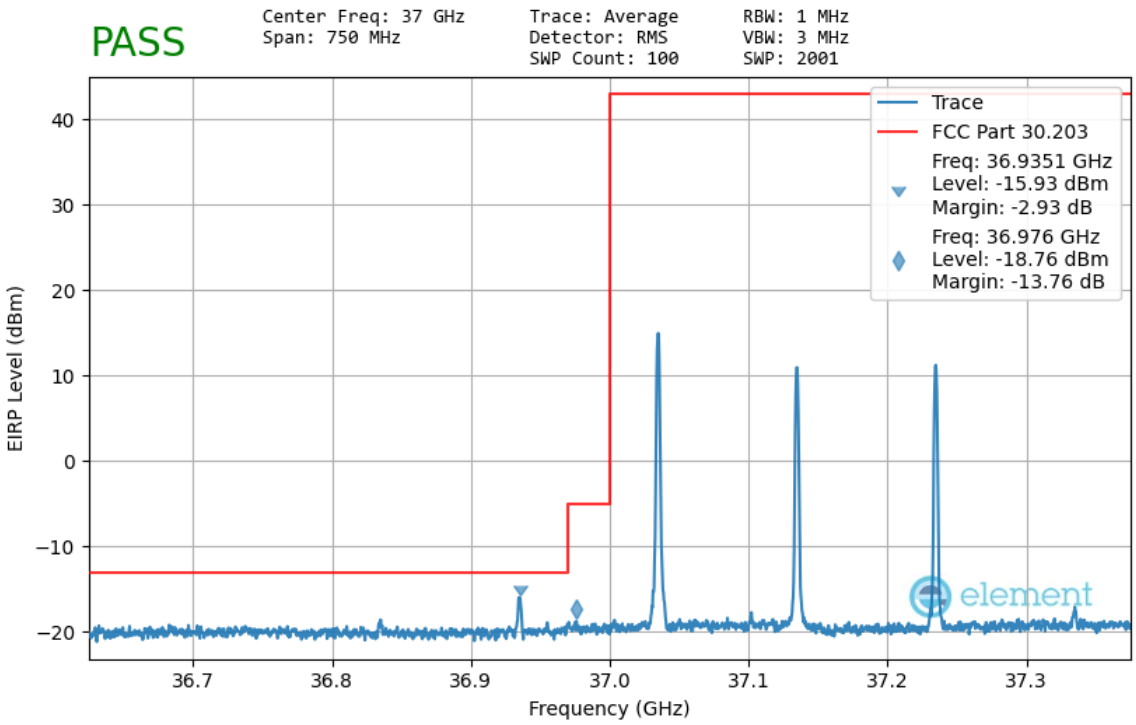
Plot 7-222.Ant 1 Upper Band Edge - (100MHz-1CC – DFT-s-OFDM π/2 BPSK 1 RB)



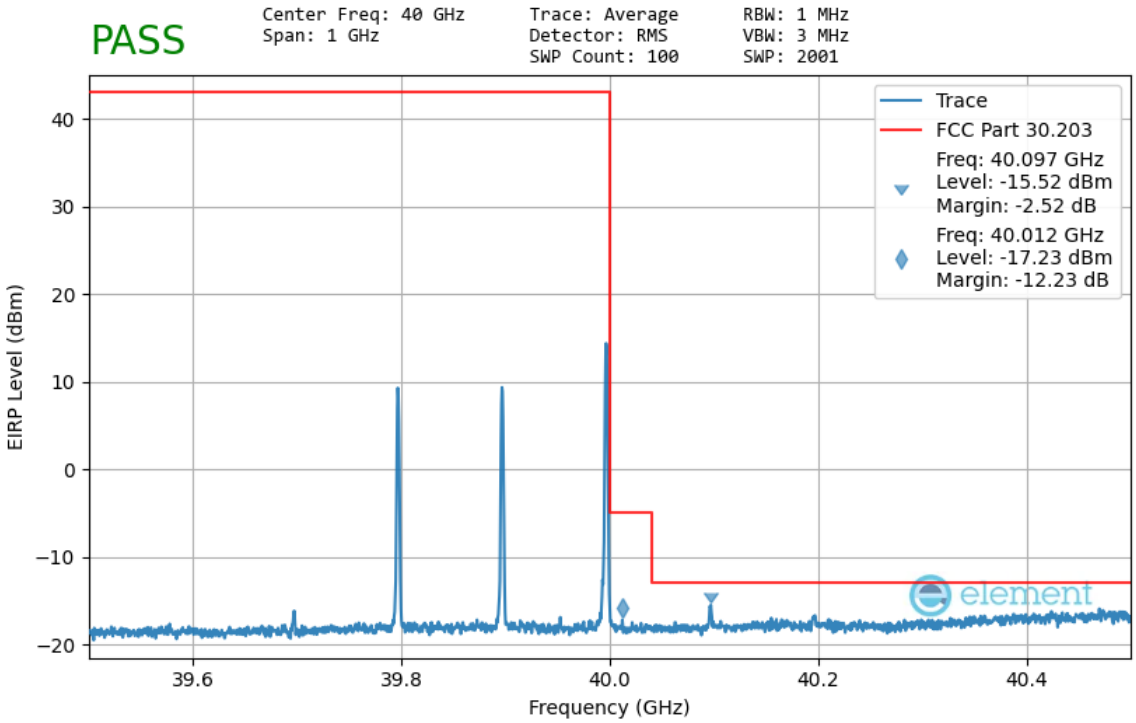
Plot 7-223.Ant 1 Lower Band Edge- TRP (100MHz-2CC – DFT-s-OFDM π/2 BPSK 1 RB)



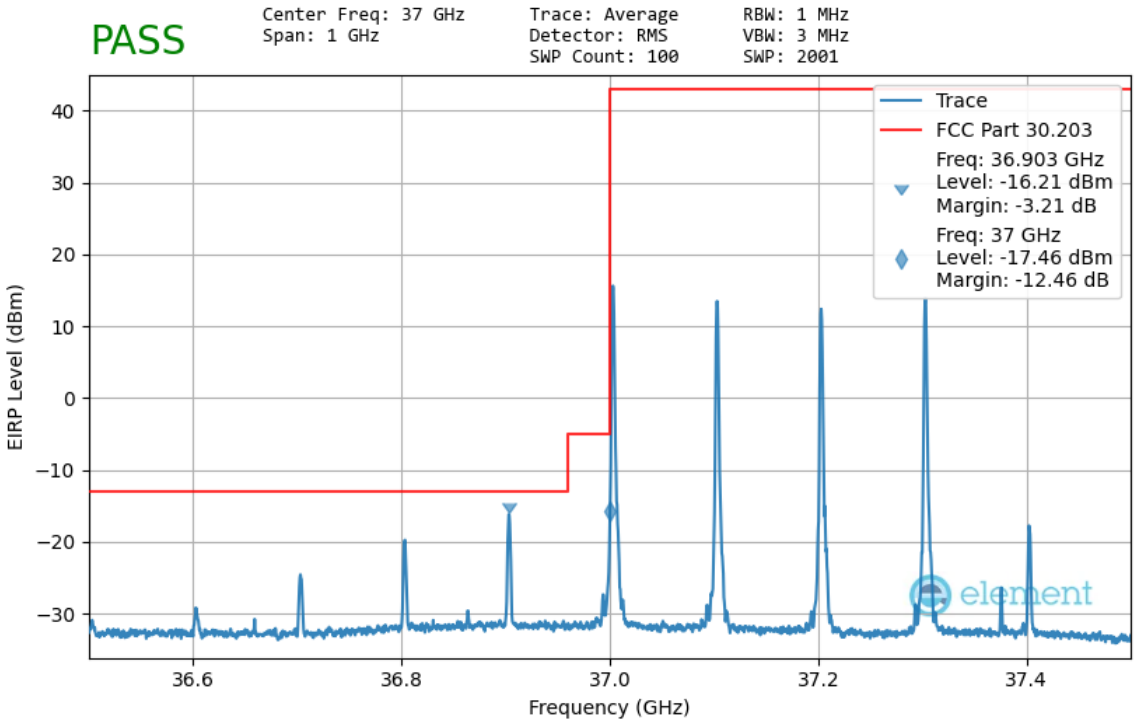
Plot 7-224.Ant 1 Upper Band Edge (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



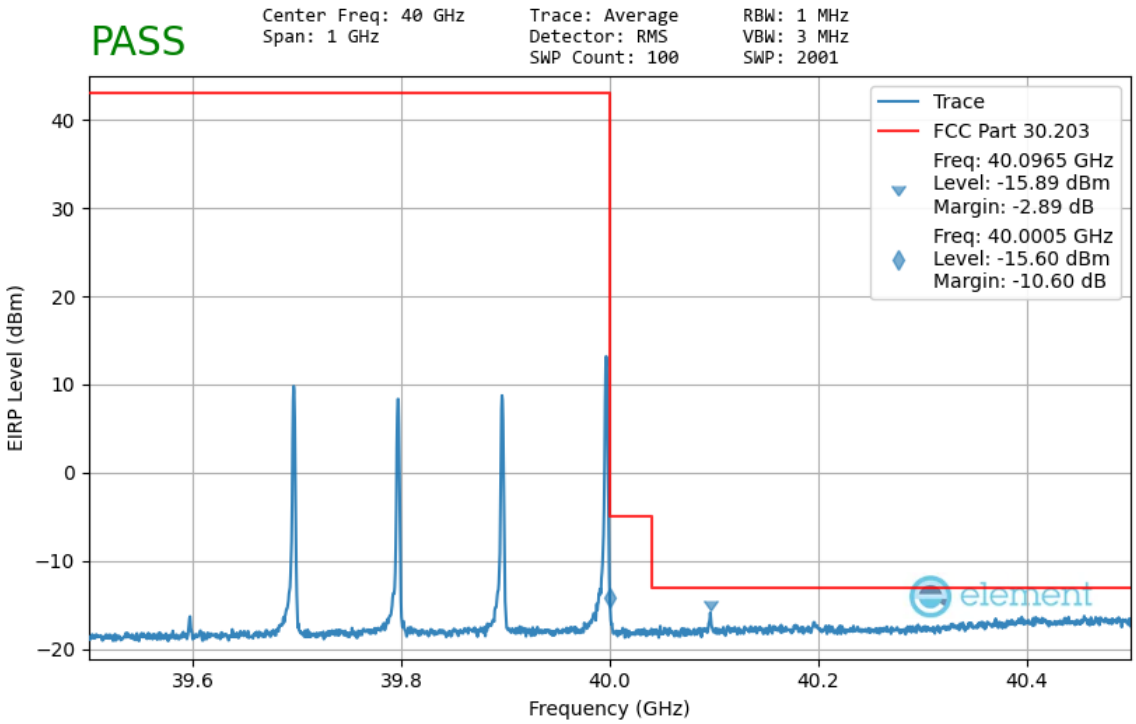
Plot 7-225.Ant 1 Lower Band Edge - (100MHz-3CC – DFT-s -OFDM π/2 BPSK 1 RB)



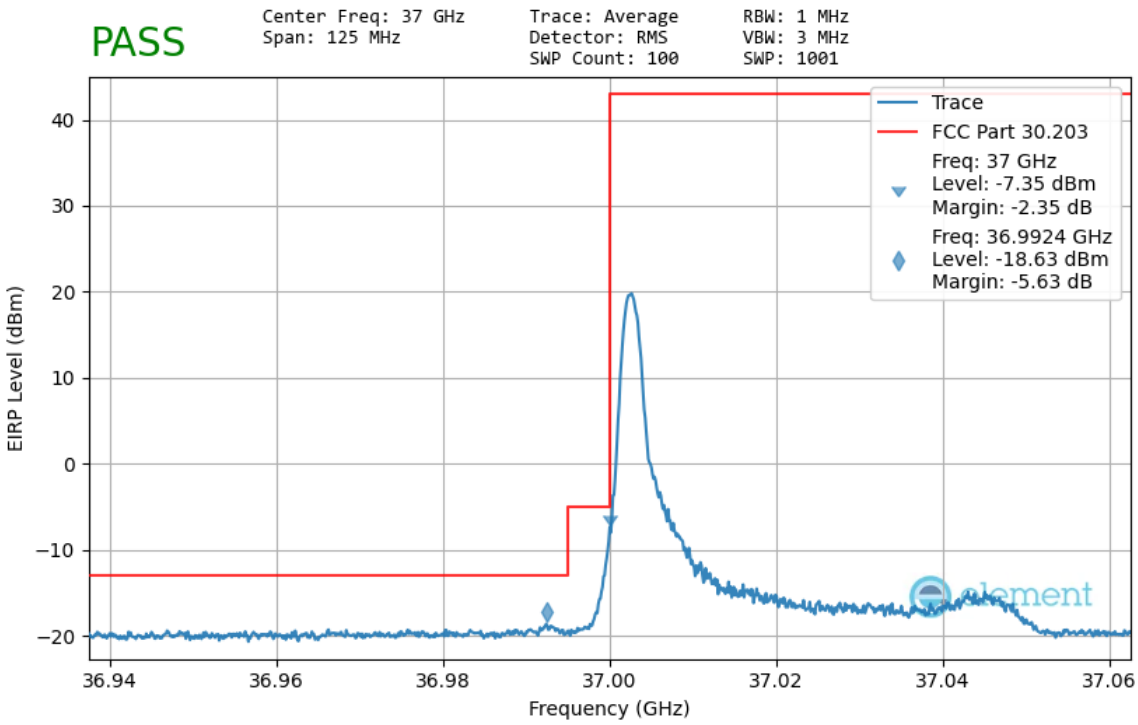
Plot 7-226.Ant 1 Upper Band Edge (100MHz-3CC – DFT-s -OFDM π/2 BPSK 1 RB)



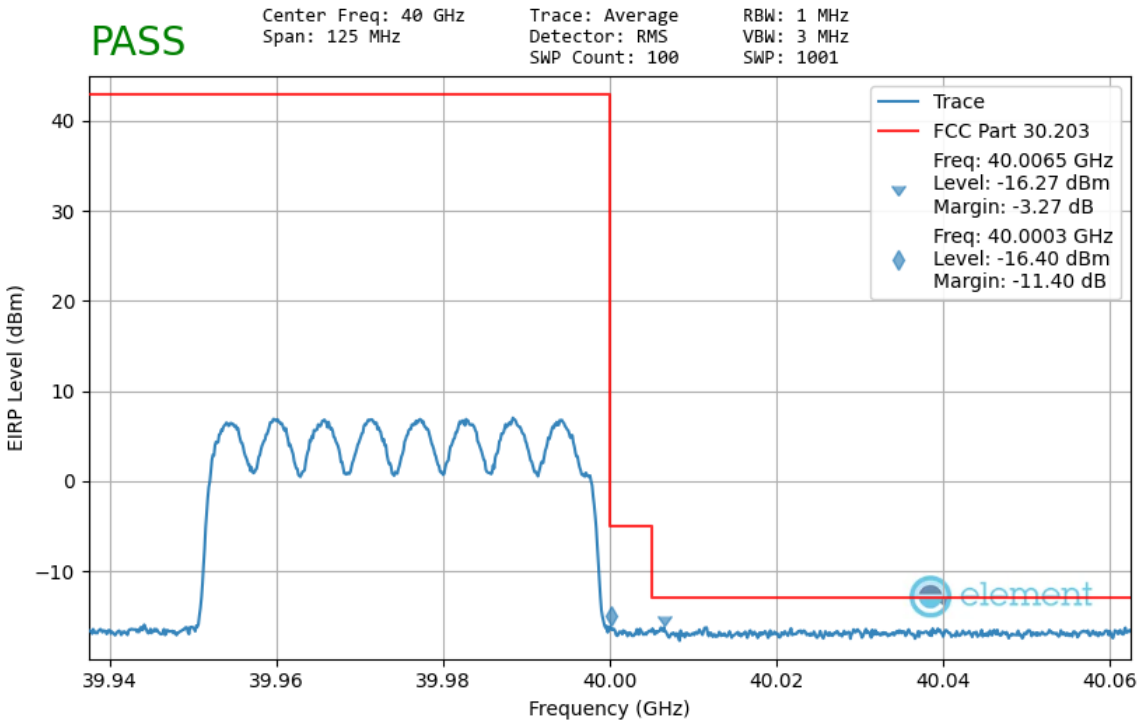
Plot 7-227.Ant 1 Lower Band Edge (100MHz-4CC – DFT-s -OFDM π/2 BPSK 1 RB)



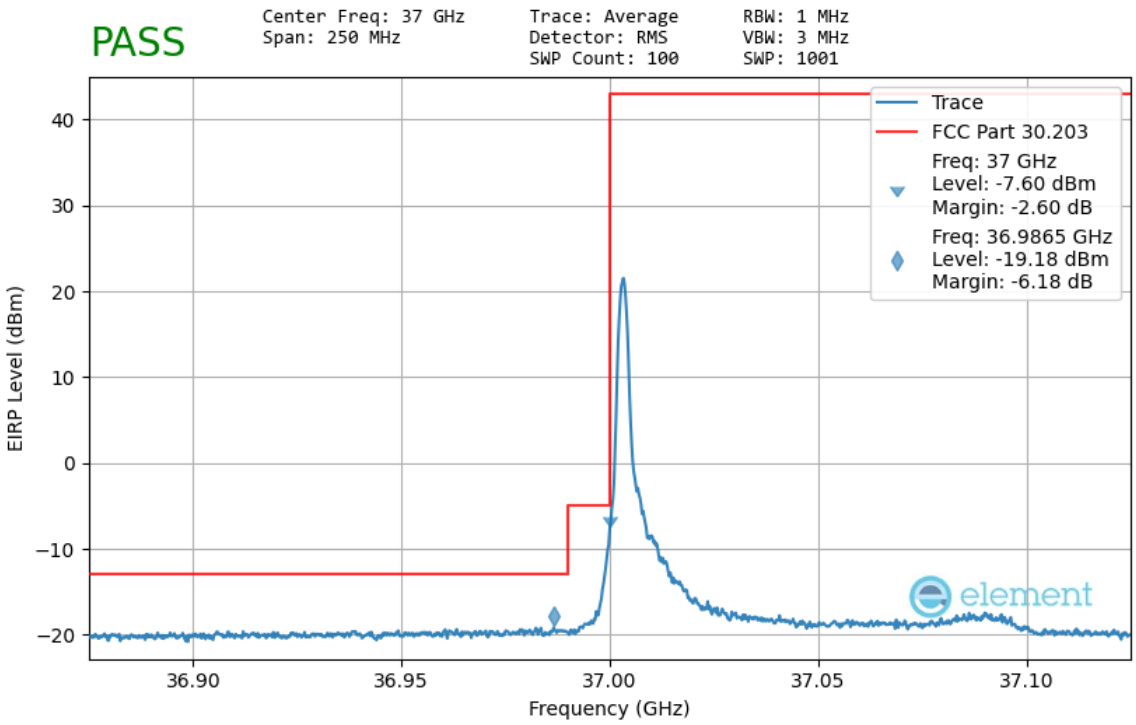
Plot 7-228.Ant 1 Upper Band Edge (100MHz-4CC – DFT-s -OFDM π/2 BPSK 1 RB)



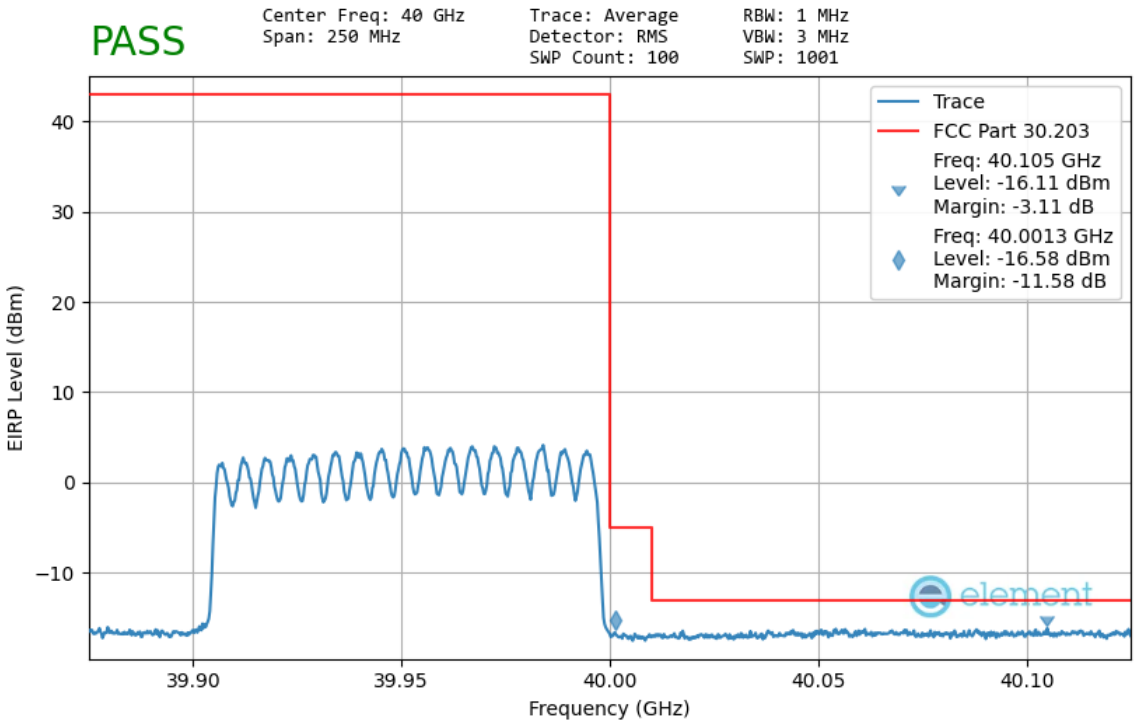
Plot 7-229.Ant 2 Lower Band Edge (50MHz-1CC – DFT-s-OFDM π/2 BPSK 1 RB)



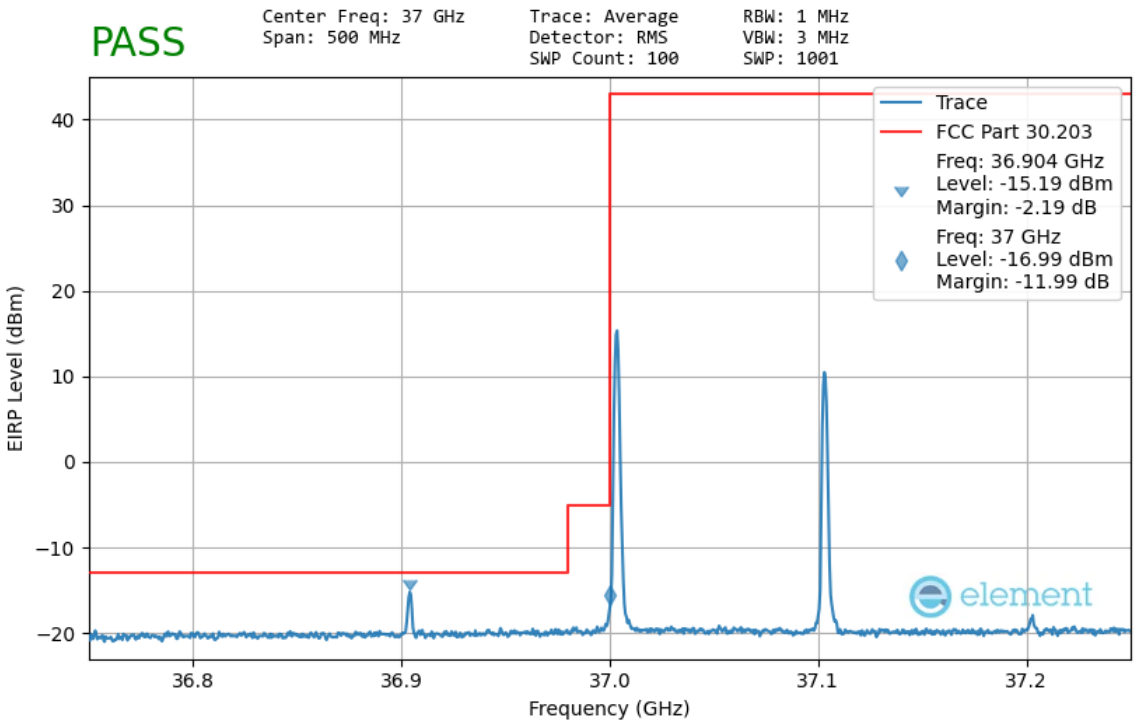
Plot 7-230.Ant 2 Upper Band Edge (50MHz-1CC – DFT-s-OFDM π/2 BPSK Full RB)



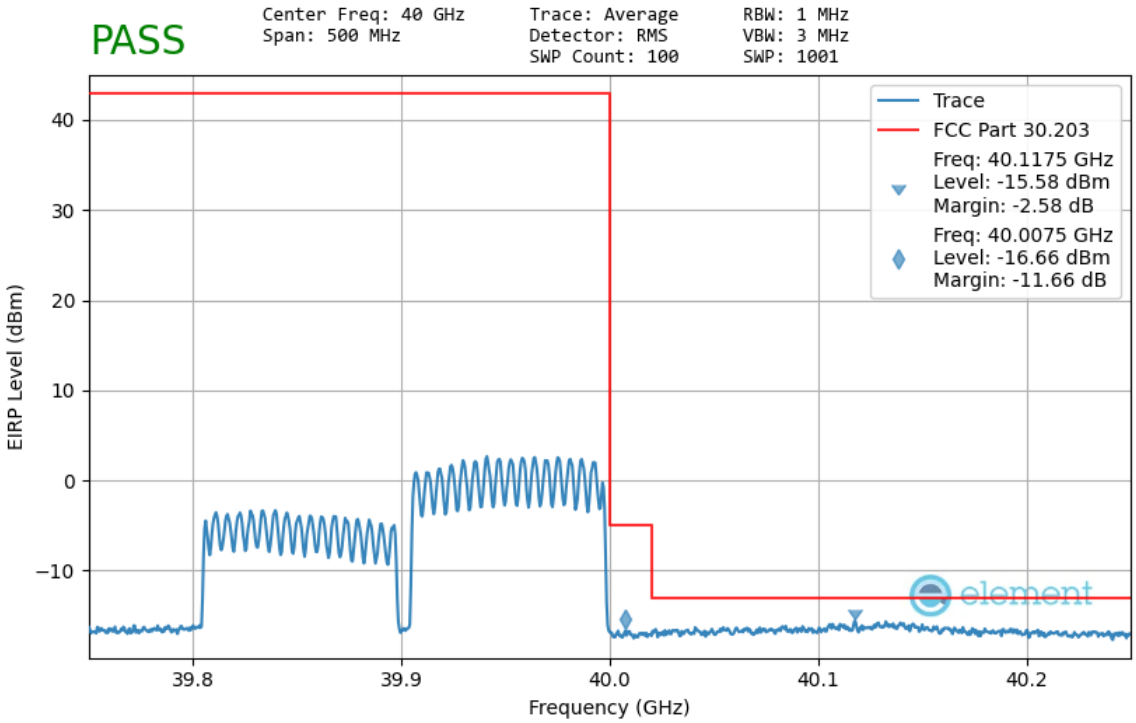
Plot 7-231.Ant 2 Lower Band Edge (100MHz-1CC – DFT-s-OFDM π/2 BPSK 1 RB)



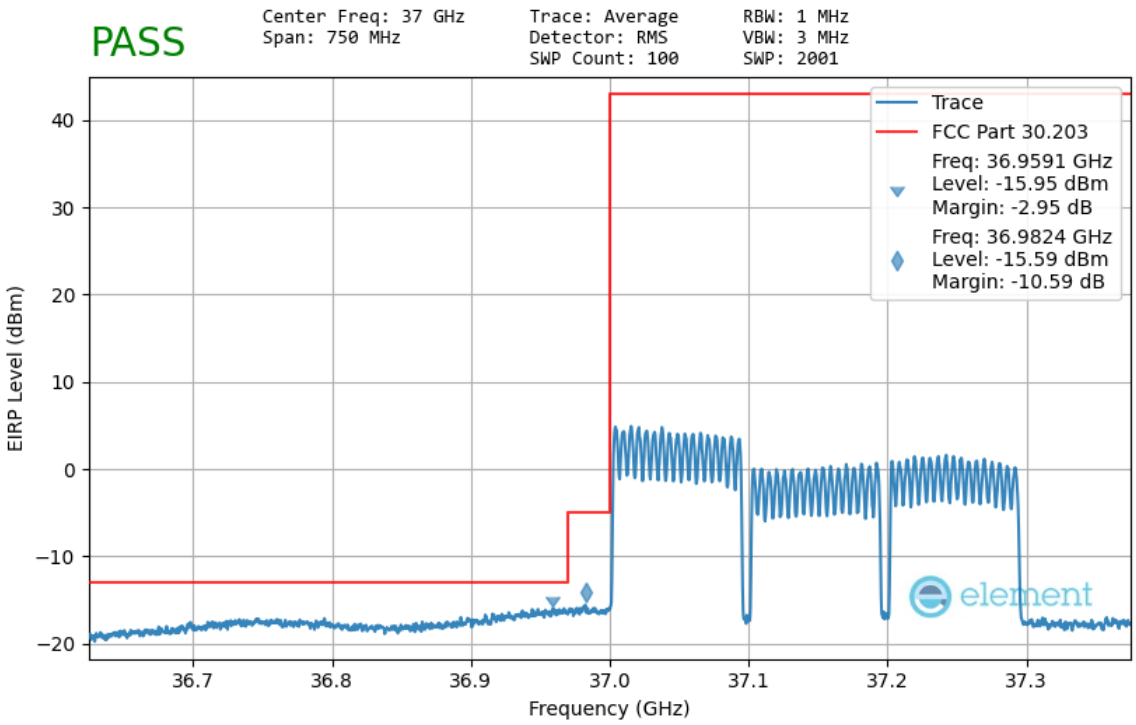
Plot 7-232.Ant 2 Upper Band Edge - (100MHz-1CC – DFT-s-OFDM π/2 BPSK Full RB)



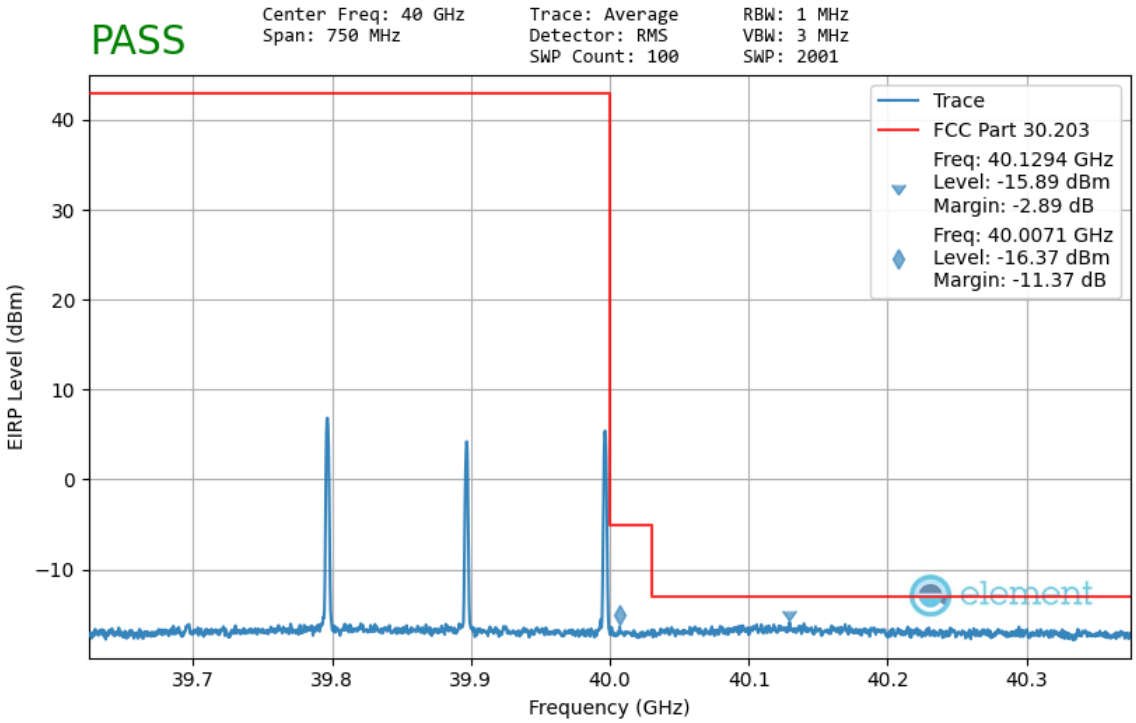
Plot 7-233.Ant 2 Lower Band Edge (100MHz-2CC – DFT-s-OFDM π/2 BPSK 1 RB)



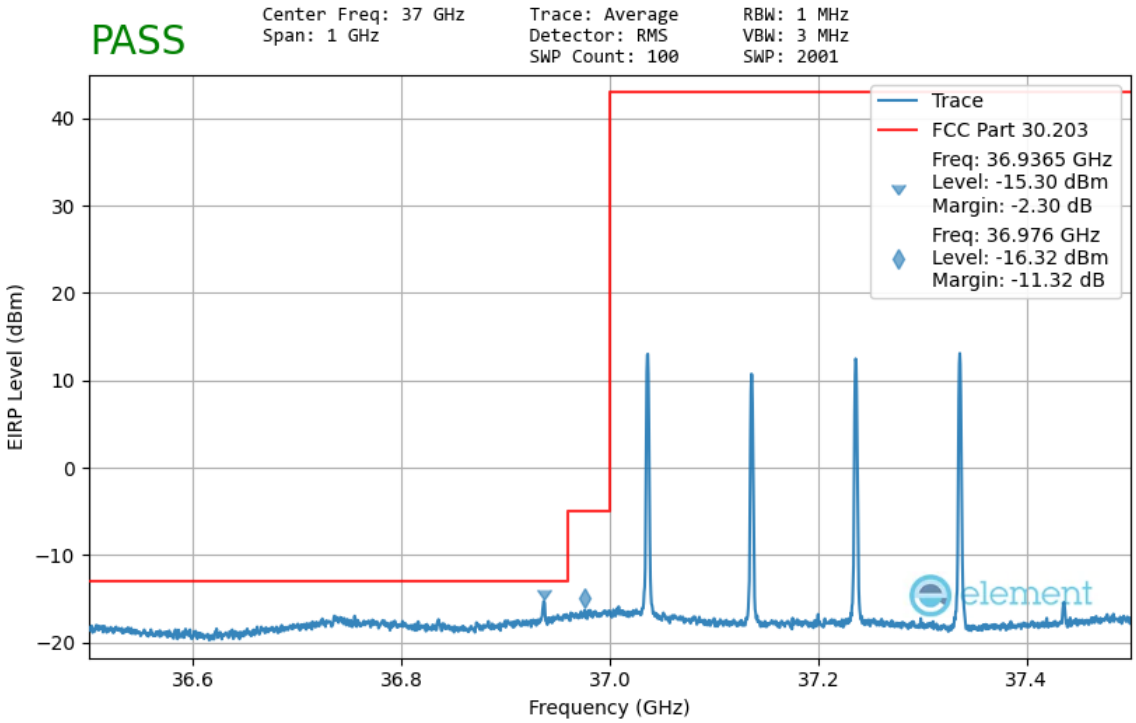
Plot 7-234.Ant 2 Upper Band Edge (100MHz-2CC – DFT-s-OFDM π/2 BPSK Full RB)



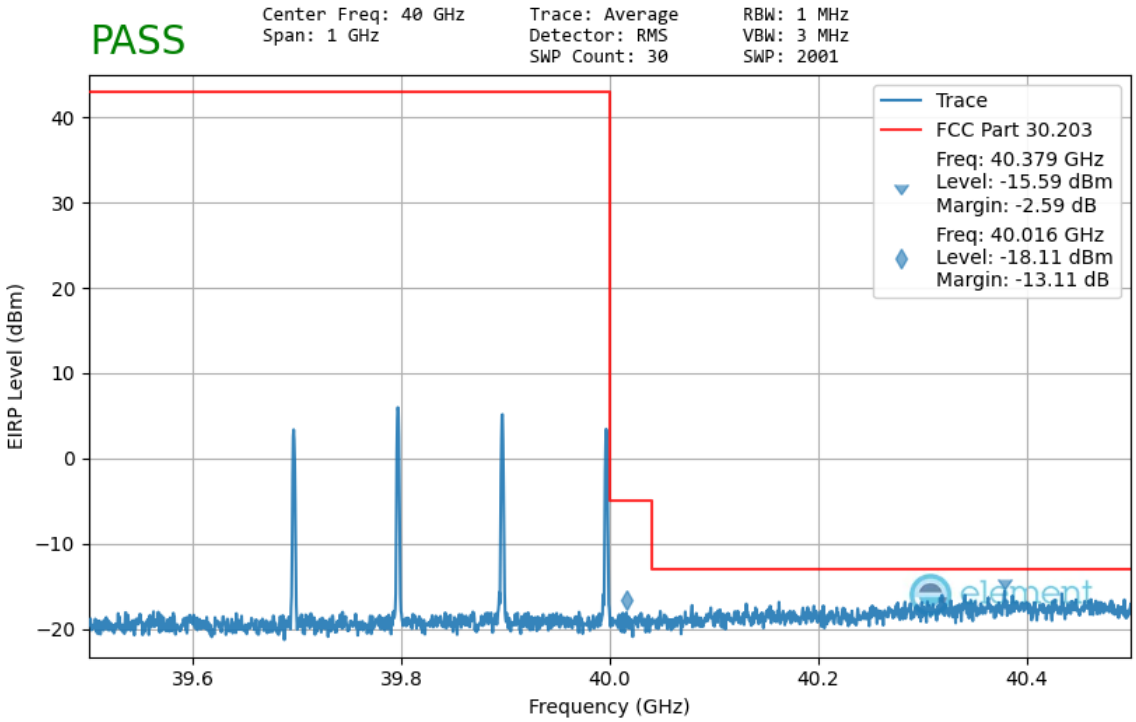
Plot 7-235.Ant 2 Lower Band Edge - (100MHz-3CC – DFT-s -OFDM π/2 BPSK Full RB)



Plot 7-236.Ant 2 Upper Band Edge (100MHz-3CC – DFT-s-OFDM π/2 BPSK 1 RB)



Plot 7-237.Ant 2 Lower Band Edge (100MHz-4CC – DFT-s-OFDM π/2 BPSK 1 RB)



Plot 7-238.Ant 2 Upper Band Edge (100MHz-4CC – DFT-s-OFDM π/2 BPSK 1 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 C63.56-2015. 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 C63.26-2015 Section 5.6
KDB 842590 D01 v01r02 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 that uses a foam plug to maintain the temperature condition inside the chamber. 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 n258)

§2.1055

OPERATING FREQUENCY:	24,349,920,000	Hz
CHANNEL:	2018331	
REFERENCE VOLTAGE:	4.27	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.27	+ 20 (Ref)	24,349,920,149	0	0.0000000
100 %		- 30	24,349,907,609	12,540	0.0000515
100 %		- 20	24,349,917,609	2,540	0.0000104
100 %		- 10	24,349,916,508	3,641	0.0000150
100 %		0	24,349,915,432	4,717	0.0000194
100 %		+ 10	24,349,922,293	-2,144	-0.0000088
100 %		+ 30	24,349,925,168	-5,019	-0.0000206
100 %		+ 40	24,349,925,642	-5,493	-0.0000226
100 %		+ 50	24,349,922,147	-1,998	-0.0000082
BATT. ENDPOINT	3.68	+ 20	24,349,920,454	-305	-0.0000013

Table 7-75. Frequency Stability Data (n258)

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 n258)

§2.1055

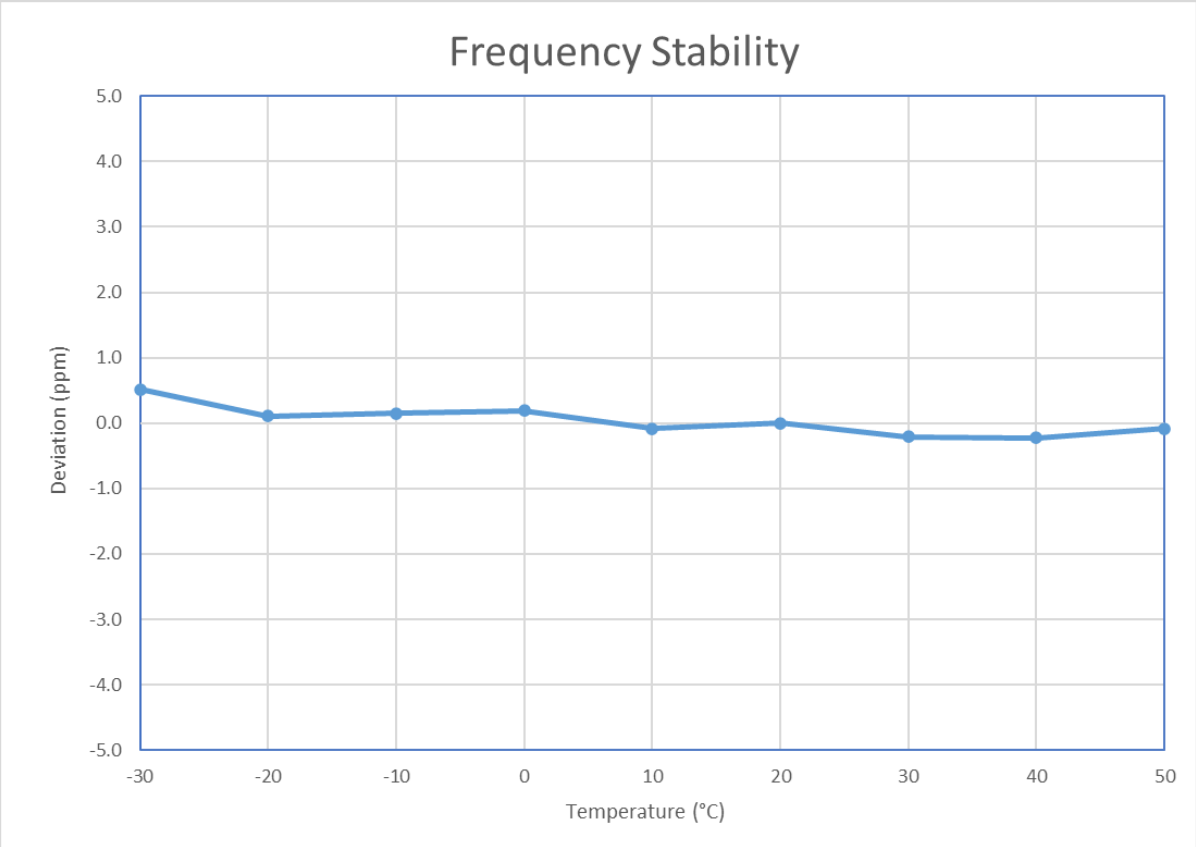


Table 7-76. Frequency Stability Graph (n258)

Frequency Stability Measurements (Band n261)

§2.1055

OPERATING FREQUENCY:	27,924,960,000	Hz
CHANNEL:	2077915	
REFERENCE VOLTAGE:	4.27	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.27	+ 20 (Ref)	27,924,961,214	0	0.0000000
100 %		- 30	27,924,963,325	-2,111	-0.0000076
100 %		- 20	27,924,971,261	-10,047	-0.0000360
100 %		- 10	27,924,967,635	-6,421	-0.0000230
100 %		0	27,924,964,661	-3,447	-0.0000123
100 %		+ 10	27,924,962,058	-844	-0.0000030
100 %		+ 30	27,924,963,355	-2,141	-0.0000077
100 %		+ 40	27,924,961,115	99	0.0000004
100 %		+ 50	27,924,959,772	1,442	0.0000052
BATT. ENDPOINT	3.68	+ 20	27,924,962,066	-852	-0.0000031

Table 7-77. 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

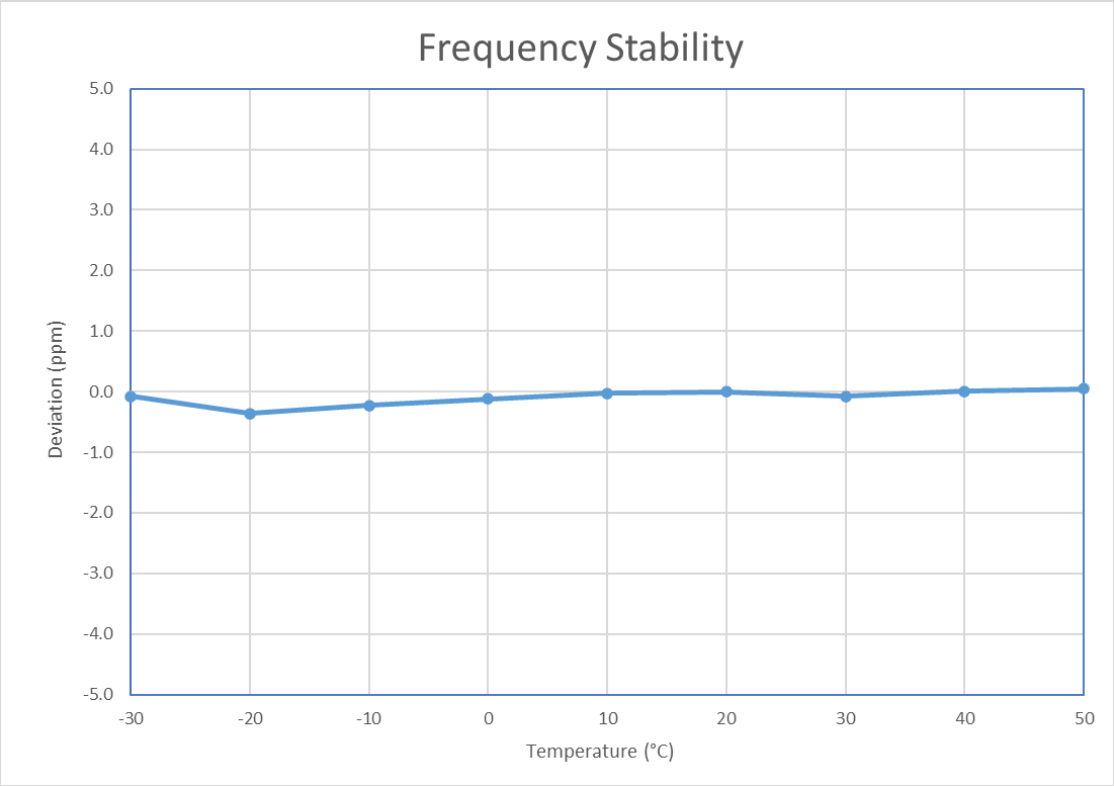


Table 7-78. Frequency Stability Graph (n261)

Frequency Stability Measurements (Band n260)

§2.1055

OPERATING FREQUENCY:	38,499,960,000	Hz
CHANNEL:	2254165	
REFERENCE VOLTAGE:	4.27	VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	4.27	+ 20 (Ref)	38,499,942,002	0	0.0000000
100 %		- 30	38,499,888,002	54,000	0.0001403
100 %		- 20	38,499,919,898	22,104	0.0000574
100 %		- 10	38,499,924,020	17,982	0.0000467
100 %		0	38,499,951,902	-9,900	-0.0000257
100 %		+ 10	38,499,953,461	-11,459	-0.0000298
100 %		+ 30	38,499,954,558	-12,556	-0.0000326
100 %		+ 40	38,499,955,655	-13,653	-0.0000355
100 %		+ 50	38,499,962,486	-20,484	-0.0000532
BATT. ENDPOINT	3.68	+ 20	38,499,962,367	-20,365	-0.0000529

Table 7-79. 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

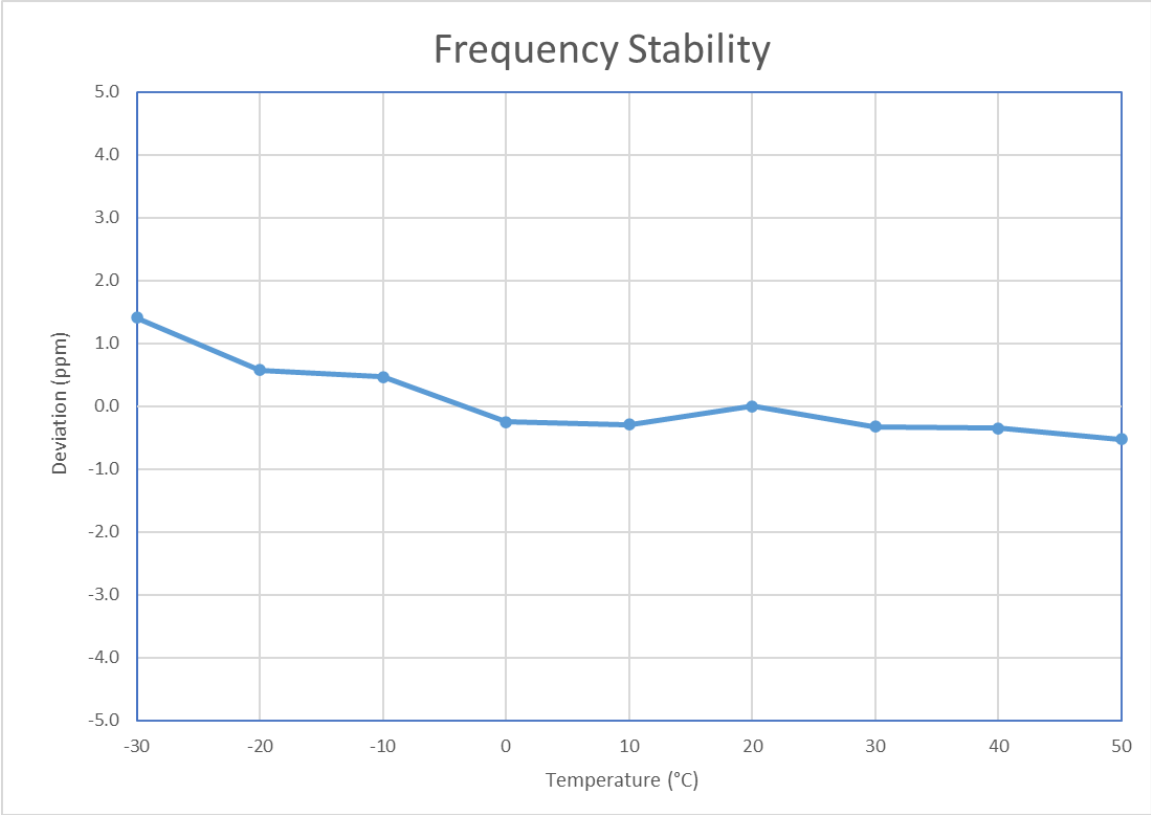


Table 7-80. Frequency Stability Graph (n260)

8.0 CONCLUSION

The data collected relate only to the item(s) tested and show that the **Samsung FCC ID: A3LSMS928U** complies with all the requirements of Part 30 of the FCC rules.

APPENDIX A – 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: Element Materials Technology
7195 Oakland Mills Road
Columbia, MD 21046
United States

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

Packing List No: 230941
Shipping Date: 3/1/2023
Today's Date: 11/08/2023
PO Number: Warranty

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	REPAIR-VDIWR5.1SAX-M-M18 - WR5.1SAX-M-M18 (140-220 GHz) / SN: SAX 682	R220106PCT

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).

Melanie R. Mitchell

Authorized Signature
Virginia Diodes, Inc

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

Certificate of Conformance

To: Element Materials Technology
7185 Oakland Mills Road
Colombia, MD 21046
United States

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

Packing List No:	230051	**Today's Date:**	11/08/2023
Shipping Date:	1/5/2023	**PO Number:**	US37100165PO-1

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	RETEST-VDIWR8.0SAX-M-M9 - WR8.0SAX (90-140 GHz) / SN: SAX 681	220597-03

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).

Melanie R. Mitchell

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Virginia Diodes, Inc
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Certificate of Conformance

To: Dan Pino
Element Materials Technology
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:	224743	**Today's Date:**	11/01/2023
Shipping Date:	11/17/2022	**PO Number:**	US37100165PO-1

Quantity Shipped	Unit	Description	Order-Job Number
1	EA	RETEST-VDIWR19.0SAX-M-M4 - WR19SAX (40-60 GHz) / SN: SAX 679	220597-01
1	EA	RETEST-VDIWR12.0SAX-M-M6 - WR12SAX (60-90 GHz) / SN: SAX 680	220597-02

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).

Melissa R. Mitchell

Authorized Signature
Virginia Diodes, Inc

APPENDIX B – TEST SCOPE ACCREDITATION

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

ELEMENT MATERIALS TECHNOLOGY WASHINGTON DC LLC
(formerly PCTEST)
7185 Oakland Mills Road
Columbia, MD 21046
RJ Ortanez Phone: 410 290 6652

ELECTRICAL

Valid To: May 31, 2024 Certificate Number: 2041.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory at the location listed above, *as well as the three satellite laboratory locations listed below*[1], to perform the following Electromagnetic Compatibility, SAR, HAC, Telecommunications, OTA, Battery, RF, and Conformance and Protocol testing of wireless devices:

Test Technology:	Test Method(s)[2]:
Emissions	
Radiated and Conducted	CFR 47, FCC Part 15B (using ANSI C63.4:2014); CFR 47, FCC Part 18 (using MP-5:1986); CFR 47, FCC Parts 15/C/E (without DFS)/F/G/H (using ANSI C63.10:2013); CFR 47, FCC Part 15E (with DFS) (using FCC KDB 905462 D02 (v02)); CFR 47, FCC Part 15D (using ANSI C63.17:2013); ANSI C63.10:2020; KDB 987594; ETSI TS 134 124 Universal Mobile Telecommunications System (UMTS); (3GPP TS 34.124); (3GPP TS38.124 NR; Electromagnetic Compatibility (EMC) Requirements for Mobile Terminals and Ancillary Equipment); ETSI TS 136 124 LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); (3GPP TS 36.124); ETSI TS 151 010-1 Digital Cellular Telecommunications System (Phase 2+) (GSM); 3GPP TS 51.010-1, Section 12 (Conducted and Radiated Spurious Emissions); EN55011; EN 55032; CNS 13438 (up to 6 GHz); AS/NZS CISPR 11; IEC/CISPR 11; CISPR 32; FCC OET/MP-5; ICES-003; KS C 9811; KS C 9832; VCCI V-3(2016.11); VCCI V-3 (2015.04); VCCI 32-1: VCCI-CISPR 32

Test Technology:	Test Method(s)[2]:
Transmitter/Receiver	RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-246; RSS-247; RSS-248; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-Gen
SAR/RF Exposure	IEEE 1528-2013; RSS-102; EN 50360-2017; EN 62209-1:2016; EN 62209-2:2010/A1:2019; IEC 62209-1 2nd Edition 2016; IEC 62209-2 2010; IEC PAS 63083-2017; EN 50566-2017; IEC 62209-2 AMD 1; Australian Communications Authority Radio Communications (Electromagnetic Radiation – Human Exposure) Standard 2014; ARPANSA RPS S-1(Rev.1):2021; Australia Radiocommunications Equipment (General) Rules 2021; FCC KDB 447498 D01, D02, D03 and D04; FCC KDB 616217 D04; FCC KDB 643646 D01; FCC KDB 865664 D01 and D02; FCC KDB 941225 D01, D05, D05A, D06, and D07; EN 50401:2017; EN 50385:2017; IEC 62311:2008; IEC 62479:2010; EN 62479:2010; EN 50663:2017; EN 62311:2007; EN 62232:2017; IEC 62232:2017; IEEE C95.1-1992; IEEE C95.1-2005; IEEE C95.1: 2019; IEEE C95.3-2002; IEEE C95.3-2021; IEC/IEEE 63195-1:2022; RSS-102 Measurement (SAR, RF Exp., NS, LPD;); SPR-003; SPR-002; SPR-001; SPR-004; SPR-APD; IEC TR 62630:2010; IEEE C95.3.1:2010; IEC TR 63170:2018; AS/NZS 2772.2:2016; EN 62209-3: 2019; IEC 62209-3:2019; ICNIRP (100kHz – 300 GHz):2020; IEC 62311:2019; EN 62311:2020; IEC/IEEE 62209-1528:2020; EN IEC/IEEE 62209-1528; IEC PAS 63184:2021; RRA Public Notification 2018-18, December 7, 2018 KS C 3370-1, KS C 3370-2
Hearing Aid Compatibility	ANSI C63.19:2011; ANSI C63.19:2019; CTIA Test Plan for Hearing Aid Compatibility v.3.1.1 (2017); RSS-HAC; ANSI/TIA-5050-2018
United States Radio	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015)

Test Technology:	Test Method(s)[2]:
European Radio	ETSI EN 302 065-1; ETSI EN 302 065-2; ETSI EN 302 065-3; ETSI EN 302 065-4; ETSI EN 302 291-1; ETSI EN 302 291-2; ETSI EN 302 502; ETSI EN 302 510-1; ETSI EN 302 510-2; ETSI EN 302 537; ETSI EN 301 511; ETSI EN 301 839; ETSI EN 301 893; ETSI EN 301 893; ETSI EN 301 908-1; ETSI EN 301 908-13; ETSI EN 300 220-2; ETSI EN 300 220-3-1; ETSI EN 300 220-3-2; ETSI EN 300 220-4; ETSI EN 300 328; ETSI EN 300 328; ETSI EN 300 330; ETSI EN 300 440; ETSI EN 300 440-2
Taiwan Radio	LP0002; DGT LP0002
Korean Radio	Regulations on Radio Equipment (MSIT Ordinance MSIT No. 86, Jan. 4, 2022); Unlicensed Radio Equipment Established Without Notice (MSIT Public Notification 2022-20, May 10, 2022); Technical Requirements for the Human Protection against Electromagnetic Waves (MSIT Public Notification 2019-4, January 16, 2019); Equipment to be Subject of the Test Procedure for Electromagnetic Field Strength and Specific Absorption Rate (RRA Public Notification (2021-16, October 12, 2021); Technical Requirements for Radio Equipment for Telecommunication Services (RRA Public Notification 2022-15 July 29, 2022); Technical Requirements for Measurement and Test Procedure of Specific Absorption Rate (RRA Public Notification 2018-18, Dec 7, 2018); Technical Requirements for Measurement of Electromagnetic Field Strength (RRA Public Notification 2021-22 Nov 29, 2021); KS X 3123; KS X 3142; KS X 3270; KS X 3271
Australia/New Zealand Radio	AS/NZS 4268:2017
RF, Protocol, and RRM Conformance	
5G NR	3GPP TS 38.508-1; 3GPP TS 38.508-2; 3GPP TS 38.521-1; 3GPP TS 38.521-2; 3GPP TS 38.521-3; 3GPP TS 38.521-4; 3GPP TS 38.522; 3GPP TS 38.523-1; 3GPP TS 38.523-2; 3GPP 38.523-3; 3GPP TS 38.533; 3GPP TS 34.229-5; VZW 5G NR FR2 RFOTA; VZW 5G Protocol Pre-Conformance (TS 38.523-1); VZW 5G NR FR1 Supp RF; VZW 5G NR RF Pre Conformance (TS 38.521-3); VZW 5G NR Radio Resource Management (RRM) Pre-Conformance (TS 38.533); 5G NR FR1 Performance/DEMOD Pre Conformance (TS 38.521-4); VZW 5G NR SA Data Retry; VZW 5G NR SA Voice Services Fallback

Test Technology:	Test Method(s)[2]:
5G NR (cont.)	VZW 5G NR SA Voice, VZW Video and Messaging; VZW 5G NR SA System Selection; VZW 5G WEA TP; VZW 5G Iconography AT&T 10776 Test Plans(5G/4G/3G/2G)
LTE	3GPP TS 36.521-1; 3GPP TS 36.521-3; 3GPP TS 36.523-1; 3GPP 37.571-1; 3GPP 37.571-2; 3GPP TS 34.229-1; ETSI EN 301 908-13 Version 13.1.1 (2019-11); 3GPP Carrier Aggregation; PTCRB NAPRD.03; PTCRB PPMD; PTCRB Cat-M (per RFT132 eMTC); PVG.09 LTE Data Throughput & TR 37.901 Data Throughput Performance; PVG.04 PTCRB Radiated Spurious Emissions; Global Certification Forum (GCF-CC) Certification / LTE Field Test (TS.11); 3GPP Cat-NB & Cat-M; MetroPCS Lab Conformance; AT&T LTE Conformance; AT&T IoT Accelerator Conformance, 19263; VZW Lab Conformance; VZW Supl RF; VZW FR2 Supplementary RF, VZW FR1 Supplementary RF; VZW Supl Signaling Conformance; VZW Supl RRM; VZW LTE LBS Performance; VZW Safe for Network (SFN), VZW Phase 1, VZW Open Development and Field Interoperability Testing (FIT) [3]; VZW Network Extender; VZW PCO; VZW Data Retry; VZW Data Throughput; VZW SMS; VZW AT Commands; VZW CMAS; VZW eMBMS; VZW APN; VZW Cat-M VoLTE; Live Network Extender and Android Test Plan; USCC Lab Conformance; KDDI LTE Device Testing; SoftBank LTE Testing
WCDMA (UTRA)	3GPP TS 34.121-1; 3GPP TS 34.123-1; SoftBank Mobile WCDMA Testing
SVLTE / Multimode	E911 Data Call Processing; Stress Testing; RSSI for MM Devices; LTE LBS Performance; VZW Multimode Supl Signaling; VZW Multimode SMS; VZW Multimode Data Retry
VoLTE	IMS VoIP; Rich Communication Services (RCS); IMS Registration and Retry; ePDG Live Network; E911 for VoLTE; VZW hVoLTE; VZW VoIP and VT Performance; VZW Interband RRM and Protocol
Carrier Aggregation	VZW Carrier Aggregation Supplementary RF; VZW Carrier Aggregation Data Throughout

Test Technology:	Test Method(s)[2]:
UICC	USIM/USAT/CSIM/ISIM Interaction Test Plan (LTE/WCDMA/GSM/CDMA/MM); 3GPP TS 31.121; 3GPP TS 31.124; ETSI TS 102 230; SIM Application Interaction Test Plan; UICC USIM ISIM Electrical; UICC USIM ISIM Protocol (LTE/WCDMA/GSM/CDMA); SWP/HCI ETSI TS 102 694-1; ETSI TS 102 695-1
SunSpec Alliance	SunSpec – CSIP (Common Smart Inverter Profile) Conformance Test Procedures; SunSpec – Advanced Function Inverter Test Lab Specification; SunSpec – UL1741 Supplement SA/Rule 21 Implementation Guide; IEEE 2030.5-2018 Smart Energy Profile Application Protocol
CBRS - OnGo/WInnForum	OnGo Alliance Certification Test Plan; WInnForum Conformance and Performance Test Technical Specification, WINNF-TS-0122

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

ELEMENT MATERIALS TECHNOLOGY WASHINGTON DC LLC
(formerly PCTEST)
7195 Oakland Mills Rd, Suite A
Columbia, MD

Test Technology:	Test Method(s) [2]:
Emissions	
Radiated and Conducted	CFR 47, FCC Part 15B (using ANSI C63.4:2014); CFR 47, FCC Part 18 (using MP-5:1986); CFR 47, FCC Parts 15/C/E (without DFS)/F/G/H (using ANSI C63.10:2013; CFR 47, FCC Part 15E (with DFS) (using FCC KDB 905462 D02 (v02)); CFR 47, FCC Part 15D (using ANSI C63.17:2013); ANSI C63.10:2020; KDB 987594; ETSI TS 134 124 Universal Mobile Telecommunications System (UMTS); (3GPP TS 34.124); ETSI TS 136 124 LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); (3GPP TS 36.124); (3GPP TS38.124 NR; Electromagnetic Compatibility (EMC) Requirements for Mobile Terminals and Ancillary Equipment); ETSI TS 151 010-1 Digital Cellular Telecommunications System (Phase 2+) (GSM); 3GPP TS 51.010-1, Section 12 (Conducted and Radiated Spurious Emissions); EN55011; EN 55032;

Test Technology:	Test Method(s) [2]:
Radiated and Conducted (cont.)	CNS 13438 (up to 6 GHz); AS/NZS CISPR 11; IEC/CISPR 11; CISPR 32; FCC OET/MP-5; ICES-003; KS C 9811; KS C 9832; VCCI V-3(2016.11); VCCI V-3 (2015.04); VCCI 32-1: VCCI-CISPR 32
Transmitter/Receiver	RSS-111; RSS-112; RSS-117; RSS-119; RSS-123; RSS-125; RSS-127; RSS-130; RSS-131; RSS-132; RSS-133; RSS-134; RSS-135; RSS-137; RSS-139; RSS-140; RSS-141; RSS-142; RSS-170; RSS-181; RSS-182; RSS-191; RSS-192; RSS-194; RSS-195; RSS-196; RSS-197; RSS-199; RSS-210; RSS-211; RSS-213; RSS-215; RSS-216; RSS-220; RSS-222; RSS-236; RSS-238; RSS-243; RSS-244; RSS-246; RSS-247; RSS-248; RSS-251; RSS-252; RSS-287; RSS-288; RSS-310; RSS-Gen No IS
Hearing Aid Compatibility	ANSI C63.19:2011; ANSI C63.19:2019; CTIA Test Plan for Hearing Aid Compatibility v.3.1.1 (2017); RSS-HAC; ANSI/TIA-5050-2018
United States Radio	47 CFR FCC Parts 20, 22, 24, 25, 27, 30, 73, 74, 80, 87, 90, 95, 96, 97, 101 (using ANSI/TIA-603-E, TIA-102.CAAA-E, ANSI C63.26:2015)
European Radio	ETSI EN 302 065-1; ETSI EN 302 065-2; ETSI EN 302 065-3; ETSI EN 302 065-4; ETSI EN 302 291-1; ETSI EN 302 291-2; ETSI EN 302 502; ETSI EN 302 510-1; ETSI EN 302 510-2; ETSI EN 302 537; ETSI EN 301 511; ETSI EN 301 839; ETSI EN 301 893; ETSI EN 301 893; ETSI EN 301 908-1; ETSI EN 301 908-13; ETSI EN 300 220-1; ETSI EN 300 220-2; ETSI EN 300 328; ETSI EN 300 328; ETSI EN 300 330; ETSI EN 300 440; ETSI EN 300 440-2
Taiwan Radio	LP0002 (2020); DGT LP0002
Korean Radio	Regulations on Radio Equipment (MSIT Ordinance MSIT No. 86, Jan. 4, 2022); Unlicensed Radio Equipment Established Without Notice (MSIT Public Notification 2022-20, May 10, 2022); Technical Requirements for the Human Protection against Electromagnetic Waves (MSIT Public Notification 2019-4, January 16, 2019); Equipment to be Subject of the Test Procedure for Electromagnetic Field Strength and Specific Absorption Rate (RRA Public Notification (2021-16, October 12, 2021); Technical Requirements for Radio Equipment for Telecommunication Services (RRA Public Notification 2022-13 Jun 28, 2022);