HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

8/10/2023

Viavi Solutions, LLC
Todd Salisbury
10200 W. York Street
Wichita, KS 67215
USA

Dear Todd Salisbury,

Enclosed is the EMC Wireless test report for compliance testing of the CX100 as tested to the requirements of FCC Part 15.247 and RSS-247 Issue 2 for Intentional Radiators (limited to radiated spurious emissions and restricted band edge.)

Thank you for using the services of Eurofins MET Labs. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,
EUROFINS MET LABS

Nancy LaBrecque
Documentation Department

Reference: WIRA121793 - Spurious - BT

Bluetooth
Test Report

for the

CX100

Tested under
FCC Part 15.247 and RSS-247 Issue 2
For Intentional Radiators
(Limited to Radiated Spurious Emissions and Restricted Band Edge)

Bryan Taylor, Wireless Team Lead
Electromagnetic Compatibility Lab

Nancy LaBrecque
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules Part 15.247 under normal use and maintenance.

Matthew Hinojosa
EMC Manager, Austin Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	8/10/2023	Initial Issue.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the CX100, with the requirements of FCC Part 15.247 and RSS-247 Issue 2. Viavi Solutions, LLC should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the CX100, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 15.247 and RSS-247 Issue 2, in accordance with Viavi Solutions, LLC purchase order number 2751009918. All tests were conducted using measurement procedures ANSI C63.4-2014 and ANSI C63.10-2013.

Testing was specifically limited to radiated spurious emissions and restricted band edge emissions in order to support a permissive change application for the CX100 device.

FCC Reference 47 CFR Part 15.247:2005	IC Reference RSS-247 Issue 2: 2017; RSS-GEN Issue 5: 2018	Description	Compliance
Title 47 of the CFR, Part 15 §15.203	---	Antenna Requirement	Reference original filing[1]
Title 47 of the CFR, Part 15 §15.207(a)	RSS-GEN(8.8)	Conducted Emission Limits	
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-247 (5.1)	20dB Occupied Bandwidth	
Title 47 of the CFR, Part 15 §15.247(a)(2)	RSS-247 (5.2)	6dB Occupied Bandwidth	
---	RSS-GEN(6.7)	99% Occupied Bandwidth	
Title 47 of the CFR, Part 15 §15.247(b)	RSS-247(5.4)	Peak Power Output	
Title 47 of the CFR, Part 15; §15.247(e)	RSS-247(5.2)	Peak Power Spectral Density	
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-247 (5.1)	Number of RF Channels	
Title 47 of the CFR, Part 15 §15.247(a)(1)	RSS-247 (5.1)	RF Channel Separation	
Title 47 of the CFR, Part 15 §15.247(d)	RSS-247(5.5)	RF Conducted Spurious Emissions Requirements	
Title 47 of the CFR, Part 15 §15.247(d); §15.209; §15.205	RSS-GEN (6.13), (8.9), & (8.10)	Radiated Spurious Emissions Requirements	Compliant

Table 1. Executive Summary

[1] These tests were not performed as part of the permissive change application since no changes were performed to the actual transmitter circuitry onboard the CX100. The radio, antenna, and mechanical design of transmitter portions of the product are unchanged from the originally certified device.

II. Equipment Configuration

A. Overview

Eurofins MET Labs was contracted by Viavi Solutions, LLC to perform testing on the CX100, under Viavi Solutions, LLC's purchase order number 2751009918.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the CX100.

The results obtained relate only to the item(s) tested.

Model(s) Tested:	CX100	
Model(s) Covered:	CX100	
EUT Specifications:	Primary Power: 120VAC	
	FCCID:	WUW-22100382
	IC:	9613A-22100382
	Integrated Transmitter Module	Laird TiWi5 Bluetooth / WiFi Module
	Type of Modulations:	Bluetooth Low Energy (BLE), GFSK, Pi/4DQPSK, 8DPSK
	Equipment Code:	DTS (BLE) FHSS (Bluetooth)
	EUT Frequency Ranges:	2402 - 2480 MHz
	Antenna Gain (declared by Viavi Solutions, LLC)	-0.6dBi
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 22.7º C	
	Relative Humidity: 55.3%	
	Barometric Pressure: 97.8kPa	
Evaluated by:	Bryan Taylor and Sergio Gutierrez	
Test Date(s):	8/7/2023 through 8/9/2023	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
RSS-247, Issue 2, February 2017	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
RSS-GEN, Issue 5, March 2019	General Requirements and Information for the Certification of Radio Apparatus
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

All testing was performed at Eurofins MET Labs, 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.97 dB	2	95%
RF Power Radiated Emissions	±2.95 dB	2	95%

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

The Viavi Solutions, LLC CX100 , is a hand-held communications test set that supports bench and field radio testing. The CX100 provides the capabilities needed to test a variety of radios, as well as commercial radio applications. The CX100 is capable of performing high power measurements, as well as fault finding for antennas, power amplifiers and interconnects. The CX100 ComXpert is powered by an internal, rechargeable battery that provides up to 3 hours of continuous operation. The CX100 is equipped with a DC input connector that supports battery charging and use of an AC power adapter for connection to an AC power supply.

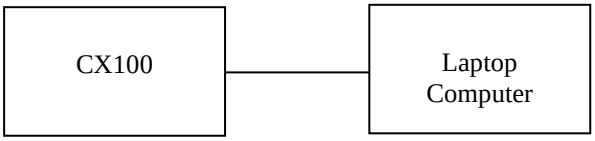


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. The laptop computer was used to send test commands to force the transmitters to operate in the appropriate test mode.

G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number	Customer Supplied Calibration Data
1	Laptop Computer	Lenovo	ThinkPad W520	None

Table 5. Support Equipment

H. Mode of Operation

The support laptop provided a direct means of controlling transmitter parameters. Unless otherwise stated or shown, all tests were performed at worst-case modulation and data rates on the following channels.

Transmit Band	Operating Mode	Frequencies Tested
2400 – 2483.5MHz	Bluetooth Low Energy	2402 / 2440 / 2480
	GFSK	2402 / 2440 / 2480
	Pi/4DQPSK	2402 / 2440 / 2480
	8DPSK	2402 / 2440 / 2480

Table 6. Test Channels Utilized

I. Method of Monitoring EUT Operation

A spectrum analyzer was used to confirm proper transmitter operation.

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Viavi Solutions, LLC upon completion of testing.

III. Radiated Spurious Emissions and Restricted Band Edge

§ 15.247(d) Radiated Spurious Emissions Requirements and Band Edge

Test Requirements:

§15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110----------	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505----------	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905----------	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128----------	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775----------	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775----------	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218----------	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825----------	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225----------	123–138	2200–2300	14.47–14.5
8.291–8.294----------	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366----------	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675----------	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475----------	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293----------	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025----------	240–285	3345.8–3358 36.	43–36.5
12.57675–12.57725----------	322–335.4	3600–4400	([2])

Table 7. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.

[2] Above 38.6

Test Requirement(s): **§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 8.

Frequency (MHz)	§ 15.209(a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 8. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedure: ANSI C63.10: 2013 was used as reference to perform the radiated spurious emission tests. A radiated scan was performed with the antenna of proper impedance installed. The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes if multiple mounting orientations are supported. Measurements were performed with the receiving antenna polarized vertically as well as horizontally. For measurements below 30MHz, a receiving loop antenna was used. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Radiated measurements below 30MHz were performed in a semi-anechoic chamber that has been correlated to an open area site.

Measurements in the spurious domain were performed with a band-reject filter in line with the preamplifier in order to attenuate the fundamental emission and allow for the accurate measurement of the low-level spurious signals. Measurements at the restricted band edge were performed without a filter in place and without an in-line preamplifier in order to show that the fundamental emissions did not infringe upon the restricted bands immediately adjacent to the transmit band.

Test Software Used: ELEKTRA Version 4.61 was used to perform this test.

Test Results: The EUT was **compliant** with the radiated spurious emissions limits from FCC Part 15 Subpart C (15.247) and RSS-247 Issue 2.

Test Engineer(s): Bryan Taylor, Sergio Gutierrez

Test Date(s): 8/7/2023 - 8/9/2023

Worst Case Tabular Spurious Emission Results:

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.046	65.45	114.30	48.85	12.03	H	39.8	1	0.200	Pass
0.047	66.51	114.21	47.70	11.97	V	10.8	1	0.200	Pass
0.093	58.70	108.20	49.50	11.58	V	49.2	1	0.200	Pass
0.249	58.71	99.68	40.97	11.43	V	58.4	1	9.000	Pass
1.154	41.95	66.36	24.40	11.74	H	345.1	1	9.000	Pass

Table 9. Worst Case Spurious Emissions, 9kHz – 30MHz, BLE[2]

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
116.370	19.88	43.52	23.64	-7.60	H	60.8	2.581	120.000	Pass
135.630	14.37	43.52	29.15	-8.16	V	168.2	1.236	120.000	Pass
271.530	22.17	46.02	23.85	-6.22	H	134.8	2.5	120.000	Pass
271.530	25.05	46.02	20.97	-6.22	V	12.2	3.192	120.000	Pass

Table 10. Worst Case Spurious Emissions, 30MHz – 1GHz, BLE[2]

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	43.92	74.00	30.08	39.55	54.00	14.45	-1.25	H	348.8	2.316	Pass
4,800.000	45.86	74.00	28.14	41.65	54.00	12.35	-4.64	H	24.7	1.261	Pass
4,800.000	44.14	74.00	29.86	38.93	54.00	15.07	-4.64	V	18.3	1.5	Pass
4,999.500	50.84	74.00	23.16	46.35	54.00	7.65	-4.69	H	350.5	2.118	Pass
4,999.500	48.03	74.00	25.97	43.05	54.00	10.95	-4.69	V	51.8	2.179	Pass

Table 11. Worst Case Spurious Emissions, 1GHz – 40GHz, BLE (Low Channel)

[2] These results represent the worst-case emissions across low, mid, and high transmit channels.

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	43.67	74.00	30.33	39.13	54.00	14.87	-1.25	H	347.3	2.361	Pass
4,800.000	45.57	74.00	28.43	41.73	54.00	12.27	-4.64	H	0.2	1.499	Pass
4,800.000	45.91	74.00	28.09	41.79	54.00	12.21	-4.64	V	-0.1	1.503	Pass
4,999.500	48.85	74.00	25.15	44.26	54.00	9.74	-4.69	H	38.6	1	Pass
4,999.500	49.45	74.00	24.55	44.69	54.00	9.31	-4.69	V	291.2	3.465	Pass
20,382.000	51.78	74.00	22.22	37.74	54.00	16.26	12.11	H	193.5	1	Pass
22,206.000	50.36	74.00	23.64	37.36	54.00	16.64	13.33	V	237	3.792	Pass
22,348.000	49.93	74.00	24.07	36.99	54.00	17.01	13.51	H	9.9	3.499	Pass
23,702.000	51.16	74.00	22.84	38.06	54.00	15.94	14.51	V	105.5	1.163	Pass

Table 12. Worst Case Spurious Emissions, 1GHz – 40GHz, BLE (Middle Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	43.40	74.00	30.60	38.89	54.00	15.11	-1.25	H	347.8	2.299	Pass
4,800.000	45.58	74.00	28.42	41.69	54.00	12.31	-4.64	H	0.3	1.501	Pass
4,800.000	43.86	74.00	30.14	38.12	54.00	15.88	-4.64	V	15.8	1.276	Pass
4,999.500	49.11	74.00	24.89	44.24	54.00	9.76	-4.69	H	38.4	1.063	Pass
4,999.500	47.64	74.00	26.36	42.84	54.00	11.16	-4.69	V	29.6	2.996	Pass

Table 13. Worst Case Spurious Emissions, 1GHz – 40GHz, BLE (High Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.046	66.37	114.28	47.91	12.01	H	12.5	1	0.200	Pass
0.047	66.57	114.15	47.58	11.93	V	64.1	1	0.200	Pass
0.093	59.12	108.24	49.11	11.60	H	93.2	1	0.200	Pass
0.095	55.92	108.08	52.16	11.53	V	59.4	1	0.200	Pass
0.474	54.14	94.09	39.95	11.28	H	34.7	1	9.000	Pass
0.740	50.00	70.22	20.22	11.46	V	33.5	1	9.000	Pass

Table 14. Worst Case Spurious Emissions, 9kHz – 30MHz, GFSK[3]

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
116.370	18.98	43.52	24.54	-7.60	H	57.2	3.928	120.000	Pass
135.630	8.57	43.52	34.95	-8.16	H	76.8	3.611	120.000	Pass
135.630	13.71	43.52	29.81	-8.16	V	151	1.269	120.000	Pass
271.530	25.04	46.02	20.98	-6.22	V	20.7	3.038	120.000	Pass

Table 15. Worst Case Spurious Emissions, 30MHz – 1GHz, GFSK[2]

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.62	74.00	29.38	39.70	54.00	14.30	-1.25	H	344.1	1.976	Pass
4,800.000	46.33	74.00	27.67	42.49	54.00	11.51	-4.64	H	14.9	1.752	Pass
4,800.000	45.91	74.00	28.09	42.07	54.00	11.93	-4.64	V	355	1.5	Pass
4,999.500	49.38	74.00	24.62	43.82	54.00	10.18	-4.69	H	340.2	2.434	Pass
4,999.500	45.65	74.00	28.35	39.59	54.00	14.41	-4.69	V	262.2	2.616	Pass

Table 16. Worst Case Spurious Emissions, 1GHz – 40GHz, GFSK (Low Channel)

[3] These results represent the worst-case emissions across low, mid, and high transmit channels.

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.13	74.00	29.87	39.74	54.00	14.26	-1.25	H	344.1	1.787	Pass
4,800.000	45.36	74.00	28.64	41.16	54.00	12.84	-4.64	H	21.5	1.217	Pass
4,800.000	43.46	74.00	30.54	37.69	54.00	16.31	-4.64	V	12.5	1.5	Pass
4,999.500	50.08	74.00	23.92	45.33	54.00	8.67	-4.69	H	339.7	2.396	Pass
4,999.500	47.98	74.00	26.02	43.09	54.00	10.91	-4.69	V	23.1	3.033	Pass
19,840.500	50.71	74.00	23.29	37.82	54.00	16.18	12.34	H	58	3.5	Pass
20,702.500	50.40	74.00	23.60	37.61	54.00	16.39	12.61	V	26.4	1.297	Pass
22,088.000	51.38	74.00	22.62	37.80	54.00	16.20	13.26	H	212	2.127	Pass
31,462.500	54.36	74.00	19.64	41.72	54.00	12.28	16.69	V	286.1	1.296	Pass

Table 17. Worst Case Spurious Emissions, 1GHz – 40GHz, GFSK (Middle Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.54	74.00	29.46	39.89	54.00	14.11	-1.25	H	344	1.929	Pass
4,800.000	42.72	74.00	31.28	36.42	54.00	17.58	-4.64	H	-0.1	2.412	Pass
4,800.000	45.65	74.00	28.35	41.33	54.00	12.67	-4.64	V	353.9	1.5	Pass
4,999.500	49.79	74.00	24.21	45.33	54.00	8.67	-4.69	H	341.7	2.321	Pass
4,999.500	48.25	74.00	25.75	43.48	54.00	10.52	-4.69	V	262.5	2.577	Pass

Table 18. Worst Case Spurious Emissions, 1GHz – 40GHz, GFSK (High Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.047	65.70	114.17	48.47	11.94	V	102.9	1	0.200	Pass
0.094	52.58	108.15	55.57	11.56	H	255.1	1	0.200	Pass
0.094	56.06	108.15	52.09	11.56	V	60.6	1	0.200	Pass
0.186	62.43	102.21	39.77	11.28	V	61.7	1	9.000	Pass
0.398	55.49	95.62	40.13	11.19	H	29.8	1	9.000	Pass

Table 19. Worst Case Spurious Emissions, 9kHz – 30MHz, Pi/4DQPSK [4]

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
116.370	19.71	43.52	23.81	-7.60	H	60.7	3.5	120.000	Pass
135.630	13.85	43.52	29.67	-8.16	V	150.8	1.077	120.000	Pass
271.530	23.44	46.02	22.58	-6.22	H	44.9	2.5	120.000	Pass
271.530	25.46	46.02	20.56	-6.22	V	32.3	3.357	120.000	Pass

Table 20. Worst Case Spurious Emissions, 30MHz – 1GHz, Pi/4DQPSK[2]

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.29	74.00	29.71	39.77	54.00	14.23	-1.25	H	340	1.597	Pass
4,800.000	45.01	74.00	28.99	41.07	54.00	12.93	-4.64	H	355.1	1.5	Pass
4,800.000	44.94	74.00	29.06	40.90	54.00	13.10	-4.64	V	353.7	1.431	Pass
4,999.500	49.84	74.00	24.16	45.24	54.00	8.76	-4.69	H	343.3	2.417	Pass
4,999.500	47.33	74.00	26.67	41.83	54.00	12.17	-4.69	V	285	3.003	Pass

Table 21. Worst Case Spurious Emissions, 1GHz – 40GHz, Pi/4DQPSK (Low Channel)

[4] These results represent the worst-case emissions across low, mid, and high transmit channels.

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	43.22	74.00	30.78	38.45	54.00	15.55	-1.25	H	345.7	1.875	Pass
4,800.000	45.34	74.00	28.66	41.03	54.00	12.97	-4.64	H	355.6	1.444	Pass
4,800.000	43.29	74.00	30.71	37.37	54.00	16.63	-4.64	V	12.8	1.5	Pass
4,999.500	50.10	74.00	23.90	45.47	54.00	8.53	-4.69	H	338.5	2.173	Pass
4,999.500	47.07	74.00	26.93	41.48	54.00	12.52	-4.69	V	17.8	1.962	Pass
20,394.000	50.60	74.00	23.40	37.70	54.00	16.30	12.16	H	82.5	2.13	Pass
20,740.500	50.52	74.00	23.48	37.59	54.00	16.41	12.59	V	289.7	1.726	Pass
23,699.000	51.01	74.00	22.99	37.83	54.00	16.17	14.51	H	43.3	1.795	Pass
31,522.000	55.41	74.00	18.59	41.85	54.00	12.15	16.79	V	151.2	3.879	Pass

Table 22. Worst Case Spurious Emissions, 1GHz – 40GHz, Pi/4DQPSK (Middle Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.51	74.00	29.49	39.77	54.00	14.23	-1.25	H	338.8	1.574	Pass
1,500.000	38.48	74.00	35.52	30.54	54.00	23.46	-1.25	V	0	2.5	Pass
4,800.000	44.99	74.00	29.01	40.77	54.00	13.23	-4.64	H	21.2	1.227	Pass
4,800.000	42.67	74.00	31.33	36.95	54.00	17.05	-4.64	V	12.5	1.5	Pass
4,999.500	49.87	74.00	24.13	45.14	54.00	8.86	-4.69	H	338.2	2.42	Pass
4,999.500	46.27	74.00	27.73	41.02	54.00	12.98	-4.69	V	277.1	1.168	Pass

Table 23. Worst Case Spurious Emissions, 1GHz – 40GHz, Pi/4DQPSK (High Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.046	67.24	114.26	47.02	12.00	H	20.8	1	0.200	Pass
0.048	66.95	114.06	47.11	11.88	V	46.4	1	0.200	Pass
0.093	54.17	108.23	54.06	11.59	V	70.4	1	0.200	Pass
0.960	48.23	67.95	19.72	11.70	V	36.1	1	9.000	Pass

Table 24. Worst Case Spurious Emissions, 9kHz – 30MHz, 8DPSK[5]

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
109.350	18.44	43.52	25.08	-7.92	V	154.4	1	120.000	Pass
116.370	19.27	43.52	24.25	-7.60	H	91	3.5	120.000	Pass
135.900	10.86	43.52	32.66	-8.19	H	135	3.841	120.000	Pass
271.530	25.18	46.02	20.84	-6.22	V	29	3.501	120.000	Pass

Table 25. Worst Case Spurious Emissions, 30MHz – 1GHz, 8DPSK[2]

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.34	74.00	29.66	39.76	54.00	14.24	-1.25	H	339	1.6	Pass
4,800.000	45.17	74.00	28.83	41.00	54.00	13.00	-4.64	H	353.9	1.5	Pass
4,999.500	49.51	74.00	24.49	44.90	54.00	9.10	-4.69	H	339	2.161	Pass
4,999.500	46.85	74.00	27.15	41.51	54.00	12.49	-4.69	V	15.8	2.088	Pass

Table 26. Worst Case Spurious Emissions, 1GHz – 40GHz, 8DPSK (Low Channel)

[5] These results represent the worst-case emissions across low, mid, and high transmit channels.

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	44.39	74.00	29.61	39.81	54.00	14.19	-1.25	H	340.9	1.599	Pass
4,800.000	44.99	74.00	29.01	40.93	54.00	13.07	-4.64	H	354.2	1.265	Pass
4,800.000	44.75	74.00	29.25	40.50	54.00	13.50	-4.64	V	354.8	1.227	Pass
4,999.500	50.18	74.00	23.82	45.73	54.00	8.27	-4.69	H	339	2.341	Pass
4,999.500	47.78	74.00	26.22	42.96	54.00	11.04	-4.69	V	284.8	3.033	Pass
20,692.000	50.24	74.00	23.76	37.36	54.00	16.64	12.59	H	0	2.27	Pass
20,722.000	51.05	74.00	22.95	37.39	54.00	16.61	12.60	V	167.8	2.499	Pass
23,821.000	51.74	74.00	22.26	38.12	54.00	15.88	14.51	H	0	1.161	Pass
31,538.000	54.78	74.00	19.22	41.77	54.00	12.23	16.80	V	85.9	1.665	Pass

Table 27. Worst Case Spurious Emissions, 1GHz – 40GHz, 8DPSK (Middle Channel)

Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Result
1,500.000	39.41	74.00	34.59	30.54	54.00	23.46	-1.25	V	0	2.003	Pass
4,800.000	44.96	74.00	29.04	40.74	54.00	13.26	-4.64	H	353.9	1.378	Pass
4,800.000	42.35	74.00	31.65	36.48	54.00	17.52	-4.64	V	13.4	1.289	Pass
4,999.500	50.25	74.00	23.75	45.67	54.00	8.33	-4.69	H	340.1	2.202	Pass
4,999.500	46.57	74.00	27.43	40.94	54.00	13.06	-4.69	V	278.2	1.228	Pass

Table 28. Worst Case Spurious Emissions, 1GHz – 40GHz, 8DPSK (High Channel)

Middle Channel Spurious Emission Plots[6]

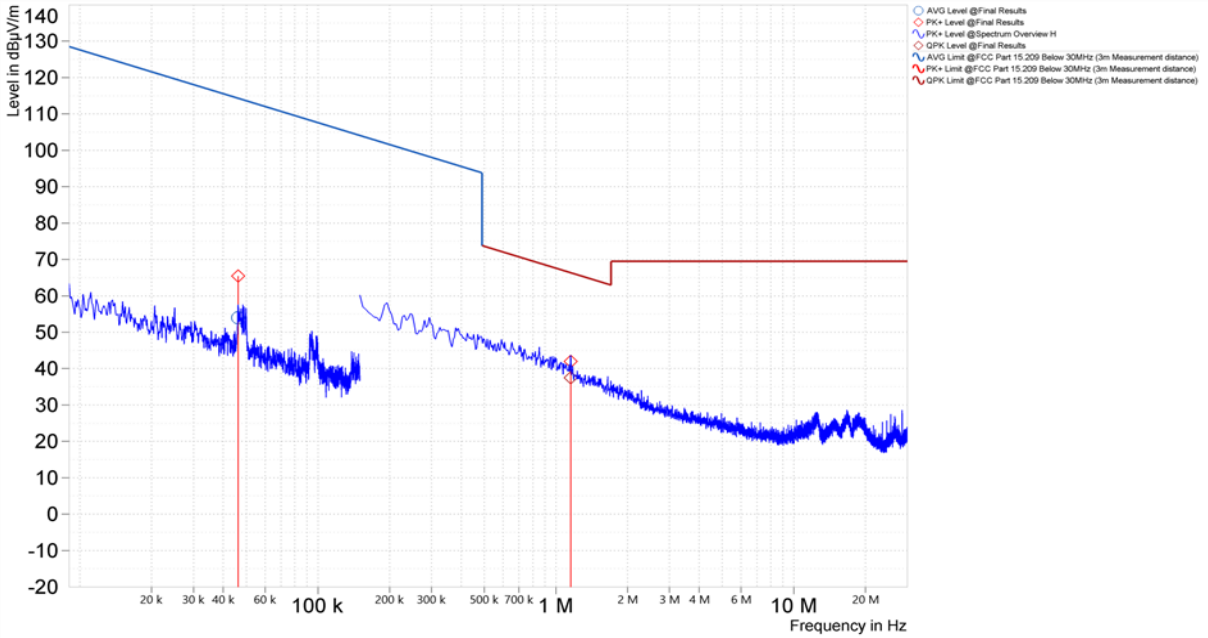


Figure 2. Worst Case Spurious Emissions, 9kHz – 30MHz, BLE, Coplanar Loop (Middle Channel)

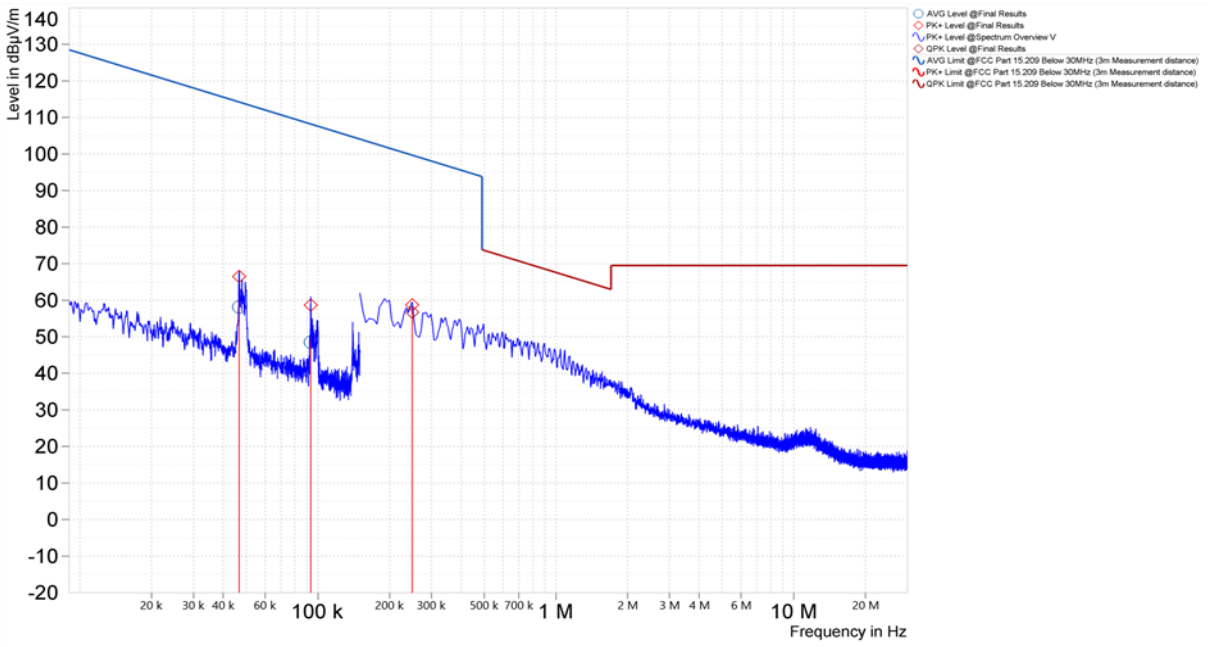


Figure 3. Worst Case Spurious Emissions, 9kHz – 30MHz, BLE, Coaxial Loop (Middle Channel)

[6] Due to the similarity of the low, mid, and high channel plots, the low and high channel plots have been omitted from this report in an effort to reduce the overall file size. The worst-case tabular data have been presented for low and high channels.

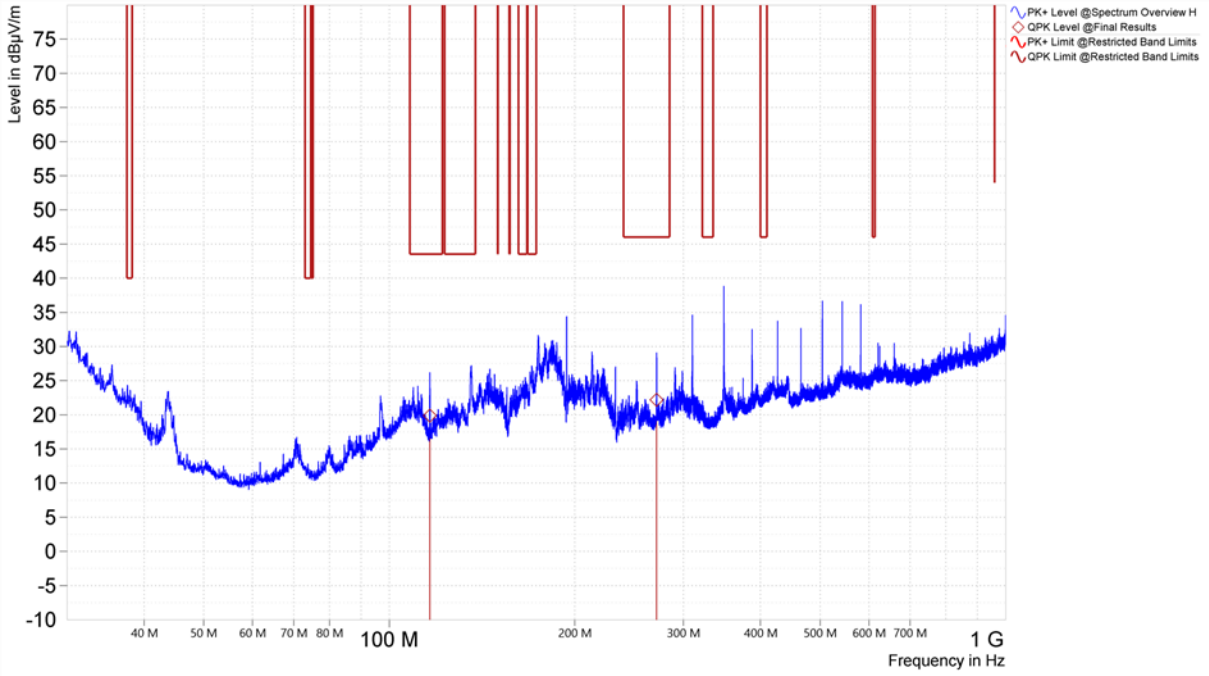


Figure 4. Worst Case Spurious Emissions, 30MHz – 1GHz, BLE, Horizontal Polarity (Middle Channel)

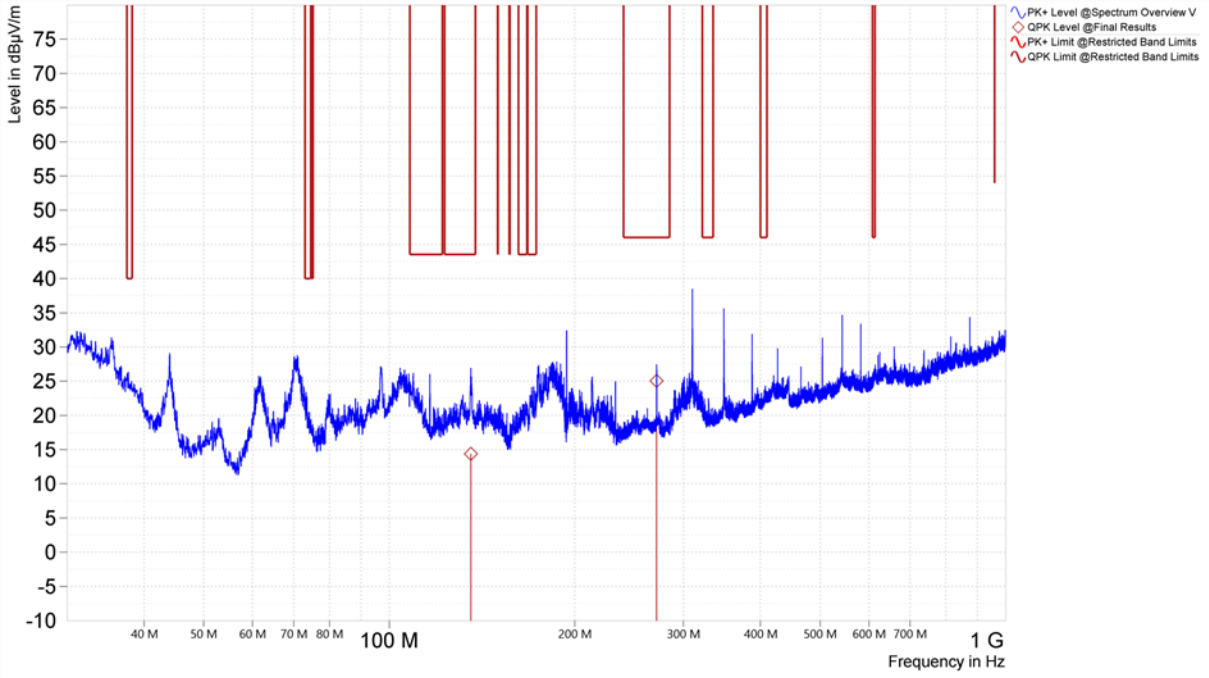


Figure 5. Worst Case Spurious Emissions, 30MHz – 1GHz, BLE, Vertical Polarity (Middle Channel)

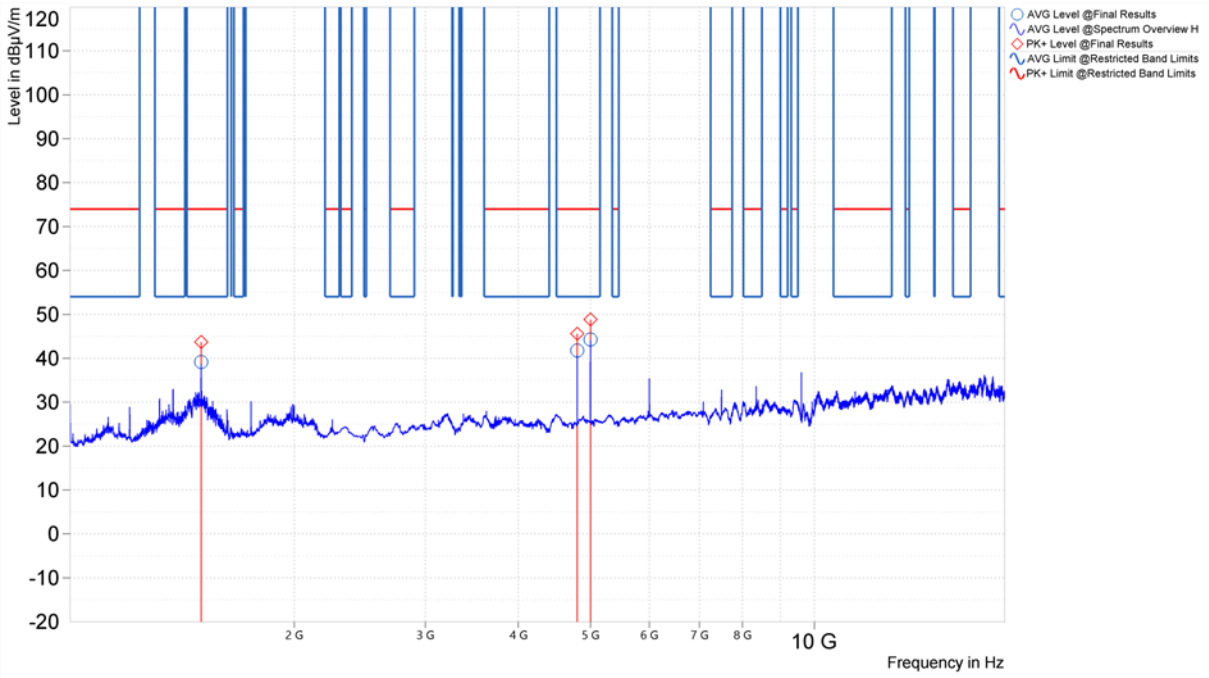


Figure 6. Worst Case Spurious Emissions, 1GHz – 18GHz, BLE, Horizontal Polarity (Middle Channel)

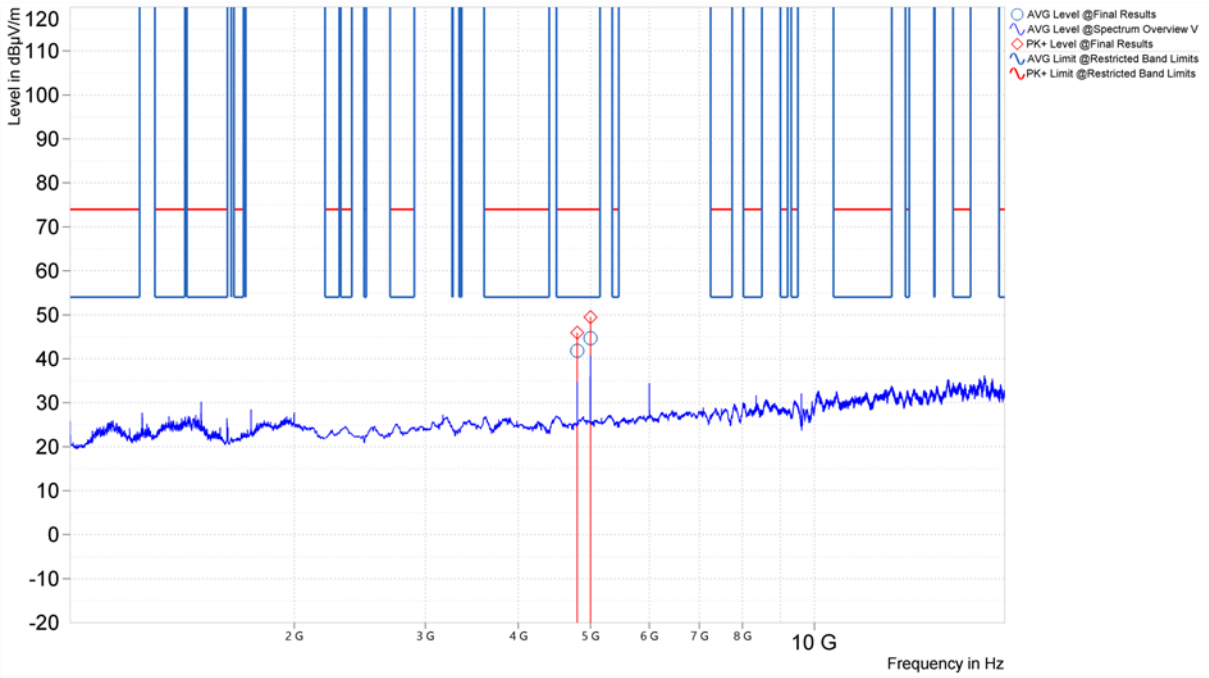


Figure 7. Worst Case Spurious Emissions, 1GHz – 18GHz, BLE, Vertical Polarity (Middle Channel)

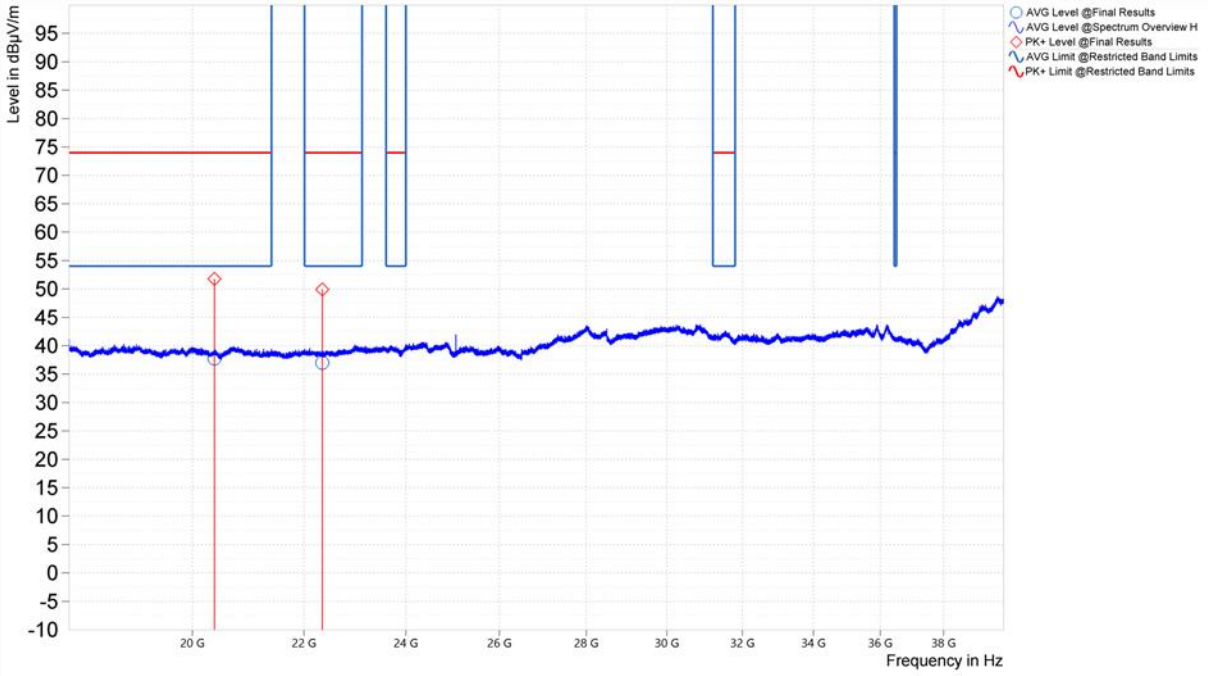


Figure 8. Worst Case Spurious Emissions, 18GHz – 40GHz, BLE, Horizontal Polarity (Middle Channel)

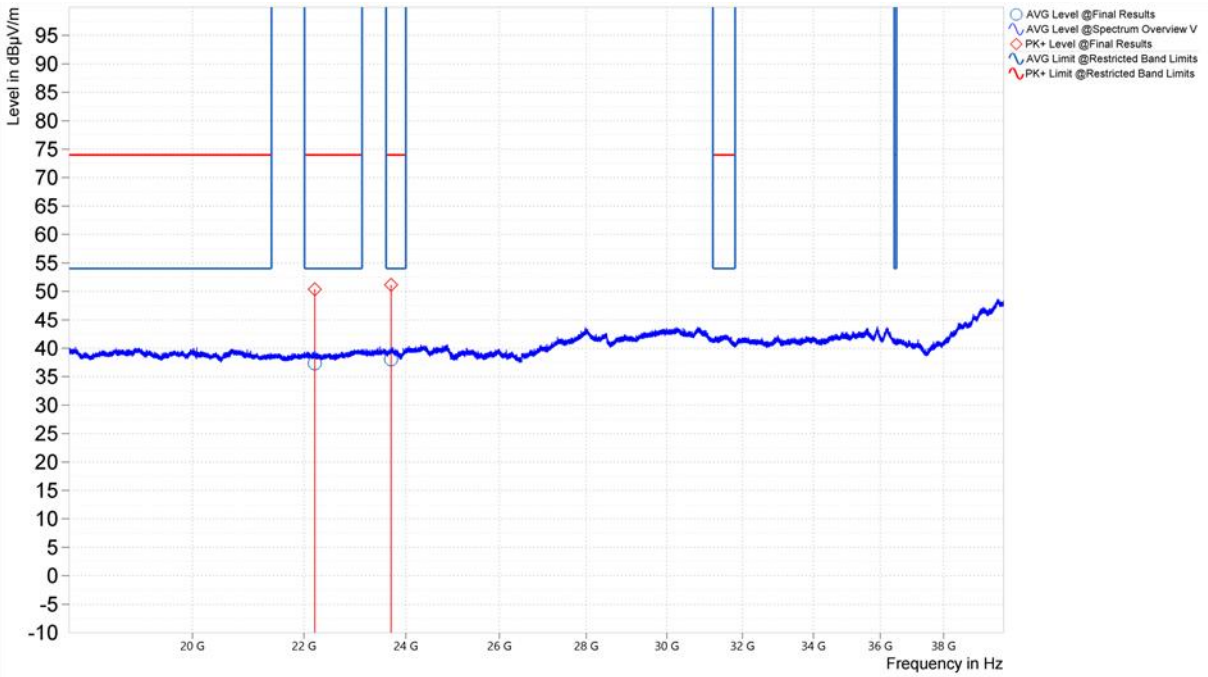


Figure 9. Worst Case Spurious Emissions, 18GHz – 40GHz, BLE, Vertical Polarity (Middle Channel)

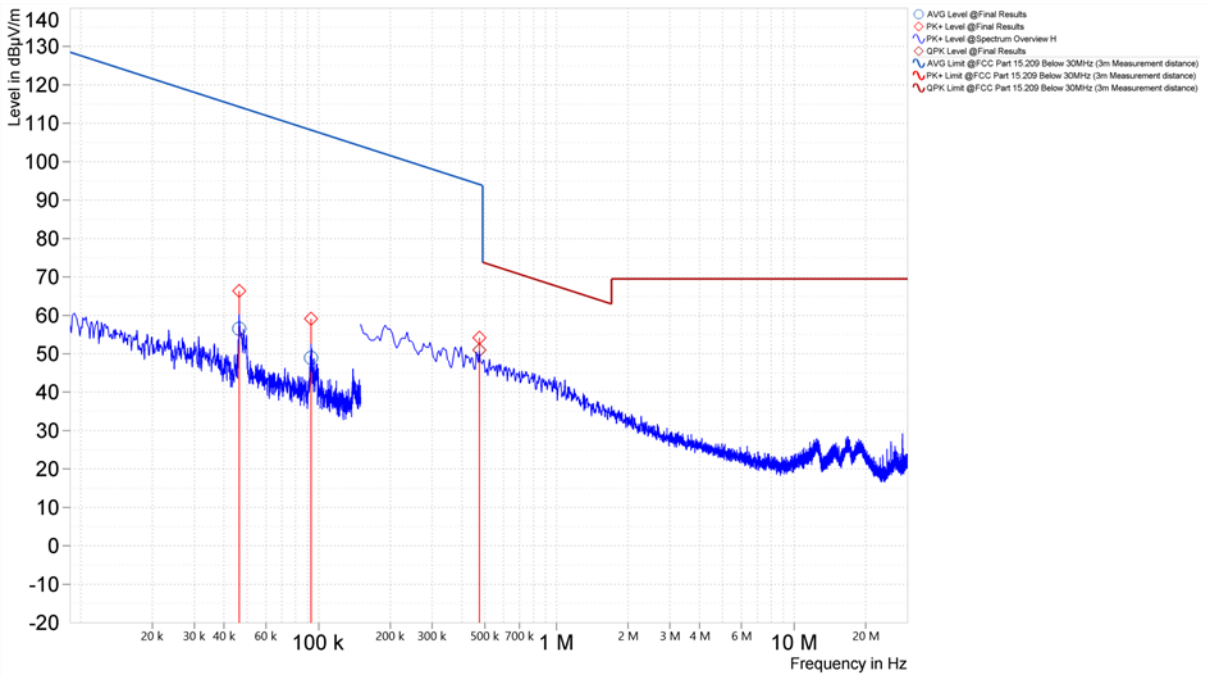


Figure 10. Worst Case Spurious Emissions, 9kHz – 30MHz, GFSK, Coplanar Loop (Middle Channel)

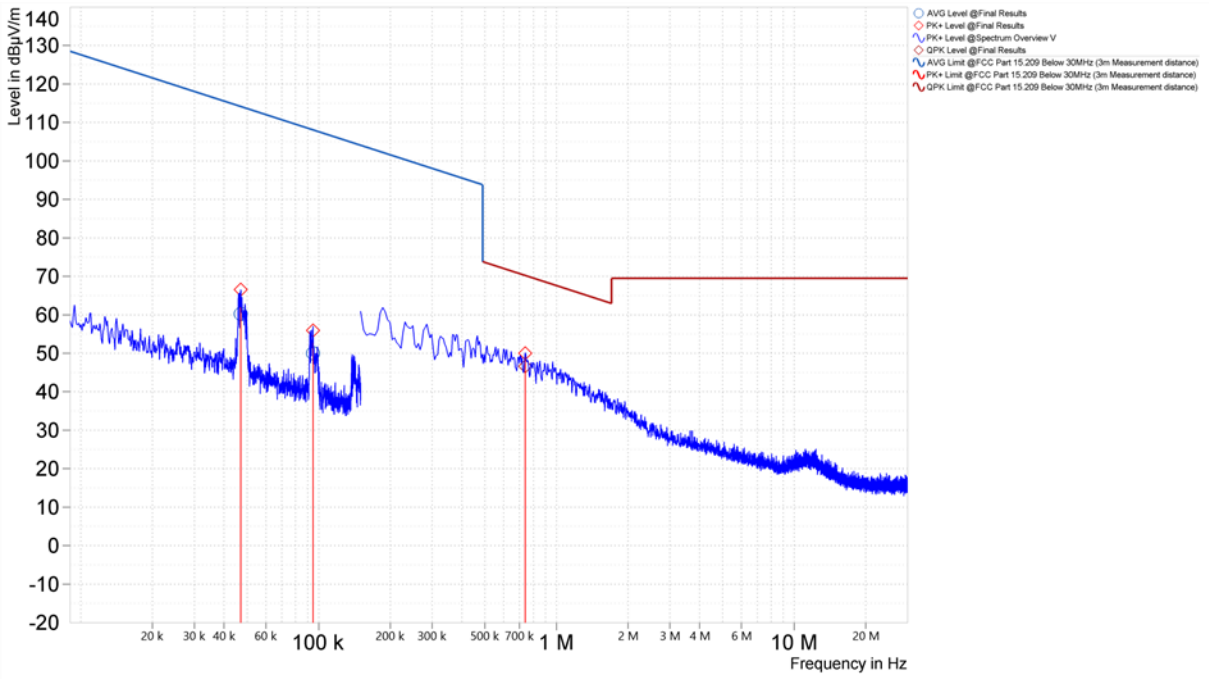


Figure 11. Worst Case Spurious Emissions, 9kHz – 30MHz, GFSK, Coaxial Loop (Middle Channel)

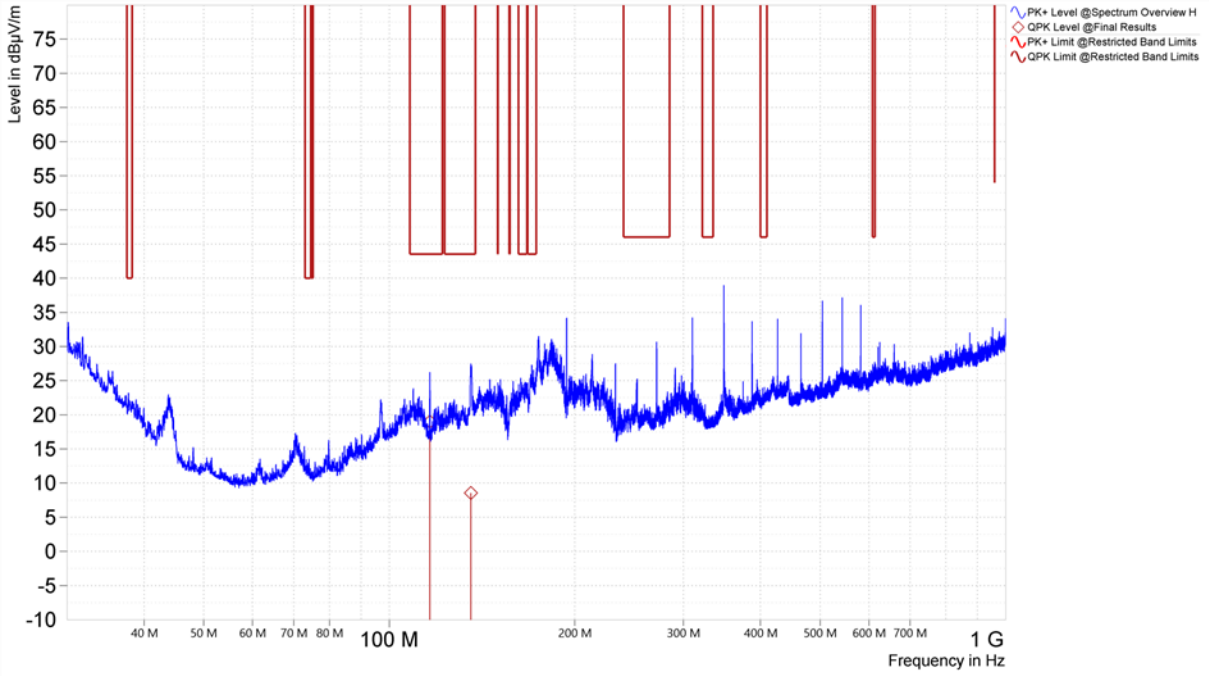


Figure 12. Worst Case Spurious Emissions, 30MHz – 1GHz, GFSK, Horizontal Polarity (Middle Channel)

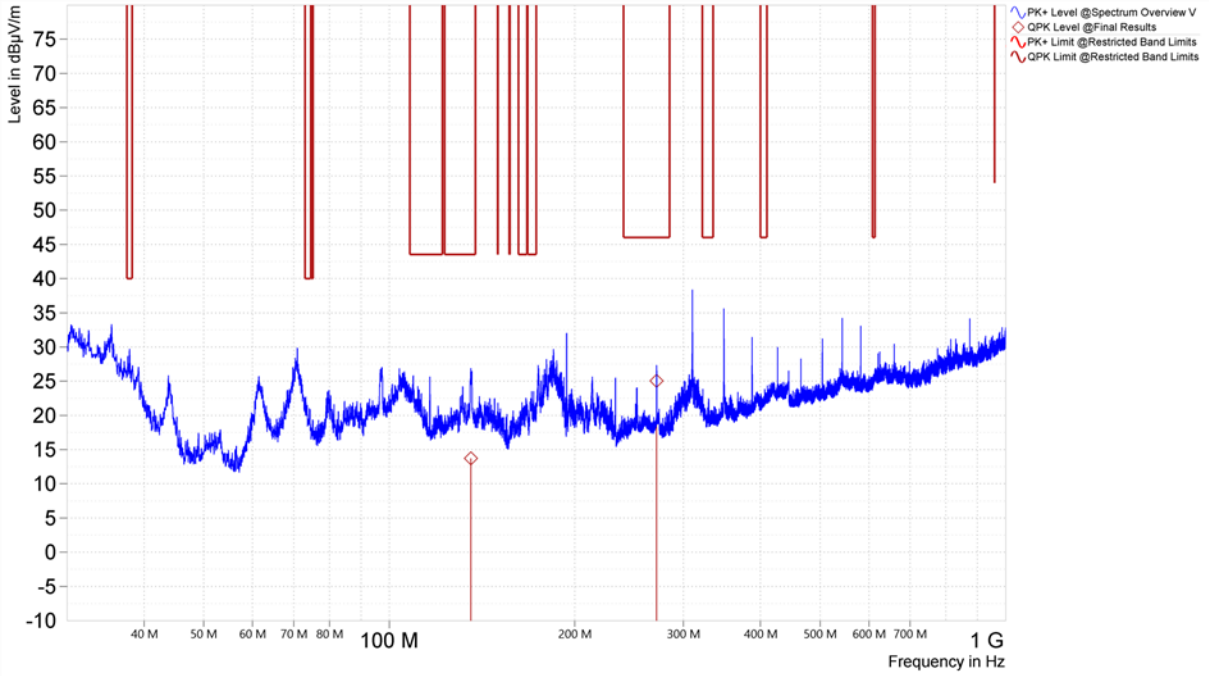


Figure 13. Worst Case Spurious Emissions, 30MHz – 1GHz, GFSK, Vertical Polarity (Middle Channel)

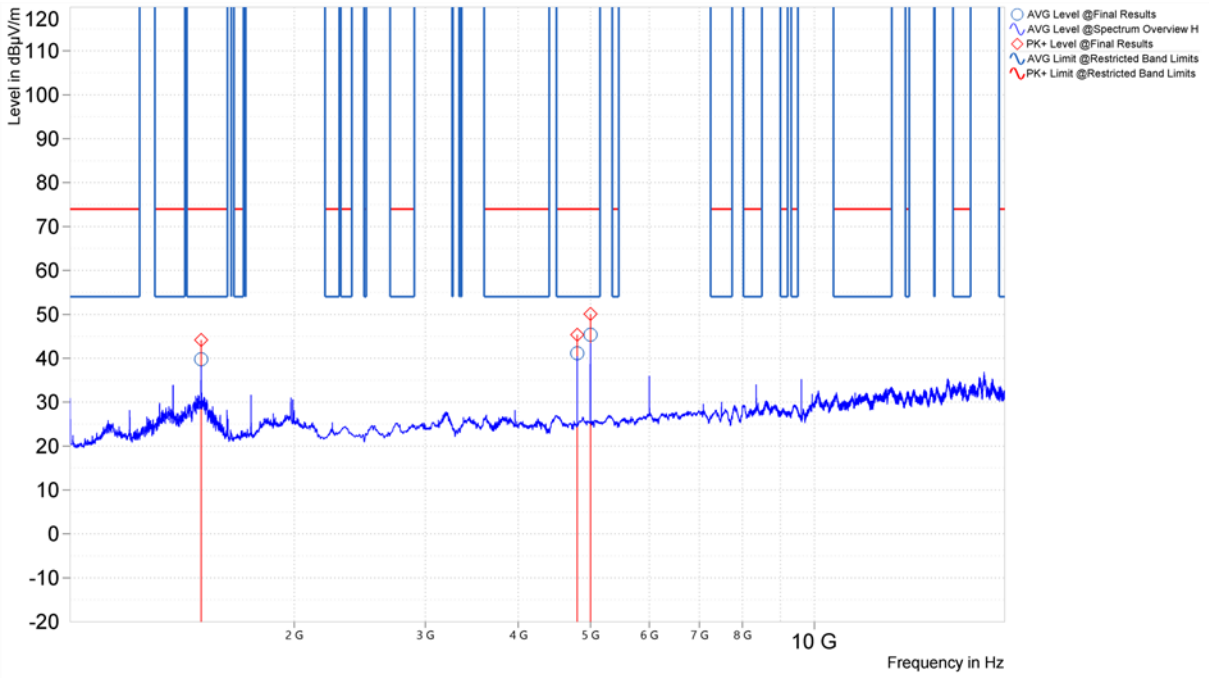


Figure 14. Worst Case Spurious Emissions, 1GHz – 18GHz, GFSK, Horizontal Polarity (Middle Channel)

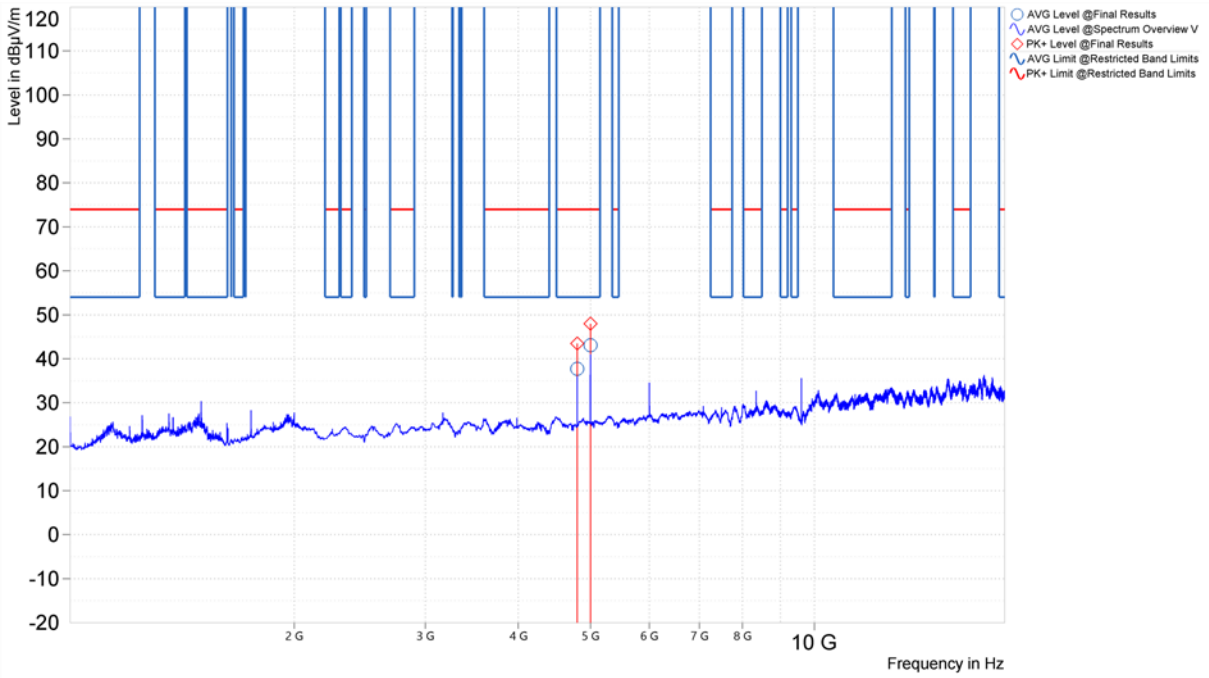


Figure 15. Worst Case Spurious Emissions, 1GHz – 18GHz, GFSK, Vertical Polarity (Middle Channel)

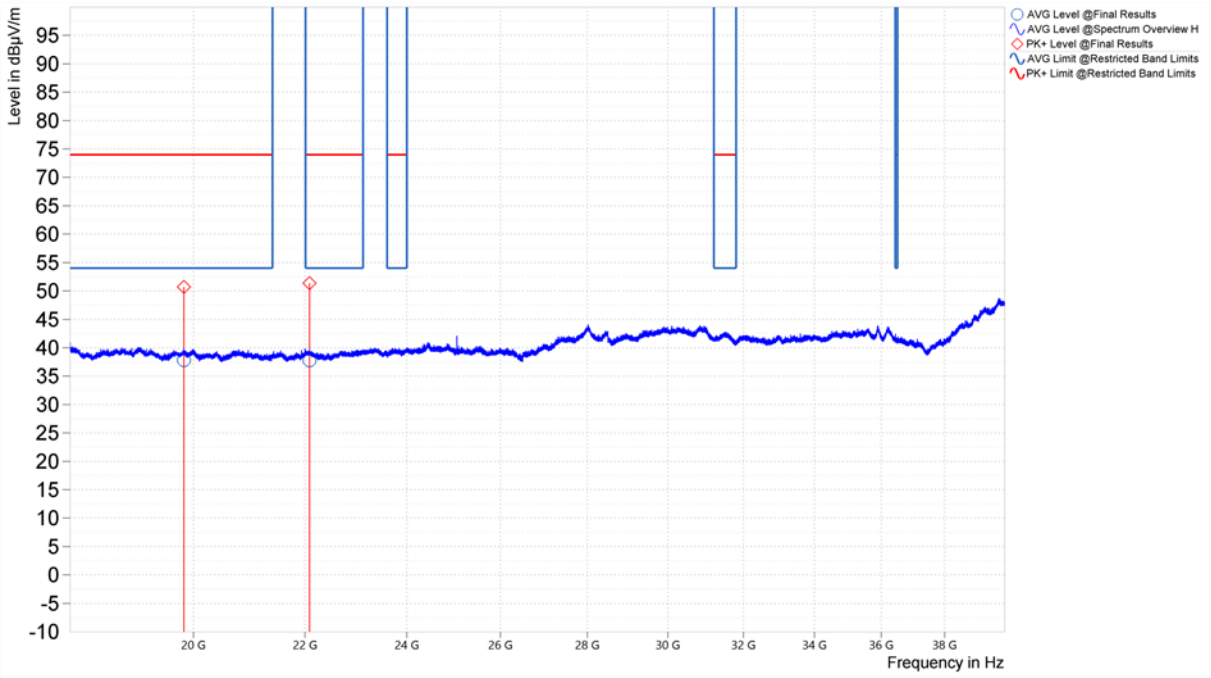


Figure 16. Worst Case Spurious Emissions, 18GHz – 40GHz, GFSK, Horizontal Polarity (Middle Channel)

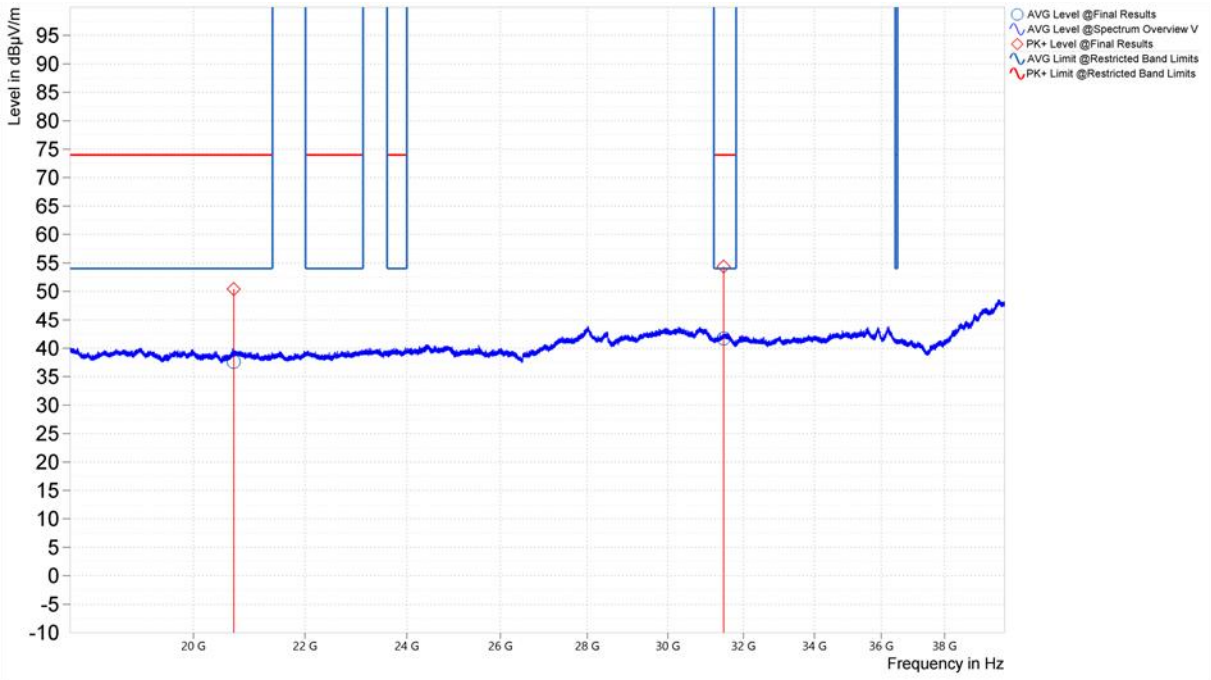


Figure 17. Worst Case Spurious Emissions, 18GHz – 40GHz, GFSK, Vertical Polarity (Middle Channel)

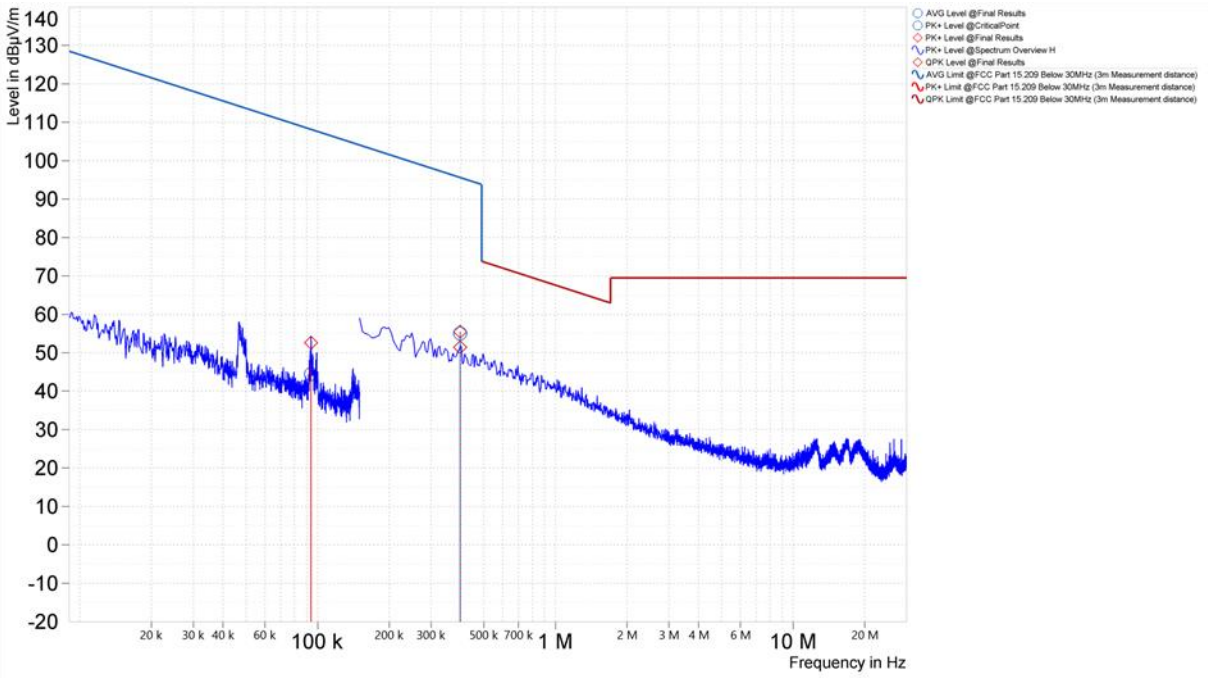


Figure 18. Worst Case Spurious Emissions, 9kHz – 30MHz, Pi/4DQPSK, Coplanar Loop (Middle Channel)

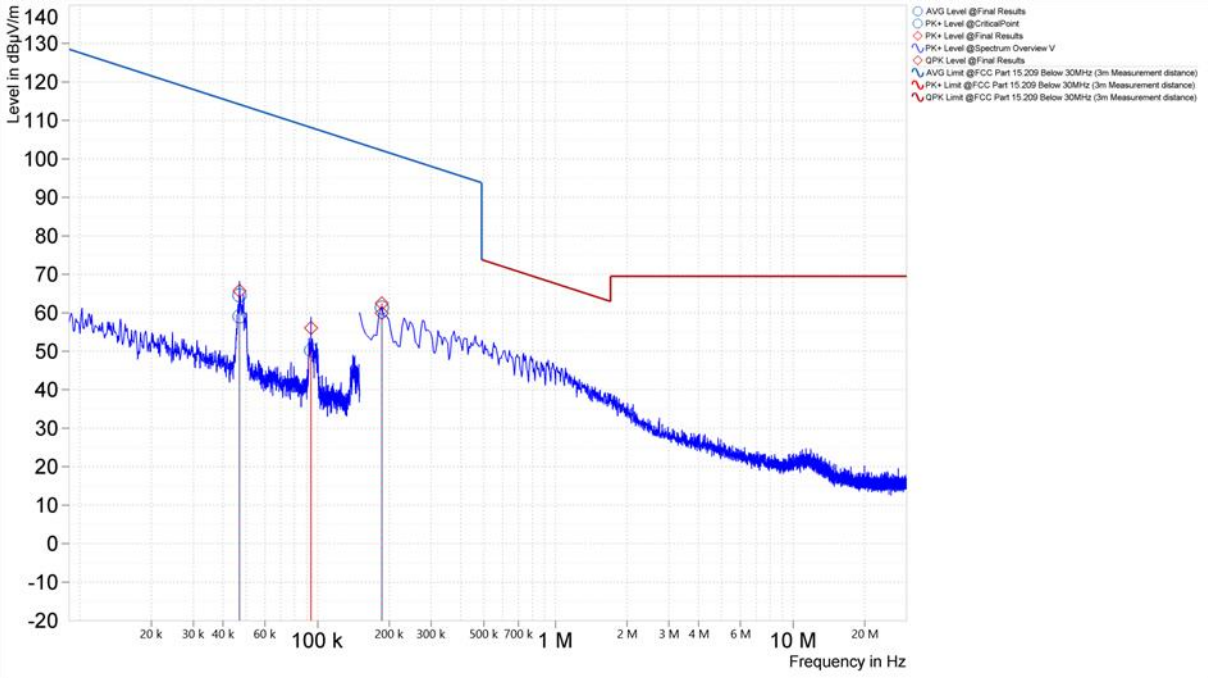


Figure 19. Worst Case Spurious Emissions, 9kHz – 30MHz, Pi/4DQPSK, Coaxial Loop (Middle Channel)

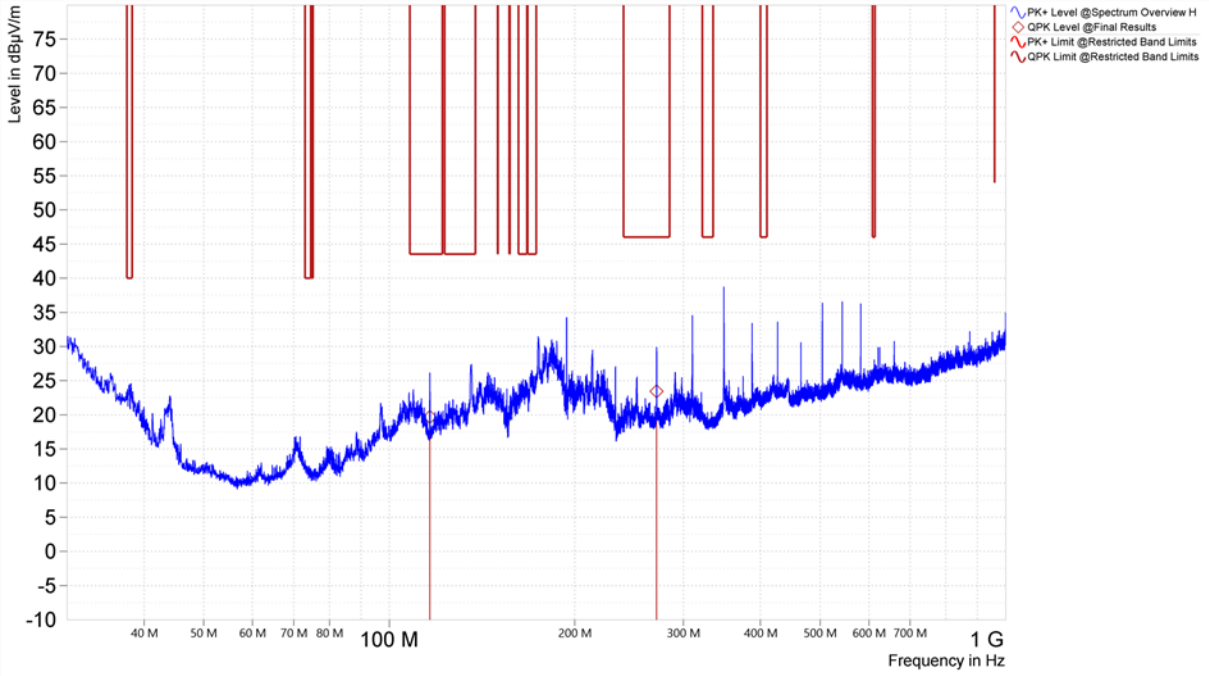


Figure 20. Worst Case Spurious Emissions, 30MHz – 1GHz, Pi/4DQPSK, Horizontal Polarity (Middle Channel)

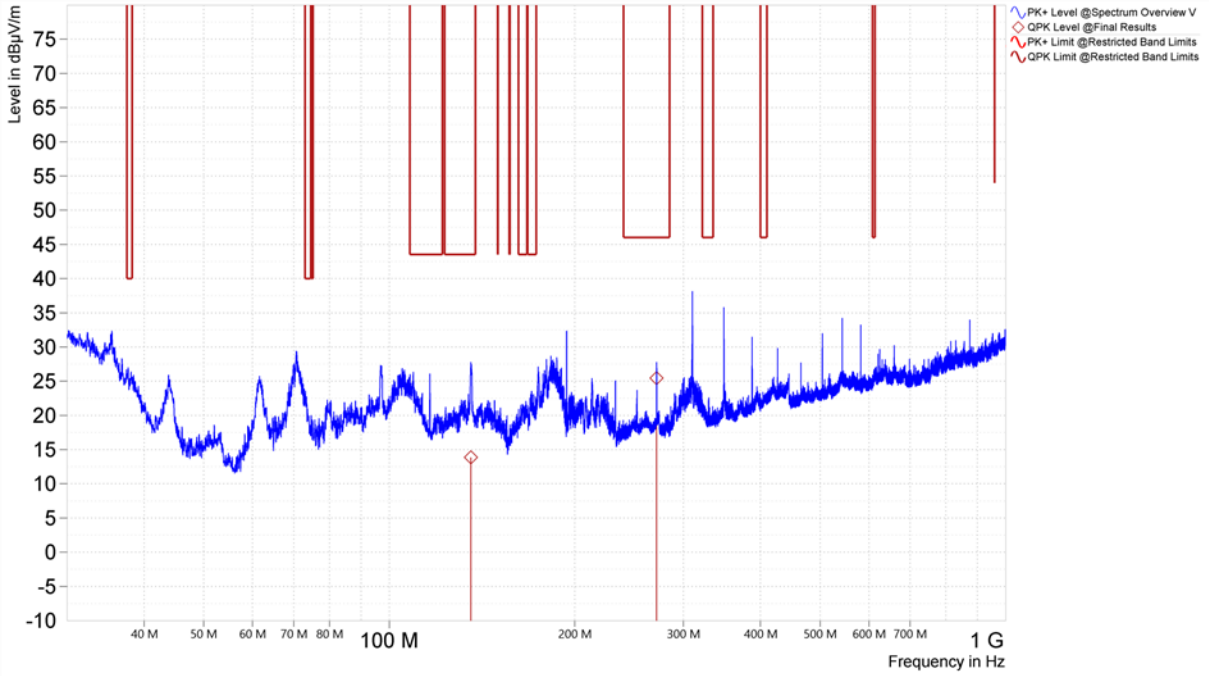


Figure 21. Worst Case Spurious Emissions, 30MHz – 1GHz, Pi/4DQPSK, Vertical Polarity (Middle Channel)

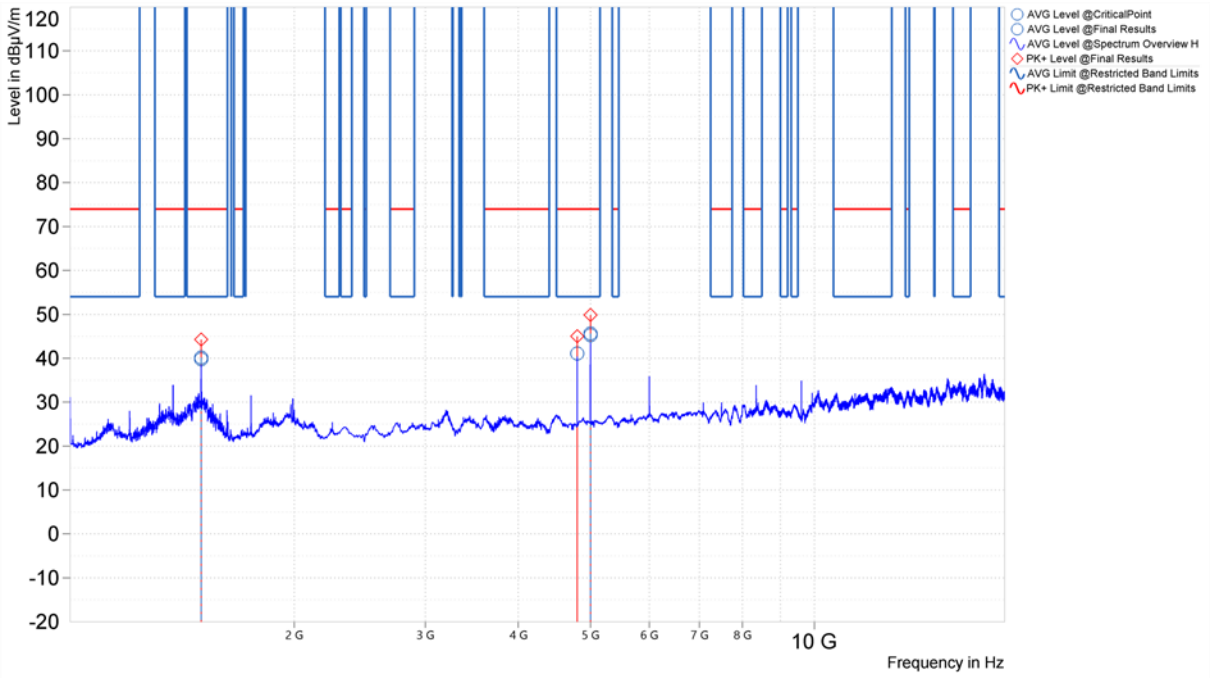


Figure 22. Worst Case Spurious Emissions, 1GHz – 18GHz, Pi/4DQPSK, Horizontal Polarity (Middle Channel)

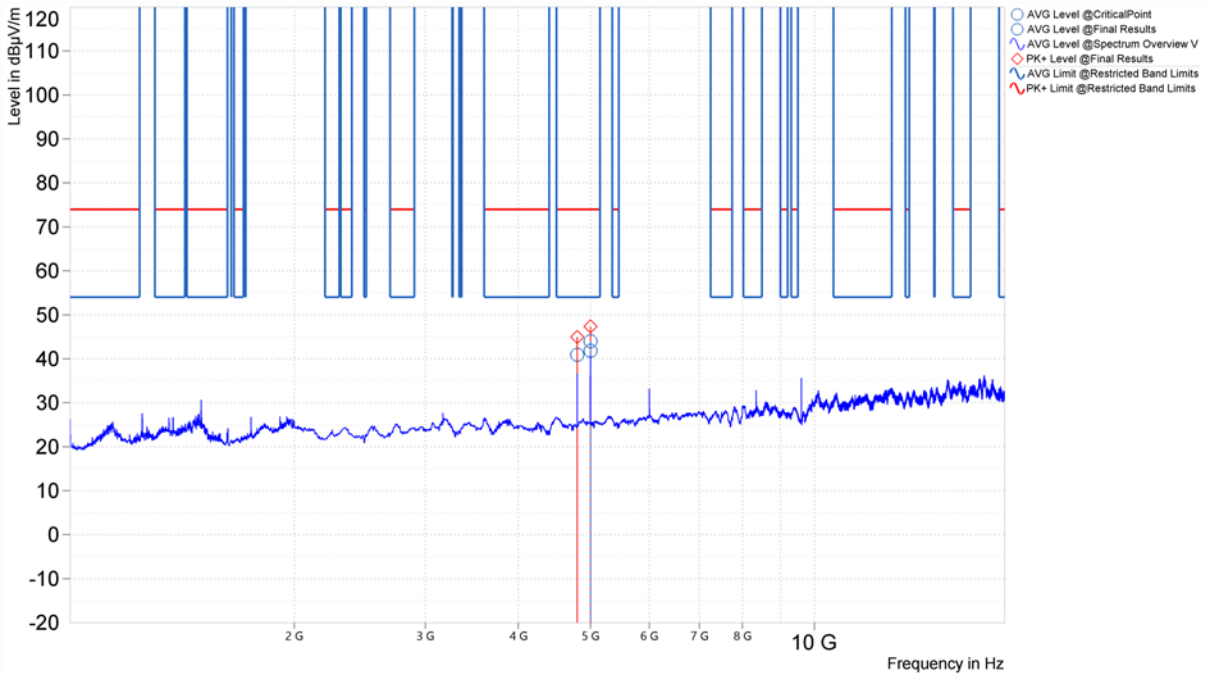


Figure 23. Worst Case Spurious Emissions, 1GHz – 18GHz, Pi/4DQPSK, Vertical Polarity (Middle Channel)

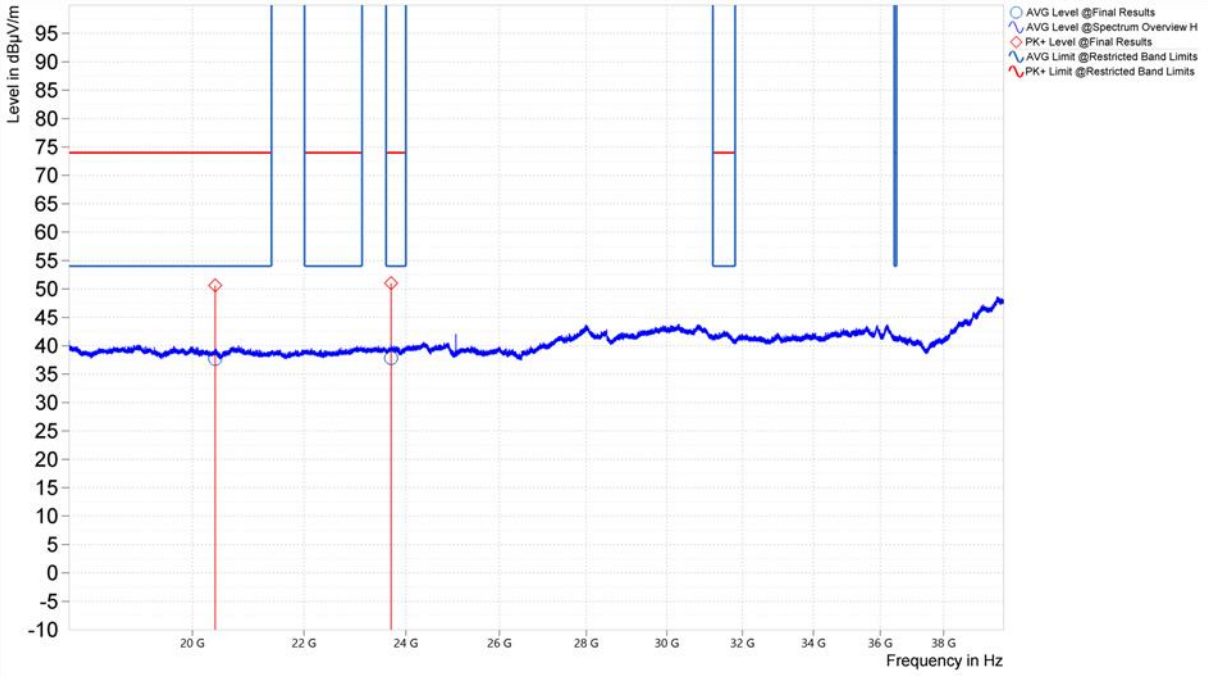


Figure 24. Worst Case Spurious Emissions, 18GHz – 40GHz, Pi/4DQPSK, Horizontal Polarity (Middle Channel)

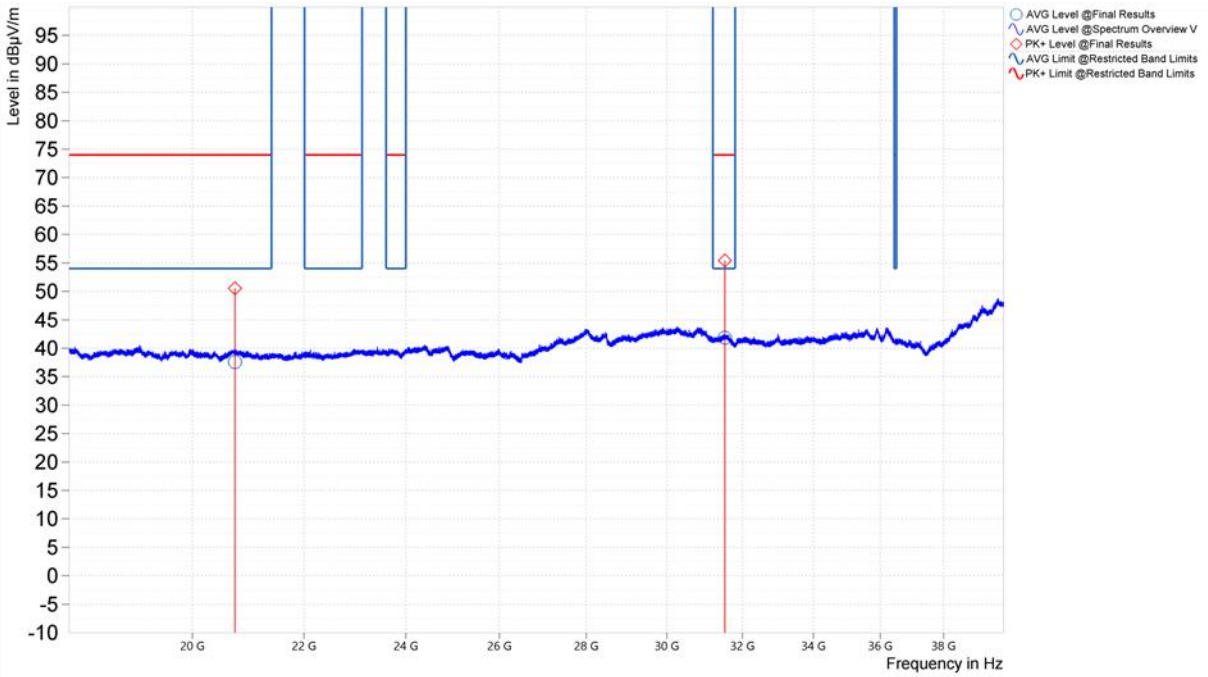


Figure 25. Worst Case Spurious Emissions, 18GHz – 40GHz, Pi/4DQPSK, Vertical Polarity (Middle Channel)

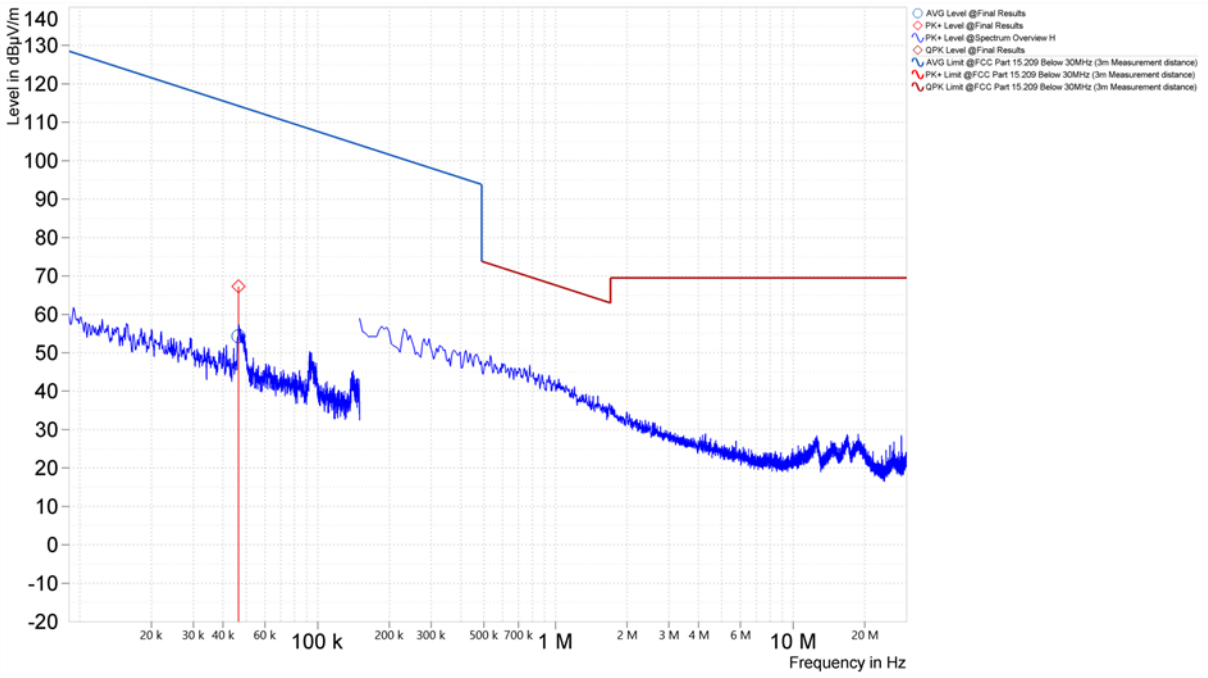


Figure 26. Worst Case Spurious Emissions, 9kHz – 30MHz, 8DPSK, Coplanar Loop (Middle Channel)

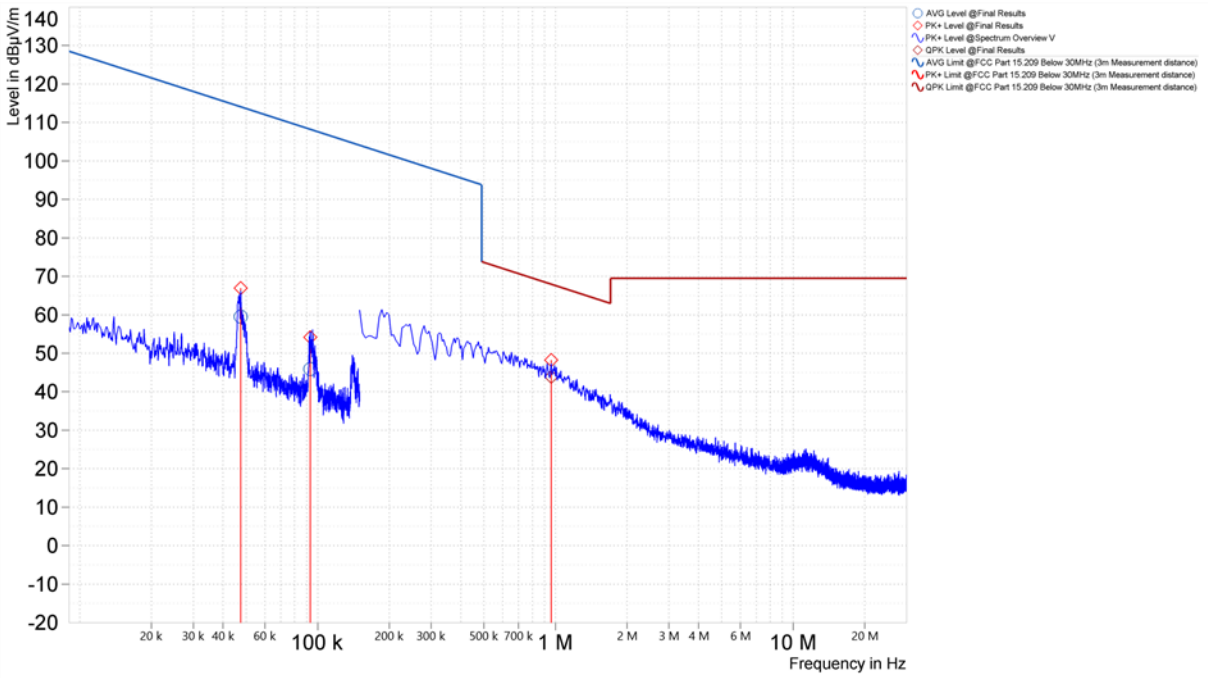


Figure 27. Worst Case Spurious Emissions, 9kHz – 30MHz, 8DPSK, Coaxial Loop (Middle Channel)

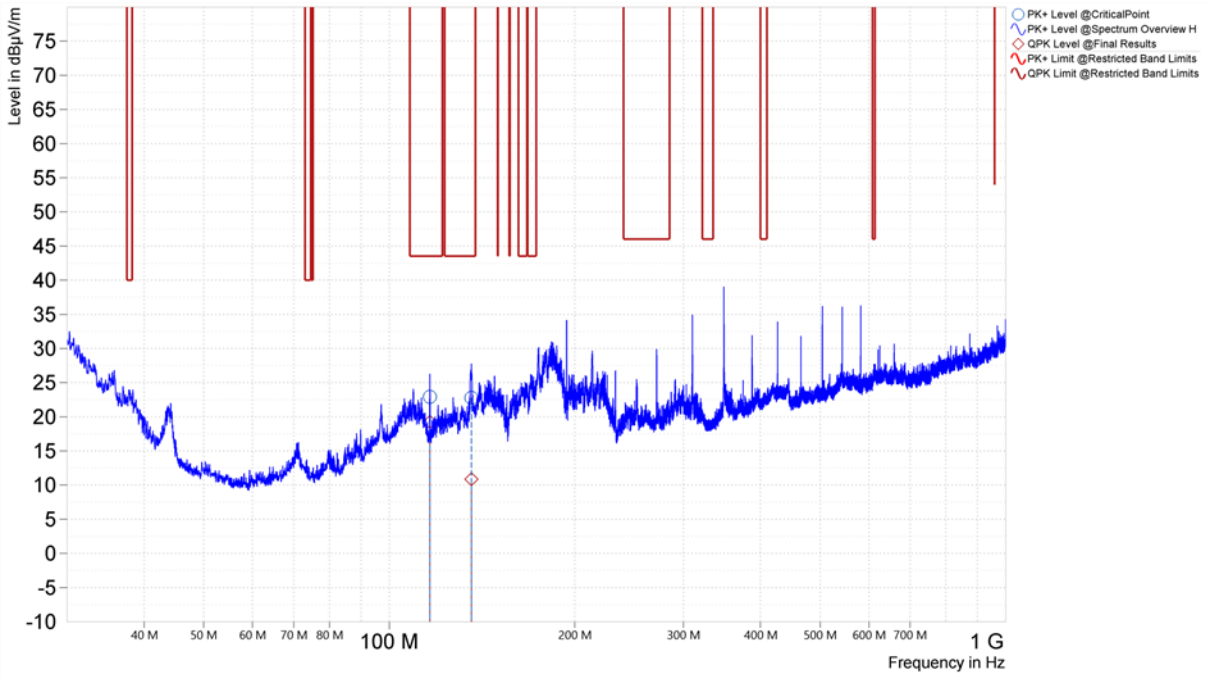


Figure 28. Worst Case Spurious Emissions, 30MHz – 1GHz, 8DPSK, Horizontal Polarity (Middle Channel)

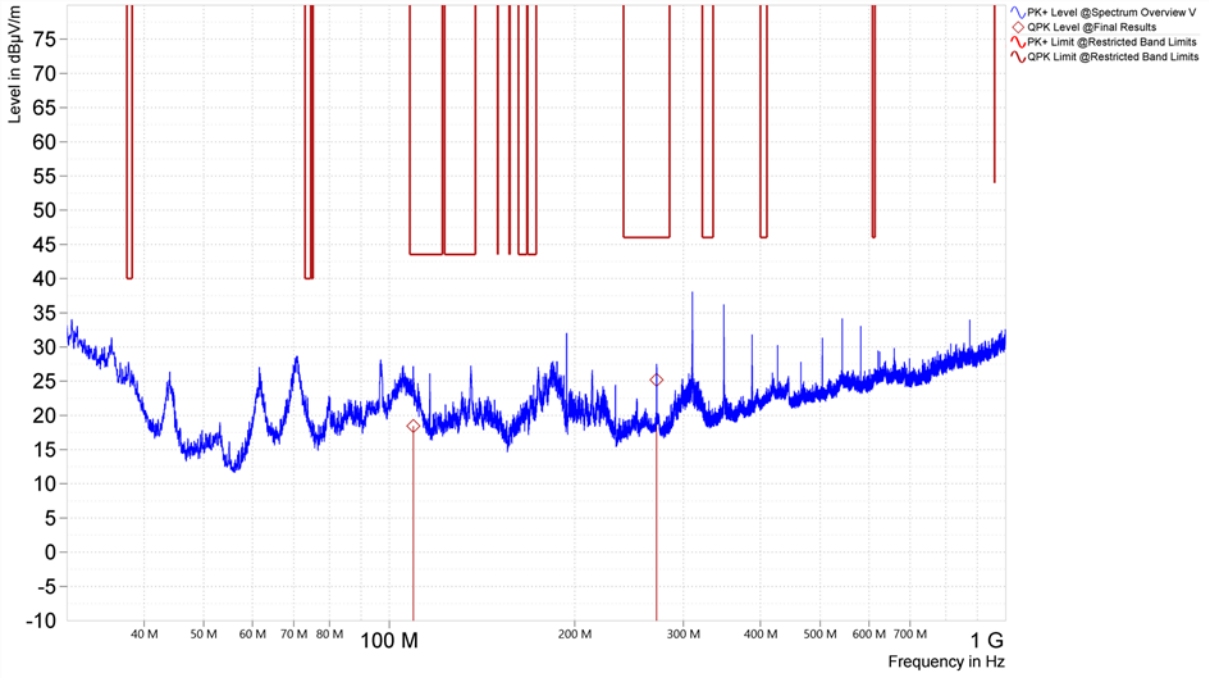


Figure 29. Worst Case Spurious Emissions, 30MHz – 1GHz, 8DPSK, Vertical Polarity (Middle Channel)

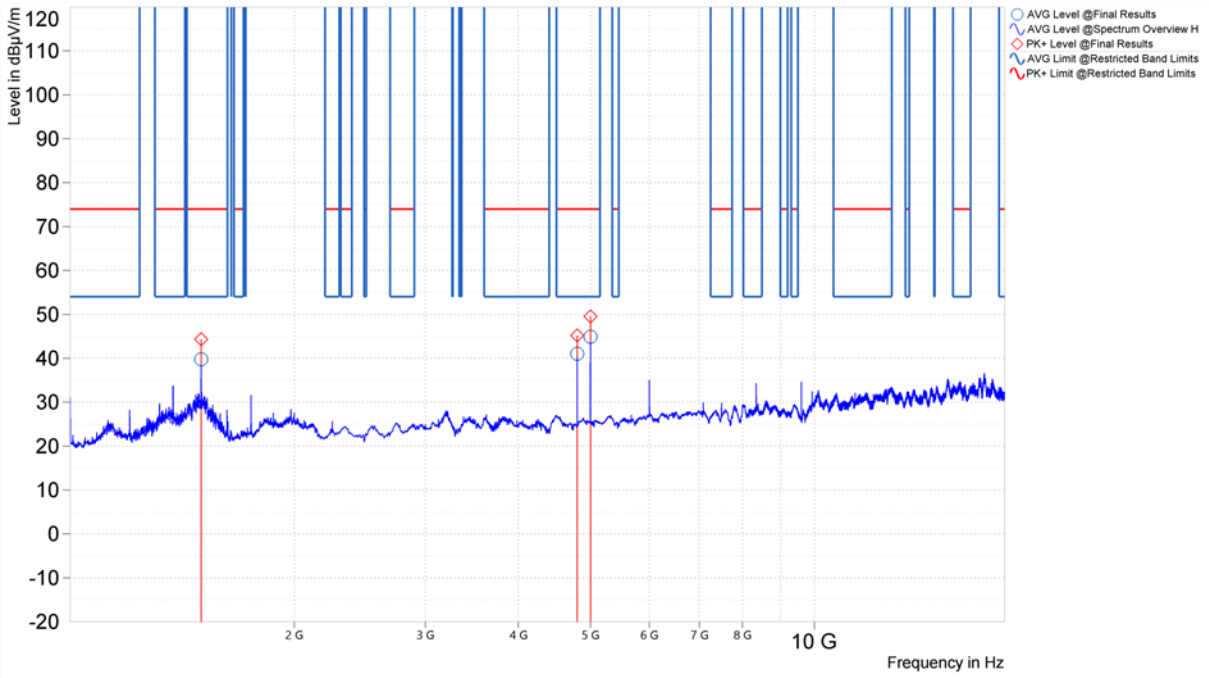


Figure 30. Worst Case Spurious Emissions, 1GHz – 18GHz, 8DPSK, Horizontal Polarity (Middle Channel)

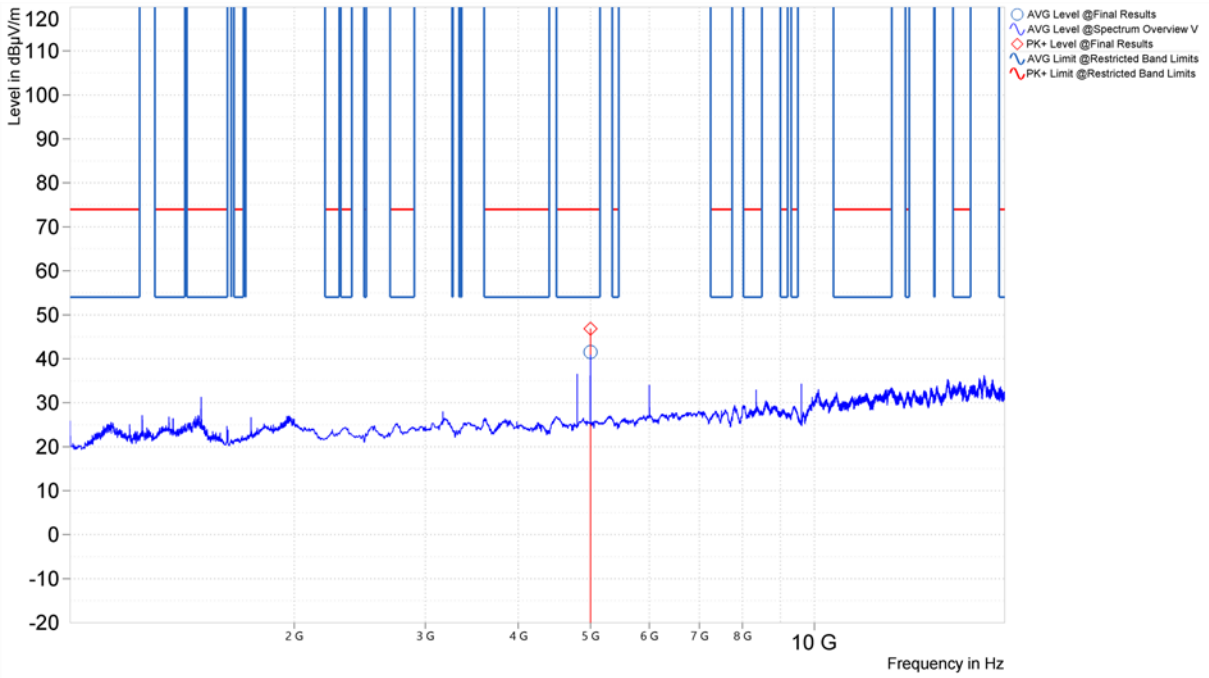


Figure 31. Worst Case Spurious Emissions, 1GHz – 18GHz, 8DPSK, Vertical Polarity (Middle Channel)

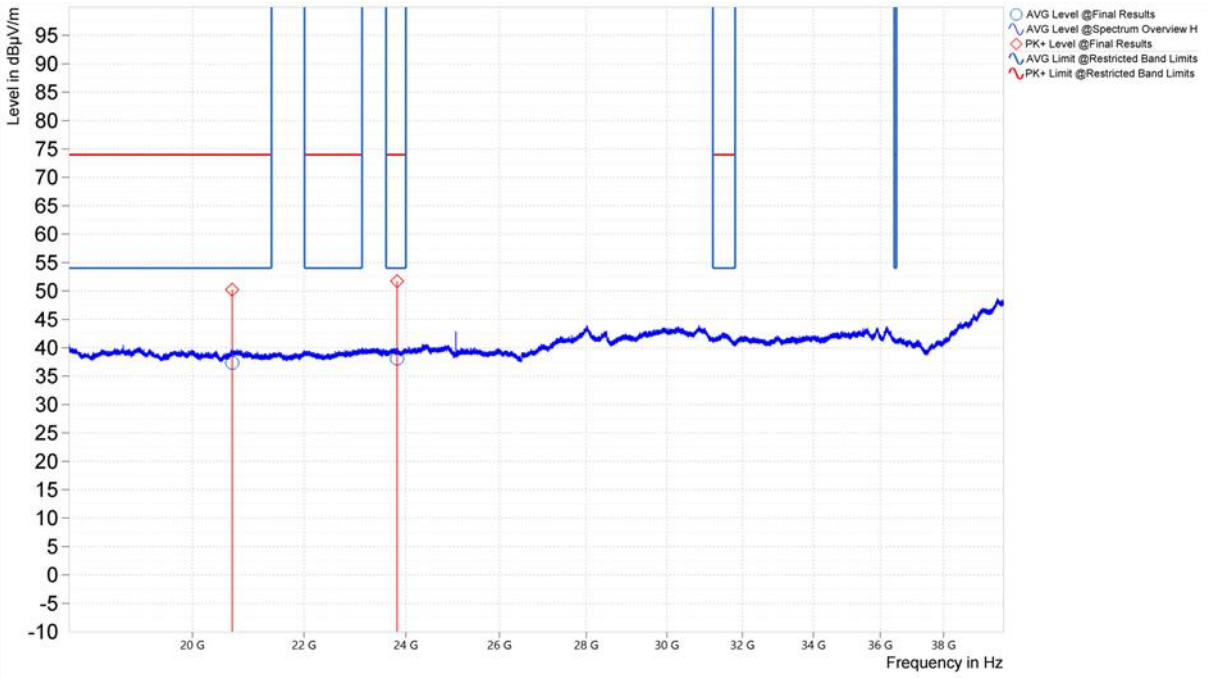


Figure 32. Worst Case Spurious Emissions, 18GHz – 40GHz, 8DPSK, Horizontal Polarity (Middle Channel)

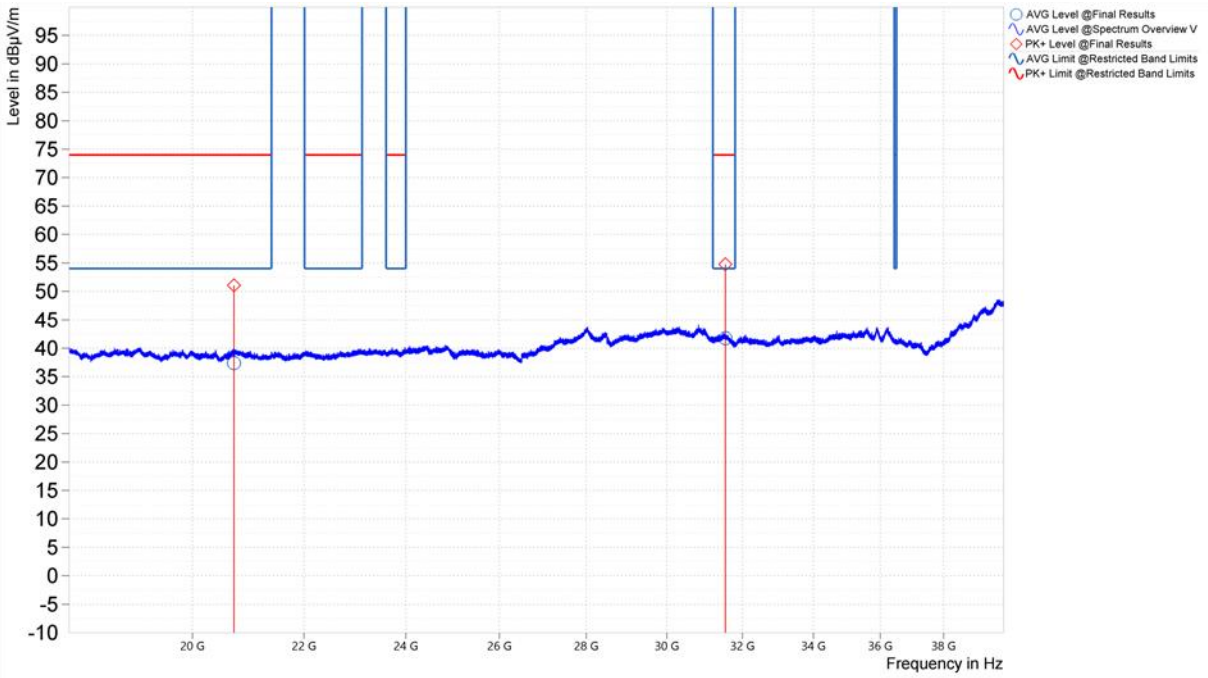
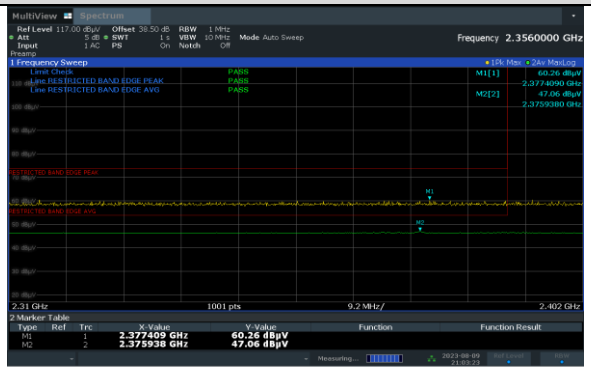


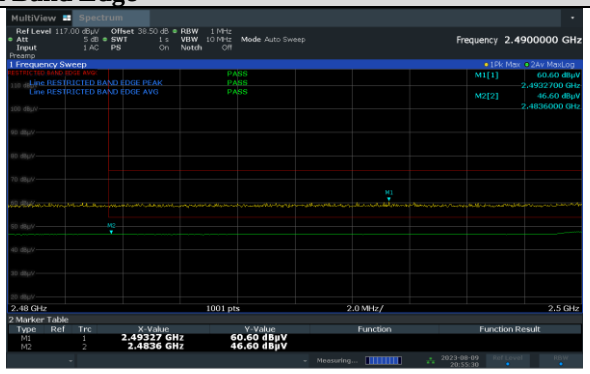
Figure 33. Worst Case Spurious Emissions, 18GHz – 40GHz, 8DPSK, Vertical Polarity (Middle Channel)

Restricted Band Edge Emission Data:

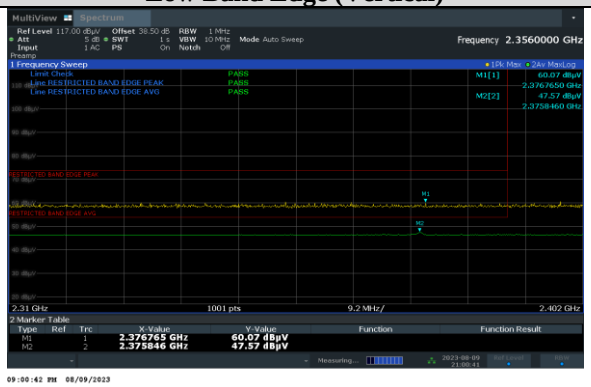
BLE Restricted Band Edge



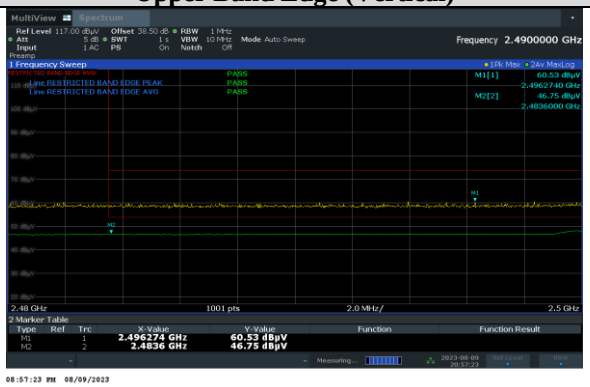
Low Band Edge (Vertical)



Upper Band Edge (Vertical)



Low Band Edge (Horizontal)

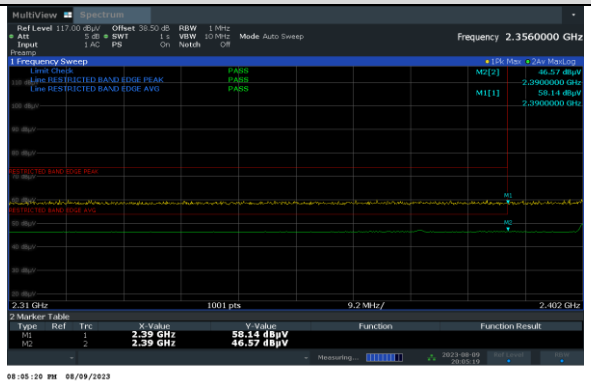


Upper Band Edge (Horizontal)

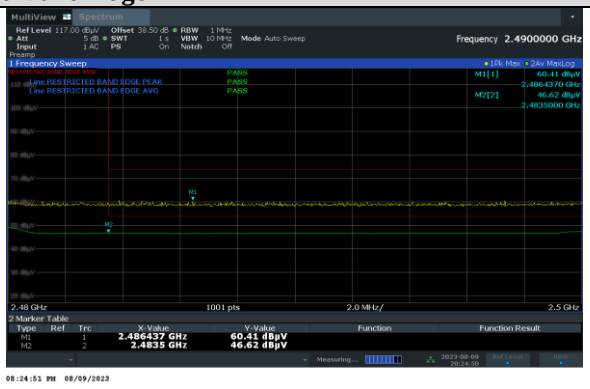
Band Edge	Polarity (V/H)	Peak Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Amplitude (dBuV/m)	Avgerage Limit (dBuV/m)	Avg Margin (dB)	Result
Low	V	2377.4	60.26	74.00	13.74	2375.9	47.06	54.00	6.94	Pass
Low	H	2376.7	60.07	74.00	13.93	2375.8	47.57	54.00	6.43	Pass
High	V	2493.2	60.60	74.00	13.4	2483.6	46.60	54.00	7.4	Pass
High	H	2496.2	60.53	74.00	13.47	2483.6	46.75	54.00	7.25	Pass

Figure 34. Restricted Band Edge Measurements (BLE)

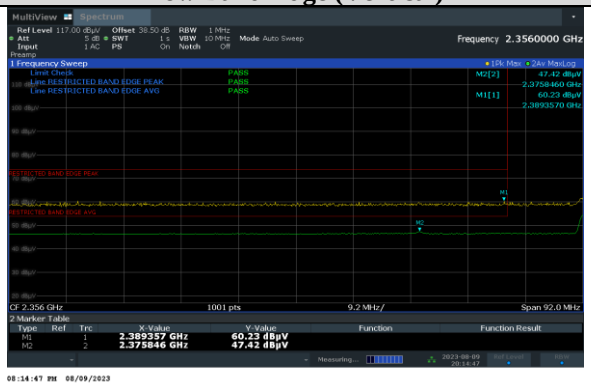
GFSK Restricted Band Edge



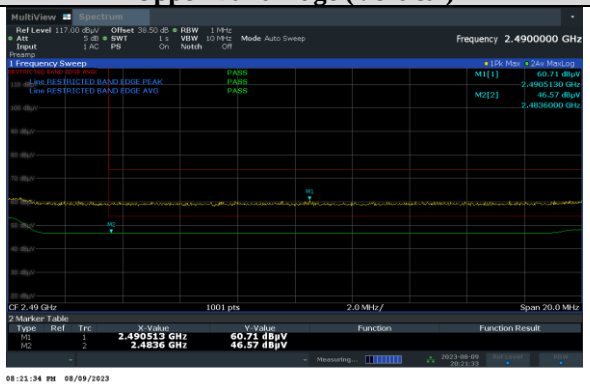
Low Band Edge (Vertical)



Upper Band Edge (Vertical)



Low Band Edge (Horizontal)

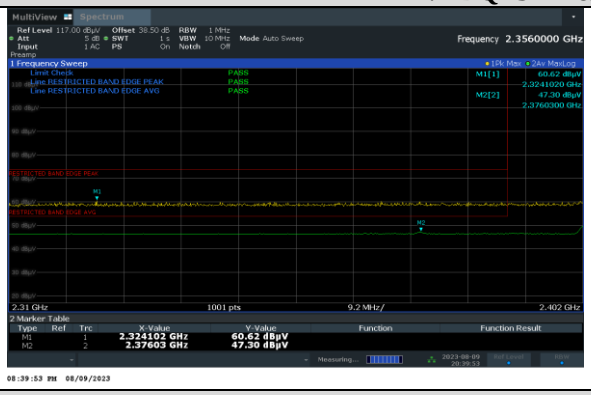


Upper Band Edge (Horizontal)

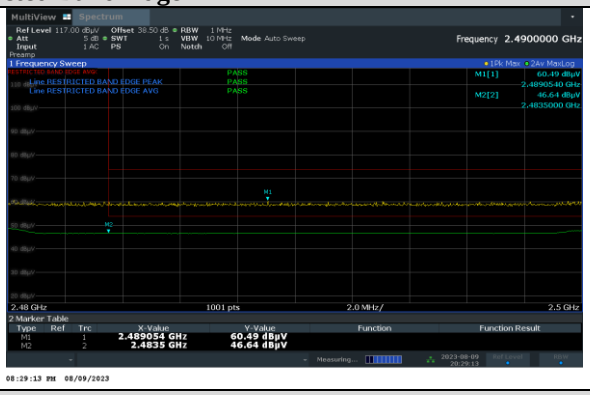
Band Edge	Polarity (V/H)	Peak Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Amplitude (dBuV/m)	Avgerage Limit (dBuV/m)	Avg Margin (dB)	Result
Low	V	2390	58.14	74.00	15.86	2390	46.57	54.00	7.43	Pass
Low	H	2389.3	60.23	74.00	13.77	2375.8	47.42	54.00	6.58	Pass
High	V	2486.4	60.41	74.00	13.59	2483.5	46.62	54.00	7.38	Pass
High	H	2490.5	60.71	74.00	13.29	2483.6	46.57	54.00	7.43	Pass

Figure 35. Restricted Band Edge Measurements (GFSK)

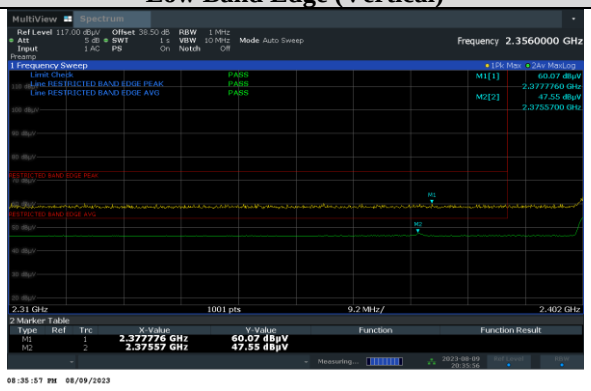
Pi/4 DQPSK Restricted Band Edge



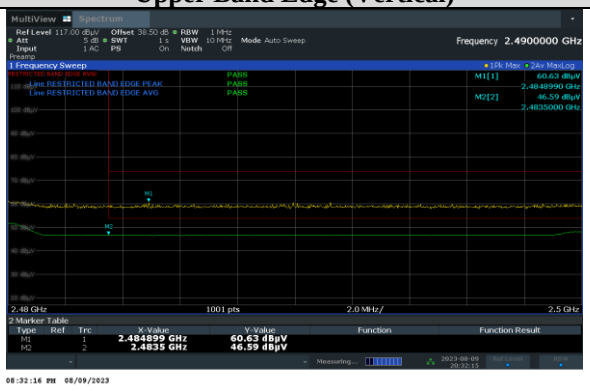
Low Band Edge (Vertical)



Upper Band Edge (Vertical)



Low Band Edge (Horizontal)

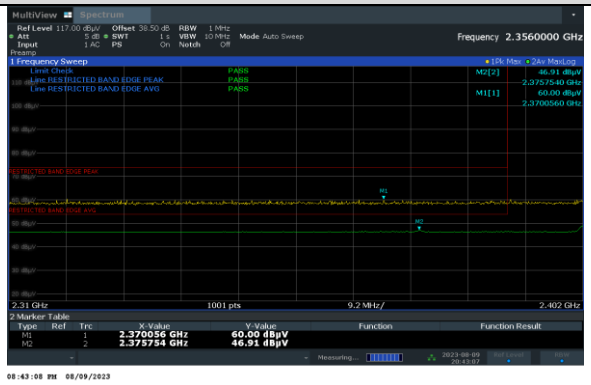


Upper Band Edge (Horizontal)

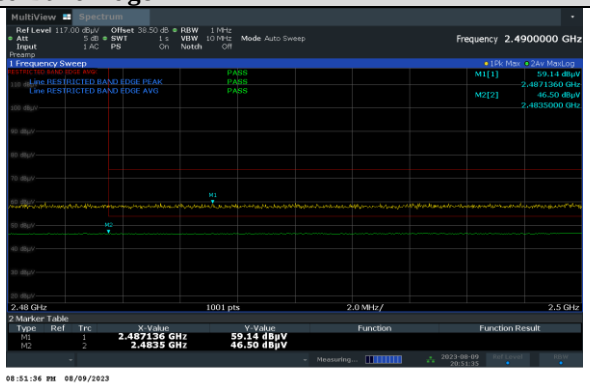
Band Edge	Polarity (V/H)	Peak Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Amplitude (dBuV/m)	Avgerage Limit (dBuV/m)	Avg Margin (dB)	Result
Low	V	2324.1	60.62	74.00	13.38	2376	47.30	54.00	6.7	Pass
Low	H	2377.7	60.07	74.00	13.93	2375.5	47.55	54.00	6.45	Pass
High	V	2489	60.49	74.00	13.51	2483.5	46.64	54.00	7.36	Pass
High	H	2484.8	60.63	74.00	13.37	2483.5	46.59	54.00	7.41	Pass

Figure 36. Restricted Band Edge Measurements (Pi/4DQPSK)

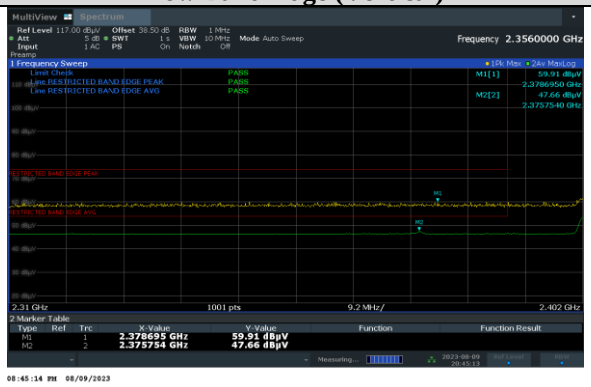
8DPSK Restricted Band Edge



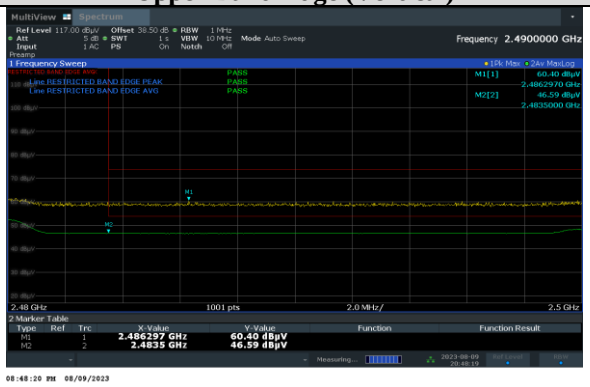
Low Band Edge (Vertical)



Upper Band Edge (Vertical)



Low Band Edge (Horizontal)



Upper Band Edge (Horizontal)

Band Edge	Polarity (V/H)	Peak Frequency (MHz)	Peak Amplitude (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average Frequency (MHz)	Average Amplitude (dBuV/m)	Avgerage Limit (dBuV/m)	Avg Margin (dB)	Result
Low	V	2370	60.00	74.00	14	2375.7	46.91	54.00	7.09	Pass
Low	H	2378.6	59.91	74.00	14.09	2375.7	47.66	54.00	6.34	Pass
High	V	2487.1	59.14	74.00	14.86	2483.5	46.50	54.00	7.5	Pass
High	H	2486.2	60.4	74.00	13.6	2483.5	46.59	54.00	7.41	Pass

Figure 37. Restricted Band Edge Measurements (8DPSK)

IV. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

MET Asset #	Description	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1250	Receiver	Rohde & Schwarz	ESW44	5/26/2023	5/26/2024
1A1176	Active Loop Antenna (9KHz-30MHz)	ETS-Lindgren	6502	7/13/2023	7/13/2024
1A1050	Bilog Antenna (30MHz – 1GHz)	Schaffner	CBL 6112D	1/24/2023	1/24/2024
1A1183	Horn Antenna (1GHz – 18GHz)	ETS Lindgren	3117	1/4/2023	1/4/2024
1A1161	Horn Antenna (18GHz – 40GHz)	ETS Lindgren	3116C	7/11/2023	7/11/2024
1A1099	Generator	Com-Power	CGO-51000	See Note	
1A1088	Preamplifier	Rohde & Schwarz	TS-PR1	See Note	
1A1044	Generator	Com-Power	CG-520	See Note	
1A1073	Multi Device Controller	ETS	2090	See Note	
1A1074	System Controller	Panasonic	WV-CU101	See Note	
1A1080	Multi-Device	ETS	2090	See Note	
1A1180	Preamplifier	Miteq	AMF-7D-01001800-22-10P	See Note	

Table 29. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report