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TEST REPORT

Report Reference Number:	E10992-2401_CastGroup_BTRM-001_ FCC-ISED_Rev1.0
Total Number of Pages:	57
Date of Issue:	March 6, 2025

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CERT #3657.02

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Manufacturer:	**Cast Group of Companies Inc.**
Address:	35 Ripley Avenue Unit 1 Toronto, Ontario, M6S 3P2
Equipment Tested:	**BTRM-001**
Model Number(s):	BTRM-001
FCC ID:	RKT-BTRM001
ISED ID:	10858A-BTRM001

REVISION HISTORY

Date	Report Number	Details	Author's Initials
January 29, 2025	E10992-2401_CastGroup_BTRM-001_ FCC-ISED_Rev0.0	Initial draft	DJ
March 6, 2025	E10992-2401_CastGroup_BTRM-001_ FCC-ISED_Rev1.0	Release	DJ
All previous versions of this report have been superseded by the latest dated revision as listed in the above table. Please dispose of all previous electronic and paper printed revisions accordingly.			

REPORT AUTHORIZATION

The data documented in this report is for the test equipment provided by the manufacturer and the results relate only to the item tested. The tests were conducted on the sample equipment as requested by the manufacturer for the purpose of demonstrating compliance with the standards outlined in Section I of this report as agreed upon by the Manufacturer under the quote 23RH07272R1.

The Manufacturer is responsible for the tested product configurations, continued product compliance, and for the appropriate auditing of subsequent products as required.

This report may comprise a partial list of tests that are required for FCC and ISED. A Declaration of Conformity can only be produced by the manufacturer. This is to certify that the following report is true and correct to the best of our knowledge.

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EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	9543A	3657.02

EMC Facility Burnaby BC, Canada

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1 EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this report is to demonstrate and document the compliance of Transmitter Module as per Sections 1.2 and 1.3.

1.2 Scope

The information documented in this report is based on the test methods and levels as per Quote 23RH07272R1:

ICES-Gen Issue 2 – General Requirements for Compliance of Interference-Causing Equipment

ICES-003 Issue 7 – Information Technology Equipment (Including Digital Apparatus) – Limits and Methods of Measurement

RSS-Gen Issue 5 – General Requirements for Compliance of Radio Apparatus

RSS-247 Issue 3 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

CFR Title 47 FCC Part 15 – Radio Frequency Devices, Subpart B – Unintentional Radiators

CFR Title 47 FCC Part 15 – Radio Frequency Devices, Subpart C – Intentional Radiators

- 5.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-58MHz.
- 15.212 Modular Transmitters

1.3 Summary of Results

The following testing was performed pursuant to FCC Title 47 Part 15 and ISED RSS-Gen to demonstrate the testimony to "FCC & IC" mark Electromagnetic Compatibility testing for the product.

No.	Test	Applicable Standard	Test Method	Result
1	Antenna Requirements	FCC 47 CFR Part 15C RSS-Gen	Manufacturers Description	Complies
2	RF Peak Output Power	FCC 47 CFR Part 15C RSS-247	ANSI C63.10: 2020 KDB 558074 D01	Complies
3	Power Spectral Density	FCC 47 CFR Part 15C RSS-247	ANSI C63.10: 2020 KDB 558074 D01	Complies
4	6 dB Occupied Bandwidth	FCC 47 CFR Part 15C RSS-247	ANSI C63.10: 2020 KDB 558074 D01	Complies
5	Out of Band Emissions	FCC 47 CFR Part 15C RSS-247	ANSI C63.10: 2020 KDB 558074 D01	Complies
6	Receiver Conducted Emissions	RSS-Gen	ANSI C63.10: 2020	Complies
7	Radiated Emissions	FCC 47 CFR Part 15B RSS-Gen ICES-003	ANSI C63.4:	Complies
7	Conducted Emissions	FCC 47 CFR Part 15B RSS-Gen ICES-003	ANSI C63.4:	Complies

Table 1: Applicable test standards and descriptions

Note: The gain of the antenna(s) is provided by the client to measure or calculate test results and is not independently measured by QAI.

1.4 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohde & Schwarz. Transducer factors like Antenna factors, Cable Losses and Amplifier gains were stored in the test templates which are used to perform the emissions measurements. After test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Quasi Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.0064	25.67	40.00	**14.33**	1000	120	315.0	H	161	4.0

Quasi-Peak reading shown in the table above is already corrected by the software using correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

Or

Corr.(dB) = Antenna factor + Cable Loss - Amp gain (if pre-amplifier was used)

The final Quasi peak reading shown in the data is calculated by the software using following equation:

Corrected Quasi-Peak (dBµV/m) = Raw Quasi-Peak Reading + Antenna factor + Cable loss

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	Quasi Peak (dBµV)	Average (dBµV)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.2410	---	23.71	**52.06**	28.35	1000.0	9.0	L1	GND	10.0
0.2411	38.98	---	**62.06**	23.08	1000.0	9.0	L1	GND	10.0

Quasi Peak or Average reading shown in above table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

The final Quasi-peak or Average reading shown in the data is calculated by the software using following equation:

Corr. Quasi-Peak/Average Reading (dBµV) = Raw Quasi-Peak/Average Reading + Antenna factor + Cable loss

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

Margin(dB) = Limit – Quasi-Peak or Average reading

1.5 Test Equipment List

The tables below contain all the equipment used by 'QAI Laboratories' in conducting all tests on the Equipment Under Test (EUT) as per Section I.

Emissions Test Equipment

	Manufacturer	Model	Description	Serial No.	S/W Version	Calibration Due Date
1	Com-Power Corporation	LI-220C	Line Impedance Stabilization Network (9kHz-30MHz)	20070025	N/A	2026-Jan-23
2	ETS Lindgren	2165	Turntable	00043677	N/A	N/A
3	Maturo GmbH	BAM 4.0-P	Boresight Antenna Mast	365	3382.01	N/A
4	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
5	Hewlett Packard	8449B	Preamplifier (1-26 GHz)	3008A00982	N/A	2025-Feb-15
6	Keysight Technologies	N9038B	MXE EMI Receiver, Multi-touch	MY60180014	N/A	2024-Aug-22
7	ETS-Lindgren	3117	Horn, Double-Ridge Guide Ant, 1.0 - 18 GHz	75944	N/A	2026-Jan-25
8	Sunol Sciences	JB1	Biconilog Antenna 30MHz – 2GHz	A070209	N/A	2026-Jan-04
9	California Instruments	PACS-1	Power Supply	72596	N/A	2025-Dec-15
10	California Instruments	OMNI 1-18i	CDN	7127	N/A	2025-Dec-15
11	California Instruments	3001i	Power Analyzer/ Display/ Control	52117	CTS3.0 v3.2.0.35	2025-Dec-15
12	TESEQ	ISN T800	Impedance Stabilization Network (150kHz – 30MHz)	27133	N/A	2026-Feb-08
13	Hewlett Packard	8447F	Preamplifier (0.1-1300MHz)	1726A00566	N/A	N/A

Note: Equipment listed above have 3 years calibration interval.

Immunity Test Equipment

	Manufacturer	Model	Description	Serial No.	S/W Version	Calibration Due Date
1	EMC Partner	CN-EFT1000	Capacitive Clamp	408	N/A	N/A
2	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
3	Ophir	5048FE	RF Amplifier 0.15-230 MHz	1035	N/A	N/A
4	Ophir	5125FE	RF Amplifier 20-1000 MHz	1030	N/A	N/A
5	Ophir	5163FE	RF Amplifier 0.8-4.2 GHz	1044	N/A	N/A
6	Fischer	F-120-9A	Bulk Injection Clamp	399	N/A	N/A
7	Haefely Trench	PESD 1600	ESD Generator	H601-018	N/A	2025-Nov-02
8	ETS-Lindgren	HI-6005	Isotropic Field Probe 100 kHz-6 GHz	34277	N/A	2025-Sept-01
9	Berkeley Nucleonics	845-20-pe3-9K	Signal Generator	421-33A6D0507-2231	N/A	N/A
10	TESEQ	CDN 3061	Coupling Decoupling Network – 1-ph, 265V, 16A	184	N/A	2026-Jan-29
11	TESEQ	INA 6502-CIB	Programmable Step Transformer – 16A	124	N/A	2026-Jan-29

12	TESEQ	CDN 3063-C32	Coupling Decoupling Network - 3-ph, 480V, 32A	2019	N/A	2026-Jan-29
13	TESEQ	NSG 3060	Multi-Function Transient Generator - 6.6kV	1507	WIN3000 v1.3.2/ FV V2.20	2026-Jan-29

Measurement Software List

	Manufacturer	Model	Version	Description
1	Rohde & Schwarz	EMC 32	10.35.10	Emissions Test Software
2	TESEQ	WIN 3000	1.2.0	Surge, EFT & Voltage Dips Immunity Test Program
3	California Instruments	CTS 3.0	3.2.0.35	Harmonics and Flicker Test Program
4	ETS-Lindgren	TILE	7.7.2.24	Conducted Immunity and Radiated Immunity Test Program

2 GENERAL INFORMATION

2.1 Product Description

The information provided in this section is for the Equipment Under Test (EUT) and the corresponding Auxiliary Equipment needed to perform the tests as a complete system.

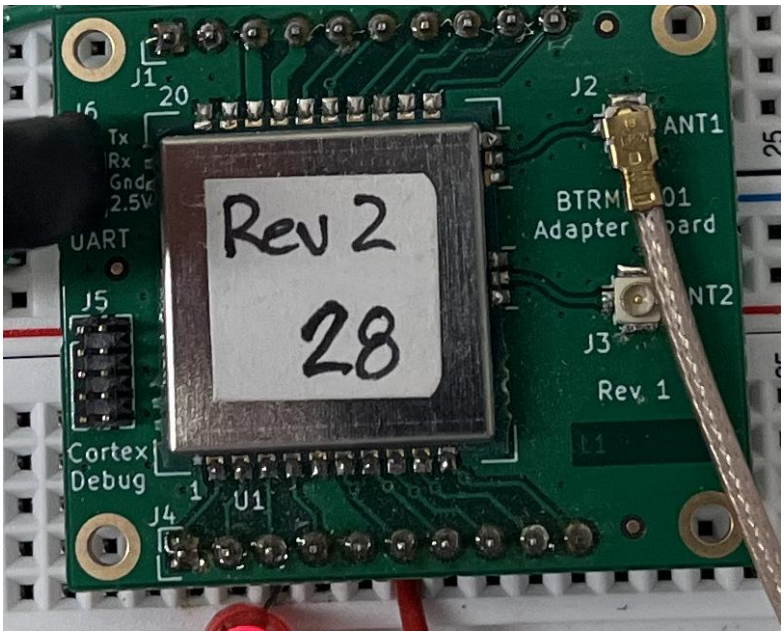


Figure 1: BTRM-001 Radio Module

Equipment Under Test (EUT)

Equipment	2400 MHz
Description	Short range radio transceiver module, 802.15.4
Manufacturer	Cast Group of Companies Inc.
Model No.	BTRM-001
Serial No.	28
Clock frequencies tuned upon within the EUT: Highest frequency generated within the EUT:	16 MHz, 48MHz 2480 MHz

Equipment Under Test (EUT) – RF Information

RF device type	DTS
Model No. (HVIN)	BTRM-001
Operating frequency	2405-2480 MHz
Number of available Channels/Transmitter	16
Channel separation	5 MHz
Channel bandwidth	2 MHz
Output Power/Transmitter	10 dBm
Modulation type	O-QPSK DSSS
Test Channels (L, M, H)	2405 MHz, 2445 MHz, 2480 MHz
Data Rate	250 kbps
Adaptive	No
Geo-location-capable	No
Number of antennas	2 (only one transmission at a time)
Antenna type	Flexible printed circuit, stick-on dipole
Antenna gain	4.0 dBi

Notes: None.

Equipment Under Test (EUT) – General Information

Tested as	Table top
Dimensions	20 x 20 x 3.4 mm
Declared operating temperature range:	-30 to +70 °C
Input power	3V, 40mA, 120 mW
Grounded	No
Device use	Transmitter module – Fixed, Mobile, Portable

Notes: None.

Test Modes

Test Mode	Transmitter State	Power
1	ON – O-QPSK DSSS	Powered from Universal Power Supply manufactured by Protek
2	OFF – Rx only	Powered from Universal Power Supply manufactured by Protek

Auxiliary Manufacturer Supplied Equipment

Equipment	Manufacturer	Product Description	Model No.
Aux 1	Lenovo	Laptop with Python script for controlling EUT	Model No
Aux 2	FTDI	USB serial port adapter cable	TTL-232RG

2.2 Environmental Conditions

The equipment under test was operated and tested under the following environmental conditions:

Parameter	Conditions
Location	Indoors – QAI Burnaby
Temperature	24.2 °C
Relative Humidity	41%

2.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz-1GHz	± 2.40 dB
Radiated Emissions, 1GHz-40GHz	± 2.48 dB
Radio Frequency	±1.5 x 10-5 MHz
Total RF Power Conducted	±1.36 dB
Spurious Emissions, Conducted	±1.36 dB
RF Power Density, Conducted	±1.36 dB
Temperature	±1ºC
Humidity	±5 %
DC and low frequency voltages	±3 %

2.4 Worst Test Case

Worst-case orientation was determined during the preliminary testing. The final radiated emissions were performed in the worst-case orientation.

2.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohde & Schwarz. Transducer factors such as antenna factors, cable losses and amplifier gains were stored in the test templates which are used to perform the emissions measurements. After the test is finished, data is generated from the EMC32 consisting of product details, emission plots and final data tables as shown below.

Frequency (MHz)	Q-Peak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Ant. Ht. (cm)	Pol	Turntable Position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
42.663900	33.0	1000.000	120.000	100.0	H	70.0	13.2	7.5	40.5

Table 2: Sample Quasi-Peak Correction Data – Radiated

Quasi-Peak reading shown in the table above is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

Or

Corr.(dB) = Antenna factor + Cable Loss - Amp gain (if pre-amplifier was used)

The final Quasi peak reading shown in the data is calculated by the software using following equation:

Corrected Quasi-Peak (dBµV/m) = Raw Quasi-Peak Reading + Antenna factor + Cable loss

To obtain the final Quasi-Peak or Average reading during power line conducted emissions, transducer factors are included in the final measurement as shown below.

Frequency (MHz)	Q-Peak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	44.3	1000.000	9.000	GND	0.6	21.7	66.0

Table 3: Sample Quasi-Peak Correction Data - Conducted Emissions

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150	27.2	1000.000	9.000	GND	0.6	28.8	56.0

Table 4: Sample Average Correction Data- Conducted Emissions

Quasi Peak or Average reading shown in the preceding table is already corrected by the software using the correction factor shown in column "Corr." The correction factor listed under "Corr." table calculated as:

Corr.(dB) = Antenna factor + Cable loss

The final Quasi-peak or Average reading shown in the data is calculated by the software using following equation:

Corr. Quasi-Peak/Average Reading (dBµV) = Raw Quasi-Peak/Average Reading + Antenna factor + Cable loss

The allowable margin from the limits, as per the standards, were calculated for both radiated and conducted emissions:

Margin(dB) = Limit – Quasi-Peak or Average reading

3 DATA & TEST RESULTS

3.1 Antenna Requirements

Date Performed: January 8, 2025

Test Standard: FCC CFR 47 Part 15.203
RSS-Gen Issue 5

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Regulations:

The purpose of this requirement is to make certain that no other antenna, except for that provided by the responsible party, shall be used with the Equipment-Under-Test (EUT) as defined in Section 1.1.

"An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited." … "the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in the Part are not exceeded."

Data:

Ant port.	Manufacturer	Part Number	Type	Connection	Max Gain (dBi)
1	Pulse Electronics	W3334B0100	Flexible Printed Circuit Stick-on Dipole	U.FL	4.0
2	SAME AS ABOVE				

Note(s): Antenna gain provided by manufacturer of antenna

- Only one antenna transmits or receives at a time, the module is not equipped with simultaneous transmissions and reciever.

3.2 RF Peak Output Power

Date Performed:	January 9, 2025
Test Standard:	FCC CFR 47 Part 15.247 (b)(3) RSS-247 Issue 3 (5.4 d)
Test Method:	ANSI C63.10: 2013 11.9.1.1
Modifications:	None.
Final Result:	Complies

Applicable Regulation:

FCC 47 CFR Part 15.247 (b)(3): Peak Conducted Output Power

> For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation ar possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

RSS-247 Issue 3 (5.4 d): Peak Conducted Output Power

> For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The E.I.R.P shall not exceed 4 W, except as provided for fixed point-to-point systems.
>
> As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per FCC KDB 558074 D01 DTS Measurement Guidance V04.

Measurement Data and Plots:

Carrier Frequency (MHz)	Modulation	Raw Peak (dBm)	Correction Factor[1] (dB)	Corrected Peak Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Results
2405	O-QPSK	-10.47	20.80	10.33	30	19.67	Complies
2445	O-QPSK	-10.46	20.70	10.24	30	19.76	Complies
2480	O-QPSK	-10.70	21.00	10.30	30	19.70	Complies
Correction factor consists of cable loss, external attenuator, and adapter(s)							

Table 5: RF Peak Output Power at Antenna Port 1

Carrier Frequency (MHz)	Modulation	Corrected Peak Conducted Output Power (dBm)	Antenna Gain[1] (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Results
2405	O-QPSK	10.33	4.0	14.33	36	21.67	Complies
2445	O-QPSK	10.24	4.0	14.24	36	21.76	Complies
2480	O-QPSK	10.30	4.0	14.30	36	21.70	Complies
Antenna gain provided by manufacturer and not independently verified by QAI							

Table 6: EIRP at Antenna Port 1

Carrier Frequency (MHz)	Modulation	Raw Peak (dBm)	Correction Factor[1] (dB)	Corrected Peak Conducted Output Power (dBm)	Limit (dBm)	Margin (dB)	Results
2405	O-QPSK	-11.15	20.80	9.65	30	20.35	Complies
2445	O-QPSK	-11.07	20.70	9.63	30	20.37	Complies
2480	O-QPSK	-11.26	21.00	9.74	30	20.26	Complies
Correction factor consists of cable loss, external attenuator, and adapter(s)							

Table 7: RF Peak Output Power at Antenna Port 2

Carrier Frequency (MHz)	Modulation	Corrected Peak Conducted Output Power (dBm)	Antenna Gain[1] (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Results
2405	O-QPSK	9.65	4.0	13.65	36	22.35	Complies
2445	O-QPSK	9.63	4.0	13.63	36	22.35	Complies
2480	O-QPSK	9.74	4.0	13.74	36	22.26	Complies
Antenna gain provided by manufacturer and not independently verified by QAI							

Table 8: EIRP at Antenna Port 2

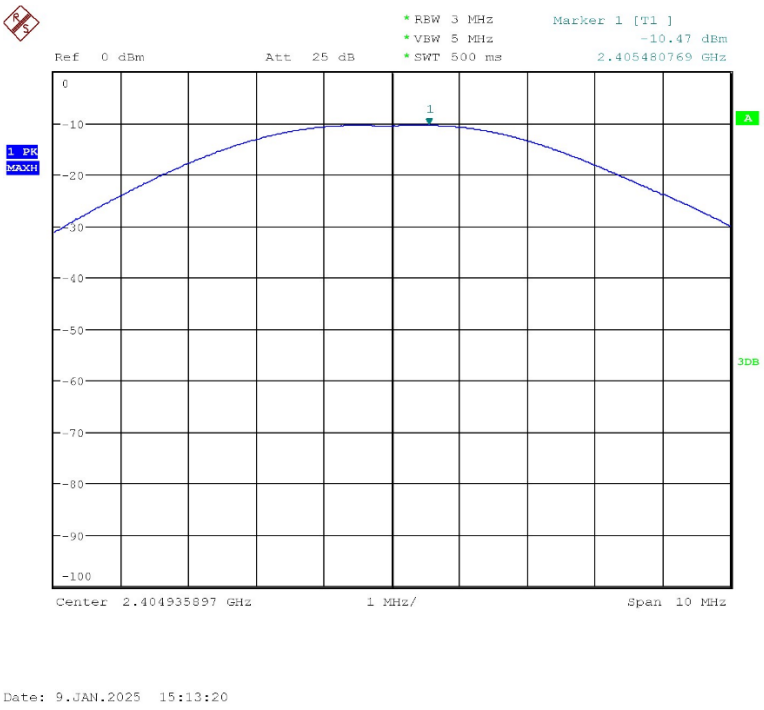


Figure 2: Peak Output Power at Antenna Port 1 – Low Channel

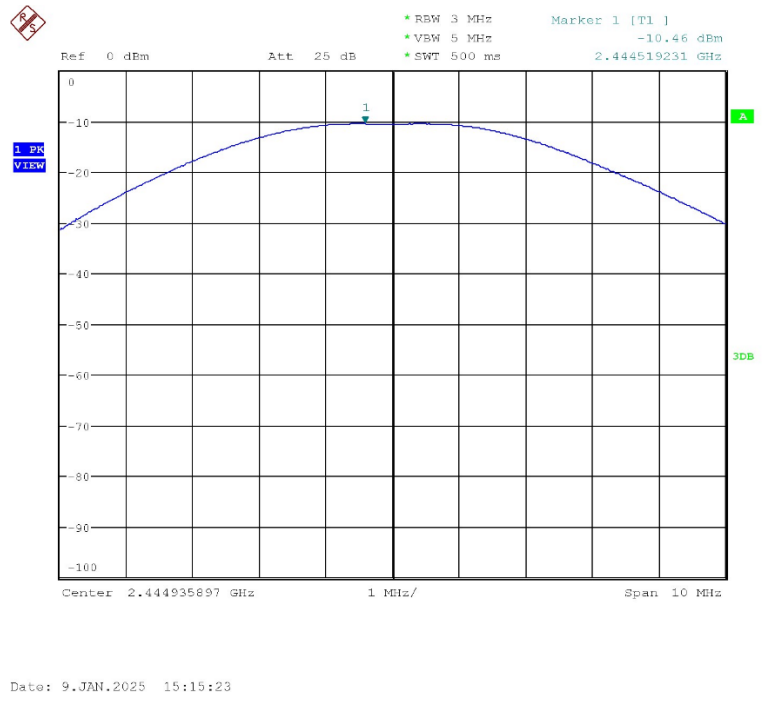


Figure 3: Peak Output Power at Antenna Port 1 – Mid Channel

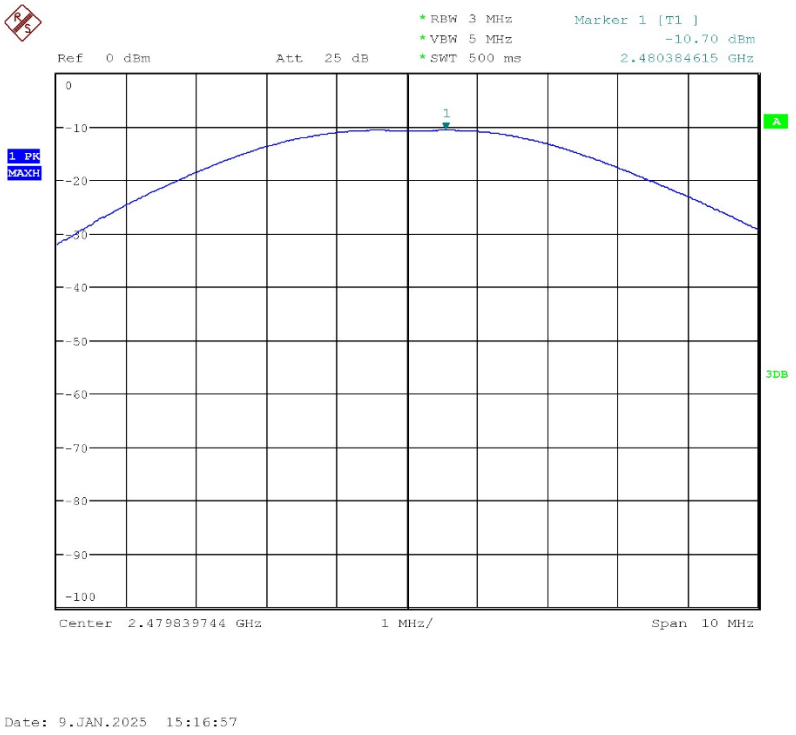


Figure 4: Peak Output Power at Antenna Port 1 – High Channel

Figure 5: Peak Output Power at Antenna Port 2 – Low Channel

Figure 6: Peak Output Power at Antenna Port 2 – Mid Channel

Figure 7: Peak Output Power at Antenna Port 2 – High Channel

3.3 Power Spectral Density

Date Performed: January 8, 2025

Test Standard: FCC CFR 47 Part 15.247 (e)
RSS-247 Issue 3

Test Method: ANSI C63.10: 2013 11.10.2

Modifications: None.

Final Result: Complies

Applicable Regulation:

FCC 47 CFR Part 15.247 (e): Power Spectral Density

> For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The same method of determining the conducted output power shall be used to determine the power spectral density.

RSS-247 Issue 3 (5.2 b): Power Spectral Density

> The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The power spectral density shall be determined using the same method as is used to determine the conducted output power.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per FCC KDB 558074 D01 DTS Measurement Guidance V04.

Measurement Data and Plots:

Carrier Frequency (MHz)	Modulation	Raw Peak (dBm/3kHz)	Correction Factor[1] (dB)	Corrected Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Results
2405	O-QPSK	-30.07	20.80	-9.27	8	17.27	Complies
2445	O-QPSK	-27.01	20.70	-6.31	8	14.31	Complies
2480	O-QPSK	-27.09	21.00	-6.09	8	14.09	Complies
Correction factor consists of cable loss, external attenuator, and adapter(s)							

Table 9: Power Spectral Density at Port 1

Carrier Frequency (MHz)	Modulation	Raw Peak (dBm/3kHz)	Correction Factor[1] (dB)	Corrected Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Results
2405	O-QPSK	-28.47	20.80	-7.67	8	15.67	Complies
2445	O-QPSK	-27.90	20.70	-7.20	8	15.20	Complies
2480	O-QPSK	-27.58	21.00	-6.58	8	14.58	Complies
Correction factor consists of cable loss, external attenuator, and adapter(s)							

Table 10: Power Spectral Density at Port 2

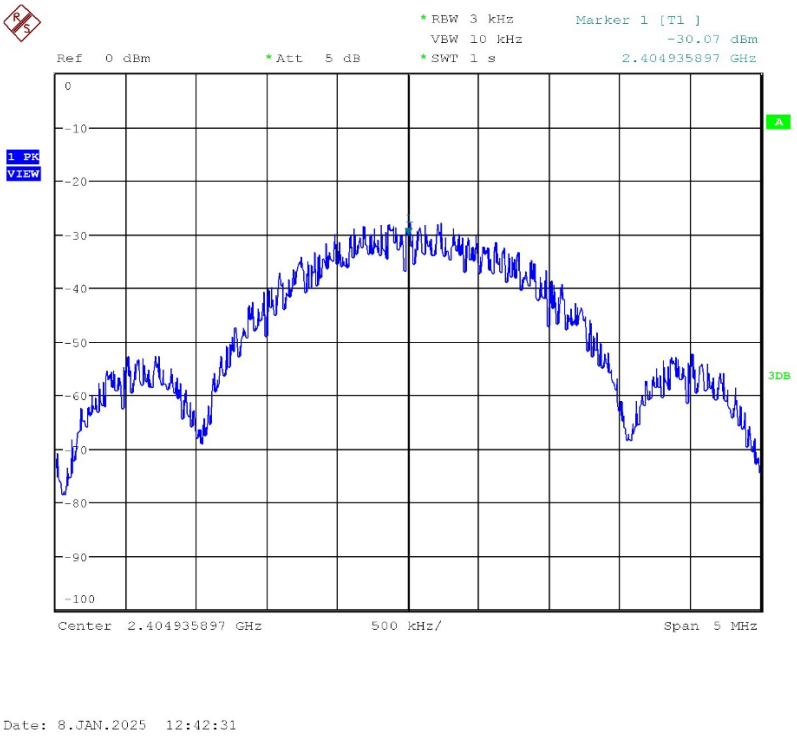


Figure 8: Power Spectral Density at Antenna Port 1 – Low Channel

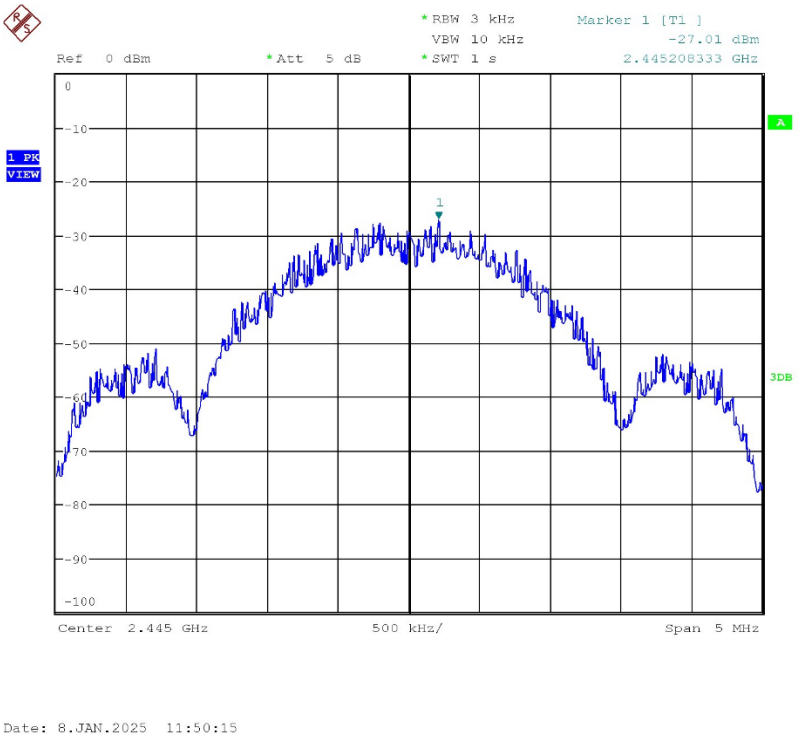


Figure 9: Power Spectral Density at Antenna Port 1– Mid Channel

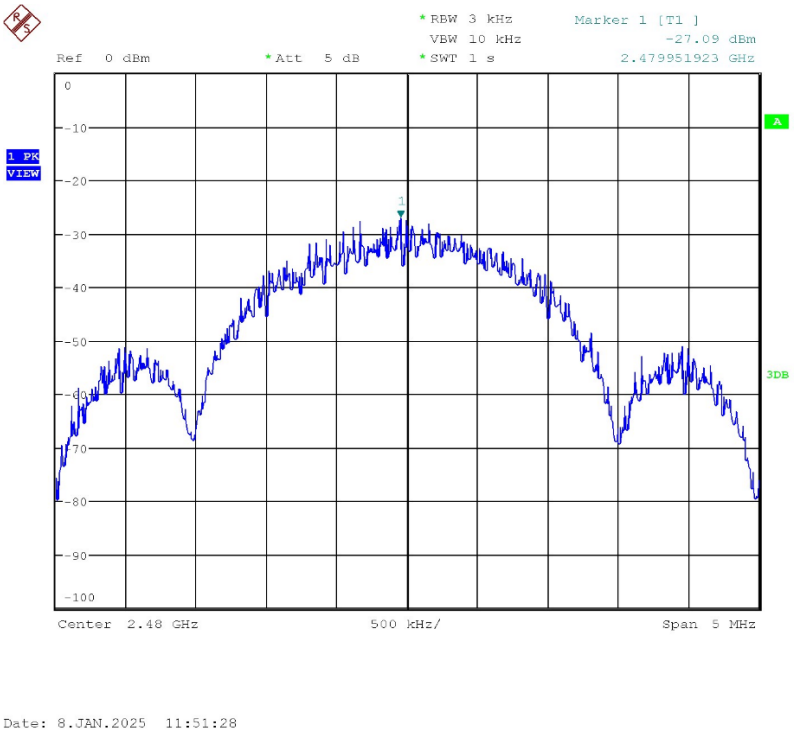


Figure 10: Power Spectral Density at Antenna Port 1 – High Channel

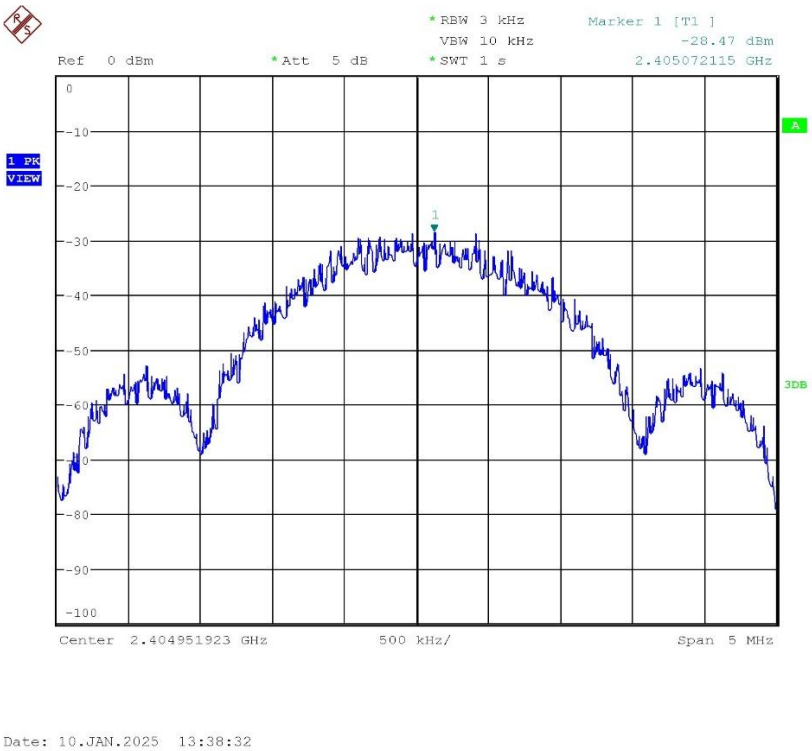


Figure 11: Power Spectral Density at Antenna Port 2 – Low Channel

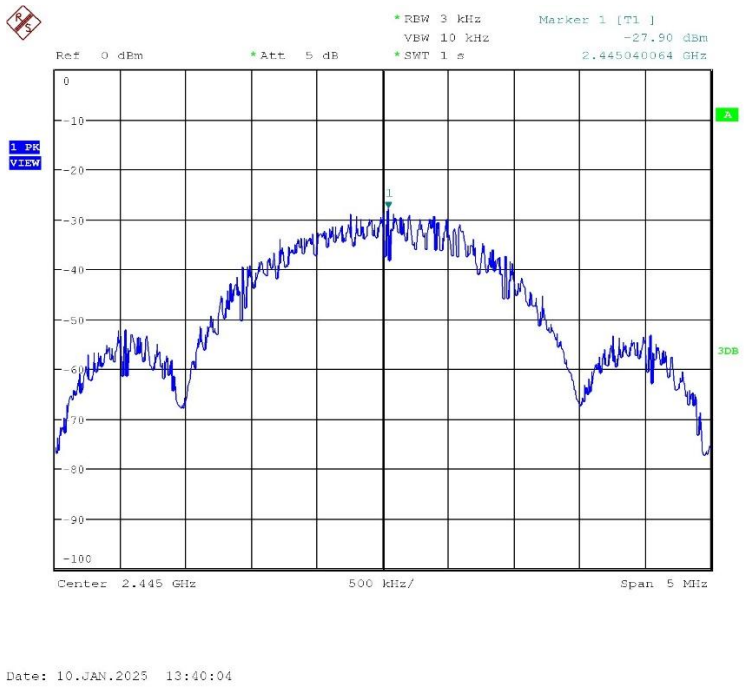


Figure 12: Power Spectral Density at Antenna Port 2 – Mid Channel

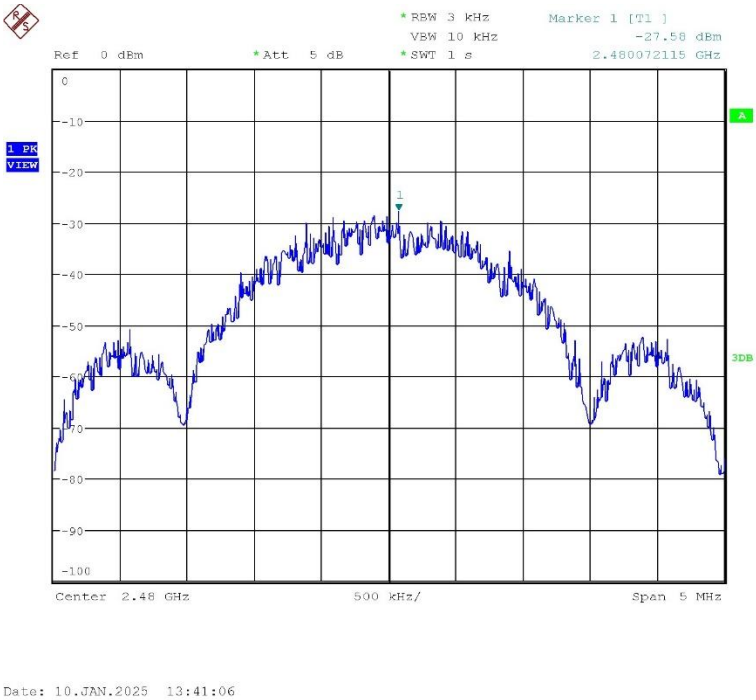


Figure 13: Power Spectral Density at Antenna Port 2– High Channel

3.4 6 dB Bandwidth

Date Performed: January 8, 2025

Test Standard: FCC 47 CFR Part 15.247 (a)(2)
RSS-247 Issue 3 (5.2)

Test Method: ANSI C63.10: 2013 11.10.2

Modifications: None

Final Result: Complies

Applicable Regulations:

FCC 47 CFR Part 15.247 (a)(2): Occupied Bandwidth

> Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

RSS-247 Issue 3 (5.2 a): Occupied Bandwidth

> DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequency systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz: The minimum 6 dB bandwidth shall be 500 kHz.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per ANSI C63.10: 2013.

A spectrum analyzer or other instrument providing a spectral display is recommended for these measurements. When using a spectrum analyzer or other instrument providing a spectral display, the video bandwidth shall be set to a value at least three times greater than the IF bandwidth of the measuring instrument to avoid the introduction of unwanted amplitude smoothing. Video filtering is not used during occupied bandwidth tests.

Measurement Data and Plots:

Channels	Carrier Frequency (MHz)	Modulation	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)	Result
Low	2405	O-QPSK	1482	500	982	Complies
Middle	2445	O-QPSK	1330	500	830	Complies
High	2480	O-QPSK	1322	500	822	Complies

Table 11: 6 dB Bandwidth Results at Port 1

Channels	Carrier Frequency (MHz)	Modulation	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)	Result
Low	2405	O-QPSK	1482	500	982	Complies
Middle	2445	O-QPSK	1290	500	790	Complies
High	2480	O-QPSK	1514	500	1014	Complies

Table 12: 6 dB Bandwidth Results at Port 2

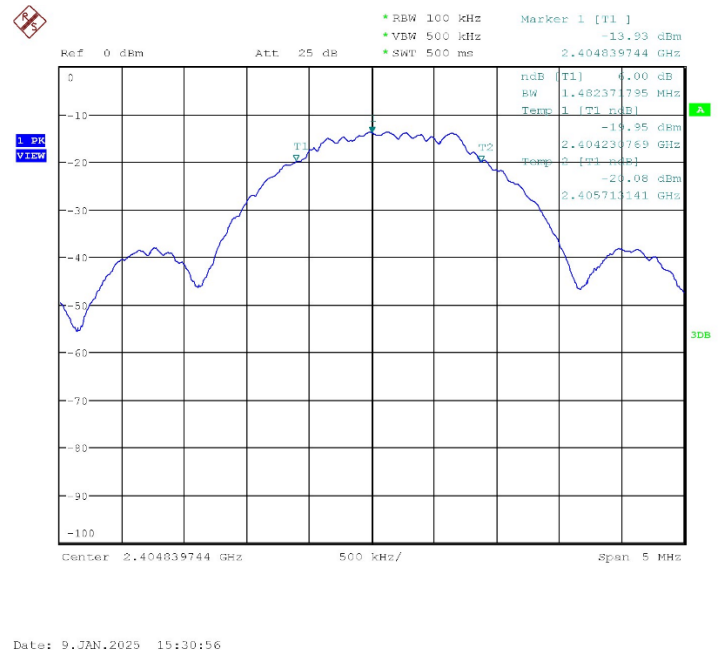


Figure 14: 6 dB Bandwidth at Antenna Port 1– Low Channel

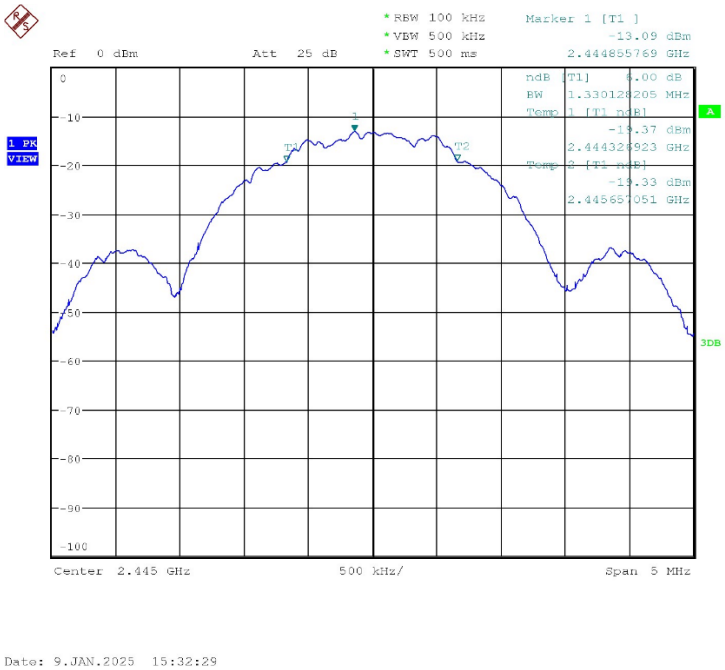


Figure 15: 6 dB Bandwidth at Antenna Port 1 – Mid Channel

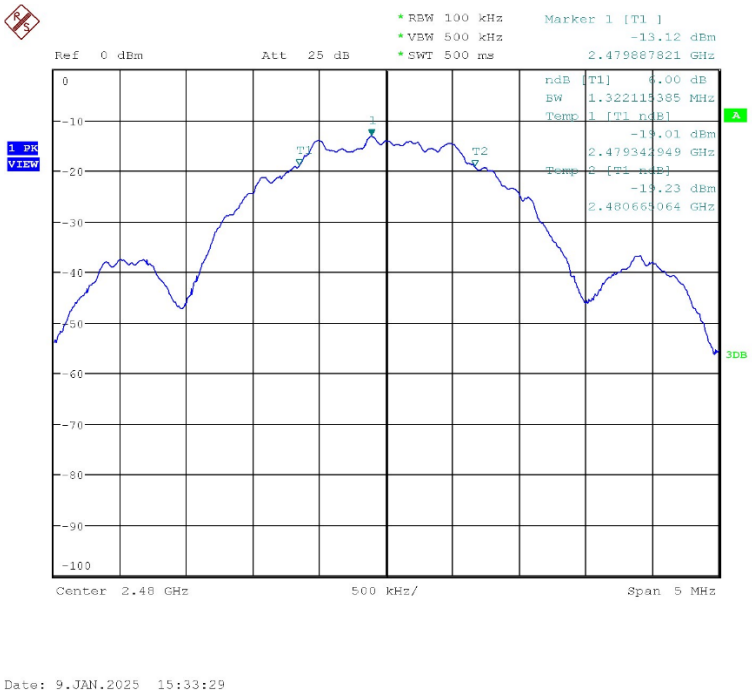


Figure 16: 6 dB Bandwidth at Antenna Port 1- High Channel

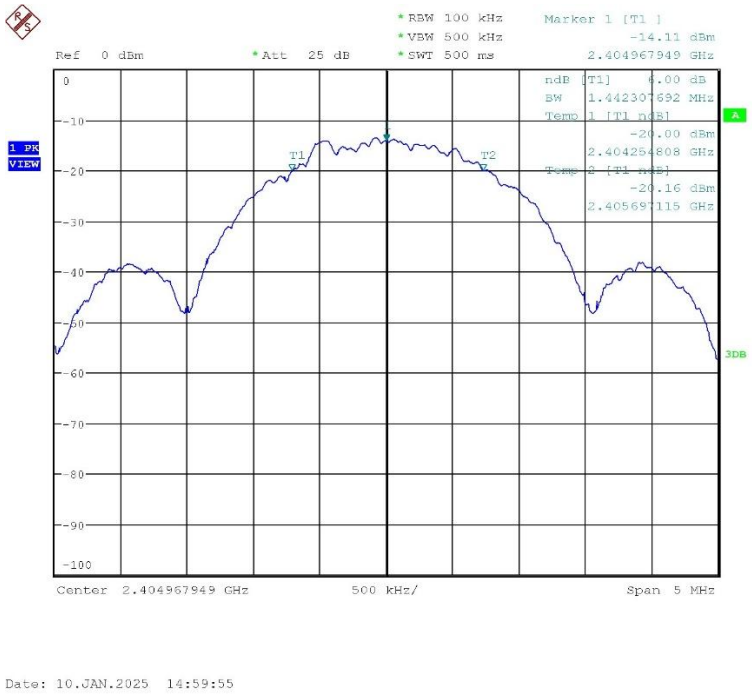


Figure 17: 6 dB Bandwidth at Antenna Port 2 - Low Channel

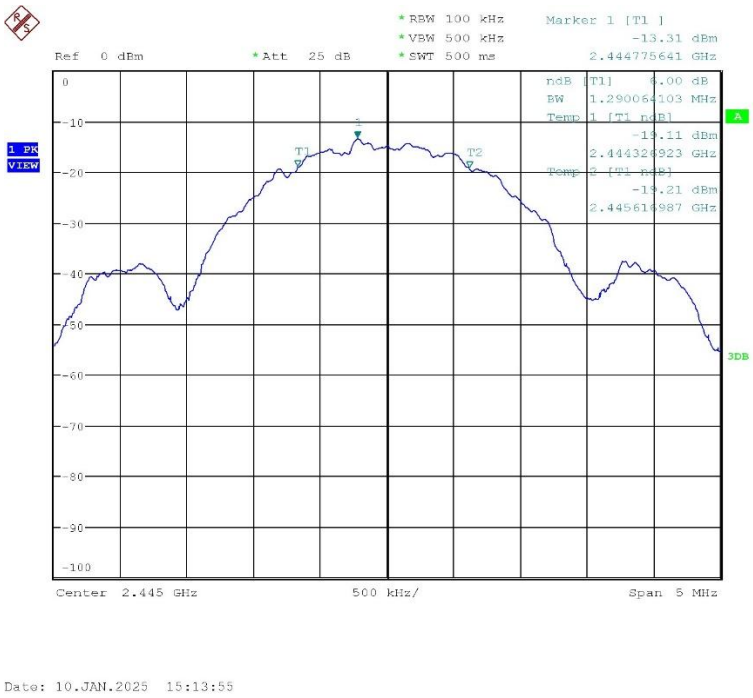


Figure 18: 6 dB Bandwidth at Antenna Port 2 - Mid Channel

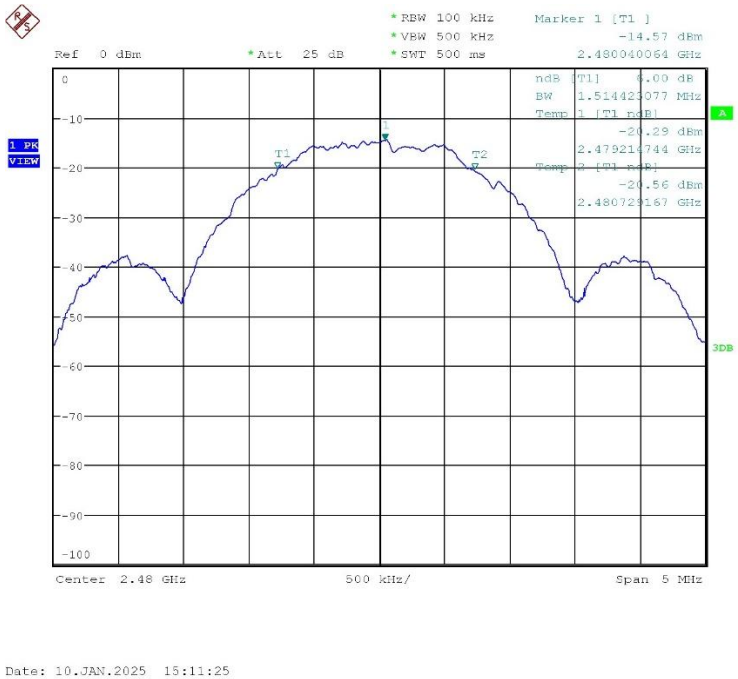


Figure 19: 6 dB Bandwidth at Antenna Port 2- High Channel

3.5 Out-Of-Band Emissions (Band Edge)

Date Performed: January 8, 2025

Test Standard: FCC 47 CFR Part 15.247 (d)
RSS-247 Issue 3 (5.5)

Test Method: ANSI C63.10: 2013 6.10.4

Modifications: None

Final Result: Complies

Applicable Regulation:

FCC 47 CFR Part 15.247 (d): Out of Band Emissions

> In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, shall be at least 20 dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, the attenuation required shall be 30 dB instead of 20dB.

RSS-247 Issue 3 (5.5): Unwanted Emissions

> In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per ANSI C63.10:2013.

Measurement Data and Plots:

Band Edge	Carrier Frequency (MHz)	Modulation	Highest Out of Band Emission (dB)	Limit (dB)	Margin (dB)	Result
Low	2405	O-QPSK	-38.70	-20	18.70	Complies
High	2480	O-QPSK	-36.96	-20	16.96	Complies

Table 13: Band Edge Results at Port 1

Band Edge	Carrier Frequency (MHz)	Modulation	Highest Out of Band Emission (dB)	Limit (dB)	Margin (dB)	Result
Low	2405	O-QPSK	-39.80	-20	19.80	Complies
High	2480	O-QPSK	-38.16	-20	18.16	Complies

Table 14: Band Edge Results at Port 2

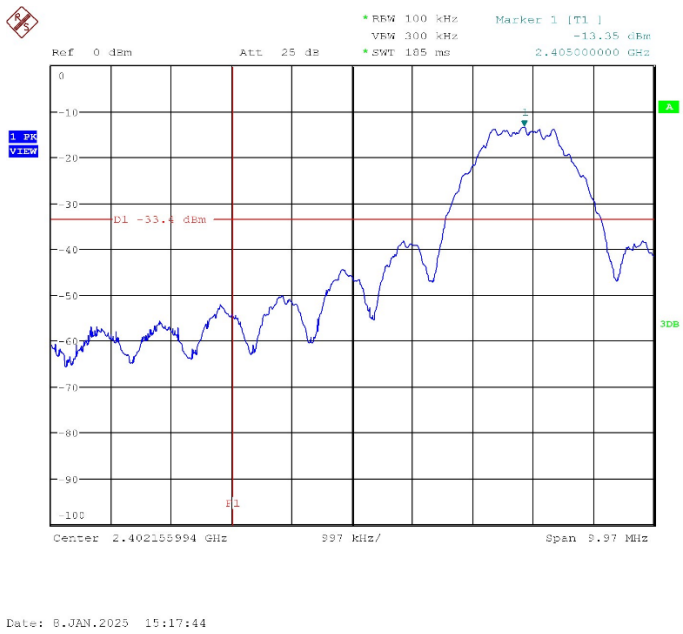


Figure 20: Band Edge - Low Channel at Port 1

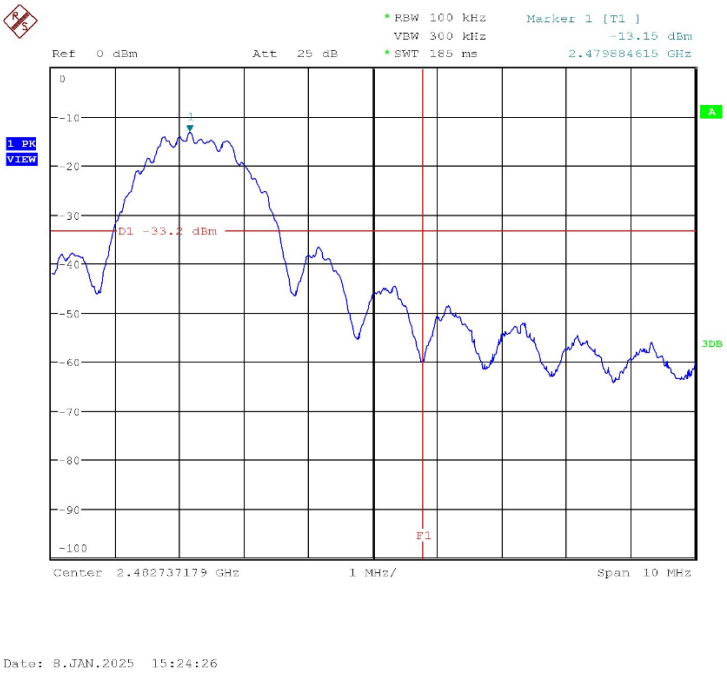


Figure 21: Band Edge - High Channel at Port 1

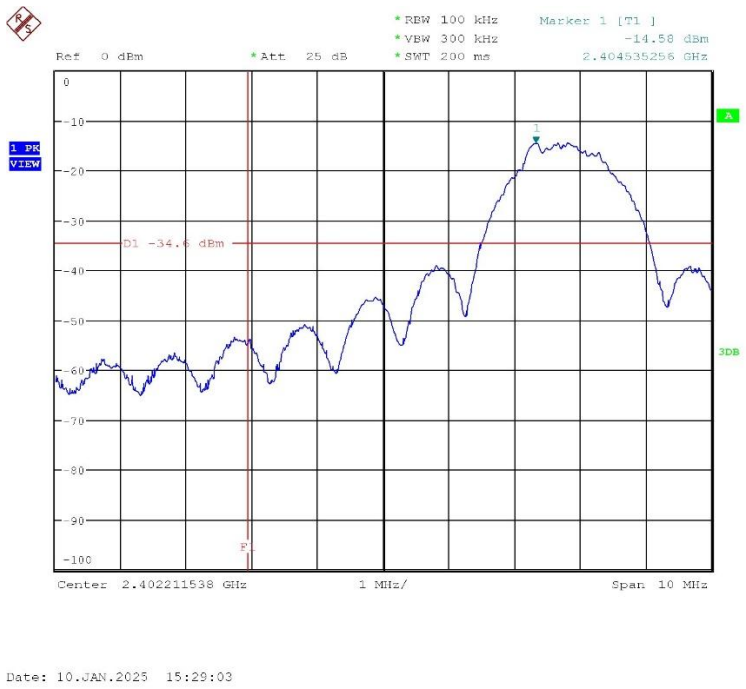


Figure 22: Band Edge - High Channel at Port 2

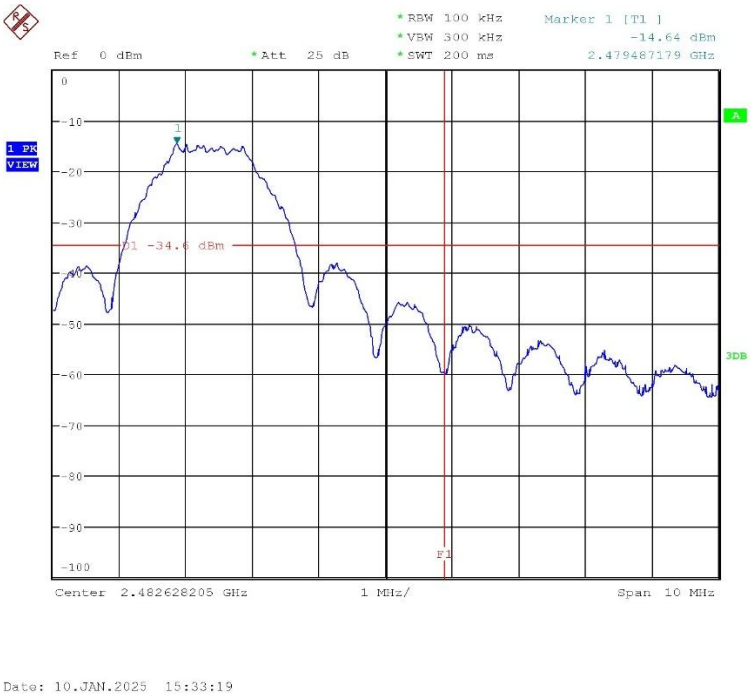


Figure 23: Band Edge - High Channel at Port 2

3.6 Receiver Conducted Emissions

Date Performed: December 17, 2024

Test Standard: RSS-Gen Issue 5 (7.4)

Test Method: ANSI C63.10: 2013 11.12.2.4

Modifications: None

Final Result: Complies

Applicable Regulation:

RSS-Gen Issue 5 (7.4): Receiver Conducted Emissions Limits

> If the receiver has a detachable antenna of known impedance, an antenna-conducted spurious emissions measurement is permitted as an alternative to radiated measurement. However, the radiated method of section 7.3 is preferred.
>
> The antenna-conducted test shall be performed with the antenna disconnected and with the receiver antenna port connected to a measuring instrument having equal input impedance to that specified for the antenna. The RF cable connecting the receiver under test to the measuring instrument shall also have the same impedance to that specified for the receiver's antenna.
>
> The spurious emissions from the receiver at any discrete frequency, measured at the antenna port by the antenna-conducted method, shall not exceed 2 nW in the frequency range 30-1000 MHz and 5 nW above 1 GHz.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per ANSI C63.10:2013.

Measurement Data and Plots:

Frequency Range	Highest Emission (pW)	Limit (pW)	Margin (pW)	Result
30 – 1000 MHz	74.943	2000	1925.057	Complies
1 – 25 GHz	85.035	5000	4914.965	Complies

Table 15: Receiver Emissions Results at Port 1

Frequency Range	Highest Emission (pW)	Limit (pW)	Margin (pW)	Result
30 – 1000 MHz	23.699	2000	1976.301	Complies
1 – 25 GHz	26.036	5000	4973.964	Complies

Table 16: Receiver Emissions Results at Port 2

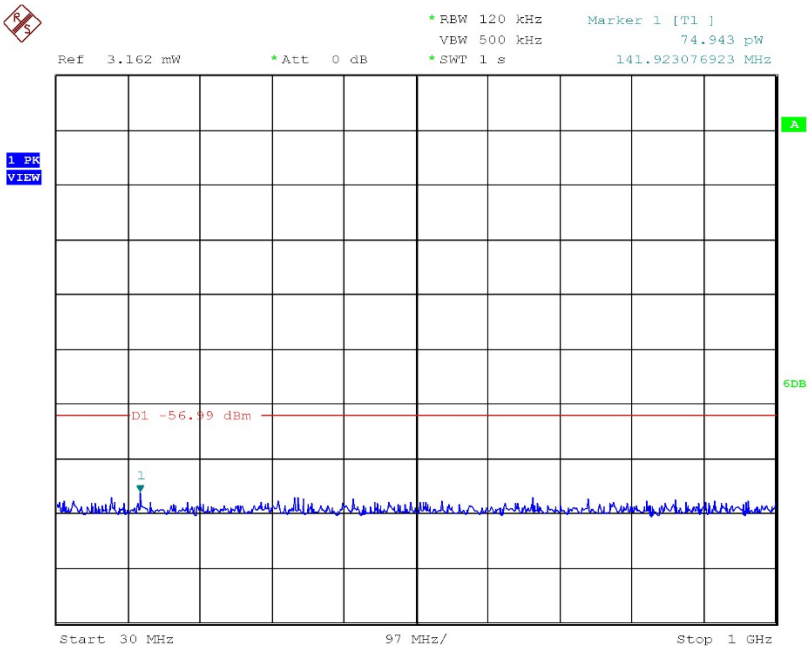


Figure 24: Receiver Emissions from 30 to 1000 MHz at Port 1

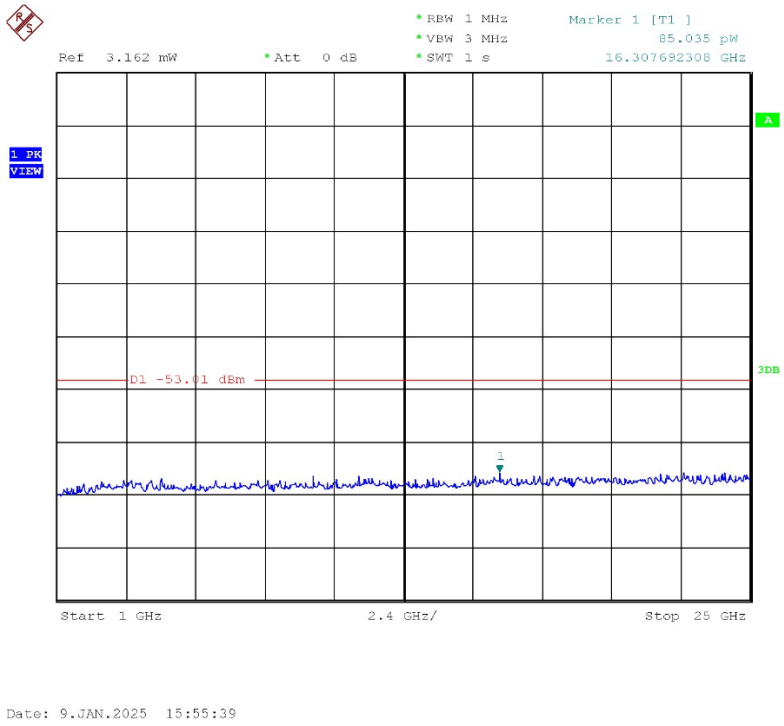


Figure 25: Receiver Emissions from 1 to 25 GHz at Port 1

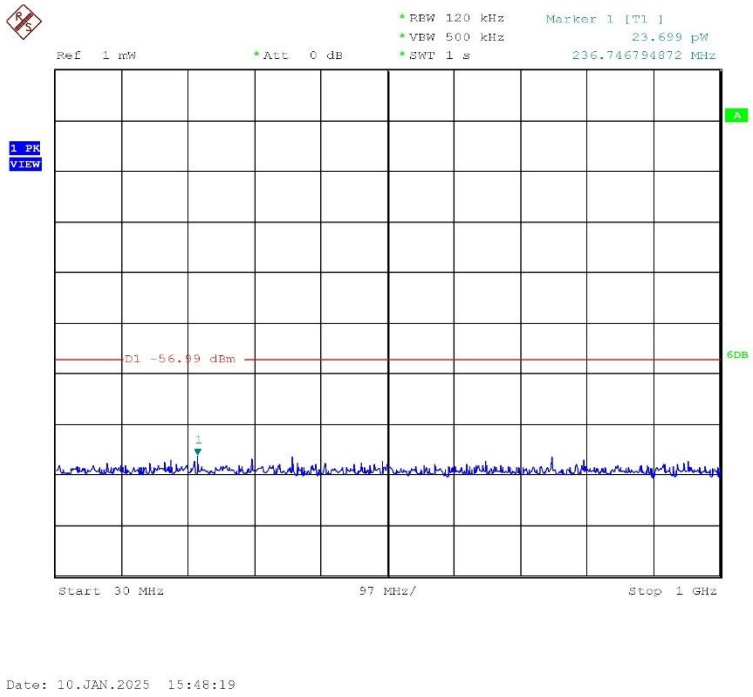


Figure 26: Receiver Emissions from 30 to 1000 MHz at Port 2

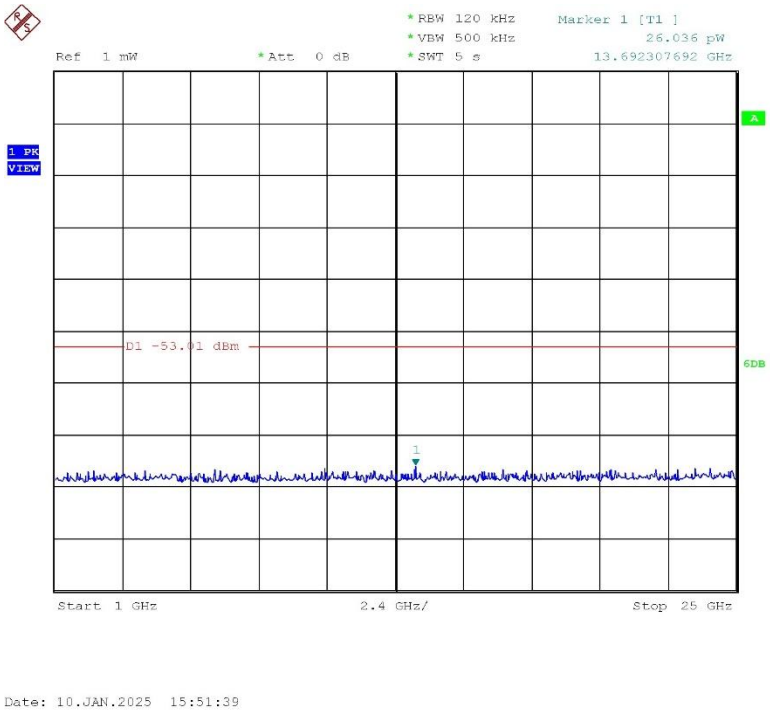


Figure 27: Receiver Emissions from 1 to 25 GHz at Port 2

3.7 Radiated Emissions

Date Performed: January 6, 2025

Test Standard: FCC 47 CFR Part 15.33 (a)(1), (5)
FCC 47 CFR Part 15.205 (a), (b)
FCC 47 CFR Part 15.209 (a)
RSS-GEN Issue 5 (8.9)
ICES-003 Issue 7 (3.2.2)

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Standard:

FCC 47 CFR Part 15.33 (a)(1), (5): Frequency range of radiated measurements

For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

FCC 47 CFR Part 15.205 (a), (b): Restricted bands of operation

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
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	2690-2900	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	
13.36-13.41			

The field strength of emissions appearing within these frequency bands shall not exceed the limits show in § 15.209

FCC 47 CFR Part 15.209 (a): Radiated emission limits; general requirements

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency, f (MHz)	Maximum Field strength Quasi-peak (dBµV/m at 3 m)
0.009 – 0.490	20*log(2400/F(kHz)) + 40 dB
0.490 – 1.705	20*log(24000/F(kHz)) + 20 dB
1.705 – 30.0	49.5
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Note 1: The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

Note 2: The emissions limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz., 110-490 kHz. and above 1000 MHz.

Radiated emission limits in these three bands are based on measurements employing an average detector

RSS-GEN Issue 5 (8.9): Transmitter Emission Limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in the following tables. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits at Frequencies Below 30 MHz		
Frequency	**Magnetic Field Strength (H-Field) (µA/m)**	**Measurement Distance (m)**
9 – 490 kHz	6.37/f (f in kHz)	300
490 – 1705 kHz	63.7/f (f in kHz	30
1.705 – 30 MHz	0.08	30

General Field Strength Limits at Frequencies Above 30 MHz	
Frequency (MHz)	**Field Strength (µV/m at 3m)**
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

ICES-003 Issue 7 (3.2.2): Radiated Emission Limits

The quasi-peak limits for the electric component of the radiated field strength emitted from the ITE or digital apparatus, within 30 MHz to 1 GHz, for a measurement distance of 3 m or 10 m are presented in the following table.

Radiated Emissions Limits (30 MHz to 1 GHz)				
Frequency Range (MHz)	**Class A (3m) QP (dBµV/m)**	**Class A (10m) QP (dBµV/m)**	**Class B (3m) QP (dBµV/m)**	**Class B (10m) QP (dBµV/m)**
30 – 88	50.0	40.0	40.0	30.0
88 – 216	54.0	43.5	43.5	33.1
216 – 230	56.9	46.4	46.0	35.6
230 – 960	57.0	47.0	47.0	37.0
960 – 1000	60.0	49.5	54.0	43.5

At and above 1 GHz, except for outdoor units of home satellite receiving systems, the ITE or digital apparatus shall comply with the limits specified in the following tables. The product under test shall comply with both he average and the peak limits.

Required Highest Measurement Frequency for Radiated Emissions	
Highest Internal Frequency (F_x)	**Field Strength (µV/m at 3m)**
$F_x \leq 108$ MHz	1 GHz
108 MHz $\leq F_x \leq$ 500 MHz	2 GHz
500 MHz $\leq F_x \leq$ 1 GHz	5 GHz
$F_x \geq 1$ GHz	5 x F_x up to a maximum of 40 GHz
F_x is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.	

Radiated Emission Limits at 3 m distance (at and above 1 GHz)				
Frequency Range (MHz)	**Class A Average (dBµV/m)**	**Class A Peak (dBµV/m)**	**Class B Average (dBµV/m)**	**Class B Peak (dBµV/m)**
1 - F_M	60	80	54	74
The highest measurement frequency, F_M, in GHz, shall be determined per the preceding table.				

Test Setup:

The EUT was tested in a 3 m SAC and was positioned on the front of the turntable. The transmitter was set for continuous transmission. The radiated output of the device was measured for all emissions from 9 kHz up to the 10th harmonic of the highest fundamental frequency.

The transmitter was set for continuous transmission at maximum transmit power and terminated antenna ports. Both ports as well as Low, Middle and High Channels were investigated. The plots and data were for the worst case emissions from High Channel when using antenna port 1.

The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed as indicated in the test photos.

Measurement Data and Plots:

3.7.1 Radiated Emissions from 9kHzMHz to 30MHz

Tested January 29, 2025:

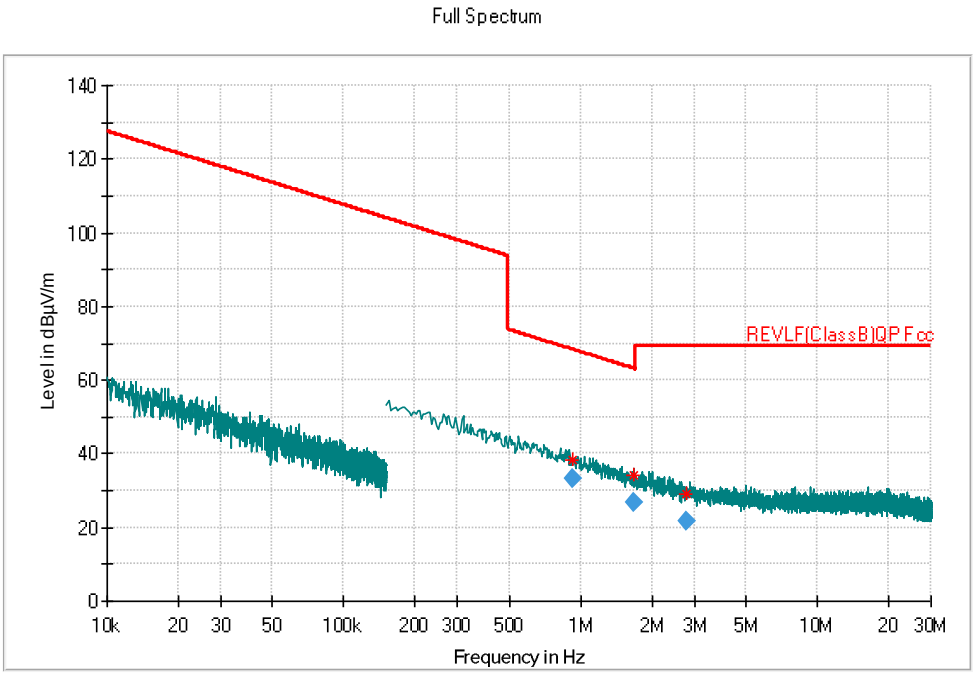


Figure 28: Radiated Emissions from 30-1000MHz Measured at 3m, Low Channel

Frequency (MHz)	Quasi-Peak (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
0.9274	33.07	100	V	147	20.5	68.27	35.20	Complies
1.6691	26.93	100	V	0	20.6	63.18	36.26	Complies
2.8061	21.81	100	V	227	20.6	69.50	47.69	Complies

[1] Correction factor includes system gains and losses

Table 17: Radiated Emissions (0.009 to 30 MHz) Loop Antenna Measured at 3m distance, High Channel

3.7.2 Radiated Emissions from 30MHz to 1000MHz

Tested January 6, 2025:

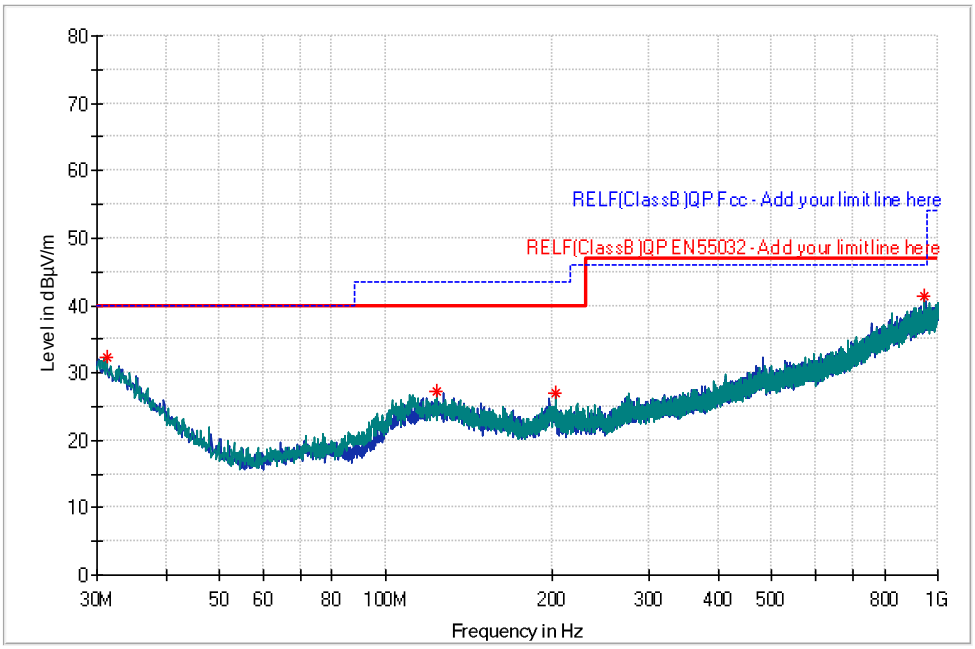


Figure 29: Radiated Emissions from 30-1000MHz Measured at 3m, Low Channel

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
31.2610	32.35	300.0	V	238	-2.9	40.00	13.05	Complies
123.4110	27.32	350	V	226	-3.7	53.90	12.68	Complies
202.8540	26.95	150	V	33	-4.5	40.00	13.05	Complies
947.5230	41.33	250	V	0	8.6	40.00	5.67	Complies

[1] Correction factor includes system gains and losses

Table 18: Radiated Emissions (30-1000 MHz) Measured at 3m, Low Channel

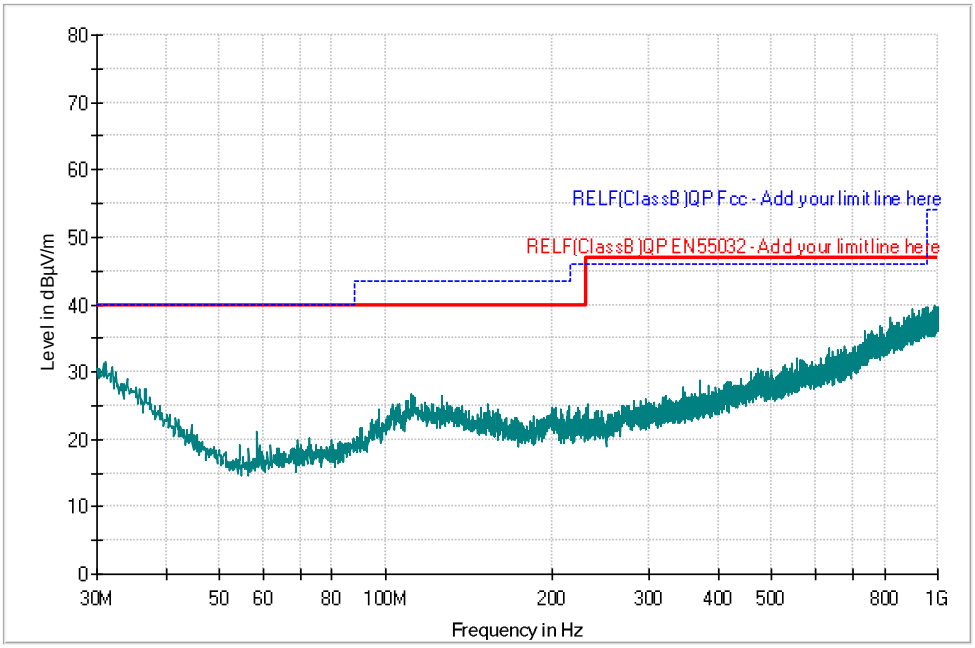


Figure 30: Radiated Emissions from 30-1000MHz Measured at 3m, Mid Channel

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
30.1434	30.91	275.0	H	107	4.6	40.00	9.09	Complies
106.6306	27.56	105.0	V	70	-5.4	40.00	12.44	Complies
200.5934	25.23	293.0	V	68	-4.3	40.00	14.77	Complies
961.2966	40.13	100.0	V	206	8.3	47.0	6.87	Complies

[1] Correction factor includes system gains and losses

Table 19: Radiated Emissions (30-1000 MHz) Measured at 3m, Mid Channel

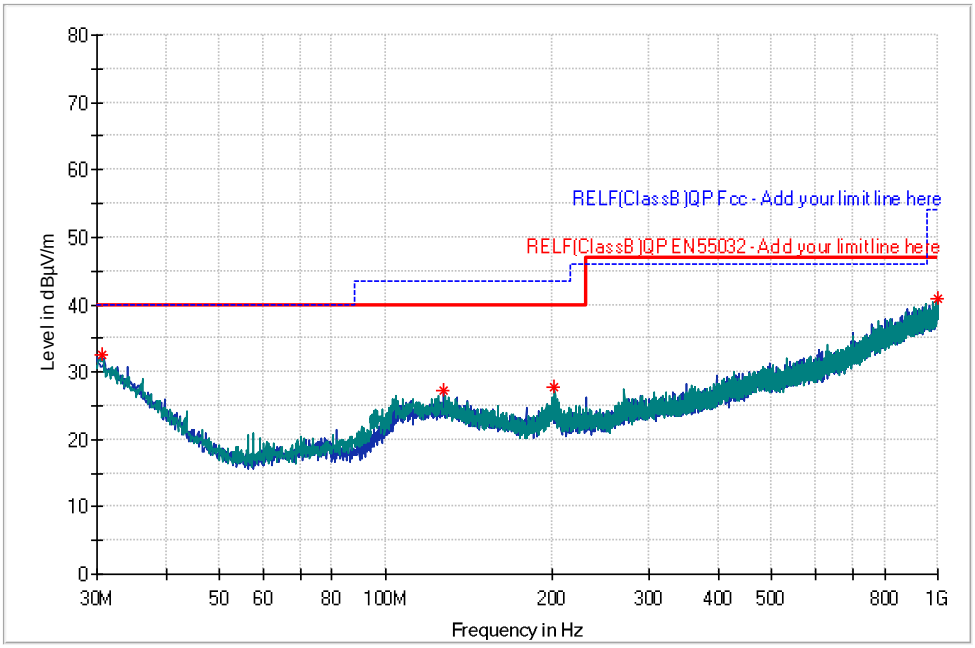


Figure 31: Radiated Emissions from 30-1000MHz Measured at 3m, High Channel

Frequency (MHz)	Peak (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
30.5820	32.62	300.0	V	128	4.3	40.00	7.38	Complies
127.3880	27.18	250.0	H	288	-2.9	40.00	12.82	Complies
202.3690	27.65	250.00	V	68	-4.4	40.00	12.35	Complies
997.7690	40.80	200.00	V	188	9.7	47.00	6.20	Complies

[1] Correction factor includes system gains and losses

Table 20: Radiated Emissions (30-1000 MHz) Measured at 3m, High Channel

3.7.3 1 GHz to 6 GHz

Tested January 6, 2025:

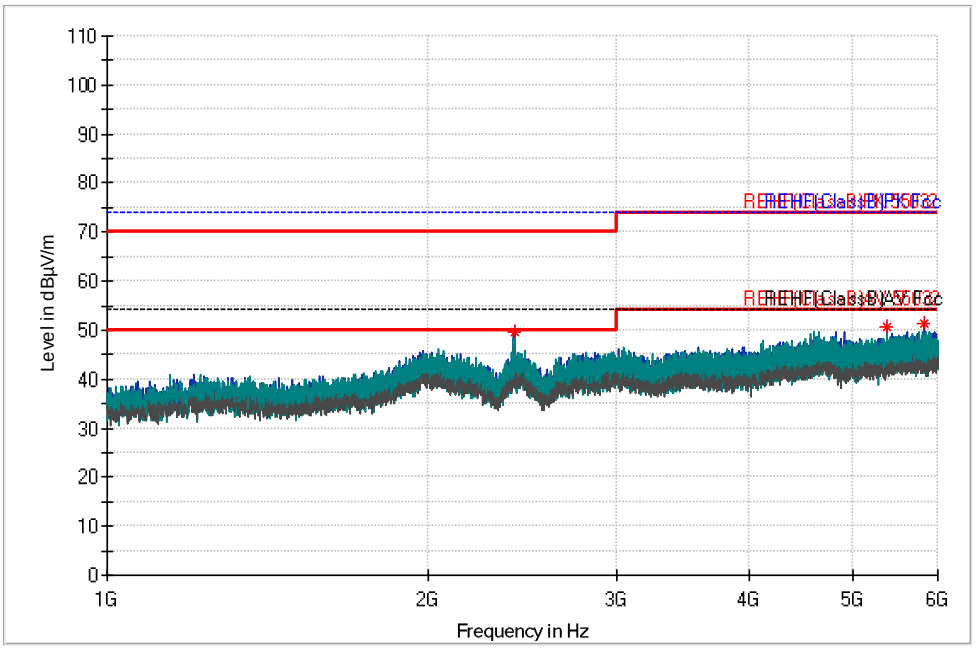


Figure 32: Radiated Emissions from 1 to 6GHz Measured at 3m, Low Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
2405.5000	49.50	100.0	H	332	0.1	70.00	20.50	Complies
5373.5000	50.55	100.0	V	280	7.4	74.00	23.45	Complies
5823.0000	51.48	100.0	H	0	8.2	74.00	22.52	Complies

[1] Correction factor includes system gains and losses

Table 21: Radiated Emissions (1-6 GHz) Measured at 3m, Average, Low Channel

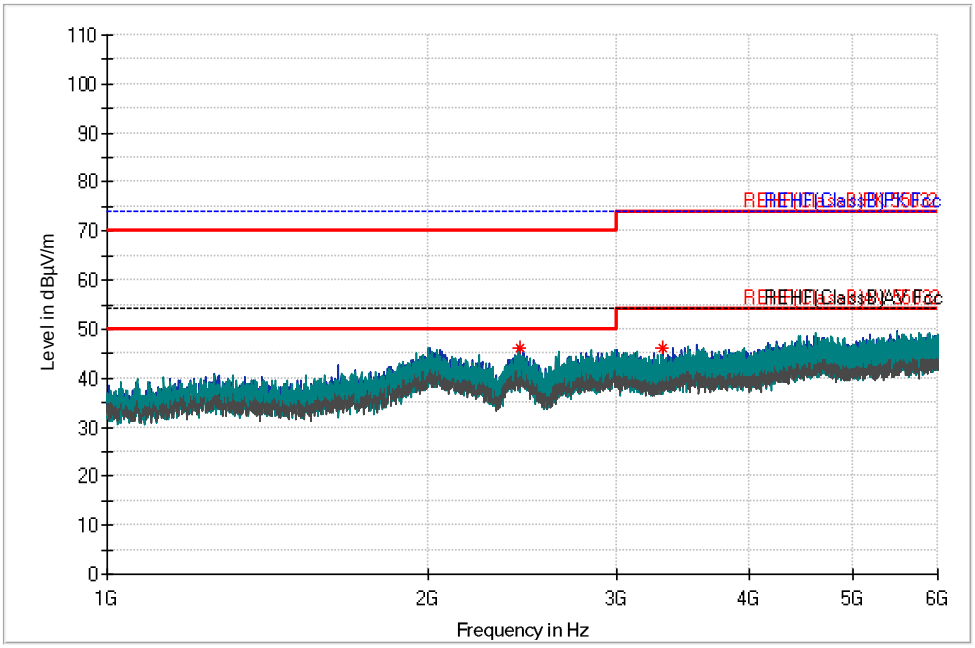


Figure 33: Radiated Emissions from 1 to 6GHz Measured at 3m, Mid Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
2433.5000	46.15	100.0	H	321	0.2	70.0	23.85	Complies
3311.0000	46.18	100.0	H	0	2.4	74.0	27.85	Complies

[1] Correction factor includes system gains and losses

Table 22: Radiated Emissions (1-6 GHz) Measured at 3m, Average, Mid Channel

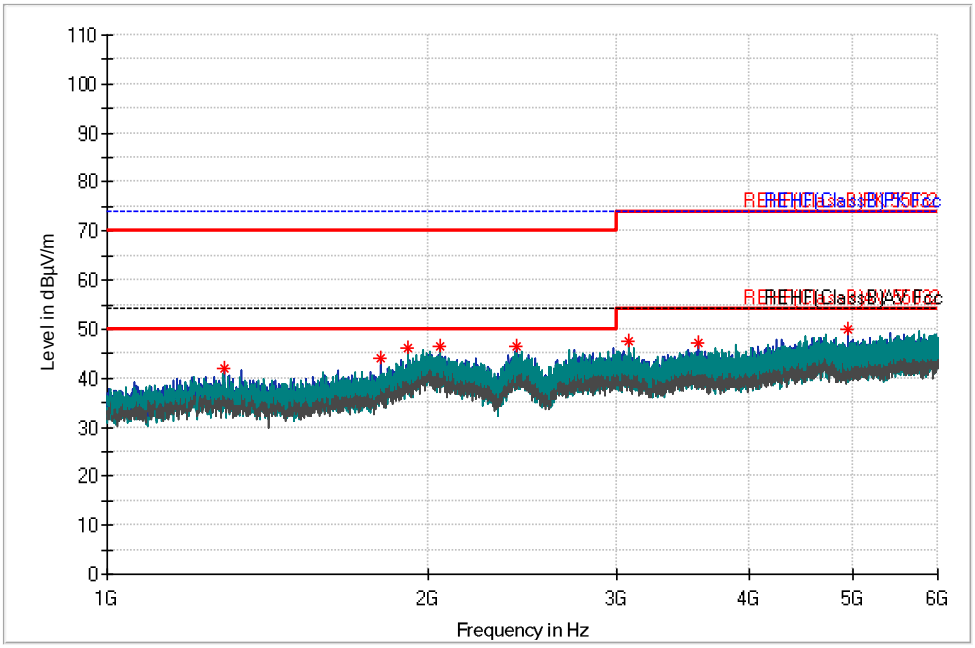


Figure 34: Radiated Emissions from 1 to 6GHz Measured at 3m, High Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
1286.0000	42.00	100.0	H	224	-5.3	70.00	28.00	Complies
1804.5000	44.10	100.0	H	147	-2.0	70.00	25.90	Complies
1911.5000	46.29	100.0	V	243	0.0	70.00	23.71	Complies
2053.0000	46.42	100.0	V	299	1.1	70.00	23.58	Complies
2422.0000	46.50	100.0	H	0	0.2	70.00	23.50	Complies
3079.0000	47.50	100.0	V	57	1.8	74.00	26.50	Complies
3574.5000	47.10	100.0	H	109	3.3	74.00	26.90	Complies
4948.0000	49.86	100.0	H	83	6.9	74.00	24.14	Complies

[1] Correction factor includes system gains and losses

Table 23: Radiated Emissions (1-6 GHz) Measured at 3m, Average, High Channel

3.7.4 6 GHz to 18 GHz

Tested November 22, 2024:

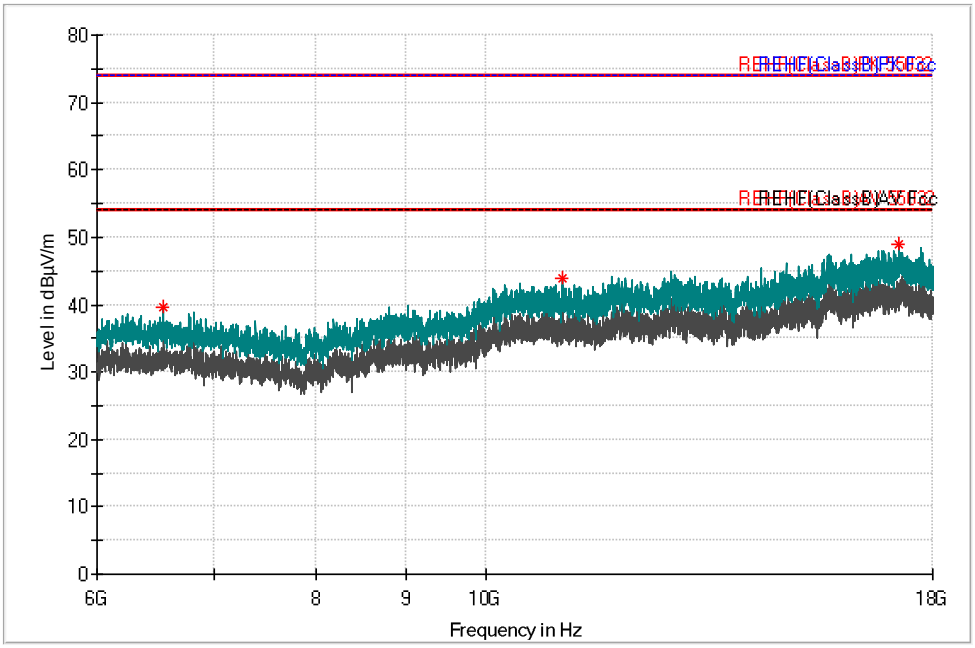


Figure 35: Radiated Emissions from 6 to 18GHz Measured at 3m, Low Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
6552.0000	39.58	100.0	V	50	-6.4	74.00	34.42	Complies
11064.0000	43.84	100.0	V	0	4.7	74.00	30.16	Complies
17229.6000	48.96	100.0	V	108	13.4	74.00	25.04	Complies

[1] Correction factor includes system gains and losses

Table 24: Radiated Emissions (6-18 GHz) Measured at 3m, Average, Low Channel

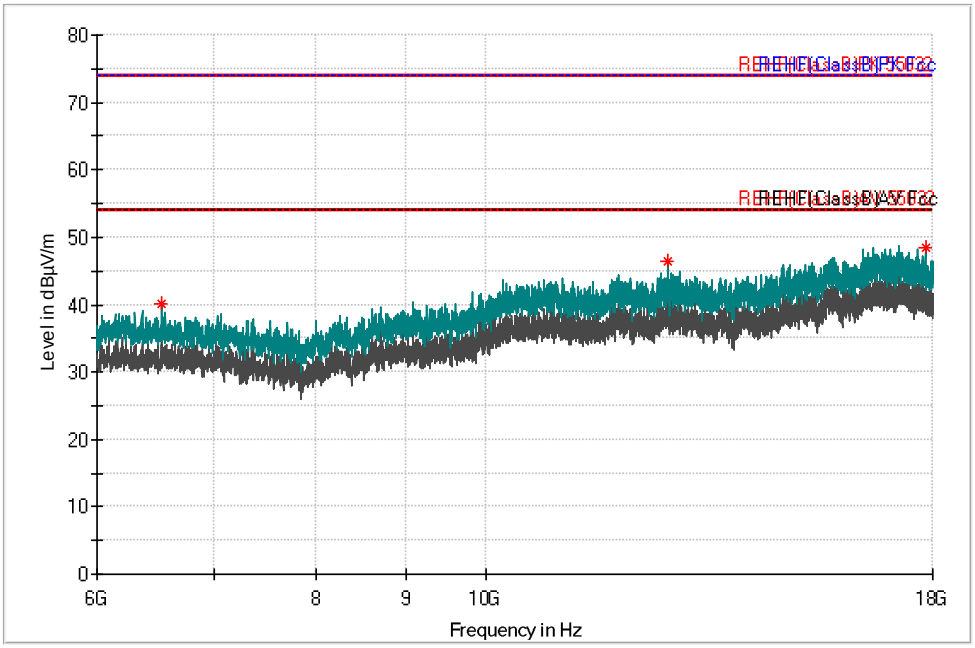


Figure 36: Radiated Emissions from 6 to 18GHz Measured at 3m, Mid Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
6195.6000	39.64	100.0	V	0	-7.3	74.00	34.36	Complies
11605.2000	44.07	100.0	V	332	5.9	74.00	29.93	Complies
15841.2000	49.12	100.0	V	347	12.4	74.00	24.88	Complies

[1] Correction factor includes system gains and losses

Table 25: Radiated Emissions (6-18 GHz) Measured at 3m, Average, Mid Channel

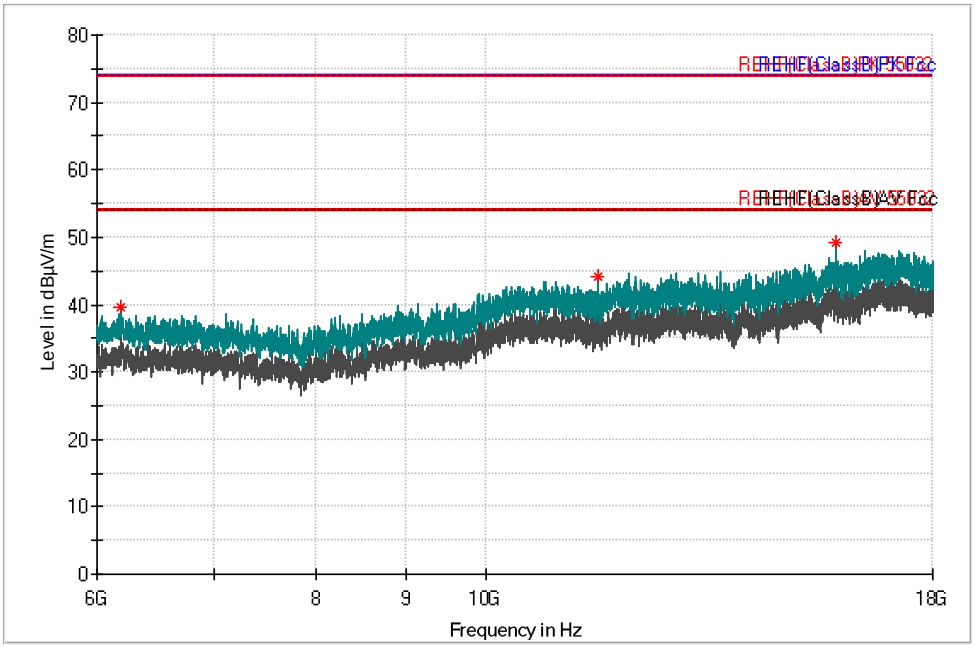


Figure 37: Radiated Emissions from 6 to 18GHz Measured at 3m, High Channel

Frequency (MHz)	Average (dBµV/m)	Height (cm)	Pol	Azimuth (°)	Corr. Factor[1] (dB)	Limit (dBµV/m)	Margin (dB)	Result
6195.6000	39.64	100.0	V	0	-7.3	74.00	34.36	Complies
11605.2000	44.07	100.0	V	332	5.9	74.00	29.93	Complies
15841.2000	49.12	100.0	V	347	12.4	74.00	24.88	Complies

[1] Correction factor includes system gains and losses

Table 26: Radiated Emissions (6-18 GHz) Measured at 3m, Average, High Channel

Note: The radiated emissions at port 1 emissions were higher then Port2.

3.8 AC Main Conducted Emissions

Date Performed: January 29, 2025

Test Standard: FCC 47 CFR Part 15.207
RSS-GEN Issue 5 (8.8)

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Standard:

FCC 47 CFR Part 15.207: Frequency range of radiated measurements

> For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal..

FCC 47 CFR Part 15.209 (a): Conducted limits
RSS-GEN Issue 5 (8.8): Conducted Limits

> The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency, f (MHz)	Conducted limit (dBµV) Quasi-peak	Conducted limit (dBµV) Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
Note 1: *Decreases with the logarithm of the frequency .		

Test Setup:

The EUT was tested in a 3 m SAC and was positioned on the Table at 0.8m elevation above the Horizontal ground plane & 80 cm away from any metallic surface including the LISN.

The transmitter was set for continuous transmission at maximum transmit power and terminated antenna ports. Both ports; Low, Middle and High Channels were investigated. The plots and data were for the worst case emissions from High Channel when using antenna port 1.

The AC Mains was provided by an AC/DC power converter operating at 120Vac 60Hz to 5Vdc of the device was measured for all emissions from 150 kHz up to 30MHz

Measurement Data and Plots:

3.8.1 AC Mains Conducted Emissions from 150kHz to 30MHz

Tested January 29, 2025:

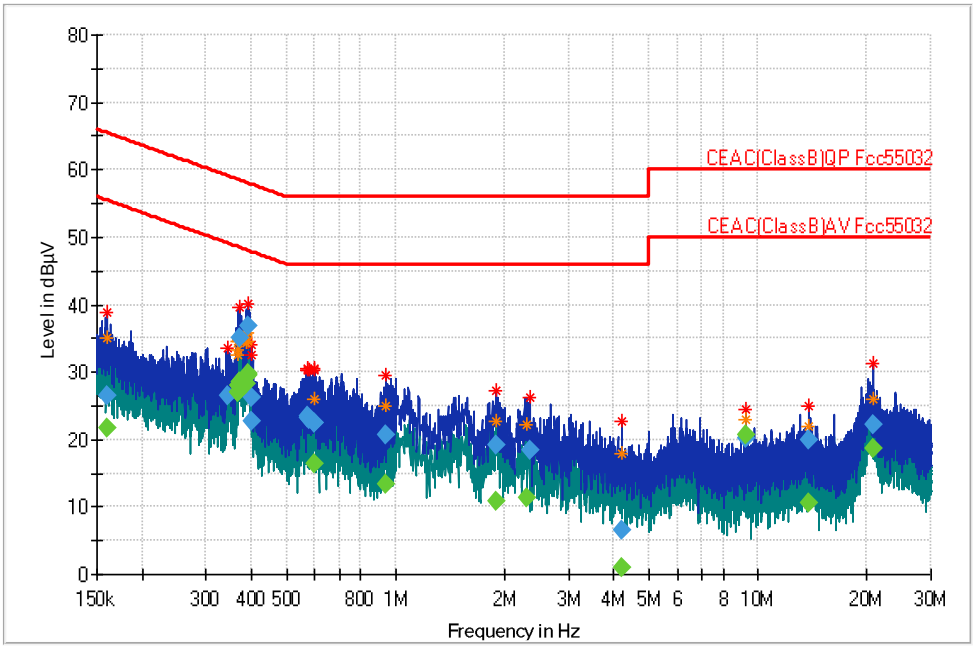


Figure 38: Conducted Emissions from 0.15 to 30MHz Measured using 120Vac 60Hz Line 1

Frequency (MHz)	QuasiPeak (dBµV)	Avg (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)
0.1599	26.52	---	65.47	38.95	1000.0	9.0	10.0
0.1600	---	21.64	55.46	33.82	1000.0	9.0	10.0
0.3451	26.57	---	59.08	32.51	1000.0	9.0	10.0
0.3665	---	26.90	48.58	21.68	1000.0	9.0	10.0
0.3668	---	27.12	48.57	21.46	1000.0	9.0	10.0
0.3685	---	28.14	48.54	20.40	1000.0	9.0	10.0
0.3694	---	28.42	48.52	20.09	1000.0	9.0	10.0
0.3717	---	28.40	48.46	20.07	1000.0	9.0	10.0
0.3730	35.08	---	58.43	23.35	1000.0	9.0	10.0
0.3731	---	27.76	48.43	20.67	1000.0	9.0	10.0
0.3880	---	28.15	48.11	19.96	1000.0	9.0	10.0
0.3893	---	29.17	48.08	18.91	1000.0	9.0	10.0
0.3911	---	29.74	48.04	18.30	1000.0	9.0	10.0
0.3925	---	29.57	48.01	18.44	1000.0	9.0	10.0
0.3930	36.78	---	58.00	21.22	1000.0	9.0	10.0
0.4010	26.32	---	57.83	31.52	1000.0	9.0	10.0
0.4025	22.76	---	57.80	35.04	1000.0	9.0	10.0
0.5716	23.18	---	56.00	32.82	1000.0	9.0	10.0
0.5725	23.47	---	56.00	32.53	1000.0	9.0	10.0
0.5758	23.04	---	56.00	32.96	1000.0	9.0	10.0
0.5951	22.36	---	56.00	33.64	1000.0	9.0	10.0
0.5980	---	16.38	46.00	29.62	1000.0	9.0	10.0
0.5999	22.49	---	56.00	33.51	1000.0	9.0	10.0
0.9400	20.68	---	56.00	35.32	1000.0	9.0	10.0
0.9400	---	13.37	46.00	32.63	1000.0	9.0	10.0
1.8990	19.27	---	56.00	36.73	1000.0	9.0	10.1

1.9019	---	10.80	46.00	35.20	1000.0	9.0	10.1
2.2963	---	11.41	46.00	34.59	1000.0	9.0	10.1
2.3485	18.41	---	56.00	37.59	1000.0	9.0	10.1
4.2103	6.45	---	56.00	49.55	1000.0	9.0	10.2
4.2103	---	0.99	46.00	45.01	1000.0	9.0	10.2
9.2215	20.15	---	60.00	39.85	1000.0	9.0	10.4
9.2244	---	20.79	50.00	29.21	1000.0	9.0	10.4
13.8325	---	10.59	50.00	39.41	1000.0	9.0	10.5
13.8325	19.83	---	60.00	40.17	1000.0	9.0	10.5
20.7461	---	18.64	50.00	31.36	1000.0	9.0	10.8
20.7461	22.27	---	60.00	37.73	1000.0	9.0	10.8
Correction factor includes system and cable losses							

Table 27: Conducted Emissions from 0.15 to 30MHz Measured using 120Vac 60Hz Line 1

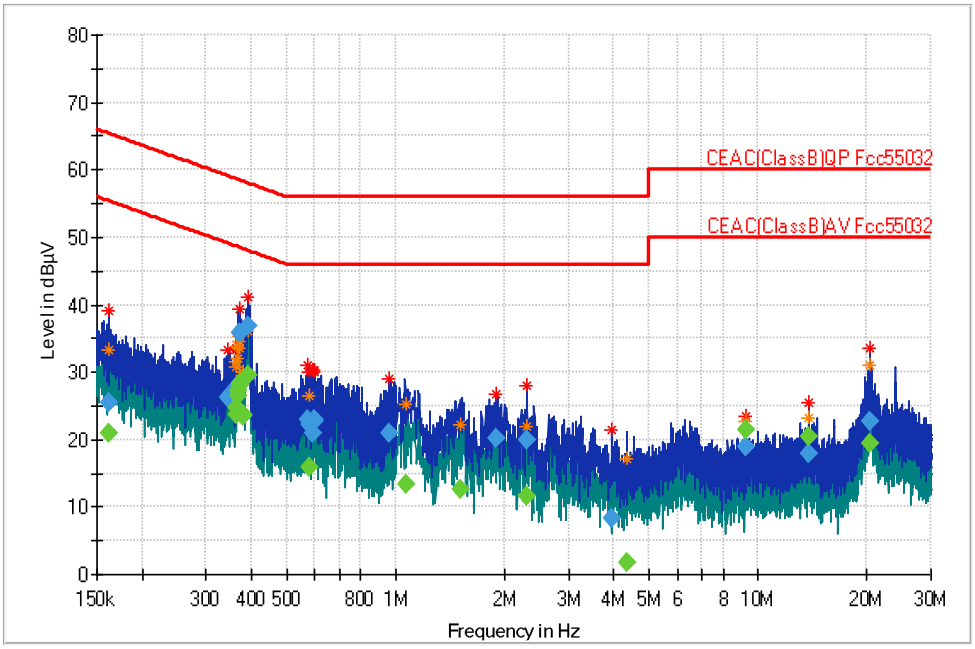


Figure 39: Conducted Emissions from 0.15 to 30MHz Measured using 120Vac 60Hz Line 2

Frequency (MHz)	QuasiPeak (dBµV)	Avg (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Band width (kHz)	Corr. (dB)
0.1622	25.41	---	65.35	39.94	1000.0	9.0	10.0
0.1622	---	20.97	55.35	34.38	1000.0	9.0	10.0
0.3450	26.34	---	59.08	32.75	1000.0	9.0	10.0
0.3624	27.19	---	58.67	31.49	1000.0	9.0	10.0
0.3627	27.71	---	58.67	30.96	1000.0	9.0	10.0
0.3639	---	23.65	48.64	24.99	1000.0	9.0	10.0
0.3645	---	24.62	48.62	24.00	1000.0	9.0	10.0
0.3663	---	26.59	48.58	21.99	1000.0	9.0	10.0
0.3670	---	27.15	48.57	21.42	1000.0	9.0	10.0
0.3707	35.80	---	58.48	22.69	1000.0	9.0	10.0
0.3708	---	28.38	48.48	20.11	1000.0	9.0	10.0
0.3716	---	28.22	48.47	20.24	1000.0	9.0	10.0
0.3724	---	27.96	48.45	20.49	1000.0	9.0	10.0
0.3803	---	23.56	48.27	24.71	1000.0	9.0	10.0
0.3809	---	23.73	48.26	24.53	1000.0	9.0	10.0
0.3915	36.83	---	58.03	21.20	1000.0	9.0	10.0
0.3917	---	29.64	48.03	18.39	1000.0	9.0	10.0
0.5717	23.07	---	56.00	32.93	1000.0	9.0	10.0
0.5770	22.19	---	56.00	33.81	1000.0	9.0	10.0
0.5771	---	15.97	46.00	30.03	1000.0	9.0	10.0
0.5906	20.95	---	56.00	35.05	1000.0	9.0	10.0
0.5967	22.97	---	56.00	33.03	1000.0	9.0	10.0
0.5989	22.78	---	56.00	33.22	1000.0	9.0	10.0
0.9641	20.95	---	56.00	35.05	1000.0	9.0	10.0
1.0638	---	13.48	46.00	32.52	1000.0	9.0	10.0
1.5075	---	12.60	46.00	33.40	1000.0	9.0	10.1
1.8874	20.22	---	56.00	35.78	1000.0	9.0	10.1
2.3021	20.00	---	56.00	36.00	1000.0	9.0	10.1
2.3050	---	11.56	46.00	34.44	1000.0	9.0	10.1
3.9493	8.24	---	56.00	47.76	1000.0	9.0	10.2
4.3466	---	1.72	46.00	44.28	1000.0	9.0	10.2
9.2215	18.90	---	60.00	41.10	1000.0	9.0	10.4
9.2244	---	21.39	50.00	28.61	1000.0	9.0	10.4

13.8325	17.86	---	60.00	42.14	1000.0	9.0	10.5
13.8383	---	20.47	50.00	29.53	1000.0	9.0	10.5
20.4329	22.72	---	60.00	37.28	1000.0	9.0	10.8
20.4358	---	19.44	50.00	30.56	1000.0	9.0	10.8
Correction factor includes system and cable losses							

Table 28: Conducted Emissions from 0.15 to 30MHz Measured using 120Vac 60Hz Line 2

Appendix A: SETUP PHOTOS

Figure 40: Conducted Measurement Setup

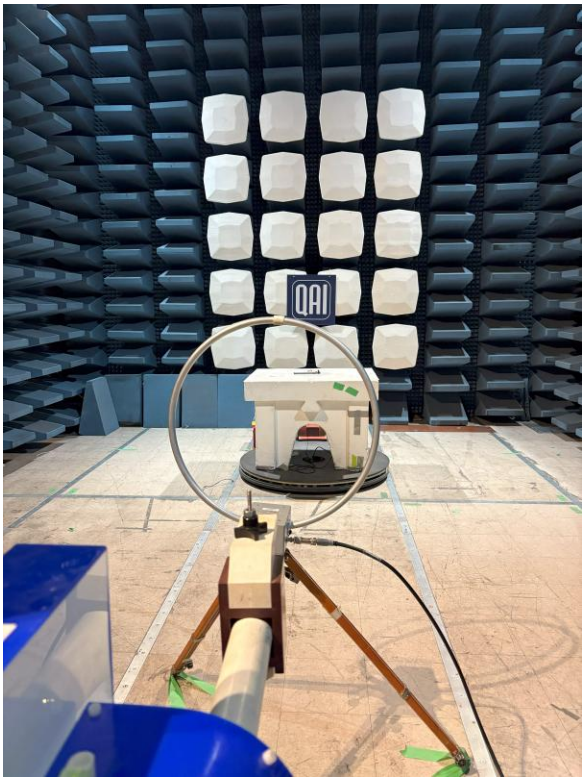


Figure 41: Radiated Emissions 0.009 to 30 MHz – Loop antenna

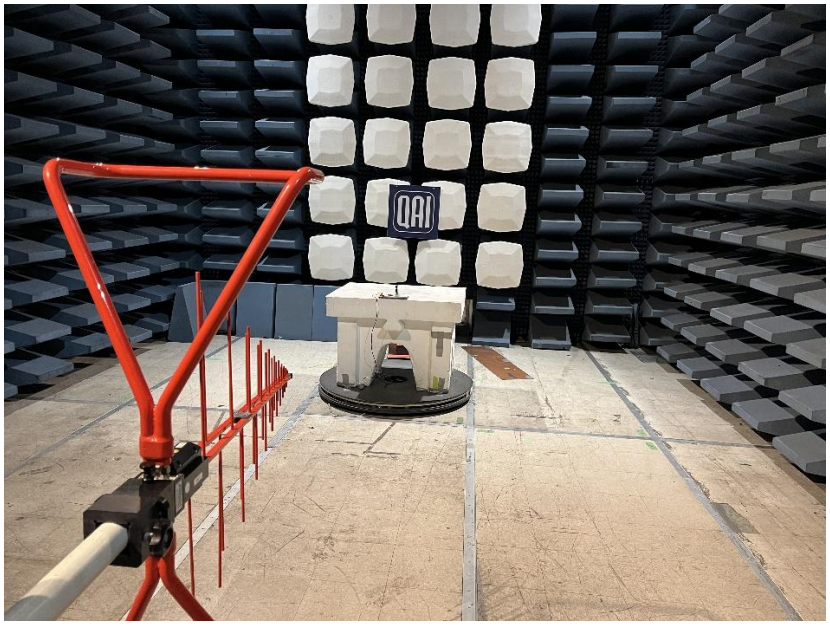


Figure 42: Radiated Emissions 30 to 1000 MHz

Figure 43: Radiated Emissions 1 – 18 GHz

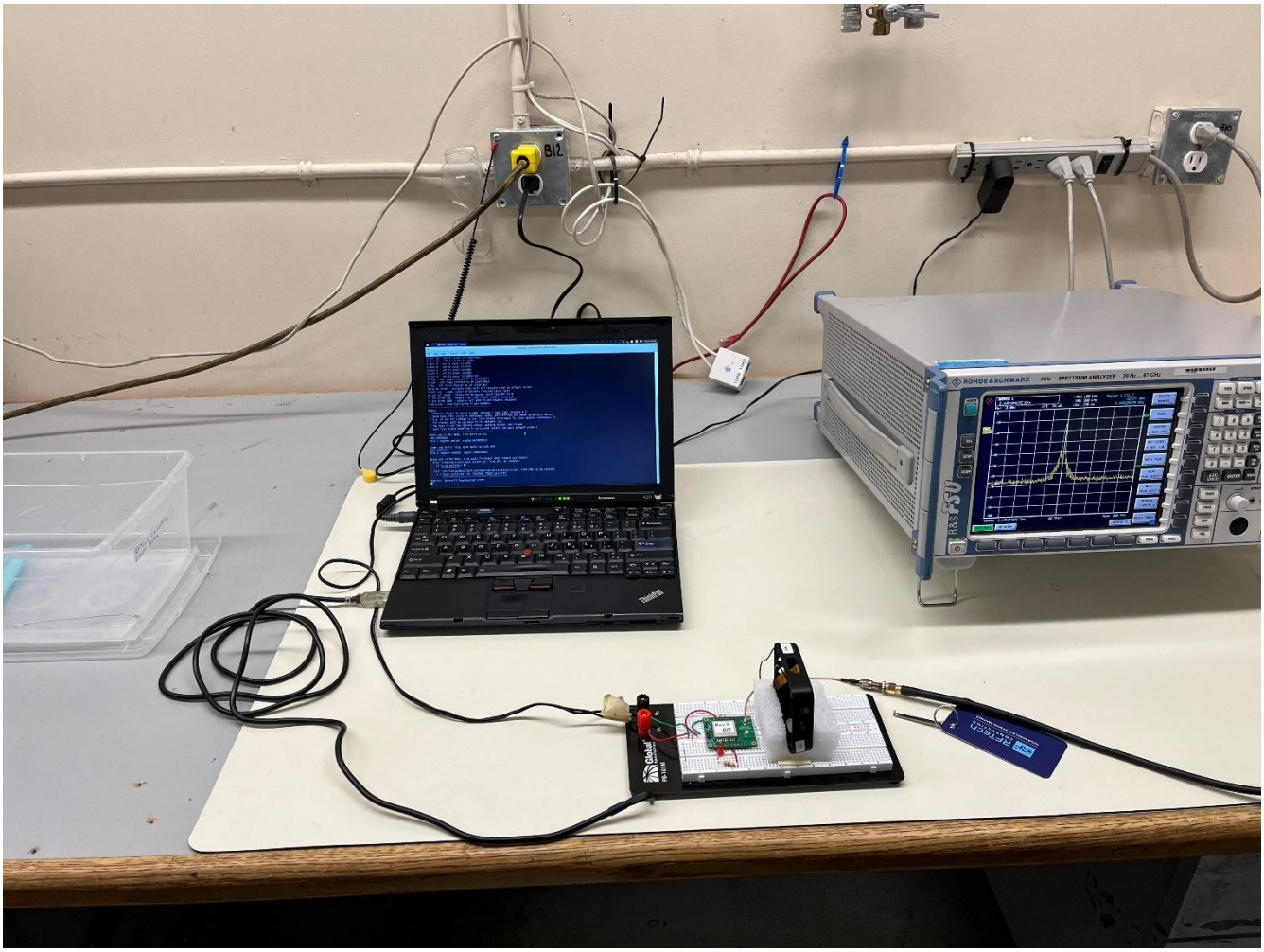
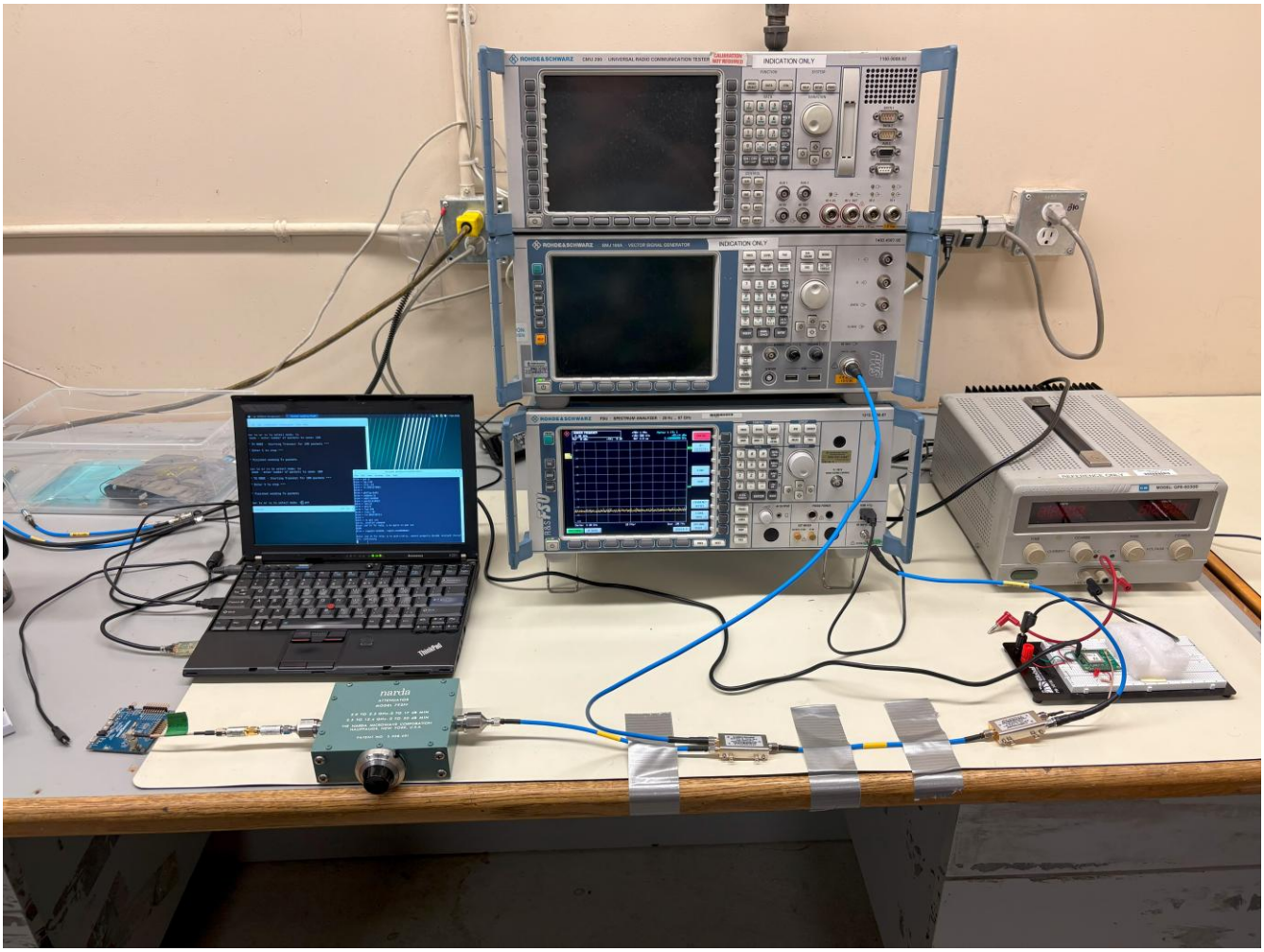


Figure 44: Radio Test Station


ROHDE&SCHWARZ
INDICATION ONLY
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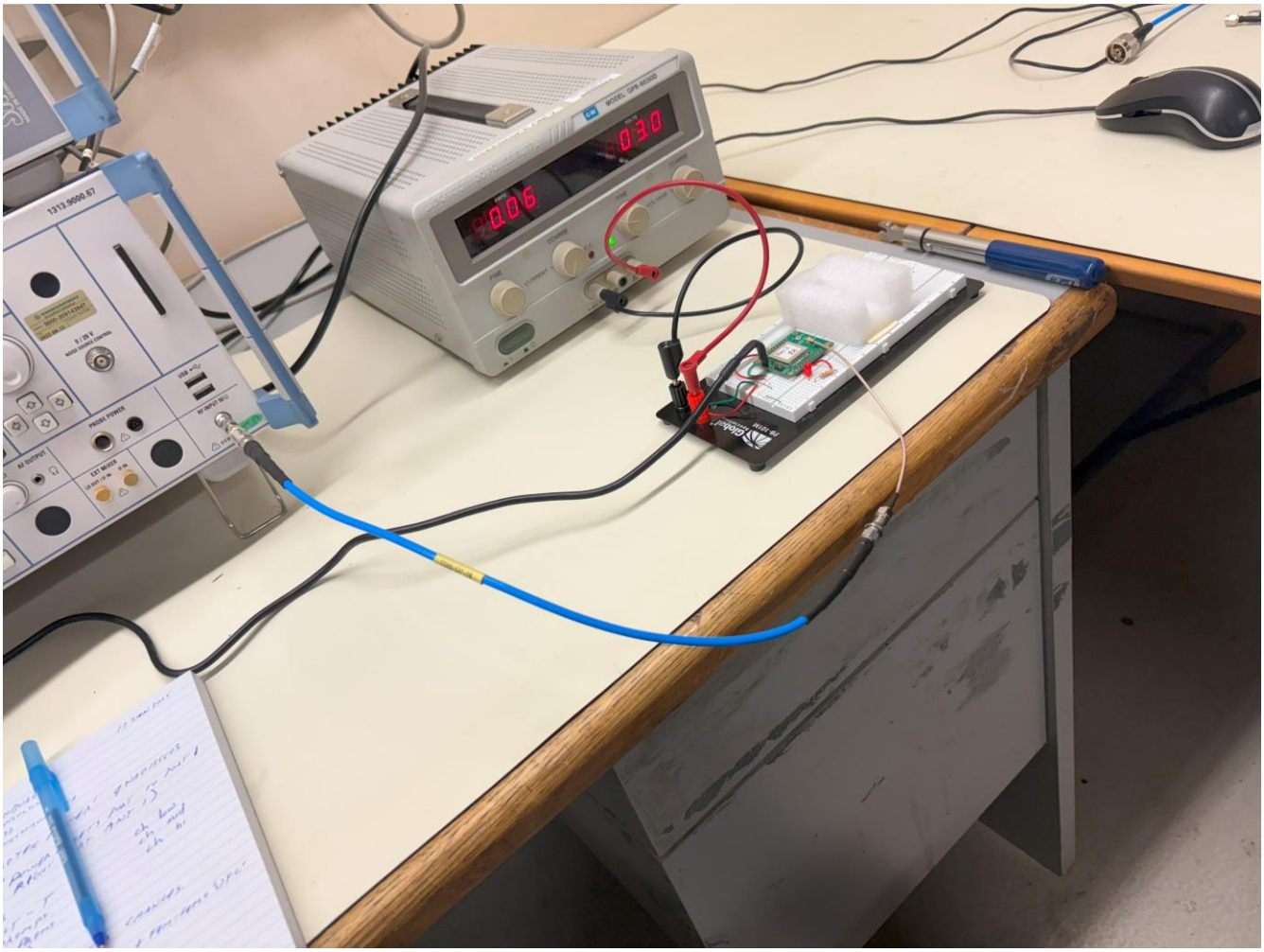
0.06
0.30

Appendix B: ABBREVIATIONS

Abbreviation	Definition
AC	Alternating Current
AM	Amplitude Modulation
CE	European Conformity
CISPR	Comité International Spécial des Perturbations Radioélectriques (International Special Committee on Radio Interference)
DC	Direct Current
EFT	Electrical Fast Transient
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
FCC	Federal Communications Commission
FVIN	Firmware Version Identification Number FVIN
IC	Industry Canada
ICES	Interference Causing Equipment Standard
IEC	International Electrotechnical Commission
LISN	Line Impedance Stabilizing Network
OATS	Open Area Test Site
RF	Radio Frequency
RMS	Root-Mean-Square
SAC	Semi-Anechoic Chamber

END OF REPORT