TEST REPORT

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ACCREDITED
CERT #3657.02

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Manufacturer:	**Star Solutions International Inc**
Address:	#120, 4600 Jacombs Rd Richmond, BC V6V 3B1
Equipment Tested:	LTE Base Station: Band Class 12
Model Number(s):	NL-1210, NL-1211
FCC ID:	S52-7-12-12-00-1
ISED ID:	8076A-71212001

REVISION HISTORY

Date	Report Number	Details	Author's Initials
September 11, 2023	E10599-2301_StarSolutions_iCell COMPAC-N LTE BC12_Rev0.0	Initial draft	AH
September 13, 2023	E10599-2301_StarSolutions_iCell COMPAC-N LTE BC12_Rev0.1	Draft	AH
September 25, 2023	E10599-2301_StarSolutions_iCell COMPAC-N LTE BC12_Rev0.2	Draft	JS
September 27, 2023	E10599-2301_StarSolutions_iCell COMPAC-N LTE BC12_Rev0.3	Draft	AH
October 3, 2023	E10599-2301_StarSolutions_iCell COMPAC-N LTE BC12_Rev1.0	Final	AH
All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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 23RH05175R2.

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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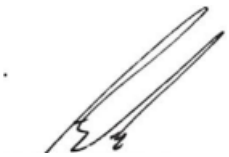

Testing Performed by
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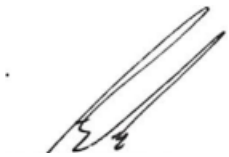

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EMC Laboratory Location	FCC Designation (3m SAC)	IC Registration (3m SAC)	A2LA Certificate
Burnaby, BC, Canada	CA9543	9543A	3657.02

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 Star Solutions COMPAC-N LTE BC12 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 23RH05175R2:

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

CFR Title 47 FCC Part 27 – Miscellaneous Wireless Communications Services

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

RSS-130 Issue 2 – Equipment Operating in the Frequency Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz

SRSP-518 Issue 2 – Technical Requirements in the Bands 617-652 MHz, 663-698 MHz, 698-756 MHz and 777-787 MHz

1.3 Summary of Results

The following testing was performed pursuant to FCC Title 47 Part 15 and Industry Canada ICES-003 to demonstrate the testimony to "FCC, IC, & CE" mark Electromagnetic Compatibility testing for the product.

No.	Test	Applicable Standard	Test Method	Result
1	Peak Power and Peak to Average Ratio	RSS-130, 4.6 FCC 27.50 (c)(9)	ANSI C63.26:2015 KDB 971168 D01	Complies
2	99% Bandwidth	RSS-Gen, 6.7 FCC 27.54 (c)(3)	ANSI C63.26:2015	Complies
3	Band Edge	RSS-130, 4.7.1 FCC 27.53 (g)	ANSI C63.26:2015	Complies
4	RF Conducted Out of Band Emissions	RSS-130, 4.7.1 FCC 27.53 (g)	ANSI C63.26:2015	Complies
5	Conducted Emissions: AC Power Line	ICES-003 FCC 15.107	ANSI C63.4:2014	Complies
6	Conducted Emissions: Telecom	Client Request	CISPR 32	Complies
7	Unintentional Radiated Emissions	RSS-Gen FCC 15.109	ANSI C63.4:2014	Complies
8	Frequency Stability	RSS-Gen, 6.11 RSS-130, 4.5 FCC 27.54 FCC 2.1055 (d) FCC 2.1055 (a)(1)	ANSI C63.4:2014	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.

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: EUT

Equipment Under Test (EUT)

Equipment	iCell COMPAC-N LTE BC12
Description	LTE Base Station: Band Class 12
Manufacturer	Star Solutions International Inc
Model No.	NL-1211/NL-1210
Serial No.	1217R23032300001 A0
Clock frequencies tuned upon within the EUT:	19.2 MHz, 25 MHz, 38.4 MHz
Highest frequency generated within the EUT:	746 MHz

Notes: Model number NL-1211 was the model tested; model number NL-1210 is equivalent model

Equipment Under Test (EUT) – RF Information

RF device type	LTE Base Station
Model No.	NL-1210 NL-1211
Operating frequency	729 – 746 MHz
Channel bandwidth	5 MHz, 10 MHz
Output Power/Transmitter	2x20 W (43 dBm)
Modulation type	QPSK 16-QAM 64-QAM 256-QAM
Test Channels (L, M, H)	10 MHz BW: 734, 737.5, 741 MHz 5 MHz BW: 731.5, 737.5, 743.5 MHz
Adaptive	No
Geo-location-capable	Yes
Number of antenna ports	2

Notes: Model number NL-1211 was the model tested; model number NL-1210 is equivalent model

Equipment Under Test (EUT) – General Information

Tested as	Tabletop
Dimensions	47 x 33 x 18.5 cm
Declared operating temperature range:	-40 °C to +55 °C
Input power	250 Watts (max) 215 Watts (average)
Grounded	Yes
Device use	Fixed location

Notes: None.

Test Modes

Mode	Transmitter State	Power
1	On – No data connection (QPSK/16QAM)	48 VDC, 5A, 250W peak
2	On – Phone connected, no data transmission (QPSK/64QAM)	48 VDC, 5A, 250W peak
3	On – Phone connected, transmitting data (QPSK/256QAM)	48 VDC, 5A, 250W peak
4	Off – Receive Only	48 VDC, 5A, 250W peak

Auxiliary Manufacturer Supplied Equipment

Equipment	Manufacturer	Product Description	Model No.
Aux 1	Dell	Laptop	D630 PP18L
Aux 2	Apple	Test Phone: iPhone	iPhone 6

2.2 Environmental Conditions

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

Parameter	Conditions
Location	Indoors
Temperature	25 °C
Relative Humidity	37 %rh

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 RF Peak Output Power & Peak to Average Ratio

Date Performed: July 26, 2023

Test Standard: FCC CFR 47 Part 27.50 (c)
IC RSS-130 Issue 5
SRSP-518 Issue 2

Test Method: FCC KDB 971168 D01 Power Meas License Digital Systems v03r01
ANSI C63.26: 2015

Modifications: None.

Final Result: Complies

Applicable Regulation:

FCC CFR 47 Part 27.50 (c)(3)

Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with the following table:

Antenna height (AAT) in Meters (feet)	Effective radiated power (ERP) in Watts
Above 1372 (4500)	65
Above 1220 (4000) to 1372 (4500)	70
Above 1067 (3500) to 1220 (4000)	75
Above 915 (3000) to 1067 (3500)	100
Above 763 (2500) to 915 (3000)	140
Above 610 (2000) to 763 (2500)	200
Above 458 (1500) to 610 (2000)	350
Above 305 (1000) to 458 (1500)	600
Up to 305 (1000)	1000

FCC CFR 47 Part 27.50 (c)(4)

Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with the following table:

Antenna height (AAT) in Meters (feet)	Effective radiated power (ERP) in Watts
Above 1372 (4500)	130
Above 1220 (4000) to 1372 (4500)	140
Above 1067 (3500) to 1220 (4000)	150
Above 915 (3000) to 1067 (3500)	200
Above 763 (2500) to 915 (3000)	280
Above 610 (2000) to 763 (2500)	400
Above 458 (1500) to 610 (2000)	700
Above 305 (1000) to 458 (1500)	1200
Up to 305 (1000)	2000

RSS-130 Issue 2:

4.6.1 General

The transmitter output power shall be measured in terms of average power. In addition, the peak to average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

4.6.3 Frequency bands 698-756 MHz and 777-787 MHz

The e.r.p. shall not exceed 30 watts for mobile equipment and outdoor fixed subscriber equipment. The e.r.p. shall not exceed 3 watts for portable equipment and indoor fixed subscriber equipment.

For base and fixed equipment other than fixed subscriber equipment, refer to SRSP-518 for the e.i.r.p. limits.

SRSP-518 Issue 2:

5.1 Radiated power and antenna height limits for fixed and base stations

For fixed and base stations transmitting in accordance with section 4 of SRSP-518 issue 2, the maximum permissible equivalent isotropically radiated power (e.i.r.p.) is 1640 watts and 1640 watts/MHz for a channel bandwidth less than or equal to 1 MHz, respectively. These e.i.r.p. limits apply for stations with an antenna height above average terrain (HAAT) up to 305 meters.

Fixed and base stations located in geographical areas at a distance greater than 26 km from large or medium population centers and transmitting in accordance with section 4 of SRSP-518 issue 2, may increase their e.i.r.p. up to a maximum of 3280 watts/MHz (i.e. No more than 3280 watts e.i.r.p. in any 1 MHz band segment), with an antenna HAAT up to 305 meters.

Within 26 km of any large or medium population center, fixed and base stations may operate at increased e.i.r.p. if more than 50% of the population within a particular sector's coverage is located outside these large and medium population centers.

Fixed and base stations with increase e.i.r.p. must not be used to provide coverage to large and medium population centers. However, some incidental coverage of these large and medium population centers by stations with increased e.i.r.p. is permitted.

This provision also applies for fixed and base stations with a channel bandwidth equal to or less than 1 MHz (i.e. e.i.r.p may be increase up to a maximum of 3280 watts).

For all installations with an antenna HAAT in excess of 305 meters, a corresponding reduction in e.i.r.p. according to the following formula shall be applied:

$$EIRP_{reduction} = 20\log_{10}\left(\frac{HAAT}{305}\right)\ dB$$

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per KDB 971168 D01 Power Meas License Digital Systems v03r01 and ANSI C63.26:2015

Measurement Data and Plots:

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	13.99	7.92	31.00	38.92	7.80	6.07	13	6.93	Complies
737.5	14.25	6.39	30.97	37.36	5.45	7.86	13	5.14	Complies
743.5	13.90	7.00	30.96	37.96	6.25	6.90	13	6.10	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 5: Ant 1 RF Output Power:5 MHz BW, QPSK/16-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	17.22	12.01	31.00	43.01	20.00	5.21	13	7.79	Complies
737.5	17.08	11.84	30.97	42.81	19.10	5.24	13	7.76	Complies
743.5	17.37	12.04	30.96	43.00	20.00	5.33	13	7.67	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 6: Ant 1 RF Output Power:5 MHz BW, QPSK/64-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	17.22	12.01	31.00	43.01	20.00	5.21	13	7.79	Complies
737.5	16.89	12.34	30.97	43.31	21.43	4.55	13	8.45	Complies
743.5	16.92	11.85	30.96	42.81	19.10	5.07	13	7.93	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 7: Ant 1 RF Output Power:5 MHz BW, QPSK/256-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	16.87	7.47	31.00	38.47	7.03	9.40	13	3.60	Complies
737.5	16.56	6.49	30.97	37.46	5.57	10.07	13	2.93	Complies
741.0	16.41	6.70	30.96	37.66	5.83	9.71	13	3.29	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 8: Ant 1 RF Output Power:10 MHz BW, QPSK/16-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	19.82	13.10	31.00	44.10	25.70	6.72	13	6.28	Complies
737.5	19.77	12.71	30.97	43.68	23.33	7.06	13	5.94	Complies
741.0	20.08	12.63	30.96	43.59	22.86	7.45	13	5.55	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 9: Ant 1 RF Output Power:10 MHz BW, QPSK/64-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	20.06	12.97	31.00	43.97	24.95	7.09	13	5.91	Complies
737.5	19.81	12.87	30.97	43.84	24.21	6.94	13	6.06	Complies
741.0	19.87	12.63	30.96	43.59	22.86	7.24	13	5.76	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 10: Ant 1 RF Output Power:10 MHz BW, QPSK/256-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	13.68	8.53	31.00	39.53	8.97	5.15	13	7.85	Complies
737.5	13.67	8.00	30.97	38.97	7.89	5.67	13	7.33	Complies
743.5	13.79	8.22	30.96	39.18	8.28	5.57	13	7.43	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 11: Ant 2 RF Output Power:5 MHz BW, QPSK/16-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	16.93	11.90	31.00	42.90	19.50	5.03	13	7.97	Complies
737.5	14.88	12.16	30.97	43.13	20.56	2.72	13	10.28	Complies
743.5	17.37	12.74	30.96	43.70	23.40	4.63	13	8.37	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 12: Ant 2 RF Output Power:5 MHz BW, QPSK/64-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
731.5	16.91	12.59	31.00	43.59	22.86	4.32	13	8.68	Complies
737.5	16.95	11.85	30.97	42.82	19.14	5.10	13	7.90	Complies
743.5	16.91	11.74	30.96	42.70	18.62	5.17	13	7.83	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 13: Ant 2 RF Output Power:5 MHz BW, QPSK/256-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	14.30	6.66	31.00	37.66	5.83	7.64	13	5.36	Complies
737.5	15.63	7.86	30.97	38.83	7.64	7.77	13	5.23	Complies
741.0	14.45	6.67	30.96	37.63	5.79	7.78	13	5.22	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 14: Ant 2 RF Output Power:10 MHz BW, QPSK/16-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	19.58	12.93	31.00	43.93	24.72	6.65	13	6.35	Complies
737.5	19.65	13.12	30.97	44.09	25.64	6.53	13	6.47	Complies
741.0	19.74	12.58	30.96	43.54	22.59	7.16	13	5.84	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 15: Ant 2 RF Output Power:10 MHz BW, QPSK/64-QAM

Carrier Frequency (MHz)	Raw Peak (dBm)	Raw Avg (dBm)	Correction Factor[1] (dB)	Corrected Avg Output Power (dBm)	Corrected Avg Output Power (W)	PAPR (dB)	Limit (dB)	Margin (dB)	Results
734.0	19.61	12.51	31.00	43.51	22.44	7.10	13	5.90	Complies
737.5	19.80	12.89	30.97	43.86	24.32	6.91	13	6.09	Complies
741.0	20.02	12.64	30.96	43.60	22.91	7.38	13	5.62	Complies

[1] Correction factor consists of cable loss, external attenuator, and adapter(s)

Table 16: Ant 2 RF Output Power:10 MHz BW, QPSK/256-QAM

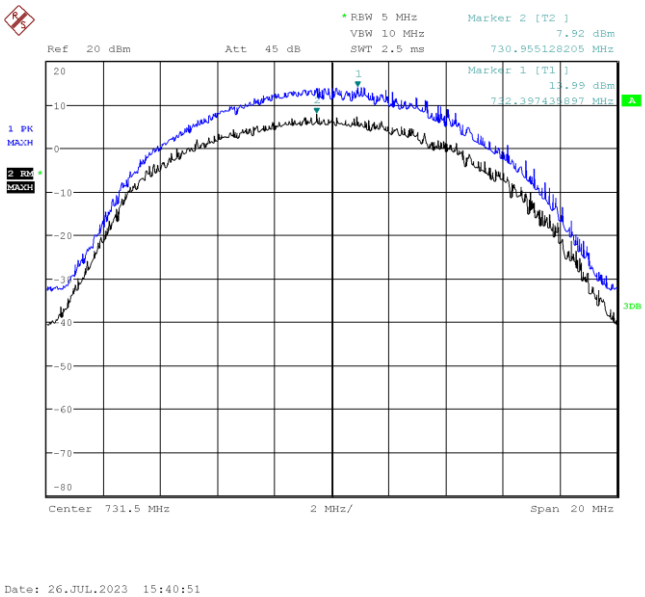

Figure 2: Ant 1 Output Power, 5 MHz BW, QPSK/16QAM, Low Channel

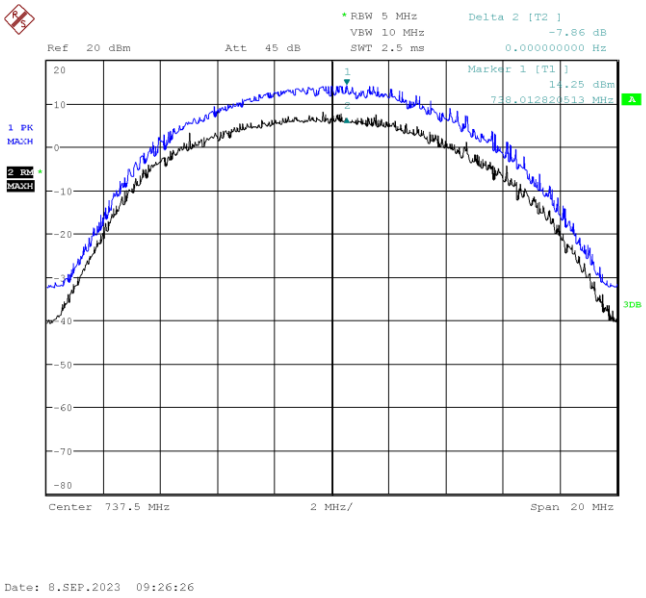

Figure 3: Ant 1 Output Power, 5 MHz BW, QPSK/16QAM, Mid Channel

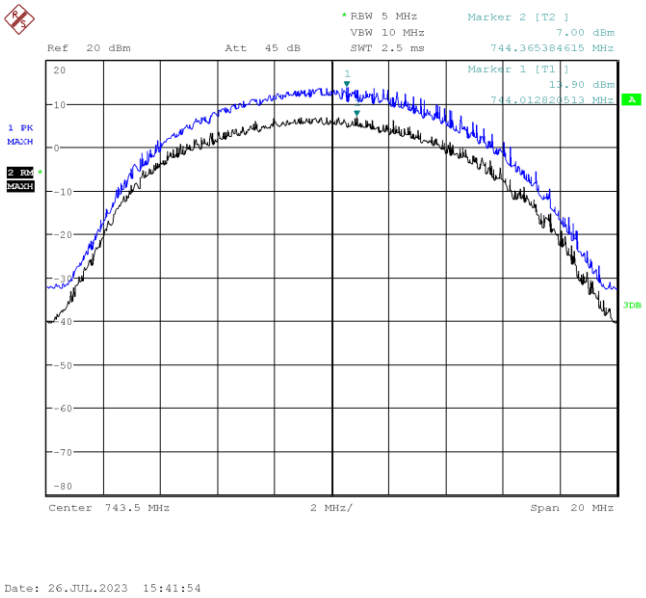

Figure 4: Ant 1 Output Power, 5 MHz BW, QPSK/16QAM, High Channel

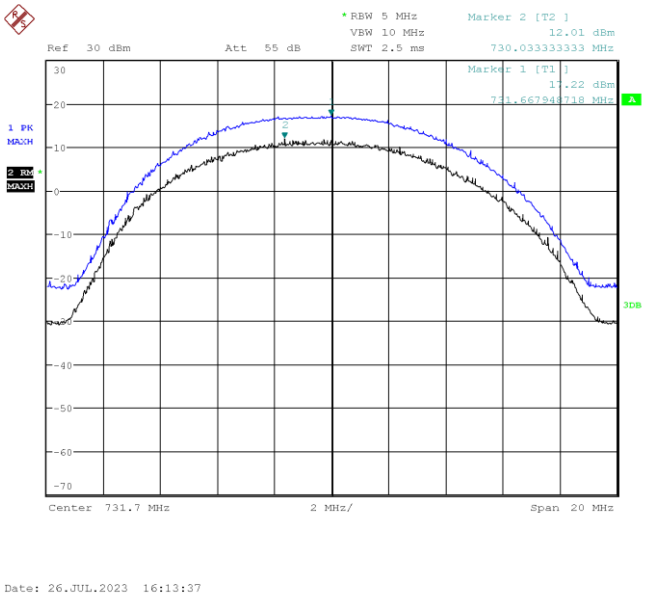

Figure 5: Ant 1 Output Power, 5 MHz BW, QPSK/64QAM, Low Channel

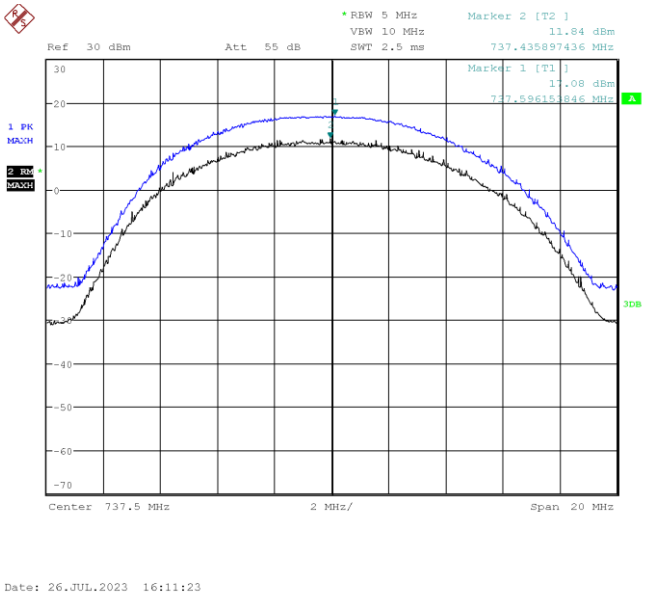

Figure 6: Ant 1 Output Power, 5 MHz BW, QPSK/64QAM, Mid Channel

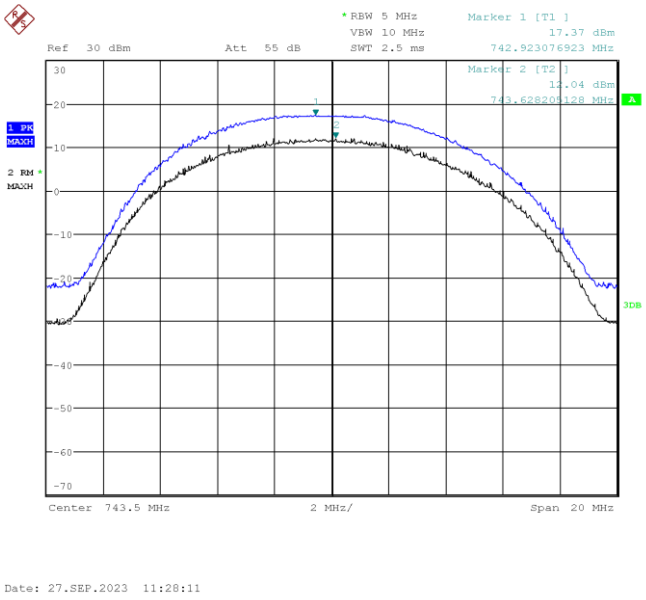

Figure 7: Ant 1 Output Power, 5 MHz BW, QPSK/64QAM, High Channel

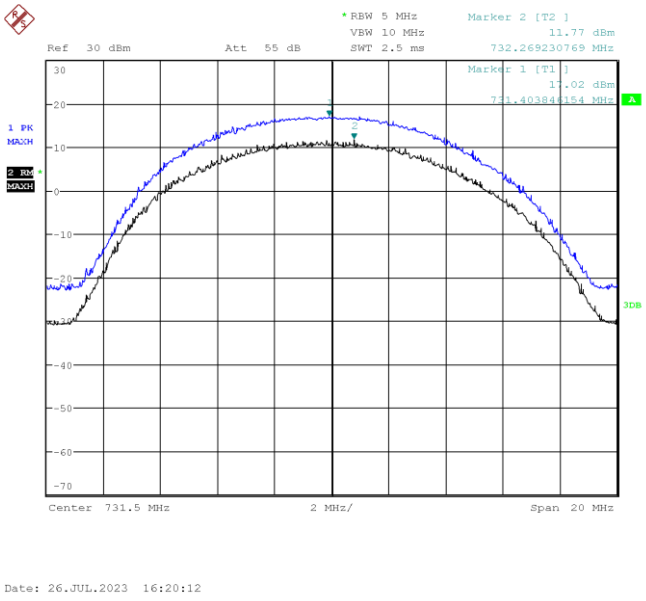

Figure 8: Ant 1 Output Power, 5 MHz BW, QPSK/256QAM, Low Channel

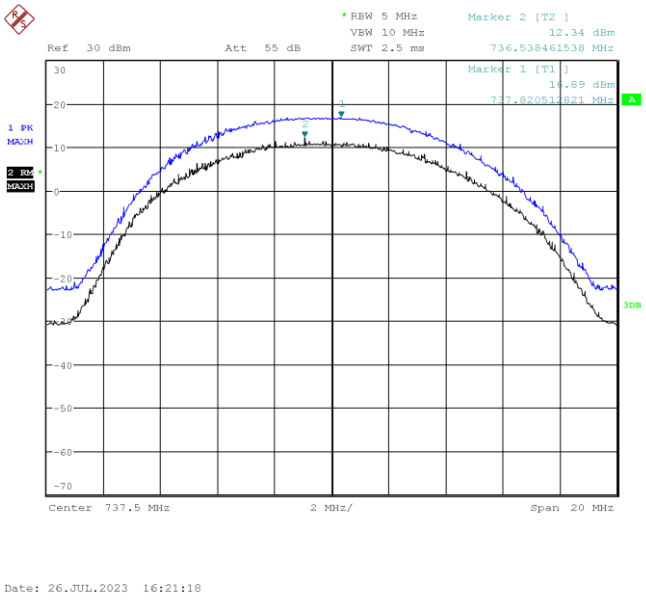

Figure 9: Ant 1 Output Power, 5 MHz BW, QPSK/256QAM, Mid Channel

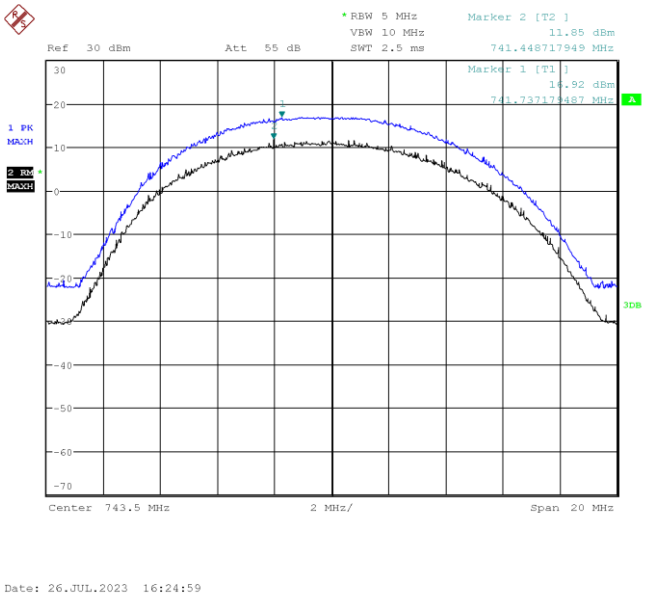

Figure 10: Ant 1 Output Power, 5 MHz BW, QPSK/256QAM, High Channel

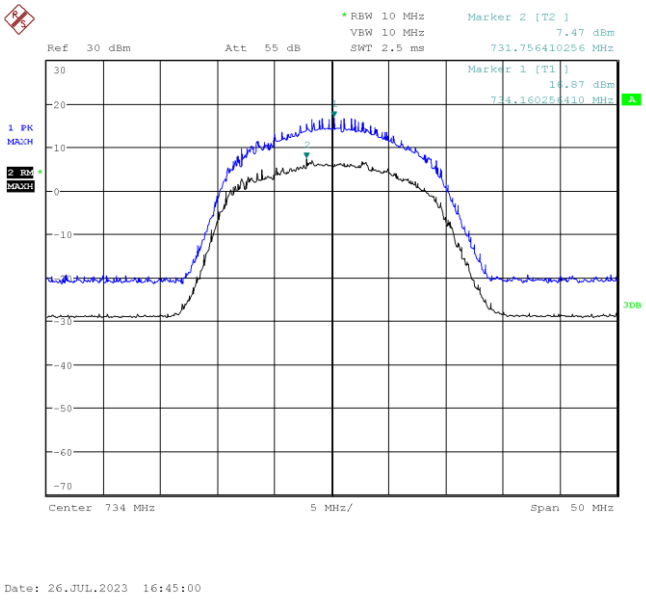

Figure 11: Ant 1 Output Power, 10 MHz BW, QPSK/16QAM, Low Channel

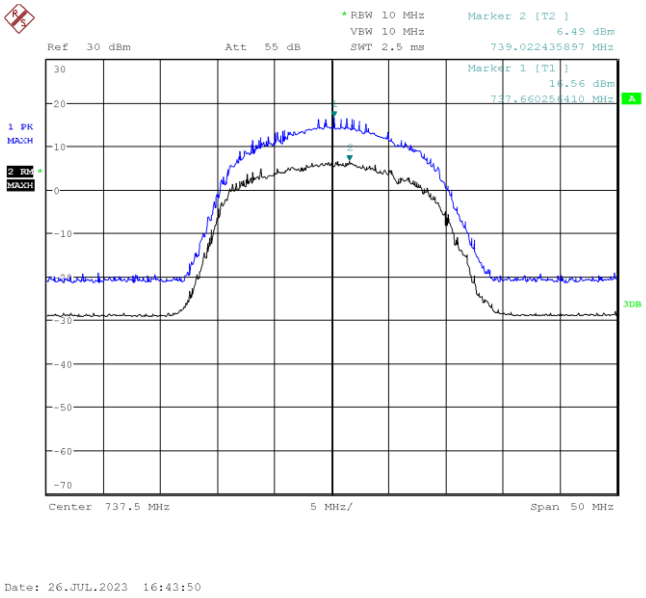

Figure 12: Ant 1 Output Power, 10 MHz BW, QPSK/16QAM, Mid Channel

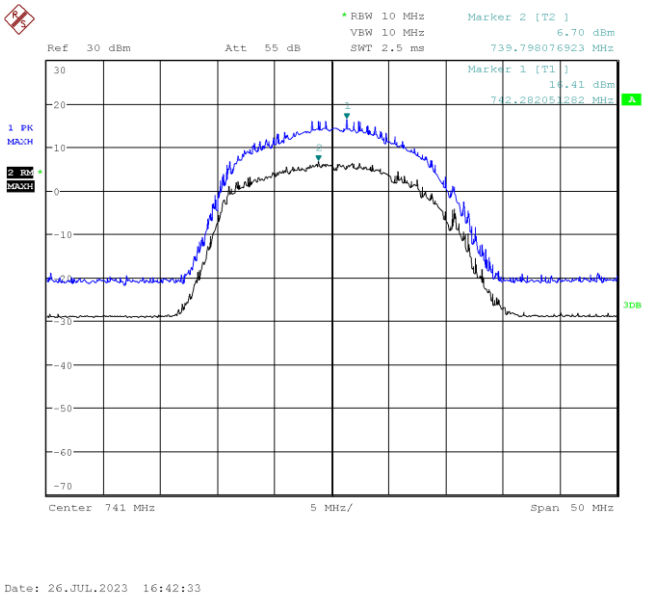

Figure 13: Ant 1 Output Power, 10 MHz BW, QPSK/16QAM, High Channel

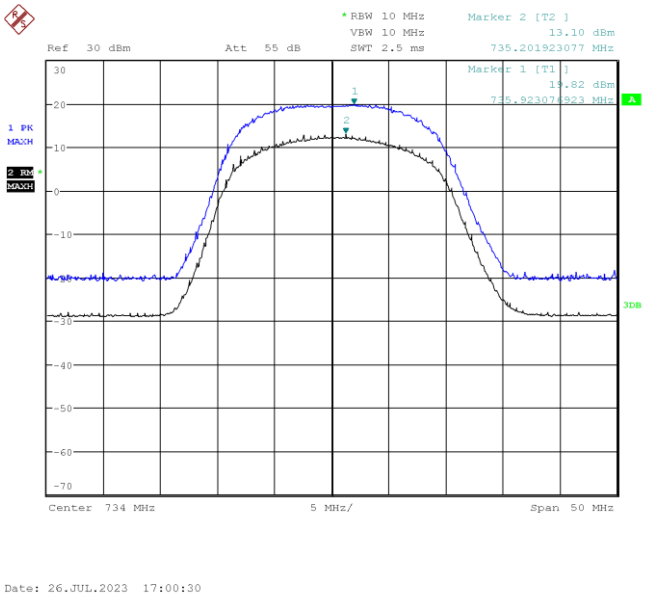

Figure 14: Ant 1 Output Power, 10 MHz BW, QPSK/64QAM, Low Channel

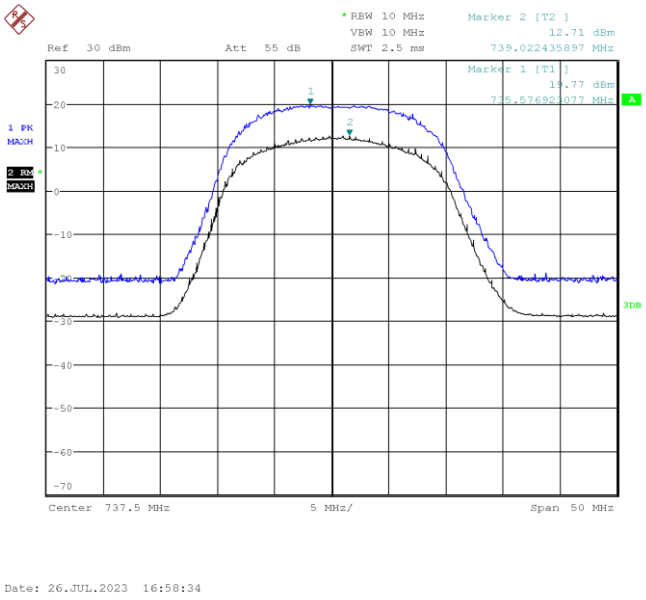

Figure 15: Ant 1 Output Power, 10 MHz BW, QPSK/64QAM, Mid Channel

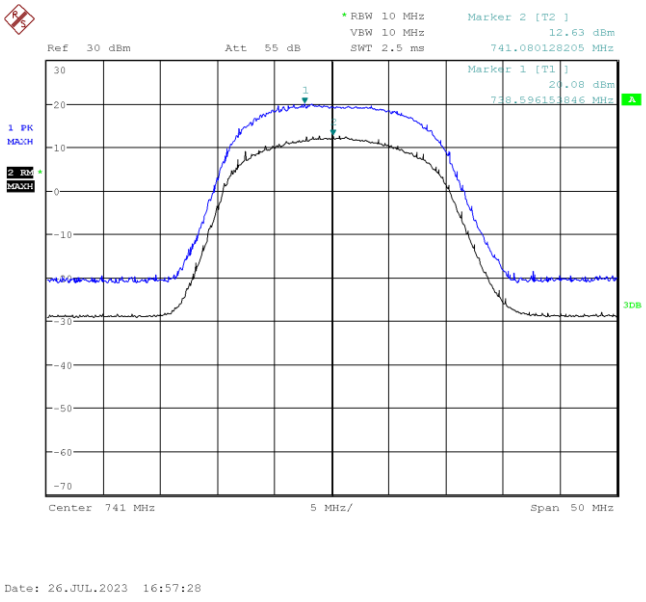

Figure 16: Ant 1 Output Power, 10 MHz BW, QPSK/64QAM, High Channel

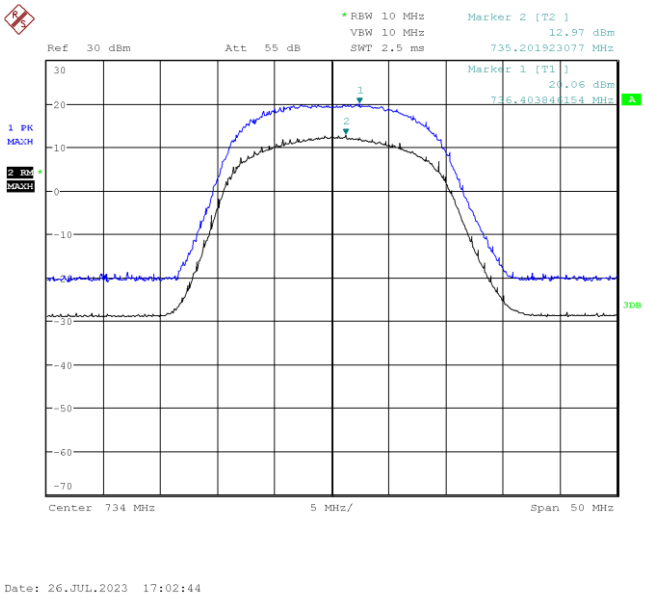

Figure 17: Ant 1 Output Power, 10 MHz BW, QPSK/256QAM, Low Channel

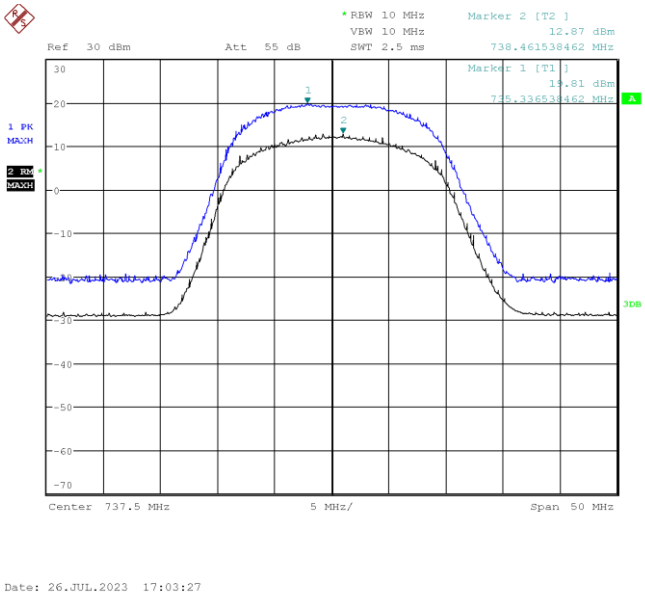

Figure 18: Ant 1 Output Power, 10 MHz BW, QPSK/256QAM, Mid Channel

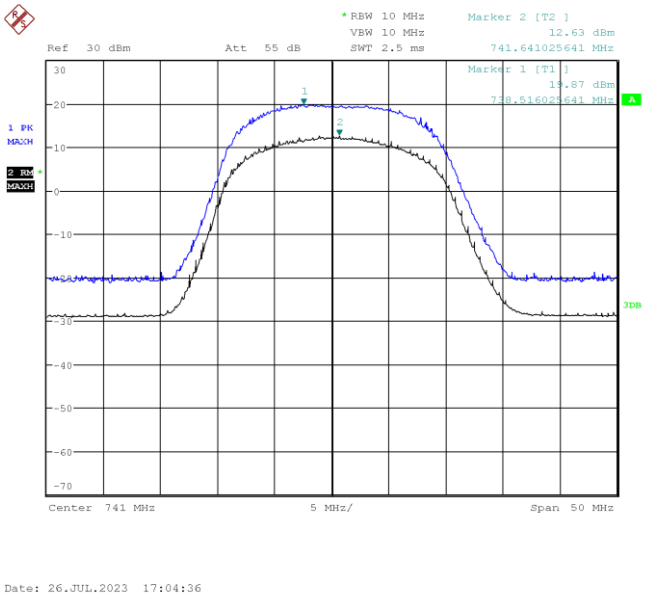

Figure 19: Ant 1 Output Power, 10 MHz BW, QPSK/256QAM, High Channel

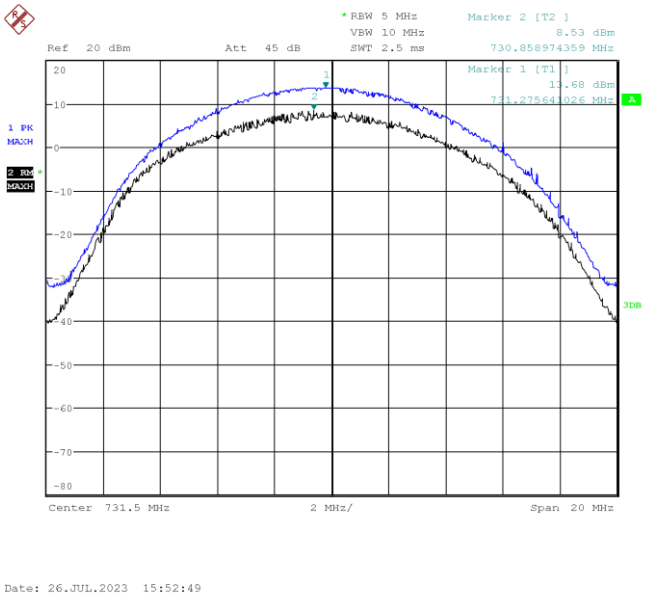

Figure 20: Ant 2 Output Power, 5 MHz BW, QPSK/16QAM, Low Channel

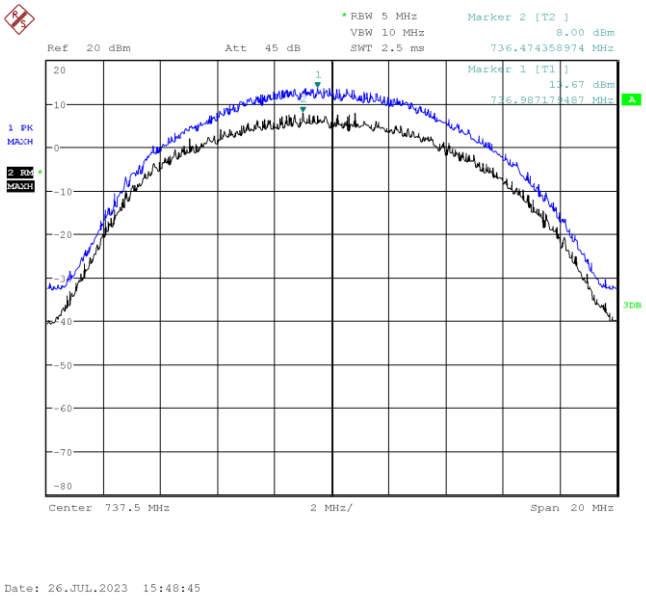

Figure 21: Ant 2 Output Power, 5 MHz BW, QPSK/16QAM, Mid Channel

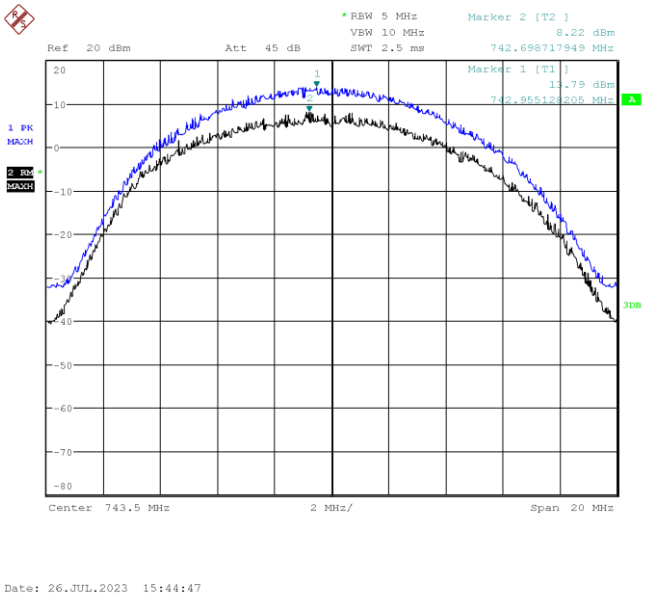

Figure 22: Ant 2 Output Power, 5 MHz BW, QPSK/16QAM, High Channel

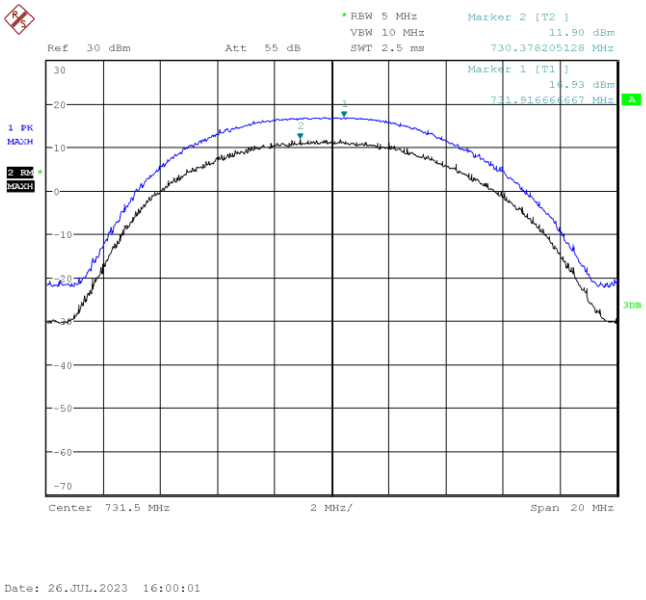

Figure 23: Ant 2 Output Power, 5 MHz BW, QPSK/64QAM, Low Channel

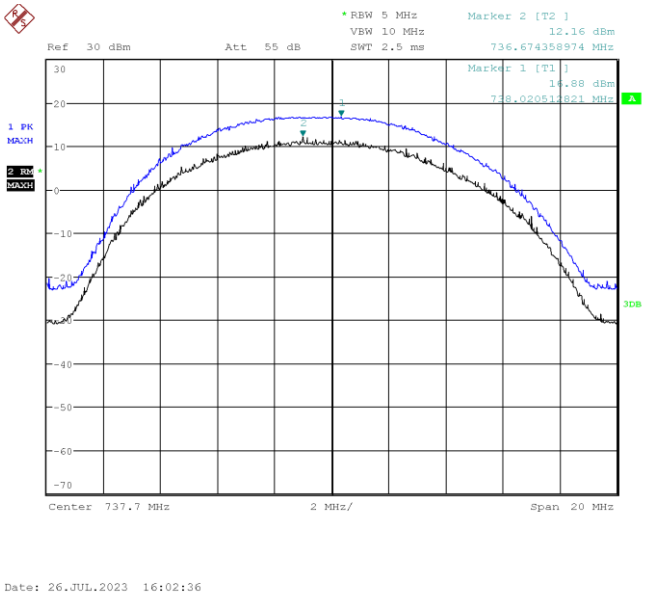

Figure 24: Ant 2 Output Power, 5 MHz BW, QPSK/64QAM, Mid Channel

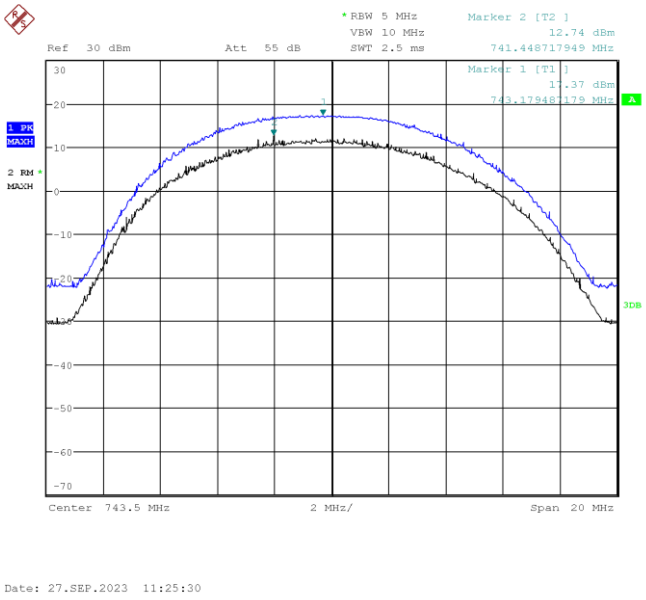

Figure 25: Ant 2 Output Power, 5 MHz BW, QPSK/64QAM, High Channel

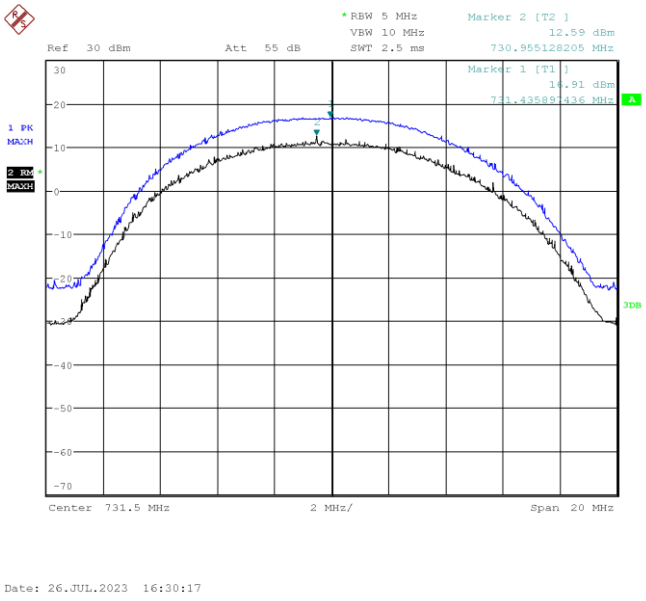

Figure 26: Ant 2 Output Power, 5 MHz BW, QPSK/256QAM, Low Channel

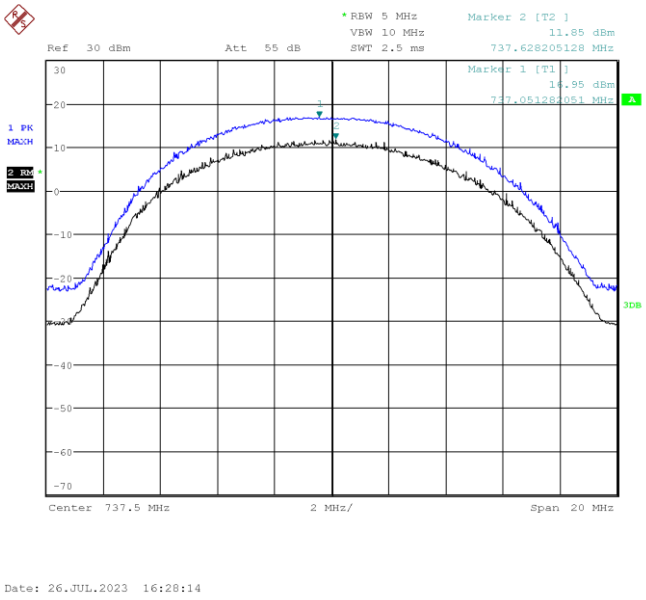

Figure 27: Ant 2 Output Power, 5 MHz BW, QPSK/256QAM, Mid Channel

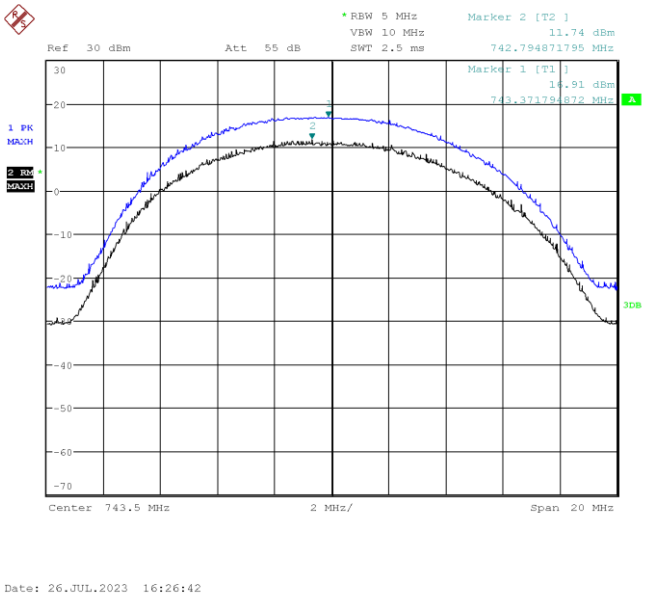

Figure 28: Ant 2 Output Power, 5 MHz BW, QPSK/256QAM, High Channel

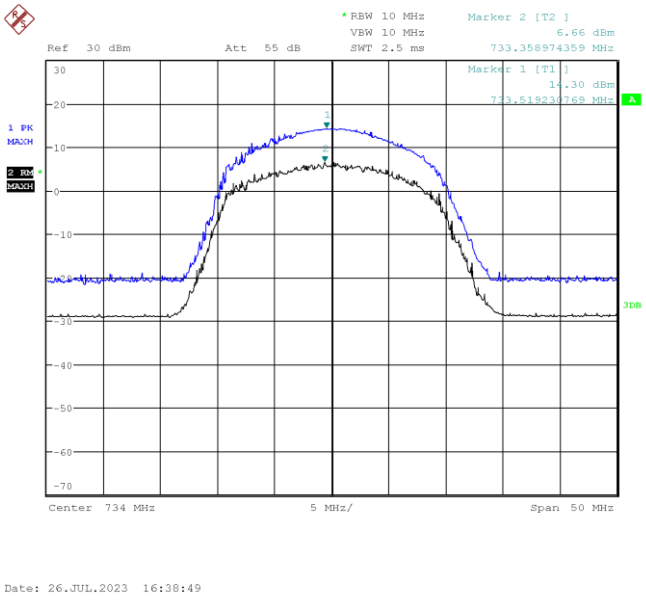

Figure 29: Ant 2 Output Power, 10 MHz BW, QPSK/16QAM, Low Channel

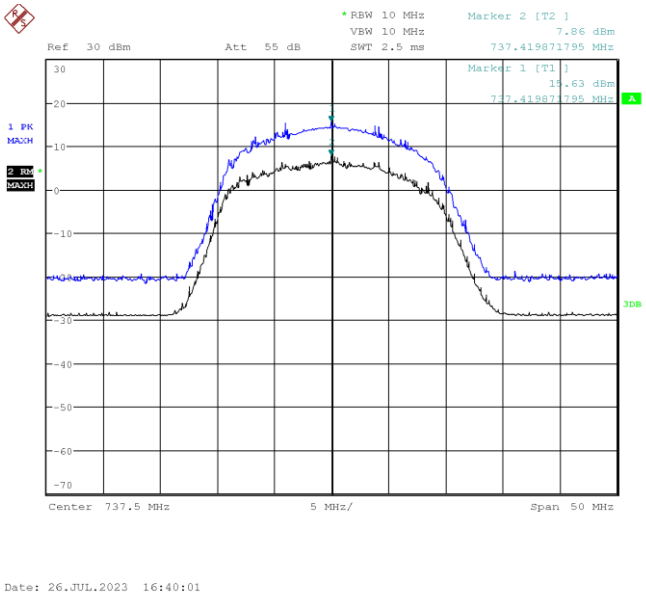

Figure 30: Ant 2 Output Power, 10 MHz BW, QPSK/16QAM, Mid Channel

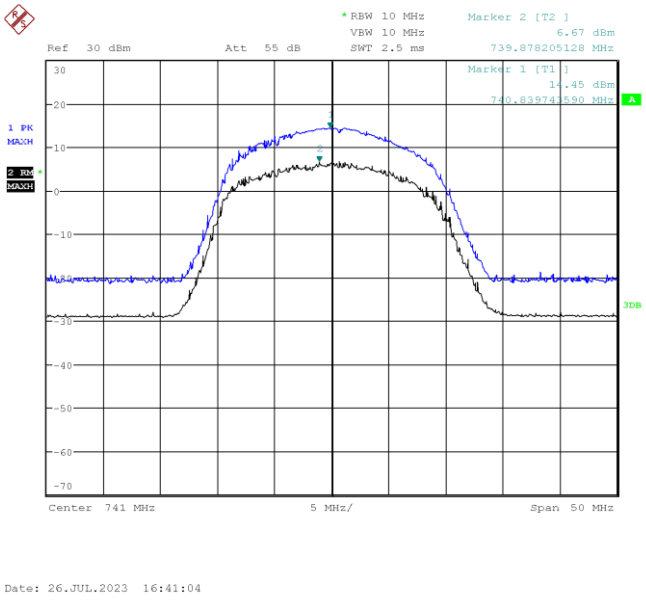

Figure 31: Ant 2 Output Power, 10 MHz BW, QPSK/16QAM, High Channel

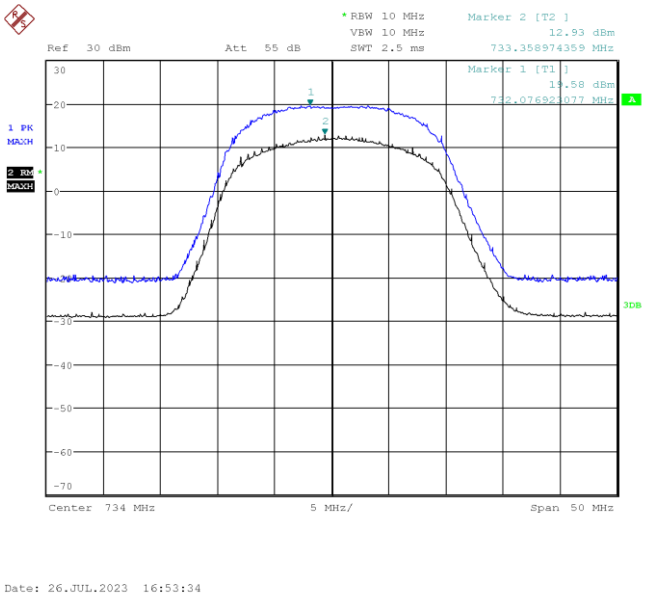

Figure 32: Ant 2 Output Power, 10 MHz BW, QPSK/64QAM, Low Channel

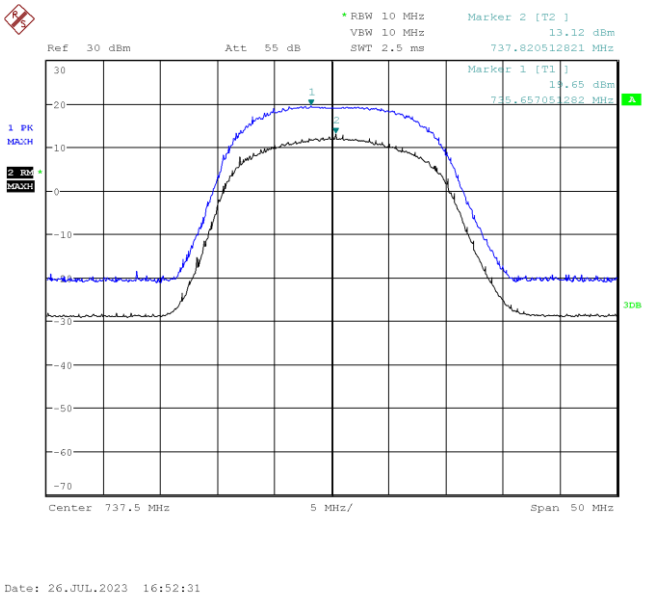

Figure 33: Ant 2 Output Power, 10 MHz BW, QPSK/64QAM, Mid Channel

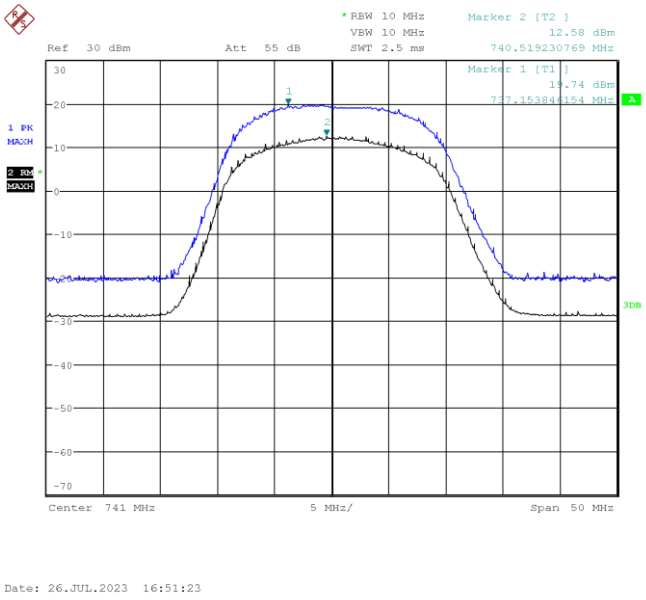

Figure 34: Ant 2 Output Power, 10 MHz BW, QPSK/64QAM, High Channel

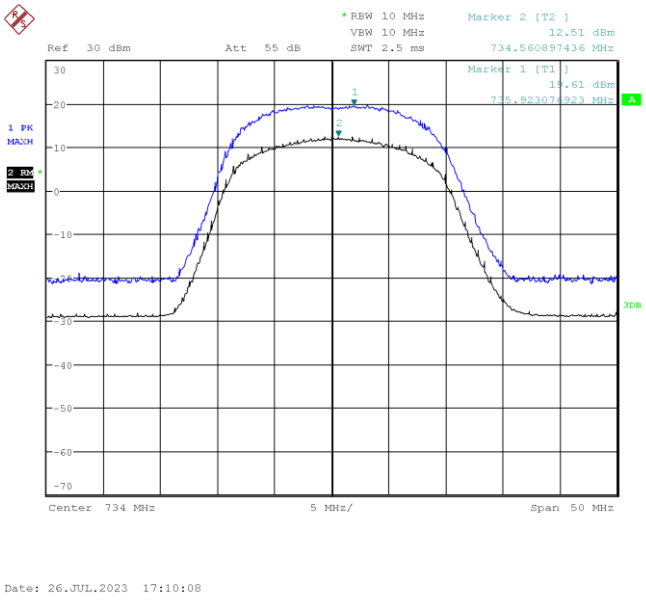

Figure 35: Ant 2 Output Power, 10 MHz BW, QPSK/256QAM, Low Channel

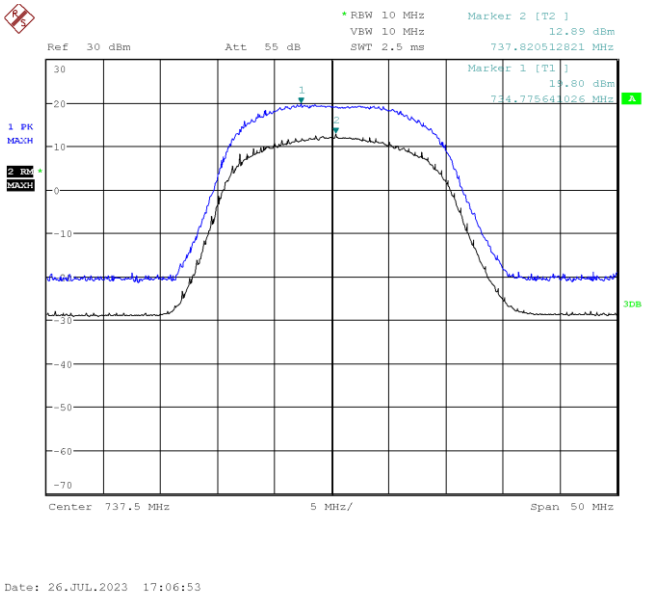

Figure 36: Ant 2 Output Power, 10 MHz BW, QPSK/256QAM, Mid Channel

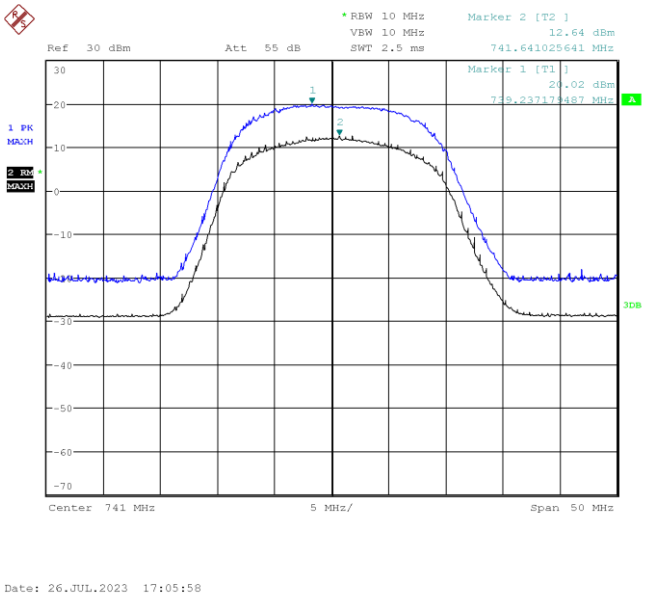

Figure 37: Ant 2 Output Power, 10 MHz BW, QPSK/256QAM, High Channel

3.2 99% Bandwidth

Date Performed: July 26, 2023

Test Standard: FCC CFR 47 Part 27.50 (c)
RSS-Gen Issue 5
SRSP-518 Issue 2

Test Method: RSS-Gen Issue 5
ANSI C63.26: 2015

Modifications: None.

Final Result: Complies

Applicable Regulation:

FCC CFR 47 Part 27.50 (c)(3)

Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with the following table:

Antenna height (AAT) in Meters (feet)	Effective radiated power (ERP) in Watts
Above 1372 (4500)	65
Above 1220 (4000) to 1372 (4500)	70
Above 1067 (3500) to 1220 (4000)	75
Above 915 (3000) to 1067 (3500)	100
Above 763 (2500) to 915 (3000)	140
Above 610 (2000) to 763 (2500)	200
Above 458 (1500) to 610 (2000)	350
Above 305 (1000) to 458 (1500)	600
Up to 305 (1000)	1000

FCC CFR 47 Part 27.50 (c)(4)

Fixed and base stations located in a county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, and transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 2000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 2000 watts/MHz ERP in accordance with the following table:

Antenna height (AAT) in Meters (feet)	Effective radiated power (ERP) in Watts
Above 1372 (4500)	130
Above 1220 (4000) to 1372 (4500)	140
Above 1067 (3500) to 1220 (4000)	150
Above 915 (3000) to 1067 (3500)	200
Above 763 (2500) to 915 (3000)	280
Above 610 (2000) to 763 (2500)	400
Above 458 (1500) to 610 (2000)	700
Above 305 (1000) to 458 (1500)	1200
Up to 305 (1000)	2000

RSS-Gen Issue 5:

6.7 Occupied bandwidth (or 99% emission bandwidth) and x dB bandwidth)

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per RSS-Gen Issue 5 and ANSI C63.26:2015

Measurement Data and Plots:

Modulation Scheme	Carrier Frequency (MHz)	BW Setting (MHz)	99% Bandwidth (MHz)	Result
QPSK / 16QAM	737.5	5	4.487	Complies
QPSK / 16QAM	737.5	10	8.910	Complies
QPSK / 64QAM	737.5	5	4.455	Complies
QPSK / 64QAM	737.5	10	8.942	Complies
QPSK / 256QAM	737.5	5	4.455	Complies
QPSK / 256QAM	737.5	10	8.942	Complies

Table 17: 99% Bandwidth

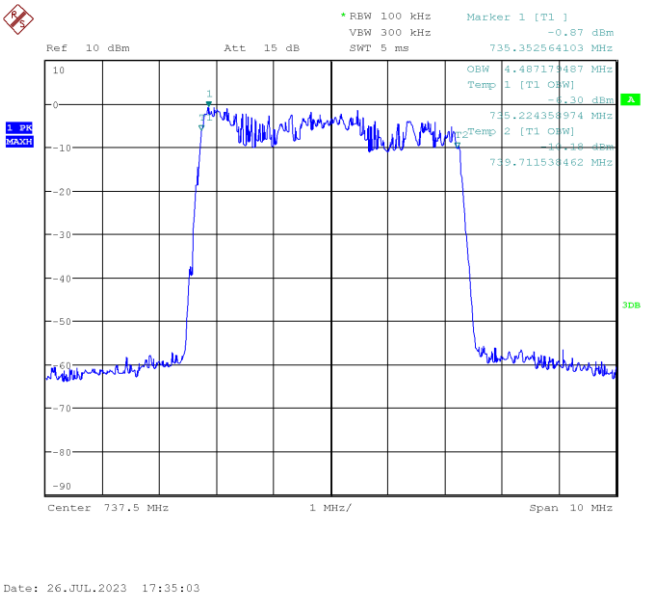

Figure 38: 99% Bandwidth, QPSK/16QAM, 5 MHz BW

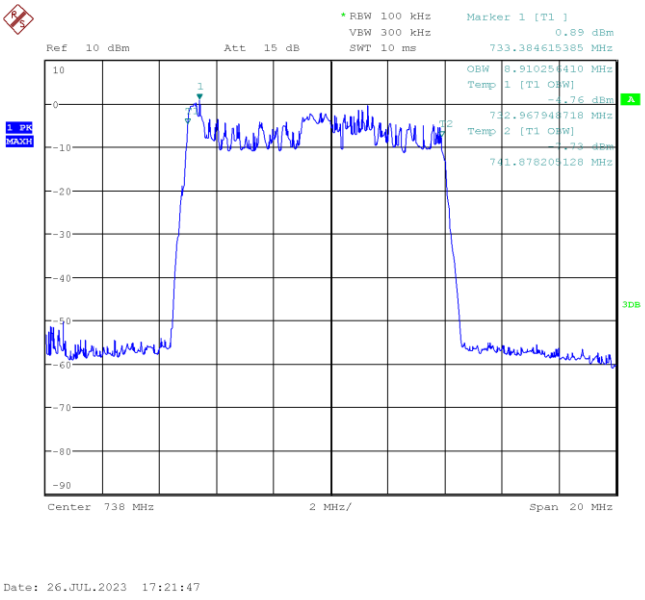

Figure 39: 99% Bandwidth, QPSK/16QAM, 10 MHz BW

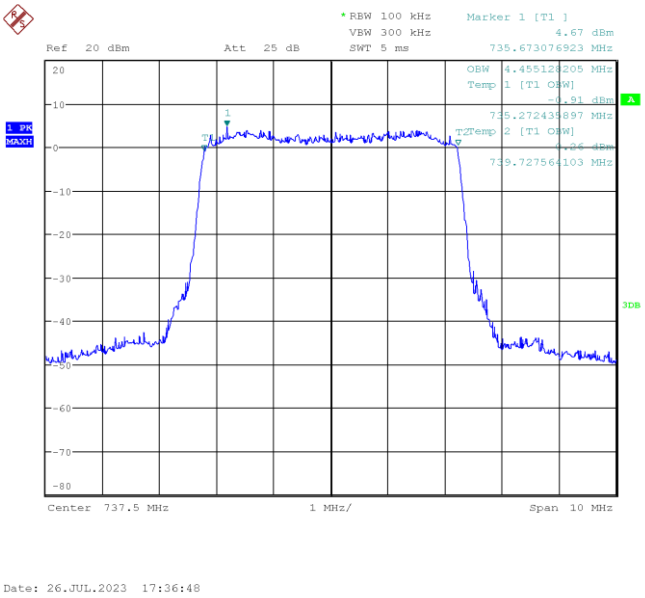

Figure 40: 99% Bandwidth, QPSK/64QAM, 5 MHz BW

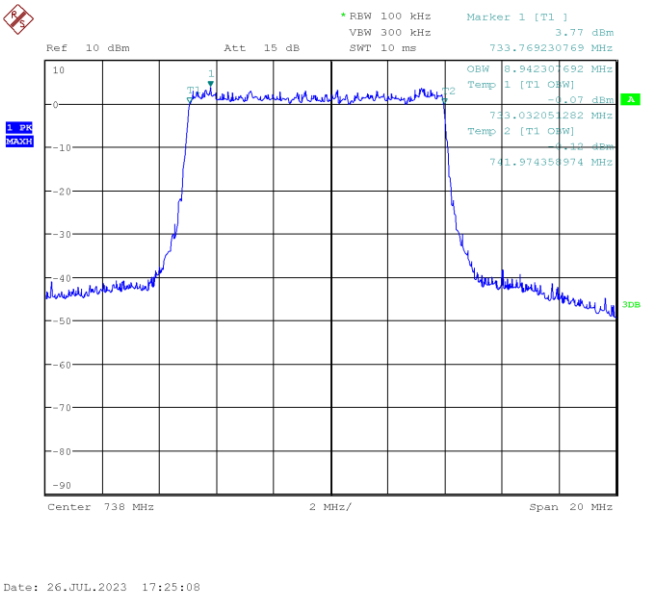

Figure 41: 99% Bandwidth, QPSK/64QAM, 10 MHz BW

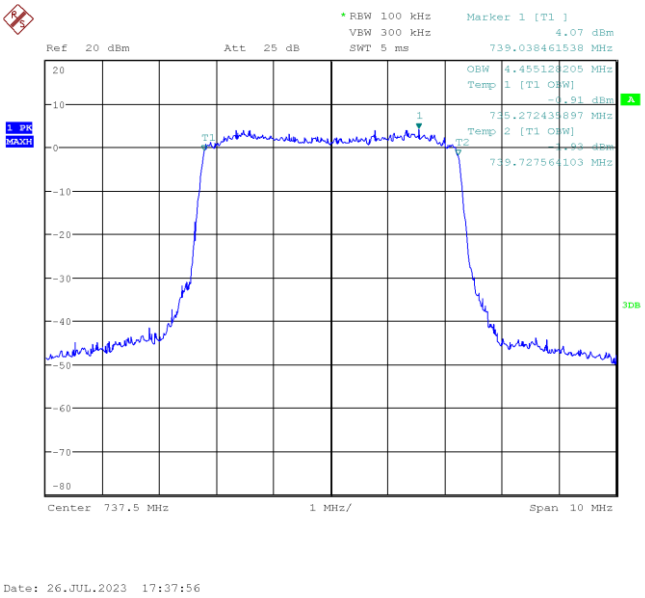

Figure 42: 99% Bandwidth, QPSK/256QAM, 5 MHz BW

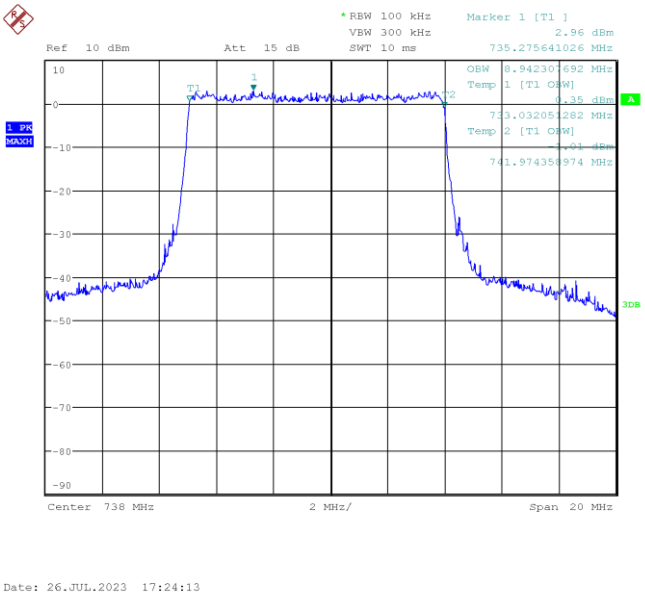

Figure 43: 99% Bandwidth, QPSK/256QAM, 10 MHz BW

3.3 Band Edge

Date Performed: July 27, 2023

Test Standard: FCC CFR 47 Part 27.53 (g)
RSS-130 Issue 2

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Regulation:

FCC CFR 47 Part 27.53 (g):

> For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130 Issue 2:

> 4.7.1 General unwanted emissions limits
>
> The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per ANSI C63.26:2015.

Measurement Data and Plots:

Channel Frequency (MHz)	Band Edge	Modulation	Signal Attenuation (dB)	Limit (dB)	Margin (dB)	Result
731.5	Low	QPSK/16QAM	50.85	42.86	7.99	Complies
743.5	High	QPSK/16QAM	52.68	44.72	7.96	Complies
731.5	Low	QPSK/64QAM	56.33	47.72	8.61	Complies
743.5	High	QPSK/64QAM	48.98	48.04	0.94	Complies
731.5	Low	QPSK/256QAM	51.58	47.03	4.55	Complies
743.5	High	QPSK/256QAM	49.29	47.82	1.47	Complies

Table 18: Band Edge, 5 MHz BW

Channel Frequency (MHz)	Band Edge	Modulation	Signal Attenuation (dB)	Limit (Minimum) (dB)	Margin (dB)	Result
734.0	Low	QPSK/16QAM	52.78	44.99	7.79	Complies
741.0	High	QPSK/16QAM	52.26	44.90	7.36	Complies
734.0	Low	QPSK/64QAM	48.49	48.48	0.01	Complies
741.0	High	QPSK/64QAM	50.63	47.21	3.42	Complies
734.0	Low	QPSK/256QAM	50.76	47.10	3.66	Complies
741.0	High	QPSK/256QAM	49.43	47.96	1.47	Complies

Table 19: Band Edge, 10 MHz BW

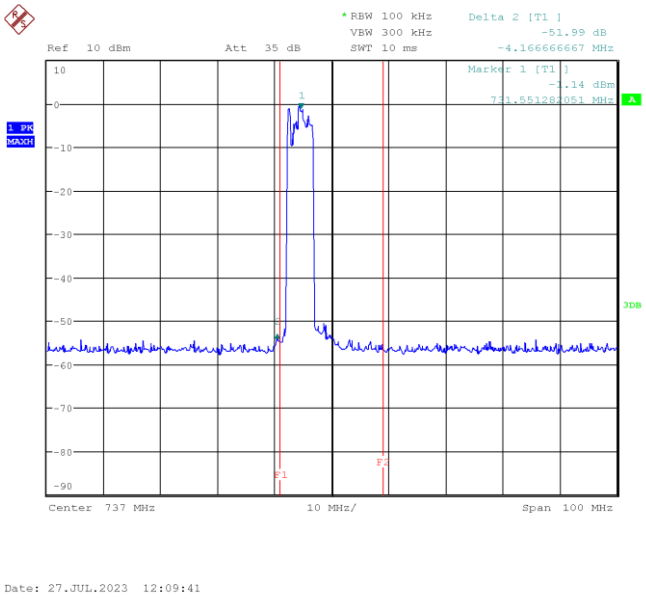

Figure 44: Low Band Edge, 5 MHz BW, QPSK/16QAM

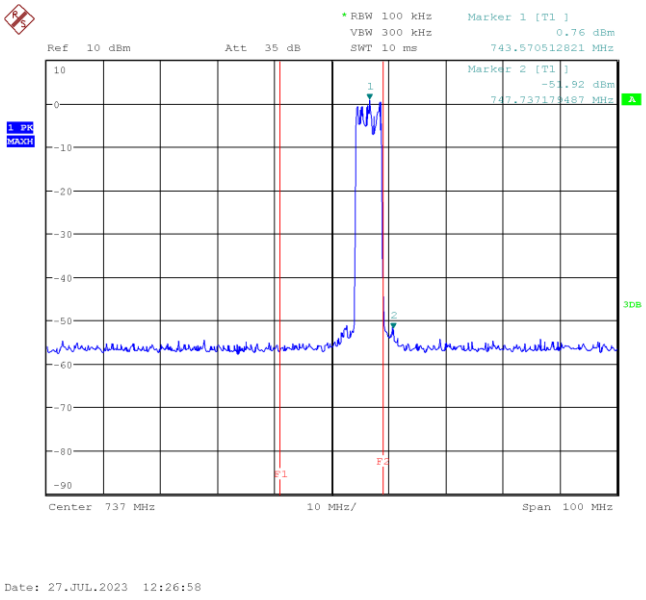

Figure 45: High Band Edge, 5 MHz BW, QPSK/16QAM

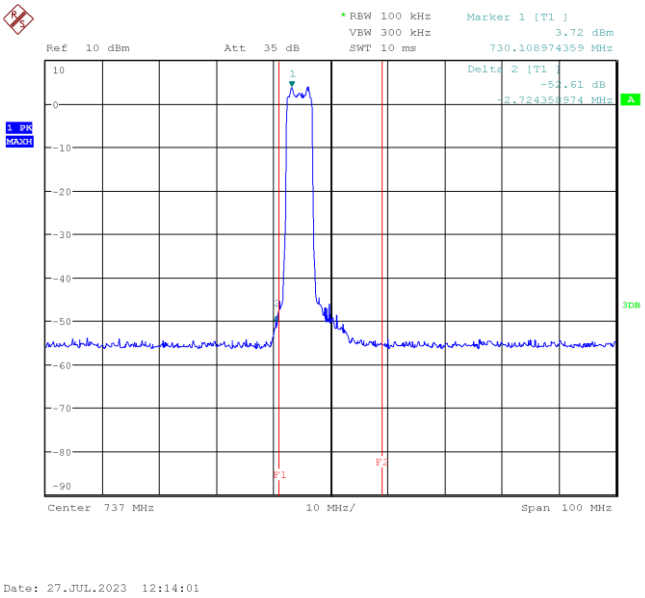

Figure 46: Low Band Edge, 5 MHz BW, QPSK/64QAM

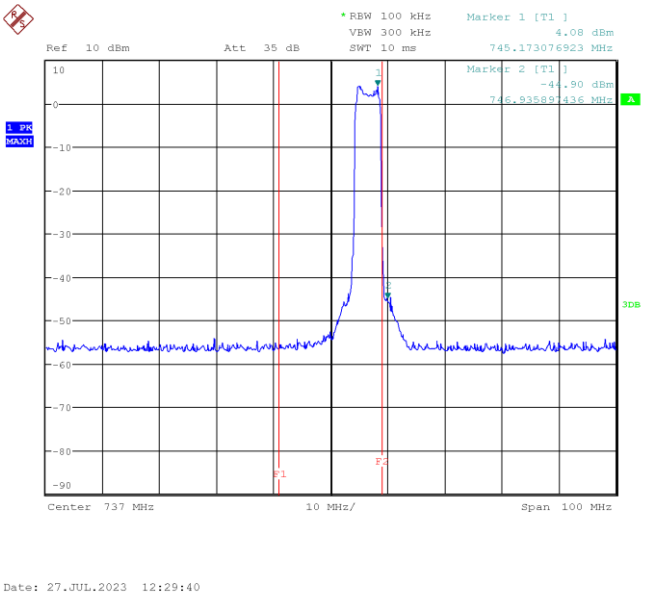

Figure 47: High Band Edge, 5 MHz BW, QPSK/64QAM

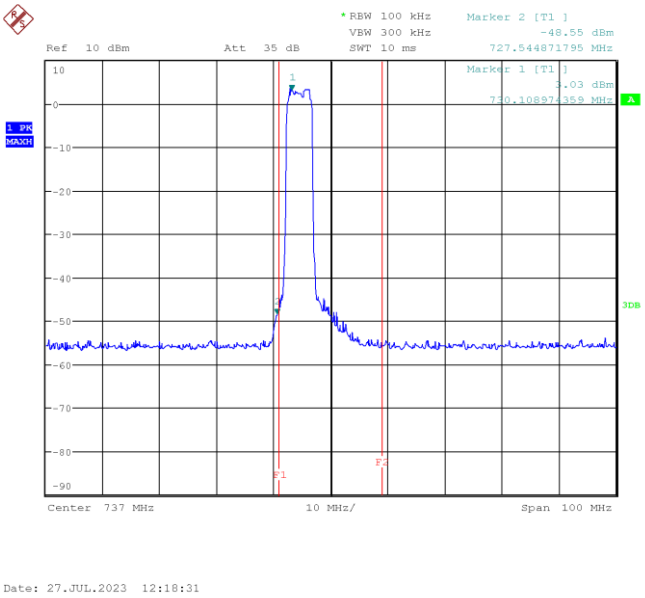

Figure 48: Low Band Edge, 5 MHz BW, QPSK/256QAM

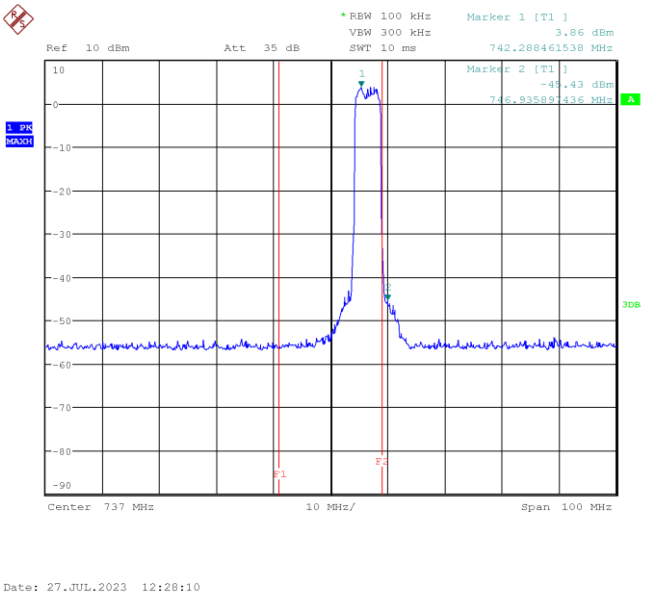

Figure 49: High Band Edge, 5 MHz BW, QPSK/256QAM

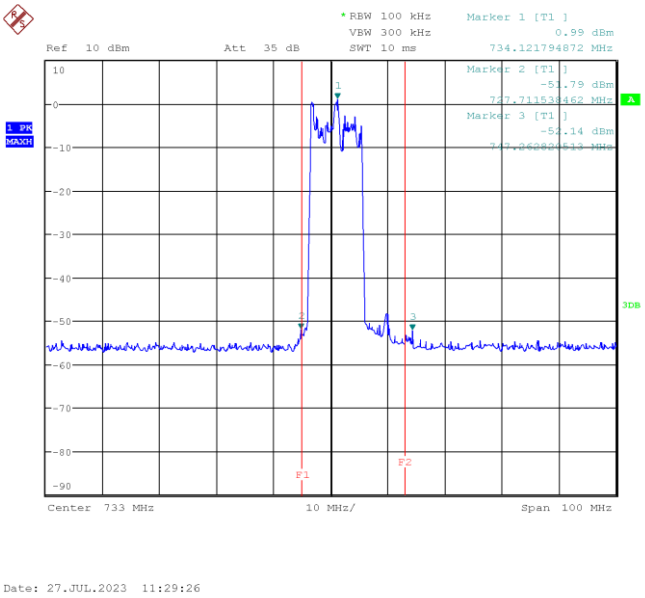

Figure 50: Low Band Edge, 10 MHz BW, QPSK/16QAM

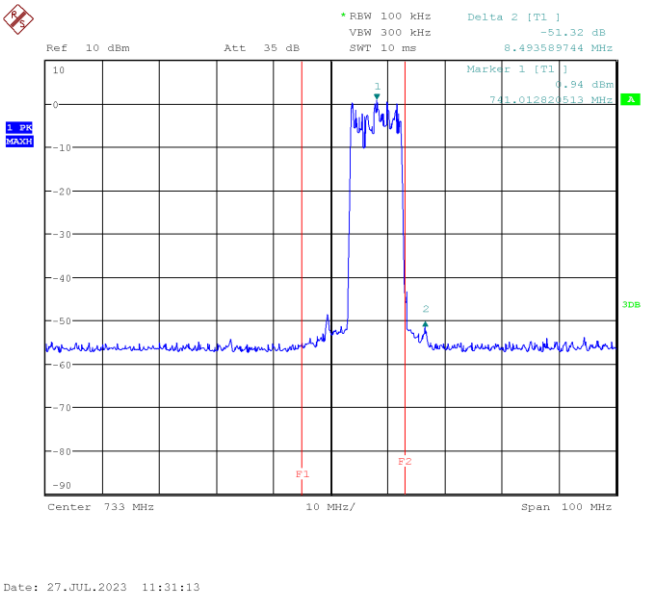

Figure 51: High Band Edge, 10 MHz BW, QPSK/16QAM

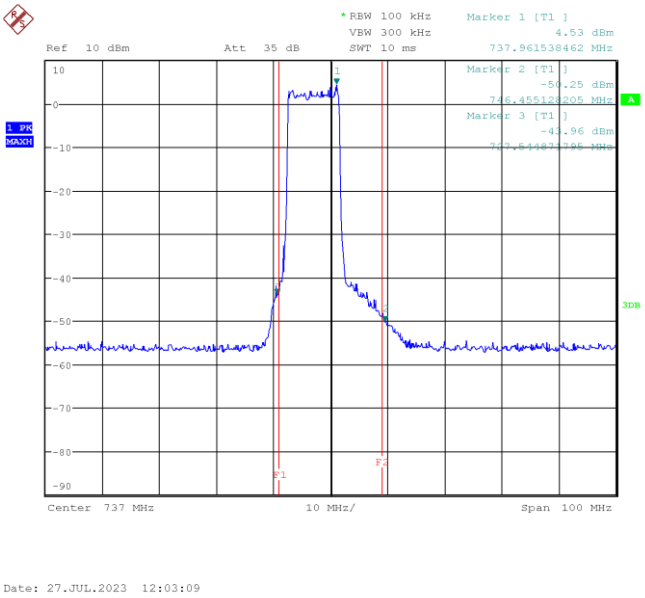

Figure 52: Low Band Edge, 10 MHz BW, QPSK/64QAM

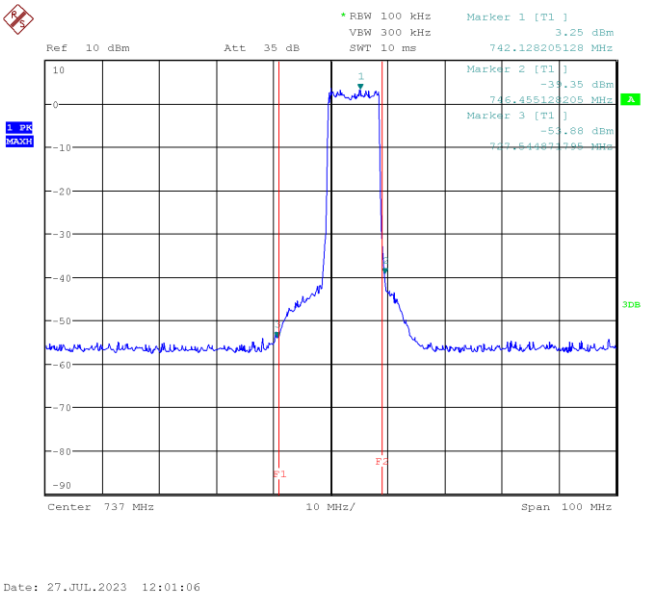

Figure 53: High Band Edge, 10 MHz BW, QPSK/64QAM

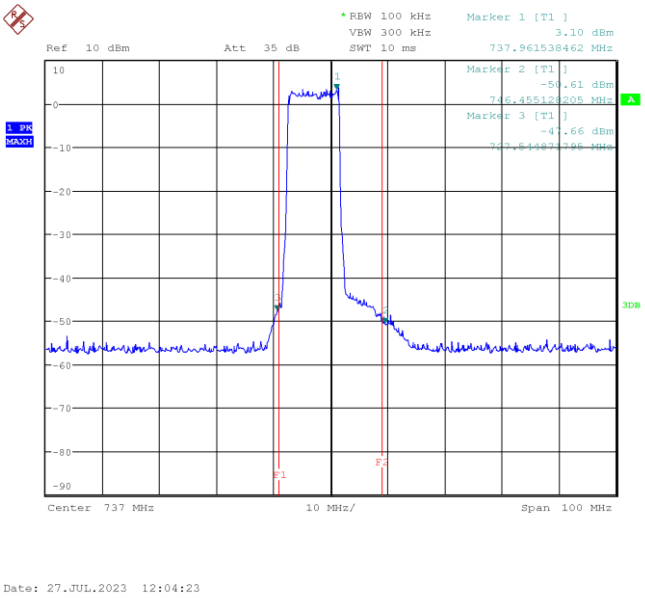

Figure 54: Low Band Edge, 10 MHz BW, QPSK/256QAM

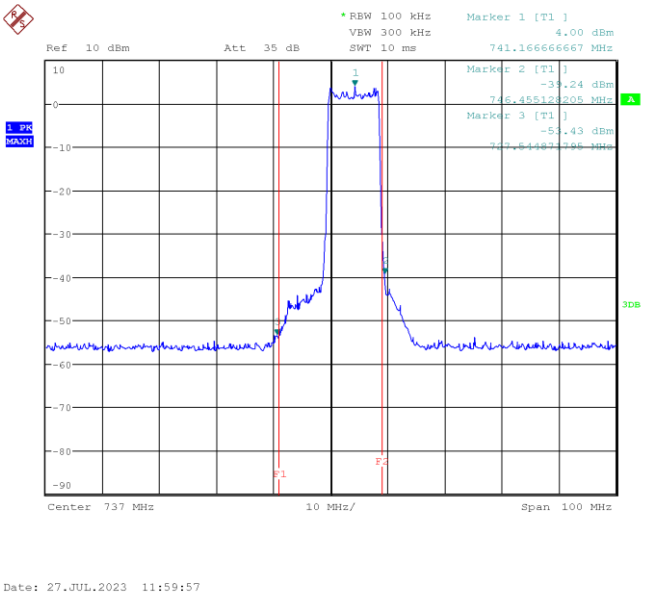

Figure 55: High Band Edge, 10 MHz BW, QPSK/256QAM

3.4 RF Conducted Out of Band Emissions

Date Performed: July 27, 2023

Test Standard: FCC CFR 47 Part 27.53 (g)
RSS-130 Issue 2

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Regulation:

FCC CFR 47 Part 27.53 (g):

> For operations in the 600 MHz band and the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

RSS-130 Issue 2:

> 4.7.1 General unwanted emissions limits
>
> The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

Test Setup:

The EUT was tested outside the SAC via output conducted measurements per ANSI C63.26:2015.

Measurement Data and Plots:

Channel Frequency (MHz)	BW (MHz)	Modulation	Signal Attenuation (dB)	Limit (dB)	Margin (dB)	Result
737.5	5	QPSK/16QAM	47.63	41.16	6.47	Complies
737.5	5	QPSK/64QAM	> 52	46.65	5.35	Complies
737.5	5	QPSK/256QAM	51.70	45.26	6.44	Complies
737.5	10	QPSK/16QAM	> 50	43.28	6.72	Complies
737.5	10	QPSK/64QAM	> 50	44.90	5.10	Complies
737.5	10	QPSK/256QAM	> 53	47.45	5.55	Complies

Table 20: RF Conducted Out of Band Emissions

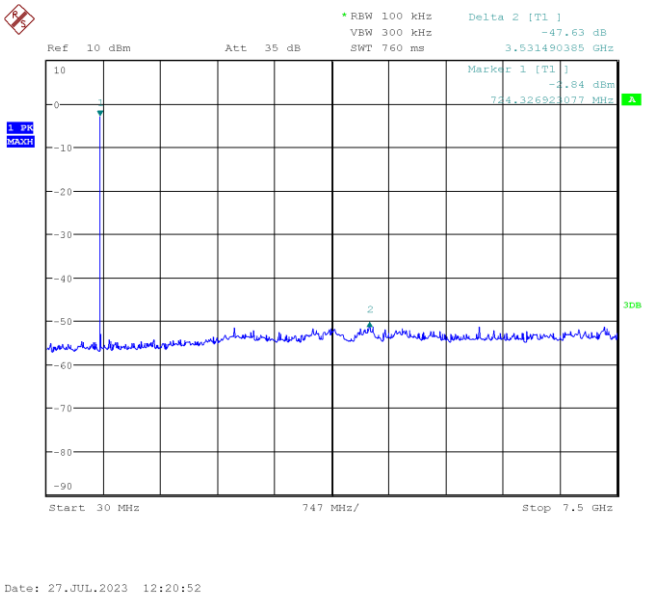

Figure 56: RF Conducted Out of Band Emissions, 5 MHz BW, QPSK/16QAM

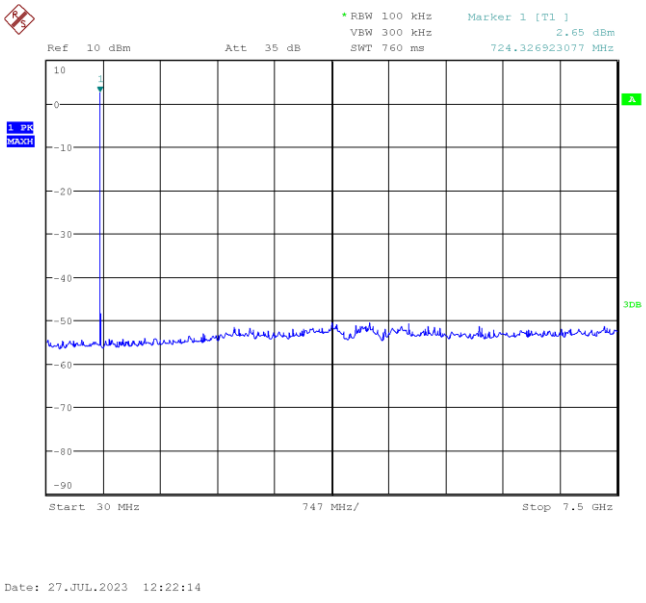

Figure 57: RF Conducted Out of Band Emissions, 5 MHz BW, QPSK/64QAM

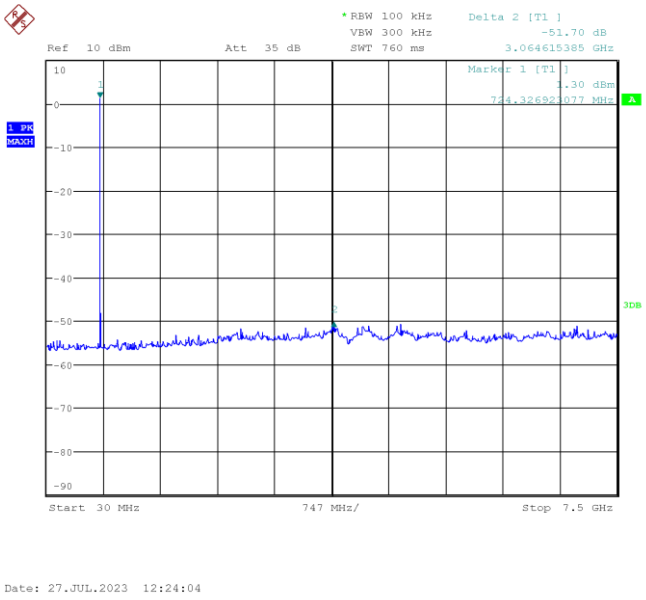

Figure 58: RF Conducted Out of Band Emissions, 5 MHz BW, QPSK/256QAM

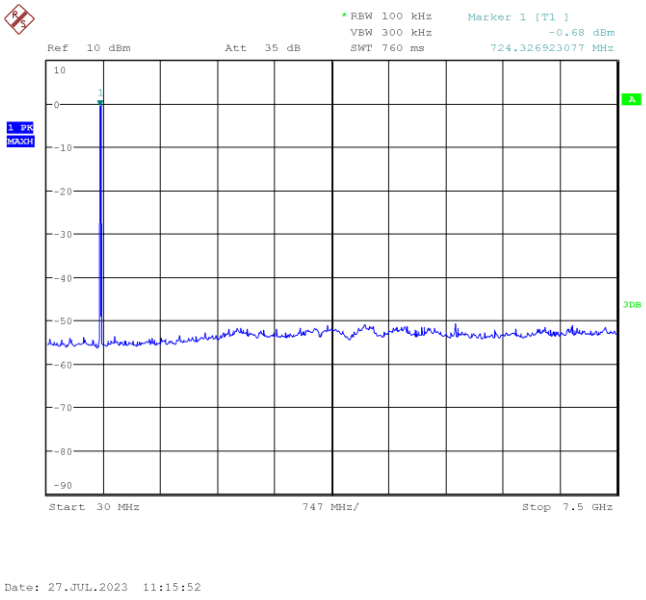

Figure 59: RF Conducted Out of Band Emissions, 10 MHz BW, QPSK/16QAM

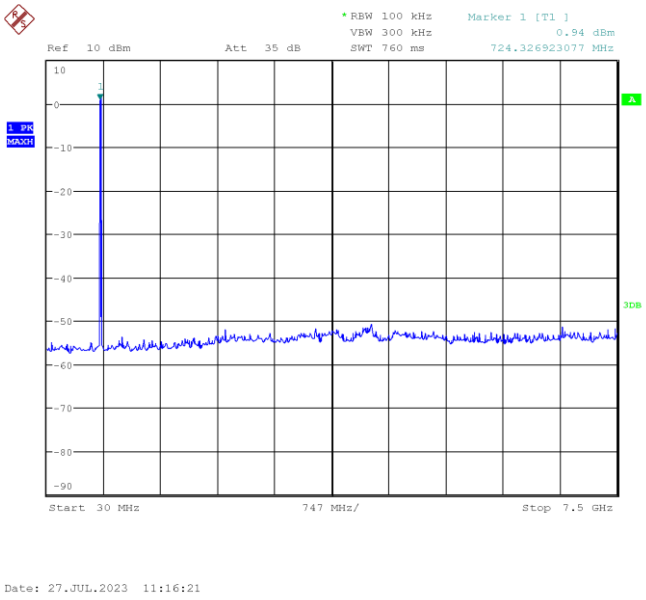

Figure 60: RF Conducted Out of Band Emissions, 10 MHz BW, QPSK/64QAM

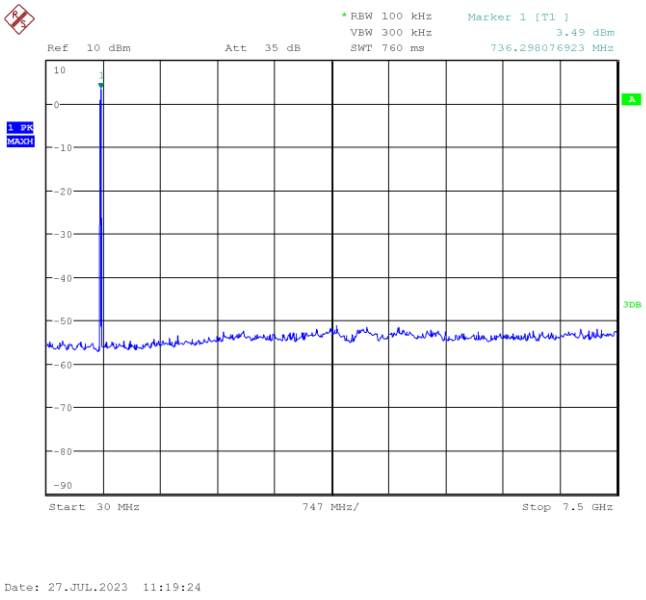

Figure 61: RF Conducted Out of Band Emissions, 10 MHz BW, QPSK/256QAM

3.5 Conducted Emissions: AC Power Line

Date Performed: July 26, 2023

Test Standard: FCC 15.107
ICES-003 Issue 7

Test Method: ANSI C63.10:2013

Modifications: None

Final Result: Complies

Applicable Standard:

FCC 47 CFR Part 15.107: Conducted limits

a) For Class A digital device 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, withing the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH / 50 Ω 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. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	79	66
0.5 – 30	73	60

ICES-003 Issue 7 3.2.1: Conducted emissions limits

The ITE or digital apparatus shall comply with the conducted emission limits specified in the following table at its AC mains power terminals. The product under test shall comply with both the quasi-peak and the average limits.

Where the product under test is powered through an external device (for example, through an external power supply, or by means of a device providing power over Ethernet to the product under test), the conducted emission limits apply at the AC mains power terminals of the external device, while this is powering the product under test: see ICES-Gen.

Frequency of emission (MHz)	Conducted limit (dBµV)			
	Class A Quasi-peak	Class A Average	Class B Quasi-peak	Class B Average
0.15 – 0.5	79	66	66 to 56 Note 1	56 to 46 Note 1
0.5 – 5	73	60	56	46
5 – 30	73	60	60	50

Note 1 The level decreases linearly with the logarithm of the frequency.

Test Setup:

The EUT was tested inside the SAC using a 50 µH / 50 Ω lisn per ANSI C63.10:2013.

Measurement Data and Plots:

Frequency MHz	QuasiPeak (dBuV/m)	Average (dBuV/m)	Line	PE	Corr. (dB/m)	Limit (dBuV/m)	Margin (dB)	Result
5.3020	---	47.34	L1	GND	10.2	60.00	12.66	Complies
5.4340	---	41.67	L1	GND	10.2	60.00	18.33	Complies
5.5660	---	39.52	L1	GND	10.2	60.00	20.48	Complies
5.8320	---	43.68	L1	GND	10.2	60.00	16.32	Complies
6.0960	---	40.05	L1	GND	10.2	60.00	19.95	Complies
6.6260	---	40.69	L1	GND	10.2	60.00	19.32	Complies
10.3380	---	43.39	L1	GND	10.3	60.00	16.61	Complies
10.6020	---	46.47	L1	GND	10.3	60.00	13.53	Complies
10.8680	---	46.48	L1	GND	10.3	60.00	13.52	Complies
11.1320	---	50.75	L1	GND	10.3	60.00	9.25	Complies
11.3960	---	47.95	L1	GND	10.3	60.00	12.05	Complies
11.6620	---	47.93	L1	GND	10.3	60.00	12.07	Complies
11.9260	---	48.80	L1	GND	10.3	60.00	11.20	Complies
12.4540	---	43.03	L1	GND	10.3	60.00	16.97	Complies

Table 21: AC Conducted Emissions, Line 1

Frequency MHz	QuasiPeak (dBuV/m)	Average (dBuV/m)	Line	PE	Corr. (dB/m)	Limit (dBuV/m)	Margin (dB)	Result
5.3000	---	44.42	L2	GND	10.2	60.00	15.58	Complies
5.4340	---	31.00	L2	GND	10.2	60.00	29.00	Complies
5.5660	---	47.95	L2	GND	10.2	60.00	12.05	Complies
5.8300	---	45.60	L2	GND	10.2	60.00	14.40	Complies
6.0960	---	38.15	L2	GND	10.2	60.00	21.85	Complies
6.6260	---	34.22	L2	GND	10.2	60.00	25.78	Complies
7.1560	---	36.67	L2	GND	10.2	60.00	23.33	Complies
10.3380	---	44.00	L2	GND	10.3	60.00	16.00	Complies
10.6020	---	49.62	L2	GND	10.3	60.00	10.38	Complies
10.8660	---	51.00	L2	GND	10.3	60.00	9.00	Complies
11.1320	---	50.97	L2	GND	10.3	60.00	9.03	Complies
11.3960	---	52.22	L2	GND	10.3	60.00	7.78	Complies
11.6620	---	48.73	L2	GND	10.3	60.00	11.27	Complies
11.9260	---	49.63	L2	GND	10.3	60.00	10.37	Complies
12.4580	---	42.95	L2	GND	10.3	60.00	17.05	Complies
12.7220	---	42.02	L2	GND	10.3	60.00	17.98	Complies

Table 22: AC Conducted Emissions, Line 2

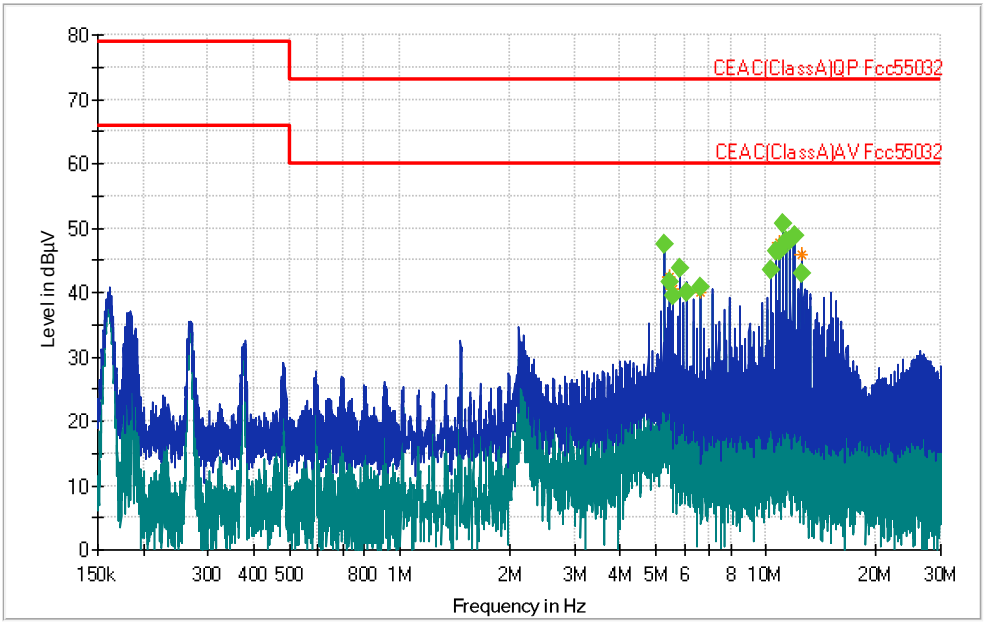

Figure 62: AC Conducted Emissions, Line 1

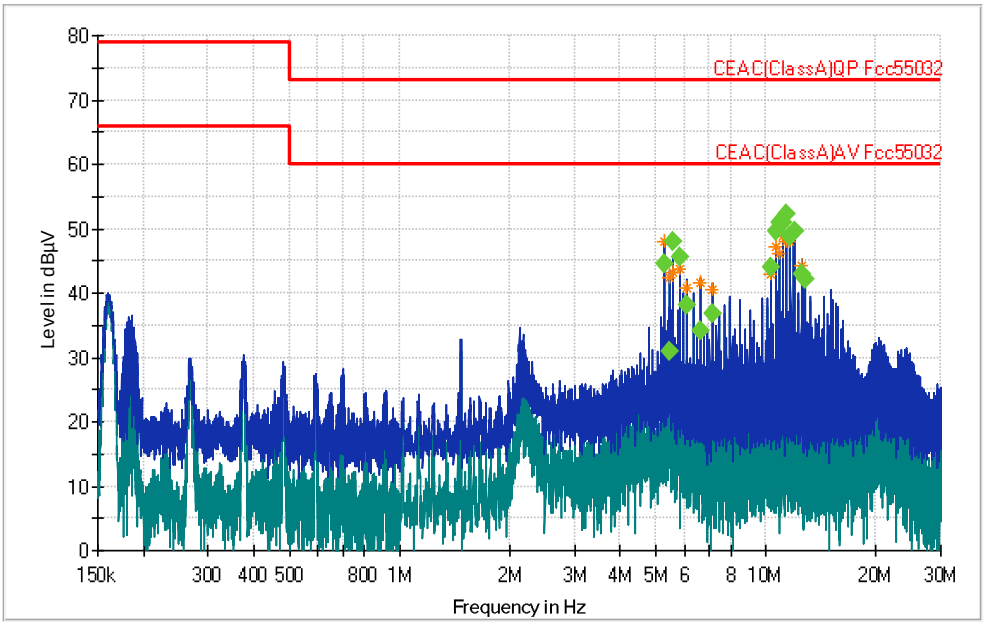

Figure 63: AC Conducted Emissions, Line 2

3.6 Conducted Emissions: Telecom

Date Performed: July 26, 2023

Test Standard: CISPR 32

Test Method: CISPR 32

Modifications: None

Final Result: Complies

Applicable Standard:

CISPR 32 Annex A.3: Requirements for conducted emissions

The EUT is deemed to comply with the conducted emission requirements when it has been shown to be compliant with all applicable limits as given in the following table(s).

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	97 to 87	84 to 74
0.5 – 30	87	74

Test Setup and Measurement Method:

CISPR 32 Annex C.4.1.6.2

Measurement is made at wired network ports using AANs with longitudinal conversion losses as defined in Table C.2. The AAN for the cable category specified by the equipment documentation provided to the user shall be used. The level of emissions from the EUT shall not exceed the applicable limits of Annex A.

When emission voltage measurements are performed, the AAN shall provide a voltage measurement port suitable for connection to a measuring receiver while simultaneously satisfying the analogue/digital data port common mode termination impedance requirements.

For unscreened cables containing balanced pairs, an AAN conforming to C.41.2 shall be used. The LCL values of the AAN shall be within the tolerance given in Table C.2 for an AAN appropriate to the cable category connected to the EUT.

The procedure shall be as follows:

- Arrange the EUT, local AE and associated cabling;
- Measure the voltage at the measurement port of the AAN;
- Correct the measured voltage by adding the AAN voltage division factor defined in C.4.1.2 e)
- Compare the corrected voltage with the limit

Measurement Data and Plots:

Frequency MHz	QuasiPeak (dBuV/m)	Average (dBuV/m)	Corr. (dB/m)	Limit (dBuV/m)	Margin (dB)	Result
1.4700	---	68.69	19.4	74.00	5.31	Complies
9.2760	---	63.59	19.6	74.00	10.41	Complies
9.5440	---	61.23	19.6	74.00	12.77	Complies
9.8040	---	64.30	19.6	74.00	9.70	Complies
10.0720	---	67.67	19.6	74.00	6.33	Complies
10.3360	---	67.51	19.6	74.00	6.49	Complies
10.6040	---	66.20	19.6	74.00	7.80	Complies
10.8680	---	67.87	19.6	74.00	6.13	Complies
11.1320	---	66.65	19.6	74.00	7.35	Complies
11.3960	---	66.69	19.6	74.00	7.31	Complies

Table 23: Conducted Emissions: Telecom

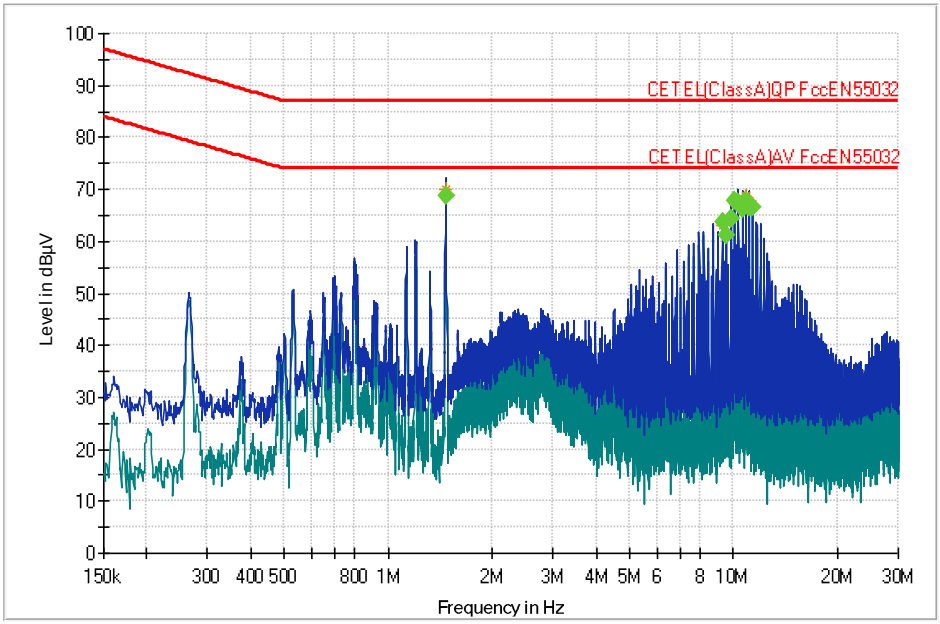

Figure 64: Conducted Emissions: Telecom

3.7 Unintentional Radiated Emissions

Date Performed: July 26, 2023

Test Standard: FCC 47 CFR Part 15.33 (a)(1), (5)
FCC 47 CFR Part 15.109
ICES-003 Issue 7
RSS-247

Test Method: ANSI C63.4:2014

Modifications: None

Final Result: Complies

Applicable Standard:

FCC 47 CFR Part 15.33 (b)(1): Frequency range of radiated measurements

For an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.075	30
1.075 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

FCC 47 CFR Part 15.109: Radiated emission limits

b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission (MHz)	Field strength at 10m (microvolts/meter)	Field strength at 10m (dBuV/meter)	Field strength at 3 m (microvolts/meter)	Field strength at 3 m (dBuV/meter)
30 – 88	90	39.1	100	40.0
88 – 216	150	43.5	160	44.1
216 – 960	210	46.4	220	46.8
Above 960	300	49.5	310	49.8

ICES-003 3.2.2 Radiated emission limits

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

Frequency Range (MHz)	Class A (3 m) Quasi-peak (dBµV/m)	Class A (10 m) Quasi-peak (dBµV/m)	Class B (3 m) Quasi-peak (dBµV/m)	Class B (10 m) Quasi-peak (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:

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

F_M is determined by:

Highest internal frequency (F_X)	Highest measurement frequency (F_M)
$F_X \leq$ 108 MHz	1 GHz
108 MHz $\leq F_X \leq$ 500 MHz	2 GHz
500 MHz $\leq F_X \leq$ 1 GHz	5 GHz
$F_X >$ 1 GHz	5 x F_X up to a maximum of 40 GHz

Test Setup:

The EUT was tested in a 3 m SAC and was positioned on the front of the turntable and the radiated output of the device was measured for all emissions up to 18 GHz.

Measurement Data and Plots:

Frequency MHz	QuasiPeak (dBuV/m)	Height (cm)	Pol	Azimuth (°)	Corr. (dB/m)	Limit (dBuV/m)	Margin (dB)	Result
44.7944	40.96	100.0	V	163	15.7	49.50	8.54	Complies
66.5786	37.86	149.0	V	224	12.9	49.50	11.64	Complies
73.9496	31.66	100.0	V	183	13.2	49.50	17.84	Complies
118.7460	33.84	131.0	H	244	18.9	53.90	20.06	Complies
499.9856	41.24	122.0	H	44	24.3	56.90	15.66	Complies
524.9963	35.75	100.0	V	289	24.3	56.90	21.15	Complies

Table 24: Unintentional Radiated Emissions: 30 MHz - 1 GHz

Frequency MHz	MaxPeak (dBuV/m)	Average (dBuV/m)	Height (cm)	Pol	Azimuth (°)	Corr. (dB/m)	Limit (dBuV/m)	Margin (dB)	Result
---	---	---	---	---	---	---	---	---	Complies

Table 25: Unintentional Radiated Emissions: 1 GHz - 18 GHz

No emissions were observed at frequencies above 1 GHz.

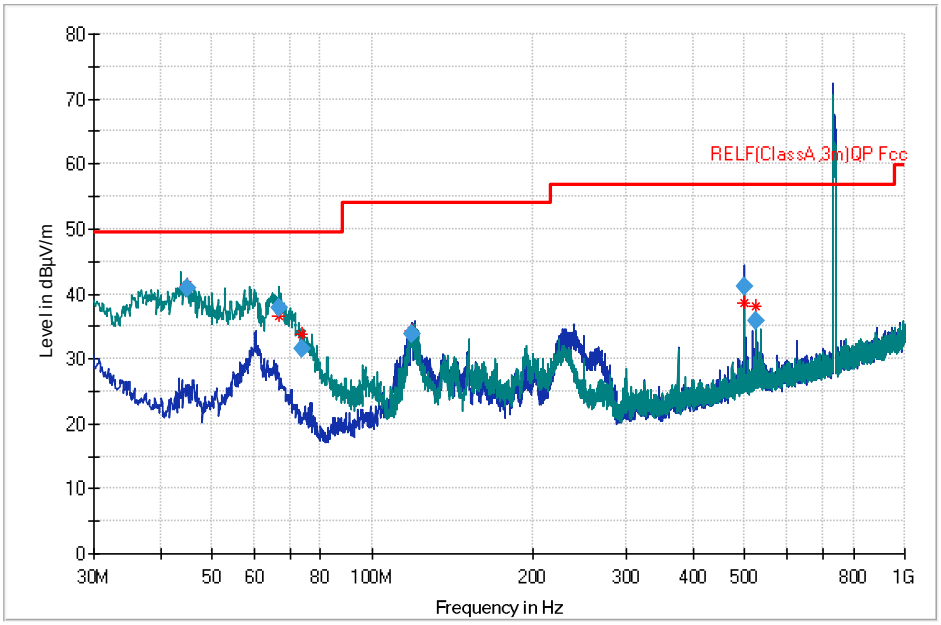

Figure 65: Radiated Emissions: 30 MHz - 1 GHz

Note: Emission at 735 MHz is the intentional transmitter

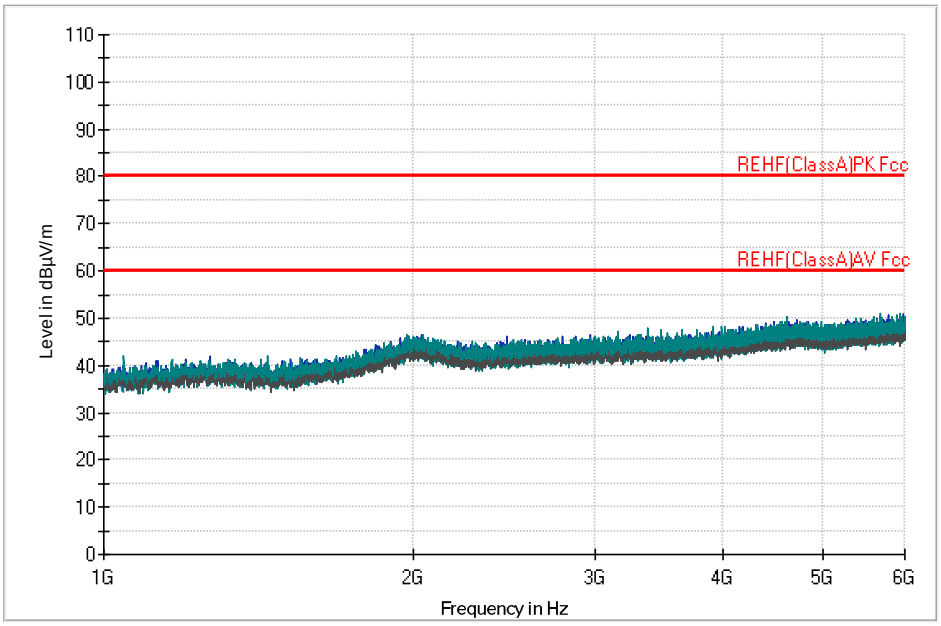

Figure 66: Radiated Emissions: 1 GHz – 6 GHz

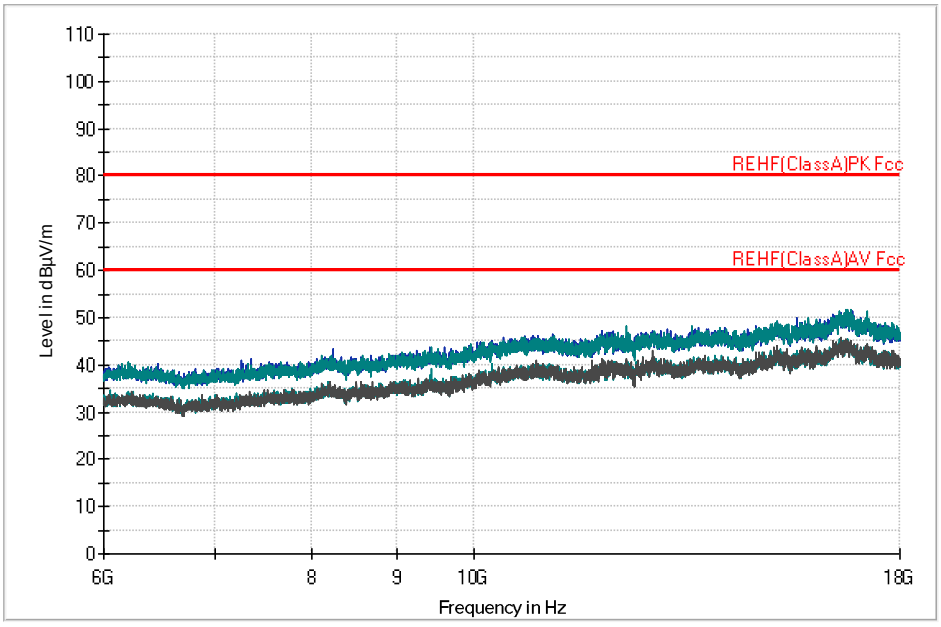

Figure 67: Radiated Emissions: 6 GHz – 18 GHz

3.8 Frequency Stability

Date Performed:	July 27, 2023
Test Standard:	FCC CFR 47 Part 27.54 FCC CFR 47 Part 2.1055 (a)(1) FCC CFR 47 Part 2.1055 (d) RSS-130 Issue 2 RSS-Gen Issue 5
Test Method:	ANSI C63.10:2013 RSS-Gen Issue 5
Modifications:	The EUT was unable to produce an unmodulated CW signal, therefor the LO bleed through was used to monitor the EUT frequency.
Final Result:	Complies

Applicable Regulation:

FCC CFR 47 Part 27.54:

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

FCC CFR 47 Part 2.1055 (a)(1):

The frequency stability shall be measured with variation of ambient temperature from -30° to +50° centigrade.

FCC CFR 47 Part 2.1055 (d)(1):

The frequency stability shall be measured with variation of primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

RSS-130 Issue 2:

4.5 Transmitter frequency stability

For equipment that is capable of transmitting numerous channels simultaneously for different applications (e.g. LTE and narrowband – Internet of Things (IoT)), the occupied bandwidth shall be the bandwidth representing the sum of the occupied bandwidths of these channels.

The frequency stability shall be sufficient to ensure that the occupied bandwidth remains within each frequency block range when tested at the temperature and supply voltage variations specified in RSS-Gen.

RSS-Gen Issue 5:

Frequency stability is a measure of frequency drift due to temperature and supply voltage variations, with reference to the frequency measured at an appropriate reference temperature and the rated supply voltage.

When the measurement method of transmitter frequency stability is not stated in the applicable RSS or reference standards, the following conditions apply:

a) The reference temperature for radio transmitters is +20°C (+68°F).
b) A hand-held device that is only capable of operating using internal batteries shall be tested at the battery's nominal voltage, and again at the battery's operating end-point voltage, which shall be specified by the equipment manufacturer. For this test, either a battery or an external power supply can be used.

c) The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environmental test chamber, the unmodulated carrier frequency and frequency stability shall be measured under the conditions specified below for licensed and licence-exempt devices, unless specified otherwise in the applicable RSS. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement.

For licensed devices, the following measurement conditions apply:

a) at the temperatures of -30°C (-22°F), +20°C (+68°F) and +50°C (+122°F), and at the manufacturer's rated supply voltage
b) at the temperature of +20°C (+68°F) and at ±15% of the manufacturer's rated supply voltage

If the frequency stability limits are only met within a temperature range that is smaller than the range specified in (a) for licensed or licence-exempt devices, the frequency stability requirement will be deemed to be met if the transmitter is automatically prevented from operating outside this smaller temperature range and if the published operating characteristics for the equipment are revised to reflect this restricted temperature range.

Test Setup:

The EUT was tested in an environmental chamber per RSS-Gen and ANSI C63.26:2015.

Measurement Data and Plots:

Temperature (°C)	Transmitter Frequency (MHz)	PPM Change From Reference Temp	Limit (PPM)	Margin (PPM)	Result
-30	737.50000	0	1	1	Complies
-20	737.50000	0	1	1	Complies
-10	737.50000	0	1	1	Complies
0	737.50000	0	1	1	Complies
10	737.50000	0	1	1	Complies
20	737.50000	Ref	---	---	---
30	737.50000	0	1	1	Complies
40	737.50000	0	1	1	Complies
50	737.50000	0	1	1	Complies

Table 26: Frequency Stability with Temperature Change

Supply Voltage (V)	Transmitter Frequency (MHz)	PPM Change From Reference Temp	Limit (PPM)	Margin (PPM)	Result
102	737.50000	0	1	1	Complies
120	737.50000	Ref	---	---	---
138	737.50000	0	1	1	Complies

Table 27: Frequency Stability with Voltage Change

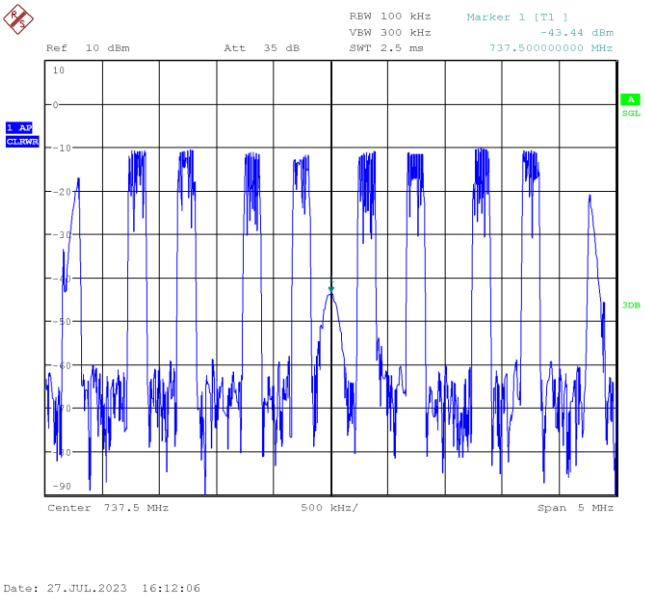

Figure 68: Output Frequency: -30 °C

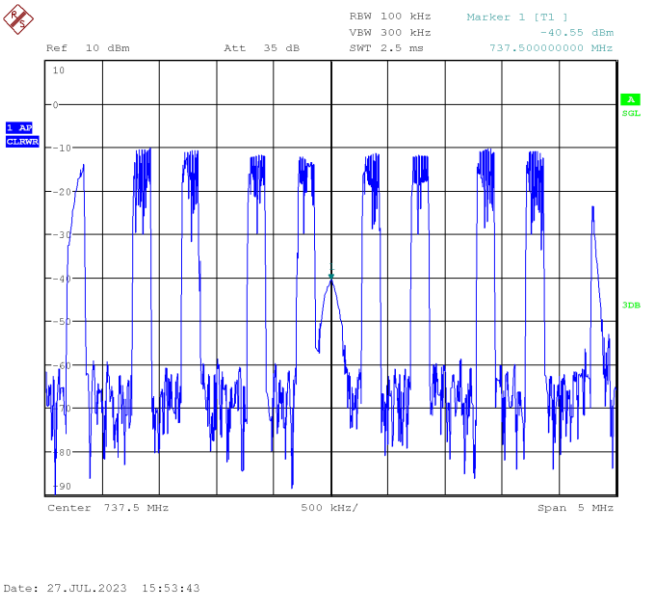

Figure 69: Output Frequency: -20 °C

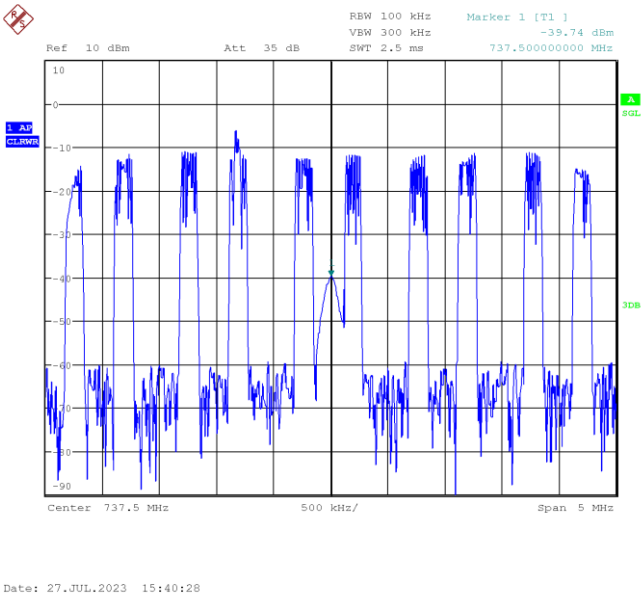

Figure 70: Output Frequency: -10 °C

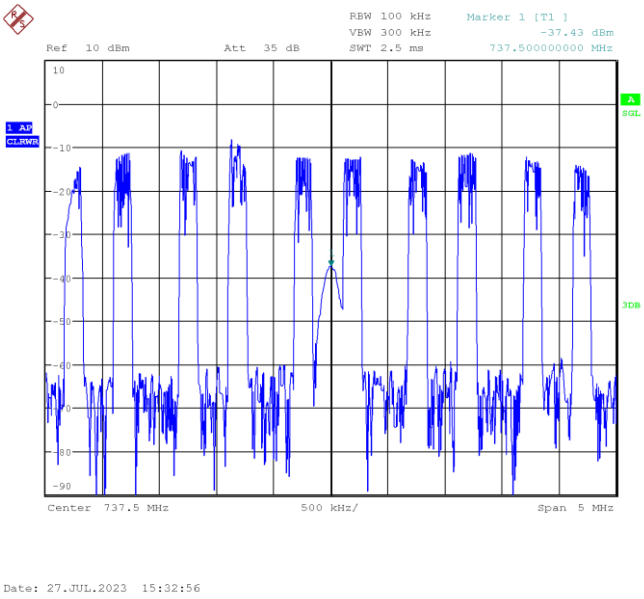

Figure 71: Output Frequency: 0 °C

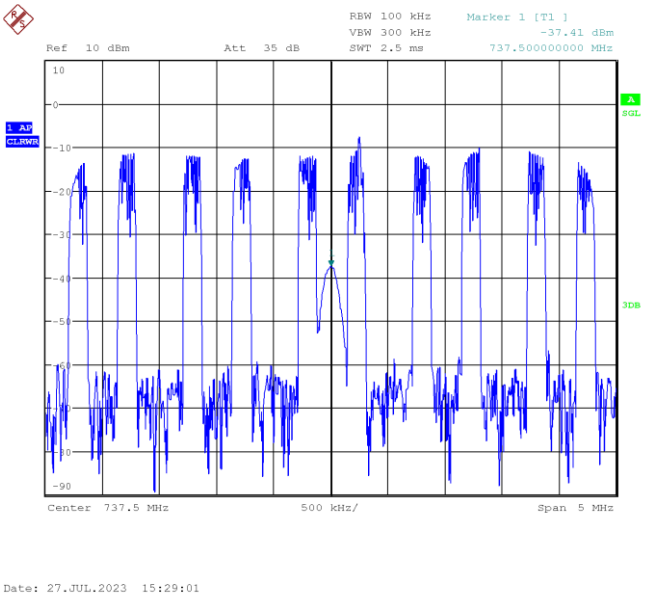

Figure 72: Output Frequency: 10 °C

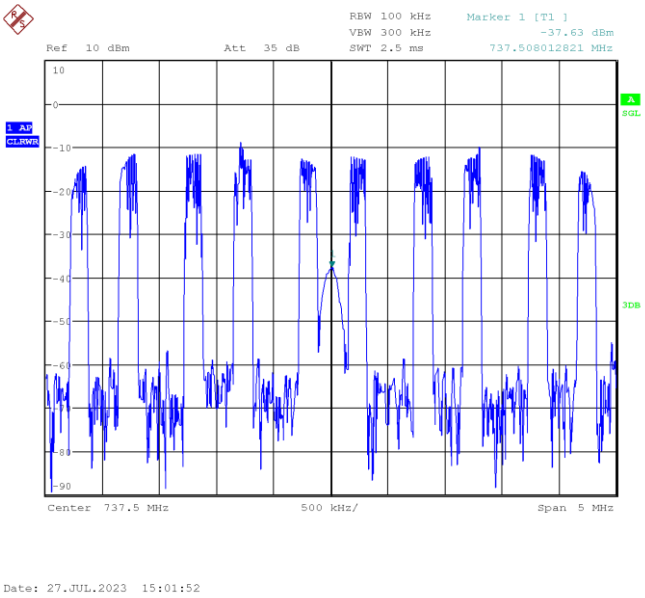

Figure 73: Output Frequency: 20 °C

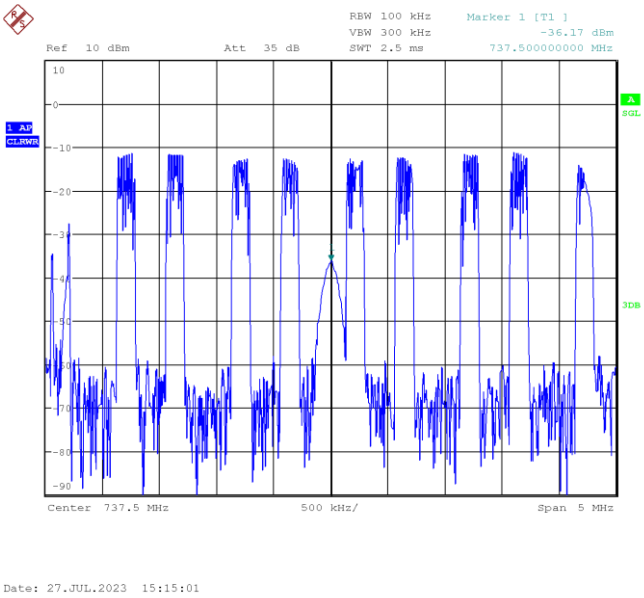

Figure 74: Output Frequency: 30 °C

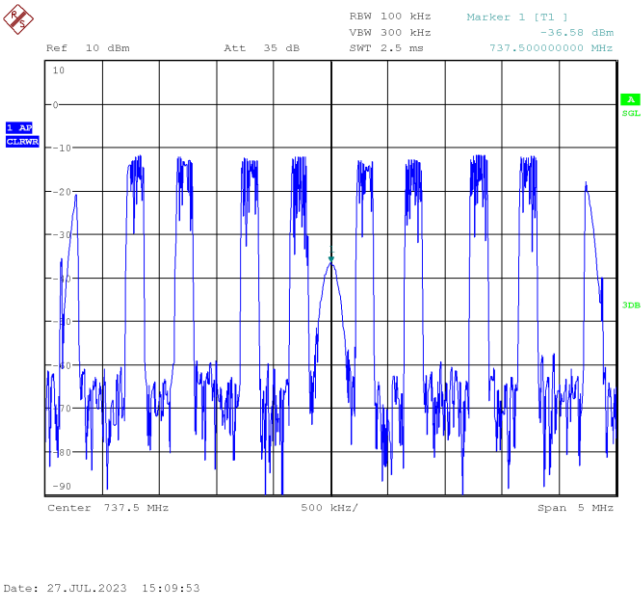

Figure 75: Output Frequency: 40 °C

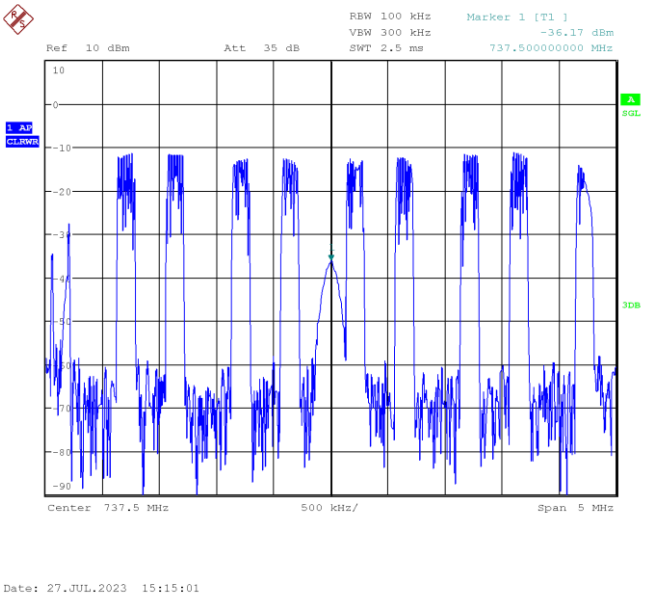

Figure 76: Output Frequency: 50 °C

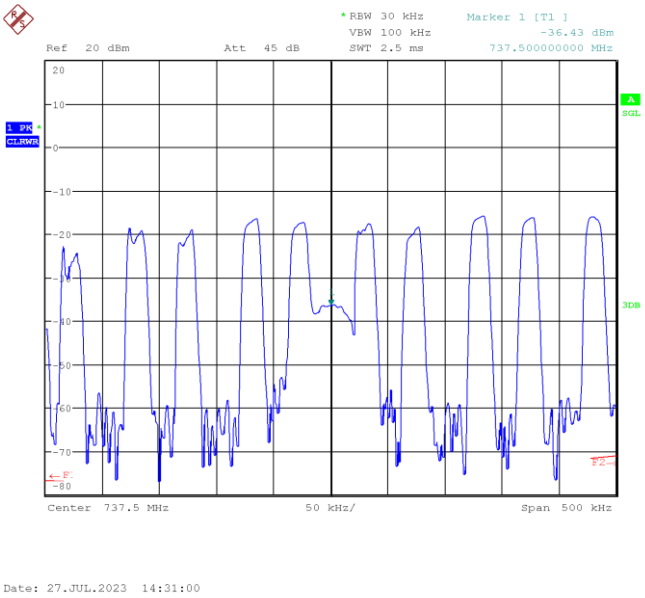

Figure 77: Output Frequency: 102V

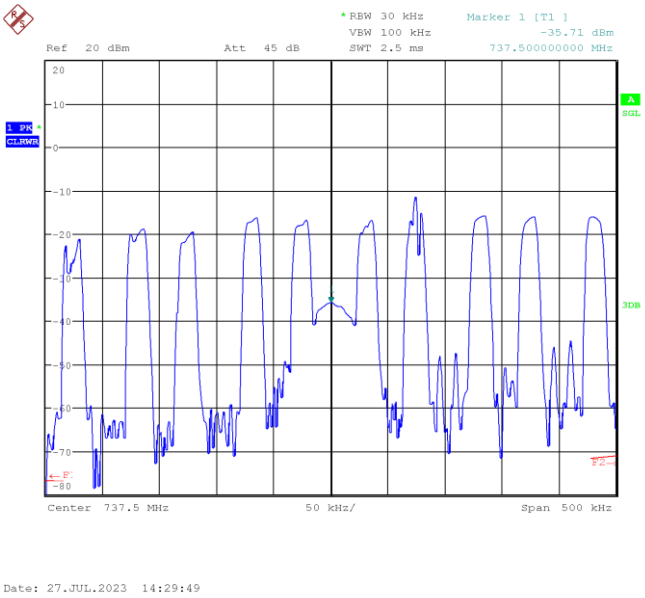

Figure 78: Output Frequency: 120V

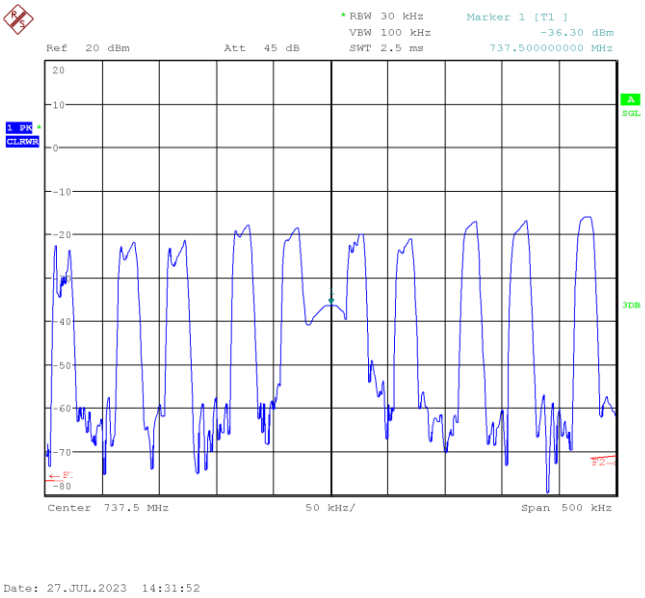

Figure 79: Output Frequency: 138V

Appendix A: Test Setup Photos

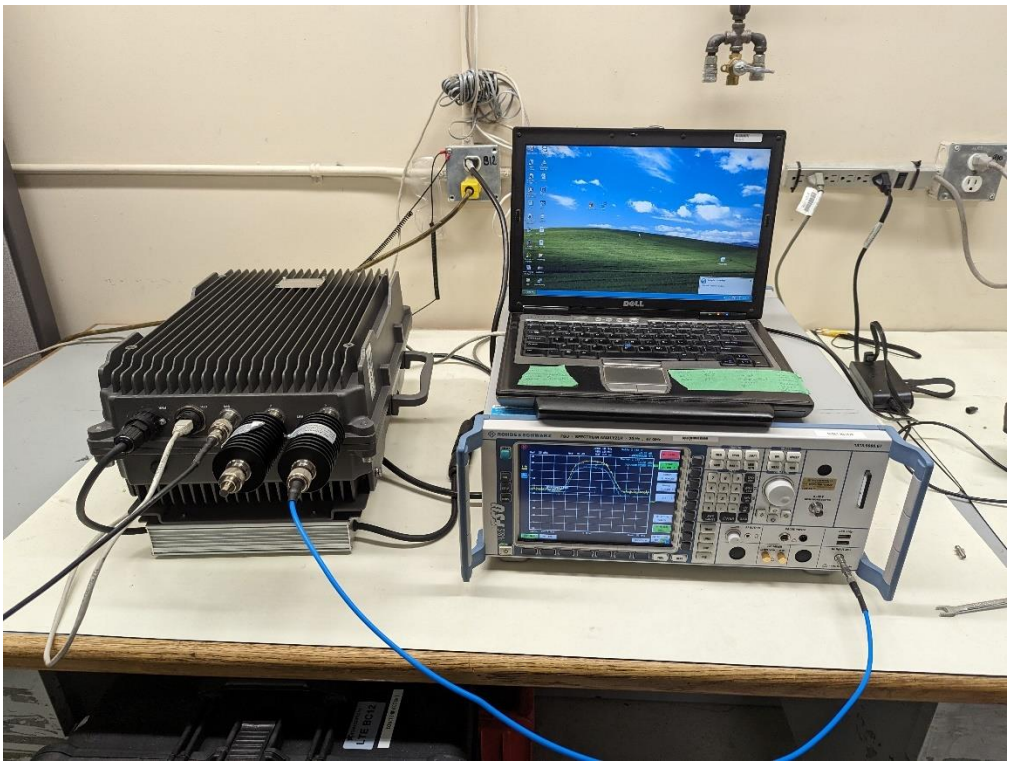

Figure 80: RF Conducted Measurement Setup

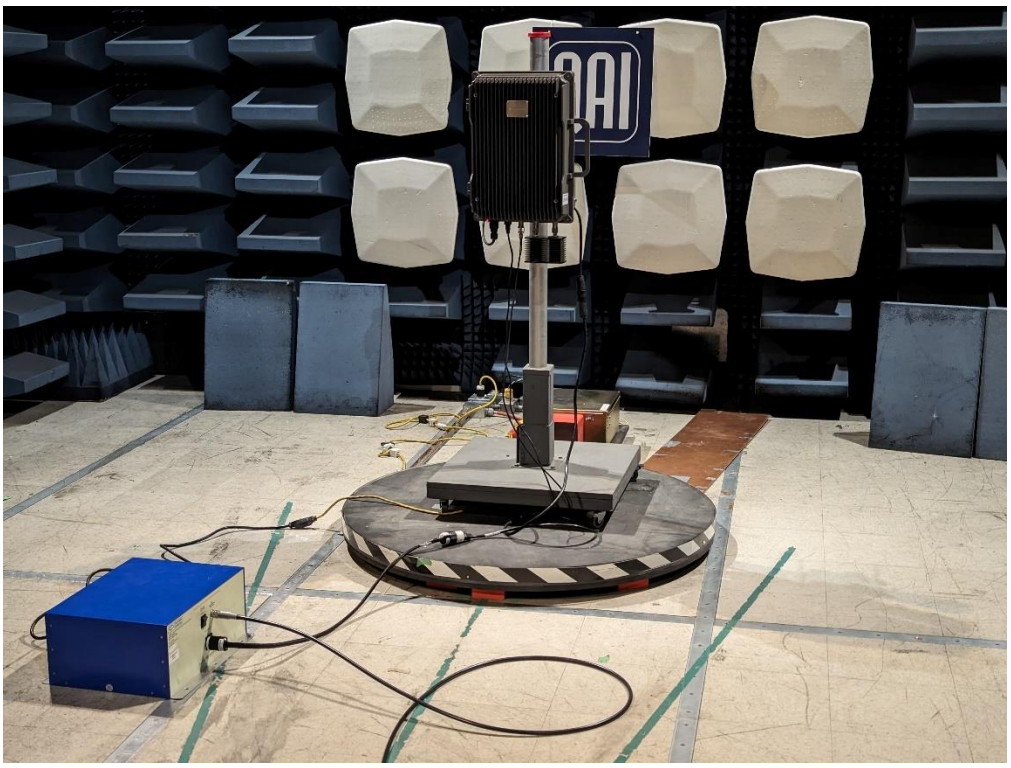

Figure 81: Conducted Emissions: AC Power Line Measurement Setup

Figure 82: Conducted Emissions: Telecom Measurement Setup

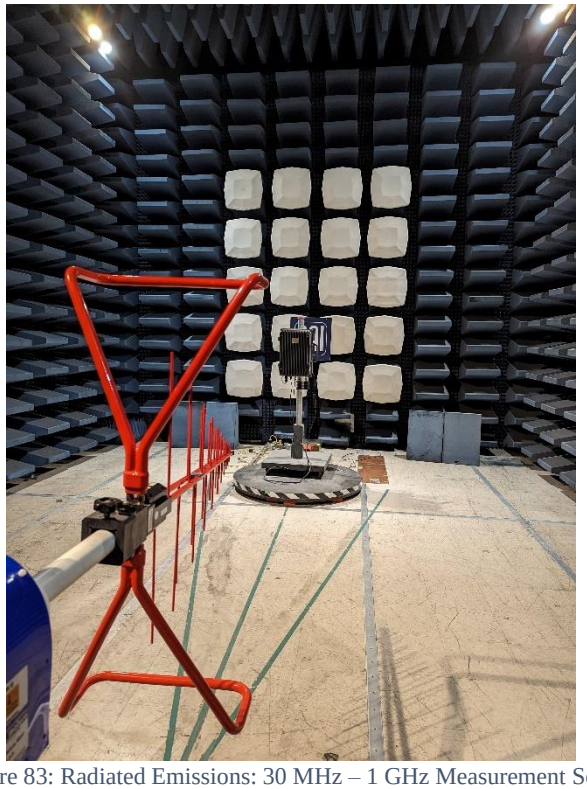

Figure 83: Radiated Emissions: 30 MHz – 1 GHz Measurement Setup

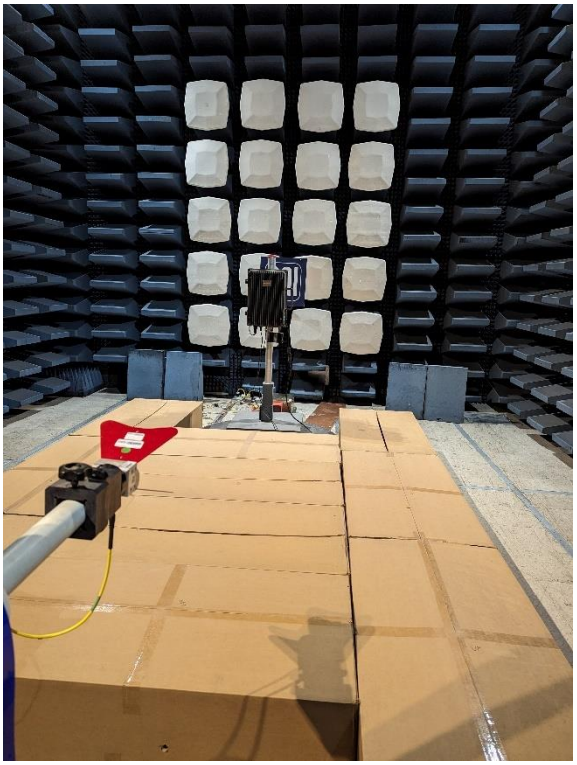

Figure 84: Radiated Emissions: 1 GHz – 18 GHz Measurement Setup

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