INTENTIONAL RADIATOR
TEST REPORT

Report Reference Number:	E10599-2205-Star Solutions International Inc_iCell COMPAC- N LTE BTS B66_Rev-1.4
Total Number of Pages:	55
Date of Issue:	September 15, 2022
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Manufacturer:	**Star Solutions International Inc**
Address:	120 - 4600 Jacombs Road Richmond BC V6V 3B1 Canada
Equipment Tested:	**iCell COMPAC-N-LTE BTS B66**
Model Number(s):	NL-6611.0
ISED ID:	8076A-71266001
FCC ID:	S52-7-12-66-00-1

REVISION HISTORY

Date	Report Number	Revisions	Details	Author's Initials
August 17, 2022	E10599-2205-Star Solutions International Inc_iCell COMPAC- N LTE BTS-B66_Rev-1.0	1.0	Draft	AN
September 15, 2022	E10599-2205-Star Solutions International Inc_iCell COMPAC- N LTE BTS-B66_Rev-1.4	1.4	Removed Typo 0610	AN
All previous versions of this report have been superseded by the latest dated revision as listed in the above table.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. 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 22RH06162R2 and 22RH07115.

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 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

TABLE OF CONTENTS

Section I: GENERAL INFORMATION

1.1 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.

Equipment Under Test (EUT)

EUT	**iCell COMPAC-N-LTE BTS B66**
Manufacturer	Star Solutions International Inc
HVIN/Model No.	NL-6611
PMN	**iCell COMPAC-N-LTE BTS B66**
FVIN	-
Frequency Range	TX 2110-2180 MHz, and RX 1710-1780 MHz

Technical Specifications

CAPACITY/Performance	Configurations	2TRX LTE
	RF Output Power	2 x 20W
Frequency BANDs	Supported Bands	LTE Band Class 66- BW 5, 10, 15 and 20 MHz
PROTOCOL SUPPORT	Signaling	GPS / IP
INTERFACES	Antenna Connectors	N-type female
HARDWARE	Dimensions	450 mm H × 320 mm W x 180 mm D (17.7 x 12.6 x 7.0 in.)
	Weight	16 kilograms
	Input Voltage	120 AC
	Power Consumption	Power consumption 170W typical
	Options	Mounting brackets for wall or pole
	Type of Modulations	QPSK, 16QAM, 64QAM, 256QAM
ENVIRONMENTAL	Temperature	Operating: -40 to +50°C
		Storage: -40 to +50°C
	Humidity	5−95% non-condensing

1.2 Environmental Conditions

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

Parameter	Conditions
Location	Indoors
Temperature	26ºC
Relative Humidity	48.9%
Atmospheric Pressure	101.3 kPa

1.3 Measurement Uncertainty

Parameter	Uncertainty
Radiated Emissions, 30MHz.-1GHz.	± 2.40 dB
Radiated Emissions, 1GHz.-40GHz.	± 2.48 dB
Conducted Emissions, 0.15MHz.-30MHz.	± 2.82 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 %

1.4 Worst Test Case

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

1.5 Sample Calculations of Emissions Data

Radiated and conducted emissions were performed using EMC32 software developed by Rohdes & 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.)	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

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.)	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

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

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

1.6 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 1.

Emissions Test Equipment

Note: Equipment listed above have 3 years calibration interval.

Measurement Software List Emissions Test Equipment

Sl. NO.	Manufacturer	Model	Description	Serial No.	S/W Version	Calibration Due Date
1	AH Systems	PAM118	Amplifier (10KHz-18GHz)	189	N/A	Conditional Use
2	EMCO	3825/2	LISN (150kHz-30MHz)	9002-1601	N/A	2023-Oct-01
3	ETS Lindgren	2165	Turntable	00043677	N/A	N/A
4	ETS Lindgren	2125	Mast	00077487	N/A	N/A
5	ETS Lindgren	S201	5-meter Semi-Anechoic Chamber	1030	N/A	N/A
6	Hewlett Packard	8449B	Preamplifier (1-26 GHz)	2933A00198	N/A	2025-Feb-15
7	Rohde & Schwarz	ESU40	EMI Receiver	100011	EMC32 v10.35.10/ FV 4.73 SP4	2023-Jul-05
8	Sunol Sciences	DRH-118	Horn Antenna, 1.0-18 GHz	A050905	N/A	2023-07-28
9	Sunol Sciences	SM46C	Turntable	051204-2	N/A	N/A
10	Sunol Sciences	TWR95	Mast	TREML0001	N/A	N/A
11	Sunol Sciences	JB3	Biconilog Antenna 30MHz – 3GHz	A042004	N/A	2023-Jul-30
12	TTi	HA1600A	Power Analyzer; Harm/Flicker	318801	N/A	2022-Oct-01
13	TTi	AC1000A	Power Supply, Low Distortion	317113	N/A	2022-Oct-01
14	Rigol	RSA5065-TG	Spectrum Analyser	39775	N/A	4/11/2023

Note: Equipment listed above have 3 years calibration interval.

Measurement Software List

Sl. No.	Manufacturer	Model	Version	Description
1	Rhode & Schwarz	EMC 32	10.35.10	Emissions Test Software
2	TESEQ	WIN 3000	1.2.0	Surge, EFT & Voltage Dips Immunity Test Program
3	Thurlby Thandar Instruments	HA-PC Link Version	2.02	Harmonics and Flicker Test Program
4	VI Automation	Via EMC Immunity Executive	1.0.308	Radiated and Conducted Immunity Test Program

Section II: EXECUTIVE SUMMARY OF STANDARDS AND LIMITS

2.1 Purpose

The purpose of this report is to demonstrate and document the compliance of "iCell COMPAC-N-LTE BC66" as per Sections 2.2 of this report.

2.2 Scope

The information documented in this report is based on the test methods and levels as per Quote. The requirements specified in ICES-Gen applies as well as the chosen measurement procedure (CAN/CSA-CISPR 32:17 and ANSI C63.26:2015).

RSS 133 Issue 6 – 2 GHz Personal Communications Services - Only sections applicable to band 66
RSS-139 Issue 3 — Advanced Wireless Services (AWS) Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz
SRSP-513 Issue 3 — Technical Requirements for Advanced Wireless Services (AWS) in the Bands 1710–1780 MHz and 2110–2180 MHz
RSS-Gen Issue 5 – General Requirements for Compliance of Radio Apparatus
ICES-003 Issue 7 - Digital Apparatus Spectrum - Information Technologies and Telecommunications.
CFR Title 47 FCC Part 2 - Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR Title 47 FCC Part 15 - Radio Frequency Devices, Subpart B – Unintentional Radiators
CFR Title 47 FCC Part 22 – Public Mobile Services, Subpart H – Cellular Radiotelephone Service
- Only applicable sections will be included
CFR Title 47 FCC Part 24 – Personal Communications Services - Only applicable sections will be included
CFR Title 47 Part 27 – Miscellaneous Wireless Communication Services- Only applicable sections will be included

2.3 Summary of Results

The following tests demonstrate the testimony to "FCC and ISED" Mark Electromagnetic compatibility testing for "WP5 Wireless Platform 5" manufactured by JSF Technologies Inc.

Test or Measurement	Performance Criteria
Receiver Spurious emissions	**Comply**
Transmitter unwanted emissions (out of band emission limits)	**Comply**
Frequency Stability	**Comply**
Transmitter Output Power	**Comply**
Occupied channel BW	**Comply**

Section III: DATA & TEST RESULTS

3.1 Frequency Stability

Date Performed: July 26, 28, 2022

Test Standard: As per Section 2.2.

Test Method: ANSI C63.26:2015

Test Setup: The carrier frequency shall not depart from the reference frequency in excess of ±1.0 ppm for base stations.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Sub-band	Channel	Frequency	Freq. at 50°C	Deviation at 50°C	Freq. at 40°	Deviation at 40°C	Freq. at 300°C	Deviation at 30°C	Freq. at 20°C	Deviation at 20°C	Limit	Results
(MHz)		(Hz)	(Hz)	ppm	(Hz)	ppm	(Hz)	ppm	(Hz)	ppm	ppm	
2110-2180	66536	2,120,000	2,120,002	0.9	2,120,002	0.9	2,120,001	0.5	2,120,002	0.5	±1.0	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,999	0.5	2,145,001	0.5	±1.0	Comply
2110-2180	67036	2,170,000	2,170,001	0.5	2,170,001	0.5	2,169,999	0.5	2,170,001	0.5	±1.0	Comply
2110-2180	66536	2,120,000	2,120,001	0.5	2,120,001	0.5	2,120,001	0.5	2,120,001	0.5	±1.0	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,998	0.9	2,145,001	0.9	±1.0	Comply

Sub-band	Channel	Frequency	Freq. at 10°C	Deviation at 10°C	Freq. at 0°	Deviation at 0°C	Freq. at -10°C	Deviation at -10°C	Freq. at -20°C	Deviation at -20°C	Limit	Results
(MHz)		(Hz)	(Hz)	ppm	(Hz)	ppm	(Hz)	Ppm	(Hz)	ppm	ppm	
2110-2180	66536	2,120,000	2,120,001	0.9	2,120,002	0.9	2,120,000	0.5	2,120,001	0.5	±1.0	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,999	0.5	2,145,000	0.5	±1.0	Comply
2110-2180	67036	2,170,000	2,170,001	0.5	2,170,001	0.5	2,169,999	0.5	2,170,001	0.5	±1.0	Comply
2110-2180	66536	2,120,000	2,120,000	0.5	2,120,001	0.5	2,120,000	0.5	2,120,000	0.5	±1.0	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,998	0.9	2,145,001	0.9	±1.0	Comply

Sub-band	Channel	Frequency	Freq. at 115% Vnom	Deviation 115% Vnom	Freq. at Vnom	Deviation Vnom	Freq. at 85% Vnom	Deviation at 85% Vnom	Results
(MHz)		(Hz)	(Hz)	ppm	(Hz)	ppm	(Hz)	ppm	
2110-2180	66536	2,120,000	2,120,002	0.9	2,120,002	0.9	2,120,001	0.5	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,999	0.5	Comply
2110-2180	67036	2,170,000	2,170,001	0.5	2,170,001	0.5	2,169,999	0.5	Comply
2110-2180	66536	2,120,000	2,120,001	0.5	2,120,001	0.5	2,120,001	0.5	Comply
2110-2180	66786	2,145,000	2,145,001	0.5	2,145,001	0.5	2,144,998	0.9	Comply

Table 1: Frequency Stability

3.2 Transmitter Output Power and EIRP for Correlated transmitter

Date Performed: July 25, 26, 19, 21, 2022, August 16, 2022

Test Standard: As per Section 2.2

Test Method: ANSI C63.26:2015

Test Requirement:

For fixed and base stations operating within the frequency range 2110-2180 MHz with a channel bandwidth greater than 1 MHz, the maximum permissible e.i.r.p. is 1640 watts/MHz e.i.r.p. (i.e. no more than 1640 watts e.i.r.p. in any 1 MHz band segment) with an antenna height above average terrain (HAAT) up to 300 metres.

When multiple antennas are used at a station to transmit the same digital data in a given symbol period (even with different coding or phase shifts) for transmit diversity or to steer signal energy towards a particular direction for enhanced directional gain (i.e. beamforming) or to devise any other transmission mode where signals from different antennas are correlated, the e.i.r.p. shall be calculated based on the aggregate power conducted across all antennas and resulting directional gain $10 \log_{10}(N) + G_{max}$ dBi. Here, N is the number of antennas and G_{max} is the highest gain in dBi among all antennas.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data:

Sub-band (MHz)	Side Channel	Channel	Center Freq (MHz)	Raw Conducted Power Peak (dBm)	Raw Conducted Power Ave (dBm)	PAPR (dB)	Attenuation (dB)	Conducted Power Peak (dBm)	Conducted Power Ave (dBm)	Conducted Power Ave (Watts)	Status
2110-2180 QPSK	Low	66536	2120	-25.1	-28.55	3.45	63.3	38.2	34.75	2.98	Comply
	Mid	66786	2145	-25.24	-28.71	3.47	63.3	38.06	34.59	2.87	Comply
	High	67036	2170	-25.79	-28.81	3.02	63.3	37.51	34.49	2.81	Comply
2110-2180 64 QAM	Low	66536	2120	-20.58	-24.71	4.13	63.3	42.72	38.59	7.22	Comply
	Mid	66786	2145	-20.68	-24.45	3.77	63.3	42.62	38.85	7.16	Comply
	High	67036	2170	-20.57	-24.55	3.98	63.3	42.73	38.75	7.49	Comply
2110-2180 256 QAM	Low	66536	2120	-20.41	-24.59	4.18	63.3	42.89	38.71	7.43	Comply
	Mid	66786	2145	-20.66	-24.35	3.69	63.3	42.64	38.95	7.85	Comply
	High	67036	2170	-20.51	-24.47	3.96	63.3	42.79	38.83	7.63	Comply

Table 2: Transmitter Output Power 20 MHz BW

Sub-band (MHz)	Side Channel	Channel	Center Freq (MHz)	Raw Conducted Power Peak (dBm)	Raw Conducted Power Ave (dBm)	PAPR (dB)	Attenuation (dB)	Conducted Power Peak (dBm)	Conducted Power Ave (dBm)	Conducted Power Ave (Watts)	Status
2110-2180 QPSK	Low	66511	2117.5	-24.15	-26.31	2.16	63.3	39.15	36.99	5.00	Comply
	Mid	66786	2145.0	-23.52	-26.65	3.13	63.3	39.78	36.65	4.62	Comply
	High	67061	2172.5	-23.05	-26.27	3.22	63.3	40.25	37.03	5.04	Comply
2110-2180 64 QAM	Low	66511	2117.5	-23.16	-26.79	3.63	63.3	40.14	36.51	4.47	Comply
	Mid	66786	2145.0	-22.97	-26.32	3.35	63.3	40.33	36.98	4.98	Comply
	High	67061	2172.5	-23.07	-26.34	3.27	63.3	40.23	36.96	4.96	Comply
2110-2180 256 QAM	Low	66511	2117.5	-23.21	-26.7	3.49	63.3	40.09	36.6	4.57	Comply
	Mid	66786	2145.0	-23.46	-26.41	2.95	63.3	39.84	36.89	4.88	Comply
	High	67061	2172.5	-23.75	-26.17	2.42	63.3	39.55	37.13	5.16	Comply

Table 3: Transmitter Output Power 15 MHz BW

Sub-band (MHz)	Side Channel	Channel	Center Freq (MHz)	Raw Conducted Power Peak (dBm)	Raw Conducted Power Ave (dBm)	PAPR (dB)	Attenuation (dB)	Conducted Power Peak (dBm)	Conducted Power Ave (dBm)	Conducted Power Ave (Watts)	Status
2110-2180 QPSK	Low	66486	2115	-25.21	-28.51	3.3	63.3	38.09	34.79	3.01	Comply
	Mid	66786	2145	-25.18	-28.69	3.51	63.3	38.12	34.61	2.89	Comply
	High	67086	2175	-25.59	-28.77	3.18	63.3	37.71	34.53	2.83	Comply
2110-2180 64 QAM	Low	66486	2115	-20.36	-24.79	4.43	63.3	42.94	38.51	7.09	Comply
	Mid	66786	2145	-20.77	-24.64	3.87	63.3	42.53	38.66	7.34	Comply
	High	67086	2175	-20.47	-24.56	4.09	63.3	42.83	38.74	7.48	Comply
2110-2180 256 QAM	Low	66486	2115	-20.49	-24.75	4.26	63.3	42.81	38.55	7.16	Comply
	Mid	66786	2145	-20.56	-24.45	3.89	63.3	42.74	38.85	7.67	Comply
	High	67086	2175	-20.49	-24.59	4.1	63.3	42.81	38.71	7.43	Comply

Table 4: Transmitter Output Power 10 MHz BW

Sub-band (MHz)	Side Channel	Channel	Center Freq (MHz)	Raw Conducted Power Peak (dBm)	Raw Conducted Power Ave (dBm)	PAPR (dB)	Attenuation (dB)	Conducted Power (dBm)	Conducted Power Ave (dBm)	Conducted Power Ave (Watts)	Status
2110-2180 QPSK	Low	66461	2112.5	-25.17	-28.48	3.31	63.3	38.13	34.82	3.03	Comply
	Mid	66786	2145	-25.31	-28.57	3.26	63.3	37.99	34.73	2.97	Comply
	High	67011	2167.5	-25.42	-28.76	3.34	63.3	37.88	34.54	2.84	Comply
2110-2180 64 QAM	Low	66461	2112.5	-20.41	-24.45	4.04	63.3	42.89	38.85	7.16	Comply
	Mid	66786	2145	-20.51	-24.59	4.08	63.3	42.79	38.71	7.43	Comply
	High	67011	2167.5	-20.57	-24.53	3.96	63.3	42.73	38.77	7.53	Comply
2110-2180 256 QAM	Low	66461	2112.5	-20.44	-24.69	4.25	63.3	42.86	38.61	7.26	Comply
	Mid	66786	2145	-20.46	-24.49	4.03	63.3	42.84	38.81	7.60	Comply
	High	67011	2167.5	-20.52	-24.41	3.89	63.3	42.78	38.89	7.74	Comply

Table 5: Transmitter Output Power 5 MHz BW

3.3 Transmitter Unwanted Emissions- Out of band

Date Performed: July 19,20,25,26 2022

Test Standard: As per section 2.2

Test Method: ANSI C63.26:2015

Test Requirement:

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz. band immediately outside and adjacent to each of the sub-bands specified in the standard , the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz. immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz. bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz. is required.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)
2110-2180 QPSK	Low	65636	2120
	High	67036	2170
2110-2180 64 QAM	Low	65636	2120
	High	67036	2170
2110-2180 256 QAM	Low	65636	2120
	High	67036	2170

Table 6: Data: Out of Band Emissions QPSK 20MHz BW

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)
2110-2180 QPSK	Low	66511	2117.5
	High	67061	2172.5
2110-2180 64 QAM	Low	66511	2117.5
	High	67061	2172.5
2110-2180 256 QAM	Low	66511	2117.5
	High	67061	2172.5

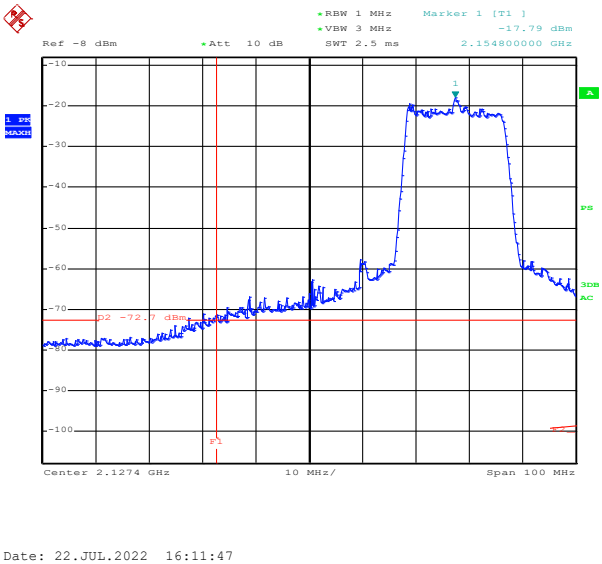
Table 7: Data: Out of Band Emissions 15MHzBW

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)
2110-2180 QPSK	Low	66486	2115
	High	67086	2175
2110-2180 64 QAM	Low	66486	2115
	High	67086	2175
2110-2180 256 QAM	Low	66486	2115
	High	67086	2175

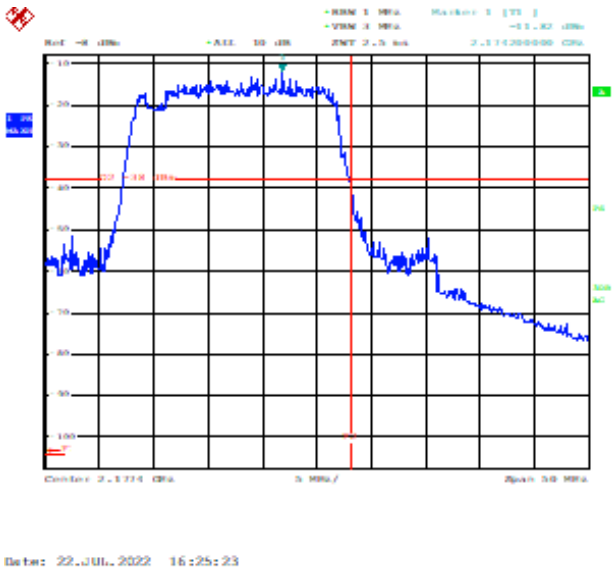
Table 8: Data: Out of Band Emissions 10MHzBW

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)
2110-2180 QPSK	Low	66461	2112.5
	High	67011	2167.5
2110-2180 64 QAM	Low	66461	2112.5
	High	67011	2167.5
2110-2180 256 QAM	Low	66461	2112.5
	High	67011	2167.5

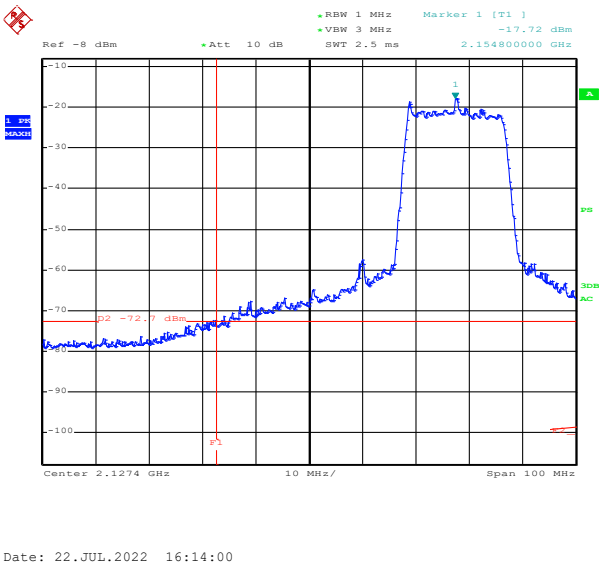
Table 9: Data: Out of Band Emissions 5MHz BW



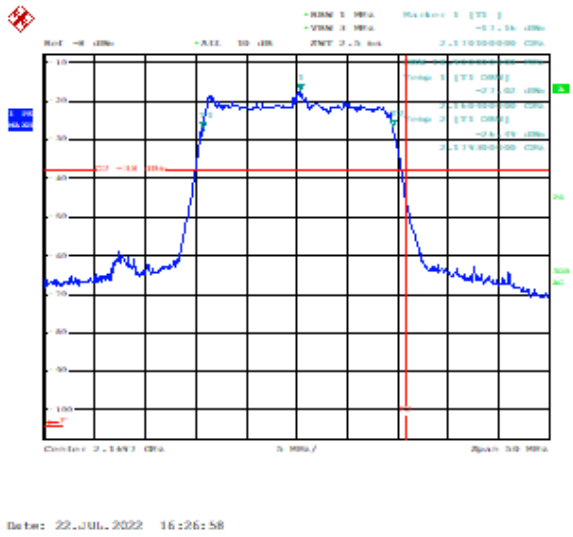
Plot 1: Bandedge_20MHz_Low CH 65636 (F1 at 2100 MHz)



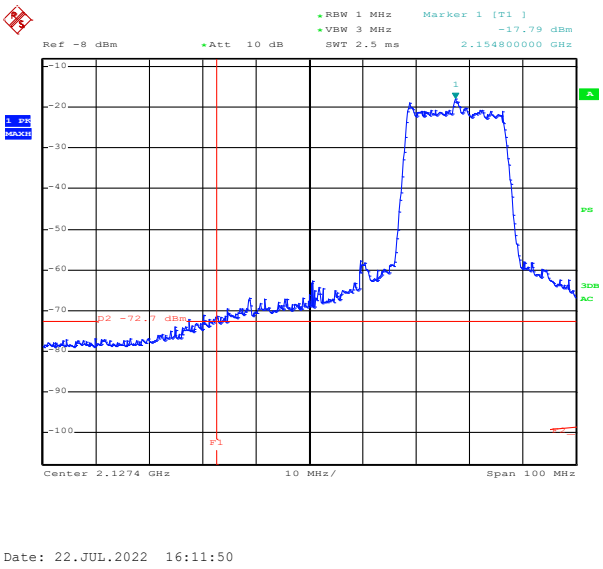
Plot 2: Bandedge_20MHz_Hi CH 67036 (F2 at 2180 MHz)



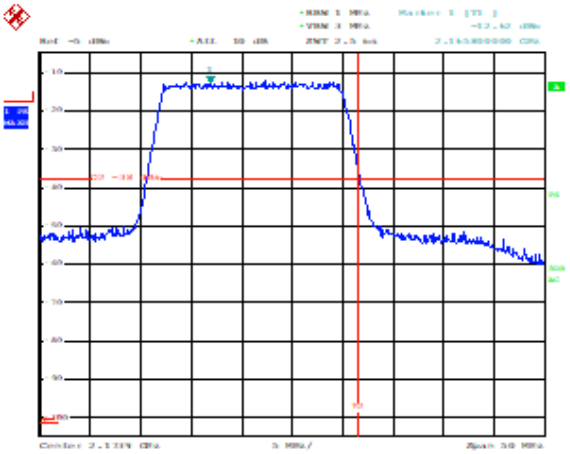
Plot 3: Bandedge_20MHz_Low CH 65636 (F1 at 2100 MHz)



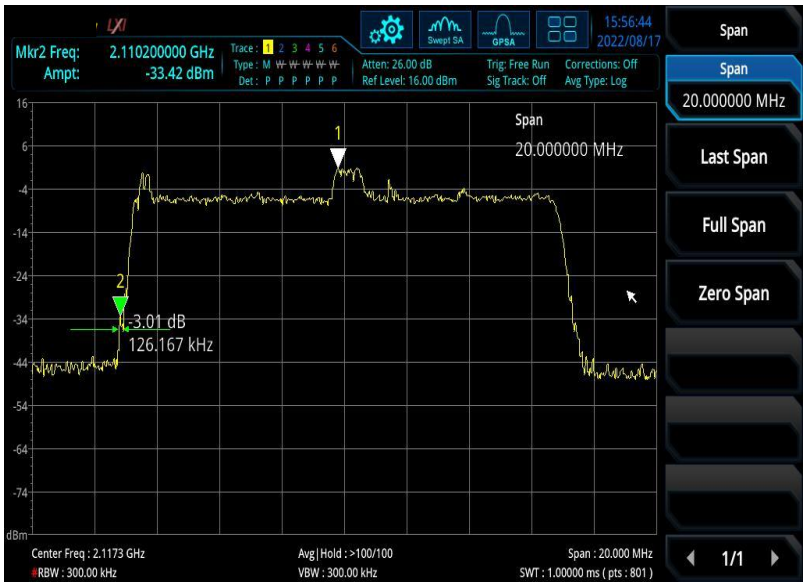
Plot 4: Bandedge_20MHz_Hi CH 67036 (F2 at 2180 MHz)



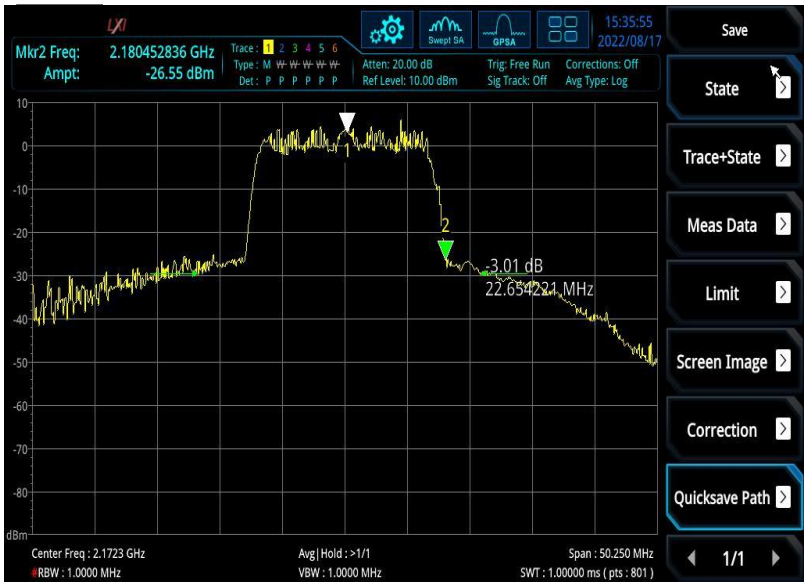
Plot 5: Bandedge_20MHz_Low CH 65636 (F1 at 2100 MHz)



Plot 6: Bandedge_20MHz_High CH 65636 (F1 at 2100 MHz)

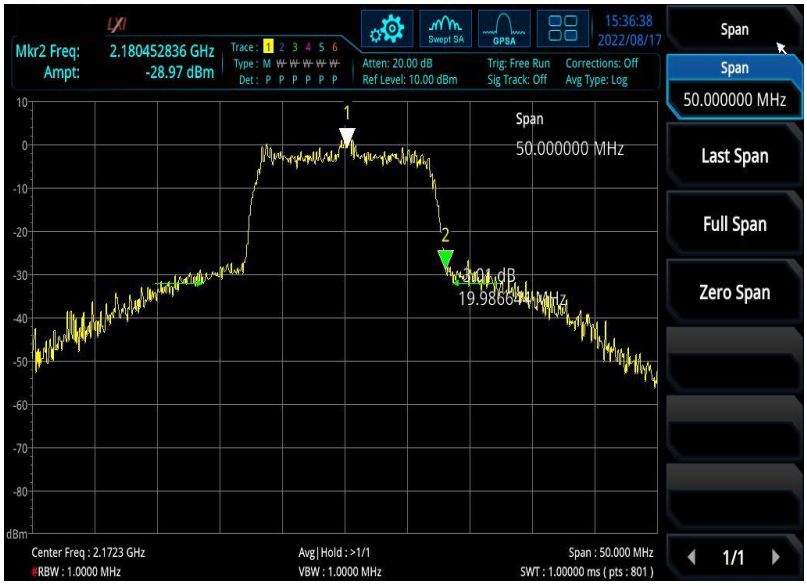


Plot 7: Bandedge_15MHz_Low QPSK (F1 at 2117.5 MHz limit)

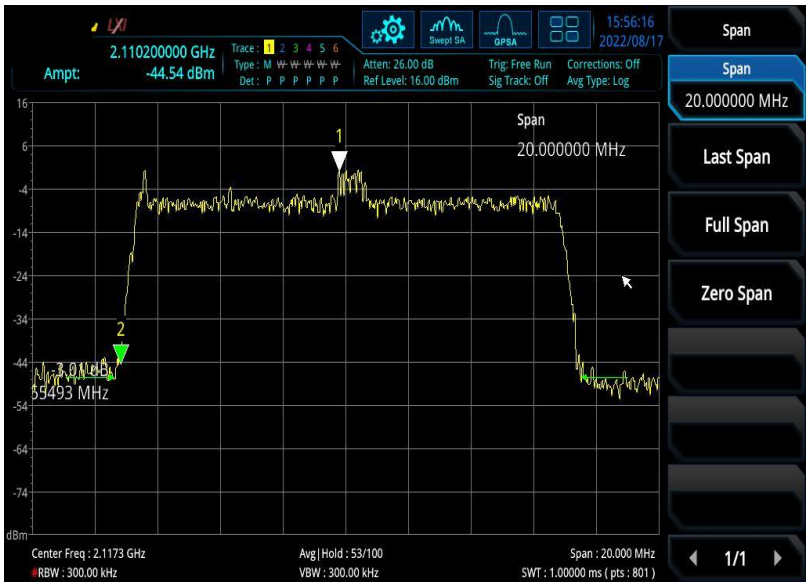


Plot 8: Bandedge_20MHz_High QPSK (F1 at 2175.5 MHz)

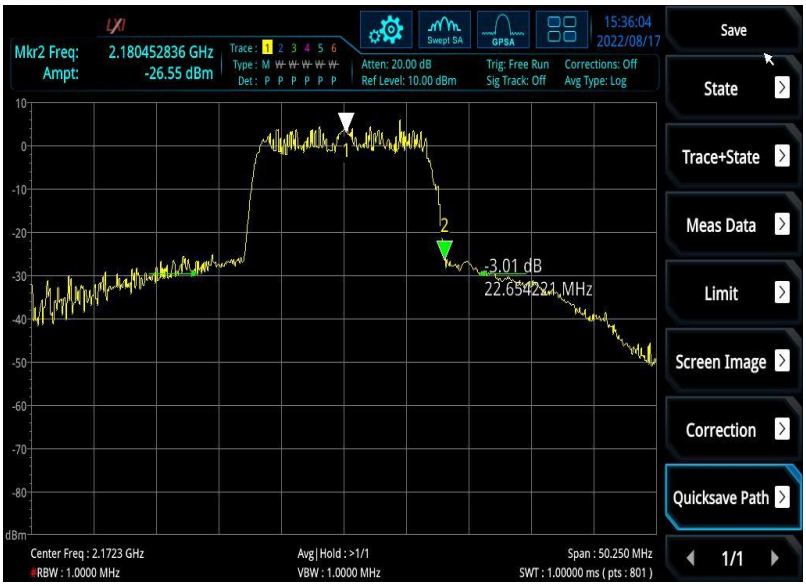
Plot 9: Bandedge_15MHz_Low CH 64 QAM (F1 at 2117.5 MHz)



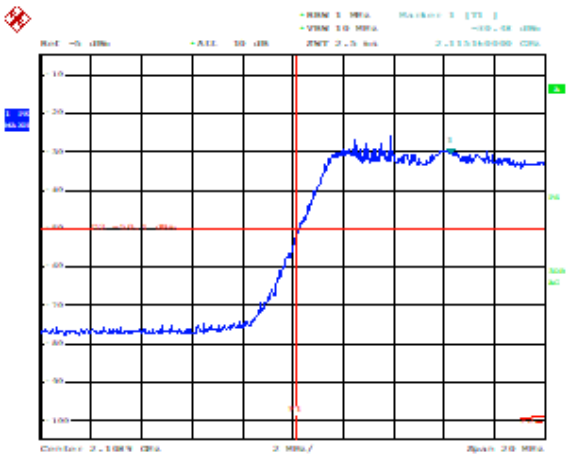
Plot 10: Bandedge_15MHz_High 64 QAM (F1 at 2175.5 MHz)



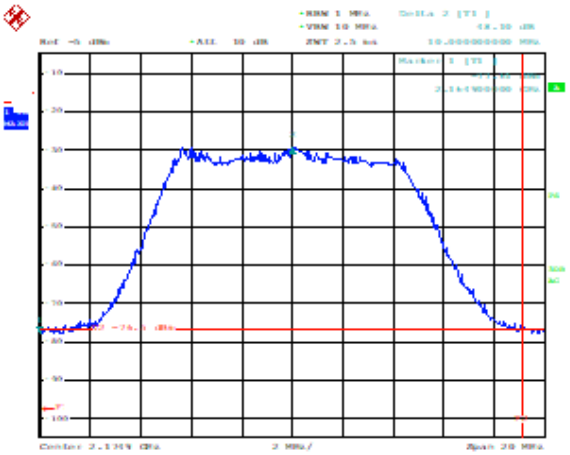
Plot 11: Bandedge_15MHz_Low CH 256 QAM (F1 at 2117.5 MHz)



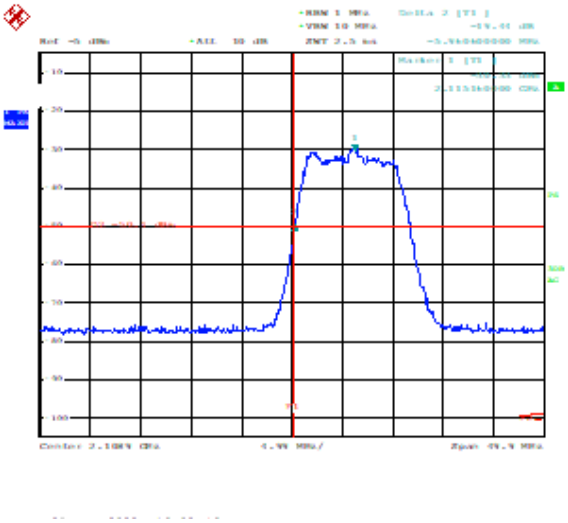
Plot 12: Bandedge_15MHz_High 256 QAM (F1 at 2175.5 MHz)



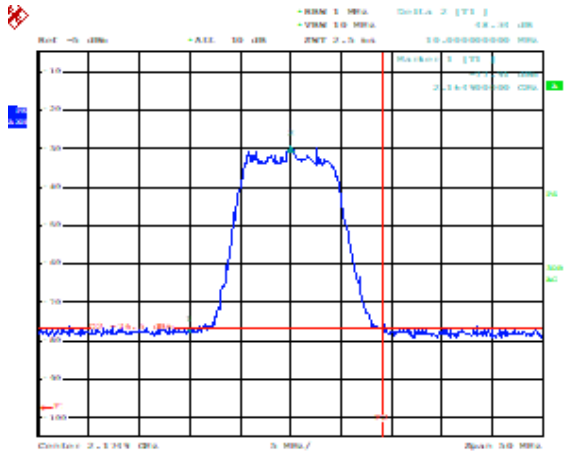
Plot 13: Bandedge_10MHz_low CH 66486 (F1 at 2110 MHz)



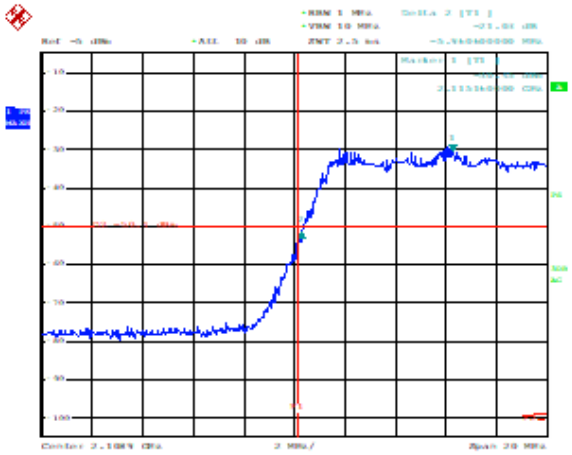
Plot 14: Bandedge_10MHz_Hi CH 66786 (F2 at 2180 MHz)



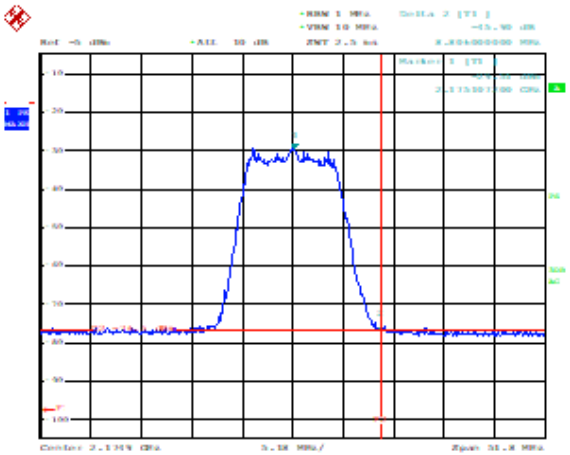
Plot 15: Bandedge_10MHz_low CH 66486(F1 at 2110 MHz)



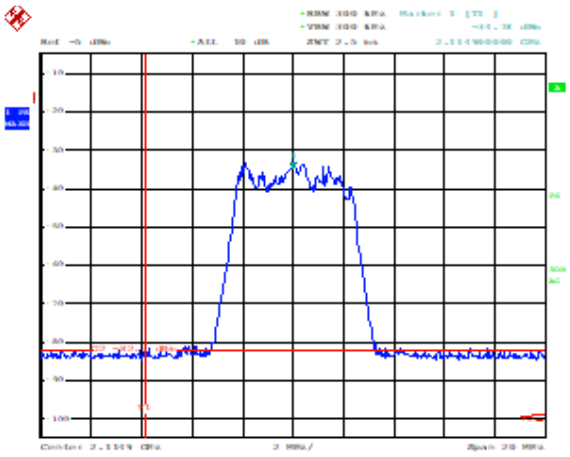
Plot 16: Bandedge_10MHz_Hi CH 66786 (F2 at 2180 MHz)



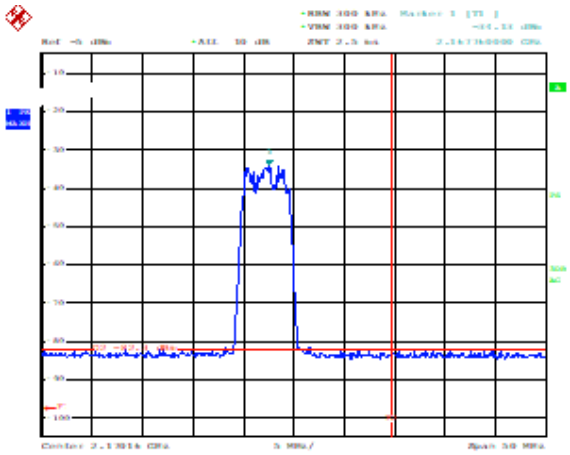
Plot 17: Bandedge_10MHz_low CH 66486/plot110 (F1 at 2110 MHz)



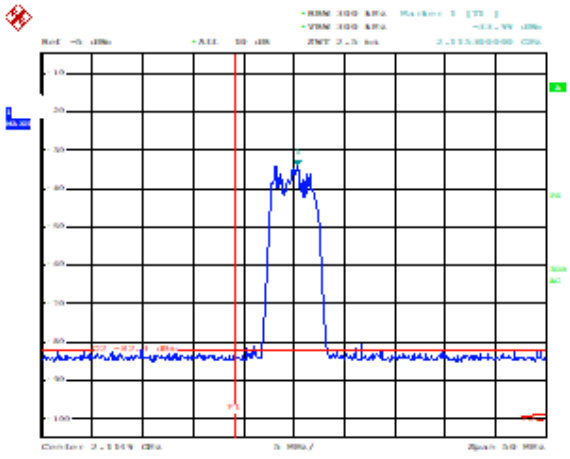
Plot 18: Bandedge_10MHz_Hi CH 66786 (F2 at 2180 MHz)



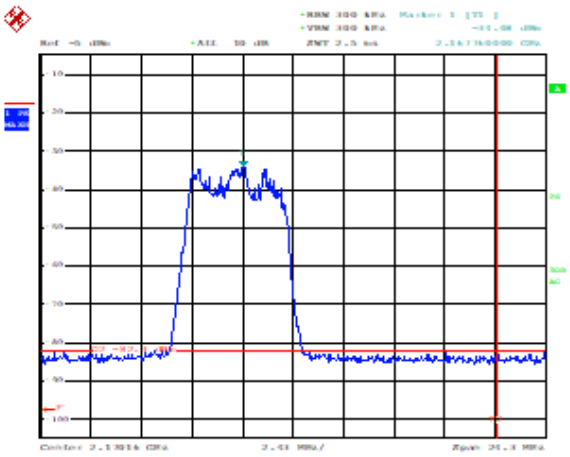
Plot 19: Bandedge_5MHz_Low CH 66461 (F1 at 2110 MHz limit)



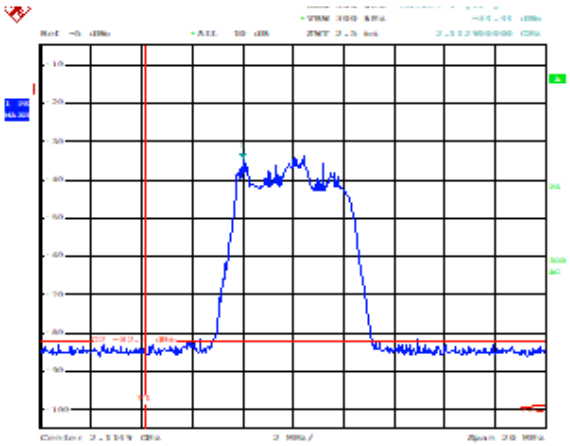
Plot 20: Bandedge_50MHz_Hi CH 67011/plot175 (F2 at 2180 MHz)



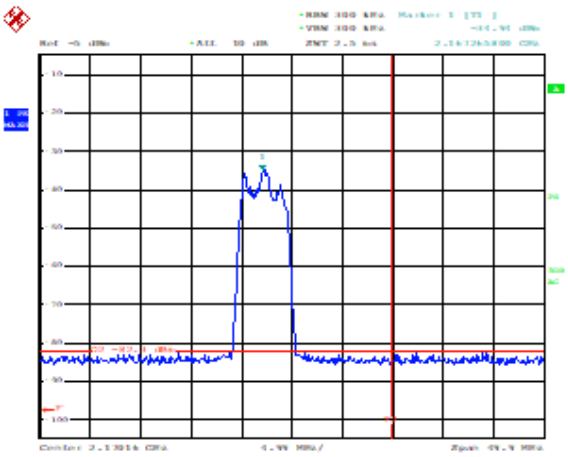
Plot 21: Bandedge_5MHz_Low CH 66461 (F1 at 2110 MHz)



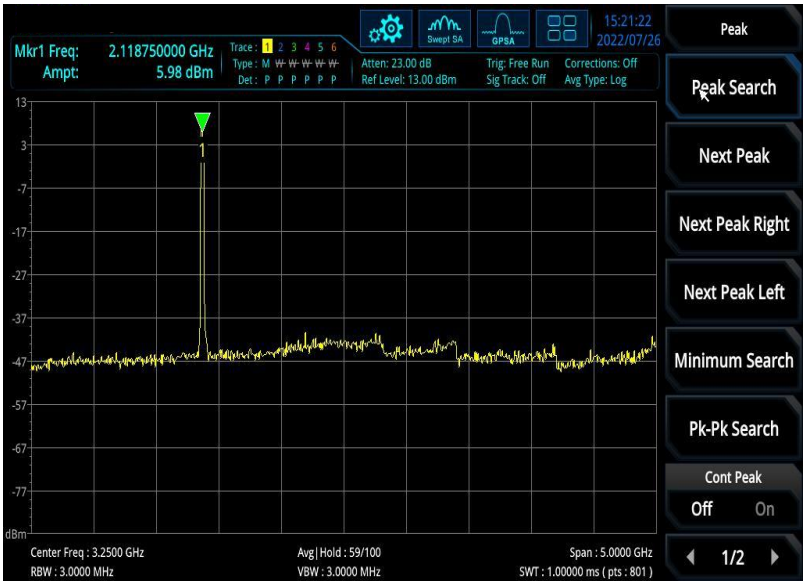
Plot 22: Bandedge_50MHz_Hi CH 67011 (F2 at 2180 MHz)



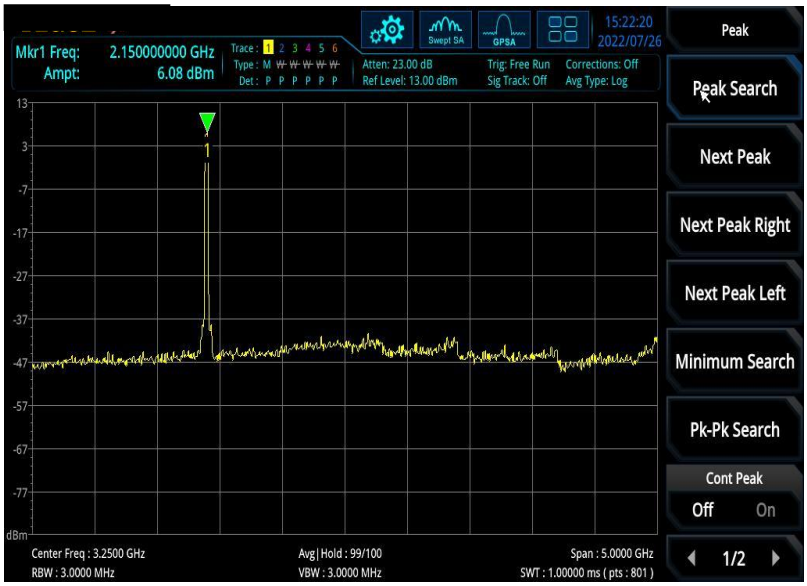
Plot 23: Bandedge_5MHz_Low CH 66461 (F1 at 2110 MHz)



Plot 24: Bandedge_50MHz_Hi CH 67011 (F2 at 2180 MHz)

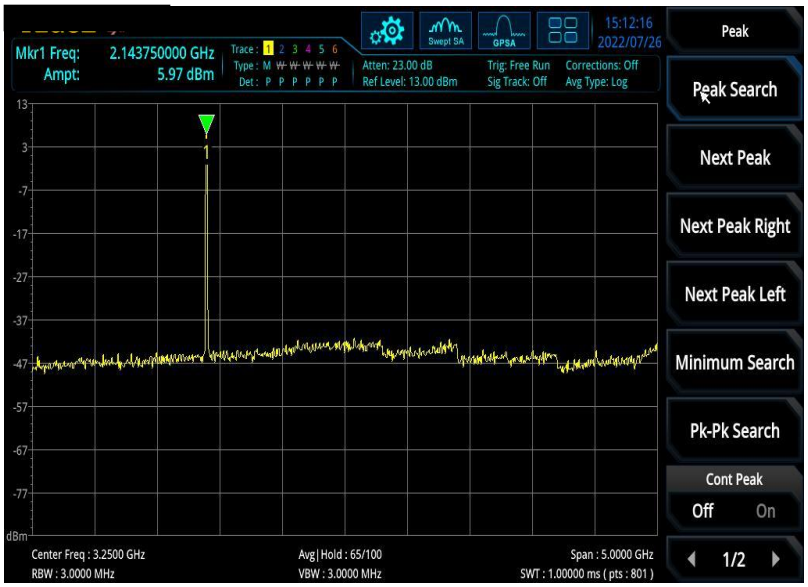


Plot 25: Out of band Emissions_Channel 66536

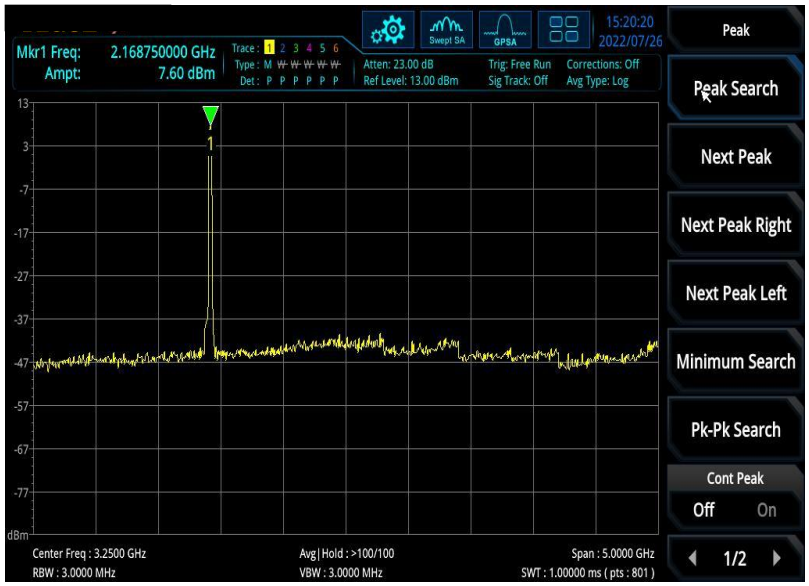


Plot 26: Out of band Emissions_Channel 66786

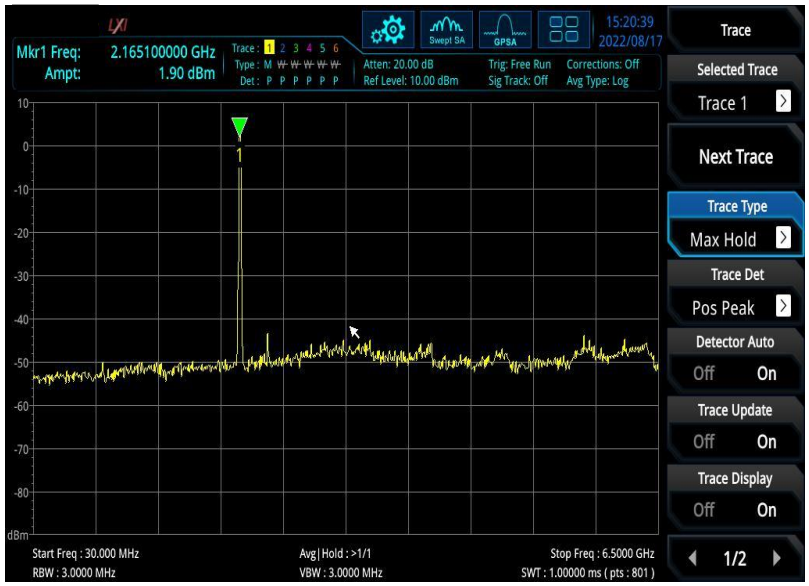
Plot 27: Out of band Emissions_Channel 67036



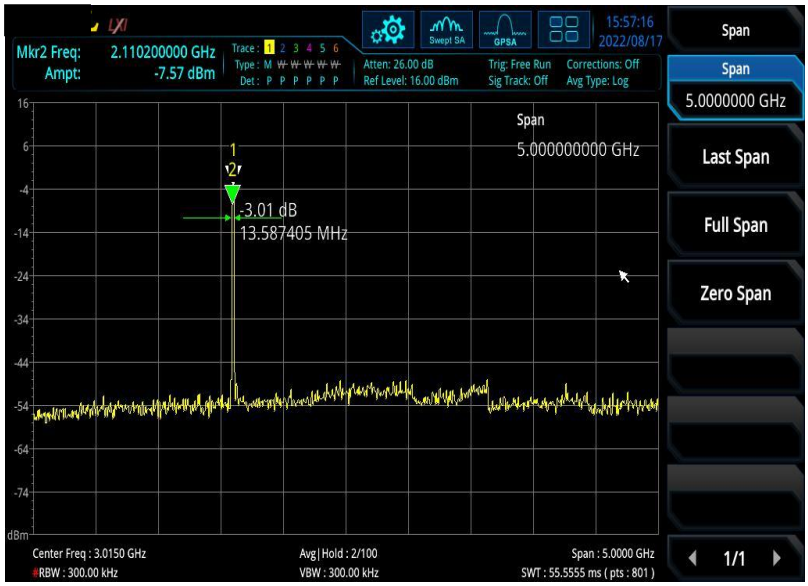
Plot 28: Out of band Emissions_Channel 66766



Plot 29: Out of band Emissions_Channel 67016



Plot 30: Out of band Emissions_Channel 66511



Plot 31: Out of band Emissions_Channel 67061

3.4 Occupied Bandwidth

Date Performed: July 14, 26, 27, 28, 2022

Test Standard: As per section 2.2

Test Method: ANSI C63.26:2015

Test Setup:

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are 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.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

Measurement Data and Plot:

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)	OBW MHz	Status
2110-2180 QPSK	Low	66536	2120	18.9	Comply
	Mid	66786	2145	19.0	Comply
	High	67036	2170	18.9	Comply
2110-2180 64 QAM	Low	66536	2120	18.9	Comply
	Mid	66786	2145	18.9	Comply
	High	67036	2170	18.9	Comply
2110-2180 256 QAM	Low	66536	2120	18.9	Comply
	Mid	66786	2145	18.9	Comply
	High	67036	2170	18.9	Comply

Table 10: Data: Occupied Bandwidth – 20MHz

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)	OBW MHz	Status
2110-2180 QPSK	Low	66511	2117.5	14.32	Comply
	Mid	66786	2145.0	14.32	Comply
	High	67061	2172.5	14.32	Comply
2110-2180 64 QAM	Low	66511	2117.5	14.10	Comply
	Mid	66786	2145.0	14.16	Comply
	High	67061	2172.5	14.10	Comply
2110-2180 256 QAM	Low	66511	2117.5	14.08	Comply
	Mid	66786	2145.0	14.12	Comply
	High	67061	2172.5	13.90	Comply

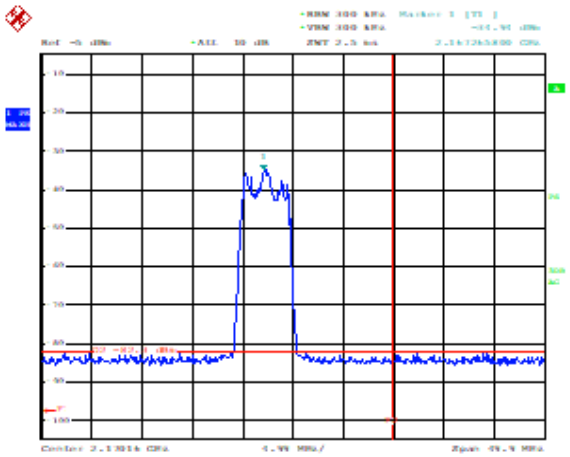
Table 11: Data: Occupied Bandwidth – 15MHz

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)	OBW MHz	Status
2110-2180 QPSK	Low	66486	2115	9.11	Comply
	Mid	66786	2145	9.12	Comply
	High	67086	2175	9.95	Comply
2110-2180 64 QAM	Low	66486	2115	9.06	Comply
	Mid	66786	2145	9.12	Comply
	High	67086	2175	9.95	Comply
2110-2180 256 QAM	Low	66486	2115	9.96	Comply
	Mid	66786	2145	9.12	Comply
	High	67086	2175	9.15	Comply

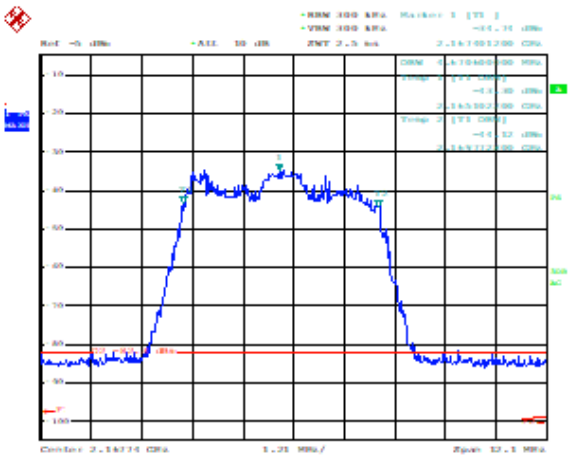
Table 12: Data: Occupied Bandwidth – 10MHz

Sub-band MHz	Side Channel	Channel	Center Freq (MHz)	OBW MHz	Status
2110-2180 QPSK	Low	66461	2112.5	4.61	Comply
	Mid	66786	2145	4.55	Comply
	High	67011	2167.5	4.66	Comply
2110-2180 64 QAM	Low	66461	2112.5	4.70	Comply
	Mid	66786	2145	4.66	Comply
	High	67011	2167.5	4.68	Comply
2110-2180 256 QAM	Low	66461	2112.5	4.64	Comply
	Mid	66786	2145	4.68	Comply
	High	67011	2167.5	4.64	Comply

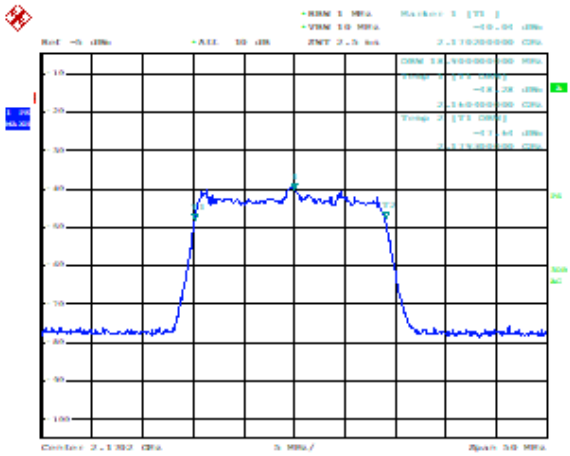
Table 13: Data: Occupied Bandwidth – 5MHz



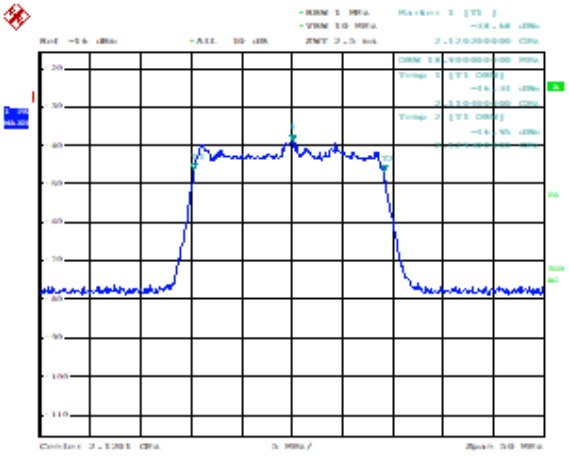
Plot 32: Occupied Bandwidth-Center 2120 MHz-Low Channel BW 20MHz QPSK



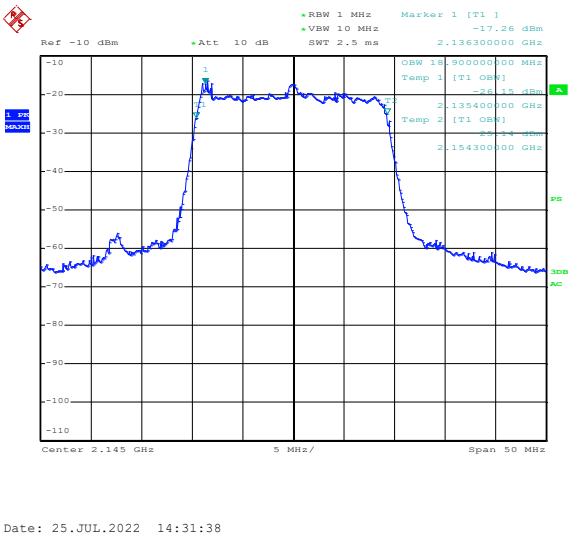
Plot 33: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 20MHz QPSK



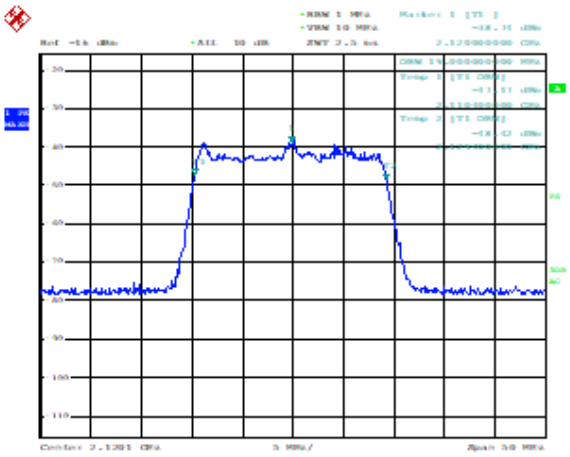
Plot 34: Occupied Bandwidth-Center 2120 MHz- High Channel BW 20MHz QPSK



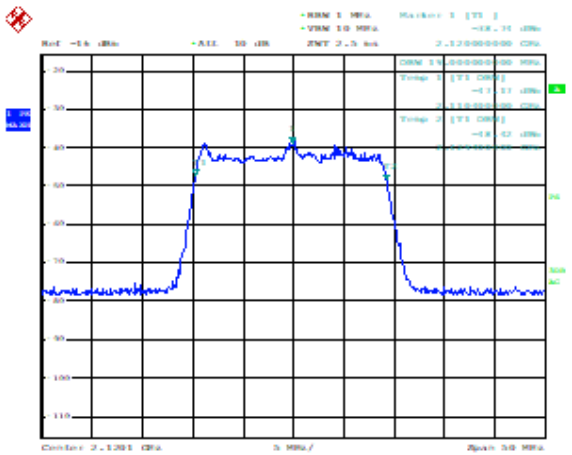
Plot 35: Occupied Bandwidth-Center 2120 MHz-Low Channel BW 20MHz -64QAM



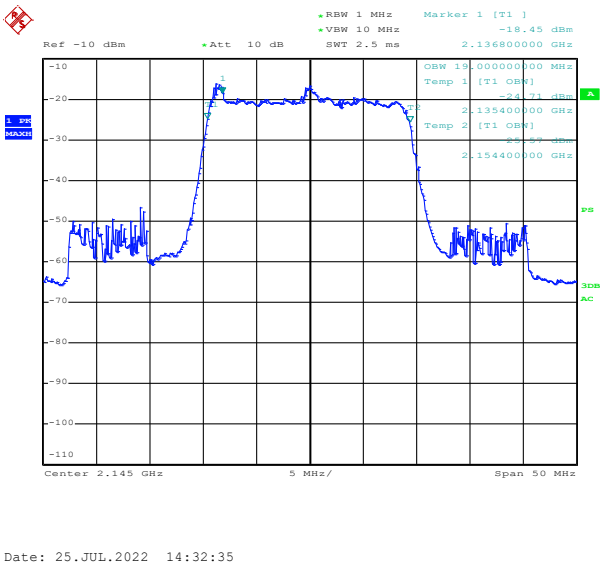
Plot 36: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 20MHz -4QAM



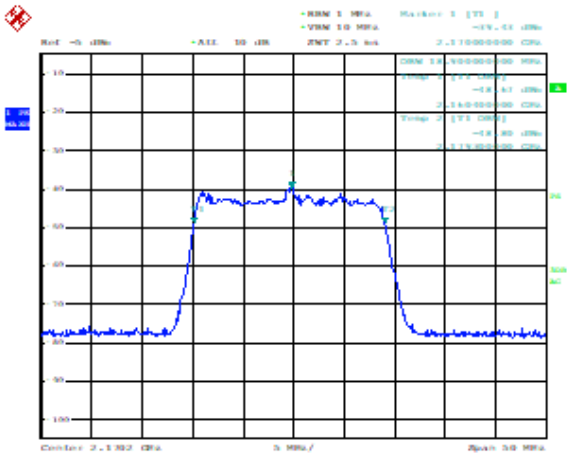
Plot 37: Occupied Bandwidth-Center 2120 MHz- High Channel BW 20MHz -64QAM



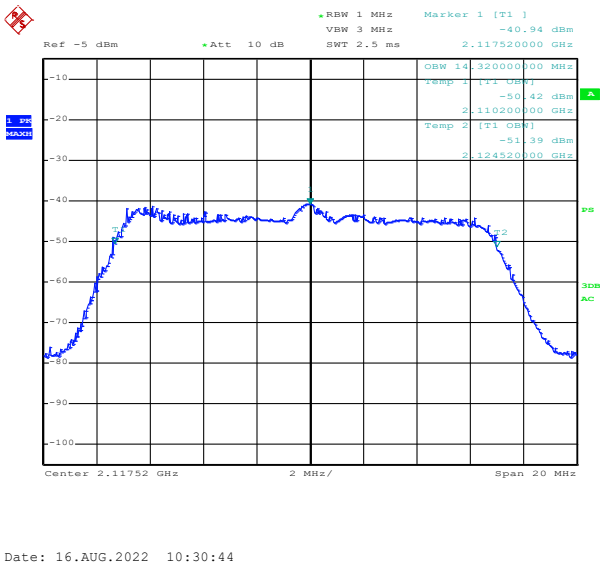
Plot 38: Occupied Bandwidth-Center 2120 MHz-Low Channel BW 20MHz - 256QAM



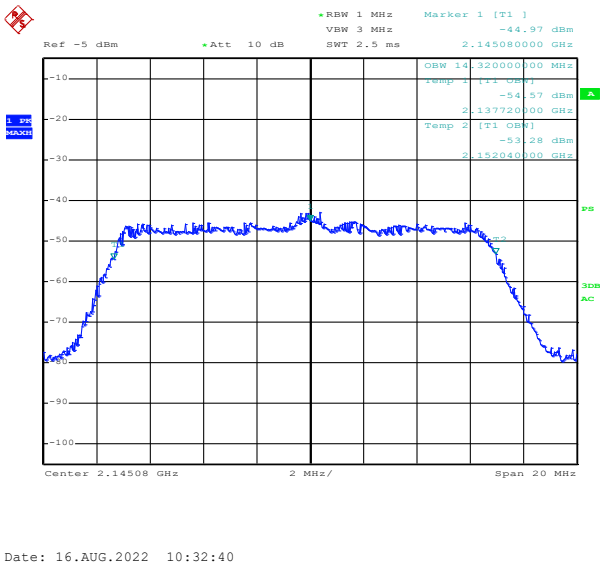
Plot 39: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 20MHz - 256QAM



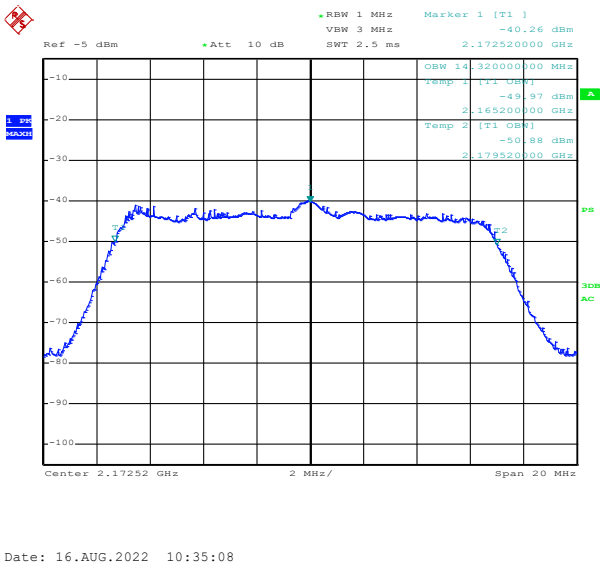
Plot 40: Occupied Bandwidth-Center 2120 MHz- High Channel BW 20MHz - 256QAM



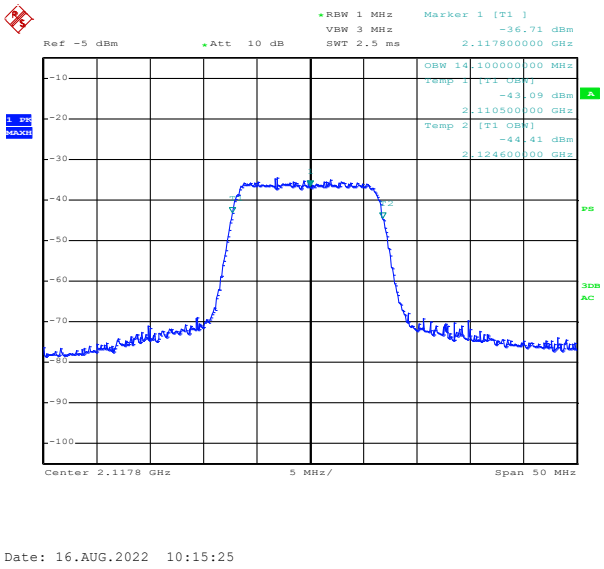
Plot 41: Occupied Bandwidth-Center 2117.5 MHz-Low Channel BW 15MHz- QPSK



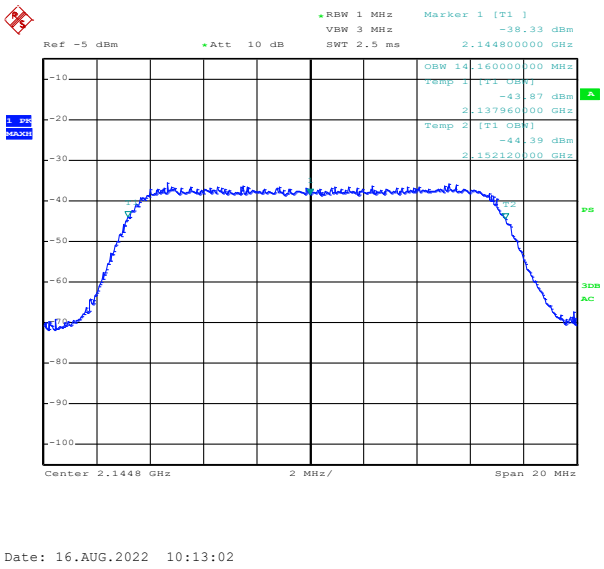
Plot 42: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 15MHz-QPSK



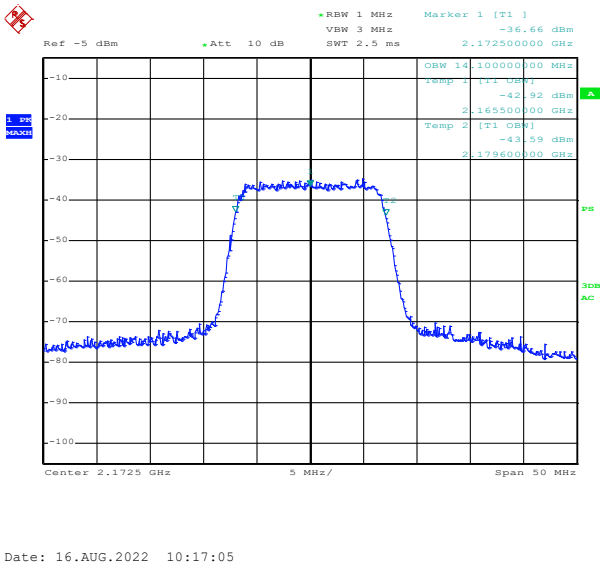
Plot 43: Occupied Bandwidth-Center 2172.5 MHz-High Channel BW 15MHz-QPSK



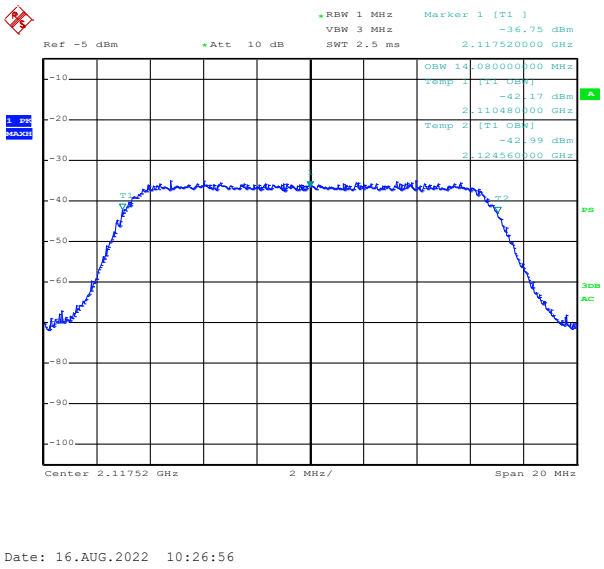
Plot 44: Occupied Bandwidth-Center 2117.5 MHz-Low Channel BW 15MHz- 64QAM



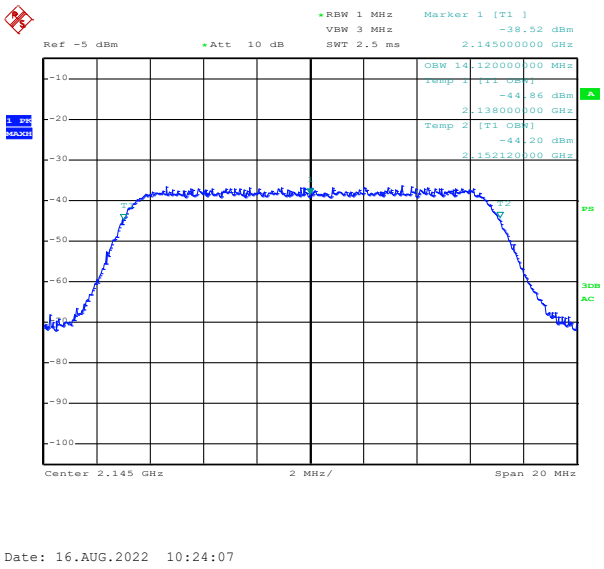
Plot 45: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 15MHz-64QAM



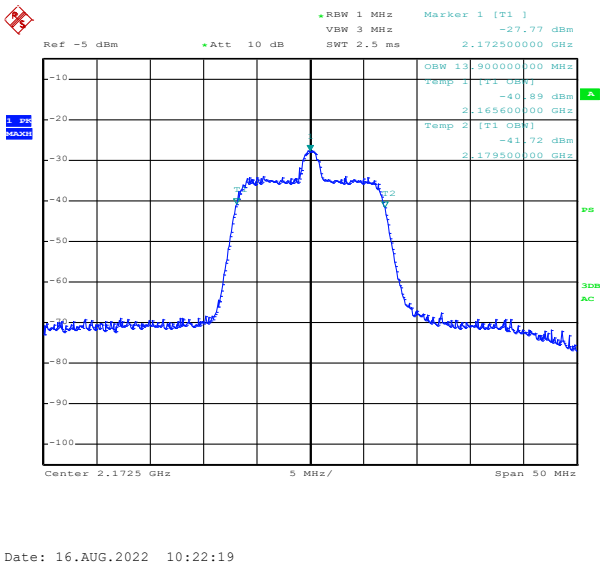
Plot 46: Occupied Bandwidth-Center 2172.5 MHz-High Channel BW 15MHz-64QAM



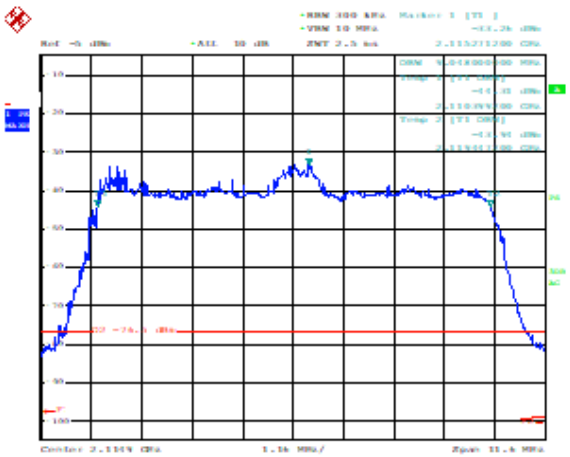
Plot 47: Occupied Bandwidth-Center 2117.5 MHz-Low Channel BW 15MHz-256QAM



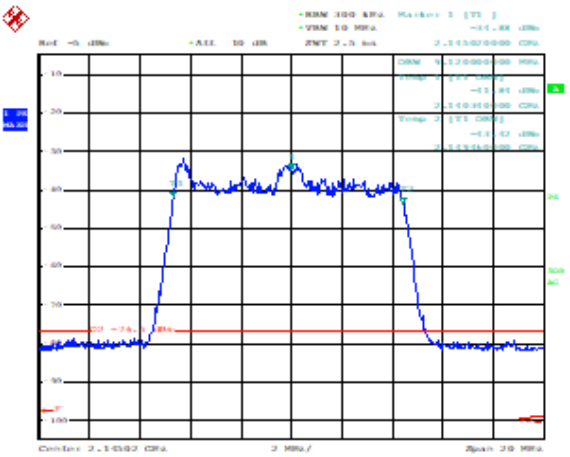
Plot 48: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 15MHz -256QAM



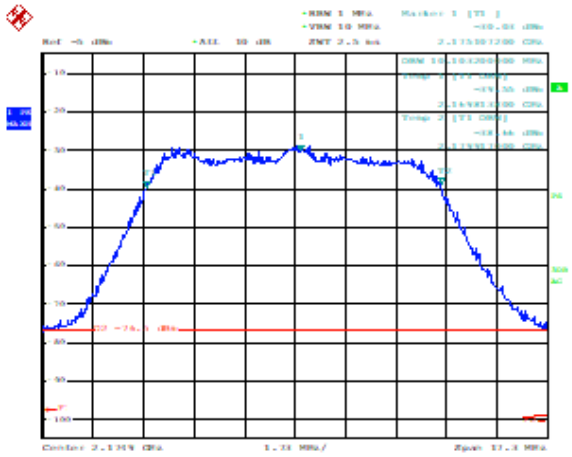
Plot 49: Occupied Bandwidth-Center 2172.5 MHz-High Channel BW 15MHz -256QAM



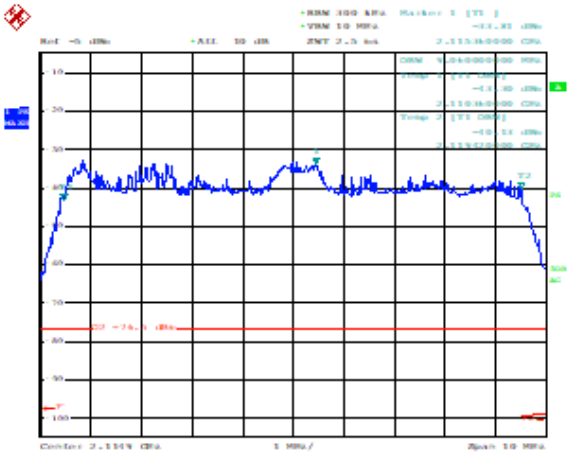
Plot 50: Occupied Bandwidth-Center 2115 MHz- Low Channel BW 10MHz - QPSK



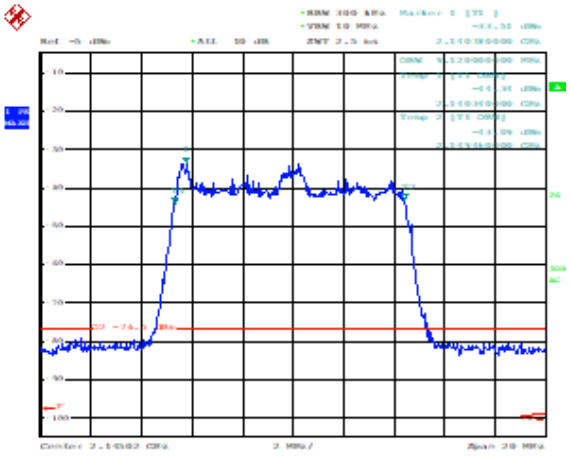
Plot 51: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 10MHz - QPSK



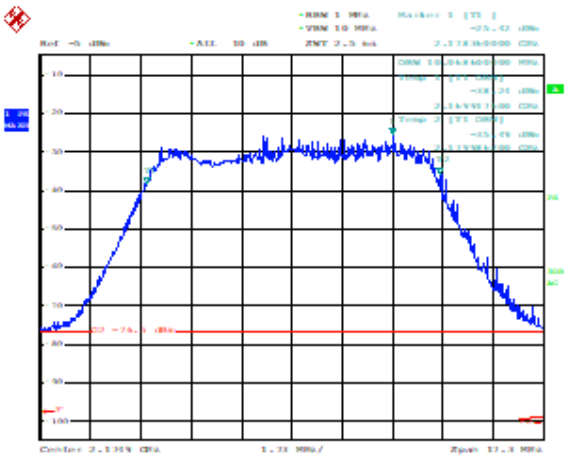
Plot 52: Occupied Bandwidth-Center 2175 MHz- High Channel BW 10MHz - QPSK



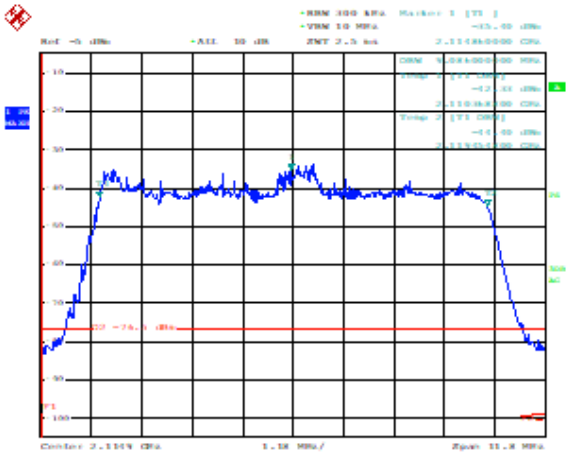
Plot 53: Occupied Bandwidth-Center 2115 MHz- Low Channel BW 10MHz - 64QAM



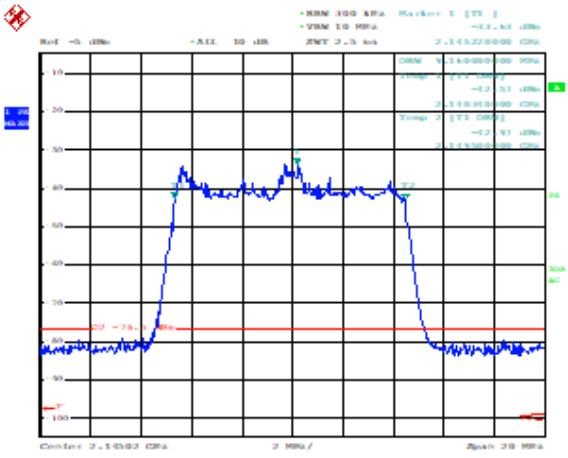
Plot 54: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 10MHz - 64QAM



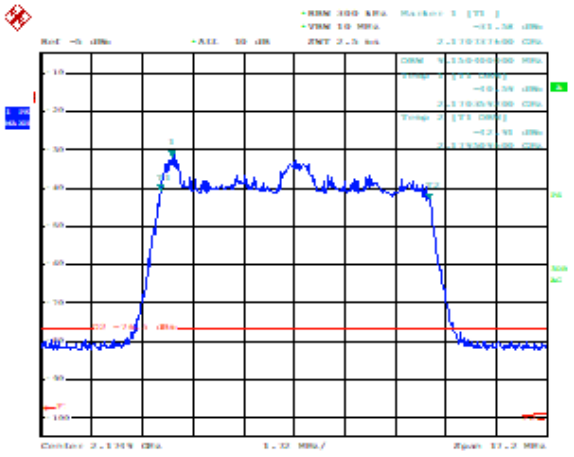
Plot 55: Occupied Bandwidth-Center 2175 MHz- High Channel BW 10MHz -64QAM



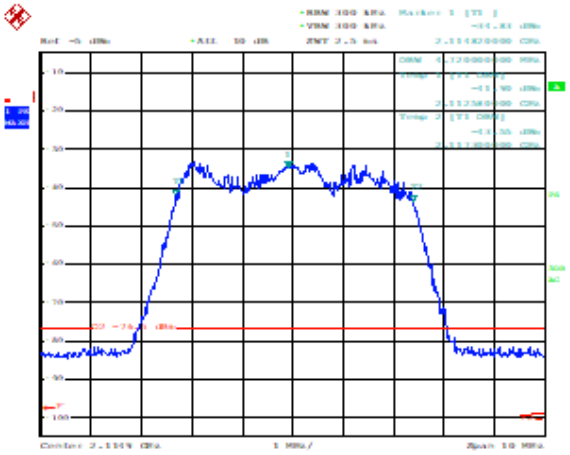
Plot 56: Occupied Bandwidth-Center 2115 MHz- Low Channel BW 10MHz - 256QAM



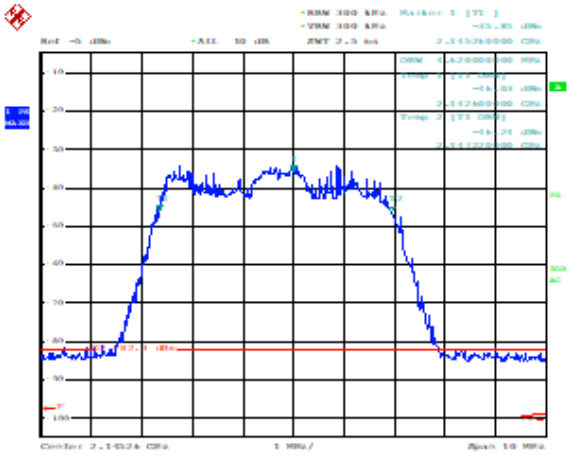
Plot 57: Occupied Bandwidth-Center 2145 MHz-Mid Channel BW 10MHz - 256QAM



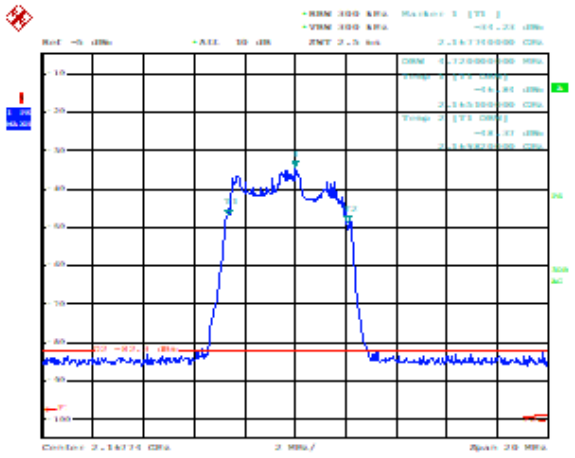
Plot 58: Occupied Bandwidth-Center 2175 MHz- High Channel BW 10MHz -256QAM



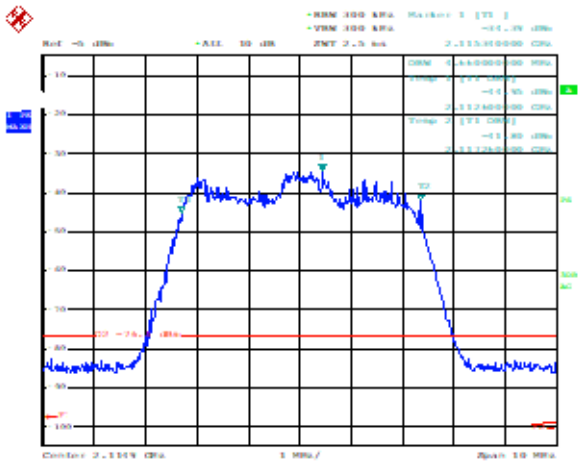
Plot 59: Occupied Bandwidth-Center 2112.5 MHz- Low Channel BW 5MHz -256QAM



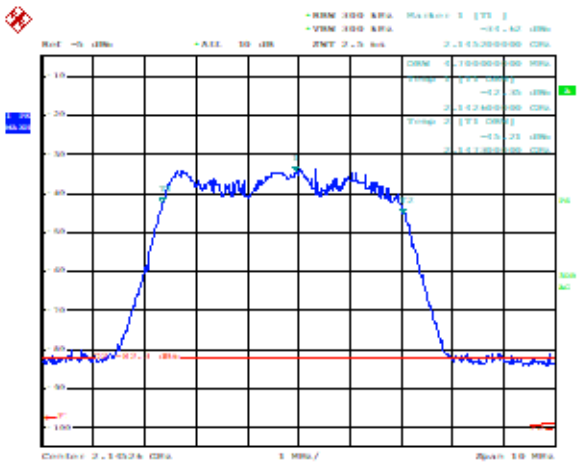
Plot 60: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 5MHz - 256QAM



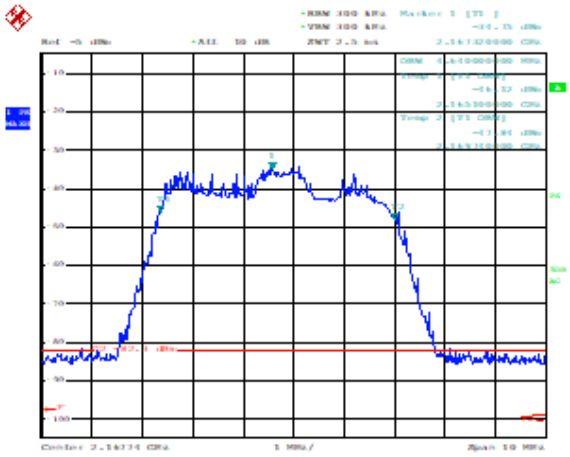
Plot 61: Occupied Bandwidth-Center 2167.5 MHz- High Channel BW 5MHz - 256QAM



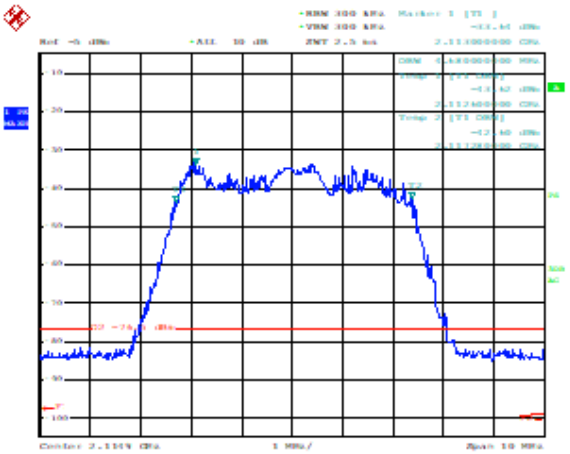
Plot 62: Occupied Bandwidth-Center 2112.5 MHz- Low Channel BW 5MHz - 256QAM



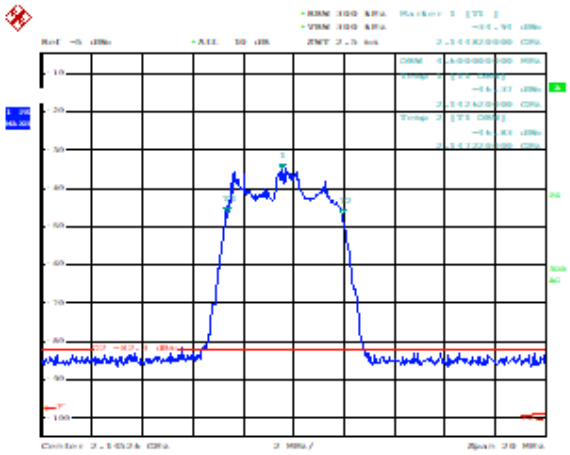
Plot 63: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 5MHz -256QAM



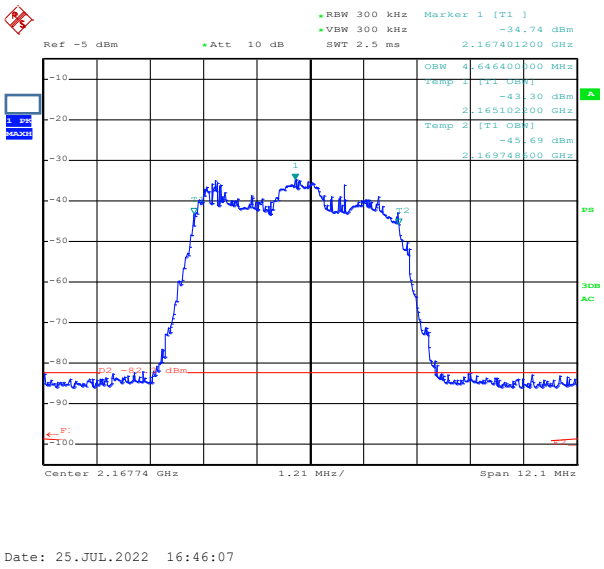
Plot 64: Occupied Bandwidth-Center 2167.5 MHz- High Channel BW 5MHz -256QAM



Plot 65: Occupied Bandwidth-Center 2112.5 MHz- Low Channel BW 5MHz -256QAM



Plot 66: Occupied Bandwidth-Center 2145 MHz- Mid Channel BW 5MHz - 256QAM



Plot 67: Occupied Bandwidth-Center 2167.5 MHz- High Channel BW 5MHz -256QAM

3.6 Modulation Characteristics

Date Performed: July 26, 2022

Test Standard: 47CFR2.1047, 47CFR2.201, RSS-199, RS-Gen

Test Method: ANSI C63.26:2015

The Occupied bandwidth was measured to be 4.58 MHz, 9.32, 14.54 and 19.1 MHZ for Configurations QPSK, 16 QAM 64QAM, and 256 QAM and transmitting 2110-2180 MHz, and receiving 1710-1780 MHz. Channels were chosen based on the subbands frequency range and the occupied bandwidth associated with it.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

3.7 Receiver Spurious Emissions

Date Performed: July 11,12 2022

Test Standard: As per section 2.2

Test Method: ANSI C63.26

Test Requirement:

Radiated emission measurements shall be performed with the receiver antenna connected to the receiver antenna ports. The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz., whichever is higher, to at least five times the highest tunable or local oscillator frequency, whichever is higher, without exceeding 40 GHz.
Spurious emissions from receivers shall not exceed the radiated emissions limits shown in table 3 below.

Frequency (MHz.)	Field Strength Quasi Peak (Class B) (dBµV/m @ 3m SAC)		Result
30 – 88	40.0		Comply
88 – 216	43.5		
216 – 960	46.0		
Above 960	54.0		
Frequency (GHz.)	**Maximum Field Strength (dB mV/m at 3 m)**		**Result**
	Peak	**Average**	
1-40	74	54	Comply Up to 18 GHz.
Note 1: The lower limit shall apply at the transition frequency. **Note 2**: Additional provisions may be required for cases where interference occurs.			

Table 14: Transmitter emission limits

Test Setup:

The EUT was tested in our 3 m SAC and was positioned on the center of the turntable. The transmitter was set for continuous transmission. The RF radiated emissions were measured in the frequency range of 150kHz. to 18 GHz. The EUT was pre-scanned in 3 different orthogonal orientations and was found to radiate highest when placed flat on the tabletop as indicated in the test photos.

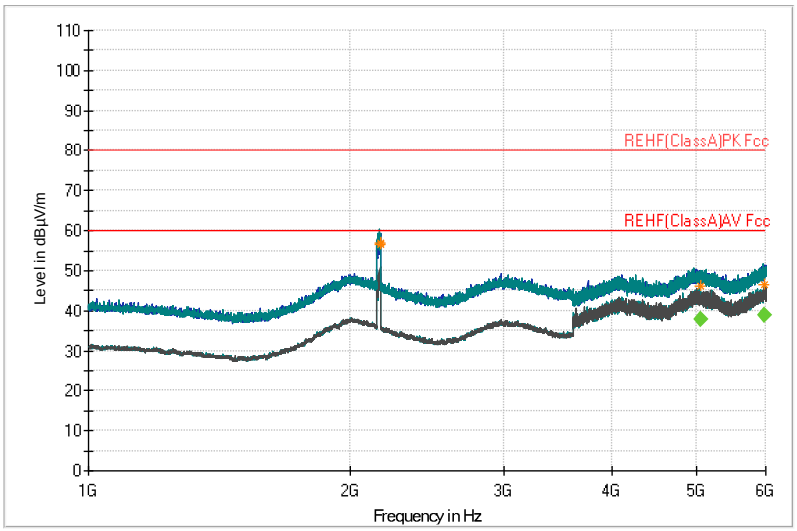
Measurement Method:

ANSI C63.26:2015 radiated emissions procedure was followed to demonstrate the compliance of Bluetooth low energy.

Modifications: No modification was required to comply for this test.

Final Result: The EUT complies with the applicable standard.

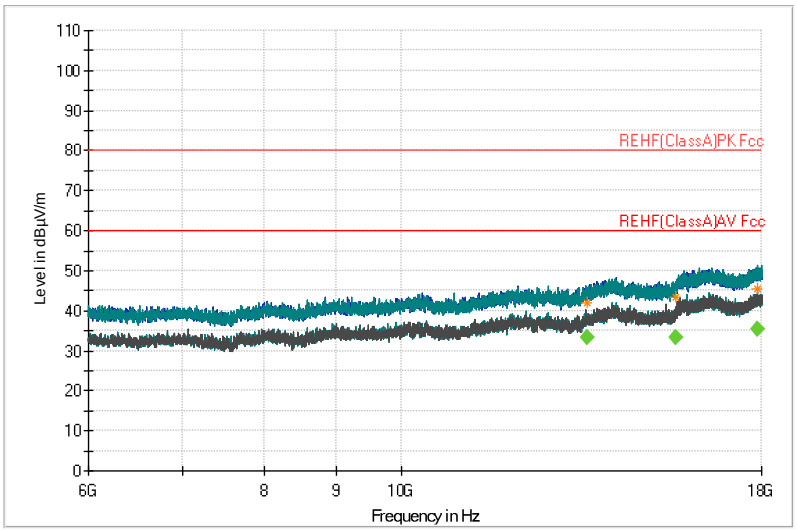
Measurement Data and Plot:



Plot 68: Conducted Emissions 1-6 GHz
Note: No emission of significance were observed. Transmitter is ON

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Corr. (dB)	Height (cm)	Pol
5049.3160	---	37.99	60.00	22.01	210	4.4	349.0	H
5985.5473	---	38.76	60.00	21.24	0	5.6	400.0	H

Table 15: Radiated emissions 1-6 GHz

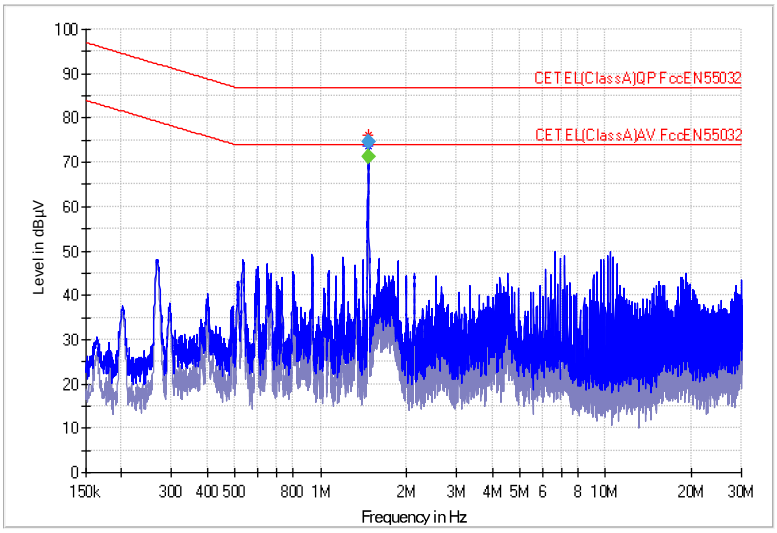


Plot 69: Radiated Emissions 6-18 GHz

Note: No emission of significance were observed. Transmitter is ON

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Azimuth (deg)	Corr. (dB)	Height (cm)	Pol
13524.5480	---	33.48	60.00	26.52	243	4.5	130.0	V
15650.2480	---	33.44	60.00	26.56	53	8.3	266.0	V
17858.4480	---	35.30	60.00	24.70	163	12.7	122.0	V

Table 16: Radiated emissions 6-18 GHz

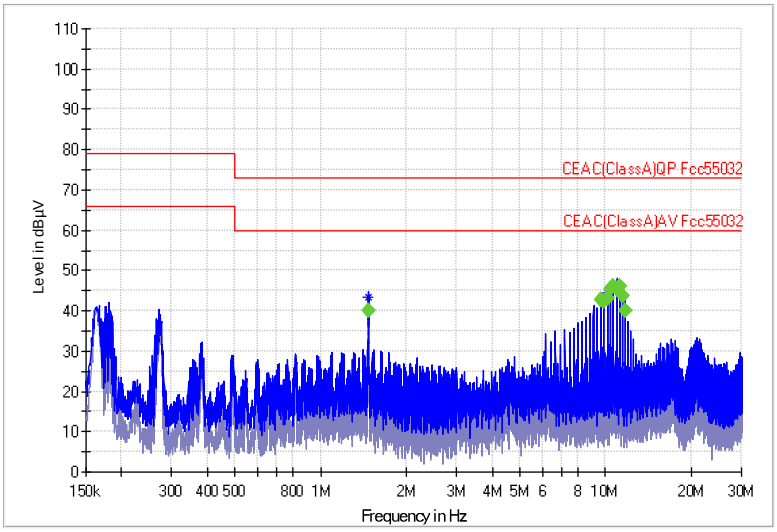


Plot 70: Conducted Emissions Telecom: 150 kHz -30 MHz

Note: No emission of significance were observed. Transmitter is ON

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Corr. (dB)	PE
1.4692	---	71.3	74.0	2.7	1000	9.000	20.2	GND
1.4692	74.5	---	87.0	12.5	1000	9.000	20.2	GND

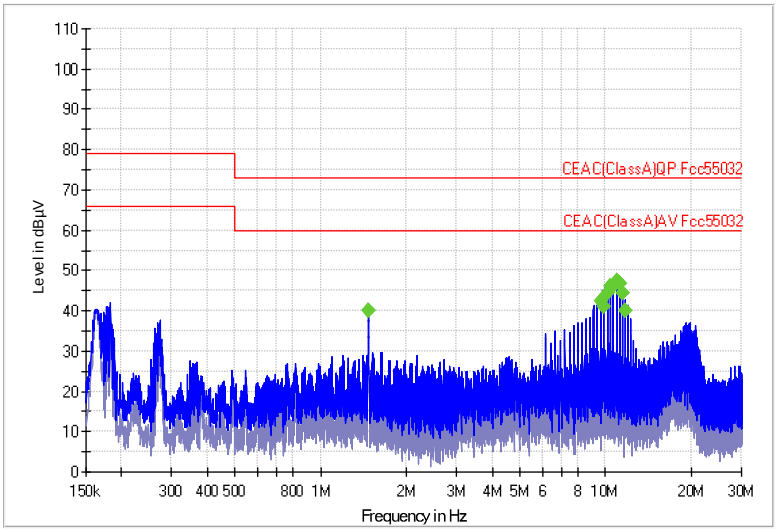
Table 17: **Conducted Emissions Telecom: 150 kHz -30 MHz**
Note: No emission of significance were observed. Transmitter is ON.



Plot 71: Conducted Emissions Line 1: 150 kHz -30 MHz
Note: No emission of significance were observed. Transmitter is ON.

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
1.4712	---	40.0	60.0	20.0	1000	9.000	L1	10.6
9.6040	---	42.6	60.0	17.4	1000	9.000	L1	10.5
9.8720	---	42.4	60.0	17.6	1000	9.000	L1	10.6
10.1400	---	42.9	60.0	17.1	1000	9.000	L1	10.6
10.4040	---	45.5	60.0	14.5	1000	9.000	L1	10.6
10.6720	---	46.0	60.0	14.0	1000	9.000	L1	10.6
10.9400	---	45.5	60.0	14.5	1000	9.000	L1	10.6
11.2040	---	46.1	60.0	13.9	1000	9.000	L1	10.6
11.4720	---	43.9	60.0	16.1	1000	9.000	L1	10.6
11.7400	---	40.0	60.0	20.0	1000	9.000	L1	10.6

Table 18: Final Data of Conducted Emissions Line 1–(150kHz - 30MHz)



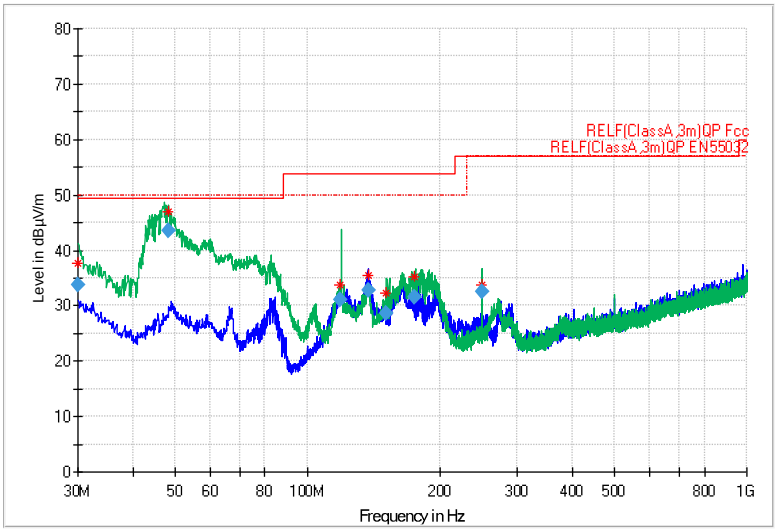
Plot 72: Conducted Emissions Line 2: 150 kHz -30 MHz

Note: No emission of significance were observed. Transmitter is ON.

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
1.4704	---	39.9	60.0	20.1	1000	9.000	L2	10.6
9.6040	---	42.5	60.0	17.5	1000	9.000	L2	10.5
9.8680	---	41.1	60.0	18.9	1000	9.000	L2	10.6
10.1360	---	44.5	60.0	15.5	1000	9.000	L2	10.6
10.4040	---	46.0	60.0	14.0	1000	9.000	L2	10.6
10.6720	---	46.0	60.0	14.0	1000	9.000	L2	10.6
10.9360	---	47.4	60.0	12.6	1000	9.000	L2	10.6
11.2040	---	46.6	60.0	13.4	1000	9.000	L2	10.6
11.4720	---	44.5	60.0	15.5	1000	9.000	L2	10.6
11.7360	---	40.0	60.0	20.0	1000	9.000	L2	10.6

Table 19: Conducted Emissions Line 2: 150 kHz -30 MHz

Note: No emission of significance were observed. Transmitter is ON.



Plot 73: Radiated Emissions: 30 MHz-1GHz.
Note: No emission of significance were observed. Transmitter is ON.

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Corr. (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.0674	33.8	49.5	15.7	25.4	120.000	148.0	V	307
48.3131	43.6	49.5	5.9	13.5	120.000	104.0	V	288
118.1862	31.1	53.9	22.8	19.2	120.000	109.0	V	20
137.6680	32.9	53.9	21.0	19.1	120.000	230.0	H	123
150.7221	28.6	53.9	25.3	18.4	120.000	192.0	V	289
175.2910	31.5	53.9	22.4	17.2	120.000	145.0	V	212
249.9949	32.5	56.9	24.4	17.9	120.000	122.0	V	13

Table 20: Final Data of Radiated Emissions at 3m SAC–(30MHz-1GHz)

Appendix A: TEST SETUP PHOTOS

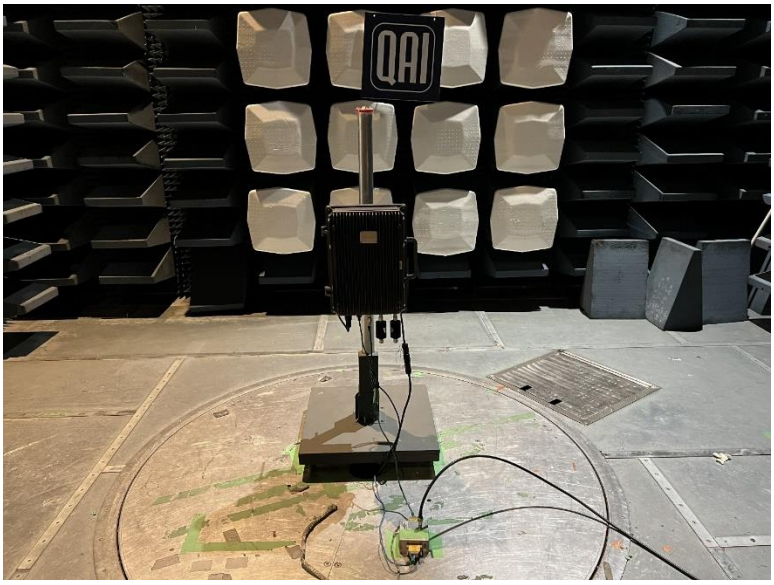


Figure 1: Conducted Emissions- Telecom.

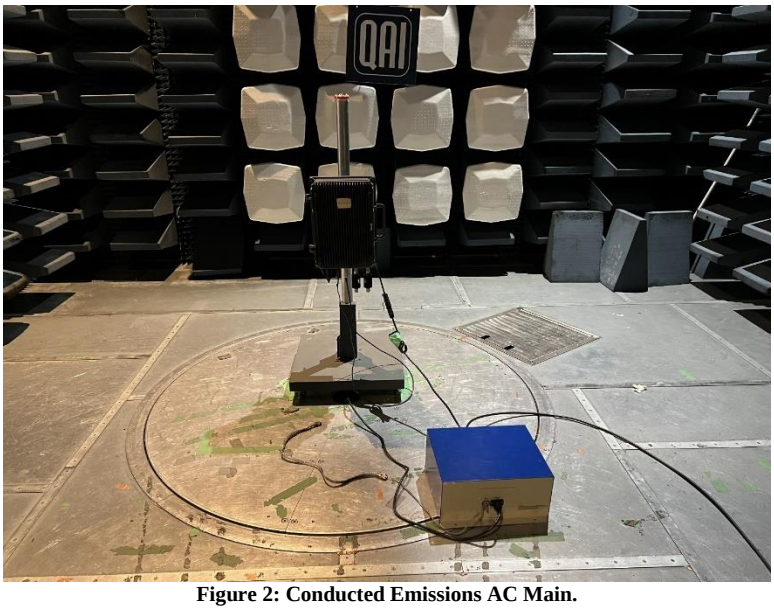


Figure 2: Conducted Emissions AC Main.

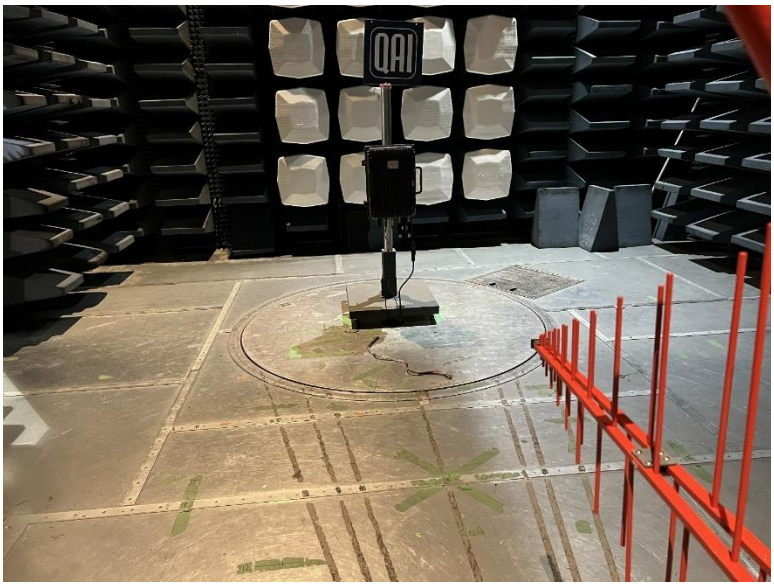


Figure 3: Radiated Emissions 30MHz. – 1GHz.

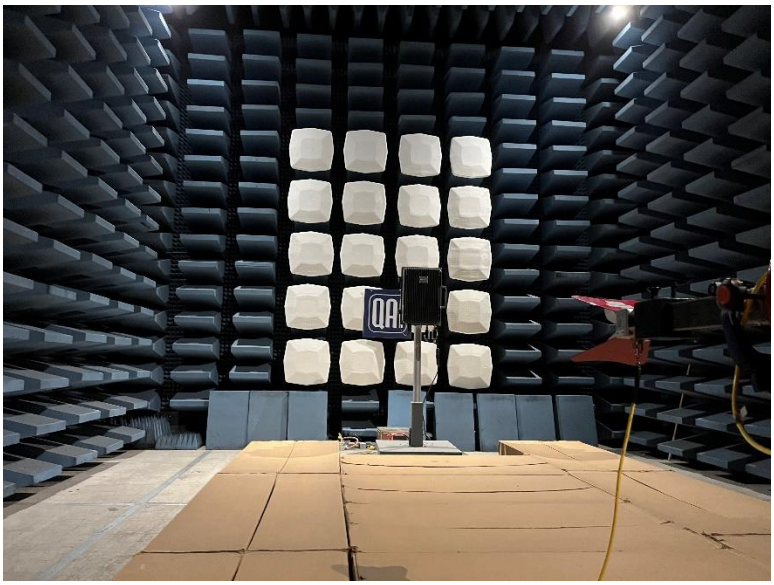


Figure 4: Radiated Emissions 1GHz to 18 GHz

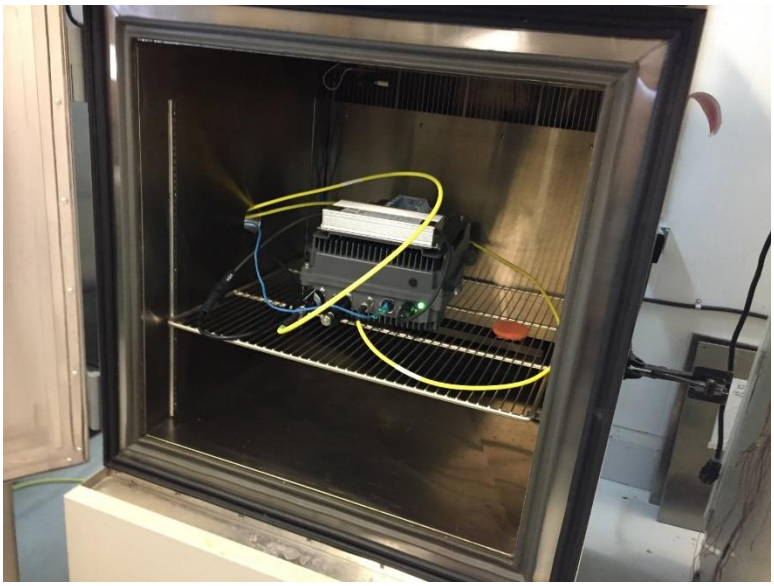


Figure 5: Frequency Stability Testing

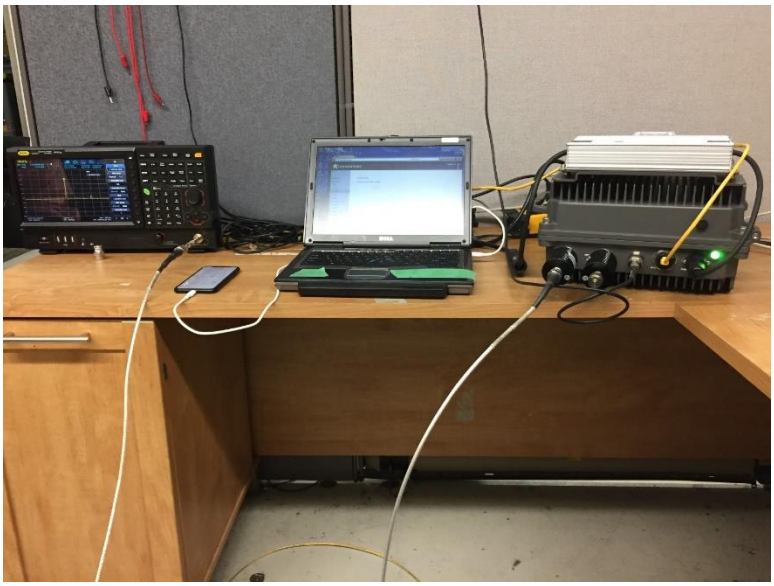


Figure 6: Radio Testing Station

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
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