



FCC / ISED Test Report

For:

Proxfinity Inc.

Model Name:

CUE 2.0

Product Description:

CUE 2.0 SMART BADGE

FCC ID: 2AFPT-CUE020

IC ID: 22224-CUE020

Applied Rules and Standards:

47 CFR Part 15.247 (DSS)

RSS-247 Issue 2 (FHSs) & RSS-Gen Issue 5

REPORT #: EMC_PROXF-001-19001_15.247_DSS_Rev1

DATE: 2020-08-17



A2LA Accredited

IC recognized #
3462B-2

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1 **Assessment**

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
Proxfinity Inc.	CUE 2.0 SMART BADGE	CUE 2.0

Responsible for Testing Laboratory:

Cindy Li (EMC Lab Manager)			
2020-08-17	Compliance		
Date	Section	Name	Signature

Responsible for the Report:

Kevin Wang (Senior EMC Engineer)			
2020-08-17	Compliance		
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Cindy Li
Responsible Project Leader:	Rami Saman

2.2 Identification of the Client

Client's Name:	PROXFINITY, INC.
Street Address:	227 W. MONROE ST. SUITE 5200
City/Zip Code	CHICAGO, IL 60606
Country	United States

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as Client
Manufacturers Address:	-----
City/Zip Code	-----
Country	-----

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	CUE 2.0
HW Version :	2.0
SW Version :	v1.04.37
FCC-ID :	2AFPT-CUE020
IC-ID:	22224-CUE020
FVIN:	v1.04.37
HVIN:	CUE 2.0
PMN:	CUE
Product Description:	CUE2.0 Smart Badge
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 78), 79 Channels
Radio Information:	<u>Bluetooth:</u> Module Name: Murata Module Number: LBEE5KL1DX-883 FCC ID: VPYLB1DX IC ID: 772C-LBV1DX Type(s) of Modulation: BDR/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK
Modes of Operation:	Hopping
Antenna Information as declared:	max gain -5.12 dBi
Max. declared output Powers:	Conducted Power 9.54dBm(From FCC Grant)
Power Supply/ Rated Operating Voltage Range:	Vmin: 3.3 VDC/ Vnom: 3.8 VDC / Vmax: 4.2 VDC
Operating Temperature Range	-10 °C to 85 °C
Other Radios included in the device:	Bluetooth 4.2 Low Energy (BT LE) Wi-Fi 2.4GHz ZigBee, 802.15.4
Sample Revision	☐ Prototype Unit; ☒ Production Unit; ☐ Pre-Production

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	#1	2.0	v1.04.37	Zigbee conducted sample #1
2	#2	2.0	v1.04.37	Zigbee conducted sample #2, Bluetooth radiated sample
3	#3	2.0	v1.04.37	Zigbee radiated sample #3, WiFi sample, 15B sample
4	#4	2.0	v1.04.37	Bluetooth conducted sample

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	-----	-----	-----	-----

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#2	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The internal antenna was connected.
2	EUT#4	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The measurement equipment was connected to the 50 ohm RF port of the EUT.

3.5 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle.

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 2 of ISED Canada.

This test report is to support a request for new equipment authorization under

- FCC ID: 2AFPT-CUE020
- IC ID: 22224-CUE020

Testing procedures are based on ANSI C63.10:2013 including section 7.8 for FHSS systems.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(b)(1) RSS-247 5.4(b)	Maximum Peak Conducted Output Power	Nominal	GFSK	■	□	□	Note1 Note2
§15.247(d) RSS-247 5.5 RSS-Gen 8.10	Band Edge Compliance	Nominal	-----	□	□	■	Note1
§15.247(a)(1) RSS-247 5.1(b)	Spectrum Bandwidth	Nominal	-----	□	□	■	Note1
§15.247(a)(1) RSS-247 5.1(b)	Carrier Frequency Separation	Nominal	-----	□	□	■	Note1
§15.247(a)(1) RSS-247 5.1(d)	Number of Hopping Channels	Nominal	-----	□	□	■	Note1
§15.247(a)(1)(iii) RSS-247 5.1(d)	Time of occupancy	Nominal	-----	□	□	■	Note1
§15.247(d) §15.209 (a) RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	GFSK	■	□	□	Complies
§15.207(a) RSS-Gen 8.8	AC Conducted Emissions	Nominal	-----	□	□	■	Note1

Note: NA= Not Applicable; NP= Not Performed.

Note1: Data leveraged from modular approval, FCC ID: VPYLB1DX, IC ID: 772C-LBV1DX

Note2: Partially tested, for verification purposed only

6 **Measurements**

6.1 **Measurement Uncertainty**

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor $k=1$.

Radiated measurement

9 kHz to 30MHz	± 2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	± 2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	± 2.3 dB (Horn Antenna)

Conducted measurement

RF conducted measurement ± 0.5 dB

6.2 **Environmental Conditions During Testing:**

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

6.3 **Dates of Testing:**

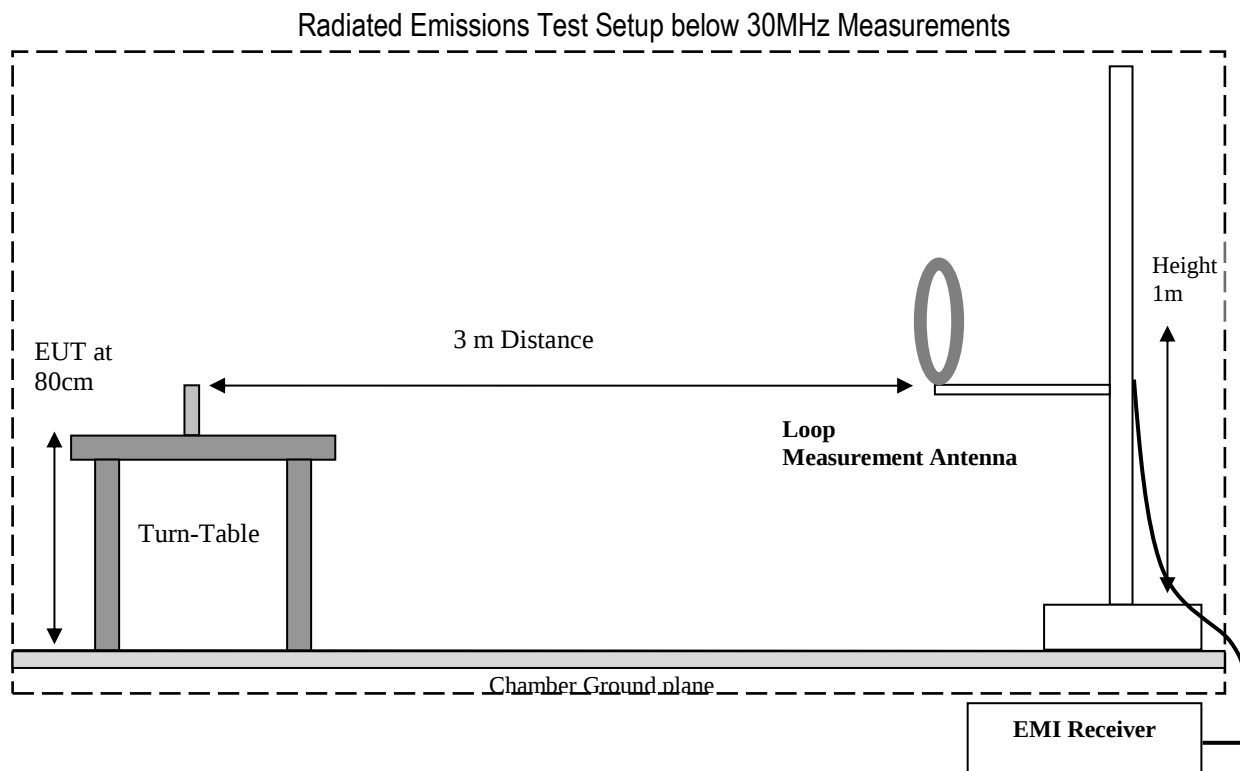
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7 Measurement Procedures

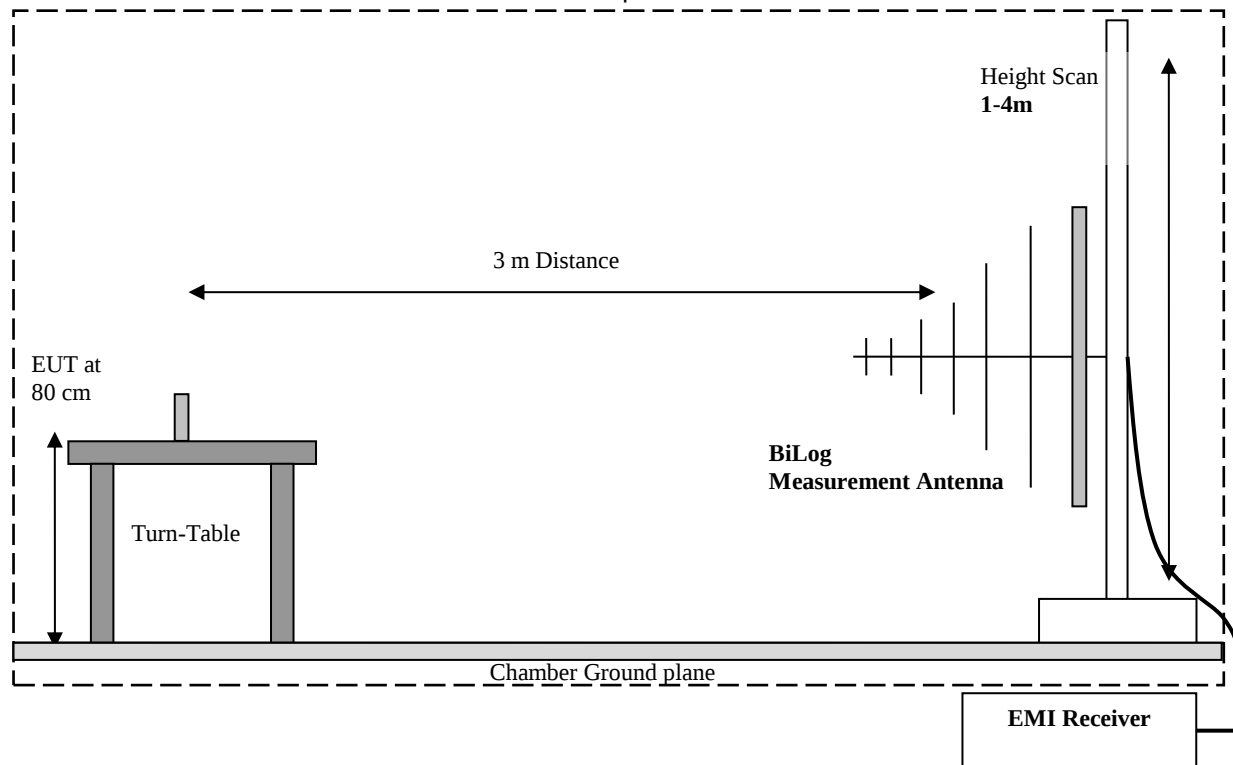
7.1 Radiated Measurement

The radiated measurement is performed according to: ANSI C63.10 (2013)

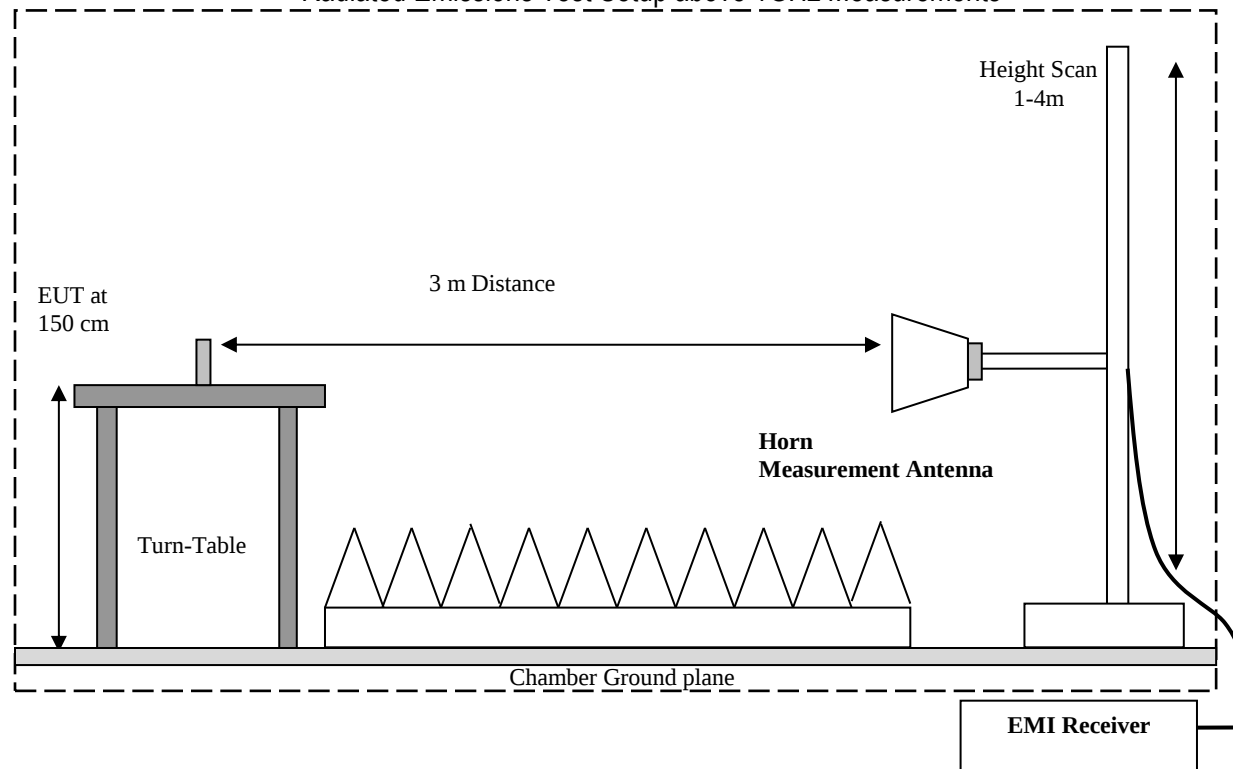
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dB μ V
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

$$FS \text{ (dB}\mu\text{V/m)} = \text{Measured Value on SA (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}$$

Example:

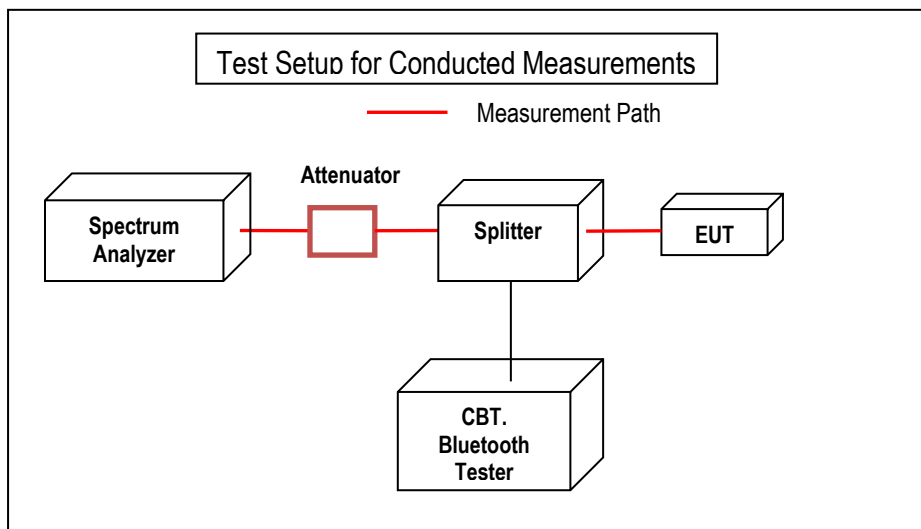
Frequency (MHz)	Measured SA (dB μ V)	Cable Loss (dB)	Antenna Factor Correction (dB)	Field Strength Result (dB μ V/m)
1000	80.5	3.5	14	98.0

7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

7.3 RF Conducted Measurement Procedure

Reference: ANSI C63.10 (2013) Section 6.9, 6.10, and 7.8



- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

8 Test Result Data

8.1 Maximum Peak Conducted Output Power

8.1.1 Measurement according to ANSI C63.10 Section 7.8.5

Spectrum Analyzer settings:

- Span = approximately 5 times the 20 dB bandwidth
- RBW > the 20 dB bandwidth of the emission being measured
- VBW $\geq$ RBW
- Sweep = Auto Couple
- Detector function = Peak
- Trace = Max hold
- Use the marker-peak function to set the marker to the peak of the emission.

8.1.2 Limits:

Maximum Peak Output Power:

FCC §15.247: (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

- (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

IC RSS-247 5.4:

- (b) For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels.

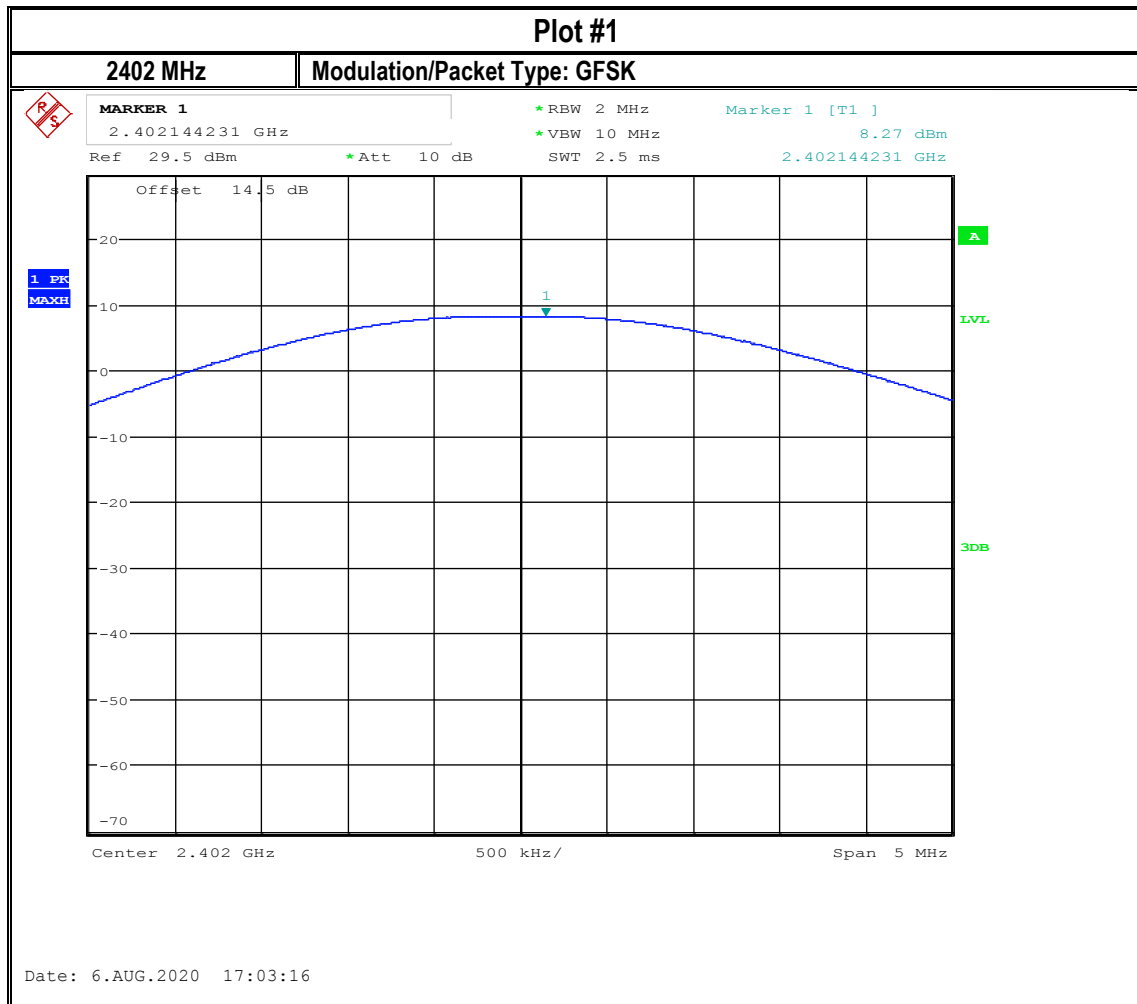
8.1.3 Test conditions and setup:

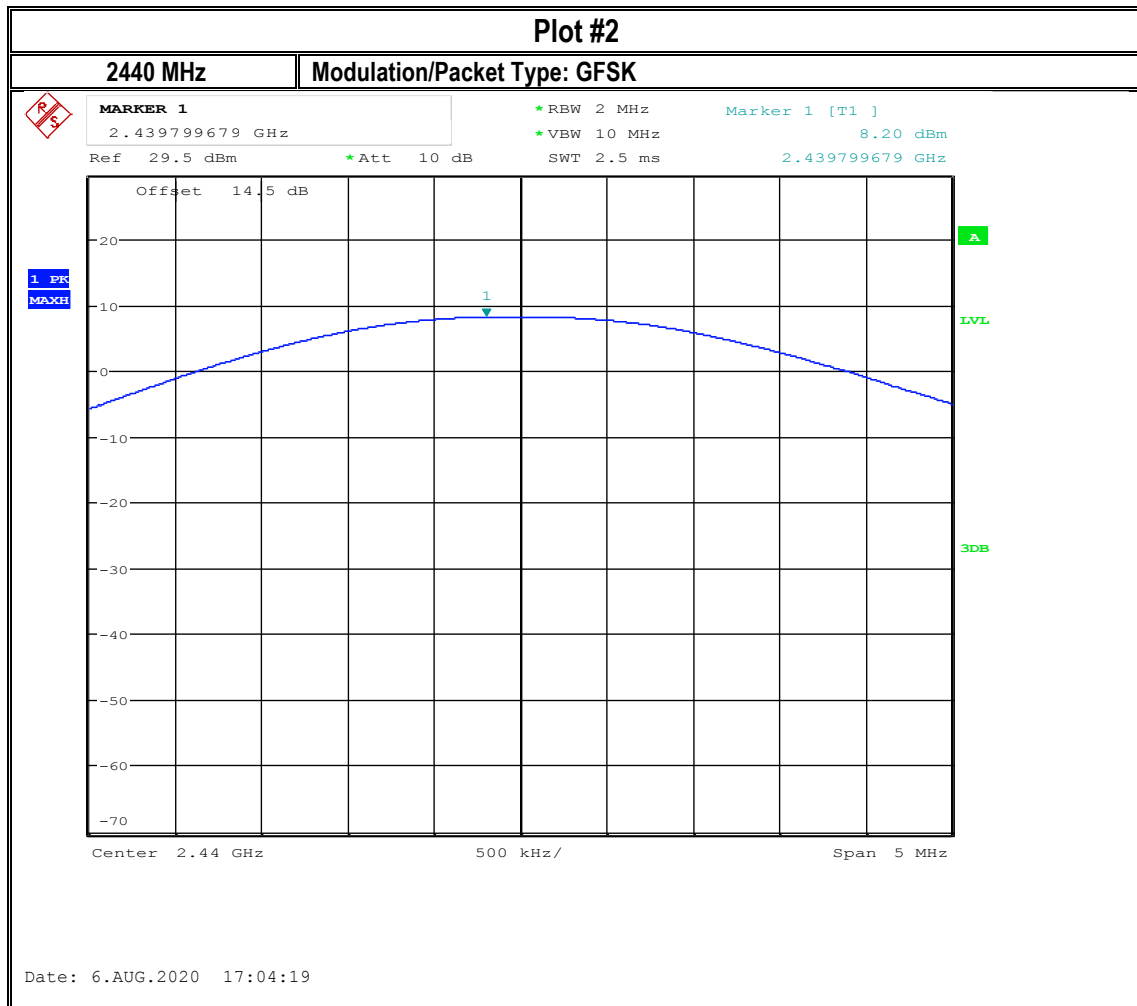
Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input	Antenna Gain
23° C	2	GFSK, QPSK, 8DPSK	120VAC	-5.12dBi

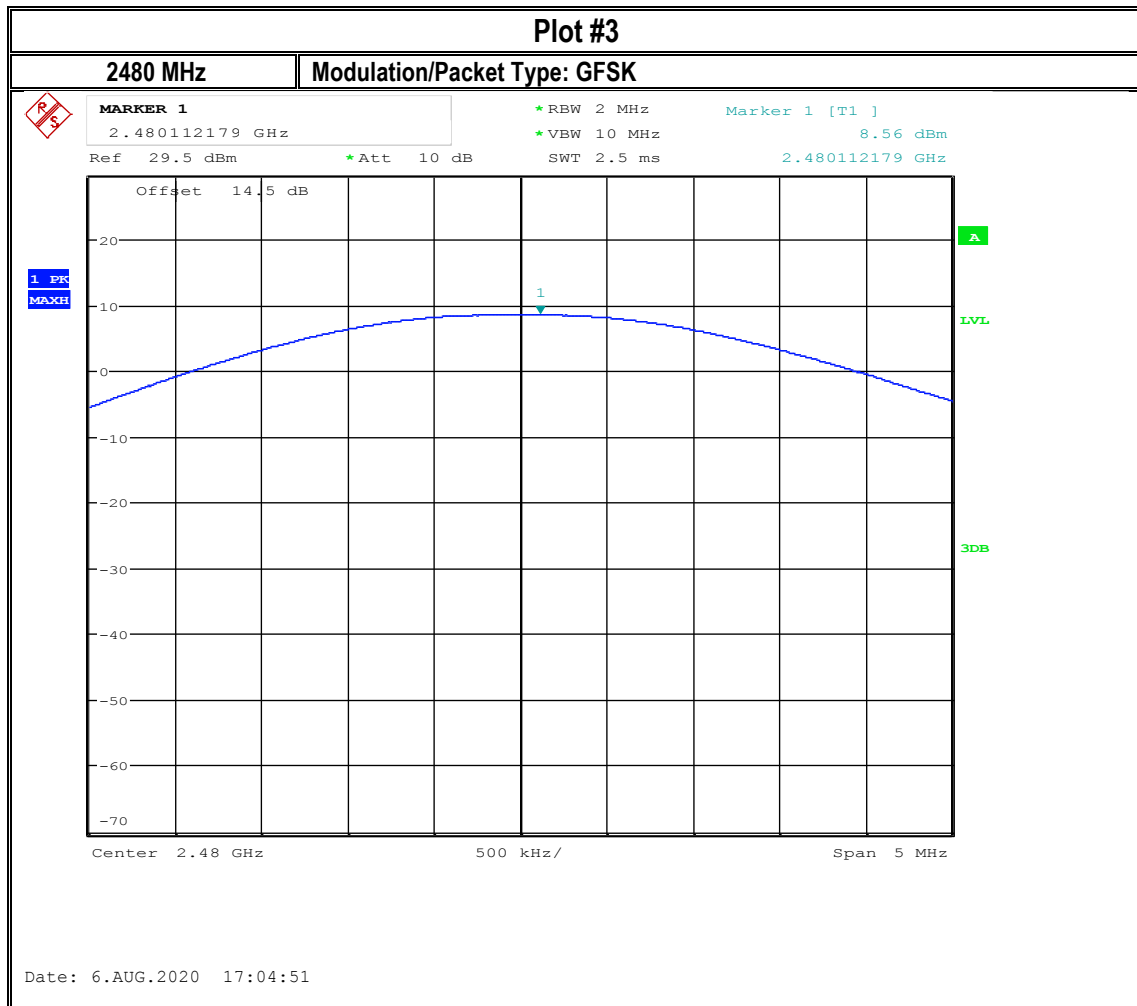
8.1.4 Measurement result:

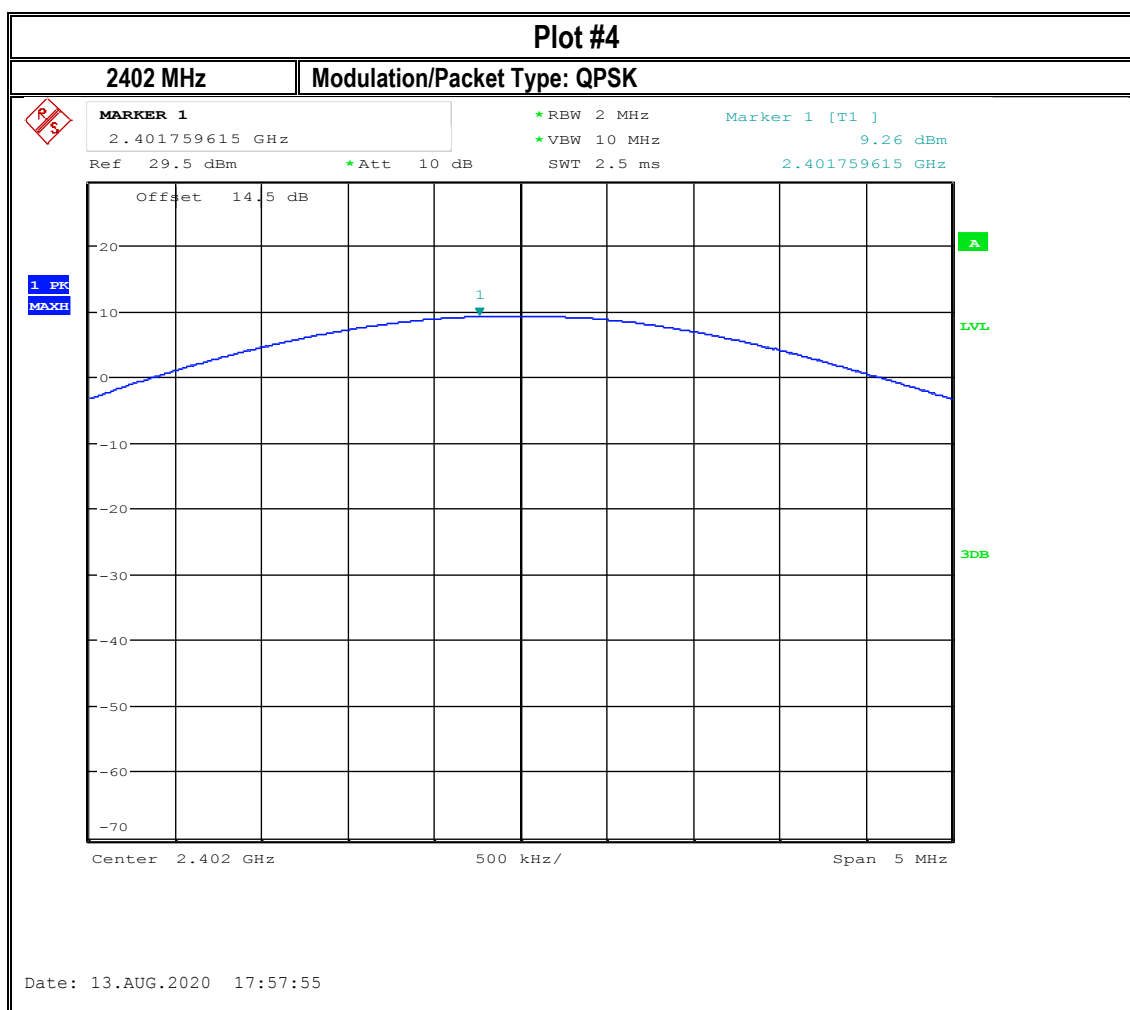
Plot #	Frequency (MHz)	EUT operating mode	Maximum Peak Conducted Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
1	2402	GFSK	8.27	3.15	30(Pk) / 36(EIRP)	Pass
2	2440	GFSK	8.20	3.08	30(Pk) / 36(EIRP)	Pass
3	2480	GFSK	8.56	3.44	30(Pk) / 36(EIRP)	Pass
4	2402	QPSK	9.26	4.14	30(Pk) / 36(EIRP)	Pass
5	2440	QPSK	8.71	3.59	30(Pk) / 36(EIRP)	Pass
6	2480	QPSK	9.21	4.09	30(Pk) / 36(EIRP)	Pass
7	2402	8DPSK	9.39	4.27	30(Pk) / 36(EIRP)	Pass
8	2440	8DPSK	8.94	3.82	30(Pk) / 36(EIRP)	Pass
9	2480	8DPSK	9.4	4.28	30(Pk) / 36(EIRP)	Pass

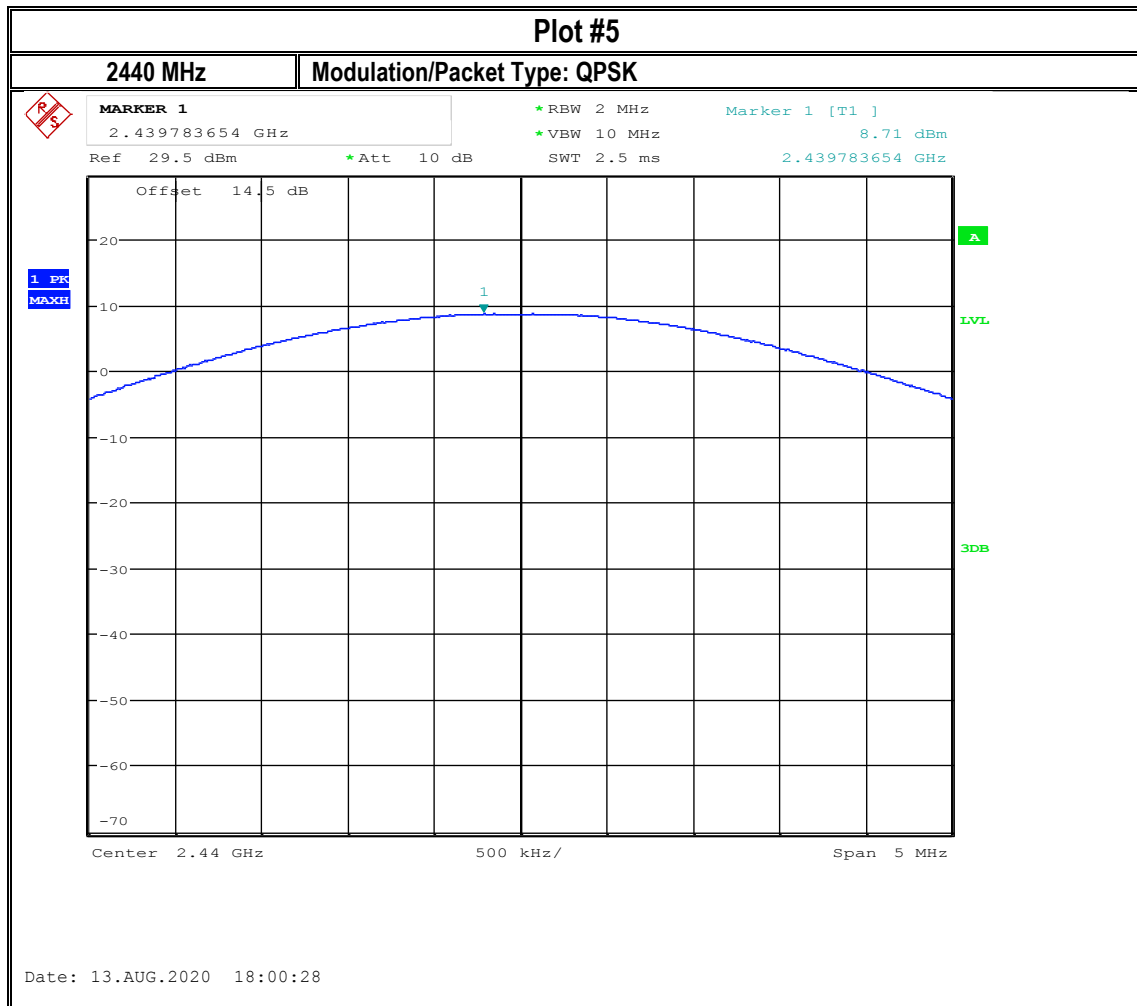
8.1.5 Measurement Plots:

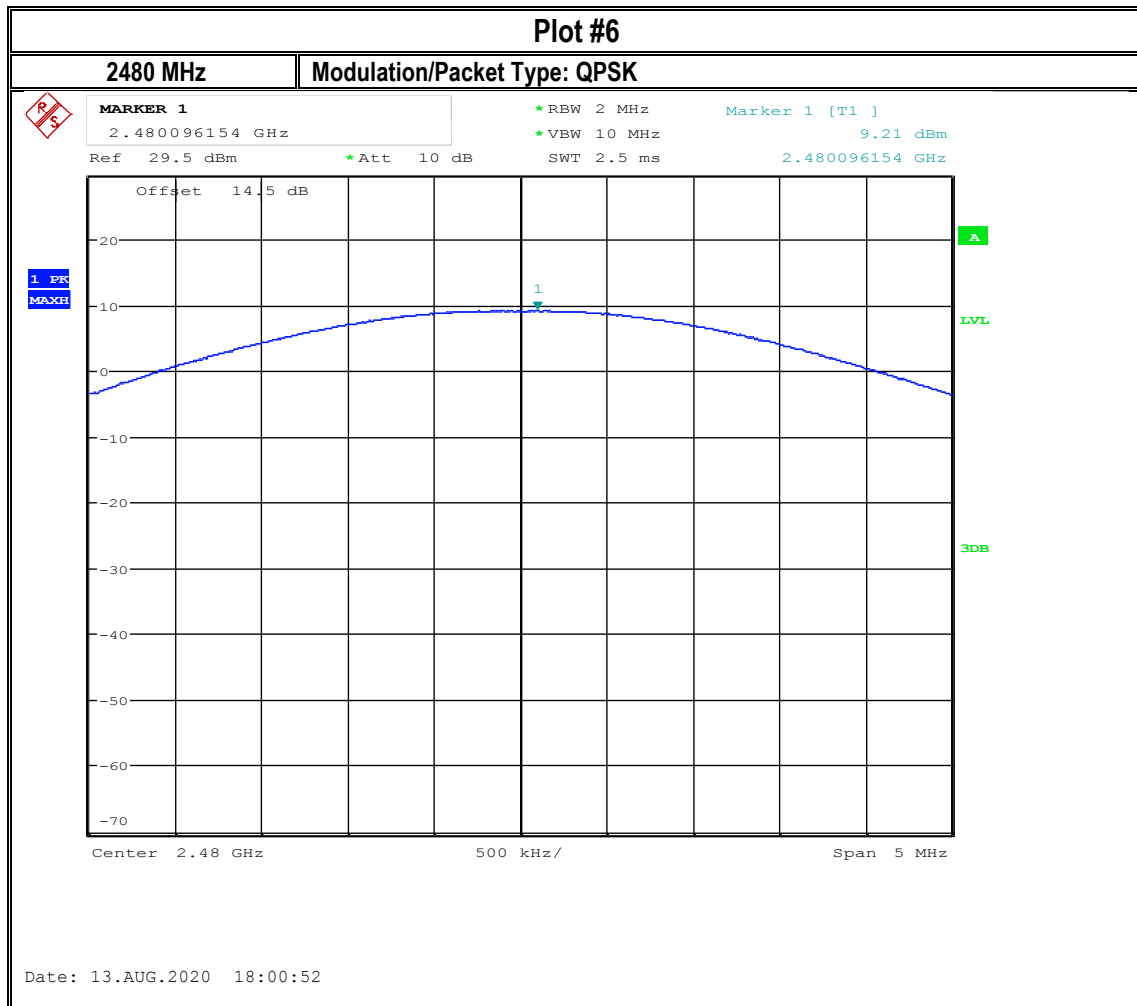


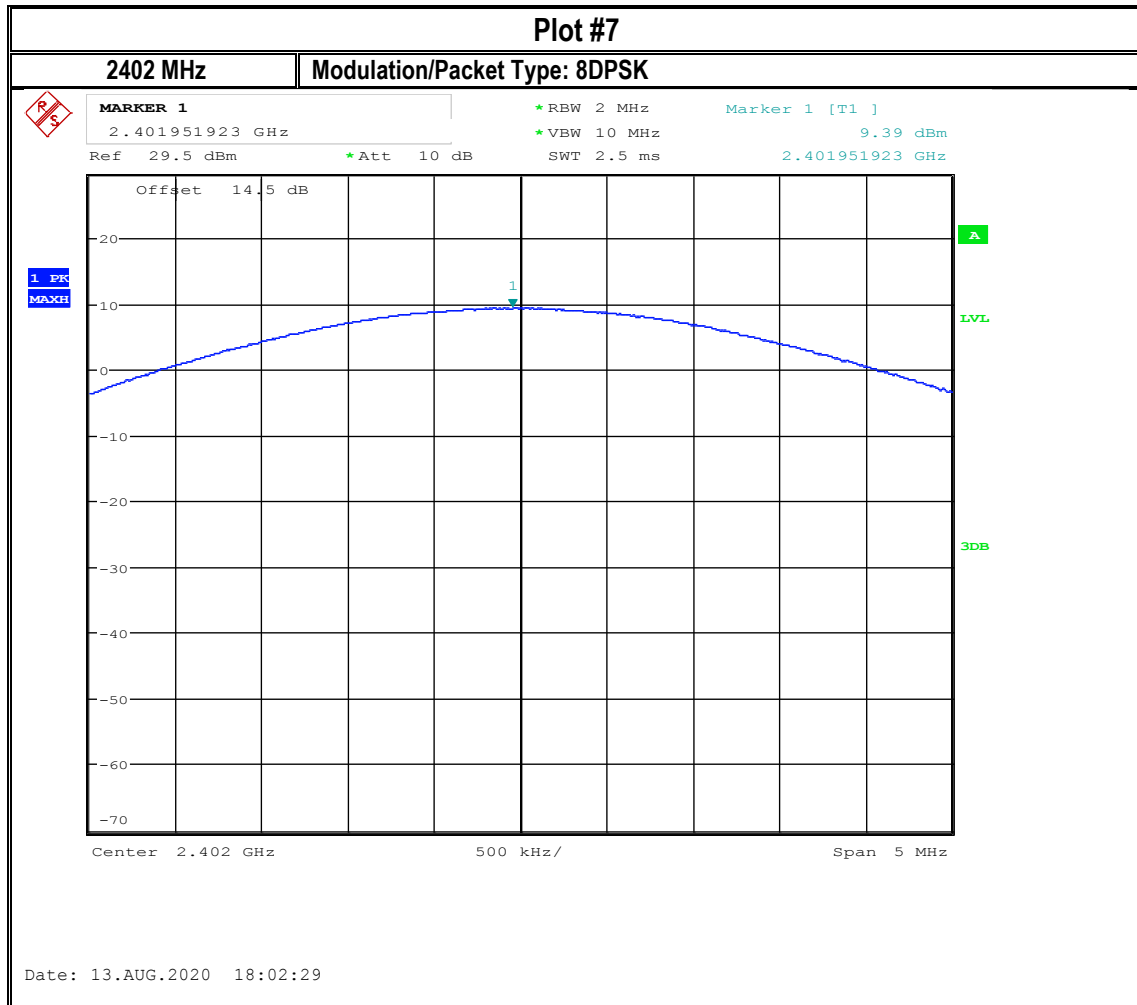


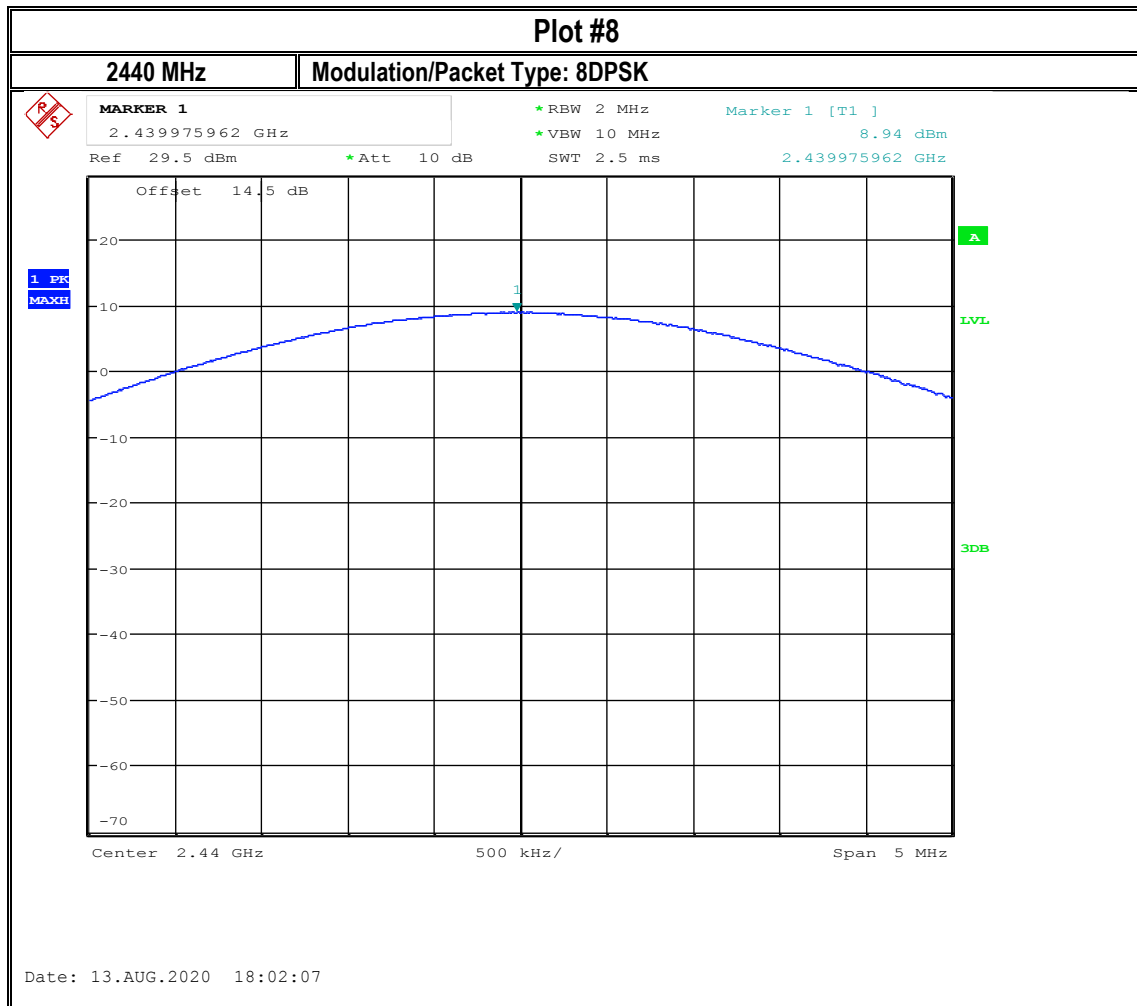


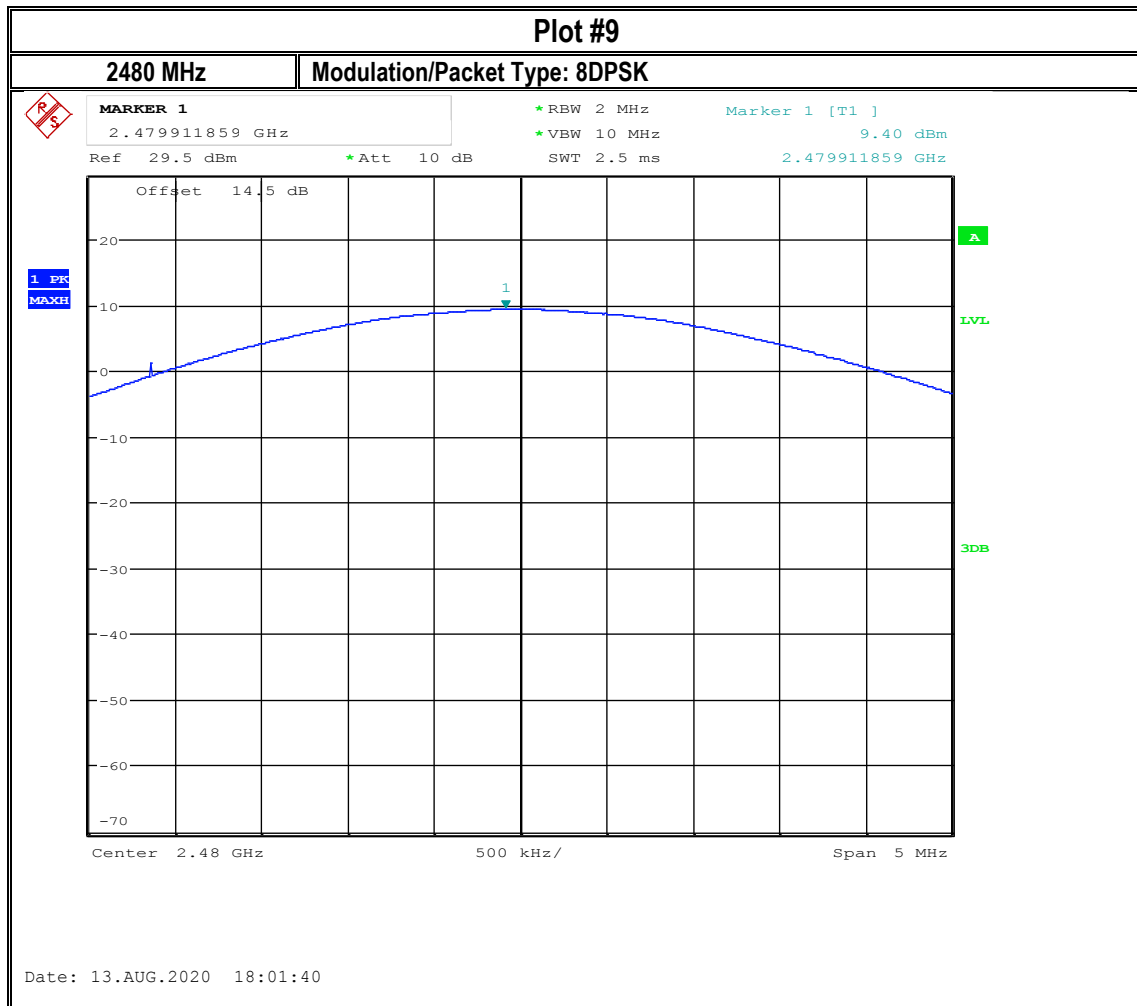












8.2 Transmitter Spurious Emissions and Restricted Bands

8.2.1 Measurement according to ANSI C63.10

Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector = Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW = 120 KHz (<1 GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing frequencies below 30 MHz at distance other than the specified in the standard, the limit conversion is calculated by using the FCC materials for the ANSI 63 committee issued on January, 27 1991.

8.2.2 Limits: FCC 15.247(d)/15.209(a) /RSS-Gen 6.13

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
- PEAK LIMIT= 74dB μ V/m
- AVG. LIMIT= 54dB μ V/m
- Except as shown in CFR 47 Part 15.205 paragraph (d), only spurious emissions are permitted in any of the frequency bands listed below

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

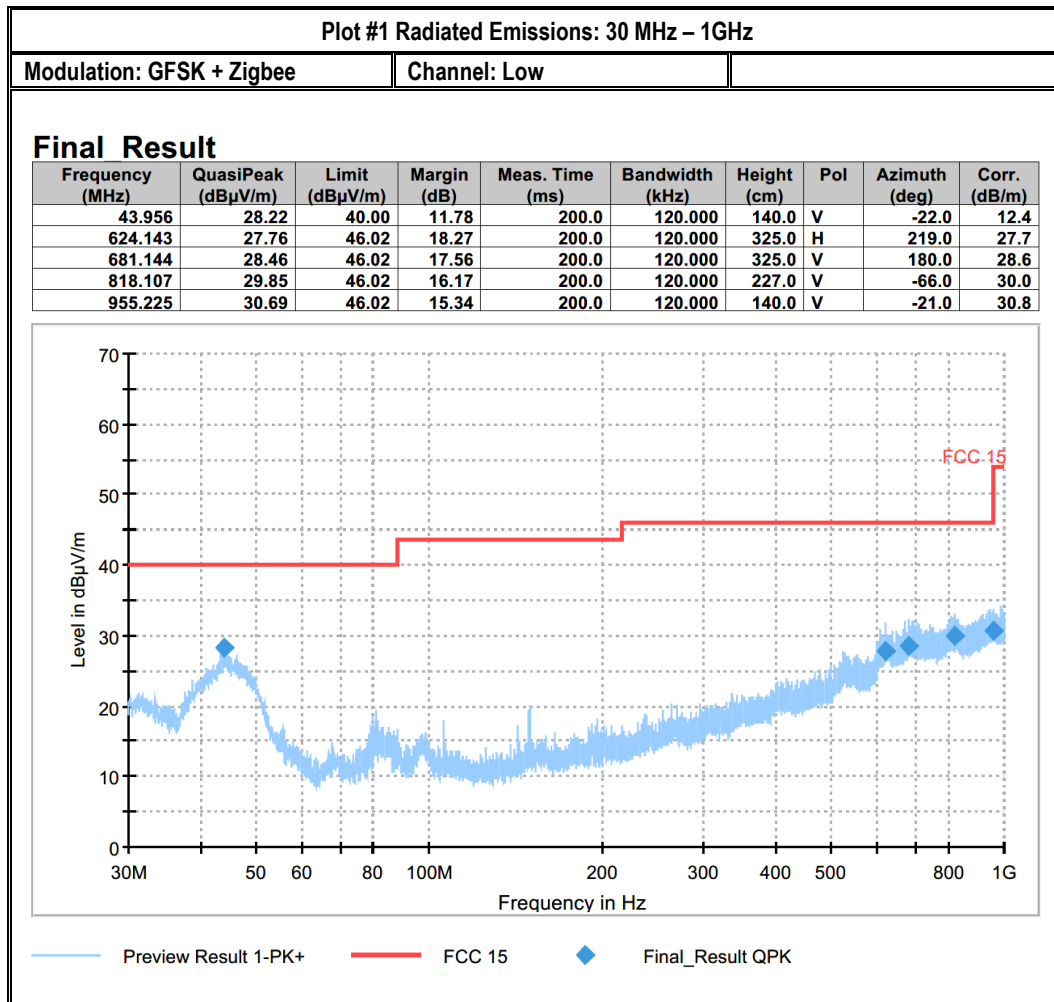
8.2.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	GFSK fixed channel + Zigbee	120 VAC

8.2.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1-3	Low	30 MHz – 18 GHz	See section 8.7.2	Pass
4-8	Mid	9 kHz – 26 GHz	See section 8.7.2	Pass
9-11	High	30 MHz – 18 GHz	See section 8.7.2	Pass

8.2.5 Measurement Plots:



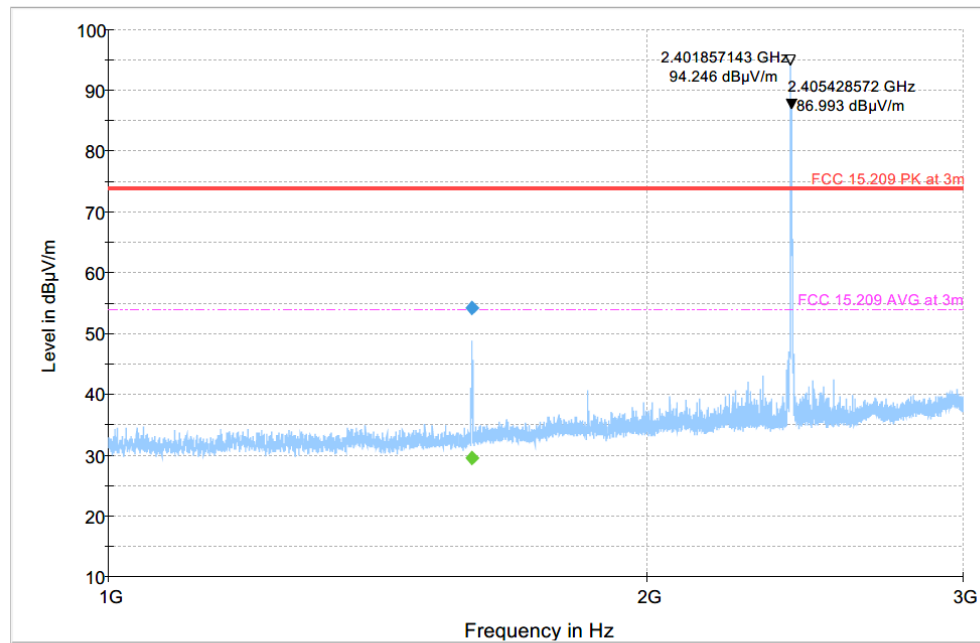
Plot # 2 Radiated Emissions: 1-3 GHz

Modulation: GFSK + Zigbee

Channel: Low

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1594.429	---	29.45	53.98	24.53	500.0	1000.000	140.0	H	233.0	3.6	
1594.429	54.10	---	73.98	19.88	500.0	1000.000	140.0	H	233.0	3.6	



◆ Preview Result 1-PK+ Final_Result PK+ ◆ FCC 15.209 PK at 3m Final_Result CAV - - - - - FCC 15.209 AVG at 3m

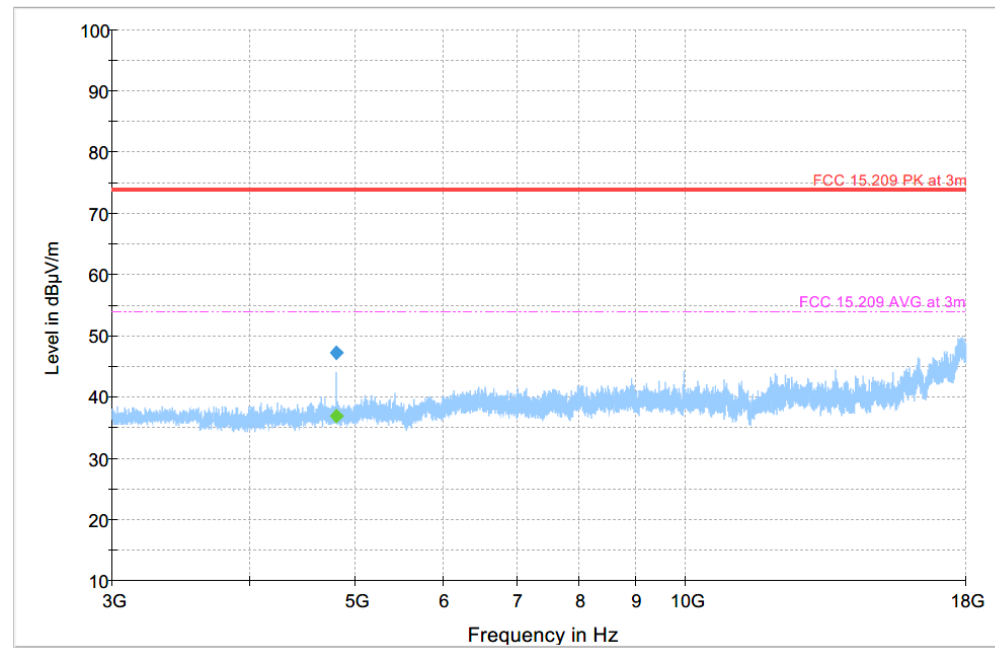
Plot # 3 Radiated Emissions: 3-18 GHz

Modulation: GFSK + Zigbee

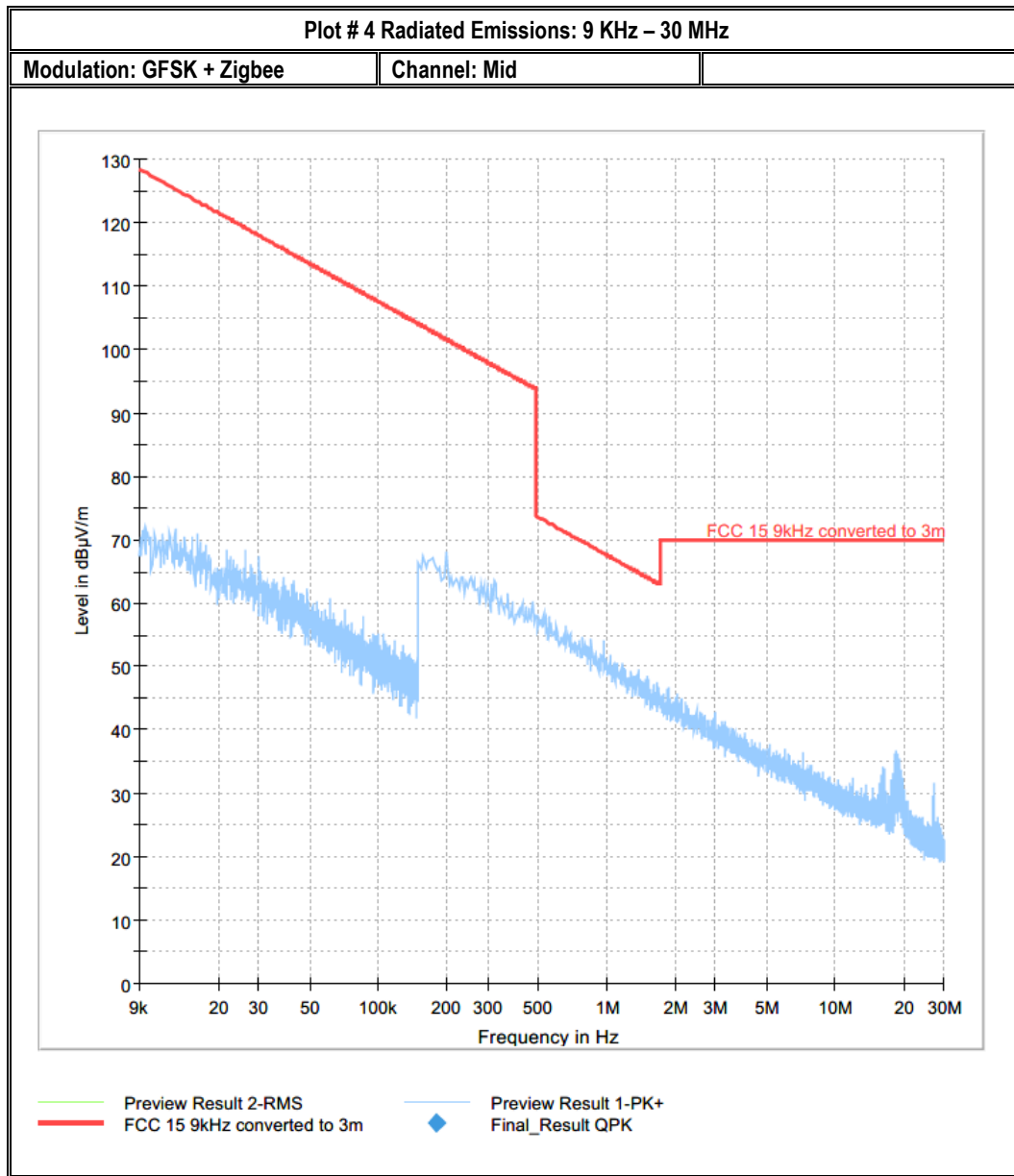
Channel: Low

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4804.000	---	36.84	53.98	17.14	500.0	1000.000	140.0	H	201.0	-4.8	
4804.000	47.21	---	73.98	26.77	500.0	1000.000	140.0	H	201.0	-4.8	



Preview Result 1-PK+ Final_Result PK+ FCC 15.209 PK at 3m FCC 15.209 AVG at 3m
Final_Result CAV



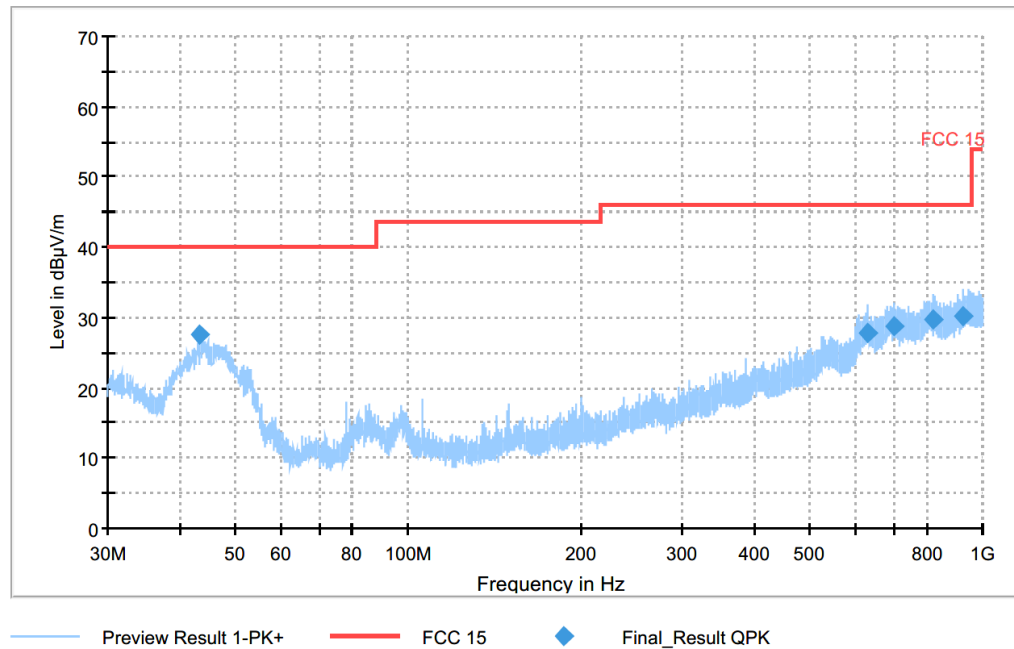
Plot #5 Radiated Emissions: 30 MHz – 1GHz

Modulation: GFSK + Zigbee

Channel: Mid

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.464	27.57	40.00	12.43	200.0	120.000	152.0	V	319.0	12.7
628.918	27.77	46.02	18.25	200.0	120.000	325.0	H	228.0	27.8
700.846	28.87	46.02	17.15	200.0	120.000	282.0	V	116.0	29.1
820.493	29.68	46.02	16.34	200.0	120.000	160.0	V	199.0	29.9
926.750	30.10	46.02	15.92	200.0	120.000	303.0	V	180.0	30.2



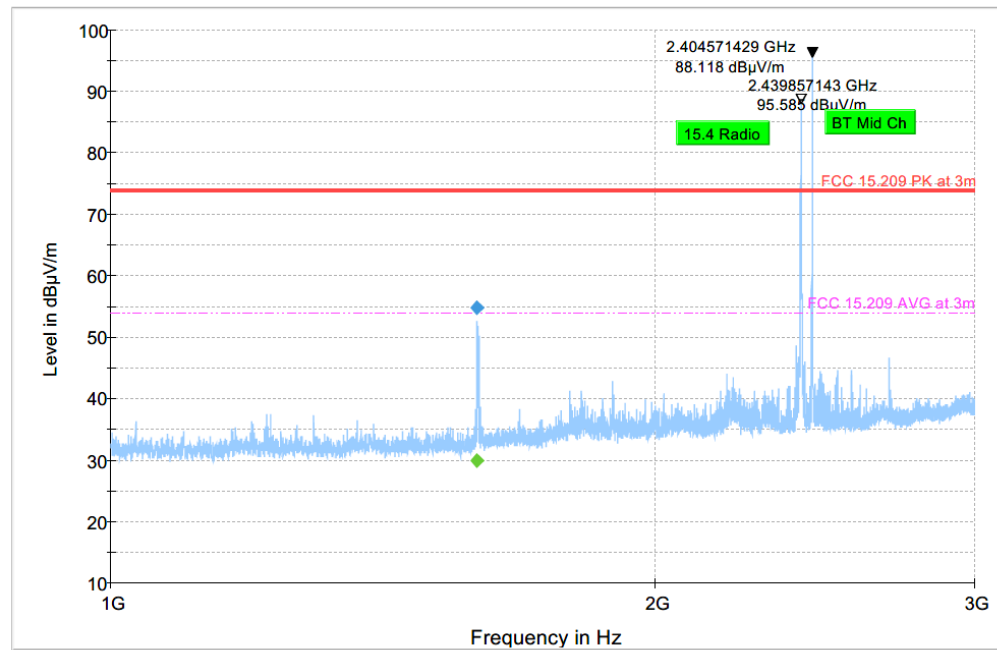
Plot #6 Radiated Emissions: 1-3 GHz

Modulation: GFSK + Zigbee

Channel: Mid

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1593.286	---	29.96	53.98	24.02	500.0	1000.000	140.0	H	237.0	3.6	
1593.286	54.85	---	73.98	19.13	500.0	1000.000	140.0	H	237.0	3.6	



Preview Result 1-PK+ Final_Result PK+ FCC 15.209 PK at 3m FCC 15.209 AVG at 3m

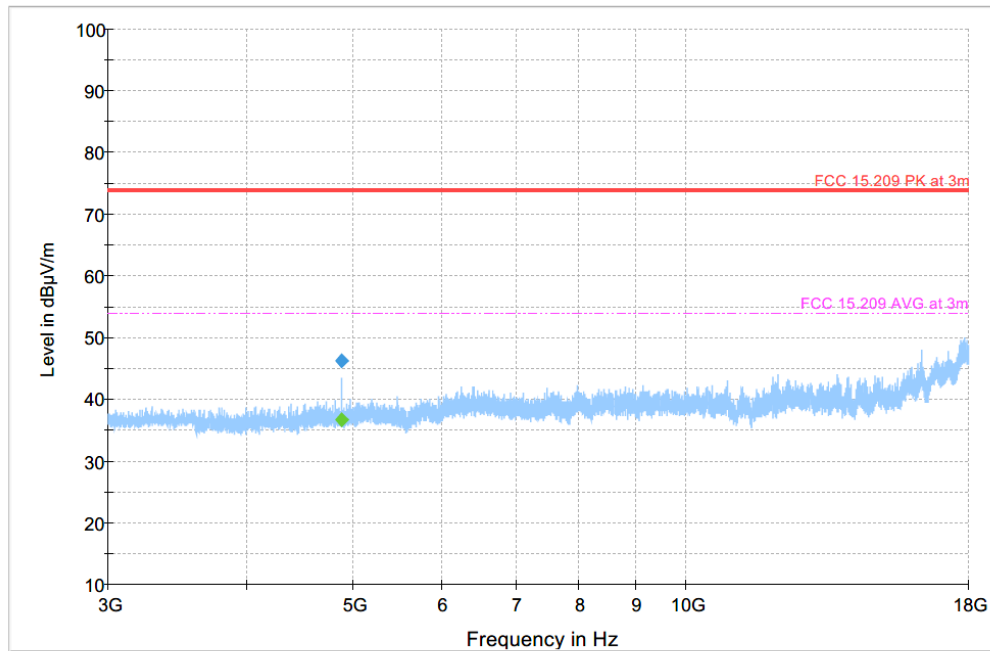
Plot #7 Radiated Emissions: 3-18 GHz

Modulation: GFSK + Zigbee

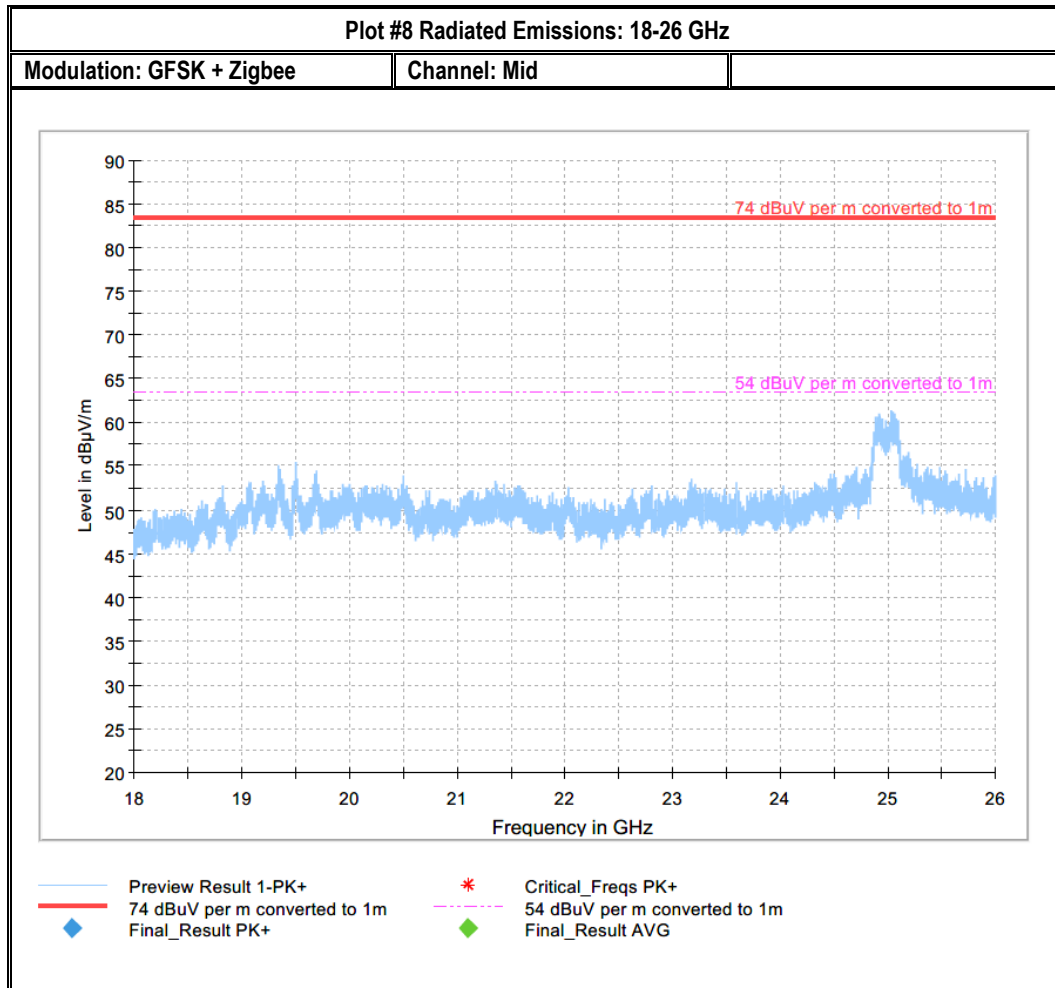
Channel: Mid

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4880.000	---	36.59	53.98	17.39	500.0	1000.000	140.0	H	3.0	-5.0	
4880.000	46.28	---	73.98	27.70	500.0	1000.000	140.0	H	3.0	-5.0	



Preview Result 1-PK+ FCC 15.209 PK at 3m FCC 15.209 AVG at 3m
Final_Result PK+ Final_Result CAV



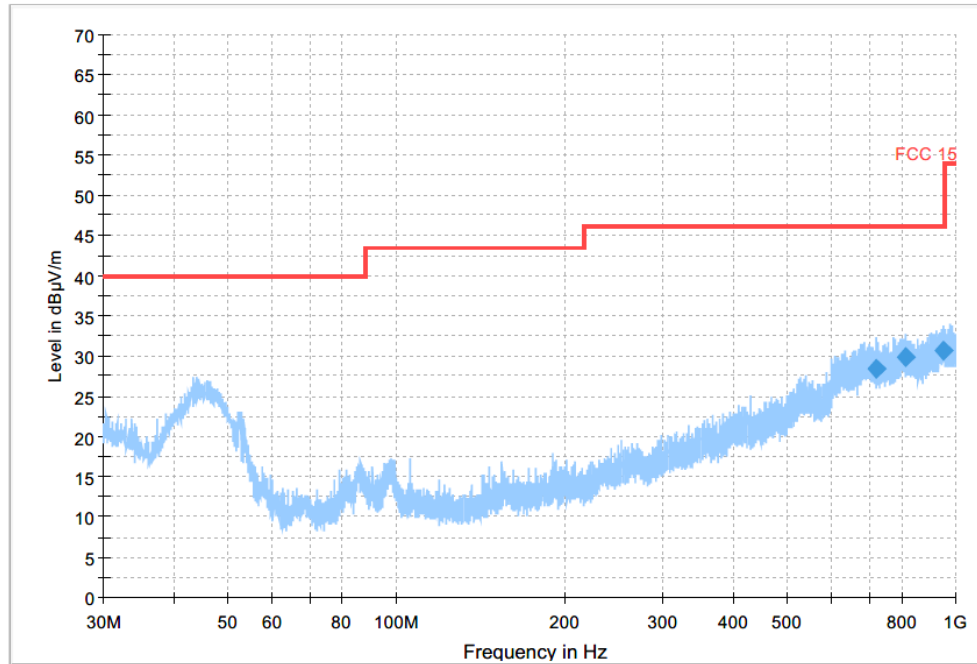
Plot #9 Radiated Emissions: 30 MHz – 1GHz

Modulation: GFSK + Zigbee

Channel: High

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
724.341	28.32	46.02	17.70	200.0	120.000	300.0	V	205.0	28.6
814.936	29.89	46.02	16.13	200.0	120.000	186.0	H	145.0	30.1
950.367	30.73	46.02	15.29	200.0	120.000	184.0	V	-66.0	30.9

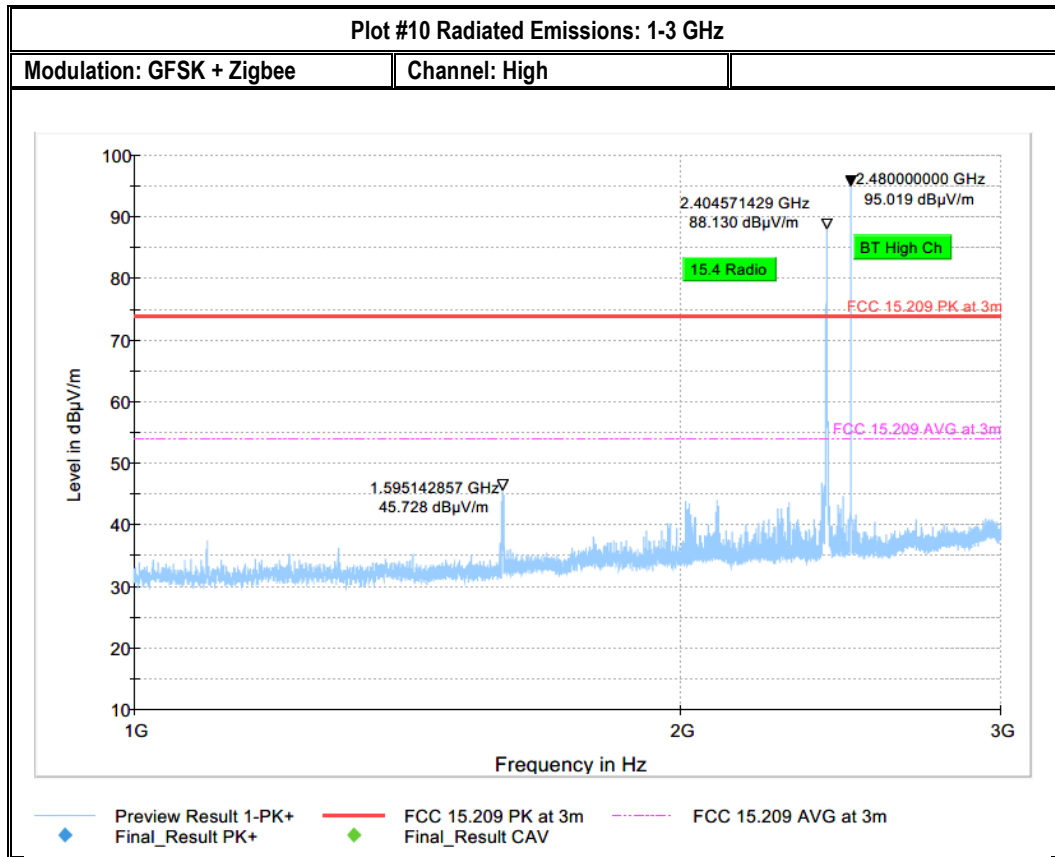


Preview Result 1-PK+

FCC 15



Final_Result QPK



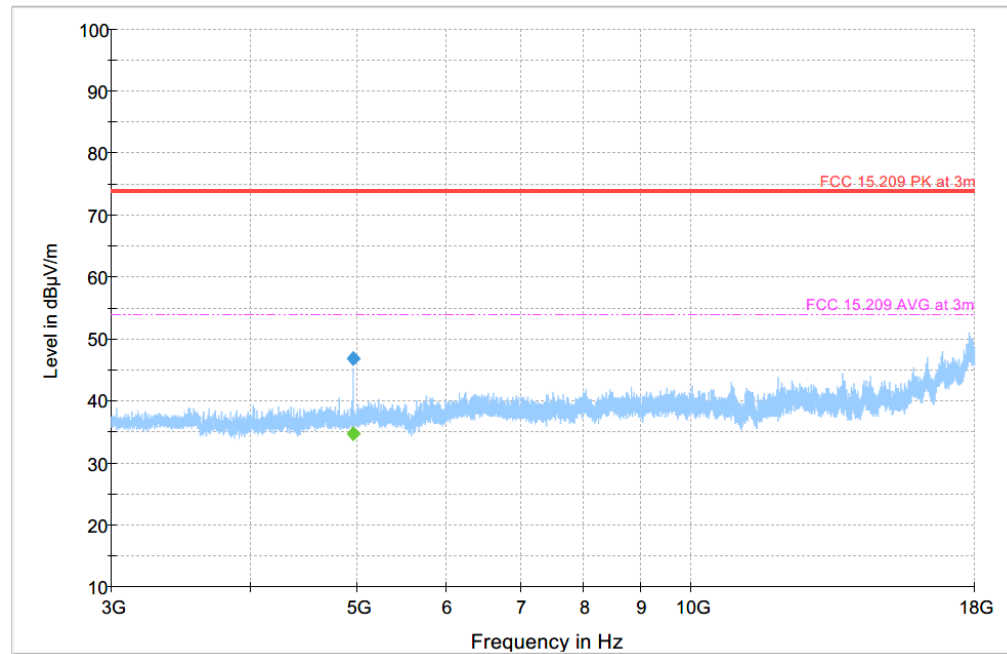
Plot #11 Radiated Emissions: 3-18 GHz

Modulation: GFSK + Zigbee

Channel: High

Final Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
4959.500	---	34.59	53.98	19.38	500.0	1000.000	228.0	H	299.0	-4.5	
4959.500	46.92	---	73.98	27.06	500.0	1000.000	228.0	H	299.0	-4.5	



Preview Result 1-PK+ Final_Result PK+ FCC 15.209 PK at 3m Final_Result CAV FCC 15.209 AVG at 3m

9 Test setup photos

Setup photos are included in supporting file name: "EMC_PORXF-001-19001_FCC_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Biconilog 3142E	Biconilog Antenna	EMCO	3142E	166067	3 years	6/27/2017
Magnetic Loop Antenna	Loop Antenna	ETS Lindgren	6512	164698	3 years	7/28/2017
Antenna Horn 3115 SN 35111	Horn Antenna	EMCO	3115	35111	3 years	7/31/2017
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	10/31/2017
Antenna Horn 3117	Horn Antenna	ETS Lindgren	3117-PA	159547	3 years	8/8/2017
FSU26	Spectrum Analyzer	R&S	FSU26	200302	3 years	7/16/2019
LISN	Line Impedance Stabilization Network	FCC	FCC-LISN-50-25-2-08	8014	1 Year	7/19/2019
Thermometer Humidity	Thermometer Humidity	Control Company	36934-164	19187199 4	2 Year	1/10/2019

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
2020-07-15	EMC_PROXF-001-19001_15.247_DSS	Initial Version	Kevin Wang
2020-08-17	EMC_PROXF-001-19001_15.247_DSS_Rev1	Added conducted output power data, and updated the spurious emission data	Kevin Wang

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