



FCC Test Report

FOR:

Crane Payment Innovations

Model Name:

AIO2210-US101

Product Description:

ALIO Note is a card reader bezel that incorporates mag stripe, contact, and contactless card reader capabilities in support of unattended cashless sales. It is mechanically mounted on a bill acceptor during normal use further enhancing payment capability at the POS. It utilizes 4g CAT M (Telit module ME910G1WW) cellular radio, NFC (13.56 MHz) to read cards, and BLE (QUALCOMM CSR1010) to support diagnostic capability.

FCC ID: QP8ALIONOTEVZ

Per:

47 CFR: Part 24, Part 27

REPORT #: EMC_MEIGR-011-21001_FCC_27

DATE: 2021-04-23



A2LA Accredited

IC recognized #
3462B-1

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1 Assessment

The following device as further described in section 3 of this report was evaluated for radiated spurious emissions in simultaneous transmission of cellular and unlicensed radios according to criteria specified in the Code of Federal Regulations Title 47 parts 24, 27.

Company	Description	Model #
Crane Payment Innovations	ALIO Note is a card reader bezel that incorporates mag stripe, contact, and contactless card reader capabilities in support of unattended cashless sales. It is mechanically mounted on a bill acceptor during normal use further enhancing payment capability at the POS. It utilizes 4g CAT M (Telit module ME910G1WW) cellular radio, NFC (13.56 MHz) to read cards, and BLE (QUALCOMM QualCom CSR1010) to support diagnostic capability.	AIO2210-US101

No deficiencies were ascertained.

Responsible for Testing Laboratory:

2021-04-23	Compliance	Kevin Wang (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2021-04-23	Compliance	Yuchan Lu (Test Engineer)	
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
Lab Manager:	Kevin Wang
Responsible Project Leader:	Rami Saman

2.2 Identification of the Client

Client's Name:	Crane Payment Innovations
Street Address:	3222 Phoenixville Pike, Suite 200
City/Zip Code	Malvern, PA 19355
Country	USA

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

Hardware Version Identification Number (HVIN):	AIO2210-US101
Product Marketing Name (PMN):	ALIO
Antenna Information as declared:	Taoglas antenna PT# FXUB65, 180mm long IPEX 1.37 coax cable, and connects onto the PCB through an IPEX MHFHT connector. Impedance = 50 Ω . Gain at Band 4 = 2 dBi Peak, and Band 13 = 2 dBi Peak.
Other Radios included in the device:	❖ <u>BLE</u> • Manufacture: Qualcomm • Module name/number: CRS 1010 QFN ❖ <u>NFC</u> • Manufacture: ST • Module name/number: ST25R3911B
Power Supply/ Rated Operating Voltage Range:	Vmin: 20 VDC/ Vnom: 24 VDC / Vmax: 42 VDC
Operating Temperature Range:	Low -15°C, Nominal 25°C, High 60°C
Sample Revision	☐ Prototype Unit; ☒ Production Unit; ☐ Pre-Production
EUT Dimensions(mm):	167.6 x 76.2 x 88.9
Weight(grams):	379
EUT Diameter	☒ < 60 cm ☐ Other _____

Module Information	
Module Name:	Telit
Model Number:	ME910G1-WW
FCC ID:	RI7ME910G1WW

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	42000000152	G1	5.X	Radiated Measurement

3.3 Accessory Equipment details

AE #	Type	Manufacture	Model	P/N
1	Switching Adapter	Sunny Computer Technology	SYS1548-6524-T2	G160305126068
2	Vending demo tester	-	-	-
3	RXIA PCB	-	-	-

3.4 Support Equipment

SE #	Description
1	Router, Manufacture: tp-link, Model: TL-WR841N
2	BLE interface PCB
3	Laptop, Manufacture: DELL, Model: Latitude E5470

3.5 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1 + AE#1 + AE#2 + AE#3	Worst Case

3.6 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular Transmission	Cellular was tested on CAT M1 Low, Mid, High Channels at the maximum power, and co-transmitting with BLE mid channel. For radiated measurements, the internal antenna was connected.

3.7 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets on CAT M1 low, mid and high channels and co-transmitting with BLE mid channel at the maximum power transmission.

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 evaluation conducted by CETECOM Inc. is to support a request for new equipment authorization under **FCC ID: RI7ME910G1WW**.

The pre-certified module to be integrated (ME910G1-WW) as described in Section 3, Radiated Spurious Emissions test was performed. Results have been checked to meet limits per Code of Federal Regulations Title 47 parts 24, 27.

The conducted module test data that can be obtained under the **FCC Filing ID: QP8ALIONOTEVZ** is applicable for the host described in section 3.

4.1 Dates of Testing:

03/11/2021-03/16/2021

4.2 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)

4.3 Environmental Conditions during Testing:

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

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

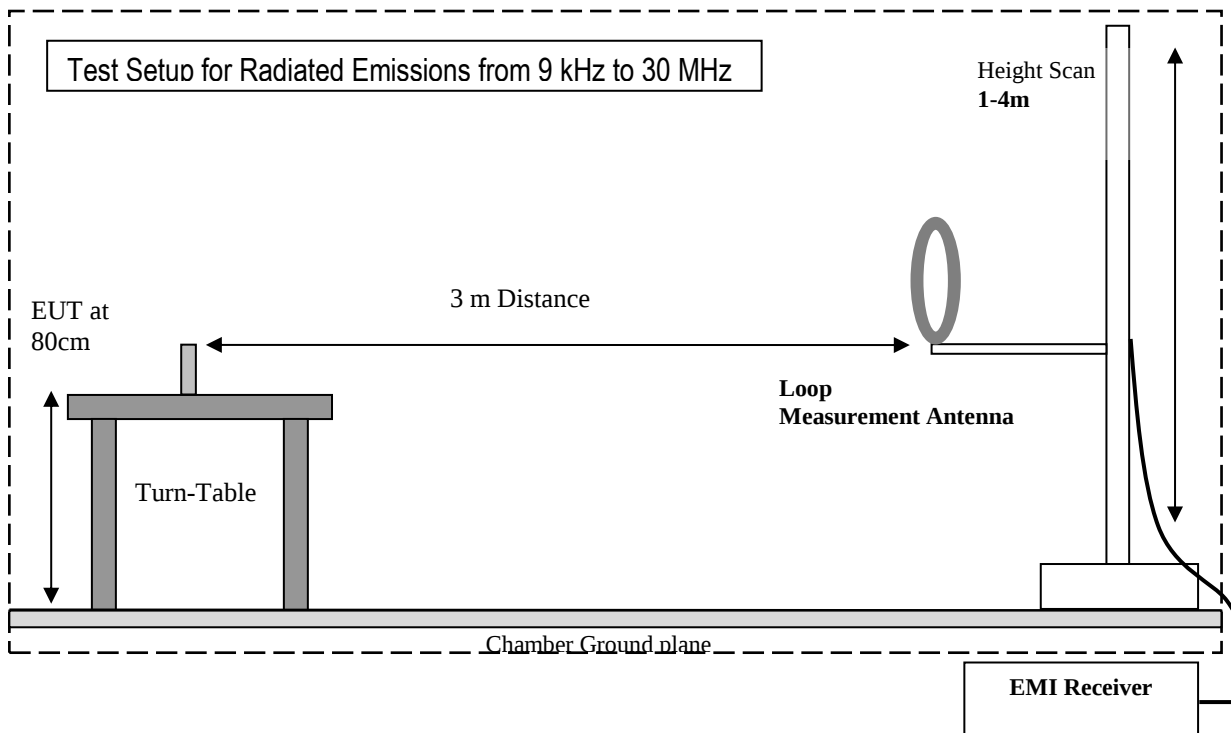
Deviating test conditions are indicated at individual test description where applicable.

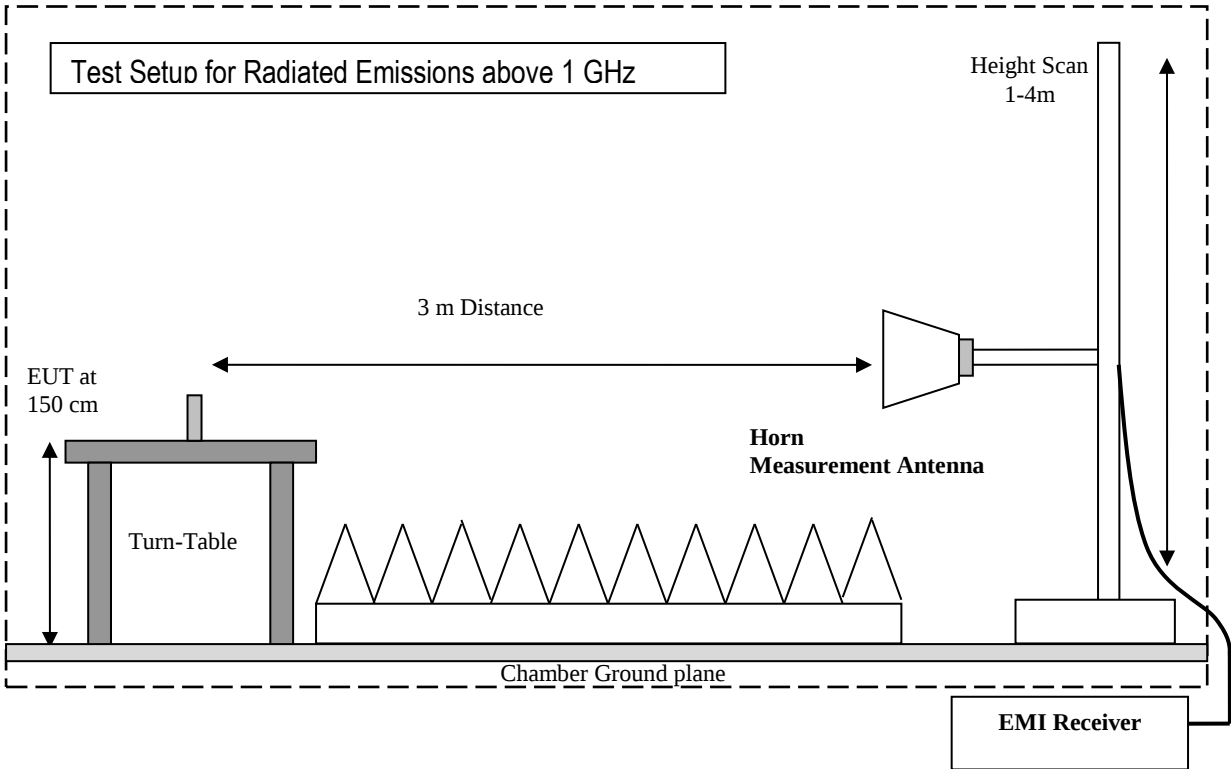
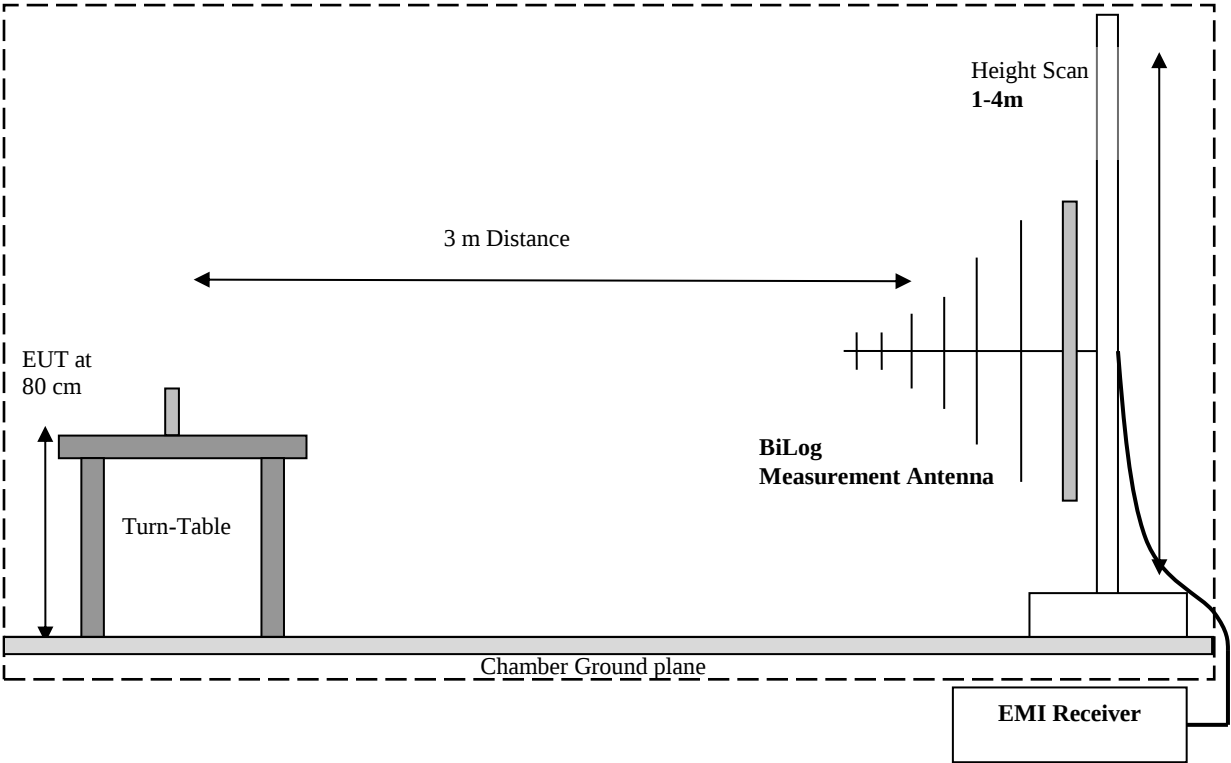
5 Measurement Procedures

Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03 – “Measurement Guidance for Certification of Licensed Digital Transmitters” and according to ANSI C63.26 as detailed below.

5.1 Radiated Measurement

- 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.





5.2 Sample Calculations for Field Strength Measurements

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

- Measured reading in dB μ V
- Cable Loss between the receiving antenna and SA in dB and
- 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:

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

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

6 Measurement Results Summary

6.1 FCC 27:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50 (d)	RF Output Power	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1055; §27.54	Frequency Stability	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1053; §27.53(g); §27.53(h);	Radiated Spurious Emissions	Nominal	Op.1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification FCC ID: RI7ME910G1WW

7 Test Result Data

7.1 E(I)RP

Band	Frequency Range (MHz)	Power conducted (W)	Emission Designator	Antenna Gain + Cable loss (dBi)	gain linear	EIRP ¹ (W)	ERP ¹ (W)	Frequency deviation (ppm)	Limit ERP (W)
LTE 4	1710.7 – 1754.3	0.24	1M10G7D	2	1.585	0.380	-	2.5	1
LTE 4	1710.7 – 1754.3	0.23	940KW7D	2	1.585	0.365	-	2.5	1
LTE 13	779.5 - 784.5	0.200	1M10G7D	2	1.585	0.317	0.193	2.5	3
LTE 13	779.5 - 784.5	0.200	939KW7D	2	1.585	0.317	0.193	2.5	3

Note 1: E(I)RP are calculated from maximum power in grant of cellular module ME910G1-WW adding the maximum gain of the utilized cellular antenna per operational description.

7.2 Radiated Spurious Emissions

7.2.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR Part 24.238 and Part 27.53 utilizing KDB 971168 D01 Power Meas License Digital Systems v03, and according to ANSI C63.26 2017

Spectrum Analyzer Settings for FCC 24 and 27

Frequency Range	30MHz – 1 GHz	1 – 2.7 GHz	2.7 – 18 GHz	18 – 19.1 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto	Auto

7.2.2 Limits:

- FCC Part 24.238(a), Part 27.53 (g) and Part 27.53 (h)

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB = (-13dBm)

7.2.3 Test conditions and setup:

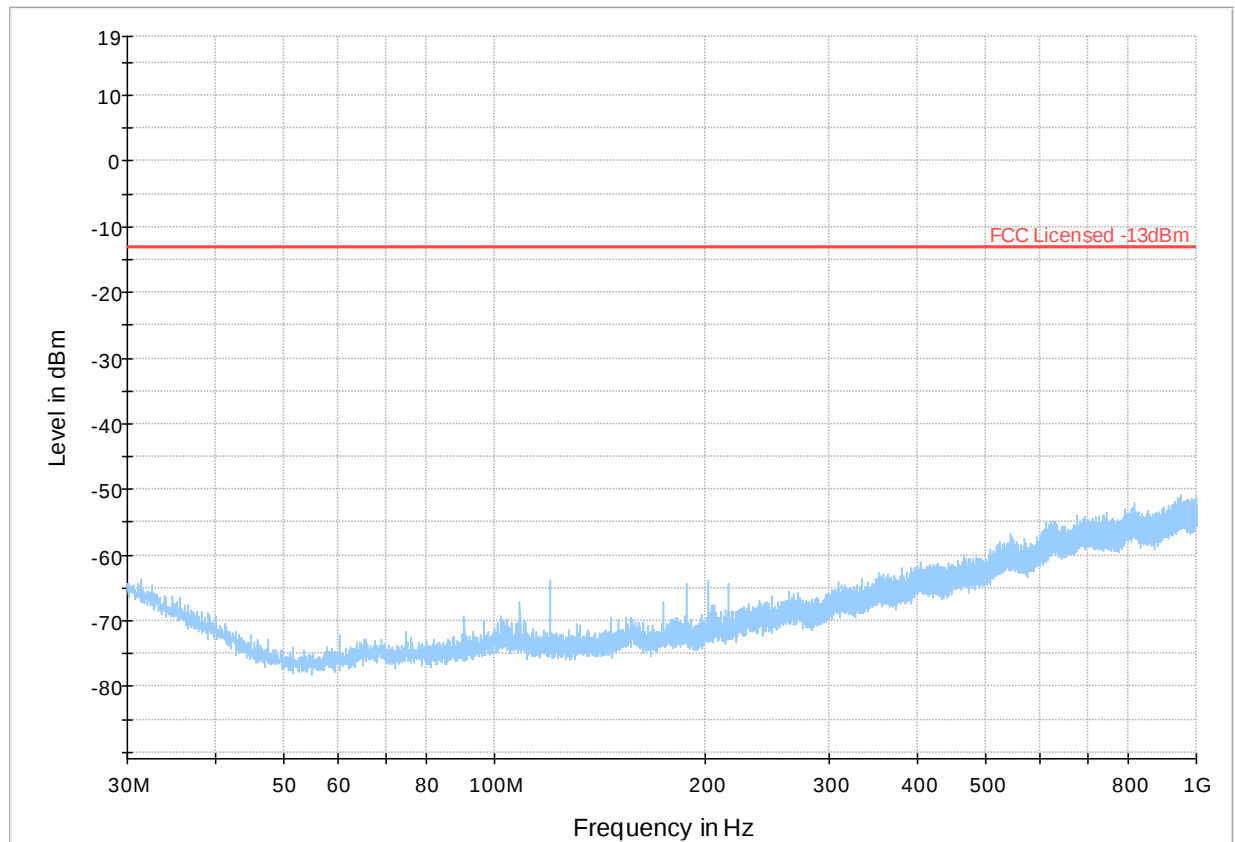
Ambient Temperature (C)	EUT operating mode	Power Input
22	Op. 1	110 VAC

7.2.4 Measurement Plots:

LTE Band 4

Plot # 1 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low



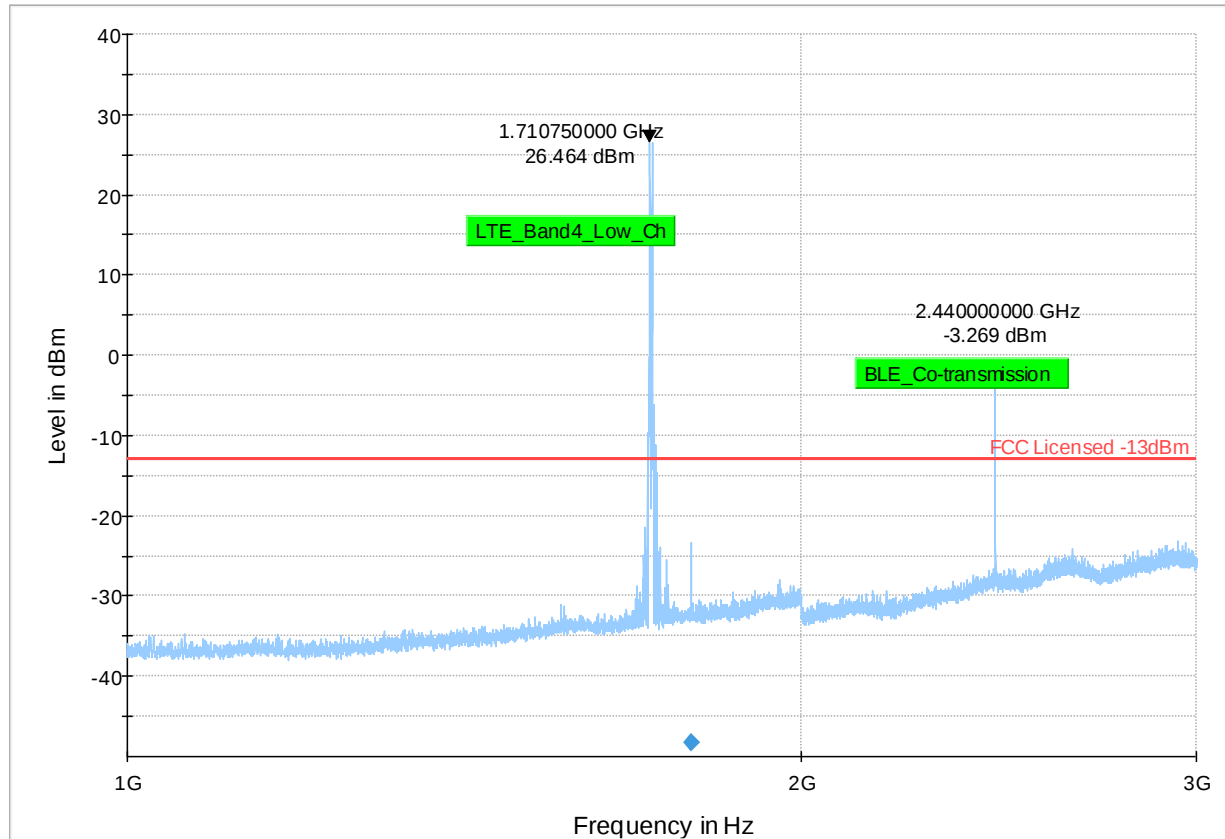
— Preview Result 1-PK+ * Critical_Freqs PK+ — FCC Licensed -13dBm ◆ Final_Result RM

Plot # 2 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1785.500	-48.17	-13.00	35.17	500.0	1000.000	236.0	H	110.0	-62.2	



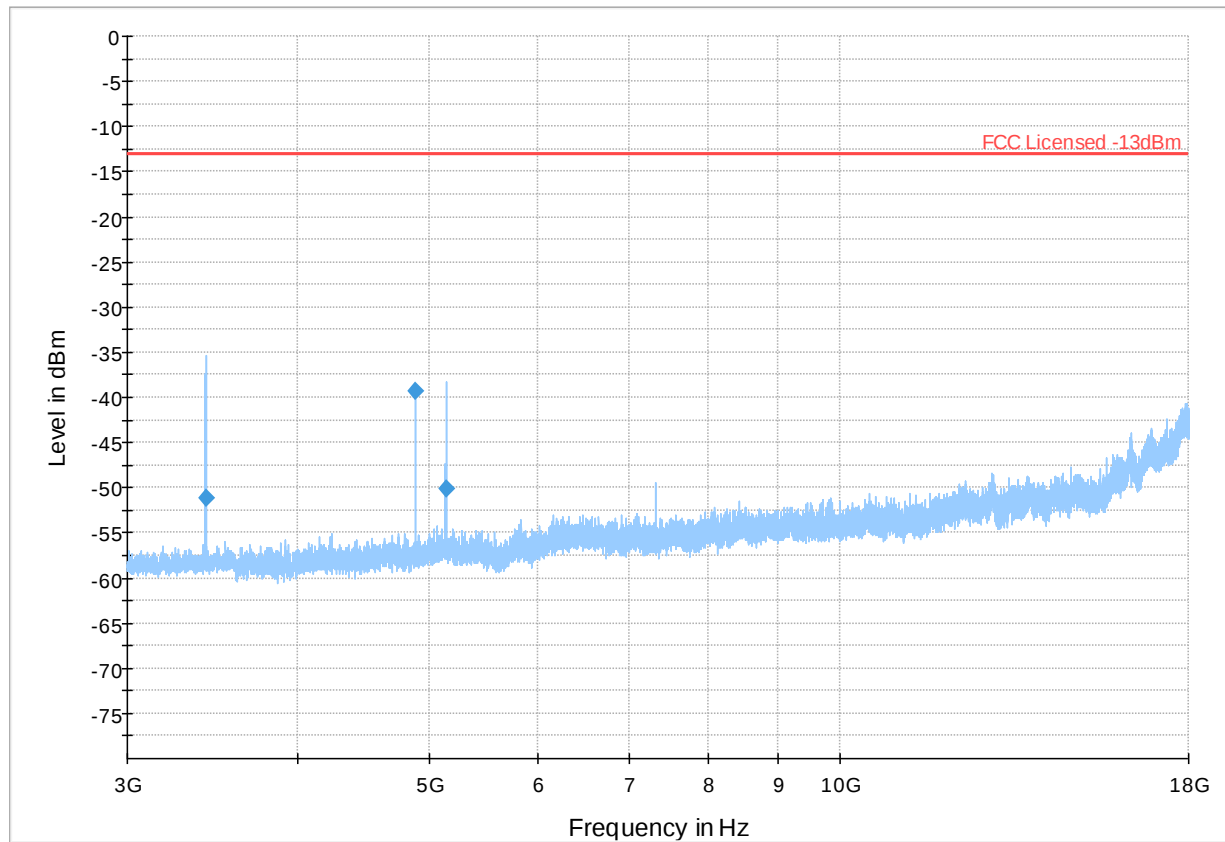
— Preview Result 1-PK+ — FCC Licensed -13dBm ◆ Final_Result RMS

Plot # 3 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low

Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3430.000	-51.22	-13.00	38.22	500.0	1000.000	163.0	H	180.0	-103.2	
4880.000	-39.32	-13.00	26.32	500.0	1000.000	211.0	H	243.0	-100.2	
5145.500	-50.11	-13.00	37.11	500.0	1000.000	186.0	H	290.0	-99.1	

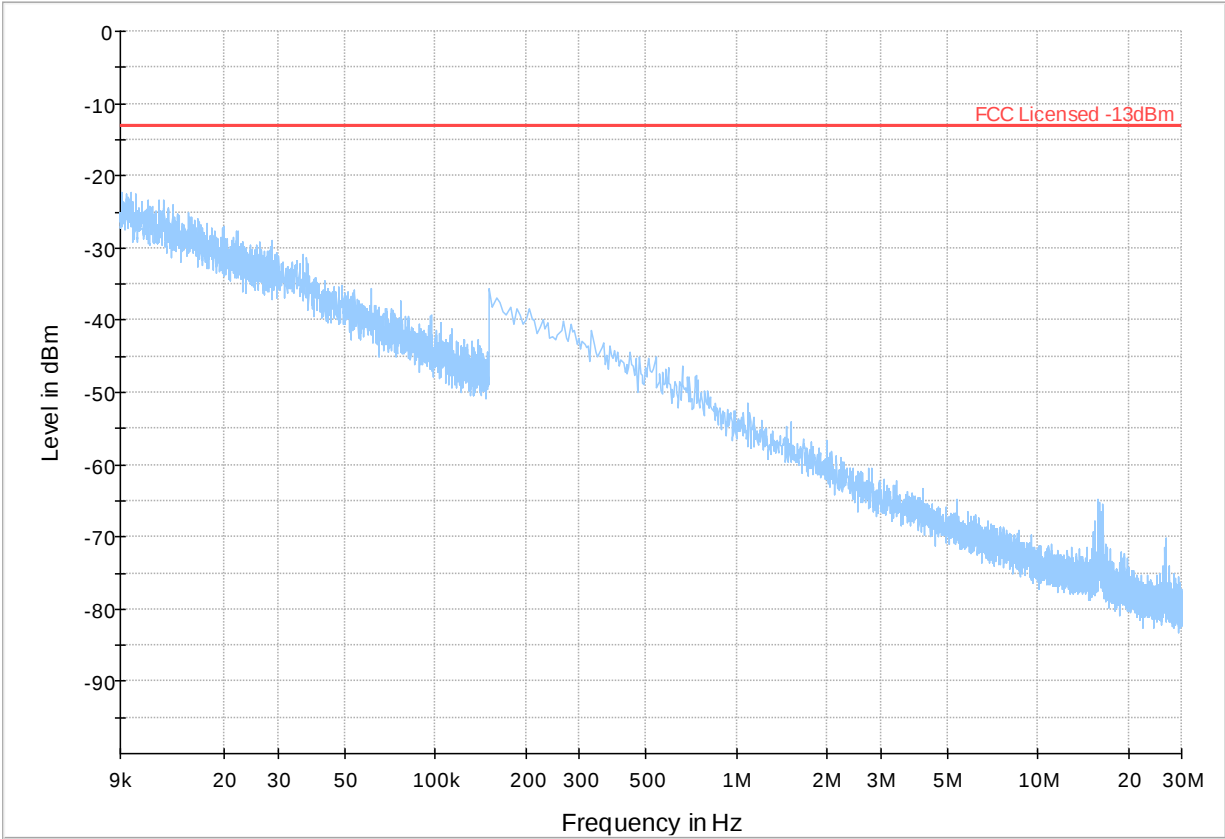


Preview Result 1-PK+ FCC Licensed -13dBm Final_Result RMS



Plot # 4 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid

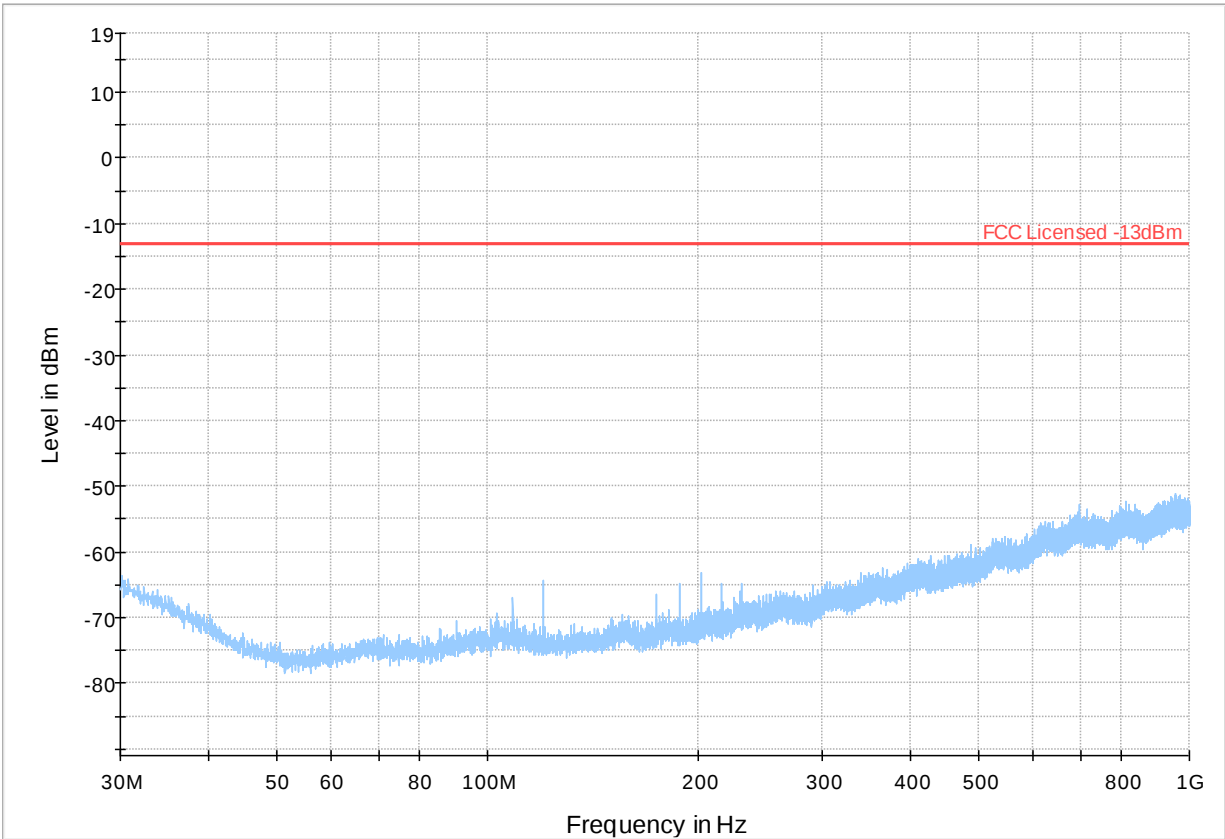


Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM



Plot # 5 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid

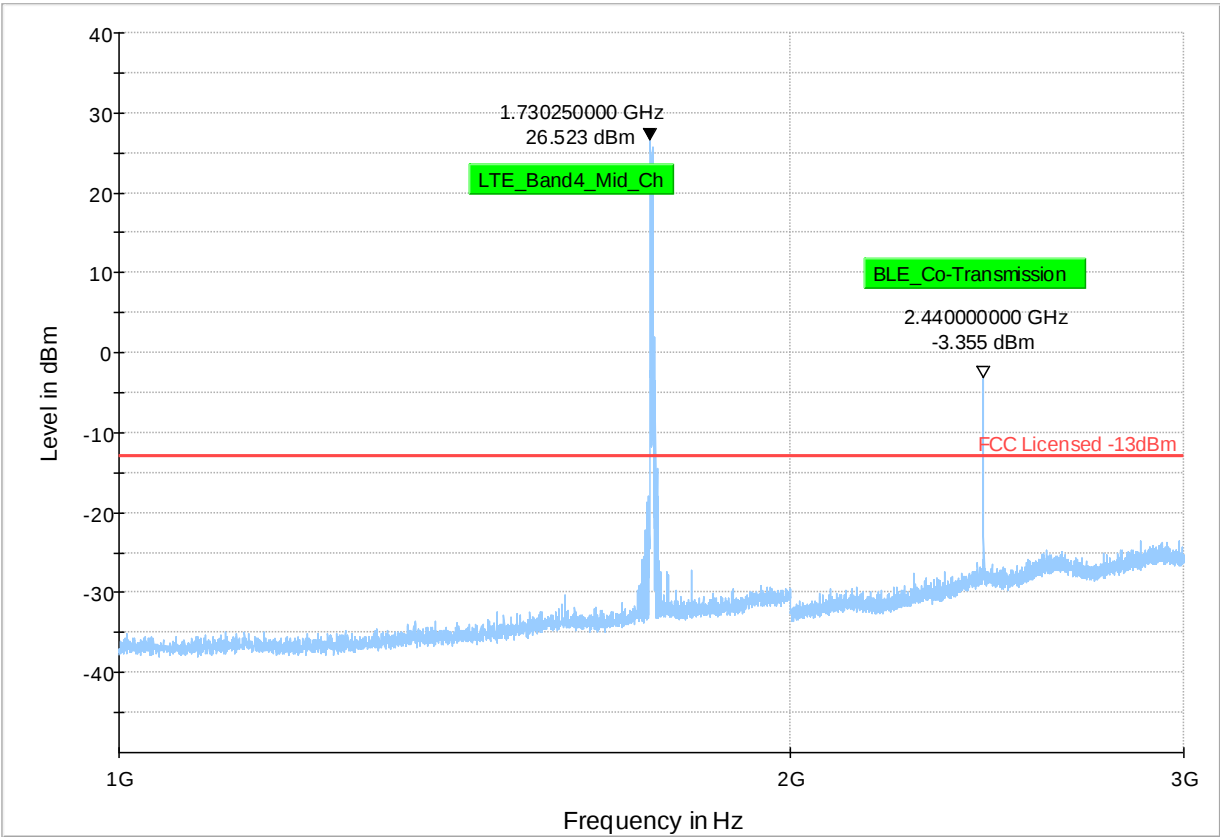


Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM



Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



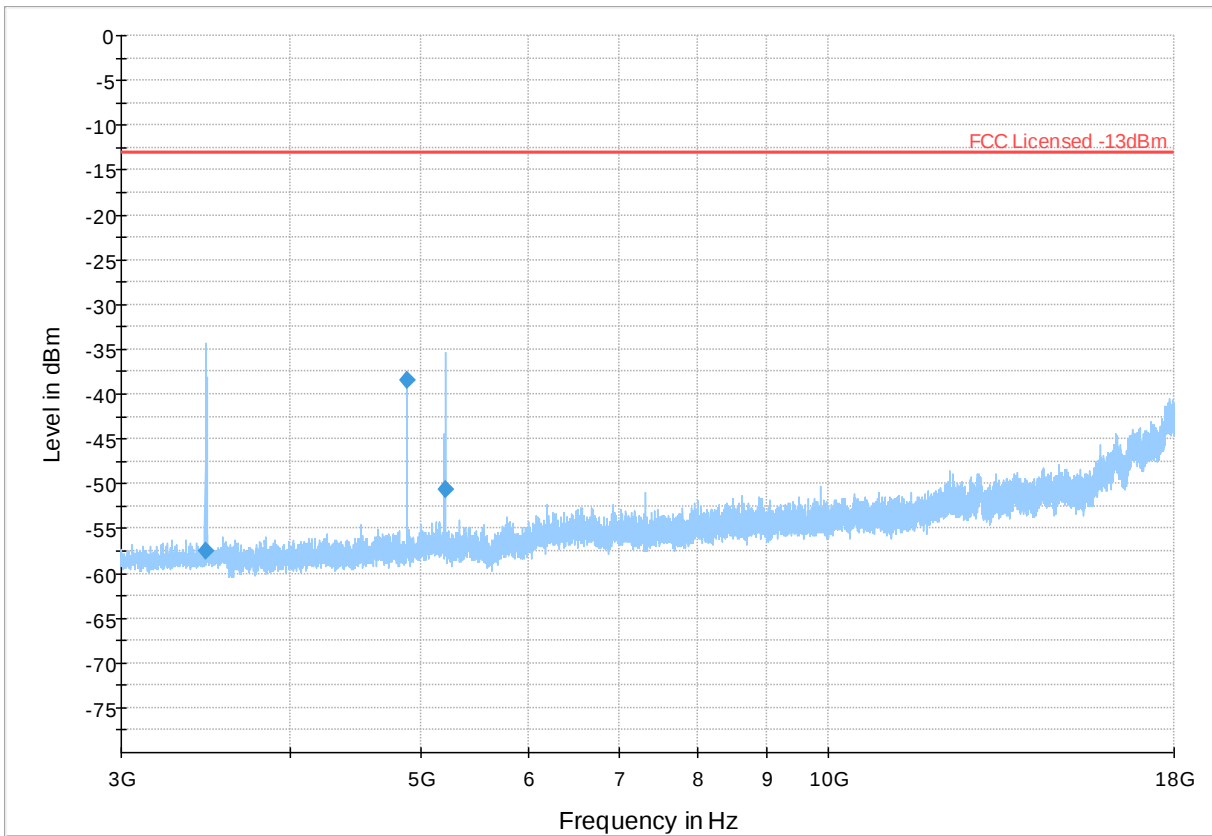
Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

Plot # 7 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid

Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3460.500	-57.44	-13.00	44.44	500.0	1000.000	182.0	H	82.0	-103.1	
4880.000	-38.47	-13.00	25.47	500.0	1000.000	198.0	H	246.0	-100.2	
5204.000	-50.67	-13.00	37.67	500.0	1000.000	163.0	V	216.0	-99.2	

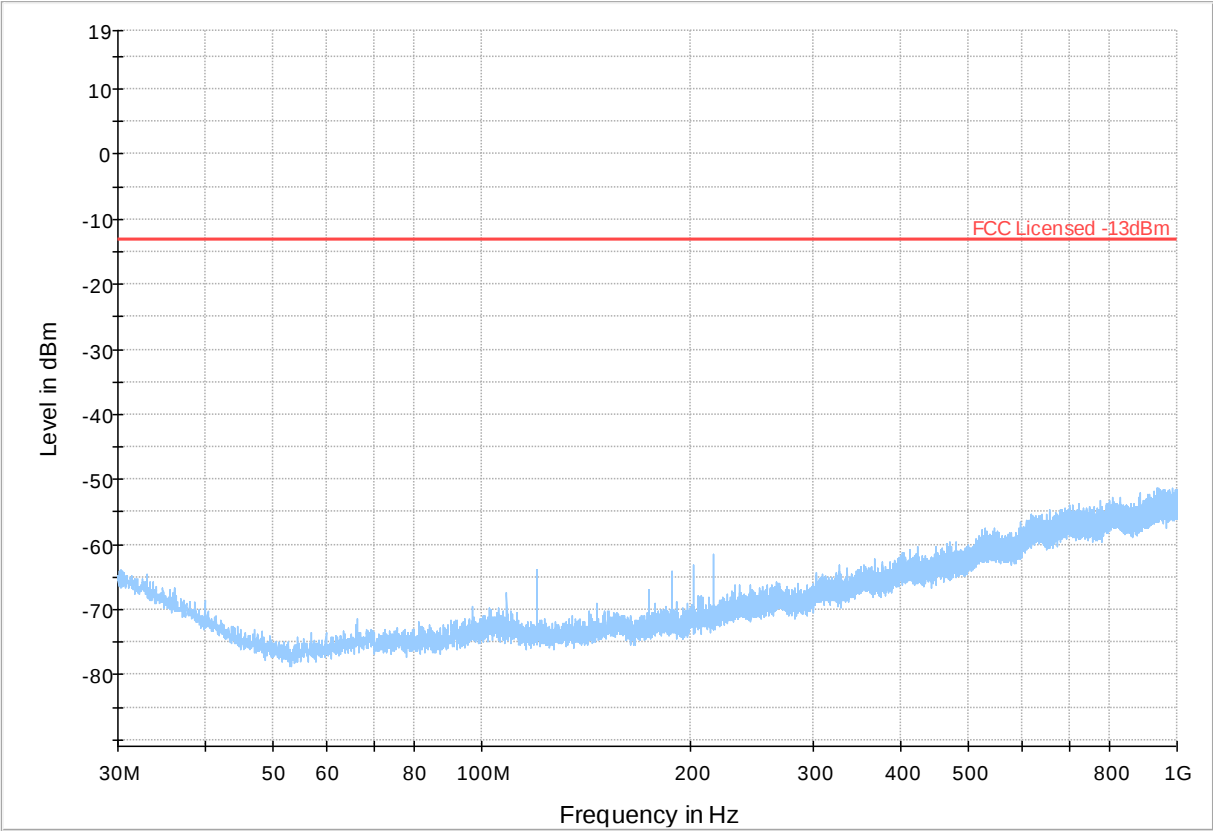


Preview Result 1-PK+ FCC Licensed -13dBm Final_Result RMS



Plot # 8 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



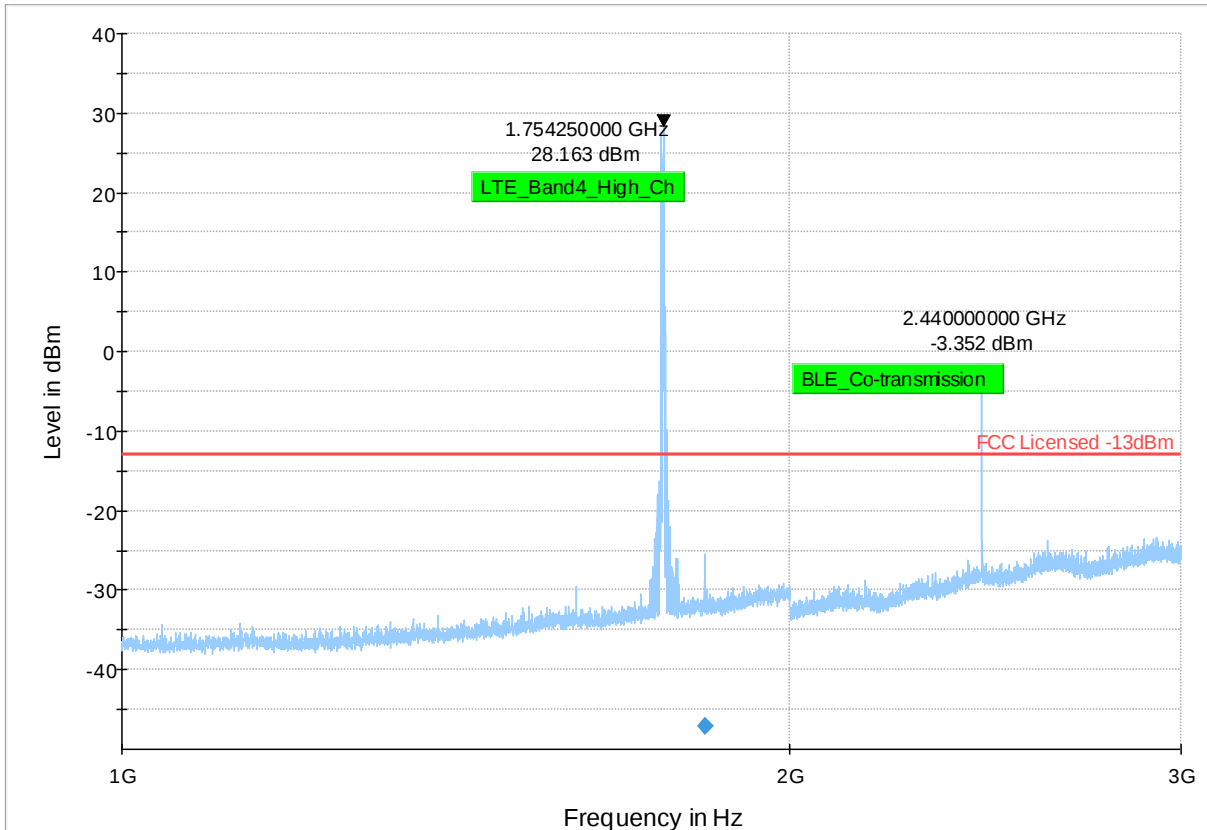
Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

Plot # 9 Radiated Emissions: 1 GHz - 3 GHz

Channel: High

Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1830.500	-47.17	-13.00	34.17	500.0	1000.000	140.0	H	120.0	-61.9	



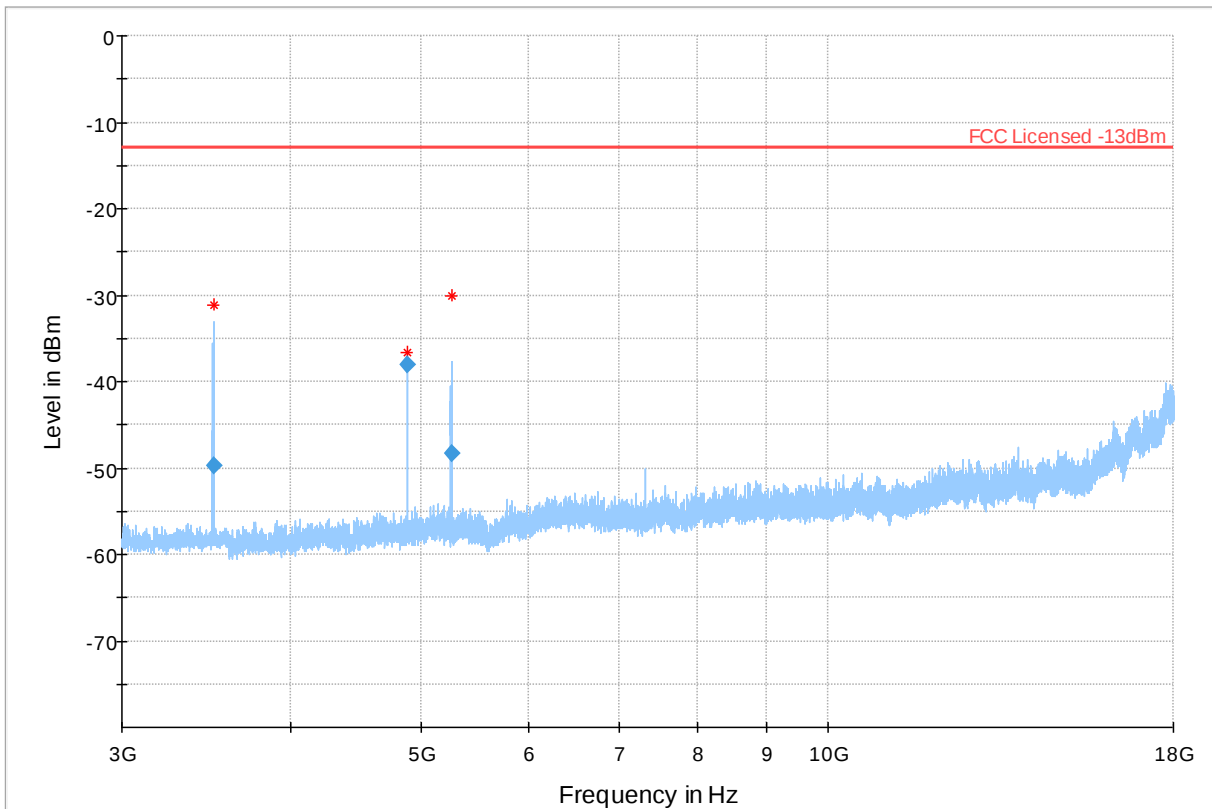
Preview Result 1-PK+ FCC Licensed -13dBm Final_Result RMS

Plot # 10 Radiated Emissions: 3 GHz - 18 GHz

Channel: High

Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3508.000	-49.71	-13.00	36.71	500.0	1000.000	183.0	H	162.0	-102.9	
4880.000	-38.08	-13.00	25.08	500.0	1000.000	217.0	H	246.0	-100.2	
5262.500	-48.39	-13.00	35.39	500.0	1000.000	230.0	H	281.0	-99.2	



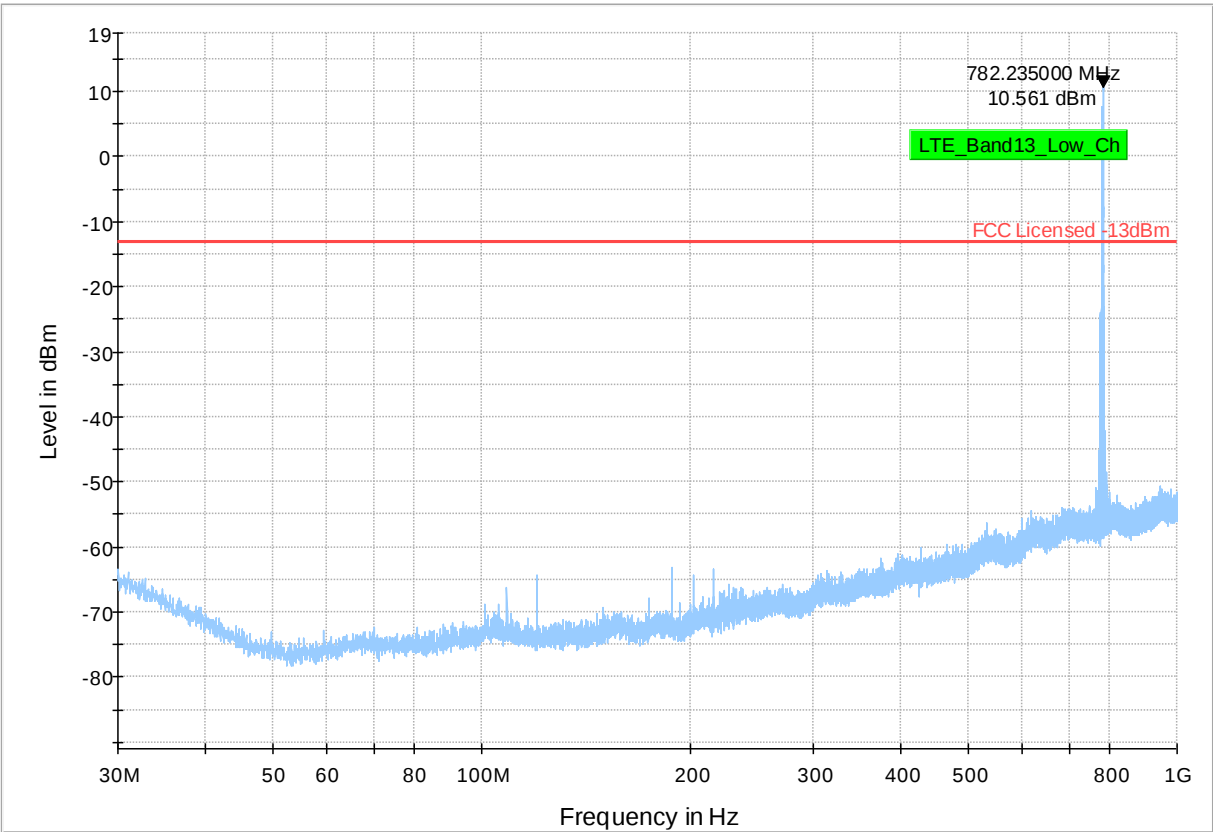
◆ Preview Result 1-PK+ Final_Result RMS * PK+ MaxPeak-PK+ (Single) — FCC Licensed -13dBm + RMS (Single)



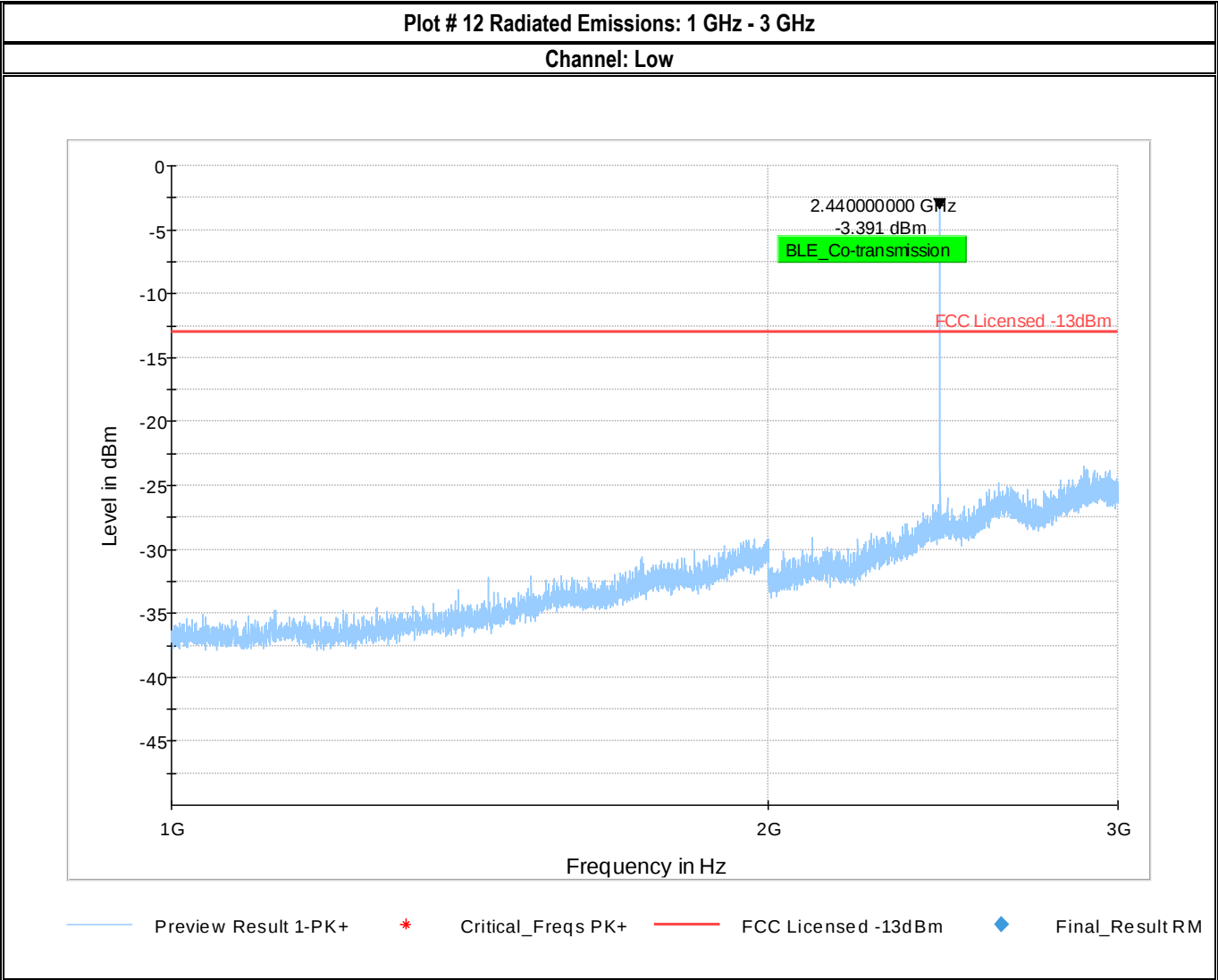
LTE Band 13

Plot # 11 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low



Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

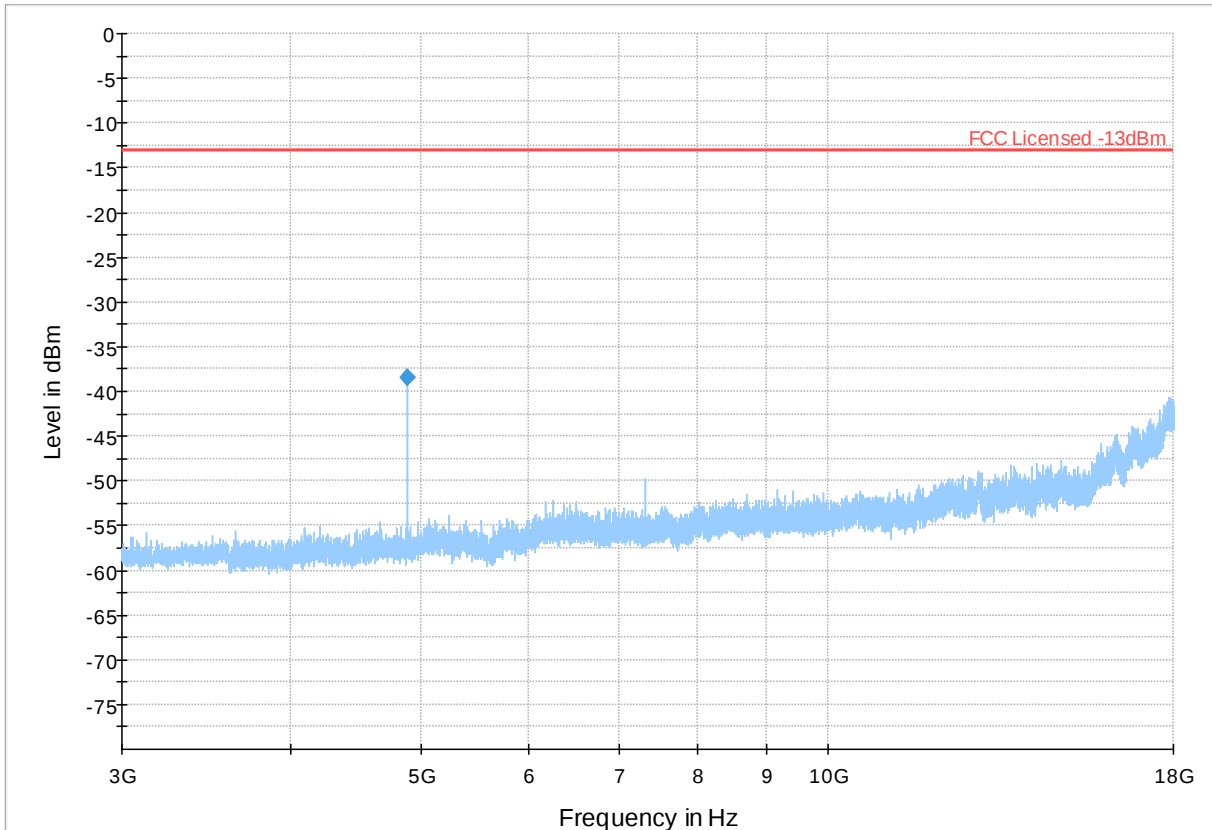


Plot # 13 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
4880.000	-38.43	-13.00	25.43	500.0	1000.000	216.0	H	245.0	-100.2	

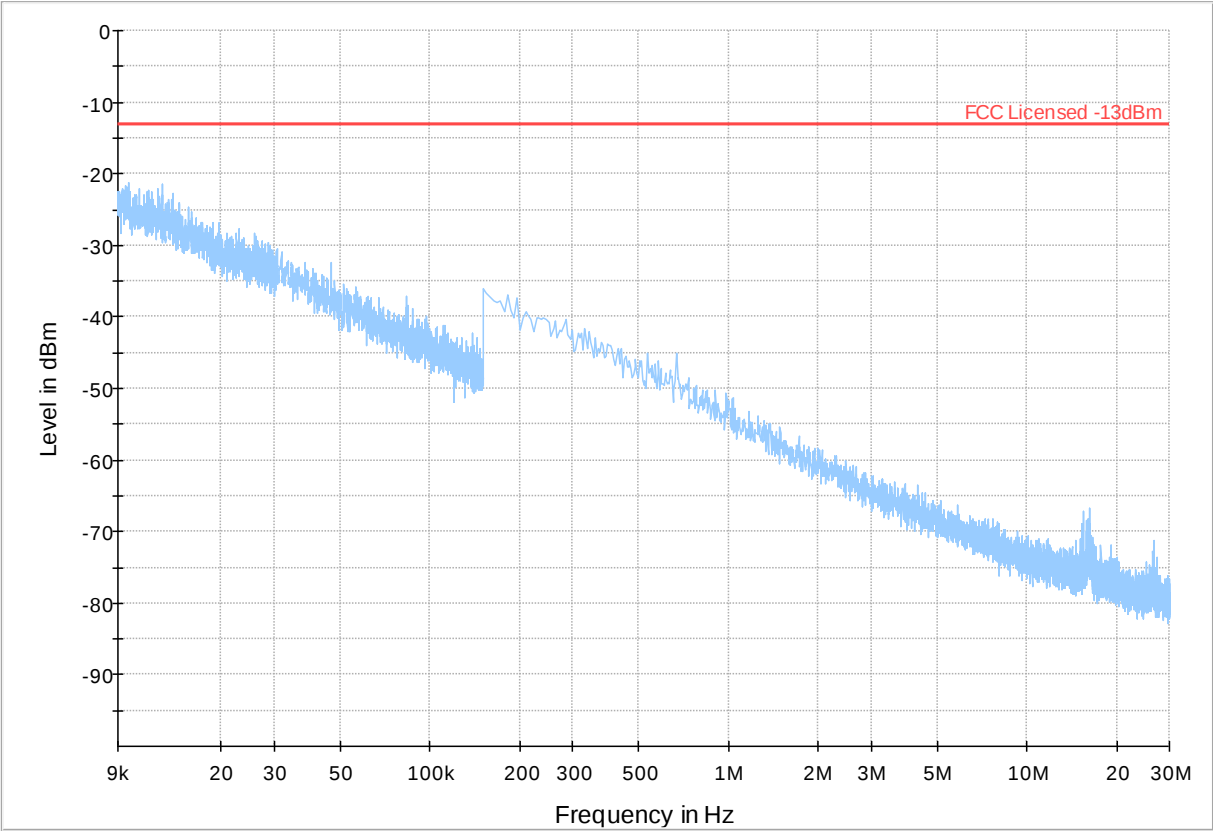


— Preview Result 1-PK+ — FCC Licensed -13dBm ◆ Final_Result RMS



Plot # 14 Radiated Emissions: 9 kHz - 30 MHz

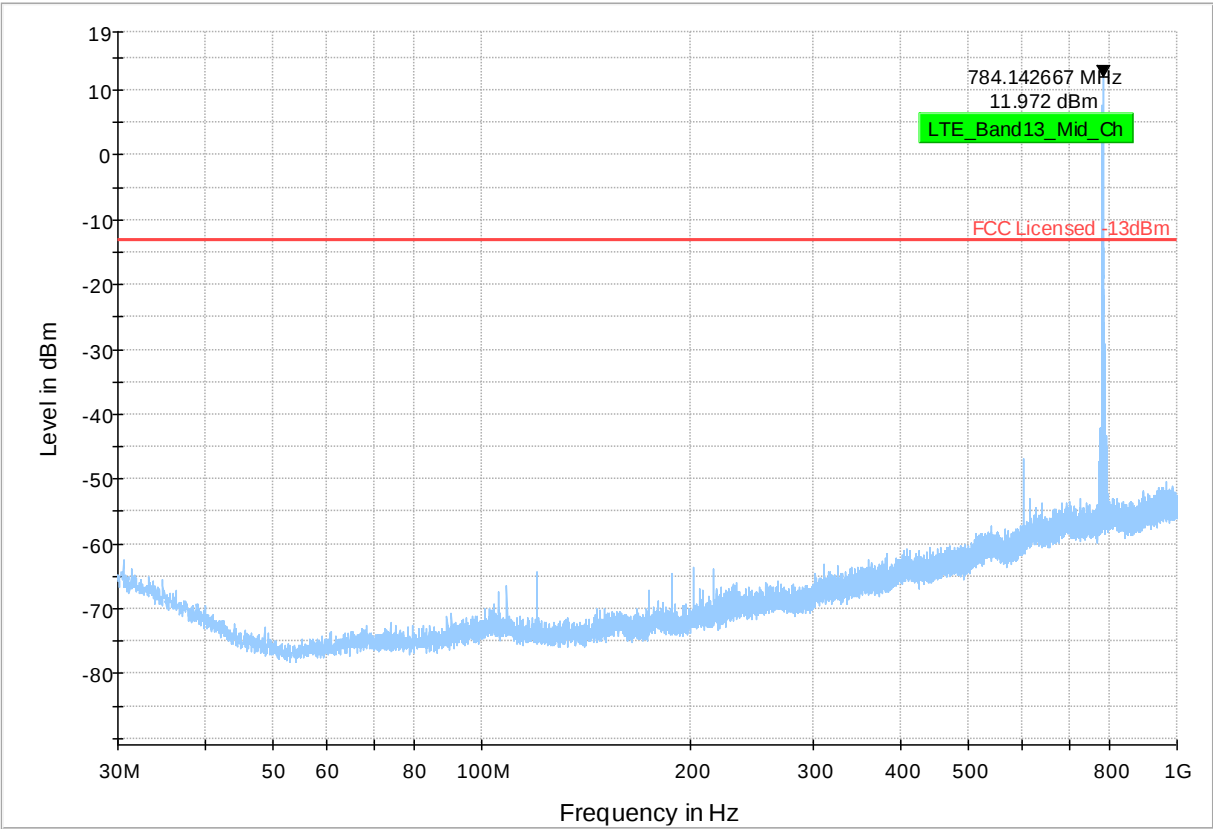
Channel: Mid



Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

Plot # 15 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid

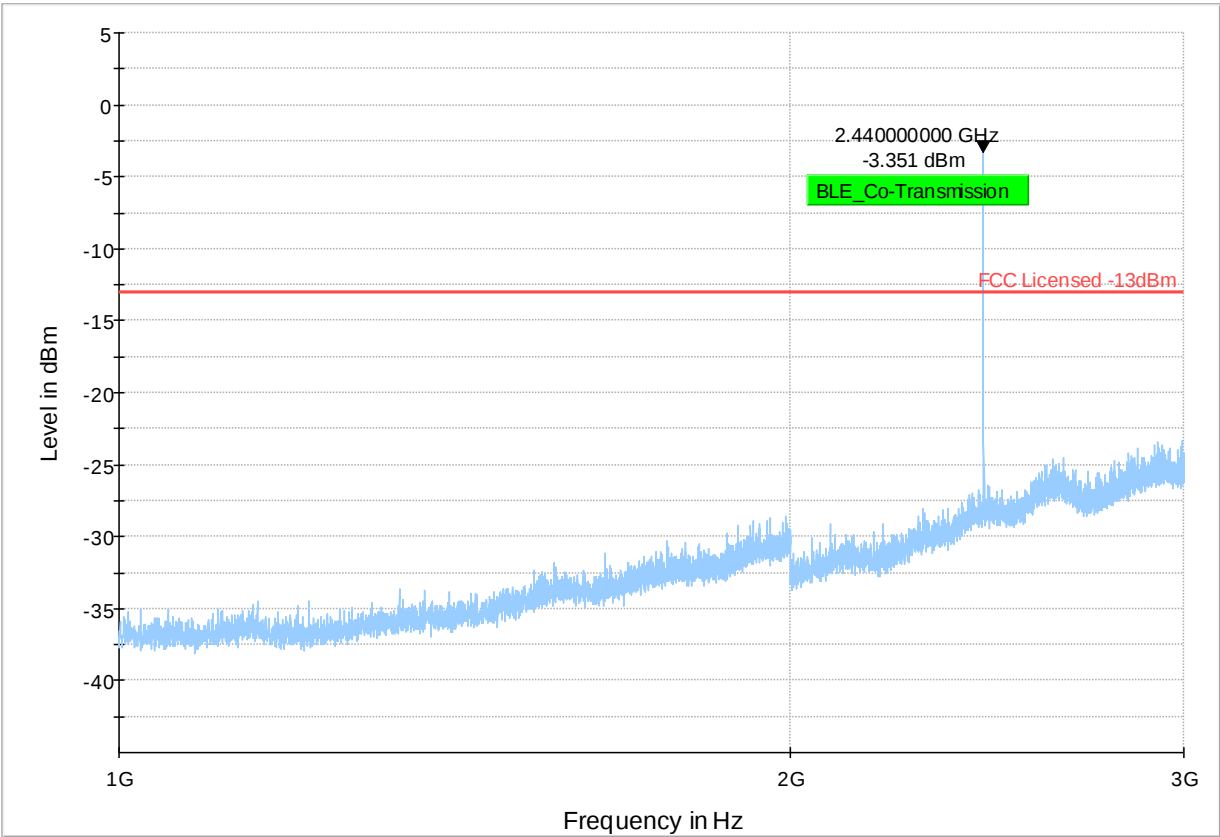


Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm ♦ Final_Result RM



Plot # 16 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



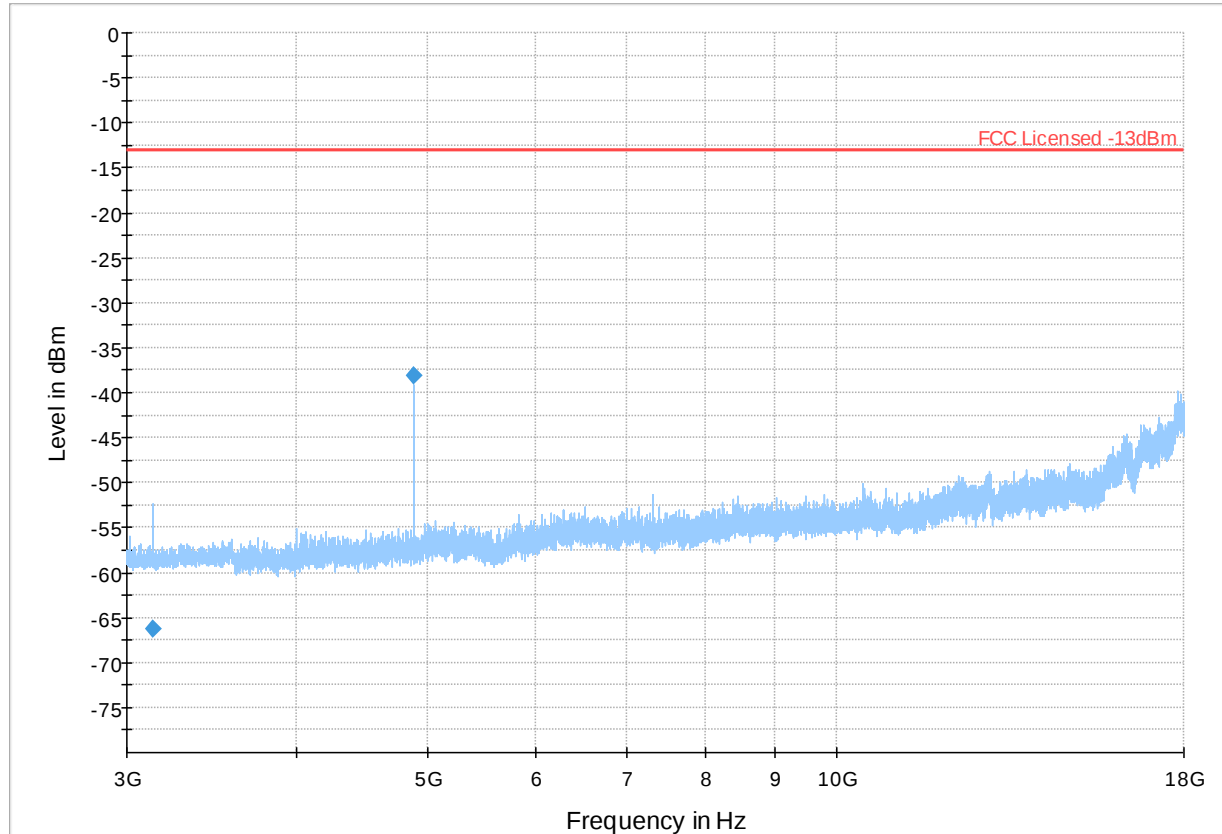
Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

Plot # 17 Radiated Emissions: 3 GHz – 18GHz

Channel: Mid

Final Result

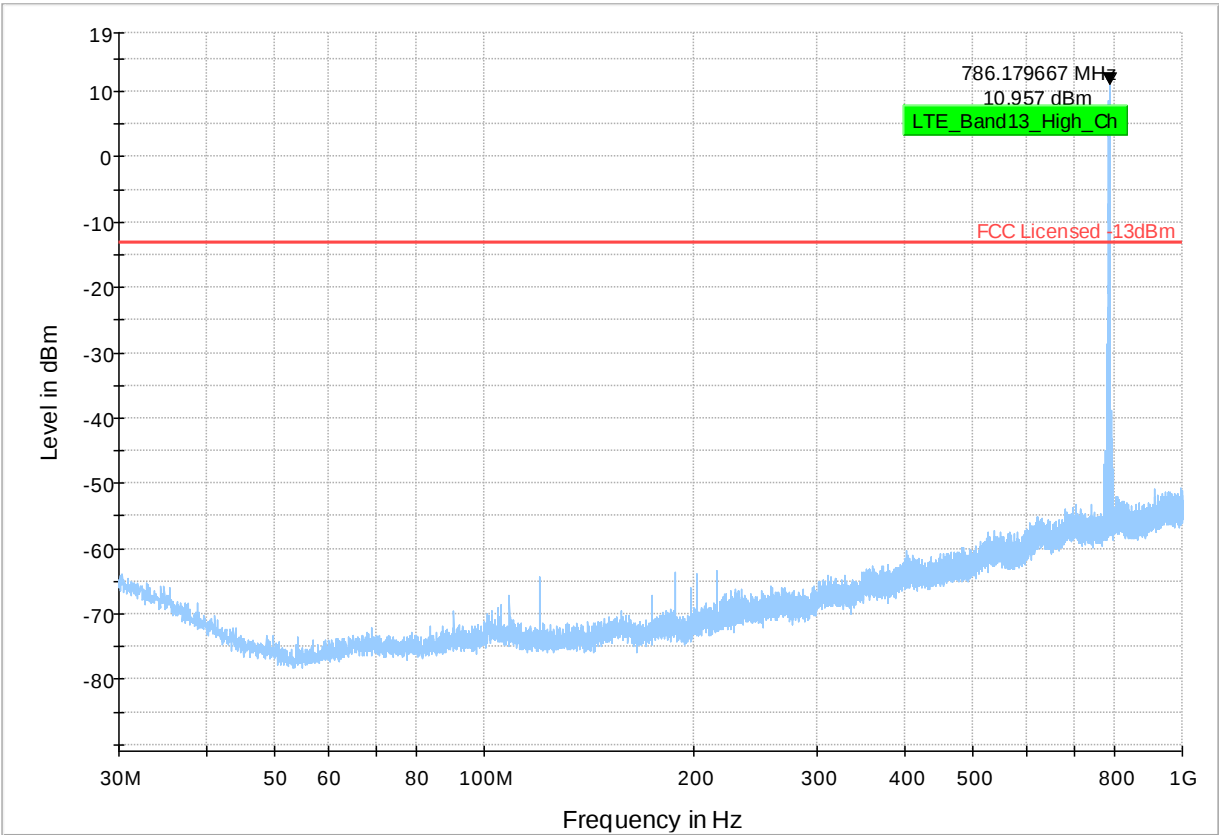
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3136.500	-66.31	-13.00	53.31	500.0	1000.000	194.0	H	106.0	-104.1	
4880.000	-38.16	-13.00	25.16	500.0	1000.000	214.0	H	247.0	-100.2	



Preview Result 1-PK+ FCC Licensed -13dBm Final_Result RMS

Plot # 18 Radiated Emissions: 30 MHz - 1 GHz

Channel: High

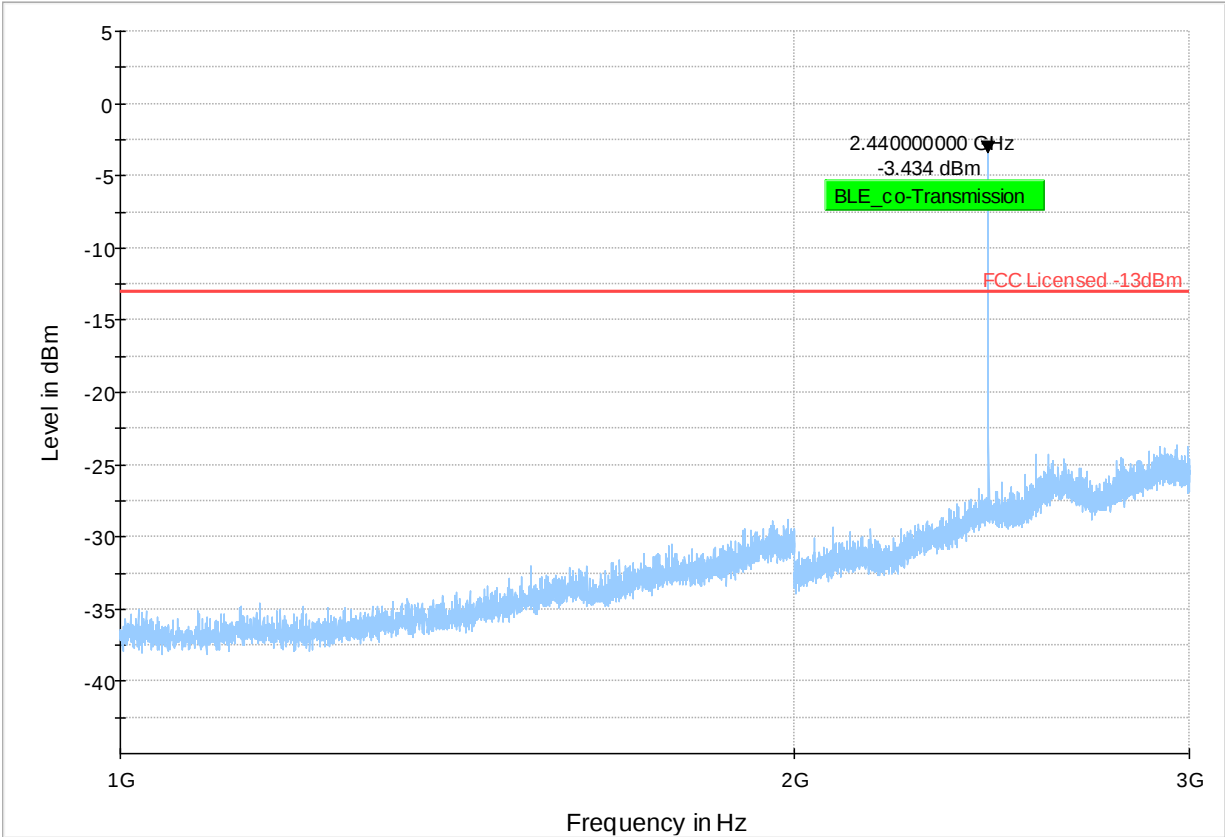


Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM



Plot # 19 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



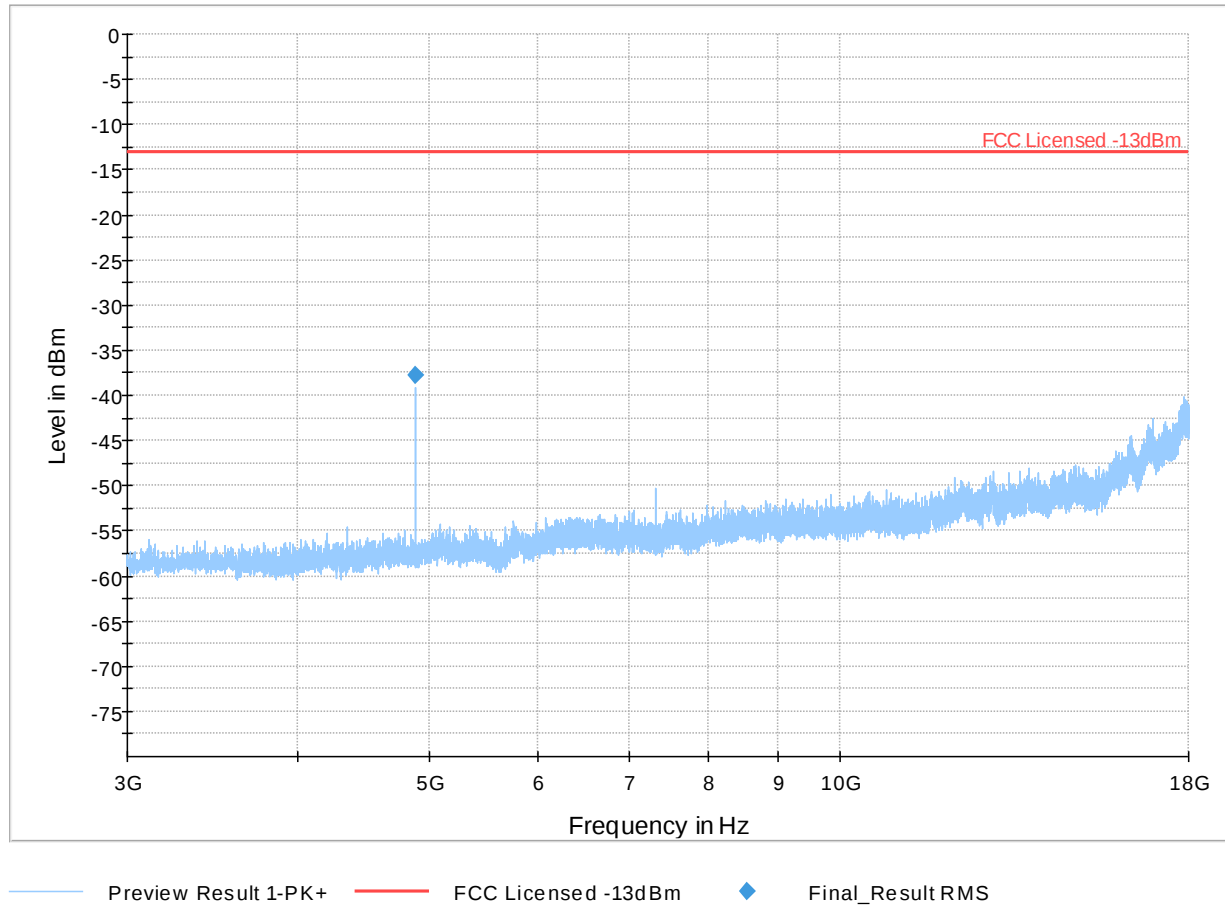
Preview Result 1-PK+ * Critical_Freqs PK+ FCC Licensed -13dBm Final_Result RM

Plot # 20 Radiated Emissions: 3 GHz - 18 GHz

Channel: High

Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
4880.000	-37.85	-13.00	24.85	500.0	1000.000	217.0	H	247.0	-100.2	



8 Test setup photo

Setup photos are included in supporting file name: "EMC_MEIGR-011-21001_Setup_Photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP ANTENNA	ETS LINDGREN	6507	00161344	3 YEARS	10/30/2020
BILOG ANTENNA	ETS.LINDGREN	3142E	00166067	3 YEARS	03/12/2020
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	08/10/2020
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 YEARS	01/31/2021
HORN ANTENNA	ETS.LINDGREN	3116	00070497	3 YEARS	11/23/2020
SPECTRUM ANALYZER	R&S	FSU26	200065	3 YEARS	07/16/2019
SIGNAL ANALYZER	R&S	FSV 40	101022	3 YEARS	07/15/2019
TEST RECEIVER	R&S	ESU.EMI	100256	3 YEARS	07/16/2019
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	10510-922	200236891	3 YEARS	04/13/2020
DIGITAL THERMOMETER	CONTROL COMPANY	36934-164	181230565	3 YEARS	01/10/2019
LINE IMPEDANCE STABILIZATION NETWORK	FCC	FCC-LISN-50-25-2-08	08014	3 YEARS	07/19/2019

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.

10 Revision History

Date	Report Name	Changes to report	Report prepared by
2021-04-23	EMC_MEIGR-011-21001_FCC_27	Initial version	Yuchan Lu

<<The End>>