FCC / ISED & Test Report

For:
Roadrunner Recycling, Inc.

Model Number:
C01

Product Description:
Compactor Camera

FCC ID: 2BEZ8-C01

Applied Rules and Standards:
47 CFR Parts 24, 27

REPORT #: EMC_COMPO_028_24001_FCC_24_27

DATE: 10/7/2024

A2LA Accredited

IC recognized # 3462B

***CETECOM* Inc.**
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1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 24, 27.

No deficiencies were ascertained.

Company	Description	Model #
Roadrunner Recycling, Inc.	Compactor Camera	C01

Responsible for the Report:

Date	Section	Name	Signature
2024-10-07	Compliance	Art Thammanavarat (Senior EMC Engineer)	Art Thammanavarat Digitally signed by: Art Thammanavarat DN: CN = Art Thammanavarat email = art.thammanavarat@cetecom.com C = AD Date: 2024.10.08 09:43:59 -07'00'

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:	Alvin Ilarina
Responsible Project Leader:	Akanksha Baskaran

2.2 Identification of the Client

Client Firm/Name:	Roadrunner Recycling, Inc
Street Address:	40 Boardman Place
City/Zip Code	San Francisco California 94103
Country	United States

2.3 Identification of the Manufacturer

Manufacturer's Name:	All Quality & Services, Inc
Manufacturers Address:	47817 Fremont Blvd
City/Zip Code	Fremont, CA 94538
Country	United States

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No:	C01
Marketing Name:	Compactor Camera
HW Version:	revD
SW Version:	anvil-001a
FCC ID:	2BEZ8-C01
Product Description:	Compactor Camera
Frequency Range / number of channels (All Radios)	FCC BANDS LTE-Band 2: 1850 – 1910 MHz LTE-Band 4: 1710 – 1755 MHz LTE-Band 12: 699 – 716 MHz
Modes of Operation / Type(s) of Modulation (All Radios):	Module: U-blox SARA-R510M8S (LTE-M) FCC ID: XPYUBX19KM01; IC: 8595A-UBX19KM01. 4G: FDD LTE Bands 2, 4,12
Antenna Information [as]MFG:2J **declared:**	Name: 2J Type: 4G Cellular Connector Surface Mount Location: Internal Peak Gain: • LTE-Band 2: 4.1 dBi • LTE-Band 4: 4.1 dBi • LTE-Band 12: 1.2 dBi
Max. Peak Output Power [All]LTE **Radios):**	LTE power class 3 (23 dBm)
Power Supply/ Rated Operating Voltage Range:	3.6VDC nominal input
Operating Temperature Range	-30C - 75C
Sample Revision:	☐ Production Unit; ☑ Pre-Production
Product dimensions [mm]:	23cm x 9.4cm x 8cm
Weight (g)	574g
EUT Diameter	23cm
Note: The information of the EUT specifications in the table above is provided by the client.	

3.2 EUT Sample details

EUT #	IMEI Number	Serial Number	HW Version	SW Version	Comments
1	352709570915207	02516687844B3E	revD	anvil-001a	Radiated Emission

3.3 Accessory Equipment (AE) details

EUT #	IMEI Number	Serial Number	HW Version	SW Version	Comments
1	N/A	N/A	N/A	N/A	N/A

3.4 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT#1	- Radiated RF measurements were performed with EUT configured via customer provided GUE and instructions. - EUT powered by 3.6Vdc battery - Camera image capture and all peripheral sensors enabled by test software loaded on power up (battery plug in)

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	LTE	Cellular was tested on Low, Mid, High Channels at maximum power.

3.6 Justification Mode of Operation

During the testing process the EUT was tested with transmitter sets on low, mid and high channels at the maximum power, which is the worst case of the radios supported, based on the maximum average conducted output power from the reports.

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 evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 parts 24, 27.

5 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=2.

Radiated measurement

Measurement System		EMC 1	EMC 2
Conducted emissions (mains port)	150 kHz – 30 MHz	2.47 dB	N/A
Radiated emissions	9 kHz – 30 MHz	2.68 dB	2.53 dB
	30 – 100 MHz	4.39 dB	3.85 dB
	100 MHz – 1 GHz	5.65 dB	5.24 dB
	1 – 6 GHz	5.0 dB	4.88 dB
	6 – 18 GHz	4.76 dB	4.58 dB
	18 – 40 GHz	4.65 dB	4.61 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3dB to the limit.

5.1 Environmental Conditions During Testing:

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

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

5.2 Dates of Testing:

9/5/2024 - 9/12/2024

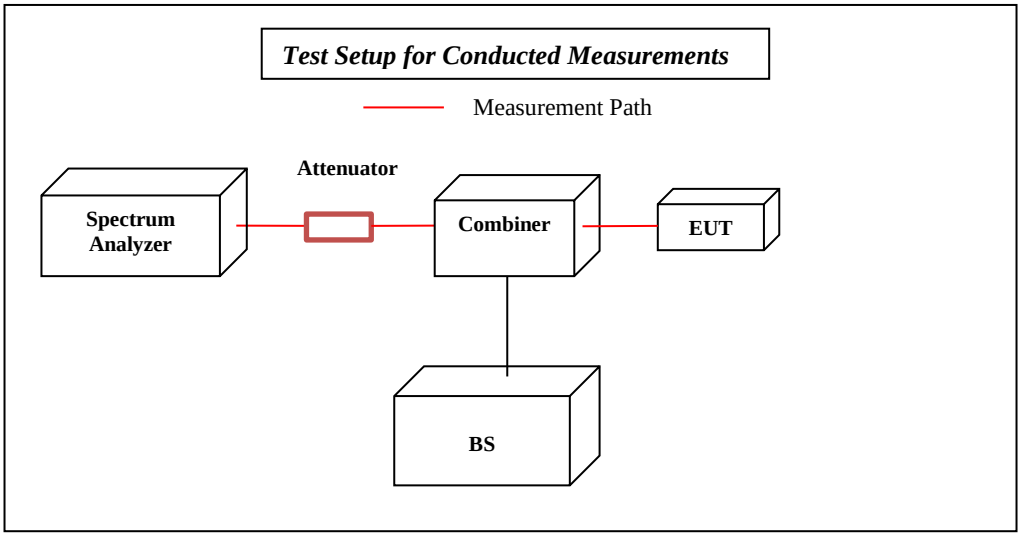
5.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

6 Measurement Procedures

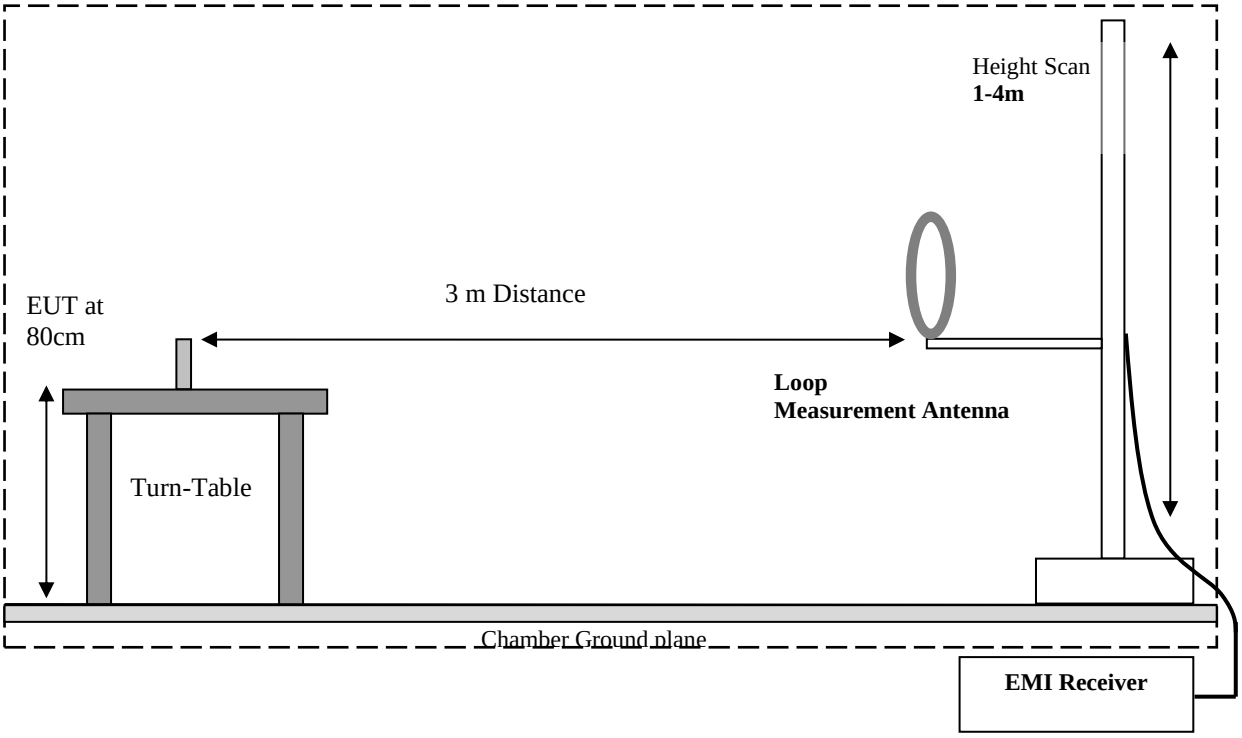
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03r01 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



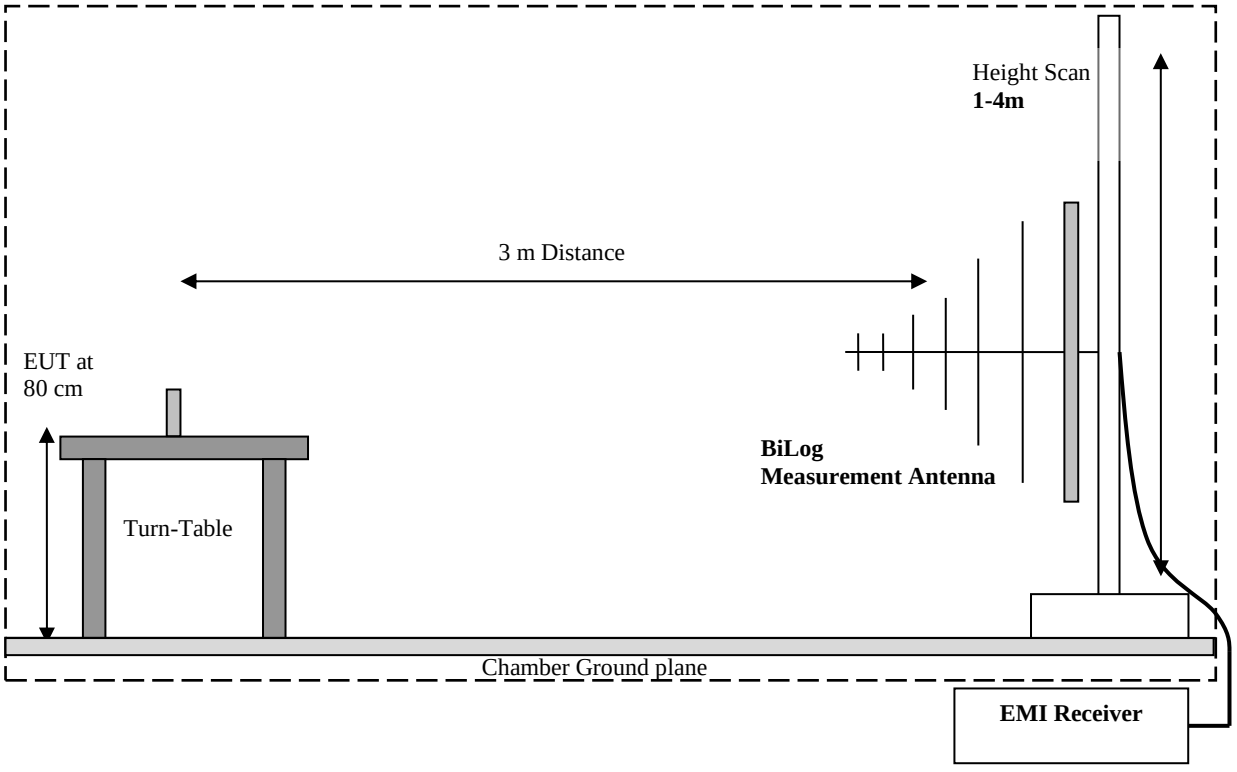
6.1 Radiated Measurement

- 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.

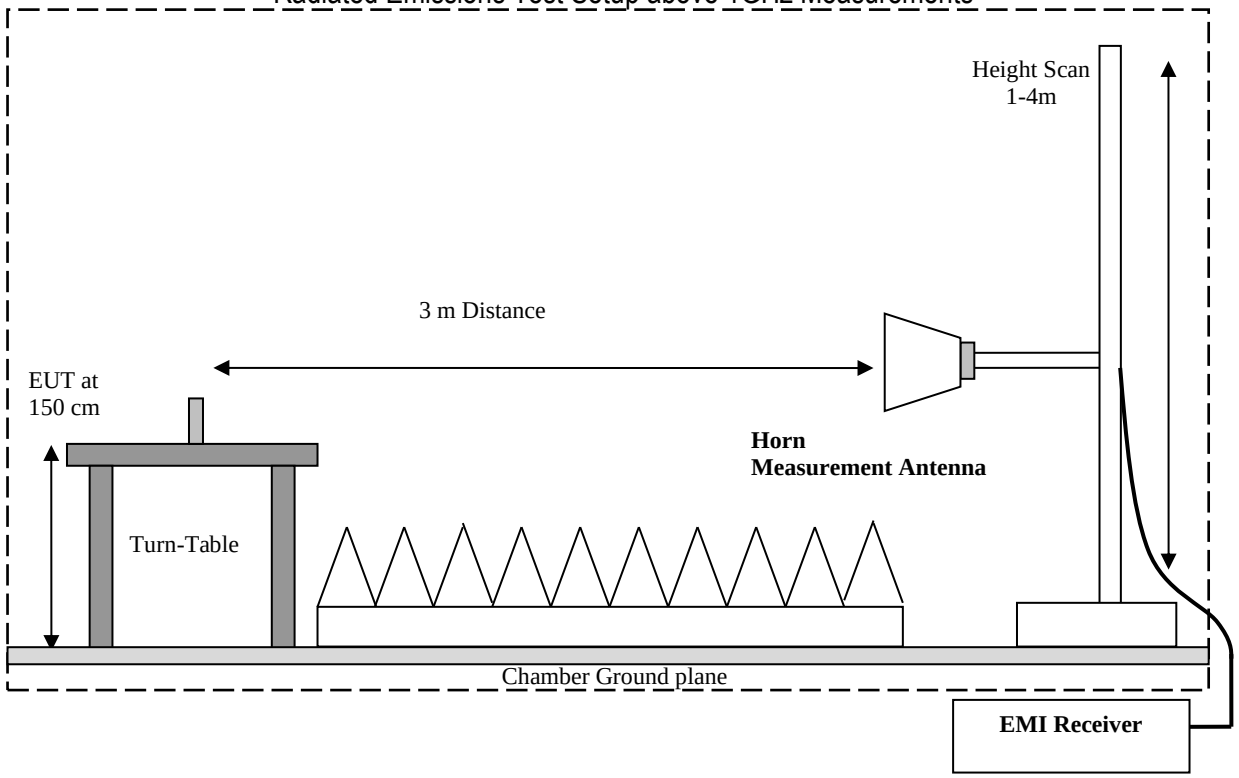
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



6.2 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 dBµV
- 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:

FS (dBµV/m) = Measured Value on SA (dBµV)+ Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

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

7 Measurement Results Summary

7.1 FCC 24

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a)	RF Output Power	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1047	Modulation Characteristics	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1055; §24.235	Frequency Stability	Extreme Temperature and Voltage	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	-	☐	☐	☐	■	Complies Note 1 5Note 2
§2.1053; §24.238	Radiated Spurious Emissions	Nominal	Op. 1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification u-blox SARA-R510M8S (LTE-M) (FCC ID: XPYUBX19KM01, ISED: 8595A-UBX19KM01)

7.2 FCC 27

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50	RF Output Power	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1047; §27.50,	Modulation Characteristics	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1055; §27.54	Frequency Stability	Extreme Temperature and Voltage	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	-	☐	☐	☐	■	Complies Note 1 Note 2

§2.1053; §27.53	Radiated Spurious Emissions	Nominal	Op. 1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification u-blox SARA-R510M8S (LTE-M) (FCC ID: XPYUBX19KM01, ISED: 8595A-UBX19KM01) Test Report Numbers : MDE_UBLIX_1905_FCC_01_rev01, MDE_UBLOX_1905_FCC_02, MDE_UBLIX_2105_FCC_01

8 Test Result Data

8.1 ERP/EIRP

FCC Rule Parts	Band	Frequency Range	Power Conducted Note 1	Power Conducted	Gain	EIRP Note 2	ERP Note 2	Limit EIRP	Limit ERP
		(MHz)	(dBm)	(W)	(dBi)	(W)	(W)	(W)	(W)
24E	LTE 2	1850 – 1910	22.67	0.185	4.10	0.475	0.290	2	-
27	LTE 4	1710 – 1755	23.17	0.207	4.10	0.533	0.325	1	-
27	LTE 12	699 – 716	22.21	0.166	1.20	0.219	0.134	-	3

Note 1: Power Conducted (dBm) leveraged from test report "MDE_UBLOX_1905_FCC_01_rev01" prepared by 7layers GmbH Germany of cellular module u-blox SARA-R510M8S (LTE-M) (FCC ID: XPYUBX19KM01, ISED: 8595A-UBX19KM01).

Note 2: ERP/EIRP are based on calculations from Power Conducted by adding the declared maximum gain of the utilized cellular antenna per operational description.

8.2 Radiated Spurious Emissions

8.2.1 Measurement utilizing KDB 971168 D01 Power Meas License Digital Systems v03r01, and according to ANSI/TIA-603-D-2010

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

8.2.2 Limits:

8.2.2.1 FCC Part 24.238 (a); FCC Part 27.53 (h)

Out of band emissions. 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.

8.2.3 Test conditions and setup:

Ambient Temperature (°C)	EUT Set-Up #	EUT operating mode	Power Input
24.7	1	Op. 1	3.6VDC nominal input

8.2.4 Measurement result:

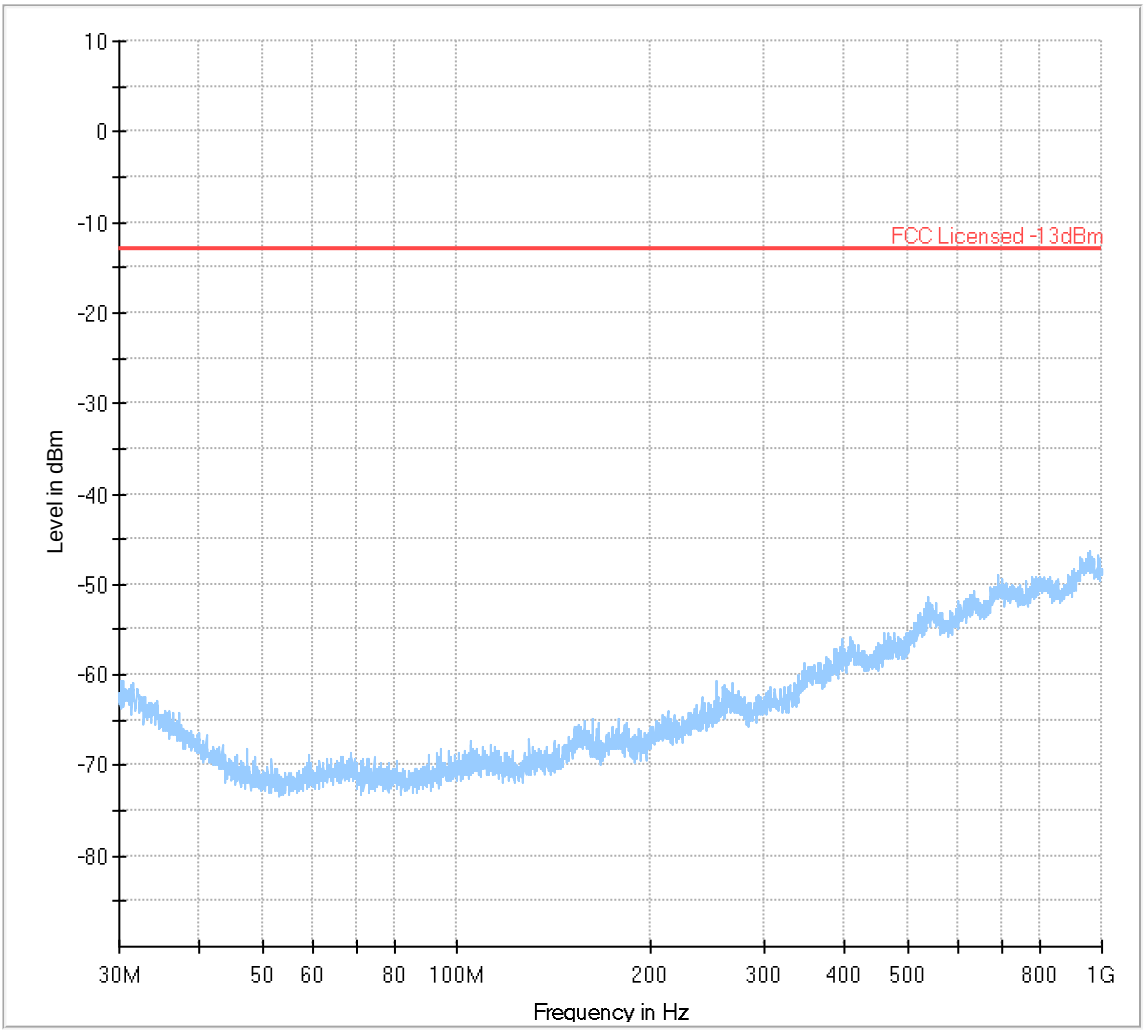
Plot #	Channel	EUT operating mode	Scan Frequency	Lowest margin emission (dBm)	Limit (dBm)	Result
1-4	Low	LTE Band 2	30 MHz – 20 GHz	-54.48	-13	Pass
5-8	Mid		30 kHz – 20 GHz		-13	Pass
9-12	High		30 MHz – 20 GHz		-13	Pass
13-15	Low	LTE Band 4	30 MHz – 18 GHz	-49.49	-13	Pass
16-18	Mid		30 kHz – 18 GHz		-13	Pass
19-21	High		30 MHz – 18 GHz		-13	Pass
22-24	Low	LTE Band 12	30 MHz – 8 GHz	-47.49	-13	Pass
25-27	Mid		30 kHz – 8 GHz		-13	Pass
28-30	High		30 MHz – 8 GHz		-13	Pass

8.2.5 Measurement Plots:

LTE Band 2

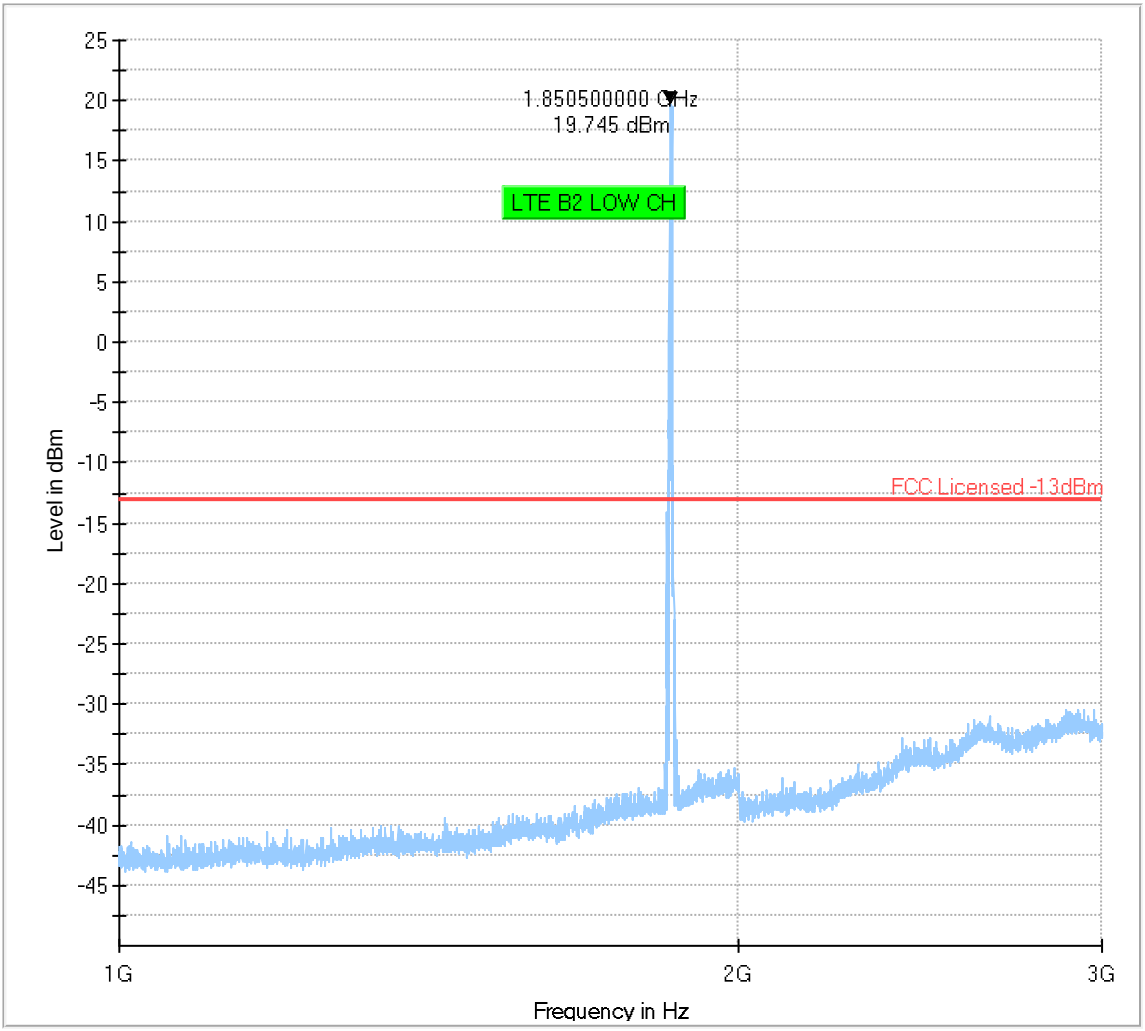
Plot #1 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot # 2 Radiated Emissions: 1-3 GHz

Channel: Low



Plot # 3 Radiated Emissions: 3-18 GHz

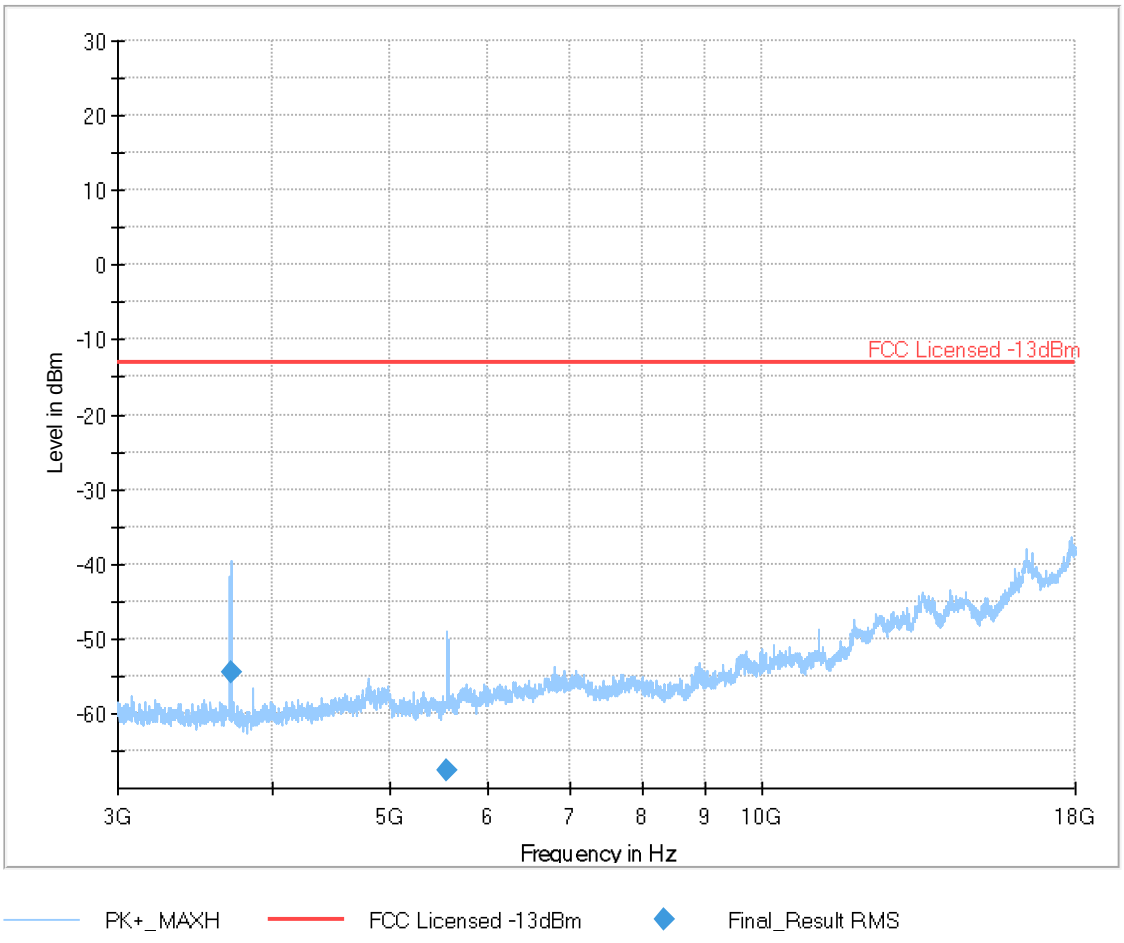
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3709.219	-54.475	-13.00	41.48	500.0	1000.000	160.0	V	284.0	-101.5	6.2	-45.5
5551.875	-67.615	-13.00	54.61	500.0	1000.000	158.0	H	-10.0	-99.0	7.8	-46.6

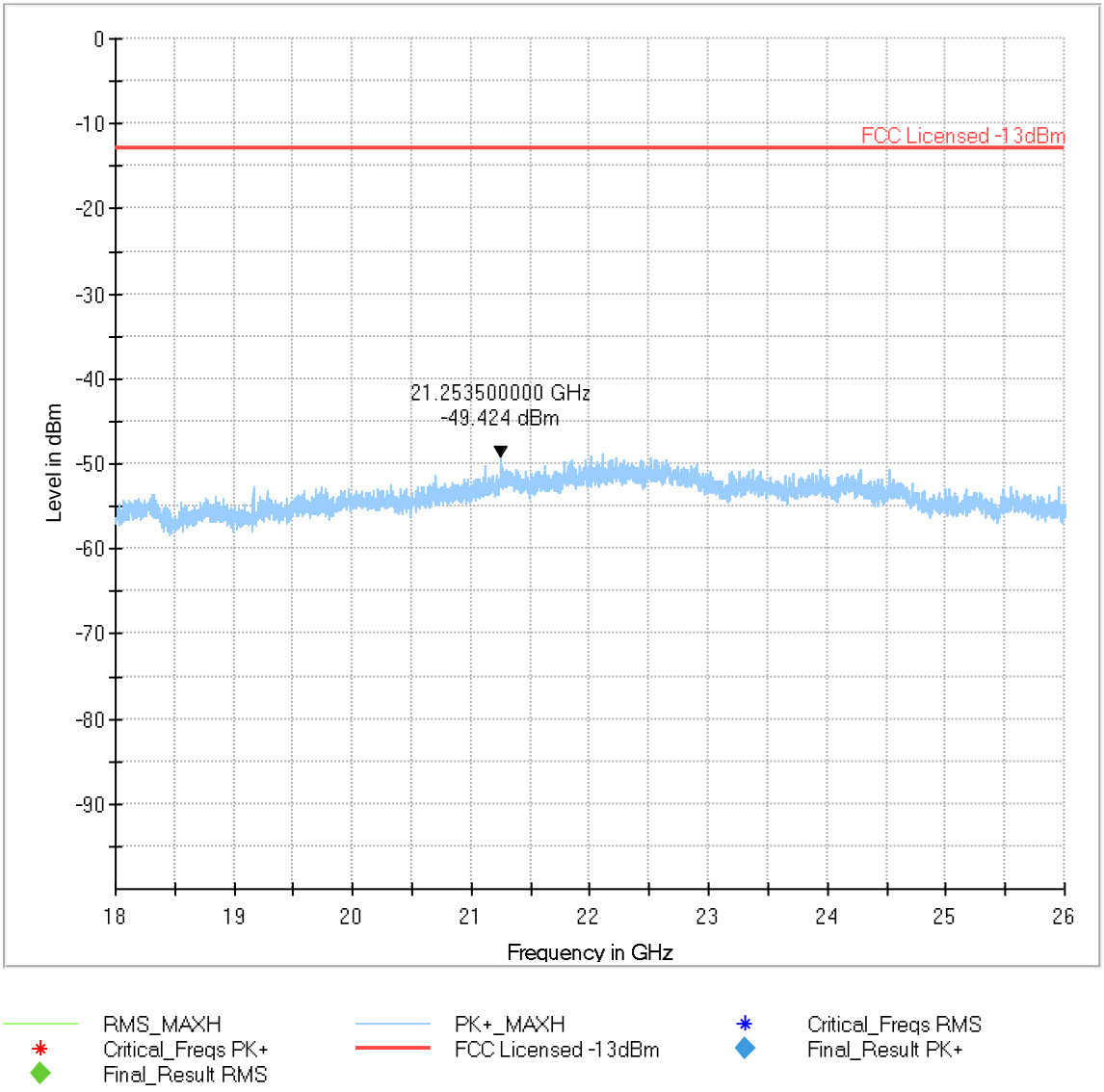
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3709.219	-62.2	47.0
5551.875	-60.3	31.4



Plot #4 Radiated Emissions: 18-26GHz

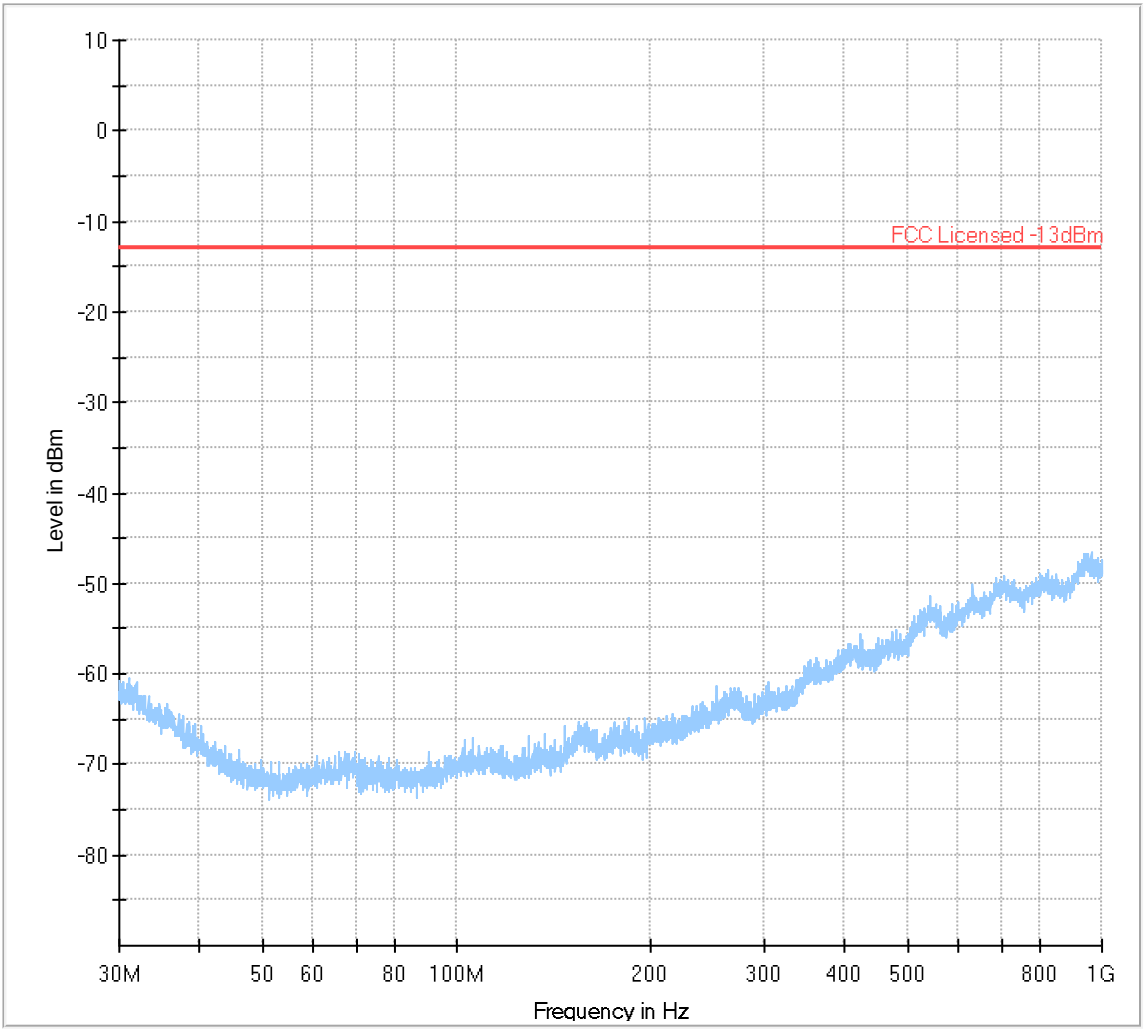
Channel: Low



Plot #5 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid

Final_Result

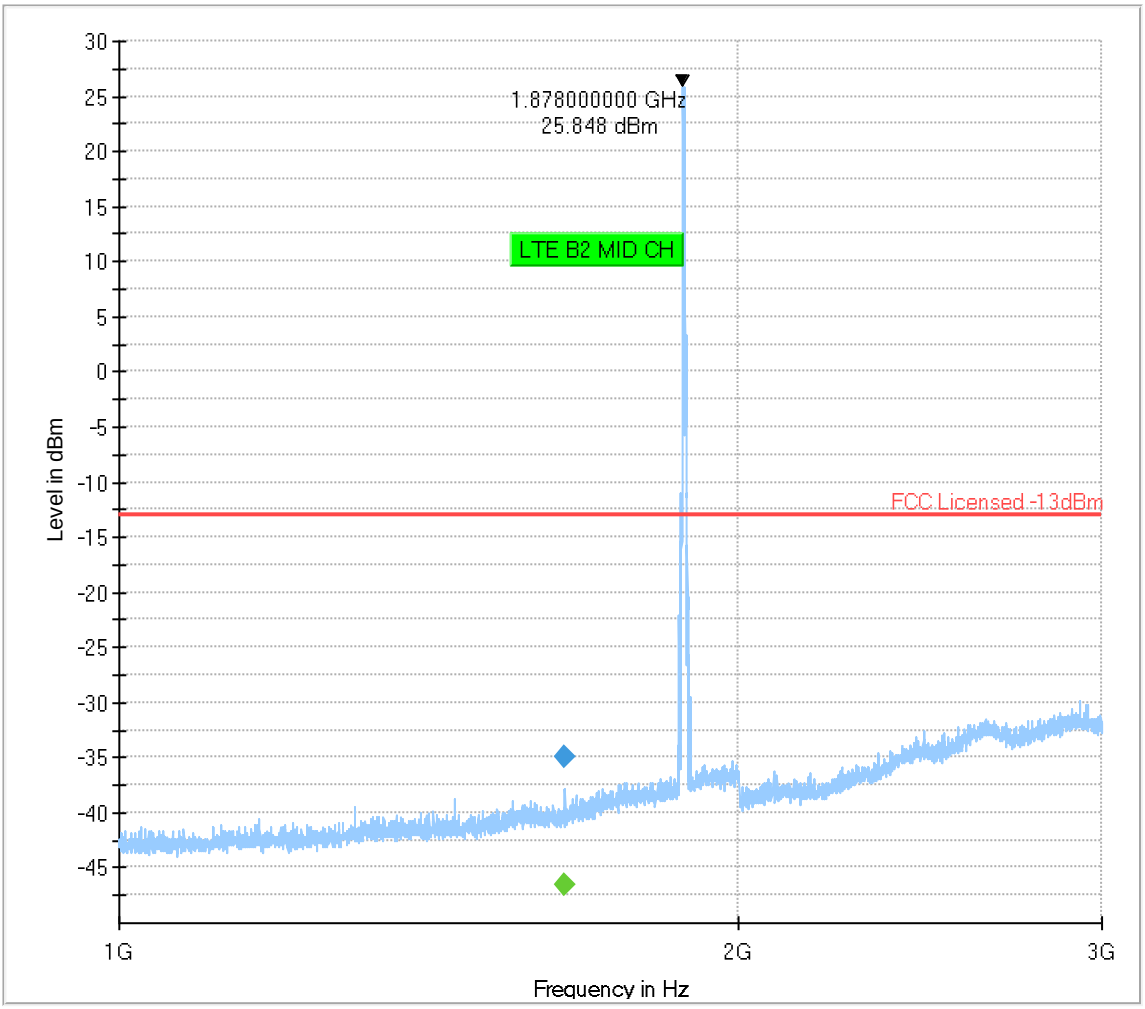


Plot #6 Radiated Emissions: 1-3 GHz

Channel: Mid

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1644.750	---	-46.57	---	---	500.0	1000.0	272.0	V	25.0	-65.1
1644.750	-34.96	---	-13.00	21.96	500.0	1000.0	272.0	V	25.0	-65.1



Plot #7 Radiated Emissions: 3-18 GHz

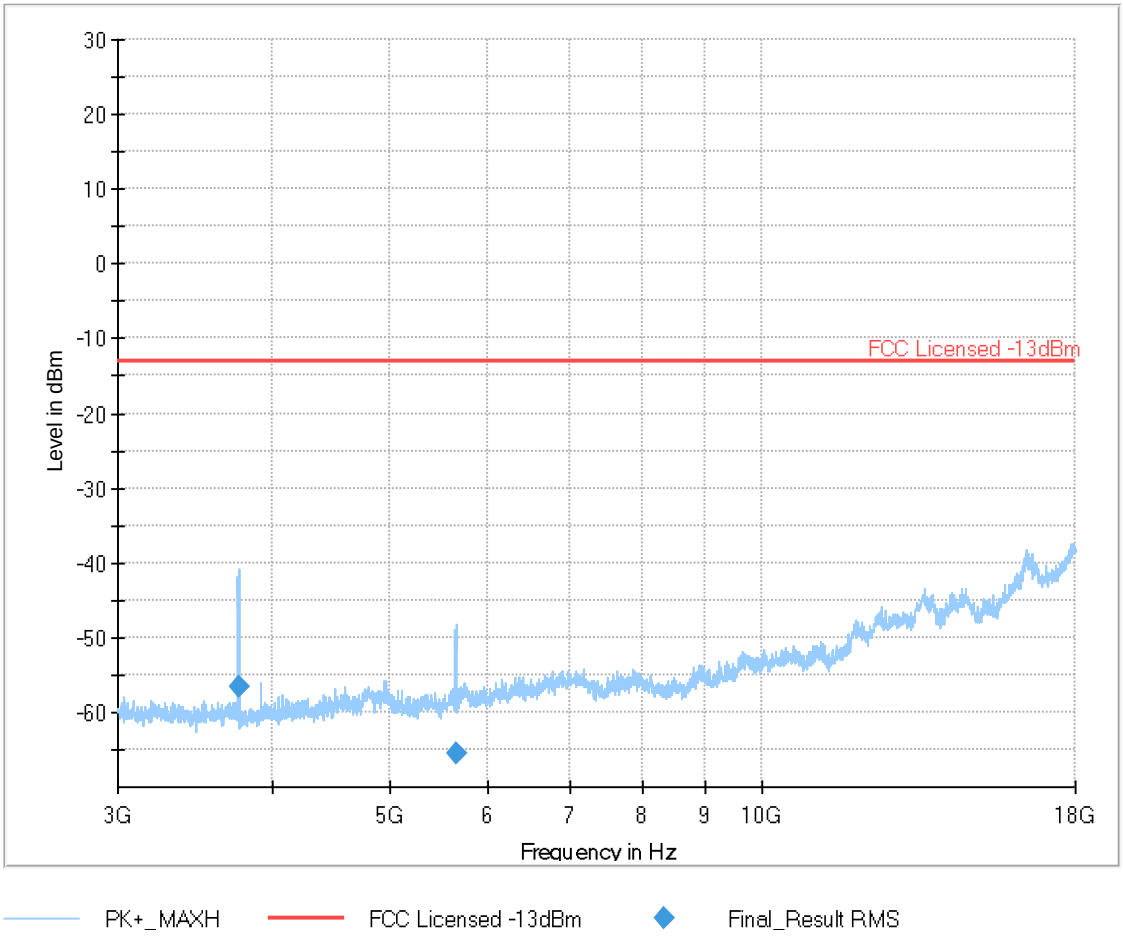
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3764.063	-56.594	-13.00	43.59	500.0	1000.000	100.0	V	73.0	-101.7	6.2	-45.8
5646.094	-65.630	-13.00	52.63	500.0	1000.000	143.0	V	255.0	-98.6	7.7	-46.1

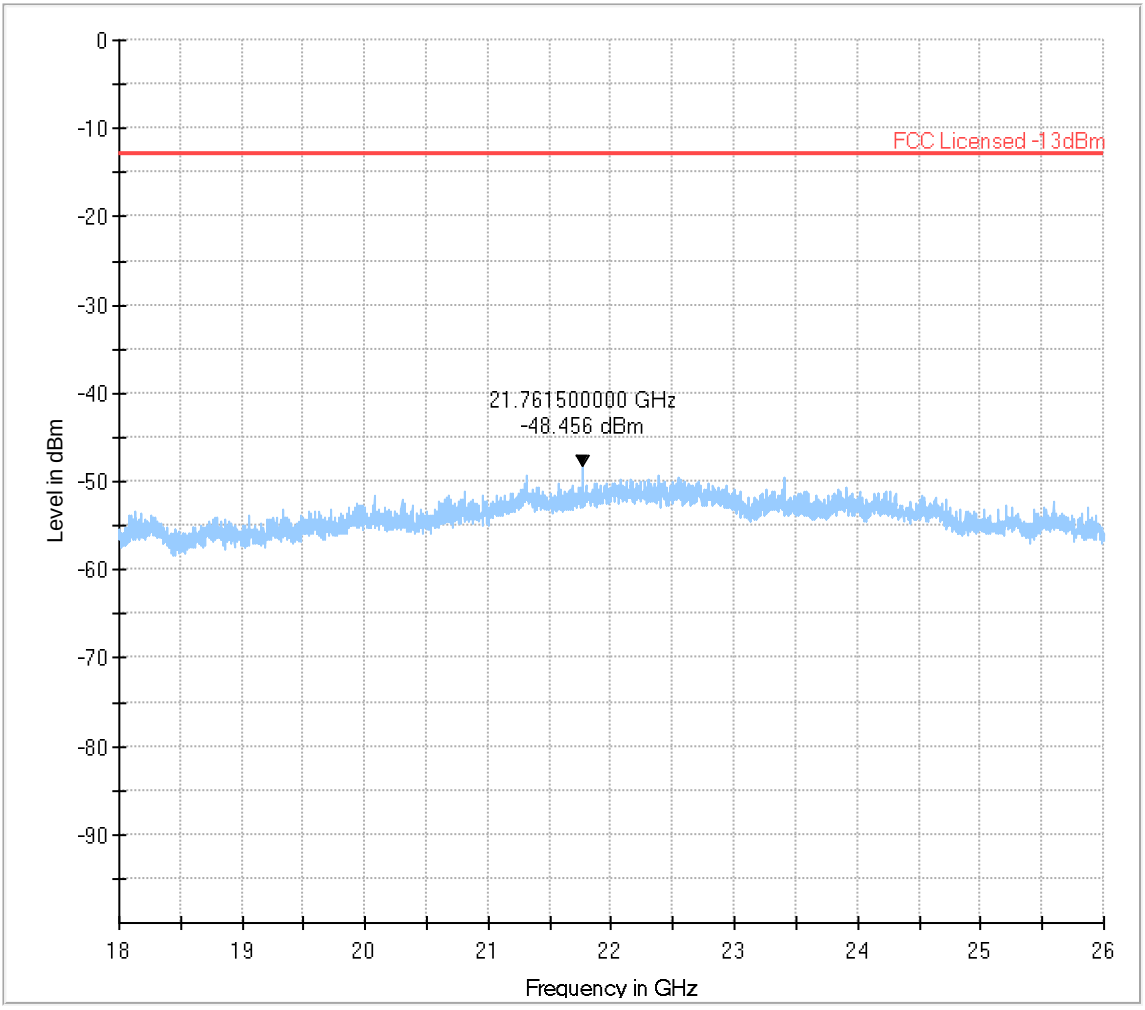
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3764.063	-62.2	45.1
5646.094	-60.2	33.0



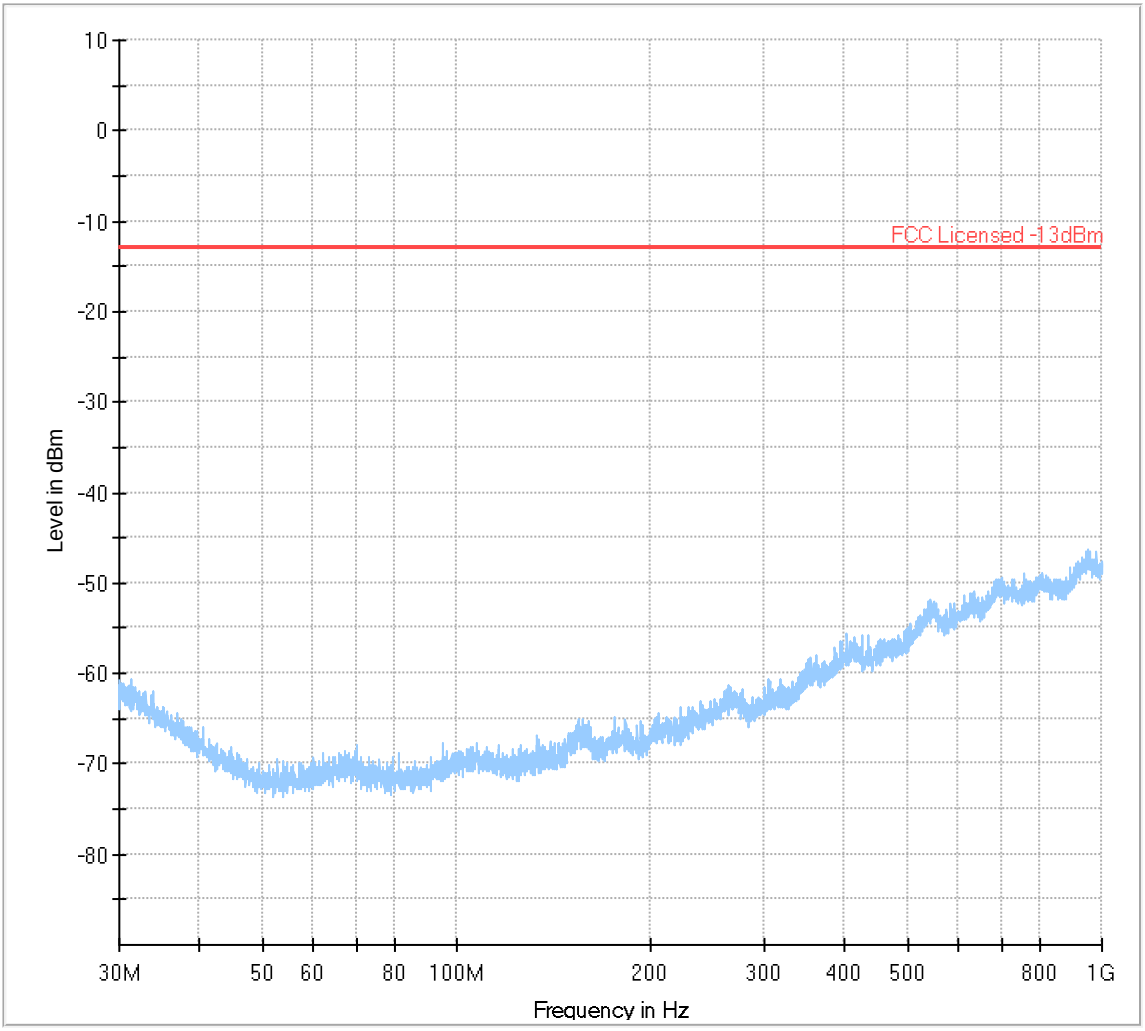
Plot #8 Radiated Emissions: 18-26 GHz

Channel: Mid



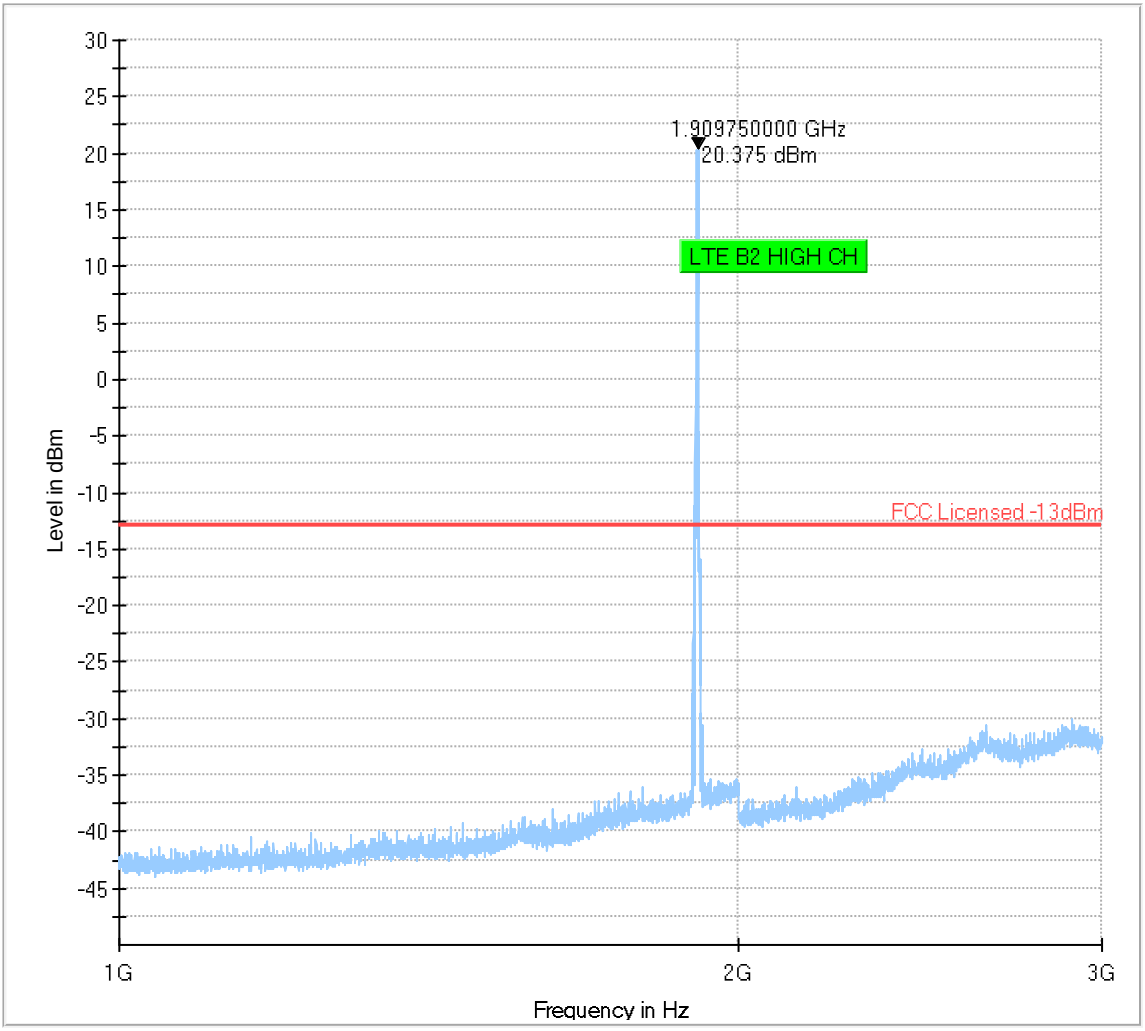
Plot #9 Radiated Emissions: 30 MHz – 1 GHz

Channel: High



Plot #10 Radiated Emissions: 1-3 GHz

Channel: High



Plot #11 Radiated Emissions: 3-18 GHz

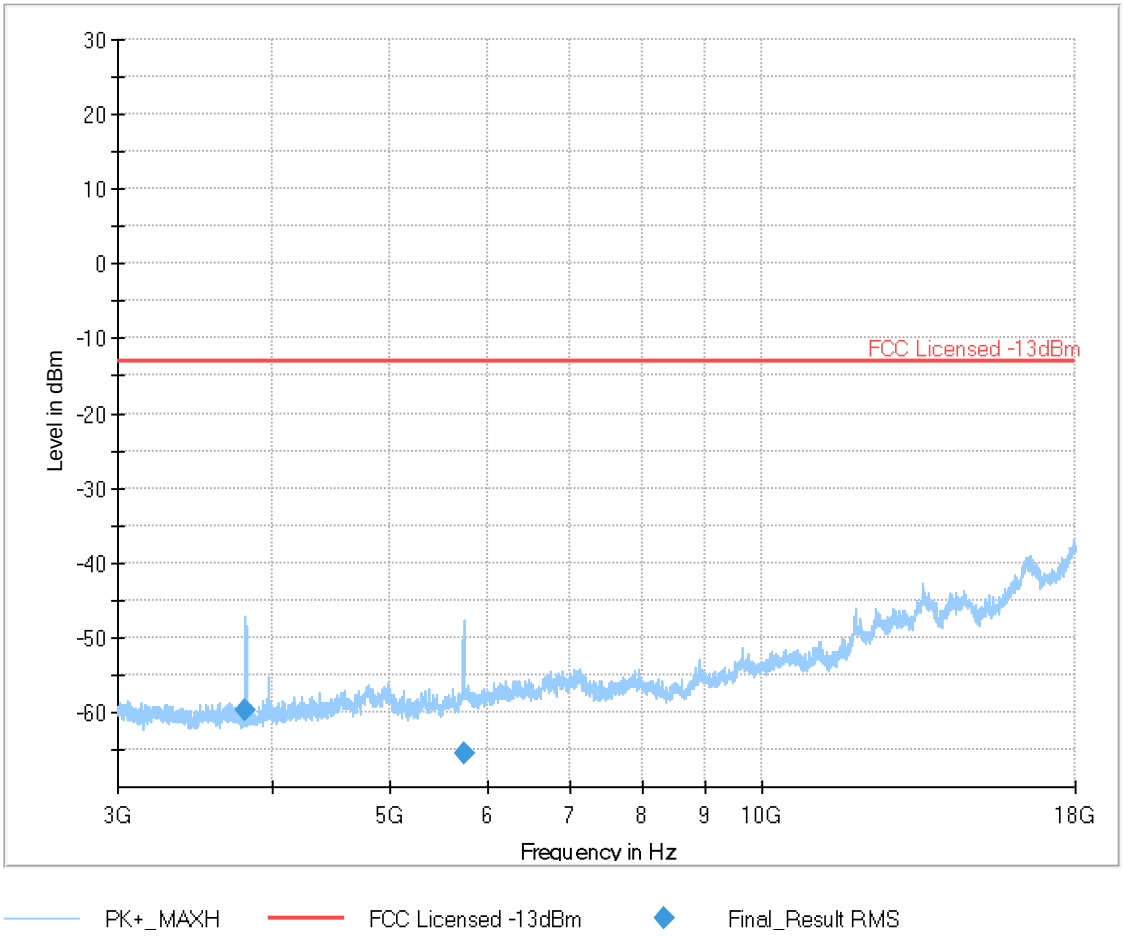
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3810.938	-59.856	-13.00	46.86	500.0	1000.000	100.0	V	75.0	-101.8	6.3	-45.9
5728.594	-65.433	-13.00	52.43	500.0	1000.000	167.0	V	232.0	-97.8	7.9	-45.5

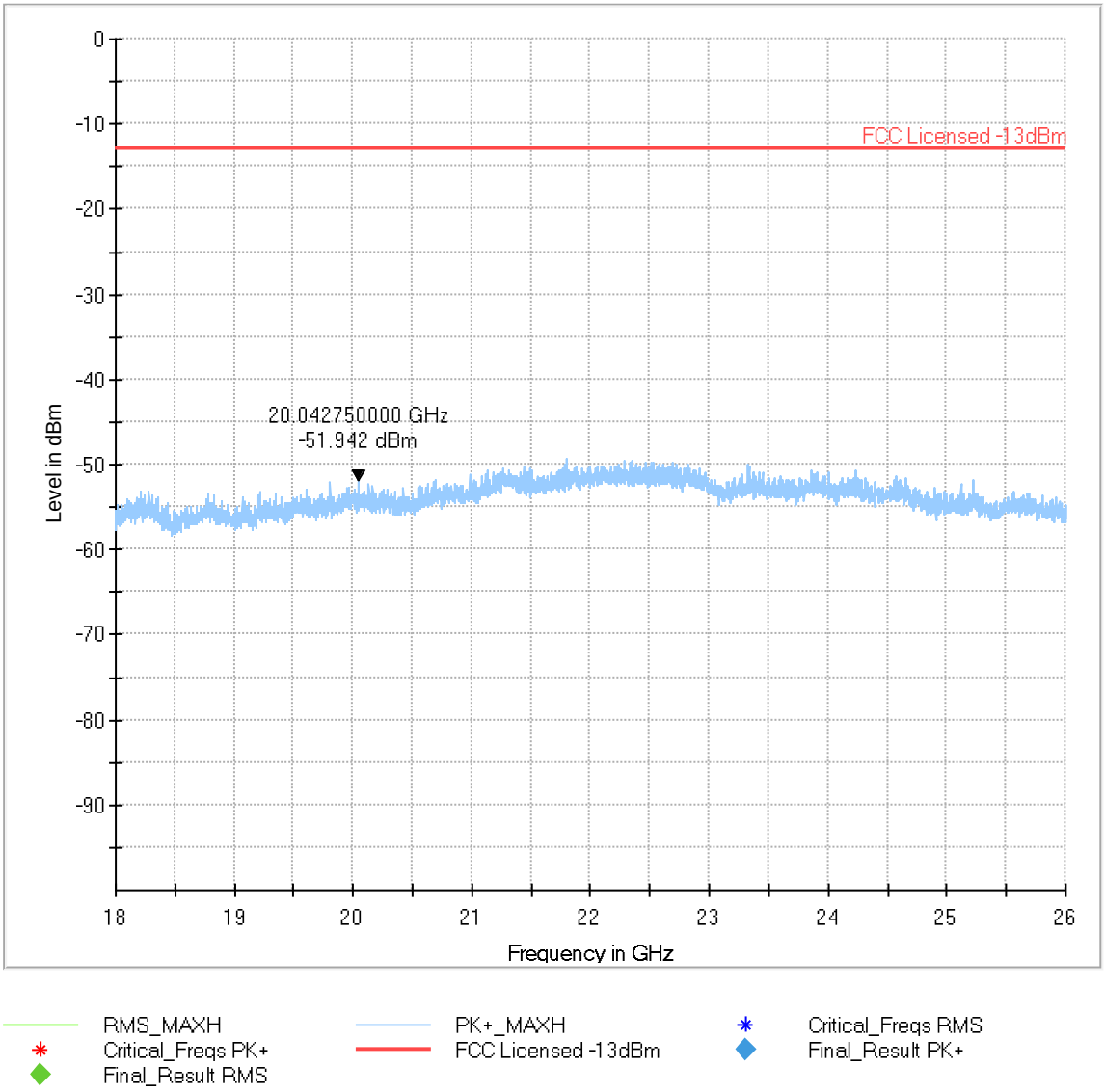
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3810.938	-62.1	41.9
5728.594	-60.2	32.3



Plot #12 Radiated Emissions: 18-26 GHz

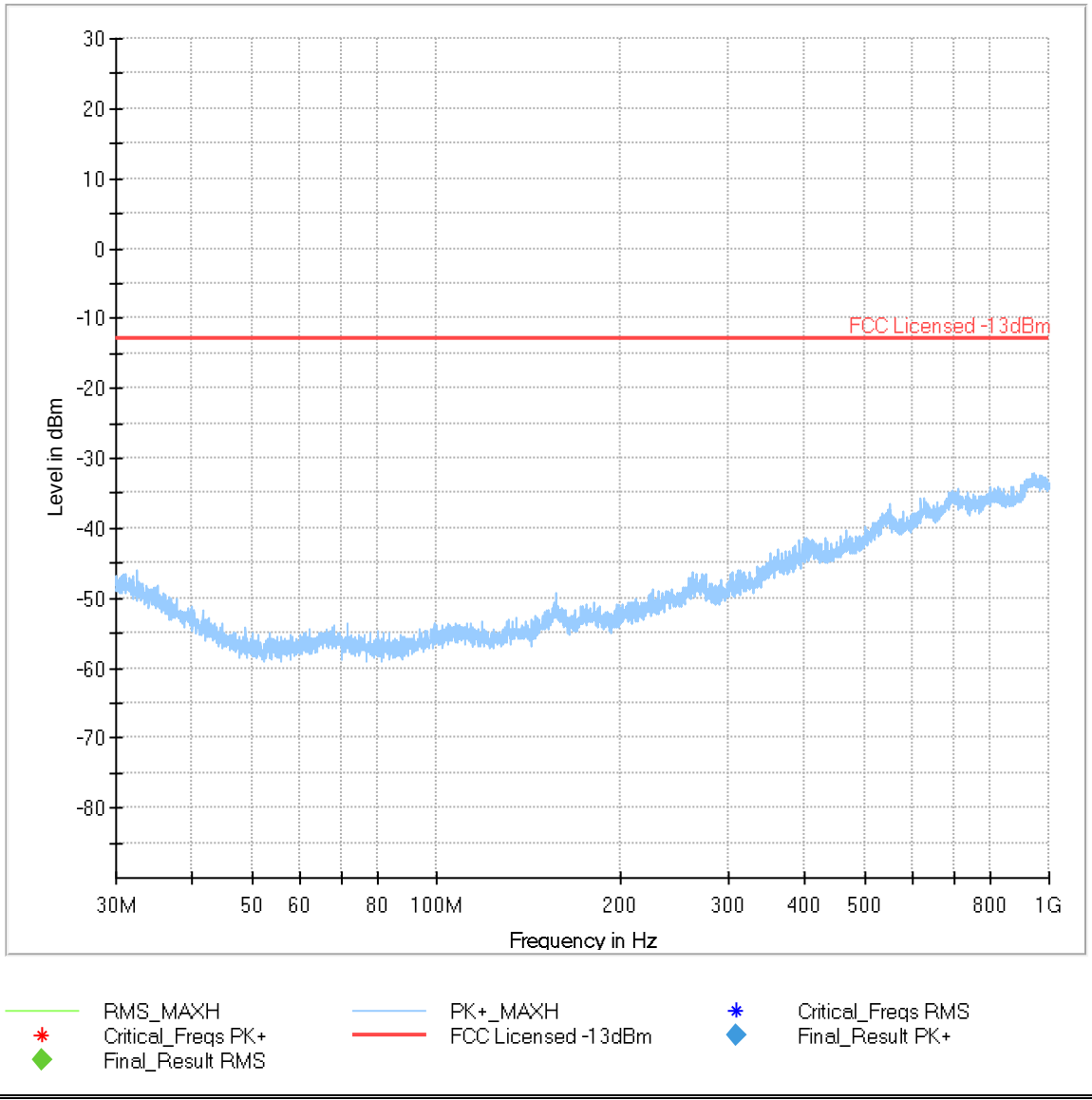
Channel: High



LTE Band 4

Plot #13 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

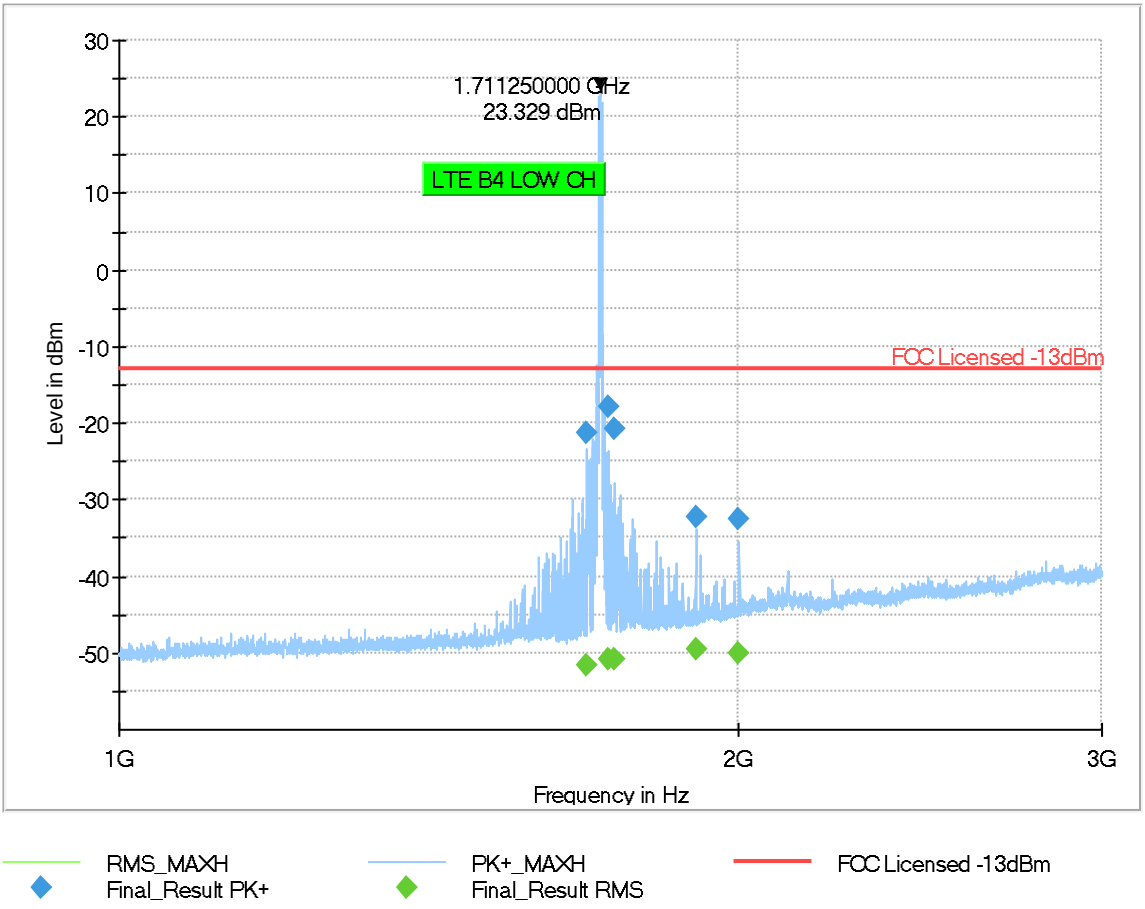


Plot # 14 Radiated Emissions: 1-3 GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1685.250	---	-51.55	---	---	500.0	1000.0	218.0	H	323.0	-65.5
1685.250	-21.30	---	-13.00	8.30	500.0	1000.0	218.0	H	323.0	-65.5
1728.500	---	-50.90	---	---	500.0	1000.0	152.0	H	239.0	-65.1
1728.500	-17.83	---	-13.00	4.83	500.0	1000.0	152.0	H	239.0	-65.1
1738.250	---	-50.97	---	---	500.0	1000.0	173.0	H	231.0	-65.0
1738.250	-20.84	---	-13.00	7.84	500.0	1000.0	173.0	H	231.0	-65.0
1905.250	---	-49.49	---	---	500.0	1000.0	141.0	H	242.0	-64.1
1905.250	-32.26	---	-13.00	19.26	500.0	1000.0	141.0	H	242.0	-64.1
2000.250	---	-50.02	---	---	500.0	1000.0	100.0	H	75.0	-63.4
2000.250	-32.54	---	-13.00	19.54	500.0	1000.0	100.0	H	75.0	-63.4



Plot # 15 Radiated Emissions: 3-18 GHz

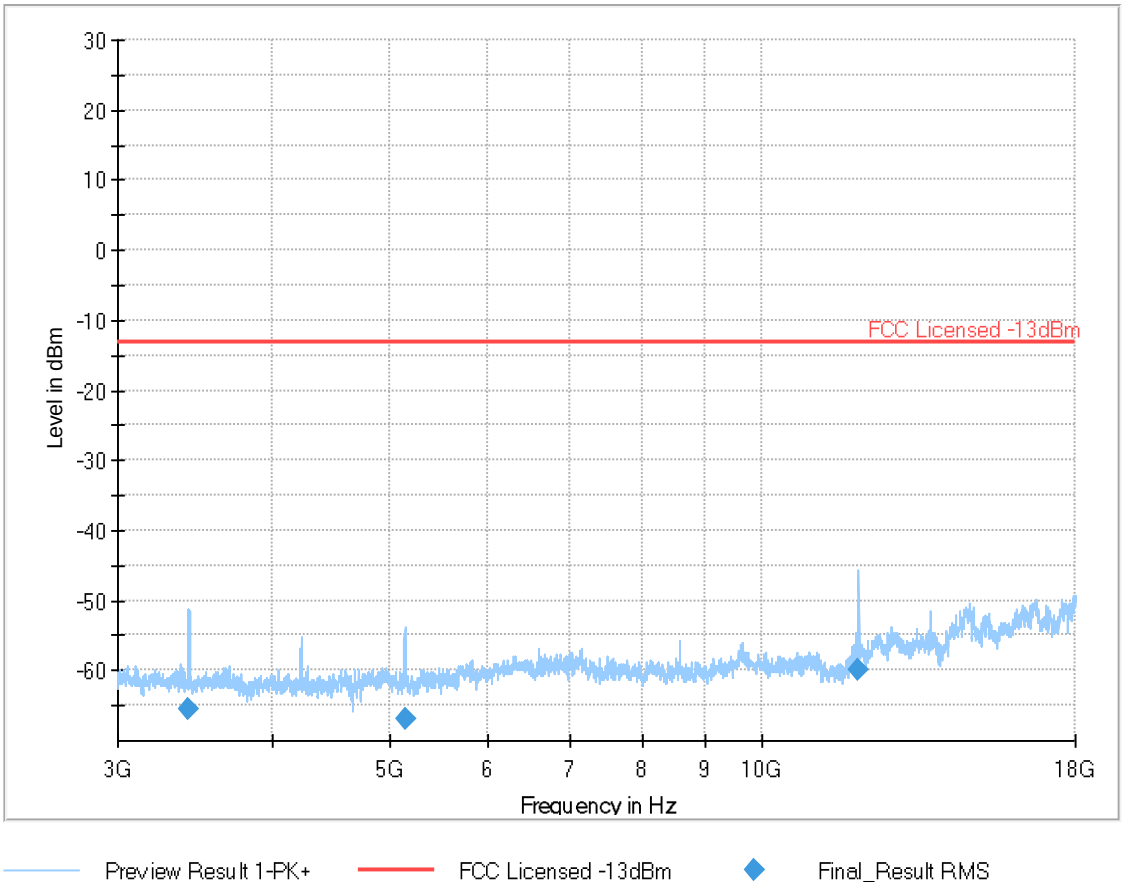
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3428.906	-65.413	-13.00	52.41	500.0	1000.000	158.0	V	74.0	-102.6	5.9	-46.0
5131.875	-66.784	-13.00	53.78	500.0	1000.000	177.0	V	280.0	-99.6	7.6	-46.3
12002.813	-59.905	-13.00	46.91	500.0	1000.000	125.0	V	294.0	-90.5	11.8	-45.7

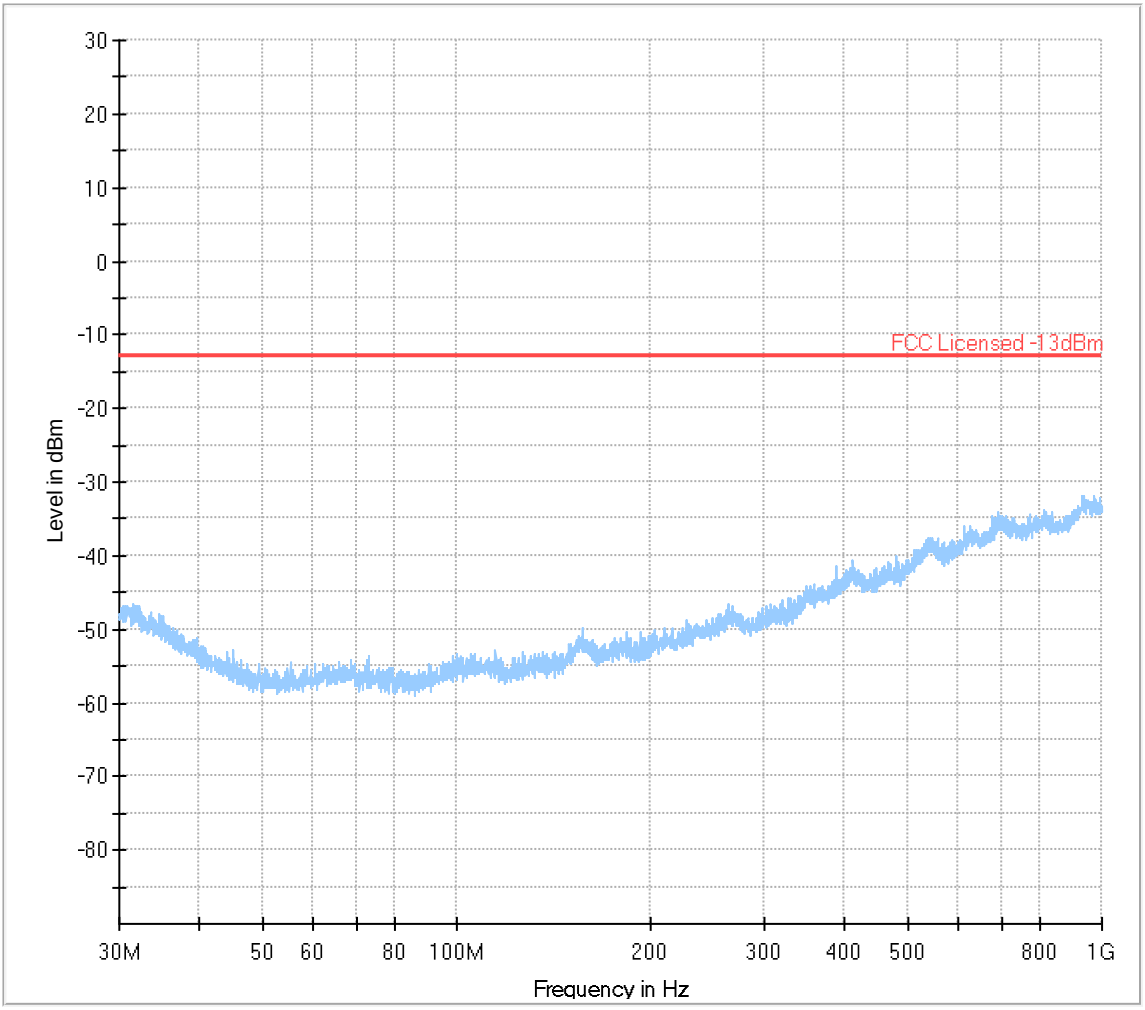
(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3428.906	-62.5	37.2
5131.875	-60.9	32.8
12002.813	-56.7	30.6



Plot #16 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid

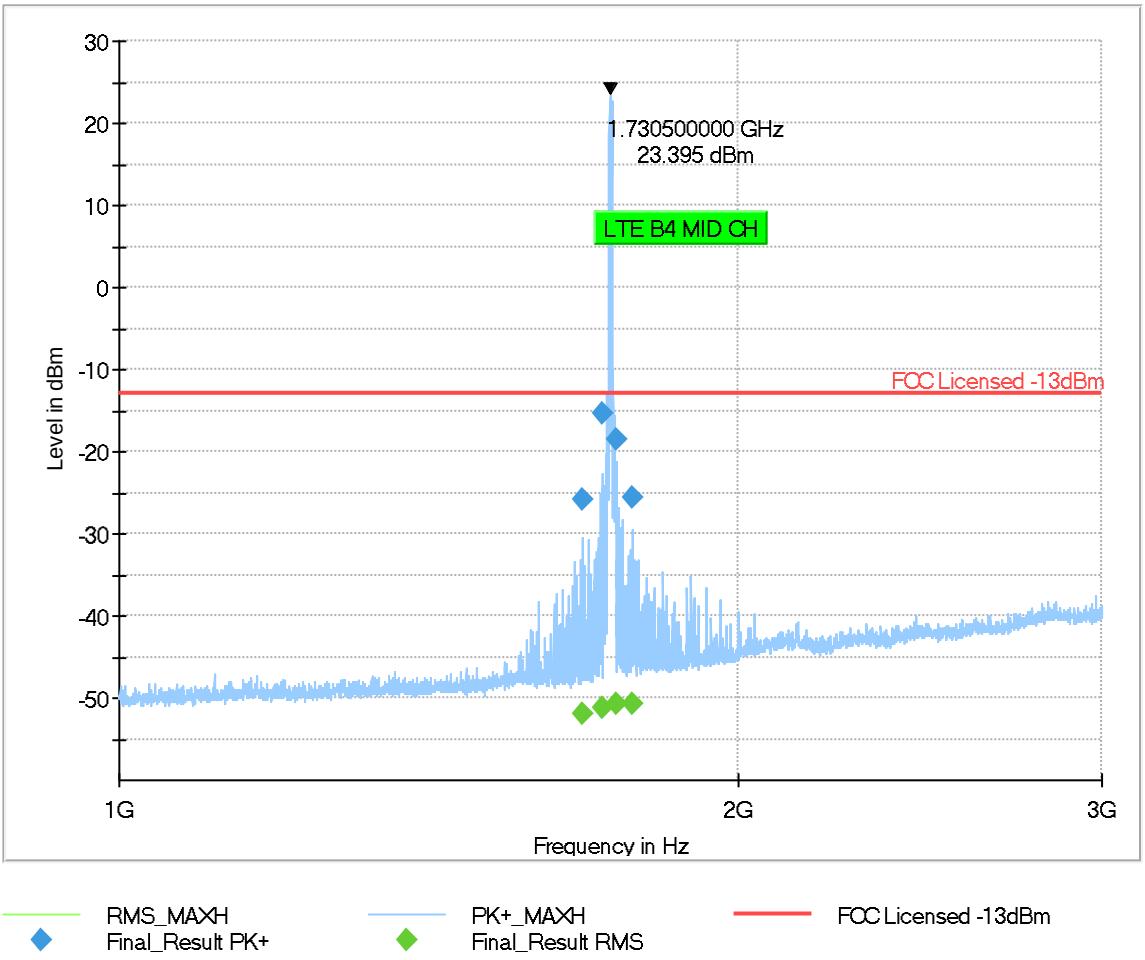


Plot #17 Radiated Emissions: 1-3 GHz

Channel: Mid

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1679.250	---	-51.92	---	---	500.0	1000.0	107.0	H	307.0	-65.6
1679.250	-25.75	---	-13.00	12.75	500.0	1000.0	107.0	H	307.0	-65.6
1717.750	---	-51.11	---	---	500.0	1000.0	128.0	H	312.0	-65.2
1717.750	-15.41	---	-13.00	2.41	500.0	1000.0	128.0	H	312.0	-65.2
1742.250	---	-50.71	---	---	500.0	1000.0	152.0	H	228.0	-65.0
1742.250	-18.58	---	-13.00	5.58	500.0	1000.0	152.0	H	228.0	-65.0
1774.750	---	-50.76	---	---	500.0	1000.0	152.0	H	71.0	-64.7
1774.750	-25.49	---	-13.00	12.49	500.0	1000.0	152.0	H	71.0	-64.7



Plot #18 Radiated Emissions: 3-18 GHz

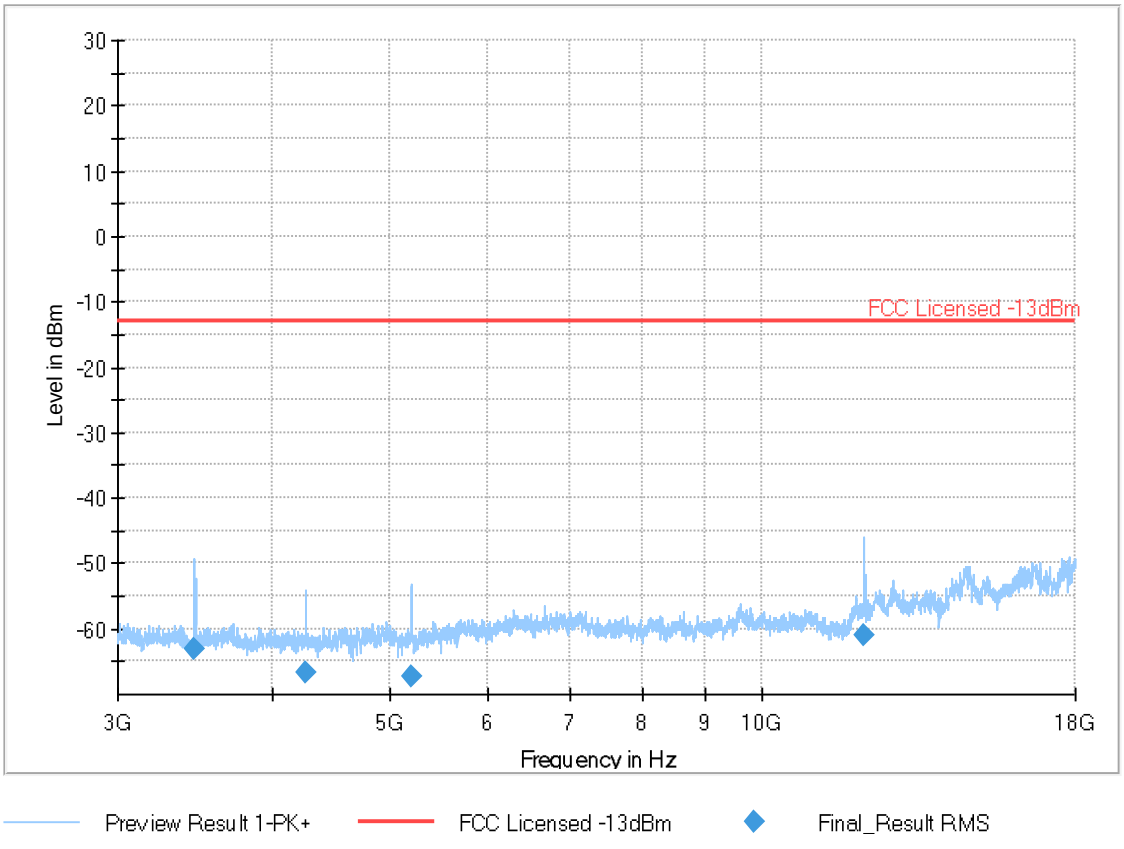
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3461.250	-62.947	-13.00	49.95	500.0	1000.000	183.0	V	87.0	-102.7	5.9	-46.1
4266.563	-66.590	-13.00	53.59	500.0	1000.000	193.0	H	269.0	-100.4	6.8	-45.4
5191.406	-67.213	-13.00	54.21	500.0	1000.000	125.0	V	261.0	-99.6	7.4	-46.2
12113.906	-60.968	-13.00	47.97	500.0	1000.000	340.0	V	50.0	-90.9	11.6	-45.9

(continuation of the "Final_Result" table from column 18 ...)

Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3461.250	-62.5	39.7
4266.563	-61.7	33.8
5191.406	-60.8	32.4
12113.906	-56.6	29.9

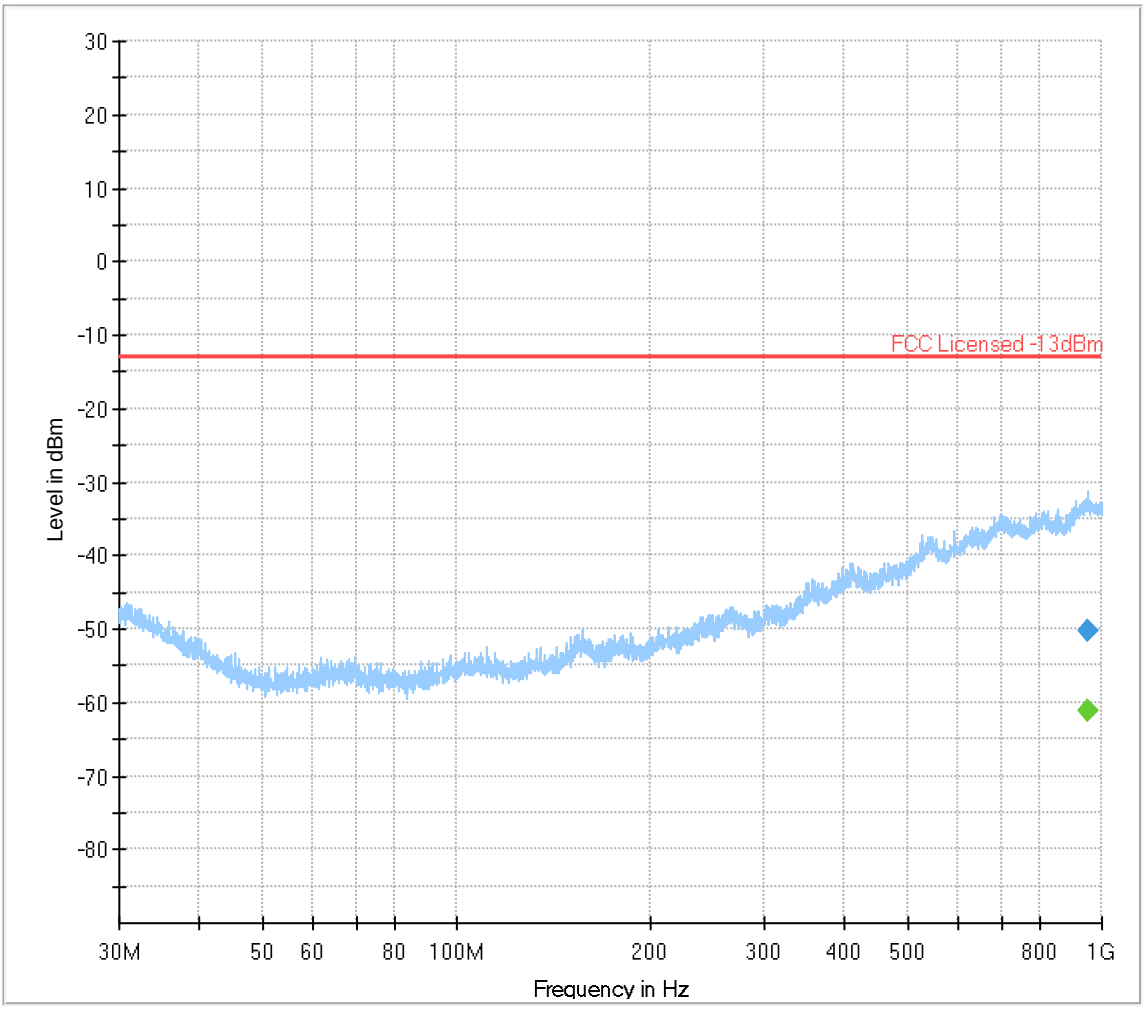


Plot #19 Radiated Emissions: 30 MHz – 1 GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
949.495	---	-61.07	---	---	500.0	100.0	139.0	V	65.0	-63.2
949.495	-50.25	---	-13.00	37.25	500.0	100.0	139.0	V	65.0	-63.2

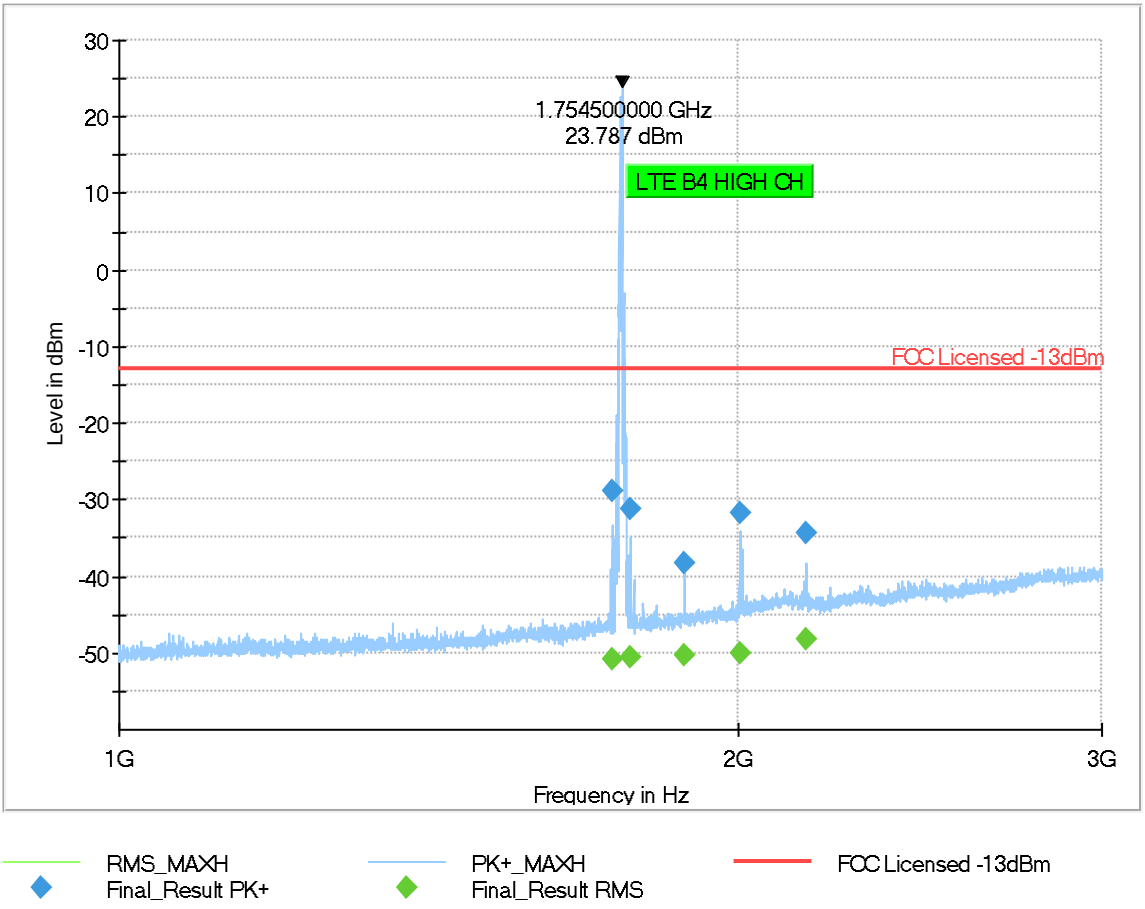


Plot #20 Radiated Emissions: 1-3 GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1735.500	---	-50.91	---	---	500.0	1000.0	183.0	V	-7.0	-64.8
1735.500	-28.80	---	-13.00	15.80	500.0	1000.0	183.0	V	-7.0	-64.8
1772.250	---	-50.64	---	---	500.0	1000.0	232.0	V	2.0	-64.5
1772.250	-31.34	---	-13.00	18.34	500.0	1000.0	232.0	V	2.0	-64.5
1880.000	---	-50.28	---	---	500.0	1000.0	152.0	H	321.0	-64.3
1880.000	-38.28	---	-13.00	25.28	500.0	1000.0	152.0	H	321.0	-64.3
2001.250	---	-50.12	---	---	500.0	1000.0	100.0	H	82.0	-63.4
2001.250	-31.77	---	-13.00	18.77	500.0	1000.0	100.0	H	82.0	-63.4
2154.000	---	-48.22	---	---	500.0	1000.0	398.0	V	170.0	-62.7
2154.000	-34.41	---	-13.00	21.41	500.0	1000.0	398.0	V	170.0	-62.7



Plot #21 Radiated Emissions: 3-18 GHz

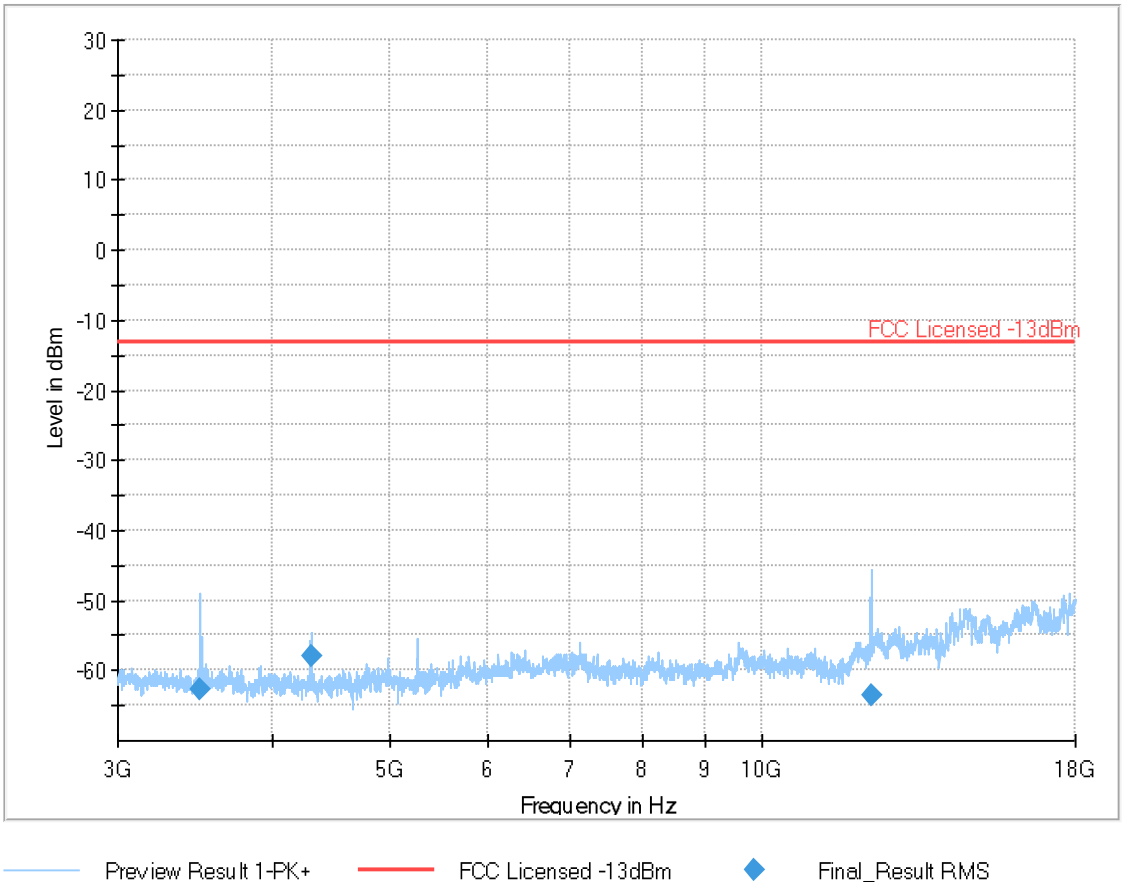
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Sig Path (dB)	Preamp (dB)
3501.094	-62.768	-13.00	49.77	500.0	1000.000	151.0	V	85.0	-102.2	6.2	-46.0
4306.875	-58.063	-13.00	45.06	500.0	1000.000	142.0	H	261.0	-100.5	6.7	-45.5
12282.188	-63.571	-13.00	50.57	500.0	1000.000	184.0	H	253.0	-90.2	11.7	-45.3

(continuation of the "Final_Result" table from column 18 ...)

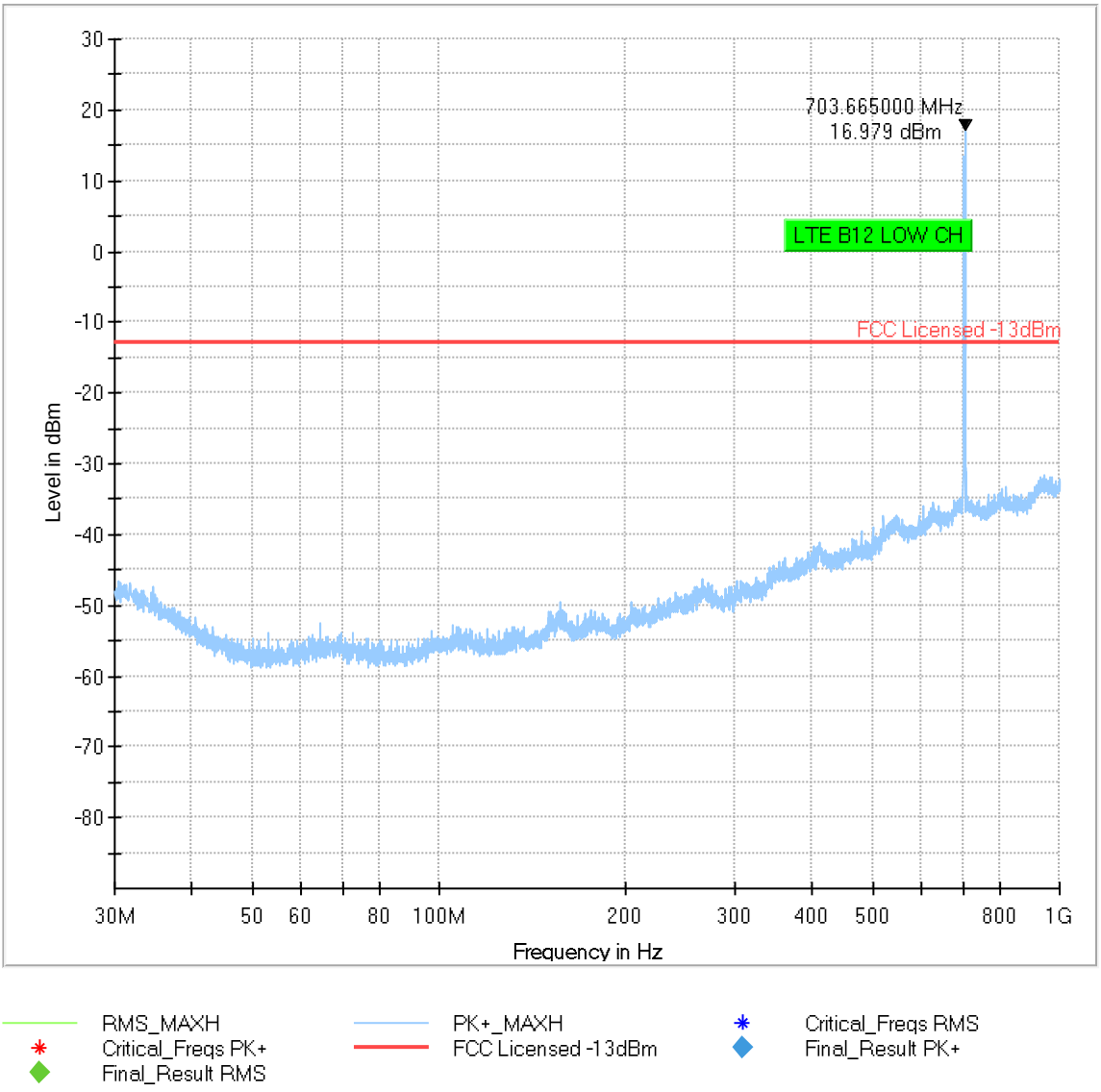
Frequency (MHz)	Trd Corr. (dB)	Raw Rec (dBµV)
3501.094	-62.4	39.5
4306.875	-61.7	42.5
12282.188	-56.6	26.6



LTE Band 12

Plot #22 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

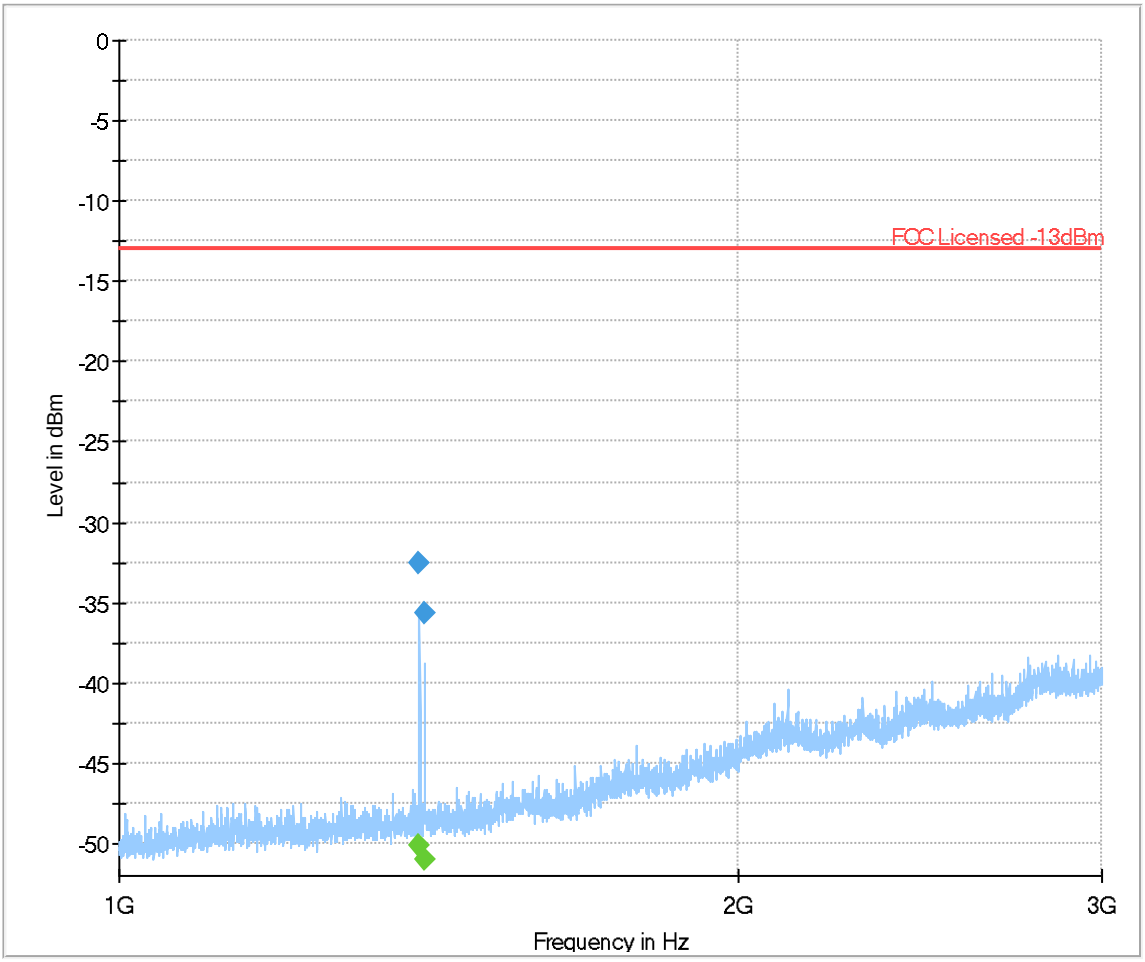


Plot # 23 Radiated Emissions: 1-3 GHz

Channel: Low

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1399.000	-32.49	---	-13.00	19.49	500.0	1000.0	140.0	H	320.0	-66.4
1399.000	---	-50.08	---	---	500.0	1000.0	140.0	H	320.0	-66.4
1407.500	-35.63	---	-13.00	22.63	500.0	1000.0	151.0	H	216.0	-66.4
1407.500	---	-51.01	---	---	500.0	1000.0	151.0	H	216.0	-66.4

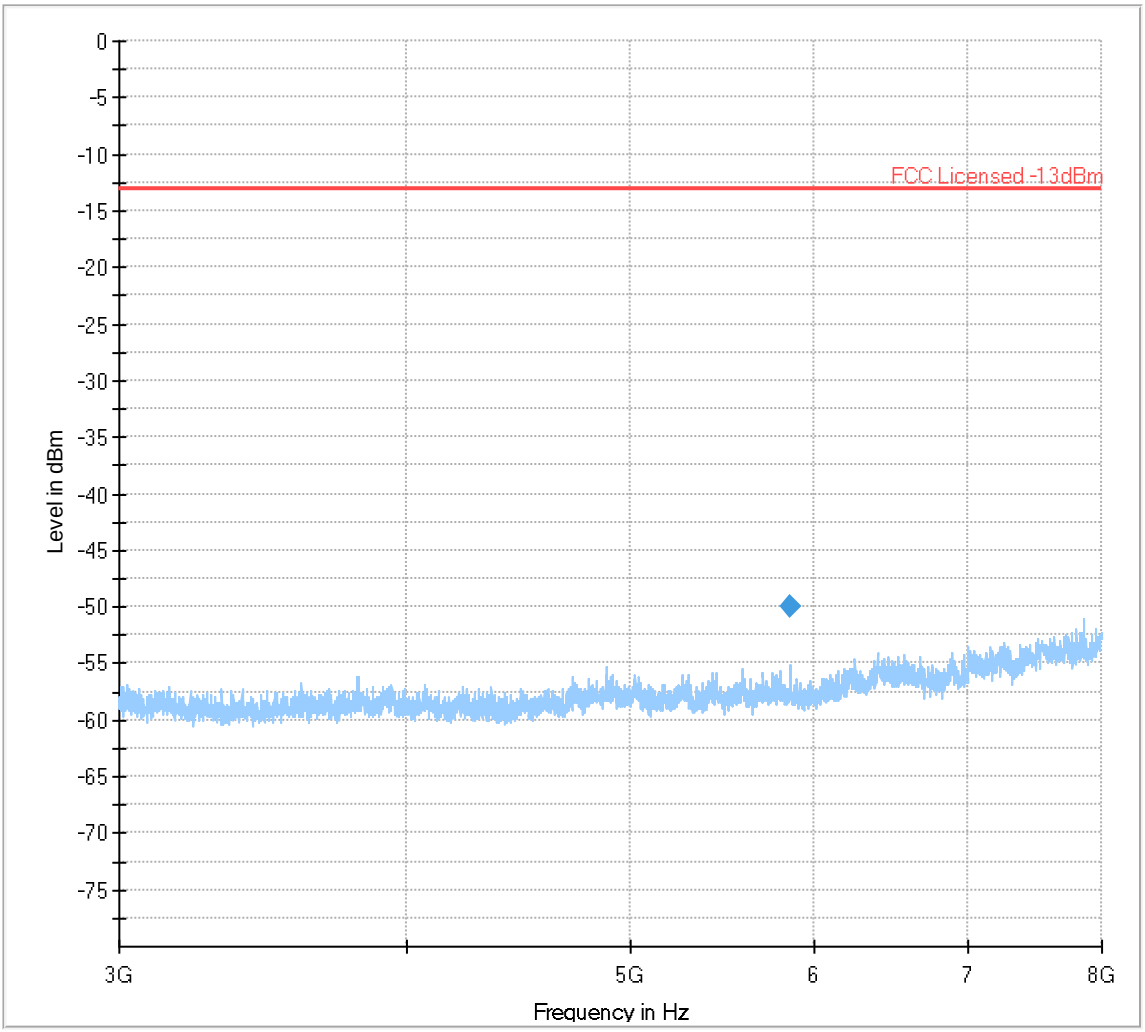


Plot # 24 Radiated Emissions: 3-8 GHz

Channel: Low

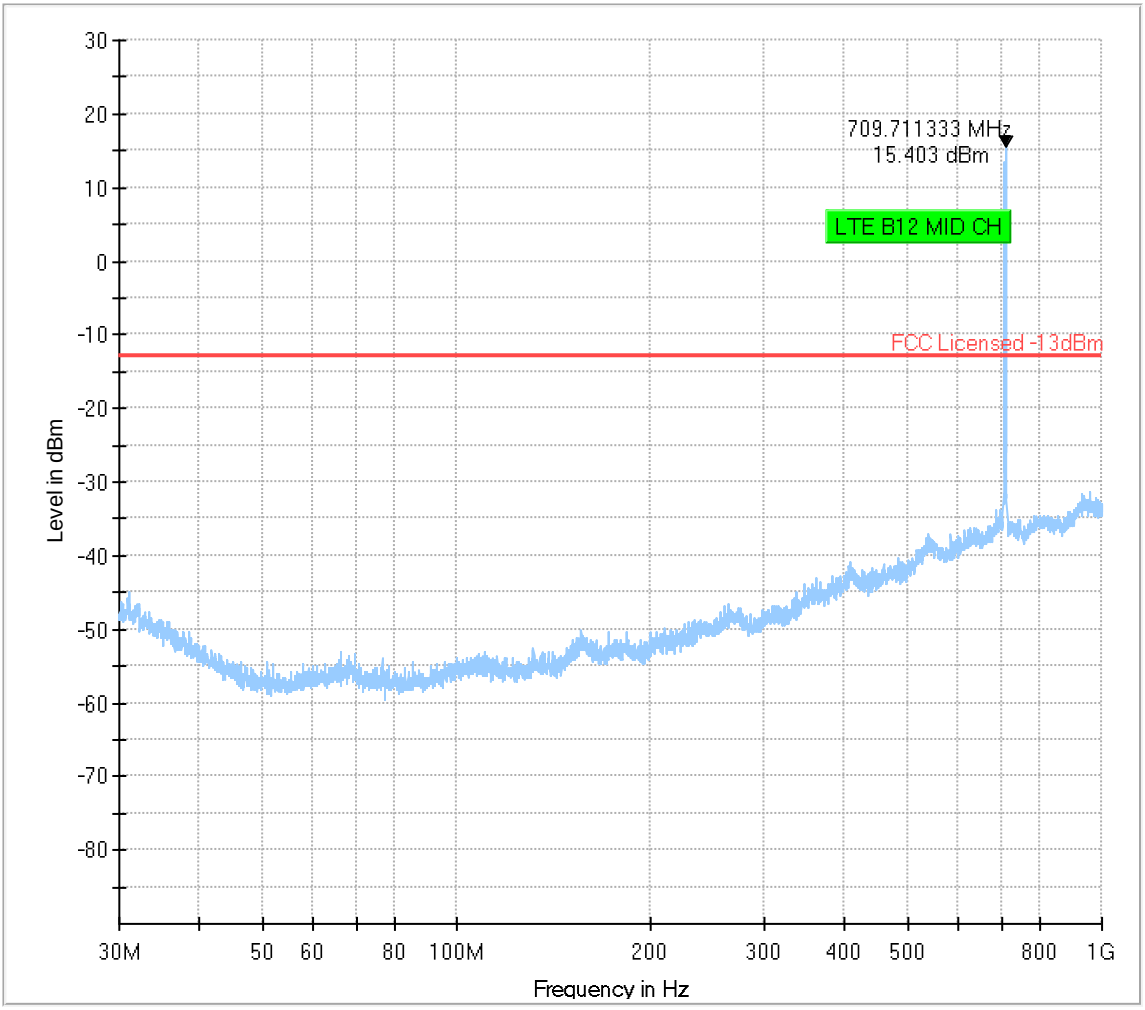
Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
5860.625	-49.99	---	-13.00	36.99	500.0	1000.0	149.0	V	304.0	-97.7



Plot #25 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid

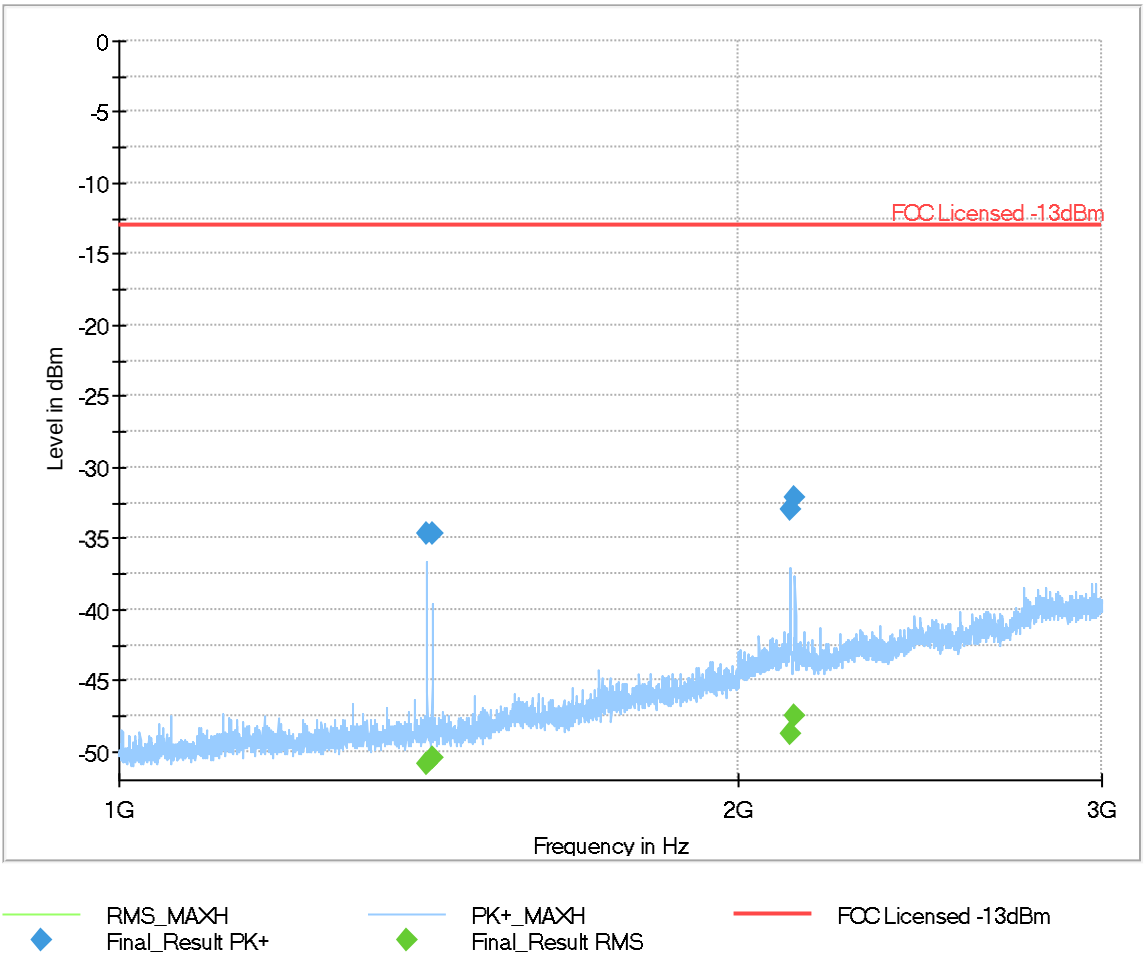


Plot #26 Radiated Emissions: 1-3 GHz

Channel: Mid

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1411.000	-34.63	---	-13.00	21.63	500.0	1000.0	214.0	H	311.0	-66.4
1411.000	---	-50.82	---	---	500.0	1000.0	214.0	H	311.0	-66.4
1419.500	---	-50.46	---	---	500.0	1000.0	100.0	H	214.0	-66.4
1419.500	-34.63	---	-13.00	21.63	500.0	1000.0	100.0	H	214.0	-66.4
2116.500	---	-48.81	---	---	500.0	1000.0	140.0	H	69.0	-63.2
2116.500	-32.92	---	-13.00	19.92	500.0	1000.0	140.0	H	69.0	-63.2
2129.000	-32.07	---	-13.00	19.07	500.0	1000.0	129.0	H	68.0	-63.3
2129.000	---	-47.49	---	---	500.0	1000.0	129.0	H	68.0	-63.3

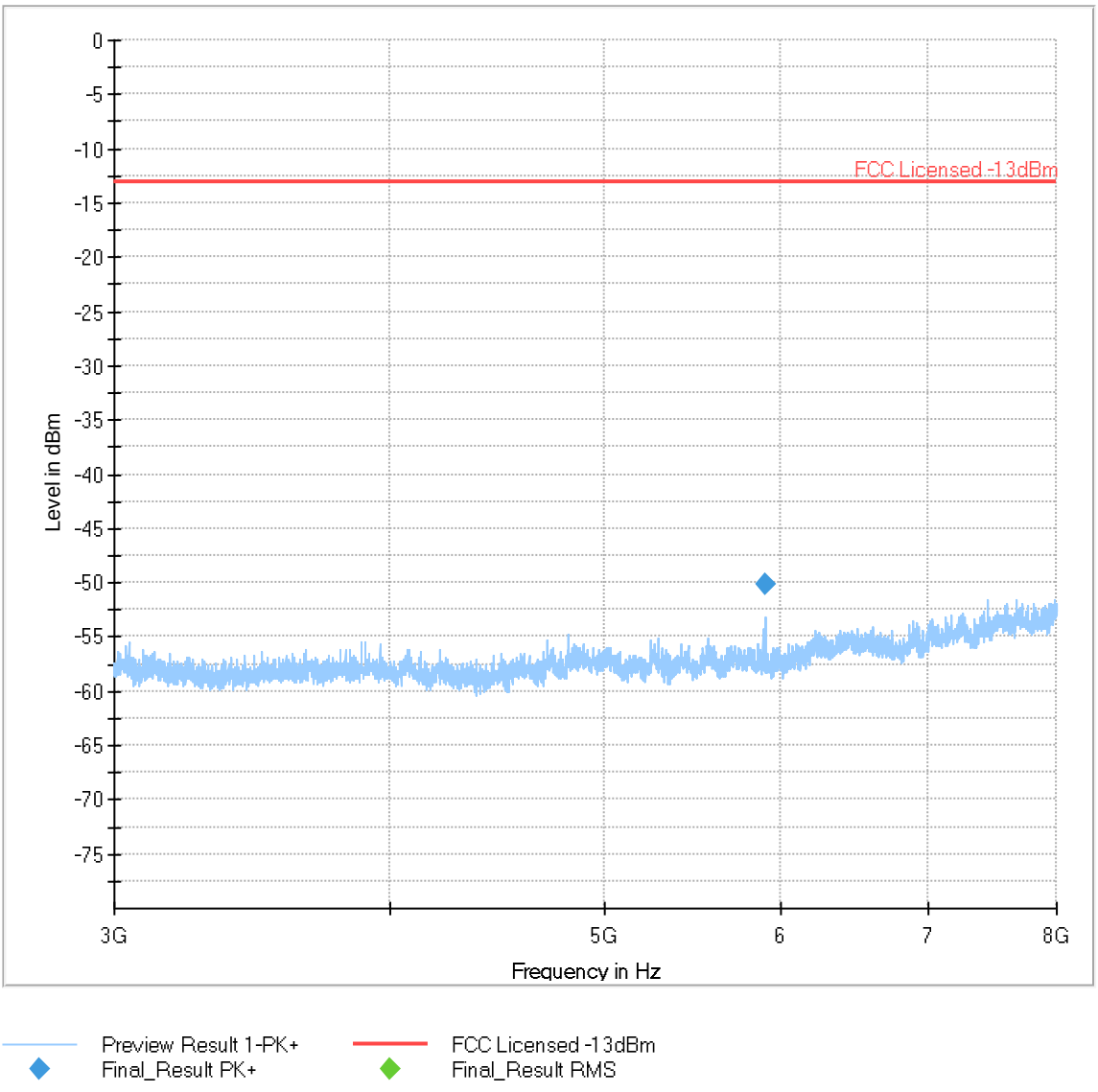


Plot #27 Radiated Emissions: 3-8 GHz

Channel: Mid

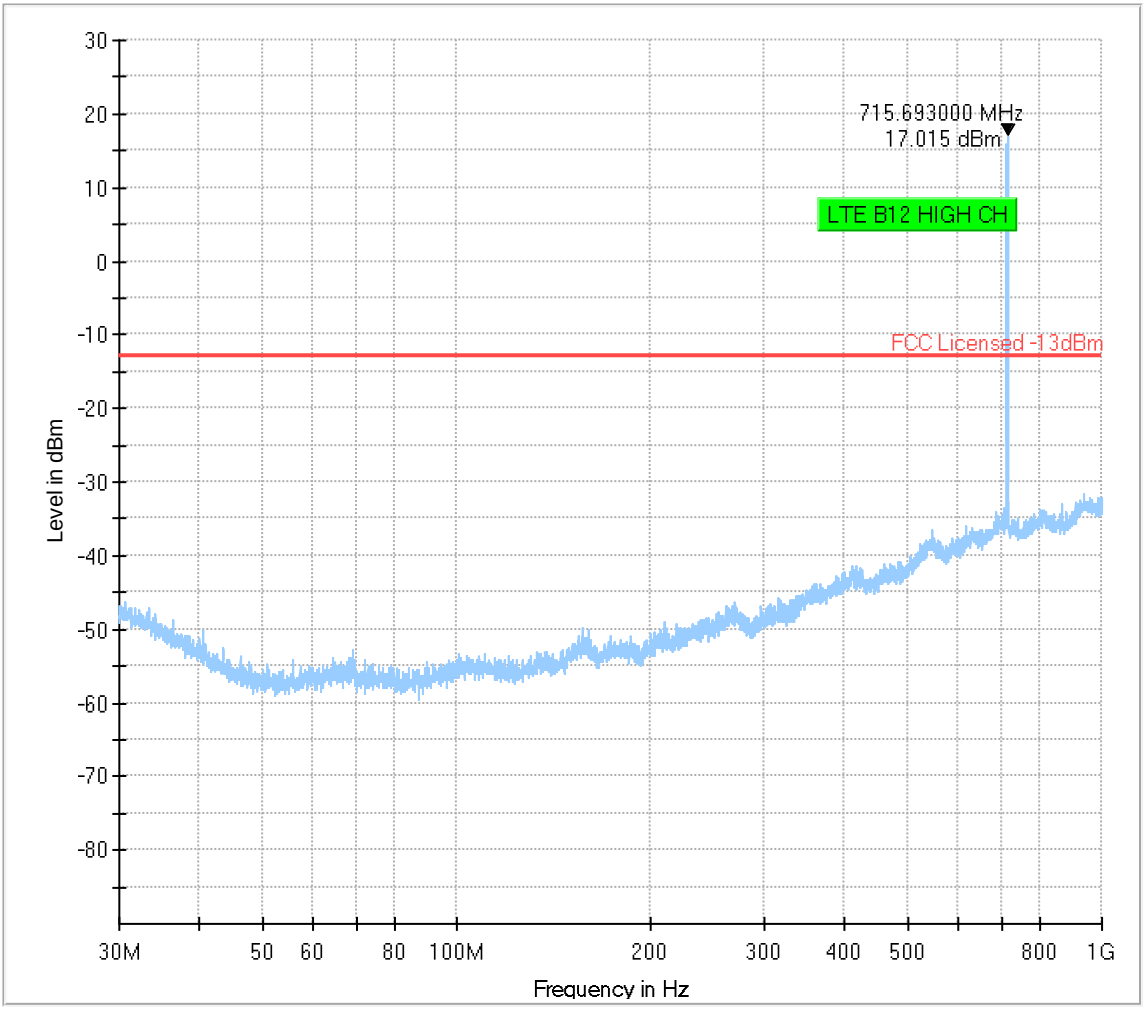
Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
5908.750	-50.22	---	-13.00	37.22	500.0	1000.0	117.0	V	297.0	-98.0



Plot #28 Radiated Emissions: 30 MHz – 1 GHz

Channel: High

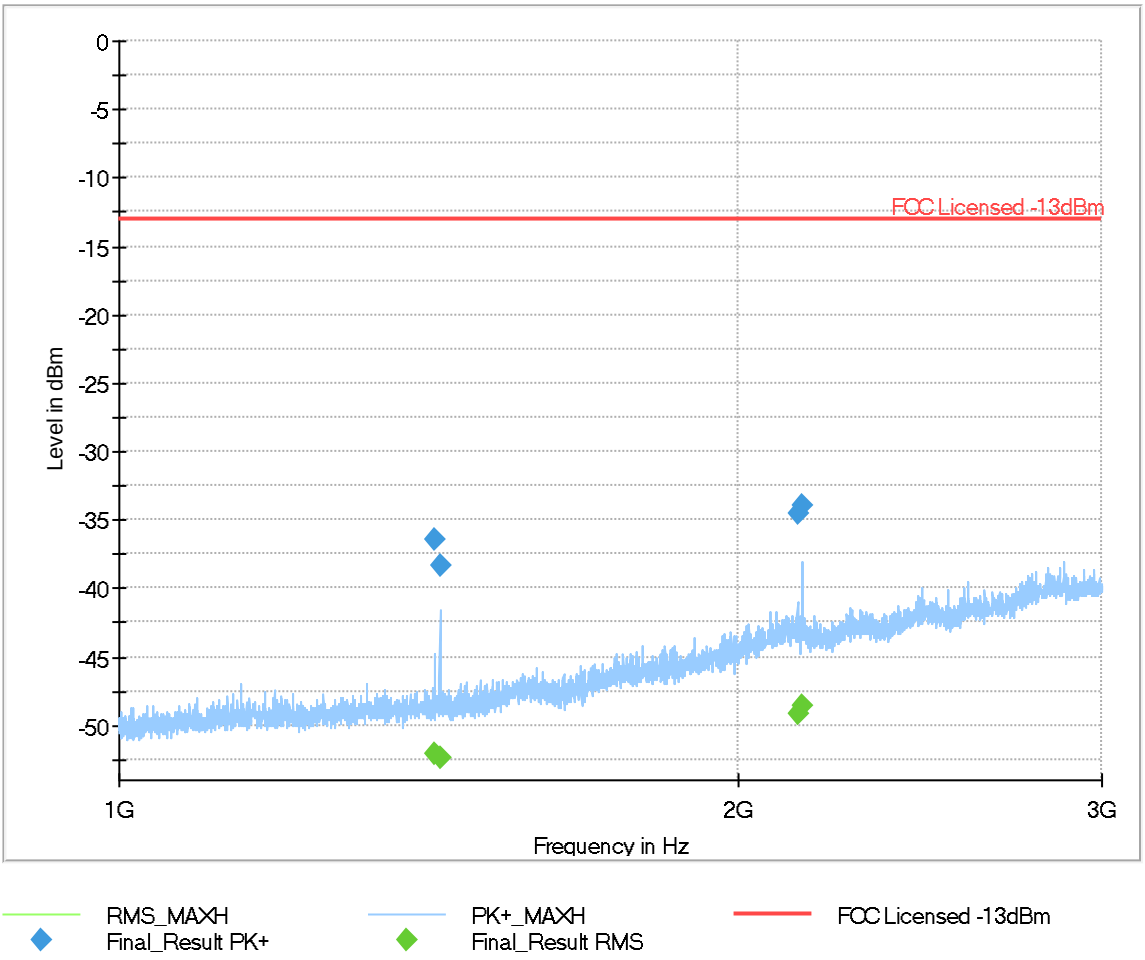


Plot #29 Radiated Emissions: 1-3 GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1423.000	---	-52.12	---	---	500.0	1000.0	140.0	H	216.0	-66.3
1423.000	-36.37	---	-13.00	23.37	500.0	1000.0	140.0	H	216.0	-66.3
1431.250	-38.31	---	-13.00	25.31	500.0	1000.0	215.0	H	309.0	-66.3
1431.250	---	-52.33	---	---	500.0	1000.0	215.0	H	309.0	-66.3
2134.500	---	-49.14	---	---	500.0	1000.0	327.0	H	74.0	-63.3
2134.500	-34.52	---	-13.00	21.52	500.0	1000.0	327.0	H	74.0	-63.3
2147.000	-33.96	---	-13.00	20.96	500.0	1000.0	256.0	H	91.0	-63.3
2147.000	---	-48.57	---	---	500.0	1000.0	256.0	H	91.0	-63.3

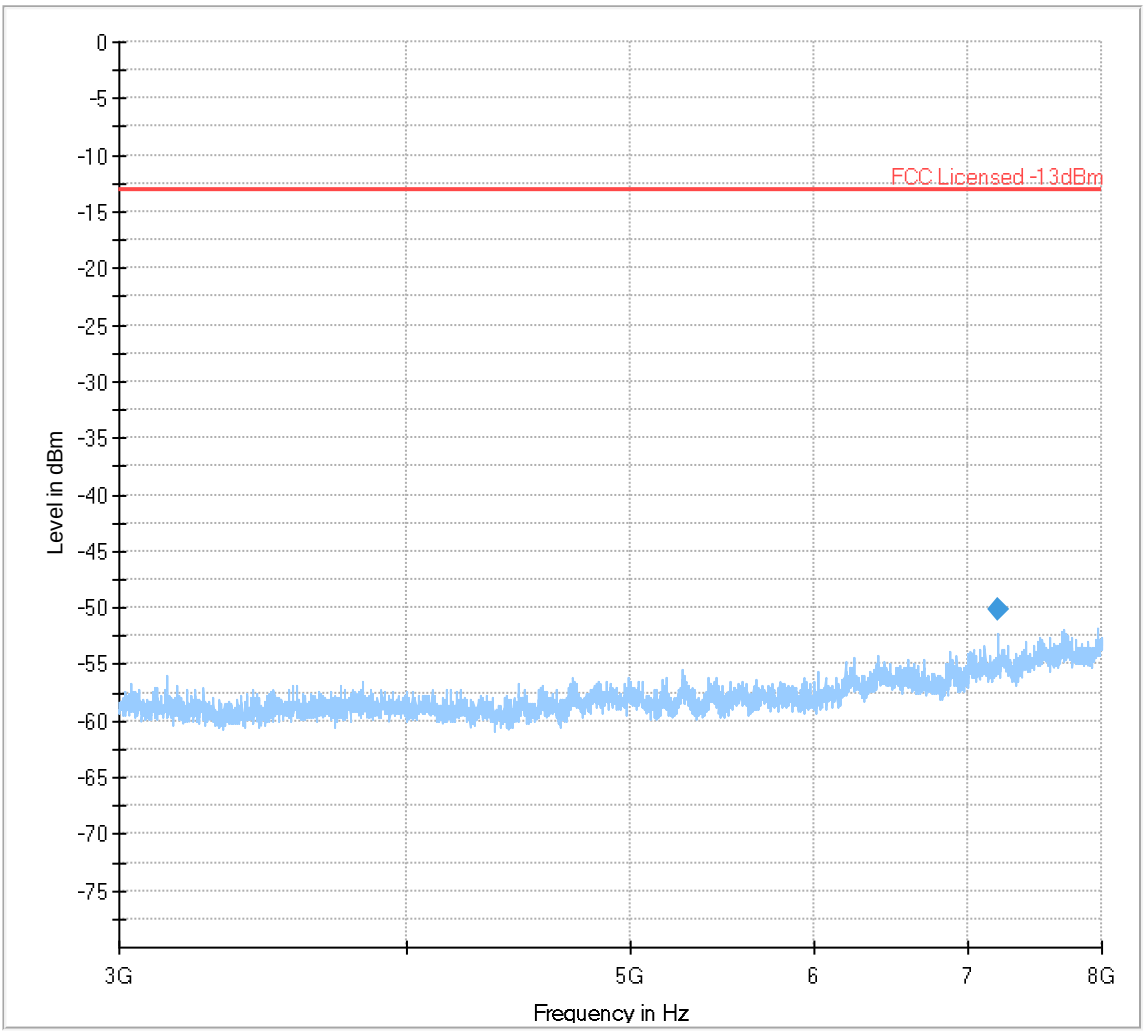


Plot #30 Radiated Emissions: 3-8 GHz

Channel: High

Final_Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
7217.031	-50.11	---	-13.00	37.11	500.0	1000.0	107.0	V	-16.0	-94.0



9 Test setup photos

Setup photos are included in supporting file name: "EMC_COMPO_028_24001_FCC_24_27_Setup_Photos"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
BILOG ANTENNA	ETS.LINDGREN	3142E	00166067	3 Years	08/01/2024
HORN ANTENNA	EMCO	3115	00035114	3 Years	09/13/2023
HORN ANTENNA	ETS.LINDGREN	3117	00215984	3 Years	10/26/2023
HORN ANTENNA	ETS LINDGREN	3116C-PA	00166821	3 Years	10/26/2023
TEST RECEIVER	R&S	ESU40	100251	3 Years	10/26/2023
TEST RECEIVER	R&S	ESW44	103143	2 Years	09/12/2024
DIGITAL THERMOMETER	CONTROL COMPANY	4410,90080-03	230713059	3 Years	10/18/2023
Multimeter	Fluke	115	56090717MV	3 Years	09/26/2023
Software	EMC32	Version 11.40.00	-	-	-

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	Prepared by
10/7/2024	EMC_COMPO_028_24001_FCC_24_27	Initial Version	Art Thammanavarat

<<< The End >>>