FCC / ISED & Test Report

For:

Magnetti Marelli

Model Name:

FTM

Product Description:

Fleet Telematics Module

Applied Rules and Standards:

47 CFR Parts 22, 24, and 27
RSS: 132 Issue 3, 133 Issue 6, 139 Issue 3

FCC ID: RX2FTM
IC ID: 4983A-FTM

REPORT #: EMC_MAGNE_004_FCC_22_24_27
DATE: 2018-05-23

A2LA Accredited

IC recognized # 3462B-1

***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 22, 24 and 27, and Industry Canada Standards RSS-GEN issue 5, RSS-132 issue 3, RSS-133 issue 6 and RSS-139 issue 3.

No deficiencies were ascertained.

Company Name	Product Description	Model #
Magneti Marelli	Fleet Telematics Module	FTM

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2018-05-23	Compliance	James Donnellan (Lab Manager - EMC)	James Donnellan

Responsible for the Report:

Date	Section	Name	Signature
2018-05-23	Compliance	Kevin Wang (Senior EMC Engineer)	Kevin Wang Digitally signed by Kevin Wang DN: cn=Kevin Wang, o=CETECOM Inc., ou=EMC, email=Kevin.Wang@cetecom.com, c=US Date: 2018.05.30 17:20:55 -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
Compliance Manager:	James Donnellan
Responsible Project Leader:	Kevin Wang

2.2 Identification of the Client

Applicant's Name:	Magnetti Marelli
Street Address:	900 North Squirrel Road, Suite 205
City/Zip Code	Auburn Hills (MI) /48326
Country	USA

2.3 Identification of the Manufacturer

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

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No	FTM
HW Version	Serie
SW Version	5.0
FCC-ID	RX2FTM
IC-ID:	4983A-FTM
HVIN:	FTM
PMN:	Fleet Telematics Module
Product Description	Fleet Telematics Module
Transceiver Technology / Type(s) of Modulation	Telit LE910 NA1; HW Rev. LE910NA1002T701, SW Rev. 20.00.522 FCC ID: RI7LE910NAV2; IC ID: 5131A-LE910NAV2 •FDD II / FDD V •FDD LTE 2 / FDD LTE 4 / FDD LTE 5 / FDD LTE 12 / FDD LTE 13
Frequency Range	FDD II: 1850 – 1910; FDD V: 824 – 849; LTE Band 2: 1850 – 1910; LTE Band 4: 1710 – 1755; LTE Band 5: 824 - 849; LTE Band 12: 699 – 716; LTE Band 13: 777 – 787;
Max. declared antenna gain	Max gain: 3dBi
Power Supply/ Rated Operating Voltage Range	9V (Low) / 12V (Nominal) / 16V (Max), DC
Operating Temperature Range	–40°C ~ +85°C
Sample Revision	☐Prototype ☐Production ■ Pre-Production

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	356961076171522	Serie	5.0	This unit is only used for LTE testing
2	356961076213696	Serie	5.0	This unit is only used for UMTS testing

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	DC Power Supply	3003B	Protek	H012772

3.4 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT#1+AE#1	Radiated Measurements for LTE testing, and the EUT is powered by the 12VDC power supply.
2	EUT#2+AE#1	Radiated Measurements for UMTS testing, and the EUT is powered by the 12VDC power supply

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 22, 24, 27 and ISED Standards RSS-132 issue 3, RSS-133 issue 6, and RSS-139 issue 3.

4.1 Dates of Testing:

04/30/2018 - 05/02/2018

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)

Conducted measurement

150 kHz to 30 MHz	±0.7 dB (LISN)
RF conducted measurement	±0.5 dB

4.3 Environmental Conditions during Testing:

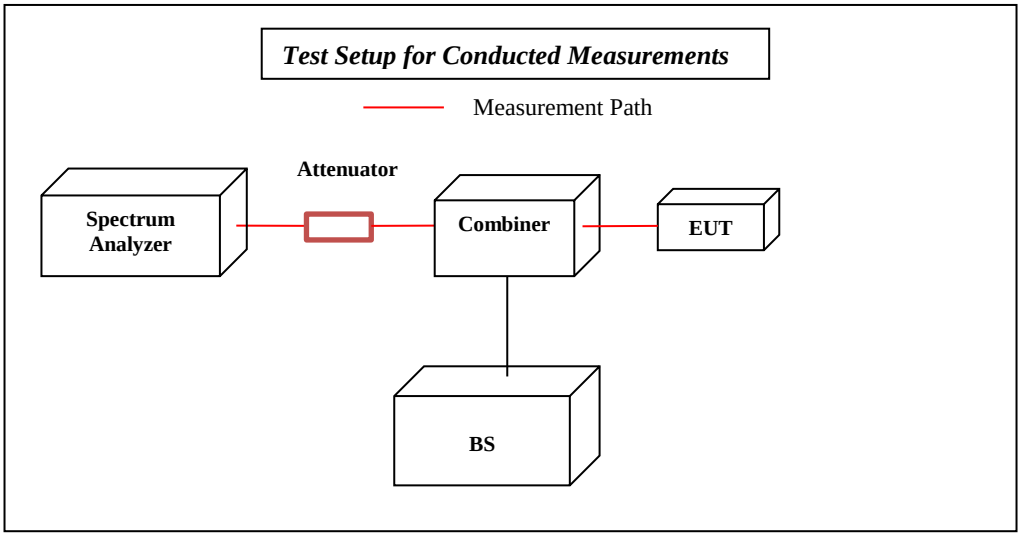
The following environmental conditions were maintained during the course of testing:

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

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

5 Measurement Procedures

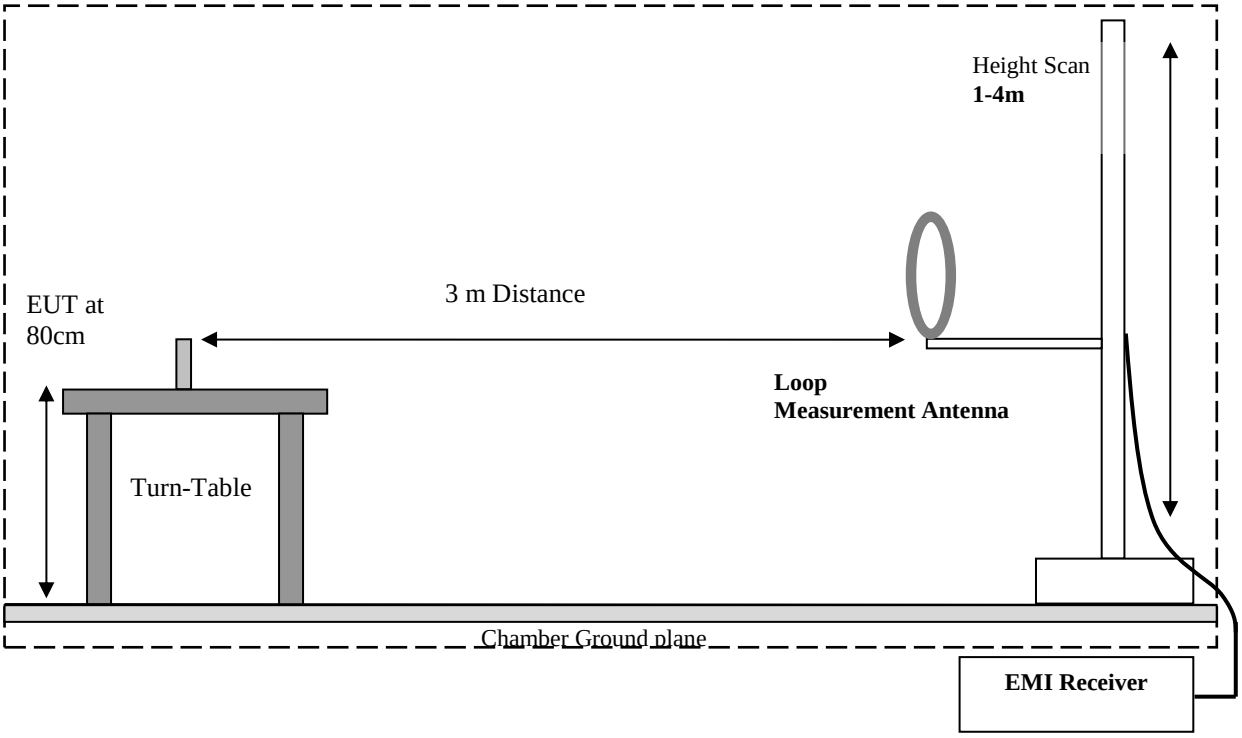
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



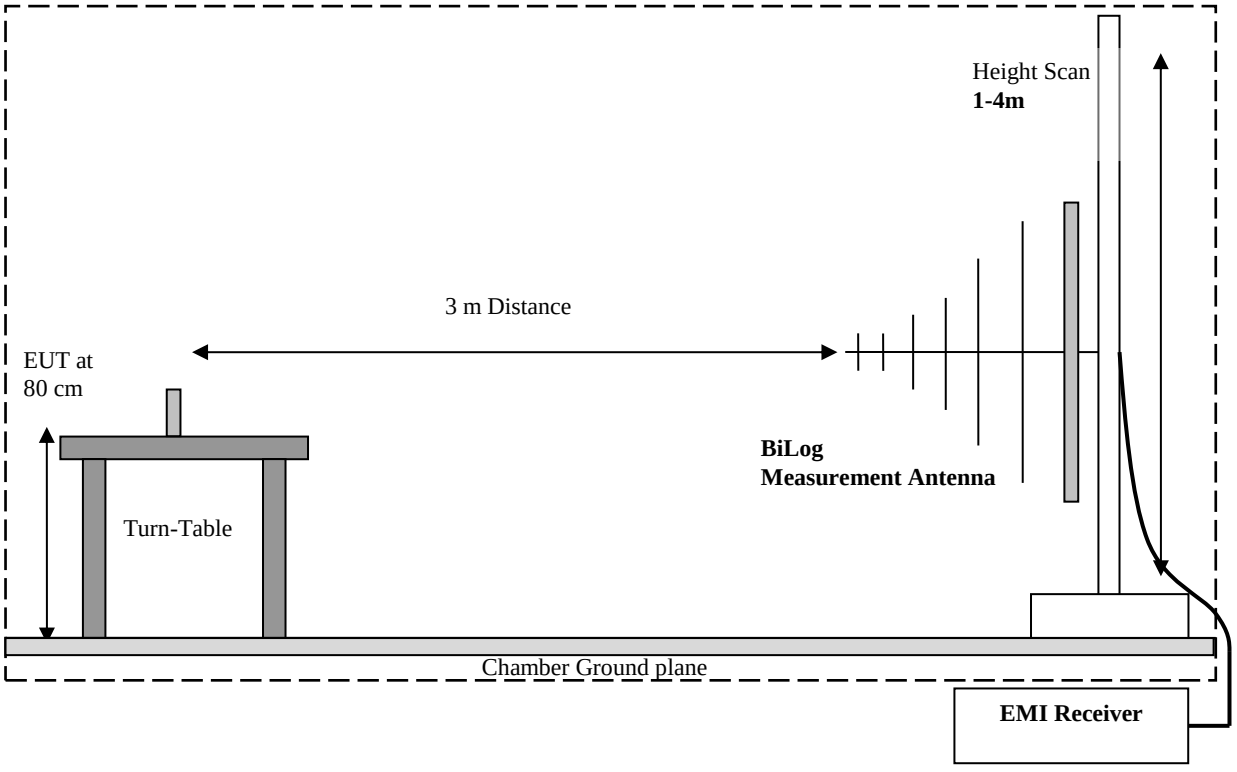
5.1 Radiated Measurement

- 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.

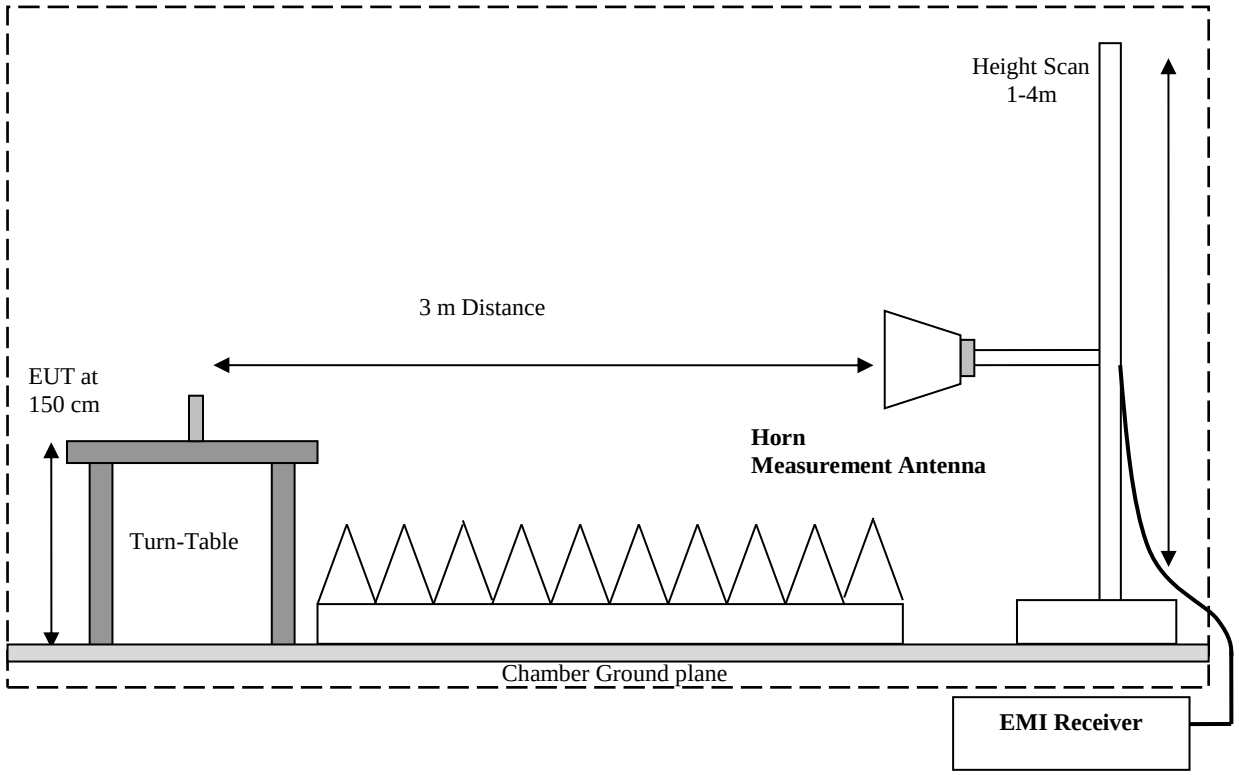
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



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 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

6 Measurement Results Summary

6.1 Part 22 / RSS-132

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §22.913 (a)	RF Output Power	Nominal	FDD V and LTE Band 5	☐	☐	☐	■	Note 2
§2.1055; §22.355	Frequency Tolerance	Extreme Temperature and Voltage	FDD V and LTE Band 5	☐	☐	☐	■	Note 2
§2.1049; §22.917	Occupied Bandwidth	Nominal	FDD V and LTE Band 5	☐	☐	☐	■	Note 2
§2.1051; §22.917	Band Edge Compliance	Nominal	FDD V and LTE Band 5	☐	☐	☐	■	Note 2
§2.1051; §22.917	Conducted Spurious Emissions	Nominal	FDD V and LTE Band 5	☐	☐	☐	■	Note 3
§2.1053; §22.917	Radiated Spurious Emissions	Nominal	FDD V and LTE Band 5	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval, FCC ID: RI7LE910NAV2; IC ID: 5131A-LE910NAV2.
Note 3: Spurious emissions were evaluated with radiated measurement.

6.2 Part 24 / RSS-133

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a)	RF Output Power	Nominal	FDD II and LTE Band 2	☐	☐	☐	■	Note 2
§2.1055; §24.235	Frequency Stability	Extreme Temperature and Voltage	FDD II and LTE Band 2	☐	☐	☐	■	Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	FDD II and LTE Band 2	☐	☐	☐	■	Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	FDD II and LTE Band 2	☐	☐	☐	■	Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	FDD II and LTE Band 2	☐	☐	☐	■	Note 3
§2.1053; §24.238	Radiated Spurious Emissions	Nominal	FDD II and LTE Band 2	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval, FCC ID: RI7LE910NAV2; IC ID: 5131A-LE910NAV2.
Note 3: Spurious emissions were evaluated with radiated measurement.

6.3 FCC 27 / RSS-139

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50	RF Output Power	Nominal	LTE Band 4, 12 and 13	☐	☐	☐	■	Note 2
§2.1055; §27.54	Frequency Stability	Extreme Temperature and Voltage	LTE Band 4, 12 and 13	☐	☐	☐	■	Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	LTE Band 4, 12 and 13	☐	☐	☐	■	Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	LTE Band 4, 12 and 13	☐	☐	☐	■	Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	LTE Band 4, 12 and 13	☐	☐	☐	■	Note 3
§2.1053; §27.53	Radiated Spurious Emissions	Nominal	LTE Band 4, 12 and 13	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval, FCC ID: RI7LE910NAV2; IC ID: 5131A-LE910NAV2.
Note 3: Spurious emissions were evaluated with radiated measurement.

7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to ANSI/TIA-603-D-2010

Spectrum Analyzer Settings for FCC 22

Frequency Range	30MHz – 1 GHz	1 – 1.58 GHz	1.58 – 9 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto

Spectrum Analyzer Settings for FCC 24

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

7.1.2 Limits:

7.1.2.1 FCC Part 22.917 (a); 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.

7.1.2.2 RSS-132 Part 5.5; RSS-133 Part 6.5; RSS-139 Part 6.6 Transmitter Unwanted Emissions

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 Section 5.1, 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 log10p (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.

Note: The limit calculation result is a constant of -13 dBm.

7.1.3 Test conditions and setup:

Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	LTE Band 2, 4, 5, 12 and 13	12VDC
22	2	FDD II and V	12VDC

7.1.4 Measurement result:

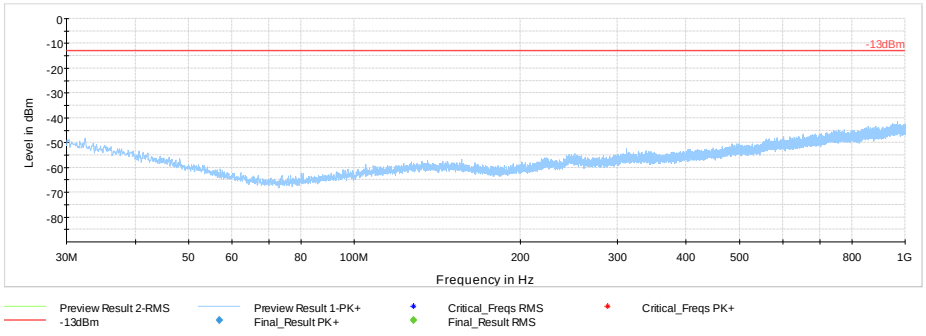
Plot #	Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1-3	Low	FDD II	30 MHz – 18 GHz	-13	Pass
4-8	Mid	FDD II	9 kHz – 26 GHz	-13	Pass
9-11	High	FDD II	30 MHz – 18 GHz	-13	Pass
12-14	Low	FDD V	30 MHz – 18 GHz	-13	Pass
15-18	Mid	FDD V	9 kHz – 18 GHz	-13	Pass
19-21	High	FDD V	30 MHz – 18 GHz	-13	Pass
22-24	Low	LTE Band 2	30 MHz – 18 GHz	-13	Pass
25-29	Mid	LTE Band 2	9 kHz – 26 GHz	-13	Pass
30-32	High	LTE Band 2	30 MHz – 18 GHz	-13	Pass
33-35	Low	LTE Band 4	30 MHz – 18 GHz	-13	Pass
36-40	Mid	LTE Band 4	9 kHz – 26 GHz	-13	Pass
41-43	High	LTE Band 4	30 MHz – 18 GHz	-13	Pass
44-46	Low	LTE Band 5	30 MHz – 18 GHz	-13	Pass
47-50	Mid	LTE Band 5	9 kHz – 18 GHz	-13	Pass
51-53	High	LTE Band 5	30 MHz – 18 GHz	-13	Pass
54-56	Low	LTE Band 12	30 MHz – 18 GHz	-13	Pass
57-60	Mid	LTE Band 12	9 kHz – 18 GHz	-13	Pass
61-63	High	LTE Band 12	30 MHz – 18 GHz	-13	Pass
64-67	Mid	LTE Band 13	30 MHz – 18 GHz	-13	Pass

7.1.5 Measurement Plots:

7.1.6 FDD II

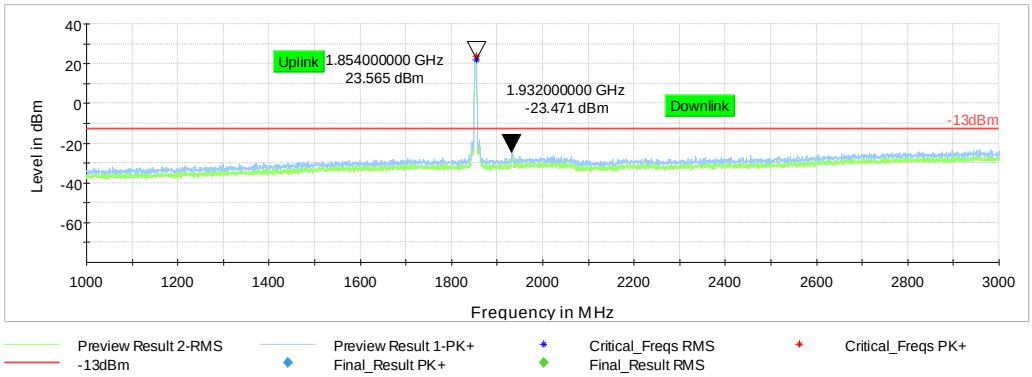
Plot #1 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot # 2 Radiated Emissions: 1-3 GHz

Channel: Low

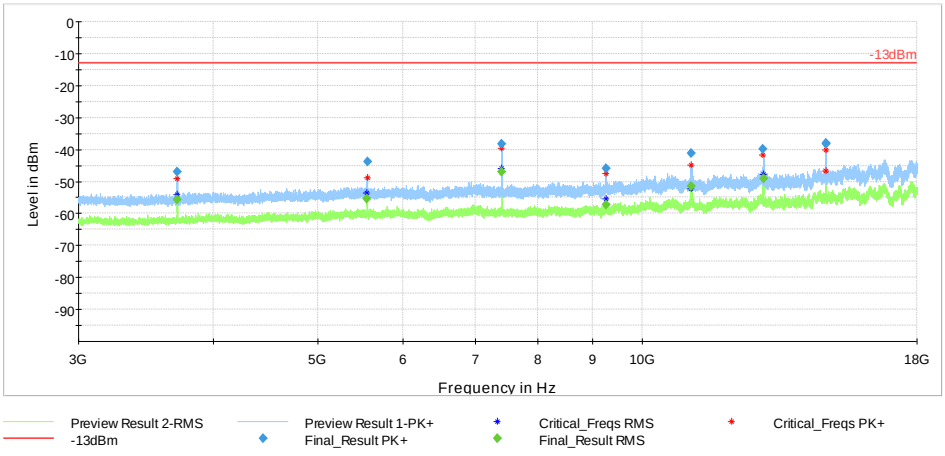


Plot # 3 Radiated Emissions: 3-18 GHz

Channel: Low

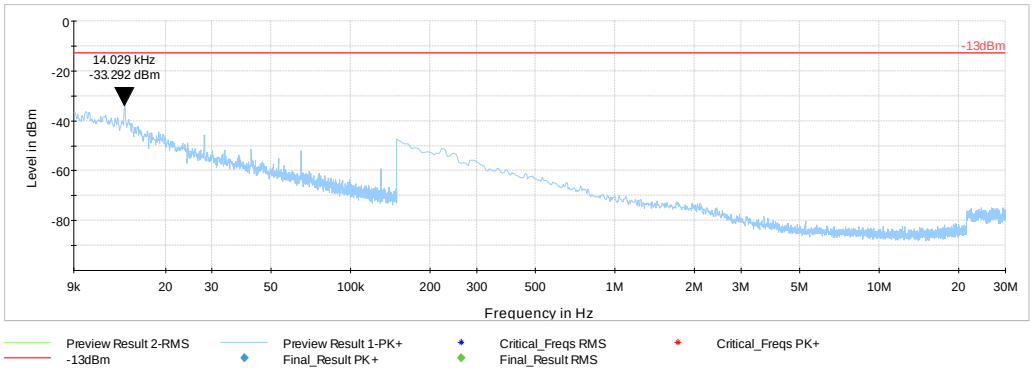
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3702.430667	-47.01	---	-13.00	34.01	200.0	1000.000	275.0	H	133.0	-
3702.930000	---	-55.80	---	---	200.0	1000.000	149.0	H	89.0	-
5553.988000	---	-55.34	---	---	200.0	1000.000	269.0	V	217.0	-
5561.140000	-43.68	---	-13.00	30.68	200.0	1000.000	237.0	V	49.0	-
7412.478667	---	-46.95	---	---	200.0	1000.000	197.0	V	229.0	-
7414.437333	-38.21	---	-13.00	25.21	200.0	1000.000	172.0	V	229.0	-
9255.821333	-45.79	---	-13.00	32.79	200.0	1000.000	275.0	V	208.0	-
9256.171333	---	-57.32	---	---	200.0	1000.000	253.0	V	229.0	-
11108.41133	-41.03	---	-13.00	28.03	200.0	1000.000	263.0	V	277.0	-
11108.71666	---	-51.32	---	---	200.0	1000.000	263.0	V	276.0	-
12957.73333	-39.84	---	-13.00	26.84	200.0	1000.000	165.0	V	276.0	-
12963.58933	---	-49.17	---	---	200.0	1000.000	258.0	V	274.0	-
14808.54866	-37.93	---	-13.00	24.93	200.0	1000.000	165.0	V	254.0	-
14818.11533	-38.39	---	-13.00	25.39	200.0	1000.000	206.0	V	257.0	-
3702.430667	-47.01	---	-13.00	34.01	200.0	1000.000	275.0	H	133.0	-
3702.930000	---	-55.80	---	---	200.0	1000.000	149.0	H	89.0	-



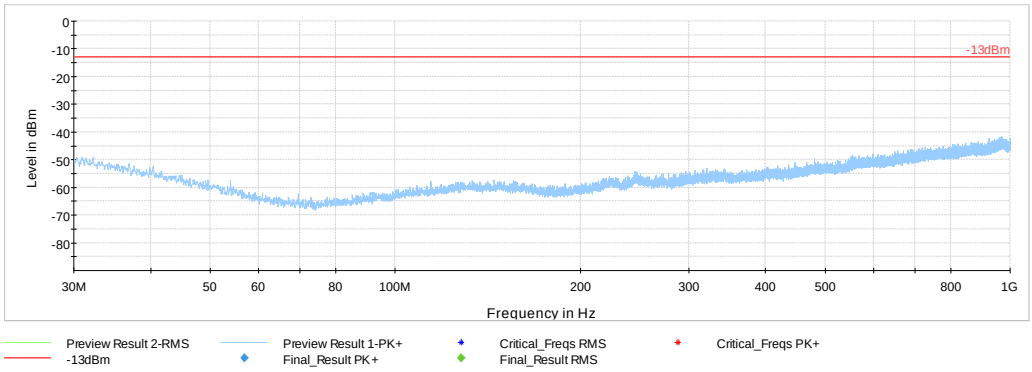
Plot #4 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



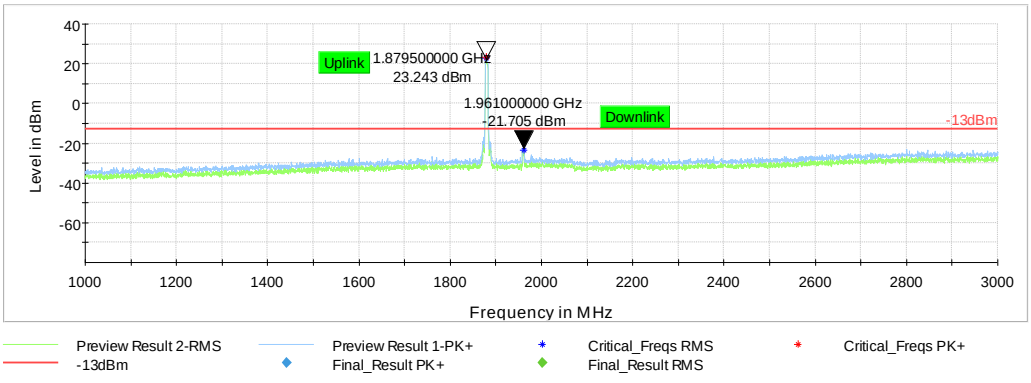
Plot #5 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 6 Radiated Emissions: 1-3 GHz

Channel: Mid

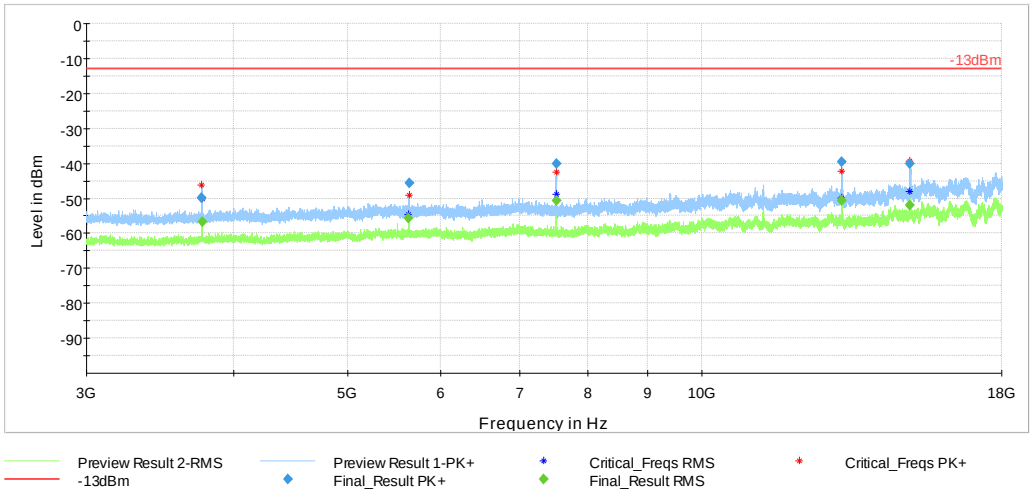


Plot # 7 Radiated Emissions: 3-18 GHz

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)
3757.518667	-49.80	---	-13.00	36.80	200.0	1000.000	251.0	H	102.0	-
3762.285333	---	-56.68	---	---	200.0	1000.000	141.0	H	29.0	-
5637.847333	---	-55.70	---	---	200.0	1000.000	195.0	V	47.0	-
5643.597333	-45.65	---	-13.00	32.65	200.0	1000.000	189.0	V	40.0	-
7524.695333	-40.12	---	-13.00	27.12	200.0	1000.000	175.0	V	231.0	-
7525.044667	---	-50.62	---	---	200.0	1000.000	177.0	V	227.0	-
13163.61266	---	-50.62	---	---	200.0	1000.000	181.0	V	266.0	-
13167.57400	-39.58	---	-13.00	26.58	200.0	1000.000	164.0	V	27.0	-
15033.48733	---	-51.96	---	---	200.0	1000.000	142.0	V	259.0	-
15040.80933	-40.00	---	-13.00	27.00	200.0	1000.000	150.0	V	259.0	-
3757.518667	-49.80	---	-13.00	36.80	200.0	1000.000	251.0	H	102.0	-
3762.285333	---	-56.68	---	---	200.0	1000.000	141.0	H	29.0	-

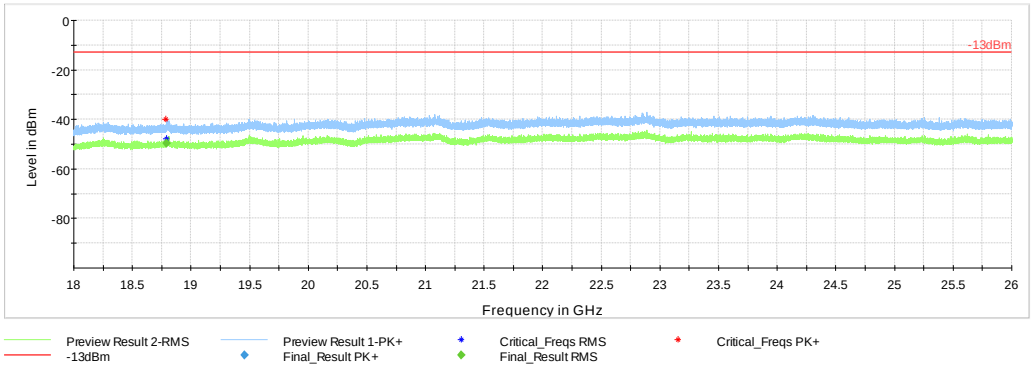


Plot # 8 Radiated Emissions: 18-26 GHz

Channel: Mid

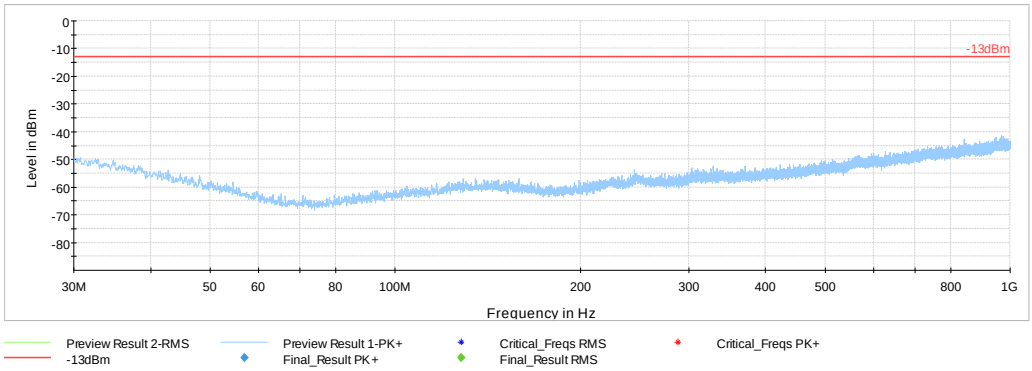
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
18794.21687	---	-49.75	-13.00	36.75	500.0	1000.000	150.0	H	24.0	-86.9



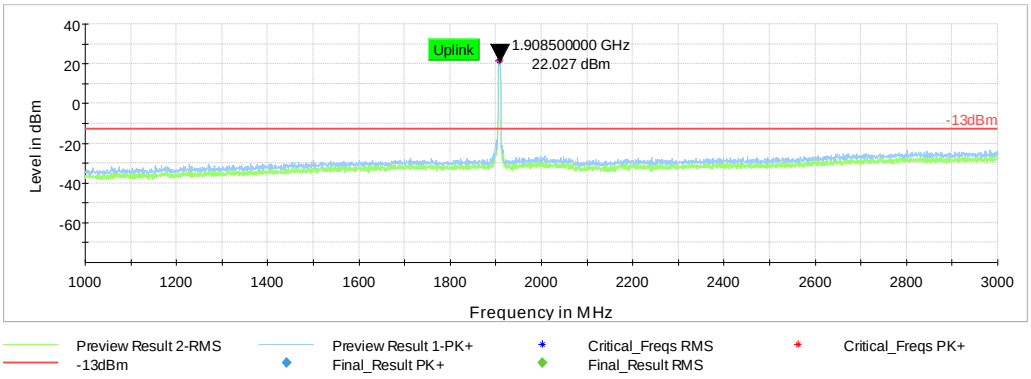
Plot #9 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot # 10 Radiated Emissions: 1-3 GHz

Channel: High

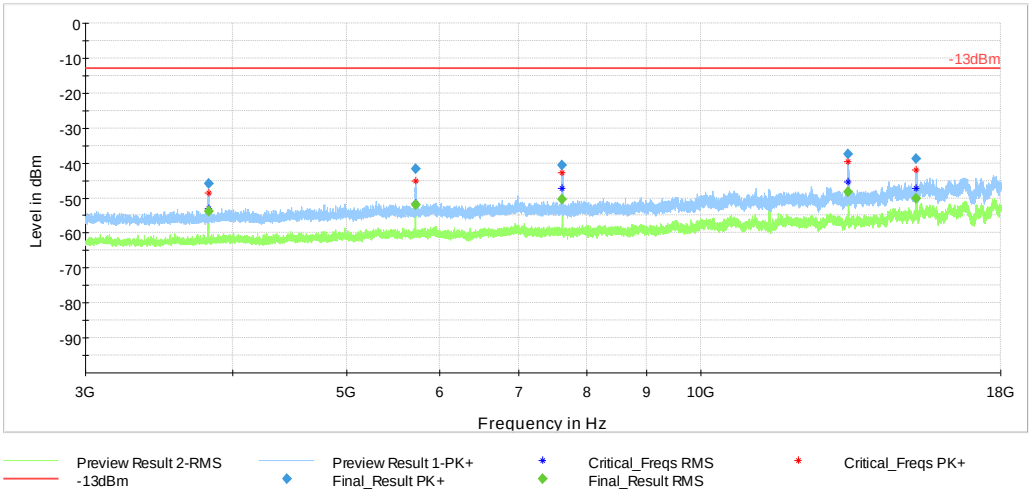


Plot # 11 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

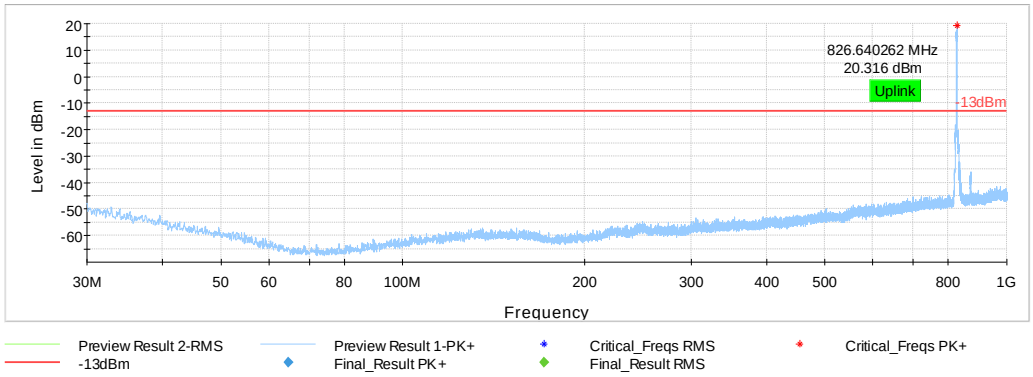
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3816.632000	---	-53.95	---	---	200.0	1000.000	182.0	H	130.0	-
3817.635333	-46.04	---	-13.00	33.04	200.0	1000.000	182.0	H	131.0	-
5726.466000	---	-52.08	---	---	200.0	1000.000	250.0	V	219.0	-
5726.612000	-41.77	---	-13.00	28.77	200.0	1000.000	250.0	V	222.0	-
7625.563333	---	-50.43	---	---	200.0	1000.000	197.0	V	229.0	-
7626.171333	-40.54	---	-13.00	27.54	200.0	1000.000	220.0	V	230.0	-
13343.91266	-37.38	---	-13.00	24.38	200.0	1000.000	165.0	V	272.0	-
13346.50533	---	-48.22	---	---	200.0	1000.000	169.0	V	269.0	-
15252.16800	-38.90	---	-13.00	25.90	200.0	1000.000	205.0	V	259.0	-
15256.91333	---	-50.15	---	---	200.0	1000.000	215.0	V	258.0	-



7.1.7 FDD V

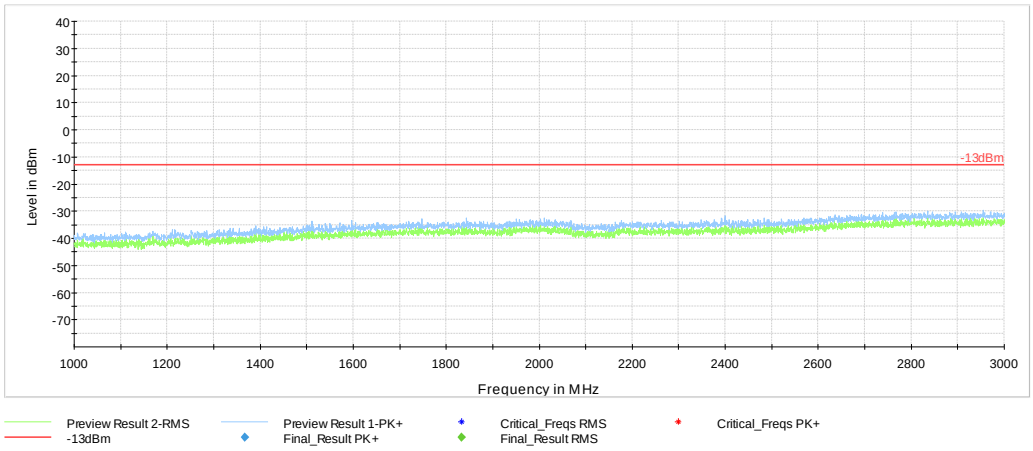
Plot #12 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot #13 Radiated Emissions: 1-3 GHz

Channel: Low

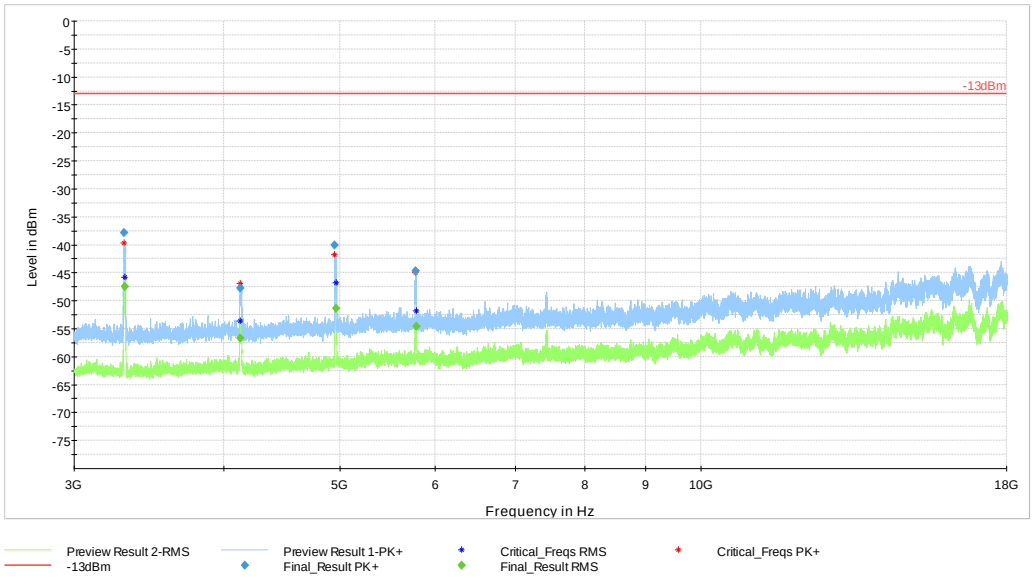


Plot # 14 Radiated Emissions: 3-18 GHz

Channel: Low

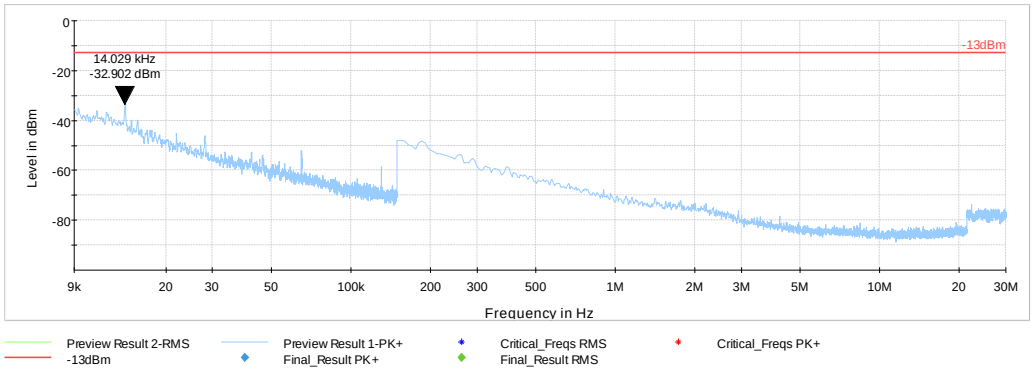
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3301.904667	-37.84	---	-13.00	24.84	500.0	1000.000	144.0	V	234.0	-
3308.462000	---	-47.50	-13.00	34.50	500.0	1000.000	144.0	V	243.0	-
4130.048000	---	-56.65	-13.00	43.65	500.0	1000.000	143.0	V	237.0	-
4130.396667	-47.82	---	-13.00	34.82	500.0	1000.000	143.0	V	300.0	-
4950.455333	-40.12	---	-13.00	27.12	500.0	1000.000	143.0	V	234.0	-
4964.760000	---	-51.37	-13.00	38.37	500.0	1000.000	143.0	V	240.0	-
5781.225333	-44.71	---	-13.00	31.71	500.0	1000.000	142.0	V	231.0	-
5792.074000	---	-54.60	-13.00	41.60	500.0	1000.000	142.0	V	231.0	-



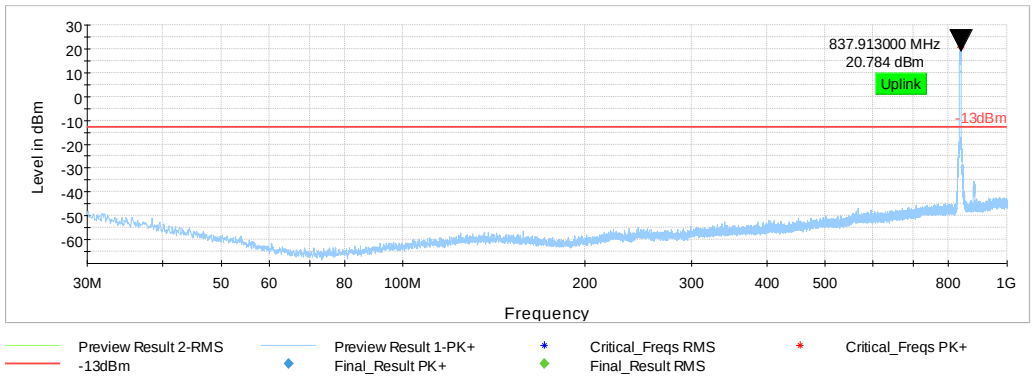
Plot # 15 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



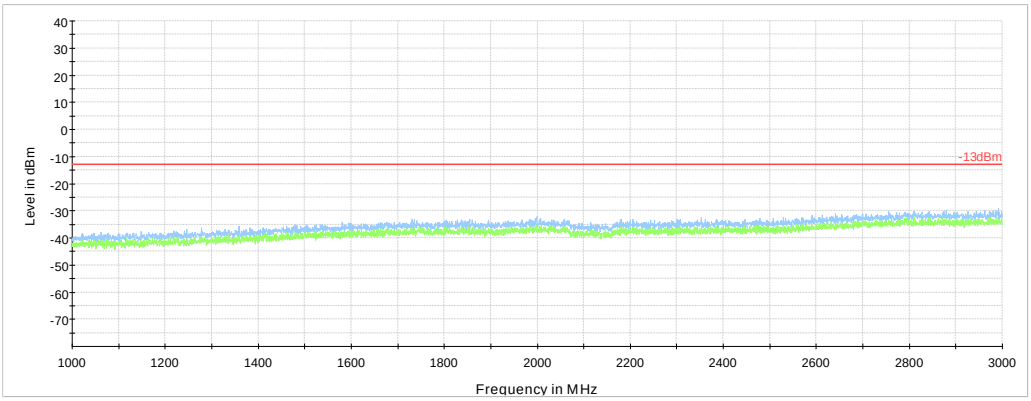
Plot # 16 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 17 Radiated Emissions: 1-3 GHz

Channel: Mid

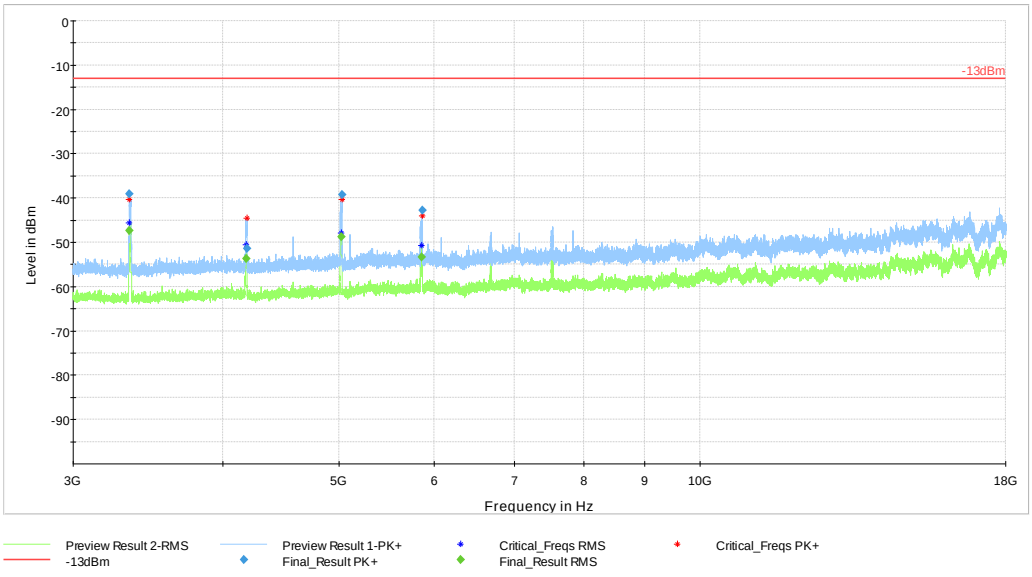


Plot # 18 Radiated Emissions: 3-18 GHz

Channel: Mid

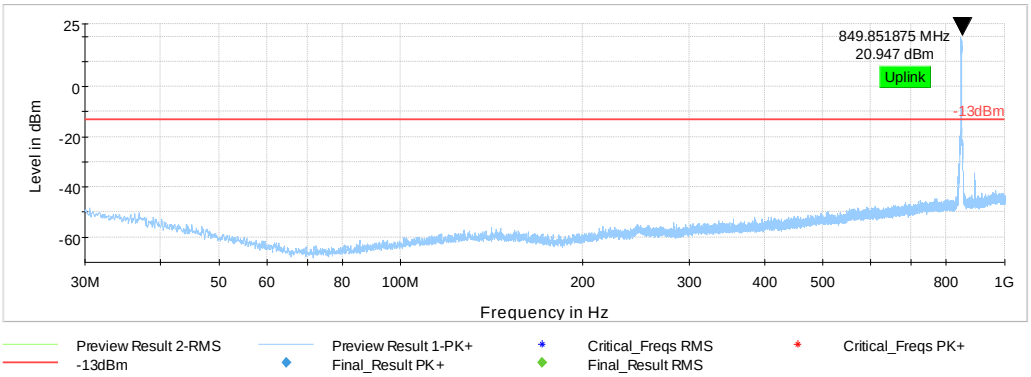
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3342.746000	-39.00	---	-13.00	26.00	500.0	1000.000	142.0	V	231.0	-
3343.472000	---	-47.30	-13.00	34.30	500.0	1000.000	134.0	V	243.0	-
4184.485333	---	-53.69	-13.00	40.69	500.0	1000.000	142.0	V	227.0	-
4189.222667	-51.43	---	-13.00	38.43	500.0	1000.000	132.0	V	332.0	-
5025.796667	---	-48.70	-13.00	35.70	500.0	1000.000	142.0	V	227.0	-
5027.546000	-39.25	---	-13.00	26.25	500.0	1000.000	132.0	V	229.0	-
5863.092667	---	-53.35	-13.00	40.35	500.0	1000.000	132.0	V	226.0	-
5865.330667	-42.81	---	-13.00	29.81	500.0	1000.000	121.0	V	230.0	-



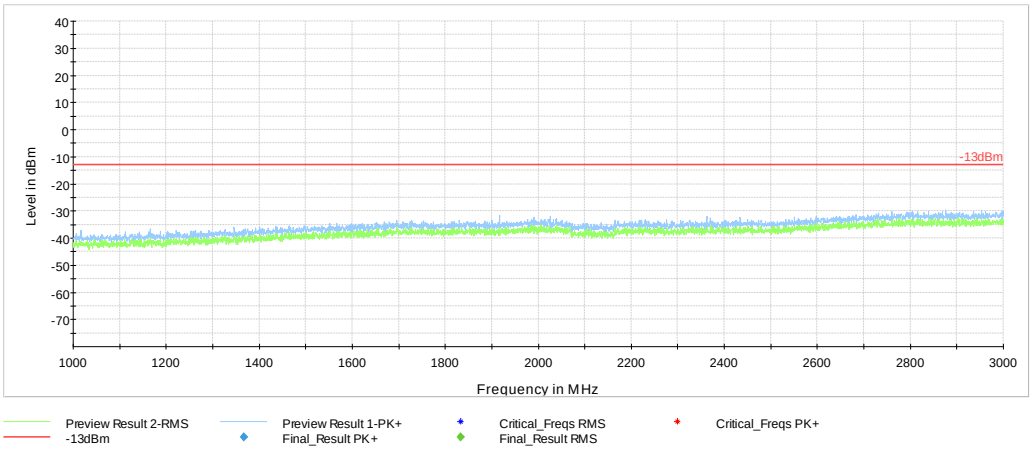
Plot # 19 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot # 20 Radiated Emissions: 1-3 GHz

Channel: High

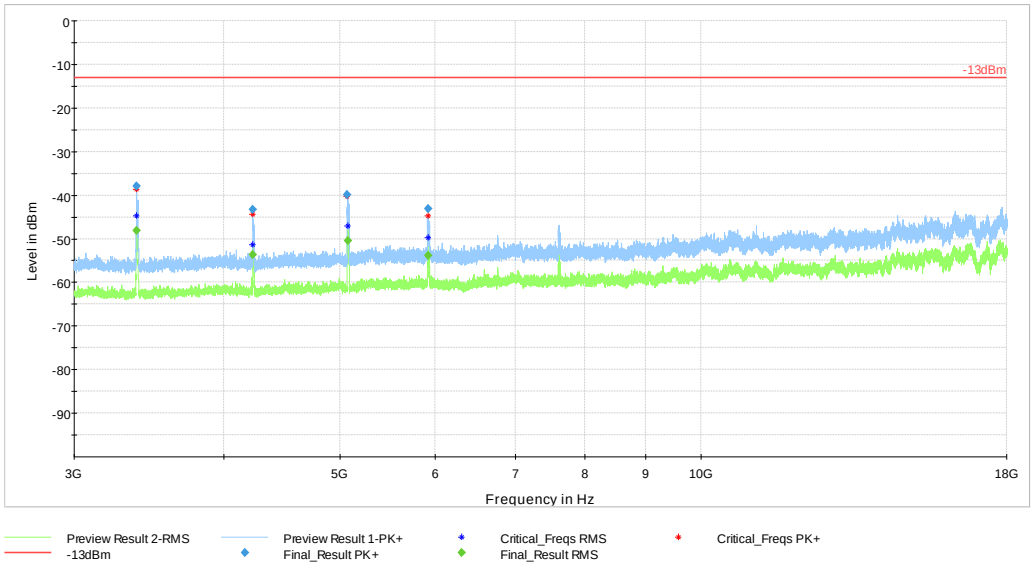


Plot # 21 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

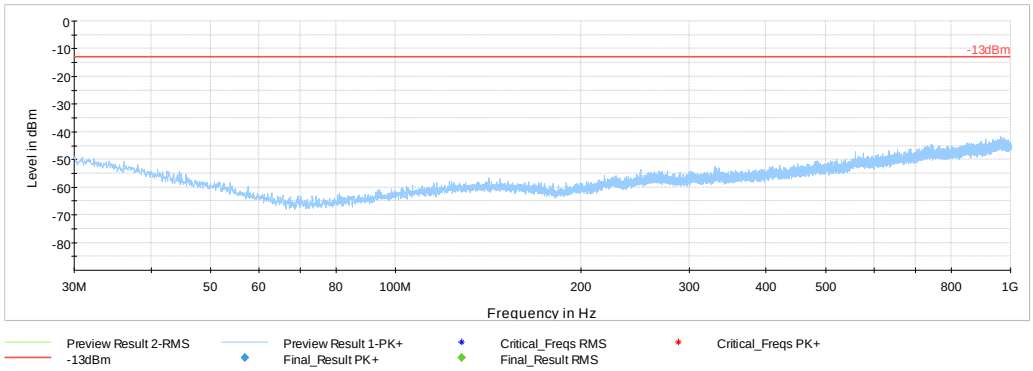
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3381.487333	---	-48.05	-13.00	35.05	500.0	1000.000	131.0	V	226.0	-
3383.018000	-38.00	---	-13.00	25.00	500.0	1000.000	136.0	V	227.0	-
4226.695333	---	-53.65	-13.00	40.65	500.0	1000.000	142.0	V	238.0	-
4227.539333	-43.35	---	-13.00	30.35	500.0	1000.000	135.0	V	233.0	-
5071.696000	-39.89	---	-13.00	26.89	500.0	1000.000	132.0	V	294.0	-
5073.446000	---	-50.45	-13.00	37.45	500.0	1000.000	131.0	V	295.0	-
5919.312000	-43.10	---	-13.00	30.10	500.0	1000.000	120.0	V	294.0	-
5919.328000	---	-53.91	-13.00	40.91	500.0	1000.000	120.0	V	297.0	-



7.1.8 LTE Band 2

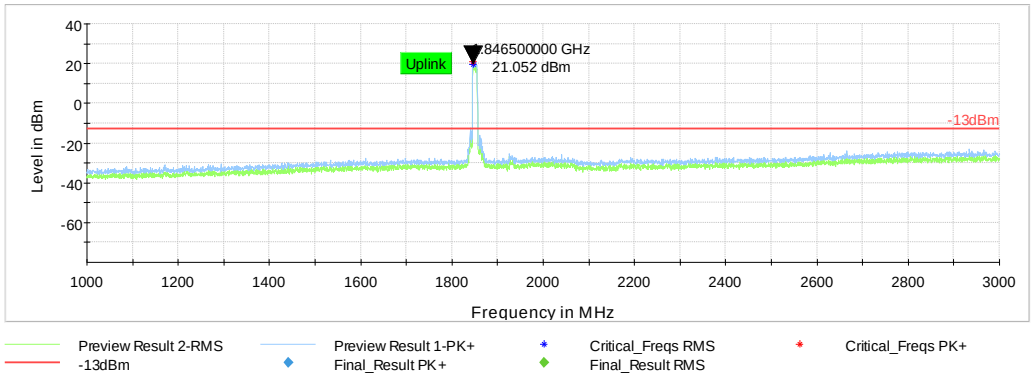
Plot # 22 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot # 23 Radiated Emissions: 1-3 GHz

Channel: Low

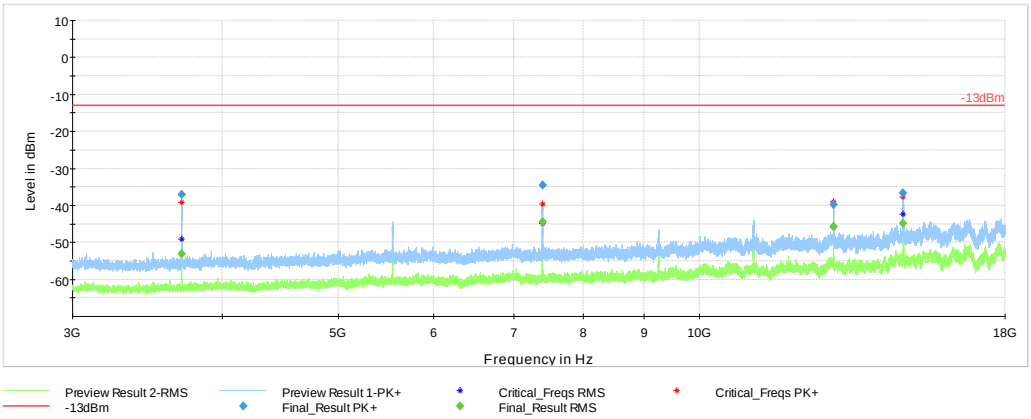


Plot # 24 Radiated Emissions: 3-18 GHz

Channel: Low

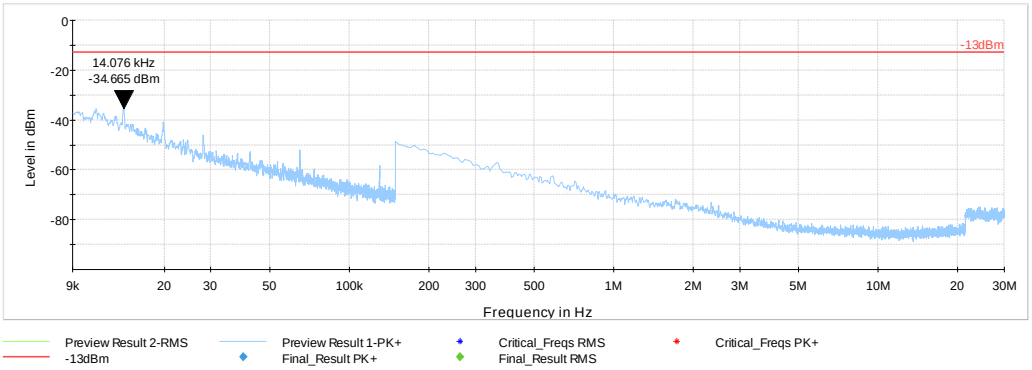
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3699.961333	---	-53.20	---	---	200.0	1000.000	145.0	V	271.0	-
3700.402667	-36.97	---	-13.00	23.97	200.0	1000.000	141.0	V	274.0	-
7399.961333	---	-44.52	---	---	200.0	1000.000	174.0	V	241.0	-
7400.033333	-34.44	---	-13.00	21.44	200.0	1000.000	171.0	V	243.0	-
12949.89400	-39.86	---	-13.00	26.86	200.0	1000.000	118.0	V	34.0	-
12950.32400	---	-45.63	---	---	200.0	1000.000	181.0	V	292.0	-
14800.02800	-36.62	---	-13.00	23.62	200.0	1000.000	141.0	V	269.0	-
14800.25333	---	-44.93	---	---	200.0	1000.000	118.0	V	275.0	-



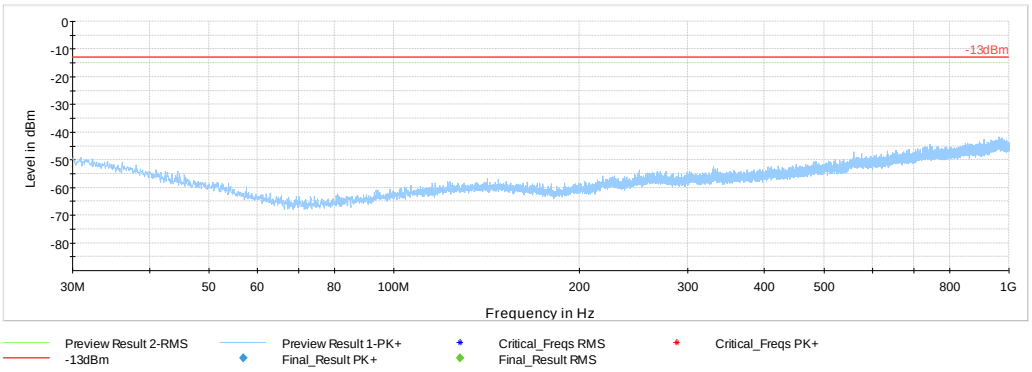
Plot # 25 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



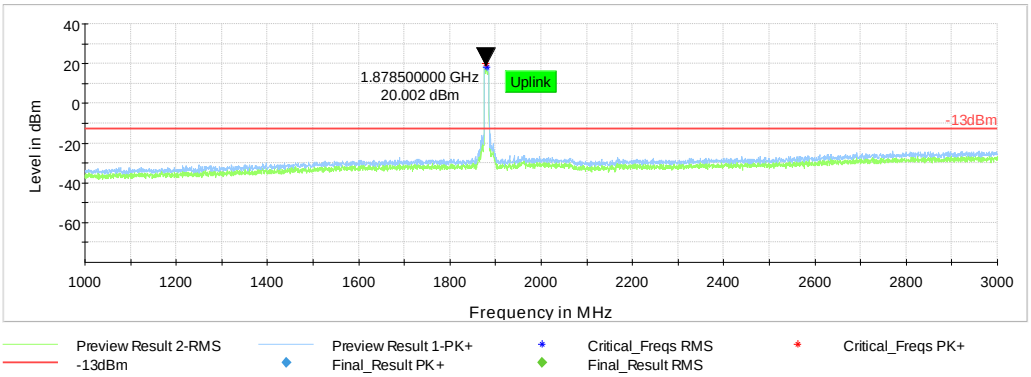
Plot # 26 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 27 Radiated Emissions: 1-3 GHz

Channel: Mid

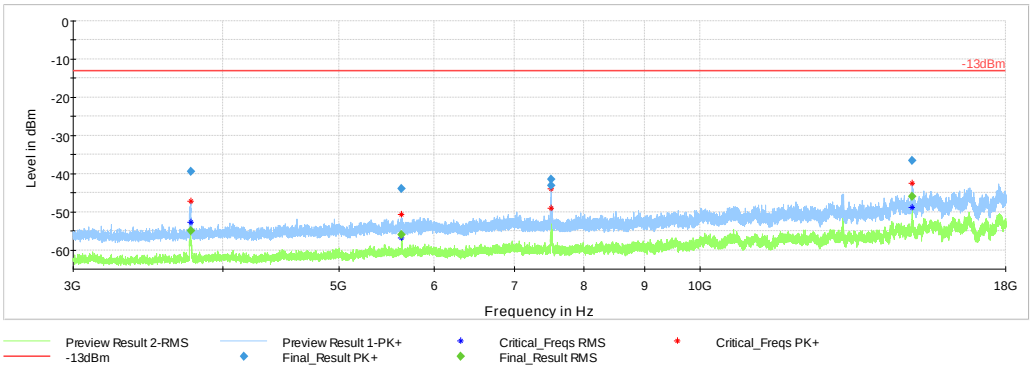


Plot # 28 Radiated Emissions: 3-18 GHz

Channel: Mid

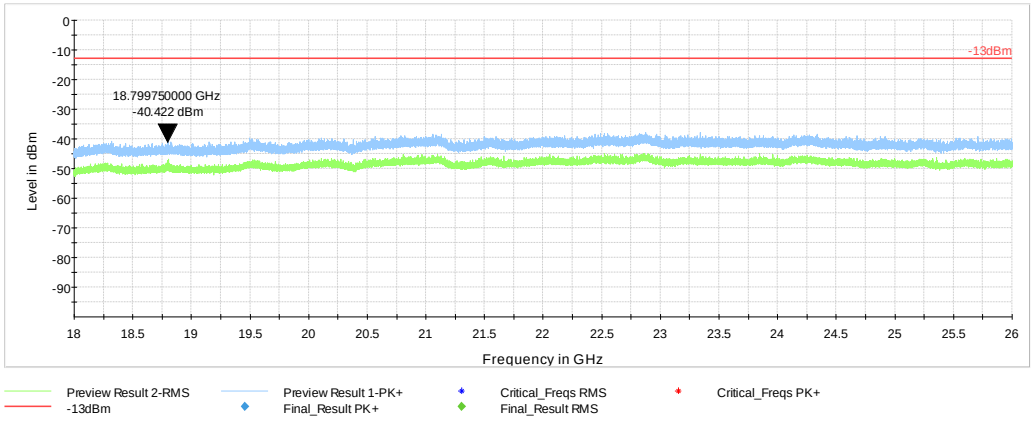
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3759.056000	---	-54.94	---	---	200.0	1000.000	250.0	H	231.0	-
3759.979333	-39.38	---	-13.00	26.38	200.0	1000.000	172.0	H	251.0	-
5639.651333	---	-55.95	---	---	200.0	1000.000	233.0	H	184.0	-
5639.721333	-43.92	---	-13.00	30.92	200.0	1000.000	205.0	H	184.0	-
7519.955333	-41.49	---	-13.00	28.49	200.0	1000.000	212.0	H	193.0	-
7520.036667	-43.05	---	-13.00	30.05	200.0	1000.000	252.0	H	184.0	-
15040.15333	---	-46.07	---	---	200.0	1000.000	157.0	V	274.0	-
15040.27933	-36.54	---	-13.00	23.54	200.0	1000.000	141.0	V	272.0	-



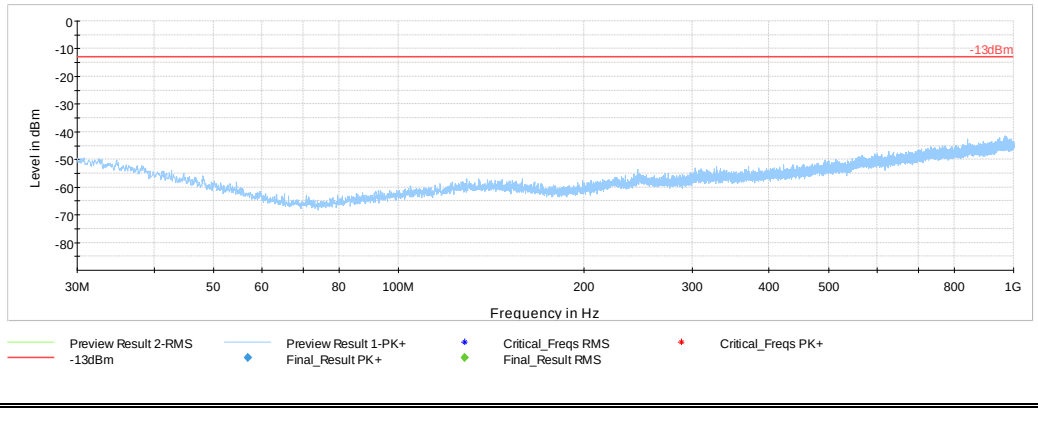
Plot # 29 Radiated Emissions: 18-26 GHz

Channel: Mid



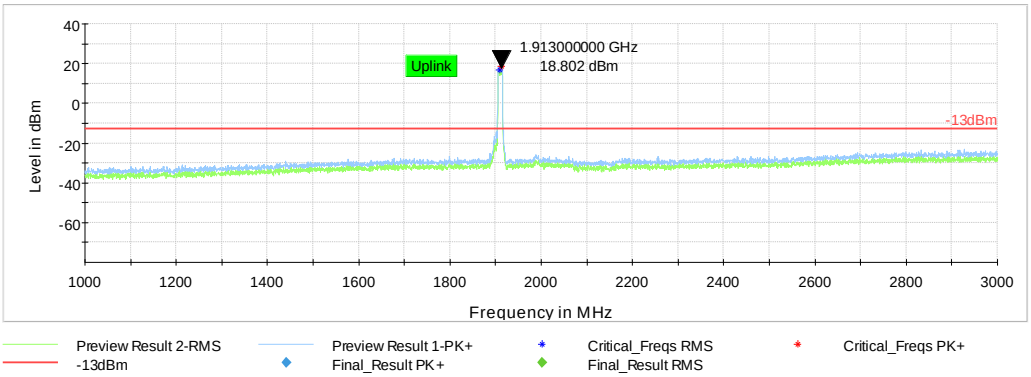
Plot # 30 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot # 31 Radiated Emissions: 1-3 GHz

Channel: High

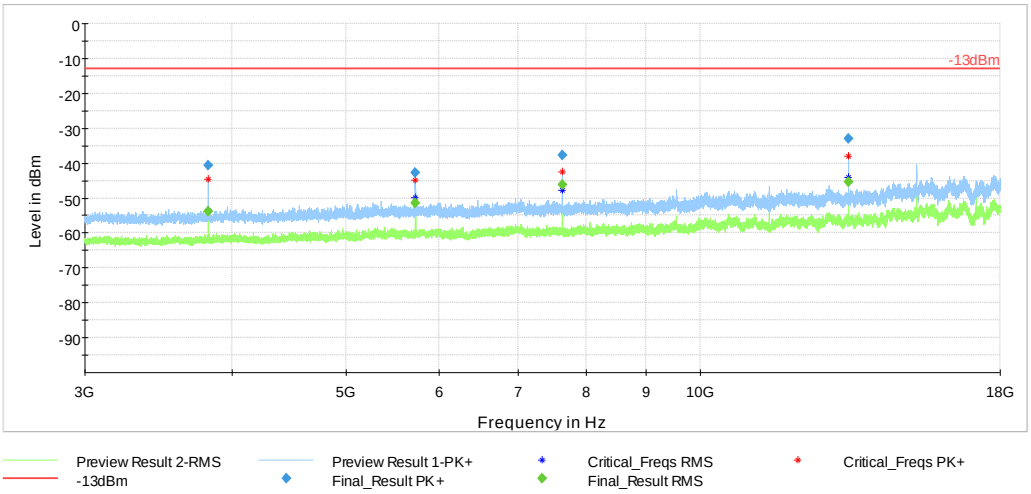


Plot # 32 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

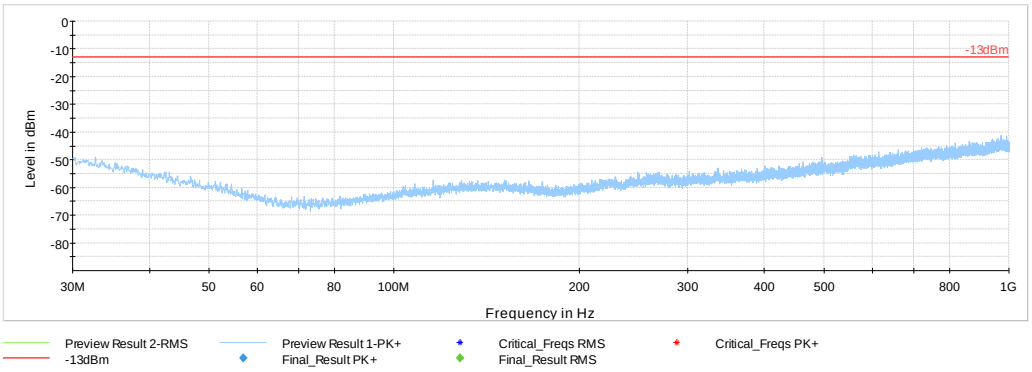
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3819.886000	-40.69	---	-13.00	27.69	200.0	1000.000	186.0	V	42.0	-
3820.408000	---	-53.74	---	---	200.0	1000.000	183.0	V	47.0	-
5727.530667	-42.65	---	-13.00	29.65	200.0	1000.000	190.0	V	81.0	-
5729.667333	---	-51.37	---	---	200.0	1000.000	150.0	V	80.0	-
7639.522000	---	-46.08	---	---	200.0	1000.000	181.0	V	240.0	-
7639.694667	-37.68	---	-13.00	24.68	200.0	1000.000	182.0	V	244.0	-
13369.11933	---	-45.42	---	---	200.0	1000.000	141.0	V	294.0	-
13370.03400	-32.92	---	-13.00	19.92	200.0	1000.000	174.0	V	286.0	-



7.1.9 LTE Band 4

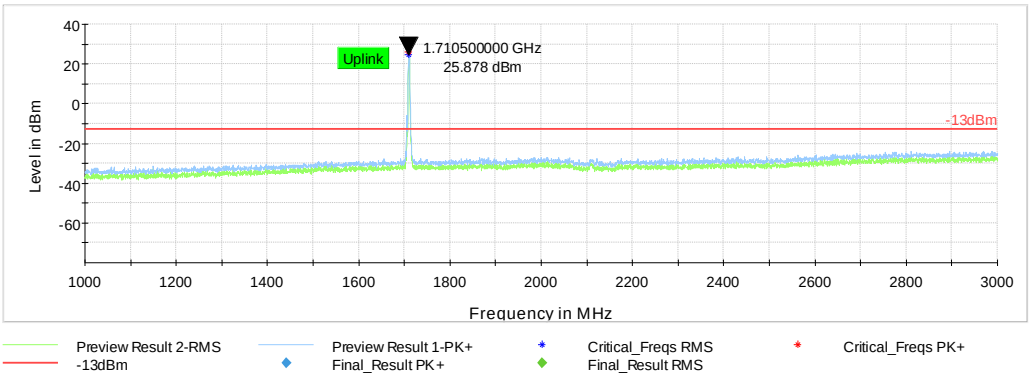
Plot # 33 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot # 34 Radiated Emissions: 1-3 GHz

Channel: Low

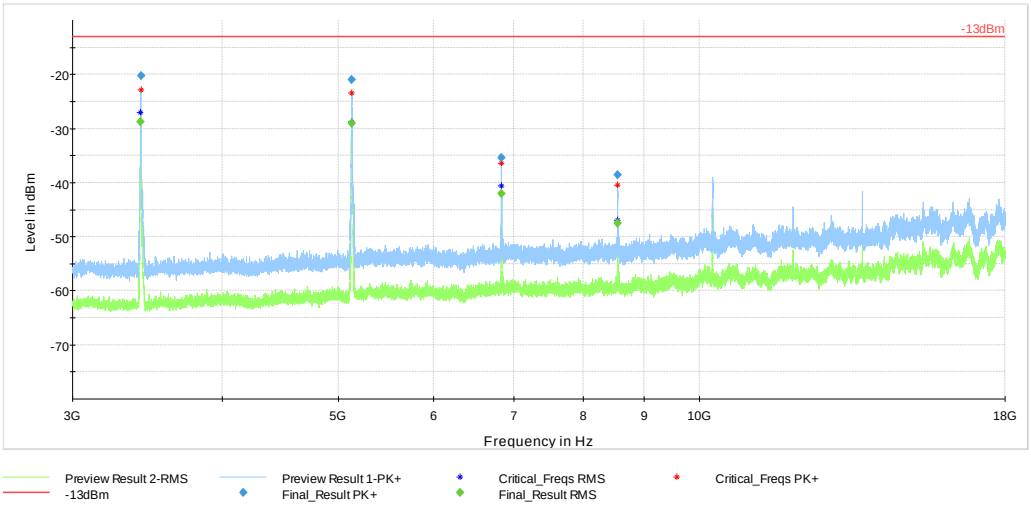


Plot # 35 Radiated Emissions: 3-18 GHz

Channel: Low

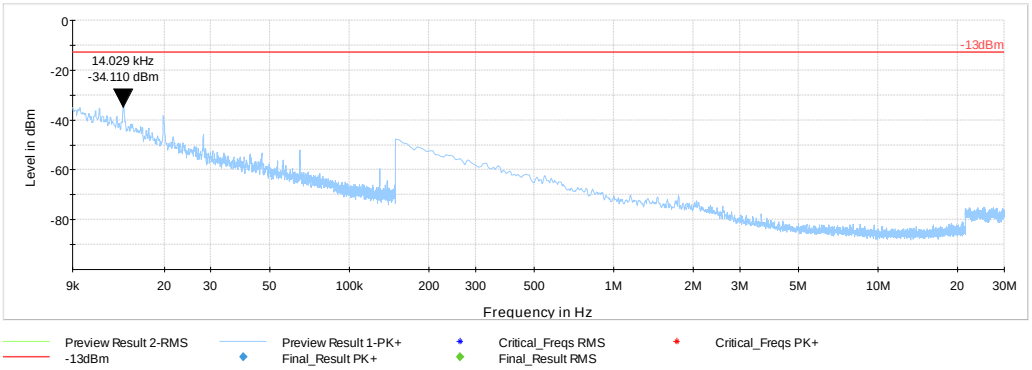
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3418.988667	---	-28.82	---	---	200.0	1000.000	176.0	V	352.0	-
3421.230000	-20.22	---	-13.00	7.22	200.0	1000.000	180.0	V	349.0	-
5128.405333	-20.95	---	-13.00	7.95	200.0	1000.000	229.0	V	297.0	-
5129.761333	---	-29.01	---	---	200.0	1000.000	221.0	V	280.0	-
6839.957333	---	-42.06	---	---	200.0	1000.000	133.0	V	0.0	-
6840.024000	-35.36	---	-13.00	22.36	200.0	1000.000	127.0	V	1.0	-
8550.101333	---	-47.52	---	---	200.0	1000.000	149.0	V	252.0	-
8550.214000	-38.59	---	-13.00	25.59	200.0	1000.000	146.0	V	262.0	-



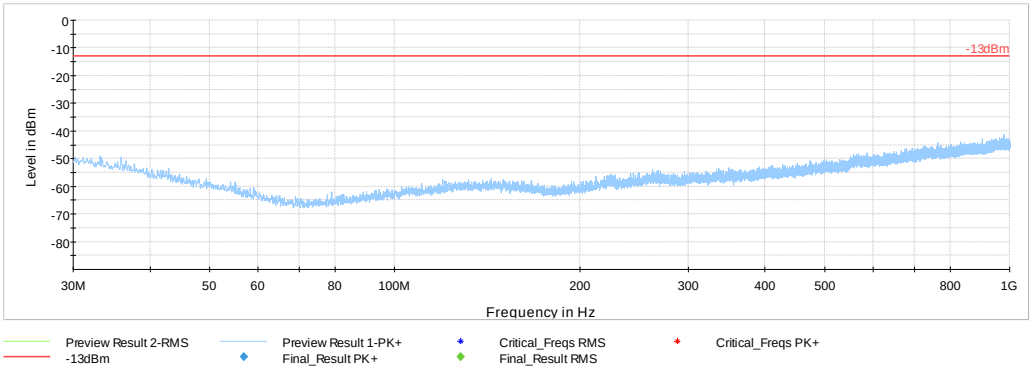
Plot # 36 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



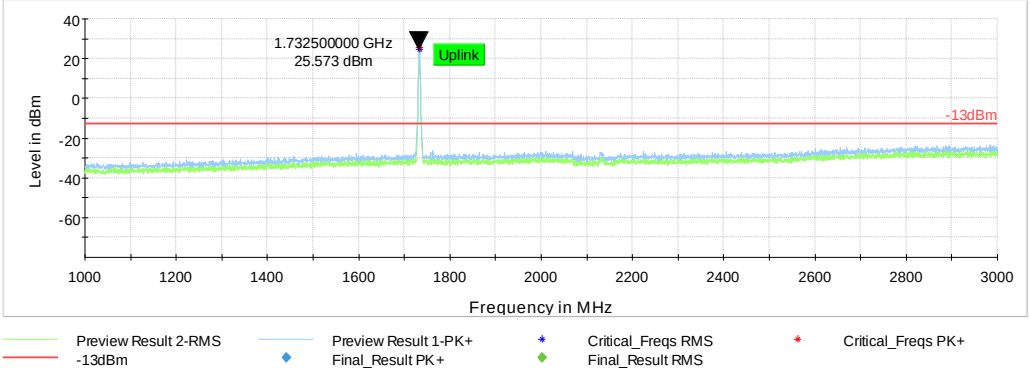
Plot # 37 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 38 Radiated Emissions: 1-3 GHz

Channel: Mid

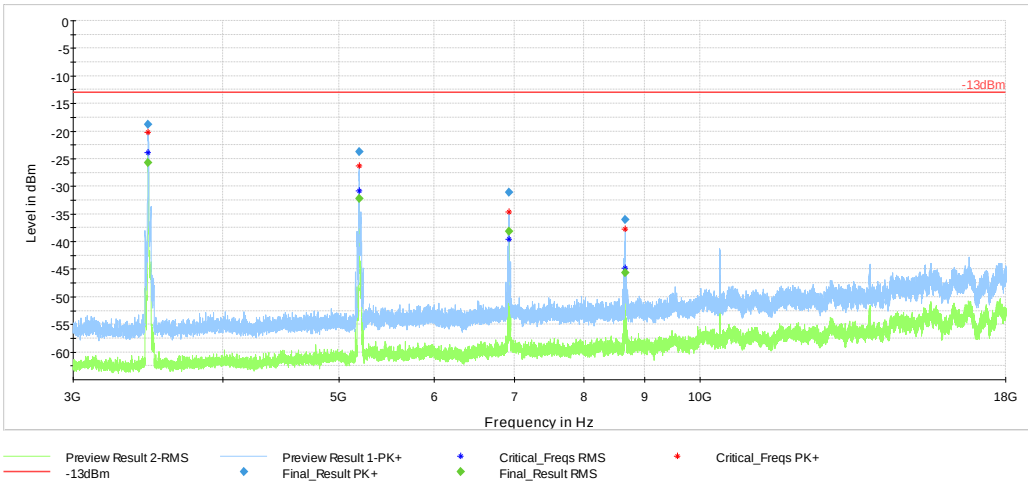


Plot # 39 Radiated Emissions: 3-18 GHz

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)
3466.059333	---	-25.70	---	---	200.0	1000.000	220.0	V	39.0	-
3466.320000	-18.73	---	-13.00	5.73	200.0	1000.000	224.0	V	351.0	-
5197.442667	-23.71	---	-13.00	10.71	200.0	1000.000	220.0	V	299.0	-
5198.984667	---	-32.17	---	---	200.0	1000.000	223.0	V	204.0	-
6927.770667	-31.06	---	-13.00	18.06	200.0	1000.000	267.0	H	300.0	-
6930.172667	---	-38.08	---	---	200.0	1000.000	261.0	H	302.0	-
8662.390000	---	-45.71	---	---	200.0	1000.000	194.0	H	113.0	-
8663.533333	-36.02	---	-13.00	23.02	200.0	1000.000	220.0	H	127.0	-

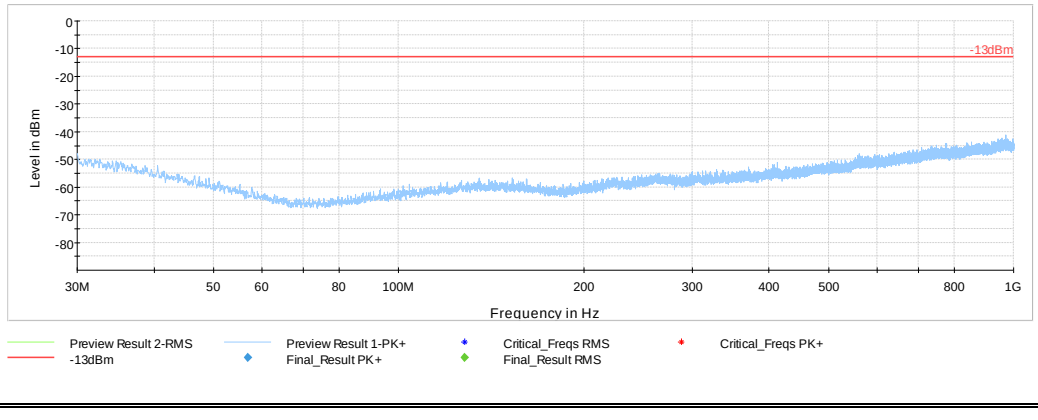


Plot # 40 Radiated Emissions: 18-26 GHz

Channel: Mid

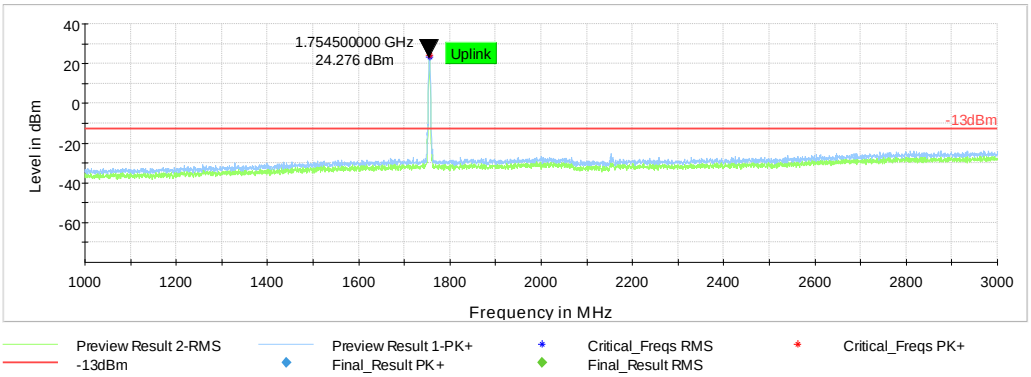
Plot # 41 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot # 42 Radiated Emissions: 1-3 GHz

Channel: High

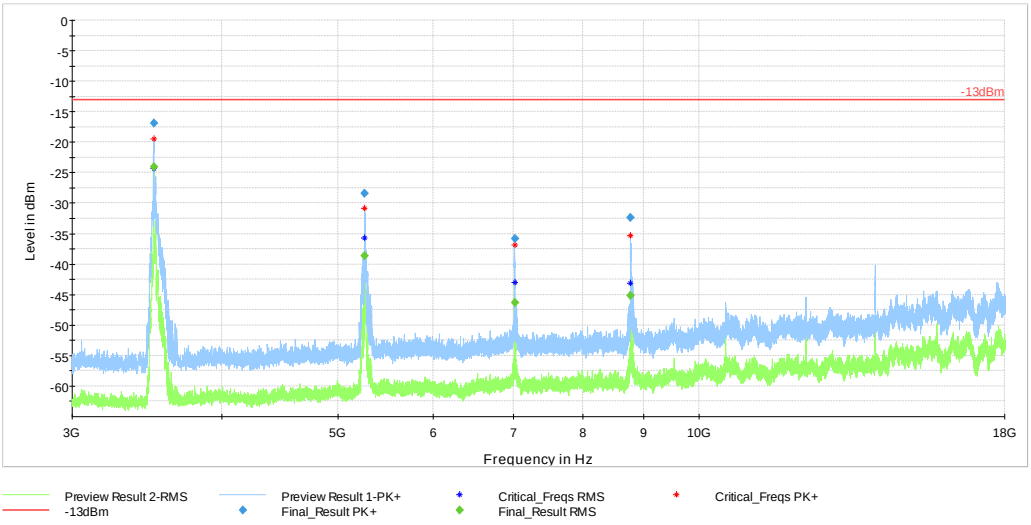


Plot # 43 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

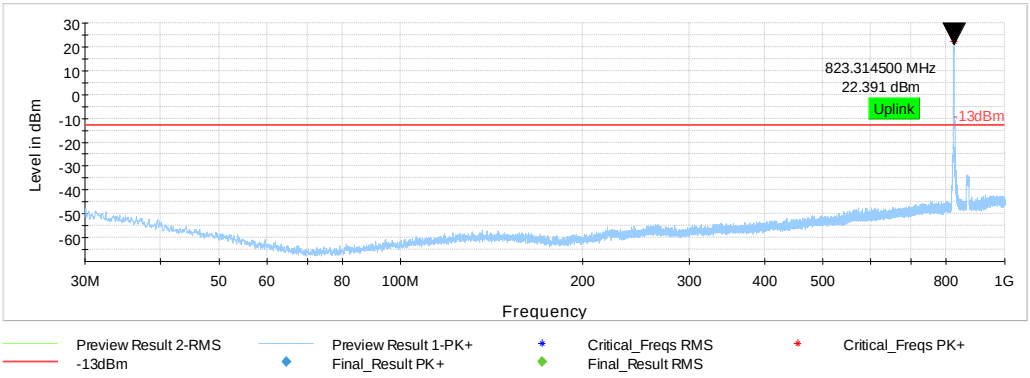
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3510.964667	---	-24.06	---	---	200.0	1000.000	245.0	V	51.0	-
3511.109333	-16.91	---	-13.00	3.91	200.0	1000.000	246.0	V	52.0	-
5262.978000	---	-38.66	---	---	200.0	1000.000	198.0	V	204.0	-
5263.154000	-28.36	---	-13.00	15.36	200.0	1000.000	212.0	V	206.0	-
7021.912667	-35.86	---	-13.00	22.86	200.0	1000.000	198.0	V	18.0	-
7021.992000	---	-46.36	---	---	200.0	1000.000	146.0	V	22.0	-
8774.388000	---	-45.18	---	---	200.0	1000.000	164.0	V	171.0	-
8774.406667	-32.40	---	-13.00	19.40	200.0	1000.000	158.0	V	341.0	-



7.1.10 LTE Band 5

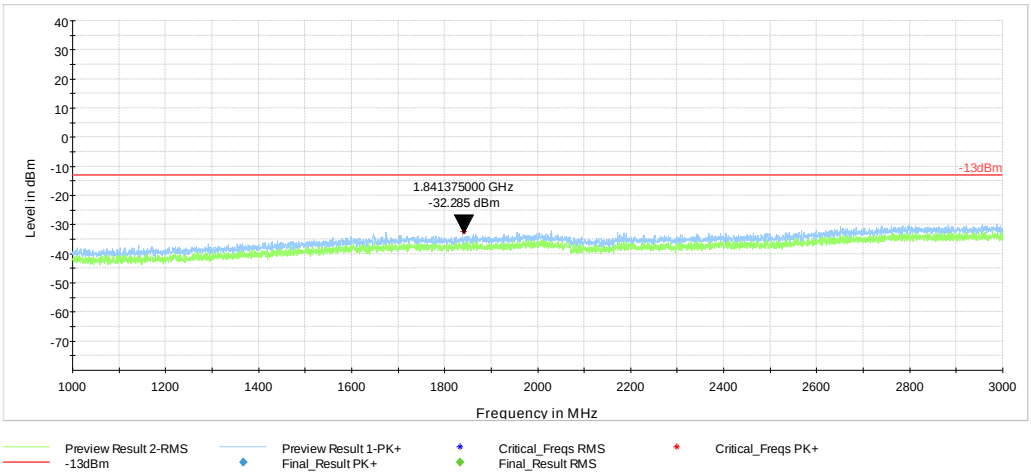
Plot # 44 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



Plot # 45 Radiated Emissions: 1-3 GHz

Channel: Low

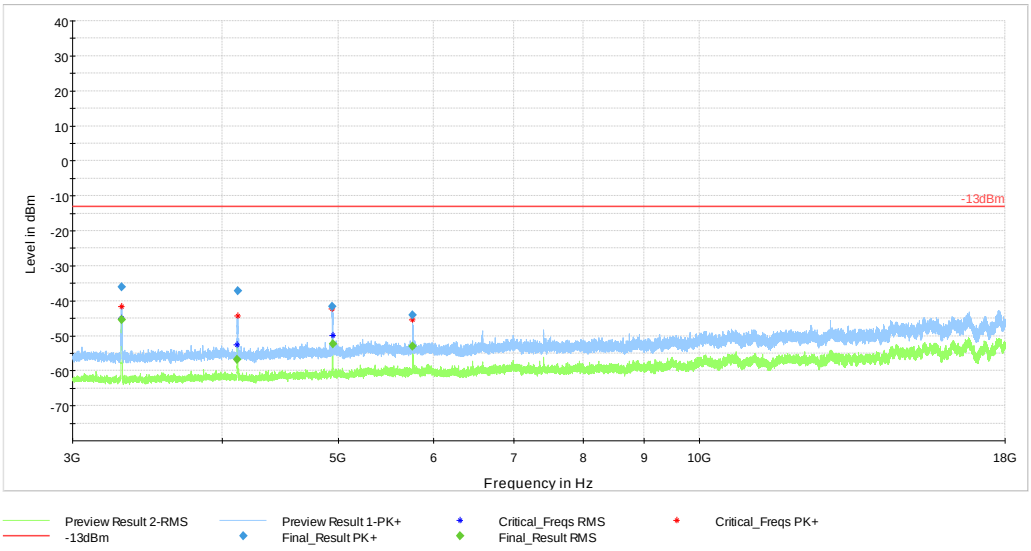


Plot # 46 Radiated Emissions: 3-18 GHz

Channel: Low

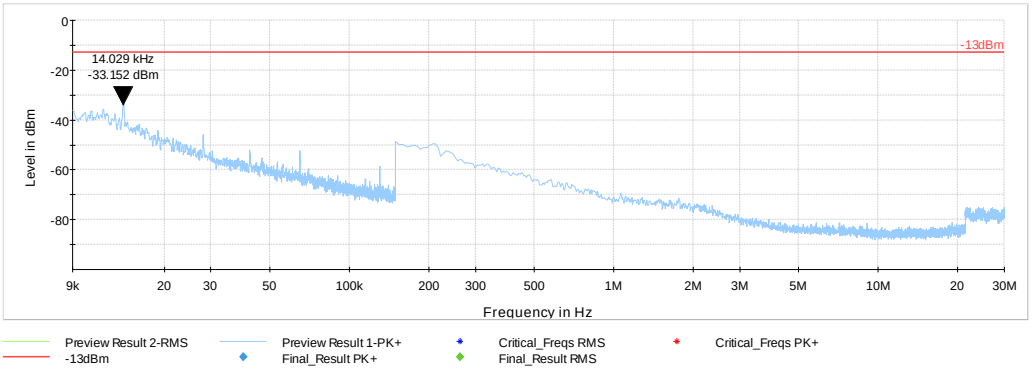
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3295.858000	---	-45.51	-13.00	32.51	500.0	1000.000	100.0	H	235.0	-
3295.939333	-35.95	---	-13.00	22.95	500.0	1000.000	100.0	H	238.0	-
4117.104000	---	-56.82	-13.00	43.82	500.0	1000.000	108.0	H	244.0	-
4120.273333	-37.13	---	-13.00	24.13	500.0	1000.000	100.0	H	235.0	-
4944.000000	-41.64	---	-13.00	28.64	500.0	1000.000	132.0	V	214.0	-
4944.680000	---	-52.29	-13.00	39.29	500.0	1000.000	100.0	H	234.0	-
5768.011333	---	-53.10	-13.00	40.10	500.0	1000.000	100.0	H	235.0	-
5768.383333	-44.19	---	-13.00	31.19	500.0	1000.000	144.0	V	211.0	-



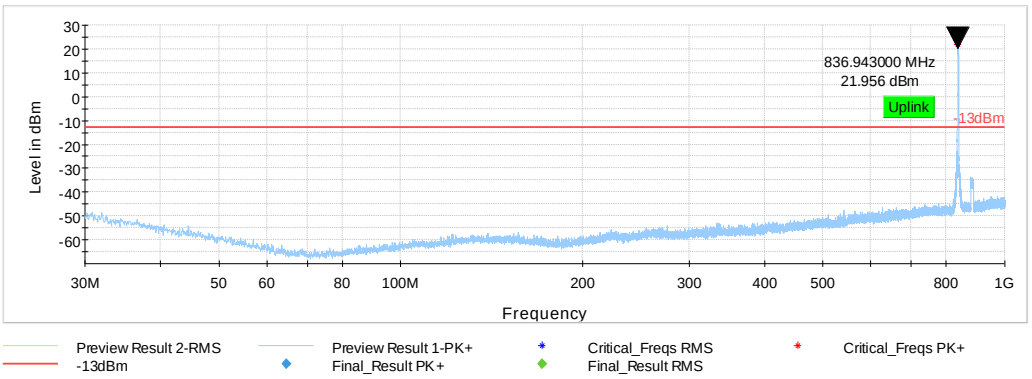
Plot # 47 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



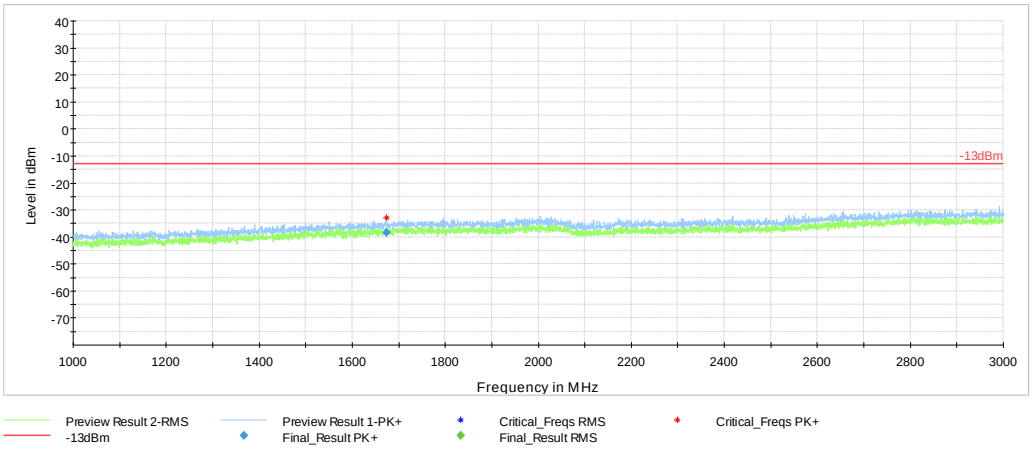
Plot # 48 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 49 Radiated Emissions: 1-3 GHz

Channel: Mid

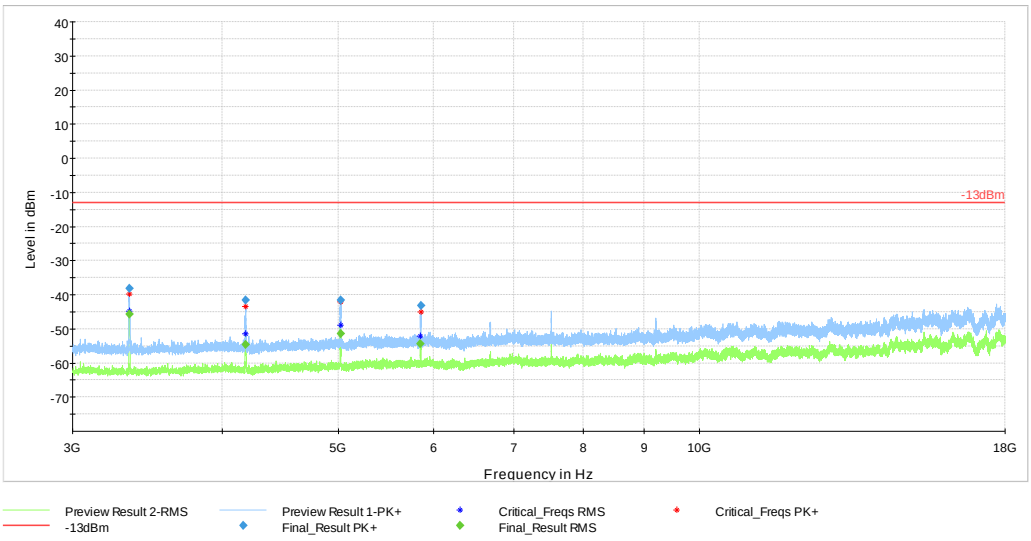


Plot # 50 Radiated Emissions: 3-18 GHz

Channel: Mid

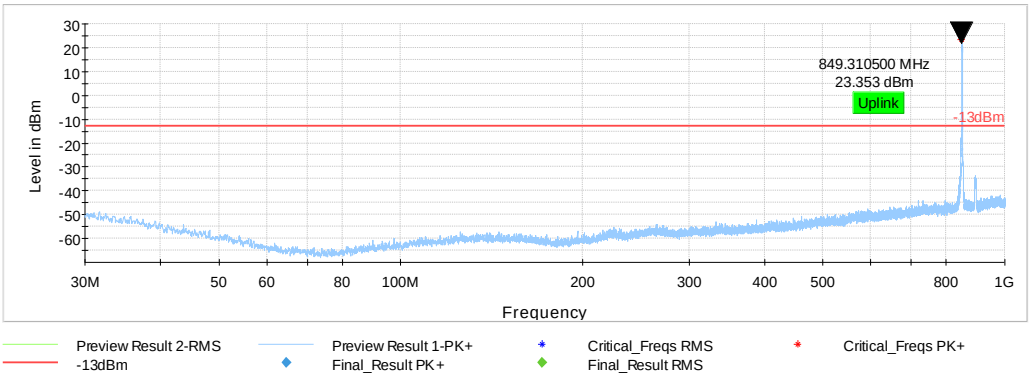
Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3345.902667	-38.28	---	-13.00	25.28	500.0	1000.000	132.0	V	235.0	-
3346.203333	---	-45.61	-13.00	32.61	500.0	1000.000	135.0	V	237.0	-
4182.210667	---	-54.73	-13.00	41.73	500.0	1000.000	132.0	V	235.0	-
4182.798667	-41.69	---	-13.00	28.69	500.0	1000.000	136.0	V	239.0	-
5019.354667	---	-51.37	-13.00	38.37	500.0	1000.000	132.0	V	237.0	-
5021.253333	-41.69	---	-13.00	28.69	500.0	1000.000	132.0	V	231.0	-
5855.716000	---	-54.31	-13.00	41.31	500.0	1000.000	132.0	V	236.0	-
5858.910000	-43.31	---	-13.00	30.31	500.0	1000.000	142.0	V	234.0	-



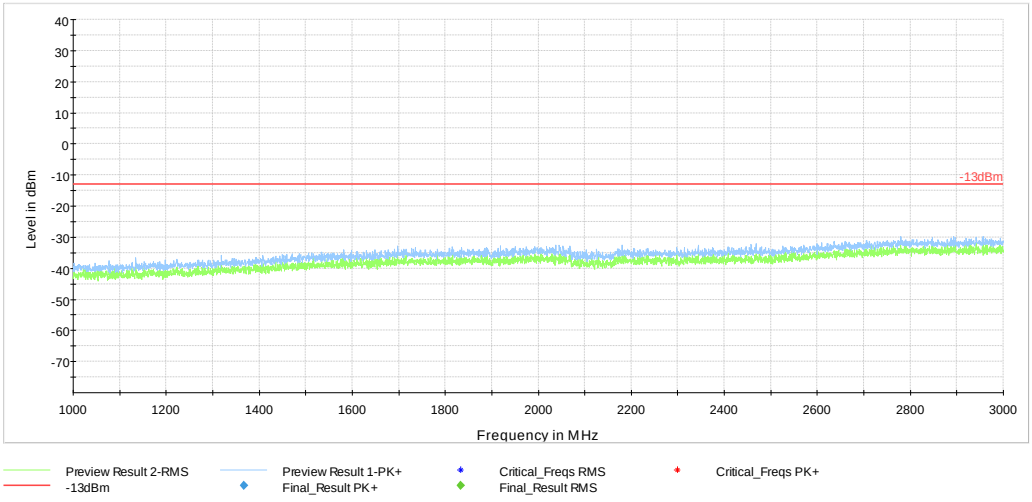
Plot # 51 Radiated Emissions: 30 MHz – 1GHz

Channel: High



Plot # 52 Radiated Emissions: 1-3 GHz

Channel: High

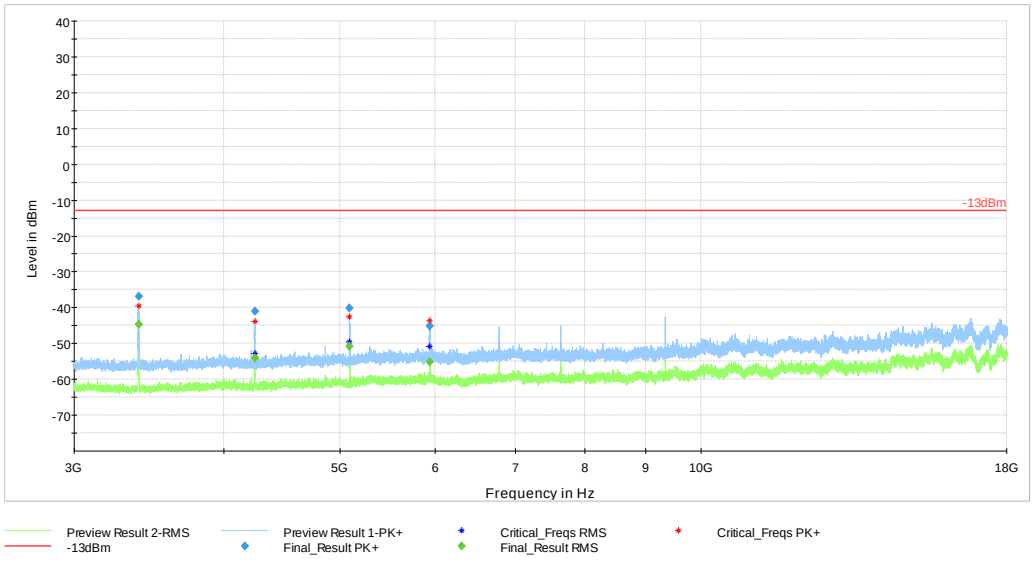


Plot # 53 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

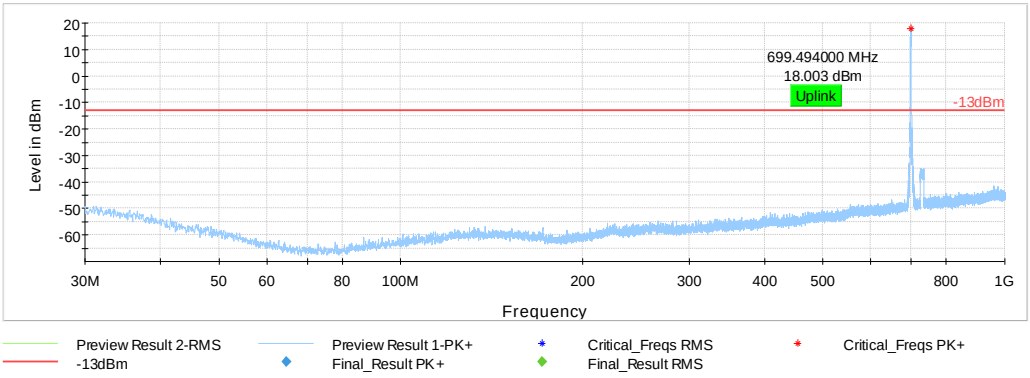
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3395.244000	-36.98	---	-13.00	23.98	500.0	1000.000	132.0	V	231.0	-
3395.479333	---	-44.80	-13.00	31.80	500.0	1000.000	132.0	V	230.0	-
4244.450000	---	-54.01	-13.00	41.01	500.0	1000.000	132.0	V	231.0	-
4244.732667	-41.12	---	-13.00	28.12	500.0	1000.000	132.0	V	228.0	-
5090.924667	-40.15	---	-13.00	27.15	500.0	1000.000	131.0	V	227.0	-
5093.274000	---	-50.81	-13.00	37.81	500.0	1000.000	132.0	V	230.0	-
5938.984000	---	-55.14	-13.00	42.14	500.0	1000.000	132.0	V	233.0	-
5943.248000	-45.06	---	-13.00	32.06	500.0	1000.000	132.0	V	229.0	-



7.1.11 LTE Band 12

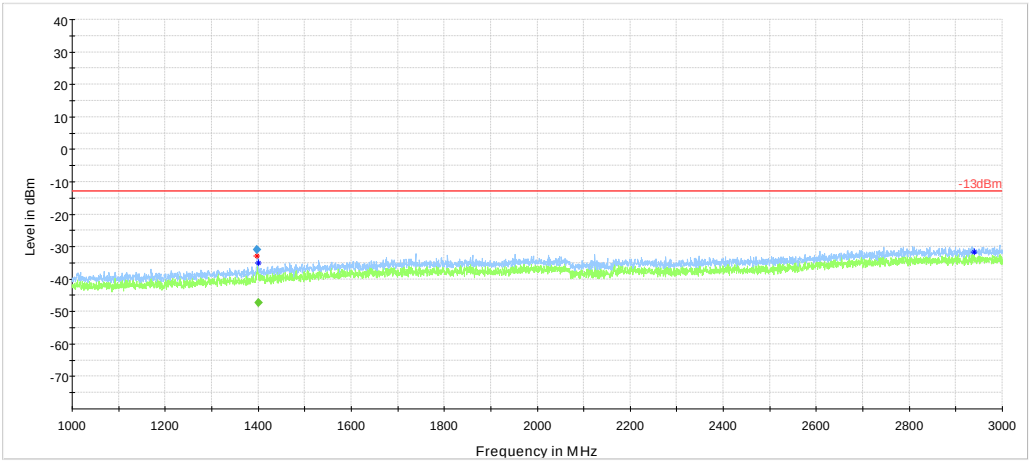
Plot # 54 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



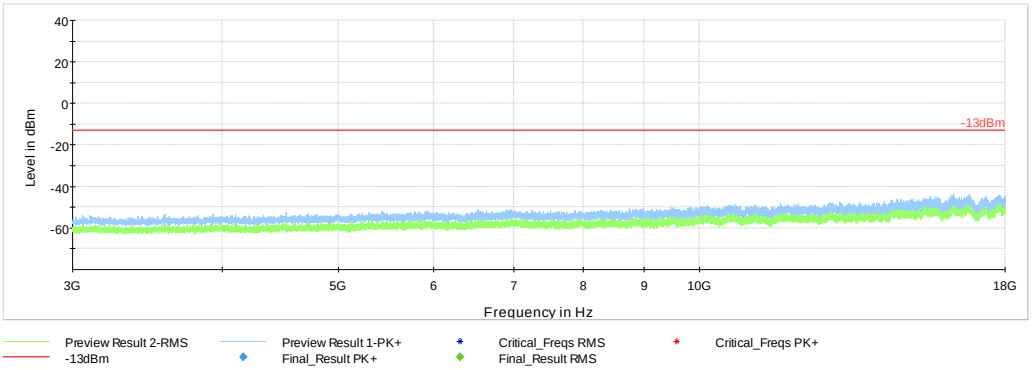
Plot # 55 Radiated Emissions: 1-3 GHz

Channel: Low



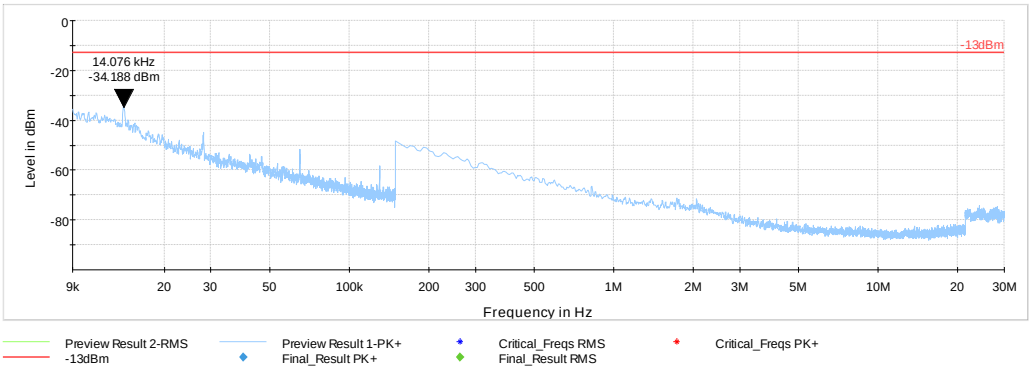
Plot # 56 Radiated Emissions: 3-18 GHz

Channel: Low



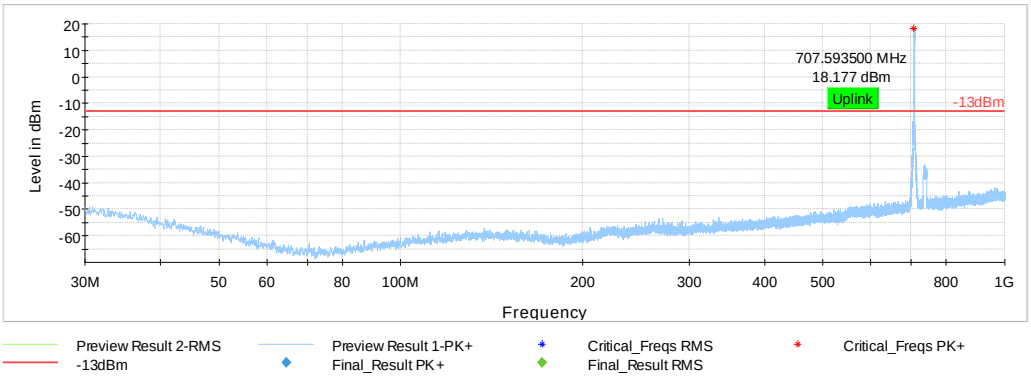
Plot # 57 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



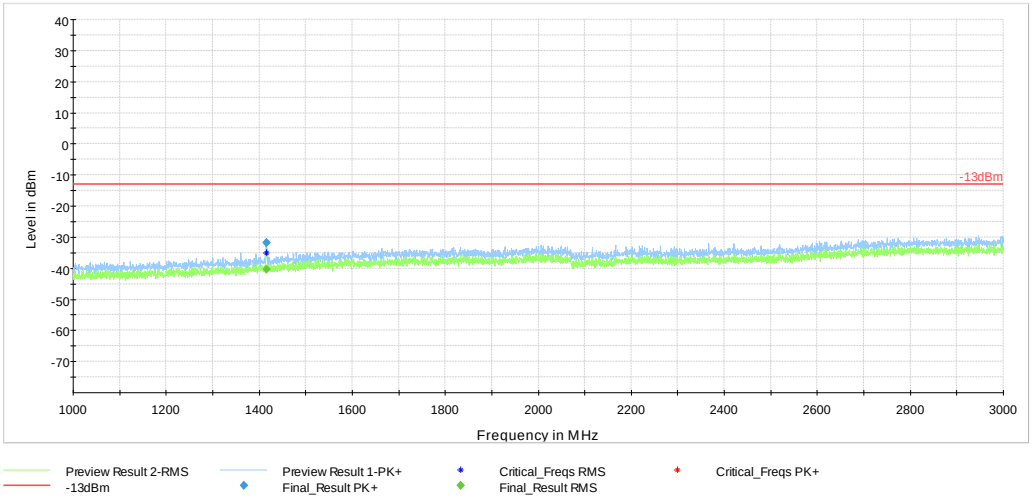
Plot # 58 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



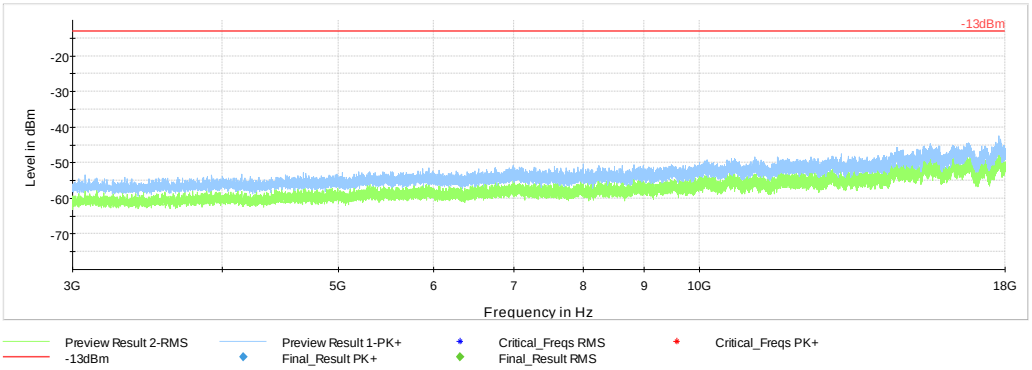
Plot # 59 Radiated Emissions: 1-3 GHz

Channel: Mid



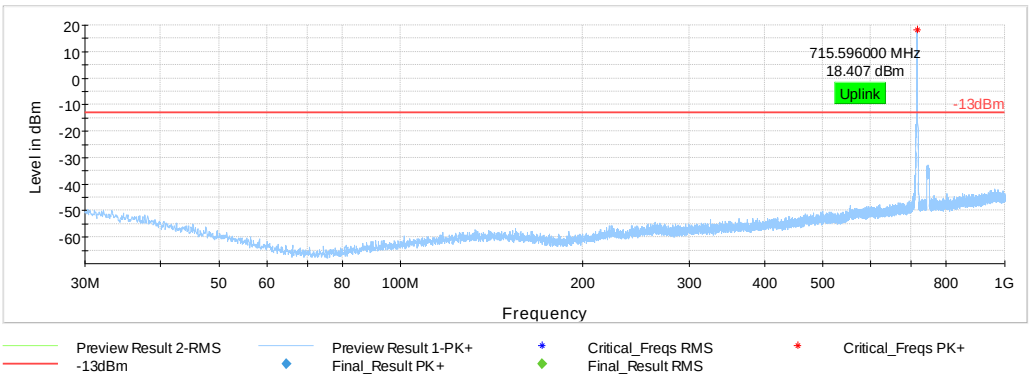
Plot # 60 Radiated Emissions: 3-18 GHz

Channel: Mid



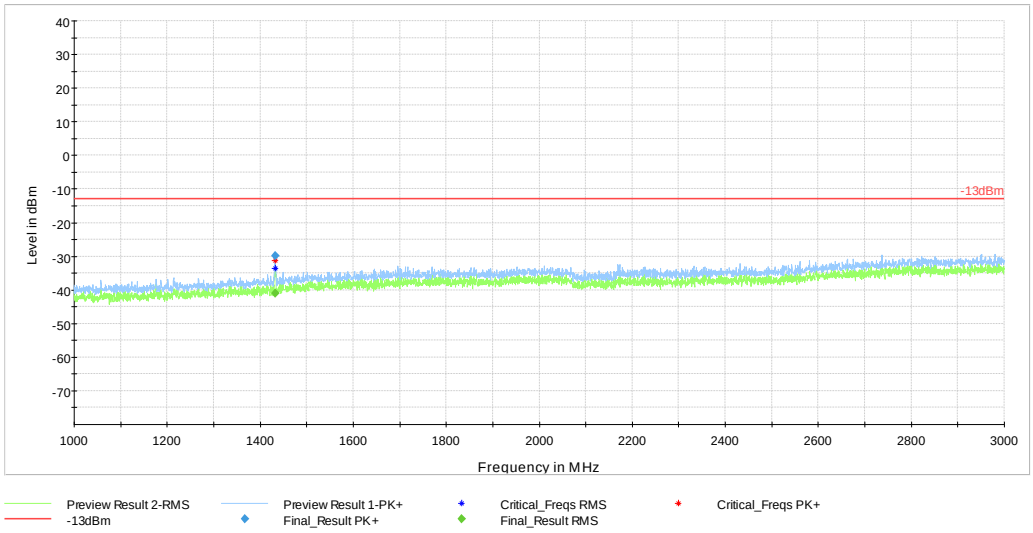
Plot # 61 Radiated Emissions: 30 MHz – 1GHz

Channel: High



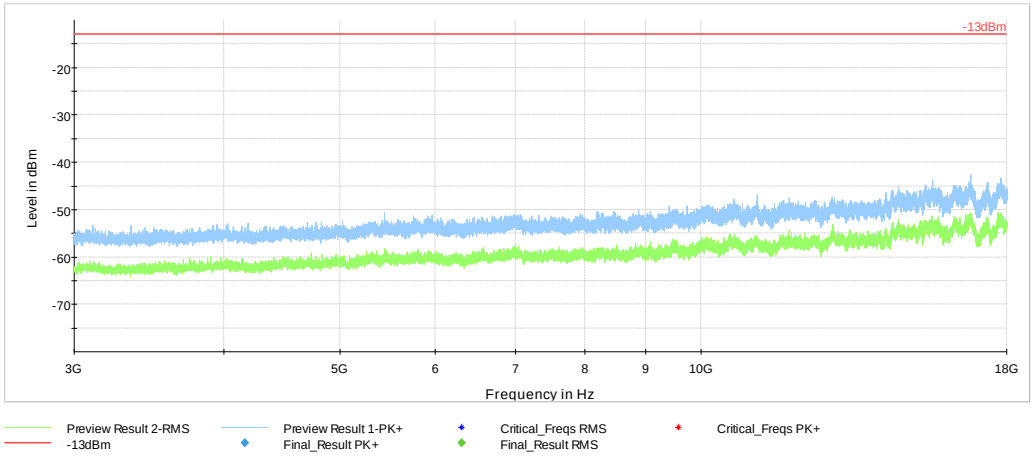
Plot # 62 Radiated Emissions: 1-3 GHz

Channel: High



Plot # 63 Radiated Emissions: 3-18 GHz

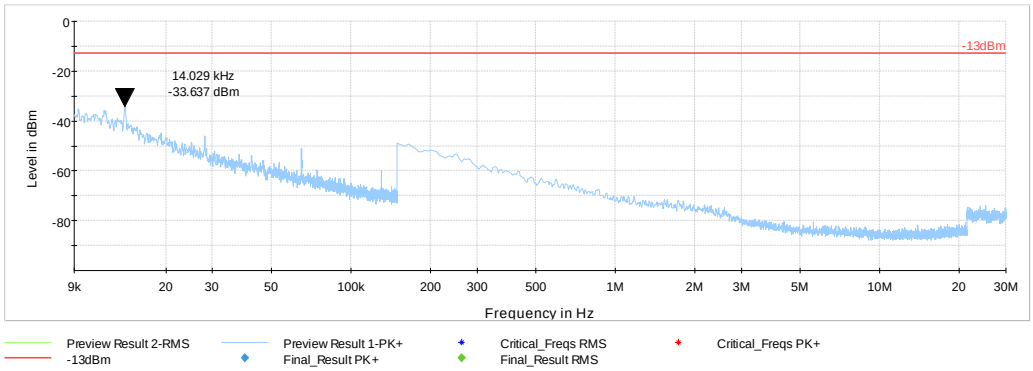
Channel: High



7.1.12 LTE Band 13

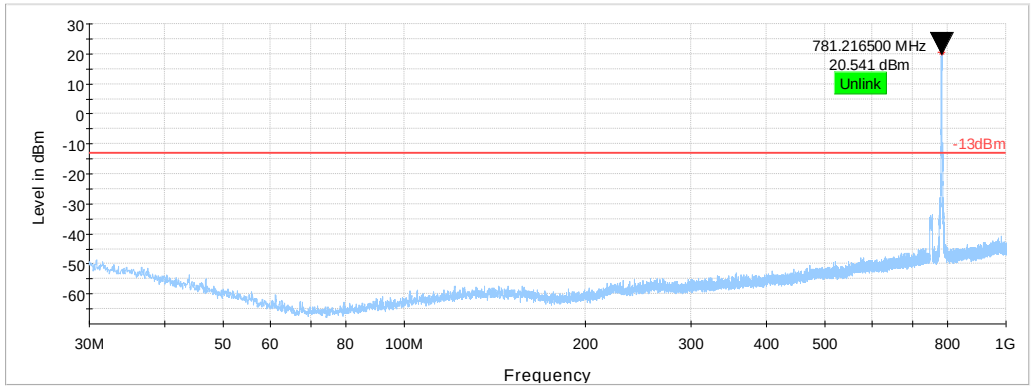
Plot # 64 Radiated Emissions: 9 kHz – 30 MHz

Channel: Mid



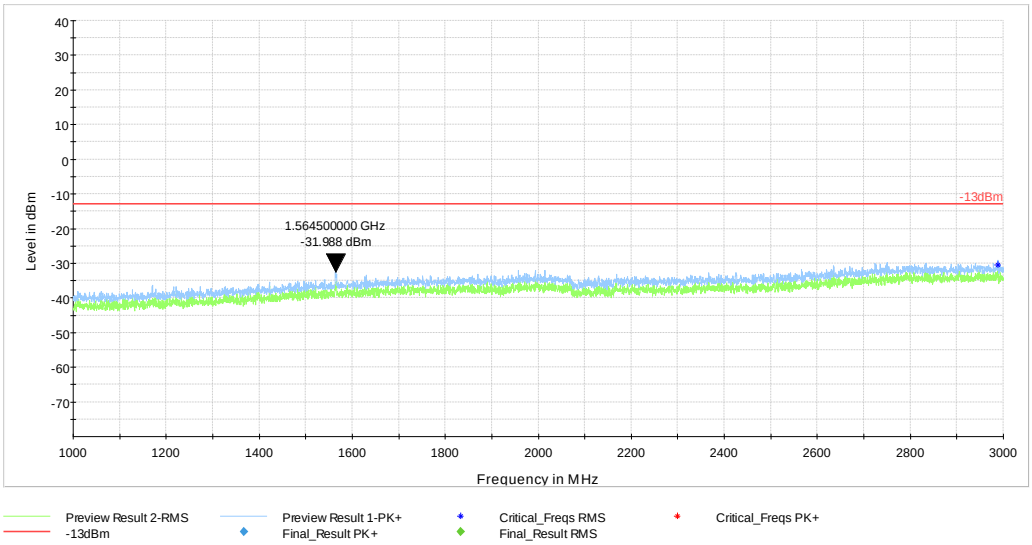
Plot # 65 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 66 Radiated Emissions: 1-3 GHz

Channel: Mid

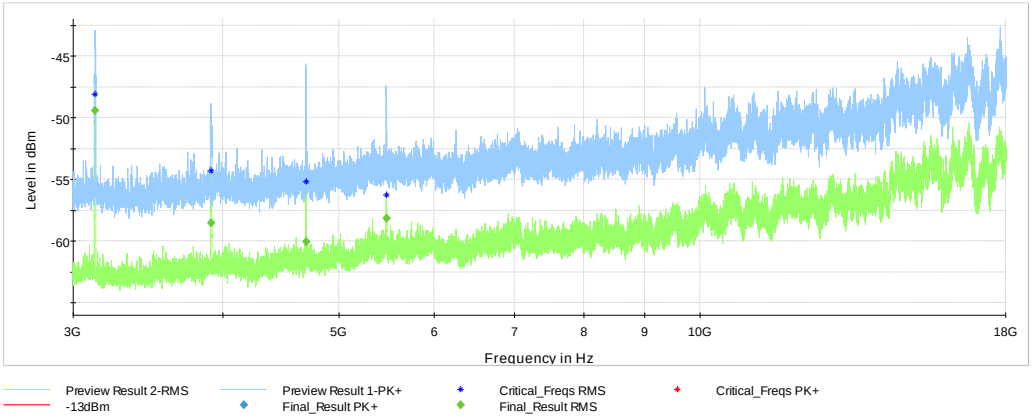


Plot # 67 Radiated Emissions: 3-18 GHz

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)
3130.225333	---	-49.38	---	---	200.0	1000.000	108.0	H	234.0	-
3911.937333	---	-58.54	---	---	200.0	1000.000	108.0	H	241.0	-
4694.667333	---	-60.07	---	---	200.0	1000.000	150.0	V	214.0	-
5477.411333	---	-58.18	---	---	200.0	1000.000	100.0	V	237.0	-



8 Test setup photos

Setup photos are included in supporting file name: "EMC_MAGNE_004_FCC_22_24_27_Setup_photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	6/28/2017
Antenna Loop 6512	Loop Antenna	ETS Lindgren	6512	49838	3 years	7/28/2017
Antenna Horn 3115 SN 35111	Horn Antenna	EMCO	3115	35111	3 years	11/17/2015
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	10/31/2017
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	2 Years	6/20/2017
CMW 500	Digital Radio Comm. Tester	R&S	CMW 500	127068	3 Years	7/1/2017
FSU26	Spectrum Analyzer	R&S	FSU26	200065	3 years	7/3/2017
FSU26	Spectrum Analyzer	R&S	FSU26	200302	3 years	7/5/2017
Thermometer Humidity TM320	Thermometer Humidity	Dickson	TM320	5280063	1 Year	11/2/2017
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	6/28/2017
Antenna Loop 6512	Loop Antenna	ETS Lindgren	6512	49838	3 years	7/28/2017

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
2018-05-23	EMC_MAGNE_004_FCC_22_24_27	Initial Version	Kevin Wang