FCC Test Report

FOR:
Synapse Product Development

Marketing Name
Bike Interface Module

Model Name
BIT-01-0-9

Product Description:
The Lyft BIM is an LTE connectivity, location, and NFC card reader module for use on battery powered shared electric vehicles.

FCC ID: 2ASMP0109

Per:
Title 47 CFR: FCC Part 27

REPORT #:
EMC_SYNAP_035_19001_FCC_27

DATE: 5/16/2019

A2LA Accredited

IC recognized # 3462B-2

***CETECOM* Inc.**
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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 NFC radios according to criteria specified in the Code of Federal Regulations Title 47 CFR: FCC Part 27.

Company	Description	Model #
Synapse Product Development	The Lyft BIM is an LTE connectivity, location, and NFC card reader module for use on battery powered shared electric vehicles.	BIT-01-0-9

No deficiencies were ascertained.

According to section 6 of this report, the overall result is PASS.

Responsible for Testing Laboratory:

Date	Section	Name	Signature
5/16/2019	Compliance	Li, Cindy (Lab Manager)	Cindy Li Digitally signed by Cindy Li DN: cn=Cindy Li, o=Cetecom Inc., ou=EMC, email=cindy.li@cetecom.com, c=US Date: 2019.05.16 16:07:37 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
5/16/2019	Compliance	Ghanma, Issa (EMC Engineer)	Digitally signed by: Issa Ghanma DN: CN = Issa Ghanma email = issa.ghanma@cetecom.com C = US O = CETECOM INC. OU = EMC Date: 2019.05.16 11:19:22 -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
Lab Manager:	Li, Cindy
Responsible Project Leader:	Palacios, Cathy

2.2 Identification of the Client

Applicant's Name:	Synapse Product Development
Street Address:	640 Bryant St
City/Zip Code	San Francisco, CA 94107
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Lyft, Inc.
Manufacturers Address:	185 Berry St Suite 5000
City/Zip Code	San Francisco, CA 94107
Country	USA

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Antenna Information as declared:	Primary RX/TX : Taoglas PCS.06.A 698 ~ 803 MHz: -0.21 dBi (Peak Gain) 1710 – 2155 MHz: 3.05 dBi (Peak Gain) Secondary RX: The secondary TX antenna connection is not used in this design.
Power Supply/ Rated Operating Voltage Range:	Low 30 VDC, Nominal 36 VDC, High 42 VDC
Operating Temperature Range:	Low -20º C, Nominal 25º C, High 50º C
Sample Revision	☐Prototype Unit; ■Production Unit; ☐Pre-Production
EUT Dimensions(mm):	270 x 70 x 40
Weight(grams):	400
EUT Diameter	■ < 60 cm ☐ Other _____
Other Radios included in the device:	❖ NFC Module: • 13.56 MHz Transceiver (TRF7960ARHBT) ❖ WLAN(Wi-Fi): 802.11 b/g/n (Receive only) • Module name: Stand-alone Wi-Fi • Model number: uBlox NINA-W132 • FCC ID: XPYNINAW13 ❖ GPS: • Module name: uBlox M8 GNSS Antenna Module • Model number: uBlox SAM-M8Q

3.2 EUT Sample details

EUT #	S/N	IMEI	HW Version	SW Version	Notes/Comments
1	B1M40098	3 352613071080510	1.0	1.0	Radiated Spurious Emissions

3.3 Accessory Equipment

AE #	Comments
-	According to the User Manual, No accessories are to be used with this device.

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
-	-	-

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	LTE CAT-1 and NFC	Cellular was tested on Low, Mid, High Channels at the maximum power in a co-transmission mode. No special and/or AT commands were used. The cellular radio auto connects to the base station, and NFC radio was configured previously by the client. The internal antenna was connected.

3.6 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets on low, mid and high channels at the maximum power simultaneous transmission with NFC.

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:** 2ASMPBIT0109

The pre-certified module to be integrated (Digi XBEE Cellular LTE CAT1 XBC-V1-UT-101) 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 CFR: FCC Part 27.

The conducted module test data that can be obtained under the **FCC Filing ID:** RI7LE866SV1/ **IC ID:** 5131A-LE866SV1 is applicable for the host described in section 3.

4.1 Dates of Testing:

04/01/2019 – 04/04/2019

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%

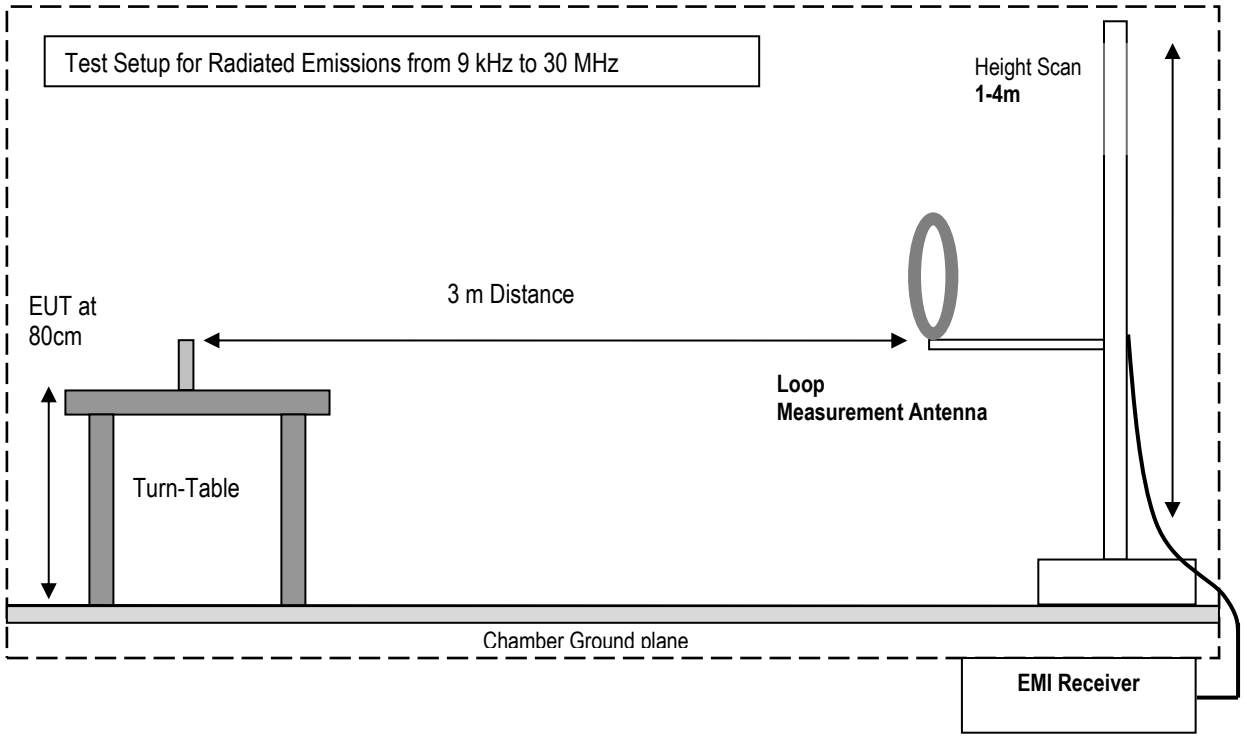
Deviating test conditions are indicated at individual test description where applicable.

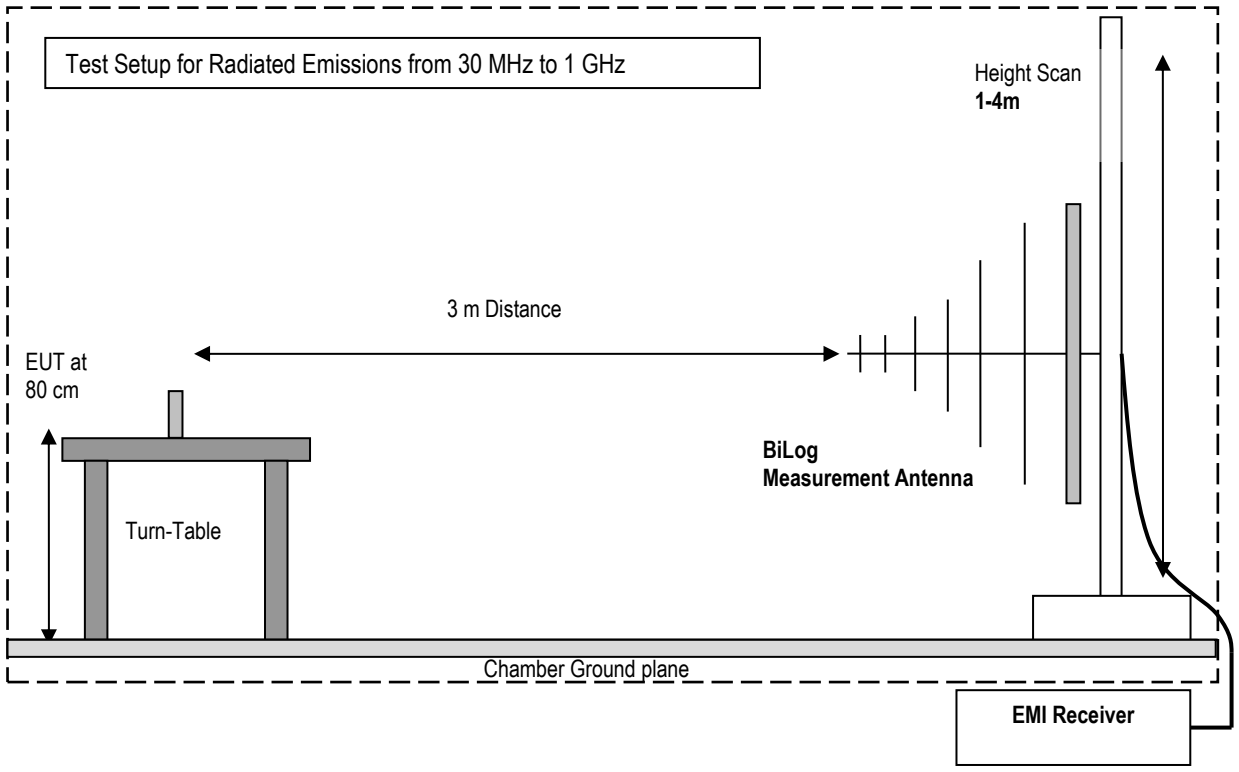
5 Measurement Procedures

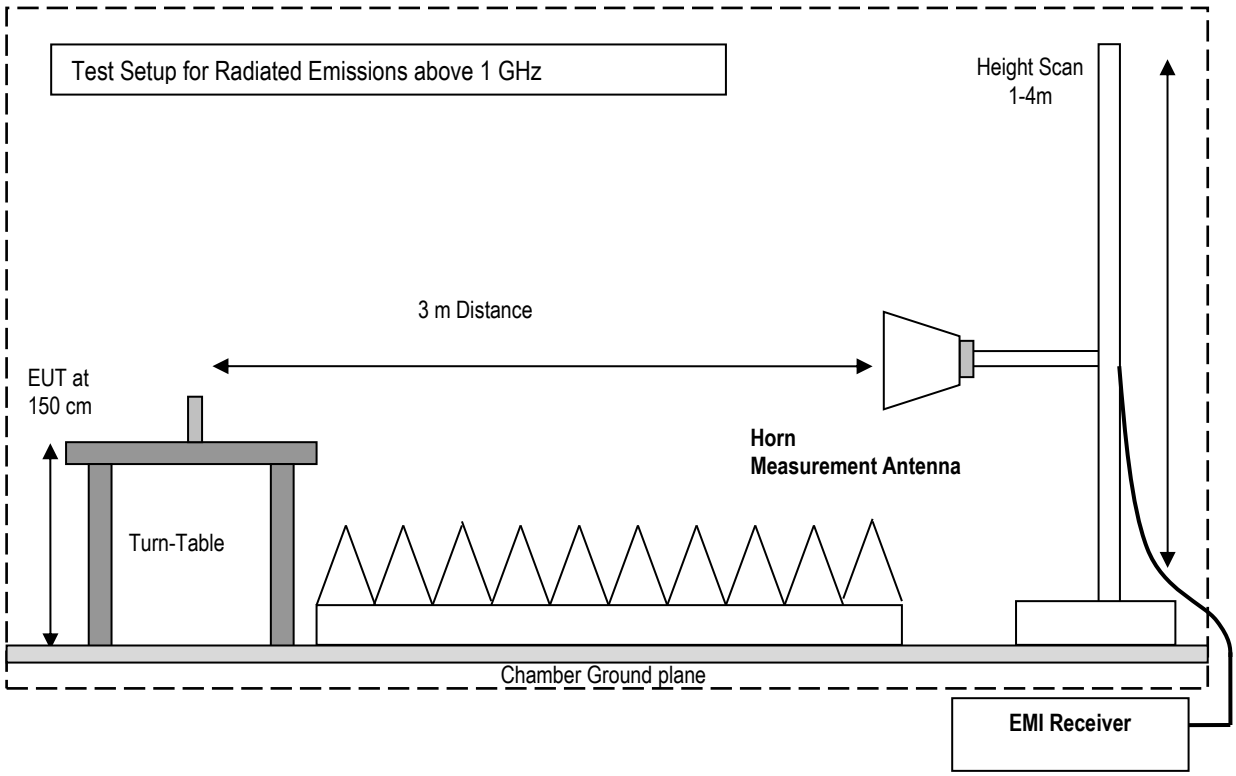
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to ANSI C63.26 as detailed below.

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 360º continuous measurement 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.




Test Setup for Radiated Emissions from 30 MHz to 1 GHz
Height Scan
1-4m
3 m Distance
EUT at
80 cm
BiLog
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver


Test Setup for Radiated Emissions above 1 GHz
Height Scan
1-4m
3 m Distance
EUT at
150 cm
Horn
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver

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 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	LTE CAT-1 and NFC (Co-TX)	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification Digi XBEE Cellular LTE CAT1 XBC-V1-UT-101 **FCC Filing ID:** RI7LE866SV1/ **IC ID:** 5131A-LE866SV1

7 Test Result Data

7.1 ERP / EIRP

Module Name:	Digi XBEE Cellular LTE CAT1
Model Number:	XBC-V1-UT-101
FCC ID:	RI7LE866SV1
IC ID:	5131A-LE866SV1

Band	Frequency range (MHz)	Power (Watts)	Gain (dBi / Lin)	ERP (Watts)	EIRP (Watts)	Frequency Tolerance	Emission Designator	Type of modulation(s)
LTE 4	1712.5 - 1752.5	0.220	3.05 / -	-	0.44	0.17 PM	4M52G7D	QPSK, 16-QAM
LTE 4	1720.0 - 1745.0	0.160	3.05 / -	-	0.32	0.17 PM	17M9G7D	QPSK, 16-QAM
LTE 13	799.5 – 784.5	0.230	-0.21 / 095	0.13	0.22	0.33 PM	4M46G7D	QPSK, 16-QAM
LTE 13	782.0 – 782.0	0.16	-0.21 / 095	0.09	0.15	0.33 PM	8M94G7D	QPSK, 16-QAM

Note: ERP / EIRP are calculated from maximum power in grant of cellular module, adding the maximum gain of the utilized cellular antenna.

7.2 Radiated Spurious Emissions

7.2.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR 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 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 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	36v DC

7.2.4 Measurement result:

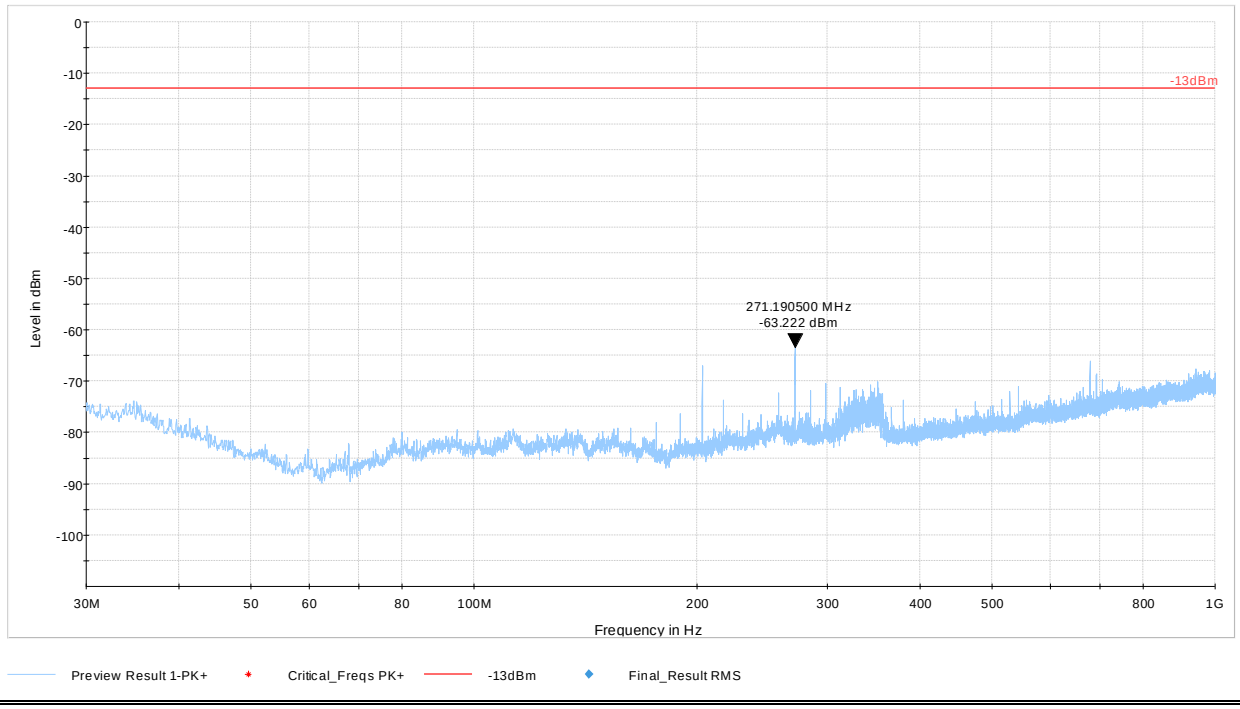
Plot #	Cellular Channel	EUT Operating mode	Scan Frequency	Limit [dBm]	Critical Frequency [MHz]	Emission level [dBm]	Detector	Result
1 – 3	Low	LTE 4	30 MHz – 18 GHz	-13	271.19	-63.22	Peak	Pass
4 – 7	Mid		9 kHz – 18 GHz	-13	0.03	-27.36	RMS	Pass
8 – 10	High		30 MHz – 18 GHz	-13	271.19	-53.88	Peak	Pass
11 – 13	Low	LTE 13	30 MHz – 9 GHz	-13	NF	-		Pass
14 – 17	Mid		9 kHz – 9 GHz	-13	0.03	-13.27	RMS	Pass
18 - 20	High		30 MHz – 9 GHz	-13	271.19	-51.19	Peak	Pass

***NF: Noise Floor.**

7.2.5 Measurement Plots:

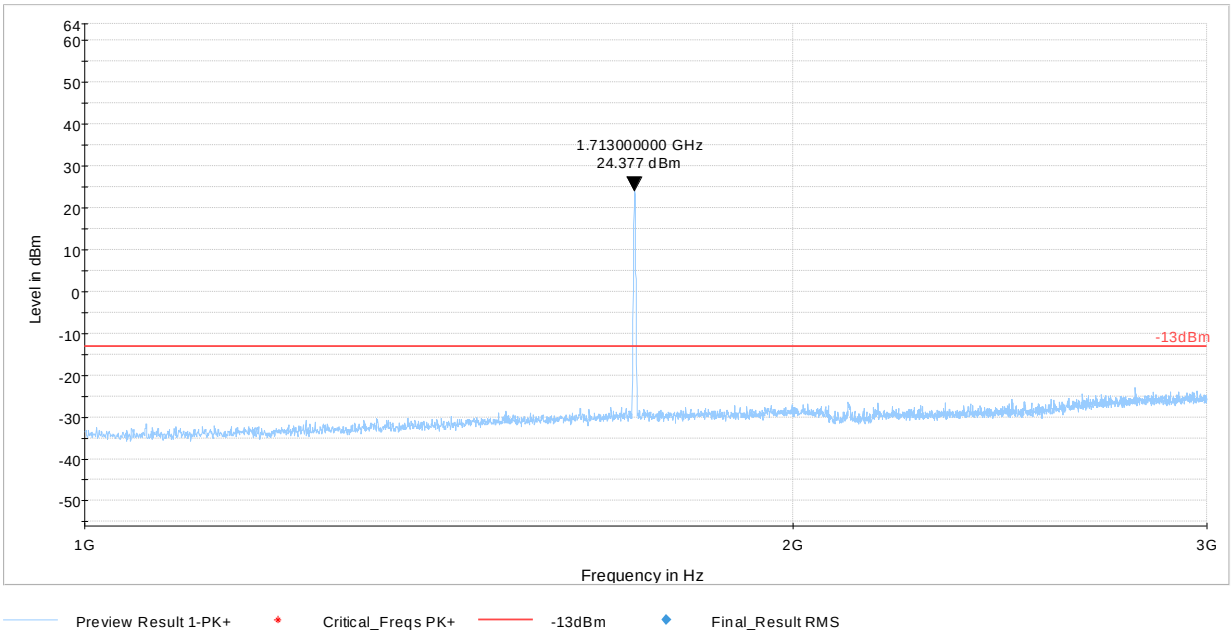
LTE Band 4

Plot # 1 Radiated Emissions: 30 MHz - 1 GHz
Channel: Low



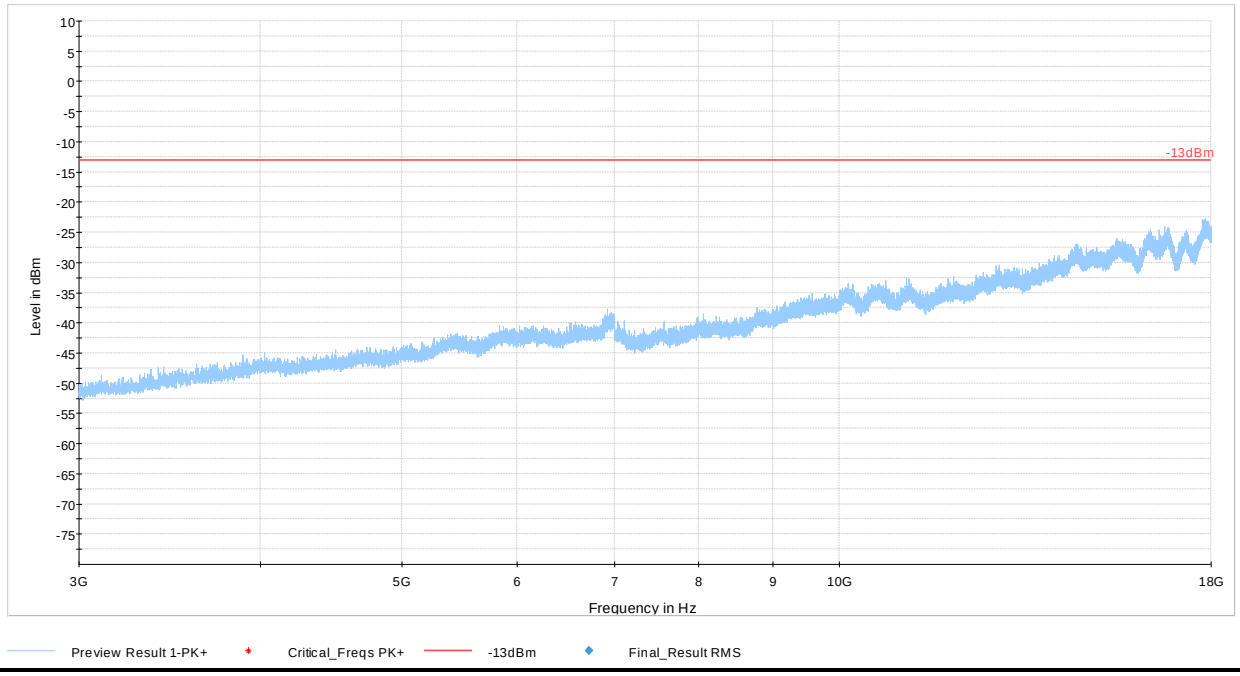
Plot # 2 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 3 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low

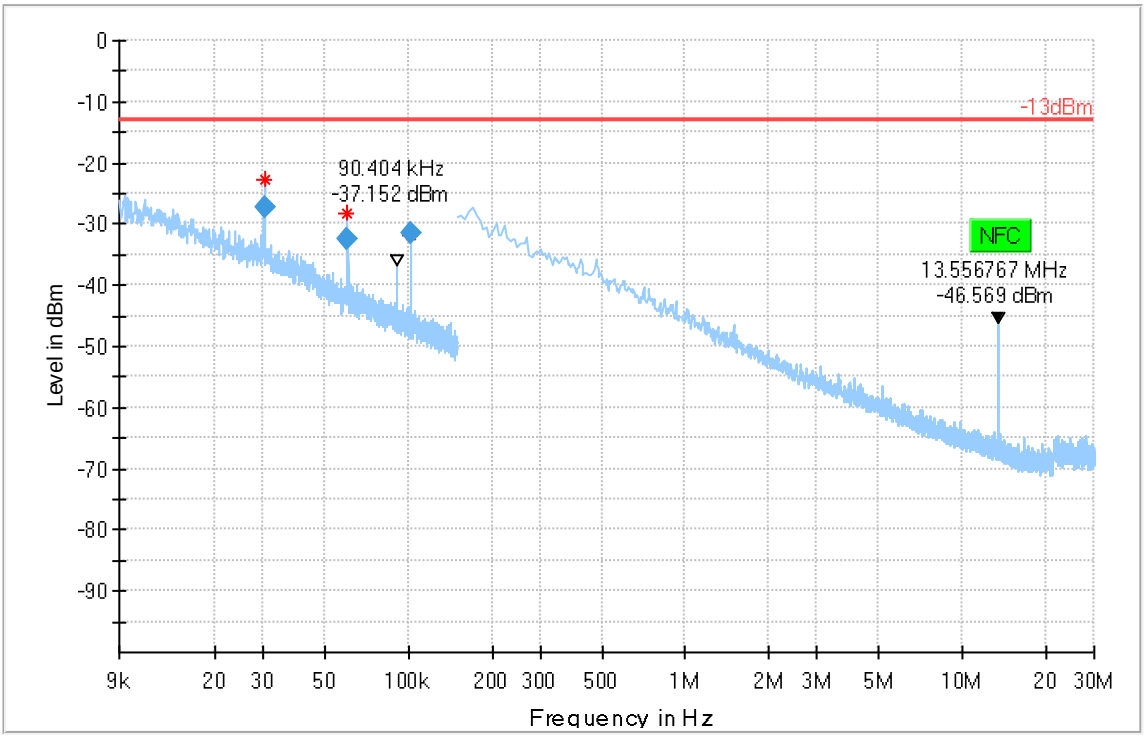


Plot # 4 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid

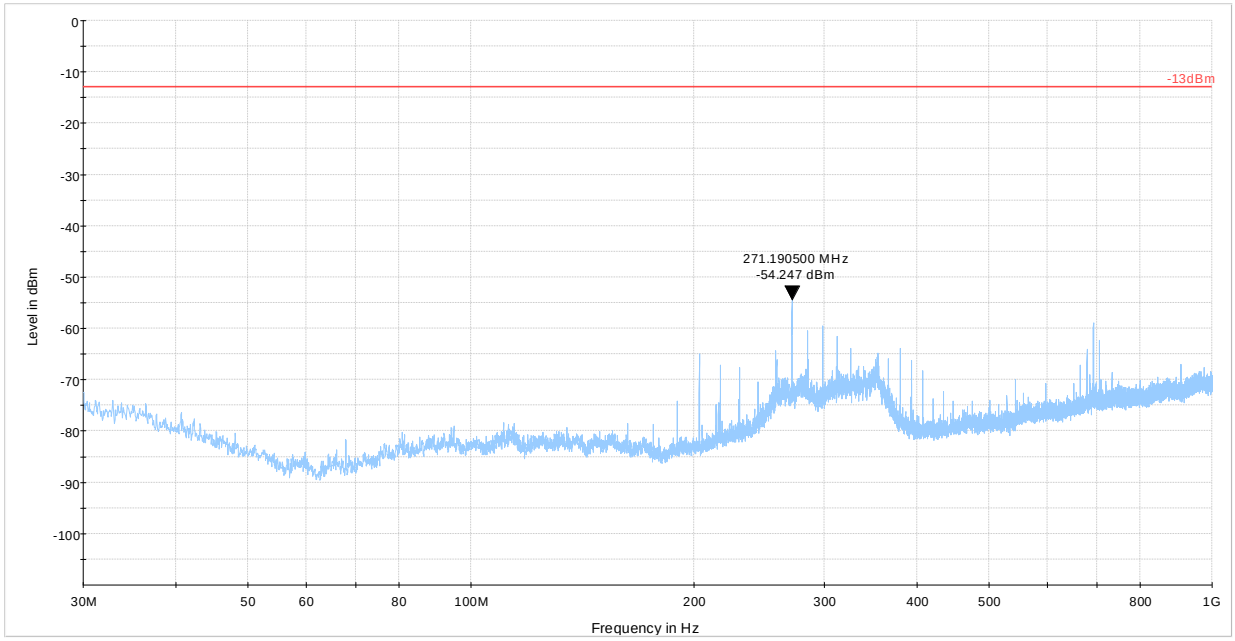
Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
0.03	-27.36	-13.00	14.36	100.0	-0.1	100.0	V	350.0	-76	3:34:10 PM - 4/1/2019
0.06	-32.37	-13.00	19.37	100.0	0.1	100.0	H	126.0	-79	3:37:11 PM - 4/1/2019
0.10	-31.61	-13.00	18.61	100.0	0.1	100.0	H	213.0	-80	3:39:50 PM - 4/1/2019



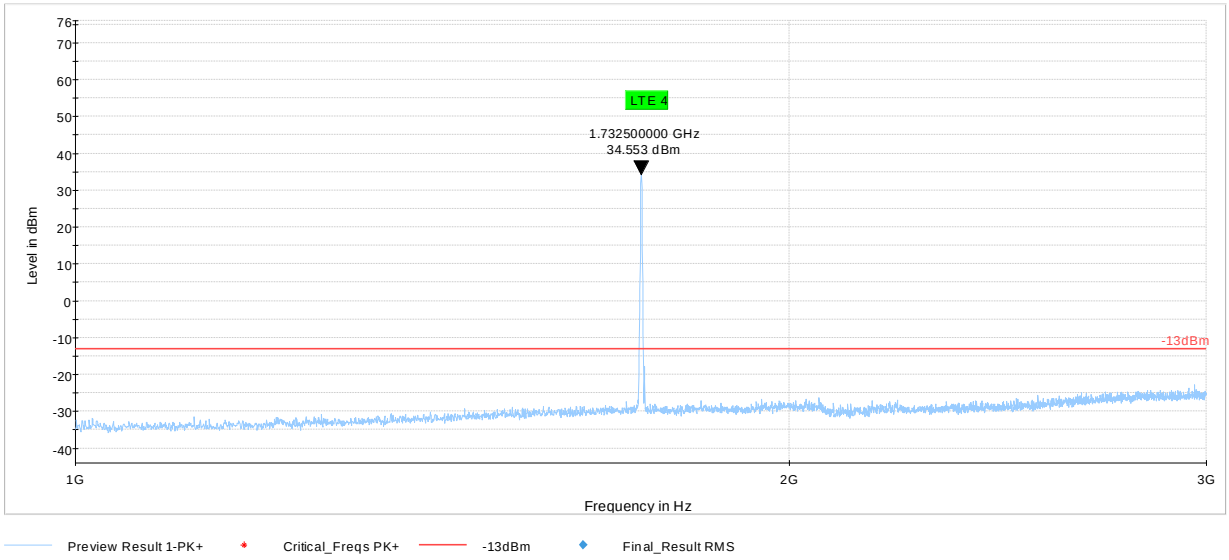
Plot # 5 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



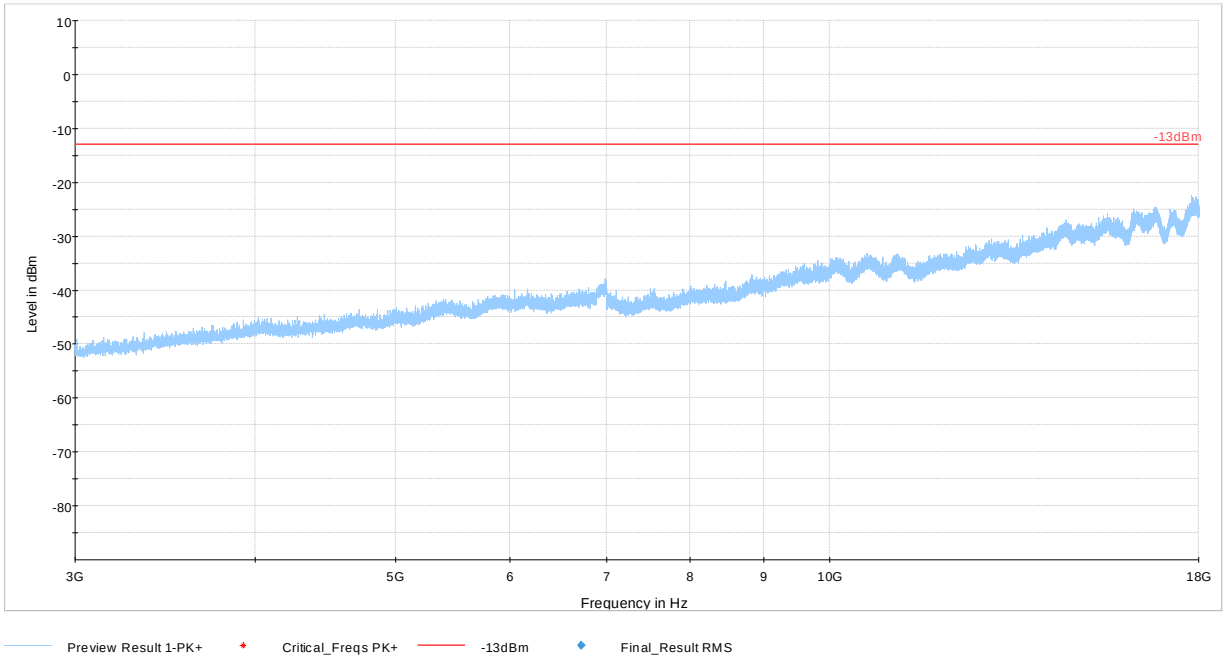
Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



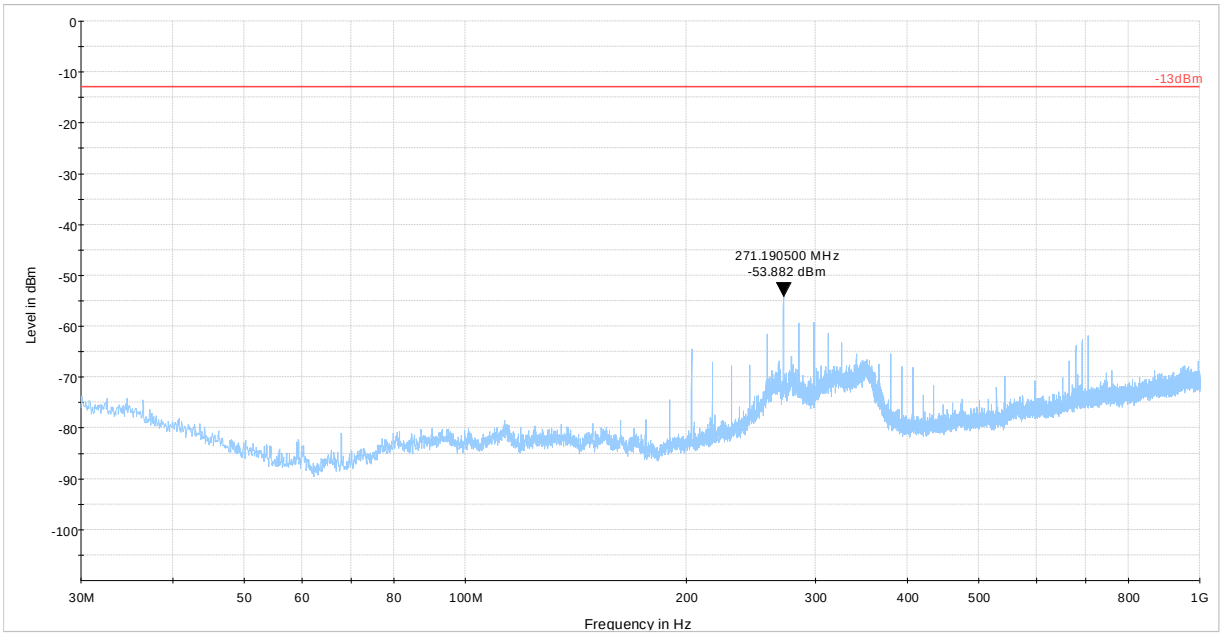
Plot # 7 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid



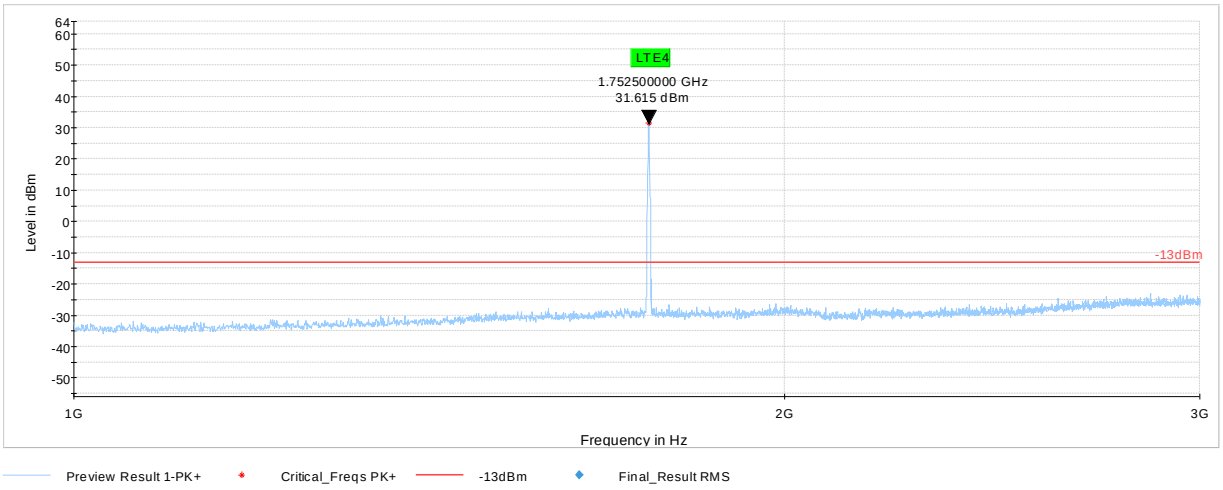
Plot # 8 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



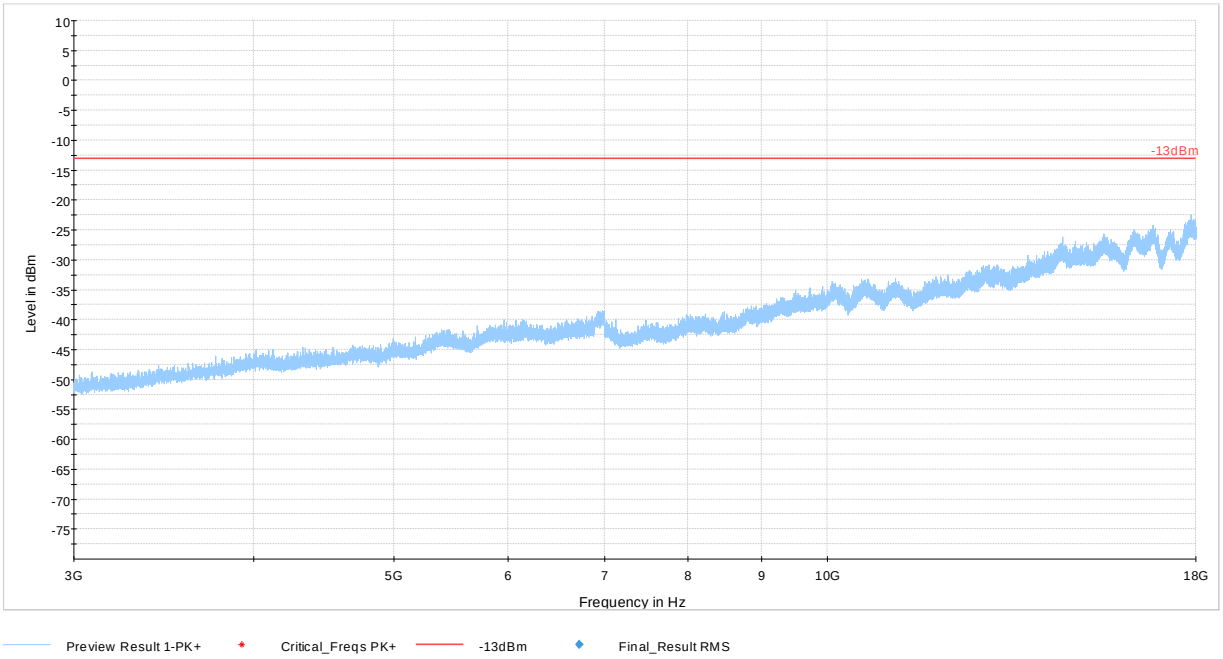
Plot # 9 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 10 Radiated Emissions: 3 GHz - 18 GHz

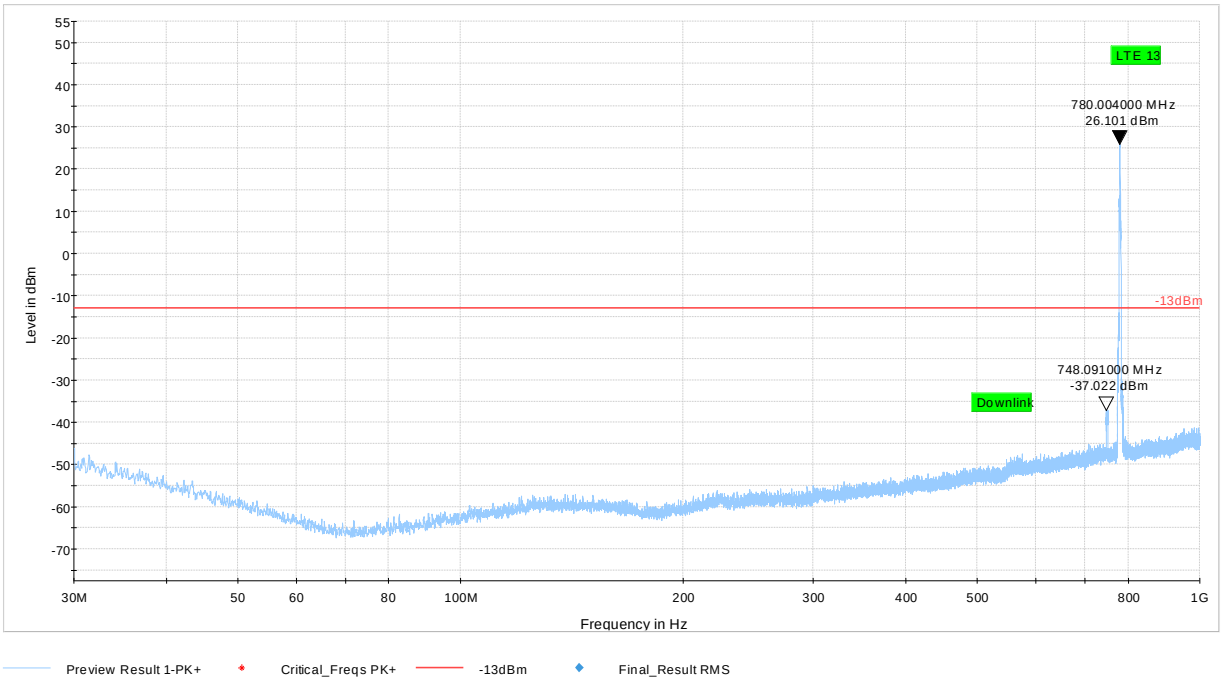
Channel: High



LTE Band 13

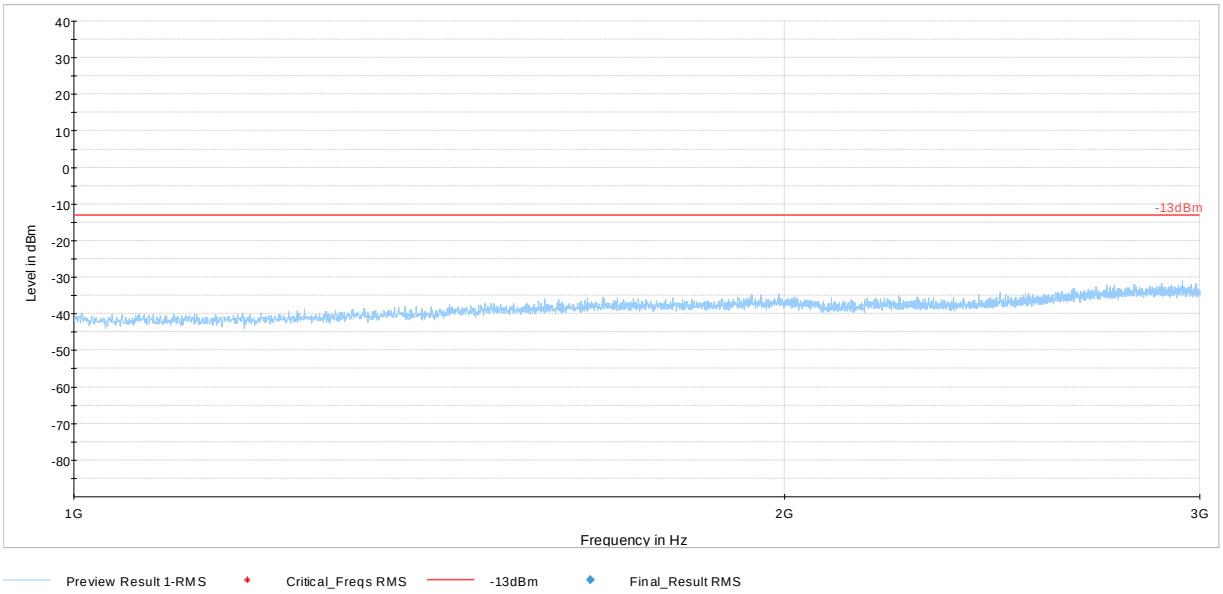
Plot # 11 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low



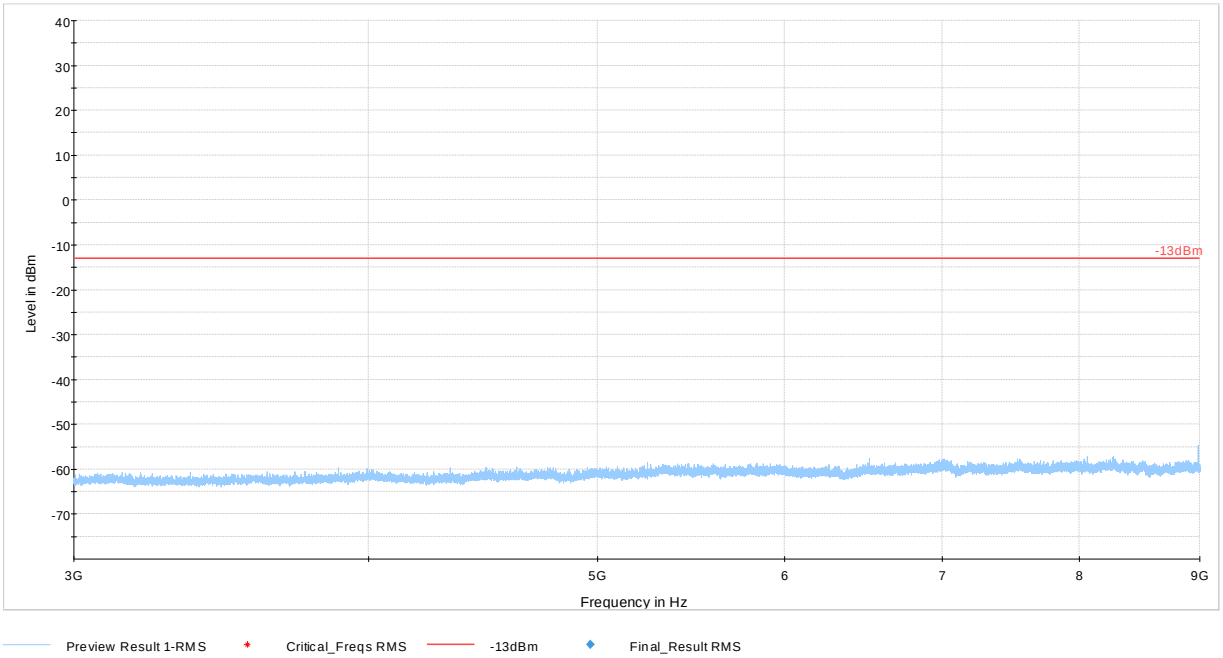
Plot # 12 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 13 Radiated Emissions: 3 GHz - 9 GHz

Channel: Low

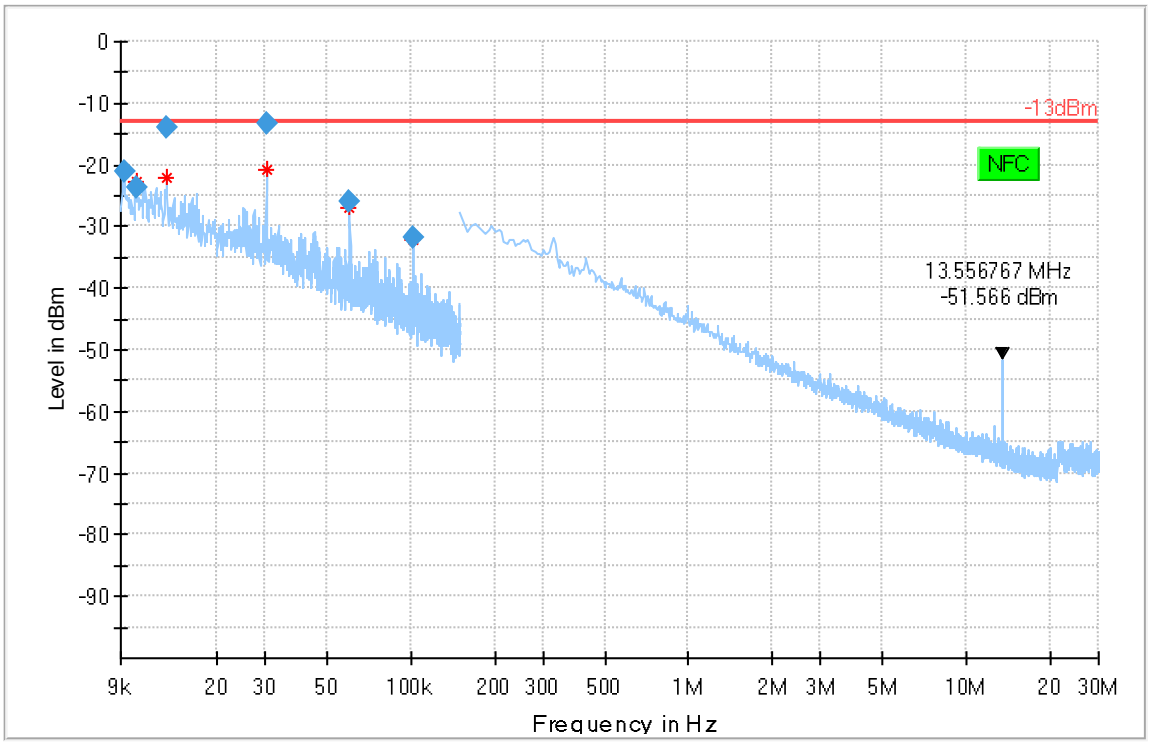


Plot # 14 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid

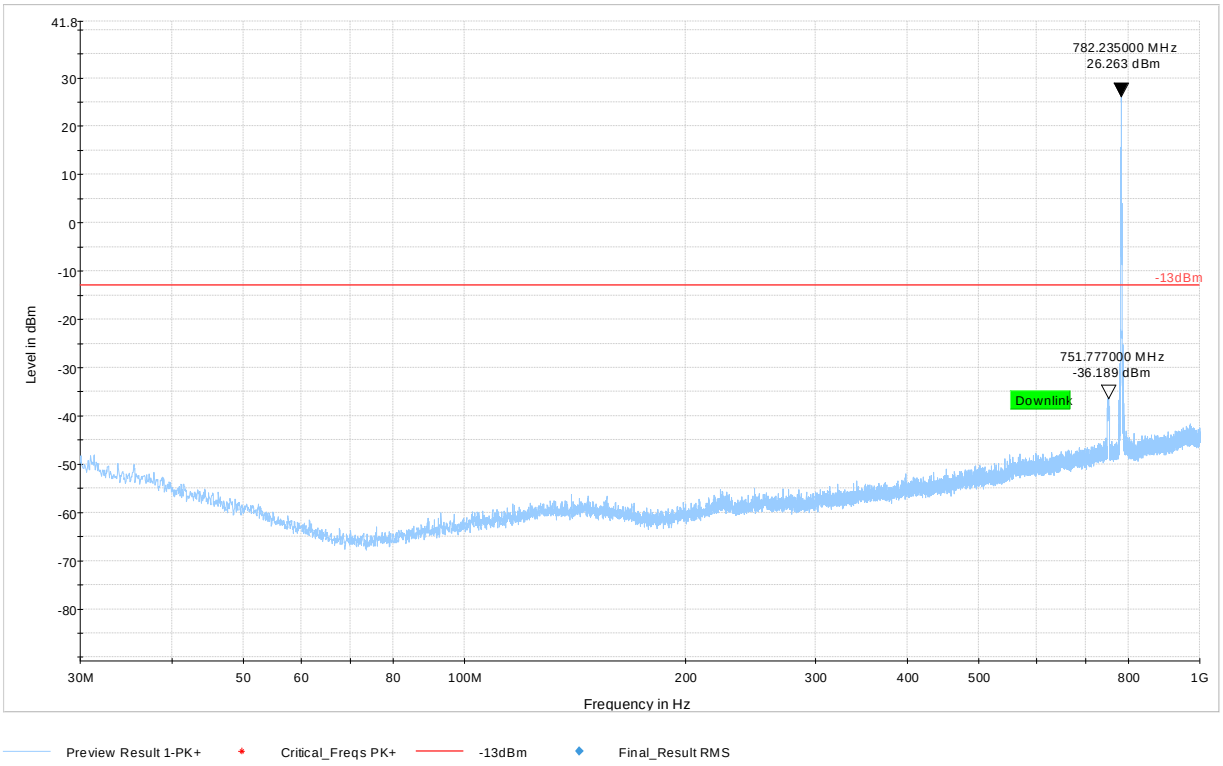
Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
0.01	-20.99	-13.00	7.99	100.0	0.1	100.0	H	67.0	-68	6:19:42 PM - 4/1/2019
0.01	-23.78	-13.00	10.78	100.0	0.1	100.0	H	64.0	-69	6:13:55 PM - 4/1/2019
0.01	-13.91	-13.00	0.91	100.0	0.1	107.0	H	133.0	-70	5:15:13 PM - 4/1/2019
0.03	-13.27	-13.00	0.27	100.0	0.1	100.0	H	131.0	-76	5:13:01 PM - 4/1/2019
0.06	-26.09	-13.00	13.09	100.0	0.1	100.0	H	157.0	-79	5:18:10 PM - 4/1/2019
0.10	-31.95	-13.00	18.95	100.0	0.1	100.0	H	271.0	-80	5:20:56 PM - 4/1/2019



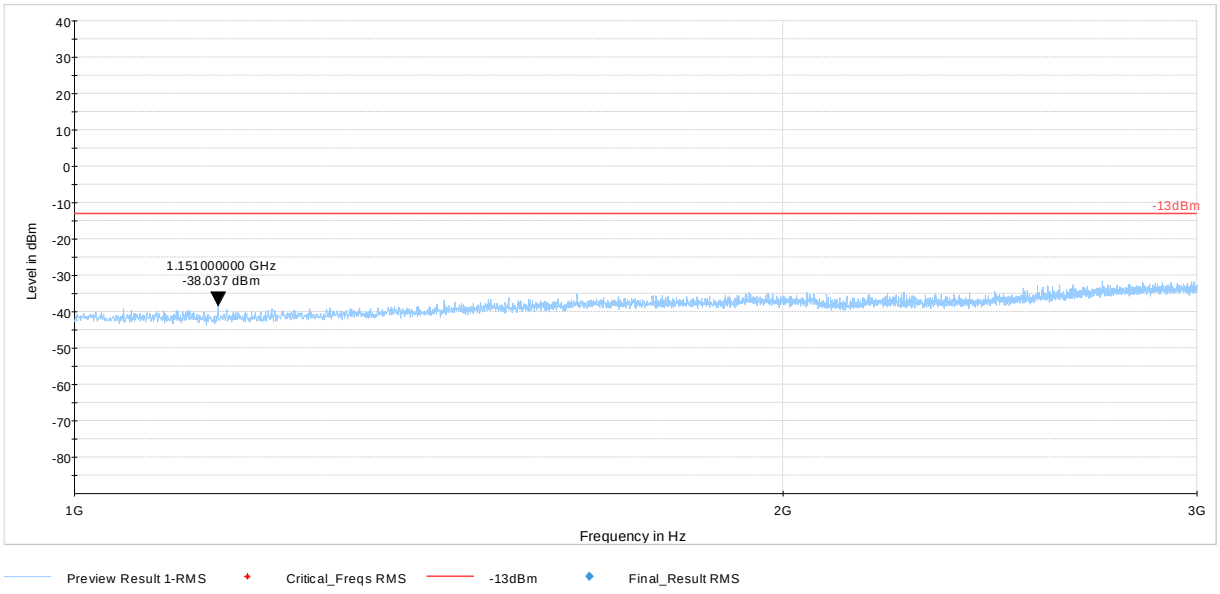
Plot # 15 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid



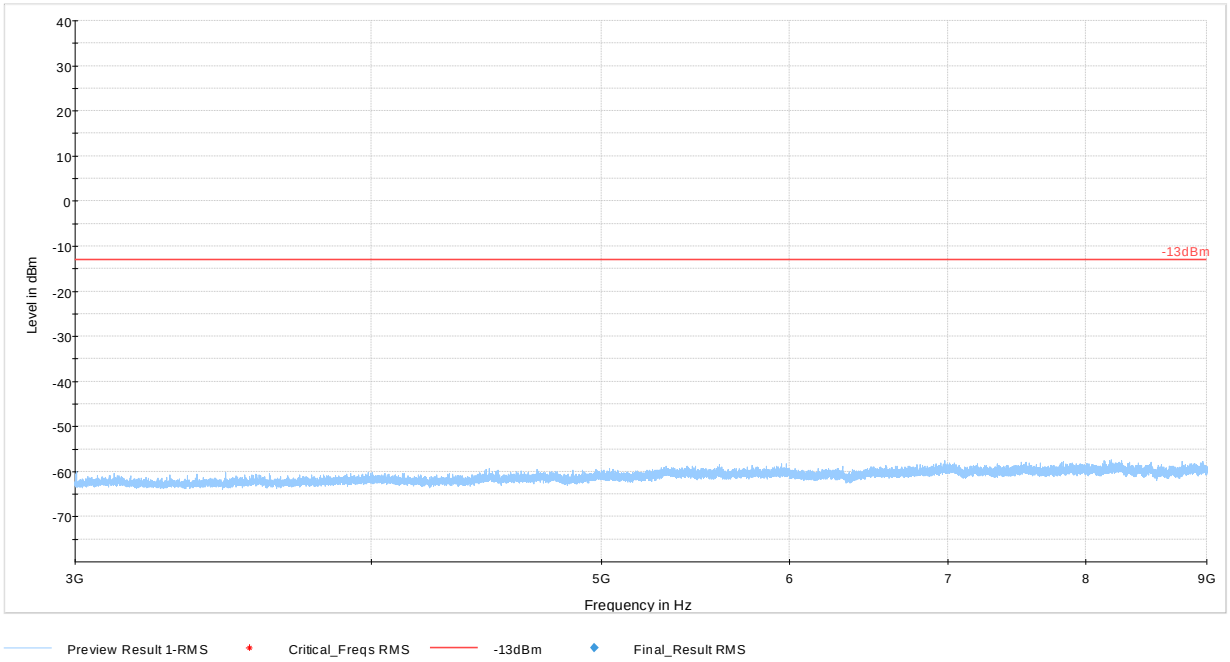
Plot # 16 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



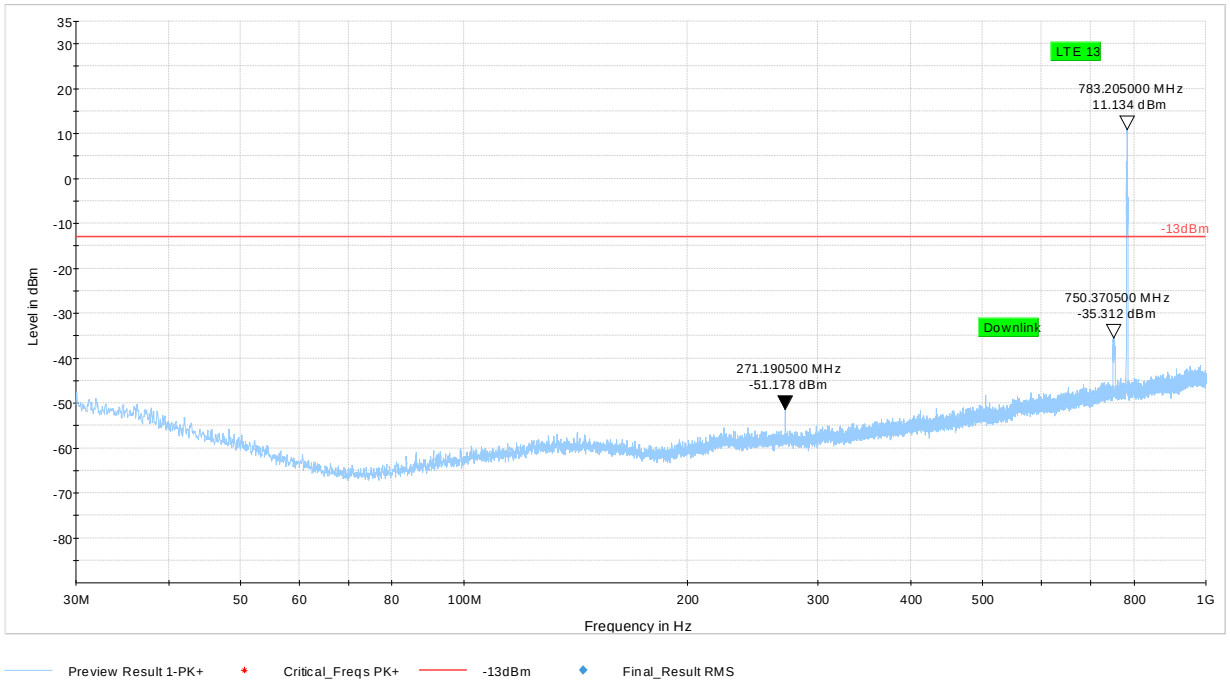
Plot # 17 Radiated Emissions: 3 GHz – 9GHz

Channel: Mid



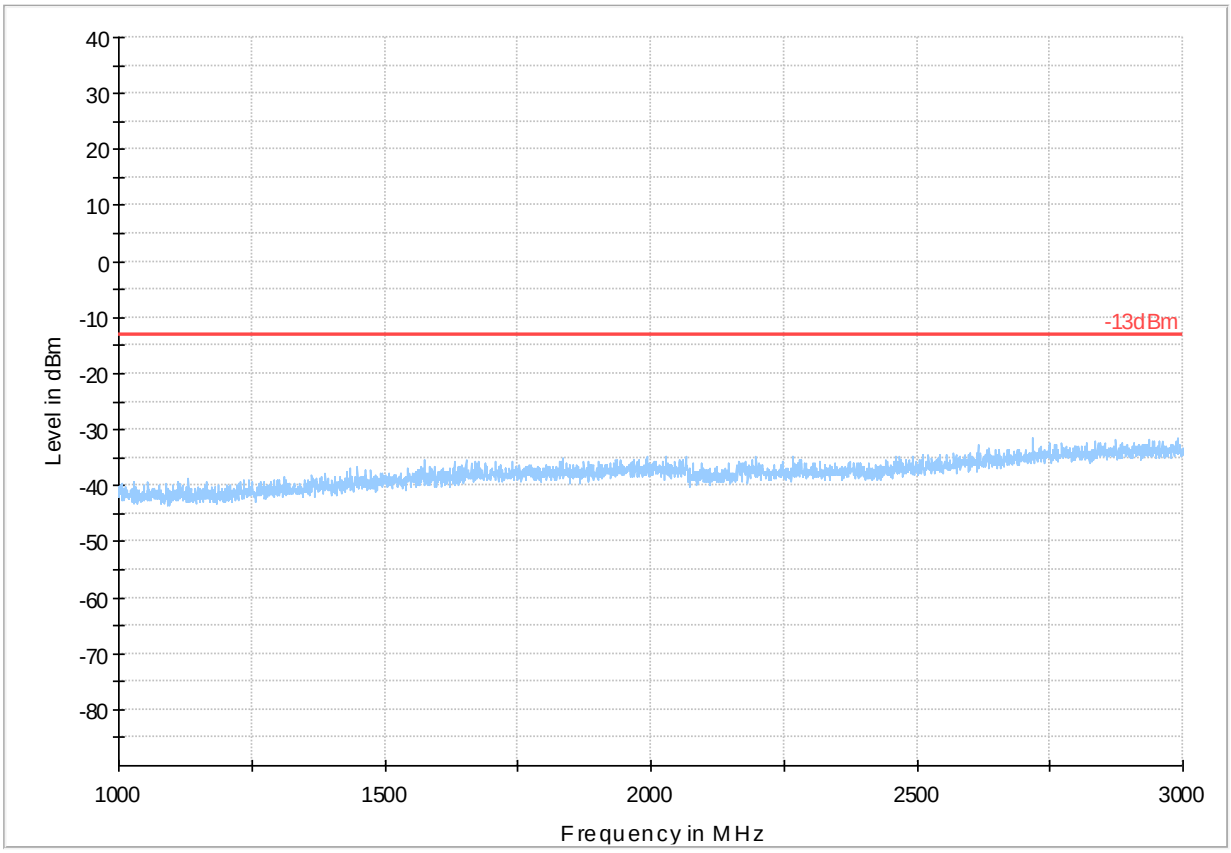
Plot # 18 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



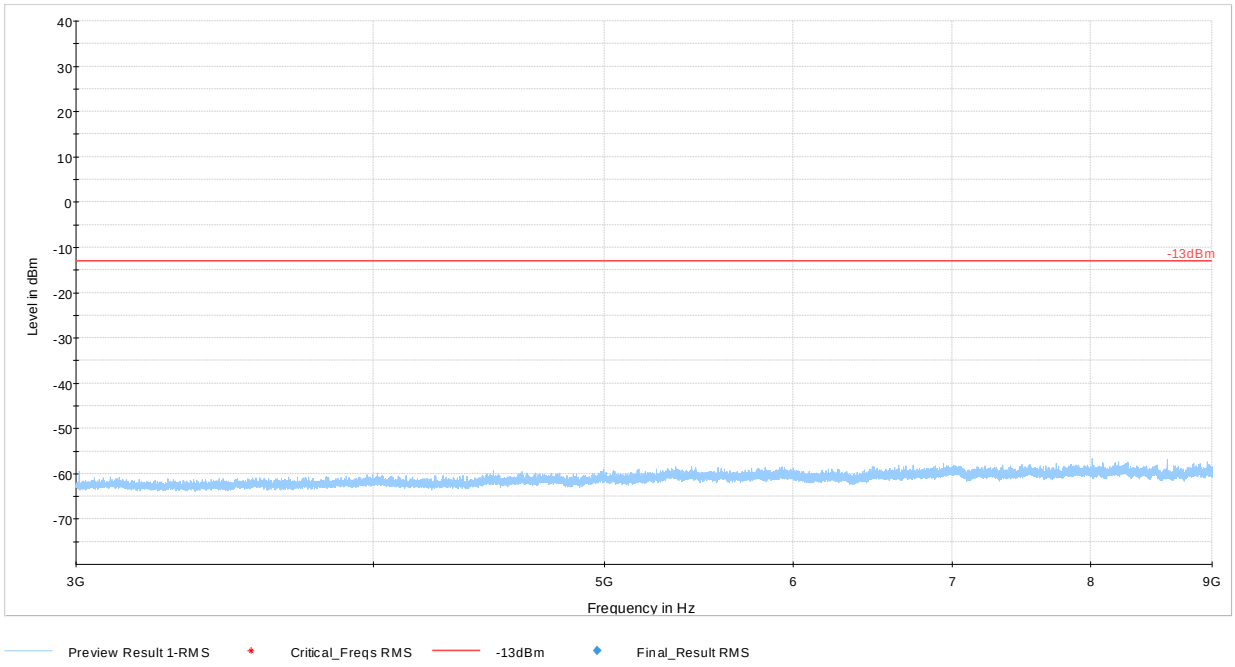
Plot # 19 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 20 Radiated Emissions: 3 GHz - 9 GHz

Channel: High



8 Test setup photos

Setup photos are included in supporting file name: "EMC_SYNAP_035_19001_FCC_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	10/26/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	EMCO	3115	00035114	3 YEARS	07/31/2017
HORN ANTENNA	ETS LINDGREN	3117	00167061	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00166821	3 YEARS	09/24/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/05/2017
VWR THERMOMETER	CONTROL COMPANY	36934-164	191871994	2 YEARS	01/10/2019

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

10 Revision History

Date	Report Name	Changes to report	Report prepared by
5/16/2019	EMC_SYNAP_035_19001_FCC_27	Initial Version	Issa Ghanma