FCC/ISED Test Report

FOR:
Zonar Systems

Model Number:
ZTCU4A

Product Description:
Vehicle mounted Telematics device

FCC ID: SEJ-ZTCU4A
IC ID: 5266A-ZTCU4A

Per:
47 CFR: Part 22, Part 24, Part 27
RSS-130; RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3

REPORT #: EMC_ZONAR_018_19001_FCC_22_24_27_ISED

DATE: 2019-05-09

A2LA Accredited

IC recognized #
3462B-2

***CETECOM* Inc.**
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CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

TABLE OF CONTENTS

1 Assessment

The following device as further described in section 3 of this report was evaluated for radiated spurious emissions in simultaneous transmission of cellular and unlicensed radios according to criteria specified in the Code of Federal Regulations Title 47 parts 22, 24, 27 and Industry Canada Radio Standard Specifications RSS: 130, 132 Issue 3, 133 Issue 6 and 139 Issue3.

Company	Description	Model #
Zonar Systems	Vehicle mounted Telematics device	ZTCU4A

No deficiencies were ascertained.

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2019-05-09	Compliance	Cindy Li (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: 2019.05.09 16:15:01 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
2019-05-09	Compliance	Yuchan Lu (Test Engineer)	Yuchan Lu Digitally signed by: Yuchan Lu DN: CN = Yuchan Lu email = Yuchan.Lu@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2019.05.09 15:54:04 -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:	Cindy Li
Responsible Project Leader:	Sangeetha Sivaraman

2.2 Identification of the Client

Applicant's Name:	Zonar Systems
Street Address:	18200 Cascade Avenue North
City/Zip Code	Seattle Washington, 98188
Country	USA

2.3 Identification of the Manufacturer

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

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Firmware Version Identification Number (FVIN):	4.8
Hardware Version Identification Number (HVIN):	ZTCU4A
Product Marketing Name (PMN):	N/A
Antenna Information as declared:	Primary antenna gains: • GSM 850: 0.77 dBi • GSM 1900: 2.92 dBi • WCDMA II: 2.92 dBi • WCDMA V: 0.77 dBi • LTE Band 2: 2.92 dBi • LTE Band 4: 3.05 dBi • LTE Band 5: 0.77 dBi • LTE Band 12: -0.21 dBi
Other Radios included in the device:	❖ Bluetooth Classic, BLE • Module name: ublox • Module number: NINA-B222 • FCC/IC ID: XPYNINAB22 / 8595A-NINAB22 • PIFA 3 dBi ❖ GPS • Module name: ublox • Module number: MAX-M8Q-0-01
Power Supply/ Rated Operating Voltage Range:	Low 9 VDC, Nominal 13-14 VDC, High 32 VDC
Operating Temperature Range:	Low -40º C, Nominal 23º C, High 85º C
Sample Revision	☐Prototype Unit; ☐Production Unit; ■Pre-Production
EUT Dimensions(mm):	152 x 94 x 32
Weight(grams):	220
EUT Diameter	■ < 60 cm ☐ Other _____

Module Information	
Module Name:	ublox
Model Number:	TOBY-R200
FCC ID:	XPY1EHM44NN
IC ID:	8595A-1EHM44NN

3.2 EUT Sample details

EUT #	IMEI number	HW Version	SW Version	Notes/Comments
1	352848082730603	3	4.8	Radiated Measurement

3.3 Accessory Equipment (AE) Details

AE #	Comments
1	Power cable(4-pin connector)

3.4 Support Equipment

SE #	Comments
1	USB cable for interface with different vehicles (6-pin connector)

3.5 Test Sample Configuration

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

3.6 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular and BLE Co-Transmission	Cellular was tested on Low, Mid, High Channels at the maximum power in a co-transmission mode. Special commands through command window used to configure the BLE Mid channel provided by the client that will not be available to the end user For radiated measurements: The internal antenna was connected.

3.7 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets on low, mid and high channels at the maximum power simultaneous transmission with BLE Mid channel. Which it 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 evaluation conducted by CETECOM Inc. is to support a request for new equipment authorization under **FCC ID:** SEJ-ZTCU4A / **IC ID**: 5266A-ZTCU4A

The pre-certified module to be integrated (SW WP7603) as described in Section 3, Radiated Spurious Emissions test was performed. Results have been checked to meet limits per Code of Federal Regulations Title 47 parts 22, 24, 27 and Industry Canada Radio Standard Specifications RSS: 130, 132 Issue 3, 133 Issue 6 and 139 Issue 3.

The conducted module test data that can be obtained under the **FCC Filing ID:** XPY1EHM44NN is applicable for the host described in section 3.

4.1 Dates of Testing:

04/04/2019 – 04/09/2019

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%

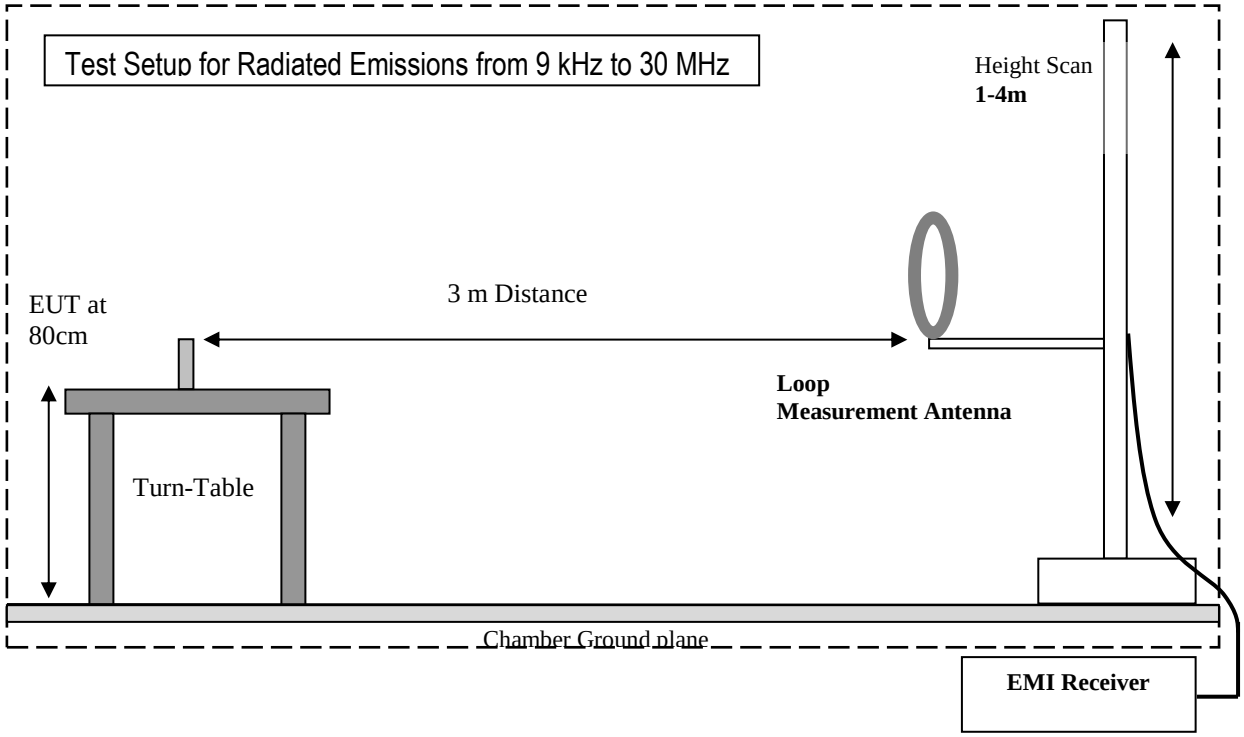
Deviating test conditions are indicated at individual test description where applicable.

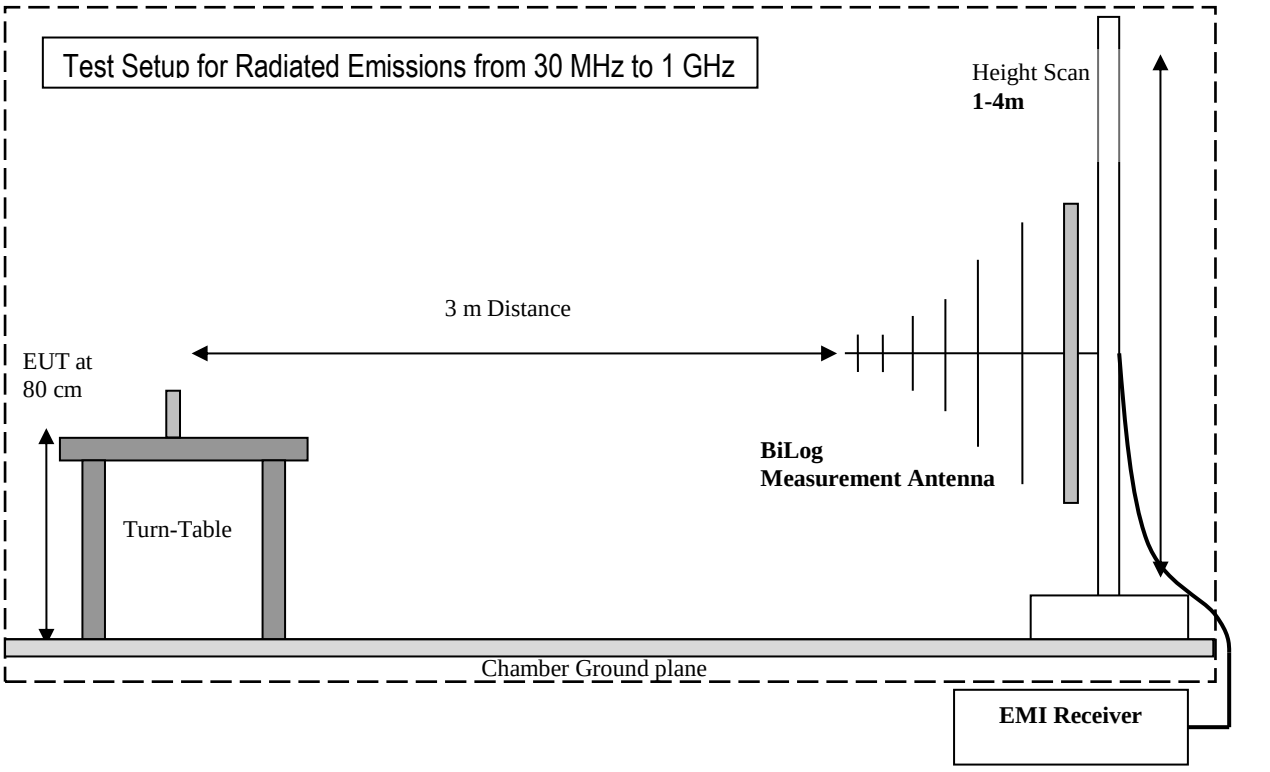
5 Measurement Procedures

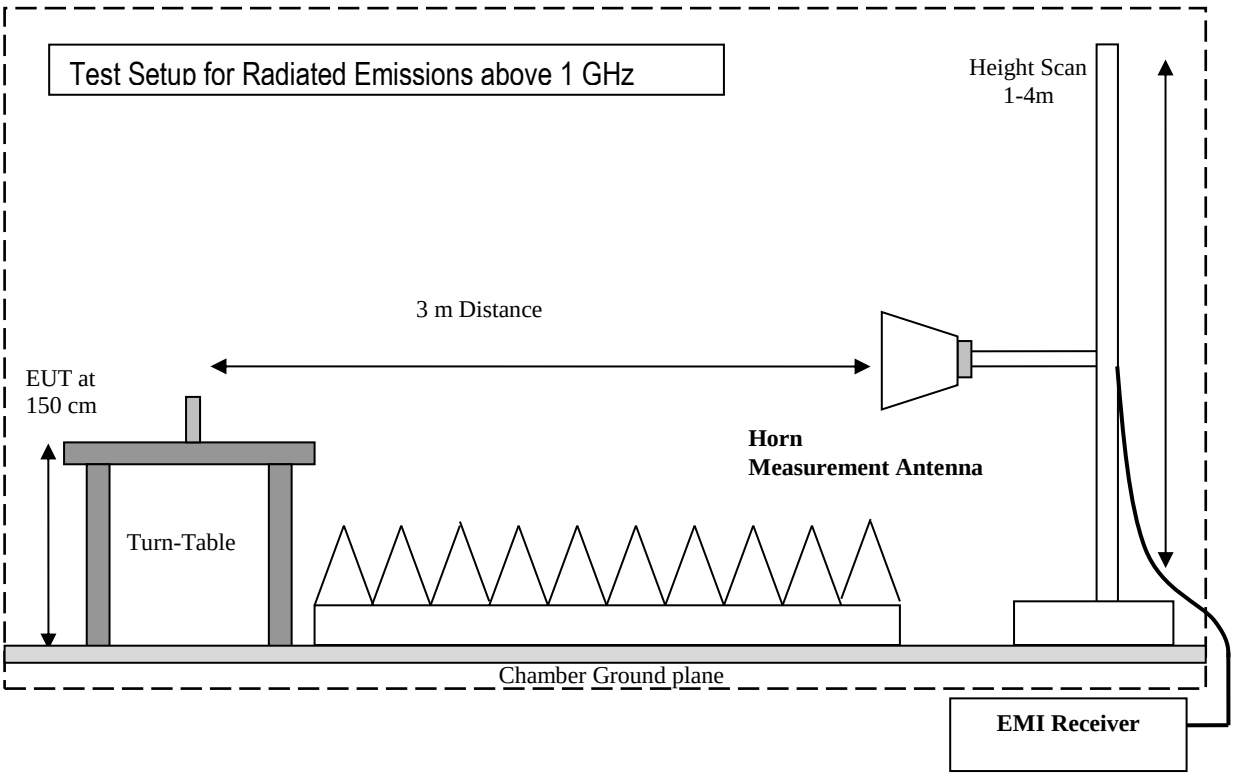
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to ANSI C63.26 as detailed below.

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 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.




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 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	-	☐	☐	☐	■	Note 1 Note 2
§2.1055; §22.355	Frequency Stability	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1049; §22.917	Occupied Bandwidth	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §22.917	Band Edge Compliance	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §22.917	Conducted Spurious Emissions	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1053; §22.917(a); RSS-132 Issue 3-5.5;	Radiated Spurious Emissions	Nominal	Op.1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification FCC ID: XPY1EHM44NN

6.2 FCC 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	-	☐	☐	☐	■	Note 1 Note 2
§2.1055; §24.235	Frequency Stability	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	-	☐	☐	☐	■	Note 1 Note 2
§2.1053; §24.238(a); RSS-133 Issue 6-6.5.1;	Radiated Spurious Emissions	Nominal	Op.1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification FCC ID: XPY1EHM44NN

6.3 FCC 27, RSS-130, RSS-139:

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); RSS-130 Issue 1-4.6; RSS-139 Issue 3-6.6;	Radiated Spurious Emissions	Nominal	Op.1	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification FCC ID: XPY1EHM44NN

7 Test Result Data

7.1 ERP

Band	Frequency Range (MHz)	Power conducted (W)	Emission Designator	Gain (dBi)	gain linear	EIRP[1]	ERP[1] (W)	Frequency deviation (ppm)	Limit ERP (W)
GSM 850	824.2 – 848.8	2.05	315KGXW	0.77	1.194	2.448	1.492	0.1	7
GSM1900	1850.2 – 1909.8	-	319KGXW	-	-	0.975[2]	-	0.1	2
WCDMA II	1852.4 – 1907.6	0.294	4M71F9W	2.92	1.959	0.576	-	0.1	2
WCDMA V	826.4 – 846.6	0.27	4M71F9W	0.77	1.194	0.322	0.197	0.1	7
LTE 2	1857.5 – 1902.5	0.156	13M7G7D	2.92	1.959	0.306	-	0.1	2
LTE 2	1860 – 1900	0.155	18M2G7D	2.92	1.959	0.304	-	0.1	2
LTE 4	1717.5 – 1747.5	0.168	13M7G7D	3.05	2.018	0.339	-	0.1	1
LTE 4	1720 – 1745	0.157	18M3G7D	3.05	2.018	0.317	-	0.1	1
LTE 5	829 – 844	0.161	9M06G7D	0.77	1.194	0.192	0.117	0.1	7
LTE 12	704 – 711	0.158	9M06G7D	-0.21	0.953	0.151	0.092	0.1	3

Note 1: ERP are calculated from maximum power in grant of cellular module TOBY-R200 adding the maximum gain of the utilized cellular antenna per operational description.
Note 2: EIRP result for GSM1900 is from CETECOM OTA result.

7.2 Radiated Spurious Emissions

7.2.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR Part 22.917; CFR Part 24.238, 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 22

Frequency Range	30 MHz – 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 and 27

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

7.2.2 Limits:

- **FCC Part 22.917(a) and Part 24.238(a), Part 27.53 (g), and Part 27.53 (h)**
- **RSS-130-4.6, RSS-132 Issue 3 5.5, RSS-133 Issue 6 6.5.1, RSS-139 Issue 3 6.6**

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	12 VDC

7.2.4 Measurement result:

Plot #	Cellular Channel	EUT operating mode	Scan Frequency	Critical Frequency [MHz]	Emission level [dBm]	Limit [dBm]	Result
1 – 3	Low	GSM 850	30 MHz – 9 GHz	875.665	-38.52	-13	Pass
4 – 7	Mid	GSM 850	9 kHz – 9 GHz	1672.900	-37.48	-13	Pass
8 – 10	High	GSM 850	30 MHz – 9 GHz	1698.000	-32.89	-13	Pass
11 – 13	Low	GSM 1900	30 MHz – 18 GHz	3700.298	-46.79	-13	Pass
14 – 18	Mid	GSM 1900	9 kHz – 26 GHz	875.764	-49.09	-13	Pass
19 – 21	High	GSM 1900	30 MHz – 18 GHz	3819.526	-49.56	-13	Pass
22 – 24	Low	WCDMA II	30 MHz – 18 GHz	420.010	-63.93	-13	Pass
25 – 29	Mid	WCDMA II	9 kHz – 26 GHz	420.020	-64.32	-13	Pass
30 – 32	High	WCDMA II	30 MHz – 18 GHz	420.000	-63.95	-13	Pass
33 – 35	Low	WCDMA V	30 MHz – 9 GHz	-	-	-13	Pass
36 – 39	Mid	WCDMA V	9 kHz – 9 GHz	-	-	-13	Pass
40 – 42	High	WCDMA V	30 MHz – 9 GHz	-	-	-13	Pass
43 – 45	Low	LTE 2	30 MHz – 18 GHz	917.092	-79.84	-13	Pass
46 – 50	Mid	LTE 2	9 kHz – 26 GHz	460.005	-64.90	-13	Pass
51 – 53	High	LTE 2	30 MHz – 18 GHz	580.017	-62.64	-13	Pass
54 – 56	Low	LTE 4	30 MHz – 18 GHz	3871.120	-57.67	-13	Pass
57 – 60	Mid	LTE 4	9 kHz – 18 GHz	0.030	-25.19	-13	Pass
61 – 63	High	LTE 4	30 MHz – 18 GHz	460.001	-62.97	-13	Pass
64 – 66	Low	LTE 5	30 MHz – 9 GHz	-	-	-13	Pass
67 – 70	Mid	LTE 5	9 kHz – 9 GHz	0.030	-26.83	-13	Pass
71 – 73	High	LTE 5	30 MHz – 9 GHz	-	-	-13	Pass
74 – 76	Low	LTE 12	30 MHz – 9 GHz	-	-	-13	Pass
77 – 80	Mid	LTE 12	9 kHz – 9 GHz	0.030	-24.25	-13	Pass
81 – 83	High	LTE 12	30 MHz – 9 GHz	-	-	-13	Pass

7.2.5 Measurement Plots:

GSM 850

Plot # 1 Radiated Emissions: 30 MHz - 1 GHz

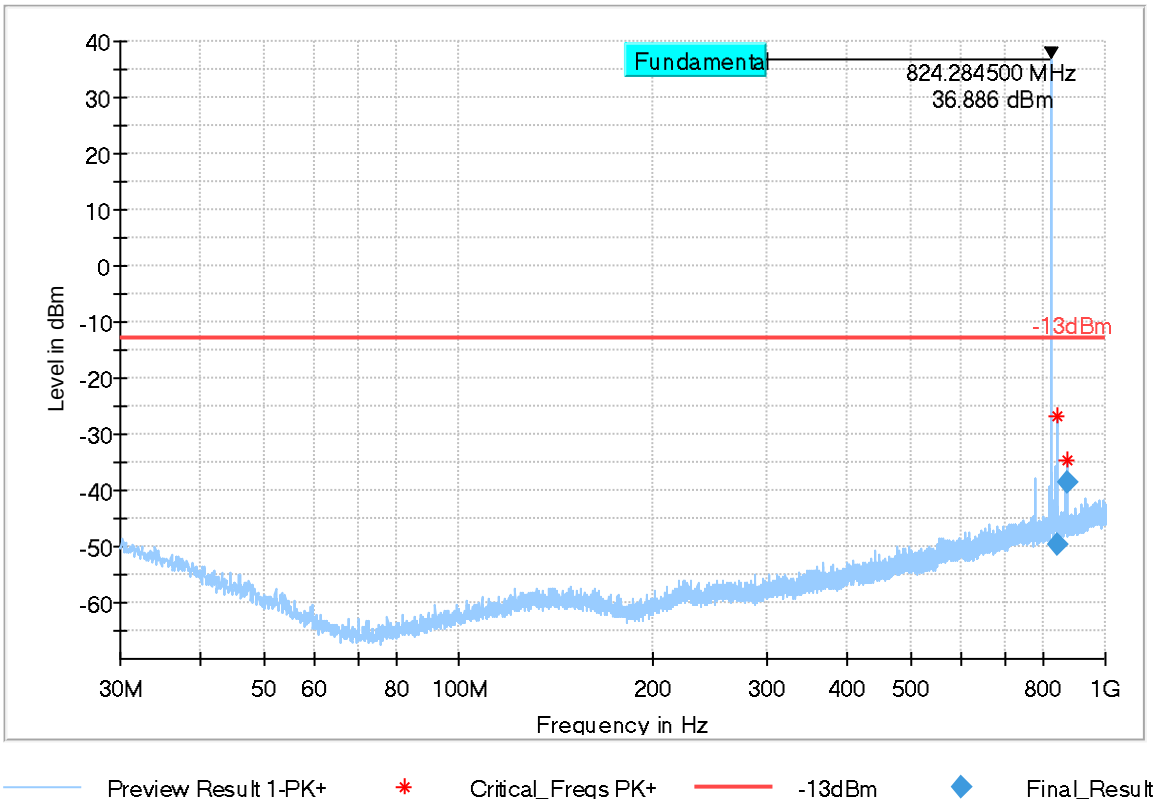
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
843.146	-49.60	-13.00	36.60	500.0	100.0	100.0	H	170.0	-69
875.665	-38.52	-13.00	25.52	500.0	100.0	241.0	V	5.0	-69

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
843.146	10:55:01 AM - 4/9/2019
875.665	10:51:47 AM - 4/9/2019



Plot # 2 Radiated Emissions: 1 GHz - 3 GHz

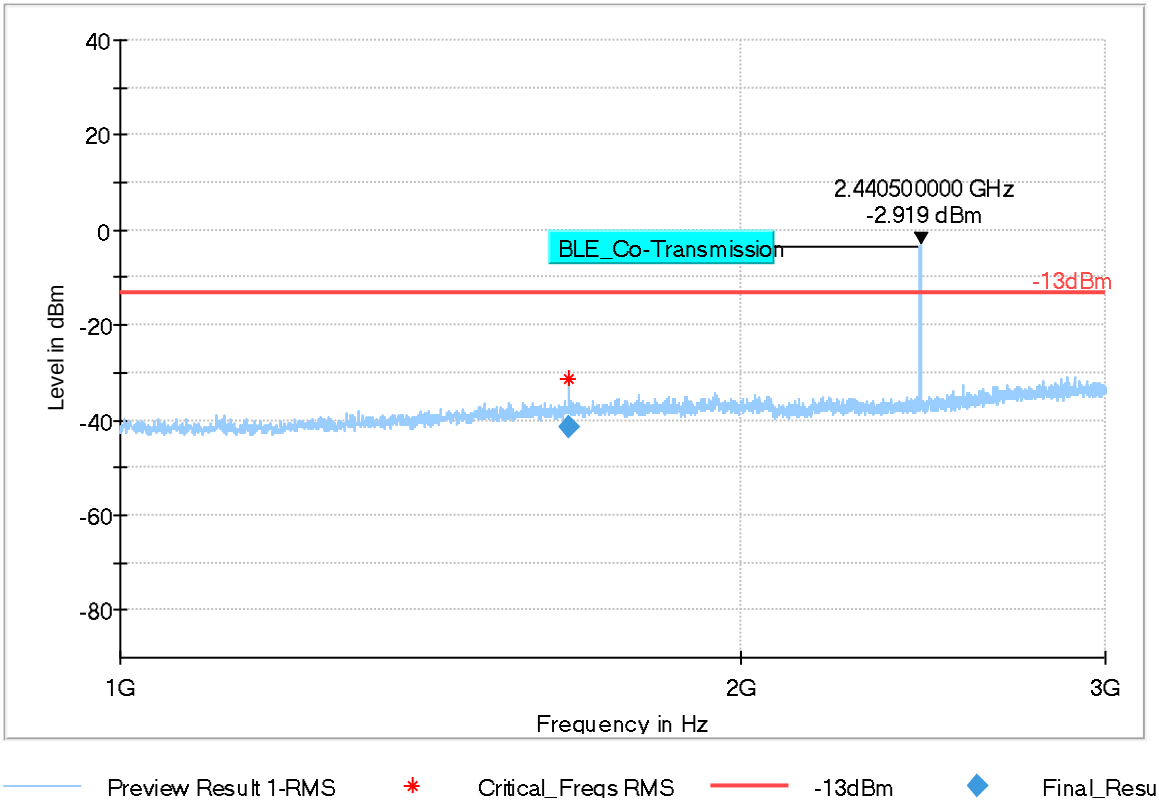
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1648.235	-41.61	-13.00	28.61	500.0	1000.0	132.0	H	339.0	-87

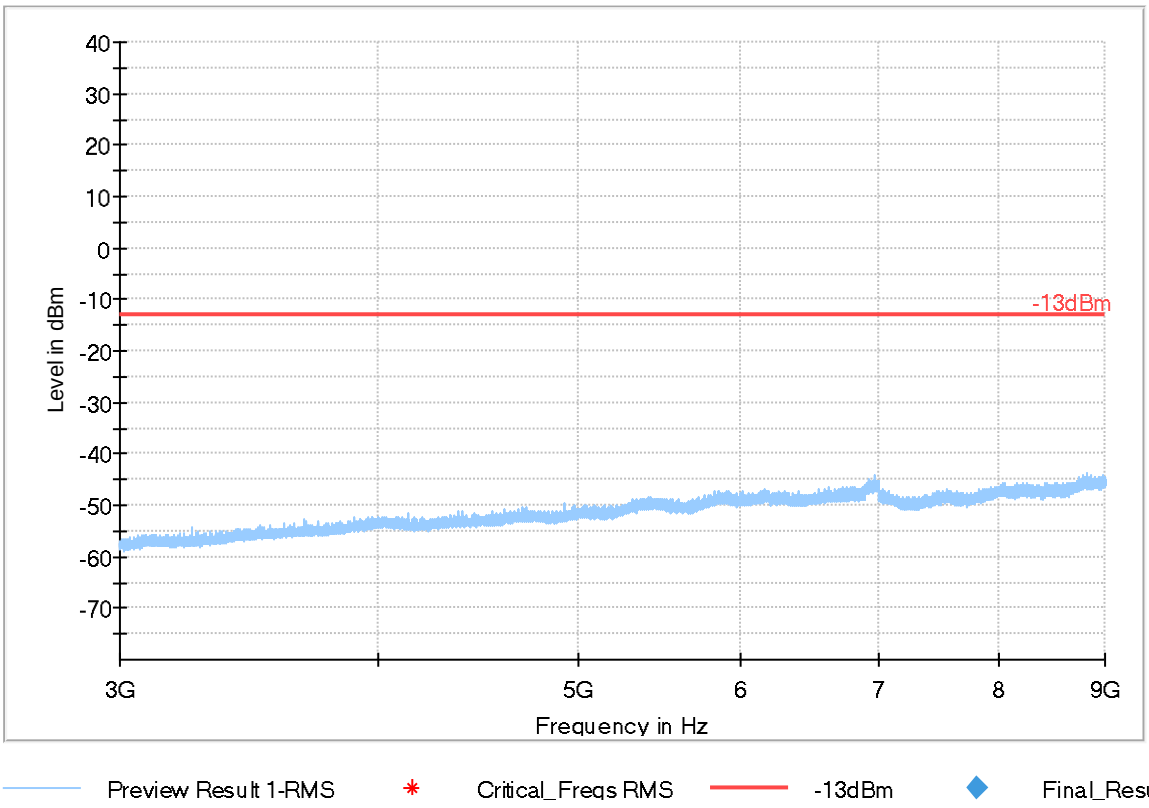
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
1648.235	



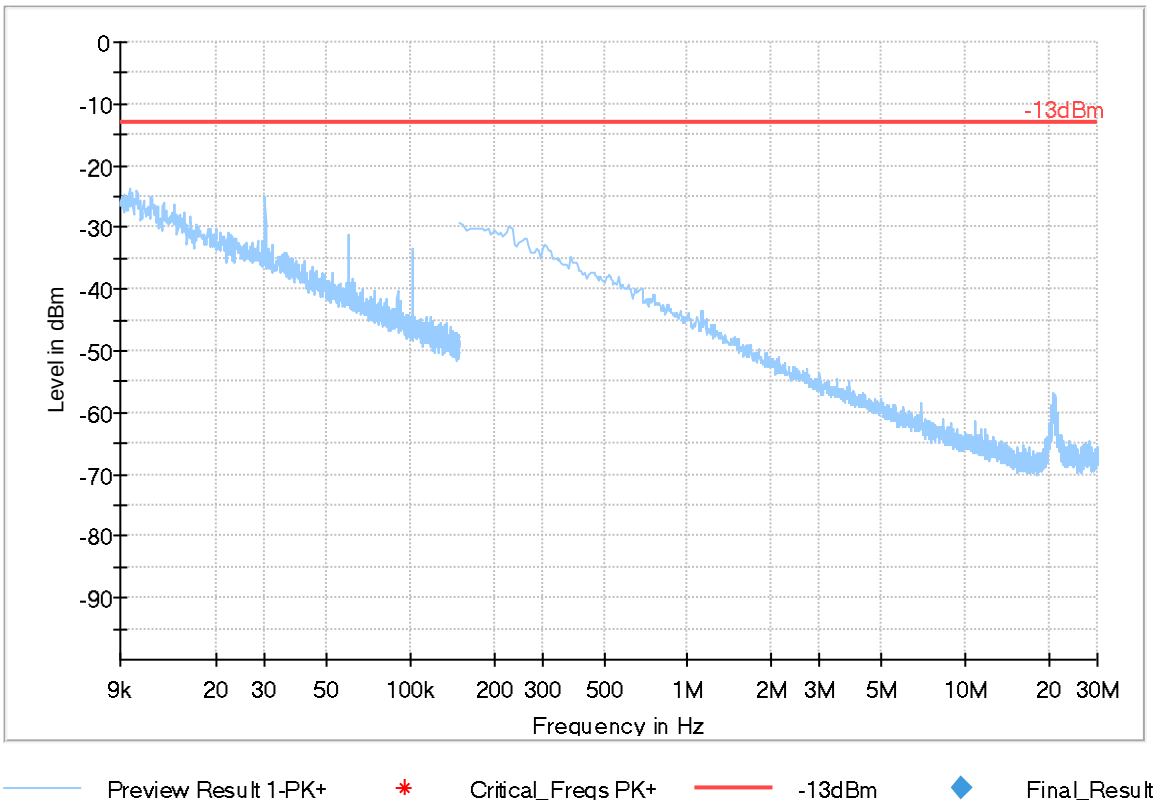
Plot # 3 Radiated Emissions: 3 GHz - 9 GHz

Channel: Low



Plot # 4 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



Plot # 5 Radiated Emissions: 30 MHz – 1 GHz

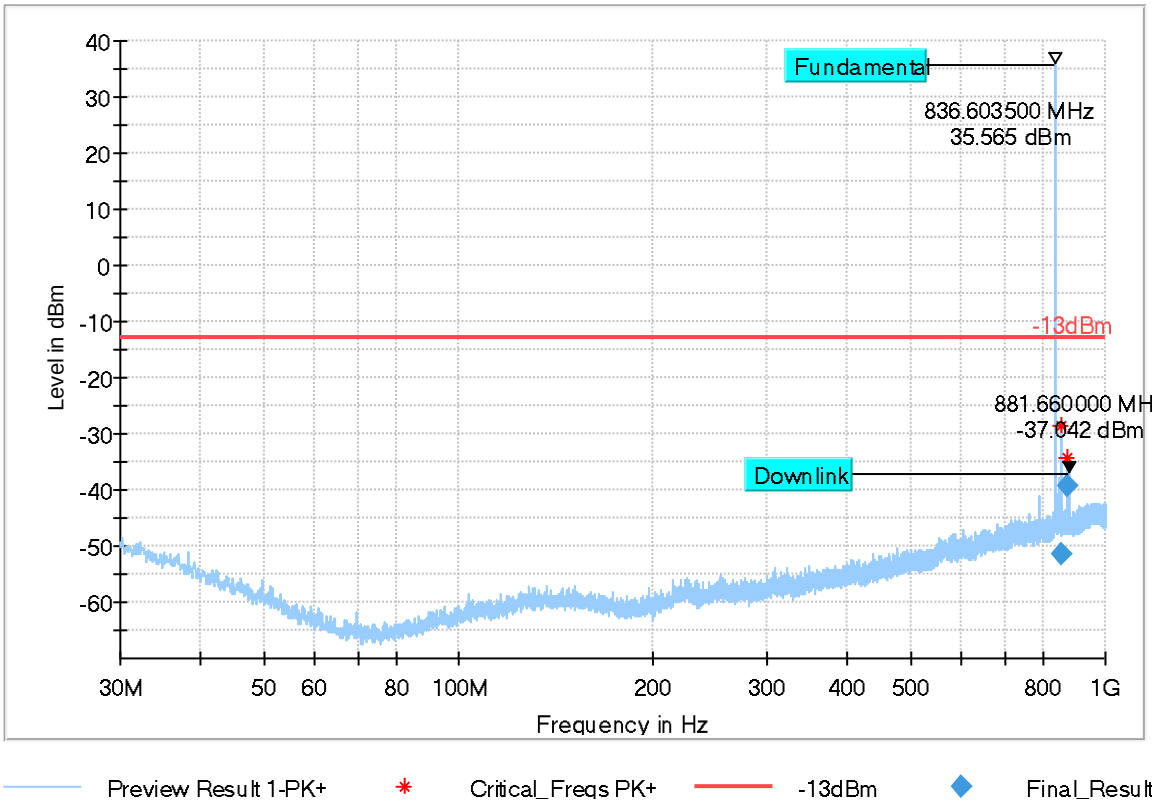
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
855.616	-51.53	-13.00	38.53	500.0	100.0	100.0	H	50.0	-69
875.614	-39.15	-13.00	26.15	500.0	100.0	234.0	V	2.0	-69

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
855.616	10:39:01 AM - 4/9/2019
875.614	10:35:51 AM - 4/9/2019



Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

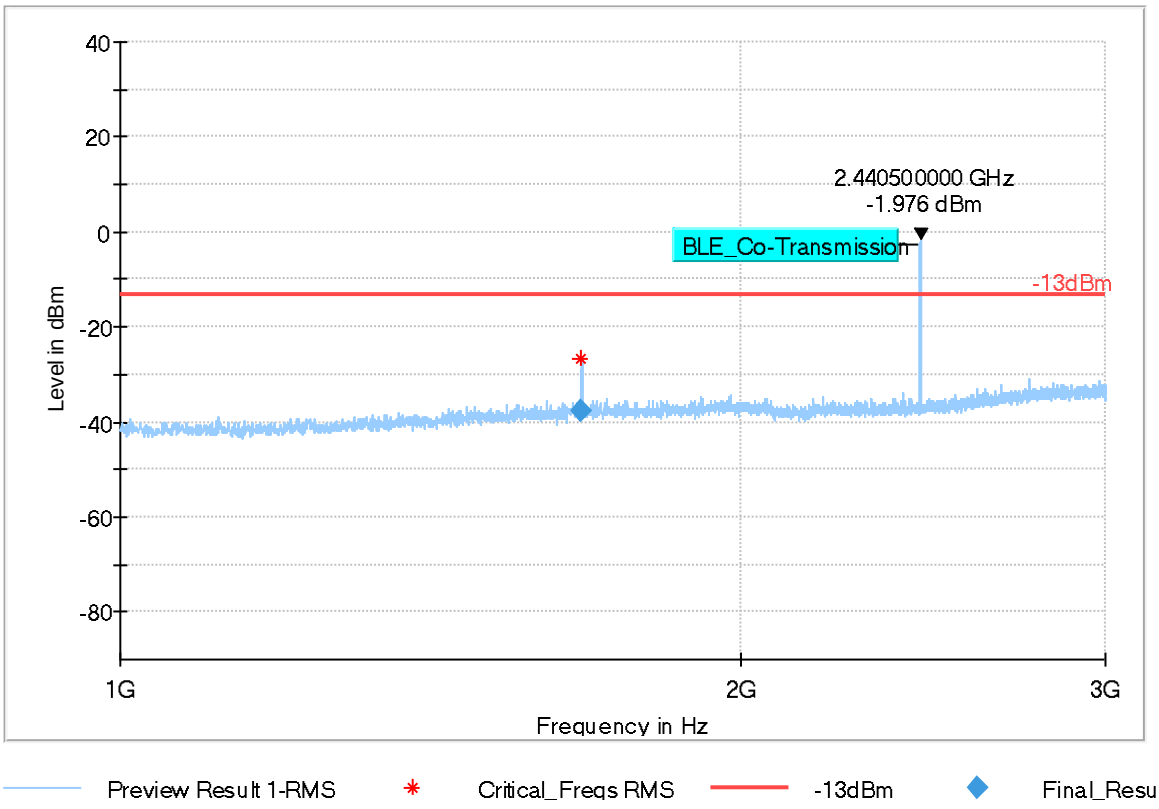
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1672.900	-37.48	-13.00	24.48	500.0	1000.0	169.0	H	214.0	-87

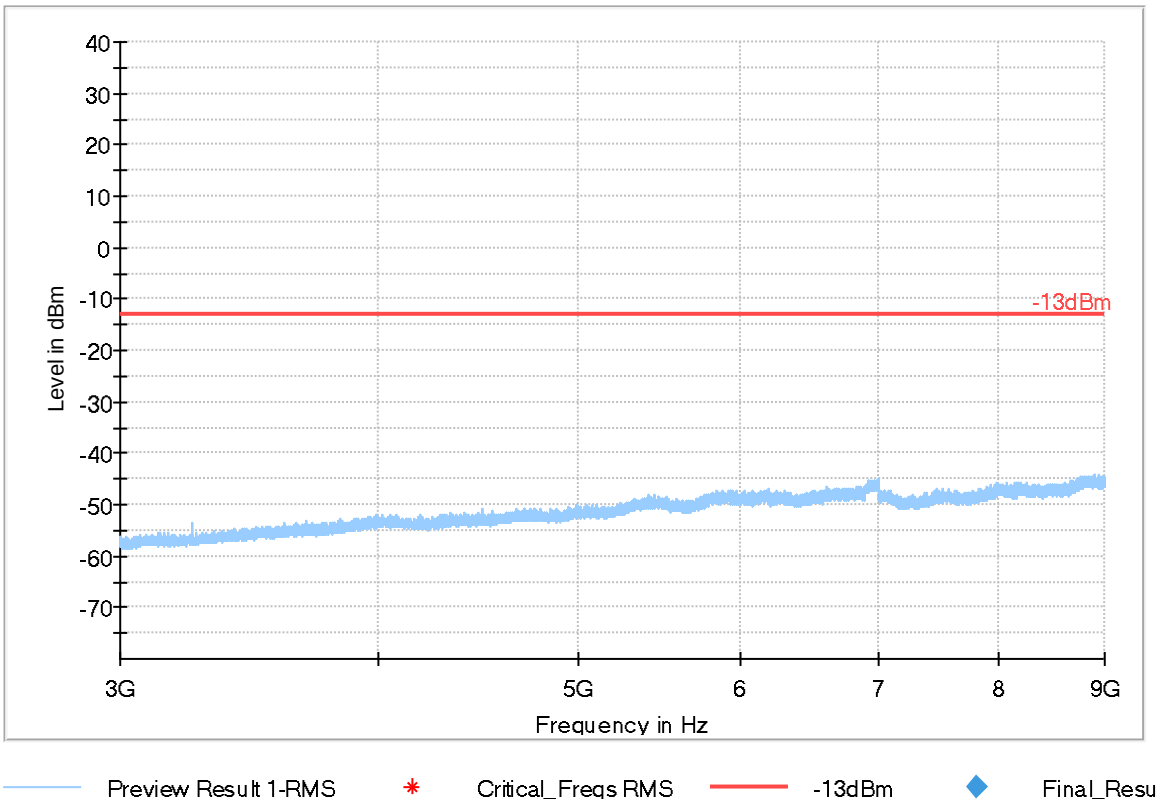
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
1672.900	



Plot # 7 Radiated Emissions: 3 GHz – 9GHz

Channel: Mid



Plot # 8 Radiated Emissions: 30 MHz - 1 GHz

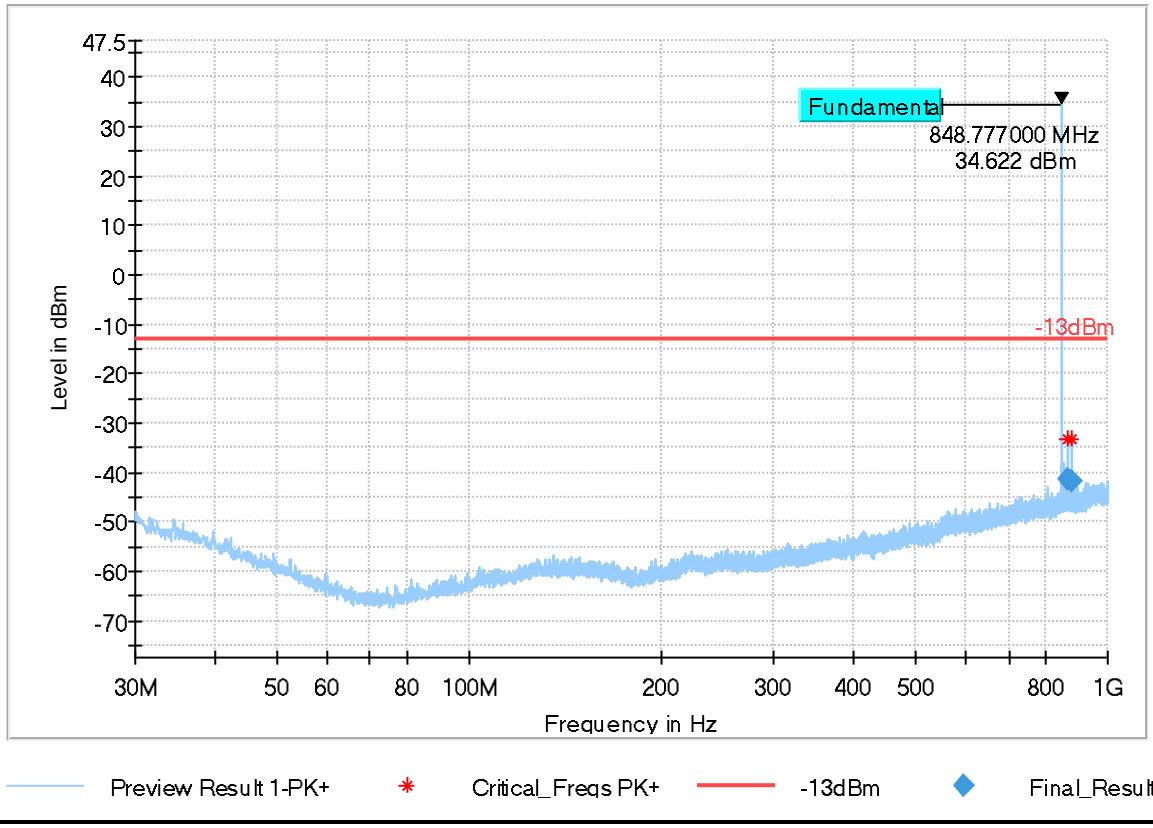
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
867.965	-41.32	-13.00	28.32	500.0	100.0	100.0	H	49.0	-69
875.684	-41.59	-13.00	28.59	500.0	100.0	233.0	H	215.0	-69

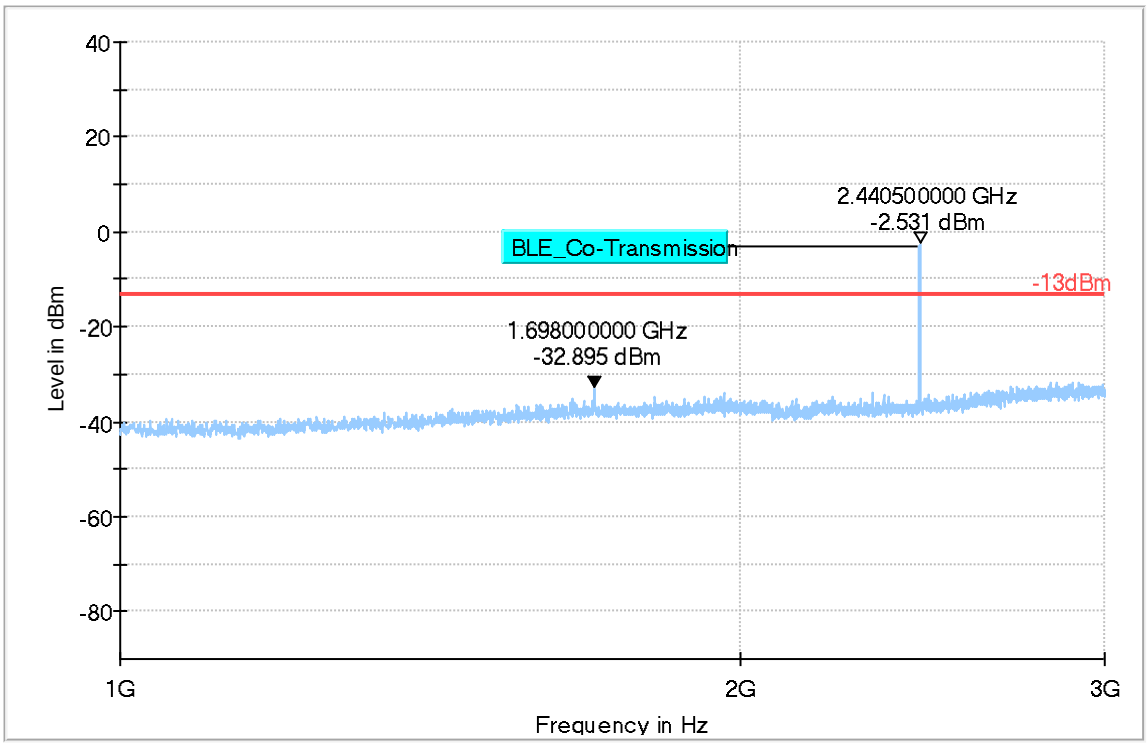
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
867.965	11:51:01 AM - 4/9/2019
875.684	11:53:49 AM - 4/9/2019



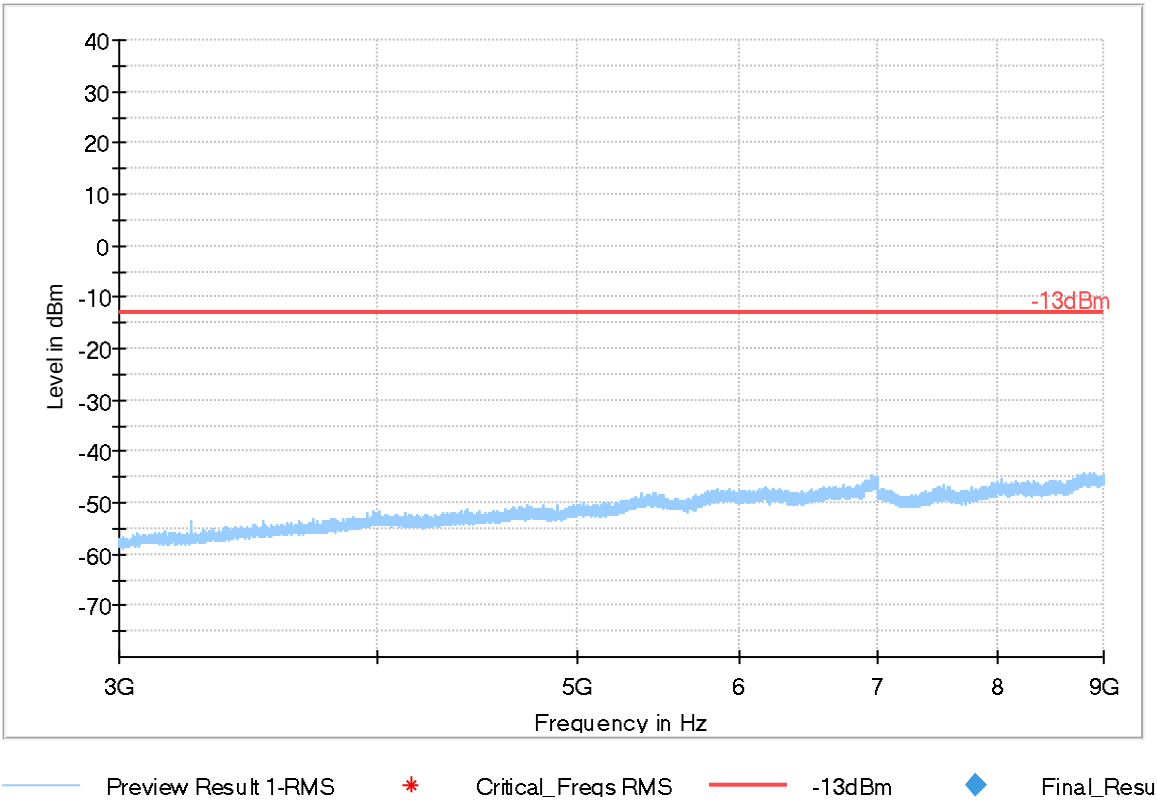
Plot # 9 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 10 Radiated Emissions: 3 GHz - 9 GHz

Channel: High



GSM 1900

Plot # 11 Radiated Emissions: 30 MHz - 1 GHz

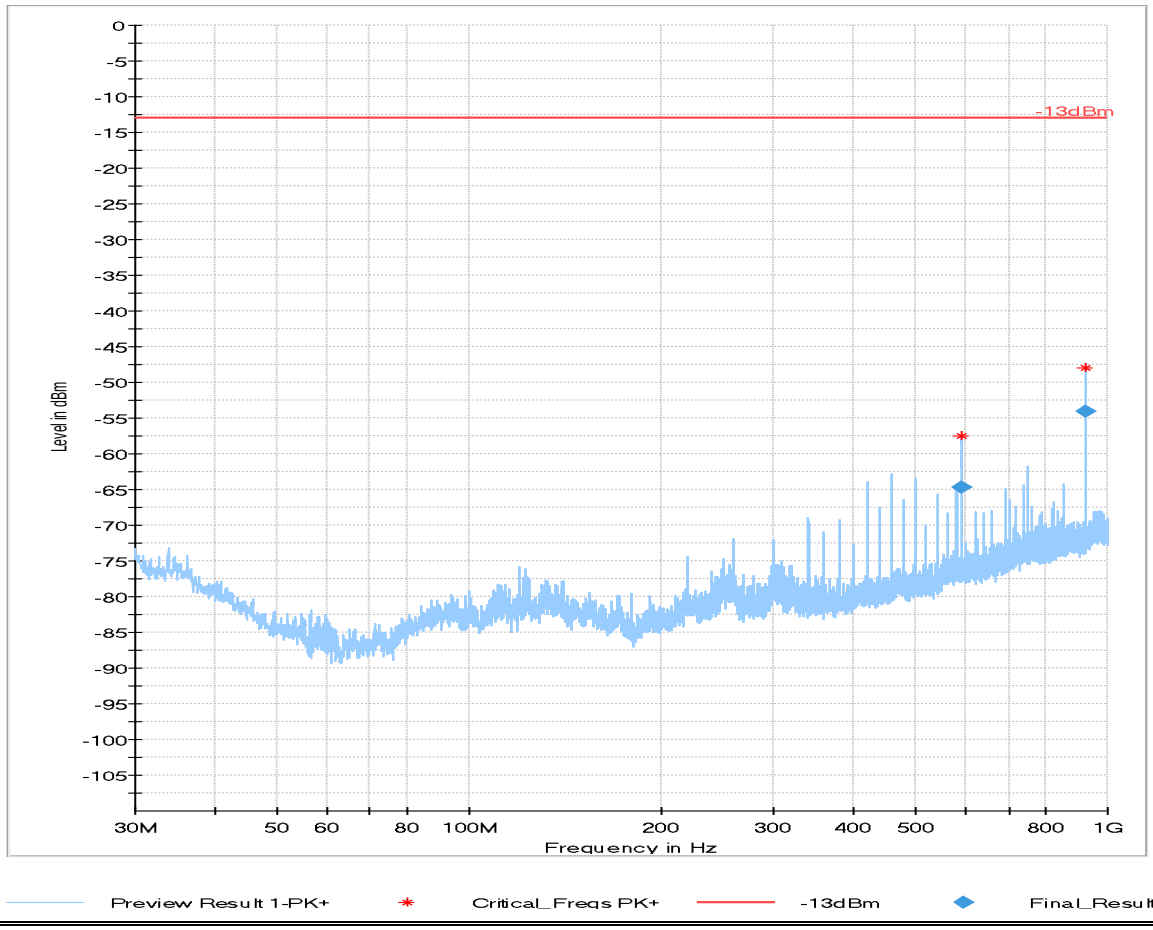
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
589.737	-64.63	-13.00	51.63	200.0	100.0	166.0	V	96.0	-106
925.150	-54.09	-13.00	41.09	200.0	100.0	100.0	H	43.0	-101

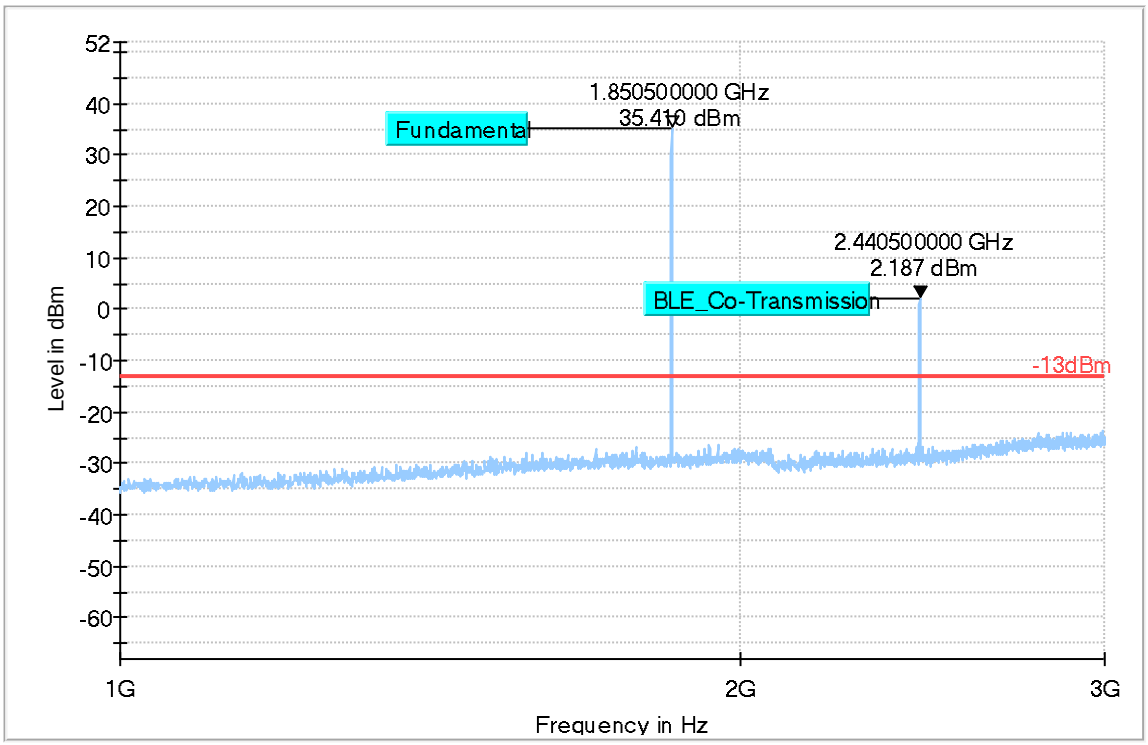
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
589.737	11:23:03 AM - 4/9/2019
925.150	11:20:13 AM - 4/9/2019



Plot # 12 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 13 Radiated Emissions: 3 GHz - 18 GHz

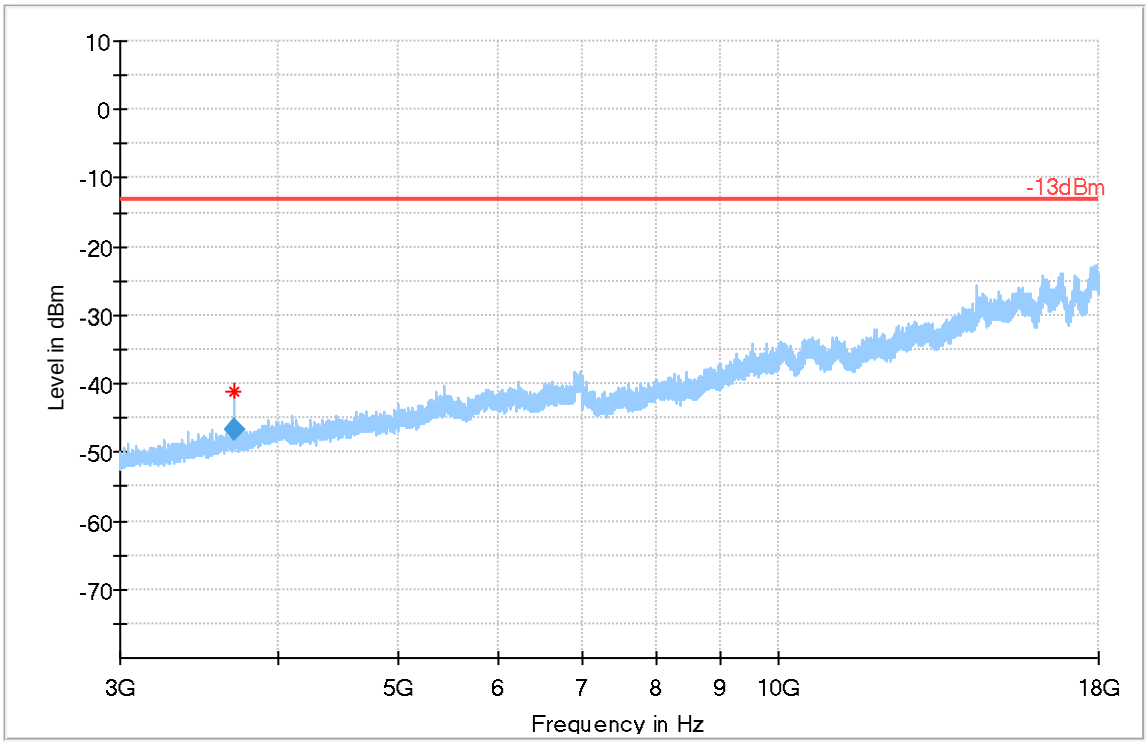
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3700.298	-46.79	-13.00	33.79	200.0	1000.0	251.0	H	333.0	-104

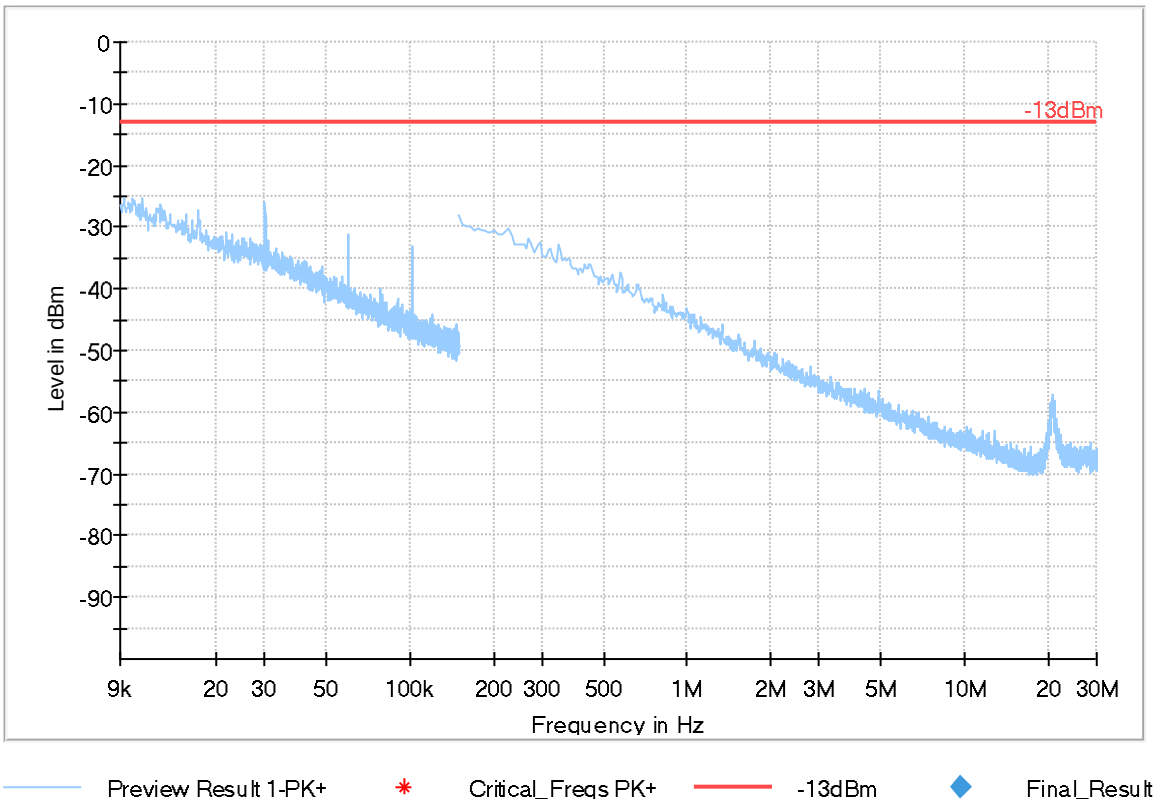
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
3700.298	2:14:03 PM - 4/5/2019



Plot # 14 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



Plot # 15 Radiated Emissions: 30 MHz – 1GHz

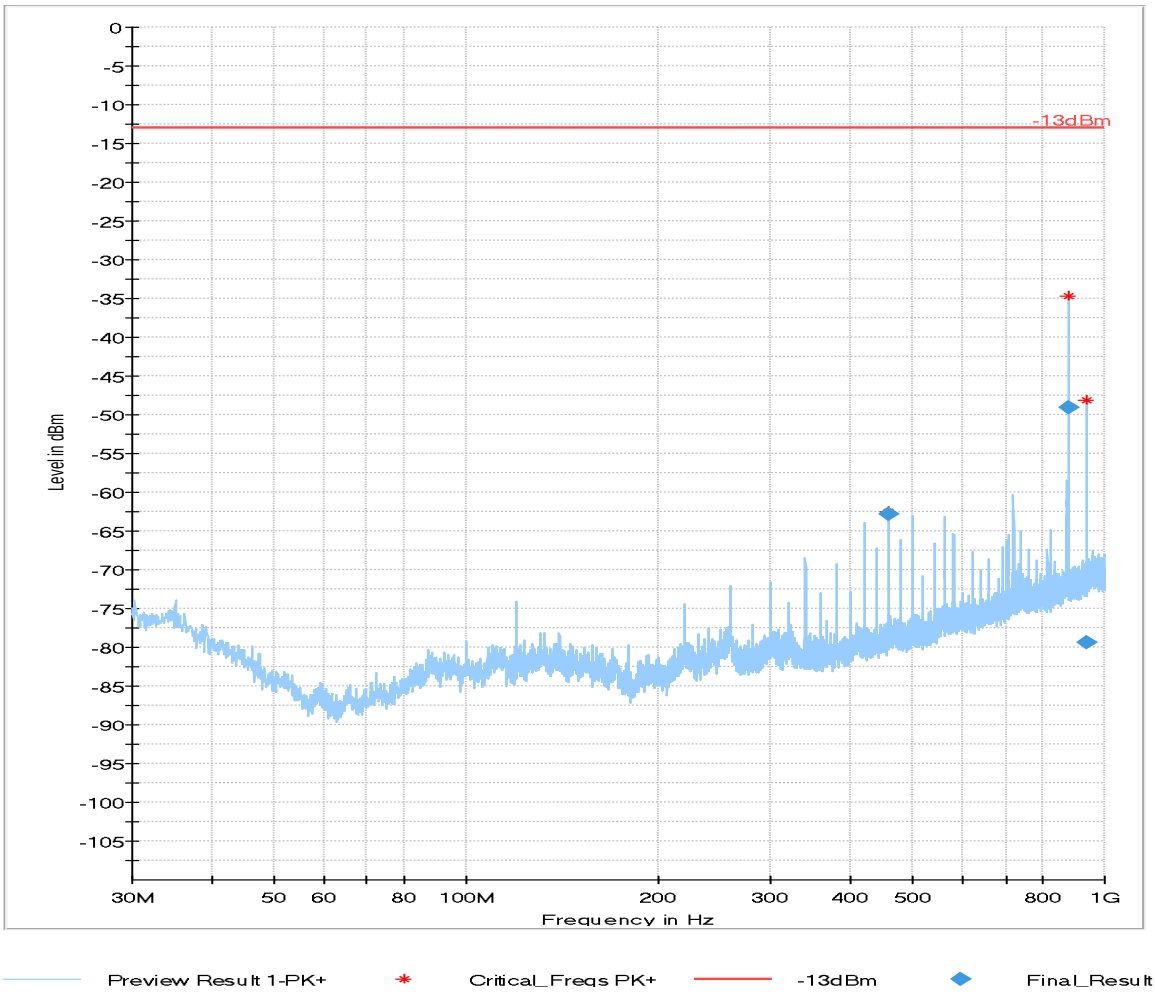
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
460.011	-62.85	-13.00	49.85	200.0	100.0	100.0	H	194.0	-108
875.764	-49.09	-13.00	36.09	200.0	100.0	230.0	H	216.0	-101
939.396	-79.37	-13.00	66.37	200.0	100.0	206.0	H	-5.0	-101

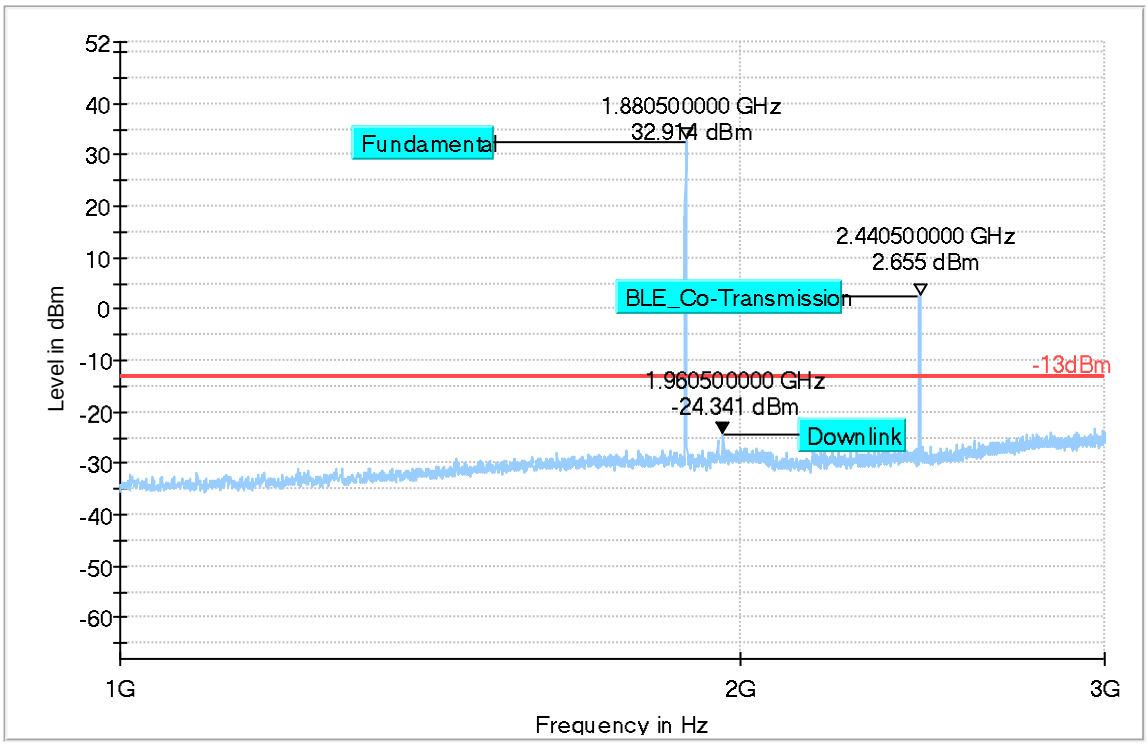
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
460.011	11:08:13 AM - 4/9/2019
875.764	11:10:45 AM - 4/9/2019
939.396	11:05:08 AM - 4/9/2019



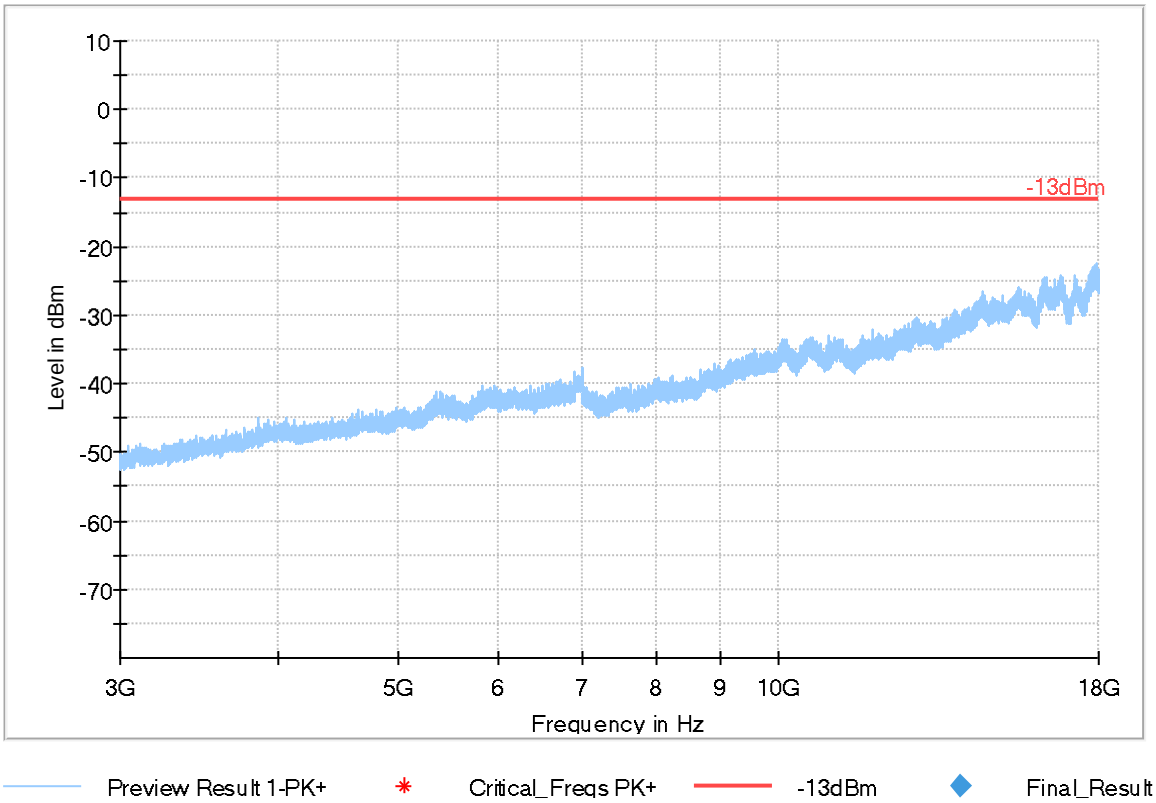
Plot # 16 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



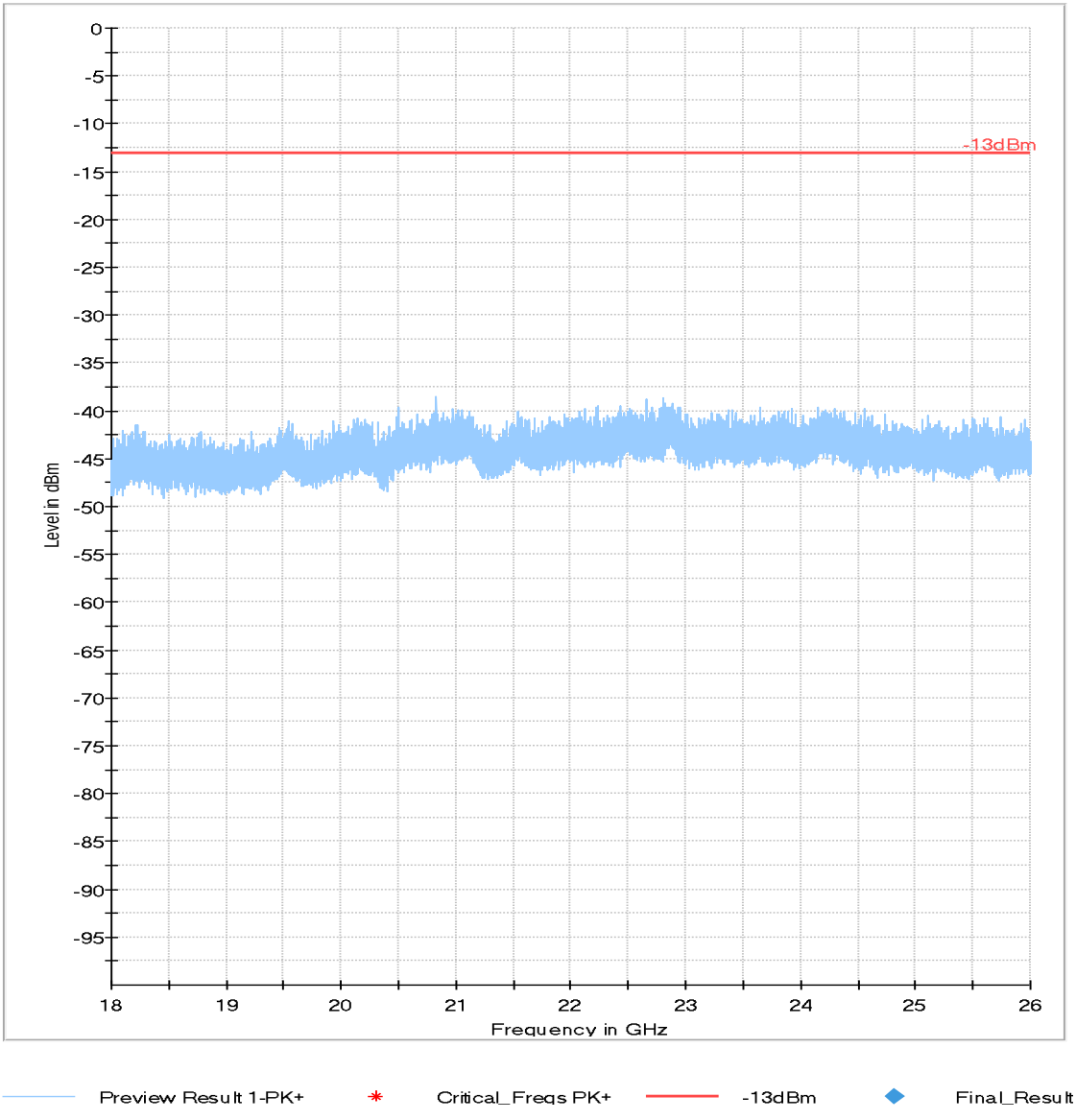
Plot # 17 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid



Plot # 18 Radiated Emissions: 18 GHz – 26 GHz

Channel: Mid



Plot # 19 Radiated Emissions: 30 MHz - 1 GHz

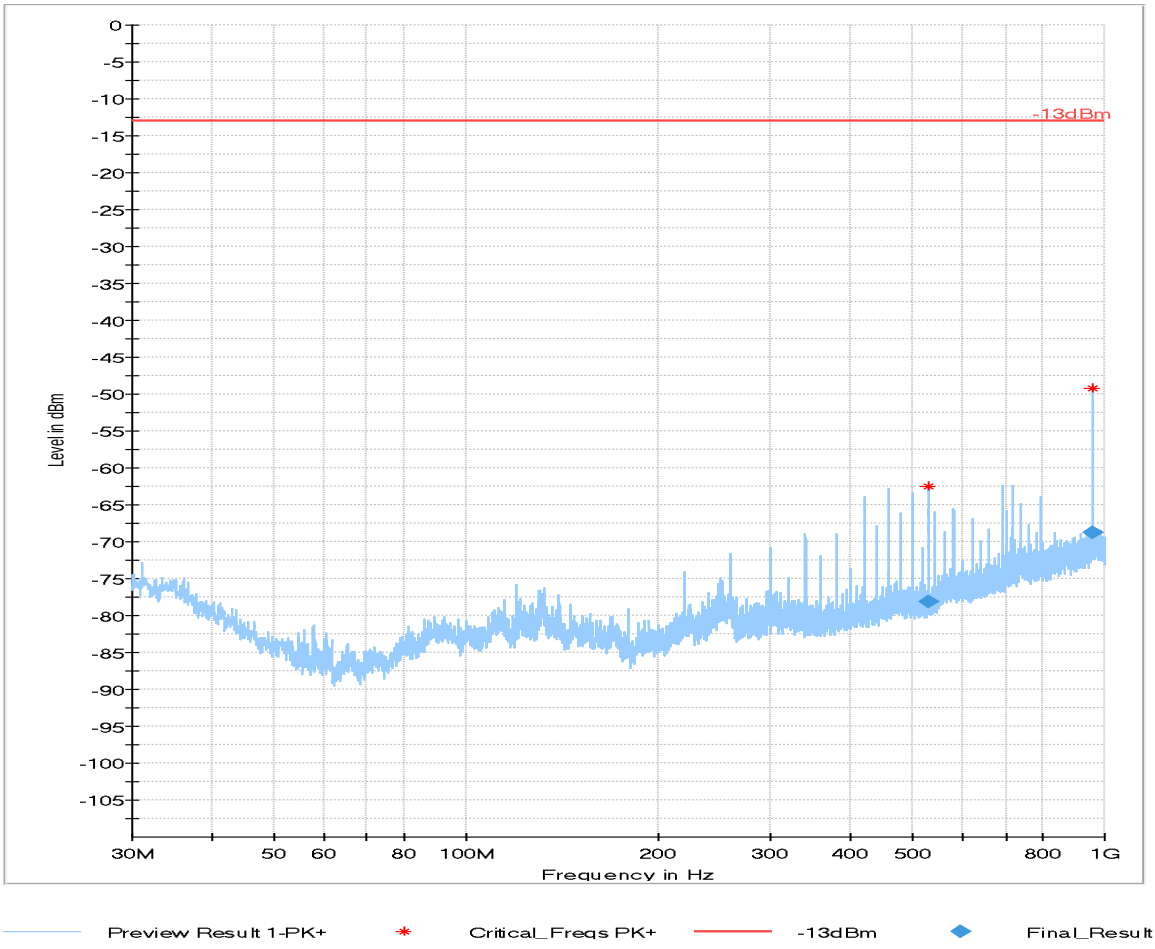
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
529.751	-78.16	-13.00	65.16	200.0	100.0	225.0	H	335.0	-107
955.033	-68.73	-13.00	55.73	200.0	100.0	100.0	H	53.0	-100

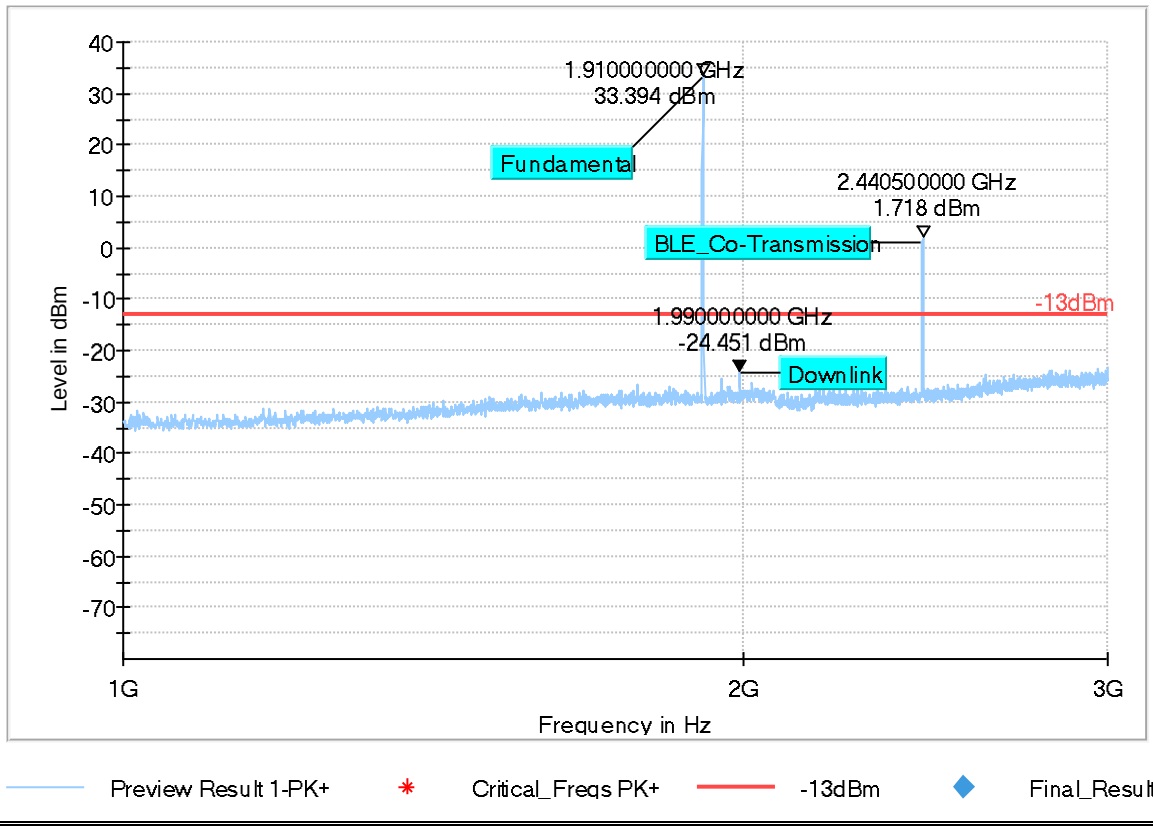
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
529.751	11:38:09 AM - 4/9/2019
955.033	11:35:20 AM - 4/9/2019



Plot # 20 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 21 Radiated Emissions: 3 GHz - 18 GHz

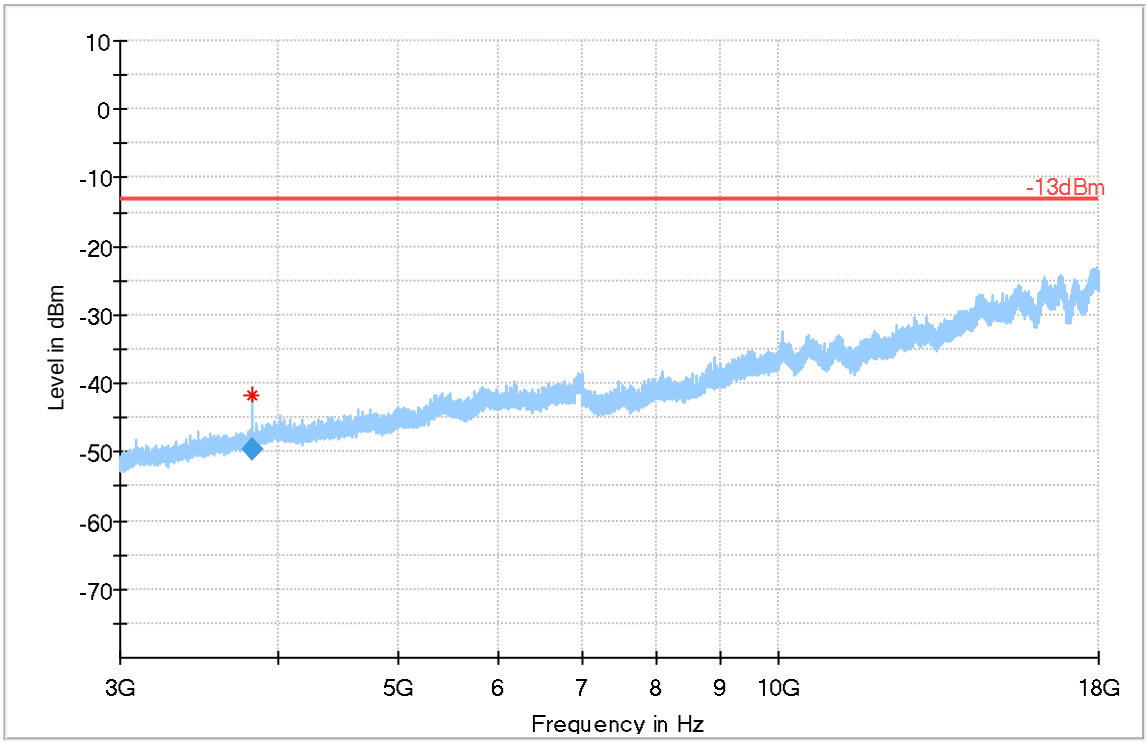
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3819.526	-49.56	-13.00	36.56	200.0	1000.0	149.0	H	332.0	-103

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
3819.526	2:22:38 PM - 4/5/2019



WCDMA Band II

Plot # 22 Radiated Emissions: 30 MHz - 1 GHz

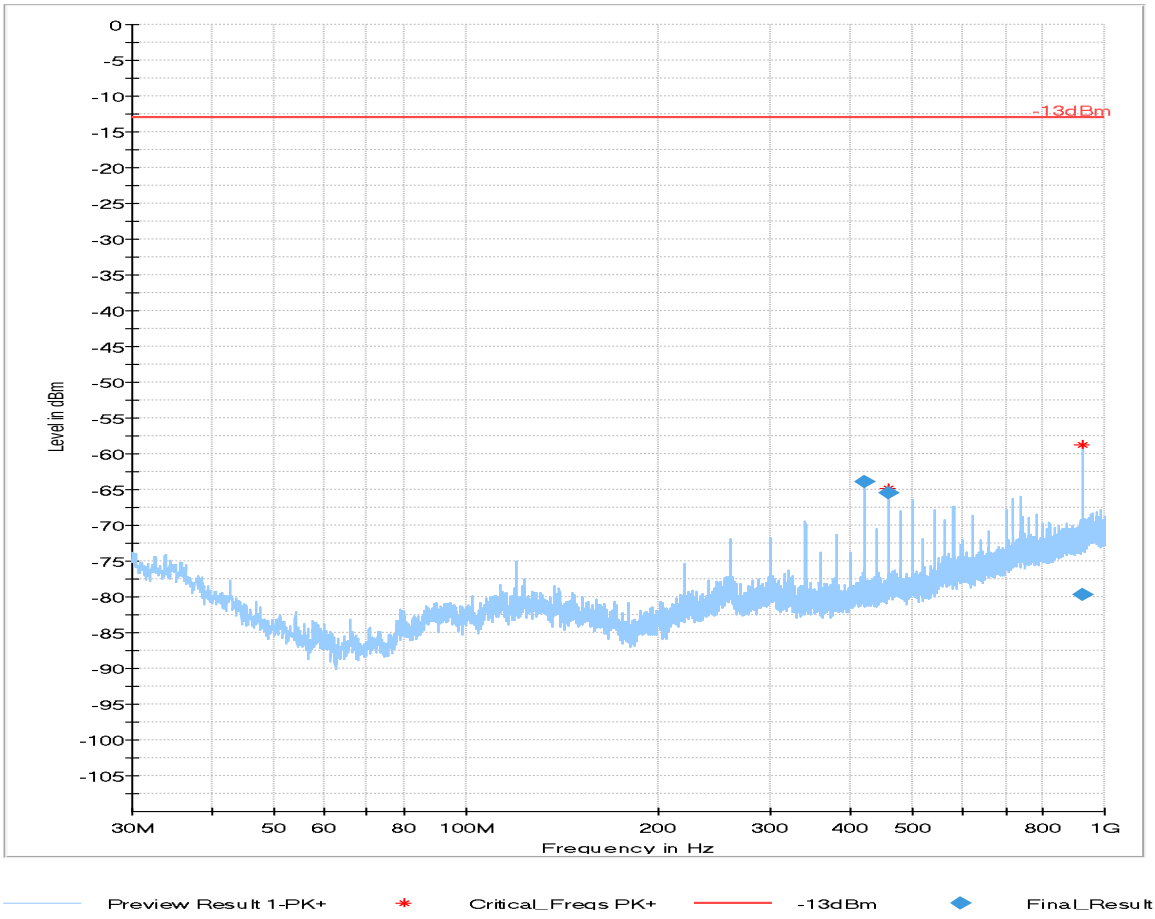
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
420.010	-63.93	-13.00	50.93	200.0	100.0	100.0	H	183.0	-109
460.000	-65.52	-13.00	52.52	200.0	100.0	100.0	H	192.0	-108
925.465	-79.74	-13.00	66.74	200.0	100.0	125.0	V	-50.0	-101

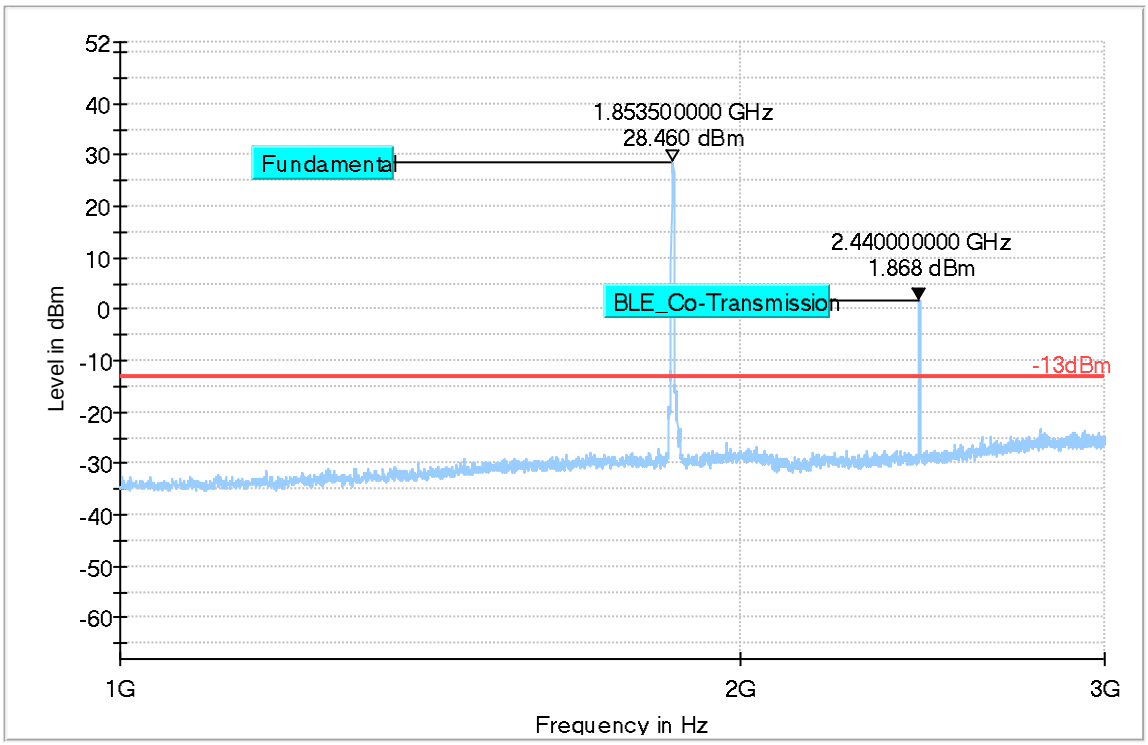
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
420.010	5:38:44 PM - 4/8/2019
460.000	5:41:27 PM - 4/8/2019
925.465	5:35:30 PM - 4/8/2019



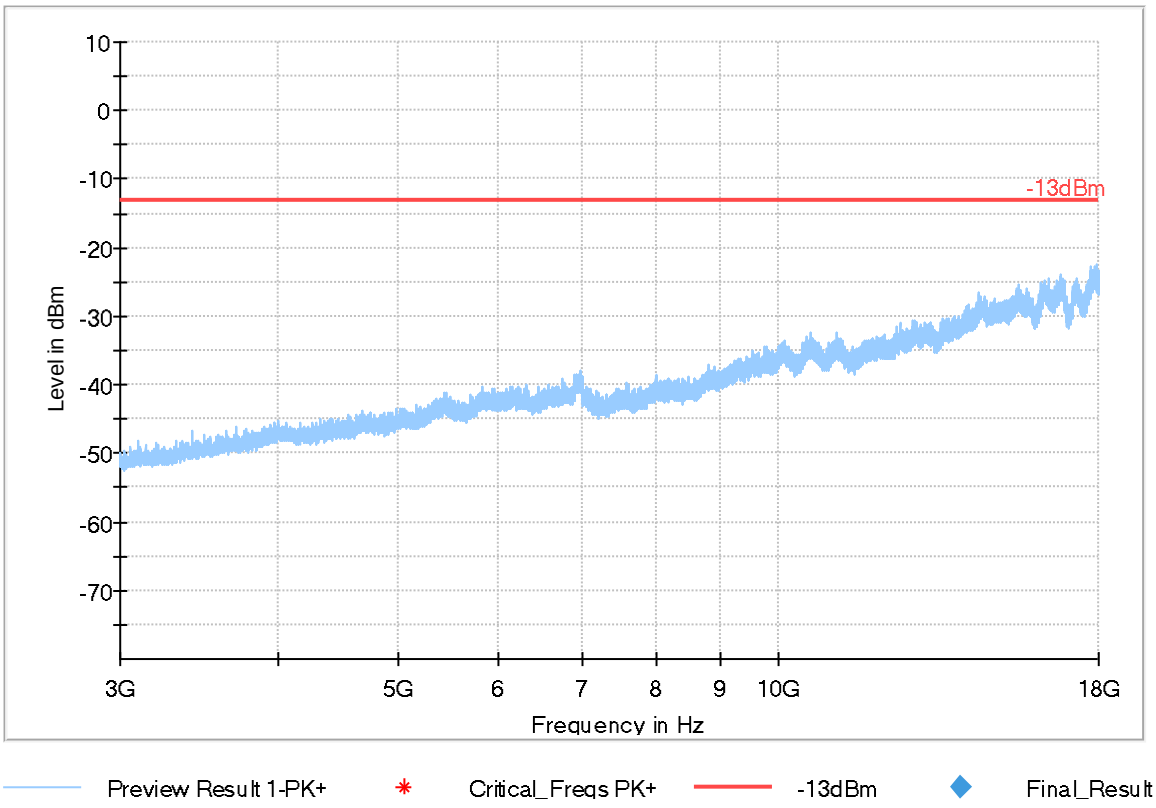
Plot # 23 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



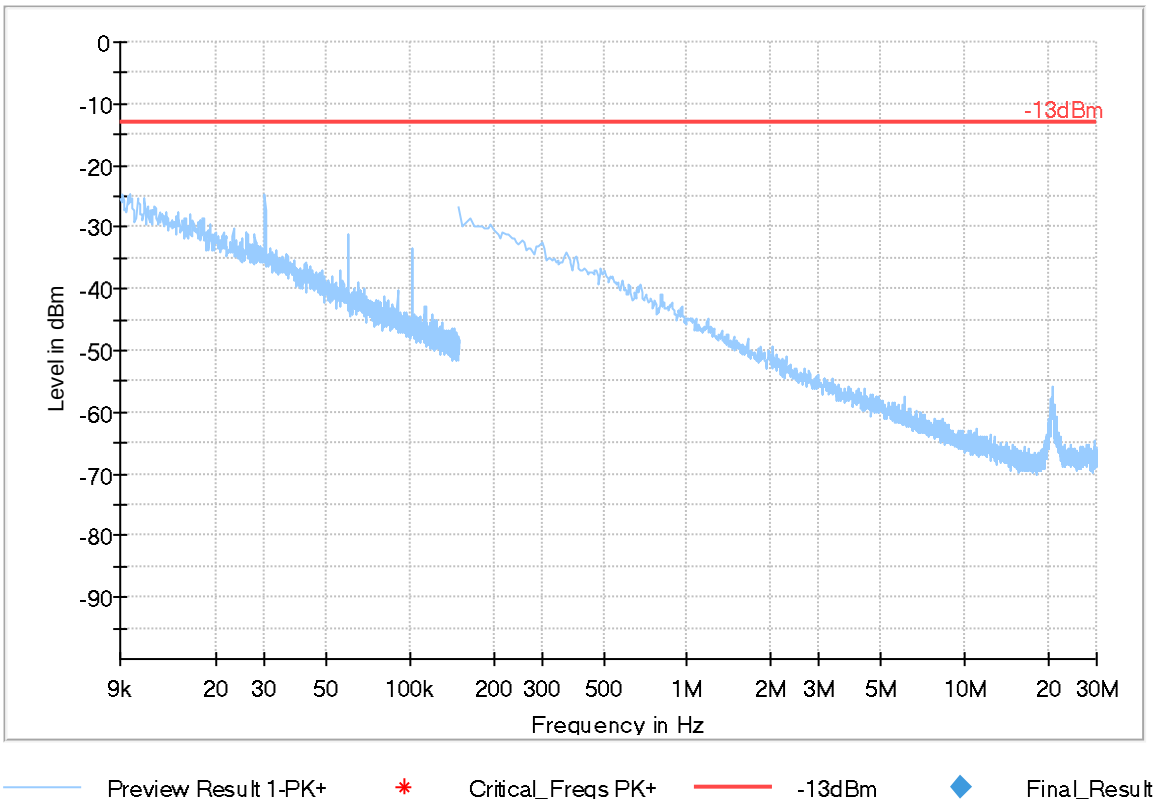
Plot # 24 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low



Plot # 25 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



Plot # 26 Radiated Emissions: 30 MHz – 1GHz

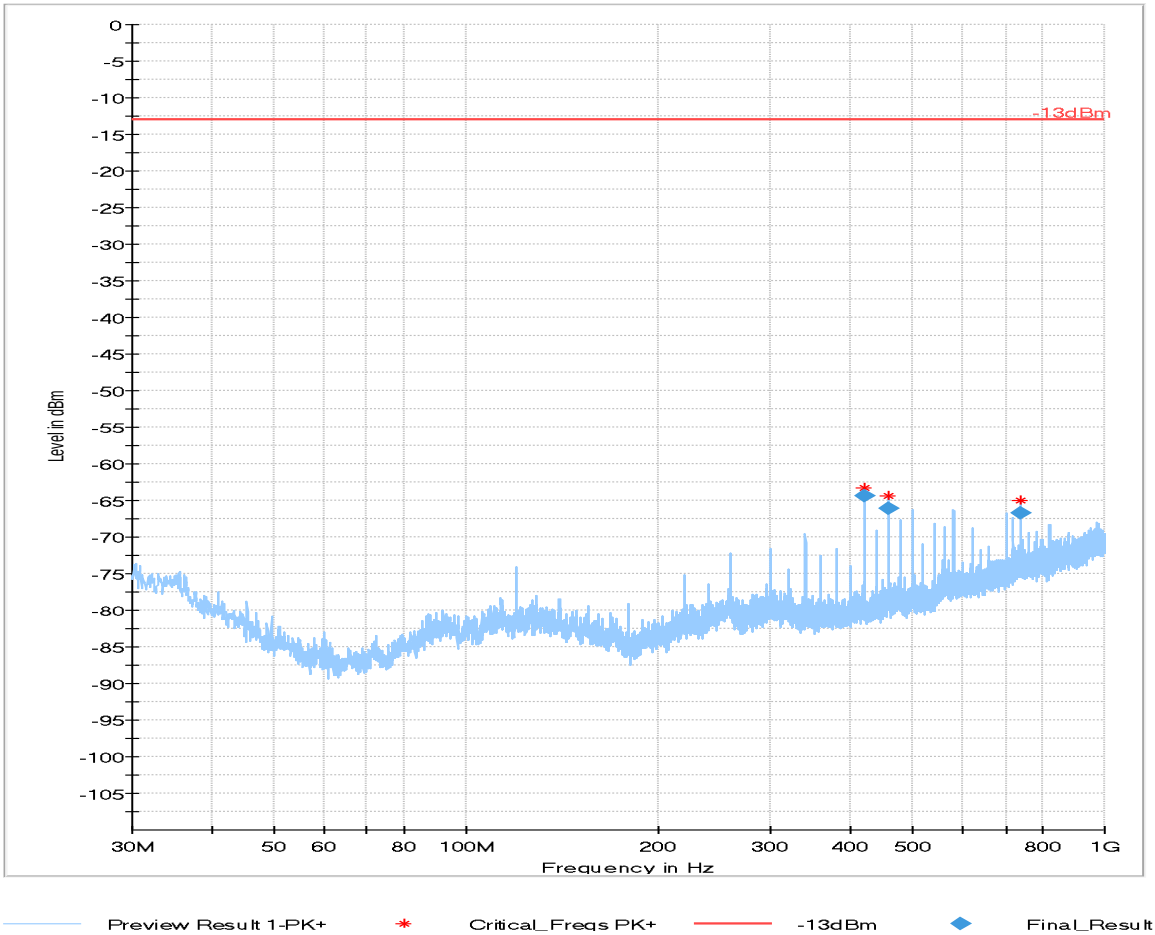
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
420.020	-64.32	-13.00	51.32	200.0	100.0	100.0	H	180.0	-109
460.023	-66.10	-13.00	53.10	200.0	100.0	100.0	H	190.0	-108
740.008	-66.69	-13.00	53.69	200.0	100.0	107.0	H	23.0	-103

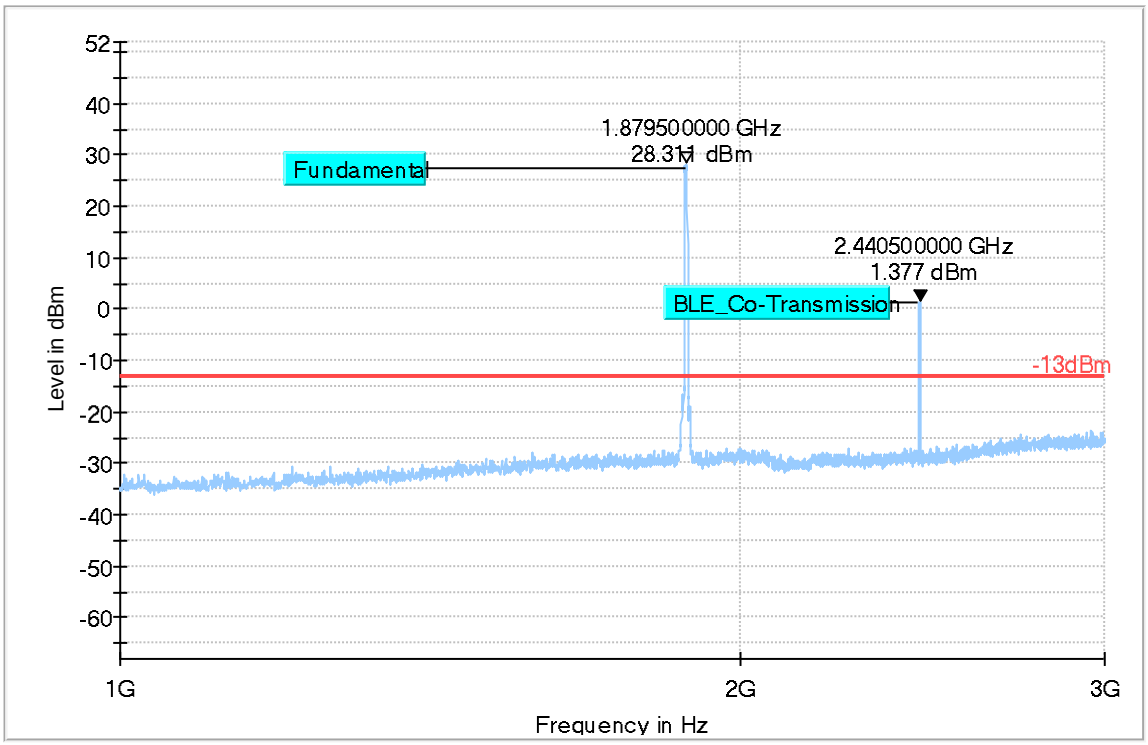
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
420.020	5:54:35 PM - 4/8/2019
460.023	5:57:17 PM - 4/8/2019
740.008	5:51:33 PM - 4/8/2019



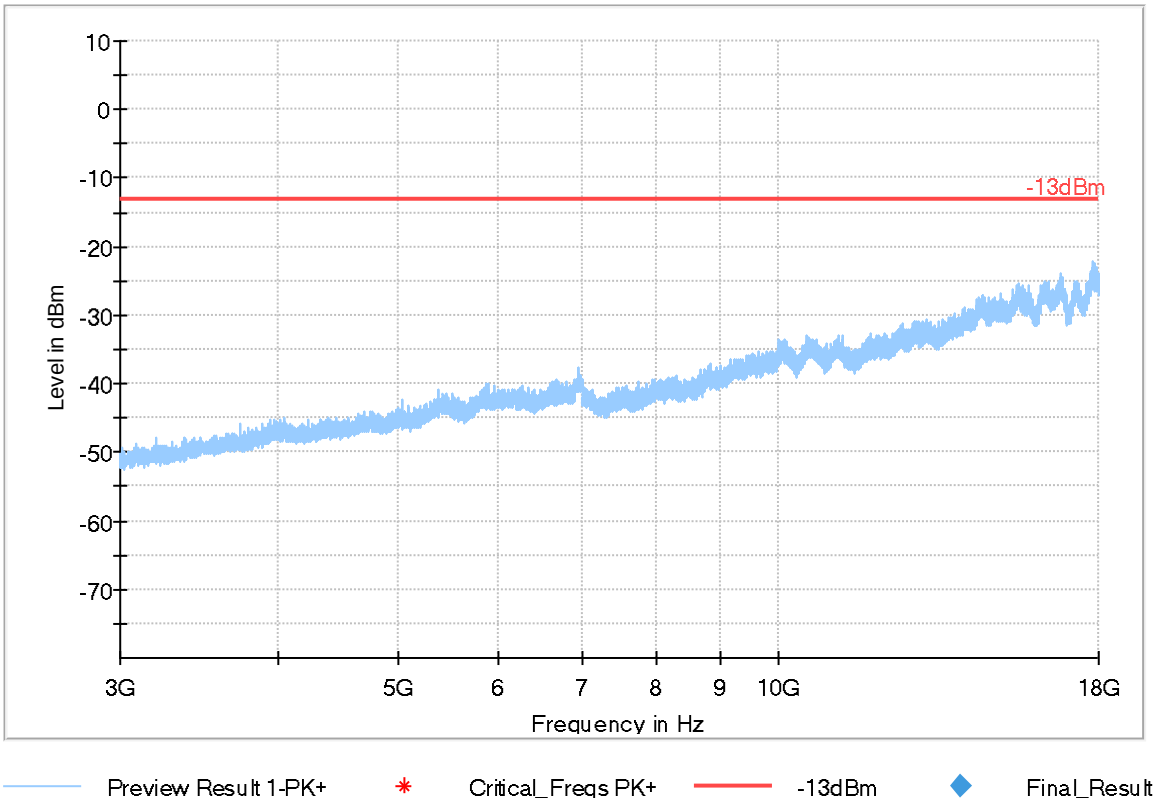
Plot # 27 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



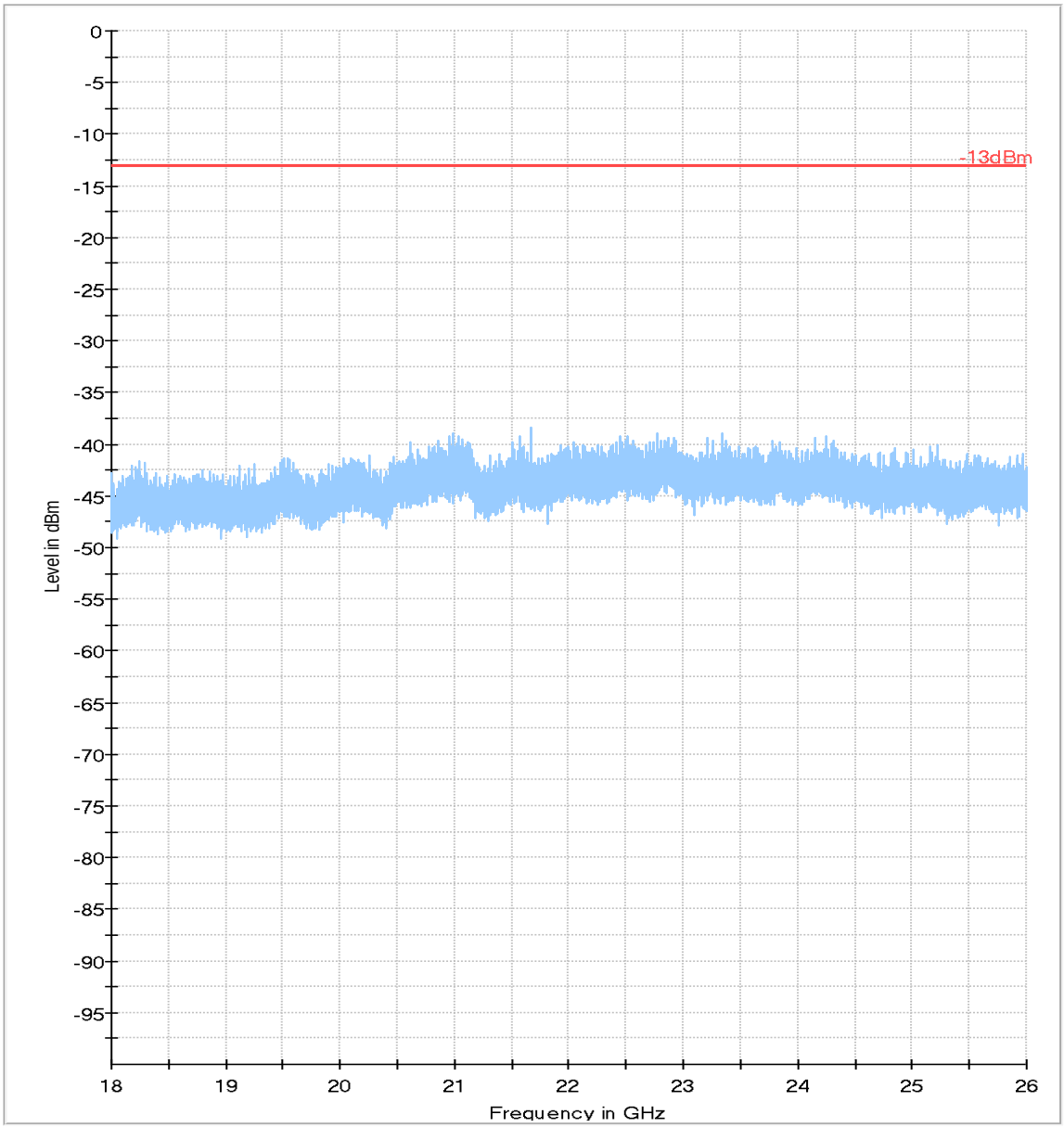
Plot # 28 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid



Plot # 29 Radiated Emissions: 18 GHz – 26 GHz

Channel: Mid



Plot # 30 Radiated Emissions: 30 MHz - 1 GHz

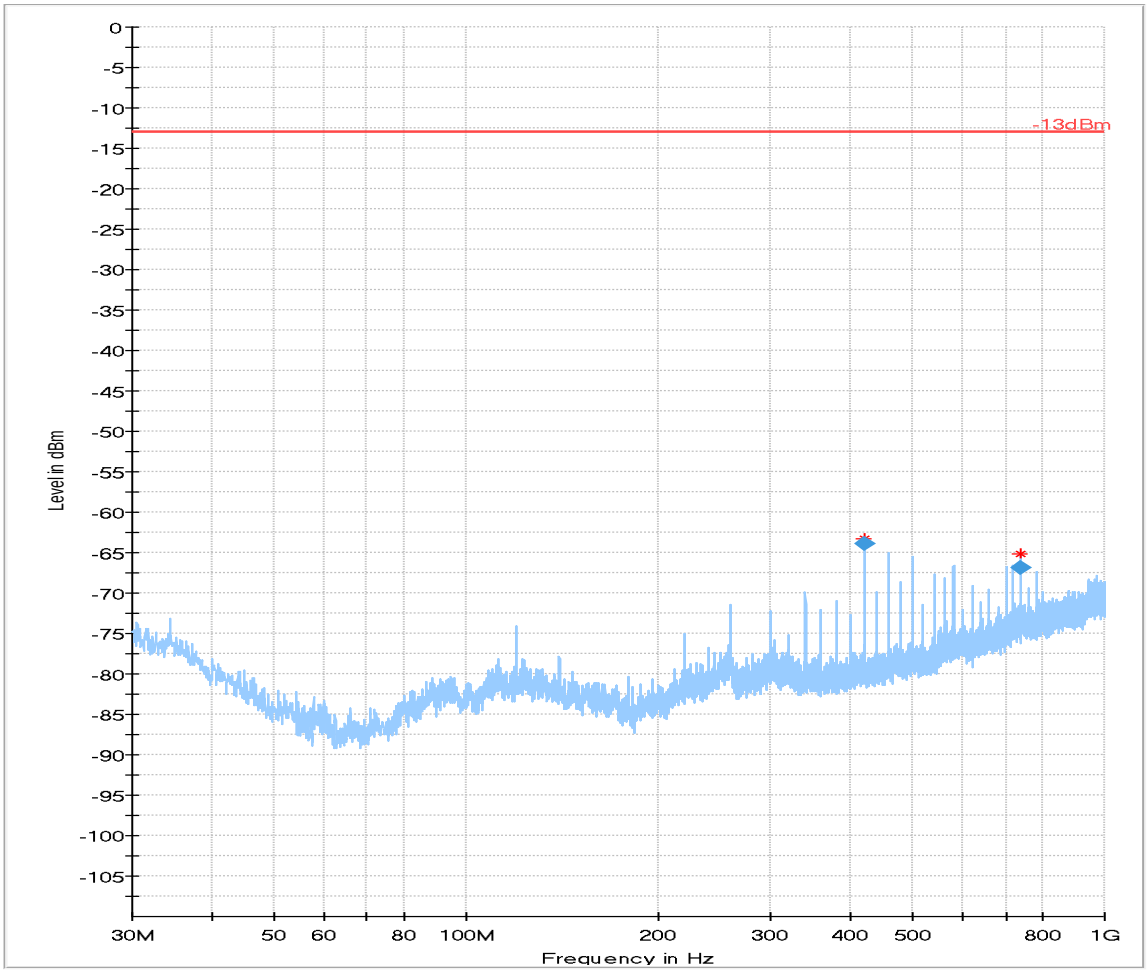
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
420.000	-63.95	-13.00	50.95	200.0	100.0	100.0	H	302.0	-109
740.018	-66.83	-13.00	53.83	200.0	100.0	107.0	H	23.0	-103

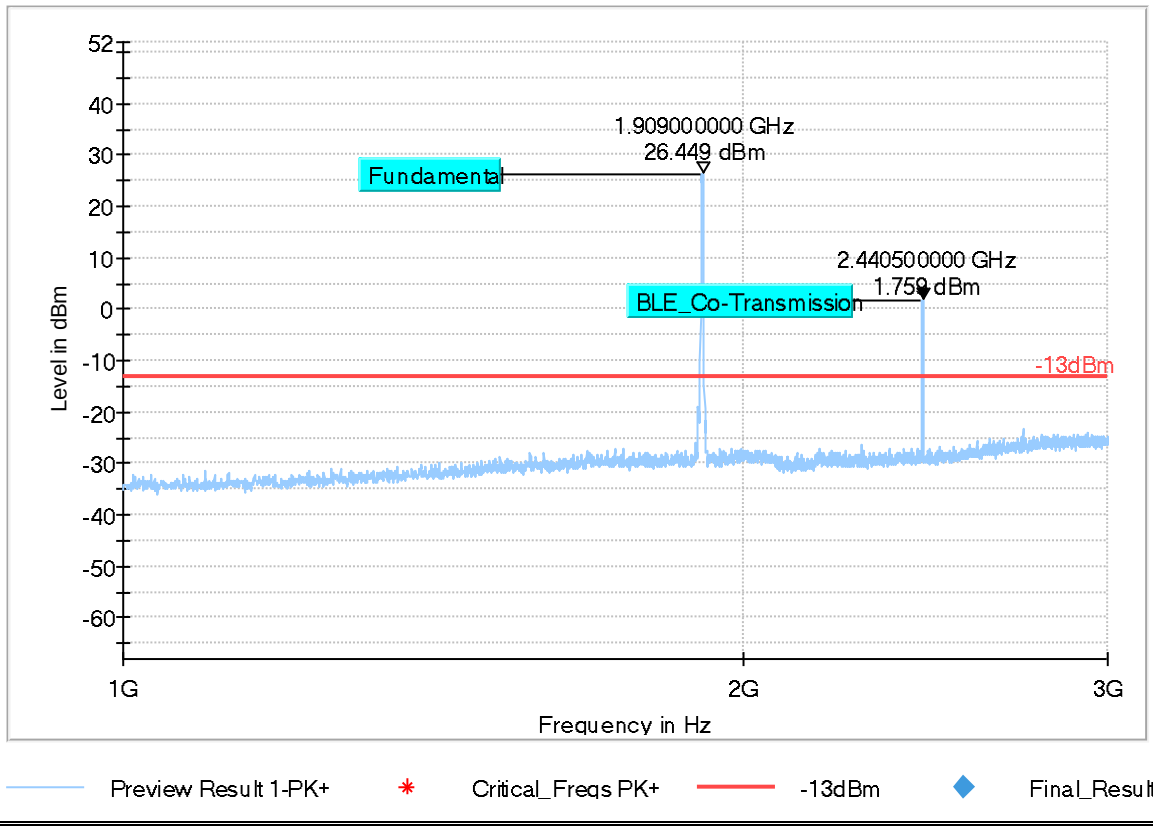
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
420.000	6:11:31 PM - 4/8/2019
740.018	6:08:20 PM - 4/8/2019



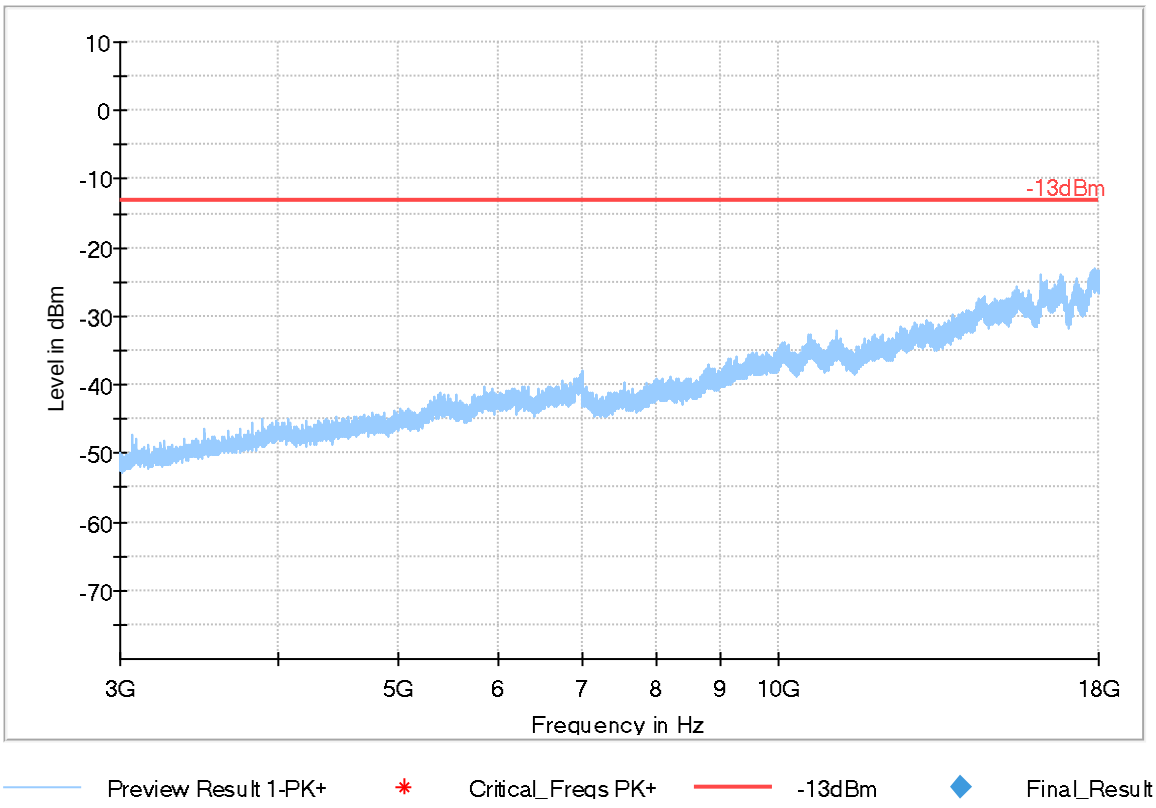
Plot # 31 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 32 Radiated Emissions: 3 GHz - 18 GHz

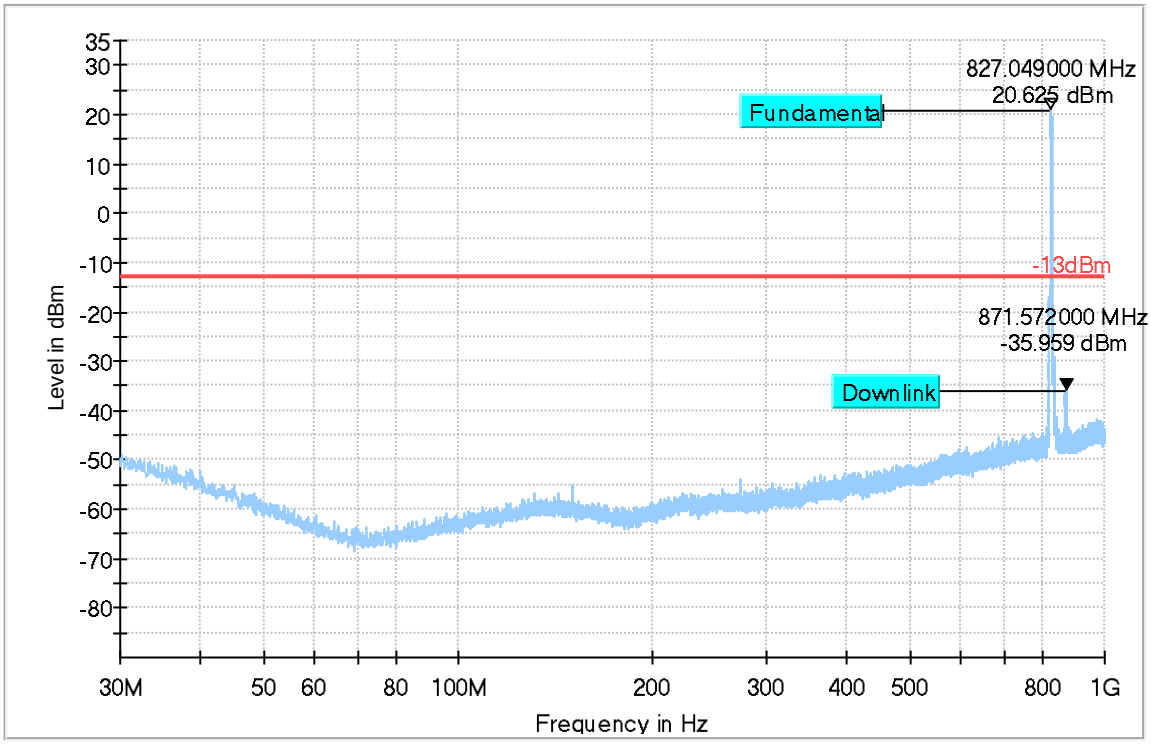
Channel: High



WCDMA Band V

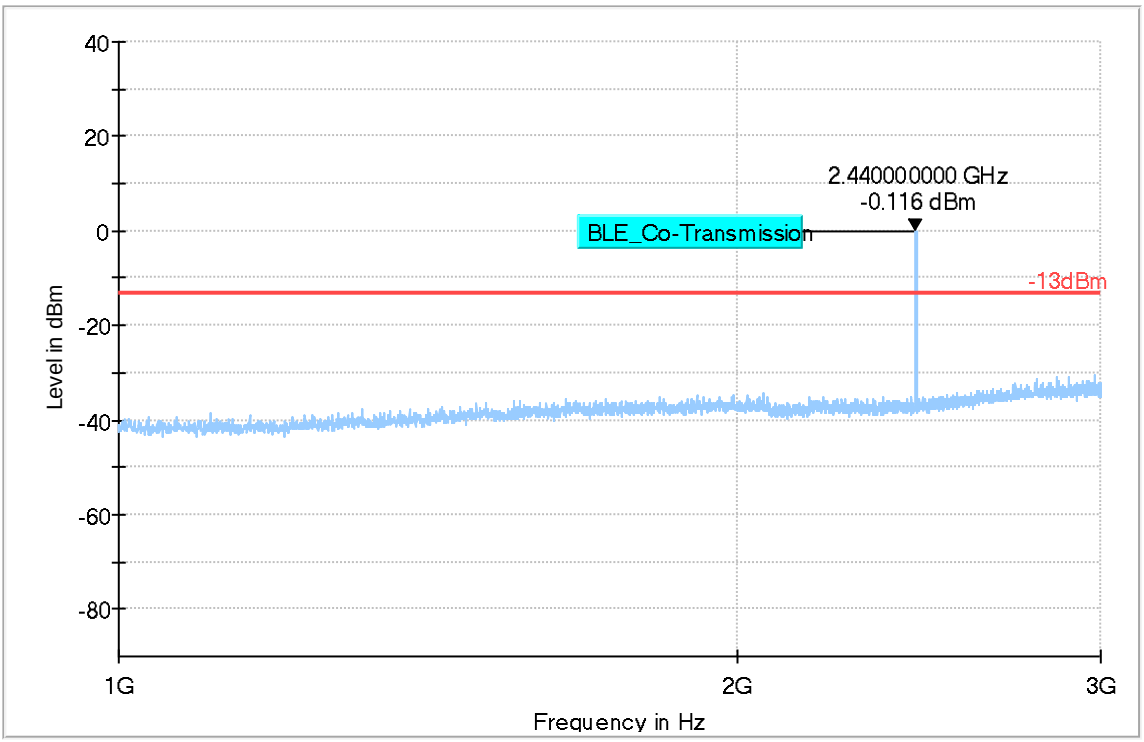
Plot # 33 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low



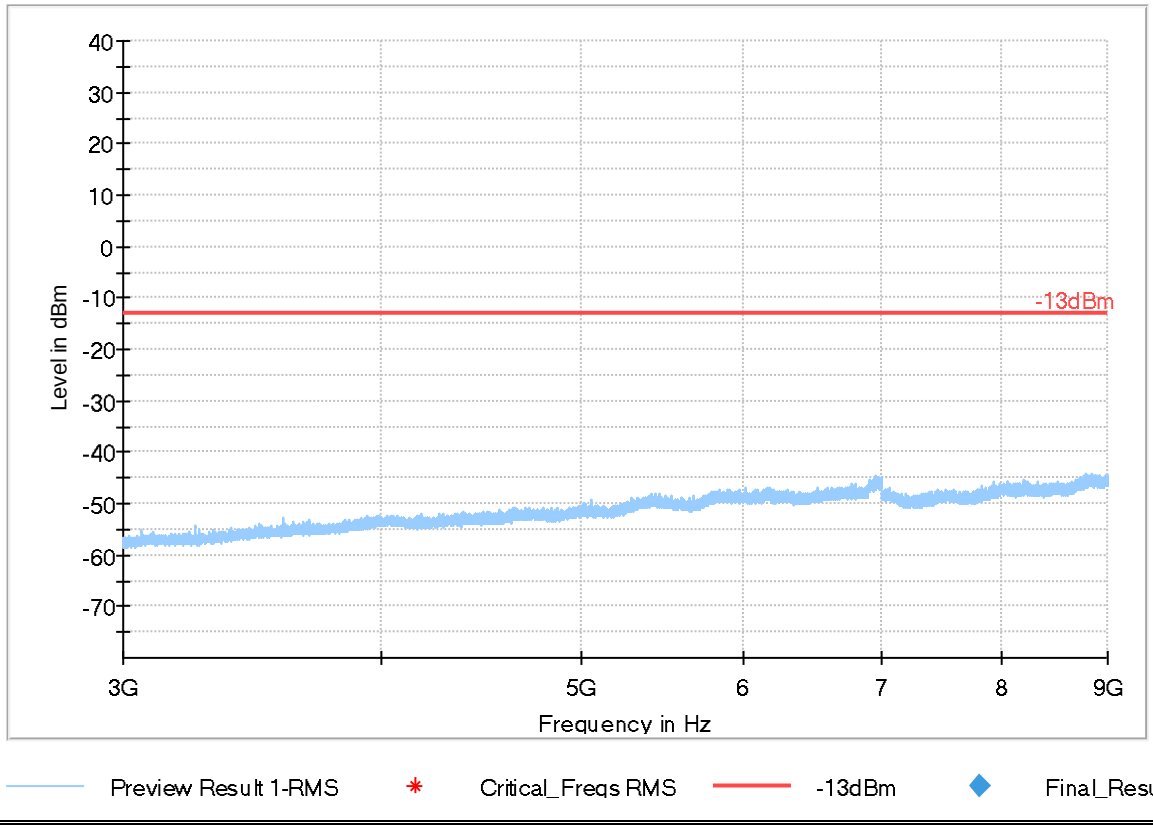
Plot # 34 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



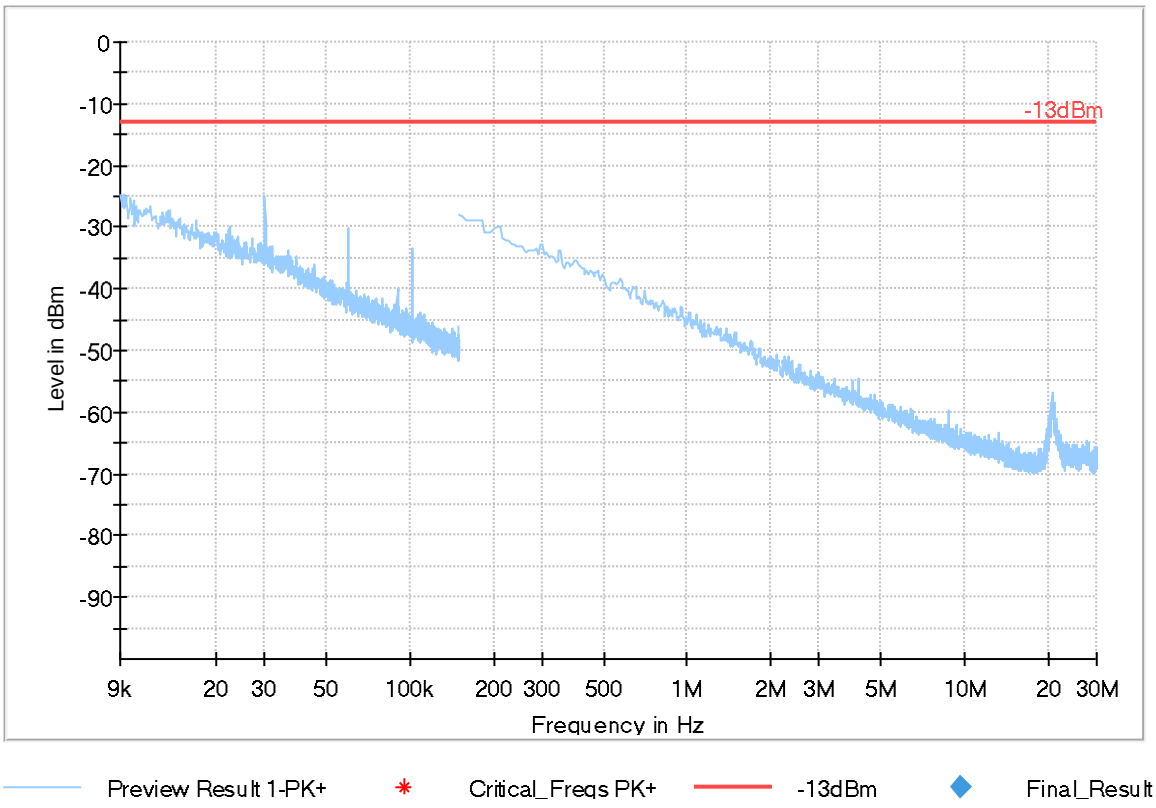
Plot # 35 Radiated Emissions: 3 GHz - 9 GHz

Channel: Low



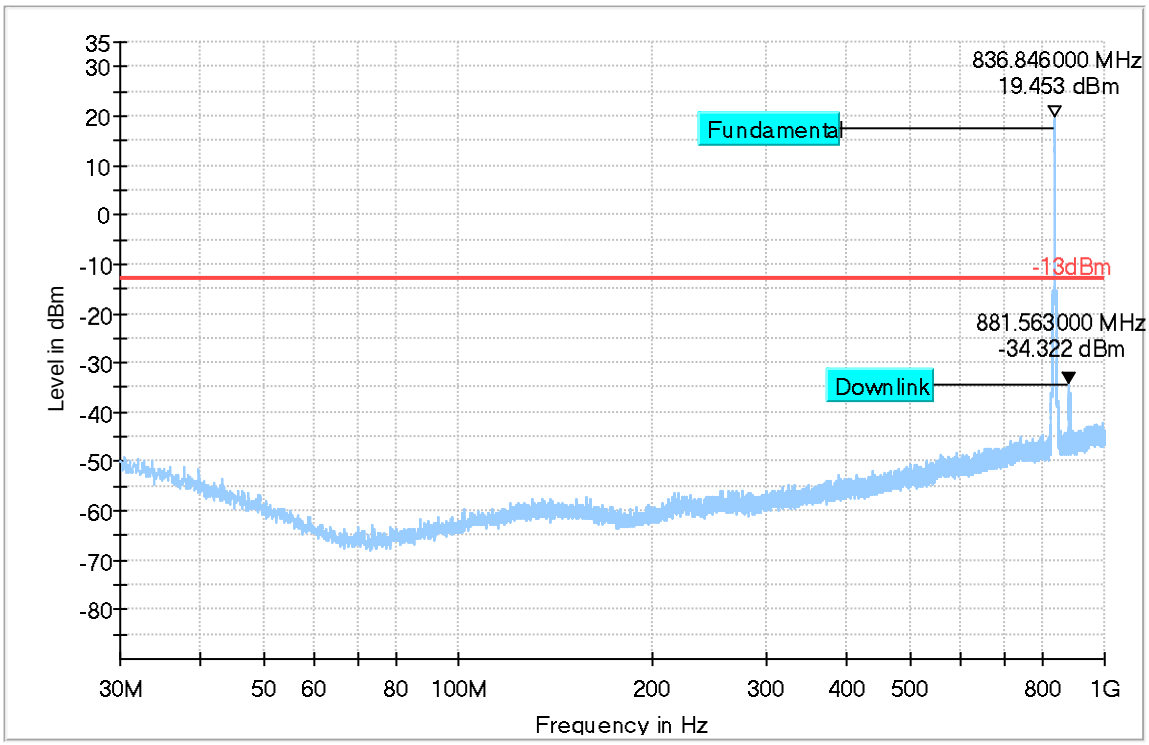
Plot # 36 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



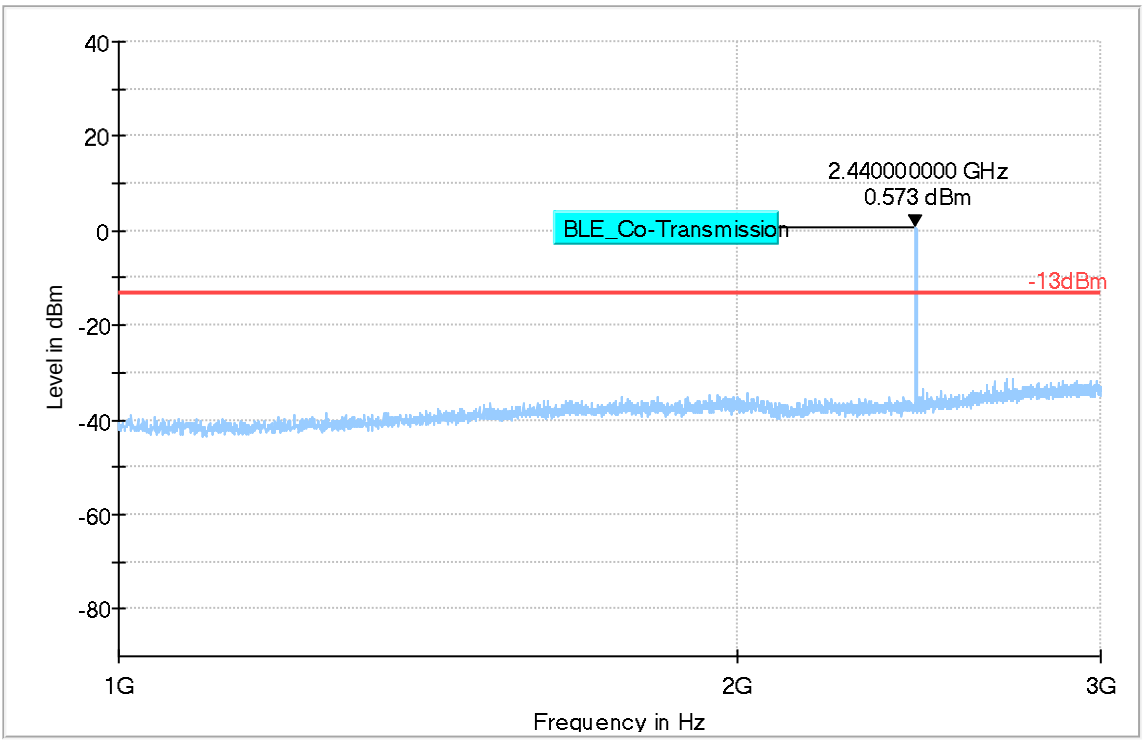
Plot # 37 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid



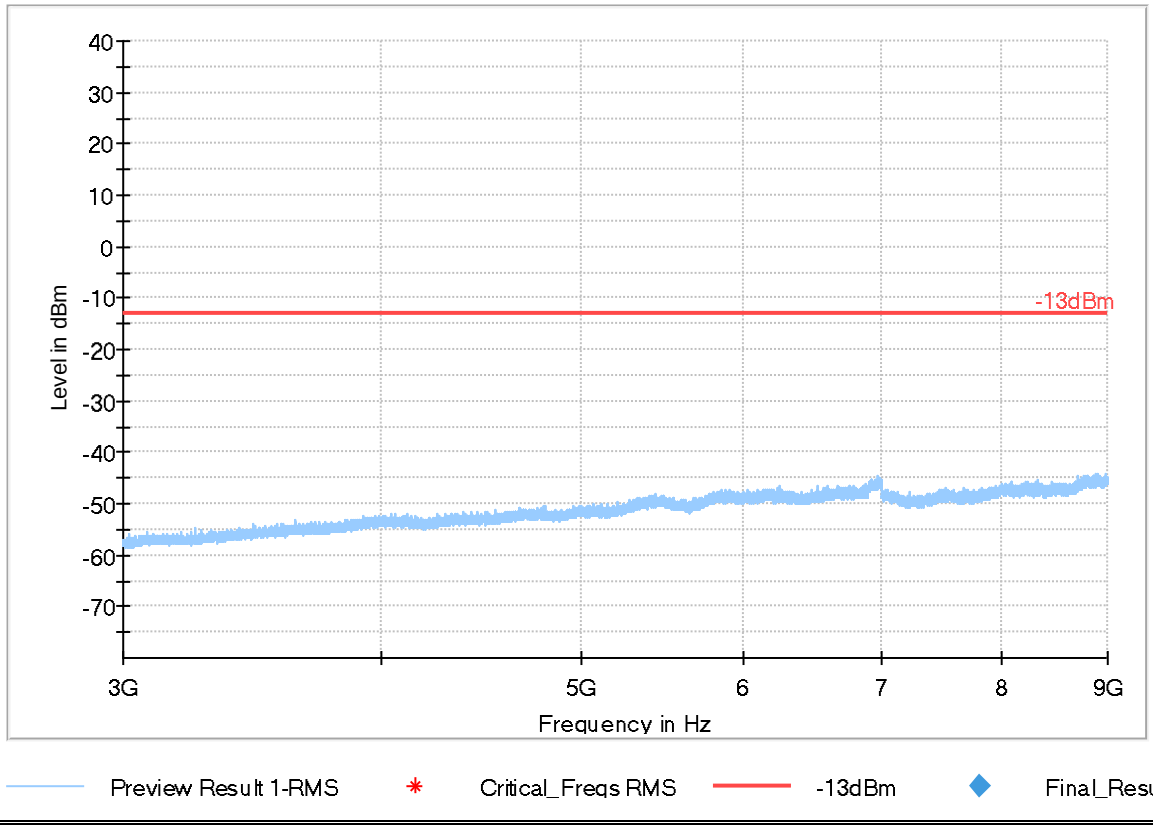
Plot # 38 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



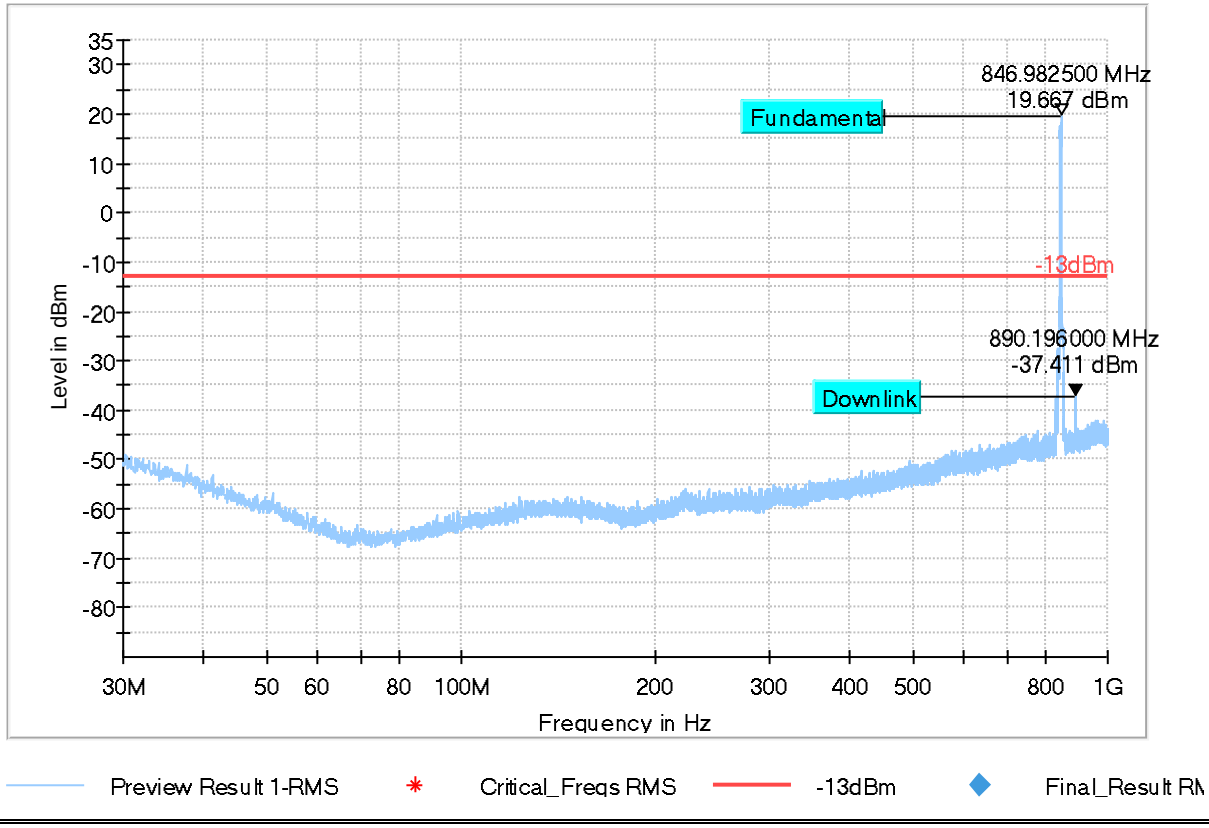
Plot # 39 Radiated Emissions: 3 GHz – 9GHz

Channel: Mid



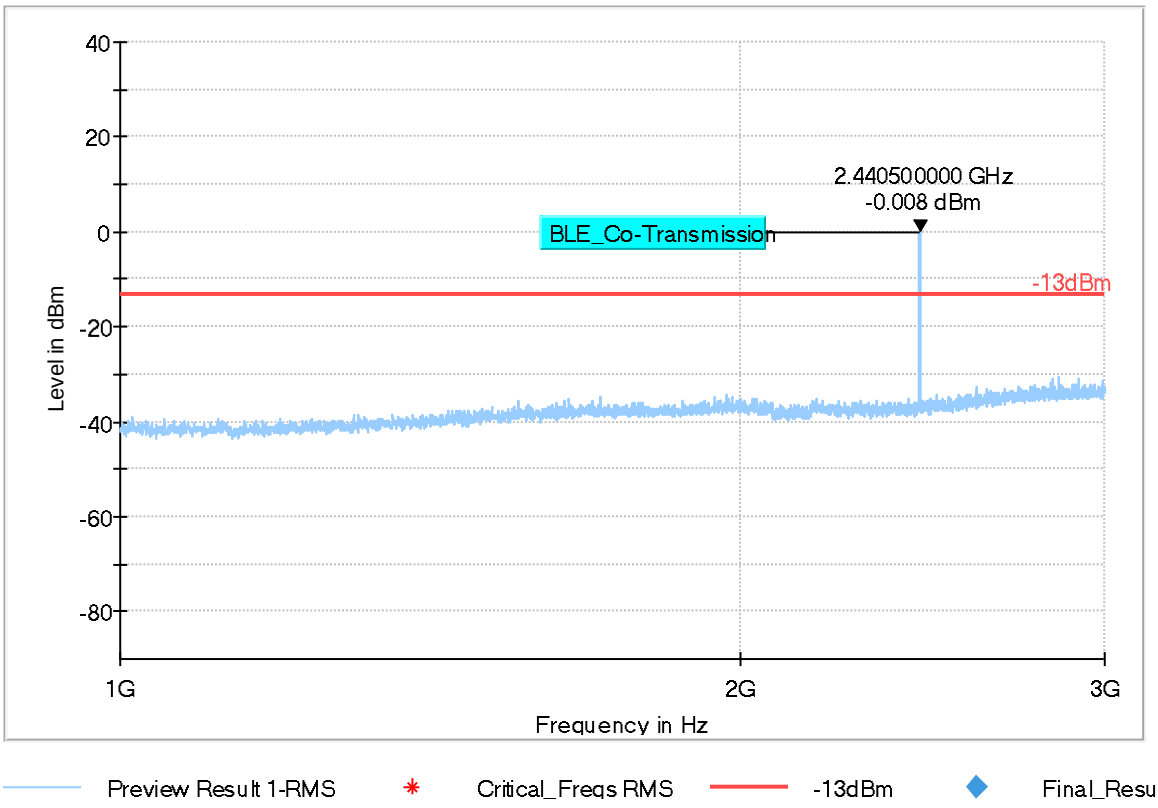
Plot # 40 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



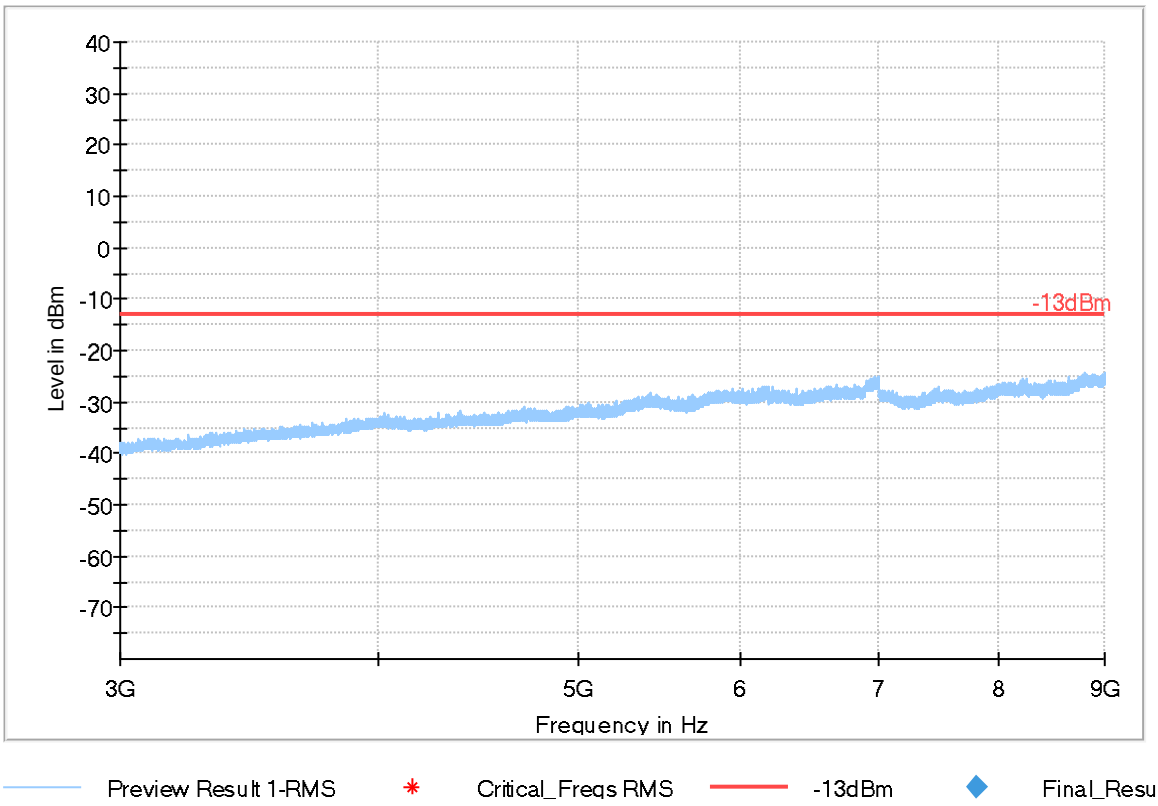
Plot # 41 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 42 Radiated Emissions: 3 GHz - 9 GHz

Channel: High



LTE Band 2

Plot # 43 Radiated Emissions: 30 MHz - 1 GHz

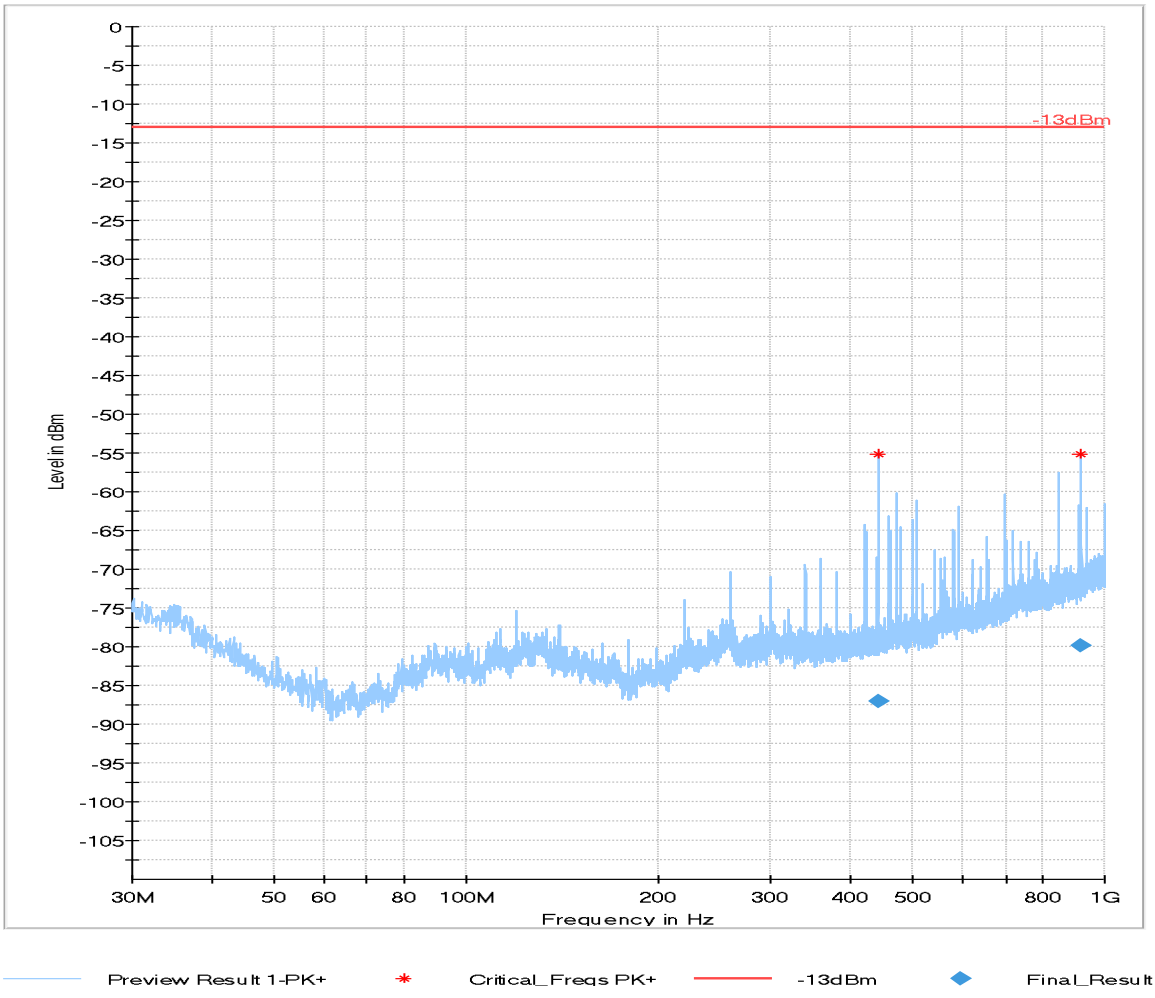
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
441.264	-87.09	-13.00	74.09	200.0	100.0	100.0	V	-29.0	-110
917.092	-79.84	-13.00	66.84	200.0	100.0	293.0	V	-51.0	-101

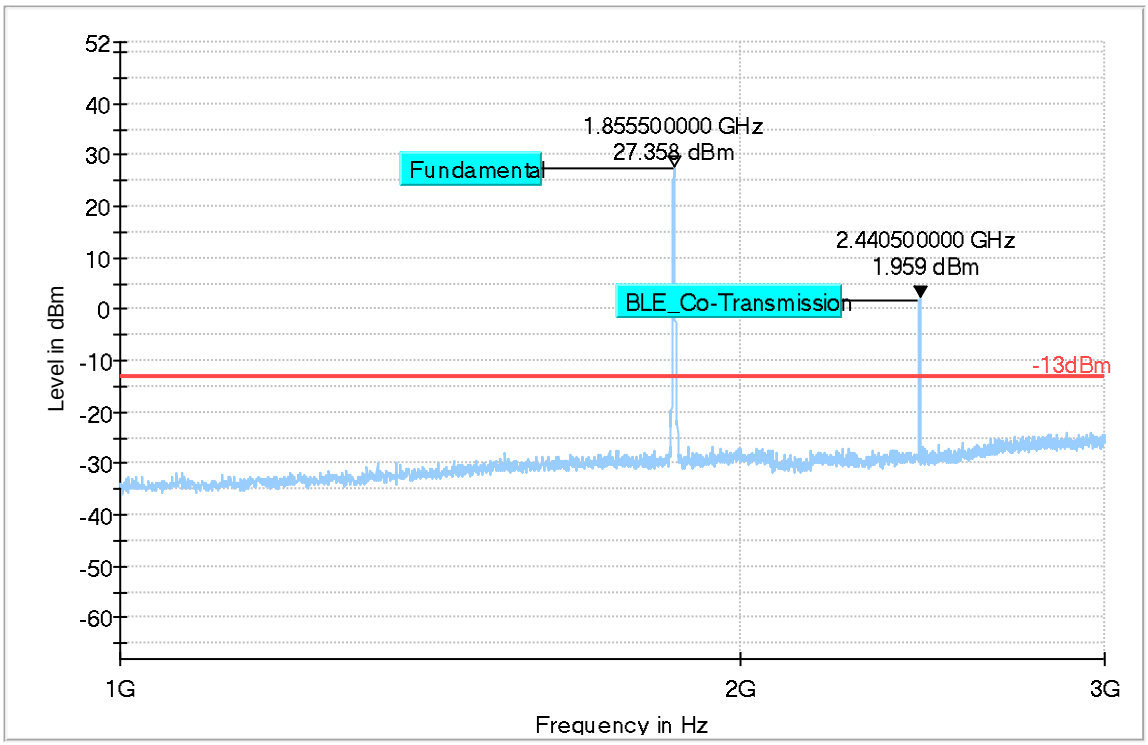
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
441.264	12:41:13 PM - 4/9/2019
917.092	12:43:51 PM - 4/9/2019



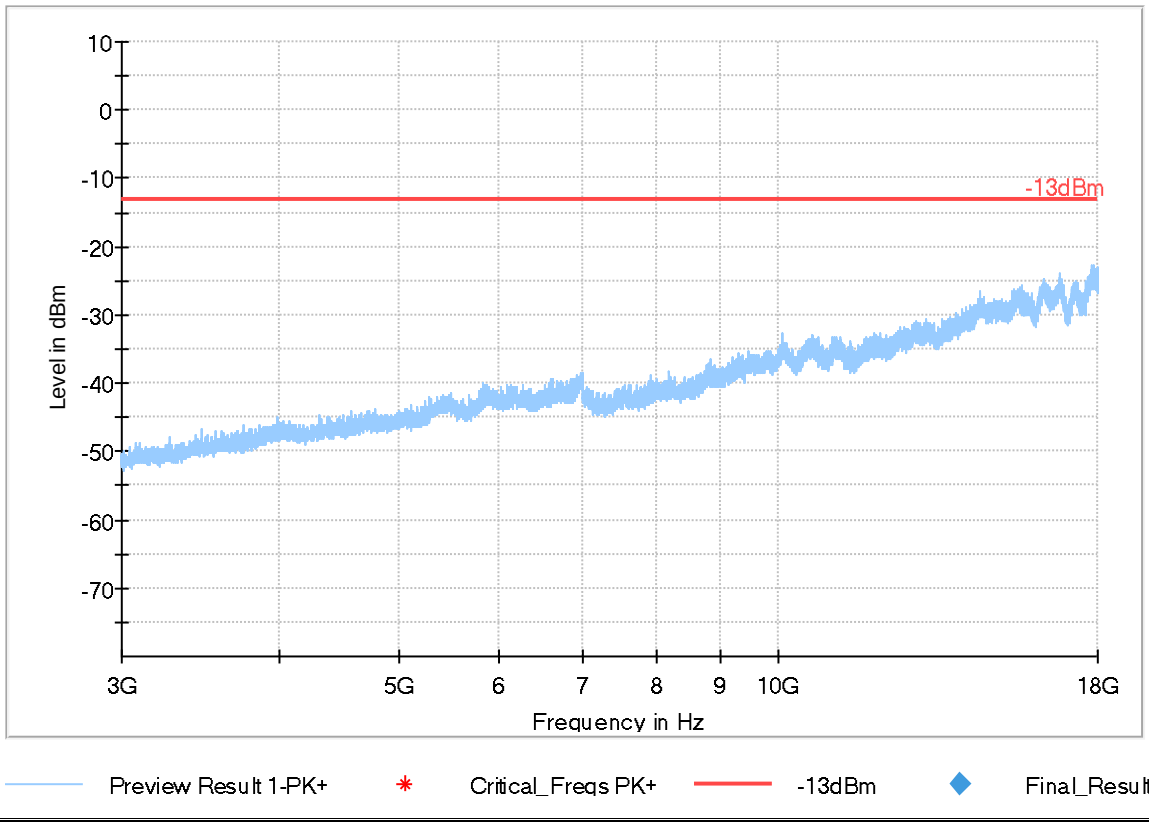
Plot # 44 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



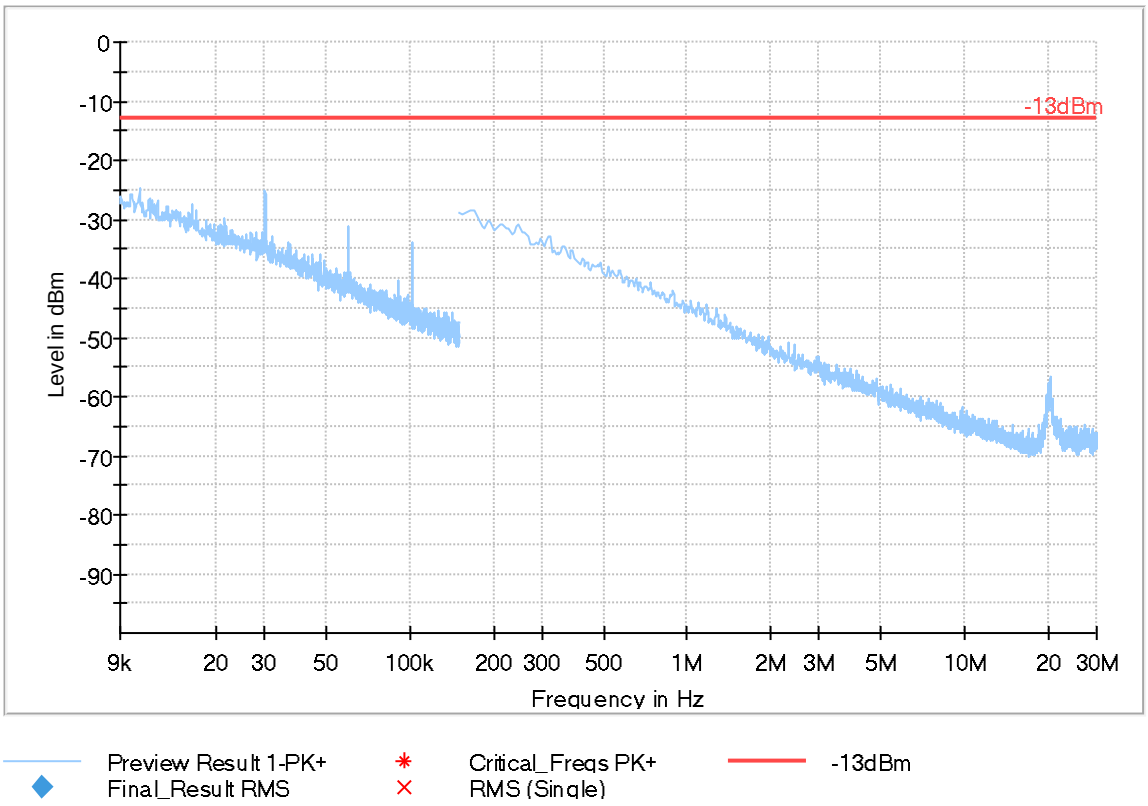
Plot # 45 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low



Plot # 46 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



Plot # 47 Radiated Emissions: 30 MHz – 1GHz

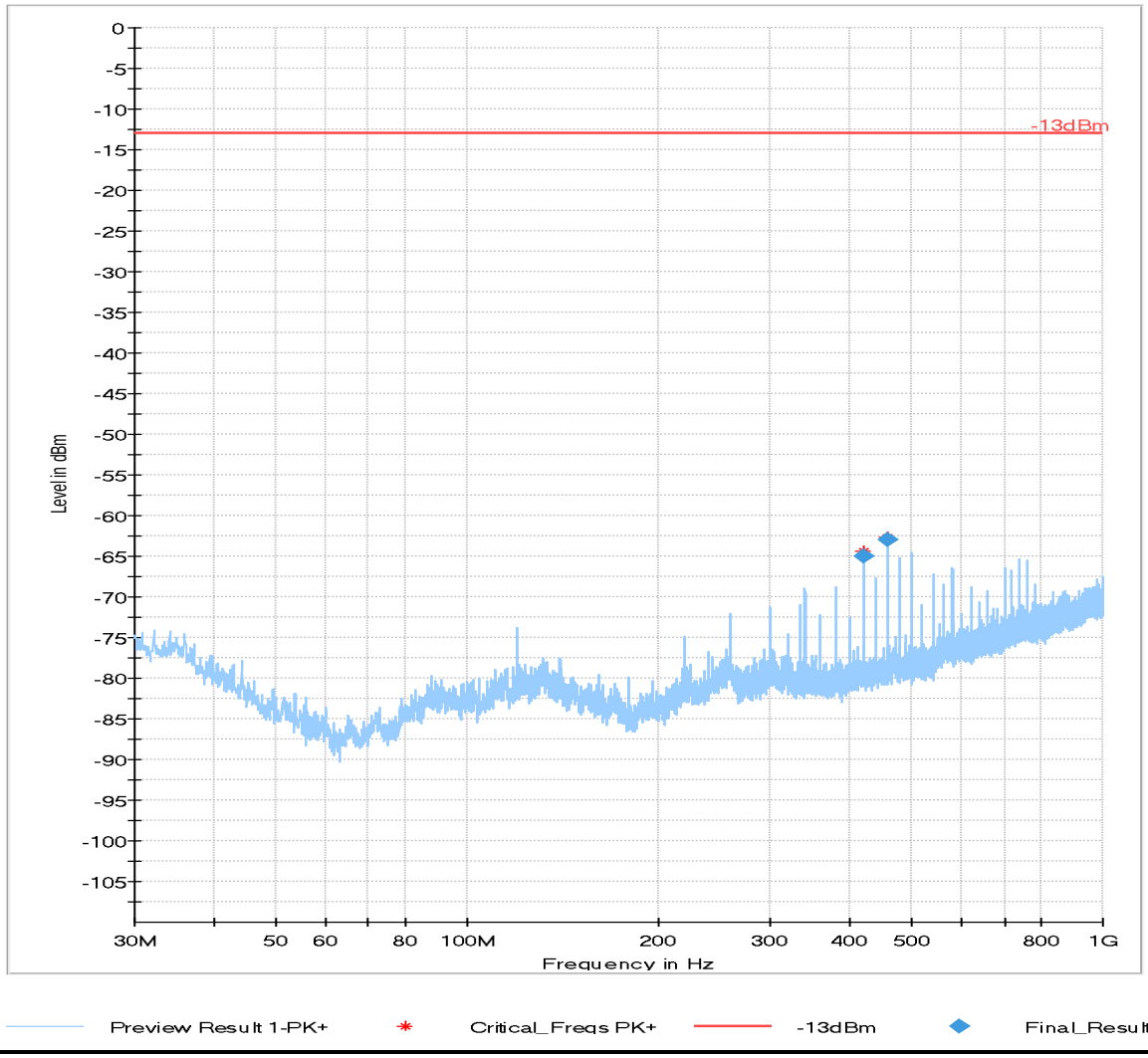
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
420.006	-64.93	-13.00	51.93	200.0	100.0	100.0	H	180.0	-109
460.005	-62.90	-13.00	49.90	200.0	100.0	100.0	H	193.0	-108

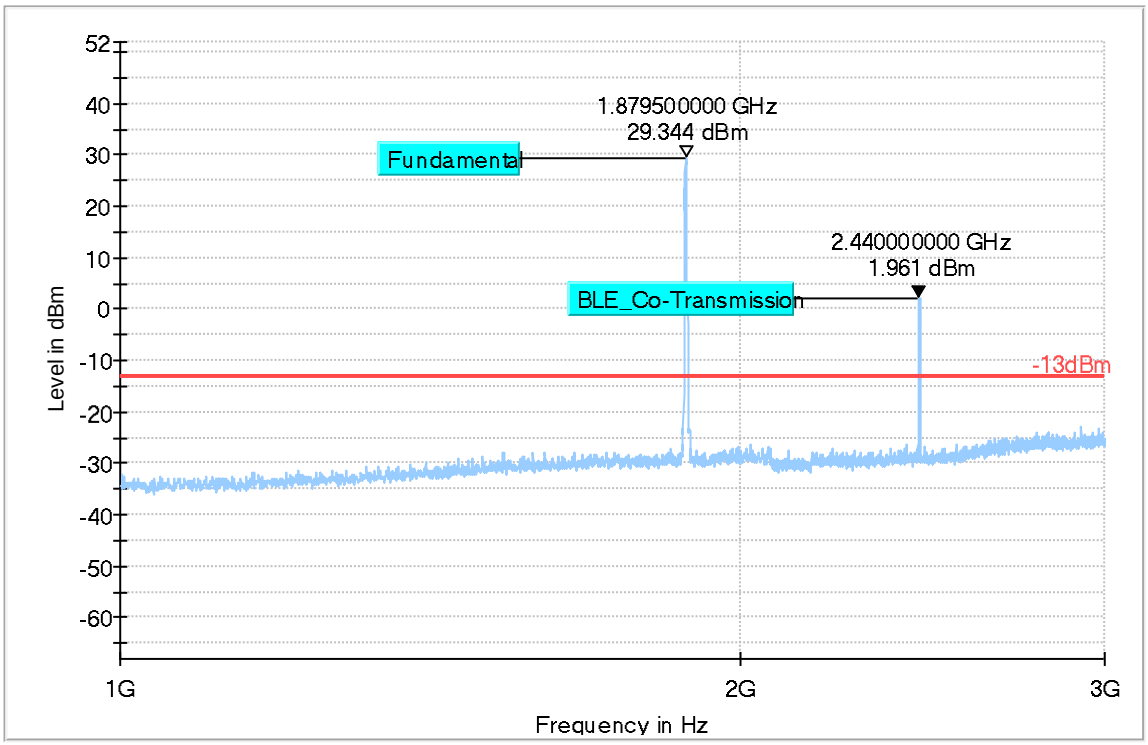
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
420.006	12:19:52 PM - 4/9/2019
460.005	12:22:30 PM - 4/9/2019



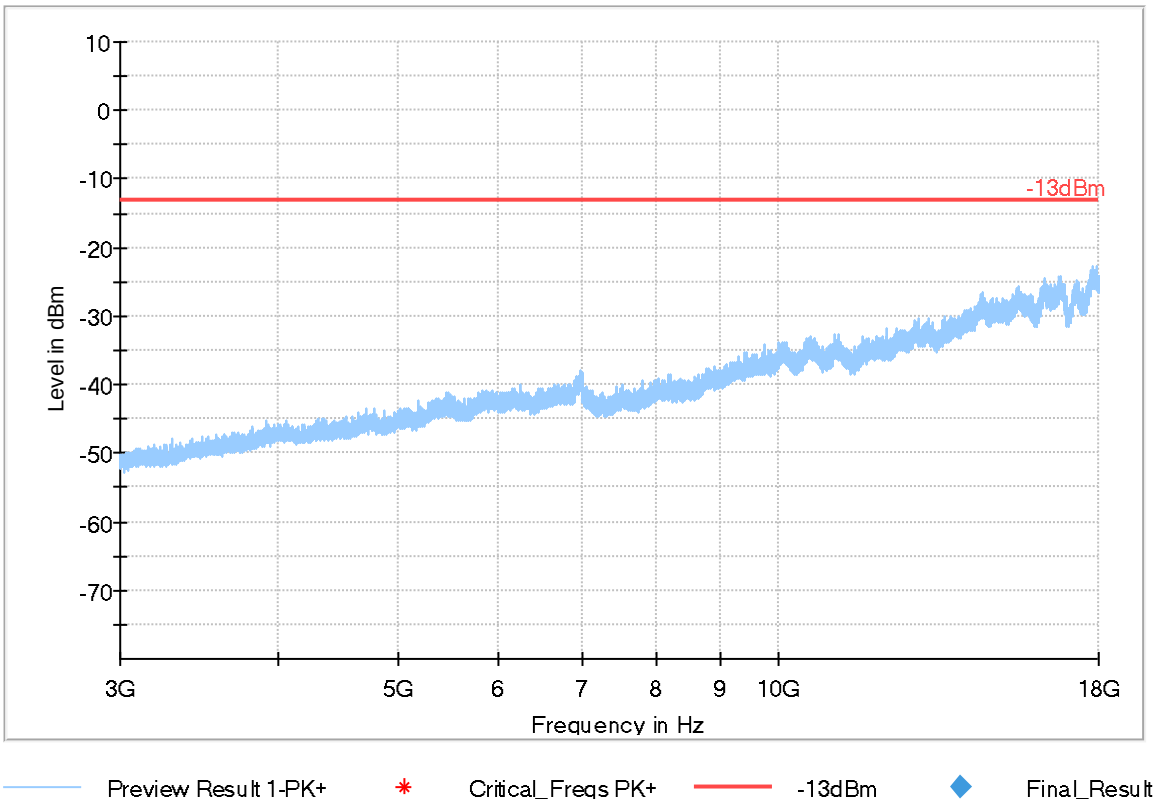
Plot # 48 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



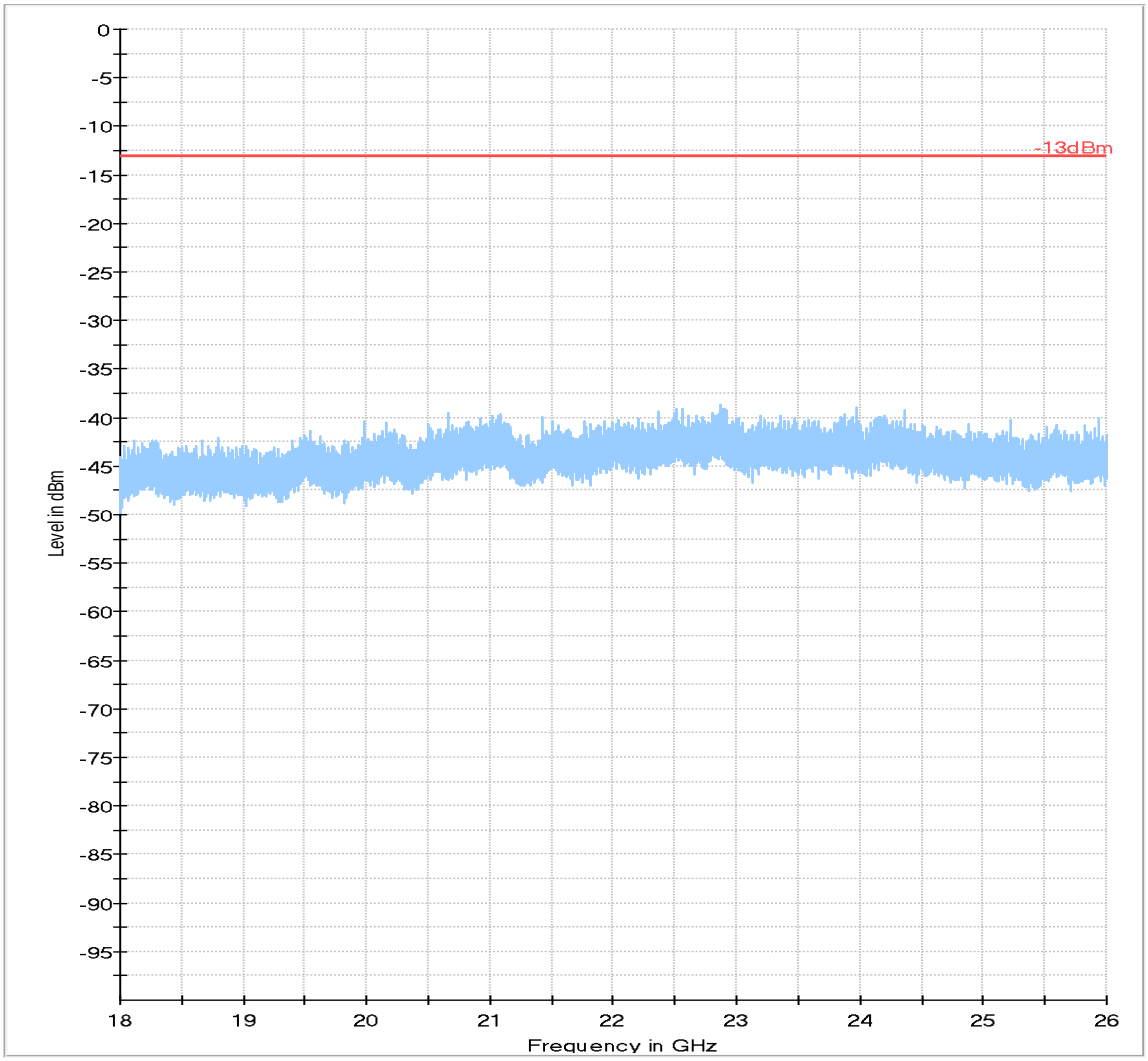
Plot # 49 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid



Plot # 50 Radiated Emissions: 18 GHz – 26 GHz

Channel: Mid



Plot # 51 Radiated Emissions: 30 MHz - 1 GHz

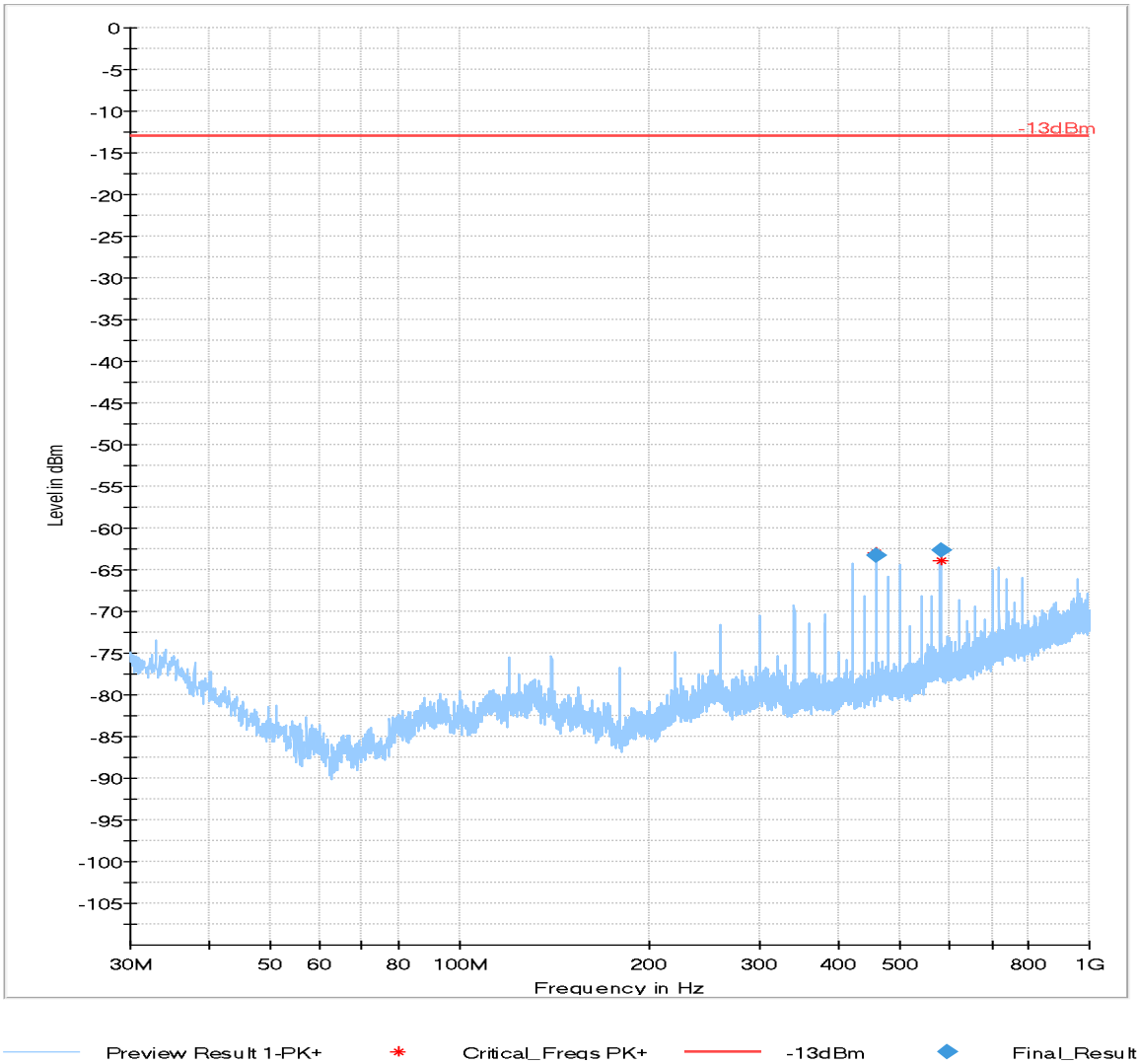
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
460.008	-63.21	-13.00	50.21	200.0	100.0	100.0	H	190.0	-108
580.017	-62.64	-13.00	49.64	200.0	100.0	131.0	H	272.0	-105

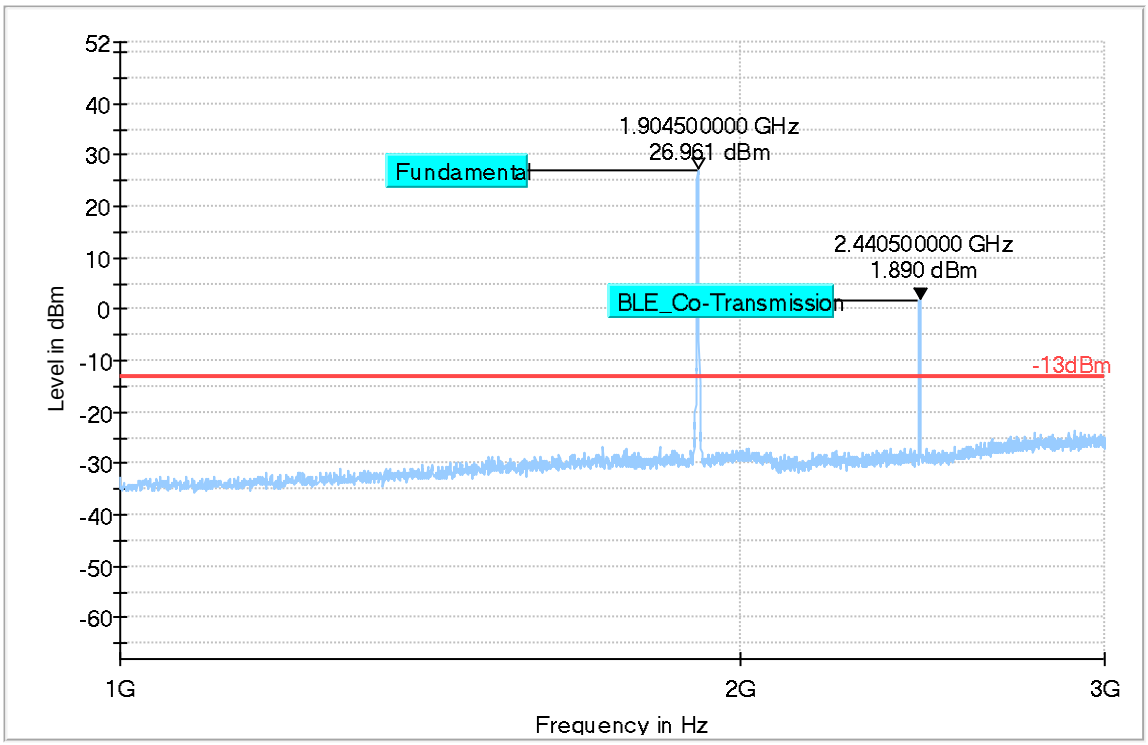
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
460.008	1:21:57 PM - 4/9/2019
580.017	1:24:44 PM - 4/9/2019



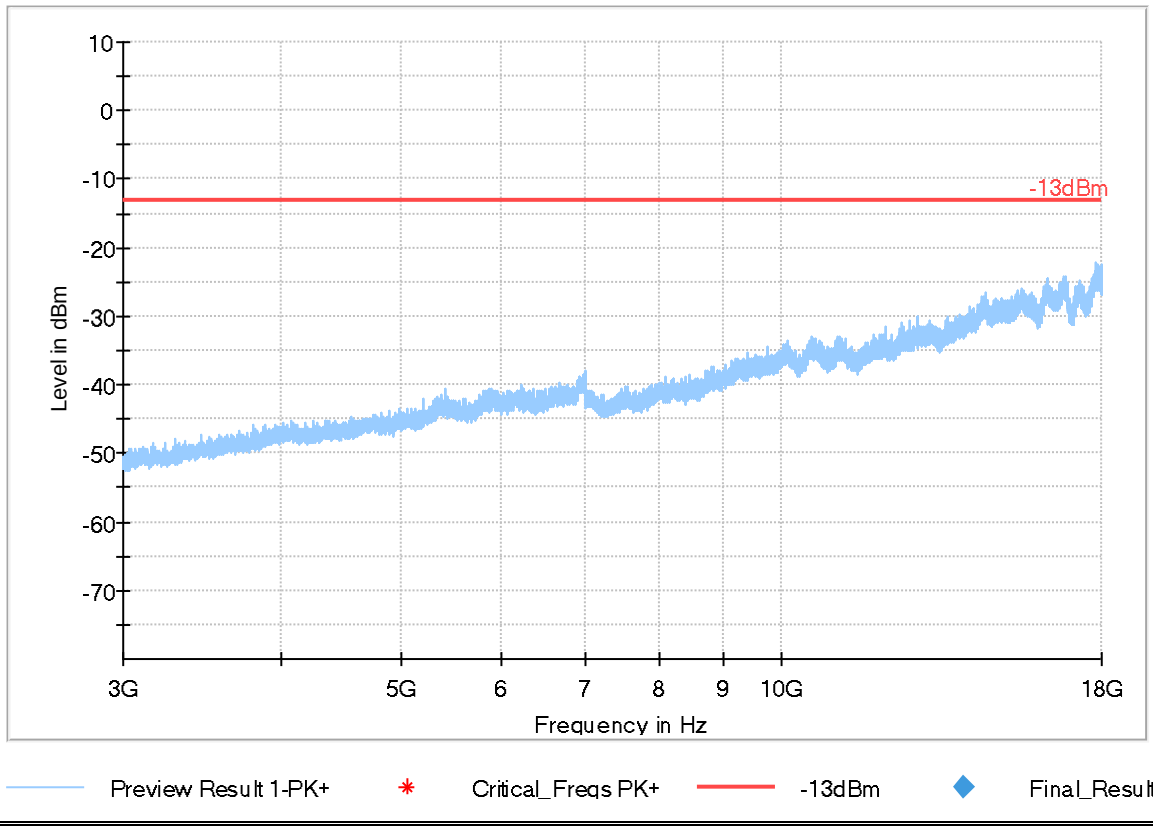
Plot # 52 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 53 Radiated Emissions: 3 GHz - 18 GHz

Channel: High



LTE Band 4

Plot # 54 Radiated Emissions: 30 MHz - 1 GHz

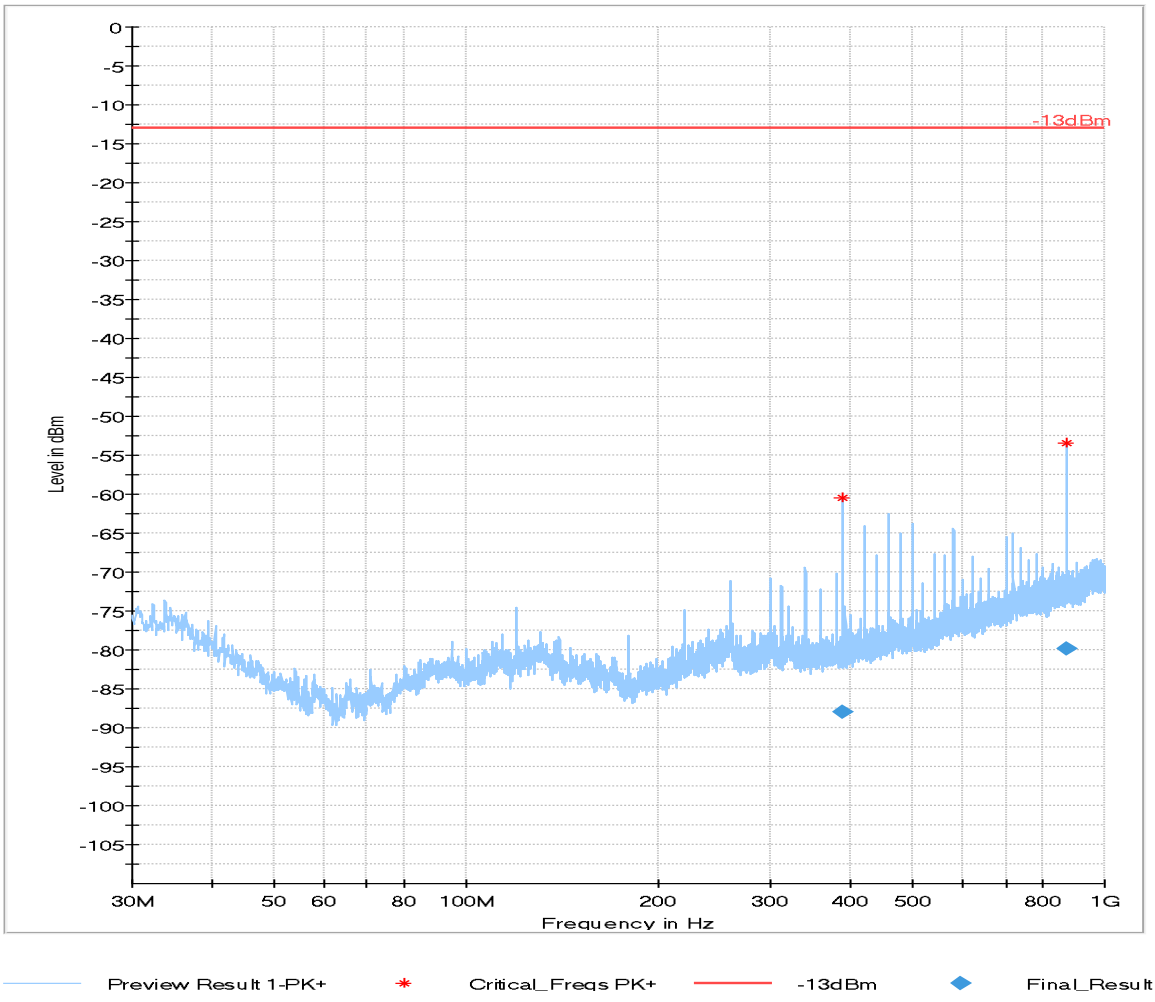
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
388.799	-87.98	-13.00	74.98	200.0	100.0	213.0	V	49.0	-111
873.464	-79.83	-13.00	66.83	200.0	100.0	242.0	H	248.0	-101

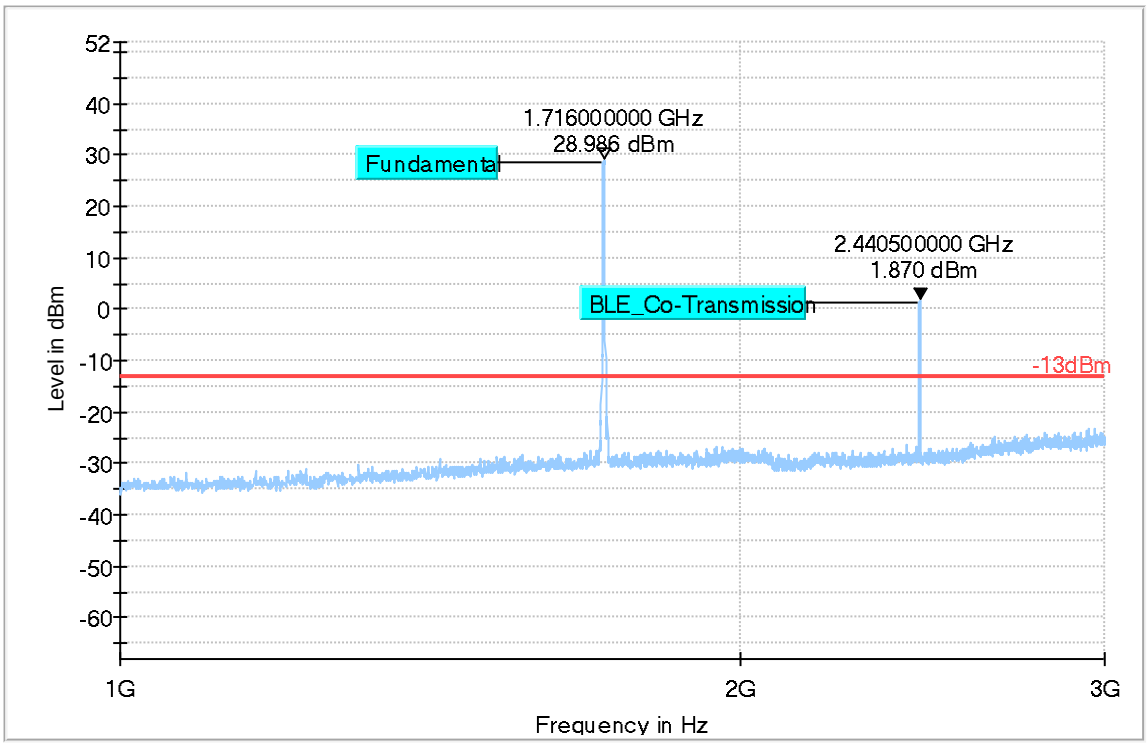
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
388.799	1:54:39 PM - 4/9/2019
873.464	1:57:37 PM - 4/9/2019



Plot # 55 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 56 Radiated Emissions: 3 GHz - 18 GHz

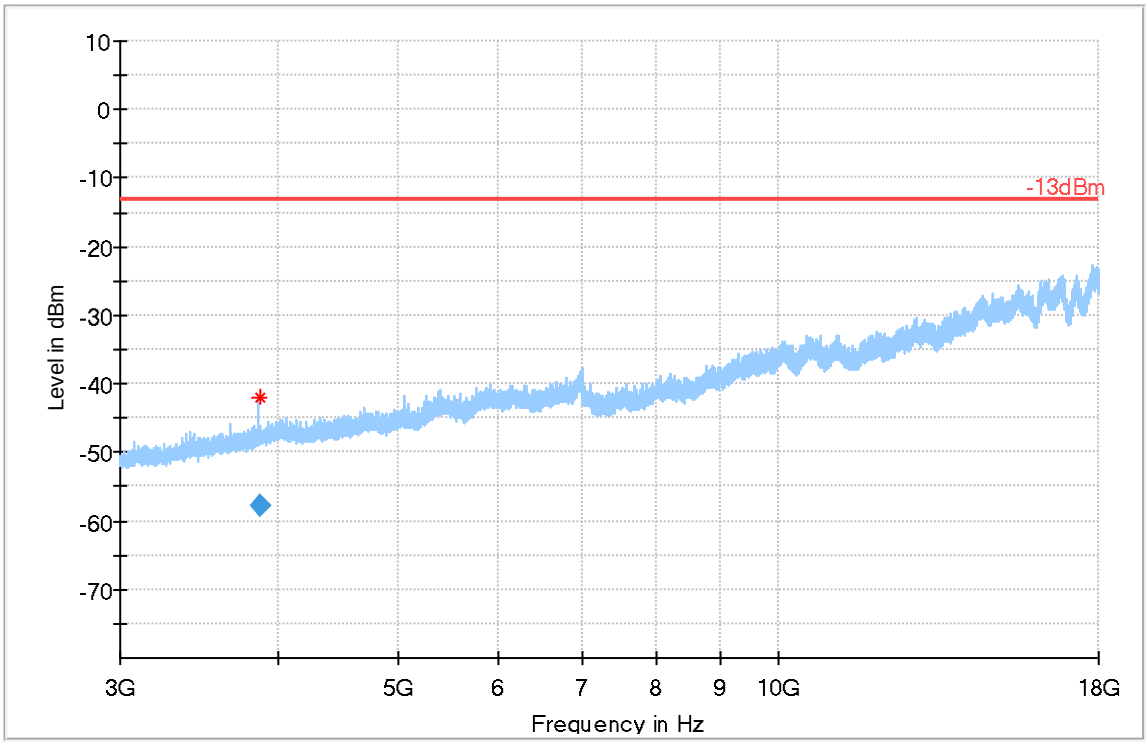
Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3871.120	-57.67	-13.00	44.67	200.0	1000.0	149.0	V	184.0	-103

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
3871.120	3:58:19 PM - 4/5/2019



Plot # 57 Radiated Emissions: 9 kHz - 30 MHz

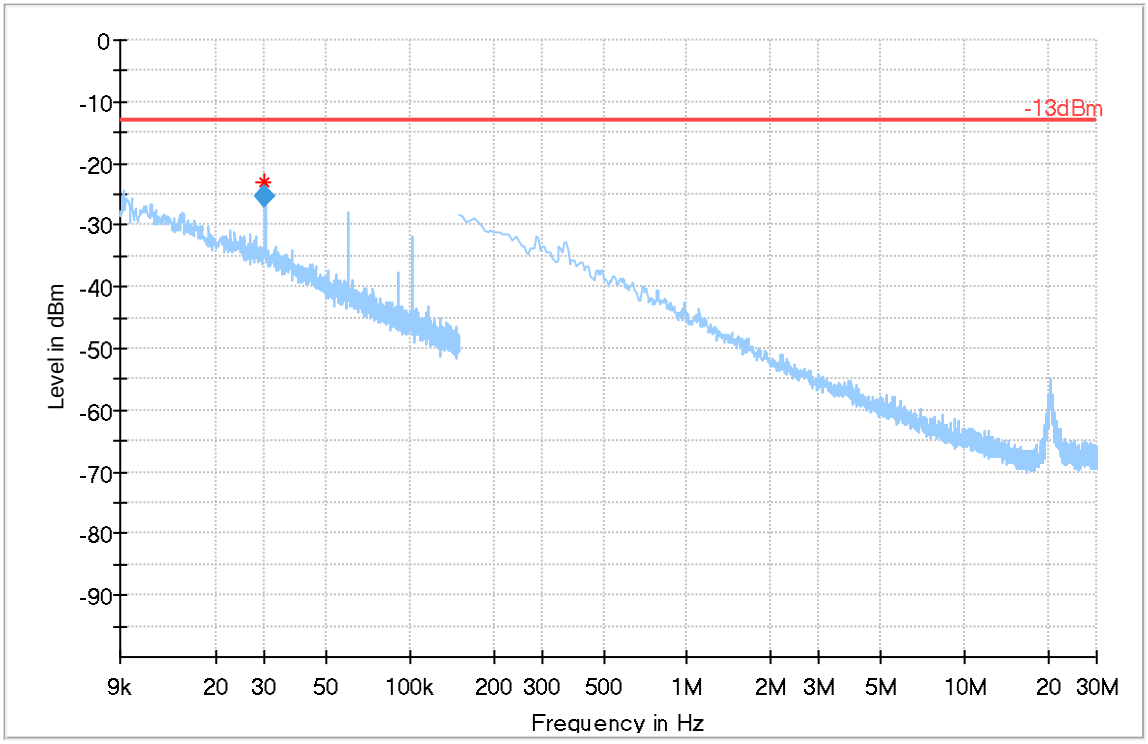
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.030	-25.19	-13.00	12.19	100.0	0.1	100.0	V	319.0	-76

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
0.030	4:10:14 PM - 4/9/2019



Plot # 58 Radiated Emissions: 30 MHz – 1 GHz

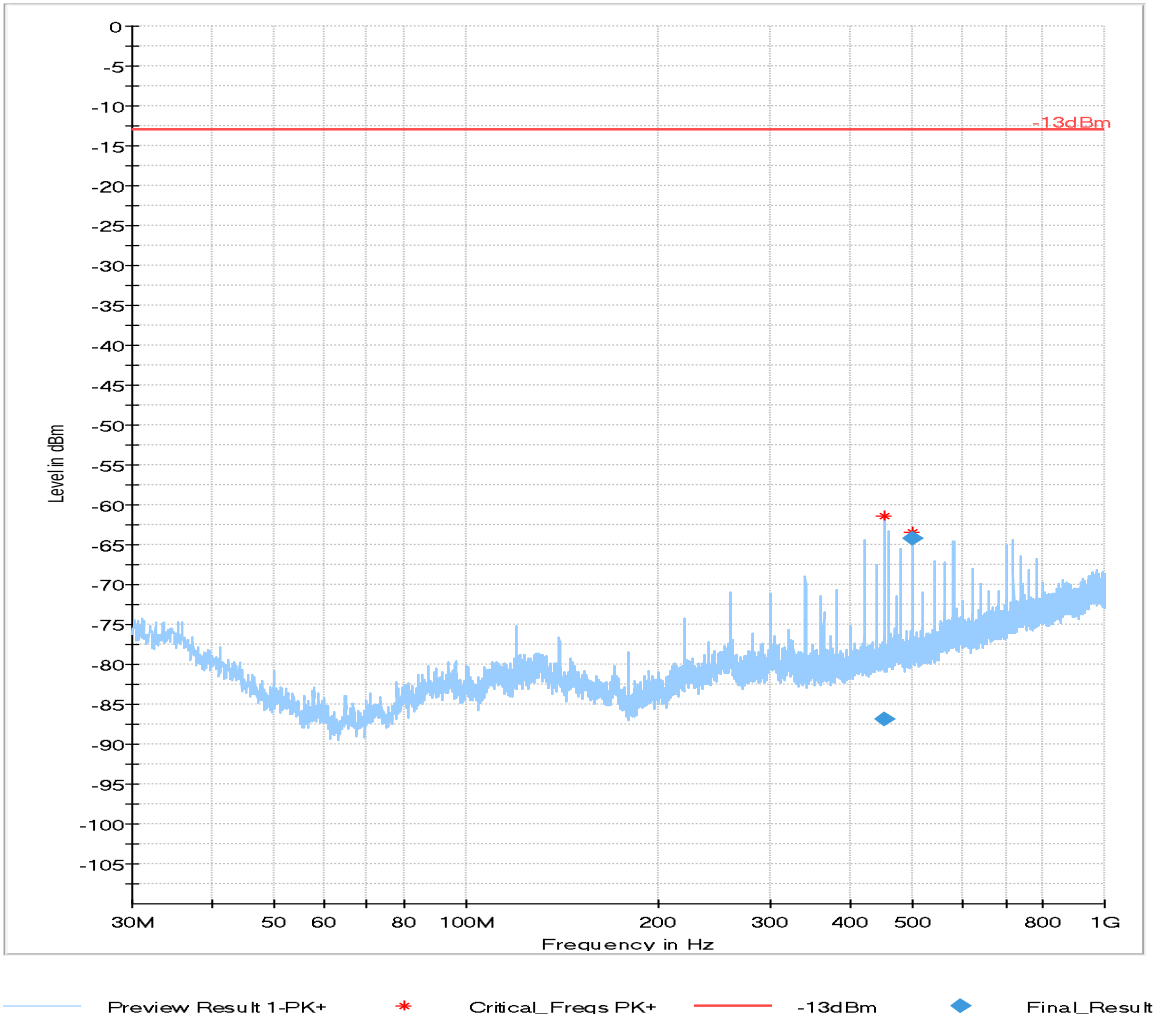
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
451.903	-86.93	-13.00	73.93	200.0	100.0	100.0	V	172.0	-109
500.007	-64.26	-13.00	51.26	200.0	100.0	100.0	H	196.0	-107

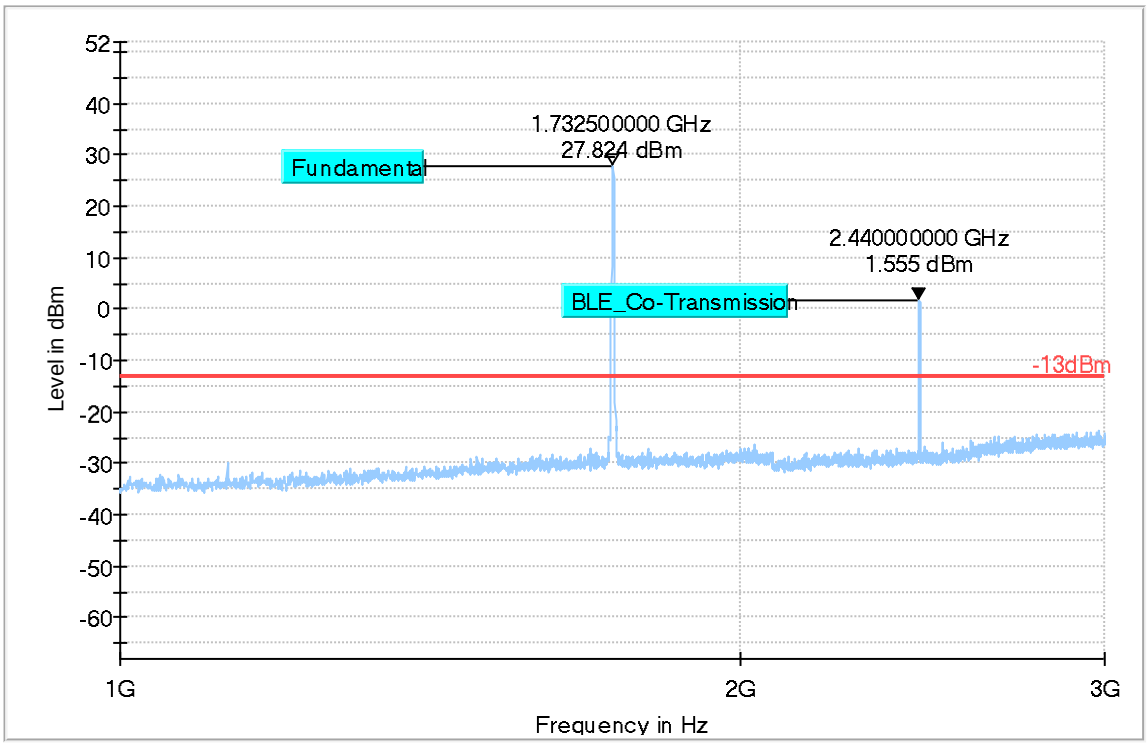
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
451.903	1:39:10 PM - 4/9/2019
500.007	1:41:58 PM - 4/9/2019



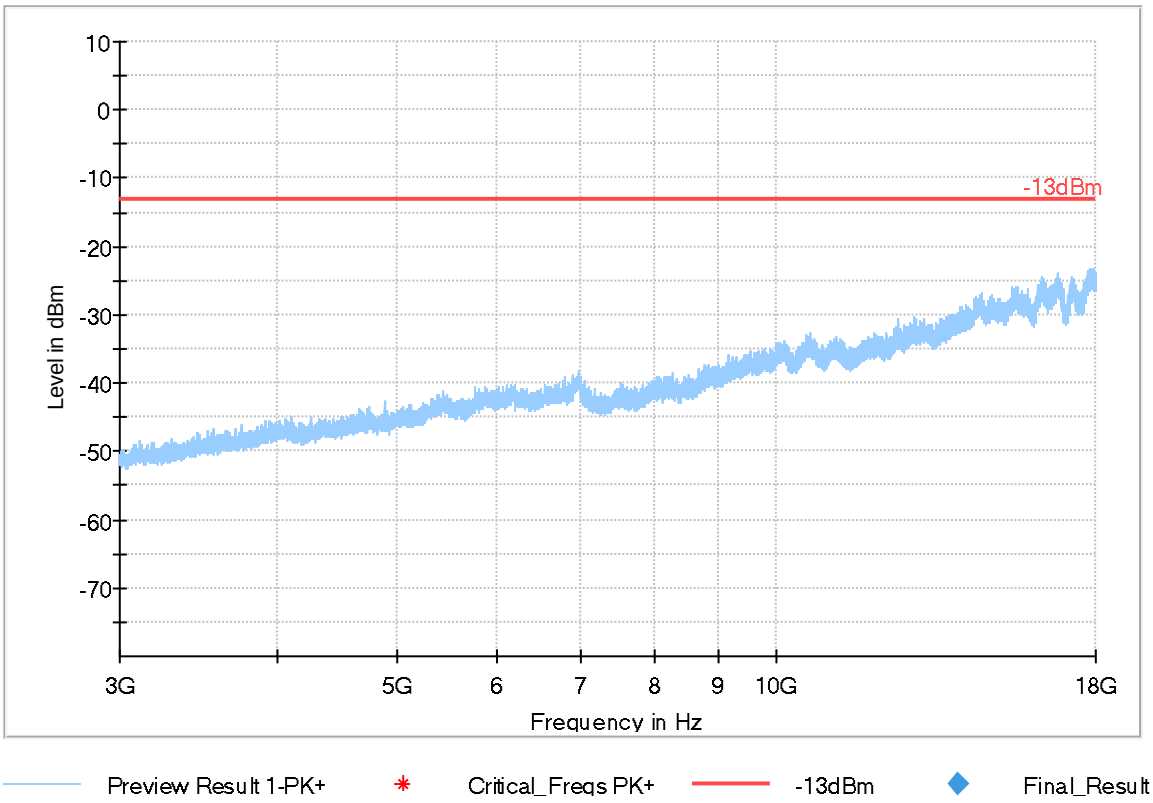
Plot # 59 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



Plot # 60 Radiated Emissions: 3 GHz – 18GHz

Channel: Mid



Plot # 61 Radiated Emissions: 30 MHz - 1 GHz

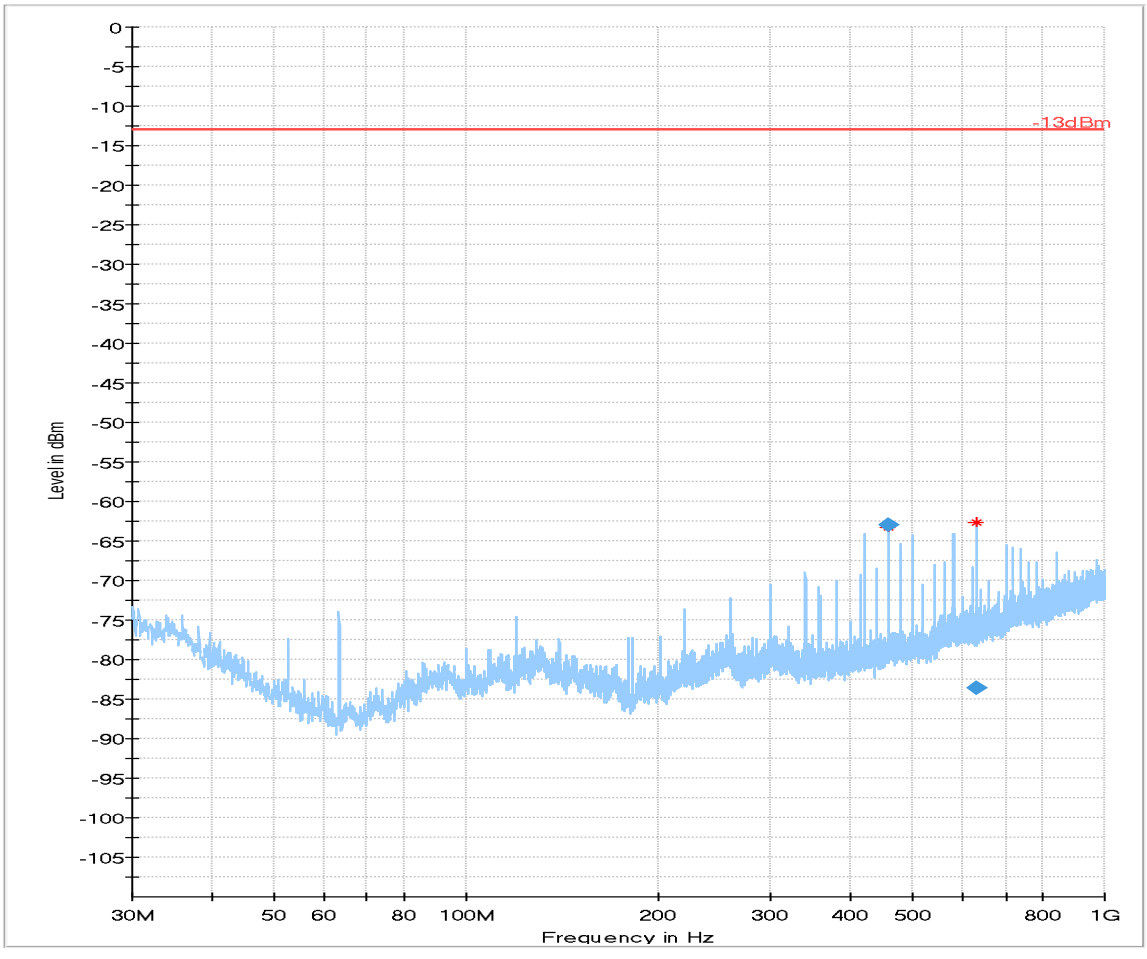
Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
460.001	-62.97	-13.00	49.97	200.0	100.0	100.0	H	190.0	-108
629.115	-83.63	-13.00	70.63	200.0	100.0	114.0	V	71.0	-105

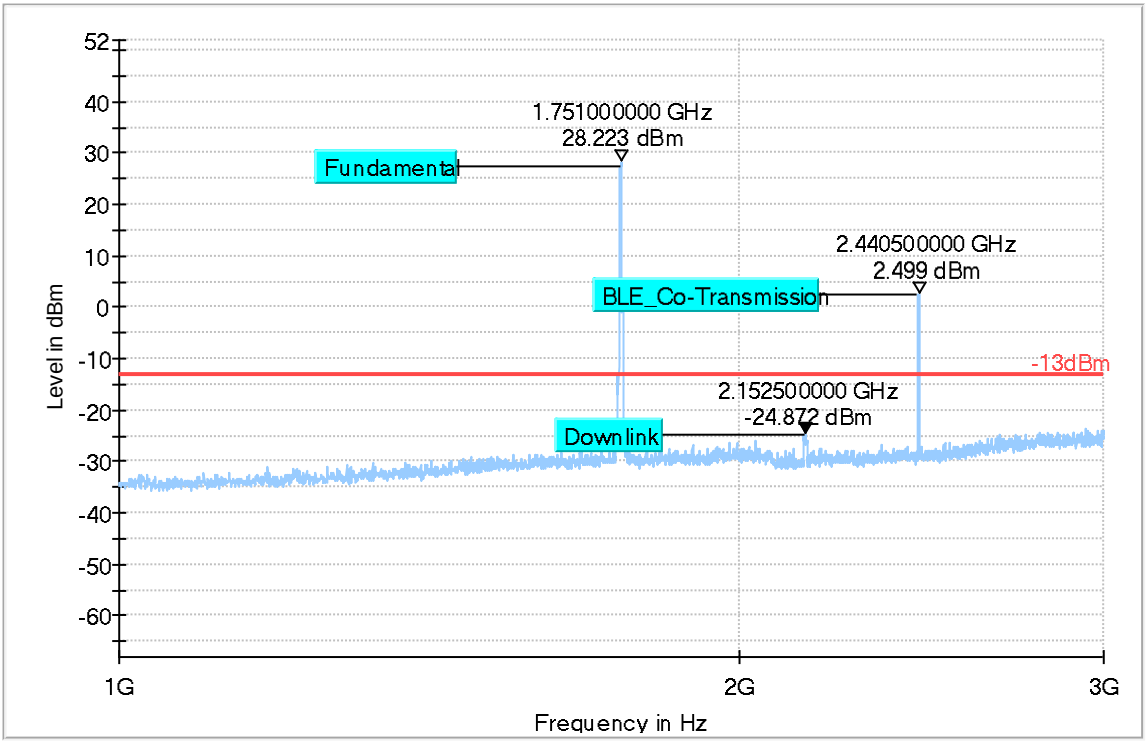
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
460.001	2:10:22 PM - 4/9/2019
629.115	2:07:19 PM - 4/9/2019



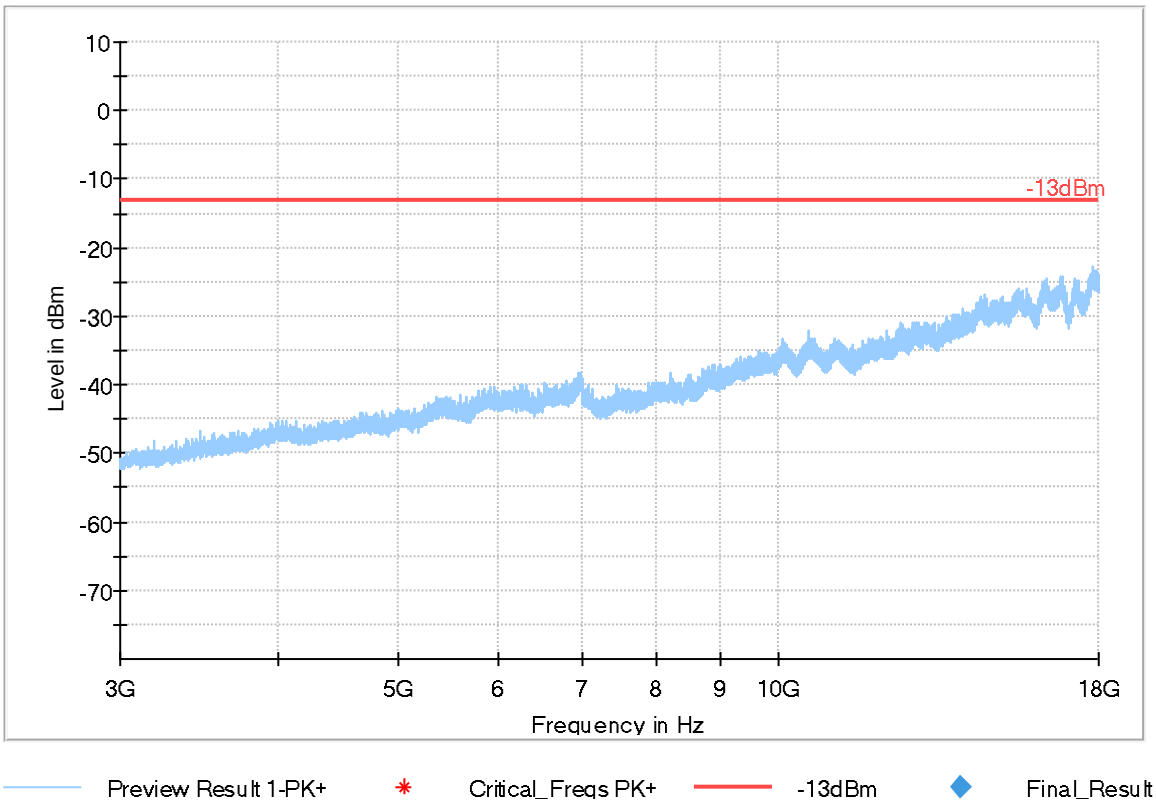
Plot # 62 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 63 Radiated Emissions: 3 GHz - 18 GHz

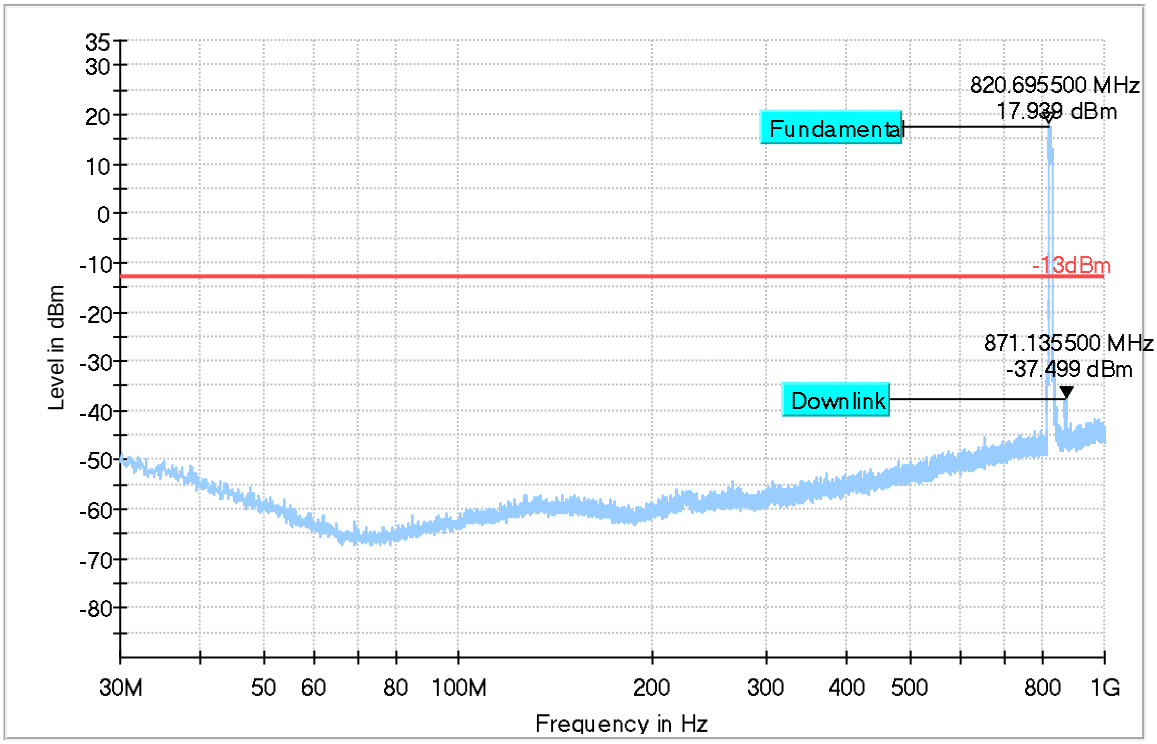
Channel: High



LTE Band 5

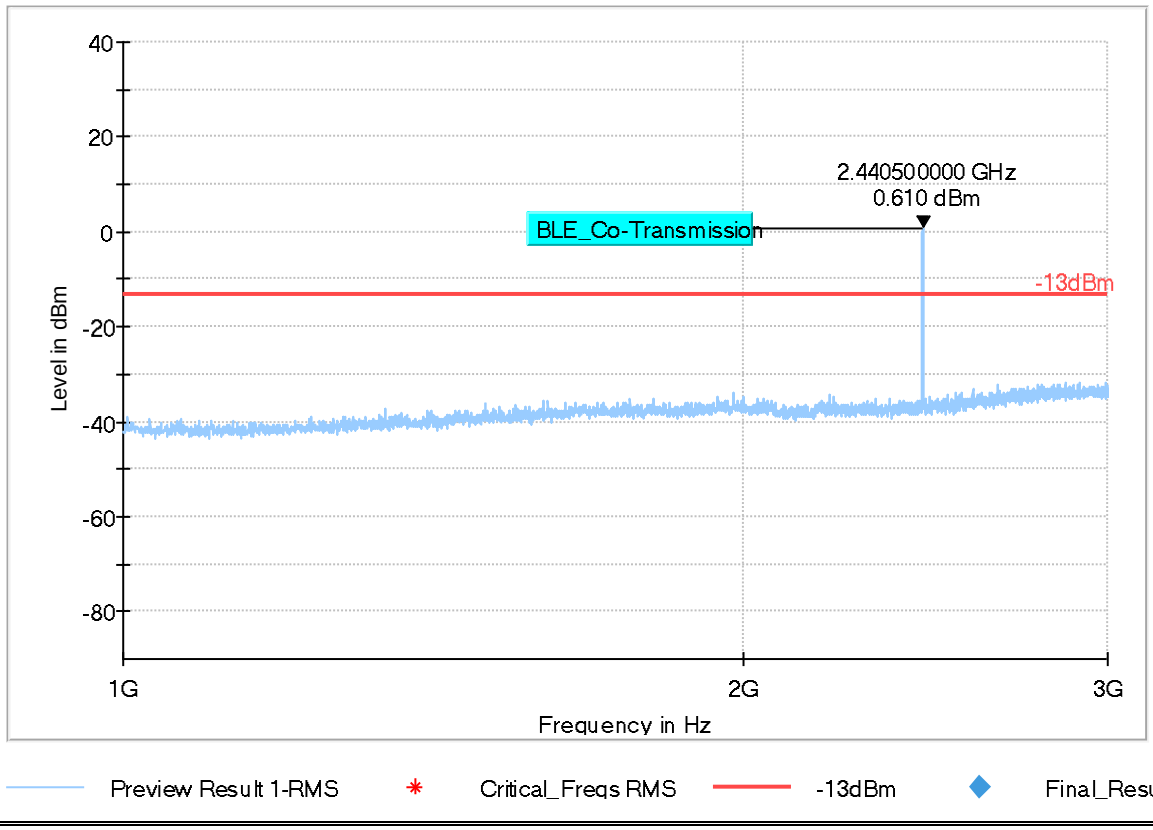
Plot # 64 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low



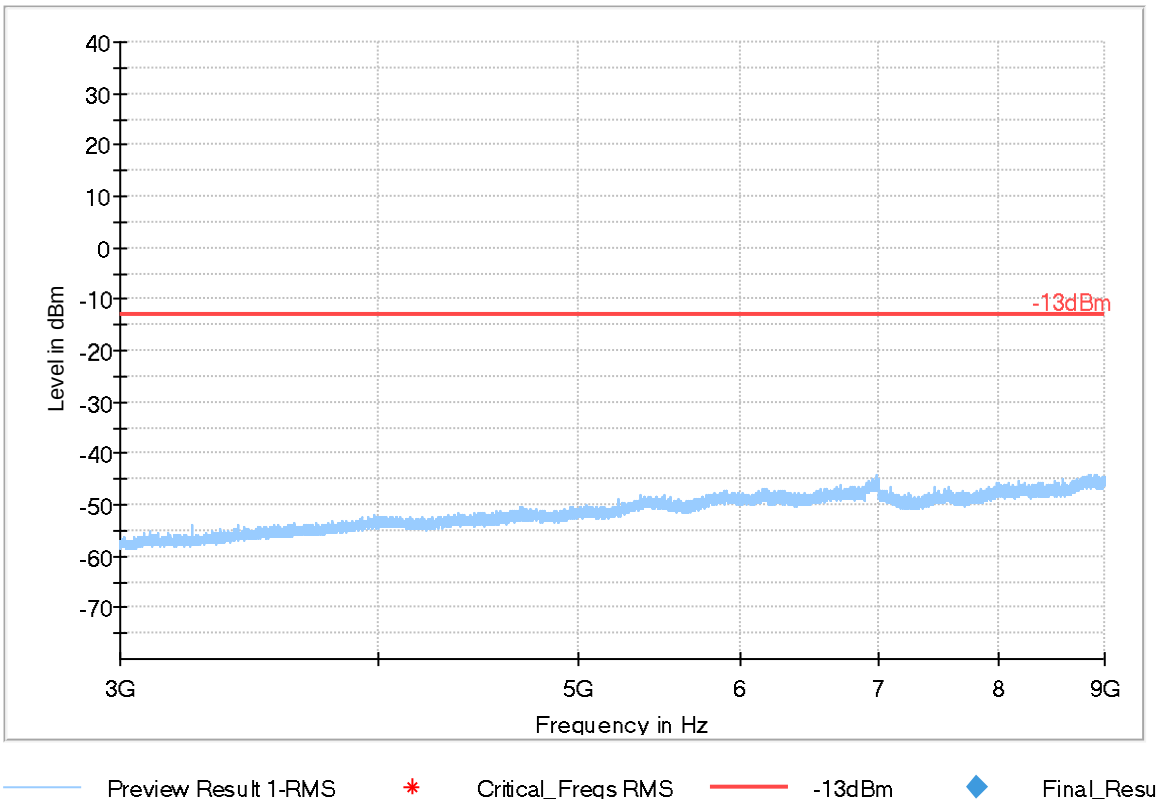
Plot # 65 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 66 Radiated Emissions: 3 GHz - 9 GHz

Channel: Low



Plot # 67 Radiated Emissions: 9 kHz - 30 MHz

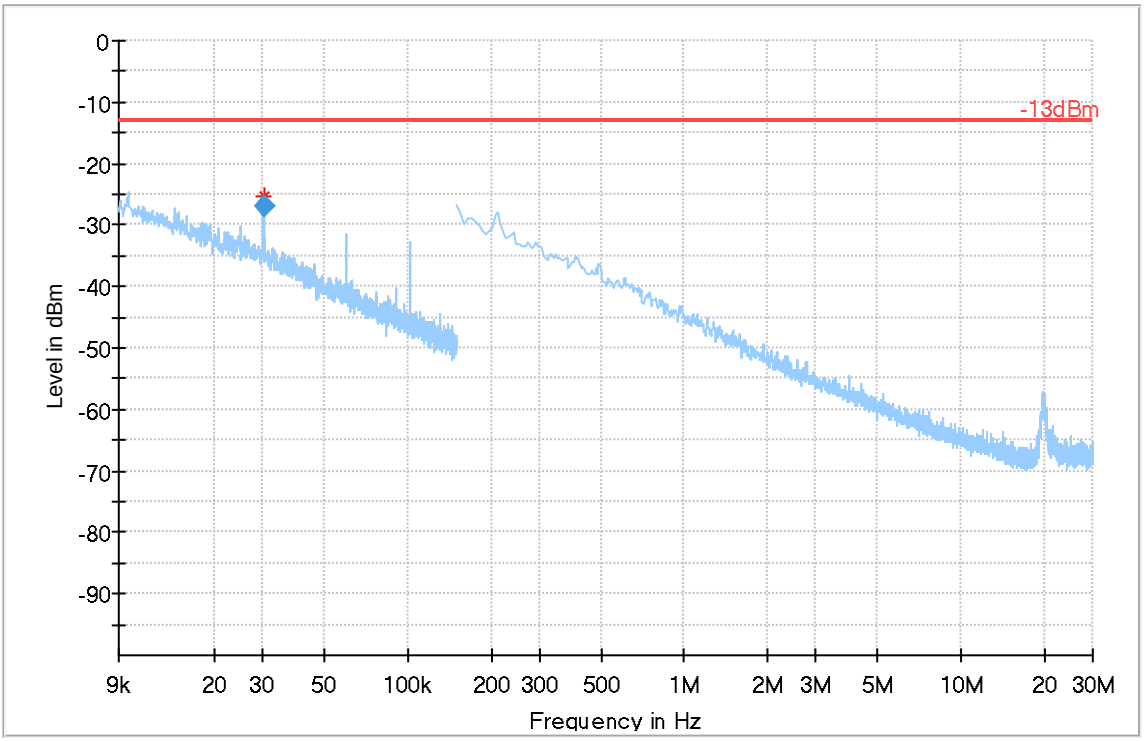
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.030	-26.83	-13.00	13.83	100.0	0.1	100.0	H	78.0	-76

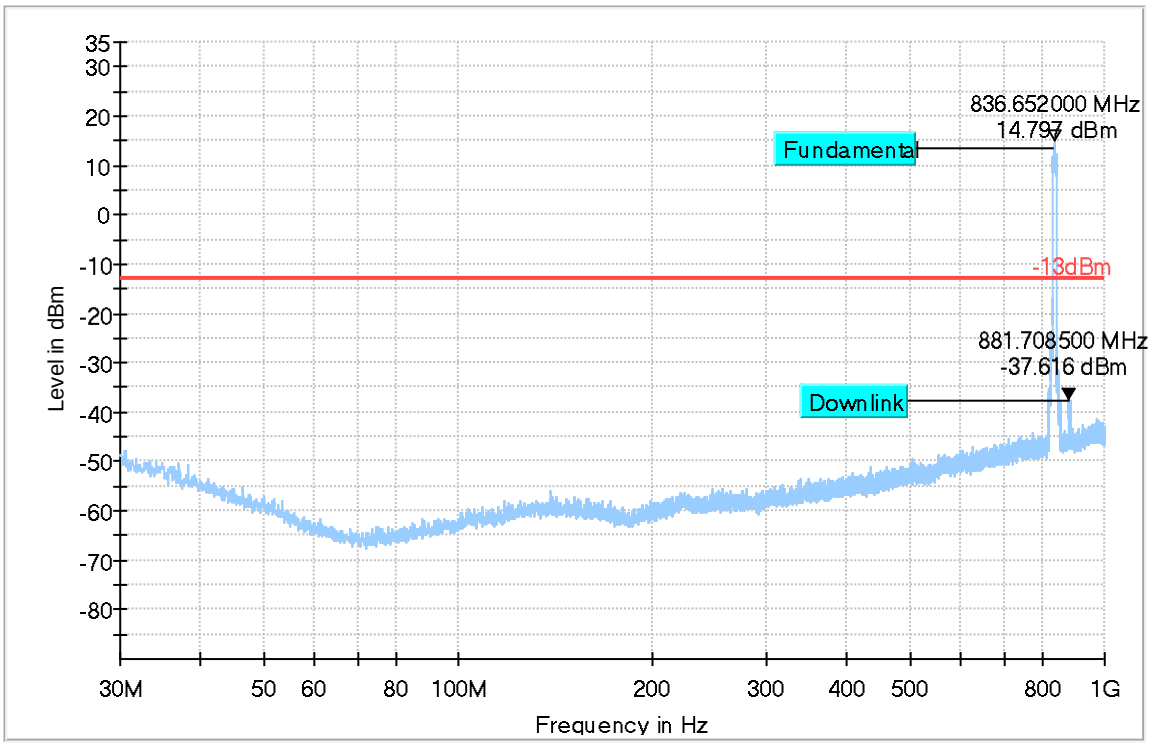
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
0.030	3:35:42 PM - 4/9/2019



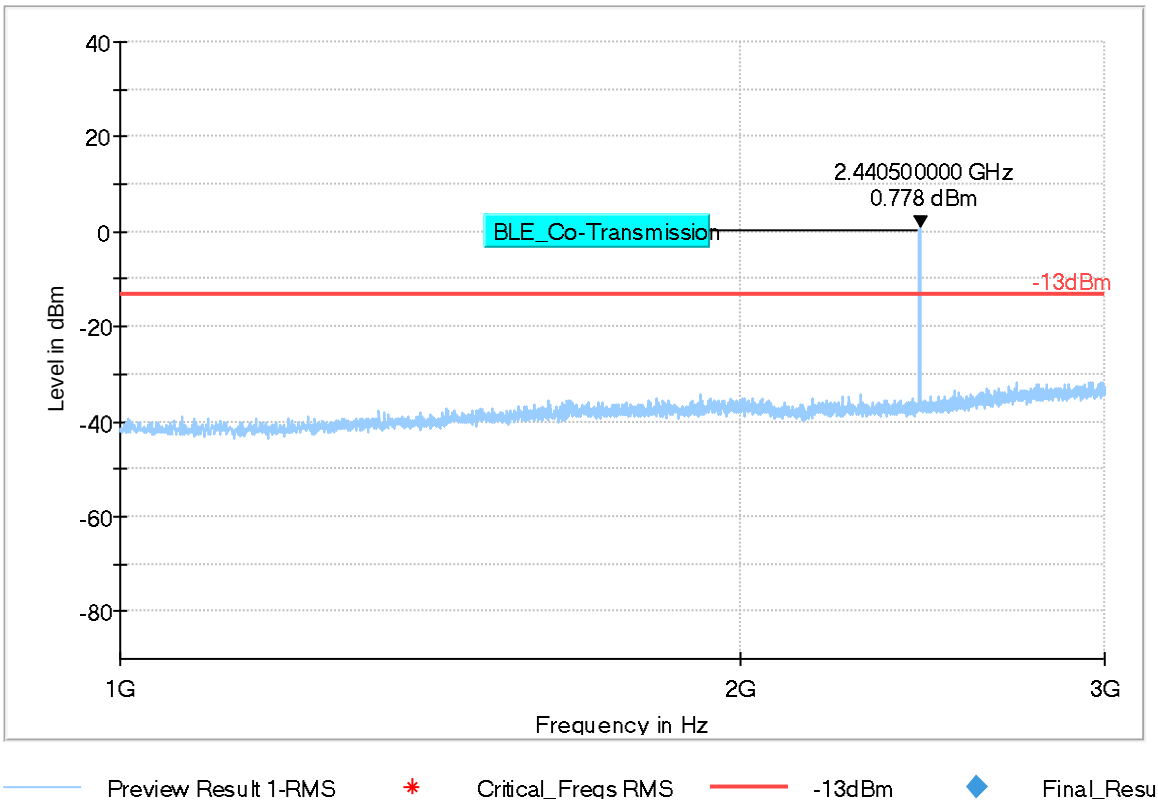
Plot # 68 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid



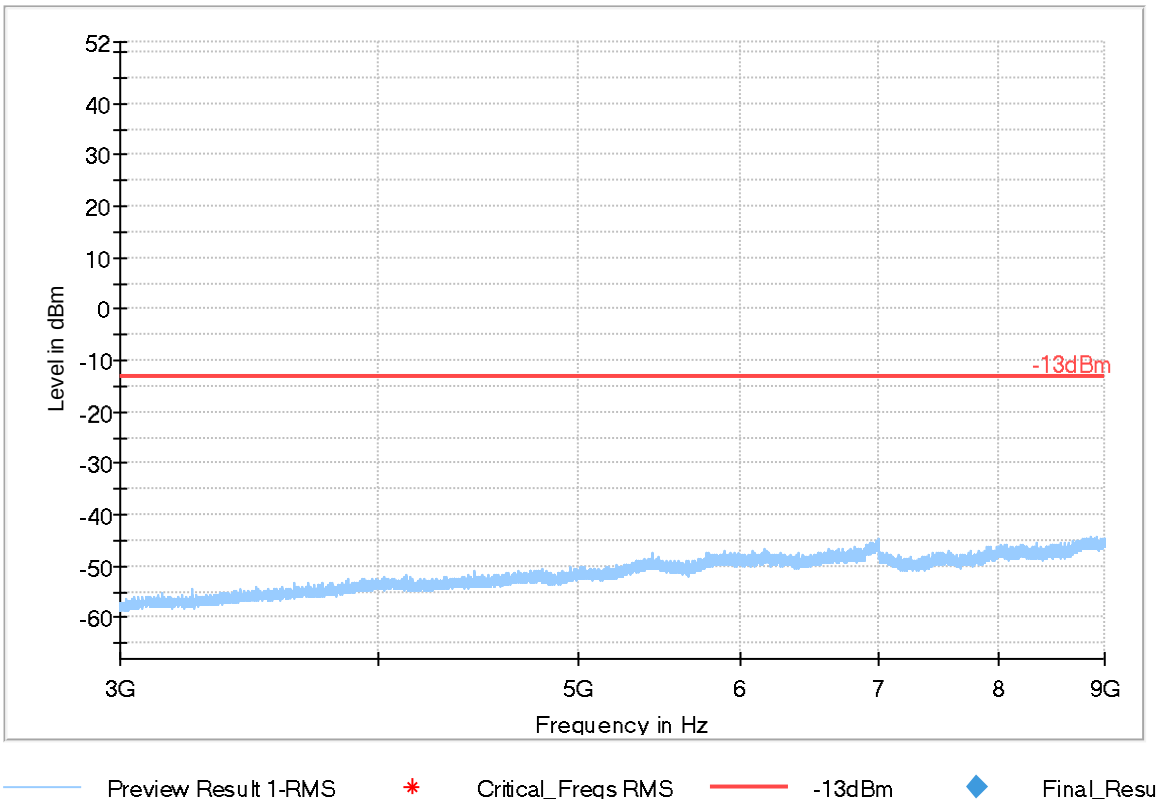
Plot # 69 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



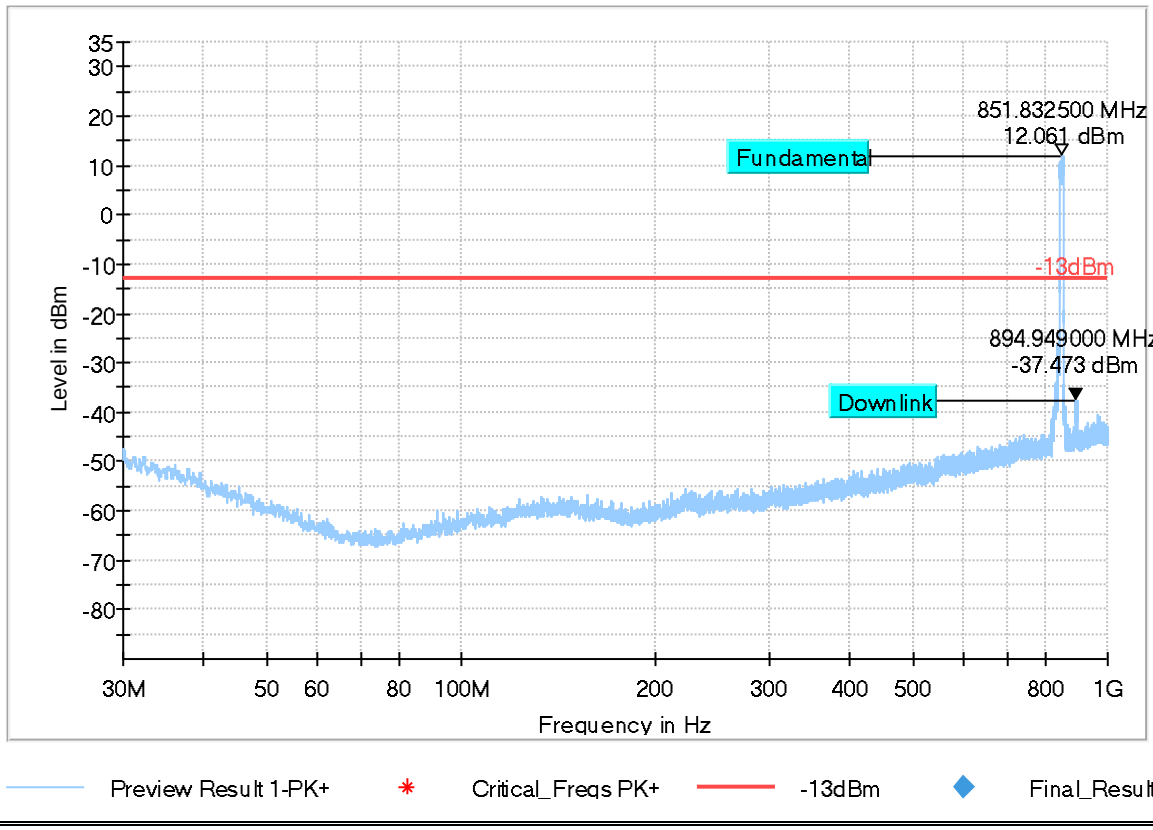
Plot # 70 Radiated Emissions: 3 GHz – 9 GHz

Channel: Mid



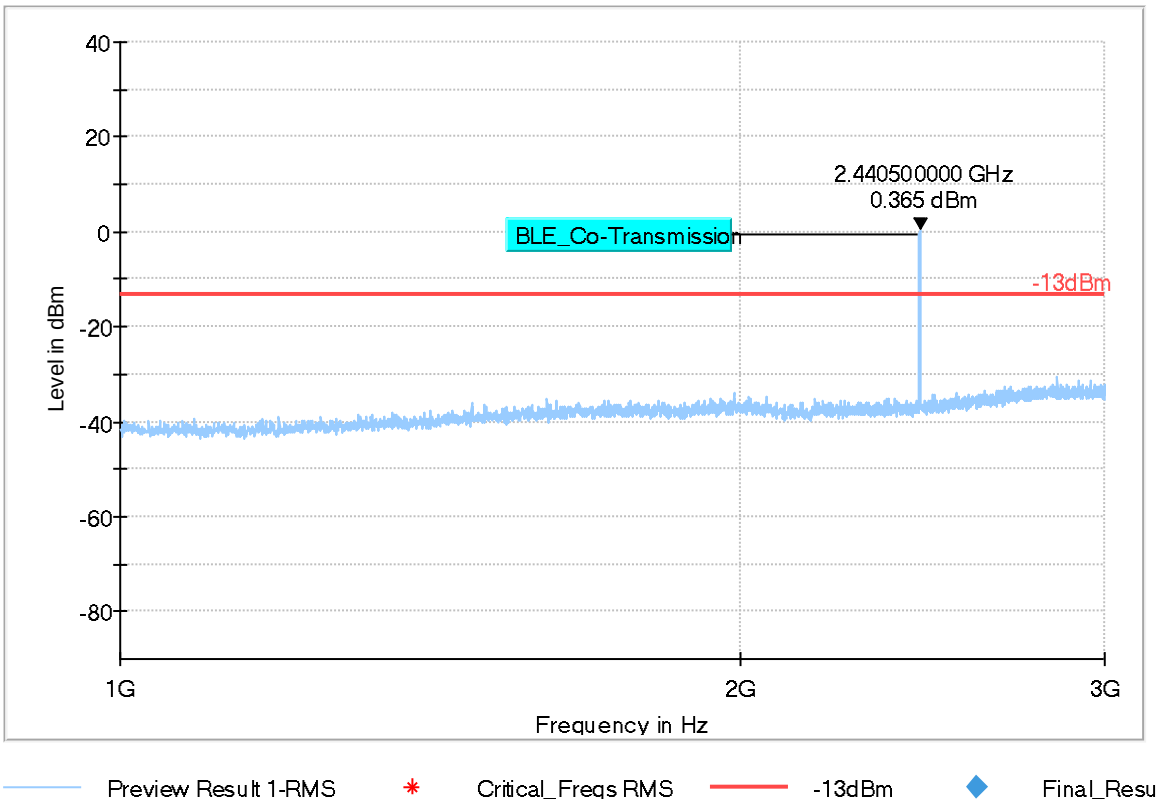
Plot # 71 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



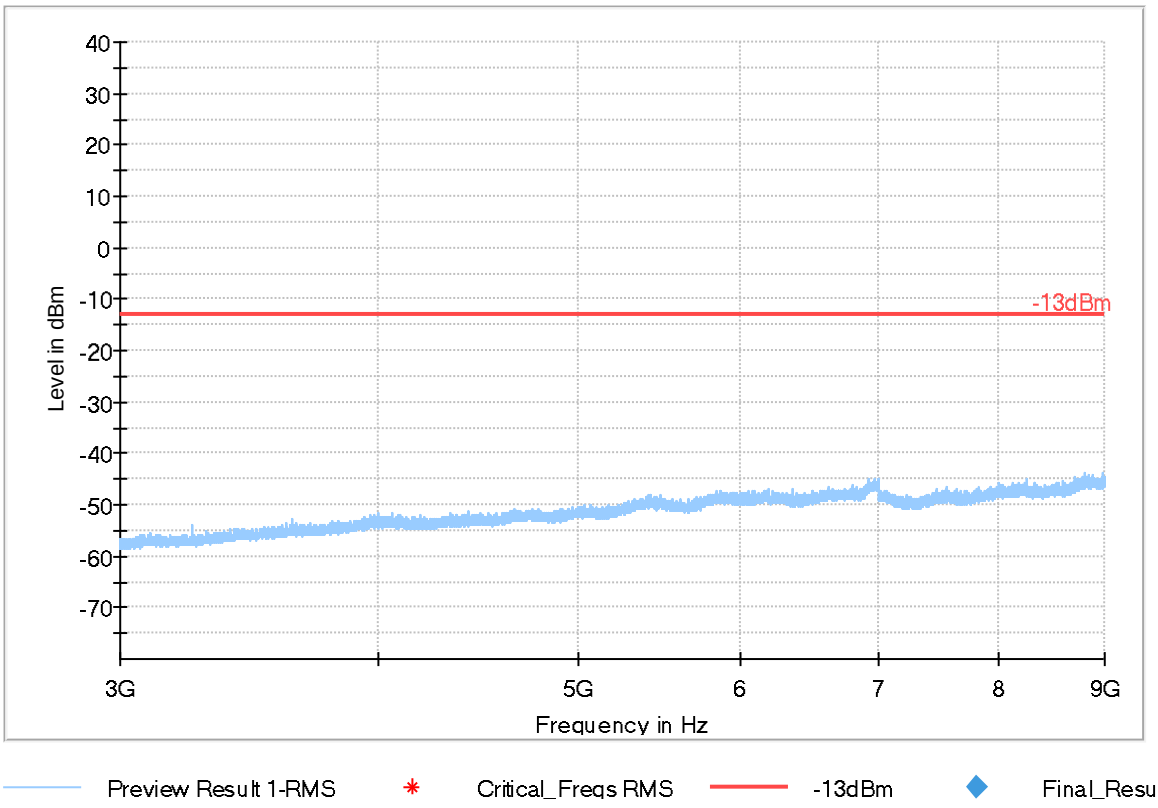
Plot # 72 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 73 Radiated Emissions: 3 GHz - 9 GHz

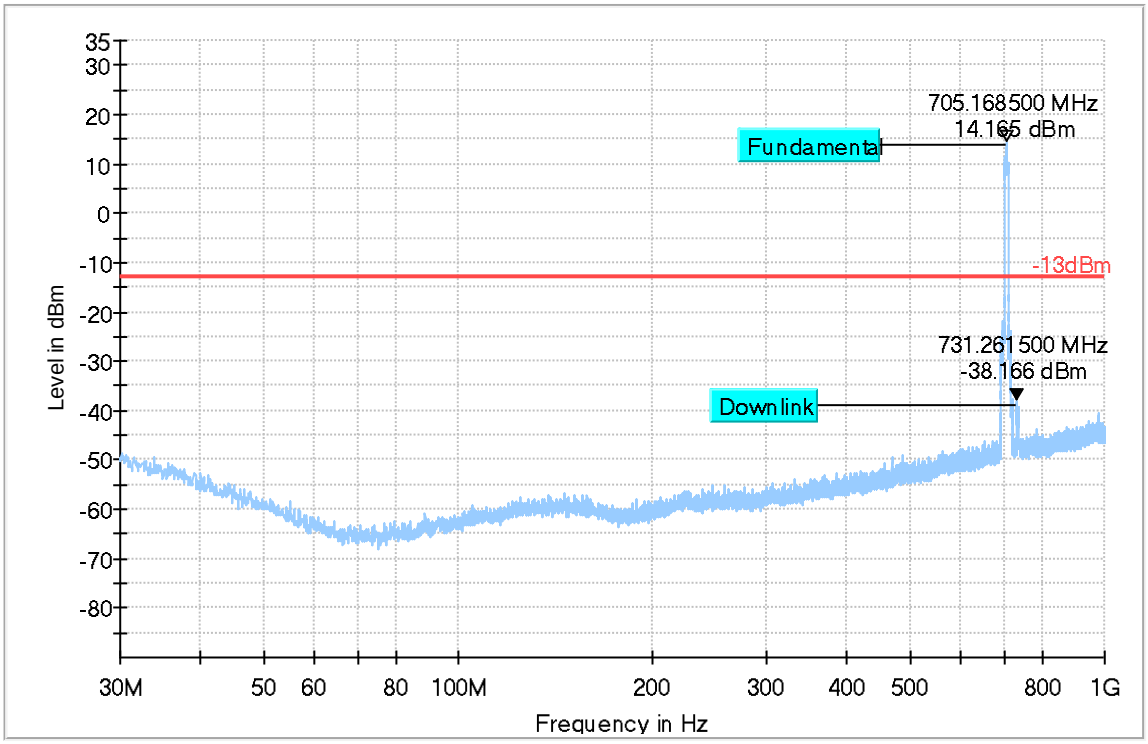
Channel: High



LTE Band 12

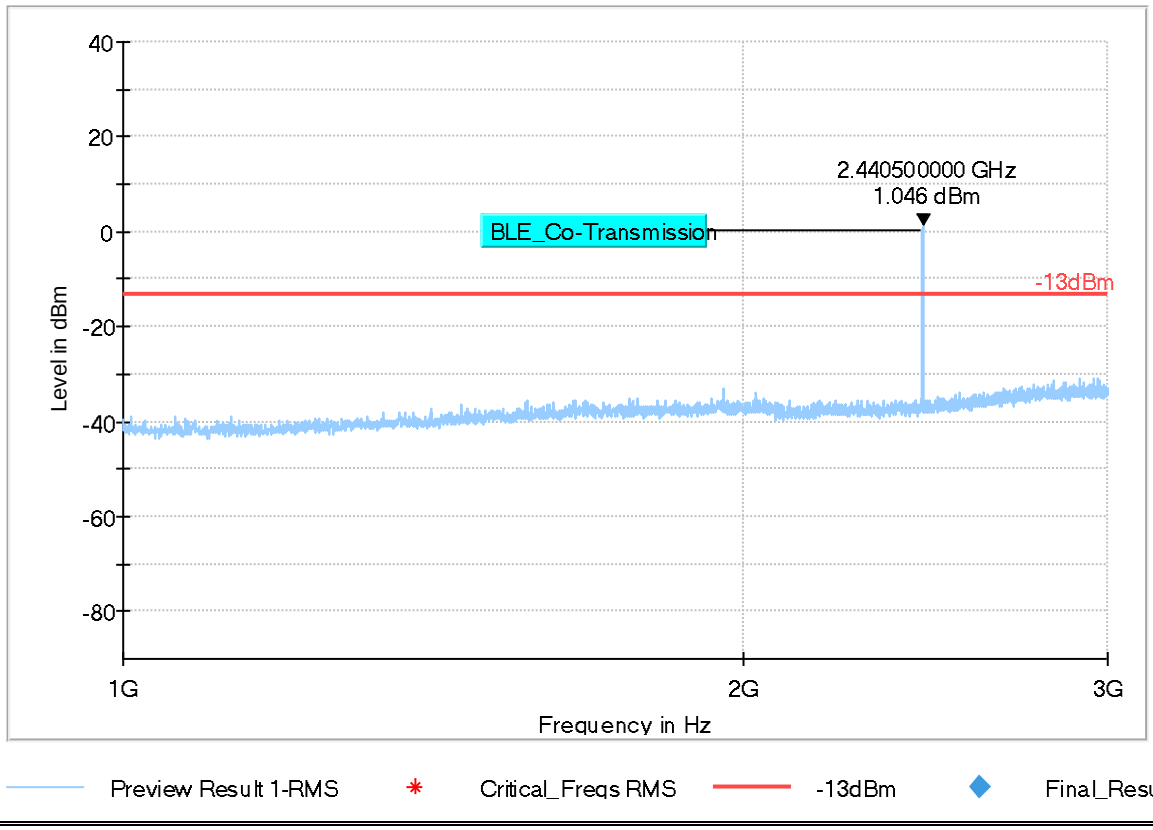
Plot # 74 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



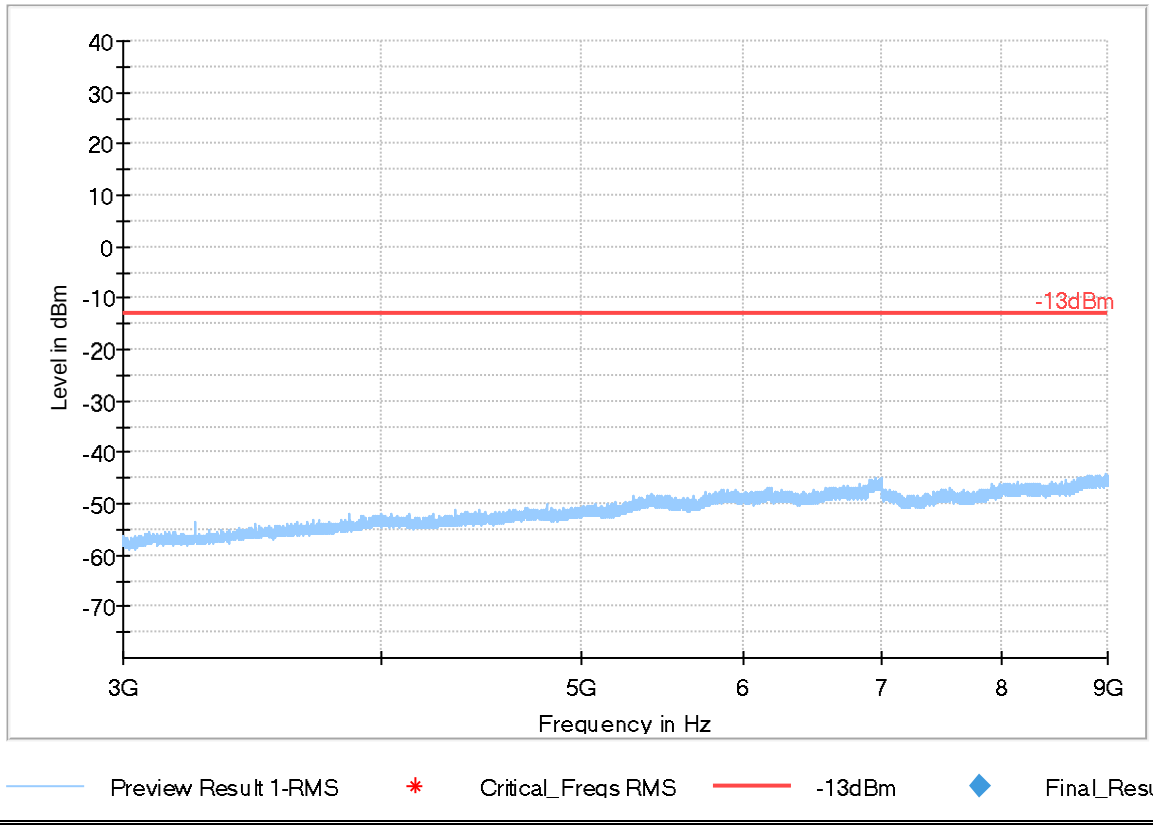
Plot # 75 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Plot # 76 Radiated Emissions: 3 GHz – 9 GHz

Channel: Low



Plot # 77 Radiated Emissions: 9 kHz - 30 MHz

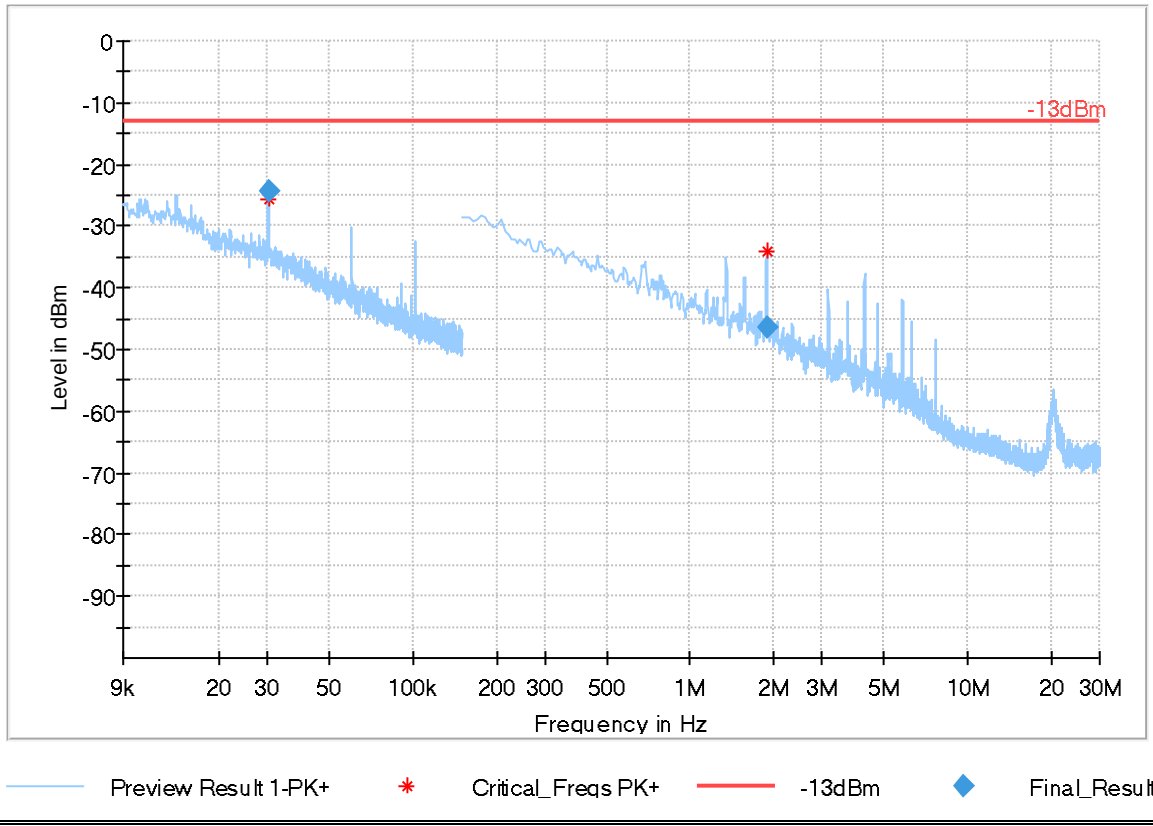
Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.030	-24.25	-13.00	11.25	100.0	0.1	100.0	V	100.0	-76
1.890	-46.30	-13.00	33.30	500.0	9.0	100.0	H	31.0	-79

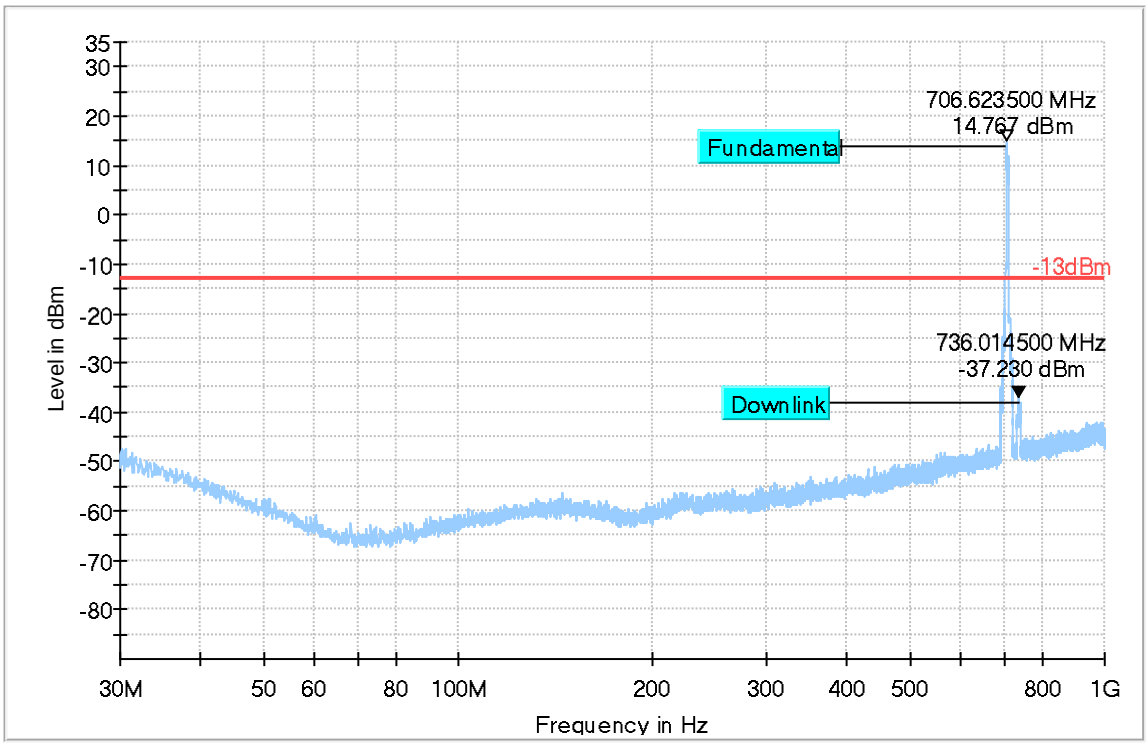
(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
0.030	3:51:45 PM - 4/9/2019
1.890	3:48:34 PM - 4/9/2019



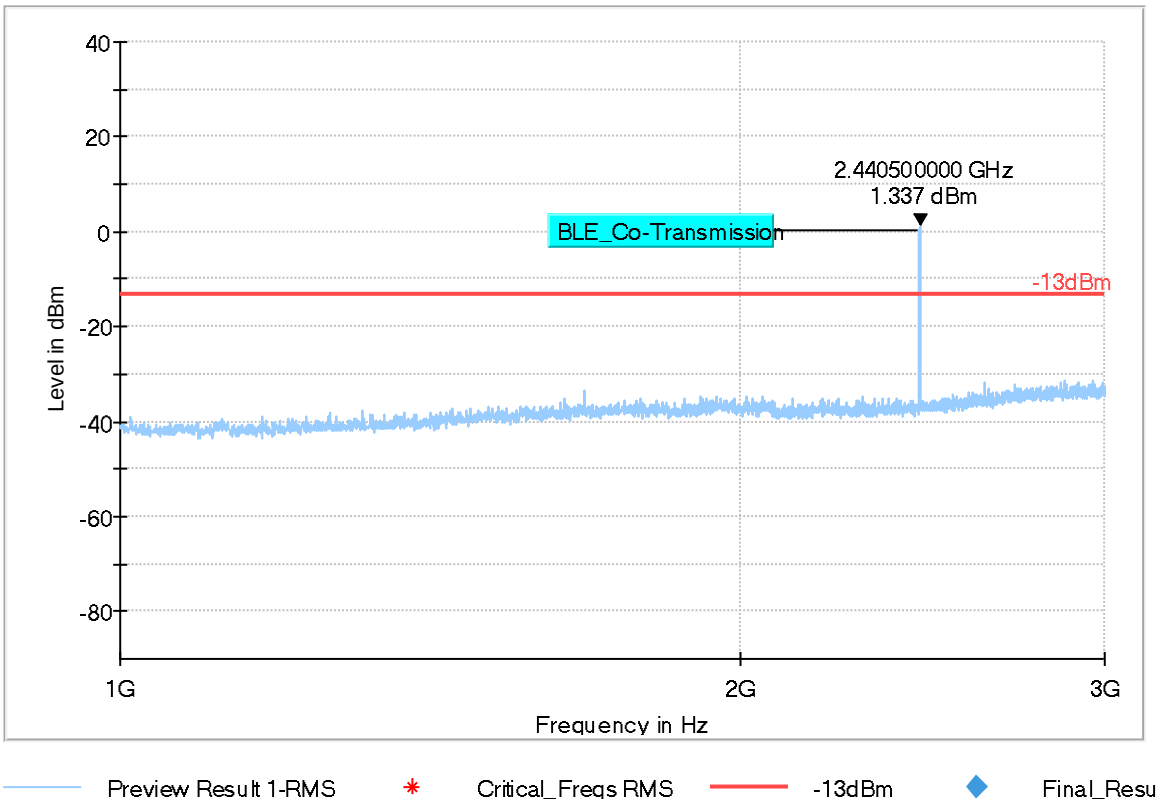
Plot # 78 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



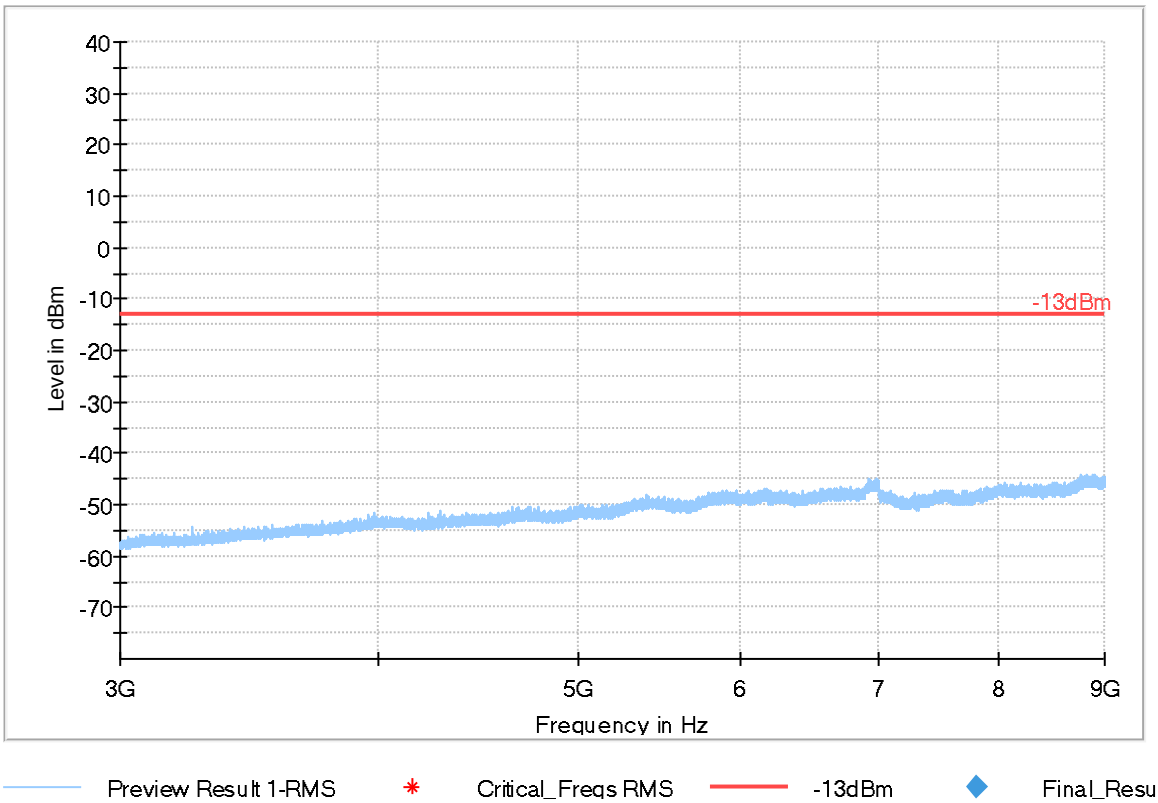
Plot # 79 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



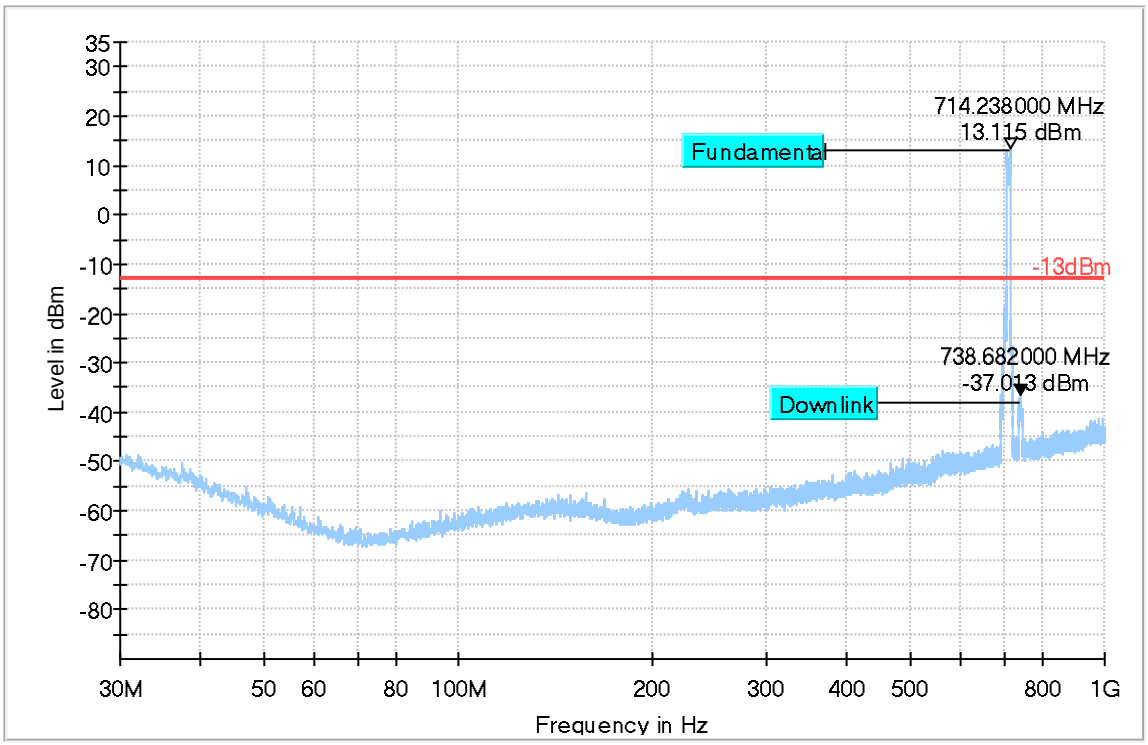
Plot # 80 Radiated Emissions: 3 GHz – 9 GHz

Channel: Mid



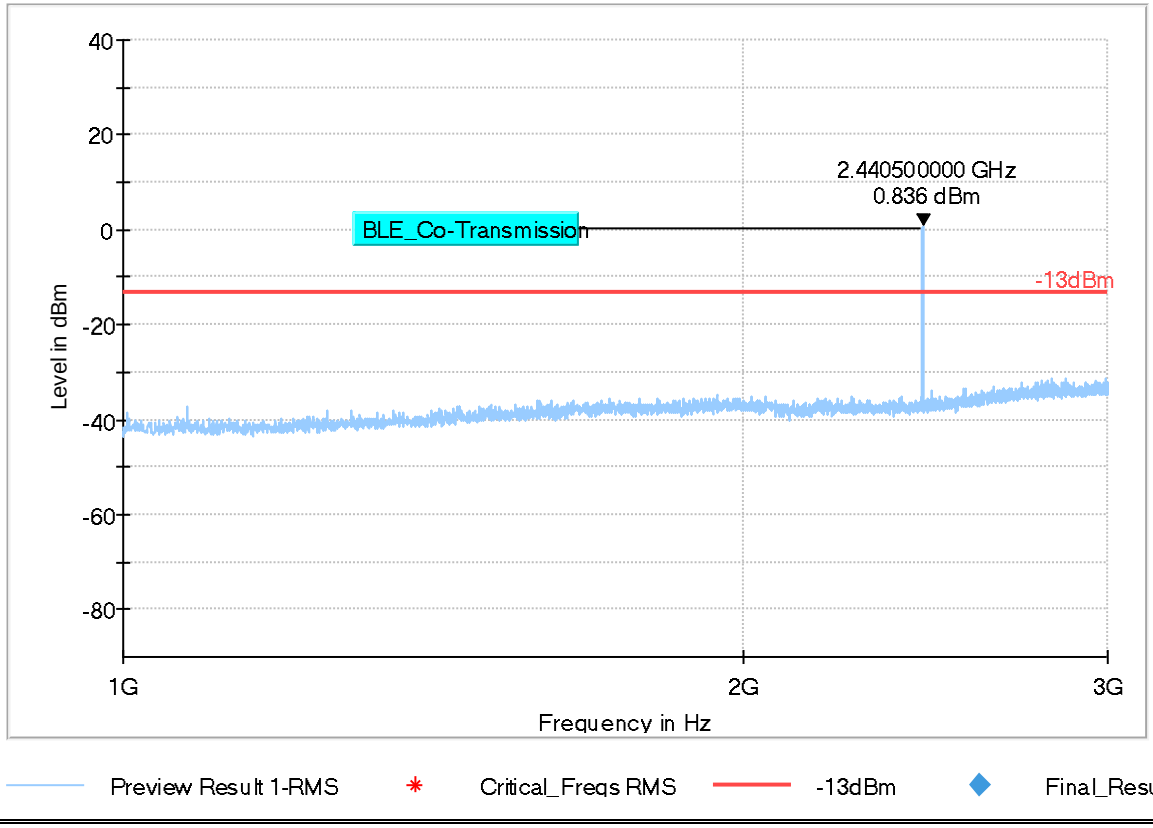
Plot # 81 Radiated Emissions: 30 MHz – 1GHz

Channel: High



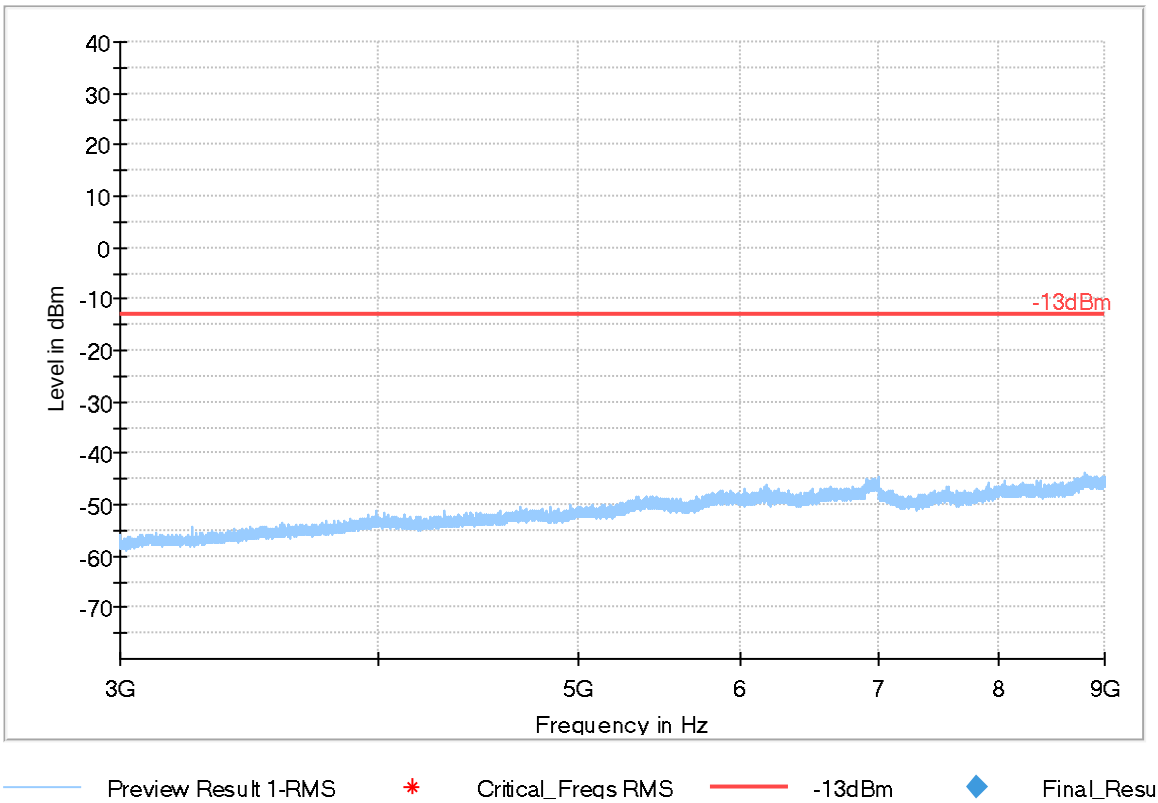
Plot # 82 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 83 Radiated Emissions: 3 GHz – 9 GHz

Channel: High



8 Test setup photo

Setup photos are included in supporting file name: "EMC_ZONAR_018_19001_ISED_Setup_Photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP ANTENNA	ETS LINDGREN	6512	00164698	3 YEARS	08/08/2017
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
UNIVERSAL RADIO COMMUNICATION TESTER	R&S	CMU 200	101821	2 YEARS	07/06/2017
WIDEBAND RADIO COMMUNICATION	R&S	CMW500	127068	2 YEARS	07/01/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/05/2017
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	2 YEARS	06/20/2017
DIGITAL THRMOMETER	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
2019-05-09	EMC_ ZONAR_018_19001_FCC_22_24_27_ISED	Initial version	Yuchan Lu