



FCC/ISED Test Report

FOR:
Zonar Systems

Model Number:
ZTCU4B

Product Description:
Vehicle mounted Telematics device

FCC ID: SEJ-ZTCU4B
IC ID: 5266A-ZTCU4B

Per:
47 CFR: Part 27
RSS-130; RSS-139 Issue 3

REPORT #: EMC_ZONAR-021-19001_FCC_27_ISED

DATE: 2019-08-08



A2LA Accredited

IC recognized #
3462B-2

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1 Assessment

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

Company	Description	Model #
Zonar Systems	Vehicle mounted Telematics device	ZTCU4B

No deficiencies were ascertained.

Responsible for Testing Laboratory:

2019-08-08	Compliance	Cindy Li (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2019-08-08	Compliance	Yuchan Lu (Test Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section3.

CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Lab Manager:	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):	ZTCU4B
Product Marketing Name (PMN):	V4 Base
Antenna Information as declared:	Antenna gains: • LTE Band 4: 3.05 dBi • LTE Band 17: -0.21 dBi
Other Radios included in the device:	❖ <u>Bluetooth Classic, BLE</u> • Module name: ublox • Module number: NINA-B222 • FCC/IC ID: XPYNINAB22 / 8595A-NINAB22 ❖ <u>WLAN:</u> • Module name: ublox • Module number: ELLA-W131 • FCC/IC ID: PV7-WIBEAR11N-SF1 / 7738A-WB11NSF1 ❖ <u>GPS</u> • 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 -40° C, Nominal 23° C, High 85° 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:	XPYTOBYL200
IC ID:	8595A-TOBYL200

3.2 EUT Sample details

EUT #	IMEI number	HW Version	SW Version	Notes/Comments
1	358661100012399	2.1	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 WiFi/Cellular 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	Worst Case

3.6 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular and WLAN 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 WLAN n mode, HT40, Low 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 WLAN n mode, HT40, Low 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-ZTCU4B / IC ID: 5266A-ZTCU4B**

The pre-certified module to be integrated (TOBY-R200) 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 27 and Industry Canada Radio Standard Specifications RSS: 130 and 139 Issue 3.

The conducted module test data that can be obtained under the **FCC Filing ID: XPYTOBYL200** is applicable for the host described in section 3.

4.1 **Dates of Testing:**

07/24/2019 – 7/25/2019

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%

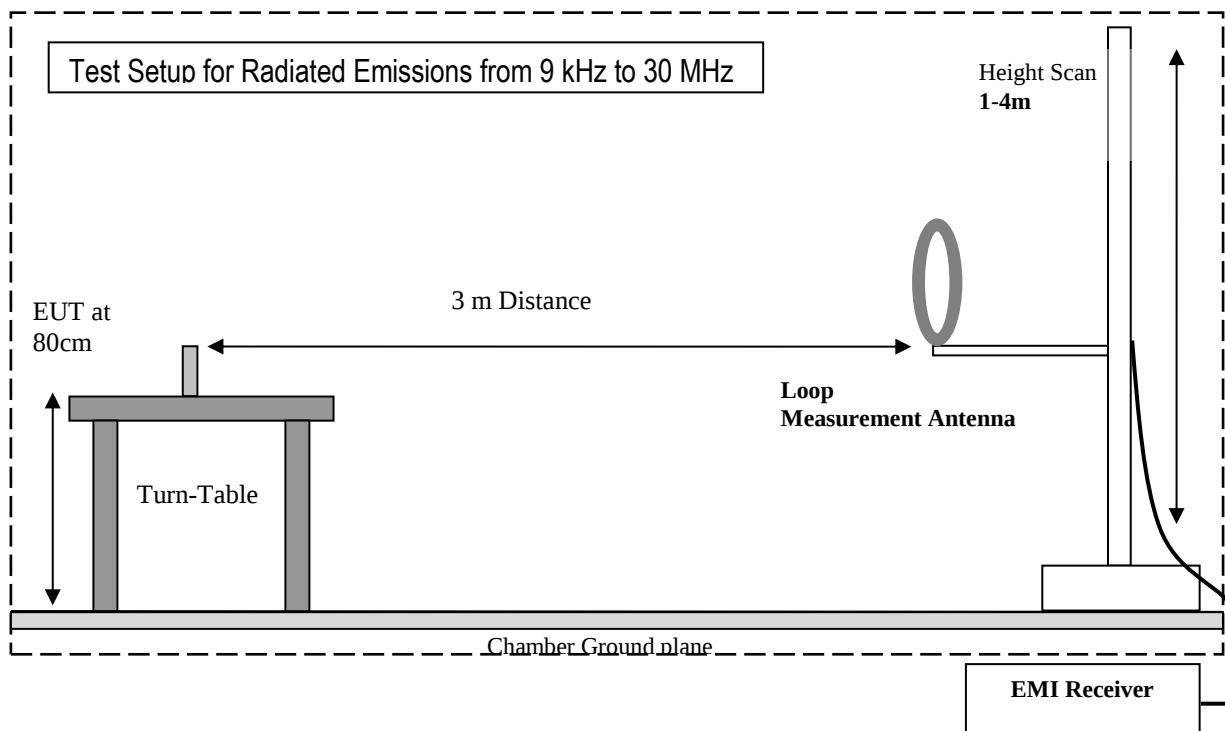
Deviating test conditions are indicated at individual test description where applicable.

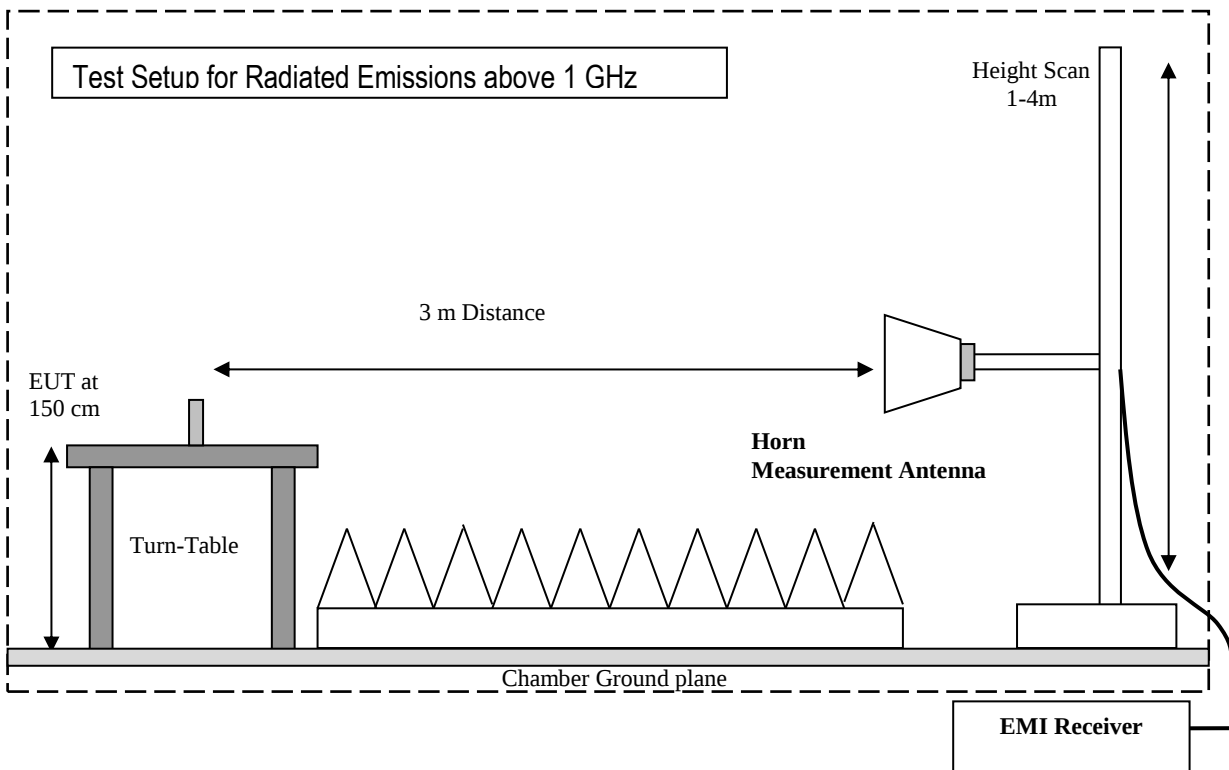
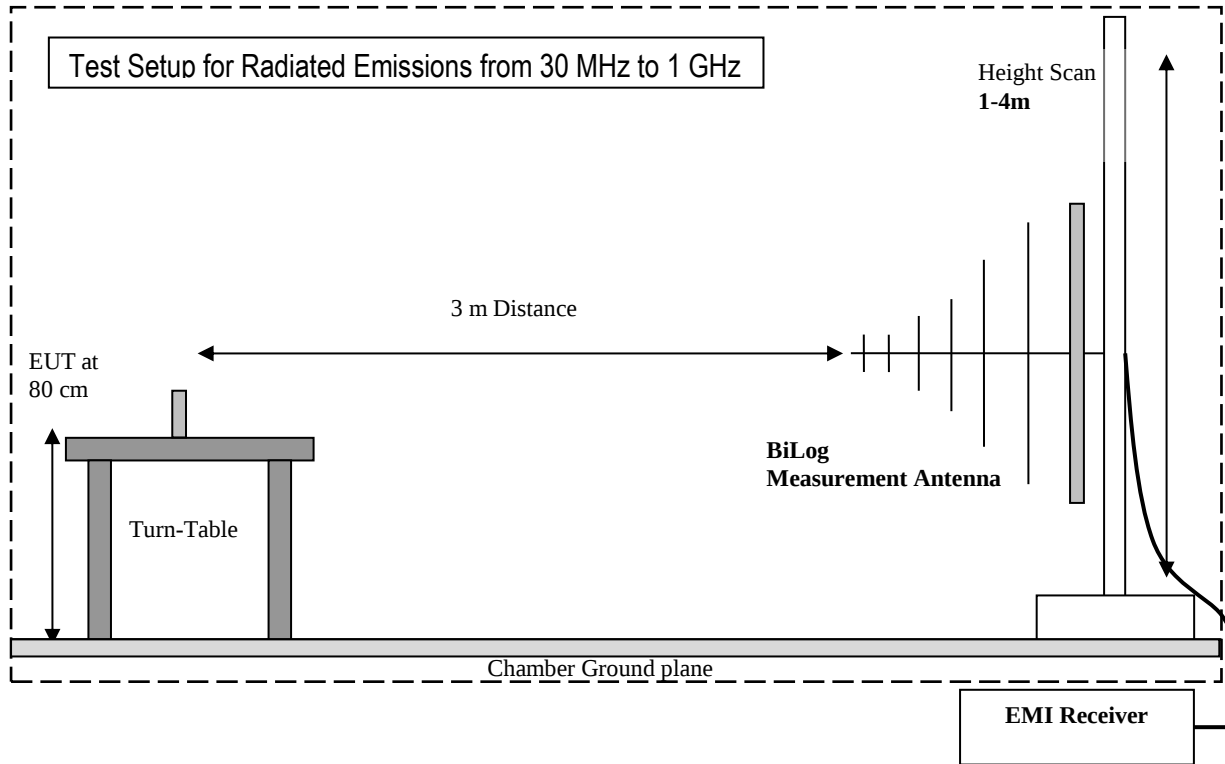
5 Measurement Procedures

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.





5.2 Sample Calculations for Field Strength Measurements

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

- Measured reading in dB μ V
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

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

Example:

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

6 Measurement Results Summary**6.1 FCC 27, 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: XPYTOBYL200

7 Test Result Data

7.1 EIRP

Band	Frequency Range (MHz)	EIRP Power dBm	EIRP ¹ (W)	ERP ¹ (W)	Limit ERP (W)
LTE 4	1710.7 – 1754.3	21.6	0.144	-	1
LTE 17	706.5 – 713.5	20.2	0.104	0.064	3

Note 1: EIRP is leveraged from EMC_ZONAR-016-17001_FCC_22_24_27_Rev1 based on examination and finding of reduced power in the updated cellular module grant for TOBY-L200 for affected bands.

7.2 Radiated Spurious Emissions

7.2.1 Measurement according to FCC: CFR 47 Part 2.1053; 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)
- RSS-130-4.6, 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	LTE 4	30 MHz – 18 GHz	580.00	-61.95	-13	Pass
4 – 7	Mid	LTE 4	9 kHz – 18 GHz	-	-	-13	Pass
8 – 10	High	LTE 4	30 MHz – 18 GHz	580.02	-62.06	-13	Pass
11 – 13	Low	LTE 17	30 MHz – 9 GHz	-	-	-13	Pass
14 – 17	Mid	LTE 17	9 kHz – 9 GHz	520.55	-20.43	-13	Pass
18 – 20	High	LTE 17	30 MHz – 9 GHz	-	-	-13	Pass

7.2.5 Measurement Plots:

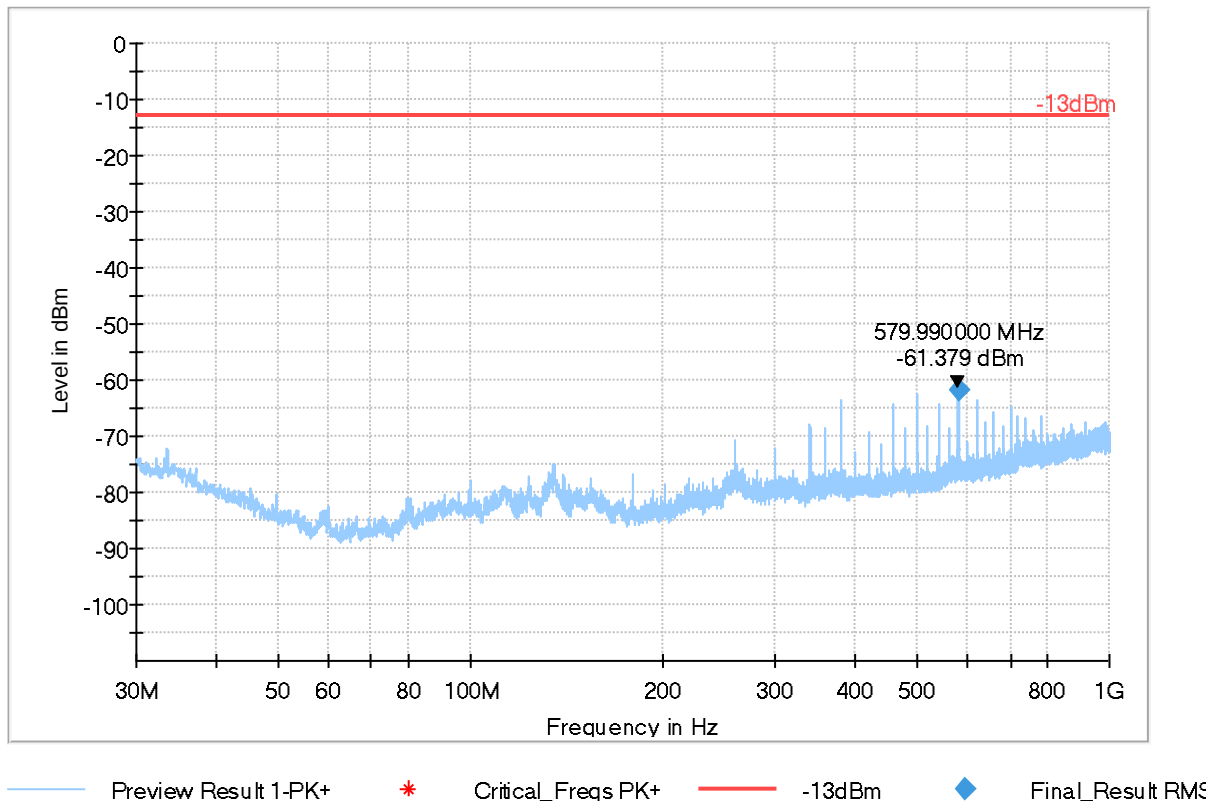
LTE Band 4

Plot # 1 Radiated Emissions: 30 MHz - 1 GHz

Channel: Low

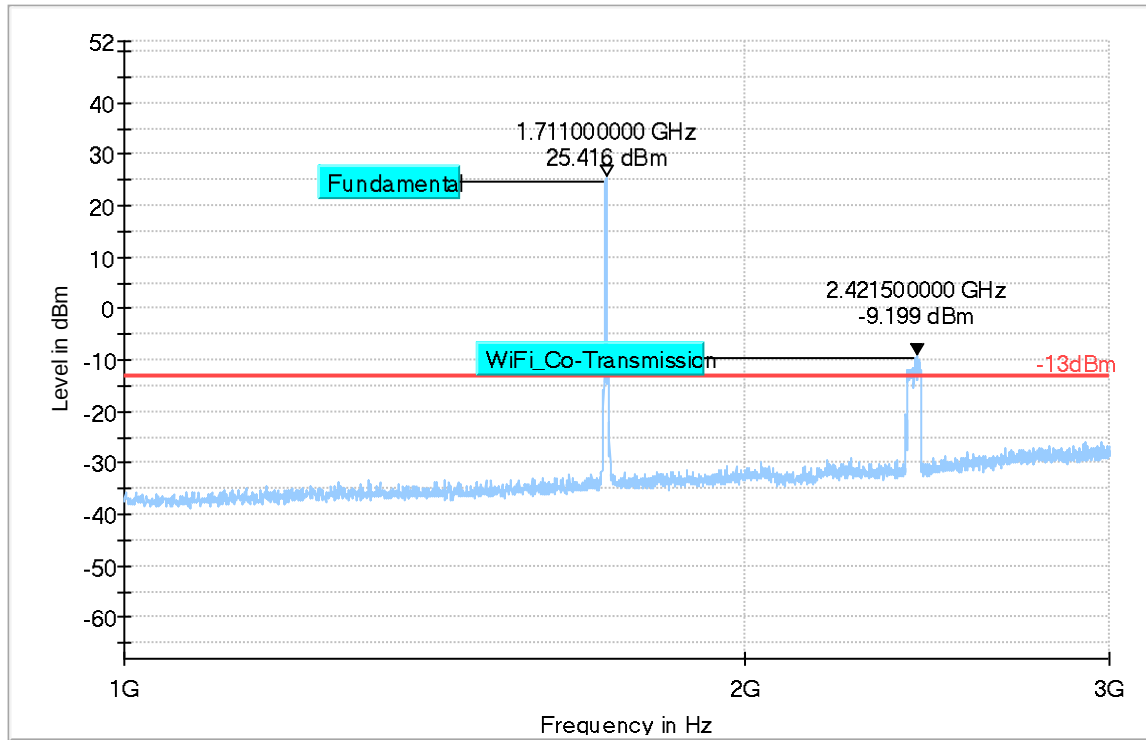
Final Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (Hz)	Height	Pol	Azimuth	Corr. (dB)	Comment
580.002	-61.952	-13.00	48.95	200.0	100.000	100.0	V	200.0	-105.4	1:43:56 PM - 7/25/2019



Plot # 2 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



Preview Result 1-PK+



Critical_Freqs PK+

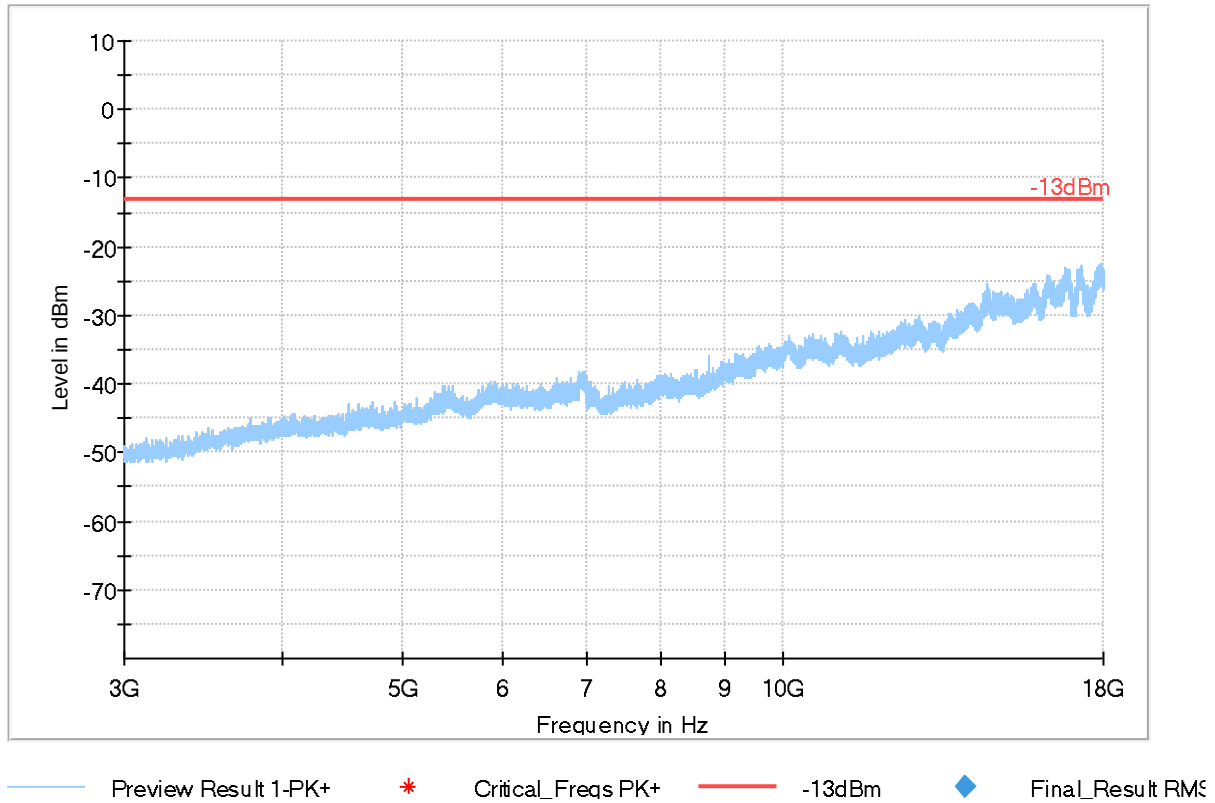
-13dBm



Final_Result RMS

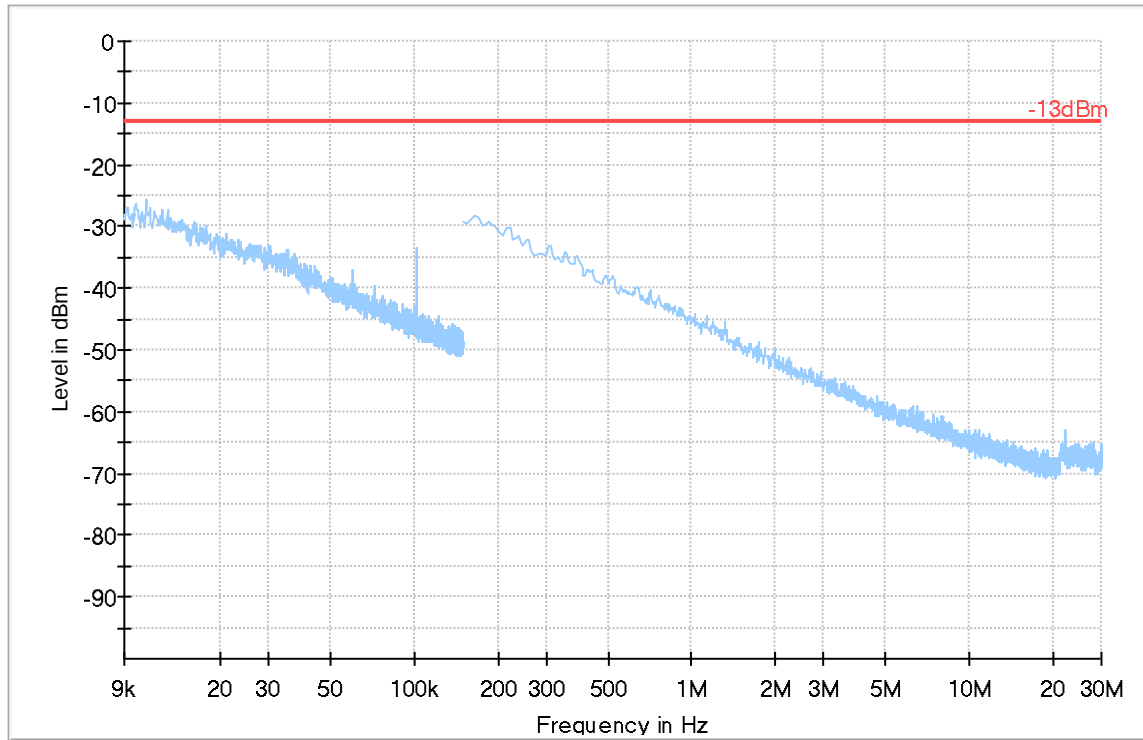
Plot # 3 Radiated Emissions: 3 GHz - 18 GHz

Channel: Low



Plot # 4 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



Preview Result 1-PK+



Critical_Freqs PK+

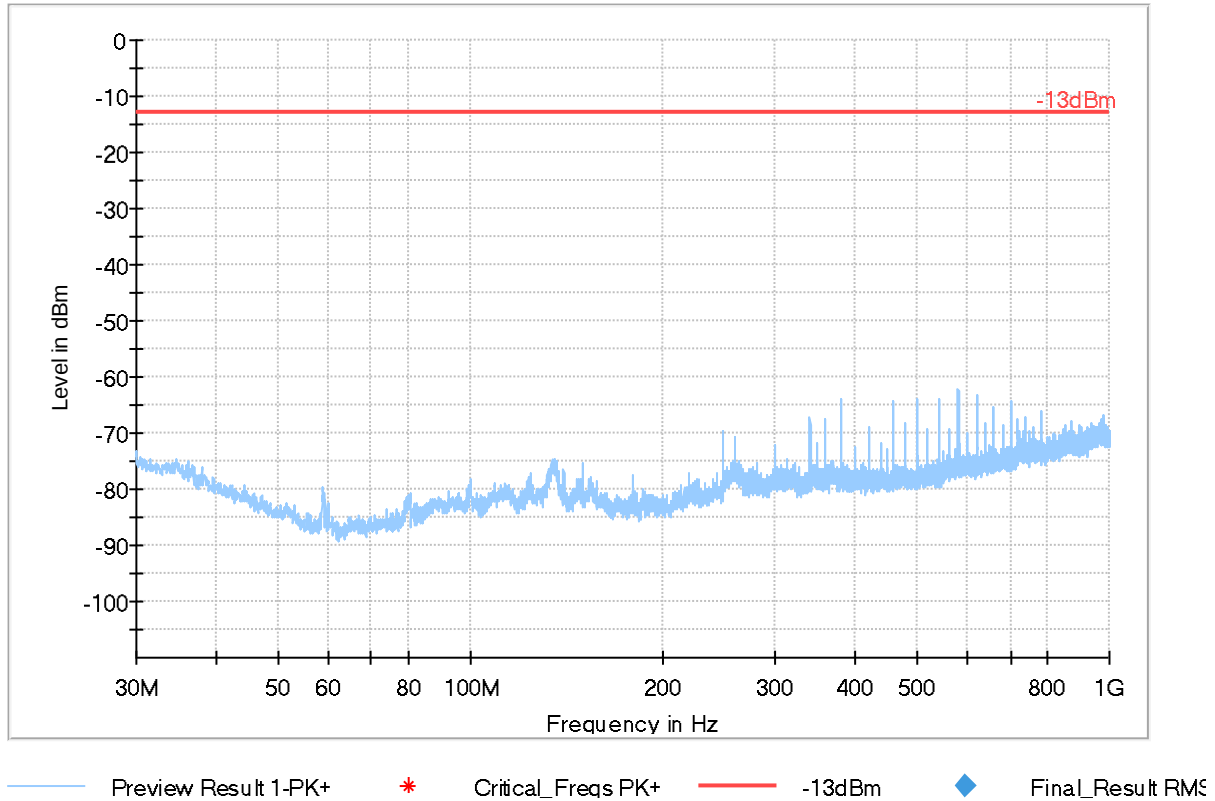
-13dBm



Final_Result RMS

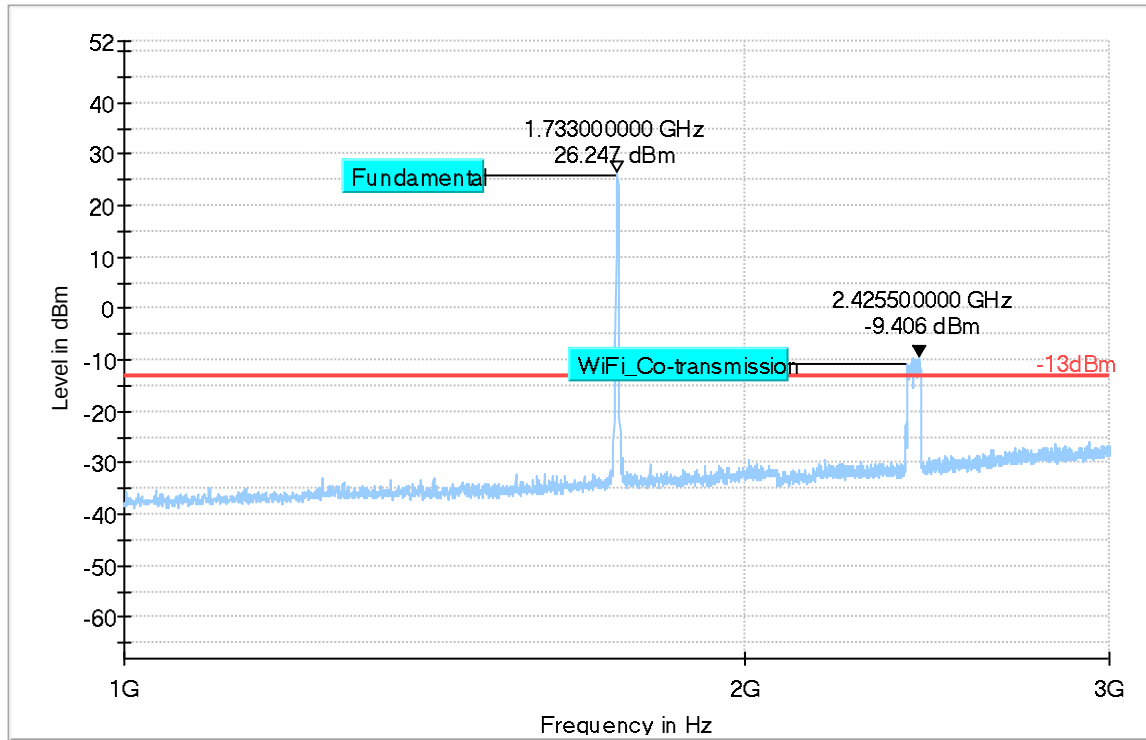
Plot # 5 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid



Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



Preview Result 1-PK+



Critical_Freqs PK+

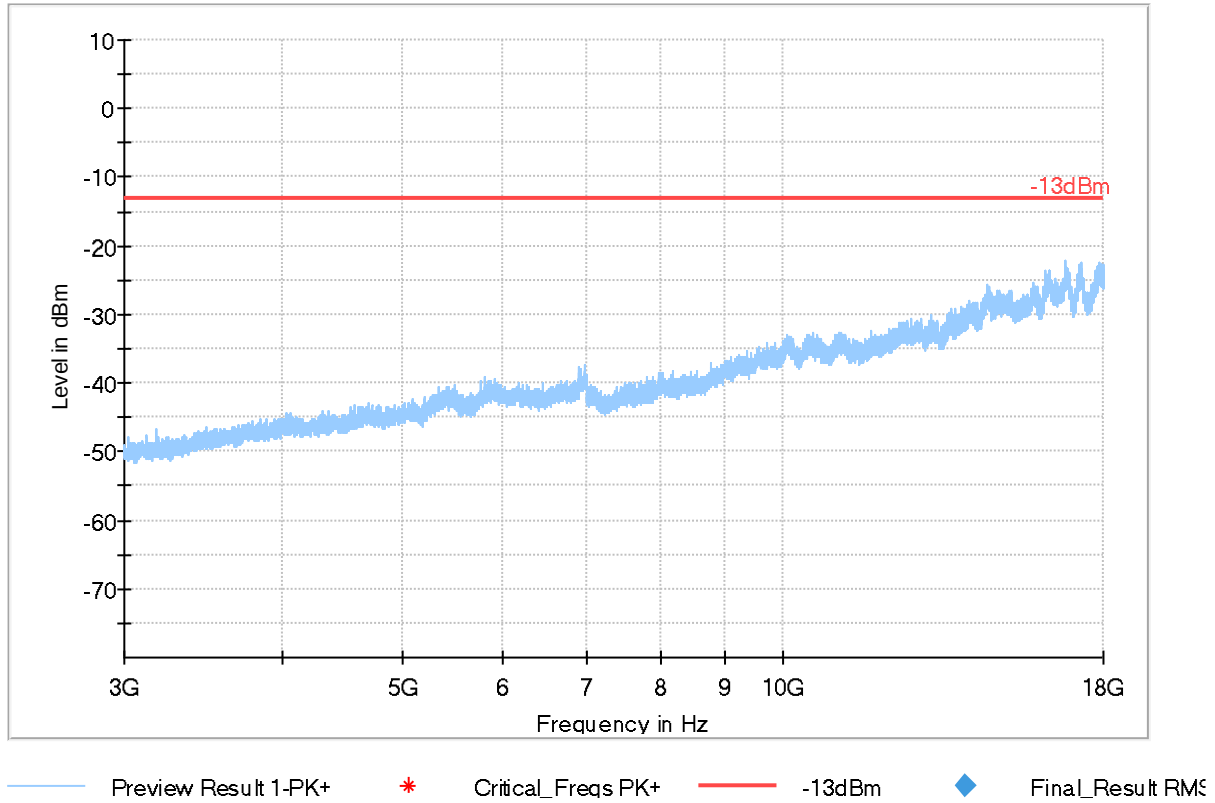
-13dBm



Final_Result RMS

Plot # 7 Radiated Emissions: 3 GHz – 18GHz

Channel: Mid

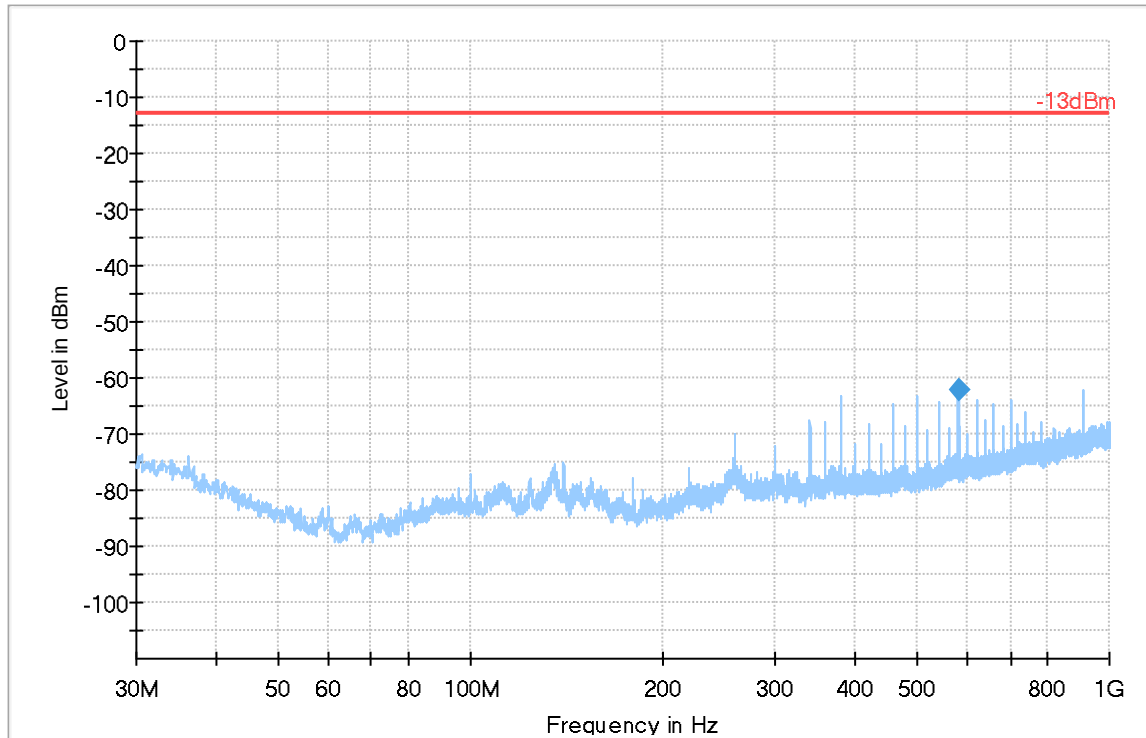


Plot # 8 Radiated Emissions: 30 MHz - 1 GHz

Channel: High

Final_Result

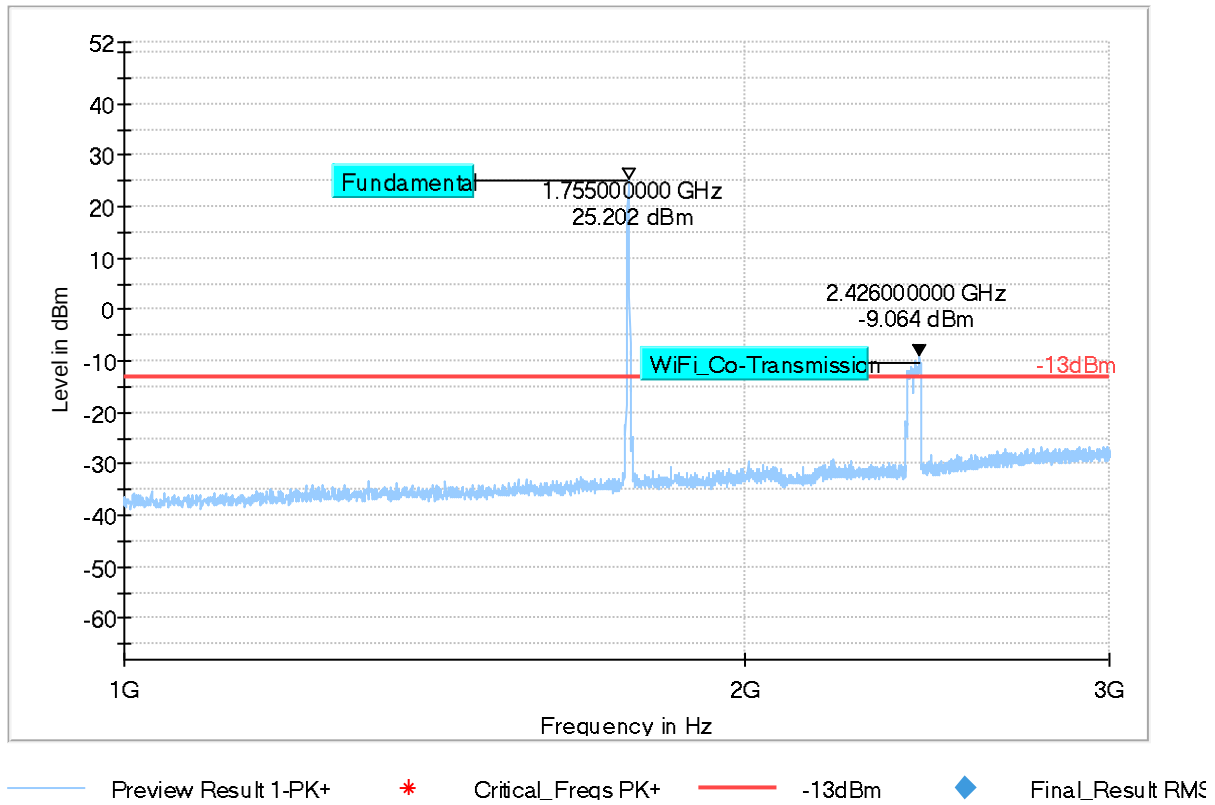
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin	Meas. Time (ms)	Bandwidth (h)	Height (t)	Pol	Azimuth (h)	Corr. (dB)	Comment
580.015	-62.062	-13.00	49.06	200.0	100.000	107.0	V	203.0	-105.4	1:54:37 PM - 7/25/2019



— Preview Result 1-PK+ * Critical_Freqs PK+ — -13dBm ◆ Final_Result RMS

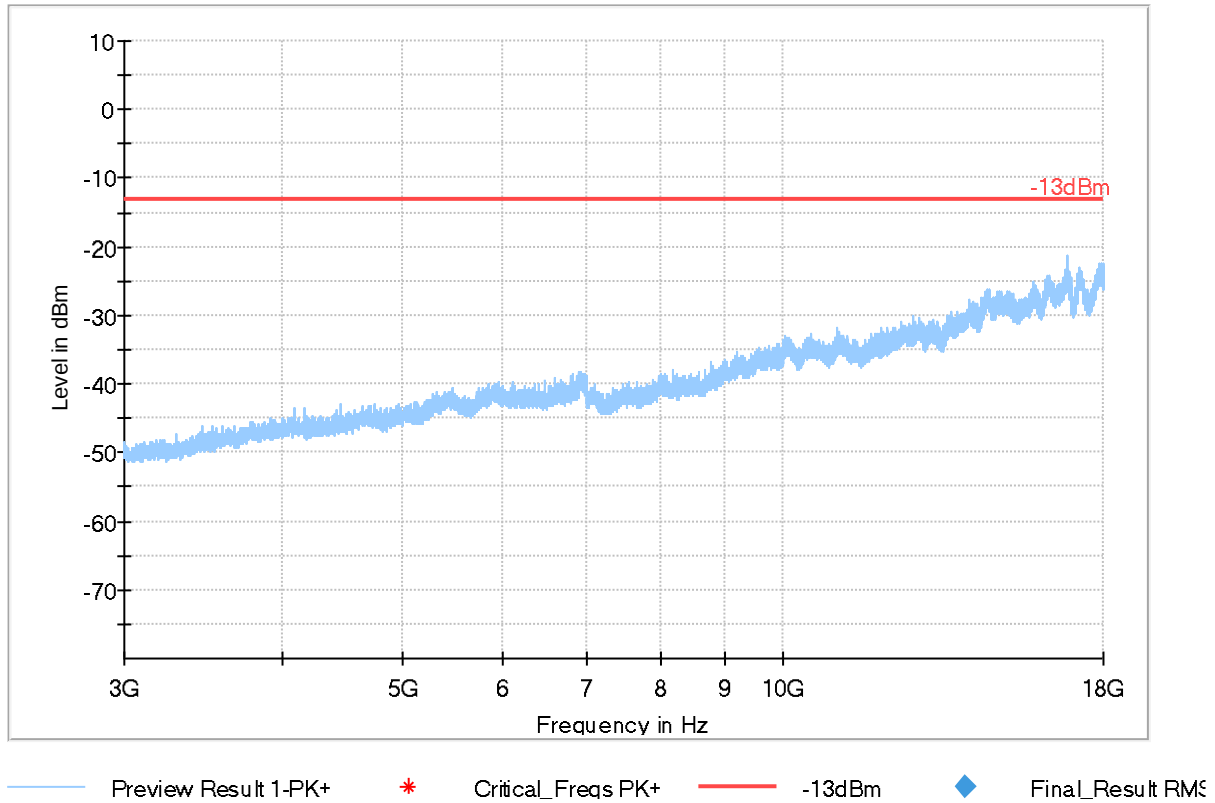
Plot # 9 Radiated Emissions: 1 GHz - 3 GHz

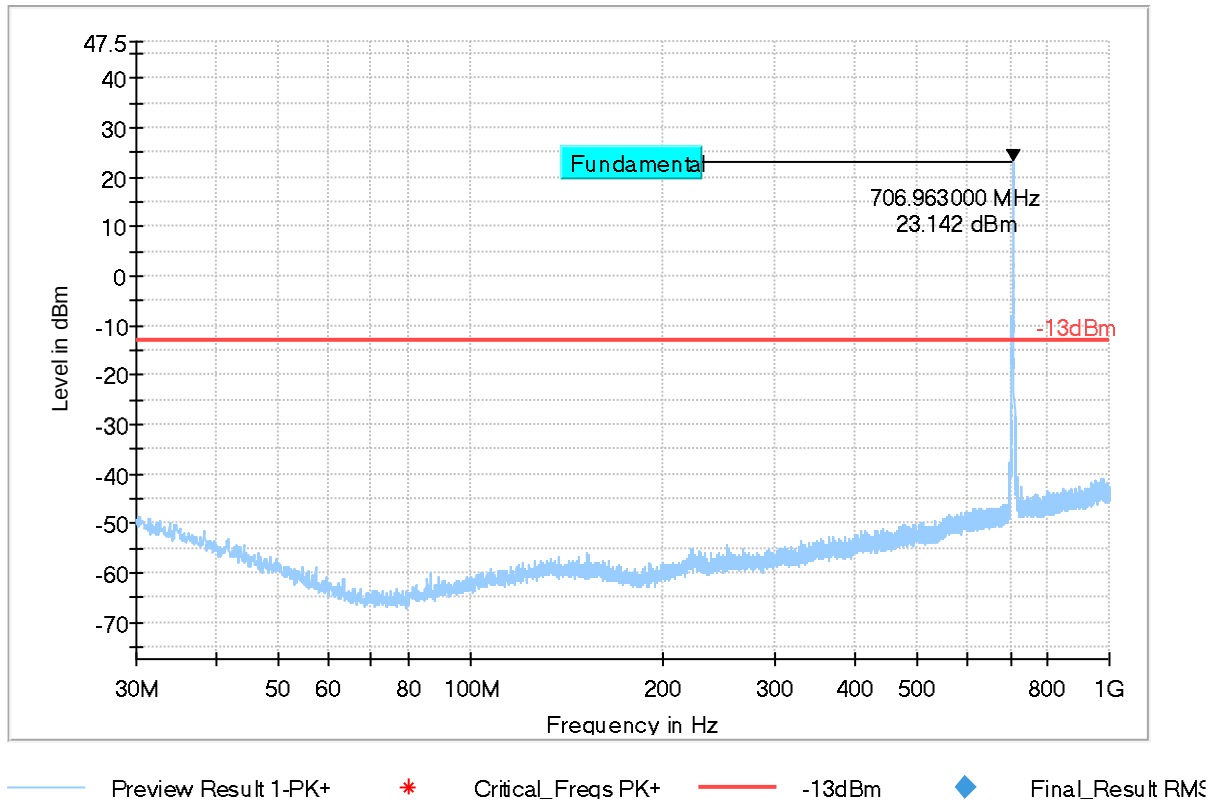
Channel: High



Plot # 10 Radiated Emissions: 3 GHz - 18 GHz

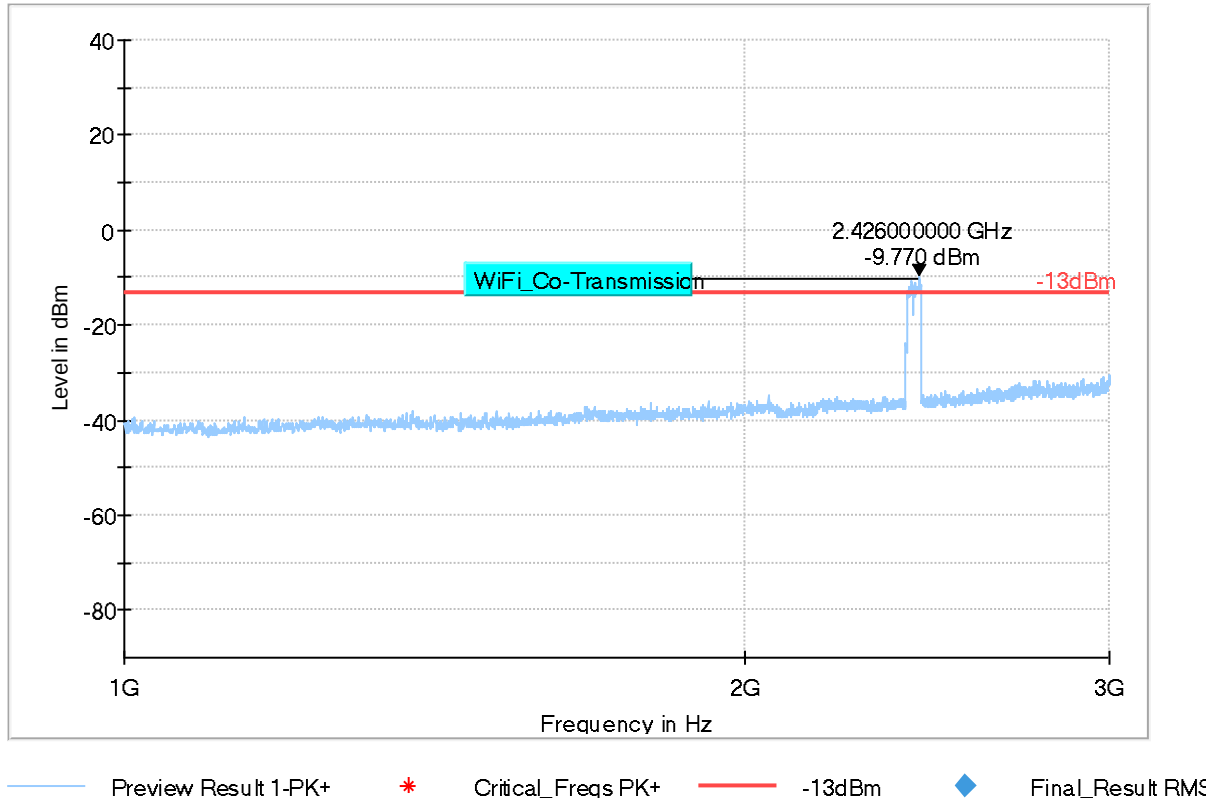
Channel: High



LTE Band 17**Plot # 11 Radiated Emissions: 30 MHz - 1 GHz****Channel: Low**

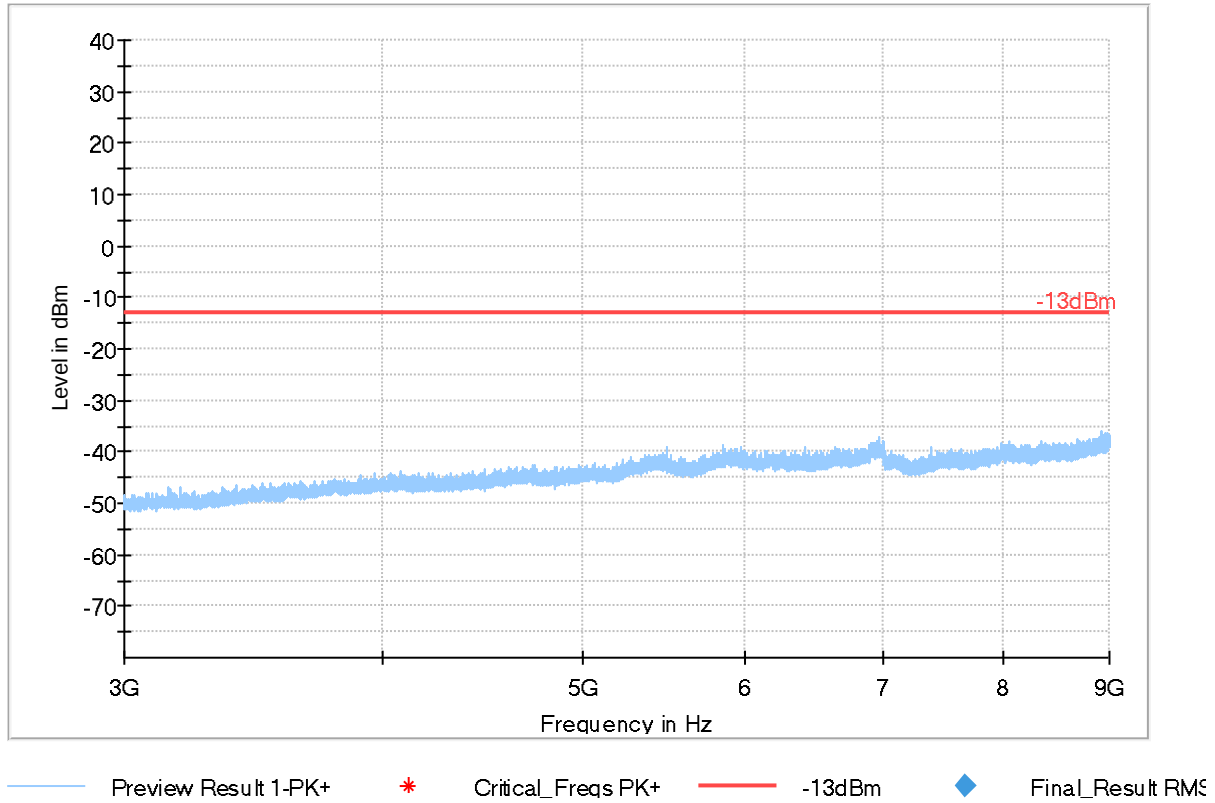
Plot # 12 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



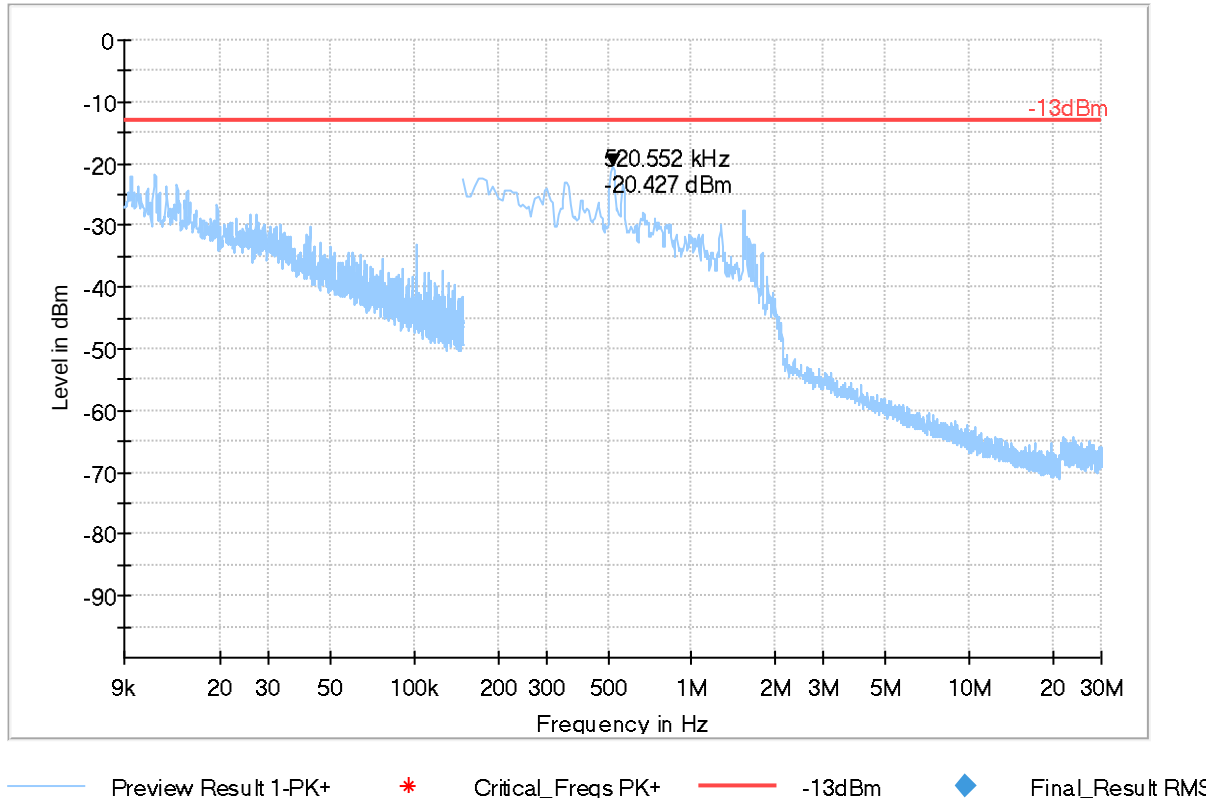
Plot # 13 Radiated Emissions: 3 GHz - 9 GHz

Channel: Low



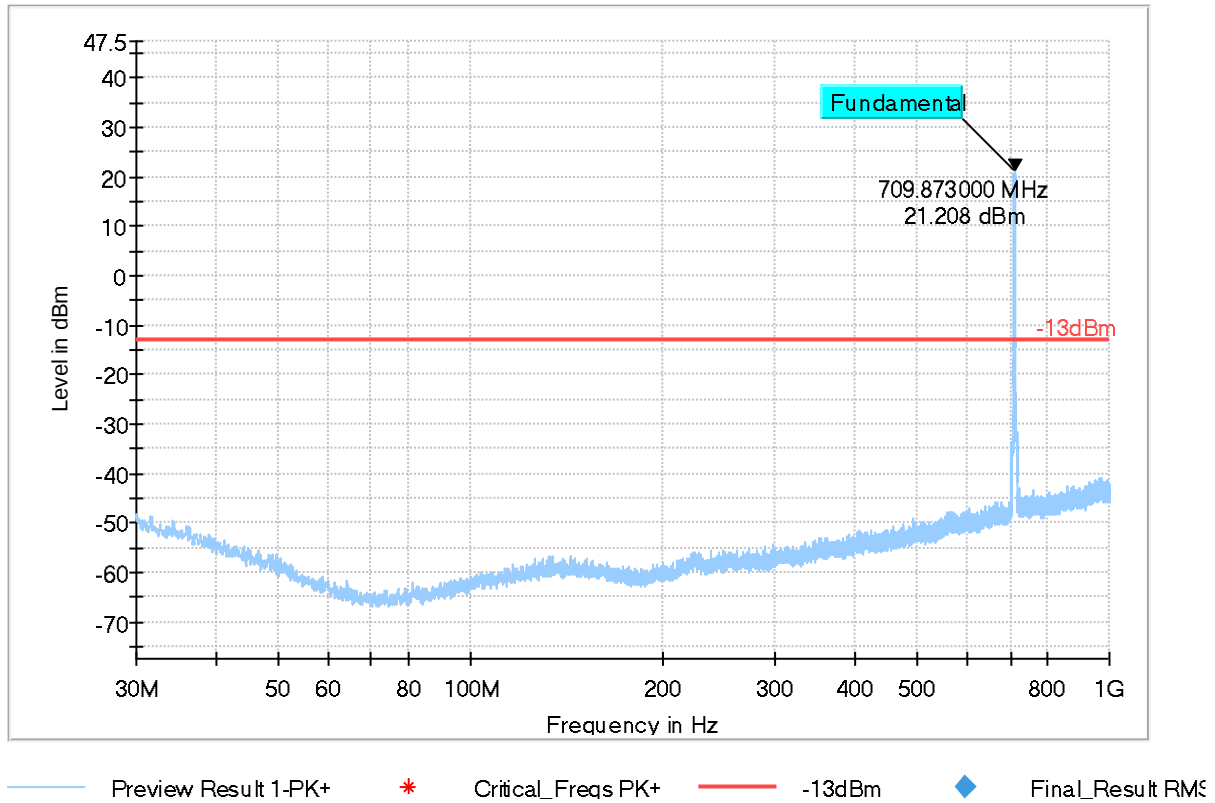
Plot # 14 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



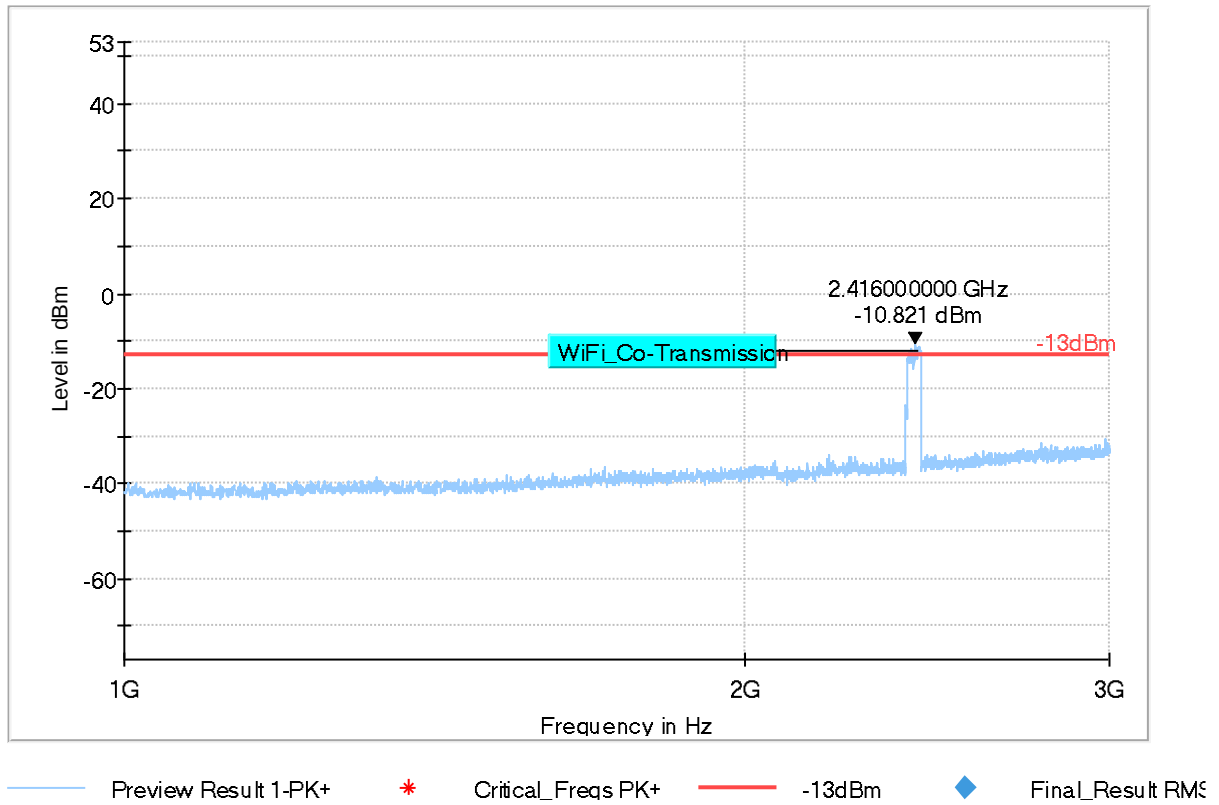
Plot # 15 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid



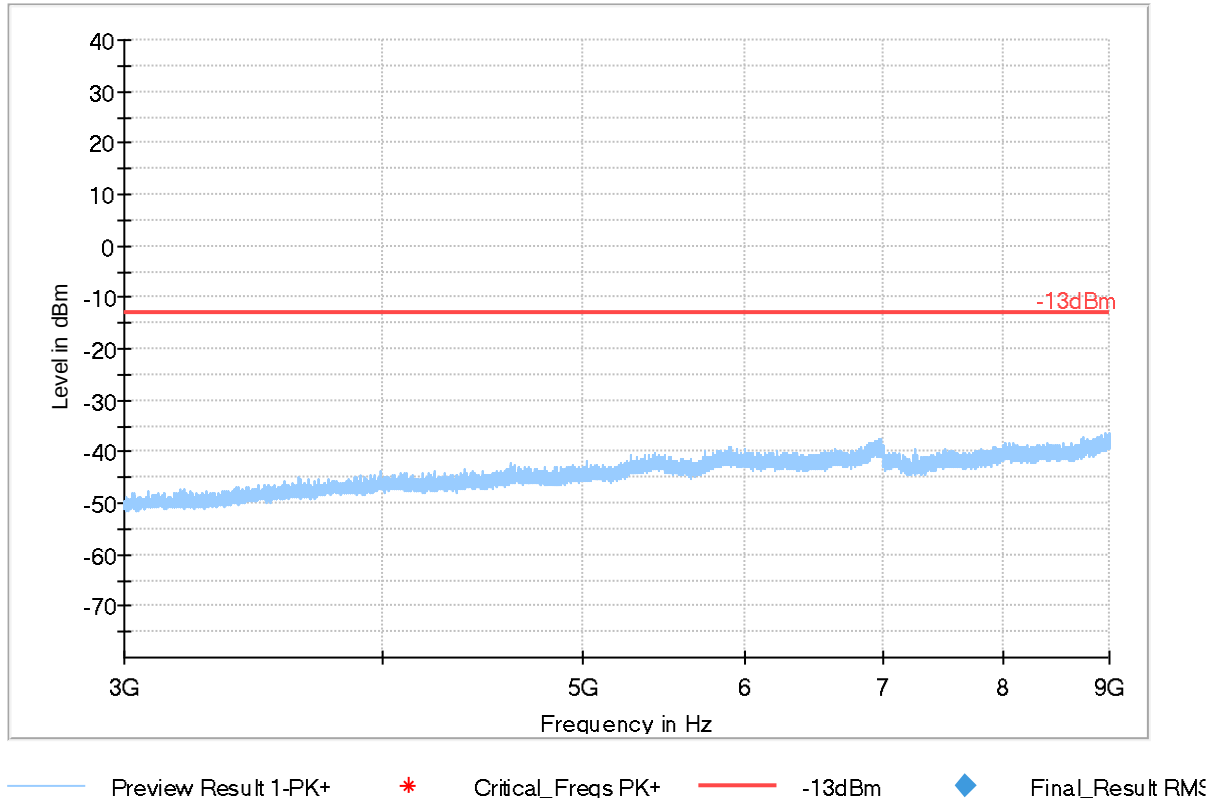
Plot # 16 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



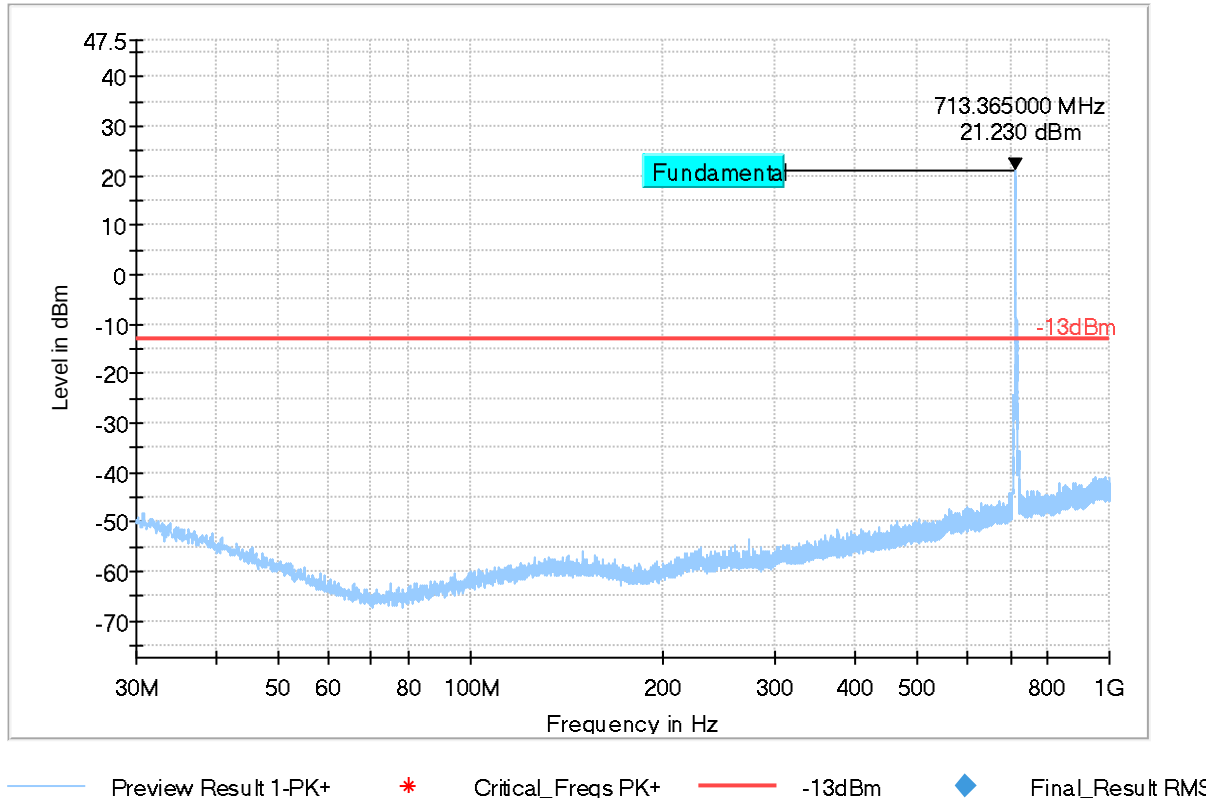
Plot # 17 Radiated Emissions: 3 GHz – 9 GHz

Channel: Mid



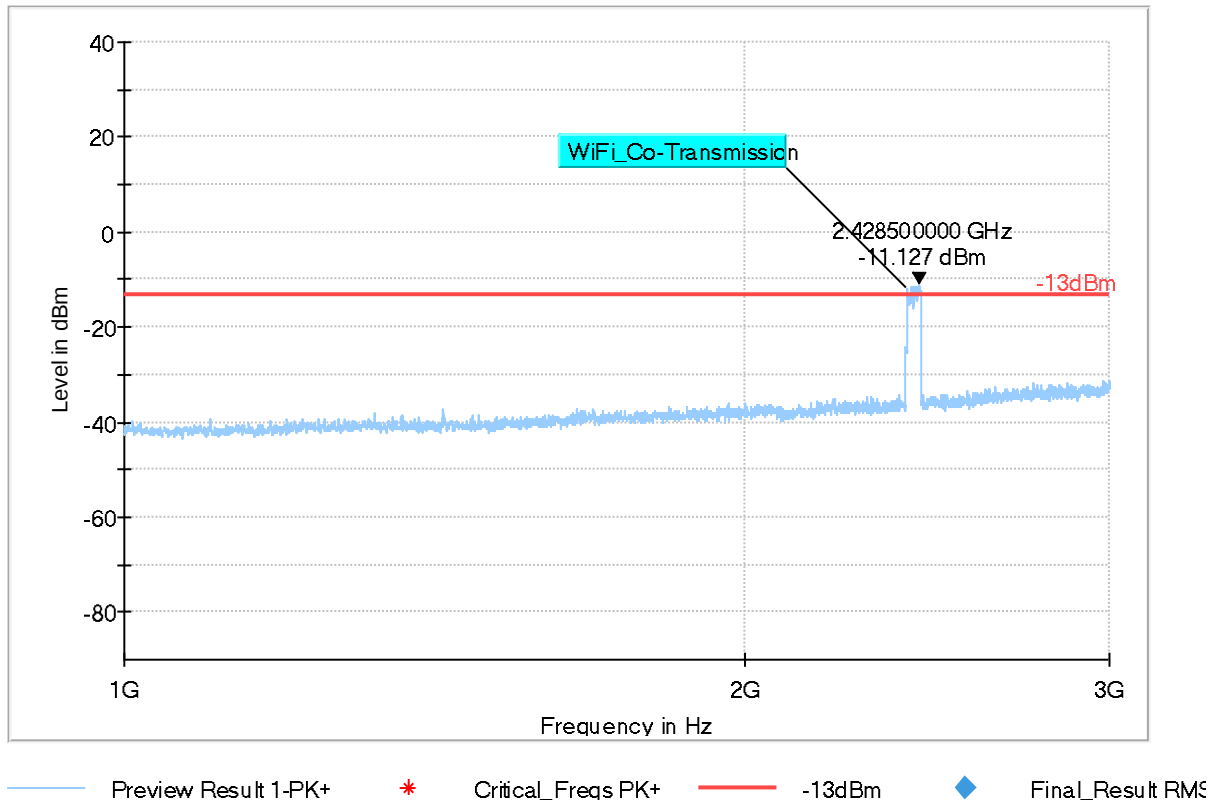
Plot # 18 Radiated Emissions: 30 MHz - 1 GHz

Channel: High



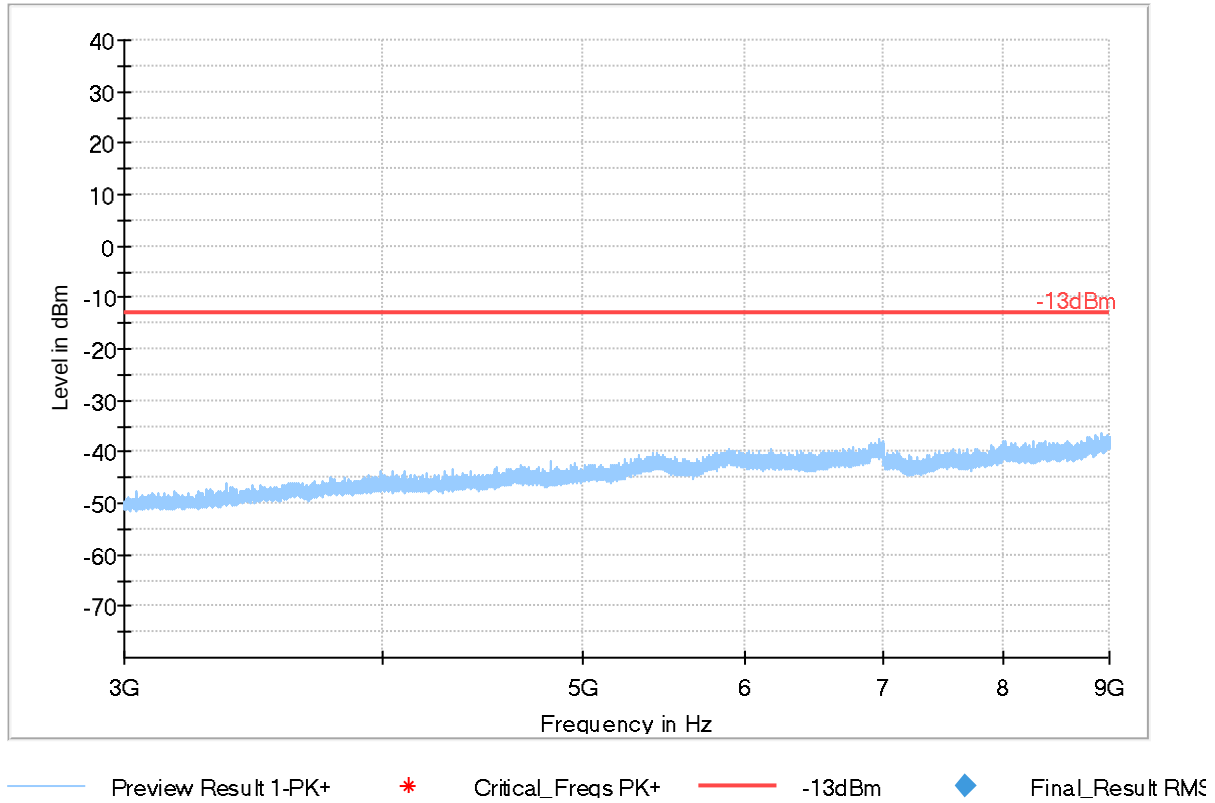
Plot # 19 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



Plot # 20 Radiated Emissions: 3 GHz - 9 GHz

Channel: High



8 Test setup photo

Setup photos are included in supporting file name: "EMC_ZONAR-021-19001_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	3 YEARS	07/06/2017
WIDEBAND RADIO COMMUNICATION	R&S	CMW500	127068	3 YEARS	07/01/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	3 YEARS	07/05/2017
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	3 YEARS	06/20/2017
DIGITAL 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
2019-08-08	EMC_ZONAR-021-19001_FCC_27_ISED	Initial version	Yuchan Lu