FCC/ISED Test Report

FOR:
Geotab Inc.

Model #:
GP9-LTE

Product Description:
GO9 Telematics device with on-board Wi-Fi hotspot functionality

FCC ID: 2AV57GP9LTE
IC ID: 11140A-GP9LTE

Per:
Title 47 CFR: Part 22, Part 24, Part 27
RSS-130 Issue 2, RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3

REPORT #: EMC_GEOTA_032_20001_FCC_22_24_27_ISED

DATE: 6/10/2020

A2LA Accredited

IC recognized #
3462B-1
3462B-2

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecom.com ◆ http://www.cetecom.com
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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 Wi-Fi 2.4 GHz radio according to criteria specified in the Code of Federal Regulations Title 47 CFR: Part 22, Part 24, Part 27 and Industry Canada Radio Standard Specifications RSS-130 Issue 2, RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3.

Company	Description	Model #
Geotab Inc.	GO9 Telematics device with on-board Wi-Fi hotspot functionality	GP9-LTE

No deficiencies were ascertained.

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

Responsible for Testing Laboratory:

Date	Section	Name	Signature
6/10/2020	Compliance	Cindy Li (Lab Manager)	Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-06-12 15:35:56

Responsible for the Report:

Date	Section	Name	Signature
6/10/2020	Compliance	Ghanma, Issa (EMC Engineer)	Digitally signed by: Issa W Ghanma DN: CN = Issa W Ghanma email = Issaghanma@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2020.06.11 16:23:09 -07'00'

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:	Li, Cindy
Responsible Project Leader:	Sivaraman, Sangeetha

2.1 Identification of the Client

Applicant's Name:	Geotab Inc.
Street Address:	2440 Winston Park Drive
City/Zip Code	Oakville, ON L6H 7V2
Country	Canada

2.2 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

Model #:	GP9-LTE
FCC ID:	2AV57GP9LTE
IC ID:	11140A-GP9LTE
HW Version :	A
SW Version :	123
HVIN:	GP9-LTE
PMN:	GP9-LTE
Product Description:	GO9 Telematics device with on-board Wi-Fi hotspot functionality
Transceiver Technology / Type(s) of Modulation:	❖ Cellular Module: M18Q2F-1 • 4G: LTE FDD Bands 2, 4, 5, 12 • 3G: UMTS FDD Bands II, V
Frequency Range:	• UMTS Band II: 1852.4 ~ 1907.6 MHz • UMTS Band V: 826.4 ~ 846.6 MHz • LTE Band 2: 1850 ~ 1910 MHz • LTE Band 4: 1710 ~ 1755 MHz • LTE Band 5: 824 ~ 849 MHz • LTE Band 12: 699 ~ 716 MHz
Max. declared antenna gain:	❖ Internal, 3D printed antenna • Peak gain [dBi] ▪ 699 MHz : - 0.89 ▪ 704-716 MHz : - 0.73 ▪ 824-849 MHz : - 0.27 ▪ 1710-1785 MHz : 2.10 ▪ 1850-1880 MHz : 3.90 ▪ 1910 MHz : 4.28
Operating voltage:	Vehicle: 12, 24 V DC
Operating Temperature Range	-40ºC to 85 ºC

Other Radios included in the device:	❖ Onboard Wi-Fi: • Qualcomm Chipset 9377 • 802.11 b/g/n 2.4GHz ❖ GPS Receiver: • 72-channel engine (GPS/GLONASS/Beidou/Galileo/SBAS/WAAS/EGNOSMSAS/GAGAN)
Sample Revision	☐ Prototype Unit; ☐ Production Unit; ■ Pre-Production
EUT Diameter	■ < 60 cm ☐ Other _____

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	GP9000002	A	123	Radiated

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
N/A	-	-	-	-

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The EUT was connected to an engineering test harnesses for test setup. These harnesses allow Powering the device on a bench setup and AT commands access.

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular & Wi-Fi Co-TX	Cellular was tested on Low, Mid and High Channels at the maximum power, simultaneous transmission with Wi-Fi 2.4 GHz. Cellular was configured using AT commands, through TeraTerm terminal. "QRCT 4" software tool was provided by the client, to configure the Wi-Fi 2.4GHz radio: ▪ Mode: **g** ▪ Transmit mode: Continuous **TX** ▪ Duty cycle: **100%** ▪ Power: **15 dBm (Max Power)** ▪ Hopping: **No** ▪ Hopping Type: **Single Frequency** ▪ Channel: Low , Mid, High, **Channel # 11** ▪ Data rate: **6 Mb/s** The internal antenna was connected.

3.6 Justification for Worst Case Mode of Operation

During the testing process the cellular radio was tested with transmitter sets to low, mid and high channel at the maximum power in simultaneous transmission mode with the worst case mode of Wi-Fi 2.4GHz radio.

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 perform and check radiated spurious emissions against the limits per Code of Federal Regulations Title 47 CFR: Part 22, Part 24, Part 27 and Industry Canada Radio Standard Specifications RSS-130 Issue 2, RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3, in simultaneous transmission mode of Cellular (Wistron NeWeb M18Q2F-1 FCC/IC ID: NKRM18Q2/4441A-M18Q2) and Wi-Fi 2.4 GHz (Qualcomm Chipset 9377) Radios.

4.1 Dates of Testing:

03/26/2019 – 04/14/2019

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:

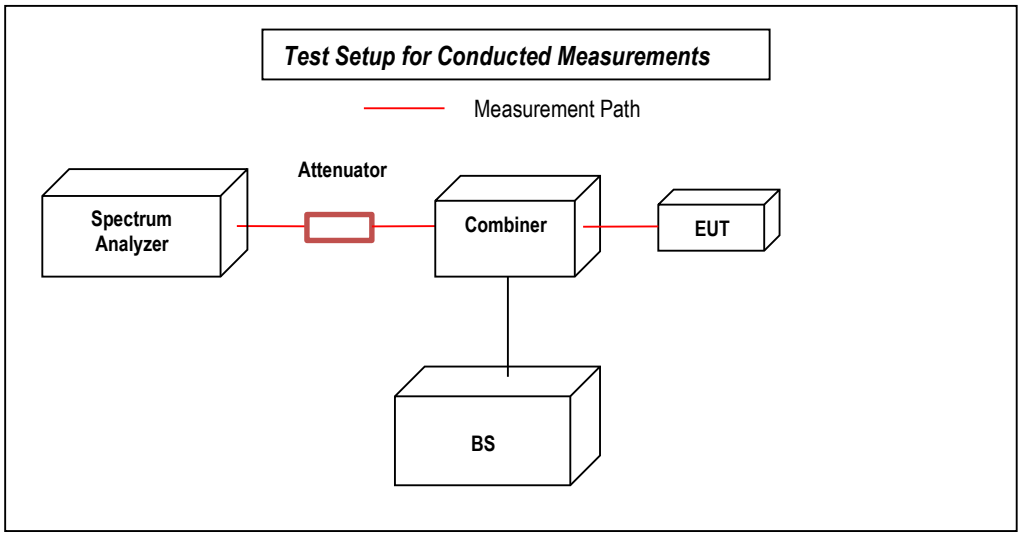
The following environmental conditions were maintained during the course of testing:

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

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

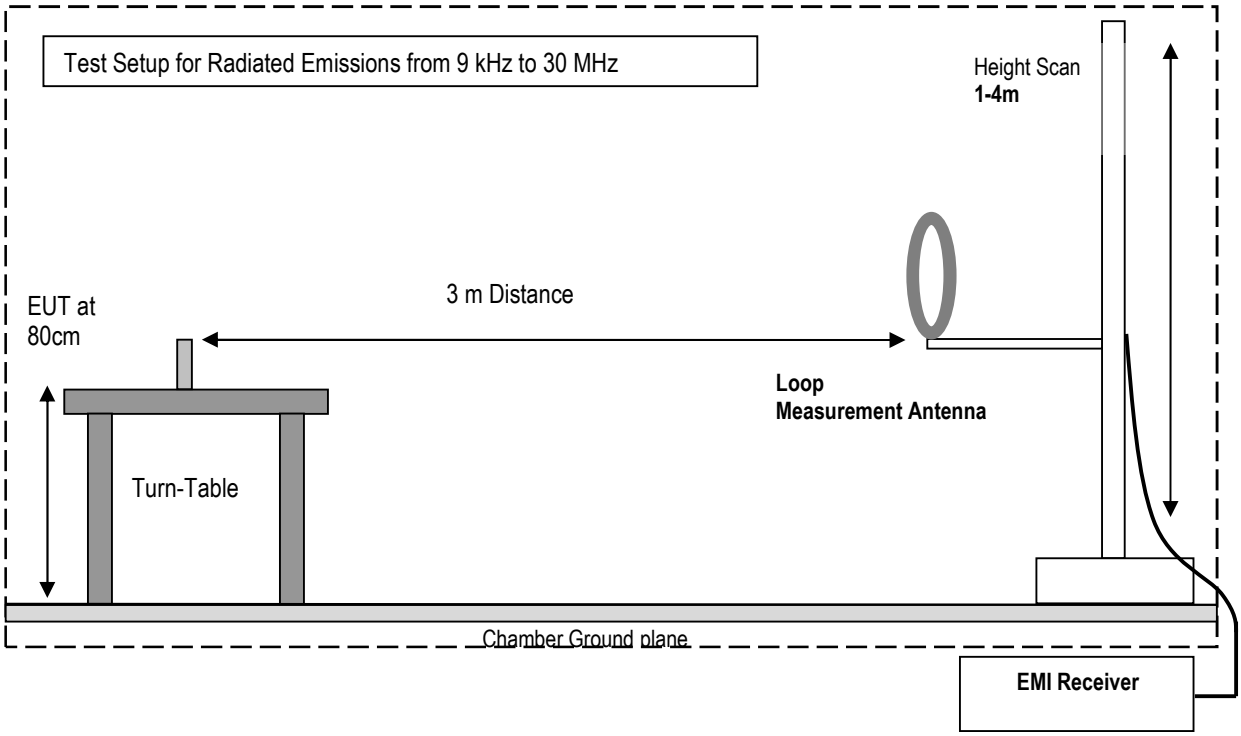
5 Measurement Procedures

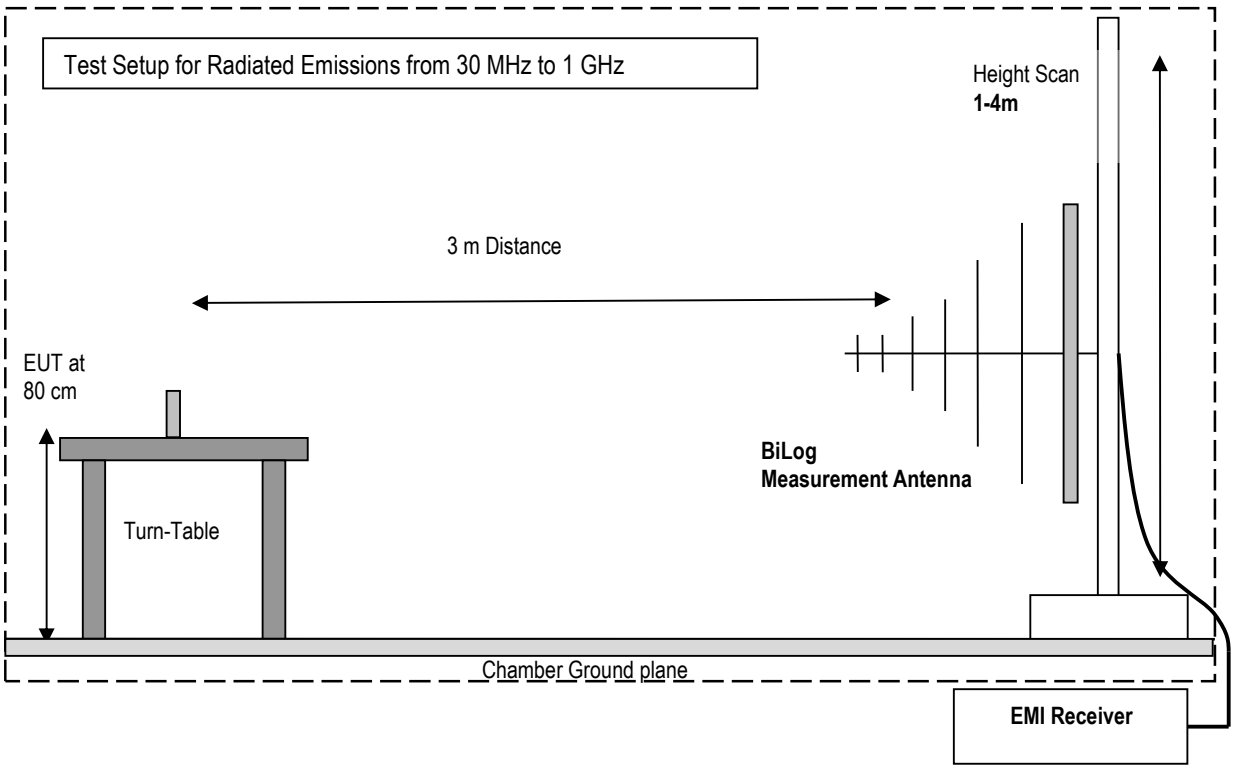
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v03r01 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to ANSI C63.26 as detailed below.

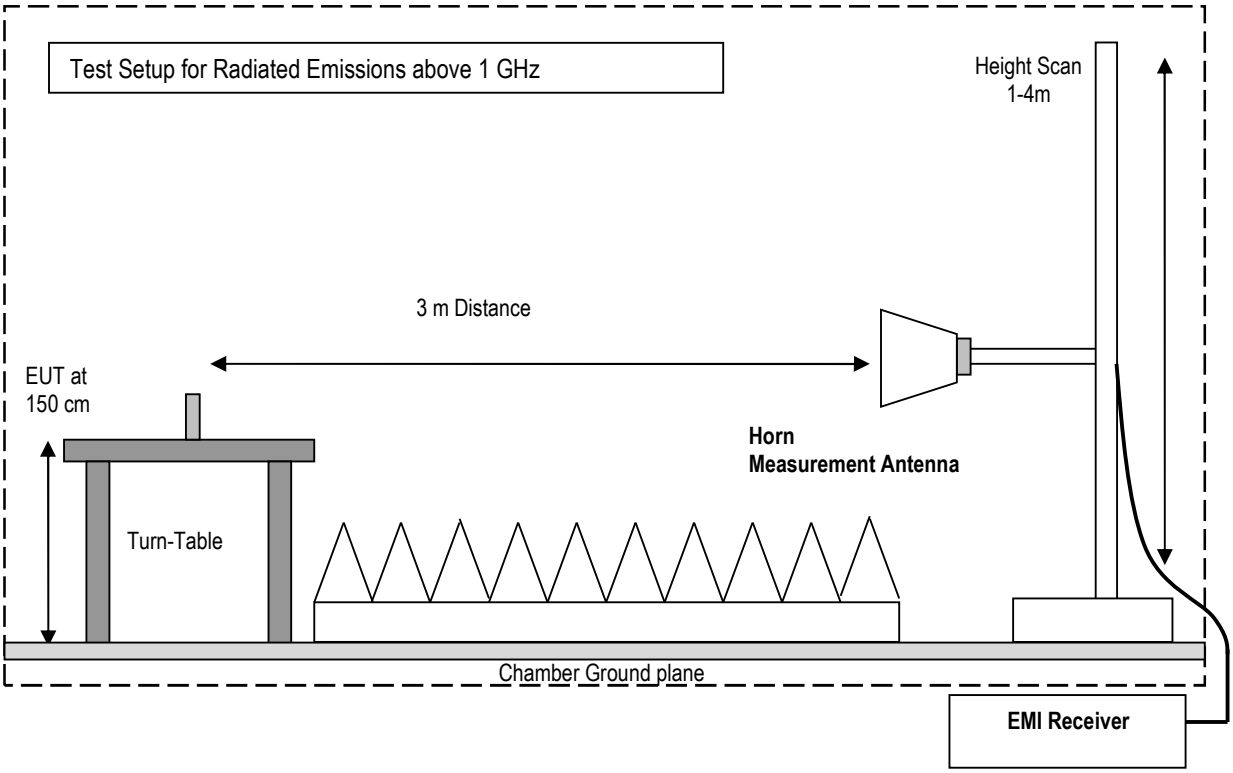


5.1 Radiated Measurement

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 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 9 kHz to 30 MHz
Height Scan
1-4m
3 m Distance
EUT at
80cm
Loop
Measurement Antenna
Turn-Table
Chamber Ground plane
EMI Receiver


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	-	-	☐	☐	☐	■	Note 1 Note 2
§2.1055; §22.355	Frequency Stability	-	-	☐	☐	☐	■	Note 1 Note 2
§2.1049; §22.917	Occupied Bandwidth	-	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §22.917	Band Edge Compliance	-	-	☐	☐	☐	■	Note 1 Note 2
§2.1051; §22.917	Conducted Spurious Emissions	-	-	☐	☐	☐	■	Note 1 Note 2
§2.1053; §22.917(a); RSS-132 Issue 3-5.5;	Radiated Spurious Emissions	Nominal	UMTS V, LTE 5	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification M18Q2F-1 FCC ID: NKRM18Q2/ IC ID: 4441A-M18Q2; Report No. FG622601B for LTE Band 5 and Report No. FG622601A for UMTS Band V

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

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification Wistron NeWeb M18Q2F-1 FCC ID: NKRM18Q2/ IC ID: 4441A-M18Q2, Report No. FG622601B for LTE Band 2 and Report No. FG622601A for UMTS Band II

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 2-4.7; RSS-139 Issue 3-6.6;	Radiated Spurious Emissions	Nominal	LTE 4, 12	■	☐	☐	☐	Complies

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Leveraged from module certification Wistron NeWeb M18Q2F-1 FCC ID: NKRM18Q2/ IC ID: 4441A-M18Q2, Report No. FG622601B

7 Test Result Data

7.1 ERP / EIRP

Module Name:		Wistron NeWeb
Model Number:		M18Q2F-1
FCC ID:		NKRM18Q2
IC ID:		4441A-M18Q2
Max. declared antenna gain:	❖	❖ Internal, 3D printed antenna • Peak gain [dBi] ▪ 699 MHz : - 0.89 ▪ 704-716 MHz : - 0.73 ▪ 824-849 MHz : - 0.27 ▪ 1710-1785 MHz: 2.10 ▪ 1850-1880 : 3.90 ▪ 1910 MHz : 4.28

Band	Frequency range (MHz)	Emission Designator	Power (Watts)	Gain (dBi / Lin)	ERP (Watts)	EIRP (Watts)
UMTS II	1852.4 – 1907.6	4M13F9W	0.26	4.28 / 2.68	-	0.697
UMTS V	826.4 – 846.6	4M13F9W	0.28	-0.27 / 0.94	0.160	0.263
LTE 2	1850.7 – 1909.3	18M5G7D	0.203	4.28 / 2.68	-	0.544
LTE 2	1860.0 – 1900.0	1M09W7D	0.162	4.28 / 2.68	-	0.434
LTE 2	1860.0 – 1900.0	18M3W7D	0.141	4.28 / 2.68	-	0.378
LTE 4	1710.7 – 1754.3	1M09W7D	0.23	2.1 / 1.62	-	0.373
LTE 4	1720.0 – 1745.0	18M3G7D	0.24	2.1 / 1.62	-	0.389
LTE 5	825.5 – 847.5	2M73W7D	0.179	-0.27 / 0.94	0.103	0.168
LTE 5	829.0 – 844.0	8M99G7D	0.22	-0.27 / 0.94	0.126	0.207
LTE 12	699.7 – 715.3	1M10W7D	0.182	-0.73 / 0.85	0.094	0.154
LTE 12	704.0 – 711.0	9M11G7D	0.224	-0.73 / 0.85	0.115	0.189

Note: ERP / EIRP are calculated from maximum power in cellular module Report, adding known peak 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 22.917; CFR Part 24.238, Part 27.53 utilizing KDB 971168 D01 Power Meas License Digital Systems v03r01, and according to ANSI C63.26 2015

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:

7.2.2.1 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.

7.2.2.2 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.

7.2.3 Test conditions and setup:

Ambient Temperature (C)	EUT operating mode	Power Input
22	Op. 1	12v DC

7.2.4 Measurement result:

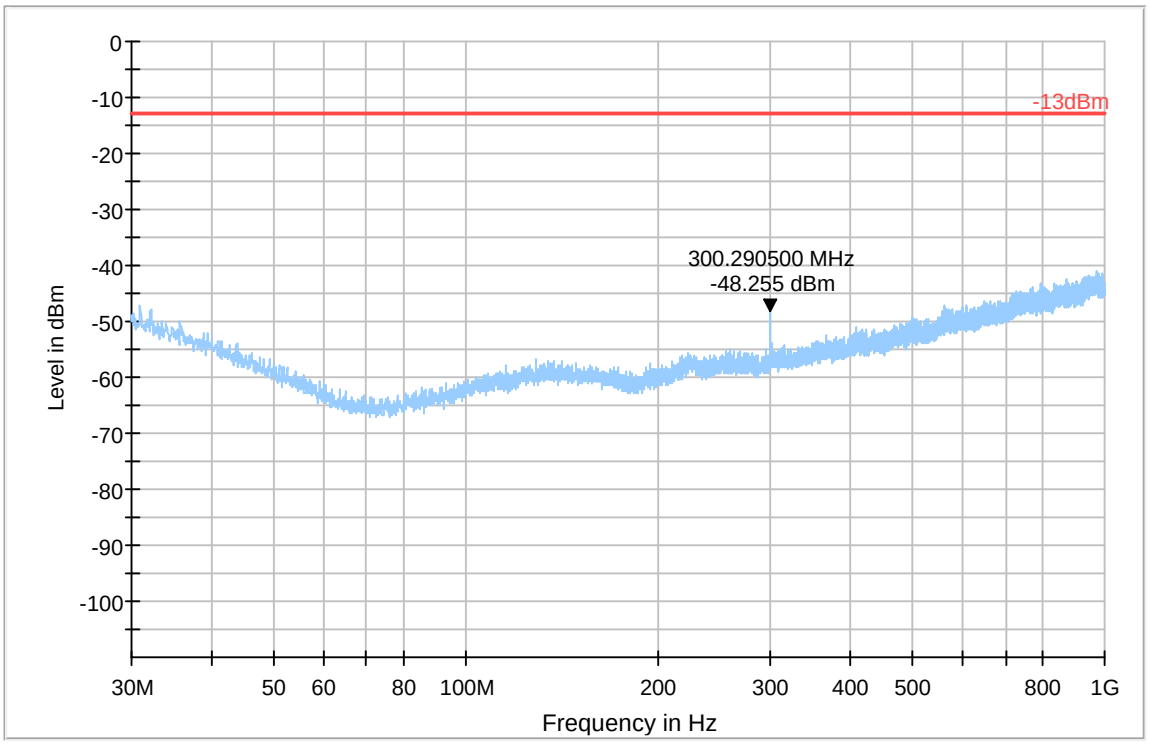
Plot #	Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1-3	Low	UMTS Band II	30 MHz – 18 GHz	-13	Pass
4-8	Mid		9 kHz – 26 GHz	-13	Pass
9-11	High		30 MHz – 18 GHz	-13	Pass
12-14	Low	UMTS Band V	30 MHz – 9 GHz	-13	Pass
15-18	Mid		9 kHz – 9 GHz	-13	Pass
19-21	High		30 MHz – 9 GHz	-13	Pass
22-24	Low	LTE Band 2	30 MHz – 18 GHz	-13	Pass
25-29	Mid		9 kHz – 26 GHz	-13	Pass
30-32	High		30 MHz – 18 GHz	-13	Pass
33-35	Low	LTE Band 4	30 MHz – 18 GHz	-13	Pass
36-39	Mid		9 kHz – 18 GHz	-13	Pass
40-42	High		30 MHz – 18 GHz	-13	Pass
43-45	Low	LTE Band 5	30 MHz – 9 GHz	-13	Pass
46-49	Mid		9 kHz – 9 GHz	-13	Pass
50-52	High		30 MHz – 9 GHz	-13	Pass
53-55	Low	LTE Band 12	30 MHz – 9 GHz	-13	Pass
56-59	Mid		9 kHz – 9 GHz	-13	Pass
60-62	High		30 MHz – 9 GHz	-13	Pass

7.2.5 Measurement plots:

UMTS II

Plot # 1 Radiated Emissions: 30 MHz – 1GHz

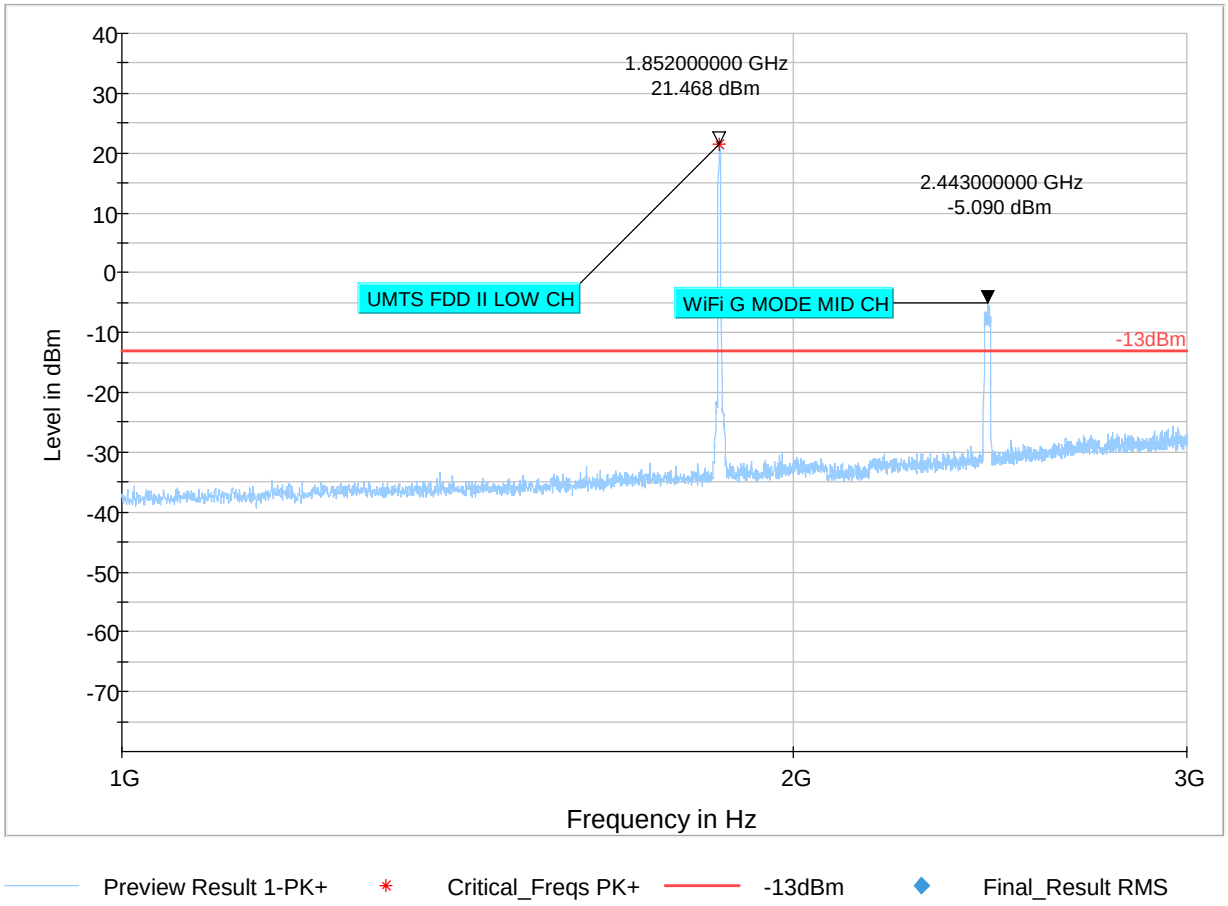
Channel: Low



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 2 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

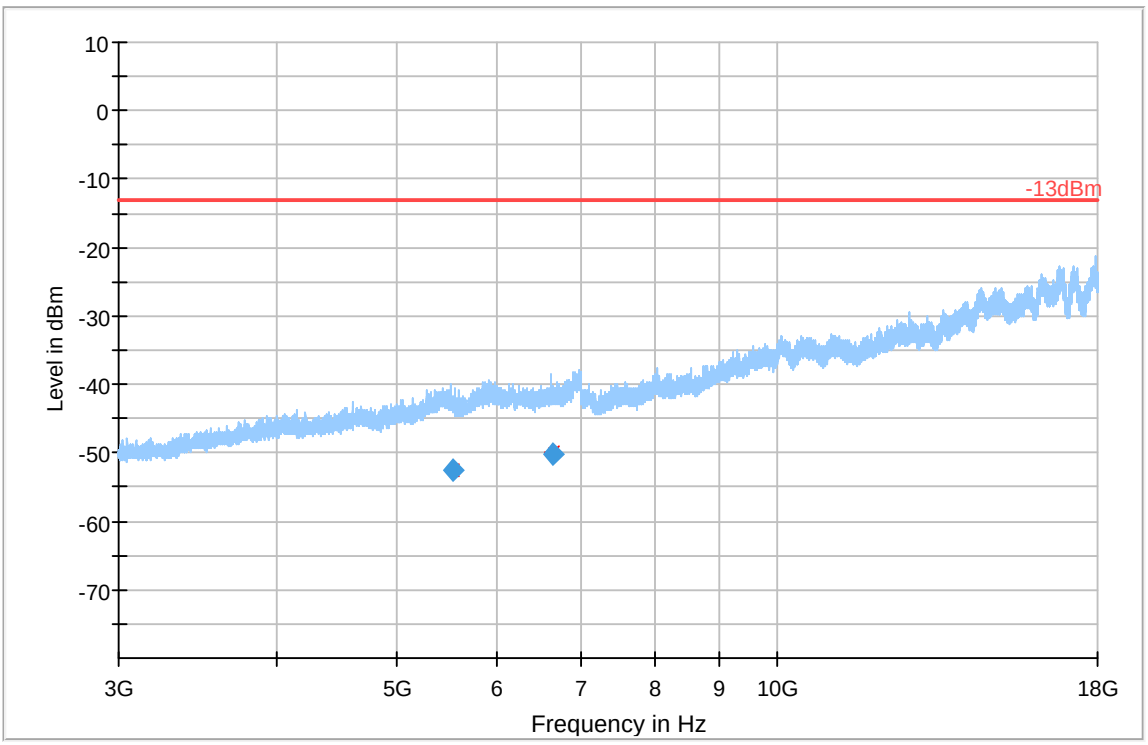


Plot # 3 Radiated Emissions: 3 GHz – 18 GHz

Channel: Low

Final_Result

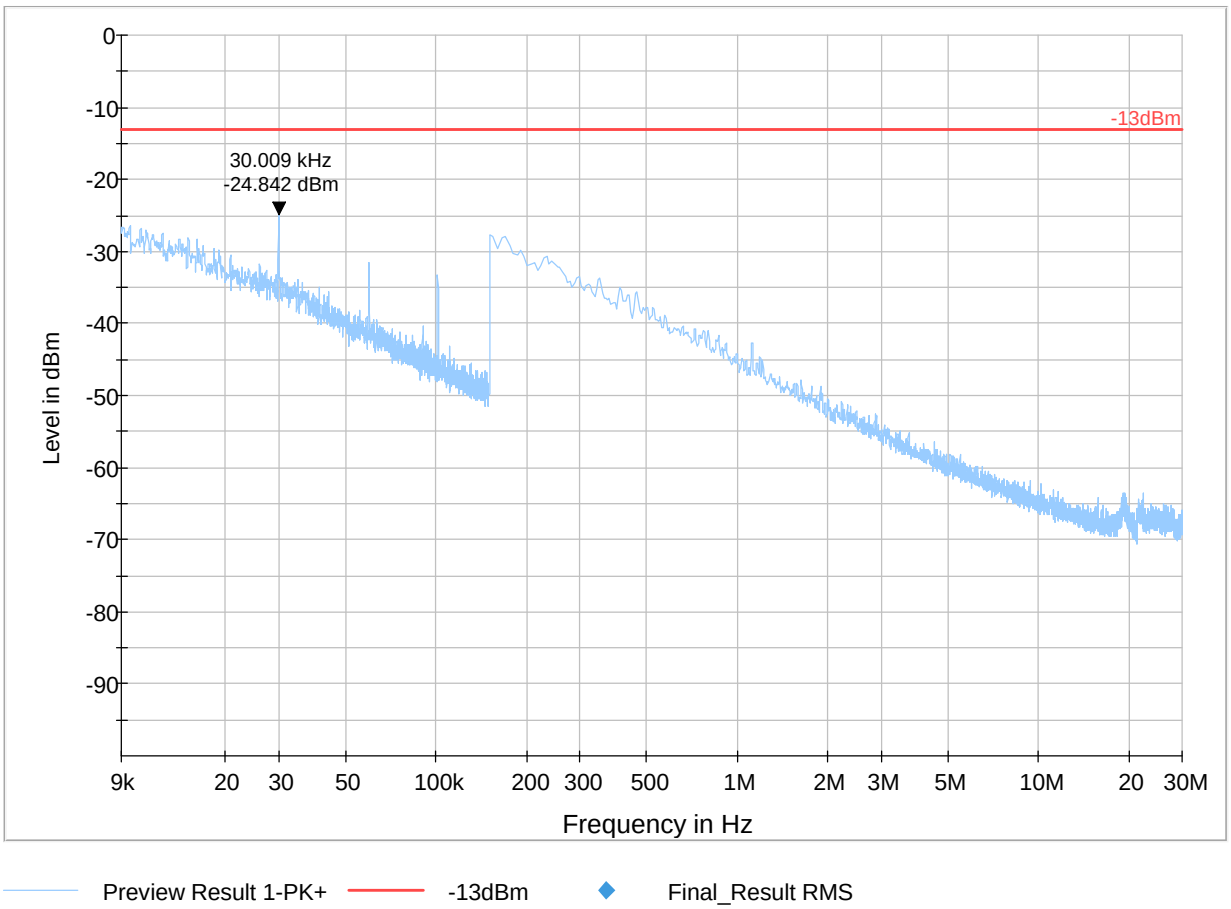
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
5522.065	-52.598	-13.00	39.60	200.0	1000.000	225.0	V	288.0	-99.1	10:41:11 AM - 3/27/2020
6632.509	-50.145	-13.00	37.15	200.0	1000.000	162.0	H	188.0	-97.8	10:37:57 AM - 3/27/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

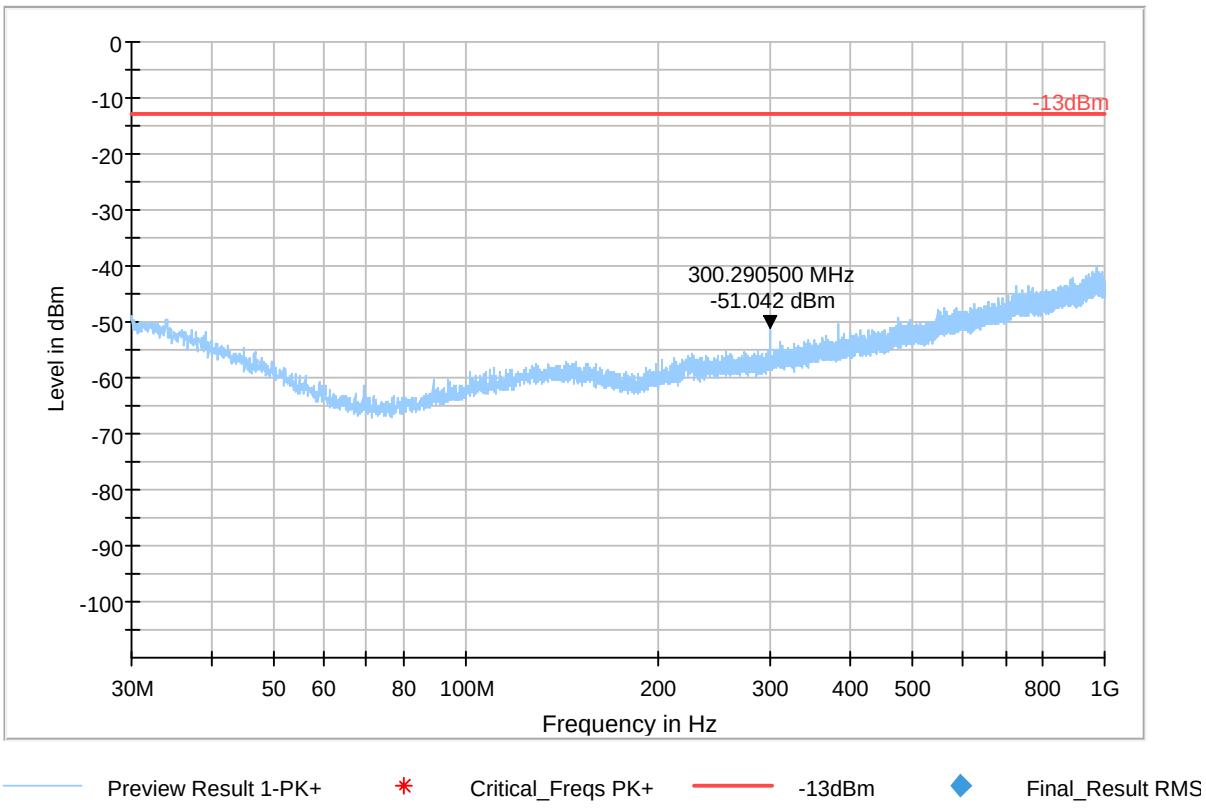
Plot # 4 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



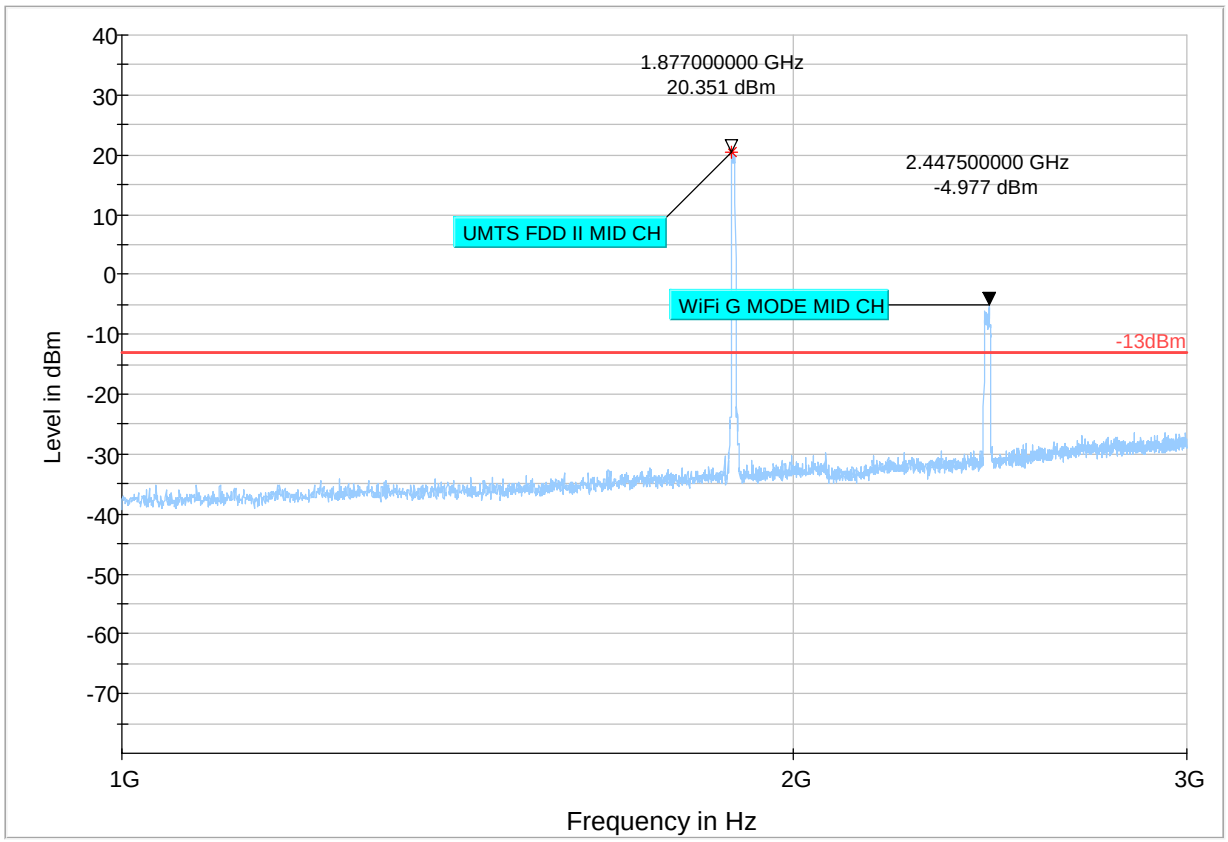
Plot # 5 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



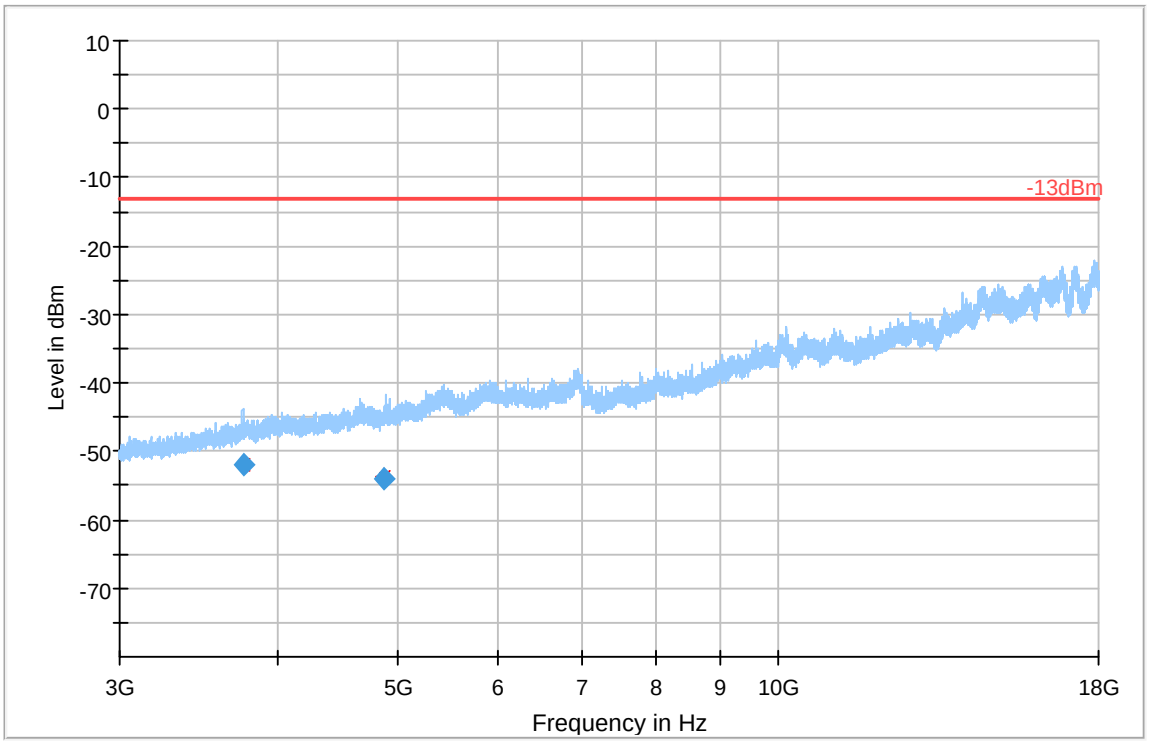
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 7 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid

Final_Result

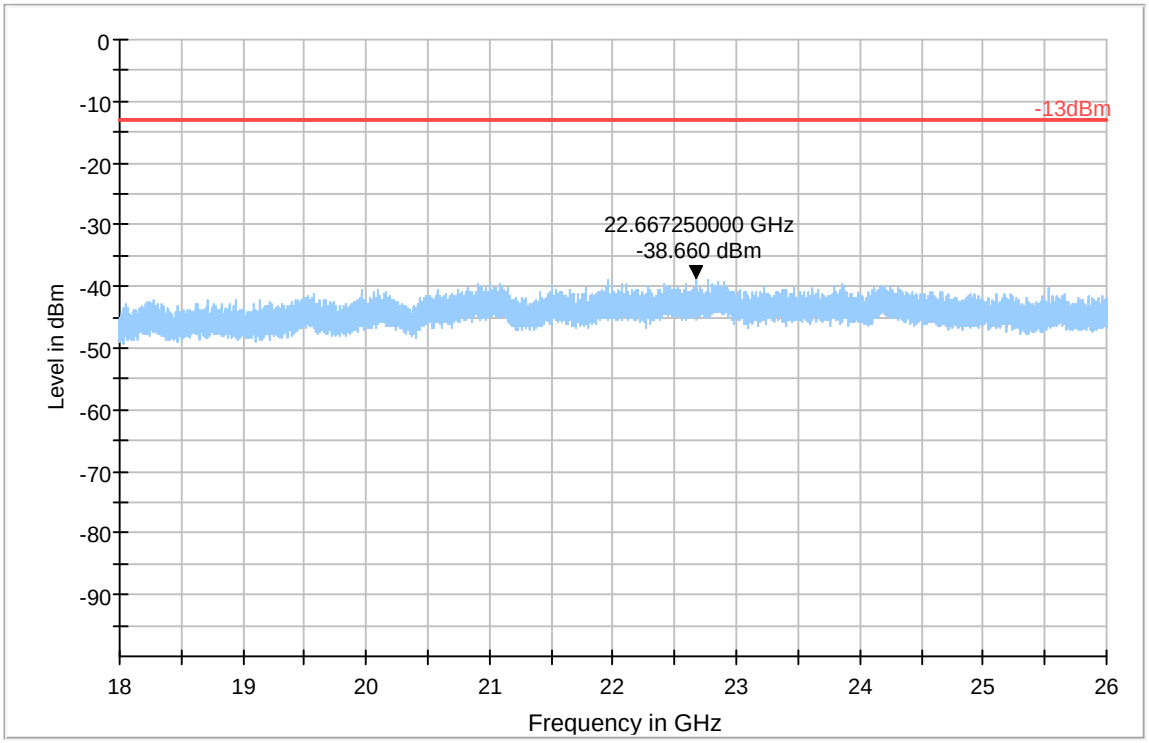
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3758.789	-52.072	-13.00	39.07	200.0	1000.000	263.0	H	-14.0	-	10:26:29 AM - 3/27/2020
4872.529	-53.926	-13.00	40.93	200.0	1000.000	138.0	V	33.0	-	10:23:20 AM - 3/27/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 8 Radiated Emissions: 18 GHz – 26 GHz

Channel: Mid



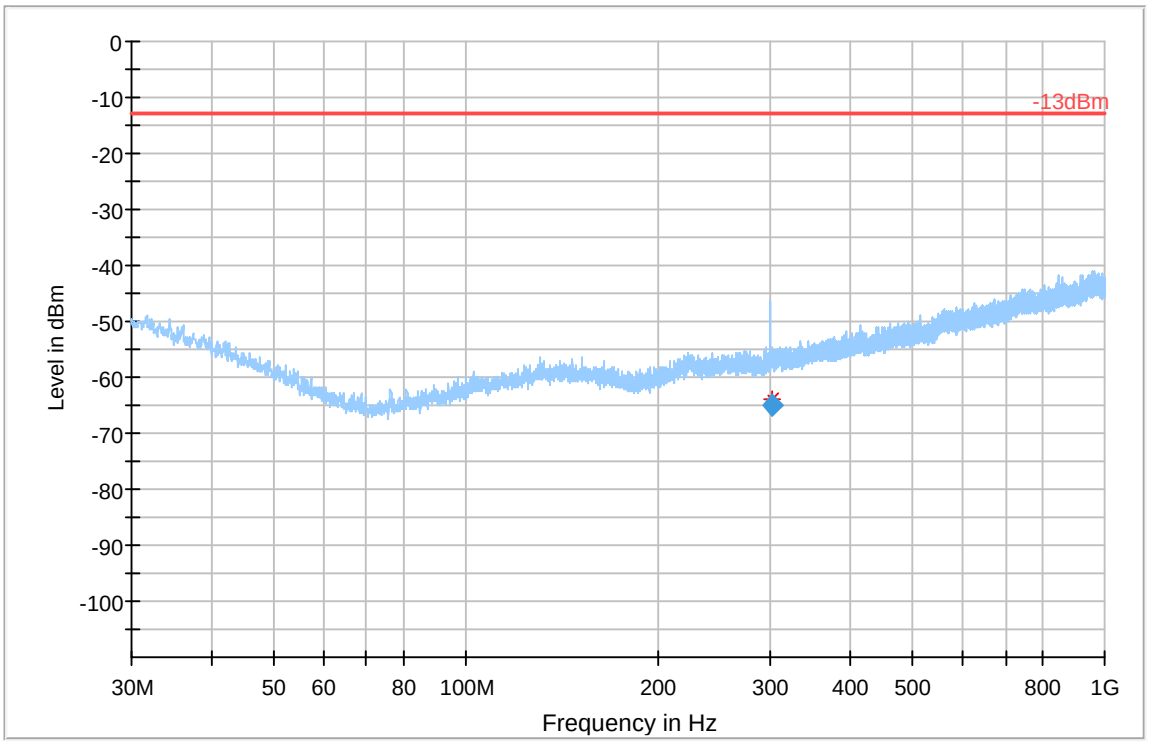
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 9 Radiated Emissions: 30 MHz – 1GHz

Channel: High

Final_Result

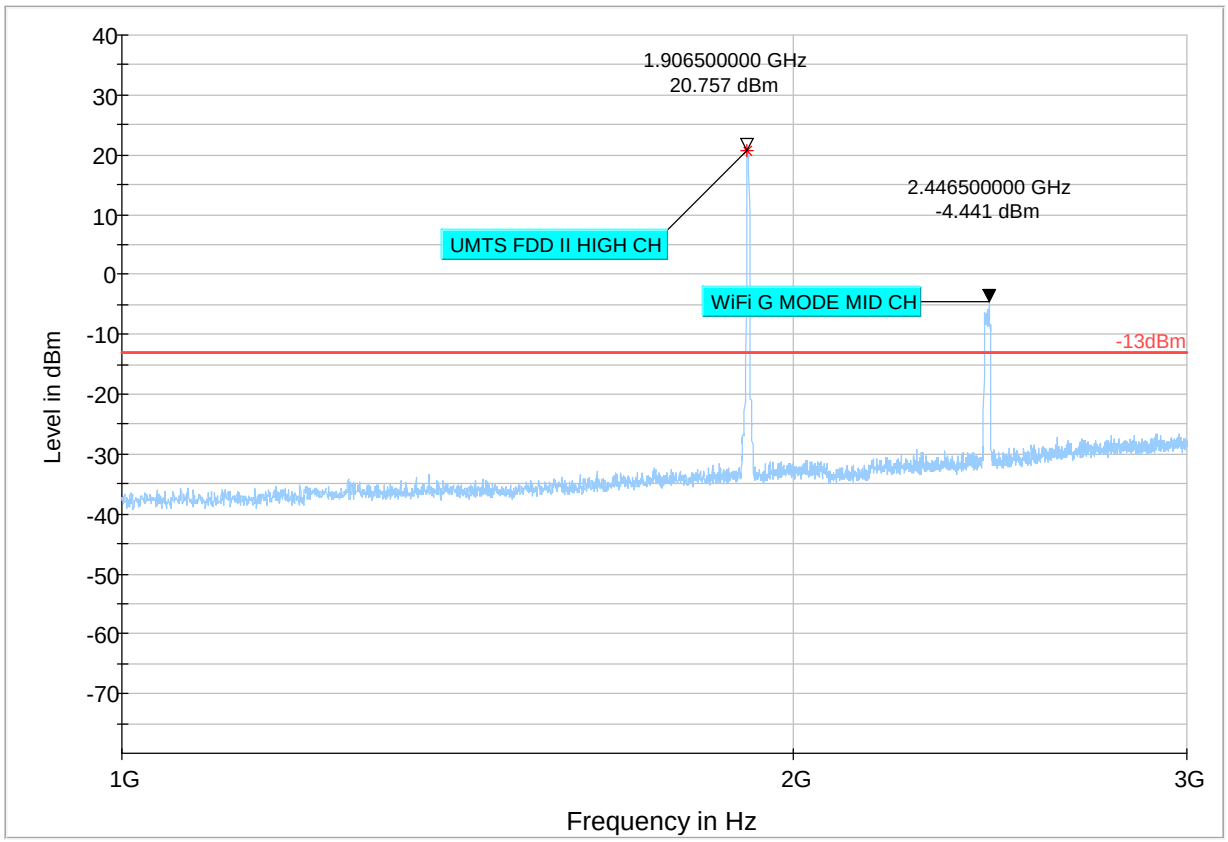
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
301.254	-64.908	-13.00	51.91	200.0	100.000	156.0	H	231.0	-79.3	1:02:10 PM - 4/14/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 10 Radiated Emissions: 1 GHz - 3 GHz

Channel: High



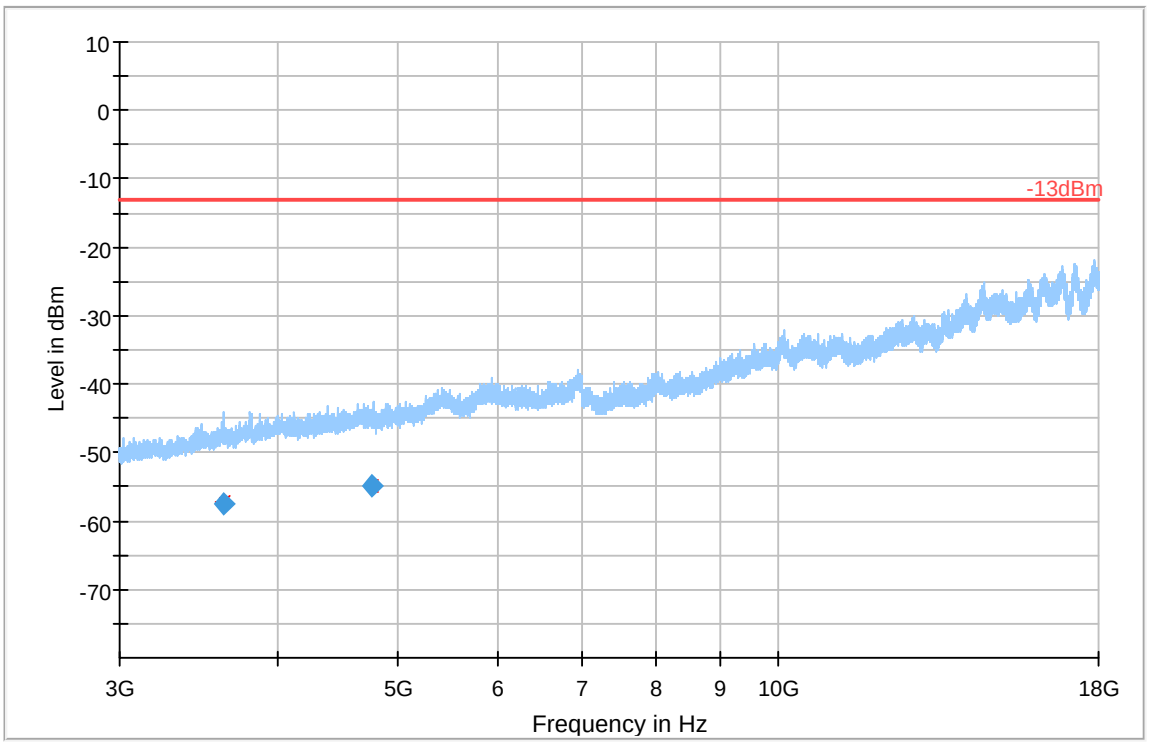
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 11 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)	Comment
3635.354	-57.398	-13.00	44.40	200.0	1000.000	143.0	V	234.0	-	10:58:01 AM - 3/27/2020
4763.686	-54.963	-13.00	41.96	200.0	1000.000	310.0	V	351.0	-	10:54:45 AM - 3/27/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

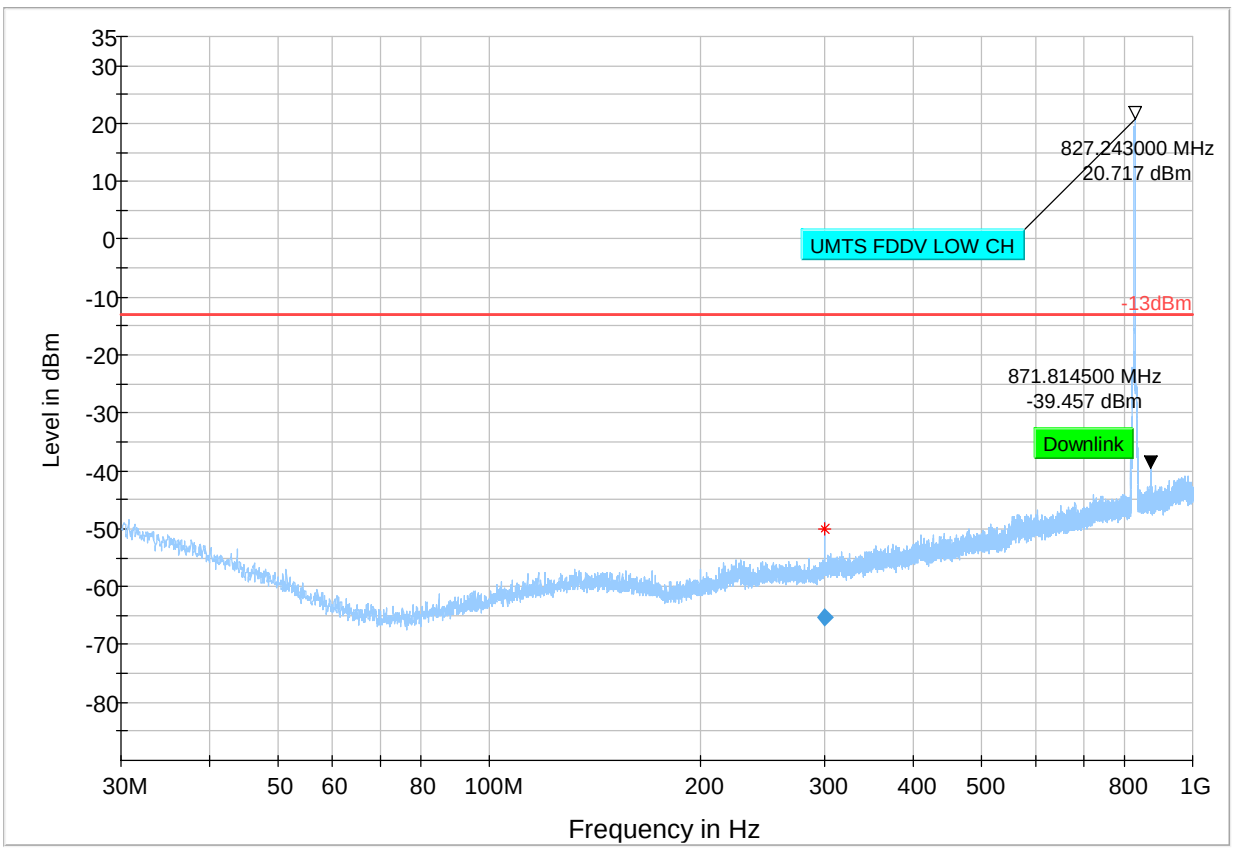
UMTS V

Plot # 12 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.362	-65.371	-13.00	52.37	500.0	100.000	139.0	H	294.0	-79.4	11:55:54 AM - 4/14/2020



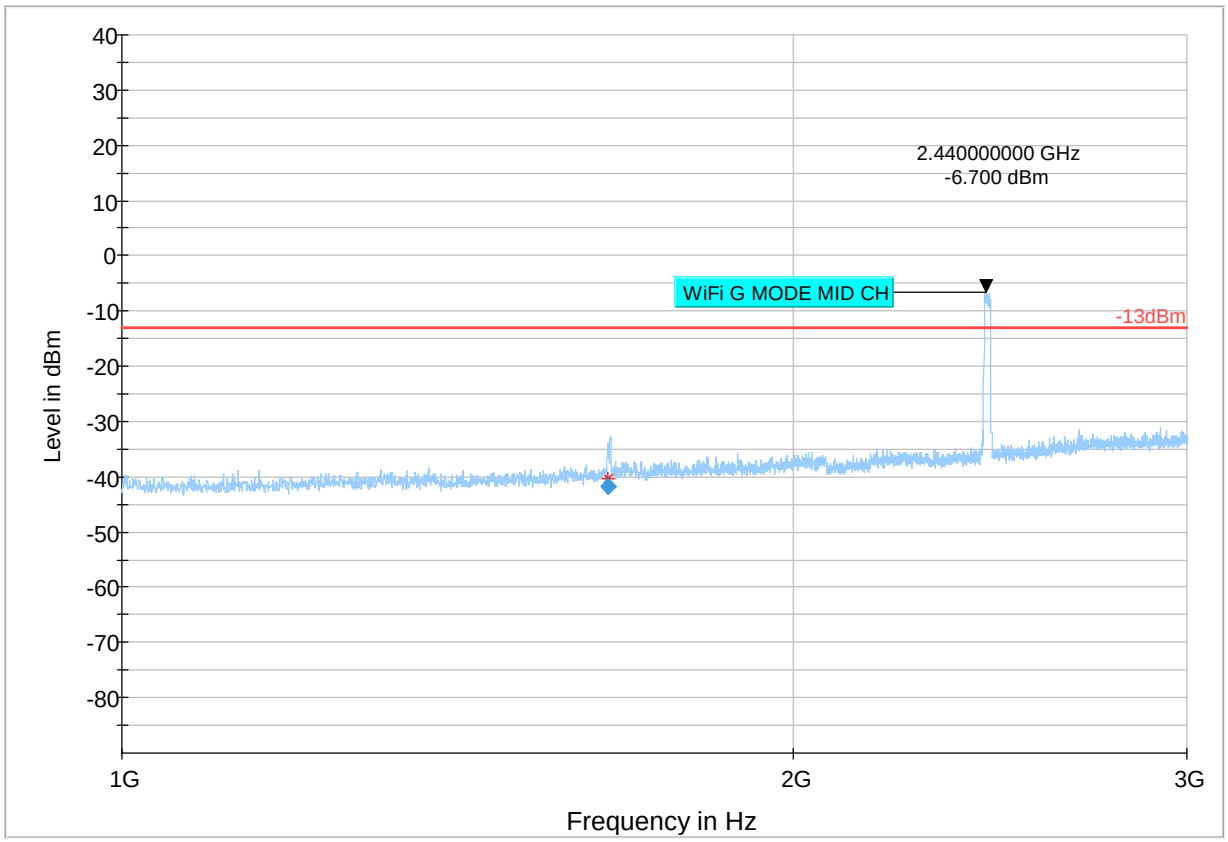
Preview Result 1-PK+ ✳ Critical_Freqs PK+ -13dBm ◆ Final_Result RMS

Plot # 13 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

Final_Result

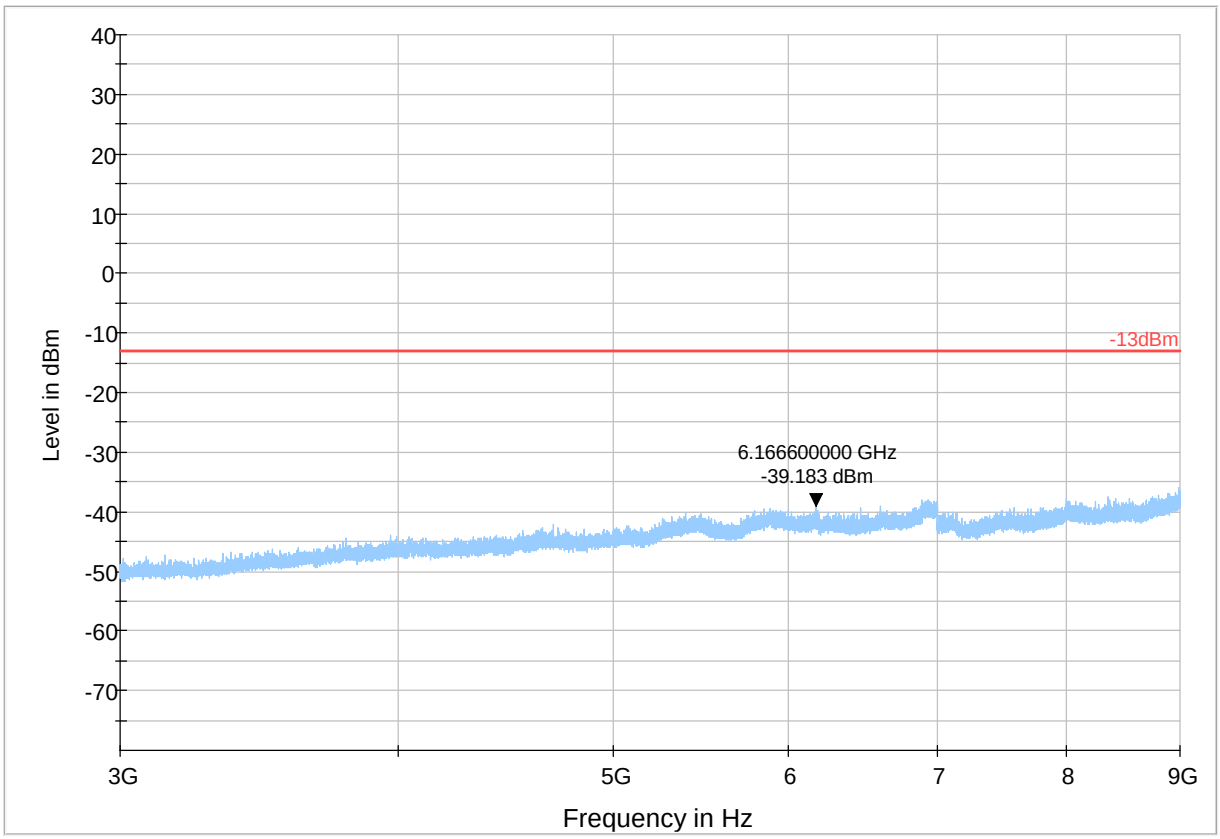
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1650.955	-41.708	-13.00	28.71	500.0	1000.000	147.0	V	112.0	-90.8	1:22:26 PM - 4/13/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 14 Radiated Emissions: 3 GHz – 9 GHz

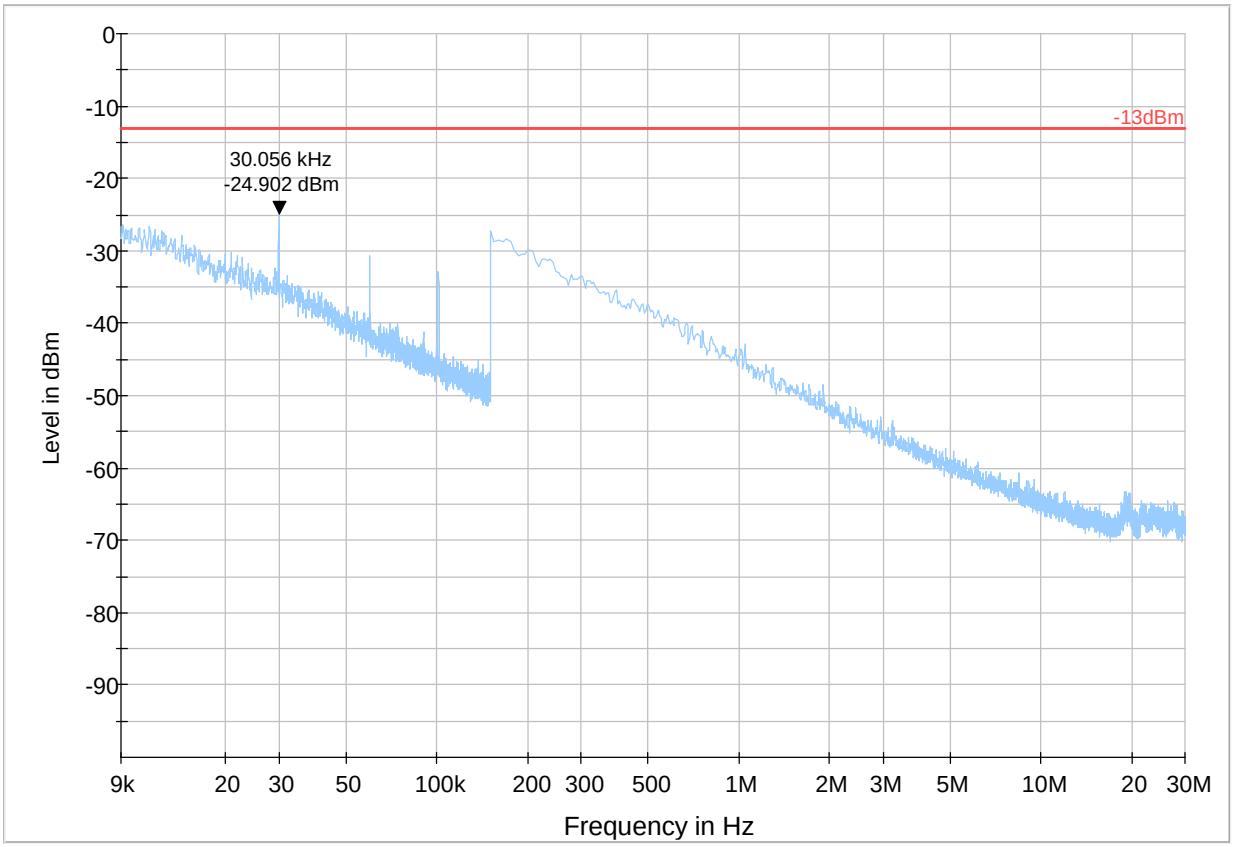
Channel: Low



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 15 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



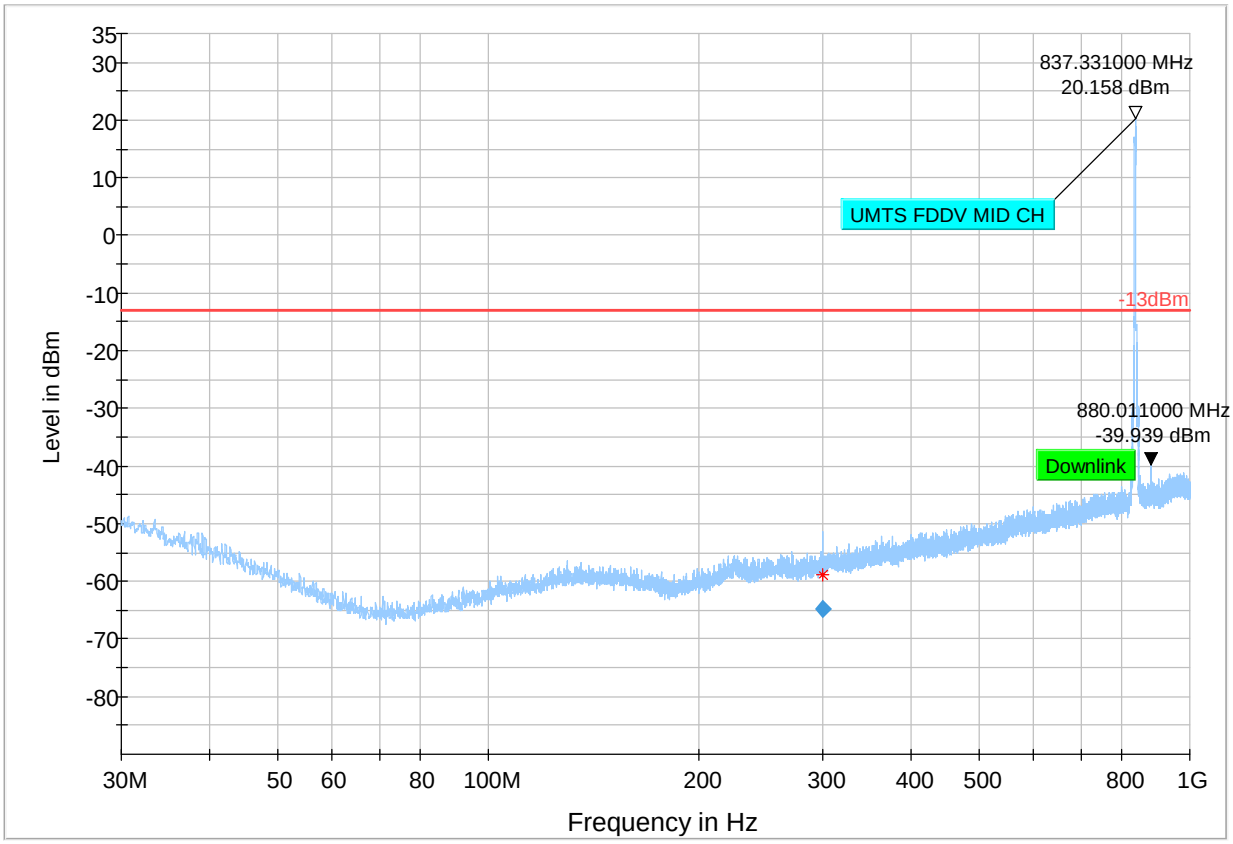
Preview Result 1-PK+ -13dBm Final_Result RMS

Plot # 16 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)	Comment
300.263	-64.782	-13.00	51.78	500.0	100.000	141.0	V	165.0	-79.0	12:08:53 PM - 4/14/2020



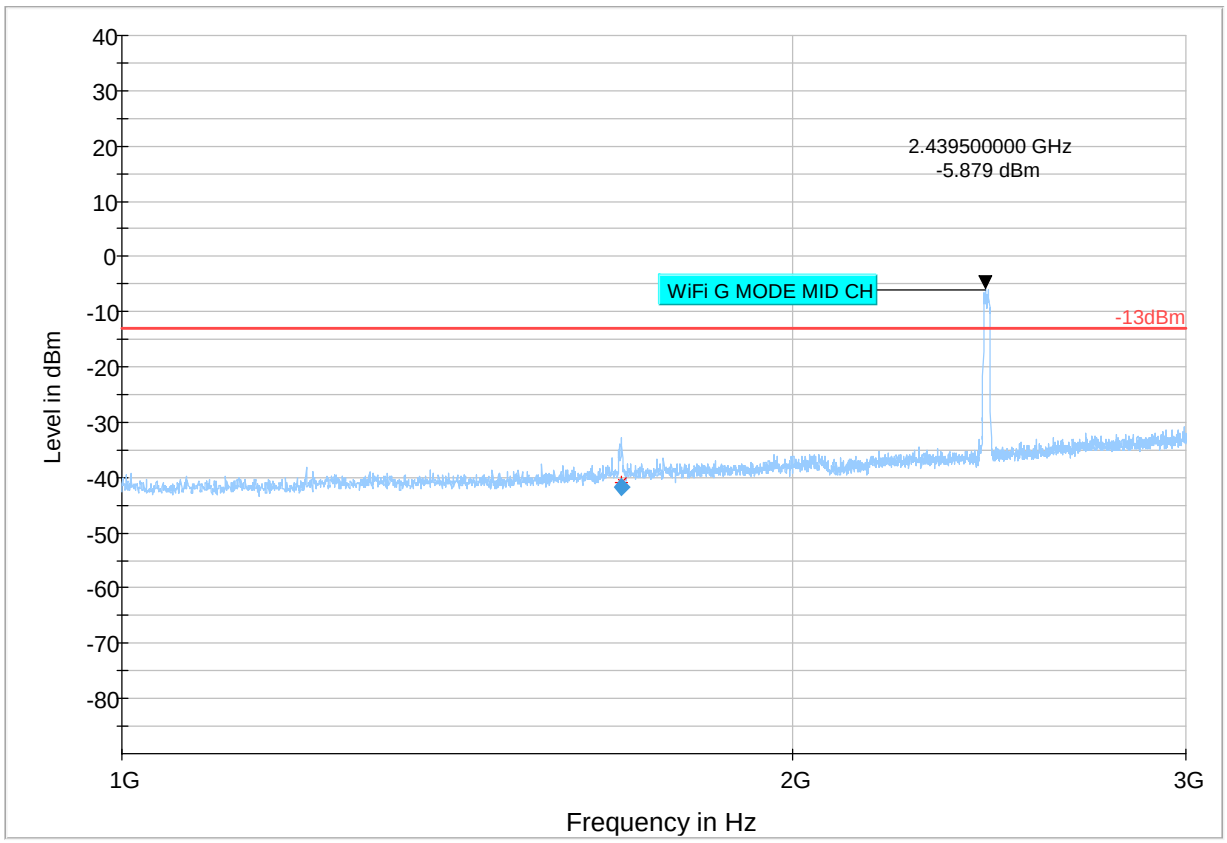
Preview Result 1-PK+ ✳ Critical_Freqs PK+ -13dBm ◆ Final_Result RMS

Plot # 17 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid

Final_Result

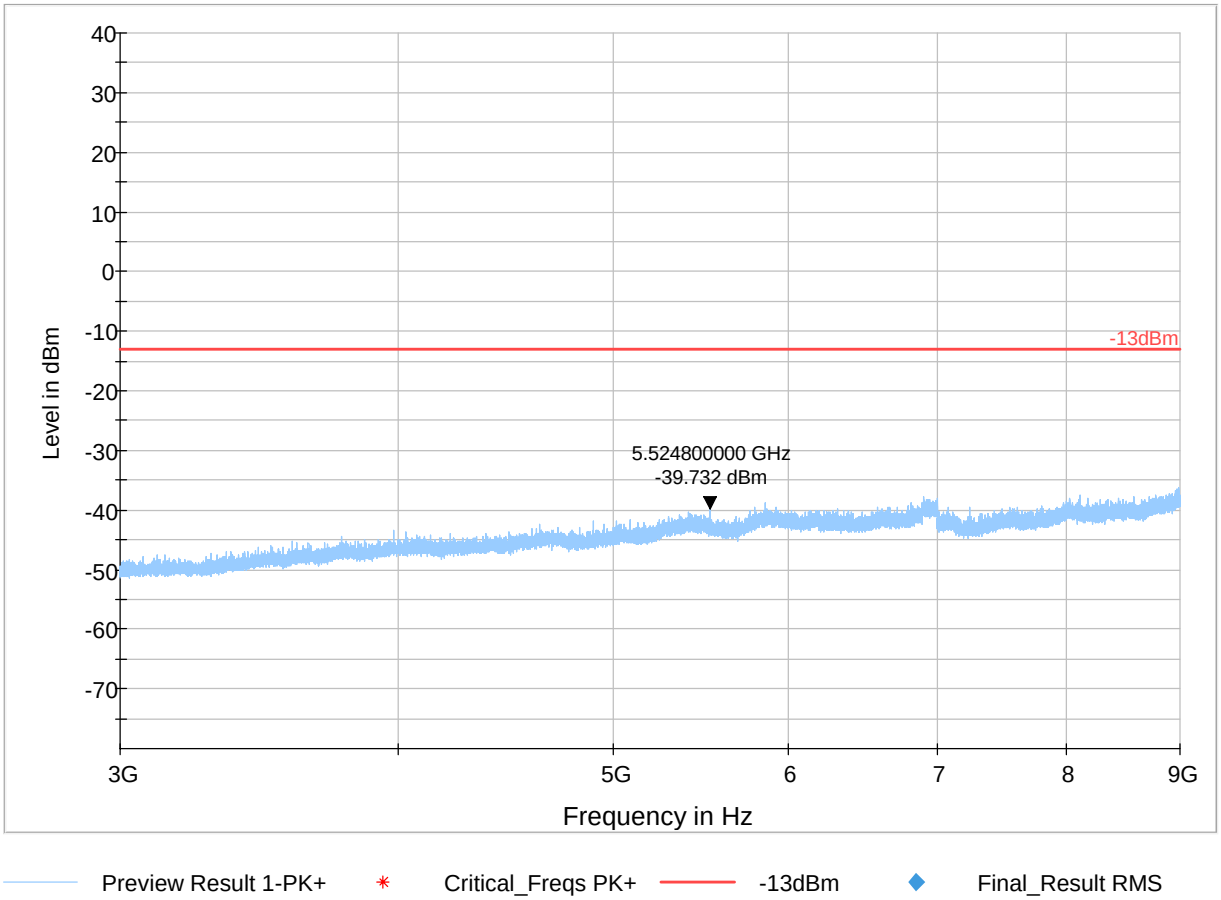
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1675.620	-41.866	-13.00	28.87	500.0	1000.000	142.0	V	126.0	-90.5	1:08:58 PM - 4/13/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

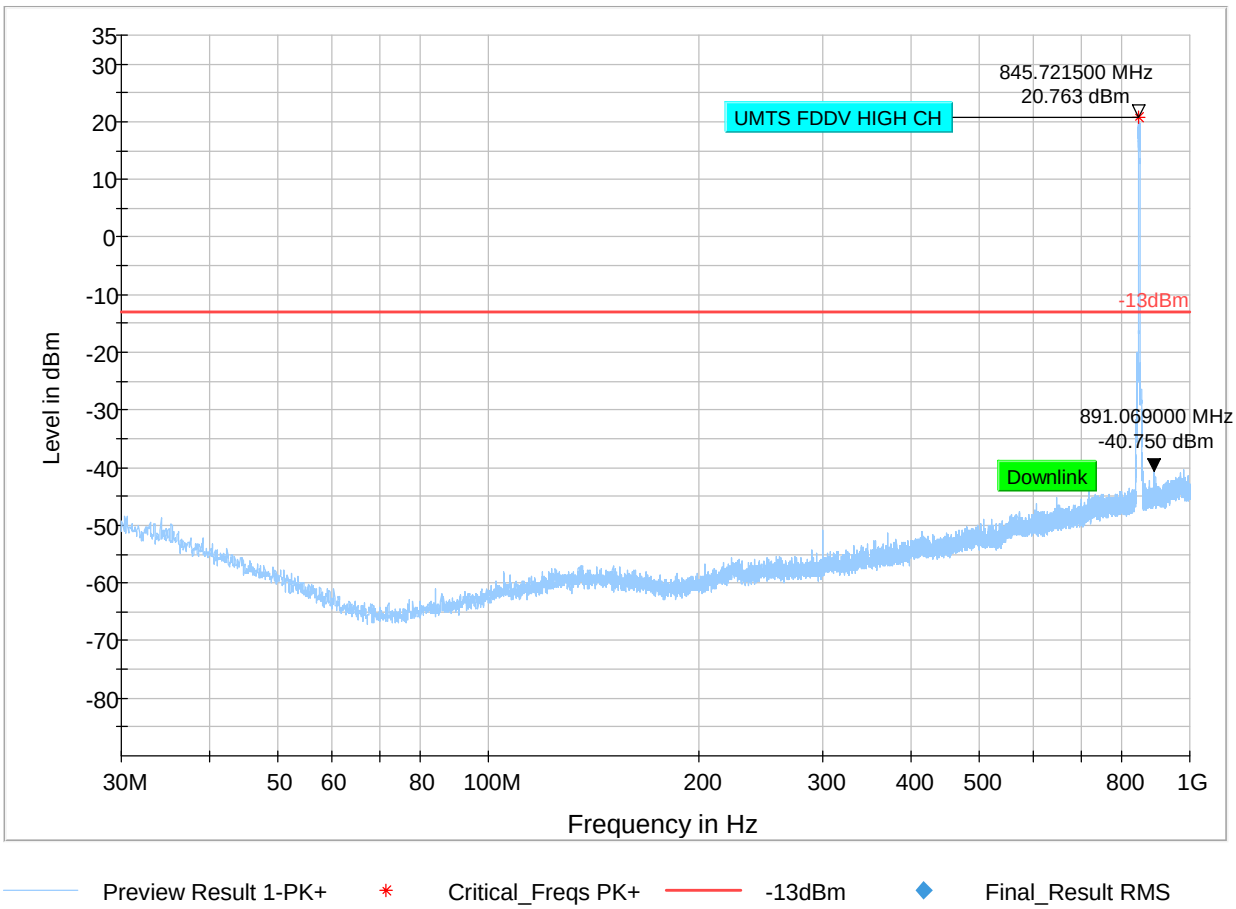
Plot # 18 Radiated Emissions: 3 GHz – 9 GHz

Channel: Mid



Plot # 19 Radiated Emissions: 30 MHz – 1GHz

Channel: High

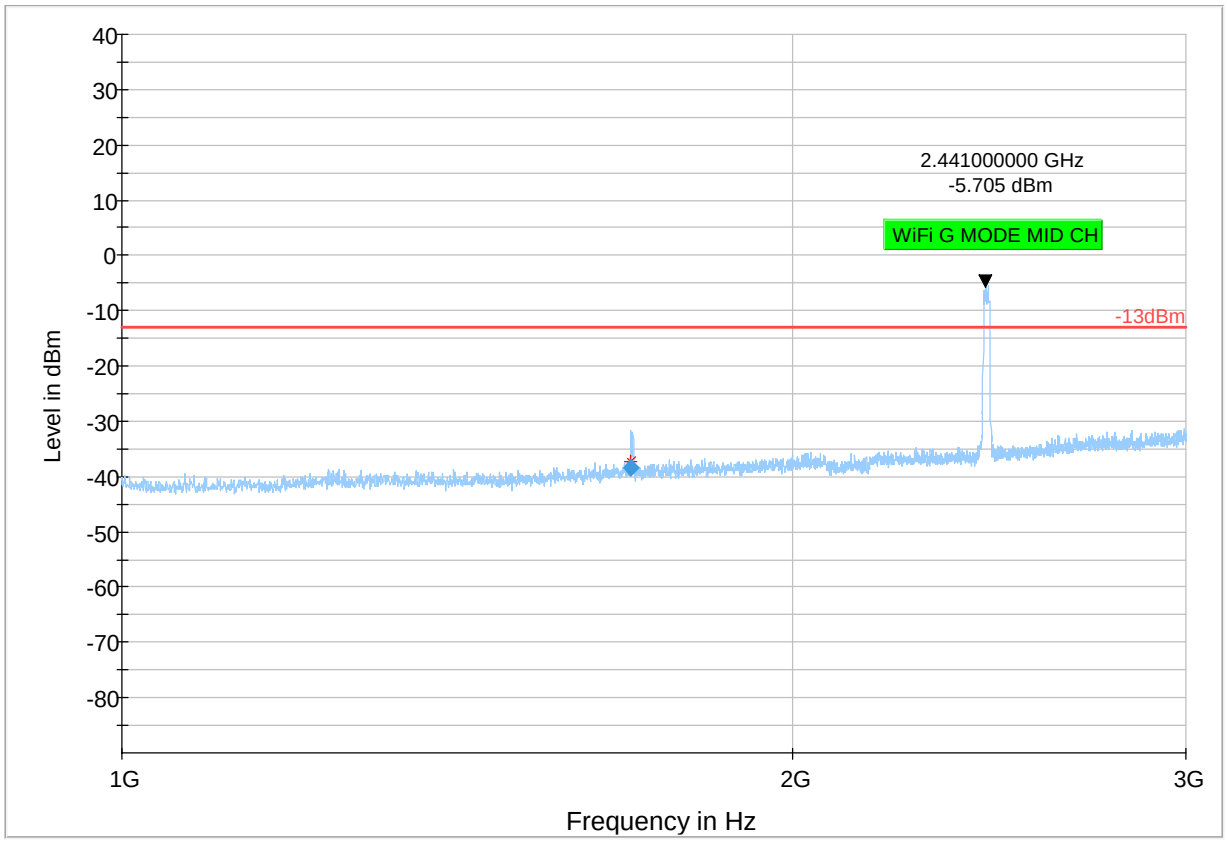


Plot # 20 Radiated Emissions: 1 GHz - 3 GHz

Channel: High

Final_Result

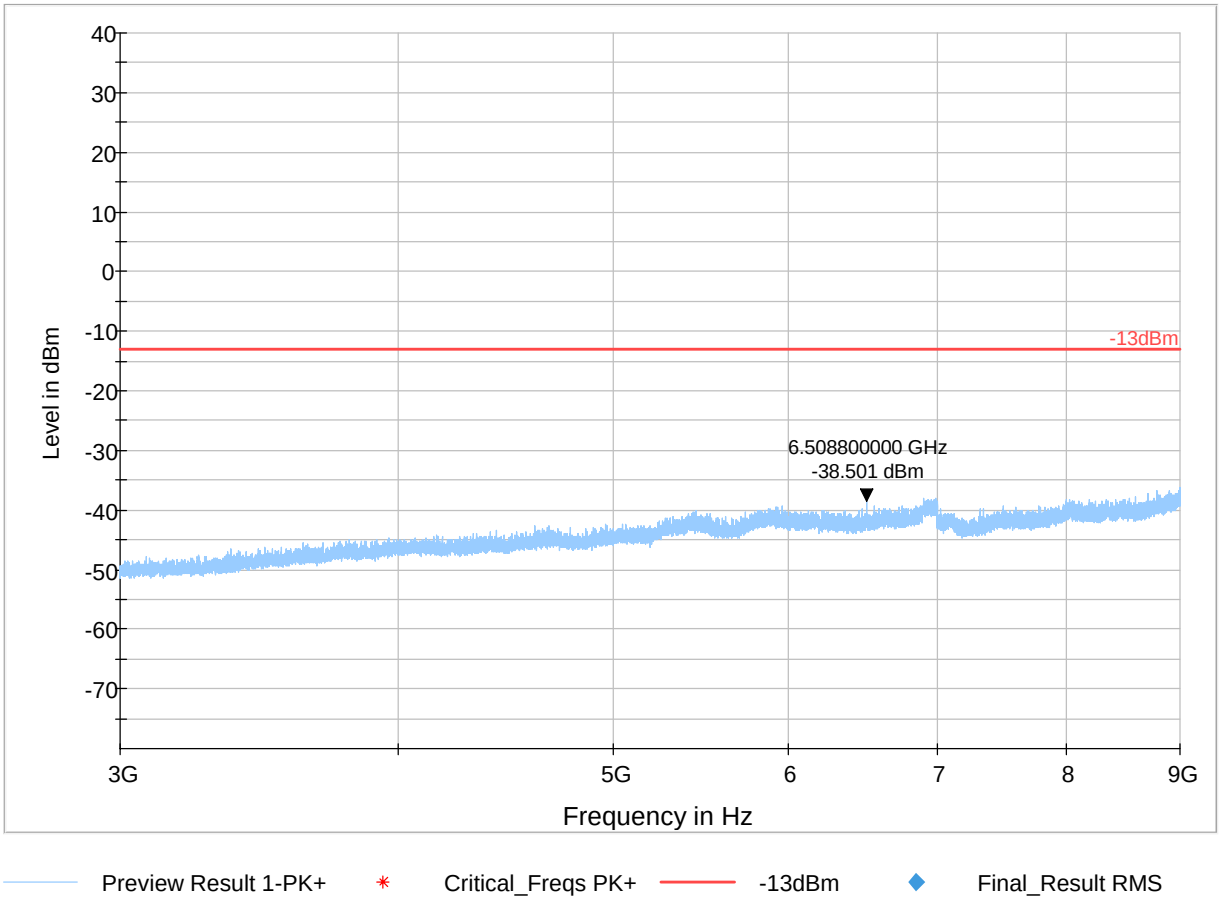
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1691.745	-38.274	-13.00	25.27	500.0	1000.000	221.0	H	112.0	-90.5	1:33:20 PM - 4/13/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 21 Radiated Emissions: 3 GHz – 9 GHz

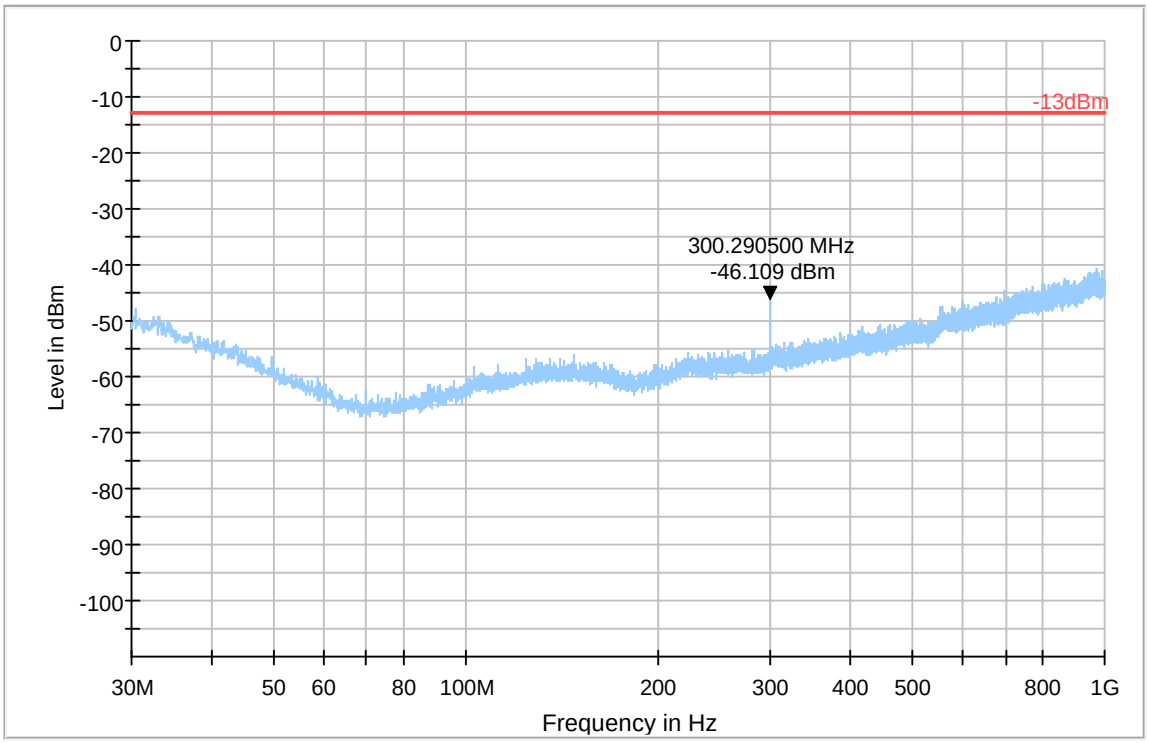
Channel: High



LTE 2

Plot # 22 Radiated Emissions: 30 MHz – 1GHz

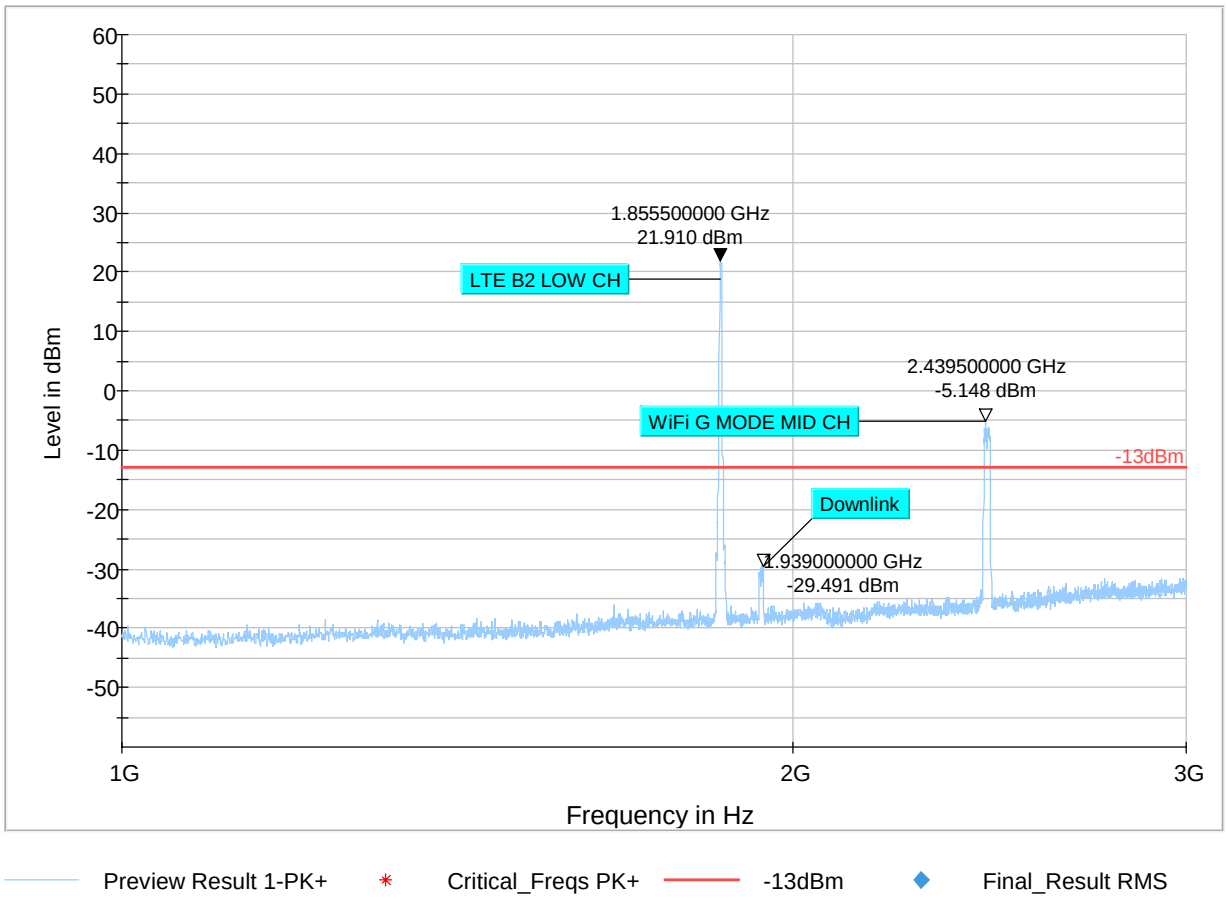
Channel: Low



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 23 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

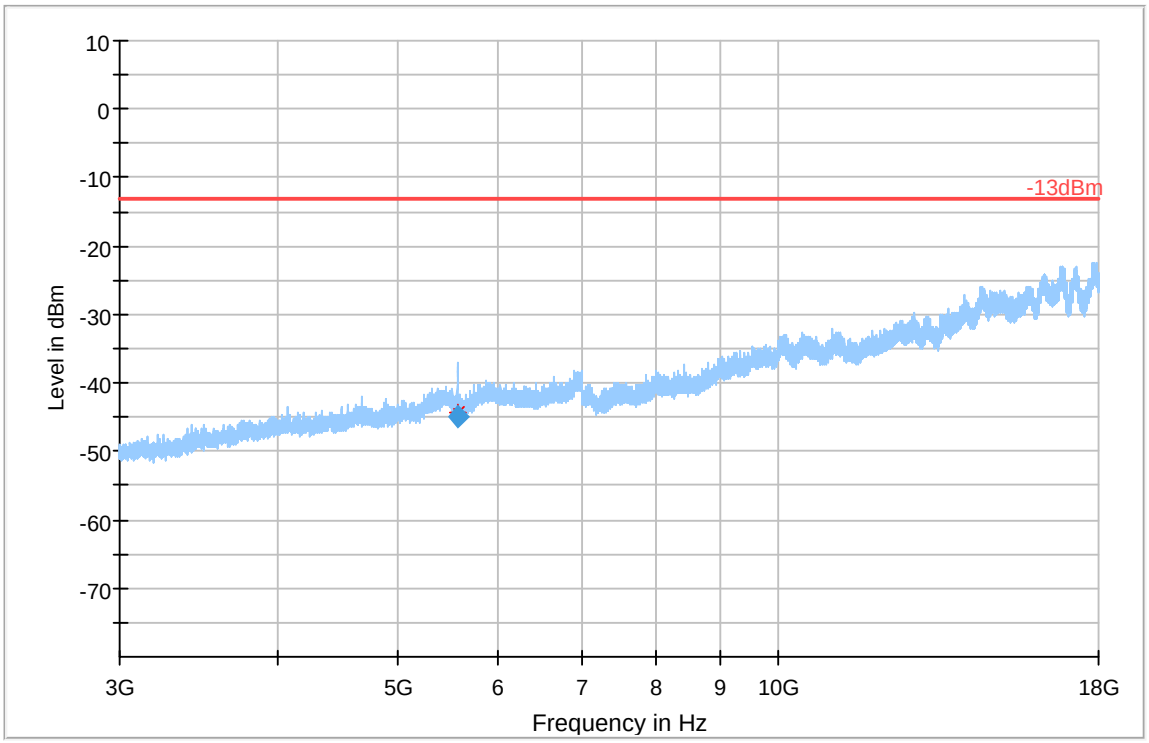


Plot # 24 Radiated Emissions: 3 GHz – 18 GHz

Channel: Low

Final_Result

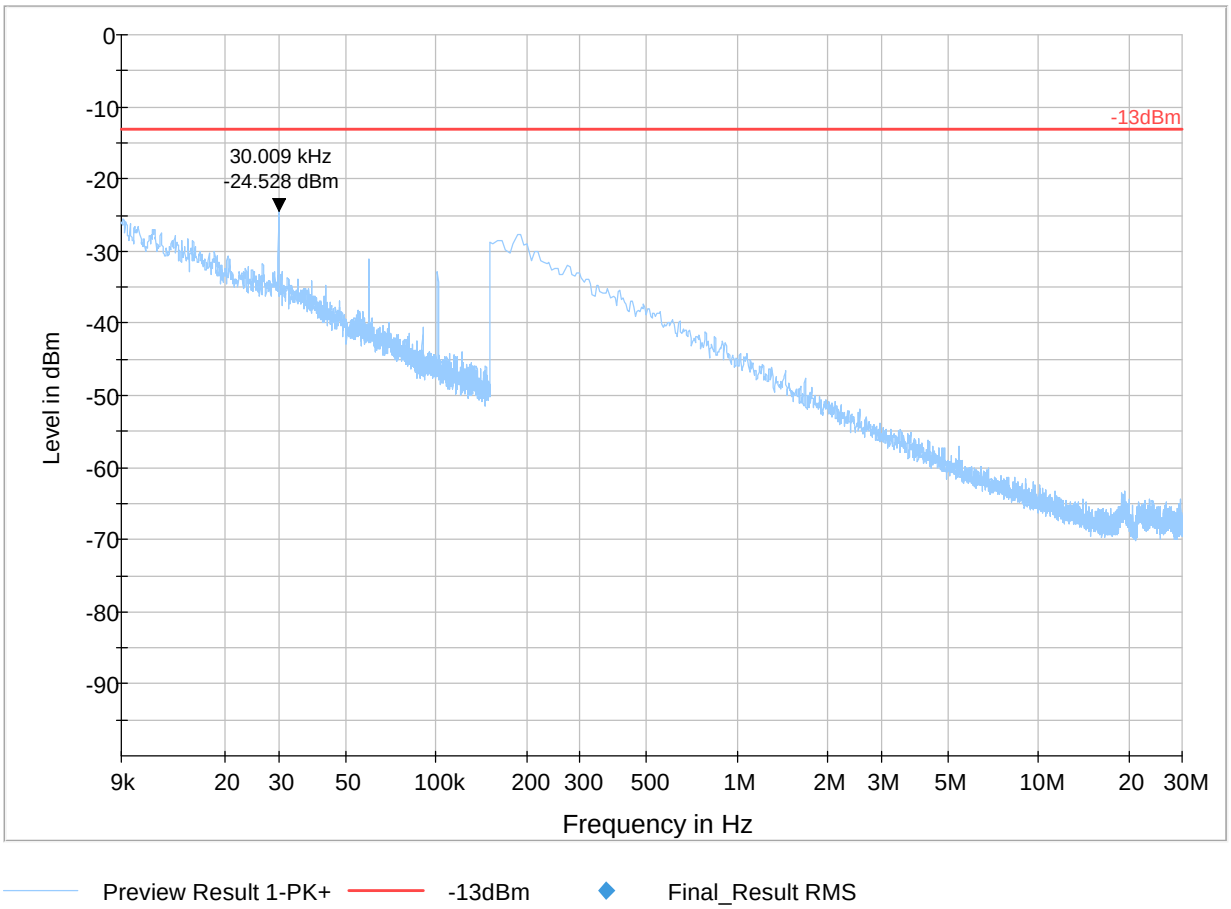
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
5565.023	-44.954	-13.00	31.95	200.0	1000.000	132.0	H	252.0	-99.2	5:13:56 PM - 3/26/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 25 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid

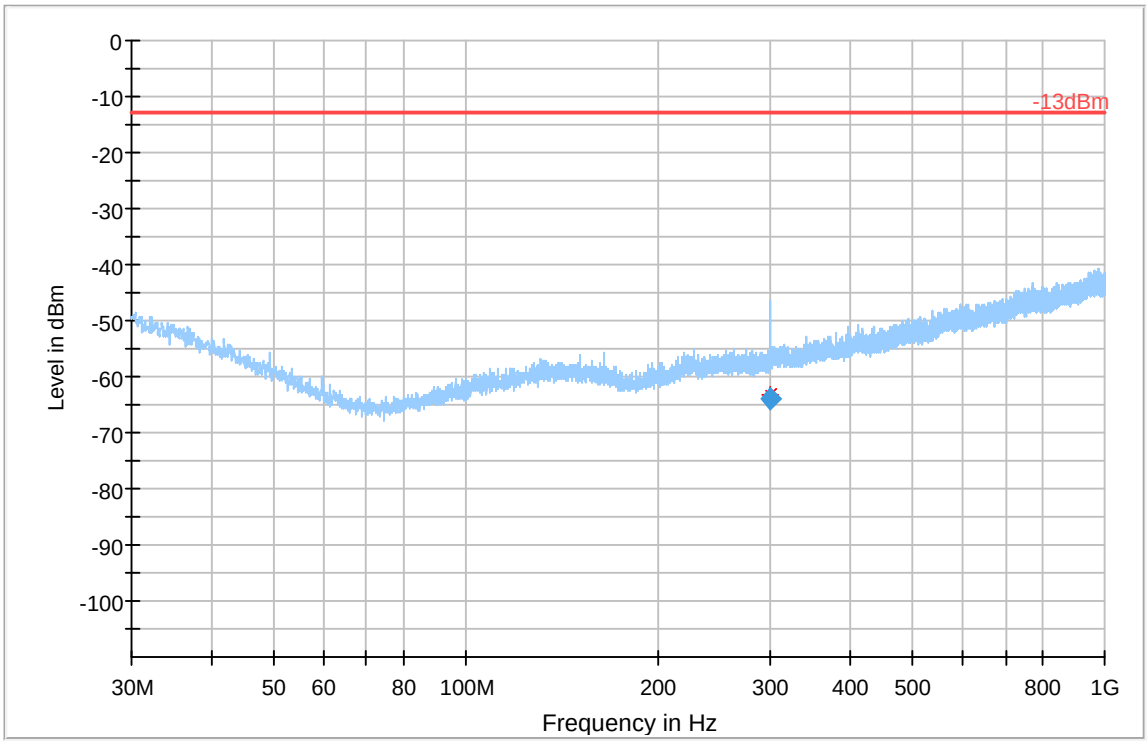


Plot # 26 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid

Final_Result

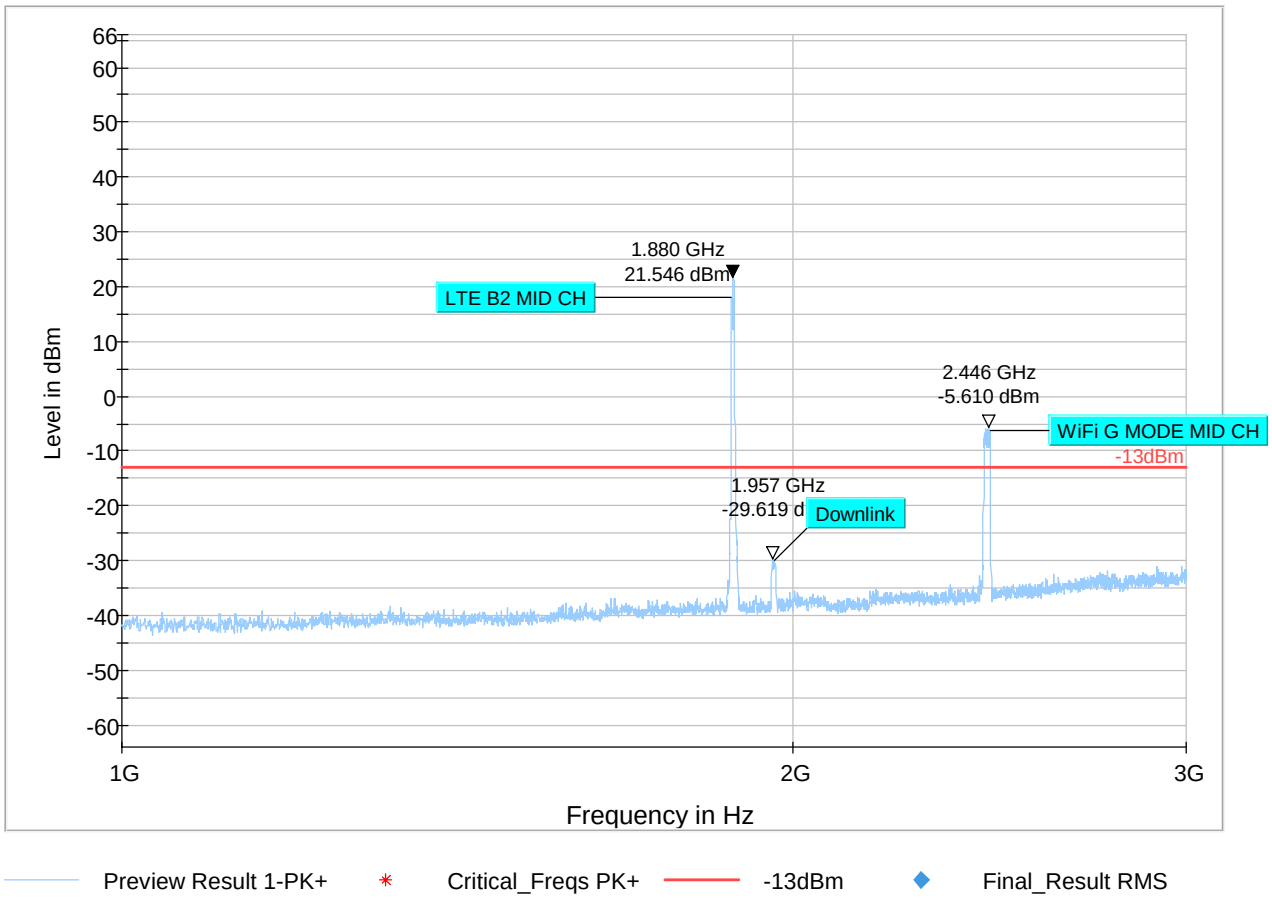
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.631	-63.954	-13.00	50.95	200.0	100.000	196.0	H	115.0	-79.3	10:50:20 AM - 4/14/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 27 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid

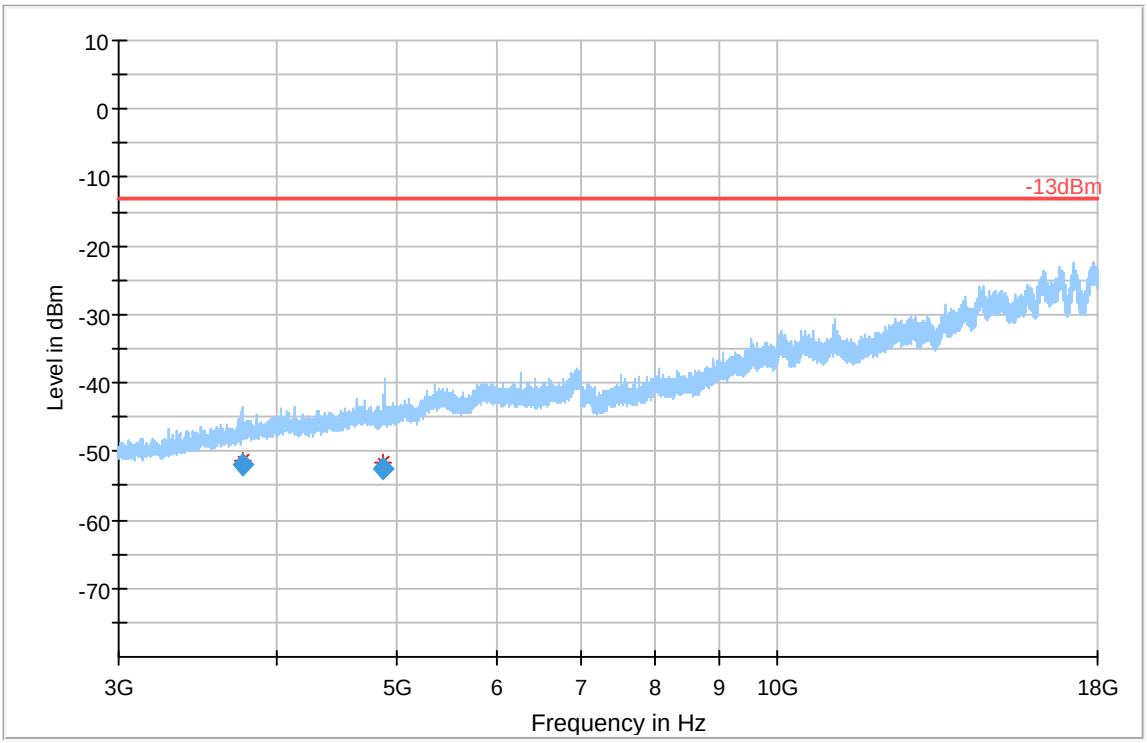


Plot # 28 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid

Final_Result

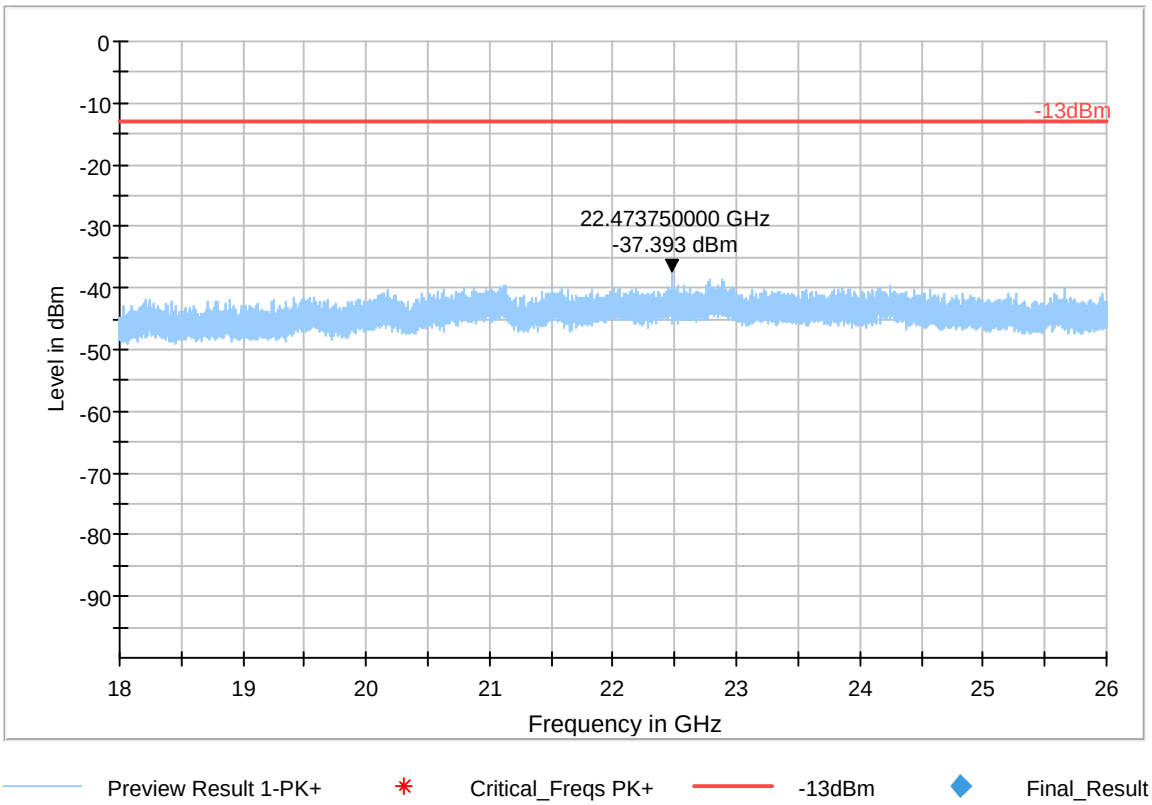
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3759.177	-51.832	-13.00	38.83	200.0	1000.000	156.0	H	310.0	-	5:00:12 PM - 3/26/2020
4874.773	-52.390	-13.00	39.39	200.0	1000.000	144.0	H	165.0	-	4:56:55 PM - 3/26/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

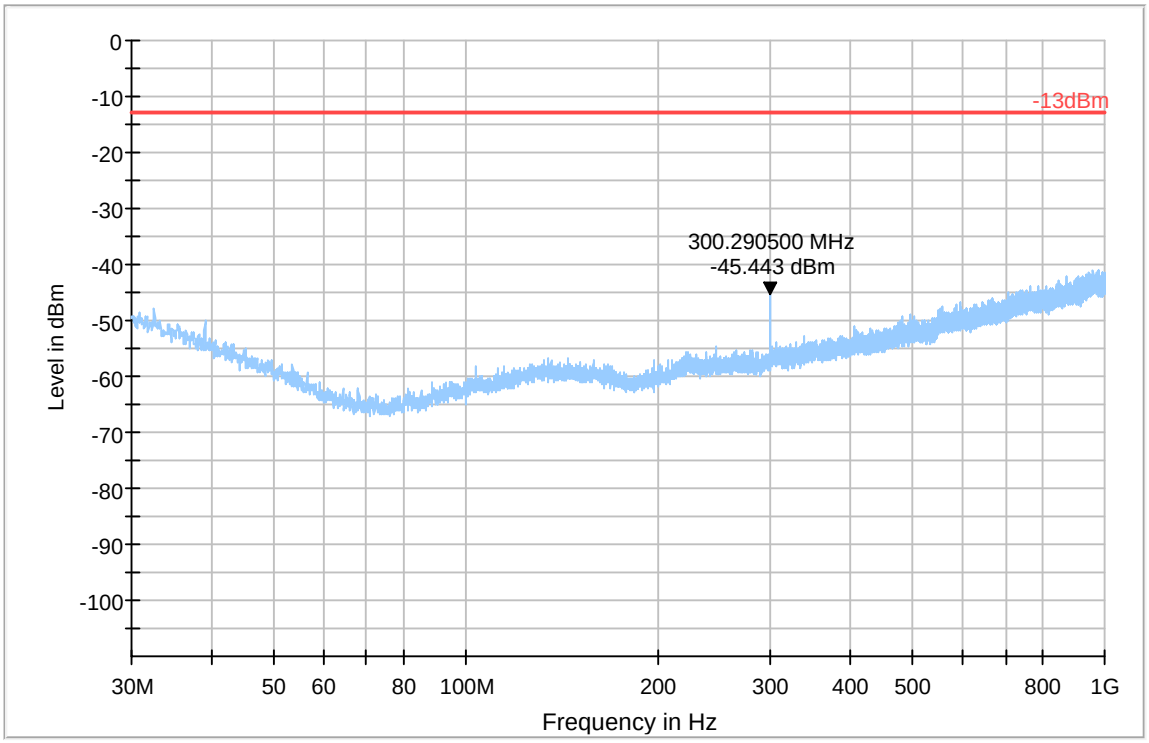
Plot # 29 Radiated Emissions: 18 GHz – 26 GHz

Channel: Mid



Plot # 30 Radiated Emissions: 30 MHz – 1GHz

Channel: High



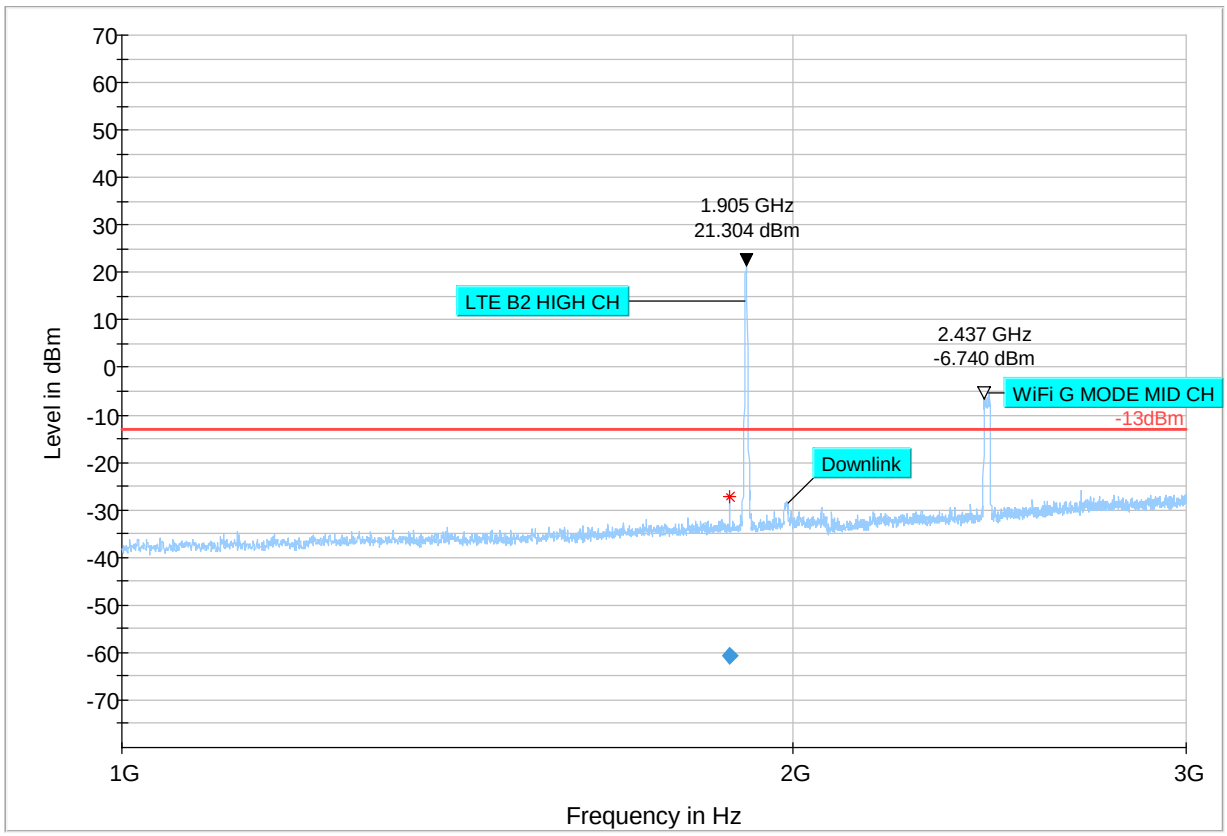
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 31 Radiated Emissions: 1 GHz - 3 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)	Comment
1873.658	-60.688	-13.00	47.69	500.0	1000.000	125.0	V	259.0	-91.0	11:51:17 AM - 4/13/2020



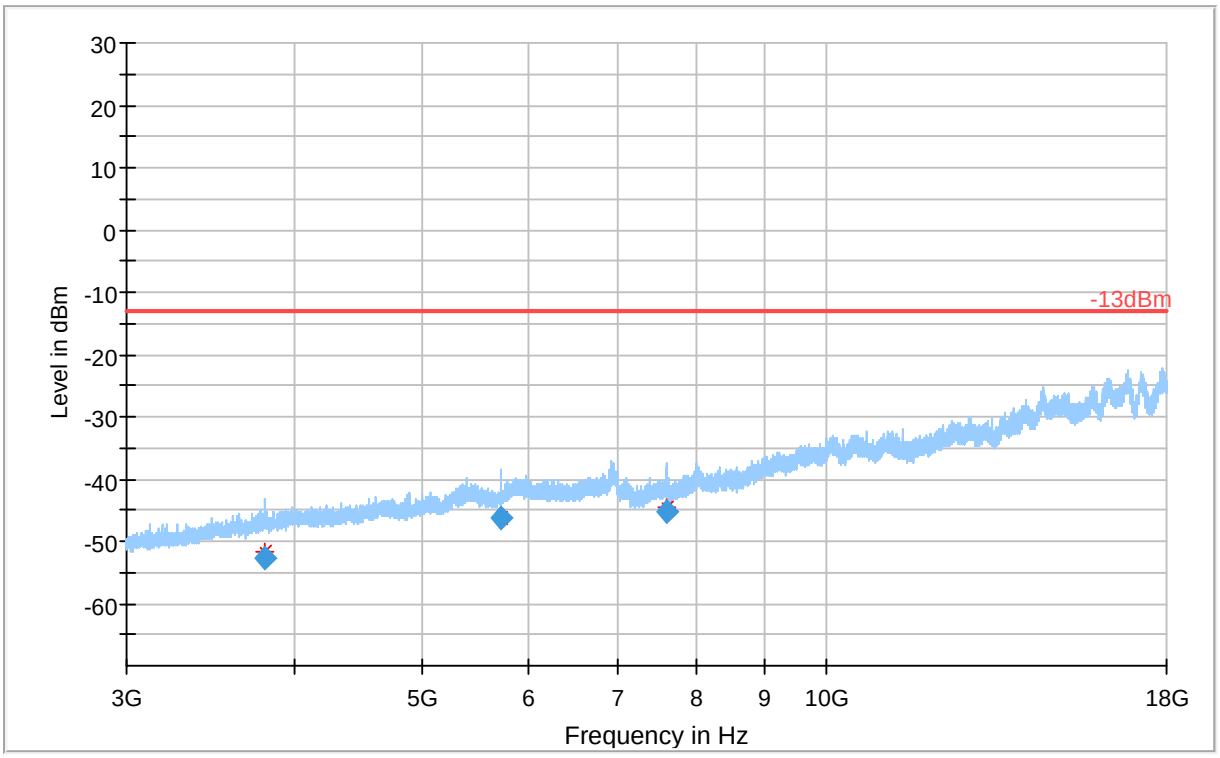
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 32 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)	Comment
3811.324	-52.564	-13.00	39.56	200.0	1000.000	144.0	H	310.0	-	5:28:09 PM - 3/26/2020
5715.261	-46.407	-13.00	33.41	200.0	1000.000	149.0	H	260.0	-99.2	5:31:16 PM - 3/26/2020
7620.085	-45.151	-13.00	32.15	200.0	1000.000	126.0	H	297.0	-97.1	5:25:02 PM - 3/26/2020



Preview Result 1-PK+ | Critical_Freqs PK+ | -13dBm
Final_Result RMS | MaxPeak-PK+ (Single) | RMS (Single)

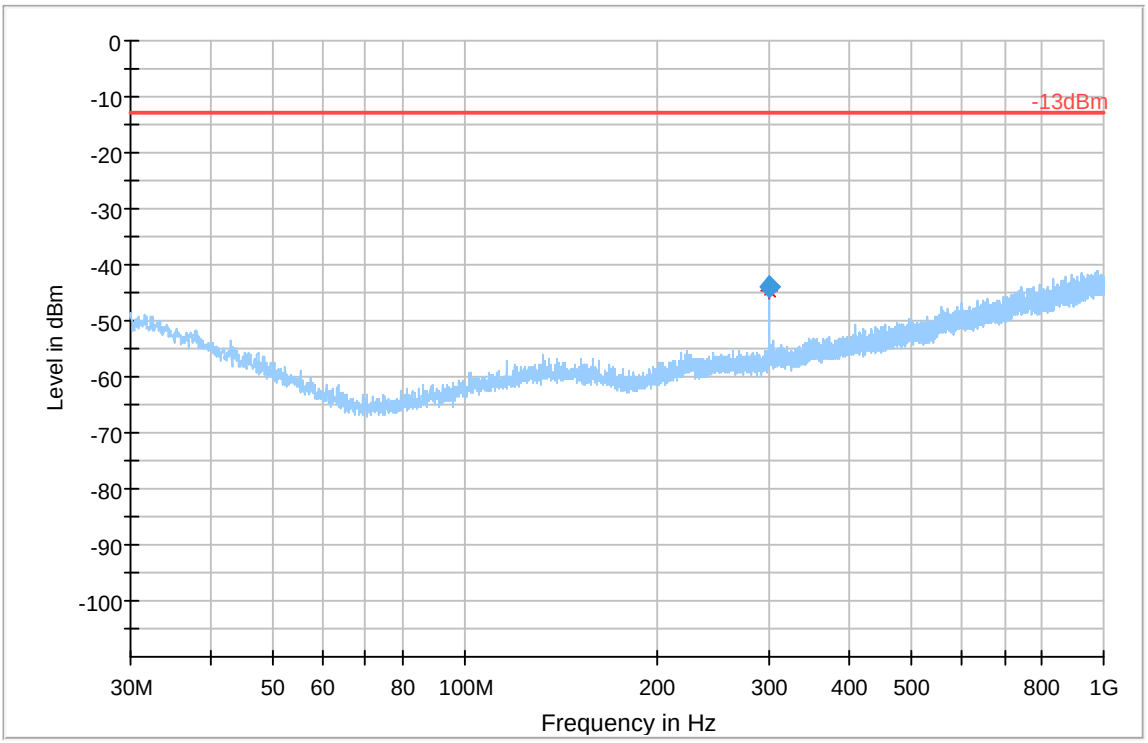
LTE 4

Plot # 33 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

Final_Result

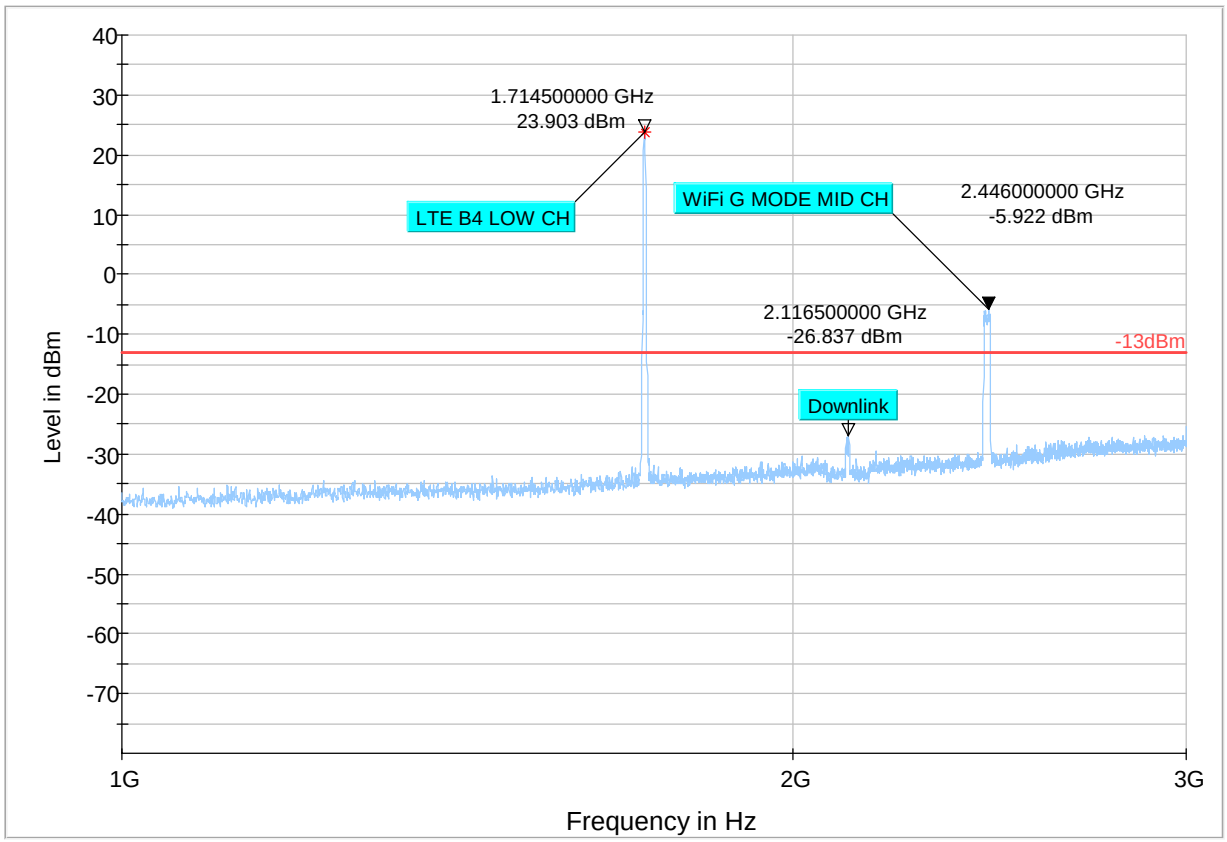
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.296	-43.968	-13.00	30.97	200.0	100.000	126.0	H	285.0	-79.4	11:41:18 AM - 4/14/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 34 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low



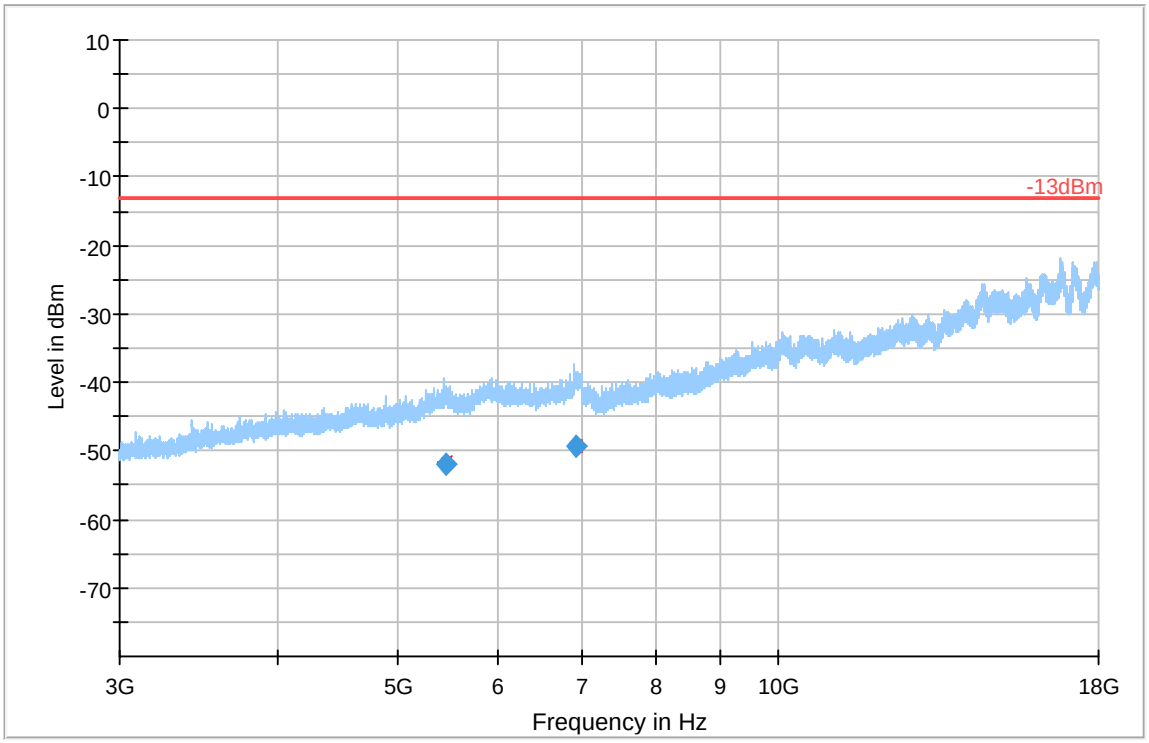
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 35 Radiated Emissions: 3 GHz – 18 GHz

Channel: Low

Final_Result

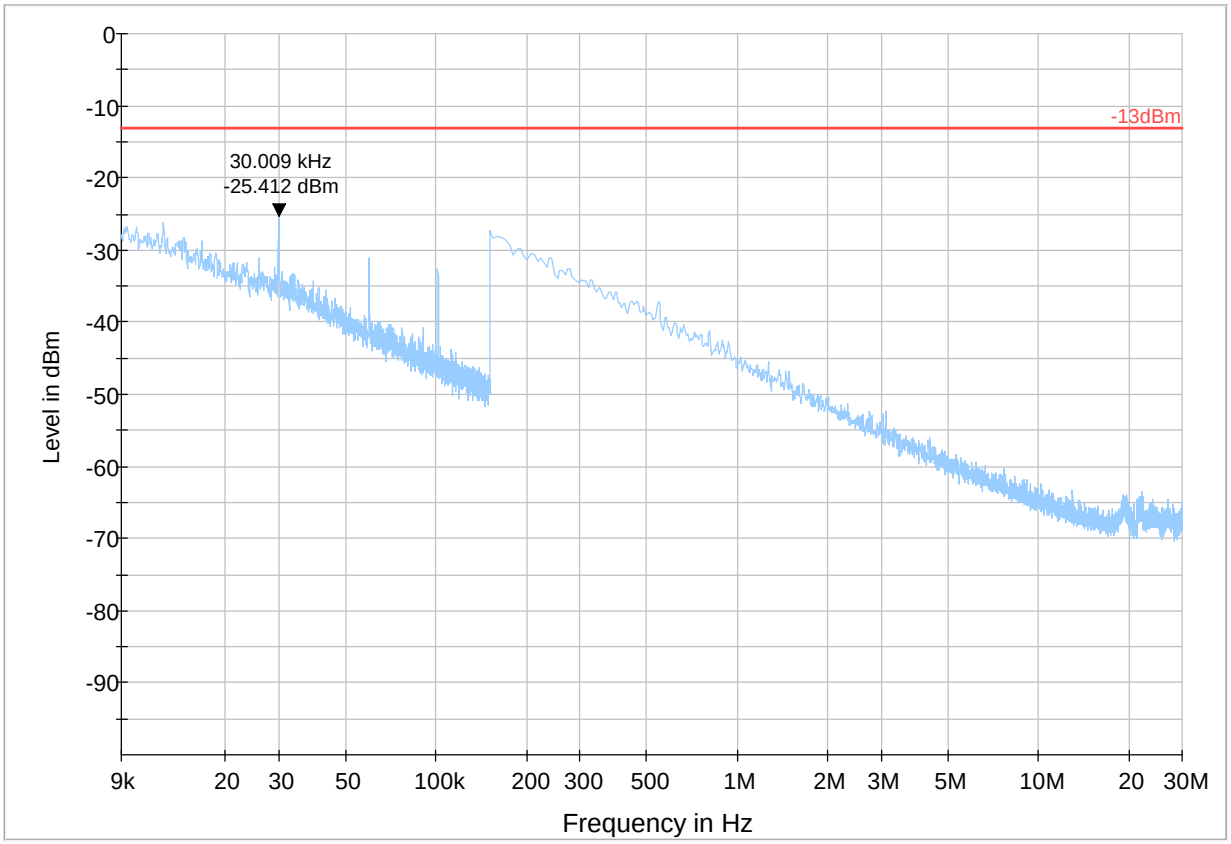
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
5441.449	-51.891	-13.00	38.89	200.0	1000.000	149.0	V	316.0	-98.7	6:04:33 PM - 3/26/2020
6906.110	-49.421	-13.00	36.42	200.0	1000.000	297.0	V	47.0	-97.5	6:01:05 PM - 3/26/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 36 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



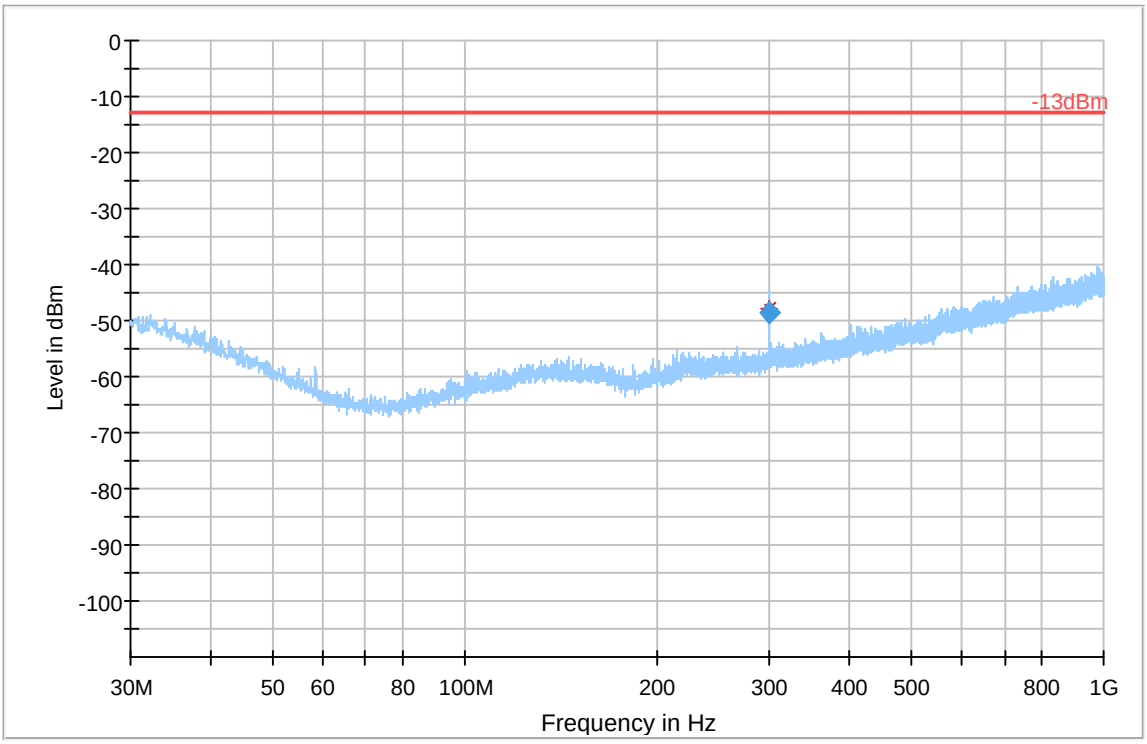
Preview Result 1-PK+ -13dBm Final_Result RMS

Plot # 37 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid

Final_Result

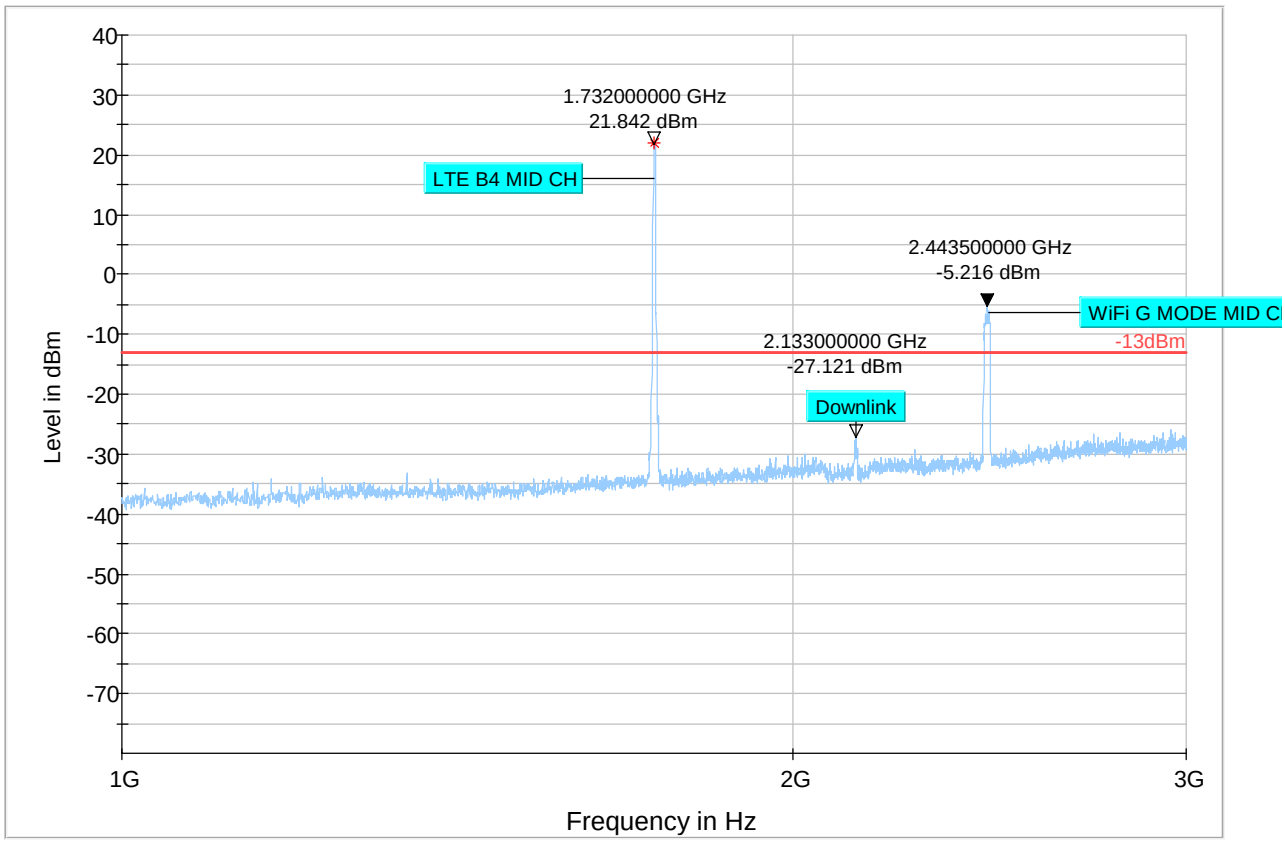
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.275	-48.415	-13.00	35.42	200.0	100.000	107.0	H	286.0	-79.4	11:30:07 AM - 4/14/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 38 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid



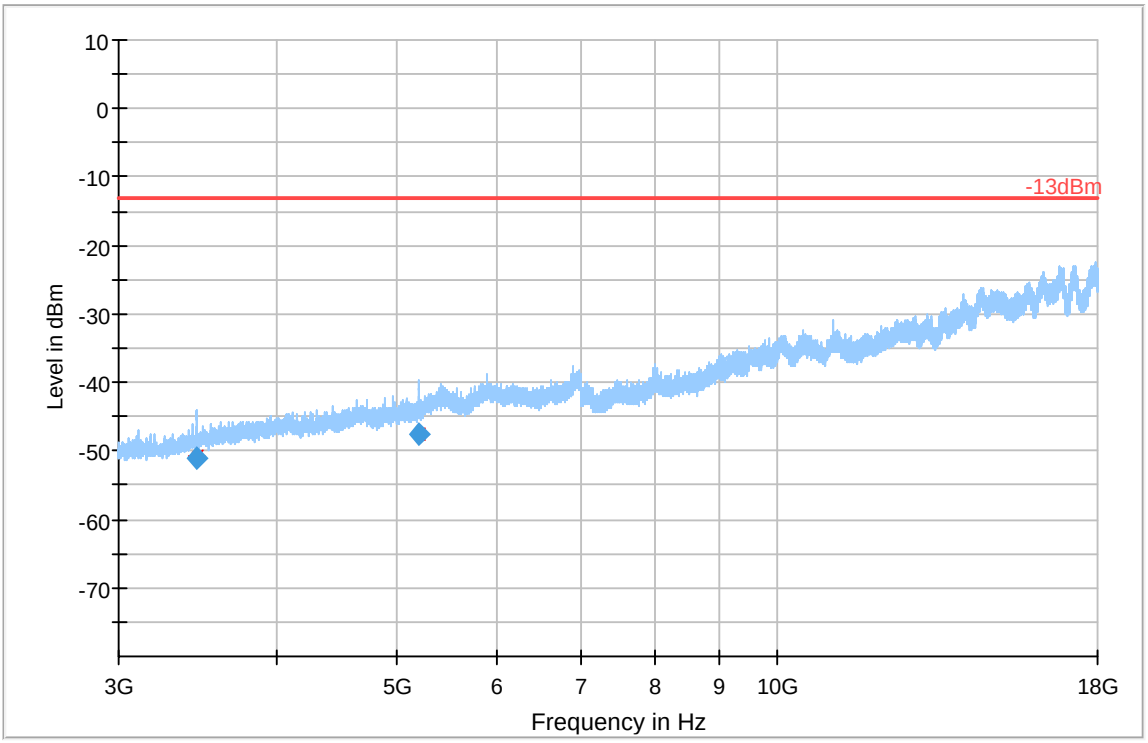
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 39 Radiated Emissions: 3 GHz – 18 GHz

Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3466.029	-51.180	-13.00	38.18	200.0	1000.000	173.0	H	326.0	-103.8	5:42:41 PM - 3/26/2020
5197.149	-47.703	-13.00	34.70	200.0	1000.000	114.0	H	326.0	-100.4	5:45:45 PM - 3/26/2020



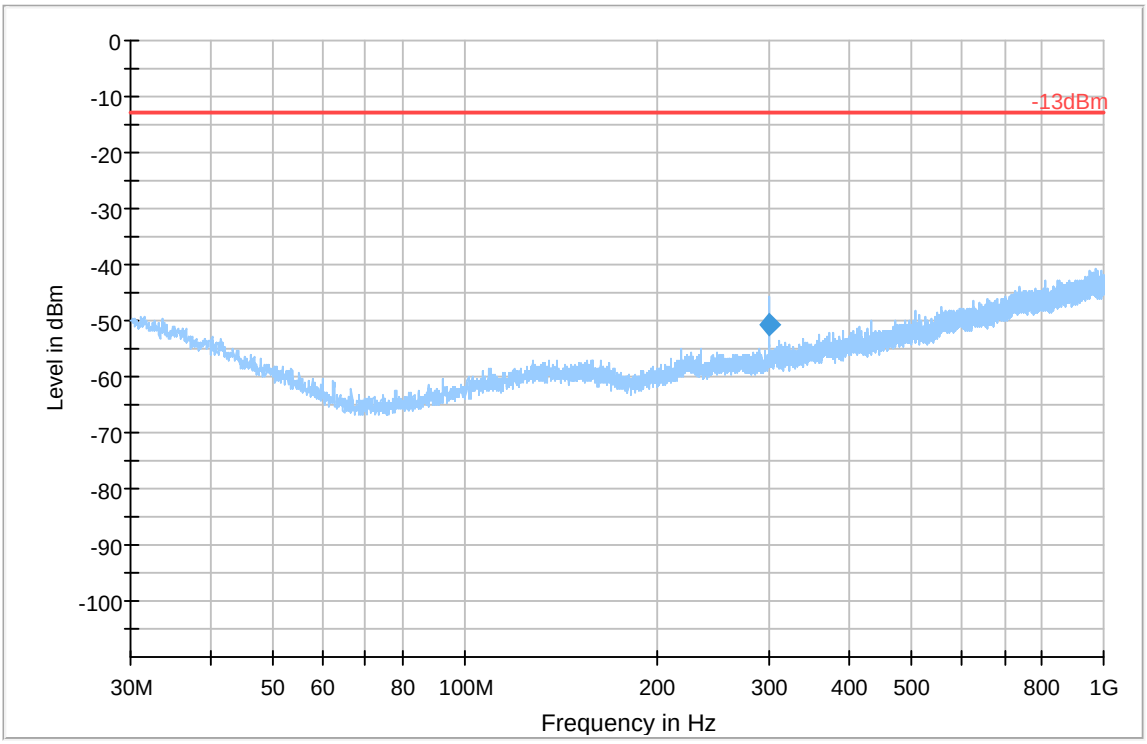
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 40 Radiated Emissions: 30 MHz – 1GHz

Channel: High

Final_Result

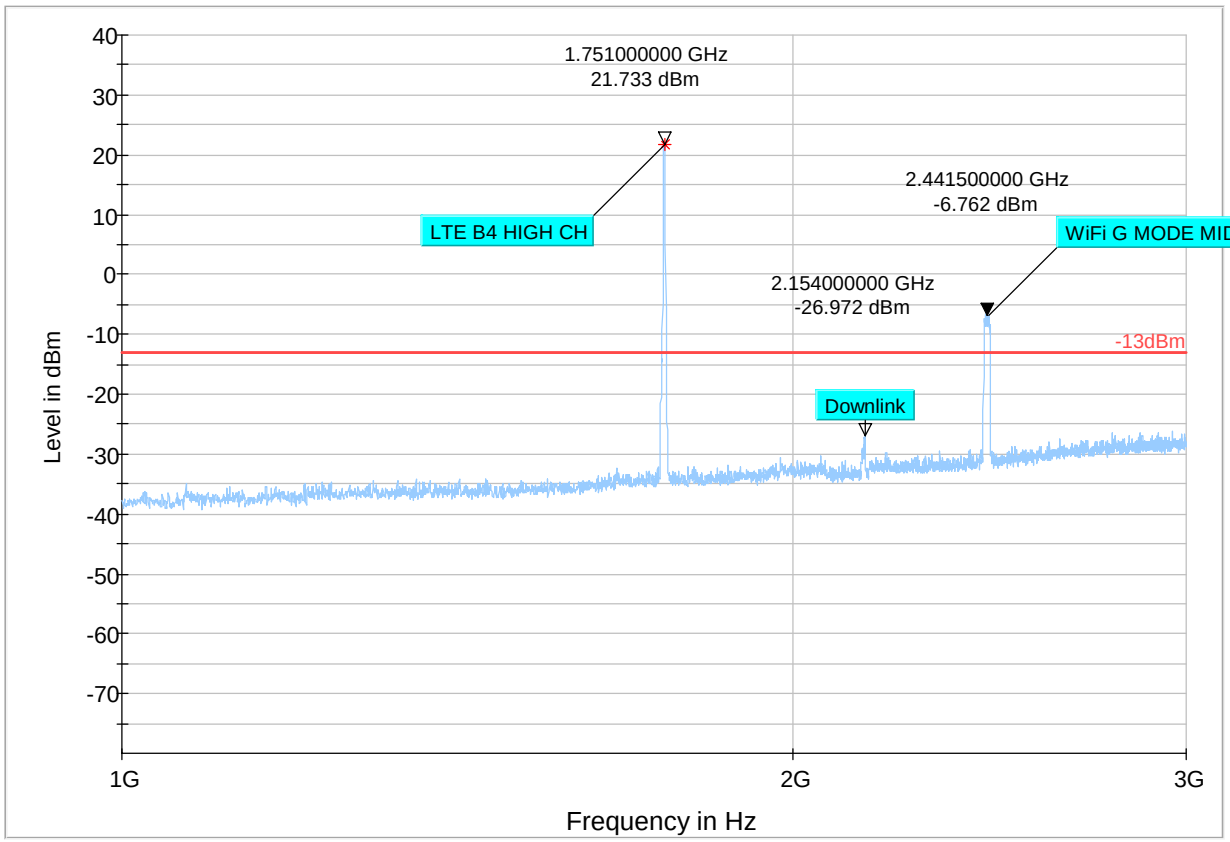
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.343	-50.635	-13.00	37.64	200.0	100.000	132.0	H	317.0	-79.4	11:19:41 AM - 4/14/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 41 Radiated Emissions: 1 GHz - 3 GHz

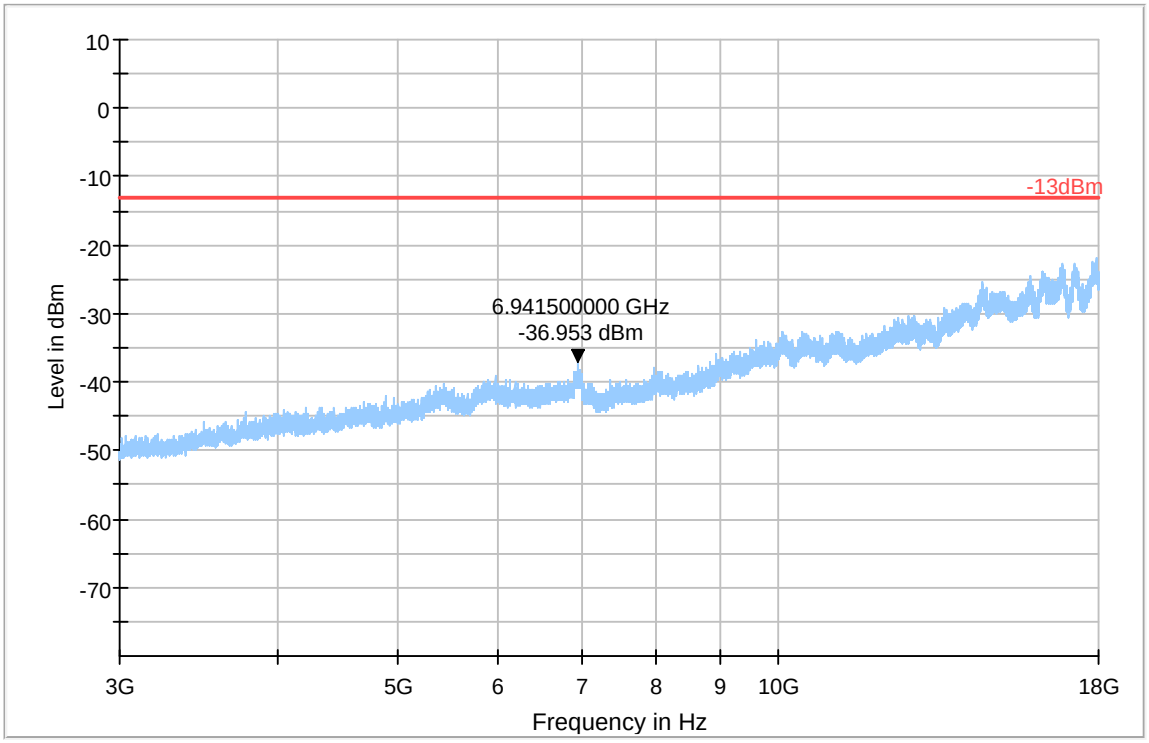
Channel: High



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 42 Radiated Emissions: 3 GHz – 18 GHz

Channel: High



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

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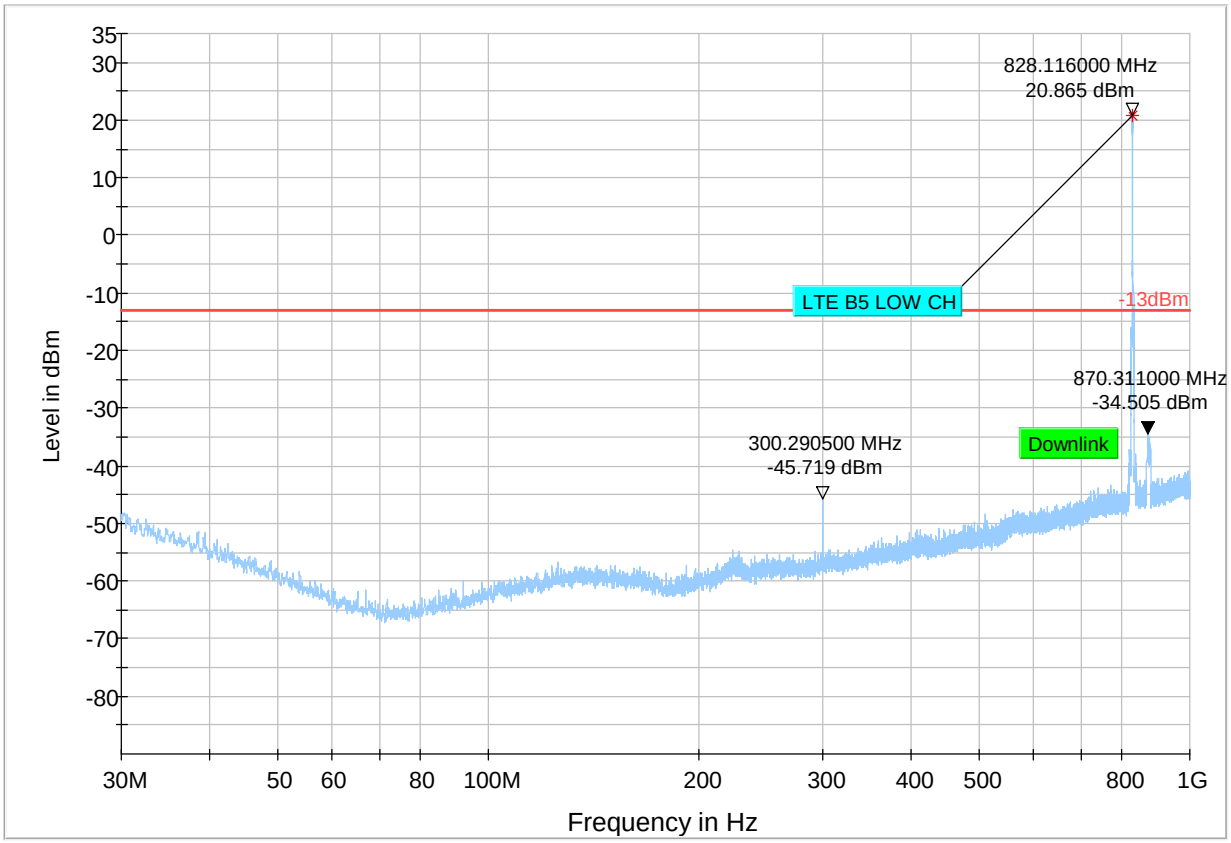
Plot # 43 Radiated Emissions: 30 MHz – 1GHz

Channel: Low



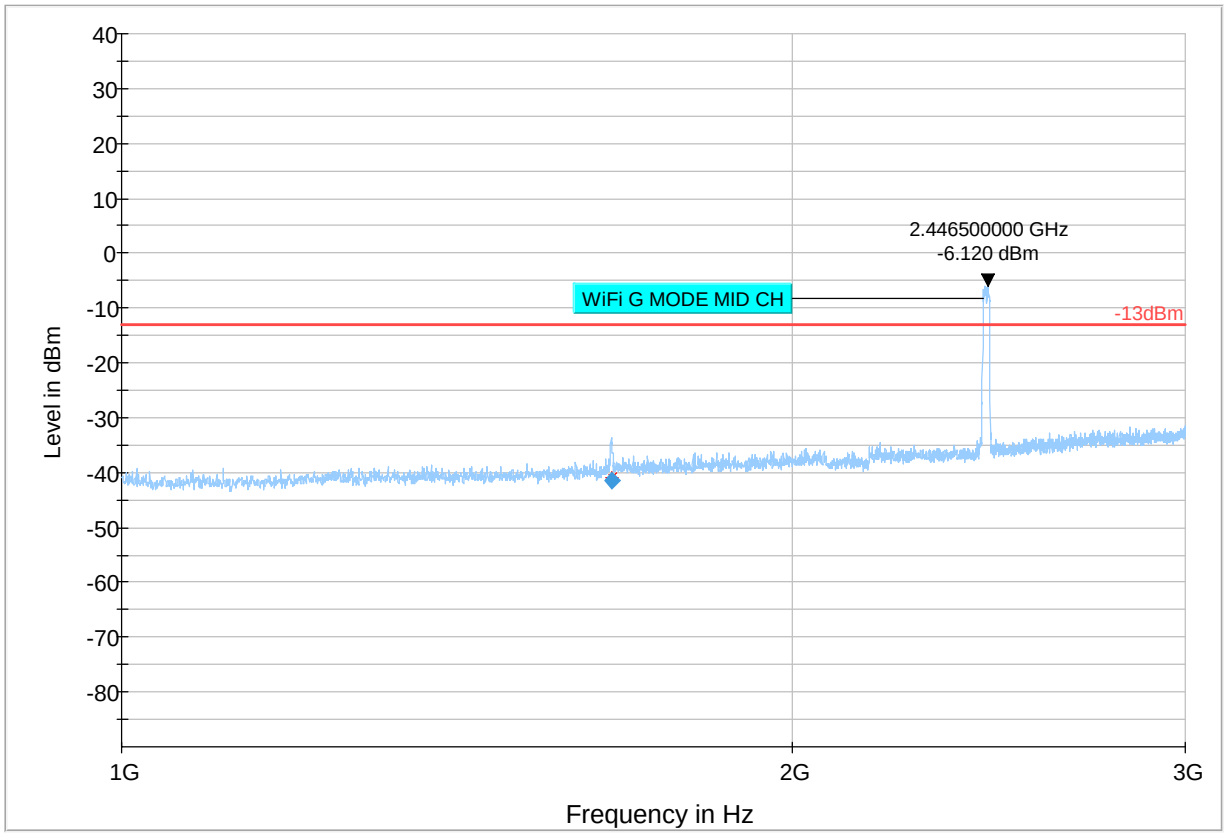
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 44 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

Final_Result

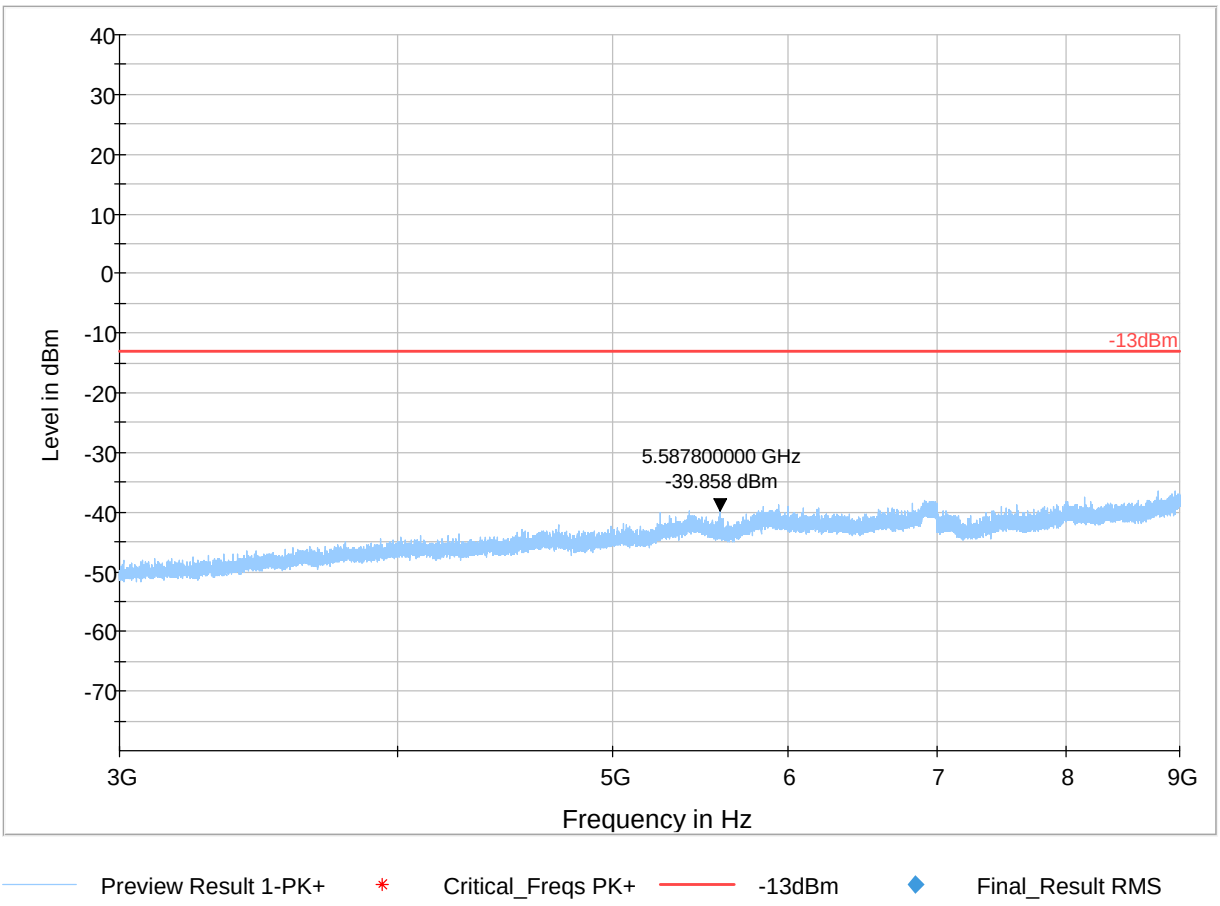
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1658.330	-41.401	-13.00	28.40	500.0	1000.000	238.0	V	118.0	-90.7	10:57:44 AM - 4/13/2020



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

Plot # 45 Radiated Emissions: 3 GHz – 9 GHz

Channel: Low

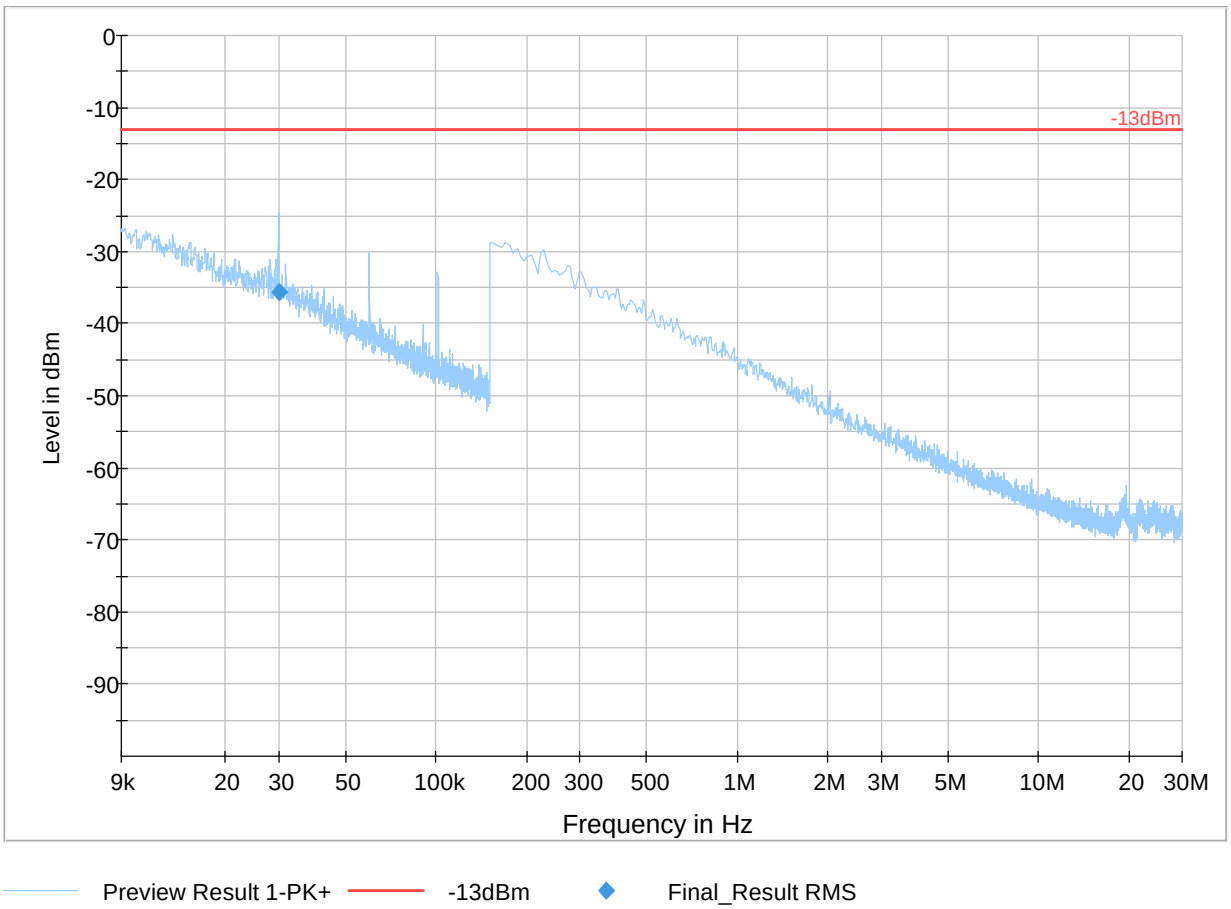


Plot # 46 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth	Corr. (dB)	Comment
0.030	-35.592	-13.00	22.59	100.0	0.100	100.0	H	64.0	-75.7	2:29:01 PM - 4/14/2020

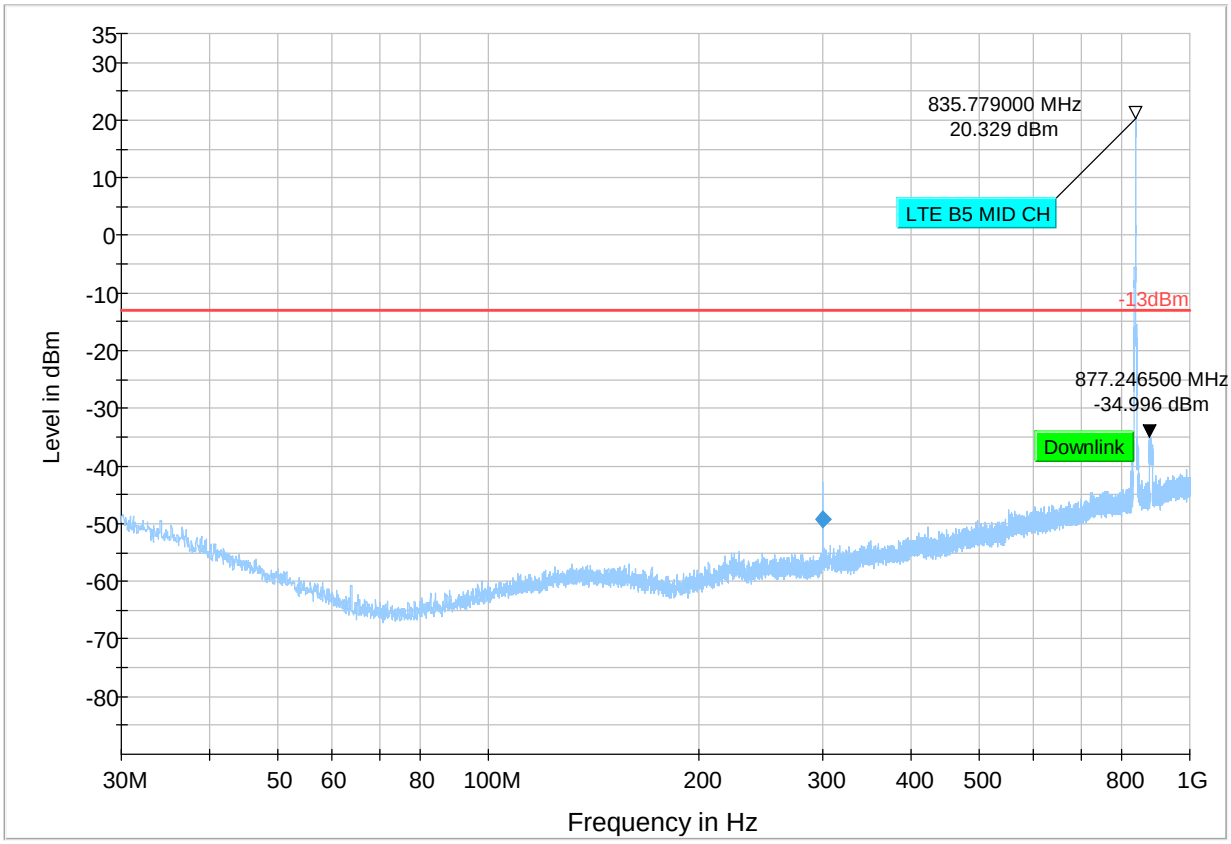


Plot # 47 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.291	-49.227	-13.00	36.23	500.0	100.000	117.0	H	280.0	-79.4	10:18:09 AM - 4/14/2020



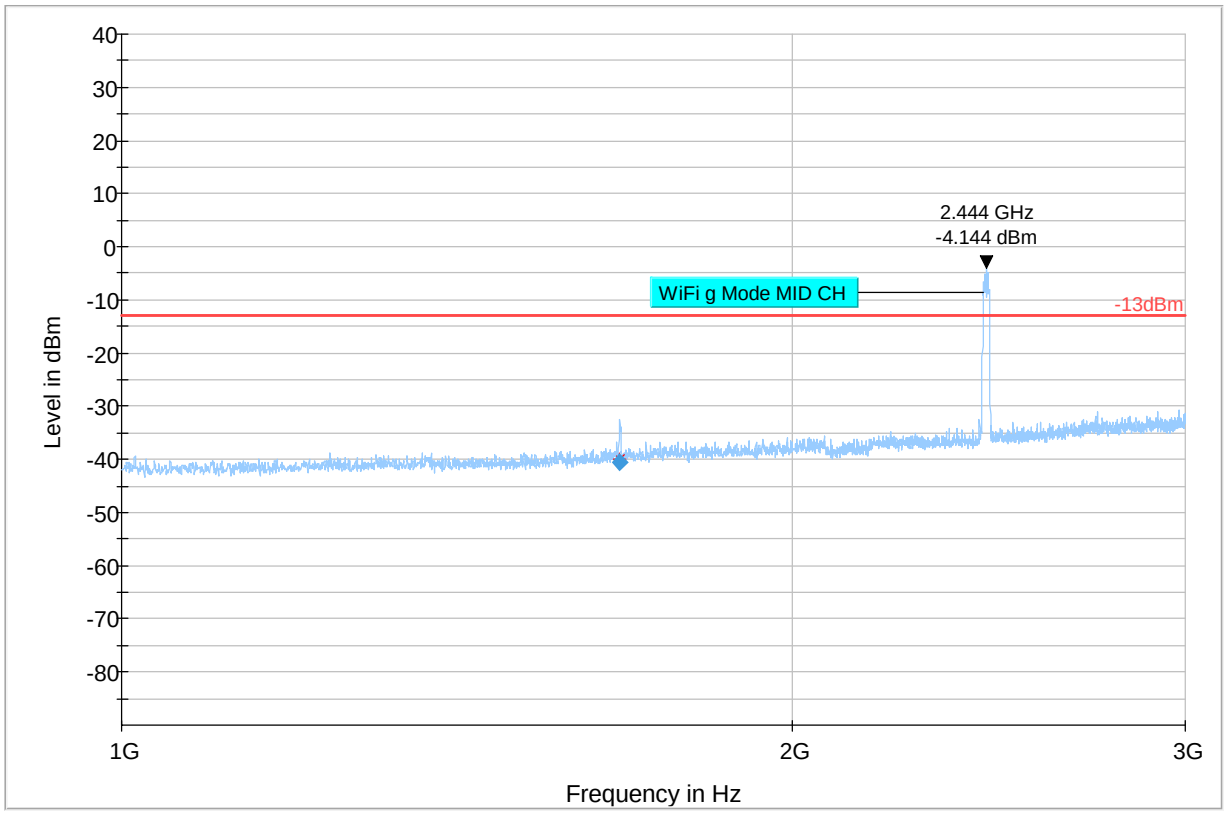
Preview Result 1-PK+ ✳ Critical_Freqs PK+ -13dBm ◆ Final_Result RMS

Plot # 48 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid

Final_Result

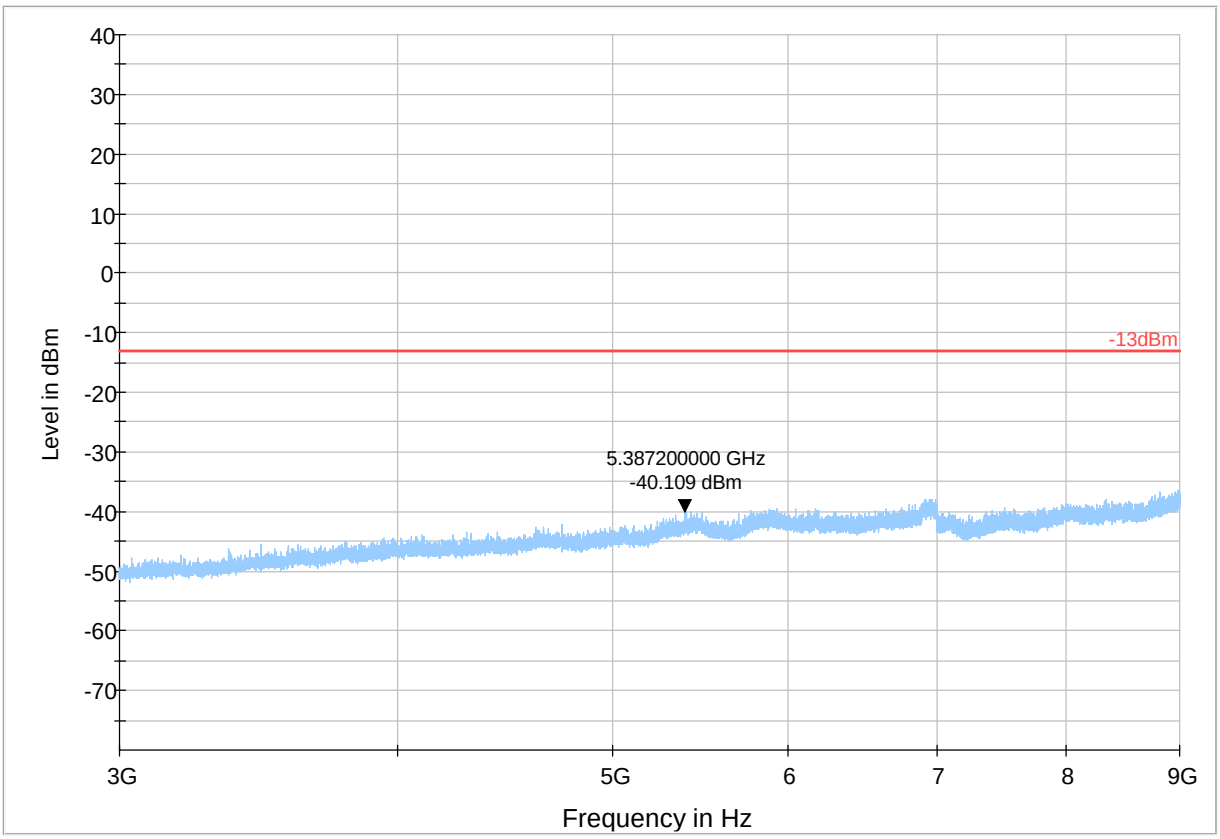
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1673.025	-40.538	-13.00	27.54	500.0	1000.000	143.0	V	128.0	-90.5	10:47:15 AM - 4/13/2020



Preview Result 1-PK+ | Critical_Freqs PK+ | -13dBm
Final_Result RMS | MaxPeak-PK+ (Single) | RMS (Single)

Plot # 49 Radiated Emissions: 3 GHz – 9 GHz

Channel: Mid



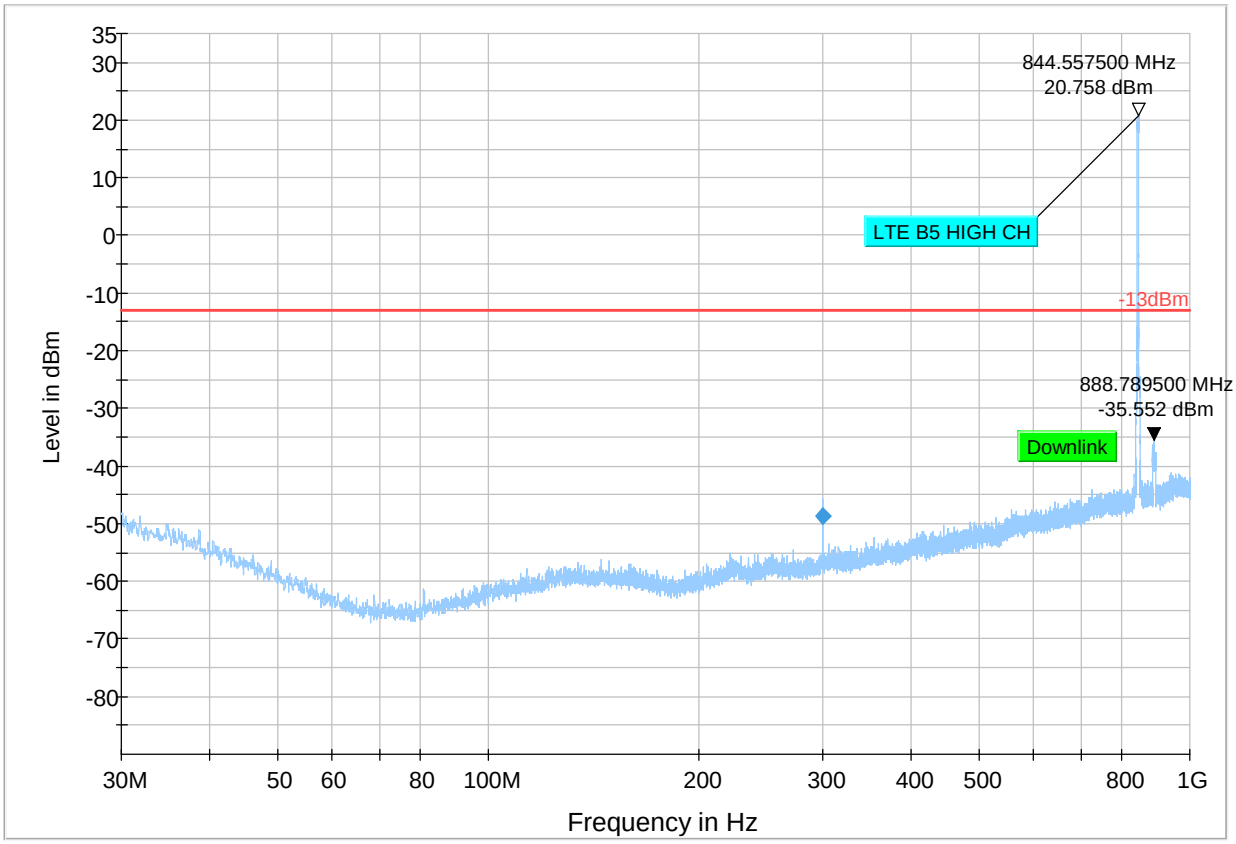
Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 50 Radiated Emissions: 30 MHz – 1GHz

Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.301	-48.703	-13.00	35.70	500.0	100.000	116.0	H	314.0	-79.4	10:40:00 AM - 4/14/2020



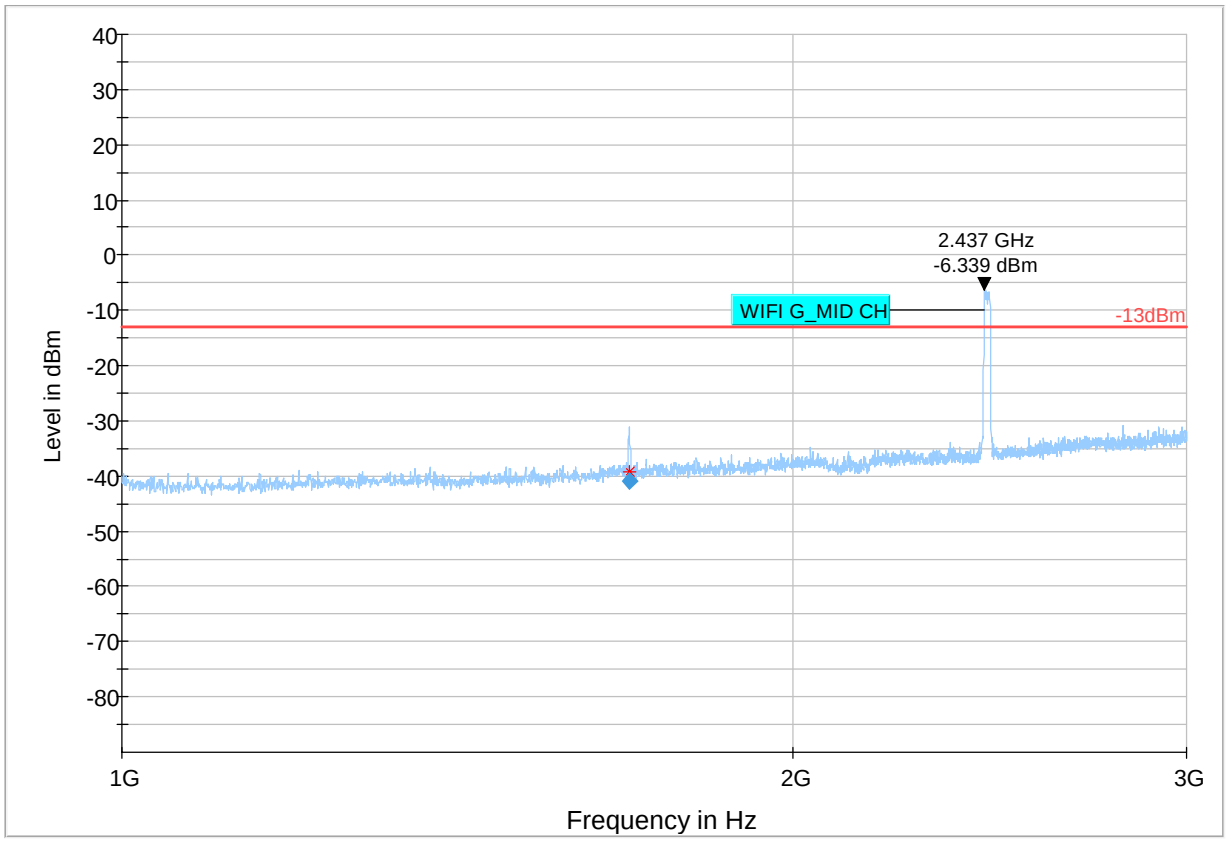
Preview Result 1-PK+ ✳ Critical_Freqs PK+ -13dBm ◆ Final_Result RMS

Plot # 51 Radiated Emissions: 1 GHz - 3 GHz

Channel: High

Final_Result

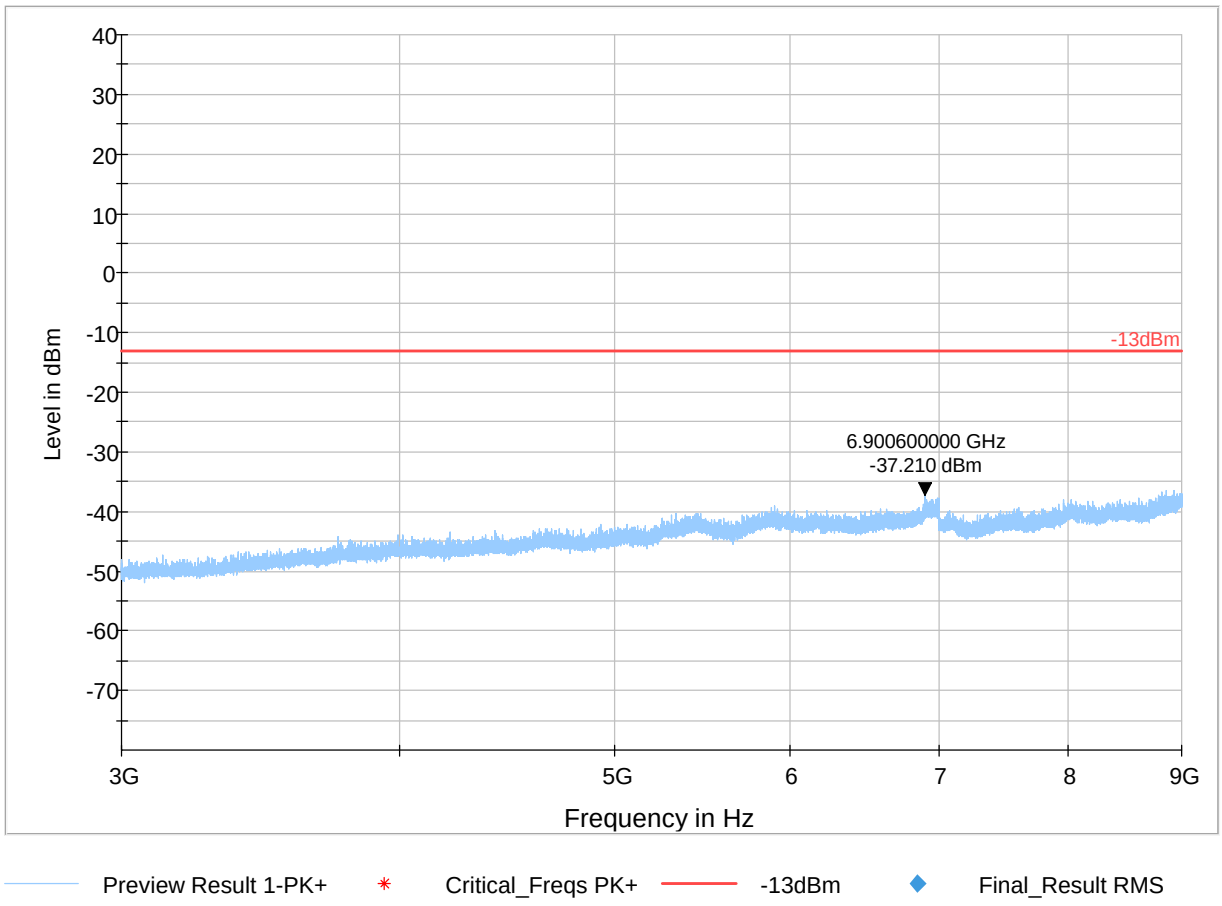
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1687.975	-40.987	-13.00	27.99	500.0	1000.000	219.0	H	112.0	-90.4	11:14:12 AM - 4/13/2020



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

Plot # 52 Radiated Emissions: 3 GHz – 9 GHz

Channel: High



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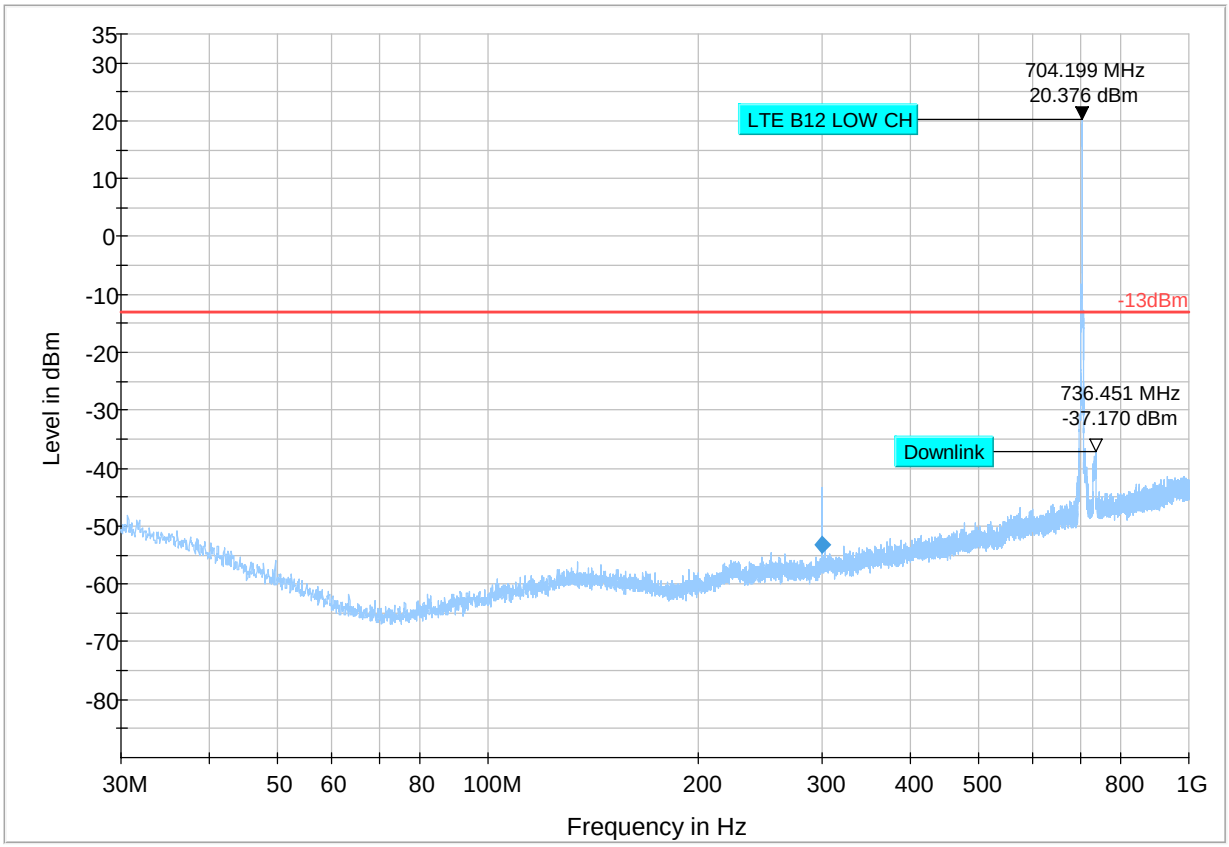
Plot # 53 Radiated Emissions: 30 MHz – 1GHz

Channel: Low

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.326	-53.148	-13.00	40.15	500.0	100.000	149.0	H	129.0	-79.4	10:07:27 AM - 4/14/2020



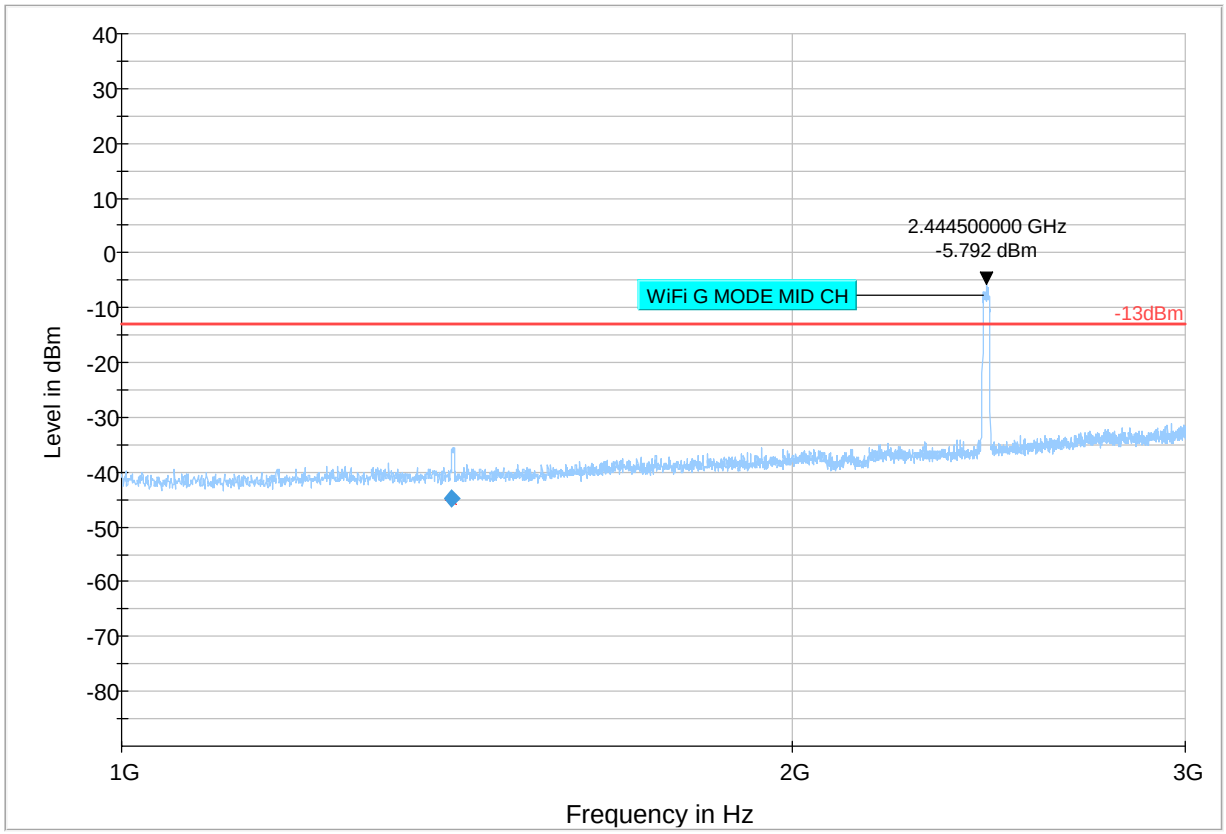
Preview Result 1-PK+ ✳ Critical_Freqs PK+ -13dBm ◆ Final_Result RMS

Plot # 54 Radiated Emissions: 1 GHz - 3 GHz

Channel: Low

Final_Result

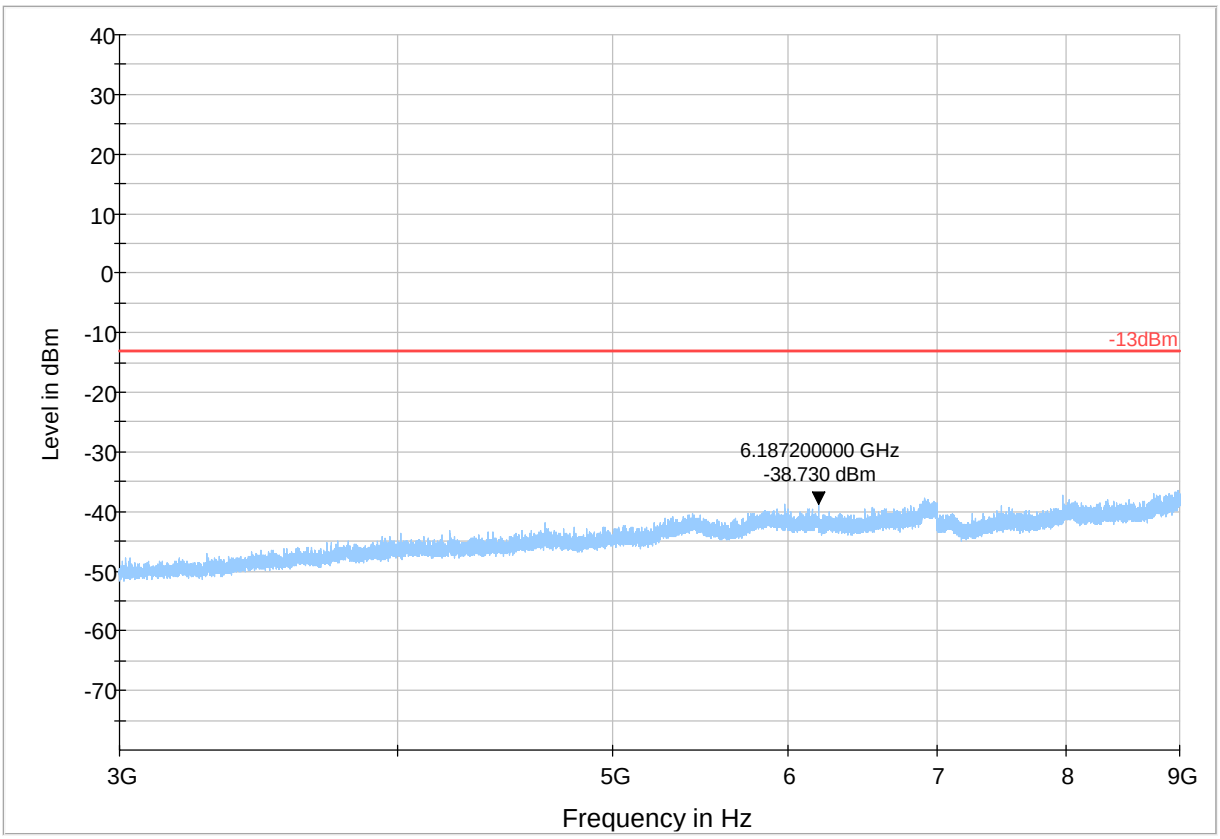
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1406.405	-44.897	-13.00	31.90	500.0	1000.000	153.0	H	150.0	-92.3	10:26:31 AM - 4/13/2020



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

Plot # 55 Radiated Emissions: 3 GHz – 9 GHz

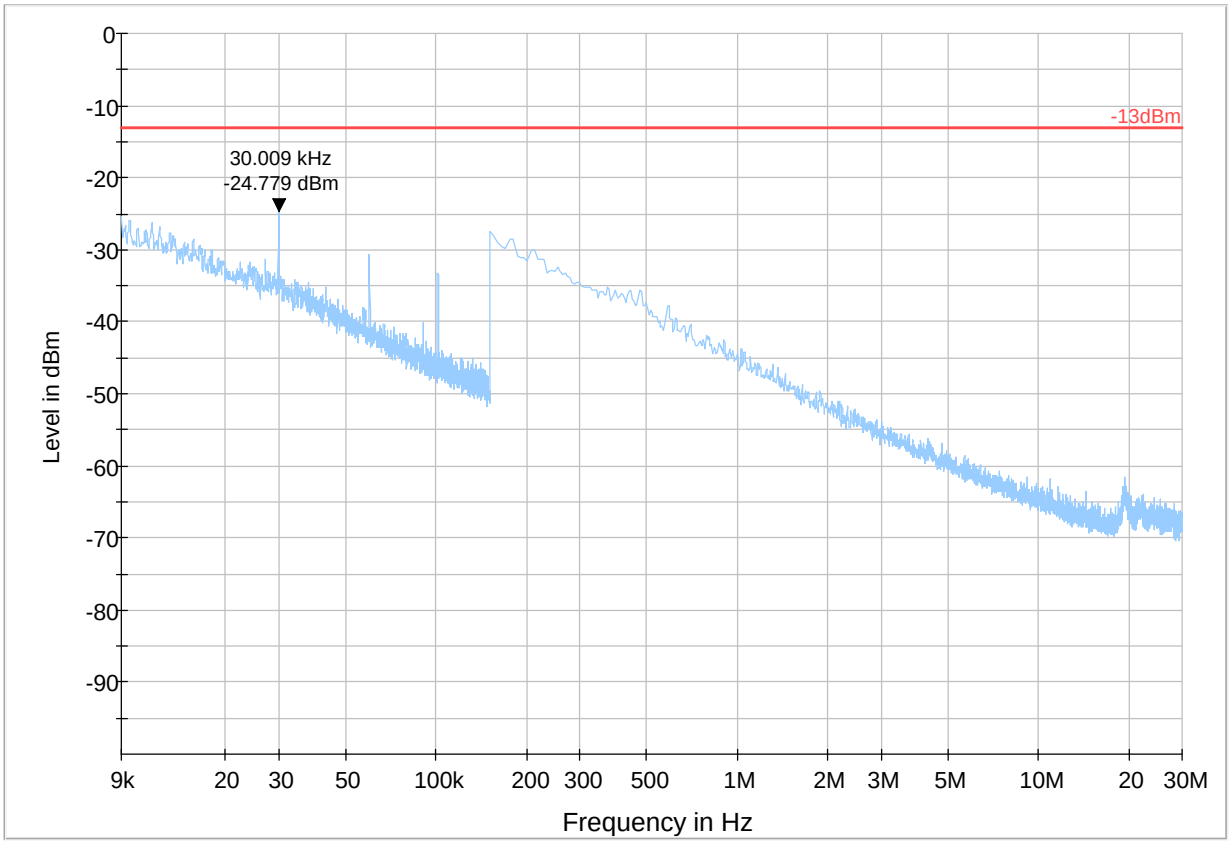
Channel: Low



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 56 Radiated Emissions: 9 kHz - 30 MHz

Channel: Mid



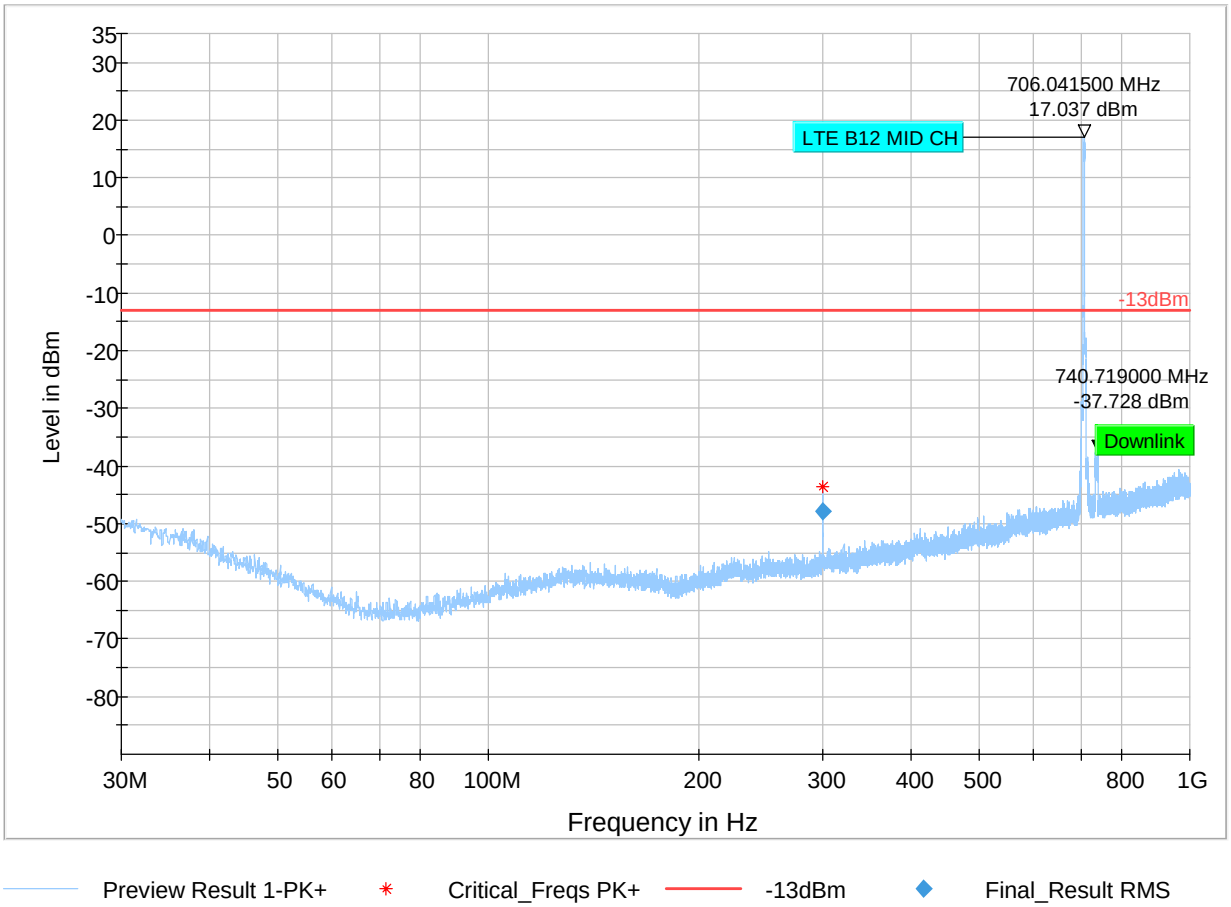
Preview Result 1-PK+ -13dBm Final_Result RMS

Plot # 57 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)	Comment
300.282	-47.783	-13.00	34.78	500.0	100.000	133.0	H	257.0	-79.4	4:49:54 PM - 4/13/2020



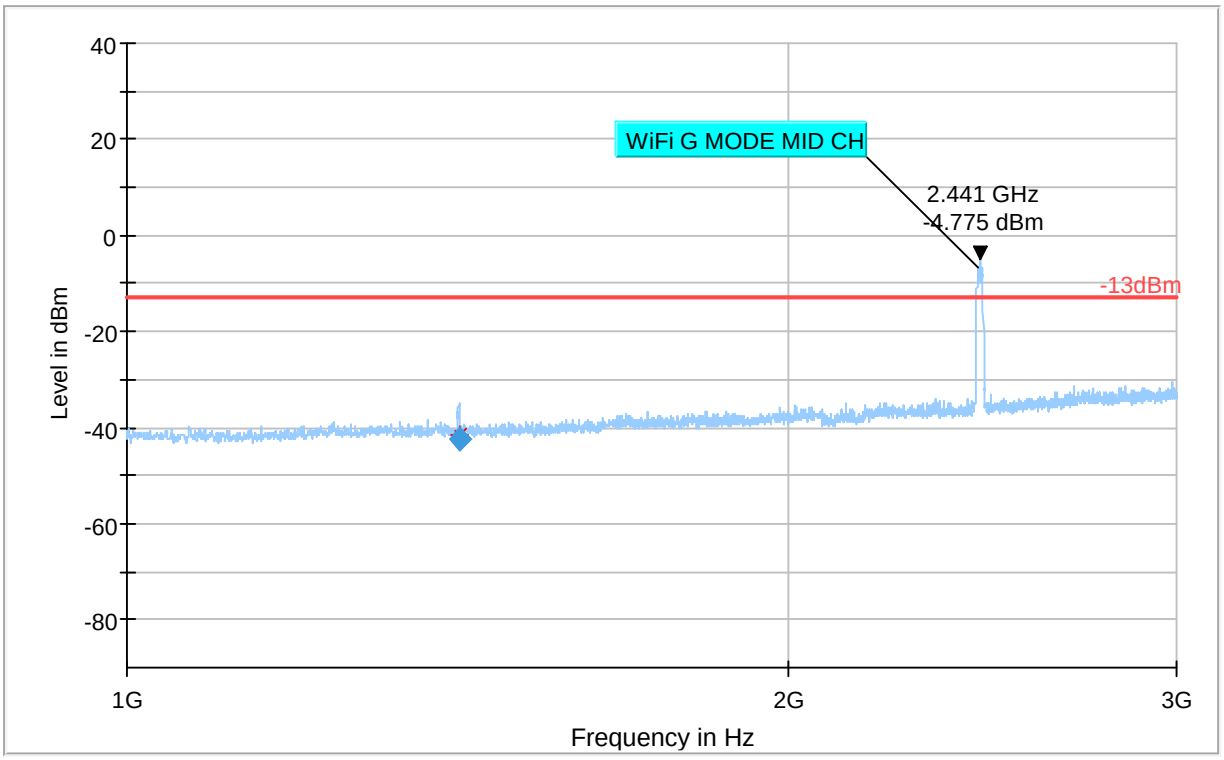
Plot # 58 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1416.465	-42.323	-13.00	29.32	500.0	1000.000	120.0	H	124.0	-92.2	10:16:29 AM - 4/13/2020

vv



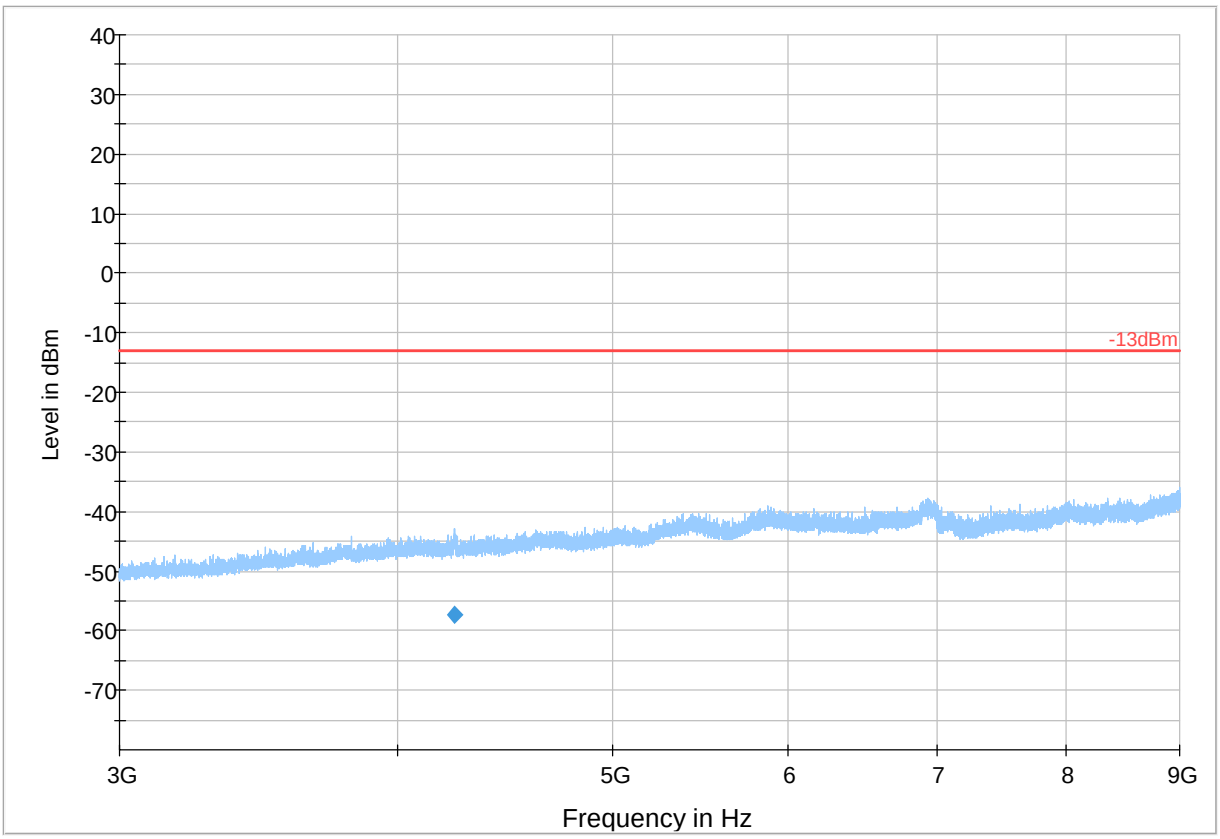
Preview Result 1-PK+ | Critical_Freqs PK+ | -13dBm
Final_Result RMS | MaxPeak-PK+ (Single) | RMS (Single)

Plot # 59 Radiated Emissions: 3 GHz – 9 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)	Comment
4241.840	-57.230	-13.00	44.23	500.0	1000.000	158.0	V	3.0	-101.9	2:37:28 PM - 4/13/2020



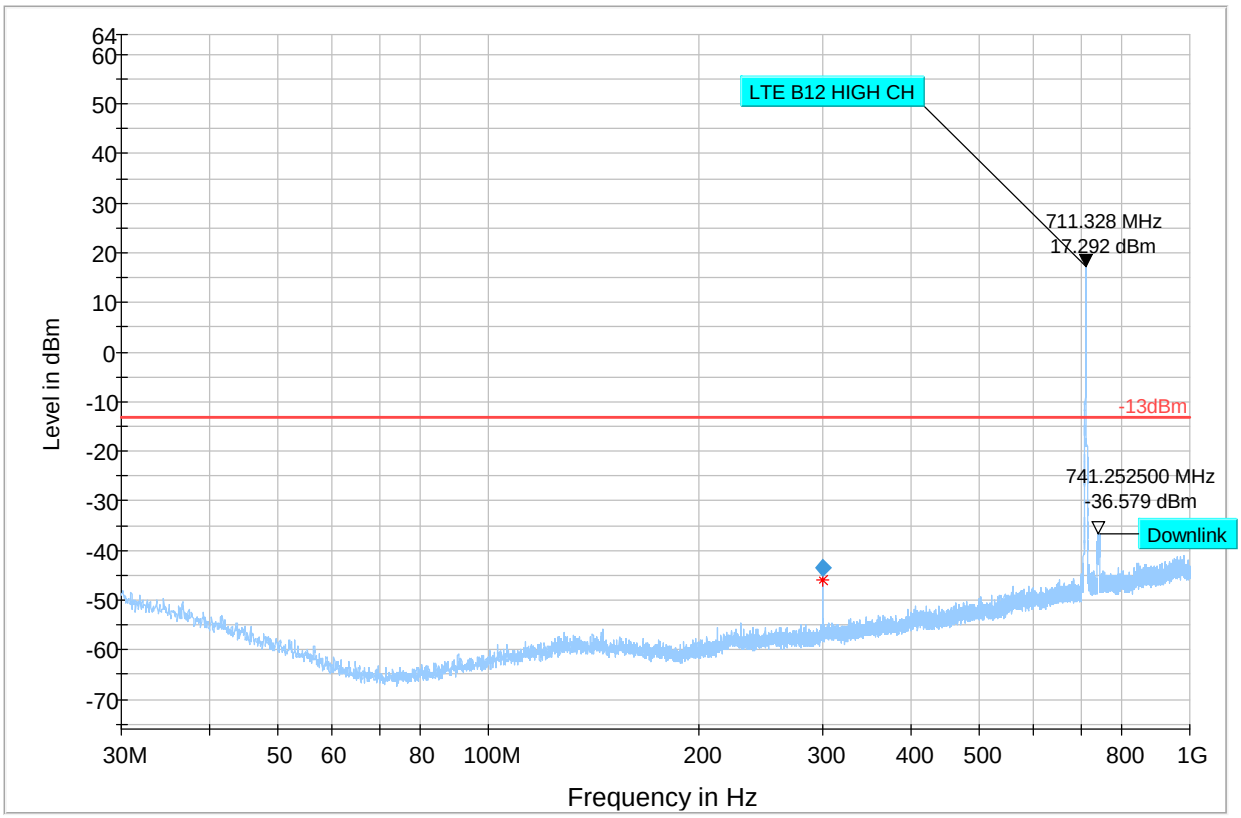
Preview Result 1-PK+ -13dBm Final_Result RMS

Plot # 60 Radiated Emissions: 30 MHz – 1GHz

Channel: High

Final_Result

Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
300.274	-43.566	-13.00	30.57	500.0	100.000	125.0	H	279.0	-79.4	4:35:20 PM - 4/13/2020



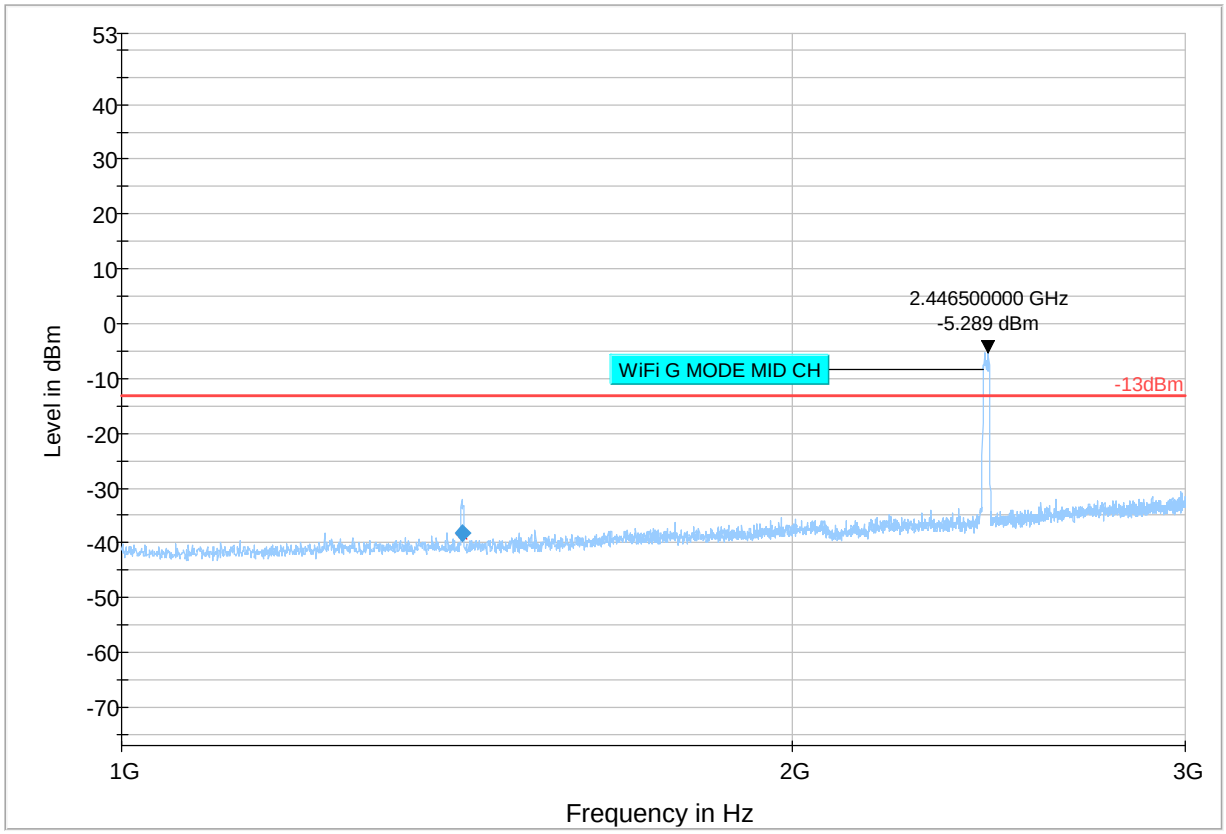
Preview Result 1-PK+ [Preview Result 1.Result:1]
-13dBm [..\]
Critical_Freqs PK+ [Critical_Freqs.Result:4]
Final_Result RMS [Final_Result.Result:4]

Plot # 61 Radiated Emissions: 1 GHz - 3 GHz

Channel: High

Final_Result

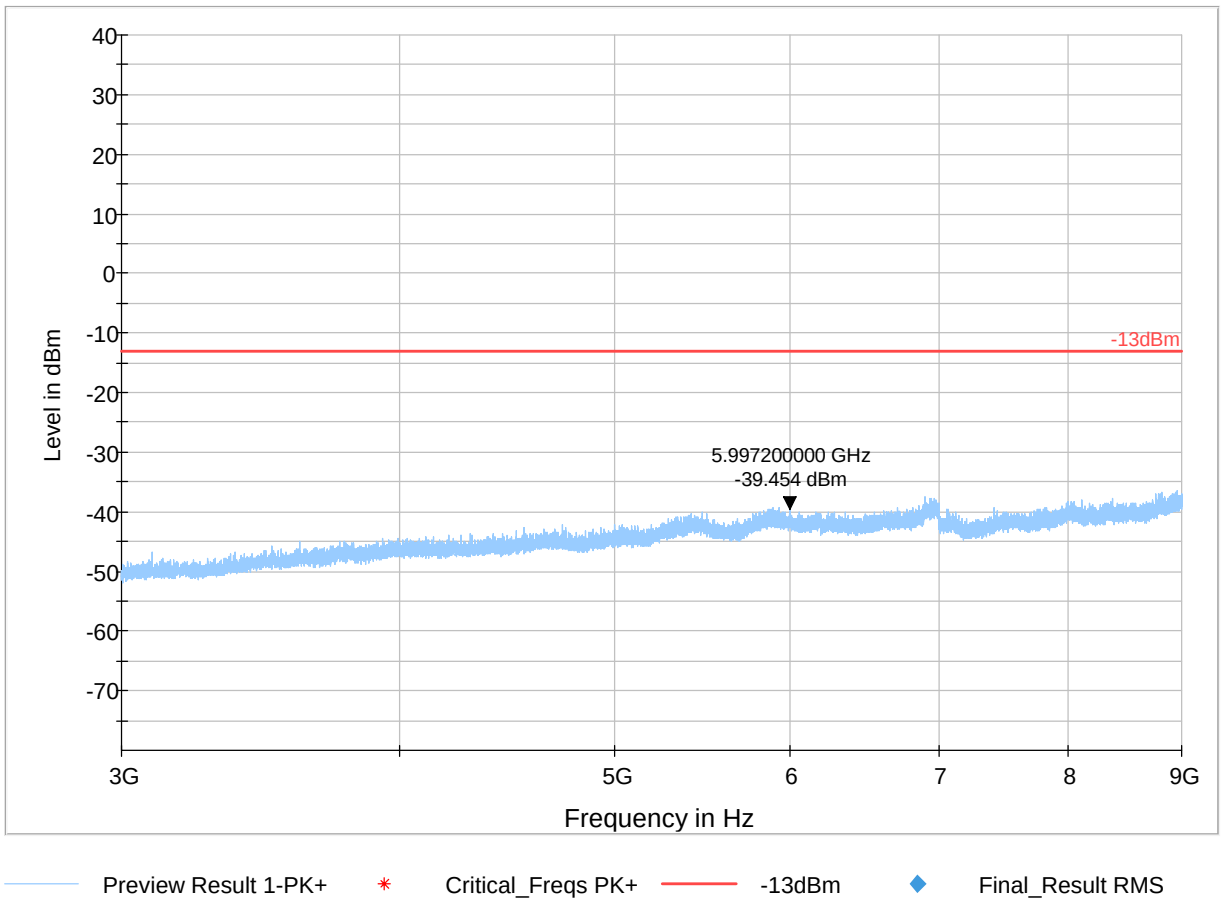
Frequency (MHz)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
1422.425	-38.124	-13.00	25.12	500.0	1000.000	142.0	H	252.0	-92.2	10:36:43 AM - 4/13/2020



Preview Result 1-PK+ Critical_Freqs PK+ -13dBm Final_Result RMS

Plot # 62 Radiated Emissions: 3 GHz – 9 GHz

Channel: High



8 Test setup photos

Setup photos are included in supporting file name: "EMC_GEOTA-032-20001_FCC_ISED_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	00035111	3 YEARS	04/17/2019
HORN ANTENNA	ETS LINDGREN	3117	00169547	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00169535	3 YEARS	09/24/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	3 YEARS	07/16/2019
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
6/10/2020	EMC_GEOTA-032-20001_FCC_22_24_27_ISED	Initial Version	Issa Ghanma

<<< The End >>>