FCC / ISED & Test Report

For:

Zonar Systems

Model Name:

V4

Product Description:

Vehicle mounted telematics device

Applied Rules and Standards:

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

FCC ID: SEJ-V4
IC ID: 5526A-V4

REPORT #: EMC_ZONAR-016-17001_FCC_22_24_27
DATE: 2018-03-08

A2LA Accredited

IC recognized # 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
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

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1 Assessment

The following device as further described in section 3 of this report was evaluated against the applicable criteria specified in the Code of Federal Regulations Title 47 parts 22 and 24, and Industry Canada Standards RSS-GEN issue 4, RSS-132 issue 3 and RSS-133 issue 6.

No deficiencies were ascertained.

Company Name	Product Description	Model #
Zonar Systems	Vehicle mounted telematics device	V4

Responsible for Testing Laboratory:

Date	Section	Name	Signature
2018-03-08	Compliance	James Donnellan (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
2018-03-08	Compliance	Elijah Garcia (EMC Engineer)	Elijah Garcia Digitally signed by Elijah Garcia DN: cn=Elijah Garcia, o, ou, email=Elijah.Garcia@cetecom.com, c=US Date: 2018.03.08 19:27:59 -08'00'

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:	James Donnellan
Responsible Project Leader:	Ruther Navarro

2.2 Identification of the Client

Applicant's Name:	Zonar Systems
Street Address:	18200 Cascade Avenue South
City/Zip Code	Seattle, WA 98188
Country	USA
Contact Person:	David Pascoe
Phone No.	+1 (206) 878 2459
e-mail:	David.pascoe@zonarsystems.com

2.3 Identification of the Manufacturer

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

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Model No	V4
HW Version	1
SW Version	4
FCC-ID	SEJ-V4
IC-ID:	5226A-V4
HVIN:	V4
Product Description	Vehicle mounted telematics device
Transceiver Technology / Type(s) of Modulation	ublox TOBY-L200-02S-00; FCC ID: XPYTOBYL200; IC ID: 8595A-TOBYL200 •850/1900 MHz GSM/GPRS/EDGE; GSM&GPRS&EDGE(MCS-1-4): GMSK; EDGE(MCS-5-8): 8PSK; •850/1700/1900 MHz WCDMA / HSPA+; HSDPA Category 14 data rate - 21 Mbps; HSUPA Category 6 data rate - 5.76 Mbps; modulation: all QPSK (no QAM in uplink for given data rates) •850/1700/1900/2600/700 MHz LTE; LTE Band 2 (PCS),4 (AWS),5 (850),7 (2600),17 (700)
Frequency Range	GSM 850: 824.2-848.8 MHz; 123 channels; PCS 1900: 1850.2-1909.8 MHz; 298 channels; FDD V: 826.4 - 846.6 MHz; 101 channels; FDD II: 1852.4 – 1907.6 MHz; 276 channels; FDD IV: 1712.4 – 1752.6 MHz; 201 channels; LTE Band 2: 1850 - 1910 MHz; 60 MHz bandwidth; LTE Band 4: 1710 - 1755 MHz; 45 MHz bandwidth; LTE Band 5: 824 - 849 MHz; 25 MHz bandwidth; LTE Band 7: 2500 - 2570 MHz; 70 MHz bandwidth; LTE Band 17: 704 - 716 MHz; 12 MHz bandwidth;
Max. declared antenna gain	taoglas antenna solutions, Part No: PCS.06.A Havok; Peak Gain: 3.72dBi.
Power Supply/ Rated Operating Voltage Range	8.0 VDC (Low) / 12 VDC (Nominal) / 30 VDC (Max)
Operating Temperature Range	–40°C ~ +85°C
Sample Revision	☐Prototype ■Production ☐ Pre-Production

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	18999166	1	4	Radiated Emissions

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	DC Power Supply	3003B	Protek	AC, 2648
2	Laptop	E5420	Dell	JYCNLQ1

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The internal antenna was connected.
2	EUT#1 + AE#1 + AE#2	The radio of the EUT was configured to a fixed channel transmission with highest possible duty cycle using software that is not available to the end user. The internal antenna was connected.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to evaluate the compliance of the EUT against the relevant requirements specified in the Code of Federal Regulations Title 47 parts 22, 24, 27 and ISED Standards RSS-132 issue 3, RSS-133 issue 6, and RSS-139 issue 3.

4.1 Dates of Testing:

12/11/2017 - 02/09/2018

4.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

9 kHz to 30MHz	±2.5 dB (Magnetic Loop Antenna)
30 MHz to 1000 MHz	±2.0 dB (Biconilog Antenna)
1 GHz to 40 GHz	±2.3 dB (Horn Antenna)

Conducted measurement

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

4.3 Environmental Conditions during Testing:

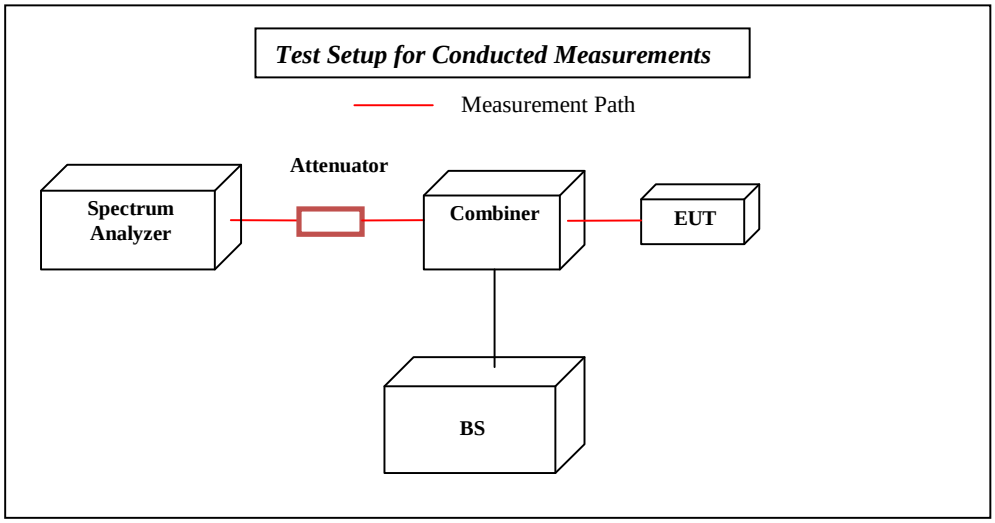
The following environmental conditions were maintained during the course of testing:

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

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

5 Measurement Procedures

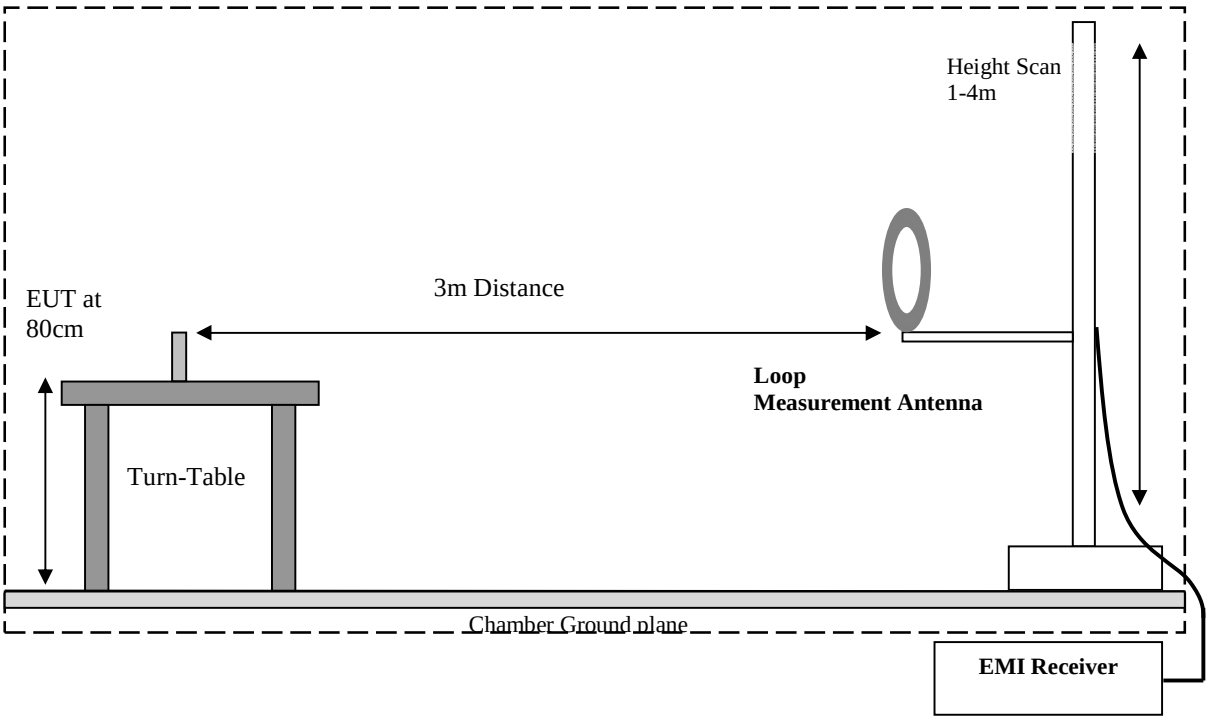
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – "Measurement Guidance for Certification of Licensed Digital Transmitters" and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



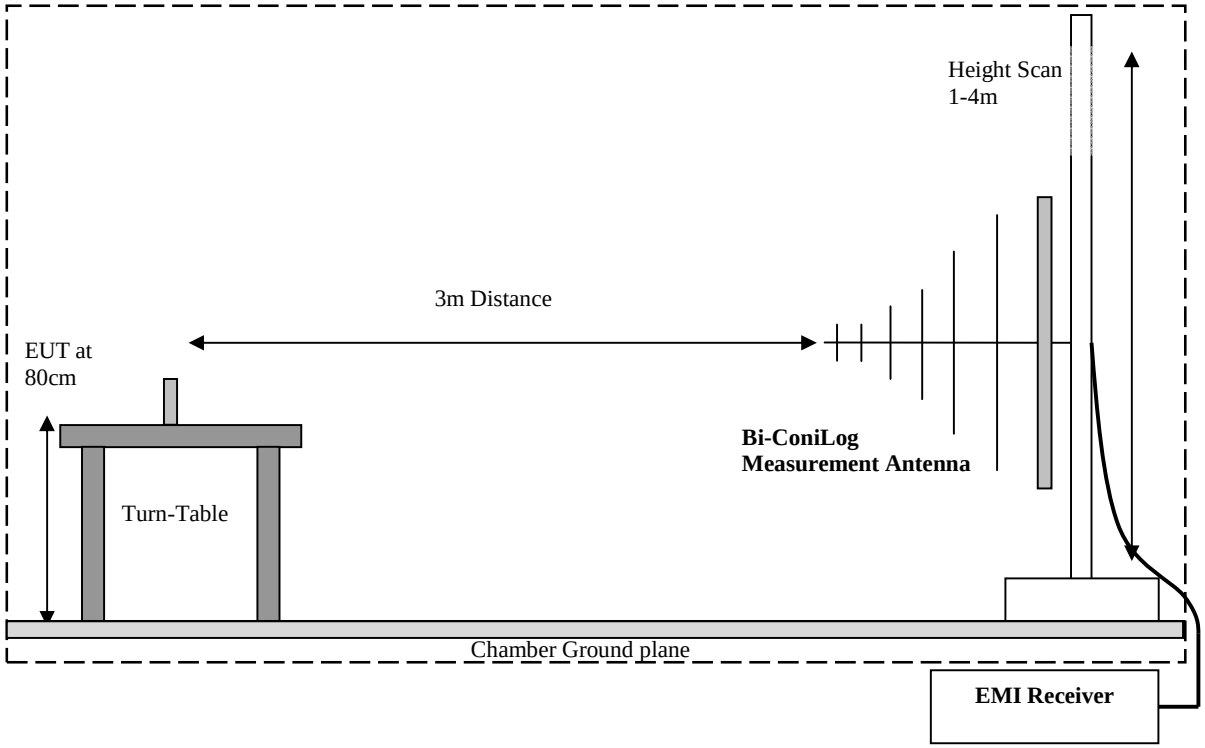
5.1 Radiated Measurement

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

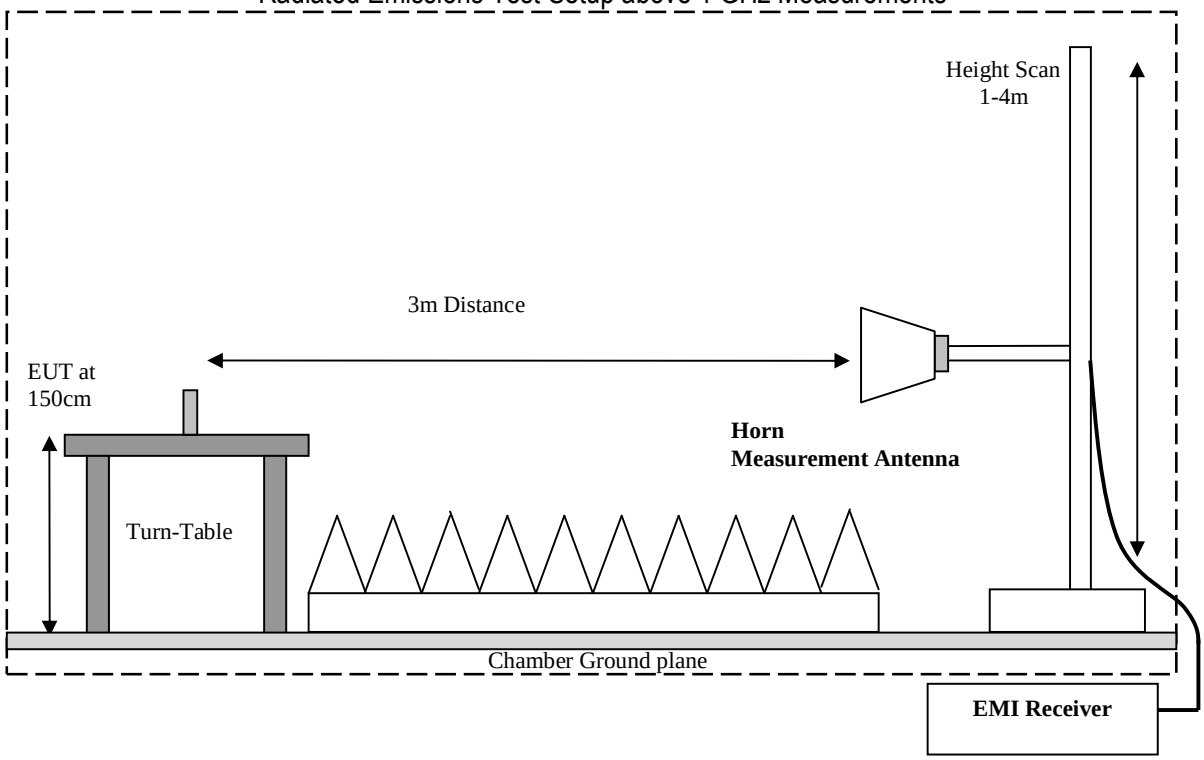
Radiated Emissions Test Setup below 30 MHz Measurements



Radiated Emissions Test Setup 30 MHz-1 GHz Measurements



Radiated Emissions Test Setup above 1 GHz Measurements



5.2 Sample Calculations for Field Strength Measurements

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

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

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

FS (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

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

6 Measurement Results Summary

6.1 Part 22 / RSS-132

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

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval FCC ID: XPYTOBYL200

6.2 Part 24 / RSS-133

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

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval FCC ID: XPYTOBYL200

6.3 FCC 27 / RSS-139

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50	RF Output Power	Nominal	LTE Band 2, 4, 5, 7, 17	☐	☐	☐	■	Note 2
§2.1055; §27.54	Frequency Stability	Extreme Temperature and Voltage	LTE Band 2, 4, 5, 7, 17	☐	☐	☐	■	Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	LTE Band 2, 4, 5, 7, 17	☐	☐	☐	■	Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	LTE Band 2, 4, 5, 7, 17	☐	☐	☐	■	Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	LTE Band 2, 4, 5, 7, 17	☐	☐	■	☐	NA
§2.1053; §27.53	Radiated Spurious Emissions	Nominal	LTE Band 2, 4, 5, 7, 17	■	☐	☐	☐	Note 2

Note 1: NA= Not Applicable; NP= Not Performed.
Note 2: Data leveraged from modular approval FCC ID: XPYTOBYL200

7 Test Result Data

7.1 Radiated Spurious Emissions

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

Spectrum Analyzer Settings for FCC 22

Frequency Range	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

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

7.1.2 Limits:

7.1.2.1 FCC Part 22.917 (a); FCC Part 24.238 (a); FCC Part 27.53 (h)

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p (watts).

ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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

7.1.3 Test conditions and setup:

Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	3	GSM 850 / 1900 FDD II / IV / FDD V LTE Band 2 ,4, 5, 7, 17	12 VDC

7.1.4 Measurement result:

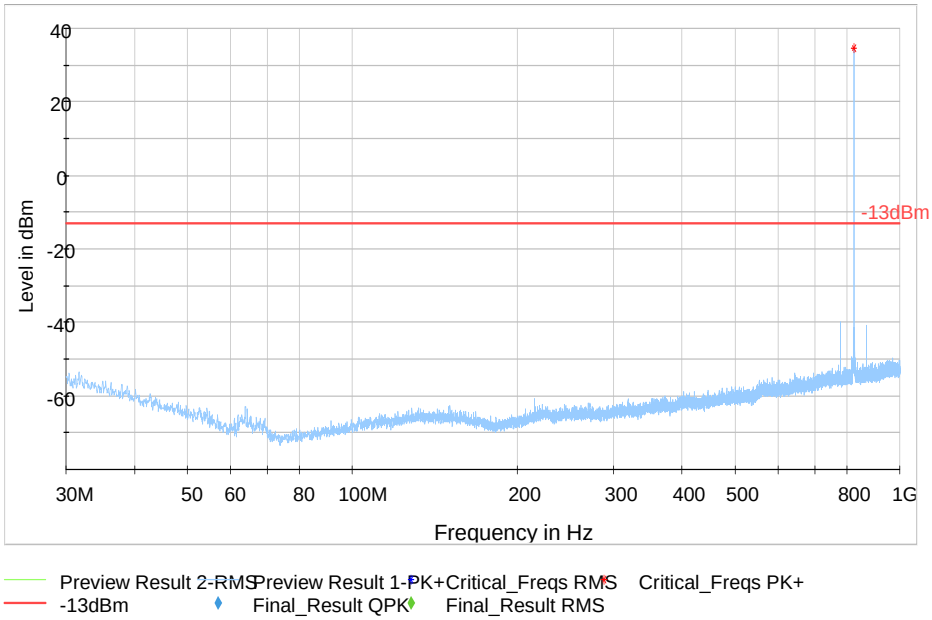
Plot #	Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1-3	Low	GSM 850	30 MHz – 9 GHz	-13	Pass
4-7	Mid	GSM 850	9 kHz – 9 GHz	-13	Pass
8-10	High	GSM 850	30 MHz – 9 GHz	-13	Pass
11-13	Low	GSM 1900	30 MHz – 18 GHz	-13	Pass
14-18	Mid	GSM 1900	9 kHz – 26 GHz	-13	Pass
19-21	High	GSM 1900	30 MHz – 18 GHz	-13	Pass
22-24	Low	UMTS FDD V	30 MHz – 9 GHz	-13	Pass
25-28	Mid	UMTS FDD V	9 kHz – 9 GHz	-13	Pass
29-31	High	UMTS FDD V	30 MHz – 9 GHz	-13	Pass
32-34	Low	UMTS FDD II	30 MHz – 18 GHz	-13	Pass
35-39	Mid	UMTS FDD II	9 kHz – 26 GHz	-13	Pass
40-42	High	UMTS FDD II	30 MHz – 18 GHz	-13	Pass
43-45	Low	UMTS FDD IV	30 MHz – 9 GHz	-13	Pass
46-49	Mid	UMTS FDD IV	9 kHz – 9 GHz	-13	Pass
50-52	High	UMTS FDD IV	30 MHz – 9 GHz	-13	Pass
53-55	Low	LTE Band 2	30 MHz – 18 GHz	-13	Pass
56-60	Mid	LTE Band 2	9 kHz – 26 GHz	-13	Pass
61-63	High	LTE Band 2	30 MHz – 18 GHz	-13	Pass
64-66	Low	LTE Band 4	30 MHz – 18 GHz	-13	Pass
67-70	Mid	LTE Band 4	9 kHz – 18 GHz	-13	Pass
71-73	High	LTE Band 4	30 MHz – 18 GHz	-13	Pass
74-76	Low	LTE Band 5	30 MHz – 9 GHz	-13	Pass
77-80	Mid	LTE Band 5	9 kHz – 9 GHz	-13	Pass
81-83	High	LTE Band 5	30 MHz – 9 GHz	-13	Pass
84-86	Low	LTE Band 7	30 MHz – 18 GHz	-13	Pass
87-91	Mid	LTE Band 7	9 kHz – 26 GHz	-13	Pass
92-94	High	LTE Band 7	30 MHz – 18 GHz	-13	Pass
95-97	Low	LTE Band 17	30 MHz – 9 GHz	-13	Pass
98-101	Mid	LTE Band 17	9 kHz – 9 GHz	-13	Pass
102-104	High	LTE Band 17	30 MHz – 9 GHz	-13	Pass

7.1.5 Measurement Plots:

7.1.6 GSM 850

Plot #1 Radiated Emissions: 30 MHz – 1 GHz

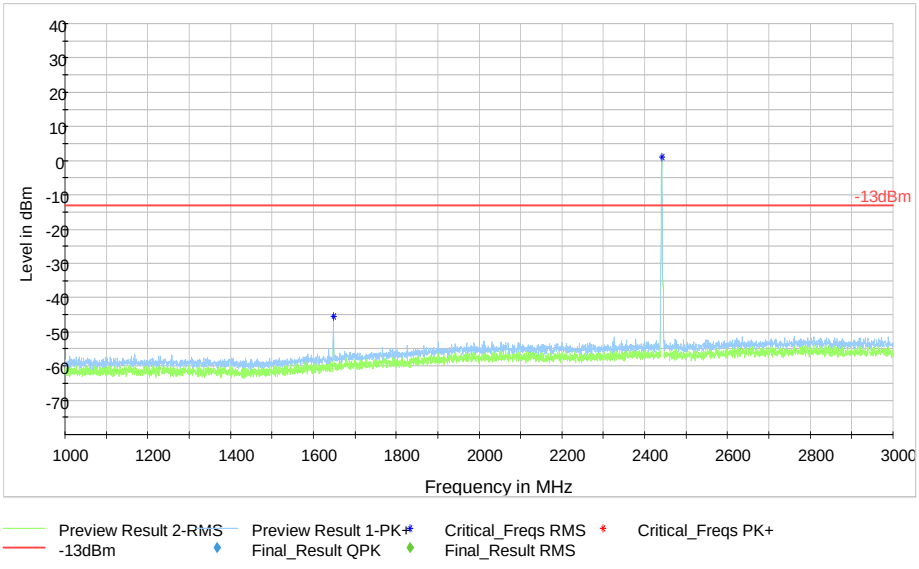
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on GSM 850 Band: 824.2 MHz (uplink), 869.2 MHz (downlink)

Plot # 2 Radiated Emissions: 1-3 GHz

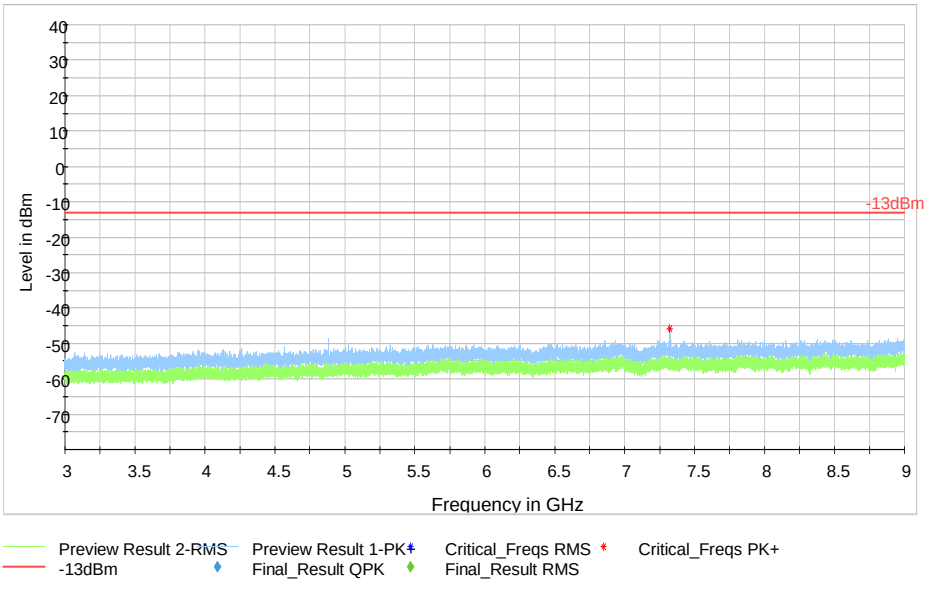
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

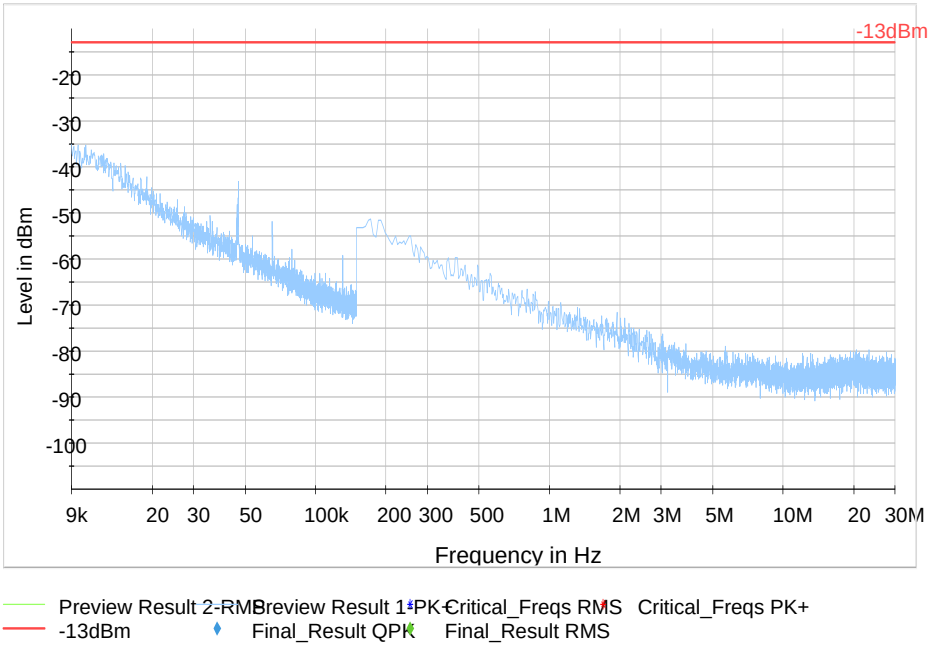
Plot # 3 Radiated Emissions: 3-9 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



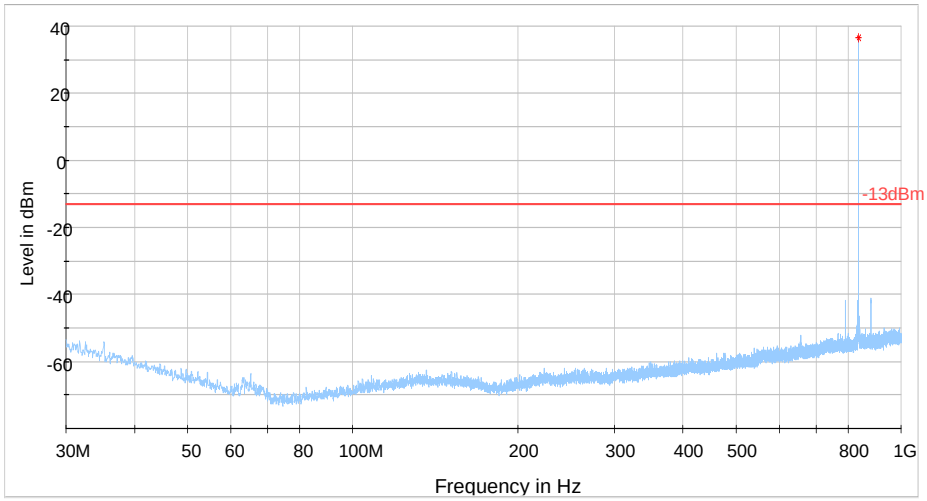
Plot # 4 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #5 Radiated Emissions: 30 MHz – 1 GHz

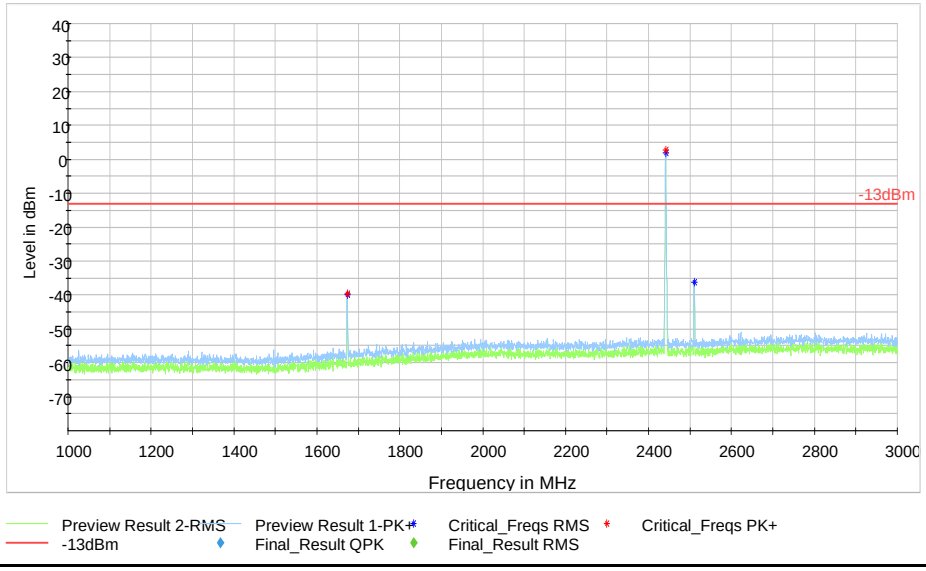
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on GSM 850 Band: 836.5 MHz (uplink), 881.5 MHz (downlink)

Plot #6 Radiated Emissions: 1-3 GHz

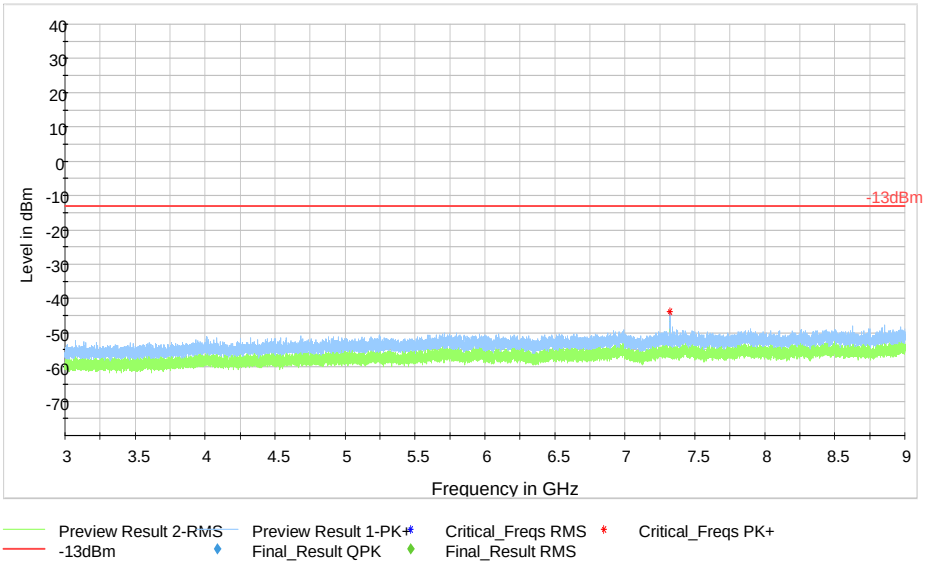
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

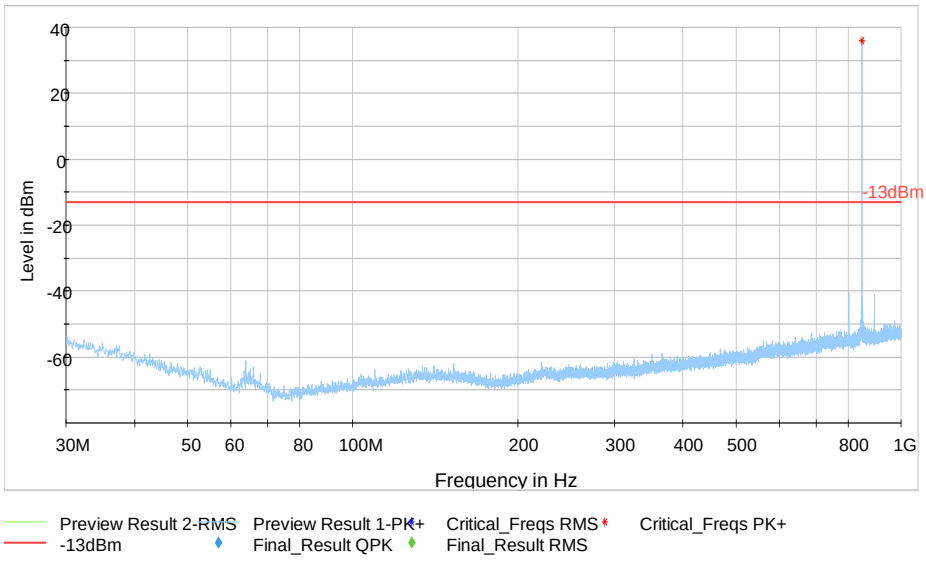
Plot #7 Radiated Emissions: 3-9 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



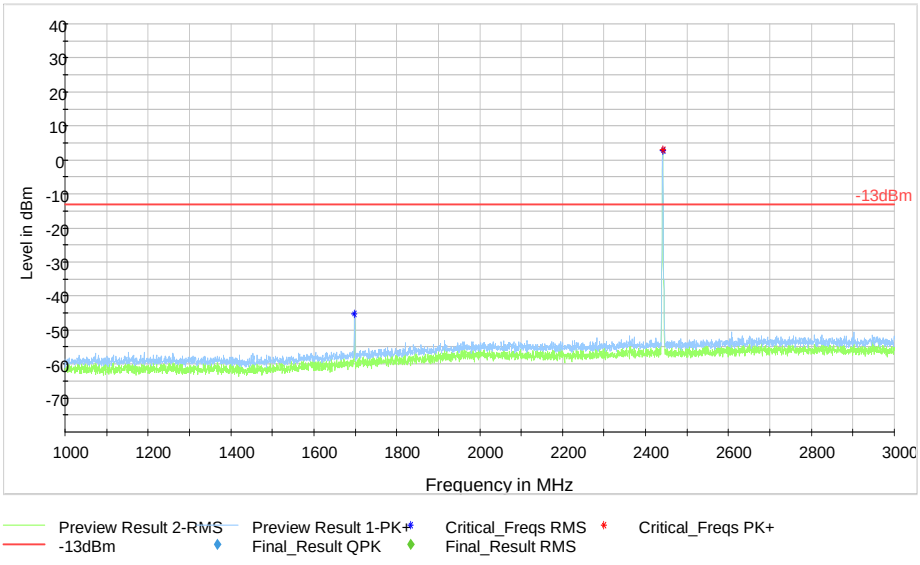
Plot #8 Radiated Emissions: 30 MHz – 1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on GSM 850 Band: 848.8 MHz (uplink), 893.8 MHz (downlink)

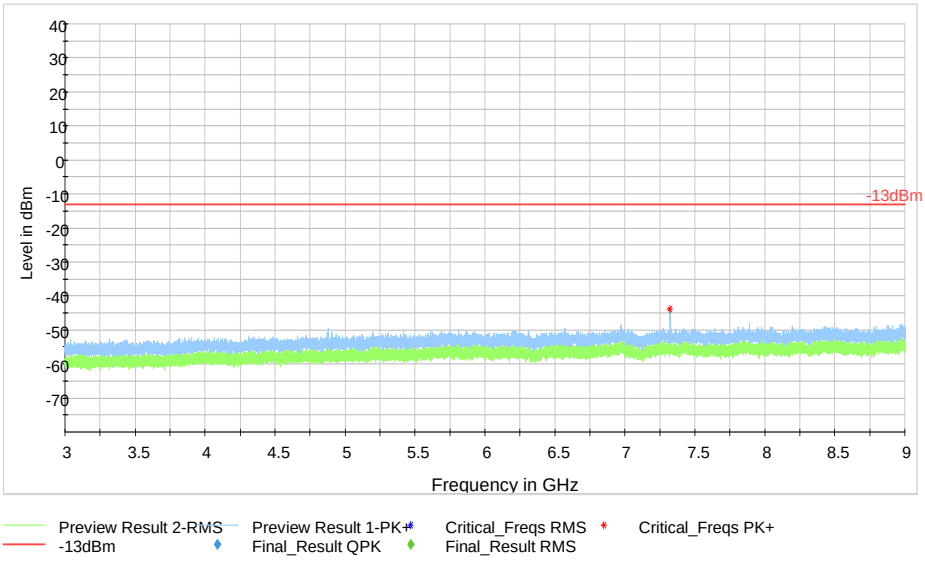
Plot #9 Radiated Emissions: 1-3 GHz
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

Plot #10 Radiated Emissions: 3-9 GHz

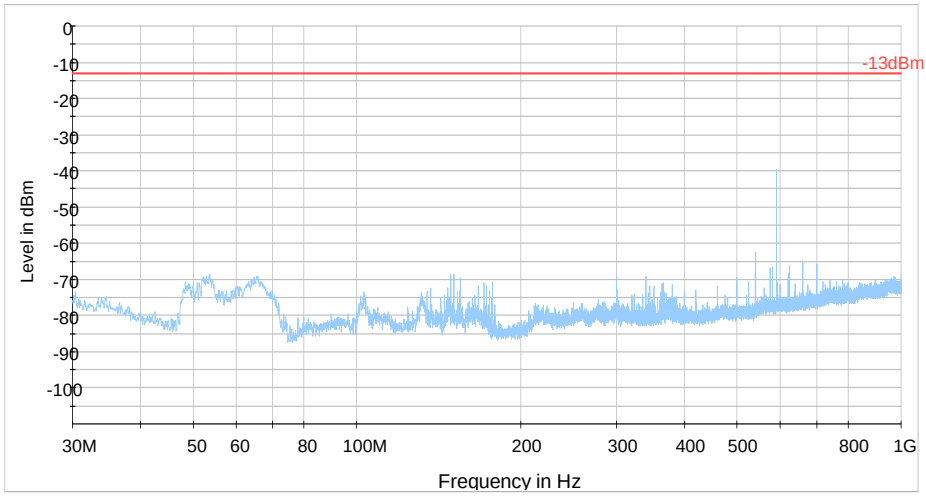
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.7 GSM 1900

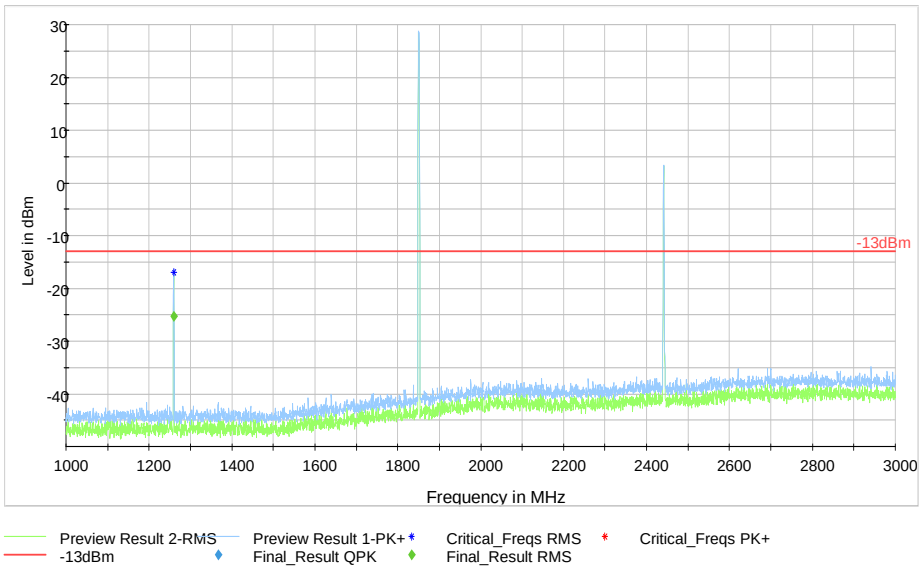
Plot #11 Radiated Emissions: 30 MHz – 1GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot # 12 Radiated Emissions: 1-3 GHz

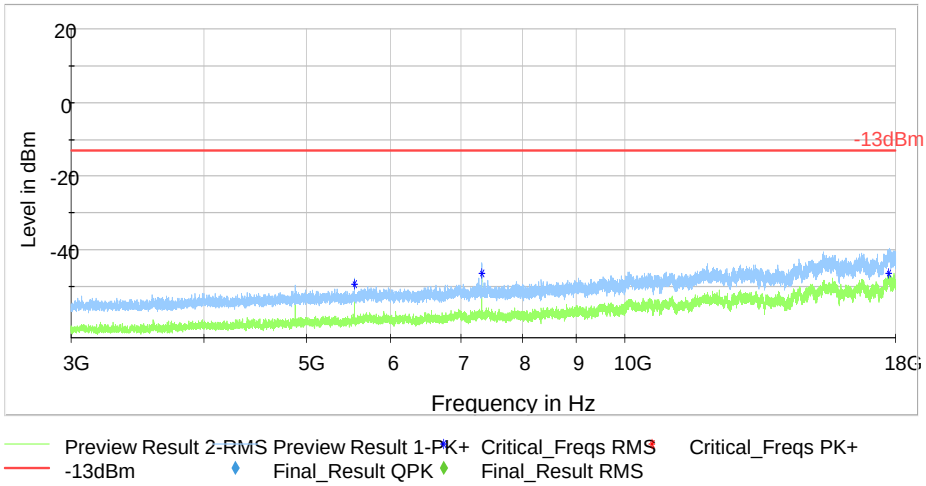
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on GSM 1900 PCS Band: 1850.2 MHz (uplink), 1930.2 MHz (downlink)

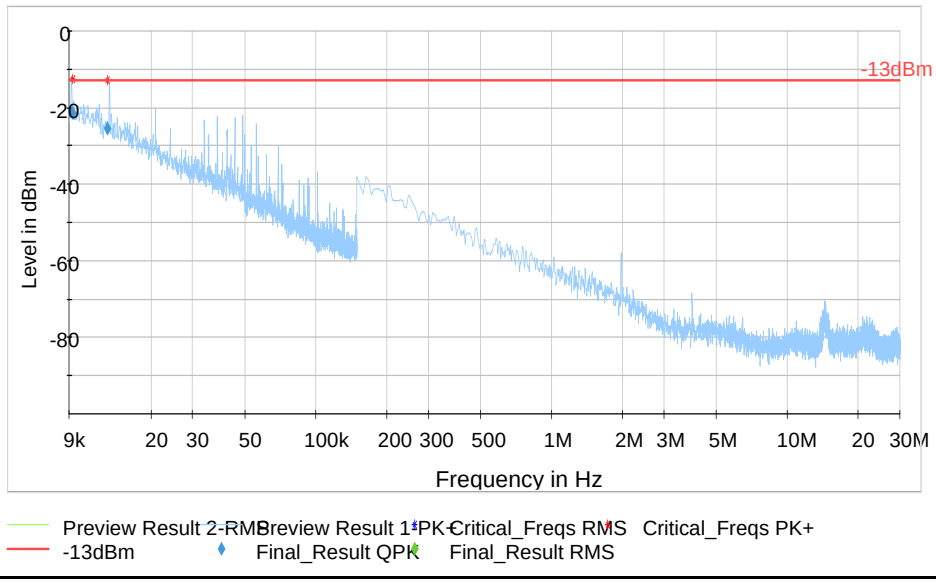
Plot # 13 Radiated Emissions: 3-18 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



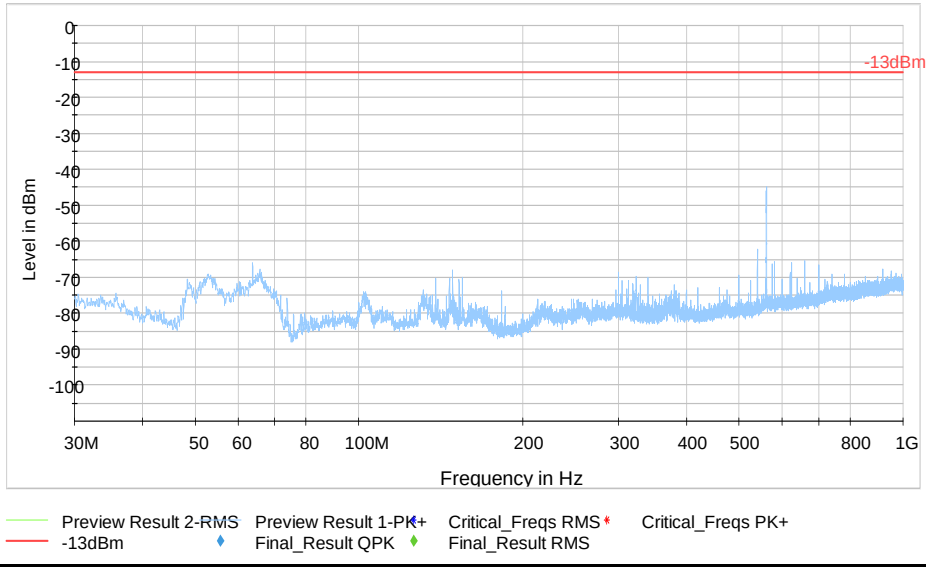
Plot # 14 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



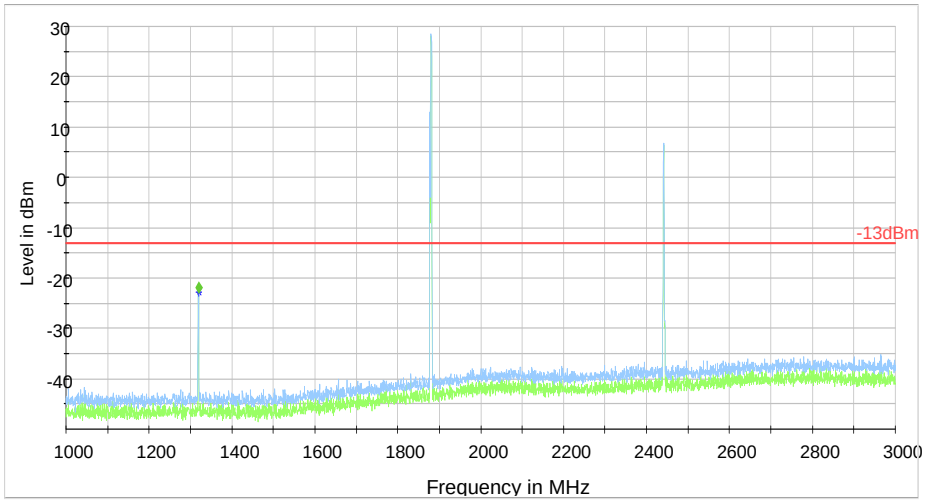
Frequency (MHz)	Quasi Peak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.009311	-21.27	---	-13.00	8.27	500.0	0.200	166.0	V	163.0	-34.4
0.013030	-25.50	---	-13.00	12.50	500.0	0.200	100.0	H	222.0	-36.7

Plot #15 Radiated Emissions: 30 MHz – 1 GHz
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #16 Radiated Emissions: 1-3 GHz

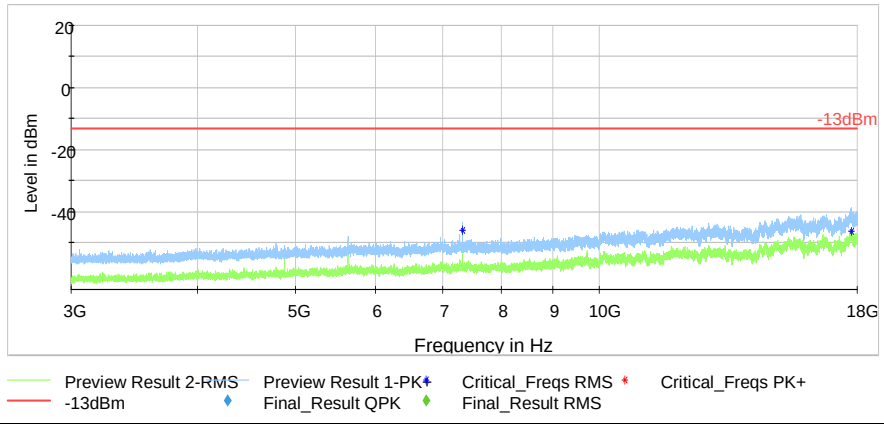
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on GSM 1900 PCS Band: 1880 MHz (uplink), 1960 MHz (downlink)

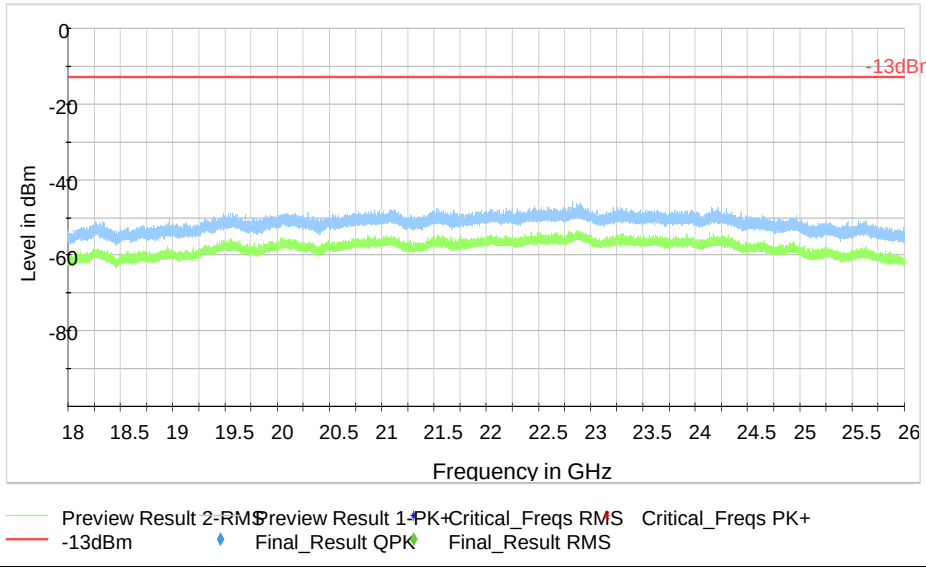
Plot #17 Radiated Emissions: 3-18 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



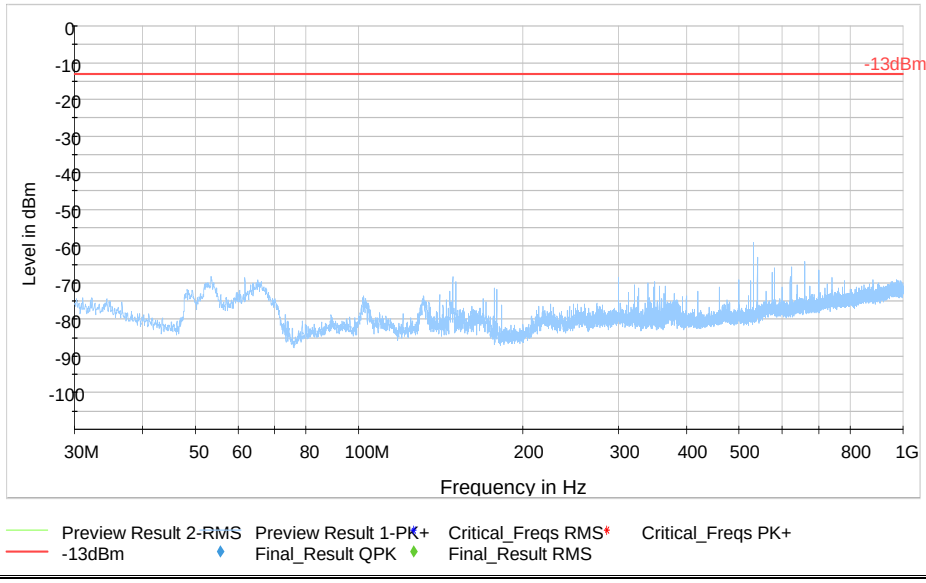
Plot #18 Radiated Emissions: 18-26 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



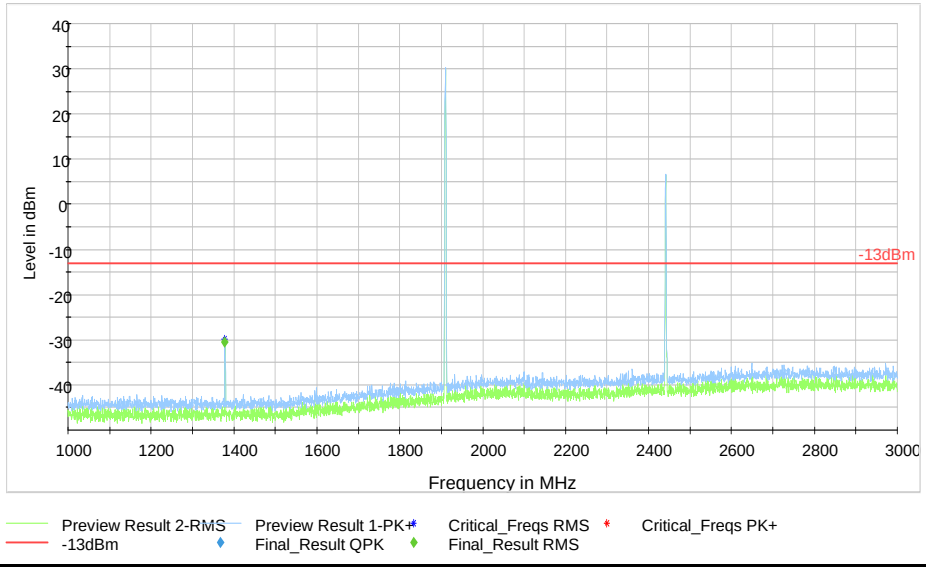
Plot #19 Radiated Emissions: 30 MHz – 1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Plot #20 Radiated Emissions: 1-3 GHz

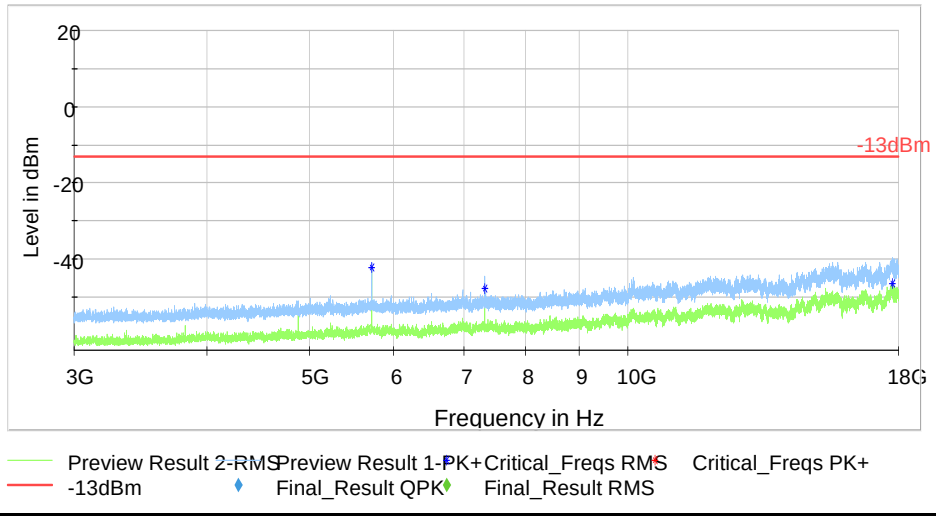
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on GSM 1900 PCS Band: 1909.8 MHz (uplink), 1989.8 MHz (downlink)

Plot #21 Radiated Emissions: 3-18 GHz

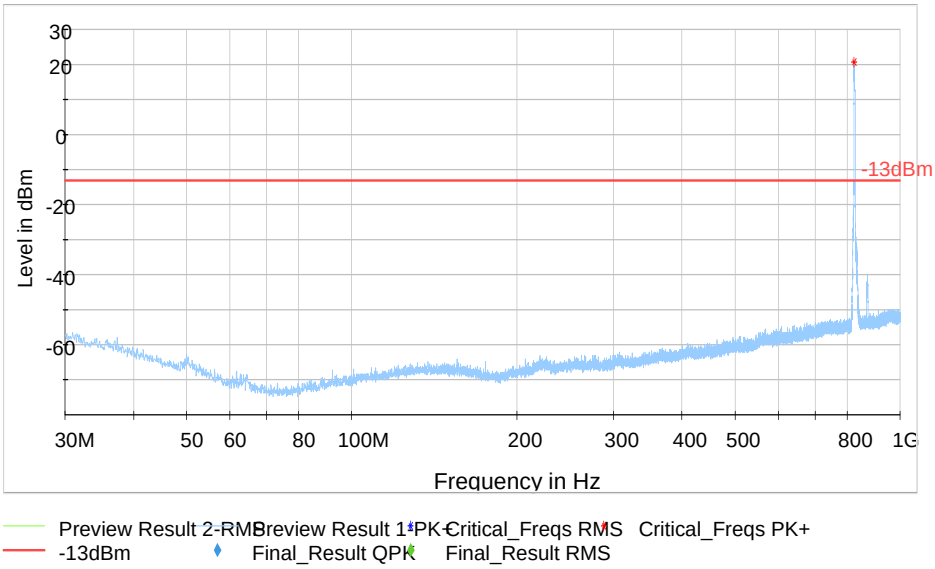
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.8 UMTS FDD V

Plot #22 Radiated Emissions: 30 MHz – 1 GHz

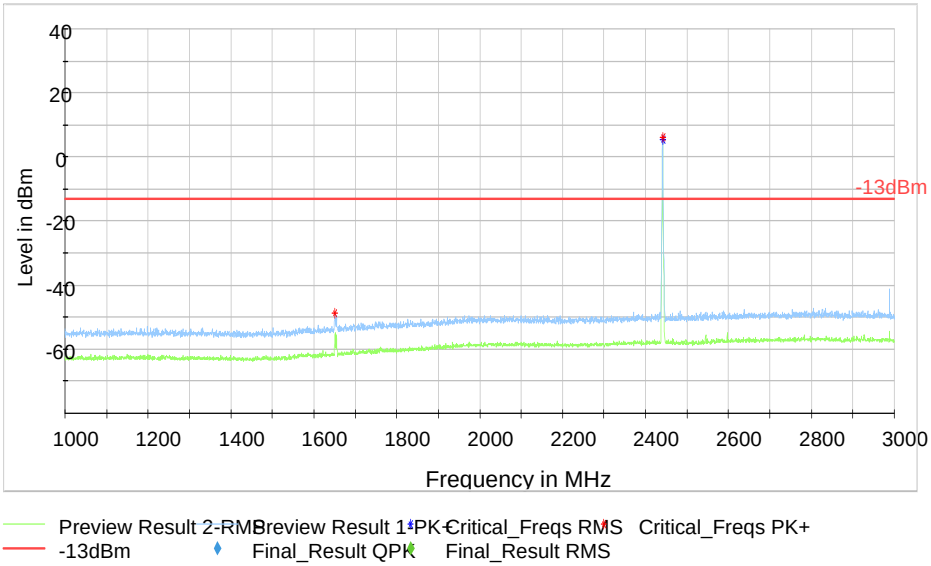
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on UMTS Band V: 824 MHz (uplink), 869 MHz (downlink)

Plot # 23 Radiated Emissions: 1-3 GHz

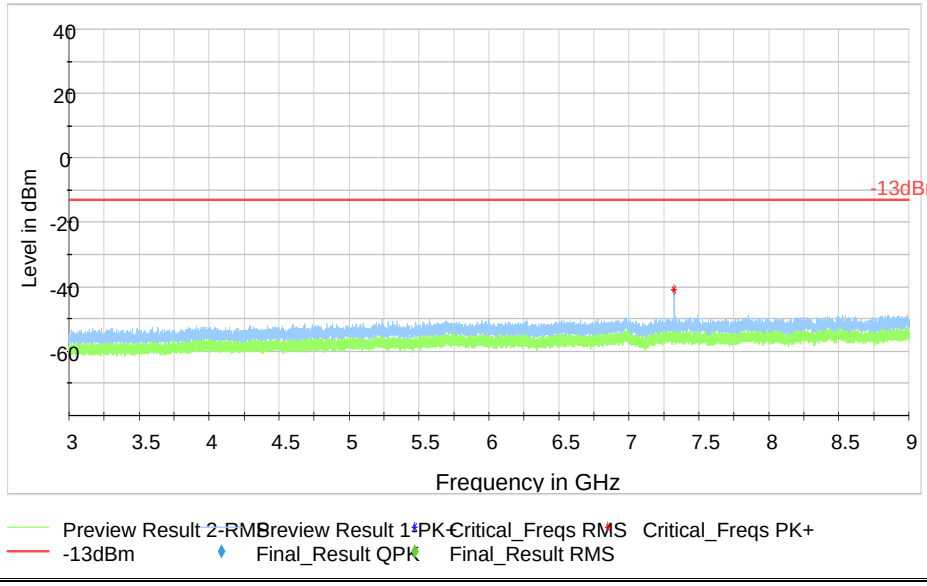
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

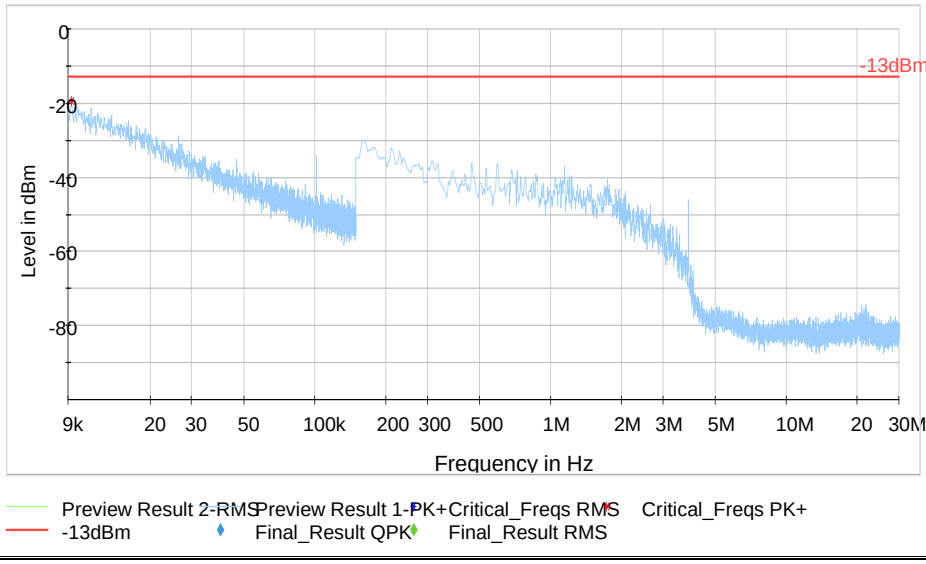
Plot # 24 Radiated Emissions: 3-9 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



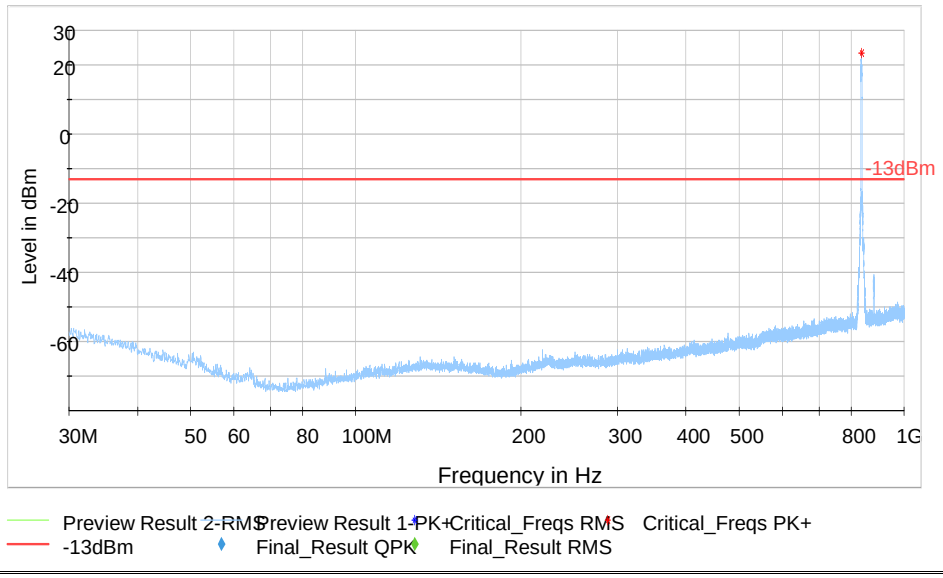
Plot # 25 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



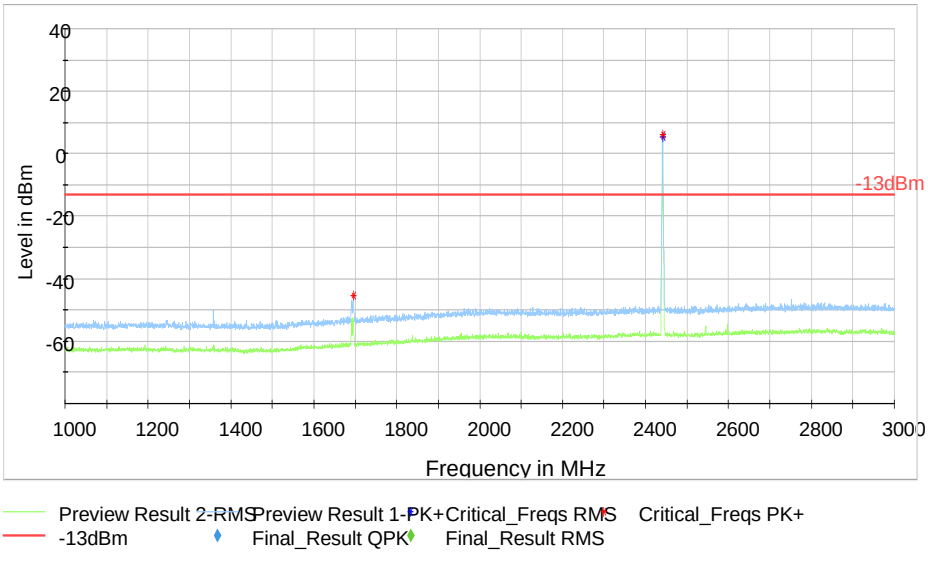
Plot #26 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on UMTS Band V: 836.6 MHz (uplink), 881.6 MHz (downlink)

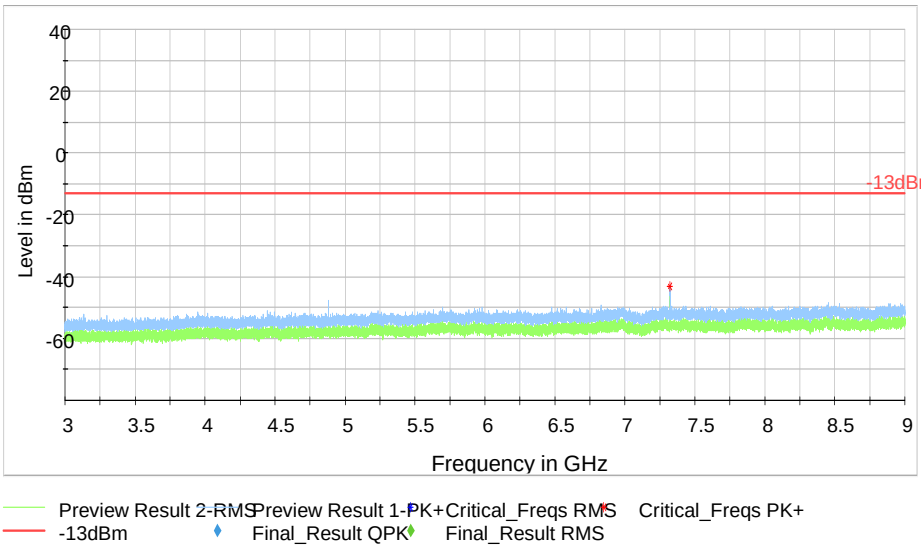
Plot #27 Radiated Emissions: 1-3 GHz
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

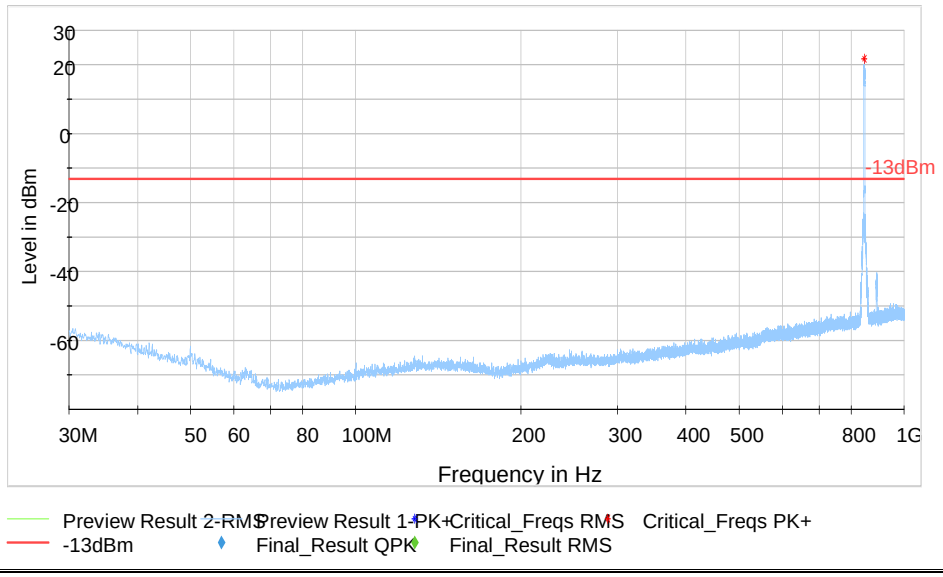
Plot #28 Radiated Emissions: 3-9 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #29 Radiated Emissions: 30 MHz – 1 GHz

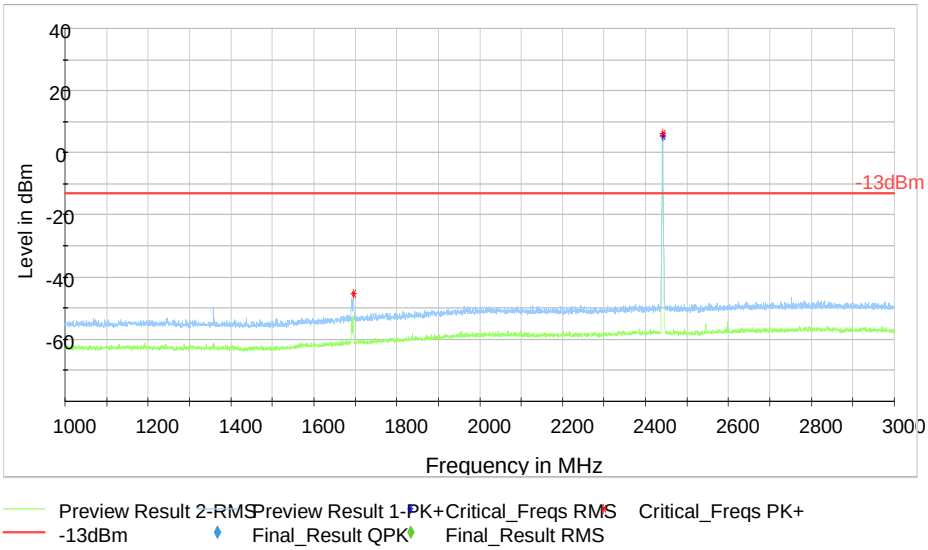
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on UMTS Band V: 846.6 MHz (uplink), 891.6 MHz (downlink)

Plot #30 Radiated Emissions: 1-3 GHz

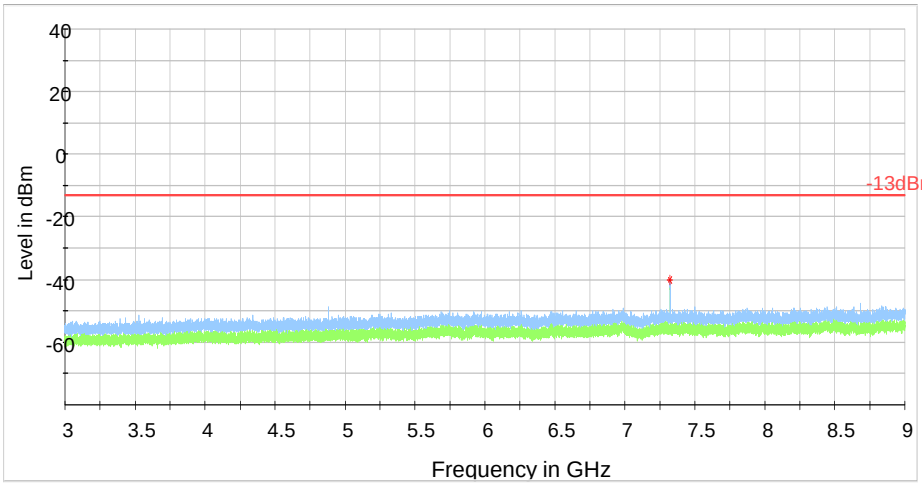
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

Plot #31 Radiated Emissions: 3-9 GHz

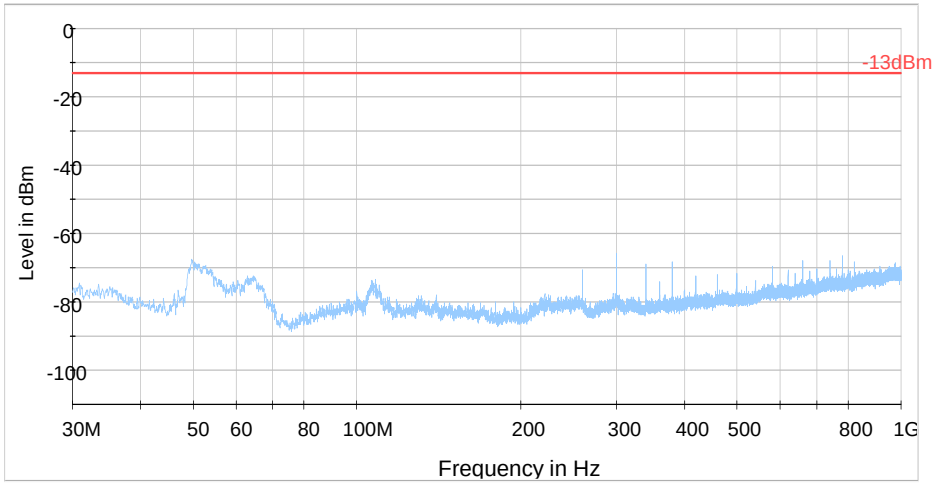
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.9 UMTS FDD II

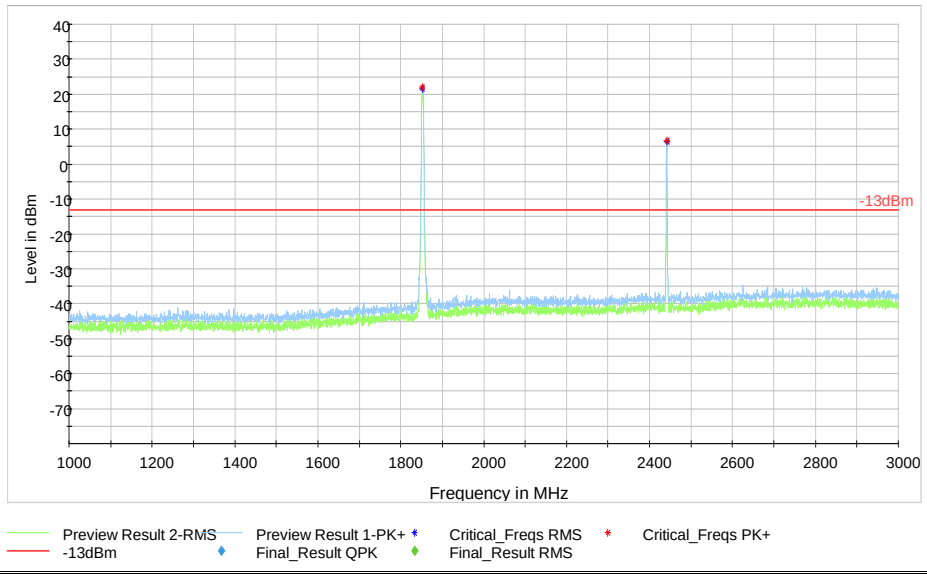
Plot #32 Radiated Emissions: 30 MHz – 1 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot # 33 Radiated Emissions: 1-3 GHz

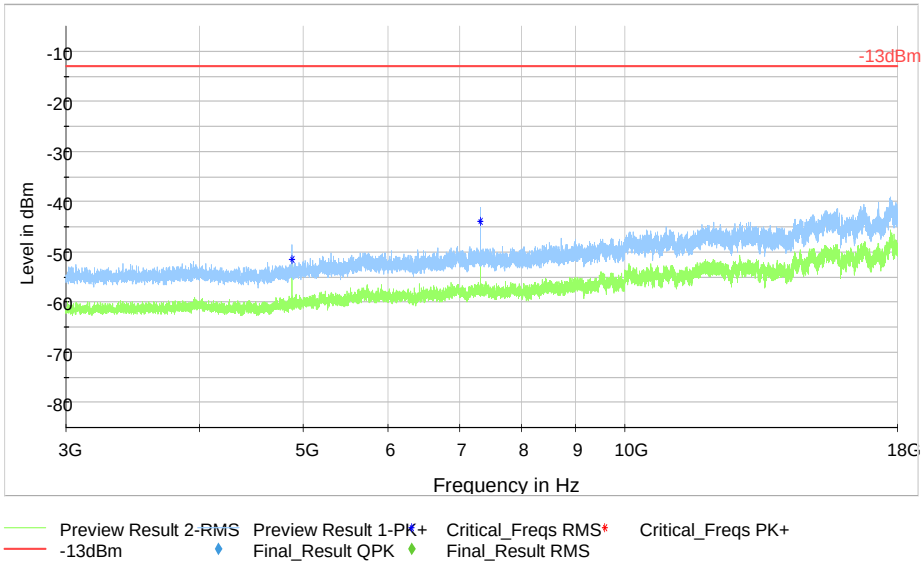
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band II: 1852.4 MHz (uplink), 1932.4 MHz (downlink)

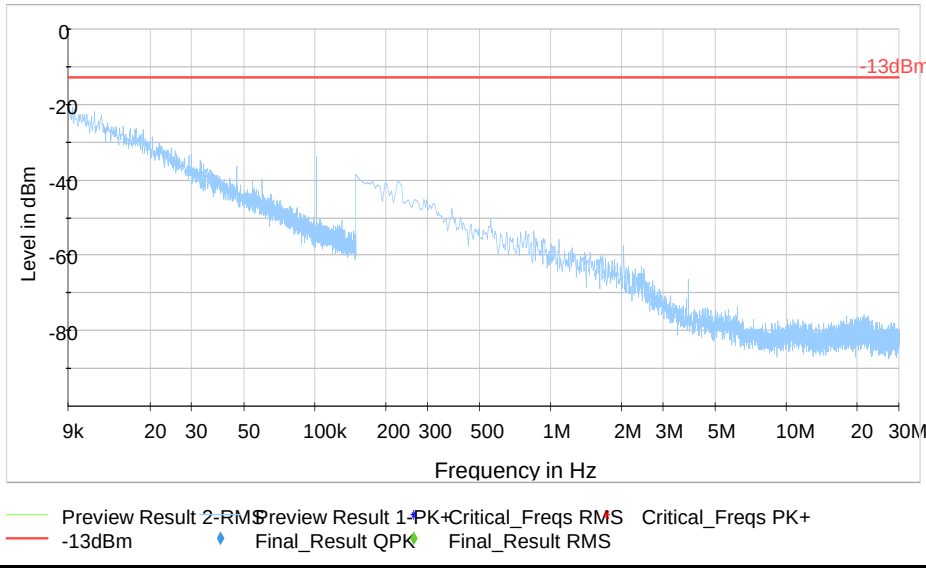
Plot # 34 Radiated Emissions: 3-18 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



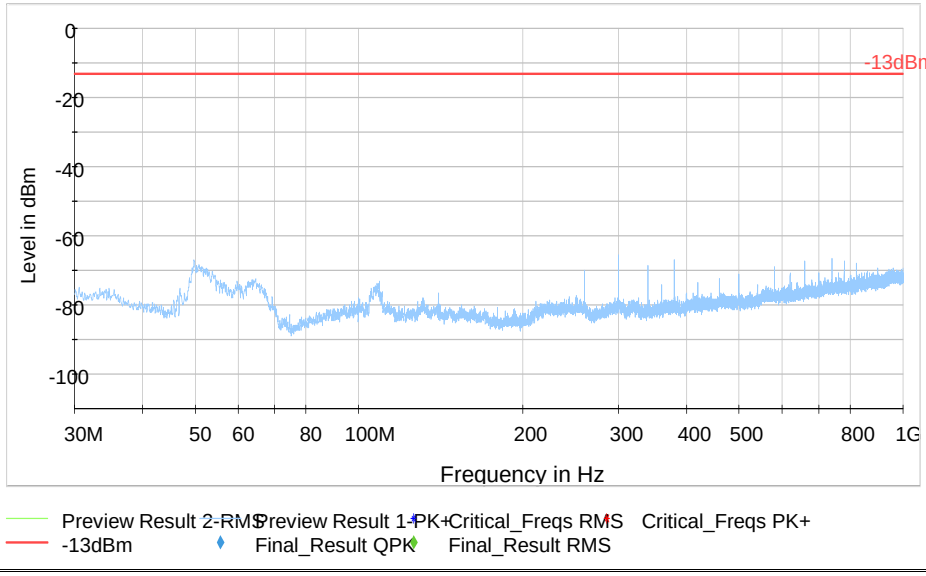
Plot # 35 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



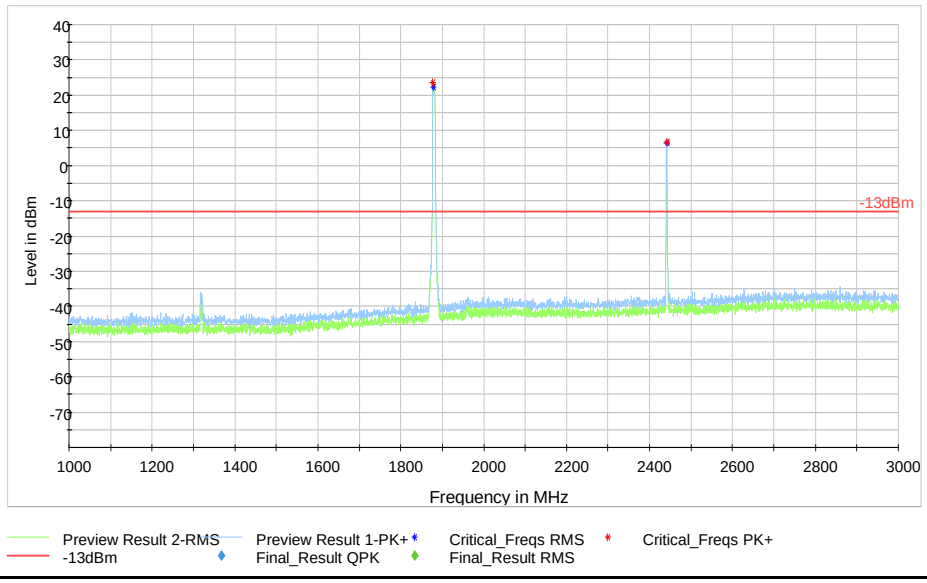
Plot #36 Radiated Emissions: 30 MHz – 1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #37 Radiated Emissions: 1-3 GHz

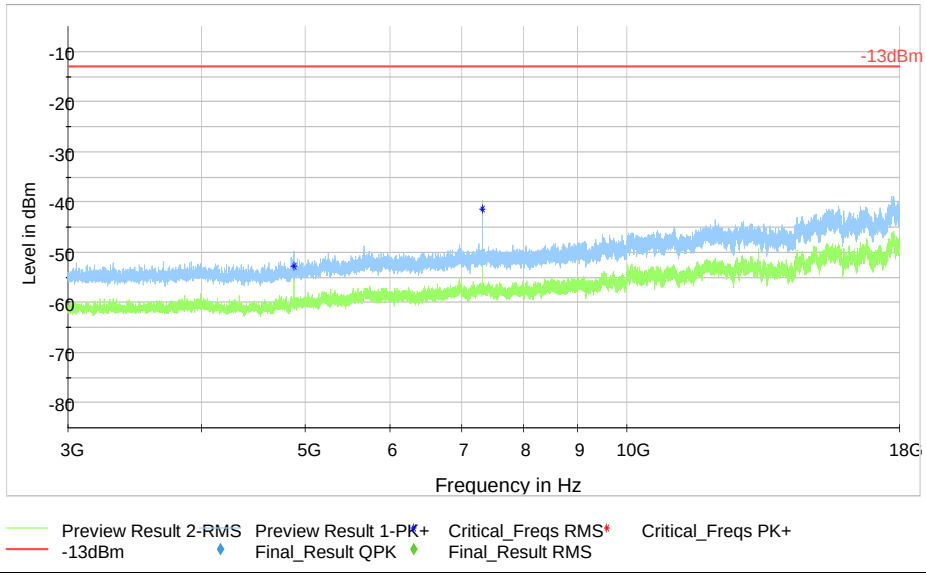
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band II: 1880 MHz (uplink), 1960 MHz (downlink)

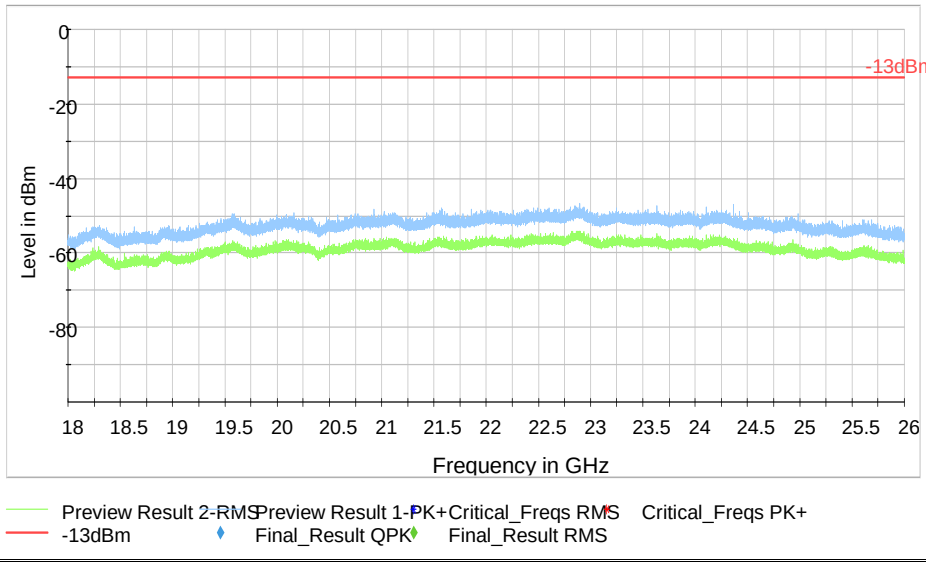
Plot #38 Radiated Emissions: 3-18 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



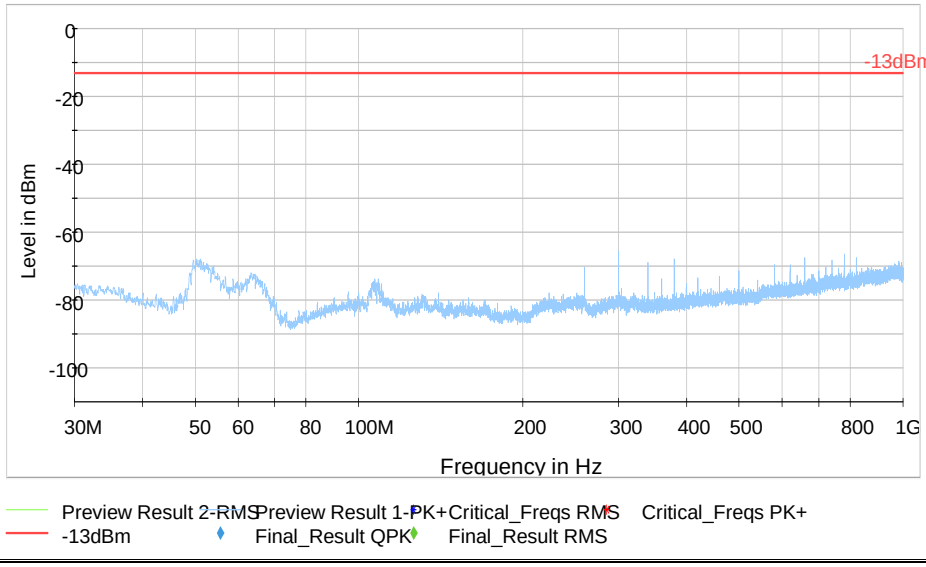
Plot #39 Radiated Emissions: 18-26 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



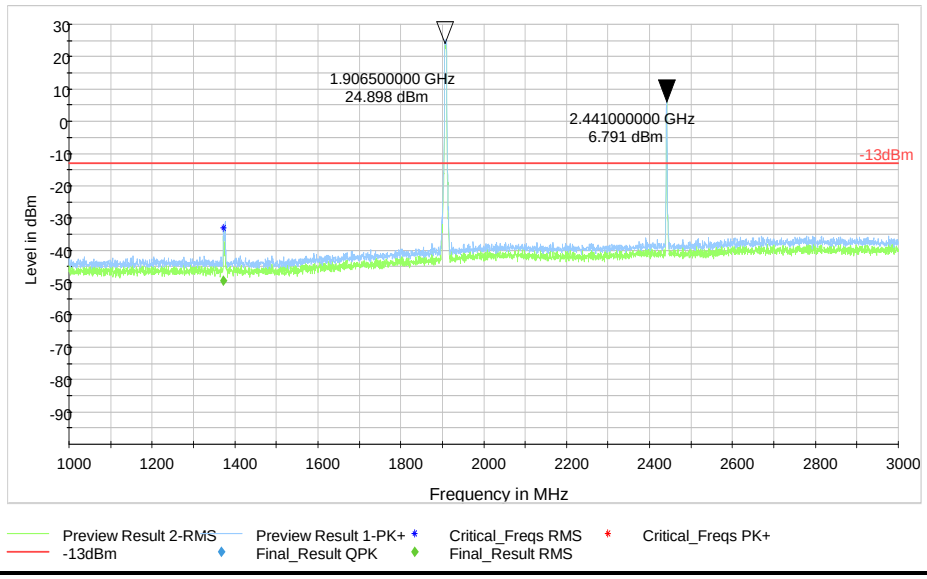
Plot #40 Radiated Emissions: 30 MHz – 1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Plot #41 Radiated Emissions: 1-3 GHz

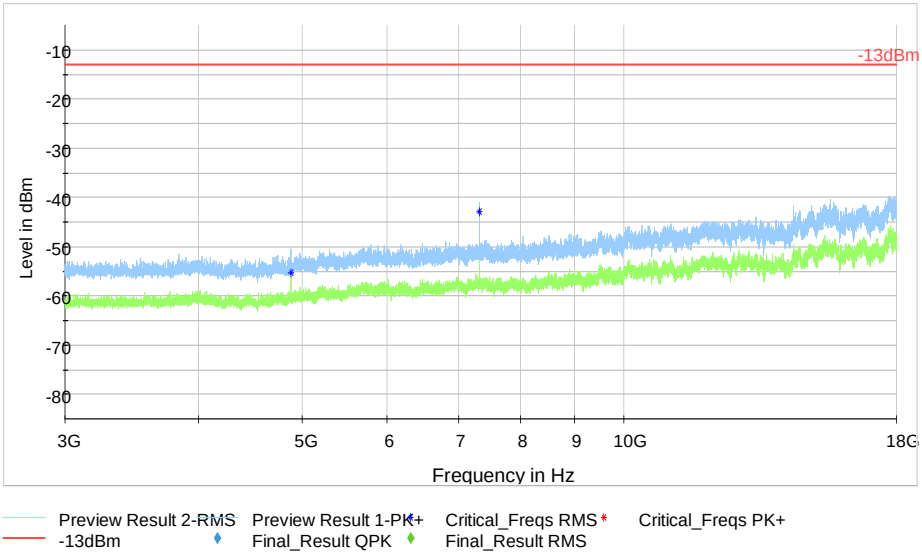
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band II: 1907.6 MHz (uplink), 1987.6 MHz (downlink)

Plot #42 Radiated Emissions: 3-18 GHz

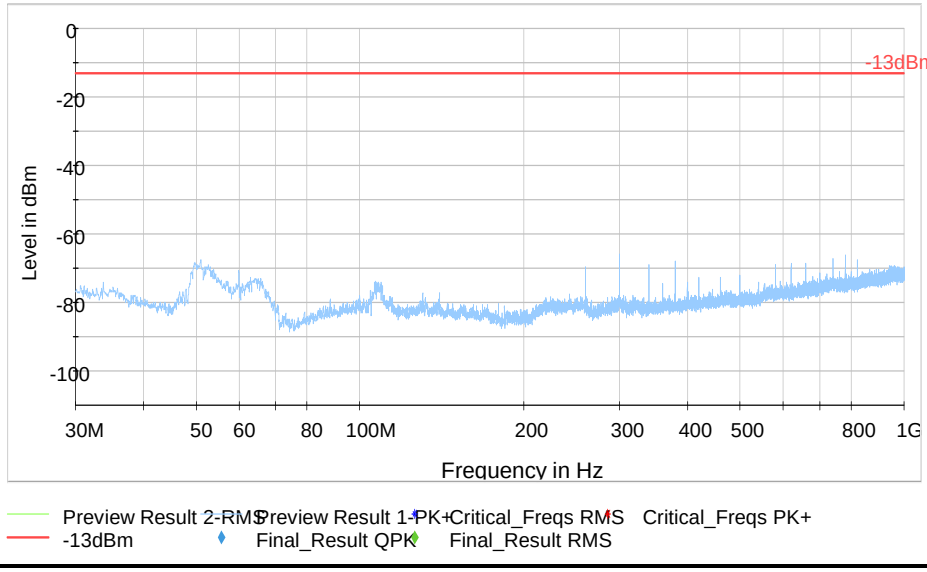
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.10 UMTS FDD IV

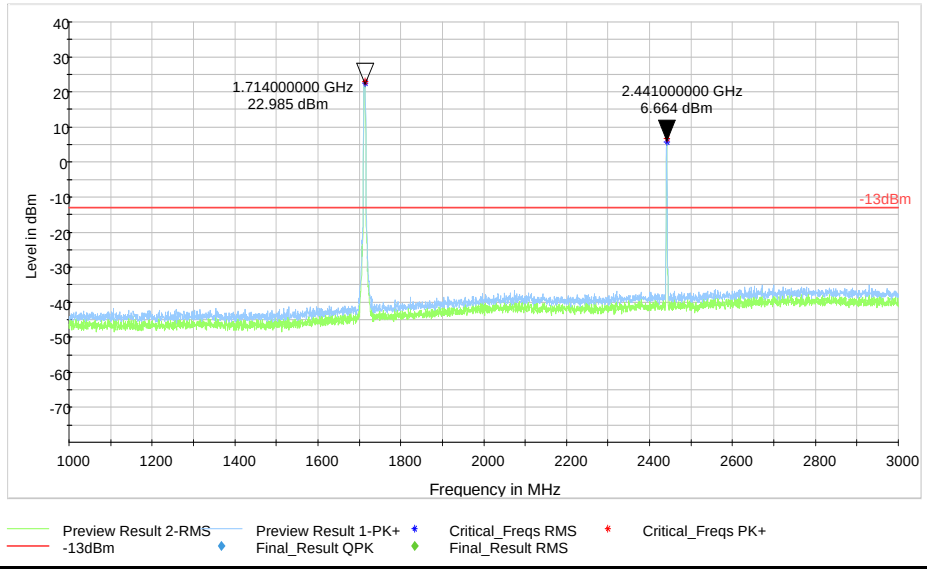
Plot #43 Radiated Emissions: 30 MHz-1 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot #44 Radiated Emissions: 1-3 GHz

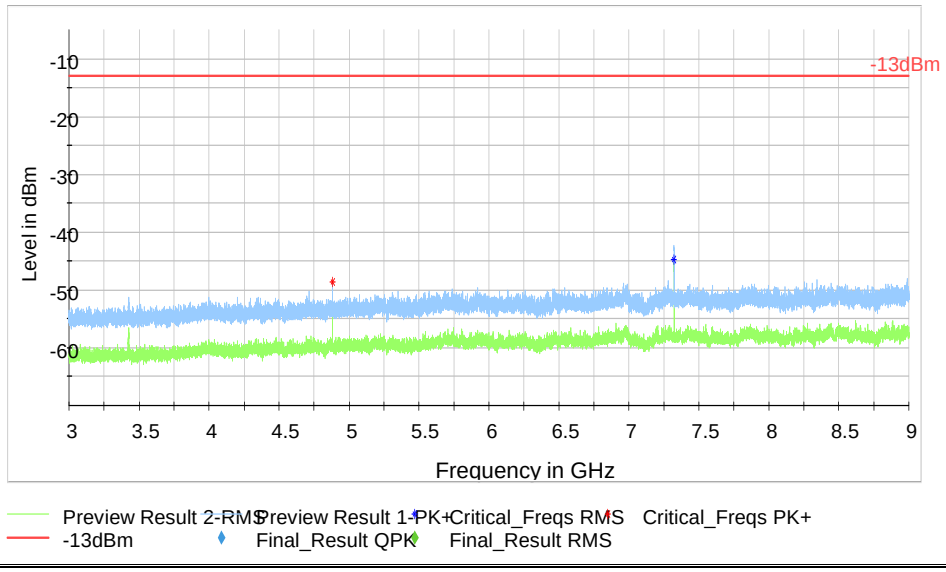
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band IV: 1712.4 MHz (uplink), 2112.4 MHz (downlink)

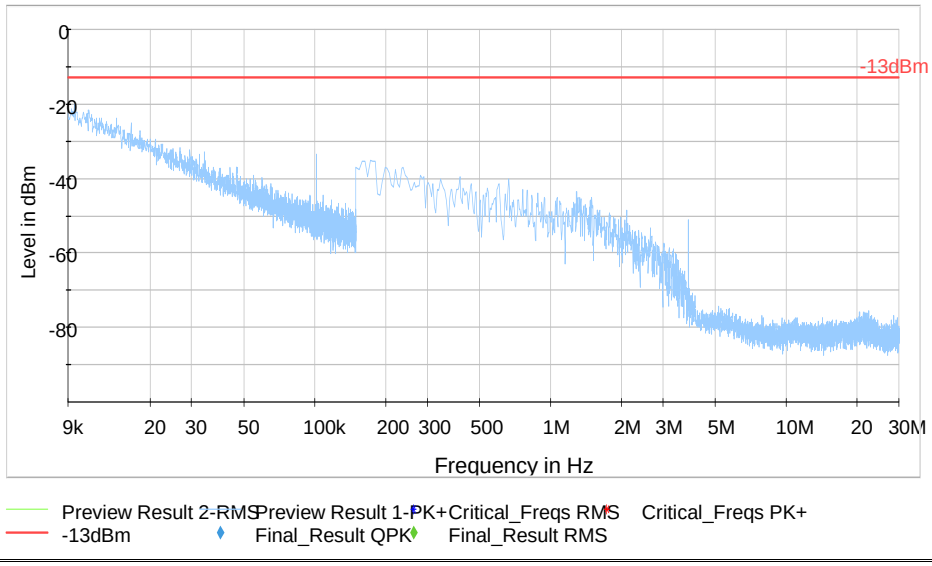
Plot #45 Radiated Emissions: 3-9 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



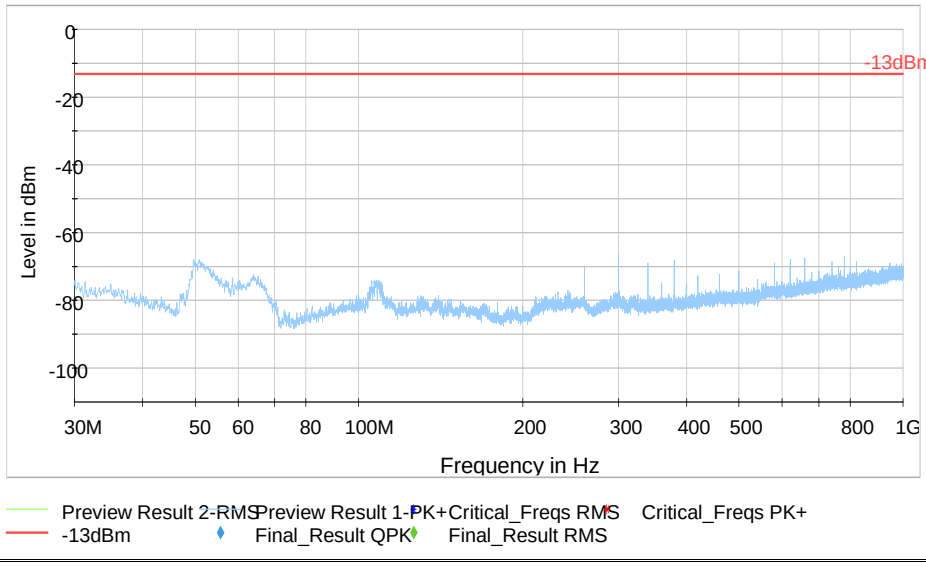
Plot #46 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



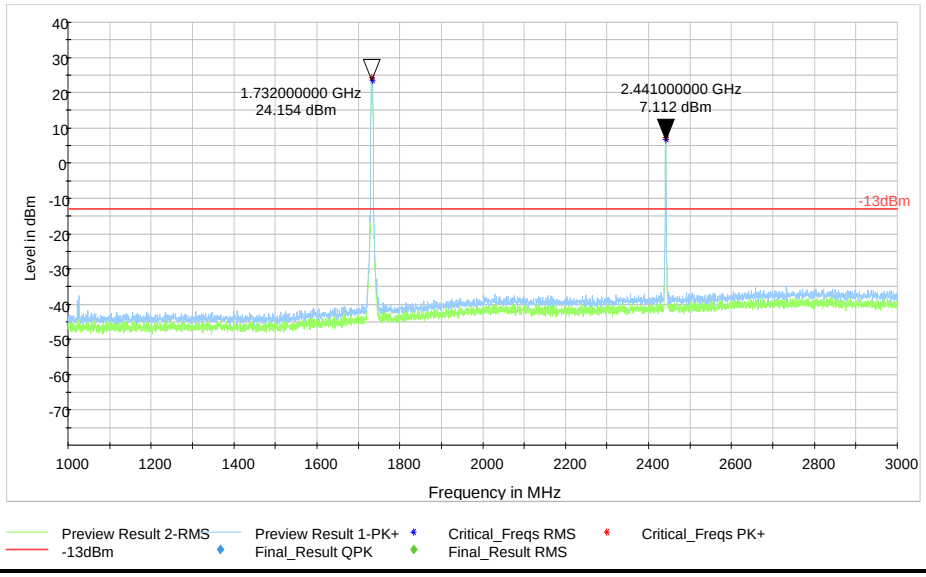
Plot #47 Radiated Emissions: 30 MHz-1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #48 Radiated Emissions: 1-3 GHz

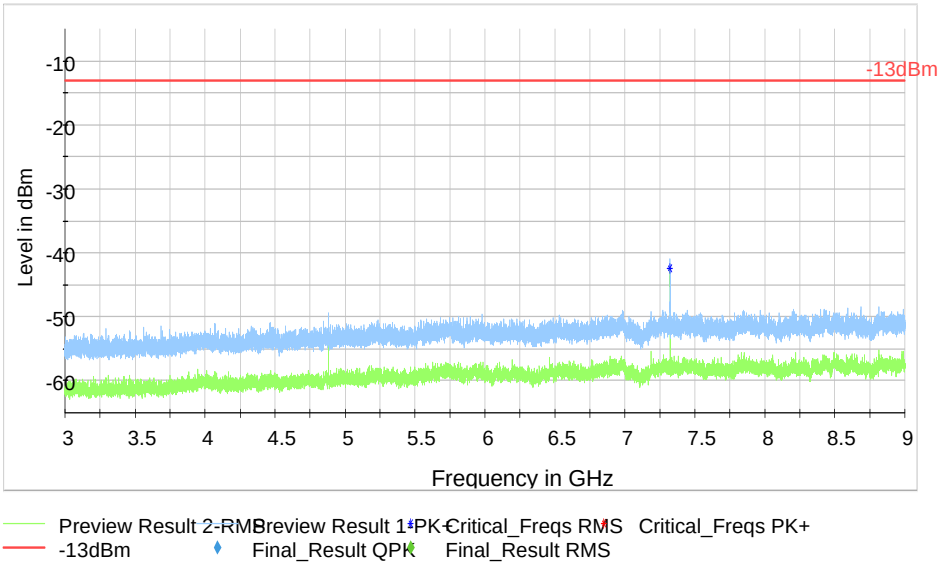
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band IV: 1732.6 MHz (uplink), 2132.6 MHz (downlink)

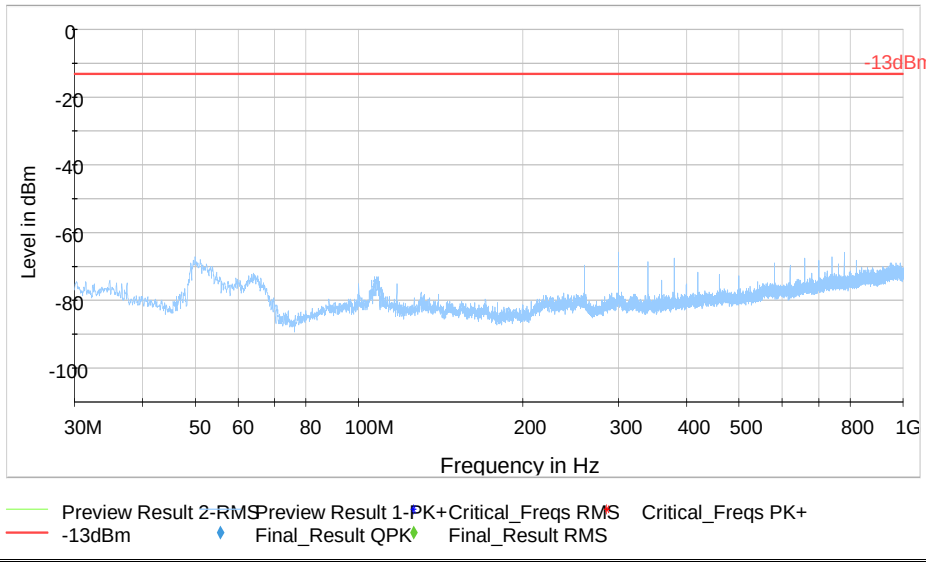
Plot #49 Radiated Emissions: 3-9 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



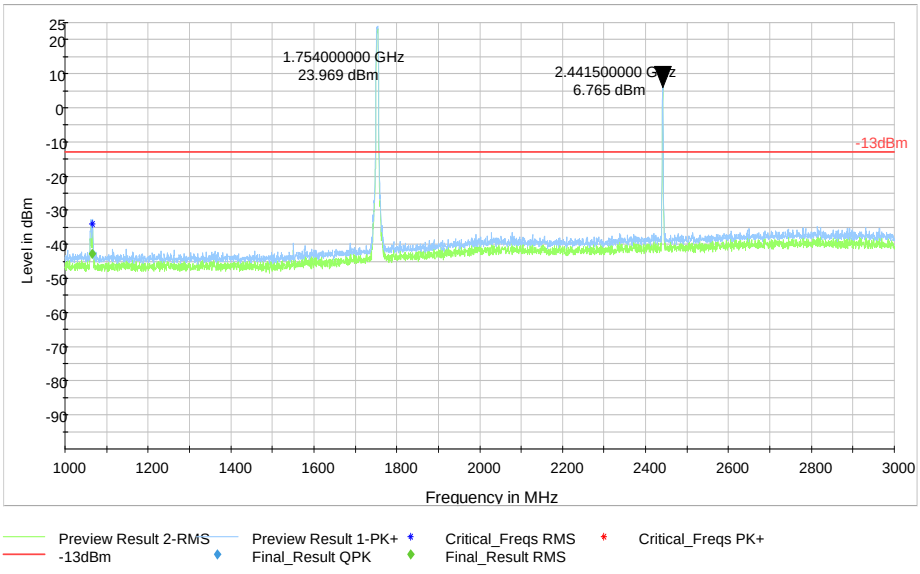
Plot #50 Radiated Emissions: 30 MHz-1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



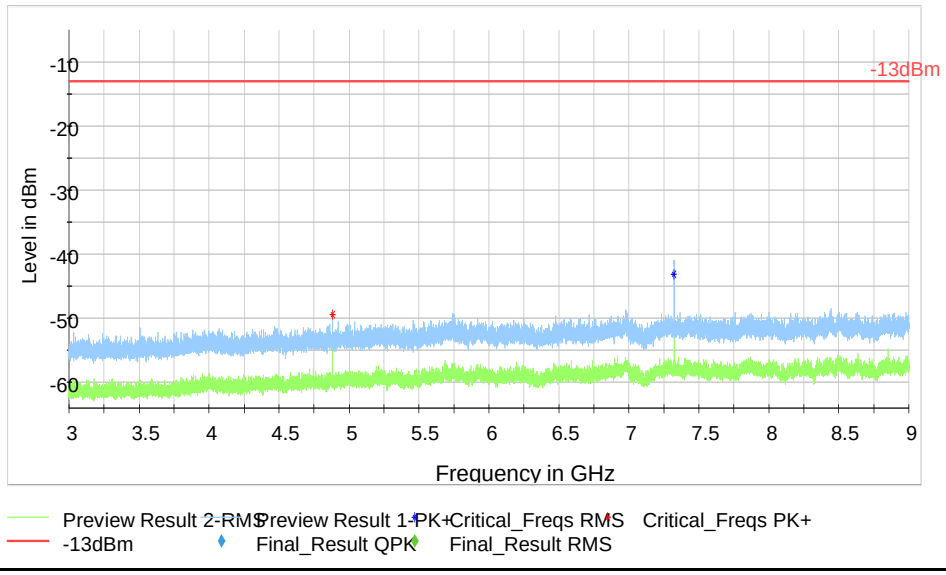
Plot #51 Radiated Emissions: 1-3 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on UMTS Band IV: 1752.6 MHz (uplink), 2152.6 MHz (downlink)

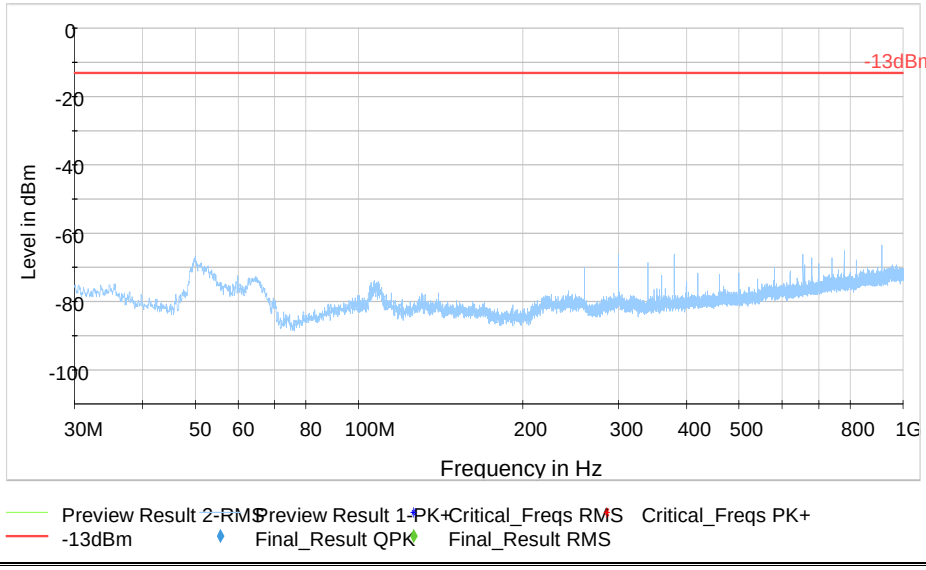
Plot #52 Radiated Emissions: 3-9 GHz
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.11 LTE Band 2

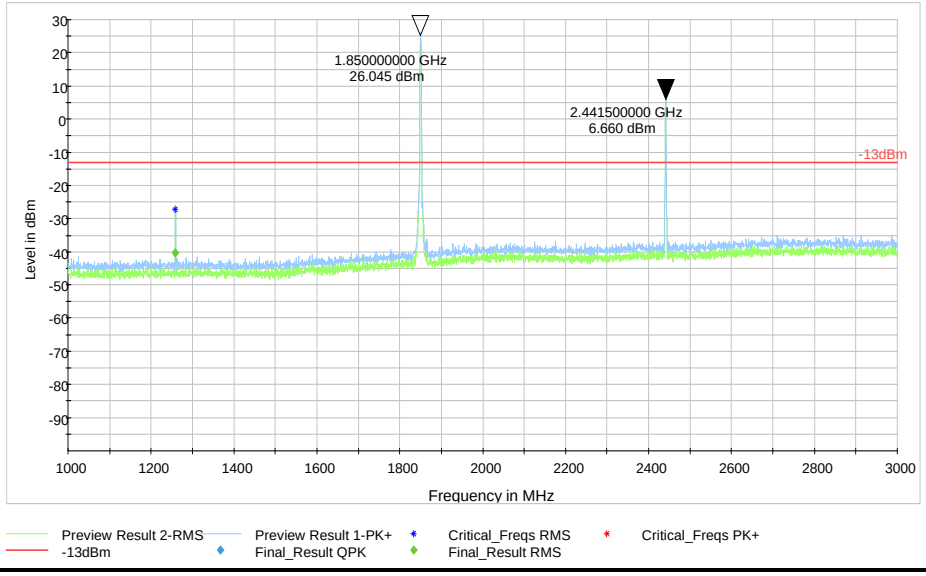
Plot #53 Radiated Emissions: 30 MHz-1 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot #54 Radiated Emissions: 1-3 GHz

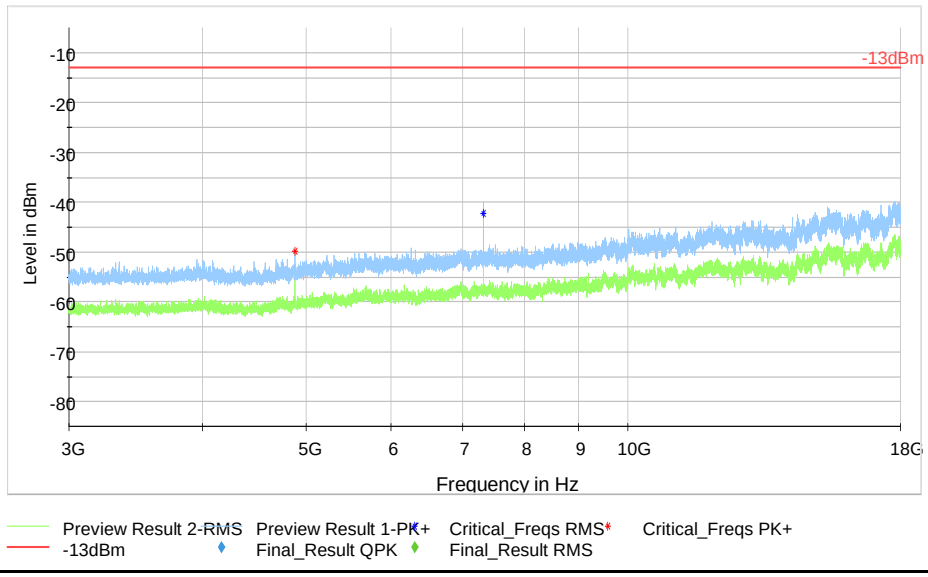
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 2: 1850 MHz (uplink), 1930 MHz (downlink)

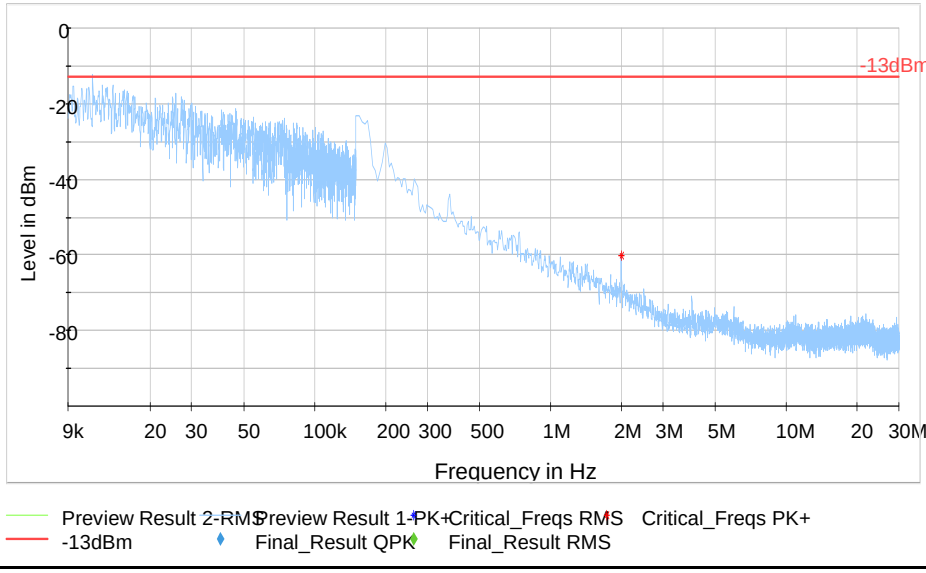
Plot #55 Radiated Emissions: 3-18 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



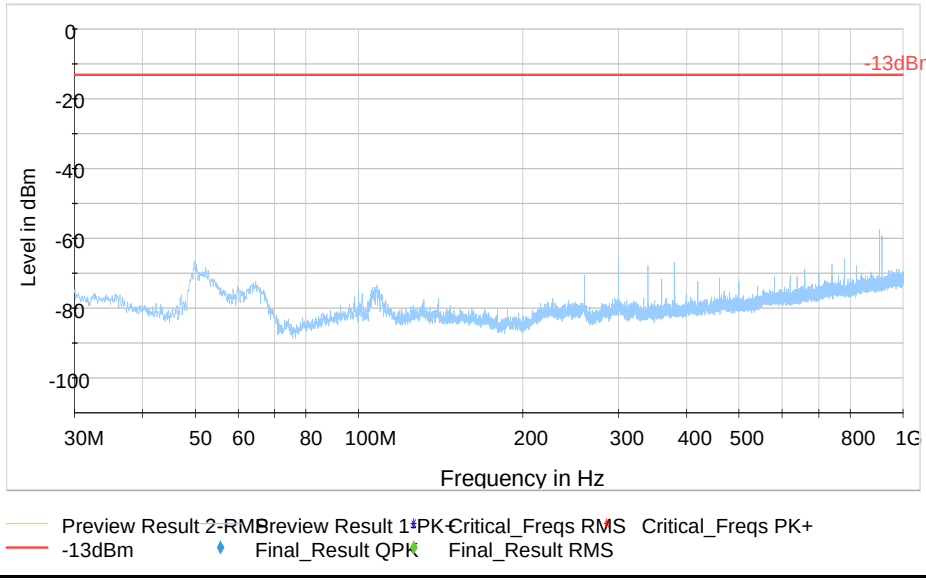
Plot #56 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



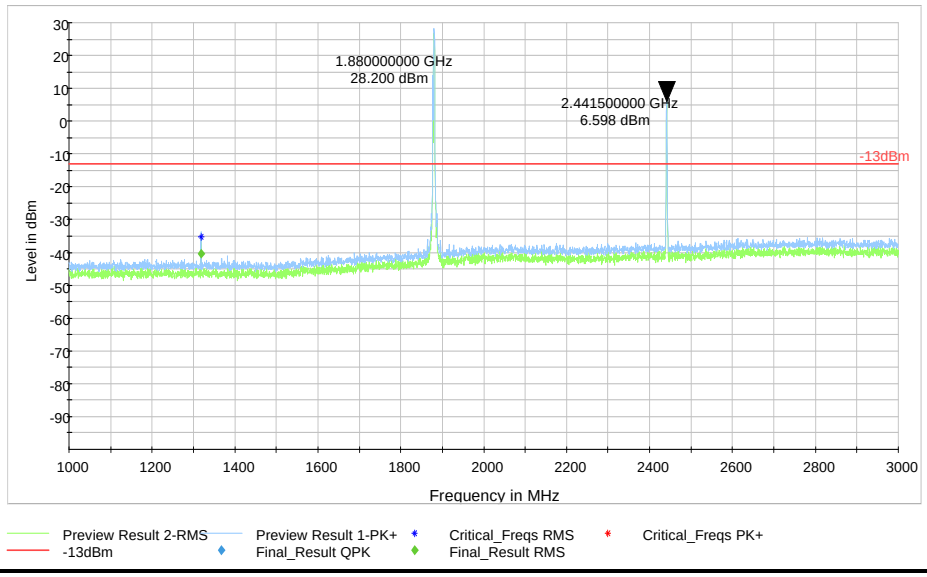
Plot #57 Radiated Emissions: 30 MHz-1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #58 Radiated Emissions: 1-3 GHz

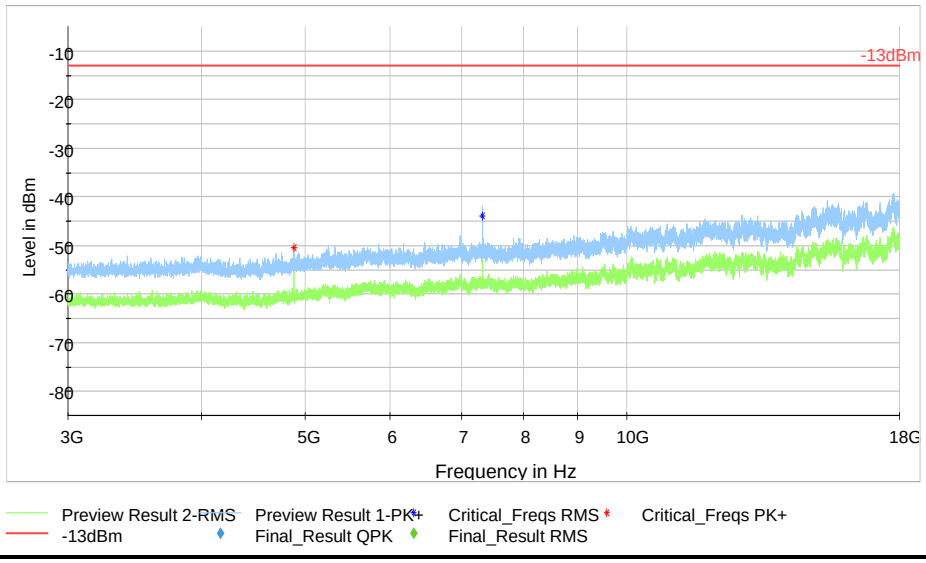
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 2: 1880 MHz (uplink), 1960 MHz (downlink)

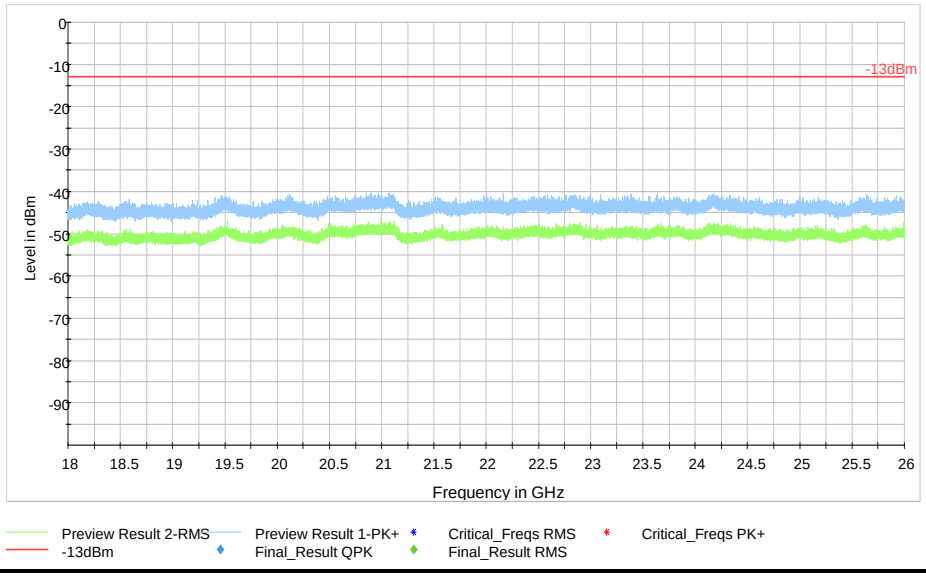
Plot #59 Radiated Emissions: 3-18 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



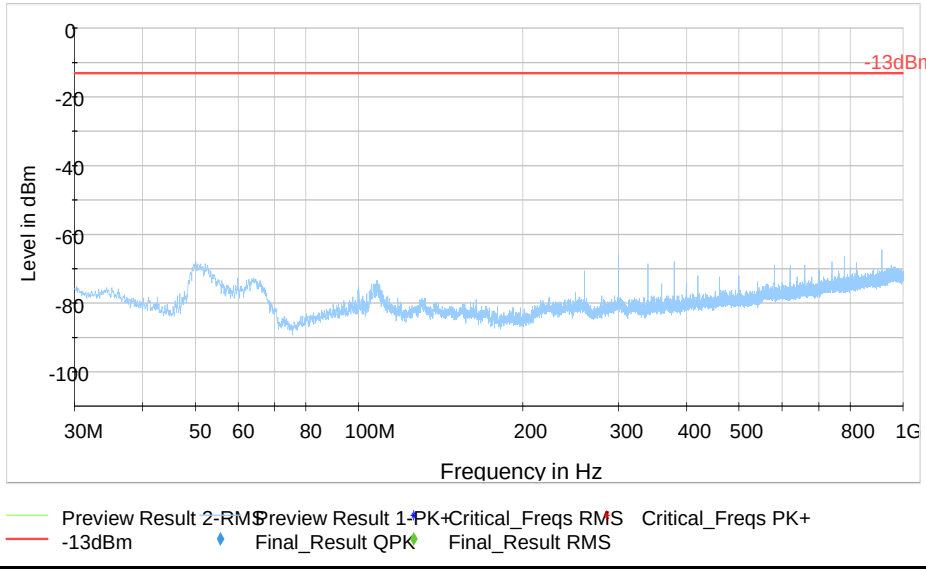
Plot #60 Radiated Emissions: 18-26 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



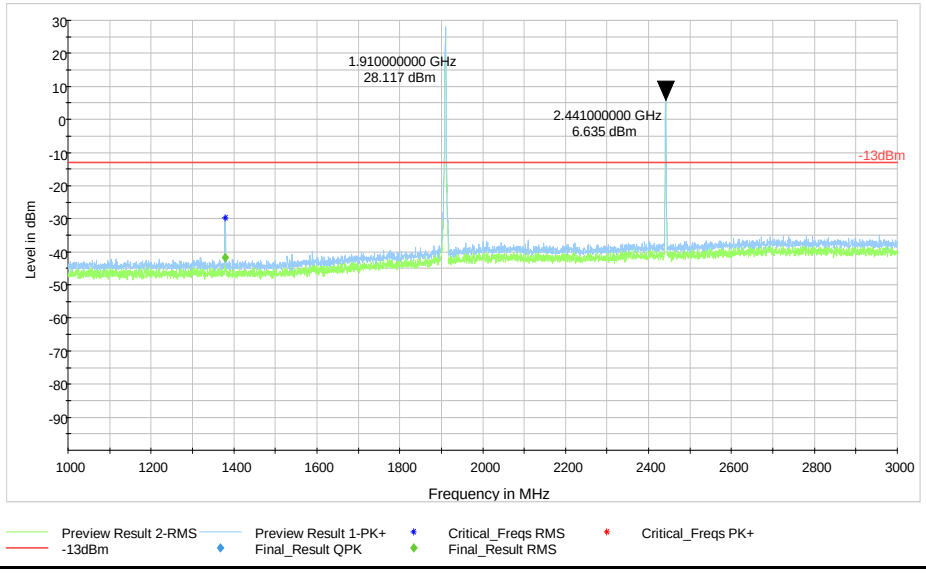
Plot #61 Radiated Emissions: 30 MHz-1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Plot #62 Radiated Emissions: 1-3 GHz

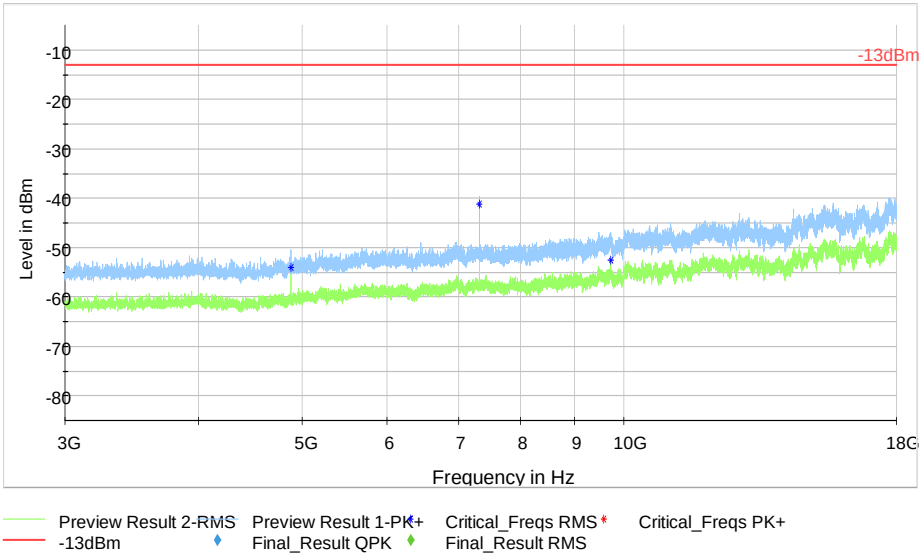
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 2: 1910 MHz (uplink), 1990 MHz (downlink)

Plot #63 Radiated Emissions: 3-18 GHz

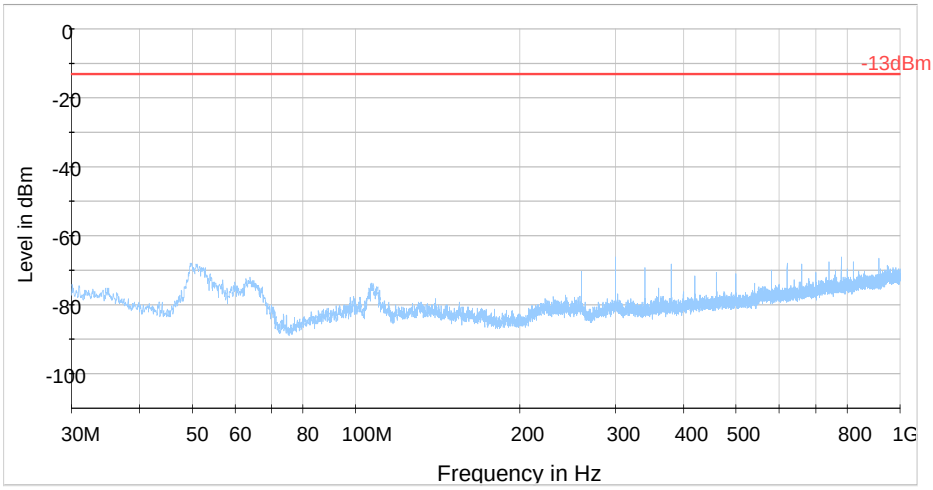
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.12 LTE Band 4

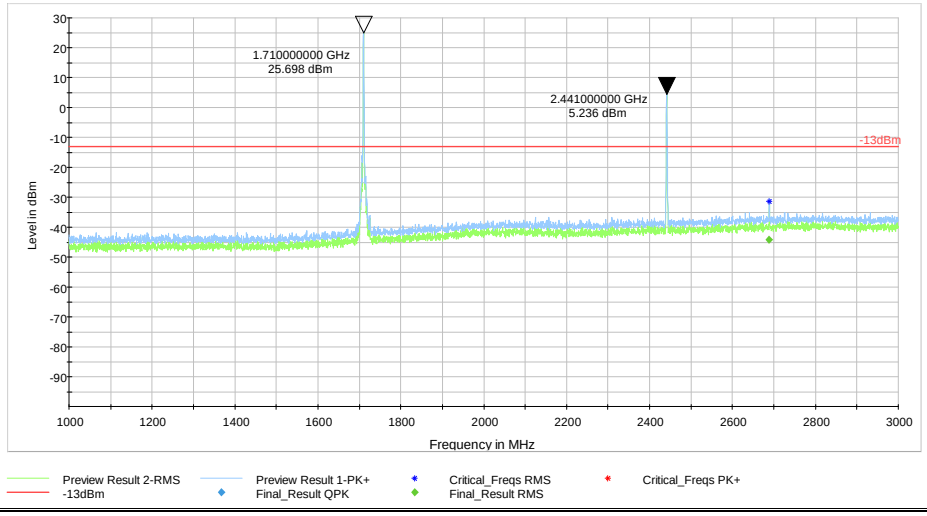
Plot #64 Radiated Emissions: 30 MHz-1 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot #65 Radiated Emissions: 1-3 GHz

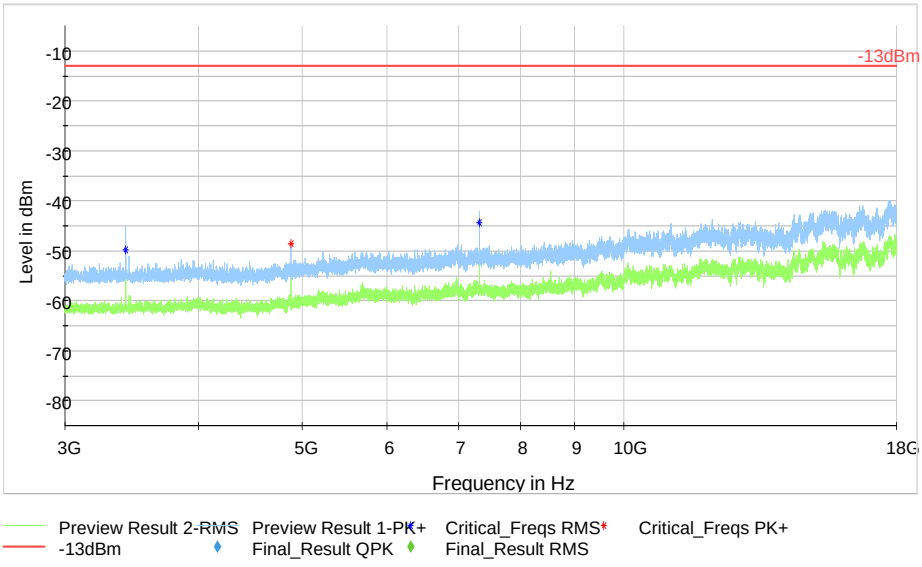
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 4: 1710 MHz (uplink), 2110 MHz (downlink)

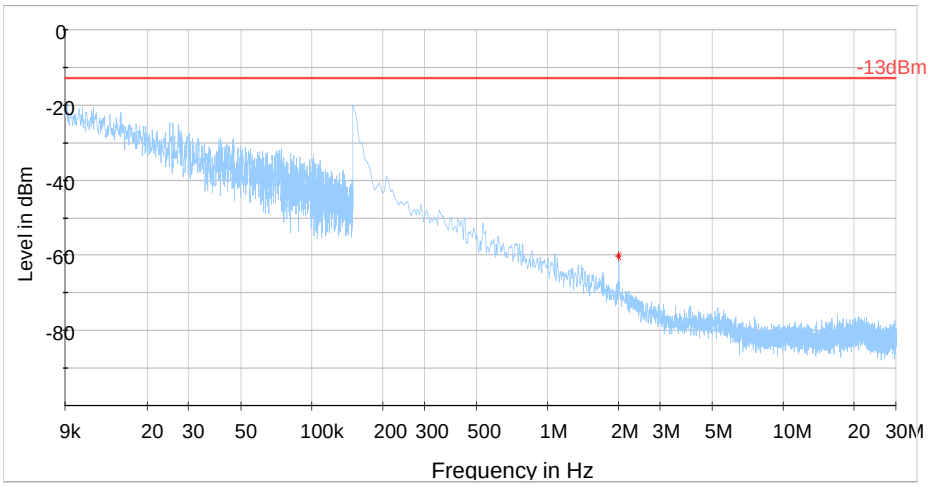
Plot #66 Radiated Emissions: 3-18 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



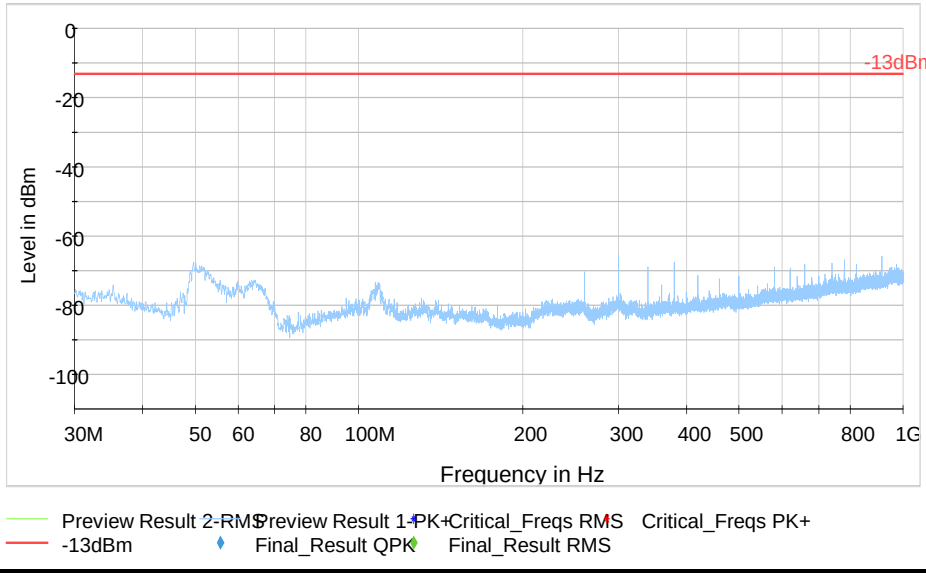
Plot #67 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



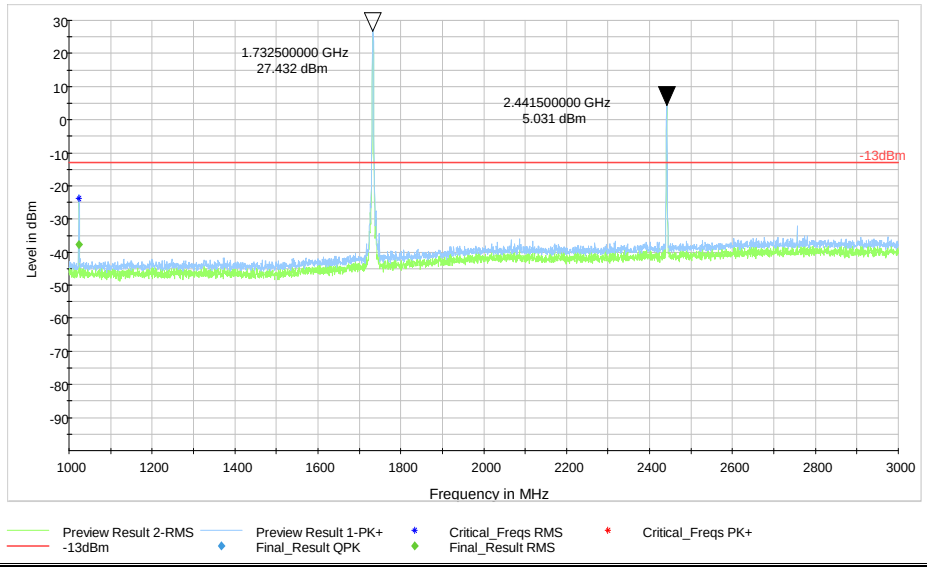
Plot #68 Radiated Emissions: 30 MHz-1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #69 Radiated Emissions: 1-3 GHz

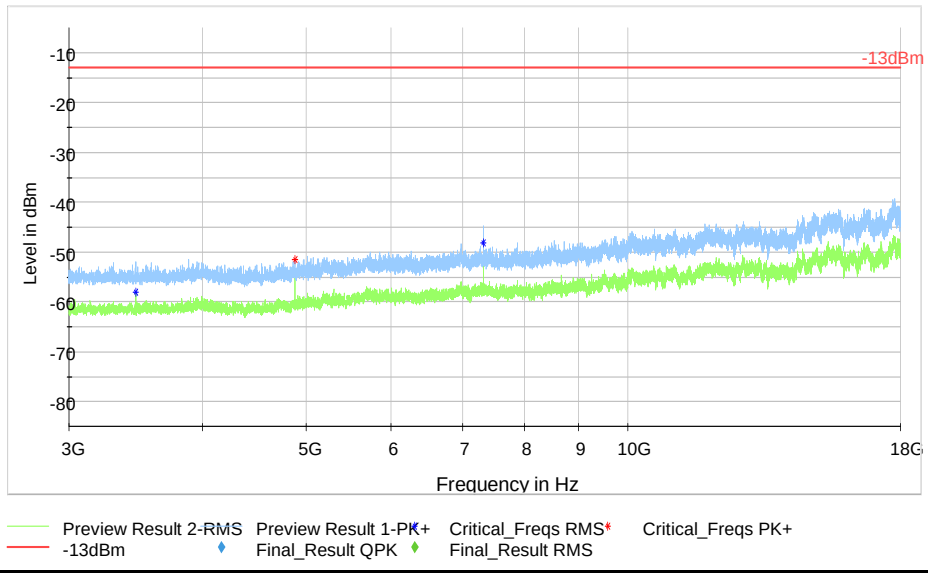
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 4: 1732.5 MHz (uplink), 2132.5 MHz (downlink)

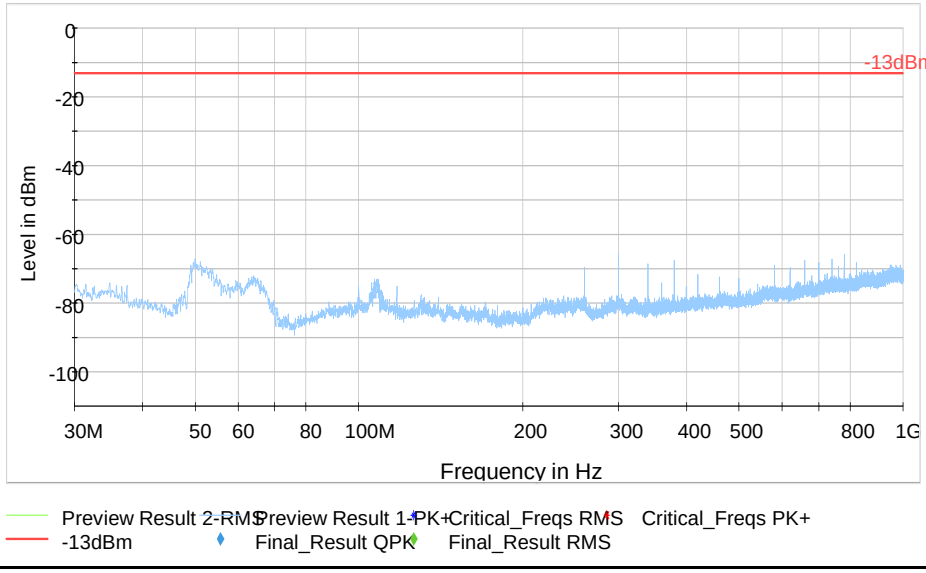
Plot #70 Radiated Emissions: 3-18 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



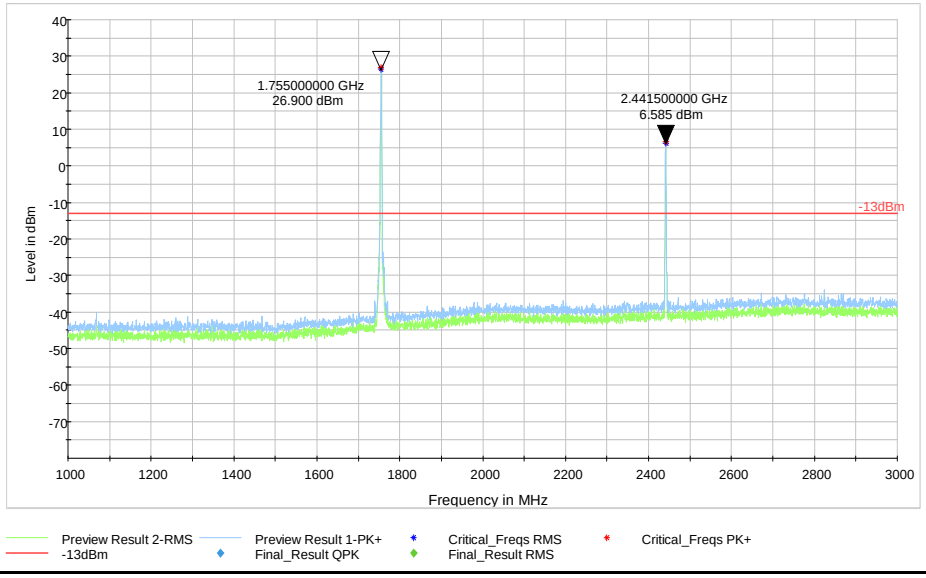
Plot #71 Radiated Emissions: 30 MHz-1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Plot #72 Radiated Emissions: 1-3 GHz

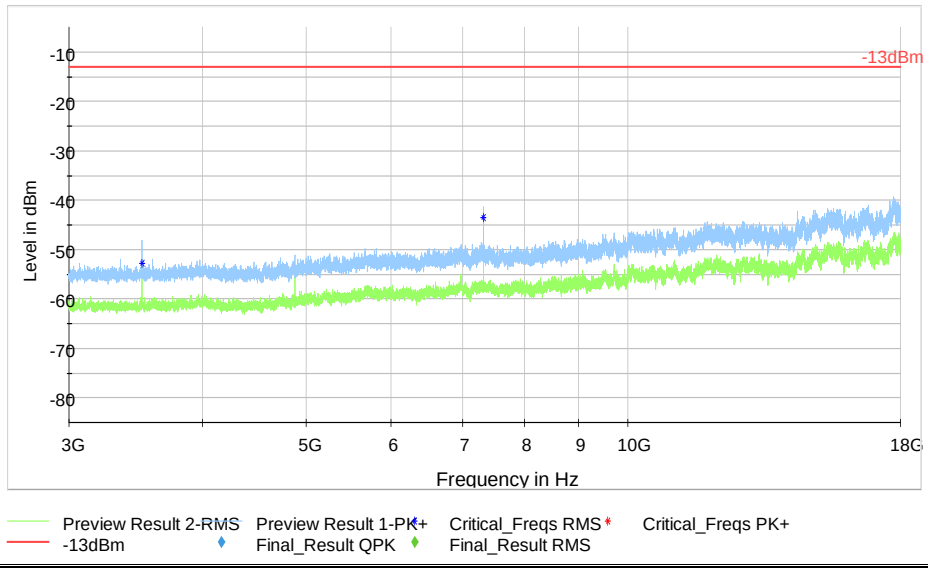
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 4: 1755 MHz (uplink), 2155 MHz (downlink)

Plot #73 Radiated Emissions: 3-18 GHz

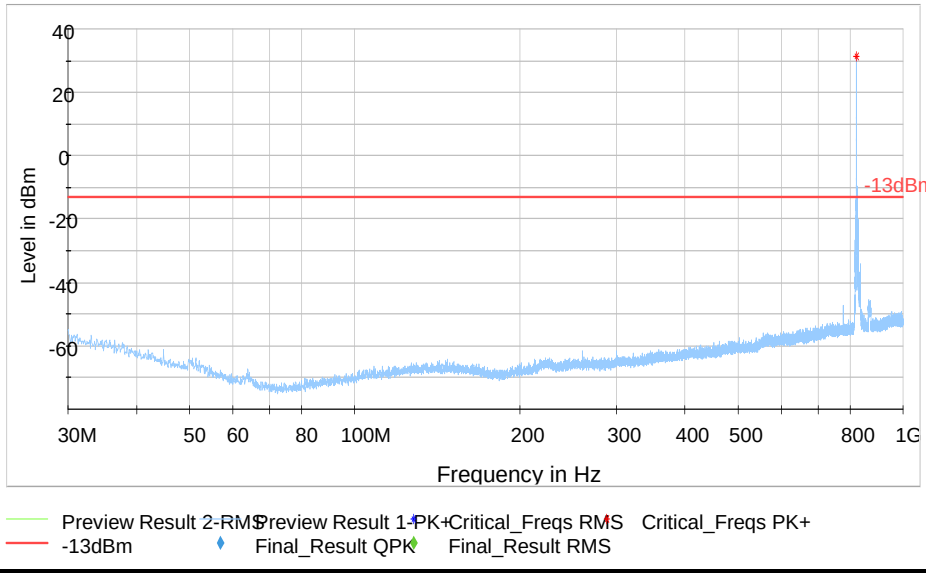
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.13 LTE Band 5

Plot #74 Radiated Emissions: 30 MHz-1 GHz

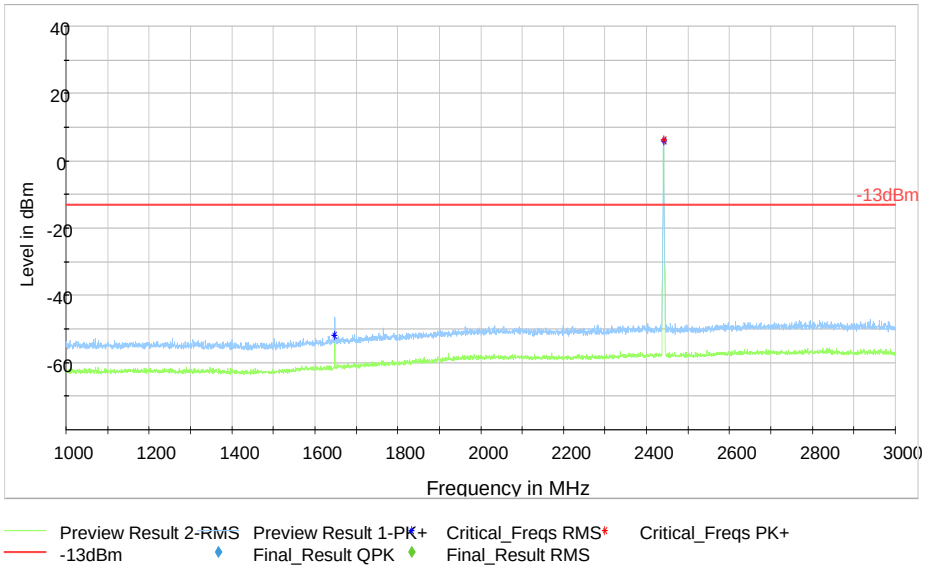
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 5: 824 MHz (uplink), 869 MHz (downlink)

Plot #75 Radiated Emissions: 1-3 GHz

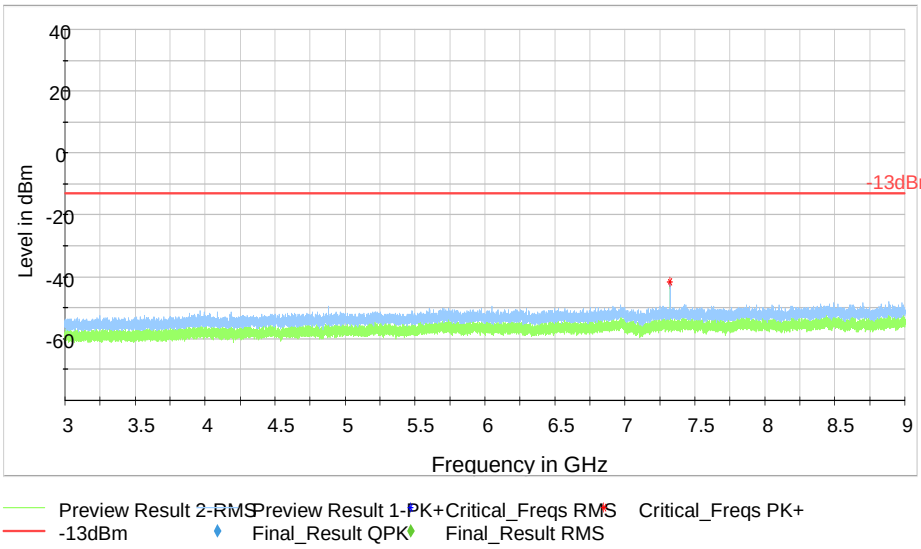
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

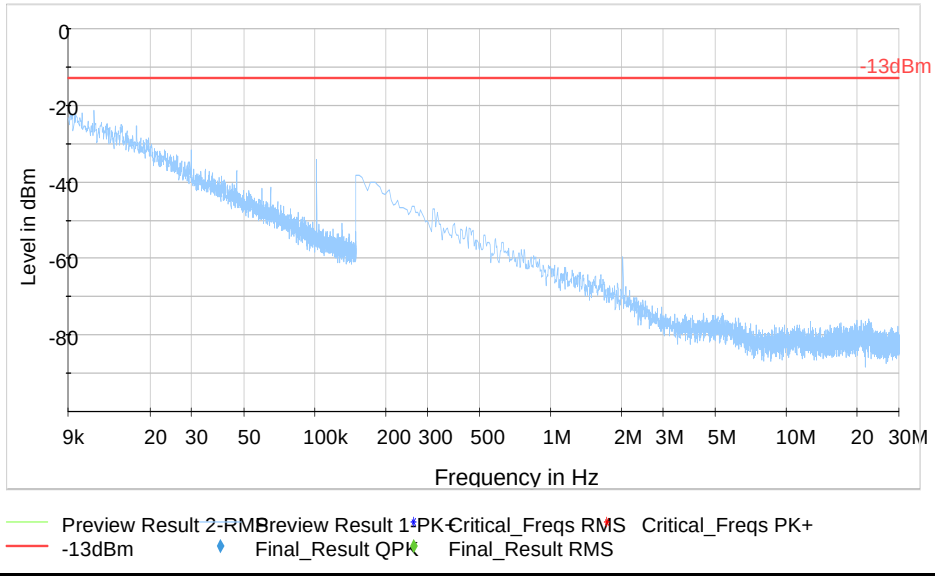
Plot #76 Radiated Emissions: 3-9 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



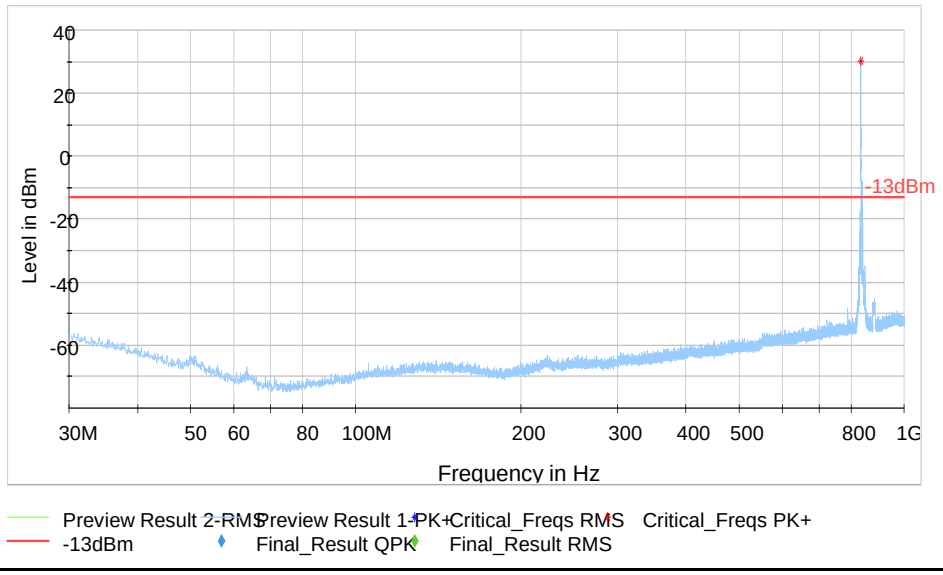
Plot #77 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #78 Radiated Emissions: 30 MHz-1 GHz

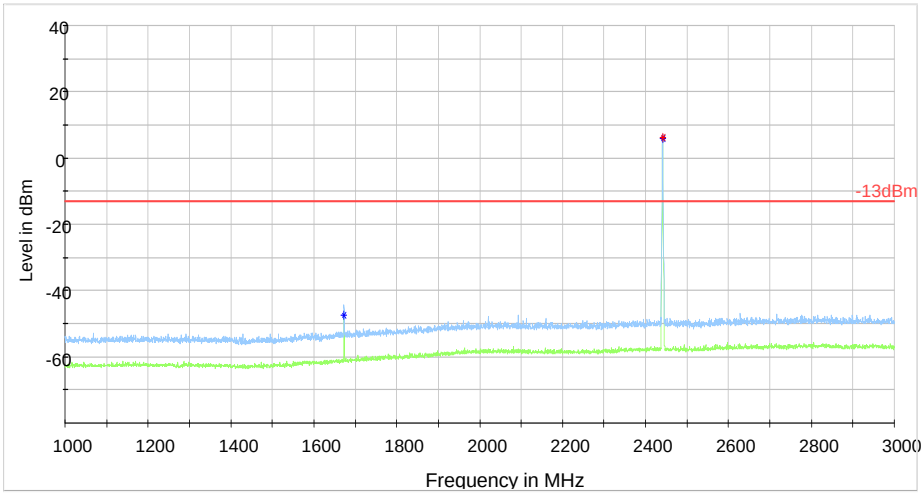
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 5: 836.5 MHz (uplink), 881.5 MHz (downlink)

Plot #79 Radiated Emissions: 1-3 GHz

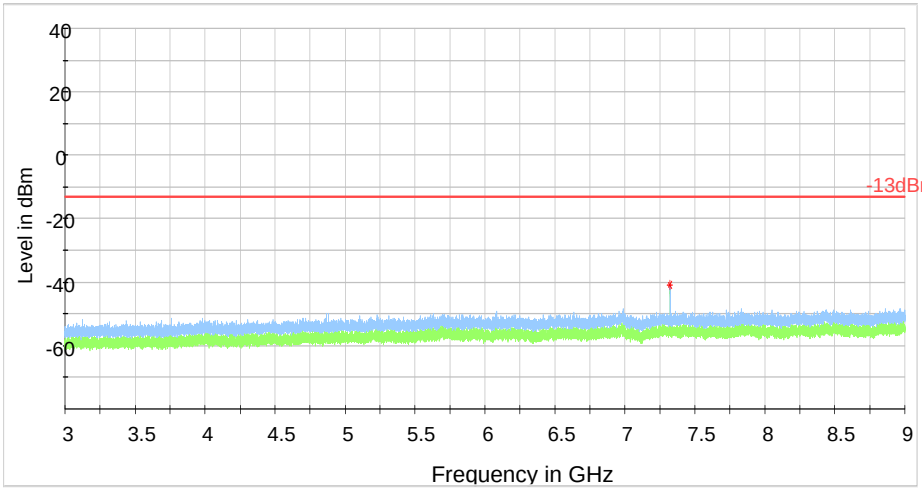
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

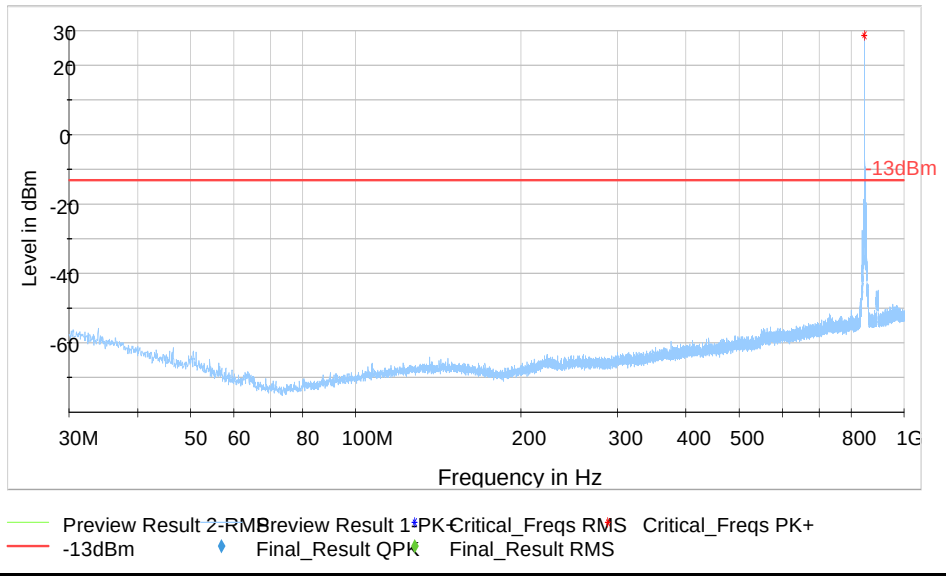
Plot #80 Radiated Emissions: 3-9 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #81 Radiated Emissions: 30 MHz-1 GHz

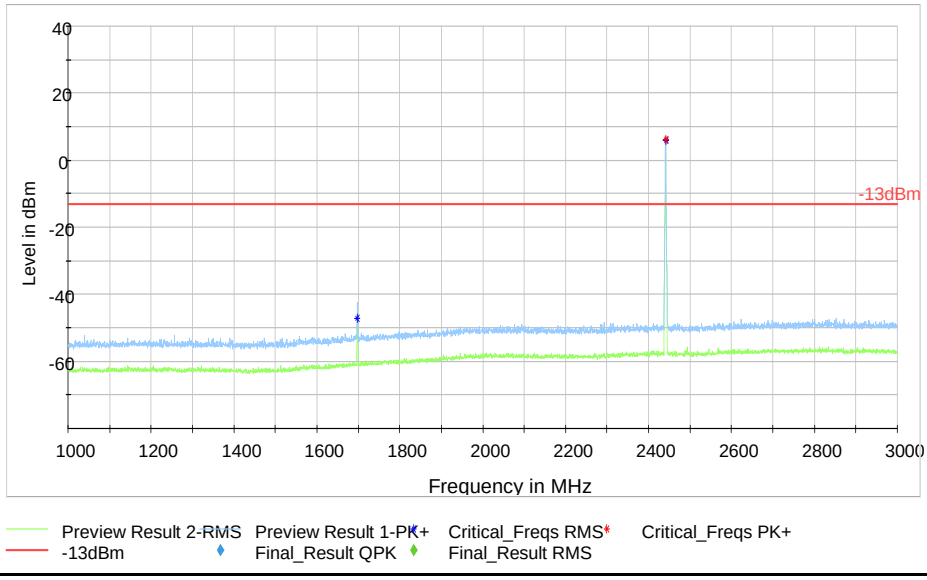
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 5: 849 MHz (uplink), 894 MHz (downlink)

Plot #82 Radiated Emissions: 1-3 GHz

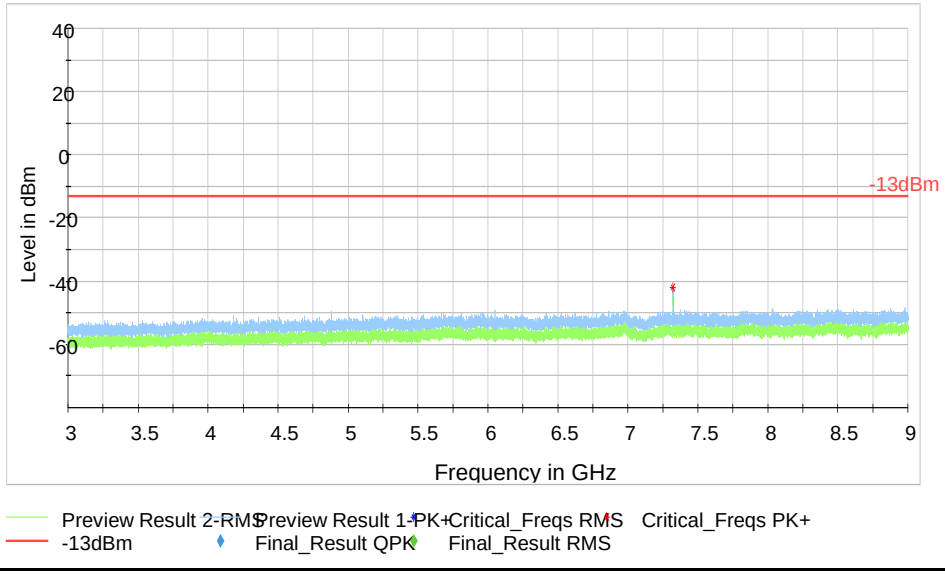
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

Plot #83 Radiated Emissions: 3-9 GHz

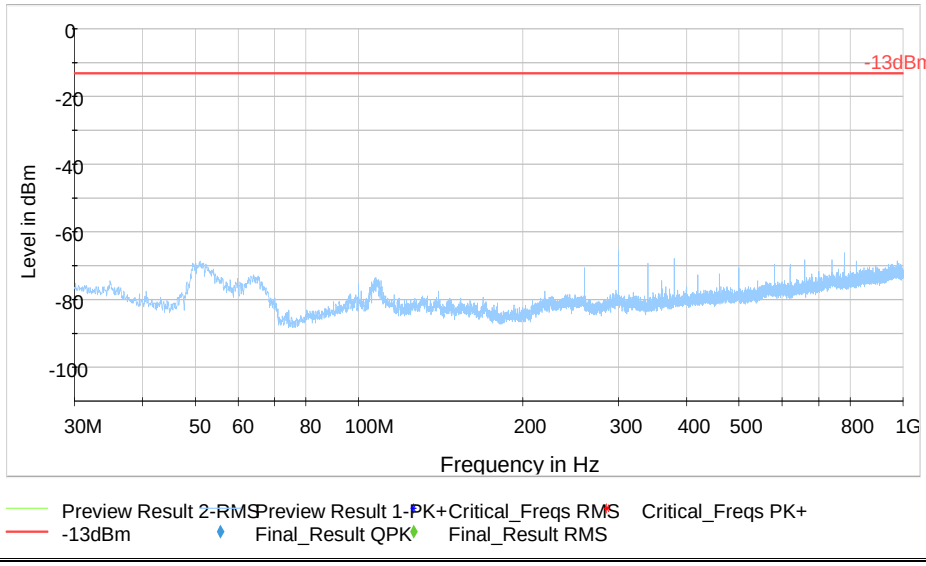
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.14 LTE Band 7

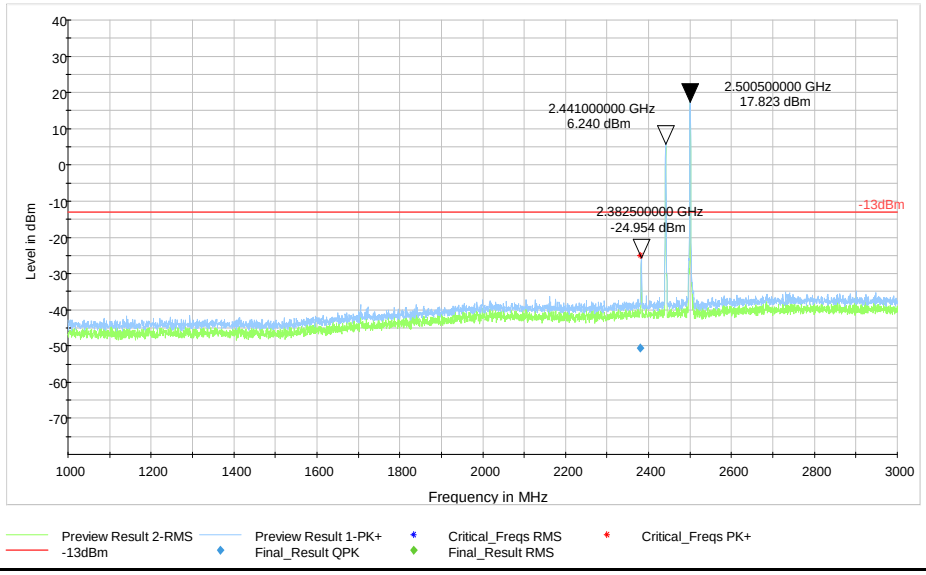
Plot #84 Radiated Emissions: 30 MHz-1 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



Plot #85 Radiated Emissions: 1-3 GHz

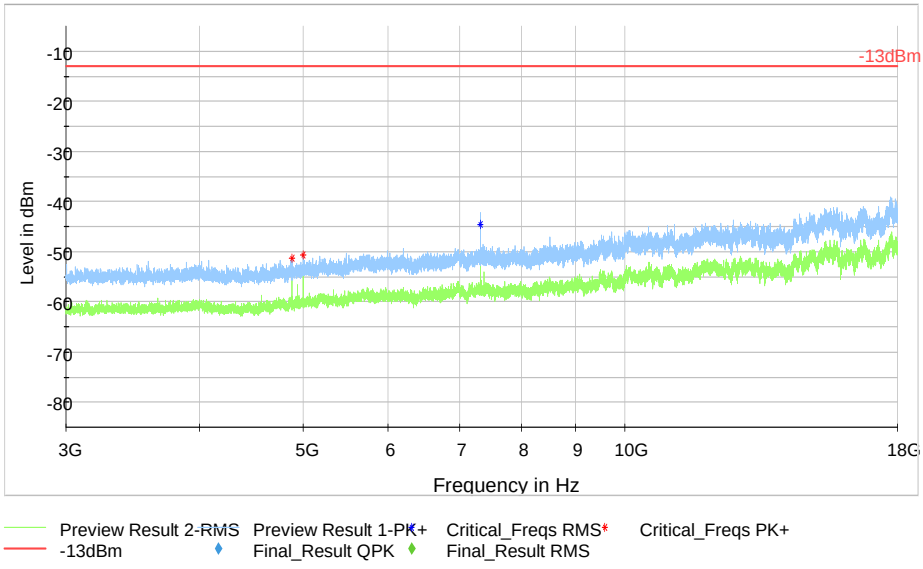
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 7: 2500 MHz (uplink), 2620 MHz (downlink)

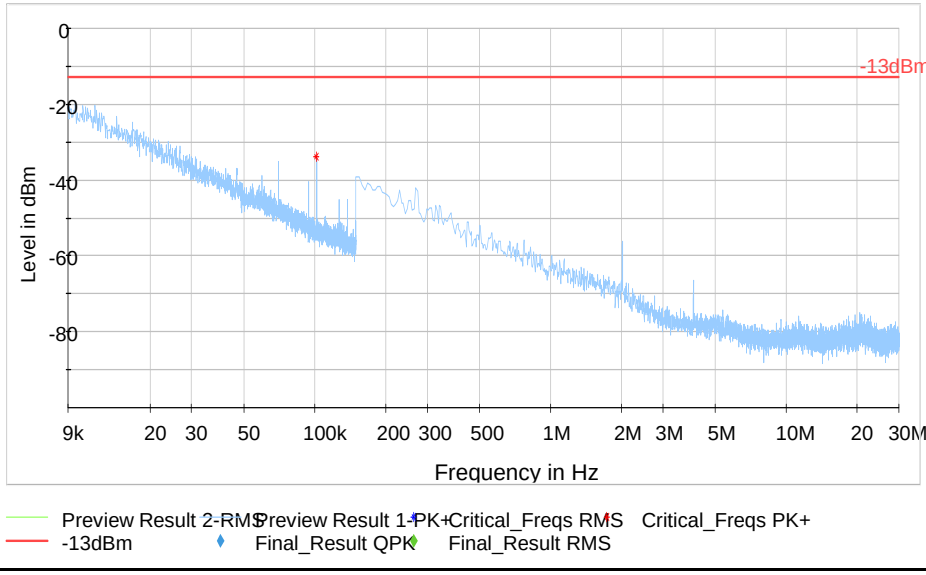
Plot #86 Radiated Emissions: 3-18 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



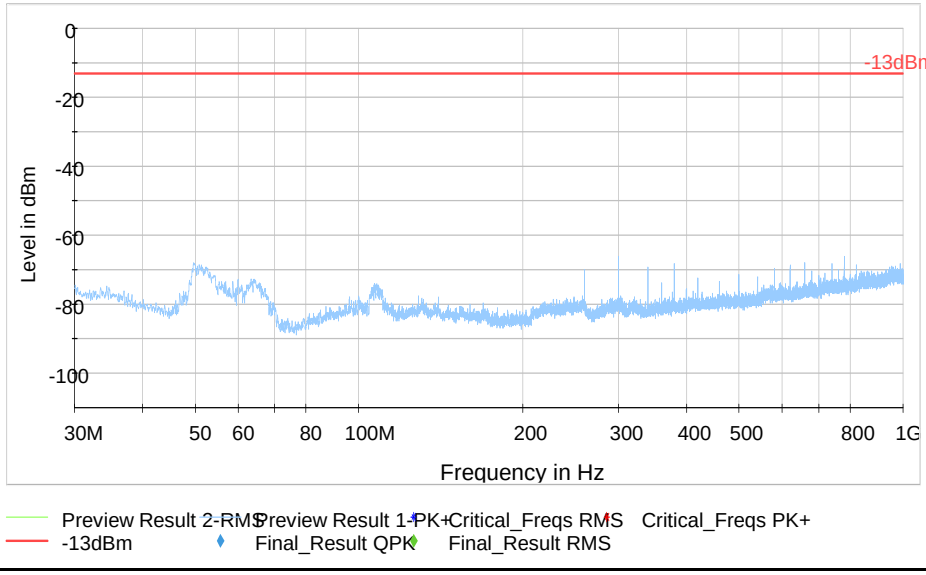
Plot #87 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



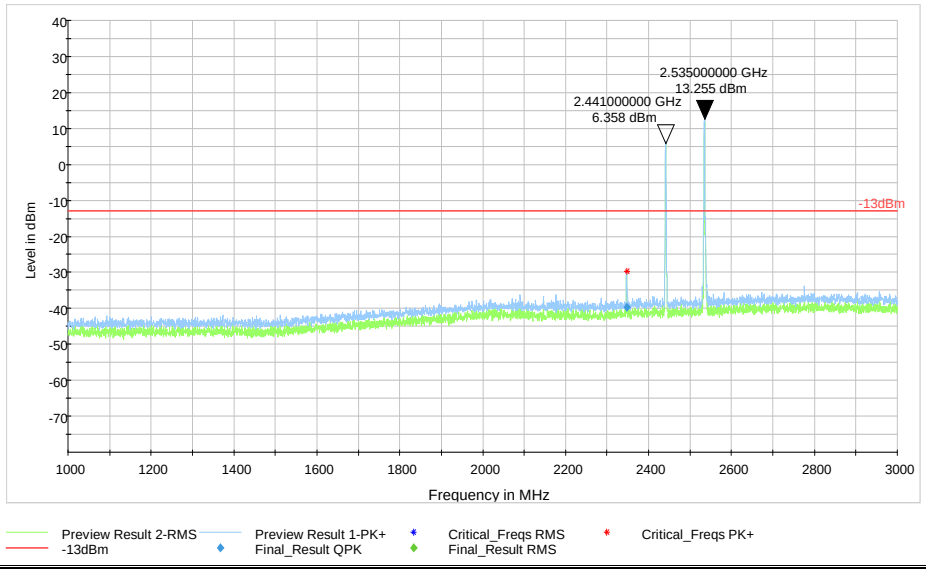
Plot #88 Radiated Emissions: 30 MHz-1 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #89 Radiated Emissions: 1-3 GHz

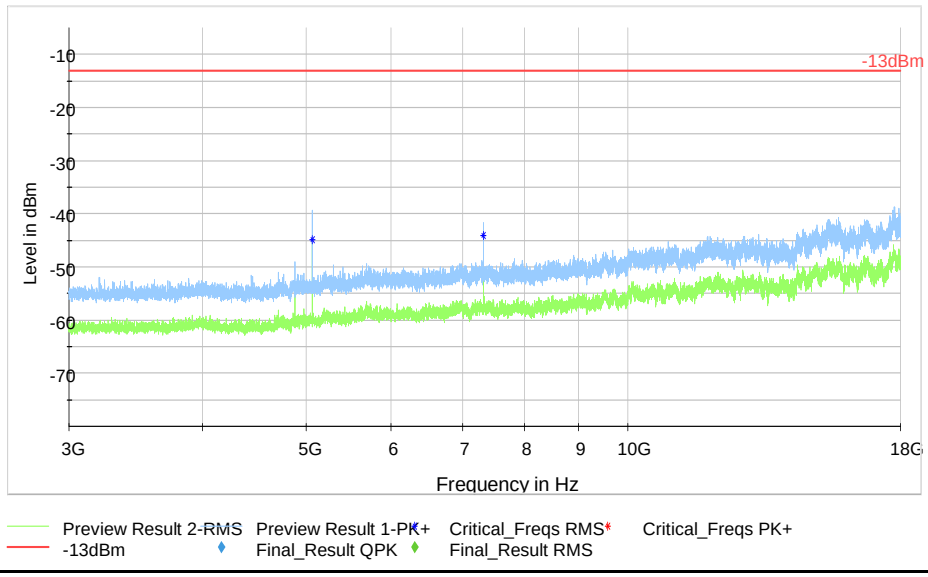
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 7: 2535 MHz (uplink), 2655 MHz (downlink)

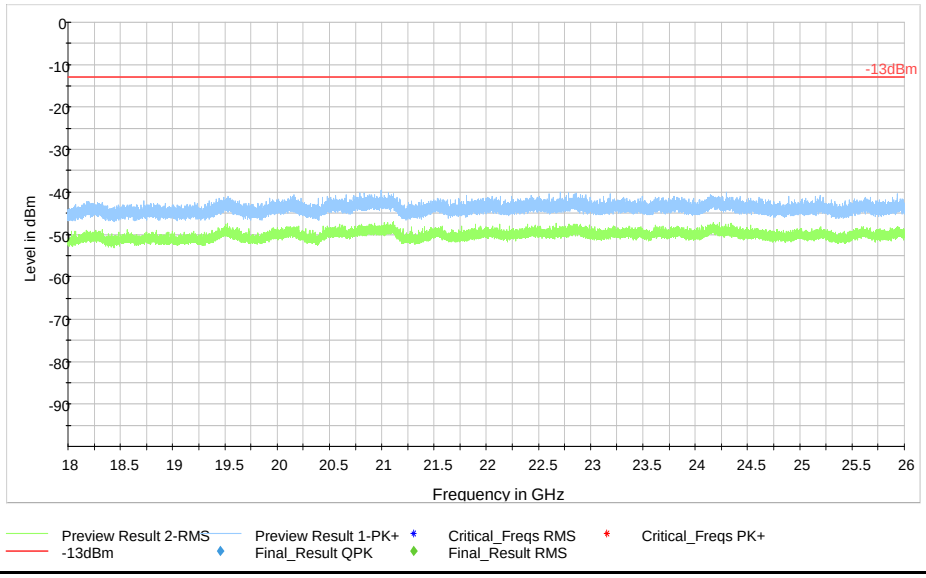
Plot #90 Radiated Emissions: 3-18 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



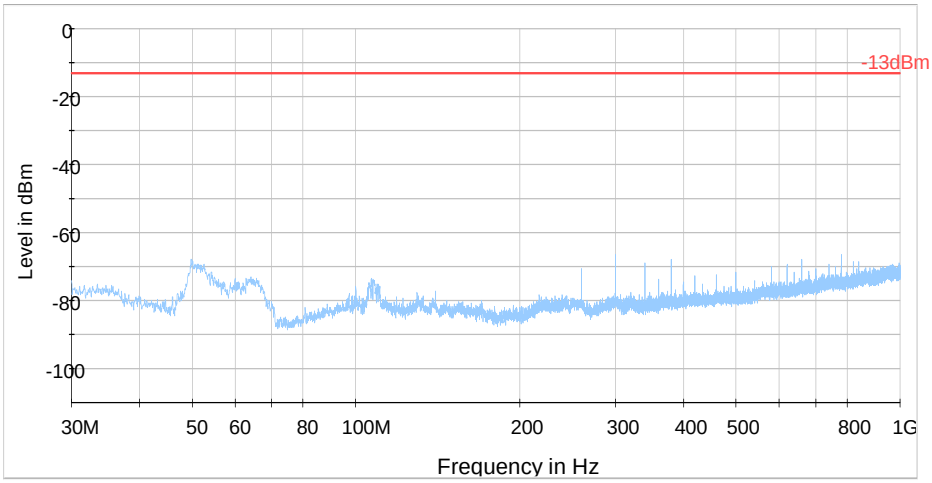
Plot #91 Radiated Emissions: 18-26 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



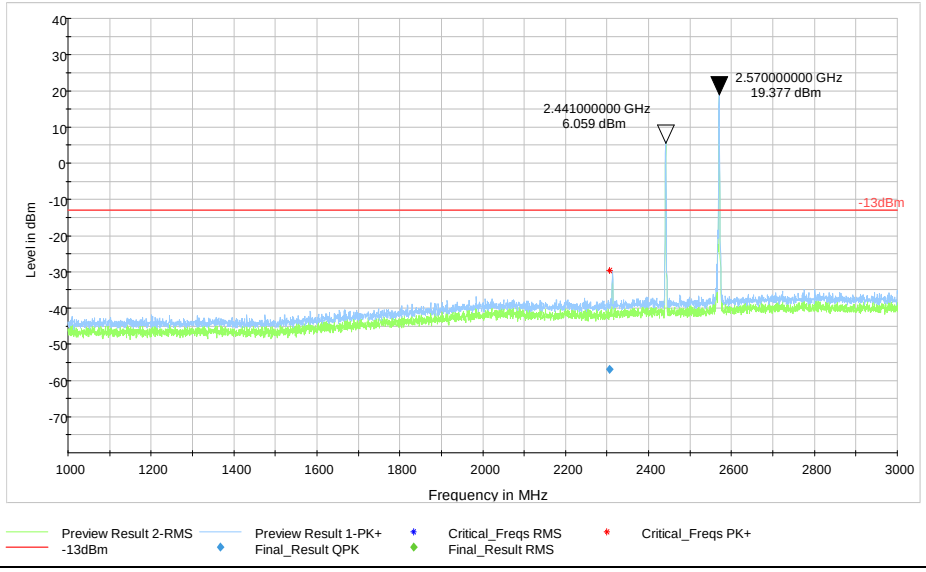
Plot #92 Radiated Emissions: 30 MHz-1 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



Plot #93 Radiated Emissions: 1-3 GHz

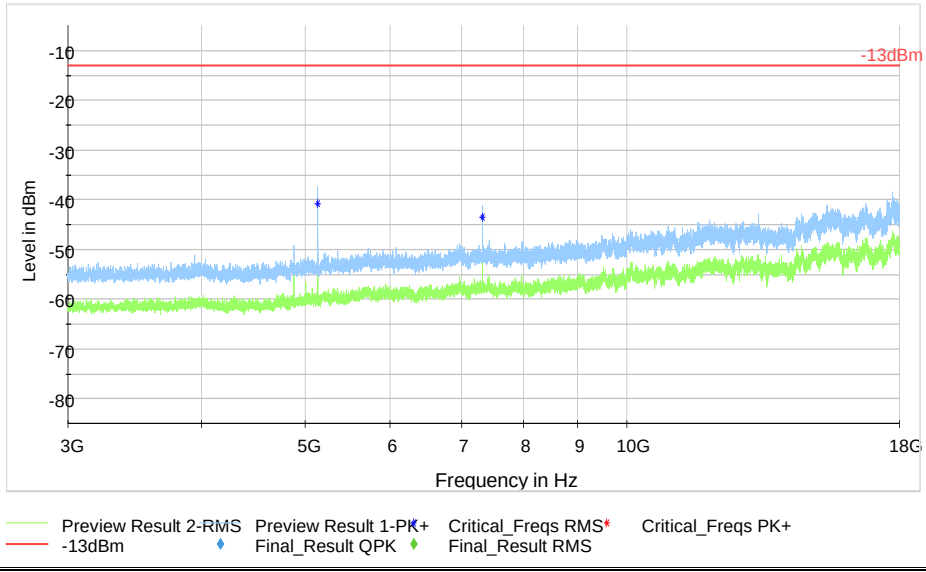
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz
Note: Intentional Transmission occurring on LTE Band 7: 2570 MHz (uplink), 2690 MHz (downlink)

Plot #94 Radiated Emissions: 3-18 GHz

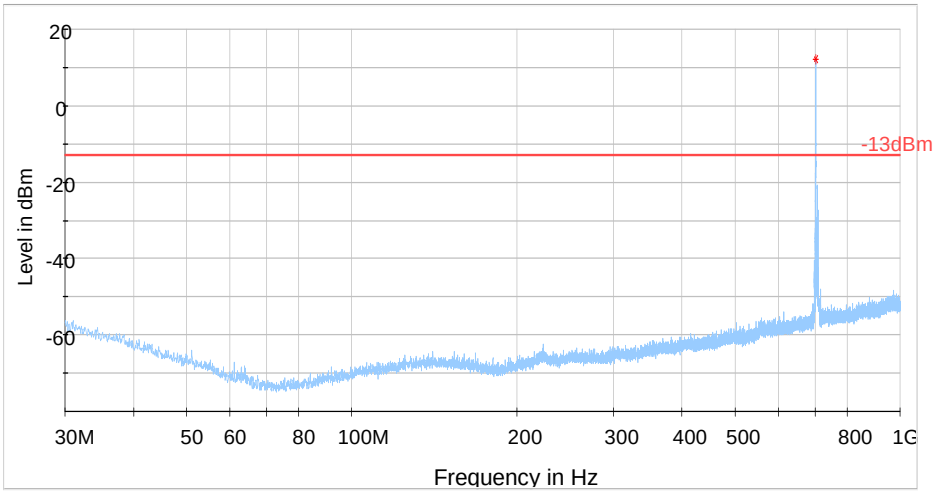
Channel: High (with BTLE Co. Tx. on Mid channel)



7.1.15 LTE Band 17

Plot #95 Radiated Emissions: 30 MHz-1 GHz

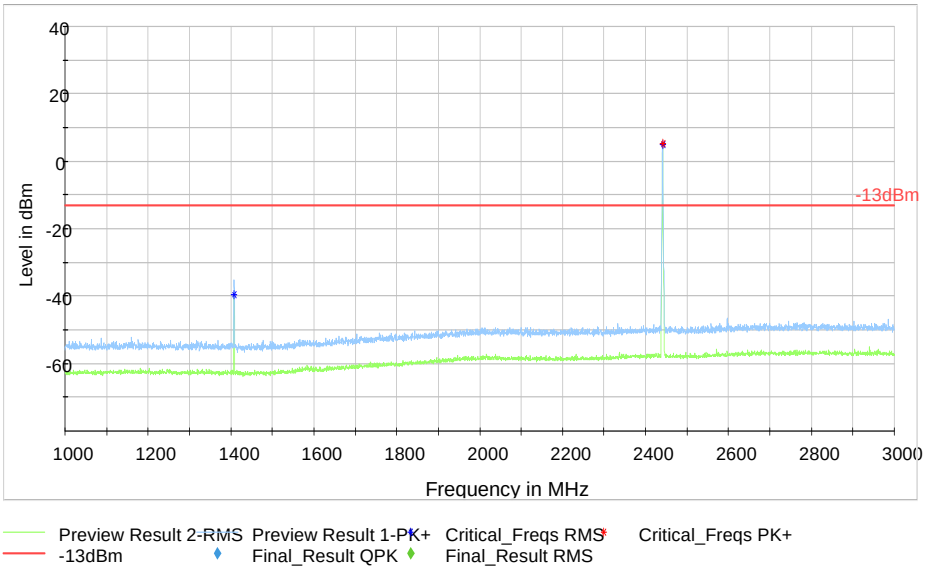
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 17: 704 MHz (uplink), 734 MHz (downlink)

Plot #96 Radiated Emissions: 1-3 GHz

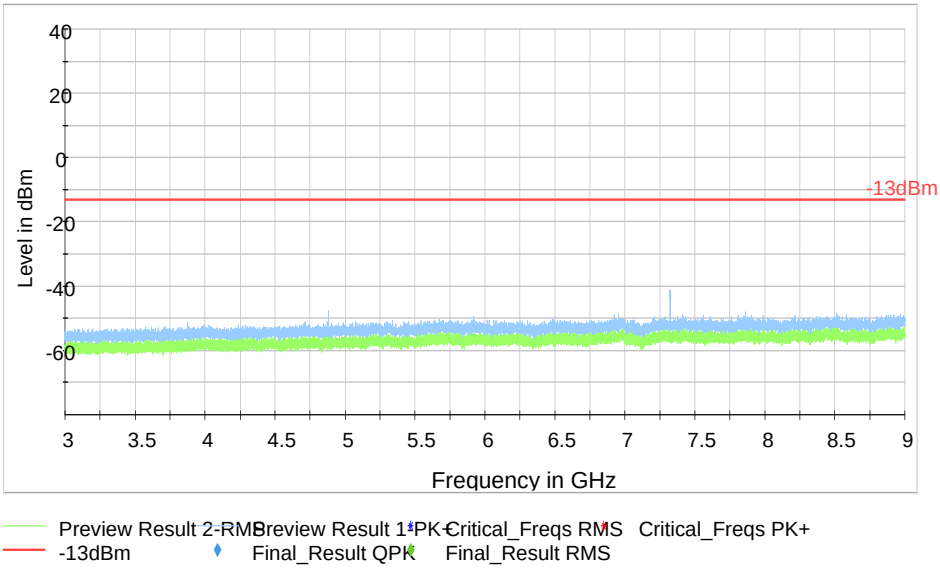
Channel: Low (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

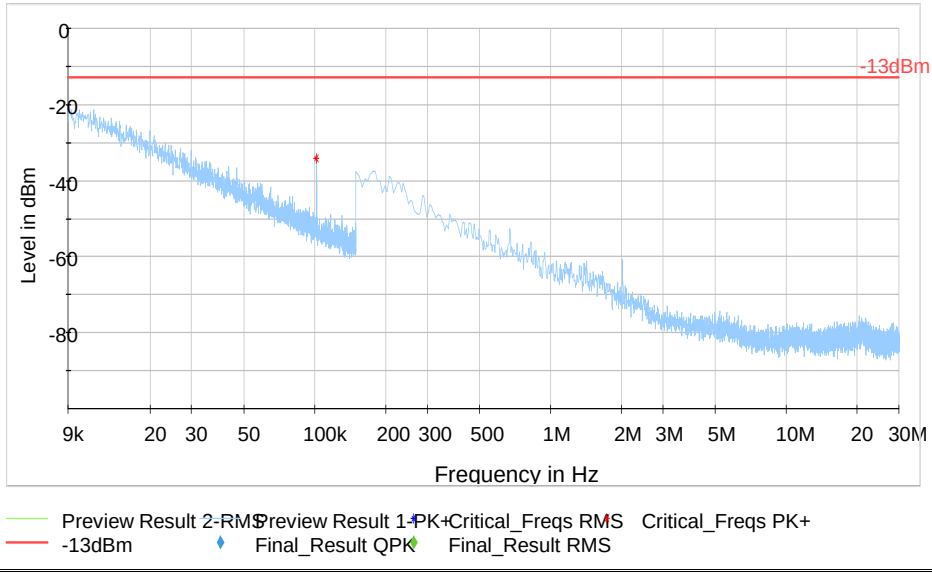
Plot #97 Radiated Emissions: 3-9 GHz

Channel: Low (with BTLE Co. Tx. on Mid channel)



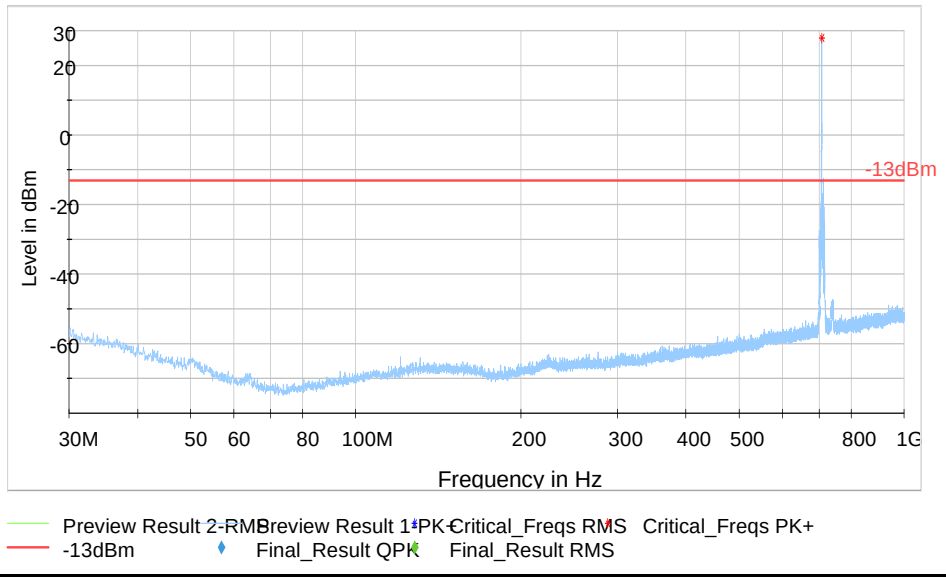
Plot #98 Radiated Emissions: 9 kHz-30 MHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #99 Radiated Emissions: 30 MHz-1 GHz

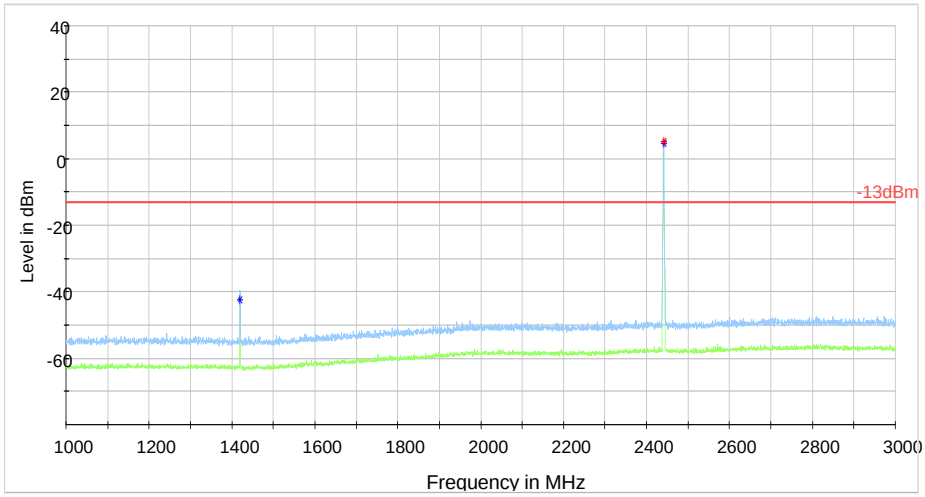
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 17: 710 MHz (uplink), 740 MHz (downlink)

Plot #100 Radiated Emissions: 1-3 GHz

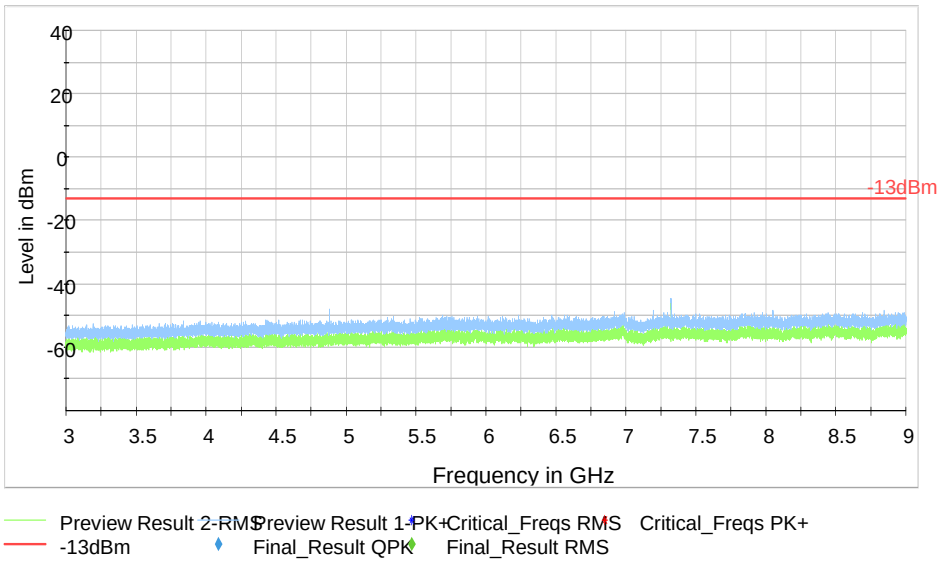
Channel: Mid (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

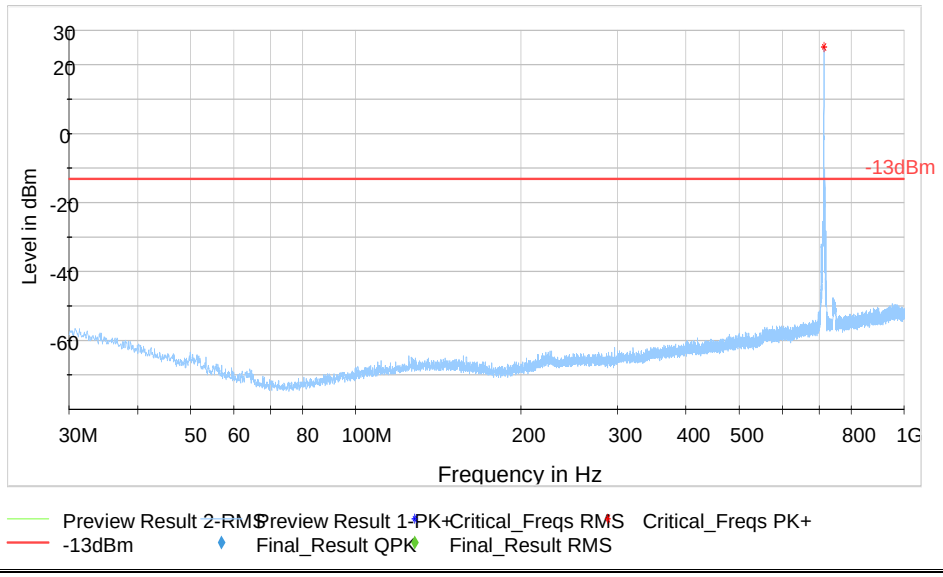
Plot #101 Radiated Emissions: 3-9 GHz

Channel: Mid (with BTLE Co. Tx. on Mid channel)



Plot #102 Radiated Emissions: 30 MHz-1 GHz

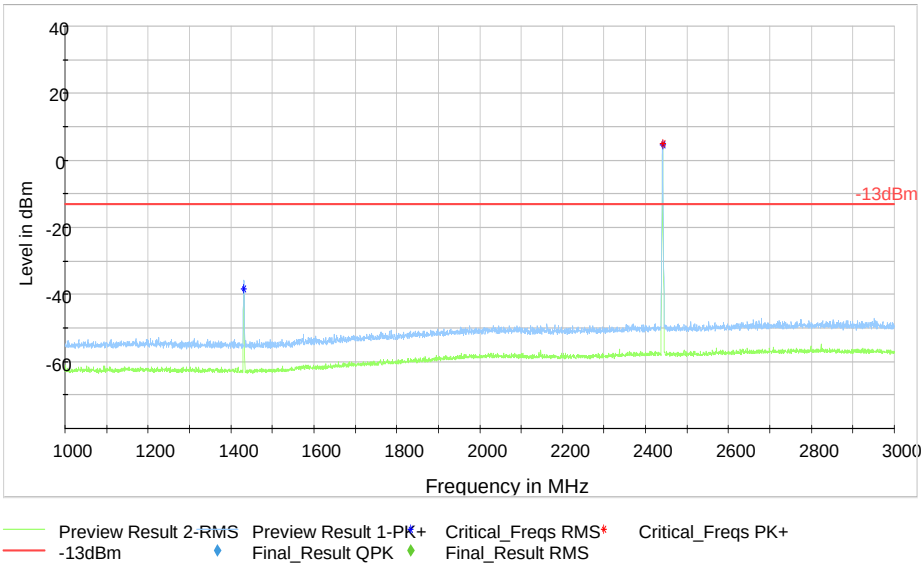
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on LTE Band 17: 716 MHz (uplink), 746 MHz (downlink)

Plot #103 Radiated Emissions: 1-3 GHz

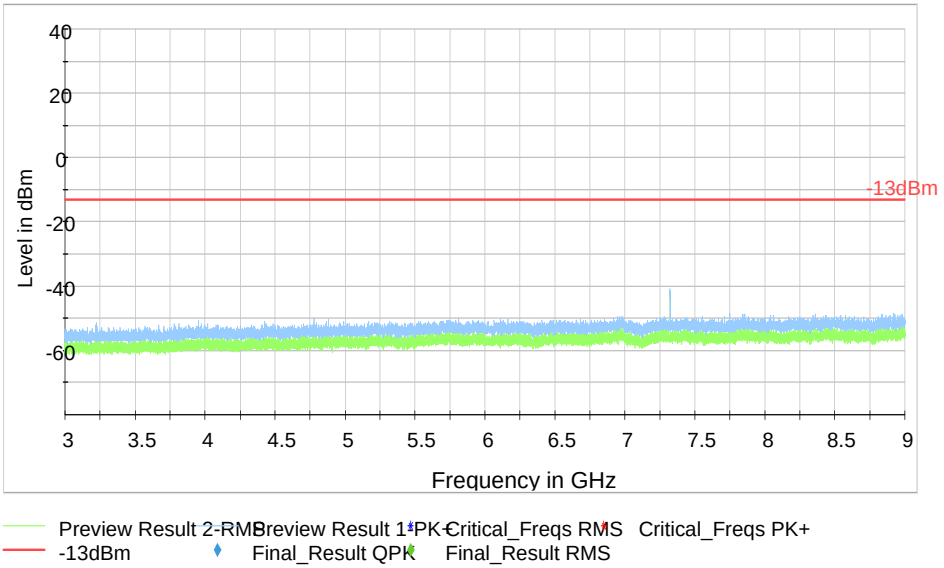
Channel: High (with BTLE Co. Tx. on Mid channel)



Note: Intentional Transmission occurring on Bluetooth mid channel: 2441 MHz

Plot #104 Radiated Emissions: 3-9 GHz

Channel: High (with BTLE Co. Tx. on Mid channel)



8 Test setup photos

Setup photos are included in supporting file name: "EMC_ZONAR-016-17001_FCC_22_24_27_Setup_photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Biconilog 3142E	BiConiLog Antenna	EMCO	3142E	166067	3 years	06/27/2017
Magnetic Loop Antenna	Loop Antenna	ETS Lindgren	6512	49838	3 years	07/28/2017
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	10/31/2017
Antenna Horn 3115	Horn Antenna	ETS Lindgren	3115	35111	3 years	07/24/2015
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	2 Years	06/08/2017
Thermometer Humidity	Thermometer Humidity	Dickson	TM323	16253651	1 Year	11/02/2017
Receiver ESU40	EMI Receiver	R&S	ESU40	100251	3 years	07/01/2017
Digital Radio Comm. Tester CMU 500	Digital Radio Comm. Tester	R&S	CMW500	127068	2 Years	7/01/2017

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

10 Revision History

Date	Report Name	Changes to report	Report prepared by
2018-03-07	EMC_ ZONAR-016-17001 _FCC_22_24_27	Initial Version	Elijah Garcia