



FCC/ISED Test Report

For: Connected Development.

Model number: 28330, 28331

Product Description: Continuous Positive Airway Pressure (CPAP) Device.

FCC ID: 2AACL-AIR104G

IC ID: 9103A-AIR104G

Per:

47 CFR: Part 22, Part 24, Part 27

RSS-130; RSS-132 Issue 3; RSS-133 Issue 6; RSS-139 Issue 3

REPORT #: EMC_CONNE_058_17001_FCC_22_24_27_ISED

DATE: 07/24/2018



A2LA Accredited

IC recognized #
3462B-2

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1 Assessment

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

Based on manufacturer declaration:

The following designated products (model/name) are equivalent:

- 28330 AirCurve 10 ST-A
- 28330 AirCurve 10 ST-A

All the above stated products have exactly the same hardware and the same cellular software.

No deficiencies were ascertained.

Responsible for Testing Laboratory:

07/24/2018	Compliance	James Donnellan (Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

07/24/2018	Compliance	Issa Ghanma (EMC Engineer)	
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section3.
CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
Lab Manager:	James Donnellan
Responsible Project Leader:	Cathy Palacios

2.2 Identification of the Client

Applicant's Name:	Connected Development
Street Address:	5020 Weston Parkway, Suite 215
City/Zip Code	Cary, NC 27513
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	ResMed
Manufacturers Address:	1 Elizabeth Macarthur Drive
City/Zip Code	Bella Vista NSW 2153
Country	Australia

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Marketing name:	Lumis LTE							
Brand:	ResMed							
Model number:	28330, 28331							
Module Name:	Gemalto EIS61-US							
Module Number:	ELS61-US							
FCC ID:	QIPELS61-US							
IC ID:	7830A-ELS61US							
Max. documented values from the modular grant:	Band	Frequency range (MHz)	Output Power (Watts)	Type of modulation				
	WCDMA II	1852.4 – 1907.6	0.19	QPSK				
	WCDMA IV	1712.4 – 1752.6	0.2	QPSK				
	WCDMA V	826.4 – 846.4	0.22	QPSK				
	LTE 2	1850.7 – 1909.3	0.15	QPSK, 16-QAM				
	LTE 4	1710.7 – 1754.3	0.15	QPSK, 16-QAM				
	LTE 5	824.7 – 848.3	0.17	QPSK, 16-QAM				
	LTE 12	669.7 – 715.3	0.16	QPSK, 16-QAM				
	Operating Voltage Range							
Low 23 V / Nominal 24 V / High 25 V								
Operating Temperature Range								
Low 5 °C – High 35°C								
Other Radios included in the								

Sample Revision	<input type="checkbox"/> Prototype Unit; <input checked="" type="checkbox"/> Production Unit; <input type="checkbox"/> Pre-Production							
EUT Dimensions (cm)	24.5 (L) X 15 (W) X 11.3 (H)							
Weight (lb)	~3.0							
EUT Diameter	<input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____							

3.2 EUT Sample details

EUT #	S/N	HW Version	SW Version	Comments
1	22181235229	28330	SX558	Radiated Measurements

3.3 Antenna Specification

Product Name:	Ultra Wide-Band LTE/Cellular/CDMA SMT Antenna for 2G/3G/4G applications LTE / GSM / CDMA /DCS /PCS / WCDMA / UMTS / HSDPA / GPRS / EDGE /IMT, 698MHz to 960MHz, 1710MHz to 2690Mhz			
Frequency [MHz]	698~960	1710~2170	2300~2400	2500~2700
Peak Gain [dBi]	1.71	3.03	1.53	2.69

3.4 Accessory Equipment

AE #	Manufacturer	Type	Model No.	Comments
1	ResMed Ltd	90W AC Adapter	370001	<ul style="list-style-type: none">AC INPUT: 100-240v ~ 50-60Hz 1.0-1.5A, 115V~400Hz 1.5ADC OUTPUT: +24V ____ 3.75A

3.5 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT #1 + AE #1	Radiated Measurements

3.6 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular	Cellular was tested on Low, Mid, High Channels at the maximum power. AC Adapter was connected to the equipment under test while testing.

4 Subject of Investigation

The objective of the evaluation conducted by CETECOM Inc. is to support a request for new equipment authorization under **FCC ID: 2AChL-AIR104G / IC ID: 9103A-AIR104G**

The pre-certified module to be integrated (**Gemalto EIS61-US**) as described in Section 3, Radiated Spurious Emissions test was performed. Results have been checked to meet limits per Code of Federal Regulations Title 47 parts 22, 24, 27 and Industry Canada Radio Standard Specifications RSS: 130, 132 Issue 3, 133 Issue 6 and 139 Issue 3.

The conducted module test data that can be obtained under the **FCC Filing ID: QIPELS61-US / IC ID: 7830A-ELS61US** is applicable for the host described in section 3.

4.1 Dates of Testing:

05/25/2018

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)

4.3 Environmental Conditions during Testing:

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

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

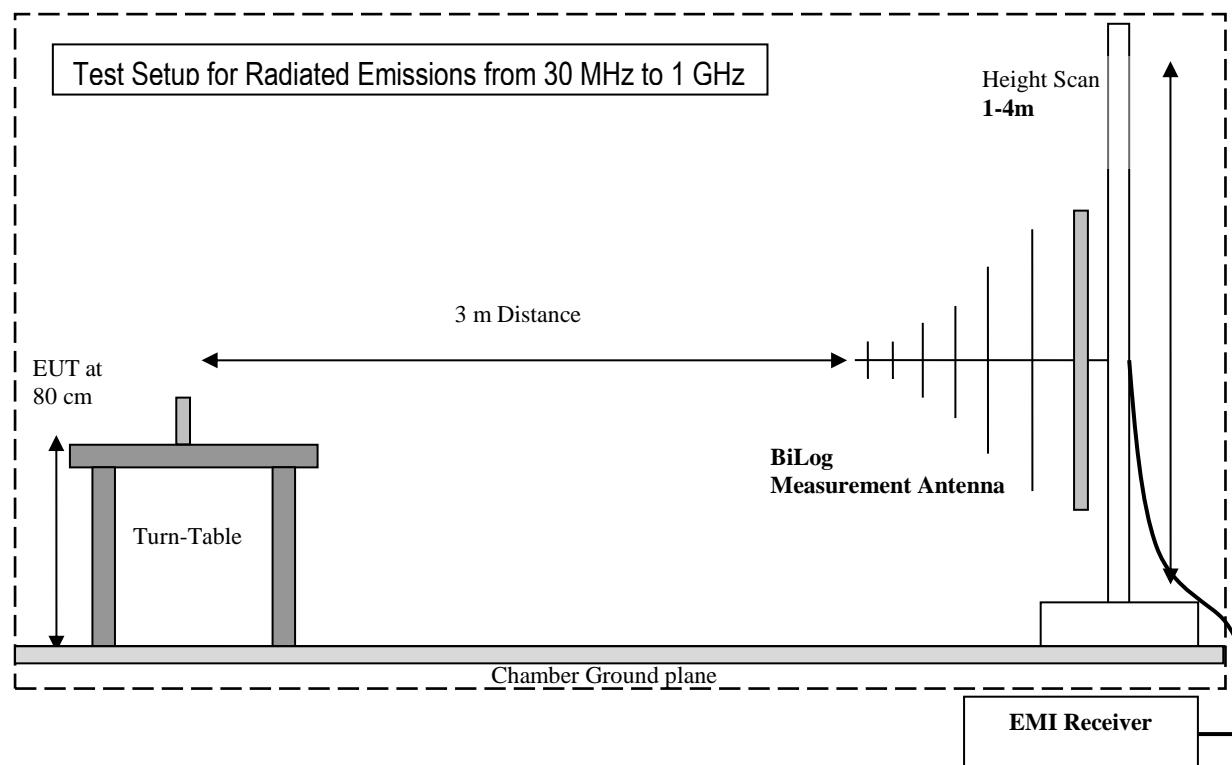
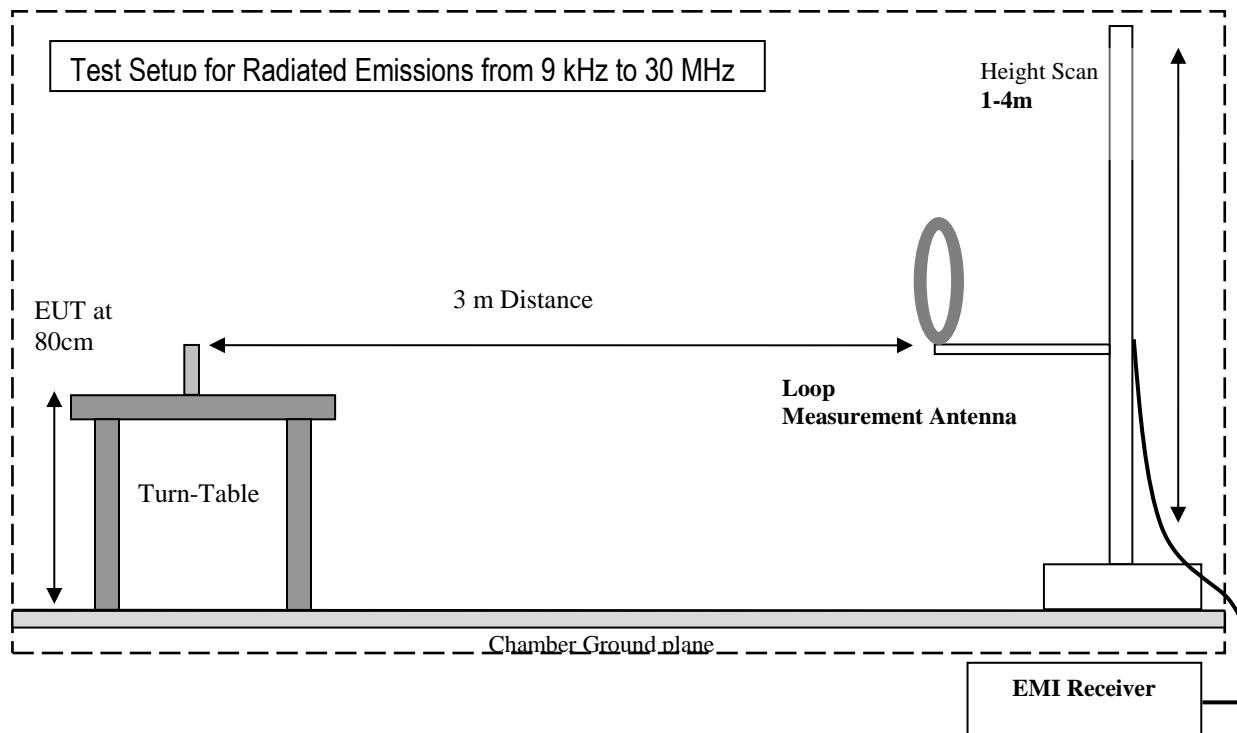
Deviating test conditions are indicated at individual test description where applicable.

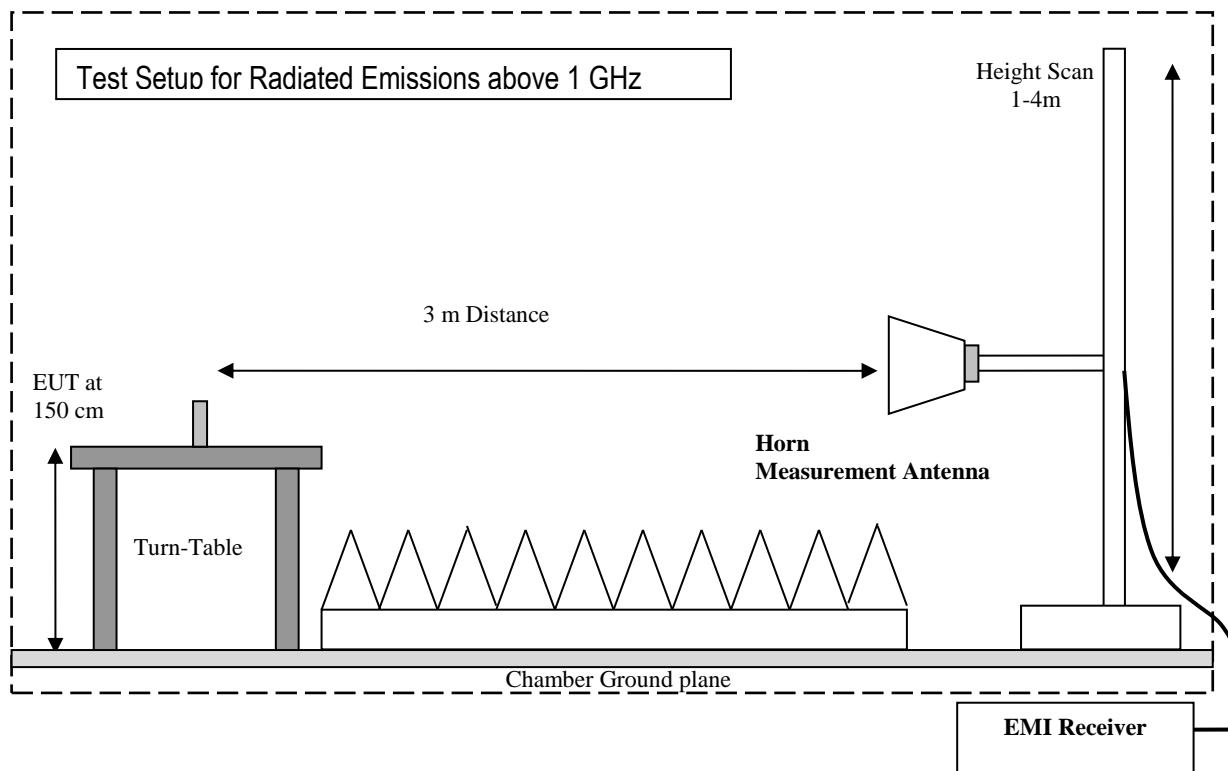
5 Measurement Procedures

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

5.1 Radiated Measurement

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





5.2 Sample Calculations for Field Strength Measurements

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

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

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

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

Example:

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

6 Measurement Results Summary

6.1 FCC 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	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1055; §22.355	Frequency Stability	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1049; §22.917	Occupied Bandwidth	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §22.917	Band Edge Compliance	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §22.917	Conducted Spurious Emissions	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1053; §22.917(a); RSS-132 Issue 3-5.5;	Radiated Spurious Emissions	Nominal	WCDMA LTE	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Gemalto ELS61-US FCC ID: QIPELS61-US / IC ID: 7830A-ELS61US

6.2 FCC 24, RSS-133:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a)	RF Output Power	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1055; §24.235	Frequency Stability	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1053; §24.238(a); RSS-133 Issue 6-6.5.1;	Radiated Spurious Emissions	Nominal	WCDMA LTE	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Gemalto ELS61-US FCC ID: QIPELS61-US / IC ID: 7830A-ELS61US

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	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1055; §27.54	Frequency Stability	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	-	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	■	Complies Note 1 Note 2
§2.1053; §27.53(g); §27.53(h); RSS-130 Issue 1-4.6; RSS-139 Issue 3-6.6;	Radiated Spurious Emissions	Nominal	WCDMA LTE	■	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

Note 1: NA= Not Applicable; NP= Not Performed.

Note 2: Leveraged from module certification Gemalto ELS61-US FCC ID: QIPELS61-US / IC ID: 7830A-ELS61US

7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR Part 22.917; CFR Part 24.238, Part 27.53 utilizing KDB 971168 D01 Power Meas License Digital Systems v03, and according to ANSI C63.26 2017

Spectrum Analyzer Settings for FCC 22

Frequency Range	30 MHz – 1 GHz	1 – 1.58 GHz	1.58 – 9 GHz
Resolution Bandwidth	100 kHz	1 MHz	1 MHz
Video Bandwidth	100 kHz	1 MHz	1 MHz
Detector	Peak	Peak	Peak
Trace Mode	Max Hold	Max Hold	Max Hold
Sweep Time	Auto	Auto	Auto

Spectrum Analyzer Settings for FCC 24 and 27

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

7.1.2 Limits:

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

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P) \text{ dB} = (-13 \text{ dBm})$

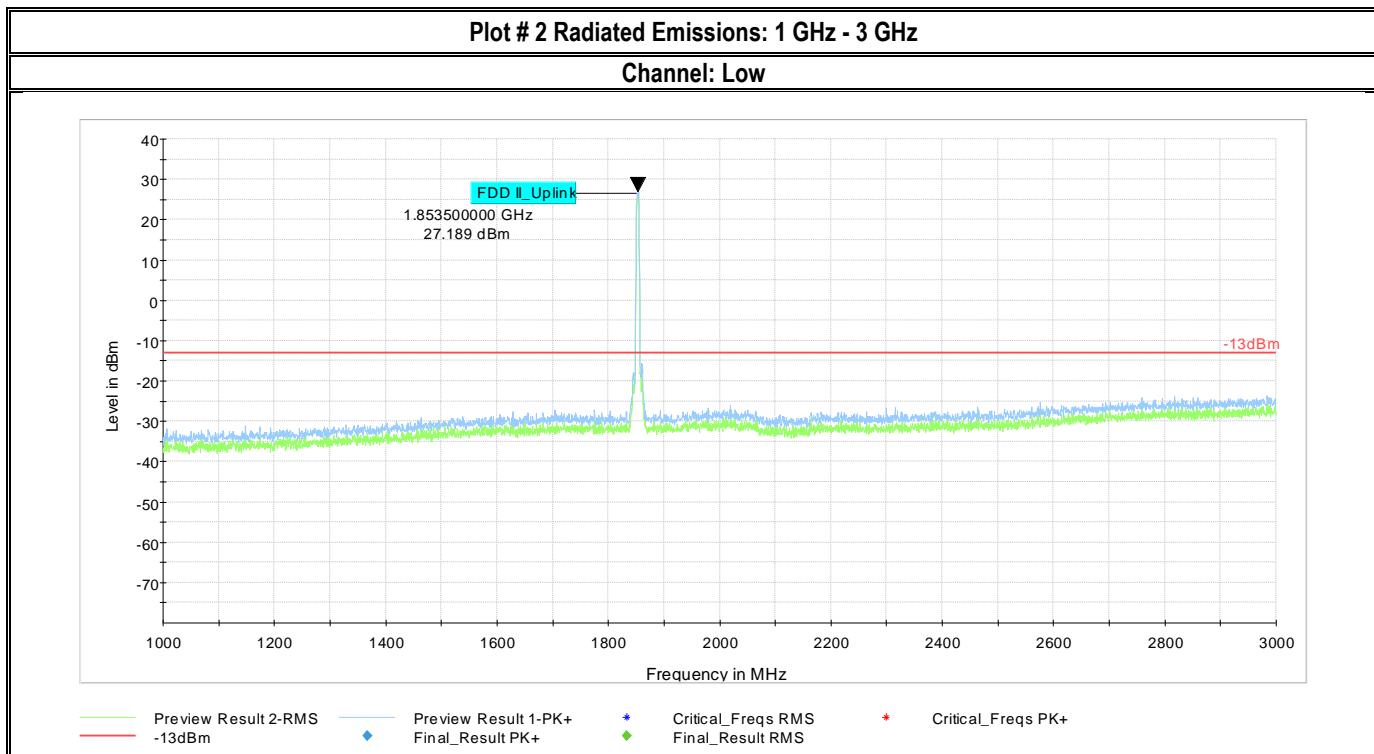
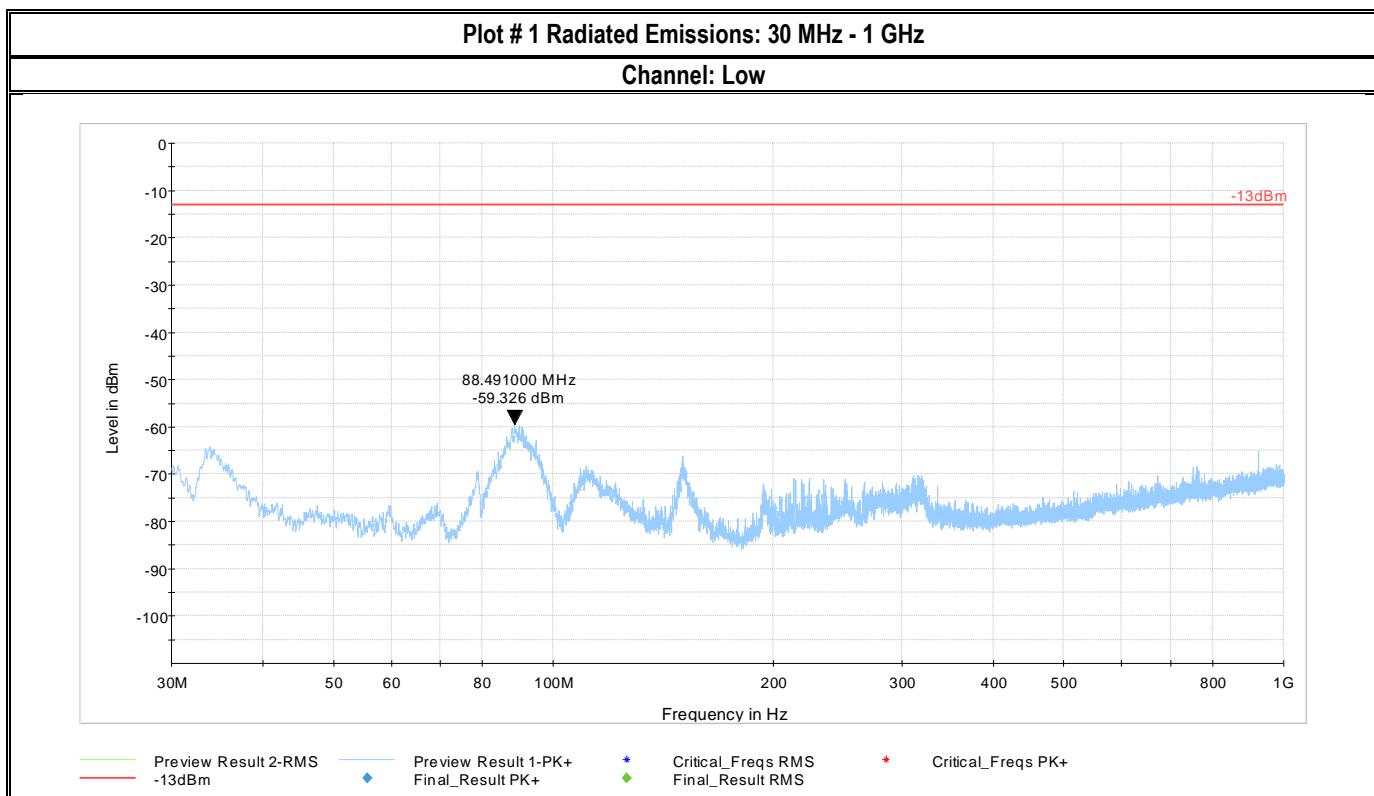
7.1.3 Test conditions and setup:

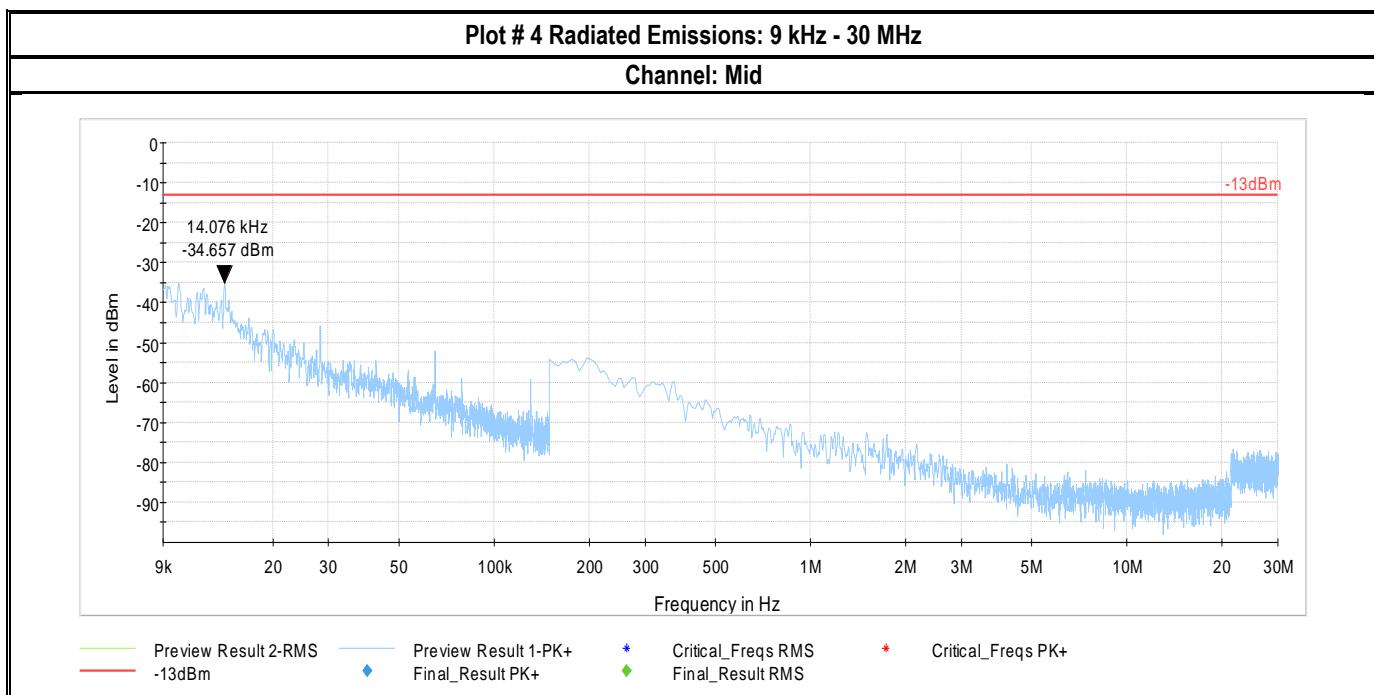
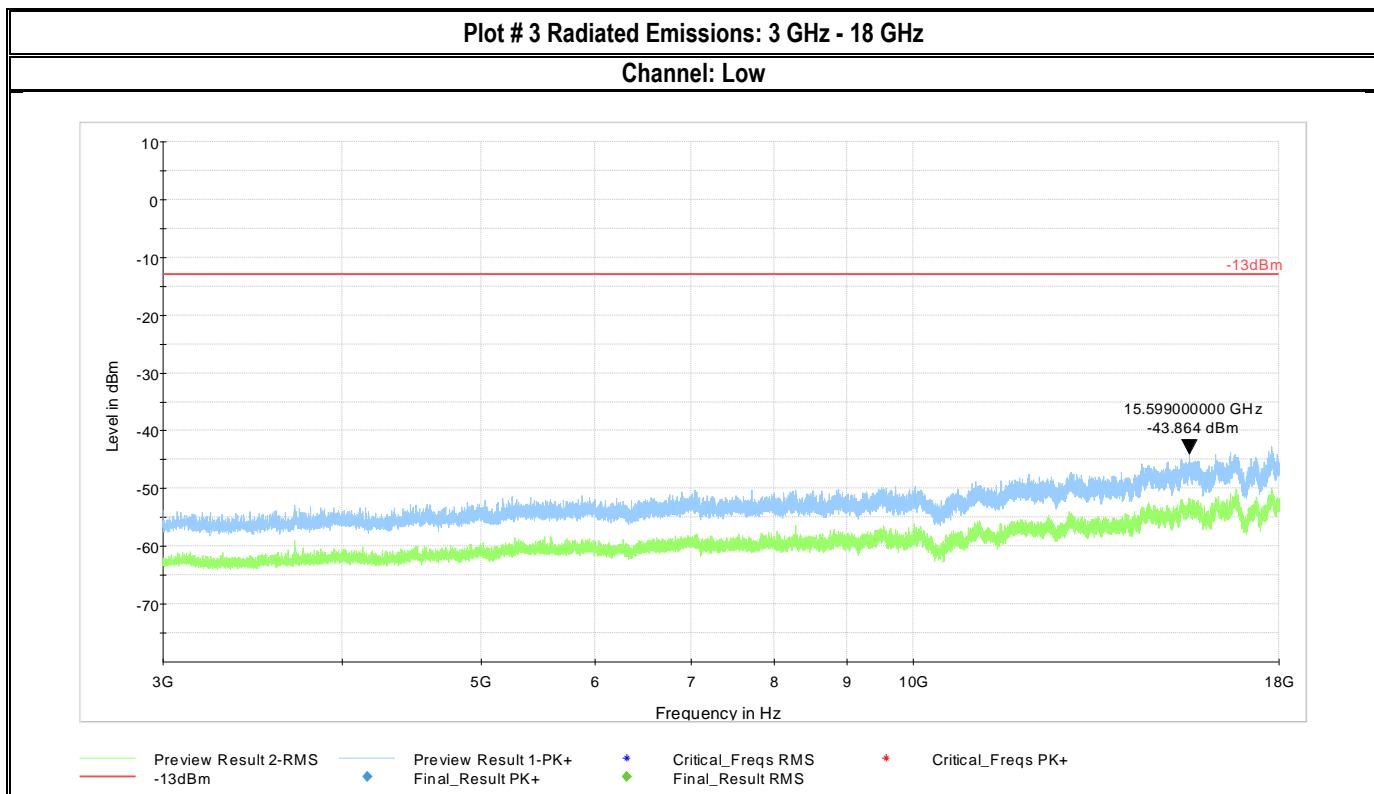
Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	Op. 1	24 V

7.1.4 Measurement result:

Plot #	Cellular Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Highest emission in dB	Frequency of highest emission in MHz	Result
1 – 3	Low	WCDMA II	30 MHz – 18 GHz	-13	-43.86	15599	Pass
4 – 8	Mid	WCDMA II	9 kHz – 26 GHz	-13	-34.65	0.014	Pass
9 – 11	High	WCDMA II	30 MHz – 18 GHz	-13	-60.49	88	Pass
12 – 14	Low	WCDMA IV	30 MHz – 18 GHz	-13	-48.62	3426	Pass
15 – 18	Mid	WCDMA IV	9 kHz – 18 GHz	-13	-42.82	3467	Pass
19 – 21	High	WCDMA IV	30 MHz – 18 GHz	-13	-49.76	3506	Pass
22 - 24	Low	WCDMA V	30 MHz – 9 GHz	-13	NF*	-	Pass
25 – 28	Mid	WCDMA V	9 kHz – 9 GHz	-13	-33.21	0.014	Pass
29 – 31	High	WCDMA V	30 MHz – 9 GHz	-13	NF*	-	Pass
32 – 34	Low	LTE 2	30 MHz – 18 GHz	-13	-57.41	3355	Pass
35 – 39	Mid	LTE 2	9 kHz – 26 GHz	-13	-33.29	0.014	Pass
40 - 42	High	LTE 2	30 MHz – 18 GHz	-13	-59.69	89.21	Pass
43 - 45	Low	LTE 4	30 MHz – 18 GHz	-13	-54.20	3429	Pass
46 – 49	Mid	LTE 4	9 kHz – 18 GHz	-13	-32.79	0.014	Pass
50 - 52	High	LTE 4	30 MHz – 18 GHz	-13	-56.07	3499	Pass
53 - 55	Low	LTE 5	30 MHz – 9 GHz	-13	NF*	-	Pass
56 - 59	Mid	LTE 5	9 kHz – 9 GHz	-13	-32.56	0.014	Pass
60 - 62	High	LTE 5	30 MHz – 9 GHz	-13	NF*	-	Pass
63 - 65	Low	LTE 12	30 MHz – 9 GHz	-13	NF*	-	Pass
66 - 69	Mid	LTE 12	9 kHz – 9 GHz	-13	-35.68	0.014	Pass
70 - 72	High	LTE 12	30 MHz – 9 GHz	-13	NF*	-	Pass

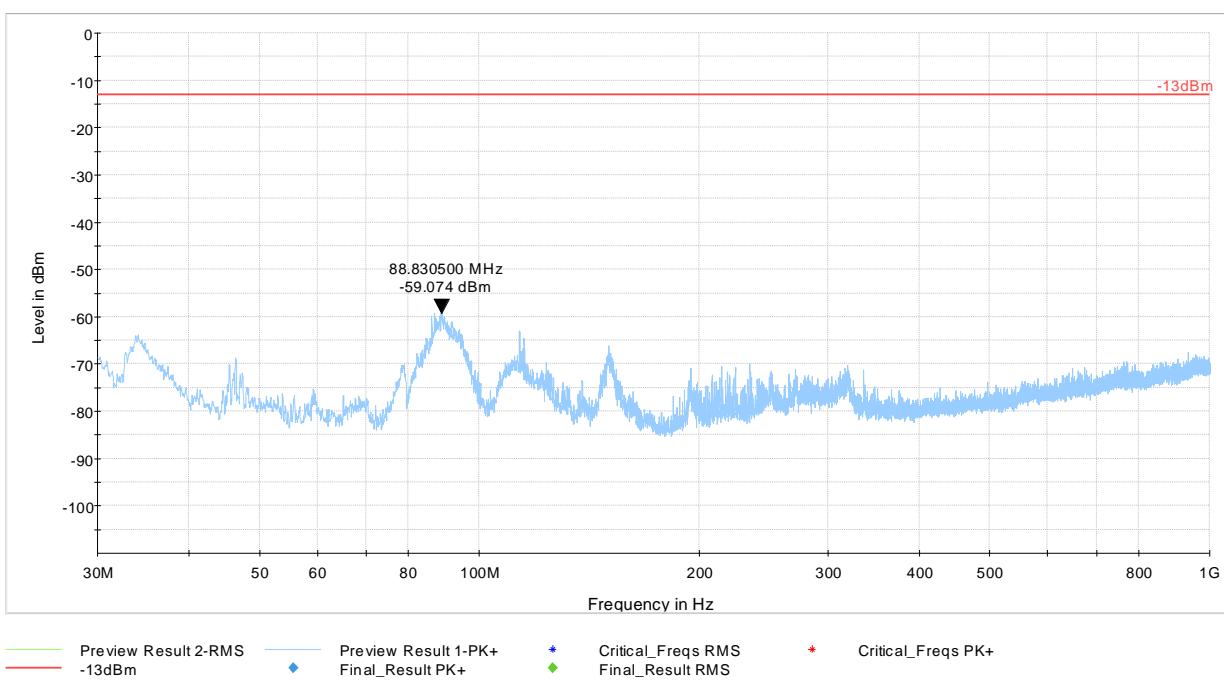
NF*: Noise Floor

7.1.5 Measurement Plots:**WCDMA Band II**



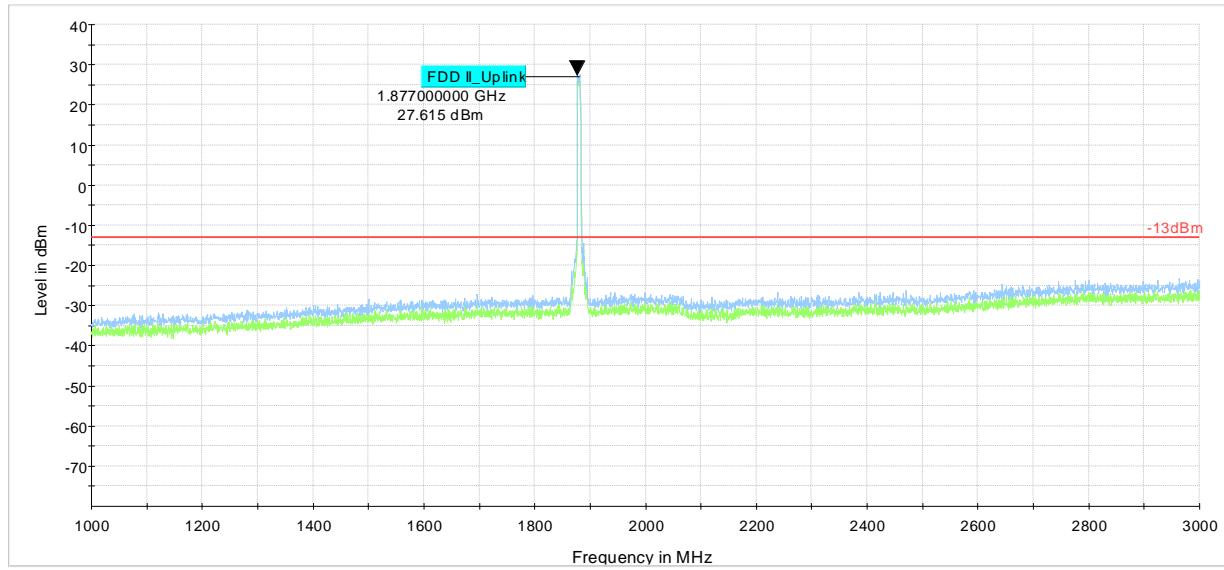
Plot # 5 Radiated Emissions: 30 MHz – 1GHz

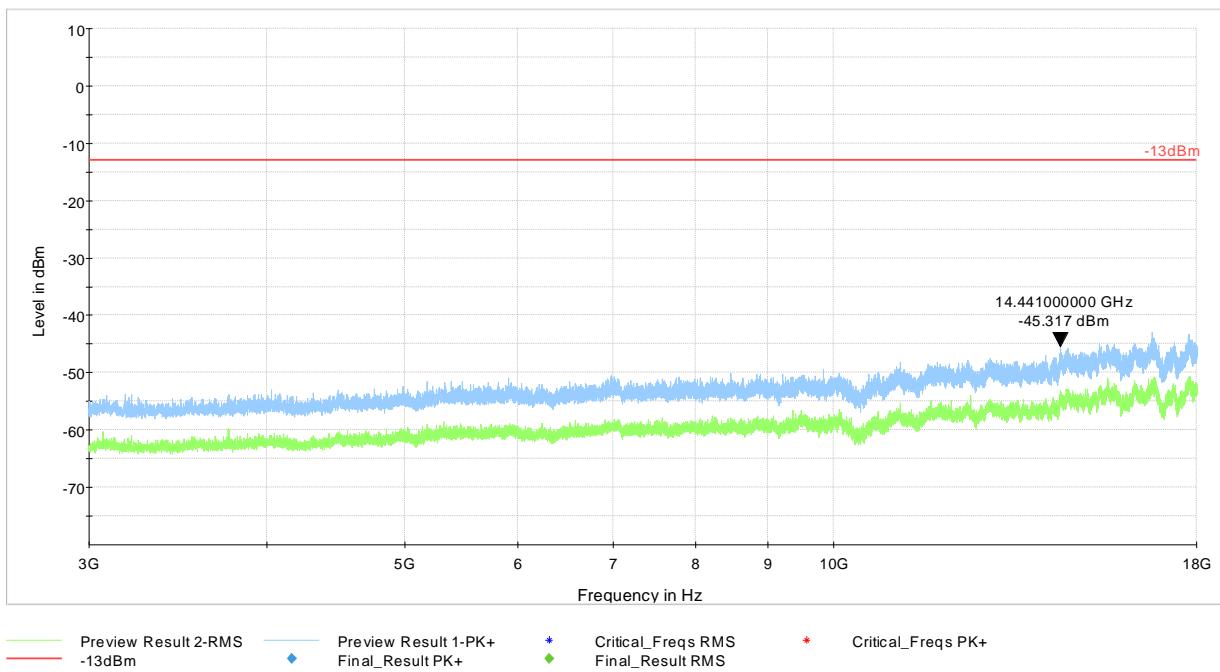
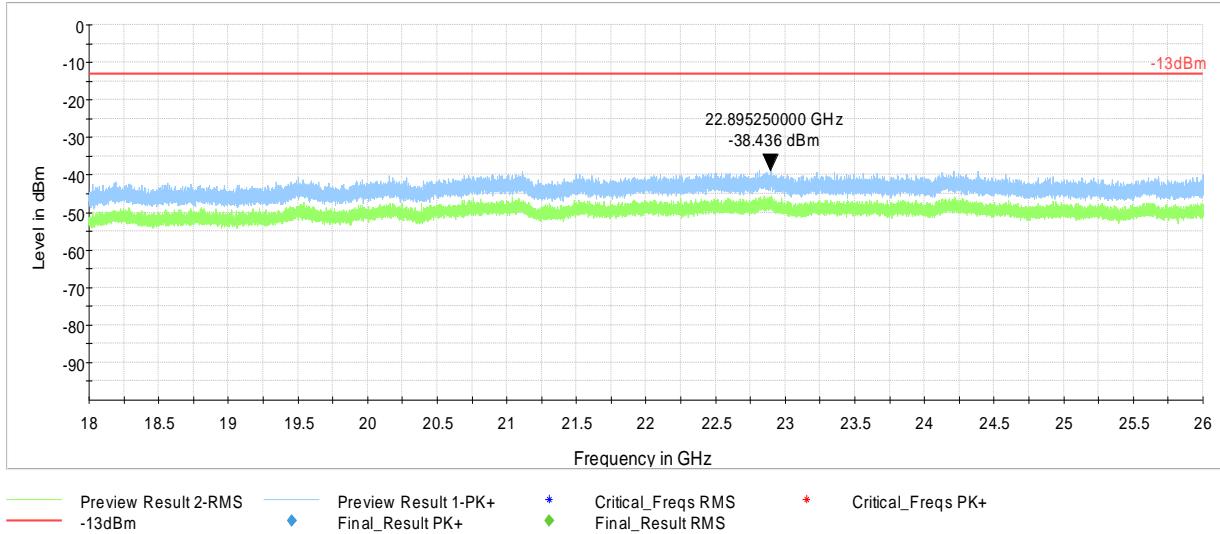
Channel: Mid

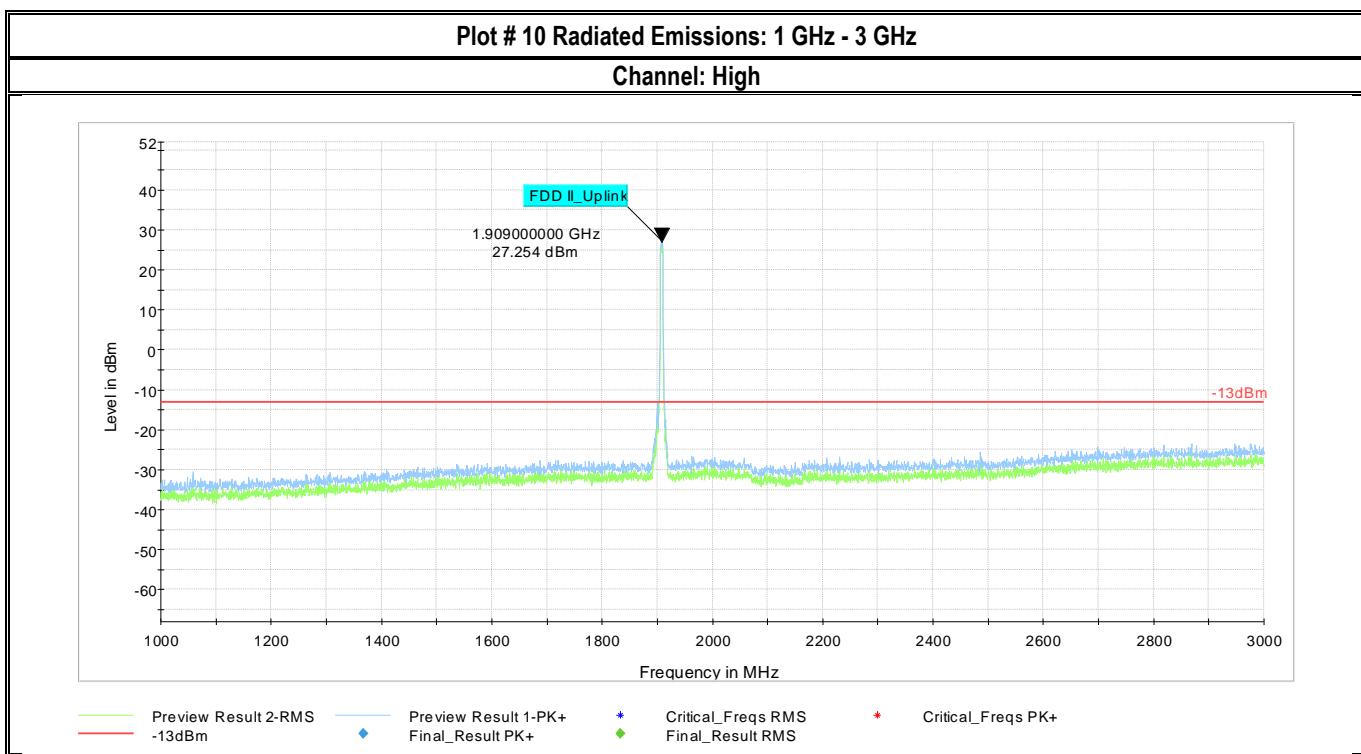
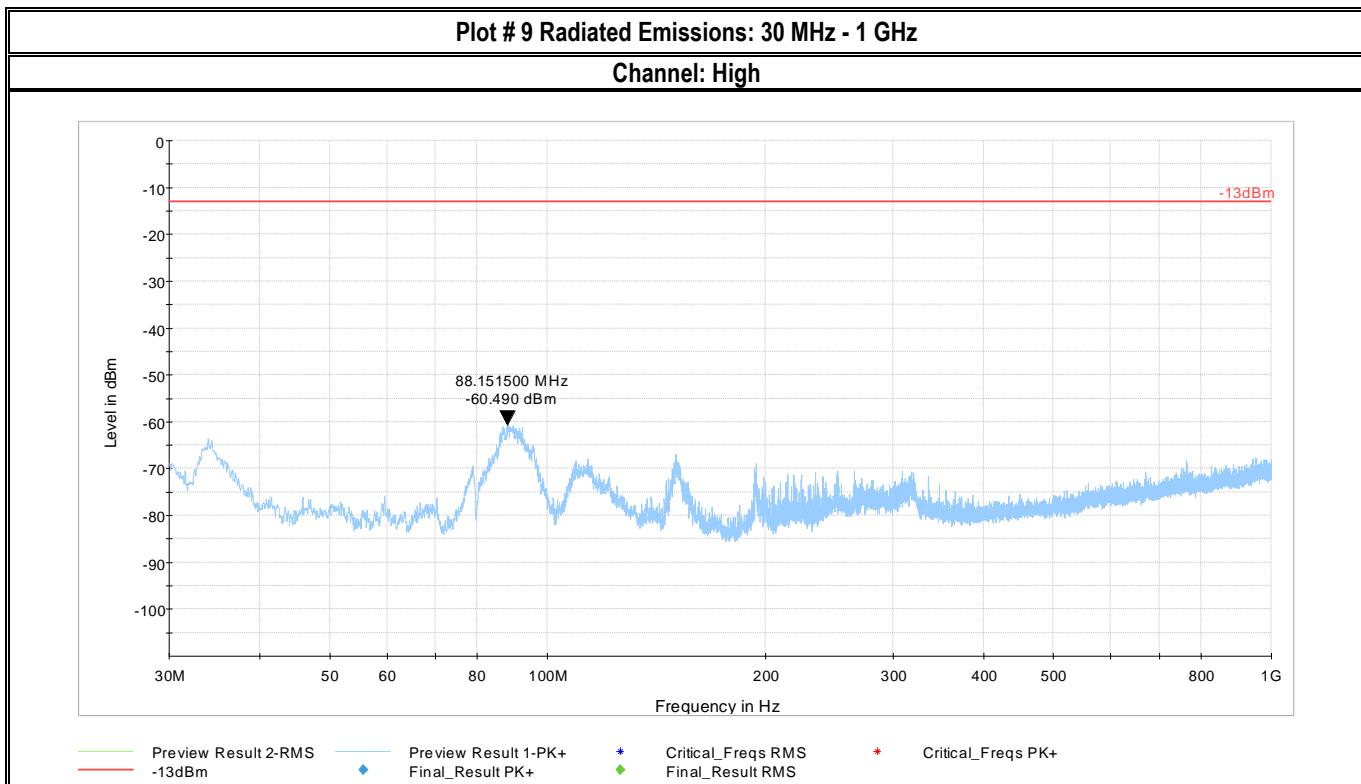


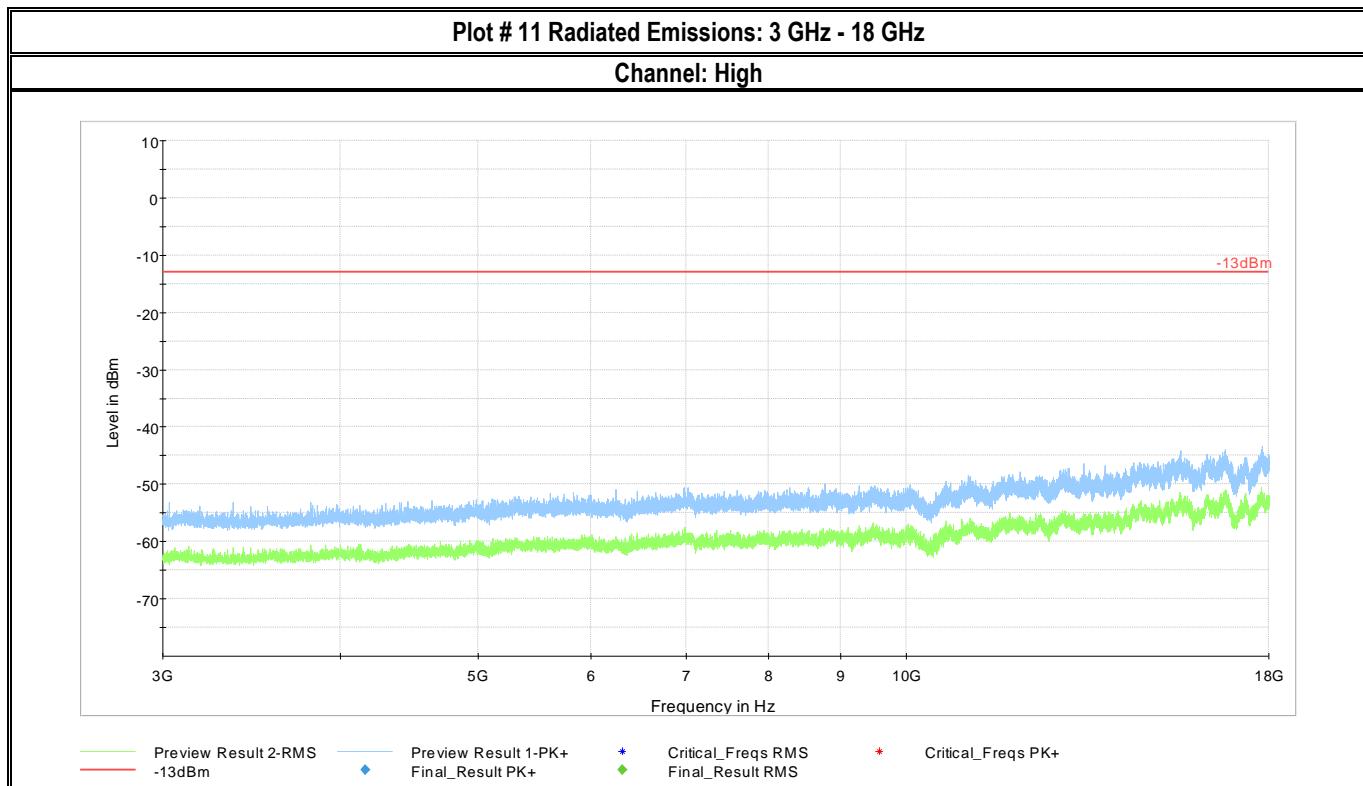
Plot # 6 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid

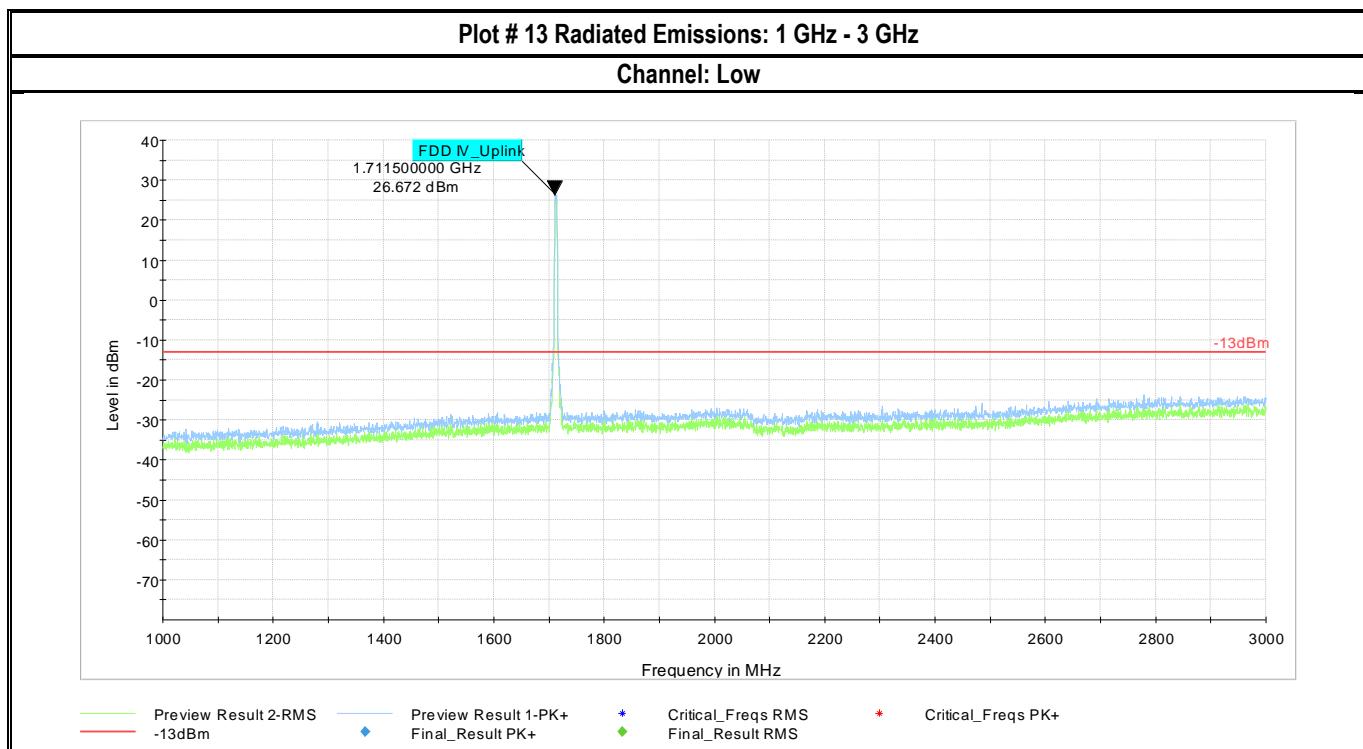
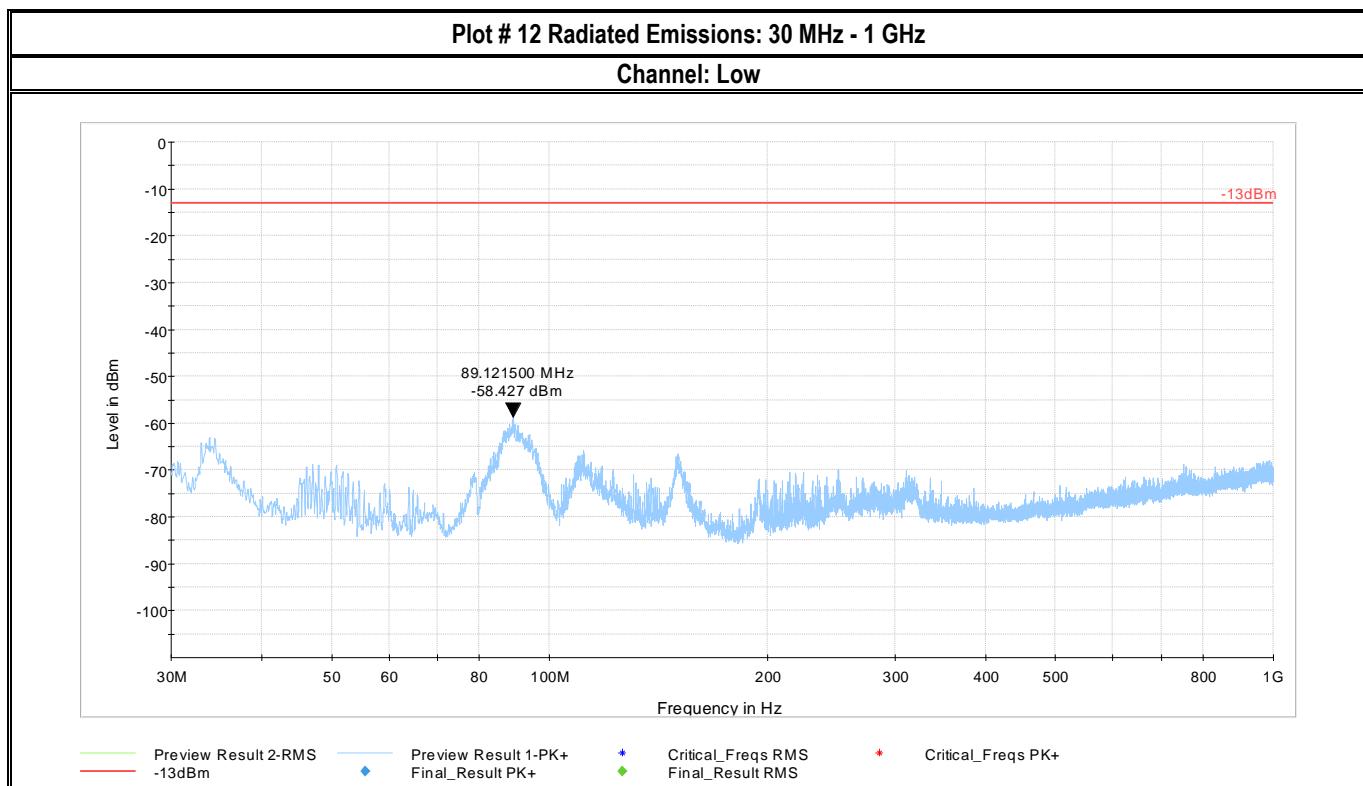


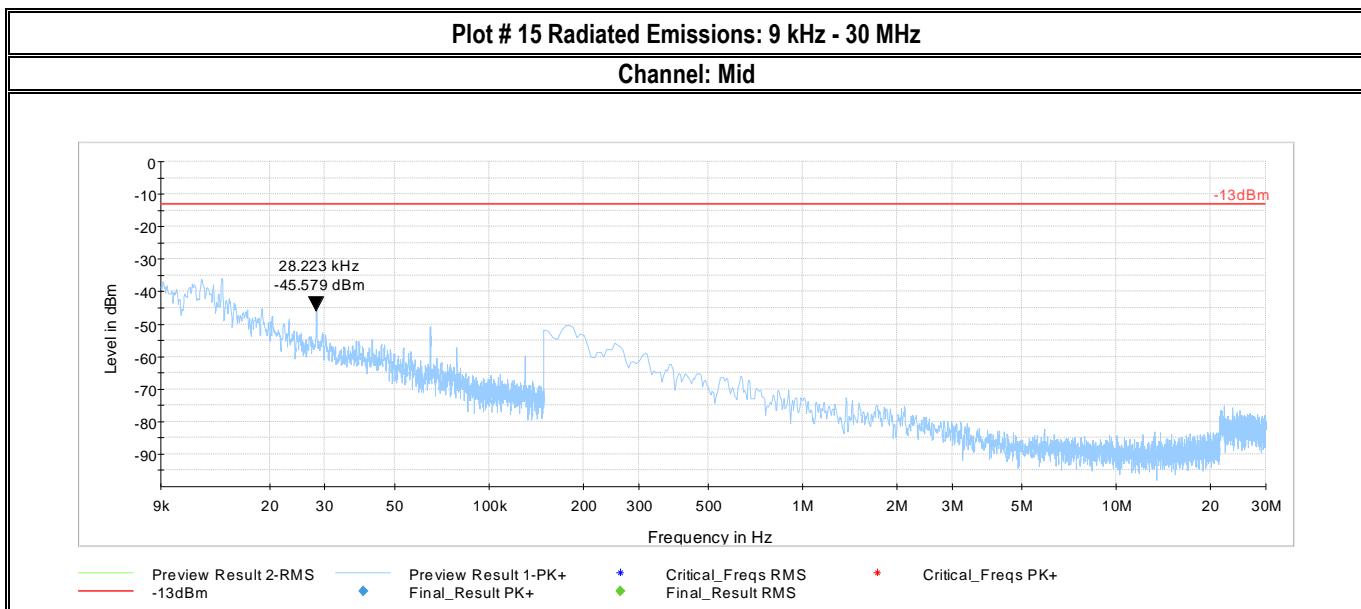
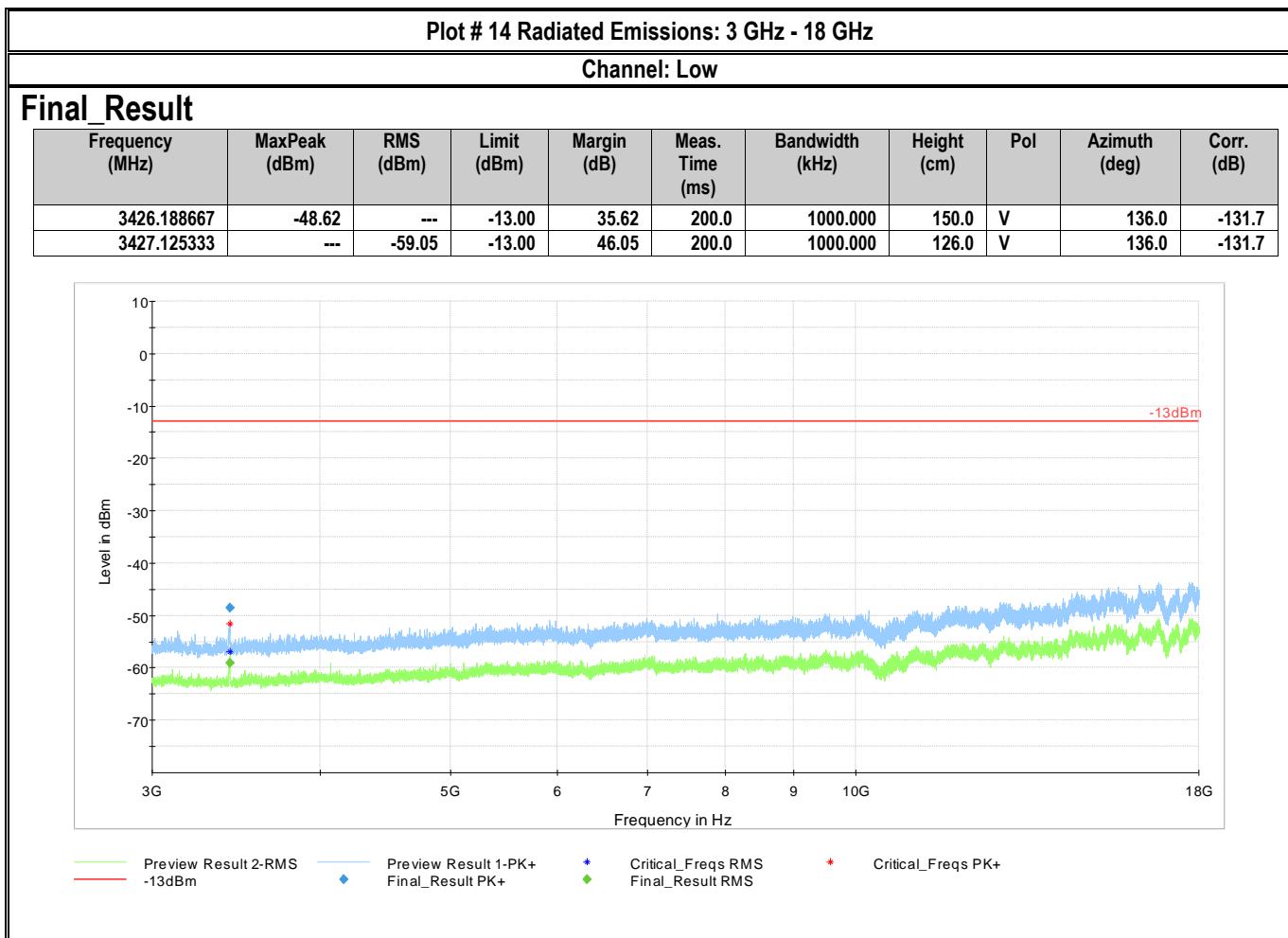
Plot # 7 Radiated Emissions: 3 GHz – 18 GHz**Channel: Mid****Plot # 8 Radiated Emissions: 18 GHz – 26 GHz****Channel: Mid**

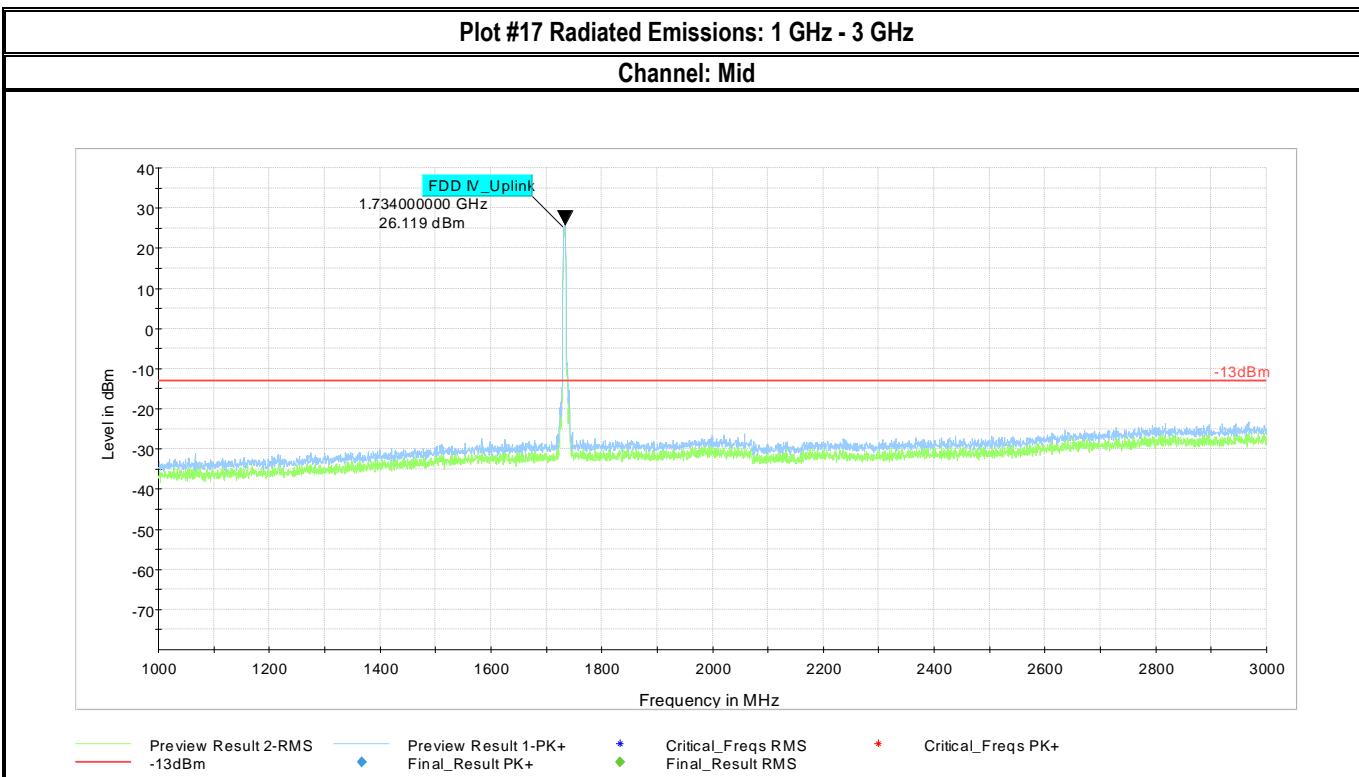
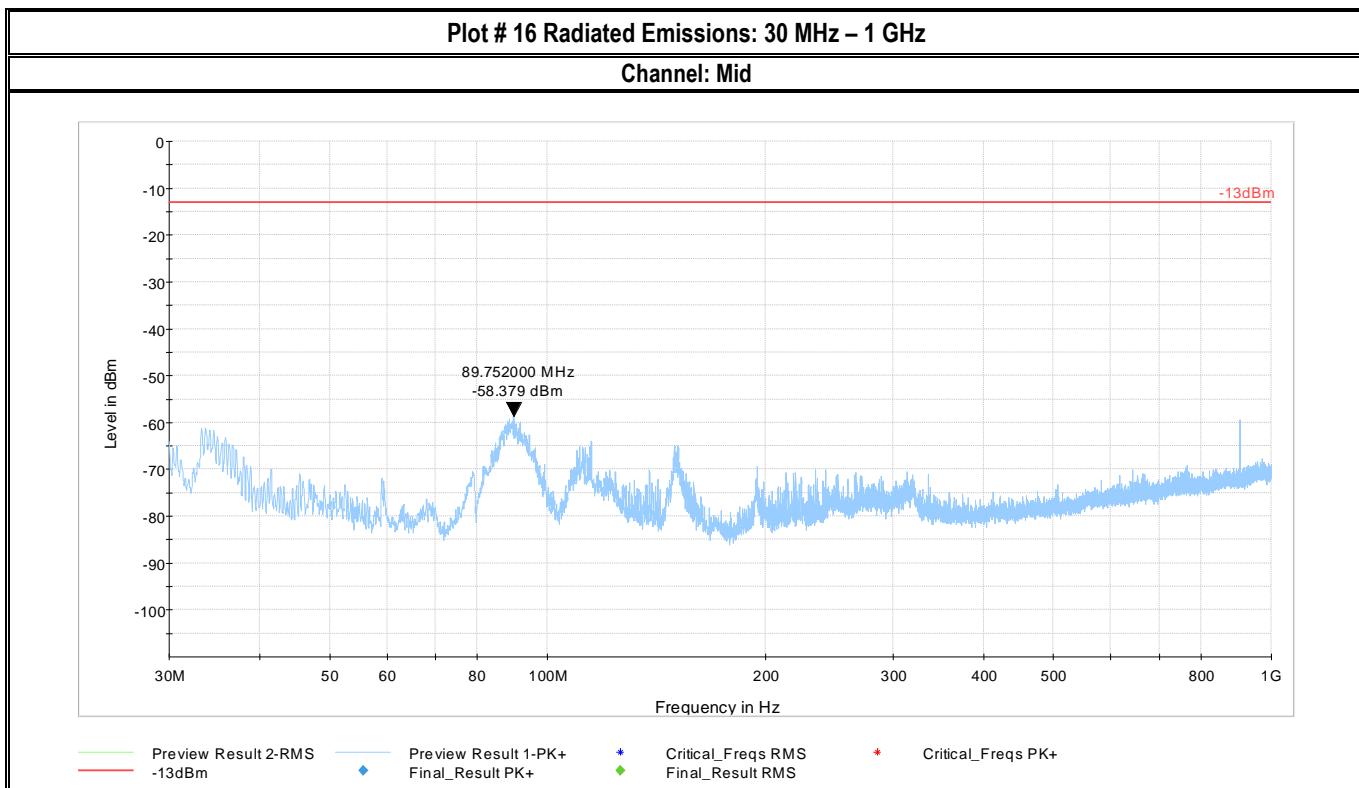


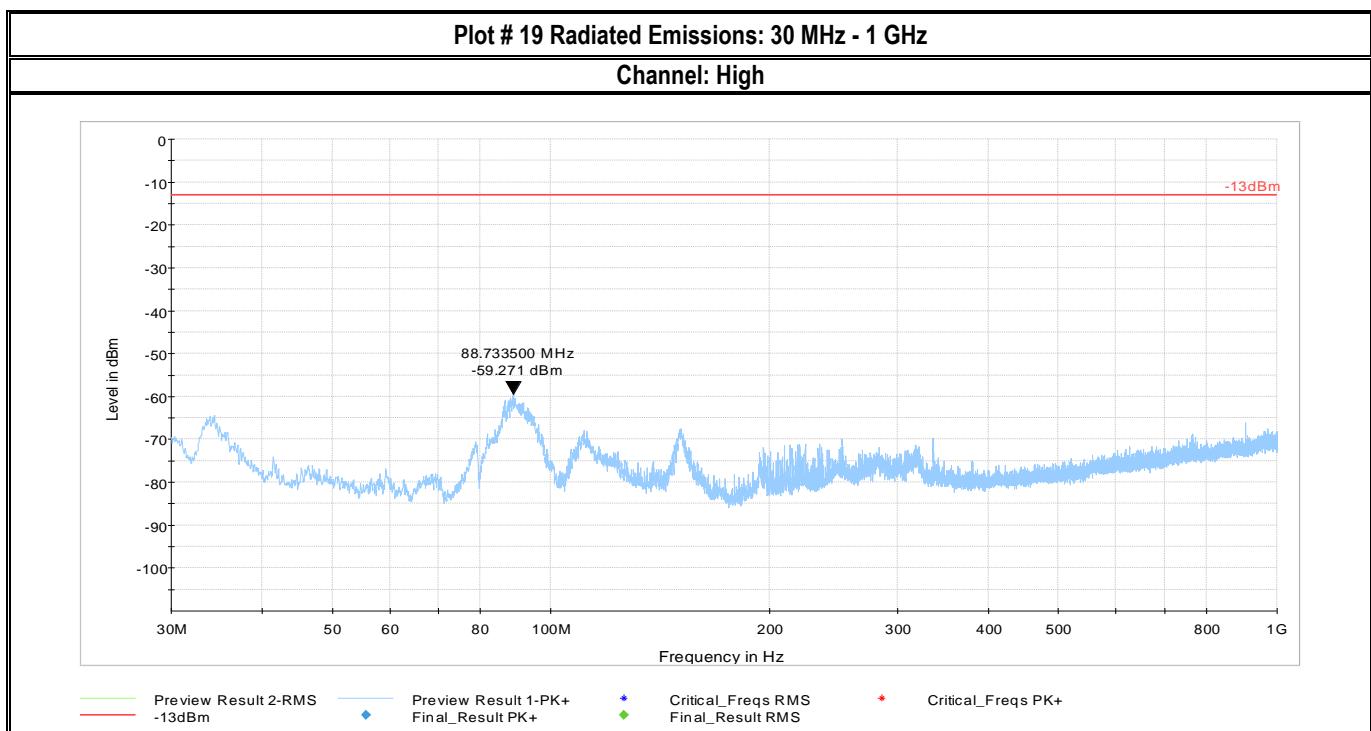
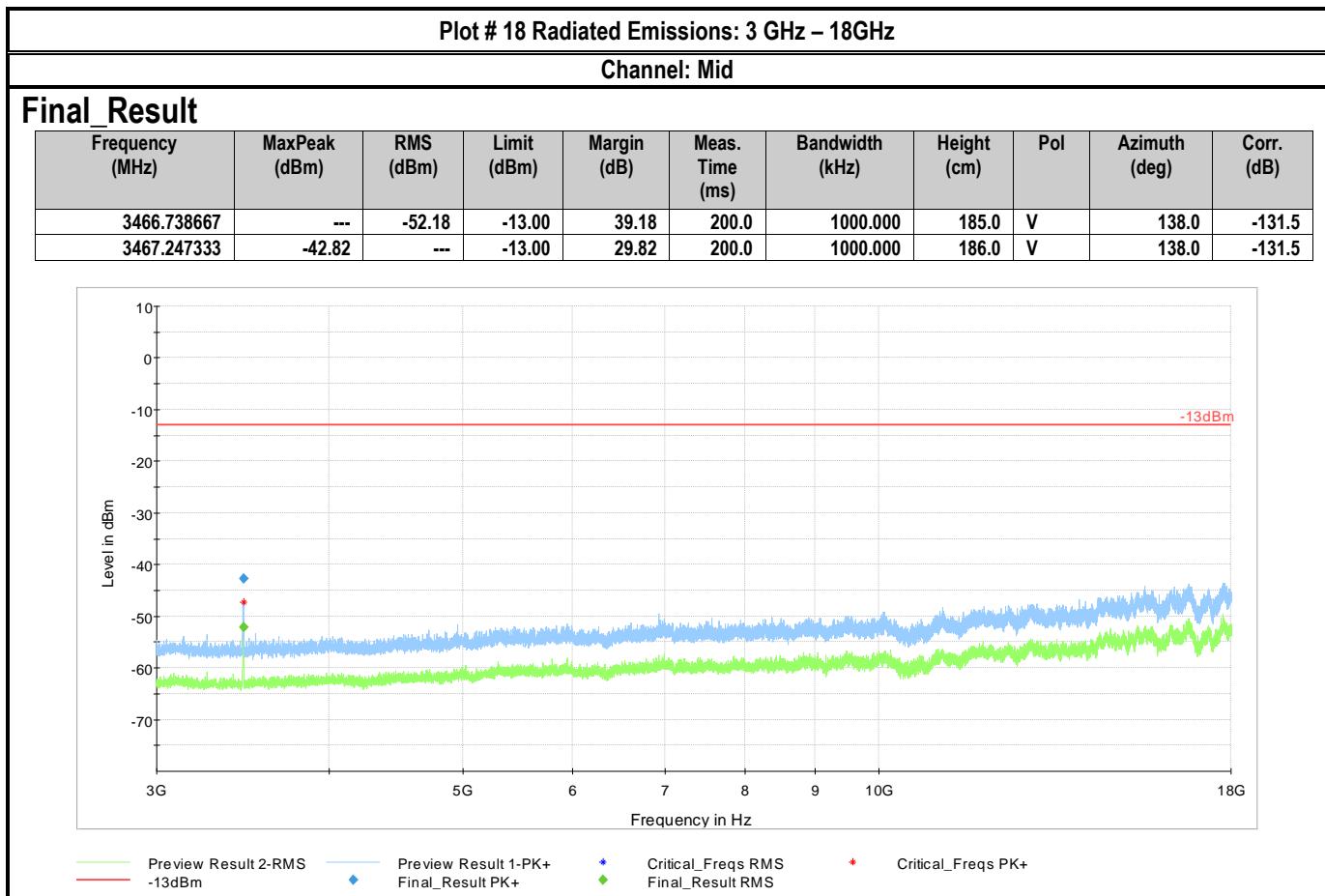


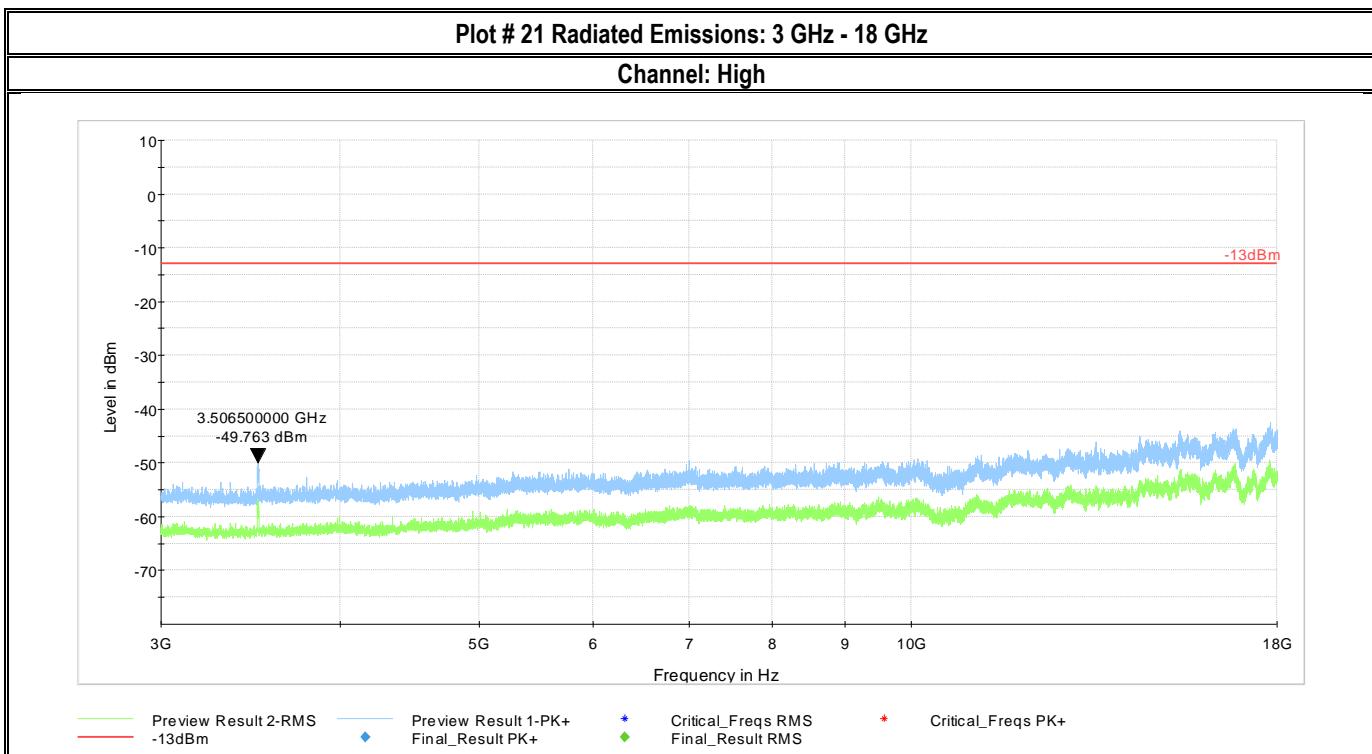
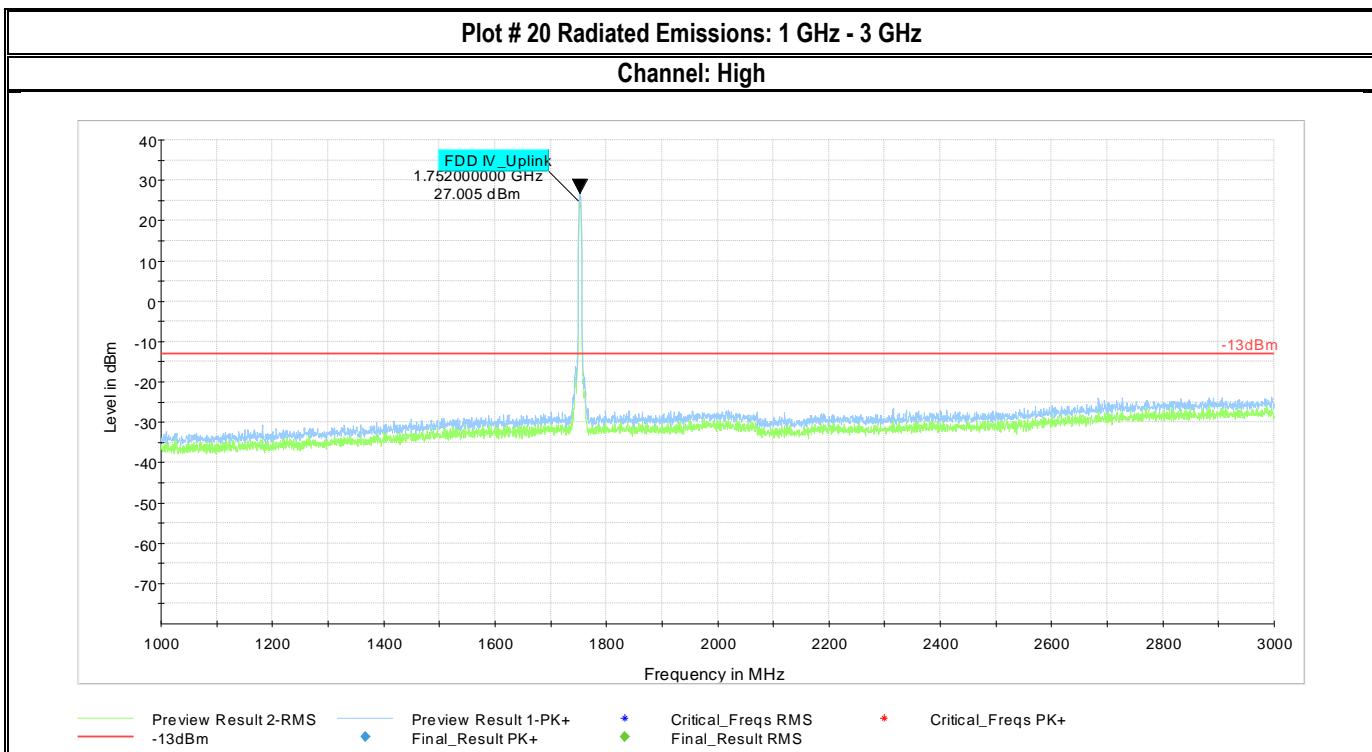
WCDMA Band IV

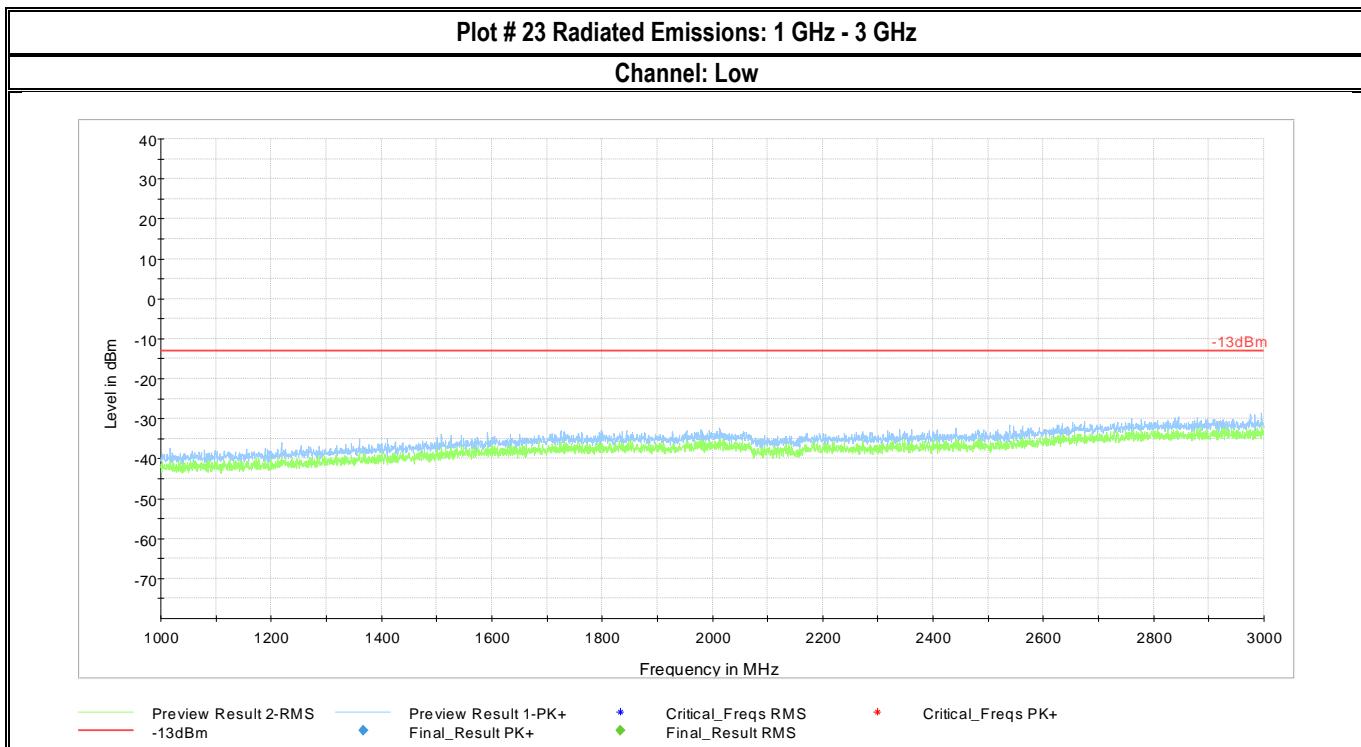
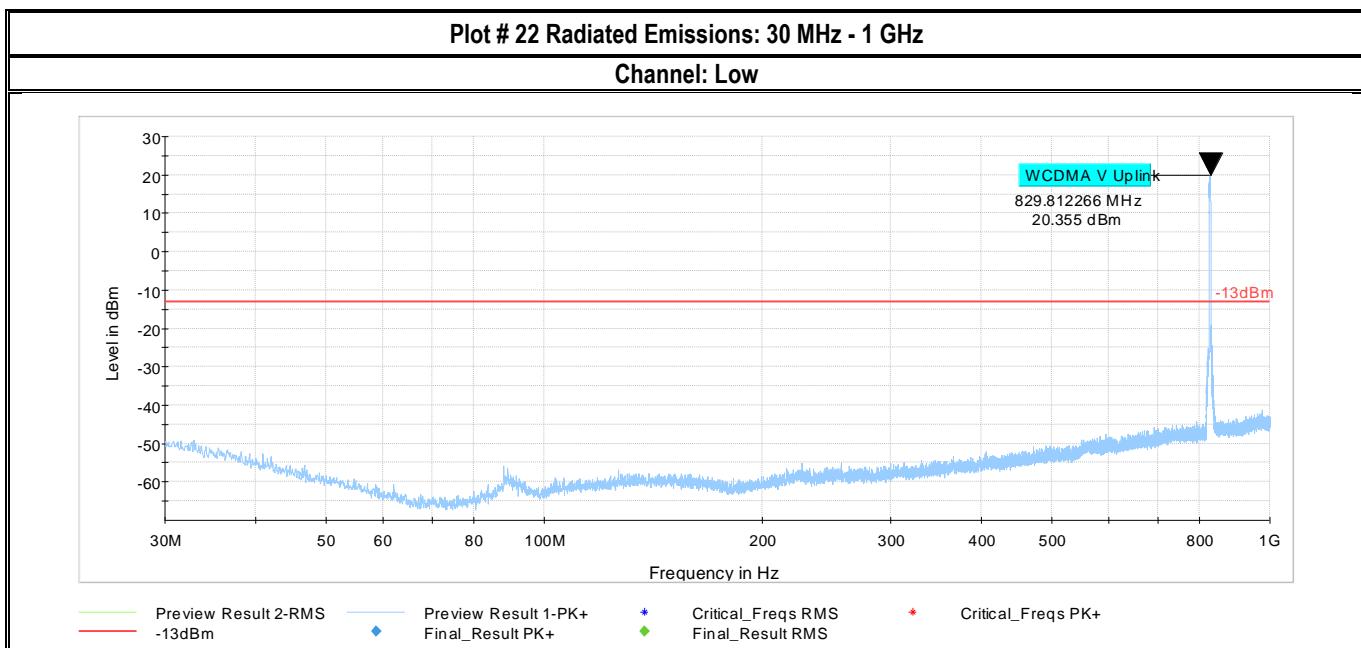


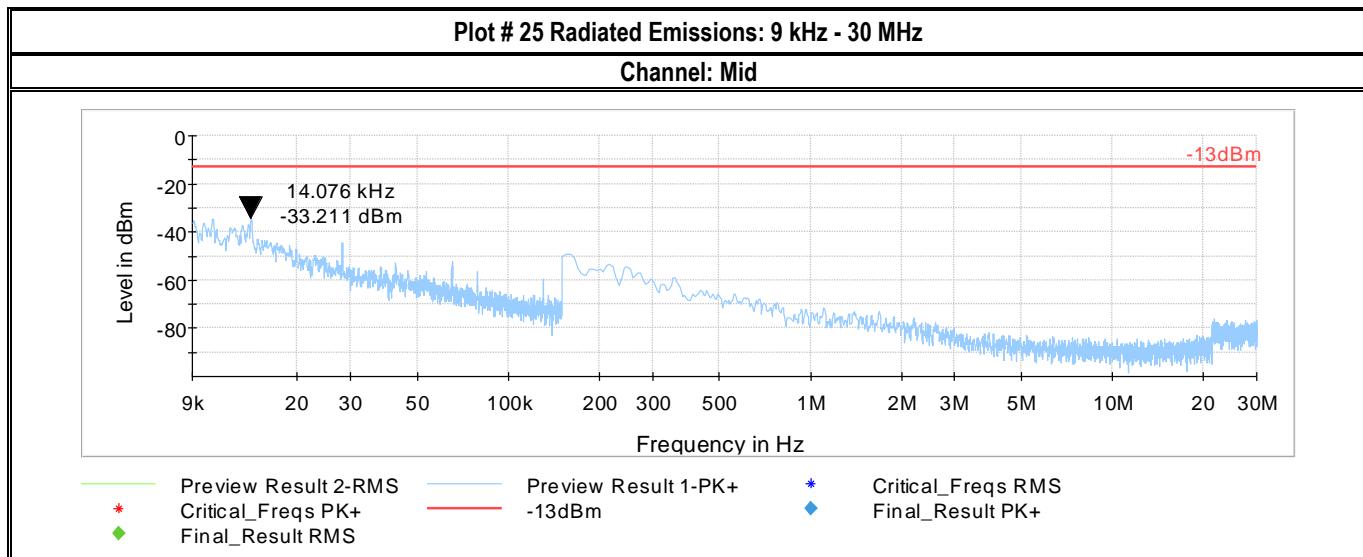
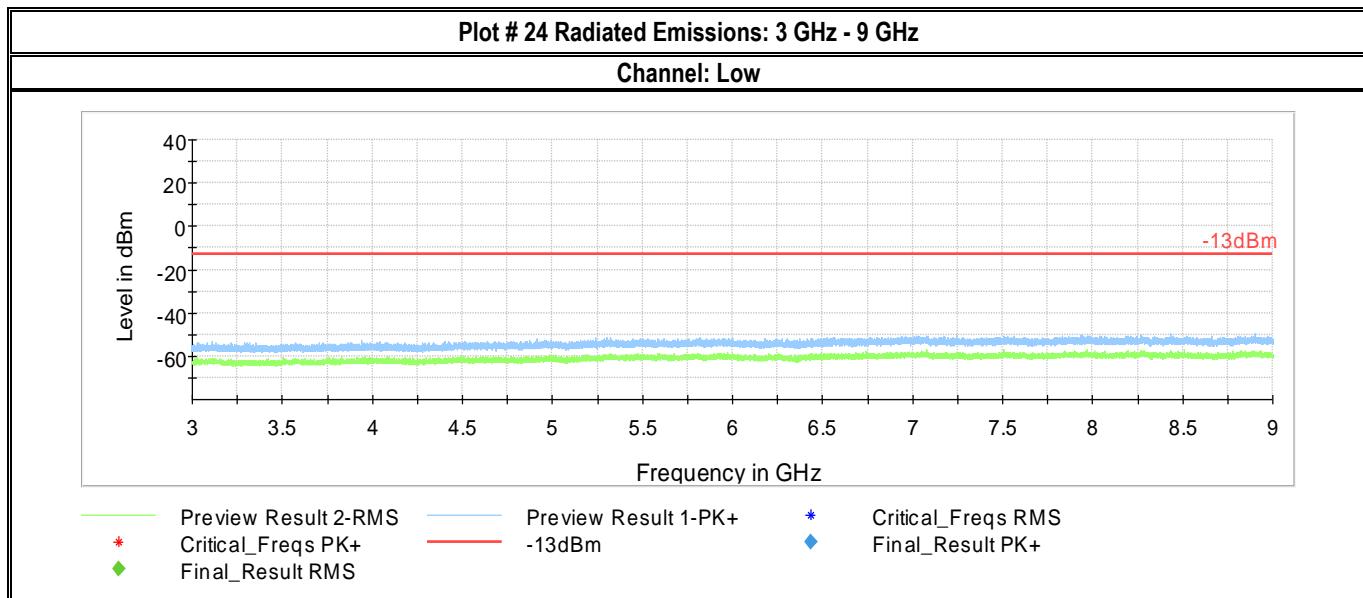


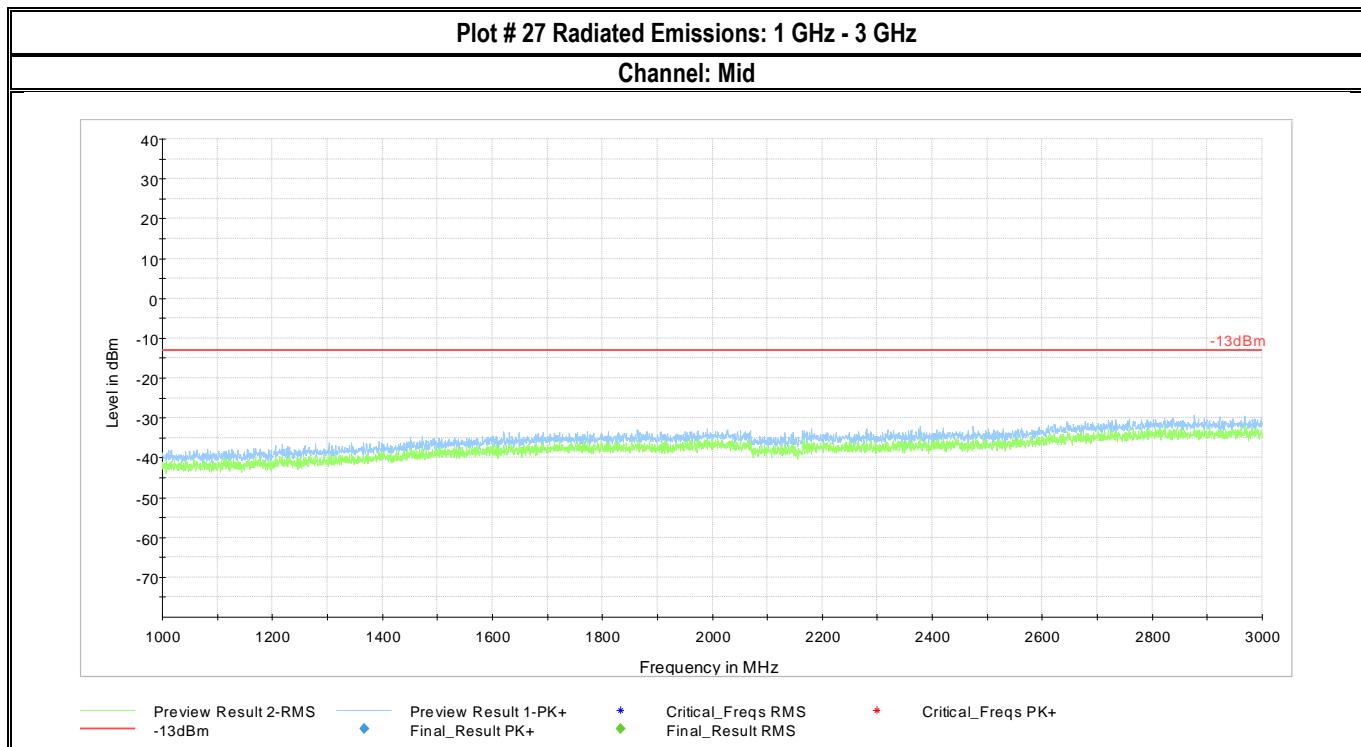
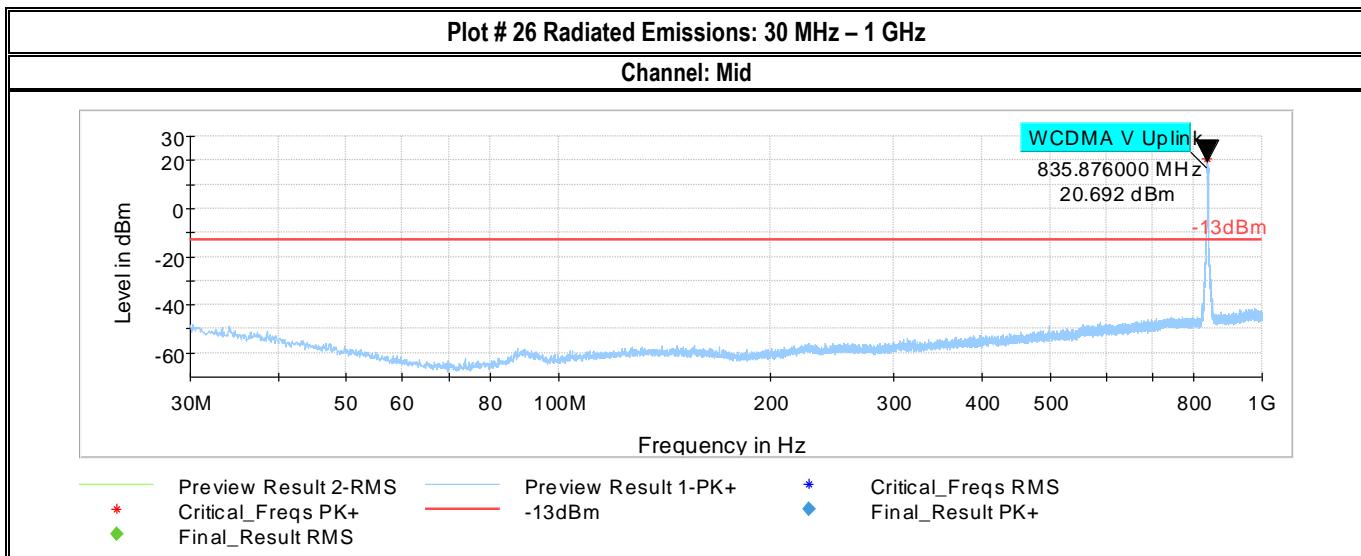


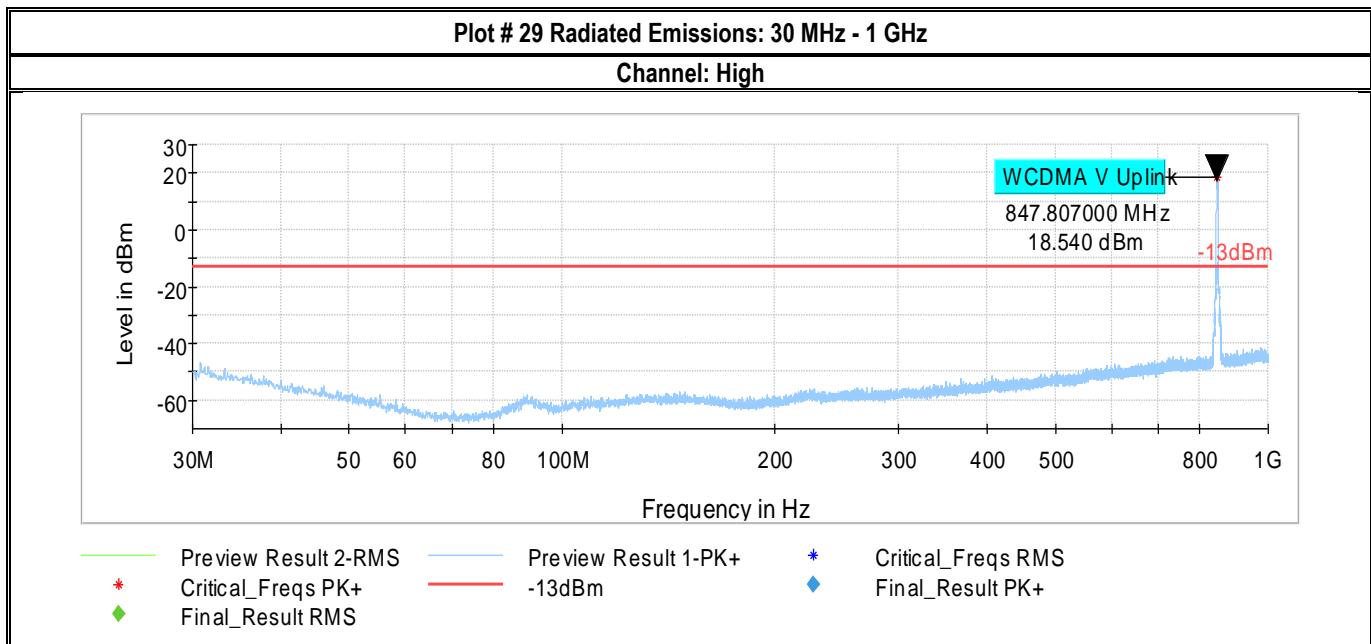
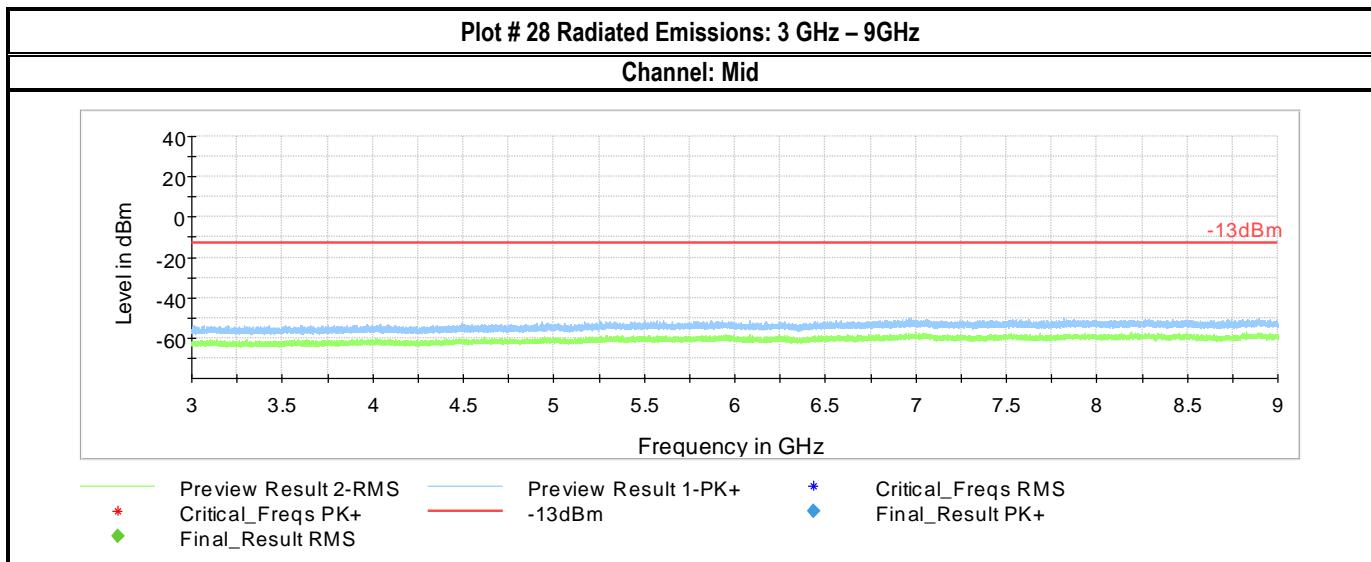


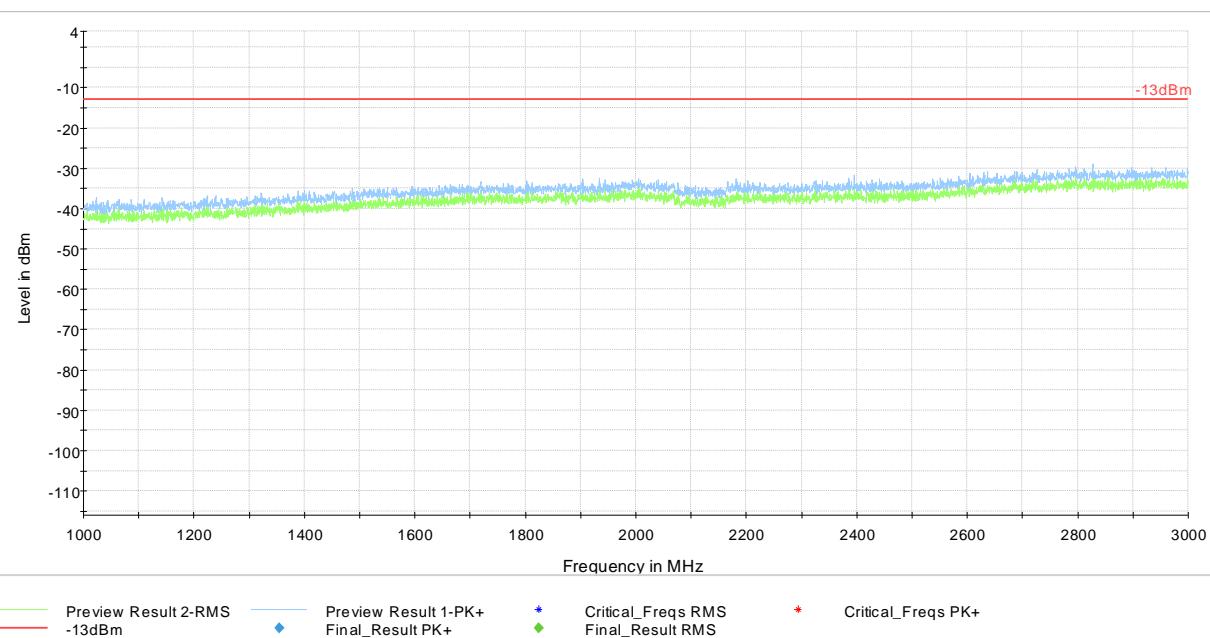
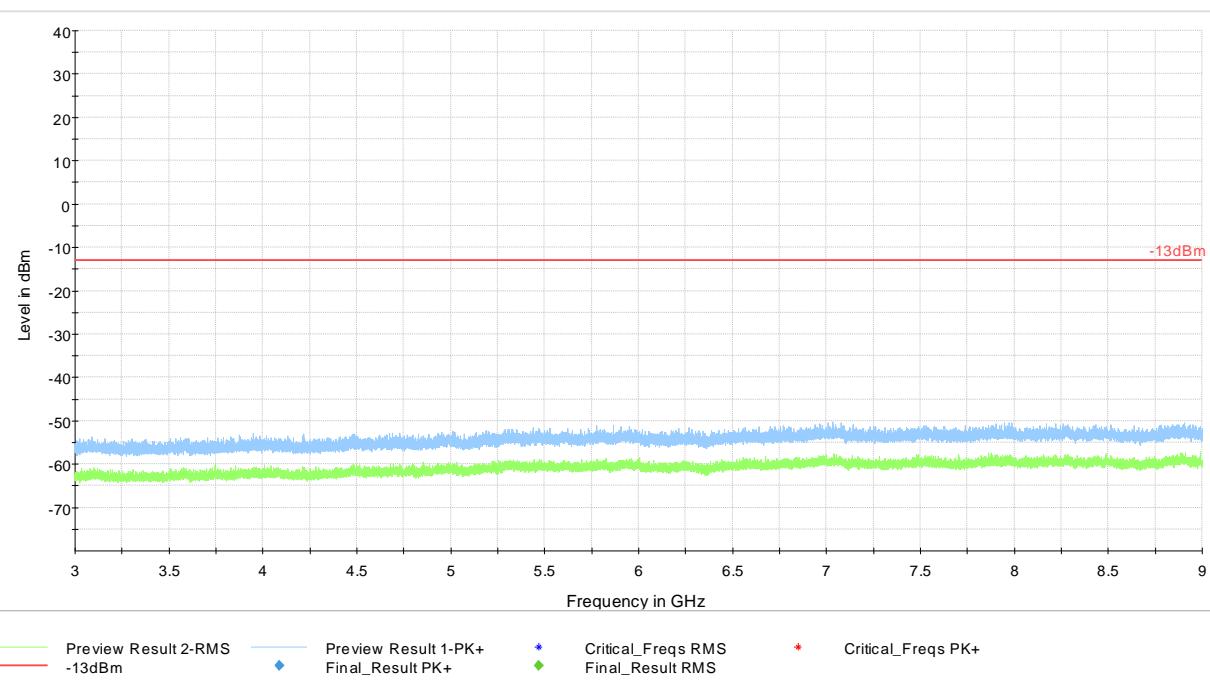


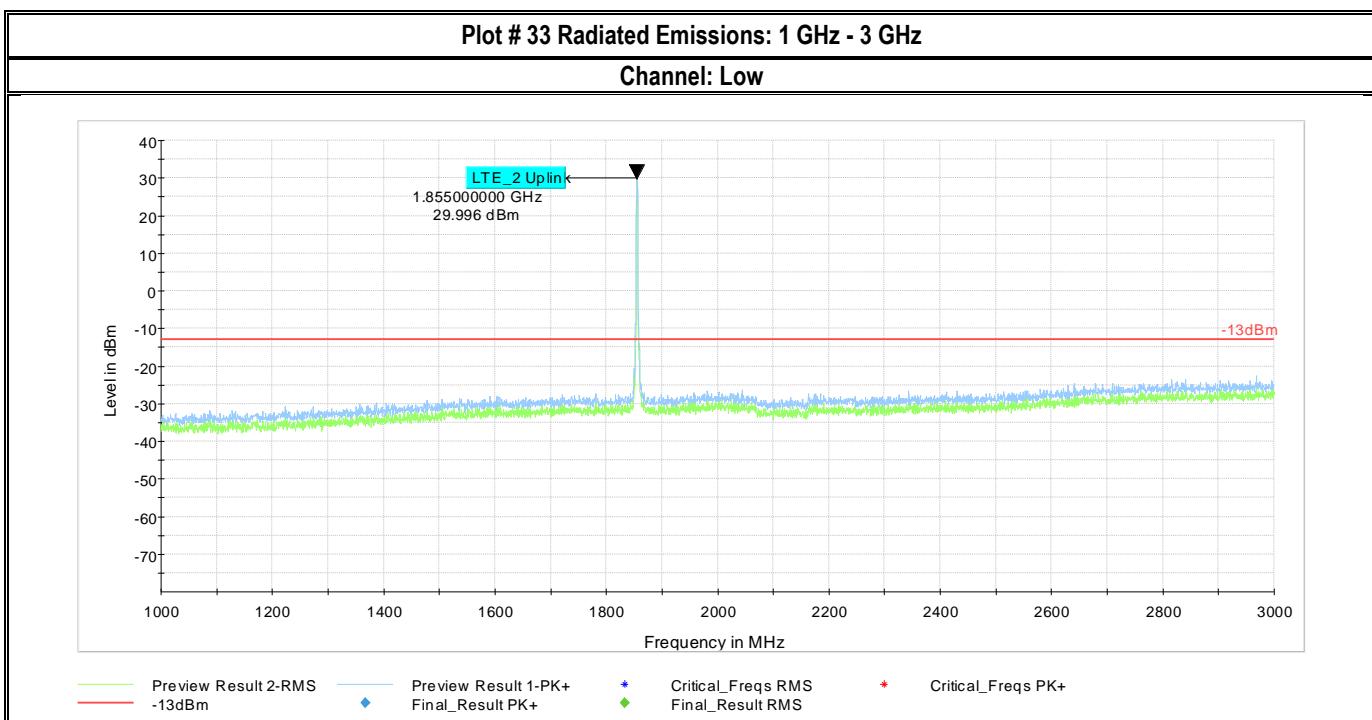
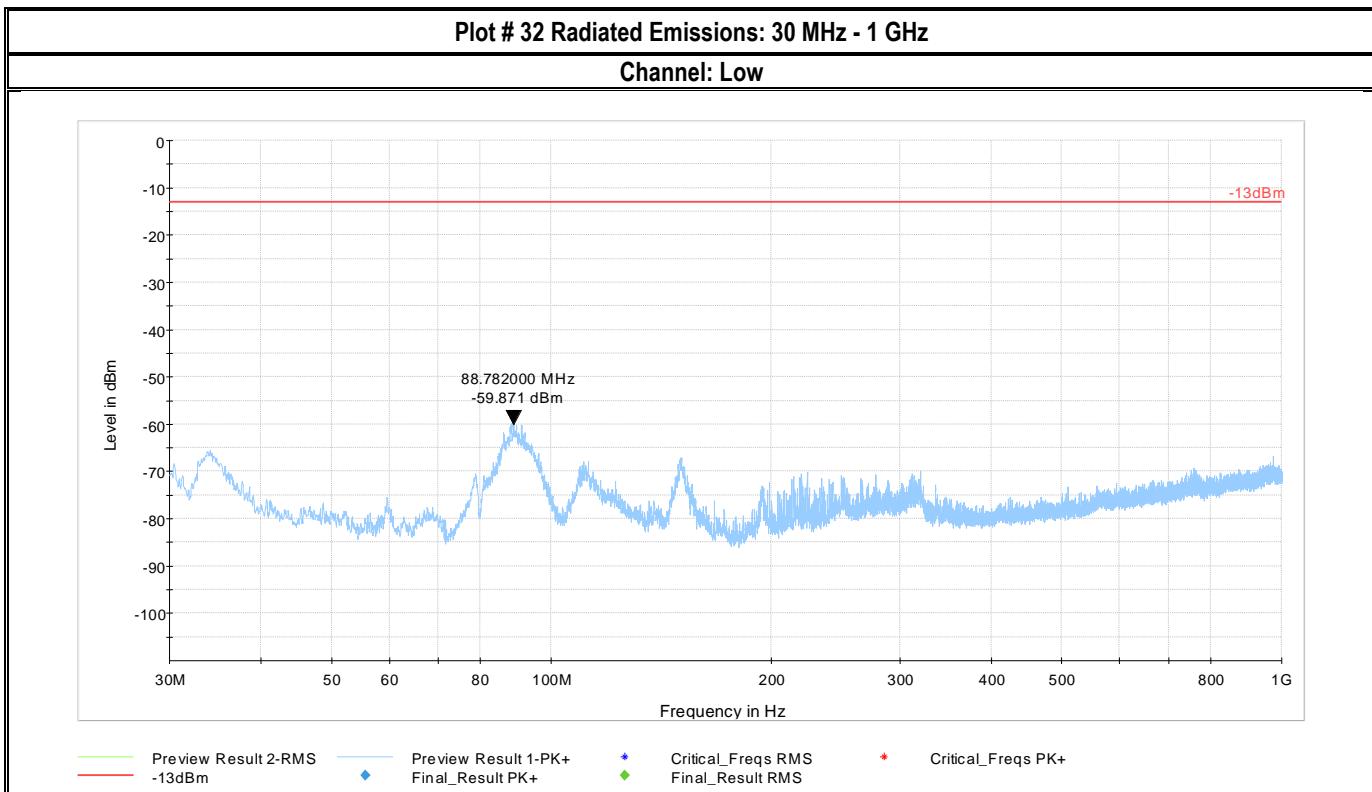
WCDMA Band V





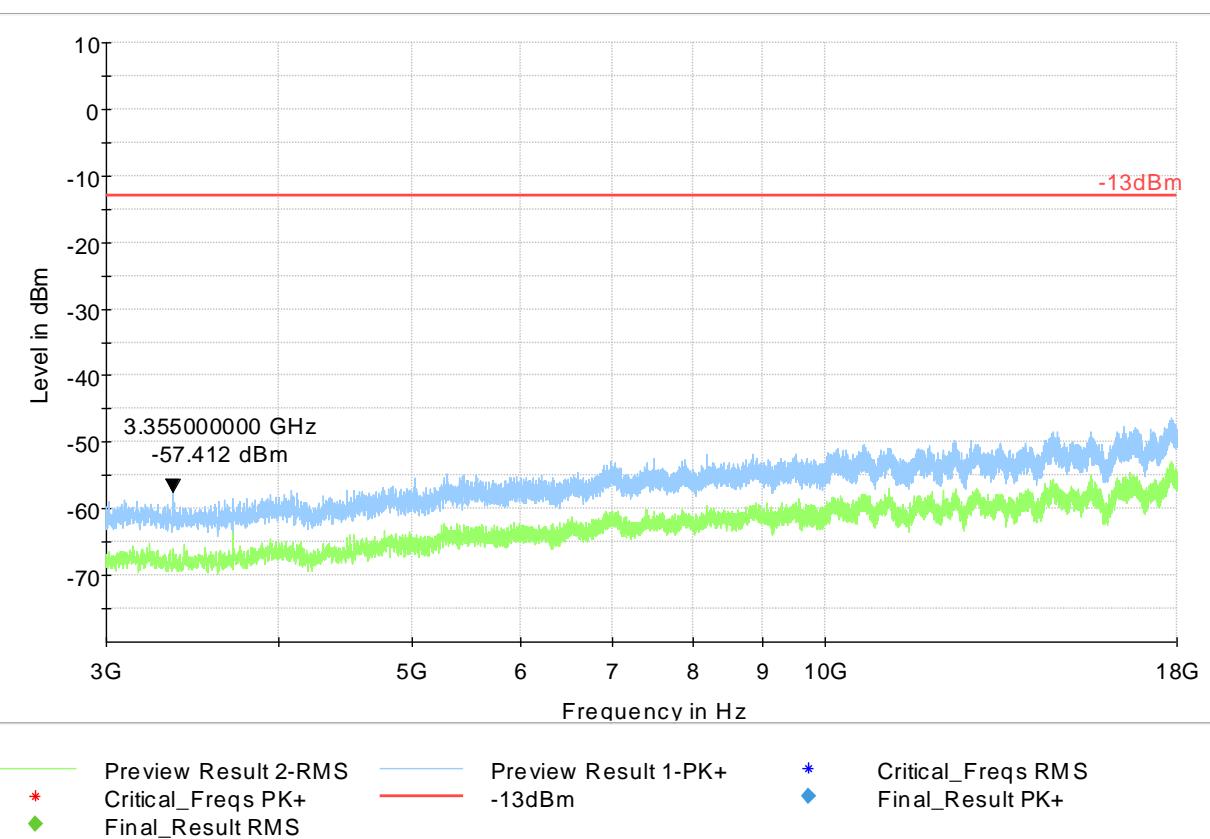


Plot # 30 Radiated Emissions: 1 GHz - 3 GHz**Channel: High****Plot # 31 Radiated Emissions: 3 GHz - 9 GHz****Channel: High**

LTE Band 2

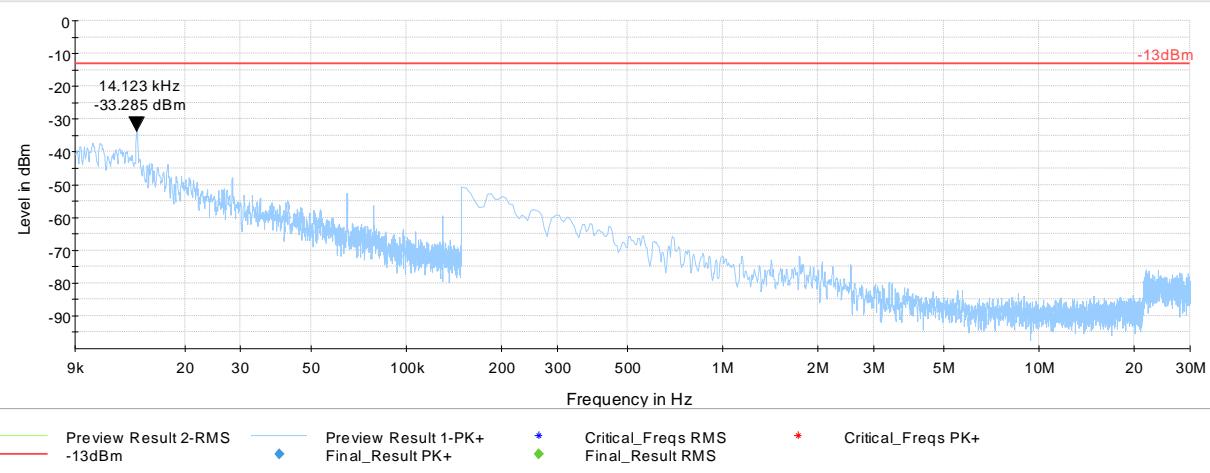
Plot # 34 Radiated Emissions: 3 GHz - 18 GHz

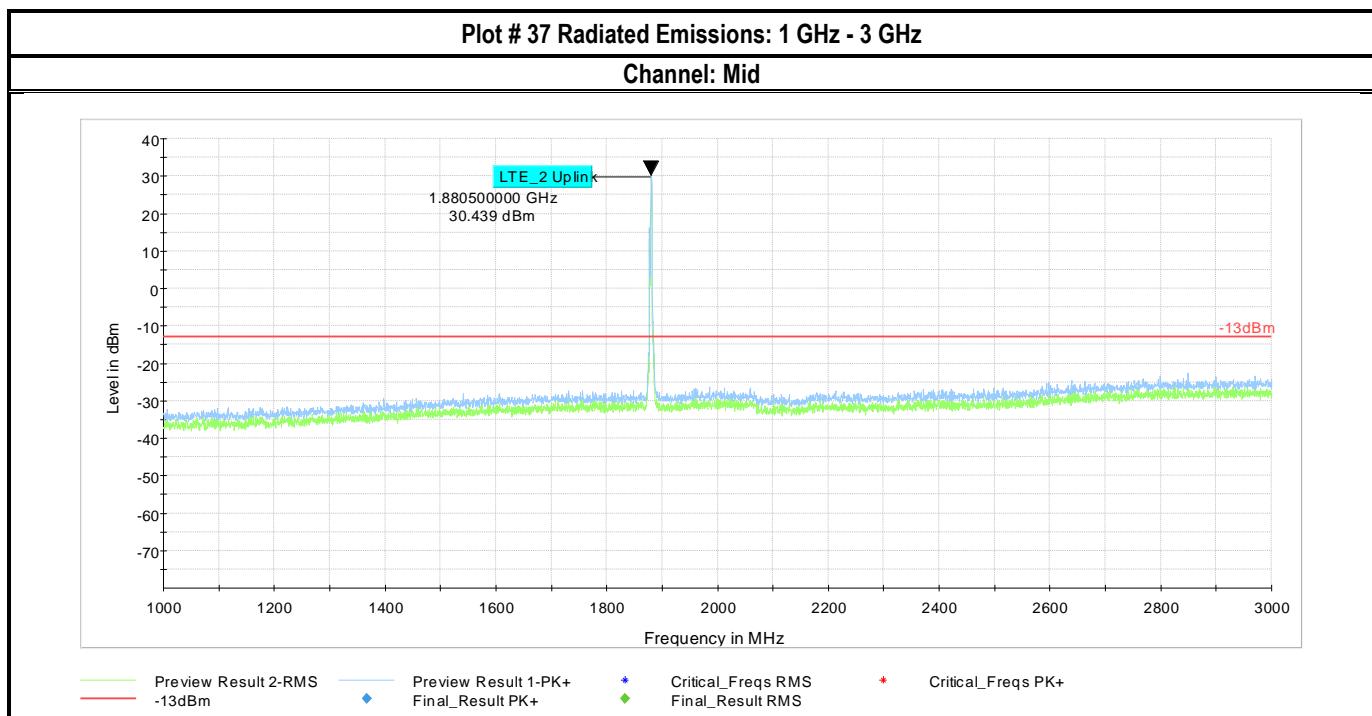
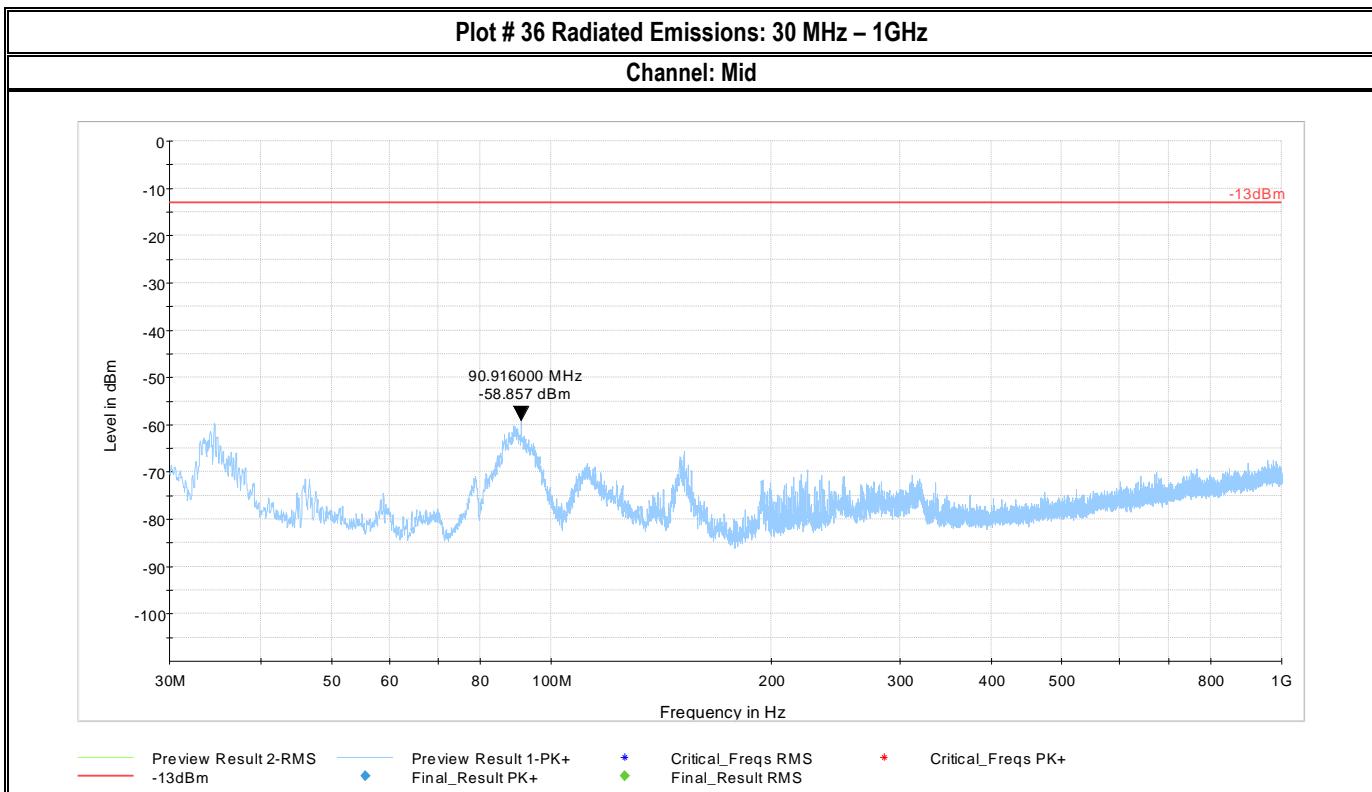
Channel: Low

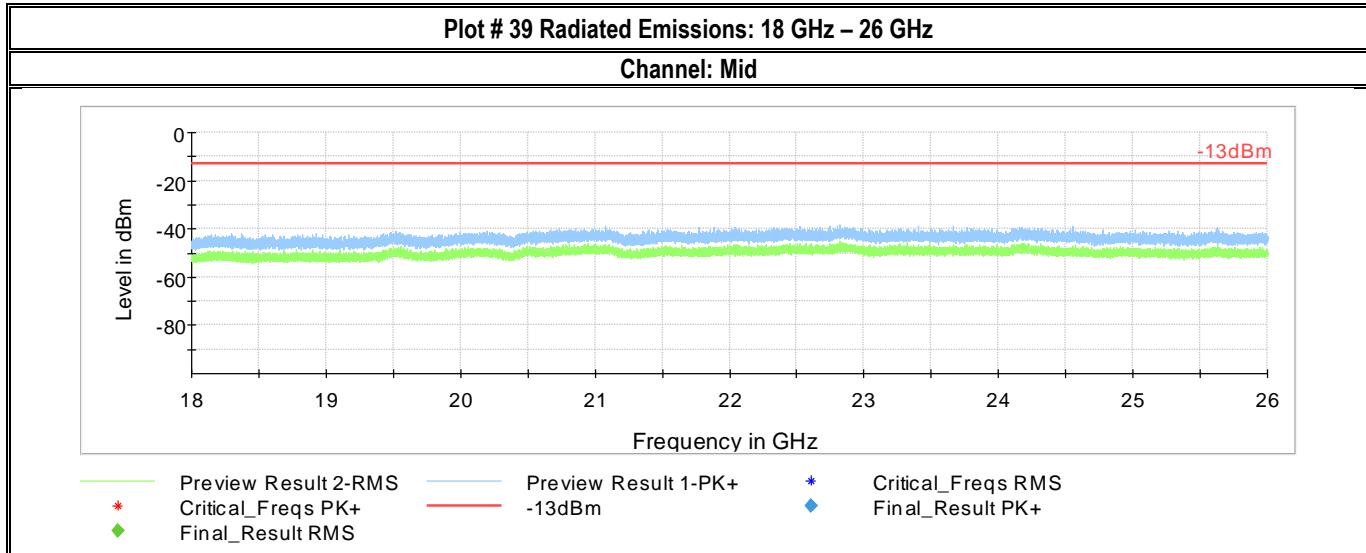
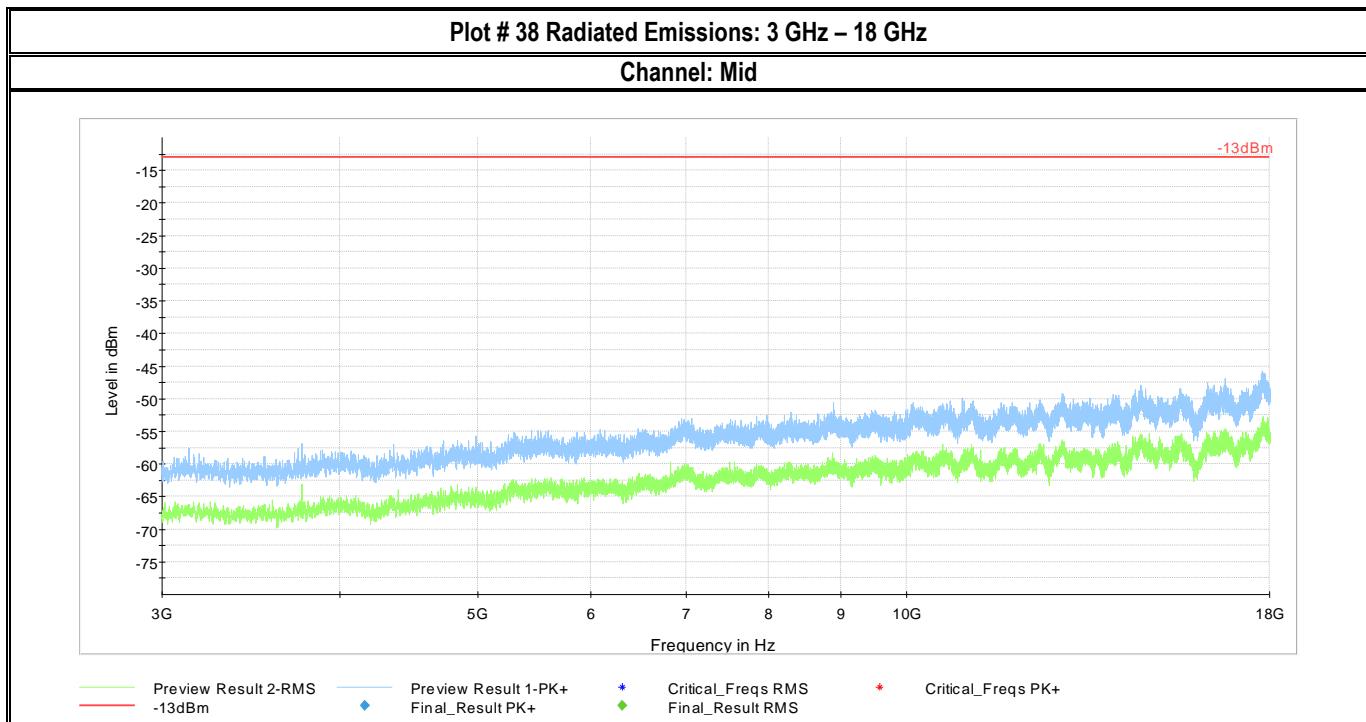


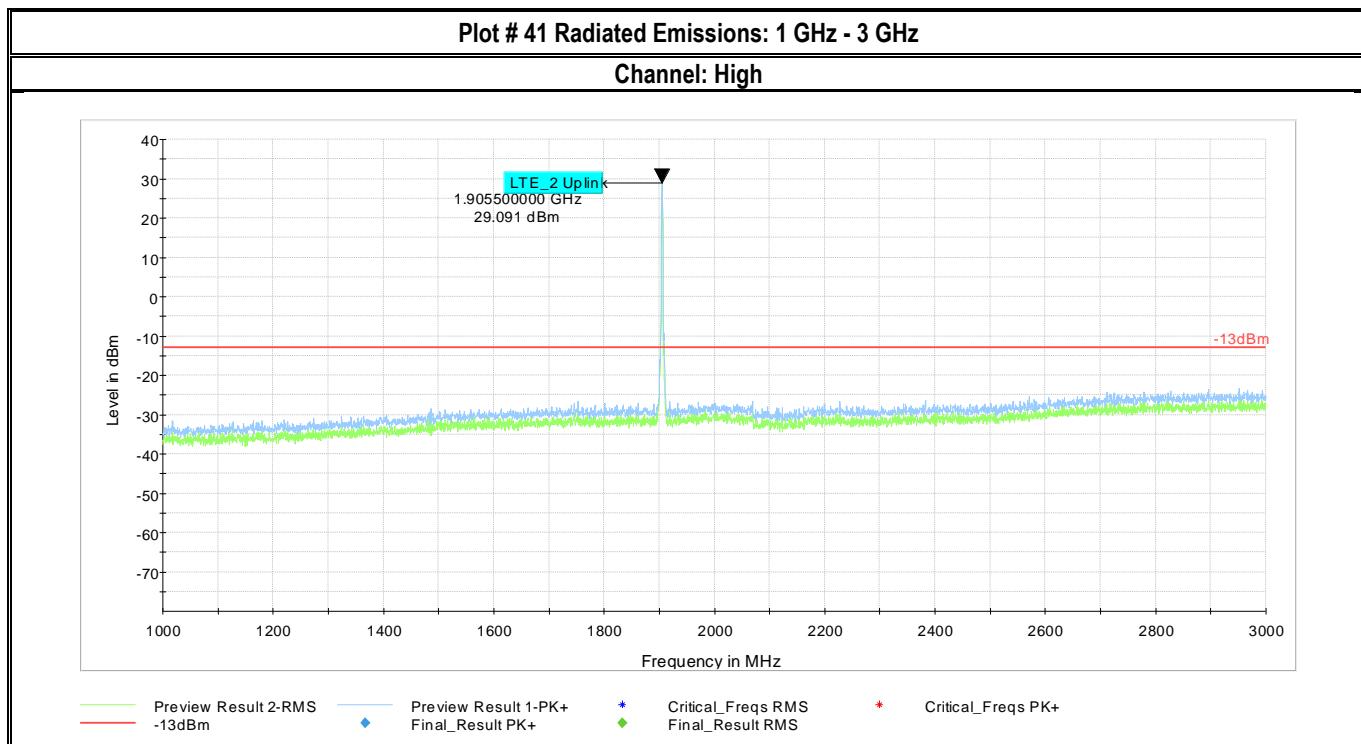
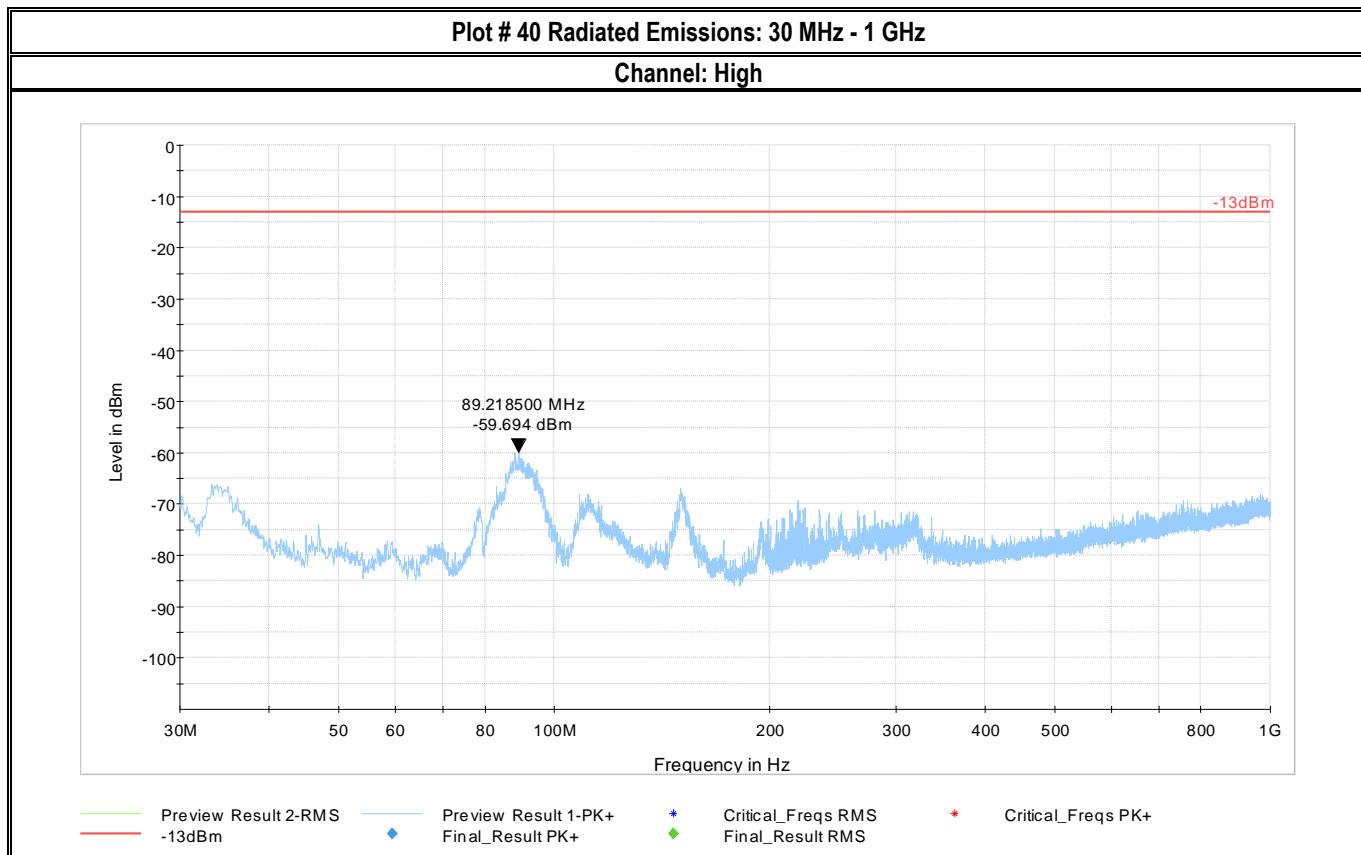
Plot # 35 Radiated Emissions: 9 kHz - 30 MHz

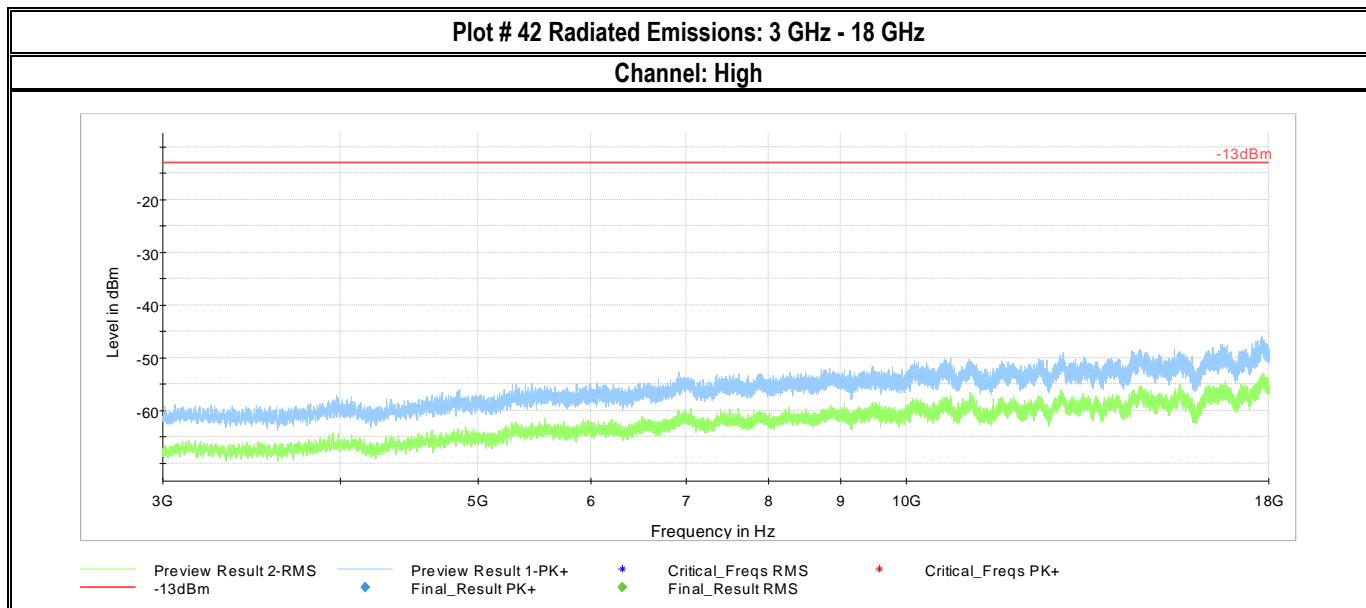
Channel: Mid

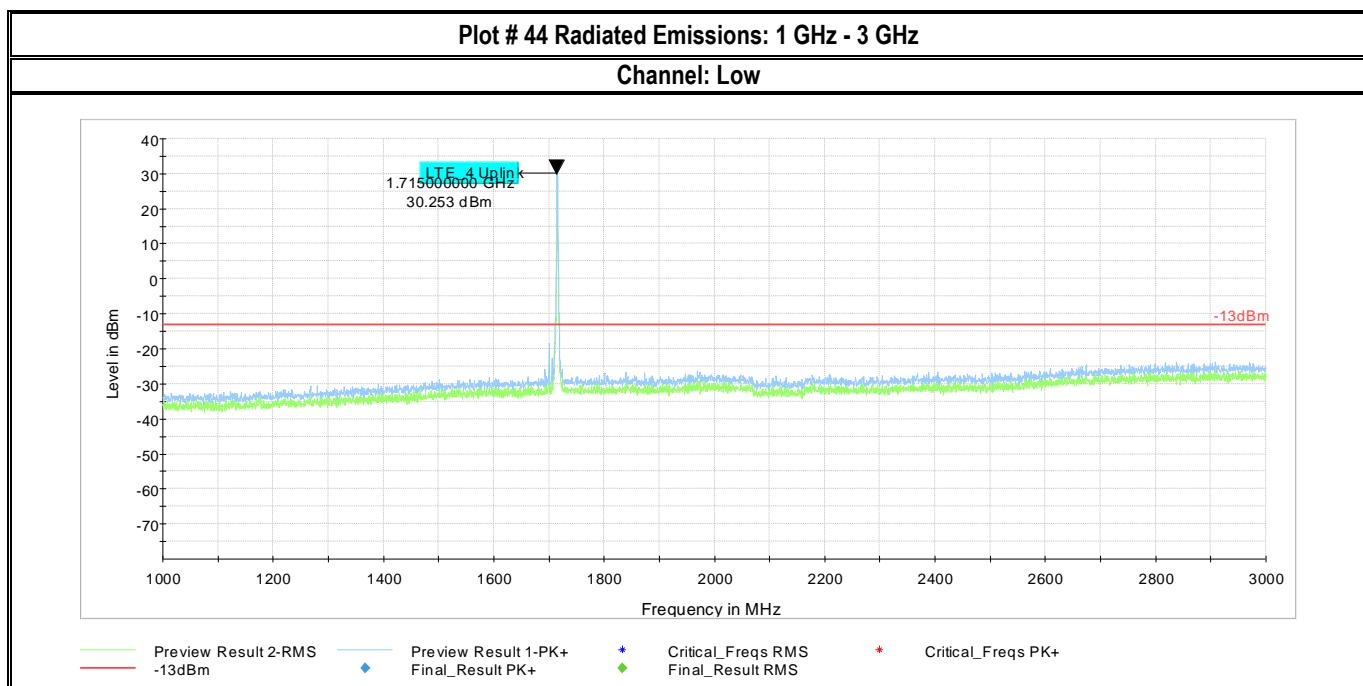
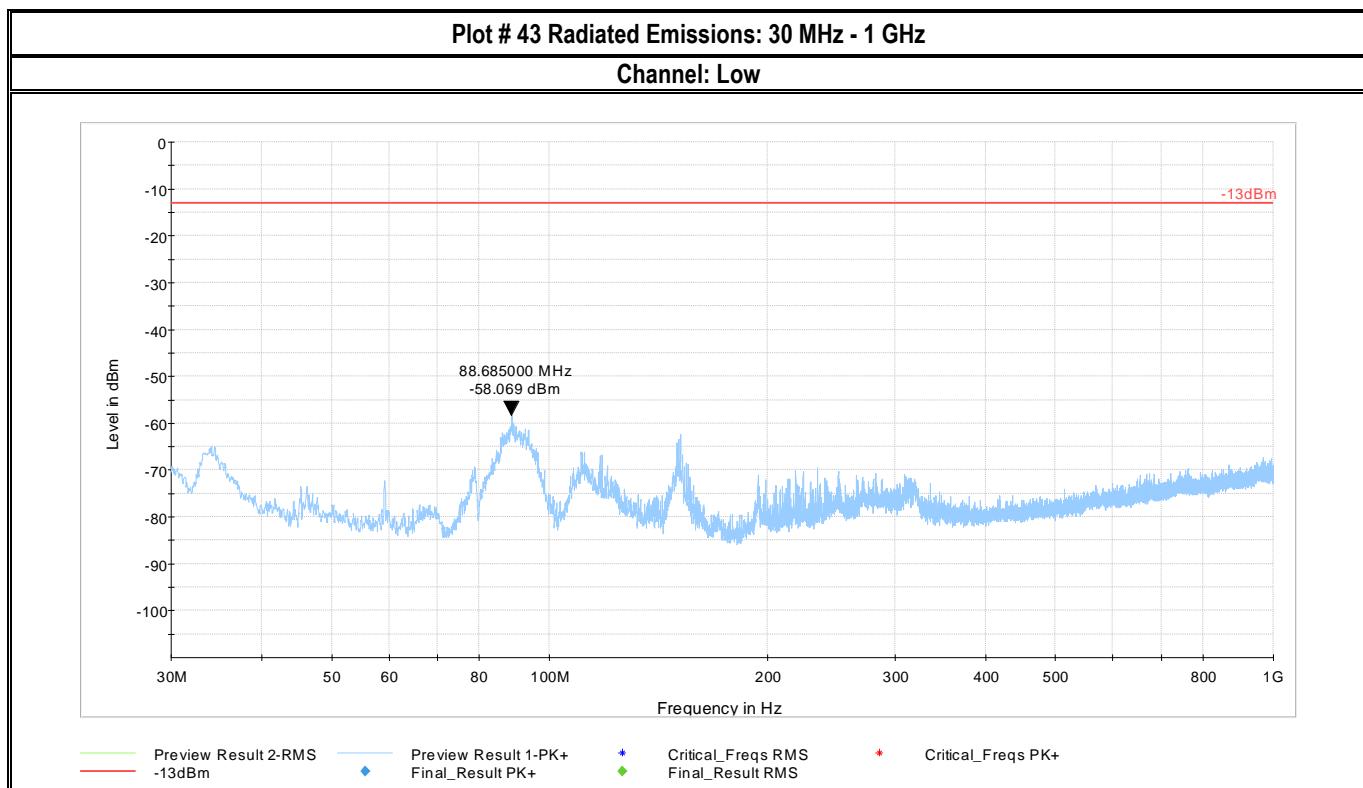


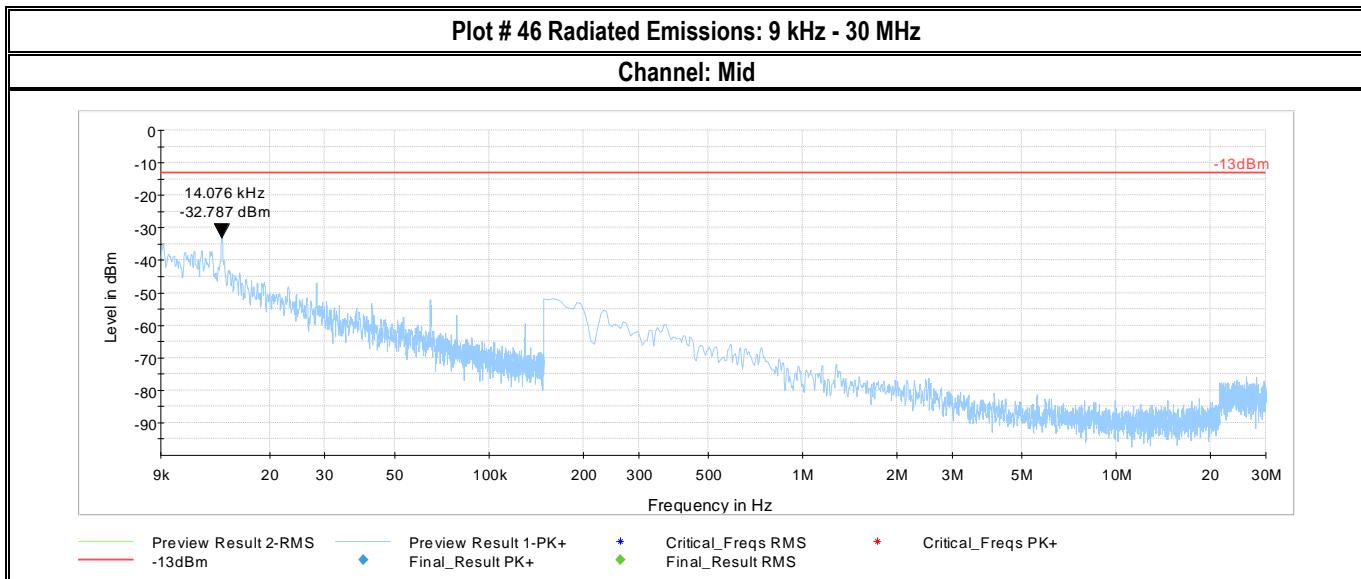
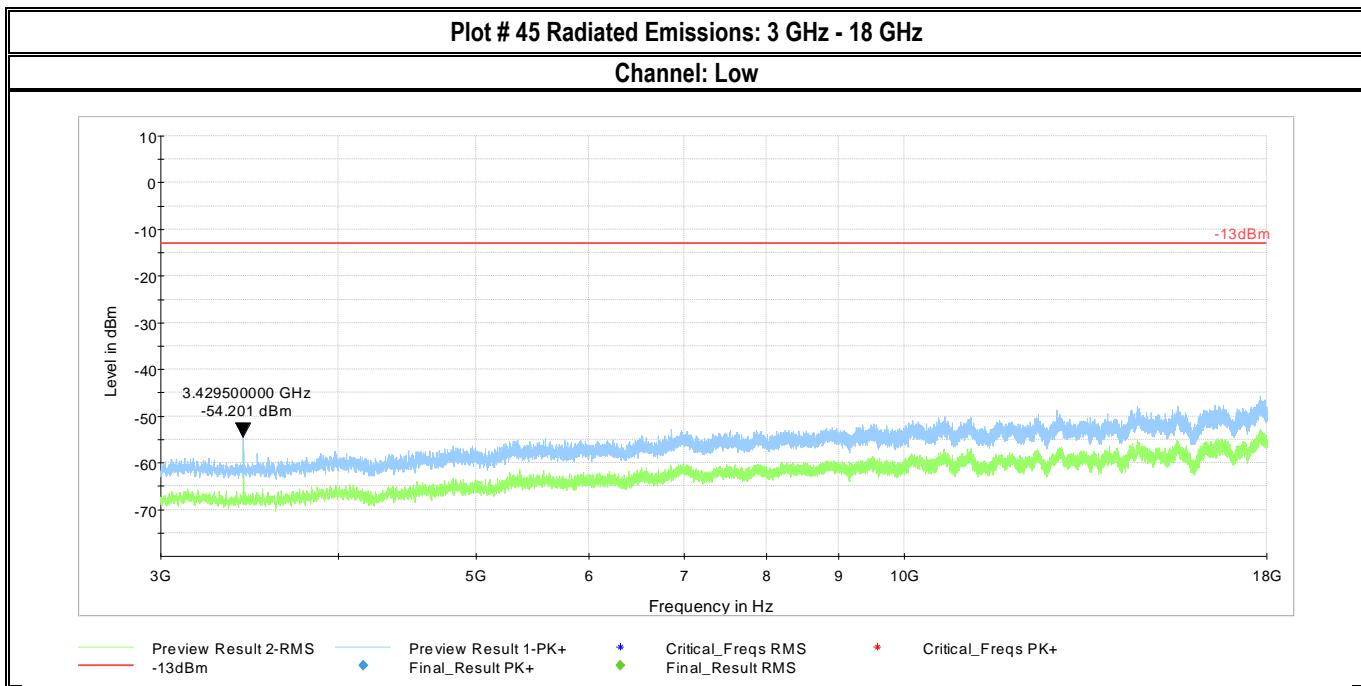


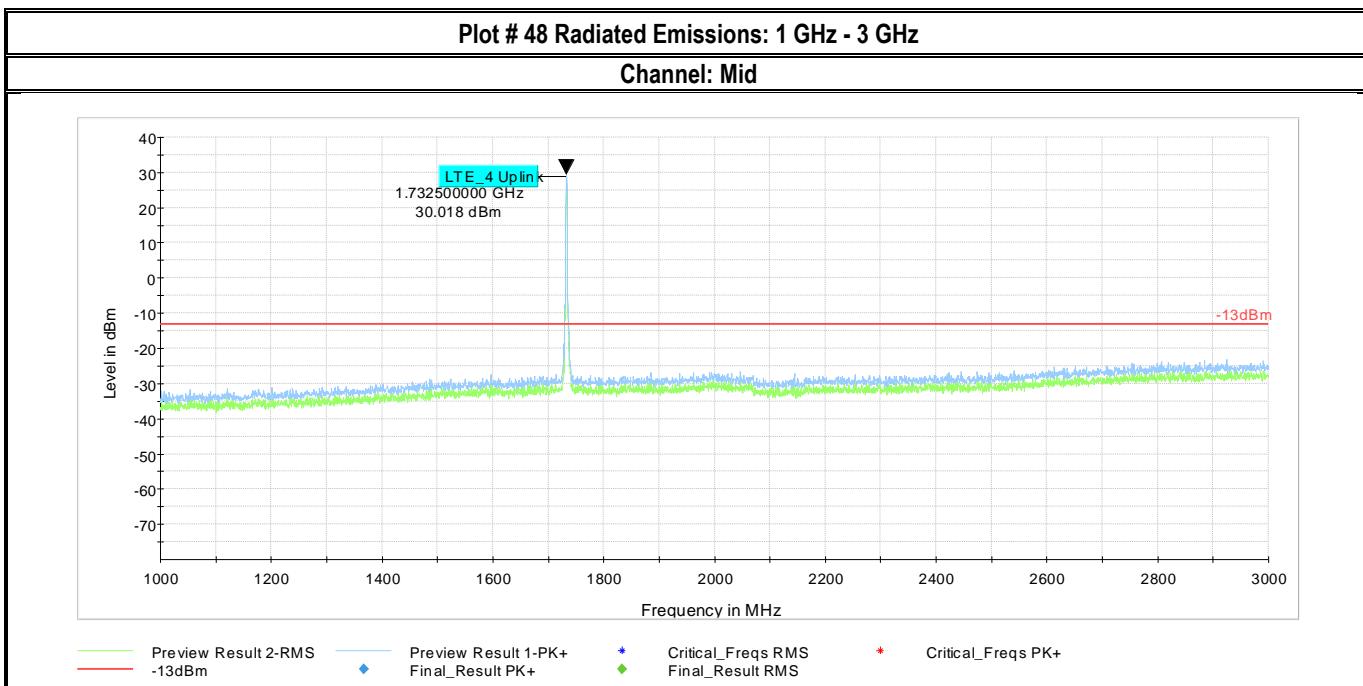
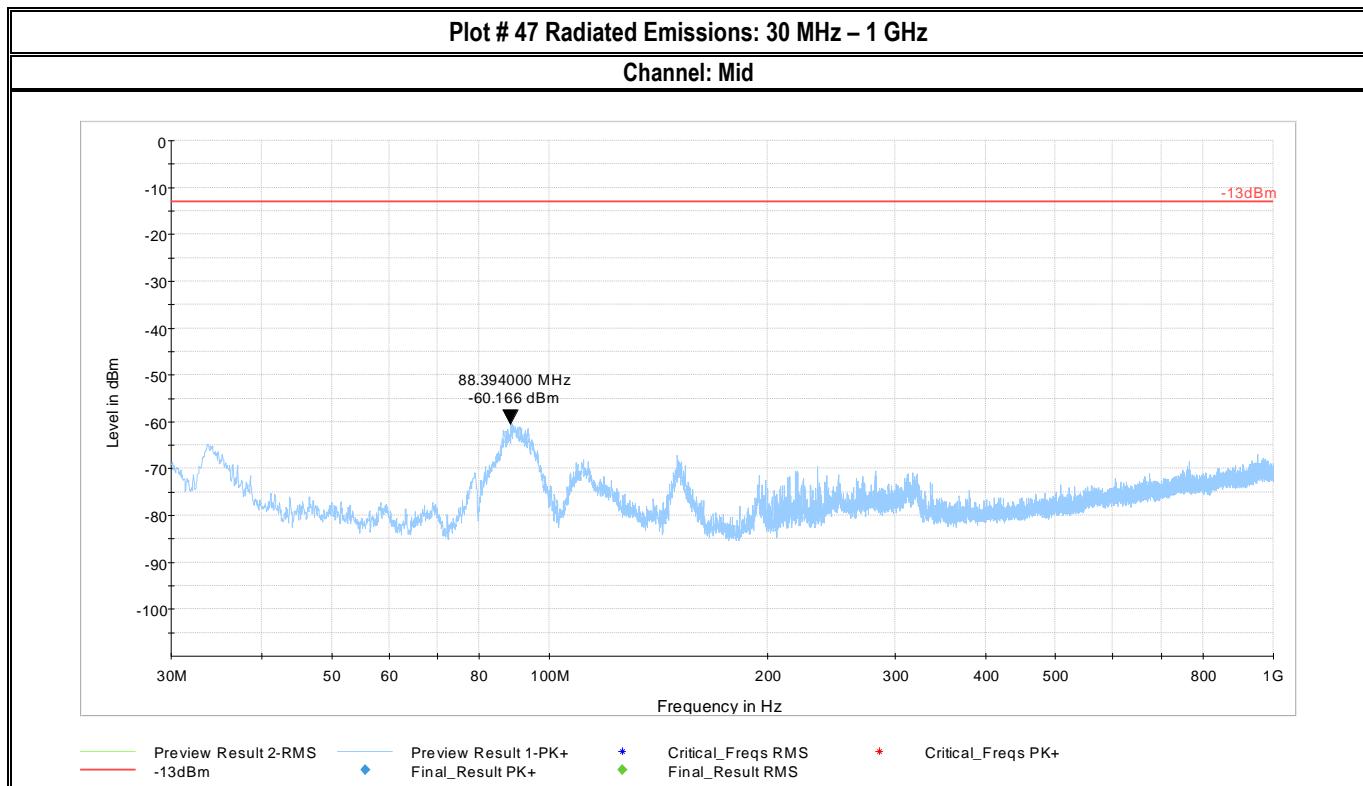


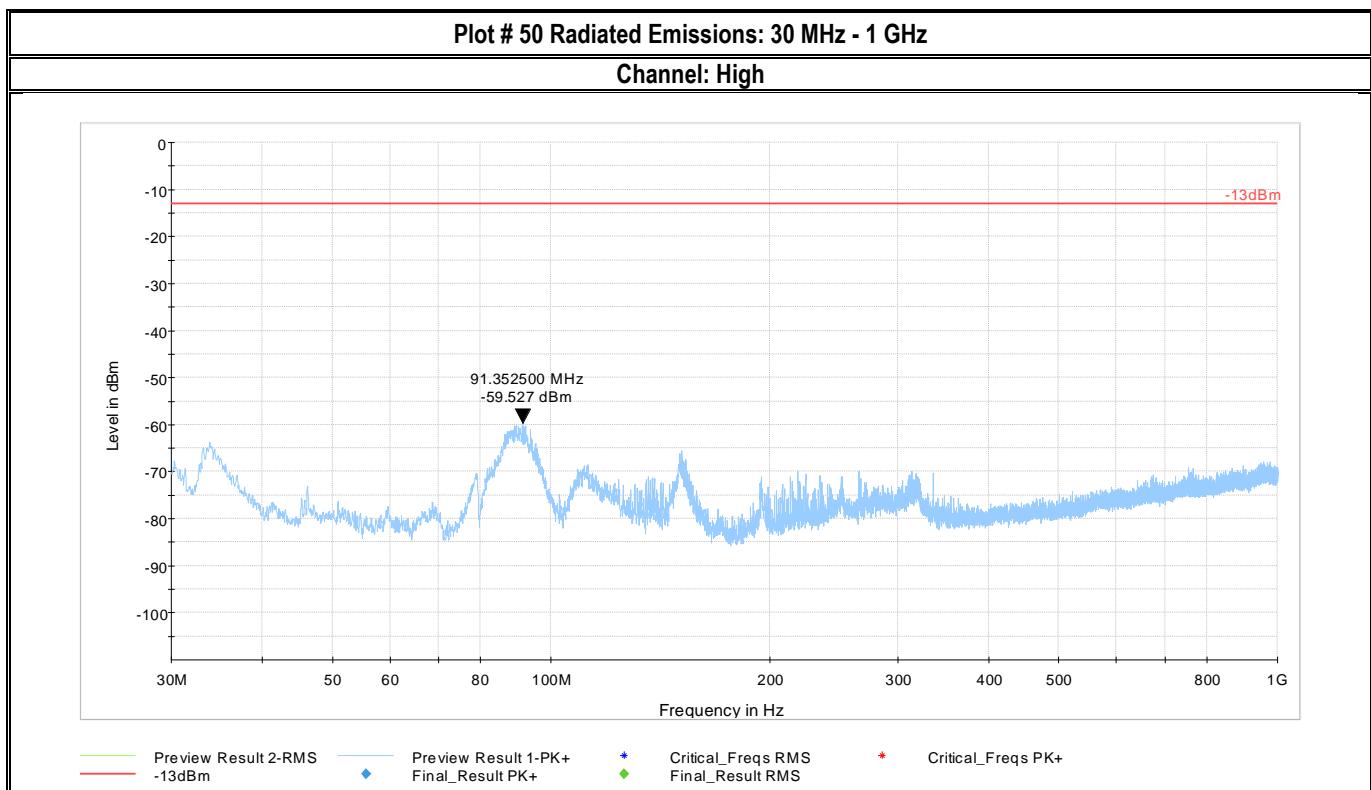
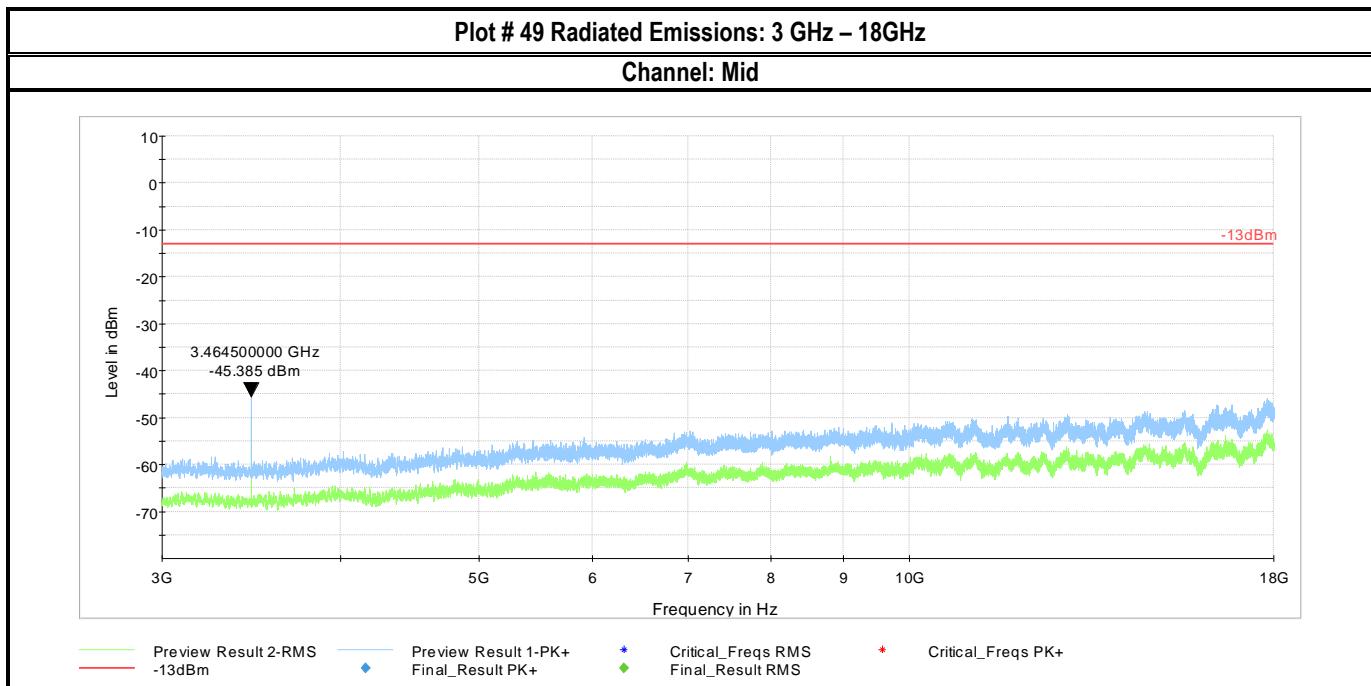


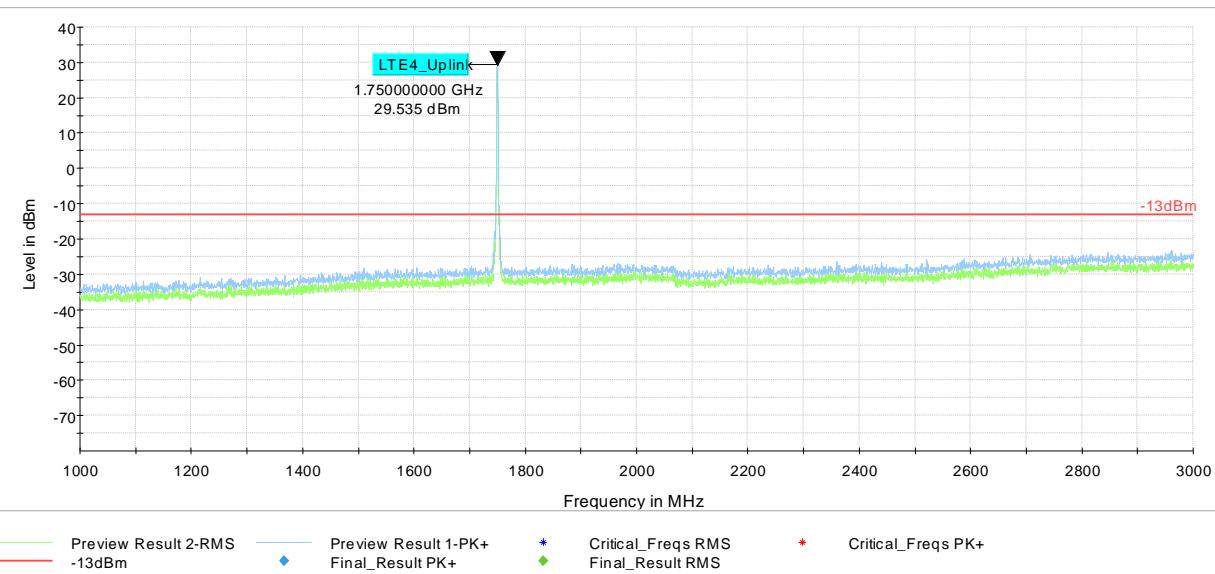
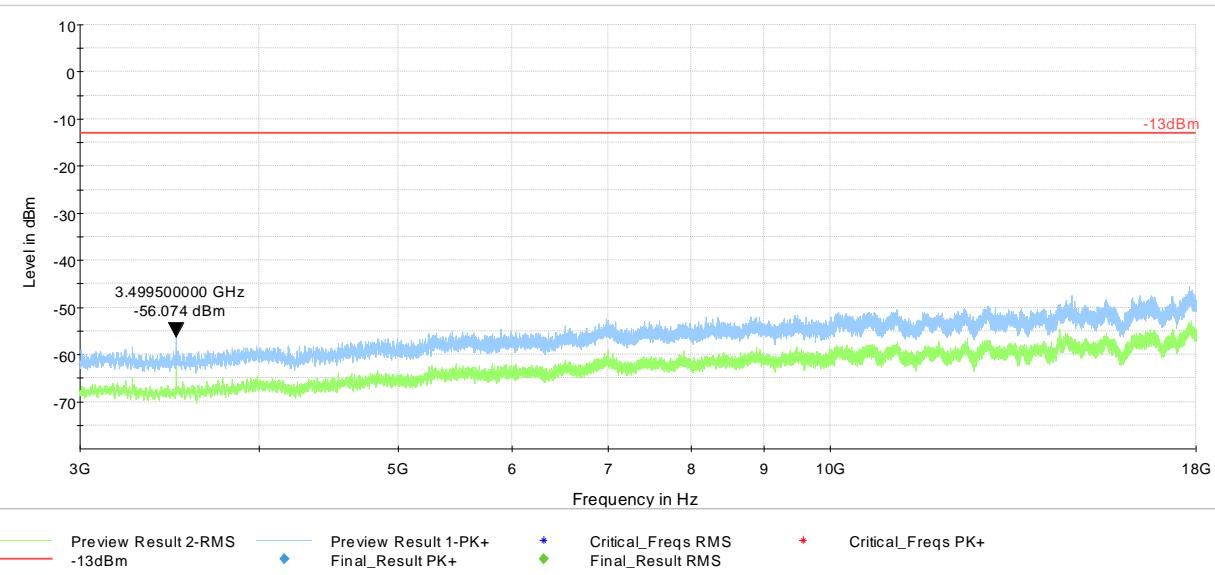


LTE Band 4

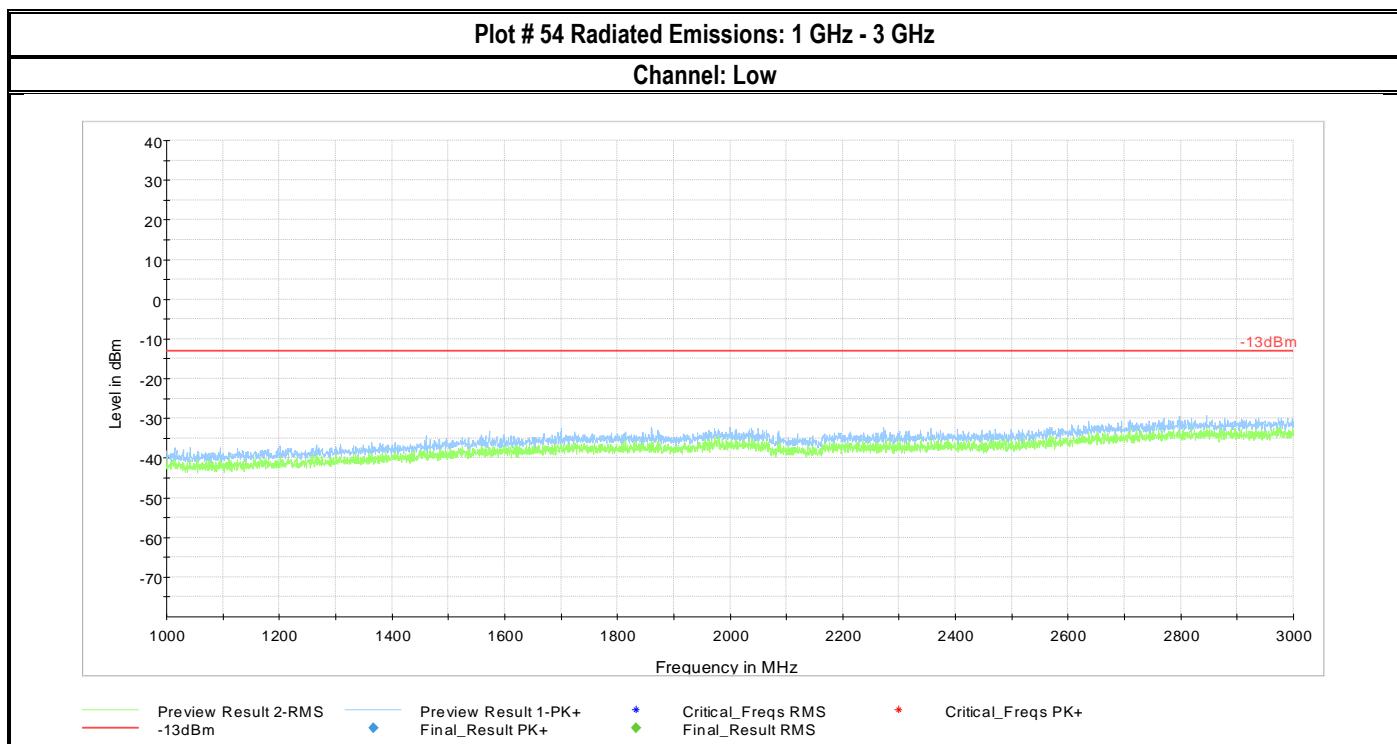
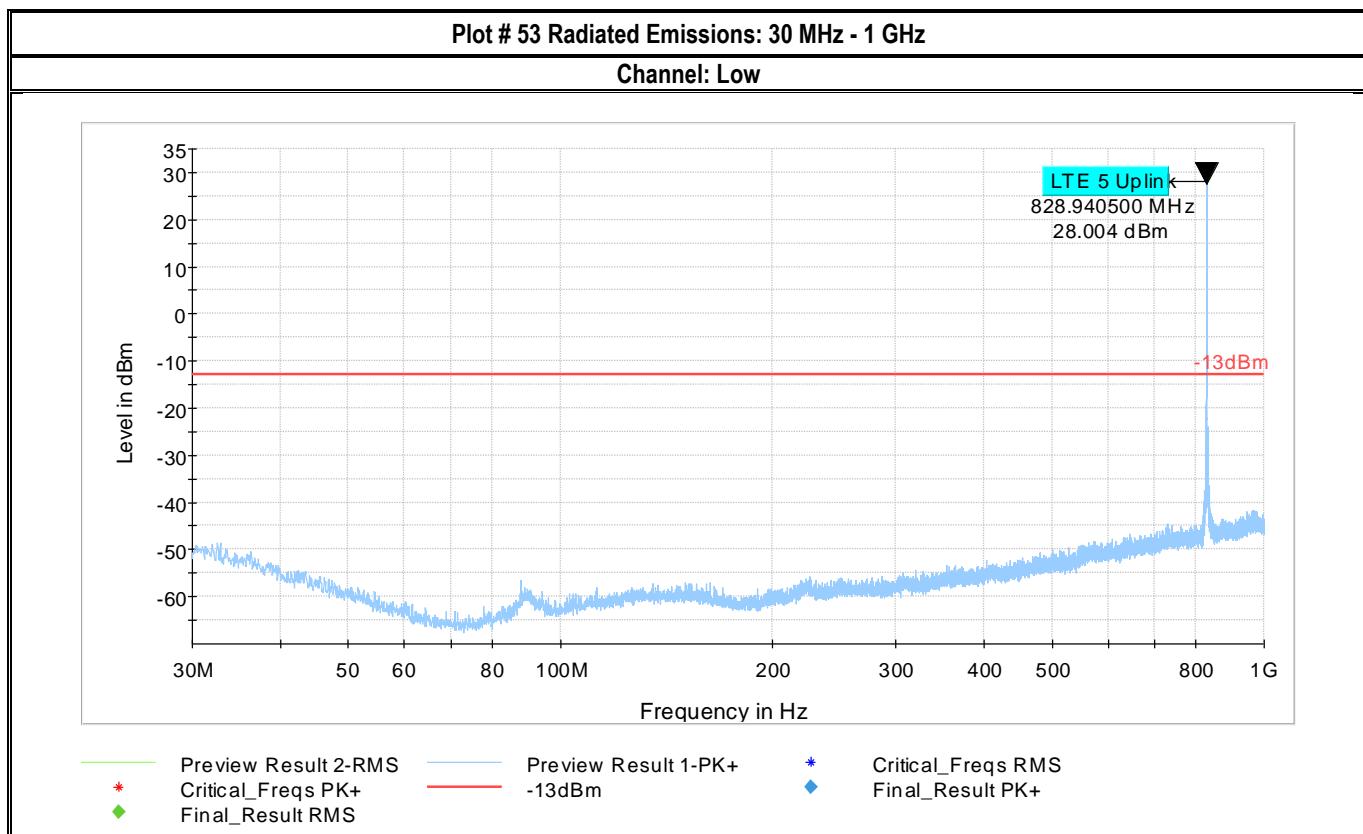


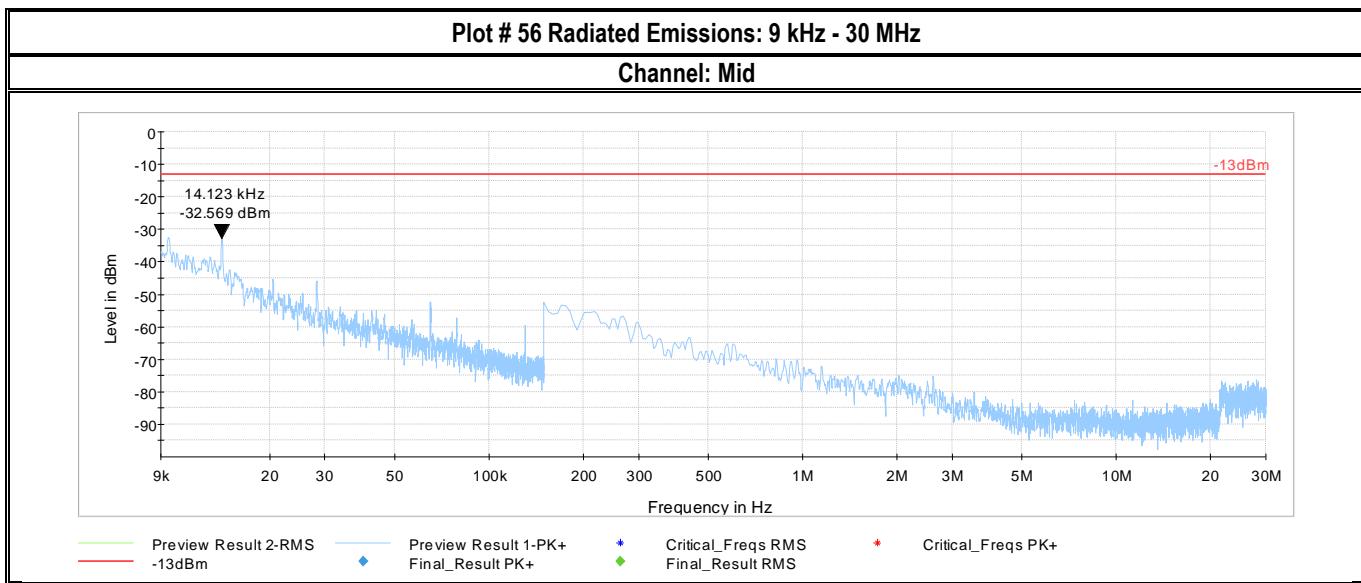
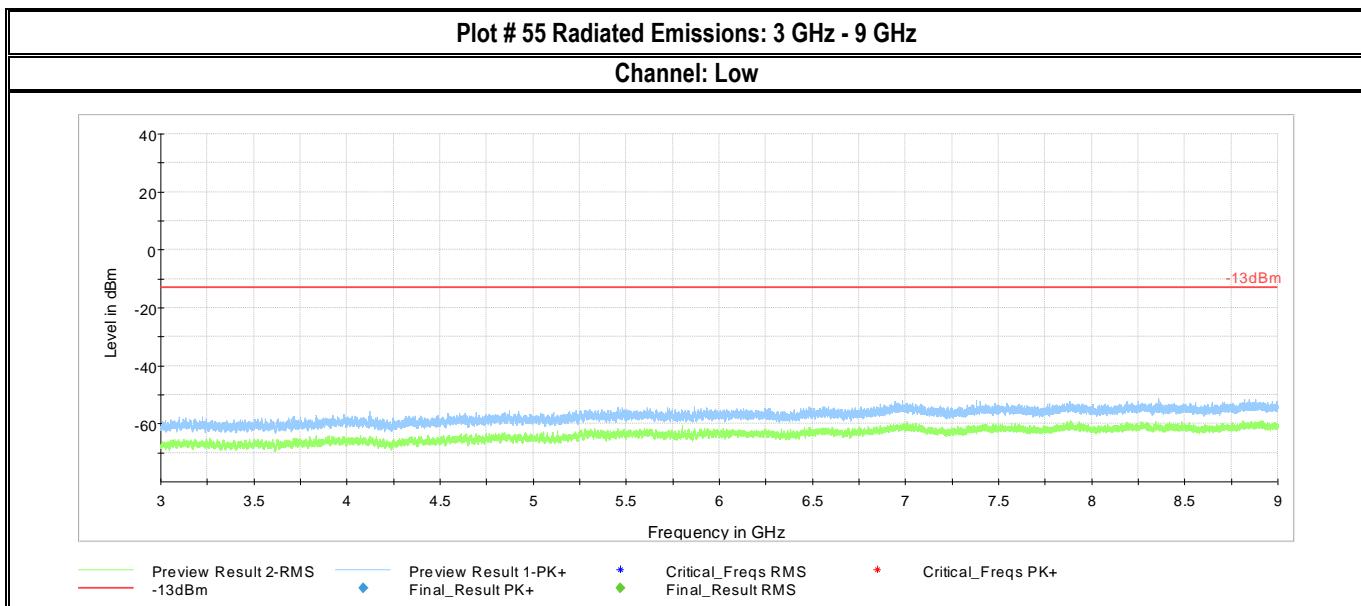


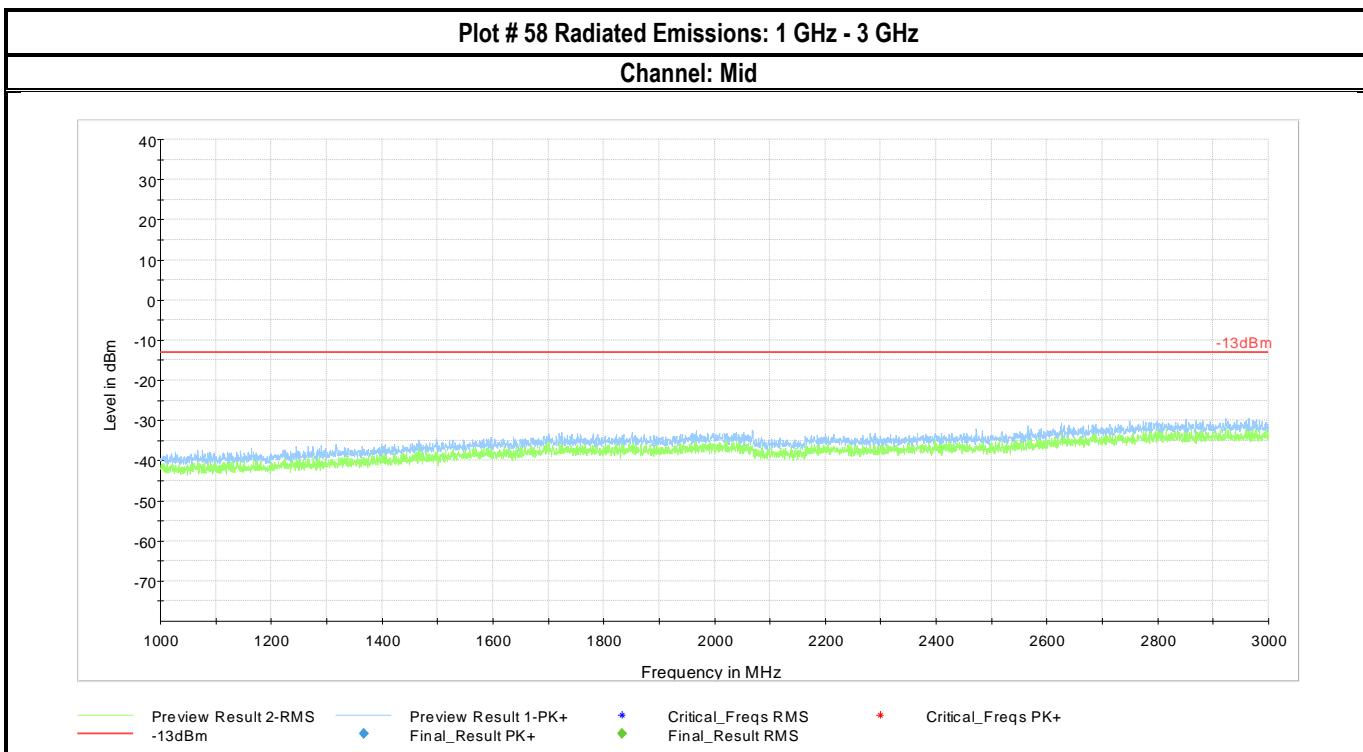
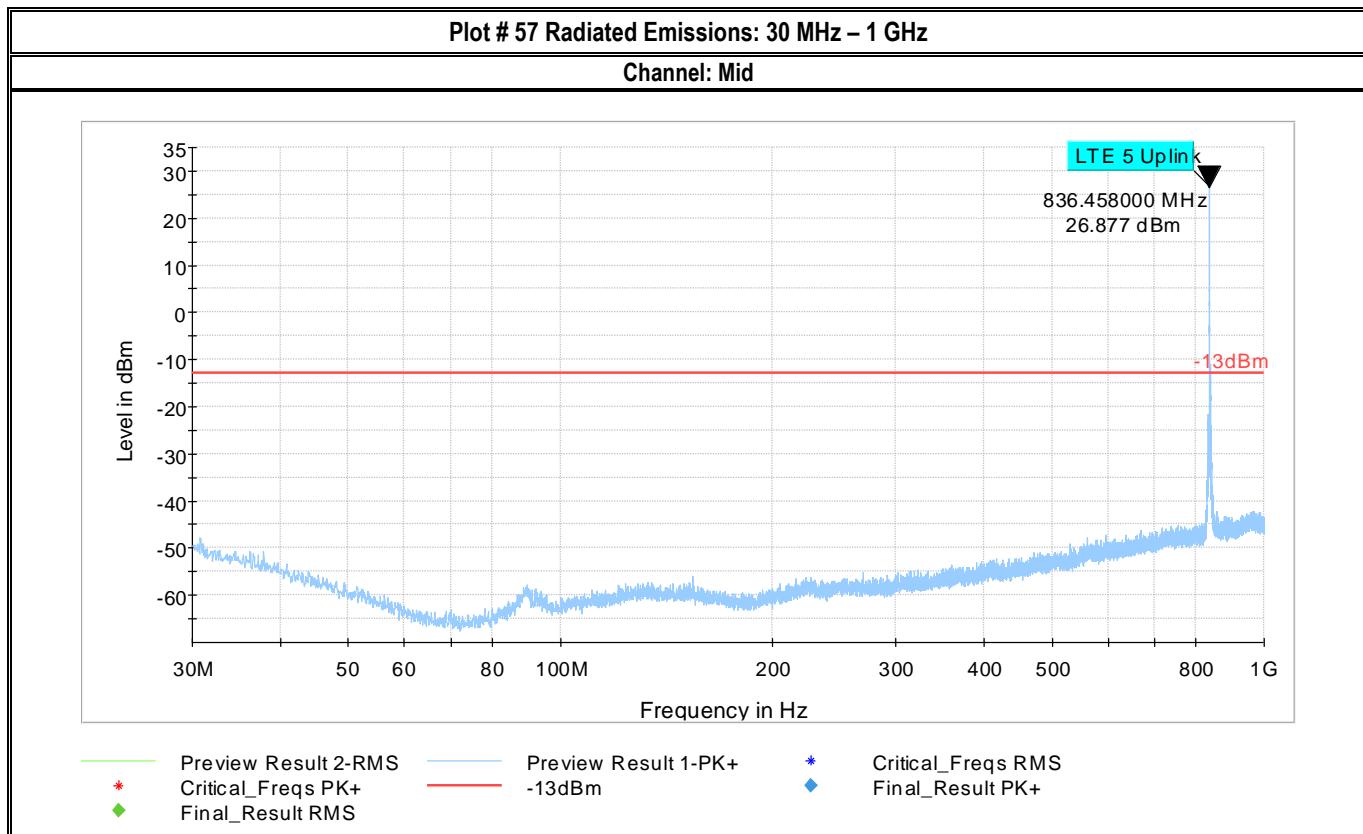


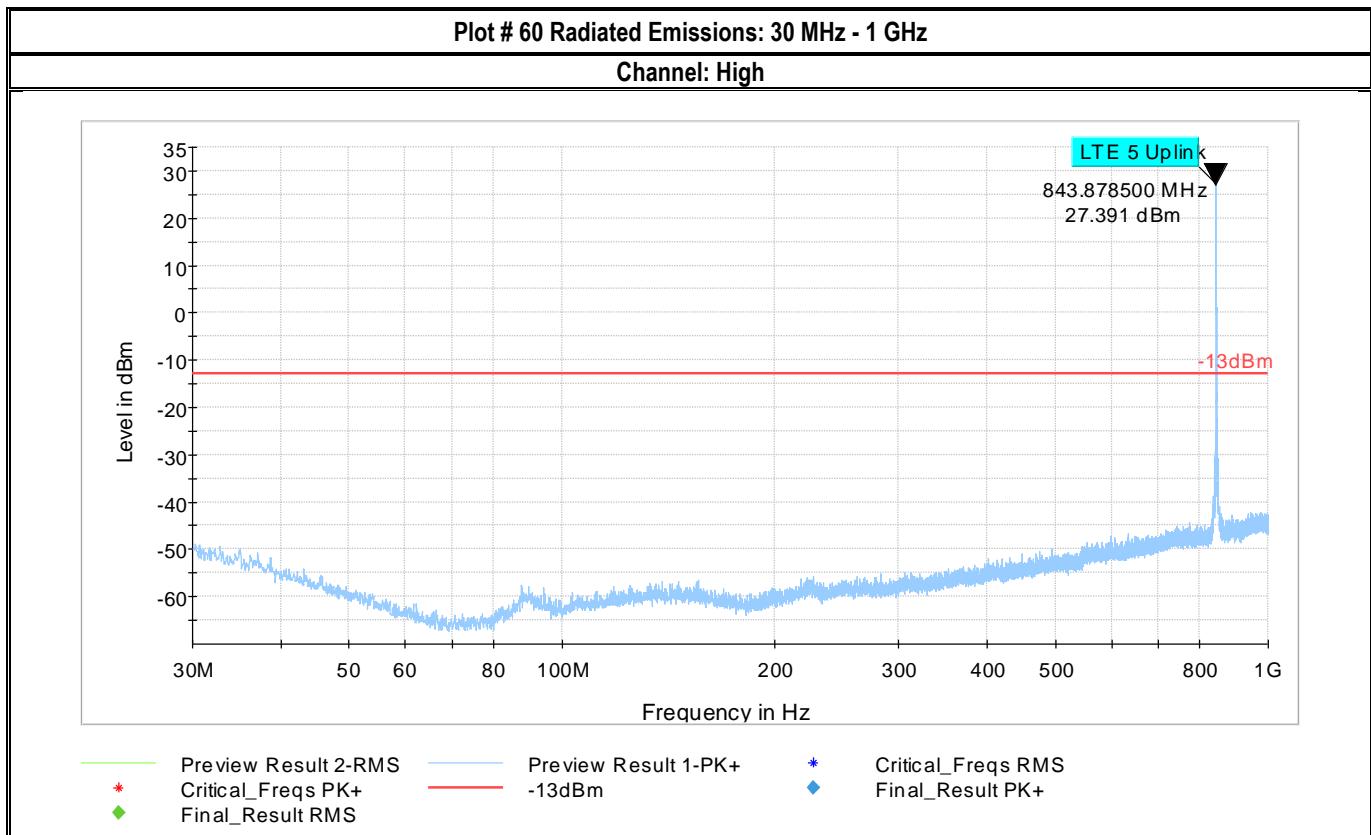
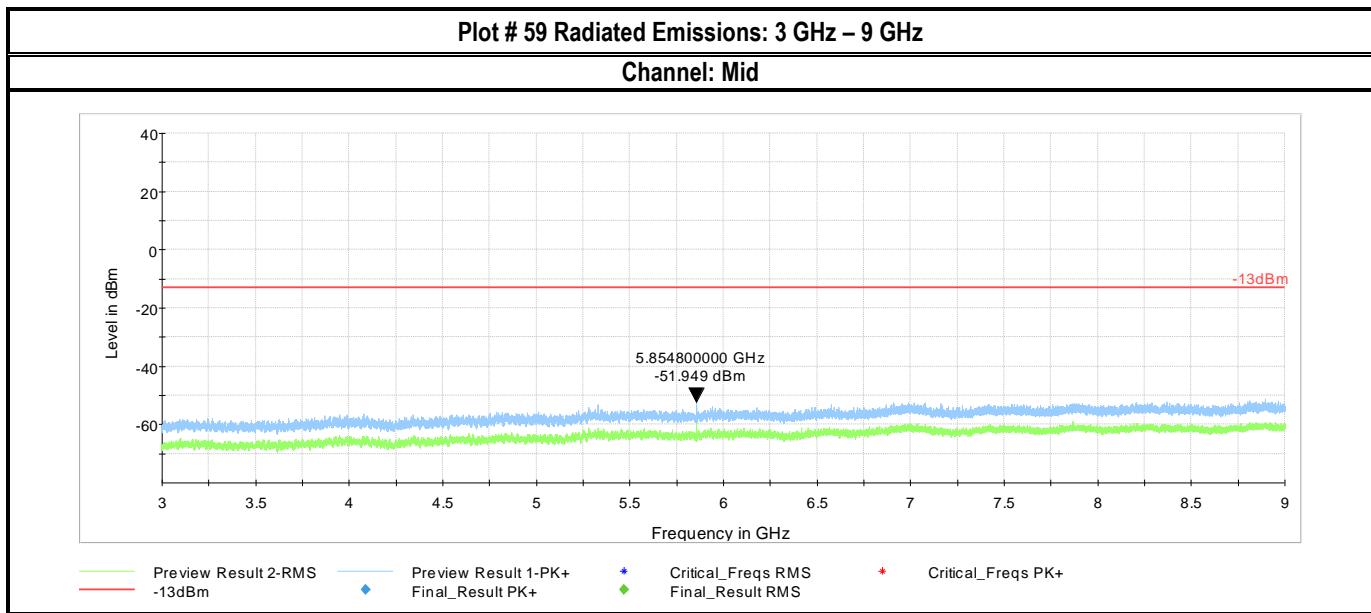
Plot # 51 Radiated Emissions: 1 GHz - 3 GHz**Channel: High****Plot # 52 Radiated Emissions: 3 GHz - 18 GHz****Channel: High**

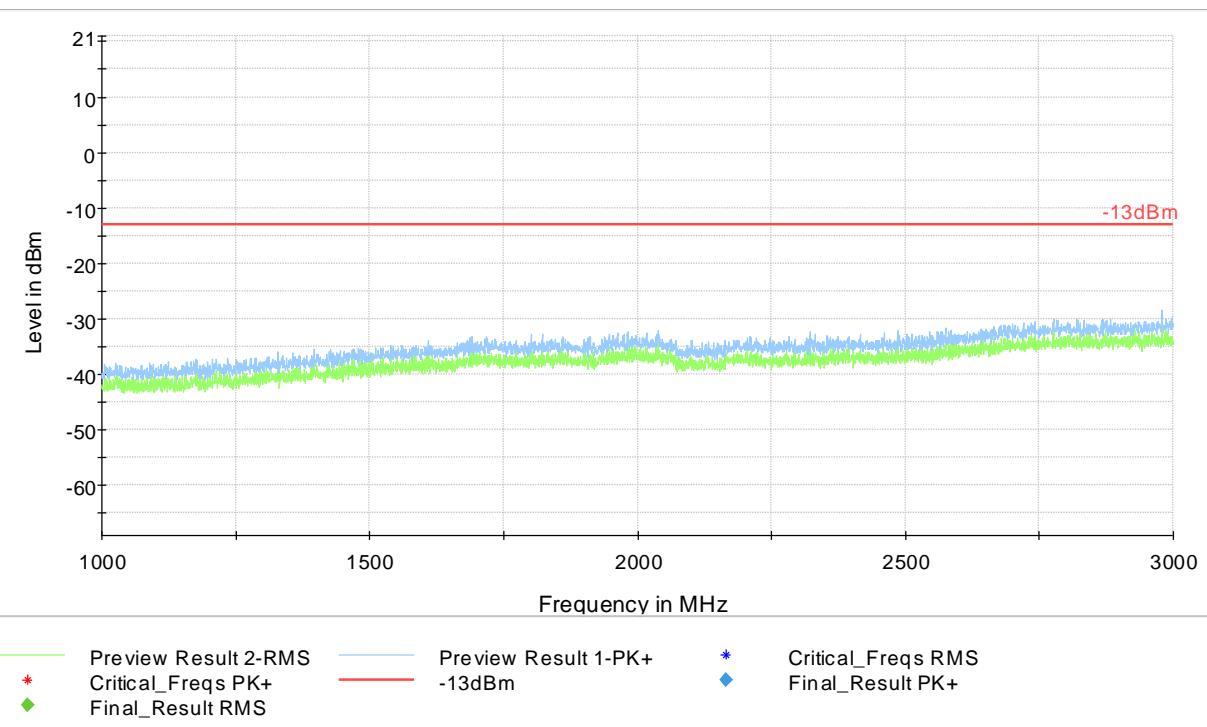
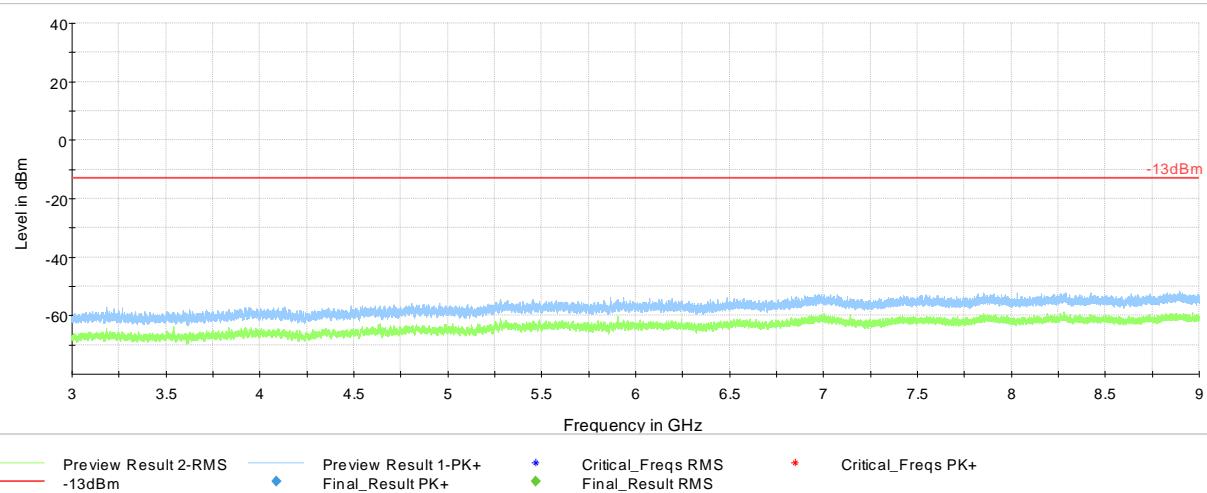
LTE Band 5

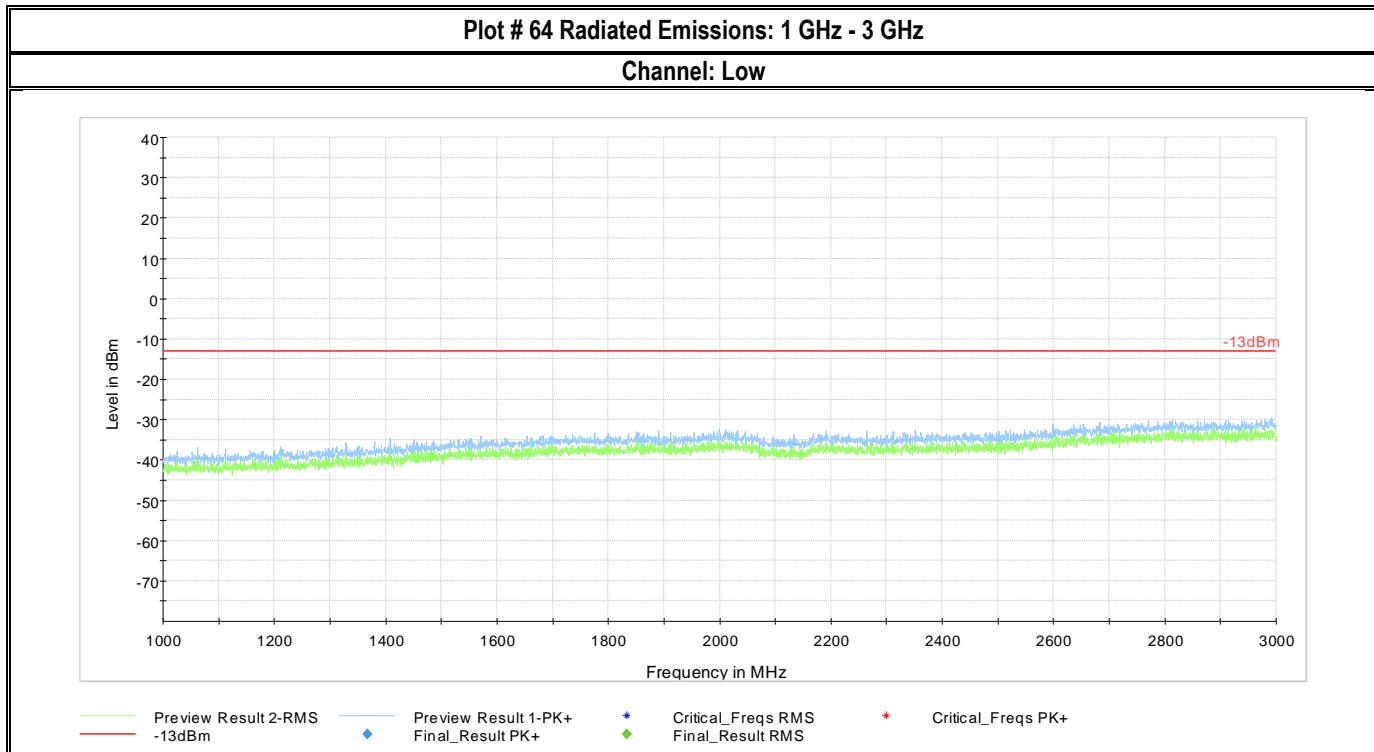
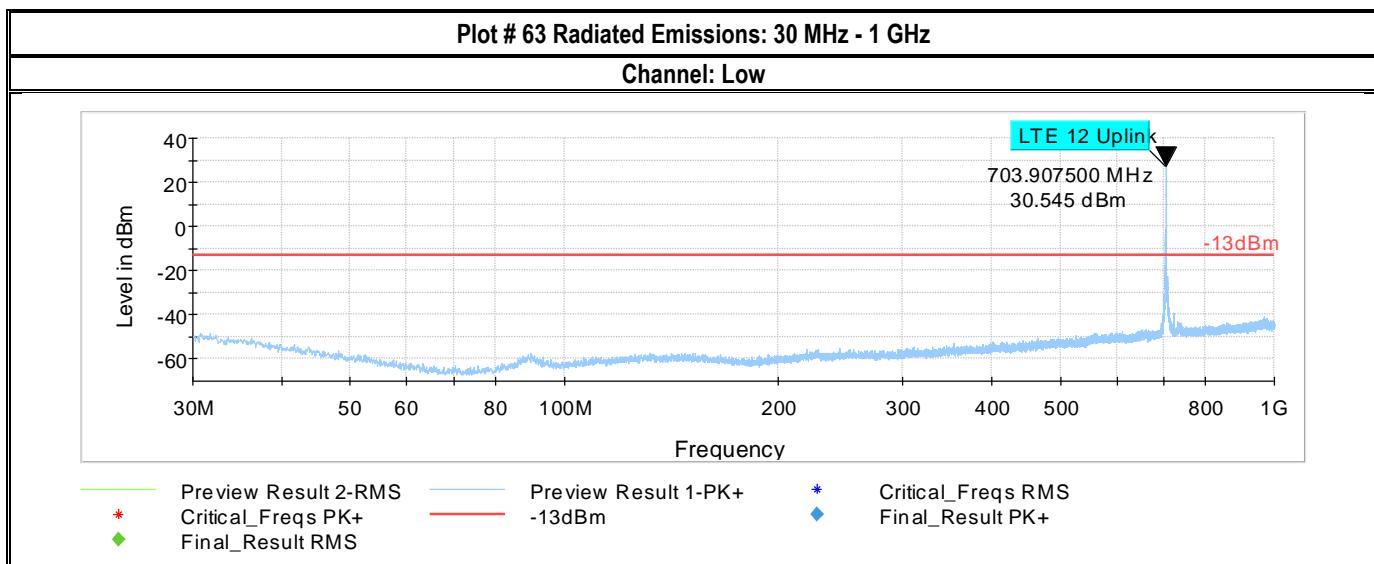


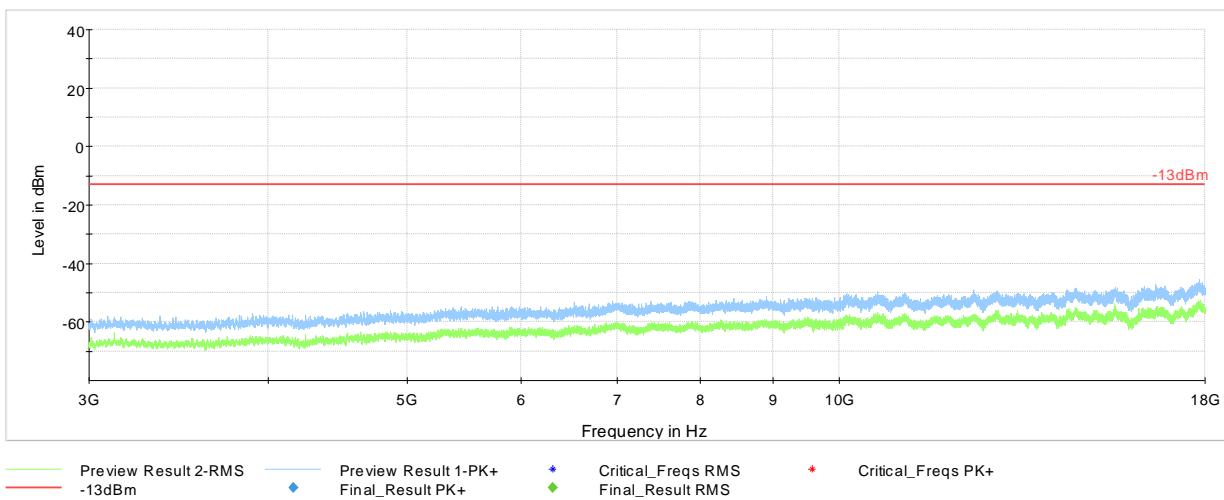
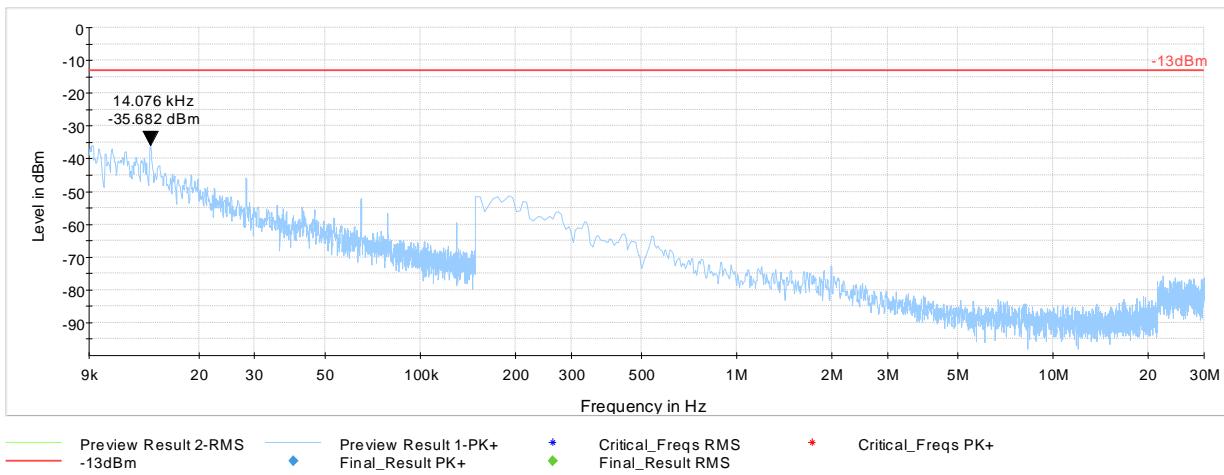






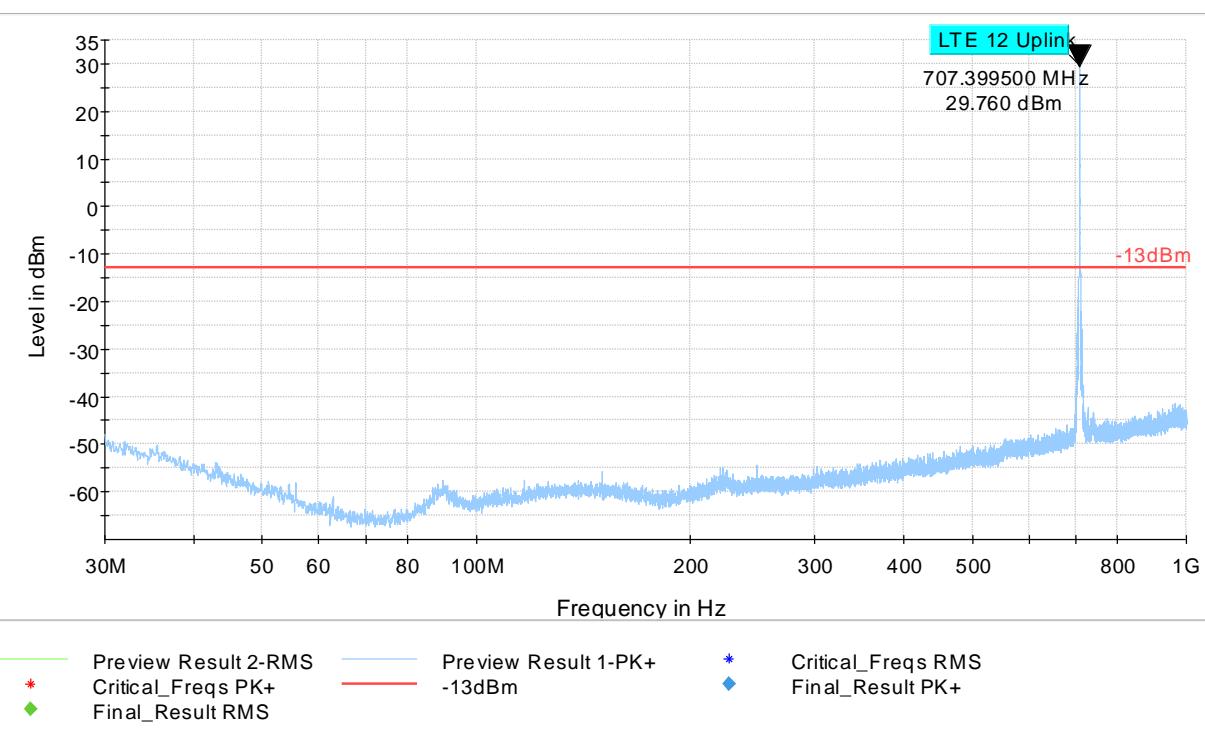
Plot # 61 Radiated Emissions: 1 GHz - 3 GHz**Channel: High****Plot # 62 Radiated Emissions: 3 GHz - 9 GHz****Channel: High**

LTE Band 12

Plot # 65 Radiated Emissions: 3 GHz - 9 GHz**Channel: Low****Plot # 66 Radiated Emissions: 9 kHz - 30 MHz****Channel: Mid**

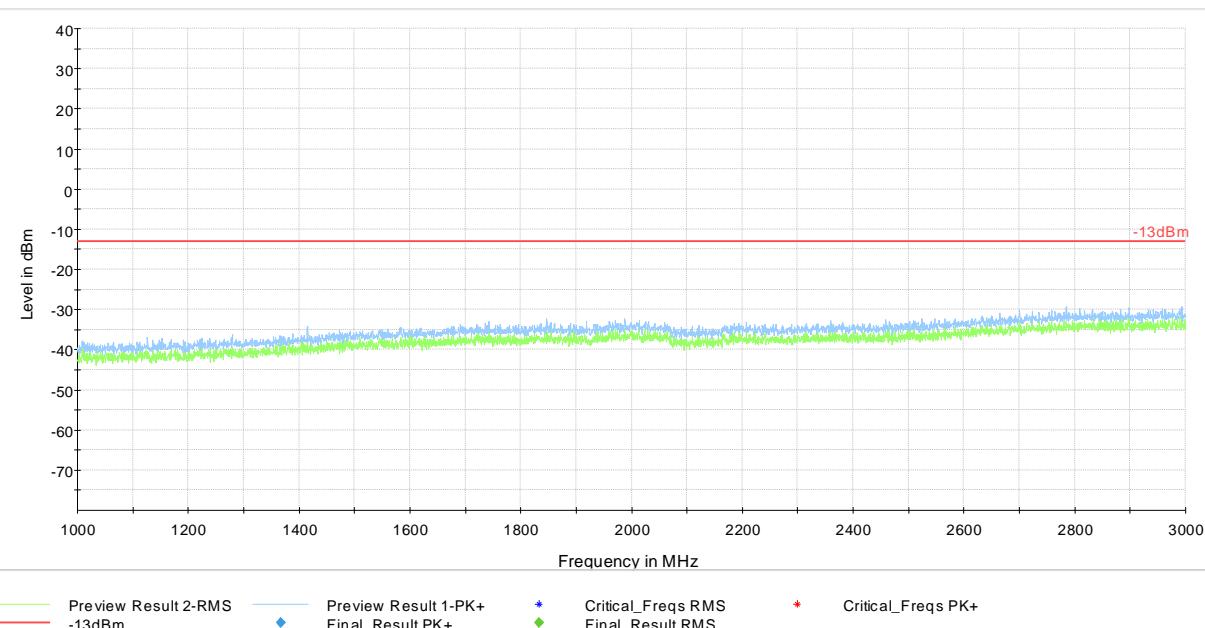
Plot # 67 Radiated Emissions: 30 MHz – 1GHz

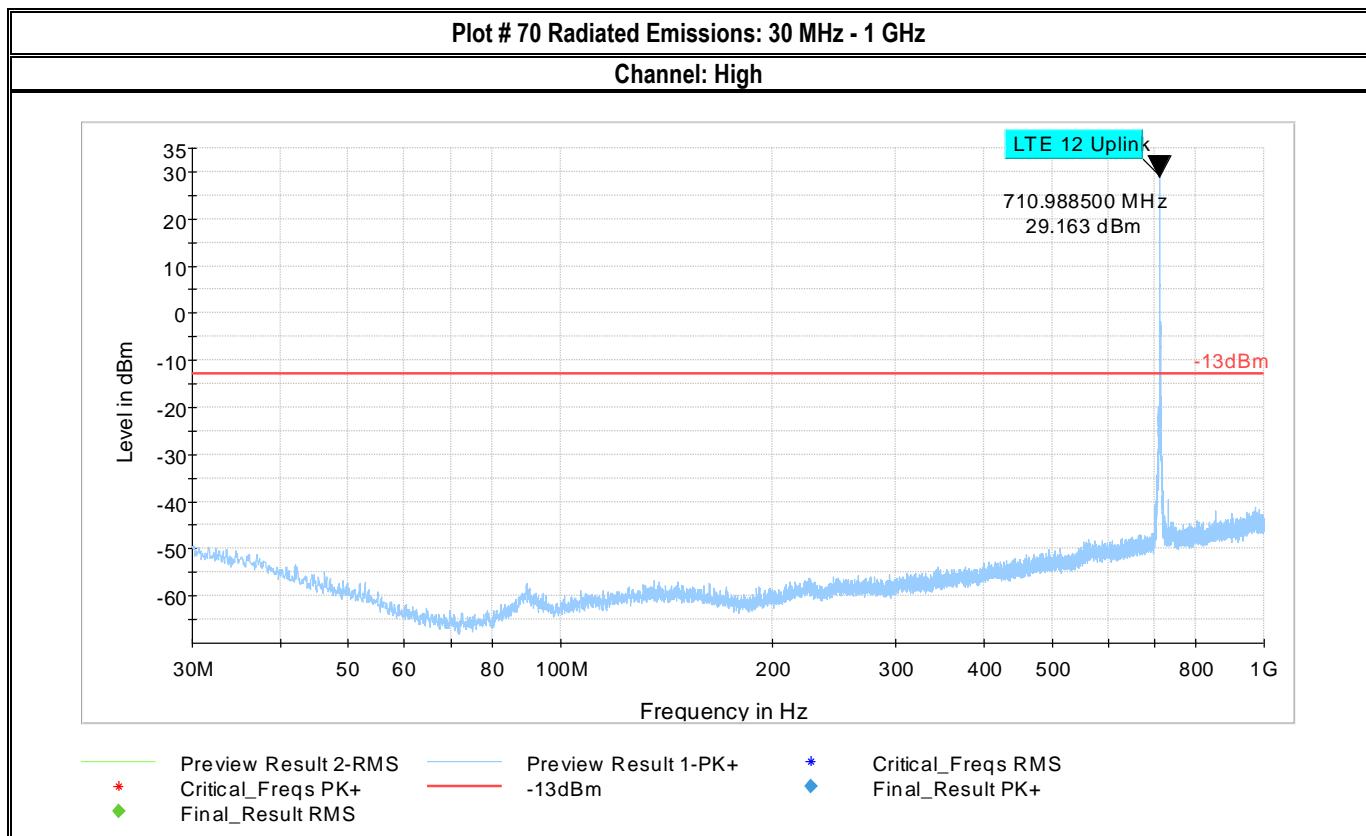
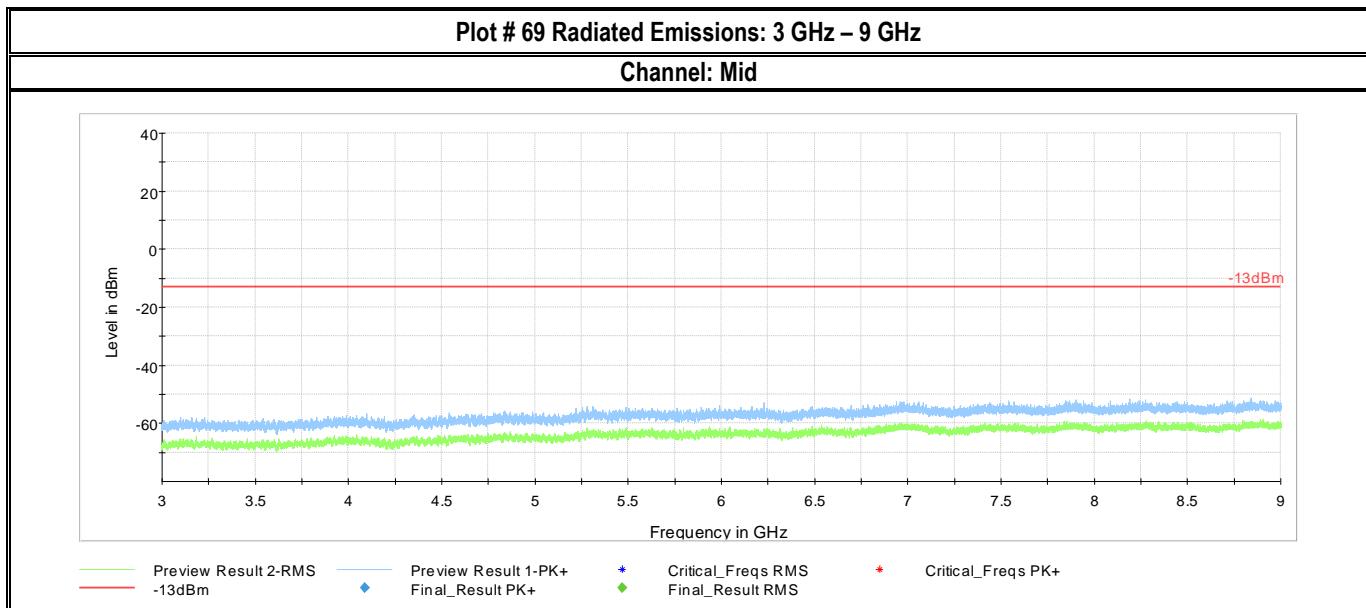
Channel: Mid

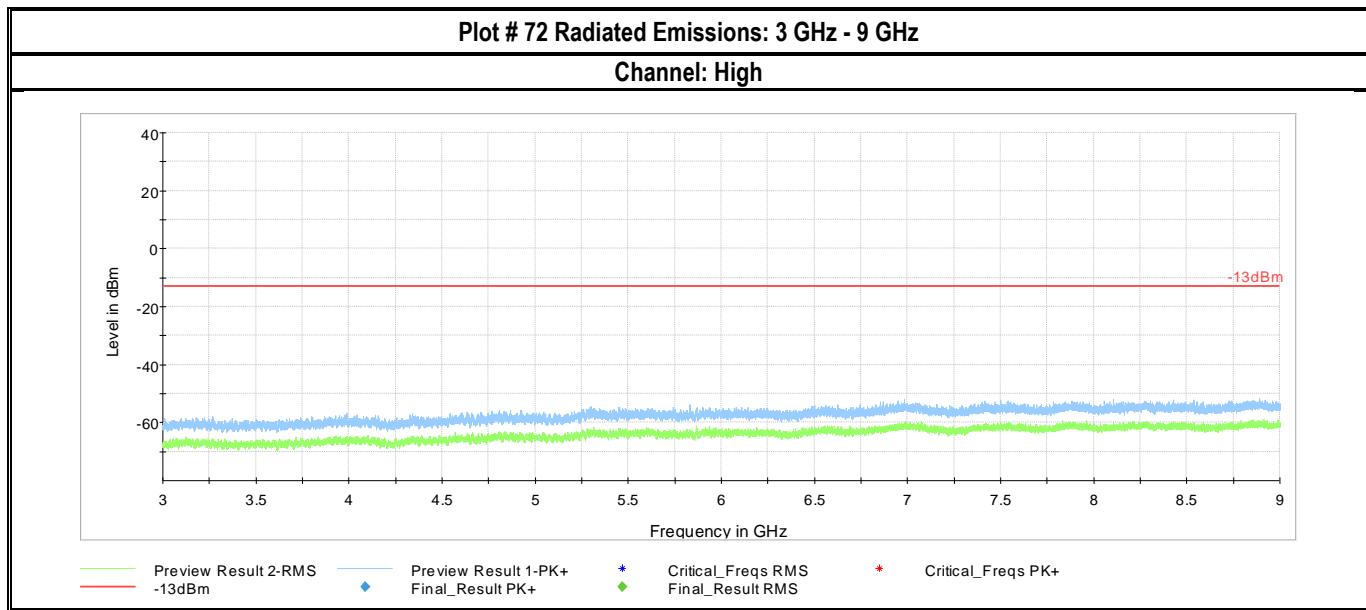
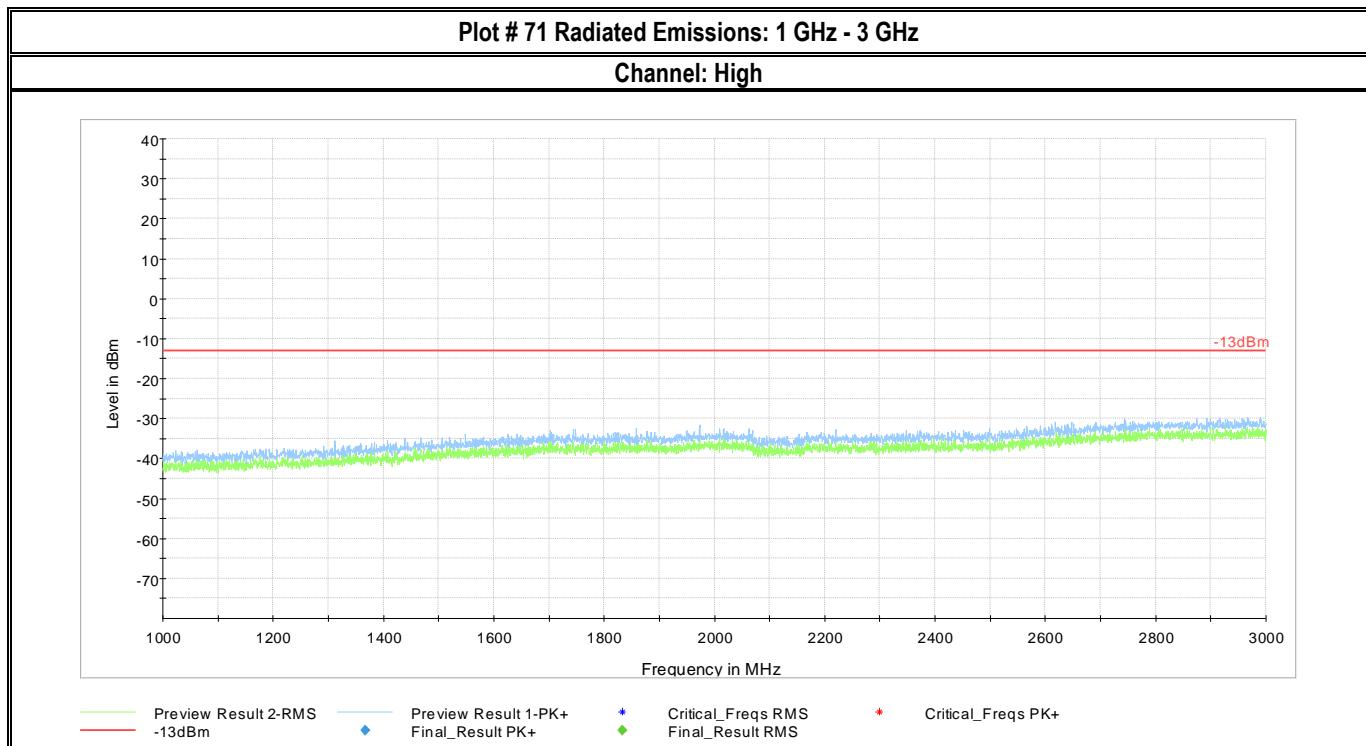


Plot # 68 Radiated Emissions: 1 GHz - 3 GHz

Channel: Mid







8 Test setup photos

Setup photos are included in supporting file name: "EMC_CONNE_058_17001_FCC_ISED_Setup_Photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP ANTENNA	ETS LINDGREN	6512	00164698	3 YEARS	08/08/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	EMCO	3115	00035111	3 YEARS	11/17/2015
HORN ANTENNA	ETS LINDGREN	3117	00167061	3 YEARS	08/08/2017
HORN ANTENNA	ETS LINDGREN	3116C	00166821	3 YEARS	09/24/2017
UNIVERSAL RADIO COMMUNICATION TESTER	R&S	CMU 200	101821	2 YEARS	07/06/2017
WIDEBAND RADIO COMMUNICATION	R&S	CMW500	127068	2 YEARS	07/01/2017
SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/05/2017
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	2 YEARS	06/08/2017
THRMOMETER HUMIDIY	DICKSON	TM320	16253639	1 YEARS	11/02/2017

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
07/24/2018	EMC_CONNE_058_17001_FCC_22_24_27_ISED	Initial Version	Issa Ghanma