



## FCC/IC Test Report

For:  
CalAmp

Model Number:  
LMU3030LABL, LMU3035LABL

Product Description:  
GPS tracking device with OBD support

FCC ID: APV-3030LAB  
IC ID: 5843C-3030LAB

Applied Rules and Standards:  
47 CFR: Part 24, Part 27,  
RSS: 133 Issue 6, 139 Issue 3

REPORT #: EMC\_CALAM-071-18001\_FCC\_24\_27\_rev1

DATE: 2019-01-24



A2LA Accredited

IC recognized #  
3462B-1

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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 radiated spurious emission of the EUT against selected applicable criteria specified in the Code of Federal Regulations Title 47 parts 24, 27, and Industry Canada Radio Standard Specifications RSS: 133 Issue 6, 139 Issue 3. No deficiencies were ascertained.

WWAN Module Telit LE910B1-SA (FCC ID: RI7LE910B1SA / IC ID: 5131A-LE910B1SA) is used in this device as client declared.

Company Name	Product Description	Model
CalAmp	GPS tracking device with OBD support	LMU3030LABL, LMU3035LABL

### Responsible for Testing Laboratory:

2018-12-13	Compliance	Cindy Li (EMC Lab Manager)	
Date	Section	Name	Signature

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### Responsible for the Report:

2018-12-13	Compliance	Tri Nguyen (Associate EMC Engineer)	
Date	Section	Name	Signature

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The test results of this test report relate exclusively to the test item specified in Section 3. 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

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

### 2.2 Identification of the Client

<b>Applicant's Name:</b>	CalAmp
<b>Street Address:</b>	2177 Salk Ave, Suite 200
<b>City/Zip Code</b>	Carlsbad, CA 90228
<b>Country</b>	USA

### 2.3 Identification of the Manufacturer

<b>Manufacturer's Name:</b>	Same as Client
<b>Manufacturers Address:</b>	-----
<b>City/Zip Code</b>	-----
<b>Country</b>	-----

### 3 Equipment under Test (EUT)

#### 3.1 EUT Specifications

<b>Model No</b>		LMU3030LABL, LMU3035LABL			
<b>HW Version</b>		REV C			
<b>SW Version</b>		7.6			
<b>FCC-ID</b>		APV-3030LAB			
<b>IC-ID:</b>		5843C-3030LAB			
<b>HVIN:</b>		LMU3030LABL, LMU3035LABL			
<b>PMN:</b>		LMU-3030, LMU-3035			
<b>Product Description</b>		GPS tracking device with OBD support			
<b>Module Information</b>		<b>Module:</b> Telit LE910B1-SA		<b>FCC-ID:</b> RI7LE910B1SA	
<b>Mode</b>	<b>LTE</b>	<b>Band</b>	<b>UL Frequency (MHz)</b>	<b>DL Frequency (MHz)</b>	<b>Modulation</b>  QPSK, 16QAM
		2	1850 – 1910	1930 – 1990	
		4	1710 – 1755	2110 – 2155	
		12	699 – 716	729 – 746	
<b>Max. declared antenna gain</b>		Taoglas customized antenna for LMU3030, peak gain is 2.5dBi			
<b>Max. declared average conducted output power from module report</b>		LTE Band 2 = 23.635 dBm LTE Band 4 = 23.088 dBm LTE Band 12 = 24.430 dBm			
<b>Operating Voltage Range</b>		Vmin: 9 VDC/ Vnom: 12 VDC / Vmax: 16 VDC			
<b>Operating Temperature Range</b>		-30 °C to +75 °C			
<b>Other Radios included in the device</b>		Chip based BLE 4.0 GPS			
<b>Sample Revision</b>		<input type="checkbox"/> Prototype <input checked="" type="checkbox"/> Production <input type="checkbox"/> Pre-Production			
<b>EUT Dimensions</b>		43cm X 64cm X 25cm			
<b>EUT Diameter</b>		<input checked="" type="checkbox"/> < 60 cm <input type="checkbox"/> Other _____			

### 3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	N/A	REV C	7.6	Radiated Emissions

### 3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	P/N
1	-	-	-	-

### 3.4 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT#1	Co-transmit with BLE middle channel

#### **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: APV-3030LAB and IC ID: 5843C-3030LAB.

According to the guidelines from FCC KDB 996369 for the product under evaluation, and the pre-certified module to be integrated (Telit LE910B1-SA) as described in Section 3, the output power has been verified to be within the specified production tolerances and measurement uncertainties, and where relevant test procedures did not change the conducted test results from module certification are re-used. Full Radiated Spurious Emissions test was performed, per Code of Federal Regulations Title 47 parts 24, 27, and Industry Canada Radio Standard Specifications RSS: 133 Issue 6, and 139 Issue 3.

Bluetooth Low Energy was turned on and configured to the highest power in order to measure spurious emission during co-transmission and catch the worst case.

The module test data can be obtained under the FCC Filing ID: R17LE910B1SA, IC ID: 5131A-LE910B1SA.

##### **4.1 Dates of Testing:**

11/19/2018 - 12/13/2018

##### **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)
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RF conducted measurement	±0.5 dB
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##### **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%

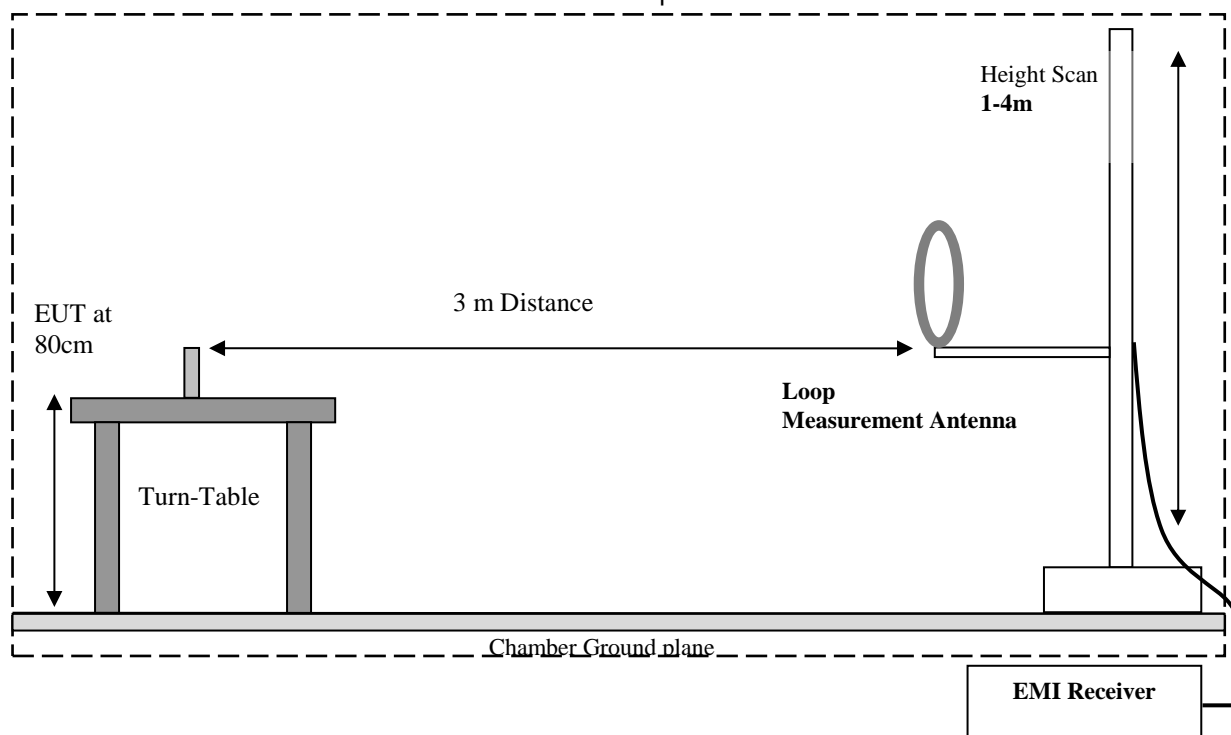
Deviating test conditions are indicated at individual test description where applicable.

## 5 Measurement Procedures

### 5.1 Radiated Measurement

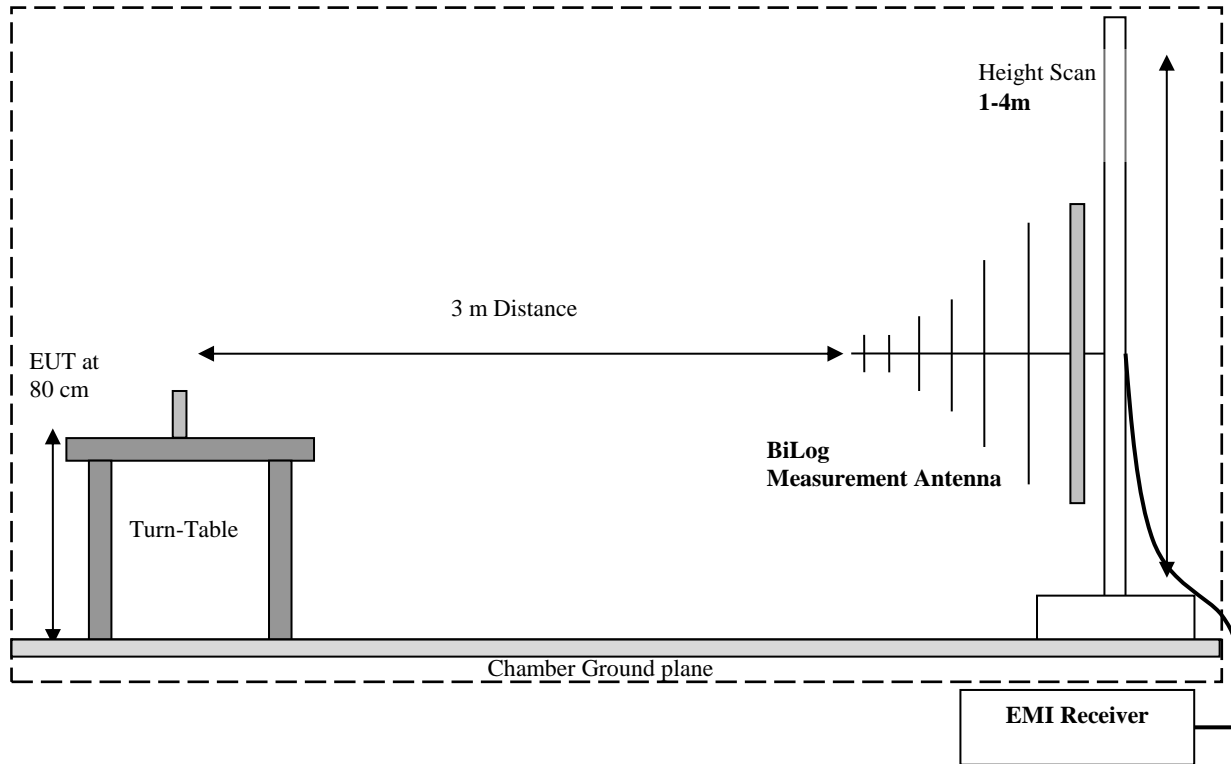
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to 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 30MHz Measurements

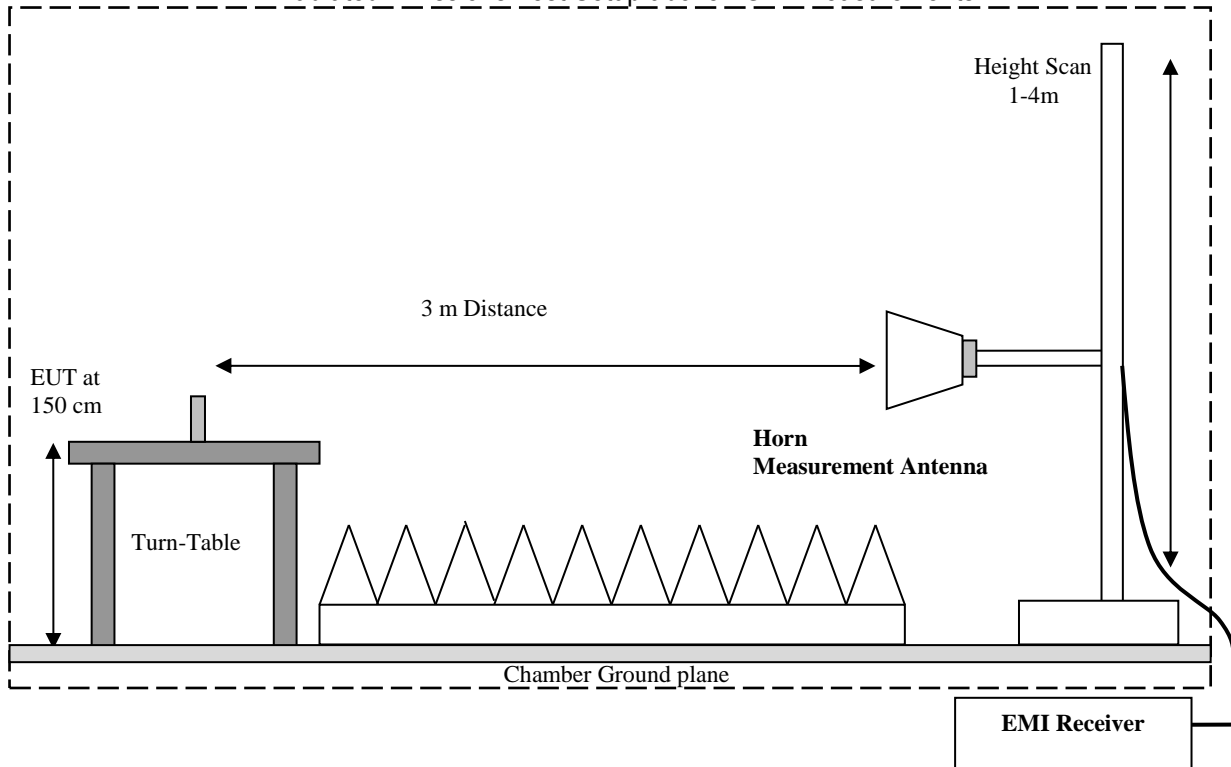




**Radiated Emissions Test Setup 30MHz-1GHz Measurements**



**Radiated Emissions Test Setup above 1GHz 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 dB $\mu$ V
- Cable Loss between the receiving antenna and SA in dB and
- Antenna Factor in dB/m

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

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

Example:

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

## 6 Measurement Results Summary

### 6.1 FCC 24 / RSS-133:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §24.232 (a); RSS-133 6.4	RF Output Power	Nominal	GSM WCDMA	■	□	□	□	Complies Note 2
§2.1055; §24.235; RSS-133 6.3	Frequency Stability	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1049; §24.238; RSS-133 6.2	Occupied Bandwidth	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1051; §24.238; RSS-133 6.5	Band Edge Compliance	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1051; §24.238; RSS-133 6.5	Conducted Spurious Emissions	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1053; §24.238; RSS-133 6.5	Radiated Spurious Emissions	Nominal	GSM WCDMA	■	□	□	□	Complies

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

Note 2: ERP/EIRP calculated from conducted power from modular grant and maximum declared gain.

### 6.2 FCC 27 / RSS-139:

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	Fail	NA	NP	Result
§2.1046; §27.50 (d); RSS-139 6.5	RF Output Power	Nominal	GSM WCDMA	■	□	□	□	Complies Note 2
§2.1055; §27.54; RSS-139 6.4	Frequency Stability	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1049; §27.53; RSS-139 6.2	Occupied Bandwidth	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1051; §27.53; RSS-139 6.6	Band Edge Compliance	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1051; §27.53; RSS-139 6.6	Conducted Spurious Emissions	Nominal	GSM WCDMA	□	□	□	■	Complies Note 2
§2.1053; §27.53; RSS-139 6.6	Radiated Spurious Emissions	Nominal	GSM WCDMA	■	□	□	□	Complies

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

Note 2: ERP/EIRP calculated from conducted power from modular grant and maximum declared gain.

## 7 Test Result Data

### 7.1 ERP/EIRP

Radio	Frequency Range [MHz]	Power [W]	Frequency Offset	Emission Designator	gain dBi	gain linear	max ERP / EIRP	min ERP / EIRP
LTE 2	1857.5 - 1902.5	0.23	1.0 PM	13M5G7D	2.8	1.91	0.44	0.0009
LTE 2	1860.0 - 1900.0	0.20	1.0 PM	18M0G7D	2.8	1.91	0.38	0.0008
LTE 4	1717.5 - 1747.5	0.20361	1.0 PM	13M5G7D	2.8	1.91	0.39	0.0008
LTE 4	1720.0 - 1745.0	0.18823	1.0 PM	18M0G7D	2.8	1.91	0.36	0.0007
LTE 12	704.0 - 711.0	0.27733	1.0 PM	9M09W7D	2.8	1.91	0.32	0.0006

This table contains ERP for < 1 GHz bands and EIRP for > 1GHz bands.

Listed is emission with the highest power and the one with the highest bandwidth for each radio technology. Both criteria may be covered by a single emission.

ERP/EIRP are calculated based on the powers in the FCC grant and adding the gain.

### 7.2 Radiated Spurious Emissions

7.2.1 Measurement according to FCC: CFR 47 Part 2.1053; Part 24.238; Part 27.53; RSS-132 5.5; RSS-139 6.6, utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to TIA-603C 2004- 2.2.12

#### Spectrum Analyzer Settings for FCC 22

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

#### Spectrum Analyzer Settings for FCC 24 and 27

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

### 7.2.2 Limits:

7.2.2.1 FCC Part 24.238 (a), and Part 27.53 (h)

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

7.2.2.2 RSS-133 6.5; RSS-139 6.6

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 equipment's operating frequency block, 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  $43 + 10 \log_{10} p$  (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  $43 + 10 \log_{10} p$  (watts).

7.2.3 Test conditions and setup:

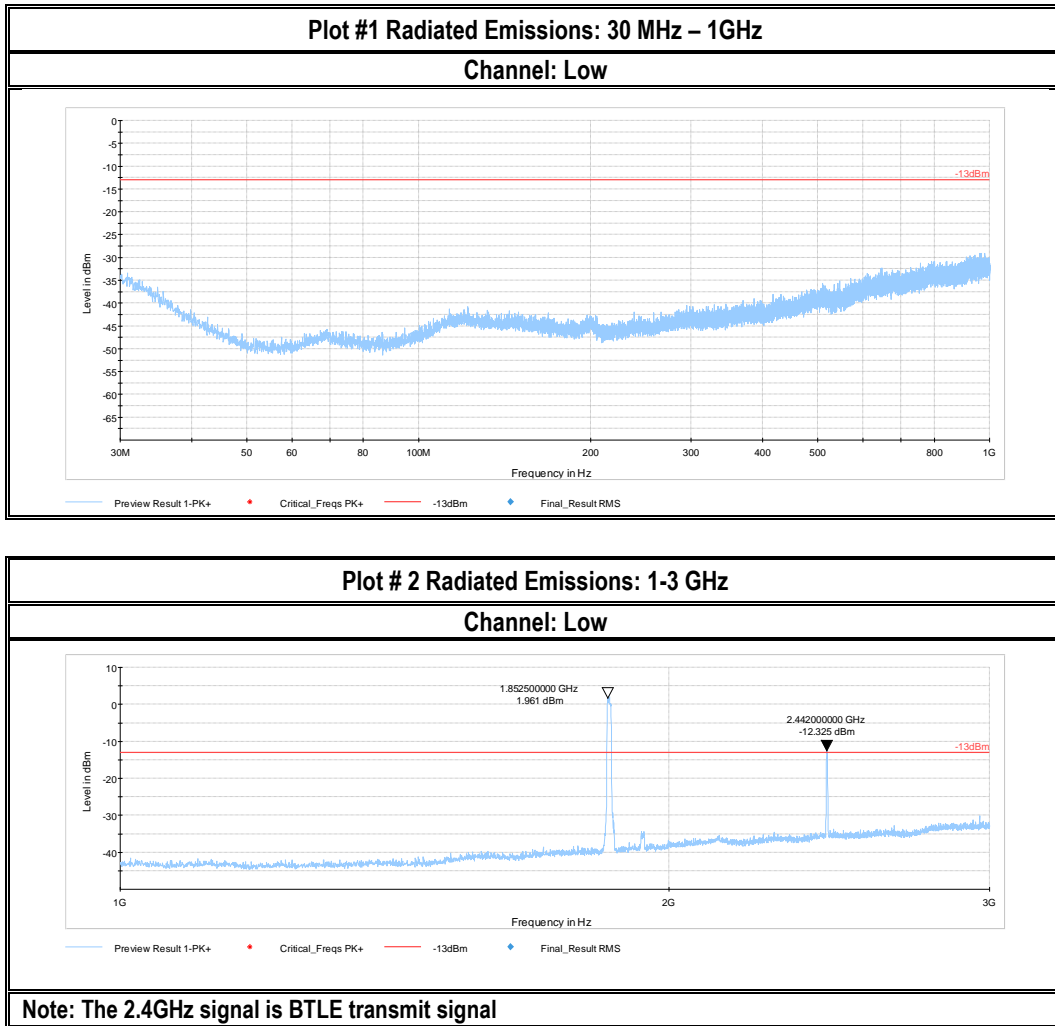
Ambient Temperature (°C)	EUT Set-Up #	EUT operating mode	Power Input
23	1	LTE BAND 2/4/12 + BLE	12VDC

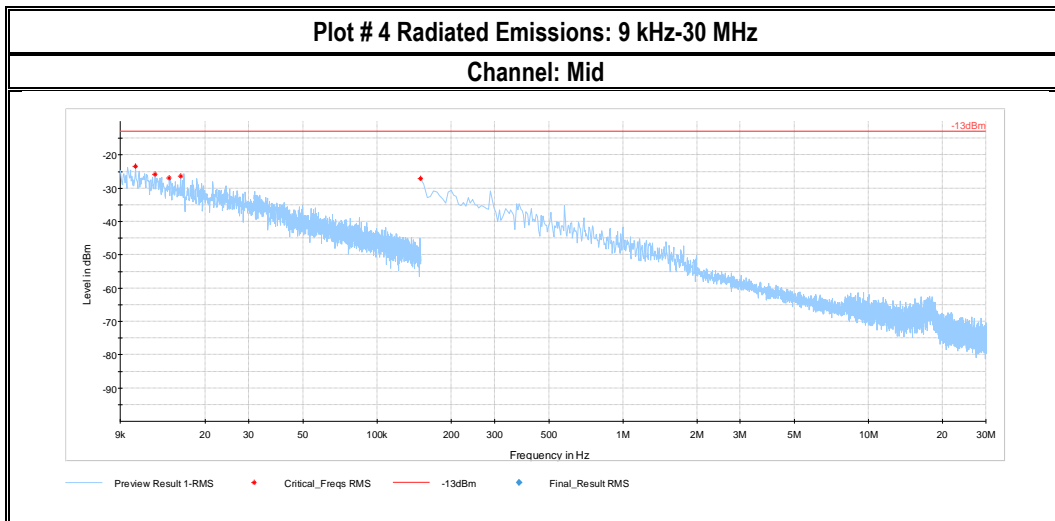
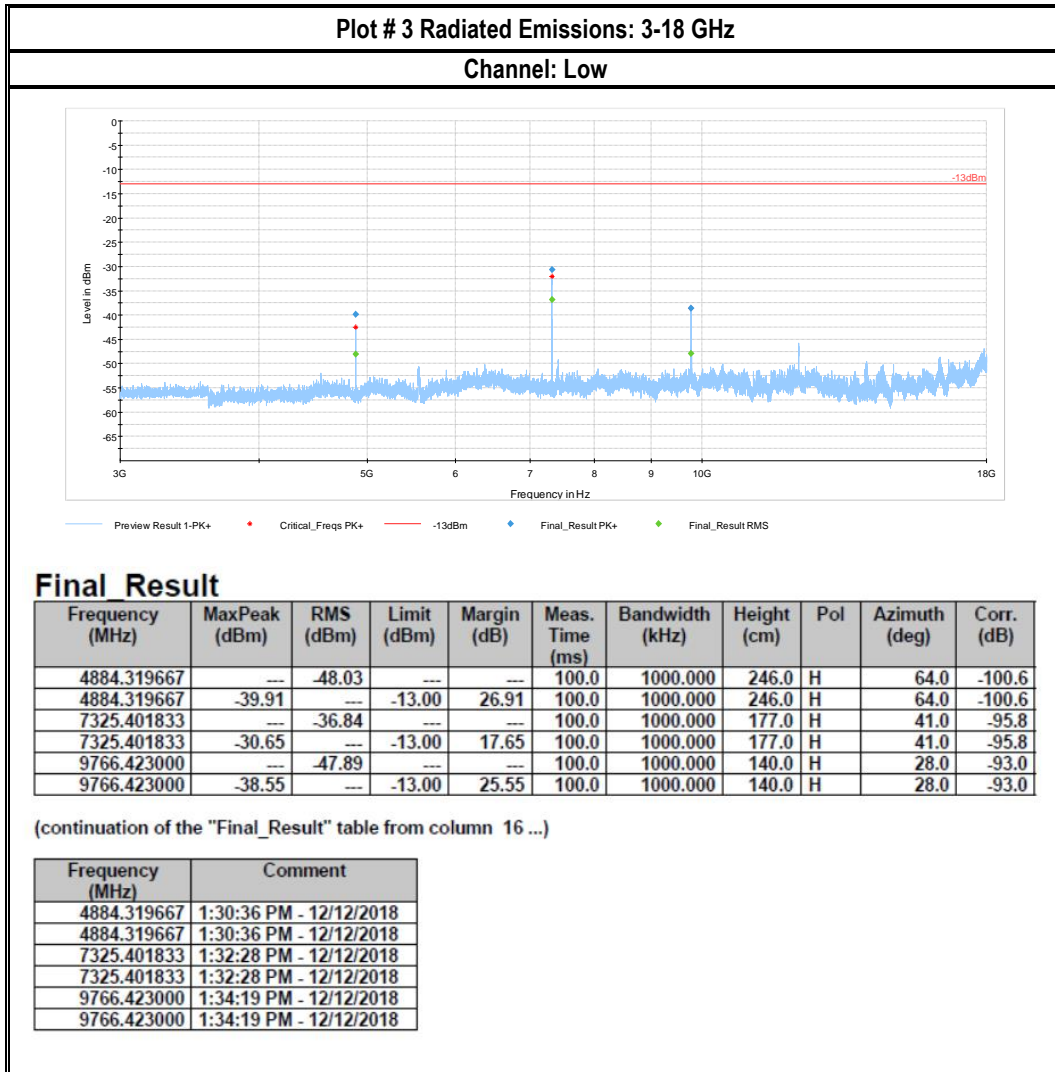
7.2.4 Measurement result:

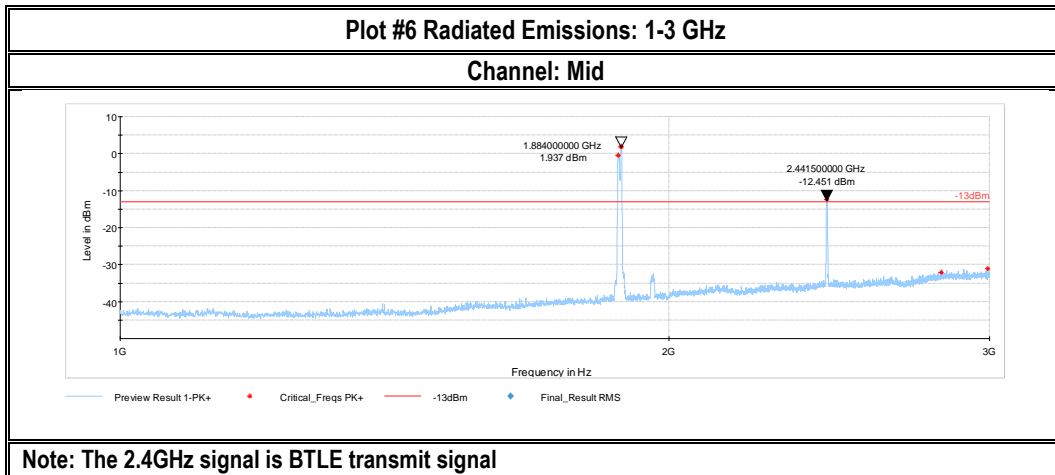
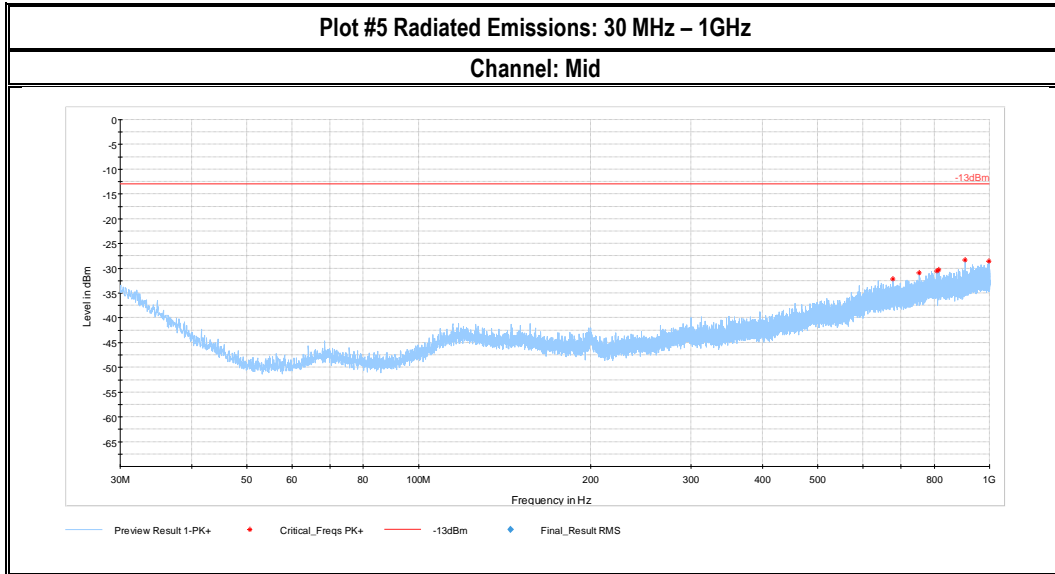
Plot #	Channel #	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1-3	Low	LTE BAND2 + BLE	30 MHz – 18 GHz	-13	Pass
4-7	Mid	LTE BAND2 + BLE	9 kHz – 26 GHz	-13	Pass
8-10	High	LTE BAND2 + BLE	30 MHz – 18 GHz	-13	Pass
11-13	Low	LTE BAND4 + BLE	30 MHz – 18 GHz	-13	Pass
14-18	Mid	LTE BAND4 + BLE	9 kHz – 26 GHz	-13	Pass
19-21	High	LTE BAND4 + BLE	30 MHz – 18 GHz	-13	Pass
22-24	Low	LTE BAND12 + BLE	30 MHz – 9 GHz	-13	Pass
25-29	Mid	LTE BAND12 + BLE	9 kHz – 9 GHz	-13	Pass
30-32	High	LTE BAND12 + BLE	30 MHz – 9 GHz	-13	Pass

### 7.2.5 Measurement Plots:

#### 7.2.5.1 LTE BAND 2 + BLE

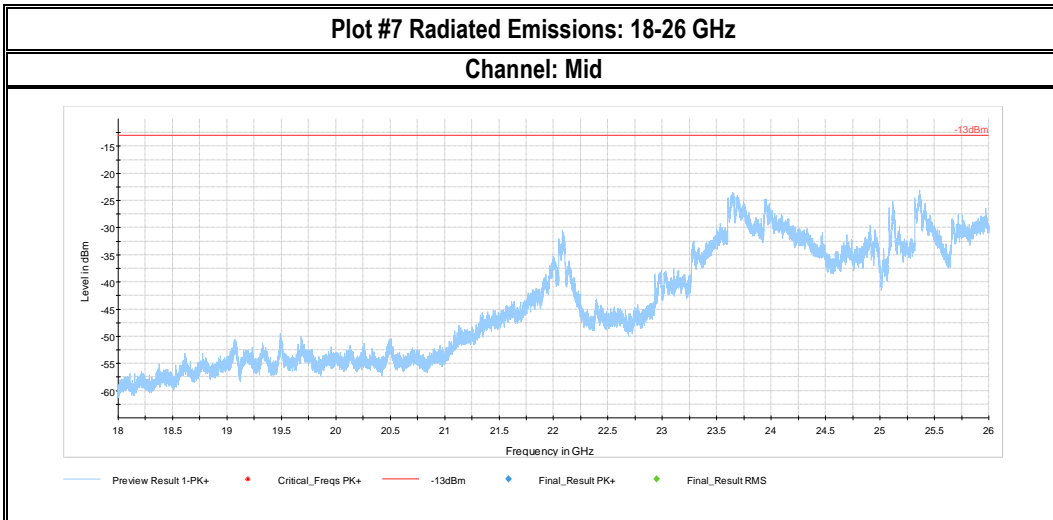
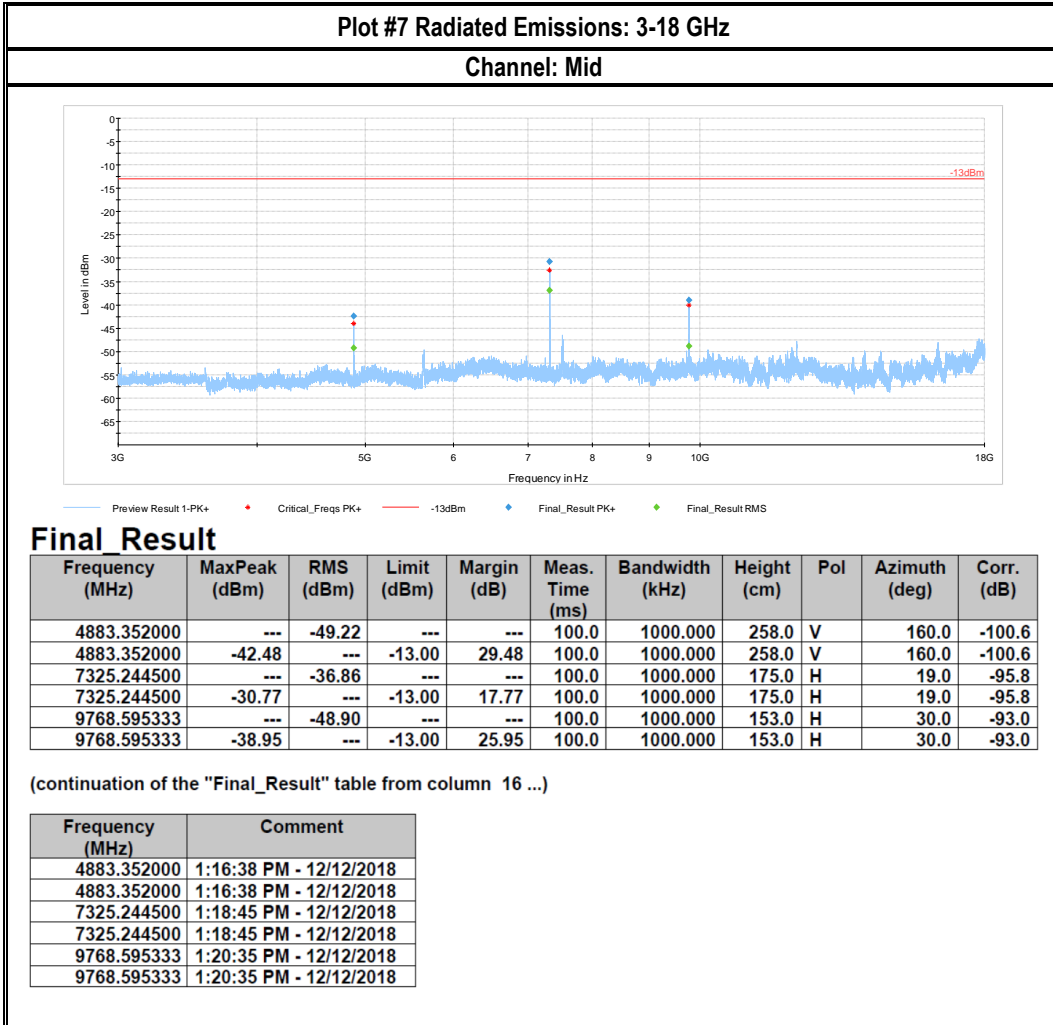


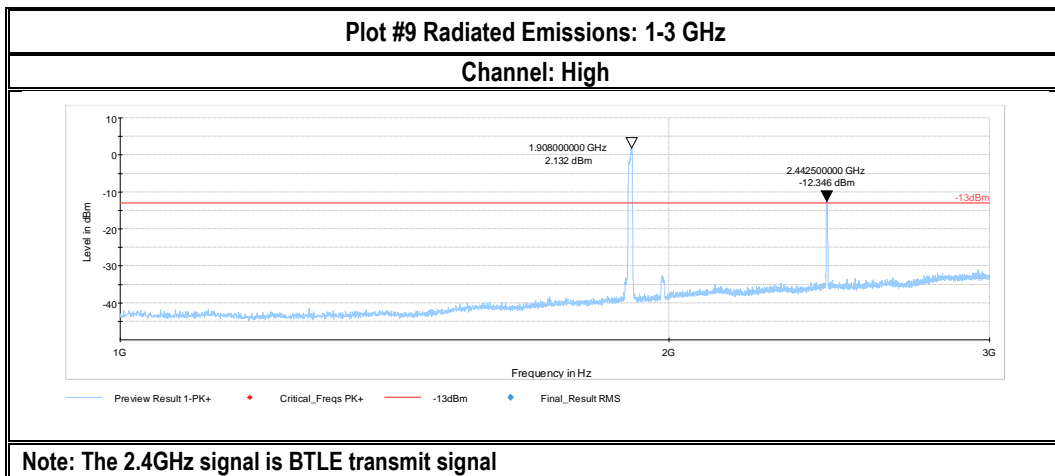
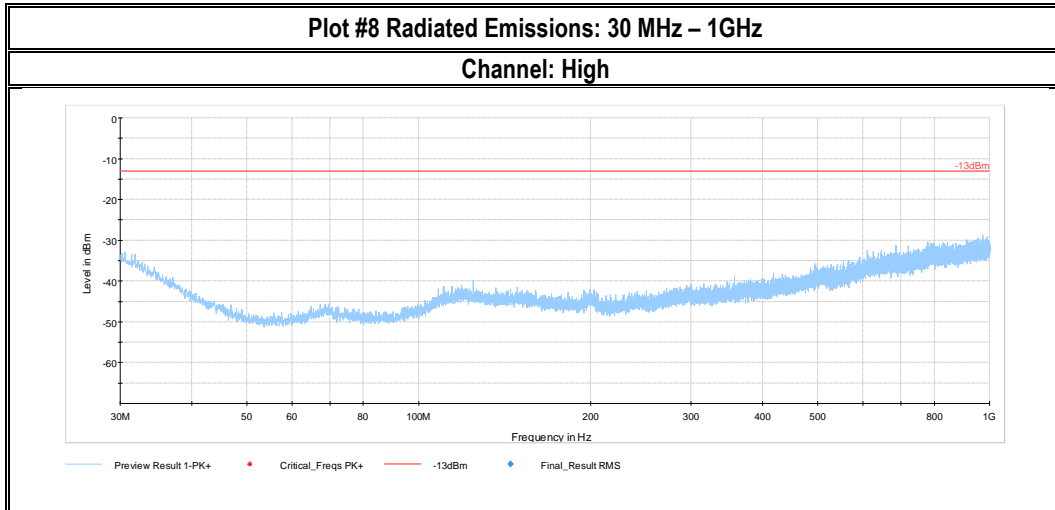




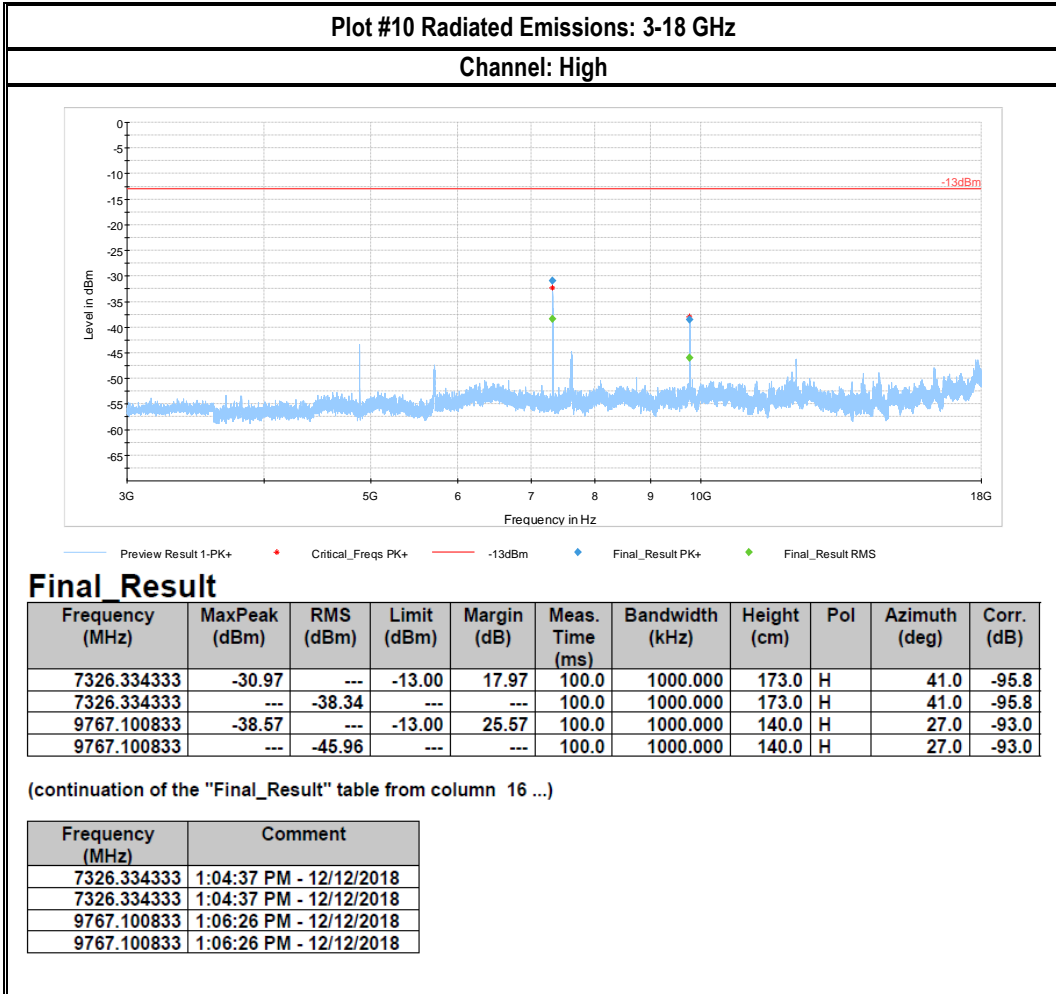
**Note: The 2.4GHz signal is BTLE transmit signal**



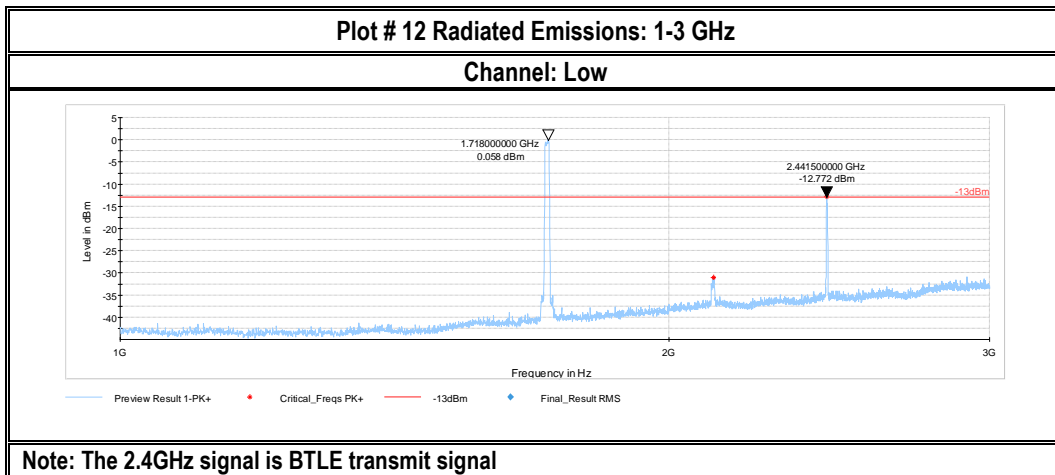
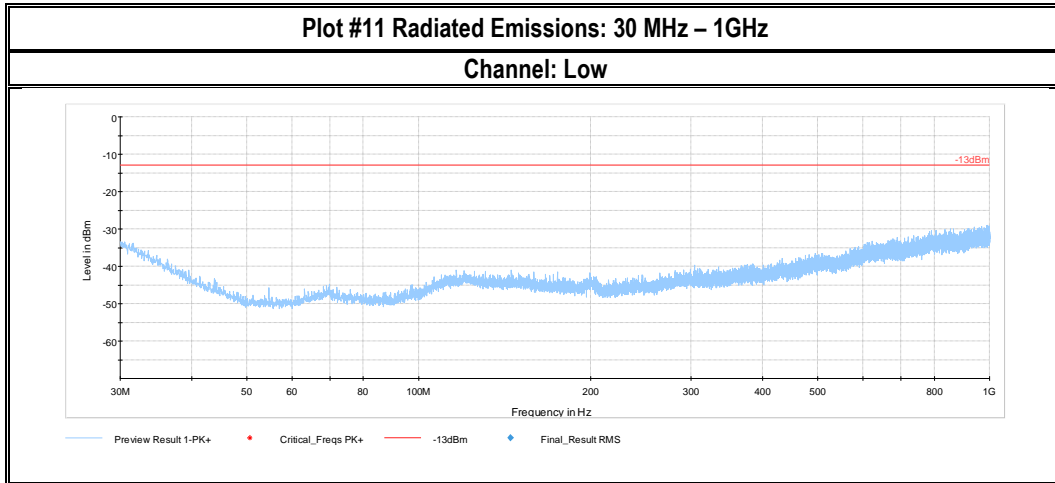




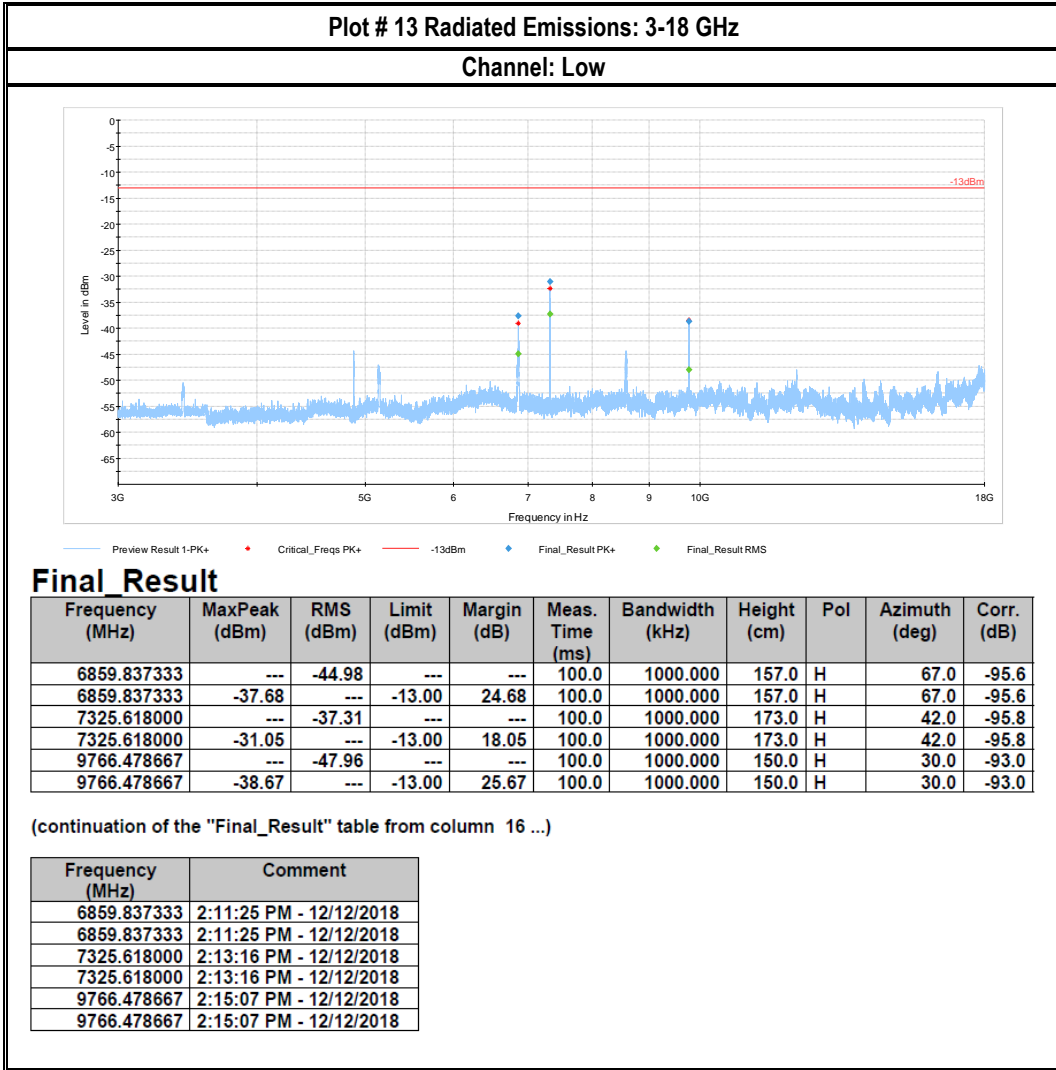
**Note: The 2.4GHz signal is BTLE transmit signal**

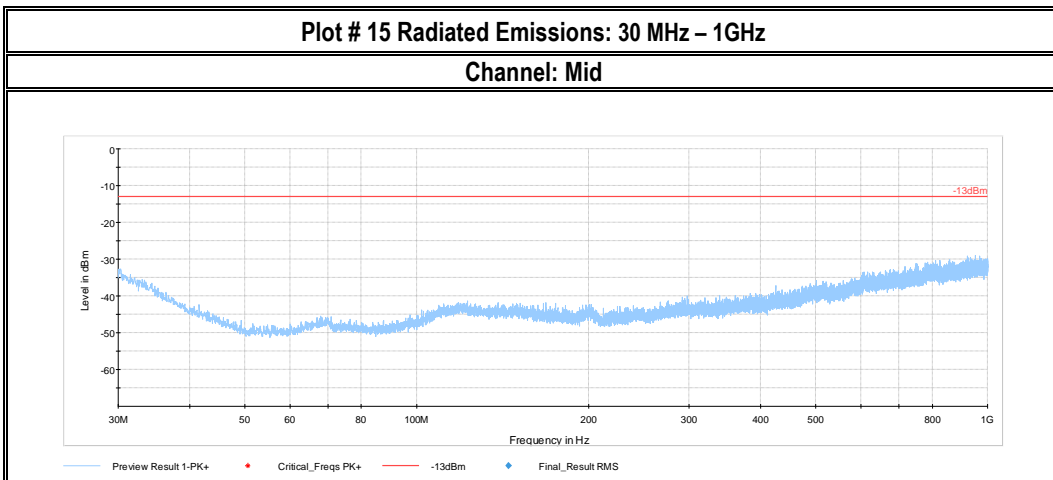
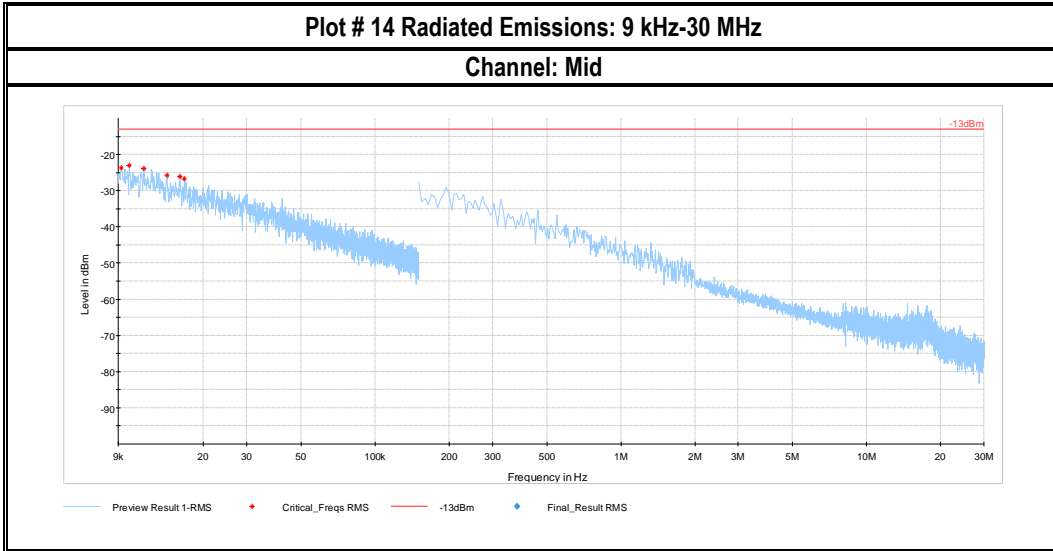


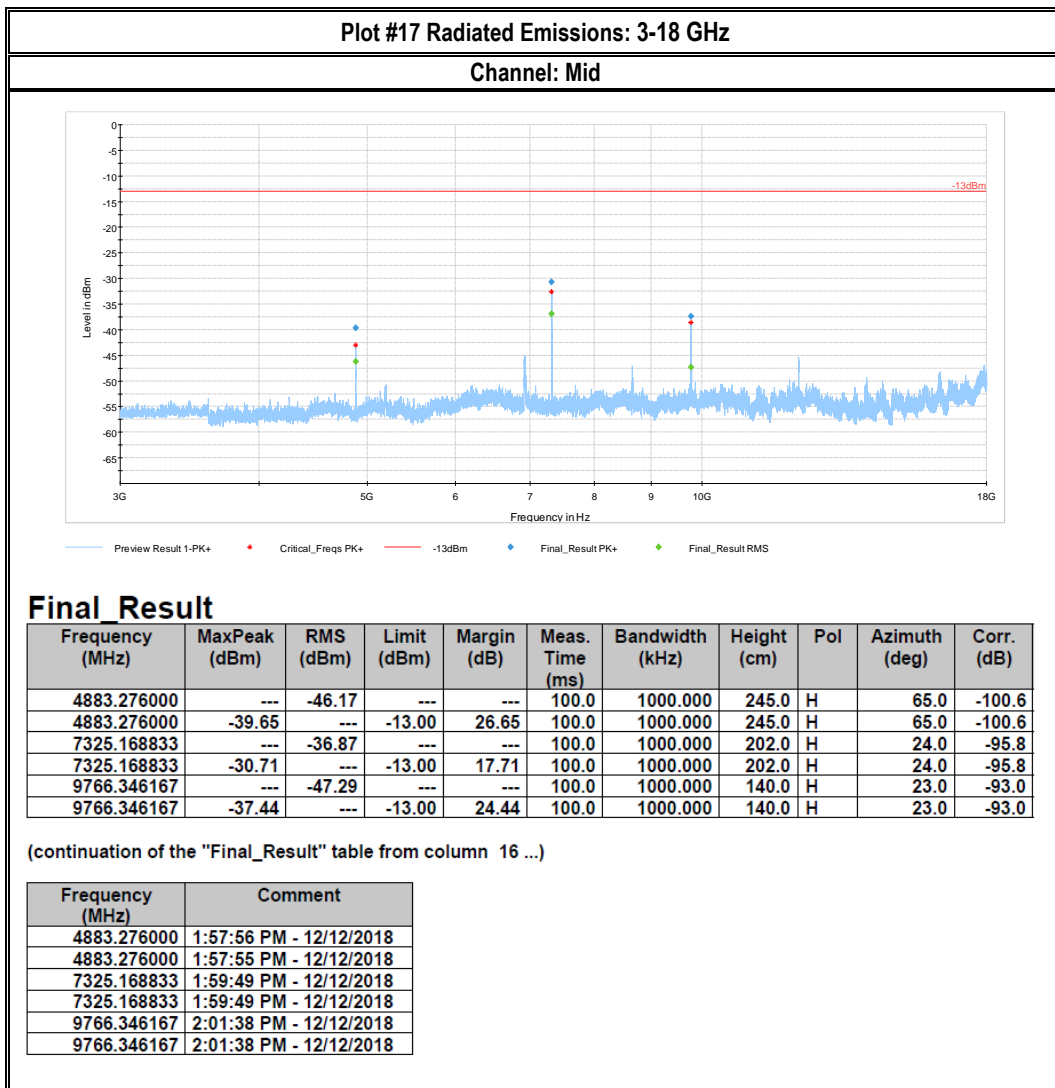
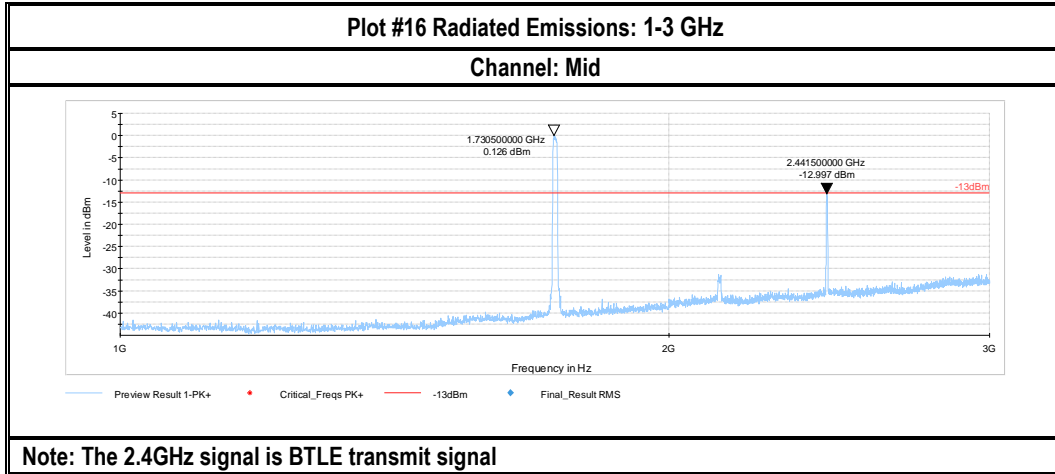
7.2.5.2 LTE BAND 4 + BLE

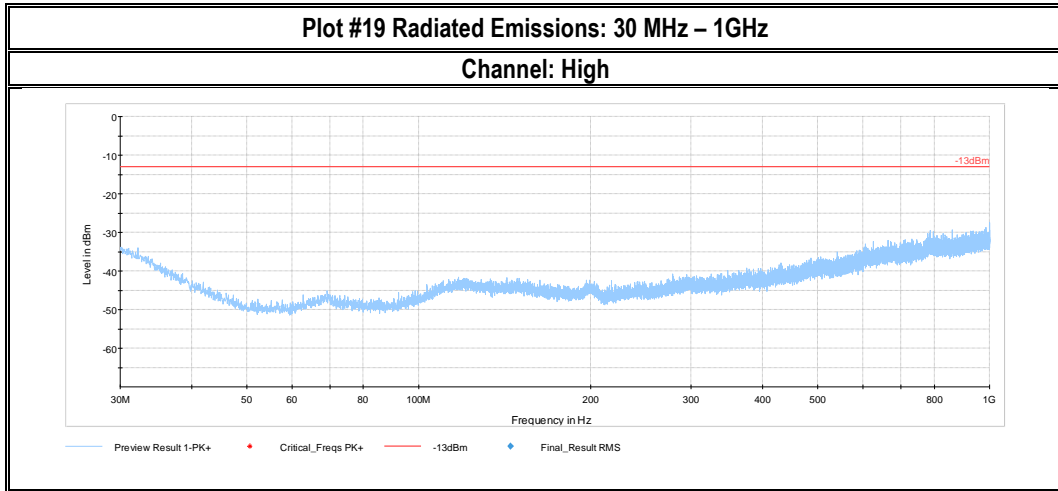
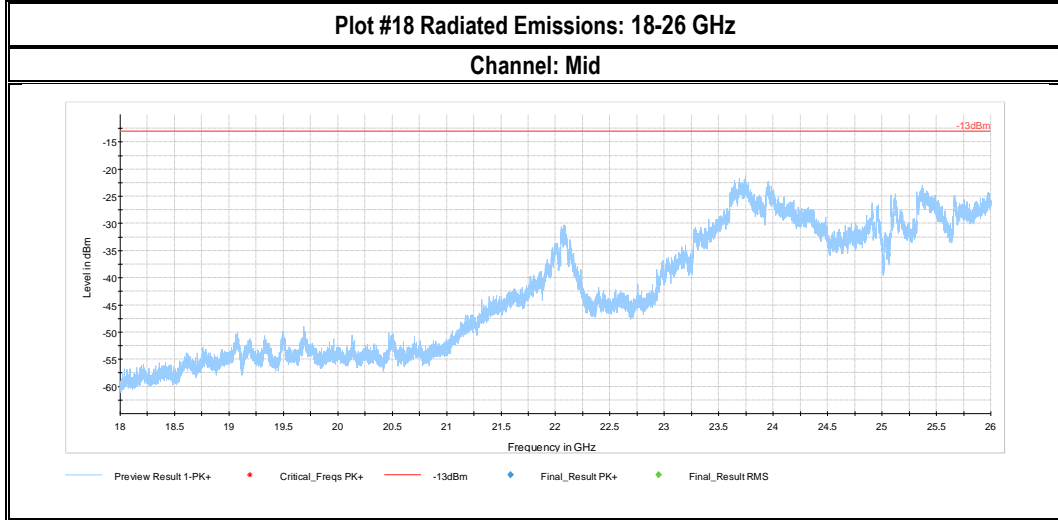


**Note: The 2.4GHz signal is BTLE transmit signal**

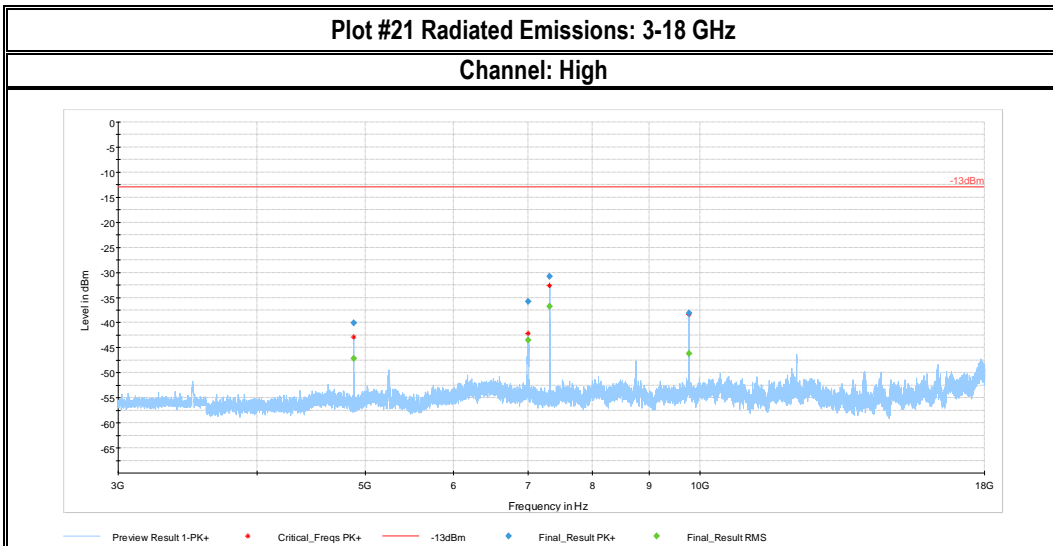
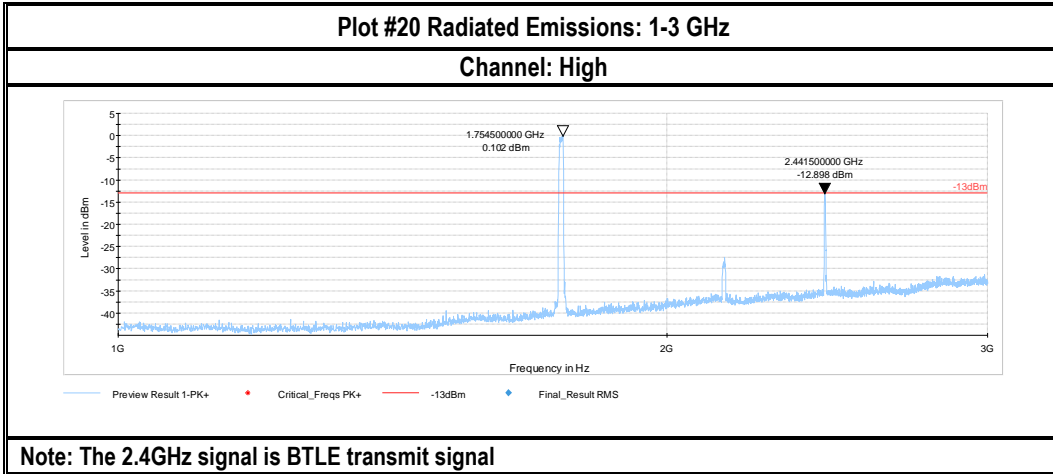












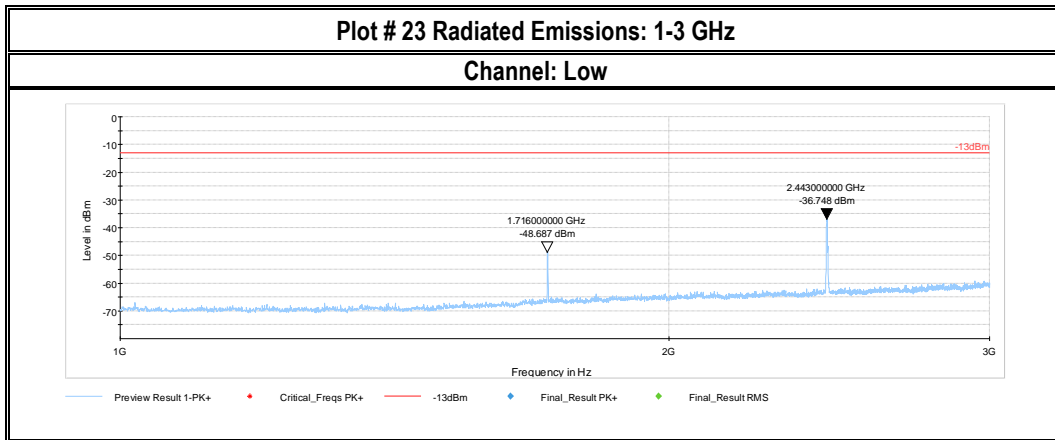
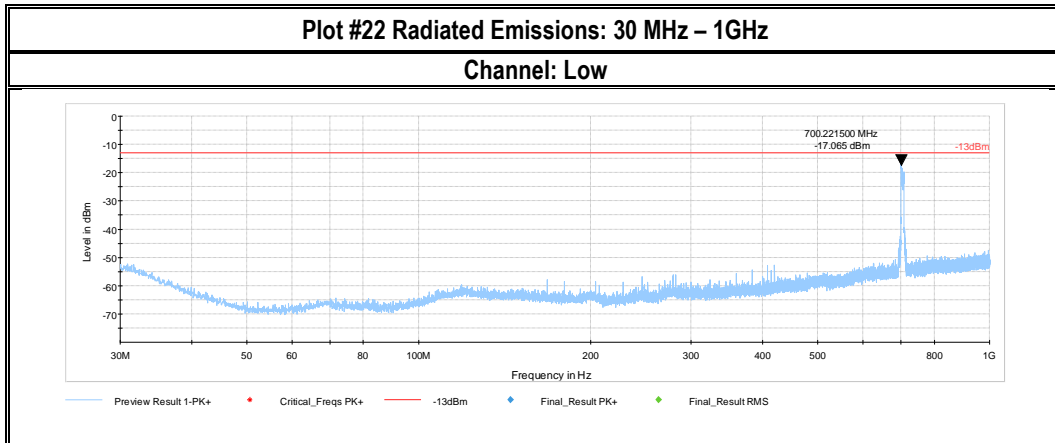
**Final Result**

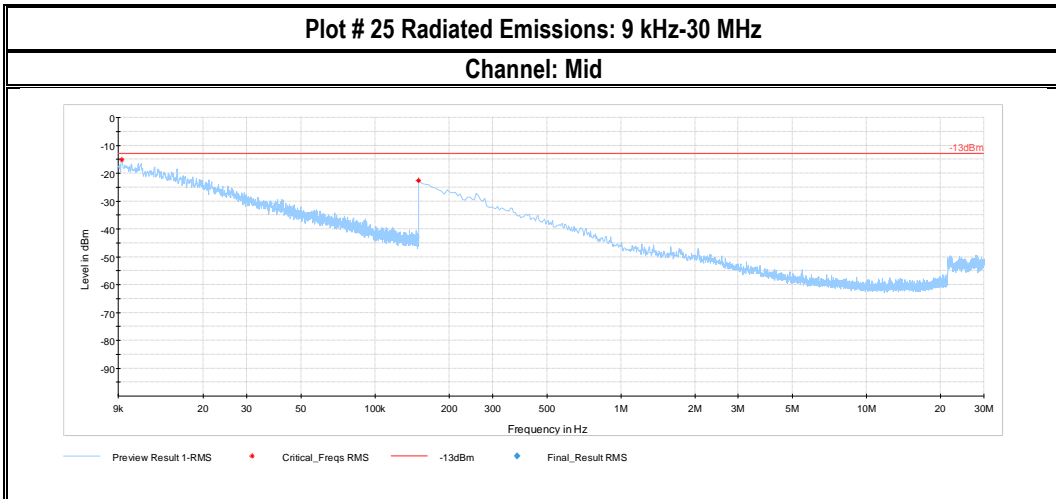
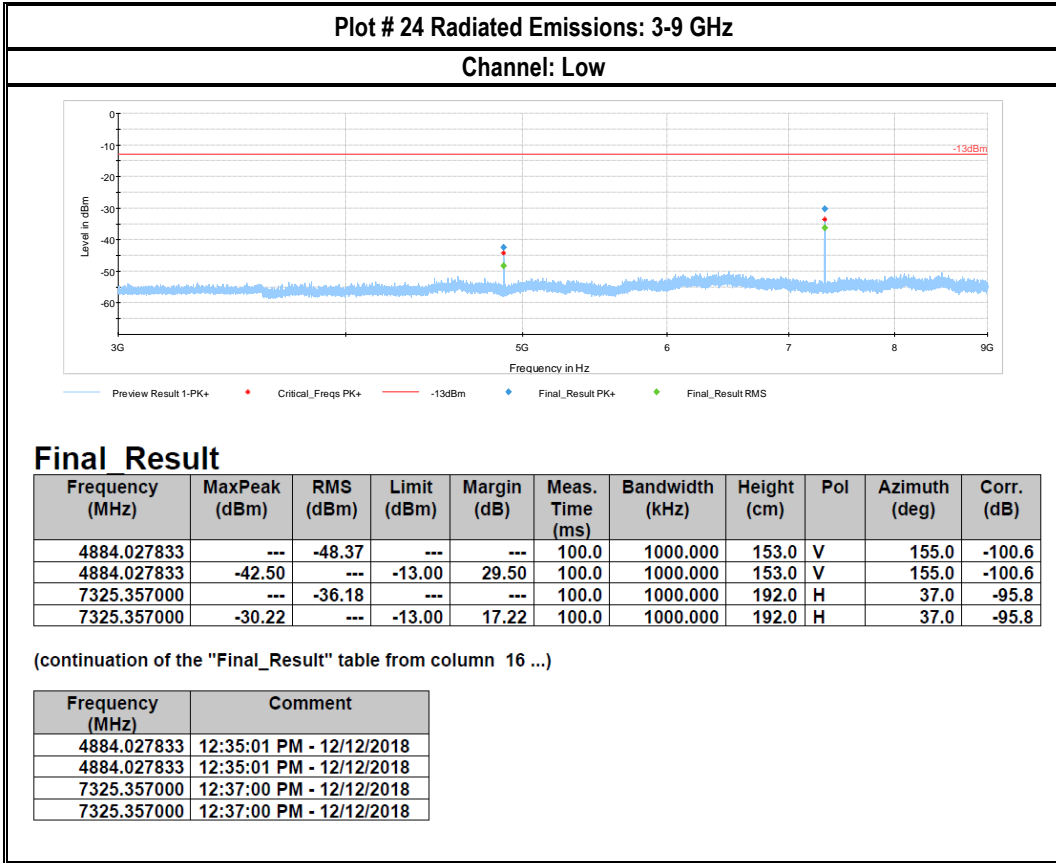
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4883.223500	---	-47.17	---	---	100.0	1000.000	242.0	H	67.0	-100.6
4883.223500	-40.09	---	-13.00	27.09	100.0	1000.000	242.0	H	67.0	-100.6
6999.921167	---	-43.45	---	---	100.0	1000.000	190.0	V	359.0	-95.3
6999.921167	-35.79	---	-13.00	22.79	100.0	1000.000	190.0	V	359.0	-95.3
7325.202333	---	-36.81	---	---	100.0	1000.000	175.0	H	36.0	-95.8
7325.202333	-30.79	---	-13.00	17.79	100.0	1000.000	175.0	H	36.0	-95.8
9767.206000	---	-46.21	---	---	100.0	1000.000	151.0	H	25.0	-93.0
9767.206000	-38.10	---	-13.00	25.10	100.0	1000.000	151.0	H	25.0	-93.0

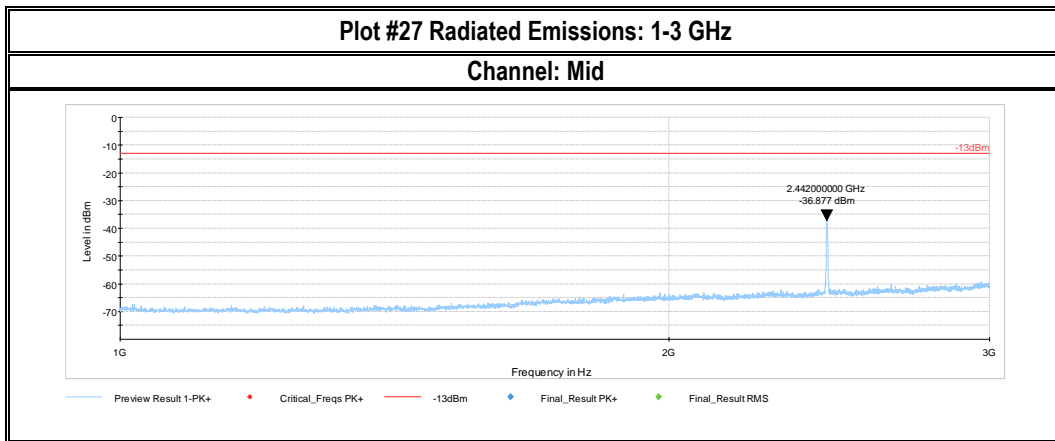
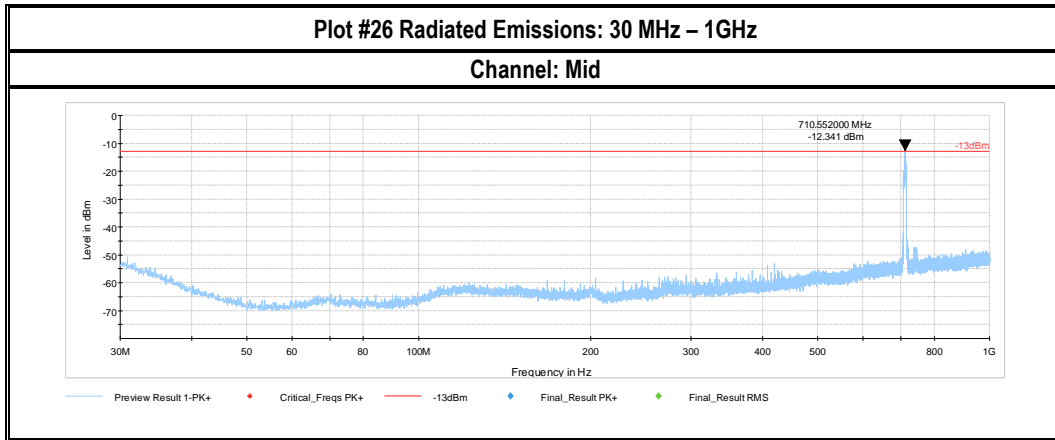
(continuation of the "Final\_Result" table from column 16 ...)

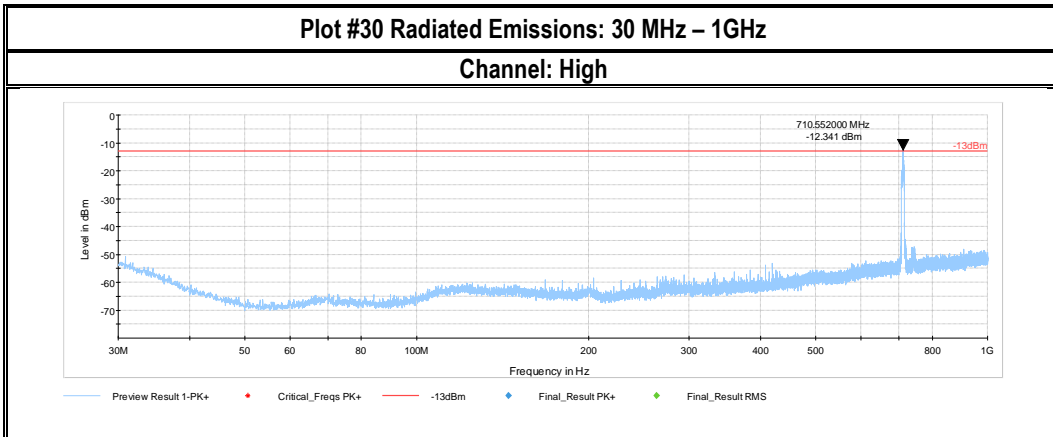
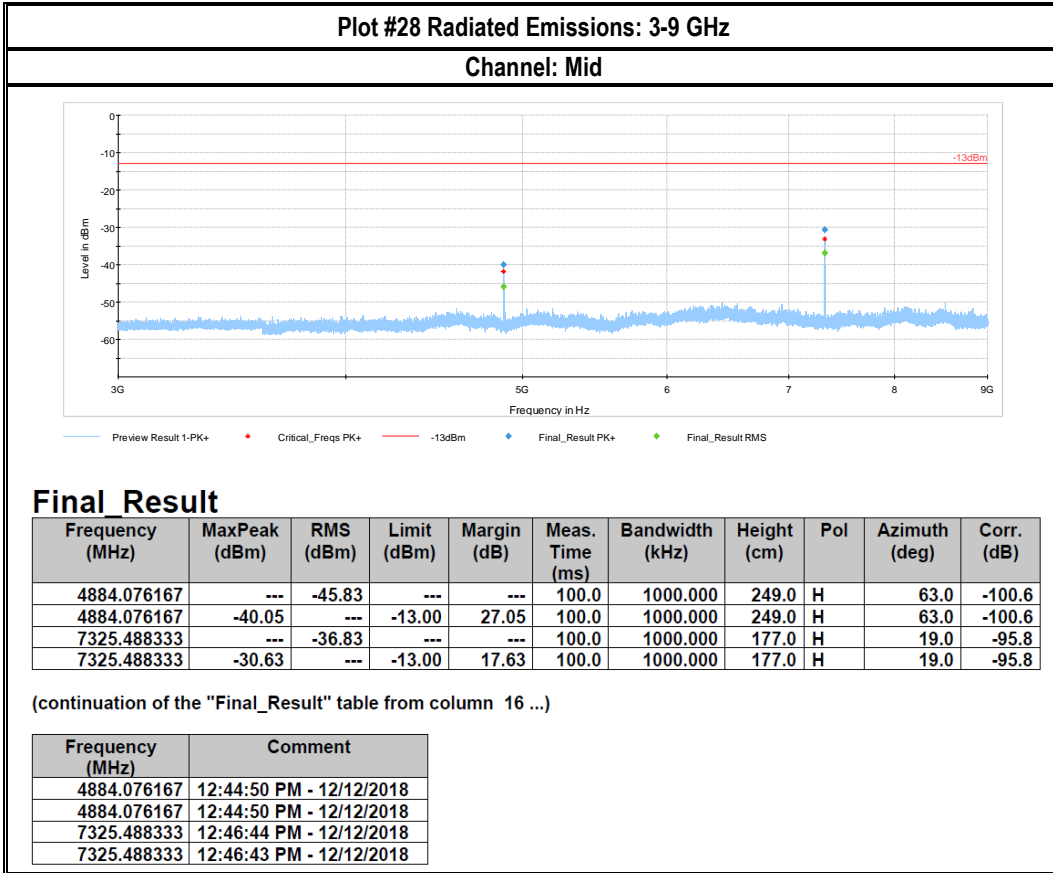
Frequency (MHz)	Comment
4883.223500	1:42:55 PM - 12/12/2018
4883.223500	1:42:55 PM - 12/12/2018
6999.921167	1:45:13 PM - 12/12/2018
6999.921167	1:45:13 PM - 12/12/2018
7325.202333	1:47:34 PM - 12/12/2018
7325.202333	1:47:34 PM - 12/12/2018
9767.206000	1:49:25 PM - 12/12/2018
9767.206000	1:49:25 PM - 12/12/2018

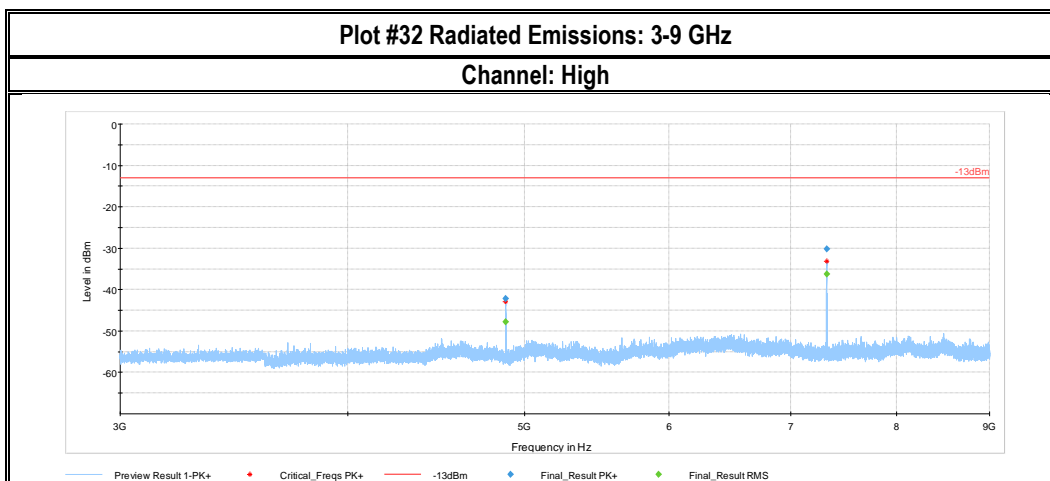
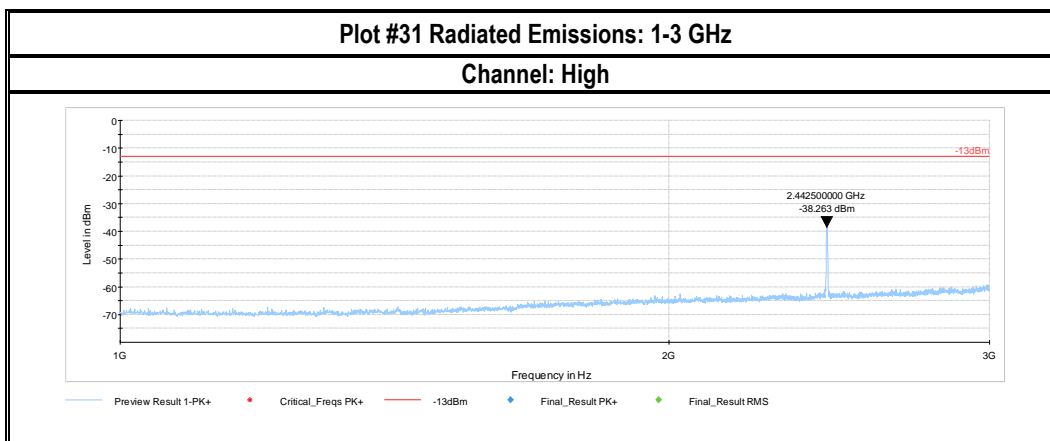
7.2.5.3 LTE BAND 12 + BLE











**Final Result**

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4883.490333	---	-47.86	---	---	100.0	1000.000	164.0	V	148.0	-100.6
4883.490333	-42.16	---	-13.00	29.16	100.0	1000.000	164.0	V	148.0	-100.6
7325.136000	---	-36.30	---	---	100.0	1000.000	180.0	H	21.0	-95.8
7325.136000	-30.20	---	-13.00	17.20	100.0	1000.000	180.0	H	21.0	-95.8

(continuation of the "Final\_Result" table from column 16 ...)

Frequency (MHz)	Comment
4883.490333	12:54:28 PM - 12/12/2018
4883.490333	12:54:28 PM - 12/12/2018
7325.136000	12:56:29 PM - 12/12/2018
7325.136000	12:56:28 PM - 12/12/2018

## 8 Test setup photos

Setup photos are included in supporting file name: "EMC\_CALAM-071-18001\_FCC\_Setup\_Photos"

## 9 Test Equipment and Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	6/27/2017
Magnetic Loop Antenna	Loop Antenna	ETS Lindgren	6512	164698	3 years	7/8/2017
Antenna Horn 3115	Horn Antenna	ETS Lindgren	3115	35114	3 years	7/31/2017
Antenna Horn 3117-PA	Horn Antenna	ETS Lindgren	3117-PA	169547	3 years	8/8/2017
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	2 Years	6/8/2017
FSV40	Spectrum Analyzer	R&S	FSV40	101022	2 years	5/7/2017
FSU26	Spectrum Analyzer	R&S	FSU26	200302	2 years	7/5/2017
Thermometer Humidity TM320	Thermometer Humidity	Dickson	TM320	1625369	3Year	6/1/2017

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.

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## 10 Revision History

Date	Report Name	Changes to report	Report prepared by
2019-01-24	EMC_CALAM-071-18001_FCC_24_27_rev1	Adding ERP / EIRP evaluation.	Tri Nguyen
2018-12-13	EMC_CALAM-071-18001_FCC_24_27	Initial Version	Tri Nguyen