



FCC / ISED & Test Report

For:
CalAmp

Model Name:
LMU-3640 HSPA

Product Description:
Telematics Gateway

Applied Rules and Standards:

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

FCC ID: APV-3640HEB
IC ID: 5843A-3640HEB

REPORT #: EMC_CALAM_064_FCC_22_24
DATE: 2018-06-20



A2LA Accredited

IC recognized #
3462B-1

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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 5, RSS-132 issue 3 and RSS-133 issue 6.

No deficiencies were ascertained.

Company Name	Product Description	Model Name
CalAmp	Telematics Gateway	LMU-3640 HSPA

Responsible for Testing Laboratory:

2018-06-20	Compliance	James Donnellan (Lab Manager-EMC)	
Date	Section	Name	Signature

Responsible for the Report:

2018-06-20	Compliance	Kevin Wang (Senior EMC Engineer)	
Date	Section	Name	Signature

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

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
Compliance Manager:	James Donnellan
Responsible Project Leader:	Kevin Wang

2.2 Identification of the Client

Applicant's Name:	CalAmp
Street Address:	2177 Salk Ave, Suite 200
City/Zip Code	Carlsbad, CA 90228
Country	United States

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	LMU-3640 HSPA
HW Version	REV A
SW Version	6.2
FCC-ID	APV-3640HEB
IC-ID:	5843A-3640HEB
HVIN:	LMU3640HEB
PMN:	LMU3640HSPA
Product Description	Telematics Gateway
Transceiver Technology / Type(s) of Modulation	CINTERION EHS6 FCC ID: QIPEHS6; IC ID: 7830A-EHS6 GSM/GPRS/EDGE/UMTS/HSPA Module TI CC2564, Dual -mode Bluetooth Controller FCC ID: APV-3640LAB/APV-3640LVB IC ID: 5843A-3640LAB/5843A-3640LVB Bluetooth and Bluetooth Low Energy: GFSK / $\pi/4$ -DQPSK / 8DPSK
Frequency Range	GSM 850: 824.2-848.8; GSM 1900: 1850.2-1909.8; FDD II: 1850 – 1910; FDD V: 824 - 849; Bluetooth: 2402-2480; Bluetooth Low Energy: 2402-2480;
Max. declared antenna gain	Ethertronics model: M830820; Peak Gain: 1.39dBi Cellular Antenna, Peak Gain: 850MHz, 1.3dBi; 1900MHz, 2.4dBi (Calculated) Note1
Power Supply/ Rated Operating Voltage Range	8V (Low) / 12-24V (Nominal) / 32V (Max), DC
Operating Temperature Range	-30°C ~ +75°C
Sample Revision	<input type="checkbox"/> Prototype <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production

Note1: the Cellular Antenna gain was calculated as below:

	Max Measured EIRP (dBm)	Max documented conducted output power(dBm)	Antenna Gain (dBi)
GSM850	32.58	32.33	0.25
GSM1900	31.615	29.32	2.295
FDD V	24.592	23.33	1.262
FDD II	25.753	23.33	2.423

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	E17B005458	REV A	6.2	Radiated Sample
2	E17B005457	REV A	6.2	Conducted Sample

3.3 Accessory Equipment (AE) details

AE #	Type	Model	Manufacturer	Serial Number
1	DC Power Supply	3003B	Protek	-
2	Laptop	Latitude 5420	Dell	161554860001

3.4 Test Sample Configuration

Set-up #	EUT / AE used for set-up	Comments
1	EUT#1+AE#1+AE#2	Radiated Testing, the EUT is directly powered by the DC power supply.

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 and ISED Standards RSS-132 issue 3 and RSS-133 issue 6.

4.1 Dates of Testing:

05/18/2018 - 06/06/2018

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:

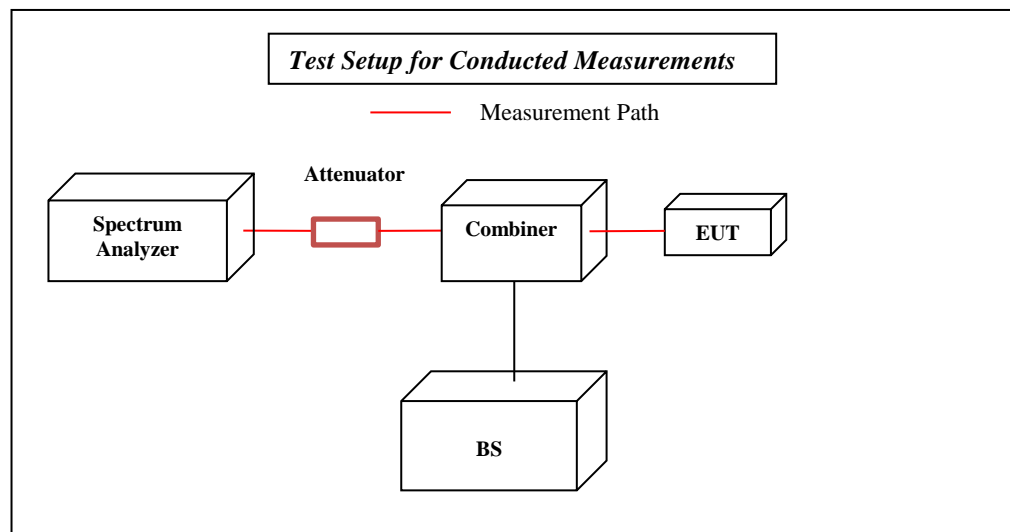
The following environmental conditions were maintained during the course of testing:

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

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

5 Measurement Procedures

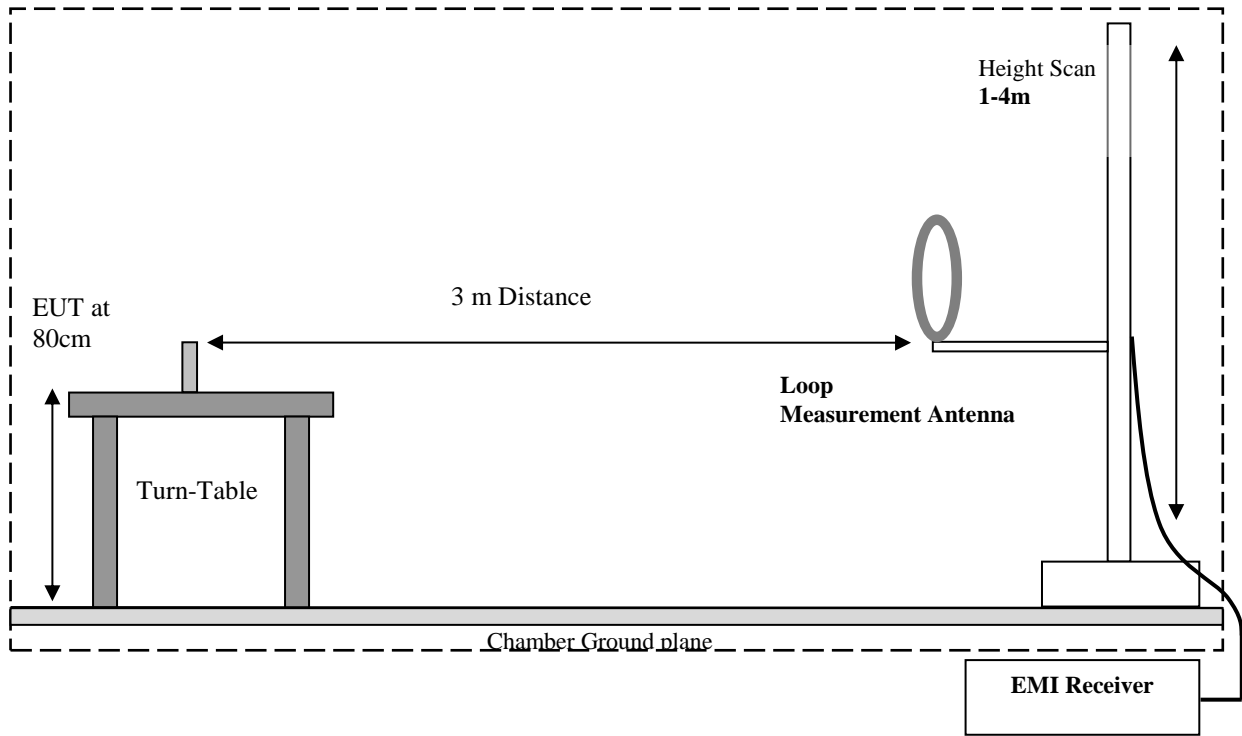
Testing is performed according to the guidelines provided in FCC publication (KDB) 971168 D01 v02r02 – “Measurement Guidance for Certification of Licensed Digital Transmitters” and according to relevant parts of ANSI/TIA-603-D-2010 as detailed below.



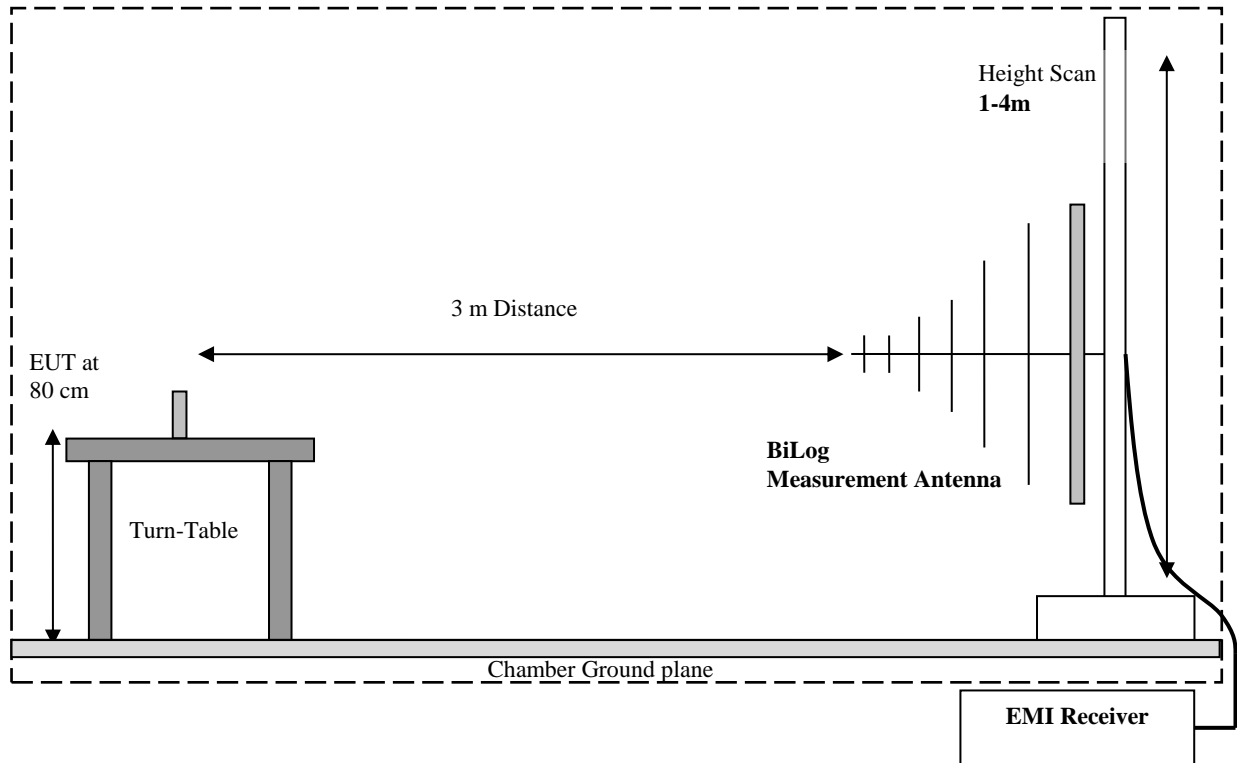
5.1 Radiated Measurement

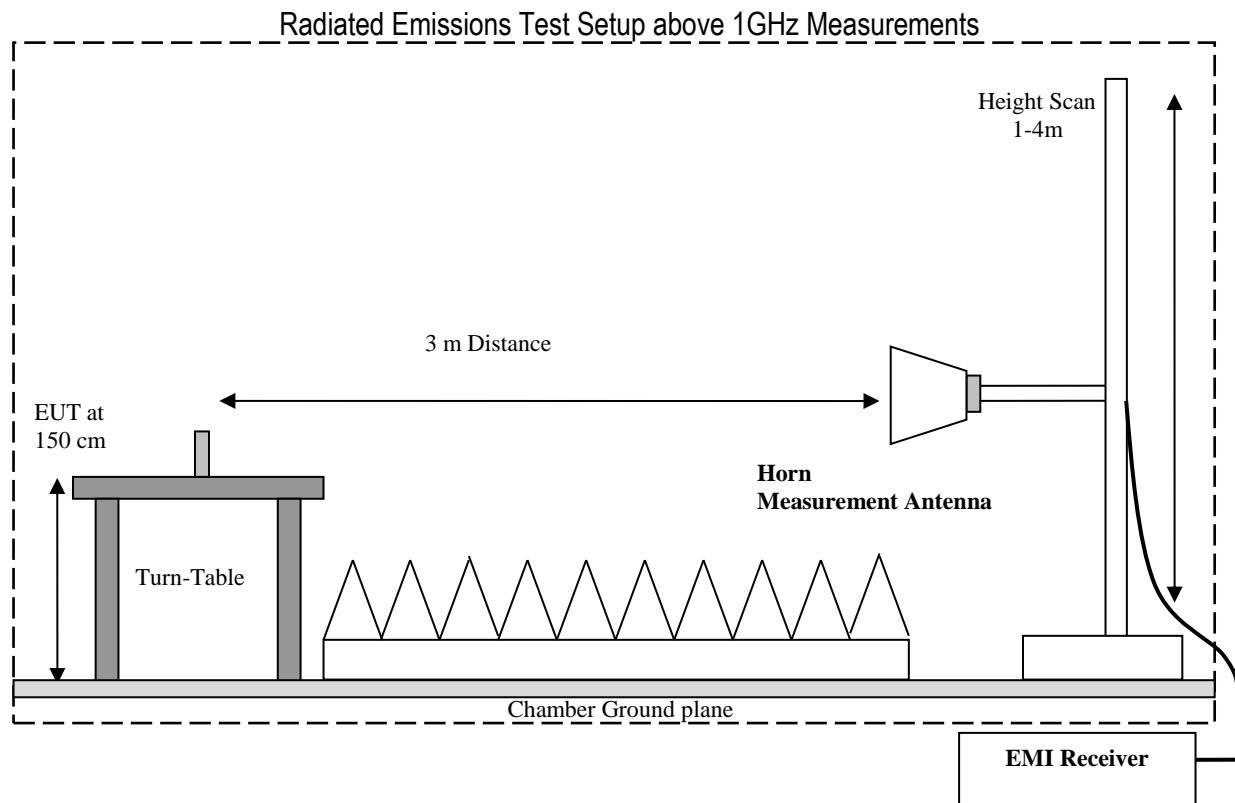
- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to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



Radiated Emissions Test Setup 30MHz-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 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:

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

Example:

Frequency (MHz)	Measured SA (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/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1055; §22.355	Frequency Tolerance	Extreme Temperature and Voltage	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1049; §22.917	Occupied Bandwidth	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1051; §22.917	Band Edge Compliance	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1051; §22.917	Conducted Spurious Emissions	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1053; §22.917	Radiated Spurious Emissions	Nominal	GSM/UMTS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

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

Note 2: Data leveraged from modular approval, FCC ID: QIPEHS6; IC ID: 7830A-EHS6

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/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1055; §24.235	Frequency Stability	Extreme Temperature and Voltage	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1049; §24.238	Occupied Bandwidth	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1051; §24.238	Band Edge Compliance	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1051; §24.238	Conducted Spurious Emissions	Nominal	GSM/UMTS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Note 2
§2.1053; §24.238	Radiated Spurious Emissions	Nominal	GSM/UMTS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Complies

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

Note 2: Data leveraged from modular approval, FCC ID: QIPEHS6; IC ID: 7830A-EHS6

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	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

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:

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 $43 + 10 \log_{10} p$ (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). 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:

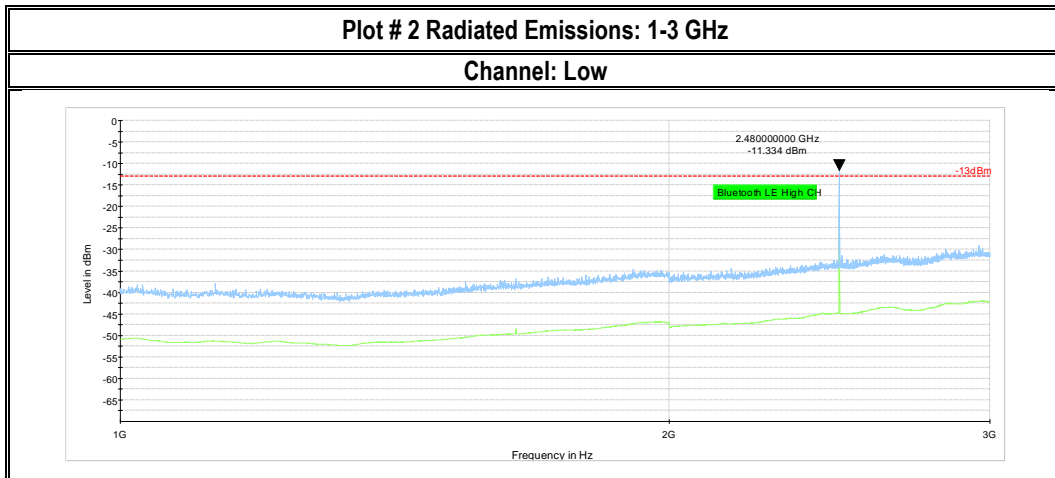
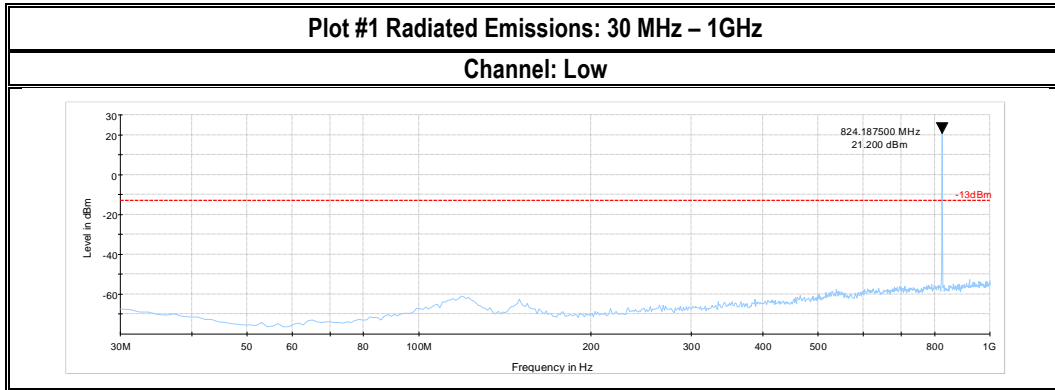
Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	GSM 850 / 1900 or FDD II / FDD V + Worst Case Bluetooth(Bluetooth 8DPSK High Channel)	12VDC

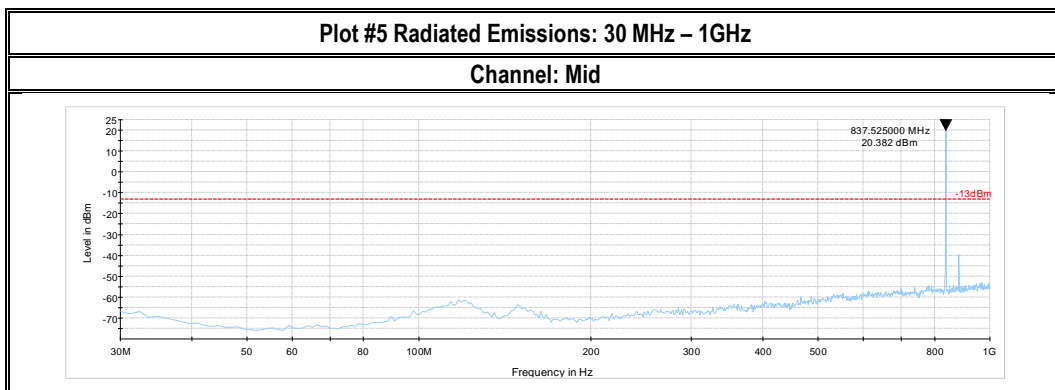
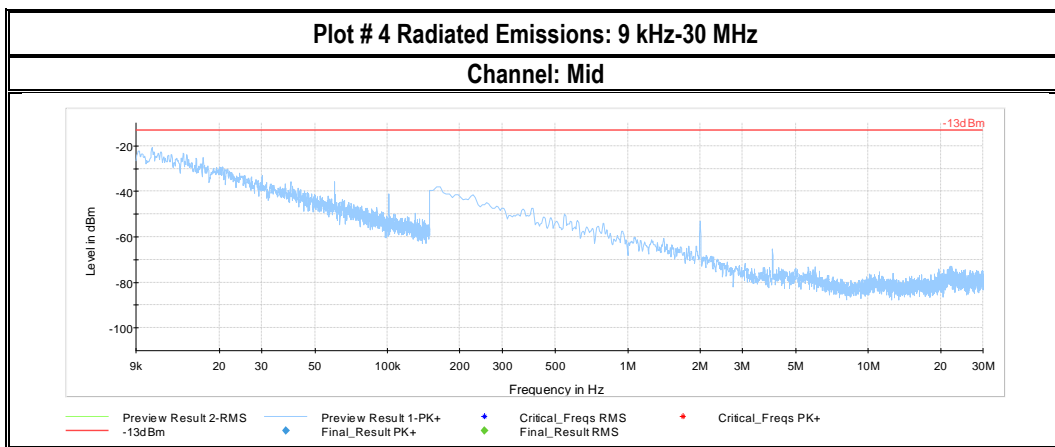
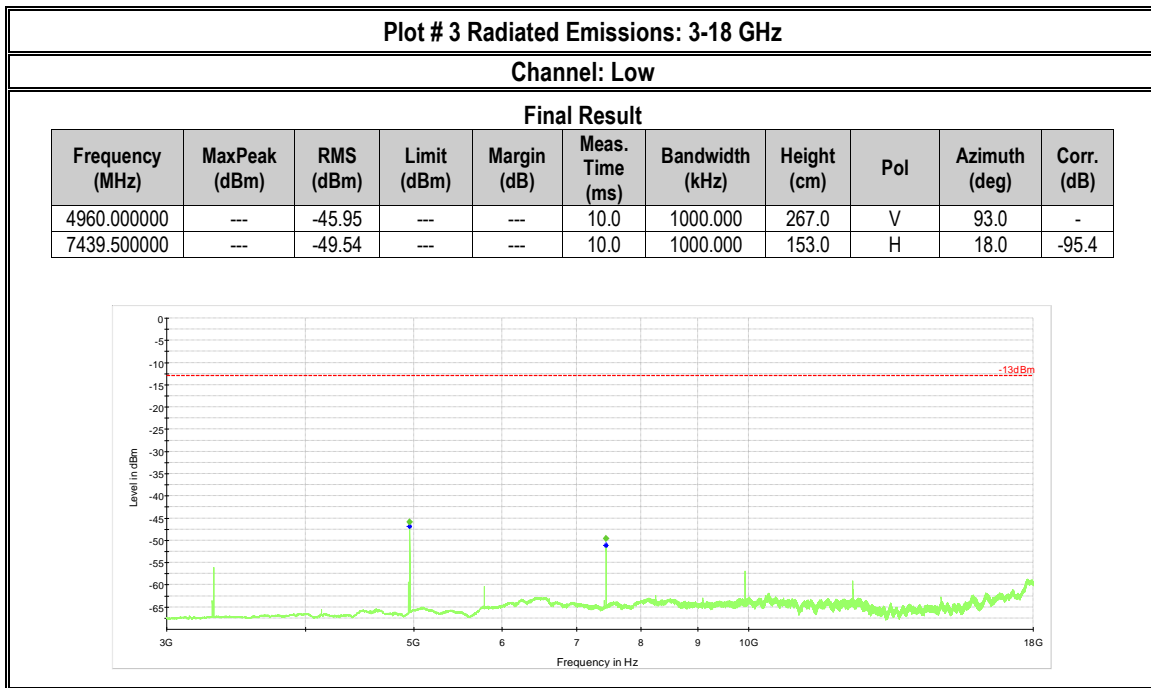
7.1.4 Measurement result:

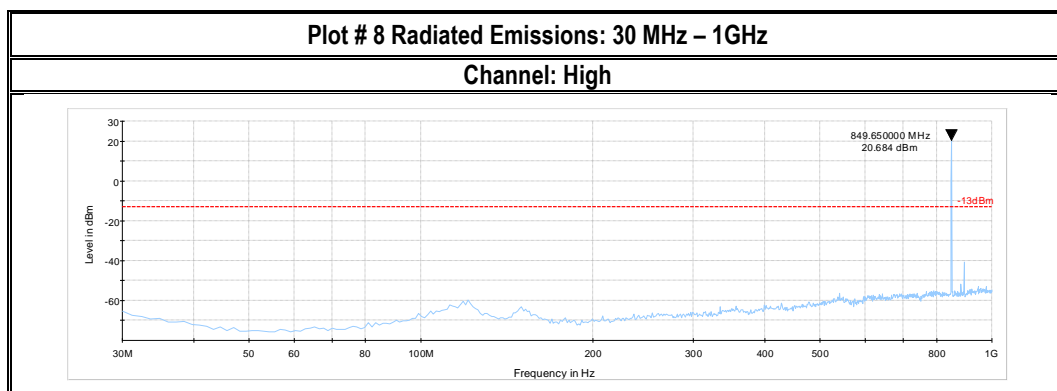
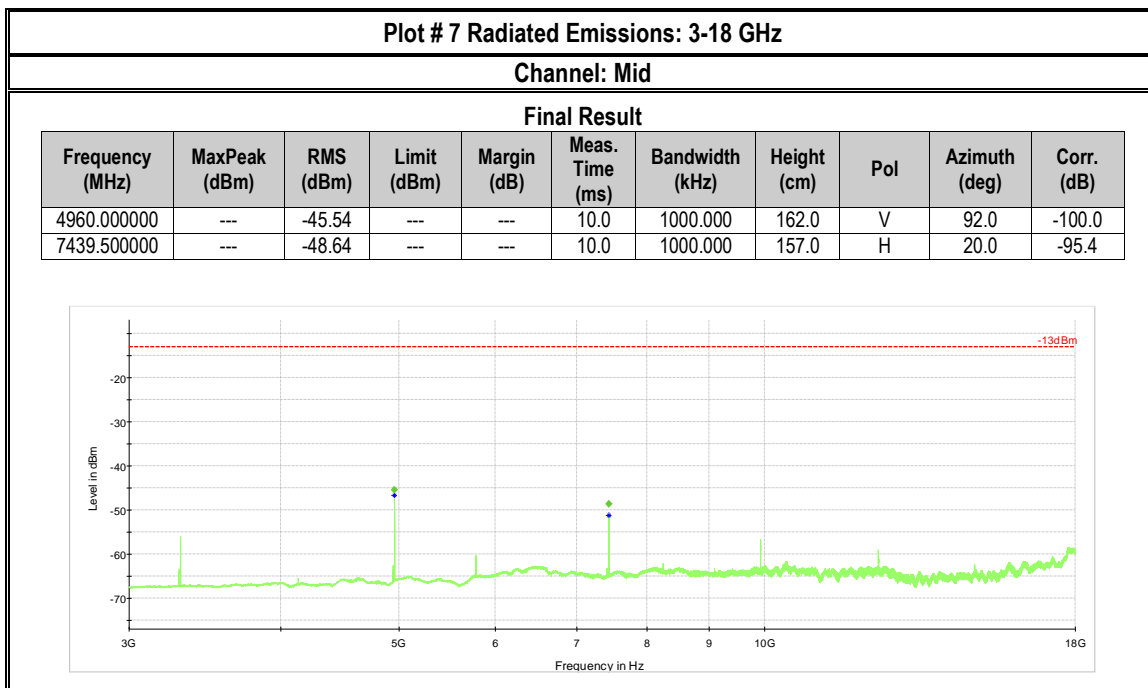
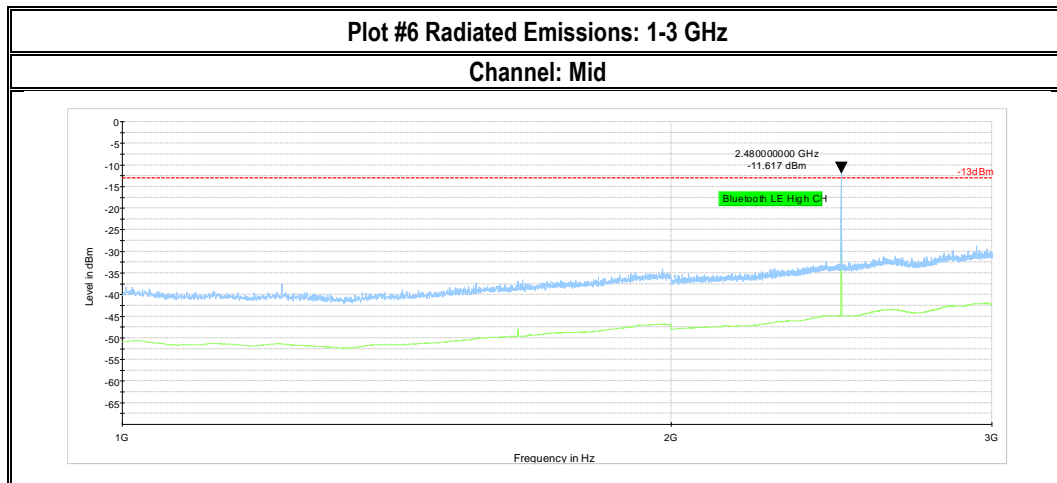
Plot #	Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1-3	Low	GSM 850	30 MHz – 18 GHz	-13	Pass
4-7	Mid	GSM 850	9 kHz – 18 GHz	-13	Pass
8-10	High	GSM 850	30 MHz – 18 GHz	-13	Pass
11-13	Low	GSM 1900	30 MHz – 18 GHz	-13	Pass
14-18	Mid	GSM 1900	9 kHz – 26 GHz	-13	Pass
19-21	High	GSM 1900	30 MHz – 18 GHz	-13	Pass
22-24	Low	FDD V	30 MHz – 18 GHz	-13	Pass
25-28	Mid	FDD V	9 kHz – 18 GHz	-13	Pass
29-31	High	FDD V	30 MHz – 18 GHz	-13	Pass
32-34	Low	FDD II	30 MHz – 18 GHz	-13	Pass
35-39	Mid	FDD II	9 kHz – 26 GHz	-13	Pass
40-42	High	FDD II	30 MHz – 18 GHz	-13	Pass

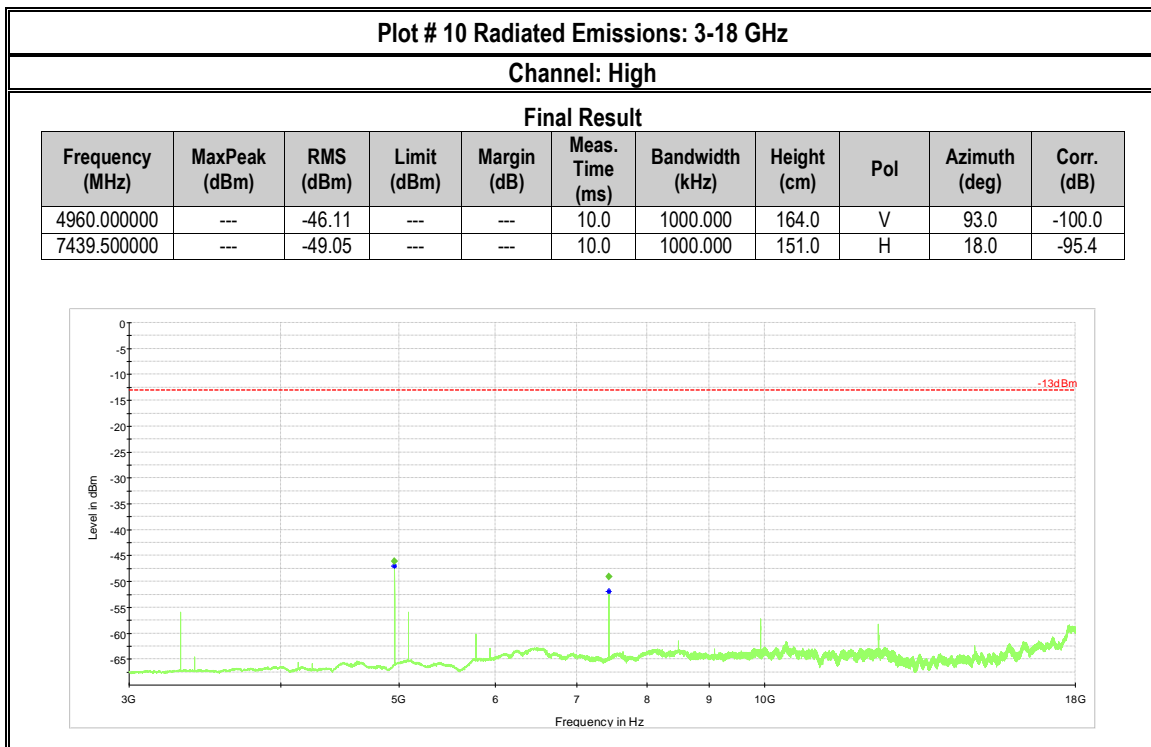
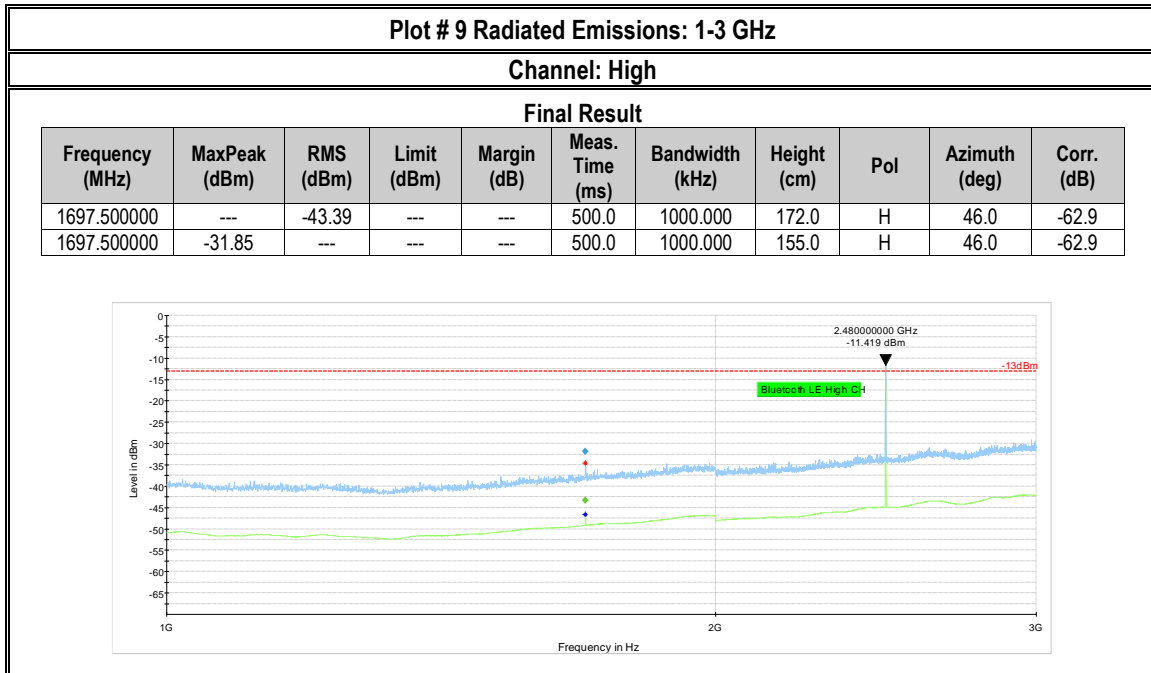
7.1.5 Measurement Plots:

7.1.6 GSM 850

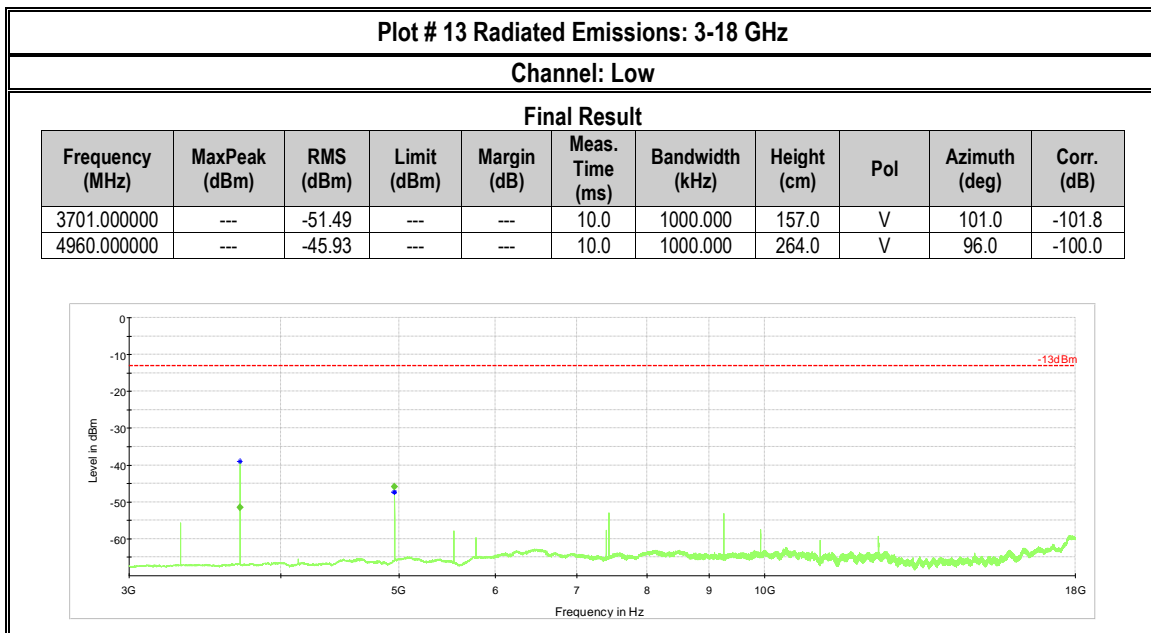
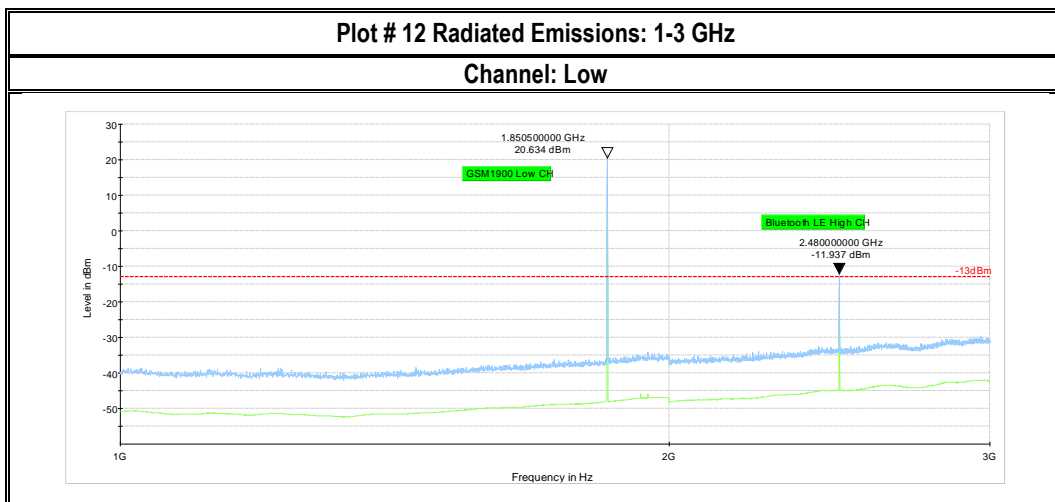
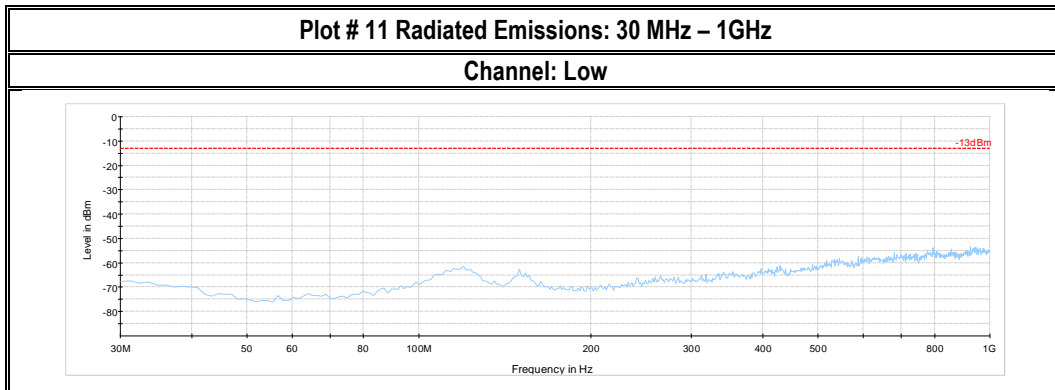


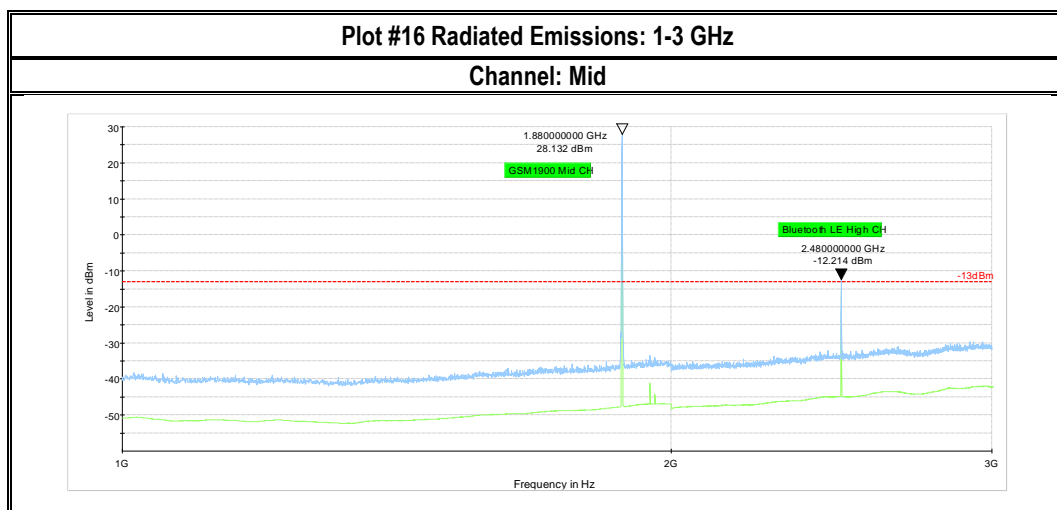
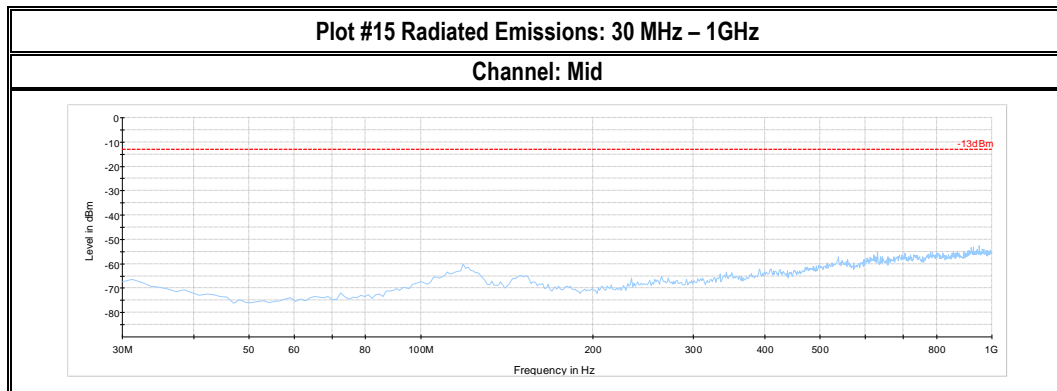
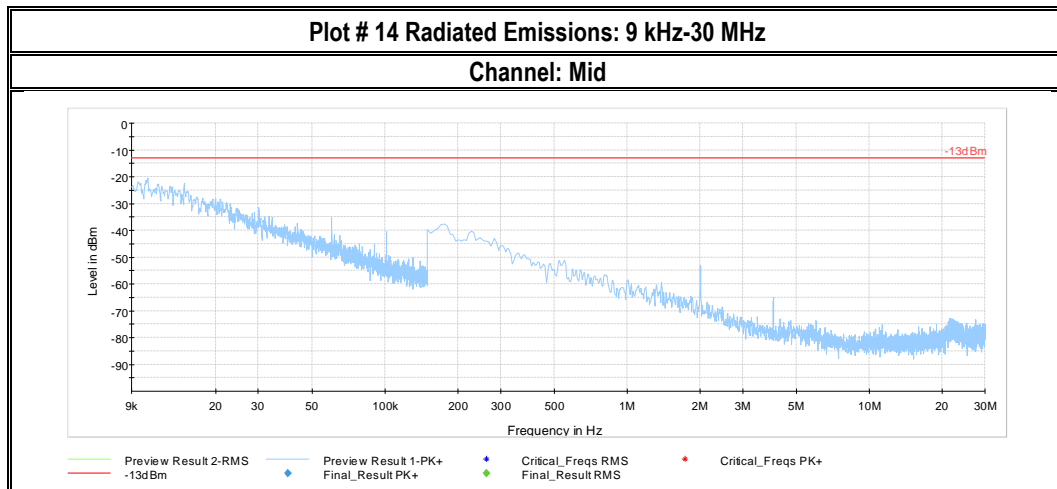


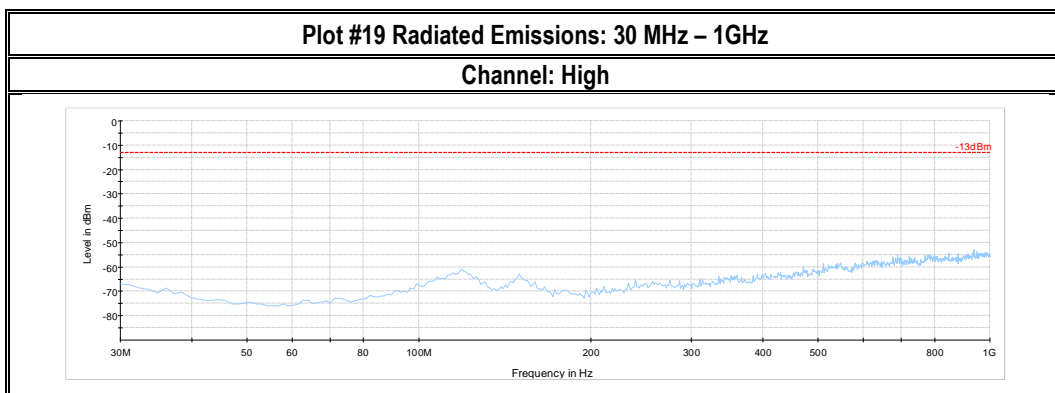
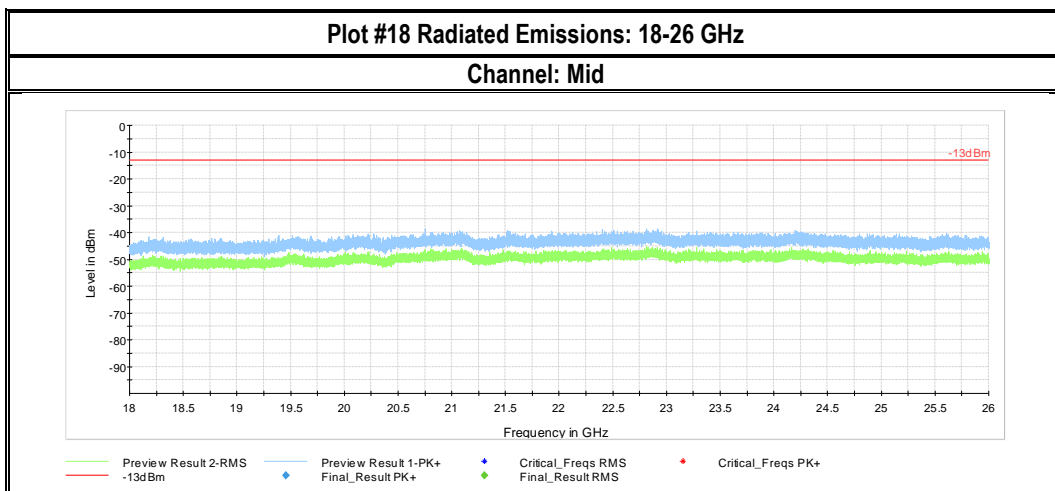
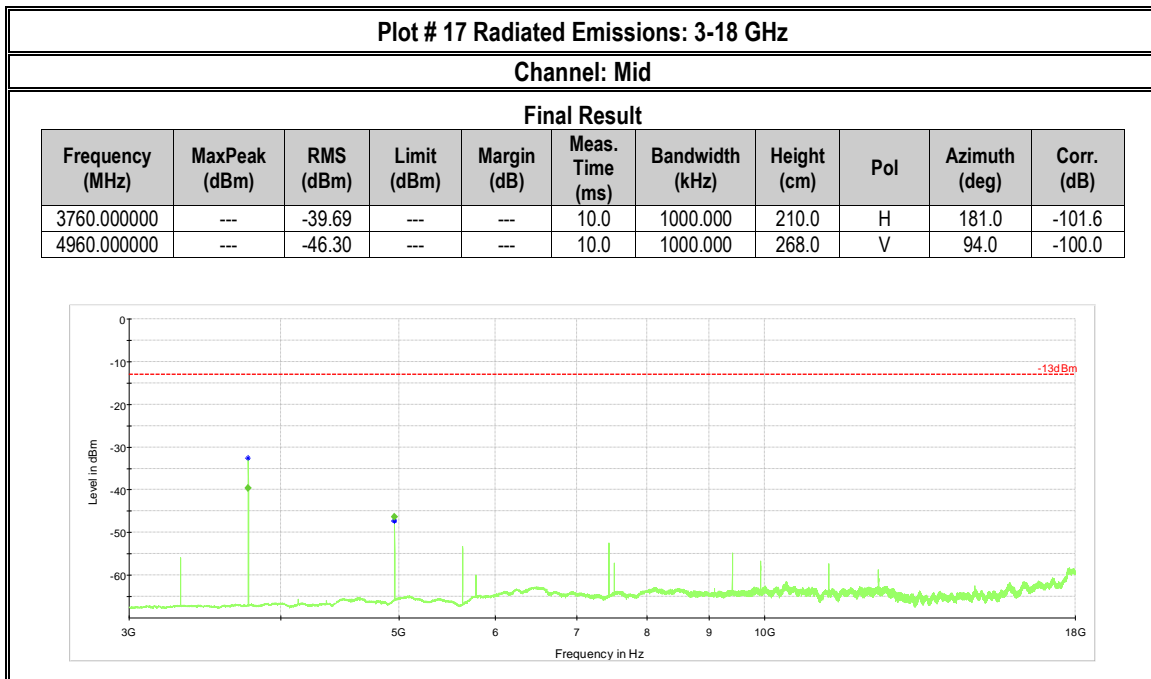


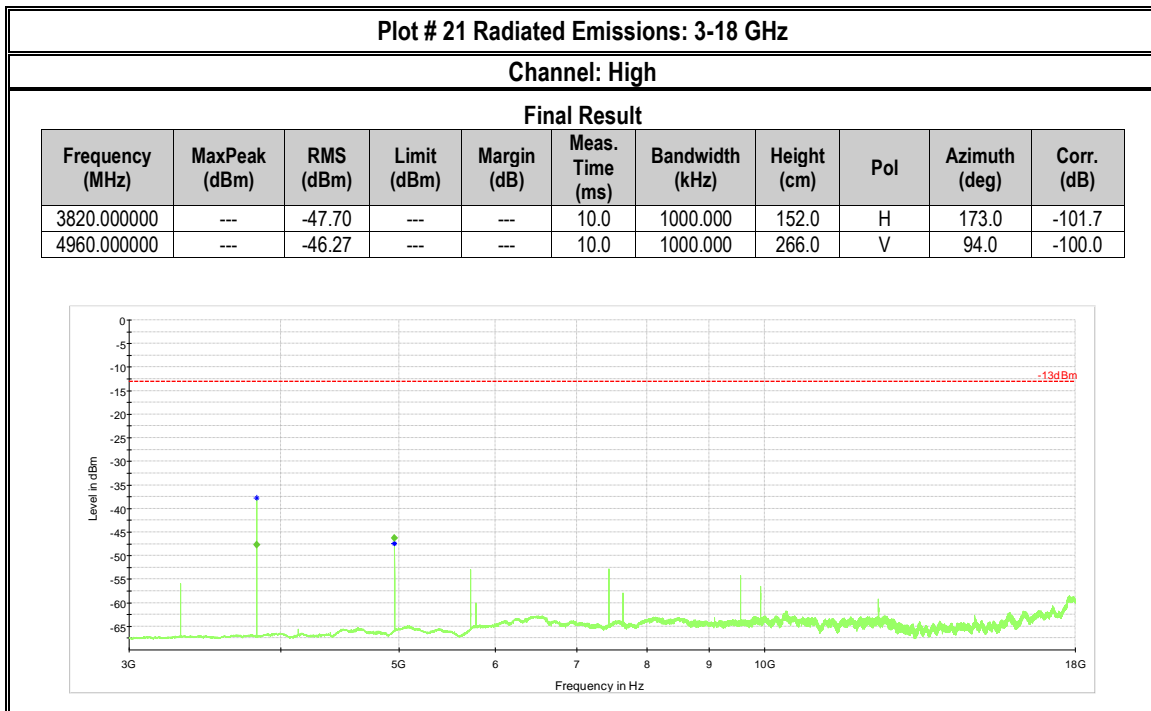
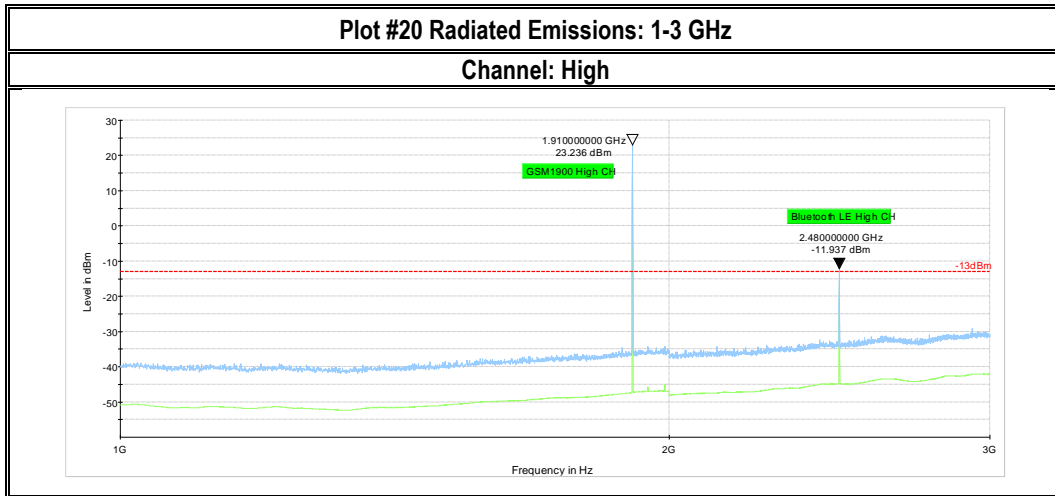


7.1.7 GSM 1900

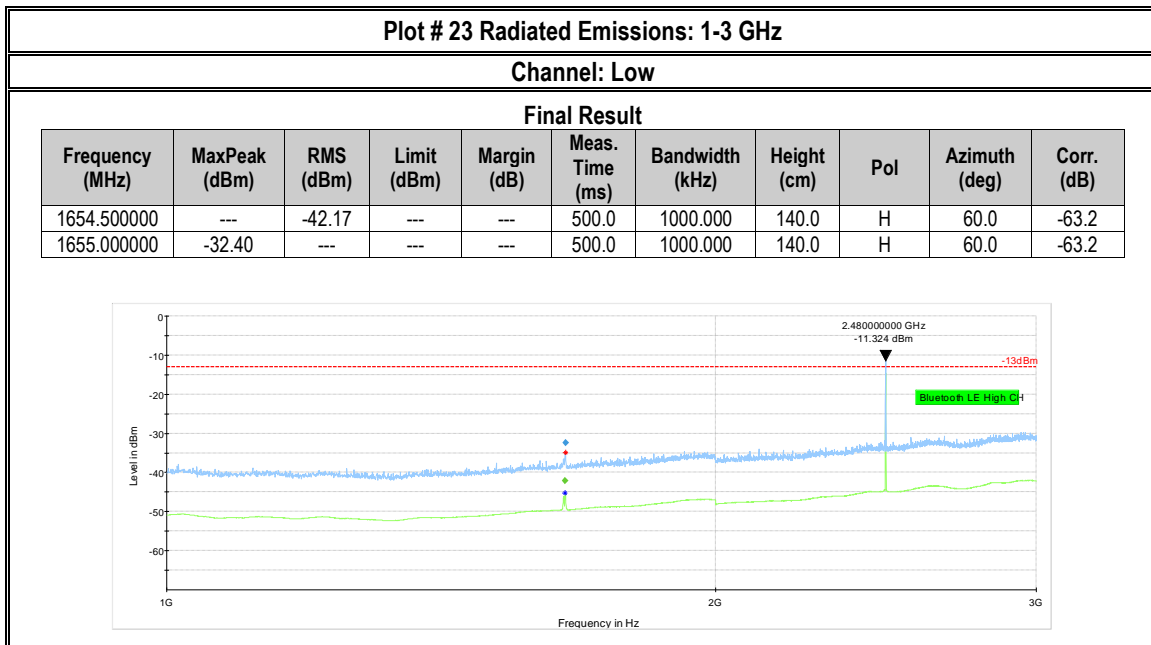
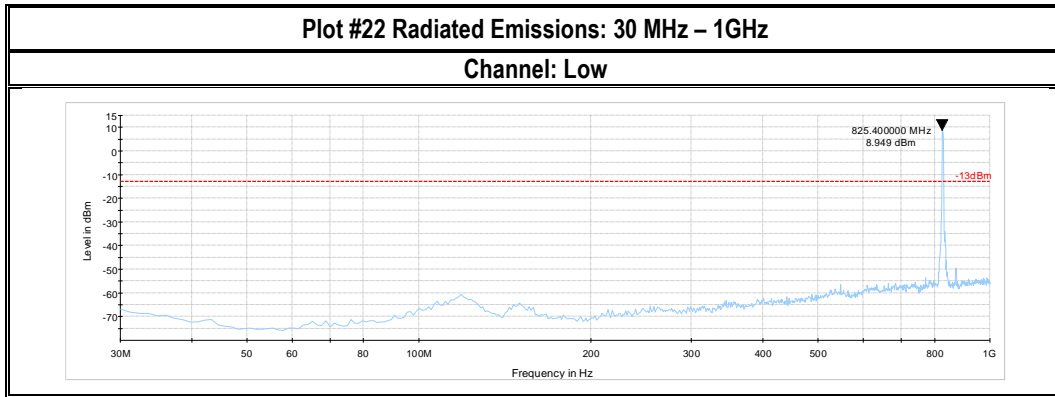


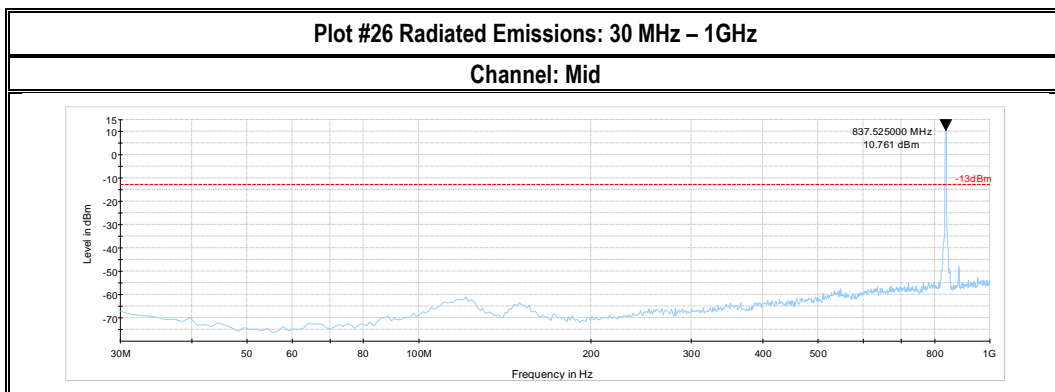
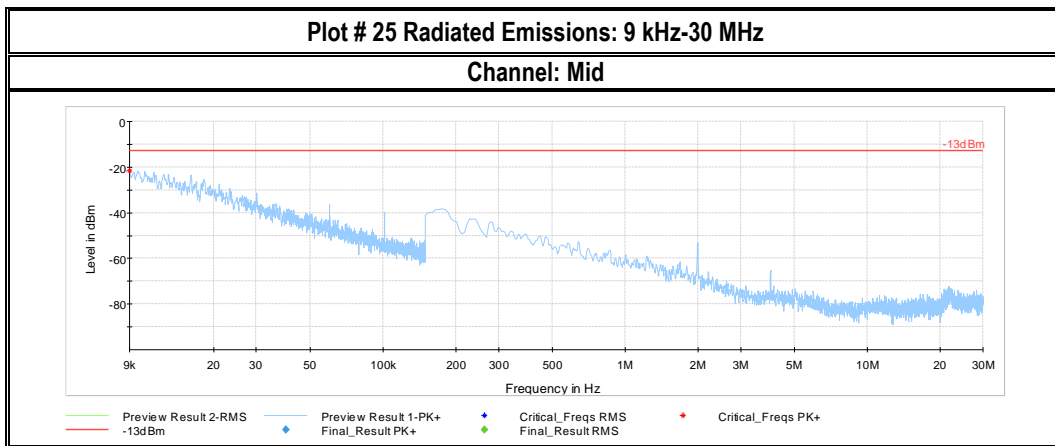
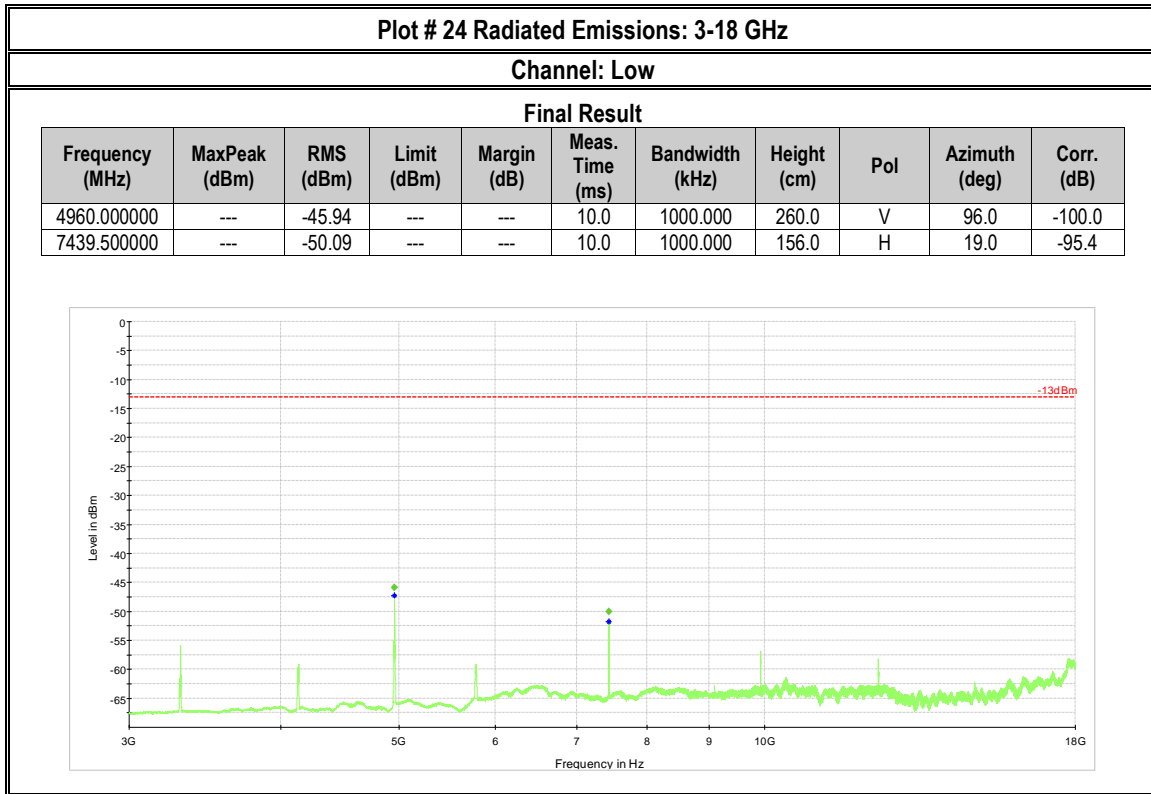


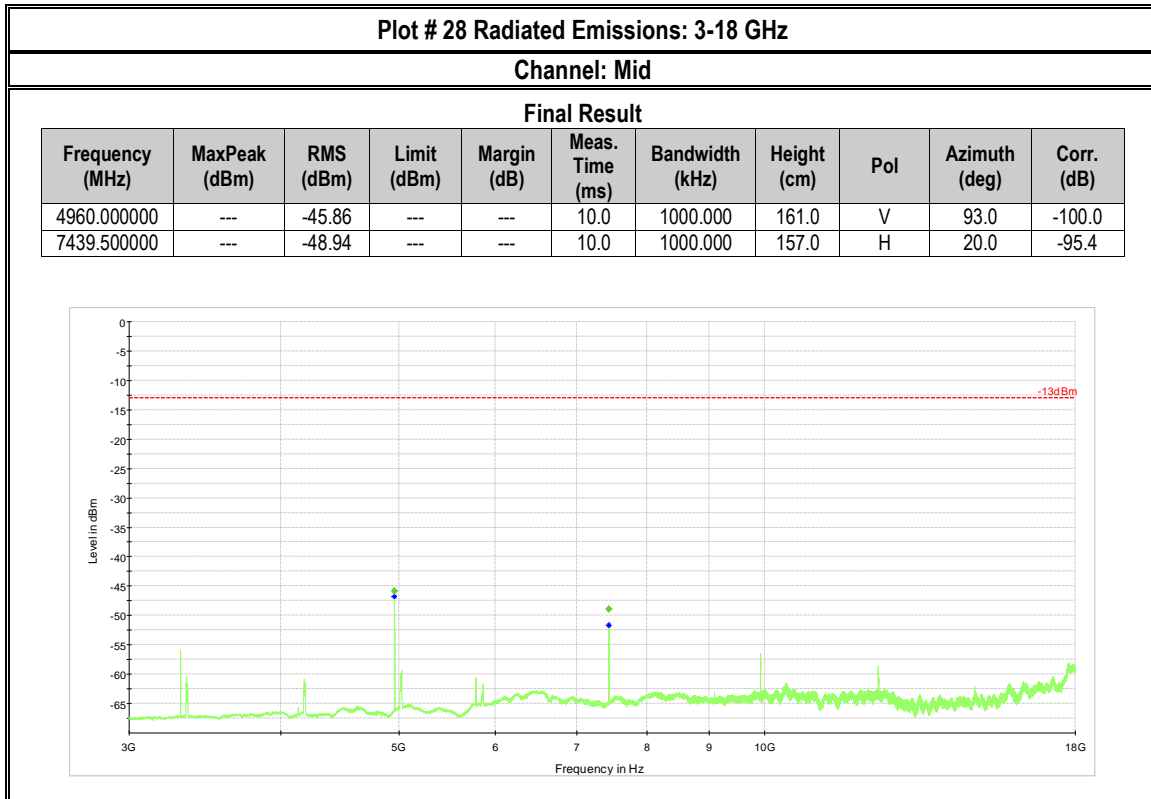
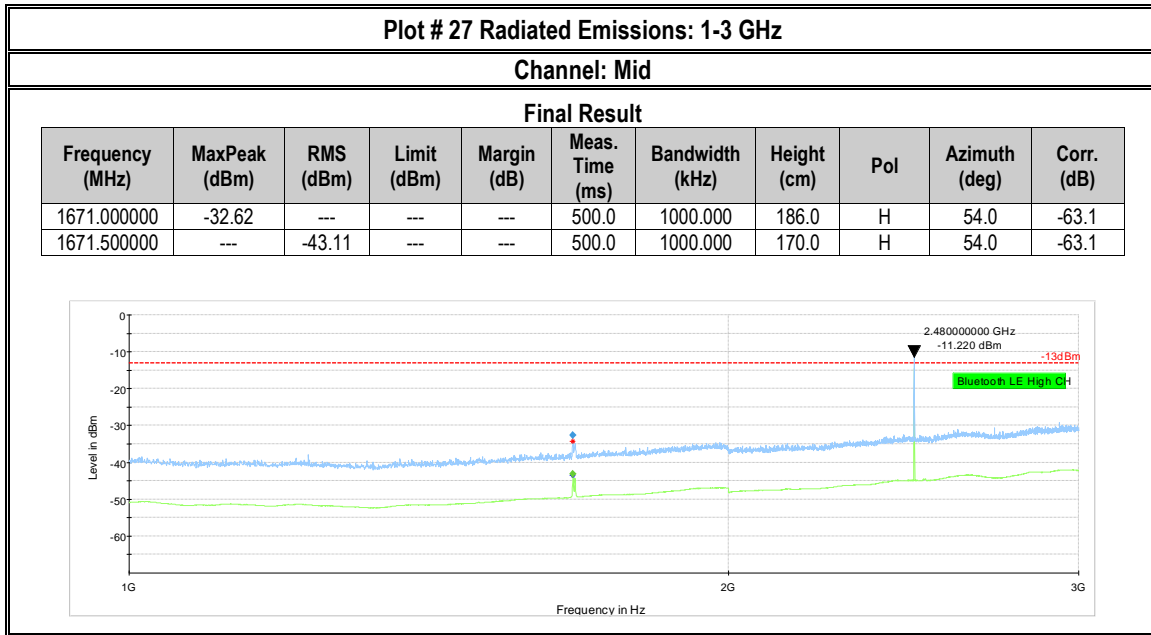


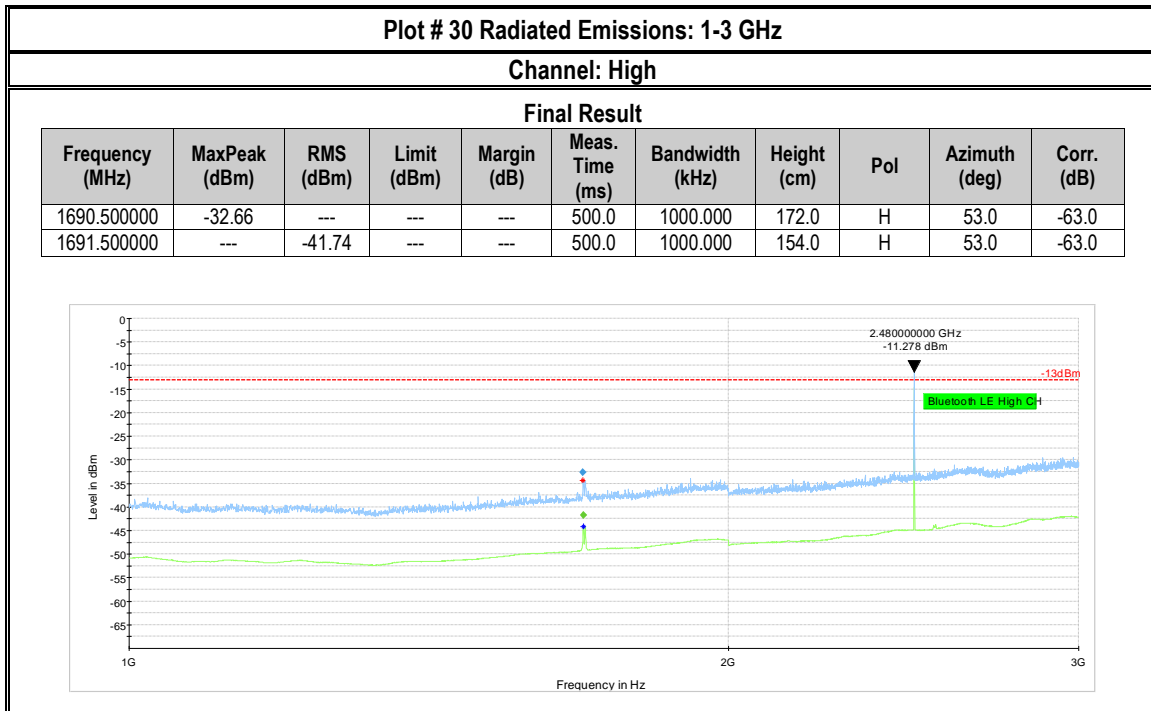
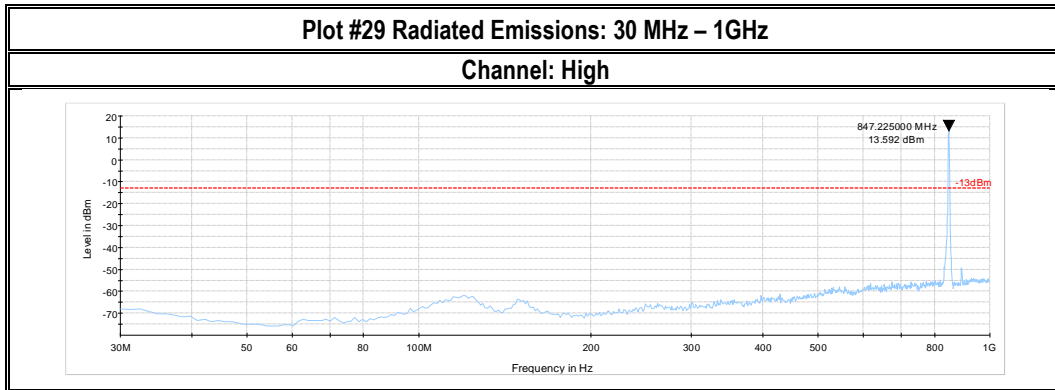


7.1.8 FDD V









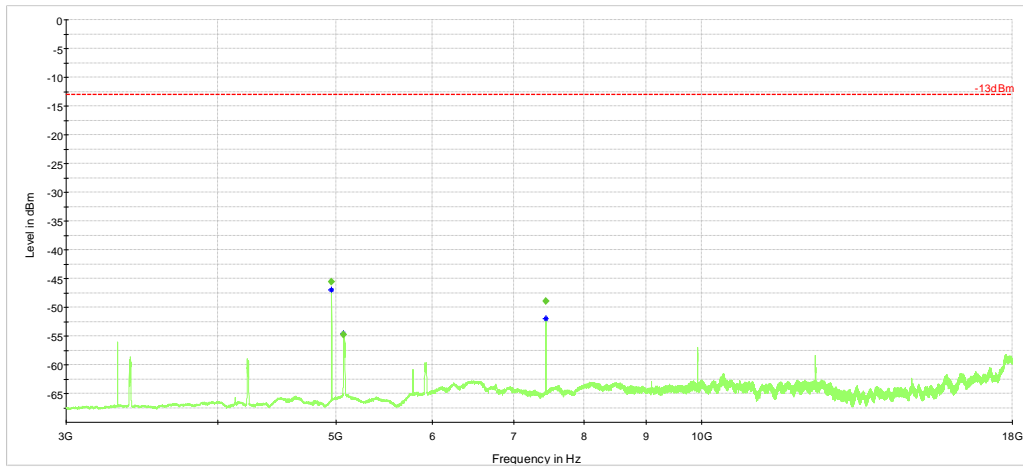


Plot # 31 Radiated Emissions: 3-18 GHz

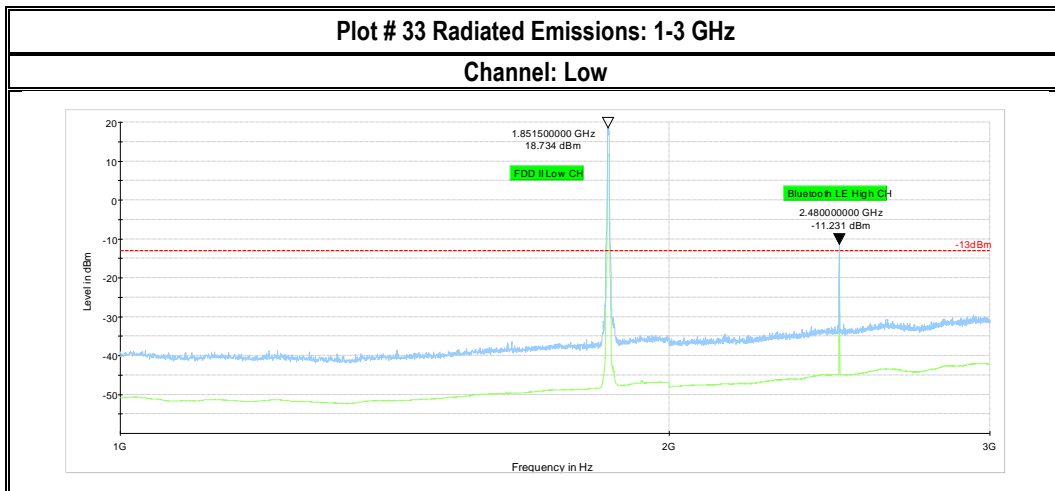
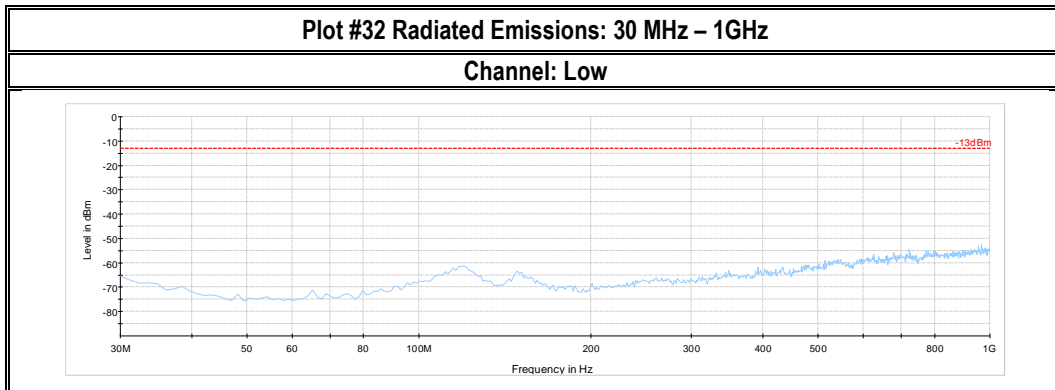
Channel: High

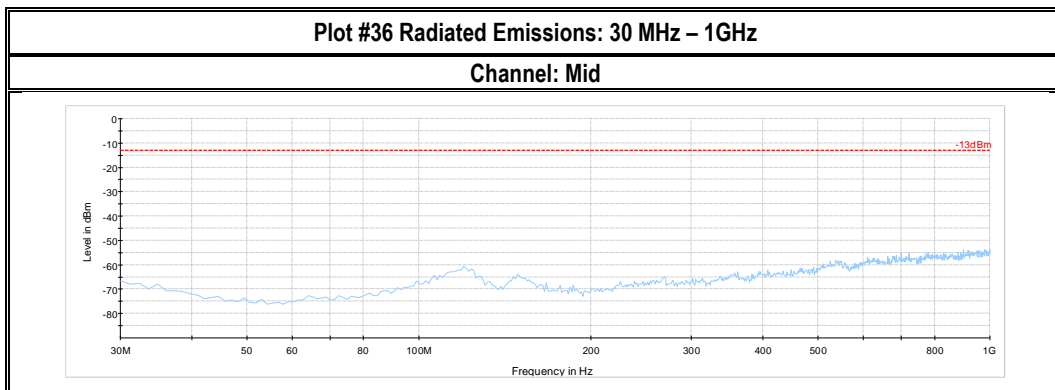
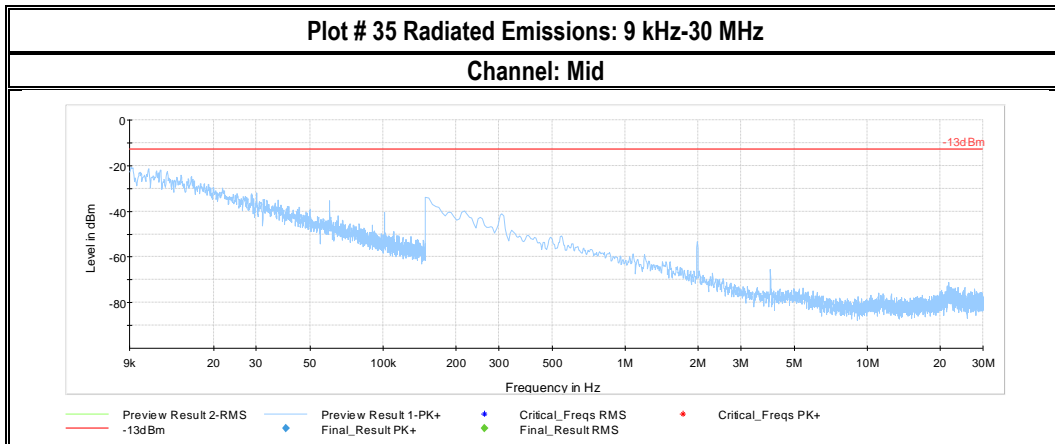
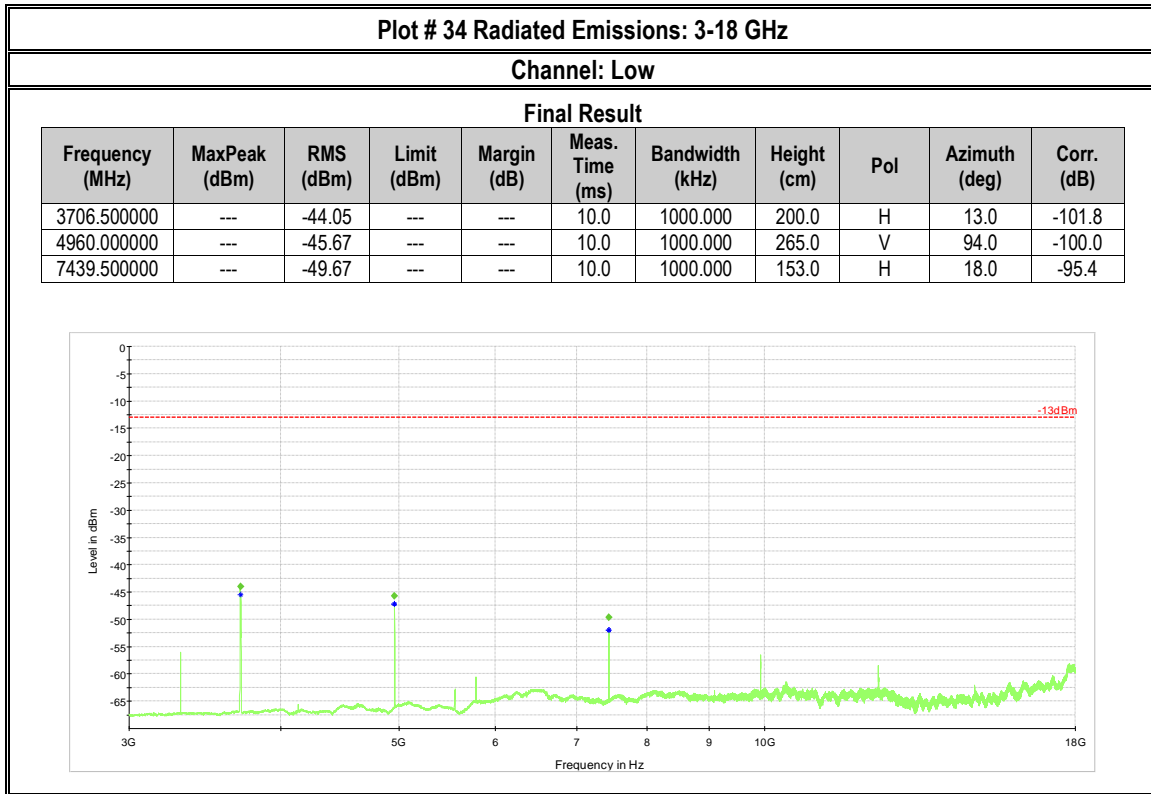
Final Result

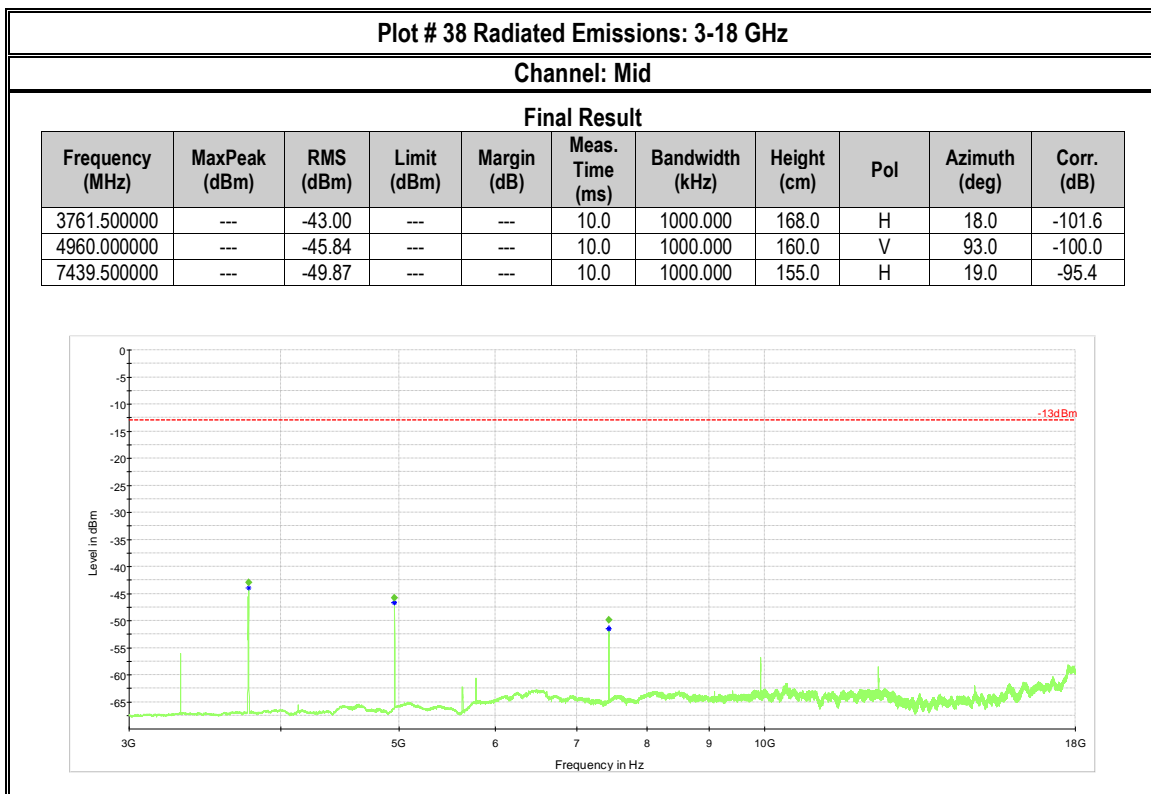
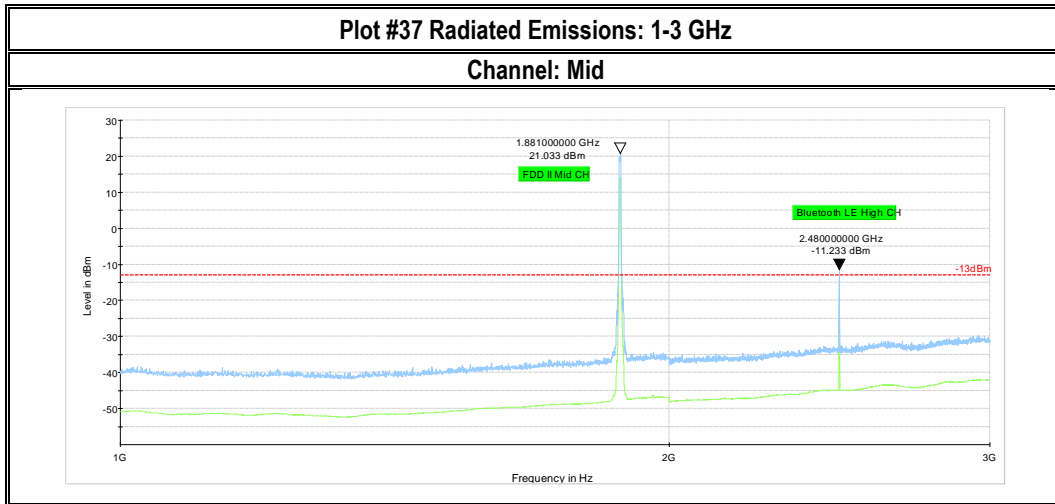
Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4960.000000	---	-45.62	---	---	10.0	1000.000	266.0	V	95.0	-100.0
5074.000000	---	-54.73	---	---	10.0	1000.000	178.0	H	-8.0	-99.1
7439.500000	---	-48.99	---	---	10.0	1000.000	157.0	H	20.0	-95.4

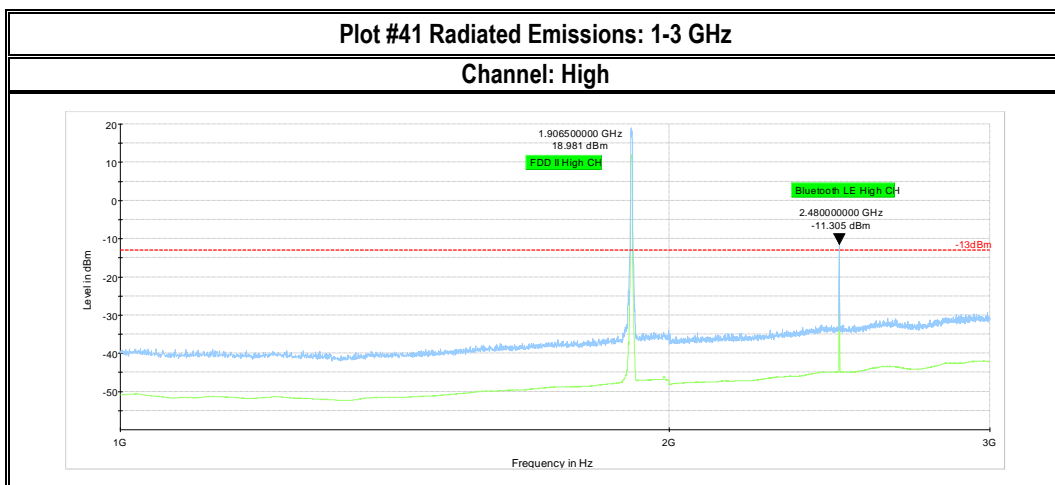
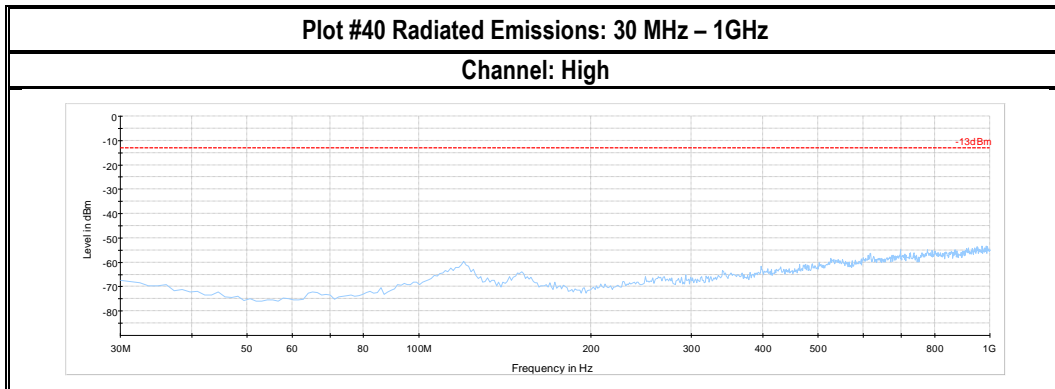
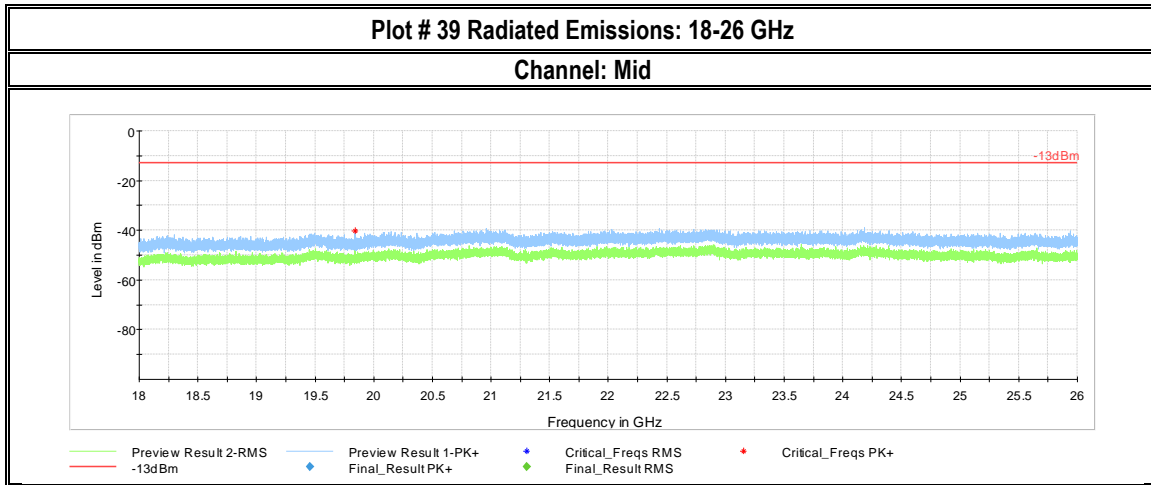


7.1.9 FDD II







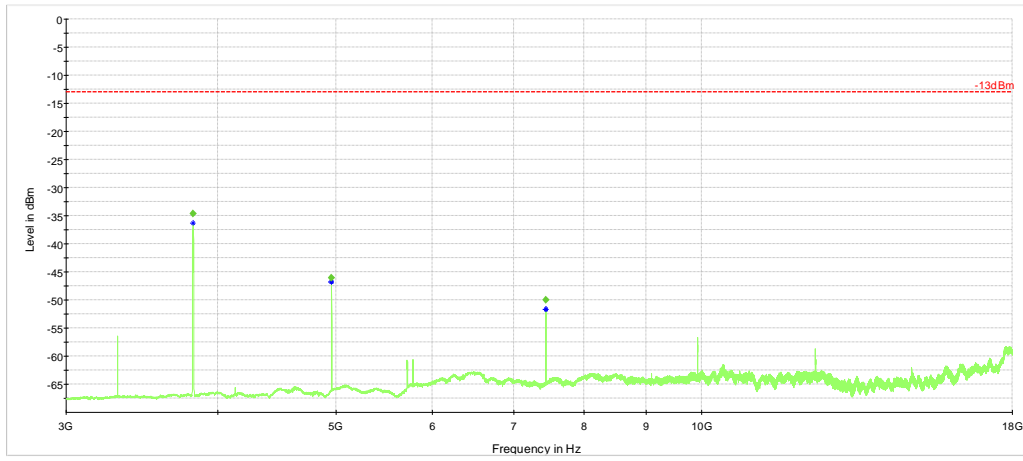


Plot # 42 Radiated Emissions: 3-18 GHz

Channel: High

Final Result

Frequency (MHz)	MaxPeak (dBm)	RMS (dBm)	Limit (dBm)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3817.000000	---	-34.68	---	---	10.0	1000.000	171.0	H	7.0	-101.7
4960.000000	---	-46.01	---	---	10.0	1000.000	163.0	V	93.0	-100.0
7439.500000	---	-50.04	---	---	10.0	1000.000	153.0	H	19.0	-95.4



8 Test setup photos

Setup photos are included in supporting file name: "EMC_CALAM_064_Setup_photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Antenna Loop 6507	Active Loop Antenna	ETS Lindgren	6507	161344	3 years	10/26/2017
Antenna Biconilog 3142E	Biconlog Antenna	EMCO	3142E	166067	3 years	06/27/2017
Antenna Horn 3115 SN 35111	Horn Antenna	EMCO	3115	35111	3 years	07/24/2015
Antenna Horn 3117	Horn Antenna	ETS Lindgren	3117-PA	215984	3 years	01/26/2018
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	07/22/2015
EMI Test Receiver	EMI Test Receiver	Rohde & Schwarz	ESU40	100251	3 years	01/31/2018
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	3 Years	06/08/2017
CMU 200	Digital Radio Comm. Tester	R&S	CMU 200	101821	2 Years	07/06/2017
CBT	Bluetooth Tester	R&S	CBT	100212	2 Years	07/09/2017
Thermometer Humidity TM325	Thermometer Humidity	Dickson	TM325	16253651	1 Year	11/02/2017
Agilent Signal Generator	Signal Generator	Agilent	E4433B	GB40050 855	N/A	N/A
Turn table	Turn table	EMCO	2075	N/A	N/A	N/A
MAPS Position Controller	MAPS Position Controller	ETS Lindgren	2092	0004- 1510	N/A	N/A
Antenna Mast	Antenna Mast	EMCO	2075	N/A	N/A	N/A
Relay Switch Unit	Relay Switch Unit	R&S	RSU	338964/0 01	N/A	N/A

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
2018-06-20	EMC_CALAM_064_FCC_22_24	Initial Version	Kevin Wang