



FCC/IC Test Report

For:
CalAmp

Model:
LMU3640LVB

Product Description:
Vehicle tracking and telemetry device

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

Per:
47 CFR: Part 27
RSS-130; RSS-139 Issue 3

REPORT #: EMC_CALAM-063-17001_FCC_27-IC_SVL_REV1
DATE: 10/10/2017



A2LA Accredited

IC recognized #
3462B-1

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

TABLE OF CONTENTS

1	ASSESSMENT.....	3
2	ADMINISTRATIVE DATA	4
2.1	IDENTIFICATION OF THE TESTING LABORATORY ISSUING THE EMC TEST REPORT	4
2.2	IDENTIFICATION OF THE CLIENT	4
2.3	IDENTIFICATION OF THE MANUFACTURER.....	4
3	EQUIPMENT UNDER TEST (EUT).....	5
3.1	EUT SPECIFICATIONS	5
3.2	EUT SAMPLE DETAILS	5
3.3	TEST SAMPLE CONFIGURATION	6
3.4	MODE OF OPERATION DETAILS	6
4	SUBJECT OF INVESTIGATION	7
4.1	DATES OF TESTING:	7
4.2	MEASUREMENT UNCERTAINTY	7
4.3	ENVIRONMENTAL CONDITIONS DURING TESTING:	7
5	MEASUREMENT PROCEDURES	8
5.1	RADIATED MEASUREMENT.....	8
5.2	SAMPLE CALCULATIONS FOR FIELD STRENGTH MEASUREMENTS	10
6	MEASUREMENT RESULTS SUMMARY	11
6.1	FCC 27, RSS-130, RSS-139:	11
7	TEST RESULT DATA	12
7.1	RADIATED SPURIOUS EMISSIONS	12
8	TEST SETUP PHOTOS	31
9	TEST EQUIPMENT AND ANCILLARIES USED FOR TESTING	31
10	REVISION HISTORY	32

1 Assessment

The following device as further described in section 3 of this report was evaluated against selected applicable criteria specified in the Code of Federal Regulations Title 47 parts 27 and Industry Canada Radio Standard Specifications RSS: 130, and 139 Issue 3.

No deficiencies were ascertained.

Company Name	Product Description	Model
CalAmp	Location Monitoring Unit	LMU3640LVB

Responsible for Testing Laboratory:

Peter Nevermann

10/10/2017 Compliance (Director Radio Communications and EMC)

Date	Section	Name	Signature
------	---------	------	-----------

Responsible for the Report:

Issa Ghanma

10/10/2017 Compliance (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
Director Radio Com. and EMC:	Peter Nevermann
Responsible Project Leader:	Issa Ghanma

2.2 Identification of the Client

Applicant's Name:	CalAmp
Street Address:	2177 Salk Ave, Suite 200
City/Zip Code	Carlsbad, CA 90228
Country	USA
Contact Person:	Imad Rizk
Phone No.	760 814 9697
e-mail:	lrizk@calamp.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		LMU3640LVB			
HW Version		REV A			
SW Version		6.1			
FCC-ID		APV-3640LVB			
IC ID		5843A-3640LVB			
FWIN:		N/A			
HVIN:		LMU3640LVB			
PMN:		LMU-3640			
Product Description		Vehicle tracking and telemetry device			
Module Information		Module: LE910-SVL			
Mode	LTE	Band	UL Frequency (MHz)	DL Frequency (MHz)	Modulation
		4	1710.7 ~ 1754.3	2110.7 ~ 2154.3	QPSK, 16QAM
		13	777 ~ 787	746 ~ 756	QPSK, 16QAM
BT/EDR		2.4GHz 8DPSK			
Max. documented antenna gain		EIRP measurements from OTA testing used because antenna gain is unknown. LTE Band 4: 4.99 dBi LTE Band 13: 3.38dBi			
Max. documented average conducted output power		LTE Band 4: 22.888 dBm LTE Band 13: 22.315 dBm			
Operating Voltage Range		8 VDC – 32 VDC			
Operating Temperature Range		-10 ⁰ to 60 ⁰ C			
Other Radios included in the device		BT/EDR, BLE			
Sample Revision		☐ Prototype Unit; ☒ Production Unit; ☐ Pre-Production			
EUT Dimensions		144X54X30mm			
EUT Diameter		☒ < 60 cm ☐ Other _____			

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Comments
1	00041	REV A	6.1	Radiated Measurements

3.3 Test Sample Configuration

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

3.4 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	Cellular and Bluetooth Co-location	Cellular was tested on Low, Mid and High Channels Co-Transmitting with Bluetooth Mid 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-3640LVB IC ID: 5843A-3640LVB.

According to the guidelines from FCC KDB 996369 for the product under evaluation, and the pre-certified module to be integrated (Telit LE910-SVL) 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 conducted, per Code of Federal Regulations Title 47 parts 27 and Industry Canada Radio Standard Specifications RSS: 130 and 139 Issue 3.

The module test data can be obtained under the FCC Filing ID: RI7LE910SVL / IC ID: 5131A-LE910SVL.

4.1 Dates of Testing:

8/23/2017 – 9/22/2017

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

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%

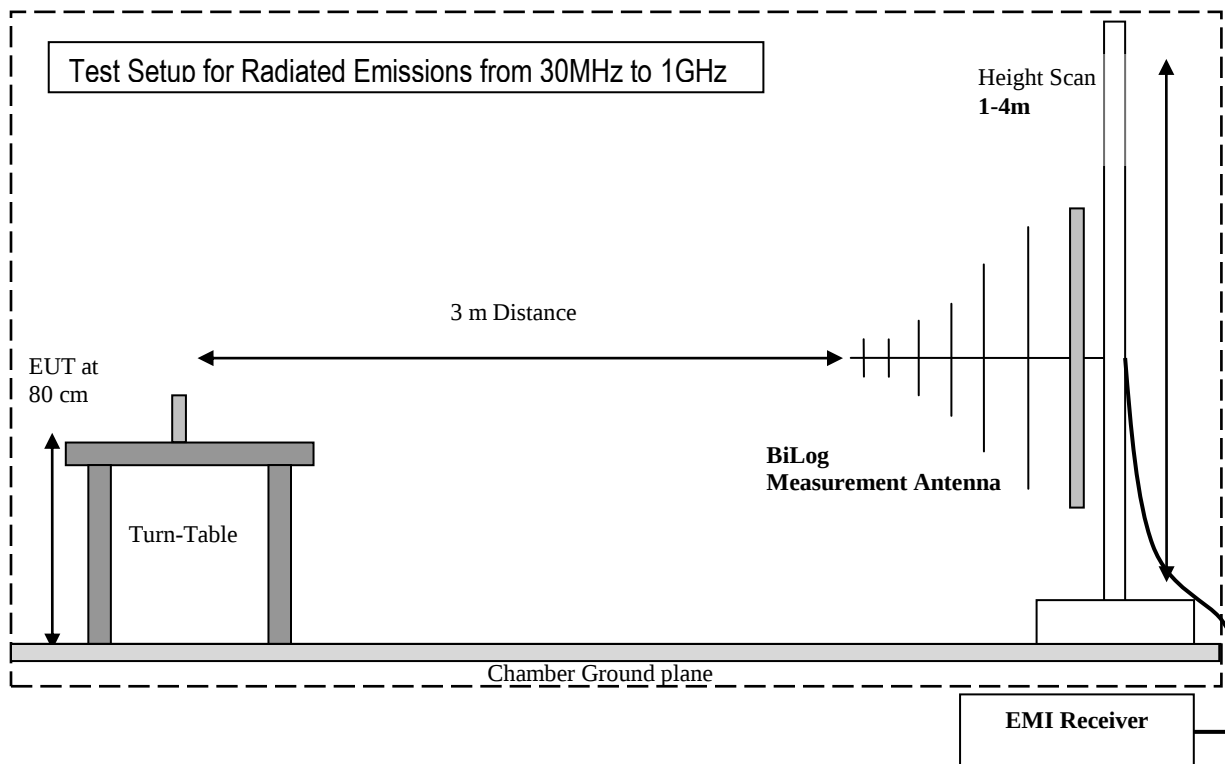
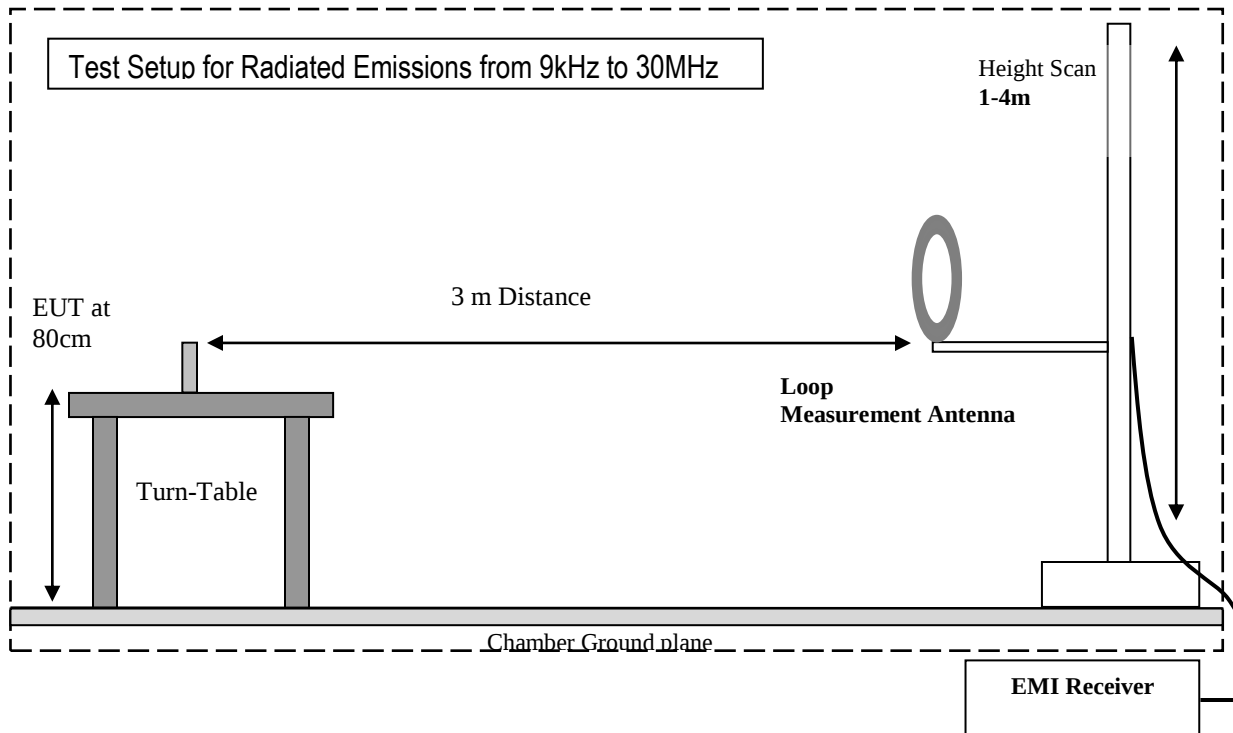
Deviating test conditions are indicated at individual test description where applicable.

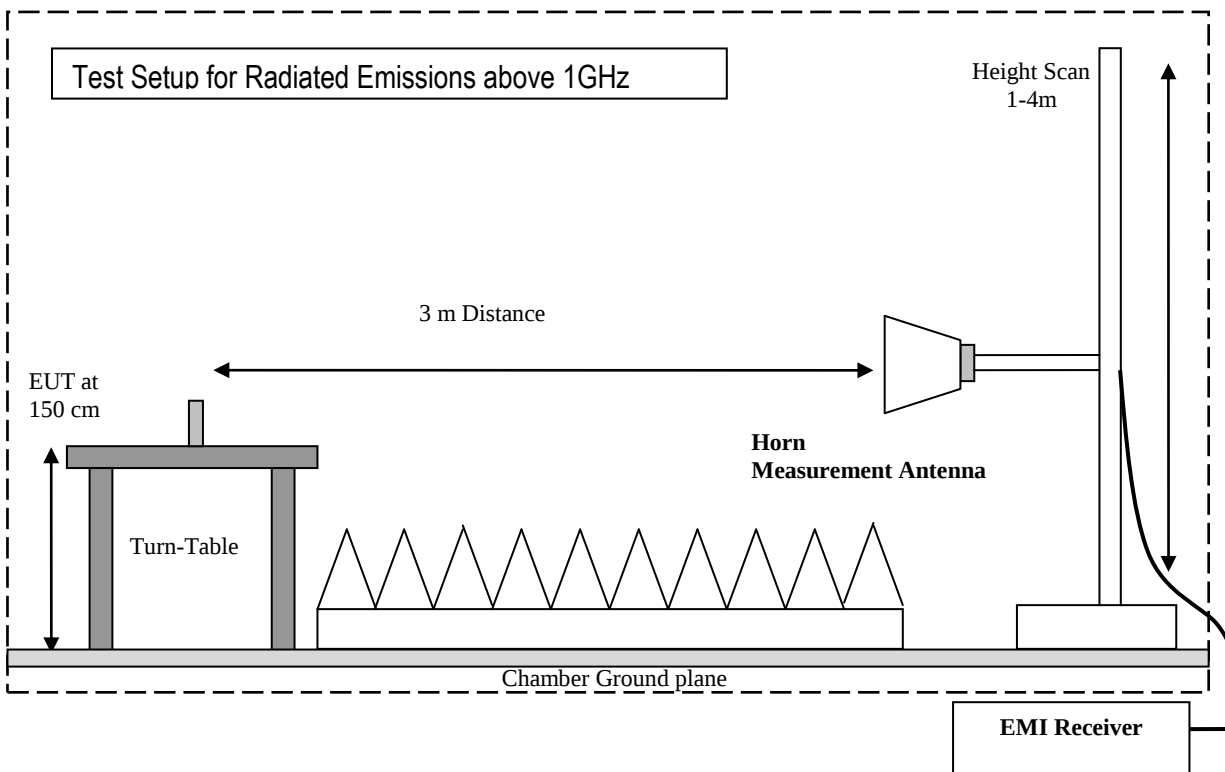
5 Measurement Procedures

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 TIA-603C 2004 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:

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

Example:

Frequency (MHz)	Measured SA (dB 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 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	UMTS LTE	☐	☐	☐	■	Complies Note 2
§2.1055; §27.54	Frequency Stability	Nominal	UMTS LTE	☐	☐	☐	■	Complies Note 2
§2.1049; §27.53	Occupied Bandwidth	Nominal	UMTS LTE	☐	☐	☐	■	Complies Note 2
§2.1051; §27.53	Band Edge Compliance	Nominal	UMTS LTE	☐	☐	☐	■	Complies Note 2
§2.1051; §27.53	Conducted Spurious Emissions	Nominal	UMTS LTE	☐	☐	☐	■	Complies Note 2
§2.1053; §27.53(c); §27.53(h); RSS-130 Issue 1-4.6; RSS-139 Issue 3-6.6;	Radiated Spurious Emissions	Nominal	UMTS LTE	■	☐	☐	☐	Complies

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

Note 2: Leveraged from module certification LE910-SVL FCC ID: RI7LE910SVL / IC ID: 5131A-LE910SVL.

7 Test Result Data

7.1 Radiated Spurious Emissions

7.1.1 Measurement according to FCC: CFR 47 Part 2.1053; CFR Part 27.53, utilizing KDB 971168 D01 Power Meas License Digital Systems v02r02, and according to TIA-603C 2004- 2.2.12 Add Canada rules

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

7.1.2 Limits:

- Part 27.53 (c) and Part 27.53 (h)
- RSS-130-4.6 and 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 $43 + 10 \log(P)$ dB = (-13dBm)

7.1.3 Test conditions and setup:

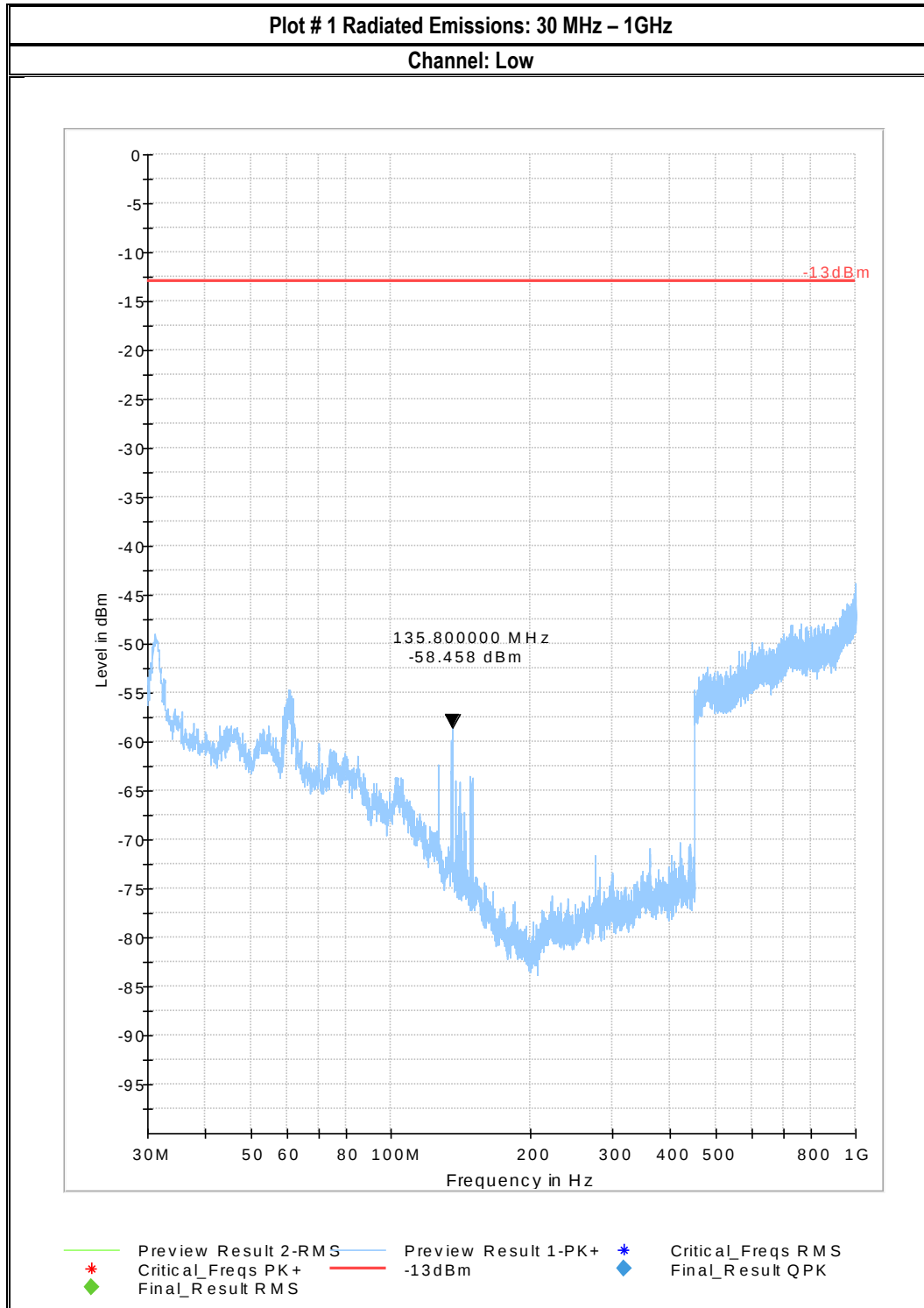
Ambient Temperature (C)	EUT Set-Up #	EUT operating mode	Power Input
22	1	LTE,FDD co-transmitting with Bluetooth	12 VDC

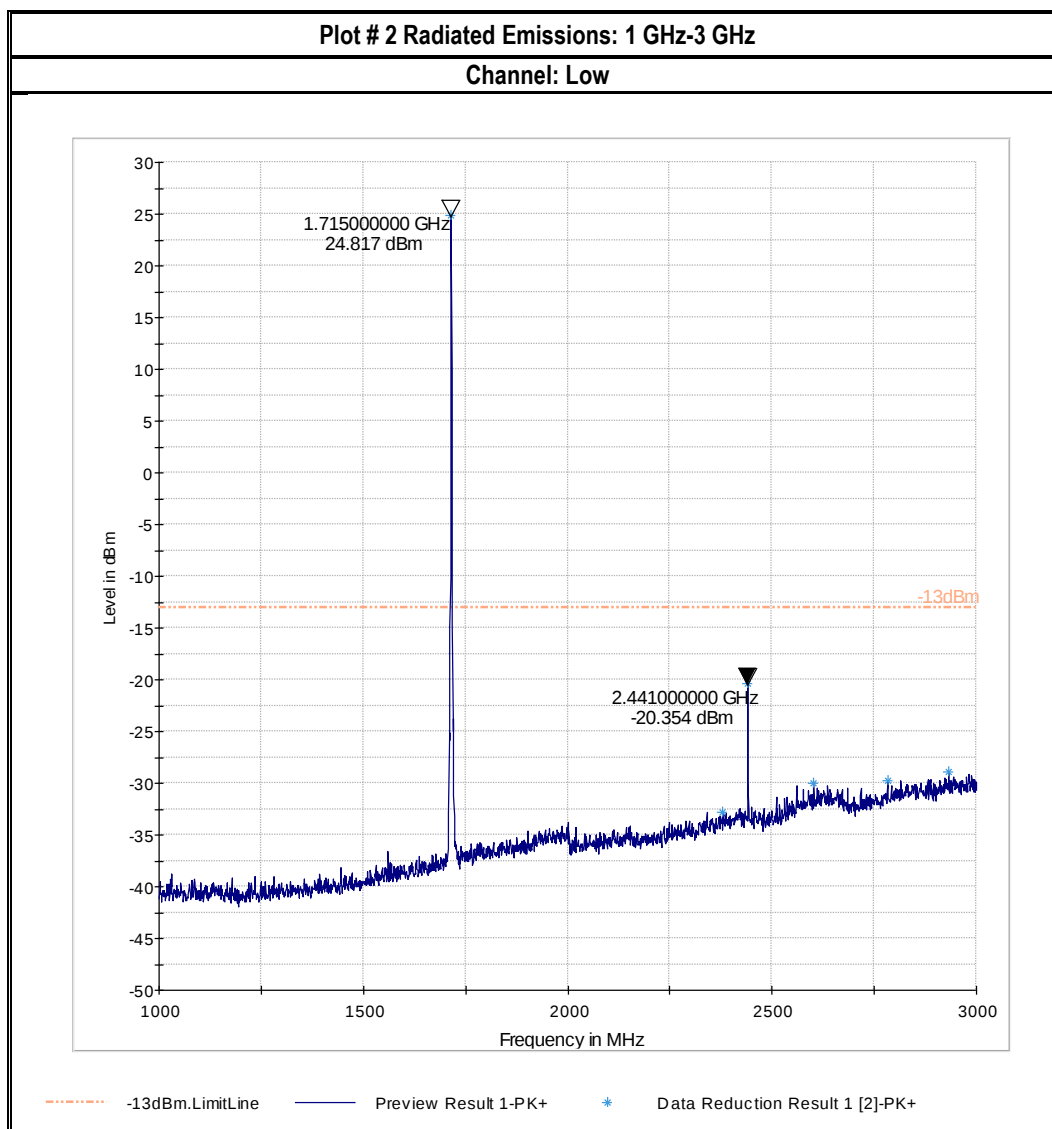
7.1.4 Measurement result:

Plot #	Cellular Channel	BT Channel	EUT operating mode	Scan Frequency	Limit (dBm)	Result
1 - 3	Low	Mid	LTE 4	30 MHz – 18 GHz	-13	Pass
4 - 7	Mid	Mid	LTE 4	9 kHz – 18 GHz	-13	Pass
8 - 10	High	Mid	LTE 4	30 MHz – 18 GHz	-13	Pass
11 - 12	Low	Mid	LTE 13	30 MHz – 9 GHz	-13	Pass
13 - 15	Mid	Mid	LTE 13	9 kHz – 9 GHz	-13	Pass
16 – 17	High	Mid	LTE 13	30 MHz – 9 GHz	-13	Pass

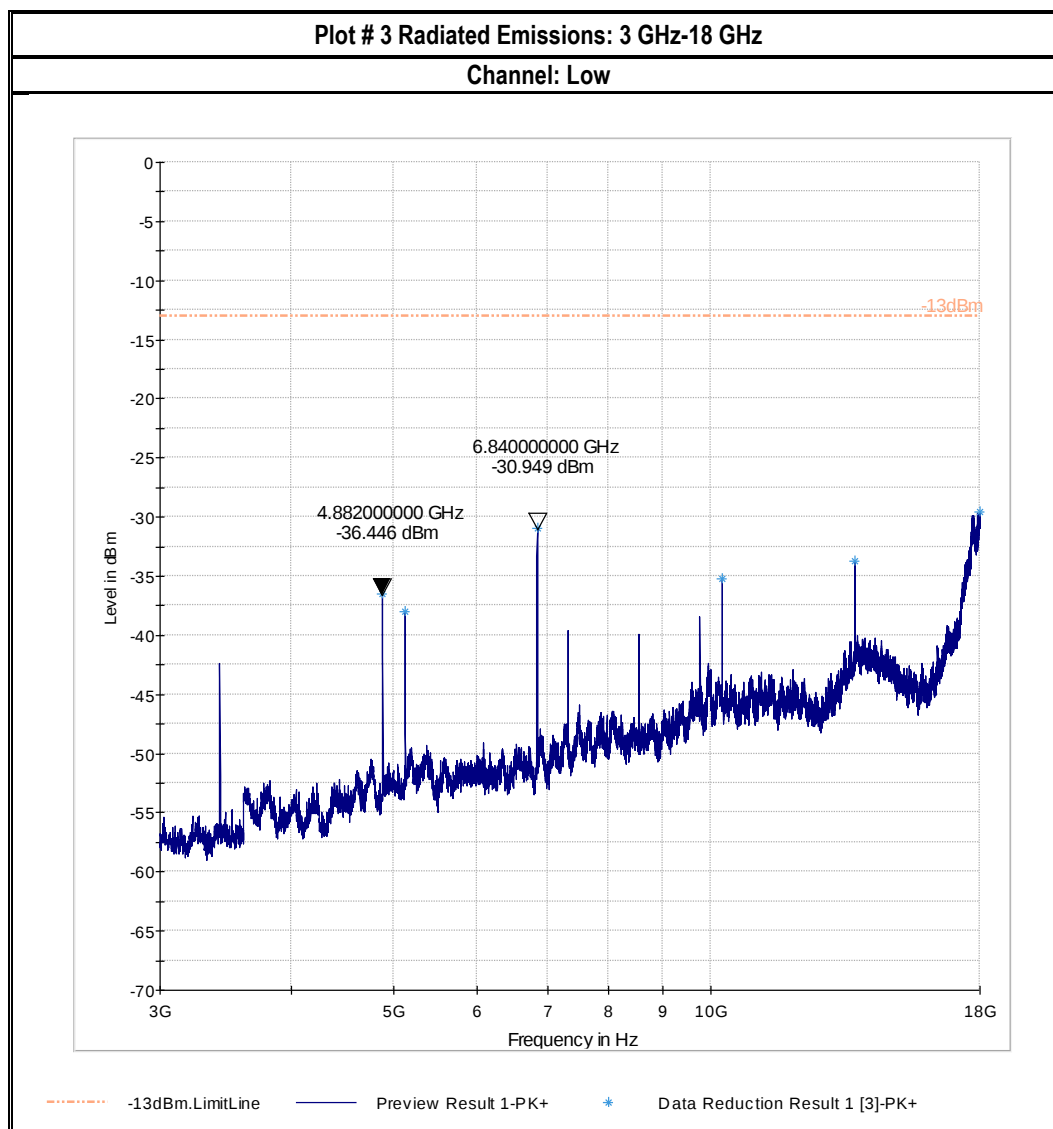
7.1.5 Measurement Plots:

LTE 4



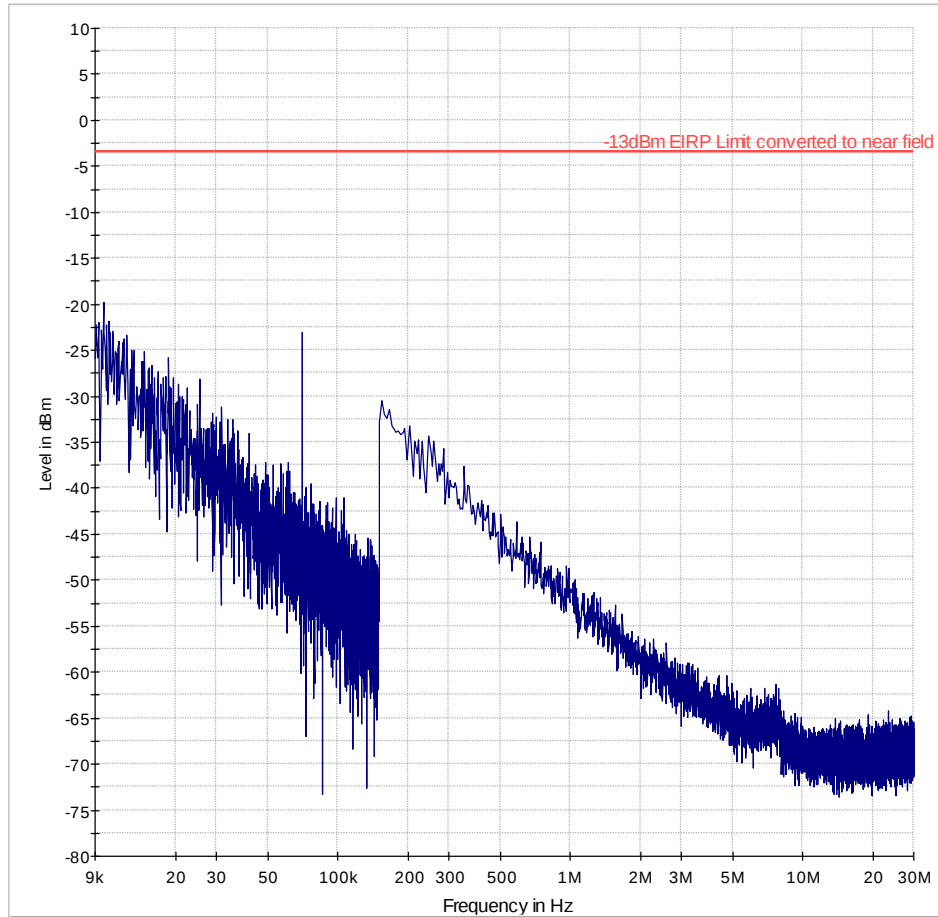


Note: The peak signal above is the transmit channel.



Plot # 4 Radiated Emissions: 9 kHz-30 MHz

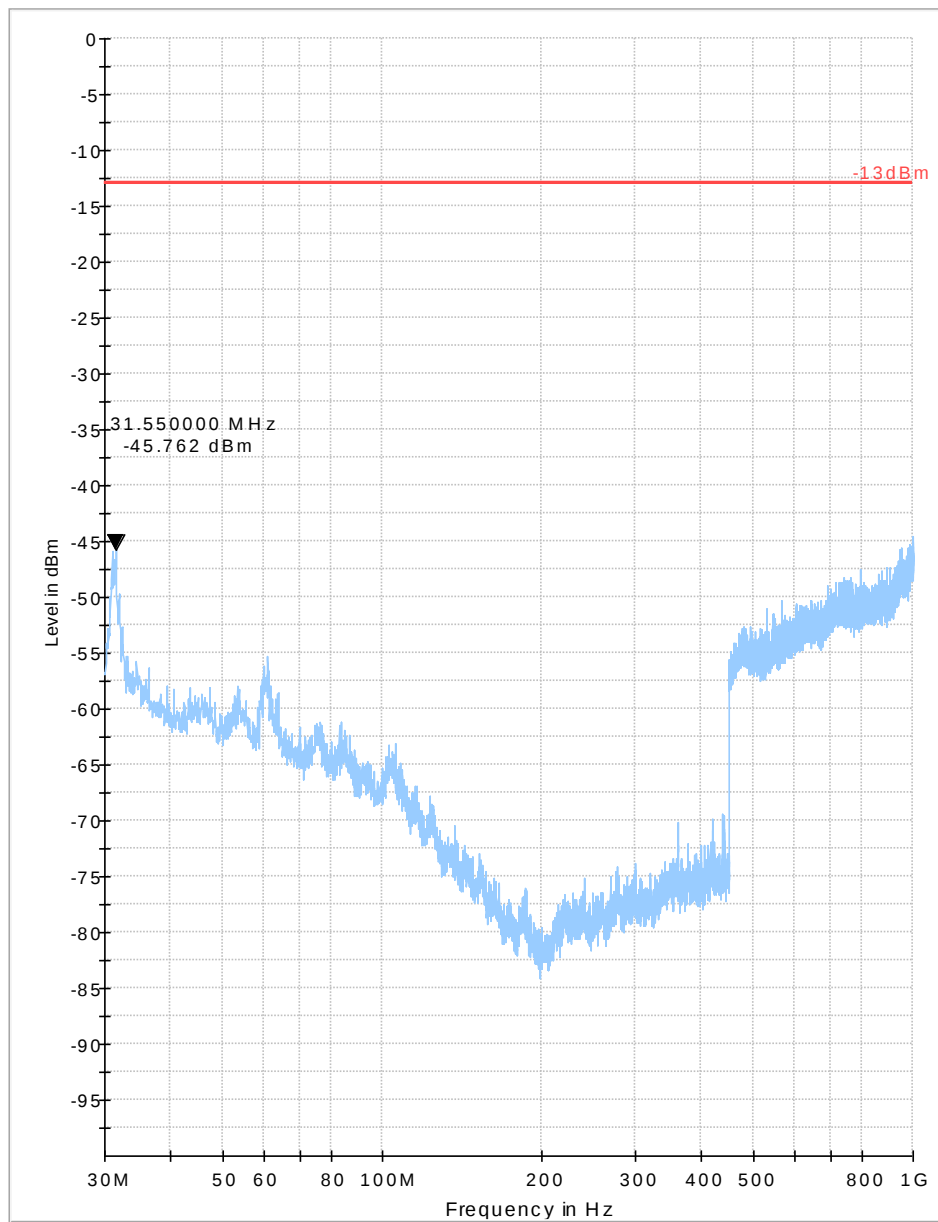
Channel: Mid



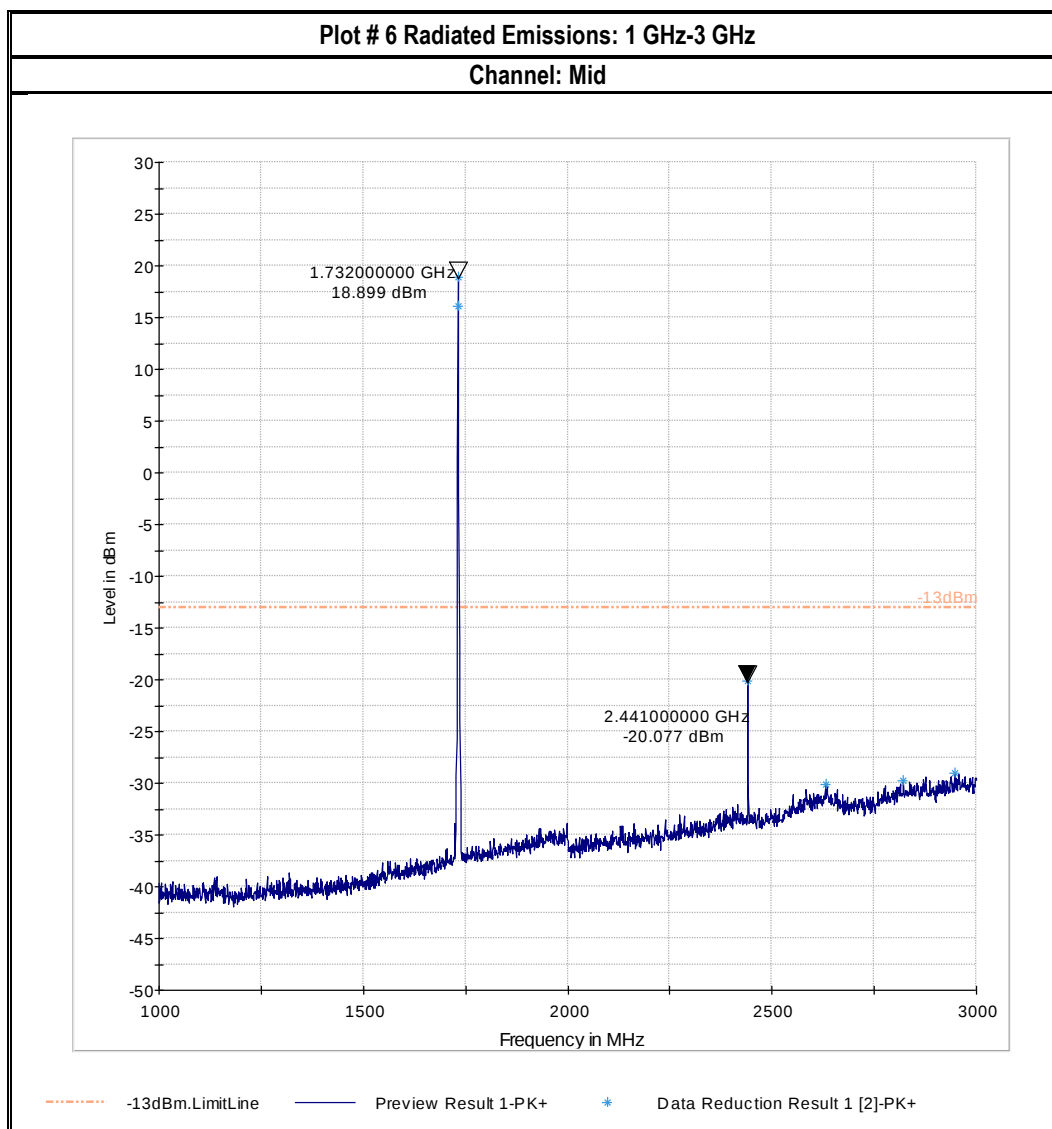
— -13dBm EIRP Limit converted to near field — Preview Result 1-PK+

Plot # 5 Radiated Emissions: 30 MHz – 1GHz

Channel: Mid



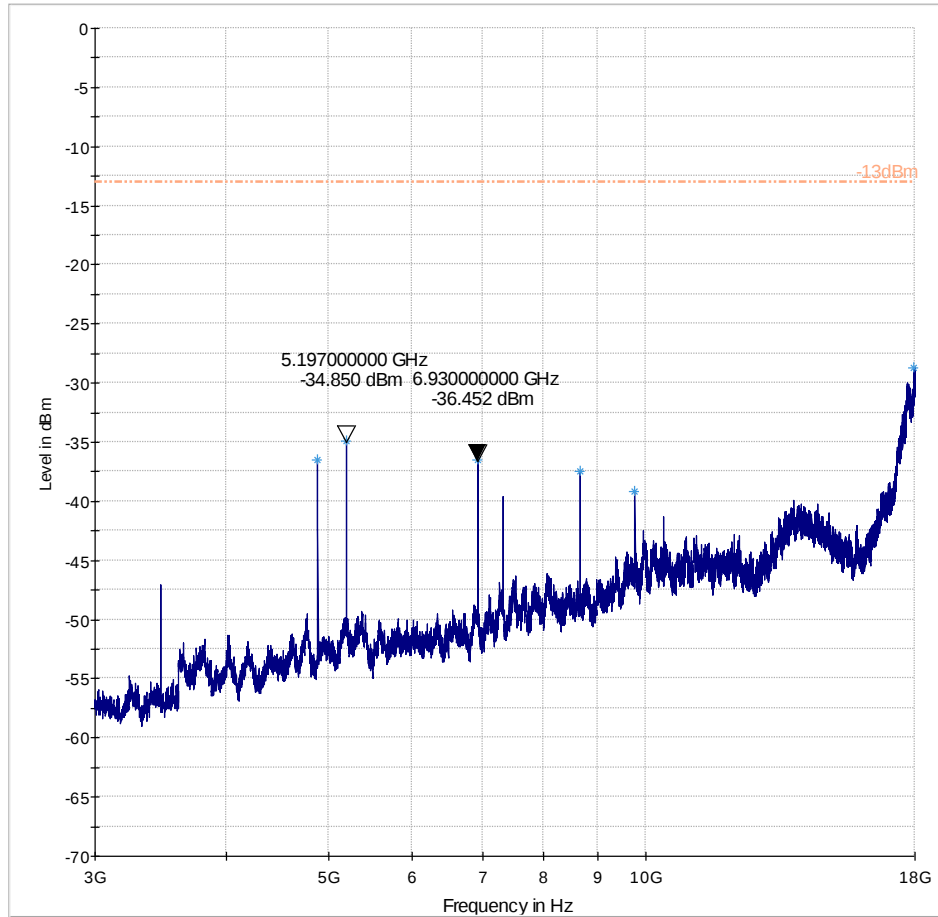
Preview Result 2-RMS Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ -13dBm * Final_Result QPK
◆ Final_Result RMS ◆



Note: The peak signal above is the transmit channel.

Plot # 7 Radiated Emissions: 3 GHz – 18GHz

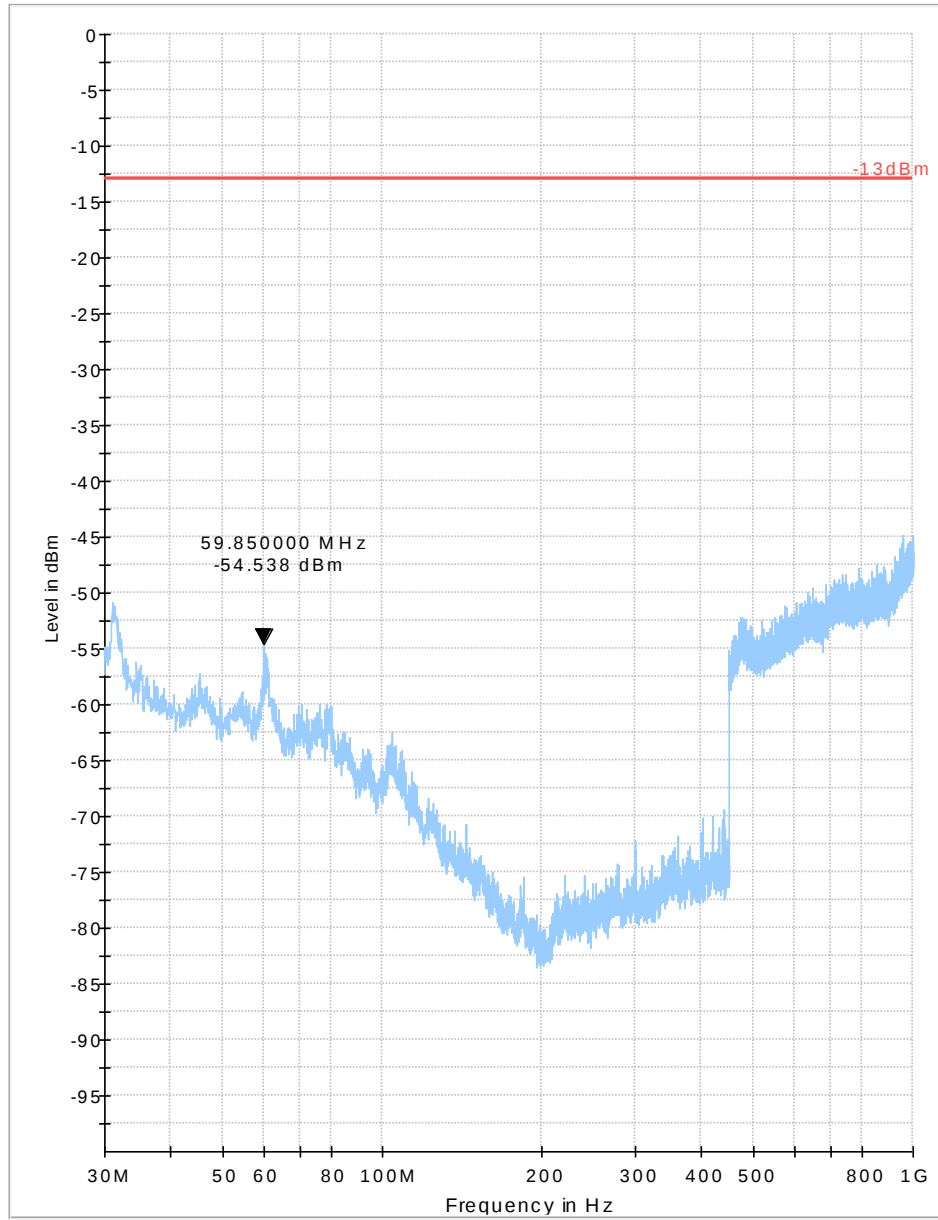
Channel: Mid



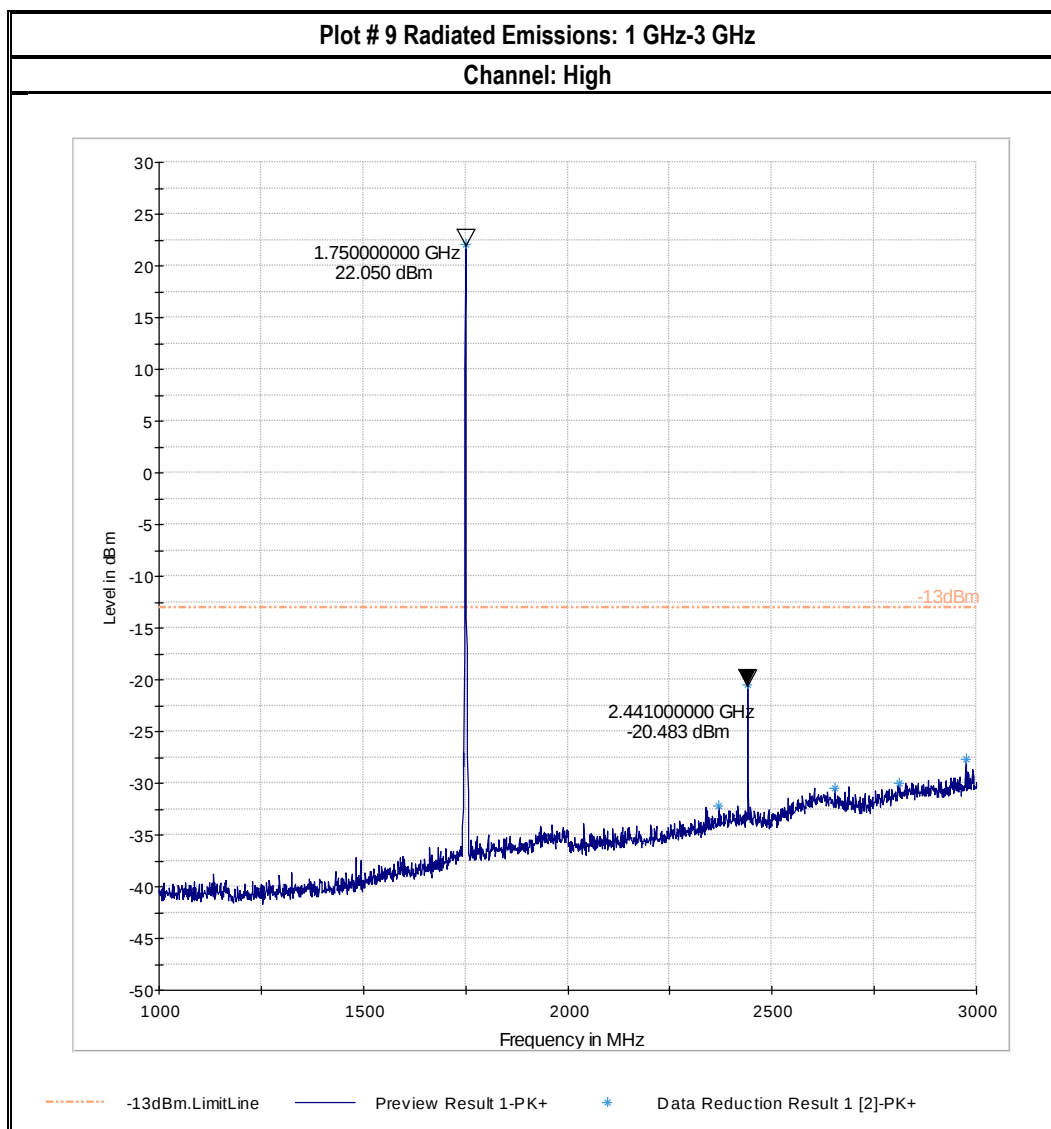
--- -13dBm.LimitLine — Preview Result 1-PK+ * Data Reduction Result 1 [3]-PK+

Plot # 8 Radiated Emissions: 30 MHz – 1GHz

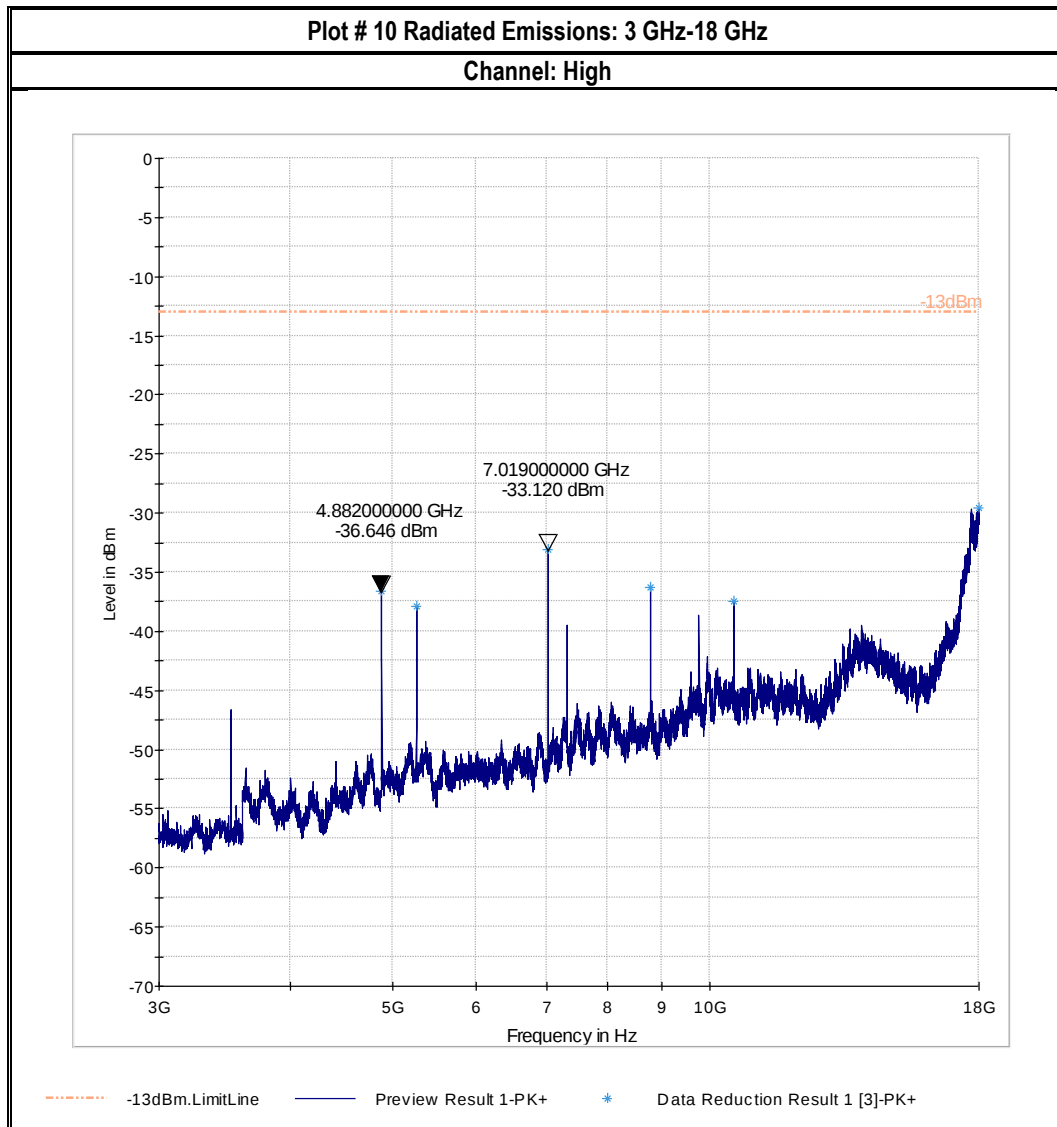
Channel: High



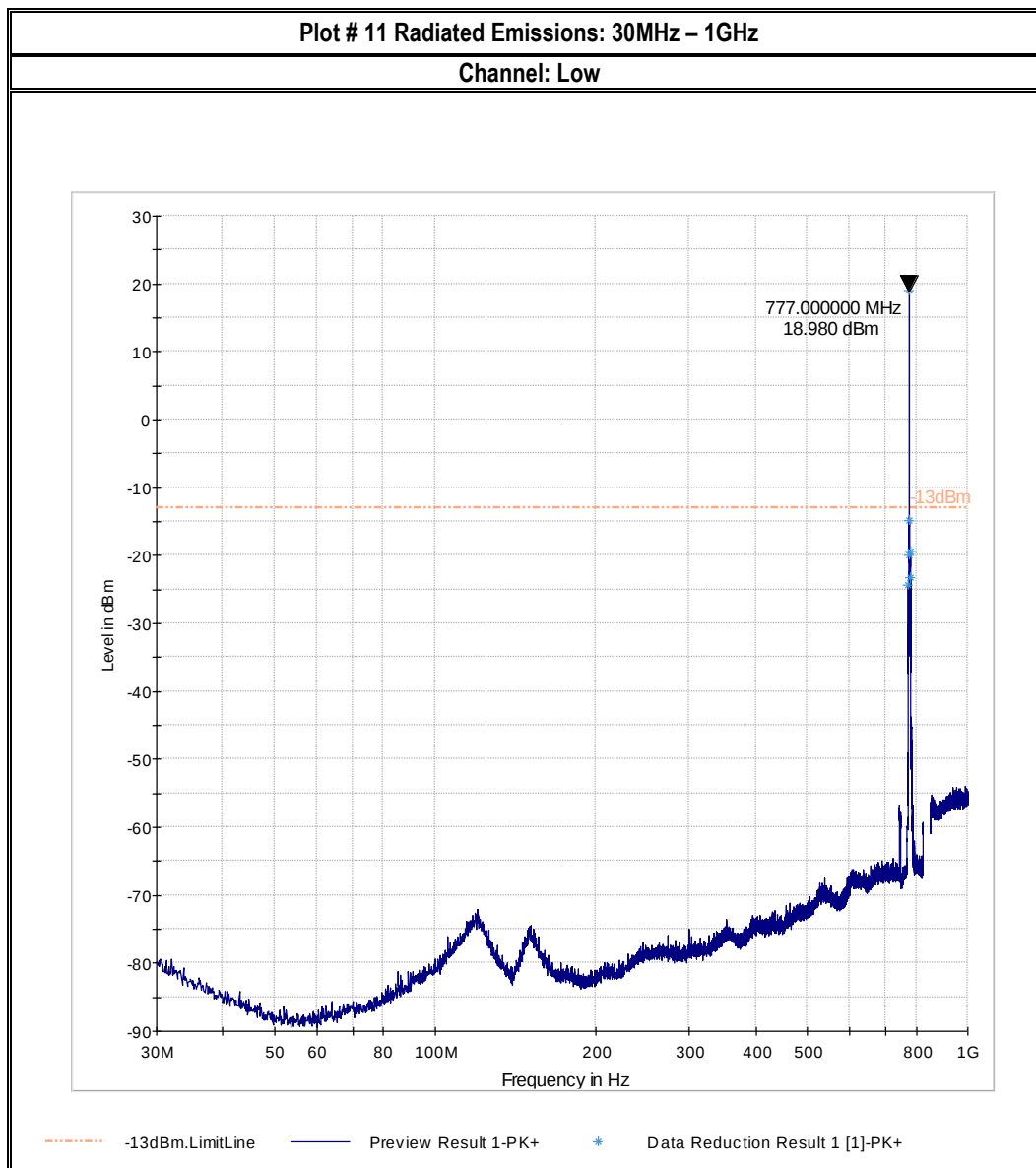
Preview Result 2-RMS Preview Result 1-PK+ * Critical_Freqs RMS
* Critical_Freqs PK+ -13dBm ♦ Final_Result QPK
♦ Final_Result RMS



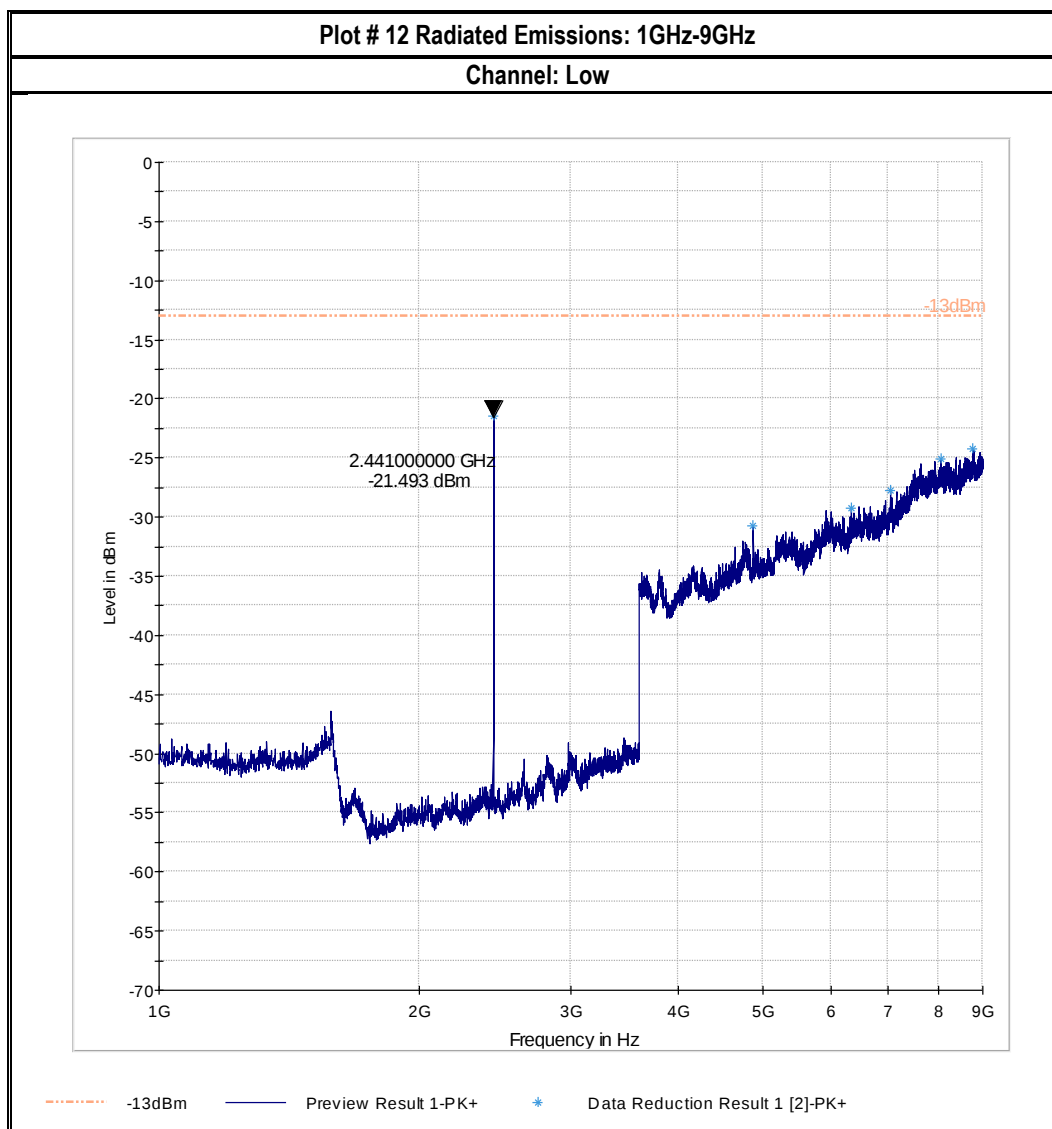
Note: The peak signal above is the transmit channel.



LTE 13

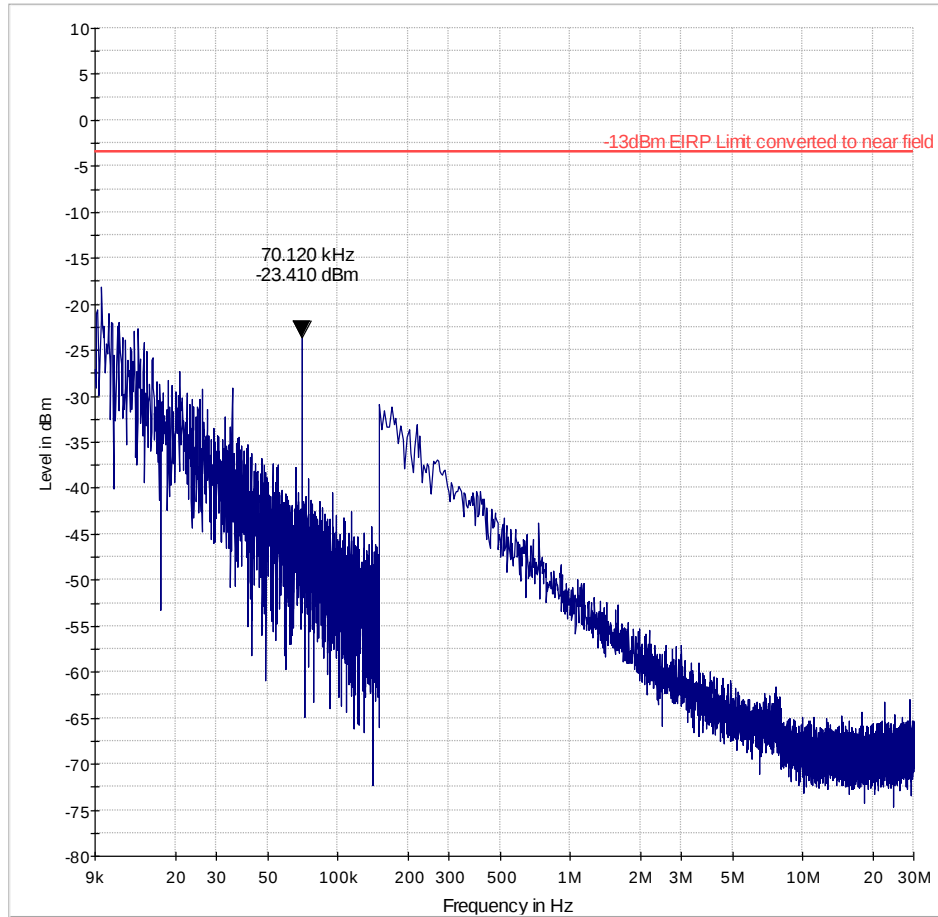


Note: The peak signal above is the transmit channel.

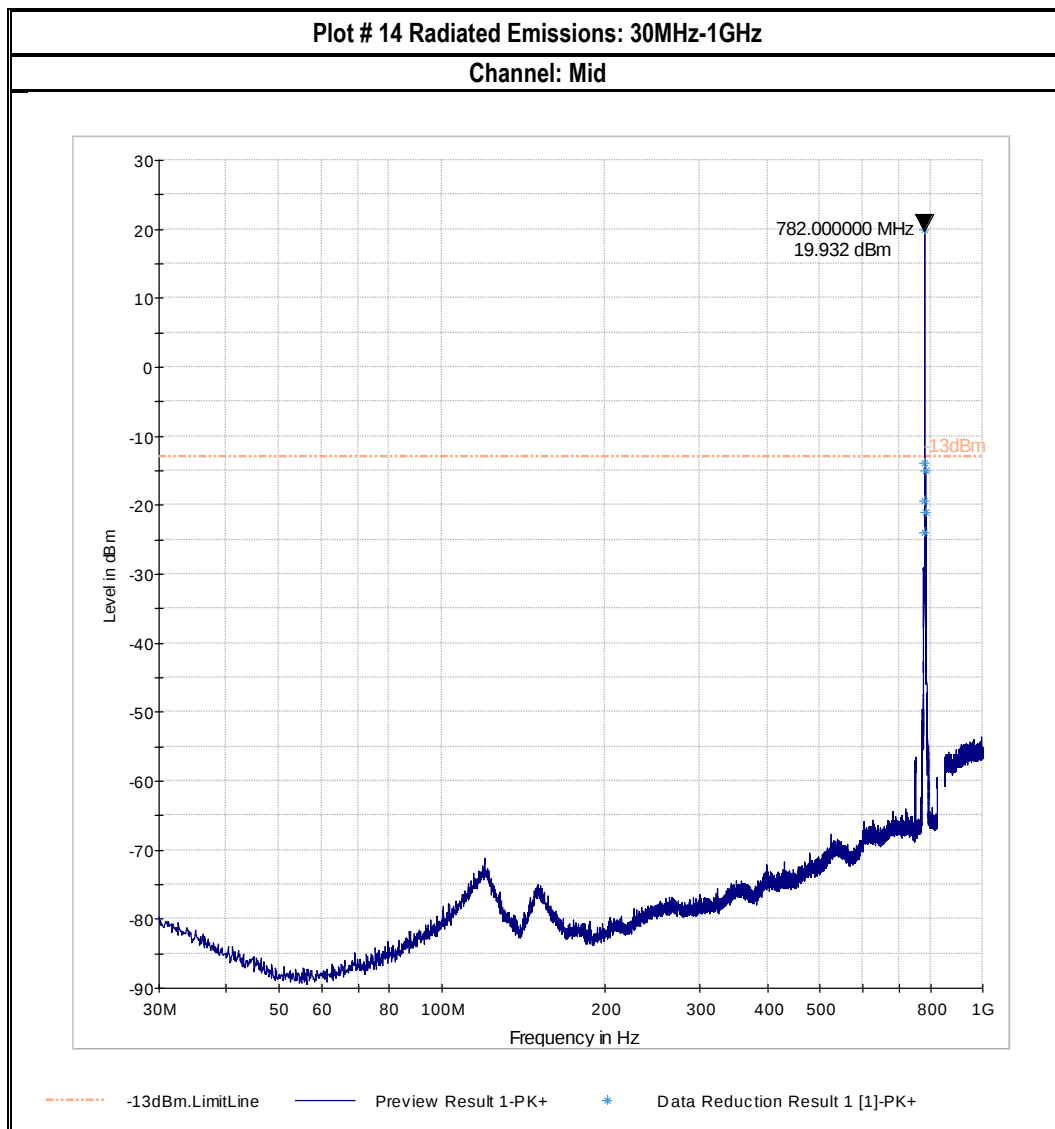


Plot # 13 Radiated Emissions: 9KHz-30MHz

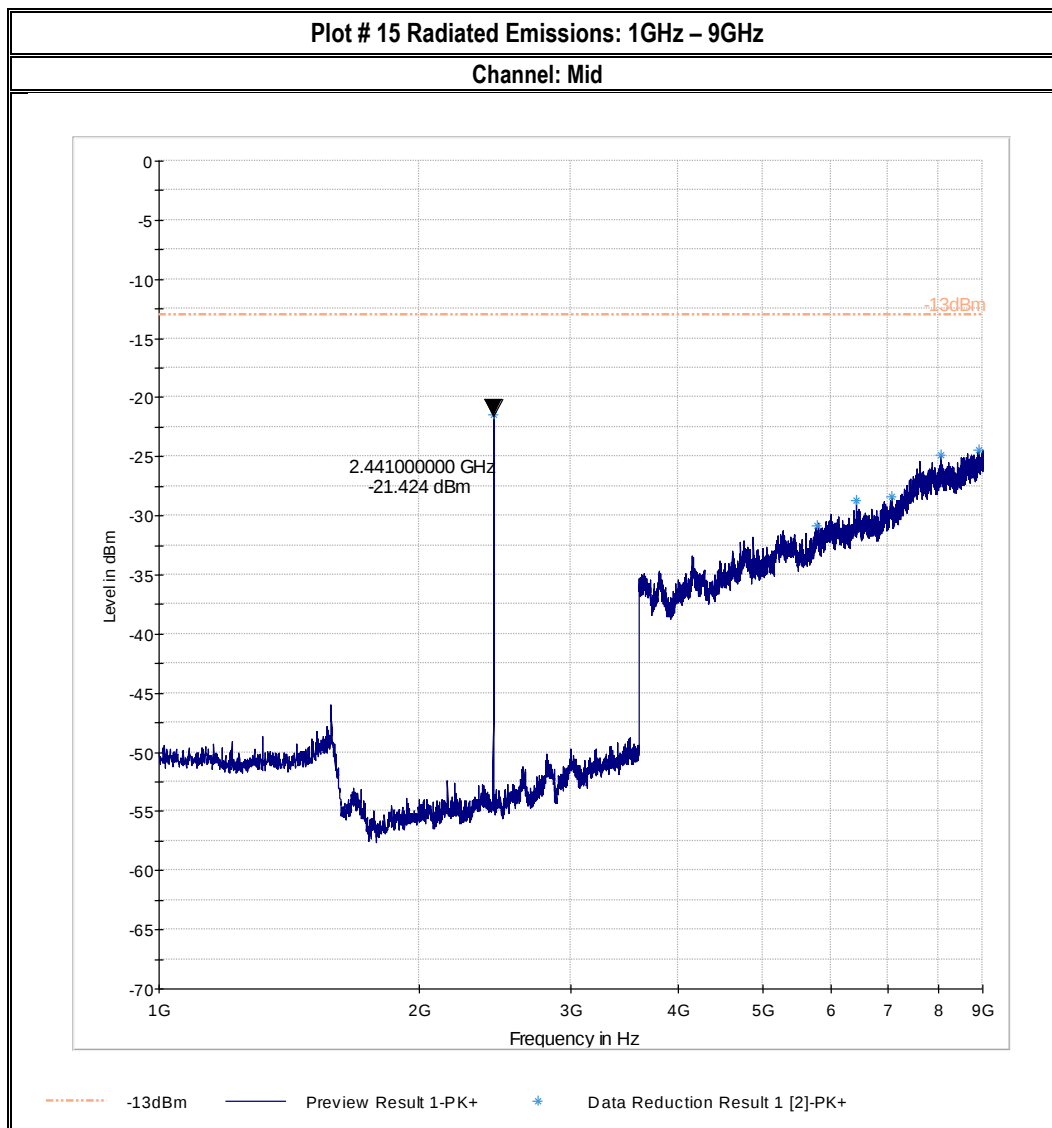
Channel: Mid

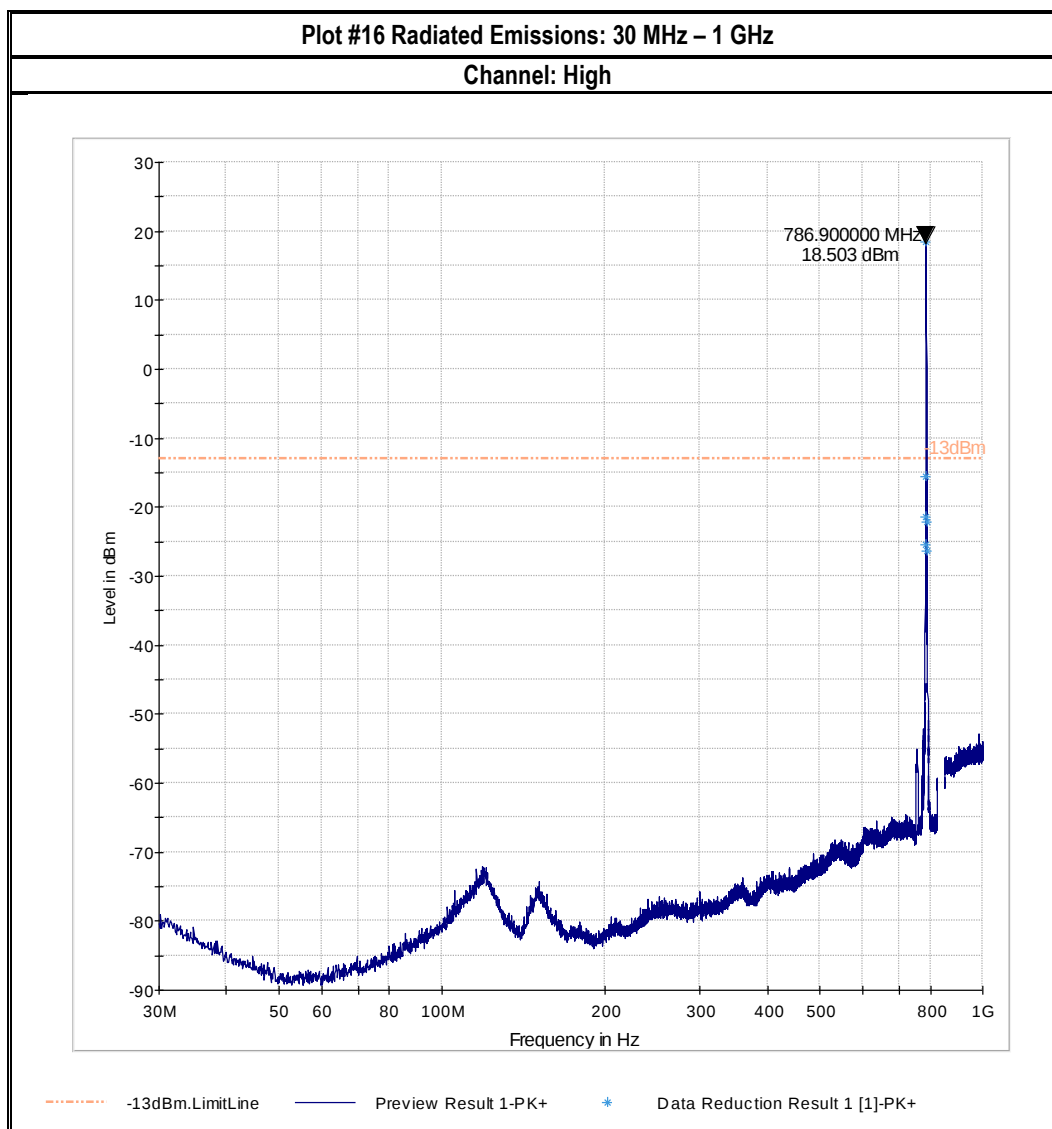


-13dBm EIRP Limit converted to near field Preview Result 1-PK+

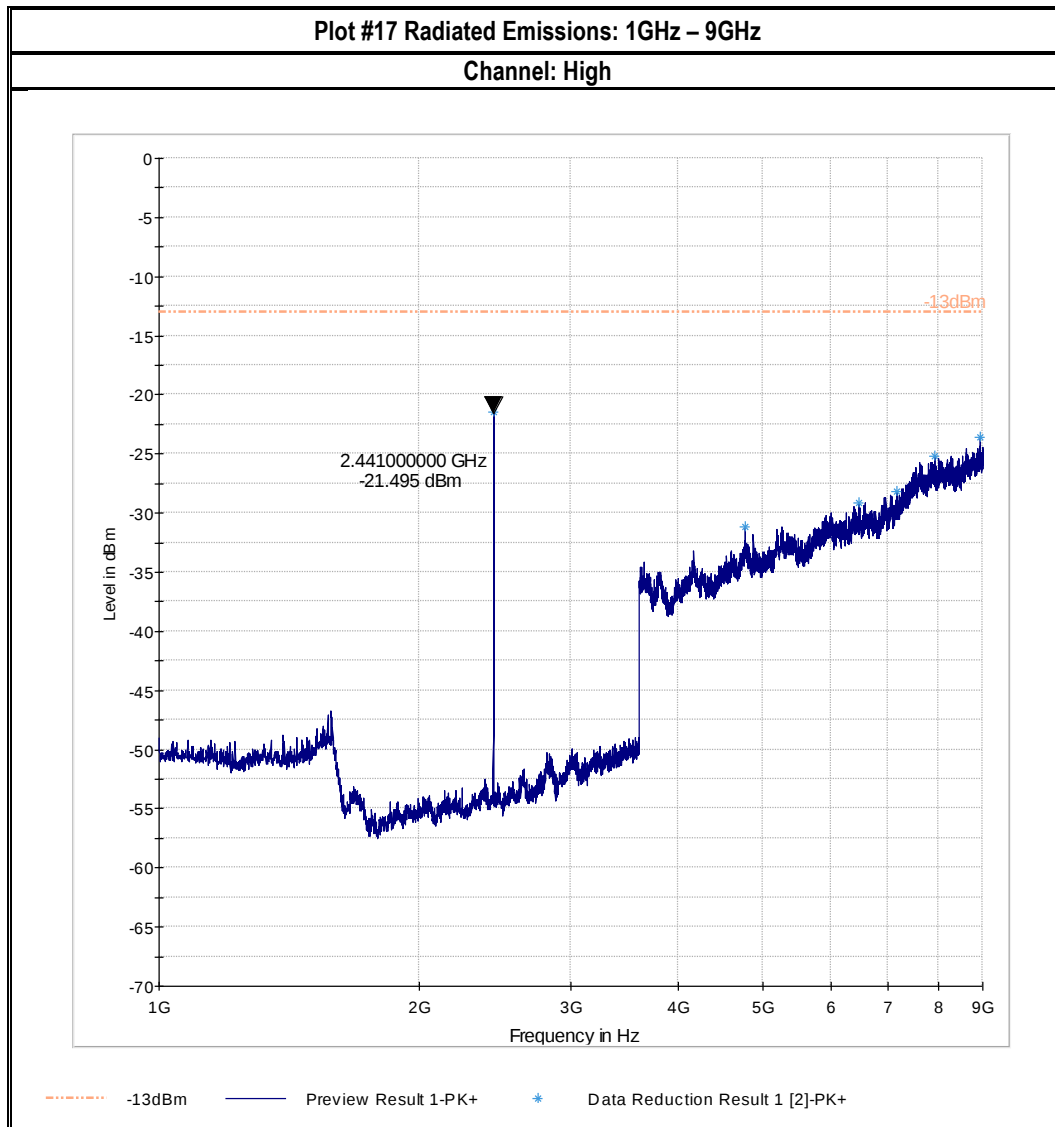


Note: The peak signal above is the transmit channel.





Note: The peak signal above is the transmit channel.



8 Test setup photos

Setup photos are included in supporting file name: "EMC_CALAM-063-17001_FCC_IC_Setup_Photos.pdf"

9 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
Biconilog Antenna 3142E	Biconilog Antenna	EMCO	3142E	00166067	3 years	6/22/2017
Biconical Antenna SAS-545	Biconical Antenna	A.H.System INC.	SAS-545	427	1 Year	8/21/2017
Active Loop 6507	Loop Antenna	ETS Lindgren	6507	00161344	3 years	2/13/2015
Antenna Horn 3115	Horn Antenna	EMCO	3115	35111	3 years	7/24/2015
Antenna Horn 3116	Horn Antenna	ETS Lindgren	3116	70497	3 years	7/22/2015
FSV. Signal Analyzer	Signal Analyzer	R&S	FSV 40	1321.3008K39-101022-ih	2 Years	7/5/2017
Digital Barometer	Compact Digital Barometer	Control Company	35519-055	91119547	1 Years	6/5/2017
CBT. Bluetooth Tester	Bluetooth Tester	R&S	CBT	100212	2 Years	7/9/2017
ESU . EMI Test Receiver	Test Receiver	R&S	ESU	1302.6005K40-100251-KB	2 years	7/10/2017
Thermometer Humidity TM320	Thermometer Humidity	Dickson	AY1072	0528	1 Year	11/02/2016

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 indated "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
10/05/2017	EMC_CALAM-063-17001_FCC_27-IC_SVL	Initial Version	Issa Ghanma
10/10/2017	EMC_CALAM-063-17001_FCC_27-IC_SVL_REV1	Section 3.1 Add the Max.Documented antenna gain for each band.	Issa Ghanma