FCC / ISED Test Report

FOR:
NetraDyne, Inc.

Model Name:
DRI-128

Product Description:
Intelligent Driving Monitoring System Smart Connected Dash Cam

FCC ID: 2AM8R-DRI128
IC ID: 23098-DRI128

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)
RSS-247 Issue 2 (DTSs) & RSS-Gen Issue 4

REPORT #: EMC_NETRA_002_17001_15.247_ISED_BT_DTS

DATE: 01/25/2018

A2LA Accredited

IC recognized #
3462B-2

***CETECOM* Inc.**
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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 for radiated spurious emissions in simultaneous transmission of unlicensed and cellular radios according to criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

Company	Description	Model #
NetraDyne, Inc.	Intelligent Driving Monitoring System Connected Dash Cam	DRI-128

Responsible for Testing Laboratory:

Date	Section	Name	Signature
01/25/2018	Compliance	James Donnellan (Lab Manager)	

Responsible for the Report:

Date	Section	Name	Signature
01/25/2018	Compliance	Issa Ghanma (EMC Engineer)	Digitally signed by ISSA GHANMA DN: cn=ISSA GHANMA, c=US, o=CETECOM Inc., email=issa.ghanma@cetecom.com Date: 2018.01.25 12:18:53 -08'00'

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

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

2.2 Identification of the Client

Applicant's Name:	NetraDyne, Inc.
Street Address:	4350 Executive DR., suite 150
City/Zip Code	San Diego, CA 92127
Country	USA
Contact Person:	Sandeep Pandya
Phone No.	8582455169
e-mail:	Sandeep.pandya@netradyne.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	DRI-128
HW Version	RevD
SW Version	0.2.1
FCC-ID	2AM8R-DRI128
IC-ID:	23098-DRI128
FWIN:	0.2.1
HVIN:	RevD
PMN:	Driver i
Product Description	Intelligent Driving Monitoring System Smart Connected Dash Cam
Module Information	
Module Name:	Jetson TX-1
Module Number:	900-82180-0001-000
FCC ID:	VOB-P2180
IC ID:	7361A-P2180
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 channels
Type(s) of Modulation:	Bluetooth low energy version 4.0, GFSK modulation.
Modes of Operation:	Bluetooth LE in both advertising and connected mode of operation
Max. declared output Powers form modular grant:	Conducted Power 0.006 Watts
Antenna Information as declared:	FXP831 Patch Antenna, Internal Frequency: 2.4 ~ 2.5GHz, Peak Gain: 2.5dBi(Free space) 3.0dBi(Plastic)
Power Supply/ Rated Operating Voltage Range:	Low 10.5 VDC, Nominal 12 VDC, High 14.5 VDC
Operating Temperature Range	-20^{0} to 55^{0} C
Other Radios included in the device:	Cellular, GPS, Bluetooth Classic, WLAN (Wi-Fi)2.4 and 5GHz.

Sample Revision	☐Prototype Unit; ■Production Unit; ☐Pre-Production
EUT Dimensions	20X8X8cm
Weight	300 grams
EUT Diameter	■ < 60 cm ☐ Other _____

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes/Comments
1	16300054	RevD	0.2.1	Radiated Emissions

3.3 Accessory Equipment (AE) details

AE #	Comments
1	Superstar 12V Car Battery

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	EUT#1 + AE#1	Radiated Measurement

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	BLE Co-Transmission	Tera Term tool used to configure the EUT to the highest power and duty cycle. The internal antenna was connected.

3.6 Justification for Worst Case Mode of Operation

During the testing process the EUT was tested with transmitter sets on low, mid and high channels, and 98% duty cycle Co-Transmit with LTE band 2 (The highest conducted output power of Cellular radio from modular grant).

For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 2 of ISED Canada.

This test report is to support a request for new equipment authorization under the:

- FCC ID: 2AM8R-DRI128
- IC ID: 23098-DRI128

The conducted module test data can be obtained under the FCC Filing ID: VOB-P2180 / IC ID: 7361A-P2180.

Testing procedures are based on 558074 D01 DTS Meas Guidance v04 – "GUIDANCE FOR PERFORMING COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEMS (DTS) OPERATING UNDER SECTION 15.247" - April 5, 2017, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

5 Measurement Results Summary

Test Specification	Test Case	Temperature and Voltage Conditions	Mode	Pass	NA	NP	Result
§15.247(a)(2) RSS-247 5.2(a)	Emission Bandwidth	Nominal	-	☐	☐	■	Note 1 Note 3 Complies
§15.247(e) RSS-247 5.2(b)	Power Spectral Density	Nominal	-	☐	☐	■	Note 1 Note 3 Complies
§15.247(b)(3) RSS-247 5.4(d)	Maximum Conducted Output Power and EIRP	Nominal	-	☐	☐	■	Note 1 Note 3 Complies
§15.247(d) RSS-247 5.5	Band edge compliance Unrestricted Band Edges	Nominal	-	☐	☐	■	Note 1 Note 3 Complies
§15.247; 15.209; 15.205 RSS-Gen 8.9; 8.10	Band edge compliance Restricted Band Edges	Nominal	-	☐	☐	■	Note 1 Note 3 Complies
§15.247(d); §15.209 RSS-Gen 6.13	TX Spurious emissions-Radiated	Nominal	BLE	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	-	-	☐	■	☐	Note 2 Complies

Note1: NA= Not Applicable; NP= Not Performed.
Note2: Device does not connect to AC main power.
Note3: Leveraged from module certification FCC Filing ID: VOB-P2180 / IC ID: 7361A-P2180

6 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 30 MHz	±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)

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

6.1 Environmental Conditions During Testing:

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

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

6.2 Dates of Testing:

11/21/2017 – 12/04/2017

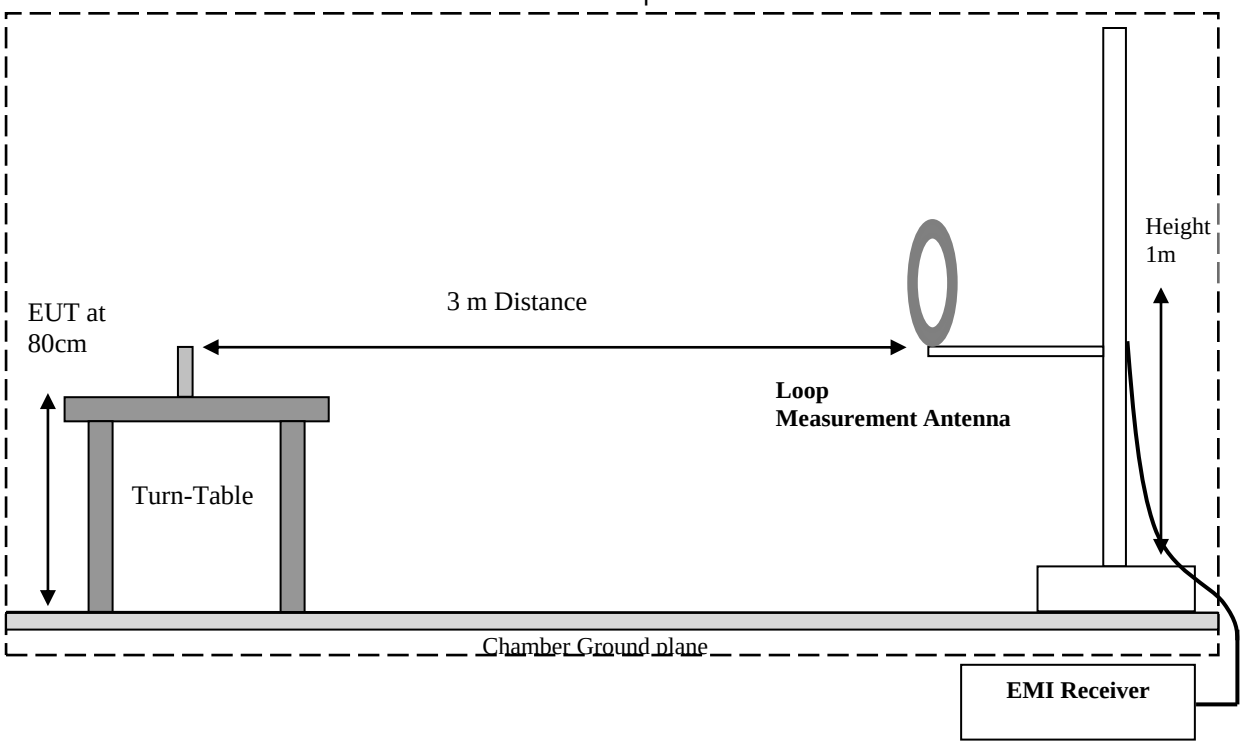
7 Measurement Procedures

7.1 Radiated Measurement

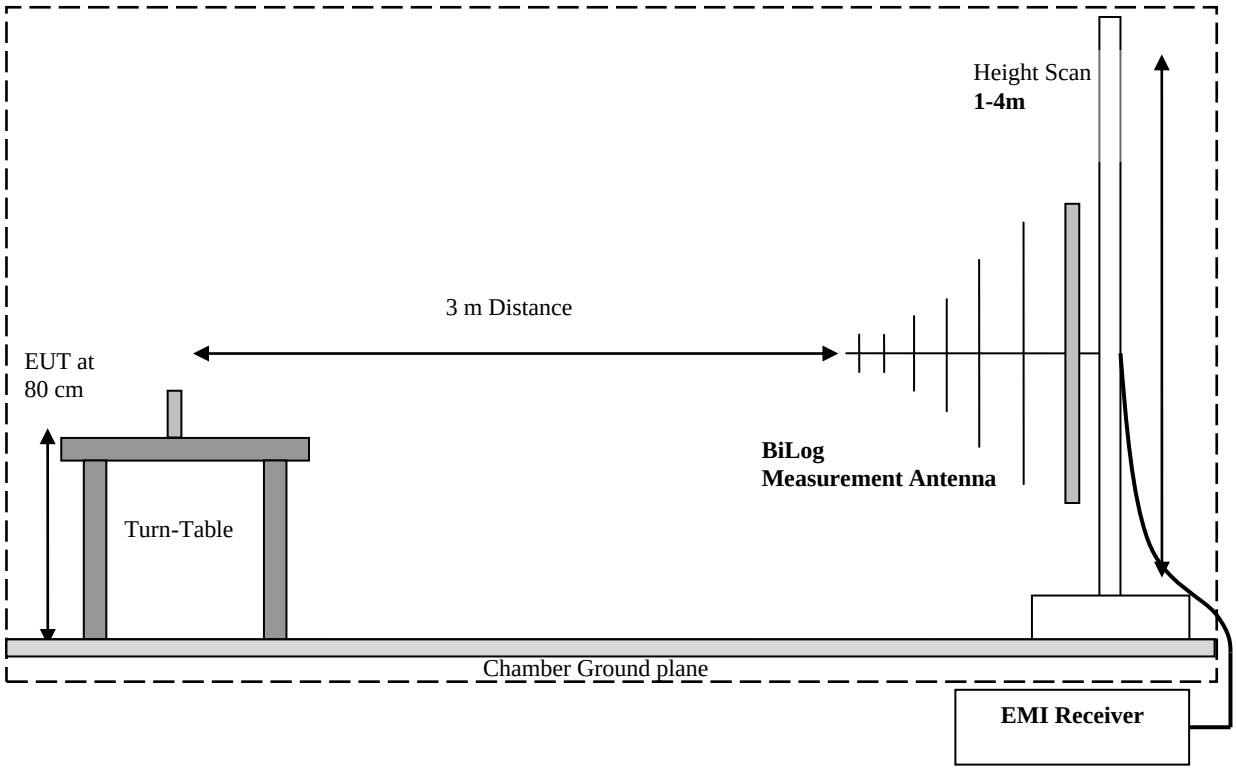
The radiated measurement is performed according to ANSI C63.10 (2013)

- 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.

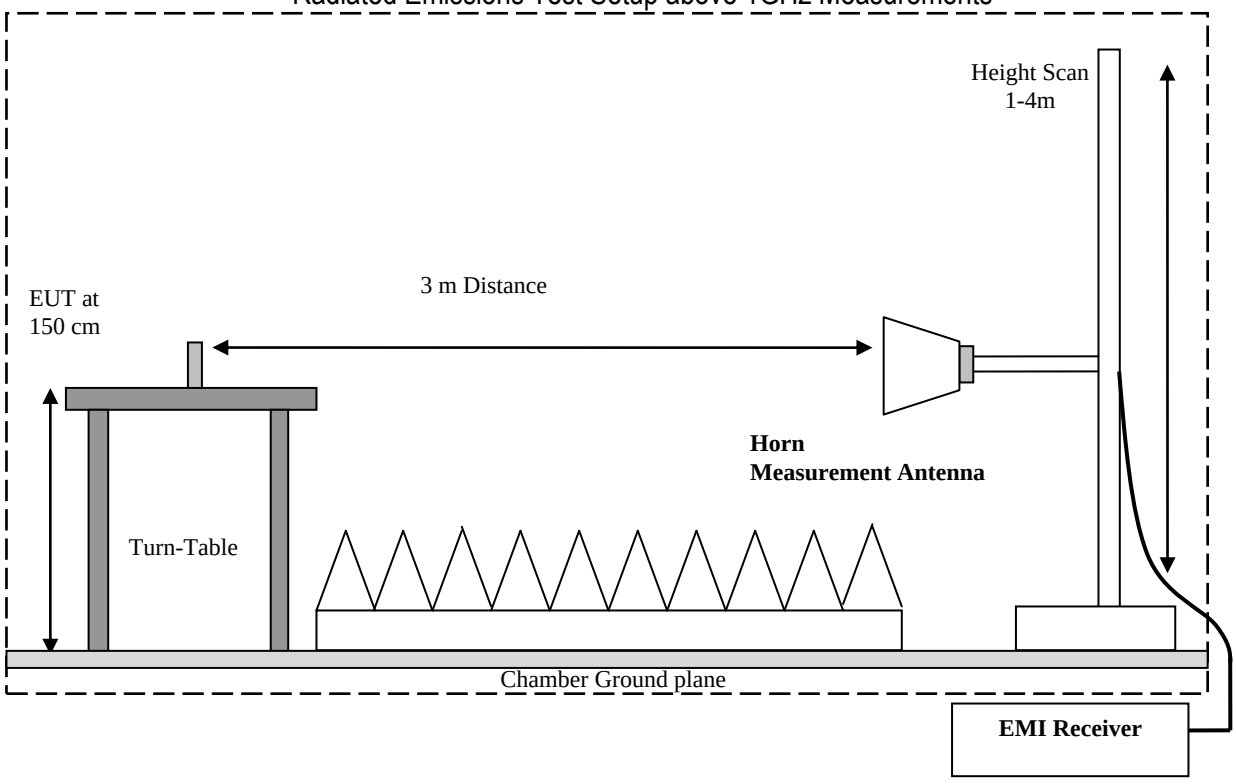
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements



Radiated Emissions Test Setup above 1GHz Measurements



7.1.1 Sample Calculations for Field Strength Measurements

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

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

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

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

Example:

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

8 Test Result Data

8.1 Radiated Transmitter Spurious Emissions and Restricted Bands

8.1.1 Measurement according to ANSI C63.10 (2013)

Spectrum Analyzer Settings:

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

8.1.2 Limits:

FCC §15.247

- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency of emission (MHz)	Field strength (µV/m)	Measurement Distance (m)	Field strength @ 3m (dBµV/m)
0.009–0.490	2400/F(kHz) / ---------	300	-
0.490–1.705	24000/F(kHz) / --------	30	-
1.705–30.0	30 / (29.5)	30	-
30–88	100	3	40 dBµV/m
88–216	150	3	43.5 dBµV/m
216–960	200	3	46 dBµV/m
Above 960	500	3	54 dBµV/m

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

8.1.3 Test conditions and setup:

Ambient Temperature	EUT Set-Up #	EUT operating mode	Power Input
23° C	1	BLE continuous fixed channel Co-Transmission with Cellular LTE2 Mid channel	Vehicle 12 VDC

8.1.4 Measurement result:

Plot #	Channel #	Scan Frequency	Limit	Result
1 – 3	Low	30 MHz – 18 GHz	See section 8.1.2	Pass
4 – 8	Mid	9 kHz – 40 GHz	See section 8.1.2	Pass
9 – 11	High	30 MHz – 18 GHz	See section 8.1.2	Pass

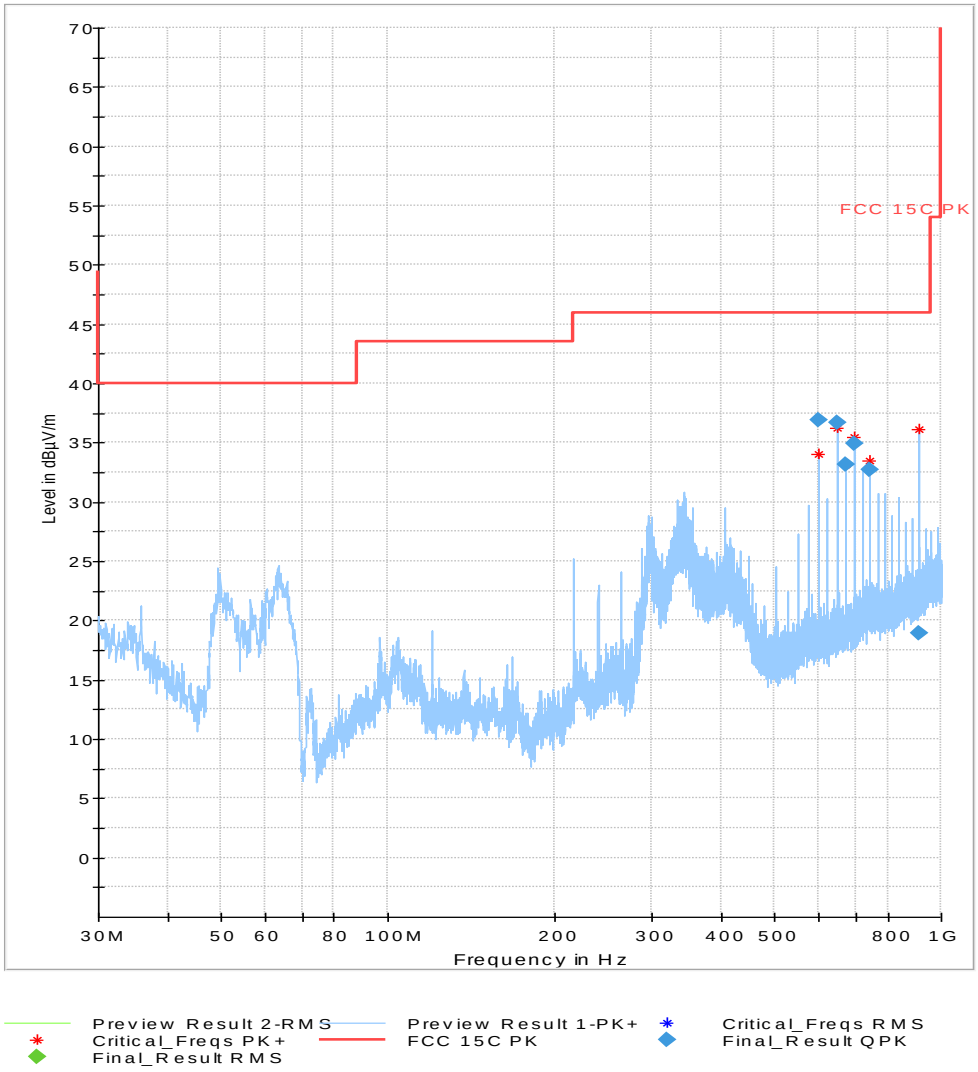
8.1.5 Measurement Plots:

Plot #1 Radiated Emissions: 30MHz – 1GHz

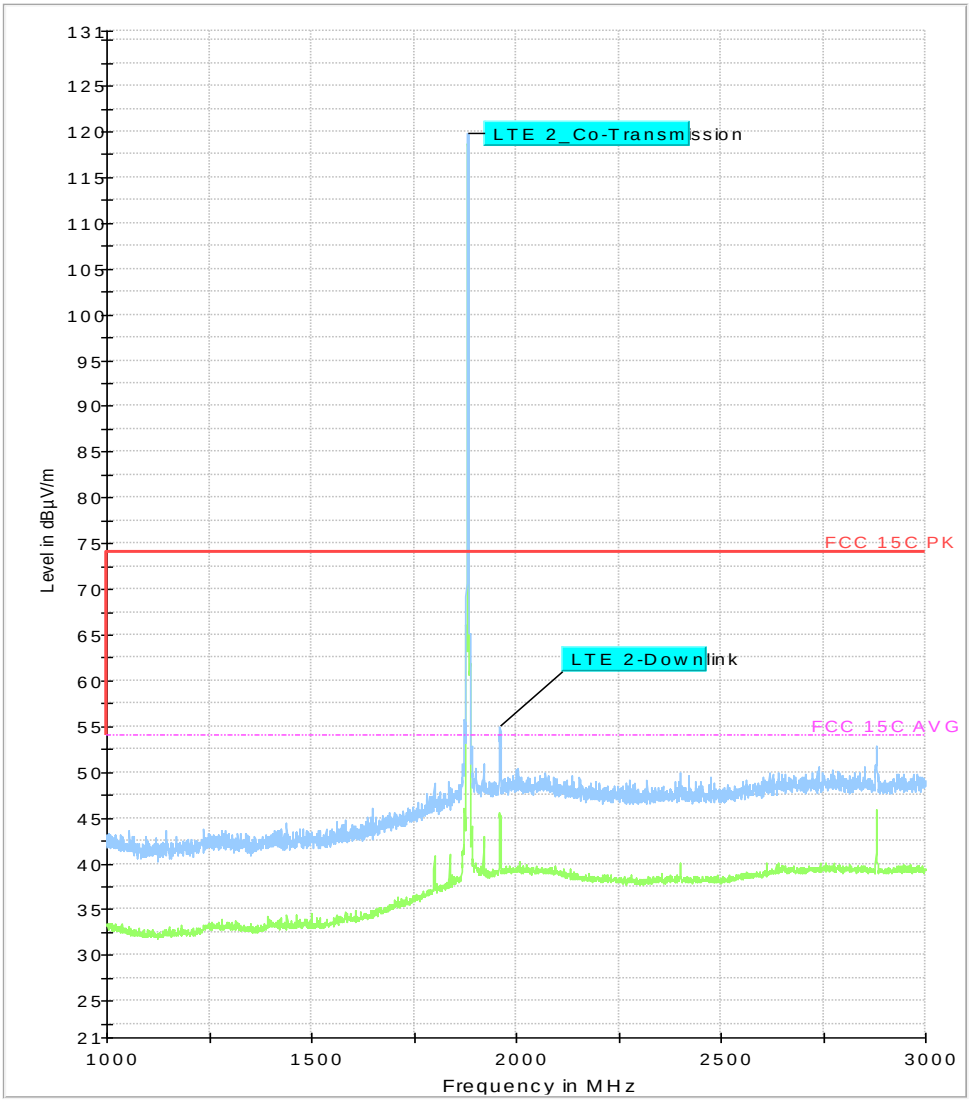
Modulation: BT LE	Channel: Low	98% Dynamic Duty cycle

Final_Result

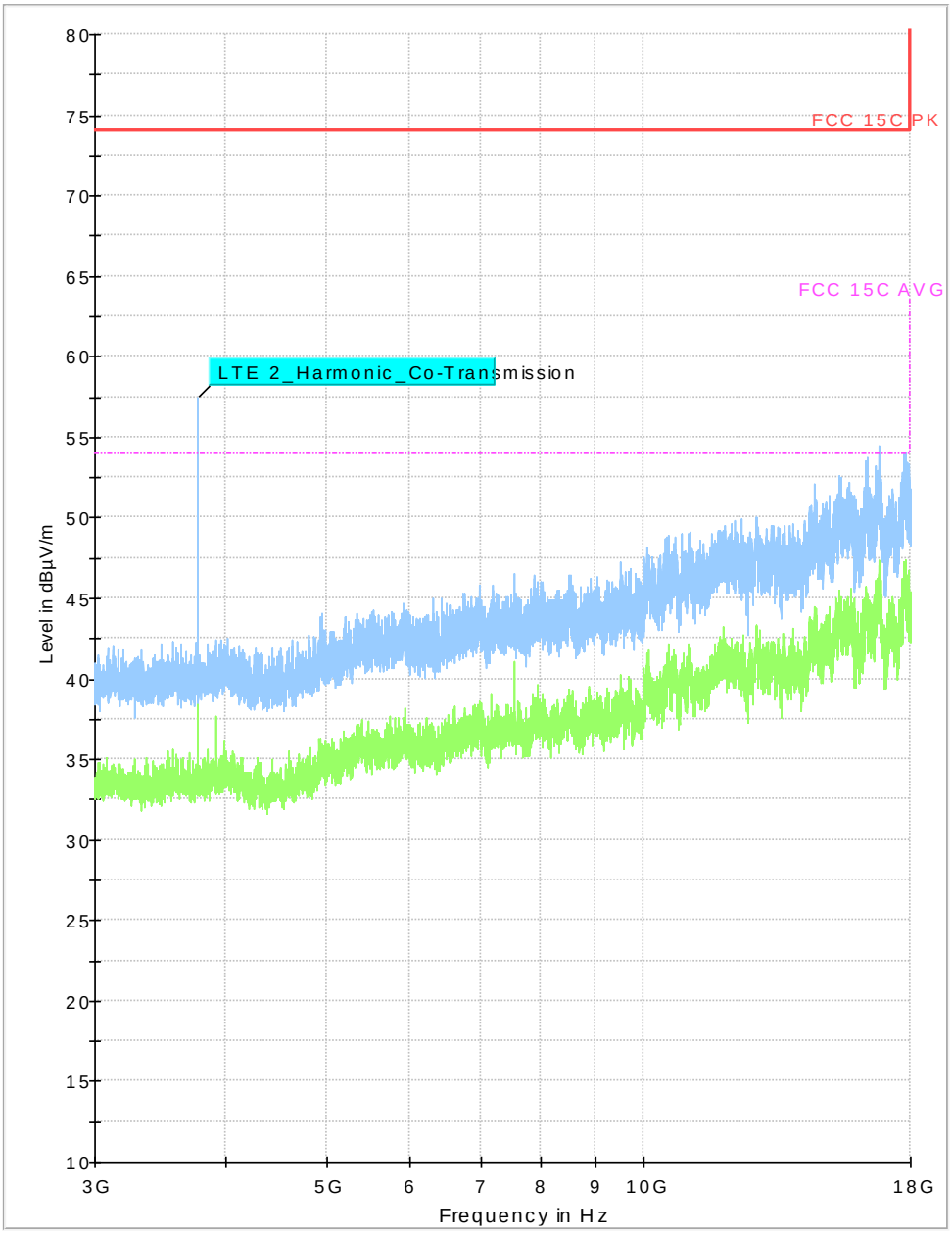
Frequency (MHz)	QuasiPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
599.969795	36.90	---	46.00	9.10	100.0	120.000	155.0	H	-6.0
648.028910	36.66	---	46.00	9.34	100.0	120.000	134.0	H	0.0
672.012130	33.21	---	46.00	12.79	100.0	120.000	139.0	H	-7.0
696.049885	34.92	---	46.00	11.08	100.0	120.000	134.0	H	8.0
744.051410	32.73	---	46.00	13.27	100.0	120.000	124.0	H	346.0
913.765920	18.89	---	46.00	27.11	100.0	120.000	281.0	V	10.0



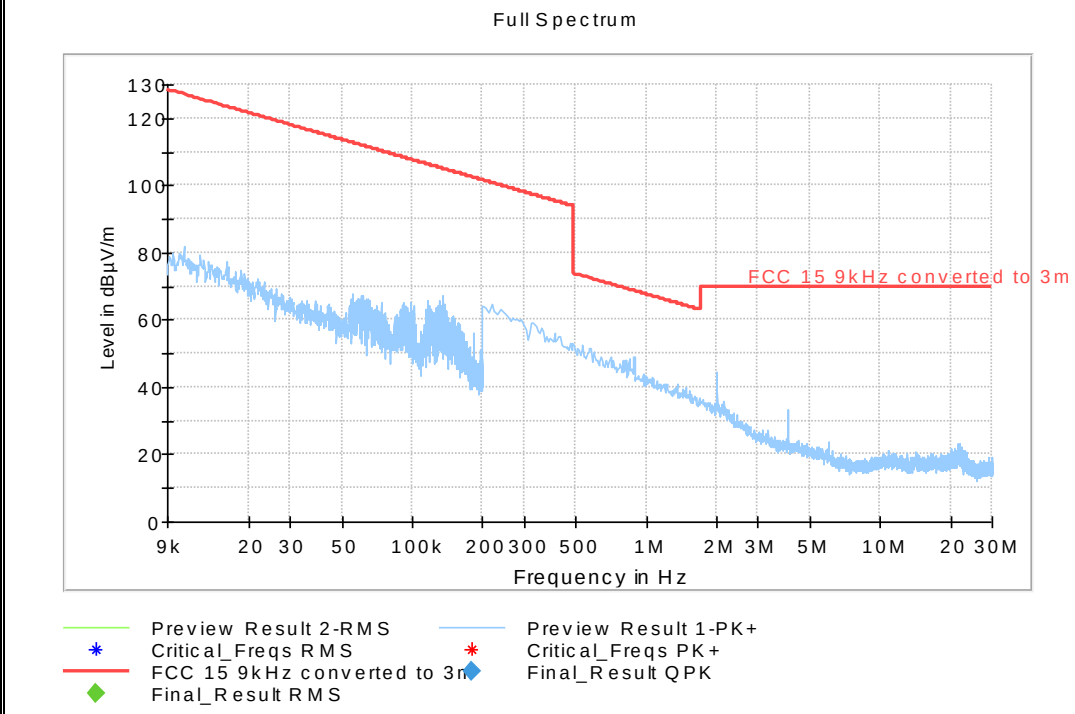
Plot # 2 Radiated Emissions: 1 – 3GHz		
Modulation: BT LE	**Channel: Low**	**98% Dynamic Duty cycle**



Plot # 3 Radiated Emissions: 3 – 18GHz		
Modulation: BT LE	**Channel: Low**	**98% Dynamic Duty cycle**



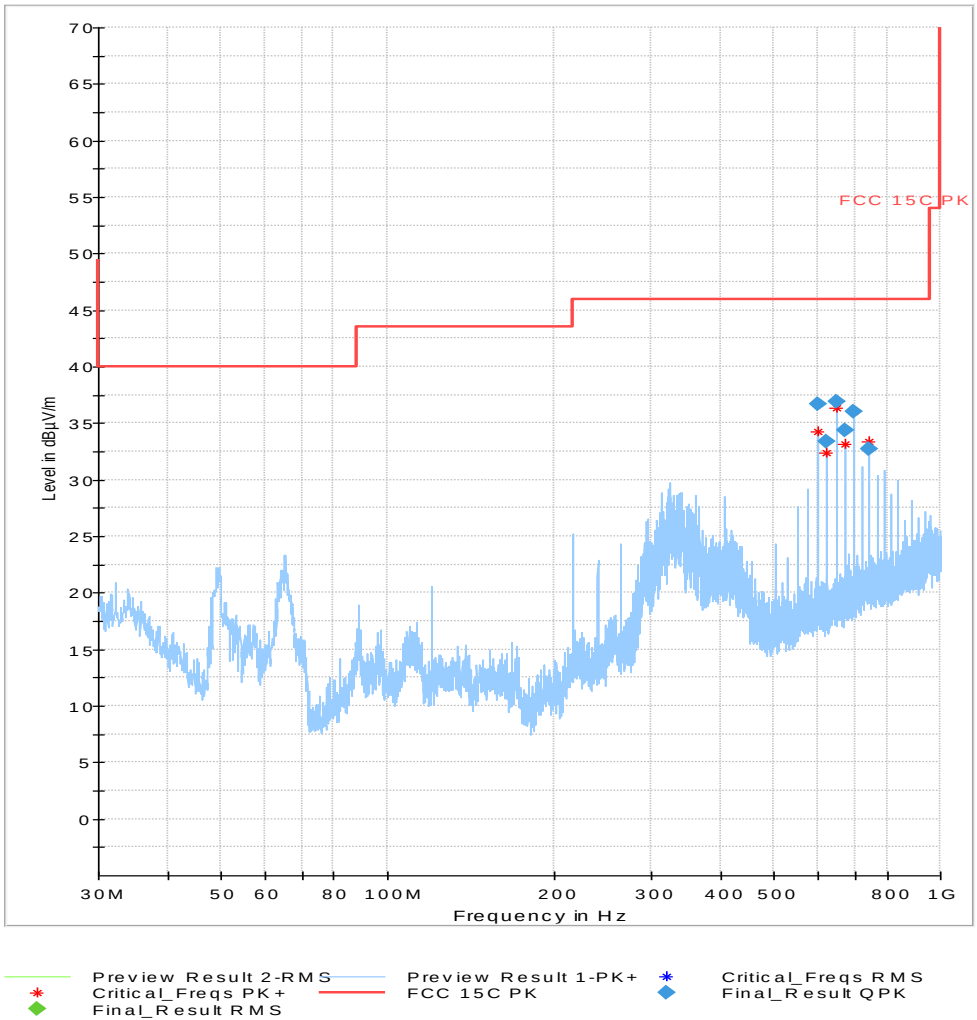
Plot # 4 Radiated Emissions: 9KHz – 30MHz		
Modulation: BT LE	**Channel: Mid**	**98% Dynamic Duty cycle**



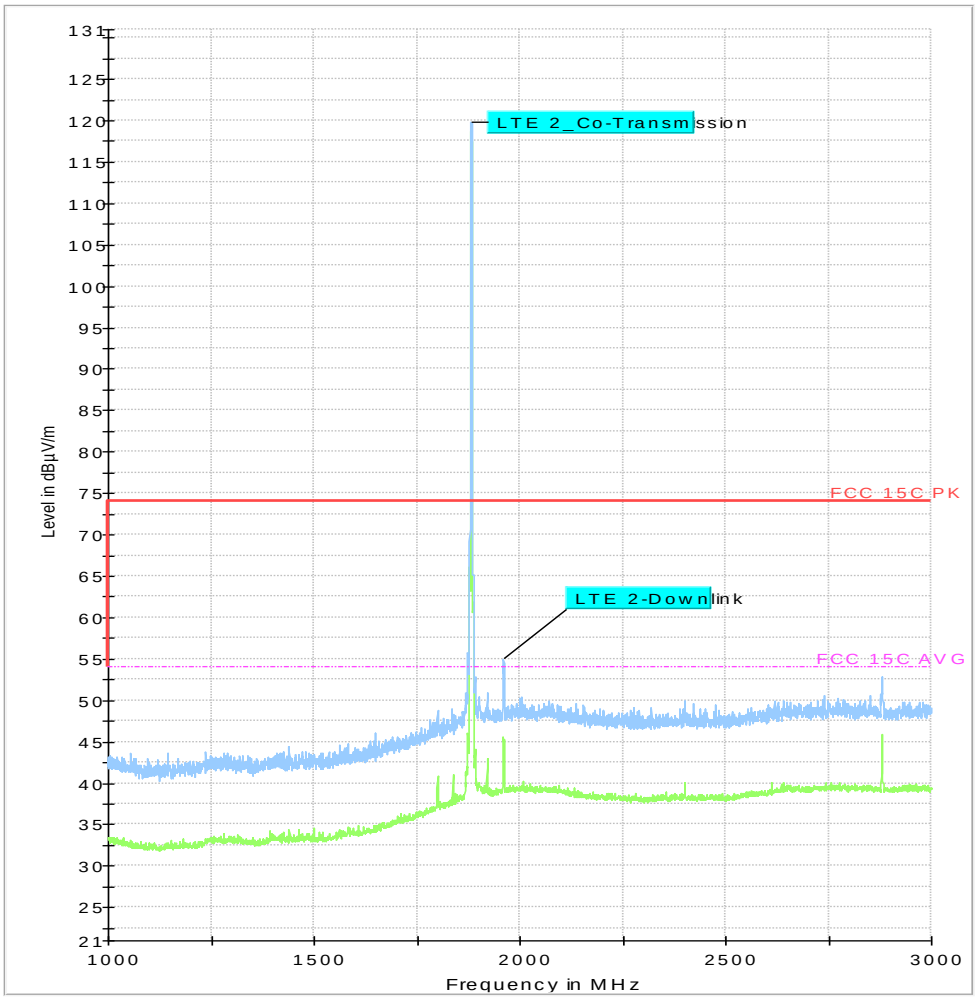
Plot #5 Radiated Emissions: 30MHz – 1GHz		
Modulation: BT LE	**Channel: Mid**	**98% Dynamic Duty cycle**

Final_Result

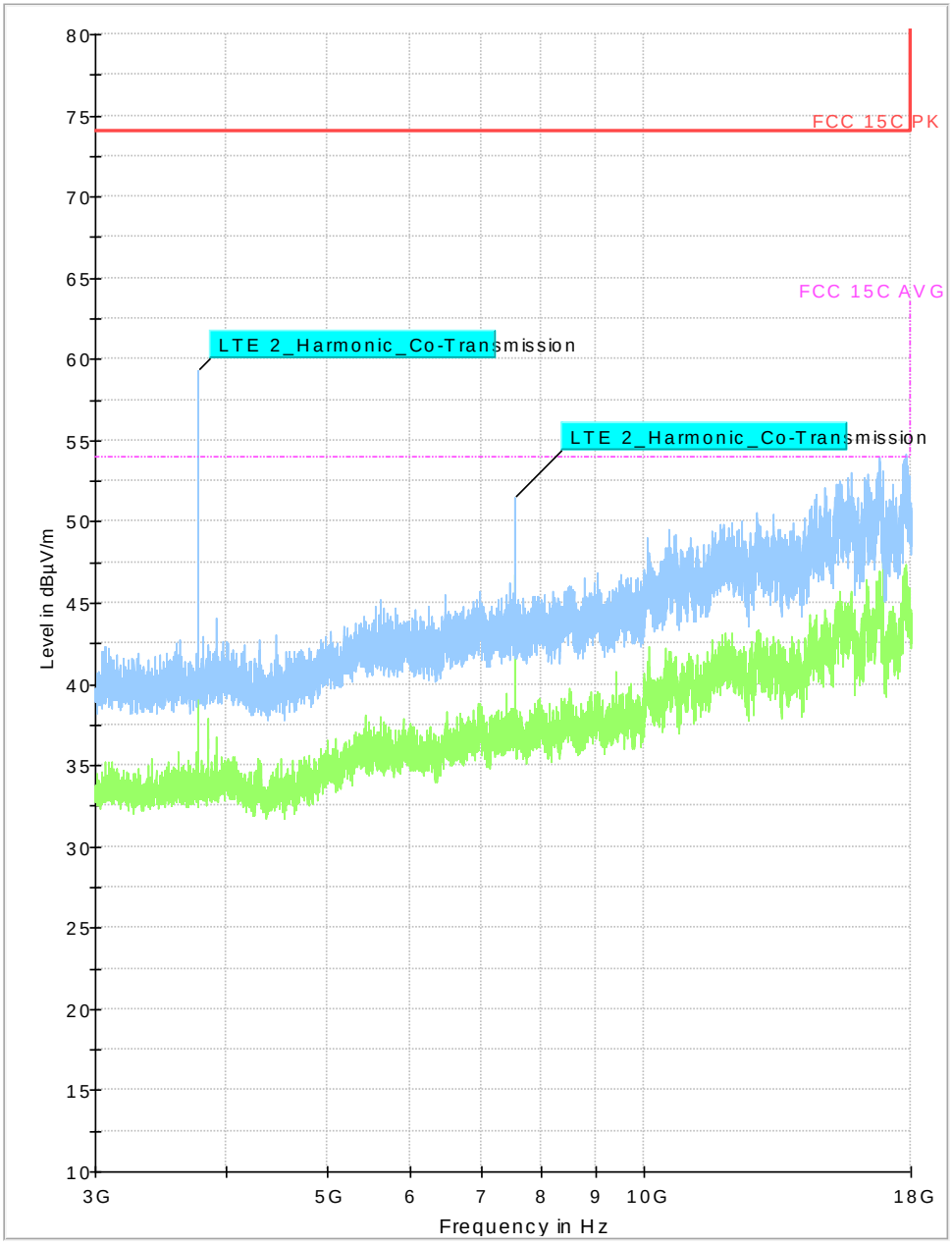
Frequency (MHz)	QuasiPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
600.036800	36.74	---	46.00	9.26	100.0	120.000	156.0	H	20.0
624.006715	33.38	---	46.00	12.62	100.0	120.000	140.0	H	22.0
648.017950	36.91	---	46.00	9.09	100.0	120.000	139.0	H	22.0
672.011585	34.41	---	46.00	11.59	100.0	120.000	139.0	H	28.0
696.051090	36.02	---	46.00	9.98	100.0	120.000	135.0	H	35.0
744.053725	32.70	---	46.00	13.30	100.0	120.000	114.0	H	-8.0



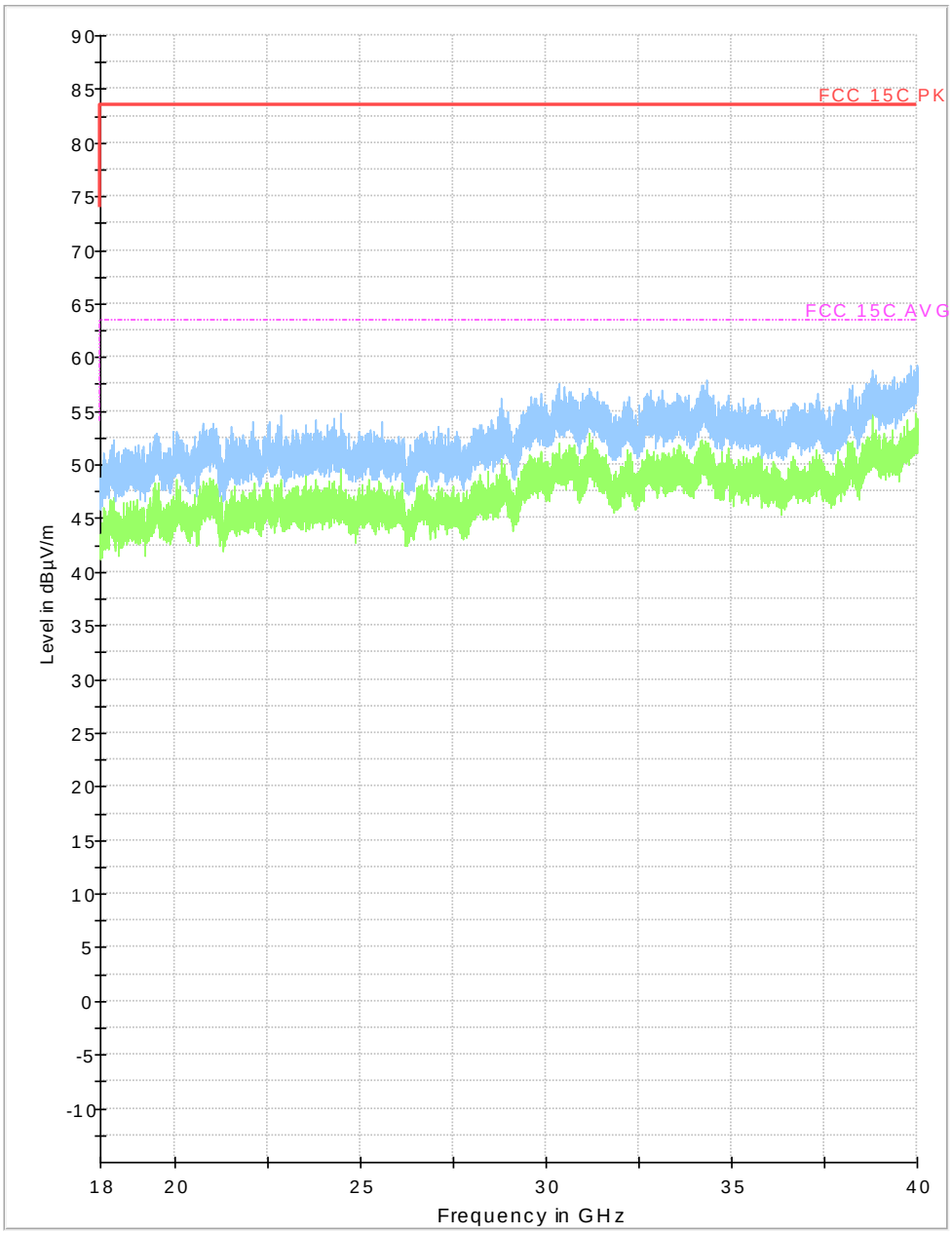
Plot #6 Radiated Emissions: 1 – 3GHz		
Modulation: BT LE	**Channel: Mid**	**98% Dynamic Duty cycle**



Plot #7 Radiated Emissions: 3 – 18GHz		
Modulation: BT LE	**Channel: Mid**	**98% Dynamic Duty cycle**



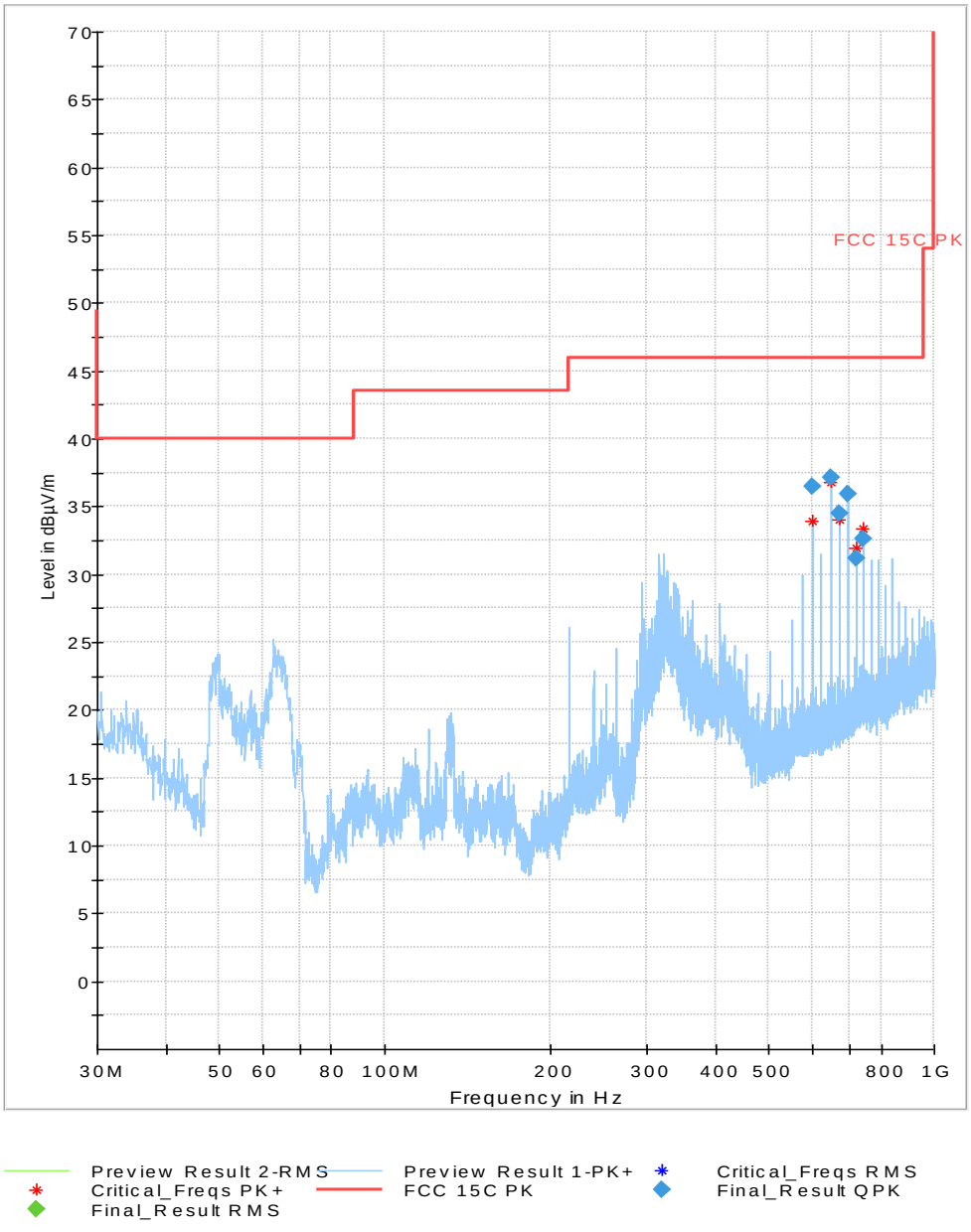
Plot #8 Radiated Emissions: 18 – 40GHz		
Modulation: BT LE	**Channel: Mid**	**98% Dynamic Duty cycle**



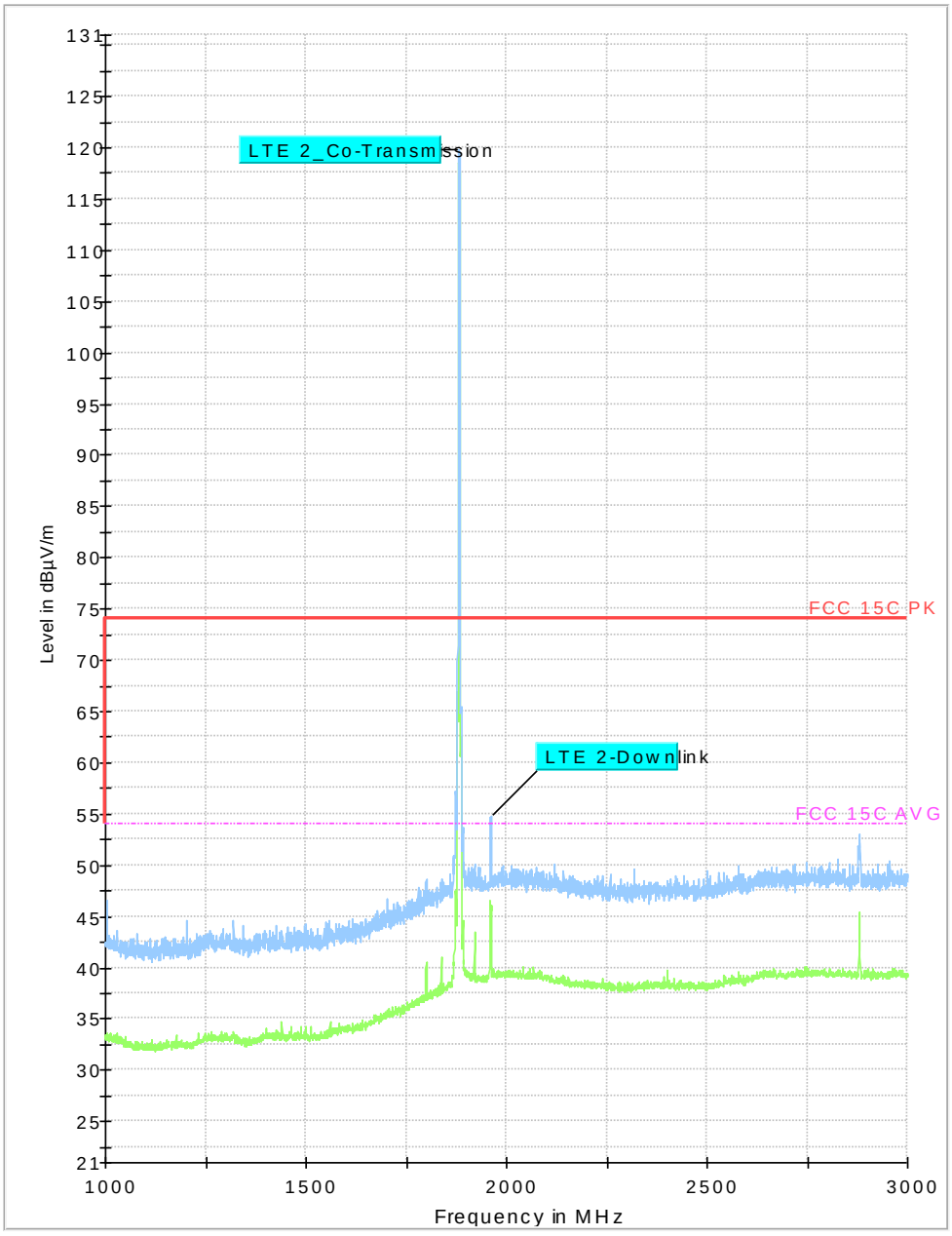
Plot #9 Radiated Emissions: 30MHz – 1GHz		
Modulation: BT LE	**Channel: High**	**98% Dynamic Duty cycle**

Final_Result

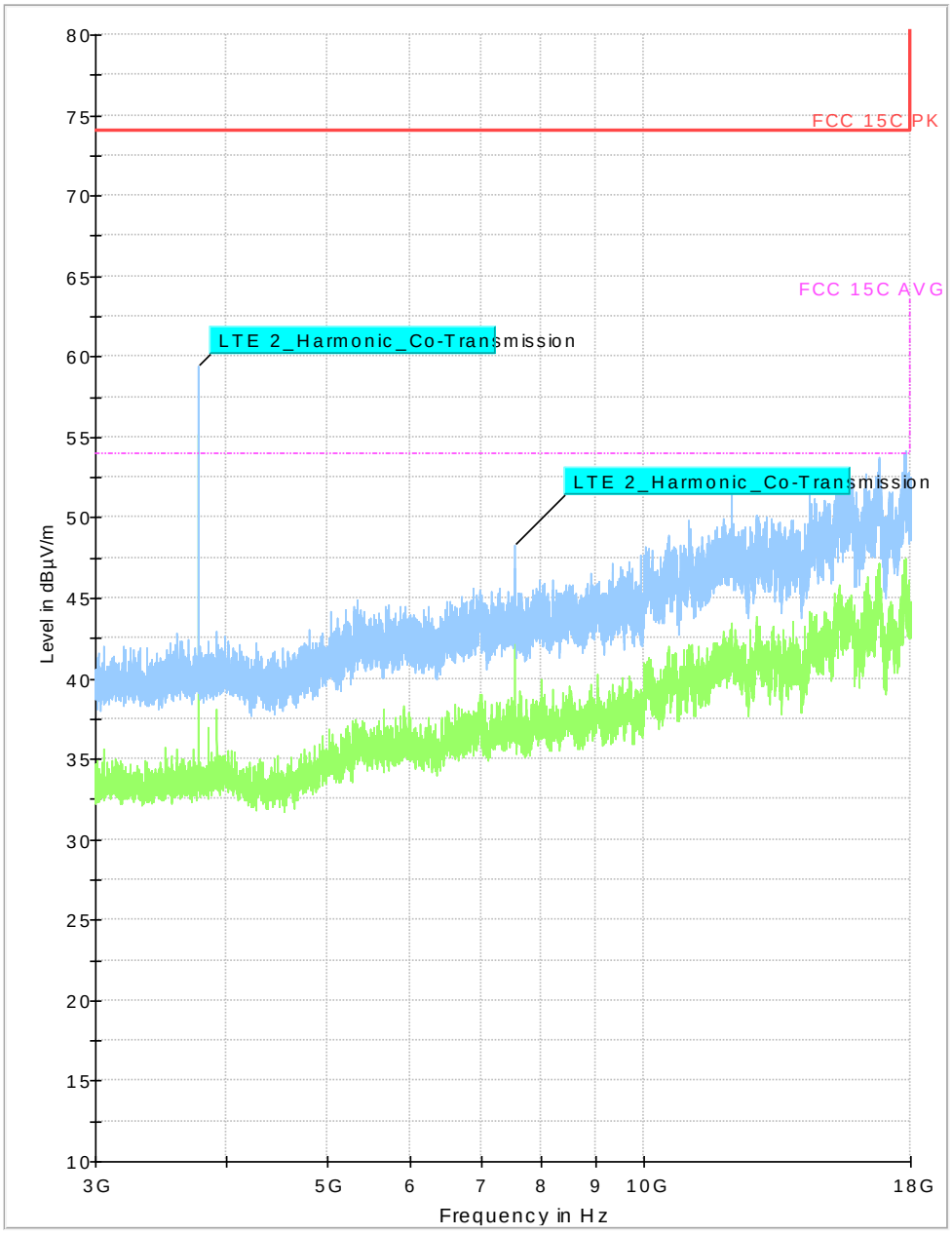
Frequency (MHz)	QuasiPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
600.051725	36.50	---	46.00	9.50	100.0	120.000	155.0	H	18.0
648.048045	37.13	---	46.00	8.87	100.0	120.000	139.0	H	18.0
671.999665	34.45	---	46.00	11.55	100.0	120.000	138.0	H	27.0
696.057810	35.94	---	46.00	10.06	100.0	120.000	134.0	H	36.0
720.029695	31.15	---	46.00	14.85	100.0	120.000	124.0	H	36.0
744.028735	32.58	---	46.00	13.42	100.0	120.000	119.0	H	-7.0



Plot # 10 Radiated Emissions: 1 – 3GHz		
Modulation: BT LE	**Channel: High**	**98% Dynamic Duty cycle**



Plot #11 Radiated Emissions: 3 – 18GHz		
Modulation: GFSK	**Channel: High**	**98% Dynamic Duty cycle**



9 Test setup photos

Setup photos are included in supporting file name: "EMC_NETRA_002_17001_FCC_ISED_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Item Name	Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
PASSIVE LOOP ANTENNA	LOOP ANTENNA	ETS LINDGREN	6512	00164698	3 YEARS	08/08/2017
CBL 6141B BILOG ANTENNA	BOLOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
3117 HORN ANTENNA	HORN ANTENNA	ETS LINDGREN	3117	00167061	3 YEARS	08/08/2017
3116C HORN ANTENNA	HORN ANTENNA	ETS LINDGREN	3116C	00166821	3 YEARS	09/24/2017
SPECTRUM ANALYZER FSU26	SIGNAL ANALYZER	R&S	FSU26	200065	2 YEARS	03/07/2017
CMU200	UNIVERSAL RADIO COMMUNICATION	R&S	CMU200	121673	2 YEARS	06/07/2017
CMW500	WIDEBAND RADIO COMMUNICATION	R&S	CMW500	125231	2 YEARS	10/07/2017
FSV	SIGNAL ANALYZER	R&S	FSV 40	101022	2 YEARS	07/05/2017
DIGITAL BAROMETER	COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	1 YEARS	06/05/2017
TM320	THRMOMETER HUMIDIY	DICKSON	TM320	16253639	1 YEARS	11/02/2017

Note:

1. 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.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
01/25/2018	EMC_NETRA_002_17001_15.247_ISED_BT_DTS	Initial Version	Issa Ghanma