FCC / ISED Test Report

FOR: Keep Truckin.

Model Name: LBB-3.5CA

Product Description:
Uses BT to synchronize log data to companion app running on smartphone or tablet.
Can use LTE to sync with cloud directly when companion device is not connected.

FCC ID: 2AQM7-35
IC ID: 24516-35

Applied Rules and Standards:
47 CFR Part 15.247 (DTS)
RSS-247 Issue 2 (DTS) & RSS-Gen Issue 5

REPORT #: EMC_KPTRK_006_18001_FCC_15.247_ISED_WiFi_DTS

DATE: 03/15/2019

A2LA Accredited

IC recognized #
3462B-1
3462B-2

***CETECOM* Inc.**
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1 Assessment

The following device as further described in section 3 of this report was evaluated for radiated spurious emissions for unlicensed radio according to criteria specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-GEN and RSS-247.

No deviations were ascertained.

According to section 5 of this report, the overall result is PASS.

Company	Description	Model #
Keep Truckin	Uses BT to synchronize log data to companion app running on smartphone or tablet. Can use LTE to sync with cloud directly when companion device is not connected. There are IOS and Android versions of the app.	LBB-3.5CA

Responsible for Testing Laboratory:

Date	Section	Name	Signature
03/15/2019	Compliance	Cindy Li (Lab Manager)	Cindy Li Digitally signed by Cindy Li DN: cn=Cindy Li, o=Cetecom Inc., ou=EMC, email=cindy.li@cetecom.com, c=US Date: 2019.03.16 21:12:12 -07'00'

Responsible for the Report:

Date	Section	Name	Signature
03/15/2019	Compliance	Issa Ghanma (EMC Engineer)	Digitally signed by: Issa Ghanma DN: CN = Issa Ghanma email = issa.ghanma@cetecom.com C = US O = CETECOM INC. OU = EMC Date: 2019.03.15 15:21:22 -07'00'

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:	Cindy Li
Responsible Project Leader:	Trina Noor

2.2 Identification of the Client

Applicant's Name:	Keep Truckin
Street Address:	370 Townsend St.
City/Zip Code	San Francisco, CA 94107
Country	USA

2.3 Identification of the Manufacturer

Manufacturer's Name:	Same as client.
Manufacturers Address:	
City/Zip Code	
Country	

3 Equipment Under Test (EUT)

3.1 EUT Specifications

Firmware Version Identification Number (FVIN):	HL75xx.A.2.13
Hardware Version Identification Number (HVIN):	1
Product Marketing Name (PMN):	LBB-3.5CA
Frequency Range / number of channels:	Nominal band: 2400 MHz – 2483.5 MHz; Center to center: 2412 MHz (Ch.1) – 2462 MHz (Ch.11), 11 Channels
Type(s) of Modulation:	802.11b/g/n
Modes of Operation:	Fix channel transmission.
Maximum output Powers in modular grant [Watts **]:**	0.2519
Antenna Information as declared:	2.45 GHz SMD Antenna, EIA 1210, Detuning resilient, Edge Mount Design General Specifications: • Part Number: 2450AT18D0100 • Frequency (GHz): 2.4 – 2.48 Peak Gain (dBi): 1.5
Other Radios included in the device:	❖ Cellular: • Sierra Wireless HL7588 • FCC ID: N7NHL7588 • IC ID: 2417C-HL7588 • Bands: o WCDMA II, V o LTE 2, 4, 5, 13, 17 ❖ Bluetooth: • LSR Sterling-LWB • FCC ID: TFB-1003 • IC ID: 5969A-1003 ❖ GPS: • Module name: Ublox • Model number: NEO-M8u-0-10
Power Supply/ Rated Operating Voltage Range:	Low 6 VDC, Nominal 14 VDC, High 30 VDC
Operating Temperature Range:	Low -40º C, Nominal 20º C, High 115º C
Sample Revision:	☐Prototype Unit; ☐Production Unit; ■Pre-Production

EUT Dimensions [cm]:	11.1 x 9.7 x 2.5
Weight:	250
EUT Diameter:	■ < 60 cm ☐ Other _____
Module Information	
Module Name:	Sterling-LWB
FCC ID:	TFB-1003
IC ID:	5969A-1003

3.2 EUT Sample details

EUT #	Serial Number	HW Version	SW Version	Notes / Comments
1	01117221	3.5	62040	Radiated Emissions

3.3 Accessory Equipment (AE) details

AE #	Comments
-	**-**

3.4 Test Sample Configuration

EUT Set-up #	Combination of AE used for test set up	Comments
1	**EUT#1**	**-**

3.5 Mode of Operation details

Mode of Operation	Description of Operating modes	Additional Information
Op. 1	802.11g (6 Mb/s)	Putty terminal tool and special commands provided by the customer used to configure the radio to: • Modulated TX • Low, Mid, High channel. • Maximum output power. • Maximum duty cycle. • b/g/n mode • Configure data rate. Note: The commands will not be available to the end user. 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 the highest duty cycle and output power, and the worst case of modulation supported based on the maximum conducted output power in the 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 transmitter spurious emissions of the EUT according to the relevant requirements specified in FCC rules 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 Issue 2 and RSS-GEN Issue 5 of ISED Canada.

This test report is to support a request for new equipment authorization under the:
FCC ID: 2AQM7-35
IC ID: 24516-35

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-247 5.5; 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	802.11g (6 Mb/s)	■	☐	☐	Complies
§15.207(a) RSS Gen 8.8	AC Conducted Emissions	Nominal	-	☐	■	☐	Note 1 Note 2

Note1: NA= Not Applicable; NP= Not Performed.
Note2: Device does not connect to and AC main.
Note3: Leveraged form module certification FCC ID: 2AQM7-35 / IC ID: 24516-35

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:

03/11/2019

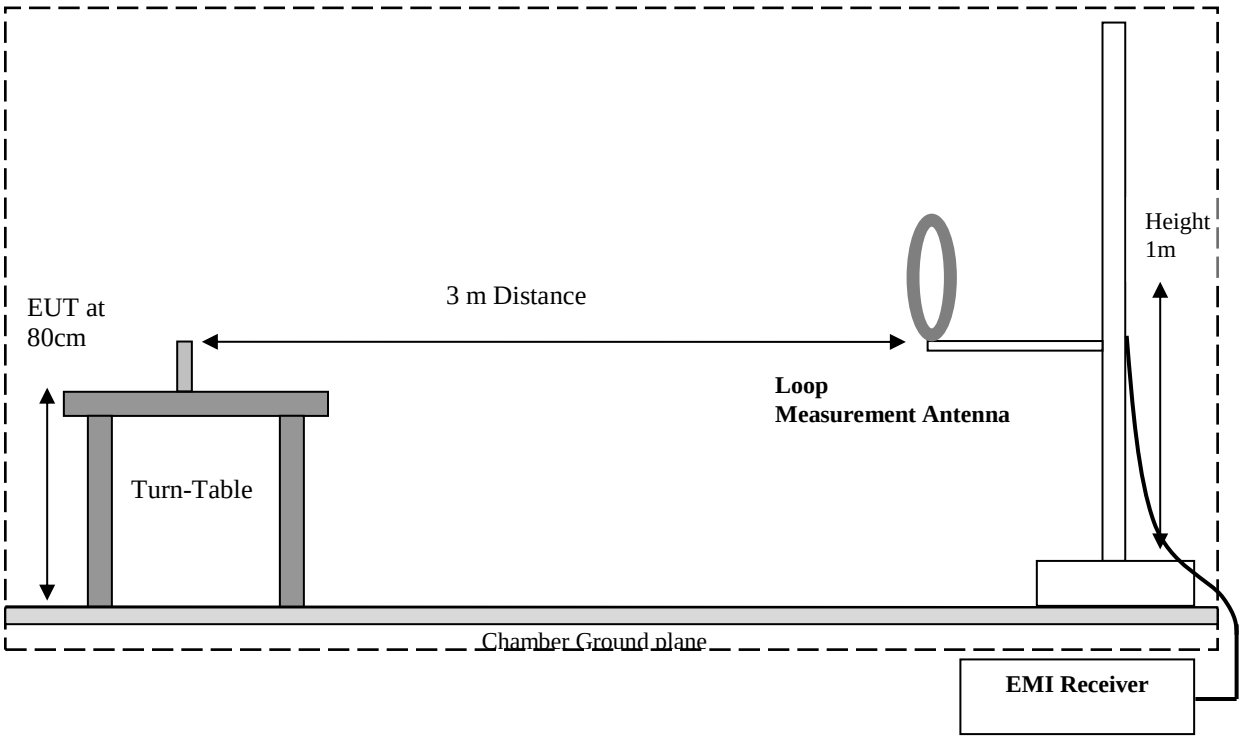
7 Measurement Procedures

7.1 Radiated Measurement

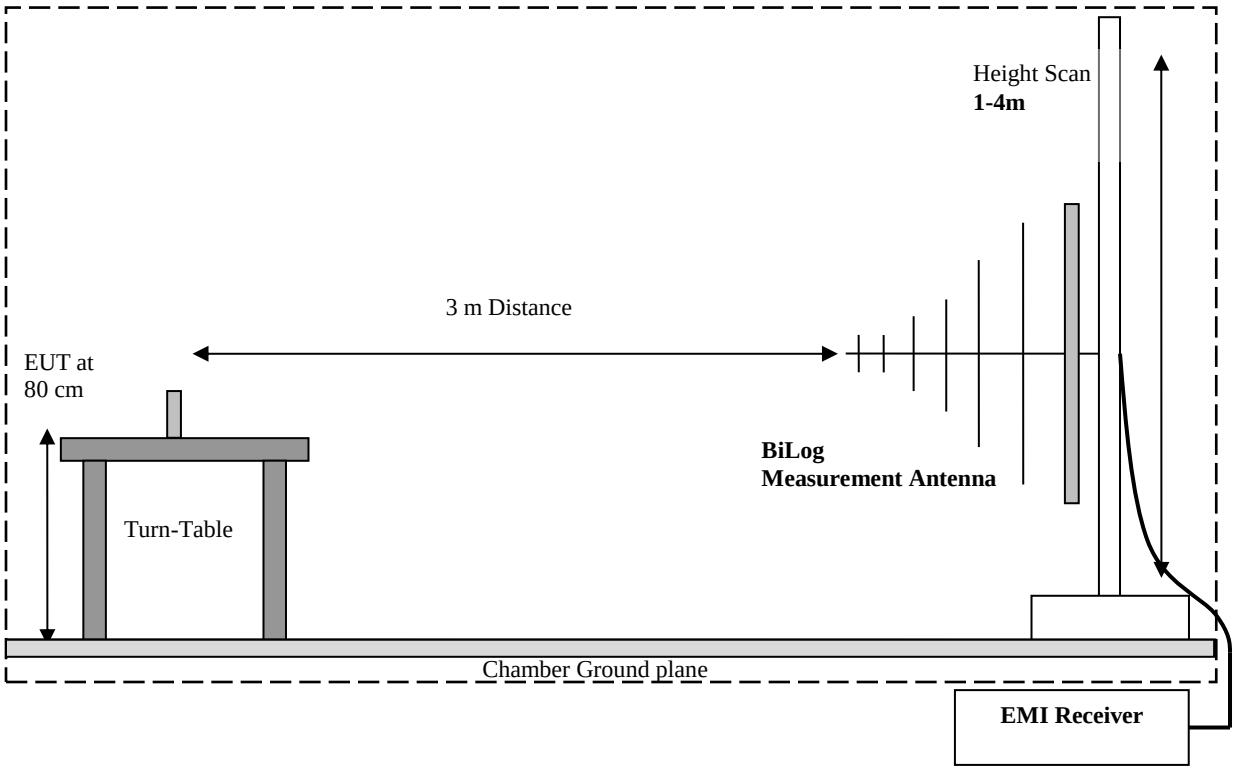
The radiated measurement is performed according to ANSI C63.10 (2013)

- 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.

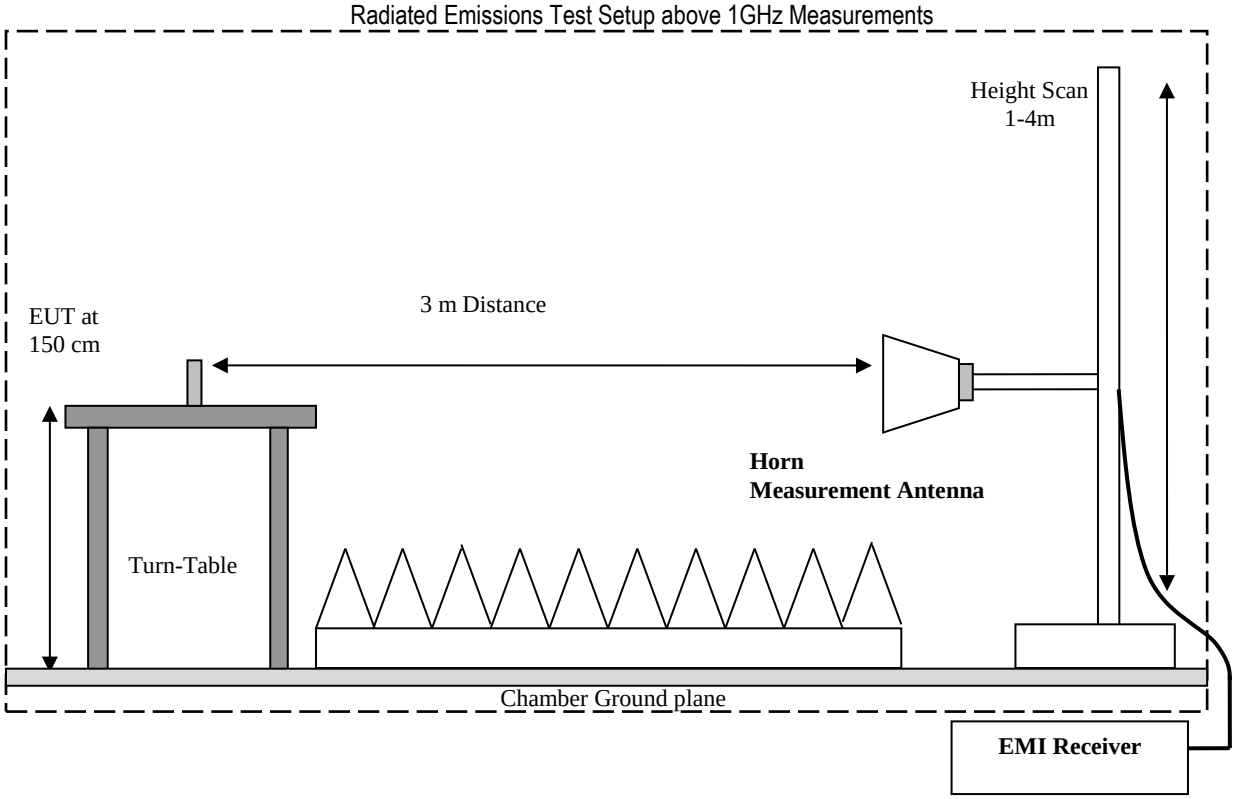
Radiated Emissions Test Setup below 30MHz Measurements



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

- d) 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 #	EUT operating mode	Power Input
22° C	1	Op.1	12v DC

8.1.4 Measurement result:

Plot #	Channel #	Scan Frequency	Critical Frequency [MHz]	Emission level [dBuV/m]	Emission Detector	Limit	Result
1 – 3	1	30 MHz – 18 GHz	933.937	41.63	MaxPeak	See section 8.1.2	Pass
4 – 8	6	9 kHz – 26 GHz	865.273	43.19	MaxPeak	See section 8.1.2	Pass
9 – 11	11	30 MHz – 18 GHz	934.426	44.04	MaxPeak	See section 8.1.2	Pass

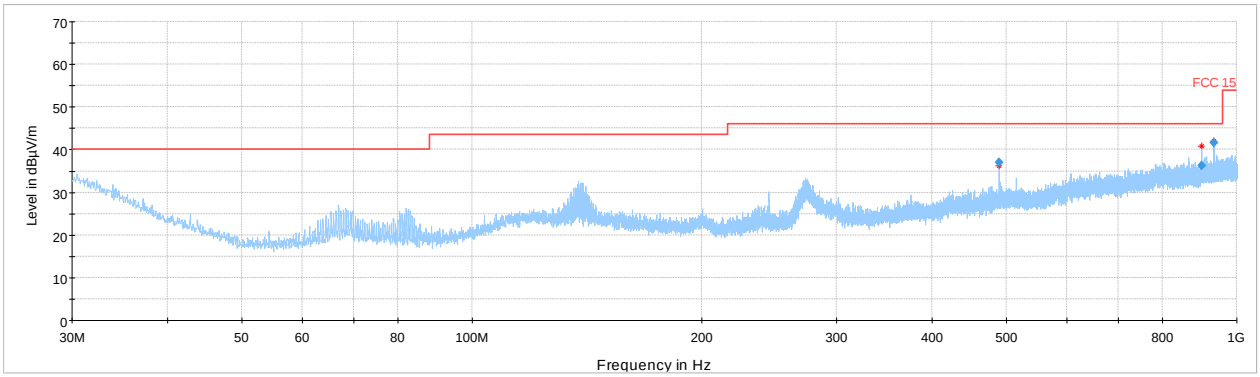
8.1.5 Measurement Plots:

Plot # 1 Radiated Emissions: 30MHz – 1GHz

Modulation: 802.11g | **Channel: 1**

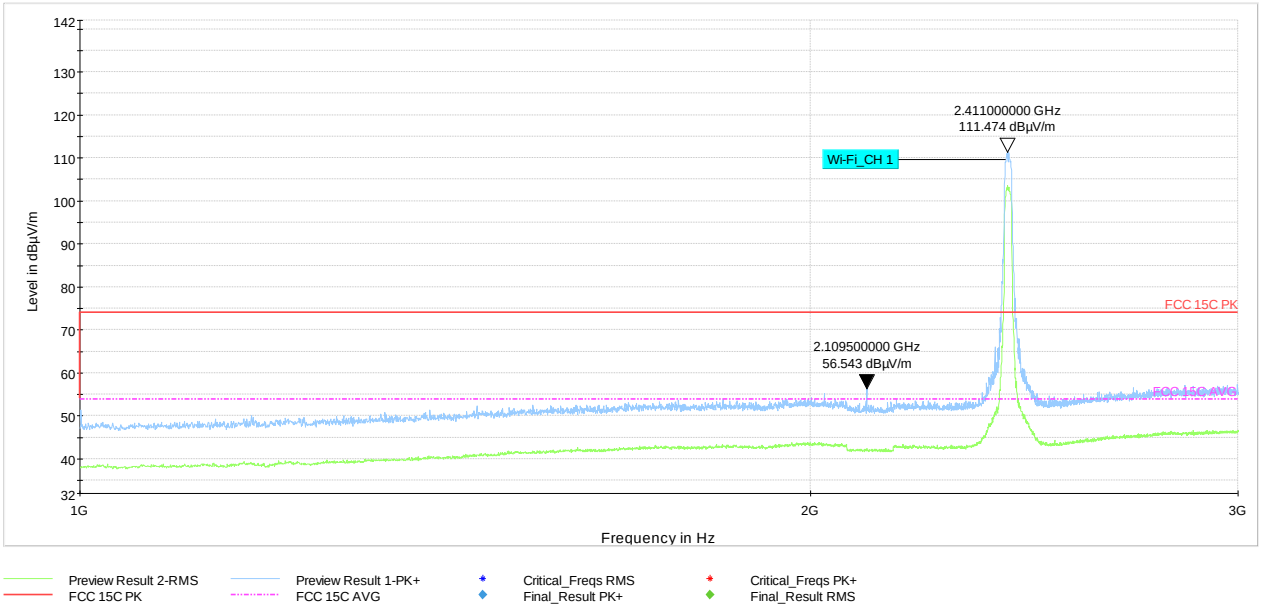
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
489.397	36.97	46.02	9.05	200.0	120.000	229.0	H	180.0	27.0	6:28:45 PM - 3/11/2019
898.861	36.33	46.02	9.69	200.0	120.000	152.0	H	254.0	31.6	6:30:39 PM - 3/11/2019
933.937	41.63	46.02	4.39	200.0	120.000	140.0	H	252.0	32.5	6:32:21 PM - 3/11/2019



Plot # 2 Radiated Emissions: 1 – 3GHz

Modulation: 802.11g | **Channel: 1**

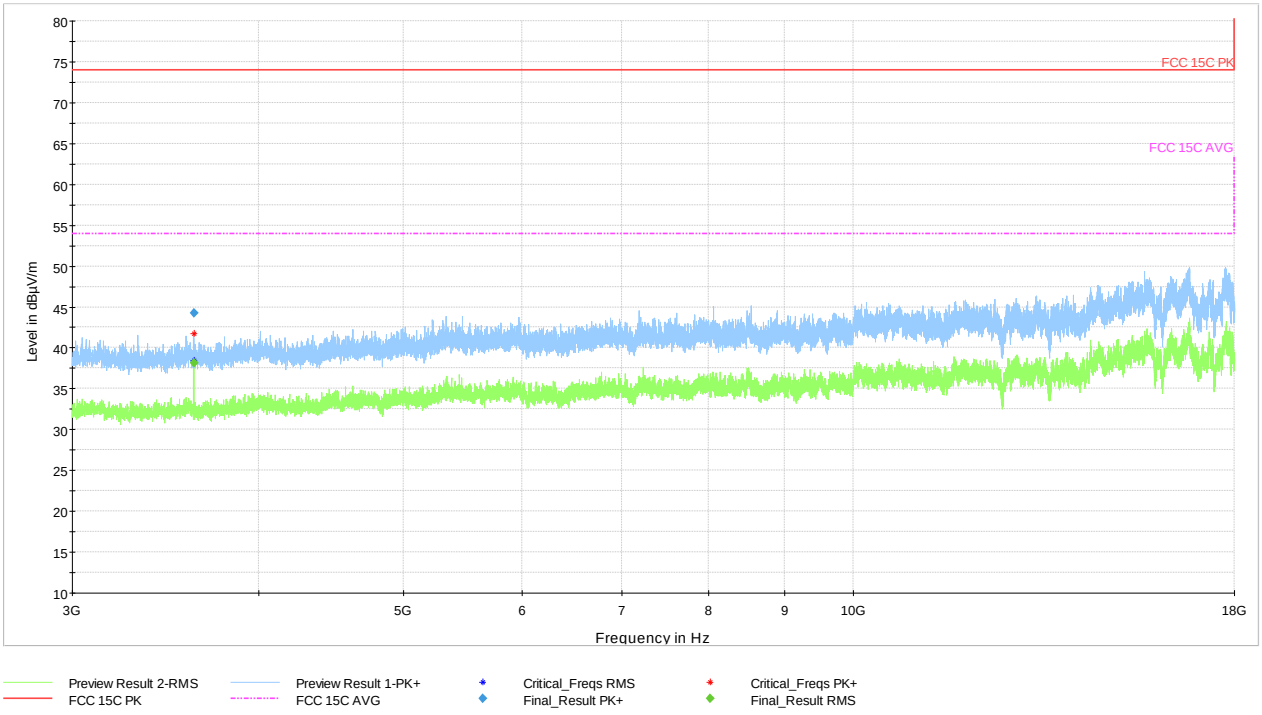


Plot # 3 Radiated Emissions: 3 – 18GHz

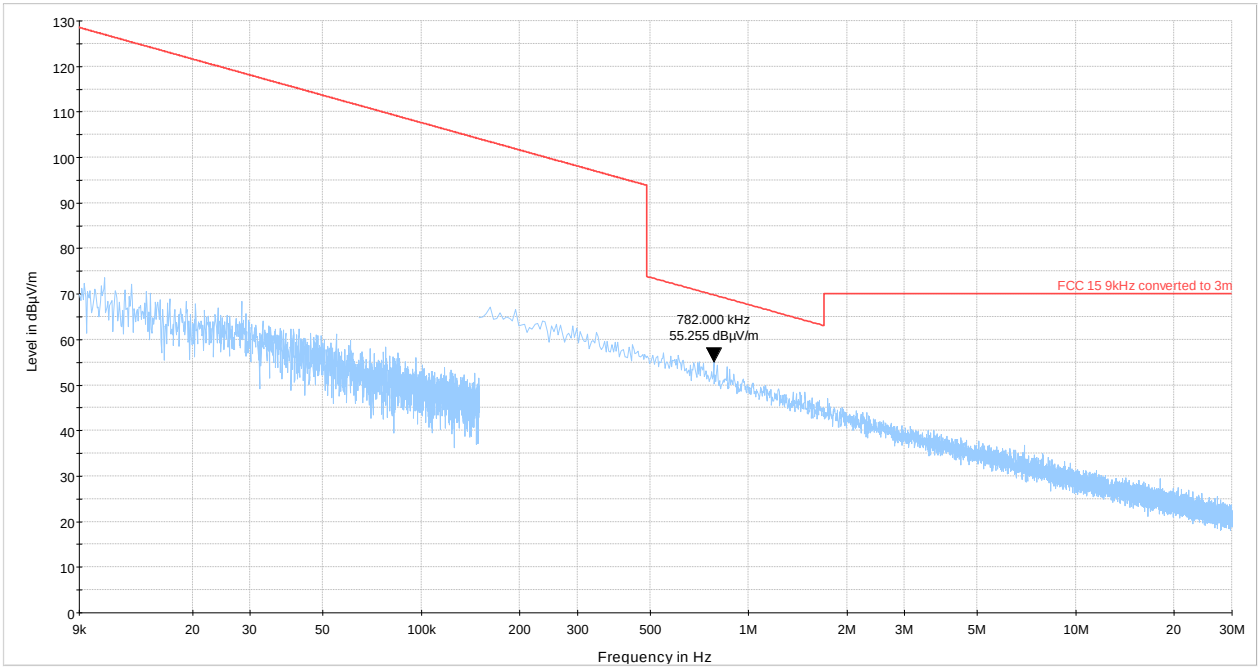
Modulation: 802.11g | **Channel: 1**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
3617.844	44.28	---	73.99	29.71	200.0	1000.0	256.0	H	113.0	-35	4:51:32 PM - 3/11/2019
3617.916	---	38.17	53.98	15.81	200.0	1000.0	242.0	H	115.0	-35	4:54:33 PM - 3/11/2019



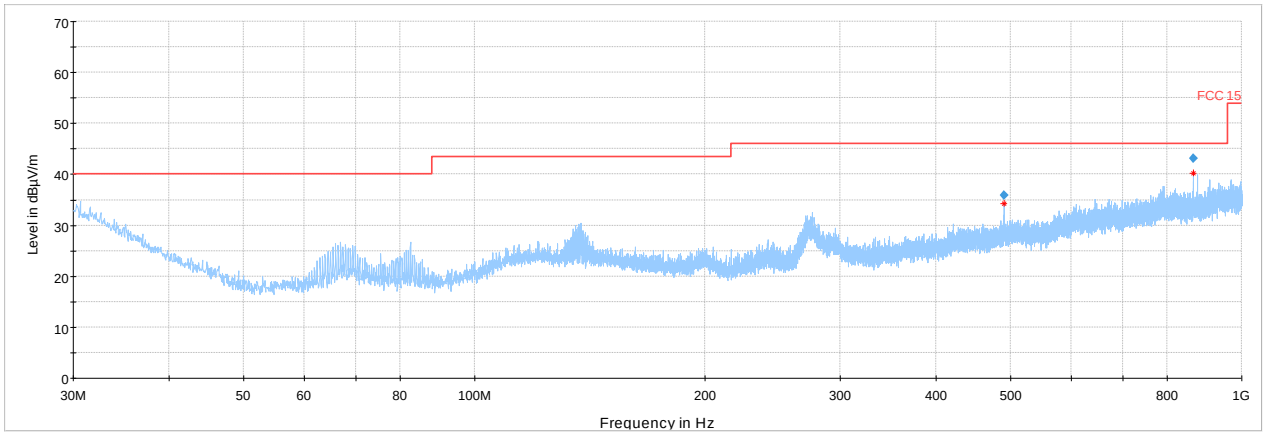
Plot # 4 Radiated Emissions: 9KHz – 30MHz	
Modulation: 802.11g	**Channel: 6**



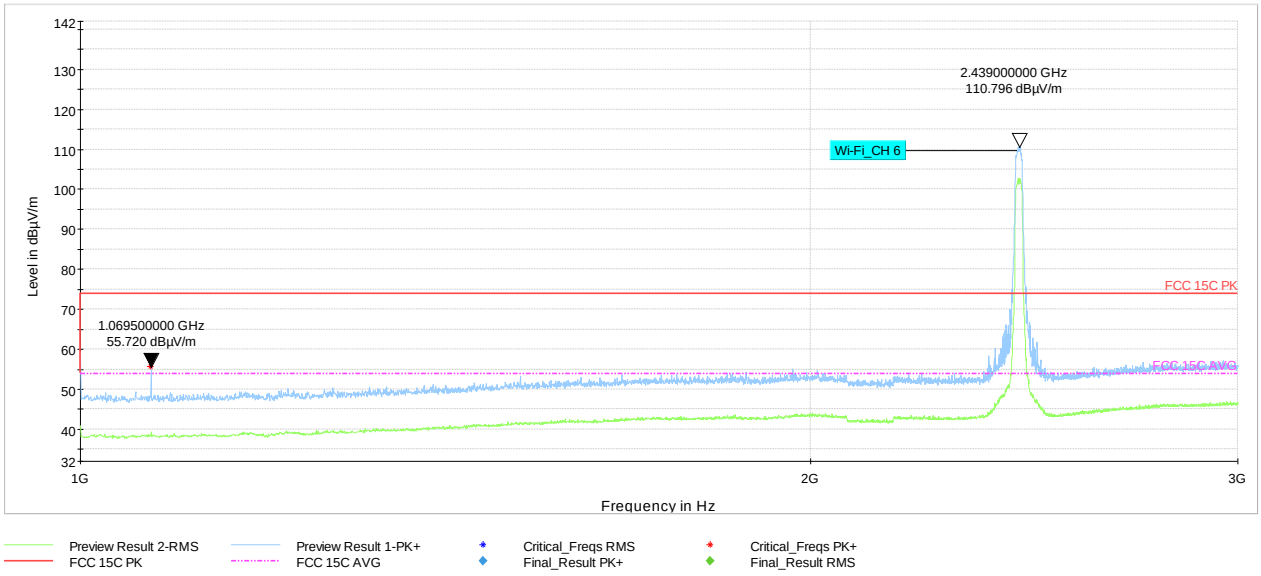
Plot # 5 Radiated Emissions: 30MHz – 1GHz	
Modulation: 802.11g	**Channel: 6**

Final_Result

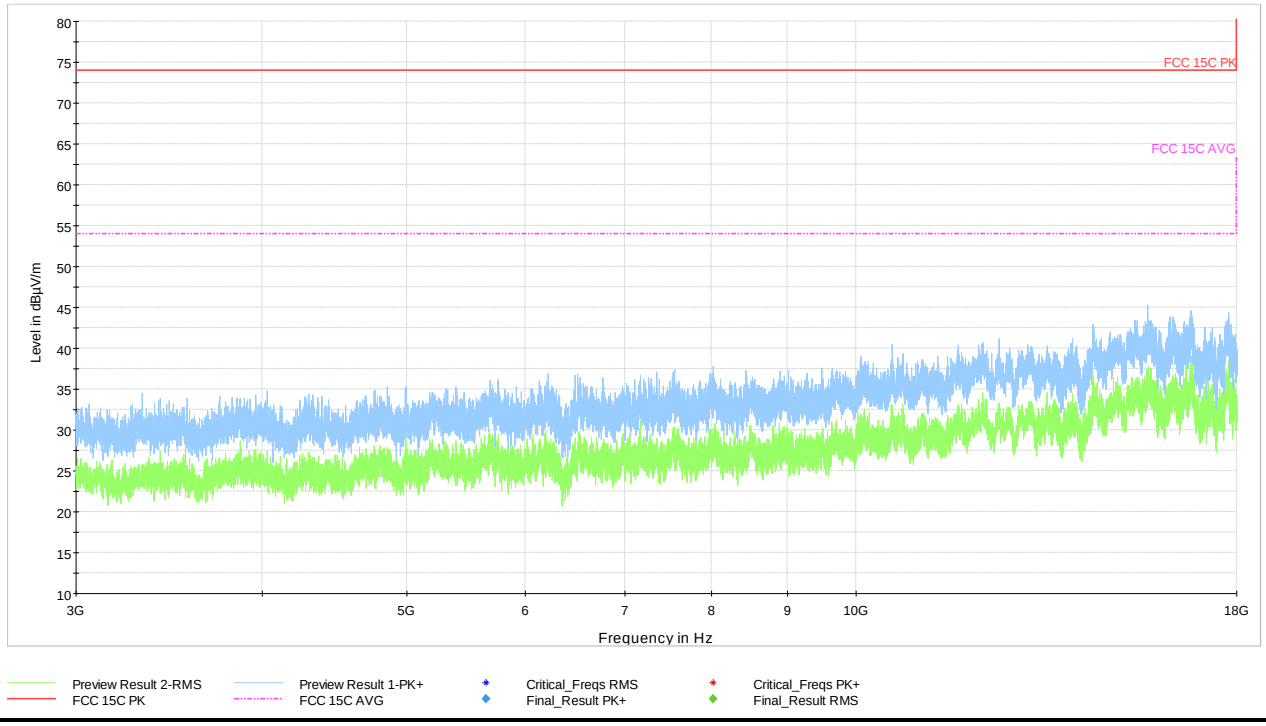
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
489.849	35.90	46.02	10.12	200.0	120.000	246.0	H	182.0	27.0	6:39:58 PM - 3/11/2019
865.273	43.19	46.02	2.84	200.0	120.000	201.0	H	100.0	31.5	6:41:51 PM - 3/11/2019



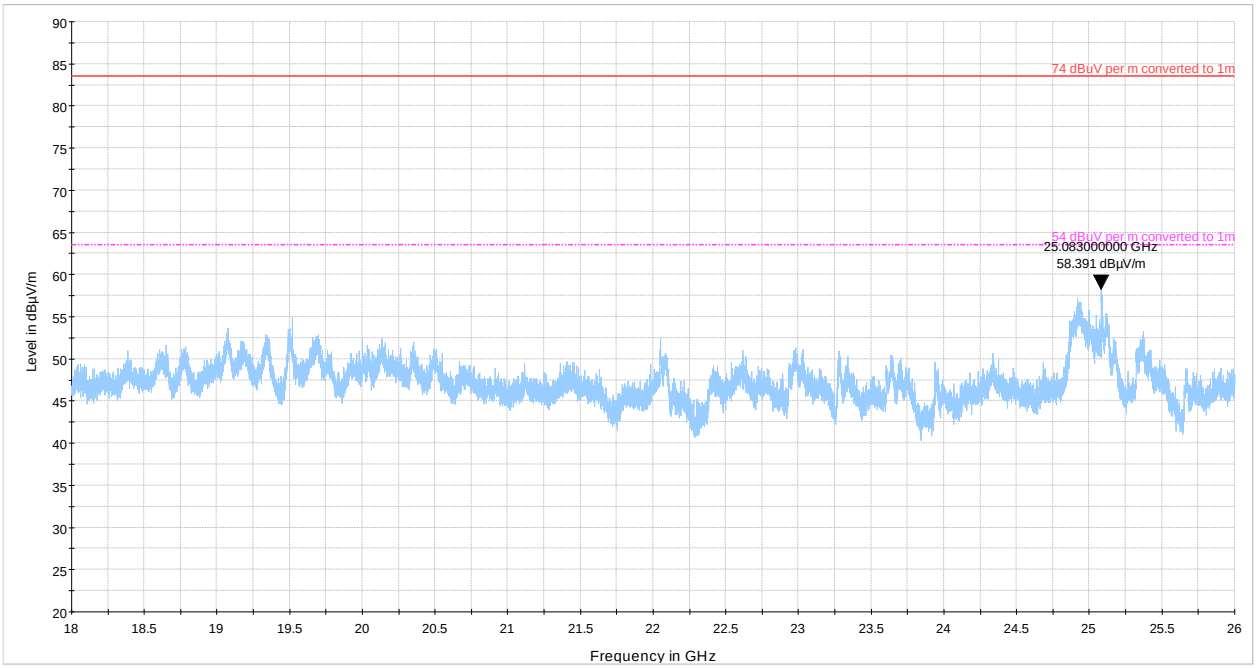
Plot # 6 Radiated Emissions: 1 – 3GHz	
Modulation: 802.11g	**Channel: 6**



Plot # 7 Radiated Emissions: 3 – 18GHz	
Modulation: 802.11g	**Channel: 6**



Plot # 8 Radiated Emissions: 18 – 26GHz	
Modulation: 802.11g	**Channel: 6**

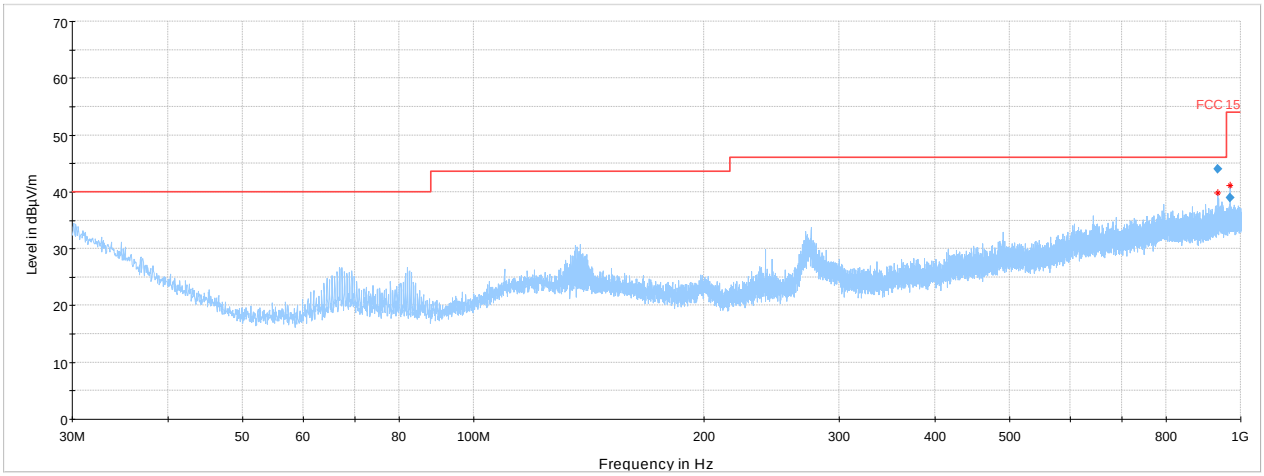


Plot # 9 Radiated Emissions: 30MHz – 1GHz

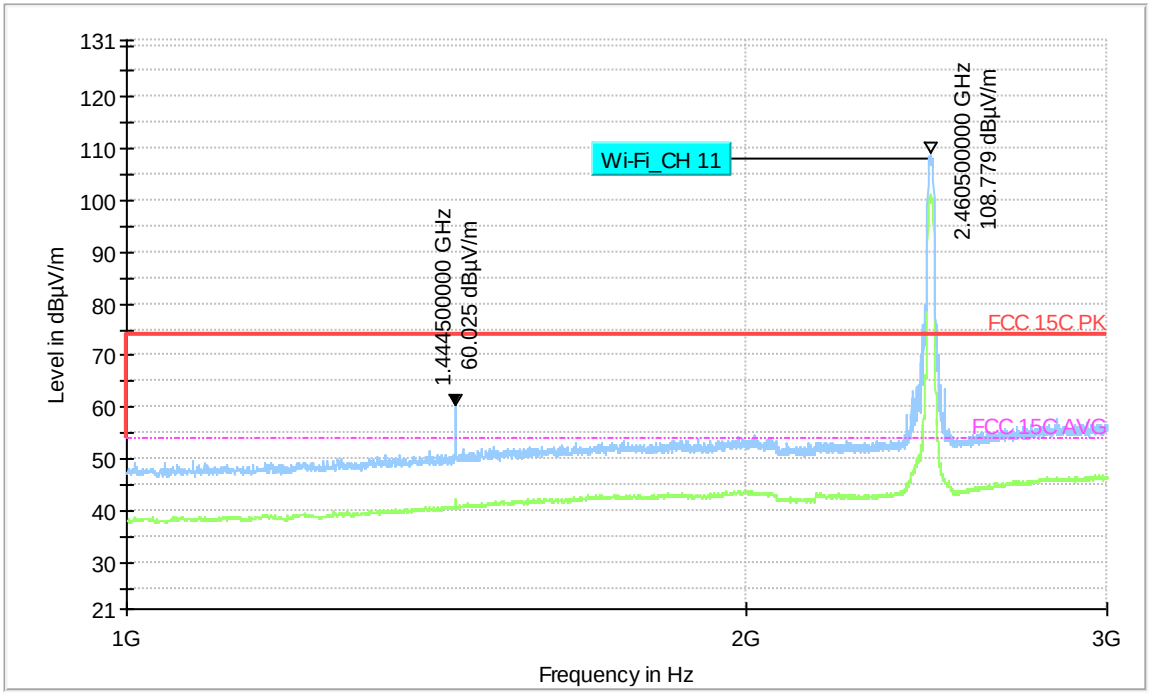
Modulation: 802.11g | **Channel: 11**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
934.426	44.04	46.02	1.98	200.0	120.000	272.0	H	251.0	32.5	6:48:26 PM - 3/11/2019
969.111	38.95	53.98	15.03	200.0	120.000	325.0	H	111.0	32.7	6:50:13 PM - 3/11/2019



Plot # 10 Radiated Emissions: 1 – 3GHz	
Modulation: 802.11g	**Channel: 11**

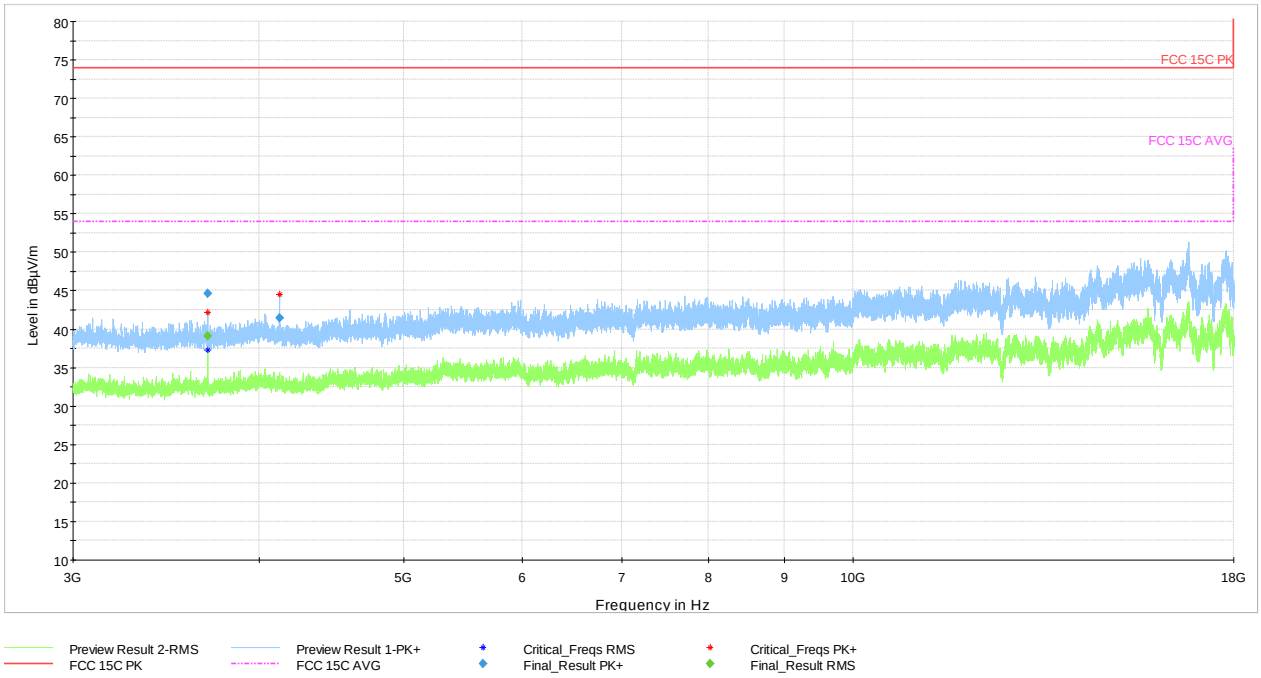


Plot # 11 Radiated Emissions: 3 – 18GHz

Modulation: 802.11g | **Channel: 11**

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Comment
3693.053	---	39.06	53.98	14.92	200.0	1000.0	310.0	H	116.0	-36	4:27:28 PM - 3/11/2019
3693.064	44.59	---	73.99	29.40	200.0	1000.0	163.0	H	114.0	-36	4:20:52 PM - 3/11/2019
4124.769	41.41	---	73.99	32.58	200.0	1000.0	118.0	V	0.0	-34	4:24:13 PM - 3/11/2019



9 Test setup photos

Setup photos are included in supporting file name: "EMC_KPTRK_006_18001_FCC_ISED_Setup_Photos.pdf"

10 Test Equipment And Ancillaries Used For Testing

Equipment Type	Manufacturer	Model	Serial #	Calibration Cycle	Last Calibration Date
ACTIVE LOOP	ETS.LINDGREN	6507	00161344	3 YEARS	10/26/2017
BILOG ANTENNA	TESEO	CBL 6141B	41106	3 YEARS	11/01/2017
HORN ANTENNA	ETS.LINDGREN	3115	00035114	3 YEARS	07/31/2017
HORN ANTENNA	ETS.LINDGREN	3117	0167061	3 YEARS	08/08/2017
HORN ANTENNA	ETS.LINDGREN	3116	0070497	3 YEARS	10/31/2017
TEST RECEIVER	R&S	ESU.EMI	100256	3 YEARS	01/31/2018
SIGNAL ANALAYZER	R&S	FSV 40	101022	3 YEARS	07/05/2017
COMPACT DIGITAL BAROMETER	CONTROL COMPANY	35519-055	91119547	2 YEARS	06/20/2017
THRMOMETER HUMIDIY	DICKSON	TM320	16253639	3 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.

11 Revision History

Date	Report Name	Changes to report	Report prepared by
03/15/2019	EMC_KPTRK_006_18001_FCC_15.247_ISED_WiFi_DTS	Initial Version	Issa Ghanma