

FCC UNII RF TEST REPORT



Vista Labs
TEST • CERTIFY • COMPLY

Test Report Number.....	CMP-19061922-LC-FCC-IC-UNII
Applicant.....	CalAmp
Applicant Address.....	2177 Salk Ave, Suite 200, Carlsbad, CA 92008 USA
Product Name.....	HotSpot OBD Dongle
Model Number.....	LMU3240LAW
Family Product/Model.....	N/A
FCC ID.....	APV-3240LA
ISED ID.....	5843C-3240LA
Date of EUT received.....	06/27/2019
Date of Test.....	06/27/2019 – 07/11/2019
Report Issue Date.....	07/19/2019
Test Standards.....	47CFR Part 15.407 RSS-247 Issue2: Feb 2017
Test Result.....	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This report is not to be reproduced by any means except in full and in any case not without the written approval of Vista Laboratories.

Tested by:

Bruce Li/Test Engineer

Approved By:

David Zhang/Technical Manager

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



Laboratory Introduction

Vista Labs is an A2LA accredited 17025 compliant regulatory compliance testing laboratories (Cert. number: 4848-01) strategically located in Orange County, providing services in the electrical and telecommunication industries. Vista labs is also recognized testing facility for Australia (ACMA), Chinese Taipei (BSMI), Chinese Taipei (NCC), Hong Kong (OFCA), Israel (MOC), Korea (RRA), Singapore (IMDA), Vietnam (MIC), etc.

Our comprehensive testing services include safety testing, EMC emission and susceptibility testing, RF and wireless testing (including DFS).

As your partner, Vista investigates appropriate test standards, develops test plans, performs troubleshooting & failure analysis, reviews documentation, and provides test reports for a complete compliance testing and certification package.



17025 Product Testing Accreditation Certificate



17065 Product Certification Accreditation Certificate



Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

1261 Puerta Del Sol
San Clemente, CA, 92673
+1 (949) 393-1123
www.vista-compliance.com

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



TABLE OF CONTENTS

1	GENERAL INFORMATION	5
1.1	Applicant	5
1.2	Product information	5
1.3	Test standard and method	7
1.4	Test Purpose and statement	7
2	TEST SITE INFORMATION	8
3	MODIFICATION OF EUT	8
4	TEST CONFIGURATION AND OPERATION	8
4.1	EUT test configuration.....	8
4.2	EUT test mode	8
4.3	Supporting Equipment	9
4.4	EUT setup diagram	9
4.5	EUT operation	9
4.6	Test software.....	9
5	EUT AND TEST SETUP PICTURES	10
5.1	EUT pictures	10
5.2	EUT test setup pictures	11
6	TEST SUMMARY	13
7	UNCERTAINTY OF MEASUREMENT	14
8	TEST SUMMARY AND RESULT	15
8.1	Antenna Requirement.....	15
8.2	DTS (6 dB) Bandwidth.....	16
8.3	Occupied Bandwidth (99%)	20
8.4	Maximum Output Power.....	22
8.5	Power Spectral Density	26
8.6	Automatically Discontinue Transmission	29
8.7	Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands.....	30
9	TEST INSTRUMENT LIST	46

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



REVISION HISTORY

Revision	Issue Date	Description	Note
Original	07/19/2019	Original release	N/A

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1 General Information

1.1 Applicant

Applicant:	CalAmp
Applicant address:	2177 Salk Ave, Suite 200, Carlsbad, CA 92008 USA
Manufacturer:	CalAmp
Manufacturer Address:	2177 Salk Ave, Suite 200, Carlsbad, CA 92008 USA

1.2 Product information

Product Name	HotSpot OBD Dongle
Model Number	LMU3240LAW
Family Model Number	N/A
Serial Number	N/A
Frequency Band	BT BDR/EDR: 2402-2480MHz BLE: 2402-2480MHz 802.11b/g/n-20MHz: 2412-2462MHz 802.11n-40MHz: 2422-2452MHz 802.11a/n-20MHz: 5725-5825MHz 802.11n-40MHz: 5755-5795MHz 802.11ac: 5210MHz, 5775MHz WCDMA Band II: 1852.4 – 1907.6 MHz WCDMA Band V: 826.4 – 846.6 MHz LTE Band 2: 1850.7-1909.3MHz LTE Band 4: 1710.7-1754.3MHz LTE Band 5: 824.7-848.3MHz LTE Band 12: 699.7-715.3MHz
Type of modulation	BT BDR/EDR: GFSK, $\pi/4$ DQPSK, 8DPSK BLE: GFSK 802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11a/n/ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) WCDMA: QPSK LTE: QPSK, 16QAM
Equipment Class/ Category	DSS, DTS, UNII, PCB
Maximum output power	See test result
Antenna Information	LDS antenna P/N: 81XKAG15.G11 Peak Gain: 2.4GHz: 0.52 dBi, 5GHz: 1.79 dBi; Cellular B2: 2.04 dBi; B4: 2.74 dBi; B5: -0.70 dBi; B12: -0.33 dBi.
Clock Frequencies	32.768 KHz, 12 MHz, 48 MHz
Port/Connectors	Micro USB, CAN bus
Input Power	Vehicle Battery powered: 12-24VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BT, WLAN and WCDMA/LTE can transmit simultaneously

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



Additional Info

EUT is Hot Spot OBD dongle installed into vehicle resides passenger and light duty trucks that support OBD vehicle bus, it is a single box enclosure incorporating a processor, a GPS receiver, a wireless data modem in addition to WLAN, Bluetooth capabilities with vehicle-rated power supply and Vehicle bus interface.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1.3 Test standard and method

Test standard	47CFR Part 15.247 RSS-247 Issue 2.0: Feb 2017
Test method	ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r02 RSS-Gen Issue 5: Apr 2018

1.4 Test Purpose and statement

The purpose of this test report is intended to demonstrate the compliance of product listed in section 1.2, received from company listed in section 1.1, to the requirements of standard and method listed in section 1.3. Based on our test results, we conclude that the product tested complies with the requirements of the standards indicated.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



2 Test site information

Lab performing tests	Vista Laboratories
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.Vista-compliance.com

Test condition	Test Engineer	Test Environment	Test Date
RF conducted	Bruce Li	23.5°C / 58.2%/996 mbar	06/27/2019 – 07/11/2019
Radiated	Cameron Wu	23.5°C / 58.2%/996 mbar	06/27/2019 – 07/11/2019

3 Modification of EUT

The EUT is an engineering test sample loaded with RF testing firmware specifically designed to support the RF TX/RX measurement in different aspects.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external DC power supply for testing purpose. EUT's RF antenna port is connected to spectrum analyzer through RF test cable for measurement. The test software is used to set EUT to different transmission mode in terms of radio mode (WLAN, BLE), test channel, data rate, etc.

4.2 EUT test mode

Radio	Channel
802.11-a	5745
802.11-a	5785
802.11-a	5825
802.11-n-20	5745
802.11-n-20	5785
802.11-n-20	5825
802.11-n-40	5755
802.11-n-40	5795
802.11-ac-80	5775

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	DC Power Supply	DP712	DP7B194900487	RIGOL	N/A

4.4 EUT setup diagram



4.5 EUT operation

The operation, control and display are done by the built-in buttons and OLED display.

4.6 Test software

Index	Description	Remark
1	Qualcomm Radio Control Tool	To set EUT into continuous TX and RX mode under different modulation, data rate and channel, etc.
2	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



6 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
§15.203	-	Antenna Requirement	8.1	Pass
§15.207 (a)	RSS-Gen §8.8	AC Power Line Conducted Emissions	N/A	N/A
§15.407(e)	RSS-247 §6.2	6 dB Bandwidth	8.2	Pass
-	RSS-Gen §6.7	Occupied Bandwidth	8.3	Pass
§15.407(a)	RSS-247 §6.2	Conducted Maximum Output Power	8.4	Pass
§15.407(a)	RSS-247 §6.2	Power Spectral Density	8.5	Pass
§15.407(c)	RSS-247 §6.4	Automatically Discontinue Transmission	8.6	Pass
§15.205, §15.209	RSS-247 §6.2	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.7	Pass

Note1: EUT is powered by Vehicle mains. It does not connect to public AC mains. This item is not applicable.

7 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8 Test summary and result

8.1 Antenna Requirement

8.1.1 Requirement

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

8.1.2 Result

Analysis:

- EUT uses LDS antenna.
- The LDS antenna which connect to the main board with unique spring loaded pins when is installed and attached to the main body. No standard RF connector or coupling is used.

Conclusion:

EUT complies with antenna requirement in § 15.203.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



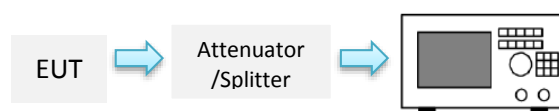
8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.407 (e), RSS-247 §6.2

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

8.2.2 Test setup



8.2.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, Section C) Emission bandwidth.

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Use automatic bandwidth measurement capability on instrument to obtain BW result.

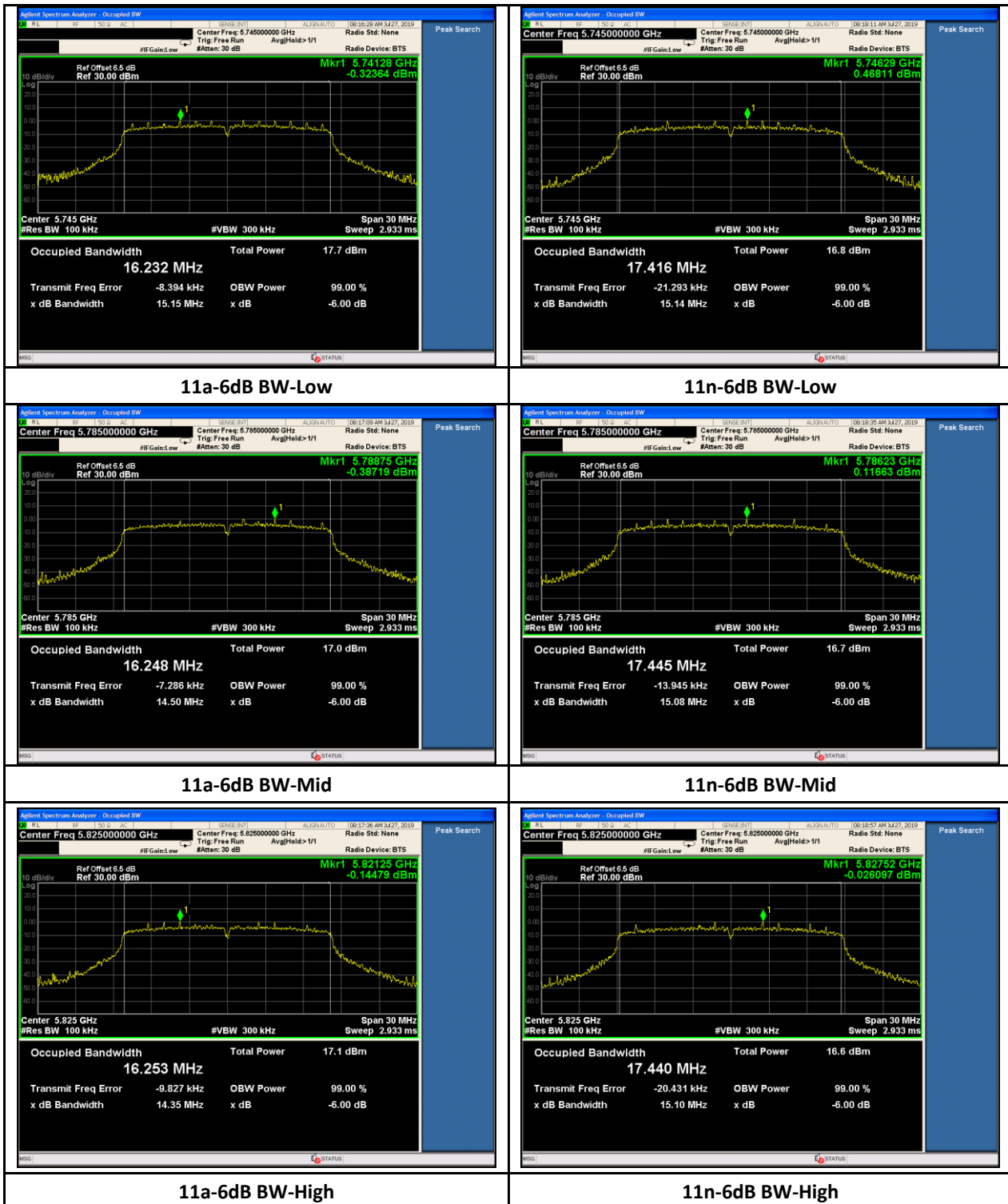
Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



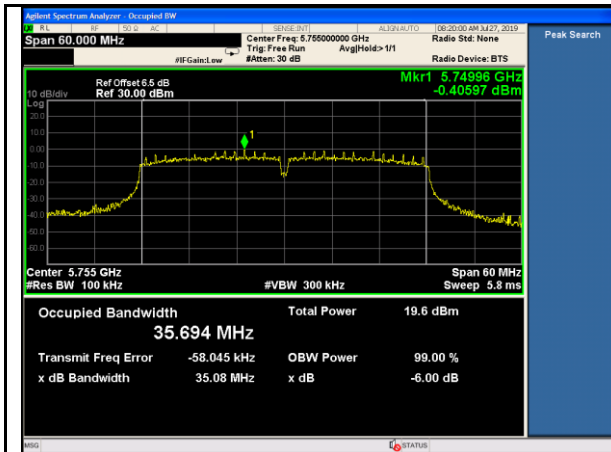
8.2.4 Test Result

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11a	149	5745	6Mbps	16232	500	Pass
11a	157	5785	6Mbps	16248	500	Pass
11a	165	5825	6Mbps	16253	500	Pass
11n-20M	149	5745	MCS0	17416	500	Pass
11n-20M	157	5785	MCS0	17445	500	Pass
11n-20M	165	5825	MCS0	17440	500	Pass
11n-40M	155	5755	MCS0	35694	500	Pass
11n-40M	159	5795	MCS0	35732	500	Pass
11ac-80M	155	5775	VHC-MCS0	75004	500	Pass

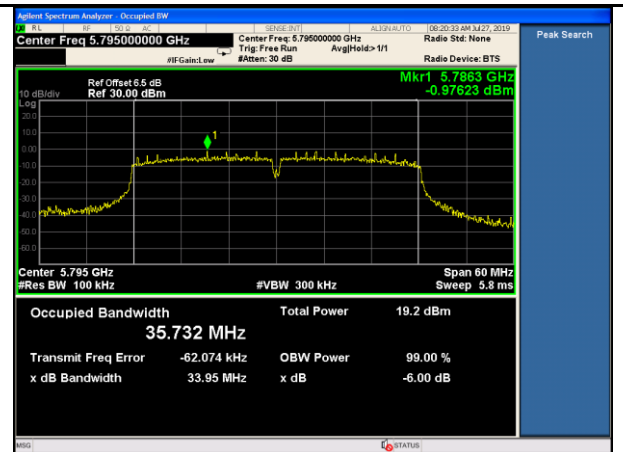
8.2.5 Test Plots



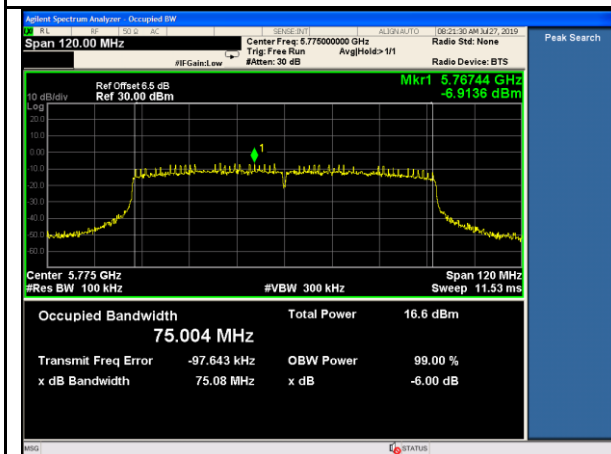
Report Number: CMP-19061922-LC-FCC-IC-UNII
Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



11n-40MHz-6dB BW-Low



11n-40MHz-6dB BW-High



11ac-80MHz-6dB BW

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



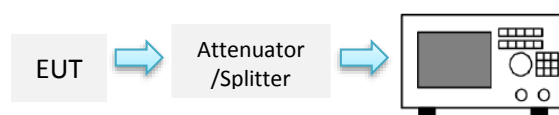
8.3 Occupied Bandwidth (99%)

8.3.1 Requirement

RSS-Gen §6.7

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.3.2 Test setup



8.3.3 Test Procedure

According to section RSS-Gen §6.7

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = large enough to capture all products of the modulation process
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.3.4 Test Result

Mode/ Bandwidth	Channel	Frequency (MHz)	Data rate	Measured 99% OBW (KHz)	Limit (KHz)	Result
11a	149	5745	6Mbps	17375	N/A	N/A
11a	157	5785	6Mbps	16239	N/A	N/A
11a	165	5825	6Mbps	16243	N/A	N/A
11n-20M	149	5745	MCS0	17428	N/A	N/A
11n-20M	157	5785	MCS0	17400	N/A	N/A
11n-20M	165	5825	MCS0	17749	N/A	N/A
11n-40M	155	5755	MCS0	35826	N/A	N/A
11n-40M	159	5795	MCS0	36484	N/A	N/A
11ac-80M	155	5775	VHC-MCS0	74965	N/A	N/A

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



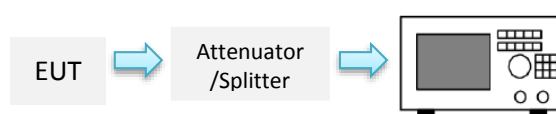
8.4 Maximum Output Power

8.4.1 Requirement

For the band 5.725-5.85 GHz, RSS-247 §6.2

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.4.2 Test setup



8.4.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v01, Section E) Maximum conducted output power, 2, b), method SA-1

1. Set span to encompass the entire emission bandwidth (EBW)(or, alternatively, the entire 99% occupied bandwidth)of the signal.
2. Set RBW=1MHz
3. Set VBW $\geq 3 \times$ RBW
4. Number of points in sweep $\geq 2 \times$ span/ RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto couple.
6. Detector = Power averaging (RMS)
7. Trace average at least 100 traces in power averaging(rms)mode.
8. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.4.4 Test Result

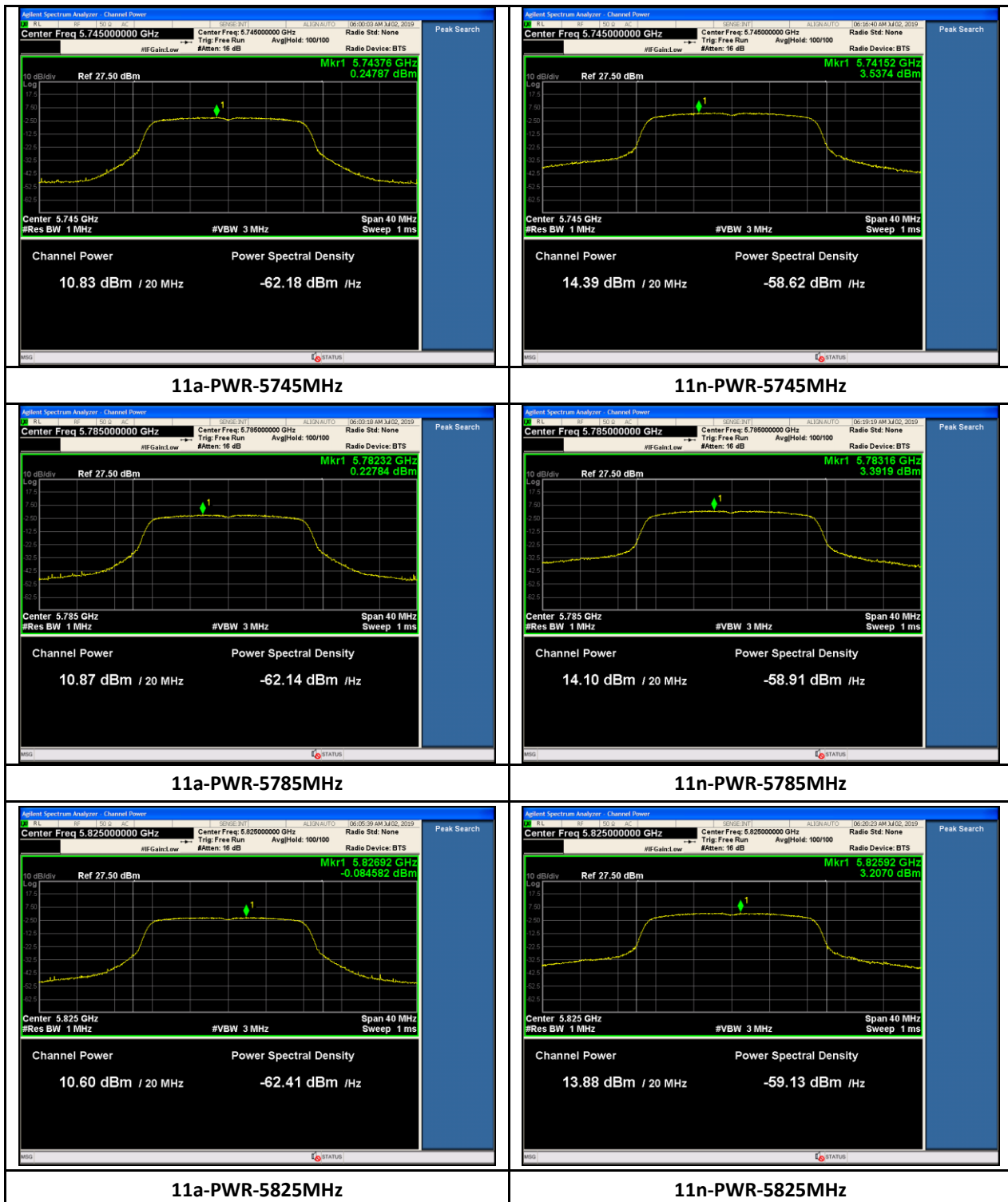
Conducted Output Power

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
11a	5745	6Mbps	10.83	30	Pass
11a	5785	6Mbps	10.87	30	Pass
11a	5825	6Mbps	10.60	30	Pass
11n-20M	5745	MCS0	14.39	30	Pass
11n-20M	5785	MCS0	14.10	30	Pass
11n-20M	5825	MCS0	13.88	30	Pass
11n-40M	5755	MCS0	12.66	30	Pass
11n-40M	5795	MCS0	12.69	30	Pass
11ac-80M	5775	VHC-MCS0	8.52	30	Pass

E.I.R.P per RSS-247

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Antenna Gain (dBi)	E.I.R.P Result (dBm)	Limit (dBm)
11a	5745	6Mbps	10.83	1.79	12.62	36
11a	5785	6Mbps	10.87	1.79	12.66	36
11a	5825	6Mbps	10.60	1.79	12.39	36
11n-20M	5745	MCS0	14.39	1.79	16.18	36
11n-20M	5785	MCS0	14.10	1.79	15.89	36
11n-20M	5825	MCS0	13.88	1.79	15.67	36
11n-40M	5755	MCS0	12.66	1.79	14.45	36
11n-40M	5795	MCS0	12.69	1.79	14.48	36
11ac-80M	5775	VHC-MCS0	8.52	1.79	10.31	36

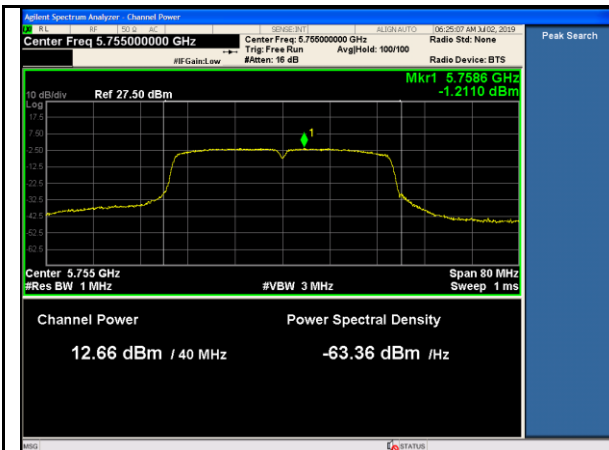
8.4.5 Test Plots



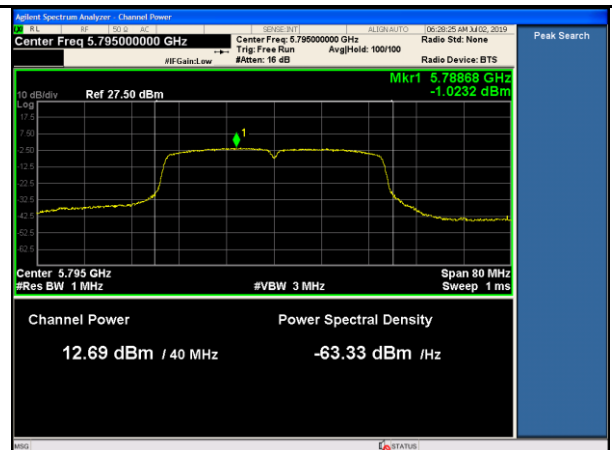
Report Number: CMP-19061922-LC-FCC-IC-UNII
Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



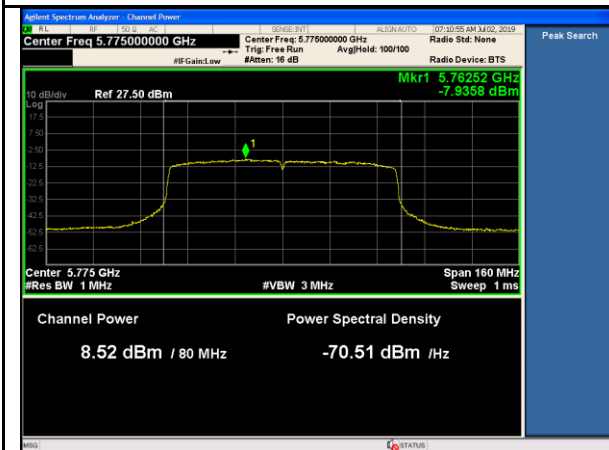
Testing Cert #4848-01



11n-40MHz-PWR-5755MHz



11n-40MHz-PWR-5795MHz



11ac-80MHz-5775MHz

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.5 Power Spectral Density

8.5.1 Requirement

For the band 5.725-5.85 GHz, RSS-247 §6.2

The maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.5.2 Test setup



8.5.3 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, section F)
Maximum power spectral density. Method SA-1

1. Set span to encompass the entire emission bandwidth (EBW)(or, alternatively, the entire 99% occupied bandwidth)of the signal.
2. Set RBW=1MHz
3. Set VBW $\geq 3 \times$ RBW
4. Number of points in sweep $\geq 2 \times$ span/ RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)
5. Sweep time = auto couple.
6. Detector = Power averaging (RMS)
7. Trace average at least 100 traces in power averaging(rms)mode.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.5.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/MHz)	Corrected PSD (dBm/500KHz)	Max PSD (dBm/500KHz)	Result
11a	5745	6Mbps	0.248	-2.76	30	Pass
11a	5785	6Mbps	0.228	-2.78	30	Pass
11a	5825	6Mbps	-0.008	-3.02	30	Pass
11n-20M	5745	MCS0	3.537	0.53	30	Pass
11n-20M	5785	MCS0	3.392	0.38	30	Pass
11n-20M	5825	MCS0	3.207	0.20	30	Pass
11n-40M	5755	MCS0	-1.211	-4.22	30	Pass
11n-40M	5795	MCS0	-1.023	-4.03	30	Pass
11ac-80M	5775	VHC-MCS0	-7.936	-10.95	30	Pass

Note: If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.5.5 Test Plots

Refer to test plots in conducted peak output power

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



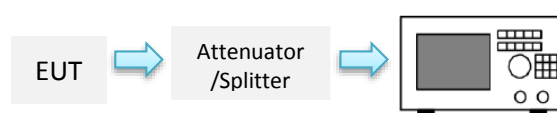
8.6 Automatically Discontinue Transmission

8.6.1 Requirement

§ 15.407 (c), RSS-247 §6.4

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

8.6.2 Test setup



8.6.3 Test Result

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

8.7 Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands

8.7.1 Requirement

§ 15.205, 15.209, 15.407(b), RSS-247 §6.2

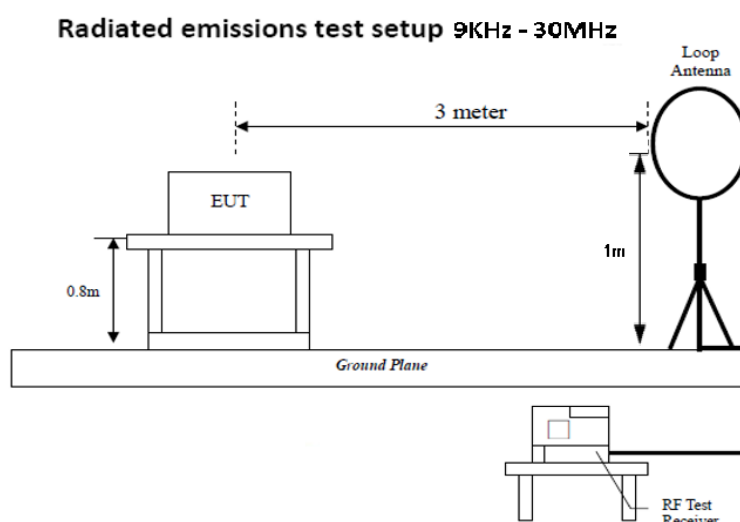
(4) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(5) Restricted band, emission must also comply with the radiated emission limits specified in 15.209

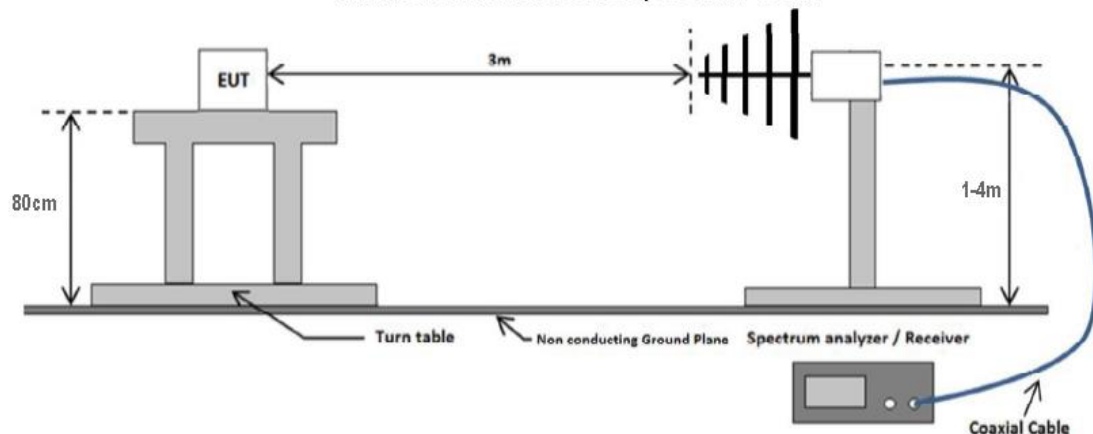
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength ($\mu\text{V/m}$)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

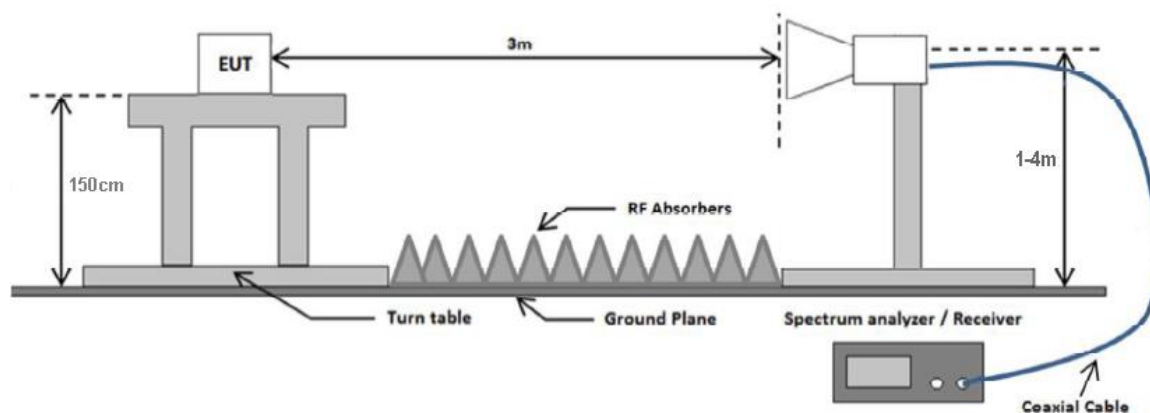
8.7.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.7.3 Test Procedure

According to FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement. And subclause 12.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

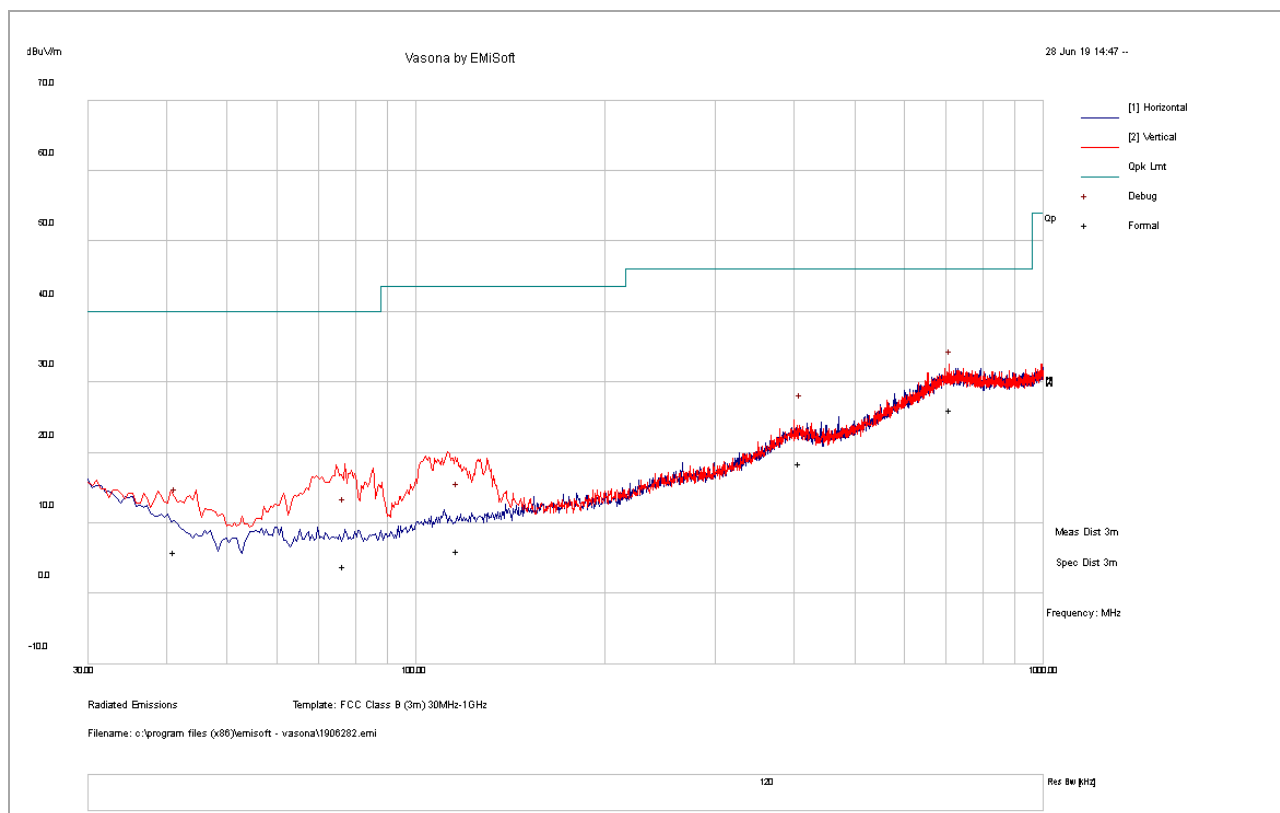
Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.7.4 Test Result

30-1000MHz test result

Test Standard:	15.209, 15.407	Mode:	802.11a-5745MHz
Frequency Range:	30-1000MHz	Test Date:	06/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
710.49	25.23	7.31	-6.47	26.07	QP	H	183	289	46	-19.93
409.63	25.76	6.34	-13.57	18.53	QP	V	282	79	46	-27.47
41.27	24.55	2.58	-21.12	6.00	QP	H	100	62	40	-34.00
76.74	25.15	3.27	-24.48	3.93	QP	H	357	353	40	-36.07
116.38	25.47	3.82	-23.25	6.03	QP	H	384	0	44	-37.47

Note:

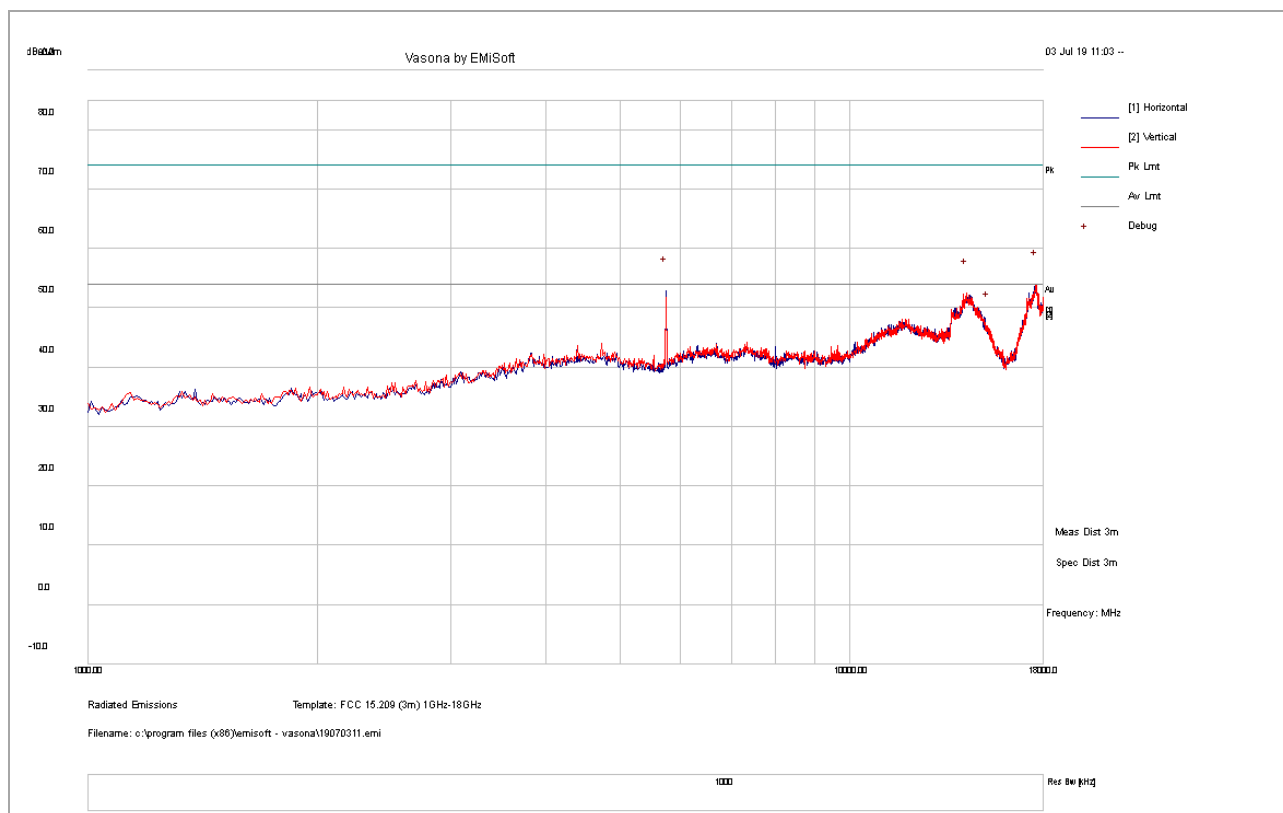
- 1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11a 5745MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



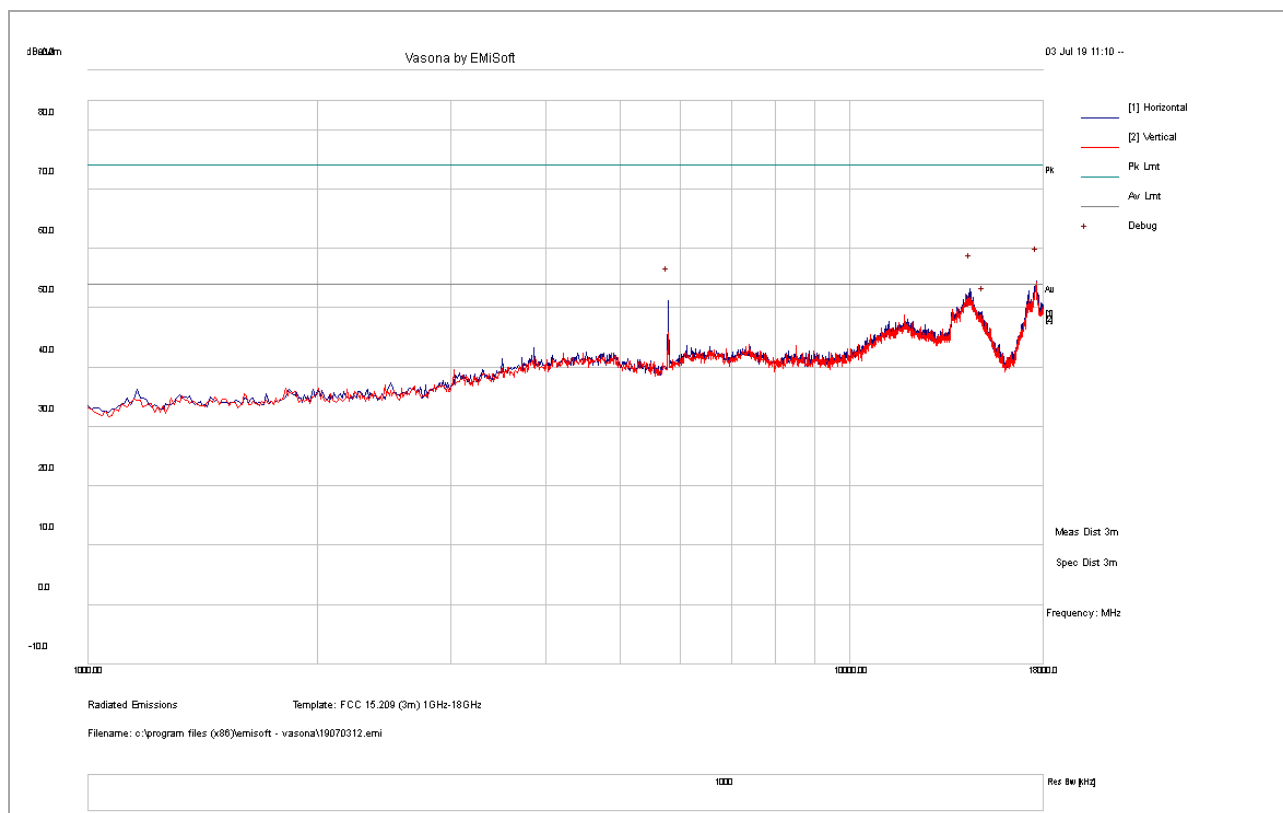
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14249.38	12.50	22.28	14.62	49.40	PK	V	200	113	54	-4.60
15205.63	13.57	24.35	9.07	46.99	PK	V	100	182	54	-7.01
17596.25	10.67	25.28	15.01	50.96	PK	H	200	162	54	-3.04

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11a 5785MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



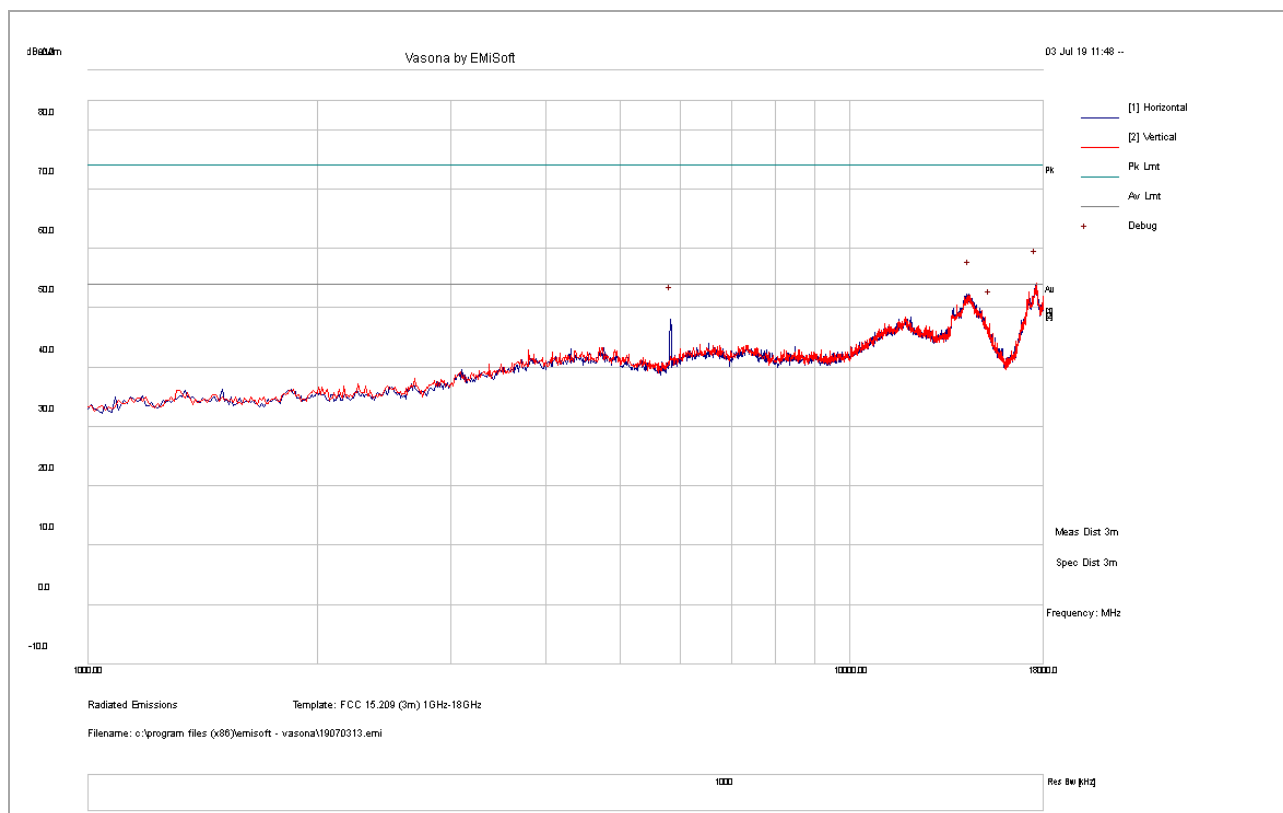
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17628.13	11.64	25.32	14.47	51.43	PK	H	100	113	54	-2.57
14419.38	13.22	22.79	14.27	50.28	PK	H	200	92	54	-3.72
15025.00	13.36	24.48	10.08	47.92	PK	H	100	102	54	-6.08

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11a 5825MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



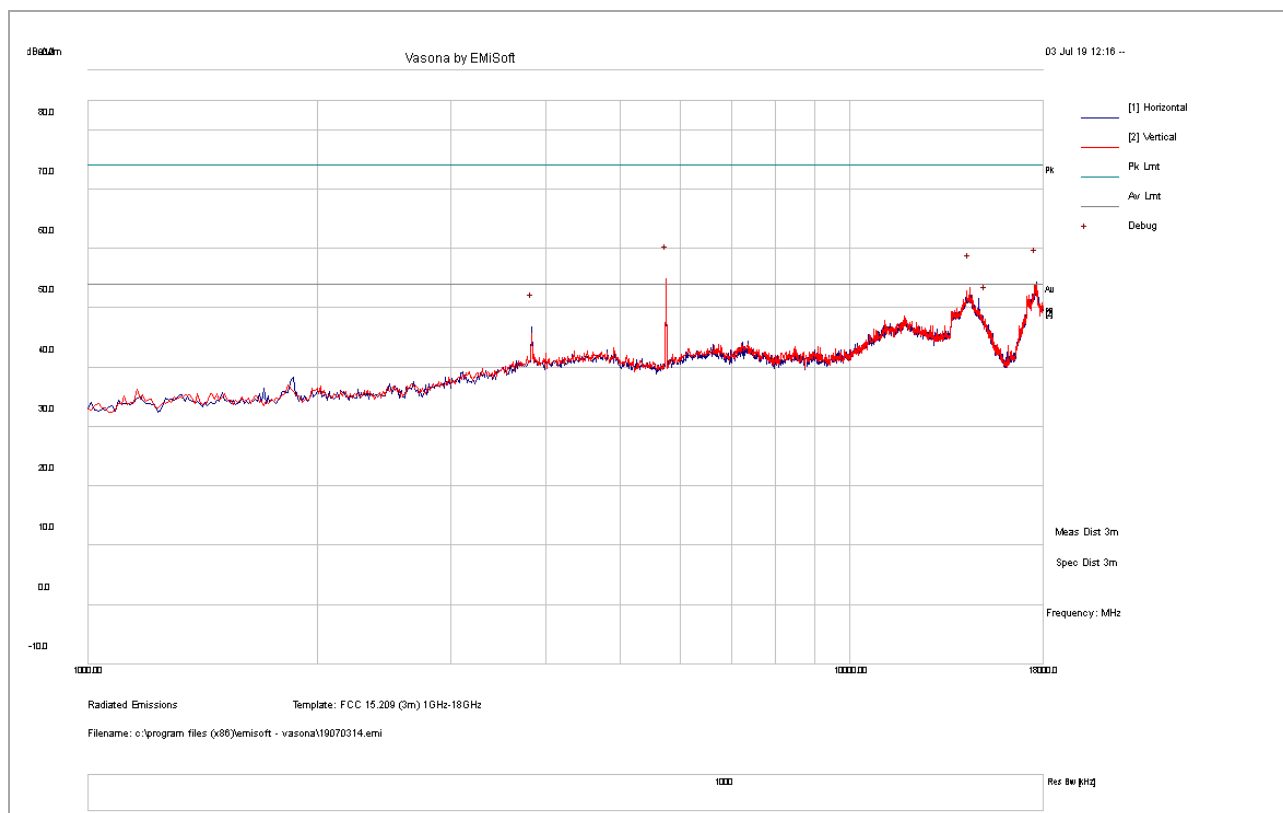
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	11.79	25.28	15.01	52.08	PK	V	300	109	54	-1.92
14355.63	13.08	22.60	14.68	50.36	PK	H	200	114	54	-3.64
15301.25	14.46	24.28	8.49	47.23	PK	V	200	82	54	-6.77

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11n 5745MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



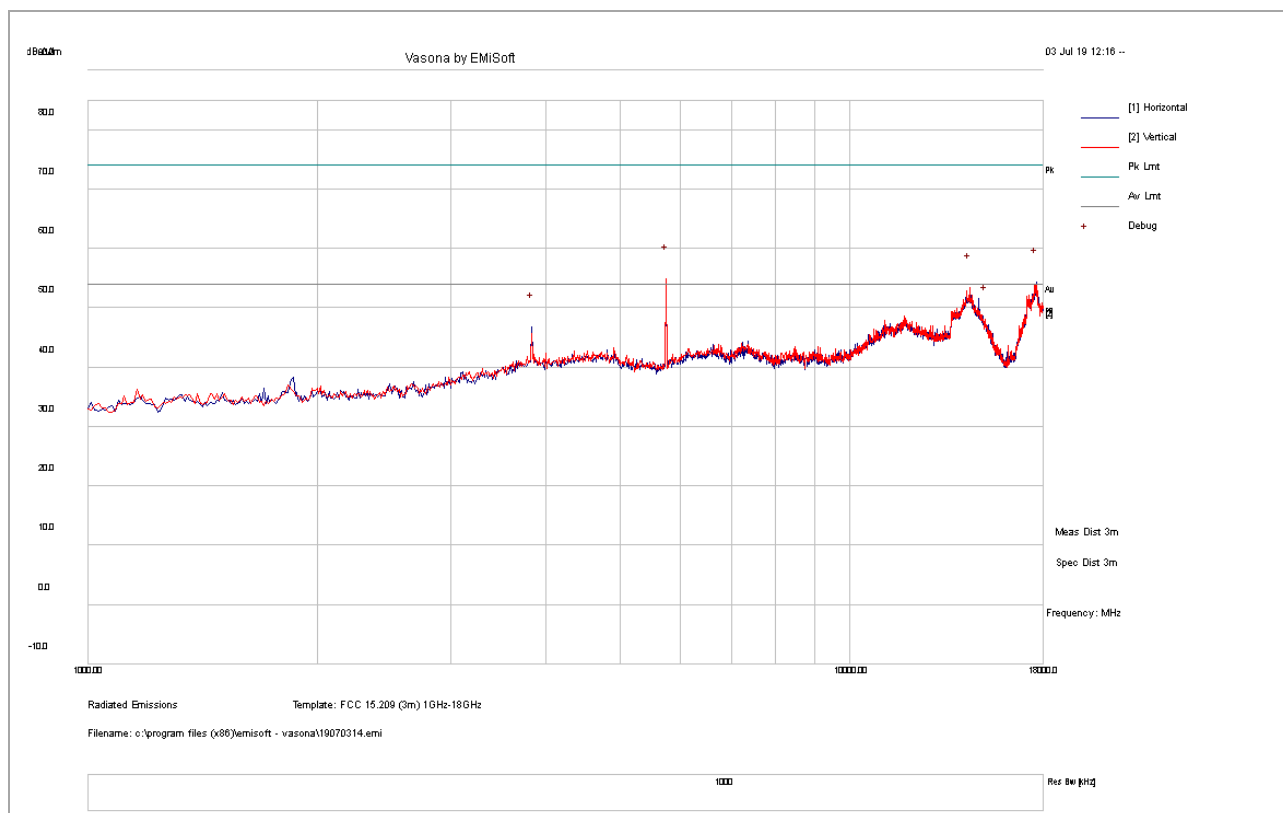
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
3826.25	26.34	12.46	7.87	46.67	PK	H	100	92	54	-7.33
14398.13	14.17	22.73	14.44	51.34	PK	V	300	112	54	-2.66
15088.75	13.87	24.43	9.71	48.01	PK	V	100	134	54	-5.99
17606.88	10.10	25.30	14.92	50.32	PK	H	200	72	54	-3.68

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11n 5785MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



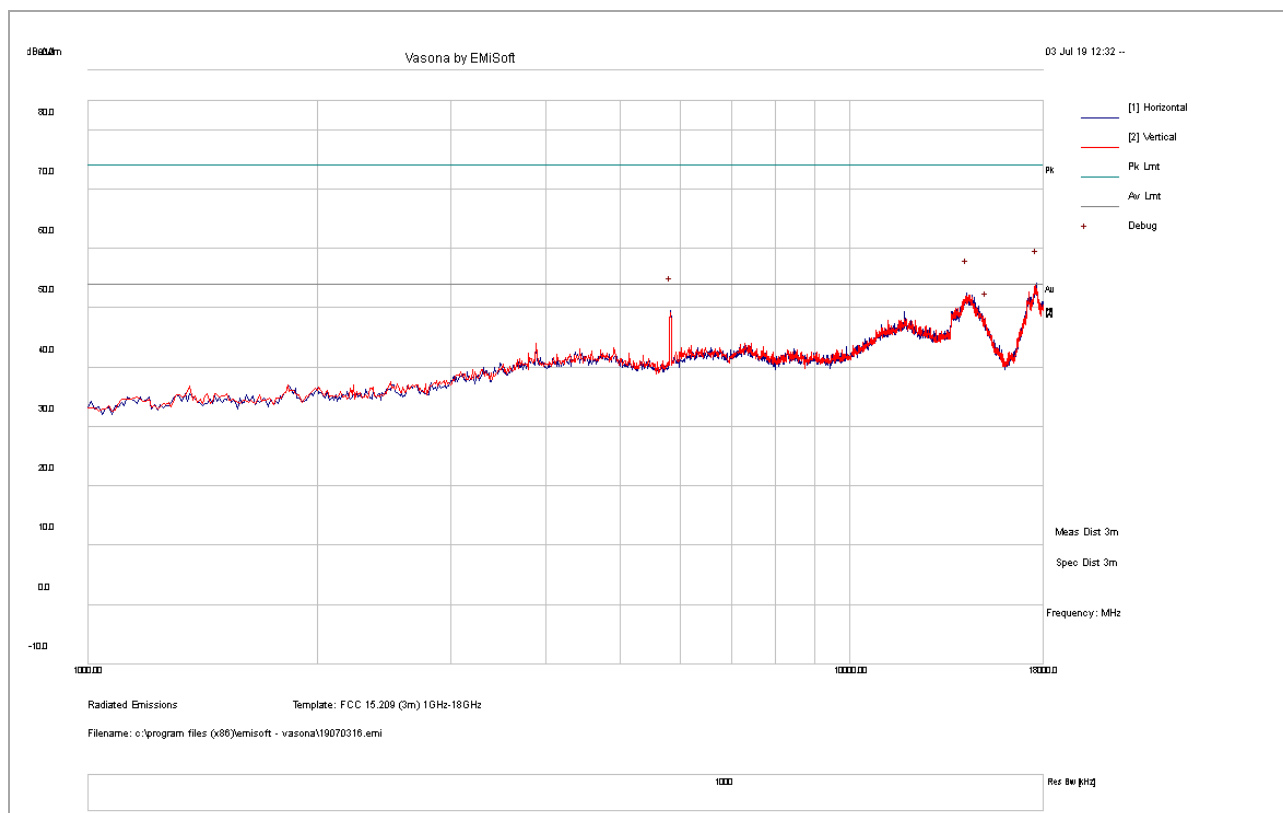
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17564.38	11.03	25.24	14.59	50.86	PK	H	100	110	54	-3.14
14430.00	13.37	22.82	14.18	50.37	PK	V	300	82	54	-3.63
15195.00	13.44	24.36	9.12	46.92	PK	V	300	116	54	-7.08

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11n 5825MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



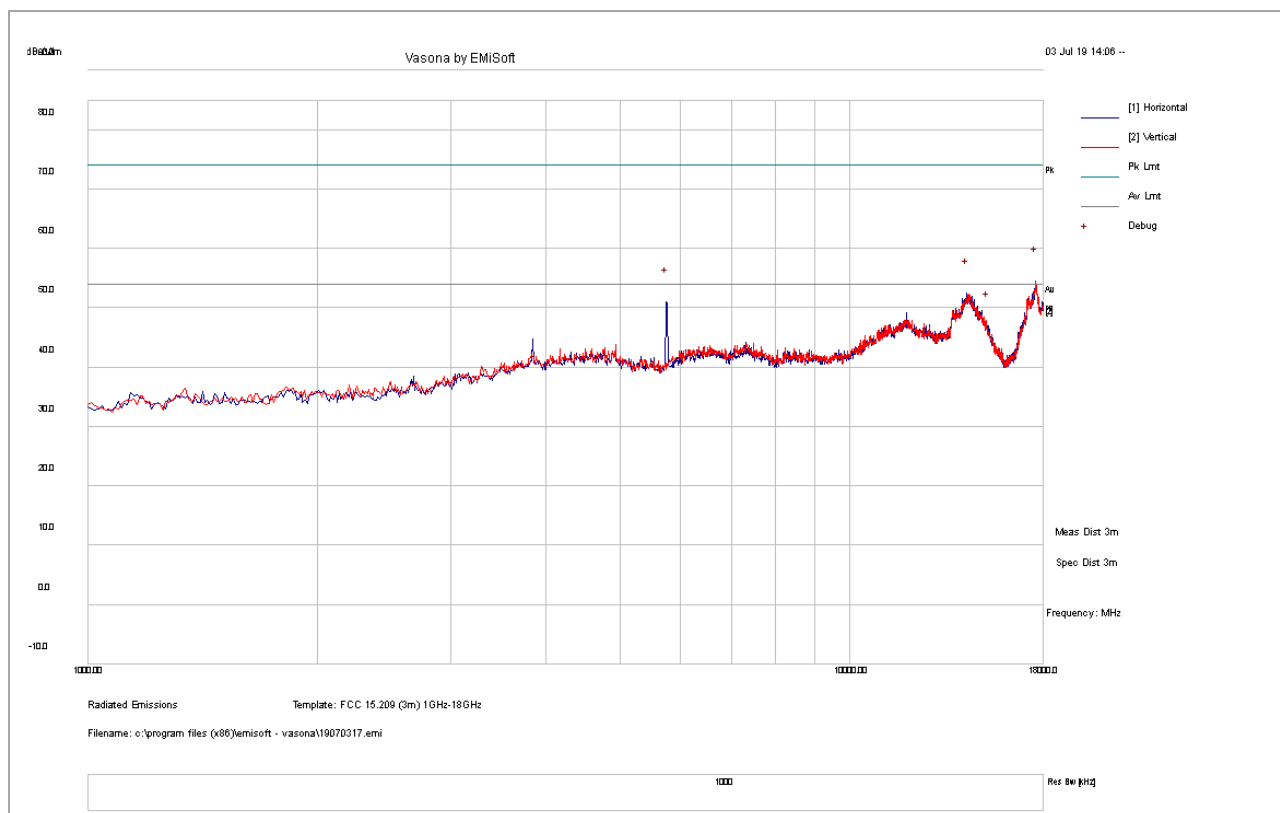
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17617.50	11.12	25.31	14.69	51.12	PK	H	200	73	54	-2.88
14270.63	13.23	22.34	14.65	50.22	PK	H	300	281	54	-3.78
15152.50	13.23	24.39	9.35	46.97	PK	H	300	215	54	-7.03

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11n-40MHz 5755MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



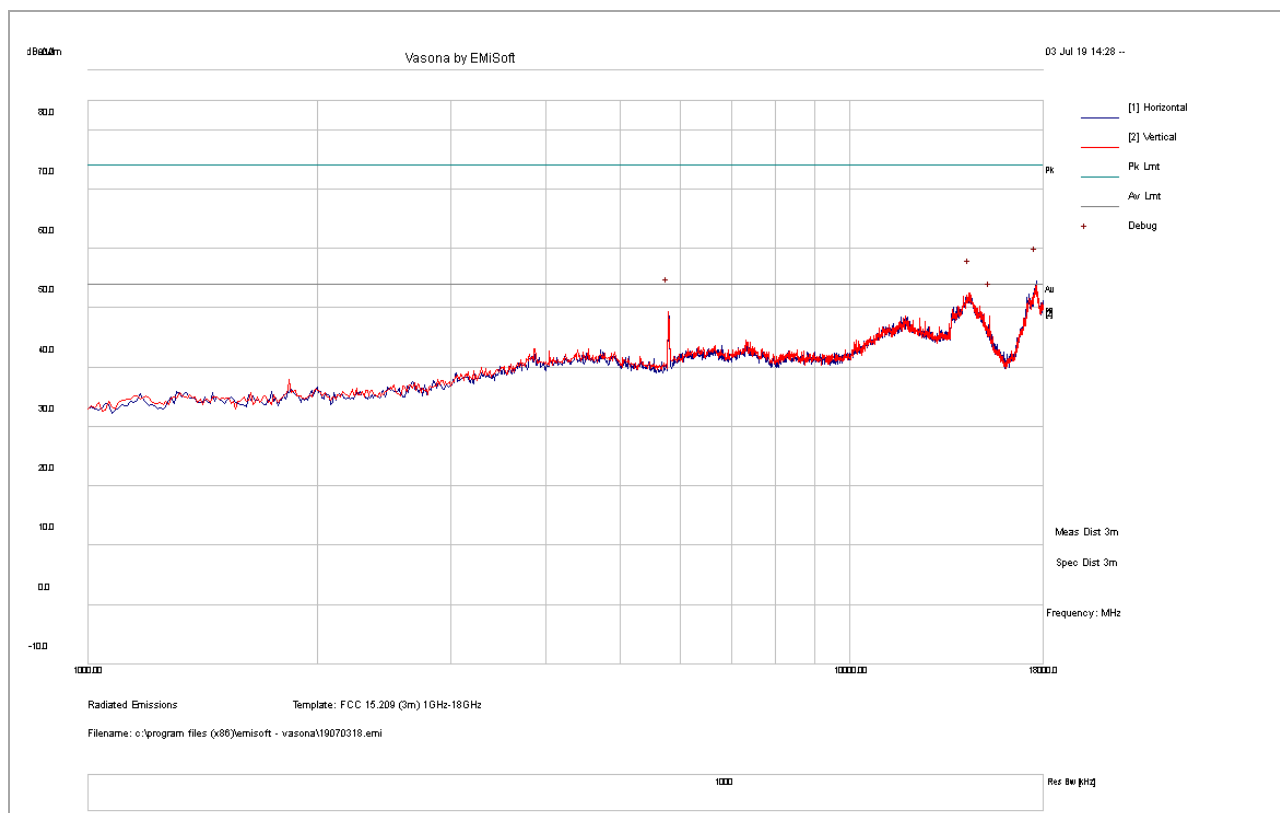
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14450.13	14.23	22.88	14.01	51.12	PK	V	100	72	54	-2.88
17161.71	12.98	24.70	12.79	50.47	PK	V	100	113	54	-3.53
17614.00	11.35	25.30	14.77	51.42	PK	V	100	183	54	-2.58

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11n-40MHz 5795MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



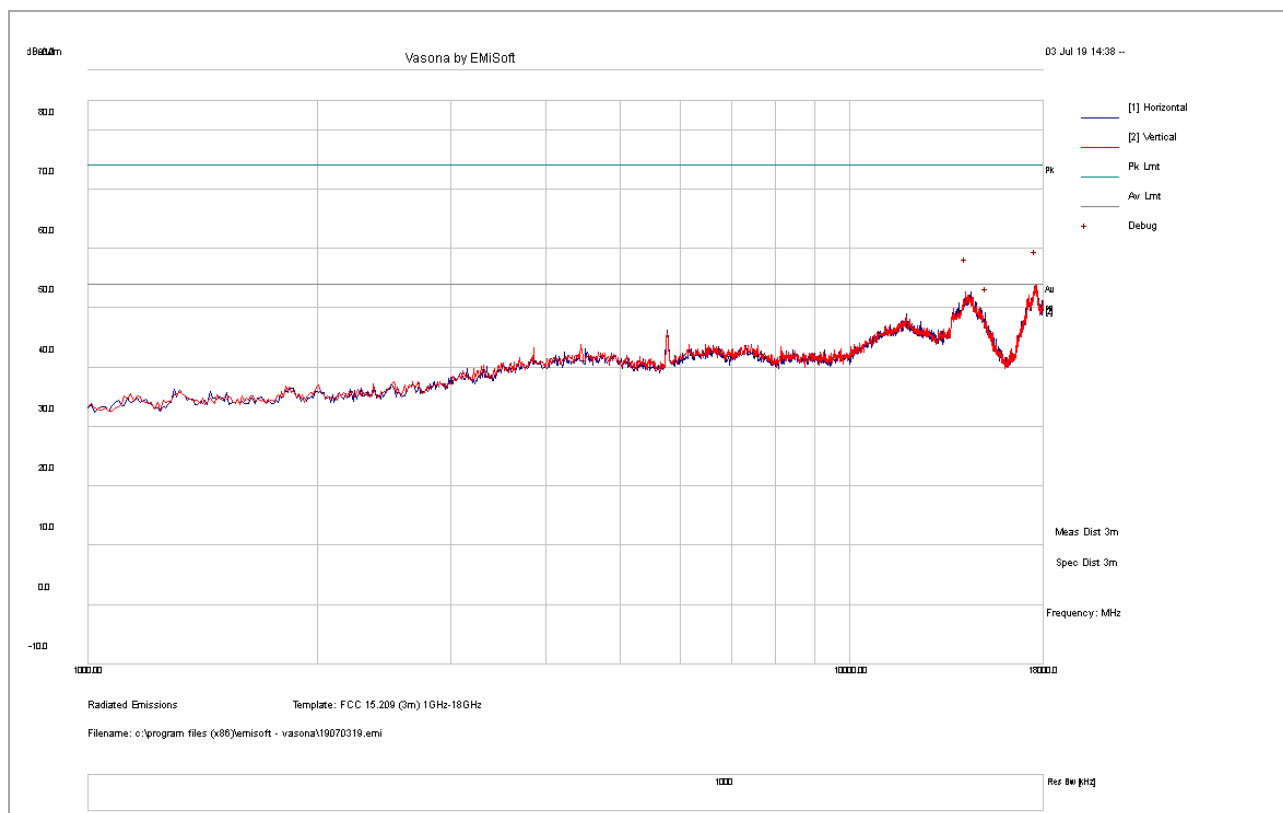
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	10.16	25.28	15.01	50.45	PK	H	200	82	54	-3.55
14366.25	13.68	22.63	14.62	50.93	PK	V	100	113	54	-3.07
15290.63	15.70	24.29	8.56	48.55	PK	V	200	173	54	-5.45

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



1GHz – 18GHz test result

Test Standard:	15.209, 15.407	Mode:	11ac-80MHz 5775MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/03/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	10.70	25.28	15.01	50.99	PK	V	300	71	54	-3.01
14238.75	13.80	22.25	14.60	50.65	PK	V	100	119	54	-3.35
15141.88	13.82	24.40	9.41	47.63	PK	V	300	172	54	-6.37

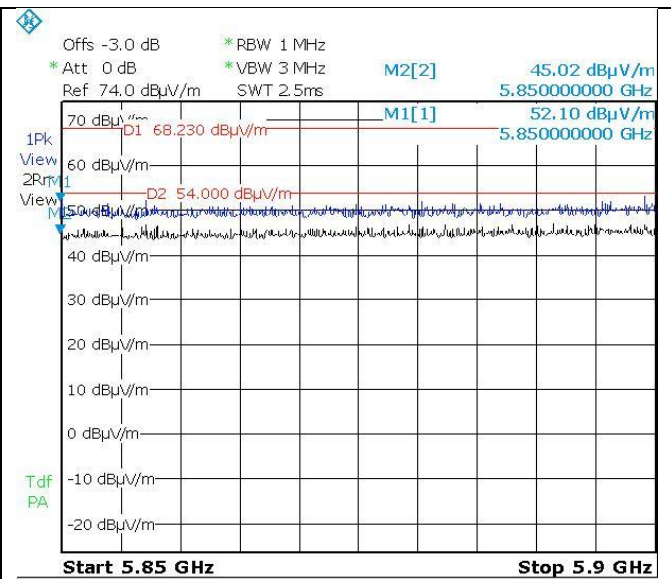
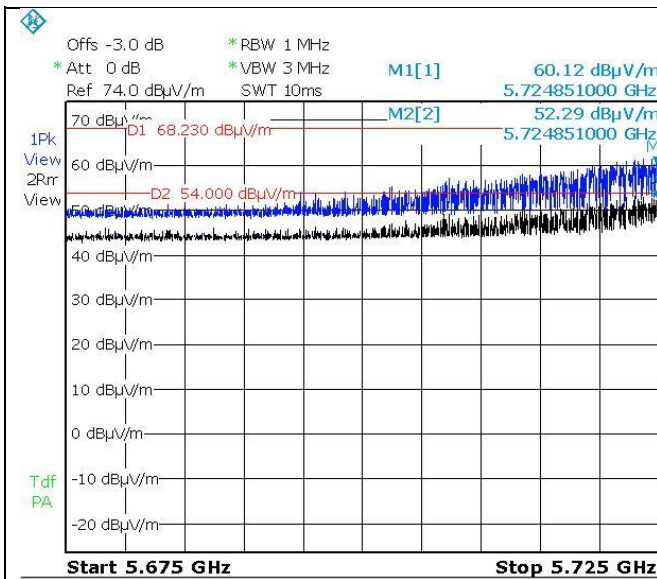
Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



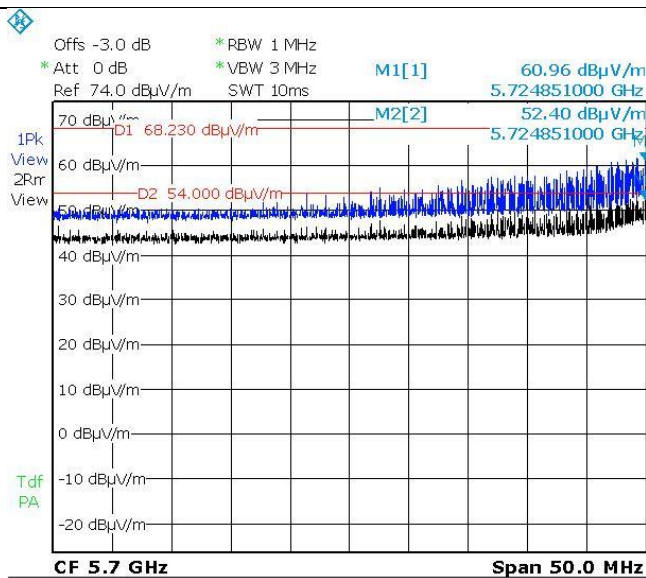
18GHz – 40GHz test result

Note: no substantial emission is found other than the noise floor. Different modes have been verified.

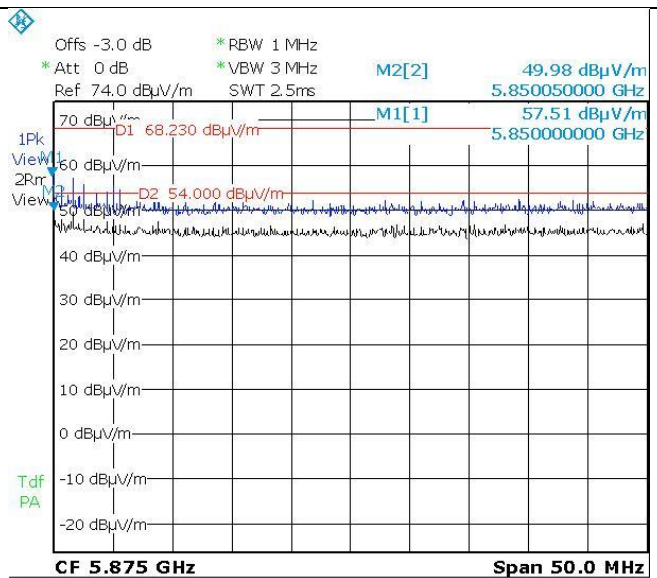
Radiated Band Edge measurement result



Radiated Band Edge-802.11a 5745M– Edge 5725MHz



Radiated Band Edge-802.11a 5825M– Edge 5850MHz



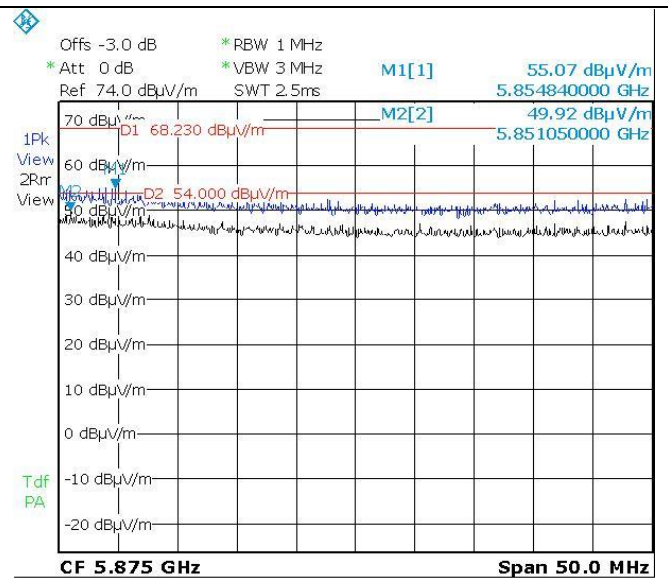
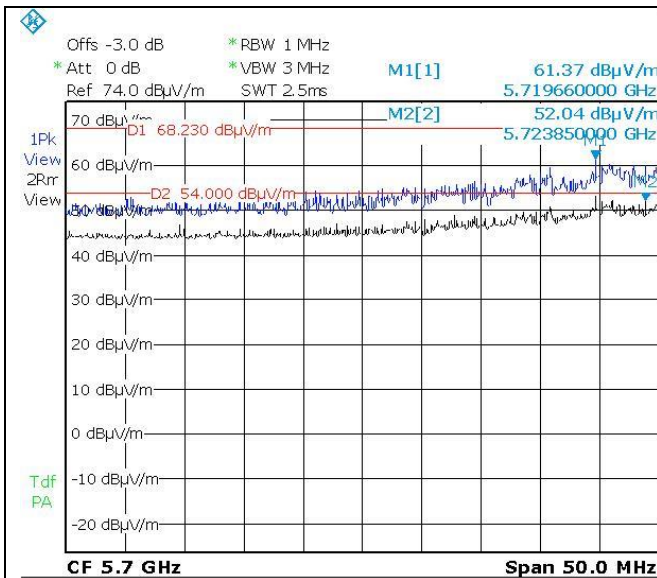
Radiated Band Edge-802.11n 5745M– Edge 5725MHz

Radiated Band Edge-802.11n 5825M– Edge 5850MHz

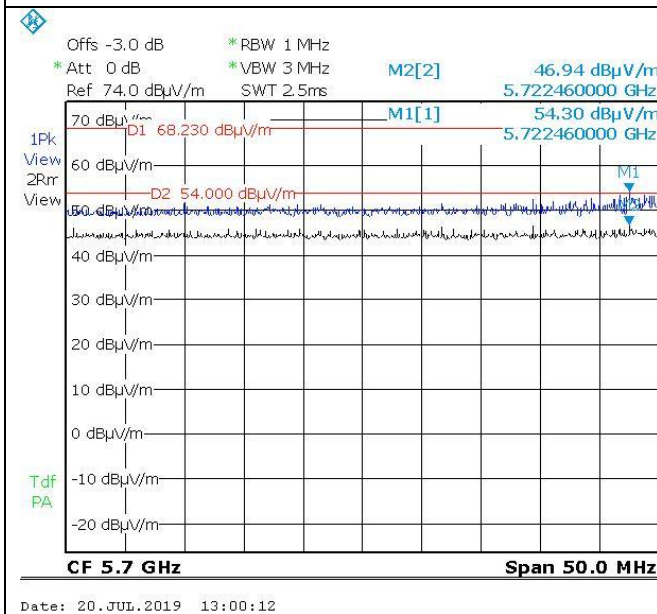
Report Number: CMP-19061922-LC-FCC-IC-UNII
Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



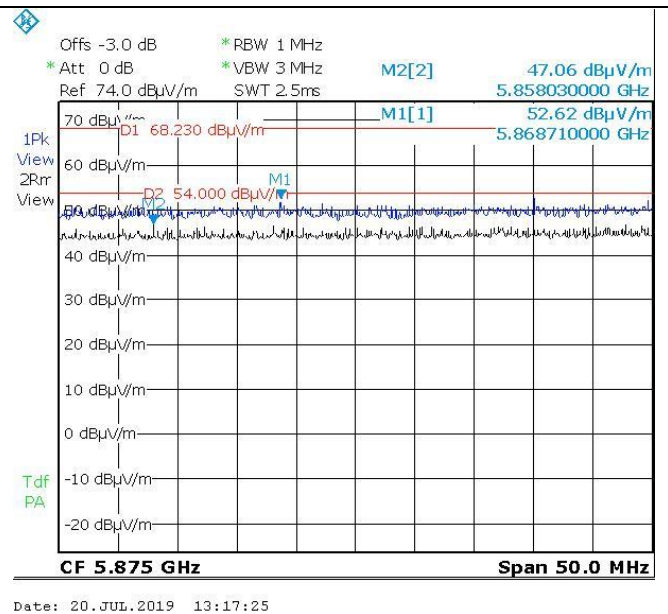
Page 45 of 46



Radiated Band Edge-802.11n 5755M– Edge 5725MHz



Radiated Band Edge-802.11n 5795M– Edge 5850MHz



Restricted Band-802.11ac 5775M– Edge 5725MHz

Radiated Band Edge-802.11ac 5775M– Edge 5850MHz



Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

1261 Puerta Del Sol
San Clemente, CA, 92673
+1 (949) 393-1123
www.vista-compliance.com

Report Number:	CMP-19061922-LC-FCC-IC-UNII
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



9 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2019	5/11/2020
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2019	5/4/2020
EMC Test Receiver	R&S	ESL6	100230	5/7/2019	5/7/2020
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2019	5/4/2020
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2018	11/15/2019
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2019	5/2/2020
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2019	5/2/2020
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2019	5/10/2020
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2019	5/10/2020
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2019	5/9/2020
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2019	5/10/2020
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392- 77150-11	064	5/10/2019	5/10/2020
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/9/2019	5/9/2020
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2019	5/10/2020
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2019	5/10/2020
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2019	5/10/2020
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2019	5/15/2020
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2019	5/10/2020
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2019	5/9/2020
Wideband Communication	R&S	CMW500	147508	5/8/2019	5/8/2020