

FCC DTS RF TEST REPORT



Test Report Number..... CMP-19061922-LC-FCC-IC-DTS

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 15.247

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

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Tested by:

Bruce Li/Test Engineer

Approved By:

David Zhang/Technical Manager

Report Number:	CMP-19061922-LC-FCC-IC-DTS
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

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REVISION HISTORY

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

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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: 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

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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.

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1.3 Test standard and method

Test standard	47CFR Part 15.247
Test method	ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r02

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.

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	Frequency (MHz)
BLE	0	2402
BLE	20	2442
BLE	39	2480
802.11-b	1	2412
802.11-b	6	2437
802.11-b	11	2462
802.11-g	1	2412
802.11-g	6	2437
802.11-g	11	2462
802.11-n-20	1	2412
802.11-n-20	6	2437
802.11-n-20	11	2462
802.11-n-40	3	2422
802.11-n-40	6	2437
802.11-n-40	9	2452

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

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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
-	RSS-Gen §6.7	Occupied Bandwidth	8.2	Pass
§15.247 (a)(2)	RSS-247 §5.2	DTS (6 dB) Channel Bandwidth	8.3	Pass
§15.247(b)(3)	RSS-247 §5.4	Conducted Maximum Output Power	8.4	Pass
§15.247(e)	RSS-247 §5.2	Power Spectral Density	8.5	Pass
§15.247(d)	RSS-247 §5.5	Conducted Band-Edge & Unwanted Emissions	8.6	Pass
§15.205, §15.209	RSS-247 §5.5	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.

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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

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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.

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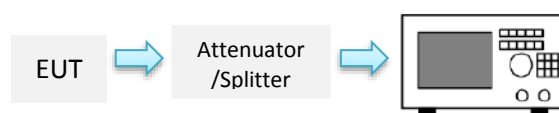
8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.247 (a)(2), RSS-247 §5.2

Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 KHz.

8.2.2 Test setup



8.2.3 Test Procedure

According to section 8.2, option 2, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.8 of ANSI C63.10-2013:

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.

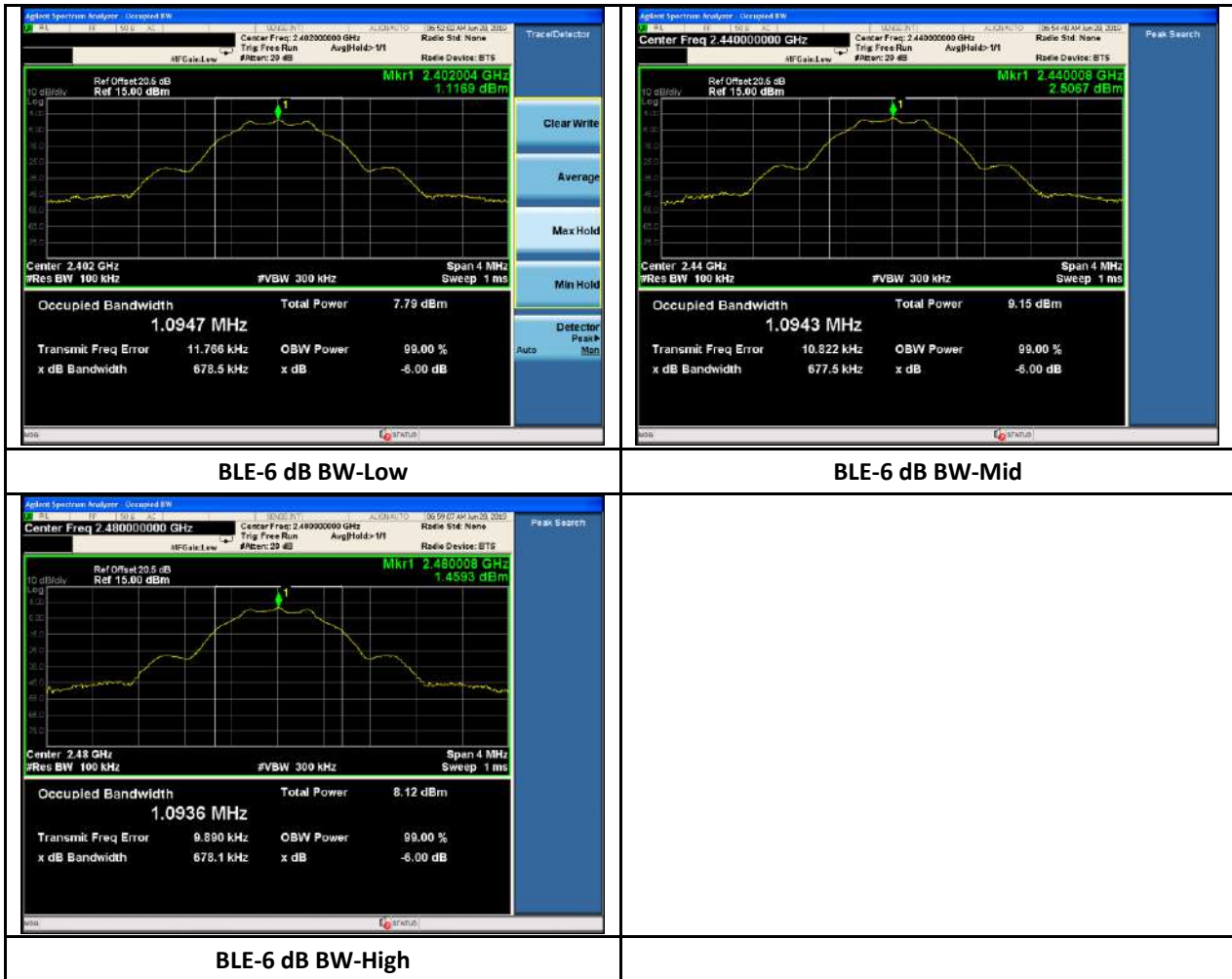
Report Number:	CMP-19061922-LC-FCC-IC-DTS
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8.2.4 Test Result

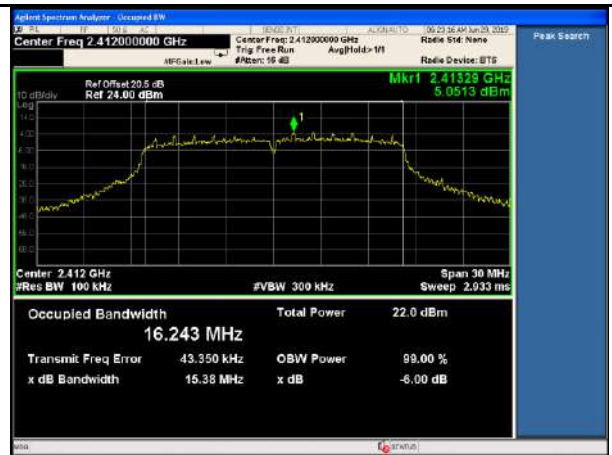
Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
BLE	2402	1Mbps	678.5	500	Pass
BLE	2440	1Mbps	677.5	500	Pass
BLE	2480	1Mbps	678.1	500	Pass
11b	2412	1Mbps	8087	500	Pass
11b	2437	1Mbps	8093	500	Pass
11b	2462	1Mbps	8066	500	Pass
11g	2412	6Mbps	15380	500	Pass
11g	2437	6Mbps	15350	500	Pass
11g	2462	6Mbps	15150	500	Pass
11n-20M	2412	MCS0	15160	500	Pass
11n-20M	2437	MCS0	15470	500	Pass
11n-20M	2462	MCS0	15160	500	Pass
11n-40M	2422	MCS0	35060	500	Pass
11n-40M	2437	MCS0	35170	500	Pass
11n-40M	2452	MCS0	33840	500	Pass

8.2.5 Test Plots





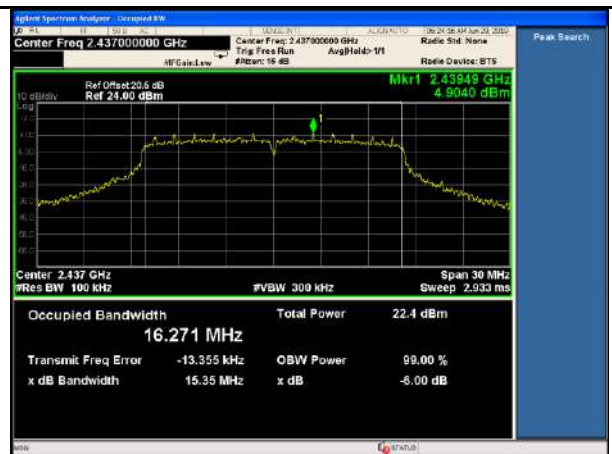
11b-6dB BW-Low



11g-6dB BW-Low



11b-6dB BW-Mid



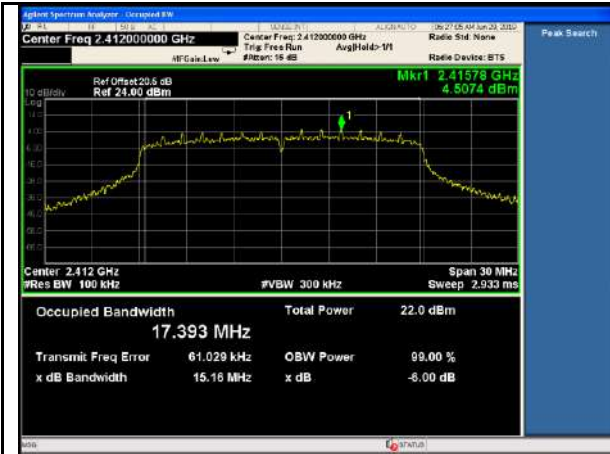
11g-6dB BW-Mid



11b-6dB BW-High



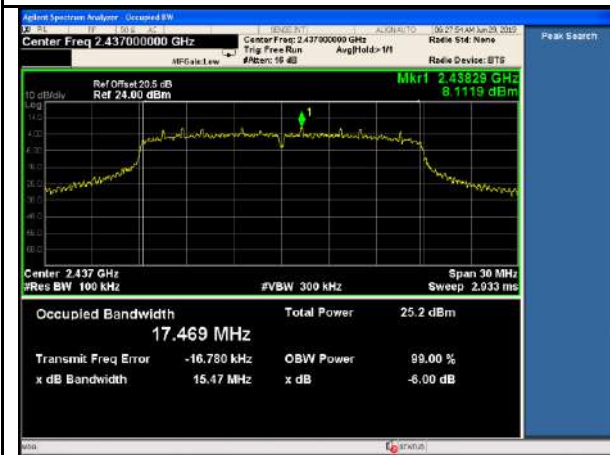
11g-6dB BW-High



11n-20MHz-6dB BW-Low



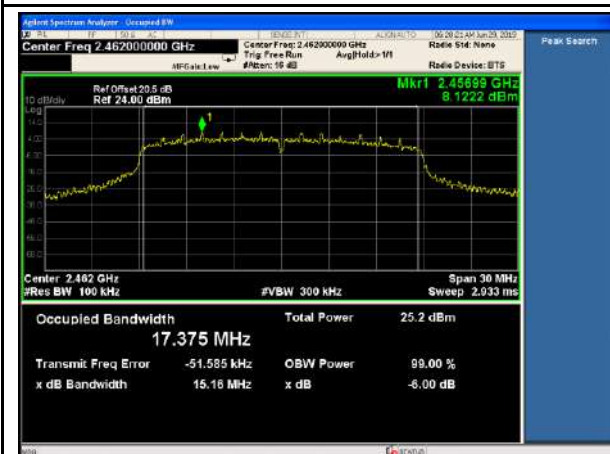
11n-40MHz-6dB BW-Low



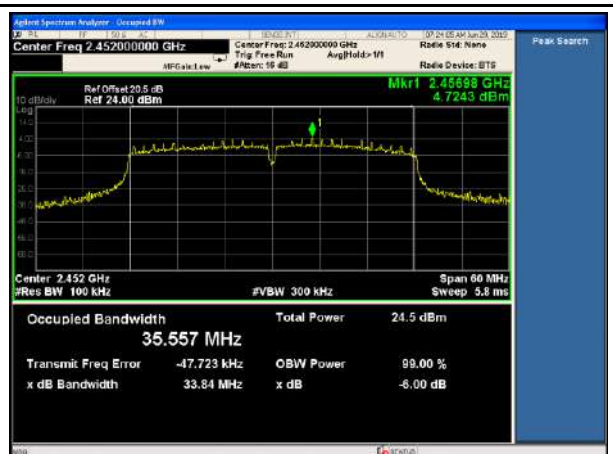
11n-20MHz-6dB BW-Mid



11n-40MHz-6dB BW-Mid



11n-20MHz-6dB BW-High



11n-40MHz-6dB BW-High

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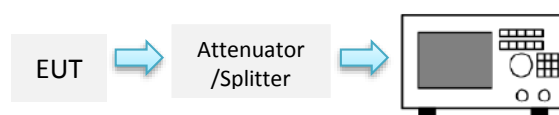
8.3 Occupied Bandwidth (99%)

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.

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8.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured 99% OBW (KHz)	Limit (KHz)	Result
BLE	2402	1Mbps	1062.9	500	Pass
BLE	2440	1Mbps	1061.8	500	Pass
BLE	2480	1Mbps	1061.7	500	Pass
11b	2412	1Mbps	13143	500	Pass
11b	2437	1Mbps	13247	500	Pass
11b	2462	1Mbps	12984	500	Pass
11g	2412	6Mbps	16516	500	Pass
11g	2437	6Mbps	16532	500	Pass
11g	2462	6Mbps	16436	500	Pass
11n-20M	2412	MCS0	17560	500	Pass
11n-20M	2437	MCS0	17610	500	Pass
11n-20M	2462	MCS0	17490	500	Pass
11n-40M	2422	MCS0	35645	500	Pass
11n-40M	2437	MCS0	36008	500	Pass
11n-40M	2452	MCS0	35688	500	Pass

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8.4 Maximum Output Power

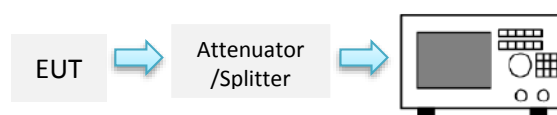
8.4.1 Requirement

§ 15.247 (b)(3), RSS-247 §5.4

or systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: the maximum output power is 1 Watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator 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

For BLE, power measurement is according to subclause 11.9.1.1 of ANSI C63.10-2013:

1. Set the RBW $\geq$ DTS bandwidth
2. Set VBW $\geq 3 \times$ RBW.
2. Set SPAN $\geq 3 \times$ RBW.
3. Sweep time = auto couple.
4. Detector = peak.
5. Trace mode = max hold
6. Allow trace to fully stabilize.
7. Use peak marker function to determine the peak amplitude level.

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For WLAN, power measurement is according to subclause 11.9.2.2.2 of ANSI C63.10-2013:

1. Set span to at least 1.5 times of the OBW.
2. Set the RBW = 1% to 5% of the OBW, not to exceed 1 MHz.
2. Set VBW $\geq 3 \times$ RBW.
3. Set number of points in sweep $\geq [2 \times \text{span} / \text{RBW}]$
4. Sweep time = auto couple.
5. Detector = RMS
6. If transmit duty cycle < 98%, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at the maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no OFF intervals) or at duty cycle 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."
7. Trace average at least 100 traces in power averaging (rms) mode.
8. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

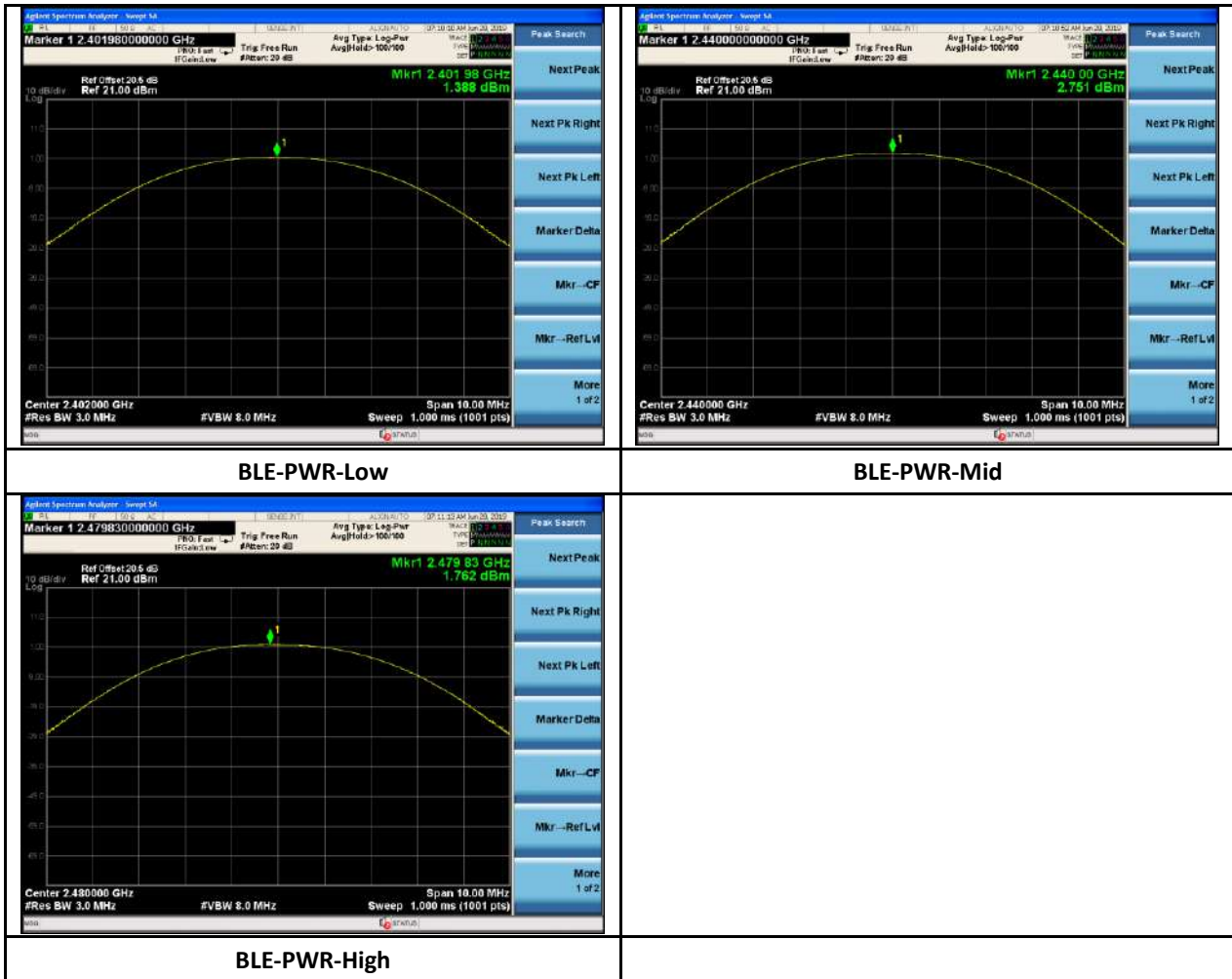
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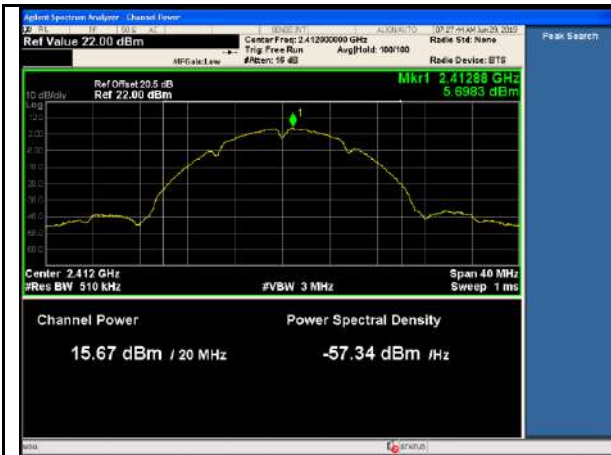
8.4.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
BLE	2402	1Mbps	1.388	30	Pass
BLE	2440	1Mbps	2.751	30	Pass
BLE	2480	1Mbps	1.762	30	Pass
11b	2412	1Mbps	15.67	30	Pass
11b	2437	1Mbps	15.83	30	Pass
11b	2462	1Mbps	16.04	30	Pass
11g	2412	6Mbps	15.63	30	Pass
11g	2437	6Mbps	16.10	30	Pass
11g	2462	6Mbps	16.05	30	Pass
11n-20M	2412	MCS0	14.52	30	Pass
11n-20M	2437	MCS0	17.79	30	Pass
11n-20M	2462	MCS0	17.74	30	Pass
11n-40M	2422	MCS0	16.08	30	Pass
11n-40M	2437	MCS0	17.02	30	Pass
11n-40M	2452	MCS0	16.80	30	Pass

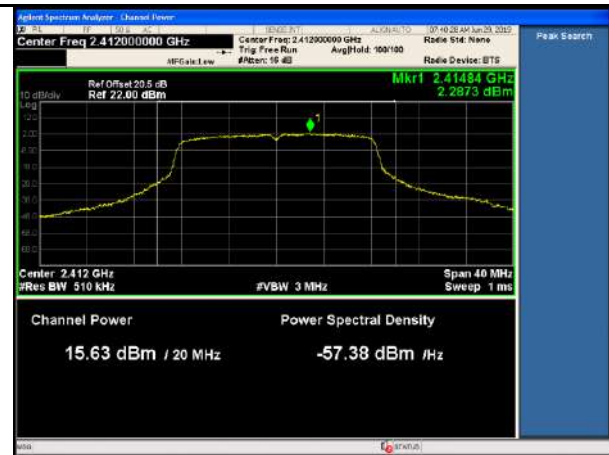
8.4.5 Test Plots



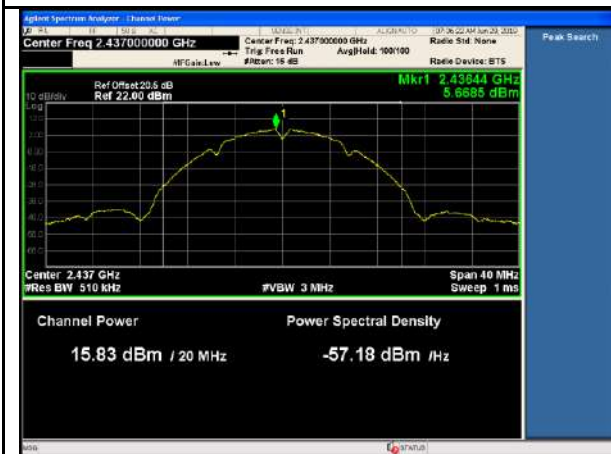
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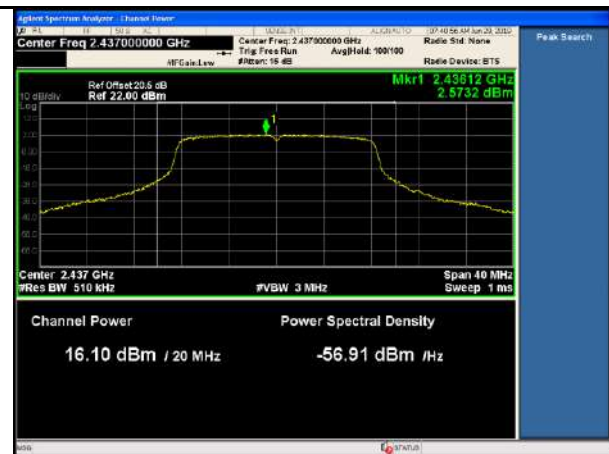
11b-PWR-Low-1Mbps



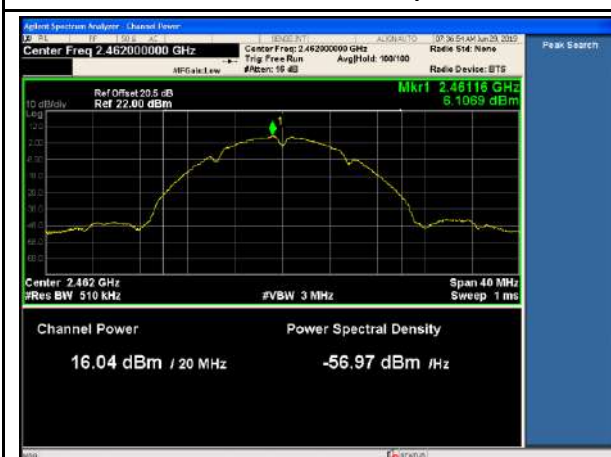
11g-PWR-Low-6Mbps



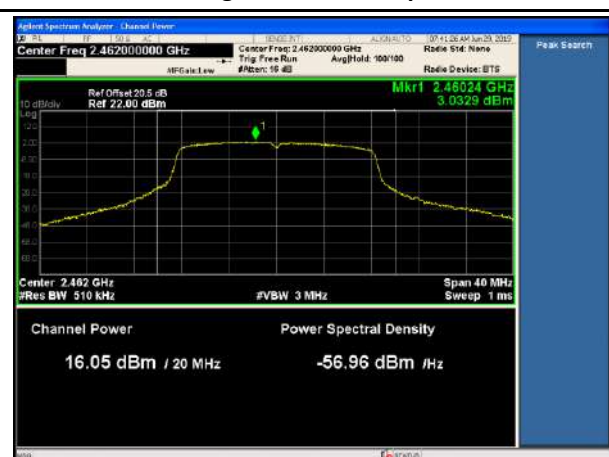
11b-PWR-Mid-1Mbps



11g-PWR-Mid-6Mbps

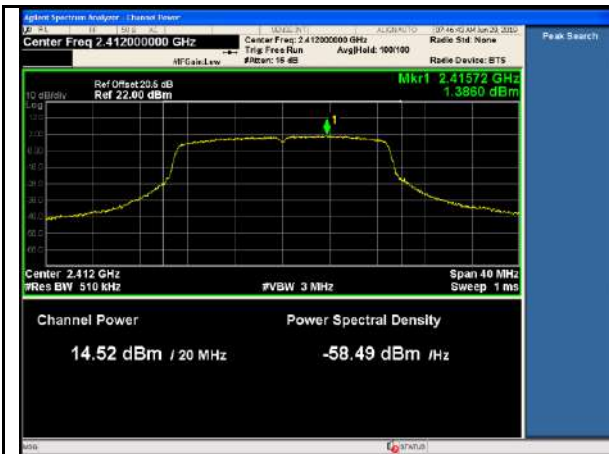


11b-PWR-High-1Mbps

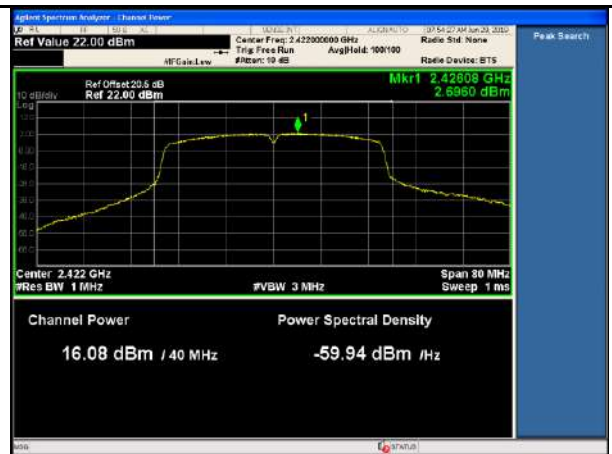


11g-PWR-High-6Mbps

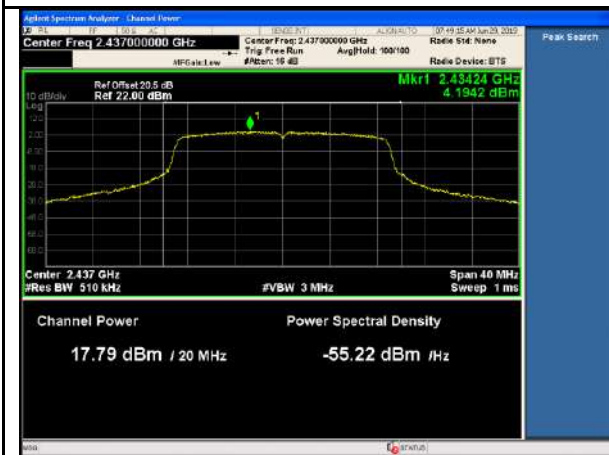
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Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



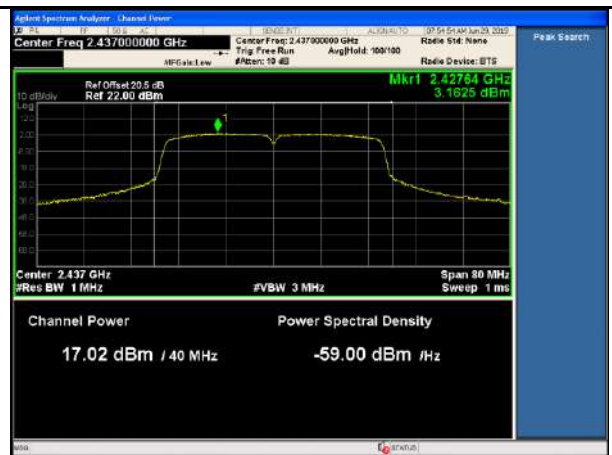
11n-20MHz-PWR-Low-MCS0



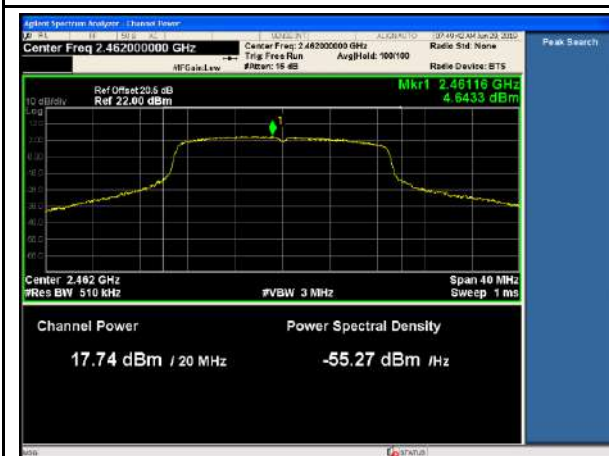
11n-40MHz-PWR-Low-MCS0



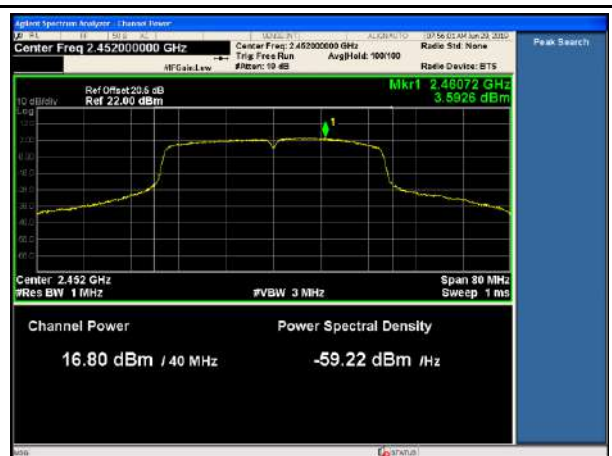
11n-20MHz-PWR-Mid-MCS0



11n-40MHz-PWR-Mid-MCS0



11n-20MHz-PWR-High-MCS0



11n-40MHz-PWR-High-MCS0

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



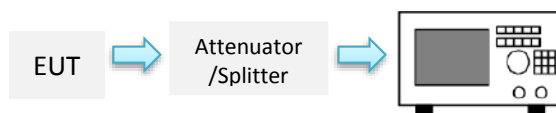
8.5 Power Spectral Density

8.5.1 Requirement

§ 15.247 (e), RSS-247 §5.2

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power is used to determine the power spectral density.

8.5.2 Test setup



8.5.3 Test Procedure

According to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 X DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

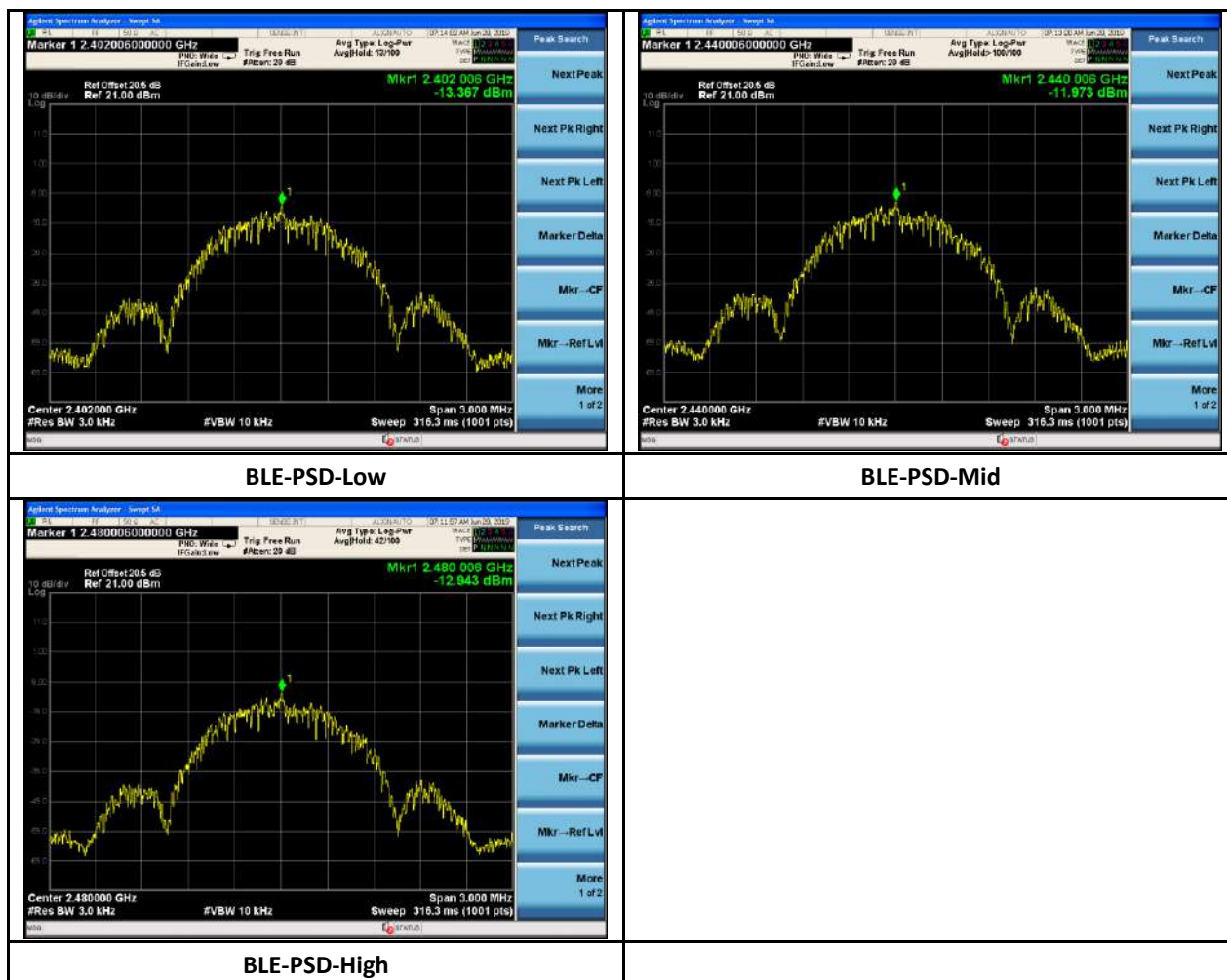
Report Number:	CMP-19061922-LC-FCC-IC-DTS
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW

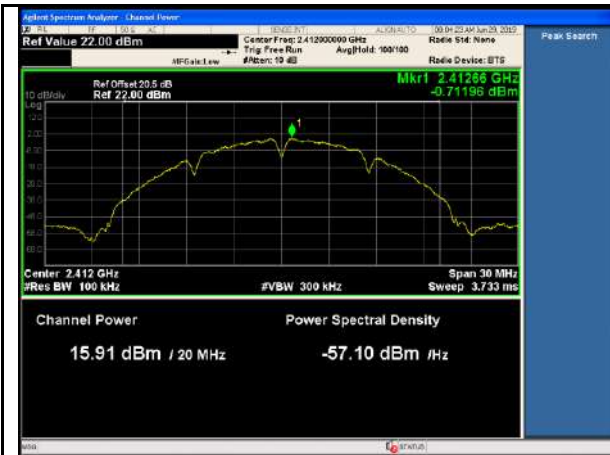


8.5.4 Test Result

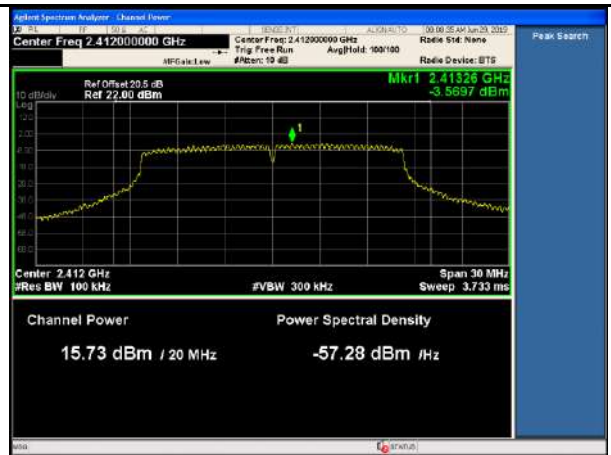
Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
BLE	2402	1Mbps	-13.367	8	Pass
BLE	2440	1Mbps	-11.973	8	Pass
BLE	2480	1Mbps	-12.943	8	Pass
11b	2412	1Mbps	-0.712	8	Pass
11b	2437	1Mbps	-0.587	8	Pass
11b	2462	1Mbps	-0.880	8	Pass
11g	2412	6Mbps	-3.570	8	Pass
11g	2437	6Mbps	-3.304	8	Pass
11g	2462	54Mbps	-3.094	8	Pass
11n-20M	2412	MCS0	-5.114	8	Pass
11n-20M	2437	MCS0	-1.994	8	Pass
11n-20M	2462	MCS0	-1.758	8	Pass
11n-40M	2422	MCS0	-13.268	8	Pass
11n-40M	2437	MCS0	-10.367	8	Pass
11n-40M	2452	MCS0	-10.878	8	Pass

8.5.5 Test Plots





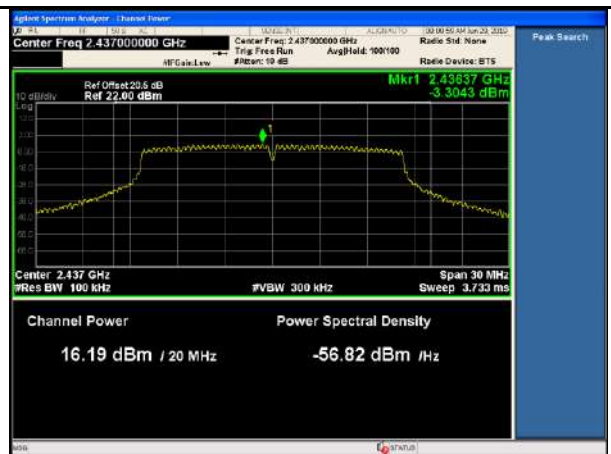
11b-PSD-Low-1Mbps



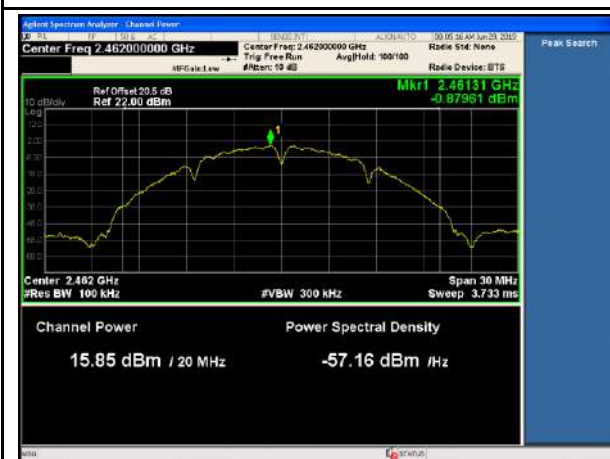
11g-PSD-Low-6Mbps



11b-PSD-Mid-1Mbps



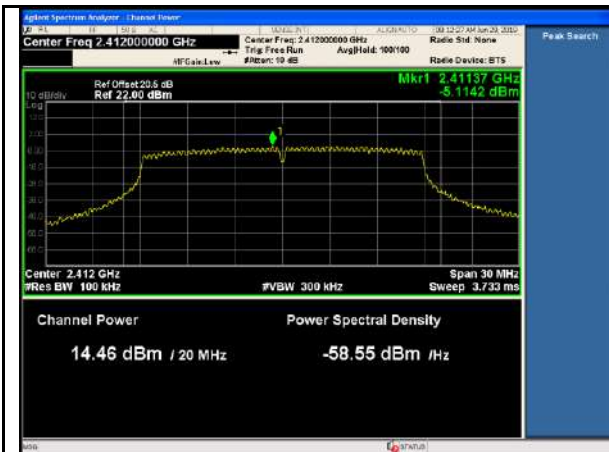
11g-PSD-Mid-6Mbps



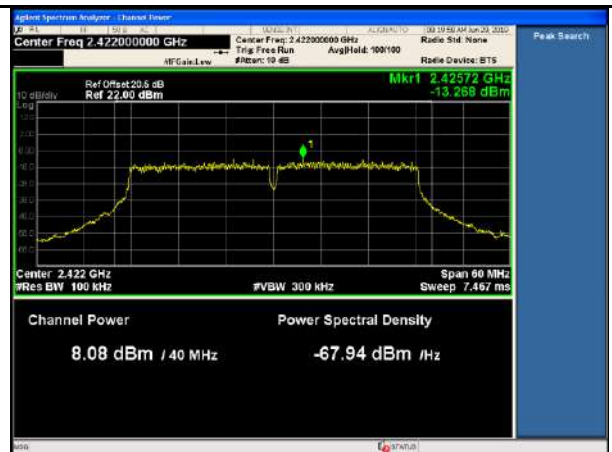
11b-PSD-High-1Mbps



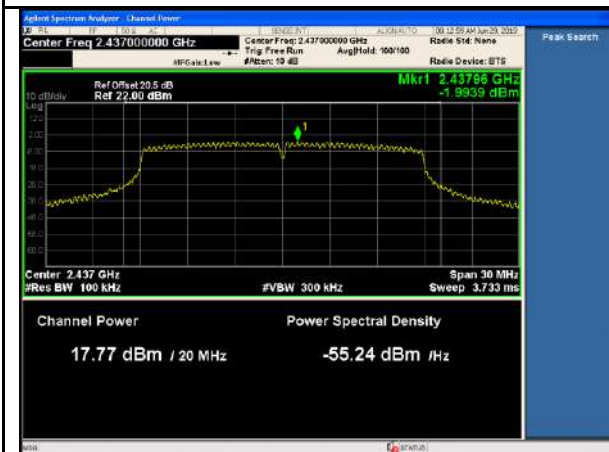
11g-PSD-High-6Mbps



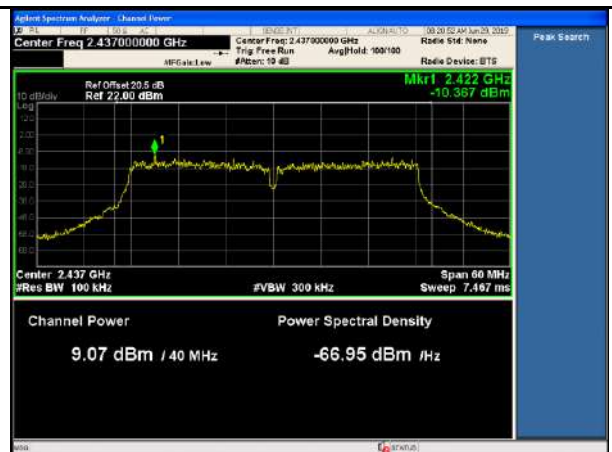
11n-20MHz-PSD-Low-MCS0



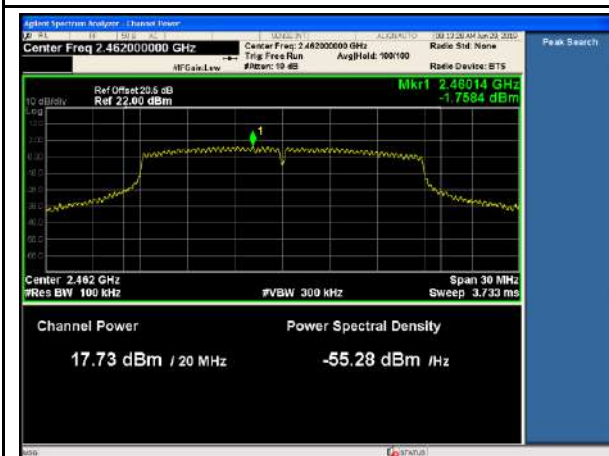
11n-40MHz-PSD-Low-MCS0



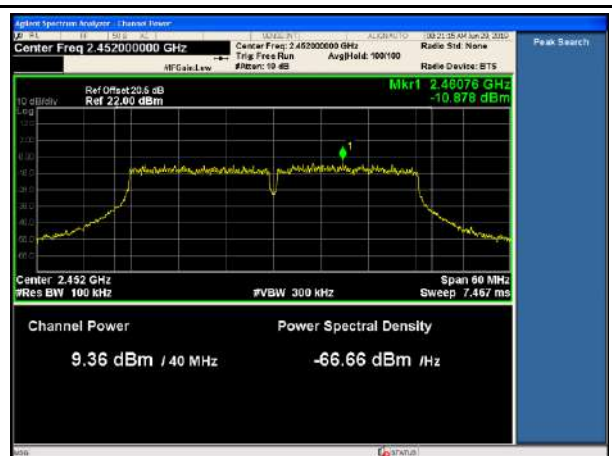
11n-20MHz-PSD-Mid-MCS0



11n-40MHz-PSD-Mid-MCS0



11n-20MHz-PSD-High-MCS0



11n-40MHz-PSD-High-MCS0

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



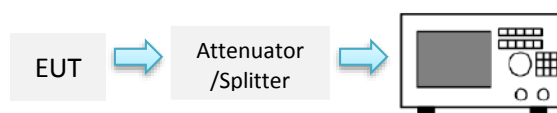
8.6 Conducted Band-Edge & Unwanted Emissions Measurement

8.6.1 Requirement

§ 15.247 (d), RSS-247 §5.5

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.

8.6.2 Test setup



8.6.3 Test Procedure

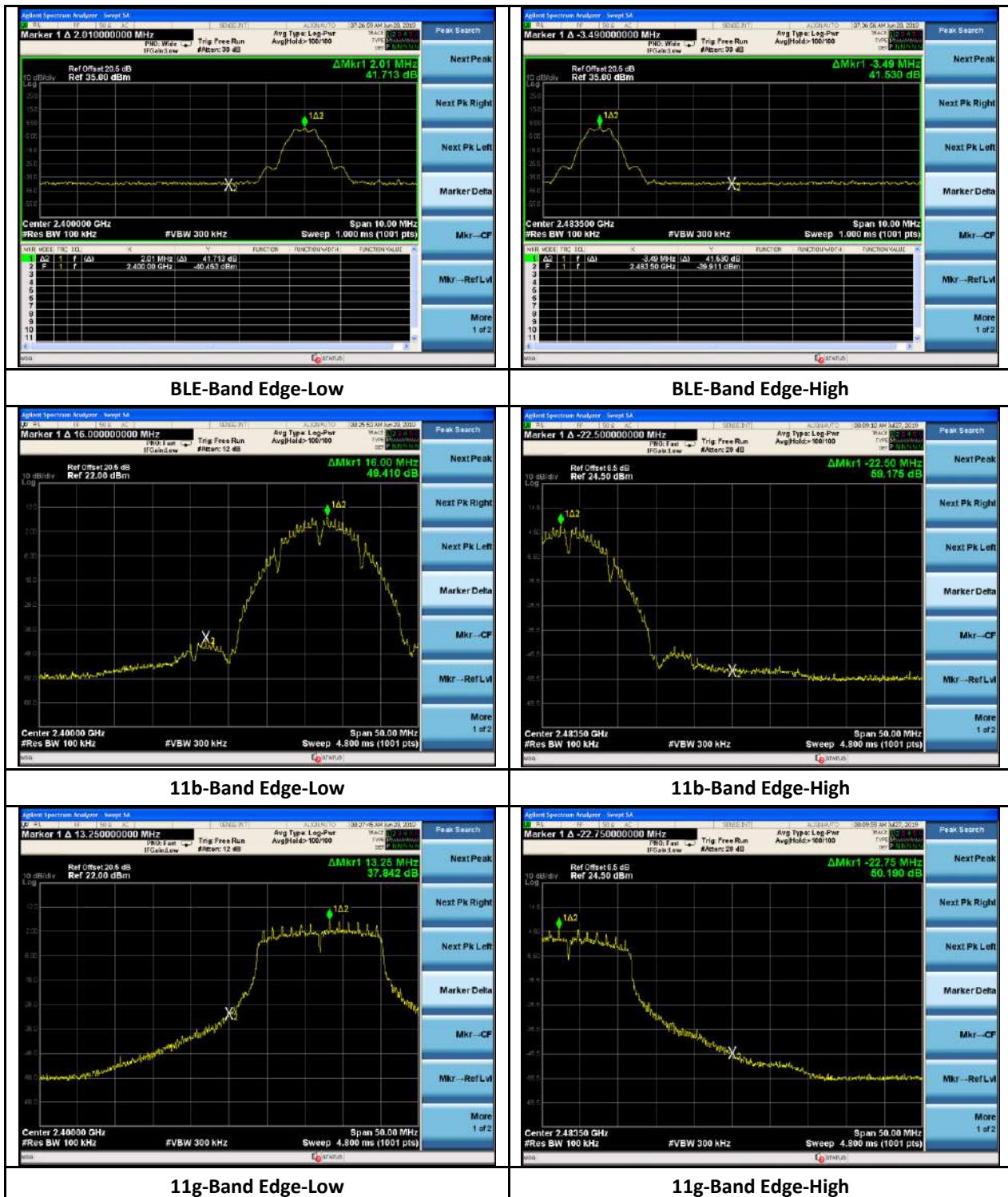
According to section 8.5 Emission level measurement, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.11.3 in ANSI C63.10-2013:

1. Set the centre frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

8.6.4 Test Result

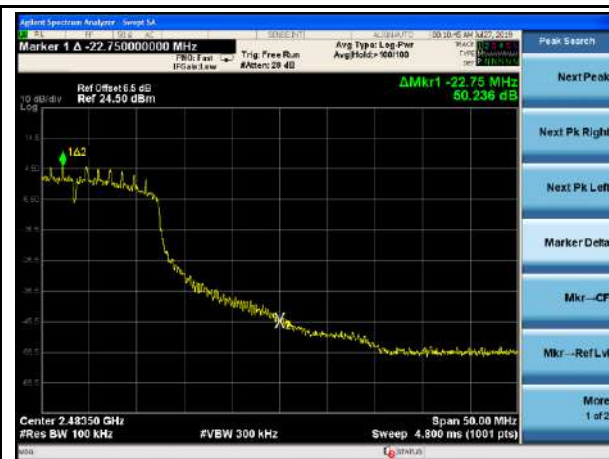
See test plots

8.6.5 Test Plots





11n-20MHz-Band Edge-Low



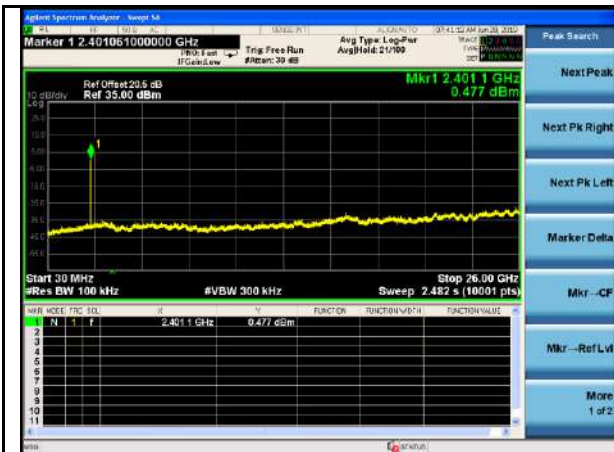
11n-20MHz-Band Edge-High



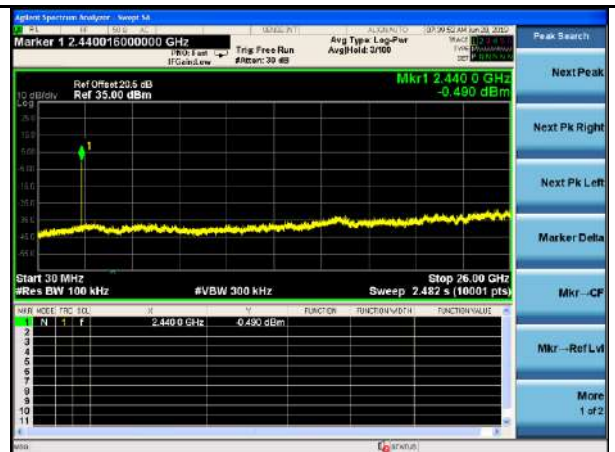
11n-40MHz-Band Edge-Low



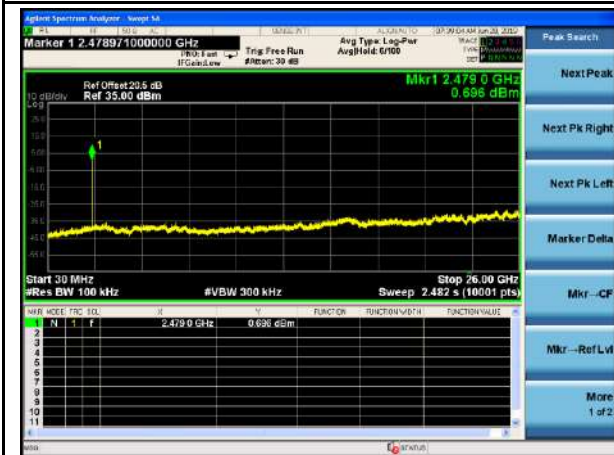
11n-40MHz-Band Edge-High



BLE-Out Of Band Emission-Low



BLE-Out Of Band Emission-Mid



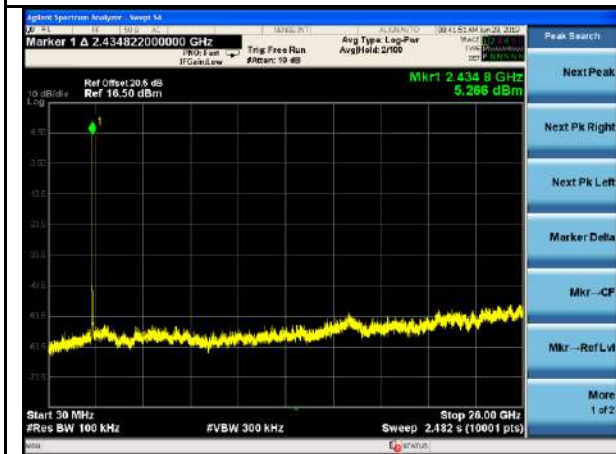
BLE-Out Of Band Emission-High



11b-Out Of Band Emission-Low



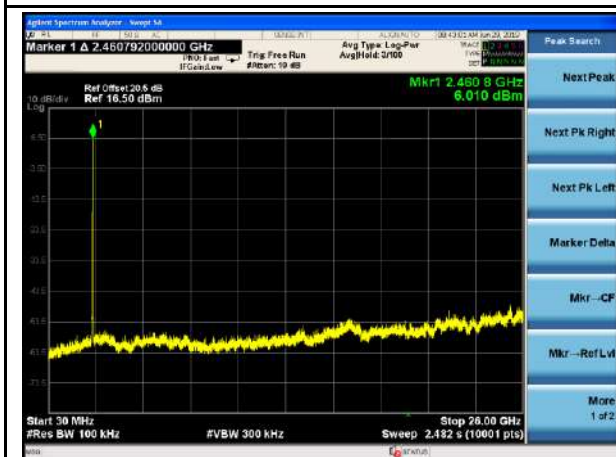
11g-Out Of Band Emission-Low



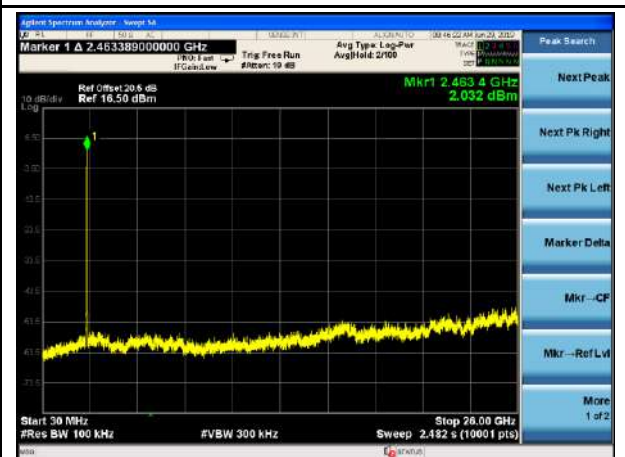
11b-Out Of Band Emission-Mid



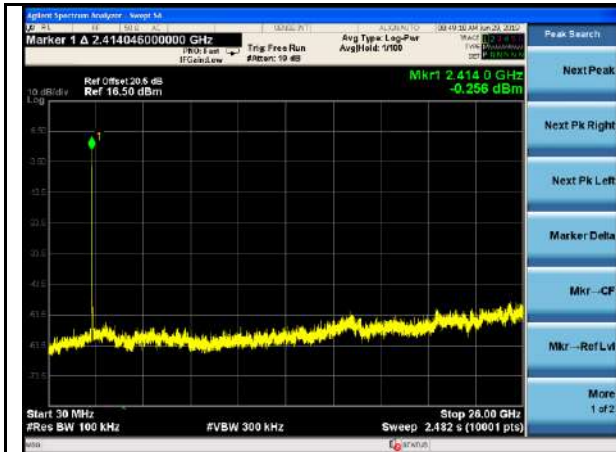
11g-Out Of Band Emission-Mid



11b-Out Of Band Emission-High



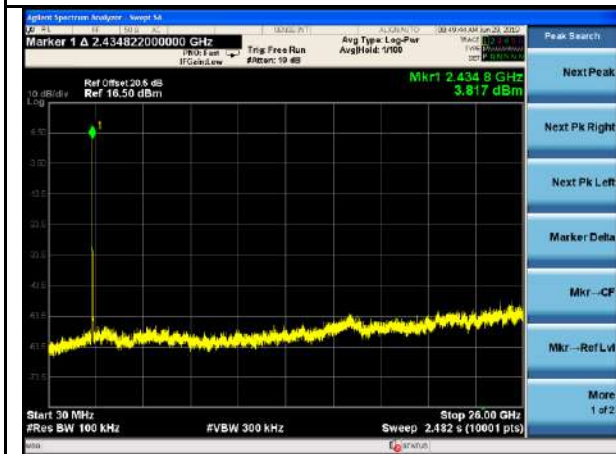
11g-Out Of Band Emission-High



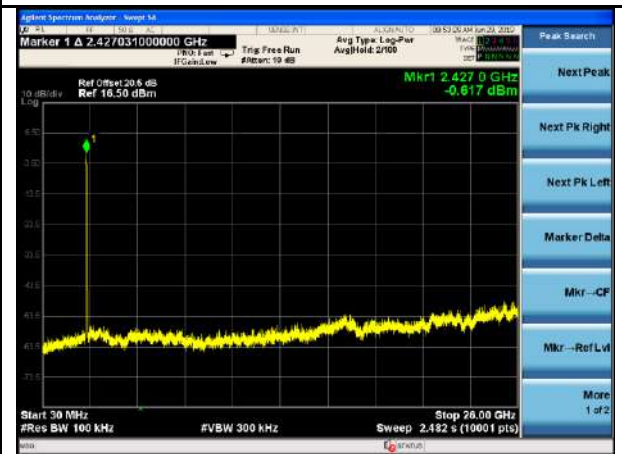
11n 20MHz-Out Of Band Emission-Low



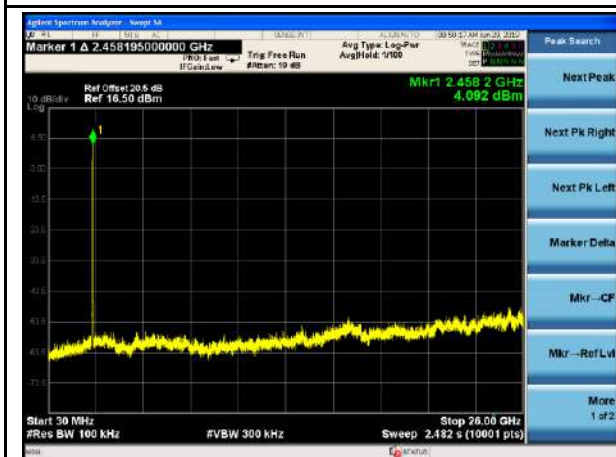
11n 40MHz-Out Of Band Emission-Low



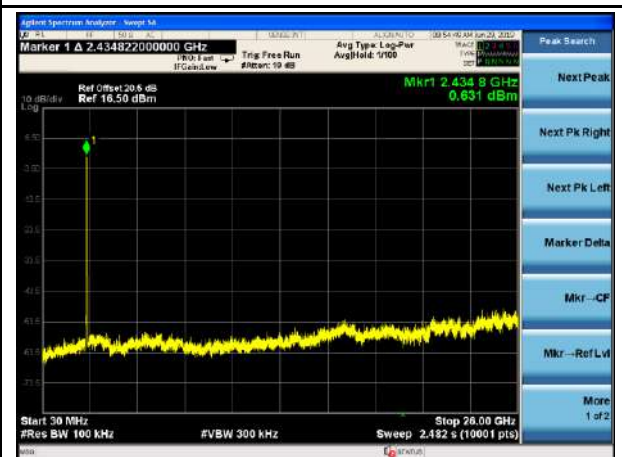
11n 20MHz-Out Of Band Emission-Mid



11n 40MHz-Out Of Band Emission-Mid



11n 20MHz-Out Of Band Emission-High



11n 40MHz-Out Of Band Emission-High

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

8.7.1 Requirement

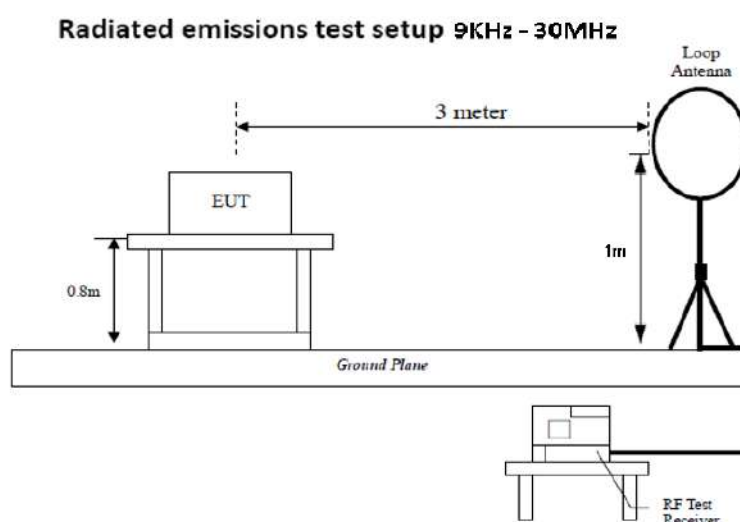
§ 15.247 (d), RSS-247 §5.5

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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

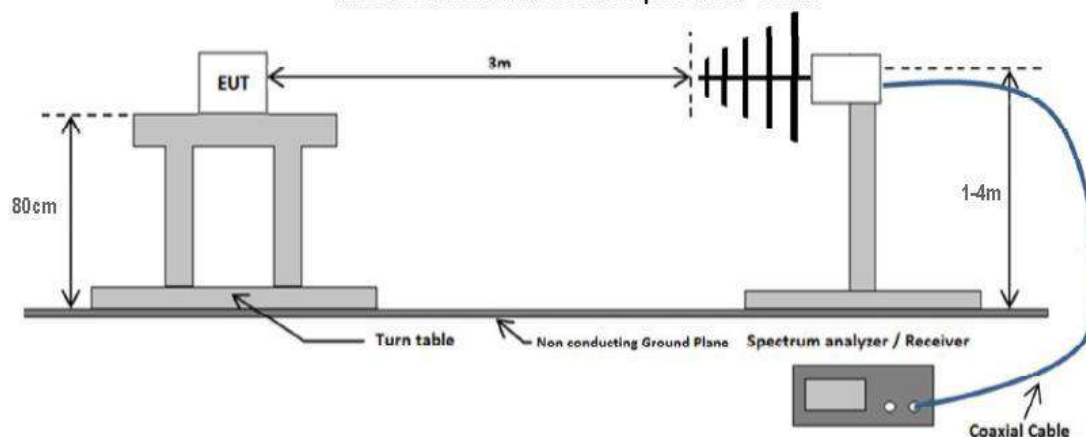
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

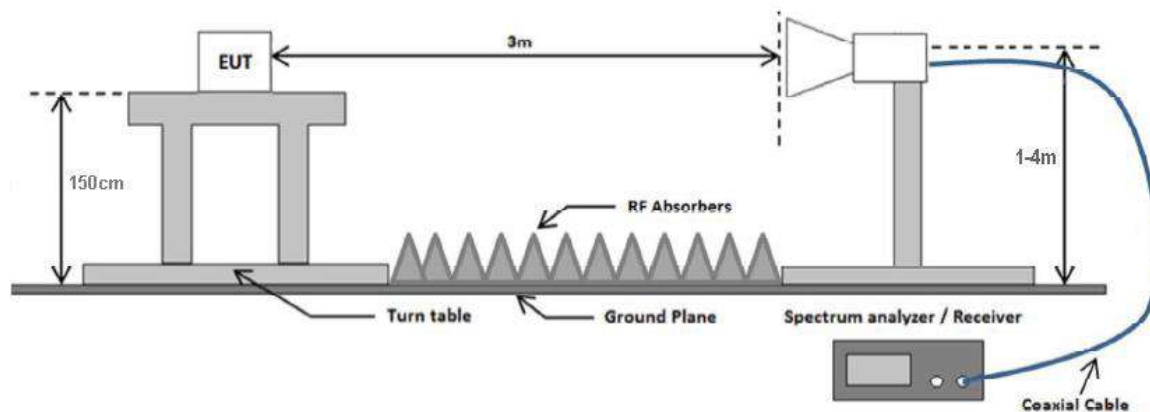
8.7.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



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



8.7.3 Test Procedure

According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.12.2.7 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.

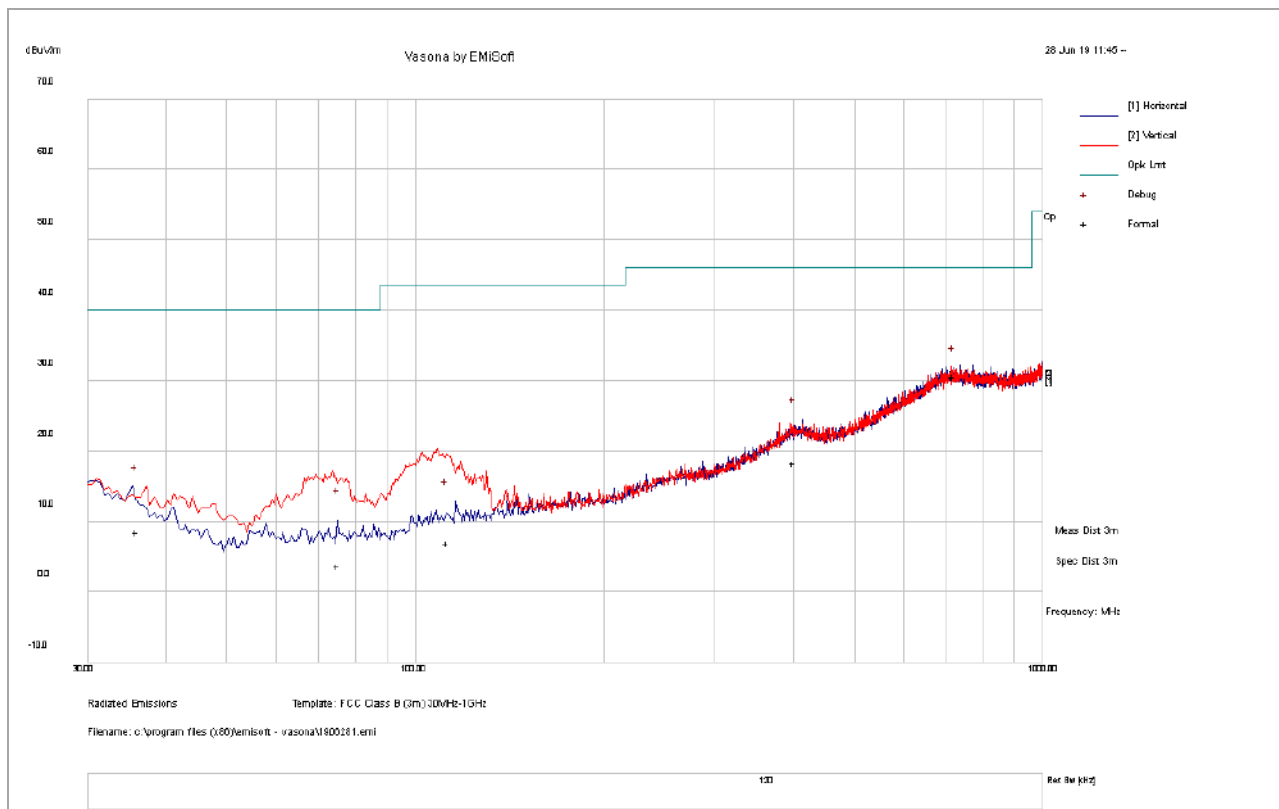
Report Number:	CMP-19061922-LC-FCC-IC-DTS
Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



8.7.4 Test Result

30-1000MHz test result

Test Standard:	15.209, 15.247	Mode:	802.11n-2437MHz
Frequency Range:	30-1000MHz	Test Date:	06/27/2019
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
719.00	29.79	7.30	-6.50	30.60	QP	H	359	55	46	-15.40
400.44	25.41	6.37	-13.43	18.34	QP	V	153	46	46	-27.66
35.93	24.22	2.42	-18.13	8.51	QP	H	273	351	40	-31.49
75.28	25.00	3.25	-24.42	3.82	QP	H	378	331	40	-36.18
112.19	26.56	3.76	-23.36	6.96	QP	H	324	115	44	-36.54

Note:

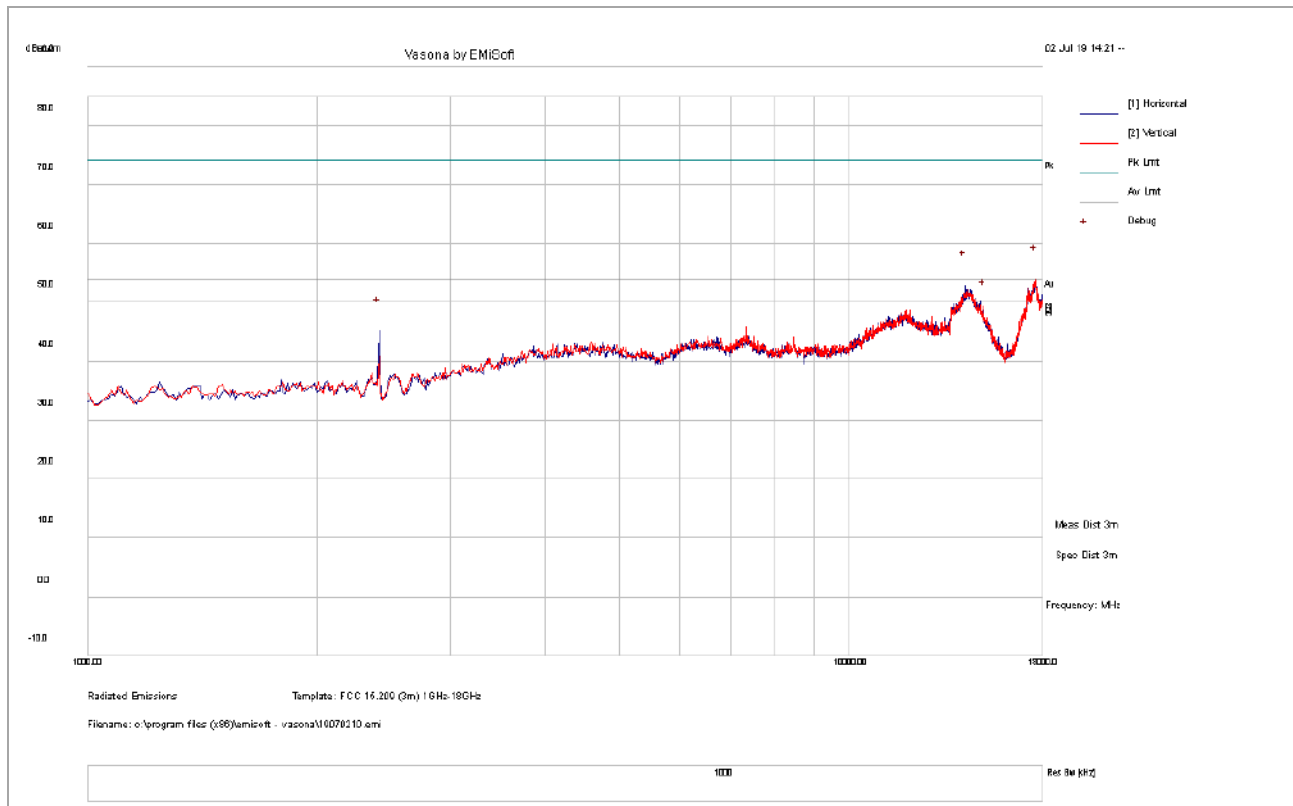
- 1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11b-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



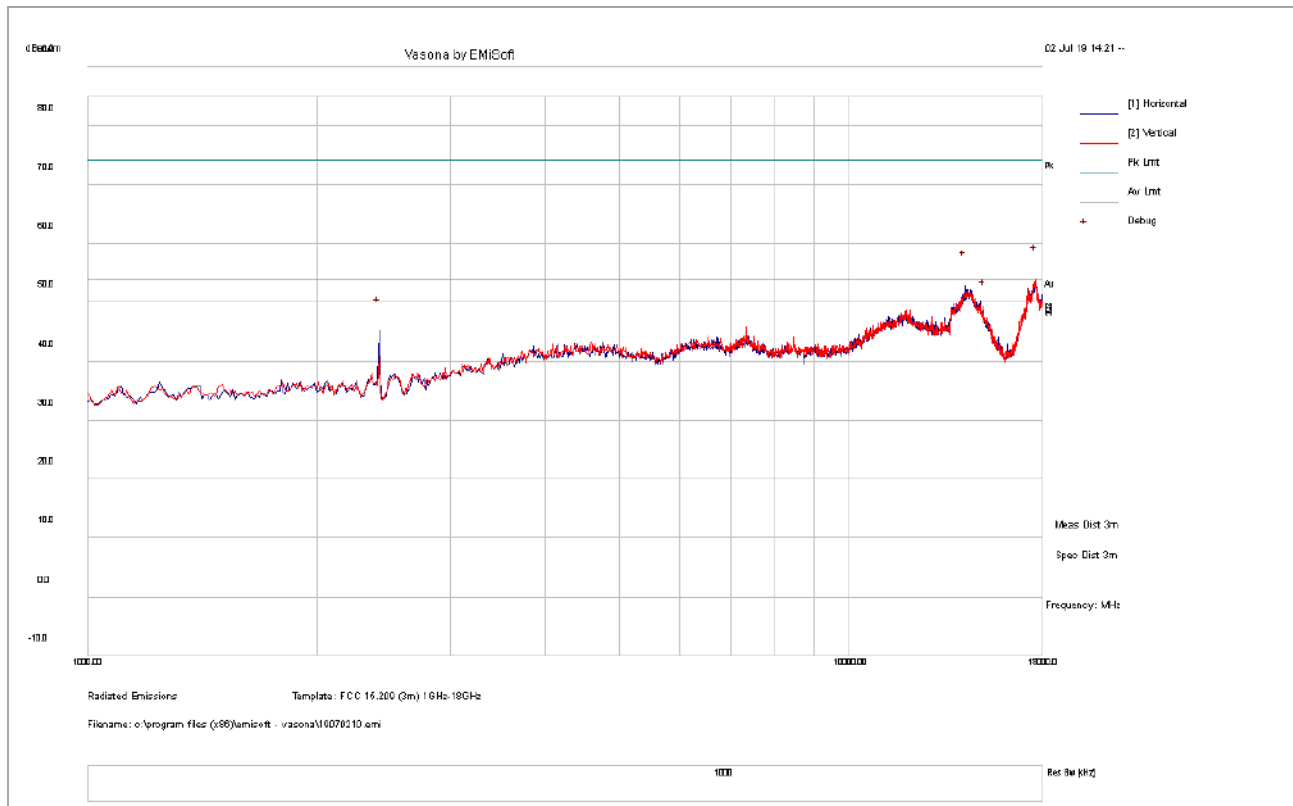
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	11.72	25.28	15.01	52.01	PK	V	100	334	54	-1.99
14206.88	14.82	22.15	14.53	51.50	PK	H	100	21	54	-2.50
15056.88	13.72	24.46	9.89	48.07	PK	V	200	153	54	-5.93

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11b-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



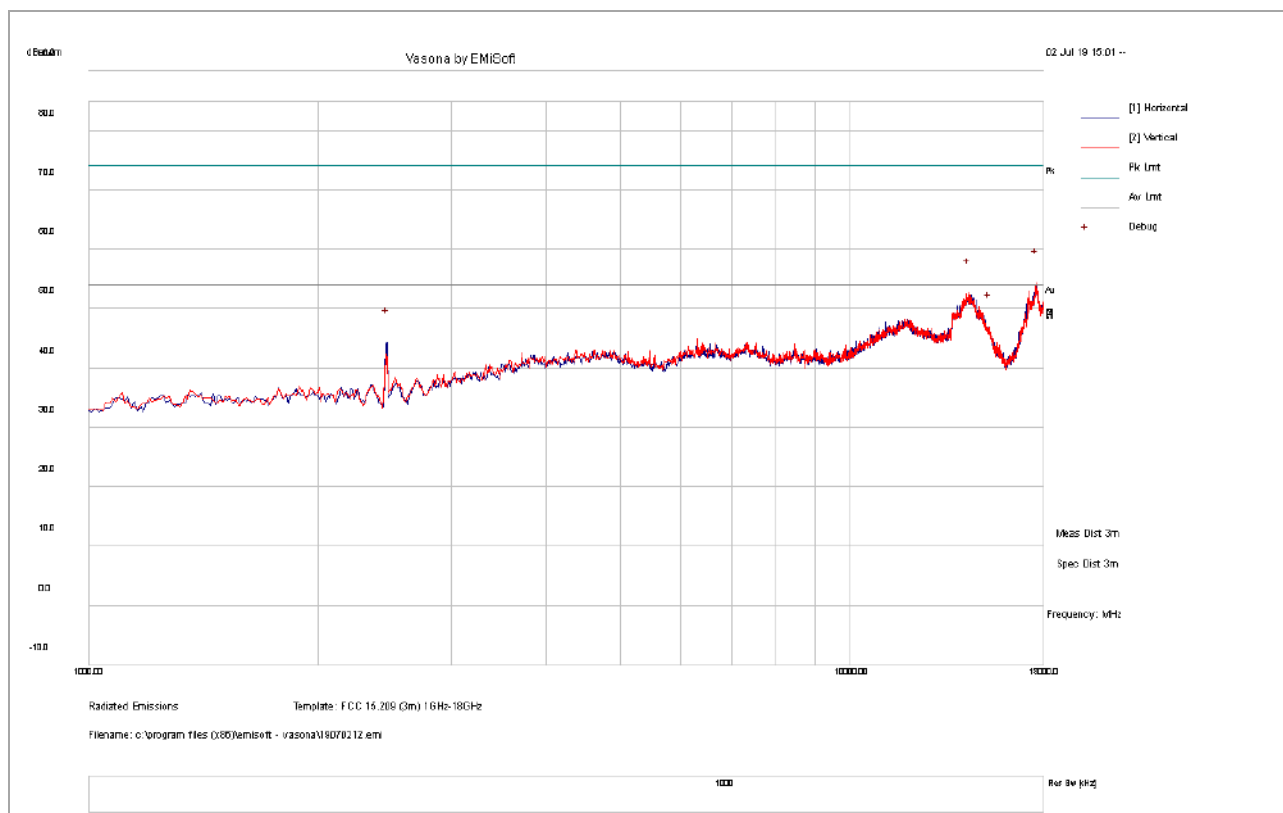
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17649.38	11.72	25.35	14.03	51.10	PK	V	200	112	54	-2.90
14345.00	14.47	22.57	14.70	51.74	PK	H	200	142	54	-2.26
15280.00	14.62	24.30	8.63	47.55	PK	V	300	187	54	-6.45

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11b-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



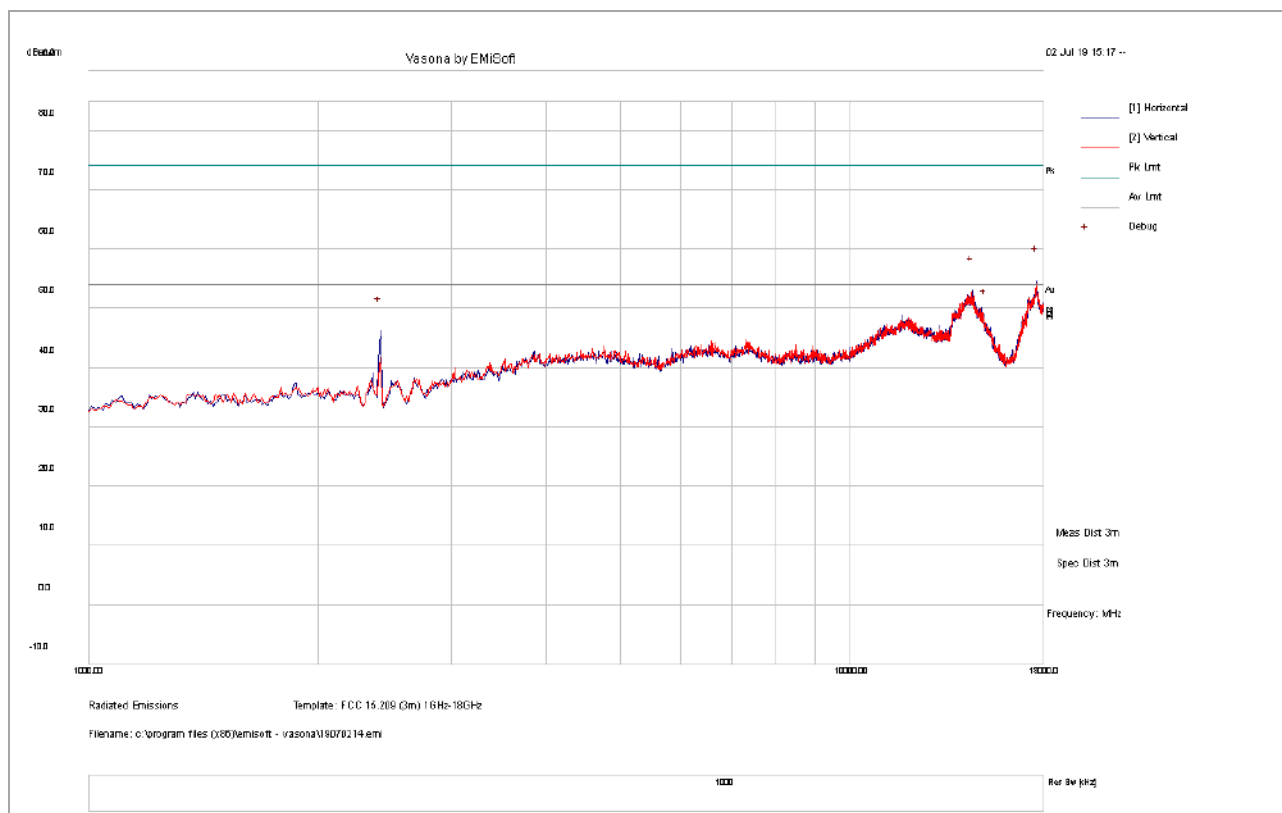
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17564.38	11.82	25.24	14.59	51.65	PK	V	300	91	54	-2.35
14313.13	14.21	22.47	14.69	51.37	PK	V	200	291	54	-2.63
15237.5	13.64	24.33	8.88	46.85	PK	V	300	182	54	-7.15

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11g-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



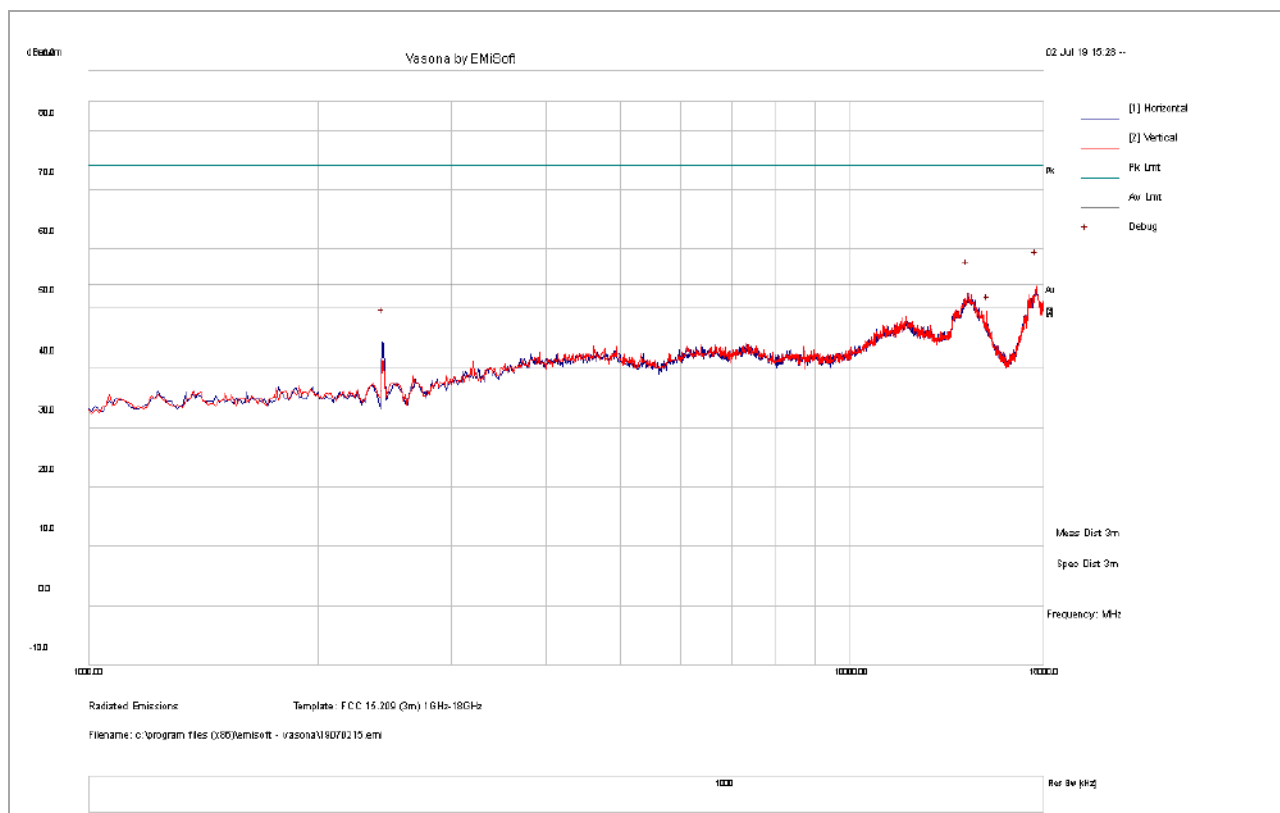
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	12.09	25.28	15.01	52.38	PK	H	200	132	54	-1.62
14483.13	14.11	22.98	13.71	50.80	PK	H	300	77	54	-3.20
15056.88	13.19	24.46	9.89	47.54	PK	H	300	92	54	-6.46

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11g-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



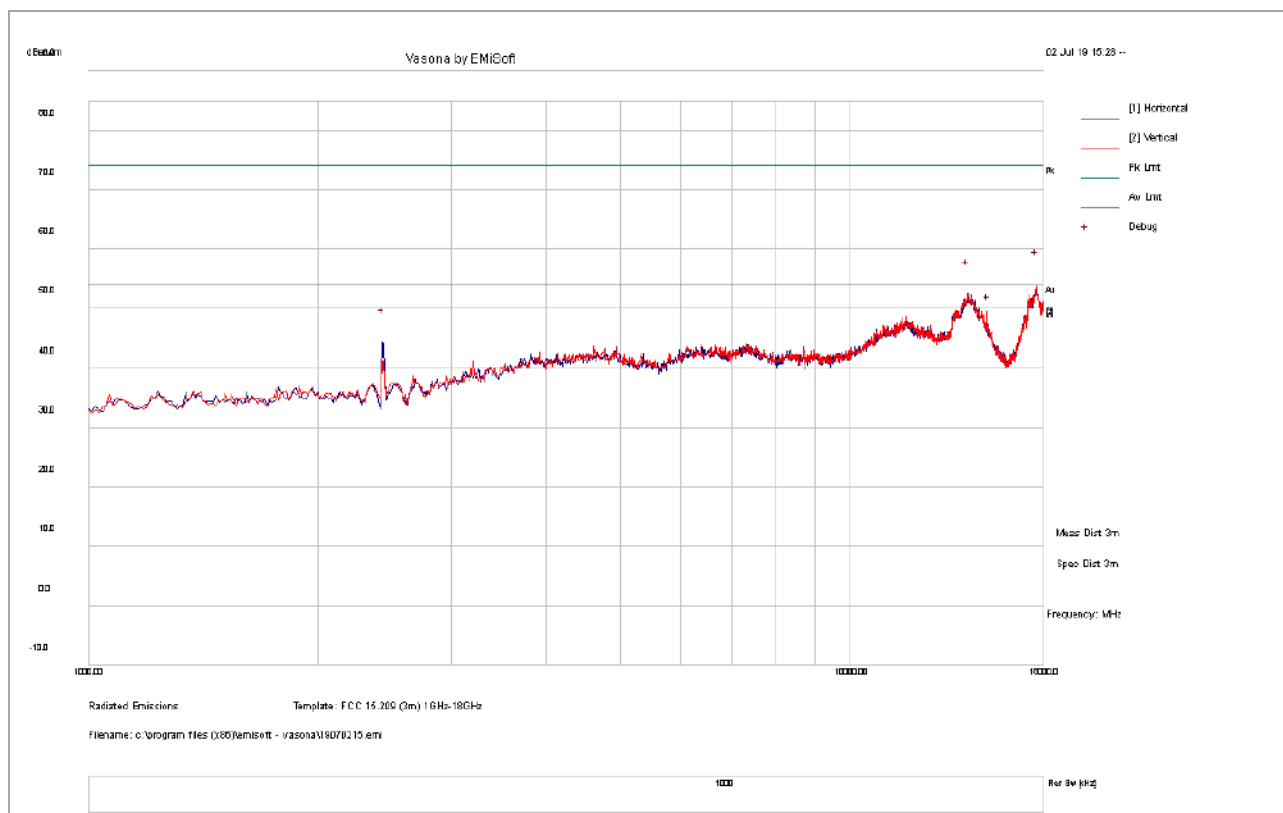
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	11.21	25.28	15.01	51.50	PK	V	200	28	54	-2.50
14270.63	14.55	22.34	14.65	51.54	PK	V	300	102	54	-2.46
15226.88	13.3	24.33	8.94	46.57	PK	V	100	114	54	-7.43

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11g-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



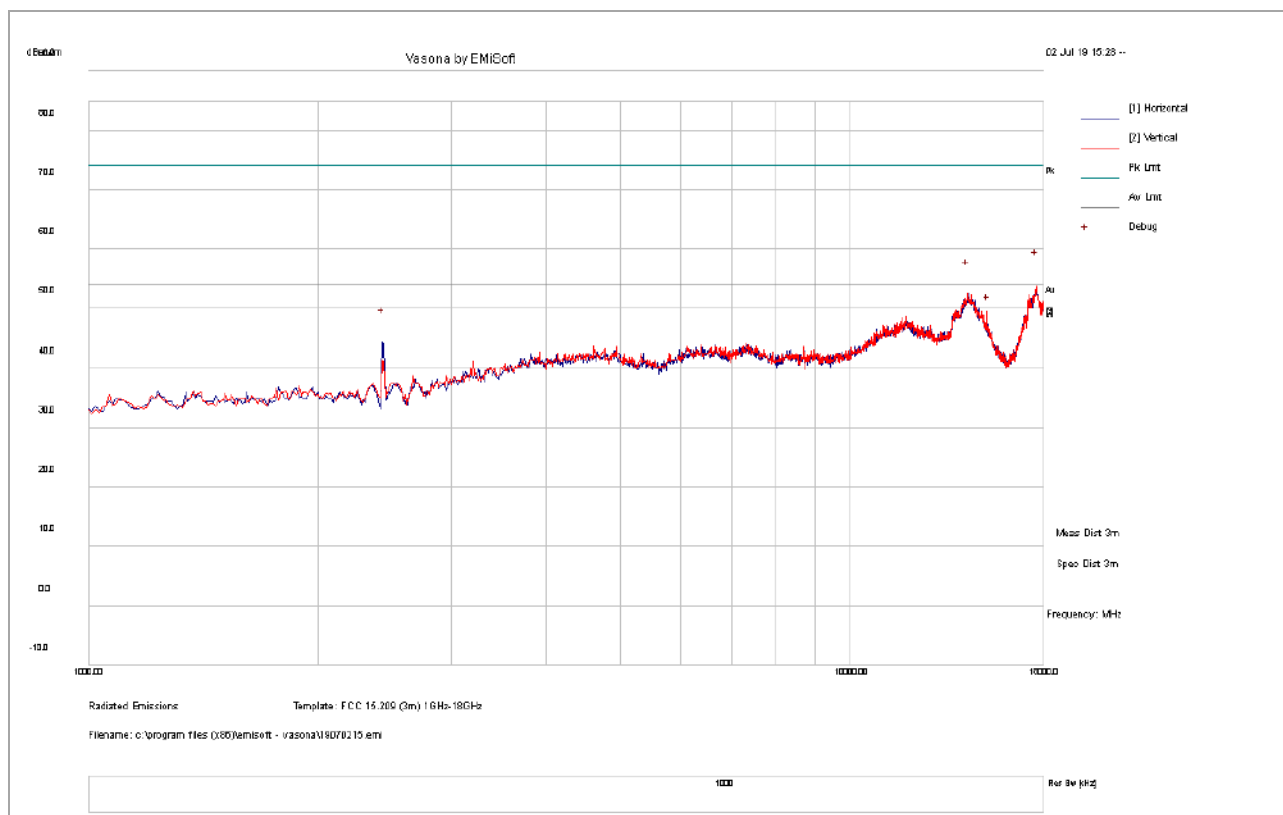
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14238.75	14.64	22.25	14.6	51.49	PK	H	300	13	54	-2.51
15163.13	13.13	24.38	9.3	46.81	PK	V	200	245	54	-7.19
17596.25	11.02	25.28	15.01	51.31	PK	V	200	175	54	-2.69

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



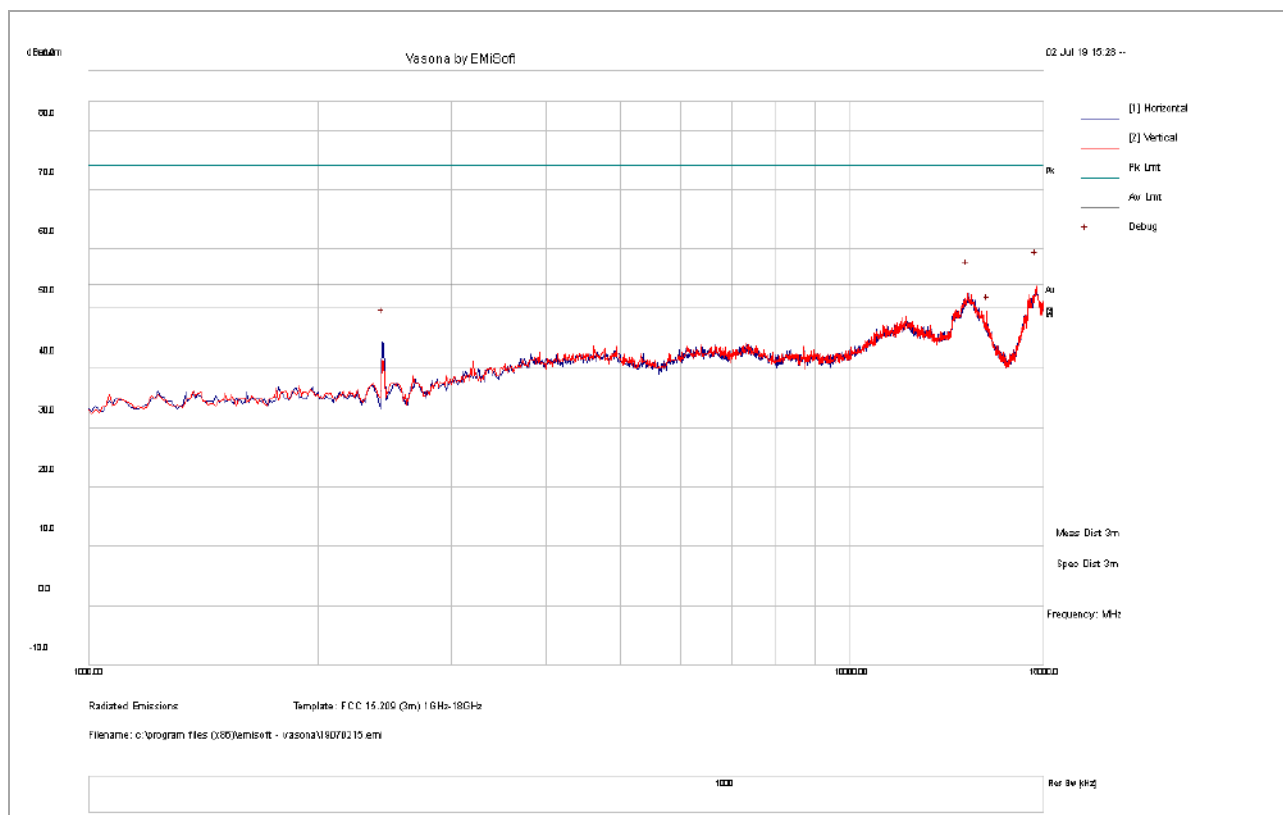
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17585.63	11.01	25.27	14.87	51.15	PK	V	200	138	54	-2.85
14398.13	13.61	22.73	14.44	50.78	PK	H	200	91	54	-3.22
15078.13	14.29	24.44	9.77	48.50	PK	V	300	114	54	-5.50

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



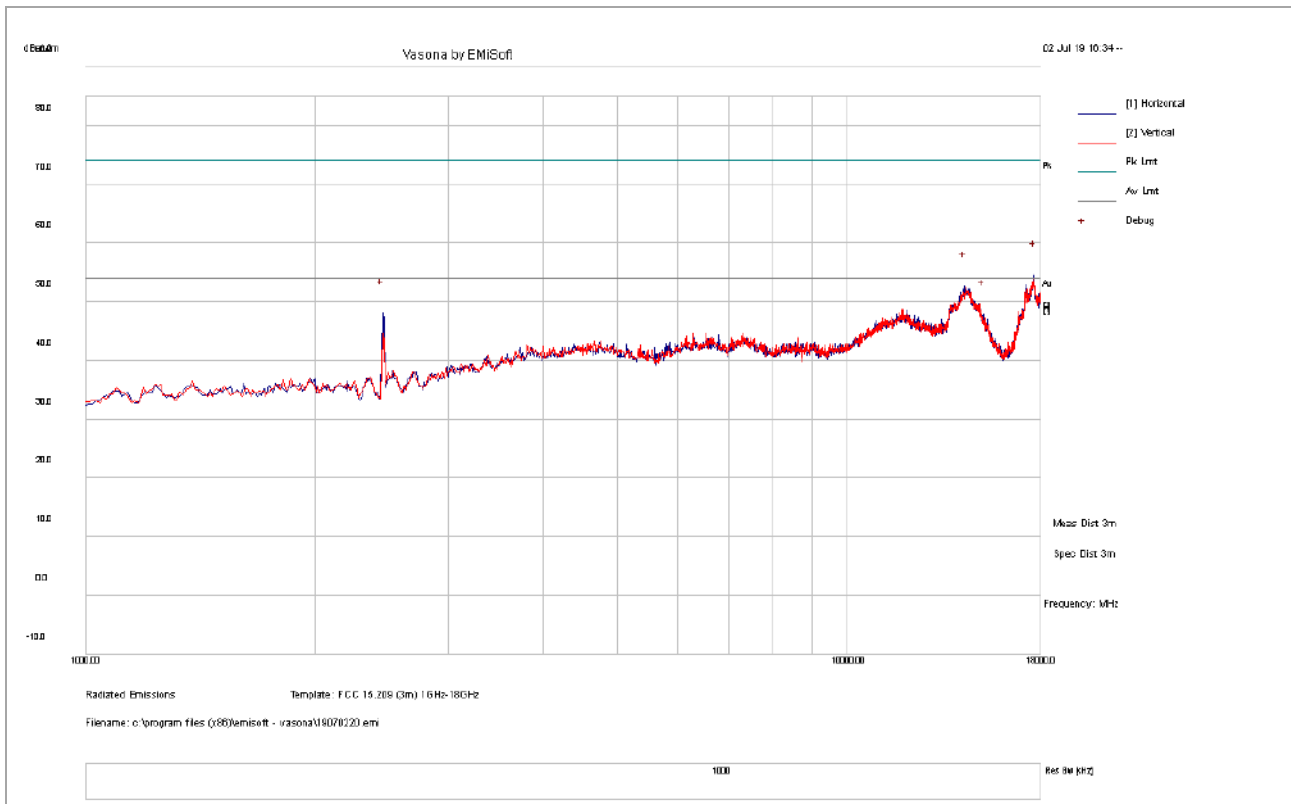
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	10.98	25.28	15.01	51.27	PK	V	200	83	54	-2.73
14355.63	13.82	22.6	14.68	51.10	PK	V	100	182	54	-2.90
15258.75	14.13	24.31	8.76	47.20	PK	H	100	163	54	-6.80

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



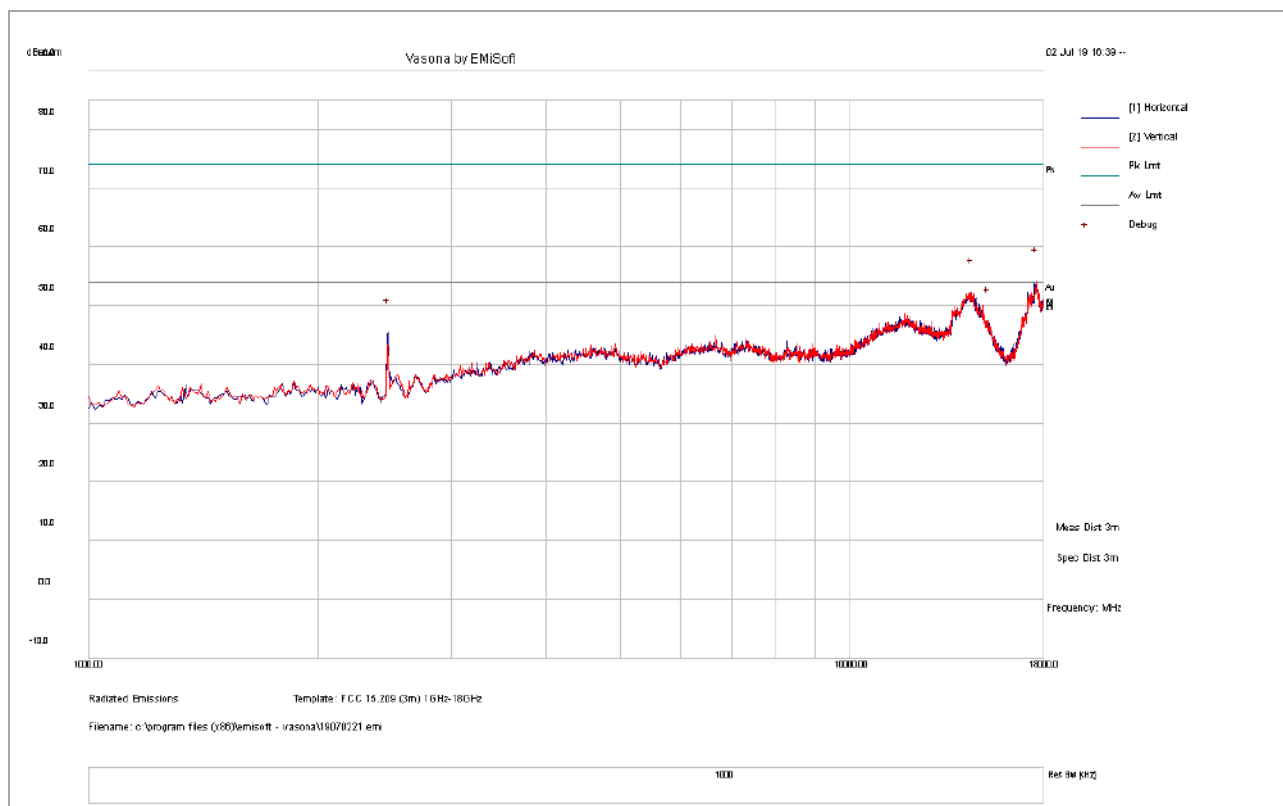
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17617.50	11.09	25.31	14.69	51.09	PK	H	200	10	54	-2.91
14270.63	14.19	22.34	14.65	51.18	PK	H	200	99	54	-2.82
2455.63	37.04	10.77	0.21	48.02	PK	H	200	114	54	-5.98

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n 40MHz-2422MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



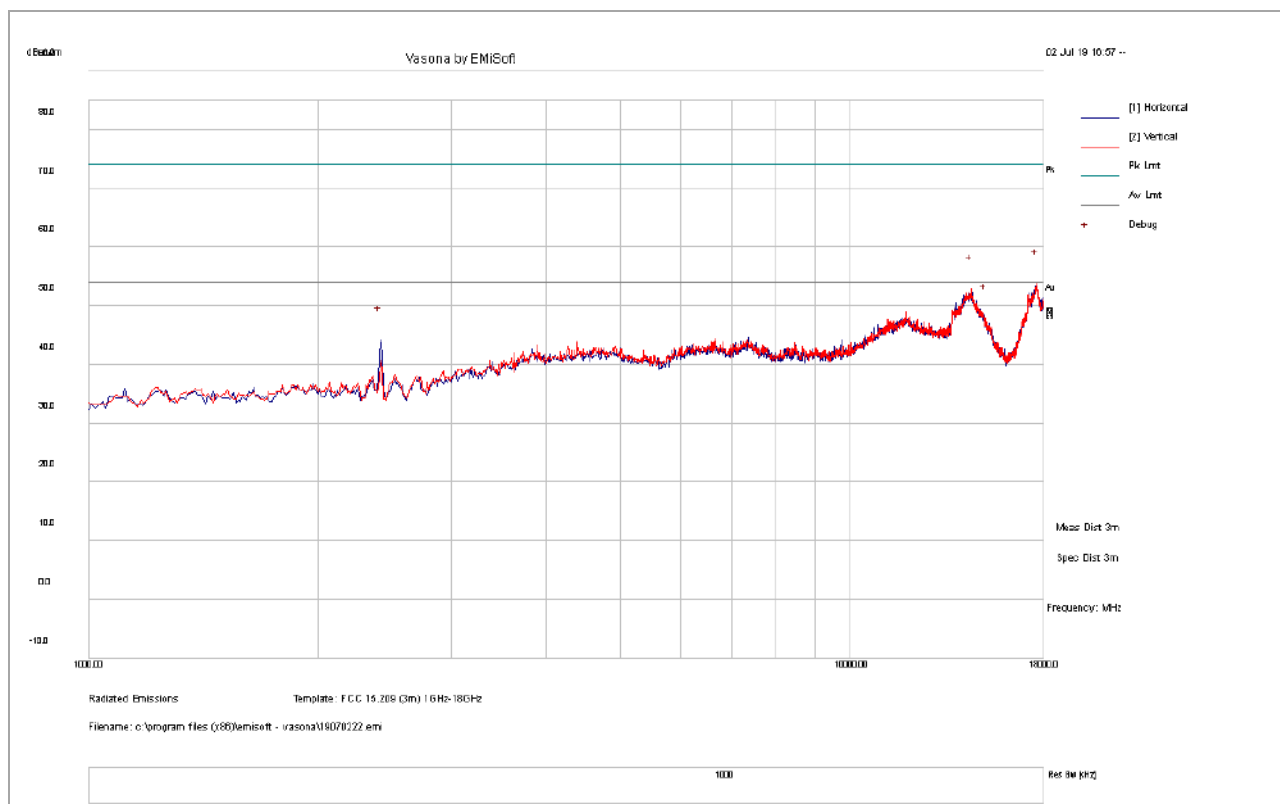
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17585.63	10.92	25.27	14.87	51.06	PK	V	100	13	54	-2.94
14451.25	13.42	22.89	14.00	50.31	PK	V	200	93	54	-3.69
15205.63	13.94	24.35	9.07	47.36	PK	H	300	177	54	-6.64

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n 40MHz-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Cameron Wu
Remark:	N/A	Test Result:	Pass



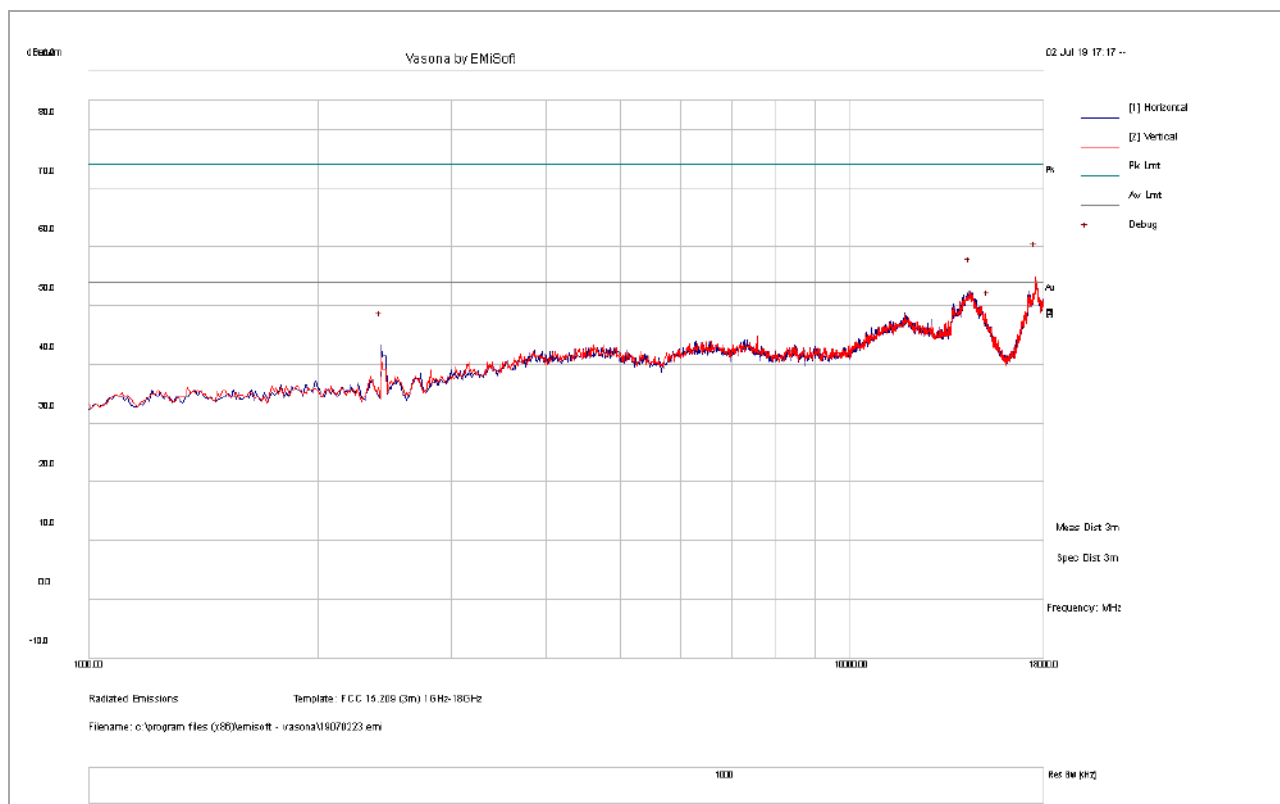
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
17596.25	10.41	25.28	15.01	50.70	PK	V	300	72	54	-3.30
14440.63	13.91	22.86	14.09	50.86	PK	V	100	167	54	-3.14
15067.50	13.55	24.45	9.83	47.83	PK	V	300	182	54	-6.17

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



1GHz – 18GHz test result

Test Standard:	15.209, 15.247	Mode:	11n 40MHz-2452MHz
Frequency Range:	1GHz-18GHz	Test Date:	07/02/2019
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
17500.63	12.53	25.15	14.26	51.94	PK	V	100	112	54	-2.06
14355.63	14.10	22.60	14.68	51.38	PK	H	300	135	54	-2.62
15195.00	13.22	24.36	9.12	46.70	PK	H	300	82	54	-7.30

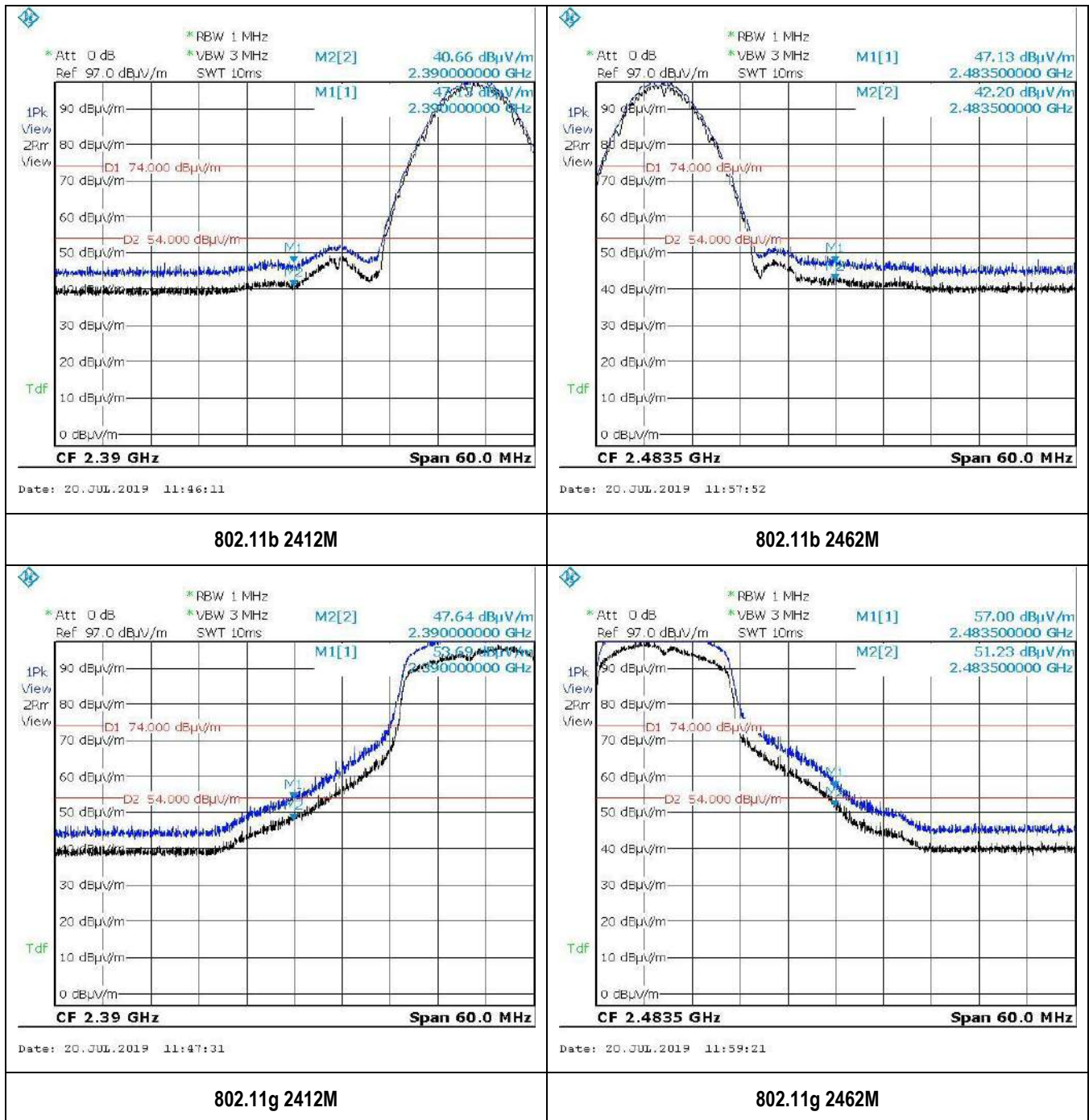
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Product:	HotSpot OBD Dongle
Model Number:	LMU3240LAW



18GHz – 40GHz test result

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

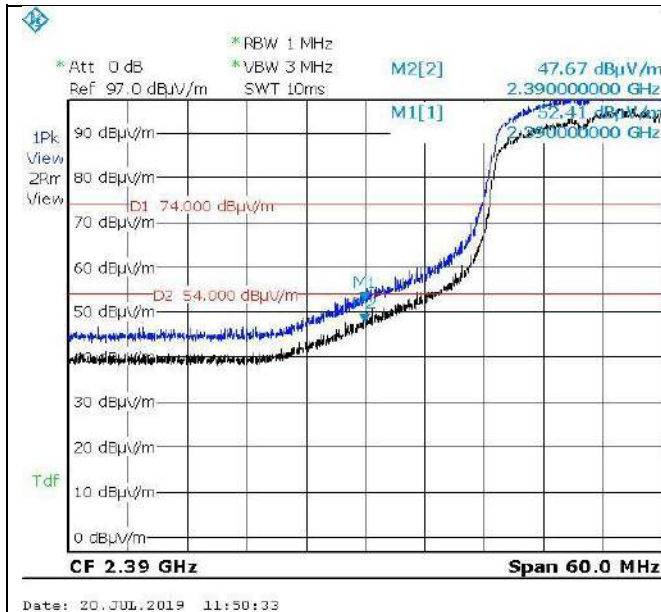
Restricted Band Measurement Result



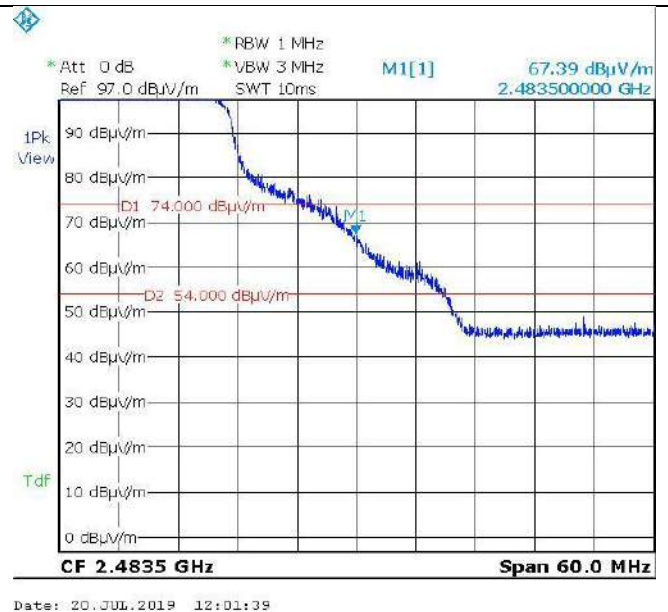
Report Number: CMP-19061922-LC-FCC-IC-DTS
Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



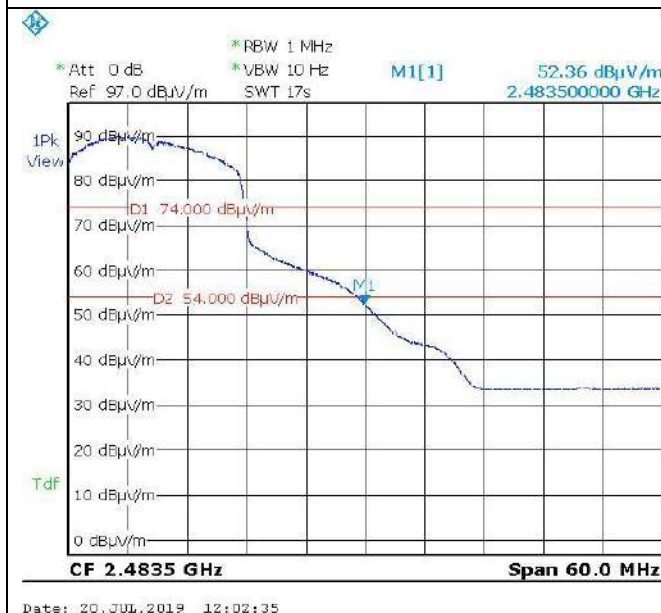
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802.11n20 2412M



802.11n20 2462M-Peak



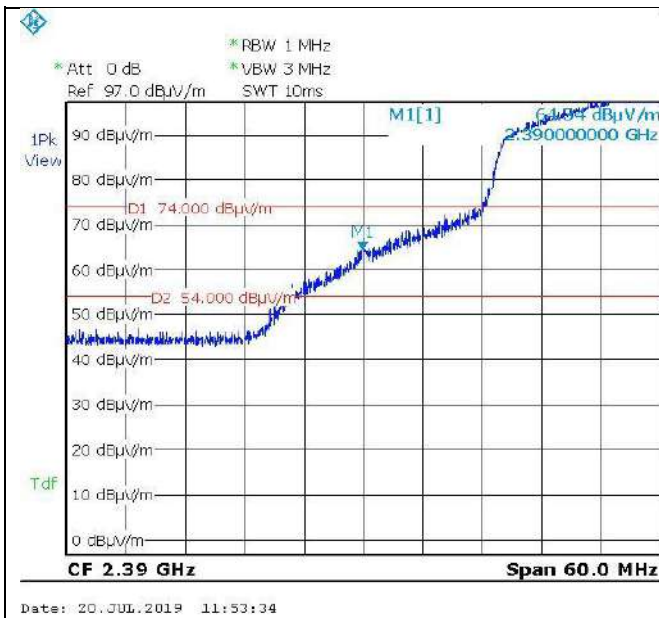
802.11n20 2462M-Average



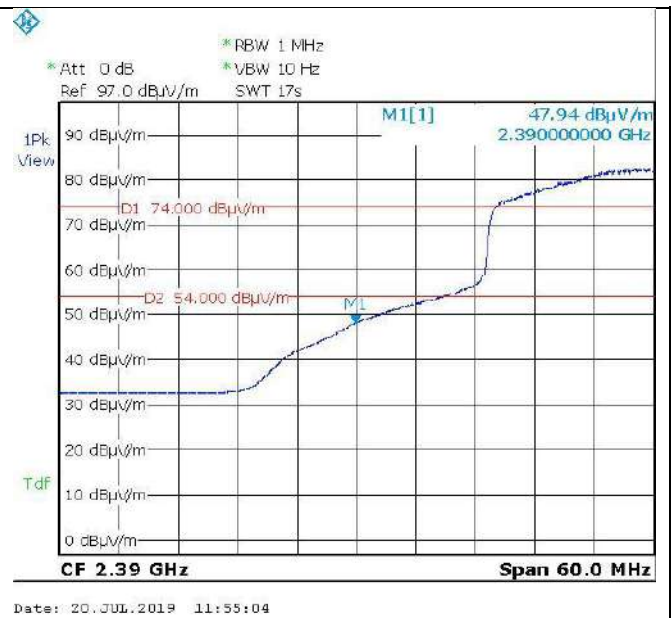
Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

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

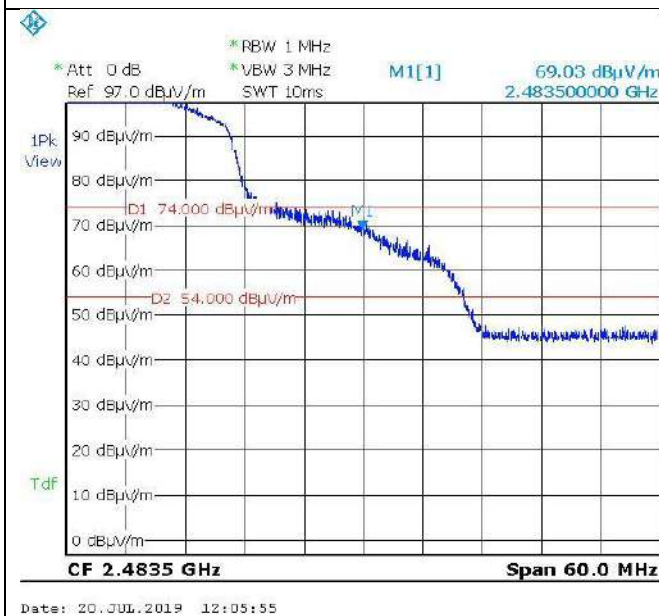
Report Number: CMP-19061922-LC-FCC-IC-DTS
Product: HotSpot OBD Dongle
Model Number: LMU3240LAW



802.11n40 2422M-Peak



802.11n40 2422M-Average



802.11n40 2452M-Peak



802.11n40 2452M-Average

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