

FCC/ISED RF TEST REPORT



Vista Labs
TEST • CERTIFY • COMPLY

Test Report Number.....	WAP-19091821-LC-FCC-IC-LTE
Applicant.....	Ford Motor Company
Applicant Address.....	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124
Product Name.....	Vehicle Telematics Control Unit
Model Number.....	FB5-TCU-NA
Family Product/Model.....	N/A
FCC ID.....	KMH-14H074-NA1
ISED ID.....	1422A-14H074NA1
Date of EUT received.....	09/27/2019
Date of Test.....	09/27/2019 – 11/25/2019
Report Issue Date.....	12/02/2019
Test Standards.....	47CFR Part 22 47CFR Part 24 47CFR Part 27 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015
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:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



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Laboratory Introduction

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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

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	12/02/2019	Original release	N/A

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Product:	Vehicle Telematics Control Unit
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1 General Information

1.1 Applicant

Applicant:	Ford Motor Company
Applicant address:	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124
Manufacturer:	Ford Motor Company
Manufacturer Address:	Building 5, 20300 Rotunda Dr., Dearborn, Michigan, United States 48124

1.2 Product information

Product Name	Vehicle Infotainment System
Model Number	FB5-TCU-NA
Family Model Number	N/A
Serial Number	ENMHF19050112411, ENMHF19050112546 (Conducted), ENMHF19050112536, ENMHF19050112440 (Radiated)
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: 5500-5580MHz, 5660-5720, 5725-5825MHz 802.11n-40MHz: 5510-5550MHz, 5630-5710, 5755-5795MHz 802.11ac: 5530, 5690MHz, 5775MHz WCDMA Band 2: 1852.4- 1907.6MHz WCDMA Band 4: 1712.4- 1752.6MHz WCDMA Band 5: 826.4- 846.6MHz LTE Band 2: 1850.7-1909.3MHz LTE Band 4: 1710.7-1754.3MHz LTE Band 5: 824.7-848.3MHz LTE Band 12: 699.7-713.5MHz LTE Band 17: 706.5-784.5 MHz LTE Band 66: 1710.7-1779.3MHz
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

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Antenna Information	Internal PCB trace antenna Peak Gain: - Antenna1: 3.40 dBi @2.4GHz WiFi/Bluetooth, 8.00 dBi @5GHz WiFi - Antenna2: 3.39 dBi @2.4GHz WiFi/Bluetooth, 6.17 dBi @5GHz WiFi
	External Antenna Peak Gain: - Antenna3: 9.74 dBi @2.4GHz WiFi/Bluetooth
	Cellular main and diversity antennas: Peak Gain: 4.32 dBi @ 698-850MHz 5.53 dBi @ 1700-1910MHz
	For 2.4GHz Wi-Fi, it has total 3 antennas that can transmit simultaneously (Internal antenna 1 &2, and external antenna). For 5GHz Wi-Fi, it has total 2 antennas that can transmit simultaneously (Internal antenna 1 &2). The directional gain is calculated per KDB 662911 D01 Multiple Transmitter Output v02r01, Directional Gain: - 12.59 dBi @2.4GHz - 10.143 dBi @5GHz
Clock Frequencies	N/A
Port/Connectors	CAN bus
Input Power	Vehicle Battery powered: 12VDC
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BT/BLE, WLAN and cellular radio can transmit simultaneously
Additional Info	N/A

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1.3 Test standard and method

Test standard	47CFR Part 22 47CFR Part 24 47CFR Part 27 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015 RSS-Gen Issue 5: Mar 2019
Test method	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01

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:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



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	09/27/2019–11/25/2019
Radiated	Bruce Li	23.5°C / 58.2%/996 mbar	09/27/2019–11/25/2019

3 Modification of EUT

N/A

4 Test configuration and operation

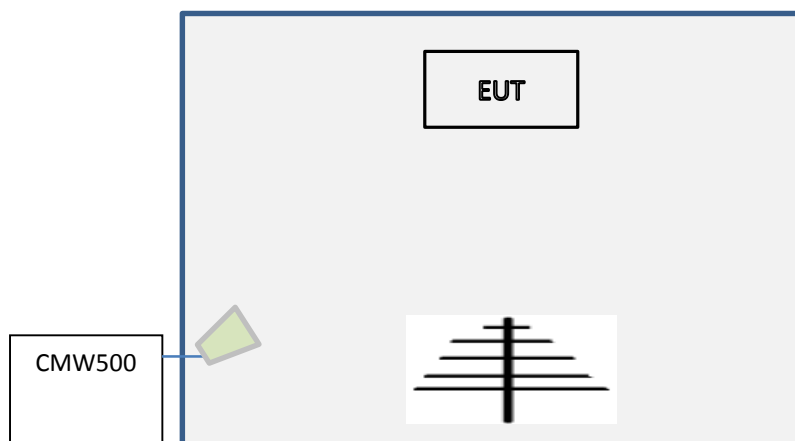
4.1 EUT test configuration

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. For Cellular radio, it's controlled by communication tester to change to different mode.

4.2 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	AC/DC Adapter	GST60A12-P1J	EB74Q81066	MEAN WELL	N/A

4.3 EUT setup diagram



4.4 EUT operation

The radio can be set to transmit continuously in different modulation, test channel and data rate.

4.5 Test software

Index	Description	Remark
1	Qualcomm QRCT ver 4.0.00138.0	Set Wi-Fi radio to different test mode
2	Window command prompt	Set BDR/EDR and BLE to different test mode
3	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

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5 EUT and test setup pictures

See FCC filing

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6 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
§ 2.1046, § 22.913 § 24.232, § 27.50 (d)	RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)	Effective (Isotropic) Radiated Power	8.1	Pass
§ 2.1046, § 22.913 § 24.232, § 27.50 (d)	RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.6)	Peak to Average Ratio	8.2	Pass
§2.1049	RSS-Gen (6.7)	Occupied bandwidth	8.3	Pass
§ 2.1051; § 22.917(a) § 24.238, § 27.53 (h)	RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)	Conducted Band Edge	8.4	Pass
§ 2.1051; § 22.917(a) § 24.238, § 27.53 (h)	RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)	Conducted Spurious Emission	8.5	Pass
§ 2.1051; § 22.917(a) § 24.238, § 27.53 (h)	RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)	Field Strength of Spurious Radiation	8.6	Pass
§ 2.1055, § 22.355 § 24.235, § 27.54	RSS-130(4.5), RSS-132(5.3), RSS-133(6.3), RSS-139(6.4)	Frequency Stability	8.7	Pass

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7 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
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

8 Test summary and result

8.1 RF Output Power

8.1.1 Requirement

§ 22.913(a) – ERP limit: 38.45 dBm

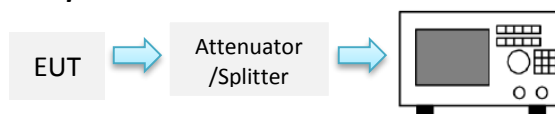
RSS-132(5.4) – EIRP limit: 40.61 dBm

§ 24.232(c) / RSS-133(6.4) – EIRP limit: 33 dBm

§ 27.50(c) / RSS-130(4.6) – EIRP limit: 44.77 dBm

§ 27.50(d) / RSS-139(6.5) – EIRP limit: 30 dBm

8.1.2 Test setup



8.1.3 Test Procedure

For Conducted Power:

- The transmitter output port was connected to base station.
- Set EUT at maximum power through base station.
- Select lowest, middle, and highest channels for each band and different test mode.

For ERP/EIRP:

- According with 971168 D01 Power Meas License Digital Systems v03r01
- The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.
- The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.
- The frequency ranges up to tenth harmonic of the fundamental frequency was investigated.
- Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
- Spurious emissions in dB = 10 log (TX power in Watts/0.001) – the absolute level
- Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts).

8.1.4 Test Result

Conducted Output Power

LTE Band 2				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	18607/1850.7	8900/1880	9193/1909.3
1.4MHz	QPSK	1	0	22.92	22.86	23.58
	QPSK	1	2	22.89	22.98	23.7
	QPSK	1	5	22.82	22.85	23.75
	QPSK	3	0	22.87	22.93	23.59
	QPSK	3	2	-	-	-
	QPSK	3	2	22.92	22.91	23.6
	QPSK	6	0	21.83	21.91	22.52
	16QAM	1	0	22.05	22.02	22.95
	16QAM	1	2	22.08	22.13	22.71
	16QAM	1	5	21.96	22.14	22.89
BW	Modulation	RB size	RB offset	18615/1851.5	18900/1880	185/1908.5
3MHz	QPSK	1	0	22.94	22.89	23.65
	QPSK	1	8	22.81	22.89	23.73
	QPSK	1	14	22.88	22.93	23.49
	QPSK	6	0	21.92	21.94	22.55
	QPSK	6	4	-	-	-
	QPSK	6	9	21.89	21.92	22.55
	QPSK	15	0	21.94	21.93	22.55
	16QAM	1	0	22.25	22.55	22.79
	16QAM	1	8	22.5	22.18	22.73
	16QAM	1	14	22.5	22.07	23.04
BW	Modulation	RB size	RB offset	18625/1852.5	18900/1880	19175/1907.5
5MHz	QPSK	1	0	22.96	22.92	23.65
	QPSK	1	13	22.99	22.99	23.74
	QPSK	1	24	22.94	23.05	23.5
	QPSK	12	0	22.02	22.03	22.67
	QPSK	12	6	-	-	-
	QPSK	12	13	21.94	21.95	22.56
	QPSK	25	0	21.97	21.97	22.64
	16QAM	1	0	22.13	22.13	23.01
	16QAM	1	13	23.06	23.11	23.6
	16QAM	1	24	23.07	22.95	23.54

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LTE Band 2				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	18650/1855	18900/1880	19150/1905
10MHz	QPSK	1	0	23.03	22.97	23.64
	QPSK	1	25	23	22.95	23.67
	QPSK	1	49	22.93	22.93	23.56
	QPSK	25	0	21.93	21.97	22.63
	QPSK	25	13	-	-	-
	QPSK	25	25	21.92	21.92	22.53
	QPSK	50	0	21.99	21.94	22.6
	16QAM	1	0	22.34	22.61	22.79
	16QAM	1	25	22.55	22.22	22.7
	16QAM	1	49	22.52	22.15	23
BW	Modulation	RB size	RB offset	18675/1857.5	18900/1880	9125/1902.5
15MHz	QPSK	1	0	23.1	23.03	23.72
	QPSK	1	38	22.97	22.93	23.67
	QPSK	1	74	22.99	23.02	23.65
	QPSK	36	0	21.98	21.97	22.61
	QPSK	36	18	-	-	-
	QPSK	36	39	21.97	21.95	22.57
	QPSK	75	0	21.95	21.95	22.61
	16QAM	1	0	22.78	22.68	22.75
	16QAM	1	38	22.63	22.59	22.77
	16QAM	1	74	22.24	22.56	23.27
BW	Modulation	RB size	RB offset	18700/1860	18900/1880	19100/1900
20MHz	QPSK	1	0	23.09	23.11	23.79
	QPSK	1	50	23.05	22.9	23.58
	QPSK	1	99	23.04	23.13	23.68
	QPSK	50	0	22.06	22.01	22.58
	QPSK	50	25	-	-	-
	QPSK	50	50	22	22.05	22.58
	QPSK	100	0	22.02	22.1	22.67
	16QAM	1	0	22.69	22.64	22.97
	16QAM	1	50	22.43	22.49	22.85
	16QAM	1	99	22.36	22.51	23.22

LTE Band 4				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	19957/1711	20175/1733	20393/1754
1.4MHz	QPSK	1	0	22.94	22.89	23.65
	QPSK	1	3	22.81	22.89	23.73
	QPSK	1	5	22.88	22.93	23.49
	QPSK	3	0	21.92	21.94	22.55
	QPSK	3	2	-	-	-
	QPSK	3	3	22.93	23.01	23.56
	QPSK	6	0	21.90	21.87	22.43
	16QAM	1	0	22.13	21.97	22.97
	16QAM	1	3	21.99	22.05	22.80
	16QAM	1	5	21.92	22.20	22.94
BW	Modulation	RB size	RB offset	19965/1712	20175/1733	20385/1753
3MHz	QPSK	1	0	22.94	22.89	23.65
	QPSK	1	8	22.81	22.89	23.73
	QPSK	1	14	22.88	22.93	23.49
	QPSK	6	0	21.92	21.94	22.55
	QPSK	6	4	-	-	-
	QPSK	6	9	21.80	21.93	22.53
	QPSK	15	0	21.93	22.00	22.56
	16QAM	1	0	22.25	22.64	22.72
	16QAM	1	8	22.47	22.19	22.67
	16QAM	1	14	22.49	22.06	22.99
BW	Modulation	RB size	RB offset	19975/1713	20175/1733	20375/1752
5MHz	QPSK	1	0	22.96	22.92	23.65
	QPSK	1	13	22.99	22.99	23.74
	QPSK	1	24	22.94	23.05	23.5
	QPSK	12	0	22.02	22.03	22.67
	QPSK	12	6	-	-	-
	QPSK	12	13	21.89	21.92	22.49
	QPSK	25	0	21.95	22.05	22.66
	16QAM	1	0	22.11	22.13	23.00
	16QAM	1	13	22.96	23.09	23.69
	16QAM	1	24	23.17	23.02	23.52

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LTE Band 4				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	20000/1715	20175/1733	20350/1750
10MHz	QPSK	1	0	23.03	22.94	23.61
	QPSK	1	25	22.97	22.89	23.72
	QPSK	1	49	22.85	22.94	23.48
	QPSK	25	0	22.03	22.00	22.66
	QPSK	25	13	-	-	-
	QPSK	25	25	21.84	21.89	22.49
	QPSK	50	0	22.01	21.87	22.61
	16QAM	1	0	22.38	22.60	22.89
	16QAM	1	25	22.60	22.28	22.63
	16QAM	1	49	22.49	22.11	23.08
BW	Modulation	RB size	RB offset	20025/1718	20175/1733	20325/1747
15MHz	QPSK	1	0	23.10	23.02	23.67
	QPSK	1	38	22.99	22.95	23.61
	QPSK	1	74	22.98	23.07	23.69
	QPSK	36	0	22.07	21.87	22.71
	QPSK	36	18	-	-	-
	QPSK	36	39	21.95	22.01	22.56
	QPSK	75	0	22.04	21.89	22.65
	16QAM	1	0	22.70	22.63	22.79
	16QAM	1	38	22.61	22.59	22.72
	16QAM	1	74	22.24	22.62	23.26
BW	Modulation	RB size	RB offset	20050/1720	20175/1733	20300/1745
20MHz	QPSK	1	0	23.08	23.07	23.85
	QPSK	1	50	23.13	22.87	23.62
	QPSK	1	99	22.95	23.21	23.75
	QPSK	50	0	21.97	21.91	22.56
	QPSK	50	25	-	-	-
	QPSK	50	50	22.06	22.03	22.51
	QPSK	100	0	22.06	22.14	22.74
	16QAM	1	0	22.65	22.72	23.03
	16QAM	1	50	22.51	22.45	22.90
	16QAM	1	99	22.33	22.47	23.21

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LTE Band 5				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	20407/824.7	20525/836.5	20643/848.3
1.4MHz	QPSK	1	0	23.14	23.03	23.21
	QPSK	1	2	23.1	23.24	23.23
	QPSK	1	5	22.98	23.02	23.3
	QPSK	3	0	22.99	23.11	23.17
	QPSK	3	2	-	-	-
	QPSK	3	3	23.01	23.15	23.21
	QPSK	6	0	22	22.07	22.16
	16QAM	1	0	22.08	22.36	22.52
	16QAM	1	2	22.96	23.07	23.19
	16QAM	1	5	23.12	23.05	23.05
BW	Modulation	RB size	RB offset	20415/825.5	20525/836.5	20635/847.5
3MHz	QPSK	1	0	23.1	23.3	23.27
	QPSK	1	8	23.11	23.09	23.26
	QPSK	1	14	23.13	23.07	23.14
	QPSK	6	0	22.07	22.16	22.28
	QPSK	6	4	-	-	-
	QPSK	6	9	22.01	22.12	22.21
	QPSK	15	0	22.06	22.12	22.24
	16QAM	1	0	22.67	22.39	22.64
	16QAM	1	8	22.31	22.76	22.54
	16QAM	1	14	22.12	22.37	22.81
BW	Modulation	RB size	RB offset	20425/826.5	20525/836.5	20625/846.5
5MHz	QPSK	1	0	23	23.13	23.28
	QPSK	1	13	23.07	23.16	23.38
	QPSK	1	24	23.04	23.31	23.15
	QPSK	12	0	22.01	22.16	22.27
	QPSK	12	6	-	-	-
	QPSK	12	13	22.11	22.18	22.15
	QPSK	25	0	21.97	21.99	22.25
	16QAM	1	0	22.36	22.24	22.22
	16QAM	1	13	22.41	22.28	22.33
	16QAM	1	24	22.11	22.57	22.15
BW	Modulation	RB size	RB offset	20450/829	20525/836.5	20600/844
10MHz	QPSK	1	0	23.01	23.04	23.28
	QPSK	1	25	22.97	23.21	23.26
	QPSK	1	49	23	23.2	23.06
	QPSK	25	0	21.98	22.13	22.15
	QPSK	25	13	-	-	-
	QPSK	25	25	21.97	22.25	22.22
	QPSK	50	0	21.96	22.12	22.24
	16QAM	1	0	22.39	22.65	22.35
	16QAM	1	25	22.65	22.41	22.16
	16QAM	1	49	22.71	22.28	22.55

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LTE Band 12				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	23017/699.7	23095/707.5	23173/715.3
1.4MHz	QPSK	1	0	22.75	22.68	22.8
	QPSK	1	3	22.83	22.83	22.66
	QPSK	1	5	22.78	22.78	22.57
	QPSK	3	0	22.75	22.66	22.56
	QPSK	3	2	-	-	-
	QPSK	3	3	22.85	22.74	22.71
	QPSK	6	0	21.76	21.62	21.64
	16QAM	1	0	22.03	21.93	21.75
	16QAM	1	3	22.79	22.68	22.57
	16QAM	1	5	22.19	21.88	21.8
BW	Modulation	RB size	RB offset	23025/700.5	23095/707.5	23165/714.5
3MHz	QPSK	1	0	22.95	22.84	22.79
	QPSK	1	8	22.96	22.73	22.67
	QPSK	1	14	22.79	22.8	22.56
	QPSK	6	0	21.8	21.87	21.76
	QPSK	6	4	-	-	-
	QPSK	6	9	21.85	21.88	21.86
	QPSK	15	0	21.94	21.85	21.69
	16QAM	1	0	22.41	21.9	22.15
	16QAM	1	8	22.01	22.3	21.95
	16QAM	1	14	21.98	22.06	22.23
BW	Modulation	RB size	RB offset	23035/701.5	23095/707.5	23155/713.5
5MHz	QPSK	1	0	22.91	22.83	22.9
	QPSK	1	13	22.98	22.75	22.82
	QPSK	1	24	22.64	22.79	22.58
	QPSK	12	0	21.85	21.78	21.67
	QPSK	12	6	-	-	-
	QPSK	12	13	21.76	21.82	21.7
	QPSK	25	0	21.76	21.8	21.67
	16QAM	1	0	21.98	21.83	22.17
	16QAM	1	13	21.9	21.83	22.23
	16QAM	1	24	21.87	22.16	21.87
BW	Modulation	RB size	RB offset	23060/704	23095/707.5	23130/711
10MHz	QPSK	1	0	22.82	22.79	22.79
	QPSK	1	25	22.91	22.78	22.8
	QPSK	1	49	22.64	22.71	22.59
	QPSK	25	0	21.77	21.9	21.83
	QPSK	25	13	-	-	-
	QPSK	25	25	21.75	21.87	21.64
	QPSK	50	0	21.89	21.77	21.79
	16QAM	1	0	22.47	21.96	22.11
	16QAM	1	25	22.16	22.45	22.02
	16QAM	1	49	22.27	22.17	21.79

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LTE Band 17				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	23755/706.5	23790/710	23825/713.5
5MHz	QPSK	1	0	23.07	22.71	22.9
	QPSK	1	13	22.77	22.76	22.73
	QPSK	1	24	22.68	22.59	22.75
	QPSK	12	0	21.8	21.76	21.81
	QPSK	12	6	-	-	-
	QPSK	12	13	21.79	21.85	21.8
	QPSK	25	0	21.89	21.75	21.77
	16QAM	1	0	22.22	21.9	21.91
	16QAM	1	13	22.13	22.24	21.97
	16QAM	1	24	21.87	21.87	22.12
BW	Modulation	RB size	RB offset	23780/709	23790/710	23800/711
10MHz	QPSK	1	0	22.92	22.94	22.95
	QPSK	1	25	22.77	22.81	22.78
	QPSK	1	49	22.7	22.72	22.81
	QPSK	25	0	21.86	21.78	21.91
	QPSK	25	13	-	-	-
	QPSK	25	25	21.85	21.74	21.76
	QPSK	50	0	21.83	21.86	21.78
	16QAM	1	0	21.98	22.17	22.3
	16QAM	1	25	22.11	21.96	22.36
	16QAM	1	49	22.03	22.21	21.79

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LTE Band 66				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	131979/1710.7	132322/1745	132665/1779.3
1.4MHz	QPSK	1	0	22.91	22.82	23.50
	QPSK	1	3	22.85	22.93	23.69
	QPSK	1	5	22.74	22.85	23.67
	QPSK	3	0	22.95	22.87	23.56
	QPSK	3	2	-	-	-
	QPSK	3	3	22.88	22.96	23.53
	QPSK	6	0	21.88	21.98	22.49
	16QAM	1	0	22.08	21.95	22.85
	16QAM	1	3	22.12	22.10	22.69
	16QAM	1	5	22.06	22.15	22.97
BW	Modulation	RB size	RB offset	131987/1711.5	132322/1745	132657/1778.5
3MHz	QPSK	1	0	22.91	22.97	23.74
	QPSK	1	8	22.86	22.82	23.75
	QPSK	1	14	22.90	22.94	23.43
	QPSK	6	0	21.90	22.02	22.48
	QPSK	6	4	-	-	-
	QPSK	6	9	21.98	21.91	22.64
	QPSK	15	0	21.92	21.87	22.53
	16QAM	1	0	22.24	22.51	22.86
	16QAM	1	8	22.41	22.25	22.74
	16QAM	1	14	22.59	22.16	22.95
BW	Modulation	RB size	RB offset	131997/1712.5	132322/1745	132647/1777.5
5MHz	QPSK	1	0	22.95	23.01	23.75
	QPSK	1	13	22.92	23.07	23.82
	QPSK	1	24	22.99	23.02	23.50
	QPSK	12	0	21.96	21.98	22.67
	QPSK	12	6	-	-	-
	QPSK	12	13	21.91	22.02	22.50
	QPSK	25	0	22.02	21.99	22.68
	16QAM	1	0	22.18	22.13	23.06
	16QAM	1	13	23.01	23.06	23.62
	16QAM	1	24	23.03	22.88	23.56

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LTE Band 66				Conducted Power(dBm) / Frequency (MHz)		
BW	Modulation	RB size	RB offset	132022/1715	132322/1745	132622/1775
10MHz	QPSK	1	0	23.03	23.01	23.62
	QPSK	1	25	23.03	22.93	23.65
	QPSK	1	49	22.97	22.95	23.62
	QPSK	25	0	21.96	21.95	22.66
	QPSK	25	13	-	-	-
	QPSK	25	25	21.87	21.88	22.63
	QPSK	50	0	22.07	21.91	22.51
	16QAM	1	0	22.43	22.61	22.84
	16QAM	1	25	22.53	22.30	22.65
	16QAM	1	49	22.47	22.19	23.02
BW	Modulation	RB size	RB offset	132047/1717.5	132322/1745	132597/1772.5
15MHz	QPSK	1	0	23.10	23.00	23.76
	QPSK	1	38	22.94	23.00	23.67
	QPSK	1	74	23.08	22.96	23.58
	QPSK	36	0	21.99	22.00	22.51
	QPSK	36	18	-	-	-
	QPSK	36	39	22.06	22.03	22.51
	QPSK	75	0	21.86	21.91	22.66
	16QAM	1	0	22.86	22.59	22.69
	16QAM	1	38	22.65	22.68	22.82
	16QAM	1	74	22.31	22.51	23.30
BW	Modulation	RB size	RB offset	132072/1720	132322/1745	132572/1770
20MHz	QPSK	1	0	23.06	23.06	23.86
	QPSK	1	50	23.03	22.95	23.63
	QPSK	1	99	22.95	23.06	23.64
	QPSK	50	0	22.04	22.01	22.63
	QPSK	50	25	-	-	-
	QPSK	50	50	21.99	22.11	22.52
	QPSK	100	0	22.01	22.14	22.64
	16QAM	1	0	22.78	22.61	22.89
	16QAM	1	50	22.39	22.45	22.89
	16QAM	1	99	22.45	22.46	23.13

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Radiated Power

LTE Band 2					
Mode	Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	18607	1850.7	28.45	33	Pass
	18900	1880.0	28.51	33	Pass
	19193	1909.3	29.28	33	Pass
3MHz (QPSK)	18615	1851.5	28.47	33	Pass
	18900	1880	28.46	33	Pass
	19185	1908.5	29.26	33	Pass
5MHz (QPSK)	18625	1852.5	28.52	33	Pass
	18900	1880	28.58	33	Pass
	19175	1907.5	29.27	33	Pass
10MHz (QPSK)	18650	1855	28.56	33	Pass
	18900	1880	28.50	33	Pass
	19150	1905	29.20	33	Pass
15MHz (QPSK)	18675	1857.5	28.63	33	Pass
	18900	1880	28.56	33	Pass
	19125	1902.5	29.25	33	Pass
20MHz (QPSK)	18700	1860	28.62	33	Pass
	18900	1880	28.66	33	Pass
	19100	1900	29.32	33	Pass
1.4MHz (16QAM)	18607	1850.7	27.61	33	Pass
	18900	1880.0	27.67	33	Pass
	19193	1909.3	28.48	33	Pass
3MHz (16QAM)	18615	1851.5	28.03	33	Pass
	18900	1880	28.08	33	Pass
	19185	1908.5	28.57	33	Pass
5MHz (16QAM)	18625	1852.5	28.60	33	Pass
	18900	1880	28.64	33	Pass
	19175	1907.5	29.13	33	Pass
10MHz (16QAM)	18650	1855	28.08	33	Pass
	18900	1880	28.14	33	Pass
	19150	1905	28.53	33	Pass
15MHz (16QAM)	18675	1857.5	28.31	33	Pass
	18900	1880	28.21	33	Pass
	19125	1902.5	28.80	33	Pass
20MHz (16QAM)	18700	1860	28.22	33	Pass
	18900	1880	28.17	33	Pass
	19100	1900	28.75	33	Pass

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LTE Band 4					
Mode	Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Conclusion
1.4MHz (QPSK)	19957	1711	28.47	30	Pass
	20175	1733	28.54	30	Pass
	20393	1754	29.26	30	Pass
3MHz (QPSK)	19965	1712	28.47	30	Pass
	20175	1733	28.46	30	Pass
	20385	1753	29.26	30	Pass
5MHz (QPSK)	19975	1713	28.52	30	Pass
	20175	1733	28.58	30	Pass
	20375	1752	29.27	30	Pass
10MHz (QPSK)	20000	1715	28.56	30	Pass
	20175	1733	28.47	30	Pass
	20350	1750	29.25	30	Pass
15MHz (QPSK)	20025	1718	28.63	30	Pass
	20175	1733	28.60	30	Pass
	20325	1747	29.22	30	Pass
20MHz (QPSK)	20050	1720	28.66	30	Pass
	20175	1733	28.74	30	Pass
	20300	1745	29.38	30	Pass
1.4MHz (16QAM)	19957	1711	27.66	30	Pass
	20175	1733	27.73	30	Pass
	20393	1754	28.50	30	Pass
3MHz (16QAM)	19965	1712	28.02	30	Pass
	20175	1733	28.17	30	Pass
	20385	1753	28.52	30	Pass
5MHz (16QAM)	19975	1713	28.70	30	Pass
	20175	1733	28.62	30	Pass
	20375	1752	29.22	30	Pass
10MHz (16QAM)	20000	1715	28.13	30	Pass
	20175	1733	28.13	30	Pass
	20350	1750	28.61	30	Pass
15MHz (16QAM)	20025	1718	28.23	30	Pass
	20175	1733	28.16	30	Pass
	20325	1747	28.79	30	Pass
20MHz (16QAM)	20050	1720	28.18	30	Pass
	20175	1733	28.25	30	Pass
	20300	1745	28.74	30	Pass

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LTE Band 5					
Mode	Channel	Frequency (MHz)	ERP (dBm)	EIRP/ERP Limit (dBm)	Conclusion
1.4MHz (QPSK)	20407	824.7	25.31	40.61 / 38.45	Pass
	20525	836.5	25.41	40.61 / 38.45	Pass
	20643	848.3	25.47	40.61 / 38.45	Pass
3MHz (QPSK)	20415	825.5	25.30	40.61 / 38.45	Pass
	20525	836.5	25.47	40.61 / 38.45	Pass
	20635	847.5	25.44	40.61 / 38.45	Pass
5MHz (QPSK)	20425	826.5	25.24	40.61 / 38.45	Pass
	20525	836.5	25.48	40.61 / 38.45	Pass
	20625	846.5	25.55	40.61 / 38.45	Pass
10MHz (QPSK)	20450	829	25.18	40.61 / 38.45	Pass
	20525	836.5	25.38	40.61 / 38.45	Pass
	20600	844	25.45	40.61 / 38.45	Pass
1.4MHz (16QAM)	20407	824.7	25.29	40.61 / 38.45	Pass
	20525	836.5	25.24	40.61 / 38.45	Pass
	20643	848.3	25.36	40.61 / 38.45	Pass
3MHz (16QAM)	20415	825.5	24.84	40.61 / 38.45	Pass
	20525	836.5	24.93	40.61 / 38.45	Pass
	20635	847.5	24.98	40.61 / 38.45	Pass
5MHz (16QAM)	20425	826.5	24.58	40.61 / 38.45	Pass
	20525	836.5	24.74	40.61 / 38.45	Pass
	20625	846.5	24.50	40.61 / 38.45	Pass
10MHz (16QAM)	20450	829	24.88	40.61 / 38.45	Pass
	20525	836.5	24.82	40.61 / 38.45	Pass
	20600	844	24.72	40.61 / 38.45	Pass



LTE Band 12					
Mode	Channel	Frequency (MHz)	ERP (dBm)	EIRP/ERP Limit (dBm)	Conclusion
1.4MHz (QPSK)	23017	699.7	25.02	- / 44.77	Pass
	23095	707.5	25.00	- / 44.77	Pass
	23173	715.3	24.97	- / 44.77	Pass
3MHz (QPSK)	23025	700.5	25.13	- / 44.77	Pass
	23095	707.5	25.01	- / 44.77	Pass
	23165	714.5	24.96	- / 44.77	Pass
5MHz (QPSK)	23035	701.5	25.15	- / 44.77	Pass
	23095	707.5	25.00	- / 44.77	Pass
	23155	713.5	25.07	- / 44.77	Pass
10MHz (QPSK)	23060	704	25.08	- / 44.77	Pass
	23095	707.5	24.96	- / 44.77	Pass
	23130	711	24.97	- / 44.77	Pass
1.4MHz (16QAM)	23017	699.7	24.96	- / 44.77	Pass
	23095	707.5	24.85	- / 44.77	Pass
	23173	715.3	24.74	- / 44.77	Pass
3MHz (16QAM)	23025	700.5	24.58	- / 44.77	Pass
	23095	707.5	24.47	- / 44.77	Pass
	23165	714.5	24.40	- / 44.77	Pass
5MHz (16QAM)	23035	701.5	24.15	- / 44.77	Pass
	23095	707.5	24.33	- / 44.77	Pass
	23155	713.5	24.40	- / 44.77	Pass
10MHz (16QAM)	23060	704	24.64	- / 44.77	Pass
	23095	707.5	24.62	- / 44.77	Pass
	23130	711	24.28	- / 44.77	Pass

LTE Band 17					
Mode	Channel	Frequency (MHz)	ERP (dBm)	EIRP/ERP Limit (dBm)	Conclusion
5MHz (QPSK)	23755	706.5	25.24	- / 44.77	Pass
	23790	710	24.93	- / 44.77	Pass
	23825	713.5	25.07	- / 44.77	Pass
10MHz (QPSK)	23780	709	25.09	- / 44.77	Pass
	23790	710	25.11	- / 44.77	Pass
	23800	711	25.12	- / 44.77	Pass
5MHz (16QAM)	23755	706.5	24.39	- / 44.77	Pass
	23790	710	24.41	- / 44.77	Pass
	23825	713.5	24.29	- / 44.77	Pass
10MHz (16QAM)	23755	706.5	24.28	- / 44.77	Pass
	23790	710	24.38	- / 44.77	Pass
	23825	713.5	24.53	- / 44.77	Pass

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LTE Band 66					
Mode	Channel	Frequency (MHz)	EIRP (dBm)	EIRP/ERP Limit (dBm)	Conclusion
1.4MHz (QPSK)	131979	1710.7	28.48	30 / -	Pass
	132322	1745	28.49	30 / -	Pass
	132665	1779.3	29.22	30 / -	Pass
3MHz (QPSK)	131987	1711.5	28.44	30 / -	Pass
	132322	1745	28.50	30 / -	Pass
	132657	1778.5	29.28	30 / -	Pass
5MHz (QPSK)	131997	1712.5	28.52	30 / -	Pass
	132322	1745	28.60	30 / -	Pass
	132647	1777.5	29.35	30 / -	Pass
10MHz (QPSK)	132022	1715	28.56	30 / -	Pass
	132322	1745	28.54	30 / -	Pass
	132622	1775	29.18	30 / -	Pass
15MHz (QPSK)	132047	1717.5	28.63	30 / -	Pass
	132322	1745	28.53	30 / -	Pass
	132597	1772.5	29.29	30 / -	Pass
20MHz (QPSK)	132072	1720	28.59	30 / -	Pass
	132322	1745	28.59	30 / -	Pass
	132572	1770	29.39	30 / -	Pass
1.4MHz (16QAM)	131979	1710.7	27.65	30 / -	Pass
	132322	1745	27.68	30 / -	Pass
	132665	1779.3	28.50	30 / -	Pass
3MHz (16QAM)	131987	1711.5	28.12	30 / -	Pass
	132322	1745	28.04	30 / -	Pass
	132657	1778.5	28.48	30 / -	Pass
5MHz (16QAM)	131997	1712.5	28.56	30 / -	Pass
	132322	1745	28.59	30 / -	Pass
	132647	1777.5	29.15	30 / -	Pass
10MHz (16QAM)	132022	1715	28.06	30 / -	Pass
	132322	1745	28.14	30 / -	Pass
	132622	1775	28.55	30 / -	Pass
15MHz (16QAM)	132047	1717.5	28.39	30 / -	Pass
	132322	1745	28.21	30 / -	Pass
	132597	1772.5	28.83	30 / -	Pass
20MHz (16QAM)	132072	1720	28.31	30 / -	Pass
	132322	1745	28.14	30 / -	Pass
	132572	1770	28.66	30 / -	Pass

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8.2 Peak to Average Ratio

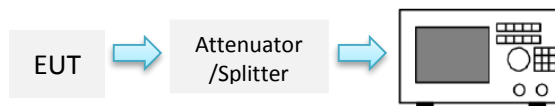
8.2.1 Requirement

§ 2.1046, § 22.913, § 24.232, § 27.50 (d)

RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

8.2.2 Test setup



8.2.3 Test Procedure

For Peak Power measurement

- The total peak output power may be measured using a broadband peak RF power meter. The power meter must have a video bandwidth that is greater than or equal to the emission bandwidth and utilize a fast-responding diode detector.

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For Average Power measurement

- As an alternative to the use of a spectrum/signal analyzer or EMI receiver to perform a measurement of the total in-band average output power, a wideband RF average power meter with a thermocouple detector or equivalent can be used under certain conditions
- If the EUT can be configured to transmit continuously (i.e., the burst duty cycle $\geq 98\%$) and at all times the EUT is transmitting at its maximum output power level, then a conventional wide-band RF power meter can be used.
- If the EUT cannot be configured to transmit continuously (i.e., the burst duty cycle $< 98\%$), then there are two options for the use of an average power meter. First, a gated average power meter can be used to perform the measurement if the gating parameters can be adjusted such that the power is measured only over active transmission bursts at maximum output power levels. A conventional average power meter can also be used if the measured burst duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent) by performing the measurement over the on/off burst cycles and then correcting (increasing) the measured level by a factor equal to $10\log(1/\text{duty cycle})$

8.2.4 Test Result

Peak to Average Ratio

LTE Band 2								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	1.4	18607	1850.7	28.05	22.92	5.13	≤13	PASS
		18900	1880.0	28.14	22.98	5.16	≤13	PASS
		19193	1909.3	28.87	23.75	5.12	≤13	PASS
	3	18615	1851.5	28.08	22.94	5.14	≤13	PASS
		18900	1880	27.96	22.93	5.03	≤13	PASS
		19185	1908.5	28.94	23.73	5.21	≤13	PASS
	5	18625	1852.5	28.11	22.99	5.12	≤13	PASS
		18900	1880	28.15	23.05	5.1	≤13	PASS
		19175	1907.5	28.89	23.74	5.15	≤13	PASS
	10	18650	1855	28.23	23.03	5.20	≤13	PASS
		18900	1880	28.05	22.97	5.08	≤13	PASS
		19150	1905	28.76	23.67	5.09	≤13	PASS
	15	18675	1857.5	28.22	23.10	5.12	≤13	PASS
		18900	1880	28.27	23.03	5.24	≤13	PASS
		19125	1902.5	28.85	23.72	5.13	≤13	PASS
	20	18700	1860	28.35	23.09	5.26	≤13	PASS
		18900	1880	28.34	23.13	5.21	≤13	PASS
		19100	1900	28.93	23.79	5.14	≤13	PASS
16QAM	1.4	18607	1850.7	27.84	22.08	5.76	≤13	PASS
		18900	1880.0	28.02	22.14	5.88	≤13	PASS
		19193	1909.3	28.74	22.95	5.79	≤13	PASS
	3	18615	1851.5	28.44	22.50	5.94	≤13	PASS
		18900	1880	28.39	22.55	5.84	≤13	PASS
		19185	1908.5	28.86	23.04	5.82	≤13	PASS
	5	18625	1852.5	29.04	23.07	5.97	≤13	PASS
		18900	1880	28.93	23.11	5.82	≤13	PASS
		19175	1907.5	29.52	23.60	5.92	≤13	PASS
	10	18650	1855	28.31	22.55	5.76	≤13	PASS
		18900	1880	28.56	22.61	5.95	≤13	PASS
		19150	1905	28.82	23.00	5.82	≤13	PASS
	15	18675	1857.5	28.73	22.78	5.95	≤13	PASS
		18900	1880	28.64	22.68	5.96	≤13	PASS
		19125	1902.5	29.15	23.27	5.88	≤13	PASS
	20	18700	1860	28.63	22.69	5.94	≤13	PASS
		18900	1880	28.57	22.64	5.93	≤13	PASS
		19100	1900	29.18	23.22	5.96	≤13	PASS

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LTE Band 4								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	1.4	19957	1711	28.02	22.92	5.10	≤13	PASS
		20175	1733	28.13	22.98	5.15	≤13	PASS
		20393	1754	28.84	23.75	5.09	≤13	PASS
	3	19965	1712	28.04	22.94	5.10	≤13	PASS
		20175	1733	27.98	22.93	5.05	≤13	PASS
		20385	1753	28.90	23.73	5.17	≤13	PASS
	5	19975	1713	28.09	22.99	5.10	≤13	PASS
		20175	1733	28.10	23.05	5.05	≤13	PASS
		20375	1752	28.90	23.74	5.16	≤13	PASS
	10	20000	1715	28.24	23.03	5.21	≤13	PASS
		20175	1733	28.06	22.97	5.09	≤13	PASS
		20350	1750	28.80	23.67	5.13	≤13	PASS
	15	20025	1718	28.17	23.10	5.07	≤13	PASS
		20175	1733	28.28	23.03	5.25	≤13	PASS
		20325	1747	28.83	23.72	5.11	≤13	PASS
	20	20050	1720	28.37	23.09	5.28	≤13	PASS
		20175	1733	28.38	23.13	5.25	≤13	PASS
		20300	1745	28.91	23.79	5.12	≤13	PASS
16QAM	1.4	19957	1711	27.88	22.08	5.80	≤13	PASS
		20175	1733	27.98	22.14	5.84	≤13	PASS
		20393	1754	28.71	22.95	5.76	≤13	PASS
	3	19965	1712	28.45	22.50	5.95	≤13	PASS
		20175	1733	28.37	22.55	5.82	≤13	PASS
		20385	1753	28.89	23.04	5.85	≤13	PASS
	5	19975	1713	29.04	23.07	5.97	≤13	PASS
		20175	1733	28.93	23.11	5.82	≤13	PASS
		20375	1752	29.49	23.60	5.89	≤13	PASS
	10	20000	1715	28.30	22.55	5.75	≤13	PASS
		20175	1733	28.59	22.61	5.98	≤13	PASS
		20350	1750	28.84	23.00	5.84	≤13	PASS
	15	20025	1718	28.71	22.78	5.93	≤13	PASS
		20175	1733	28.62	22.68	5.94	≤13	PASS
		20325	1747	29.12	23.27	5.85	≤13	PASS
	20	20050	1720	28.66	22.69	5.97	≤13	PASS
		20175	1733	28.54	22.64	5.90	≤13	PASS
		20300	1745	29.14	23.22	5.92	≤13	PASS

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LTE Band 5								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	1.4	20407	824.7	28.30	23.14	5.16	≤13	PASS
		20525	836.5	28.36	23.24	5.12	≤13	PASS
		20643	848.3	28.44	23.30	5.14	≤13	PASS
	3	20415	825.5	28.16	23.13	5.03	≤13	PASS
		20525	836.5	28.51	23.30	5.21	≤13	PASS
		20635	847.5	28.39	23.27	5.12	≤13	PASS
	5	20425	826.5	28.17	23.07	5.10	≤13	PASS
		20525	836.5	28.46	23.31	5.15	≤13	PASS
		20625	846.5	28.58	23.38	5.20	≤13	PASS
	10	20450	829	28.09	23.01	5.08	≤13	PASS
		20525	836.5	28.30	23.21	5.09	≤13	PASS
		20600	844	28.40	23.28	5.12	≤13	PASS
16QAM	1.4	20407	824.7	29.00	23.12	5.88	≤13	PASS
		20525	836.5	28.85	23.07	5.78	≤13	PASS
		20643	848.3	29.10	23.19	5.91	≤13	PASS
	3	20415	825.5	28.52	22.67	5.85	≤13	PASS
		20525	836.5	28.56	22.76	5.80	≤13	PASS
		20635	847.5	28.79	22.81	5.98	≤13	PASS
	5	20425	826.5	28.21	22.41	5.80	≤13	PASS
		20525	836.5	28.53	22.57	5.96	≤13	PASS
		20625	846.5	28.06	22.33	5.73	≤13	PASS
	10	20450	829	28.61	22.71	5.90	≤13	PASS
		20525	836.5	28.50	22.65	5.85	≤13	PASS
		20600	844	28.32	22.55	5.77	≤13	PASS

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LTE Band 12								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	1.4	23017	699.7	28.05	22.85	5.20	≤13	PASS
		23095	707.5	27.96	22.83	5.13	≤13	PASS
		23173	715.3	27.95	22.80	5.15	≤13	PASS
	3	23025	700.5	28.01	22.96	5.05	≤13	PASS
		23095	707.5	28.04	22.84	5.20	≤13	PASS
		23165	714.5	27.95	22.79	5.16	≤13	PASS
	5	23035	701.5	28.04	22.98	5.06	≤13	PASS
		23095	707.5	27.94	22.83	5.11	≤13	PASS
		23155	713.5	28.10	22.90	5.20	≤13	PASS
	10	23060	704	27.94	22.91	5.03	≤13	PASS
		23095	707.5	27.86	22.79	5.07	≤13	PASS
		23130	711	27.94	22.80	5.14	≤13	PASS
16QAM	1.4	23017	699.7	28.65	22.79	5.86	≤13	PASS
		23095	707.5	28.44	22.68	5.76	≤13	PASS
		23173	715.3	28.47	22.57	5.90	≤13	PASS
	3	23025	700.5	28.27	22.41	5.86	≤13	PASS
		23095	707.5	28.15	22.30	5.85	≤13	PASS
		23165	714.5	28.20	22.23	5.97	≤13	PASS
	5	23035	701.5	27.82	21.98	5.84	≤13	PASS
		23095	707.5	28.08	22.16	5.92	≤13	PASS
		23155	713.5	27.92	22.23	5.69	≤13	PASS
	10	23060	704	28.37	22.47	5.90	≤13	PASS
		23095	707.5	28.25	22.45	5.80	≤13	PASS
		23130	711	27.91	22.11	5.80	≤13	PASS

LTE Band 17								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	5	23755	706.5	28.16	23.07	5.09	≤13	PASS
		23790	710	27.86	22.76	5.10	≤13	PASS
		23825	713.5	28.06	22.90	5.16	≤13	PASS
	10	23780	709	27.97	22.92	5.05	≤13	PASS
		23790	710	27.97	22.94	5.03	≤13	PASS
		23800	711	28.05	22.95	5.10	≤13	PASS
16QAM	5	23755	706.5	28.05	22.22	5.83	≤13	PASS
		23790	710	27.98	22.24	5.74	≤13	PASS
		23825	713.5	28.00	22.12	5.88	≤13	PASS
	10	23780	709	27.93	22.11	5.82	≤13	PASS
		23790	710	28.10	22.21	5.89	≤13	PASS
		23800	711	28.33	22.36	5.97	≤13	PASS

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LTE Band 66								
Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	Peak (dBm)	Avg (dBm)	PAPR (dB)	Limit (dB)	Result
QPSK	1.4	131979	1710.7	28.11	22.95	5.16	≤13	PASS
		132322	1745	28.14	22.96	5.18	≤13	PASS
		132665	1779.3	28.80	23.69	5.11	≤13	PASS
	3	131987	1711.5	28.01	22.91	5.10	≤13	PASS
		132322	1745	28.05	22.97	5.08	≤13	PASS
		132657	1778.5	28.92	23.75	5.17	≤13	PASS
	5	131997	1712.5	28.04	22.99	5.05	≤13	PASS
		132322	1745	28.10	23.07	5.03	≤13	PASS
		132647	1777.5	28.99	23.82	5.17	≤13	PASS
	10	132022	1715	28.23	23.03	5.20	≤13	PASS
		132322	1745	28.14	23.01	5.13	≤13	PASS
		132622	1775	28.76	23.65	5.11	≤13	PASS
	15	132047	1717.5	28.17	23.10	5.07	≤13	PASS
		132322	1745	28.30	23.00	5.30	≤13	PASS
		132597	1772.5	28.84	23.76	5.08	≤13	PASS
	20	132072	1720	28.35	23.06	5.29	≤13	PASS
		132322	1745	28.29	23.06	5.23	≤13	PASS
		132572	1770	28.93	23.86	5.07	≤13	PASS
16QAM	1.4	131979	1710.7	27.89	22.12	5.77	≤13	PASS
		132322	1745	28.02	22.15	5.87	≤13	PASS
		132665	1779.3	28.68	22.97	5.71	≤13	PASS
	3	131987	1711.5	28.59	22.59	6.00	≤13	PASS
		132322	1745	28.37	22.51	5.86	≤13	PASS
		132657	1778.5	28.79	22.95	5.84	≤13	PASS
	5	131997	1712.5	28.96	23.03	5.93	≤13	PASS
		132322	1745	28.87	23.06	5.81	≤13	PASS
		132647	1777.5	29.49	23.62	5.87	≤13	PASS
	10	132022	1715	28.30	22.53	5.77	≤13	PASS
		132322	1745	28.63	22.61	6.02	≤13	PASS
		132622	1775	28.85	23.02	5.83	≤13	PASS
	15	132047	1717.5	28.84	22.86	5.98	≤13	PASS
		132322	1745	28.65	22.68	5.97	≤13	PASS
		132597	1772.5	29.12	23.30	5.82	≤13	PASS
	20	132072	1720	28.76	22.78	5.98	≤13	PASS
		132322	1745	28.51	22.61	5.90	≤13	PASS
		132572	1770	29.03	23.13	5.90	≤13	PASS

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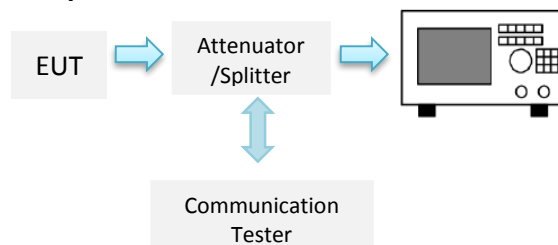
8.3 Occupied Bandwidth

8.3.1 Requirement

§2.1049, RSS-Gen (6.7)

- 99% Occupied Bandwidth(kHz)
- 26 dB Bandwidth(kHz)

8.3.2 Test setup



8.3.3 Test Procedure

- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW = 1% to 5% of the actual occupied BW.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Span = large enough to capture all products of the modulation process
- Allow the trace to stabilize.
- Use automatic bandwidth measurement capability on instrument to obtain 99% and 26 dB BW.
-

8.3.4 Test Result

Occupied Bandwidth

LTE Band 2						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	1.4	18607	1850.7	1.097	1.233
			18900	1880.0	1.093	1.238
			19193	1909.3	1.090	1.240
		3	18615	1851.5	2.735	3.068
			18900	1880	2.750	3.078
			19185	1908.5	2.742	3.071
		5	18625	1852.5	4.502	4.953
			18900	1880	4.502	4.925
			19175	1907.5	4.523	4.954
		10	18650	1855	9.023	9.908
			18900	1880	9.062	9.863
			19150	1905	9.066	9.982
		15	18675	1857.5	13.387	14.550
			18900	1880	13.484	14.630
			19125	1902.5	13.495	14.760
		20	18700	1860	17.813	19.110
			18900	1880	17.974	19.430
			19100	1900	17.924	19.140
	16QAM	1.4	18607	1850.7	1.094	1.238
			18900	1880.0	1.092	1.245
			19193	1909.3	1.089	1.233
		3	18615	1851.5	2.739	3.066
			18900	1880	2.733	3.071
			19185	1908.5	2.761	3.095
		5	18625	1852.5	4.501	4.970
			18900	1880	4.518	4.962
			19175	1907.5	4.498	4.945
		10	18650	1855	9.040	9.972
			18900	1880	9.055	9.907
			19150	1905	9.068	9.932
		15	18675	1857.5	13.430	14.450
			18900	1880	13.476	14.580
			19125	1902.5	13.514	14.470
		20	18700	1860	17.795	19.200
			18900	1880	17.955	19.240
			19100	1900	17.897	19.100

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LTE Band 4						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	1.4	19957	1711	1.0874	1.231
			20175	1733	1.0928	1.238
			20393	1754	1.0934	1.246
		3	19965	1712	2.7453	3.069
			20175	1733	2.735	3.073
			20385	1753	2.7292	3.069
		5	19975	1713	4.519	4.951
			20175	1733	4.5024	4.94
			20375	1752	4.507	4.954
		10	20000	1715	9.0101	9.903
			20175	1733	9.0286	9.928
			20350	1750	9.0336	9.993
		15	20025	1718	13.387	14.56
			20175	1733	13.46	14.63
			20325	1747	13.467	14.63
		20	20050	1720	17.749	19.09
			20175	1733	17.908	19.24
			20300	1745	17.9	19.3
	16QAM	1.4	19957	1711	1.0901	1.223
			20175	1733	1.0935	1.243
			20393	1754	1.0886	1.224
		3	19965	1712	2.7325	3.071
			20175	1733	2.7309	3.082
			20385	1753	2.7364	3.084
		5	19975	1713	4.5099	4.983
			20175	1733	4.5168	4.935
			20375	1752	4.4993	4.931
		10	20000	1715	9.0391	9.905
			20175	1733	9.028	9.988
			20350	1750	9.0476	9.979
		15	20025	1718	13.426	14.53
			20175	1733	13.488	14.54
			20325	1747	13.494	14.57
		20	20050	1720	17.787	19.18
			20175	1733	17.884	19.23
			20300	1745	17.911	19.23

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LTE Band 5						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	1.4	20407	824.7	1.103	1.233
			20525	836.5	1.091	1.240
			20643	848.3	1.089	1.242
		3	20415	825.5	2.748	3.078
			20525	836.5	2.736	3.080
			20635	847.5	2.744	3.074
		5	20425	826.5	4.496	4.971
			20525	836.5	4.493	4.933
			20625	846.5	4.513	4.940
		10	20450	829	9.054	9.964
			20525	836.5	9.021	9.887
			20600	844	9.026	9.941
	16QAM	1.4	20407	824.7	1.092	1.229
			20525	836.5	1.091	1.239
			20643	848.3	1.092	1.243
		3	20415	825.5	2.737	3.088
			20525	836.5	2.754	3.047
			20635	847.5	2.731	3.061
		5	20425	826.5	4.519	4.952
			20525	836.5	4.504	4.960
			20625	846.5	4.491	4.943
		10	20450	829	9.022	9.870
			20525	836.5	8.994	9.892
			20600	844	9.045	9.935



LTE Band 12						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	1.4	23017	699.7	1.090	1.239
			23095	707.5	1.089	1.232
			23173	715.3	1.092	1.244
		3	23025	700.5	2.747	3.100
			23095	707.5	2.731	3.079
			23165	714.5	2.750	3.053
		5	23035	701.5	4.510	4.982
			23095	707.5	4.484	4.923
			23155	713.5	4.526	5.003
		10	23060	704	9.069	9.935
			23095	707.5	8.938	9.753
			23130	711	9.041	9.901
	16QAM	1.4	23017	699.7	1.094	1.244
			23095	707.5	1.094	1.240
			23173	715.3	1.088	1.222
		3	23025	700.5	2.743	3.076
			23095	707.5	2.722	3.055
			23165	714.5	2.741	3.076
		5	23035	701.5	4.538	5.010
			23095	707.5	4.500	4.912
			23155	713.5	4.522	4.967
		10	23060	704	9.081	9.914
			23095	707.5	8.916	9.768
			23130	711	9.055	9.868

LTE Band 17						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	5	23755	706.5	4.492	4.910
			23790	710	4.487	4.934
			23825	713.5	4.525	4.998
		10	23780	709	8.949	9.813
			23790	710	8.996	9.835
			23800	711	9.935	9.929
	16QAM	5	23755	706.5	4.496	4.952
			23790	710	4.514	4.921
			23825	713.5	4.514	4.957
		10	23780	709	8.961	9.812
			23790	710	8.984	9.829
			23800	711	9.030	9.788

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LTE Band 66						
RB	Modulation	Bandwidth (MHz)	Channel	Frequency (MHz)	99% OBW (MHz)	-26dBc BW (MHz)
100%	QPSK	1.4	131979	1710.7	1.089	1.233
			132322	1745	1.093	1.240
			132665	1779.3	1.090	1.236
		3	131987	1711.5	2.729	3.070
			132322	1745	2.724	3.045
			132657	1778.5	2.732	3.037
		5	131997	1712.5	4.501	4.946
			132322	1745	4.499	4.990
			132647	1777.5	4.492	4.934
		10	132022	1715	9.039	9.889
			132322	1745	9.059	9.883
			132622	1775	9.042	9.908
		15	132047	1717.5	13.441	14.600
			132322	1745	13.494	14.600
			132597	1772.5	13.464	14.590
		20	132072	1720	17.816	19.130
			132322	1745	17.925	19.210
			132572	1770	17.862	19.270
	16QAM	1.4	131979	1710.7	1.099	1.224
			132322	1745	1.093	1.241
			132665	1779.3	1.087	1.214
		3	131987	1711.5	2.731	3.043
			132322	1745	2.721	3.076
			132657	1778.5	2.729	3.076
		5	131997	1712.5	4.496	4.918
			132322	1745	4.489	4.915
			132647	1777.5	4.499	4.893
		10	132022	1715	9.040	9.852
			132322	1745	9.042	9.875
			132622	1775	9.069	9.881
		15	132047	1717.5	13.435	14.610
			132322	1745	13.467	14.620
			132597	1772.5	13.473	14.490
		20	132072	1720	17.770	19.080
			132322	1745	17.918	19.280
			132572	1770	17.861	19.120

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8.3.5 Test Plots

See Appendix A - LTE OBW Test Plots

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8.4 Band Edge

8.4.1 Requirement

§ 2.1051, 22.917(a), 24.238(a), 27.53 (h)

RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$.

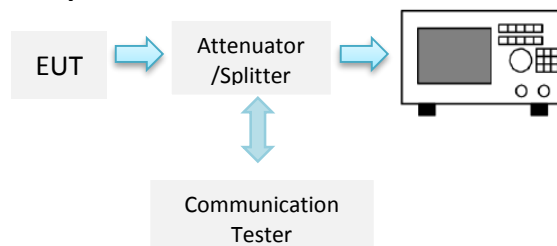
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

8.4.2 Test setup



8.4.3 Test Procedure

- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW as roughly BW/100.
- Detector = average
- Sweep = auto couple.
- Allow the trace to stabilize.
- Set Marker to edge frequency
- The Band Edges of low and high channels for the highest RF powers were measured

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8.4.4 Test Result

See Appendix B - LTE BE Test Plots

8.4.5 Test Plots

See Appendix B - LTE BE Test Plots

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8.5 Conducted Spurious Radiation

8.5.1 Requirement

§ 2.1051, 22.917(a), 24.238(a), 27.53 (h)

RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$.

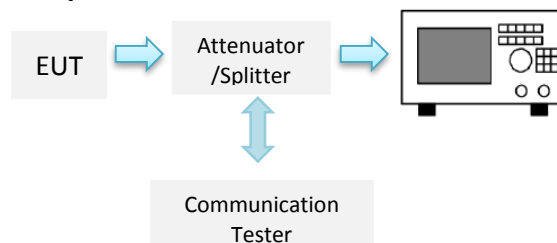
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

8.5.2 Test setup



8.5.3 Test Procedure

- The EUT was connected to Spectrum Analyzer and Base Station via power divider.
- Set RBW = 100KHz and VBW=300KHz for below 1GHz; set RBW=1MHz and VBW=3MHz for above 1GHz.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Use marker peak to search for spurious emission

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8.5.4 Test Result

See Appendix C - LTE CSE Test Plots

8.5.5 Test Plots

See Appendix C - LTE CSE Test Plots

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8.6 Field Strength of Spurious Radiation

8.6.1 Requirement

§ 2.1051, 22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log(P)$ dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log(P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

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FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least $43 + 10 \log_{10} p$ (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

- (i) $76 + 10 \log_{10} p$ (watts), dB, for base and fixed equipment, and
- (ii) $65 + 10 \log_{10} p$ (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

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RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$.

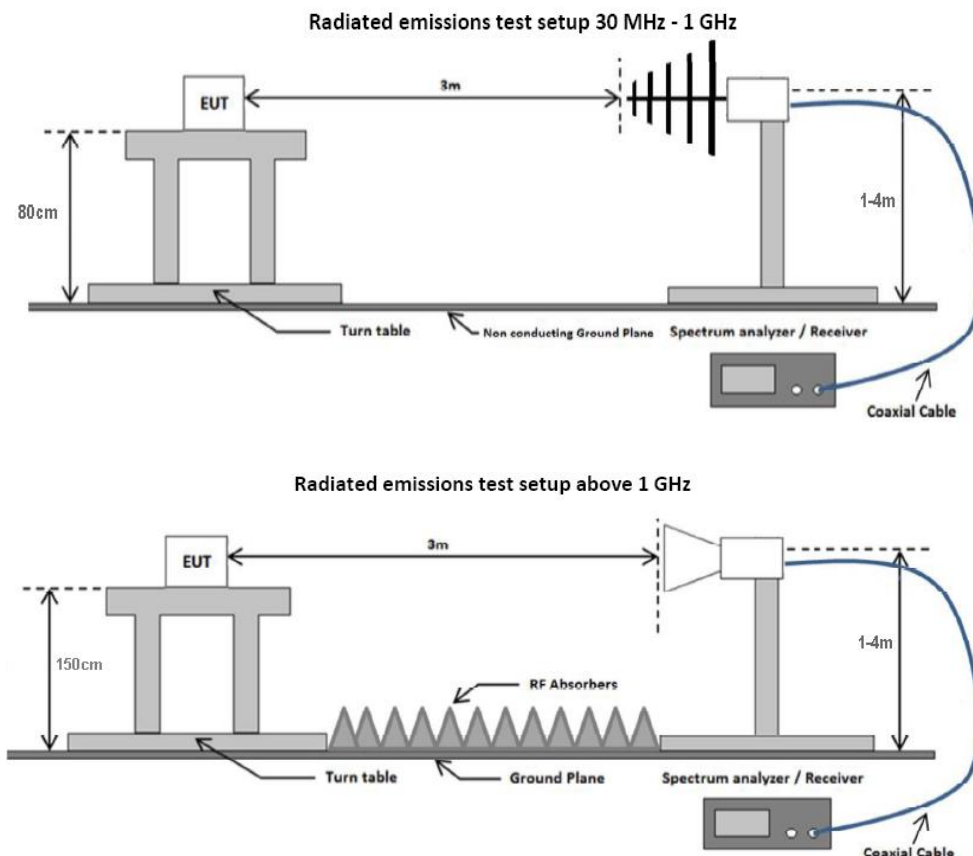
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p(\text{watts})$. If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least $43 + 10 \log_{10} p(\text{watts})$ dB.

8.6.2 Test setup



8.6.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

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.

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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. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
8. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
9. Steps 2 - 8 were repeated for the next frequency point, until all selected frequency points were measured

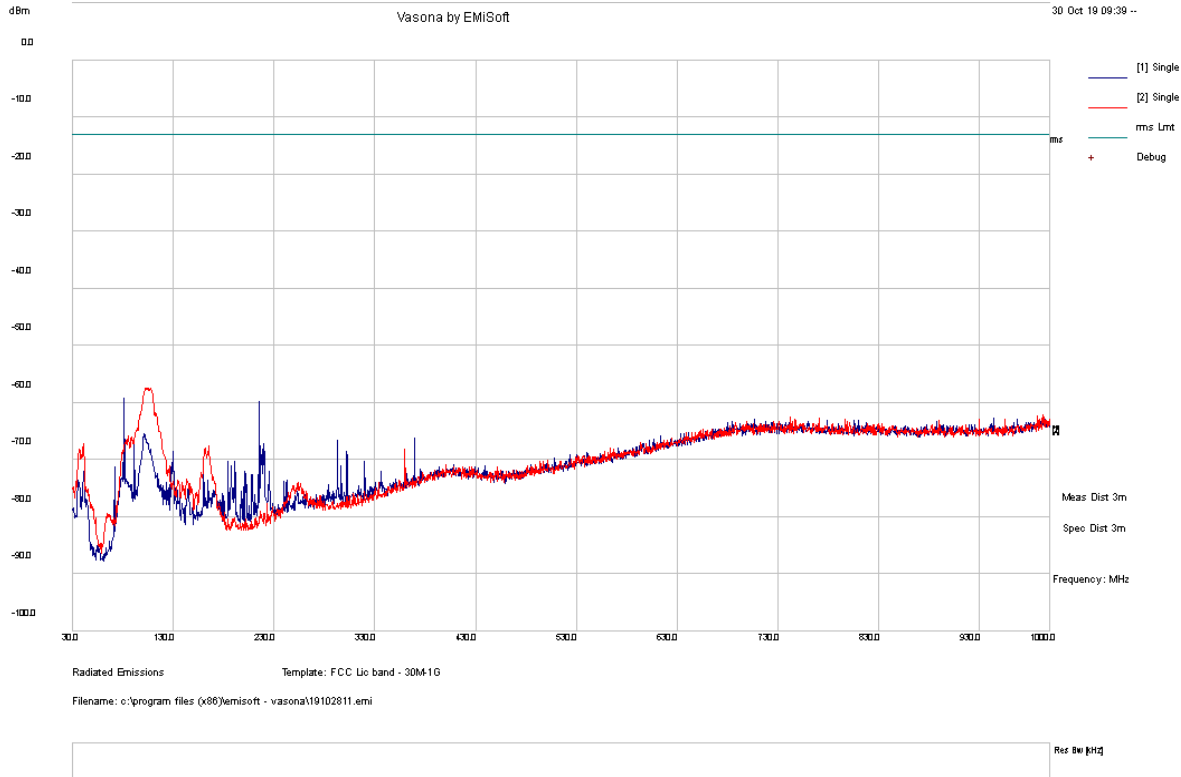
Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



8.6.4 Test Result

Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2, 20 MHz BW, 1860 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2, 20 MHz BW, 1860 MHz



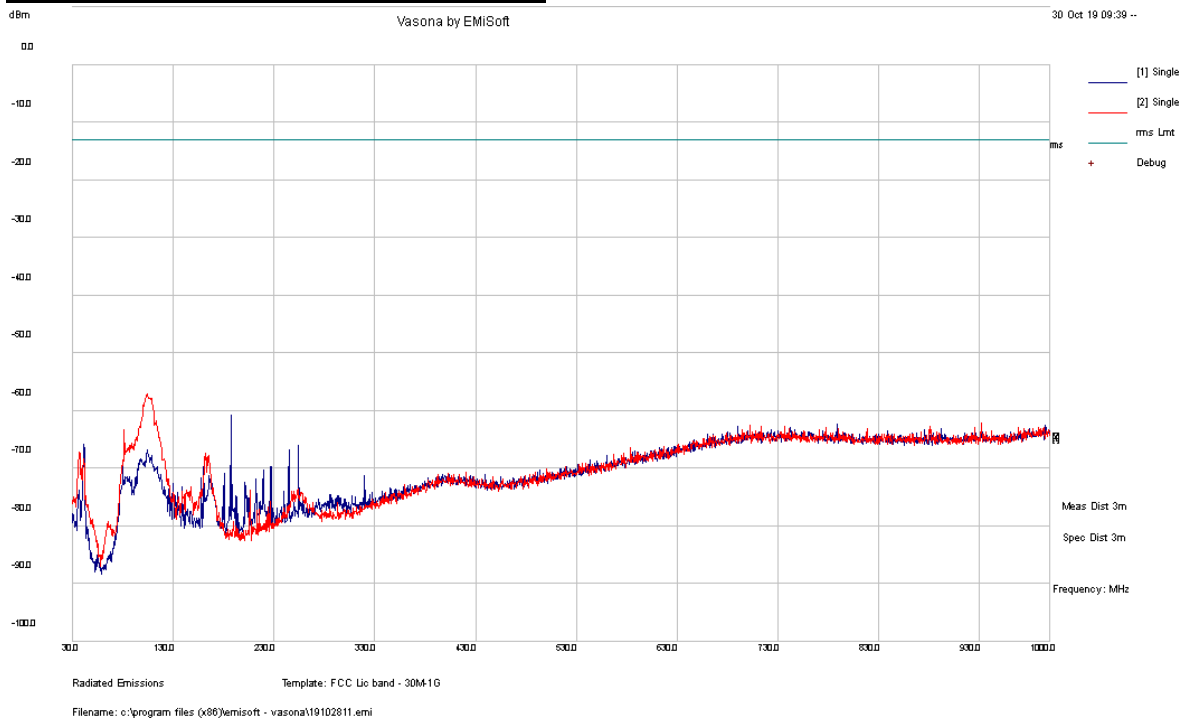
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
81.61	-56.36	3.34	-24.61	-77.63	RMS Max	H	178	0	-13	-64.63	Pass
107.01	-46.75	3.68	-23.49	-66.57	RMS Max	V	218	93	-13	-53.57	Pass
215.58	-66.24	4.91	-20.95	-82.28	RMS Max	H	154	28	-13	-69.28	Pass
40.66	-55.11	2.56	-20.8	-73.35	RMS Max	V	201	340	-13	-60.35	Pass
165.20	-53.58	4.41	-22.28	-71.45	RMS Max	V	119	355	-13	-58.45	Pass
369.73	-69.47	6.18	-15.02	-78.31	RMS Max	H	171	196	-13	-65.31	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4, 20 MHz BW, 1720 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4, 20 MHz BW, 1720 MHz



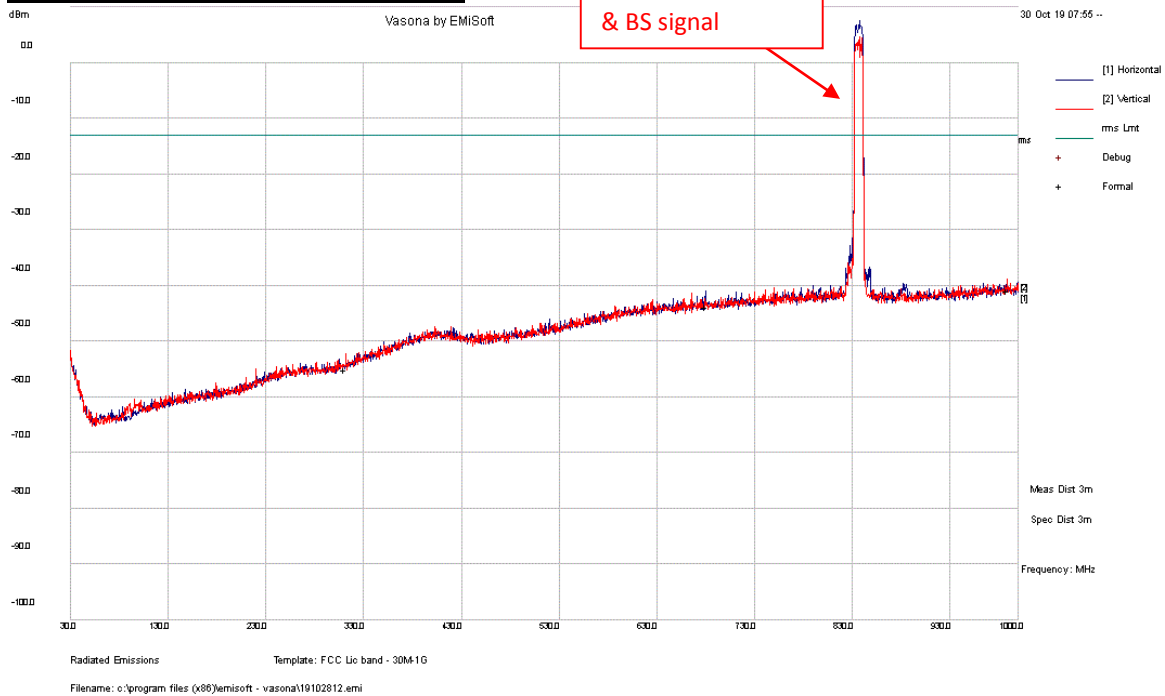
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
104.0006	-42.46	3.63	-23.58	-62.41	RMS Max	V	124	227	-13	-49.41	Pass
187.3826	-66.19	4.62	-21.97	-83.54	RMS Max	H	230	0	-13	-70.54	Pass
41.38963	-50.56	2.58	-21.19	-69.16	RMS Max	H	314	322	-13	-56.16	Pass
931.5041	-70.19	7.73	-6.89	-69.34	RMS Max	V	178	280	-13	-56.34	Pass
162.0837	-58.25	4.38	-22.33	-76.2	RMS Max	V	140	22	-13	-63.2	Pass
254.1944	-66.74	5.29	-19.2	-80.66	RMS Max	H	114	3	-13	-67.66	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part22H, RSS-132	Mode:	LTE Band 5, 10 MHz, 836 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 5, 10 MHz, 836 MHz



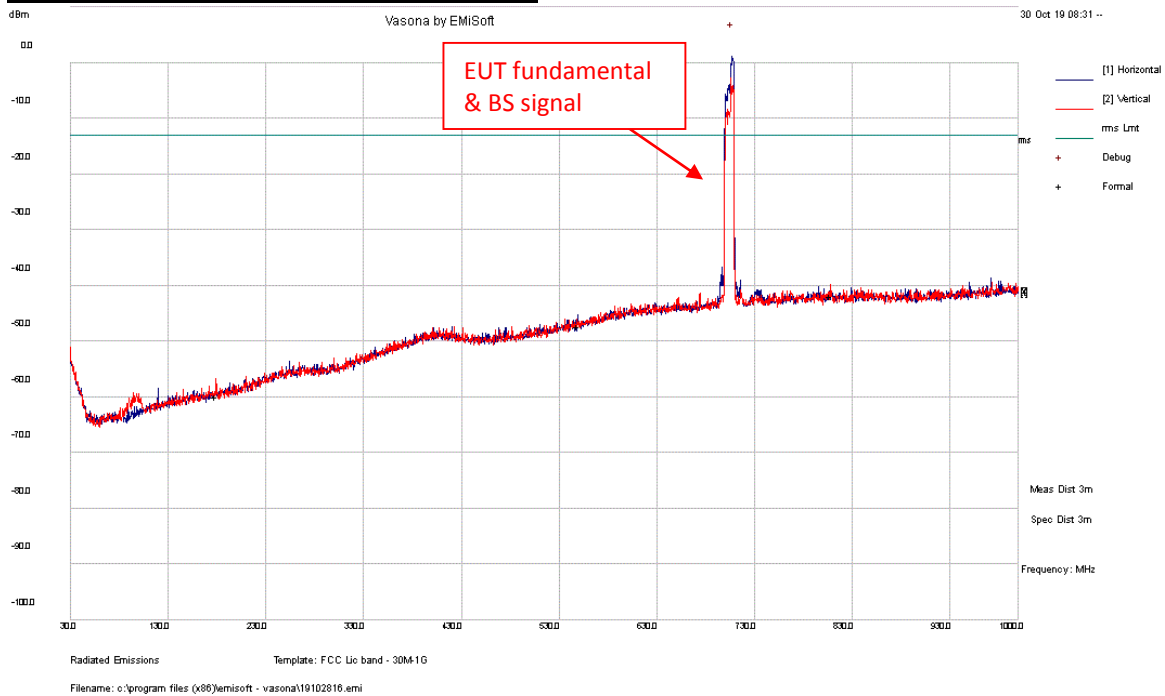
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
988.8	-84.78	19.72	24.19	-40.87	RMS Max	V	187	256	-13.00	-27.87	Pass
679.97	-85.13	19.06	22.32	-43.75	RMS Max	H	238	221	-13.00	-30.75	Pass
311.57	-85.99	17.54	13.44	-55.01	RMS Max	V	214	65	-13.00	-42.01	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 12, 10MHz BW, 705 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 12, 10MHz BW, 705 MHz



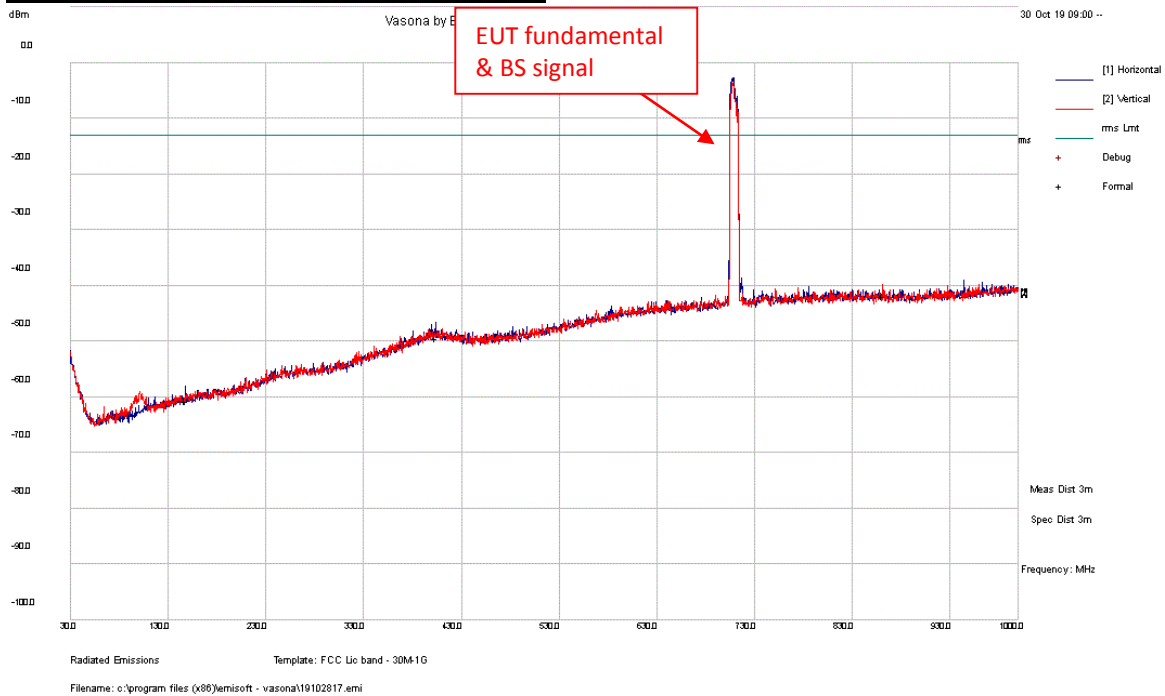
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
807.64	-84.67	19.04	23.76	-41.87	RMS Max	V	164	66	-13.00	-28.87	Pass
549.56	-85.57	18.41	19.90	-47.27	RMS Max	H	152	309	-13.00	-34.27	Pass
178.97	-85.99	16.31	9.69	-59.98	RMS Max	V	317	52	-13.00	-46.98	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 17, 10 MHz BW, 709 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 17, 10 MHz BW, 709 MHz



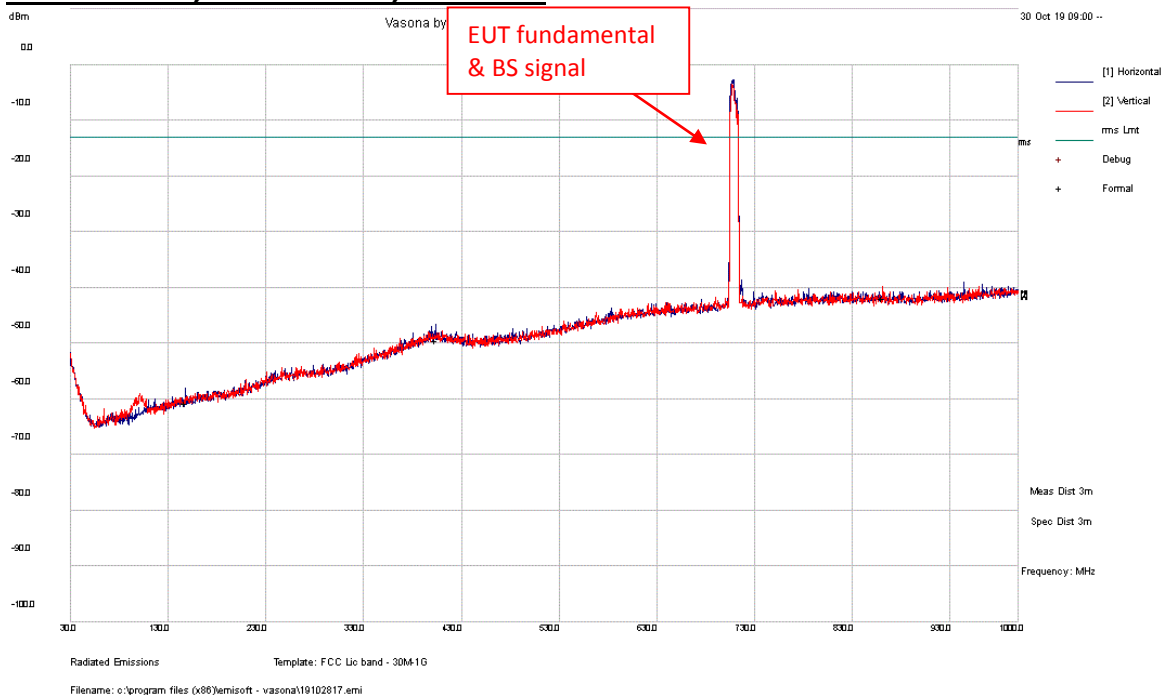
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
861.35	-84.54	19.24	23.49	-41.81	RMS Max	V	251	128	-13.00	-28.81	Pass
403.72	-85.55	18.13	18.04	-49.38	RMS Max	H	365	57	-13.00	-36.38	Pass
148.05	-85.90	15.99	9.16	-60.75	RMS Max	H	353	222	-13.00	-47.75	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 17, 10 MHz BW, 709 MHz
Frequency Range:	30 - 1000 MHz	Test Date:	10/28/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66, 10 MHz BW, 709 MHz



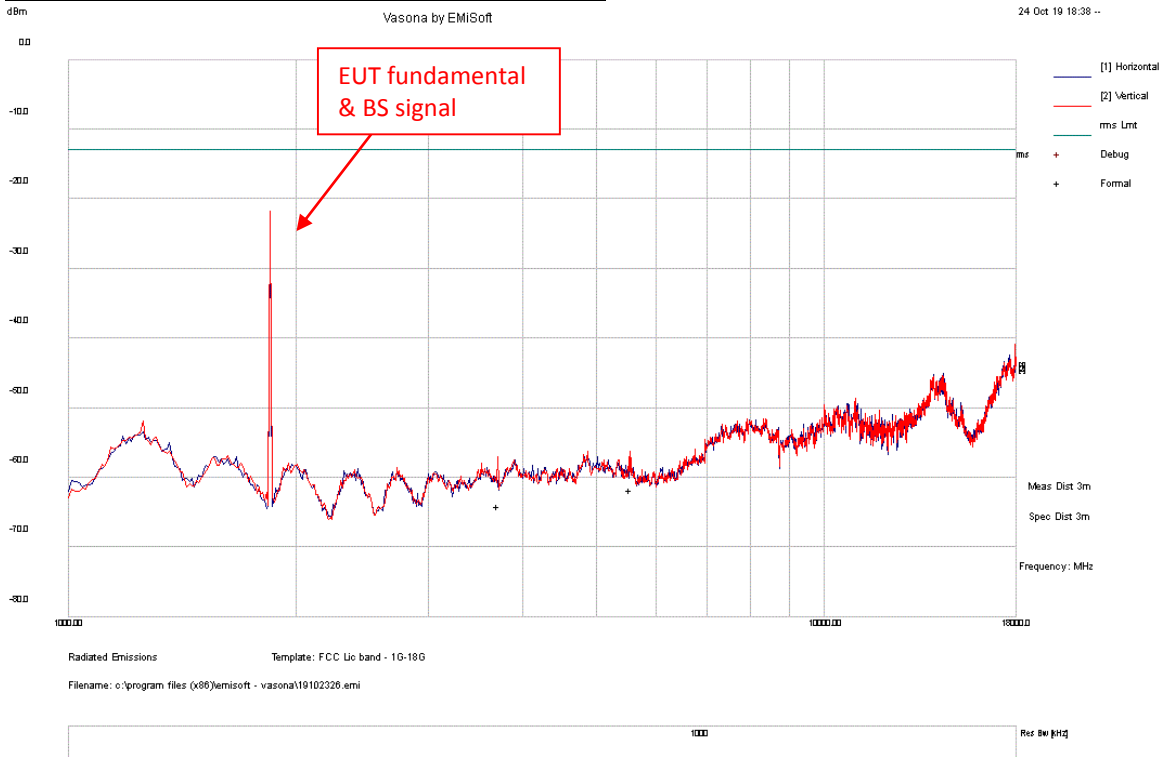
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
861.35	-84.54	19.24	23.49	-41.81	RMS Max	V	251	128	-13.00	-28.81	Pass
403.72	-85.55	18.13	18.04	-49.38	RMS Max	H	365	57	-13.00	-36.38	Pass
148.05	-85.90	15.99	9.16	-60.75	RMS Max	H	353	222	-13.00	-47.75	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 1.4 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 1.4 MHz BW Mid 1880 MHz



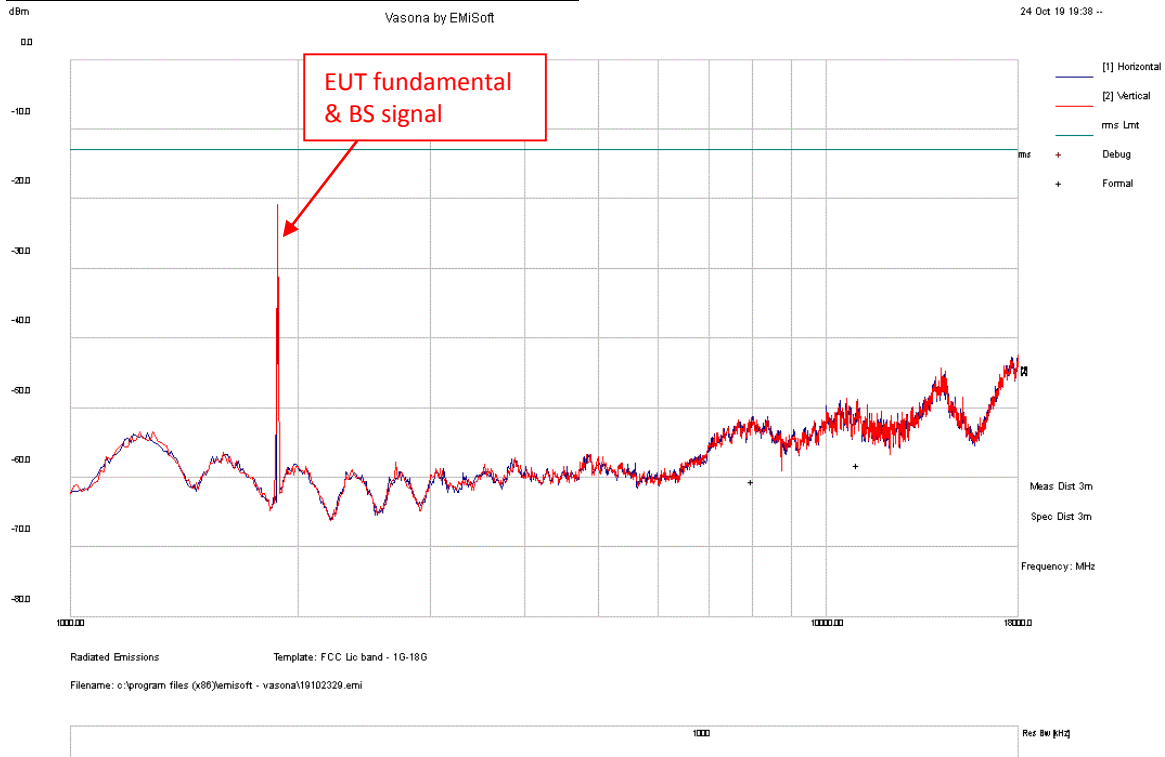
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
5551.20	-68	18.74	-12.54	-61.8	RMS Max	V	146	360	-13	-48.8	Pass
3701.30	-65.05	17.88	-16.87	-64.03	RMS Max	V	128	359	-13	-51.03	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 3 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 3 MHz BW Mid 1880 MHz



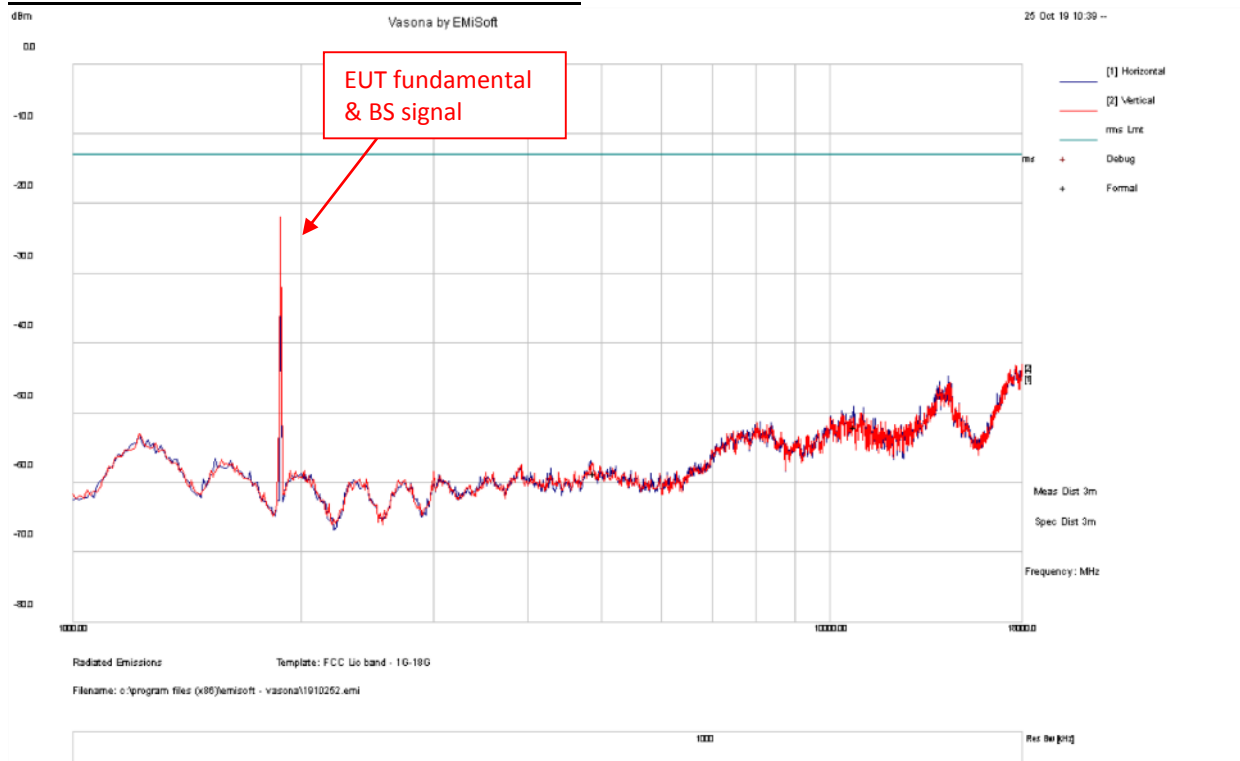
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
11017.51	-79.53	24.31	-2.88	-58.11	RMS Max	H	245	360	-13.00	-45.11	Pass
8003.29	-75.77	21.55	-6.23	-60.45	RMS Max	V	224	12	-13.00	-47.45	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 5 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 5 MHz BW Mid 1880 MHz



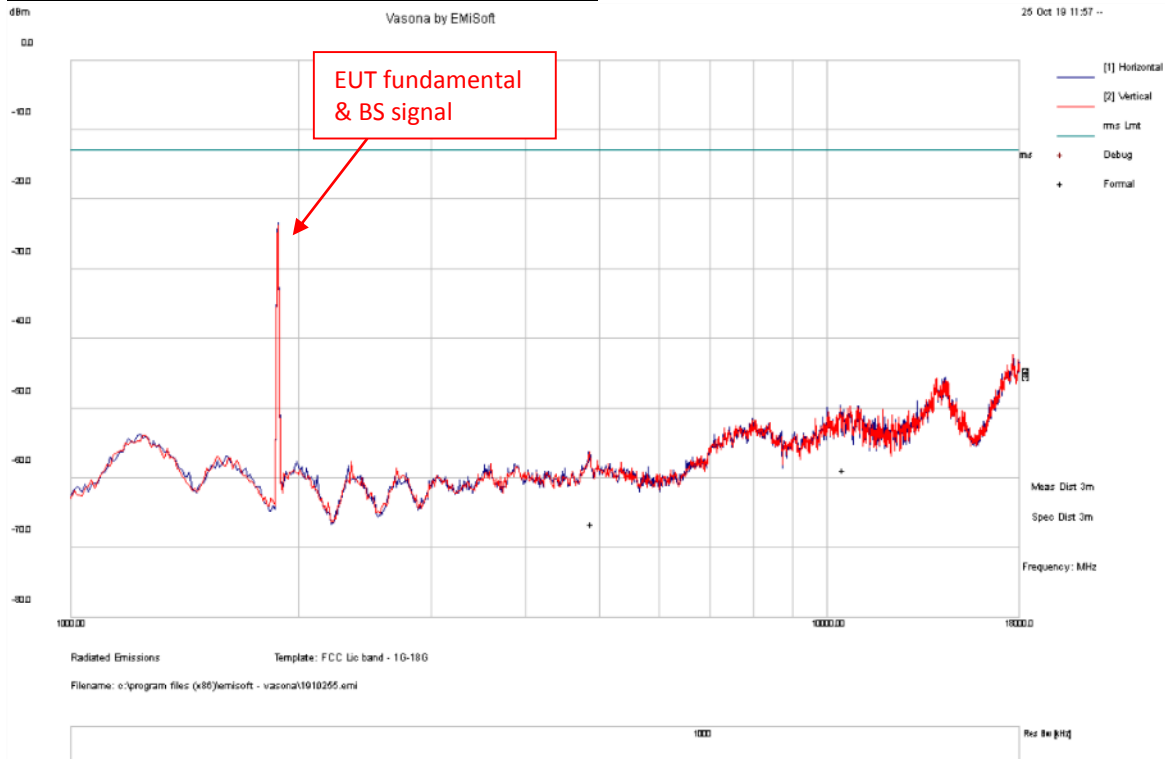
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
4888.15	-64.08	18.66	-13.26	-58.68	Peak [Scan]	V	171	133	-13	-45.68	Pass
10807.29	-72.62	24.06	-3.42	-51.98	Peak [Scan]	V	171	133	-13	-38.98	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 10 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 10 MHz BW Mid 1880 MHz



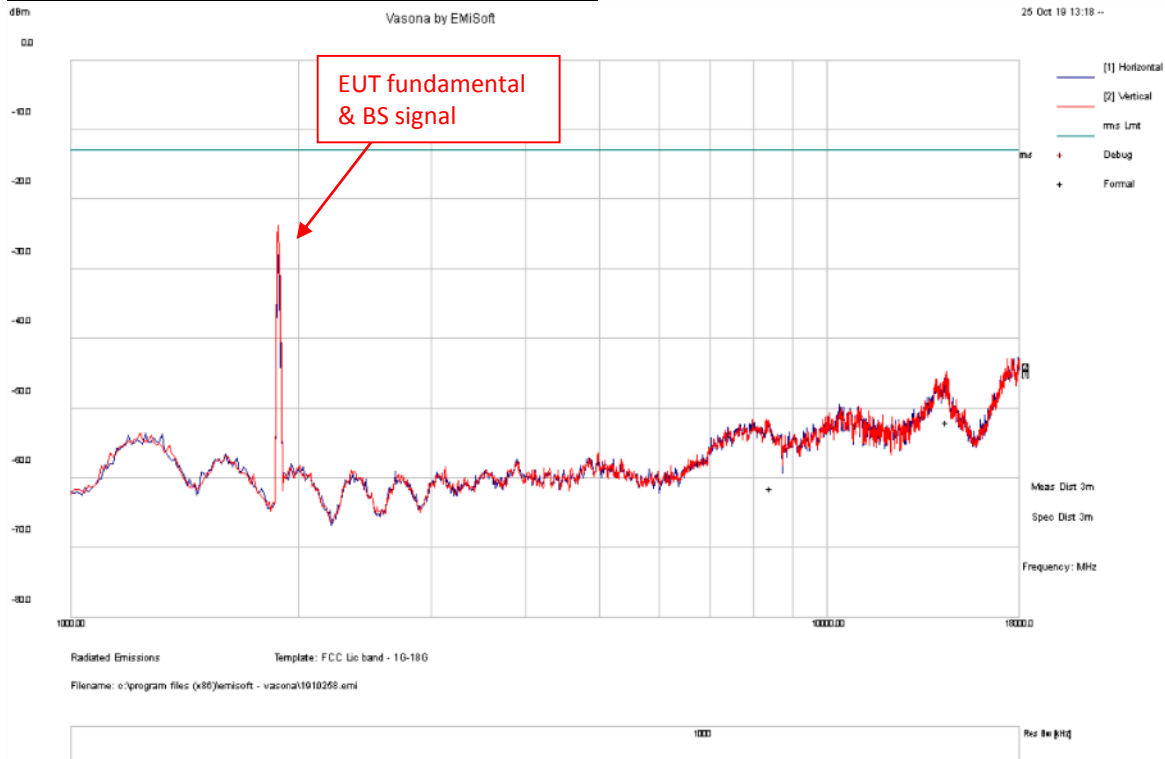
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10528.21	-79.11	23.72	-3.47	-58.86	RMS Max	V	212	200	-13.00	-45.86	Pass
4889.17	-72.02	18.66	-13.26	-66.62	RMS Max	V	228	246	-13.00	-53.62	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 15 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 15 MHz BW Mid 1880 MHz



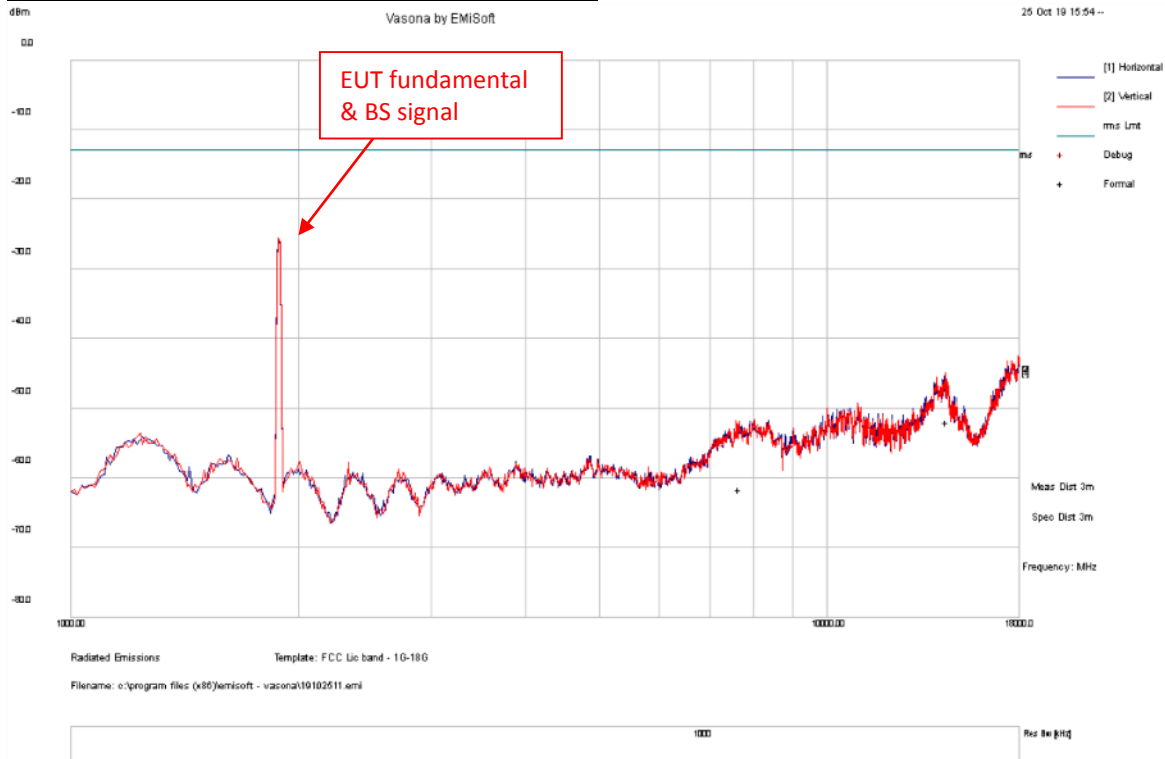
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
14409.2	-80.50	26.43	2.15	-51.91	RMS Max	V	323	256	-13.00	-38.91	Pass
8429.22	-77.47	21.62	-5.56	-61.40	RMS Max	V	100	18	-13.00	-48.40	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	LTE Band 2 20 MHz BW Mid 1880 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 2 20 MHz BW Mid 1880 MHz



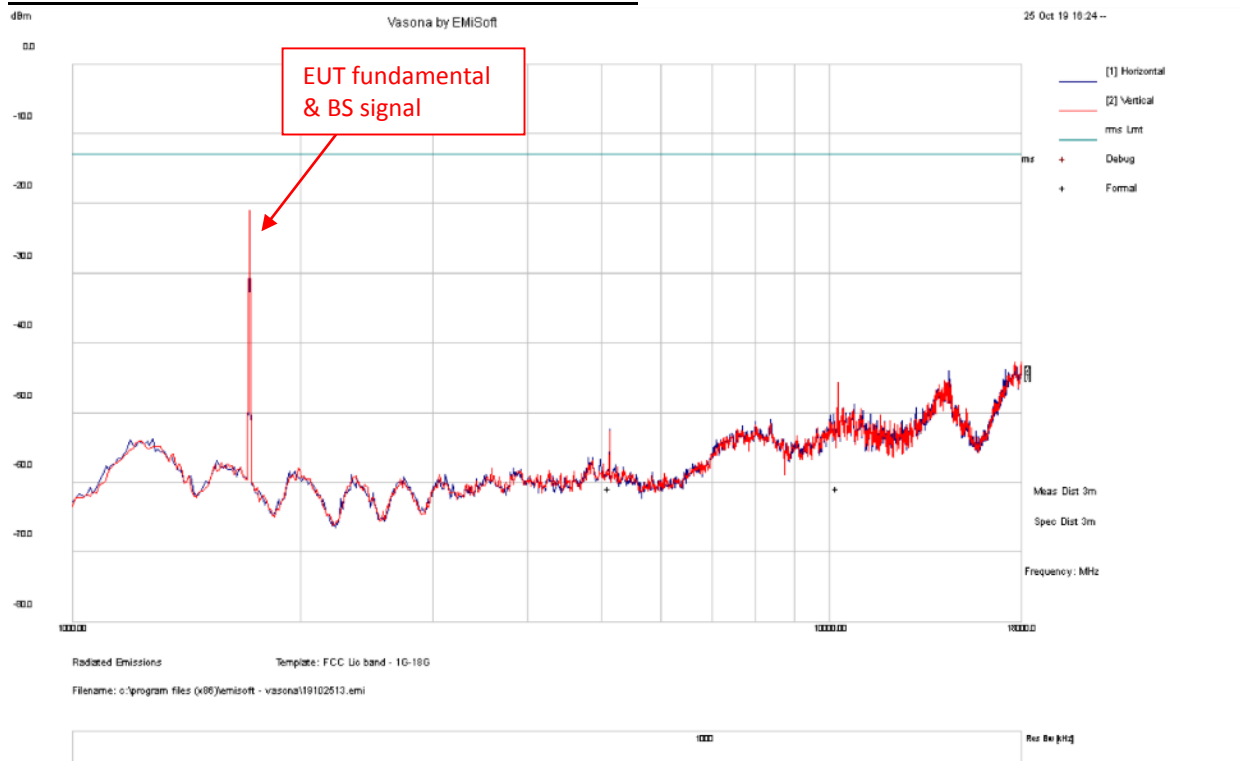
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
14408.33	-80.59	26.43	2.16	-52.00	RMS Max	V	128	78	-13.00	-39.00	Pass
7682.79	-75.85	21.56	-7.26	-61.55	RMS Max	V	128	12	-13.00	-48.55	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 1.4 MHz BW Mid 1732.6 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 1.4 MHz BW Mid 1732.6 MHz



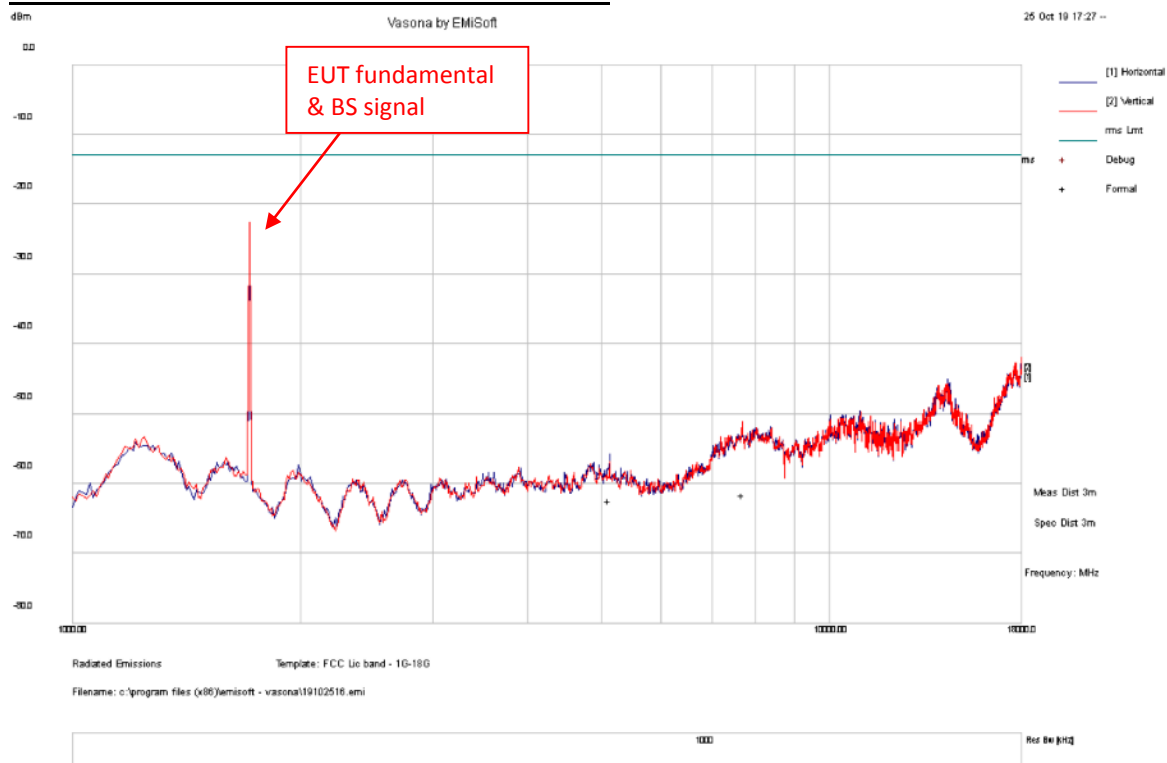
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10265.21	-80.35	23.39	-3.81	-60.77	RMS Max	V	400	169	-13.00	-47.77	Pass
5132.04	-66.70	18.67	-12.83	-60.87	RMS Max	V	312	129	-13.00	-47.87	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 3 MHz BW Mid 1732.6 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 3 MHz BW Mid 1732.6 MHz



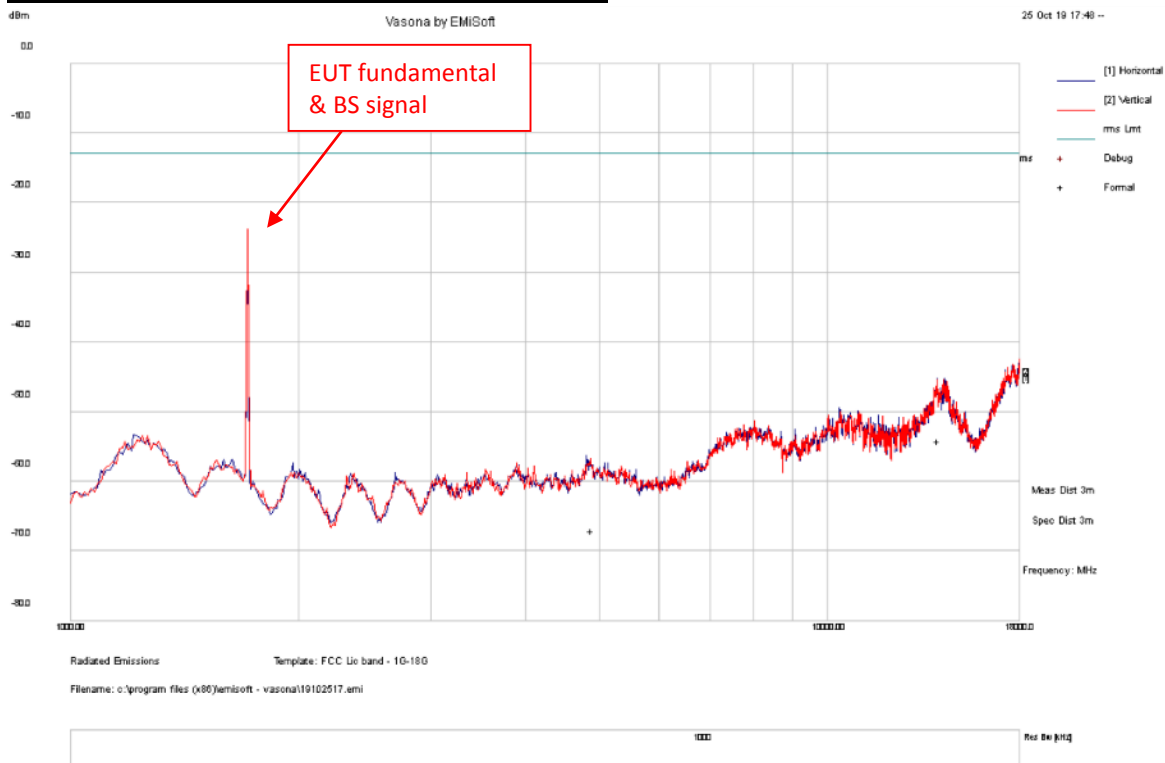
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
7683.91	-75.96	21.56	-7.26	-61.66	RMS Max	V	206	263	-13.00	-48.66	Pass
5132.84	-68.22	18.67	-12.83	-62.38	RMS Max	V	201	138	-13.00	-49.38	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 5 MHz BW Mid 1732.6 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 5 MHz BW Mid 1732.6 MHz



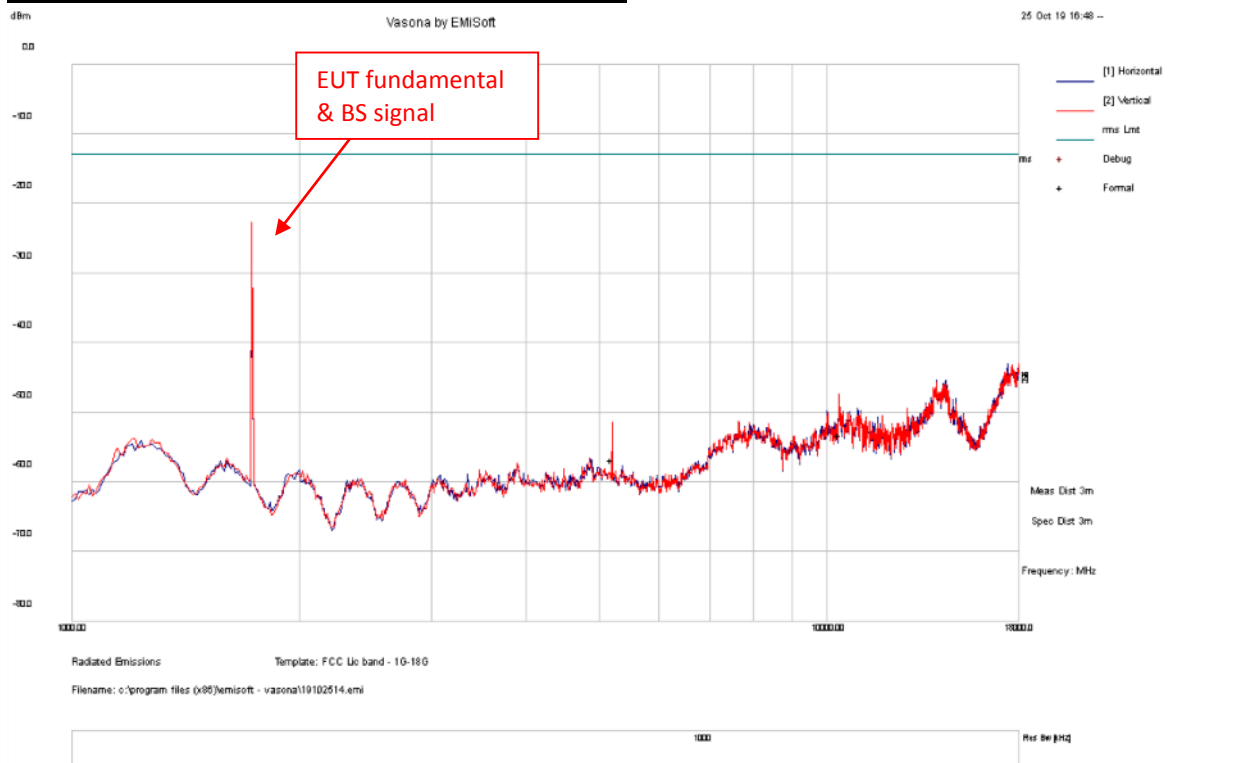
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
14040.08	-80.80	25.53	1.21	-54.06	RMS Max	V	362	69	-13.00	-41.06	Pass
4900.39	-72.40	18.66	-13.26	-66.99	RMS Max	V	342	158	-13.00	-53.99	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 10 MHz BW Mid 1732.6 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 10 MHz BW Mid 1732.6 MHz



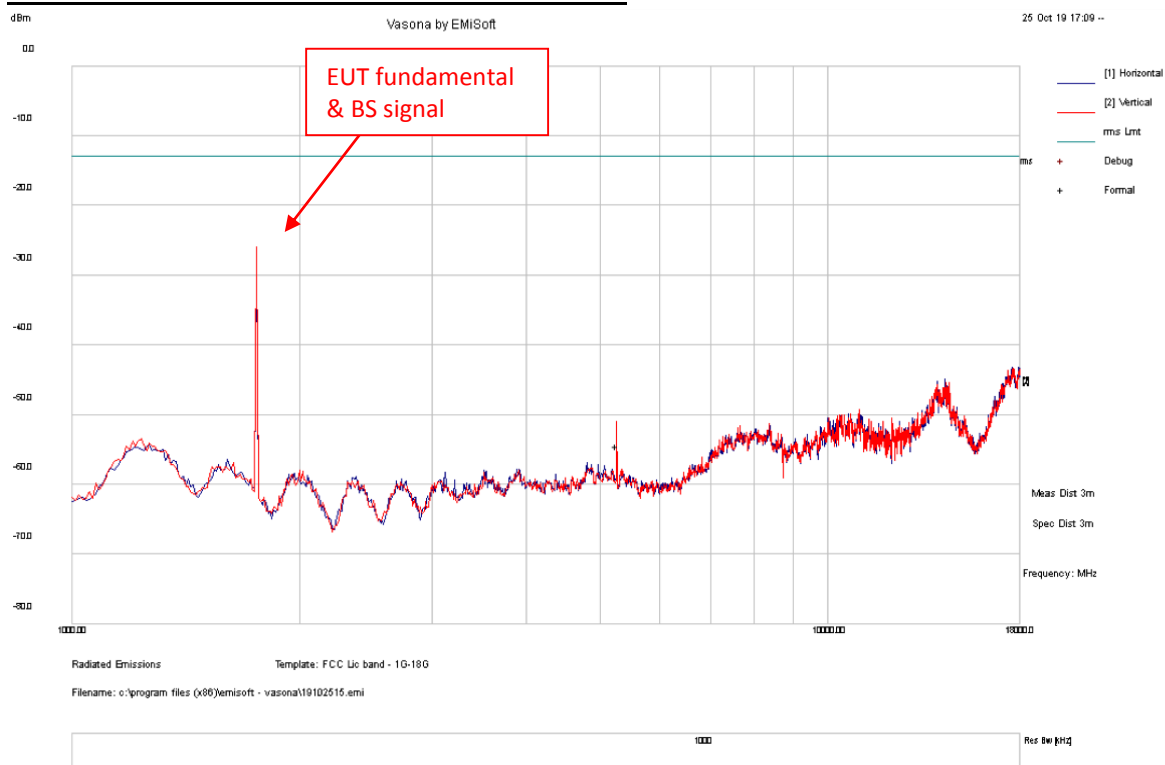
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10393.59	-73.21	23.56	-3.58	-53.24	RMS Max	V	373	199	-13.00	-40.24	Pass
5197.69	-62.81	18.66	-12.65	-56.80	RMS Max	V	264	360	-13.00	-43.80	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 15 MHz BW Mid 1732.6 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 15 MHz BW Mid 1732.6 MHz



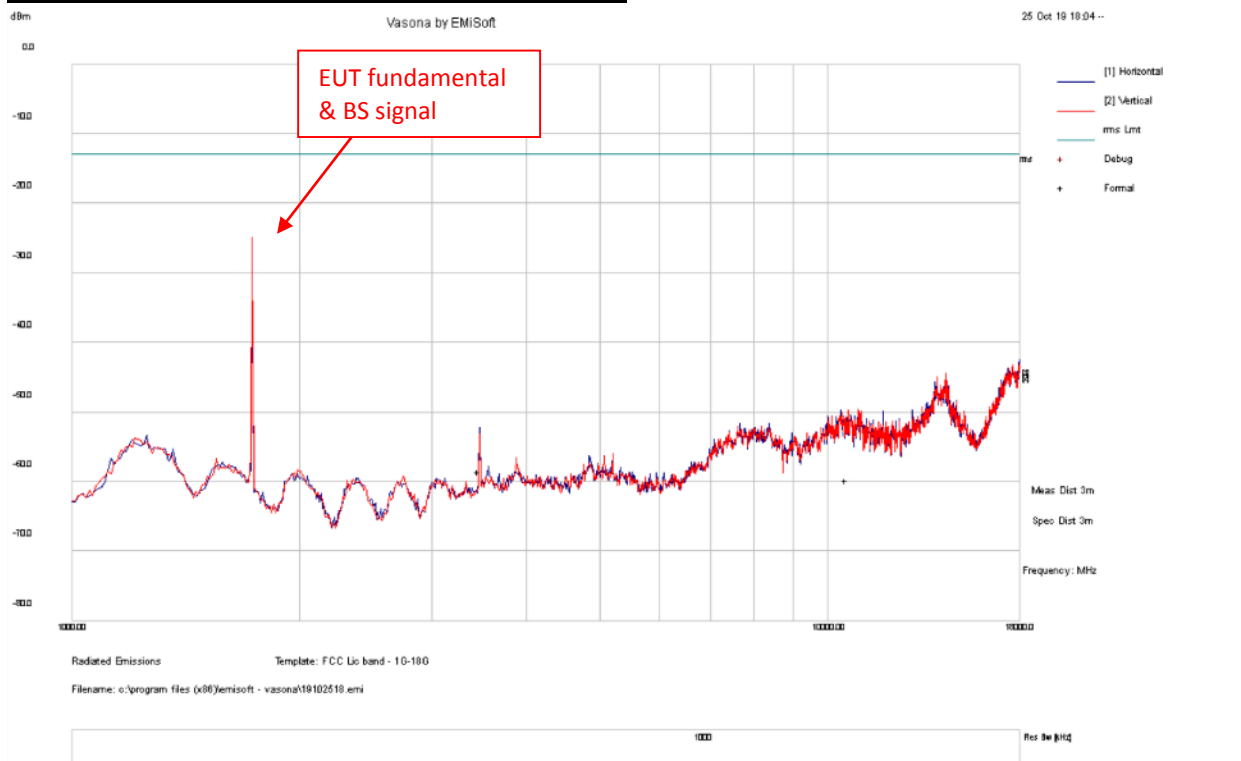
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
5263.8	-60.61	18.66	-12.46	-54.41	RMS Max	V	232	138	-13.00	-41.41	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 4 20 MHz BW Mid 1732.56MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 4 20 MHz BW Mid 1732.6 MHz



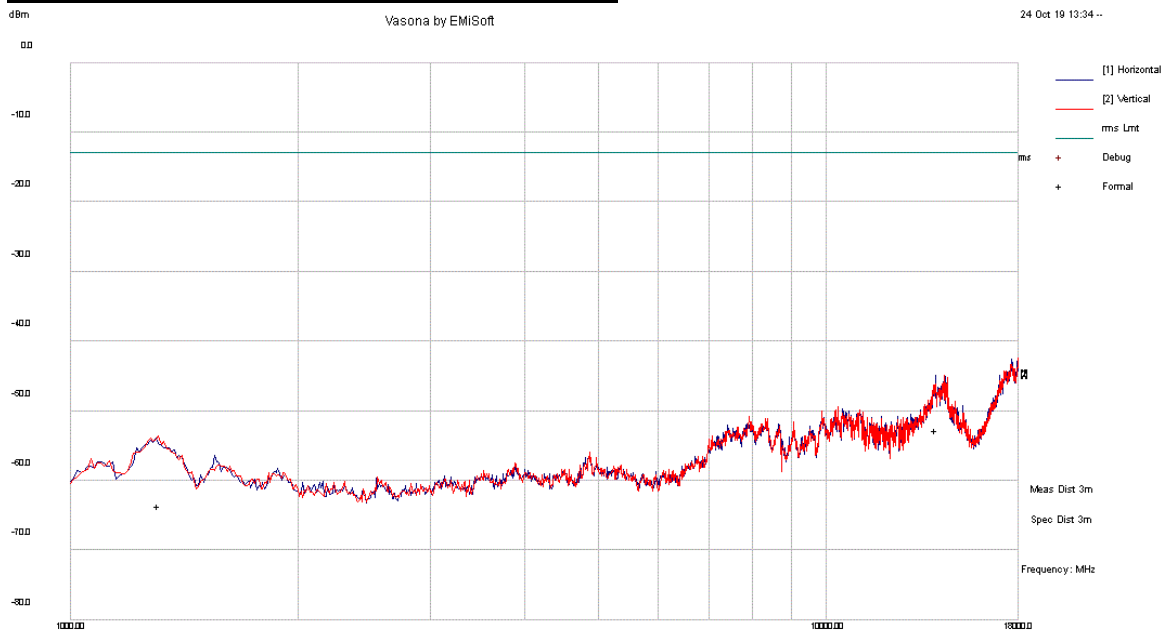
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10622.25	-80.06	23.84	-3.55	-59.77	RMS Max	V	336	0	-13.00	-46.77	Pass
3463.7	-58.04	17.63	-18.02	-58.43	RMS Max	V	118	41	-13.00	-45.43	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part22H, RSS-132	Mode:	LTE Band 5 1.4 MHz BW Mid 836.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 5 1.4 MHz BW Mid 836.5 MHz



Radiated Emissions Template: FCC Lic band - 1G-18G
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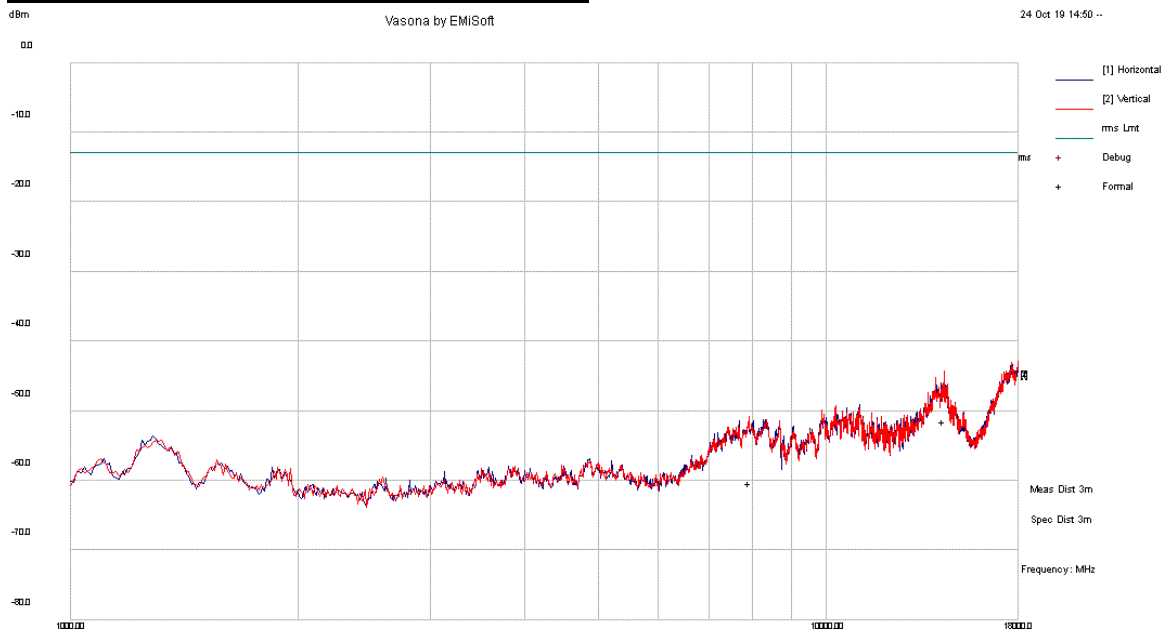
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
13984.62	-79.11	25.42	0.98	-52.71	RMS Max	V	110	244	-13.00	-39.71	Pass
1306.41	-59.51	15.91	-19.96	-63.56	RMS Max	V	159	308	-13.00	-50.56	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part22H, RSS-132	Mode:	LTE Band 5 3 MHz BW Mid 836.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 5 3 MHz BW Mid 836.5 MHz



Radiated Emissions
 Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102317.emi

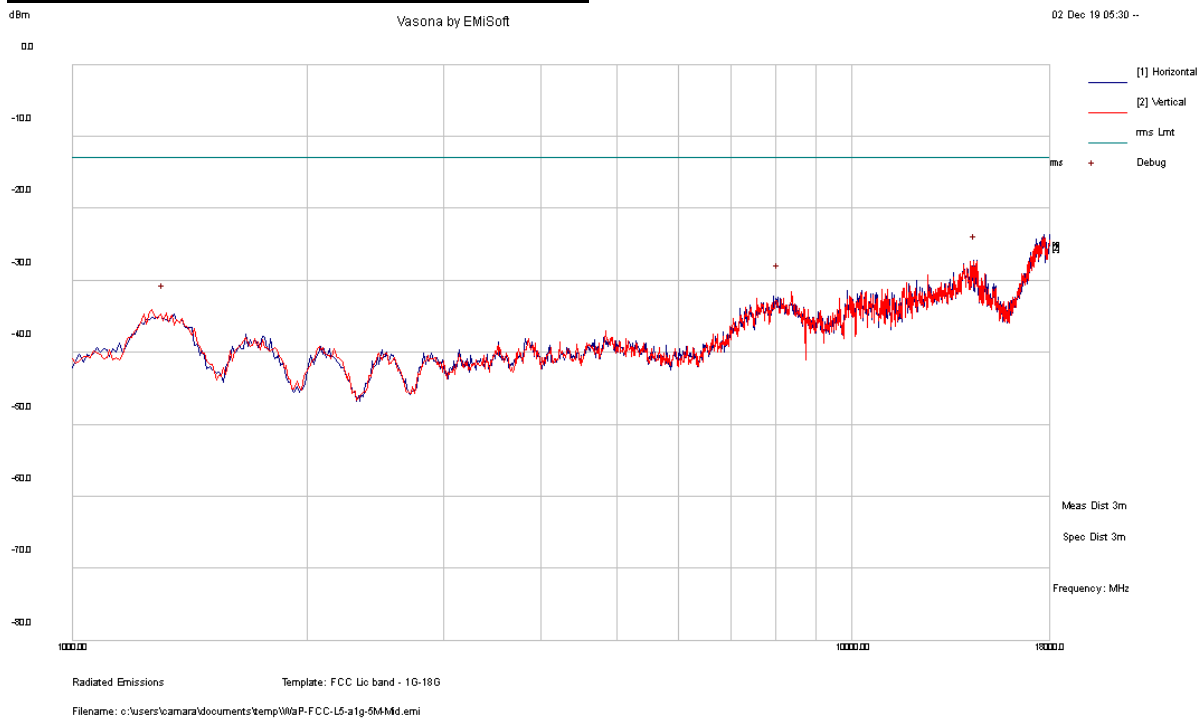
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
14337.13	-80.17	26.26	2.45	-51.46	RMS Max	V	156	74	-13.00	-38.46	Pass
7918.33	-75.34	21.55	-6.50	-60.29	RMS Max	V	335	177	-13.00	-47.29	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part22H, RSS-132	Mode:	LTE Band 5 10 MHz BW Mid 836.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 5 5 MHz BW Mid 836.5 MHz



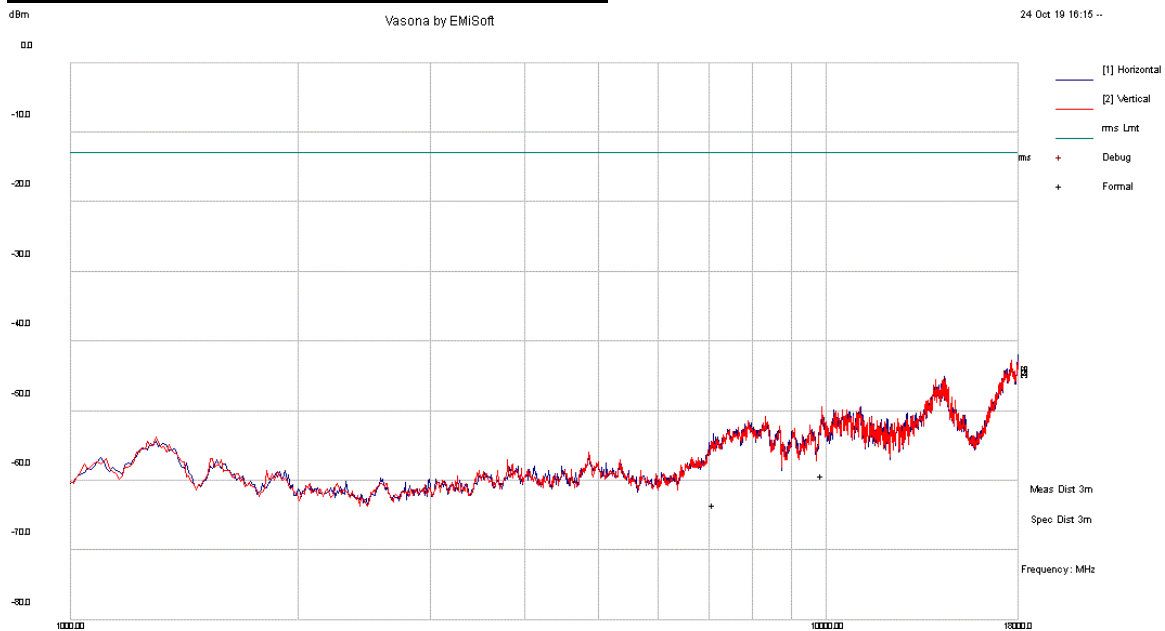
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1306.5	-51.23	15.92	0.04	-35.28	RMS Max	V	150	70	-13	-22.28	Pass
8047.8	-68.04	21.56	13.87	-32.61	RMS Max	V	150	71	-13	-19.61	Pass
14408	-77.02	26.43	22.16	-28.43	RMS Max	V	150	182	-13	-15.43	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part22H, RSS-132	Mode:	LTE Band 5 10 MHz BW Mid 836.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 5 10 MHz BW Mid 836.5 MHz



Radiated Emissions Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102320.emi

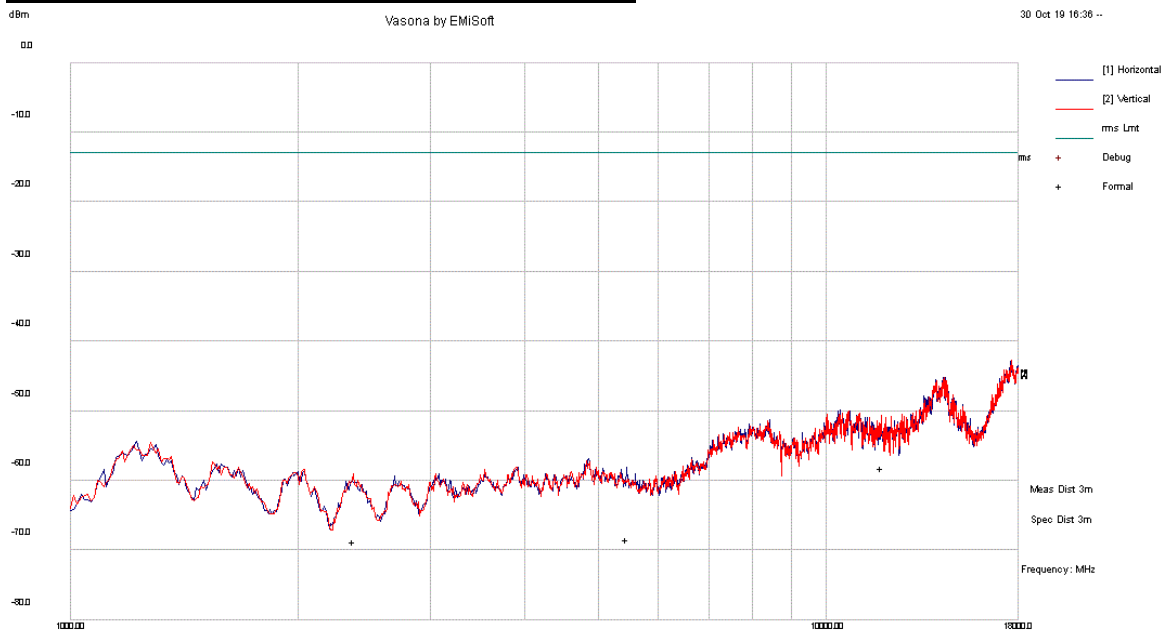
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
9895.07	-77.91	22.92	-4.33	-59.32	RMS Max	V	386	292	-13.00	-46.32	Pass
7114.73	-75.34	20.76	-8.88	-63.47	RMS Max	V	328	270	-13.00	-50.47	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 12 1.4 MHz BW Mid 707.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 12 1.4 MHz BW Mid 707.5 MHz



Radiated Emissions Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102361.emi

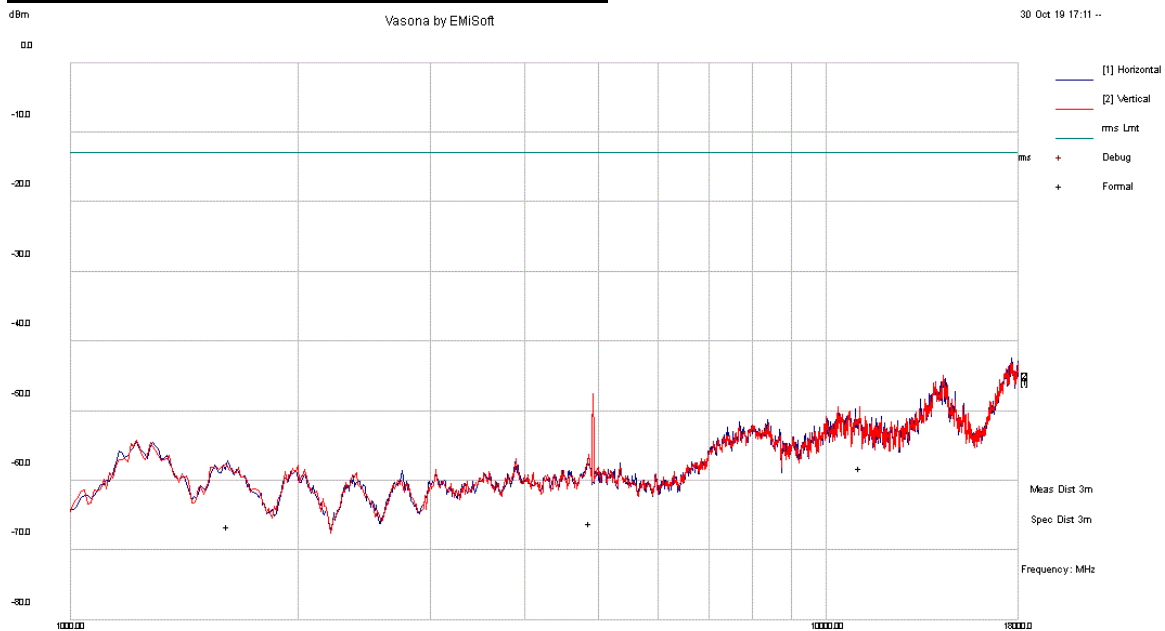
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
11850.68	-81.05	25.07	-2.25	-58.24	RMS Max	V	129	101	-13.00	-45.24	Pass
5453.3	-74.71	18.64	-12.40	-68.47	RMS Max	H	298	226	-13.00	-55.47	Pass
2371.57	-63.08	16.57	-22.20	-68.71	RMS Max	V	262	290	-13.00	-55.71	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 12 3 MHz BW Mid 707.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 12 3 MHz BW Mid 707.5 MHz



Radiated Emissions
 Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102366.emi

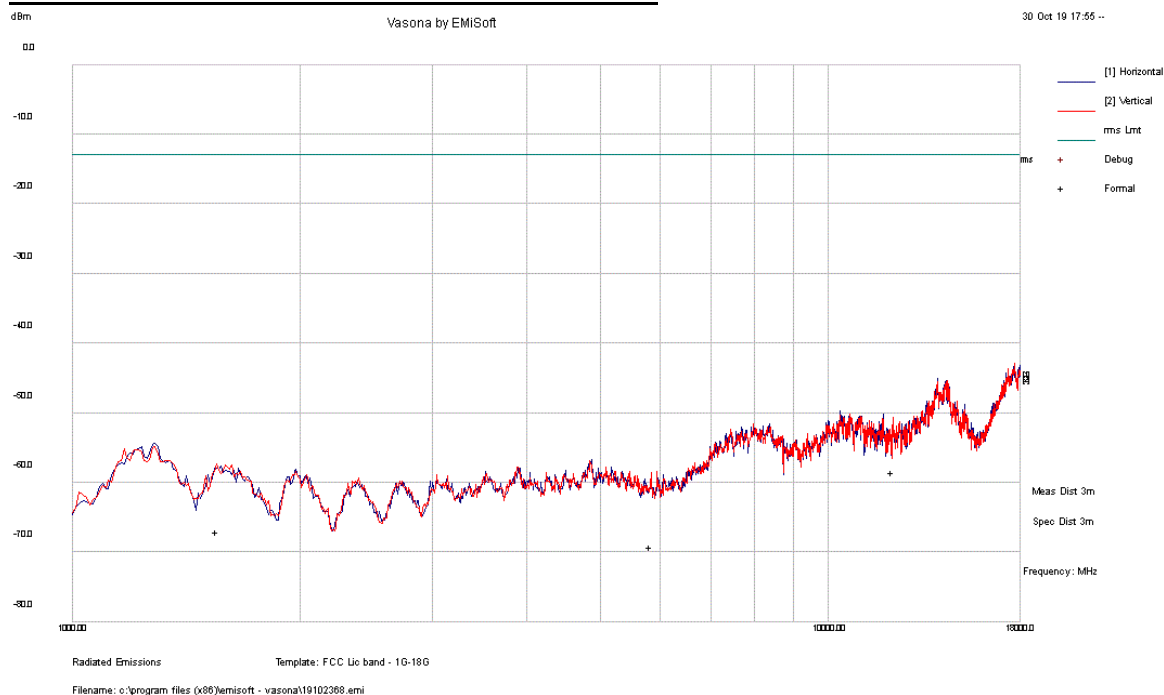
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
11096.24	-79.80	24.38	-2.82	-58.25	RMS Max	V	386	0	-13.00	-45.25	Pass
1617.19	-60.55	16.22	-22.28	-66.60	RMS Max	H	400	26	-13.00	-53.60	Pass
4872.8	-71.55	18.66	-13.27	-66.16	RMS Max	V	174	192	-13.00	-53.16	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 12 5 MHz BW Middle 707.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 12 5 MHz BW Middle 707.5 MHz



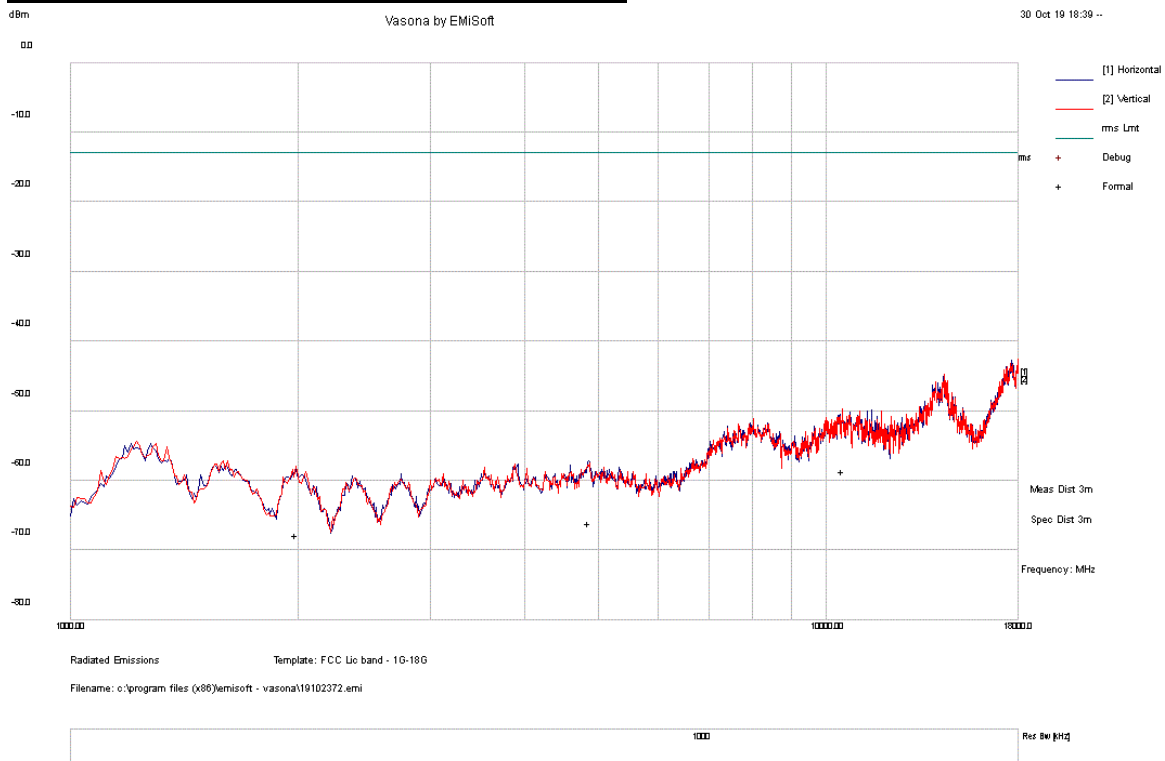
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
12202.95	-80.97	25.15	-2.69	-58.51	RMS Max	V	400	360	-13.00	-45.51	Pass
1553.51	-61.19	16.22	-22.08	-67.05	RMS Max	V	173	255	-13.00	-54.05	Pass
5834.95	-76.03	19.32	-12.45	-69.16	RMS Max	V	366	164	-13.00	-56.16	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 12 10 MHz BW Mid 707.5 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 12 10 MHz BW Mid 707.5 MHz



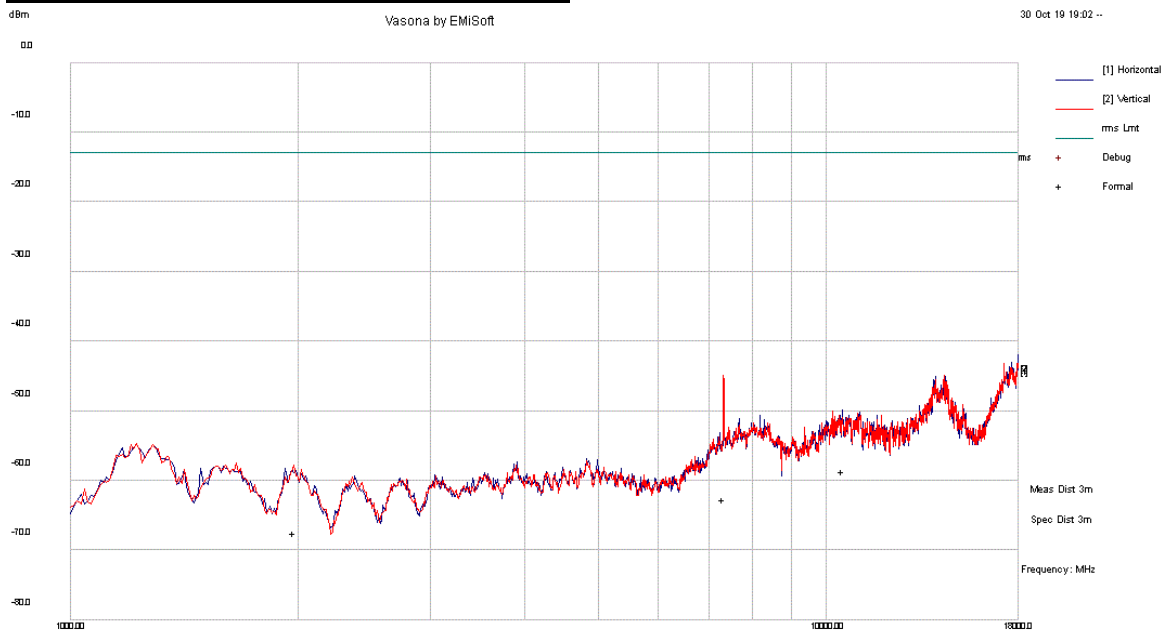
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10524.094	-78.88	23.72	-3.47	-58.63	RMS Max	V	319	299	-13	-45.63	Pass
4858.2445	-71.42	18.65	-13.28	-66.05	RMS Max	H	386	146	-13	-53.05	Pass
1989.424	-62.03	16.21	-22.04	-67.86	RMS Max	V	167	262	-13	-54.86	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 17 5 MHz BW Mid 710 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 17 5 MHz BW Mid 710MHz



Radiated Emissions Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102373.emi

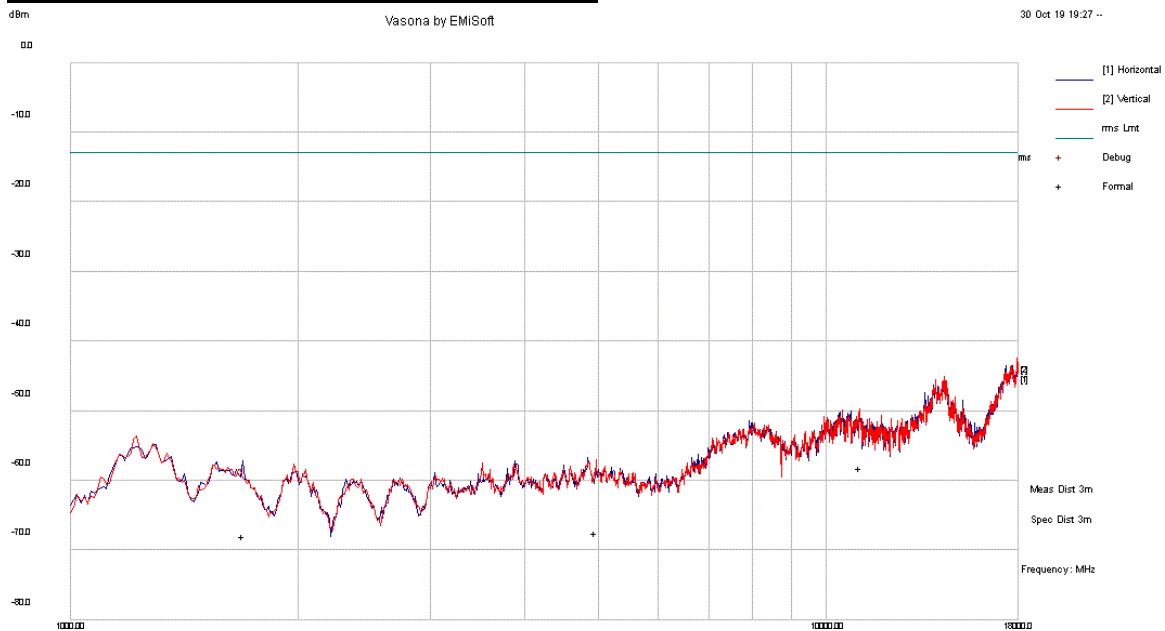
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
10525.67	-78.91	23.72	-3.47	-58.67	RMS Max	H	400	121	-13.00	-45.67	Pass
7320.91	-76.01	21.19	-7.90	-62.72	RMS Max	V	208	258	-13.00	-49.72	Pass
1977.65	-61.72	16.21	-22.00	-67.51	RMS Max	V	134	225	-13.00	-54.51	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-130	Mode:	LTE Band 17 10 MHz BW Mid 710 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 17 10 MHz BW Mid 710 MHz



Radiated Emissions Template: FCC Lic band - 1G-18G
 Filename: c:\program files (x86)\emisoft - vasona\19102377.emi

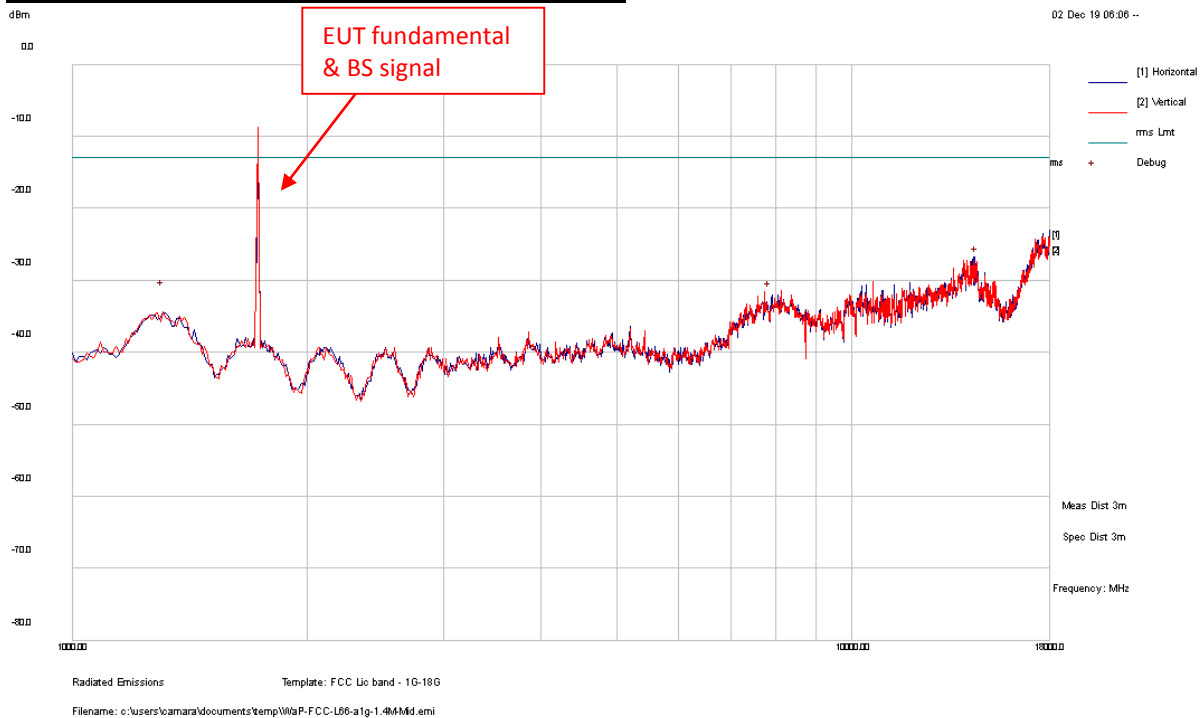
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
11091.09	-79.76	24.38	-2.82	-58.21	RMS Max	V	188	351	-13.00	-45.21	Pass
1691.72	-61.65	16.22	-22.58	-68.01	RMS Max	H	157	321	-13.00	-55.01	Pass
4964.97	-72.98	18.68	-13.22	-67.52	RMS Max	V	167	286	-13.00	-54.52	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 1.4 MHz BW Mid 1745 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 1.4 MHz BW Mid 1745 MHz



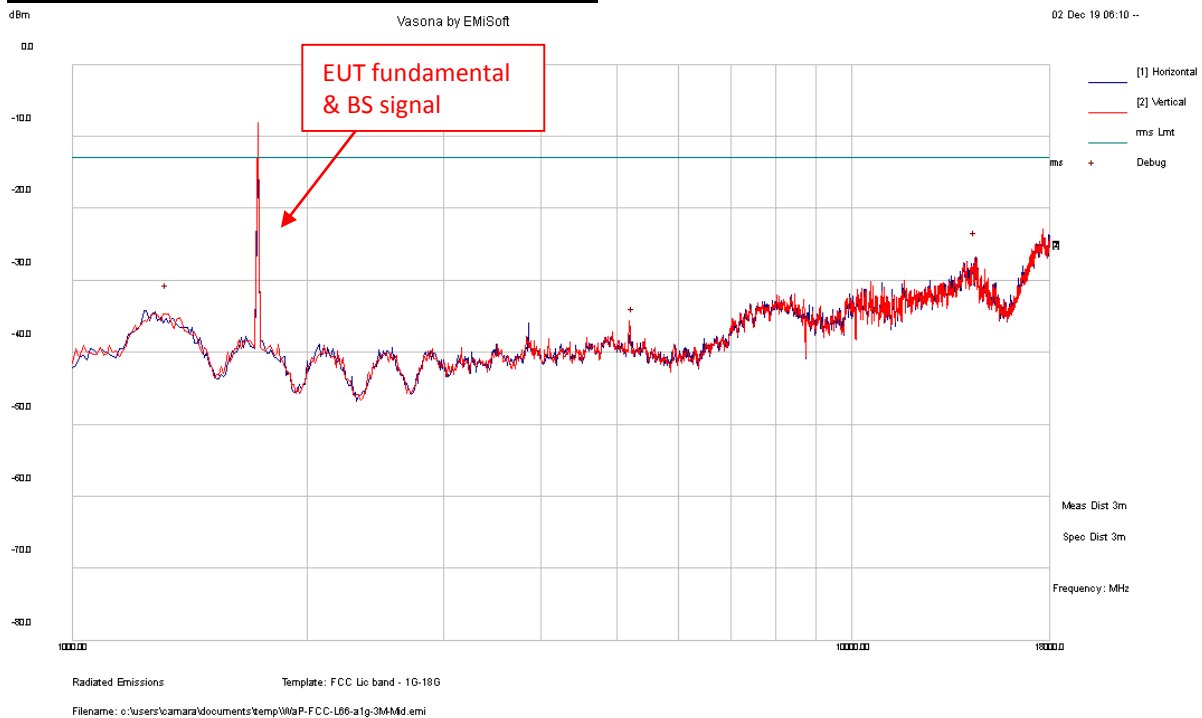
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1302.74	-50.84	15.91	0.09	-34.85	RMS Max	V	150	72	-13	-21.85	Pass
7841.18	-69.87	21.55	13.22	-35.09	RMS Max	V	150	162	-13	-22.09	Pass
14450.13	-78.57	26.53	21.84	-30.20	RMS Max	V	150	227	-13	-17.2	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 3 MHz BW Mid 1745 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 3 MHz BW Mid 1745 MHz



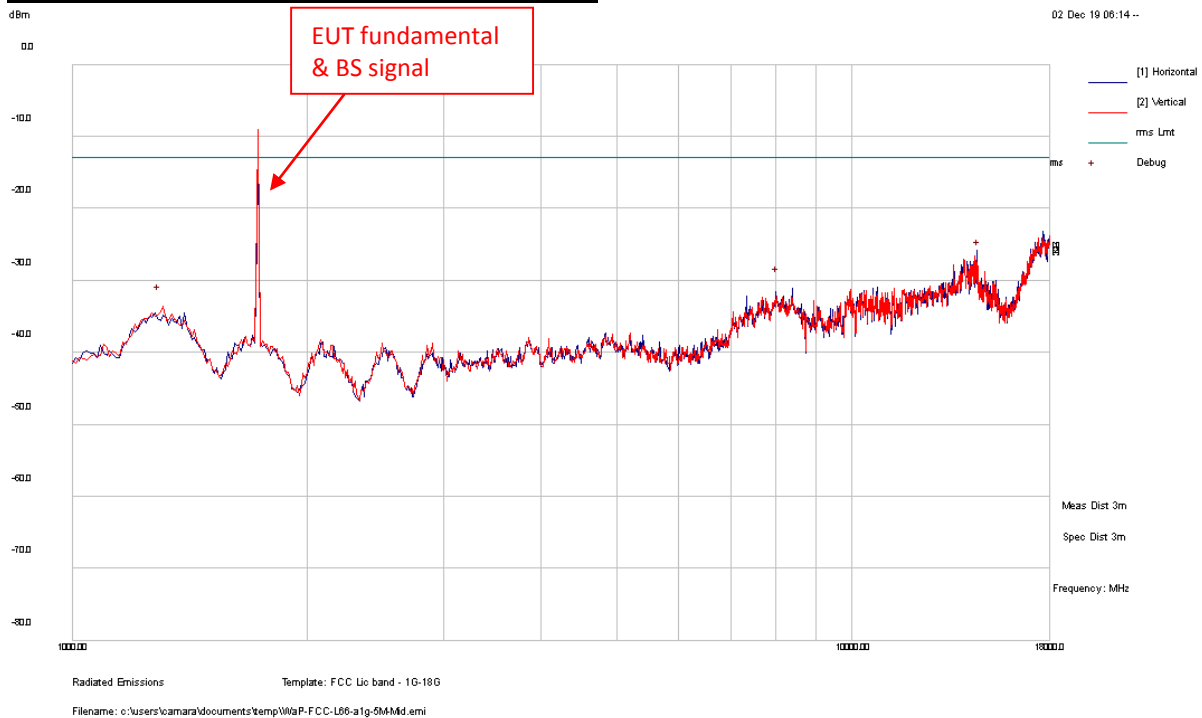
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1319.79	-51.20	15.94	-0.12	-35.39	RMS Max	V	150	143	-13	-22.39	Pass
5239.27	-64.70	18.66	7.47	-38.57	RMS Max	V	150	112	-13	-25.57	Pass
14408.43	-76.57	26.43	22.16	-27.98	RMS Max	V	150	293	-13	-14.98	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 5 MHz BW Mid 1745 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 5 MHz BW Mid 1745 MHz



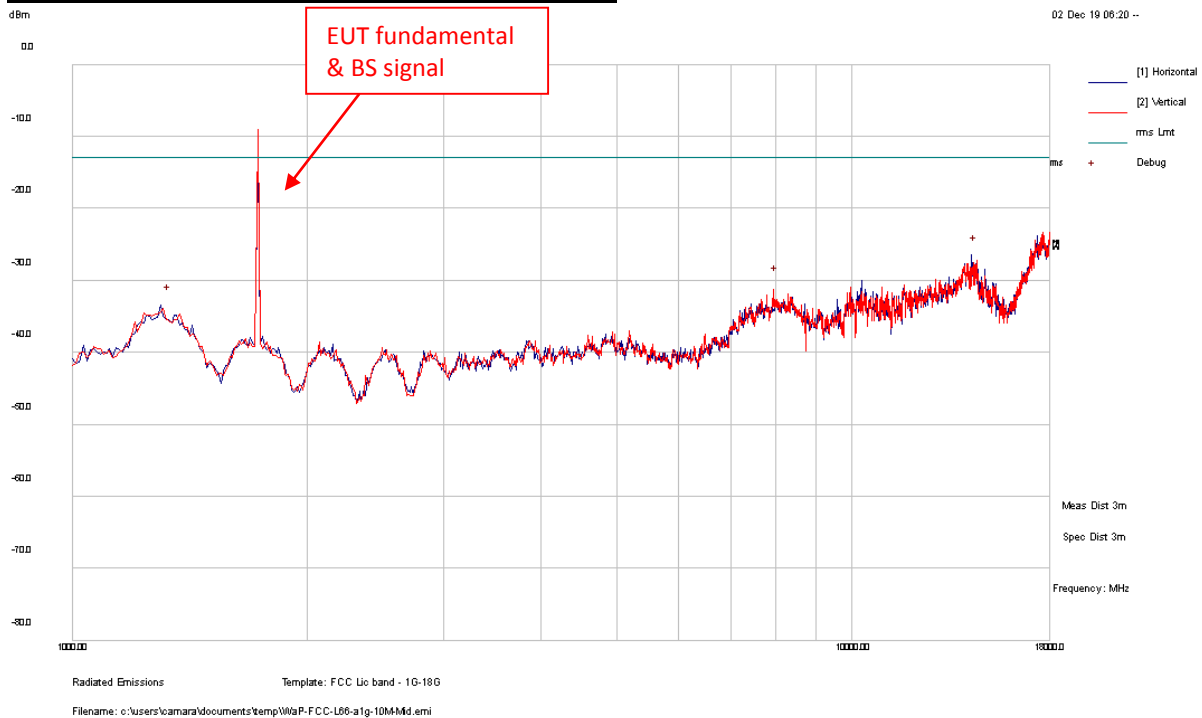
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1293.36	-51.60	15.89	0.16	-35.55	RMS Max	V	150	67	-13	-22.55	Pass
8024.61	-68.44	21.55	13.82	-33.07	RMS Max	V	150	109	-13	-20.07	Pass
14554.93	-76.93	26.79	20.90	-29.24	RMS Max	V	150	241	-13	-16.24	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 10 MHz BW Mid 1745MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 10 MHz BW Mid 1745 MHz



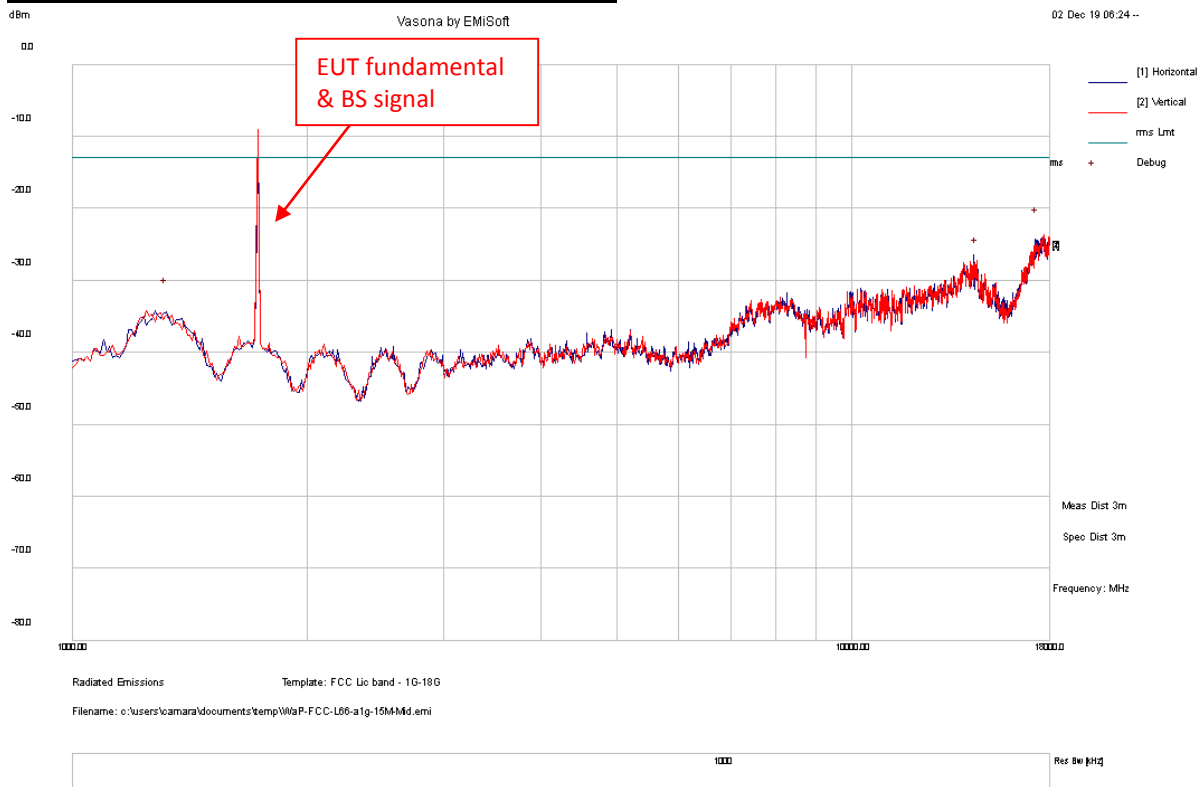
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1329.37	-51.20	15.95	-0.24	-35.49	RMS Max	V	150	36	-13	-22.49	Pass
8001.45	-68.11	21.55	13.76	-32.80	RMS Max	V	150	131	-13	-19.8	Pass
14408.43	-77.25	26.43	22.16	-28.66	RMS Max	V	150	110	-13	-15.66	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 15 MHz BW Mid 1745 MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 15 MHz BW Mid 1745 MHz



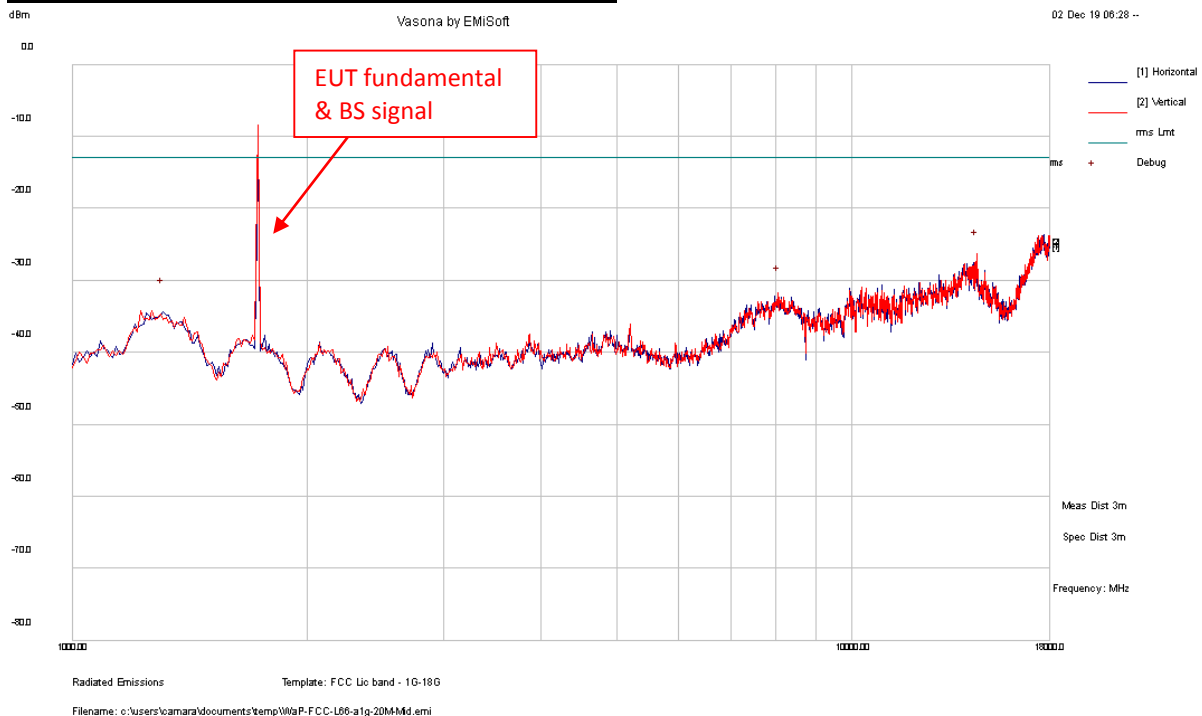
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1315.99	-50.35	15.93	-0.08	-34.50	RMS Max	V	150	98	-13	-21.5	Pass
14450.13	-77.36	26.53	21.84	-28.99	RMS Max	V	150	163	-13	-15.99	Pass
17286.17	-76.98	28.68	23.60	-24.70	RMS Max	V	150	71	-13	-11.7	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part27, RSS-139	Mode:	LTE Band 66 20 MHz BW Mid 1745MHz
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

LTE Band 66 20 MHz BW Mid 1745 MHz



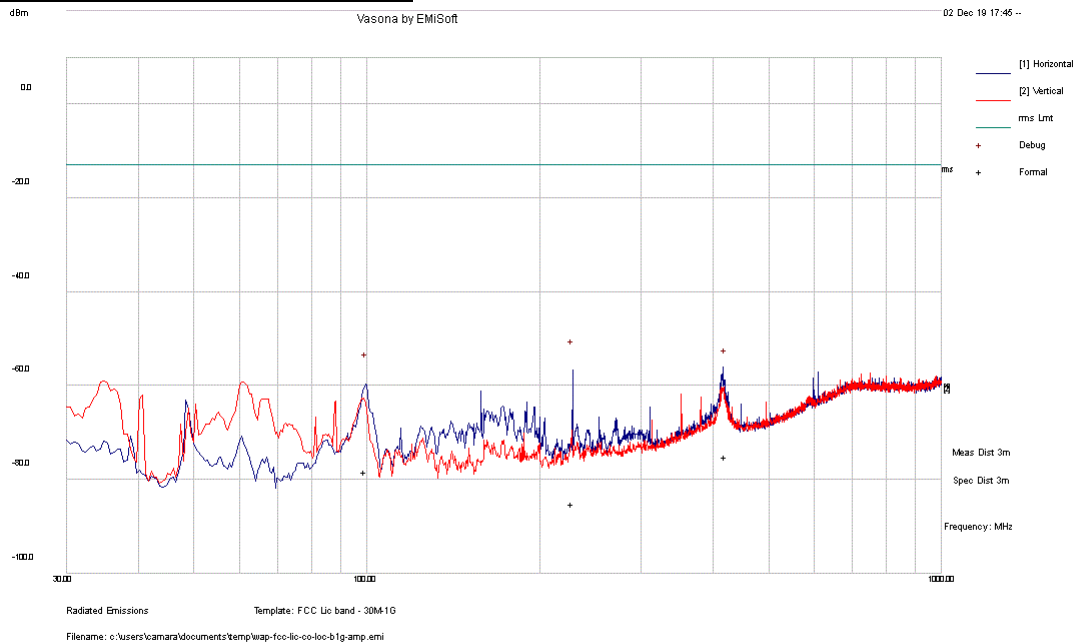
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
1302.74	-50.60	15.91	0.09	-34.61	RMS Max	V	150	10	-13.00	-21.61	Pass
8047.84	-68.35	21.56	13.87	-32.92	RMS Max	V	150	42	-13.00	-19.92	Pass
14491.96	-75.99	26.63	21.48	-27.87	RMS Max	V	150	182	-13.00	-14.87	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	BT+WLAN+Cellular co-location
Frequency Range:	30 - 1000 MHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

BT+WLAN+Cellular co-location



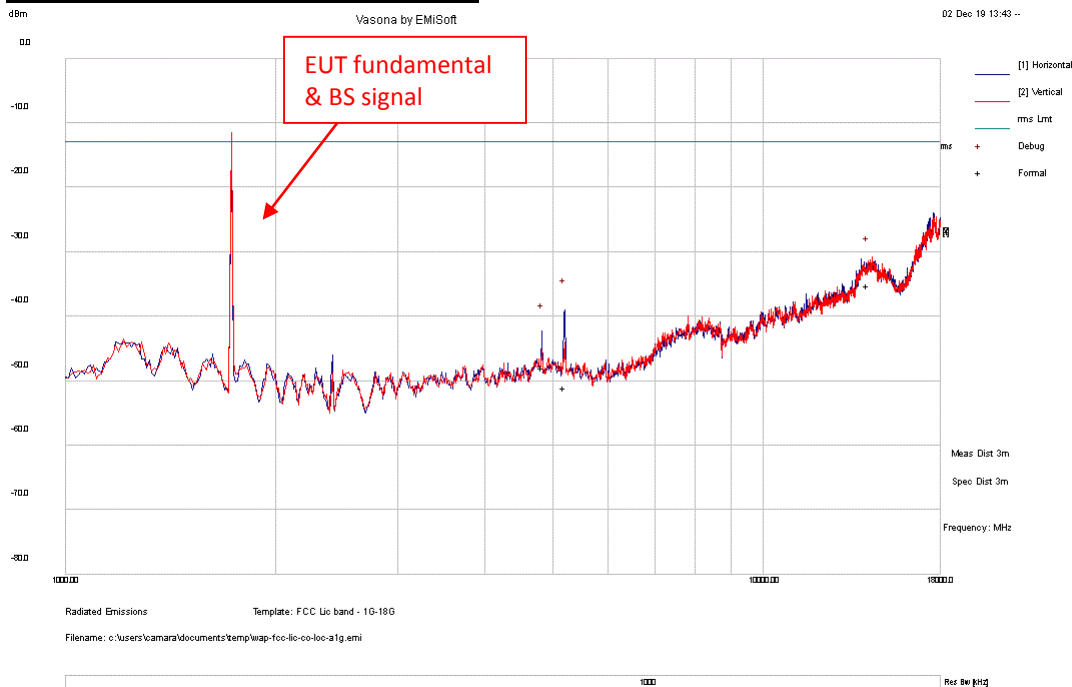
Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
227.979	-81.6	16.8	-20.3	-85.1	RMS Max	V	171	296	-13	-72.1	Pass
419.97	-79.6	18.1	-13.7	-75.2	RMS Max	V	145	184	-13	-62.2	Pass
99.432	-69.9	15.3	-23.7	-78.3	RMS Max	V	141	105	-13	-65.3	Pass

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



Test Standard:	Part24E, RSS-133	Mode:	BT+WLAN+Cellular co-location
Frequency Range:	1 - 18 GHz	Test Date:	10/22/2019 - 10/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Bruce Li
Remark:	N/A	Test Result:	Pass

BT+WLAN+Cellular co-location



Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass/Fail
14120.275	-82.6	25.7	21.7	-35.1	RMS Max	V	373	292	-13	-22.1	Pass
5197.841	-77	18.7	7.4	-51	RMS Max	V	169	177	-13	-38	Pass
4824.13	-73.2	18.6	6.6	-47.9	RMS Max	V	100	175	-13	-34.9	Pass

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



18GHz – 40GHz test result

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

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



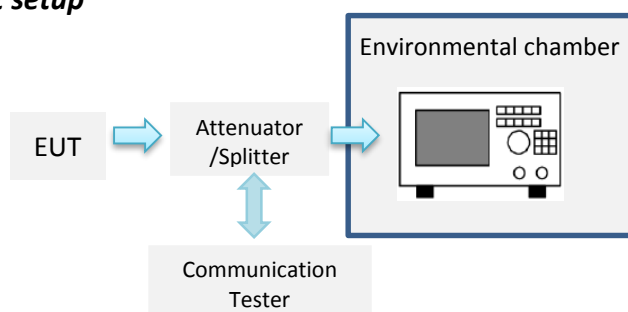
8.7 Frequency Stability

8.7.1 Requirement

§2.1055, §22.355 & §24.235, § 27.5(h); § 27.54
RSS-130(4.5), RSS-132(5.3), RSS-133(6.3), RSS-139(6.4)

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

8.7.2 Test setup



8.7.3 Test Procedure

- The testing follows ANSI C63.26 section 5.6.4.
- A communication link was established between EUT and base station.
- The EUT was set up in the thermal chamber and connected with the communication tester.
- With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
- With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.
- The frequency error was monitored and measured by base station under variation of ambient temperature and variation of primary supply voltage.

Report Number:	WAP-19091821-LC-FCC-IC-LTE
Product:	Vehicle Telematics Control Unit
Model Number:	FB5-TCU-NA



8.7.4 Test Result

LTE Band 2 - 1880MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	6	0.003	2.50	PASS
12	20	8	0.004	2.50	PASS
13.8	20	12	0.006	2.50	PASS
12	-30	5	0.002	2.50	PASS
12	-20	9	0.005	2.50	PASS
12	-10	4	0.002	2.50	PASS
12	0	4	0.002	2.50	PASS
12	10	11	0.006	2.50	PASS
12	20	5	0.003	2.50	PASS
12	30	12	0.007	2.50	PASS
12	40	11	0.006	2.50	PASS
12	50	6	0.003	2.50	PASS

LTE Band 4 - 1733MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	10	0.006	2.50	PASS
12	20	8	0.004	2.50	PASS
13.8	20	7	0.004	2.50	PASS
12	-30	8	0.005	2.50	PASS
12	-20	4	0.002	2.50	PASS
12	-10	10	0.006	2.50	PASS
12	0	3	0.002	2.50	PASS
12	10	4	0.002	2.50	PASS
12	20	8	0.005	2.50	PASS
12	30	10	0.006	2.50	PASS
12	40	6	0.003	2.50	PASS
12	50	2	0.001	2.50	PASS

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



LTE Band 5 - 836.5MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	10	0.012	2.50	PASS
12	20	11	0.013	2.50	PASS
13.8	20	14	0.017	2.50	PASS
12	-30	6	0.007	2.50	PASS
12	-20	7	0.008	2.50	PASS
12	-10	4	0.005	2.50	PASS
12	0	4	0.005	2.50	PASS
12	10	4	0.005	2.50	PASS
12	20	7	0.008	2.50	PASS
12	30	12	0.014	2.50	PASS
12	40	9	0.010	2.50	PASS
12	50	6	0.007	2.50	PASS

LTE Band 12 - 707.5MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	12	0.017	2.50	PASS
12	20	6	0.008	2.50	PASS
13.8	20	12	0.016	2.50	PASS
12	-30	7	0.010	2.50	PASS
12	-20	3	0.005	2.50	PASS
12	-10	5	0.006	2.50	PASS
12	0	10	0.014	2.50	PASS
12	10	6	0.008	2.50	PASS
12	20	4	0.006	2.50	PASS
12	30	6	0.008	2.50	PASS
12	40	10	0.014	2.50	PASS
12	50	3	0.004	2.50	PASS

Report Number: WAP-19091821-LC-FCC-IC-LTE
Product: Vehicle Telematics Control Unit
Model Number: FB5-TCU-NA



LTE Band 17 - 710MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	6	0.009	2.50	PASS
12	20	6	0.009	2.50	PASS
13.8	20	13	0.018	2.50	PASS
12	-30	9	0.013	2.50	PASS
12	-20	2	0.003	2.50	PASS
12	-10	8	0.012	2.50	PASS
12	0	8	0.011	2.50	PASS
12	10	5	0.007	2.50	PASS
12	20	4	0.006	2.50	PASS
12	30	9	0.012	2.50	PASS
12	40	7	0.009	2.50	PASS
12	50	8	0.012	2.50	PASS

LTE Band 66 - 1745MHz					
Input Power (VDC)	Temperature (°C)	Frequency error(Hz)	Frequency error(ppm)	Limit (ppm)	Verdict
10.2	20	13	0.008	2.50	PASS
12	20	7	0.004	2.50	PASS
13.8	20	8	0.005	2.50	PASS
12	-30	8	0.005	2.50	PASS
12	-20	4	0.002	2.50	PASS
12	-10	9	0.005	2.50	PASS
12	0	6	0.003	2.50	PASS
12	10	10	0.006	2.50	PASS
12	20	8	0.004	2.50	PASS
12	30	9	0.005	2.50	PASS
12	40	7	0.004	2.50	PASS
12	50	6	0.004	2.50	PASS

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	11/15/2019	11/15/2020
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
Temperature/Humidity Chamber	Thermotron	SM-8-8200	40991	9/8/2019	9/8/2020