

FCC RF TEST REPORT



Test Report Number..... FLR-19111521-LC-RF-FCC-WLAN

Applicant..... **FLIR Commercial Systems Inc.**

Applicant Address..... 6769 Hollister Ave, Goleta, CA 93117

Product Name..... Elara Radar

Model Number..... R290

Family Product/Model..... N/A

FCC ID..... 2AS9Q-R290

Date of EUT received..... 02/20/2019

Date of Test..... 02/20/2019 – 03/29/2019

Report Issue Date..... 02/20/2020

Test Standards..... 47CFR Part 15.247

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:

Sherwin Lee/Test Engineer

Approved By:

David Zhang/Technical Manager

Report Number:	FLR-19111521-LC-RF-FCC-WLAN
Product:	Elara Radar
Model Number:	R290



Laboratory Introduction

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17025 Product Testing Accreditation Certificate



17065 Product Certification Accreditation Certificate

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	02/20/2020	Original release	N/A

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1 General Information

1.1 Applicant

Applicant:	FLIR Commercial Systems Inc.
Applicant address:	6769 Hollister Ave, Goleta, CA 93117
Manufacturer:	FLIR Commercial Systems Inc.
Manufacturer Address:	6769 Hollister Ave, Goleta, CA 93117

1.2 Product information

Product Name	Elara Radar
Model Number	R290
Family Model Number	N/A
Serial Number	N/A
Frequency Band	2.4GHz Wi-Fi: 802.11b/g/n-20MHz: 2412-2462MHz 24GHz Radar: 24075 – 24175 MHz
Type of modulation	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 24GHz Radar: FMCW
Equipment Class/ Category	DTS, FDS
Maximum output power	Wi-Fi: 17.79 dBm 24GHz Radar: 25 dBm EIRP
Antenna Information	Wi-Fi PCB antenna: -6 dBi 24GHz Radar: Internal Patch Antenna, 11 dBi
Clock Frequencies	N/A
Port/Connectors	PoE, DC in
Input Power	48VDC (PoE), 12VDC (DC input), 24VAC (AC input)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	N/A
Additional Info	N/A

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1.3 Test standard and method

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

1.4 Test Purpose and statement

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

2 Test site information

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

Test condition	Test Engineer	Test Environment	Test Date
RF conducted	Sherwin Lee	23.5°C / 58.2%/996 mbar	02/20/2019 – 03/29/2019
Radiated	Sherwin Lee	23.5°C / 58.2%/996 mbar	02/20/2019 – 03/29/2019

3 Modification of EUT

The EUT is an engineering test sample loaded with RF test firmware specifically designed to support the RF TX/RX measurement in different aspects. No modification on the hardware.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external PoE power supply or AC/DC power adapter. For RF conducted measurement, the original antenna is removed and connected to spectrum analyzer for measurement. The test command is used to set EUT to different transmission mode in terms of radio mode (WLAN, BLE), test channel, data rate, etc.

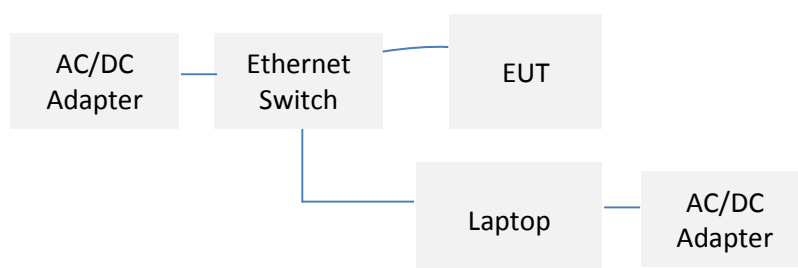
4.2 EUT test mode

Radio	Channel	Frequency (MHz)	Data Rate (Mbps)
802.11-b	1	2412	1, 11
802.11-b	6	2437	1, 11
802.11-b	11	2462	1, 11
802.11-g	1	2412	6, 54
802.11-g	6	2437	6, 54
802.11-g	11	2462	6, 54
802.11-n-20	1	2412	MCS0, MCS7
802.11-n-20	6	2437	MCS0, MCS7
802.11-n-20	11	2462	MCS0, MCS7

4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	Ethernet Switch	FS108P	2HK1223100C67	NETGEAR	Provide PoE and communication
2	AC/DC adapter	NU60-F480125-I1NN	332-10290-01	NETGEAR	-
3	Laptop	G752V	F9N0CY758592398	ASUS	Remote access
4	AC/DC adapter	ADP-180MB	N/A	ASUS	-

4.4 EUT setup diagram



4.5 EUT operation

The control of EUT is either through the Linux WL command or Web UI on test laptop.

4.6 Test software

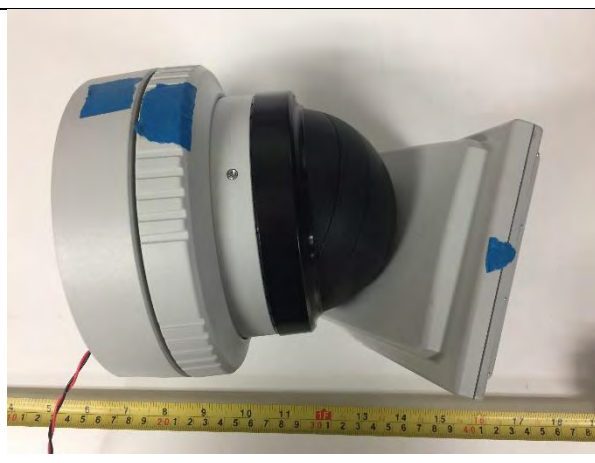
Index	Description	Remark
1	Web UI	Remote access to EUT
2	Linux WL command	Control radio setting to set EUT under RF test mode
3	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

5 EUT and test setup pictures

5.1 EUT pictures



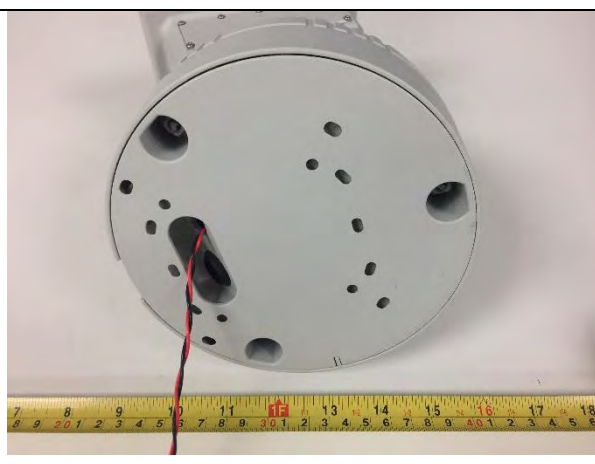
EUT Top View



EUT Bottom View



EUT Front View



EUT Rear View



EUT Left Side View

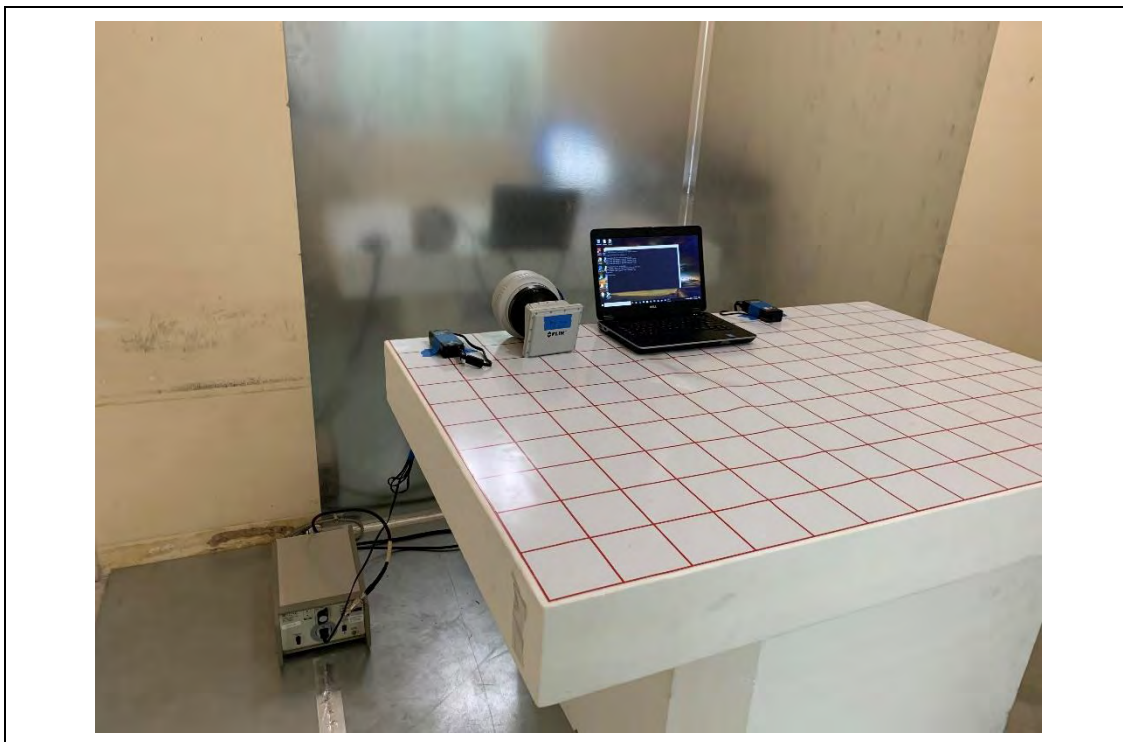


EUT Right Side View

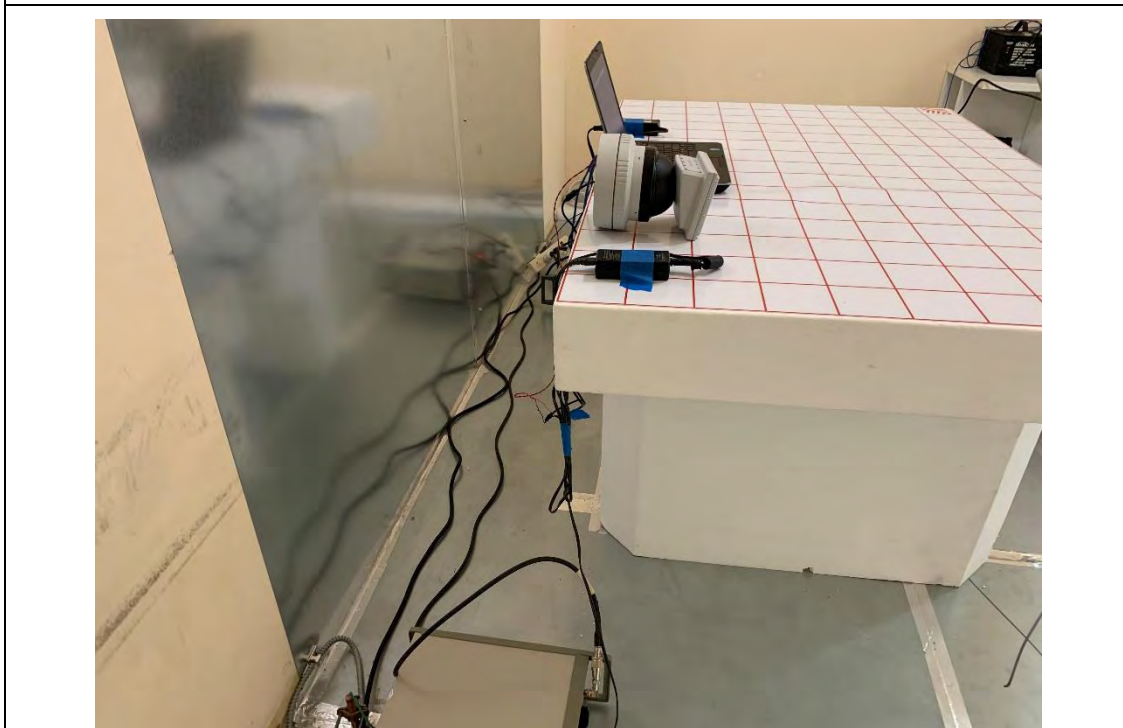
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5.2 EUT test setup pictures



AC Line Conducted Emission setup – Front



AC Line Conducted Emission setup – Rear

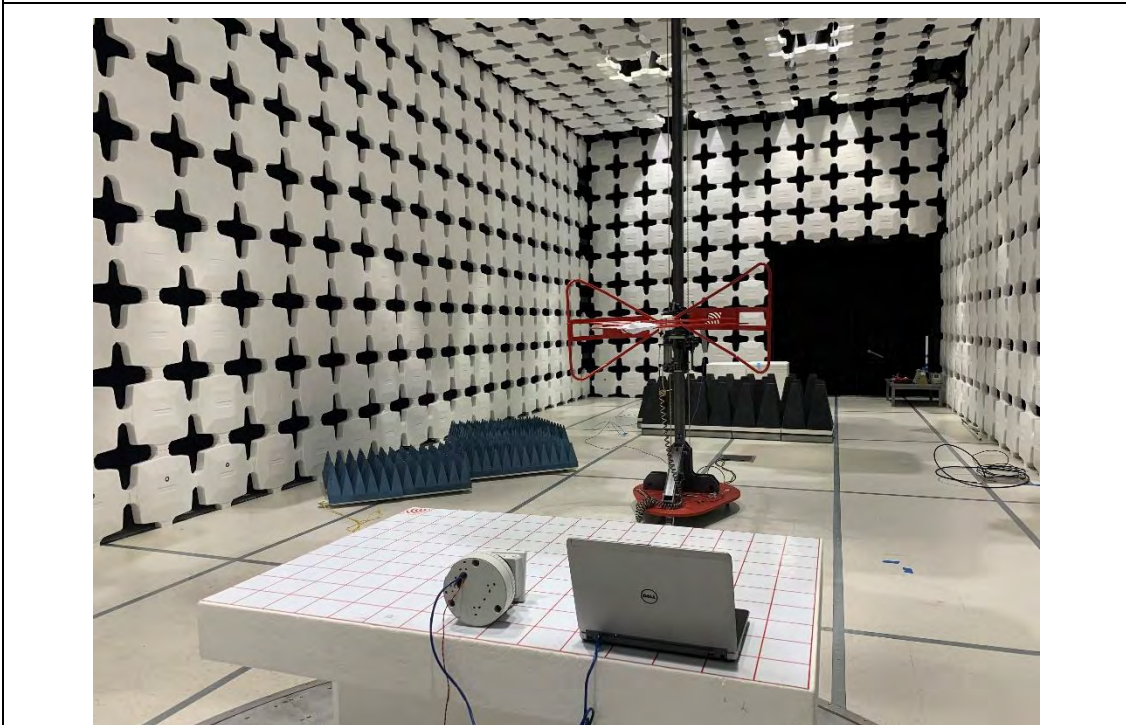
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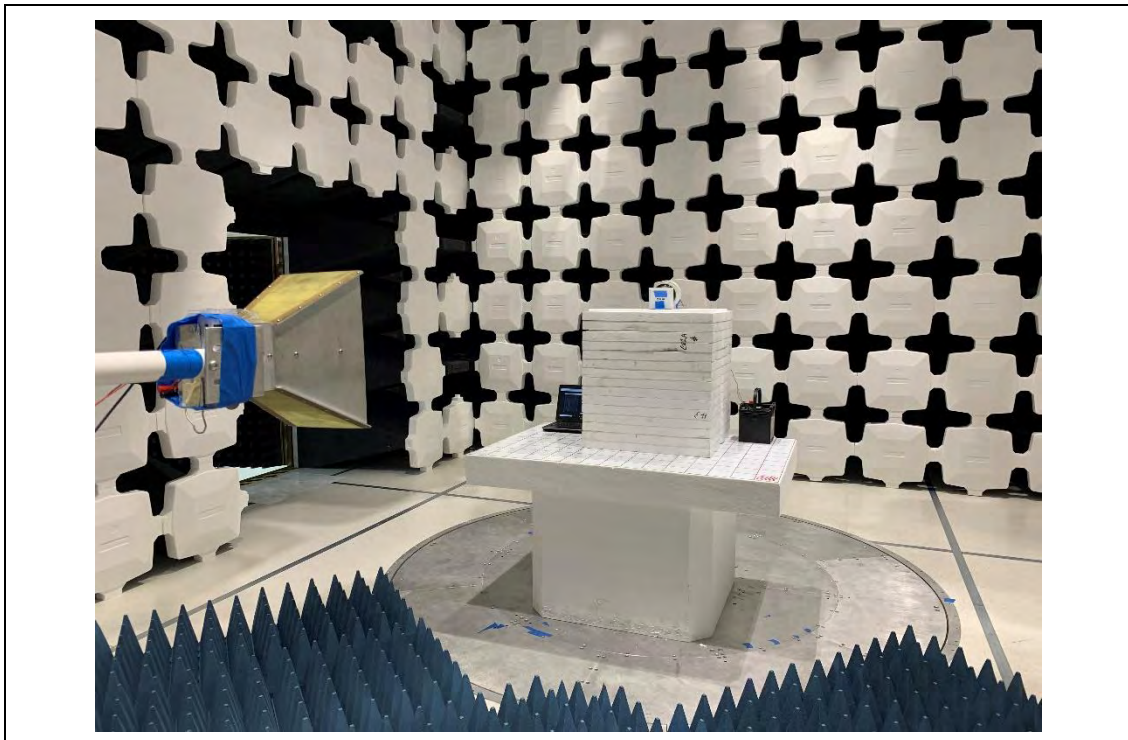
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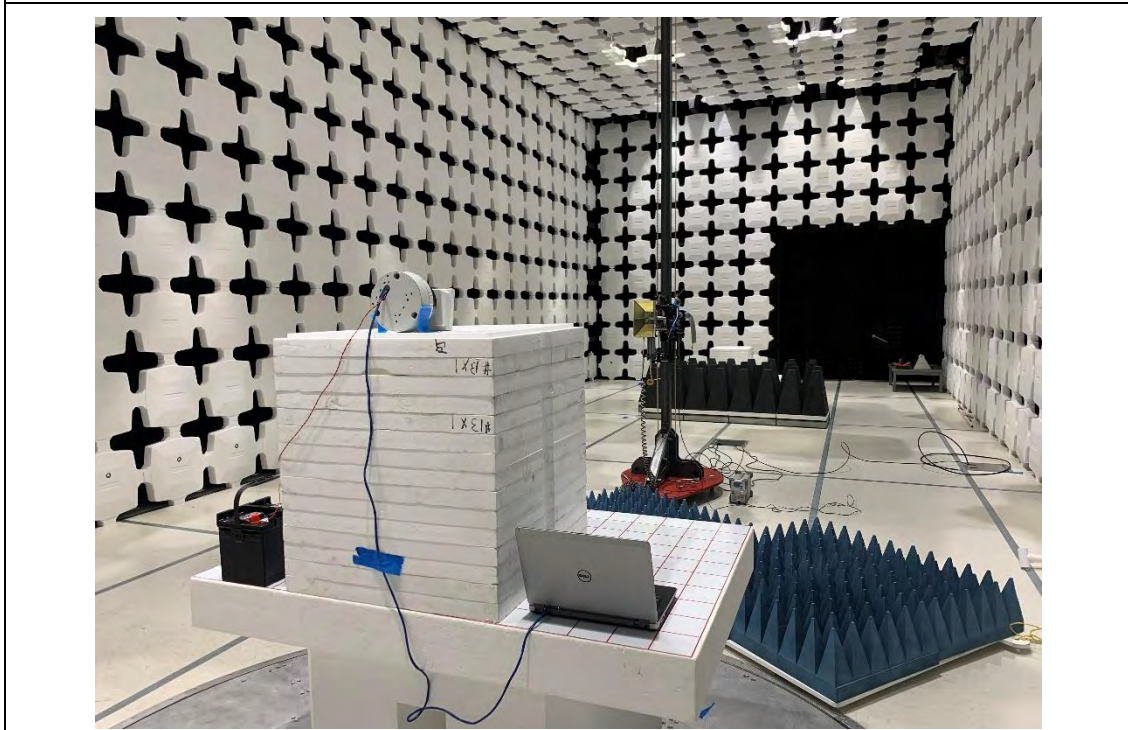
Radiated Emissions Below 1GHz setup – Front



Radiated Emissions Below 1GHz setup – Rear



Radiated Emissions Above 1GHz setup – Front



Radiated Emissions Above 1GHz setup – Rear

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6 Test Summary

FCC Rules	Test Item	Section	Verdict
§15.203	Antenna Requirement	8.1	Pass
§15.247 (a)(2)	DTS (6 dB) Channel Bandwidth	8.2	Pass
§15.247(b)(3)	Conducted Maximum Output Power	8.3	Pass
§15.247(e)	Power Spectral Density	8.4	Pass
§15.247(d)	Conducted Band-Edge & Unwanted Emissions	8.5	Pass
§15.205, §15.209, §15.247(d)	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.6	Pass
§15.207 (a)	AC Power Line Conducted Emissions	8.7	Pass

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7 Uncertainty of Measurement

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

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8 Test summary and result

8.1 Antenna Requirement

8.1.1 Requirement

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

8.1.2 Result

Analysis:

- For Wi-Fi, EUT has one removable PCB trace antennas which connect to the main board through unique U.FL RF connectors.
- For 24GHz Radar, the antenna is internal patch antenna which is not removable.

Conclusion:

EUT complies with antenna requirement in § 15.203.

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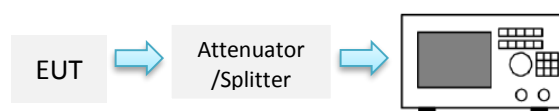
8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.247 (a)(2)

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

8.2.2 Test setup



8.2.3 Test Procedure

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

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

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

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8.2.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
11b	2412	1Mbps	9040	500	Pass
11b	2437	1Mbps	9565	500	Pass
11b	2462	1Mbps	9567	500	Pass
11b	2412	11Mbps	9210	500	Pass
11b	2437	11Mbps	9945	500	Pass
11b	2462	11Mbps	9307	500	Pass
11g	2412	6Mbps	15130	500	Pass
11g	2437	6Mbps	15120	500	Pass
11g	2462	6Mbps	15160	500	Pass
11g	2412	54Mbps	15450	500	Pass
11g	2437	54Mbps	15710	500	Pass
11g	2462	4Mbps	15670	500	Pass
11n-20M	2412	MCS0	15140	500	Pass
11n-20M	2437	MCS0	15140	500	Pass
11n-20M	2462	MCS0	15130	500	Pass
11n-20M	2412	MCS7	15750	500	Pass
11n-20M	2437	MCS7	15380	500	Pass
11n-20M	2462	MCS7	15170	500	Pass

8.2.5 Test Plots



11b-6dB BW-Low-1Mbps



11b-6dB BW-Low-11Mbps



11b-6dB BW-Mid-1Mbps



11b-6dB BW-Mid-11Mbps



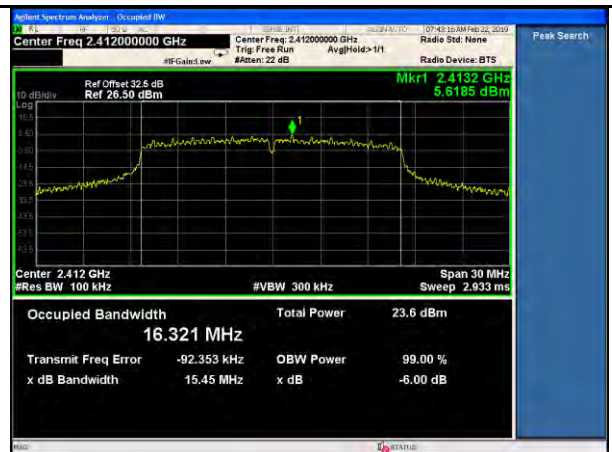
11b-6dB BW-High-1Mbps



11b-6dB BW-High-11Mbps



11g-6dB BW-Low-6Mbps



11g-6dB BW-Low-54Mbps



11b-6dB BW-Mid-6Mbps



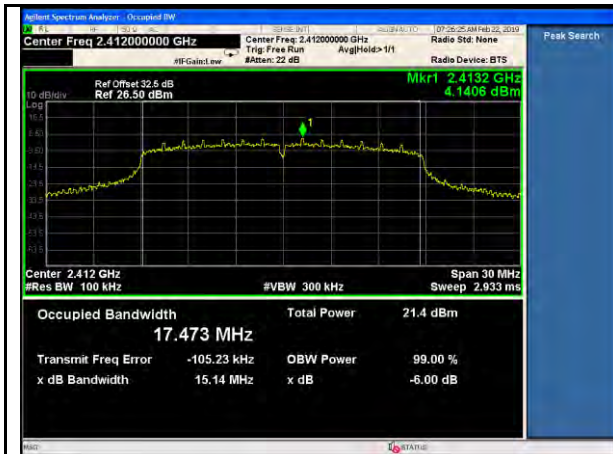
11g-6dB BW-Mid-54Mbps



11b-6dB BW-High-6Mbps



11g-6dB BW-High-54Mbps



11n-20MHz-6dB BW-Low-MCS0



11n-20MHz-6dB BW-Low-MCS7



11n-20MHz-6dB BW-Mid-MCS0



11n-20MHz-6dB BW-Mid-MCS7



11n-20MHz-6dB BW-High-MCS0



11n-20MHz-6dB BW-High-MCS7

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8.3 Maximum Output Power

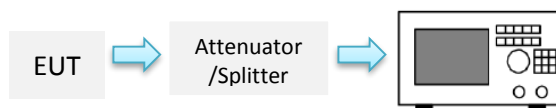
8.3.1 Requirement

§ 15.247 (b)(3)

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

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.3.2 Test setup



8.3.3 Test Procedure

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

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

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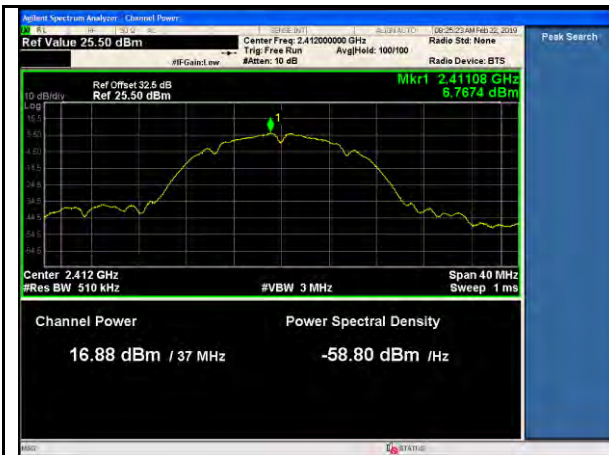


8.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
11b	2412	1Mbps	16.88	30	Pass
11b	2437	1Mbps	17.78	30	Pass
11b	2462	1Mbps	16.05	30	Pass
11b	2412	11Mbps	17.26	30	Pass
11b	2437	11Mbps	17.79	30	Pass
11b	2462	11Mbps	16.23	30	Pass
11g	2412	6Mbps	15.44	30	Pass
11g	2437	6Mbps	15.38	30	Pass
11g	2462	54Mbps	13.76	30	Pass
11g	2412	54Mbps	15.23	30	Pass
11g	2437	54Mbps	15.33	30	Pass
11g	2462	54Mbps	13.67	30	Pass
11n-20M	2412	MCS0	14.04	30	Pass
11n-20M	2437	MCS0	15.25	30	Pass
11n-20M	2462	MCS0	13.68	30	Pass
11n-20M	2412	MCS7	14.00	30	Pass
11n-20M	2437	MCS7	15.31	30	Pass
11n-20M	2462	MCS7	13.71	30	Pass



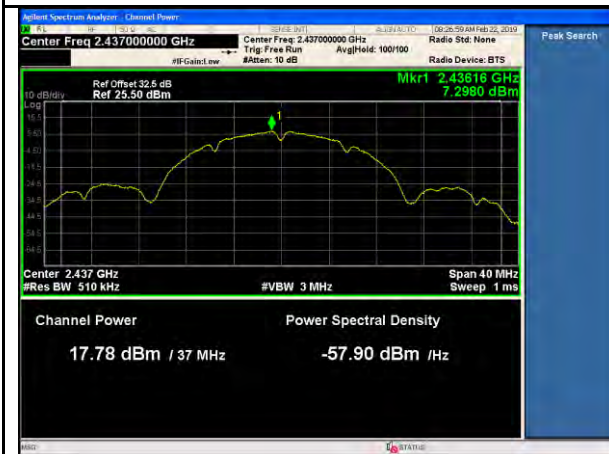
8.3.5 Test Plots



11b-PWR-Low-1Mbps



11b-PWR-Low-11Mbps



11b-PWR-Mid-1Mbps



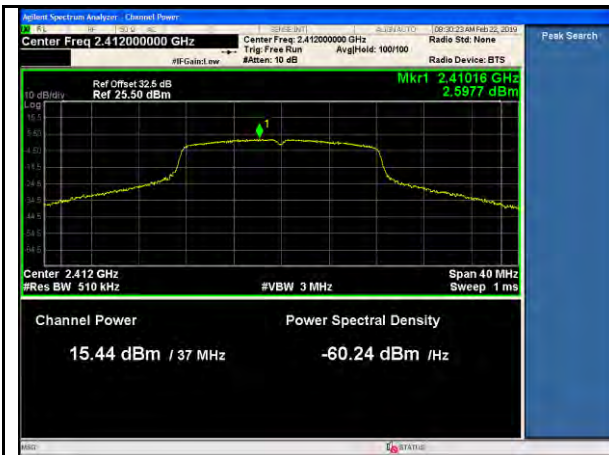
11b-PWR-Mid-11Mbps



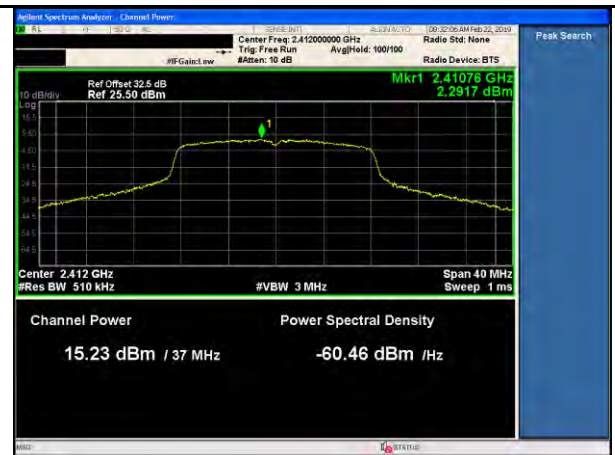
11b-PWR-High-1Mbps



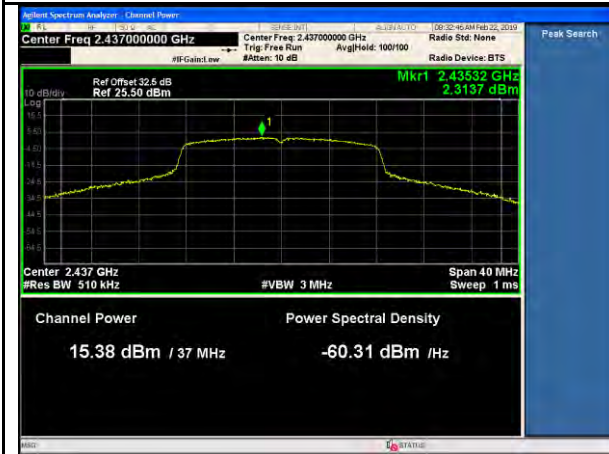
11b-PWR-High-11Mbps



11g-PWR-Low-6Mbps



11g-PWR-Low-54Mbps



11g-PWR-Mid-6Mbps



11g-PWR-Mid-54Mbps



11g-PWR-High-6Mbps

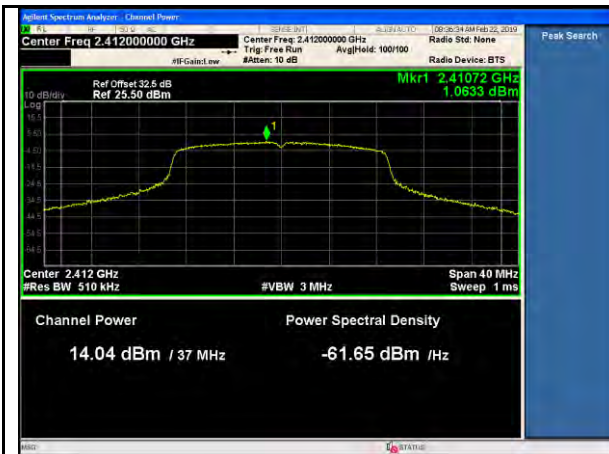


11g-PWR-High-54Mbps

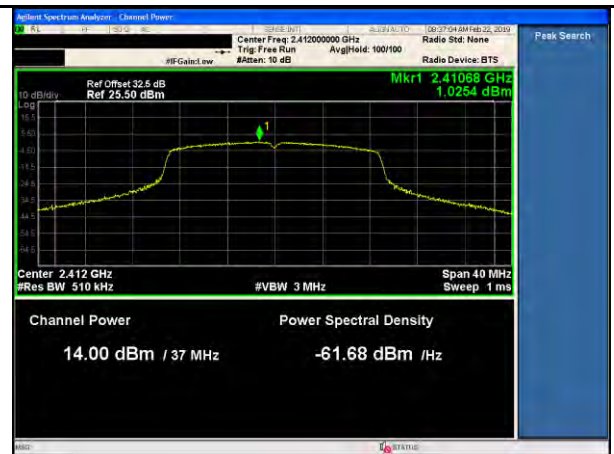
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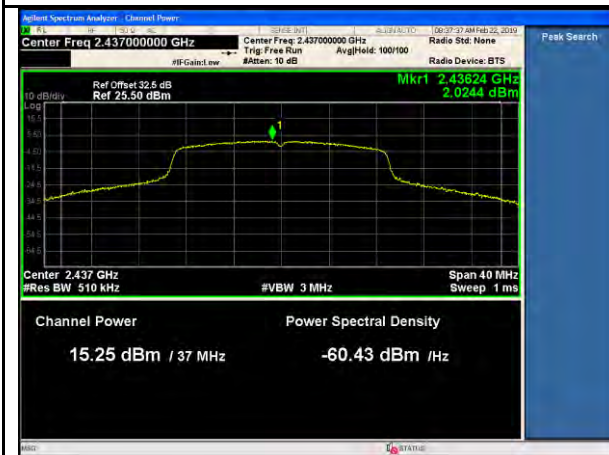
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11n-20MHz-PWR-Low-MCS0



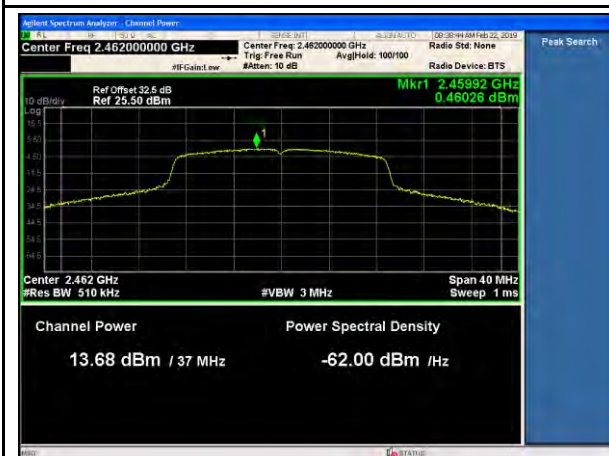
11n-20MHz-PWR-Low-MCS7



11n-20MHz-PWR-Mid-MCS0



11n-20MHz-PWR-Mid-MCS7



11n-20MHz-PWR-High-MCS0



11n-20MHz-PWR-High-MCS7



Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

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

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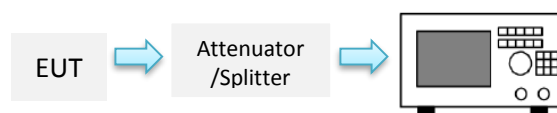
8.4 Power Spectral Density

8.4.1 Requirement

§ 15.247 (e)

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

8.4.2 Test setup



8.4.3 Test Procedure

For WLAN, PSD measurement is according to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.3 AVGPSD-1 of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 times the OBW.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = power averaging (rms) or sample detector (when rms not available).
6. Ensure that the number of measurement points in the sweep $\geq [2 \times \text{span} / \text{RBW}]$
7. Sweep time = auto couple
8. Employ trace averaging (rms) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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8.4.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
11b	2412	1Mbps	0.347	30	Pass
11b	2437	1Mbps	0.813	30	Pass
11b	2462	1Mbps	-0.694	30	Pass
11b	2412	11Mbps	0.110	30	Pass
11b	2437	11Mbps	0.522	30	Pass
11b	2462	11Mbps	-1.405	30	Pass
11g	2412	6Mbps	-3.467	30	Pass
11g	2437	6Mbps	-3.877	30	Pass
11g	2462	54Mbps	-5.165	30	Pass
11g	2412	54Mbps	-3.642	30	Pass
11g	2437	54Mbps	-3.510	30	Pass
11g	2462	54Mbps	-4.787	30	Pass
11n-20M	2412	MCS0	-5.344	30	Pass
11n-20M	2437	MCS0	-4.015	30	Pass
11n-20M	2462	MCS0	-5.106	30	Pass
11n-20M	2412	MCS7	-5.269	30	Pass
11n-20M	2437	MCS7	-3.933	30	Pass
11n-20M	2462	MCS7	-5.769	30	Pass

8.4.5 Test Plots



11b-PSD-Low-1Mbps



11b-PSD-Low-11Mbps



11b-PSD-Mid-1Mbps



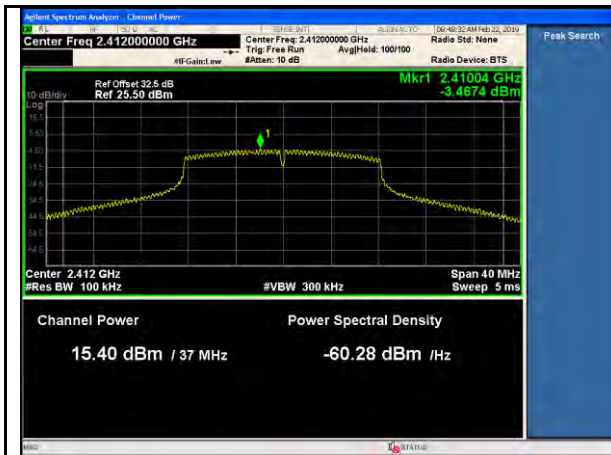
11b-PSD-Mid-11Mbps



11b-PSD-High-1Mbps



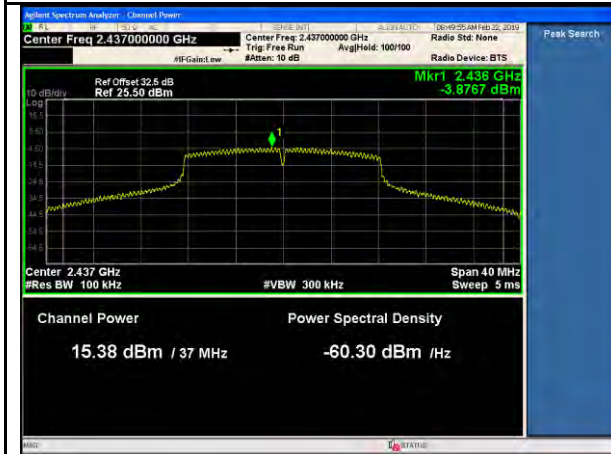
11b-PSD-High-11Mbps



11g-PSD-Low-6Mbps



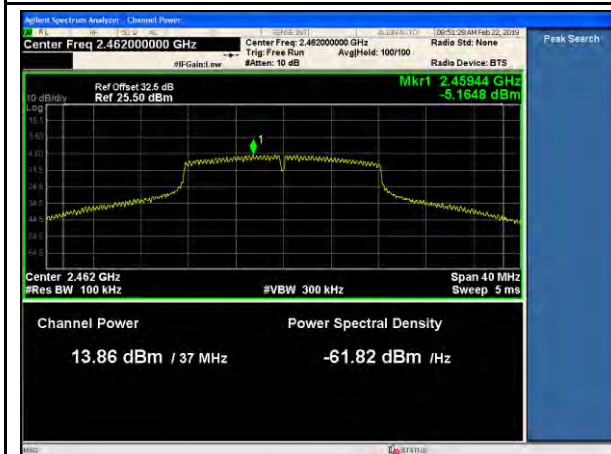
11g-PSD-Low-54Mbps



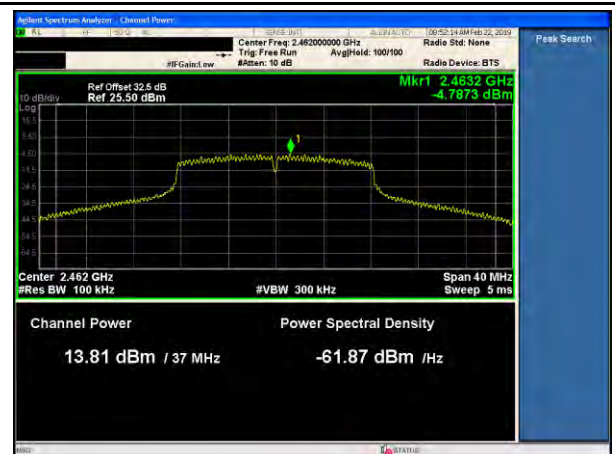
11g-PSD-Mid-6Mbps



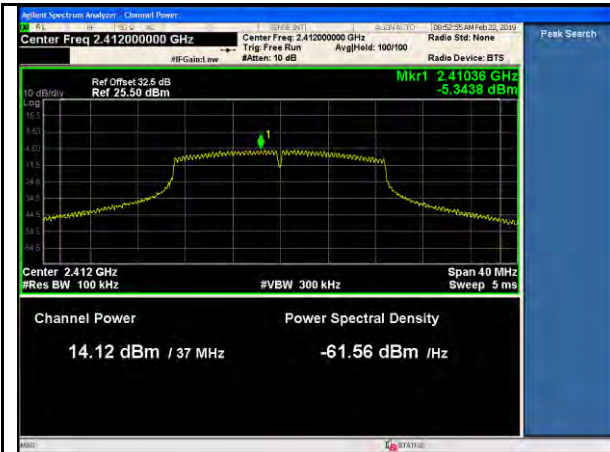
11g-PSD-Mid-54Mbps



11g-PSD-High-6Mbps



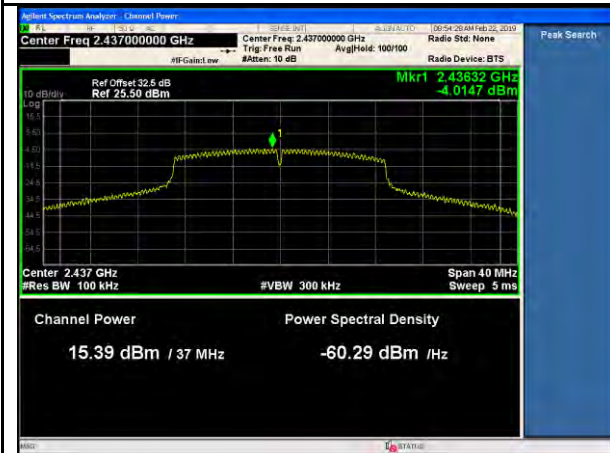
11g-PSD-High-54Mbps



11n-20MHz-PSD-Low-MCS0



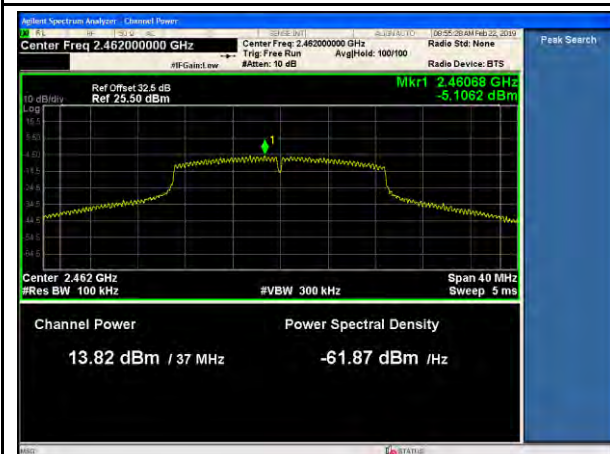
11n-20MHz-PSD-Low-MCS7



11n-20MHz-PSD-Mid-MCS0



11n-20MHz-PSD-Mid-MCS7



11n-20MHz-PSD-High-MCS0



11n-20MHz-PSD-High-MCS7

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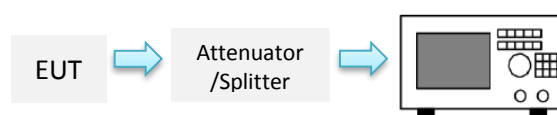
8.5 Conducted Band-Edge & Unwanted Emissions Measurement

8.5.1 Requirement

§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

8.5.2 Test setup



8.5.3 Test Procedure

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

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

8.5.4 Test Result

See test plots

8.5.5 Test Plots



11b-Band Edge-Low



11b-Band Edge-High



11g-Band Edge-Low



11g-Band Edge-High



11n-20MHz-Band Edge-Low



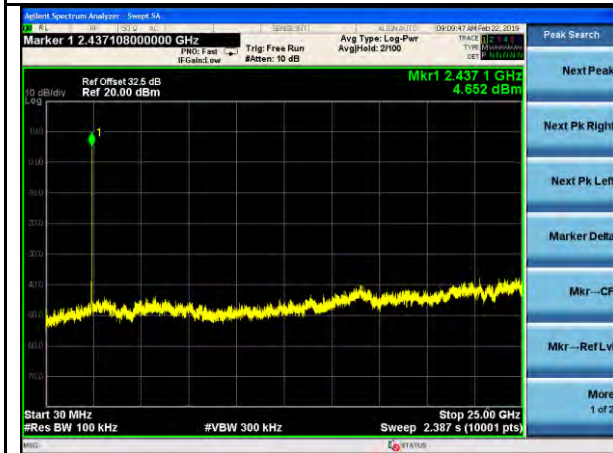
11n-20MHz-Band Edge-High



11b-Out Of Band Emission-Low



11g-Out Of Band Emission-Low



11b-Out Of Band Emission-Mid



11g-Out Of Band Emission-Mid



11b-Out Of Band Emission-High



11g-Out Of Band Emission-High

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11n 20MHz-Out Of Band Emission-Low



11n 20MHz-Out Of Band Emission-Mid



11n 20MHz-Out Of Band Emission-High



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

8.6.1 Requirement

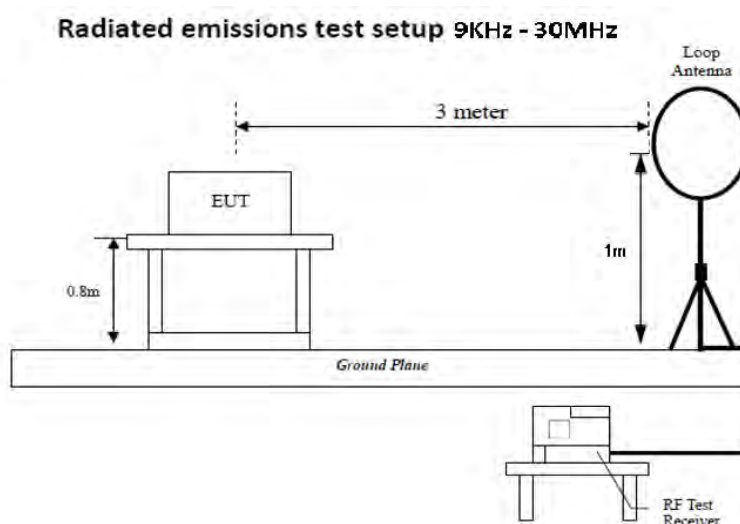
§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

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

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

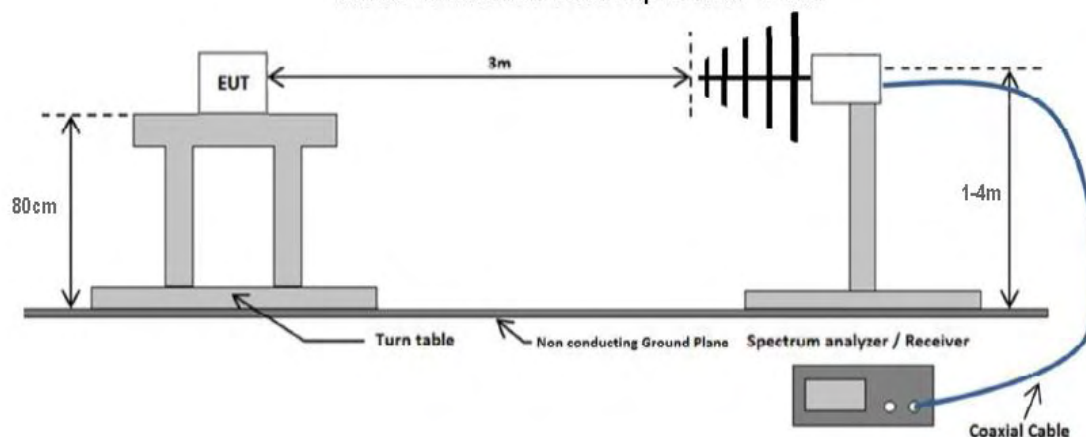
8.6.2 Test setup



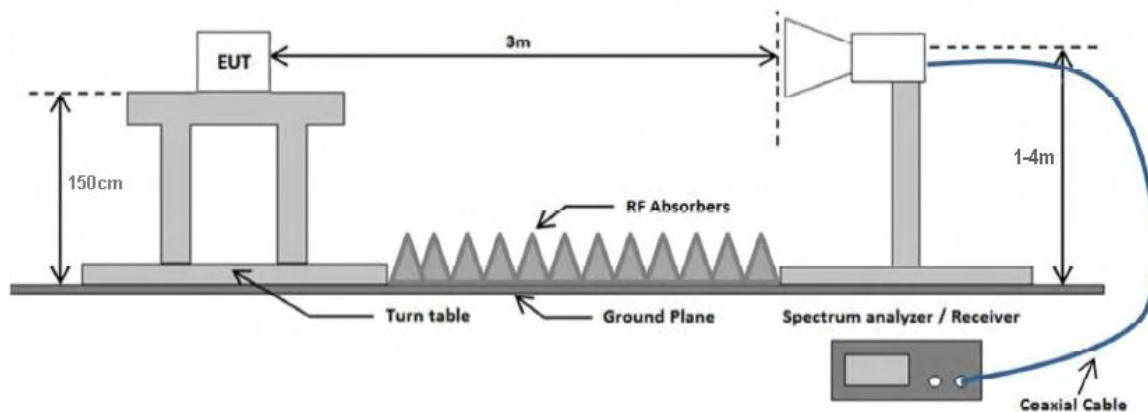
Report Number:	FLR-19111521-LC-RF-FCC-WLAN
Product:	Elara Radar
Model Number:	R290



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



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8.6.3 Test Procedure

According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

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

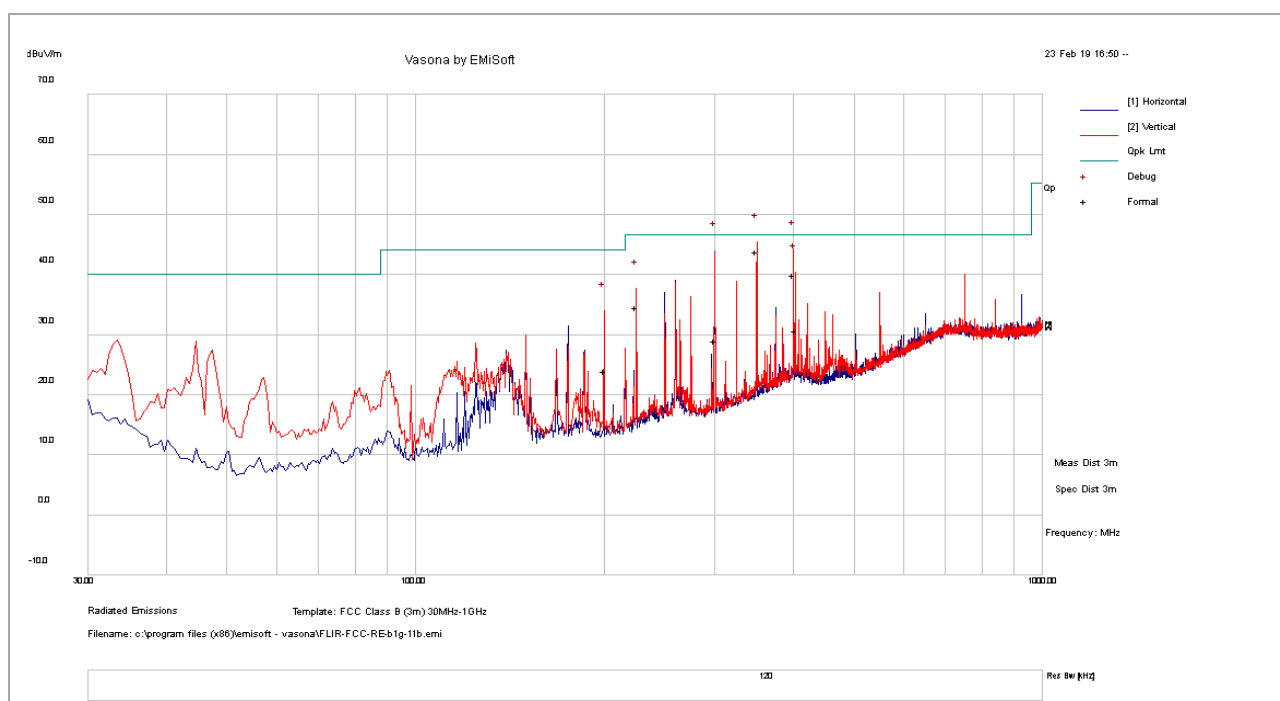
Report Number:	FLR-19111521-LC-RF-FCC-WLAN
Product:	Elara Radar
Model Number:	R290



8.6.4 Test Result

30-1000MHz test result

Test Standard:	15.209	Mode:	802.11b-2437MHz
Frequency Range:	30-1000MHz	Test Date:	02/23/2019
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
199.99	41.14	4.73	-21.81	24.06	QP	V	100	128	43.50	-19.44
225.01	50.17	5.01	-20.46	34.72	QP	V	145	110	46.00	-11.28
299.91	42.09	5.68	-18.73	29.04	QP	V	115	154	46.00	-16.96
350.00	53.96	6.05	-16.13	43.88	QP	V	104	354	46.00	-2.12
400.00	47.03	6.37	-13.43	39.97	QP	H	226	29	46.00	-6.03
403.19	37.81	6.36	-13.47	30.70	QP	V	293	287	46.00	-15.30

Note:

- 1) For below 1GHz, all different channel and modes were verified but only the worst case result under 11b mode is shown here.



Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

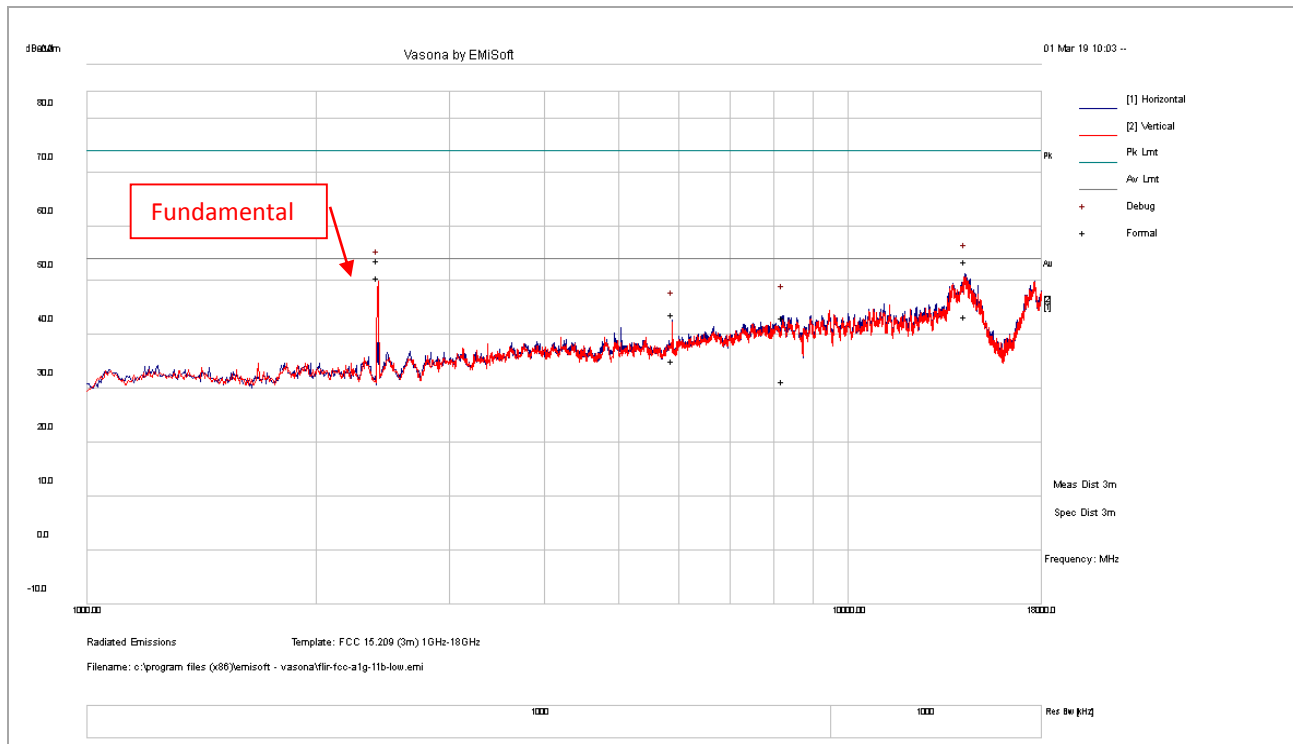
1261 Puerta Del Sol
San Clemente, CA, 92673
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Report Number: FLR-19111521-LC-RF-FCC-WLAN
Product: Elara Radar
Model Number: R290



1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11b-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



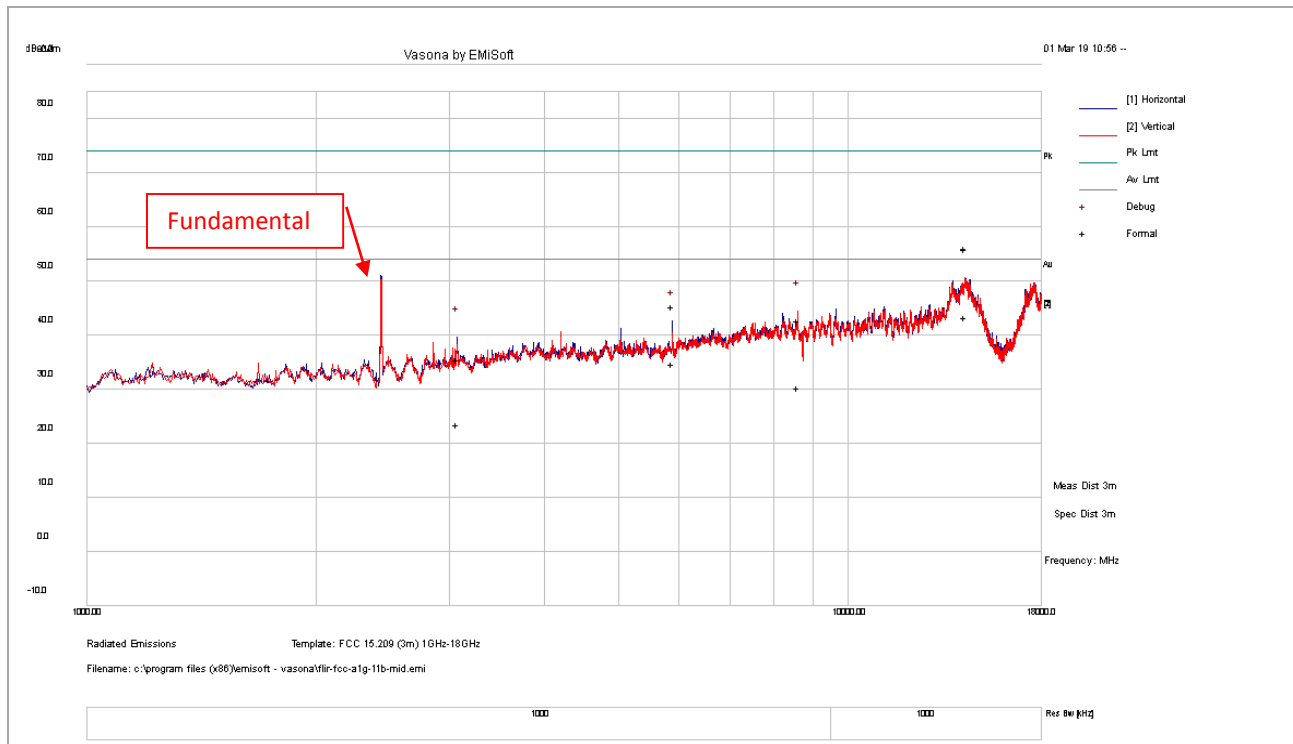
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14265.25	25.28	20.31	8.13	53.73	PK	H	360	131	74	-20.28
2412.86	52.79	10.84	-9.83	53.80	PK	V	325	28	74	-20.20
8218.64	27.87	15.82	-0.38	43.31	PK	H	259	86	74	-30.69
5880.03	33.98	13.64	-3.81	43.81	PK	V	114	35	74	-30.19
14265.25	15.01	20.31	8.13	43.46	AV	H	360	131	54	-10.55
2412.86	49.68	10.84	-9.83	50.69	AV	V	325	28	54	-3.31
8218.64	16.02	15.82	-0.38	31.46	AV	H	259	86	54	-22.54
5880.03	25.45	13.64	-3.81	35.28	AV	V	114	35	54	-18.72

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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11b-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



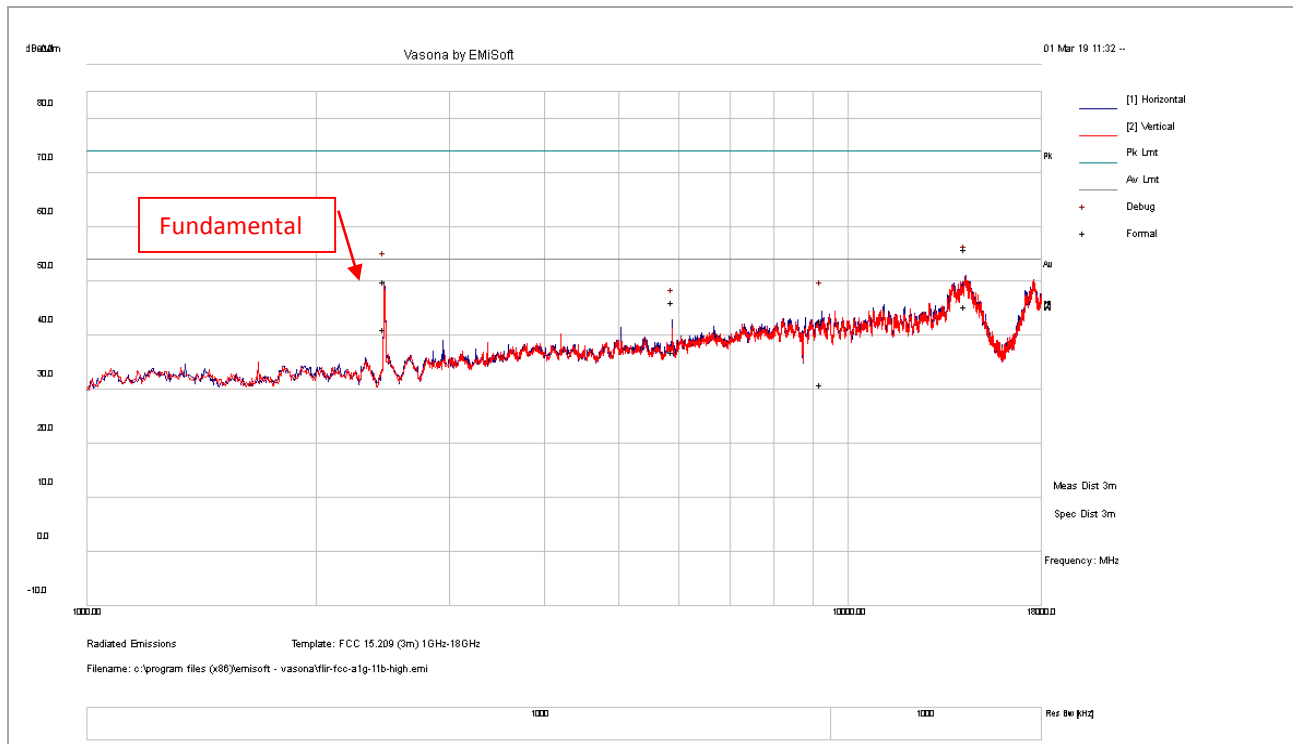
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14269.26	27.55	20.32	8.14	56.02	PK	V	205	30	74	-17.98
8608.06	26.85	15.88	0.04	42.77	PK	V	229	252	74	-31.23
5880.67	35.64	13.64	-3.80	45.48	PK	H	232	0	74	-28.53
3066.07	32.23	11.44	-7.97	35.70	PK	H	310	180	74	-38.30
14269.26	15.04	20.32	8.14	43.51	AV	V	205	30	54	-10.49
8608.06	14.49	15.88	0.04	30.41	AV	V	229	252	54	-23.59
5880.67	25.04	13.64	-3.80	34.88	AV	H	232	0	54	-19.12
3066.07	20.07	11.44	-7.97	23.54	AV	H	310	180	54	-30.46

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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11b-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



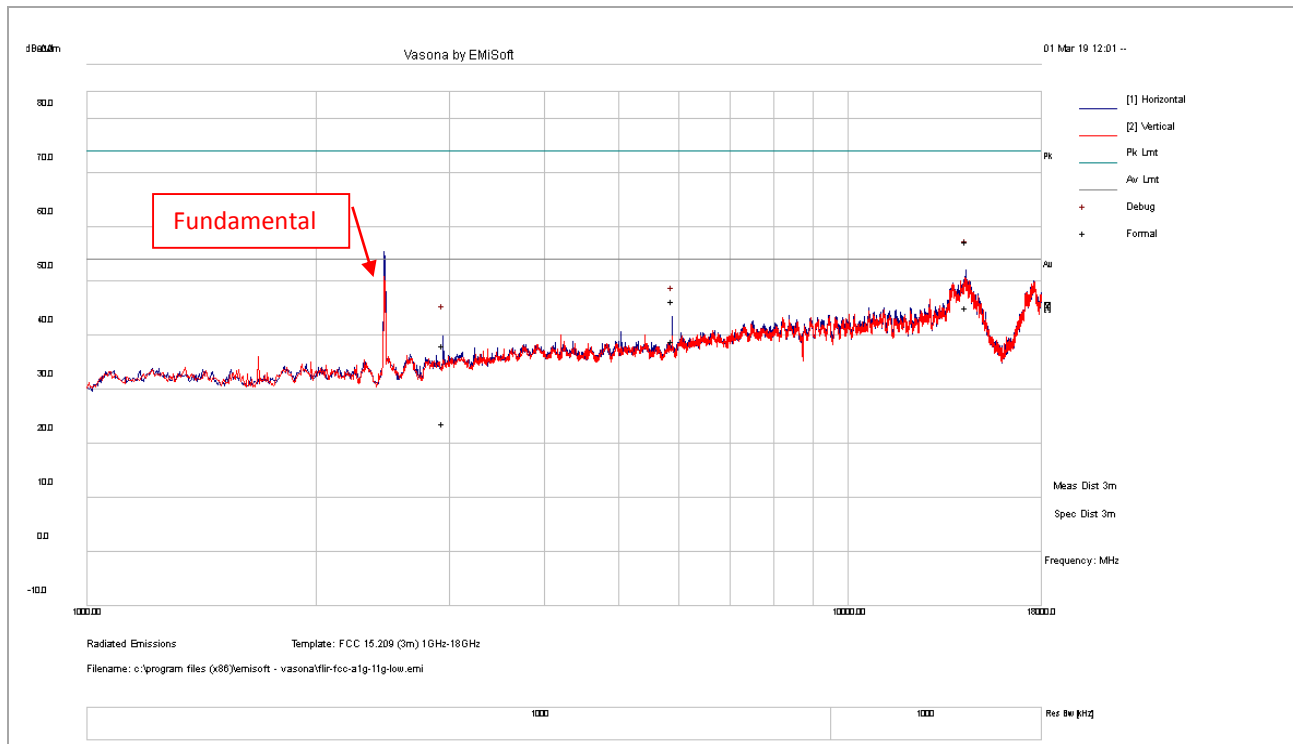
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14292.03	27.35	20.38	8.22	55.95	PK	H	315	127	74	-18.05
2461.97	48.71	10.88	-9.64	49.96	PK	H	152	83	74	-24.05
9240.04	26.59	16.28	-0.13	42.75	PK	H	255	160	74	-31.25
5880.39	36.39	13.64	-3.80	46.23	PK	H	224	0	74	-27.77
14292.03	16.79	20.38	8.22	45.39	AV	H	315	127	54	-8.61
2461.97	40.03	10.88	-9.64	41.28	AV	H	152	83	54	-12.72
9240.04	14.84	16.28	-0.13	30.99	AV	H	255	160	54	-23.01
5880.39	27.12	13.64	-3.80	36.96	AV	H	224	0	54	-17.04

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Product: Elara Radar
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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11g-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



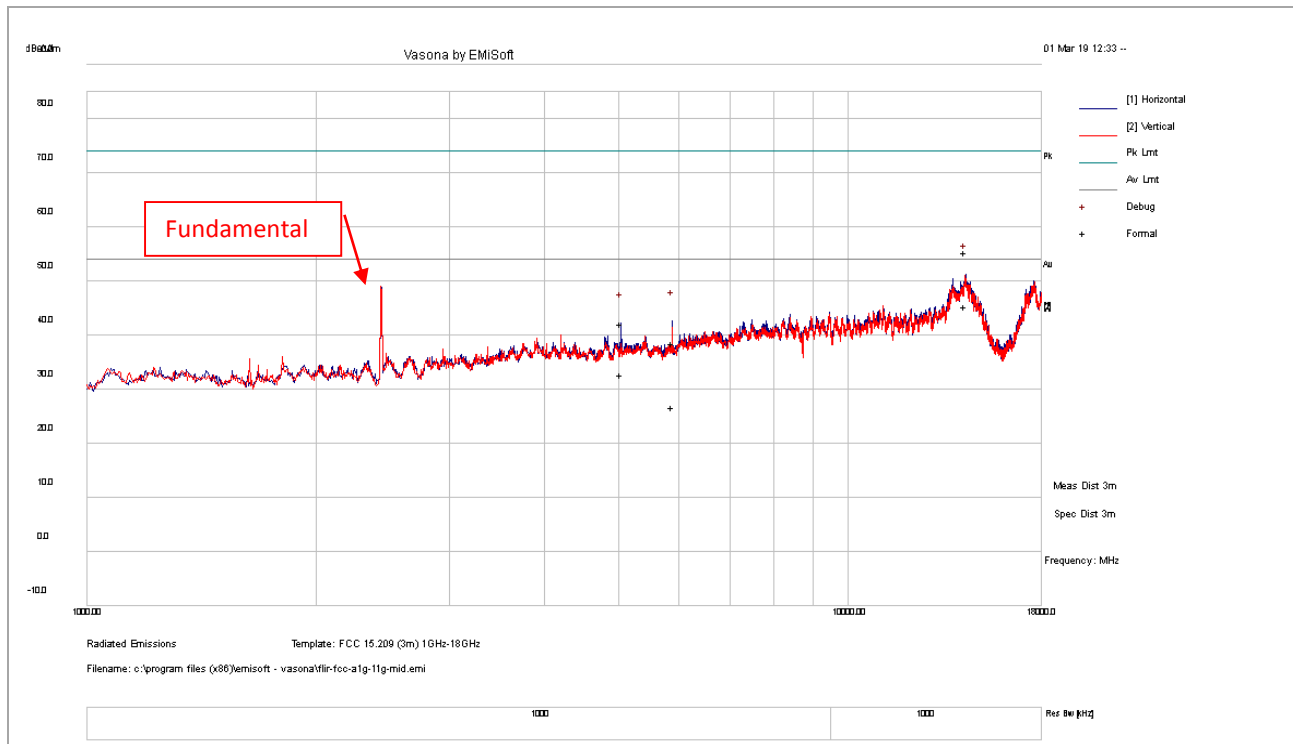
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14314.70	28.72	20.43	8.29	57.44	PK	H	339	241	74	-16.56
5880.21	36.53	13.64	-3.81	46.36	PK	H	222	1	74	-27.64
2940.03	35.44	11.32	-8.47	38.28	PK	H	245	85	74	-35.72
14314.70	16.60	20.43	8.29	45.33	AV	H	339	241	54	-8.67
5880.21	29.21	13.64	-3.81	39.04	AV	H	222	1	54	-14.96
2940.03	20.92	11.32	-8.47	23.76	AV	H	245	85	54	-30.24

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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11g-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14296.88	26.78	20.39	8.24	55.41	PK	H	400	303	74	-18.59
5881.94	28.77	13.64	-3.79	38.62	PK	V	287	344	74	-35.38
5039.41	34.89	12.91	-5.56	42.24	PK	H	100	0	74	-31.76
14296.88	16.79	20.39	8.24	45.42	AV	H	400	303	54	-8.58
5881.94	16.99	13.64	-3.79	26.84	AV	V	287	344	54	-27.16
5039.41	25.50	12.91	-5.56	32.85	AV	H	100	0	54	-21.16

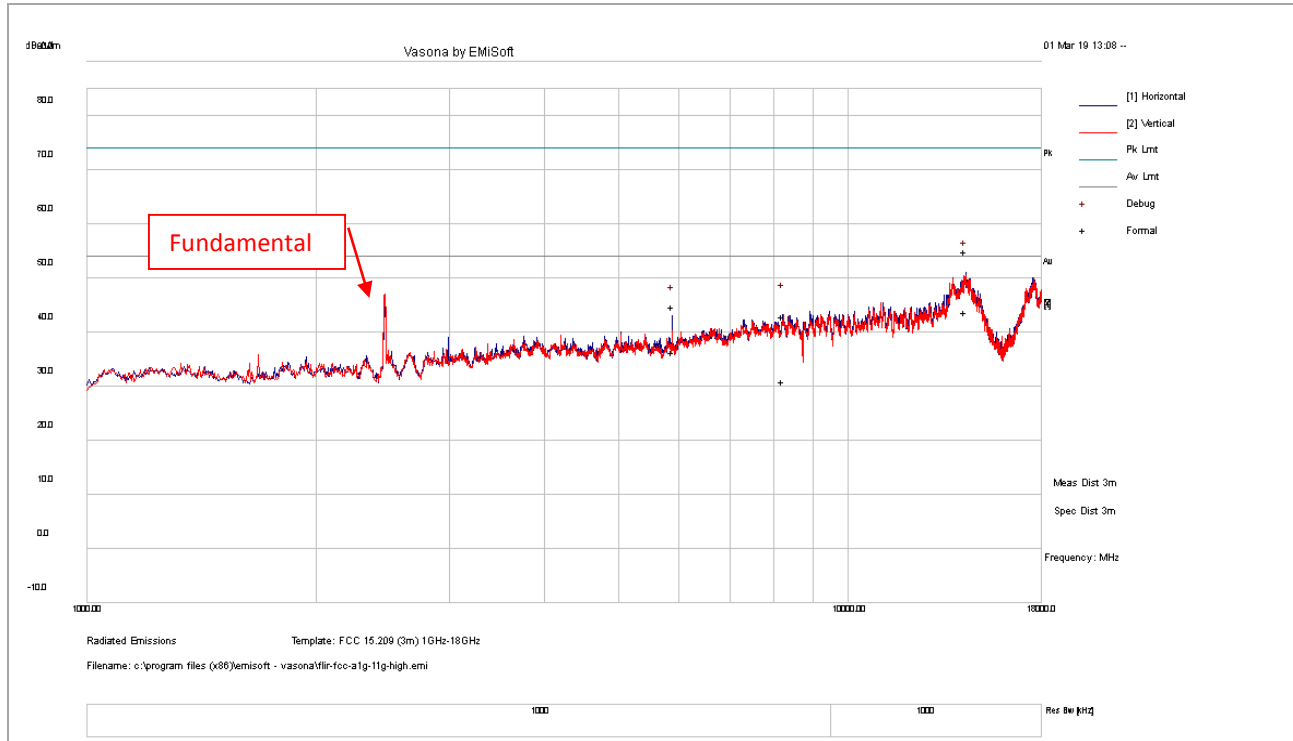
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Test Standard:	15.209	Mode:	11g-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14302.99	26.39	20.41	8.26	55.06	PK	H	196	303	74	-18.94
8228.32	27.64	15.82	-0.35	43.11	PK	V	276	233	74	-30.89
5880.36	35.02	13.64	-3.80	44.86	PK	H	291	358	74	-29.14
14302.99	15.13	20.41	8.26	43.79	AV	H	196	303	54	-10.21
8228.32	15.51	15.82	-0.35	30.98	AV	V	276	233	54	-23.02
5880.36	26.68	13.64	-3.80	36.51	AV	H	291	358	54	-17.49



Electromagnetic Compatibility
Radio Frequency
Product Certification
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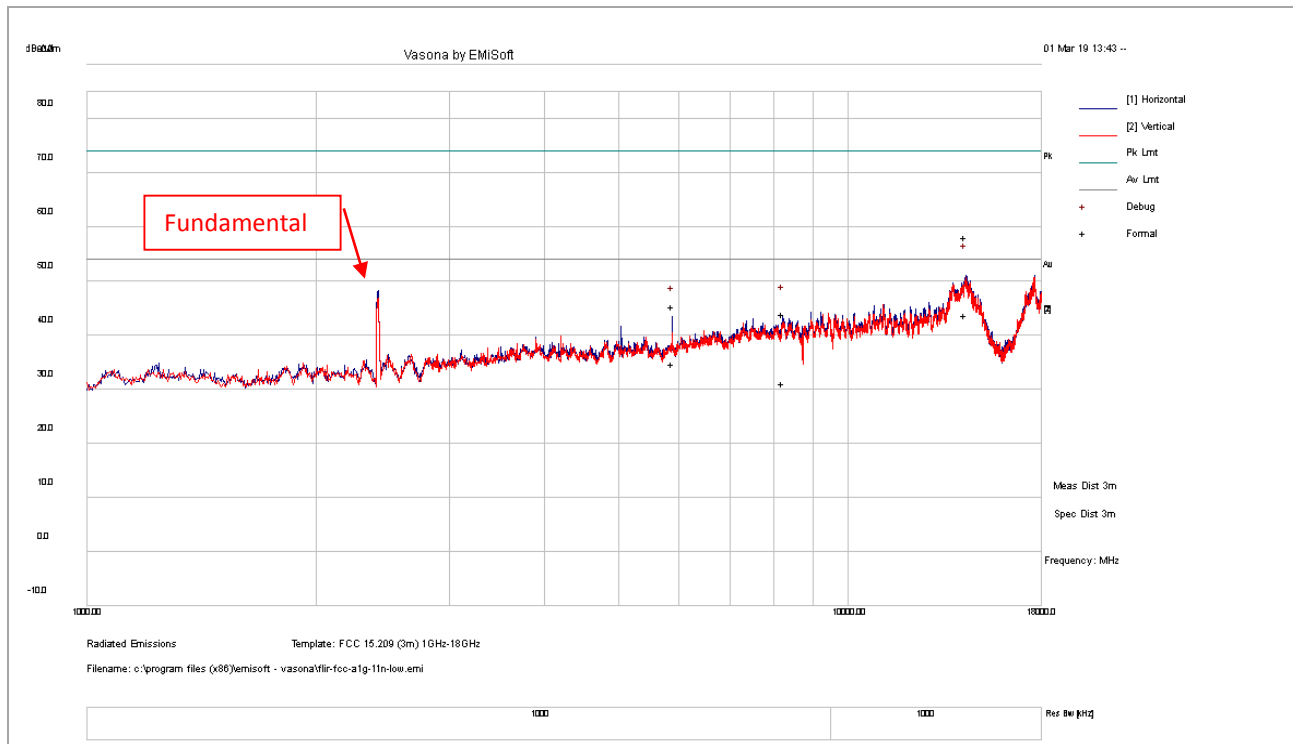
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Report Number: FLR-19111521-LC-RF-FCC-WLAN
Product: Elara Radar
Model Number: R290



1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11n-2412MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



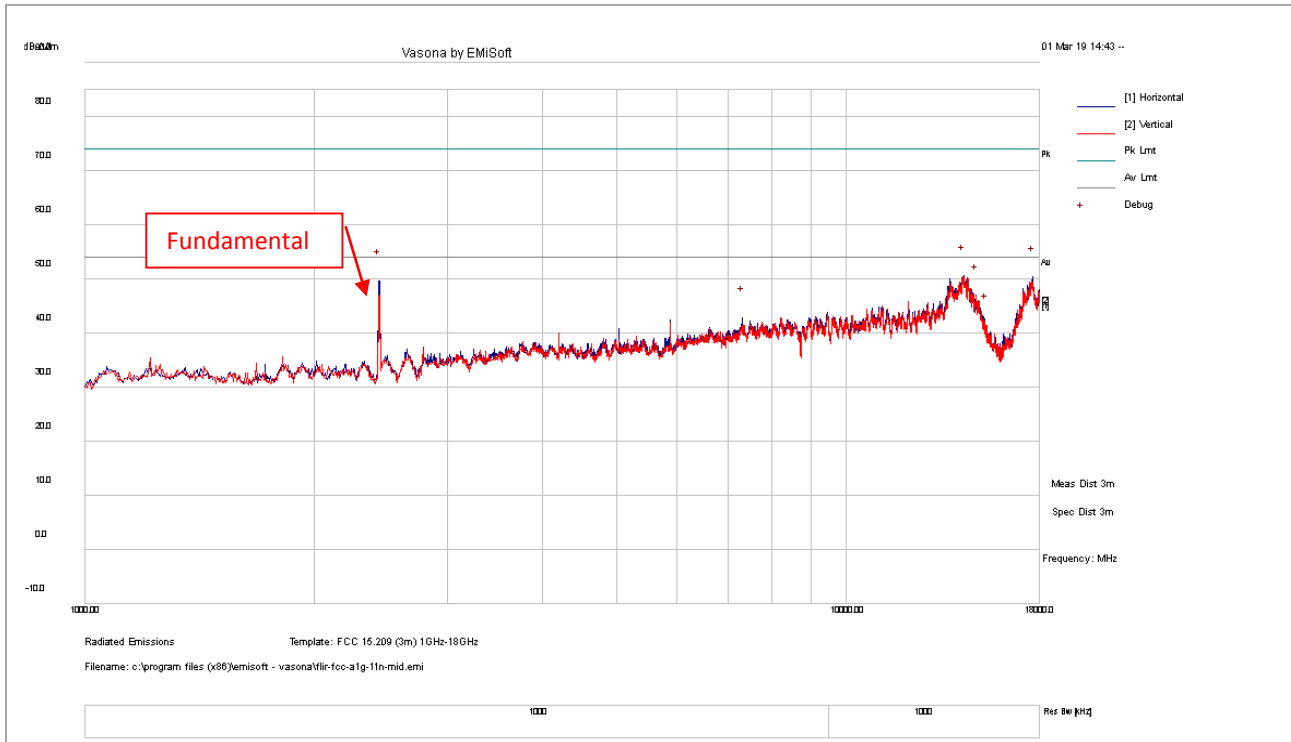
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14295.58	29.59	20.39	8.23	58.21	PK	H	365	284	74	-15.79
8210.58	28.62	15.82	-0.41	44.02	PK	H	100	108	74	-29.98
5880.65	35.57	13.64	-3.80	45.41	PK	H	275	5	74	-28.59
14295.58	15.20	20.39	8.23	43.82	AV	H	365	284	54	-10.18
8210.58	15.89	15.82	-0.41	31.29	AV	H	100	108	54	-22.71
5880.65	24.99	13.64	-3.80	34.83	AV	H	275	5	54	-19.17

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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11n-2437MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



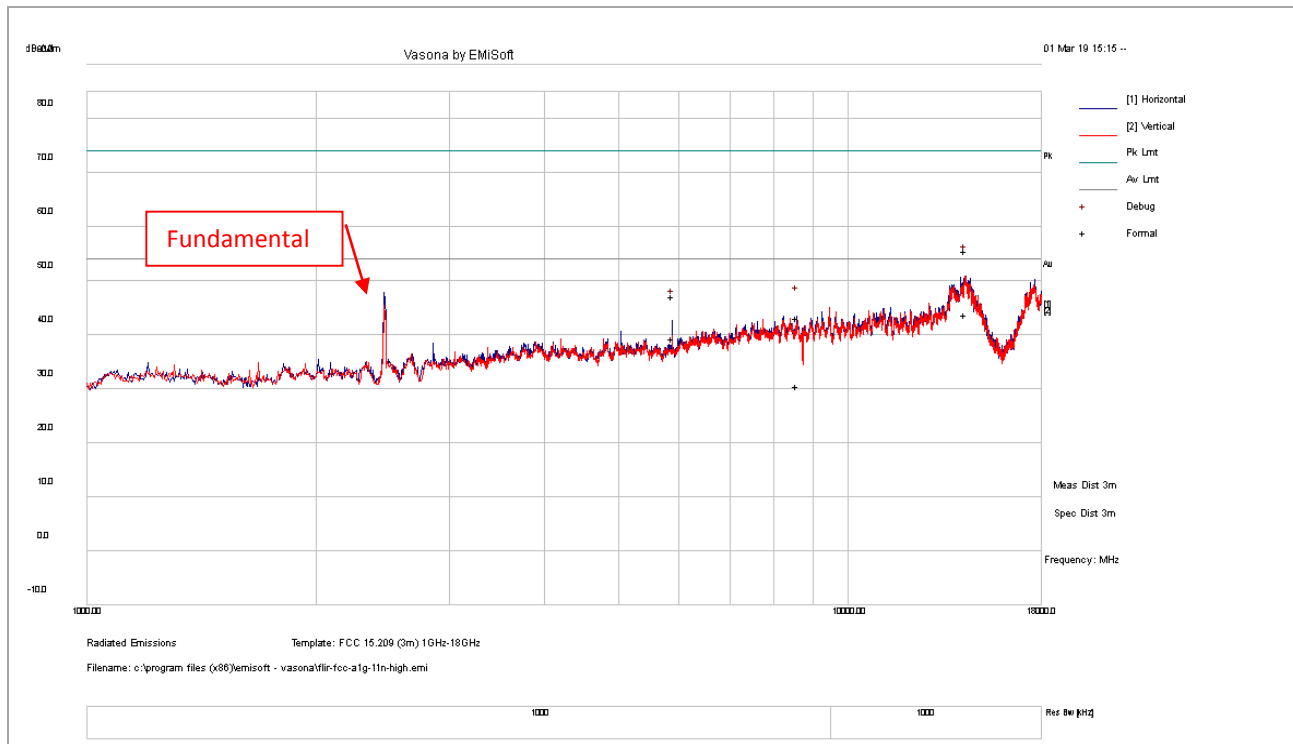
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7316.56	28.72	15.42	-1.19	42.95	PK	H	162	35	74	-31.05
14286.56	22.15	20.37	8.20	50.72	PK	H	102	27	74	-23.28
15306.56	16.12	22.07	3.35	41.54	PK	V	261	109	74	-32.46
7316.56	15.28	15.42	-1.19	29.51	AV	H	187	28	54	-24.49
14286.56	16.21	20.37	8.20	44.78	AV	H	129	72	54	-9.22
15306.56	10.73	22.07	3.35	36.15	AV	V	116	182	54	-17.85

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1GHz – 18GHz test result

Test Standard:	15.209	Mode:	11n-2462MHz
Frequency Range:	1GHz-18GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



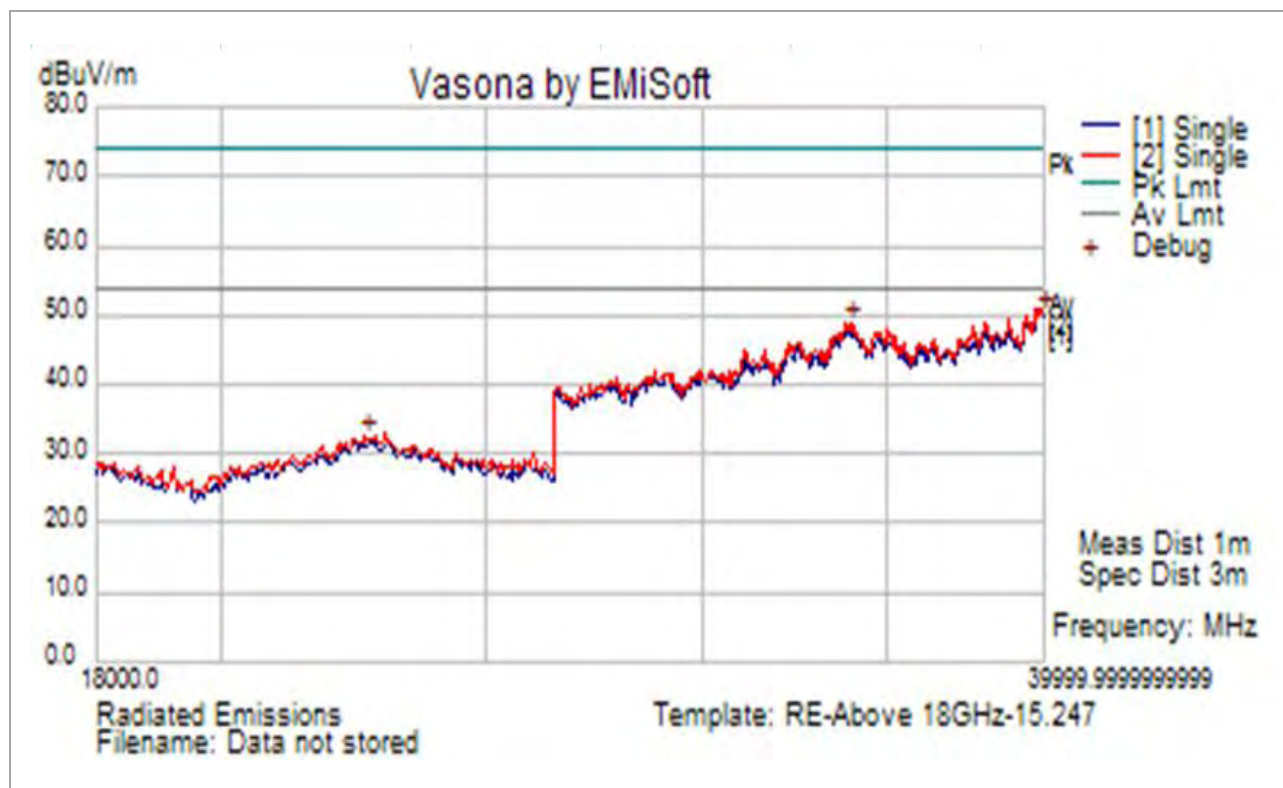
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
14296.08	27.08	20.39	8.23	55.70	PK	H	182	38	74	-18.30
8582.13	27.32	15.88	0.02	43.22	PK	H	214	25	74	-30.79
5880.20	37.47	13.64	-3.81	47.30	PK	H	221	6	74	-26.70
14296.08	15.18	20.39	8.23	43.80	AV	H	182	38	54	-10.20
8582.13	14.76	15.88	0.02	30.66	AV	H	214	25	54	-23.34
5880.20	29.60	13.64	-3.81	39.43	AV	H	221	6	54	-14.57

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Product:	Elara Radar
Model Number:	R290



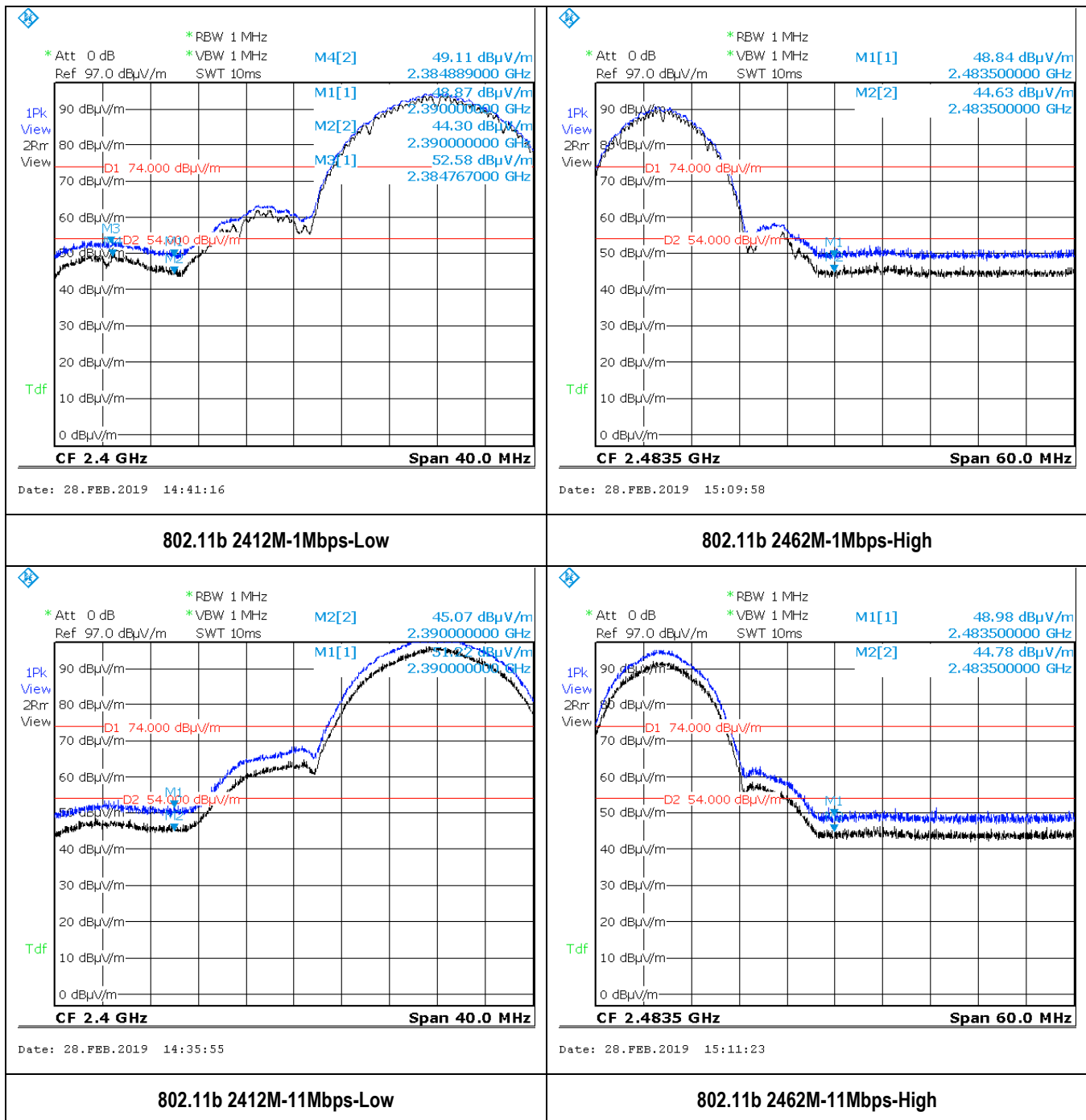
18GHz – 40GHz test result

Test Standard:	15.209	Mode:	11g-2437MHz
Frequency Range:	18GHz-40GHz	Test Date:	03/01/2019
Antenna Type/Polarity:	Horn/Hor & Ver	Test Personnel:	Sherwin Lee
Remark:	N/A	Test Result:	Pass



Note: no substantial emission is found other than the noise floor. Different modes have been verified and the worst case one is presented here.

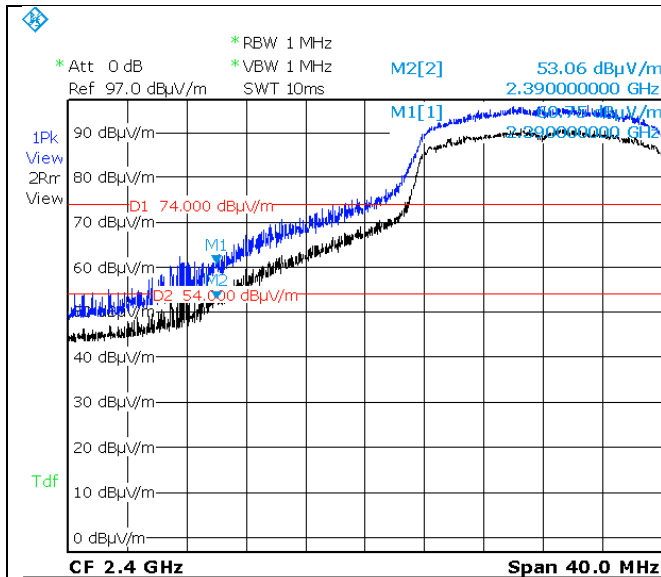
Restricted Band Measurement Plots:



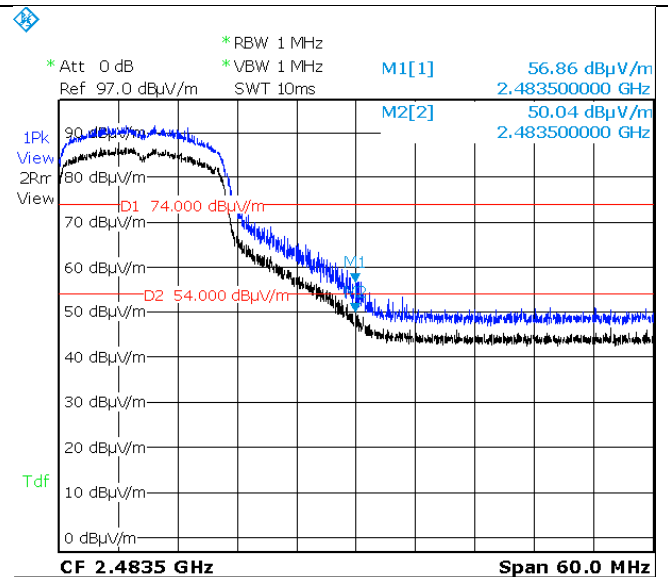
Report Number: FLR-19111521-LC-RF-FCC-WLAN
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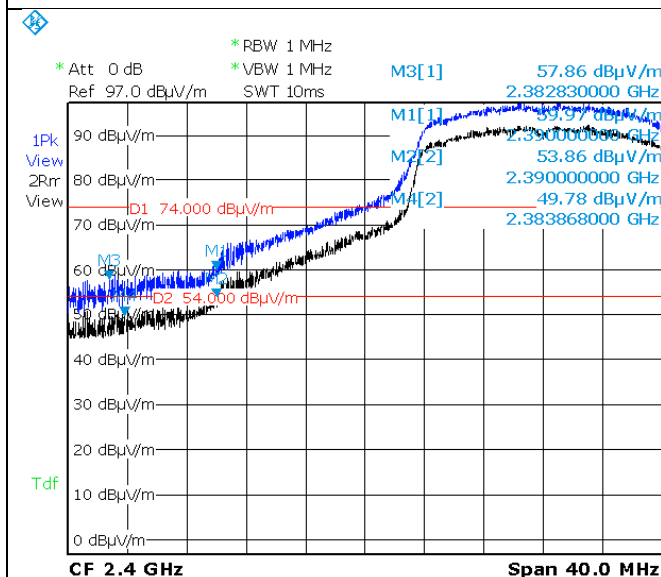


Date: 28.FEB.2019 14:44:47



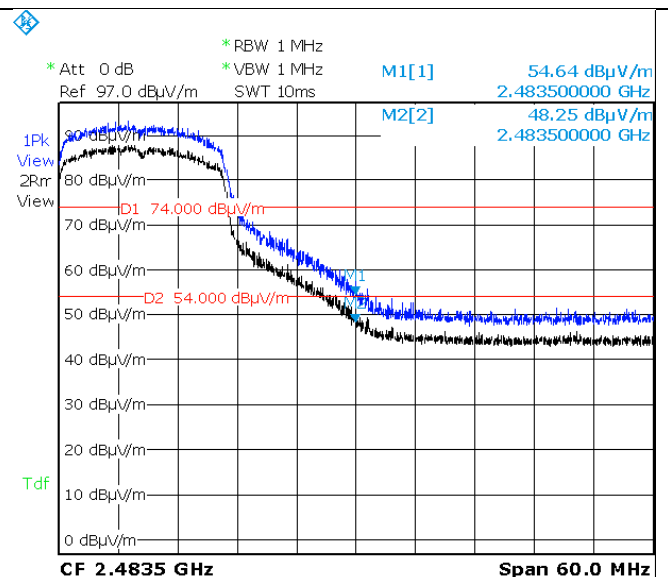
Date: 28.FEB.2019 15:12:13

802.11g 2412M-6Mbps-Low



Date: 28.FEB.2019 14:59:56

802.11g 2462M-6Mbps-High



Date: 28.FEB.2019 15:13:28

802.11g 2412M-54Mbps-Low



802.11g 2462M-54Mbps-High



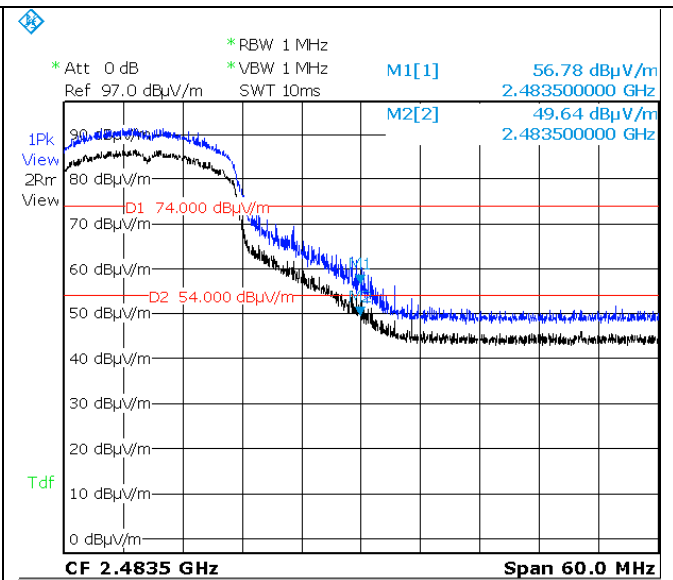
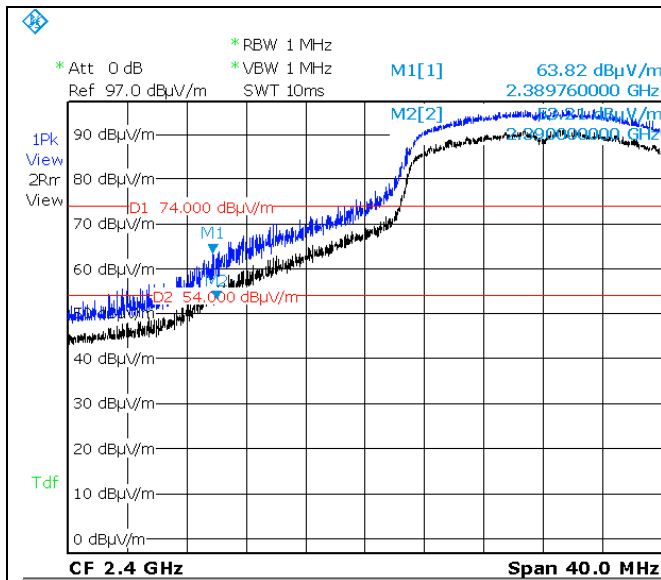
Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

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

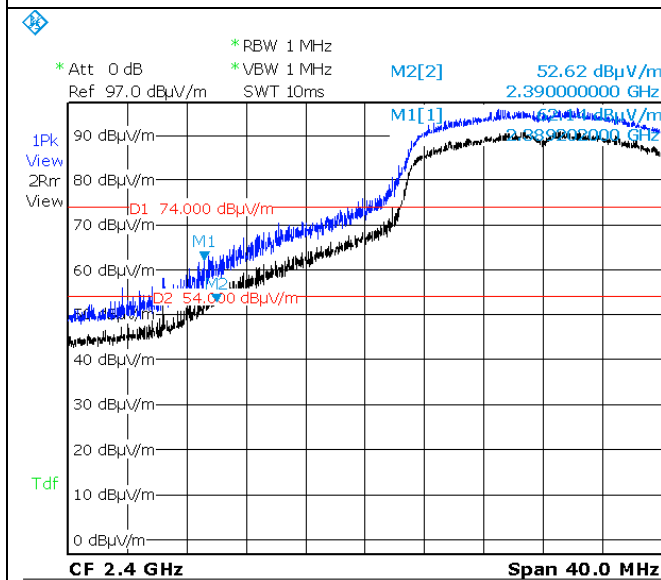
Report Number: FLR-19111521-LC-RF-FCC-WLAN
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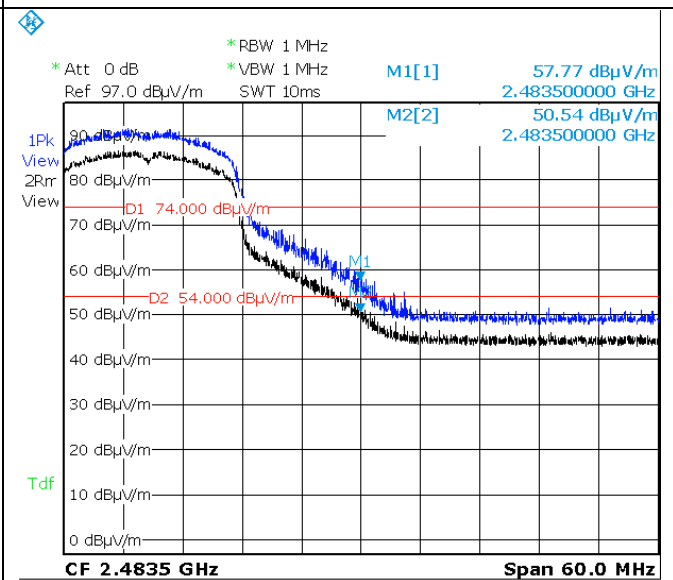
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802.11n 2412M-MCS0-Low



802.11n 2462M-MCS0-High



802.11n 2412M-MCS7-Low

802.11n 2462M-MCS7-High



Electromagnetic Compatibility
Radio Frequency
Product Certification
International Approval

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8.7 Conducted Emissions

8.7.1 Requirement

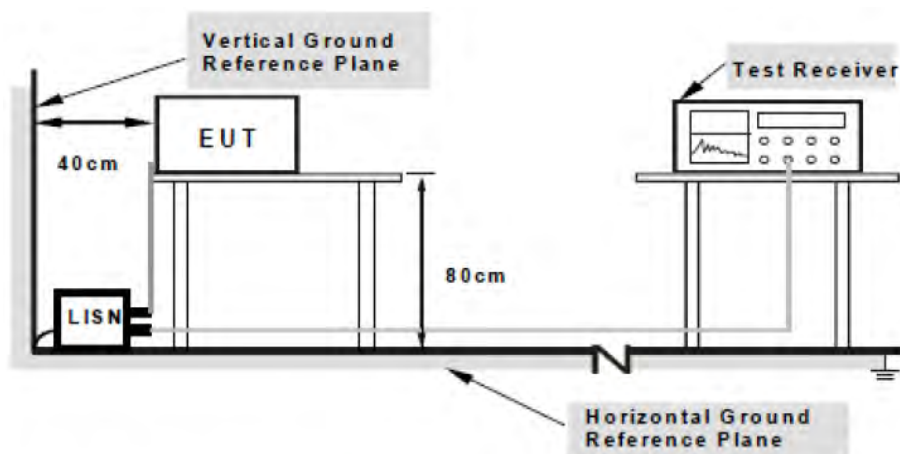
Per § 15.207 (a), an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.

8.7.2 Test setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

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8.7.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

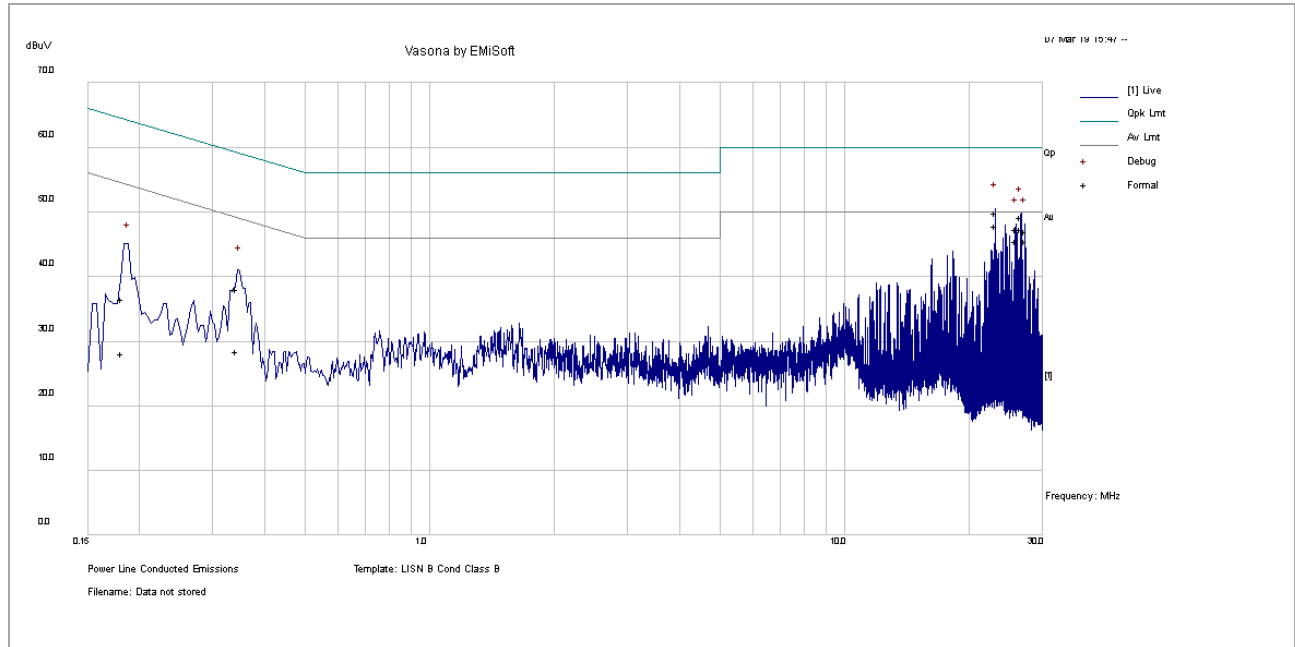
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8.7.4 Test Result

Live Line

Test Standard:	47CFR 15.207	Mode:	Line
Frequency Range:	0.15-30MHz	Test Date:	03/07/2019
Antenna Type/Polarity:	N/A	Test Personnel:	Sherwin Lee
Remark:	120VAC, 60Hz	Test Result:	Pass



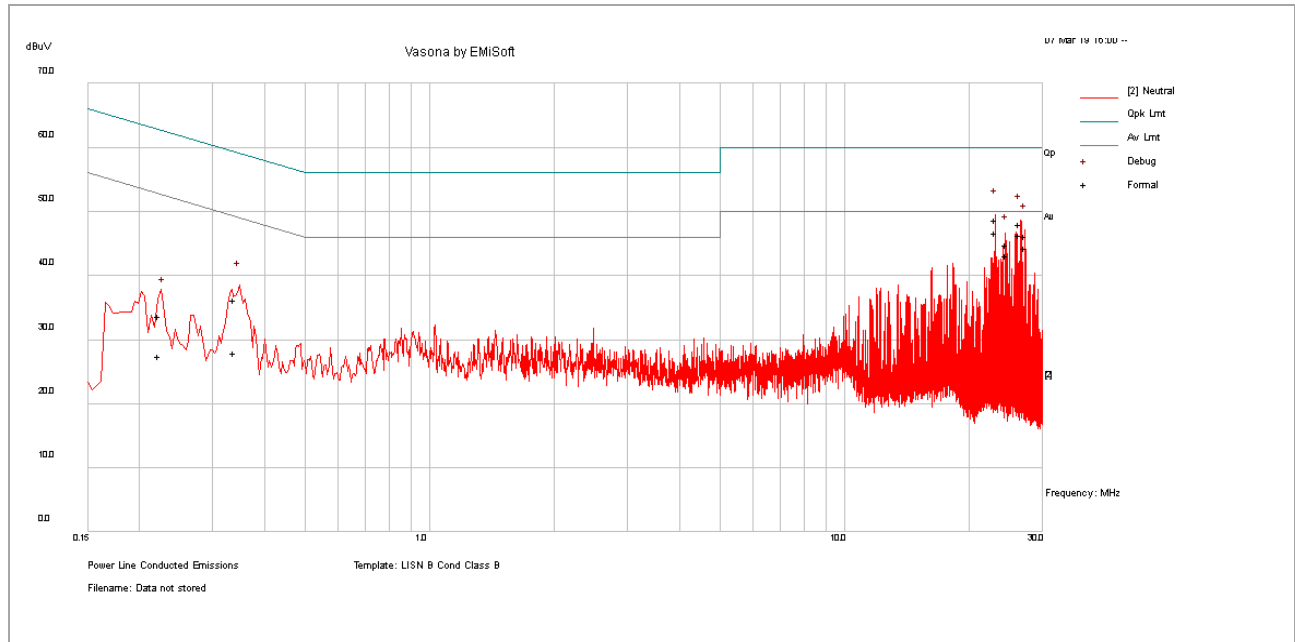
Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
23.13	38.14	11.20	0.61	49.96	QP	Live	60.00	-10.04	Pass
26.61	37.15	11.33	0.77	49.26	QP	Live	60.00	-10.74	Pass
25.88	35.27	11.30	0.73	47.30	QP	Live	60.00	-12.70	Pass
27.16	34.85	11.35	0.87	47.06	QP	Live	60.00	-12.94	Pass
0.34	27.61	10.36	0.13	38.09	QP	Live	59.12	-21.03	Pass
0.18	26.04	10.33	0.20	36.57	QP	Live	64.41	-27.84	Pass
23.13	36.06	11.20	0.61	47.88	AV	Live	50.00	-2.12	Pass
26.61	35.22	11.33	0.77	47.33	AV	Live	50.00	-2.67	Pass
25.88	33.55	11.30	0.73	45.58	AV	Live	50.00	-4.42	Pass
27.16	33.26	11.35	0.87	45.47	AV	Live	50.00	-4.53	Pass
0.34	18.00	10.36	0.13	28.49	AV	Live	49.12	-20.63	Pass
0.18	17.56	10.33	0.20	28.09	AV	Live	54.41	-26.32	Pass

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Neutral Line

Test Standard:	47CFR 15.207	Mode:	Neutral
Frequency Range:	0.15-30MHz	Test Date:	03/07/2019
Antenna Type/Polarity:	N/A	Test Personnel:	Sherwin Lee
Remark:	120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
23.13	36.86	11.20	0.61	48.67	QP	Neutral	60.00	-11.33	Pass
26.49	35.99	11.33	0.77	48.08	QP	Neutral	60.00	-11.92	Pass
27.16	34.00	11.35	0.87	46.21	QP	Neutral	60.00	-13.79	Pass
24.53	32.98	11.26	0.68	44.91	QP	Neutral	60.00	-15.09	Pass
0.34	25.66	10.36	0.13	36.15	QP	Neutral	59.22	-23.07	Pass
0.22	23.26	10.34	0.17	33.77	QP	Neutral	62.74	-28.96	Pass
23.13	34.85	11.20	0.61	46.67	AV	Neutral	50.00	-3.33	Pass
26.49	34.23	11.33	0.77	46.33	AV	Neutral	50.00	-3.67	Pass
27.16	32.18	11.35	0.87	44.40	AV	Neutral	50.00	-5.60	Pass
24.53	31.13	11.26	0.68	43.07	AV	Neutral	50.00	-6.93	Pass
0.34	17.48	10.36	0.13	27.97	AV	Neutral	49.22	-21.26	Pass
0.22	17.02	10.34	0.17	27.53	AV	Neutral	52.74	-25.21	Pass

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9 Test instrument list

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