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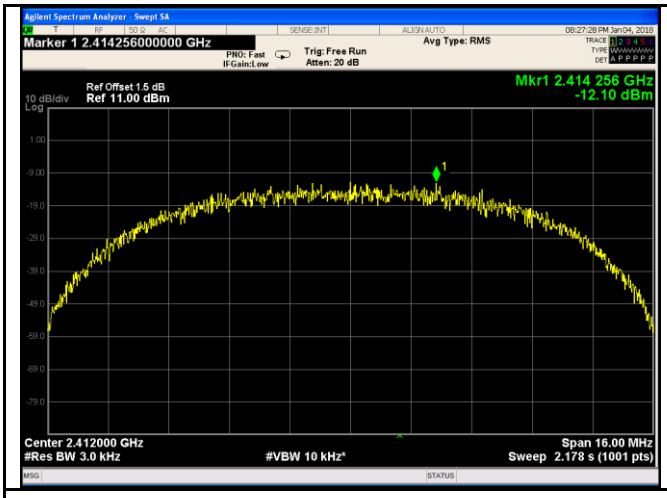
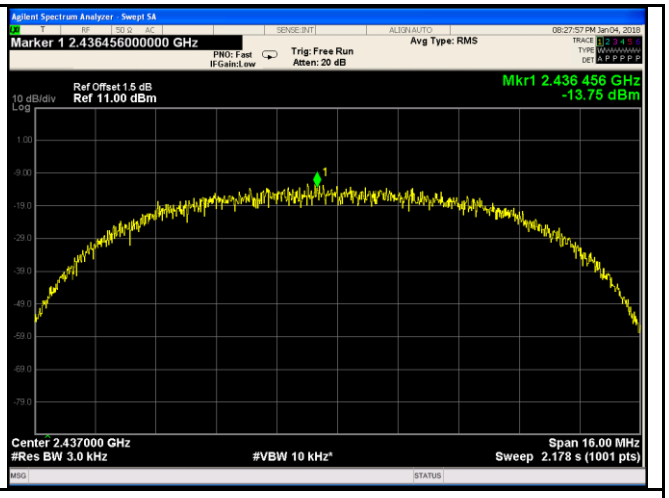
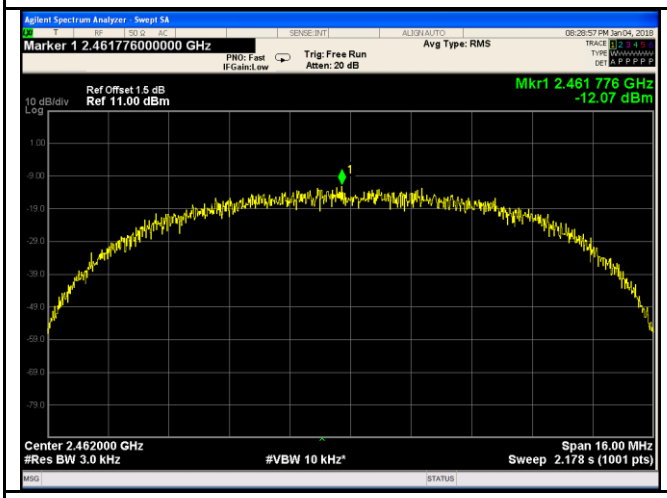


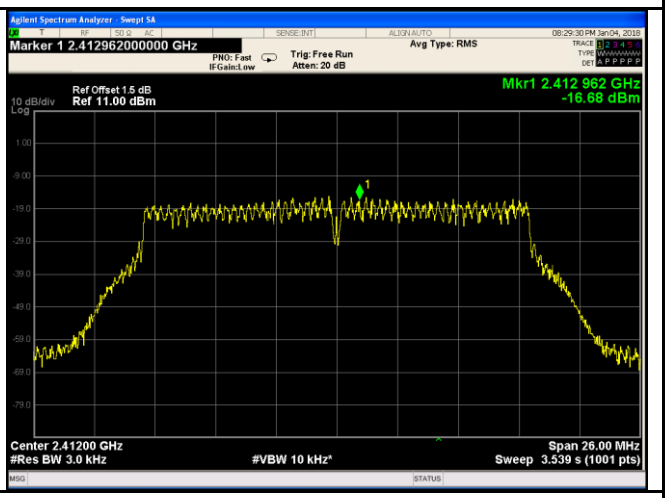
802.11b - Low CH 2412



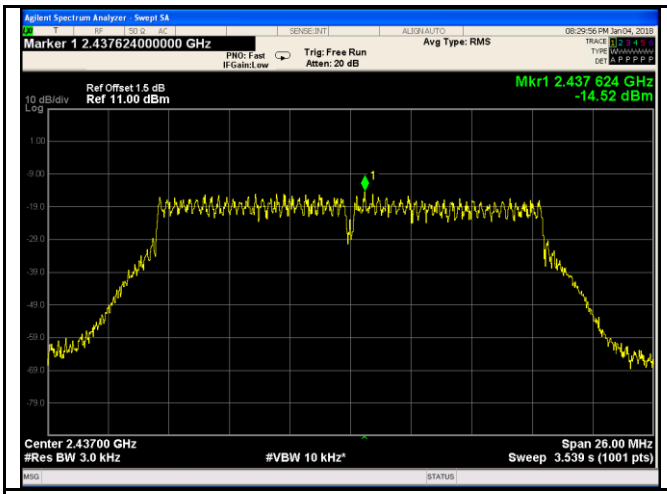
802.11b - Mid CH 2437



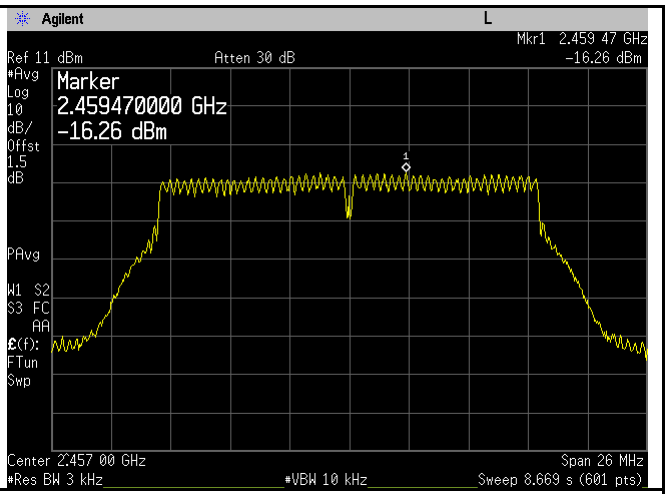
802.11b - High CH 2462



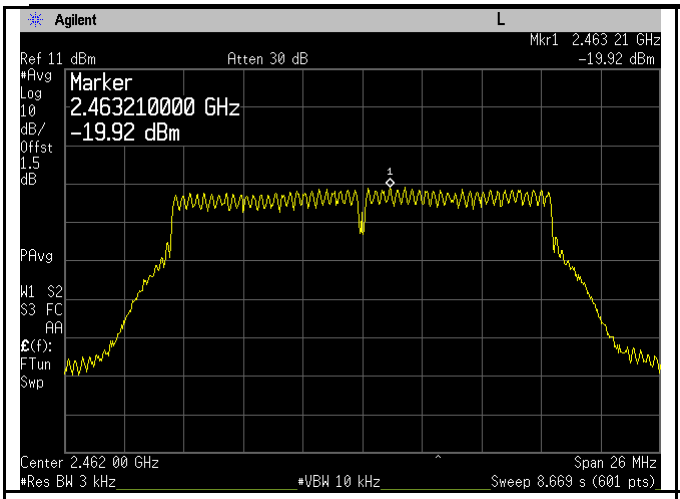
802.11g - 1 CH 2412



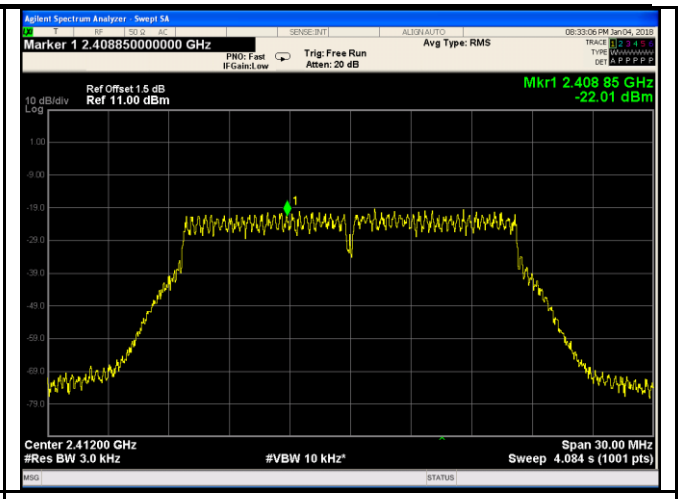
802.11g - 6 CH 2437



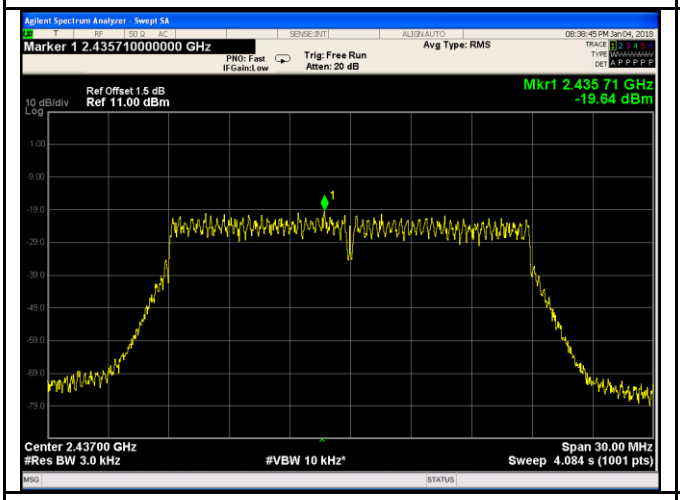
802.11g - 10 CH 2457



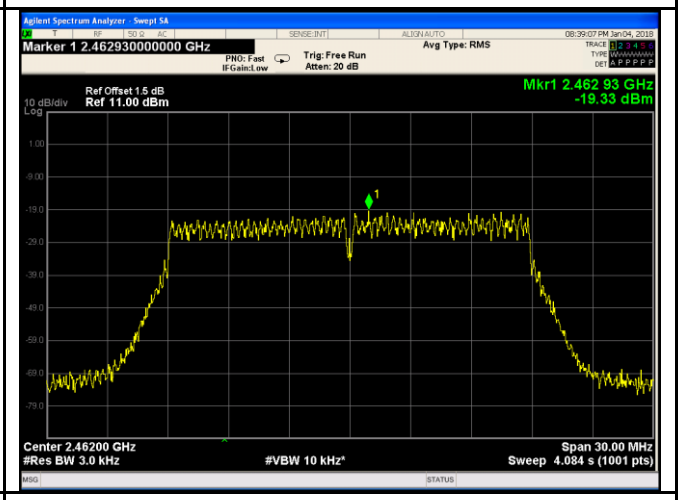
802.11g - 11 CH 2462



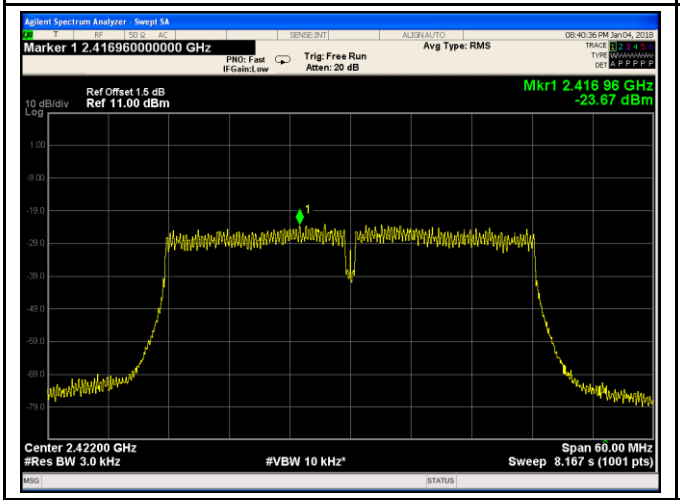
802.11n20 - 1 CH 2412



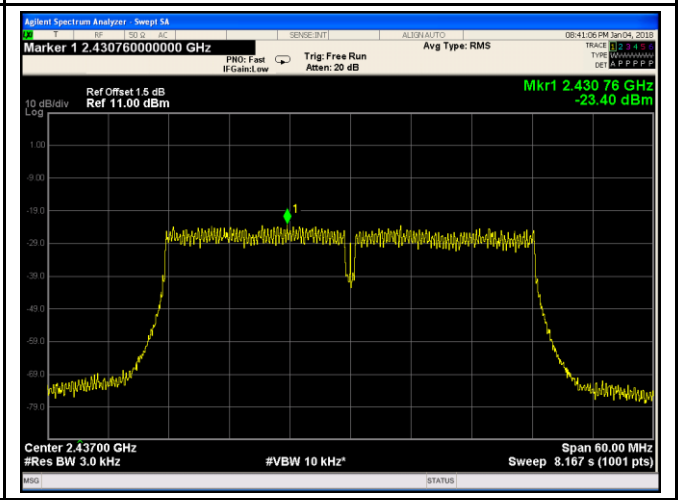
802.11n20 - 6 CH 2437



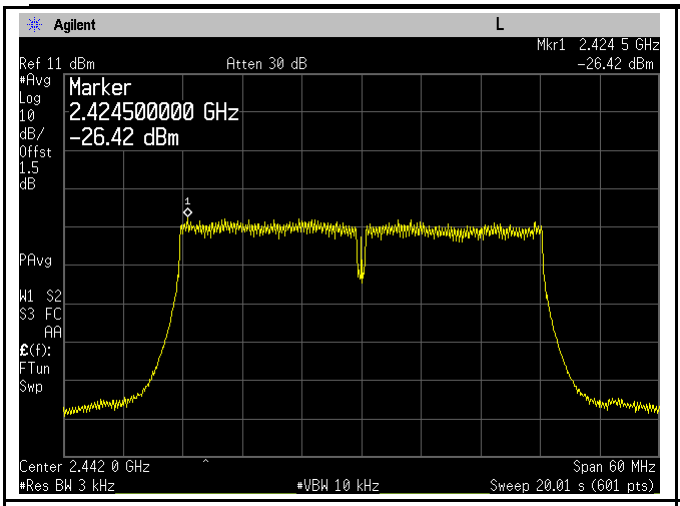
802.11n20 - 11 CH 2462



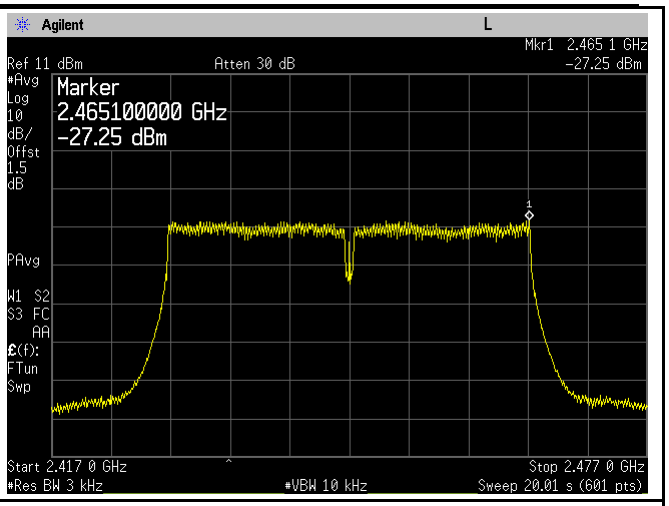
802.11n40 - 3 CH 2422



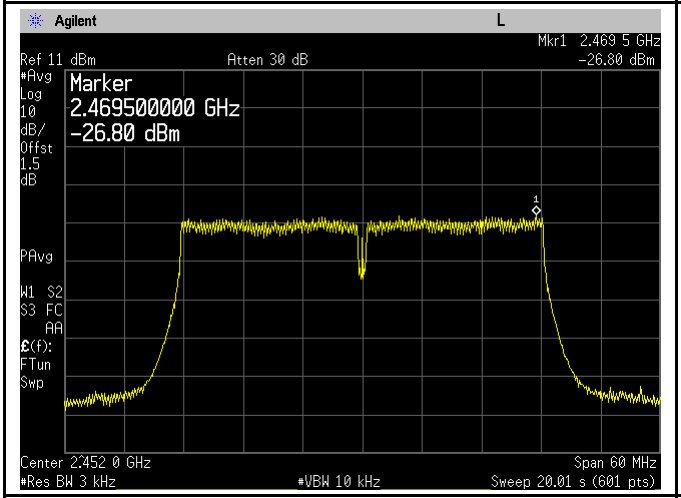
802.11n40 – 6 CH 2437



802.11n40 - 7 CH 2442

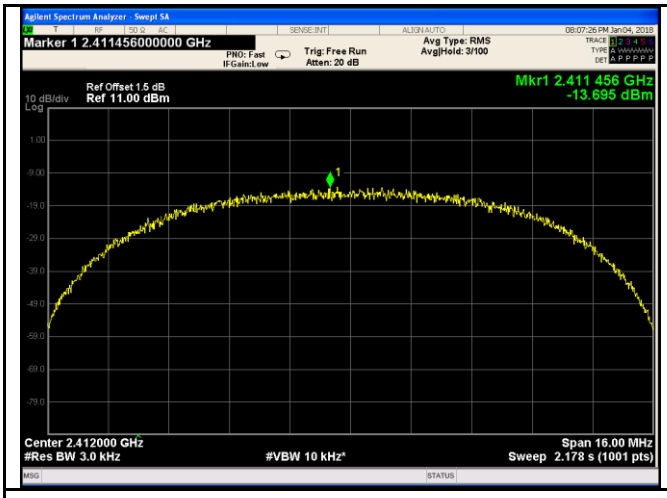


802.11n40 - 8 CH 2447

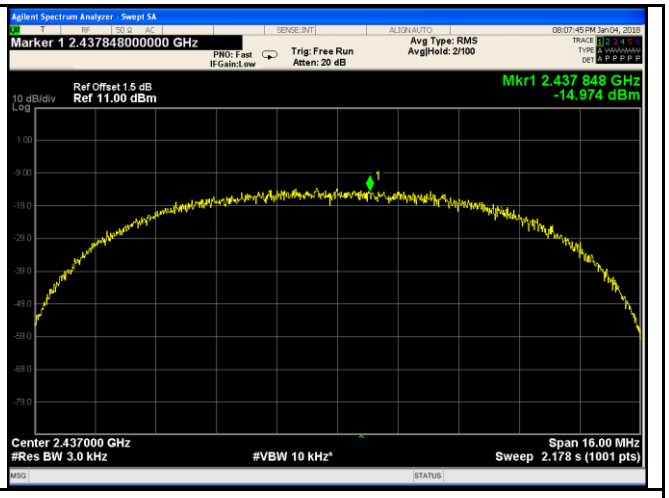


802.11n40 - 9 CH 2452

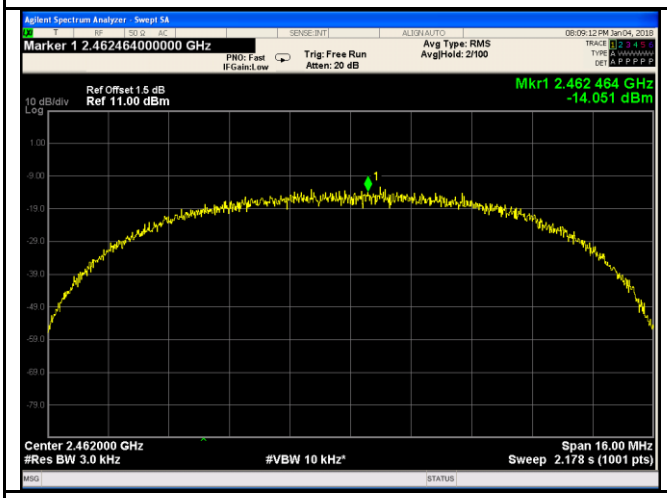
Antenna (Black):



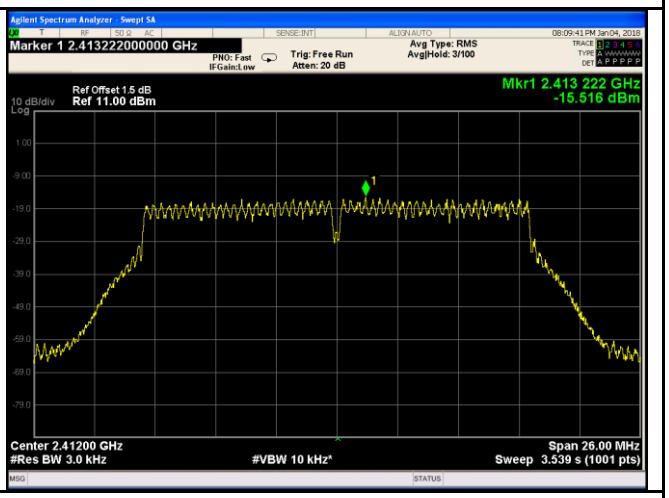
802.11b - Low CH 2412



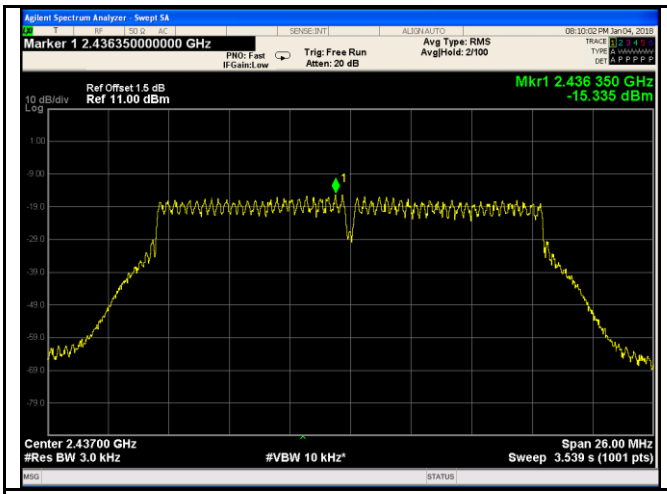
802.11b - Mid CH 2437



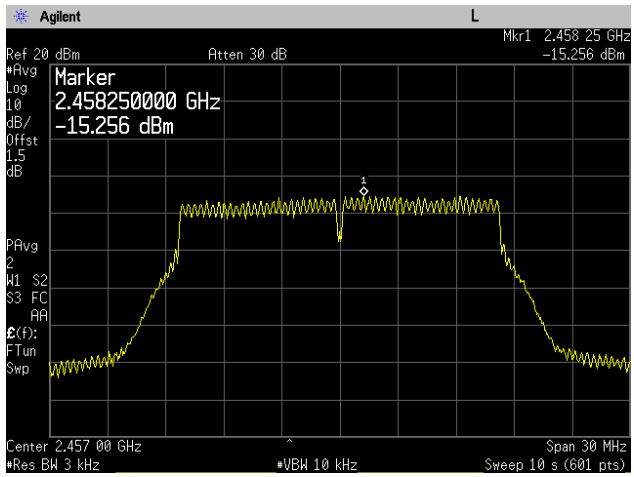
802.11b - High CH 2462



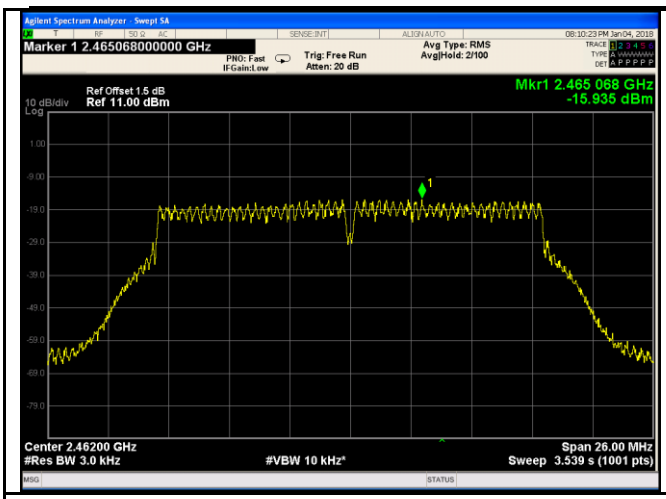
802.11g - 1 CH 2412



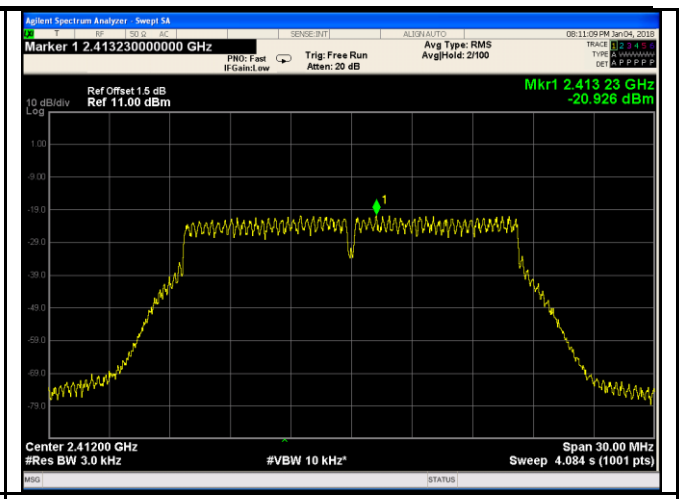
802.11g - 6 CH 2437



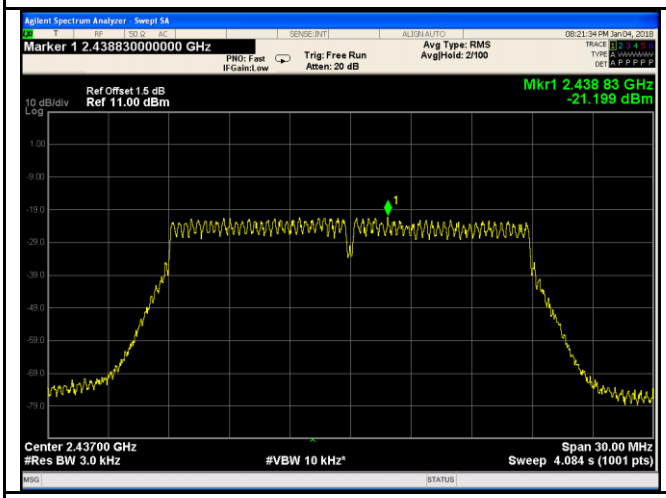
802.11g - 10 CH 2457



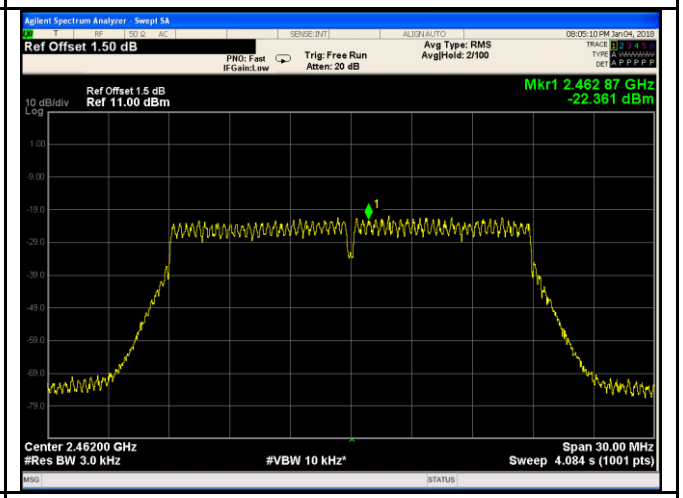
802.11g - 11 CH 2462



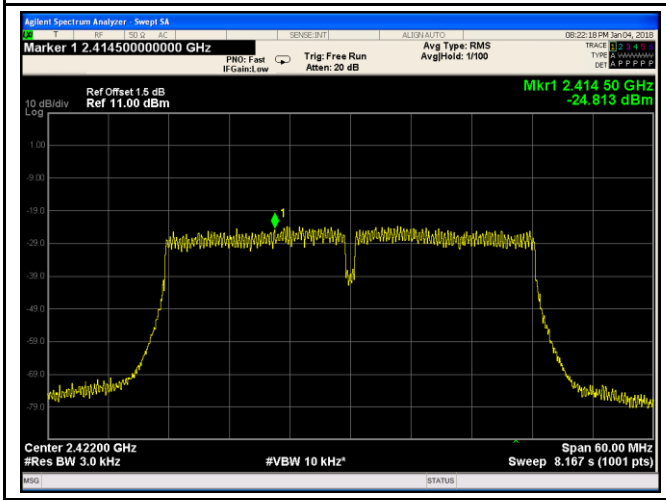
802.11n20 - 1 CH 2412



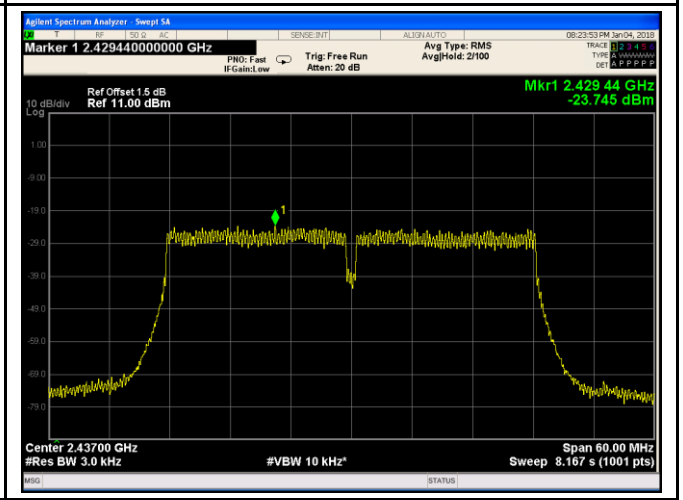
802.11n20 - 6 CH 2437



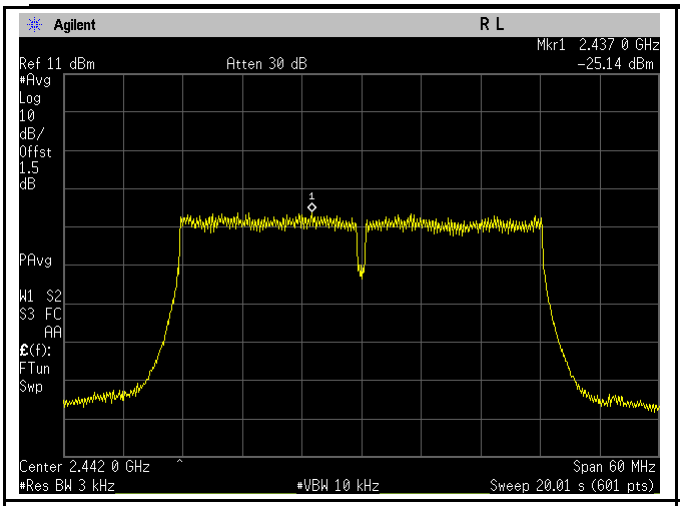
802.11n20 - 11 CH 2462



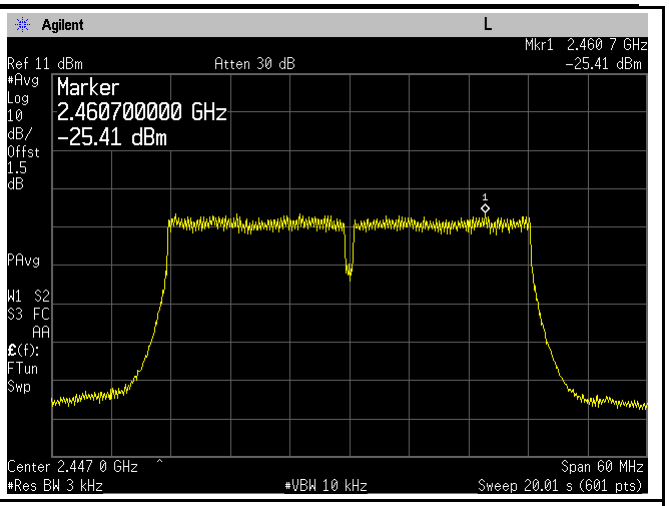
802.11n40 - 3 CH 2422



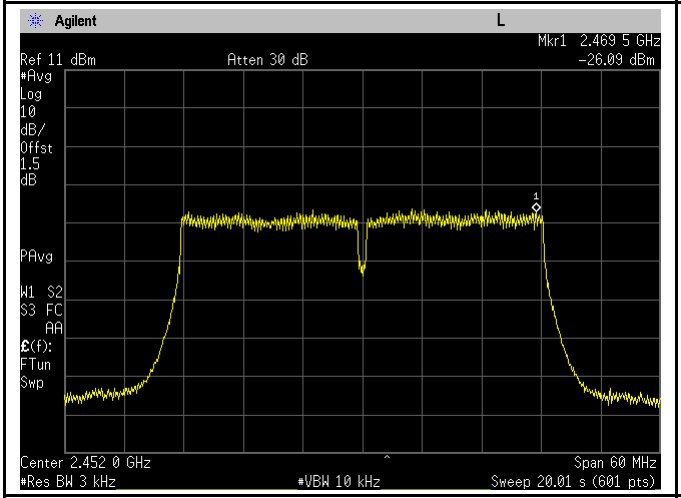
802.11n40 – 6 CH 2437



802.11n40 - 7 CH 2442



802.11n40 - 8 CH 2447

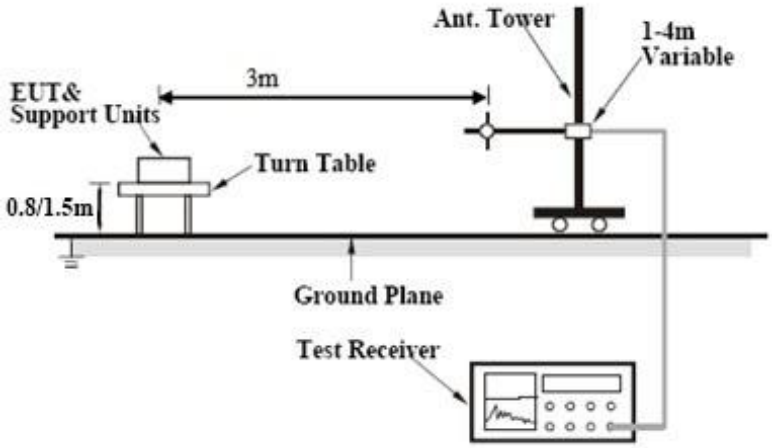


802.11n40 - 9 CH 2452

6.5 Band-Edge & Unwanted Emissions into Non-Restricted Frequency Bands

Temperature	25°C
Relative Humidity	54%
Atmospheric Pressure	1010mbar
Test date :	January 06, 2018
Tested By :	Aaron Liang

Requirement(s):

Spec	Item	Requirement	Applicable
§15.247(d)	a)	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.	☑
Test Setup			
Test Procedure	Radiated Method Only - 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator. - 2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.		

	- 3. First, set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, check the emission of EUT, if pass then set Spectrum Analyzer as below: a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasiy Peak detection at frequency below 1GHz. b. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz. - 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency. - 5. Repeat above procedures until all measured frequencies were complete.
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band)											
Modulation	N(TX)	Freq.(MHz)	Measure Distance (m)	Antenna (Green)		Antenna (Gray)		Antenna (Black)		Limit (dBuV/m) PK	Result
				Fre. (MHz) Pk	Level (dBuV/m) PK	Fre. (MHz) Pk	Level (dBuV/m) PK	Fre. (MHz) Pk	Level (dBuV/m) PK		
11b	1	2412	3	2386.03	52.69	2390.00	52.12	2386.11	52.04	74	Pass
11b	1	2462	3	2483.50	60.42	2483.50	58.19	2489.25	59.72	74	Pass
11g	1	2412	3	2390.00	72.19	2390.00	71.65	2390.00	61.99	74	Pass
11g	1	2457	3	2483.50	62.48	2483.50	60.77	2483.50	/	74	Pass
11g	1	2462	3	2483.50	73.22	2483.50	73.19	2483.50	67.14	74	Pass

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band)							
Modulation	N(TX)	Freq.(MHz)	Measure Distance(m)	Antenna (Green+Gray+Black)		Limit (dBuV/m) PK	Result
				Fre.(MHz) Pk	Level(dBuV/m) PK		
HT20	3	2412	3	2388.00	62.83	74	Pass
HT20	3	2462	3	2485.90	68.41	74	Pass
HT40	3	2422	3	2385.53	62.23	74	Pass
HT40	3	2437	3	2390.00	67.74	74	Pass
HT40	3	2442	3	2483.5	67.95	74	Pass
HT40	3	2447	3	2484.10	68.77	74	Pass
HT40	3	2452	3	2483.50	72.07	74	Pass

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band)											
Modulation	N(TX)	Freq.(MHz)	Measure Distance (m)	Antenna (Green)		Antenna (Gray)		Antenna (Black)		Limit (dBuV/m) AV	Result
				Fre. (MHz) AV	Level (dBuV/m) AV	Fre. (MHz) AV	Level (dBuV/m) AV	Fre. (MHz) AV	Level (dBuV/m) AV		
11b	1	2412	3	2386.03	39.98	2390.00	40.02	2386.11	39.96	54	Pass
11b	1	2462	3	2483.50	46.85	2483.50	46.30	2489.25	46.00	54	Pass
11g	1	2412	3	2390.00	51.14	2390.00	52.39	2390.00	43.37	54	Pass
11g	1	2457	3	2483.50	44.46	2483.50	44.07	2483.50	/	54	Pass
11g	1	2462	3	2483.50	52.76	2483.50	53.40	2483.50	47.39	54	Pass

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band)							
Modulation	N(TX)	Freq.(MHz)	Measure Distance(m)	Antenna (Green+Gray+Black)		Limit (dBuV/m) AV	Result
				Fre.(MHz) AV	Level(dBuV/m) AV		
HT20	3	2412	3	2390.00	45.52	54	Pass
HT20	3	2462	3	2485.30	49.64	54	Pass
HT40	3	2422	3	2384.57	47.02	54	Pass
HT40	3	2437	3	2390.00	52.89	54	Pass
HT40	3	2442	3	2483.50	53.46	54	Pass
HT40	3	2447	3	2484.10	53.79	54	Pass
HT40	3	2452	3	2483.50	53.81	54	Pass

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Non-restricted Band)							
Modulation	N(TX)	Test Freq,(MHz)	(i)-(O)dB			Limit(dB)	Result
			Antenna (Green)	Antenna (Gray)	Antenna (Black)		
11g	1	2412	-30.34	-30.75	/	30	Pass

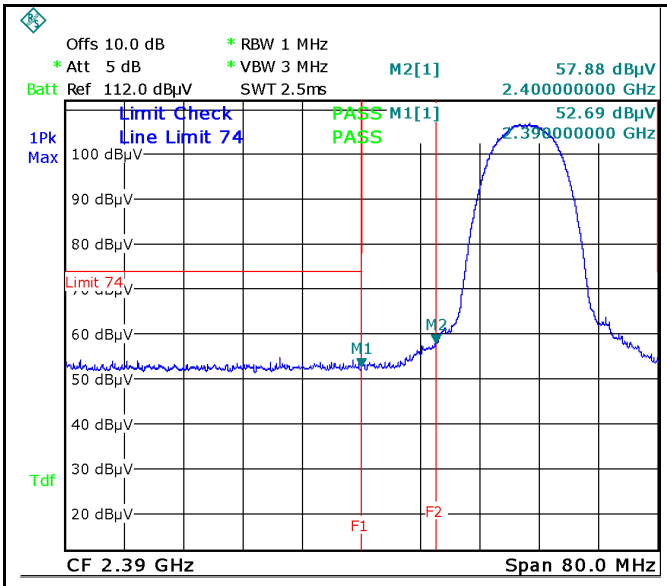
2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Non-restricted Band)					
Modulation	N(TX)	Test Freq,(MHz)	(i)-(O)dB	Limit(dB)	Result
			Antenna (Green+Gray+Black)		
HT20	3	2412	-37.06	30	Pass

Test Plots

Restricted frequency band result

b mode

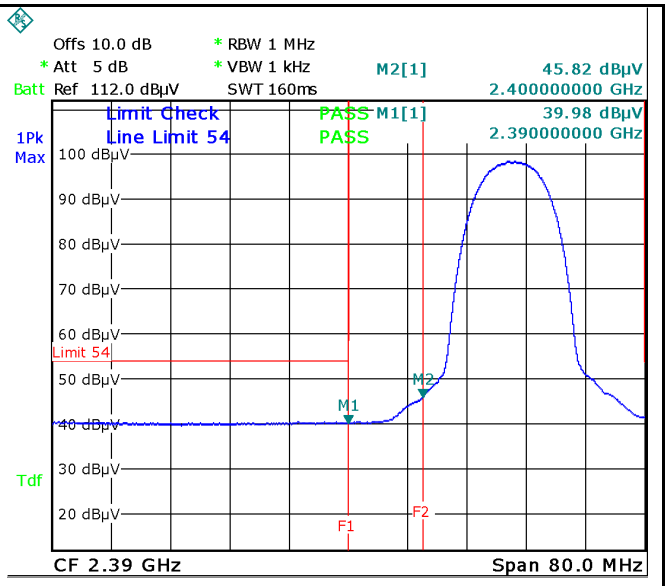
Antenna (Green)



Date: 6.JAN.2018 09:51:29

1 CH (Peak) - 802.11b

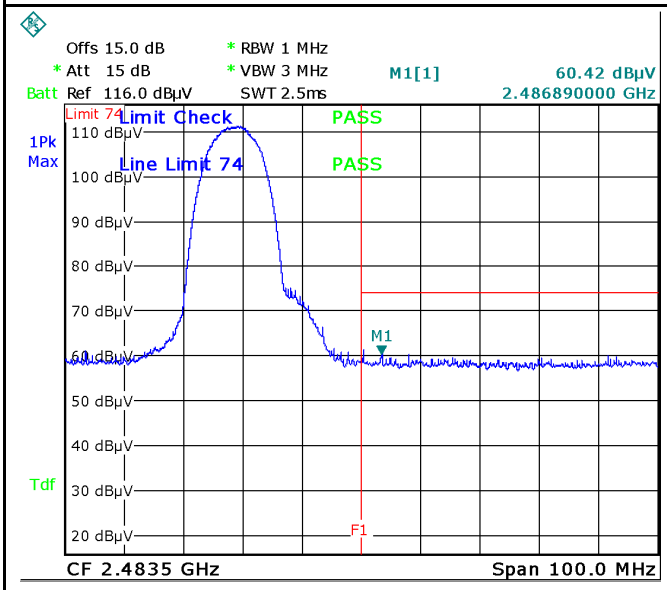
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 09:51:58

1 CH (Average) - 802.11b

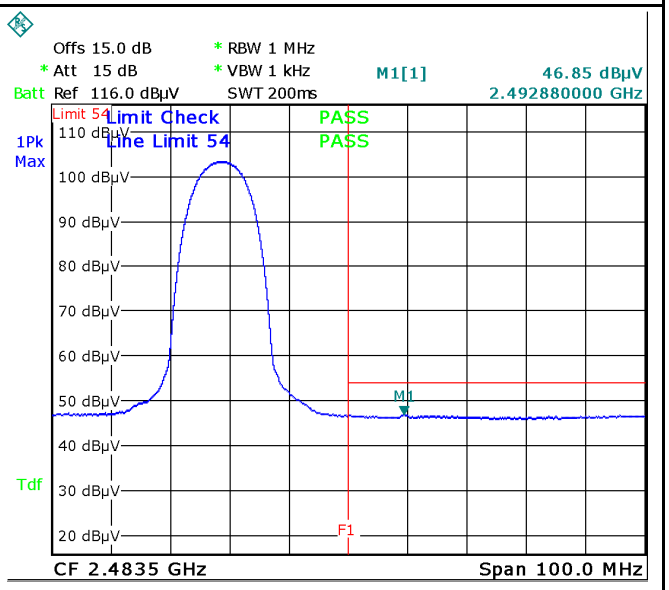
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 13:39:53

11 CH (Peak) - 802.11b

Note: F1 is frequency 2483.5MHz

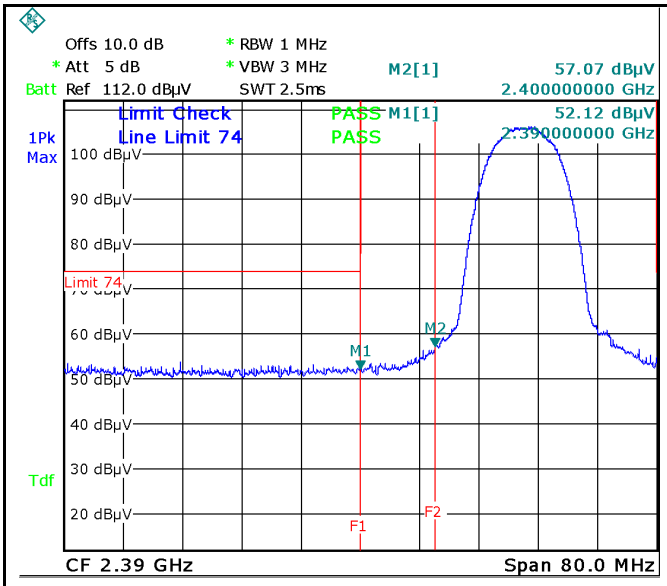


Date: 6.JAN.2018 13:40:24

11 CH (Average) - 802.11b

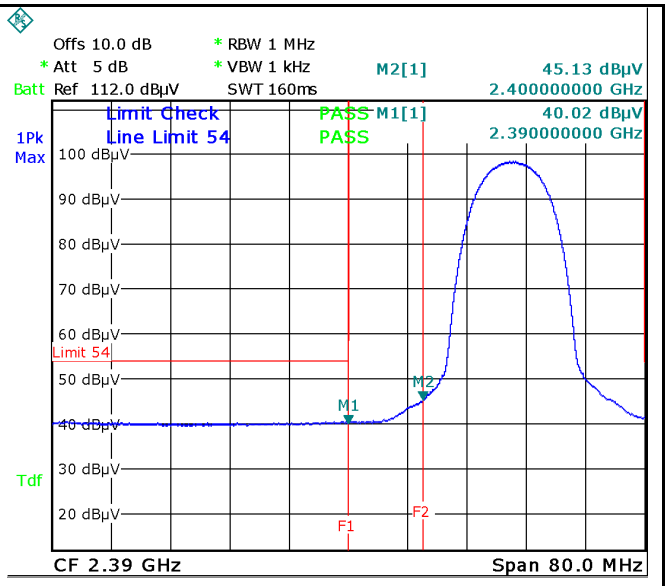
Note: F1 is frequency 2483.5MHz

Antenna (Gray):



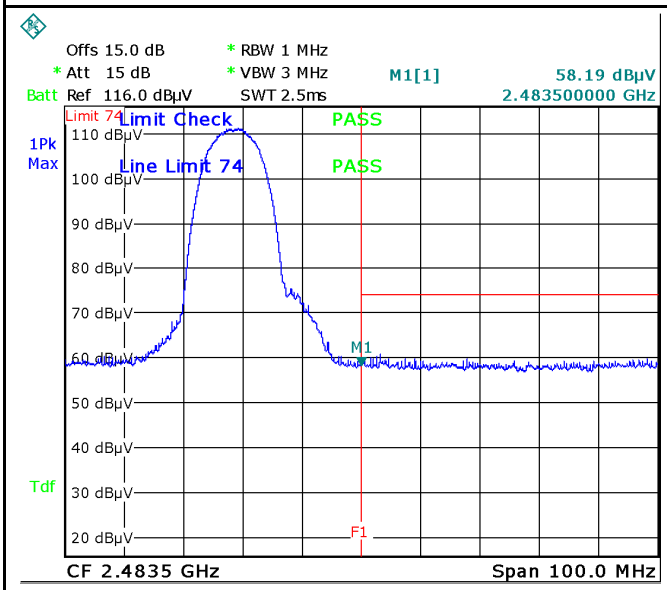
1 CH (Peak) - 802.11b

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



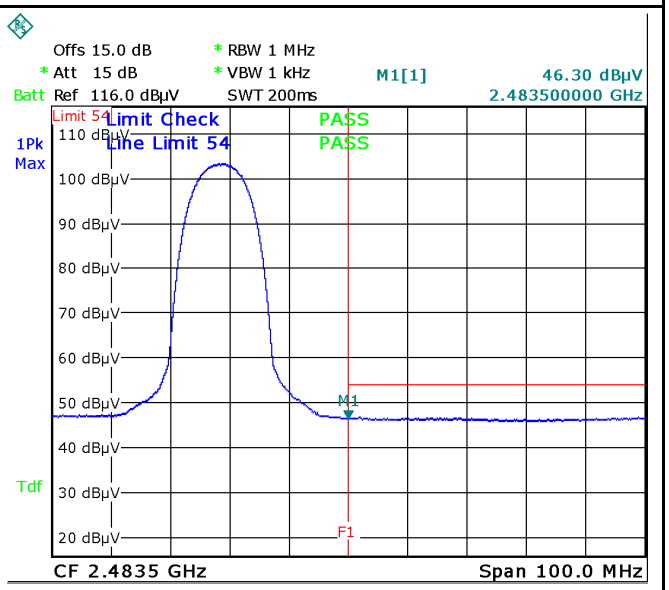
1 CH (Average) - 802.11b

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Peak) - 802.11b

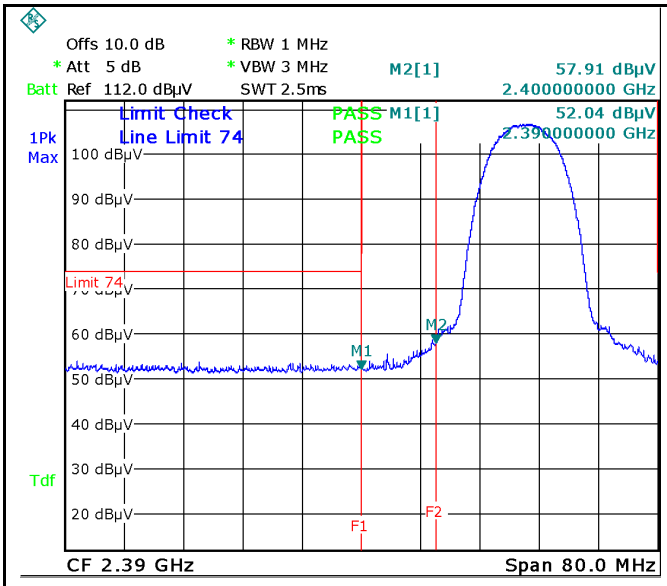
Note: F1 is frequency 2483.5MHz



11 CH (Average) - 802.11b

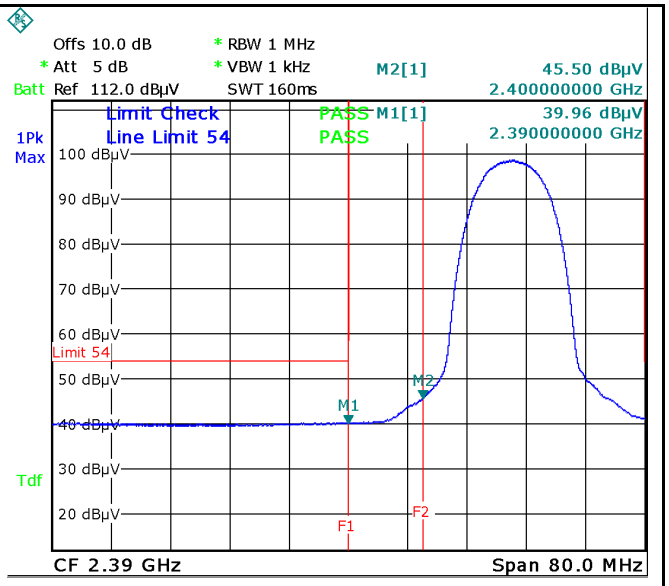
Note: F1 is frequency 2483.5MHz

Antenna (Black):



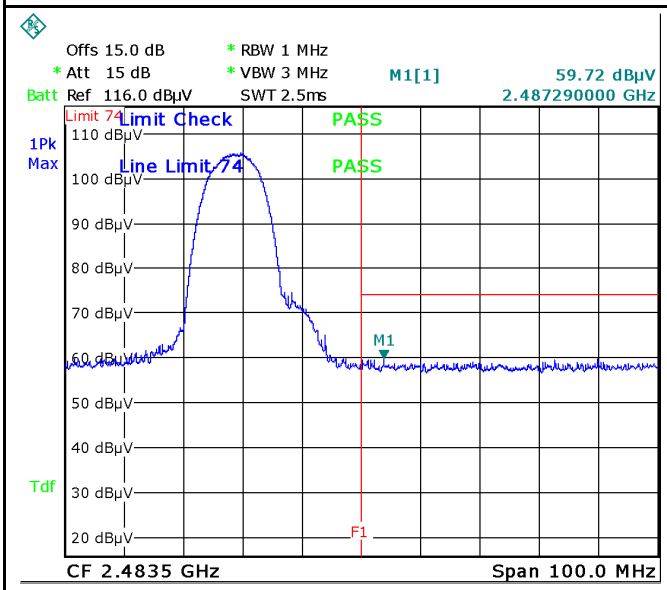
1 CH (Peak) - 802.11b

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



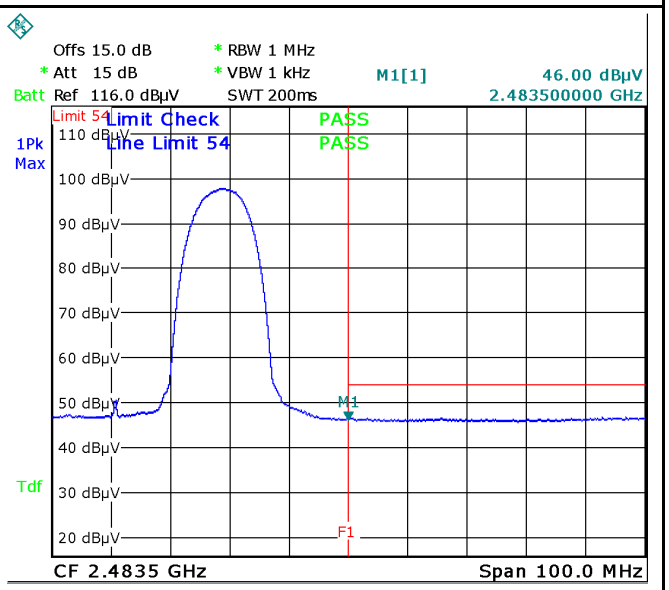
1 CH (Average) - 802.11b

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



1 CH (Peak) - 802.11b

Note: F1 is frequency 2483.5MHz

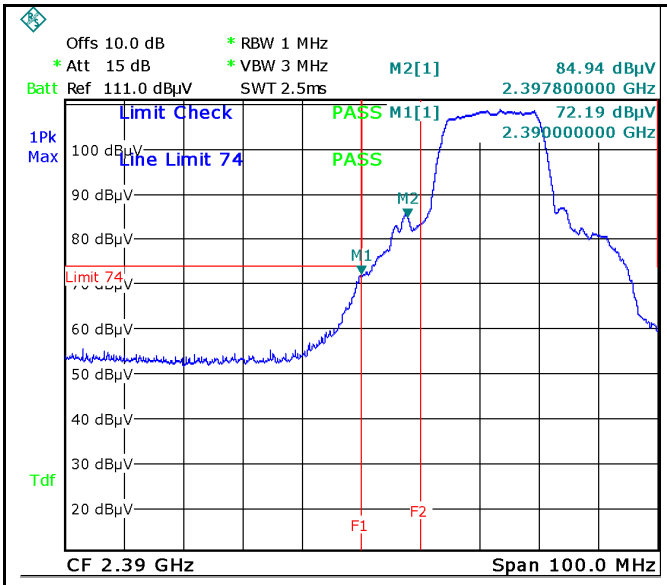


11 CH (Average) - 802.11b

Note: F1 is frequency 2483.5MHz

g mode:

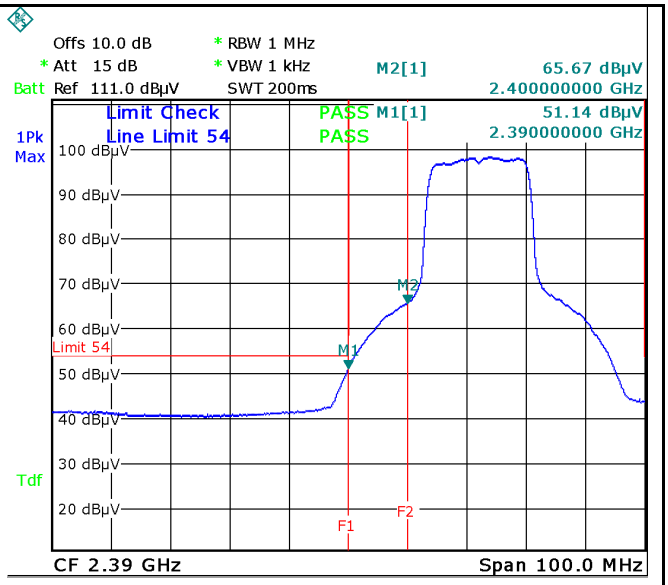
Antenna (Green):



Date: 6.JAN.2018 14:11:10

1 CH (Peak) - 802.11g

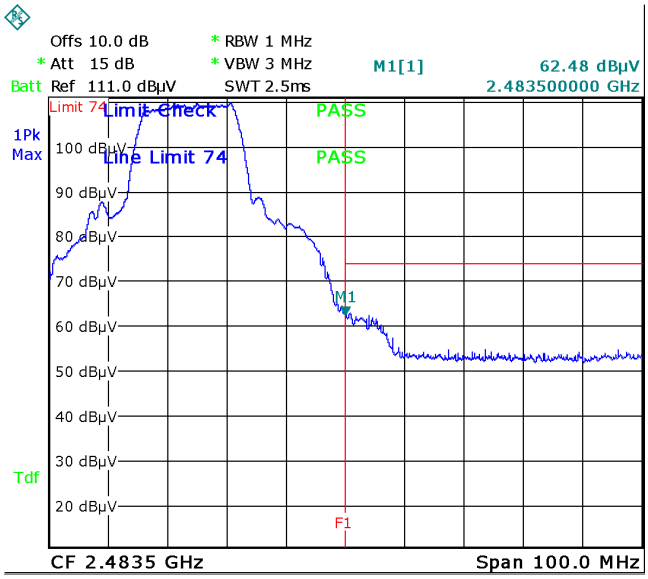
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 14:03:08

1CH (Average) - 802.11g

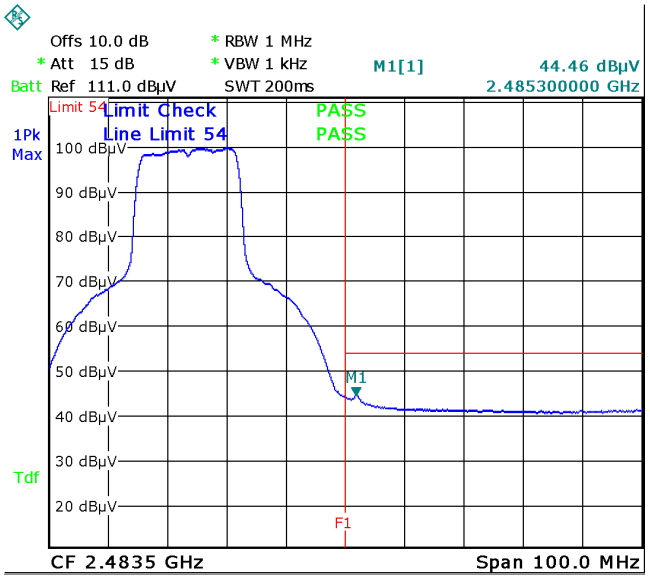
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 14:26:27

10 CH (Peak) - 802.11g

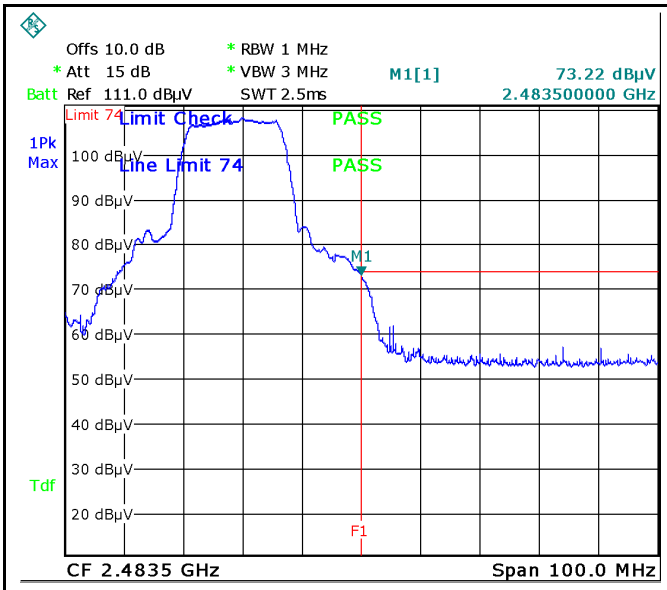
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 14:26:56

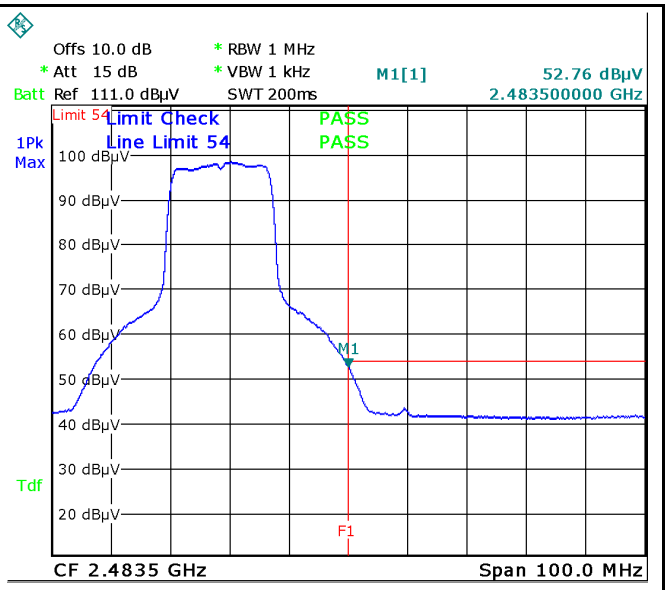
10 CH (Average) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Peak) - 802.11g

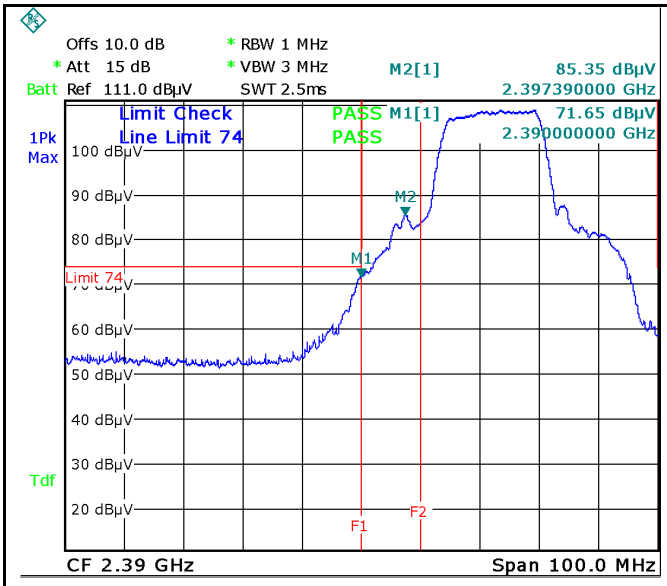
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Average) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

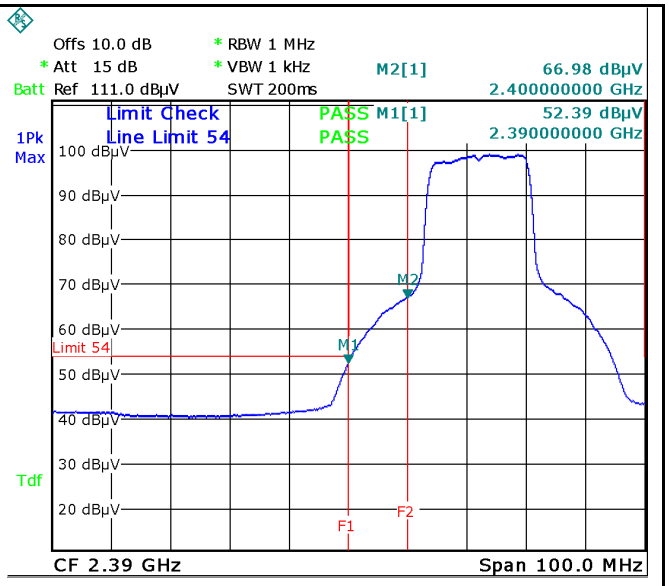
Antenna (Gray):



Date: 6.JAN.2018 10:42:08

1 CH (Peak) - 802.11g

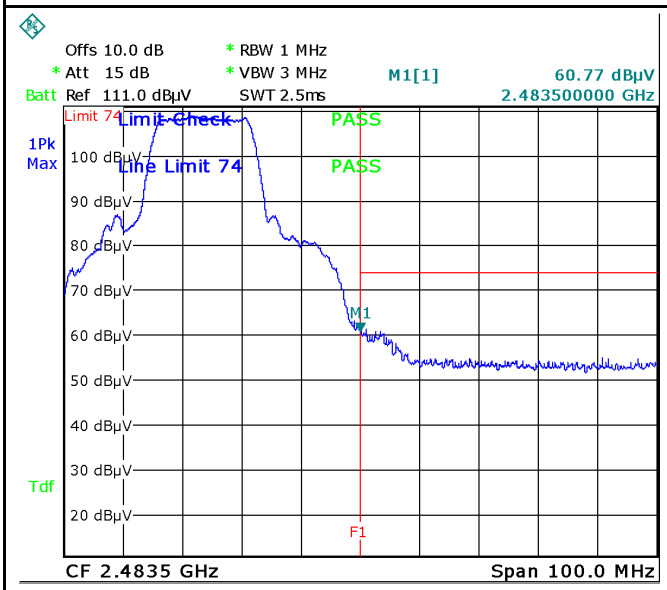
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 10:42:53

1CH (Average) - 802.11g

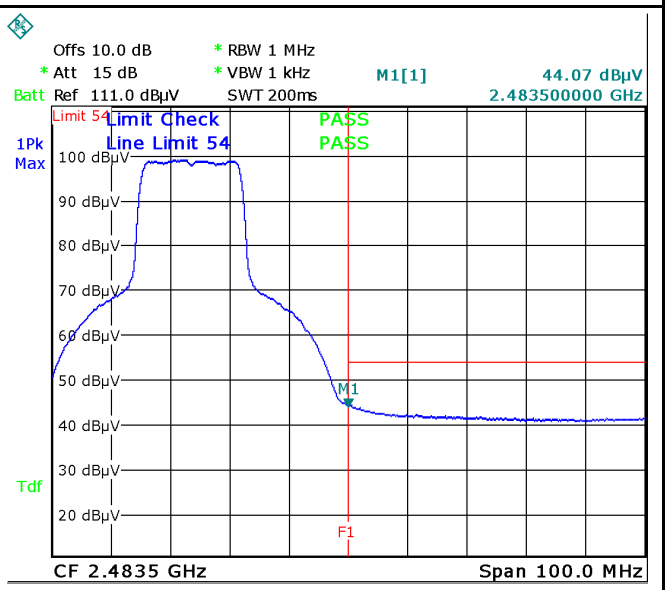
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 14:31:43

10 CH (Peak) - 802.11g

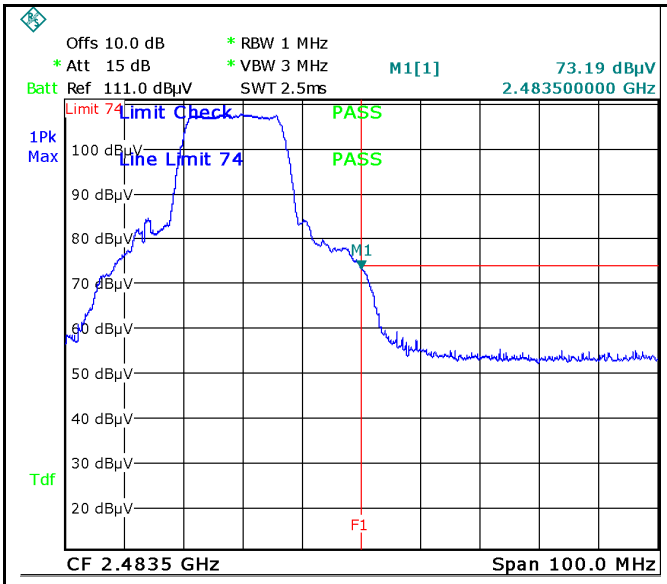
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 14:32:33

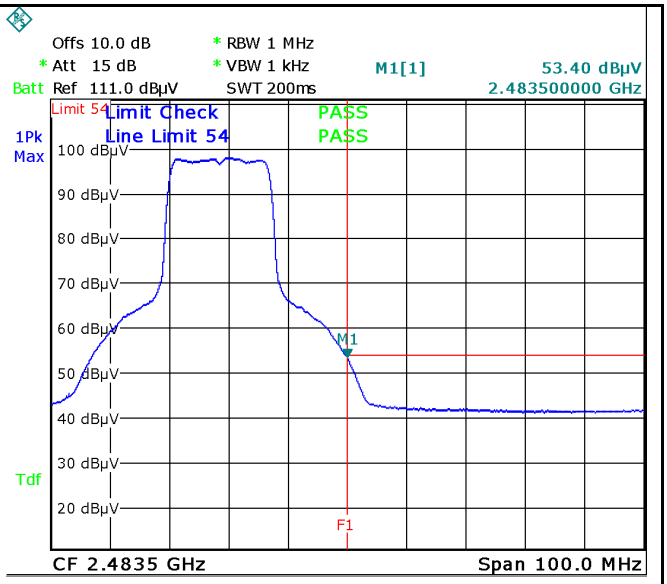
10 CH (Average) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Peak) - 802.11g

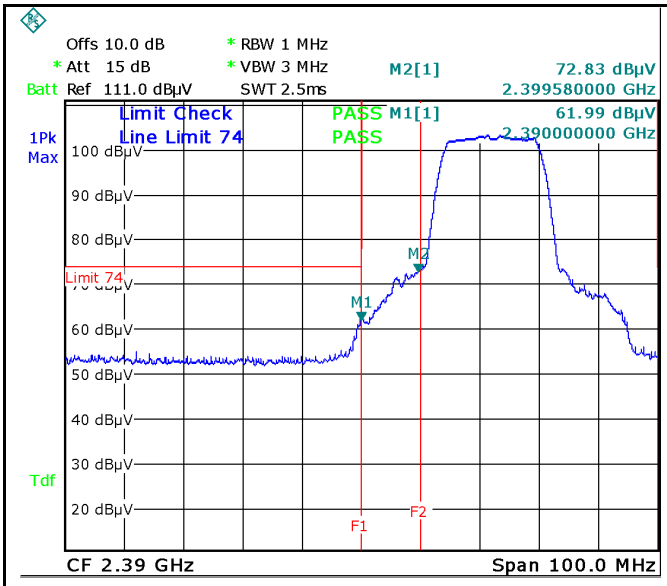
Note: F1 is frequency 2483.5MHz



11 CH (Average) - 802.11g

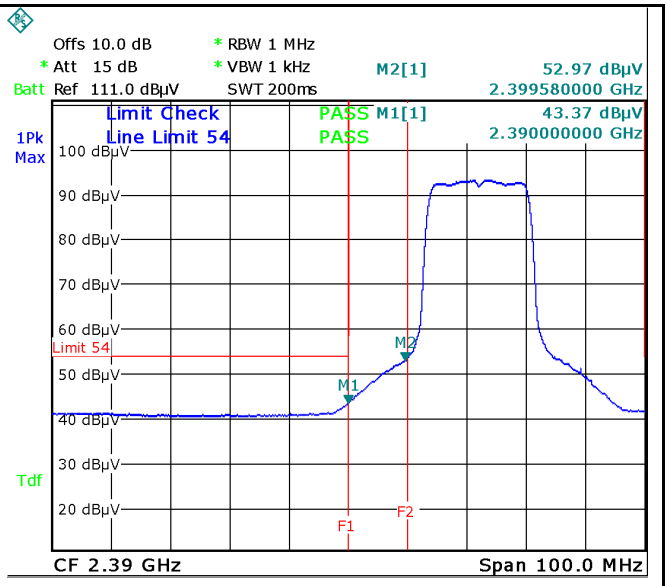
Note: F1 is frequency 2483.5MHz

Antenna (Black):



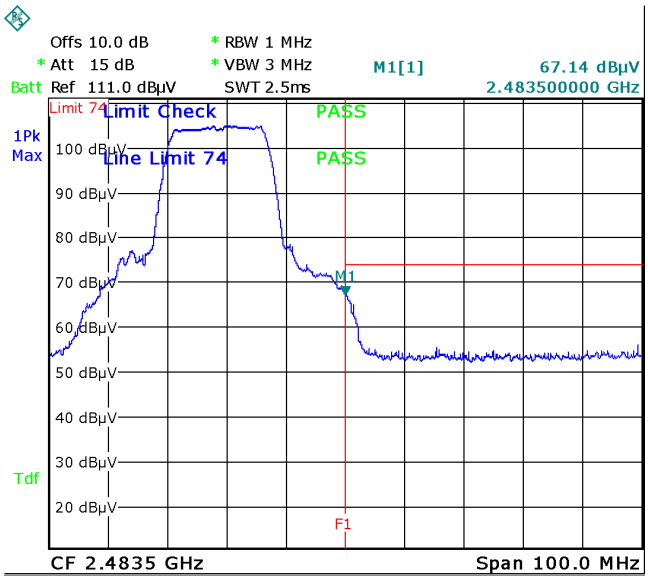
1 CH (Peak) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



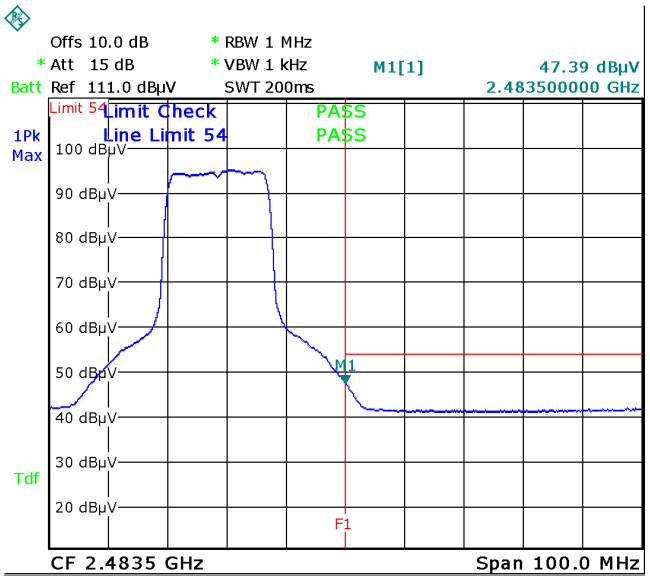
1CH (Average) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Peak) - 802.11g

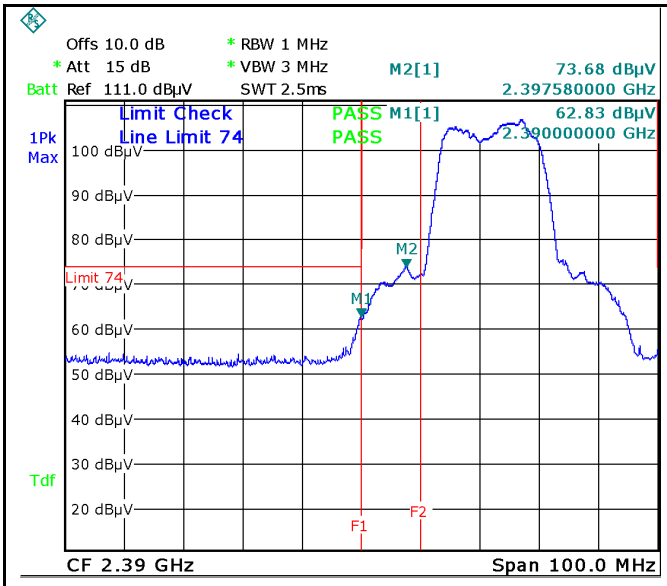
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Average) - 802.11g

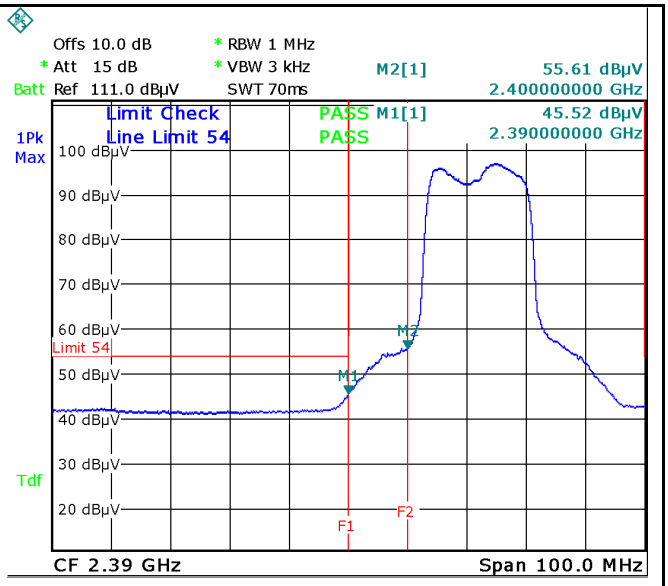
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

N20 mode:



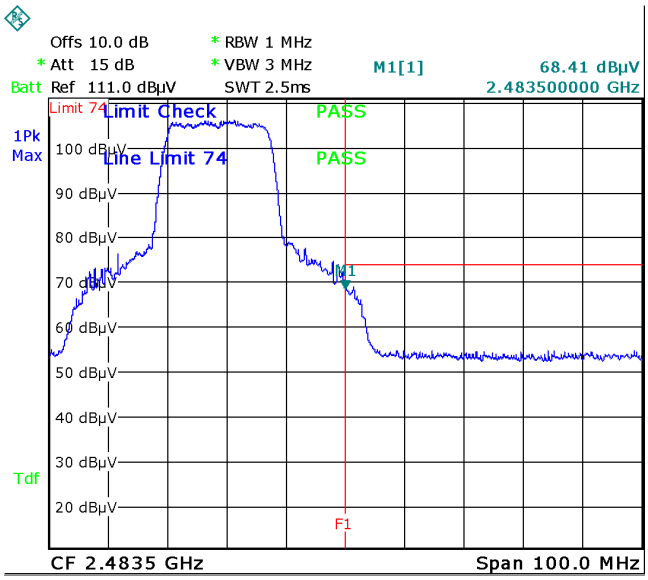
1 CH (Peak) - 802.11n20

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



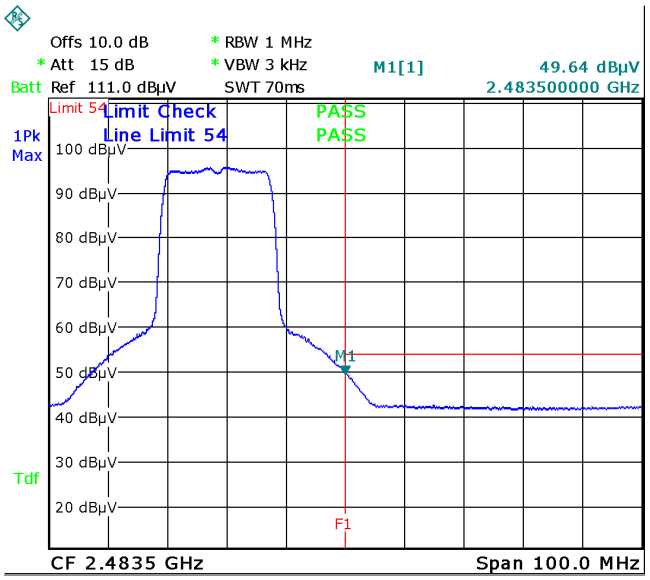
1CH (Average) - 802.11n20

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Peak) - 802.11n20

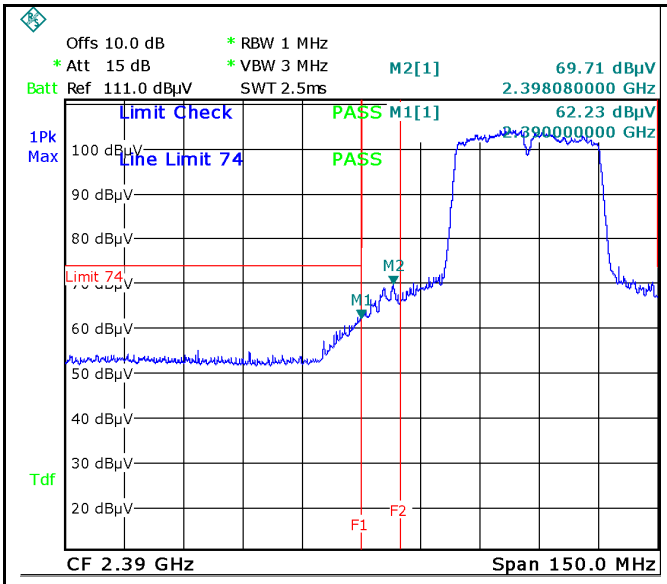
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



11 CH (Average) - 802.11n20

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

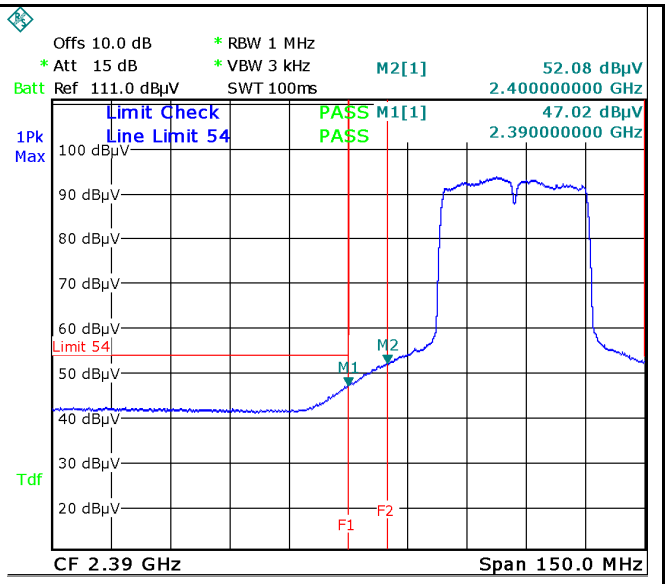
N40 mode:



Date: 6.JAN.2018 15:23:35

CH 3 (Peak) - 802.11n40

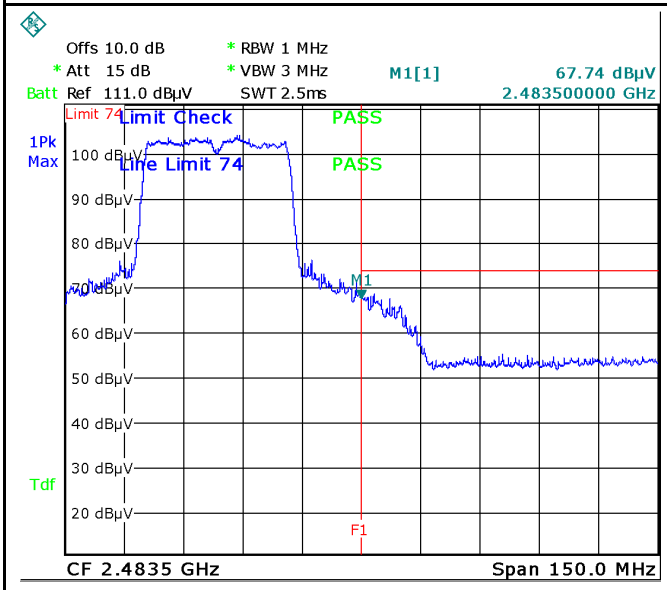
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 15:24:12

CH 3 (Average) - 802.11n40

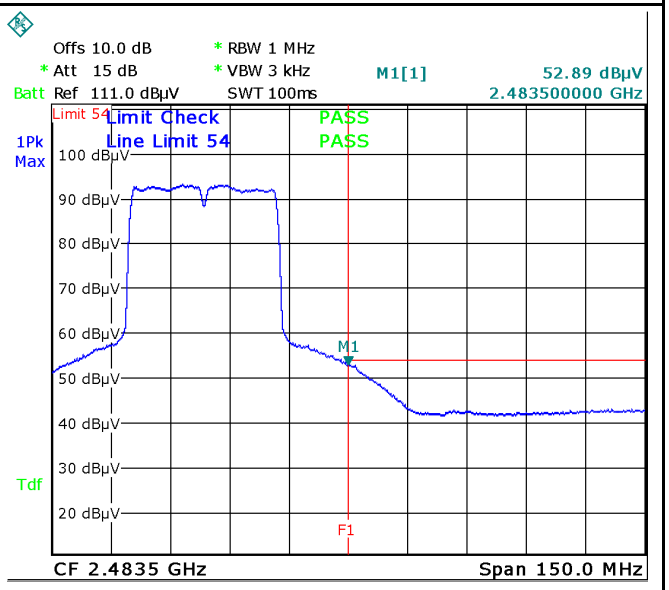
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 15:19:15

CH 6 (Peak) - 802.11n40

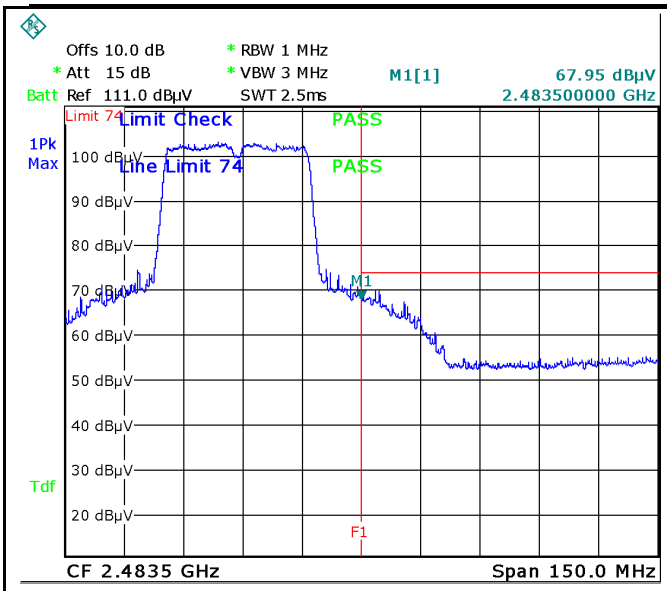
Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



Date: 6.JAN.2018 15:18:48

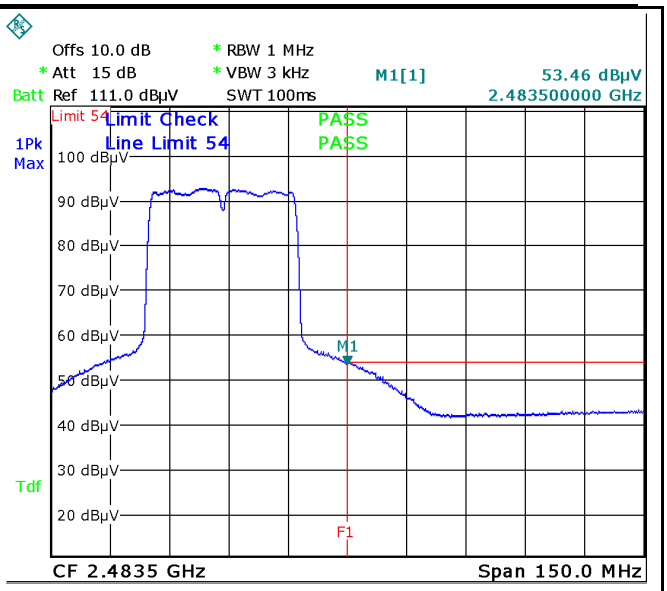
CH 6 (Average) - 802.11n40

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



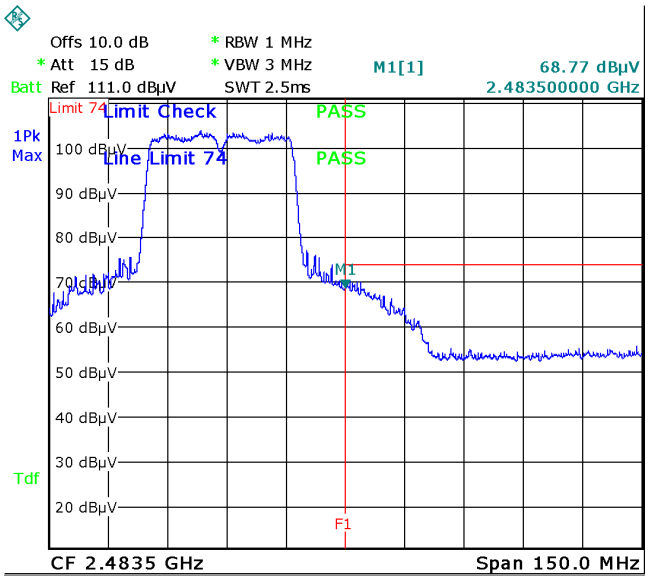
CH 7 (Peak) - 802.11n40

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



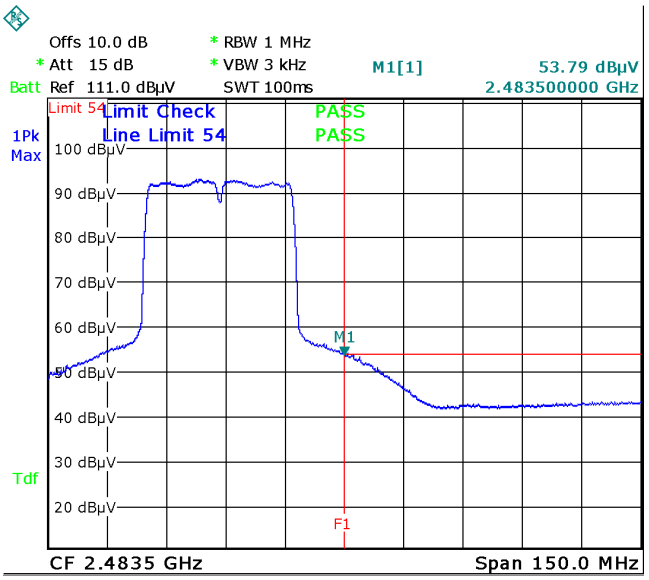
CH 7 (Average) - 802.11n40

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



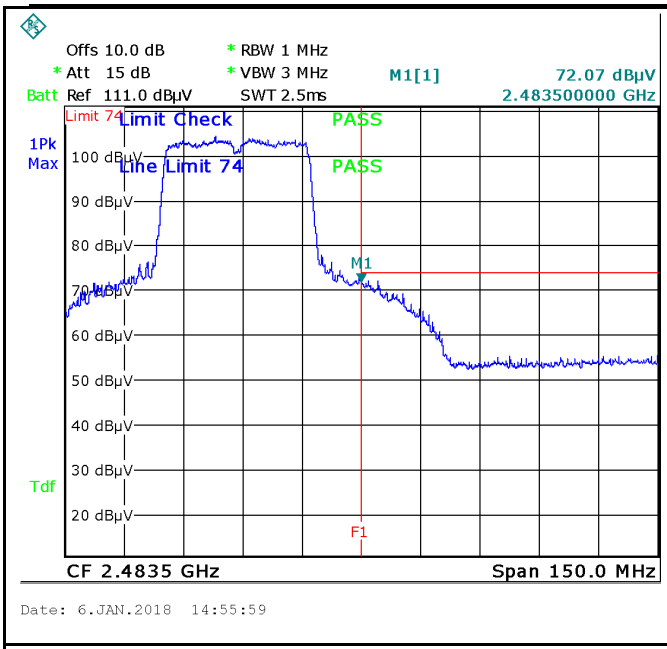
CH 8 (Peak) - 802.11n40

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



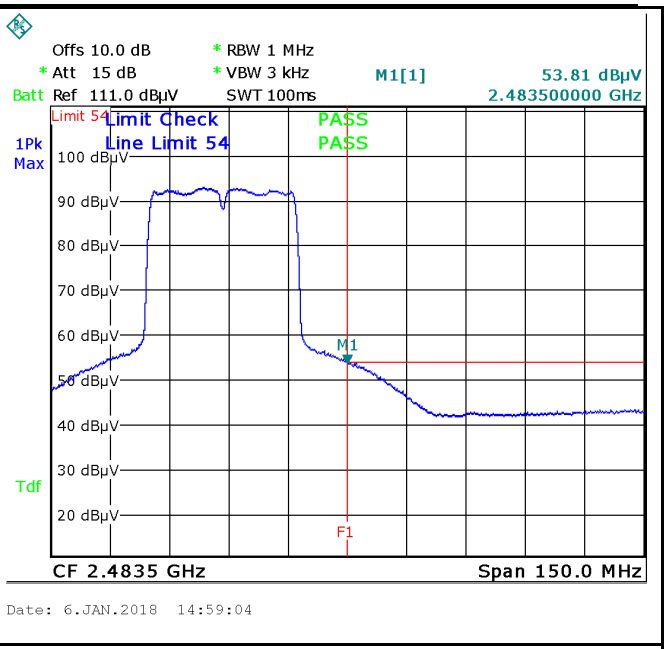
CH 8 (Average) - 802.11n40

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz



CH 9 (Peak) - 802.11n40

Note: F1 is frequency 2483.5MHz



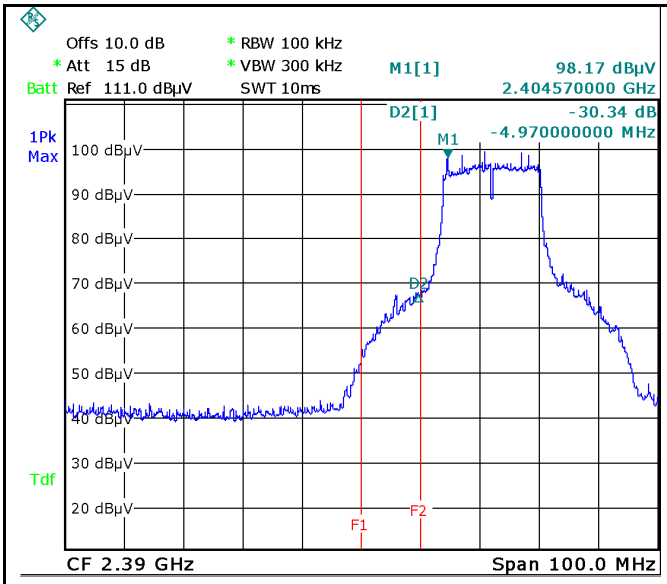
CH 9 (Average) - 802.11n40

Note: F1 is frequency 2483.5MHz

Restricted Band-edge result

g mode:

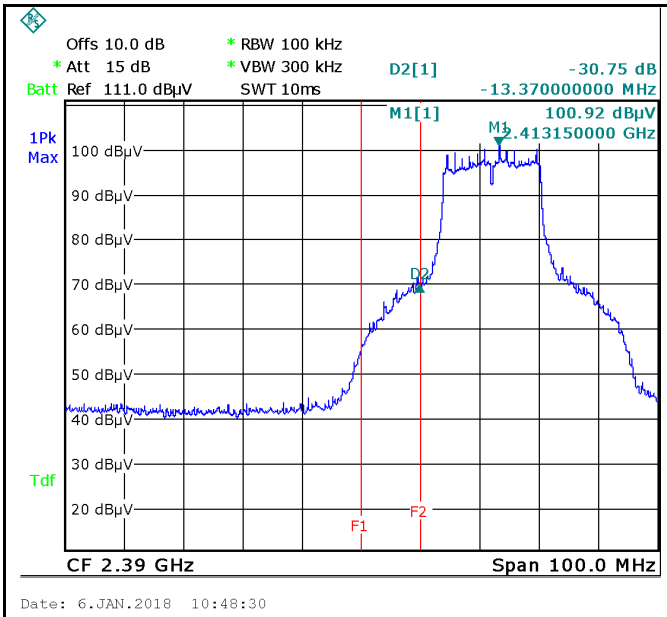
Antenna (Green):



1 CH (AV) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

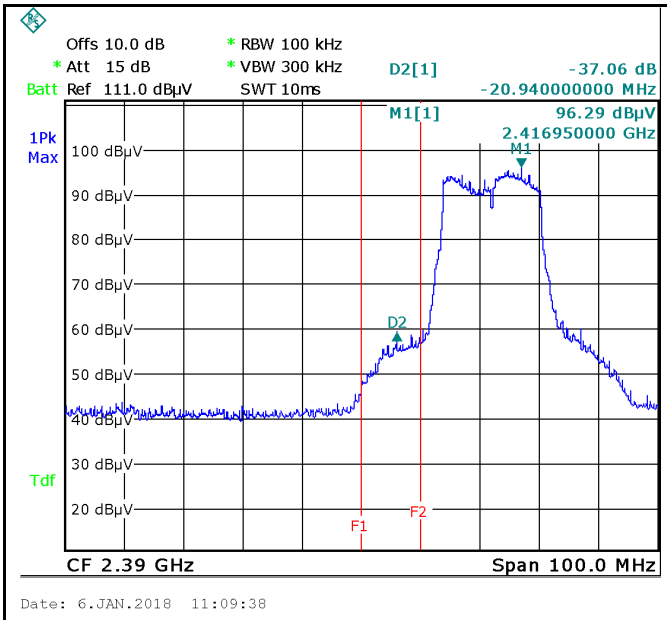
Antenna (Gray):



1 CH (AV) - 802.11g

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

N20 mode:



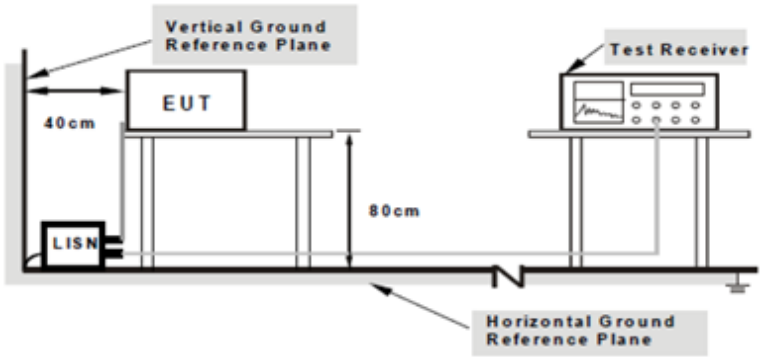
1 CH (AV) - 802.11n20

Note: F1 is frequency 2390MHz; F2 is frequency 2400MHz

6.6 AC Power Line Conducted Emissions

Temperature	25°C
Relative Humidity	54%
Atmospheric Pressure	1010mbar
Test date :	January 06, 2018
Tested By :	Aaron Liang

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§15.207, RSS210 (A8.1)</td><td>a)</td><td>For Low-power radio-frequency devices 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 [mu] H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.
<table>
<tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>QP</th><th>Average</th></tr>
<tr><td>0.15 ~ 0.5</td><td>66 – 56</td><td>56 – 46</td></tr>
<tr><td>0.5 ~ 5</td><td>56</td><td>46</td></tr>
<tr><td>5 ~ 30</td><td>60</td><td>50</td></tr>
</table></td><td>☑</td></tr>
<tr><td>Test Setup</td><td colspan="3"> 

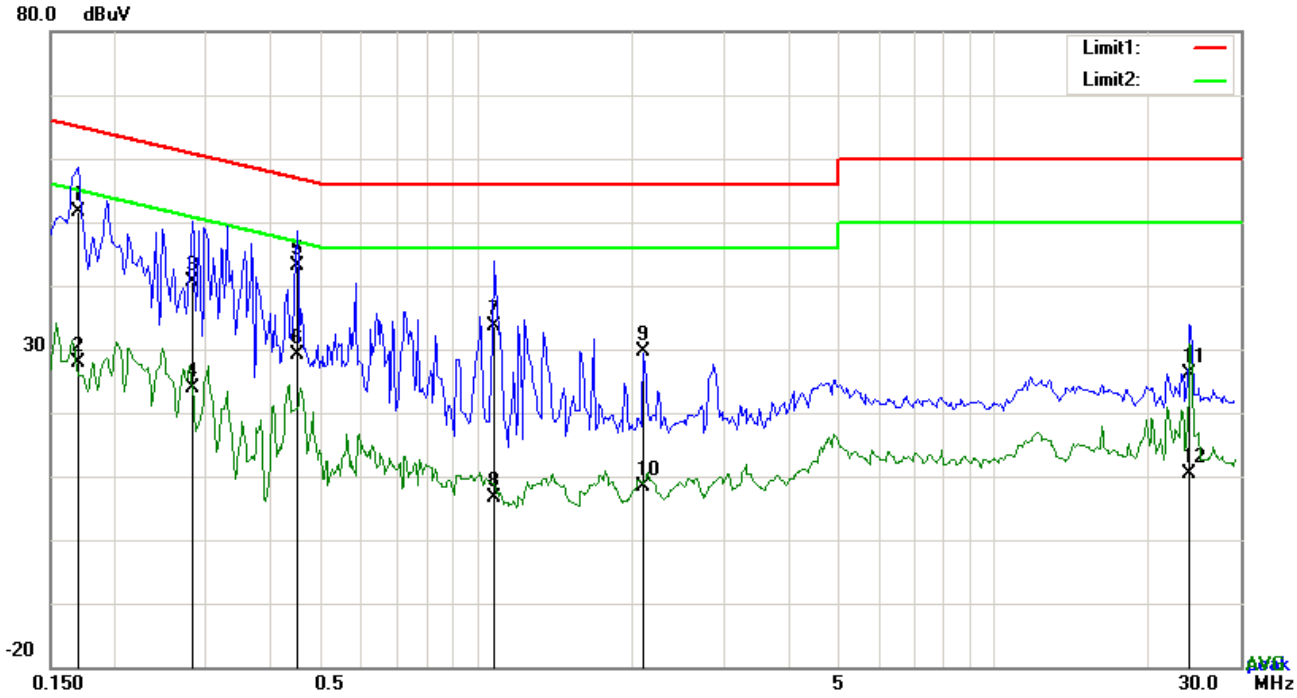
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</td></tr>
<tr><td>Procedure</td><td colspan="3">1. The EUT and supporting equipment were set up in accordance with the requirements of 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 50W/50mH 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</td></tr>
</table>

	coaxial cable. 4. All other supporting equipment were 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, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. 8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).
Remark	
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

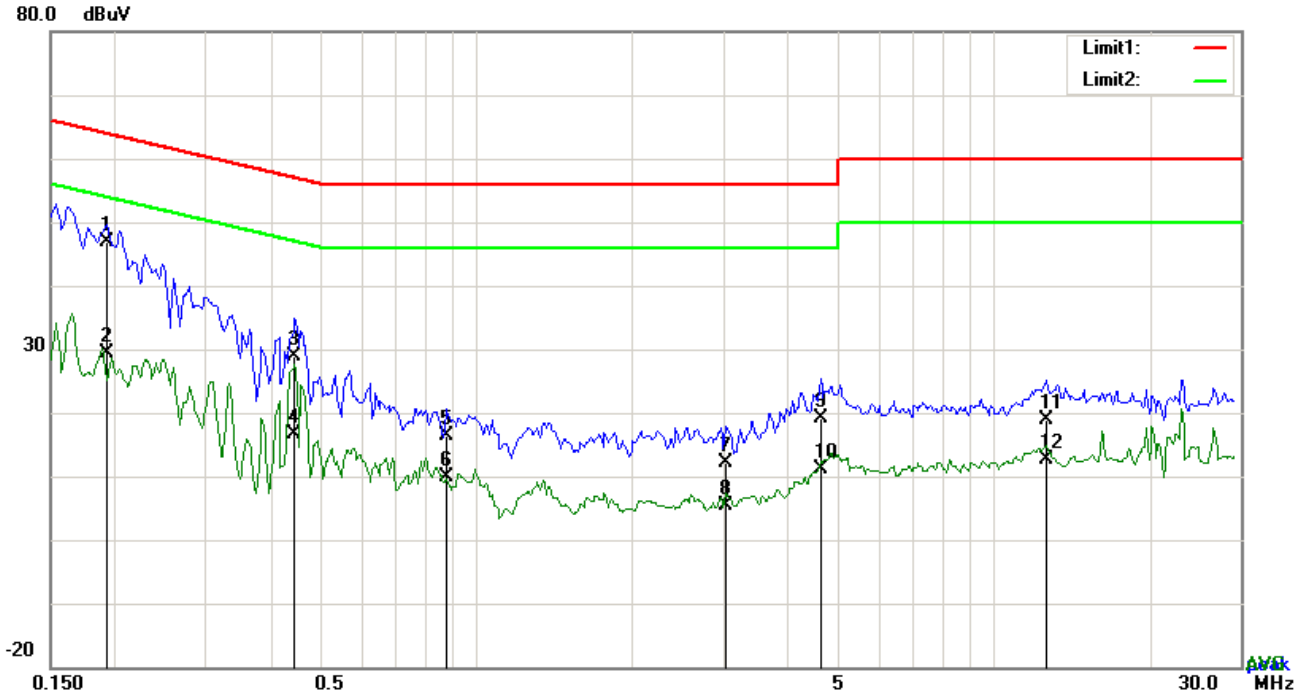
Test Model:	2.4G WIFI



Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	L	0.1695	41.60	QP	10.03	51.63	64.98	-13.35
2	L	0.1695	17.81	AVG	10.03	27.84	54.98	-27.14
3	L	0.2826	30.69	QP	10.03	40.72	60.74	-20.02
4	L	0.2826	13.90	AVG	10.03	23.93	50.74	-26.81
5	L	0.4503	32.99	QP	10.03	43.02	56.87	-13.85
6	L	0.4503	19.04	AVG	10.03	29.07	46.87	-17.80
7	L	1.0821	23.56	QP	10.03	33.59	56.00	-22.41
8	L	1.0821	-3.30	AVG	10.03	6.73	46.00	-39.27
9	L	2.1000	19.63	QP	10.04	29.67	56.00	-26.33
10	L	2.1000	-1.77	AVG	10.04	8.27	46.00	-37.73
11	L	24.0093	15.82	QP	10.38	26.20	60.00	-33.80
12	L	24.0093	0.07	AVG	10.38	10.45	50.00	-39.55

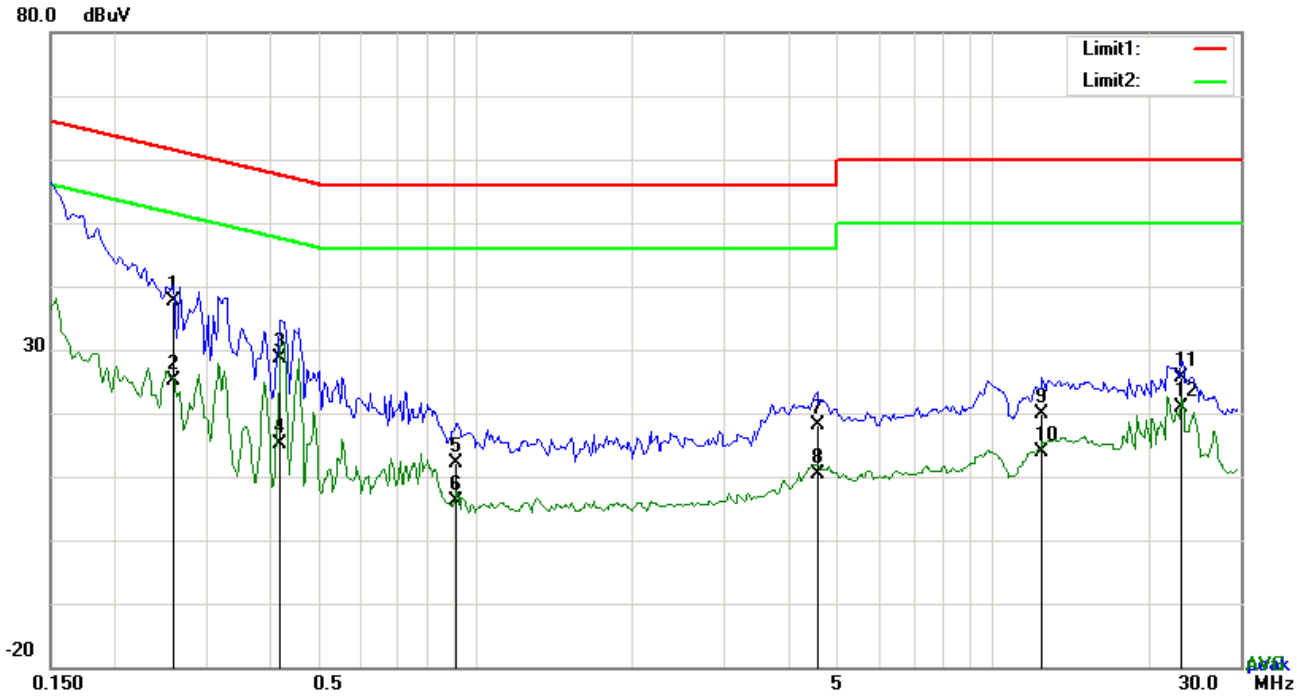


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	N	0.1929	36.96	QP	10.02	46.98	63.91	-16.93
2	N	0.1929	19.24	AVG	10.02	29.26	53.91	-24.65
3	N	0.4464	18.98	QP	10.02	29.00	56.94	-27.94
4	N	0.4464	6.55	AVG	10.02	16.57	46.94	-30.37
5	N	0.8754	6.27	QP	10.03	16.30	56.00	-39.70
6	N	0.8754	-0.08	AVG	10.03	9.95	46.00	-36.05
7	N	3.0312	2.02	QP	10.05	12.07	56.00	-43.93
8	N	3.0312	-4.73	AVG	10.05	5.32	46.00	-40.68
9	N	4.6302	9.16	QP	10.07	19.23	56.00	-36.77
10	N	4.6302	0.95	AVG	10.07	11.02	46.00	-34.98
11	N	12.6135	8.82	QP	10.17	18.99	60.00	-41.01
12	N	12.6135	2.50	AVG	10.17	12.67	50.00	-37.33

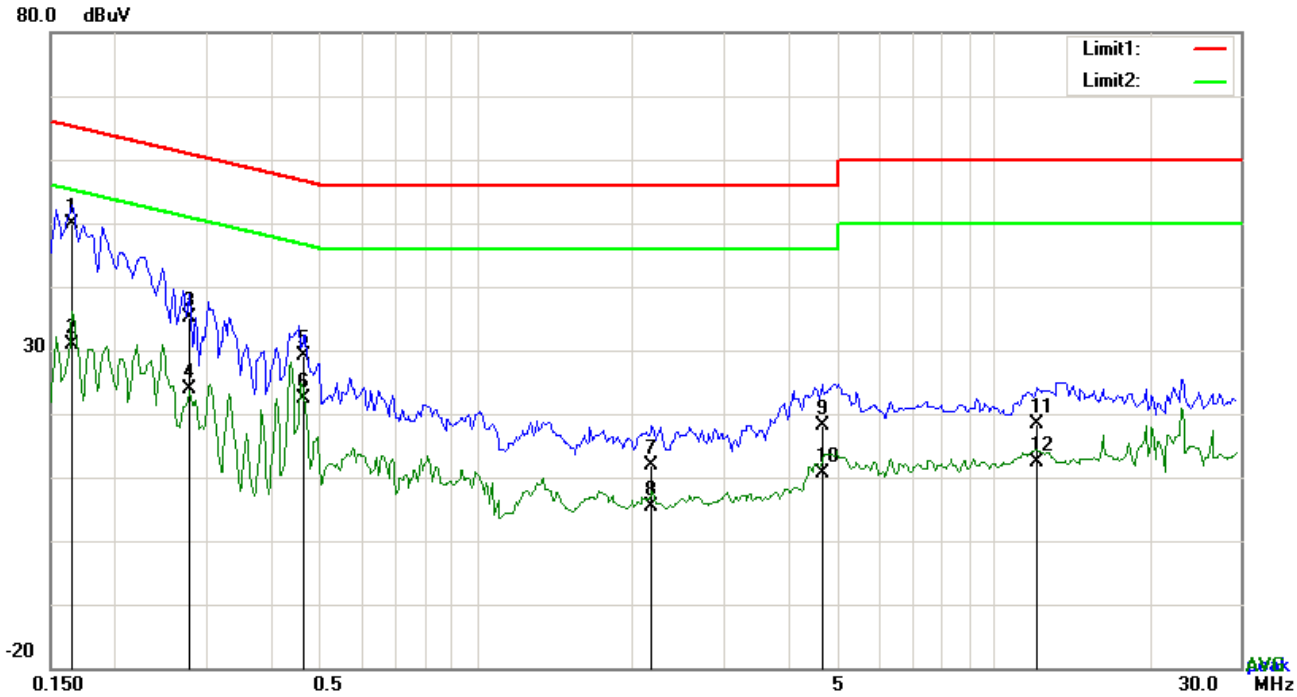
Test Mode:	2.4GWIFI



Test Data

Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.2592	27.52	QP	10.03	37.55	61.46	-23.91
2	L1	0.2592	15.22	AVG	10.03	25.25	51.46	-26.21
3	L1	0.4191	18.65	QP	10.03	28.68	57.47	-28.79
4	L1	0.4191	5.21	AVG	10.03	15.24	47.47	-32.23
5	L1	0.9183	2.17	QP	10.03	12.20	56.00	-43.80
6	L1	0.9183	-4.02	AVG	10.03	6.01	46.00	-39.99
7	L1	4.5522	8.02	QP	10.07	18.09	56.00	-37.91
8	L1	4.5522	0.19	AVG	10.07	10.26	46.00	-35.74
9	L1	12.4029	9.74	QP	10.19	19.93	60.00	-40.07
10	L1	12.4029	3.57	AVG	10.19	13.76	50.00	-36.24
11	L1	23.1318	15.20	QP	10.36	25.56	60.00	-34.44
12	L1	23.1318	10.46	AVG	10.36	20.82	50.00	-29.18



Test Data

Phase Neutral Plot at 240Vac, 60Hz

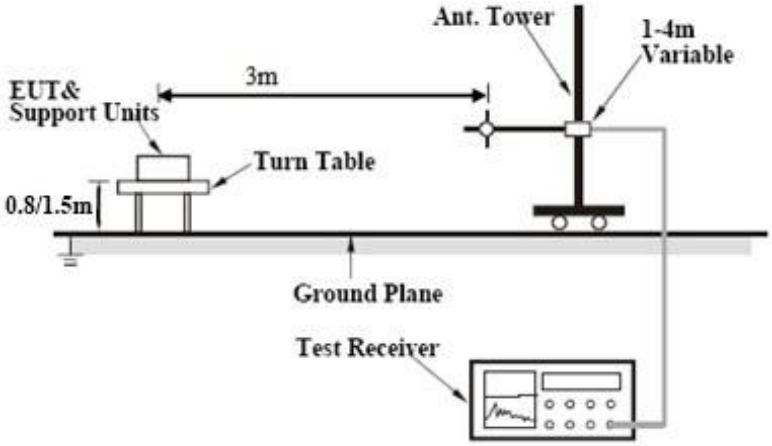
No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.1656	39.86	QP	10.02	49.88	65.18	-15.30
2	N	0.1656	20.86	AVG	10.02	30.88	55.18	-24.30
3	N	0.2787	25.12	QP	10.02	35.14	60.85	-25.71
4	N	0.2787	13.84	AVG	10.02	23.86	50.85	-26.99
5	N	0.4659	19.12	QP	10.02	29.14	56.59	-27.45
6	N	0.4659	12.30	AVG	10.02	22.32	46.59	-24.27
7	N	2.1858	1.81	QP	10.04	11.85	56.00	-44.15
8	N	2.1858	-4.63	AVG	10.04	5.41	46.00	-40.59
9	N	4.6497	8.17	QP	10.07	18.24	56.00	-37.76
10	N	4.6497	0.46	AVG	10.07	10.53	46.00	-35.47
11	N	12.1026	8.29	QP	10.17	18.46	60.00	-41.54
12	N	12.1026	2.33	AVG	10.17	12.50	50.00	-37.50

6.7 Radiated Spurious Emissions

Temperature	25°C
Relative Humidity	54%
Atmospheric Pressure	1010mbar
Test date :	January 06, 2018
Tested By :	Aaron Liang

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td rowspan="3">47CFR§15.247(d), RSS210 (A8.5)</td><td>a)</td><td>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (μV/m)</th></tr>
<tr><td>30 – 88</td><td>100</td></tr>
<tr><td>88 – 216</td><td>150</td></tr>
<tr><td>216 960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table></td><td>☑</td></tr>
<tr><td>b)</td><td>For non-restricted band, 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 or 30dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, determined by the measurement method on output power to be used. Attenuation below the general limits specified in § 15.209(a) is not required
☒ 20 dB down ☐ 30 dB down</td><td>☑</td></tr>
<tr><td>c)</td><td>or restricted band, emission must also comply with the radiated emission limits specified in 15.209</td><td>☑</td></tr>
</table>

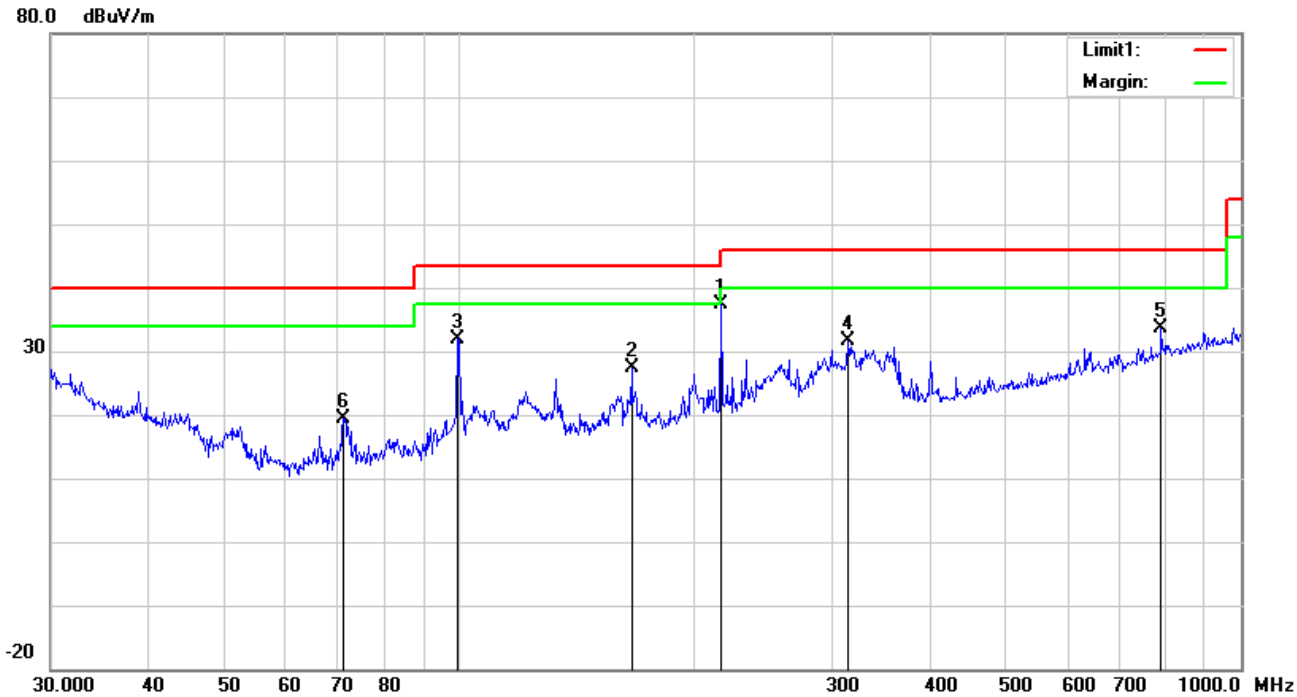
Test Setup	
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, 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 120 kHz for Quasiy Peak detection at frequency below 1GHz. 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz. 5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	Different RF configuration has been evaluated but not much difference was found. The data presented here is the worst case data with EUT under 802.11n – HT20-2437MHz mode.
Result	☑ Pass ☐ Fail

Test Data ☑ Yes ☐ N/A

Test Plot ☑ Yes (See below) ☐ N/A

Test Model:	2.4G WIFI

(Below 1GHz)

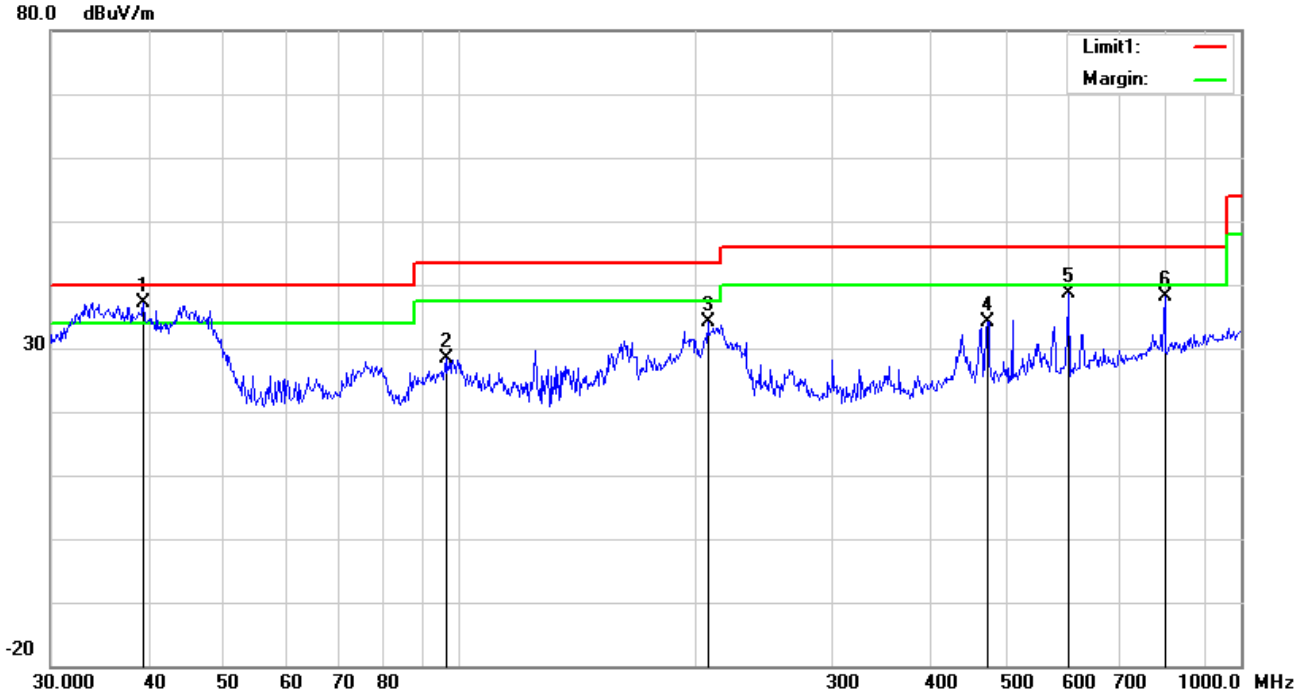


Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	H	216.0240	46.25	peak	11.88	22.35	1.59	37.37	46.00	-8.63	100	165
2	H	166.0680	36.21	peak	12.11	22.26	1.37	27.43	43.50	-16.07	100	168
3	H	99.5281	42.77	peak	10.29	22.32	1.11	31.85	43.50	-11.65	100	36
4	H	314.3765	38.01	peak	13.90	22.25	1.86	31.52	46.00	-14.48	100	131
5	H	790.6188	30.56	peak	21.29	21.17	2.94	33.62	46.00	-12.38	100	209
6	H	71.0803	32.94	peak	7.78	22.38	0.98	19.32	40.00	-20.68	100	9

(Below 1GHz)



Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	V	39.4372	44.42	QP	14.31	22.28	0.79	37.24	40.00	-2.76	200	276
2	V	96.0986	40.13	peak	9.46	22.32	1.02	28.29	43.50	-15.21	100	188
3	V	207.8501	42.98	peak	11.99	22.37	1.57	34.17	43.50	-9.33	100	82
4	V	473.8347	36.63	peak	17.18	21.86	2.27	34.22	46.00	-11.78	100	311
5	V	601.4265	38.72	peak	19.12	21.58	2.49	38.75	46.00	-7.25	100	144
6	V	798.9797	34.91	peak	21.39	21.15	2.96	38.11	46.00	-7.89	100	63

Test Mode:	Transmitting Mode

(Above 1GHz)

Note: Other modes were verified, only the result of worst case basic rate mode was presented.

Mode: 802.11b

Antenna (Green)

Low Channel (2412 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4824	47.86	AV	V	33.25	8.01	47.58	41.54	54	-12.46
4824	46.97	AV	H	33.25	8.01	47.58	40.65	54	-13.35
4824	58.02	PK	V	33.25	8.01	47.58	51.7	74	-22.3
4824	57.08	PK	H	33.25	8.01	47.58	50.76	74	-23.24
2988.4	55.87	AV	V	29.47	5.69	47.47	43.56	54	-10.44
2988.4	54.46	AV	H	29.47	5.69	47.47	42.15	54	-11.85
2988.4	64.01	PK	V	29.47	5.69	47.47	51.7	74	-22.3
2988.4	64.82	PK	H	29.47	5.69	47.47	52.51	74	-21.49

Middle Channel (2437 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4874	49.56	AV	V	34.02	6.66	47.64	42.6	54	-11.4
4874	48.22	AV	H	34.02	6.66	47.64	41.26	54	-12.74
4874	57.65	PK	V	34.02	6.66	47.64	50.69	74	-23.31
4874	57.06	PK	H	34.02	6.66	47.64	50.1	74	-23.9
2994.2	54.61	AV	V	29.93	5.76	47.95	42.35	54	-11.65
2994.2	53.41	AV	H	29.93	5.76	47.95	41.15	54	-12.85
2994.2	62.68	PK	V	29.93	5.76	47.95	50.42	74	-23.58
2994.2	65.4	PK	H	29.93	5.76	47.95	53.14	74	-20.86

High Channel (2462 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924	48.12	AV	V	33.41	8.11	47.95	41.69	54	-12.31
4924	47.7	AV	H	33.41	8.11	47.95	41.27	54	-12.73
4924	56.86	PK	V	33.41	8.11	47.95	50.43	74	-23.57
4924	56.11	PK	H	33.41	8.11	47.95	49.68	74	-24.32
2993.8	55.51	AV	V	29.99	5.79	47.59	43.7	54	-10.3
2993.8	55.02	AV	H	29.99	5.79	47.59	43.21	54	-10.79
2993.8	66.84	PK	V	29.99	5.79	47.59	55.03	74	-18.97
2993.8	60.72	PK	H	29.99	5.79	47.59	48.91	74	-25.09

Note:

*1, The testing has been conformed to 10*2462MHz=24,620MHz*

2, All other emissions more than 30 dB below the limit

3, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

Mode: 802.11g

Antenna (Green)

Channel (2412 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824	48.34	AV	V	33.25	8.01	47.58	42.02	54	-11.98
4824	48.03	AV	H	33.25	8.01	47.58	41.71	54	-12.29
4824	58.89	PK	V	33.25	8.01	47.58	52.57	74	-21.43
4824	57.97	PK	H	33.25	8.01	47.58	51.65	74	-22.35
2993.8	53.44	AV	V	29.99	5.79	47.59	41.63	54	-12.37
2993.8	53.6	AV	H	29.99	5.79	47.59	41.79	54	-12.21
2993.8	69.62	PK	V	29.99	5.79	47.59	57.81	74	-16.19
2993.8	66.66	PK	H	29.99	5.79	47.59	54.85	74	-19.15

Channel (2437 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874	48.38	AV	V	34.02	6.66	47.64	41.42	54	-12.58
4874	48.54	AV	H	34.02	6.66	47.64	41.58	54	-12.42
4874	57.55	PK	V	34.02	6.66	47.64	50.59	74	-23.41
4874	59.13	PK	H	34.02	6.66	47.64	52.17	74	-21.83
2384.5	58.49	AV	V	28.57	4.76	48.34	43.48	54	-10.52
2384.5	57.84	AV	H	28.57	4.76	48.34	42.83	54	-11.17
2384.5	66.68	PK	V	28.57	4.76	48.34	51.67	74	-22.33
2384.5	68.34	PK	H	28.57	4.76	48.34	53.33	74	-20.67

Channel (2457 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4914	49.42	AV	V	33.41	8.11	47.95	42.99	54	-11.01
4914	48.78	AV	H	33.41	8.11	47.95	42.35	54	-11.65
4914	69.35	PK	V	33.41	8.11	47.95	62.92	74	-11.08
4914	70.48	PK	H	33.41	8.11	47.95	64.05	74	-9.95
15035	24.06	AV	V	42.04	15.06	46.19	34.97	54	-19.03
15035	25.07	AV	H	42.04	15.06	46.19	35.98	54	-18.02
15035	44.67	PK	V	42.04	15.06	46.19	55.58	74	-18.42
15035	37.51	PK	H	42.04	15.06	46.19	48.42	74	-25.58

Channel (2462 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924	48.13	AV	V	33.41	8.11	47.95	41.7	54	-12.30
4924	45.68	AV	H	33.41	8.11	47.95	39.25	54	-14.75
4924	57.47	PK	V	33.41	8.11	47.95	51.04	74	-22.96
4924	56.43	PK	H	33.41	8.11	47.95	50	74	-24.00
2308	55.31	AV	V	29.28	5.48	47.89	42.18	54	-11.82
2308	54.56	AV	H	29.28	5.48	47.89	41.43	54	-12.57
2308	68.26	PK	V	29.28	5.48	47.89	55.13	74	-18.87
2308	68.73	PK	H	29.28	5.48	47.89	55.6	74	-18.40

Note:

*1, The testing has been conformed to 10*2462MHz=24,620MHz*

2, All other emissions more than 30 dB below the limit

3, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

Mode: 802.11n20

Antenna (Green+ Gray+ Black)

Channel (2412 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4824	49.23	AV	V	33.25	8.01	47.58	42.91	54	-11.09
4824	45.62	AV	H	33.25	8.01	47.58	39.3	54	-14.7
4824	60.31	PK	V	33.25	8.01	47.58	53.99	74	-20.01
4824	58.1	PK	H	33.25	8.01	47.58	51.78	74	-22.22
2988.4	53.26	AV	V	29.47	5.69	47.47	40.95	54	-13.05
2988.4	53.45	AV	H	29.47	5.69	47.47	41.14	54	-12.86
2988.4	68.61	PK	V	29.47	5.69	47.47	56.3	74	-17.7
2988.4	69.08	PK	H	29.47	5.69	47.47	56.77	74	-17.23

Channel (2437 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874	49.06	AV	V	34.02	6.66	47.64	42.1	54	-11.9
4874	47.58	AV	H	34.02	6.66	47.64	40.62	54	-13.38
4874	61.16	PK	V	34.02	6.66	47.64	54.2	74	-19.8
4874	56.76	PK	H	34.02	6.66	47.64	49.8	74	-24.2
3620	53.96	AV	V	30.73	6.36	48.11	42.94	54	-11.06
3620	53.28	AV	H	30.73	6.36	48.11	42.26	54	-11.74
3620	64.77	PK	V	30.73	6.36	48.11	53.75	74	-20.25
3620	62.38	PK	H	30.73	6.36	48.11	51.36	74	-22.64

Channel (2462 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4924	48.46	AV	V	33.41	8.11	47.95	42.03	54	-11.97
4924	45.61	AV	H	33.41	8.11	47.95	39.18	54	-14.82
4924	58.56	PK	V	33.41	8.11	47.95	52.13	74	-21.87
4924	56	PK	H	33.41	8.11	47.95	49.57	74	-24.43
2988.4	55.91	AV	V	29.47	5.69	47.47	43.6	54	-10.4
2993.8	54.04	AV	H	29.99	5.79	47.59	42.23	54	-11.77
2988.4	69.08	PK	V	29.47	5.69	47.47	56.77	74	-17.23
2993.8	57.69	PK	H	29.99	5.79	47.59	45.88	74	-28.12

Note:

*1, The testing has been conformed to 10*2462MHz=24,620MHz*

2, All other emissions more than 30 dB below the limit

3, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

Mode: 802.11n40

Antenna (Green+ Gray+ Black)

Channel (2422 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4844	46.66	AV	V	33.25	8.01	47.58	40.34	54	-13.66
4844	46.08	AV	H	33.25	8.01	47.58	39.76	54	-14.24
4844	58.29	PK	V	33.25	8.01	47.58	51.97	74	-22.03
4844	59.98	PK	H	33.25	8.01	47.58	53.66	74	-20.34
2988.4	54.72	AV	V	29.47	5.69	47.47	42.41	54	-11.59
2988.4	54.48	AV	H	29.47	5.69	47.47	42.17	54	-11.83
2988.4	70.01	PK	V	29.47	5.69	47.47	57.7	74	-16.3
2988.4	67.39	PK	H	29.47	5.69	47.47	55.08	74	-18.92

Channel (2437 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4874	48.11	AV	V	34.02	6.66	47.64	41.15	54	-12.85
4874	46.95	AV	H	34.02	6.66	47.64	39.99	54	-14.01
4874	59.42	PK	V	34.02	6.66	47.64	52.46	74	-21.54
4874	56.53	PK	H	34.02	6.66	47.64	49.57	74	-24.43
2388.8	52.12	AV	V	29.17	5.99	47.41	39.87	54	-14.13
2388.8	50.68	AV	H	29.17	5.99	47.41	38.43	54	-15.57
2388.8	67.08	PK	V	29.17	5.99	47.41	54.83	74	-19.17
2388.8	66.05	PK	H	29.17	5.99	47.41	53.8	74	-20.2

Channel (2442 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4884	48.37	AV	V	33.41	8.11	47.95	41.94	54	-12.06
4884	47.98	AV	H	33.41	8.11	47.95	41.55	54	-12.45
4884	57.49	PK	V	33.41	8.11	47.95	51.06	74	-22.94
4884	60.04	PK	H	33.41	8.11	47.95	53.61	74	-20.39
2993.8	52.16	AV	V	29.99	5.79	47.59	40.35	54	-13.65
2993.8	50.56	AV	H	29.99	5.79	47.59	38.75	54	-15.25
2993.8	67.92	PK	V	29.99	5.79	47.59	56.11	74	-17.89
2993.8	61.79	PK	H	29.99	5.79	47.59	49.98	74	-24.02

Channel (2447 MHz)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4894	48.52	AV	V	33.41	8.11	47.95	42.09	54	-11.91
4894	51.85	AV	H	33.41	8.11	47.95	45.42	54	-8.58
4894	74.06	PK	V	33.41	8.11	47.95	67.63	74	-6.37
4894	69.07	PK	H	33.41	8.11	47.95	62.64	74	-11.36
15014	23.01	AV	V	42.02	15.07	46.11	33.99	54	-20.01
15014	24.87	AV	H	42.02	15.07	46.11	35.85	54	-18.15
15014	44.49	PK	V	42.02	15.07	46.11	55.47	74	-18.53
15014	37.43	PK	H	42.02	15.07	46.11	48.41	74	-25.59

Channel (2452 MHz)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
4904	48.52	AV	V	33.41	8.11	47.95	42.09	54	-11.91
4904	50.32	AV	H	33.41	8.11	47.95	43.89	54	-10.11
4904	68.33	PK	V	33.41	8.11	47.95	61.9	74	-12.1
4904	68.7	PK	H	33.41	8.11	47.95	62.27	74	-11.73
2993.8	45.16	AV	V	29.99	5.79	47.59	33.35	54	-20.65
2993.8	45.49	AV	H	29.99	5.79	47.59	33.68	54	-20.32
2993.8	66.13	PK	V	29.99	5.79	47.59	54.32	74	-19.68
2993.8	60.85	PK	H	29.99	5.79	47.59	49.04	74	-24.96

Note:

*1, The testing has been conformed to 10*2462MHz=24,620MHz*

2, All other emissions more than 30 dB below the limit

3, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

6.8 ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

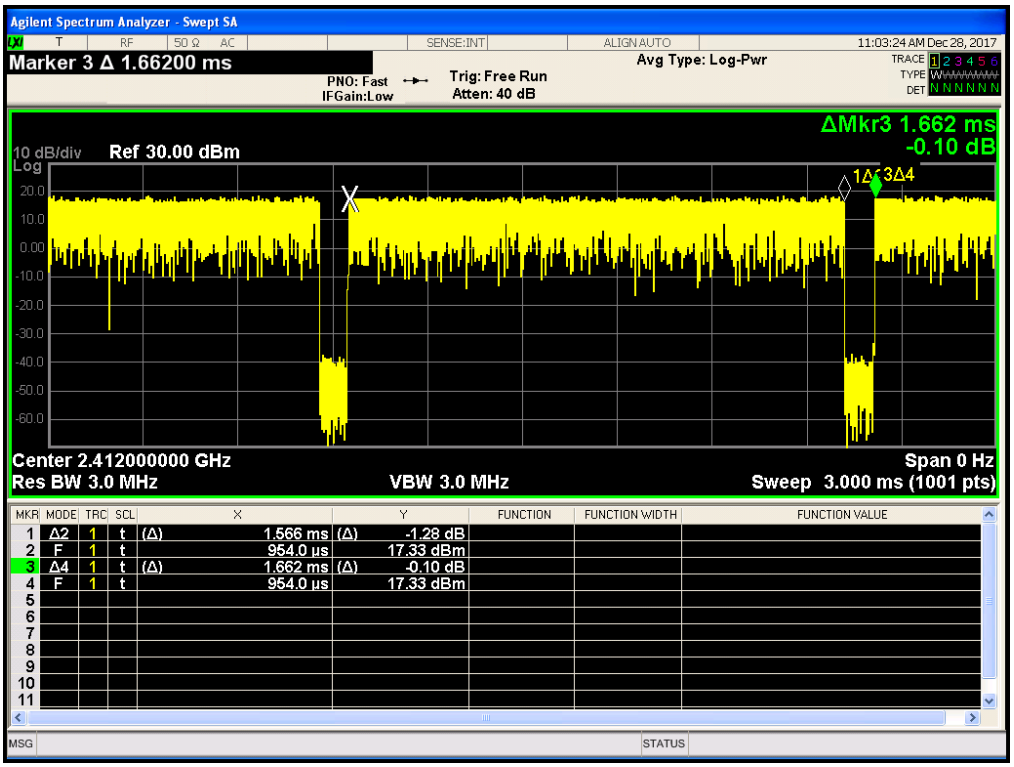
KDB 558074 Zero-Span Spectrum Analyzer Method.

Test Result

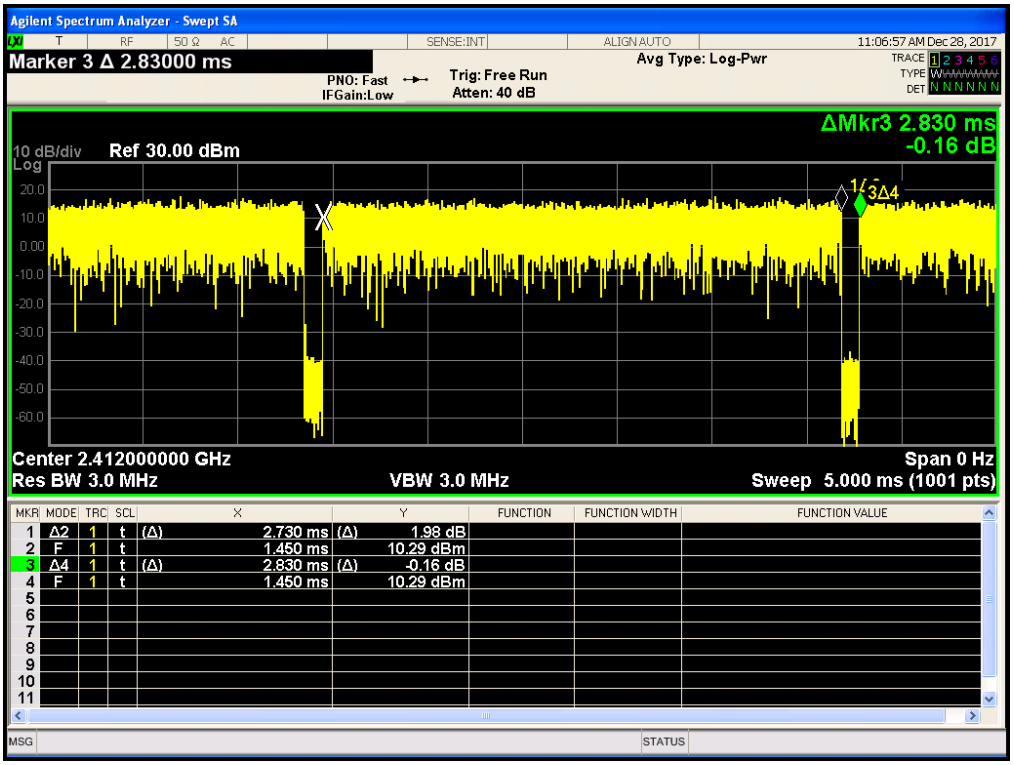
Mode	ON Time B(msec)	Period (msec)	Duty Cycle X(linear)	Duty Cycle (%)	Duty Cycle Correction Factor(dB)	1/B Minimum VBW(KHz)
802.11 b	1.566	1.662	0.9422	94.22	0.26	1KHz
802.11 g	2.730	2.830	0.9647	96.47	0.16	1KHz
802.11 n20	0.884	0.984	0.8984	89.84	0.47	3KHz
802.11 n40	0.452	0.550	0.8218	82.18	0.85	3KHz

Test plots

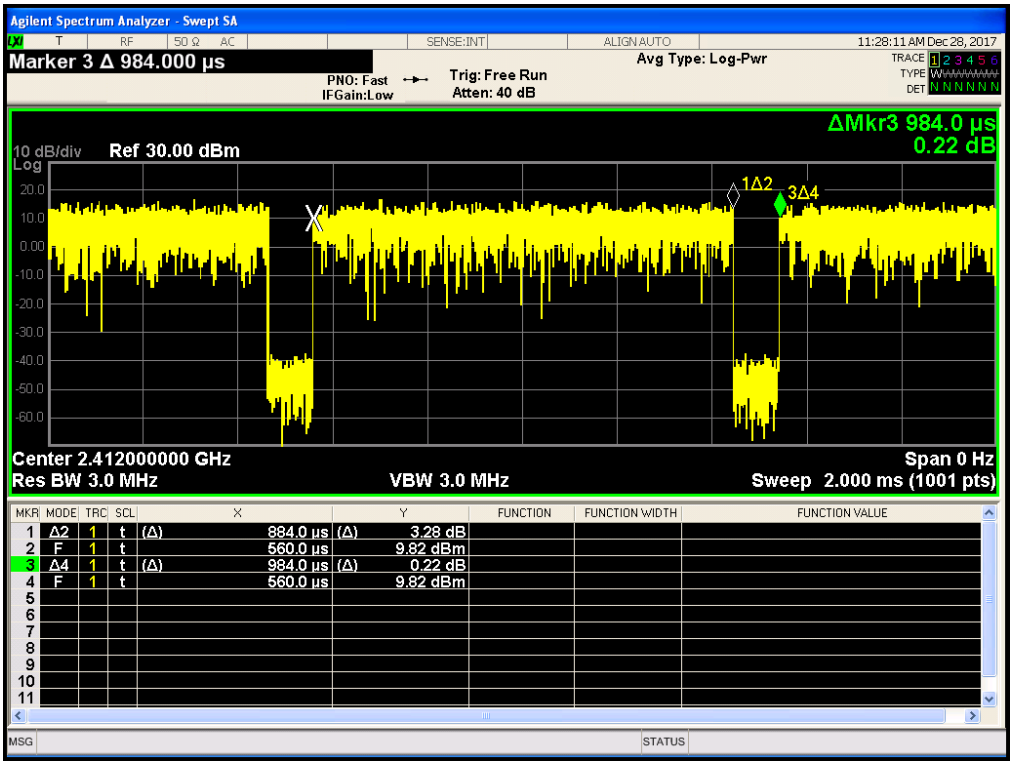
802.11 b



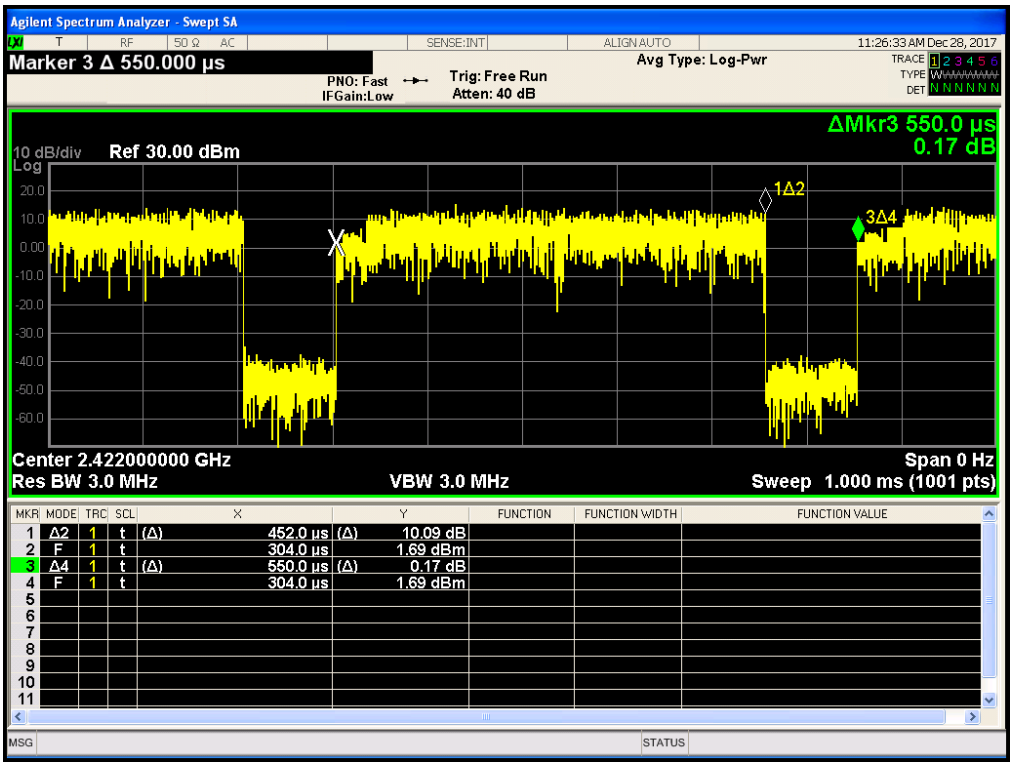
802.11 g



802.11 n20



802.11 n40



Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	☑
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	☑
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	☑
ISN	ISN T800	34373	09/23/2017	09/22/2018	☐
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	☐
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	☑
Power Splitter	1#	1#	08/30/2017	08/29/2018	☑
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	☑
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	☑
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	☑
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	☑
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	☑

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
3m Semi-anechoic Chamber	ETS-LINDGREN	9m*6m*6m	Euroshieldpn-CT0001143-1216	May 06,17	May 05,18
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Dec. 16,16	Dec. 15,17
Test Software	ADT	ADT_Radiated_V7.6.15.9.2	N/A	N/A	N/A
10dB Attenuator	JFW/USA	50HF-010-SMA	1505	Jul. 24,17	Jul. 23,18
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 10,17	Mar. 09,18
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Jul. 24,17	Jul. 23,18

Annex B. EUT and Test Setup Photographs

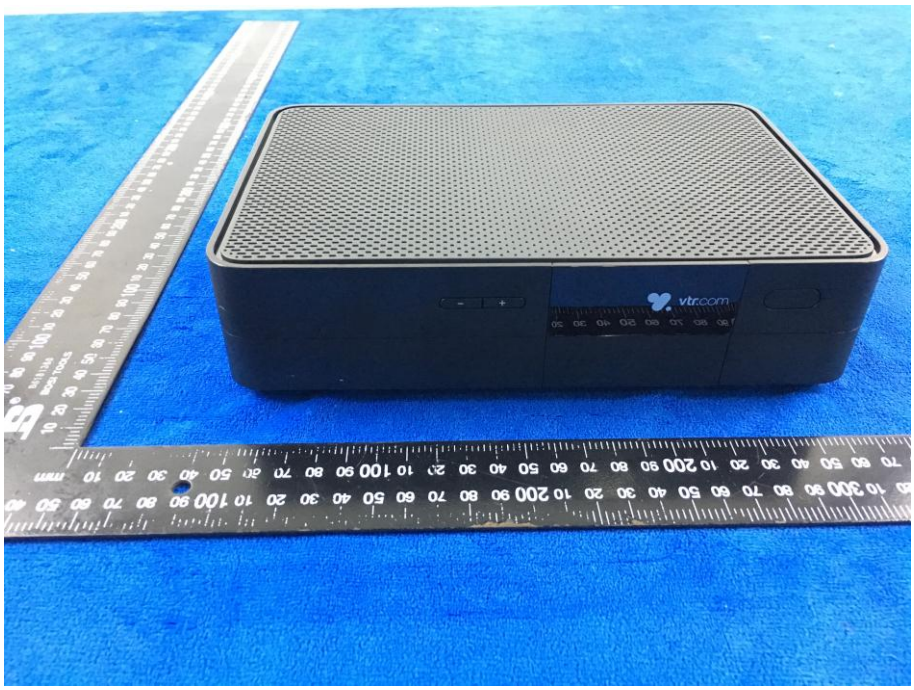
Annex B.i. Photograph EUT External Photo

Adapter - Front View

EUT - Front View

EUT - Rear View

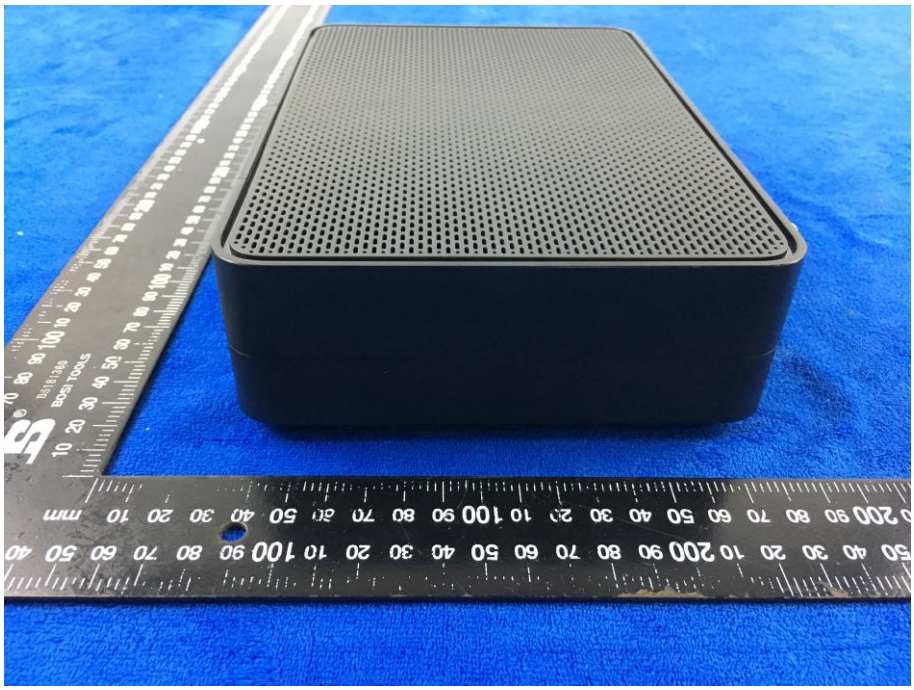
EUT - Top View



EUT - Bottom View

EUT - Left View

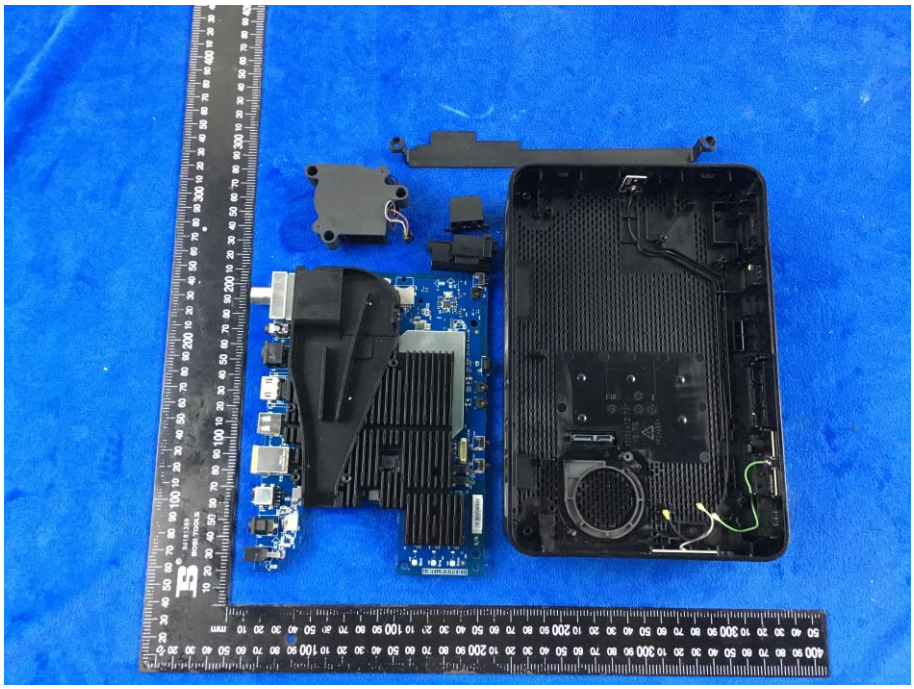
EUT - Right View



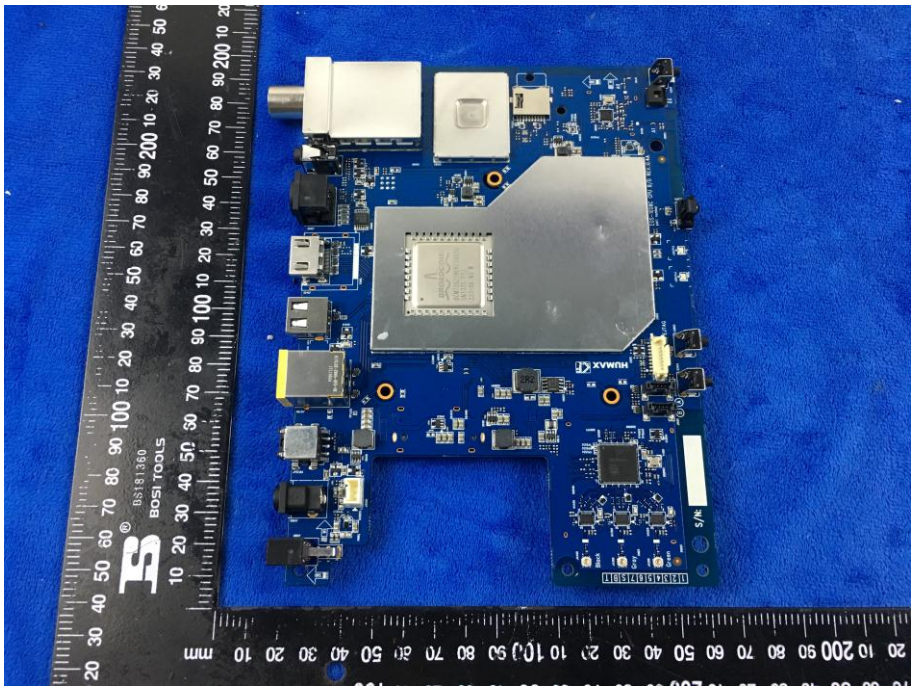
Annex B.ii. Photograph: EUT Internal Photo

Cover Off - Top View 1

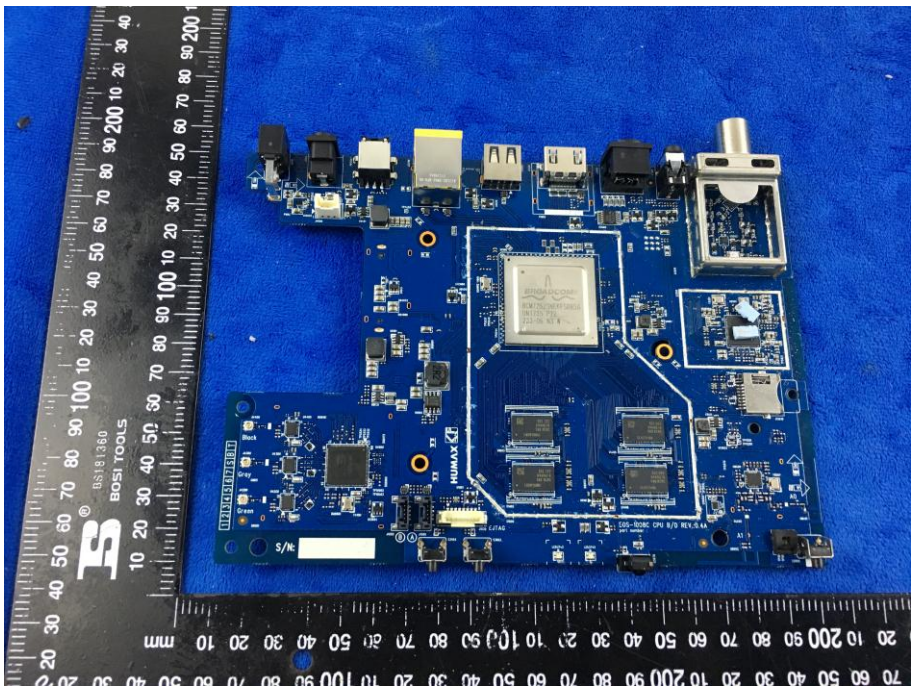
Cover Off - Top View 2



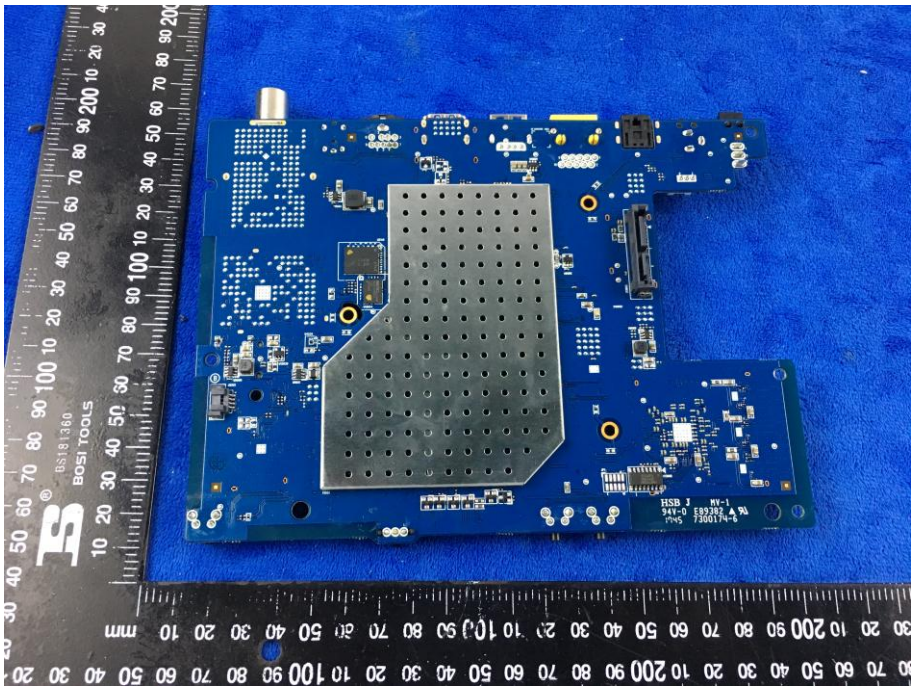
Mainboard with Shielding - Top View



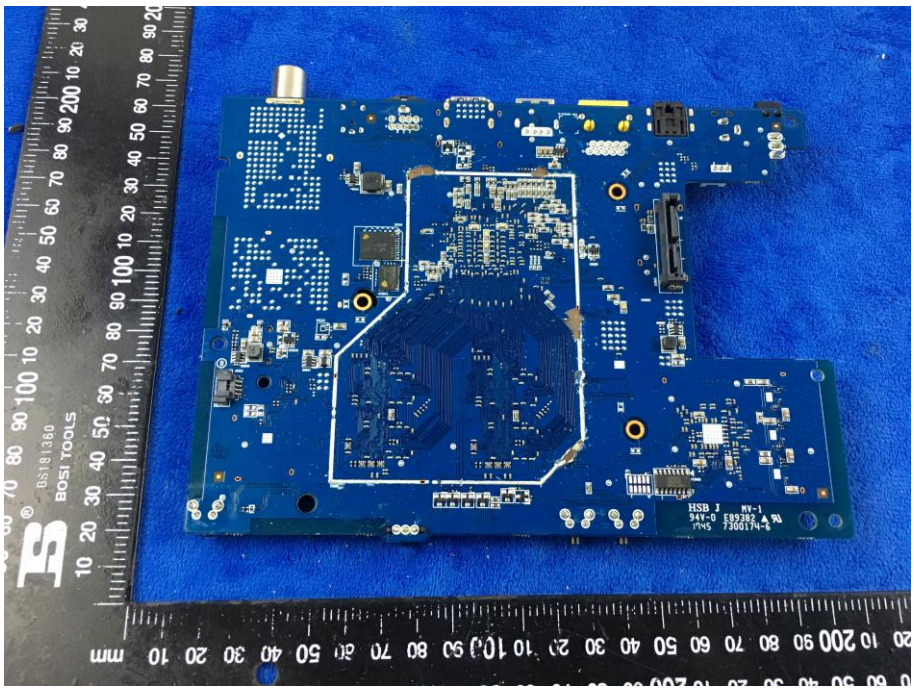
Mainboard without Shielding - Top View



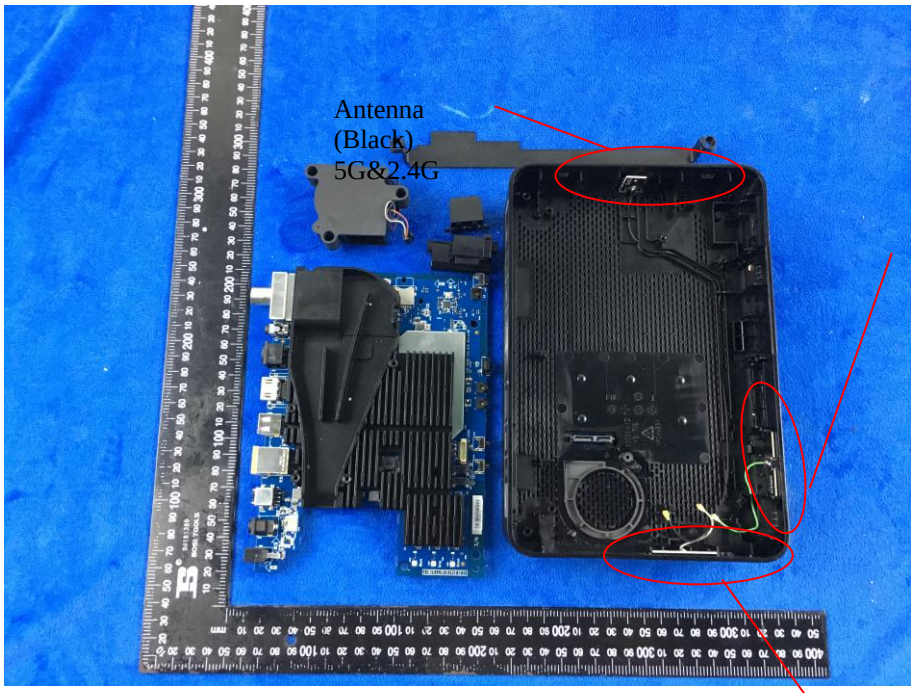
Mainboard with Shielding - Bottom View



Mainboard without Shielding - Bottom View



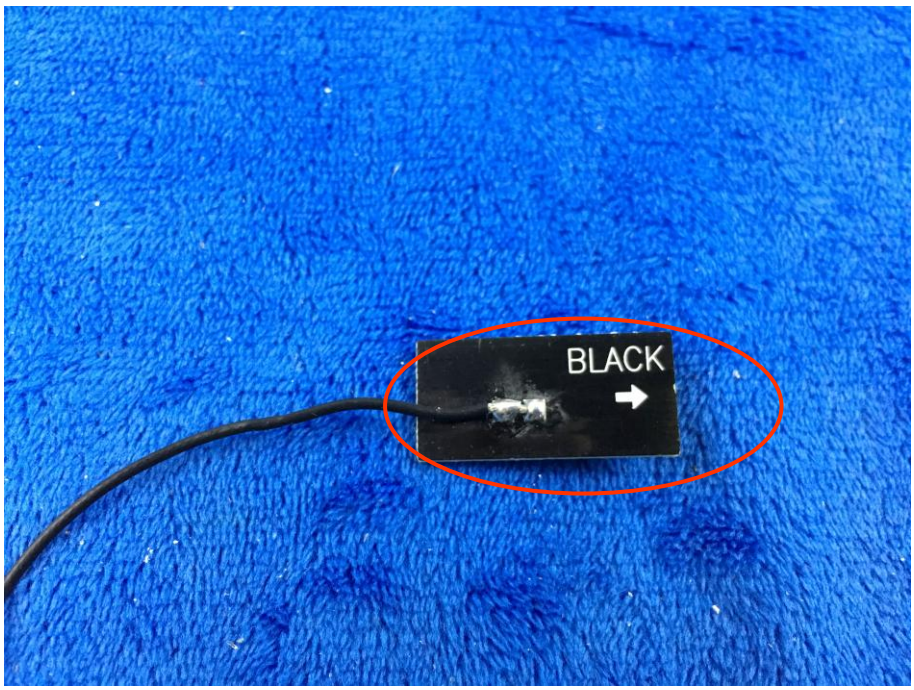
2.4G&5G Antenna View



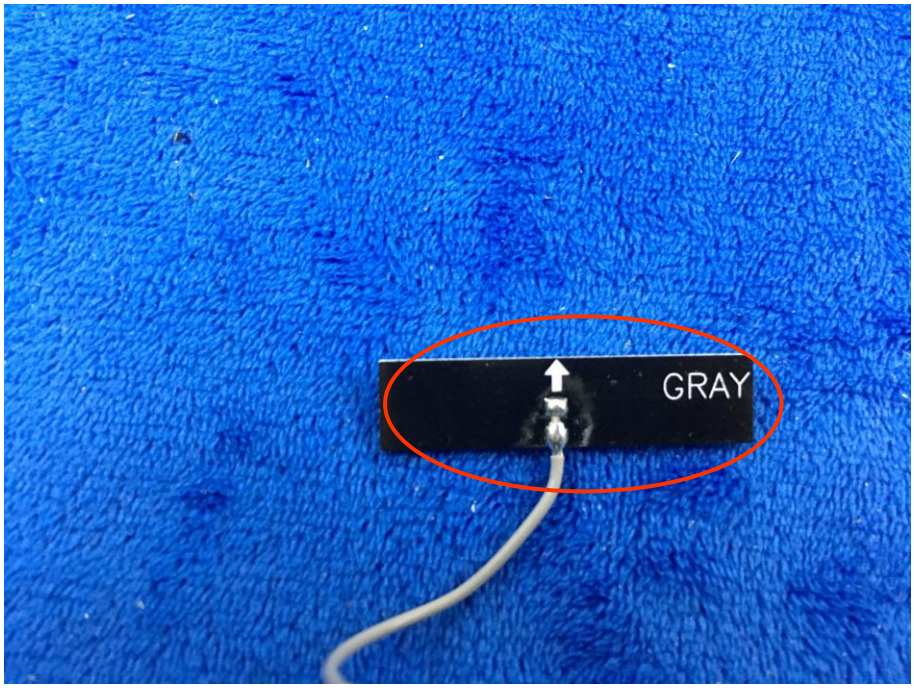
Antenna
(Gree)
5G&2.4G

Antenna
(Blue)
5G&2.4G

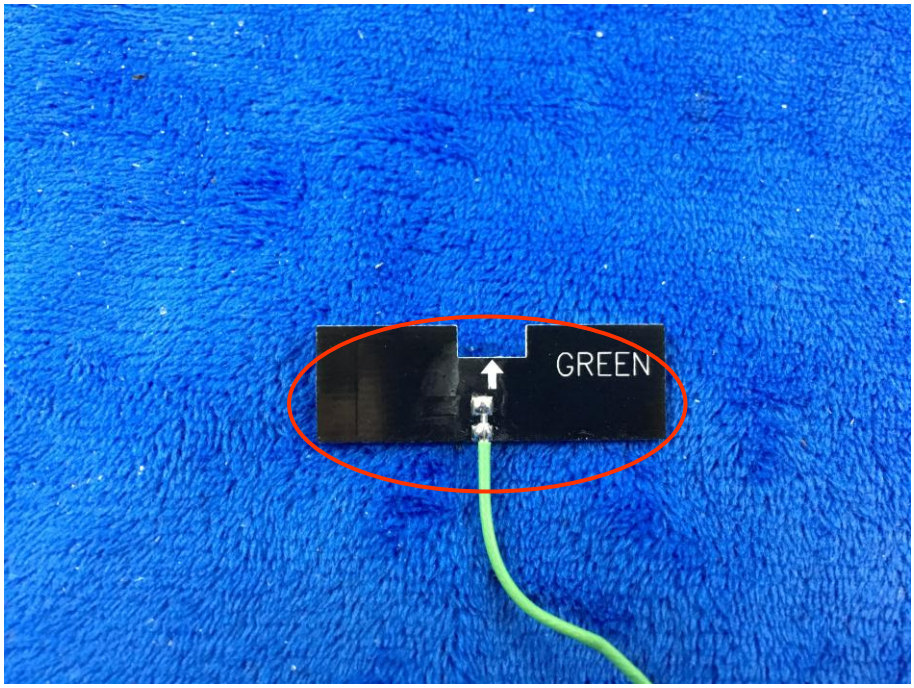
Ant. (black)



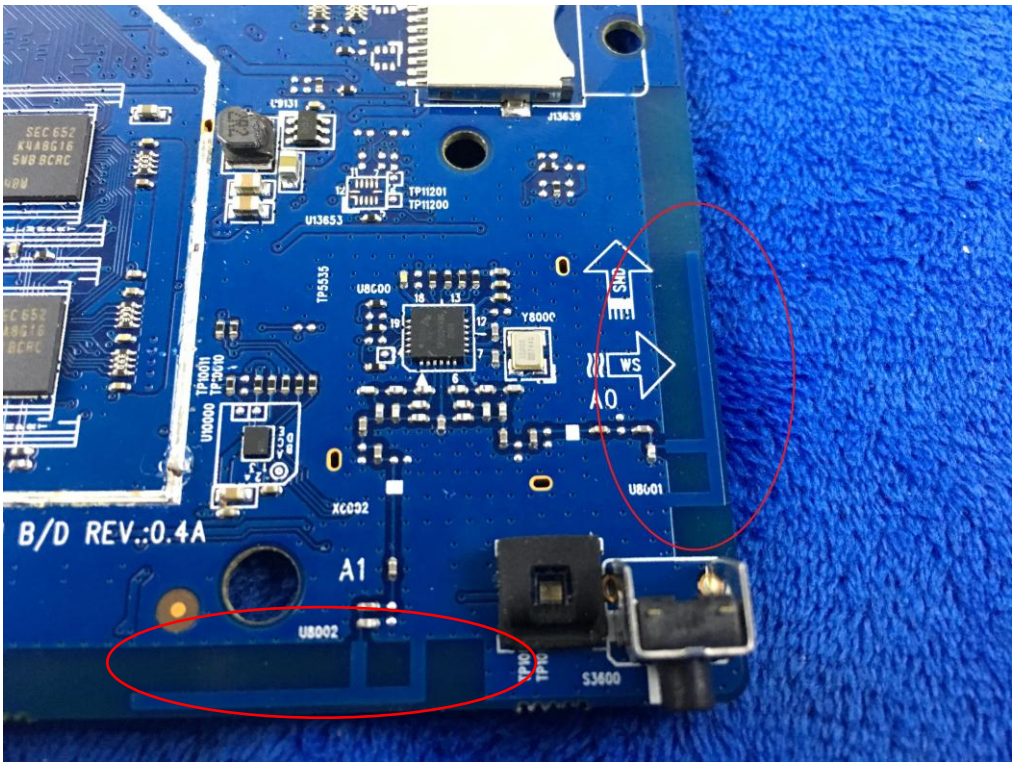
Ant. (gray)



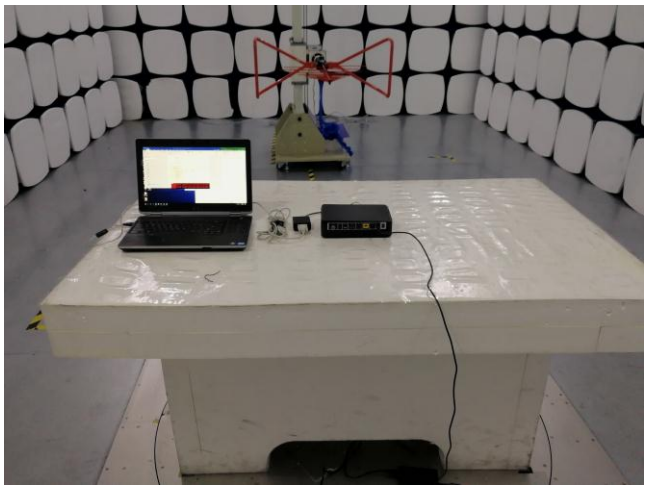
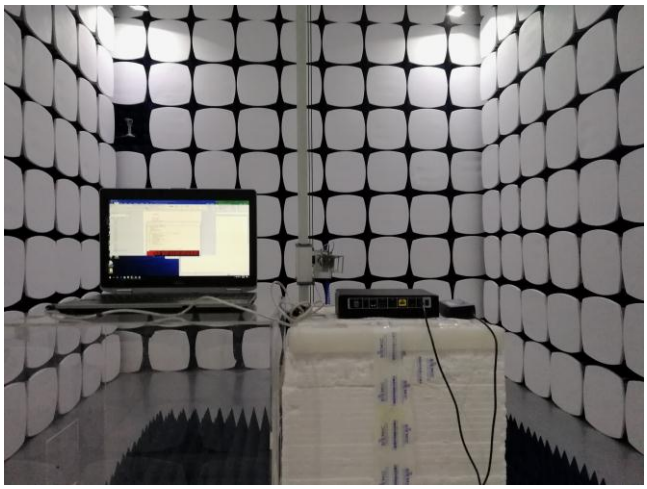
Ant. (green)



Zigbee (RF4CE)



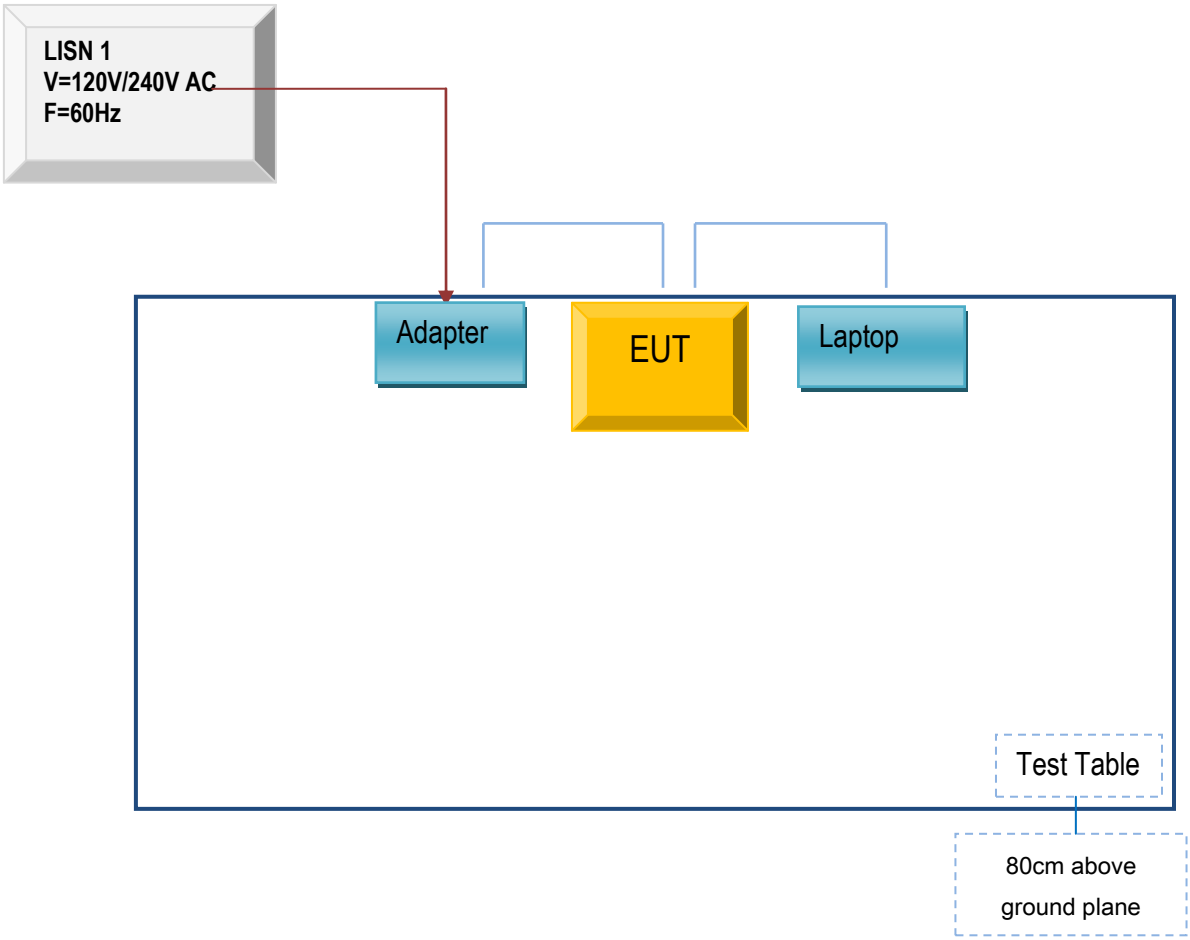
Annex B.iii. Photograph: Test Setup Photo

Conducted Emissions Test Setup Front View	Conducted Emissions Test Setup Side View
	
Radiated Spurious Emissions Test Setup Below 1GHz	Radiated Spurious Emissions Test Setup Above 1GHz

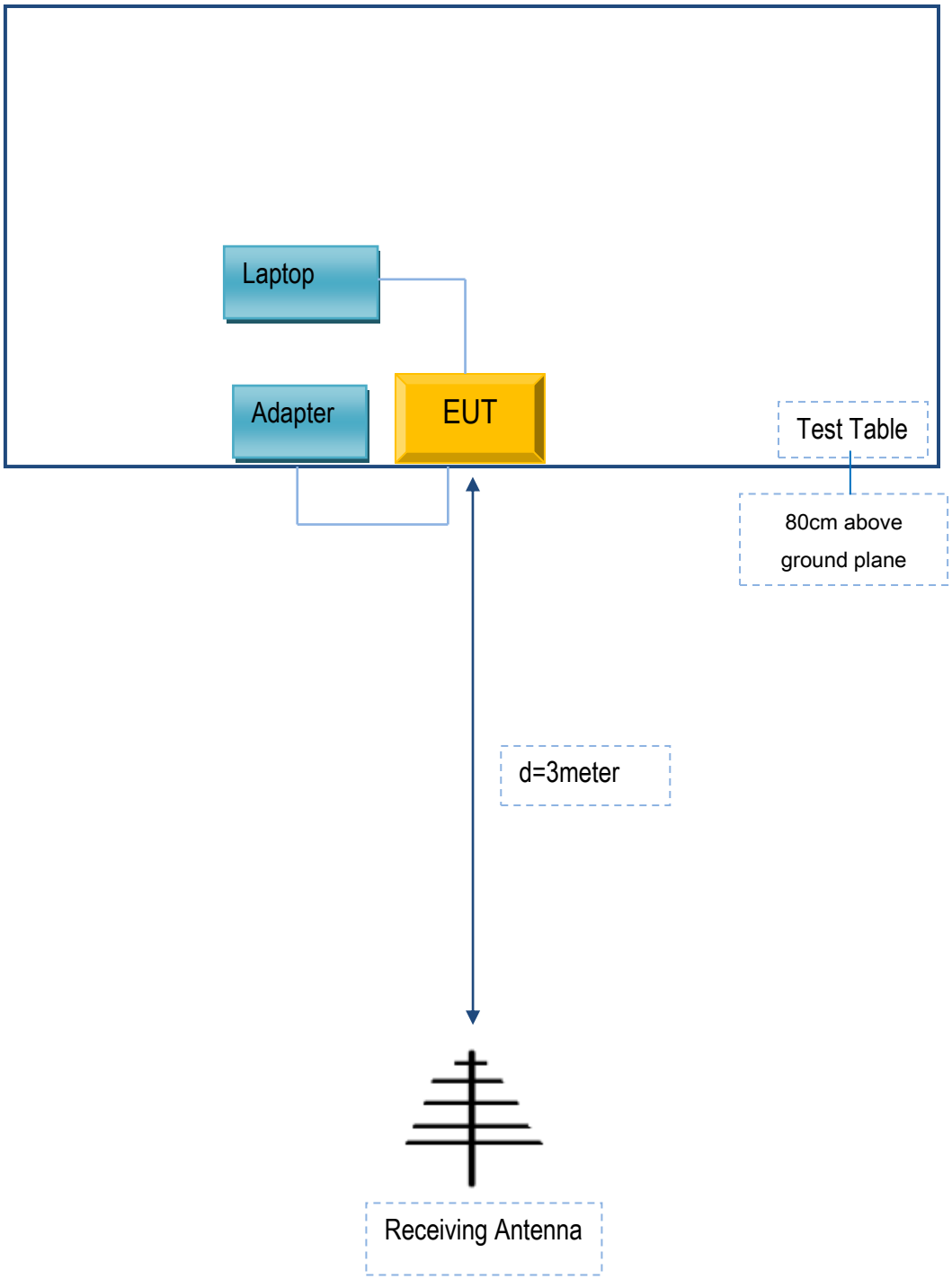
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

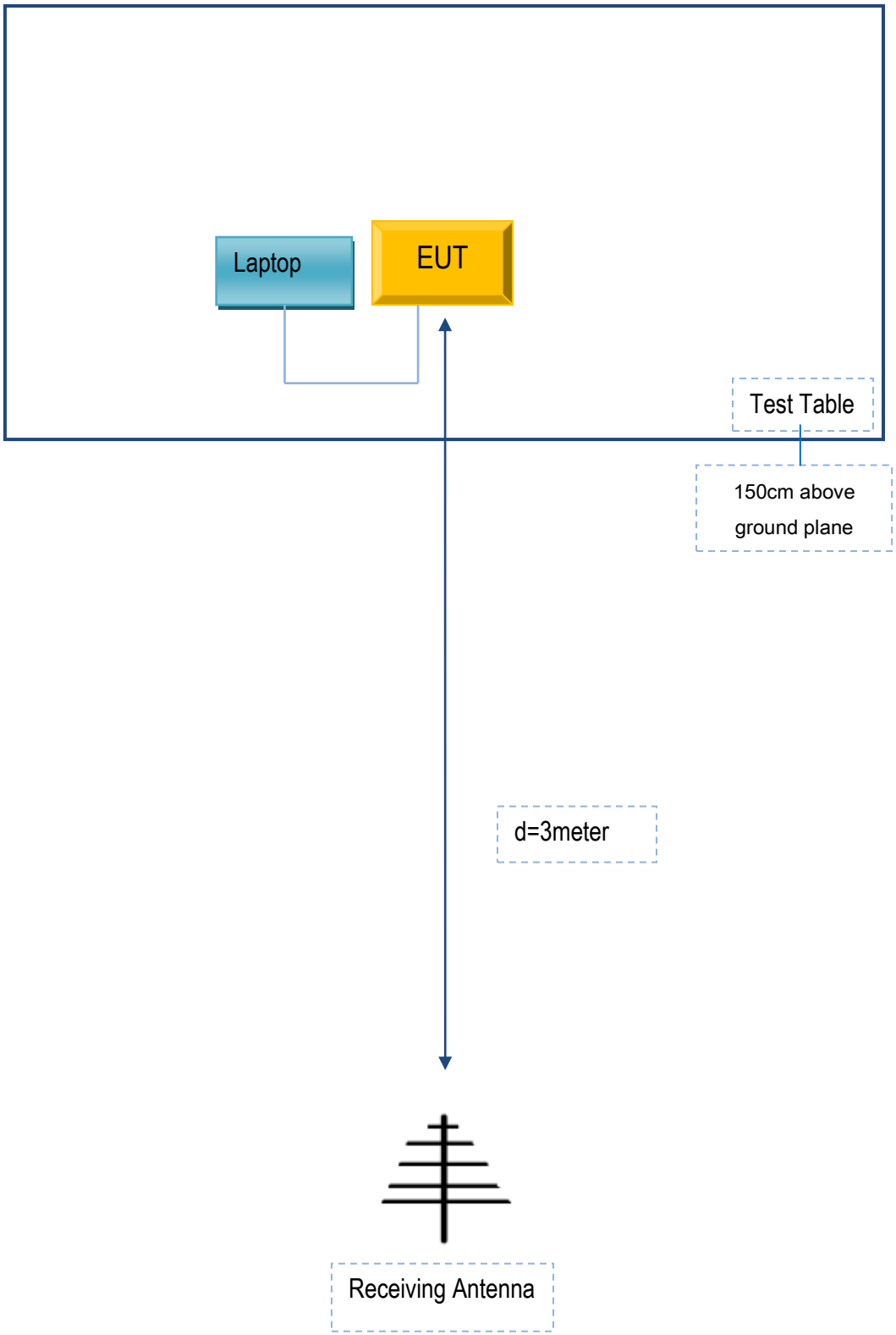
Block Configuration Diagram for AC Line Conducted Emissions



Block Configuration Diagram for Radiated Emissions （Below 1GHz）.



Block Configuration Diagram for Radiated Emissions （Above 1GHz）.



Annex C. il. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description	Model	Serial No
DELTA ELECTRONICS, INC.	Adapter	ADP-30LR A	N/A
DELL	Laptop	E6530	N/A

Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see attachment

Annex E. DECLARATION OF SIMILARITY

Humax Co., Ltd.

To: SIEMIC ,775 Montague Expressway, Milpitas, CA 95035,USA

Declaration Letter

Dear Sir,

For our business issue and marketing requirement, we would like to list 2 model numbers on the **FCC&CE** certificates and reports, as following:

Model No.: 1008R-HDD-XXX(XXX=A~Z) , 1008C-STB-XXX(XXX=A~Z)

FCC ID: O6ZEOS-1008C

We declare that, all the model PCB, Antenna and Appearance shape, accessories are the same. The difference of these is listed as below:

Main Model No	Serial Model No	Difference
1008R-HDD-XXX(XXX=A~Z)	1008C-STB-XXX(XXX=A~Z)	1008R-HDD-XXX(XXX=A~Z) has internal 3.5 " HDD, 1008C-STB-XXX(XXX=A~Z) without HDD.

Printed name/ title: Inseok Seo / Senior Engineer

Address: HUMAX BLDG., 2, Yeongmun-ro, Cheoin-gu Yongin-si, Gyeonggi-do South Korea 17040