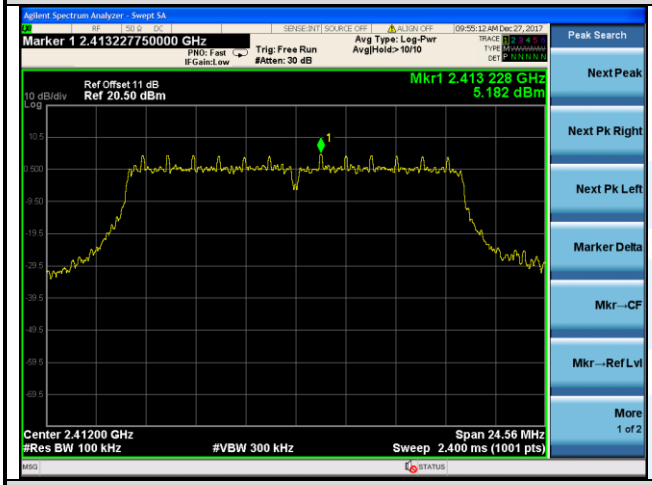
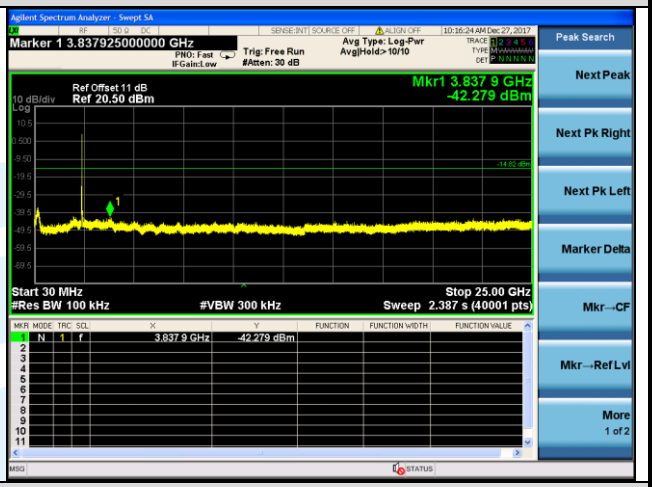
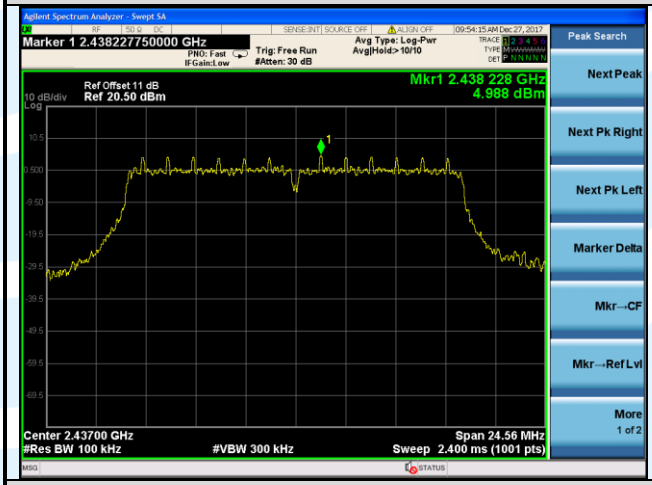
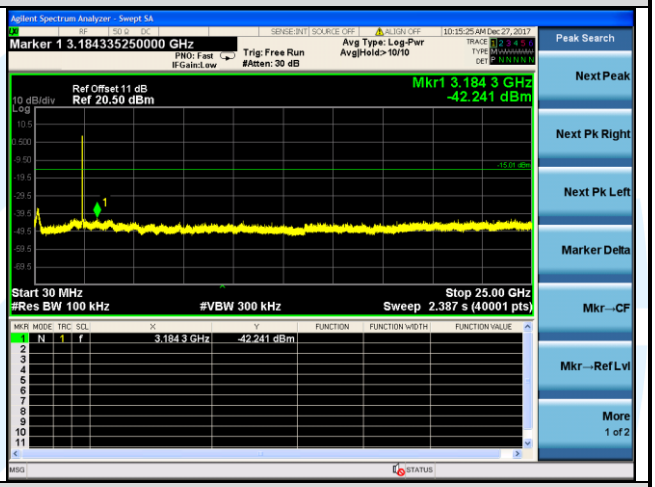
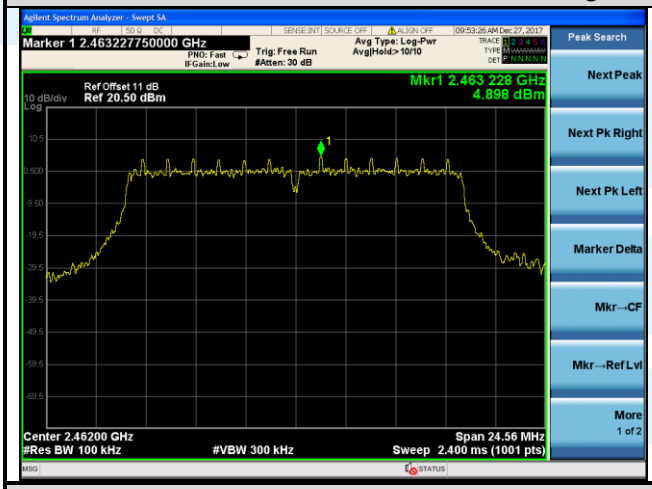
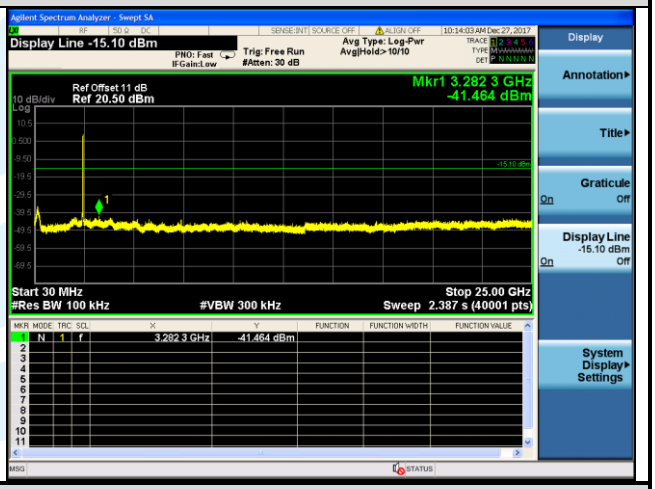
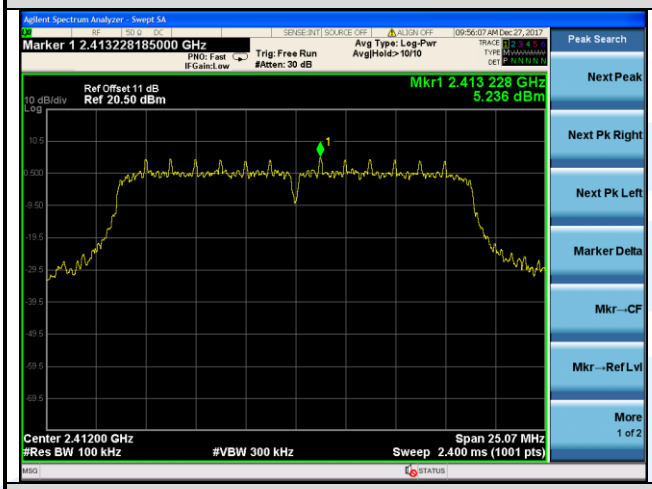
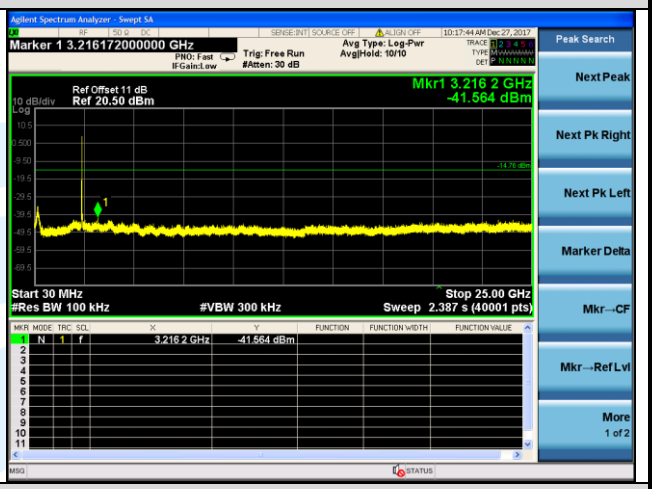
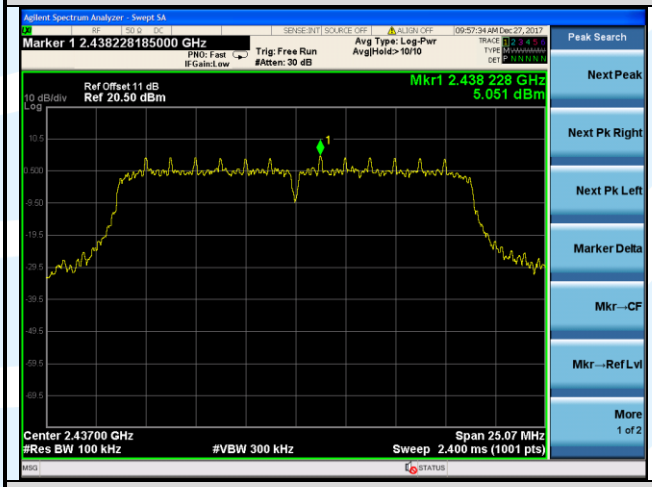
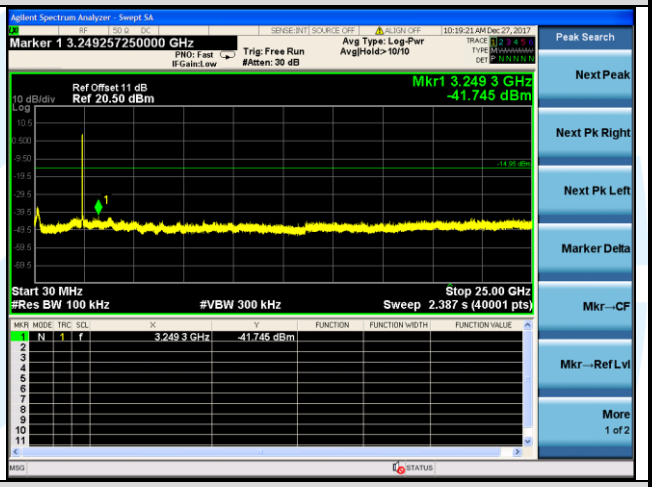
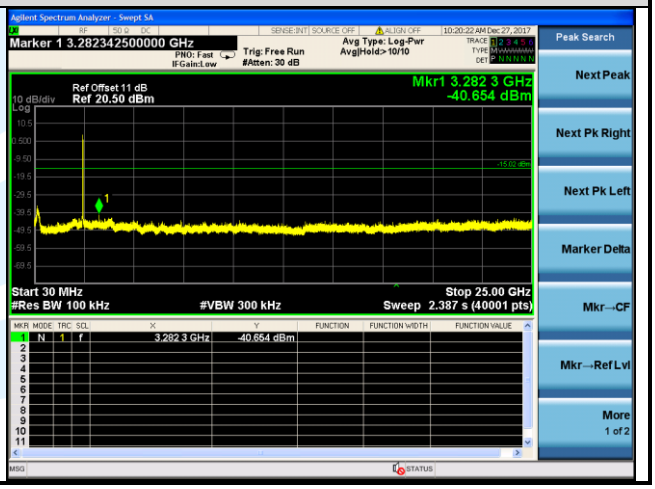
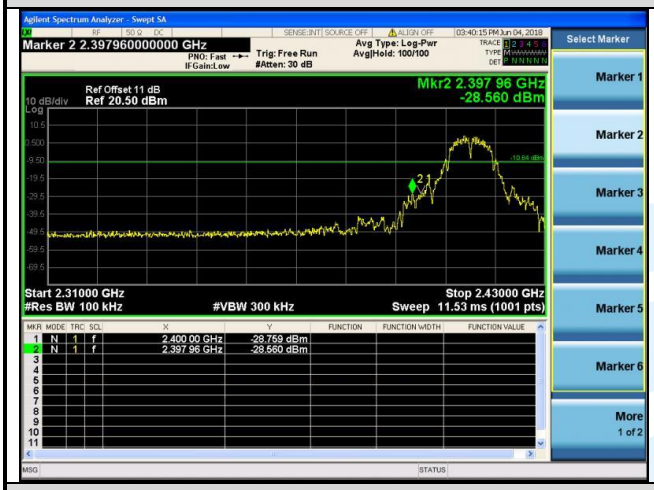
IEEE 802.11g

In-Band Reference Level	Out of Band Emission
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	
Highest Channel	

IEEE 802.11n20	
In-Band Reference Level	**Out of Band Emission**
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

BAND EDGE

802.11b



802.11g

802.11n-HT20

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

Test Method: KDB 558074 D01 v04, Section 12.1

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
2) Test the EUT in the lowest channel ,middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found

the Y axis positioning which it is worse case.

4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

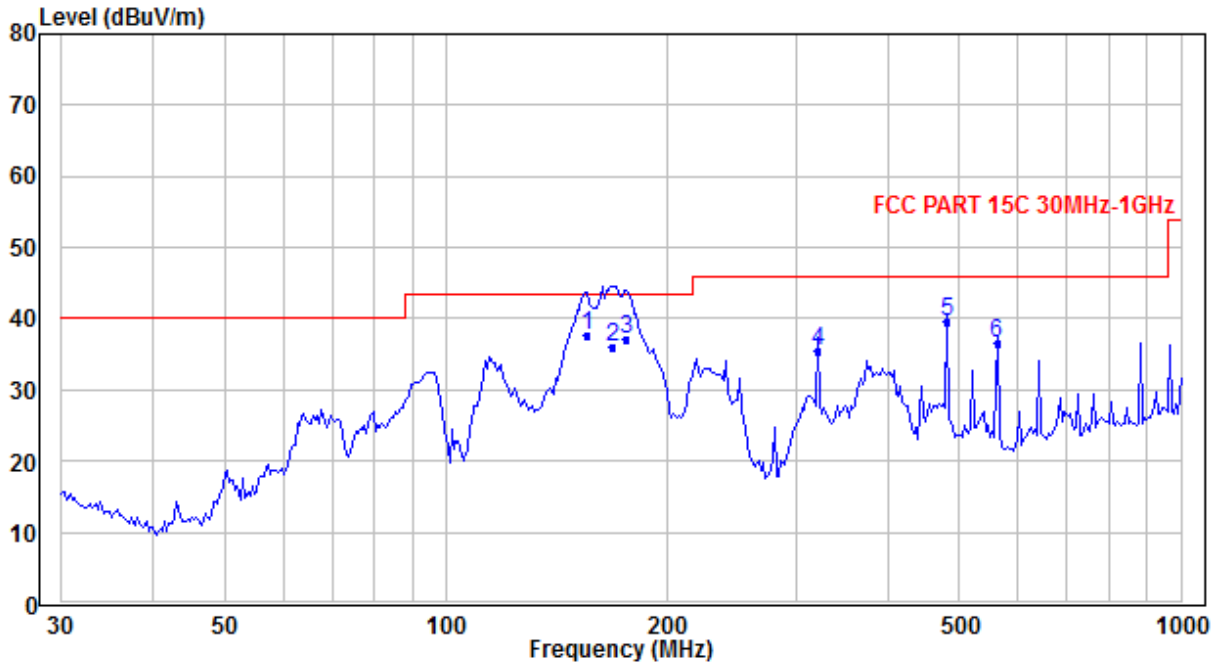
The measurement data as follows:

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

Radiated Emission Test Data (30 MHz ~ 1 GHz):

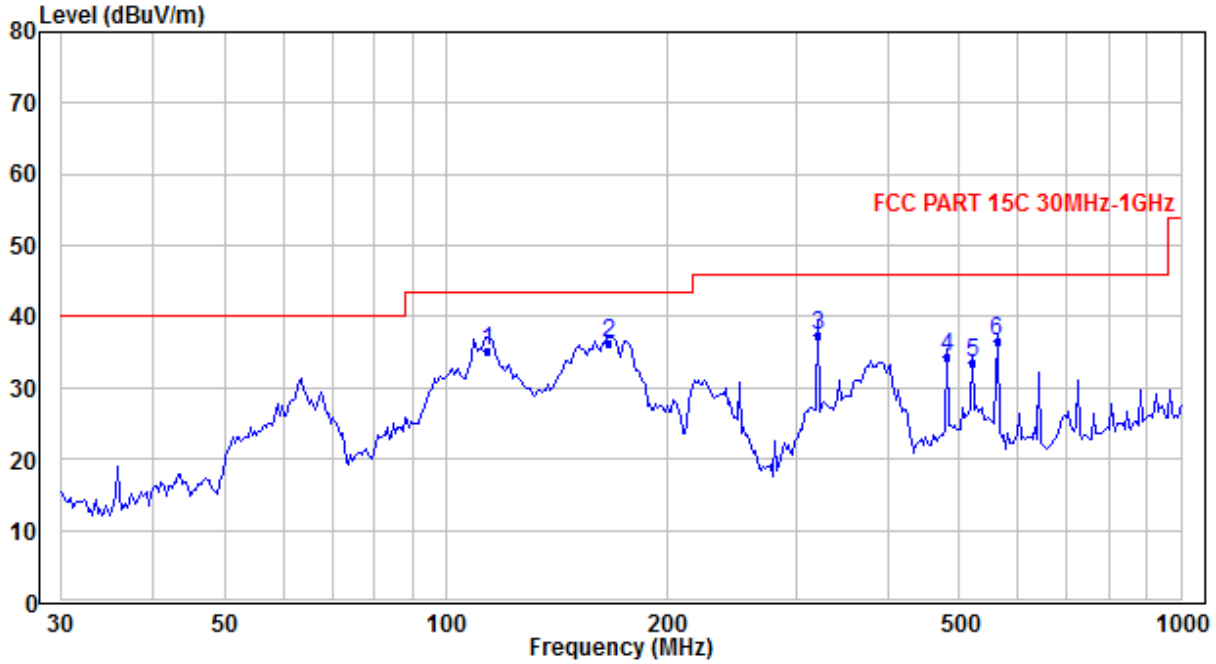
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	155.331	53.99	-16.28	37.71	43.50	-5.79	QP
2	168.565	52.30	-16.42	35.88	43.50	-7.62	QP
3	176.275	53.19	-16.07	37.12	43.50	-6.38	QP
4*	320.331	46.22	-10.73	35.49	46.00	-10.51	QP
5	481.511	46.85	-7.37	39.48	46.00	-6.52	QP
6	562.014	42.73	-6.04	36.69	46.00	-9.31	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	114.018	53.95	-18.88	35.07	43.50	-8.43	QP
2	166.639	52.86	-16.66	36.20	43.50	-7.30	QP
3	320.331	48.34	-10.85	37.49	46.00	-8.51	QP
4	481.511	41.47	-7.04	34.43	46.00	-11.57	QP
5*	520.208	39.41	-5.81	33.60	46.00	-12.40	QP
6	562.014	42.96	-6.43	36.53	46.00	-9.47	QP

Radiated Emission Test Data (Above 1GHz):

IEEE 802.11b_Lowest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	49.44	74.00	-24.56	Peak	Horizontal
2	4824.00	32.51	54.00	-21.49	Average	Horizontal
3	7236.00	45.66	74.00	-28.34	Peak	Horizontal
4	7236.00	32.06	54.00	-21.94	Average	Horizontal
5	4824.00	45.11	74.00	-28.89	Peak	Vertical
6	4824.00	29.07	54.00	-24.93	Average	Vertical
7	7236.00	44.14	74.00	-29.86	Peak	Vertical
8	7236.00	30.06	54.00	-23.94	Average	Vertical

IEEE 802.11b_Middle Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	53.52	74.00	-20.48	Peak	Horizontal
2	4874.00	35.39	54.00	-18.61	Average	Horizontal
3	7311.00	49.69	74.00	-24.31	Peak	Horizontal
4	7311.00	35.18	54.00	-18.82	Average	Horizontal
5	4874.00	50.77	74.00	-23.23	Peak	Vertical
6	4874.00	33.28	54.00	-20.72	Average	Vertical
7	7311.00	50.18	74.00	-23.82	Peak	Vertical
8	7311.00	35.36	54.00	-18.64	Average	Vertical

IEEE 802.11b_Highest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	54.47	74.00	-19.53	Peak	Horizontal
2	4924.00	36.41	54.00	-17.59	Average	Horizontal
3	7386.00	54.34	74.00	-19.66	Peak	Horizontal
4	7386.00	39.39	54.00	-14.61	Average	Horizontal
5	4924.00	50.78	74.00	-23.22	Peak	Vertical
6	4924.00	33.05	54.00	-20.95	Average	Vertical
7	7386.00	55.72	74.00	-18.28	Peak	Vertical
8	7386.00	39.78	54.00	-14.22	Average	Vertical

IEEE 802.11g_Lowest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	43.84	74.00	-30.16	Peak	Horizontal
2	4824.00	28.87	54.00	-25.13	Average	Horizontal
3	7236.00	44.66	74.00	-29.34	Peak	Horizontal
4	7236.00	30.48	54.00	-23.52	Average	Horizontal
5	4824.00	42.19	74.00	-31.81	Peak	Vertical
6	4824.00	28.26	54.00	-25.74	Average	Vertical
7	7236.00	42.93	74.00	-31.07	Peak	Vertical
8	7236.00	32.74	54.00	-21.26	Average	Vertical

IEEE 802.11g_Middle Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	44.20	74.00	-29.80	Peak	Horizontal
2	4874.00	32.22	54.00	-21.78	Average	Horizontal
3	7311.00	46.36	74.00	-27.64	Peak	Horizontal
4	7311.00	31.51	54.00	-22.49	Average	Horizontal
5	4874.00	41.29	74.00	-32.71	Peak	Vertical
6	4874.00	28.65	54.00	-25.35	Average	Vertical
7	7311.00	44.52	74.00	-29.48	Peak	Vertical
8	7311.00	30.98	54.00	-23.02	Average	Vertical

IEEE 802.11g_Highest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	49.65	74.00	-24.35	Peak	Horizontal
2	4924.00	34.80	54.00	-19.20	Average	Horizontal
3	7386.00	56.25	74.00	-17.75	Peak	Horizontal
4	7386.00	39.14	54.00	-14.86	Average	Horizontal
5	4924.00	46.39	74.00	-27.61	Peak	Vertical
6	4924.00	33.26	54.00	-20.74	Average	Vertical
7	7386.00	56.57	74.00	-17.43	Peak	Vertical
8	7386.00	39.99	54.00	-14.01	Average	Vertical

IEEE 802.11n-HT20_Lowest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4824.00	42.89	74.00	-31.11	Peak	Horizontal
2	4824.00	29.12	54.00	-24.88	Average	Horizontal
3	7236.00	43.92	74.00	-30.08	Peak	Horizontal
4	7236.00	31.00	54.00	-23.00	Average	Horizontal
5	4824.00	38.68	74.00	-35.32	Peak	Vertical
6	4824.00	26.08	54.00	-27.92	Average	Vertical
7	7236.00	41.63	74.00	-32.37	Peak	Vertical
8	7236.00	29.41	54.00	-24.59	Average	Vertical

IEEE 802.11n-HT20_Middle Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4874.00	45.63	74.00	-28.37	Peak	Horizontal
2	4874.00	32.97	54.00	-21.03	Average	Horizontal
3	7311.00	44.63	74.00	-29.37	Peak	Horizontal
4	7311.00	31.36	54.00	-22.64	Average	Horizontal
5	4874.00	42.02	74.00	-31.98	Peak	Vertical
6	4874.00	28.88	54.00	-25.12	Average	Vertical
7	7311.00	43.34	74.00	-30.66	Peak	Vertical
8	7311.00	30.39	54.00	-23.61	Average	Vertical

IEEE 802.11n-HT20_Highest Channel:

No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4924.00	48.23	74.00	-25.77	Peak	Horizontal
2	4924.00	35.49	54.00	-18.51	Average	Horizontal
3	7386.00	54.22	74.00	-19.78	Peak	Horizontal
4	7386.00	37.97	54.00	-16.03	Average	Horizontal
5	4924.00	46.54	74.00	-27.46	Peak	Vertical
6	4924.00	32.22	54.00	-21.78	Average	Vertical
7	7386.00	54.56	74.00	-19.44	Peak	Vertical
8	7386.00	38.55	54.00	-15.45	Average	Vertical

5.8 BAND EDGE MEASUREMENTS (RADIATED)

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

Test Method: KDB 558074 D01 v04, Section 12.1

Limits:

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Frequency	Limit (dBμV/m @3m)	Remark
30 MHz-88 MHz	40.0	Quasi-peak Value
88 MHz-216 MHz	43.5	Quasi-peak Value
216 MHz-960 MHz	46.0	Quasi-peak Value
960 MHz-1 GHz	54.0	Quasi-peak Value
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

Radiated band edge measurements at 2390 MHz and 2483.5 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

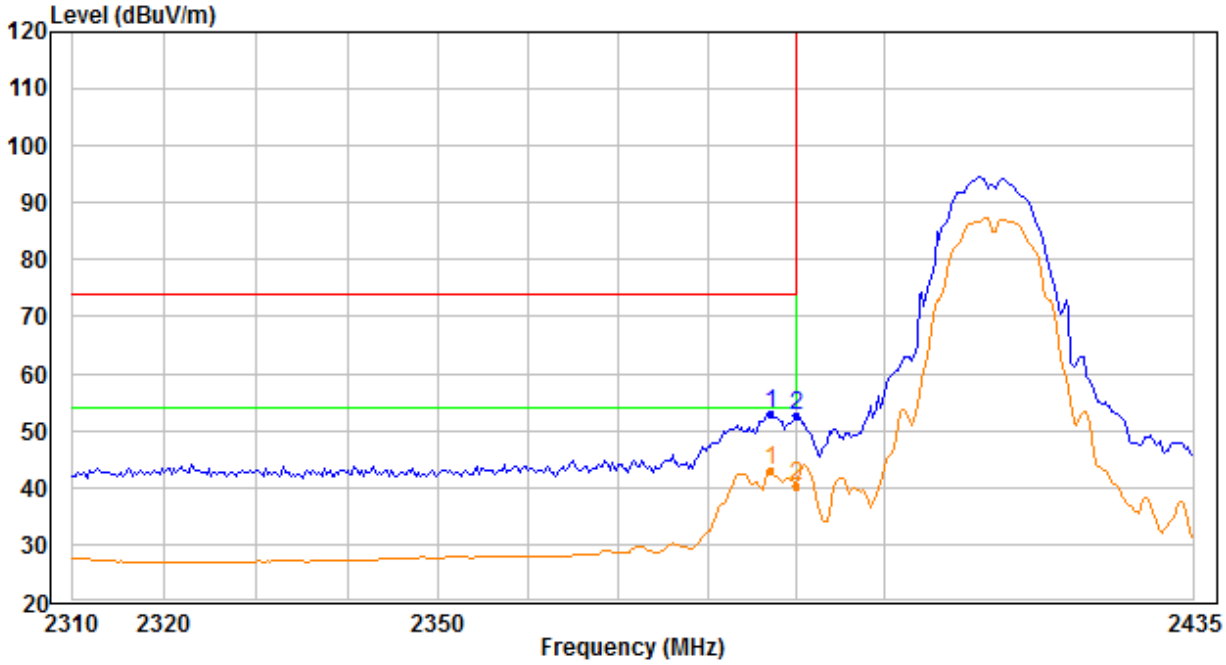
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

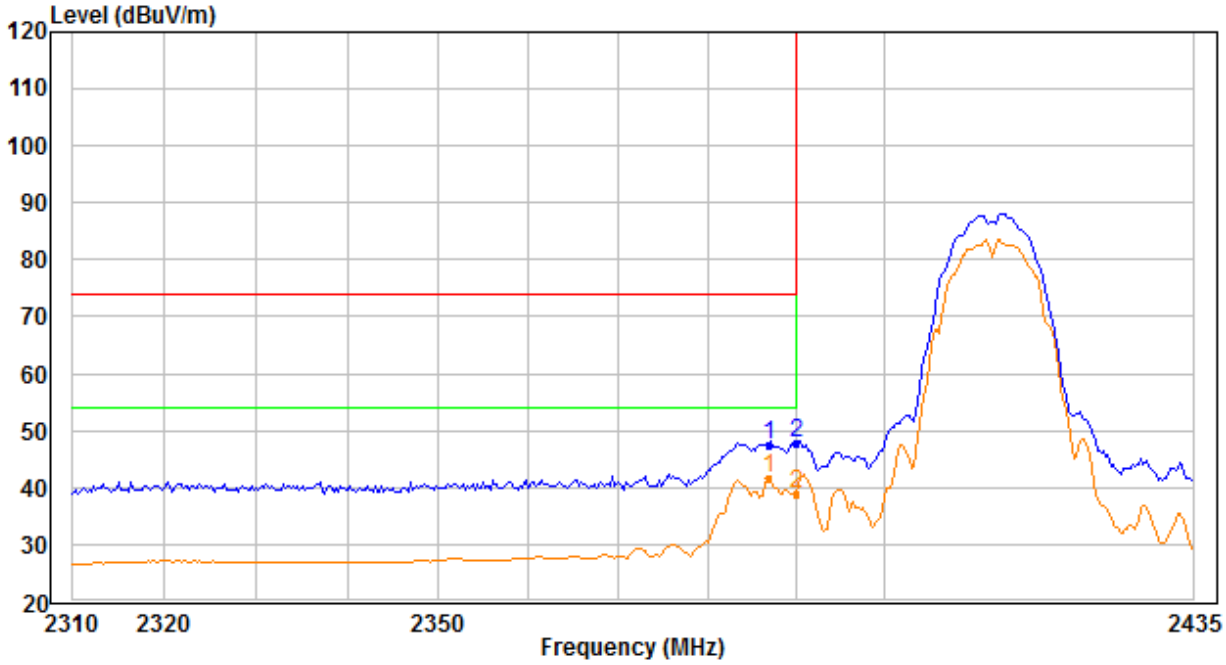
IEEE 802.11b

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



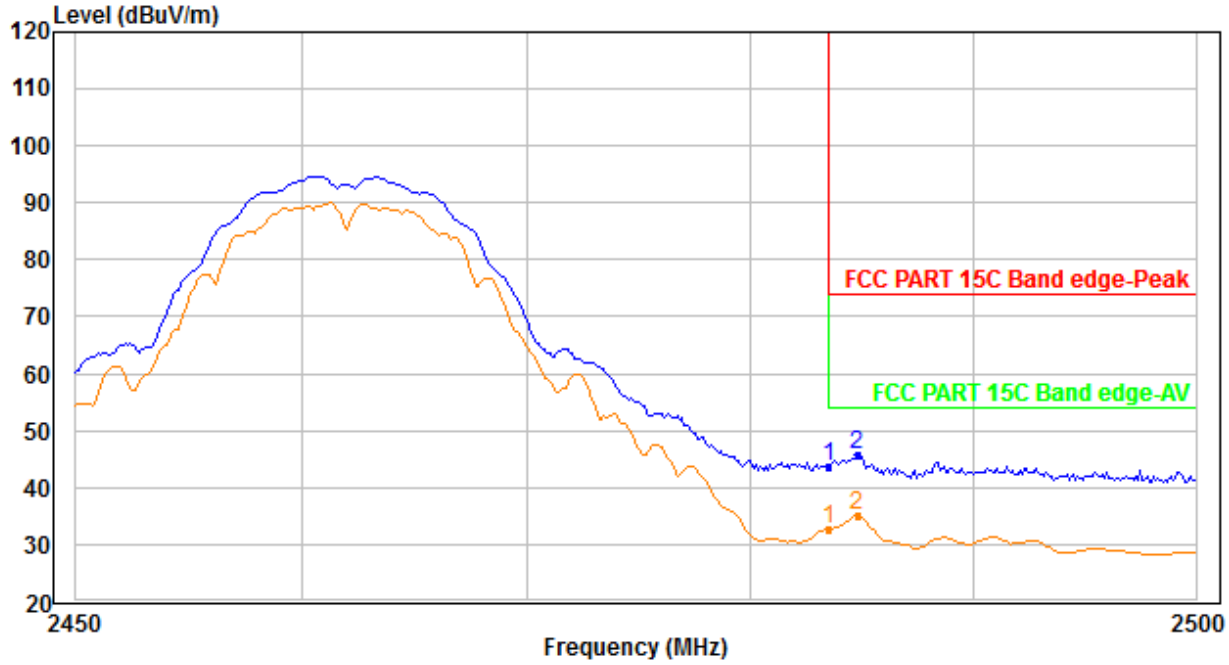
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	52.73	74	40.37	54	Pass
2387.1540	53.07	74	42.99	54	Pass

Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



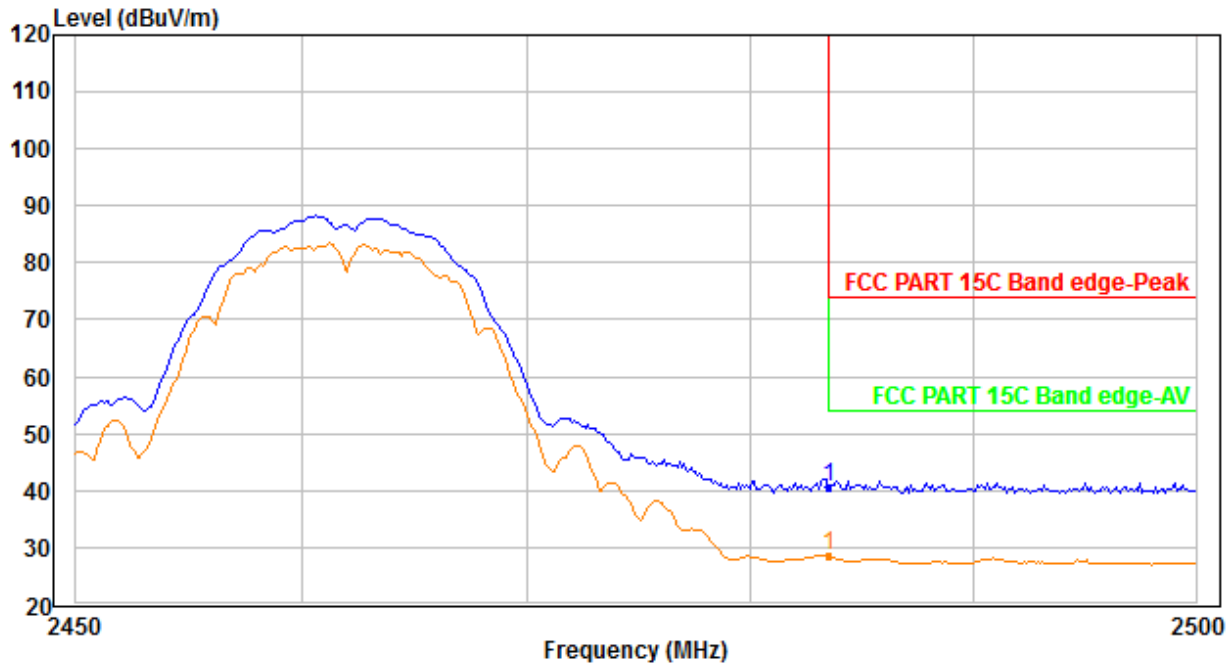
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	47.87	74	39.04	54	Pass
2386.9040	47.49	74	41.56	54	Pass

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	43.66	74	32.77	54	Pass
2484.7700	45.78	74	35.06	54	Pass

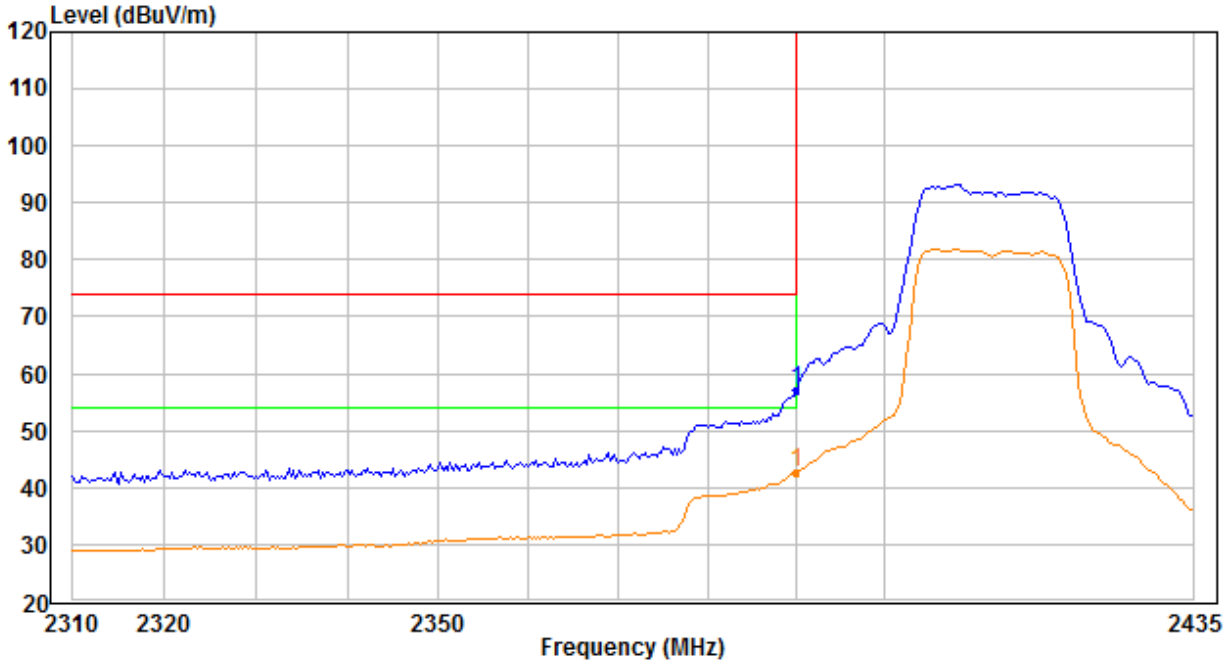
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	40.77	74	28.54	54	Pass

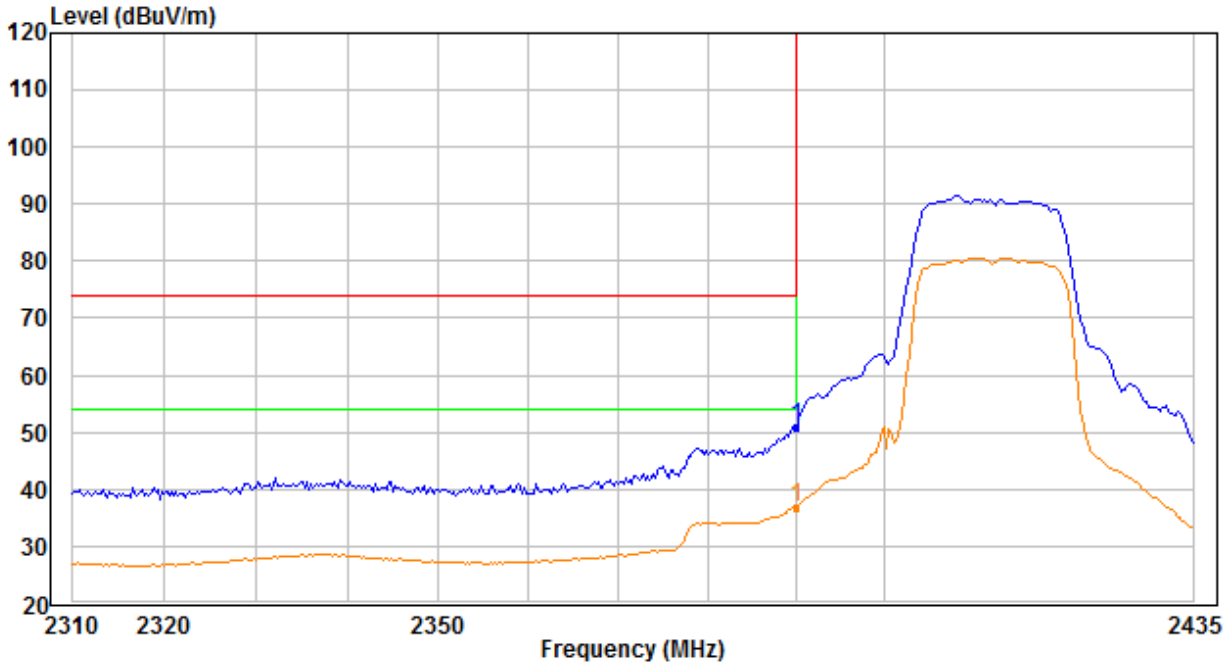
IEEE 802.11g

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



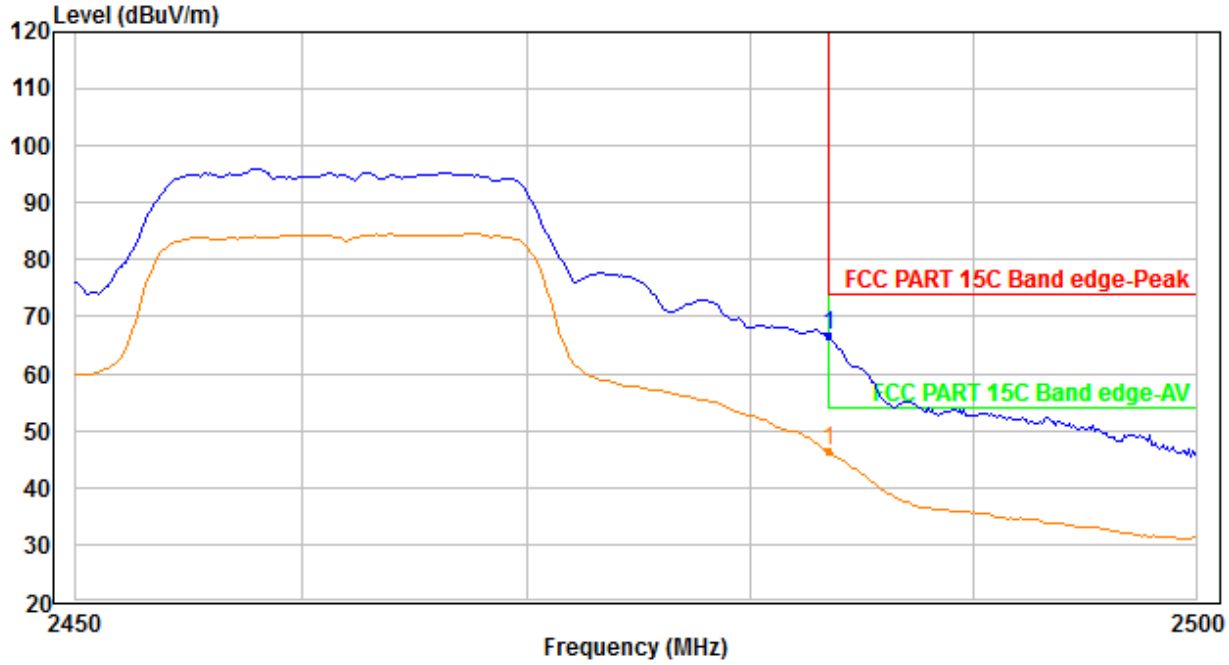
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	51.08	74	42.64	54	Pass

Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



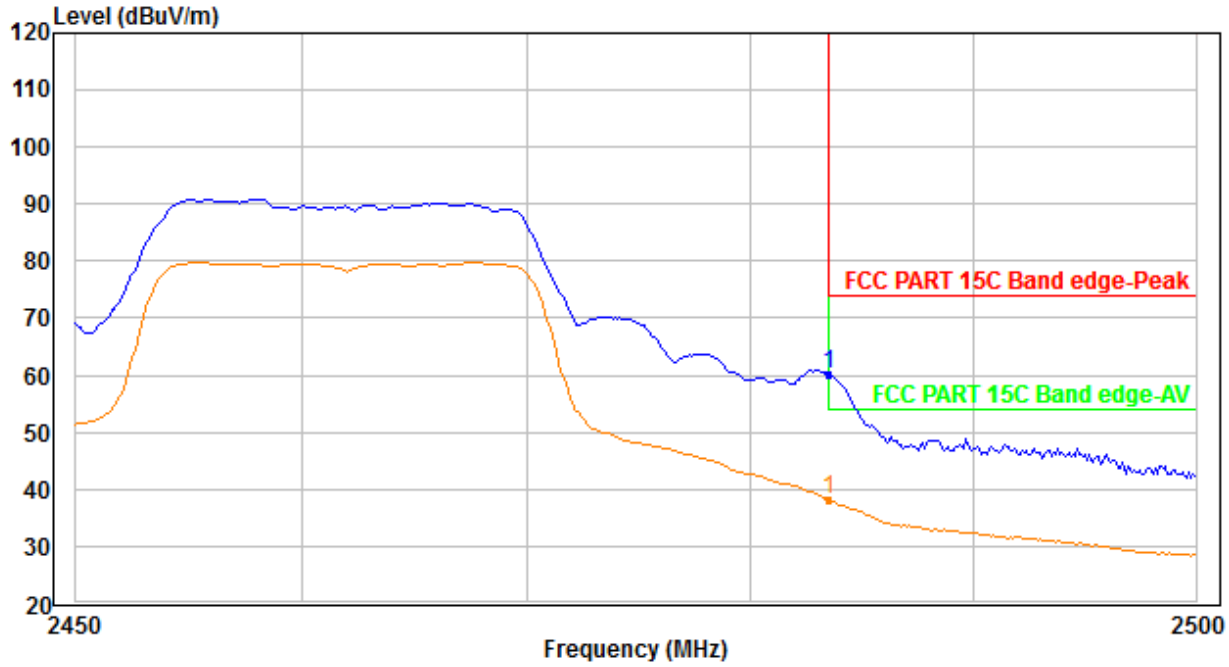
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	51.07	74	36.96	54	Pass

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	66.64	74	46.44	54	Pass

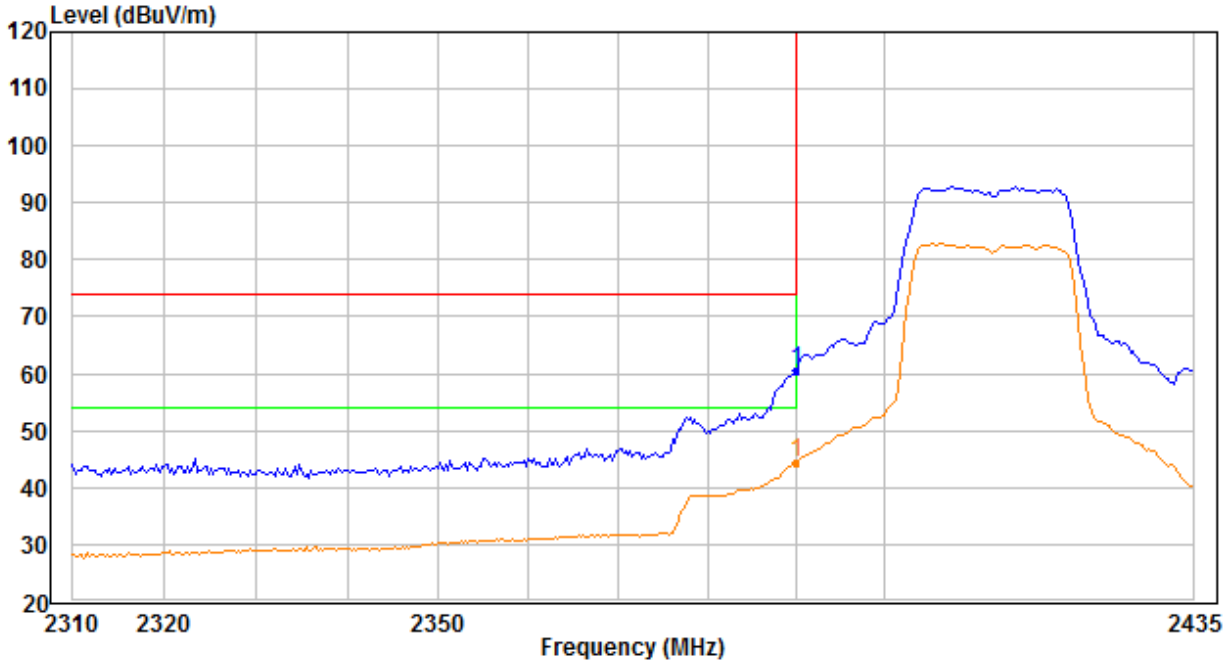
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	60.35	74	38.35	54	Pass

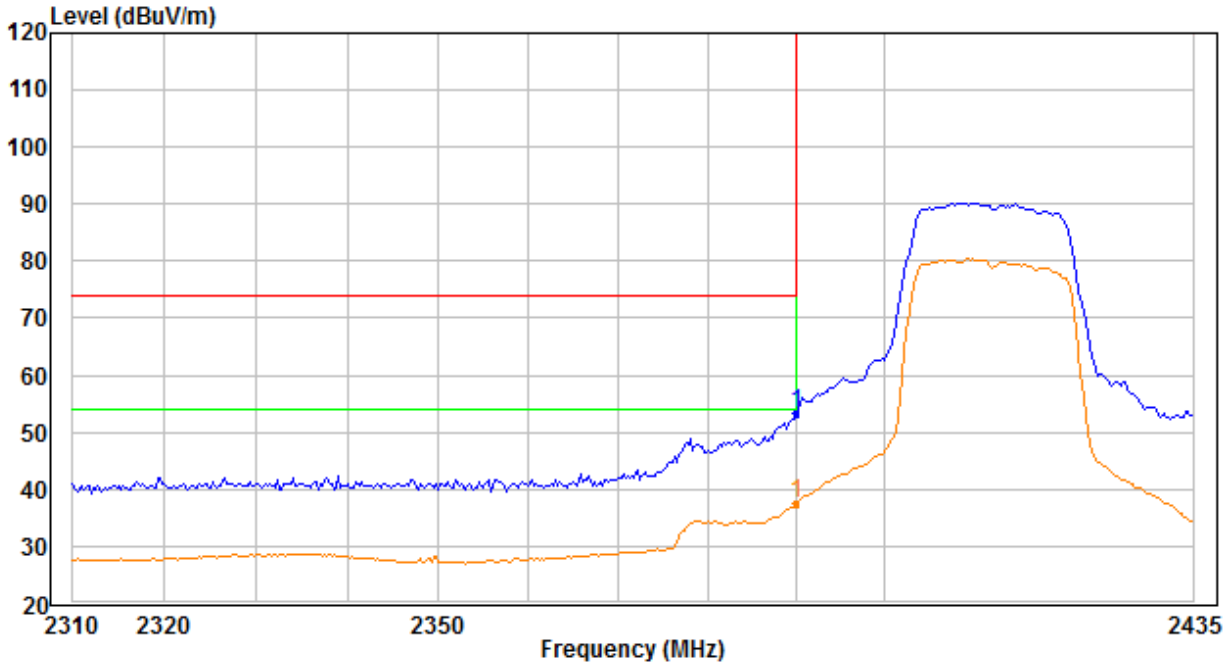
IEEE 802.11n-HT20

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



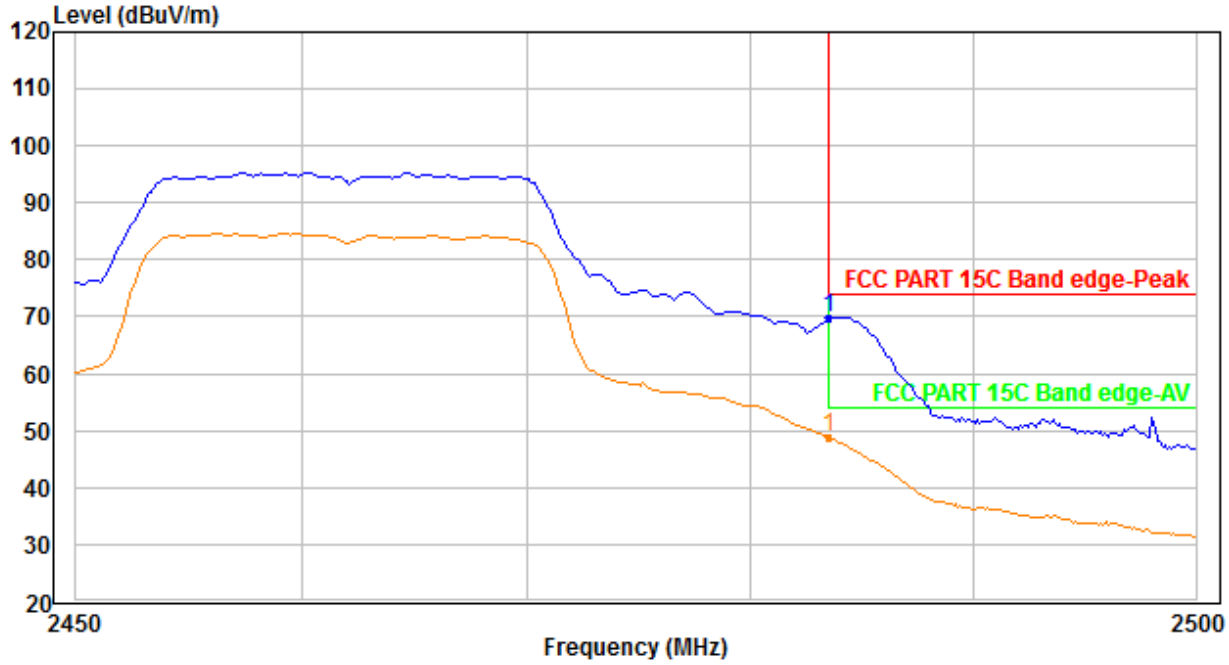
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390.0000	60.57	74	44.38	54	Pass

Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



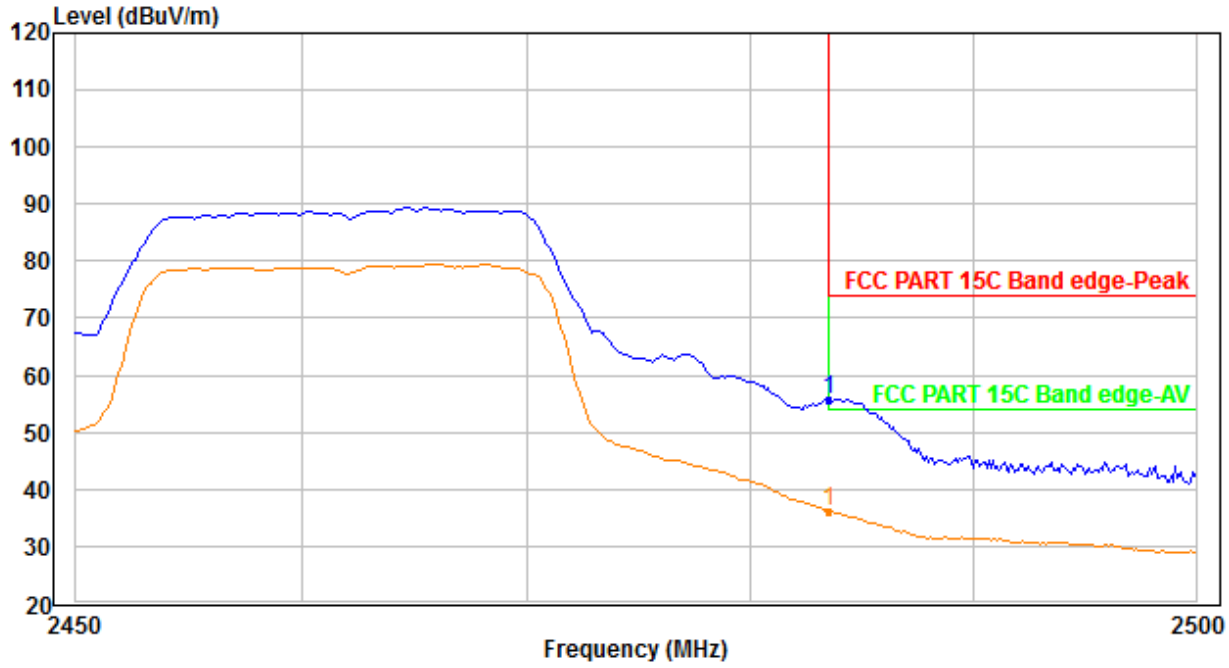
Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2390	53.37	74	37.40	54	Pass

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	69.82	74	49.72	54	Pass

Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Peak Limit (dBuv/m)	AV level (dBuv/m)	AV Limit (dBuv/m)	Conclusion
2483.5000	55.68	74	36.30	54	Pass

5.9 CONDUCTED EMISSION

Test Requirement: 47 CFR Part 15C Section 15.207

Test Method: ANSI C63.10-2013 Section 6.2

Limits:

Frequency range (MHz)	Limits (dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.4.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

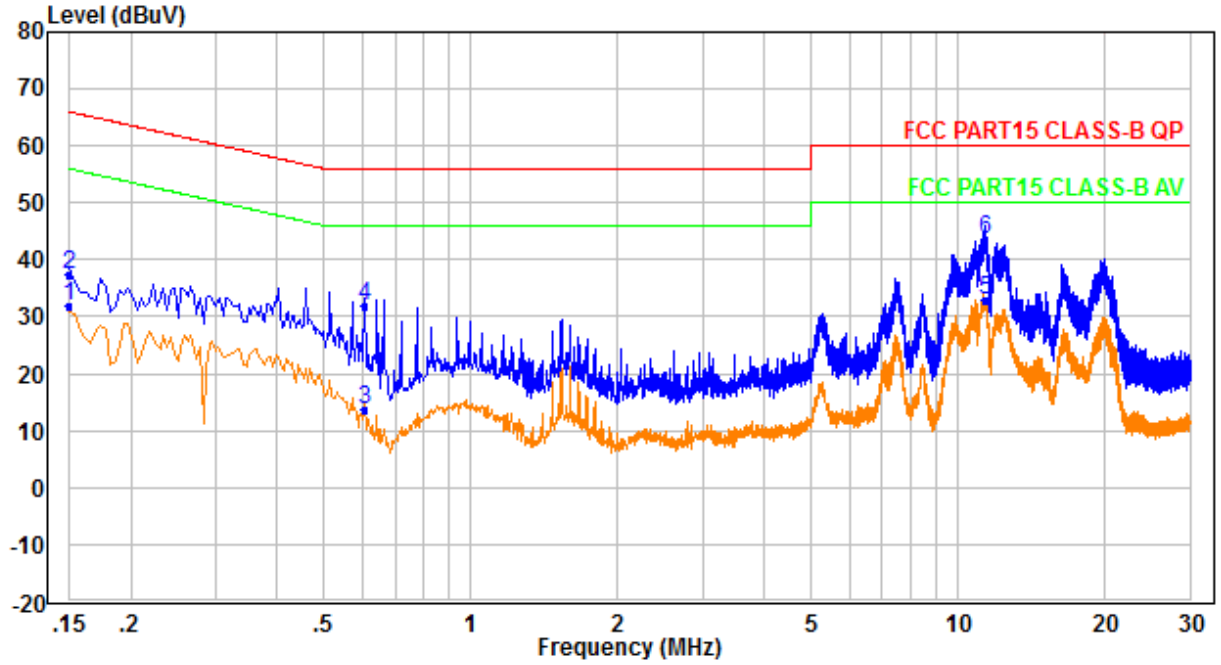
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

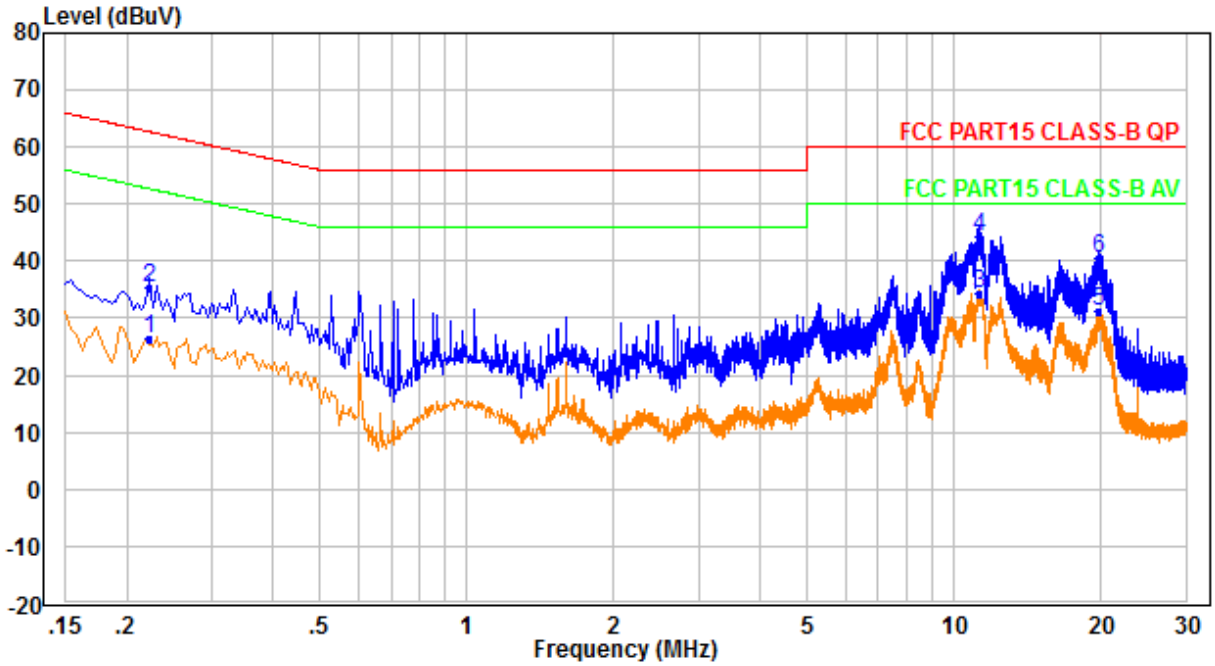
The measurement data as follows:
Quasi Peak and Average:
Mode: WIFI Link

Live Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.150	21.60	10.20	31.80	56.00	-24.20	Average
2	0.150	27.20	10.20	37.40	66.00	-28.60	QP
3*	0.606	3.40	10.20	13.60	46.00	-32.40	Average
4	0.606	21.70	10.20	31.90	56.00	-24.10	QP
5	11.401	21.90	11.20	33.10	50.00	-16.90	Average
6	11.401	32.50	11.20	43.70	60.00	-16.30	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.222	16.00	10.30	26.30	52.70	-26.40	Average
2*	0.222	25.10	10.30	35.40	62.70	-27.30	QP
3	11.277	23.00	11.30	34.30	50.00	-15.70	Average
4	11.277	33.00	11.30	44.30	60.00	-15.70	QP
5	19.933	18.50	12.80	31.30	50.00	-18.70	Average
6	19.933	27.60	12.80	40.40	60.00	-19.60	QP

Remark:
1. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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