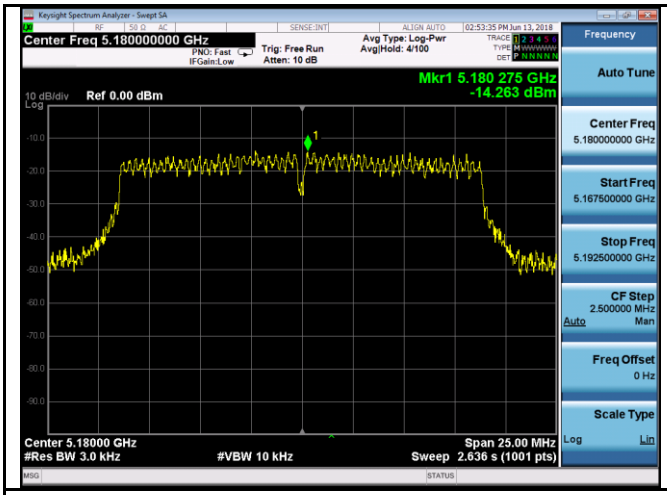
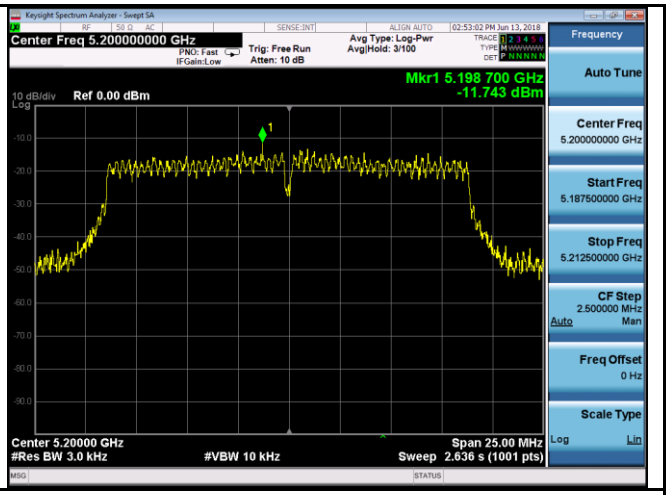
802.11ac (20M)



5150-5250MHz PSD - Low CH 5180



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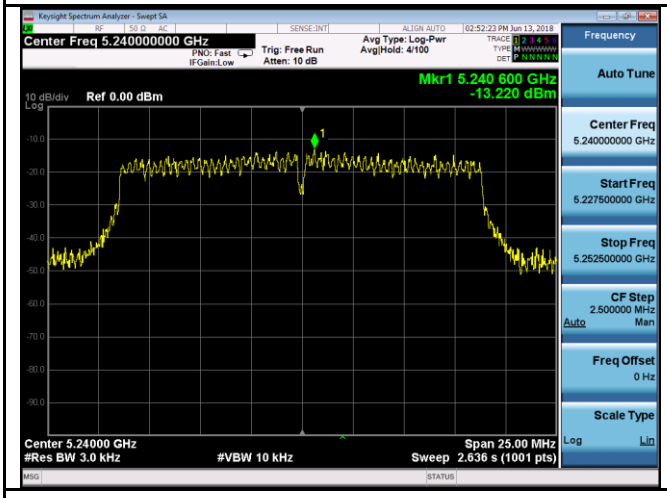

5150-5250MHz PSD - High CH 5240

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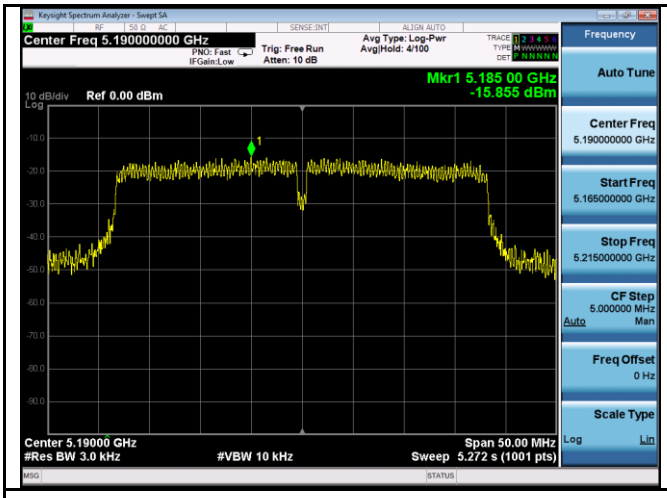

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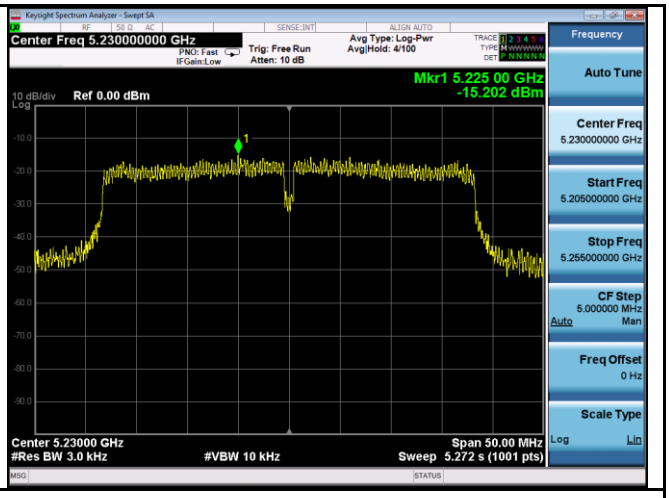

5150-5250MHz PSD - Middle CH 5230

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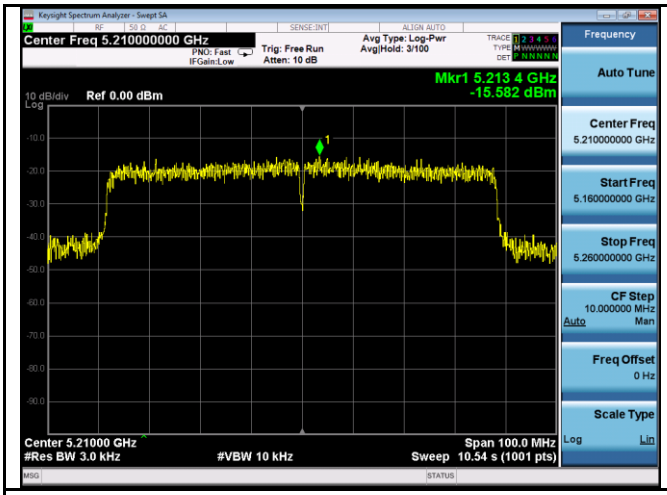
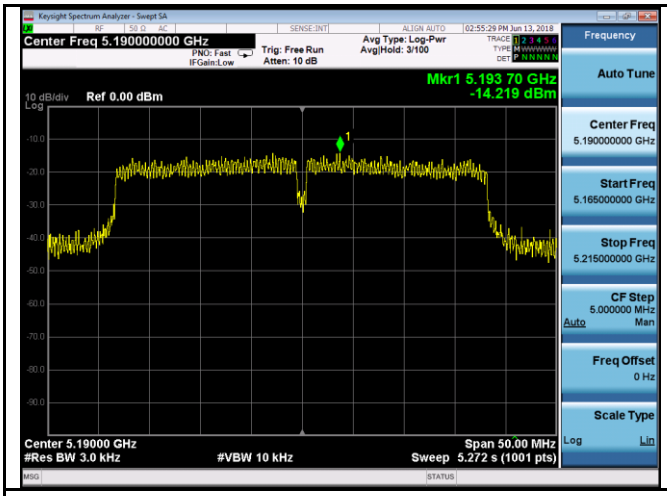
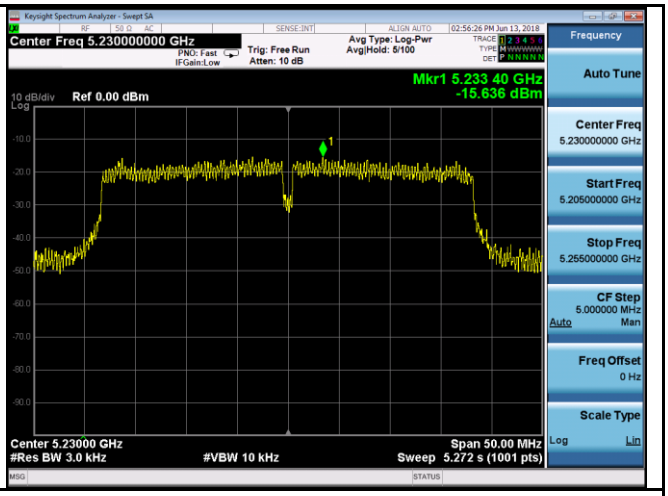


5150-5250MHz PSD - Low CH 5210

802.11n (40M)



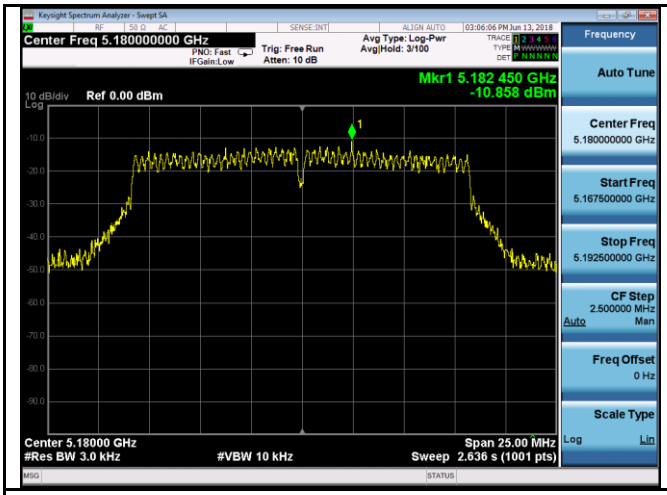
5150-5250MHz PSD - Low CH 5190



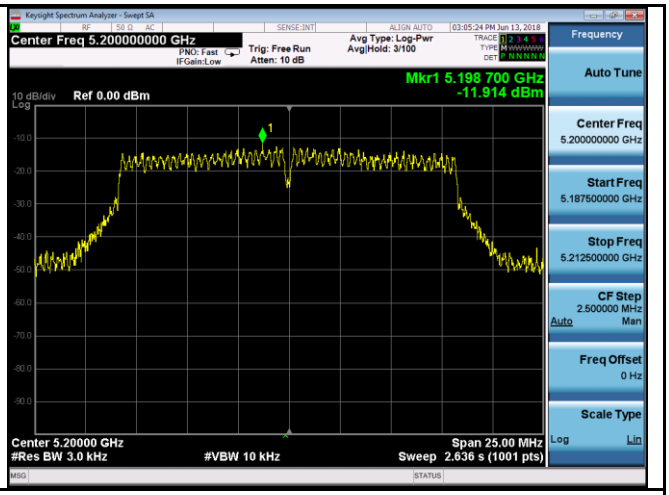
5150-5250MHz PSD - High CH 5230

Ant.1

802.11a



5150-5250MHz PSD - Low CH 5180



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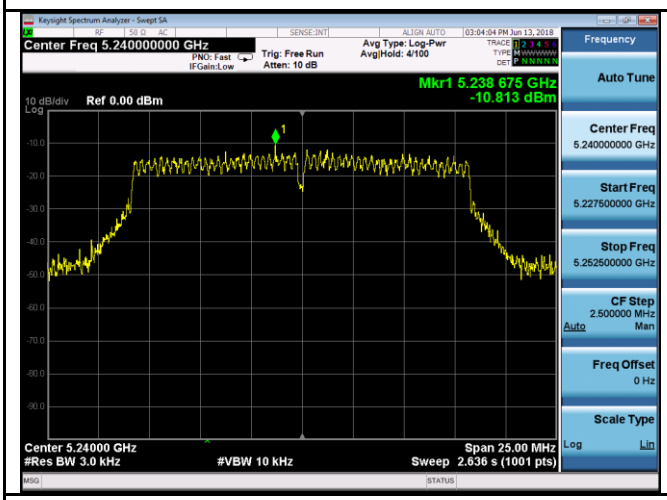
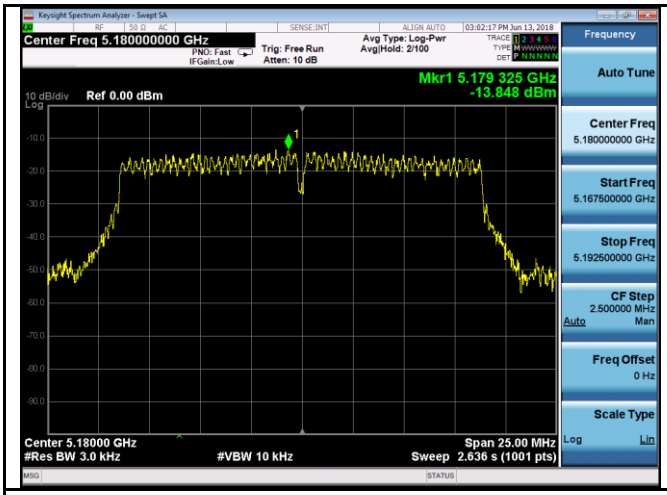


5150-5250MHz PSD - High CH 5240

802.11ac (20M)



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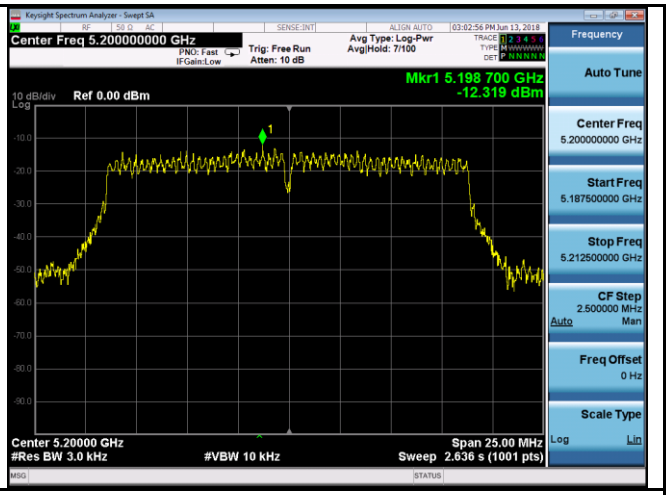
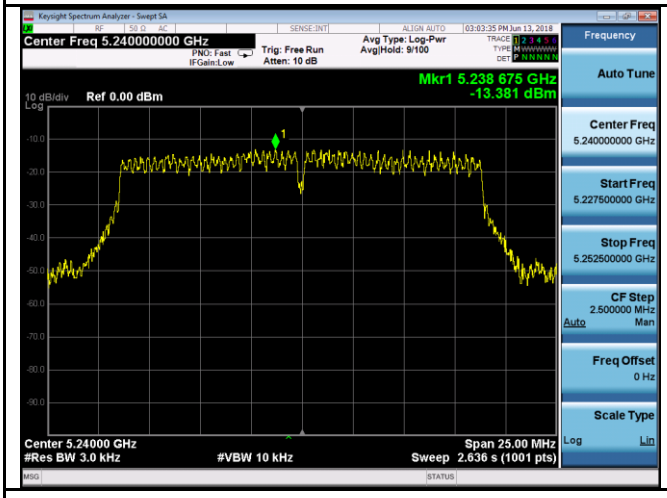
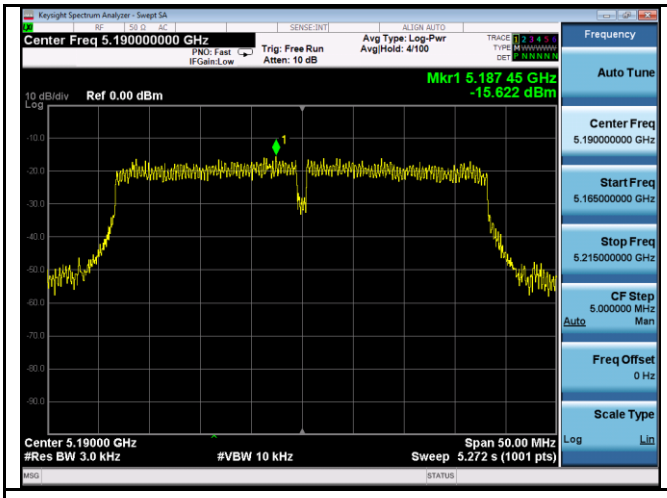


5150-5250MHz PSD - Middle CH 5200

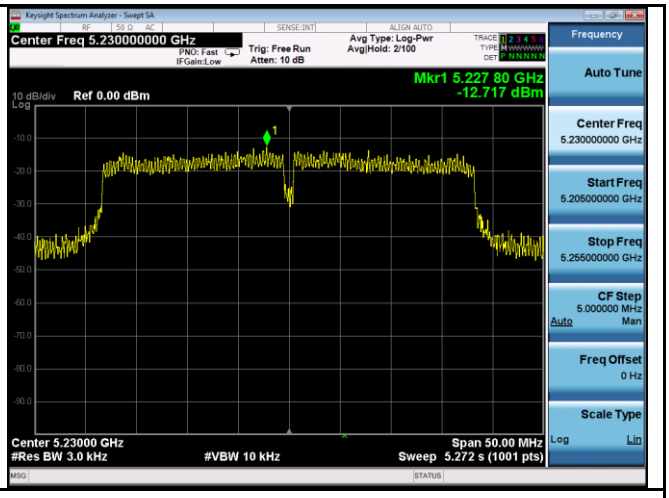


5150-5250MHz PSD - High CH 5240

802.11ac (40M)

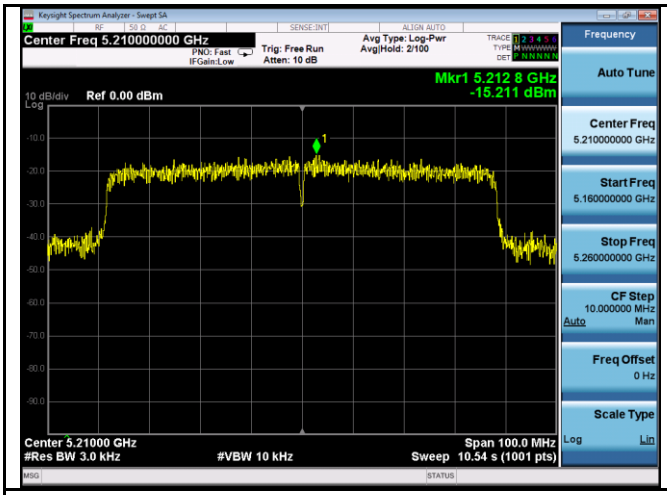


5150-5250MHz PSD - Low CH 5190



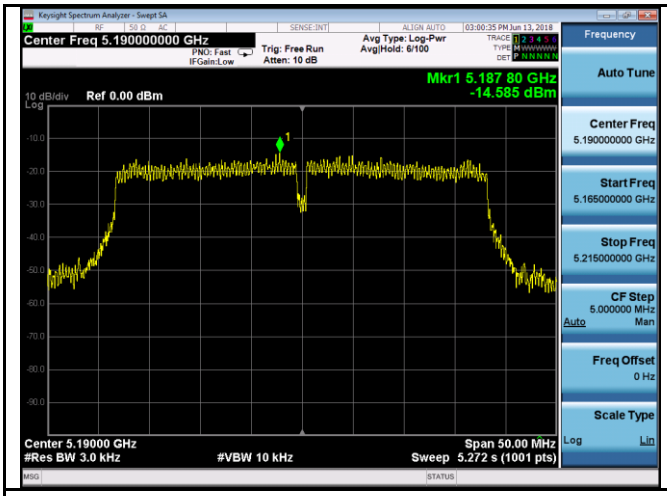
5150-5250MHz PSD - Middle CH 5230

802.11ac (80M)

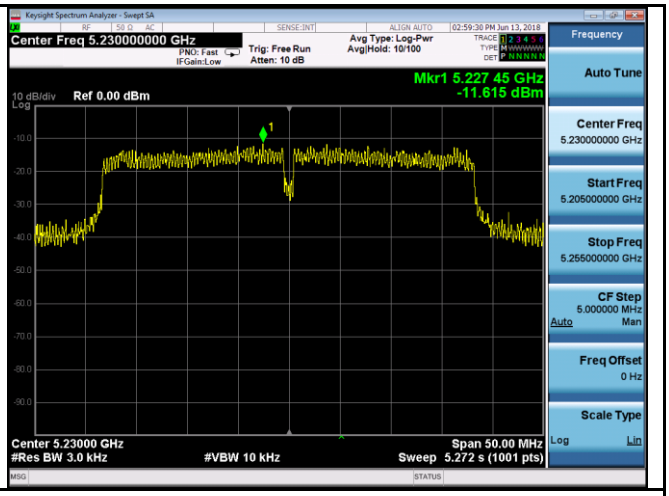


5150-5250MHz PSD - Low CH 5210

802.11n (40M)



5150-5250MHz PSD - Low CH 5190



5150-5250MHz PSD - High CH 5230

6.6 §15.407(1) and b(4) Band-Edge

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

Temperature	23°C
Relative Humidity	52%
Atmospheric Pressure	1020mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : June 26, 2018

   Tested By : Aaron Liang

Standard Requirement:

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

Procedures:

Measurement Procedure Band edge:

Bandedge are measured by setting the analyzer as follows:

(i) RBW = 1 MHz.

(ii) VBW ≥ 3 MHz.

(iii) Detector = Peak.

(iv) Sweep time = auto.

(v) Trace mode = max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described below. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 MHz of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

(i) Marker-Delta Method.

The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge..

(ii) Integration Method •

For maximum emissions measurements, follow the procedures described in section II.G.5., " Procedures for Unwanted Maximum Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI

receiver is set for peak-detection and max-hold for this measurement.

• For average emissions measurements, follow the procedures described in section II.G.6., " Procedures for Average Unwanted Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

Test Result: Pass.

Please refer to the following tables and plots.

Band edge measurement result

Ant.0

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured Bandedge (dBm)	Limit (dBm)	Result
820.11a	5150-5350	Low	5180	-48.979	-27	Pass
		High	5350	-44.546	-27	Pass
802.11ac (20M)		Low	5180	-43.270	-27	Pass
		High	5320	-44.863	-27	Pass
802.11ac (40M)		Low	5190	-41.660	-27	Pass
		High	5230	-41.829	-27	Pass
802.11ac (80M)		One	5210	-43.493	-27	Pass
802.11n (40M)		Low	5190	-45.240	-27	Pass
		High	5310	-46.338	-27	Pass

Ant.1

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured Bandedge (dBm)	Limit (dBm)	Result
820.11a	5150-5350	Low	5180	-36.433	-27	Pass
		High	5350	-36.306	-27	Pass
802.11ac (20M)		Low	5180	-36.437	-27	Pass
		High	5320	-37.045	-27	Pass
802.11ac (40M)		Low	5190	-45.169	-27	Pass
		High	5230	-45.807	-27	Pass
802.11ac (80M)		One	5210	-42.054	-27	Pass
802.11n (40M)		Low	5190	-44.741	-27	Pass
		High	5310	-39.422	-27	Pass

Test Plots

Band Edge measurement result

Ant.0

802.11a

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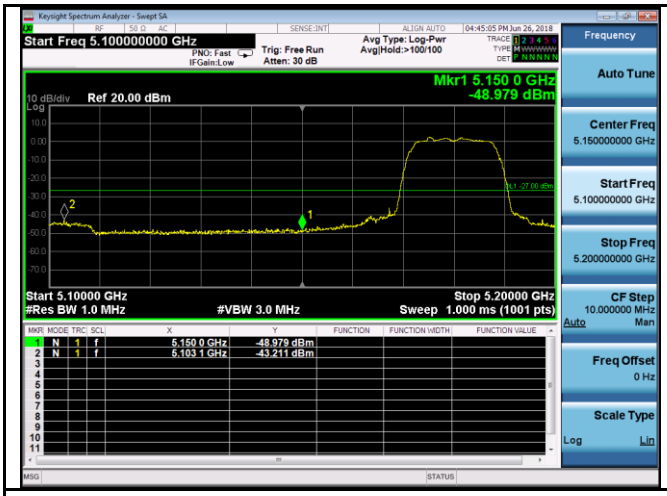
<td> 
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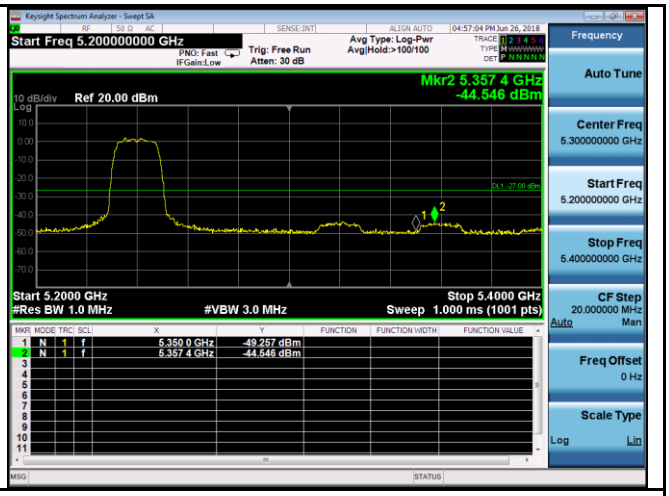
<td> 
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<td>5150-5350MHz Band Edge - Low CH 5180</td>
<td>5150-5350MHz Band Edge - High CH 5320</td>
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802.11ac (20M)

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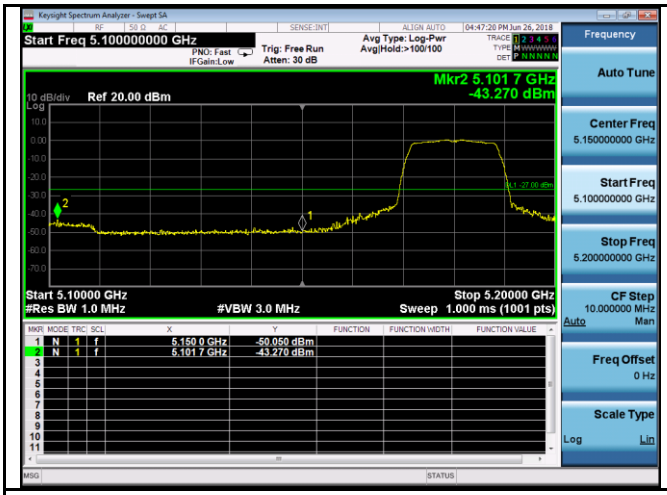
<td> 
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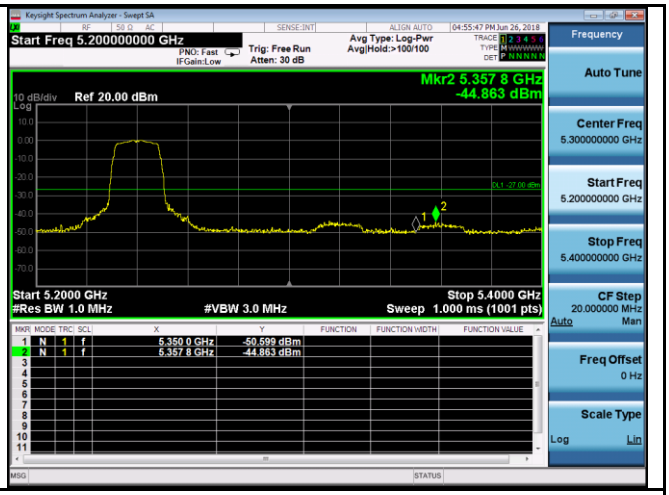
<td> 
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<td>5150-5350MHz Band Edge - High CH 5320</td>
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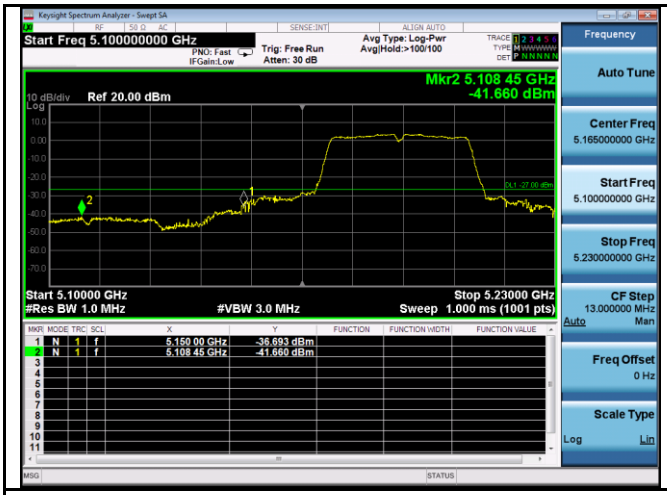
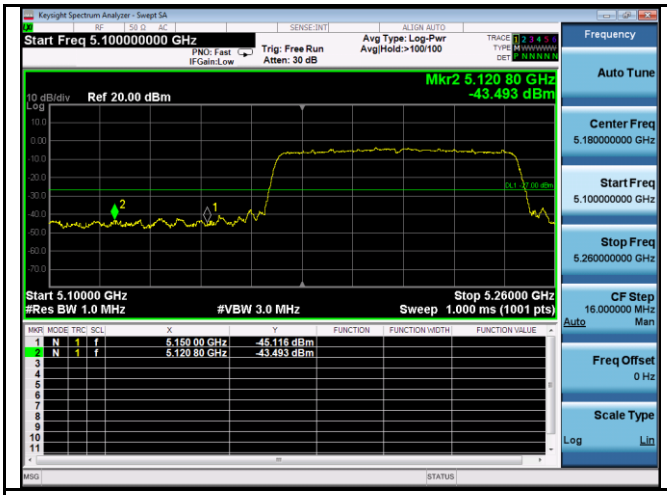
802.11ac (40M)



5150-5350MHz Band Edge - Low CH 5190

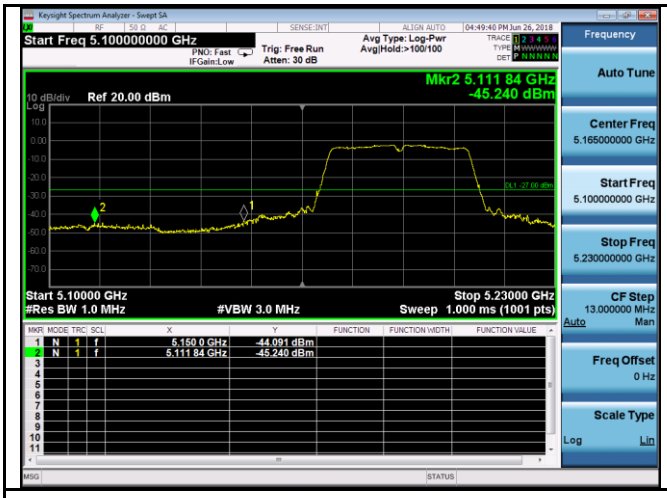
5150-5350MHz Band Edge - High CH 5230

802.11ac (80M)



5150-5350MHz Band Edge - Low CH 5210

802.11n (40M)

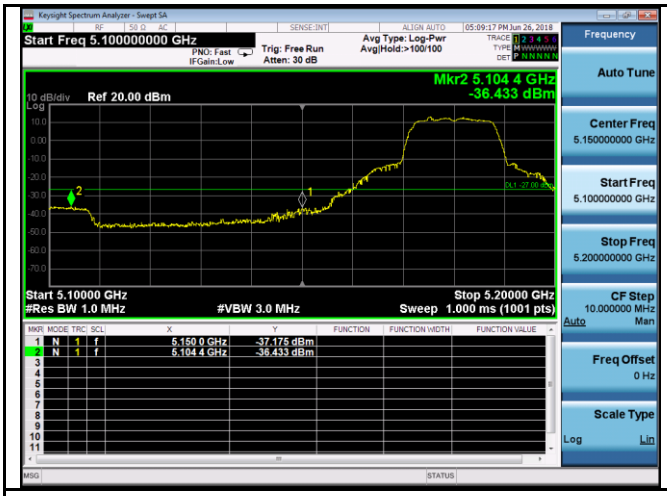


5150-5350MHz Band Edge - Low CH 5190

5150-5350MHz Band Edge - High CH 5310

Ant.1

802.11a



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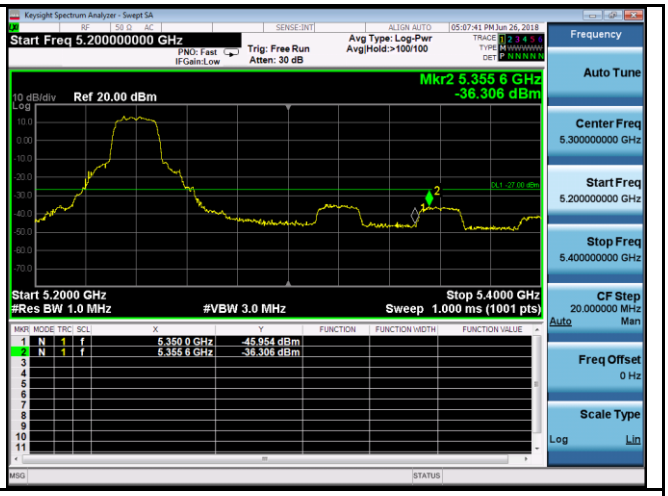
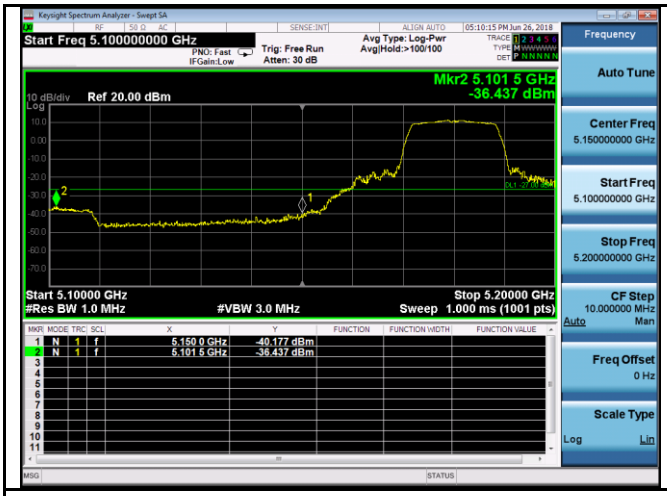


5150-5350MHz Band Edge - High CH 5320

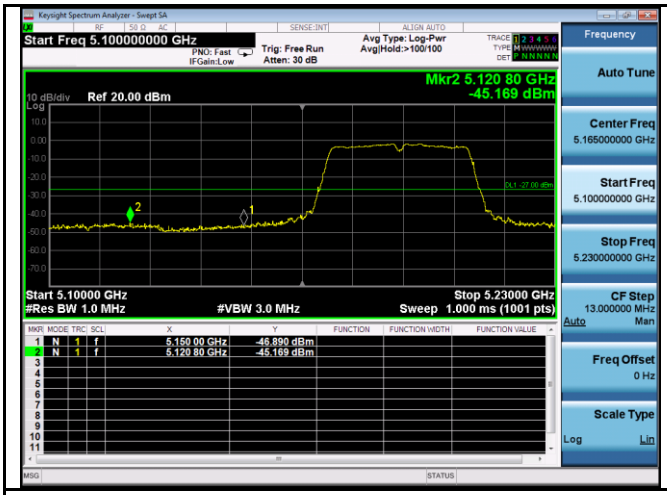
802.11ac (20M)



5150-5350MHz Band Edge - Low CH 5180

5150-5350MHz Band Edge - High CH 5320

802.11ac (40M)



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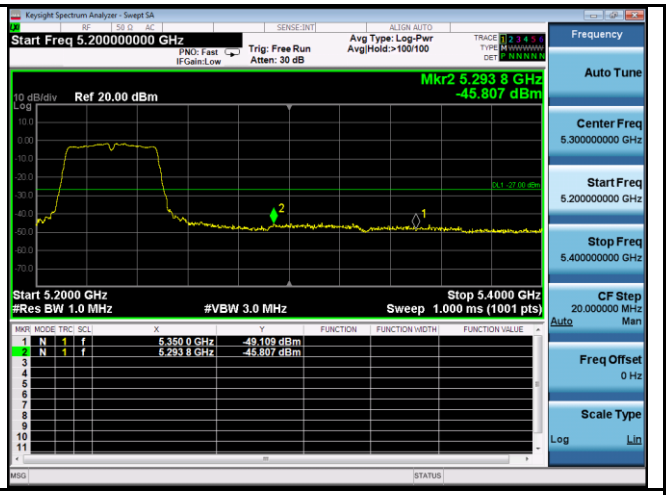
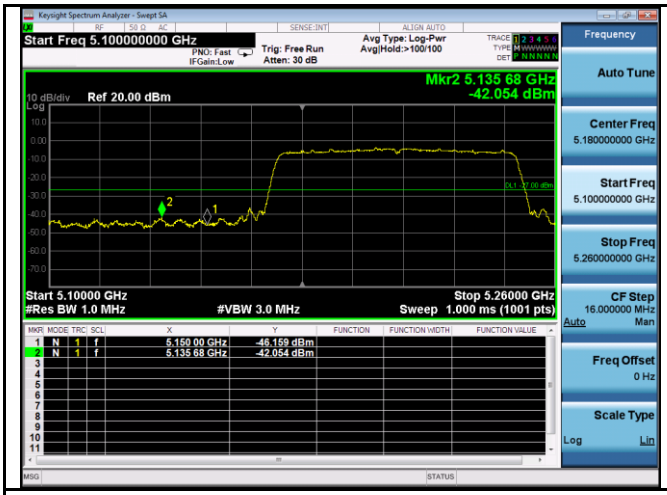


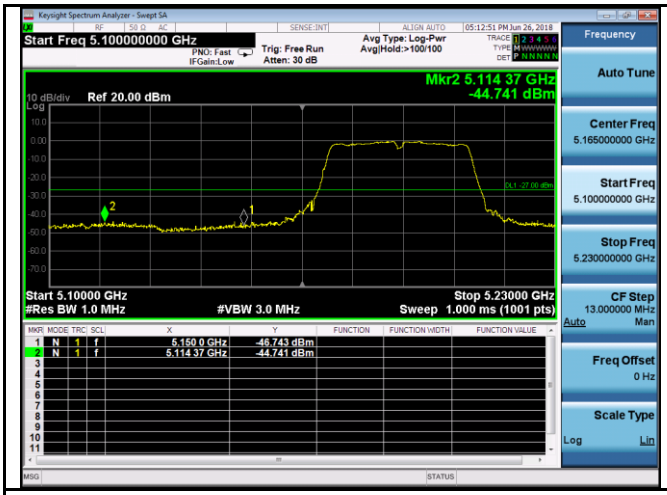
5150-5350MHz Band Edge - High CH 5230

802.11ac (80M)



5150-5350MHz Band Edge - Low CH 5210

802.11n (40M)



5150-5350MHz Band Edge - Low CH 5190

5150-5350MHz Band Edge - High CH 5310

6.7 §15.207 (a) - AC Power Line Conducted Emissions

Requirement:

Frequency of emission (MHz)	Conducted limit (dBμ V)	
	Quasi-peak	Average
0.15– 0.5	66 to 56*	56 to 46*
0.5– 5	56	46
5– 30	60	50

*Decreases with the logarithm of the frequency.

Procedures:

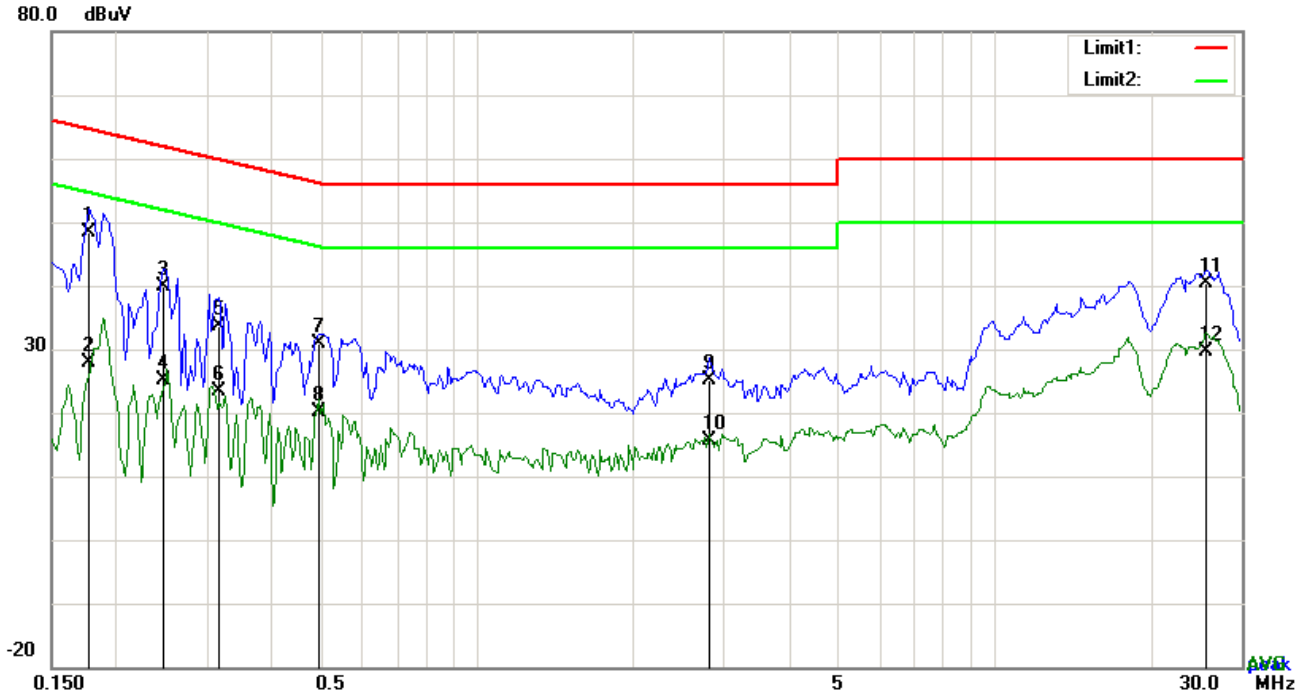
1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1014mbar

5. Test date: June 20, 2018
   Tested By : Aaron Liang

Result: Pass

Test Mode:	Transmitting Mode

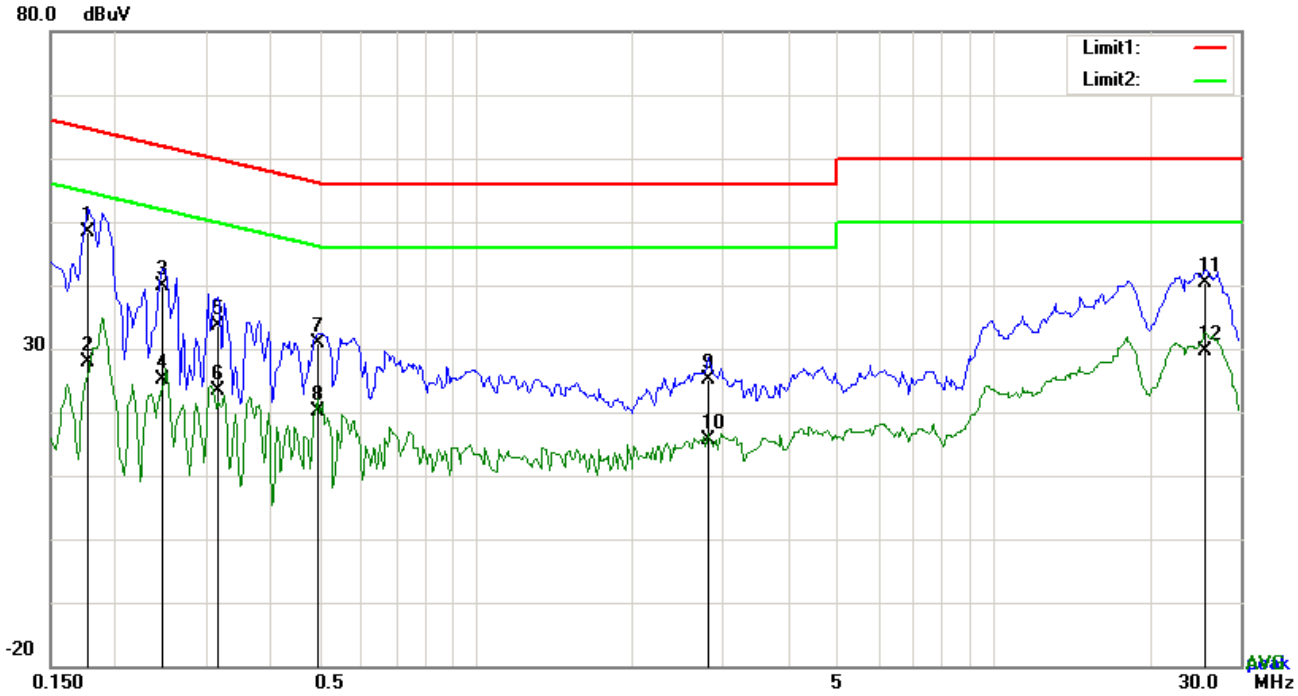


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.1773	38.26	QP	10.02	48.28	64.61	-16.33
2	L1	0.1773	17.98	AVG	10.02	28.00	54.61	-26.61
3	L1	0.2475	29.74	QP	10.02	39.76	61.84	-22.08
4	L1	0.2475	15.03	AVG	10.02	25.05	51.84	-26.79
5	L1	0.3177	23.67	QP	10.02	33.69	59.77	-26.08
6	L1	0.3177	13.30	AVG	10.02	23.32	49.77	-26.45
7	L1	0.4932	20.98	QP	10.02	31.00	56.11	-25.11
8	L1	0.4932	10.11	AVG	10.02	20.13	46.11	-25.98
9	L1	2.8020	15.15	QP	10.05	25.20	56.00	-30.80
10	L1	2.8020	5.47	AVG	10.05	15.52	46.00	-30.48
11	L1	25.6356	30.10	QP	10.35	40.45	60.00	-19.55
12	L1	25.6356	19.31	AVG	10.35	29.66	50.00	-20.34

Test Mode:	Transmitting Mode

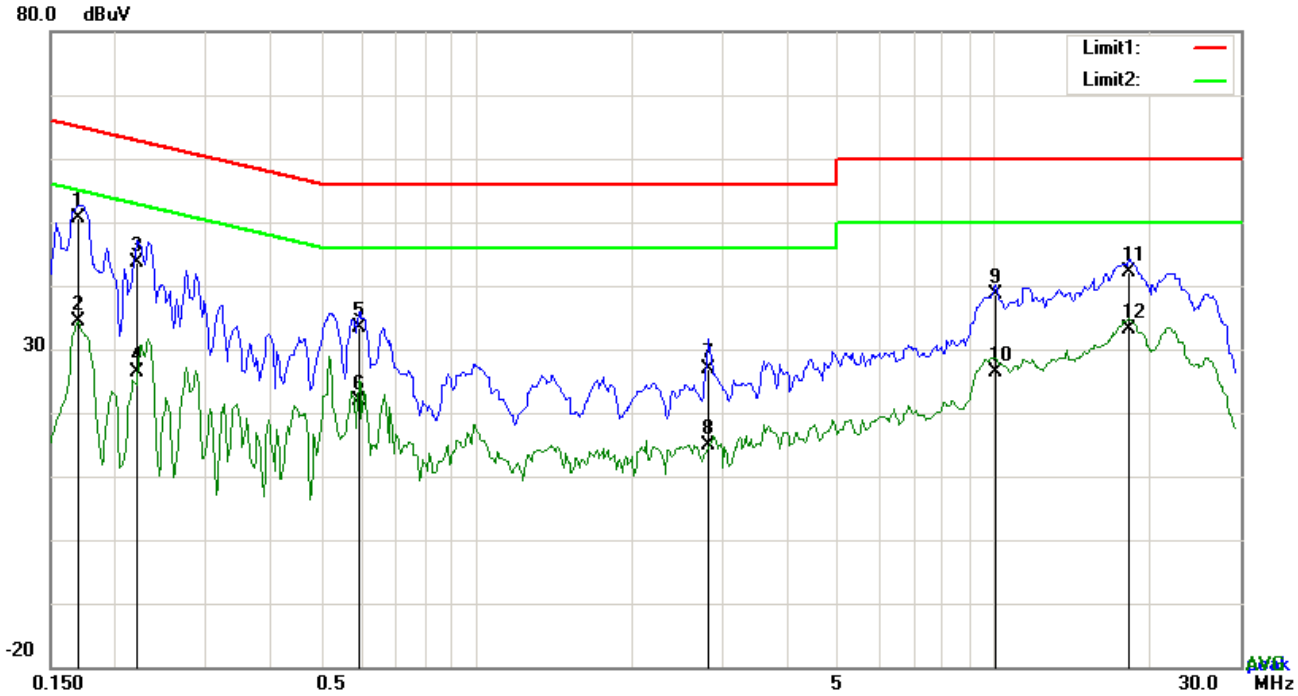


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.1773	38.26	QP	10.02	48.28	64.61	-16.33
2	N	0.1773	17.98	AVG	10.02	28.00	54.61	-26.61
3	N	0.2475	29.74	QP	10.02	39.76	61.84	-22.08
4	N	0.2475	15.03	AVG	10.02	25.05	51.84	-26.79
5	N	0.3177	23.67	QP	10.02	33.69	59.77	-26.08
6	N	0.3177	13.30	AVG	10.02	23.32	49.77	-26.45
7	N	0.4932	20.98	QP	10.02	31.00	56.11	-25.11
8	N	0.4932	10.11	AVG	10.02	20.13	46.11	-25.98
9	N	2.8020	15.15	QP	10.05	25.20	56.00	-30.80
10	N	2.8020	5.47	AVG	10.05	15.52	46.00	-30.48
11	N	25.6356	30.10	QP	10.35	40.45	60.00	-19.55
12	N	25.6356	19.31	AVG	10.35	29.66	50.00	-20.34

Test Mode:	Transmitting Mode

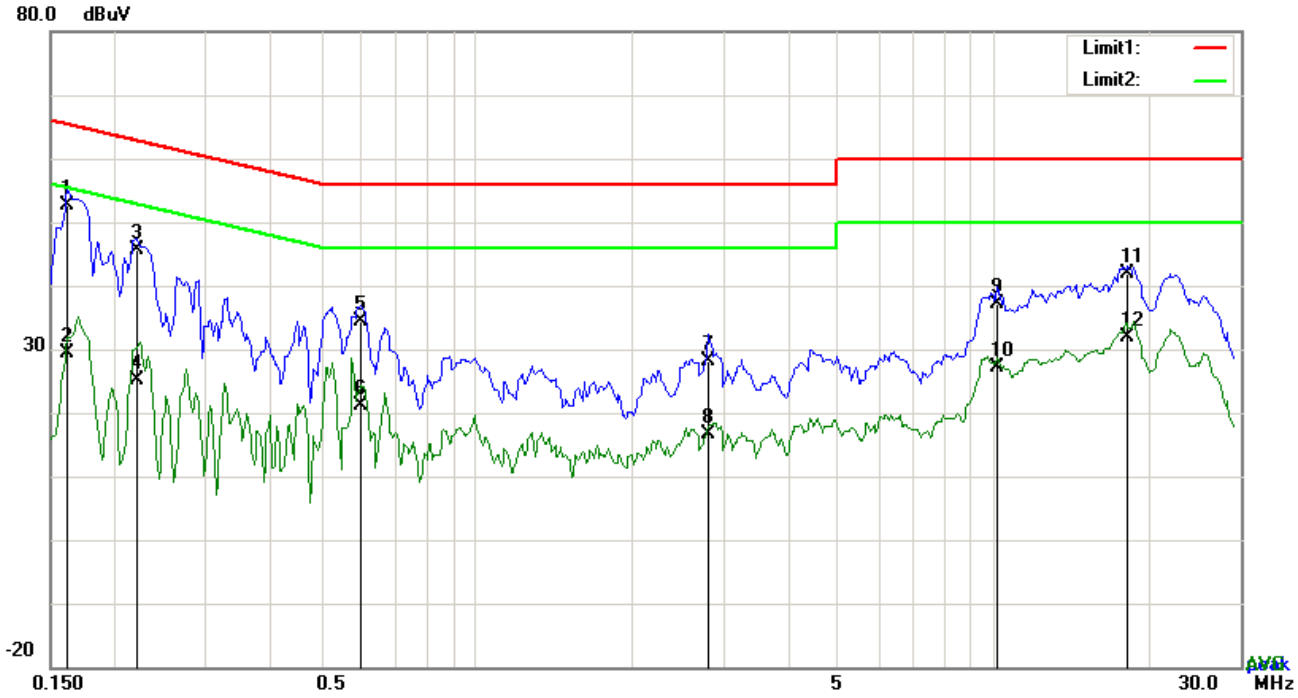


Test Data

Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.1695	40.64	QP	10.02	50.66	64.98	-14.32
2	L1	0.1695	24.26	AVG	10.02	34.28	54.98	-20.70
3	L1	0.2202	33.66	QP	10.02	43.68	62.81	-19.13
4	L1	0.2202	16.33	AVG	10.02	26.35	52.81	-26.46
5	L1	0.5946	23.32	QP	10.02	33.34	56.00	-22.66
6	L1	0.5946	11.75	AVG	10.02	21.77	46.00	-24.23
7	L1	2.8059	16.82	QP	10.05	26.87	56.00	-29.13
8	L1	2.8059	4.94	AVG	10.05	14.99	46.00	-31.01
9	L1	10.0902	28.44	QP	10.14	38.58	60.00	-21.42
10	L1	10.0902	16.33	AVG	10.14	26.47	50.00	-23.53
11	L1	18.2880	32.01	QP	10.24	42.25	60.00	-17.75
12	L1	18.2880	22.83	AVG	10.24	33.07	50.00	-16.93

Test Mode:	Transmitting Mode



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	0.1617	42.55	QP	10.02	52.57	65.38	-12.81
2	N	0.1617	19.34	AVG	10.02	29.36	55.38	-26.02
3	N	0.2202	35.50	QP	10.02	45.52	62.81	-17.29
4	N	0.2202	15.11	AVG	10.02	25.13	52.81	-27.68
5	N	0.5985	24.37	QP	10.02	34.39	56.00	-21.61
6	N	0.5985	11.06	AVG	10.02	21.08	46.00	-24.92
7	N	2.8020	18.09	QP	10.05	28.14	56.00	-27.86
8	N	2.8020	6.69	AVG	10.05	16.74	46.00	-29.26
9	N	10.1448	27.05	QP	10.14	37.19	60.00	-22.81
10	N	10.1448	16.91	AVG	10.14	27.05	50.00	-22.95
11	N	18.1554	31.73	QP	10.24	41.97	60.00	-18.03
12	N	18.1554	21.64	AVG	10.24	31.88	50.00	-18.12

6.8 §15.209, §15.205 & §15.407(b) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above (3m & 10m) is +/-6dB.
4. Environmental Conditions

Temperature	25°C
Relative Humidity	57%
Atmospheric Pressure	1014mbar

5. Test date : June 20, 2018
   Tested By : Aaron Liang

Requirement: §15.407(b) specifies that emissions which fall in the restricted bands, as defined in **§15.205(a)**, must comply with the radiated emission limits specified in **§15.209(a)**.

Procedures:

Radiated Spurious Emissions Measurement

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Established procedures for performing radiated measurements shall be used (see C63.10). All detected emissions must comply with the applicable limits.

Measurement Detectors

§15.35(a) specifies that on frequencies less than and below 1000 MHz, the radiated emissions limits assume the use of a CISPR quasi-peak detector function and related measurement bandwidths. §15.35(b) specifies that on frequencies above 1000 MHz, the radiated emissions limits assume the use of an average detector and a minimum resolution bandwidth of 1 MHz. In addition, §15.35(b) that when average radiated emissions measurements are specified there is also a limit on the peak emissions level which is 20 dB above the applicable maximum permitted average emission limit. These specifications also apply to conducted emissions measurements.

1. CISPR Quasi-Peak Measurement

The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

2. Peak Power Measurement Procedure

Utilize the peak power measurement procedure specified in Section 8.1.1 with the following modifications:

Set analyzer center frequency to the frequency associated with the restricted band emission under examination.

Set RBW = 1 MHz.

Note that if the peak measured value complies with the average limit, it is not necessary to perform a separate average measurement. If this option is exercised, it should be so noted in the test report.

3. Average Power Measurement Procedures

The average restricted band emission levels must be measured with the EUT transmitting continuously (≥ 98% duty cycle) at its maximum power control level. Optionally, video triggering/signal gating can be used to ensure that measurements are performed only when the EUT is transmitting at its maximum power control level.

The average power measurement procedures described in Section 8.2 shall be used with the following modifications:

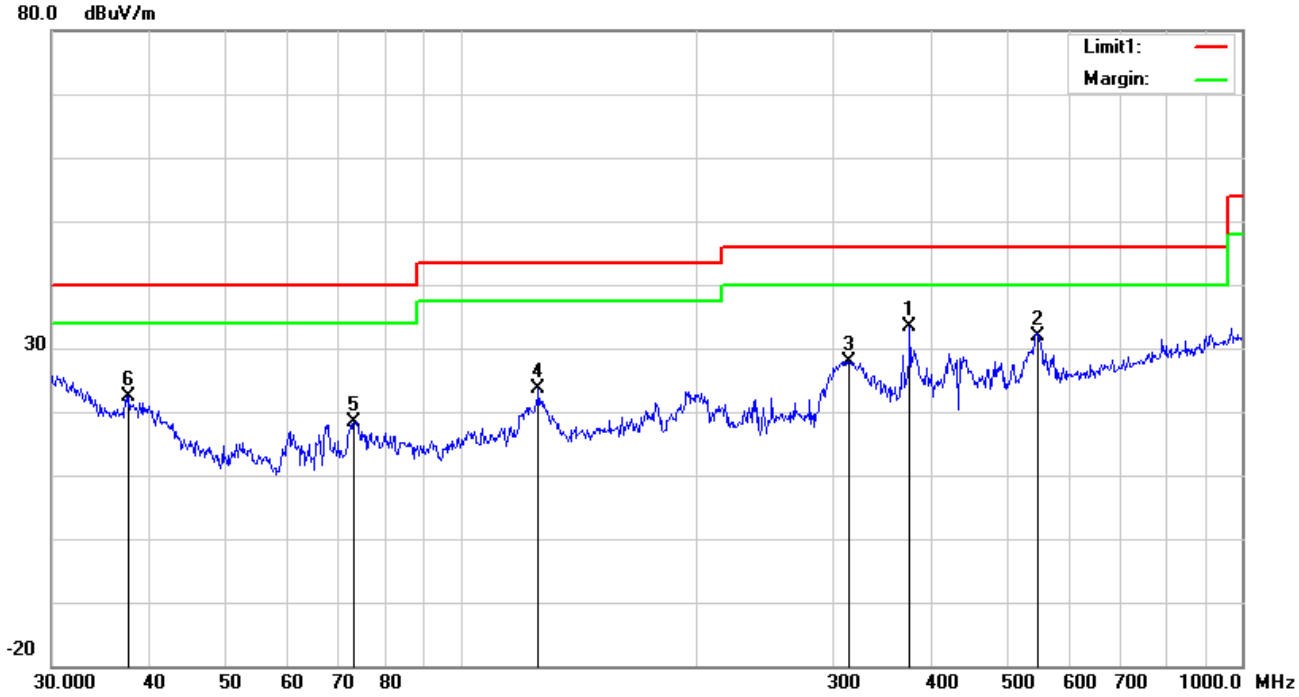
Set analyzer center frequency to the frequency associated with the restricted band emission.

Set span to at least 1 MHz.

Use peak marker function to determine the highest amplitude within the RBW (1 MHz).

Test Mode:	Transmitting Mode

(Below 1GHz)

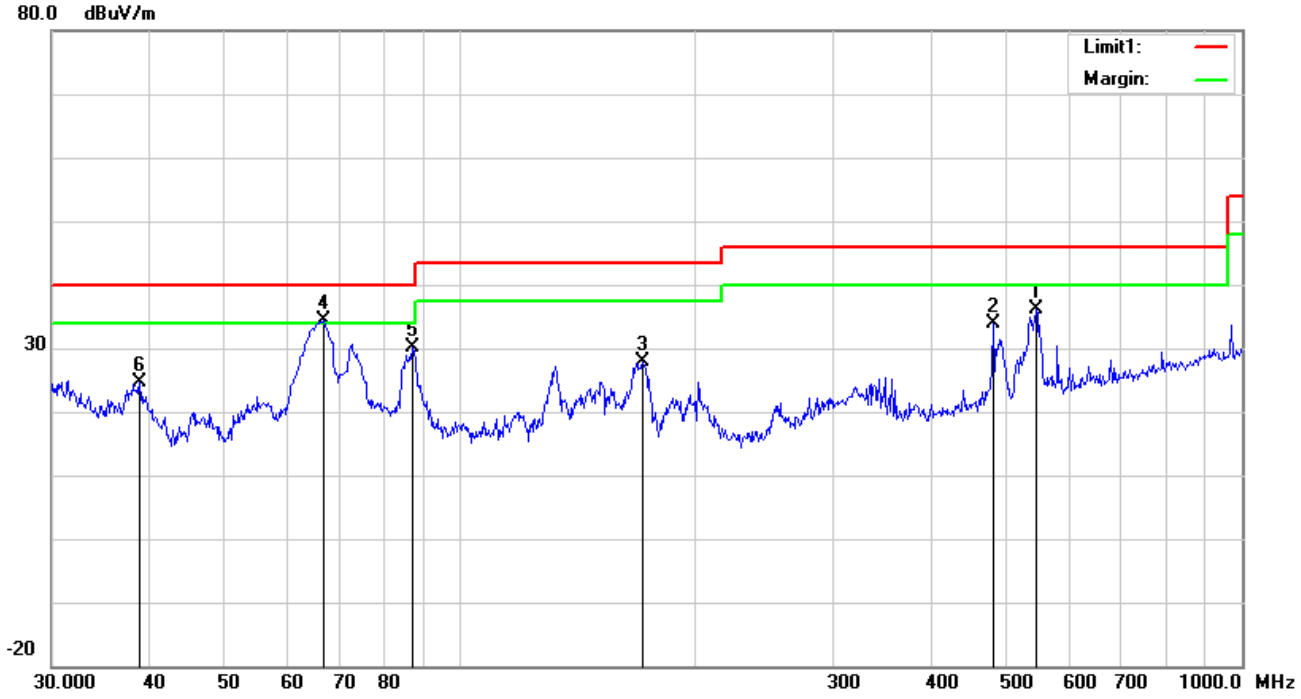


Test Data

Vertical Polarity Plot @3m

No.	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	375.9385	38.28	peak	15.19	22.08	2.02	33.41	46.00	-12.59	100	189
2	549.0195	32.63	peak	18.39	21.70	2.48	31.80	46.00	-14.20	100	302
3	314.3765	34.45	peak	13.90	22.25	1.86	27.96	46.00	-18.04	100	162
4	125.8864	31.32	peak	13.52	22.37	1.18	23.65	43.50	-19.85	100	251
5	73.1025	32.17	peak	7.74	22.39	0.97	18.49	40.00	-21.51	100	71
6	37.6798	28.36	peak	15.59	22.27	0.78	22.46	40.00	-17.54	100	0

(Below 1GHz)



Test Data

Horizontal Polarity Plot @3m

No	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)	Height	Degree
1	H	545.1826	37.14	peak	18.33	21.71	2.47	36.23	46.00	-9.77
2	H	480.5276	36.20	peak	17.31	21.85	2.31	33.97	46.00	-12.03
3	H	170.7926	37.01	peak	11.74	22.26	1.36	27.85	43.50	-15.65
4	H	66.9669	48.16	peak	7.65	22.39	0.92	34.34	40.00	-5.66
5	H	86.8068	43.63	peak	7.87	22.35	1.03	30.18	40.00	-9.82
6	H	38.8879	31.36	peak	14.71	22.27	0.78	24.58	40.00	-15.42

Above 1GHz

Low Channel (5180MHz)

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)
10360	37.08	AV	V	39.71	10.48	47.41	39.86	54	-14.14
10360	38.96	AV	H	39.71	10.48	47.41	41.74	54	-12.26
10360	58.37	PK	V	39.71	10.48	47.41	61.15	74	-12.85
10360	57.48	PK	H	39.71	10.48	47.41	60.26	74	-13.74
12075	19.26	AV	V	40.77	12.7	46.87	25.86	54	-28.14
12075	20.11	AV	H	40.77	12.7	46.87	26.71	54	-27.29
12075	40.57	PK	V	40.77	12.7	46.87	47.17	74	-26.83
12075	42.64	PK	H	40.77	12.7	46.87	49.24	74	-24.76

Middle Channel (5200MHz)

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)
10400	32.08	AV	V	39.92	10.54	47.02	35.52	54	-18.48
10400	33.96	AV	H	39.92	10.54	47.02	37.4	54	-16.6
10400	53.37	PK	V	39.92	10.54	47.02	56.81	74	-17.19
10400	52.48	PK	H	39.92	10.54	47.02	55.92	74	-18.08
10956	19.36	AV	V	40.05	10.29	47.92	21.78	54	-32.22
10956	20.11	AV	H	40.05	10.29	47.92	22.53	54	-31.47
10956	38.03	PK	V	40.05	10.29	47.92	40.45	74	-33.55
10956	37.5	PK	H	40.05	10.29	47.92	39.92	74	-34.08

High Channel (5240MHz)

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)
10480	38.15	AV	V	39.67	10.56	47.04	41.34	54	-12.66
10480	39.91	AV	H	39.67	10.56	47.04	43.1	54	-10.9
10480	58.15	PK	V	39.67	10.56	47.04	61.34	74	-12.66
10480	59.14	PK	H	39.67	10.56	47.04	62.33	74	-11.67
17835	20.06	AV	V	43.25	19.77	43.91	39.17	54	-14.83
17835	18.3	AV	H	43.25	19.77	43.91	37.41	54	-16.59
17835	39.05	PK	V	43.25	19.77	43.91	58.16	74	-15.84
17835	40.88	PK	H	43.25	19.77	43.91	59.99	74	-14.01

Annex A. TEST INSTRUMENT

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Model	Serial #	Cal Date	Cal Due	In use
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	03/22/2018	03/21/2019	☑
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 05,18	May 04,19
Horn Antenna (18GHz-40GHz)	N/A	QWH-SL-18-40-K-SG/QMS-00361	15433	Dec. 15,17	Dec. 14,18
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. 23,18	Jul. 22,19
MXE EMI Receiver	KEYSIGHT	N9038A-544	MY54450026	Mar. 09,18	Mar. 08,19
Signal Pre-Amplifier	EMSI	EMC 184045B	980259	Jul. 23,18	Jul. 22,19

Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION

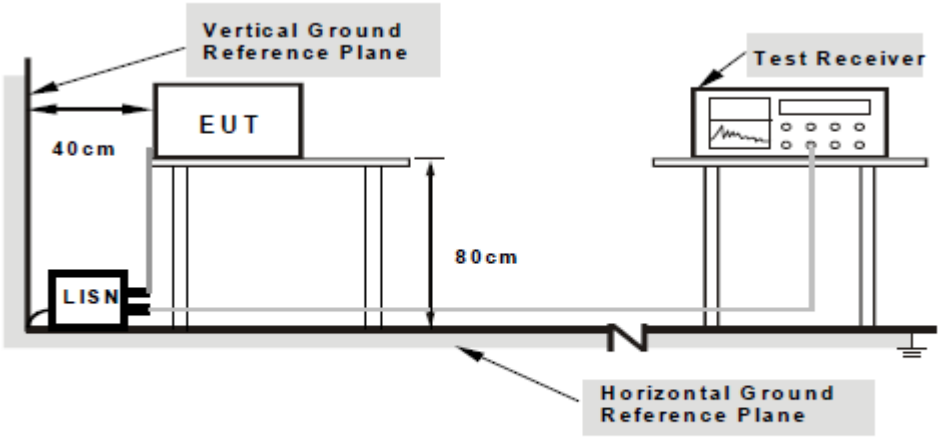
Test Set-up

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, as shown in Annex B.

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 equipments were powered separately from another main supply.



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.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration1.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. 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.

3. High peaks, relative to the limit line, were then selected.

4. 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.

5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

Description of Conducted Emission Program

This EMC Measurement software run LabView automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 150 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.

Sample Calculation Example

At 20 MHz limit = 250 μV = 47.96 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 47.96 – 40.00 = 7.96 i.e. **7.96 dB below limit**

Annex A. iii RADIATED EMISSIONS TEST DESCRIPTION

EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 10th Harmonic , was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

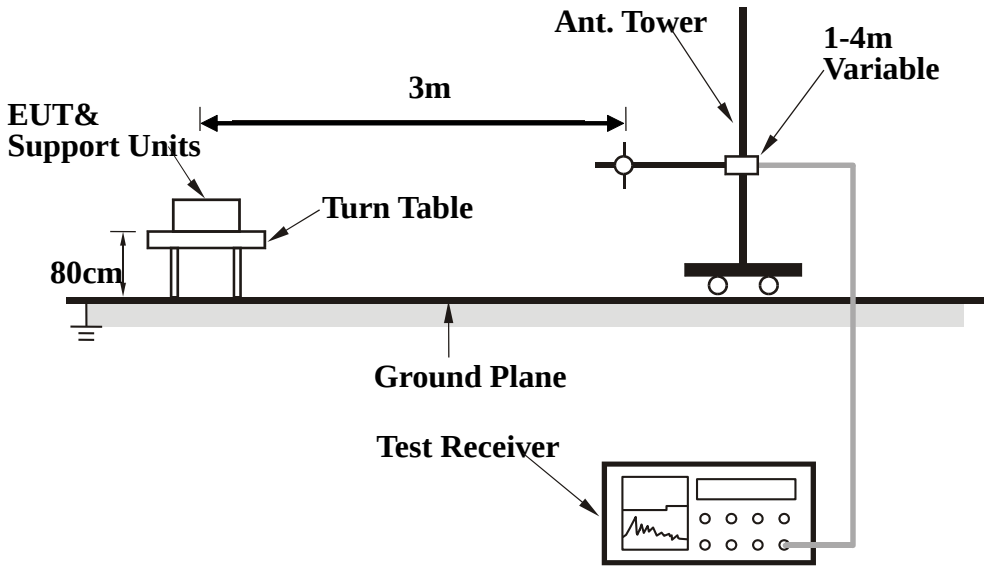
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.

2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:
1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement
1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0。 to 360。 with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

5. Repeat step 4 until all frequencies need to be measured was complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz

Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

And the average value is

Average = Peak Value + Duty Factor or

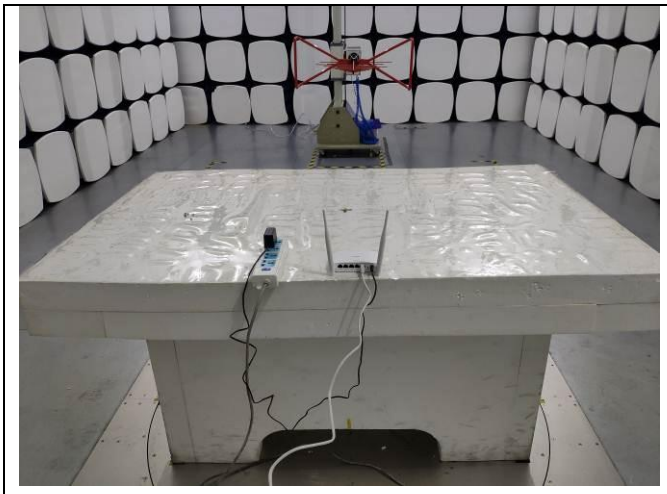
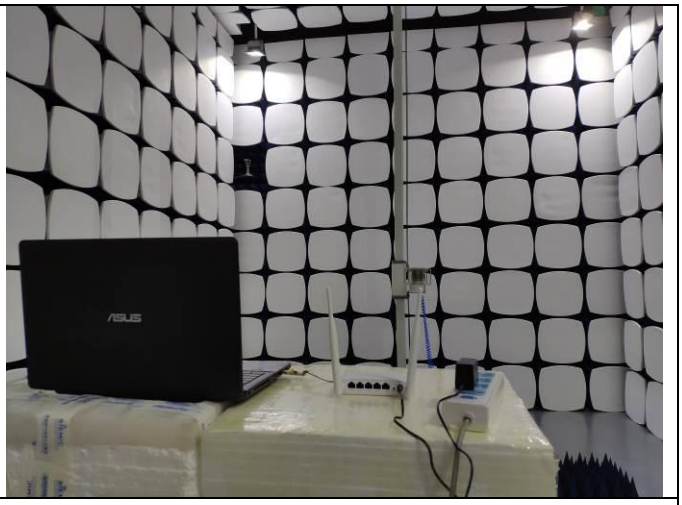
Set RBW = 1MHz, VBW = 10Hz.

Note :

If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Test Setup Photo

	
Radiated Spurious Emissions Test Setup Below 1GHz	Radiated Spurious Emissions Test Setup Above 1GHz

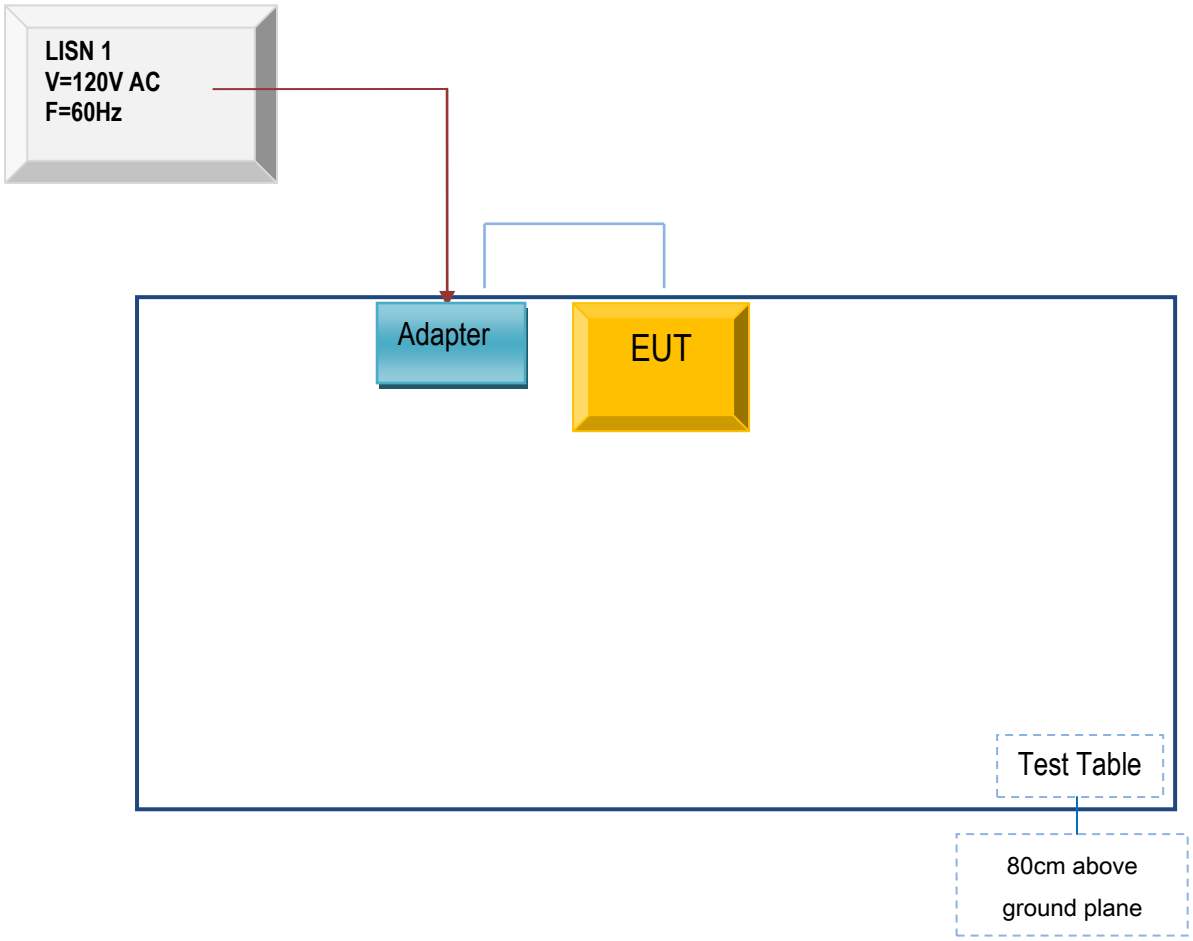
Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

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

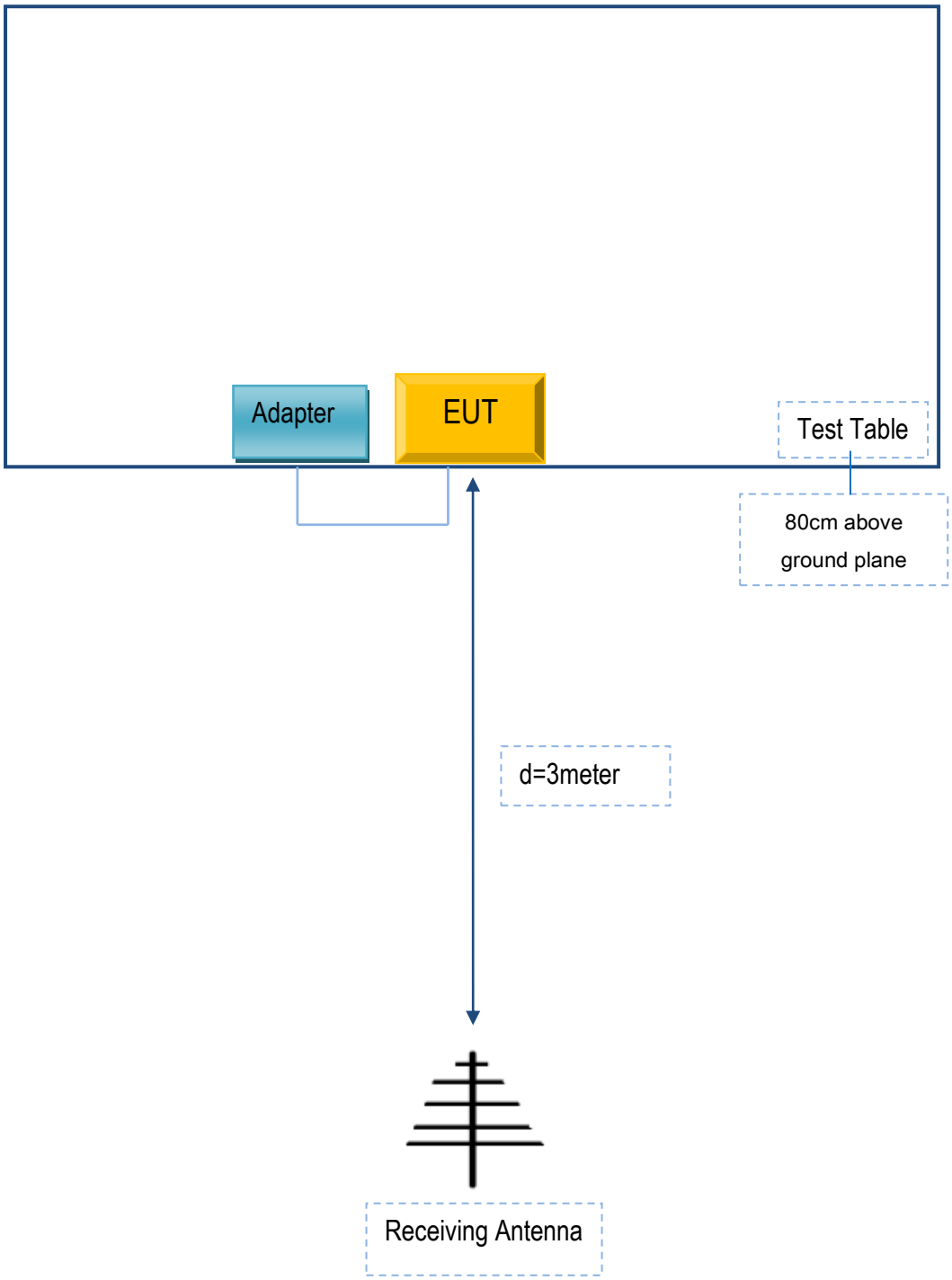
Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
Lenovo	Laptop	E40	N/A

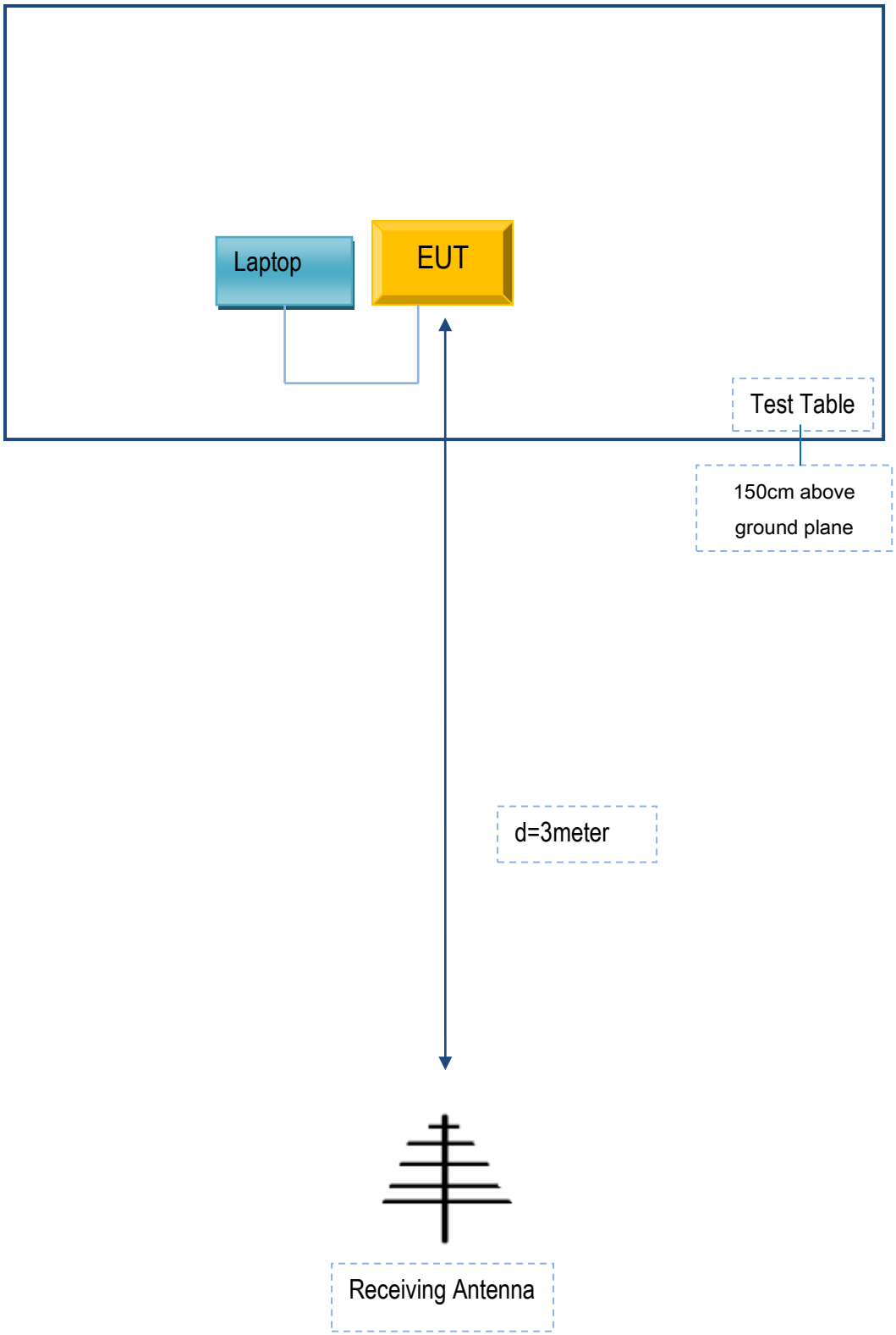
Block Configuration Diagram for AC Line Conducted Emissions



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



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



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was continuously transmitting to stimulate the worst case.

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

See attachment

Annex E. DECLARATION OF SIMILARITY

N/A