

7 Radiated Emissions

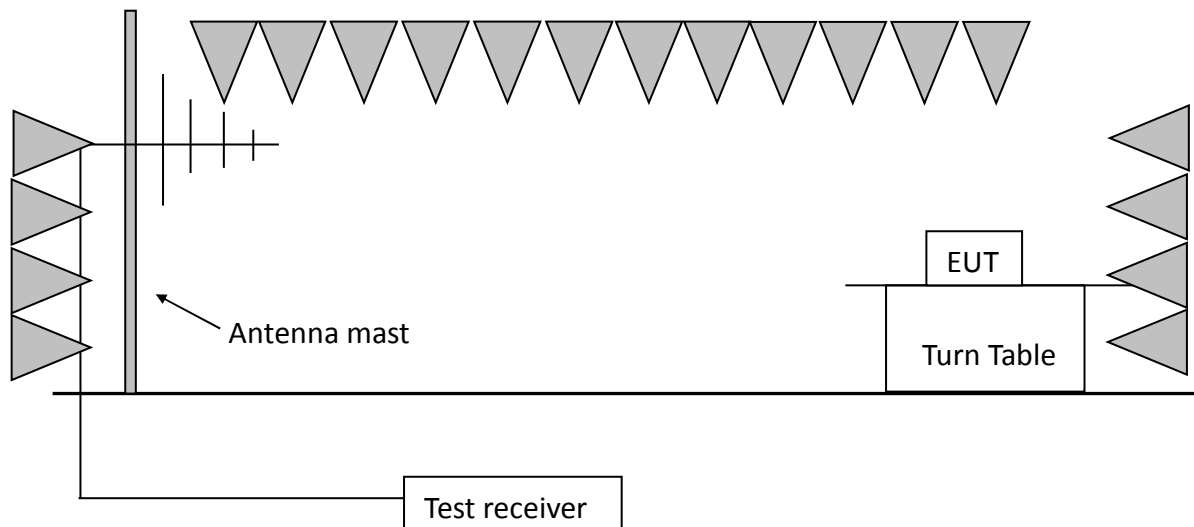
Test result: Pass

7.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

7.2 Test Configuration



7.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The EUT was tested according to DTS test procedure of KDB558074 D01 DTS "Meas Guidance" for compliance to FCC 47CFR 15.247 requirements.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

Remark:

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;
Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m,
Measured level = 10.20dBuV/m, then Margin = 54 - 10.20 = 43.80dBuV/m.

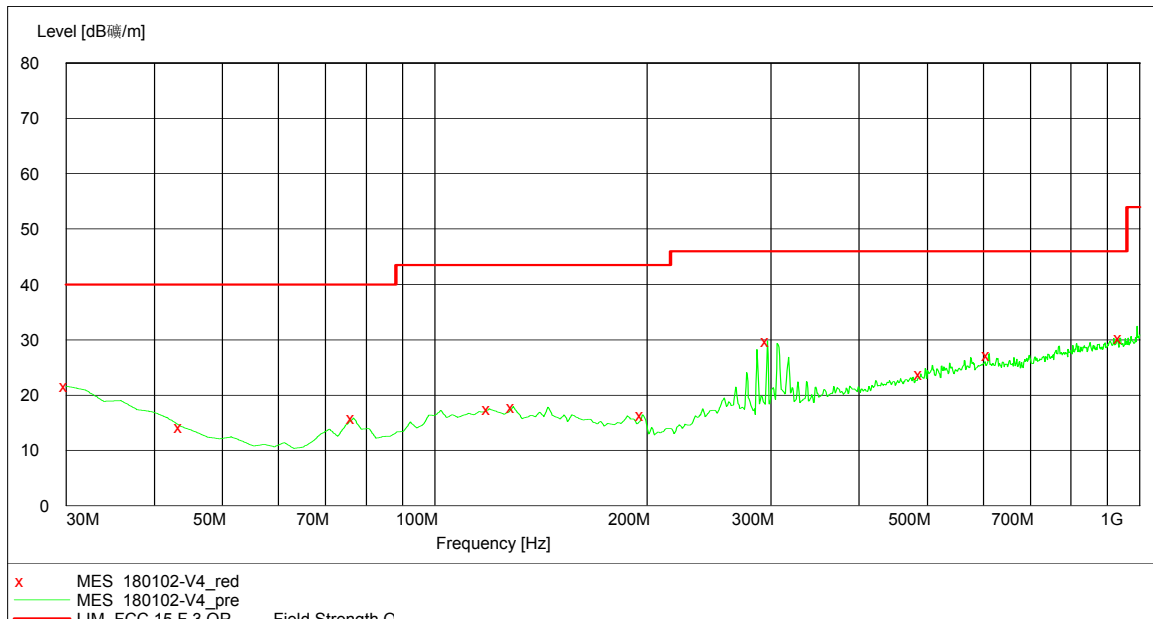
7.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

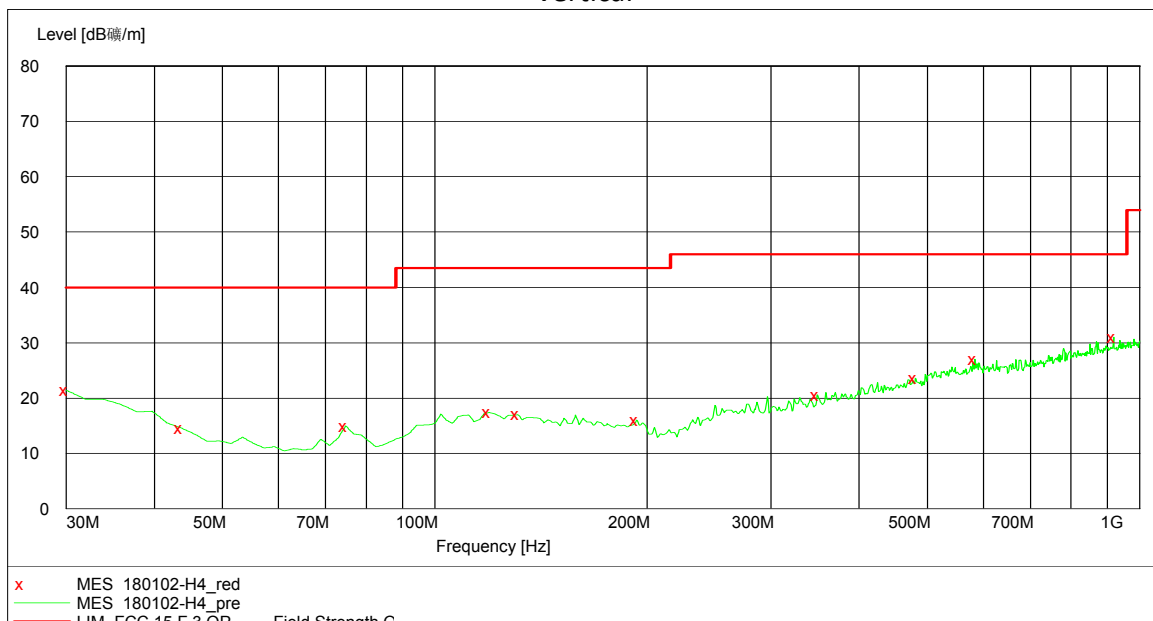
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



Test data 30MHz~1GHz:

Polarization	Frequency (MHz)	Measured level (dB μ V/m)	Correct Factor (dB/m)	Limits (dB μ V/m)	Margin (dB)	Detector
H	30.00	21.6	19.2	40.0	18.4	PK
	43.61	14.3	11.6	40.0	25.7	PK
	76.65	15.8	7.6	40.0	24.2	PK
	119.42	17.5	13.3	43.5	26.0	PK
	129.14	17.9	12.9	43.5	25.6	PK
	197.17	16.4	10.7	43.5	27.1	PK
	296.31	29.7	14.6	46.0	16.3	PK
	488.76	23.8	19.1	46.0	22.2	PK
	611.22	27.3	20.6	46.0	18.7	PK
	939.74	30.3	23.4	46.0	15.7	PK
V	30.00	21.4	19.2	40.0	18.6	PK
	43.61	14.6	11.6	40.0	25.4	PK
	74.71	14.9	7.5	40.0	25.1	PK
	119.42	17.4	13.3	43.5	26.1	PK
	131.08	17.0	12.8	43.5	26.5	PK
	193.29	16.0	10.6	43.5	27.5	PK
	348.80	20.5	16.0	46.0	25.5	PK
	480.98	23.6	18.9	46.0	22.4	PK
	584.01	27.0	20.4	46.0	19.0	PK
	918.36	31.0	23.2	46.0	15.0	PK

Note: The 802.11b channel L (2412MHz) was chosen to test for 30MHz to 1GHz as representative and list in the report.

Test result above 1GHz:

The emission was conducted from 1GHz to 25GHz.

802.11b:

CH	Antenna	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
L	H	2390.00	53.42	22.22	-20.58	74.00	31.20	PK
	H	2390.00	46.44	15.24	-7.56	54.00	31.20	AV
	H	4824.00	48.21	45.51	-25.79	74.00	2.70	PK
	V	4824.00	45.27	42.57	-28.73	74.00	2.70	PK
M	H	4874.00	44.32	41.65	-29.68	74.00	2.68	PK
	V	4874.00	42.41	39.74	-31.59	74.00	2.68	PK
H	H	2483.50	52.46	21.27	-21.54	74.00	31.19	PK
	H	2483.50	45.11	13.92	-8.89	54.00	31.19	AV
	H	4924.00	47.43	44.67	-26.57	74.00	2.77	PK
	V	4924.00	44.13	41.36	-29.87	74.00	2.77	PK

802.11g:

CH	Antenna	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
L	V	2390.00	57.54	26.34	-16.46	74.00	31.20	PK
	V	2390.00	46.45	15.25	-7.55	54.00	31.20	AV
	V	4824.00	45.66	42.96	-28.34	74.00	2.70	PK
	V	4824.00	43.36	40.66	-30.64	74.00	2.70	PK
M	V	4874.00	46.11	43.44	-27.89	74.00	2.68	PK
	V	4874.00	45.21	42.54	-28.79	74.00	2.68	PK
	V	7311.00	43.46	35.47	-30.54	74.00	7.99	PK
	V	7311.00	41.31	33.32	-32.69	74.00	7.99	PK
H	V	2483.50	55.82	24.63	-18.18	74.00	31.19	PK
	V	2483.50	45.13	13.94	-8.87	54.00	31.19	AV
	V	4924.00	46.53	43.77	-27.47	74.00	2.77	PK
	V	4924.00	44.14	41.37	-29.86	74.00	2.77	PK

802.11n (HT20):

CH	Antenna	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
L	V	2390.00	55.25	24.05	-18.75	74.00	31.20	PK
	V	2390.00	46.63	15.43	-7.37	54.00	31.20	AV
	V	4824.00	47.53	44.83	-26.47	74.00	2.70	PK
	V	4824.00	43.74	41.04	-30.26	74.00	2.70	PK
M	V	4874.00	45.43	42.76	-28.57	74.00	2.67	PK
	V	4874.00	42.45	39.78	-31.55	74.00	2.67	PK
H	V	2483.50	54.55	23.36	-19.45	74.00	31.19	PK
	V	2483.50	46.26	15.07	-7.74	54.00	31.19	AV
	V	4924.00	47.66	44.90	-26.34	74.00	2.76	PK
	V	4924.00	44.55	41.79	-29.45	74.00	2.76	PK

802.11n (HT40):

CH	Antenna	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
L	V	2390.00	63.55	32.35	-10.45	74.00	31.20	PK
	V	2390.00	52.27	21.07	-1.73	54.00	31.20	AV
	V	4844.00	48.54	45.86	-25.46	74.00	2.68	PK
	V	4844.00	45.48	42.80	-28.52	74.00	2.68	PK
M	V	4874.00	44.12	41.45	-29.88	74.00	2.67	PK
	V	4874.00	42.24	39.57	-31.76	74.00	2.67	PK
H	V	2483.50	58.54	27.35	-15.46	74.00	31.19	PK
	V	2483.50	49.65	18.46	-4.35	54.00	31.19	AV
	V	4904.00	45.37	42.72	-28.63	74.00	2.65	PK
	V	4904.00	43.88	41.23	-30.12	74.00	2.65	PK

8 Power line conducted emission

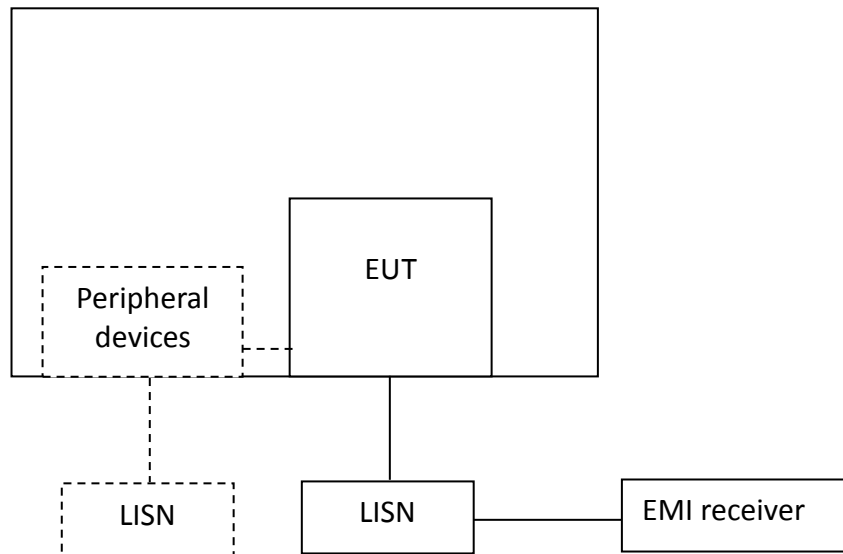
Test result: Pass

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.

8.2 Test configuration



For table top equipment, wooden support is 0.8m height table

For floor standing equipment, wooden support is 0.1m height rack.

8.3 Test procedure and test set up

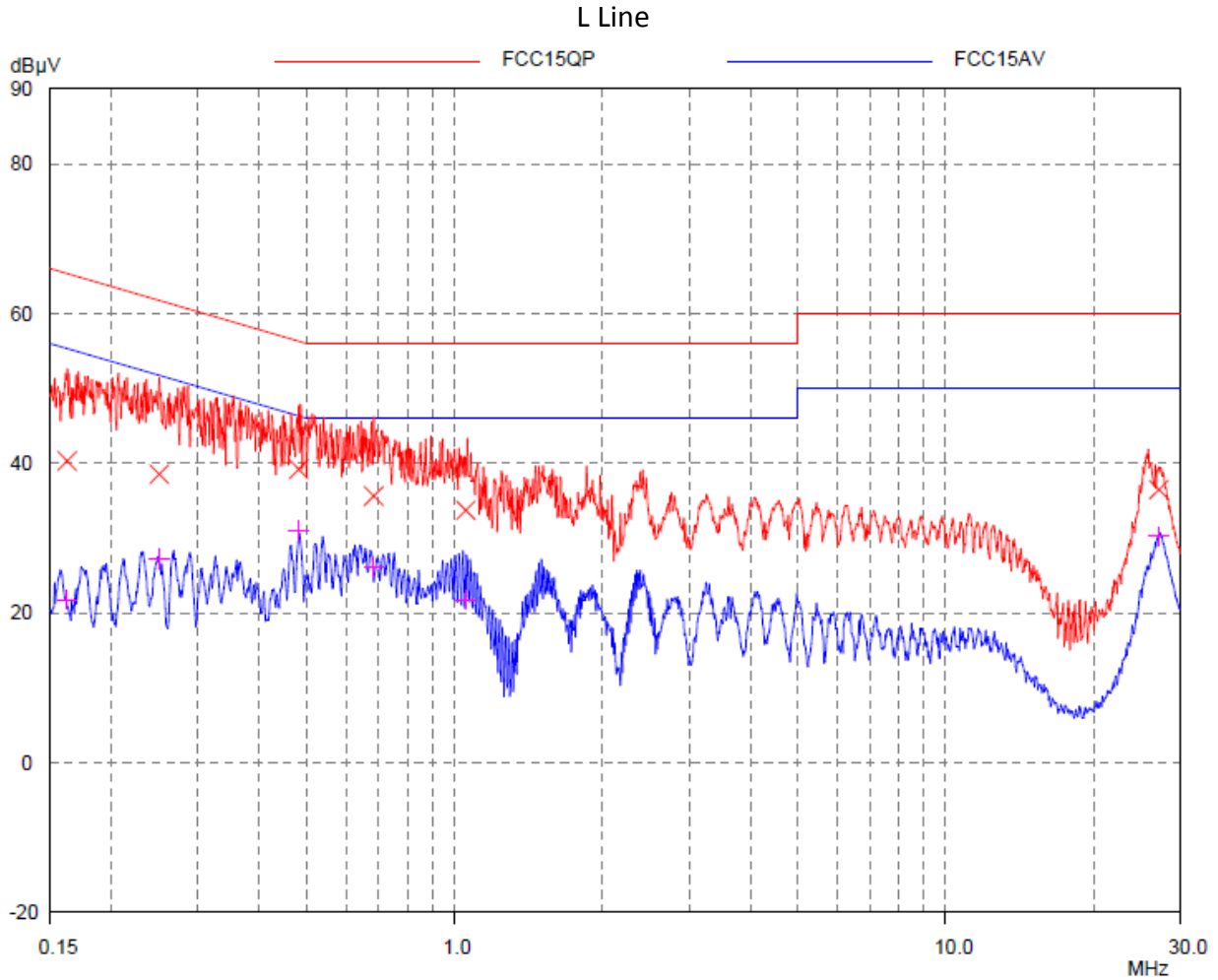
Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50 Ω LISN port (to which the EUT is connected), where permitted, terminated into a 50 Ω measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50 Ω measuring port is terminated by a measuring instrument having 50 Ω input impedance. All other ports are terminated in 50 Ω loads.

Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

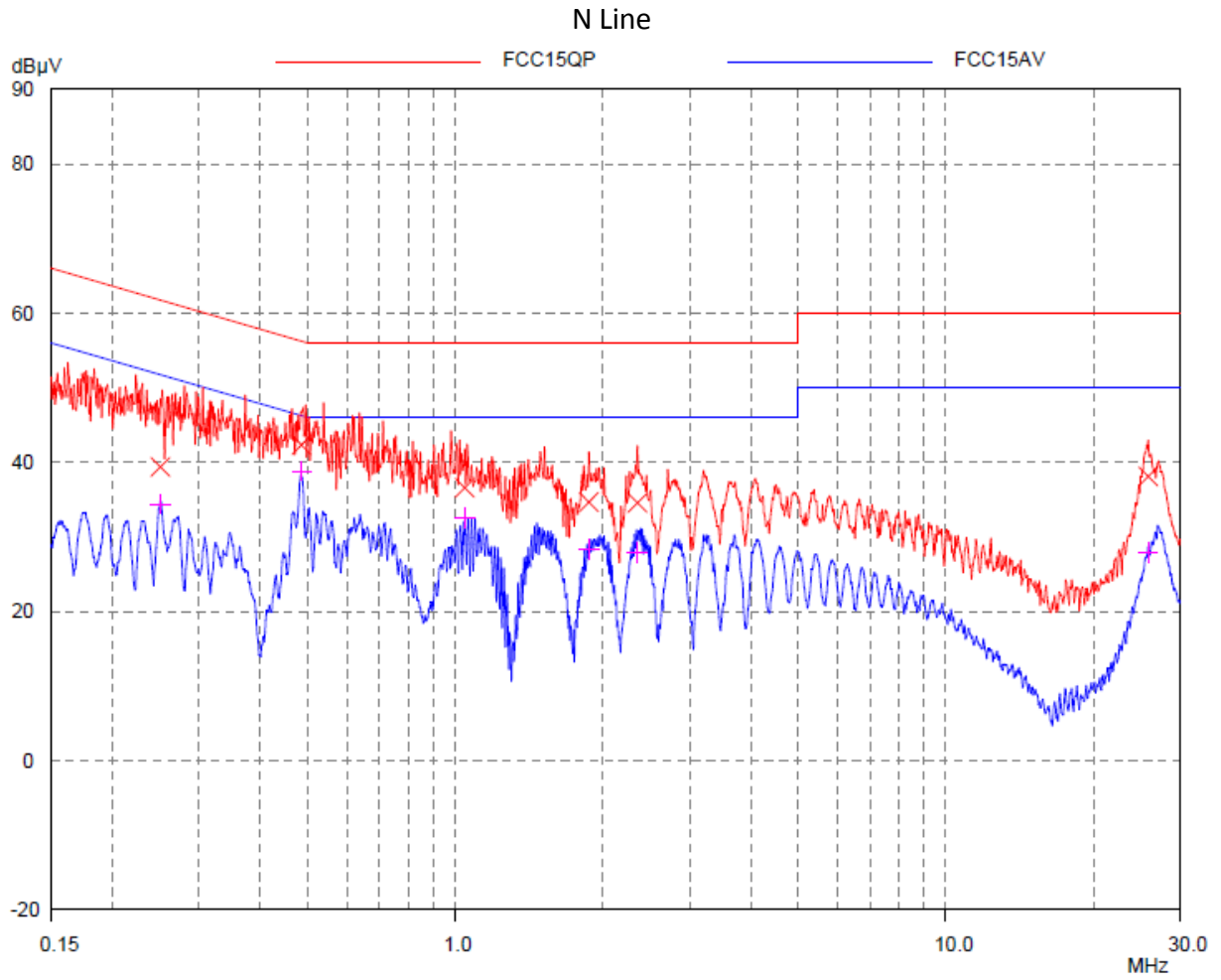
8.4 Test protocol

Temperature: 25 °C
Relative Humidity: 55 %



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.162	40.33	65.34	25.01	21.76	55.34	33.58
0.250	38.55	61.76	23.21	27.27	51.76	24.49
0.481	39.23	56.32	17.09	31.05	46.32	15.27
0.684	35.62	56.00	20.38	26.19	46.00	19.81
1.052	33.72	56.00	22.28	21.75	46.00	24.25
27.126	36.48	60.00	23.52	30.28	50.00	19.72



Test Data:

Frequency (MHz)	Quasi-peak			Average		
	level dB(µV)	Limit dB(µV)	Margin (dB)	level dB(µV)	limit dB(µV)	Margin (dB)
0.250	39.40	61.76	22.36	34.40	51.76	17.36
0.485	42.36	56.25	13.89	38.79	46.25	7.46
1.044	36.61	56.00	19.39	32.57	46.00	13.43
1.870	34.68	56.00	21.32	28.33	46.00	17.67
2.348	34.58	56.00	21.42	27.87	46.00	18.13
25.857	38.11	60.00	21.89	27.92	50.00	22.08

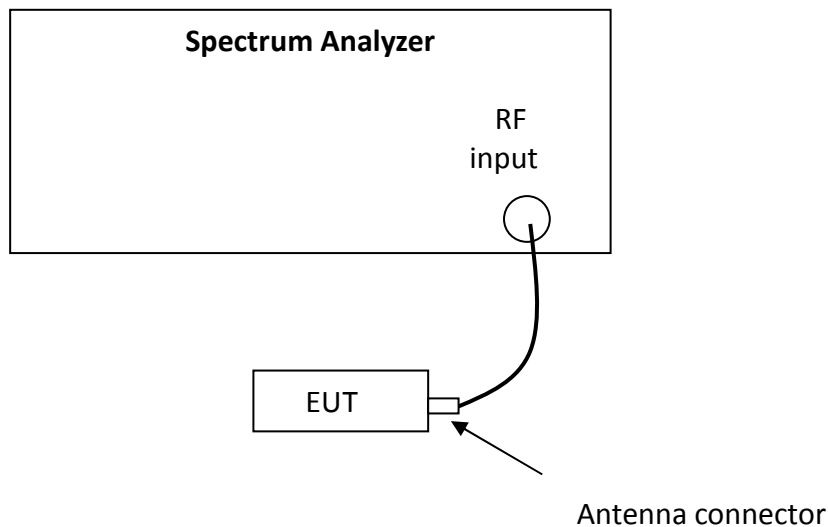
9 Occupy Bandwidth

Test result: Pass

9.1 Limit

No Limit

9.2 Test Configuration



9.3 Test Procedure and test setup

The 99% Occupy Bandwidth is measured using the Spectrum Analyzer according to RSS-Gen Issue 4, General Requirements for Compliance of Radio Apparatus clause 6.6.

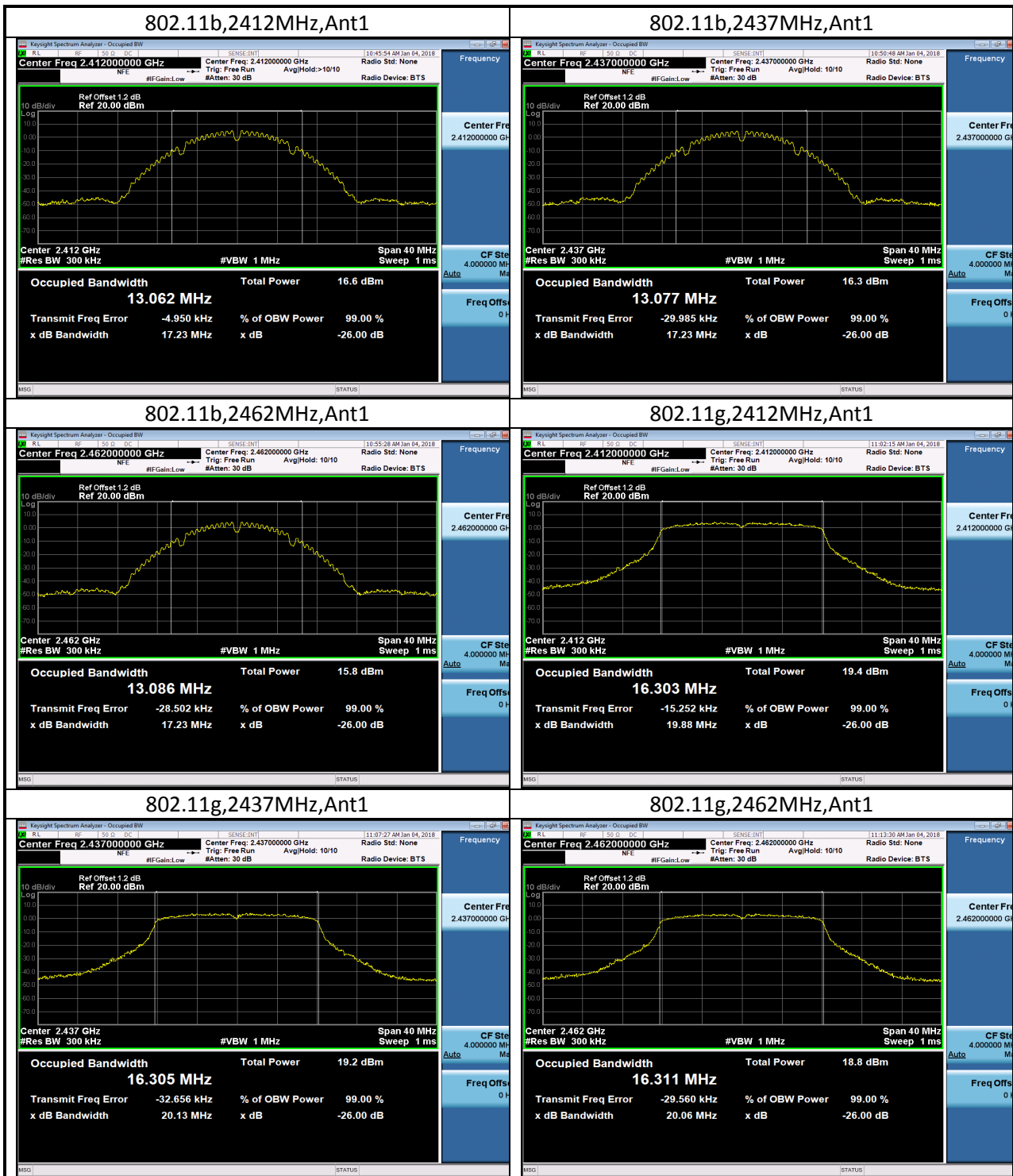
- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

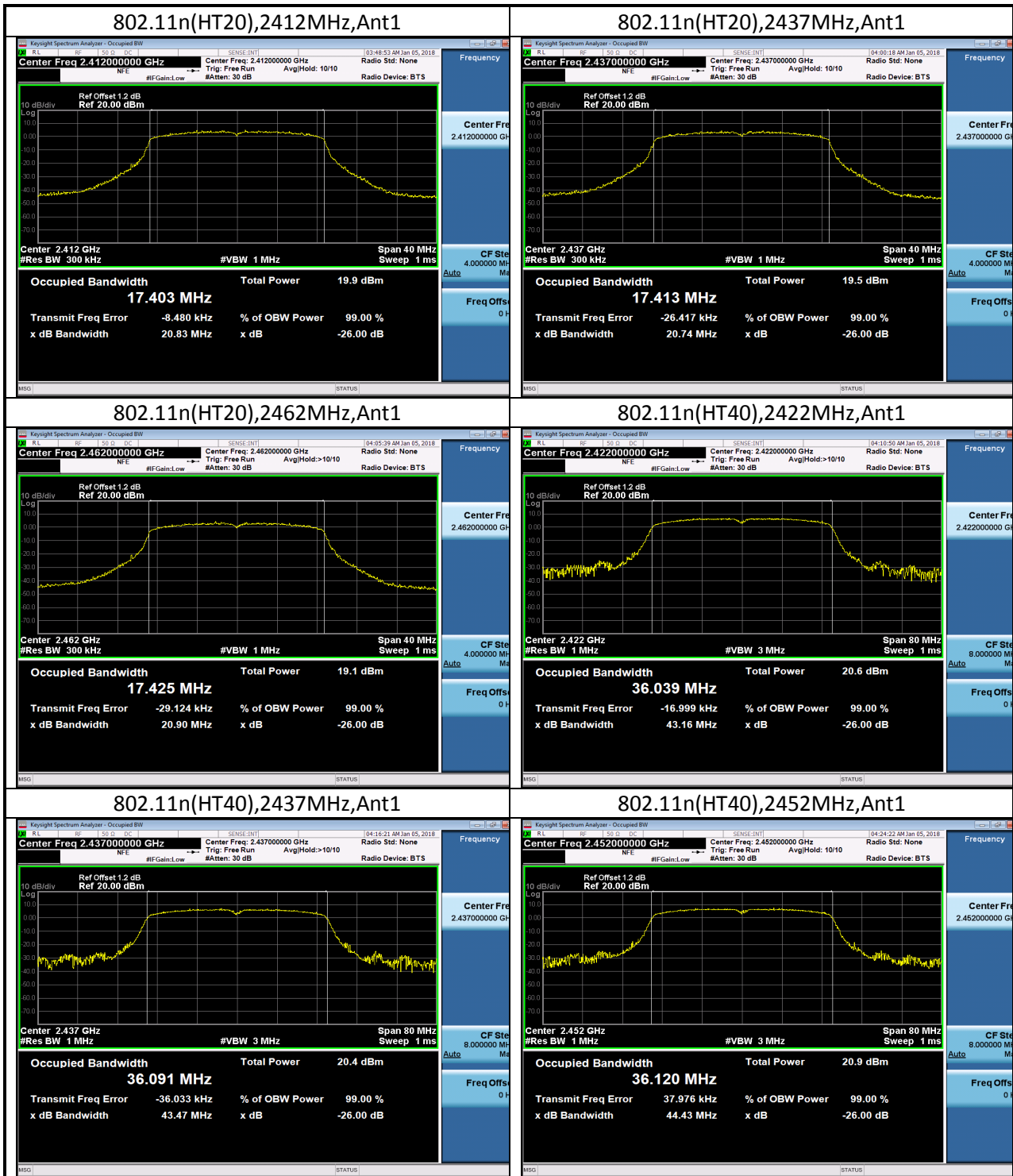
9.4 Test Protocol

Temperature: 25 °C
Relative Humidity: 55 %

WLAN 99% Occupied Bandwidth				
Mode	Test Frequency(MHz)	Ant	99% Occupied Bandwidth(MHz)	Result
802.11b	2412	Ant1	13.062	Pass
802.11b	2437	Ant1	13.077	Pass
802.11b	2462	Ant1	13.086	Pass
802.11g	2412	Ant1	16.303	Pass
802.11g	2437	Ant1	16.305	Pass
802.11g	2462	Ant1	16.311	Pass
802.11n(HT20)	2412	Ant1	17.403	Pass
802.11n(HT20)	2437	Ant1	17.413	Pass
802.11n(HT20)	2462	Ant1	17.425	Pass
802.11n(HT40)	2422	Ant1	36.039	Pass
802.11n(HT40)	2437	Ant1	36.091	Pass
802.11n(HT40)	2452	Ant1	36.120	Pass

Test Plots:





Annex: Duty Cycle

WLAN Duty Cycle				
Mode	Test Frequency(MHz)	Ant	Duty Cycle(%)	Duty Cycle Factor (dB)
802.11b	2412	Ant1	99.12	0.04
802.11b	2437	Ant1	98.72	0.06
802.11b	2462	Ant1	98.96	0.05
802.11g	2412	Ant1	94.17	0.26
802.11g	2437	Ant1	94.61	0.24
802.11g	2462	Ant1	94.61	0.24
802.11n(HT20)	2412	Ant1	91.53	0.38
802.11n(HT20)	2437	Ant1	91.83	0.37
802.11n(HT20)	2462	Ant1	93.46	0.29
802.11n(HT40)	2422	Ant1	84.68	0.72
802.11n(HT40)	2437	Ant1	89.81	0.47
802.11n(HT40)	2452	Ant1	88.40	0.54

Test Plots:



