



FCC RADIO TEST REPORT

Applicant	: Ring LLC
Address	: 1523 26th Street, Santa Monica, CA 90404 United States
Equipment	: Chime Pro (2nd Generation)
Model No.	: 5UM2E5
Trade Name	: Ring
FCC ID	: 2AEUPBHACP021

I HEREBY CERTIFY THAT :

The sample was received on Aug. 14, 2019 and the testing was completed on Oct. 25, 2019 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory





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History of this test report

Report No.	Issue Date	Description
TEFU1908104	Oct. 30, 2019	Original



1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.10:2013

FCC Rule	Description of Test	Result
15.203	CO-LOCATION	PASS

*The lab has lowered the uncertainty risk of test equipment, environment, and staff technicians according to ISO-IEC17025. Therefore we define test result as compliant when it complies with the standard without further evaluation of test result uncertainty.

*This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report(TEFD1908104).



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Frequency Range	BLE: 2400-2483.5MHz 802.11b/g/n: 2400-2483.5MHz 802.11a/n/ac: 5150-5250MHz, 5725-5850MHz
Modulation Type	BLE: GFSK 802.11b: CCK, DQPSK, DBPSK 802.11g/n/a: BPSK, QPSK, 16QAM, 64QAM 802.11ac: BPSK, QPSK, 16QAM, 64QAM, 256QAM
Modulation Technology	DSSS, OFDM, DTS
Data Rate	BLE: GFSK: 1Mbps WLAN: 2.4G 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS15, HT20/40, VHT20, VHT40 5G 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS15, HT20/40 802.11ac: MCS0 – MCS9, VHT20/40/80
Antenna Type	FPC Antenna(BLE) FPCB Antenna(WLAN)
Antenna Gain	BLE: 2400-2483.5MHz: ANT A: 2.69dBi WLAN: 2400-2483.5MHz: ANT A: 3.55dBi, ANT B: 3.37dBi 5150-5250MHz: ANT A: 4.67dBi, ANT B: 2.49dBi 5725-5850MHz: ANT A: 4.2dBi, ANT B: 4.99dBi

Note: 1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2. 802.11ac VHT20, VHT40 and VHT80 support beamforming.



2.2 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4.
- b. The complete test system included Notebook and EUT for RF test.
- c. An executive program, " QRCT ver.3.0.276.0 & hci command " under Windows OS system was executed to transmit and receive data via WLAN.
- d. The following test modes were performed for the test:
Test Mode 1. BLE GFSK CH39 + 11b CH6 + 11a CH149

2.3 Description of Test System

N/A



2.4 General Information of Test

Test Site	CerpPASS Technology Corporation Test Laboratory Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881	
	FCC	TW1439, TW1079
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication test C-4663 for Conducted emission test R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 40,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

Test Item	Test Site	Finish Date	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2019/10/25	22°C / 63%	Nick Guan
Radiated Emissions	3M02-NK	2019/10/25	22°C / 64%	Vic Yeh
RF Conduction	CON01-NK	2019/10/25	24°C / 43%	Leon Huang



2.5 Measurement Uncertainty

Measurement Item	Uncertainty
AC Power Line Conduction(150K~30MHz)	$\pm 1.60\text{dB}$
Radiated Spurious Emission(9KHz~30MHz)	$\pm 3.405\text{dB}$
Radiated Spurious Emission(30MHz~1GHz)	$\pm 5.326\text{dB}$
Radiated Spurious Emission(1GHz~40GHz)	$\pm 5.011\text{dB}$
6dB Bandwidth	$\pm 4.407\%$
26dB Bandwidth	$\pm 4.459\%$
Occupied Bandwidth	$\pm 4.403\%$
Peak Output Power(Conducted Power Meter)	$\pm 1.31\text{dB}$
Power Spectral Density	$\pm 2.106\text{dB}$
Duty Cycle	$\pm 0.17\%$
Frequency Stability	$\pm 156.543\text{Hz}$
Temperature	$\pm 1.2^{\circ}\text{C}$
Humidity	$\pm 2.7\%$



3. Test Equipment and Ancillaries Used for Tests

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M02-NK)				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Bilog Antenna	Schwarzbeck	VULB9168	369	2019/03/29	2020/03/28
Active Loop Antenna	EMCO	6507	40855	2019/05/24	2020/05/23
Horn Antenna	EMCO	3115	31589	2019/04/01	2020/03/31
Horn Antenna	EMCO	3116	31974	2019/09/17	2020/09/16
EMI Receiver	ROHDE & SCHWARZ	ESCI	101423	2019/05/14	2020/05/13
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2019/03/28	2020/03/27
Preamplifier	EM Electronics corp.	EM330	60660	2019/03/11	2020/03/10
Preamplifier	Agilent	8449B	3008A01954	2019/03/11	2020/03/10
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2018/10/31	2019/10/30
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2019/04/07	2020/04/06
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1315	2019/04/09	2020/04/08
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1316	2019/09/20	2020/09/19
Cable-0.5m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805443/4	2019/05/20	2020/05/19
Cable-3m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805796/4	2019/05/20	2020/05/19
Cable-8m(1G-40G)	HUBER SUHNER	SUCOFLEX 100	805795/4	2019/05/20	2020/05/19
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA

Test Item	RF Conducted				
Test Site	RFCON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100047	2019/03/28	2020/03/27
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2019/04/07	2020/04/06
Attenuator	KEYSIGHT	8491B	MY39250703	2019/09/12	2020/09/11
TEMP & HUMI CHAMBER	T-MACHINE	TMJ-9712	T-12-040111	2019/08/28	2020/08/27
Power Meter	Anritsu	ML2495A	1224005	2019/4/11	2020/04/10
Power Sensor	Anritsu	MA2411B	1207295	2019/04/09	2020/04/08

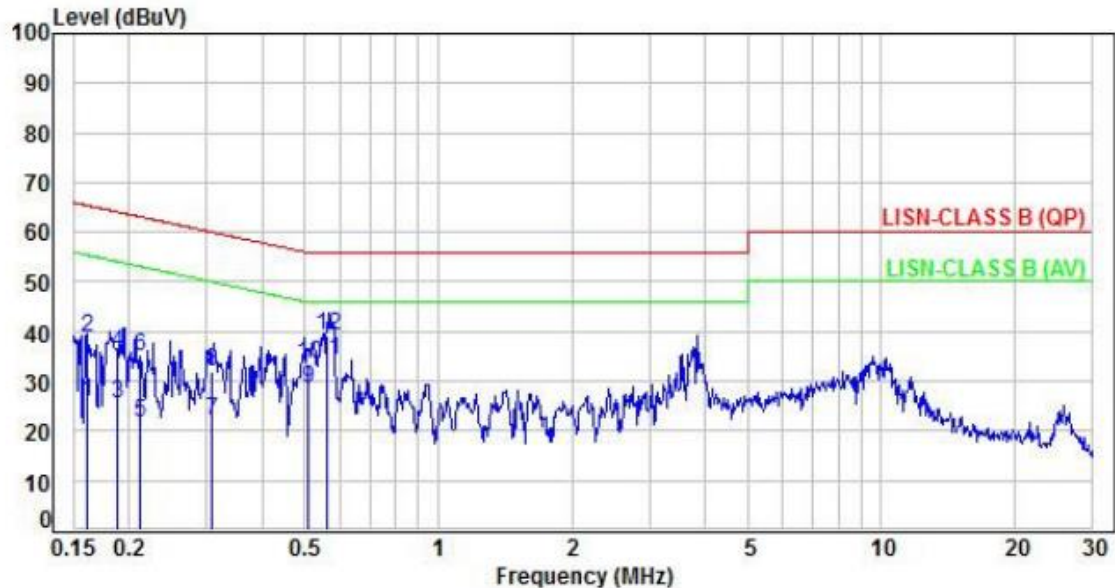
Test Item	AC Power Line Conducted Emission				
Test Site	CON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
EMI Receiver	ROHDE & SCHWARZ	ESCI	100443	2019/03/29	2020/03/28
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-568	2019/03/15	2020/03/14
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	101934	2019/03/12	2020/03/11
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130606	2019/03/14	2020/03/13
E3	AUDIX	v8.2014-8-6	RK-000531	NA	NA



4. Test of AC Power Line Conducted Emission

4.1 Test Result and Data

Power	: AC 120V / 60Hz	Pol/Phase	: LINE
Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV)	Limit (dBUV)	Margin (dB)	Detector	P/F
1	0.16	9.92	15.95	25.87	55.41	-29.54	Average	P
2	0.16	9.92	29.01	38.93	65.41	-26.48	QP	P
3	0.19	9.92	15.46	25.38	54.14	-28.76	Average	P
4	0.19	9.92	25.96	35.88	64.14	-28.26	QP	P
5	0.21	9.92	11.88	21.80	53.12	-31.32	Average	P
6	0.21	9.92	25.00	34.92	63.12	-28.20	QP	P
7	0.31	9.93	12.13	22.06	49.99	-27.93	Average	P
8	0.31	9.93	21.97	31.90	59.99	-28.09	QP	P
9	0.51	9.95	18.59	28.54	46.00	-17.46	Average	P
10	0.51	9.95	23.62	33.57	56.00	-22.43	QP	P
11	0.56	9.95	24.22	34.17	46.00	-11.83	Average	P
12	0.56	9.95	29.16	39.11	56.00	-16.89	QP	P

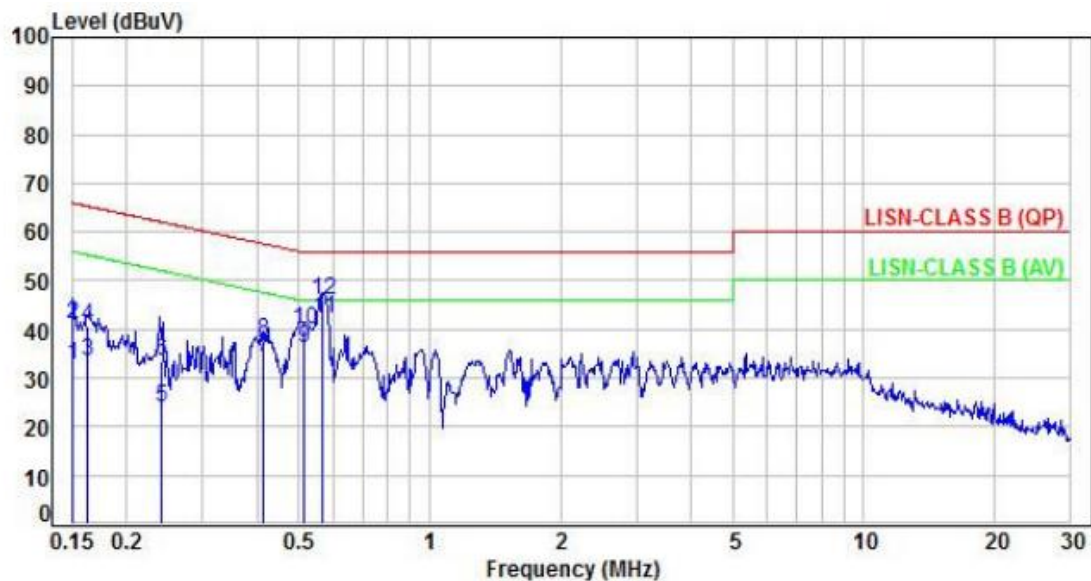
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



Power	: AC 120V / 60Hz	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1		



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.95	22.77	32.72	55.97	-23.25	Average	P
2	0.15	9.95	31.10	41.05	65.97	-24.92	QP	P
3	0.16	9.95	23.44	33.39	55.31	-21.92	Average	P
4	0.16	9.95	30.90	40.85	65.31	-24.46	QP	P
5	0.24	9.95	14.07	24.02	52.10	-28.08	Average	P
6	0.24	9.95	23.46	33.41	62.10	-28.69	QP	P
7	0.41	9.96	24.22	34.18	47.56	-13.38	Average	P
8	0.41	9.96	27.50	37.46	57.56	-20.10	QP	P
9	0.51	9.96	26.25	36.21	46.00	-9.79	Average	P
10	0.51	9.96	29.99	39.95	56.00	-16.05	QP	P
11	0.57	9.96	32.37	42.33	46.00	-3.67	Average	P
12	0.57	9.96	36.19	46.15	56.00	-9.85	QP	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=(LISN or ISN or Current Probe)Factor + Cable Loss



5. Test of Spurious Emission (Radiated)

5.1 Test Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/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

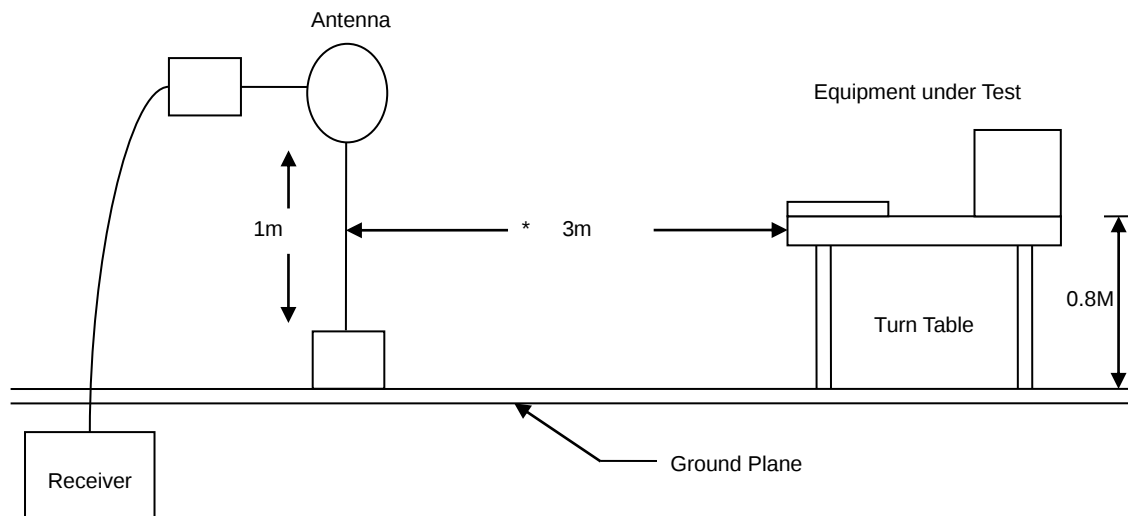
5.2 Test Procedures

- The EUT was placed on a rotatable table top 0.8 meter above ground.
- The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- The table was rotated 360 degrees to determine the position of the highest radiation.
- The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- "Cone of radiation" has been considered to be 3dB bandwidth of the measurement antenna.

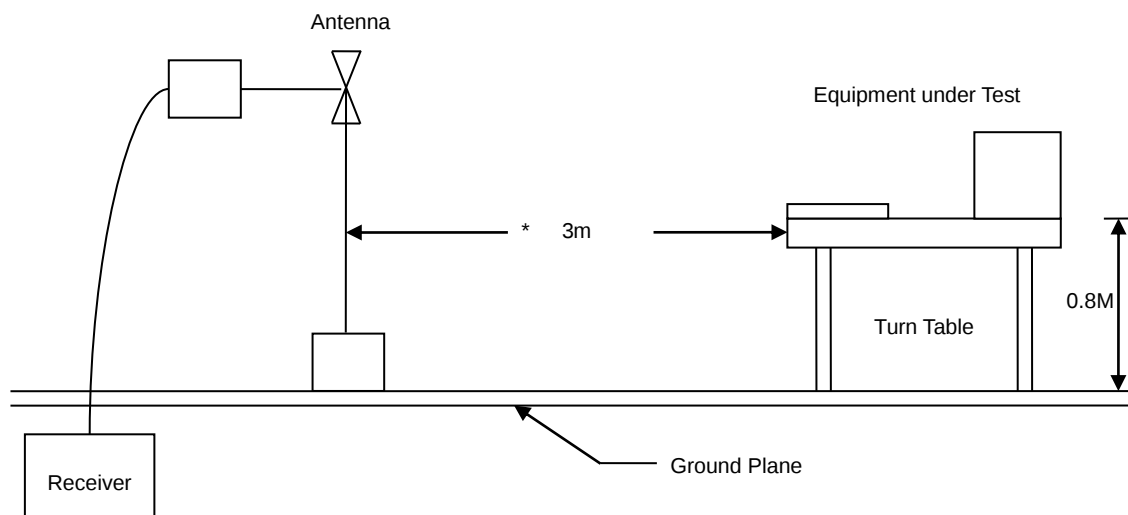


5.3 Typical Test Setup

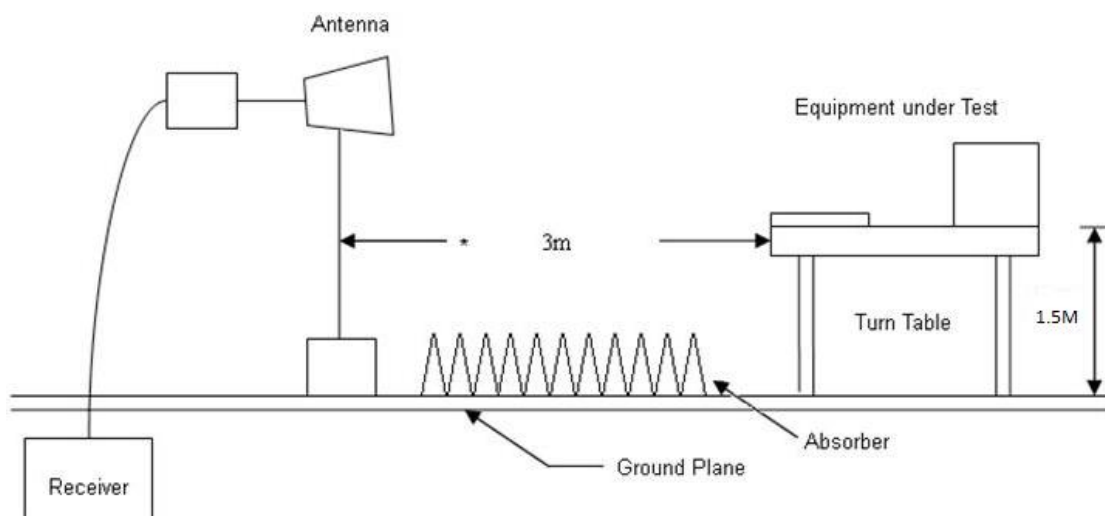
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



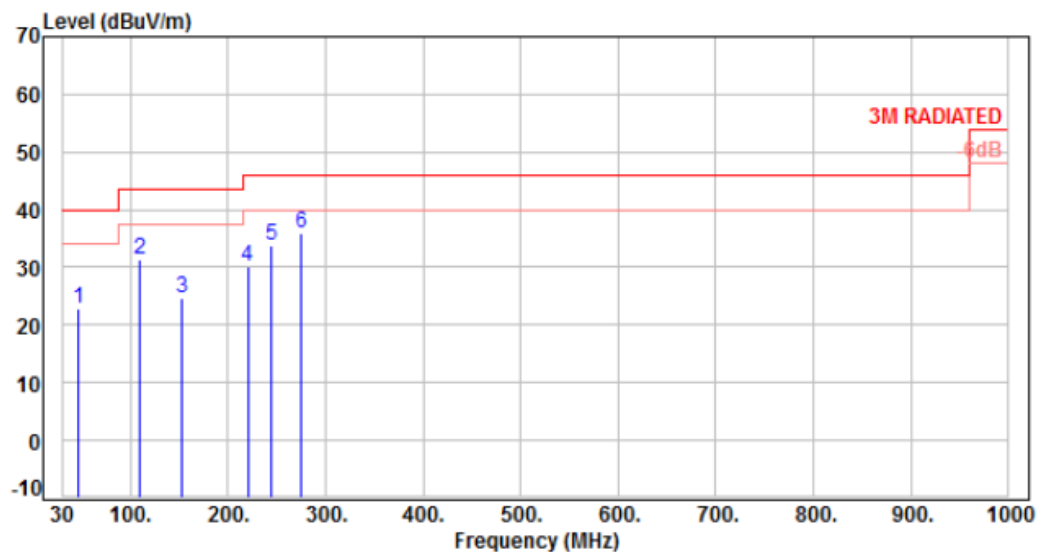


5.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

5.5 Test Result and Data (30MHz ~ 1GHz)

Power	:	AC 120V / 60Hz	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	45.86	-9.30	32.13	22.83	40.00	-17.17	Peak	100	0	P
2	110.36	-12.44	43.68	31.24	43.50	-12.26	Peak	100	0	P
3	152.34	-9.53	34.36	24.83	43.50	-18.67	Peak	100	0	P
4	220.13	-11.93	42.08	30.15	46.00	-15.85	Peak	100	0	P
5	243.71	-10.47	44.31	33.84	46.00	-12.16	Peak	100	0	P
6	274.28	-9.22	45.20	35.98	46.00	-10.02	Peak	100	0	P

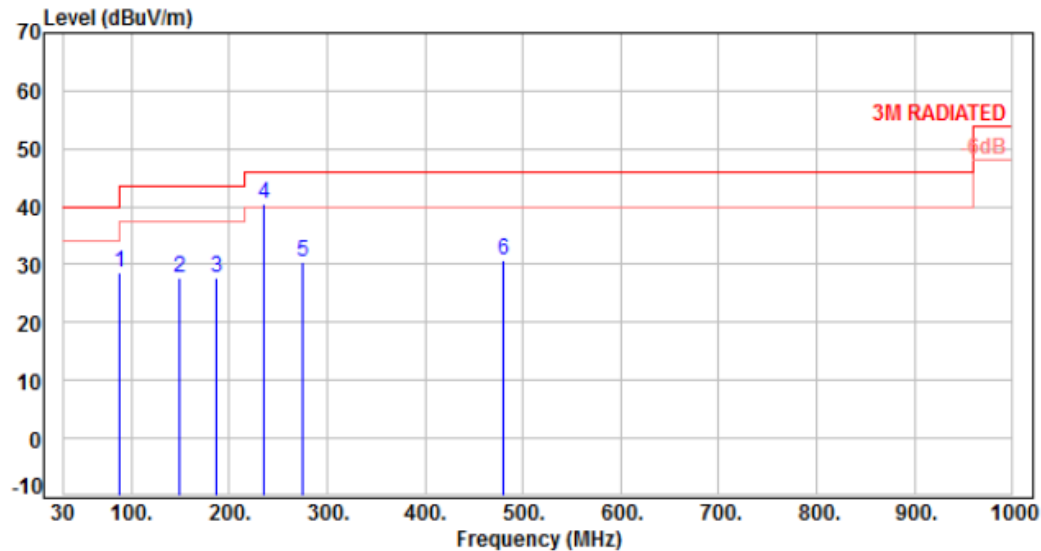
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 120V / 60Hz	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	88.15	-15.45	44.03	28.58	43.50	-14.92	Peak	100	0	P
2	149.63	-9.51	37.27	27.76	43.50	-15.74	Peak	100	0	P
3	187.16	-11.40	39.23	27.83	43.50	-15.67	Peak	100	0	P
4	235.76	-10.78	51.29	40.51	46.00	-5.49	Peak	100	0	P
5	274.76	-9.20	39.61	30.41	46.00	-15.59	Peak	100	0	P
6	480.77	-3.95	34.61	30.66	46.00	-15.34	Peak	100	0	P

Note: Level=Reading+Factor

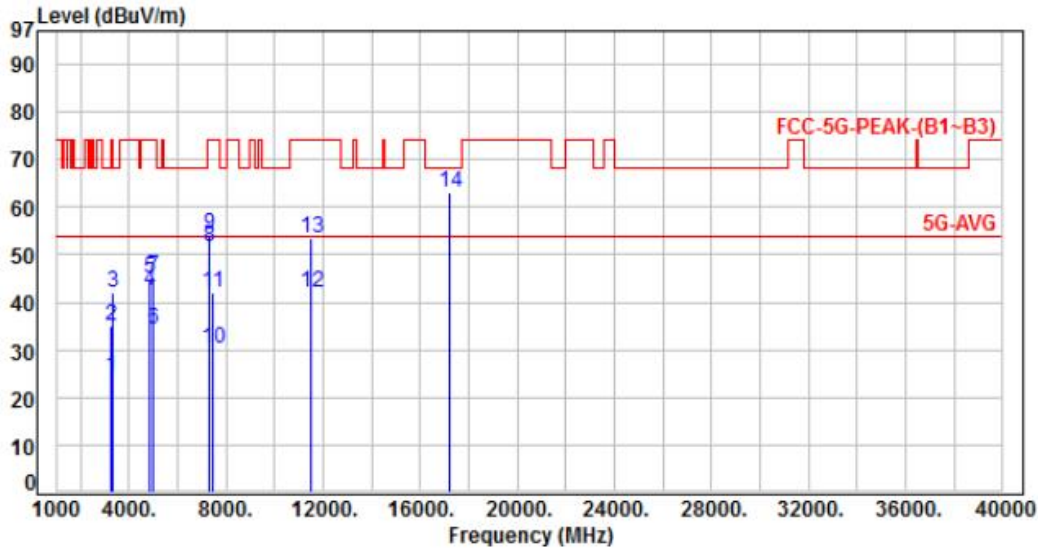
Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



5.6 Test Result and Data (1GHz ~ 40GHz)

Power	: AC 120V / 60Hz	Pol/Phase	: VERTICAL
Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	3265.00	-15.02	39.50	24.48	54.00	-29.52	Average	100	12	P
2	3265.00	-15.02	50.20	35.18	74.00	-38.82	Peak	100	12	P
3	3308.00	-14.98	57.15	42.17	68.20	-26.03	Peak	130	354	P
4	4874.00	-12.17	54.52	42.35	54.00	-11.65	Average	138	343	P
5	4874.00	-12.17	57.12	44.95	74.00	-29.05	Peak	138	343	P
6	4960.00	-11.98	46.25	34.27	54.00	-19.73	Average	100	342	P
7	4960.00	-11.98	57.20	45.22	74.00	-28.78	Peak	100	342	P
8	7311.00	-8.14	59.80	51.66	54.00	-2.34	Average	238	328	P
9	7311.00	-8.14	62.40	54.26	74.00	-19.74	Peak	238	328	P
10	7440.00	-8.02	38.45	30.43	54.00	-23.57	Average	100	236	P
11	7440.00	-8.02	49.97	41.95	74.00	-32.05	Peak	100	236	P
12	11490.00	-4.36	46.54	42.18	54.00	-11.82	Average	254	334	P
13	11490.00	-4.36	57.89	53.53	74.00	-20.47	Peak	254	334	P
14	17235.00	4.27	58.75	63.02	68.20	-5.18	Peak	100	307	P

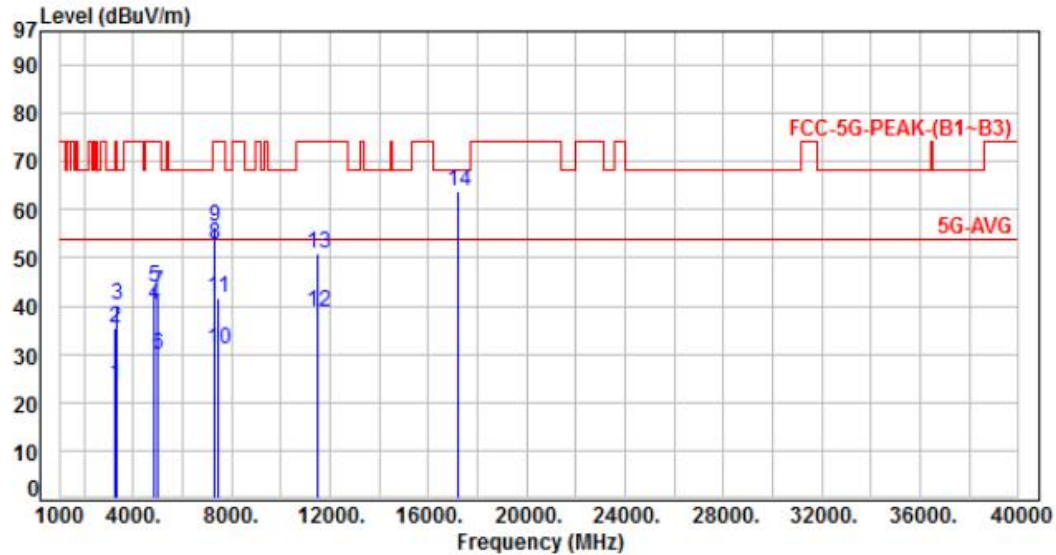
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: AC 120V / 60Hz	Pol/Phase	: HORIZONTAL
`Test Mode	: Mode 1		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	3265.00	-15.02	38.52	23.50	54.00	-30.50	Average	330	254	P
2	3265.00	-15.02	50.48	35.46	74.00	-38.54	Peak	330	254	P
3	3308.00	-14.98	55.01	40.03	68.20	-28.17	Peak	350	101	P
4	4874.00	-12.17	52.20	40.03	54.00	-13.97	Average	100	78	P
5	4874.00	-12.17	55.88	43.71	74.00	-30.29	Peak	100	78	P
6	4960.00	-11.98	41.80	29.82	54.00	-24.18	Average	100	338	P
7	4960.00	-11.98	54.80	42.82	74.00	-31.18	Peak	100	338	P
8	7311.00	-8.14	60.81	52.67	54.00	-1.33	Average	166	331	P
9	7311.00	-8.14	64.52	56.38	74.00	-17.62	Peak	166	331	P
10	7440.00	-8.02	39.03	31.01	54.00	-22.99	Average	100	317	P
11	7440.00	-8.02	49.81	41.79	74.00	-32.21	Peak	100	317	P
12	11490.00	-4.36	43.04	38.68	54.00	-15.32	Average	100	97	P
13	11490.00	-4.36	55.08	50.72	74.00	-23.28	Peak	100	97	P
14	17235.00	4.27	59.55	63.82	68.20	-4.38	Peak	100	225	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



5.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz



6. Test of Conducted Spurious Emission

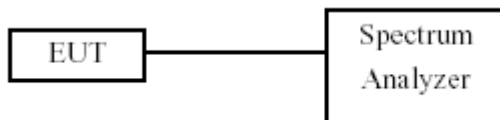
6.1 Test Limit

Below -30dB of the highest emission level of operating band (In 100 kHz Resolution Bandwidth)

6.2 Test Procedure

- The transmitter output was connected to the spectrum analyzer via a low loss cable.
- Set RBW of spectrum analyzer to 100 KHz and VBW of spectrum analyzer to 300 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
- Peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 30dB relative to the maximum measured in-band peak PSD level.
- The band edges was measured and recorded.

6.3 Test Setup Layout



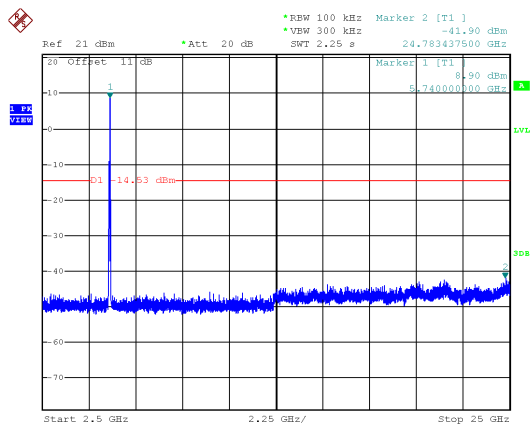
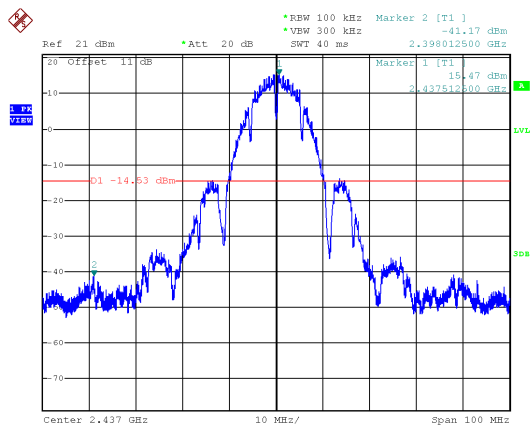
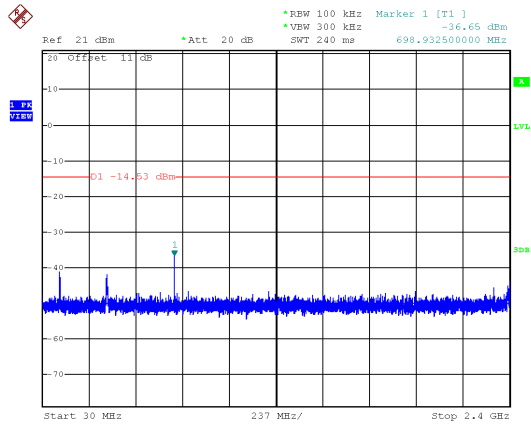
6.4 Test Result and Data

Note: Test plots refers to the following pages.



ANT A

Modulation Type: 802.11a, CH06 + CH 149





ANT B

Modulation Type: 802.11a, CH06 + CH 149

