



FCC RADIO TEST REPORT

Applicant	: Ubiquiti Inc.
Address	: 685 Third Avenue, New York, New York 10017 USA
Equipment	: AmpliFi Router
Model No.	: AFi-R, AFi-R-G
Trade Name	: ULABS
FCC ID	: SWX-AFRP

I HEREBY CERTIFY THAT :

The sample was received on Jun. 27, 2019 and the testing was completed on Oct. 08, 2019 at CerpPASS Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of CerpPASS Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





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History of this test report

Report No.	Issue Date	Description
TEFU1906241	Oct. 14, 2019	Original



1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.4:2014

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(TEFD1906241).



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Frequency Range	BT / BLE: 2400-2483.5MHz 802.11b/g/n: 2400-2483.5MHz 802.11a/n/ac: 5150-5250MHz, 5725-5850MHz
Modulation Type	BT: GFSK, $\pi/4$ -DQPSK, 8DPSK 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, FHSS, DTS
Data Rate	BT: GFSK: 1Mbps, $\pi/4$ -DQPSK: 2Mbps, 8DPSK: 3Mbps BLE: GFSK: 1Mbps WLAN: For 2.4G 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS23, HT20/40 For 5G 802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS23, HT20/40 802.11ac: MCS0 – MCS9, VHT20/40/80
Antenna Type	Internal Antenna
Antenna Gain	For BT/BLE 2400-2480MHz: 1dBi For WLAN: 2400-2483.5MHz: ANT A / B / C: 4dBi 5150-5250MHz: ANT A / B / C: 4dBi 5725-5850MHz: ANT A / B / C: 4dBi
Adapter	UBIQUITI / GP-M015-QC INPUT: 100-240Vac, 50/60Hz, 0.5A MAX OUTPUT: 5Vdc, 3.0A or 9Vdc, 1.7A or 12Vdc, 1.25A
Firmware Number	v3.3.0

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

Difference description

Model No.	Remark
AFi-R	The differences between these two model numbers is housing color.
AFi-R-G	



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, " Art2 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: BT 8DPSK CH78+11n HT40 CH06+11ac VHT40 CH46

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
Radiated Emissions	3M02-NK	2019/10/08	24°C / 50%	Vic Yeh
RF Conduction	CON01-NK	2019/10/05	20°C / 40%	Leon Huang



2.5 Measurement Uncertainty

Measurement Item	Uncertainty
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	275	2019/09/24	2020/09/23
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
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2019/08/02	2020/08/01
Preamplifier	EM Electronics corp.	EM330	60660	2019/03/11	2020/03/10
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2019/09/20	2020/09/19
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

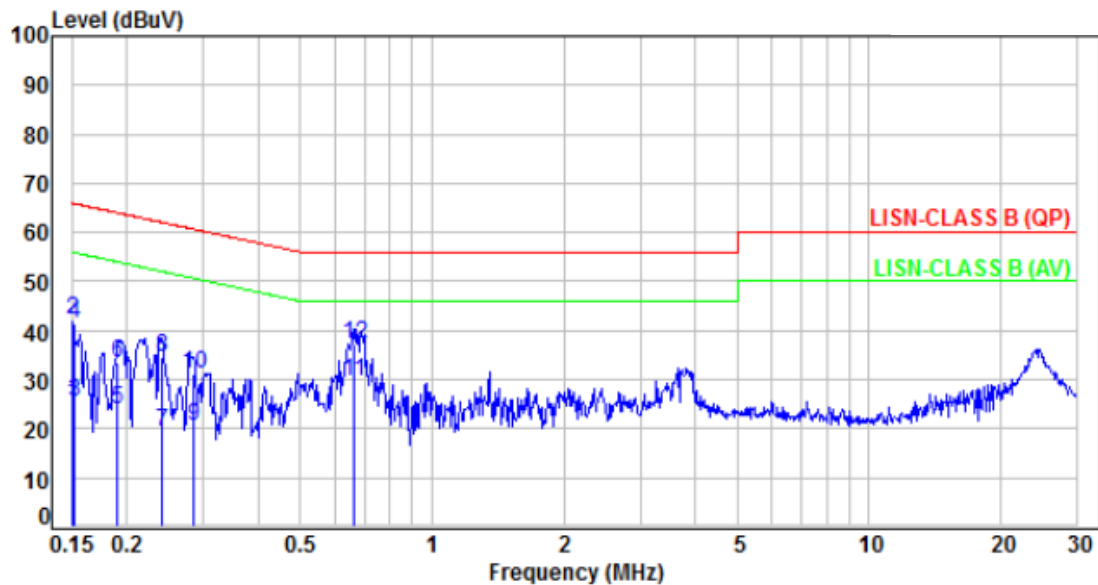
Test Item	AC Power Line Conducted Emission				
Test Site	CON01-NK				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
EMI Receiver	ROHDE & SCHWARZ	ESCI	100443	2019/03/29	2020/03/28
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-568	2019/03/15	2020/03/14
Pulse Limiter	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	0.15	9.92	15.29	25.21	55.99	-30.78	Average	P
2	0.15	9.92	32.44	42.36	65.99	-23.63	QP	P
3	0.15	9.92	15.64	25.56	55.91	-30.35	Average	P
4	0.15	9.92	31.54	41.46	65.91	-24.45	QP	P
5	0.19	9.92	14.08	24.00	53.99	-29.99	Average	P
6	0.19	9.92	23.45	33.37	63.99	-30.62	QP	P
7	0.24	9.92	9.60	19.52	52.04	-32.52	Average	P
8	0.24	9.92	24.54	34.46	62.04	-27.58	QP	P
9	0.29	9.93	10.70	20.63	50.66	-30.03	Average	P
10	0.29	9.93	21.41	31.34	60.66	-29.32	QP	P
11	0.66	9.95	19.55	29.50	46.00	-16.50	Average	P
12	0.66	9.95	27.46	37.41	56.00	-18.59	QP	P

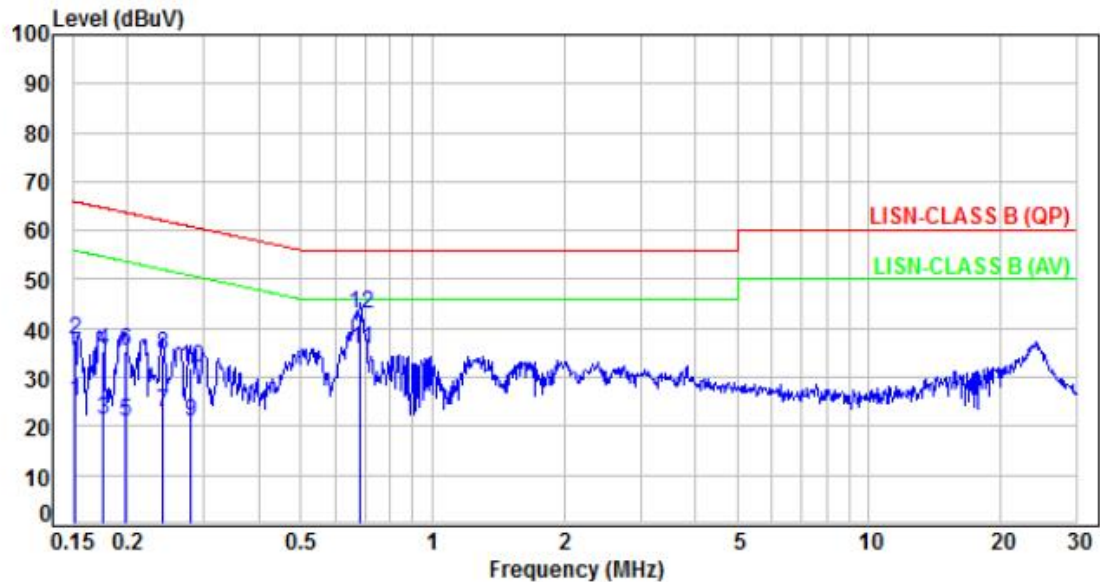
Note: Level=Reading+Factor

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	14.97	24.92	55.91	-30.99	Average	P
2	0.15	9.95	27.61	37.56	65.91	-28.35	QP	P
3	0.18	9.95	11.26	21.21	54.64	-33.43	Average	P
4	0.18	9.95	25.42	35.37	64.64	-29.27	QP	P
5	0.20	9.95	11.12	21.07	53.69	-32.62	Average	P
6	0.20	9.95	25.40	35.35	63.69	-28.34	QP	P
7	0.24	9.95	12.84	22.79	52.07	-29.28	Average	P
8	0.24	9.95	24.47	34.42	62.07	-27.65	QP	P
9	0.28	9.95	10.87	20.82	50.85	-30.03	Average	P
10	0.28	9.95	22.16	32.11	60.85	-28.74	QP	P
11	0.68	9.97	25.64	35.61	46.00	-10.39	Average	P
12	0.68	9.97	32.94	42.91	56.00	-13.09	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

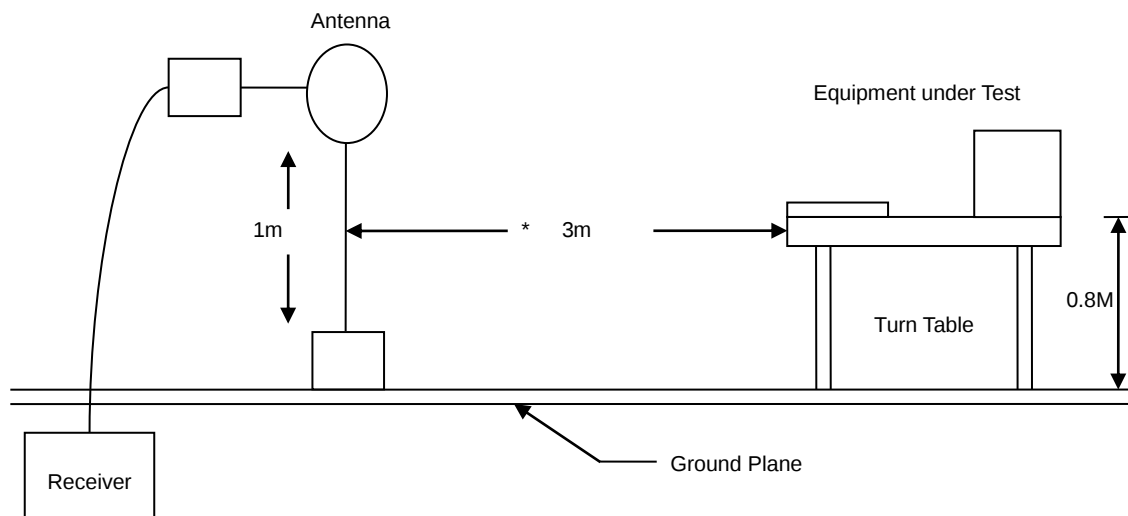
5.2 Test Procedures

- 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.

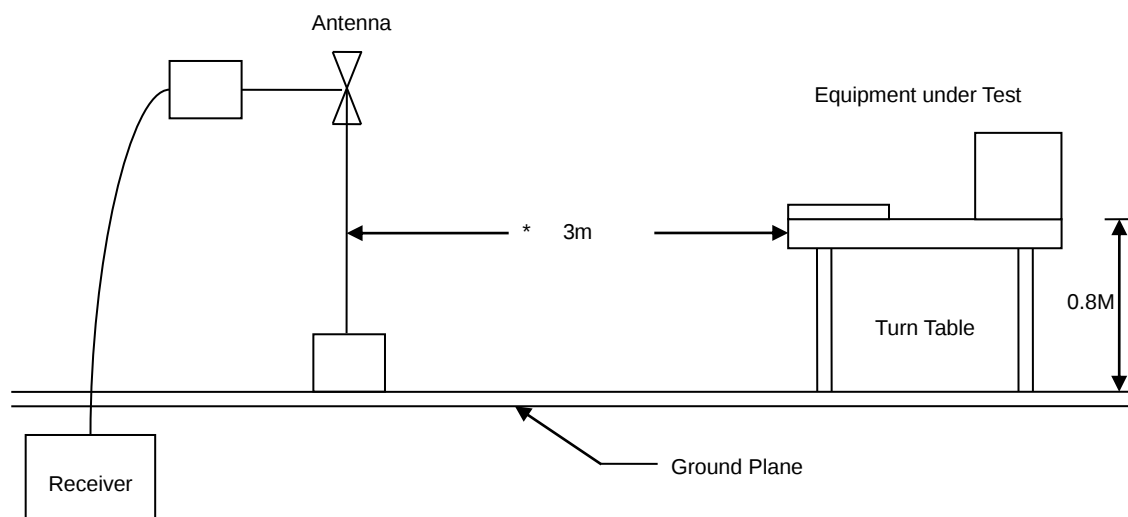


5.3 Typical Test Setup

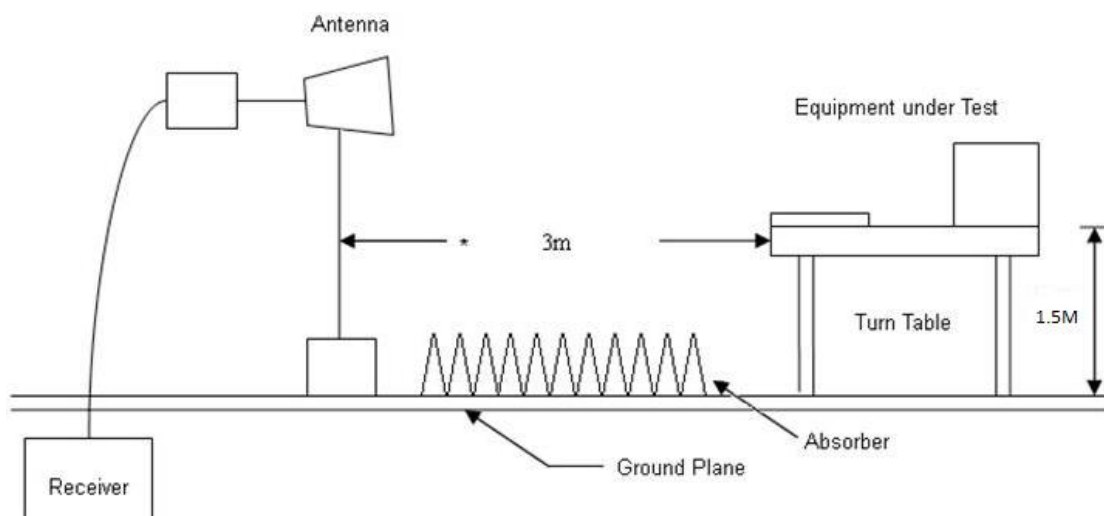
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



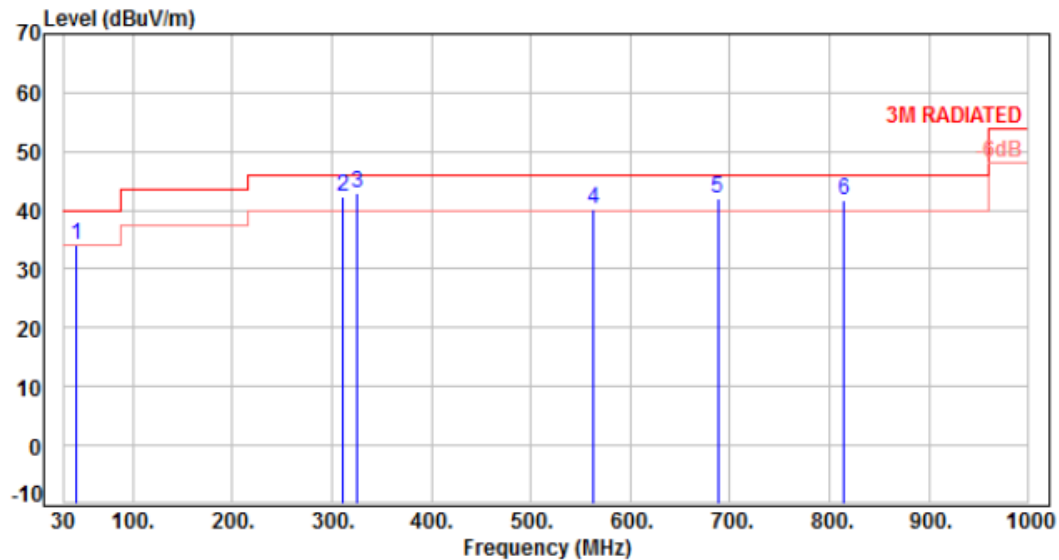


5.4 Test Result and Data (9kHz ~ 30MHz)

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	43.58	-9.37	43.50	34.13	40.00	-5.87	QP	100	325	P
2	311.30	-8.15	50.38	42.23	46.00	-3.77	Peak	100	0	P
3	324.88	-7.63	50.52	42.89	46.00	-3.11	Peak	100	0	P
4	563.50	-2.25	42.45	40.20	46.00	-5.80	Peak	100	0	P
5	687.66	-0.04	42.01	41.97	46.00	-4.03	Peak	100	0	P
6	813.76	1.97	39.60	41.57	46.00	-4.43	QP	128	13	P

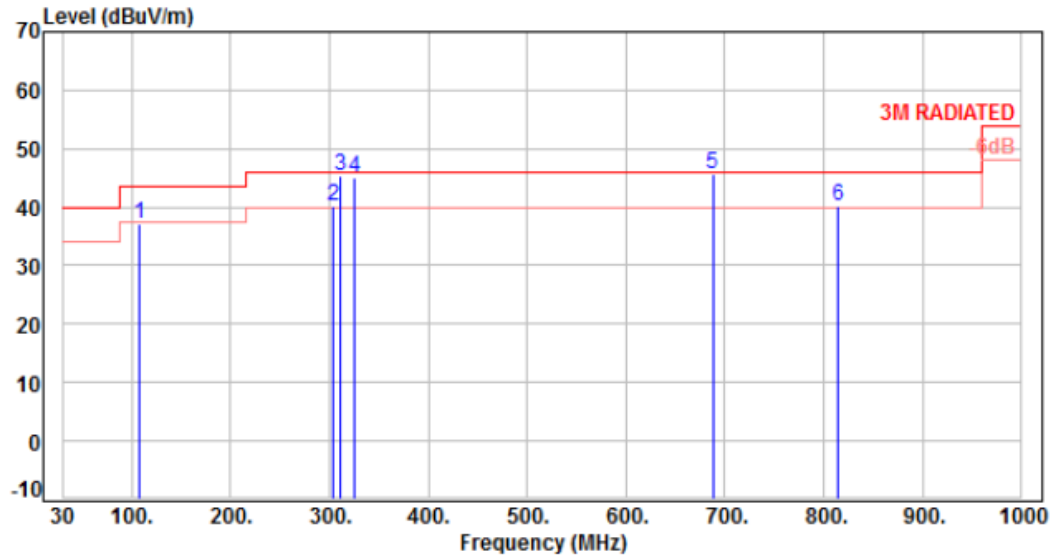
Note: Level=Reading+Factor

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	108.04	-12.75	49.79	37.04	43.50	-6.46	QP	200	262	P
2	303.54	-8.33	48.49	40.16	46.00	-5.84	QP	100	232	P
3	311.30	-8.15	53.40	45.25	46.00	-0.75	QP	100	236	P
4	325.04	-7.62	52.60	44.98	46.00	-1.02	QP	100	242	P
5	687.66	-0.04	45.70	45.66	46.00	-0.34	QP	100	102	P
6	813.76	1.97	38.31	40.28	46.00	-5.72	Peak	100	0	P

Note: Level=Reading+Factor

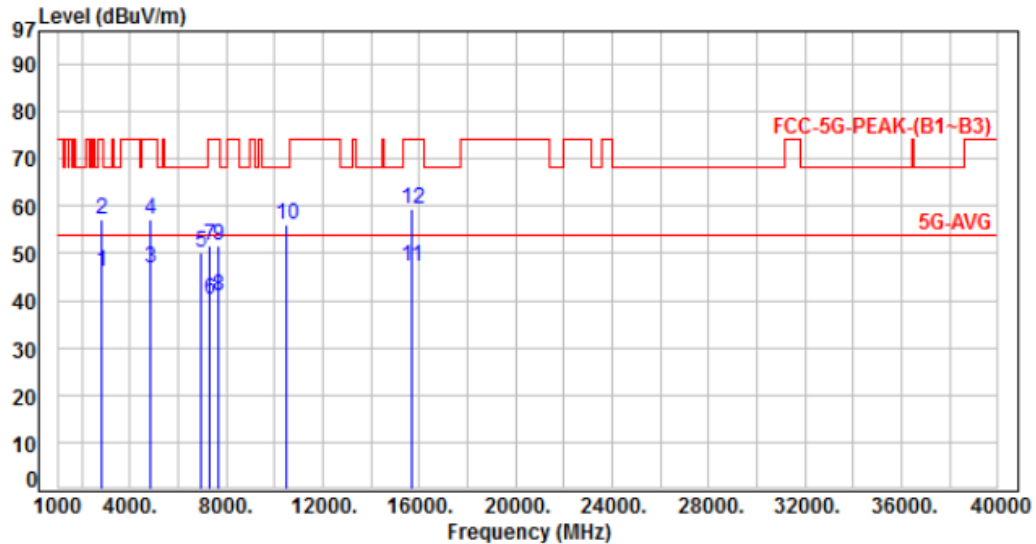
Margin=Level-Limit

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	2793.00	-2.47	48.39	45.92	54.00	-8.08	Average	192	202	P
2	2793.00	-2.47	59.55	57.08	74.00	-16.92	Peak	192	202	P
3	4874.00	3.95	42.98	46.93	54.00	-7.07	Average	337	164	P
4	4874.00	3.95	53.12	57.07	74.00	-16.93	Peak	337	164	P
5	6973.60	7.39	42.63	50.02	68.20	-18.18	Peak	100	215	P
6	7311.00	8.84	31.30	40.14	54.00	-13.86	Average	100	98	P
7	7311.00	8.84	42.95	51.79	74.00	-22.21	Peak	100	98	P
8	7667.00	8.85	32.16	41.01	54.00	-12.99	Average	100	180	P
9	7667.00	8.85	42.95	51.80	74.00	-22.20	Peak	100	180	P
10	10460.00	11.60	44.42	56.02	68.20	-12.18	Peak	100	217	P
11	15690.00	13.64	33.72	47.36	54.00	-6.64	Average	100	312	P
12	15690.00	13.64	45.63	59.27	74.00	-14.73	Peak	100	312	P

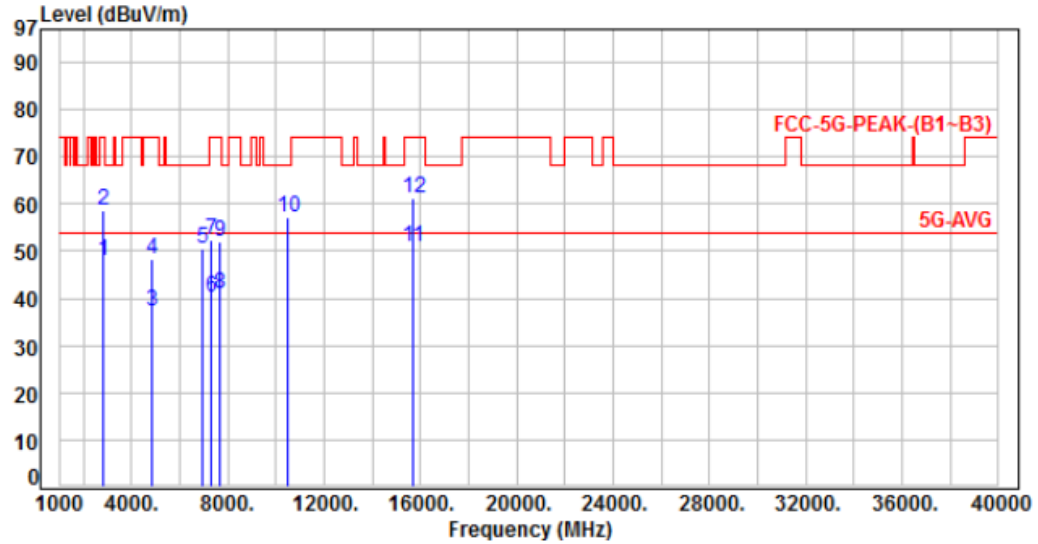
Note: Level=Reading+Factor

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	2793.00	-2.47	50.55	48.08	54.00	-5.92	Average	238	243	P
2	2793.00	-2.47	60.94	58.47	74.00	-15.53	Peak	238	243	P
3	4874.00	3.95	33.28	37.23	54.00	-16.77	Average	211	205	P
4	4874.00	3.95	44.36	48.31	74.00	-25.69	Peak	211	205	P
5	6973.60	7.39	42.97	50.36	68.20	-17.84	Peak	100	223	P
6	7311.00	8.84	31.30	40.14	54.00	-13.86	Average	100	64	P
7	7311.00	8.84	43.39	52.23	74.00	-21.77	Peak	100	64	P
8	7667.00	8.85	32.07	40.92	54.00	-13.08	Average	114	108	P
9	7667.00	8.85	43.26	52.11	74.00	-21.89	Peak	114	108	P
10	10460.00	11.60	45.60	57.20	68.20	-11.00	Peak	242	16	P
11	15690.00	13.64	37.12	50.76	54.00	-3.24	Average	287	274	P
12	15690.00	13.64	47.50	61.14	74.00	-12.86	Peak	287	274	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