



FCC RADIO TEST REPORT

Applicant : Allied Telesis K.K.
Address : 2nd. TOC Bldg. 721-11 Nishi-Gotanda, Shinagawa-ku,
Tokyo Japan, 141-0031
Equipment : 802.11ac wave2 2x2 tri-radio 2.4G/5G/5G wireless AP
Model No. : AT-TQ5403e
Trade Name : Allied Telesis
FCC ID : RSL-TQ5403E

I HEREBY CERTIFY THAT :

The sample was received on Nov. 07, 2018 and the testing was carried out on Jan. 19, 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

Tested by:

Spree Yei / Engineer

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





Contents

1. Summary of Test Procedure and Test Results.....	4
1.1 Applicable Standards	4
2. Test Configuration of Equipment under Test.....	5
2.1 Feature of Equipment under Test.....	5
2.2 Test Mode and Test Software	6
2.3 Description of Test System.....	6
2.4 General Information of Test.....	7
2.5 Measurement Uncertainty	7
3. Test Equipment and Ancillaries Used for Tests	8
4. Test of AC Power Line Conducted Emission	9
4.1 Test Limit	9
4.2 Test Procedures	9
4.3 Typical Test Setup	10
4.4 Test Result and Data	11
5. Test of Spurious Emission (Radiated)	14
5.1 Test Limit	14
5.2 Test Procedures	14
5.3 Typical Test Setup	15
5.4 Test Result and Data (9kHz ~ 30MHz).....	16
5.5 Test Result and Data (30MHz ~ 1GHz).....	16
5.6 Test Result and Data (1GHz ~ 40GHz).....	18
5.7 Restricted Bands of Operation	20
5.8 Test Photographs (30MHz ~ 1GHz)	21
5.9 Test Photographs (1GHz ~ 40GHz)	22



History of this test report

Report No.	Issue Date	Description
TEFU1804236	Jan. 25, 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

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



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Equipment	802.11ac wave2 2x2 tri-radio 2.4G/5G/5G wireless outdoor AP
Model No.	AT-TQ5403e
Brand Name	Allied Telesis
Product Description	Please refer to User's Manual.
Connecting I/O Port(s)	Please refer to User's Manual.
PoE	48Vdc/0.67A
Memo	A1
Frequency Range	802.11b/g/n/ac: 2400-2483.5MHz 802.11a/n/ac: 5150MHz-5250MHz, 5725MHz-5850MHz
Modulation Type	OFDM, DSSS
Data Rate	2.4GHz: 802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps 802.11n: MCS0 – MCS15, HT20/40, VHT20/40 5GHz: 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	Dipole Antenna
Antenna Gain	2400-2483.5MHz: ANT A: 5.2dBi, ANT B: 5.2dBi 5150-5250MHz: ANT A: 6.91dBi, ANT B: 6.91dBi 5725-5850MHz: ANT A: 7.08dBi, ANT B: 7.08dBi

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



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 remote workstation and EUT for RF test. The remote workstation included Notebook.
- c. An executive program, "qdart_conn.win.1.0_installer_00053.1" was executed to transmit and receive data via WLAN.
- d. The following test mode was performed for the test:

Conducted Emissions	
Test Mode	Operating Description
1	802.11b CH06 + 802.11a CH36 + 802.11a CH157
Radiation Emissions (30MHz ~ 1GHz)	
Test Mode	Operating Description
1	802.11b CH06 + 802.11a CH36 + 802.11a CH157
Radiation Emissions (1GHz ~ 40GHz)	
Test Mode	Operating Description
1	802.11b CH06 + 802.11a CH36 + 802.11a CH157

2.3 Description of Test System

Device	Manufacturer	Model No.	Description
Remote workstation			
Notebook	DELL	Vostro 3560	Power Cable, Unshielding, 1.8m
POE	Bluewave	JS-100GT	-



2.4 General Information of Test

Test Site	Cerpass 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 Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C. Tel: +886-2-2663-8582	
	FCC	TW1079, TW1061, TW1439
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication Test C-4663 for Conducted emission test R-3428, 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.	

2.5 Measurement Uncertainty

Measurement Item	Uncertainty
Radiated Spurious Emission(9KHz~30MHz)	$\pm 5.007\text{dB}$
Radiated Spurious Emission(30MHz~1GHz)	$\pm 5.157\text{dB}$
Radiated Spurious Emission(1GHz~18GHz)	$\pm 6.383\text{dB}$
Radiated Spurious Emission(18GHz~40GHz)	$\pm 6.648\text{dB}$
Conducted Spurious Emission	$\pm 1.253\text{dB}$
6dB Bandwidth	$\pm 6.89\%$
Power Spectral Density	$\pm 0.630\text{dB}$
26 dB Occupied Bandwidth	$\pm 6.10\%$
Frequency Stability	$\pm 375\text{KHz}$
Channel Frequencies Separation	$\pm 6.10\%$
20dB Bandwidth	$\pm 6.12\%$
Dwell Time	$\pm 1.34\%$
Peak Output Power(Conducted Power Meter)	$\pm 0.86\text{dB}$
Temperature	$\pm 1.2^{\circ}\text{C}$
Humidity	$\pm 2.7\%$
Channel Move Time	$\pm 4.53\%$
Channel Closing Transmission Time	$\pm 6.61\%$
Threshold	$\pm 0.631\text{dB}$
Non occupancy period	$\pm 1.17\%$



3. Test Equipment and Ancillaries Used for Tests

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Valid Date
EMI Receiver	R&S	ESCI3	100443	2018/03/15	2019/03/14
LISN	Schwarzbeck	NSLK 8127	8127-568	2018/02/26	2019/02/25
Pulse Limiter	R&S	ESH3-Z2	101934	2018/02/22	2019/02/21
Bilog Antenna	Schwarzbeck	VULB9168	275	2018/09/17	2019/09/16
Active Loop Antenna	EMCO	6507	40855	2018/05/22	2019/05/21
Horn Antenna	EMCO	3115	31601	2018/09/26	2019/09/25
Horn Antenna	EMCO	3116	31970	2018/03/23	2019/03/22
Preamplifier	EM	EM330	60660	2018/03/08	2019/03/07
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2018/09/18	2019/09/17
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2018/10/31	2019/10/30
MXG MW Analog Signal Generator	KEYSIGHT	N5183A	MY50142931	2018/04/10	2019/04/09
Spectrum Analyzer	R&S	FSP40	100219	2018/07/03	2019/07/02
BLUETOOTH TESTER	R&S	CBT	101133	2018/04/02	2019/04/01
Attenuator	KEYSIGHT	8491B	MY39250705	2018/09/04	2019/09/03
Rotary Attenuator	Agilent	8495B	MY42146680	2018/03/29	2019/03/28
Temp & Humi chamber	T-MACHINE	TMJ-9712	T-12-040111	2018/08/30	2019/08/29
Series Power Meter	Anritsu	ML2495A	1224005	2018/03/23	2019/03/22
Power Sensor	Anritsu	MA2411B	1207295	2018/03/23	2019/03/22
Software	Farad	Ez-EMC	ver.ct3a1	N/A	N/A
Software	AUDIX	E3	V8.2014-8-6	N/A	N/A
Software	Keysight	N7607B Signal Studio	V3.0.0.0	N/A	N/A
Software	Keysight	Inservice MonitorUtility	N/A	N/A	N/A



4. Test of AC Power Line Conducted Emission

4.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

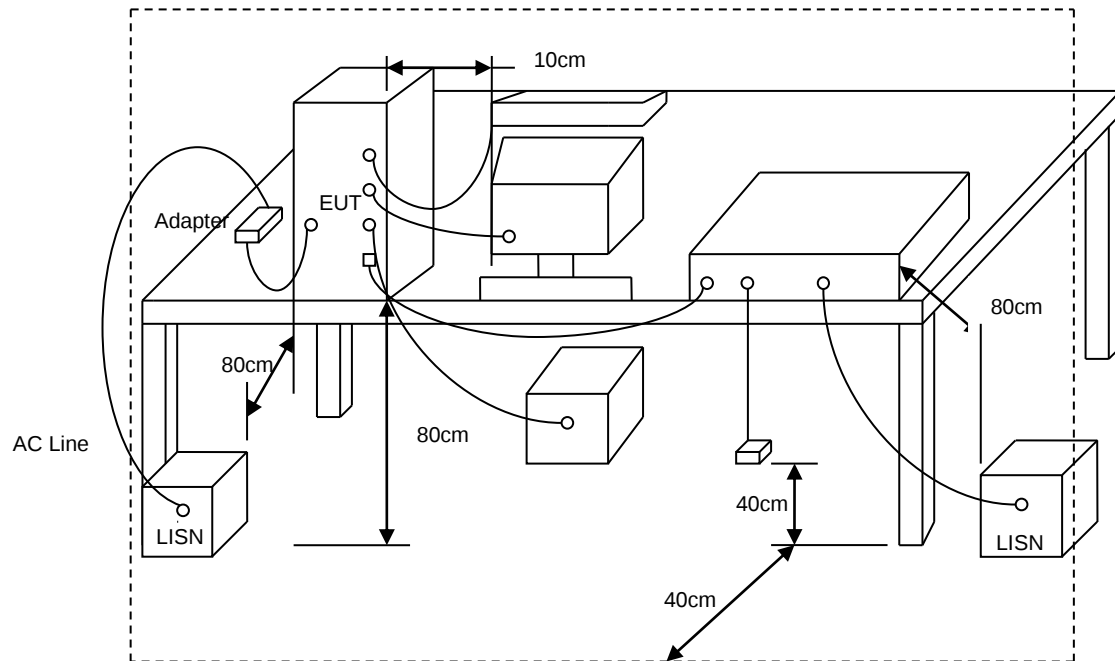
*Decreases with the logarithm of the frequency.

4.2 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



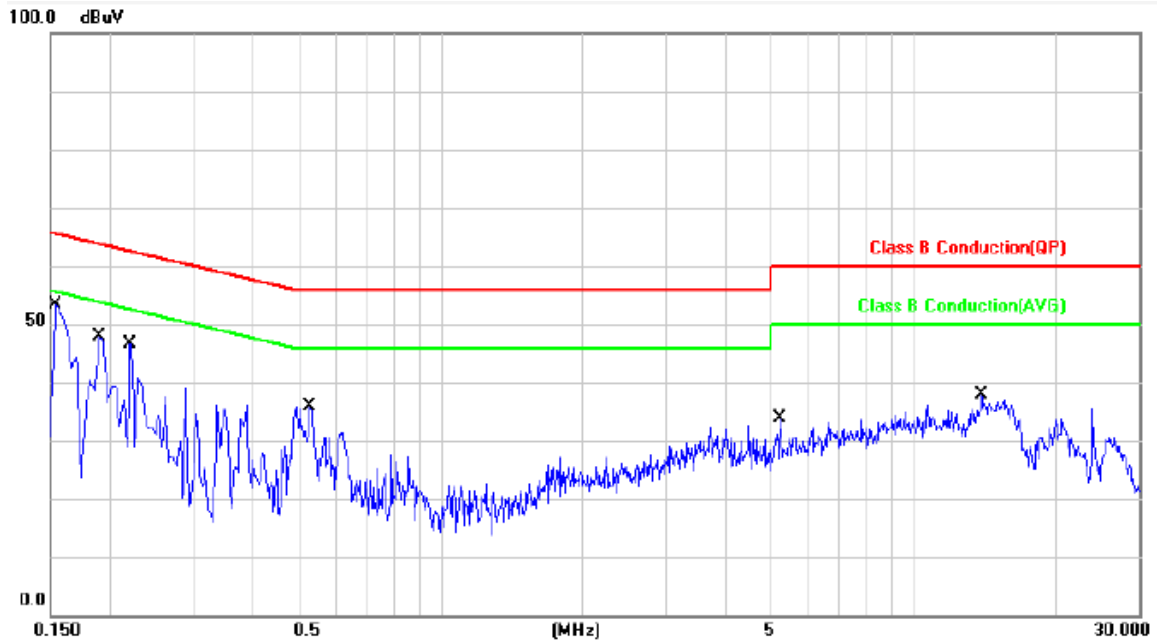
4.3 Typical Test Setup





4.4 Test Result and Data

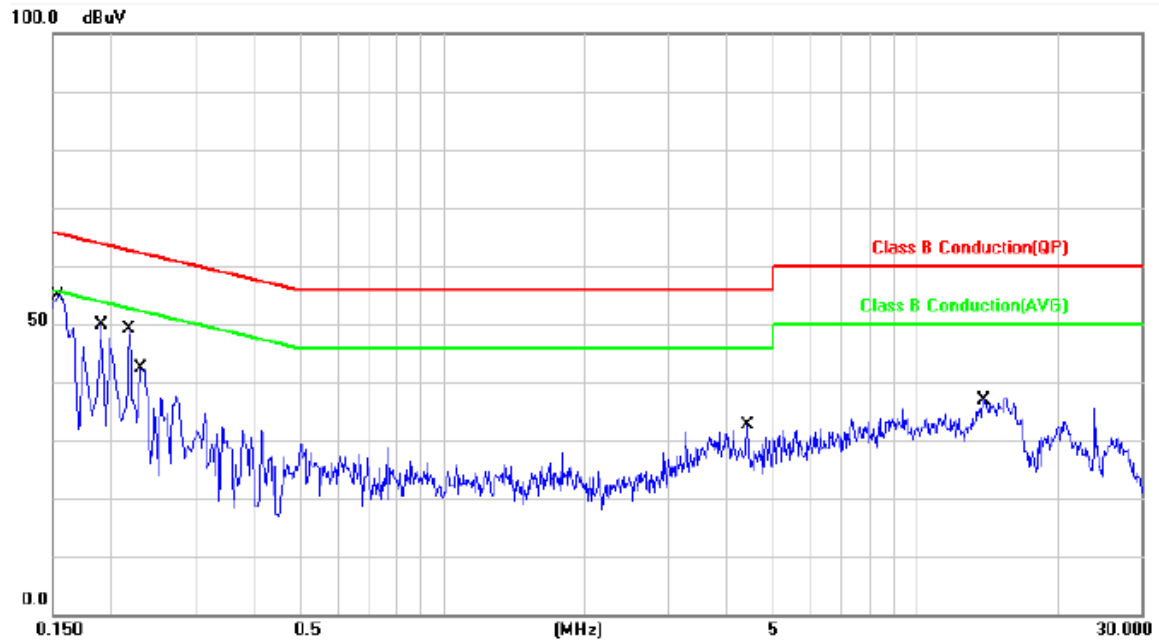
Power	: AC 120V	Pol/Phase	: LINE
Test Mode	: Mode 1	Temperature	: 22 °C
Test date	: Dec. 06, 2018	Humidity	: 63 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1539	9.98	44.35	54.33	65.78	-11.45	QP	P
2	0.1539	9.98	31.77	41.75	55.78	-14.03	AVG	P
3	0.1900	9.97	38.50	48.47	64.03	-15.56	QP	P
4	0.1900	9.97	26.06	36.03	54.03	-18.00	AVG	P
5	0.2220	9.97	27.68	37.65	62.74	-25.09	QP	P
6	0.2220	9.97	12.04	22.01	52.74	-30.73	AVG	P
7	0.5299	9.98	23.35	33.33	56.00	-22.67	QP	P
8	0.5299	9.98	16.23	26.21	46.00	-19.79	AVG	P
9	5.2220	10.18	14.19	24.37	60.00	-35.63	QP	P
10	5.2220	10.18	7.43	17.61	50.00	-32.39	AVG	P
11	13.9820	10.36	18.87	29.23	60.00	-30.77	QP	P
12	13.9820	10.36	12.66	23.02	50.00	-26.98	AVG	P



Power	: AC 120V	Pol/Phase	: NEUTRAL
Test Mode	: Mode 1	Temperature	: 22 °C
Test date	: Dec. 06, 2018	Humidity	: 63 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1539	9.98	43.85	53.83	65.78	-11.95	QP	P
2	0.1539	9.98	30.14	40.12	55.78	-15.66	AVG	P
3	0.1900	9.98	37.74	47.72	64.03	-16.31	QP	P
4	0.1900	9.98	23.08	33.06	54.03	-20.97	AVG	P
5	0.2180	9.98	27.95	37.93	62.89	-24.96	QP	P
6	0.2180	9.98	10.02	20.00	52.89	-32.89	AVG	P
7	0.2300	9.97	31.86	41.83	62.45	-20.62	QP	P
8	0.2300	9.97	17.99	27.96	52.45	-24.49	AVG	P
9	4.4140	10.17	12.49	22.66	56.00	-33.34	QP	P
10	4.4140	10.17	6.67	16.84	46.00	-29.16	AVG	P
11	13.9620	10.43	23.20	33.63	60.00	-26.37	QP	P
12	13.9620	10.43	20.01	30.44	50.00	-19.56	AVG	P



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

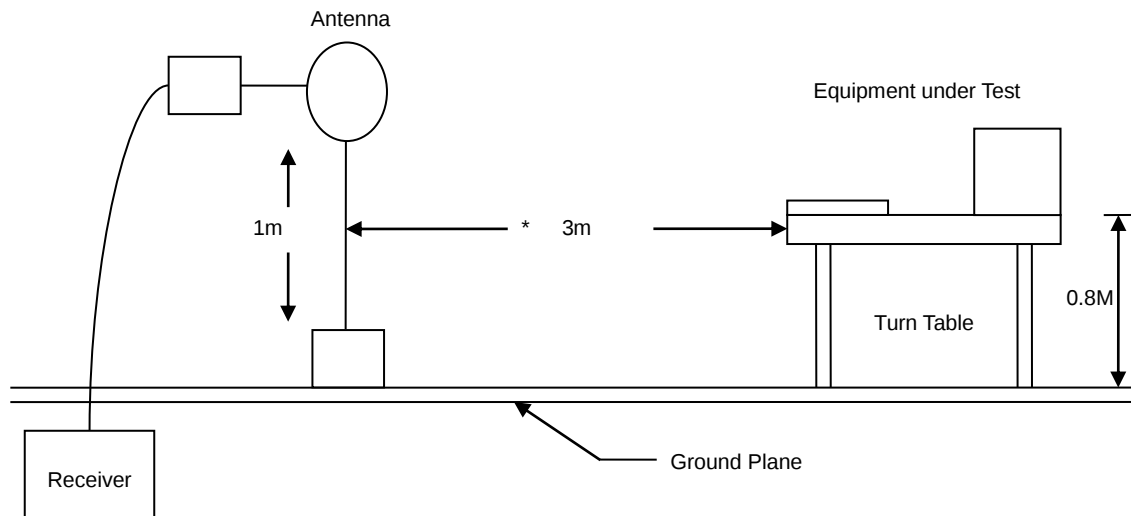
5.2 Test Procedures

- 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.

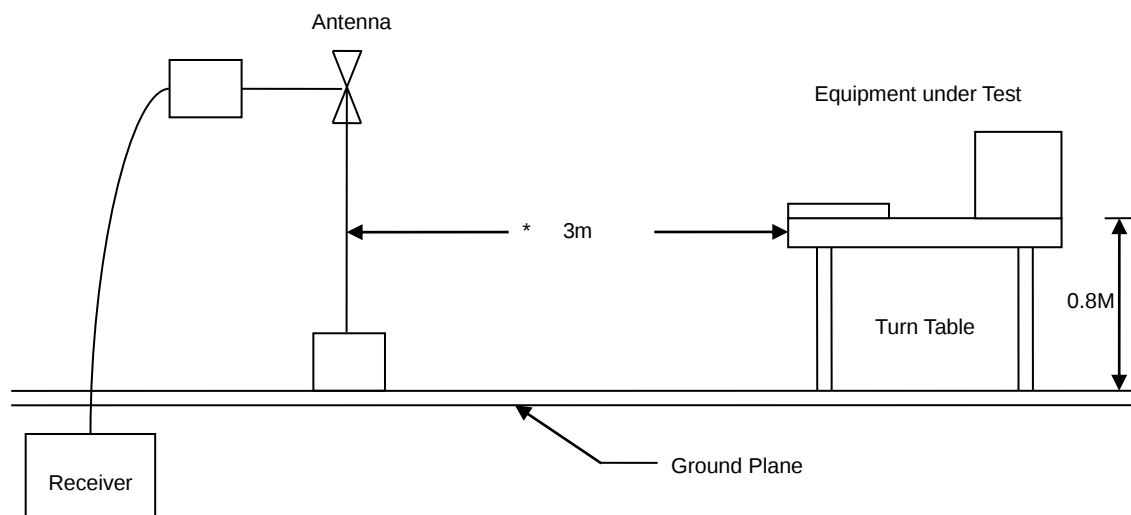


5.3 Typical Test Setup

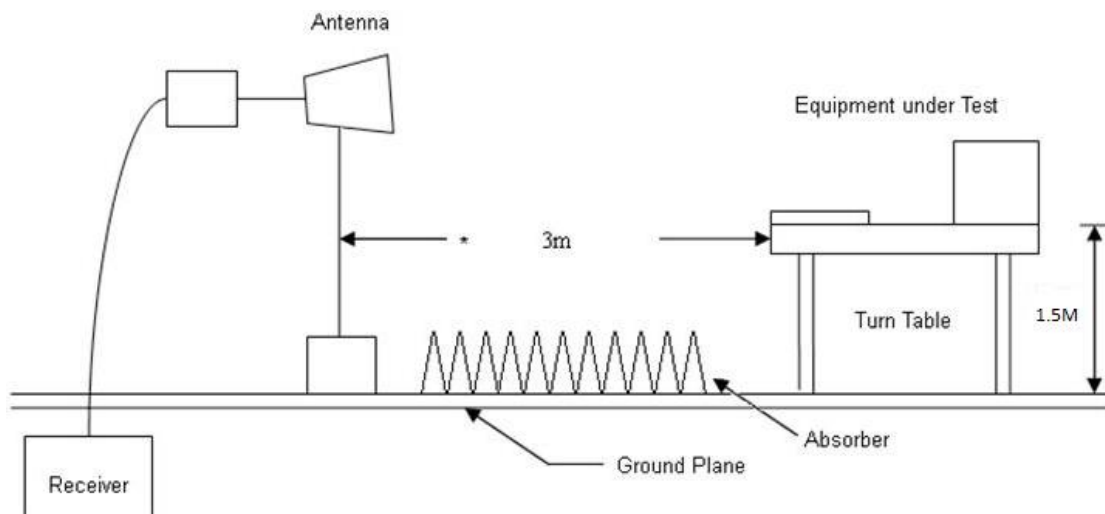
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup



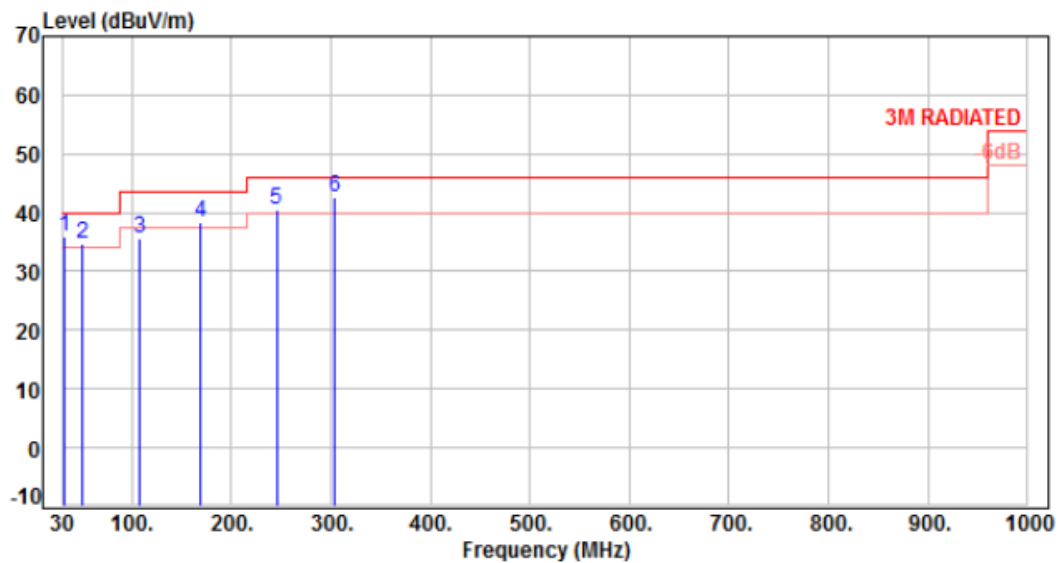


5.4 Test Result and Data (9kHz ~ 30MHz)

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

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

Power	:	From PoE	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1	Temperature	:	22 °C
Test Date	:	Dec. 06, 2018	Humidity	:	63 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	31.94	-10.56	46.40	35.84	40.00	-4.16	QP	100	162	P
2	50.37	-9.45	44.10	34.65	40.00	-5.35	QP	100	250	P
3	107.60	-13.15	48.81	35.66	43.50	-7.84	Peak	400	0	P
4	169.68	-9.51	48.00	38.49	43.50	-5.01	QP	180	332	P
5	245.34	-10.34	50.80	40.46	46.00	-5.54	QP	100	317	P
6	304.51	-8.52	51.18	42.66	46.00	-3.34	Peak	400	0	P

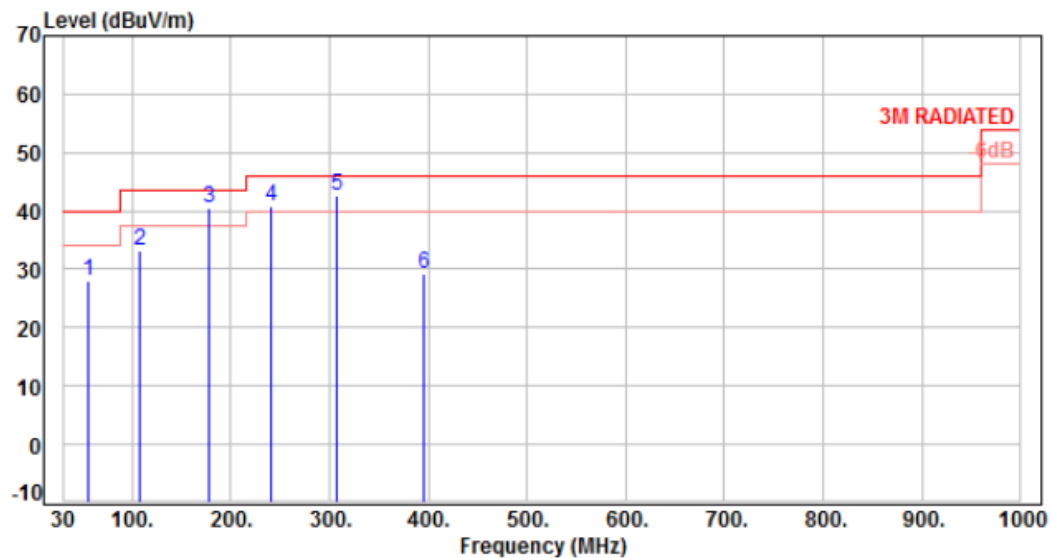
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: From PoE	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 22 °C
Test Date	: Dec. 06, 2018	Humidity	: 63 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	55.22	-9.66	37.80	28.14	40.00	-11.86	Peak	100	0	P
2	108.57	-12.99	46.04	33.05	43.50	-10.45	Peak	100	0	P
3	178.41	-10.63	50.99	40.36	43.50	-3.14	QP	100	112	P
4	241.46	-10.49	51.20	40.71	46.00	-5.29	QP	100	193	P
5	307.42	-8.44	51.19	42.75	46.00	-3.25	QP	100	201	P
6	395.69	-5.87	35.14	29.27	46.00	-16.73	Peak	100	0	P

Note: Level=Reading+Factor

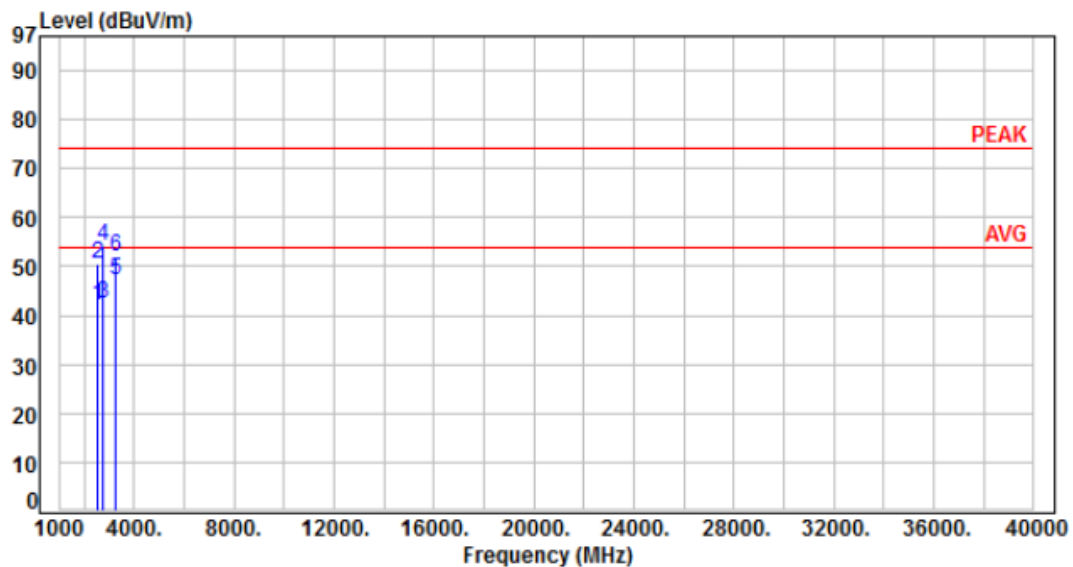
Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



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

Power	:	From PoE	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1	Temperature	:	21 °C
Test Date	:	Jan. 19, 2019	Humidity	:	60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2554.00	-15.06	56.98	41.92	54.00	-12.08	Average	200	196	P
2	2554.00	-15.06	65.70	50.64	74.00	-23.36	Peak	200	196	P
3	2736.00	-14.24	56.55	42.31	54.00	-11.69	Average	180	160	P
4	2736.00	-14.24	68.30	54.06	74.00	-19.94	Peak	180	160	P
5	3254.00	-12.33	59.55	47.22	54.00	-6.78	Average	138	323	P
6	3254.00	-12.33	64.50	52.17	74.00	-21.83	Peak	138	323	P

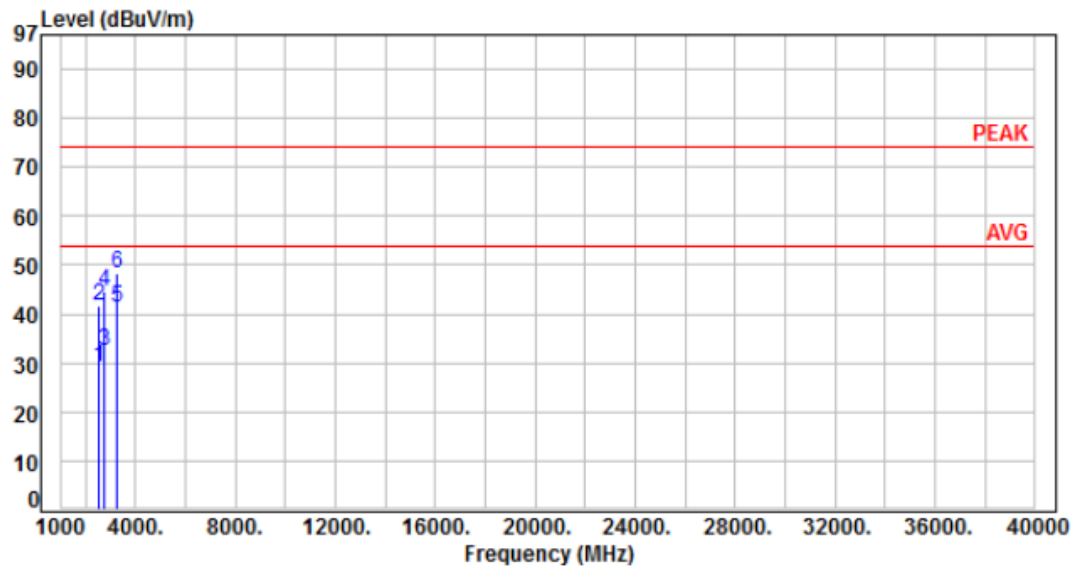
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: From PoE	Pol/Phase	: HORIZONTAL
Test Mode	: Mode 1	Temperature	: 21 °C
Test Date	: Jan. 19, 2019	Humidity	: 60 %



No.	Frequency (MHz)	Factor (dB)	Reading (dBUV)	Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2554.00	-15.06	44.20	29.14	54.00	-24.86	Average	100	74	P
2	2554.00	-15.06	56.80	41.74	74.00	-32.26	Peak	100	74	P
3	2736.00	-14.24	46.55	32.31	54.00	-21.69	Average	313	69	P
4	2736.00	-14.24	58.80	44.56	74.00	-29.44	Peak	313	69	P
5	3254.00	-12.33	53.57	41.24	54.00	-12.76	Average	180	195	P
6	3254.00	-12.33	60.50	48.17	74.00	-25.83	Peak	180	195	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