FCC Test Report

Report No.:	RF181219C02D-1
FCC ID:	2ANBG-OR100
Regulatory Model:	APOR100
Marketing Model:	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Received Date:	Feb. 18, 2020
Test Date:	Jun. 03, 2020
Issued Date:	Jun. 08, 2020
Applicant:	KeyWest Networks, Inc.
Address:	3033 Oliver Dr, San Jose, CA - 95135 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN
FCC Registration / Designation Number:	788550 / TW0003

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RF181219C02D-1	Original release	Jun. 08, 2020

1 Certificate of Conformity

Product:	Outdoor Wireless Radios
Brand:	KeyWest Radios
Regulatory Model:	APOR100
Marketing Model:	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Sample Status:	Engineering sample
Applicant:	KeyWest Networks, Inc.
Test Date:	Jun. 03, 2020
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) ANSI C63.10:2013

This report is issued as a supplementary report of RF181219C02-1. This report shall be used combined together with its original report.

Prepared by : Celine Chou , **Date:** Jun. 08, 2020

Celine Chou / Senior Specialist

Approved by : Bruce Chen , **Date:** Jun. 08, 2020

Bruce Chen / Senior Project Engineer

Note: Radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b)(6)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -1.2dB at 59.52MHz.
15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -12.76dB at 20.16600MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	N/A	Refer to Note 1
---	Occupied Bandwidth Measurement	-	Reference only.
15.407(a)(1/2/3)	Peak Power Spectral Density	N/A	Refer to Note 1
15.407(e)	6dB bandwidth	N/A	Refer to Note 1
15.407(g)	Frequency Stability	N/A	Refer to Note 1
15.203	Antenna Requirement	Pass	Antenna connector are i-pex(MHF) and MMCX not a standard connector.

Note:
1. Radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.04 dB
	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Outdoor Wireless Radios
Brand	KeyWest Radios
Regulatory Model	APOR100
Marketing Model	APOR100-B18, APOR100-X00, APOR100-C23, APOR100-C18
Model Difference	Refer to note for more details
Sample Status	Engineering sample
Power Supply Rating	48Vdc (PoE)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 867Mbps
Operating Frequency	5150 ~ 5250MHz, 5725 ~ 5850MHz
Output Power	Test Mode A 5150 ~ 5250MHz: 56.324mW 5725 ~ 5850MHz: 62.519mW Test Mode B 5150 ~ 5250MHz: 324.944mW 5725 ~ 5850MHz: 383.957mW Test Mode C 5150 ~ 5250MHz: 34.958mW 5725 ~ 5850MHz: 846.559mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	PoE
Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the original report (BV CPS report no.: RF181219C02-1) are listing as below. Radiated emission below 1GHz and conducted emission are performed for the addendum. Refer to original report for the other test data.
   - Added one PoE.
   - Added two antennas.
   - Software enable 5.25GHz to 5.35GHz and 5.47GHz to 5.725GHz bands.
   - Added 5G Band 1, 4 channels via software changing.

2. All models are listed as below.

Brand	Regulatory Model	Marketing Model	Ant. (For 5GHz Band only)	Remark
KeyWest Radios	APOR100	APOR100-B18	18dBi (MA-WC56-DP17 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized Sector antenna	For outdoor only
			17dBi (MT055S17VH/KYU Ant. with MMCX connector) 2x2 V&H Polarized Sector antenna	
		APOR100-X00	10dBi (APOR100-X00 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized Omni antenna	For outdoor only
		APOR100-C23	23dBi (MA-WA56-DP23 Ant. with i-pex(MHF) connector) 2x2 V&H Polarized panel antenna	For P to P only
			22.5dBi (MT-465039/CVH/F Ant. with MMCX connector) 2x2 V&H Polarized panel antenna	
		APOR100-C18	18dBi (MT-485053-CVH-B_ICD_KW Ant. with i-pex(MHF) connector) 2x2 V&H Polarized panel antenna	For P to P only

3. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

* The bandwidth and modulation are similar for HT20/HT40 on 802.11n mode and VHT20/VHT40 on 802.11ac mode. Therefore the investigated worst case is the representative mode in test report. (Final test mode refer section 3.2.1)

4. The EUT is powered by the following PoE. (The new PoE is PoE 2)

PoE 1	
Brand	Powertron Electronics Corp.
Model	POE1024-480T1A050
Input Power	100-240Vac, 50-60Hz, 1.0A
Output Power	+48Vdc, 0.50A

PoE 2	
Brand	KEYWEST
Model	KW-P1024-48056K
Input Power	100-240Vac, 50-60Hz, 1.0A
Output Power	+48Vdc, 0.50A

5. The following antennas were provided to the EUT. (New antennas are marked in boldface.)

Ant. No.	Marketing Model	Antenna Type	Antenna Vender	Antenna PN	Antenna Gain		Connector
					4.9GHz	5GHz	
1	APOR100-B18	Sector antenna	MARS	MA-WC56-DP17	18dBi	18dBi	i-pex(MHF)
2	APOR100-X00	Omni antenna	MARS	MA-WO56-DP10	10dBi	10dBi	N Type Male
3	APOR100-C23	Panel antenna	MARS	MA-WA56-DP23	23dBi	23dBi	i-pex(MHF)
4	APOR100-C18	Panel antenna	MTI	MT-485053-CVH-B_ICD_KW	-	18dBi	i-pex(MHF)
5	**APOR100-B18**	**Sector antenna**	**MTI**	**MT055S17VH/KYU**	**16dBi**	**17dBi**	**MMCX**
6	**APOR100-C23**	**Panel antenna**	**MTI**	**MT-465039/CVH/F**	**23dBi**	**23dBi**	**MMCX**

* Ant. 3, 4, 6 were cross polarized antenna.

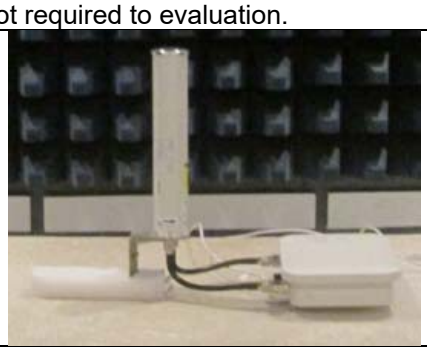
* For Marketing Model: APOR100-B18 can use Ant. 1 or Ant. 5, therefore Ant. 1 was chosen for final test.

* For Marketing Model: APOR100-X00 use Ant. 2 and chosen for final test.

* For Marketing Model: APOR100-C23 can use Ant. 3 or Ant. 6 and Marketing Model: APOR100-C18 use Ant. 6, therefore Marketing Model: APOR100-C23 with Ant. 3 was chosen for final test.

* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

6. The EUT will install at outdoor area, the highest antenna gain from the horizon above 30 degrees as below, for more detail information please refer to antenna specification and user manual

Antenna No.	Antenna gain	Antenna install degree
1	0.77dBi	
Due to device will restricted installation position as above photo, thus consider to above 30 degrees highest antenna gain are chosen from E-Plane antenna specification of 30-150° degrees, for H-Plane antenna gain it will not effect to above 30 degrees from the horizon, therefore not required to evaluation.		
2	-4.88dBi	
Due to device will restricted installation position as above photo, thus consider to above 30 degrees highest antenna gain are chosen from E-Plane antenna specification of -60-60° degrees, for H-Plane antenna gain it will not effect to above 30 degrees from the horizon, therefore not required to evaluation.		

3.2 Description of Test Modes

For 5150 ~ 5250MHz

13 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
36	5180 MHz	43	5215 MHz
37	5185 MHz	44	5220 MHz
38	5190 MHz	45	5225 MHz
39	5195 MHz	46	5230 MHz
40	5200 MHz	47	5235 MHz
41	5205 MHz	48	5240 MHz
42	5210 MHz		

9 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
38	5190 MHz	43	5215 MHz
39	5195 MHz	44	5220 MHz
40	5200 MHz	45	5225 MHz
41	5205 MHz	46	5230 MHz
42	5210 MHz		

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

For 5725 ~ 5850MHz:

17 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	158	5790MHz
150	5750MHz	159	5795MHz
151	5755MHz	160	5800MHz
152	5760MHz	161	5805MHz
153	5765MHz	162	5810MHz
154	5770MHz	163	5815MHz
155	5775MHz	164	5820MHz
156	5780MHz	165	5825MHz
157	5785MHz		

9 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	156	5780MHz
152	5760MHz	157	5785MHz
153	5765MHz	158	5790MHz
154	5770MHz	159	5795MHz
155	5775MHz		

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to		Description
	RE<1G	PLC	
A	√	√	Marketing Model: APOR100-B18 (MA-WC56-DP17 Ant. with i-pex(MHF) connector), powered by PoE 2
B	√	√	Marketing Model: APOR100-X00 (APOR100-X00 Ant. with i-pex(MHF) connector), powered by PoE 2
C	√	√	Marketing Model: APOR100-C23 (MA-WA56-DP23 Ant. with i-pex(MHF) connector), powered by PoE 2

Where RE<1G: Radiated Emission below 1GHz PLC: Power Line Conducted Emission

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A, B, C	802.11a	5180-5240	36 to 48	36	OFDM	6.0
	802.11a	5745-5825	149 to 165		OFDM	6.0

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Data Rate (Mbps)
A, B, C	802.11a	5180-5240	36 to 48	36	OFDM	6.0
	802.11a	5745-5825	149 to 165		OFDM	6.0

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE<1G	23 deg. C, 66% RH	120Vac, 60Hz	Titan Hsu
PLC	23 deg. C, 66% RH	120Vac, 60Hz	Titan Hsu

3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	80Q7	PF0KUGU6	FCC DoC Approved	-

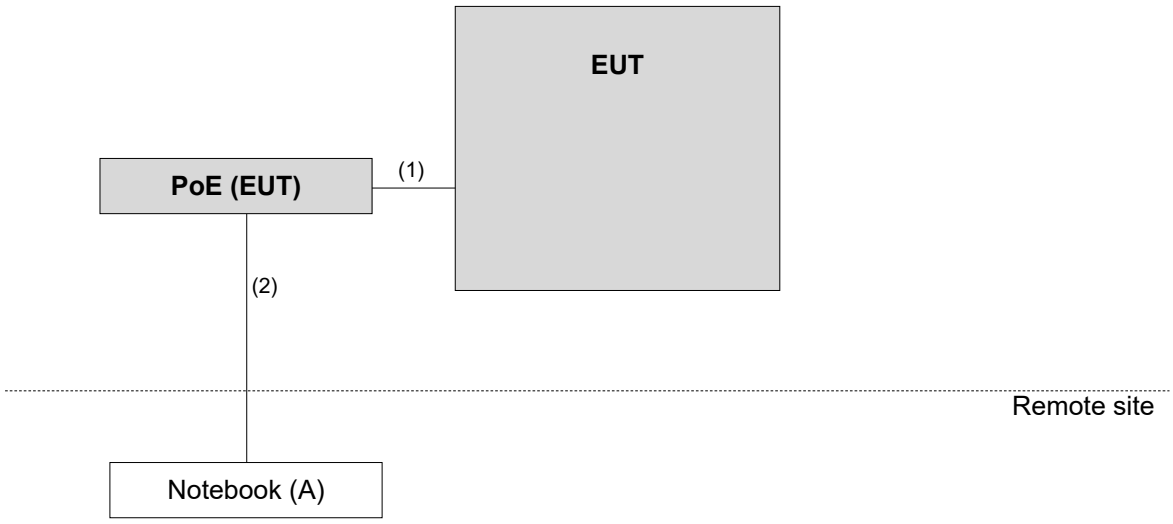
Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

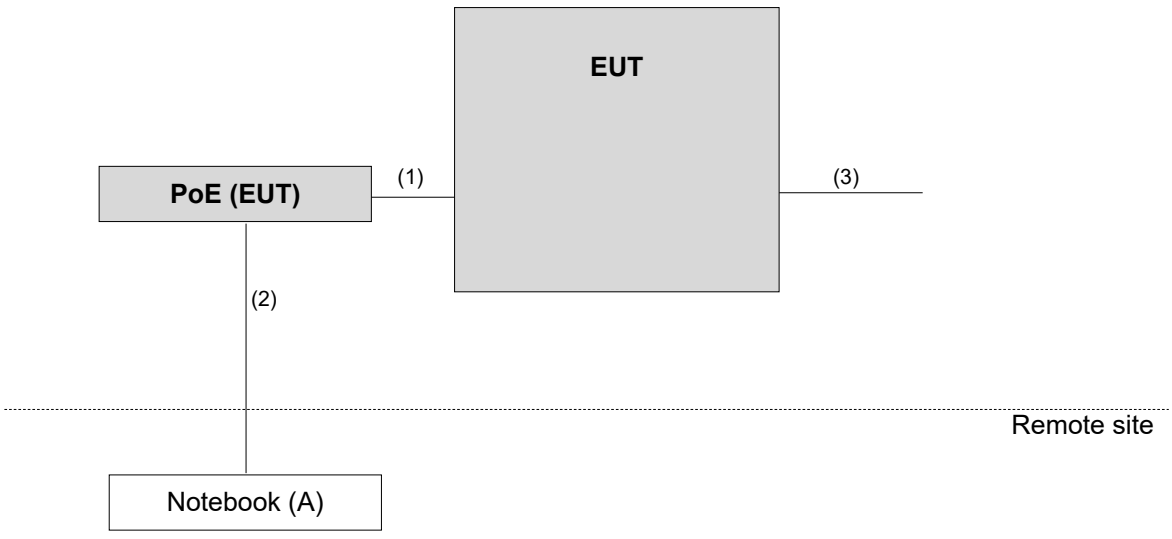
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	1	1.5	N	0	-
2.	RJ45 Cable	1	6	N	0	-
3.	Ground Cable	1	1.81	N	0	Provided by client

3.3.1 Configuration of System under Test

For AC Power Conducted Emission



For Radiated Emissions



3.4 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

Test standard:
FCC Part 15, Subpart E (15.407)
ANSI C63.10:2013

All test items have been performed and recorded as per the above standards.

References Test Guidance:
KDB 789033 D02 General UNII Test Procedure New Rules v02r01
KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

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

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

Limits of unwanted emission out of the restricted bands

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK: 74 (dBμV/m)</td><td>AV: 54 (dBμV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK: -27 (dBm/MHz)</td><td rowspan="3">PK: 68.2(dBμV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK: -27 (dBm/MHz) *1
PK: 10 (dBm/MHz) *2
PK: 15.6 (dBm/MHz) *3
PK: 27 (dBm/MHz) *4</td><td>PK: 68.2(dBμV/m) *1
PK: 105.2 (dBμV/m) *2
PK: 110.8(dBμV/m) *3
PK: 122.2 (dBμV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*1 beyond 75 MHz or more above of the band edge.
*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.
*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.
*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.</td></tr>
</table>

Note: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts).

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESR3	102579	Jun. 27, 2019	Jun. 26, 2020
BILOG Antenna SCHWARZBECK	VULB9168	9168-171	Nov. 11, 2019	Nov. 10, 2020
HORN Antenna SCHWARZBECK	9120D	209	Nov. 24, 2019	Nov. 23, 2020
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Nov. 24, 2019	Nov. 23, 2020
Loop Antenna TESEQ	HLA 6121	45745	Jul. 01, 2019	Jun. 30, 2020
Preamplifier Agilent (Below 1GHz)	8447D	2944A10738	Aug. 20, 2019	Aug. 19, 2020
Preamplifier Agilent (Above 1GHz)	8449B	3008A02367	Feb. 18, 2020	Feb. 17, 2021
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH3-01	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03 (223653/4)	Aug. 20, 2019	Aug. 19, 2020
RF signal cable HUBER+SUHNER& EMCI	SUCOFLEX 104&EMC104-SM-S M-8000	Cable-CH3-03 (309224+170907)	Aug. 20, 2019	Aug. 19, 2020
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

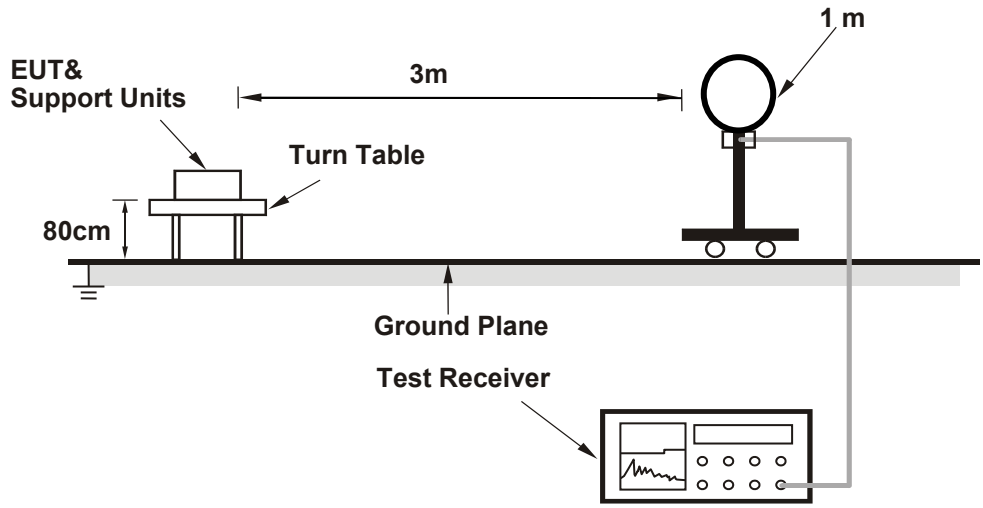
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

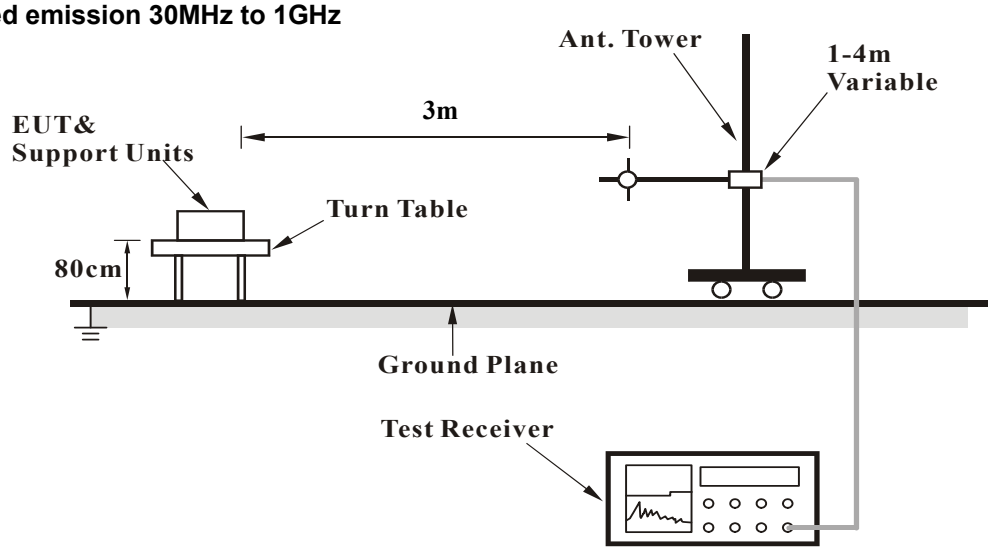
No deviation.

4.1.5 Test Setup

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Below 1GHz Worst-Case Data:

Test Mode A

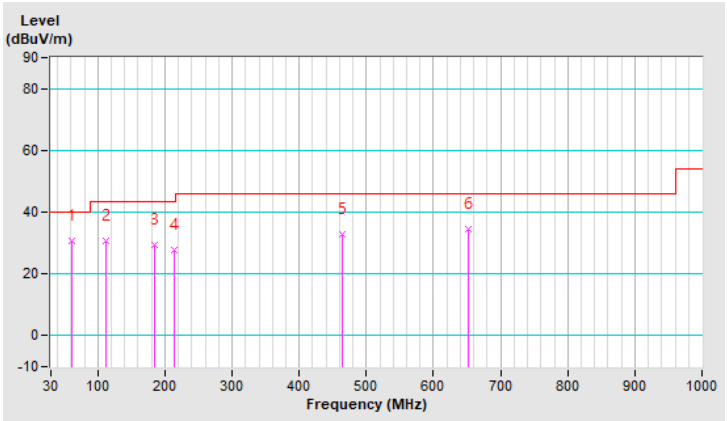
802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	60.93	30.5 QP	40.0	-9.5	1.00 H	58	39.9	-9.4
2	111.54	30.5 QP	43.5	-13.0	1.00 H	66	42.3	-11.8
3	184.64	29.5 QP	43.5	-14.0	1.50 H	43	40.0	-10.5
4	214.16	27.9 QP	43.5	-15.6	2.00 H	250	39.2	-11.3
5	464.39	32.6 QP	46.0	-13.4	1.00 H	127	34.8	-2.2
6	651.36	34.5 QP	46.0	-11.5	1.00 H	300	33.0	1.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

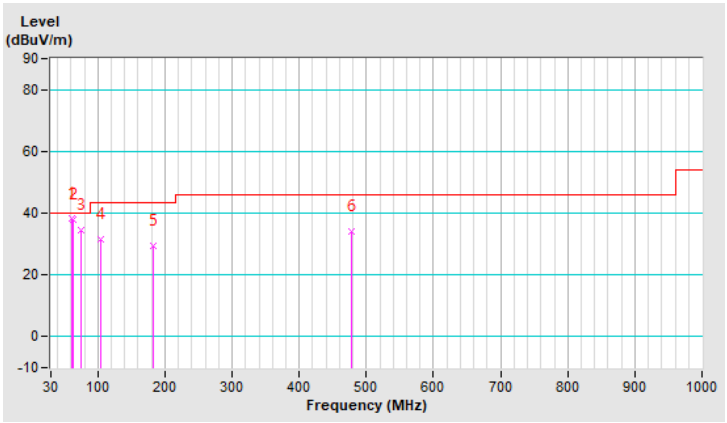


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	60.93	38.2 QP	40.0	-1.8	1.00 V	302	47.6	-9.4
2	63.74	37.8 QP	40.0	-2.2	1.00 V	347	47.3	-9.5
3	74.99	34.6 QP	40.0	-5.4	1.00 V	327	46.5	-11.9
4	104.51	31.5 QP	43.5	-12.0	1.50 V	72	43.9	-12.4
5	183.23	29.5 QP	43.5	-14.0	1.50 V	286	39.7	-10.2
6	477.04	34.0 QP	46.0	-12.0	1.00 V	245	36.0	-2.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



Test Mode B

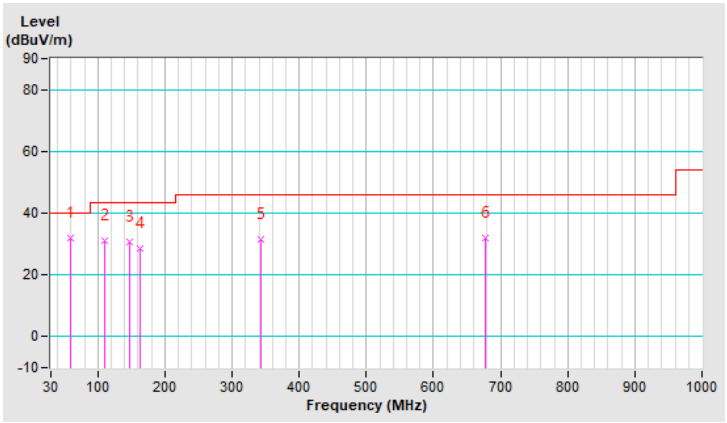
802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	59.52	32.0 QP	40.0	-8.0	1.50 H	48	41.2	-9.2
2	110.13	30.9 QP	43.5	-12.6	1.00 H	247	42.7	-11.8
3	146.68	30.8 QP	43.5	-12.7	1.50 H	13	39.5	-8.7
4	163.55	28.5 QP	43.5	-15.0	1.00 H	349	37.2	-8.7
5	342.09	31.5 QP	46.0	-14.5	1.00 H	115	37.8	-6.3
6	676.67	31.9 QP	46.0	-14.1	1.00 H	357	30.1	1.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

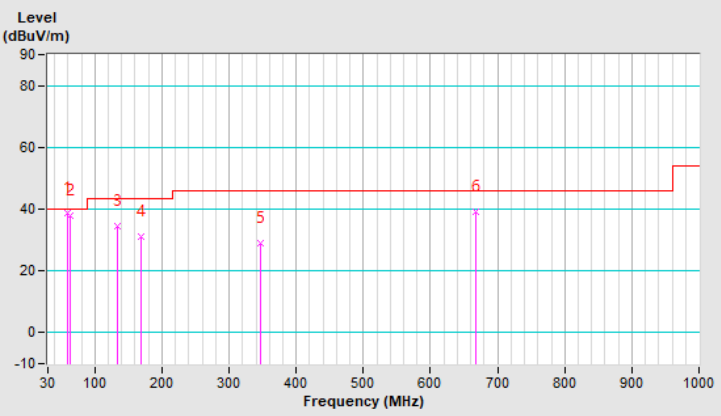


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	**59.52**	**38.8 QP**	**40.0**	**-1.2**	**1.00 V**	**20**	**48.0**	**-9.2**
2	63.74	37.7 QP	40.0	-2.3	1.50 V	1	47.2	-9.5
3	134.03	34.5 QP	43.5	-9.0	1.50 V	180	44.0	-9.5
4	169.17	31.1 QP	43.5	-12.4	1.00 V	108	40.0	-8.9
5	346.30	28.8 QP	46.0	-17.2	1.50 V	119	35.2	-6.4
6	666.83	39.3 QP	46.0	-6.7	2.00 V	181	37.6	1.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



Test Mode C

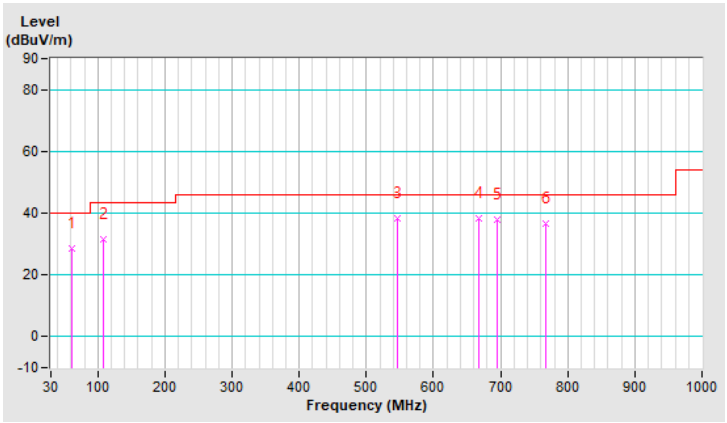
802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	60.93	28.5 QP	40.0	-11.5	1.50 H	26	37.9	-9.4
2	108.72	31.4 QP	43.5	-12.1	1.00 H	241	43.3	-11.9
3	545.93	38.4 QP	46.0	-7.6	1.00 H	165	38.9	-0.5
4	668.23	38.3 QP	46.0	-7.7	1.00 H	107	36.6	1.7
5	694.94	37.9 QP	46.0	-8.1	1.50 H	140	35.9	2.0
6	766.64	36.4 QP	46.0	-9.6	2.00 H	173	33.3	3.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

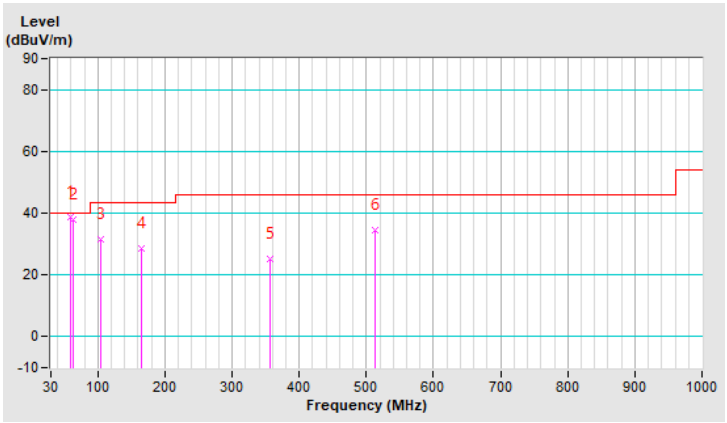


CHANNEL	TX Channel 36	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	**59.52**	**38.8 QP**	**40.0**	**-1.2**	**1.50 V**	**7**	**48.0**	**-9.2**
2	63.74	37.8 QP	40.0	-2.2	1.00 V	7	47.3	-9.5
3	104.51	31.5 QP	43.5	-12.0	1.00 V	112	43.9	-12.4
4	164.96	28.6 QP	43.5	-14.9	2.00 V	114	37.3	-8.7
5	357.55	25.3 QP	46.0	-20.7	1.00 V	164	31.3	-6.0
6	513.59	34.4 QP	46.0	-11.6	1.00 V	248	35.4	-1.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 11, 2019	Dec. 10, 2020
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2019	Sep. 04, 2020
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 20, 2020	Feb. 19, 2021
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 22, 2019	Aug. 21, 2020
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

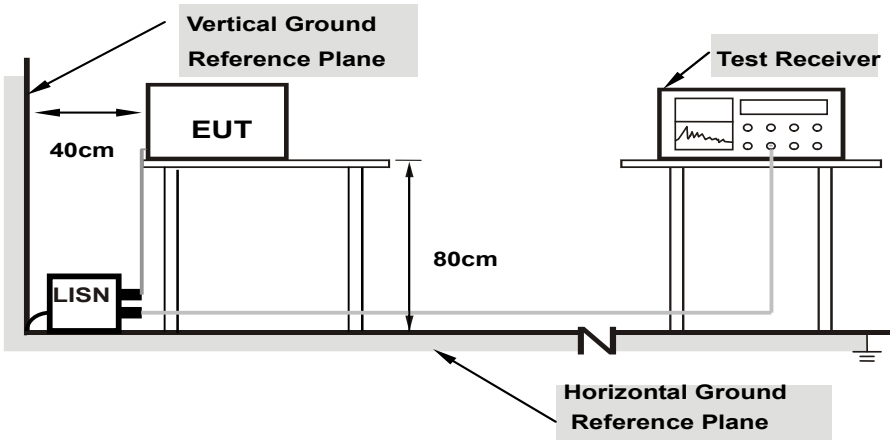
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

Worst-case data:

Test Mode A

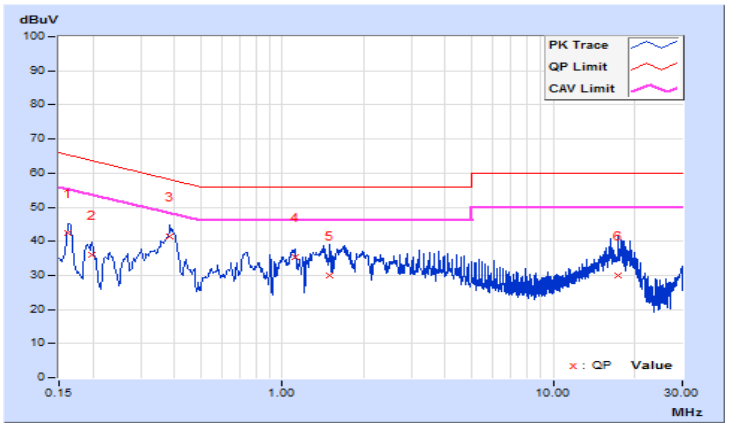
802.11a

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16190	9.63	32.92	22.71	42.55	32.34	65.37	55.37	-22.82	-23.03
2	0.19780	9.62	26.42	19.21	36.04	28.83	63.70	53.70	-27.66	-24.87
3	0.38600	9.65	31.90	20.57	41.55	30.22	58.15	48.15	-16.60	-17.93
4	1.11400	9.69	25.61	17.00	35.30	26.69	56.00	46.00	-20.70	-19.31
5	1.49000	9.70	20.25	8.88	29.95	18.58	56.00	46.00	-26.05	-27.42
6	17.29800	9.90	20.08	14.17	29.98	24.07	60.00	50.00	-30.02	-25.93

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

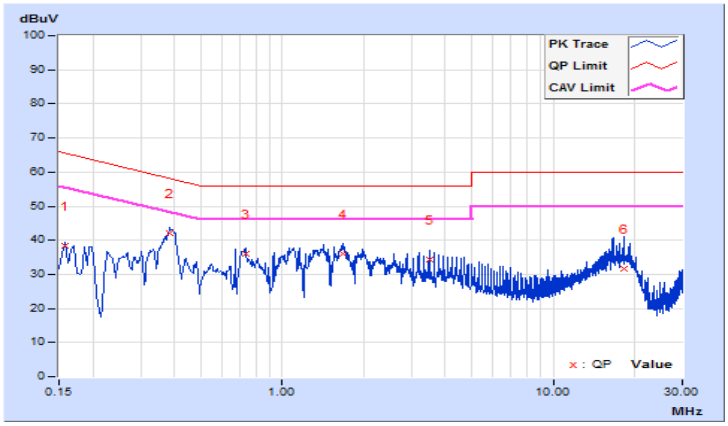


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15800	9.66	28.88	16.97	38.54	26.63	65.57	55.57	-27.03	-28.94
2	0.38600	9.67	32.40	21.04	42.07	30.71	58.15	48.15	-16.08	-17.44
3	0.73000	9.69	26.33	18.38	36.02	28.07	56.00	46.00	-19.98	-17.93
4	1.67400	9.74	26.23	18.56	35.97	28.30	56.00	46.00	-20.03	-17.70
5	3.48200	9.80	24.46	19.20	34.26	29.00	56.00	46.00	-21.74	-17.00
6	18.18600	10.01	21.72	15.65	31.73	25.66	60.00	50.00	-28.27	-24.34

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



Test Mode B

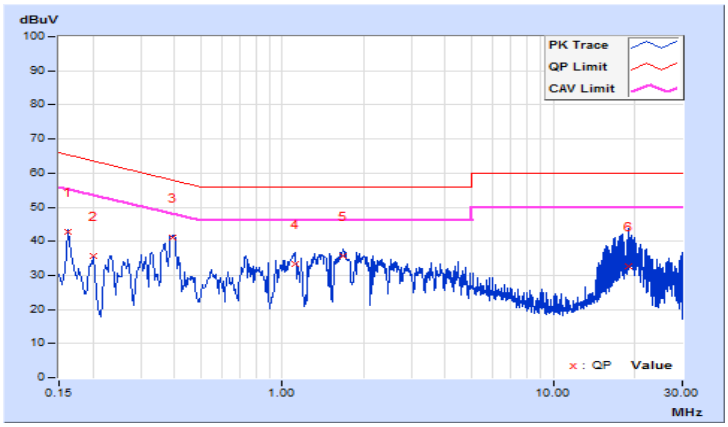
802.11a

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16200	9.63	33.09	22.27	42.72	31.90	65.36	55.36	-22.64	-23.46
2	0.20148	9.62	26.10	17.00	35.72	26.62	63.55	53.55	-27.83	-26.93
3	0.39445	9.65	31.37	24.54	41.02	34.19	57.97	47.97	-16.95	-13.78
4	1.12200	9.69	23.51	14.93	33.20	24.62	56.00	46.00	-22.80	-21.38
5	1.67995	9.71	25.85	18.47	35.56	28.18	56.00	46.00	-20.44	-17.82
6	18.92600	9.91	22.83	14.00	32.74	23.91	60.00	50.00	-27.26	-26.09

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

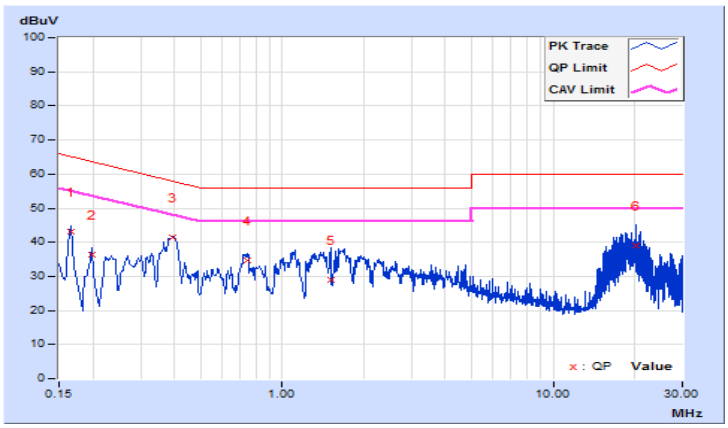


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16579	9.65	33.54	24.10	43.19	33.75	65.17	55.17	-21.98	-21.42
2	0.19800	9.64	26.89	19.23	36.53	28.87	63.69	53.69	-27.16	-24.82
3	0.39342	9.67	31.78	24.54	41.45	34.21	57.99	47.99	-16.54	-13.78
4	0.74600	9.69	24.92	15.75	34.61	25.44	56.00	46.00	-21.39	-20.56
5	1.50600	9.73	19.24	6.12	28.97	15.85	56.00	46.00	-27.03	-30.15
6	**20.16600**	**10.03**	**29.00**	**27.21**	**39.03**	**37.24**	**60.00**	**50.00**	**-20.97**	**-12.76**

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



Test Mode C

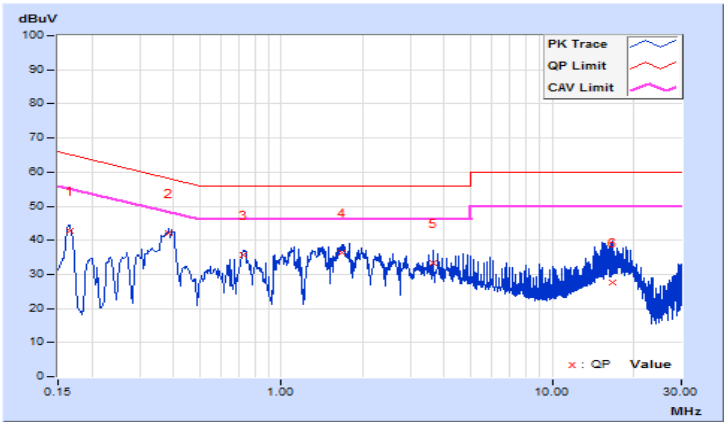
802.11a

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16535	9.63	33.23	24.36	42.86	33.99	65.19	55.19	-22.33	-21.20
2	0.38600	9.65	32.39	21.42	42.04	31.07	58.15	48.15	-16.11	-17.08
3	0.72600	9.67	26.07	18.15	35.74	27.82	56.00	46.00	-20.26	-18.18
4	1.67000	9.71	26.56	18.66	36.27	28.37	56.00	46.00	-19.73	-17.63
5	3.63800	9.78	23.58	21.27	33.36	31.05	56.00	46.00	-22.64	-14.95
6	16.67800	9.90	17.78	10.43	27.68	20.33	60.00	50.00	-32.32	-29.67

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

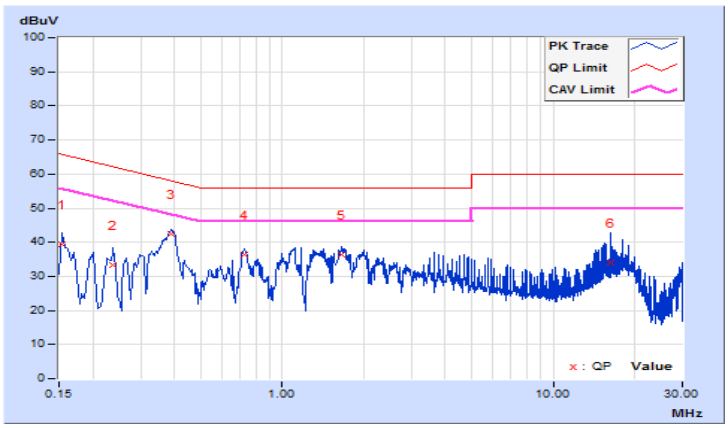


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.66	29.89	12.15	39.55	21.81	65.78	55.78	-26.23	-33.97
2	0.23785	9.65	23.64	15.70	33.29	25.35	62.17	52.17	-28.88	-26.82
3	0.38929	9.67	32.90	23.86	42.57	33.53	58.08	48.08	-15.51	-14.55
4	0.72600	9.69	26.84	18.91	36.53	28.60	56.00	46.00	-19.47	-17.40
5	1.65796	9.74	26.79	19.57	36.53	29.31	56.00	46.00	-19.47	-16.69
6	16.35000	9.99	24.05	20.89	34.04	30.88	60.00	50.00	-25.96	-19.12

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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