FCC Test Report

Report No.:	RFBFBE-WTW-P21080189
FCC ID:	I88C4000LZ
Test Model:	C4000BZ
Series Model:	C4000LZ
Received Date:	2021/8/4
Test Date:	2021/9/1 ~ 2021/9/2
Issued Date:	2021/10/7
Applicant:	Zyxel Communications Corporation
Address:	No.2 Industry East RD. IX, Hsinchu Science Park, Hsinchu 30075, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
RFBFBE-WTW-P21080189	Original release.	2021/10/7

1 Certificate of Conformity

Product:	Dual-Band Wireless AX VDSL2 Gigabit Gateway, Dual-Band Wireless AX VDSL2 Gigabit Bonding Gateway
Brand:	CenturyLink, ZYXEL
Test Model:	C4000BZ
Series Model:	C4000LZ
Sample Status:	ENGINEERING SAMPLE
Applicant:	Zyxel Communications Corporation
Test Date:	2021/9/1 ~ 2021/9/2
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** 2021/10/7

Claire Kuan / Specialist

Approved by : _____ , **Date:** 2021/10/7

Clark Lin / Technical Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -10.66dB at 0.15000MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.2dB at 666.66MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to Note 1 below
15.247(a)(2)	6dB bandwidth	N/A	Refer to Note 1 below
15.247(b)	Conducted power	N/A	Refer to Note 1 below
15.247(e)	Power Spectral Density	N/A	Refer to Note 1 below
15.203	Antenna Requirement	PASS	Antenna connector is i-pex (MHF) not a standard connector.

Note:
1. AC Power Conducted Emission test and Radiated Emissions (below 1GHz) were performed for this addendum. Other test items data refer to original test report.
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	1.9 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.5 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Dual-Band Wireless AX VDSL2 Gigabit Gateway, Dual-Band Wireless AX VDSL2 Gigabit Bonding Gateway
Brand	CenturyLink, ZYXEL
Test Model	C4000BZ
Series Model	C4000LZ
CPU Model No.	GRX350
RF Chip Model No.	WAV654
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	DSSS,OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 300 Mbps 802.11ac: up to 1733.3 Mbps 802.11ax: up to 2401.9 Mbps
Operating Frequency	**2.4GHz:** 2.412GHz ~ 2.462GHz **5GHz:** 5.18 ~ 5.24GHz, 5.26GHz ~ 5.32GHz, 5.5 ~ 5.72GHz 5.745 ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 80211ax (HE20): 11 802.11n (HT40), VHT40, 80211ax (HE40): 7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 80211ax (HE20): 25 802.11n (HT40), 802.11ac (VHT40), 80211ax (HE40): 12 802.11ac (VHT80), 80211ax (HE80): 6 802.11ac (VHT160), 802.11ax (HE160): 2
Output Power	**Non-Beamforming Mode:** **2.412 ~ 2.462 GHz:** 832.061 mW **5.18 ~ 5.24 GHz:** 827.149 mW **5.26 ~ 5.32 GHz:** 221.25 mW **5.5 ~ 5.72 GHz:** 221.692 mW **5.745 ~ 5.825 GHz:** 945.395 mW **Beamforming Mode:** **2.412 ~ 2.462 GHz:** 759.637 mW **5.18 ~ 5.24 GHz:** 827.149 mW **5.26 ~ 5.32 GHz:** 221.25 mW **5.5 ~ 5.72 GHz:** 221.692 mW **5.745 ~ 5.825 GHz:** 835.929 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	- AC Adaptor, Brand:UMEC, Model:UP0251M-12PA - AC Adaptor, Brand:DVE, Model:DSA-24PFS-12 FUS 120200 - AC Adaptor, Brand:MNC, Model:MAUS-120200 - Ethernet Cable , Non-shielded, 1.8m x1 - DSL cable , Non-shielded, 3.66m x1

Note:

1. This is a supplementary report of Report No.: RF200320E01. The differences between them are as below information:
   - ◆ Add model name :C4000BZ
   - ◆ HW change :
     1.) DSL (from single change to bonding)
     2.) Add heat sink at CPU
     3.) Add LED control IC
2. According to above condition, only AC power conducted emission test and radiated emissions (below 1GHz) test items need to be performed. And all data was verified to meet the requirements.
3. The EUT has below brand names, which are identical to each other in all aspects except for the following table:

Original			
Brand	Model	Model	Difference
Dual-Band Wireless AX VDSL2 Gigabit Gateway	CenturyLink ZYXEL	C4000LZ	Different brand names are for marketing purpose.
Newly			
Brand	Model	Model	Difference
Dual-Band Wireless AX VDSL2 Gigabit Bonding Gateway	CenturyLink ZYXEL	C4000BZ	HW change : 1.) DSL (from single change to bonding) 2.) Add heat sink at CPU 3.) Add LED control IC

From the above models, model: C4000BZ was selected as representative model for the test and its data was recorded in this report.

4. The EUT has two radios as following table:

Radio 1	Radio 2
WLAN 2.4GHz	WLAN 5GHz

5. Simultaneously transmission condition.

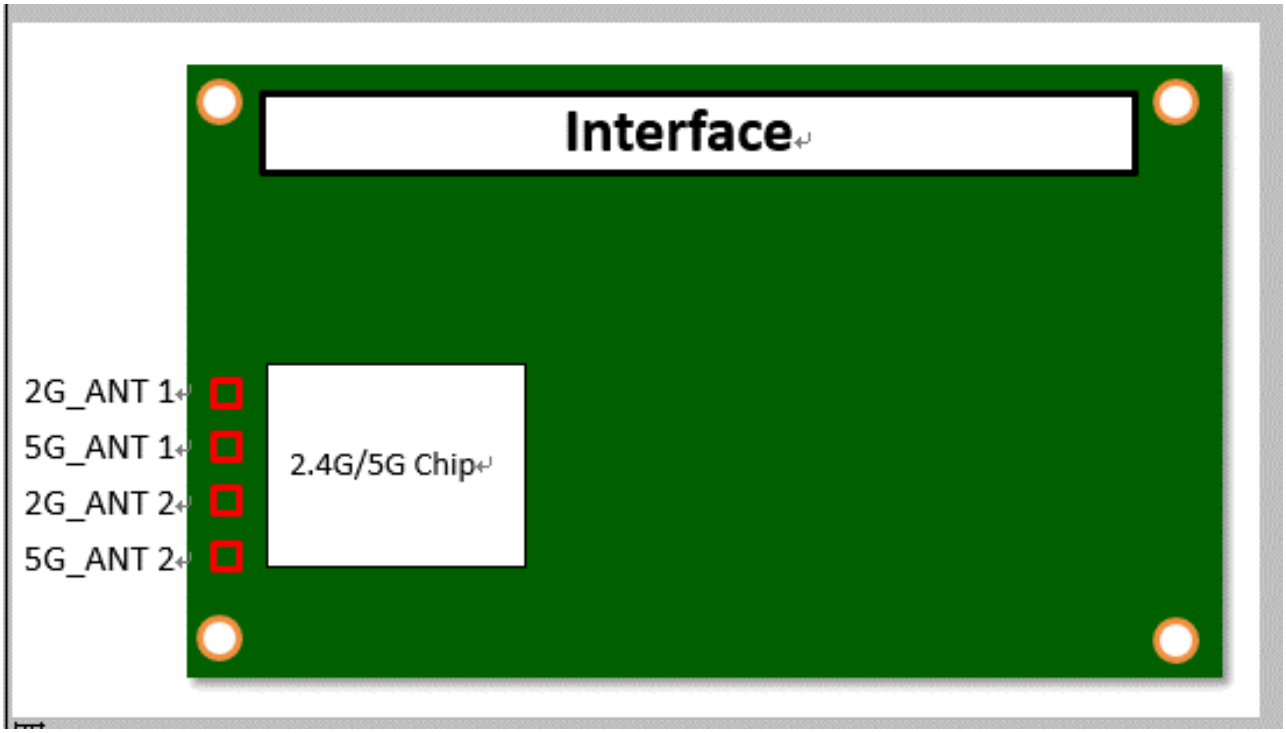
Condition	Technology	
1	WLAN 2.4GHz	WLAN 5GHz
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.		

6. The EUT must be supplied one power adapter and following different models could be chosen as following table:

No.	Brand	Model No.	Spec.
1	UMEC	UP0251M-12PA	Input: 100-240Vac, 0.6A, 50/60Hz Output: 12V, 2A DC Output cable: Unshielded, 1.8m
2	DVE	DSA-24PFS-12 FUS 120200	Input: 100-240Vac, 0.8A, 50/60Hz Output: 12V, 2A DC Output cable: Unshielded, 1.8m
3	MNC	MAUS-120200	Input: 100-240Vac, 0.7A, 50/60Hz Output: 12V, 2A DC Output cable: Unshielded, 1.8m

7. The antennas provided to the EUT, please refer to the following table:

Antenna NO.	Chain NO.	Brand	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length(mm)
2G_ANT1	Chain 0	M.gear	2.48	2.4~2.4835GHz	Dipole	i-pex(MHF)	108.8
5G_ANT1	Chain 0	M.gear	3.36	5.15~5.25GHz	Dipole	i-pex(MHF)	113.5
			3.45	5.25~5.35GHz			
			3.44	5.47~5.725GHz			
			3.36	5.725~5.85GHz			
2G_ANT2	Chain 1	M.gear	2.77	2.4~2.4835GHz	Dipole	i-pex(MHF)	148.5
5G_ANT2	Chain 1	M.gear	3.41	5.15~5.25GHz	Dipole	i-pex(MHF)	78.5
			3.18	5.25~5.35GHz			
			3.47	5.47~5.725GHz			
			3.47	5.725~5.85GHz			



* Antenna port location

8. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11b	1Tx Fixed Chain 0	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
VHT20	2TX	2RX
VHT40	2TX	2RX
802.11ax (HE20)	2TX	2RX
802.11ax (HE40)	2TX	2RX
5GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11a	2TX	2TX
802.11n (HT20)	2TX	2TX
802.11n (HT40)	2TX	2TX
802.11ac (VHT20)	2TX	2TX
802.11ac (VHT40)	2TX	2TX
802.11ac (VHT80)	2TX	2TX
802.11ax (HE20)	2TX	2TX
802.11ax (HE40)	2TX	2TX
802.11ax (HE80)	2TX	2TX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
2. The EUT support Beamforming and Non-Beamforming mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
3. The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz), VHT mode for 20MHz (40MHz) and 802.11ax mode for 20MHz (40MHz), therefore the manufacturer will control the power for 802.11n mode is the same as the VHT mode or more lower than it and investigated worst case to representative mode in test report. (Final test mode refer to section 3.2.1)

9. The power setting are list as below:

Non-Beamforming Mode											
802.11b		802.11g		VHT20		VHT40		802.11ax (HE20)		802.11ax (HE40)	
Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting
2412	25.5	2412	21	2412	19.5	2422	19	2412	19.5	2422	19
2437	25.5	2437	27	2437	25.5	2437	21.5	2437	25.5	2437	21.5
2462	25.5	2462	21	2462	20	2452	20	2462	20	2452	20

Beamforming Mode							
VHT20		VHT40		802.11ax (HE20)		802.11ax (HE40)	
Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting	Freq. (MHz)	Power Setting
2412	19.5	2422	19	2412	19.5	2422	19
2437	25.5	2437	21.5	2437	25.5	2437	21.5
2462	20	2452	20	2462	20	2452	20

10. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), VHT20 and 802.11ax (HE20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

7 channels are provided for 802.11n (HT40), VHT40 and 802.11ax (HE40):

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO		DESCRIPTION
	RE<1G	PLC	
1	√	√	Adapter 1
2	√	√	Adapter 2
3	√	√	Adapter 3

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

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.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11g	1 to 11	6	OFDM	BPSK	6Mb/s

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.

Non-Beamforming Mode					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	Data Rate Parameter
802.11g	1 to 11	6	OFDM	BPSK	6Mb/s

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE<1G	26deg. C, 66%RH	120Vac, 60Hz	Sampson Chen
PLC	26deg. C, 68%RH	120Vac, 60Hz	Sampson Chen

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.

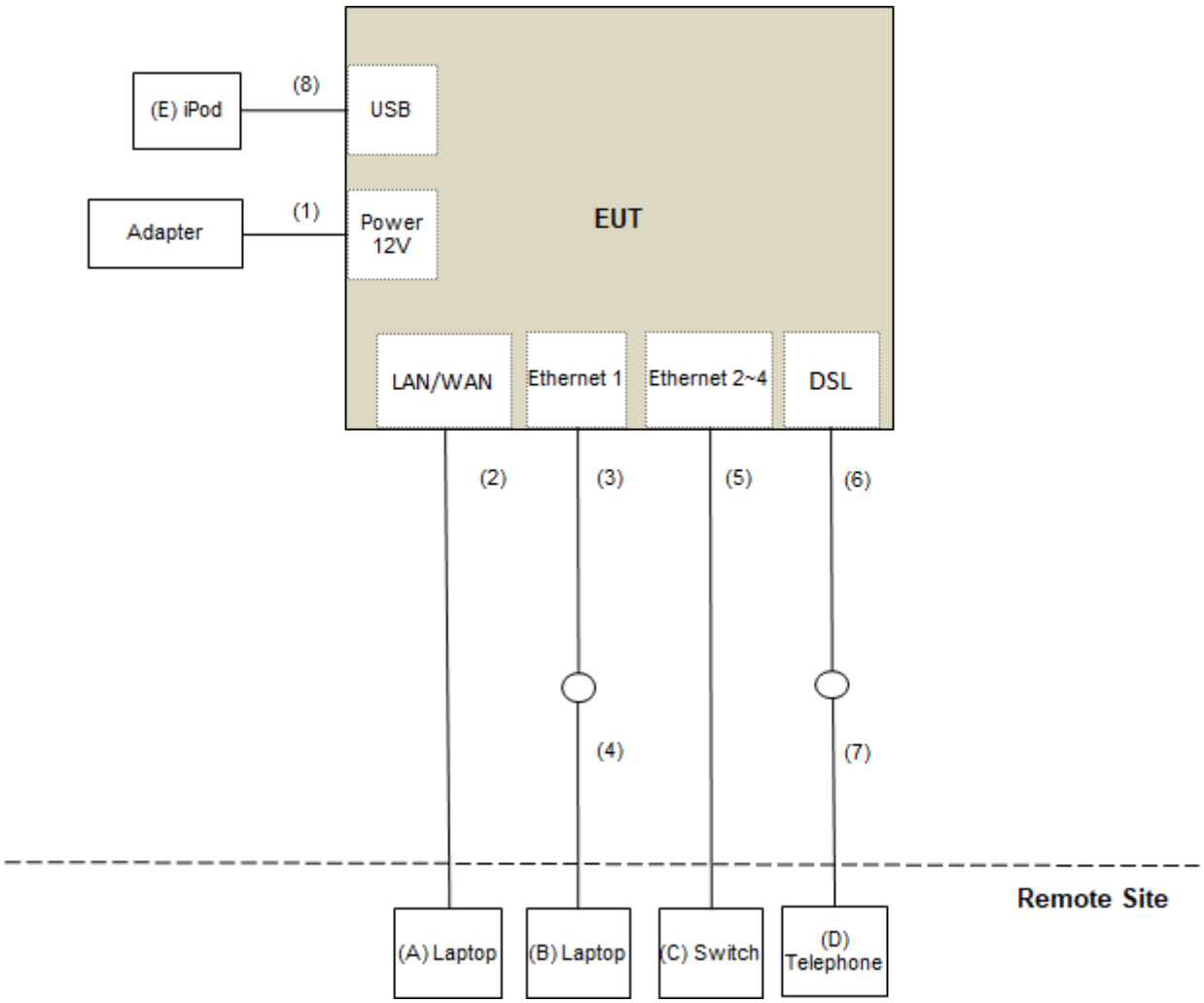
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	Lenovo	20U5S01X00 L14	PF-28LKK7	NA	Provided by Lab
B.	Laptop	Lenovo	20U5S01X00 L14	PF-1ANPYA	NA	Provided by Lab
C.	Switch	D-Link	DGS-1005D	DR8WC92000523	NA	Provided by Lab
D.	Telephone	WONDER	WD-303	7C17KA04011	NA	Provided by Lab
E.	iPod	Apple	MC749TA/A	CC4DN25WDFDM	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1.8	No	0	Supplied by client
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	1	1.8	No	0	Supplied by client
4.	RJ-45 Cable	1	10	No	0	Provided by Lab
5.	RJ-45 Cable	1	10	No	0	Provided by Lab
6.	RJ-11 Cable	1	3.66	No	0	Supplied by client
7.	RJ-11 Cable	1	10	No	0	Provided by Lab
8.	USB Cable	1	0.1	Yes	0	Provided by Lab

3.3.1 Configuration of System under Test



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 C (15.247)
ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 15.247 Meas Guidance v05r02
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. Other emissions shall be at least 30dB below the highest level of the desired power:

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.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210202	2020/12/1	2021/11/30
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Pre_Amplifier EMCI	EMC001340	980142	2021/5/24	2022/5/23
LOOP ANTENNA Electro-Metrics	EM-6879	264	2021/3/5	2022/3/4
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2021/1/7	2022/1/6
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2021/1/7	2022/1/6
Pre_Amplifier EMCI	EMC330N	980701	2021/3/10	2022/3/9
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-406	2020/11/6	2021/11/5
RF Coaxial Cable COMMATE/PEWC	8D	966-4-1	2021/3/17	2022/3/16
RF Coaxial Cable COMMATE/PEWC	8D	966-4-2	2021/3/17	2022/3/16
RF Coaxial Cable COMMATE/PEWC	8D	966-4-3	2021/3/17	2022/3/16
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-03	2021/1/11	2022/1/10

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 966 Chamber No. 4.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: 2021/9/2

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 (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) 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:

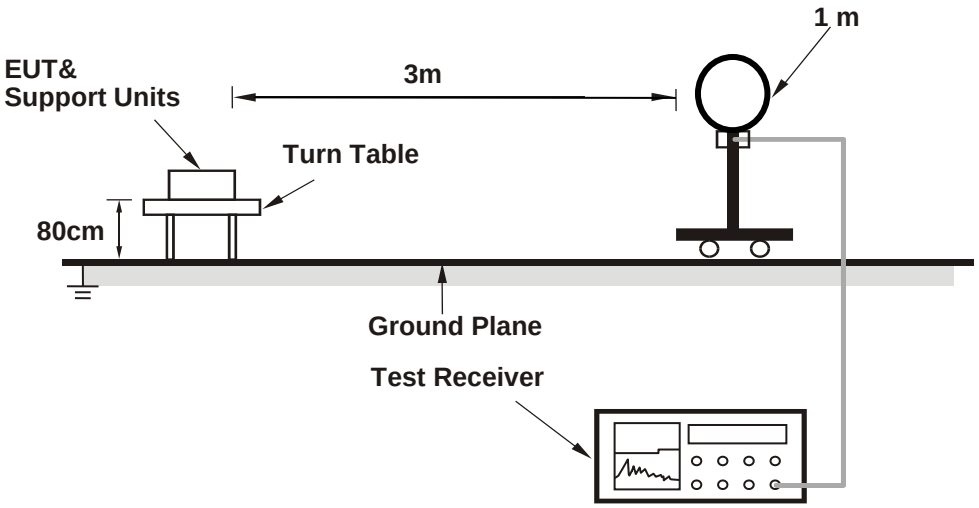
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

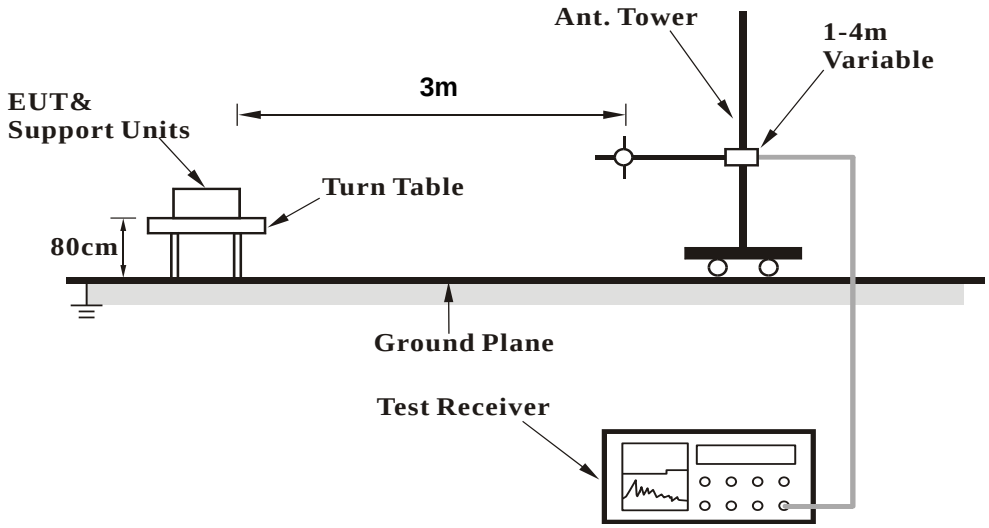
No deviation.

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. Connected the EUT with the Laptop which is placed on remote site.
b. Controlling software (DUT_setup.610.26) has been activated to set the EUT under transmission condition continuously at specific channel frenquency.

4.1.7 Test Results (Mode 1)

Below 1GHz Data:

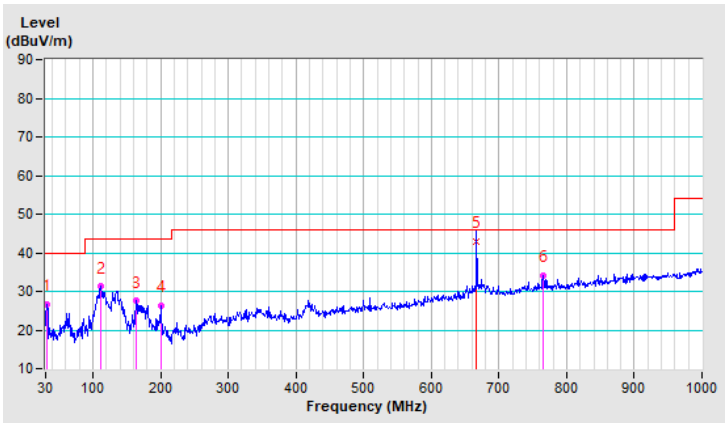
802.11g

RF Mode	TX 802.11g	**Channel**	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	32.59	26.8 QP	40.0	-13.2	1.50 H	344	40.4	-13.6
2	111.24	31.2 QP	43.5	-12.3	3.00 H	268	46.2	-15.0
3	164.54	27.5 QP	43.5	-16.0	2.00 H	84	39.7	-12.2
4	200.43	26.4 QP	43.5	-17.1	1.50 H	263	41.4	-15.0
5	**666.66**	**42.8 QP**	**46.0**	**-3.2**	**1.00 H**	**137**	**44.0**	**-1.2**
6	765.02	34.2 QP	46.0	-11.8	1.00 H	218	33.0	1.2

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.

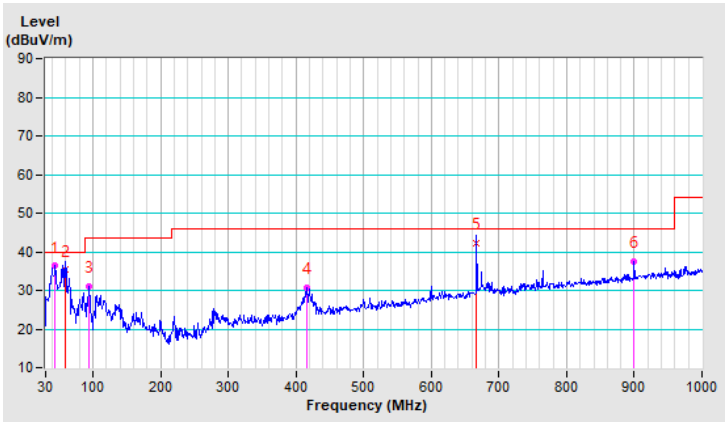


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	43.80	36.3 QP	40.0	-3.7	1.00 V	257	48.9	-12.6
2	58.74	35.3 QP	40.0	-4.7	1.00 V	207	48.4	-13.1
3	94.41	31.0 QP	43.5	-12.5	1.00 V	274	48.7	-17.7
4	416.25	30.6 QP	46.0	-15.4	1.50 V	2	37.9	-7.3
5	666.66	42.3 QP	46.0	-3.7	1.00 V	136	43.5	-1.2
6	899.41	37.4 QP	46.0	-8.6	1.50 V	222	33.9	3.5

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.



4.1.8 Test Results (Mode 2)

Below 1GHz Data:

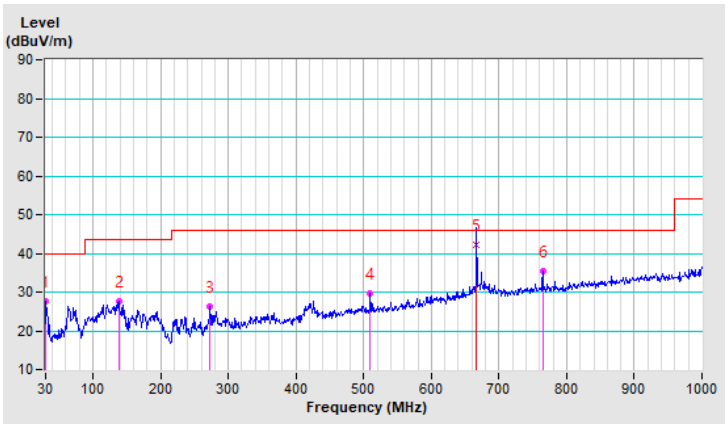
802.11g

RF Mode	TX 802.11g	**Channel**	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	**Detector Function**	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	30.63	27.6 QP	40.0	-12.4	1.00 H	2	41.2	-13.6
2	137.69	27.7 QP	43.5	-15.8	2.00 H	102	40.2	-12.5
3	273.15	26.2 QP	46.0	-19.8	1.50 H	221	37.8	-11.6
4	510.00	29.8 QP	46.0	-16.2	1.50 H	74	34.4	-4.6
5	666.66	42.3 QP	46.0	-3.7	1.00 H	230	43.5	-1.2
6	764.97	35.4 QP	46.0	-10.6	1.00 H	143	34.2	1.2

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.

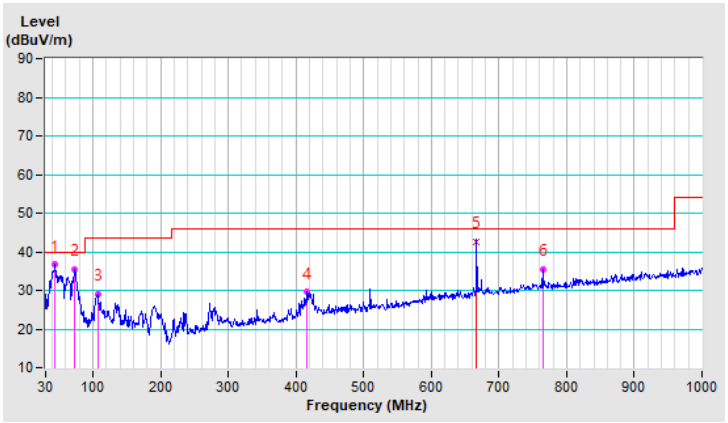


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	43.77	36.6 QP	40.0	-3.4	1.00 V	324	49.2	-12.6
2	73.12	35.5 QP	40.0	-4.5	1.00 V	232	51.2	-15.7
3	106.73	29.1 QP	43.5	-14.4	1.00 V	52	44.5	-15.4
4	416.91	29.5 QP	46.0	-16.5	1.50 V	284	36.8	-7.3
5	666.65	42.7 QP	46.0	-3.3	1.00 V	256	43.9	-1.2
6	764.97	35.5 QP	46.0	-10.5	2.00 V	360	34.3	1.2

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.



4.1.9 Test Results (Mode 3)

Below 1GHz Data:

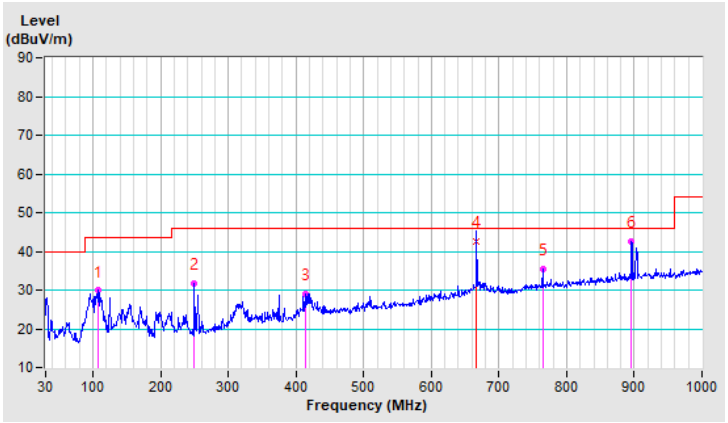
802.11g

RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	106.70	29.9 QP	43.5	-13.6	2.00 H	109	45.3	-15.4
2	250.00	31.8 QP	46.0	-14.2	1.00 H	88	44.5	-12.7
3	414.77	29.0 QP	46.0	-17.0	2.00 H	130	36.4	-7.4
4	666.66	42.5 QP	46.0	-3.5	1.50 H	5	43.7	-1.2
5	764.99	35.4 QP	46.0	-10.6	1.00 H	140	34.2	1.2
6	895.85	42.6 QP	46.0	-3.4	2.00 H	2	39.1	3.5

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.

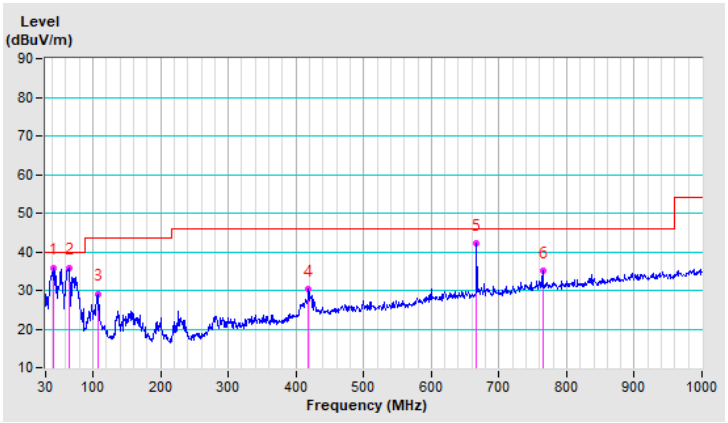


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	41.47	35.7 QP	40.0	-4.3	1.50 V	360	48.4	-12.7
2	64.77	35.8 QP	40.0	-4.2	1.00 V	150	49.8	-14.0
3	106.73	29.0 QP	43.5	-14.5	1.00 V	30	44.4	-15.4
4	418.39	30.2 QP	46.0	-15.8	1.00 V	271	37.4	-7.2
5	666.66	42.1 QP	46.0	-3.9	1.00 V	127	43.3	-1.2
6	764.99	35.0 QP	46.0	-11.0	1.50 V	113	33.8	1.2

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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
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.	Calibrated Date	Calibrated Until
Test Receiver R&S	ESCS 30	847124/029	2020/10/20	2021/10/19
LISN R&S	ESH3-Z5	848773/004	2020/10/27	2021/10/26
LISN R & S	ESH3-Z5	835239/001	2021/3/26	2022/3/25
50 ohms Terminator	50	3	2020/10/26	2021/10/25
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2020/9/26	2021/9/25
Fixed attenuator STI	STI02-2200-10	005	2021/8/27	2022/8/26
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3. Tested Date: 2021/9/1

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.

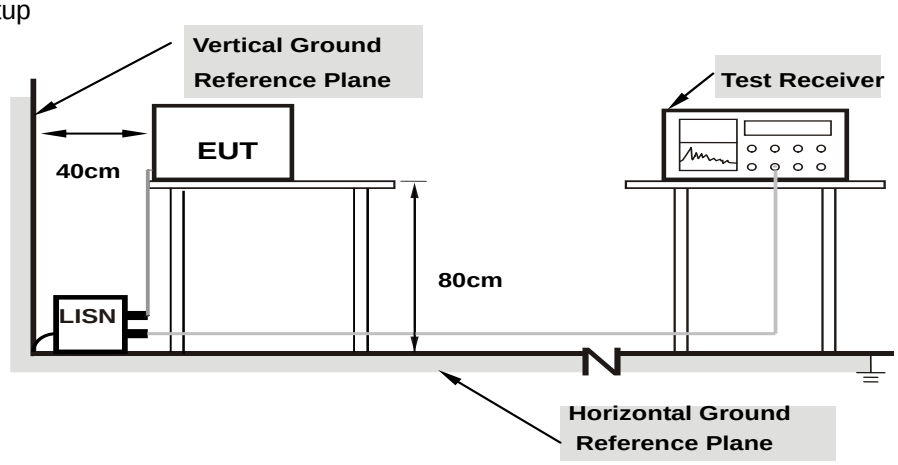
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

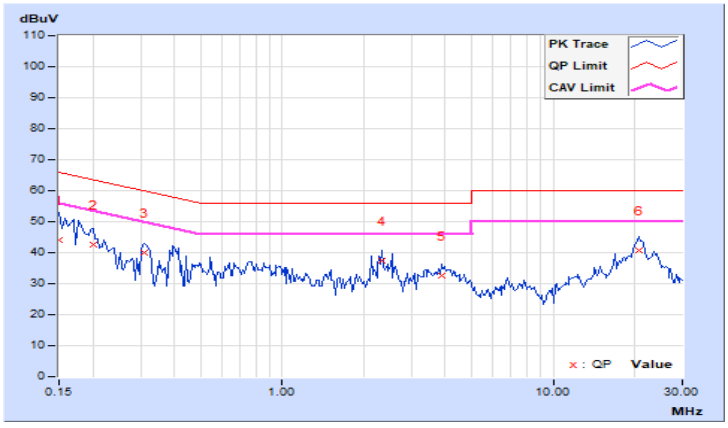
4.2.7 Test Results (Mode 1)

RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.97	34.18	20.46	44.15	30.43	66.00	56.00	-21.85	-25.57
2	0.20078	10.00	32.44	20.11	42.44	30.11	63.58	53.58	-21.14	-23.47
3	0.31016	10.02	30.07	24.25	40.09	34.27	59.97	49.97	-19.88	-15.70
4	2.32813	10.14	27.30	14.17	37.44	24.31	56.00	46.00	-18.56	-21.69
5	3.86719	10.25	22.46	15.51	32.71	25.76	56.00	46.00	-23.29	-20.24
6	20.63672	11.49	29.14	22.21	40.63	33.70	60.00	50.00	-19.37	-16.30

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

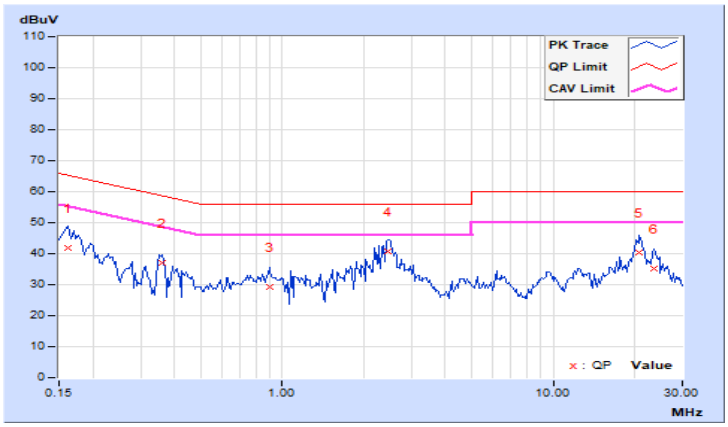


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.96	31.73	18.66	41.69	28.62	65.38	55.38	-23.69	-26.76
2	0.36094	10.02	26.84	19.34	36.86	29.36	58.71	48.71	-21.85	-19.35
3	0.89609	10.05	19.20	12.09	29.25	22.14	56.00	46.00	-26.75	-23.86
4	2.46094	10.16	30.69	19.15	40.85	29.31	56.00	46.00	-15.15	-16.69
5	20.76172	11.19	29.01	22.02	40.20	33.21	60.00	50.00	-19.80	-16.79
6	23.70313	11.25	23.95	16.67	35.20	27.92	60.00	50.00	-24.80	-22.08

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



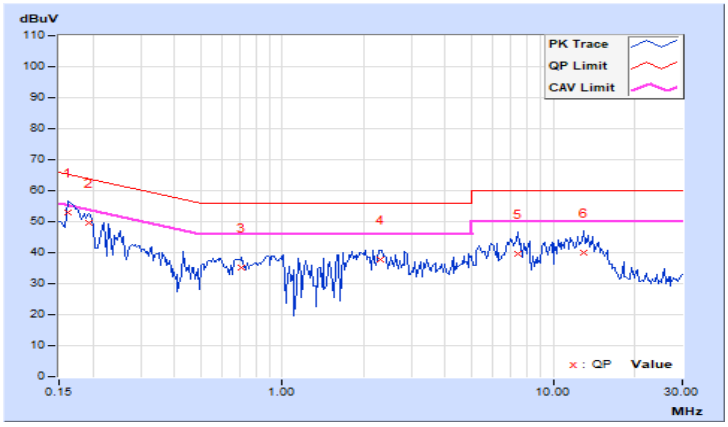
4.2.8 Test Results (Mode 2)

RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.98	43.14	20.59	53.12	30.57	65.38	55.38	-12.26	-24.81
2	0.19297	10.00	39.52	21.43	49.52	31.43	63.91	53.91	-14.39	-22.48
3	0.70859	10.05	25.32	13.05	35.37	23.10	56.00	46.00	-20.63	-22.90
4	2.29688	10.14	27.64	14.63	37.78	24.77	56.00	46.00	-18.22	-21.23
5	7.42578	10.51	29.24	18.61	39.75	29.12	60.00	50.00	-20.25	-20.88
6	12.94141	10.93	29.24	20.03	40.17	30.96	60.00	50.00	-19.83	-19.04

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

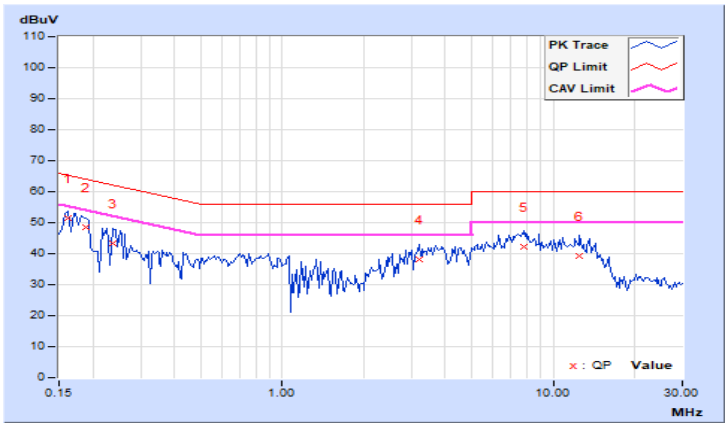


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.96	41.61	19.46	51.57	29.42	65.38	55.38	-13.81	-25.96
2	0.18906	9.99	38.53	24.81	48.52	34.80	64.08	54.08	-15.56	-19.28
3	0.23594	10.00	33.50	14.61	43.50	24.61	62.24	52.24	-18.74	-27.63
4	3.19531	10.20	28.02	16.29	38.22	26.49	56.00	46.00	-17.78	-19.51
5	7.79688	10.47	31.66	21.90	42.13	32.37	60.00	50.00	-17.87	-17.63
6	12.55469	10.75	28.68	19.59	39.43	30.34	60.00	50.00	-20.57	-19.66

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



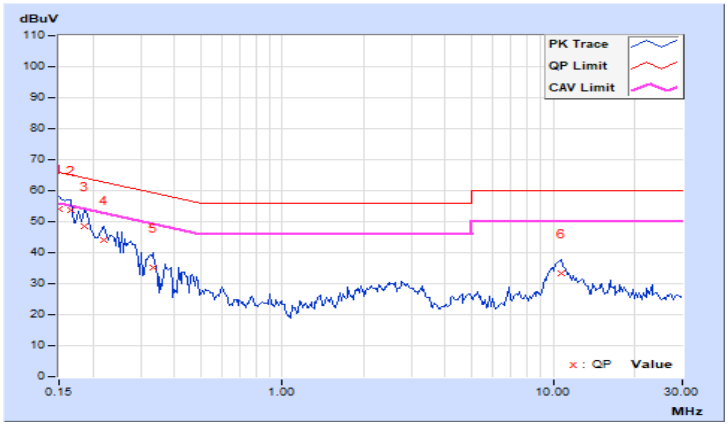
4.2.9 Test Results (Mode 3)

RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.97	44.19	28.24	54.16	38.21	66.00	56.00	-11.84	-17.79
2	0.16562	9.98	43.70	26.49	53.68	36.47	65.18	55.18	-11.50	-18.71
3	0.18516	9.99	38.47	23.51	48.46	33.50	64.25	54.25	-15.79	-20.75
4	0.22031	10.00	34.01	19.38	44.01	29.38	62.81	52.81	-18.80	-23.43
5	0.33359	10.02	25.14	14.75	35.16	24.77	59.36	49.36	-24.20	-24.59
6	10.68750	10.75	22.72	17.10	33.47	27.85	60.00	50.00	-26.53	-22.15

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

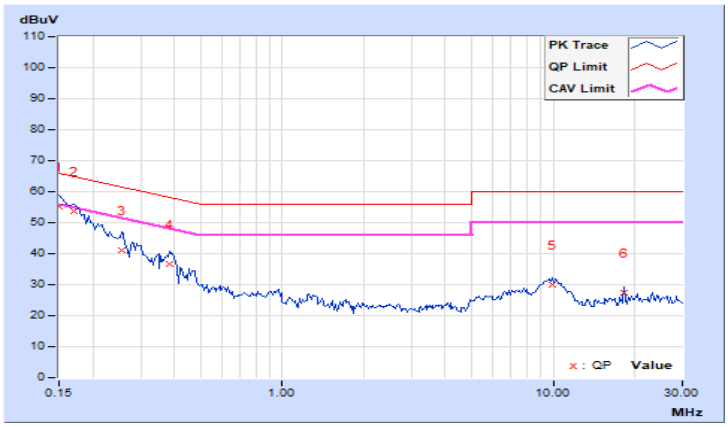


RF Mode	TX 802.11g	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15000**	**9.95**	**45.39**	**31.68**	**55.34**	**41.63**	**66.00**	**56.00**	**-10.66**	**-14.37**
2	0.16953	9.97	43.82	29.31	53.79	39.28	64.98	54.98	-11.19	-15.70
3	0.25547	10.01	31.11	14.38	41.12	24.39	61.58	51.58	-20.46	-27.19
4	0.38438	10.02	26.81	16.67	36.83	26.69	58.18	48.18	-21.35	-21.49
5	9.87500	10.59	19.42	13.91	30.01	24.50	60.00	50.00	-29.99	-25.50
6	18.24219	11.08	16.45	13.01	27.53	24.09	60.00	50.00	-32.47	-25.91

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 accredited and approved according to ISO/IEC 17025.

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

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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
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The address and road map of all our labs can be found in our web site also.

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