

Variant FCC Test Report

Report No.: RFBEKK-WTW-P20080111A

FCC ID: 2AARN-DLWPH-8M

Test Model: DLWPH-8M-RW

Series Model: DLWPH-8M

Received Date: Dec. 22, 2021

Test Date: Jan. 11 ~ Jan. 13, 2022

Issued Date: Mar. 24, 2022

Applicant: PHIHONG TECHNOLOGY CO. LTD.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RFBEKK-WTW-P20080111A	Original Release	Mar. 24, 2022

1 Certificate of Conformity

Product: EV charging system module 4G with WI-FI

Brand: Pihong Technology Co., Ltd.

Test Model: DLWPH-8M-RW

Series Model: DLWPH-8M

Sample Status: Engineering Sample


Applicant: PHIHONG TECHNOLOGY CO. LTD.

Test Date: Jan. 11 ~ Jan. 13, 2022

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 RF characteristics under the conditions specified in this report.

Prepared by :  , Date: Mar. 24, 2022
Lena Wang / Specialist

Approved by :  , Date: Mar. 24, 2022
Jeremy Lin / Project Engineer

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 -27.97 dB at 0.23785 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -2.0 dB at 325.03 MHz.
15.247(d)	Antenna Port Emission	N/A	Refer to note
15.247(a)(2)	6 dB Bandwidth	N/A	Refer to note
---	Occupied Bandwidth Measurement	N/A	Refer to note
15.247(b)	Conducted power	N/A	Refer to note
15.247(e)	Power Spectral Density	N/A	Refer to note
15.203	Antenna Requirement	Pass	Antenna connector is RP SMA PLUG.

Note:

1. This report is a partial report, only test item of AC Power Conducted Emission and Radiated Emissions tests were performed for this report. Other testing data please refer to original report.
2. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
3. 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	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.04 dB
	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~ 1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	EV charging system module 4G with WI-FI
Brand	Phihong Technology Co., Ltd.
Test Model	DLWPH-8M-RW
Series Model	DLWPH-8M
Status of EUT	Engineering Sample
Power Supply Rating	5Vdc (for DC power supply or host equipment)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS0
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20)
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. This report is prepared for FCC class II permissive change. This report is issued as a supplementary report to BV CPS report no. RFBK-K-WTW-P20080111. The difference compared with original report is changing the motherboard design and adding external antenna, therefore only AC Power Conducted Emission and Radiated Emissions tests had been performed and recorded in this report.

2. All models are listed as below

Brand	Model	WLAN Antenna type
Phihong Technology Co., Ltd.	DLWPH-8M	internal antenna
	DLWPH-8M-RW	external antenna

3. The EUT incorporates a SISO function. Physically, the EUT provides 1 completed transmitters and 1 receivers.

Modulation Mode	Tx Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	1TX

4. The following antennas were provided to the EUT. (New antenna is marked in gray)

Antenna	Brand	Model	Antenna Gain(dBi)	Antenna Type	Connector Type
Internal	Ublox	NA	2	Internal Antenna	NA
External	Gortec	DR0727-4201BSM	3.15	PCB	SMA Male Reverse
External	Aristotle	RFA-25-JP266-79-250	4	PCB	RP SMA PLUG

5. 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 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 and 802.11n (HT20):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To			Description
	RE≥1G	RE<1G	PLC	
-	√	√	√	-

Where **RE≥1G**: Radiated Emission above 1 GHz - **RE<1G**: Radiated Emission below 1 GHz
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**.
NOTE: "-" means no effect.

Radiated Emission Test (Above 1 GHz):

- 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	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Radiated Emission Test (Below 1 GHz):

- 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	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	11	OFDM	BPSK	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	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	11	OFDM	BPSK	6.0

Bandedge Measurement:

- 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	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE \geq 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Titan Hsu
RE $<$ 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Titan Hsu
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	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.

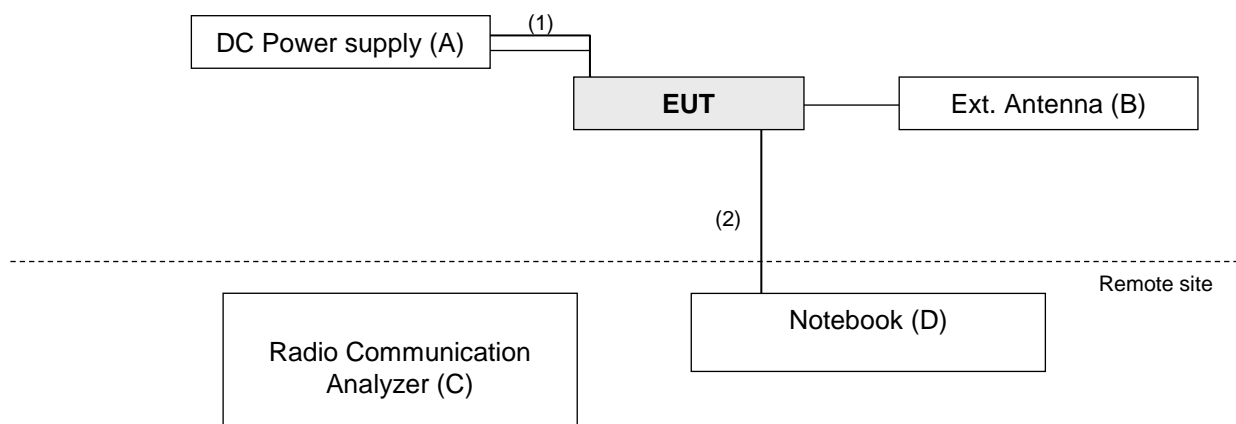
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
1.	DC Power Supply	JIN YIH TECHNOLOGY CO., LTD.	ODP3033	ODP30332027416	NA	-
2.	Ext. Antenna	Aristotle	RFA-25-JP266-79-250	NA	NA	Provided by client
3.	Notebook	DELL	E5430	2RL3YW1	NA	-
4.	Radio Communication Analyzer	Anritsu	MT8821C	6201462755	NA	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power cable	1	2	N	0	-
2.	LAN Cable	1	5	Y	0	Provided by client

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 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 20 dB 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 1000 MHz, 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 20 dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Dec. 30, 2021	Dec. 29, 2022
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Sep. 15, 2021	Sep. 14, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Nov. 01, 2021	Oct. 31, 2022
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Oct. 26, 2021	Oct. 25, 2022
Preamplifier Agilent (Below 1GHz)	8447D	2944A10631	Jun. 05, 2021	Jun. 04, 2022
Preamplifier KEYSIGHT (Above 1GHz)	83017A	MY53270295	Jun. 05, 2021	Jun. 04, 2022
RF Coaxial Cable WOKEN With 5dB PAD	8D-FB	Cable-CH4-01	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-3000	150929	Jul. 24, 2021	Jul. 23, 2022
RF Coaxial Cable EMCI	EMC102-KM-KM-600	150928	Jul. 24, 2021	Jul. 23, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Jun. 05, 2021	Jun. 04, 2022
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Jun. 05, 2021	Jun. 04, 2022
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	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 4.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- 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 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) 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.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

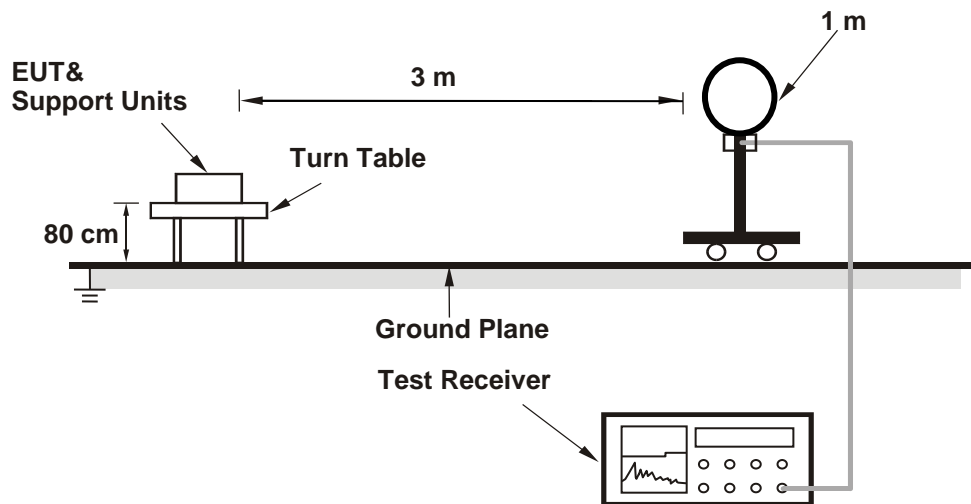
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98 %) or 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz. The duty cycle value refers to the original report. (RBW = 1 MHz, VBW = 10 Hz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

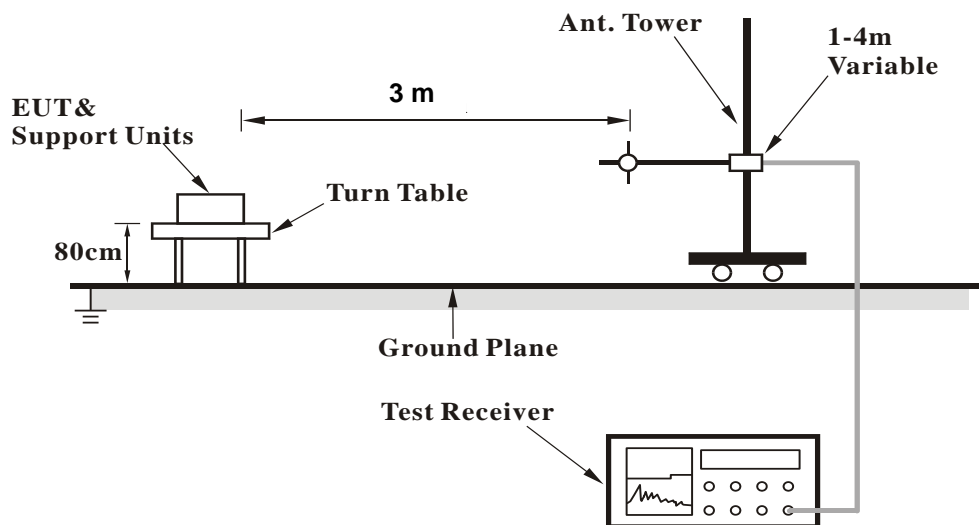
No deviation.

4.1.5 Test Set Up

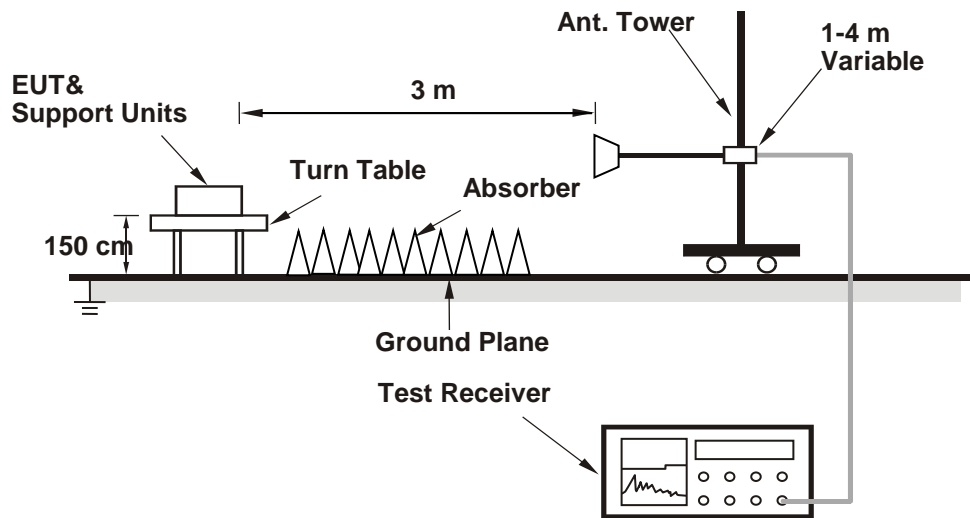
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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 a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data :

RF Mode	TX 802.11b	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	2390.00	61.9 PK	74.0	-12.1	1.75 H	187	27.8	34.1
2	2390.00	46.6 AV	54.0	-7.4	1.75 H	187	12.5	34.1
3	*2412.00	96.5 PK			1.76 H	156	62.4	34.1
4	*2412.00	94.1 AV			1.76 H	156	60.0	34.1
5	4824.00	50.7 PK	74.0	-23.3	1.20 H	71	37.1	13.6
6	4824.00	39.9 AV	54.0	-14.1	1.20 H	71	26.3	13.6
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	2390.00	61.3 PK	74.0	-12.7	3.96 V	163	27.2	34.1
2	2390.00	46.6 AV	54.0	-7.4	3.96 V	163	12.5	34.1
3	*2412.00	98.9 PK			3.96 V	163	64.8	34.1
4	*2412.00	95.7 AV			3.96 V	163	61.6	34.1
5	4824.00	52.6 PK	74.0	-21.4	1.44 V	90	39.0	13.6
6	4824.00	44.5 AV	54.0	-9.5	1.44 V	90	30.9	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11b	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2437.00	101.0 PK			1.90 H	190	66.7	34.3
2	*2437.00	98.6 AV			1.90 H	190	64.3	34.3
3	4874.00	50.8 PK	74.0	-23.2	1.28 H	75	37.2	13.6
4	4874.00	40.4 AV	54.0	-13.6	1.28 H	75	26.8	13.6

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	*2437.00	101.2 PK			3.83 V	163	66.9	34.3
2	*2437.00	98.8 AV			3.83 V	163	64.5	34.3
3	4874.00	51.0 PK	74.0	-23.0	1.18 V	111	37.4	13.6
4	4874.00	42.9 AV	54.0	-11.1	1.18 V	111	29.3	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11b	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2462.00	101.4 PK			2.14 H	190	67.1	34.3
2	*2462.00	98.9 AV			2.14 H	190	64.6	34.3
3	2483.50	62.3 PK	74.0	-11.7	2.14 H	190	28.0	34.3
4	2483.50	46.7 AV	54.0	-7.3	2.14 H	190	12.4	34.3
5	4924.00	51.0 PK	74.0	-23.0	1.31 H	75	37.6	13.4
6	4924.00	40.3 AV	54.0	-13.7	1.31 H	75	26.9	13.4

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	*2462.00	102.6 PK			3.71 V	164	68.3	34.3
2	*2462.00	100.2 AV			3.71 V	164	65.9	34.3
3	2483.50	62.9 PK	74.0	-11.1	3.71 V	164	28.6	34.3
4	2483.50	47.3 AV	54.0	-6.7	3.71 V	164	13.0	34.3
5	4924.00	53.5 PK	74.0	-20.5	1.28 V	96	40.1	13.4
6	4924.00	45.7 AV	54.0	-8.3	1.28 V	96	32.3	13.4

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11g	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	2390.00	61.8 PK	74.0	-12.2	1.75 H	185	27.7	34.1
2	2390.00	47.1 AV	54.0	-6.9	1.75 H	185	13.0	34.1
3	*2412.00	97.7 PK			1.75 H	185	63.6	34.1
4	*2412.00	88.9 AV			1.75 H	185	54.8	34.1
5	4824.00	50.8 PK	74.0	-23.2	1.41 H	88	37.2	13.6
6	4824.00	39.9 AV	54.0	-14.1	1.41 H	88	26.3	13.6

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	2390.00	61.3 PK	74.0	-12.7	3.97 V	167	27.2	34.1
2	2390.00	46.8 AV	54.0	-7.2	3.97 V	167	12.7	34.1
3	*2412.00	98.3 PK			3.96 V	164	64.2	34.1
4	*2412.00	89.3 AV			3.96 V	164	55.2	34.1
5	4824.00	51.1 PK	74.0	-22.9	1.52 V	96	37.5	13.6
6	4824.00	40.2 AV	54.0	-13.8	1.52 V	96	26.6	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11g	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2437.00	102.5 PK			1.65 H	190	68.2	34.3
2	*2437.00	93.6 AV			1.65 H	190	59.3	34.3
3	4874.00	51.1 PK	74.0	-22.9	1.43 H	82	37.5	13.6
4	4874.00	40.7 AV	54.0	-13.3	1.43 H	82	27.1	13.6

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	*2437.00	102.9 PK			3.83 V	164	68.6	34.3
2	*2437.00	93.9 AV			3.83 V	164	59.6	34.3
3	4874.00	51.1 PK	74.0	-22.9	1.48 V	93	37.5	13.6
4	4874.00	41.1 AV	54.0	-12.9	1.48 V	93	27.5	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11g	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2462.00	100.0 PK			1.63 H	189	65.7	34.3
2	*2462.00	91.1 AV			1.63 H	189	56.8	34.3
3	2483.50	65.0 PK	74.0	-9.0	1.63 H	189	30.7	34.3
4	2483.50	49.0 AV	54.0	-5.0	1.63 H	189	14.7	34.3
5	4924.00	50.6 PK	74.0	-23.4	1.33 H	85	37.2	13.4
6	4924.00	39.9 AV	54.0	-14.1	1.33 H	85	26.5	13.4

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	*2462.00	100.4 PK			3.94 V	164	66.1	34.3
2	*2462.00	91.5 AV			3.94 V	164	57.2	34.3
3	2483.50	66.0 PK	74.0	-8.0	3.94 V	164	31.7	34.3
4	2483.50	48.9 AV	54.0	-5.1	3.94 V	164	14.6	34.3
5	4924.00	50.7 PK	74.0	-23.3	1.00 V	92	37.3	13.4
6	4924.00	39.7 AV	54.0	-14.3	1.00 V	92	26.3	13.4

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.
5. " * " : Fundamental frequency.

RF Mode	TX 802.11n (HT20)	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	2390.00	63.1 PK	74.0	-10.9	1.73 H	189	29.0	34.1
2	2390.00	47.3 AV	54.0	-6.7	1.73 H	189	13.2	34.1
3	*2412.00	97.9 PK			1.73 H	189	63.8	34.1
4	*2412.00	88.5 AV			1.73 H	189	54.4	34.1
5	4824.00	50.8 PK	74.0	-23.2	2.12 H	131	37.2	13.6
6	4824.00	40.2 AV	54.0	-13.8	2.12 H	131	26.6	13.6

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	2390.00	61.3 PK	74.0	-12.7	3.95 V	166	27.2	34.1
2	2390.00	46.9 AV	54.0	-7.1	3.95 V	166	12.8	34.1
3	*2412.00	98.5 PK			3.95 V	166	64.4	34.1
4	*2412.00	88.7 AV			3.95 V	166	54.6	34.1
5	4824.00	50.4 PK	74.0	-23.6	1.55 V	93	36.8	13.6
6	4824.00	39.8 AV	54.0	-14.2	1.55 V	93	26.2	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11n (HT20)	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2437.00	105.3 PK			1.93 H	190	71.0	34.3
2	*2437.00	95.7 AV			1.93 H	190	61.4	34.3
3	4874.00	50.8 PK	74.0	-23.2	2.05 H	121	37.2	13.6
4	4874.00	39.9 AV	54.0	-14.1	2.05 H	121	26.3	13.6

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	*2437.00	105.5 PK			3.80 V	166	71.2	34.3
2	*2437.00	95.9 AV			3.80 V	166	61.6	34.3
3	4874.00	51.1 PK	74.0	-22.9	1.42 V	85	37.5	13.6
4	4874.00	40.1 AV	54.0	-13.9	1.42 V	85	26.5	13.6

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.
5. " * ": Fundamental frequency.

RF Mode	TX 802.11n (HT20)	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

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	*2462.00	100.0 PK			1.63 H	189	65.7	34.3
2	*2462.00	90.5 AV			1.63 H	189	56.2	34.3
3	2483.50	63.3 PK	74.0	-10.7	1.63 H	189	29.0	34.3
4	2483.50	48.4 AV	54.0	-5.6	1.63 H	189	14.1	34.3
5	4924.00	50.5 PK	74.0	-23.5	2.22 H	125	37.1	13.4
6	4924.00	39.6 AV	54.0	-14.4	2.22 H	125	26.2	13.4

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	*2462.00	100.2 PK			3.94 V	165	65.9	34.3
2	*2462.00	90.7 AV			3.94 V	165	56.4	34.3
3	2483.50	61.4 PK	74.0	-12.6	3.94 V	165	27.1	34.3
4	2483.50	47.7 AV	54.0	-6.3	3.94 V	165	13.4	34.3
5	4924.00	50.6 PK	74.0	-23.4	1.49 V	91	37.2	13.4
6	4924.00	39.7 AV	54.0	-14.3	1.49 V	91	26.3	13.4

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.
5. " * ": Fundamental frequency.

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

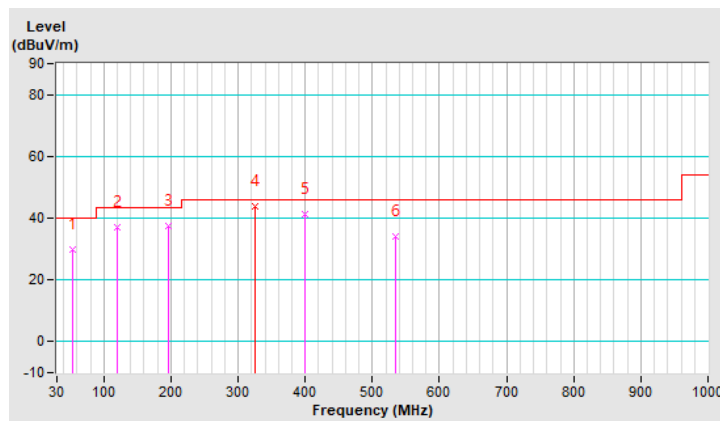
30 MHz ~ 1 GHz Worst-Case Data:

RF Mode	TX 802.11g	Channel	CH 11 : 2462 MHz
Frequency Range	30MHz ~ 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	53.28	29.7 QP	40.0	-10.3	2.00 H	129	38.4	-8.7
2	119.24	37.0 QP	43.5	-6.5	1.49 H	302	48.3	-11.3
3	196.84	37.5 QP	43.5	-6.0	1.49 H	175	49.1	-11.6
4	325.03	44.0 QP	46.0	-2.0	1.00 H	270	50.9	-6.9
5	400.54	41.2 QP	46.0	-4.8	2.00 H	199	47.2	-6.0
6	534.40	33.9 QP	46.0	-12.1	2.00 H	95	37.4	-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.

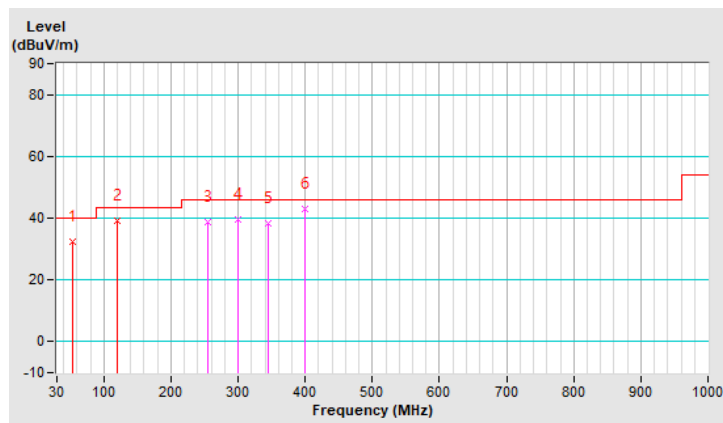


RF Mode	TX 802.11g	Channel	CH 11 : 2462 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	52.63	32.5 QP	40.0	-7.5	1.00 V	16	41.1	-8.6
2	120.03	39.2 QP	43.5	-4.3	1.00 V	99	50.3	-11.1
3	255.04	38.9 QP	46.0	-7.1	1.00 V	179	48.1	-9.2
4	299.66	39.4 QP	46.0	-6.6	1.00 V	79	46.9	-7.5
5	344.28	38.2 QP	46.0	-7.8	1.00 V	200	45.0	-6.8
6	400.54	42.8 QP	46.0	-3.2	1.00 V	184	48.8	-6.0

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. 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 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 16, 2021	Jan. 15, 2022
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 25, 2021	Feb. 24, 2022
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 07, 2021	Sep. 06, 2022
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

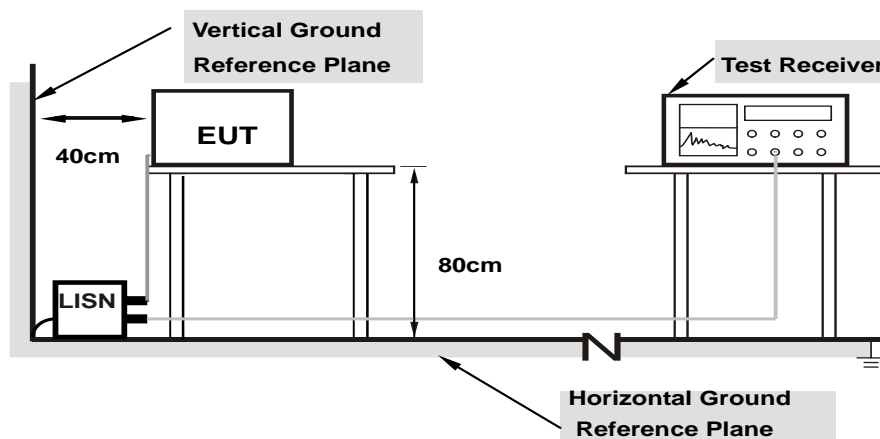
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling 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 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

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

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

- a. Placed the EUT on a testing table.
- b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

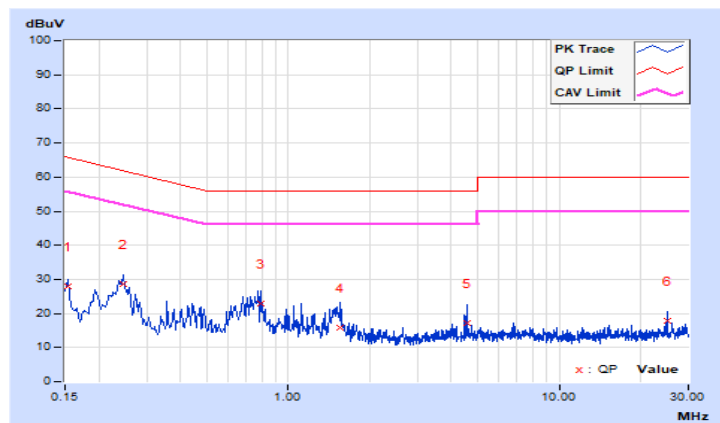
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23 °C, 66% RH
Tested by	Titan Hsu	Test Date	2022/1/13

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	0.15400	9.71	18.25	12.99	27.96	22.70	65.78	55.78	-37.82	-33.08
2	0.24600	9.71	18.75	12.52	28.46	22.23	61.89	51.89	-33.43	-29.66
3	0.79400	9.75	13.28	4.48	23.03	14.23	56.00	46.00	-32.97	-31.77
4	1.54600	9.77	6.10	0.55	15.87	10.32	56.00	46.00	-40.13	-35.68
5	4.55400	9.80	7.42	2.54	17.22	12.34	56.00	46.00	-38.78	-33.66
6	25.00200	9.80	8.01	6.34	17.81	16.14	60.00	50.00	-42.19	-33.86

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

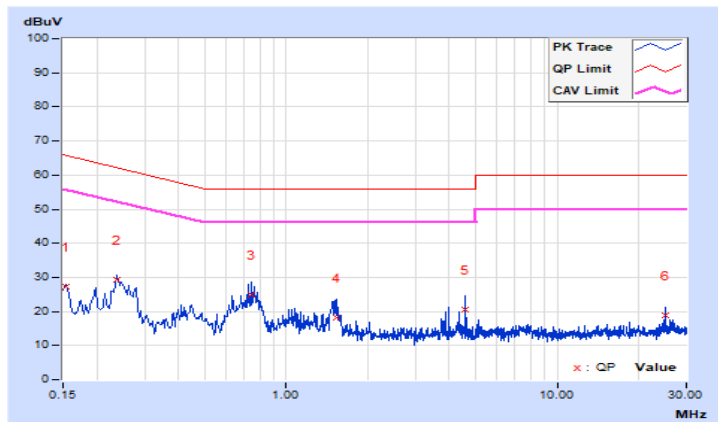


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	23 °C, 66% RH
Tested by	Titan Hsu	Test Date	2022/1/13

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	0.15400	9.77	17.53	13.81	27.30	23.58	65.78	55.78	-38.48	-32.20
2	0.23785	9.77	19.50	14.43	29.27	24.20	62.17	52.17	-32.90	-27.97
3	0.74200	9.81	15.18	8.18	24.99	17.99	56.00	46.00	-31.01	-28.01
4	1.52600	9.83	8.39	1.99	18.22	11.82	56.00	46.00	-37.78	-34.18
5	4.55000	9.86	10.53	2.86	20.39	12.72	56.00	46.00	-35.61	-33.28
6	25.00200	9.99	8.96	7.56	18.95	17.55	60.00	50.00	-41.05	-32.45

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

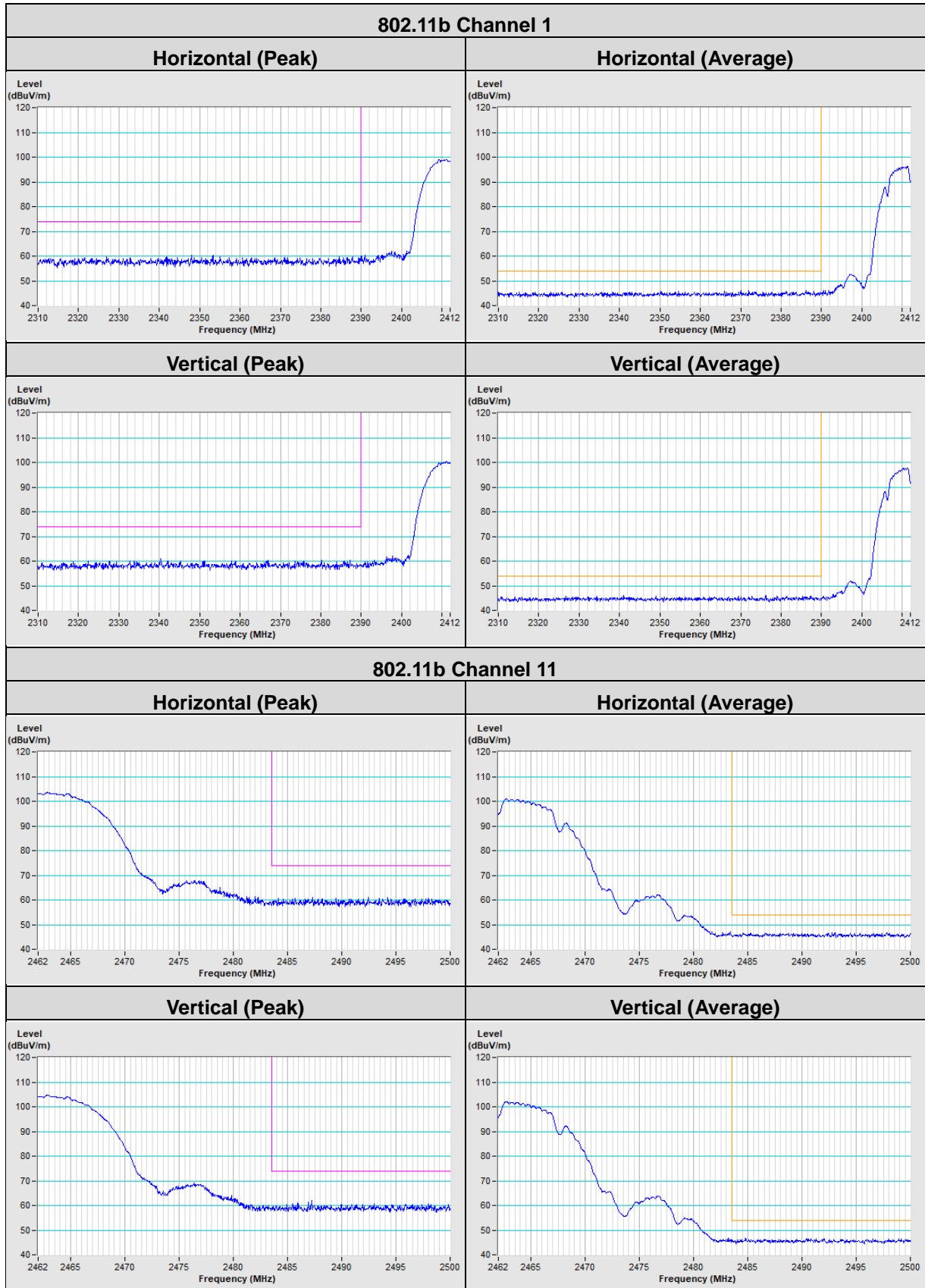


5 Pictures of Test Arrangements

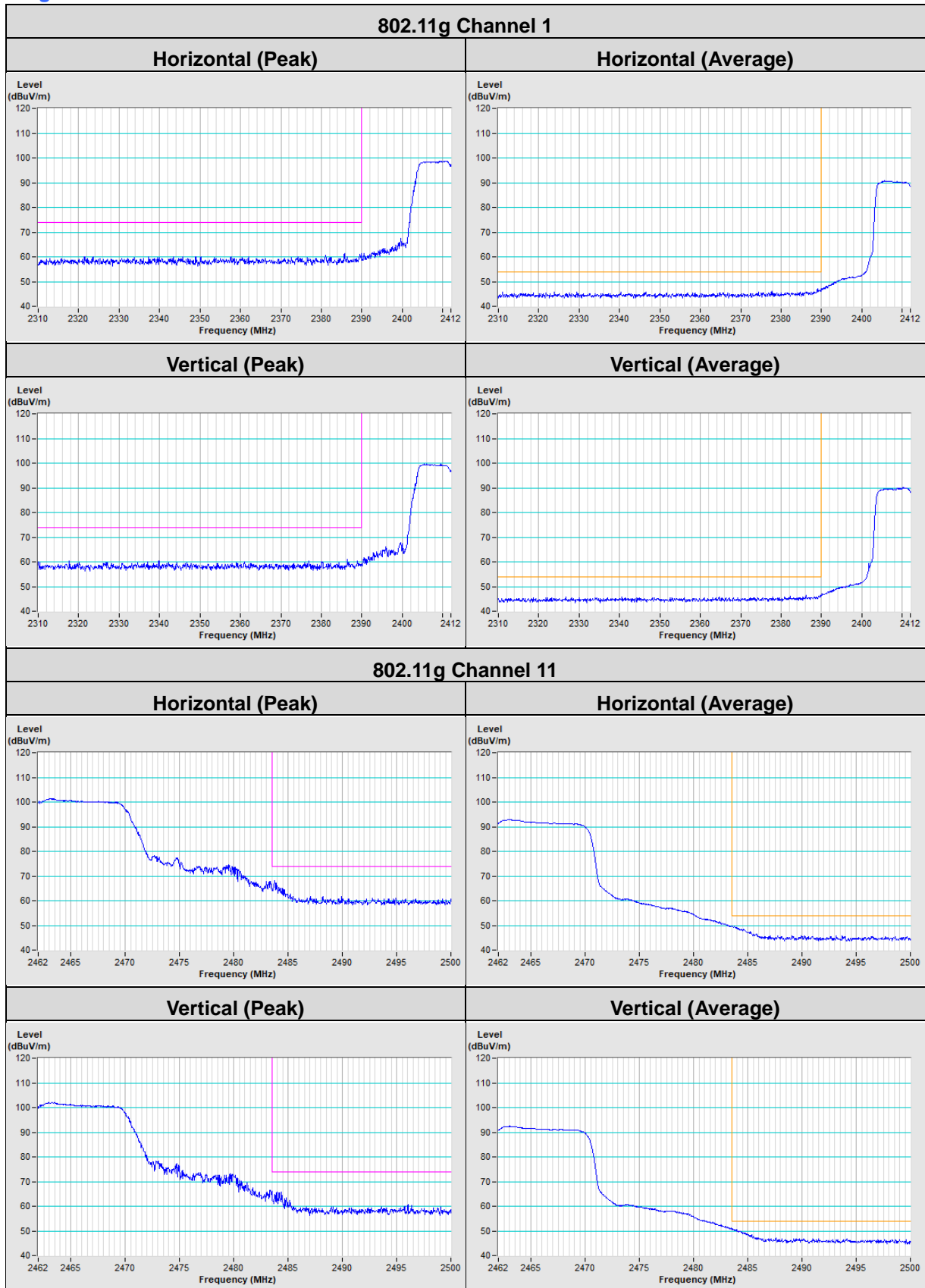
Please refer to the attached file (Test Setup Photo).

Annex A- Band Edge Measurement

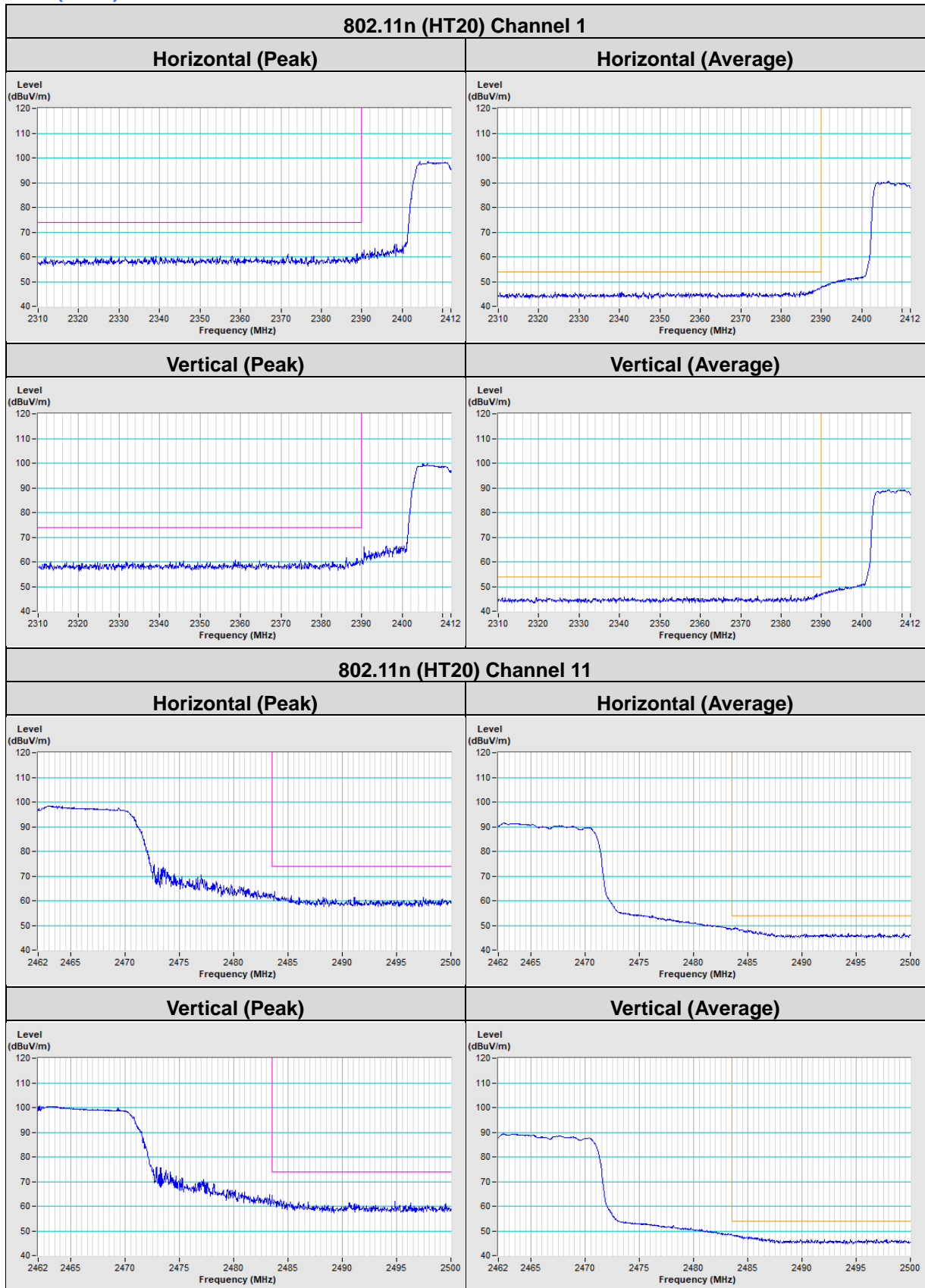
802.11b



802.11g



802.11n (HT20)



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 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 Lab

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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