

# TEST REPORT

## CERTIFICATE OF CONFORMITY

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
**Report No.:** RFBCKS-WTW-P25020487-4  
**FCC ID:** NKR-LS04B  
**Product:** ADT Base  
**Brand:** ADT  
**Model No.:** ADTBASE502R0  
**Received Date:** 2025/3/20  
**Test Date:** 2025/4/17 ~ 2025/5/2  
**Issued Date:** 2025/6/6

**Applicant:** Wistron NeWeb Corporation  
**Address:** 20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan, R.O.C.  
**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(1):** No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan  
**Test Location(2):** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan  
**Test Location(3):** No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

**FCC Registration /** 788550 / TW0003 for Test Location(1)  
**Designation Number:** 198487 / TW2021 for Test Location(2)  
281270 / TW0032 for Test Location(3)

Approved by:

Jeremy Lin

Jeremy Lin / Project Engineer

, Date:

2025/6/6

This test report consists of 38 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The test results in the report only apply to the tested sample. The test results in this report are traceable to the national or international standards.

Prepared by : Celine Chou / Senior Specialist



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

## Table of Contents

<b>Release Control Record .....</b>	<b>4</b>
<b>1 Certificate.....</b>	<b>5</b>
<b>2 Summary of Test Results .....</b>	<b>6</b>
2.1 Measurement Uncertainty .....	6
2.2 Supplementary Information .....	6
<b>3 General Information .....</b>	<b>7</b>
3.1 General Description.....	7
3.2 Antenna Description of EUT.....	8
3.3 Channel List.....	9
3.4 Test Mode Applicability and Tested Channel Detail.....	10
3.5 Duty Cycle of Test Signal.....	11
3.6 Test Program Used and Operation Descriptions .....	12
3.7 Connection Diagram of EUT and Peripheral Devices .....	12
3.8 Configuration of Peripheral Devices and Cable Connections .....	12
<b>4 Test Instruments .....</b>	<b>13</b>
4.1 RF Output Power.....	13
4.2 Power Spectral Density .....	13
4.3 6 dB Bandwidth .....	13
4.4 Conducted Out of Band Emissions .....	13
4.5 AC Power Conducted Emissions .....	14
4.6 Unwanted Emissions below 1 GHz .....	15
4.7 Unwanted Emissions above 1 GHz.....	16
<b>5 Limits of Test Items.....</b>	<b>17</b>
5.1 RF Output Power.....	17
5.2 Power Spectral Density .....	17
5.3 6 dB Bandwidth .....	17
5.4 Conducted Out of Band Emissions .....	17
5.5 AC Power Conducted Emissions .....	17
5.6 Unwanted Emissions below 1 GHz .....	17
5.7 Unwanted Emissions above 1 GHz.....	18
<b>6 Test Arrangements.....</b>	<b>19</b>
6.1 RF Output Power.....	19
6.1.1 Test Setup .....	19
6.1.2 Test Procedure.....	19
6.2 Power Spectral Density .....	19
6.2.1 Test Setup .....	19
6.2.2 Test Procedure.....	19
6.3 6 dB Bandwidth .....	20
6.3.1 Test Setup .....	20
6.3.2 Test Procedure.....	20
6.4 Conducted Out of Band Emissions .....	20
6.4.1 Test Setup .....	20
6.4.2 Test Procedure.....	20
6.5 AC Power Conducted Emissions .....	21
6.5.1 Test Setup .....	21
6.5.2 Test Procedure.....	21
6.6 Unwanted Emissions below 1 GHz .....	22
6.6.1 Test Setup .....	22
6.6.2 Test Procedure.....	23
6.7 Unwanted Emissions above 1 GHz.....	24
6.7.1 Test Setup .....	24
6.7.2 Test Procedure.....	24
<b>7 Test Results of Test Item .....</b>	<b>25</b>

7.1	RF Output Power.....	25
7.2	Power Spectral Density .....	26
7.3	6 dB Bandwidth .....	27
7.4	Conducted Out of Band Emissions .....	28
7.5	AC Power Conducted Emissions .....	29
7.6	Unwanted Emissions below 1 GHz .....	31
7.7	Unwanted Emissions above 1 GHz.....	35
<b>8</b>	<b>Pictures of Test Arrangements .....</b>	<b>37</b>
<b>9</b>	<b>Information of the Testing Laboratories .....</b>	<b>38</b>

## Release Control Record

Issue No.	Description	Date Issued
RFBCKS-WTW-P25020487-4	Original release.	2025/6/6

## 1 Certificate

**Product:** ADT Base

**Brand:** ADT

**Test Model:** ADTBASE502R0

**Sample Status:** Engineering sample

**Applicant:** Wistron NeWeb Corporation

**Test Date:** 2025/4/17 ~ 2025/5/2

**Standard:** 47 CFR FCC Part 15, Subpart C (Section 15.247)

**Measurement** ANSI C63.10-2013

**procedure:** KDB 558074 D01 15.247 Meas Guidance v05r02

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.

## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247(b)	RF Output Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	Pass	Minimum passing margin is -26.16 dB at 0.35000 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -9.8 dB at 87.69 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -21.8 dB at 3680.00 MHz
15.203	Antenna Requirement	Pass	Antenna connector is ipex(MHF) not a standard connector.

Note: 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	Specification	Expanded Uncertainty (k=2) (±)
RF Output Power	-	1.1 dB
Power Spectral Density	-	1.3 dB
6 dB Bandwidth	-	960 Hz
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.70 dB
AC Power Conducted Emissions	9 kHz ~ 30 MHz	2.90 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.00 dB
	30 MHz ~ 1 GHz	2.93 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

### 2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

### 3 General Information

#### 3.1 General Description

Product	ADT Base
Brand	ADT
Test Model	ADTBASE502R0
Status of EUT	Engineering sample
Power Supply Rating	12 Vdc from adapter 3.6 or 3.65 Vdc from battery
Modulation Type	DSSS OQPSK
Transfer Rate	100 kbps
Operating Frequency	912 MHz, 920 MHz
Number of Channel	2
Output Power	18.197 mW (12.60 dBm)

Note:

1. The EUT uses following accessories.

Item	Brand	Model	Specification
Battery 1	EVE	A0751	3.6 Vdc, 3000 mAh, 10.8 Wh
Battery 2	TENERGY	34435	3.65 Vdc, 2400 mAh, 8.76 Wh
AC Adapter	HOIOTO	ADS-26FSG-12	AC Input: 100-240 Vac, 50/60 Hz, 0.7 A DC Output: 12 Vdc, 1.5 A, 18 W Power Line: 1.5 m

2. Simultaneously transmission combination.

Combination	Technology				
1	WLAN (2.4 GHz)	BT LE	Z-wave	DECT	WWAN
2	WLAN (5 GHz)	BT LE	Z-wave	DECT	WWAN

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

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

### 3.2 Antenna Description of EUT

1. The antenna information is listed as below.

Ant. No.	Brand	Model	AntennaGain (dBi)	Frequency Range	Antenna Type	Connector Type
Z-wave	WNC	LS04B	2.82	908 MHz ~ 920 MHz	Dipole	ipex(MHF)

\* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.



### 3.3 Channel List

2 channels are provided to this EUT:

Channel	Frequency	Channel	Frequency
11	912 MHz	12	920 MHz

### 3.4 Test Mode Applicability and Tested Channel Detail

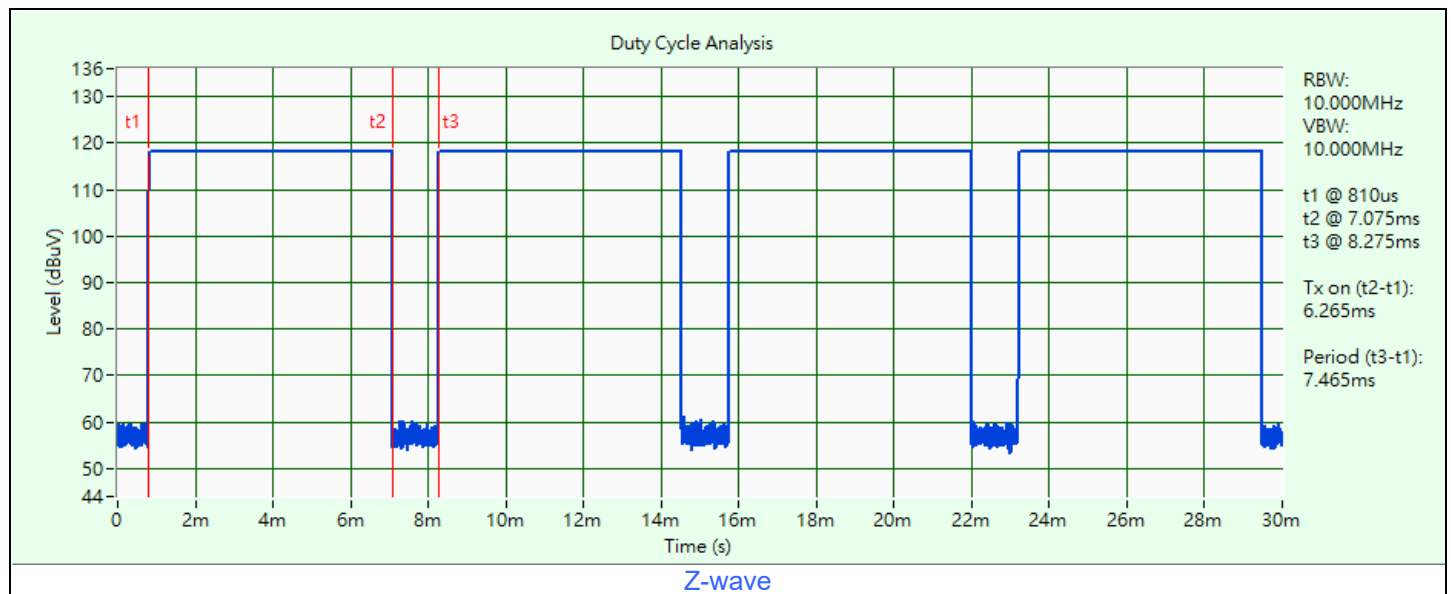
Pre-Scan:	1. The Battery has the following models: Battery 1/ Battery 2. Pre-scan these models of batteries and find the worst case as a representative test condition. 2. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
Worst Case:	1. Battery1/ Battery2 Worst Condition: Battery 1 2. The EUT is designed to be positioned on the Standing Mode only.

Following channel(s) was (were) selected for the final test as listed below:

Test Item	Tested Channel	Modulation
RF Output Power	11 (912MHz) 12 (920MHz)	DSSS OQPSK
Power Spectral Density	11 (912MHz) 12 (920MHz)	DSSS OQPSK
6 dB Bandwidth	11 (912MHz) 12 (920MHz)	DSSS OQPSK
Conducted Out of Band Emissions	11 (912MHz) 12 (920MHz)	DSSS OQPSK
AC Power Conducted Emissions	11 (912MHz)	DSSS OQPSK
Unwanted Emissions below 1 GHz	11 (912MHz) 12 (920MHz)	DSSS OQPSK
Unwanted Emissions above 1 GHz	11 (912MHz) 12 (920MHz)	DSSS OQPSK

### 3.5 Duty Cycle of Test Signal

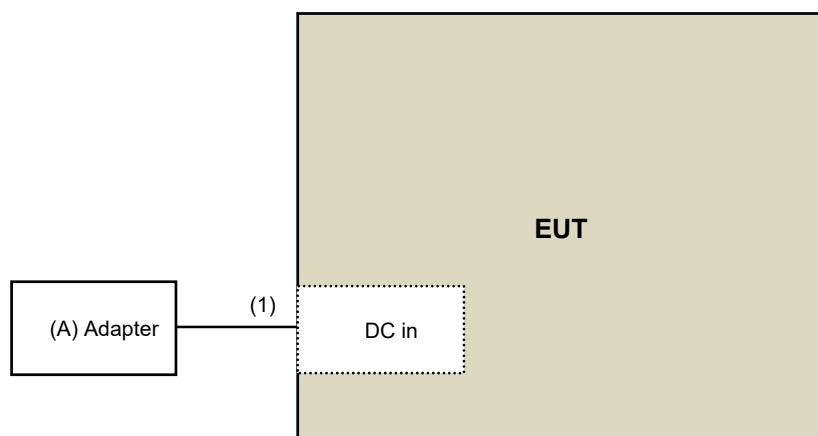
**Z-wave:** Duty cycle =  $6.265 \text{ ms} / 7.465 \text{ ms} \times 100\% = 83.9\%$ , duty factor =  $10 * \log (1/\text{Duty cycle}) = 0.76 \text{ dB}$



### 3.6 Test Program Used and Operation Descriptions

Controlling software (Tera Term v4.8) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

### 3.7 Connection Diagram of EUT and Peripheral Devices



### 3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Adapter	HOIOTO	ADS-26FSG-12	N/A	N/A	Supplied by applicant

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC Cable	1	1.5	N	0	Supplied by applicant

## 4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

### 4.1 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Pulse Power Sensor Anritsu	MA2411B	0738404	2024/5/13	2025/5/12
RF Power Meter Anritsu	ML2495A	0842014	2024/5/13	2025/5/12
USB Wideband Power Sensor Keysight	U2021XA	U2021XA_001	2024/6/7	2025/6/6

Notes:

1. The test was performed in LK - Oven
2. Tested Date: 2025/5/2

### 4.2 Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
PXA Signal Analyzer Keysight	N9030A	MY54490260	2024/7/17	2025/7/16
Signal Analyzer R&S	FSV40	101042	2024/9/12	2025/9/11
Software	ADT_RF Test Software V6.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in LK - Oven
2. Tested Date: 2025/5/2

### 4.3 6 dB Bandwidth

Refer to section 4.2 to get the tested date and information of the instruments.

### 4.4 Conducted Out of Band Emissions

Refer to section 4.2 to get the tested date and information of the instruments.

#### 4.5 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance	E1-011279	04	2024/11/28	2025/11/27
	E1-011280	05	2024/11/28	2025/11/27
	E1-011311	09	2024/11/28	2025/11/27
DC-LISN Schwarzbeck	NNBM 8126G	8126G-069	2024/11/5	2025/11/4
EMI Test Receiver R&S	ESCI	100613	2024/11/25	2025/11/24
Fixed Attenuator Mini-Circuits	HAT-10+	PAD-COND1-01	2025/1/5	2026/1/4
LISN R&S	ENV216	101826	2025/3/24	2026/3/23
	ESH3-Z5	100311	2024/9/5	2025/9/4
RF Coaxial Cable Woken	5D-FB	Cable-cond1-01	2025/1/5	2026/1/4
Software BVADT	BVADT_Cond_ V7.4.1.0	N/A	N/A	N/A
V-LISN Schwarzbeck	NNBL 8226-2	8226-142	2024/8/28	2025/8/27

**Notes:**

1. The test was performed in HY - Conduction 1.
2. Tested Date: 2025/4/28

#### 4.6 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-1213	2024/10/14	2025/10/13
EXA Signal Analyzer Agilent	N9010A	MY52220207	2024/12/30	2025/12/29
Loop Antenna TESEQ	HLA 6121	45745	2024/8/21	2025/8/20
MXE EMI Receiver Keysight	N9038B	MY60180019	2025/1/15	2026/1/14
Preamplifier EMCI	EMC330N	980782	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMCCFD400-NM-NM-500	201233	2025/1/14	2026/1/13
	EMCCFD400-NM-NM-3000	201235	2025/1/14	2026/1/13
	EMCCFD400-NM-NM-9000	201236(with PAD)	2025/1/14	2026/1/13
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2025/4/17

#### 4.7 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFT-151SS-0.5T	N/A	N/A	N/A
EXA Signal Analyzer Agilent	N9010A	MY52220207	2024/12/30	2025/12/29
Horn Antenna RFSPIN	DRH18-E	210103A18E	2024/11/10	2025/11/9
Horn Antenna Schwarzbeck	BBHA 9170	9170-1049	2024/11/10	2025/11/9
MXE EMI Receiver Keysight	N9038B	MY60180019	2025/1/15	2026/1/14
Preamplifier EMCI	EMC118A45SE	980808	2024/12/26	2025/12/25
	EMC184045SE	980788	2025/1/14	2026/1/13
RF Coaxial Cable EMCI	EMC101G-KM-KM-2000	201254	2025/1/14	2026/1/13
	EMC101G-KM-KM-3000	201258	2025/1/14	2026/1/13
	EMC101G-KM-KM-5000	201261	2025/1/14	2026/1/13
	EMC104-SM-SM-1000	210102	2025/1/14	2026/1/13
	EMC104-SM-SM-3000	201231	2025/1/14	2026/1/13
	EMC104-SM-SM-9000	201243	2025/1/14	2026/1/13
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MF-7802BS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208674	N/A	N/A

Notes:

1. The test was performed in WM - 966 chamber 8.
2. Tested Date: 2025/4/17 ~ 2025/4/18



## 5 Limits of Test Items

### 5.1 RF Output Power

For systems using digital modulation in the 902-928 MHz bands: 1 Watt (30 dBm)

### 5.2 Power Spectral Density

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz.

### 5.3 6 dB Bandwidth

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

### 5.4 Conducted Out of Band Emissions

Below 20 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

### 5.5 AC Power Conducted Emissions

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

Notes:

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.

### 5.6 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz 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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

## 5.7 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz 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)
Above 960	500	3

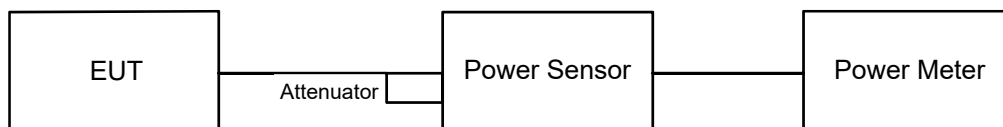
### Notes:

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.

## 6 Test Arrangements

### 6.1 RF Output Power

#### 6.1.1 Test Setup



#### 6.1.2 Test Procedure

##### Peak Power:

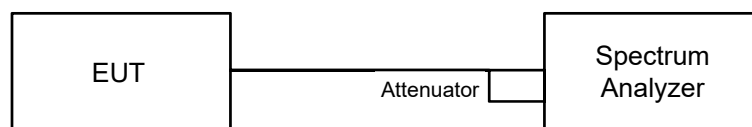
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

##### Average Power:

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

### 6.2 Power Spectral Density

#### 6.2.1 Test Setup

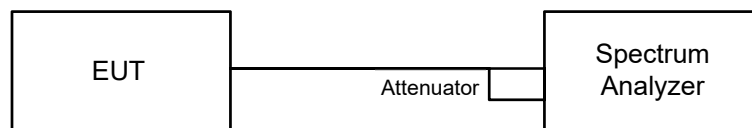


#### 6.2.2 Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz.
- Set the VBW  $\geq 3 \times$  RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

### 6.3 6 dB Bandwidth

#### 6.3.1 Test Setup

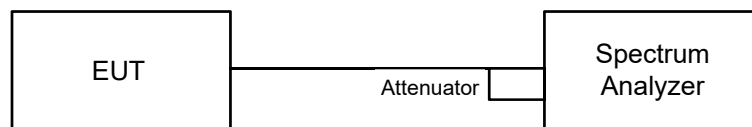


#### 6.3.2 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.4 Conducted Out of Band Emissions

#### 6.4.1 Test Setup



#### 6.4.2 Test Procedure

##### MEASUREMENT PROCEDURE REF

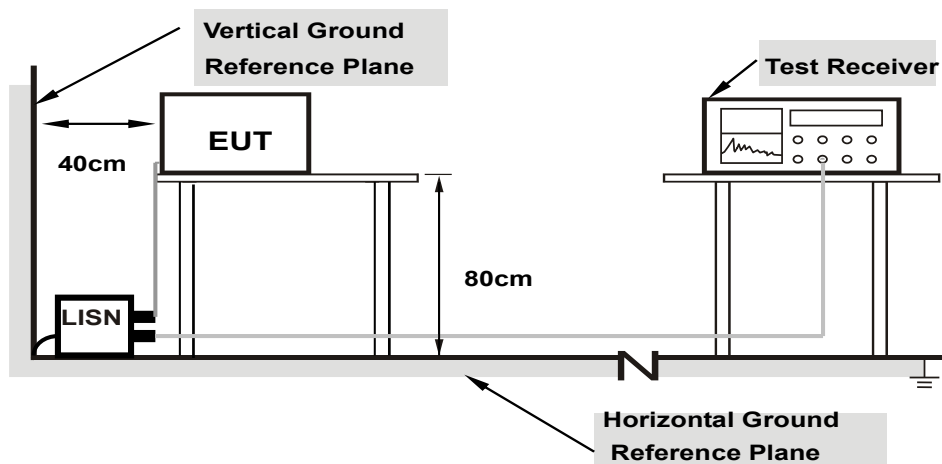
- Set the RBW = 100 kHz.
- Set the VBW  $\geq 300$  kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

##### MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW  $\geq 300$  kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

## 6.5 AC Power Conducted Emissions

### 6.5.1 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).

### 6.5.2 Test Procedure

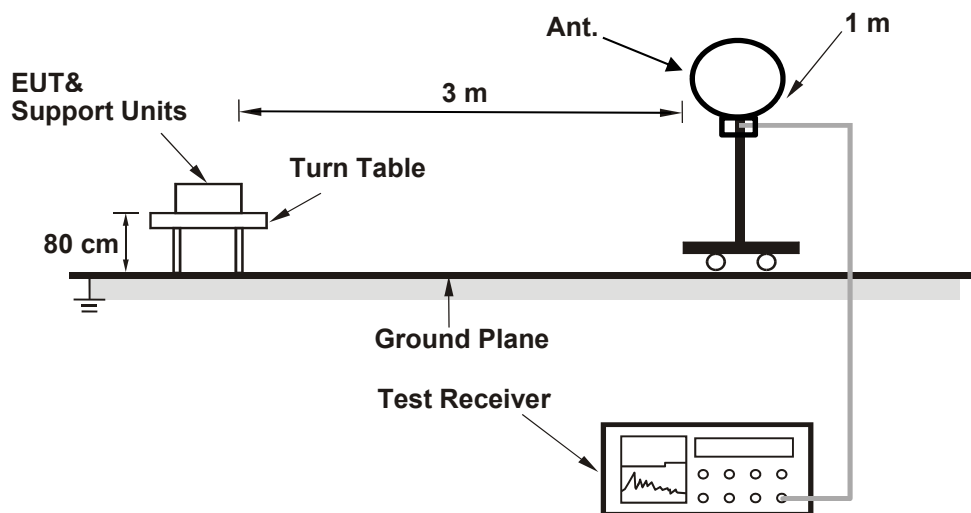
- The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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.

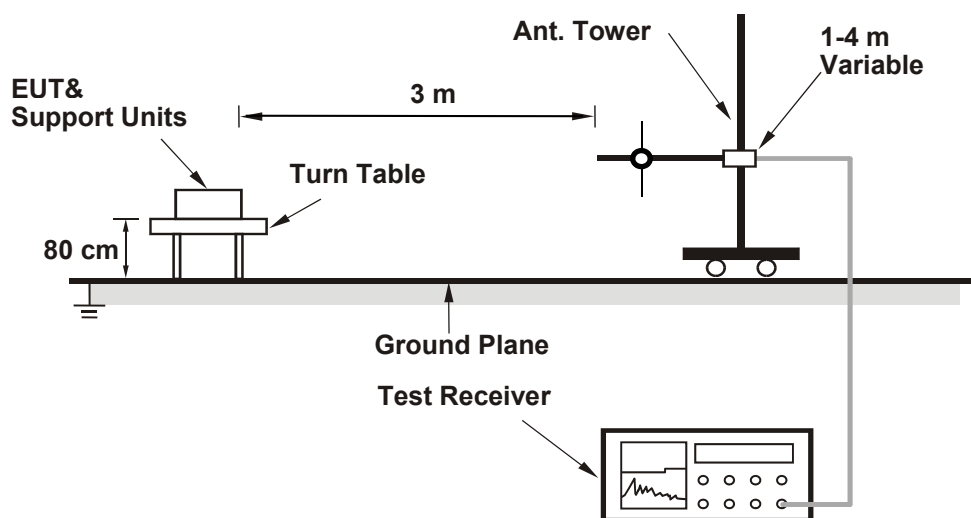
## 6.6 Unwanted Emissions below 1 GHz

### 6.6.1 Test Setup

#### For Radiated emission below 30 MHz



#### For Radiated emission above 30 MHz



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

## 6.6.2 Test Procedure

### 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 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. 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, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

#### Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

### For Radiated emission above 30 MHz

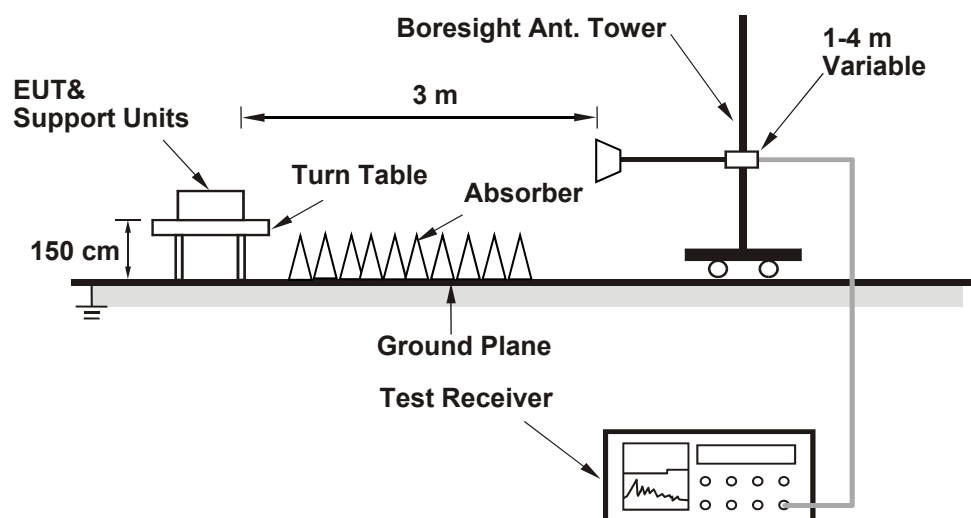
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

#### Notes:

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

## 6.7 Unwanted Emissions above 1 GHz

### 6.7.1 Test Setup



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

### 6.7.2 Test Procedure

- The EUT was placed on the top of a rotating table 1.5 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.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver/spectrum analyzer was set to peak and average detects 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.

#### Notes:

- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
- For fundamental and harmonic signal measurement, 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  $\geq 98\%$ ) for Average detection (AV) at frequency above 1 GHz.
- All modes of operation were investigated and the worst-case emissions are reported.



## 7 Test Results of Test Item

### 7.1 RF Output Power

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 76% RH	Tested By:	Waydi Tuan
--------------	----------------	---------------------------	--------------	------------	------------

#### For Peak Power

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
11	912	18.197	12.60	30	Pass
12	920	15.776	11.98	30	Pass

Note: The antenna gain is 2.82 dBi < 6 dBi, so the output power limit shall not be reduced.

#### For Average Power

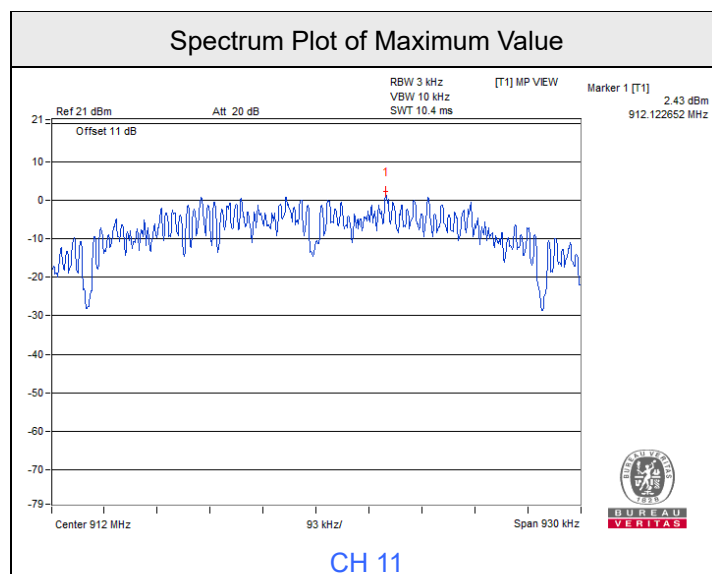
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
11	912	17.989	12.55
12	920	15.596	11.93

## 7.2 Power Spectral Density

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 76% RH	Tested By:	Waydi Tuan
--------------	----------------	---------------------------	--------------	------------	------------

Channel	Freq. (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Pass / Fail
11	912	2.43	8	Pass
12	920	1.80	8	Pass

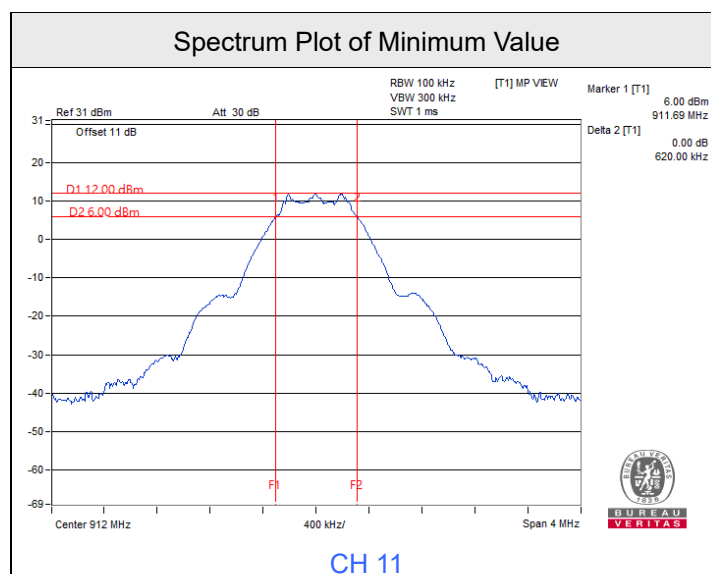
Note: The antenna gain is 2.82 dBi < 6 dBi, so the power density limit shall not be reduced.



### 7.3 6 dB Bandwidth

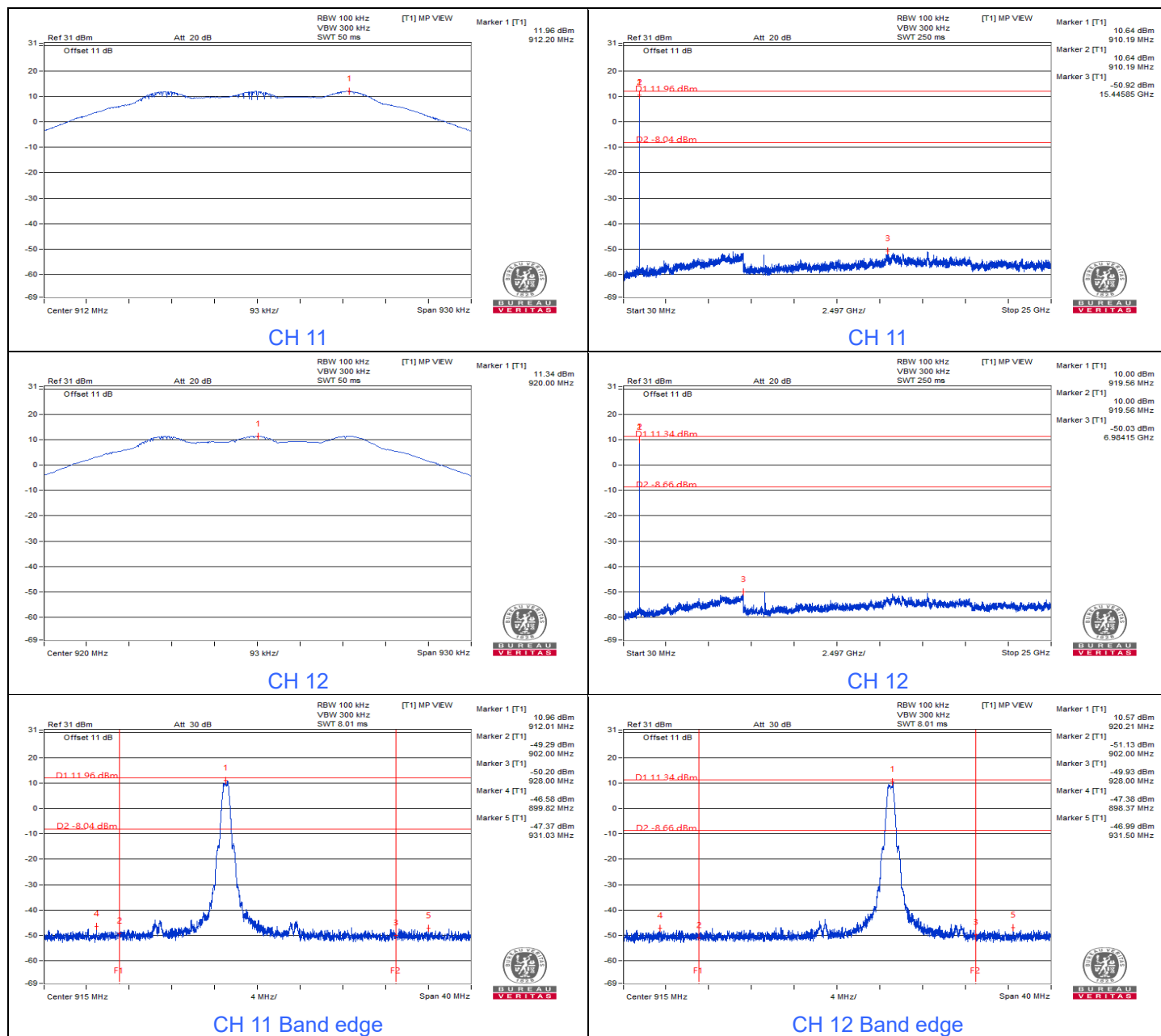
Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 76% RH	Tested By:	Waydi Tuan
--------------	----------------	---------------------------	--------------	------------	------------

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
11	912	0.62	0.5	Pass
12	920	0.62	0.5	Pass



## 7.4 Conducted Out of Band Emissions

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 76% RH	Tested By:	Waydi Tuan
--------------	----------------	---------------------------	--------------	------------	------------



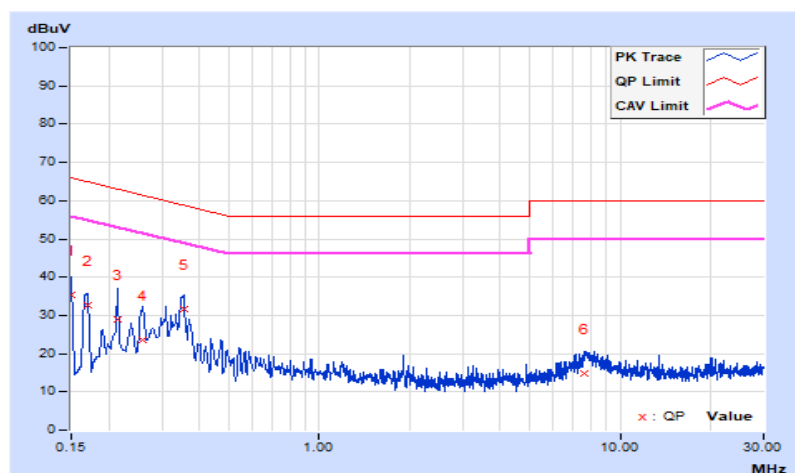
## 7.5 AC Power Conducted Emissions

RF Mode	Z-wave	Channel	CH 11 : 912 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 67 % RH
Tested By	Adair Peng		

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	9.75	25.63	5.73	35.38	15.48	66.00	56.00	-30.62	-40.52
2	0.16932	9.77	23.00	3.42	32.77	13.19	64.99	54.99	-32.22	-41.80
3	0.21400	9.80	19.25	4.96	29.05	14.76	63.05	53.05	-34.00	-38.29
4	0.25800	9.82	13.85	3.30	23.67	13.12	61.50	51.50	-37.83	-38.38
5	0.35400	9.86	21.95	10.82	31.81	20.68	58.87	48.87	-27.06	-28.19
6	7.56600	10.31	4.58	2.84	14.89	13.15	60.00	50.00	-45.11	-36.85

### 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

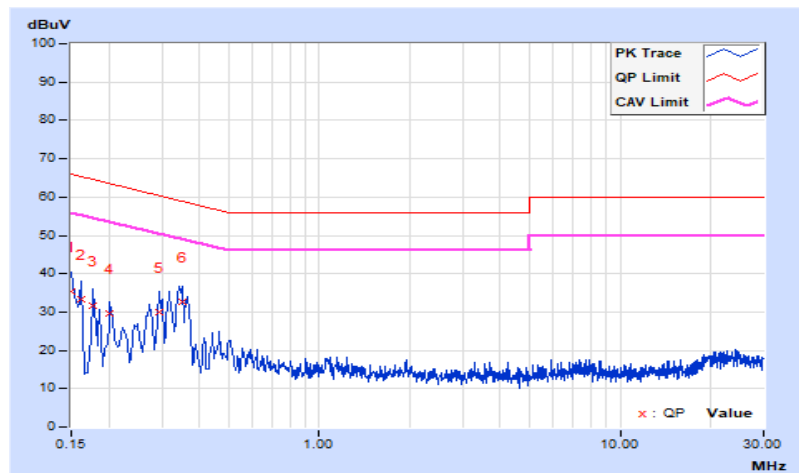


RF Mode	Z-wave	Channel	CH 11 : 912 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	23 °C, 67 % RH
Tested By	Adair Peng		

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	9.71	25.78	4.59	35.49	14.30	66.00	56.00	-30.51	-41.70
2	0.16190	9.71	23.68	3.47	33.39	13.18	65.37	55.37	-31.98	-42.19
3	0.17800	9.72	22.00	3.10	31.72	12.82	64.58	54.58	-32.86	-41.76
4	0.20200	9.72	19.97	3.52	29.69	13.24	63.53	53.53	-33.84	-40.29
5	0.29400	9.81	20.26	9.30	30.07	19.11	60.41	50.41	-30.34	-31.30
6	0.35000	9.86	22.94	12.54	32.80	22.40	58.96	48.96	-26.16	-26.56

#### 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



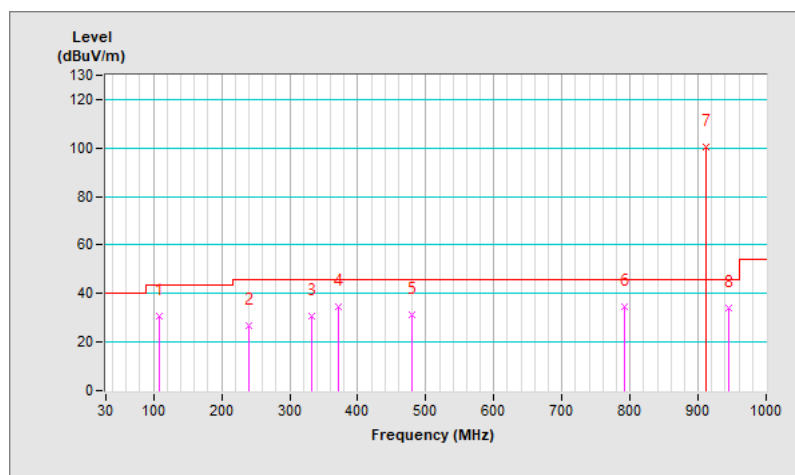
## 7.6 Unwanted Emissions below 1 GHz

RF Mode	Z-wave	Channel	CH 11 : 912 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	23.4 °C, 71.3 % RH
Tested By	Ian Chang		

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	109.03	30.8 QP	43.5	-12.7	2.91 H	267	46.6	-15.8
2	240.95	26.8 QP	46.0	-19.2	1.00 H	15	40.9	-14.1
3	332.13	30.6 QP	46.0	-15.4	2.57 H	227	41.5	-10.9
4	371.90	34.7 QP	46.0	-11.3	1.00 H	16	44.9	-10.2
5	480.54	31.2 QP	46.0	-14.8	1.43 H	90	38.6	-7.4
6	791.91	34.5 QP	46.0	-11.5	2.08 H	169	35.7	-1.2
7	*912.00	100.4 QP			1.00 H	197	69.2	31.2
8	944.20	33.9 QP	46.0	-12.1	1.81 H	136	33.5	0.4

### 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 of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.
5. " \* ": Fundamental frequency, the limit was restricted at the RF Output Power.

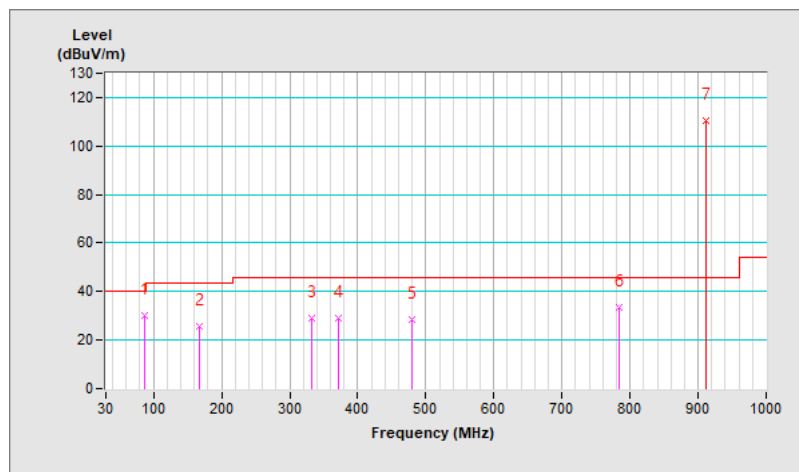


RF Mode	Z-wave	Channel	CH 11 : 912 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	23.4 °C, 71.3 % RH
Tested By	Ian Chang		

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	87.69	30.2 QP	40.0	-9.8	2.16 V	240	48.9	-18.7
2	168.20	25.7 QP	43.5	-17.8	2.43 V	272	38.6	-12.9
3	332.13	29.1 QP	46.0	-16.9	2.63 V	295	40.0	-10.9
4	371.90	29.1 QP	46.0	-16.9	3.81 V	20	39.3	-10.2
5	480.54	28.6 QP	46.0	-17.4	2.83 V	319	36.0	-7.4
6	784.15	33.3 QP	46.0	-12.7	3.12 V	351	34.6	-1.3
7	*912.00	110.4 QP			1.09 V	131	79.2	31.2

#### 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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.
5. " \* ": Fundamental frequency, the limit was restricted at the RF Output Power.



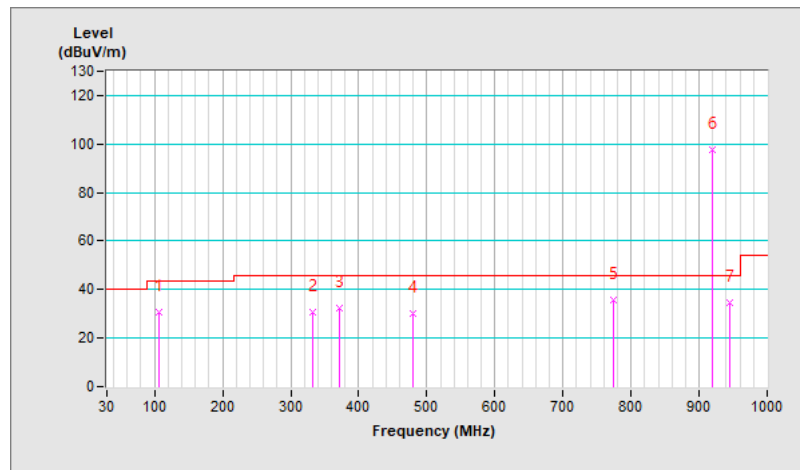


RF Mode	Z-wave	Channel	CH 12 : 920 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	23.4 °C, 71.3 % RH
Tested By	Ian Chang		

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	107.44	30.6 QP	43.5	-12.9	1.68 H	119	46.6	-16.0
2	331.76	30.7 QP	46.0	-15.3	1.97 H	153	41.6	-10.9
3	371.64	32.1 QP	46.0	-13.9	2.21 H	182	42.3	-10.2
4	479.32	30.4 QP	46.0	-15.6	2.57 H	225	37.8	-7.4
5	773.43	35.6 QP	46.0	-10.4	3.18 H	296	37.2	-1.6
6	*920.00	97.7 QP			1.00 H	198	97.5	0.2
7	945.91	34.6 QP	46.0	-11.4	2.91 H	264	34.2	0.4

#### 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 of frequency range 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.
5. " \* ": Fundamental frequency, the limit was restricted at the RF Output Power.

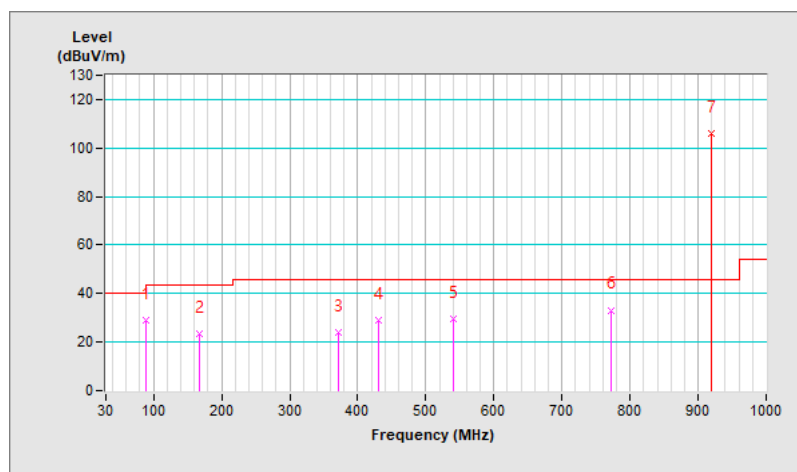


RF Mode	Z-wave	Channel	CH 12 : 920 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	23.4 °C, 71.3 % RH
Tested By	Ian Chang		

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	88.49	28.9 QP	43.5	-14.6	2.98 V	348	47.7	-18.8
2	167.26	23.4 QP	43.5	-20.1	3.15 V	8	36.1	-12.7
3	371.64	23.9 QP	46.0	-22.1	3.46 V	20	34.1	-10.2
4	431.46	28.9 QP	46.0	-17.1	3.74 V	20	37.3	-8.4
5	540.13	29.8 QP	46.0	-16.2	4.00 V	20	36.2	-6.4
6	772.44	33.2 QP	46.0	-12.8	3.96 V	20	34.8	-1.6
7	*920.00	106.0 QP			1.09 V	132	74.8	31.2

#### 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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.
5. " \* ": Fundamental frequency, the limit was restricted at the RF Output Power.



## 7.7 Unwanted Emissions above 1 GHz

<b>RF Mode</b>	Z-wave	<b>Channel</b>	CH 11 : 912 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=200 Hz, DET=Peak
<b>Input Power</b>	120 Vac, 60 Hz	<b>Environmental Conditions</b>	23.4 °C, 71.3 % RH
<b>Tested By</b>	Ian Chang		

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	#1824.00	36.0 PK			1.96 H	321	42.2	-6.2
2	#1824.00	23.5 AV			1.96 H	321	29.7	-6.2
3	3648.00	42.3 PK	74.0	-31.7	2.05 H	145	42.6	-0.3
4	3648.00	30.9 AV	54.0	-23.1	2.05 H	145	31.2	-0.3
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	#1824.00	37.4 PK			1.63 V	239	43.6	-6.2
2	#1824.00	23.9 AV			1.63 V	239	30.1	-6.2
3	3648.00	44.4 PK	74.0	-29.6	1.84 V	126	44.7	-0.3
4	3648.00	32.1 AV	54.0	-21.9	1.84 V	126	32.4	-0.3

### 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. " # ": The radiated frequency is out of the restricted band, the limit was restricted at the Conducted Out of Band Emissions.

<b>RF Mode</b>	Z-wave	<b>Channel</b>	CH 12 : 920 MHz
<b>Frequency Range</b>	1 GHz ~ 25 GHz	<b>Detector Function &amp; Bandwidth</b>	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=200 Hz, DET=Peak
<b>Input Power</b>	120 Vac, 60 Hz	<b>Environmental Conditions</b>	23.4 °C, 71.3 % RH
<b>Tested By</b>	Ian Chang		

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	#1840.00	36.2 PK			1.82 H	154	42.2	-6.0
2	#1840.00	23.4 AV			1.82 H	154	29.4	-6.0
3	3680.00	42.0 PK	74.0	-32.0	1.74 H	152	42.2	-0.2
4	3680.00	31.1 AV	54.0	-22.9	1.74 H	152	31.3	-0.2
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	#1840.00	36.4 PK			1.85 V	241	42.4	-6.0
2	#1840.00	23.7 AV			1.85 V	241	29.7	-6.0
3	3680.00	44.1 PK	74.0	-29.9	1.85 V	264	44.3	-0.2
4	3680.00	32.2 AV	54.0	-21.8	1.85 V	264	32.4	-0.2

**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.
5. " # ": The radiated frequency is out of the restricted band, the limit was restricted at the Conducted Out of Band Emissions.

## 8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

## 9 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@bureauveritas.com](mailto:service.adt@bureauveritas.com)

**Web Site:** <http://ee.bureauveritas.com.tw>

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

--- END ---