	BUREAU VERITAS
	FCC Test Report
-	RF171128D08
	EMJMHSA-P003M
	HSA-P003M
Received Date:	
	Jan. 4 ~ 9, 2018
Issued Date:	Jan. 15, 2018
Applicant:	PRIMAX ELECTRONICS LTD.
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Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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Designation Number.	
	ANTIN.
	Iac-MRA
	Testing Laboratory 2021
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# **Release Control Record**

Issue No.	Description	Date Issued
RF171128D08	Original release.	Jan. 15, 2018



## 1 Certificate of Conformity

Product:	Mouse
Brand:	hp
Test Model:	HSA-P003M
Sample Status:	Engineering sample
Applicant:	PRIMAX ELECTRONICS LTD.
Test Date:	Jan. 4 ~ 9, 2018
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.249)
	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 :

Jessica Cheng / Senior Specialist

Approved by :

Rex Lai / Associate Technical Manager

Jan. 15, 2018

Jan. 15, 2018

Date:

Date:



# 2 Summary of Test Results

	47 CFR FCC Part 15, Subpart C (SECTION 15.249)					
FCC Clause	Test Item	Result	Remarks			
15.207	AC Power Conducted Emission	N/A	Power supply is 3Vdc from batteries			
15.215	Channel Bandwidth Measurement	PASS	Meet the requirement.			
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -4.52dB at 2483.50MHz.			
15.203	Antenna Requirement	PASS	No antenna connector is used.			

# 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:

Frequency	Expanded Uncertainty (k=2) (±)
9kHz ~ 30MHz	2.38 dB
30MHz ~ 1000MHz	5.54 dB
Above 1GHz	5.48 dB
	9kHz ~ 30MHz 30MHz ~ 1000MHz

# 2.2 Modification Record

There were no modifications required for compliance.



# 3 General Information

# 3.1 General Description of EUT

Product	Mouse
Brand	hp
Test Model	HSA-P003M
Status of EUT	Engineering sample
Power Supply Rating	3Vdc from batteries
Modulation Type	GFSK
Operating Frequency	2402MHz ~ 2479MHz
Number of Channel	78
Antenna Type	Printed antenna with 3.15 dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

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 Description of Test Modes

78 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460		
19	2421	39	2441	59	2461		



# 3.2.1 Test Mode Applicability and Tested Channel Detail

		APPLIC						
CONFIGURE MODE	RE≥1G	RE<1G	PLC	APCM		DESCRIPTION		
-		√	Note 1	√	-			
here RE≥1G: Radiated Emission above 1GHz & RE<1G: Radiated Emission below 1GHz								
PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement								
<b>DTE 1</b> : No need to concern of Conducted Emission due to the EUT is powered by batteries								
adiated Em	nission Tes	t (Above 1G	Hz):					
between architectu	available m ıre).	odulations, d	ata rates and	l antenna po	rts (if EUT with ar	ossible combinations Itenna diversity		
-	channel(s) FIGURE MODE		ABLE CHANN		as listed below.	MODULATION TYPE		
EUTCON	IGURE WODE		-					
	-		0 to 77		0, 39, 77	GFSK		
	available m				e mode from all po rts (if EUT with ar	ossible combinations Itenna diversity		
between architectu Following	available m ıre). ı channel(s)	odulations, da	ata rates and selected for t	l antenna po he final test	rts (if EUT with ar as listed below.	ntenna diversity		
between architectu Following	available m ıre).	odulations, da	ata rates and	l antenna po he final test	rts (if EUT with ar			
EUT CONF ■ Following EUT CONF ■ This item mode. ■ Pre-Scan between architectu	available m ire).   channel(s)   GURE MODE - - <u>t Conducte</u> includes all has been c available m ire).	odulations, da was (were) s AVAIL ded Measuren l test value of conducted to odulations, da	ata rates and selected for t ABLE CHANN 0 to 77 nent: f each mode, determine th ata rates and	l antenna po he final test EL TE but only inc e worst-case l antenna po	rts (if EUT with an as listed below. STED CHANNEL 0 ludes spectrum pl e mode from all po rts (if EUT with an	MODULATION TYPE GFSK ot of worst value of each ossible combinations		
between architectu Following EUT CONF UT CONF This item mode. Pre-Scan between architectu Following	available m ire). I channel(s) <b>FIGURE MODE</b> - - <b>t Conducte</b> includes all has been c available m ire). I channel(s)	odulations, da was (were) s AVAIL ad Measuren test value of conducted to odulations, da was (were) s	ata rates and selected for t ABLE CHANN 0 to 77 nent: f each mode, determine th ata rates and selected for t	antenna po he final test EL TE but only inc e worst-case antenna po he final test	rts (if EUT with an as listed below. STED CHANNEL 0 ludes spectrum pl e mode from all po rts (if EUT with an as listed below.	MODULATION TYPE GFSK ot of worst value of each ossible combinations ntenna diversity		
between architectu Following EUT CONF CONF CONF CONF CONF CONF CONF CONF	available m ire).   channel(s)   GURE MODE - - <u>t Conducte</u> includes all has been c available m ire).	odulations, da was (were) s AVAIL AVAIL ed Measuren l test value of conducted to odulations, da was (were) s AVAILAI	ata rates and selected for t ABLE CHANN 0 to 77 nent: f each mode, determine th ata rates and selected for t	antenna po he final test EL TE but only inc e worst-case antenna po he final test	rts (if EUT with an as listed below. <b>STED CHANNEL</b> 0 ludes spectrum pl e mode from all po rts (if EUT with an as listed below. <b>TED CHANNEL</b>	MODULATION TYPE         GFSK         ot of worst value of each         ossible combinations         itenna diversity         MODULATION TYPE		
<ul> <li>between architectu</li> <li>Following</li> <li>EUT CONF</li> <li>Antenna Poi</li> <li>This item mode.</li> <li>Pre-Scan between architectu</li> <li>Following</li> </ul>	available m ire). I channel(s) <b>FIGURE MODE</b> - - <b>t Conducte</b> includes all has been c available m ire). I channel(s)	odulations, da was (were) s AVAIL AVAIL ed Measuren l test value of conducted to odulations, da was (were) s AVAILAI	ata rates and selected for t ABLE CHANN 0 to 77 nent: f each mode, determine th ata rates and selected for t	antenna po he final test EL TE but only inc e worst-case antenna po he final test	rts (if EUT with an as listed below. STED CHANNEL 0 ludes spectrum pl e mode from all po rts (if EUT with an as listed below.	MODULATION TYPE GFSK ot of worst value of each ossible combinations ntenna diversity		
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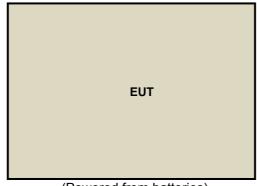
APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	21deg. C, 76%RH	3Vdc	James Wei
RE<1G	21deg. C, 76%RH	3Vdc	James Wei
APCM	25deg. C, 76%RH	3Vdc	Saxon Lee



# 3.3 Description of Support Units

The EUT has been tested as an independent unit together without any necessary accessory or support unit.

# 3.3.1 Configuration of System under Test



(Powered from batteries)

### 3.4 General Description of Applied Standards

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

## FCC Part 15, Subpart C (15.249)

ANSI C63.10-2013

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



## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

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
HP Preamplifier	8447D	2432A03504	Feb. 21, 2017	Feb. 20, 2018
HP Preamplifier	8449B	3008A01201	Feb. 22, 2017	Feb. 21, 2018
MITEQ Preamplifier	AMF-6F-260400-33-8P	892164	Feb. 21, 2017	Feb. 20, 2018
Agilent TEST RECEIVER	N9038A	MY51210129	Feb. 8, 2017	Feb. 7, 2018
Schwarzbeck Antenna	VULB 9168	139	Nov. 29, 2017	Nov. 28, 2018
Schwarzbeck Antenna	VHBA 9123	480	May 19, 2017	May 18, 2019
Schwarzbeck Horn Antenna	BBHA-9170	212	Dec. 1, 2017	Nov. 30, 2018
Schwarzbeck Horn Antenna	BBHA 9120-D1	D130	Dec. 1, 2017	Nov. 30, 2018
ADT. Turn Table	TT100	0306	NA	NA
ADT. Tower	AT100	0306	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
SUHNER RF cable With 4dB PAD	SF104	CABLE-CH6	Aug. 14, 2017	Aug. 13, 2018
SUHNER RF cable With 3dB PAD	SF102	Cable-CH8-3.6m	Aug. 14, 2017	Aug. 13, 2018
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	May 31,2017	May 30,2018
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Jul. 26, 2017	Jul. 25, 2018
Loop Antenna EMCI	LPA600	270	Aug. 11, 2017	Aug. 10, 2019
EMCO Horn Antenna	3115	00028257	Nov. 30, 2017	Nov. 29, 2018
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	NA	NA
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 29, 2017	Sep. 28, 2018
Anritsu Power Sensor	MA2411B	0738404	Apr. 24, 2017	Apr. 23, 2018
Anritsu Power Meter	ML2495A	0842014	Apr. 24, 2017	Apr. 23, 2018

**NOTE:** 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.

2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

3. The test was performed in Chamber No. 6.

4. The Industry Canada Reference No. IC 7450E-6.



### 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. Both X and Y axes 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.
- f. The test-receiver system was set to peak and average detect 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:

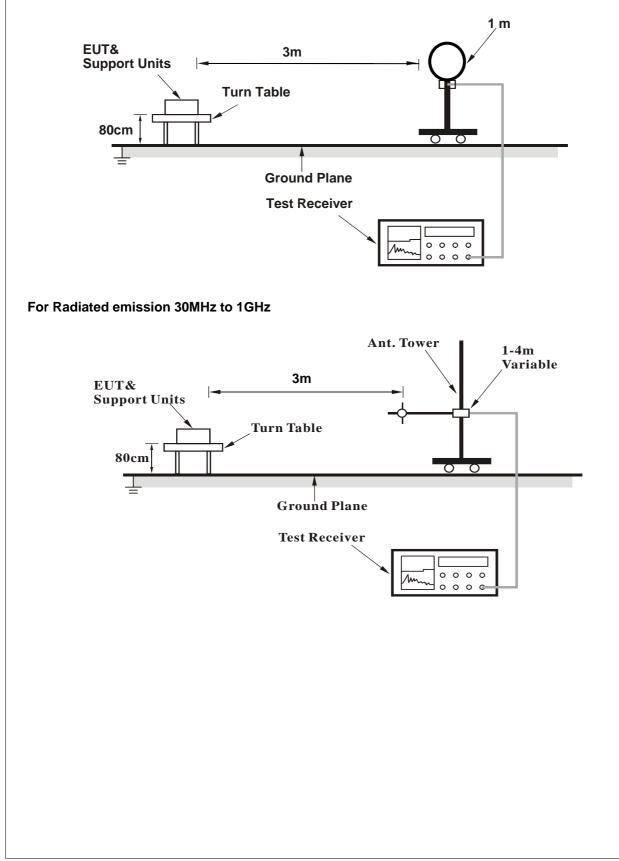
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- 3. 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 above 1GHz Ant. Tower 1-4m Variable EUT& 3m **Support Units Turn Table** Absorber 150cm 00 **Ground Plane Test Receiver** 0 0 0 0 0 0 0 G

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

# 4.1.6 EUT Operating Conditions

Set the EUT under transmission condition continuously at specific channel frequency continuously.



### 4.1.7 Test Results

#### **ABOVE 1GHz DATA**

CHANNEL	TX Channel 0	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	2390.00	62.32 PK	74.00	-11.68	1.49 H	149	64.30	-1.98	
2	2390.00	38.39 AV	54.00	-15.61	1.49 H	149	40.37	-1.98	
3	2400.00	54.80 PK	74.00	-19.20	1.49 H	149	56.85	-2.05	
4	2400.00	12.24 AV	54.00	-41.76	1.49 H	149	14.29	-2.05	
5	*2402.00	98.78 PK	114.00	-15.22	1.49 H	149	100.85	-2.07	
6	*2402.00	56.22 AV	94.00	-37.78	1.49 H	149	58.29	-2.07	
7	4804.00	49.78 PK	74.00	-24.22	1.02 H	88	45.75	4.03	
8	4804.00	7.22 AV	54.00	-46.78	1.02 H	88	3.19	4.03	
	ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ.	EMISSION LEVEL			ANTENNA HEIGHT	TABLE ANGLE	RAW VALUE	CORRECTION FACTOR	

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.41 PK	74.00	-18.59	3.85 V	219	57.39	-1.98
2	2390.00	38.51 AV	54.00	-15.49	3.85 V	219	40.49	-1.98
3	2400.00	48.92 PK	74.00	-25.08	3.85 V	219	50.97	-2.05
4	2400.00	6.36 AV	54.00	-47.64	3.85 V	219	8.41	-2.05
5	*2402.00	92.90 PK	114.00	-21.10	3.85 V	219	94.97	-2.07
6	*2402.00	50.34 AV	94.00	-43.66	3.85 V	219	52.41	-2.07
7	4804.00	48.47 PK	74.00	-25.53	1.00 V	322	44.44	4.03
8	4804.00	5.91 AV	54.00	-48.09	1.00 V	322	1.88	4.03

## **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

- 3. The other emission levels were very low against the limit.
- 4. Margin value = Emission Level Limit value
- 5. " \* ": Fundamental frequency.
- 6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

 $20 \log(\text{Duty cycle}) = 20 \log(0.12 \text{ ms}/16.11 \text{ ms}) = -42.56 \text{ dB}$ Please see page 18 for plotted duty.

CHANNEL	TX Channel 39	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M									
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)		
1	*2441.00	97.55 PK	114.00	-16.45	1.63 H	150	99.86	-2.31		
2	*2441.00	54.99 AV	94.00	-39.01	1.63 H	150	57.30	-2.31		
3	4882.00	49.48 PK	74.00	-24.52	1.00 H	81	45.28	4.20		
4	4882.00	6.92 AV	54.00	-47.08	1.00 H	81	2.72	4.20		
		ANTENNA		/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М			
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)		
1	*2441.00	92.24 PK	114.00	-21.76	3.88 V	201	94.55	-2.31		
2	*2441.00	49.68 AV	94.00	-44.32	3.88 V	201	51.99	-2.31		
3	4882.00	48.47 PK	74.00	-25.53	1.00 V	11	44.27	4.20		
4	4882.00	5.91 AV	54.00	-48.09	1.00 V	11	1.71	4.20		

## **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

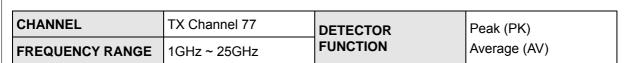
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

- 4. Margin value = Emission Level Limit value
- 5. " \* ": Fundamental frequency.
- 6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

20 log(Duty cycle) = 20 log(0.12 ms /16.11 ms) = -42.56 dB

Please see page 18 for plotted duty.



	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2479.00	97.67 PK	114.00	-16.33	1.60 H	144	99.67	-2.00	
2	*2479.00	55.11 AV	94.00	-38.89	1.60 H	144	57.11	-2.00	
3	2483.50	69.48 PK	74.00	-4.52	1.60 H	144	71.42	-1.94	
4	2483.50	37.88 AV	54.00	-16.12	1.60 H	144	39.82	-1.94	
5	4958.00	49.29 PK	74.00	-24.71	1.01 H	87	45.22	4.07	
6	4958.00	6.73 AV	54.00	-47.27	1.01 H	87	2.66	4.07	
		ANTENNA	<b>POLARIT</b>	& TEST DI	STANCE: V	ERTICAL A	Т 3 М		
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	*2479.00	92.29 PK	114.00	-21.71	3.66 V	213	94.29	-2.00	
2	*2479.00	49.73 AV	94.00	-44.27	3.66 V	213	51.73	-2.00	
3	2483.50	64.24 PK	74.00	-9.76	3.66 V	213	66.18	-1.94	
				10.07	3.66 V	213	39.27	-1.94	
4	2483.50	37.33 AV	54.00	-16.67	3.00 V	215	55.21	1.54	
4 5	2483.50 4958.00	37.33 AV 48.26 PK	54.00 74.00	-16.67 -25.74	1.12 V	73	44.19	4.07	

### **REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

5. " \* ": Fundamental frequency.

6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty factor is calculated from following formula:

20 log(Duty cycle) = 20 log(0.12 ms /16.11 ms) = -42.56 dB

Please see page 18 for plotted duty.



Marker 3 Δ         16.1100 ms         PNO: Fast ++-         Trig: Free Run         Avg Type: Log-Pwr         Trace [] 2.8.4 st         Marker           PNO: Fast ++-         Fig: Free Run         Avg Type: Log-Pwr         Trace [] 2.8.4 st         Select Ma           0 dE/div         Ref Offset 10 dB         Amkr3 16.11 ms         -0.01 dB         Select Ma           0 dE/div         Ref 116.99 dBµV         -0.01 dB         -0.01 dB         Fig: Free Run         Fig: Free Run         -0.01 dB         Fig: Free Run         Fig: Free R		PRESEL 50 Q AC		SENSE:INT	ALIGN OFF	11:08:40 AM Jan 04, 2018	
PHO: Feat       #Atten: 10 dB       Det P P NNNN         Ref Offset 10 dB       ΔMkr3 16.11 ms -0.01 dB       Select Ma         0 dB/div       Ref 116.99 dBµV       -0.01 dB       -0.01 dB         107       1Δ2       3Δ4       No         97.0       1Δ2       3Δ4       No         107       1Δ2       1Δ2       1Δ2         107       1Δ2       1Δ2       1Δ2       1Δ2         107       1Δ2       1Δ2       1Δ2       1Δ2         107       1Δ2       1Δ2       1Δ2       1Δ2         107       100       100       100       100         102       100       100       100       100     <						TRACE 1 2 3 4 5 6	Marker
Ref Offset 10 dB         ΔMkr3 16.11 ms           0 dB/div         Ref 116.99 dBµV         -0.01 dB           107         1Δ2         3Δ4           107         3Δ4         No           107         1Δ2         3Δ4           107         3Δ4         No           107         1Δ2         3Δ4           107         1Δ2         1Δ2           107         1Δ2         1Δ2           107         1Δ2         1Δ2           107         1Δ2         1Δ14           107         100         100           108         100         100           100         100         100           100         100         100           100         100         100           100         100						DET P P N N N N	Select Marker
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	dB/div		μV		Δ		3
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	.0		- v			3∆4	Norma
π///μm         x         Y         Function         Function </td <td>.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Delt</td>	.0						Delt
A2         1         Ch         Y         Function         Function vibit         Function value           Δ2         1         t         (Δ)         0.19 dB         2         F         1         1         1         10.0         16.11 ms         (Δ)         0.01 dB         4         F         1         1         7.680 ms         94.96 dB <sub>1</sub> /V         5         4         F         1         1         7.680 ms         94.96 dB <sub>1</sub> /V         5         4         F         1         1         7.680 ms         94.96 dB <sub>1</sub> /V         5         4         7         7         4         6         1         1         6         1         7         7         94.96 dB <sub>1</sub> /V         5         6         1         7         7         94.96 dB <sub>1</sub> /V         5         6         6         1 <t< td=""><td>.0 <b></b></td><td>bryn, yn if Holpenstryn yn fylden dan</td><td>en anna fanen diosadad</td><td>ip-willing-top-party-top-party-</td><td>หากรูปัน-านไขมีผู้เป็นขับของสูงที่มาในกรียนแล้งของจ</td><td>มกระจะสุขุมาสารณาให้ระบบให้สุมที่สารให</td><td>Fixed</td></t<>	.0 <b></b>	bryn, yn if Holpenstryn yn fylden dan	en anna fanen diosadad	ip-willing-top-party-top-party-	หากรูปัน-านไขมีผู้เป็นขับของสูงที่มาในกรียนแล้งของจ	มกระจะสุขุมาสารณาให้ระบบให้สุมที่สารให	Fixed
Δ2         1         t         Δ2         1         t         Δ2         0.19 dB           2         F         1         t         7.680 ms         94.96 dBµV         94.9		2000000 GHz					
2         F         1         t         7.680 ms         94.96 dBμV           3         Δ4         1         t         (Δ)         16.11 ms         (Δ)         -0.01 dB           4         F         1         t         7.680 ms         94.96 dBμV         Proper           5         -         -         7.680 ms         94.96 dBμV         Proper           6         -         -         -         -         -           7         -         -         -         -         -			#VBW	/ 3.0 MHz	Sweep 3	Span 0 Hz 0.00 ms (1001 pts)	0
	R MODE TRC	d <b>B) 1.05 MHz</b>	x	Y		0.00 ms (1001 pts)	O
	BW (-66 Δ2 1 F 1 Δ4 1 F 1	dB) 1.05 MHz scl × t (Δ) t	× <u>120.0 μs</u> (Δ) 7.680 ms 16.11 ms (Δ)	Υ -0.19 dB 94.96 dBμV -0.01 dB		0.00 ms (1001 pts)	
2 STATUS	R MODE TRC Δ2 1 F 1 Δ4 1 F 1 Δ4 1 F 1	dB) 1.05 MHz scl × t (Δ) t	× <u>120.0 μs</u> (Δ) 7.680 ms 16.11 ms (Δ)	Υ -0.19 dB 94.96 dBμV -0.01 dB		0.00 ms (1001 pts)	Properties
	S BW (-66 Δ2 1 F 1 Δ4 1 F 1 Δ4 1 F 1	dB) 1.05 MHz scl × t (Δ) t	× <u>120.0 μs</u> (Δ) 7.680 ms 16.11 ms (Δ)	Υ -0.19 dB 94.96 dBμV -0.01 dB	FUNCTION FUNCTION WIDTH	0.00 ms (1001 pts) FUNCTION VALUE	O Properties Mor 1 of



# **BELOW 1GHz WORST-CASE DATA**

CHANNEL	TX Channel 0	DETECTOR	Over Deels (OD)
FREQUENCY RANGE	9kHz ~ 1GHz	FUNCTION	Quasi-Peak (QP)

	ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	107.79	25.04 QP	43.50	-18.46	1.00 H	0	37.85	-12.81	
2	333.80	20.96 QP	46.00	-25.04	4.00 H	231	27.31	-6.35	
3	473.77	24.90 QP	46.00	-21.10	3.00 H	331	28.11	-3.21	
4	659.29	28.79 QP	46.00	-17.21	4.00 H	141	28.32	0.47	
5	728.35	30.44 QP	46.00	-15.56	2.00 H	264	28.42	2.02	
6	876.08	32.13 QP	46.00	-13.87	4.00 H	170	27.72	4.41	
		ANTENNA		/ & TEST DI	STANCE: V	ERTICAL A	Т 3 М		
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)	
1	107.70	33.98 QP	43.50	-9.52	2.00 V	0	46.80	-12.82	
2	278.76	19.25 QP	46.00	-26.75	3.00 V	159	27.18	-7.93	
3	409.66	22.58 QP	46.00	-23.42	2.00 V	360	27.53	-4.95	
4	574.61	26.42 QP	46.00	-19.58	4.00 V	47	27.59	-1.17	
5	723.26	31.16 QP	46.00	-14.84	4.00 V	0	29.32	1.84	
6	872.06	32.54 QP	46.00	-13.46	2.00 V	183	28.17	4.37	

# **REMARKS**:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

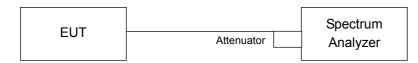
3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value



### 4.2 Channel Bandwidth

### 4.2.1 Test Setup



### 4.2.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.2.3 Test Procedure

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. Repeat above procedures until all frequencies measured were complete.
- 4.2.4 Deviation from Test Standard

No deviation.

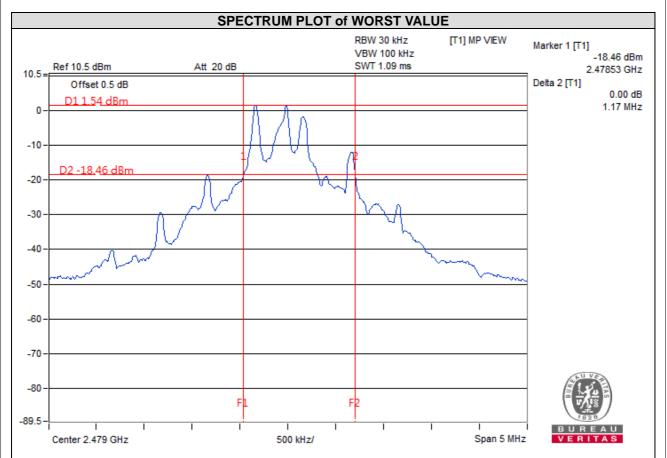
### 4.2.5 EUT Operating Condition

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.



## 4.2.6 Test Results

CHANNEL	FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	1.16
39	2441	1.16
77	2479	1.17





# 5 Pictures of Test Arrangements

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



## Appendix – Information on 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:

# Linko EMC/RF Lab

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Email: <u>service.adt@tw.bureauveritas.com</u> Web Site: <u>www.bureauveritas-adt.com</u>

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

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