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FCC TEST REPORT

REPORT NO.: RF130626E04

MODEL NO.: WM324

FCC ID: JNZWM324

RECEIVED: June 26, 2013

TESTED: June 27 to July 02, 2013

ISSUED: July 23, 2013

APPLICANT: LOGITECH FAR EAST LTD.

ADDRESS: #2 Creation Rd. 4, Science-Based Ind. Park Hsinchu
Taiwan, R.O.C.

ISSUED BY: Bureau Veritas Consumer Products Services (H.K.) Ltd.,
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LAB ADDRESS : No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen,
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

TEST LOCATION (1): No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen,
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TEST LOCATION (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung
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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130626E04	Original release	July 23, 2013



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1 CERTIFICATION

PRODUCT : 2.4GHz Cordless Mouse

BRAND NAME : DELL

MODEL NO. : WM324

TEST SAMPLE : ENGINEERING SAMPLE

APPLICANT : LOGITECH FAR EAST LTD.

TESTED : June 27 to July 02, 2013

STANDARDS : FCC Part 15, Subpart C (Section 15.249)

ANSI C63.10-2009

The above equipment (Model: WM324) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : , **DATE:** July 23, 2013
(Claire Kuan, Specialist)

APPROVED BY : , **DATE:** July 23, 2013
(May Chen, Manager)



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2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C (Section 15.249)			
STANDARD PARAGRAPH	TEST TYPE	RESULT	REMARK
15.207	Conducted Emission Test	NA	Power from battery.
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 -6.1dB at 54.30MHz

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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Measurement	Value
Radiated emissions (30MHz-1GHz)	5.63 dB
Radiated emissions (1GHz -6GHz)	3.73 dB
Radiated emissions (6GHz -18GHz)	3.90 dB
Radiated emissions (18GHz -40GHz)	4.11 dB



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3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	2.4GHz Cordless Mouse
MODEL NO.	WM324
POWER SUPPLY	DC 1.5V from battery
MODULATION TYPE	GFSK
CARRIER FREQUENCY OF EACH CHANNEL	2405MHz ~ 2474MHz
NUMBER OF CHANNEL	12
ANTENNA TYPE	PCB printed Antenna with 0.15 dBi gain
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	2.4GHz Transceiver × 1 (Brand: Logitech / Model: C-U0007)

NOTE:

1. The EUT operates in the 2.4GHz frequency spectrum and complies with GFSK techniques.
2. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.



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3.2 DESCRIPTION OF TEST MODES

Twelve channels are provided in this EUT.

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2405	4	2417	7	2441	10	2465
2	2408	5	2432	8	2444	11	2471
3	2414	6	2435	9	2462	12	2474

3.3 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

Where

RE<1G: Radiated Emission below 1GHz**RE³1G:** Radiated Emission above 1GHz**PLC:** Power Line Conducted Emission**NOTE:** No need to concern of Conducted Emission due to the EUT is powered by battery

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 12	1	GFSK

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
1 to 12	1, 8, 12	GFSK

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE ³ 1G	23deg. C, 64%RH	DC 1.5V	Chilin Lee
RE<1G	25deg. C, 68%RH	DC 1.5V	Tim Ho



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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 (Section 15.249)

ANSI C63.10-2009

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

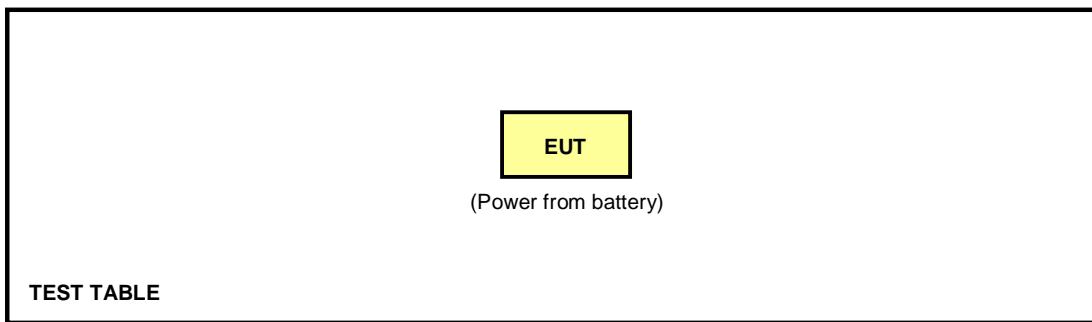


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3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

3.6 CONFIGURATION OF SYSTEM UNDER TEST



TEST TABLE



4 TEST PROCEDURES AND RESULTS

4.1 RADIATED EMISSION AND BAND EDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BAND EDGE 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 20dB below the highest level of the desired power:

RSS-210 table 2, 3		
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

RSS-210 A2.9(a)		
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

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB_{uV}/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
Spectrum Analyzer Agilent	E4446A	MY48250253	Sep. 03, 2012	Sep. 02, 2013
MXE EMI Receiver Agilent	N9038A	MY51210105	Jan. 29, 2013	Jan. 28, 2014
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 14, 2012	Nov. 13, 2013
Pre-Amplifier Agilent	8449B	3008A02578	June 25, 2013	June 24, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 14, 2012	Nov. 13, 2013
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Mar. 19, 2013	Mar. 18, 2014
Horn_Antenna AISI	AIH.8018	0000320091110	Nov. 19, 2012	Nov. 18, 2013
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 12, 2012	Oct. 11, 2013
RF Cable	NA	RF104-201 RF104-203 RF104-204	Dec. 25, 2012	Dec. 24, 2013
RF Cable	NA	CHGCAB_001	Oct. 06, 2012	Oct. 05, 2013
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
5. The VCCI Site Registration No. is G-137.
6. The CANADA Site Registration No. is IC 7450H-2.
7. Tested Date: June 27 to July 02, 2013



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4.1.3 TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters 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. 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 detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

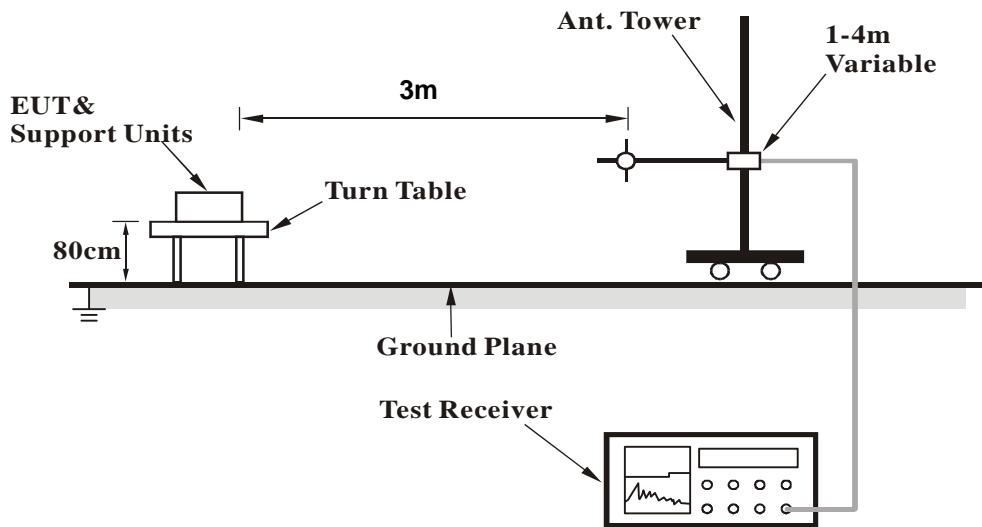
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection 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 the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.1.6 EUT OPERATING CONDITIONS

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



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4.1.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	54.69	24.8 QP	40.0	-15.3	2.00 H	81	38.05	-13.30
2	96.20	21.5 QP	43.5	-22.0	2.00 H	43	40.29	-18.76
3	142.33	24.1 QP	43.5	-19.4	1.50 H	110	37.65	-13.52
4	181.66	22.9 QP	43.5	-20.6	2.00 H	249	38.20	-15.27
5	499.38	26.1 QP	46.0	-19.9	1.00 H	360	33.87	-7.77
6	956.64	30.1 QP	46.0	-15.9	1.50 H	350	29.53	0.61

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	34.56	31.5 QP	40.0	-8.5	1.00 V	125	45.83	-14.32
2	54.30	33.9 QP	40.0	-6.1	1.50 V	226	47.03	-13.14
3	97.42	37.3 QP	43.5	-6.2	1.50 V	360	56.24	-18.97
4	142.33	30.1 QP	43.5	-13.4	1.00 V	198	43.64	-13.52
5	184.96	27.8 QP	43.5	-15.7	1.50 V	344	43.32	-15.56
6	514.66	27.6 QP	46.0	-18.4	1.00 V	212	35.09	-7.45

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



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ABOVE 1GHz DATA

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

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	2400.00	67.7 PK	74.0	-6.3	1.09 H	201	69.73	-2.03
2	2400.00	27.6 AV	54.0	-26.4	1.09 H	201	29.63	-2.03
3	*2405.00	98.4 PK	114.0	-15.6	1.09 H	201	100.42	-2.02
4	*2405.00	58.3 AV	94.0	-35.7	1.09 H	201	60.32	-2.02
5	4810.00	49.6 PK	74.0	-24.4	1.19 H	130	43.33	6.27
6	4810.00	9.5 AV	54.0	-44.5	1.19 H	130	3.23	6.27
7	7215.00	54.3 PK	74.0	-19.7	1.10 H	301	40.03	14.27
8	7215.00	14.2 AV	54.0	-39.8	1.10 H	301	-0.07	14.27

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2400.00	59.6 PK	74.0	-14.4	1.11 V	146	61.63	-2.03
2	2400.00	19.5 AV	54.0	-34.5	1.11 V	146	21.53	-2.03
3	*2405.00	90.9 PK	114.0	-23.1	1.11 V	146	92.92	-2.02
4	*2405.00	50.8 AV	94.0	-43.2	1.11 V	146	52.82	-2.02
5	4810.00	49.8 PK	74.0	-24.2	1.14 V	201	43.53	6.27
6	4810.00	9.7 AV	54.0	-44.3	1.14 V	201	3.43	6.27
7	7215.00	54.6 PK	74.0	-19.4	1.22 V	163	40.33	14.27
8	7215.00	14.5 AV	54.0	-39.5	1.22 V	163	0.23	14.27

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 radiated frequency is out of the restricted band.
7. The average value of fundamental frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (0.115 \text{ ms} / 11.67 \text{ ms}) = -40.1 \text{ dB}$ Please see page 18 for plotted duty.



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CHANNEL	TX Channel 8	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2444.00	98.3 PK	114.0	-15.7	1.10 H	200	100.17	-1.87
2	*2444.00	58.2 AV	94.0	-35.8	1.10 H	200	60.07	-1.87
3	4888.00	49.4 PK	74.0	-24.6	1.26 H	135	42.88	6.52
4	4888.00	9.3 AV	54.0	-44.7	1.26 H	135	2.78	6.52
5	7332.00	54.2 PK	74.0	-19.8	1.14 H	295	39.97	14.23
6	7332.00	14.1 AV	54.0	-39.9	1.14 H	295	-0.13	14.23
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2444.00	90.5 PK	114.0	-23.5	1.09 V	139	92.37	-1.87
2	*2444.00	50.4 AV	94.0	-43.6	1.09 V	139	52.27	-1.87
3	4888.00	50.3 PK	74.0	-23.7	1.13 V	200	43.78	6.52
4	4888.00	10.2 AV	54.0	-43.8	1.13 V	200	3.68	6.52
5	7332.00	55.0 PK	74.0	-19.0	1.20 V	175	40.77	14.23
6	7332.00	14.9 AV	54.0	-39.1	1.20 V	175	0.67	14.23

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 frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (0.115 \text{ ms} / 11.67 \text{ ms}) = -40.1 \text{ dB}$ Please see page 18 for plotted duty.



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CHANNEL	TX Channel 12	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2474.00	97.9 PK	114.0	-16.1	1.10 H	199	99.66	-1.76
2	*2474.00	57.8 AV	94.0	-36.2	1.10 H	199	59.56	-1.76
3	2483.50	63.2 PK	74.0	-10.8	1.10 H	199	64.92	-1.72
4	2483.50	23.1 AV	54.0	-30.9	1.10 H	199	24.82	-1.72
5	4948.00	50.3 PK	74.0	-23.7	1.22 H	134	43.58	6.72
6	4948.00	10.2 AV	54.0	-43.8	1.22 H	134	3.48	6.72
7	7422.00	54.8 PK	74.0	-19.2	1.09 H	311	40.67	14.13
8	7422.00	14.7 AV	54.0	-39.3	1.09 H	311	0.57	14.13

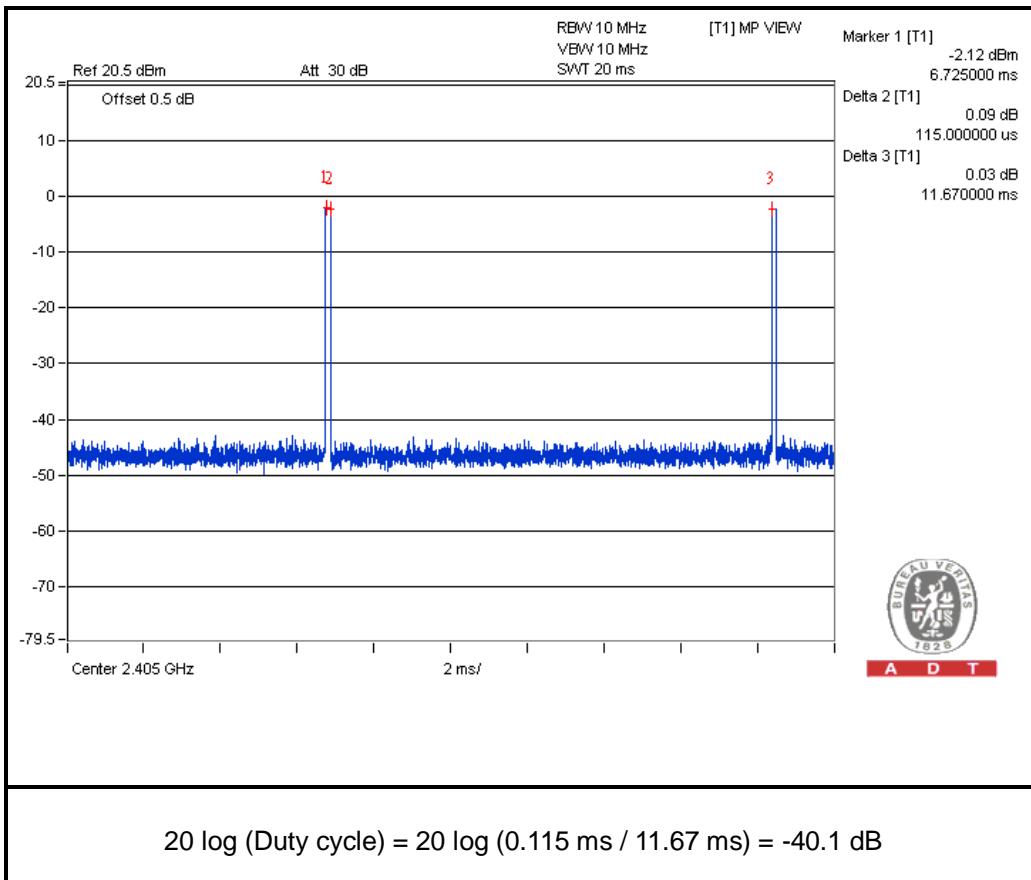
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2474.00	90.3 PK	114.0	-23.7	1.10 V	144	92.06	-1.76
2	*2474.00	50.2 AV	94.0	-43.8	1.10 V	144	51.96	-1.76
3	2483.50	60.3 PK	74.0	-13.7	1.10 V	144	62.02	-1.72
4	2483.50	20.2 AV	54.0	-33.8	1.10 V	144	21.92	-1.72
5	4948.00	50.5 PK	74.0	-23.5	1.13 V	211	43.78	6.72
6	4948.00	10.4 AV	54.0	-43.6	1.13 V	211	3.68	6.72
7	7422.00	55.3 PK	74.0	-18.7	1.25 V	165	41.17	14.13
8	7422.00	15.2 AV	54.0	-38.8	1.25 V	165	1.07	14.13

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 frequency is: Average = Peak value + 20 log(Duty cycle)
Where the duty factor is calculated from following formula: $20 \log (\text{Duty cycle}) = 20 \log (0.115 \text{ ms} / 11.67 \text{ ms}) = -40.1 \text{ dB}$ Please see page 18 for plotted duty.



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5 PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6 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:

Tel: 886-2-26052180

Fax: 886-2-26052943

Hsin Chu EMC/RF Lab:

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7 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

--- END ---