



FCC TEST REPORT

REPORT NO.: RF120416E01

MODEL NO.: M-R0028

FCC ID: JNZMR0028

RECEIVED: Apr. 16, 2012

TESTED: Apr. 18 to 19, 2012

ISSUED: Apr. 25, 2012

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.,
Taoyuan Branch

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,
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

TEST LOCATION (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung
Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

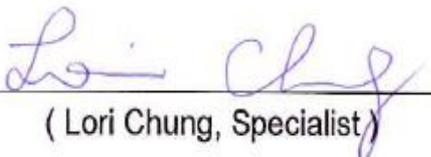
ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120416E01	Original release	Apr. 25, 2012

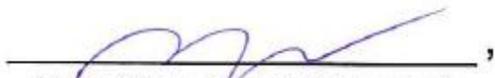


1. CERTIFICATION

PRODUCT : 2.4GHz Cordless Mouse
BRAND NAME : Logitech
MODEL NO. : M-R0028
TEST SAMPLE : ENGINEERING SAMPLE
APPLICANT : LOGITECH FAR EAST LTD.
TESTED : Apr. 18 to 19, 2012
STANDARDS : **FCC Part 15, Subpart C (Section 15.249)**
ANSI C63.10-2009

The above equipment (Model: M-R0028) 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:** Apr. 25, 2012
(Lori Chung, Specialist)

APPROVED BY : , **DATE:** Apr. 25, 2012
(May Chen, Deputy Manager)

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 -2.2dB at 2400.00MHz

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	FREQUENCY	UNCERTAINTY
Radiated emission	30MHz ~ 1GHz	5.69 dB
	1GHz ~6GHz	5.12 dB
	6GHz ~ 18GHz	5.32 dB
	18GHz ~ 40GHz	5.37 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	2.4GHz Cordless Mouse
MODEL NO.	M-R0028
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 0.33dBi antenna gain
DATA CABLE	NA
I/O PORTS	NA
ASSOCIATED DEVICES	NA

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.

3.2 DESCRIPTION OF TEST MODES

Twelve channels are provided in this EUT.

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 [≥] 1G	RE<1G	PLC	
-	√	√	-	-

Where **RE<1G**: Radiated Emission below 1GHz **RE[≥]1G**: Radiated Emission above 1GHz
PLC: Power Line Conducted Emission

NOTE: (1) No need to concern of Conducted Emission due to the EUT is powered by battery
(2): "-" means no effect.

RADIATED EMISSION TEST (BELOW 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations axis 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	12	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 axis 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



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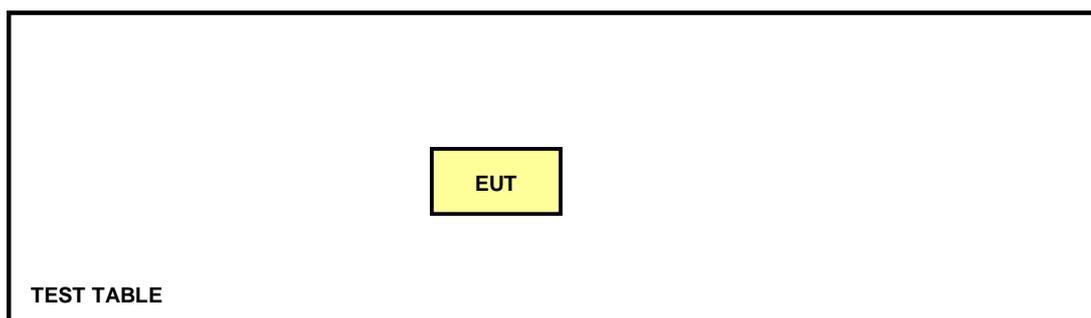
TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE ³ 1G	22deg. C, 67%RH	DC 1.5V	Amos Chuang
RE<1G	28deg. C, 72%RH	DC 1.5V	Robert Cheng

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit.

3.4.1 CONFIGURATION OF SYSTEM UNDER TEST





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

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BAND EDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BAND EDGE 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
Agilent Spectrum Analyzer	E4446A	MY48250253	Aug. 29, 2011	Aug. 28, 2012
Agilent Pre-Selector	N9039A	MY46520310	Aug. 29, 2011	Aug. 28, 2012
Agilent Signal Generator	N5181A	MY49060347	July 25, 2011	July 24, 2012
Mini-Circuits Pre-Amplifier	ZFL-1000VH2B	AMP-ZFL-04	Nov. 15, 2011	Nov. 14, 2012
Agilent Pre-Amplifier	8449B	3008A02465	Feb. 27, 2012	Feb. 26, 2013
SPACEK LABS	SLKKa-48-6	9K16	Nov. 15, 2011	Nov. 14, 2012
SCHWARZBECK Trilog Broadband Antenna	VULB 9168	9168-361	Apr. 06, 2012	Apr. 05, 2013
AISI Horn_Antenna	AIH.8018	0000220091110	Nov. 23, 2011	Nov. 22, 2012
SCHWARZBECK Horn_Antenna	BBHA 9170	9170-424	Oct. 07, 2011	Oct. 06, 2012
RF CABLE	NA	RF104-205 RF104-207 RF104-202	Dec. 27, 2011	Dec. 26, 2012
RF Cable	NA	CHHCAB_001	Oct. 08, 2011	Oct. 07, 2012
Software	ADT_Radiated_V8.7.05	NA	NA	NA
CT Antenna Tower & Turn Table	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. H.

4. The FCC Site Registration No. is 797305.

5. The CANADA Site Registration No. is IC 7450H-3.

6. Tested date: Apr. 18 to 19, 2012

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.

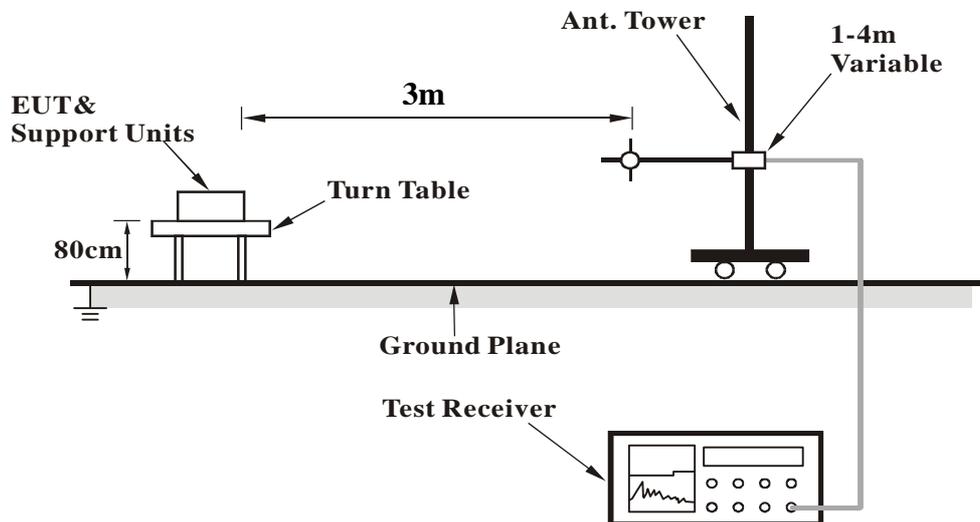
NOTE:

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.

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 condition continuously at specific channel frequency.



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4.1.7 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

CHANNEL	TX Channel 12	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	66.71	22.4 QP	40.0	-17.6	2.00 H	195	9.73	12.71
2	257.73	25.8 QP	46.0	-20.2	2.00 H	258	12.21	13.59
3	315.04	27.0 QP	46.0	-19.0	1.50 H	360	11.39	15.65
4	480.01	30.9 QP	46.0	-15.1	2.00 H	28	11.32	19.56
5	730.94	32.8 QP	46.0	-13.2	1.50 H	0	8.61	24.22
6	942.45	35.8 QP	46.0	-10.2	1.50 H	346	8.12	27.71

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	68.84	28.1 QP	40.0	-12.0	1.50 V	289	15.62	12.43
2	101.17	25.3 QP	43.5	-18.2	1.00 V	58	15.44	9.88
3	458.10	29.6 QP	46.0	-16.4	1.50 V	214	10.60	19.04
4	671.61	32.1 QP	46.0	-13.9	1.00 V	228	8.92	23.21
5	923.97	37.1 QP	46.0	-9.0	2.00 V	324	9.63	27.42
6	957.01	38.4 QP	46.0	-7.6	2.00 V	93	10.49	27.93

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).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



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	71.8 PK	74.0	-2.2	1.00 H	290	39.58	32.22
2	2400.00	41.5 AV	54.0	-12.5	1.00 H	290	9.28	32.22
3	*2405.00	100.1 PK	114.0	-13.9	1.00 H	290	67.87	32.23
4	*2405.00	69.8 AV	94.0	-24.2	1.00 H	290	37.57	32.23
5	4810.00	57.3 PK	74.0	-16.7	1.31 H	306	15.75	41.55
6	4810.00	27.0 AV	54.0	-27.0	1.31 H	306	-14.55	41.55
7	7215.00	55.8 PK	74.0	-18.2	1.00 H	283	9.91	45.89
8	7215.00	25.5 AV	54.0	-28.5	1.00 H	283	-20.39	45.89

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	61.7 PK	74.0	-12.3	1.05 V	121	29.48	32.22
2	2400.00	31.4 AV	54.0	-22.6	1.05 V	121	-0.82	32.22
3	*2405.00	91.3 PK	114.0	-22.7	1.05 V	121	59.07	32.23
4	*2405.00	61.0 AV	94.0	-33.0	1.05 V	121	28.77	32.23
5	4810.00	58.9 PK	74.0	-15.1	1.04 V	310	17.35	41.55
6	4810.00	28.6 AV	54.0	-25.4	1.04 V	310	-12.95	41.55
7	7215.00	58.9 PK	74.0	-15.1	1.04 V	118	13.01	45.89
8	7215.00	28.6 AV	54.0	-25.4	1.04 V	118	-17.29	45.89

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).
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 + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.24 \text{ ms} / 7.88 \text{ ms}) = -30.3 \text{ dB}$
Please see page 19 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	100.2 PK	114.0	-13.8	1.00 H	73	67.87	32.33
2	*2444.00	69.9 AV	94.0	-24.1	1.00 H	73	37.57	32.33
3	4888.00	57.9 PK	74.0	-16.1	1.35 H	292	16.21	41.69
4	4888.00	27.6 AV	54.0	-26.4	1.35 H	292	-14.09	41.69
5	7332.00	55.3 PK	74.0	-18.7	1.00 H	64	9.11	46.19
6	7332.00	25.0 AV	54.0	-29.0	1.00 H	64	-21.19	46.19

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	1.00 V	243	58.17	32.33
2	*2444.00	60.2 AV	94.0	-33.8	1.00 V	243	27.87	32.33
3	4888.00	59.2 PK	74.0	-14.8	1.07 V	295	17.51	41.69
4	4888.00	28.9 AV	54.0	-25.1	1.07 V	295	-12.79	41.69
5	7332.00	58.8 PK	74.0	-15.2	1.00 V	247	12.61	46.19
6	7332.00	28.5 AV	54.0	-25.5	1.00 V	247	-17.69	46.19

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).
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 + 20log(Duty cycle) Where the duty factor is calculated from following formula:
$$20 \log (\text{Duty cycle}) = 20 \log (0.24 \text{ ms} / 7.88 \text{ ms}) = -30.3 \text{ dB}$$

Please see page 19 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	100.6 PK	114.0	-13.4	1.00 H	73	68.19	32.41
2	*2474.00	70.3 AV	94.0	-23.7	1.00 H	73	37.89	32.41
3	2483.50	65.7 PK	74.0	-8.3	1.00 H	73	33.27	32.43
4	2483.50	35.4 AV	54.0	-18.6	1.00 H	73	2.97	32.43
5	4948.00	57.5 PK	74.0	-16.5	1.33 H	308	15.81	41.69
6	4948.00	27.2 AV	54.0	-26.8	1.33 H	308	-14.49	41.69
7	7422.00	56.3 PK	74.0	-17.7	1.00 H	68	9.90	46.40
8	7422.00	26.0 AV	54.0	-28.0	1.00 H	68	-20.40	46.40

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

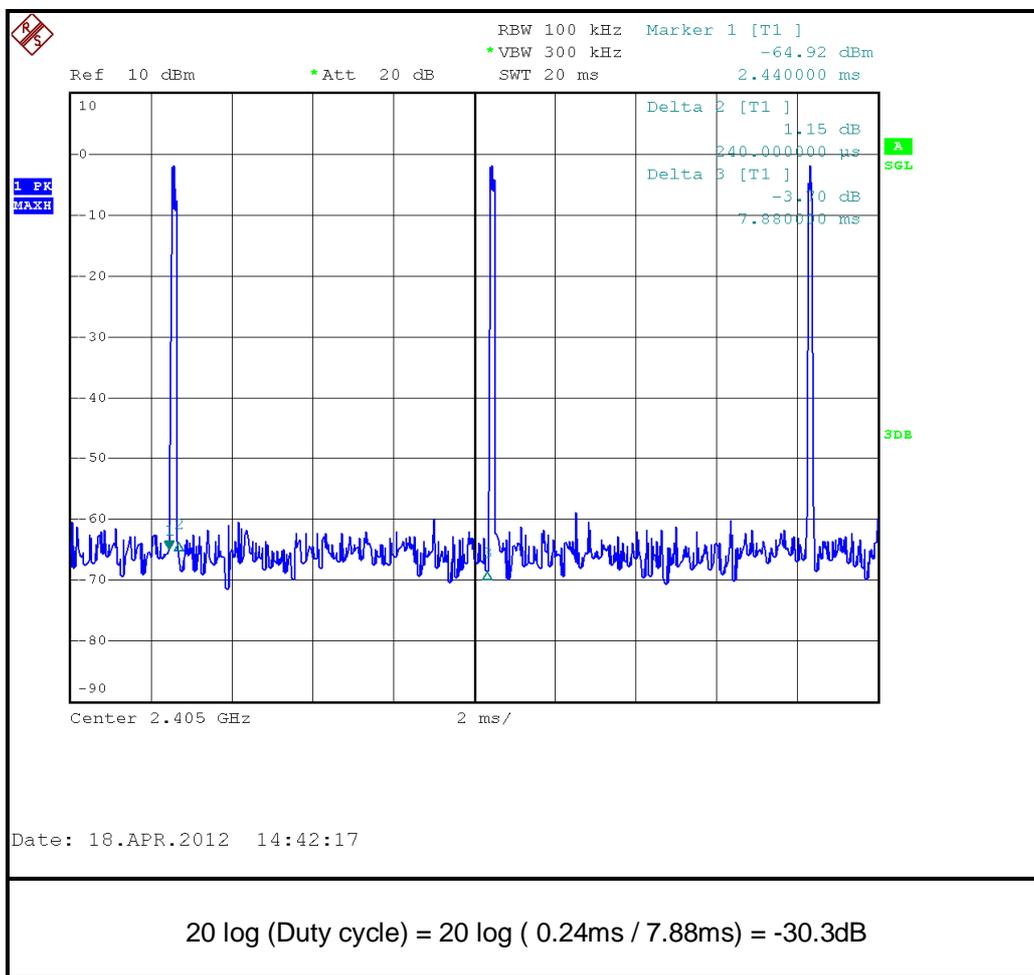
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2474.00	90.4 PK	114.0	-23.6	1.00 V	118	57.99	32.41
2	*2474.00	60.1 AV	94.0	-33.9	1.00 V	118	27.69	32.41
3	2483.50	57.5 PK	74.0	-16.5	1.00 V	118	25.07	32.43
4	2483.50	27.2 AV	54.0	-26.8	1.00 V	118	-5.23	32.43
5	4948.00	58.8 PK	74.0	-15.2	1.06 V	298	17.11	41.69
6	4948.00	28.5 AV	54.0	-25.5	1.06 V	298	-13.19	41.69
7	7422.00	59.2 PK	74.0	-14.8	1.00 V	114	12.80	46.40
8	7422.00	28.9 AV	54.0	-25.1	1.00 V	114	-17.50	46.40

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).
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 + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log (0.24 \text{ ms} / 7.88 \text{ ms}) = -30.3 \text{ dB}$
Please see page 19 for plotted duty.



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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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.

Copies of accreditation and authorization certificates of our laboratories obtained from approval agencies can be downloaded from our web site:

<http://www.adt.com.tw/index.5.phtml>. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF Lab

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.adt.com.tw

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

7. APPENDIX A – MODIFICATION RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

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

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