

# FCC TEST REPORT

 REPORT NO.:
 RF971107L22B

 MODEL NO.:
 DIR-635

 FCC ID:
 KA2DIR635B3

 RECEIVED:
 Dec. 10, 2010

 TESTED:
 Dec. 14, 2010

 ISSUED:
 Dec. 20, 2010

APPLICANT: D-Link Corporation

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- **ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
- LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang, Taipei Hsien 244, Taiwan, R.O.C.
- **TEST LOCATION:** No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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# **RELEASE CONTROL RECORD**

ISSUE NO.	ISSUE NO. REASON FOR CHANGE	
Original release	N/A	Dec. 20, 2010



# **1. CERTIFICATION**

PRODUCT: WIRELESS N Router MODEL NO.: DIR-635 BRAND: D-Link APPLICANT: D-Link Corporation TEST SAMPLE: ENGINEERING SAMPLE TESTED: Dec. 14, 2010 STANDARDS: FCC Part 15, Subpart C (Section 15.247) ANSI C63.4-2003 ANSI C63.10-2009

This report is issued as a supplementary report of **RF971007L22**. This report shall be used combined together with its original report.

PREPARED BY

(	: Andrent fim Andrea Hsia / Specialist	,	DATE:	Dec. 20, 2010
ſ	: Gary Chang / Assistant Manager	3	DATE:_	Dec. 20, 2010

APPROVED BY

**NOTE:** Only the Radiated Emission below 1GHz test & Conducted emission test were performed for this addendum. Other testing data refer to original report.



# **2. SUMMARY OF TEST RESULTS**

The EUT has been tested according to the following specifications:

AP	APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)					
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK			
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -17.15dB at 0.166MHz.			
15.247(a)(2)	Spectrum Bandwidth of a Direct Sequence Spread Spectrum System Limit: min. 500kHz	NA	Refer to Note as below			
15.247(b)	Maximum Output Power Limit: max. 30dBm	NA	Refer to Note as below			
15.247(d)	Radiated Emissions Limit: Table 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -1.2dB at 55.93MHz.			
15.247(e)	Power Spectral Density Limit: max. 8dBm	NA	Refer to Note as below			
15.247(d)	Band Edge Measurement Limit: 20dB less than the peak value of fundamental frequency	NA	Refer to Note as below			
15.203	Antenna Requirement	NA	Refer to Note as below			

**NOTE:** Only the Radiated Emission below 1GHz test & Conducted emission test were performed for this addendum. Other testing data refer to original report.

# 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB

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



#### 3. GENERAL INFORMATION 3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	WIRELESS N Router
MODEL NO.	DIR-635
FCC ID	KA2DIR635B3
POWER SUPPLY	5Vdc from AC adapter
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
MODULATION TECHNOLOGY	DSSS, OFDM
TRANSFER RATE	802.11b: 11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300.0Mbps
OPERATING FREQUENCY	2412 ~ 2462MHz
NUMBER OF CHANNEL	11 for 802.11b, 802.11g, 802.11n (20MHz) 7 for 802.11n (40MHz)
MAXIMUM OUTPUT POWER	452.289mW
ANTENNA TYPE	Detachable dipole antenna with 2dBi gain
ANTENNA CONNECTOR	R-SMA
DATA CABLE	NA
I/O PORTS	RJ45, USB
	Adapter

#### NOTE:

- 1. This report is issued as a supplementary report of BV ADT report no.: RF971107L22. The difference compared with original design is adding one adapter. Therefore we re-tested the radiated Emission below 1GHz test & conducted emission test and performed for this addendum. Other testing data refer to original report.
- 2. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and three receivers.

MODULATION MODE	TX FUNCTION
802.11b	2TX
802.11g	2TX
802.11n (20MHz)	2TX
802.11n (40MHz)	2TX

3. The EUT was powered by the following adapter.

BRAND:	D-Link
MODEL:	CF1505-B
INPUT:	100-120Vac, 50-60Hz, 0.4A
OUTPUT:	5Vdc, 2.5A
POWER LINE:	1.8m non-shielded cable without core



4. 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

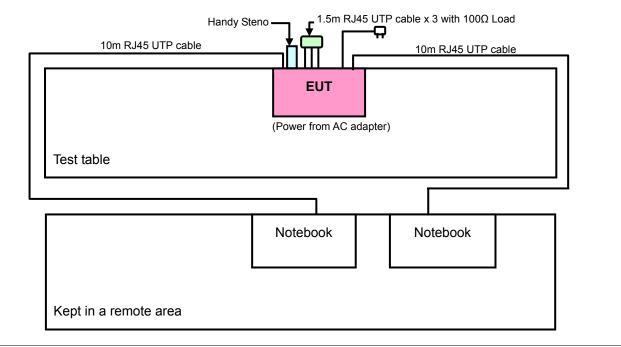
Eleven channels are provided for 802.11b, 802.11g and 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz		

Seven channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
1	2422MHz	5	2442MHz
2	2427MHz	6	2447MHz
3	2432MHz	7	2452MHz
4	2437MHz		

# 3.2.1 CONFIGURATION OF SYSTEM UNDER TEST





## 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE		ABLE TO	DESCRIPTION
MODE	RE<1G	PLC	DESCRIPTION
-	$\checkmark$	$\checkmark$	-
	F .4C. Dedicted Emission b	even Line Canduated Emission	

Where RE<

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

#### RADIATED EMISSION TEST (BELOW 1GHz):

- 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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)	AXIS
802.11g	1 to 11	6	OFDM	BPSK	6	Х

#### POWER LINE CONDUCTED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE TESTED		MODULATION	MODULATION	DATA RATE	
	CHANNEL CHANNEL		TECHNOLOGY	TYPE	(Mbps)	
802.11g	1 to 11	6	OFDM	BPSK	6	

#### **TEST CONDITION:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY	
RE<1G	23deg. C, 66%RH, 1012 hPa	120Vac, 60Hz	Frank Wang	
PLC	25deg. C, 65%RH, 1010 hPa	120Vac, 60Hz	David Huang	



# 3.3 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 (15.247) ANSI C63.4-2003 ANSI C63.10-2009

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

**NOTE:** The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

## 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND MODEL NO.		SERIAL NO.	FCC ID
1	HANDY STENO	Apacer	AH123	NA	NA
2	NOTEBOOK	DELL	PP05L	12130898320	E2K24CLNS
3	NOTEBOOK	DELL	PP05L	9954115984	E2K24CLNS

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS							
1	NA							
2	10m RJ45 UTP cable							
3	10m RJ45 UTP cable							

#### NOTE:

- 1. All power cords of the above support units are non shielded (1.8m).
- 2. Items 2 ~ 3 acted as communication partners to transfer data.
- 3. Item 1 was supplied from client.



# 4. TEST TYPES AND RESULTS

# 4.1 RADIATED EMISSION MEASUREMENT

## 4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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. As shown in 15.35(b), 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.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Aug. 04, 2010	Aug. 03, 2011
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Jul. 09, 2010	Jul. 08, 2011
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Apr. 30, 2010	Apr. 29, 2011
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-209	Aug. 02, 2010	Aug. 01, 2011
HORN Antenna BCHWARZBECK BBHA 9170		BBHA9170242	Dec. 25, 2009	Dec. 24, 2010
Preamplifier Agilent	8449B	3008A01910	Sep. 09, 2010	Sep. 08, 2011
Preamplifier Agilent	8447D	2944A10638 Nov. 03, 2010		Nov. 02, 2011
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	218190/4 231241/4 May 14, 2010		May 13, 2011
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 20, 2010	Aug. 19, 2011
Software	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn Table Controller EMCO	2090	NA	NA	NA

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

- 2. The test was performed in HwaYa Chamber 9.
- 3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 4. The FCC Site Registration No. is 460141.
- 5. The IC Site Registration No. is IC 7450F-4.



# 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 semi-anechoic chamber. 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 antenna is a broadband antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

#### NOTE:

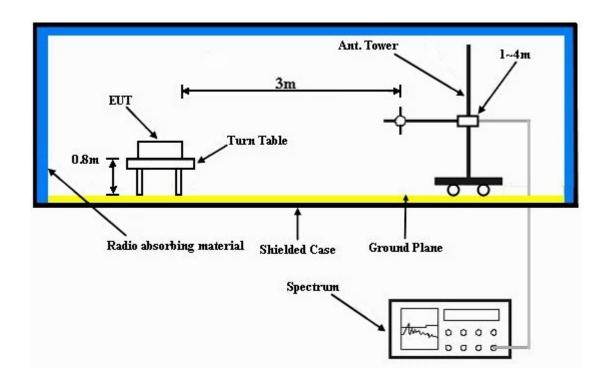
- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
- 2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz for Average detection (AV) at frequency above 1GHz.
- 4. All modes of operation were investigated and the worst-case emissions are reported.

# 4.1.4 DEVIATION FROM TEST STANDARD

No deviation.



# 4.1.5 TEST SETUP



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

# 4.1.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on the testing table.
- b. Prepared notebooks system outside of testing area to act as communication partners.
- c. The communication partner connected with EUT via a RJ45 UTP cable and run telnet program to send commands to the EUT to set the EUT under transmission condition continuously at specific channel frequency
- d. The communication partner sent data to EUT by command "PING".



# 4.1.7 TEST RESULTS

#### BELOW 1GHz WORST-CASE DATA : 802.11g

EUT TEST CONDITION		MEASUREMENT DETAIL			
CHANNEL Channel 6		FREQUENCY RANGE	Below 1000MHz		
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak		
ENVIRONMENTAL CONDITIONS	23deg. C, 66%RH 1012 hPa	TESTED BY	Frank Wang		

	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	64.90	33.3 QP	40.0	-6.7	1.25 H	70	20.80	12.50			
2	197.11	37.4 QP	43.5	-6.1	1.75 H	310	26.50	10.90			
3	249.60	42.0 QP	46.0	-4.0	1.00 H	82	29.10	12.90			
4	500.42	37.4 QP	46.0	-8.6	2.00 H	322	18.10	19.30			
5	566.52	36.1 QP	46.0	-9.9	1.50 H	136	14.90	21.20			
6	792.06	39.0 QP	46.0	-7.0	1.00 H	184	13.80	25.20			
		ANTENNA	<b>POLARIT</b>	Y & TEST DI	STANCE: V	ERTICAL A	T 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	55.93	38.8 QP	40.0	-1.2	1.00 V	235	25.20	13.60			
2	101.84	37.7 QP	43.5	-5.8	1.25 V	160	28.10	9.60			
3	249.60	38.9 QP	46.0	-7.1	1.75 V	358	26.00	12.90			
4	500.42	31.3 QP	46.0	-14.7	1.00 V	214	12.00	19.30			
5	751.23	33.5 QP	46.0	-12.5	1.00 V	286	9.50	24.00			
6	792.06	37.1 QP	46.0	-8.9	1.50 V	334	11.90	25.20			

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



# 4.2 CONDUCTED EMISSION MEASUREMENT

# FREQUENCY OF EMISSION (MHz) CONDUCTED LIMIT (dB $\mu$ V) Quasi-peak Average 0.15 ~ 0.5 66 to 56 56 to 46 0.5 ~ 5 56 46 5 ~ 30 60 50

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

NOTE: 1. The lower limit shall apply at the transition frequencies.

- 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
- 3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

# 4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO. SERIAL NO.		DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100291	Nov. 30, 2010	Nov. 29, 2011
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 30, 2009	Dec. 29, 2010
LISN ROHDE & SCHWARZ	ESH3-Z5	100312	Jun. 28, 2010	Jun. 27, 2011
LISN ROHDE & SCHWARZ	ESH3-Z5	835239/001	Feb. 10, 2010	Feb. 09, 2011
V-LISN SCHWARZBECK	NNBL 8226-2	8226-142	Jul. 12, 2010	Jul. 11, 2011
Software ADT	ADT_Cond_ V7.3.7	NA	NA	NA

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations

are traceable to NML/ROC and NIST/USA.

- 2. The test was performed in HwaYa Shielded Room 1.
- 3. The VCCI Site Registration No. is C-2040.



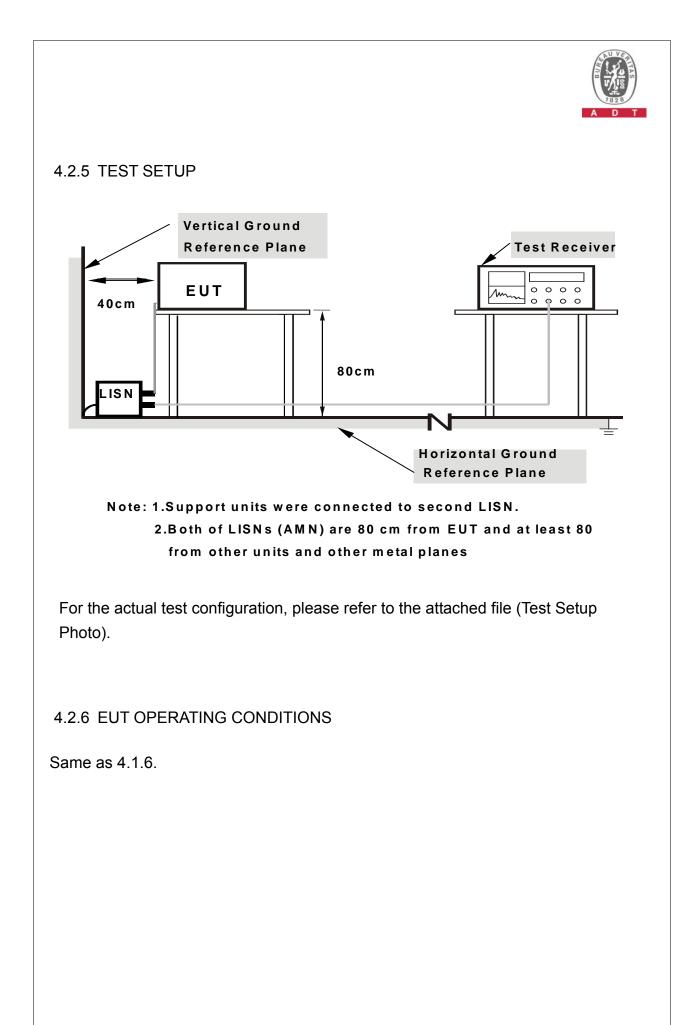
# 4.2.3 TEST PROCEDURES

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

**NOTE:** All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.



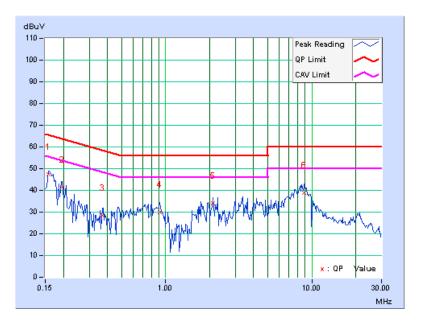


## 4.2.7 TEST RESULTS

CON	CONDUCTED WORST-CASE DATA : 802.11g										
PHA	PHASE Line 1			6	6dB BANDWIDTH 9			9kHz			
	Freq.	Corr.	Corr. Reading Value			mission Limit			Margin		
No		Factor	[dB (uV)]		[dB	5 (uV)]	[dB (uV)]		(dl	(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	
1	0.158	0.12	47.34	-	47.46	-	65.58	55.5	8 -18.12	-	
2	0.197	0.11	41.32	-	41.43	-	63.74	53.7	4 -22.31	-	
3	0.369	0.13	28.36	-	28.49	-	58.53	48.5	3 -30.04	-	
4	0.916	0.17	29.78	-	29.95	-	56.00	46.0	0 -26.05	-	
5	2.105	0.26	33.91	-	34.17	-	56.00	46.0	0 -21.83	_	
6	8.871	0.59	38.30	-	38.89	-	60.00	50.0	0 -21.11	-	

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.

- 2. "-": The Quasi-peak reading value also meets average limit and
- The emission levels of other frequencies were very low against the limit.
   Margin value = Emission level Limit value
- 5. Correction factor = Insertion loss + Cable loss
- 6. Emission Level = Correction Factor + Reading Value.

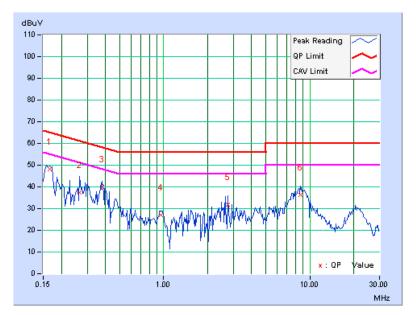




PHA	SE Line 2			6	dB BANI	OWIDTH	ę	9kHz			
	Freq.	Corr.	Readin	Reading Value		Emission Level		Limit		gin	
No		Factor	[dB (	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV	/. Q.P.	AV.	
1	0.166	0.10	47.93	-	48.03	-	65.18	55.1	18 -17.15	-	
2	0.267	0.11	37.27	-	37.38	-	61.20	51.2	20 -23.83	-	
3	0.380	0.12	39.95	-	40.07	-	58.27	48.2	27 -18.20	-	
4	0.955	0.17	26.78	-	26.95	-	56.00	46.0	00 -29.05	-	
5	2.738	0.27	31.53	-	31.80	-	56.00	46.0	00 -24.20	_	
6	8.656	0.51	35.79	-	36.30	-	60.00	50.0	00 -23.70	-	

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.

- 2. "-": The Quasi-peak reading value also meets average limit and
- measurement with the average detector is unnecessary.
- 3. The emission levels of other frequencies were very low against the limit.
- 4. Margin value = Emission level Limit value
- 5. Correction factor = Insertion loss + Cable loss
- 6. Emission Level = Correction Factor + Reading Value.





# 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 certificates of our laboratories obtained from approval agencies can be downloaded from our web site: <a href="http://www.adt.com.tw/index.5/phtml">www.adt.com.tw/index.5/phtml</a>. 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: 886-3-3185050

Web Site: <u>www.adt.com.tw</u>

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



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

No any modifications are made to the EUT by the lab during the test.

---END----