



# FCC TEST REPORT

**REPORT NO.:** RF941229L01B

**MODEL NO.:** QBTM400

**RECEIVED:** Dec. 01, 2008

**TESTED:** Dec. 10 ~ Dec. 14, 2008

**ISSUED:** Dec. 16, 2008

**APPLICANT:** Qcom Technology Inc.

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TAIWAN R.O.C.

**ISSUED BY:** Bureau Veritas Consumer Products Services  
(H.K.) Ltd., Taoyuan Branch

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**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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## TABLE OF CONTENTS

1. CERTIFICATION.....	4
2. SUMMARY OF TEST RESULTS .....	5
2.1 MEASUREMENT UNCERTAINTY.....	5
3. GENERAL INFORMATION.....	6
3.1 GENERAL DESCRIPTION OF EUT .....	6
3.2 DESCRIPTION OF TEST MODES .....	7
3.2.1 CONFIGURATION OF SYSTEM UNDER TEST .....	8
3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL .....	9
3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS .....	11
3.4 DESCRIPTION OF SUPPORT UNITS .....	11
4. TEST TYPES AND RESULTS .....	12
4.1 RADIATED EMISSION MEASUREMENT .....	12
4.1.1 LIMITS OF RADIATED EMISSION MEASUREMENT.....	12
4.1.2 TEST INSTRUMENTS.....	13
4.1.3 TEST PROCEDURES .....	14
4.1.4 DEVIATION FROM TEST STANDARD.....	14
4.1.5 TEST SETUP.....	15
4.1.6 EUT OPERATING CONDITIONS .....	15
4.1.7 TEST RESULTS .....	16
4.2 CONDUCTED EMISSION MEASUREMENT .....	23
4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT.....	23
4.2.2 TEST INSTRUMENTS.....	23
4.2.3 TEST PROCEDURES .....	24
4.2.4 DEVIATION FROM TEST STANDARD.....	24
4.2.5 TEST SETUP.....	25
4.2.6 EUT OPERATING CONDITIONS .....	25
4.2.7 TEST RESULTS .....	26
4.3 BAND EDGES MEASUREMENT .....	28
4.3.1 LIMITS OF BAND EDGES MEASUREMENT.....	28
4.3.2 TEST INSTRUMENTS.....	28
4.3.3 TEST PROCEDURE.....	28
4.3.4 DEVIATION FROM TEST STANDARD.....	28
4.3.5 EUT OPERATING CONDITION.....	28
4.3.6 TEST RESULTS .....	29
4.4 ANTENNA REQUIREMENT .....	35
4.4.1 STANDARD APPLICABLE .....	35



A D T

4.4.2 ANTENNA CONNECTED CONSTRUCTION .....	35
5. PHOTOGRAPHS OF THE TEST CONFIGURATION.....	36
6. INFORMATION ON THE TESTING LABORATORIES .....	37
7. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB .....	38



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## 1. CERTIFICATION

**PRODUCT:** Bluetooth Module

**MODEL:** QBTM400

**BRAND:** Qcom Technology Inc.

**APPLICANT:** Qcom Technology Inc.

**TEST SAMPLE:** ENGINEERING SAMPLE

**TESTED:** Dec. 10 ~ Dec. 14, 2008

**STANDARDS:** FCC Part 15, Subpart C (Section 15.247)

ANSI C63.4-2003

The above equipment (Model: QBTM400) 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** : Polly Chien , DATE : Dec. 16, 2008  
Polly Chien / Specialist

**TECHNICAL  
ACCEPTANCE** : Long Chen , DATE : Dec. 16, 2008  
Responsible for RF Long Chen / Senior Engineer

**APPROVED BY** : Gary Chang , DATE : Dec. 16, 2008  
Gary Chang / Assistant 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			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -18.62dB at 0.470MHz
15.247(d)	Radiated Emissions Limit: Table 15.209	PASS	Meet the requirement of limit. Minimum passing margin is -3.15dB at 933.99MHz.
15.247(d)	Band Edge Measurement Limit: 20dB less than the peak value of fundamental frequency	PASS	Meet the requirement of limit.

### 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:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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



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### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

EUT	Bluetooth Module
MODEL NO.	QBTM400
FCC ID	RUJ-QBTM400
POWER SUPPLY	3.3Vdc from host equipment
MODULATION TYPE	GFSK, $\pi/4$ -DQPSK, 8DPSK
MODULATION TECHNOLOGY	FHSS
TRANSFER RATE	1/2/3Mbps
FREQUENCY RANGE	2400 ~ 2483.5 MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	1.714mW
ANTENNA TYPE	Refer to note as below
DATA CABLE	NA
I/O PORTS	NA
ACCESSORY DEVICES	NA

#### NOTE:

1. This report is based on ADT report with Reference No.: RF941229L01. The original report was issued by Advance Data Technology Corp. (ADT Corp.) on Jan. 11, 2006. ADT Corp. is one of Bureau Veritas family and she has fully transferred all its test facilities, staffs & service system to Bureau Veritas Consumer Products Services (Hong Kong) Limited, Taoyuan Branch in 2008.
2. This report is prepared for FCC class II permissive change. Difference compared with the original report is adding PIFA antenna, therefore, test items for conducted and radiated emission tests had been re-tested.
3. The following antennas are used in this EUT.

NO.	BRAND	MODEL	TYPE	GAIN (dBi)	CONNECTOR	REMARK
1	NA	NA	Printed	-4.67	NA	Original ant.
2	WNC	EBJ-I2	PIFA	-0.55	U.FL	New ant.

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



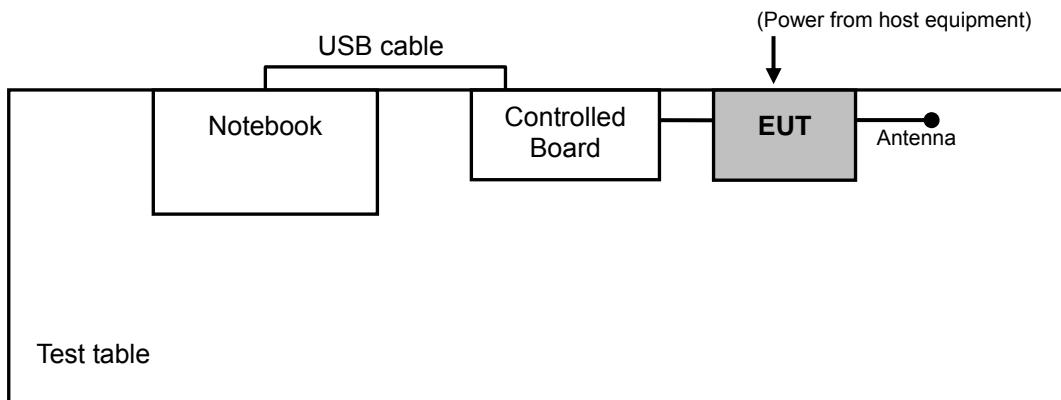
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### 3.2 DESCRIPTION OF TEST MODES

79 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	78	2480
19	2421	39	2441	59	2461		

### 3.2.1 CONFIGURATION OF SYSTEM UNDER TEST





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### 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE $\geq$ 1G	RE<1G	BM	
-	✓	✓	✓	GFSK Modulation
-	✓	-	✓	8DPSK Modulation

Where RE $\geq$ 1G: Radiated Emission above 1GHz

APCM: Antenna Port Conducted Measurement

NOTE: “-” means no effect.

RE<1G: Radiated Emission below 1GHz

BM: Bandedge Measurement

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

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	AXIS
-	0 to 78	0, 39, 78	FHSS	GFSK	DH5	Z
-	0 to 78	0, 39, 78	FHSS	8DPSK	DH5	Z

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

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE	AXIS
-	0 to 78	78	FHSS	GFSK	DH5	Z

#### POWER LINE CONDUCTED EMISSION TEST:

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	78	FHSS	GFSK	DH5



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**BANDEDGE MEASUREMENT:**

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

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
-	0 to 78	0, 78	FHSS	GFSK	DH5
-	0 to 78	0, 78	FHSS	8DPSK	DH5



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### 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**

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	NOTEBOOK COMPUTER	Compaq	N800C	470048-515	FCC DoC Approved
2	CONTROLLED BOARD	Qcom	59-6145-3A	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	2 m shielded USB cable without core.
2	NA

**NOTE:** 1. All power cords of the above support units are non shielded (1.8m).

2. Item 2 was provided by 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 (dB<sub>u</sub>V/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.



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#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	May 28, 2008	May 27, 2009
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Aug. 08, 2008	Aug. 07, 2009
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Apr. 25, 2008	Apr. 24, 2009
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-563	Aug. 06, 2008	Aug. 05, 2009
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170242	Jan. 07, 2008	Jan. 06, 2009
Preamplifier Agilent	8449B	3008A01911	Sep. 10, 2008	Sep. 09, 2009
Preamplifier Agilent	8447D	2944A10634	Oct. 23, 2008	Oct. 22, 2009
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	218190/4 231241/4	May 20, 2008	May 19, 2009
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 09, 2008	Aug. 08, 2009
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
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	May 28, 2008	May 27, 2009

**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.



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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 meter 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.

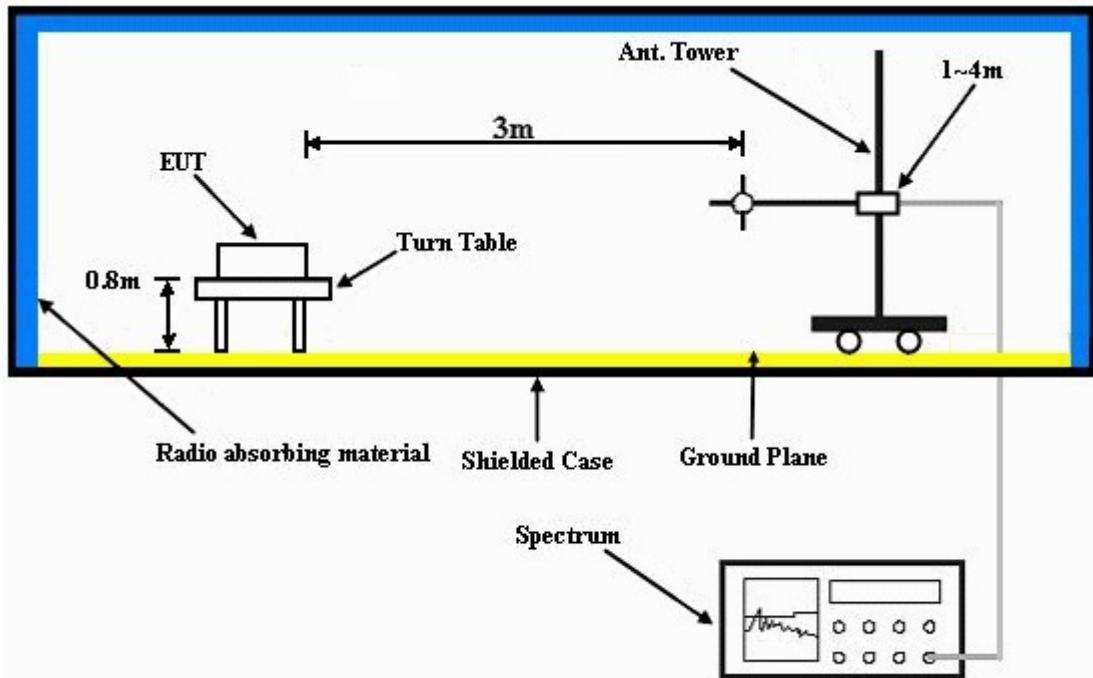
#### NOTE:

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 1 MHz 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 attached file (Test Setup Photo).

#### 4.1.6 EUT OPERATING CONDITIONS

- a. Connected the EUT to the Notebook system via controlled board.
- b. The Notebook system ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- c. The notebook system sent "H" messages to its screen.
- d. Steps c was repeated.



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#### 4.1.7 TEST RESULTS

##### GFSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL		Channel 0		FREQUENCY RANGE 1 ~ 25GHz
INPUT POWER (SYSTEM)		120Vac, 60 Hz		DETECTOR FUNCTION Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS		24deg. C, 64%RH 1000hPa		TESTED BY Match Tsui

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	1602.00	46.90 PK	74.00	-27.10	1.24 H	340	16.77	30.13
2	1602.00	41.70 AV	54.00	-12.30	1.24 H	340	11.57	30.13
3	*2402.00	97.30 PK			1.11 H	352	64.16	33.14
4	*2402.00	67.20 AV			1.11 H	352	34.06	33.14
5	4804.00	62.90 PK	74.00	-11.10	1.08 H	129	23.75	39.15
6	4804.00	32.80 AV	54.00	-21.20	1.08 H	129	-6.35	39.15
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	1602.00	46.30 PK	74.00	-27.70	1.00 V	10	16.17	30.13
2	1602.00	43.26 AV	54.00	-10.74	1.00 V	10	13.13	30.13
3	2390.00	59.55 PK	74.00	-14.45	1.05 V	201	26.47	33.08
4	2390.00	48.19 AV	54.00	-5.81	1.05 V	201	15.11	33.08
5	*2402.00	102.02 PK			1.05 V	201	68.88	33.14
6	*2402.00	71.92 AV			1.05 V	201	38.78	33.14
7	4804.00	57.47 PK	74.00	-16.53	1.34 V	346	18.32	39.15
8	4804.00	27.37 AV	54.00	-26.60	1.34 V	346	-11.75	39.15

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1000hPa	TESTED BY	Match Tsui

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	1628.00	40.53 PK	74.00	-33.47	1.14 H	288	10.31	30.22
2	1628.00	30.75 AV	54.00	-23.25	1.14 H	288	0.53	30.22
3	*2441.00	96.17 PK			1.27 H	312	62.88	33.29
4	*2441.00	66.07 AV			1.27 H	312	32.78	33.29
5	4882.00	63.72 PK	74.00	-10.28	1.22 H	286	24.58	39.14
6	4882.00	33.62 AV	54.00	-20.38	1.22 H	286	-5.52	39.14
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	*2441.00	102.79 PK			1.38 V	283	69.50	33.29
2	*2441.00	72.69 AV			1.38 V	283	39.40	33.29
3	4882.00	63.33 PK	74.00	-10.67	1.26 V	277	24.19	39.14
4	4882.00	33.23 AV	54.00	-20.77	1.26 V	277	-5.91	39.14

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	1 ~ 25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	24deg. C, 64%RH 1000hPa	TESTED BY	Match Tsui

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	*2480.00	96.93 PK			1.13 H	102	63.48	33.45
2	*2480.00	66.83 AV			1.13 H	102	33.38	33.45
3	2483.50	53.29 PK	74.00	-20.71	1.13 H	102	19.83	33.46
4	2483.50	23.19 AV	54.00	-30.81	1.13 H	102	-10.27	33.46
5	4960.00	66.24 PK	74.00	-7.76	1.04 H	128	26.57	39.67
6	4960.00	36.14 AV	54.00	-17.86	1.04 H	128	-3.53	39.67
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	1654.00	39.30 PK	74.00	-34.70	1.24 V	198	8.98	30.32
2	1654.00	33.16 AV	54.00	-20.84	1.24 V	198	2.84	30.32
3	*2480.00	102.62 PK			1.31 V	19	69.17	33.45
4	*2480.00	72.52 AV			1.31 V	19	39.07	33.45
5	2483.50	57.31 PK	74.00	-16.69	1.31 V	19	23.85	33.46
6	2483.50	27.21 AV	54.00	-26.79	1.31 V	19	-6.25	33.46
7	4960.00	59.66 PK	74.00	-14.34	1.03 V	220	19.99	39.67
8	4960.00	29.56 AV	54.00	-24.44	1.03 V	220	-10.11	39.67

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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## 8DPSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL		Channel 0		FREQUENCY RANGE 1 ~ 25GHz
INPUT POWER (SYSTEM)		120Vac, 60 Hz		DETECTOR FUNCTION Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS		24deg. C, 64%RH 1000hPa		TESTED BY Match Tsui

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	58.54 PK	74.00	-15.46	1.00 H	66	25.46	33.08
2	2390.00	47.31 AV	54.00	-6.69	1.00 H	66	14.23	33.08
3	*2402.00	94.12 PK			1.00 H	66	60.98	33.14
4	*2402.00	64.02 AV			1.00 H	66	30.88	33.14
5	4804.00	52.54 PK	74.00	-21.46	1.14 H	82	13.39	39.15
6	4804.00	22.44 AV	54.00	-31.56	1.14 H	82	-16.71	39.15
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	1602.00	45.33 PK	74.00	-28.67	1.00 V	16	15.20	30.13
2	1602.00	41.43 AV	54.00	-12.57	1.00 V	16	11.30	30.13
3	2390.00	58.88 PK	74.00	-15.12	1.06 V	201	25.80	33.08
4	2390.00	47.75 AV	54.00	-6.25	1.06 V	201	14.67	33.08
5	*2402.00	97.63 PK			1.06 V	201	64.49	33.14
6	*2402.00	67.53 AV			1.06 V	201	34.39	33.14
7	4804.00	51.08 PK	74.00	-22.92	1.12 V	321	11.93	39.15
8	4804.00	20.98 AV	54.00	-33.02	1.12 V	321	-18.17	39.15

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on  $0.625 * 5$  per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL		Channel 39		FREQUENCY RANGE 1 ~ 25GHz
INPUT POWER (SYSTEM)		120Vac, 60 Hz		DETECTOR FUNCTION Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS		24deg. C, 64%RH 1000hPa		TESTED BY Match Tsui

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	93.39 PK			1.21 H	60	60.10	33.29
2	*2441.00	63.29 AV			1.21 H	60	30.00	33.29
3	4882.00	52.67 PK	74.00	-21.33	1.21 H	0	13.53	39.14
4	4882.00	22.57 AV	54.00	-31.43	1.21 H	0	-16.57	39.14
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	*2441.00	98.77 PK			1.35 V	360	65.48	33.29
2	*2441.00	68.67 AV			1.35 V	360	35.38	33.29
3	4882.00	50.39 PK	74.00	-23.61	1.35 V	360	11.25	39.14
4	4882.00	20.29 AV	54.00	-33.71	1.35 V	360	-18.85	39.14

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL		Channel 78		FREQUENCY RANGE 1 ~ 25GHz
INPUT POWER (SYSTEM)		120Vac, 60 Hz		DETECTOR FUNCTION Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS		24deg. C, 64%RH 1000hPa		TESTED BY Match Tsui

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	*2480.00	93.82 PK			1.19 H	74	60.37	33.45
2	*2480.00	63.72 AV			1.19 H	74	30.27	33.45
3	2483.50	52.47 PK	74.00	-21.53	1.19 H	74	19.01	33.46
4	2483.50	22.37 AV	54.00	-31.63	1.19 H	74	-11.09	33.46
5	4960.00	53.23 PK	74.00	-20.77	1.19 H	360	13.56	39.67
6	4960.00	23.13 AV	54.00	-30.87	1.19 H	360	-16.54	39.67
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	*2480.00	93.82 PK			1.19 V	74	60.37	33.45
2	*2480.00	63.72 AV			1.19 V	74	30.27	33.45
3	2483.50	52.47 PK	74.00	-21.53	1.19 V	74	19.01	33.46
4	2483.50	22.37 AV	54.00	-31.63	1.19 V	74	-11.09	33.46
5	4960.00	53.23 PK	74.00	-20.77	1.19 V	360	13.56	39.67
6	4960.00	23.13 AV	54.00	-30.87	1.19 V	360	-16.54	39.67

**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 DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correlation factor be equal to:  $20\log(3.125 / 100) = -30.1$  dB.
7. Average value = peak reading +  $20\log(\text{duty cycle})$ .



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## BELOW 1GHz WORST-CASE DATA : GFSK MODULATION

EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL		Channel 78		FREQUENCY RANGE
INPUT POWER (SYSTEM)		120Vac, 60 Hz		DETECTOR FUNCTION
ENVIRONMENTAL CONDITIONS		24deg. C, 64%RH 999hPa		TESTED BY
				Match Tsui

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	47.40	29.92 QP	40.00	-10.08	2.50 H	67	16.86	13.06
2	109.62	36.79 QP	43.50	-6.71	1.50 H	94	26.30	10.49
3	171.83	38.56 QP	43.50	-4.94	2.00 H	97	25.75	12.81
4	199.05	32.30 QP	43.50	-11.20	1.50 H	103	21.64	10.67
5	698.74	35.98 QP	46.00	-10.02	2.00 H	73	13.26	22.72
6	933.99	38.65 QP	46.00	-7.35	1.25 H	124	12.28	26.37
7	945.66	35.81 QP	46.00	-10.19	1.50 H	142	9.35	26.46
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	47.40	30.54 QP	40.00	-9.46	1.00 V	136	17.49	13.06
2	105.73	32.70 QP	43.50	-10.80	1.50 V	85	22.67	10.02
3	171.83	33.75 QP	43.50	-9.75	1.25 V	100	20.94	12.81
4	856.22	34.16 QP	46.00	-11.84	1.00 V	91	8.47	25.69
5	902.89	36.41 QP	46.00	-9.59	1.25 V	172	10.28	26.13
6	<b>933.99</b>	<b>42.85 QP</b>	<b>46.00</b>	<b>-3.15</b>	<b>2.50 V</b>	<b>268</b>	<b>16.48</b>	<b>26.37</b>
7	947.60	37.05 QP	46.00	-8.95	1.00 V	142	10.58	26.47

**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.



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## 4.2 CONDUCTED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF 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

**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 0.50 MHz.
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	100288	Sep. 22, 2008	Sep. 21, 2009
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Jan. 04, 2008	Jan. 03, 2009
LISN ROHDE & SCHWARZ	ESH2-Z5	100100	Jan. 10, 2008	Jan. 09, 2009
LISN ROHDE & SCHWARZ	ESH3-Z5	100311	Jul. 30, 2008	Jul. 29, 2009
Software ADT	ADT_Cond_V7.3.6	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 2.
3. The VCCI Site Registration No. is C-2047.



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#### 4.2.3 TEST PROCEDURES

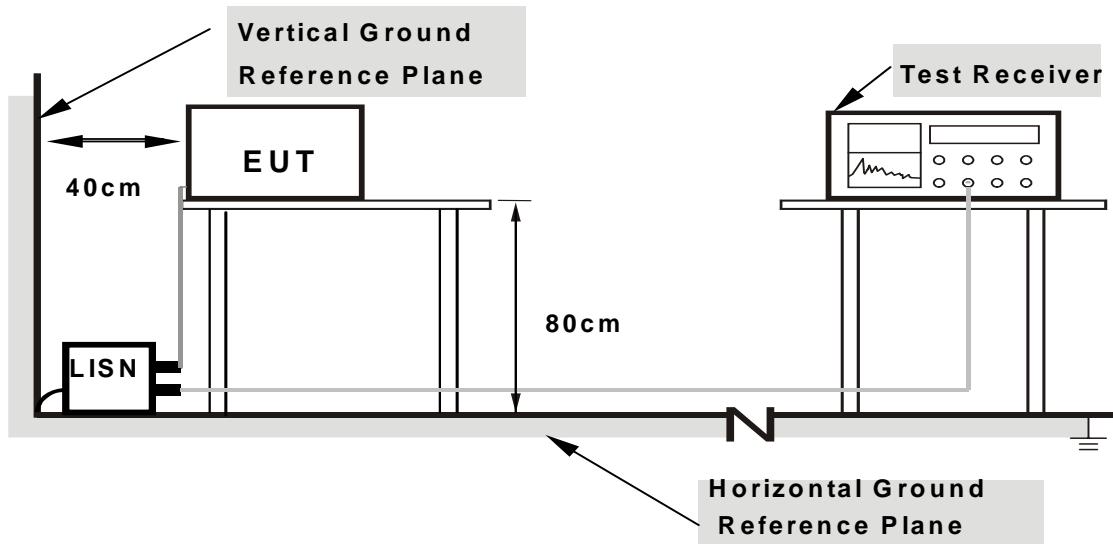
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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

#### 4.2.5 TEST SETUP



**Note:**

1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

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

#### 4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6

## 4.2.7 TEST RESULTS

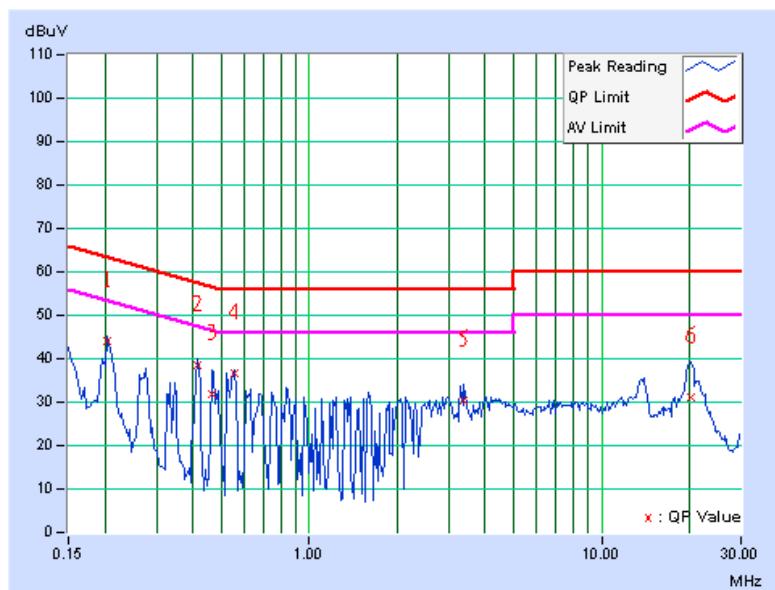
## CONDUCTED WORST CASE DATA: GFSK MODULATION

EUT TEST CONDITION			MEASUREMENT DETAIL		
CHANNEL		Channel 78			PHASE
MODULATION TYPE		GFSK			6dB BANDWIDTH
ENVIRONMENTAL CONDITIONS		25deg. C, 65%RH, 1017hPa			INPUT POWER (SYSTEM)
TESTED BY		Antony Lee			

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.205	0.13	42.86	-	42.99	-	63.42	53.42	-20.43	-
2	0.416	0.14	37.34	-	37.48	-	57.54	47.54	-20.05	-
3	0.463	0.14	30.55	-	30.69	-	56.65	46.65	-25.95	-
4	0.556	0.15	35.17	-	35.32	-	56.00	46.00	-20.68	-
5	3.387	0.38	29.01	-	29.39	-	56.00	46.00	-26.61	-
6	20.164	1.32	29.93	-	31.25	-	60.00	50.00	-28.75	-

**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.

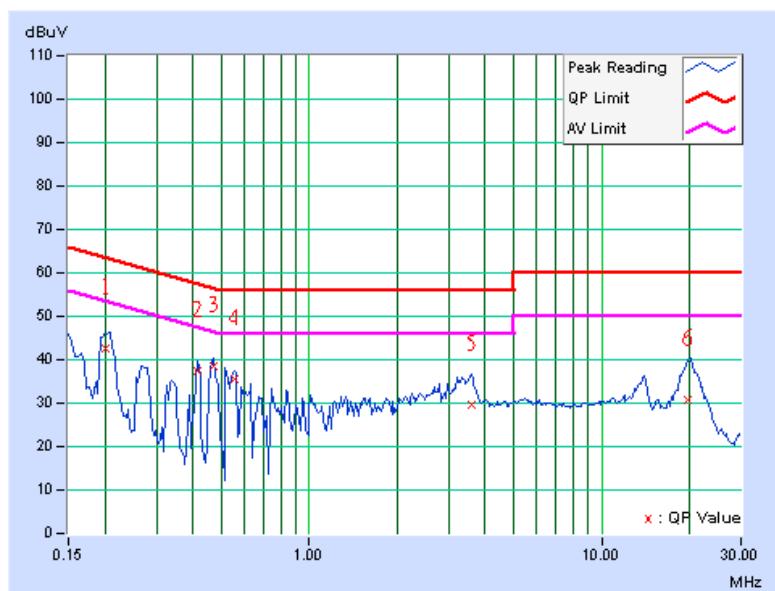


EUT TEST CONDITION			MEASUREMENT DETAIL		
CHANNEL	Channel 78		PHASE	Line 2	
MODULATION TYPE	GFSK		6dB BANDWIDTH	9 kHz	
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH, 1017hPa		INPUT POWER (SYSTEM)	120Vac, 60 Hz	
TESTED BY	Antony Lee				

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.201	0.14	41.81	-	41.95	-	63.58	53.58	-21.63	-
2	0.416	0.15	36.53	-	36.68	-	57.54	47.54	-20.85	-
3	<b>0.470</b>	<b>0.15</b>	<b>37.73</b>	-	<b>37.88</b>	-	<b>56.51</b>	<b>46.51</b>	<b>-18.62</b>	-
4	0.556	0.16	34.65	-	34.81	-	56.00	46.00	-21.19	-
5	3.574	0.39	28.80	-	29.19	-	56.00	46.00	-26.81	-
6	19.777	0.95	29.94	-	30.89	-	60.00	50.00	-29.11	-

**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 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.





## 4.3 BAND EDGES MEASUREMENT

### 4.3.1 LIMITS OF BAND EDGES MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	CALIBRATED UNTIL
R&S SPECTRUM ANALYZER	FSP40	100041	Apr. 22, 2008	Apr. 21, 2009

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

### 4.3.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low loss cable. Set both RBW and VBW of spectrum analyzer to 100 kHz and 300 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

### 4.3.4 DEVIATION FROM TEST STANDARD

No deviation.

### 4.3.5 EUT OPERATING CONDITION

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



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#### 4.3.6 TEST RESULTS

The spectrum plots are attached on the following 8 images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement in part 15.247(d).

##### GFSK MODULATION

**NOTE 1:** The band edge emission plot on the next page shows 51.44dBc between carrier maximum power and local maximum emission in restrict band (2.36880GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.1.7 is 102.02dBuV/m (Peak), so the maximum field strength in restrict band is  $102.02 - 51.44 = 50.58$  dBuV/m, which is under 74 dBuV/m limit.

Average value =  $50.58 - 30.10 = 20.48$  dBuV/m, which is under 54dBuV/m limit.

\*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correction factor be equal to:  $20\log(3.125/100) = -30.1$  dB.

Average value = peak reading – 30.1

**NOTE 2:** The band edge emission plot on the next page shows 48.82dBc between carrier maximum power and local maximum emission in restrict band (2.48350GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.1.7 is 102.62dBuV/m (Peak), so the maximum field strength in restrict band is  $102.62 - 48.82 = 53.80$  dBuV/m, which is under 74 dBuV/m limit.

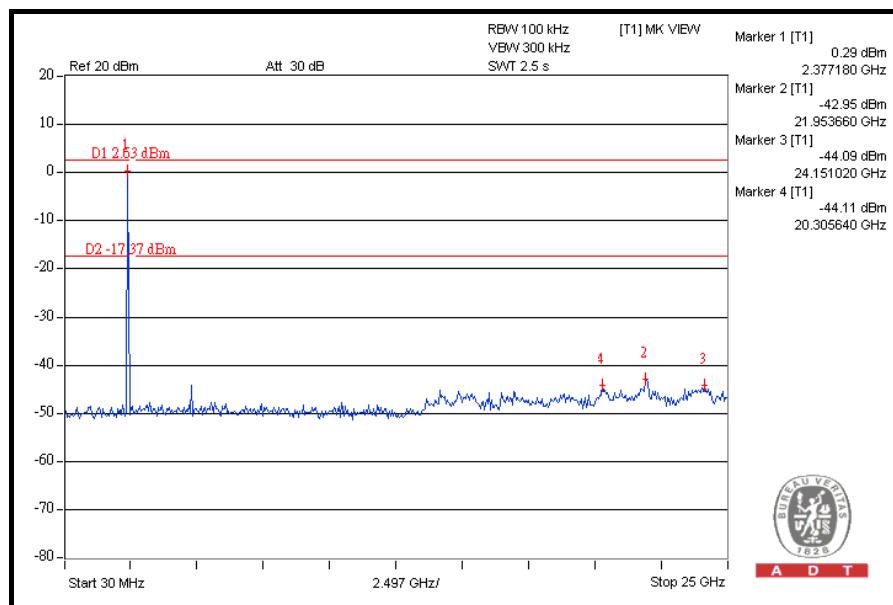
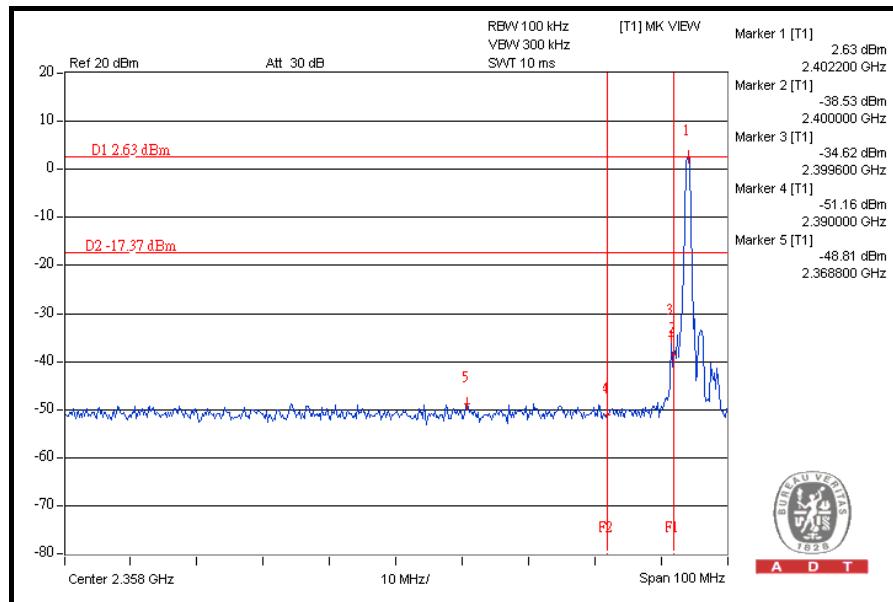
Average value =  $53.80 - 30.10 = 23.70$  dBuV/m, which is under 54dBuV/m limit.

\*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correction factor be equal to:  $20\log(3.125/100) = -30.1$  dB.

Average value = peak reading – 30.1

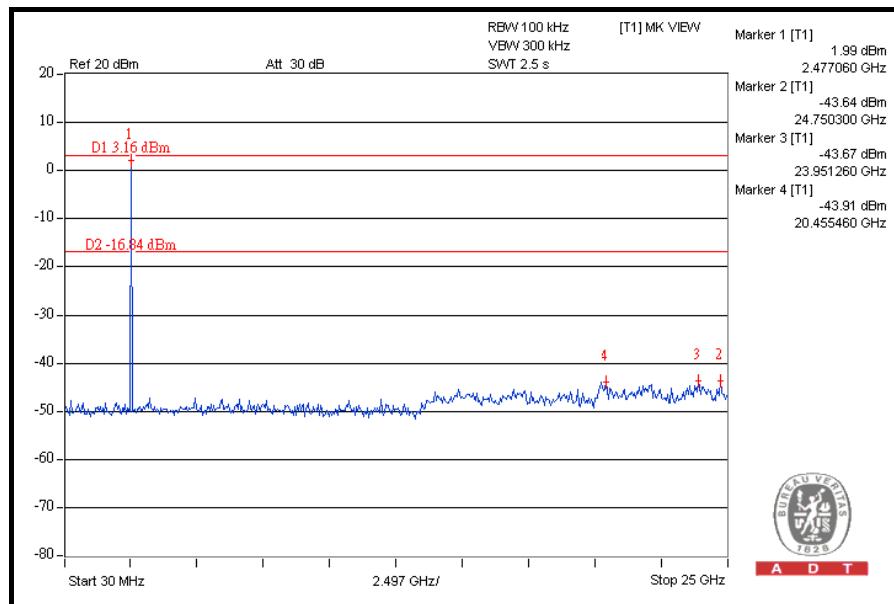
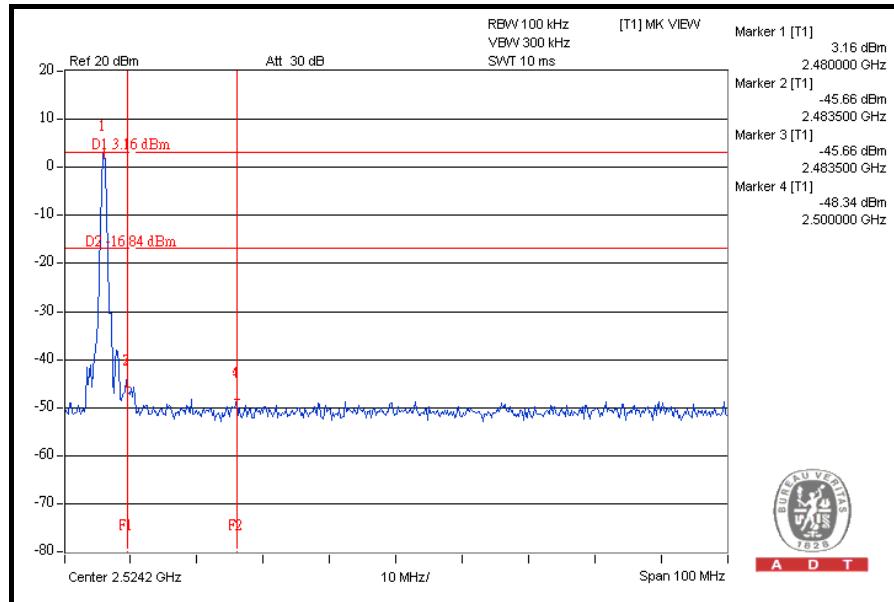


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## 8DPSK MODULATION

**NOTE 1:** The band edge emission plot on the next page shows 46.61dBc between carrier maximum power and local maximum emission in restrict band (2.38460GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.1.7 is 97.63dBuV/m (Peak), so the maximum field strength in restrict band is  $97.63 - 46.61 = 51.02$  dBuV/m, which is under 74 dBuV/m limit.

Average value =  $51.02 - 30.10 = 20.92$  dBuV/m, which is under 54dBuV/m limit.

\*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correction factor be equal to:  $20\log(3.125/100) = -30.1$  dB.

Average value = peak reading – 30.1

**NOTE 2:** The band edge emission plot on the next page shows 42.56dBc between carrier maximum power and local maximum emission in restrict band (2.48350GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.1.7 is 98.59dBuV/m (Peak), so the maximum field strength in restrict band is  $98.59 - 42.56 = 56.03$  dBuV/m, which is under 74 dBuV/m limit.

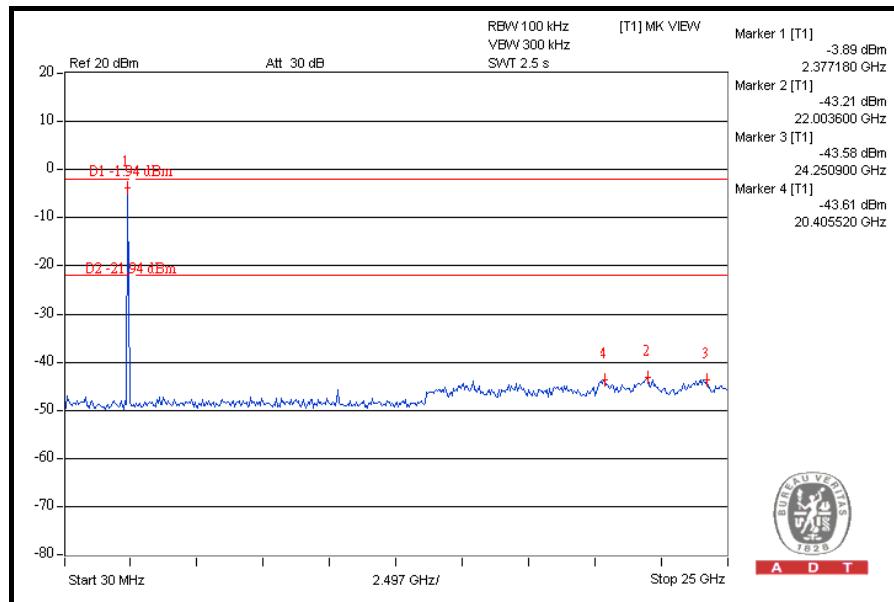
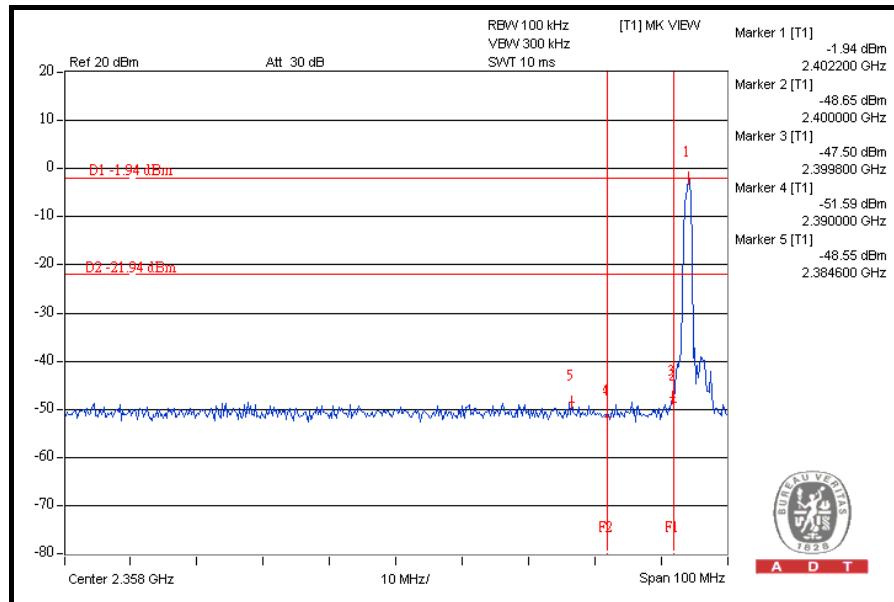
Average value =  $56.03 - 30.10 = 25.93$  dBuV/m, which is under 54dBuV/m limit.

\*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 \* 5 per 296.25 ms per channel. Therefore, the duty cycle correction factor be equal to:  $20\log(3.125/100) = -30.1$  dB.

Average value = peak reading – 30.1

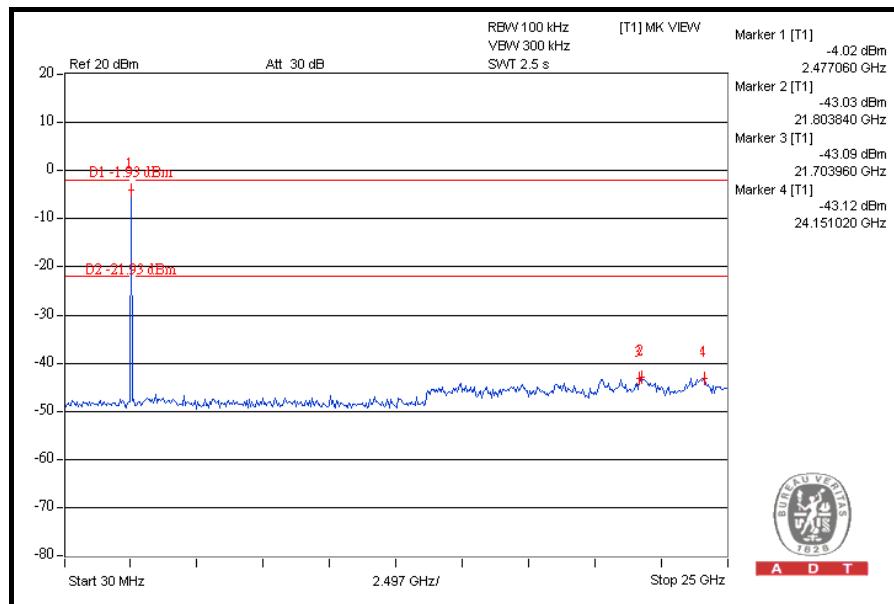
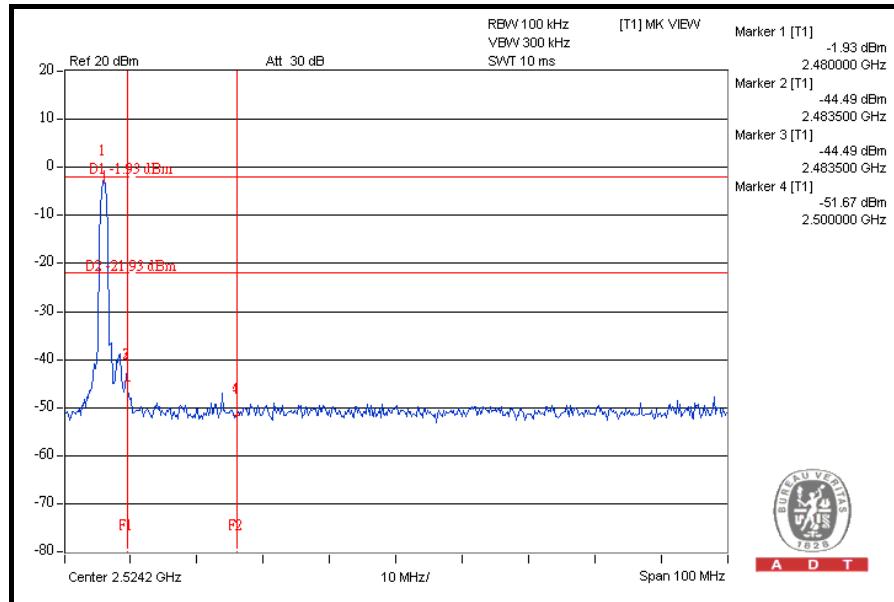


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## 4.4 ANTENNA REQUIREMENT

### 4.4.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

### 4.4.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is PIFA antenna with U.FL antenna connector. The maximum gain of this antenna is -0.55dBi.



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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 by the following approval agencies according to ISO/IEC 17025.

<b>USA</b>	FCC, NVLAP
<b>Germany</b>	TUV Rheinland
<b>Japan</b>	VCCI
<b>Norway</b>	NEMKO
<b>Canada</b>	INDUSTRY CANADA , CSA
<b>R.O.C.</b>	TAF, BSMI, NCC
<b>Netherlands</b>	Telefication
<b>Singapore</b>	GOST-ASIA(MOU)
<b>Russia</b>	CERTIS(MOU)

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

[www.adt.com.tw/index.5/phtml](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: 886-3-3185050

**Web Site:** [www.adt.com.tw](http://www.adt.com.tw)

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



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## 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.

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