

# FCC TEST REPORT

**REPORT NO.:** RF940330A01

**MODEL NO.:** HF-6W

**RECEIVED:** May 13, 2005

**TESTED:** May 17 ~ 18, 2005

**ISSUED:** May 25, 2005

**APPLICANT:** Nokia Corporation

**ADDRESS:** Joensuukatu 7E, FIN-24100 Salo, Finland

**ISSUED BY:** Advance Data Technology Corporation

**LAB LOCATION:** No. 47, 14<sup>th</sup> Ling, Chia Pau Tsuen, Lin Kou  
Hsiang 244, Taipei Hsien, Taiwan, R.O.C.

This test report consists of 50 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CNLA, A2LA or any government agency. The test results in the report only apply to the tested sample.



## 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 .....	10
3.4	DESCRIPTION OF SUPPORT UNITS .....	10
3.5	NUMBER OF HOPPING FREQUENCY USED .....	11
3.5.1	LIMIT OF HOPPING FREQUENCY USED .....	11
3.5.2	TEST INSTRUMENTS .....	11
3.5.3	TEST PROCEDURES .....	11
3.5.4	DEVIATION FROM TEST STANDARD .....	12
3.5.5	TEST SETUP .....	12
3.5.6	TEST RESULTS .....	12
3.6	DWELL TIME ON EACH CHANNEL .....	14
3.6.1	LIMIT OF DWELL TIME USED .....	14
3.6.2	TEST INSTRUMENTS .....	14
3.6.3	TEST PROCEDURES .....	14
3.6.4	DEVIATION FROM TEST STANDARD .....	15
3.6.5	TEST SETUP .....	15
3.6.6	TEST RESULTS .....	16
3.7	CHANNEL BANDWIDTH .....	20
3.7.1	LIMITS OF CHANNEL BANDWIDTH .....	錯誤! 尚未定義書籤。
3.7.2	TEST INSTRUMENTS .....	20
3.7.3	TEST PROCEDURE .....	20
3.7.4	DEVIATION FROM TEST STANDARD .....	21
3.7.5	TEST SETUP .....	21
3.7.6	EUT OPERATING CONDITION .....	21
3.7.7	TEST RESULTS .....	22
3.8	HOPPING CHANNEL SEPARATION .....	25
3.8.1	LIMIT OF HOPPING CHANNEL SEPARATION .....	25
3.8.2	TEST INSTRUMENTS .....	25
3.8.3	TEST PROCEDURES .....	25
3.8.4	DEVIATION FROM TEST STANDARD .....	25
3.8.5	TEST SETUP .....	25
3.8.6	TEST RESULTS .....	26
3.9	MAXIMUM PEAK OUTPUT POWER .....	29
3.9.1	LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT .....	29
3.9.2	INSTRUMENTS .....	29
3.9.3	TEST PROCEDURES .....	29

3.9.4	DEVIATION FROM TEST STANDARD .....	30
3.9.5	TEST SETUP .....	30
3.9.6	EUT OPERATING CONDITION .....	30
3.9.7	TEST RESULTS .....	31
3.10	RADIATED EMISSION MEASUREMENT .....	34
3.10.1	LIMITS OF RADIATED EMISSION MEASUREMENT .....	34
3.10.2	TEST INSTRUMENTS .....	35
3.10.3	TEST PROCEDURES .....	36
3.10.4	DEVIATION FROM TEST STANDARD .....	36
3.10.5	TEST SETUP .....	37
3.10.6	EUT OPERATING CONDITIONS .....	37
3.10.7	TEST RESULTS .....	38
3.11	BAND EDGES MEASUREMENT .....	43
4.8.1	LIMITS OF BAND EDGES MEASUREMENT .....	43
4.8.2	TEST INSTRUMENTS .....	43
4.8.3	TEST PROCEDURE .....	43
4.8.4	DEVIATION FROM TEST STANDARD .....	43
4.8.5	EUT OPERATING CONDITION .....	43
4.8.6	TEST RESULTS .....	44
4.9	ANTENNA REQUIREMENT .....	47
4.9.1	STANDARD APPLICABLE .....	47
4.9.2	ANTENNA CONNECTED CONSTRUCTION .....	47
4	PHOTOGRAPHS OF THE TEST CONFIGURATION .....	48
5	INFORMATION ON THE TESTING LABORATORIES .....	50

## 1 CERTIFICATION

**PRODUCT :** Wireless Plug-in Car Handsfree  
**BRAND NAME :** NOKIA  
**MODEL NO. :** HF-6W  
**APPLICANT :** Nokia Corporation  
**TESTED :** May 17 ~ 18, 2005  
**TEST SAMPLE :** ENGINEERING SAMPLE  
**STANDARDS :** FCC Part 15, Subpart C (Section 15.247)  
ANSI C63.4: 2003

The above equipment has been tested by **Advance Data Technology Corporation**, 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 :** Annie Chang, **DATE:** May 25, 2005  
(Annie Chang)

**TECHNICAL**  
**ACCEPTANCE :** Jun Wu, **DATE:** May 25, 2005  
Responsible for RF (Jun Wu)

**APPROVED BY :** Cody Chang, **DATE:** May 25, 2005  
(Cody Chang / Deputy Manager)

## 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	N/A	The EUT power from 12Vdc battery
15.247(a)(1)(iii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit
15.247(a)(1)(iii)	Dwell Time on Each Channel Spec.: Max. 0.4 second within 31.6 second	PASS	Meet the requirement of limit
15.247(a)(1)	Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, whichever is greater Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit
15.247(b)	Maximum Peak Output Power Spec.: max. 30dBm	PASS	Meet the requirement of limit
15.247(d)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is -14.47 dB at 68.88 MHz
15.247(d)	Band Edge Measurement	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	UNCERTAINTY
Conducted emissions	2.44 dB
Radiated emissions	3.86 dB

### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	Wireless Plug-in Car Handsfree
<b>MODEL NO.</b>	HF-6W
<b>POWER SUPPLY</b>	12Vdc from Battery
<b>MODULATION TYPE</b>	GFSK
<b>MODULATION TECHNOLOGY</b>	FHSS
<b>FREQUENCY RANGE</b>	2402 MHz ~ 2480 MHz
<b>NUMBER OF CHANNEL</b>	79
<b>OUTPUT POWER</b>	2.924mW
<b>ANTENNA TYPE</b>	PIFA antenna with 0dBi gain
<b>DATA CABLE</b>	N/A
<b>I/O PORTS</b>	N/A

**NOTE:**

1. The EUT is an easy fit handsfree product, which is based on Bluetooth wireless technology. You can use the handsfree to answer, end and reject a call, and to charge a compatible Nokia mobile phone. In addition, you can use voice dialing, redial a number, switch calls between the habdsfree and compatible phone, or mute and unmute active calls. The EUT includes battery charging function used for NOKIA cell phone.
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

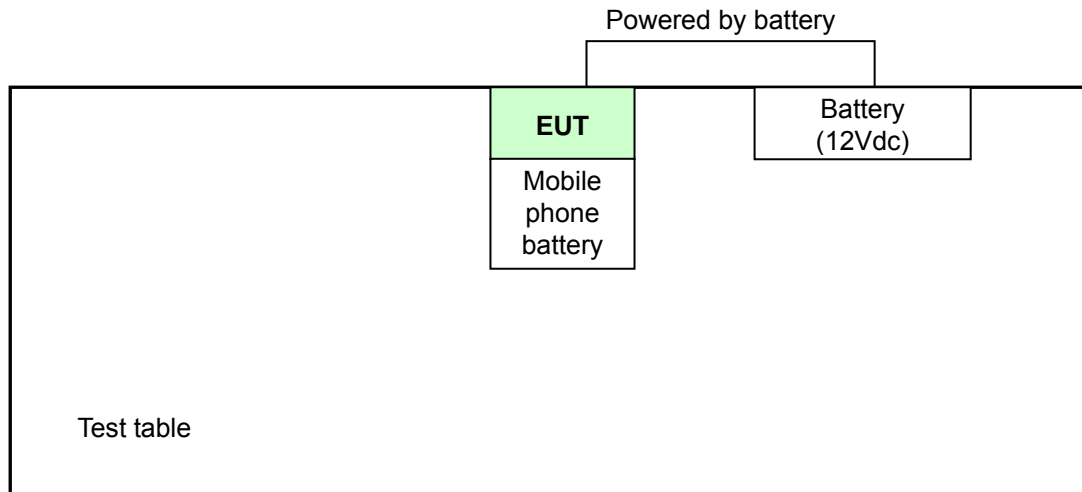
Operated in 2400 ~ 2483.5MHz Band:

79 channels are provided to this EUT.

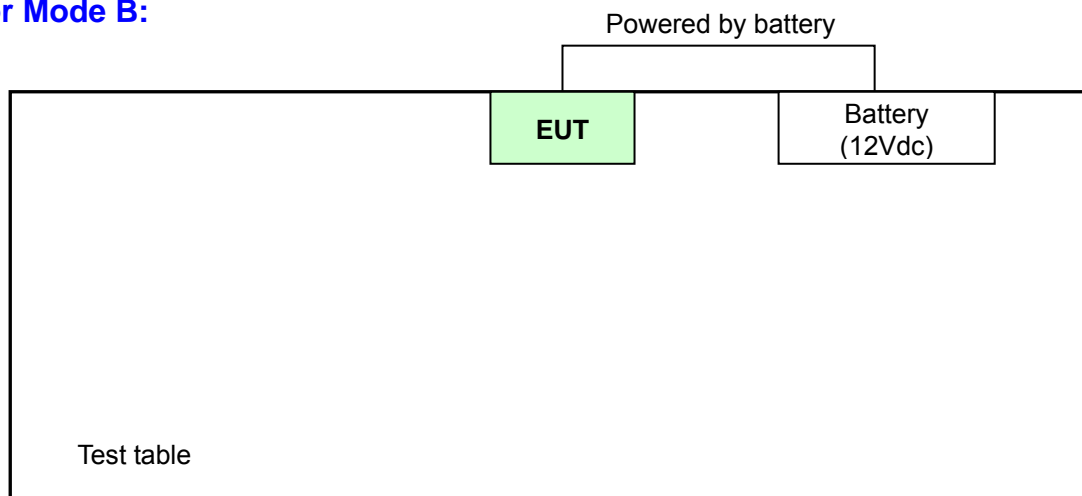
Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	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	2431	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

#### For Mode A:



#### For Mode B:





### 3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT configure mode	Applicable to				Description
	PLC	RE<1G	RE≥1G	APCM	
A	-	v	Note 1	Note 2	Operating mode with Charge function
B	-	v	Note 1	Note 2	Operating mode with Discharge function

Where PLC: Power Line Conducted Emission RE<1G charge function.RE: Radiated Emission below 1GHz

RE≥1G: Radiated Emission above 1GHz

APCM: Antenna Port Conducted Measurement

Note 1: Pre-scan charge and discharge mode were no effect for radiated emission above 1GHz and only the worst case recorded in this report.

Note 2: Conducted RF measurement is independent of charge function.

#### **Radiated Emission Test (Below 1 GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, X, Y, Z Axis and packet types
- ☒ 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
A	0 to 78	78	FHSS	GFSK	DH5	X
B	0 to 78	78	FHSS	GFSK	DH5	X

#### **Radiated Emission Test (Above 1 GHz):**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, X, Y, Z Axis and packet types.
- ☒ 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
A	0 to 78	0, 39, 78	FHSS	GFSK	DH5	X

#### **Bandedge Measurement:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 78	FHSS	GFSK	DH5

#### **Antenna Port Conducted Measurement:**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- ☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type	Packet Type
0 to 78	0, 39, 78	FHSS	GFSK	DH5

### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a Wireless Plug-in Car Handsfree. 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

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	BATTERY	GLOBAL	SMF NX100-S6L	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A

### 3.5 NUMBER OF HOPPING FREQUENCY USED

#### 3.5.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

#### 3.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20. 2006

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

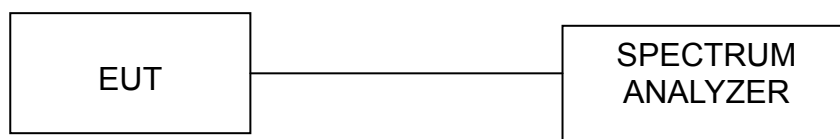
#### 3.5.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

### 3.5.4 DEVIATION FROM TEST STANDARD

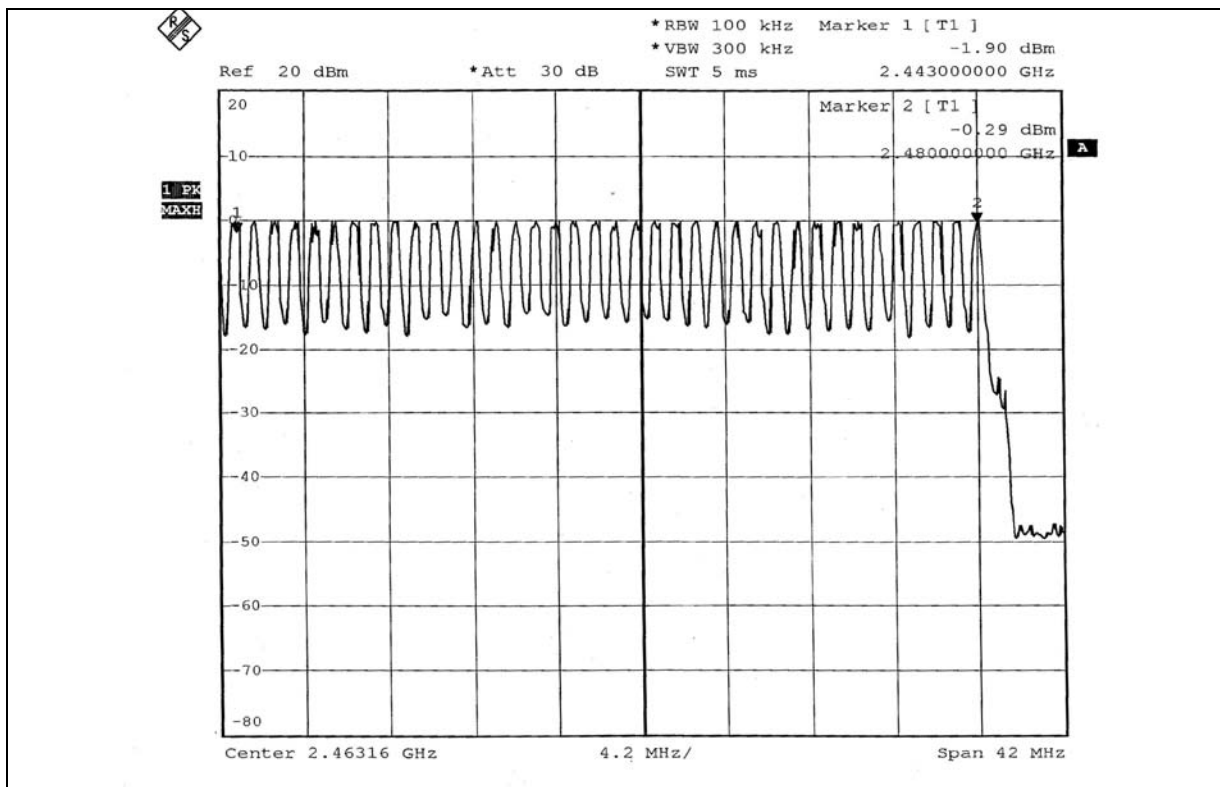
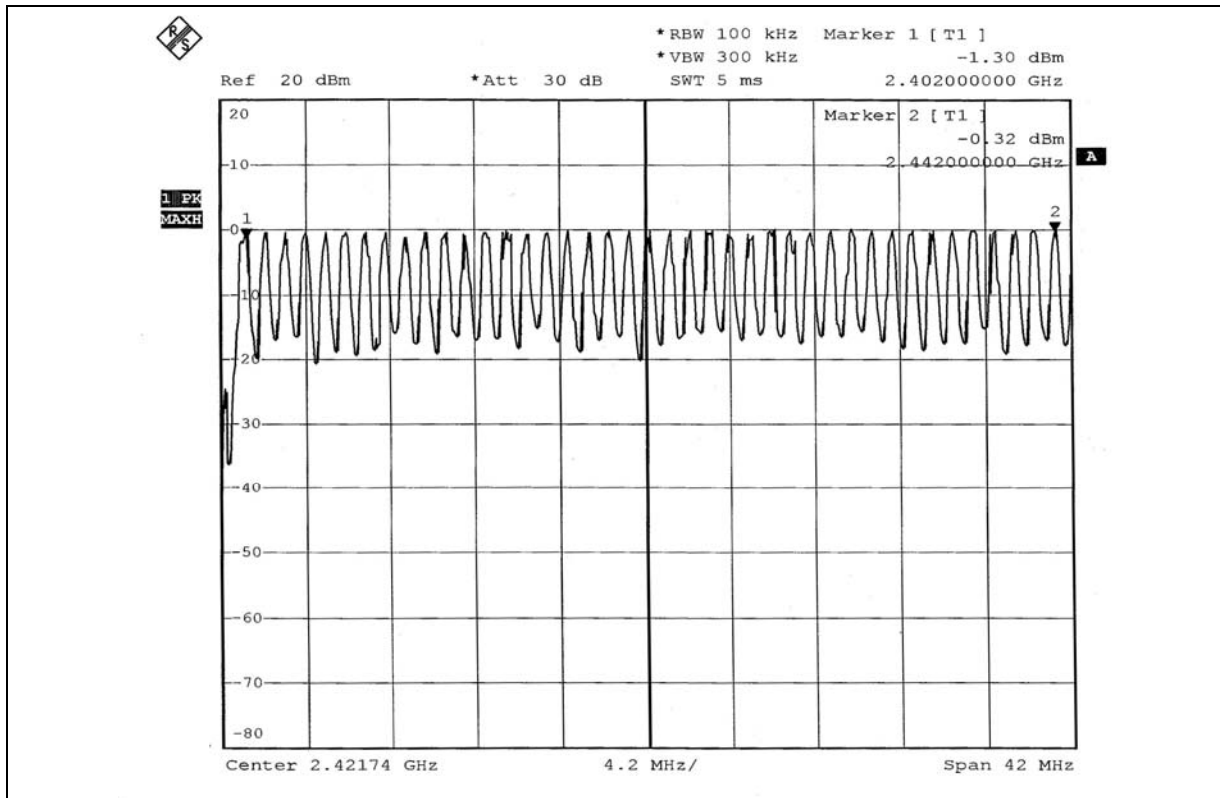
No deviation.

### 3.5.5 TEST SETUP



### 3.5.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.



### 3.6 DWELL TIME ON EACH CHANNEL

#### 3.6.1 LIMIT OF DWELL TIME USED

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### 3.6.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20, 2006

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

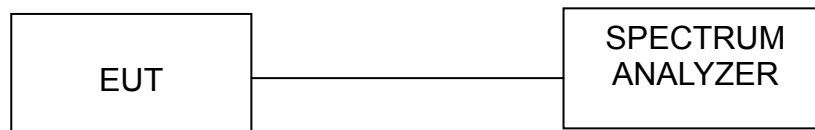
#### 3.6.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all different time-slot modes have been completed.

### 3.6.4 DEVIATION FROM TEST STANDARD

No deviation.

### 3.6.5 TEST SETUP



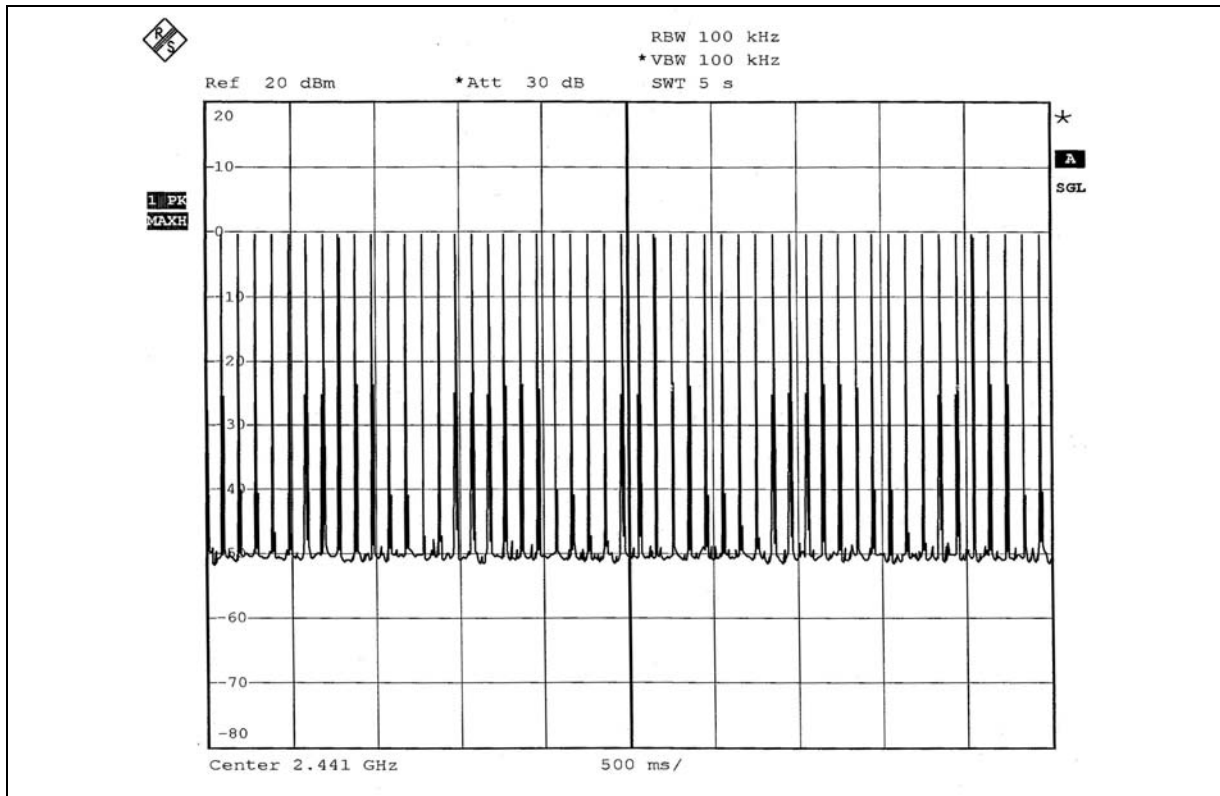
### 3.6.6 TEST RESULTS

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316 times	0.46	145.36	400
DH3	25 (times / 5 sec) *6.32=158 times	1.73	273.34	400
DH5	17 (times / 5 sec) *6.32=107 times	3.04	325.28	400

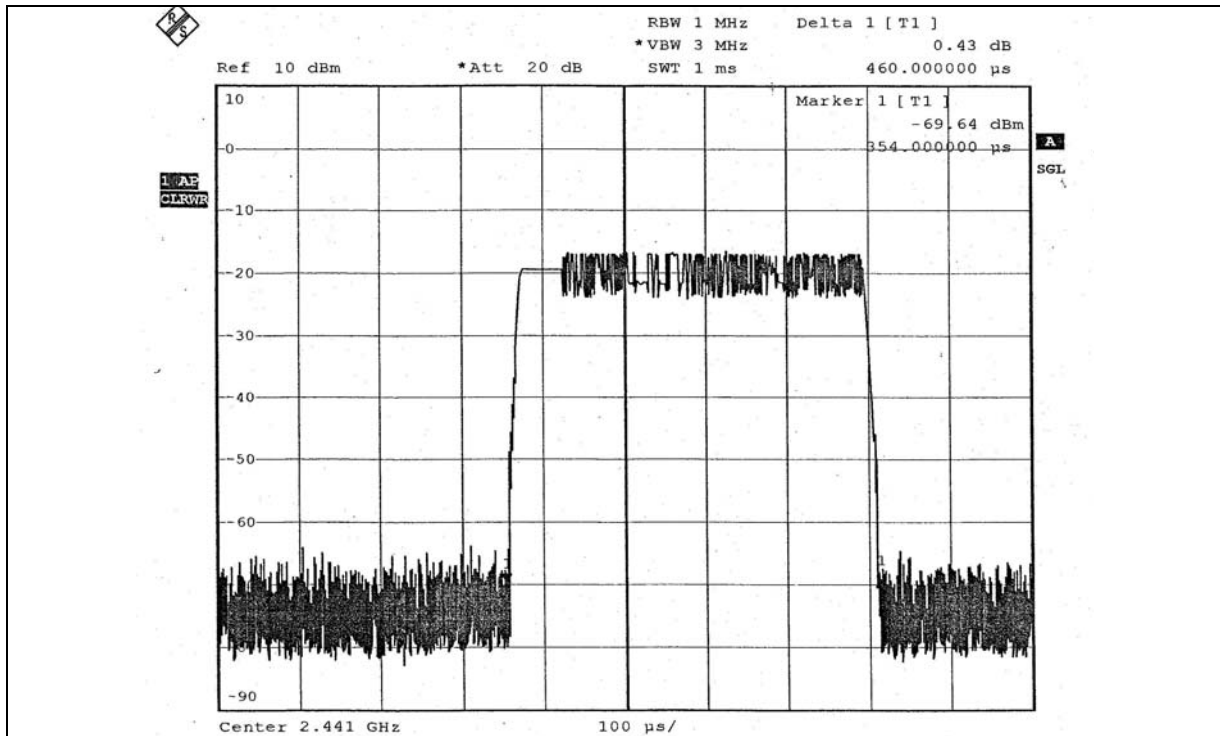
Test plots of the transmitting time slot are shown on next 3 pages.



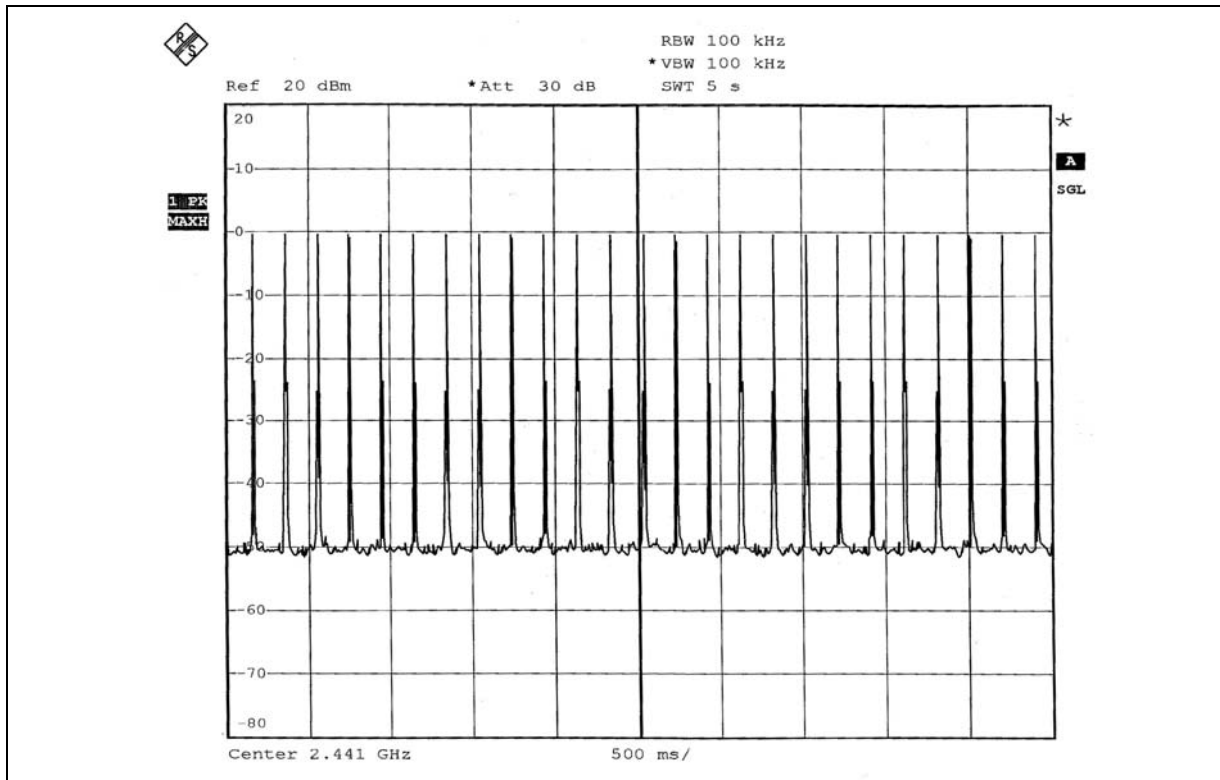
## DH1



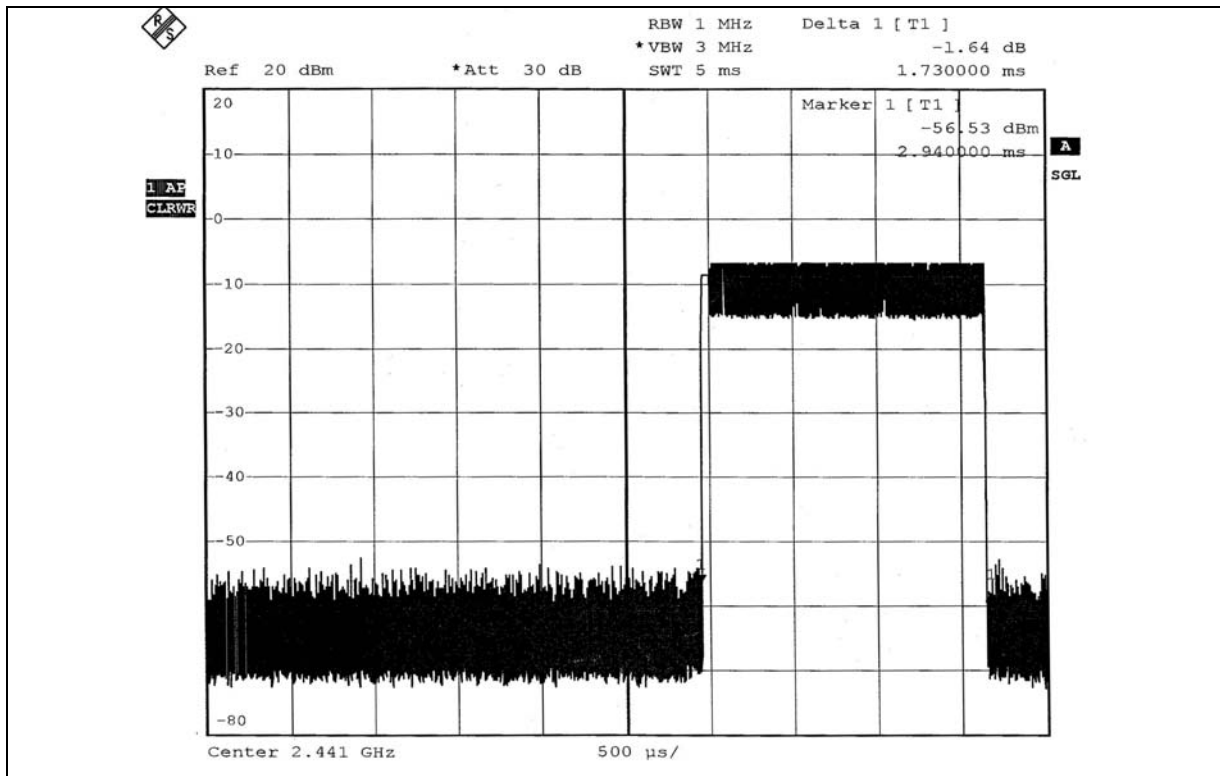
## DH1



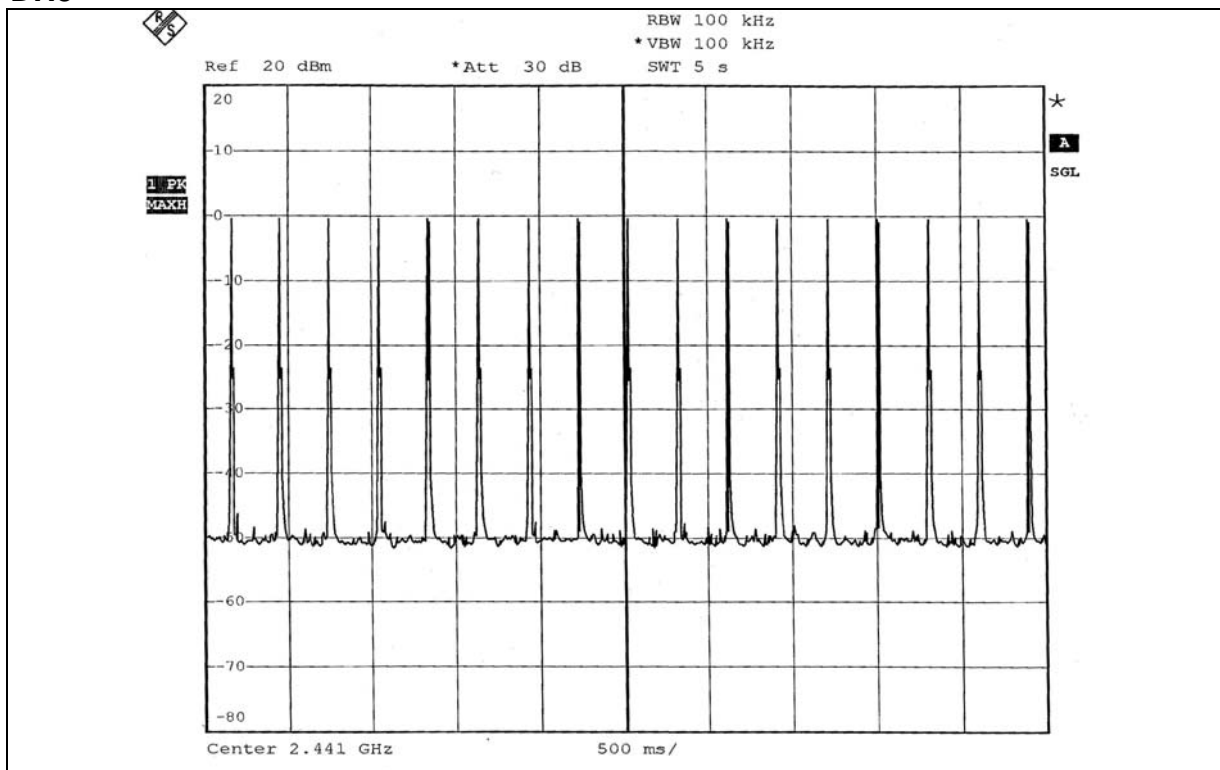
## DH3



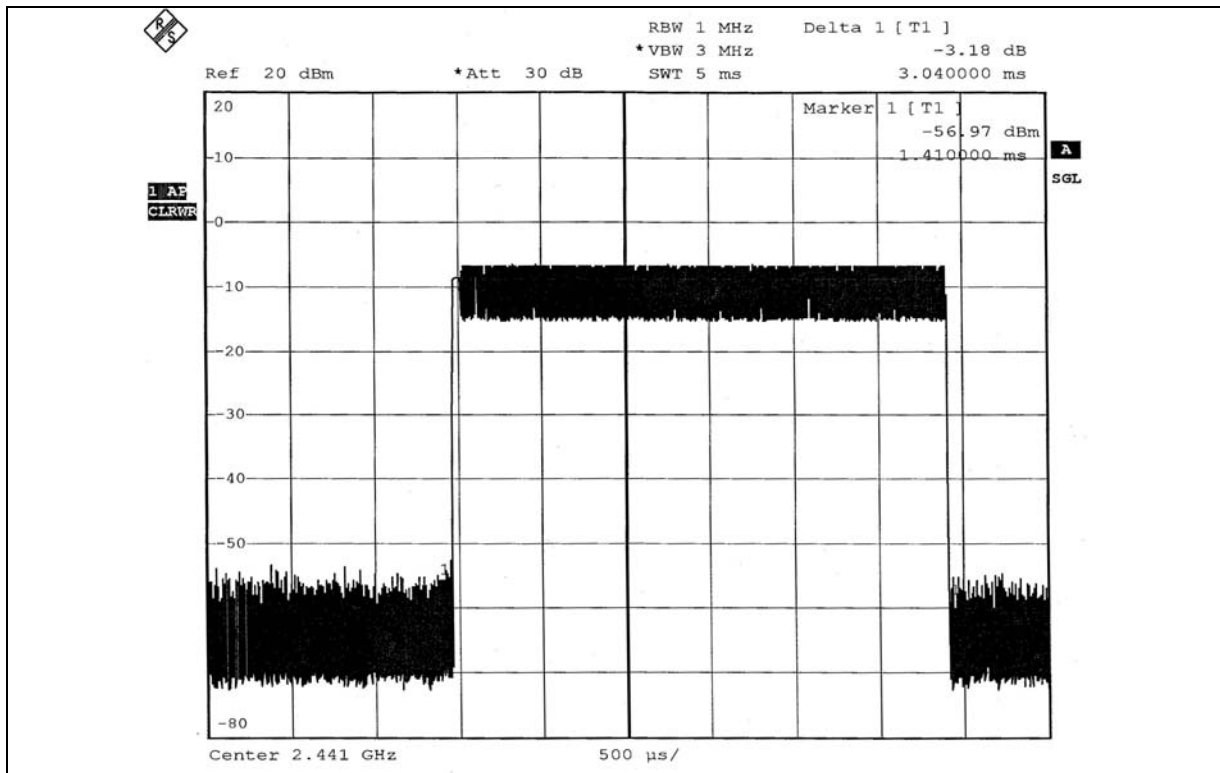
## DH3



## DH5



## DH5



## 3.7 CHANNEL BANDWIDTH

### 3.7.1 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20. 2006

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

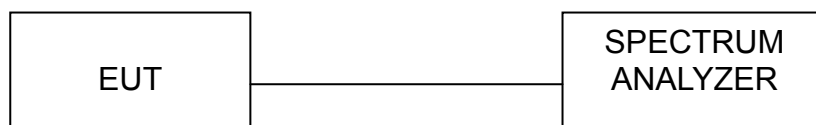
### 3.7.2 TEST PROCEDURE

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

### **3.7.3 DEVIATION FROM TEST STANDARD**

No deviation.

### **3.7.4 TEST SETUP**



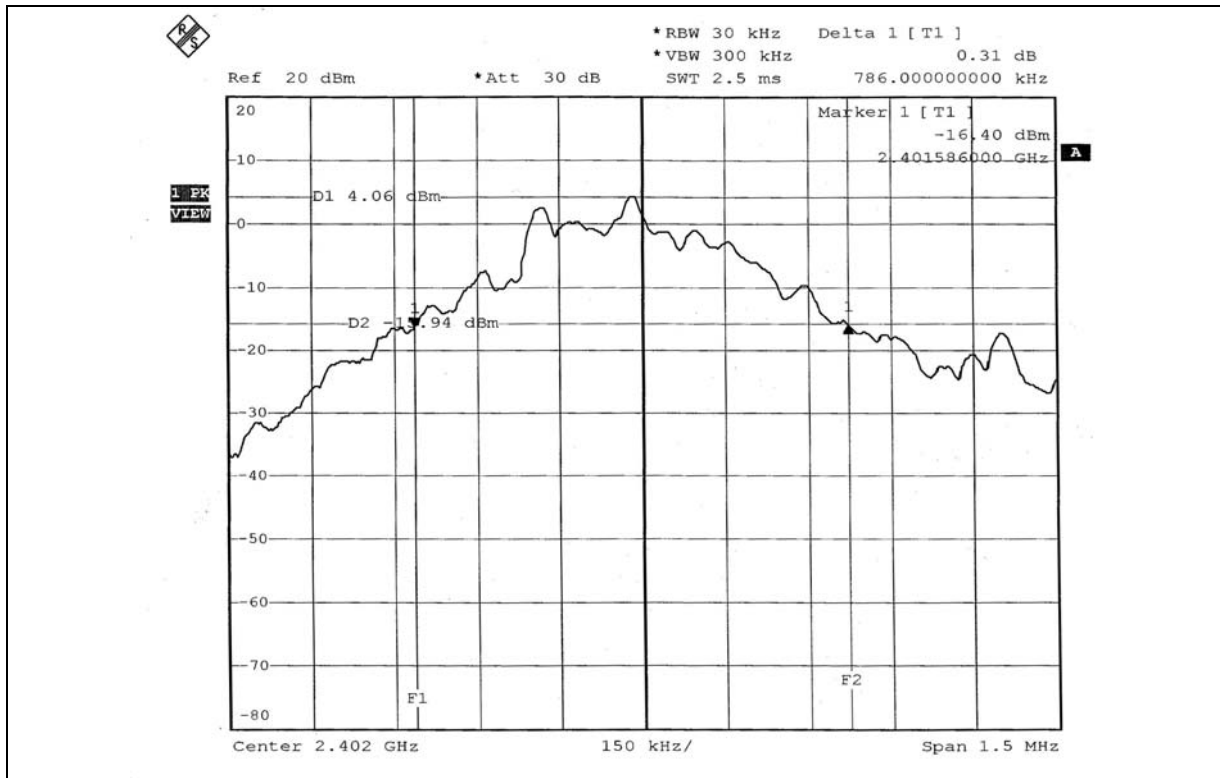
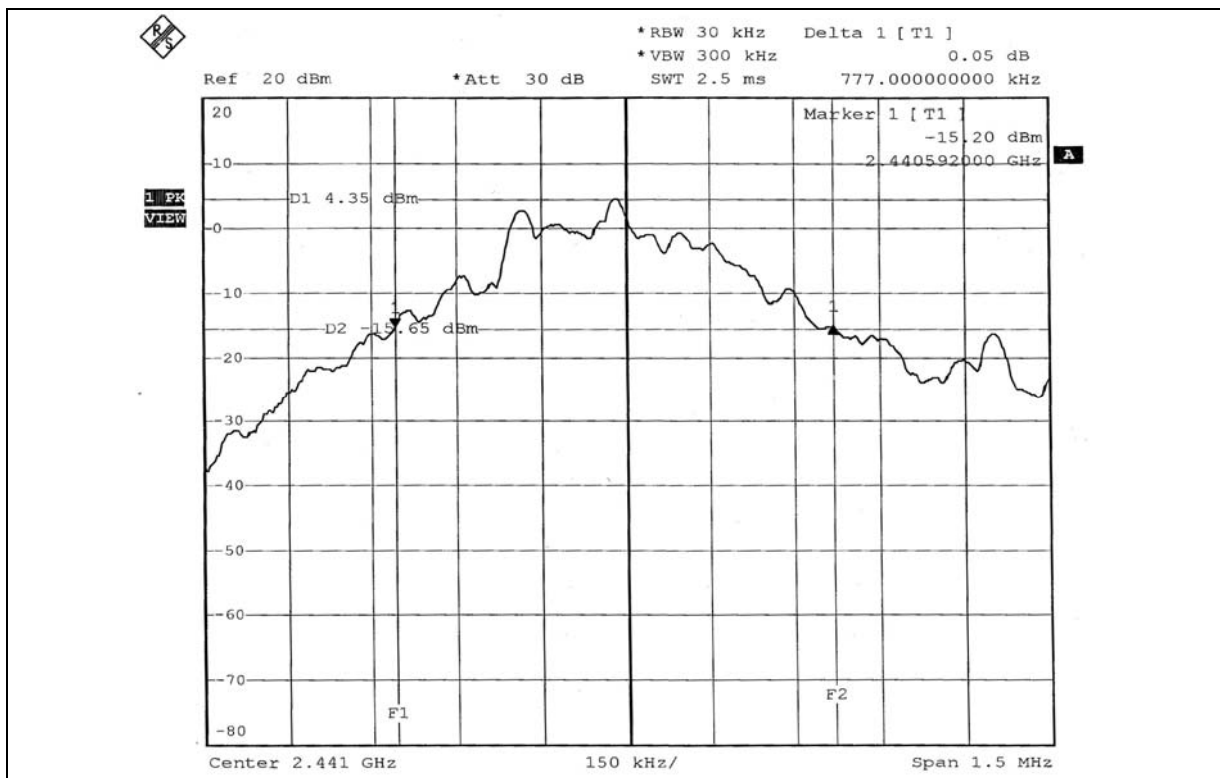
### **3.7.5 EUT OPERATING CONDITION**

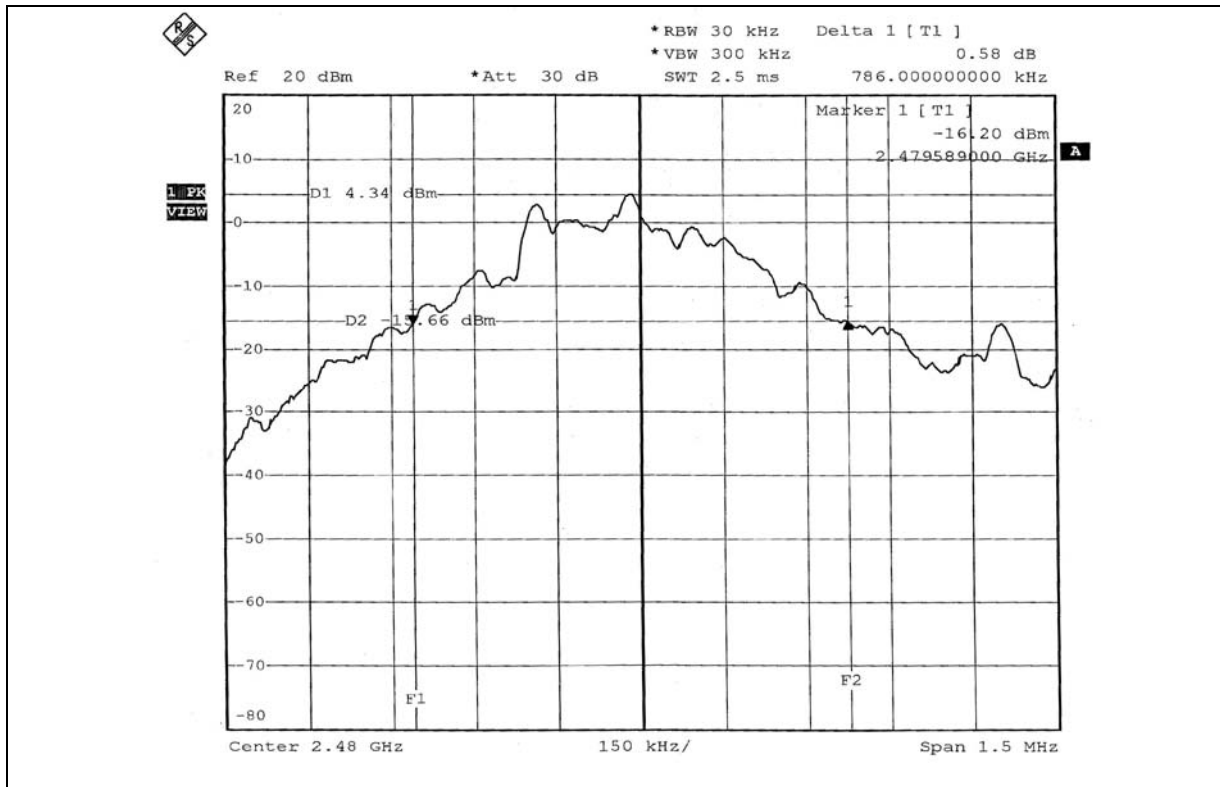
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

### 3.7.6 TEST RESULTS

<b>EUT</b>	Wireless Plug-in Car Handsfree	<b>MODEL</b>	HF-6W
<b>MODULATION TYPE</b>	GFSK	<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 70%RH, 1008hPa
<b>INPUT POWER</b>	12Vdc	<b>TESTED BY</b>	Jamison Chan

<b>CHANNEL</b>	<b>CHANNEL FREQUENCY (MHz)</b>	<b>20dB BANDWIDTH (MHz)</b>	
0	2402	0.786	
39	2441	0.777	
78	2480	0.786	

**Channel 0****Channel 39**

**Channel 78**



### 3.8 HOPPING CHANNEL SEPARATION

#### 3.8.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25 kHz or two-thirds of 20dB hopping channel bandwidth (whichever is greater).

#### 3.8.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20. 2006

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

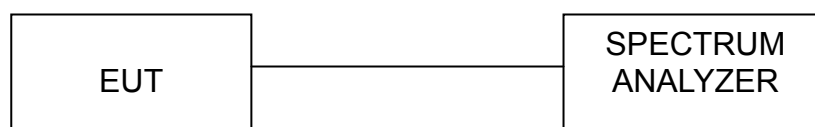
#### 3.8.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

#### 3.8.4 DEVIATION FROM TEST STANDARD

No deviation

#### 3.8.5 TEST SETUP

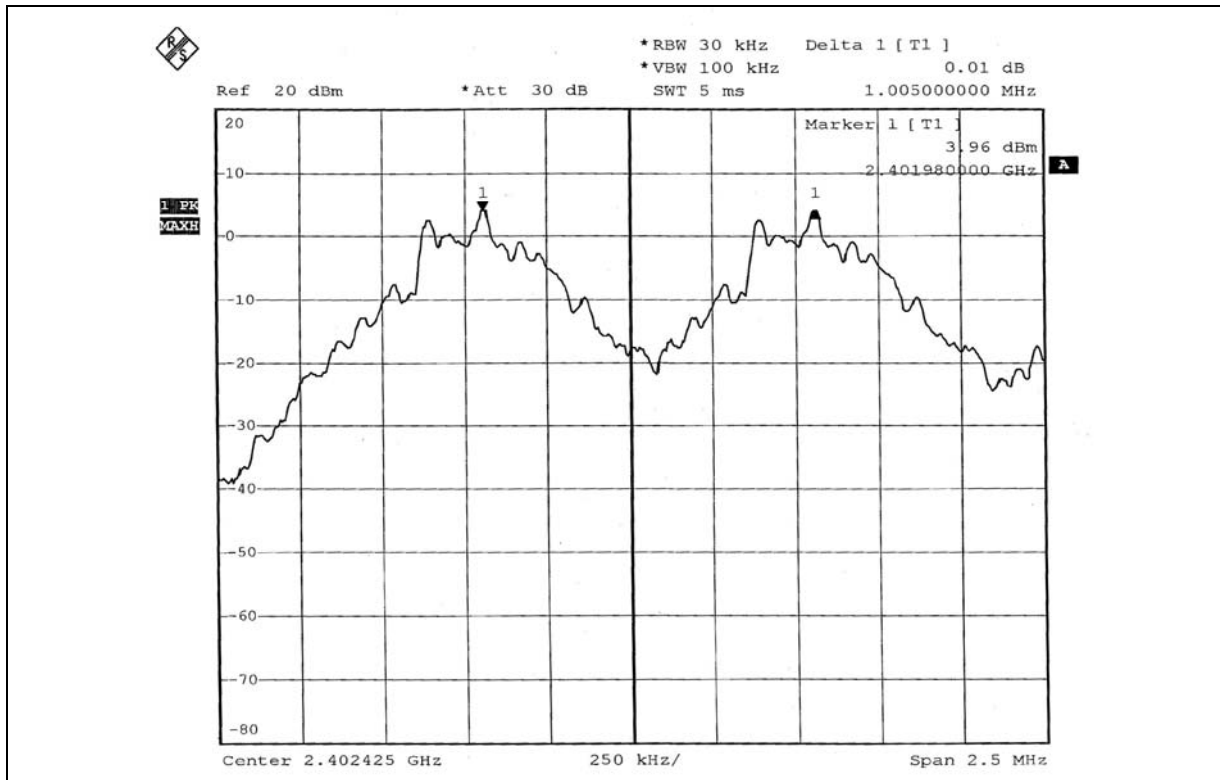
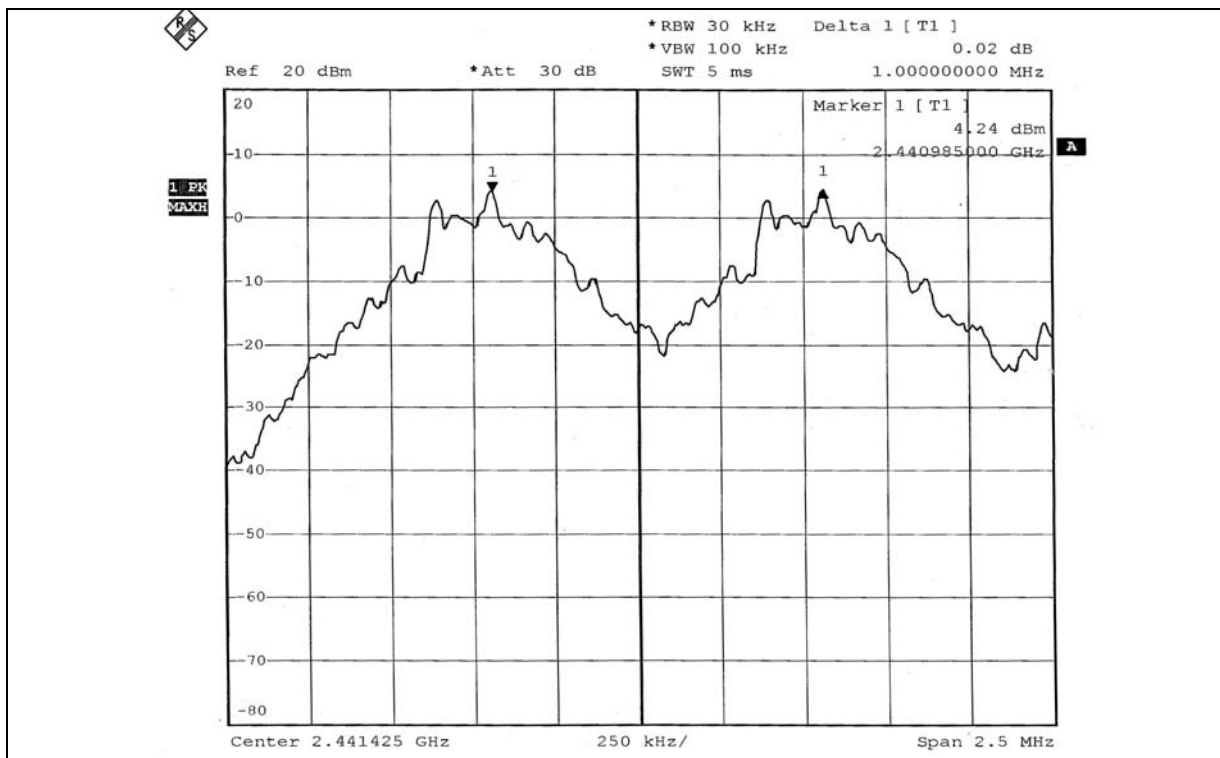


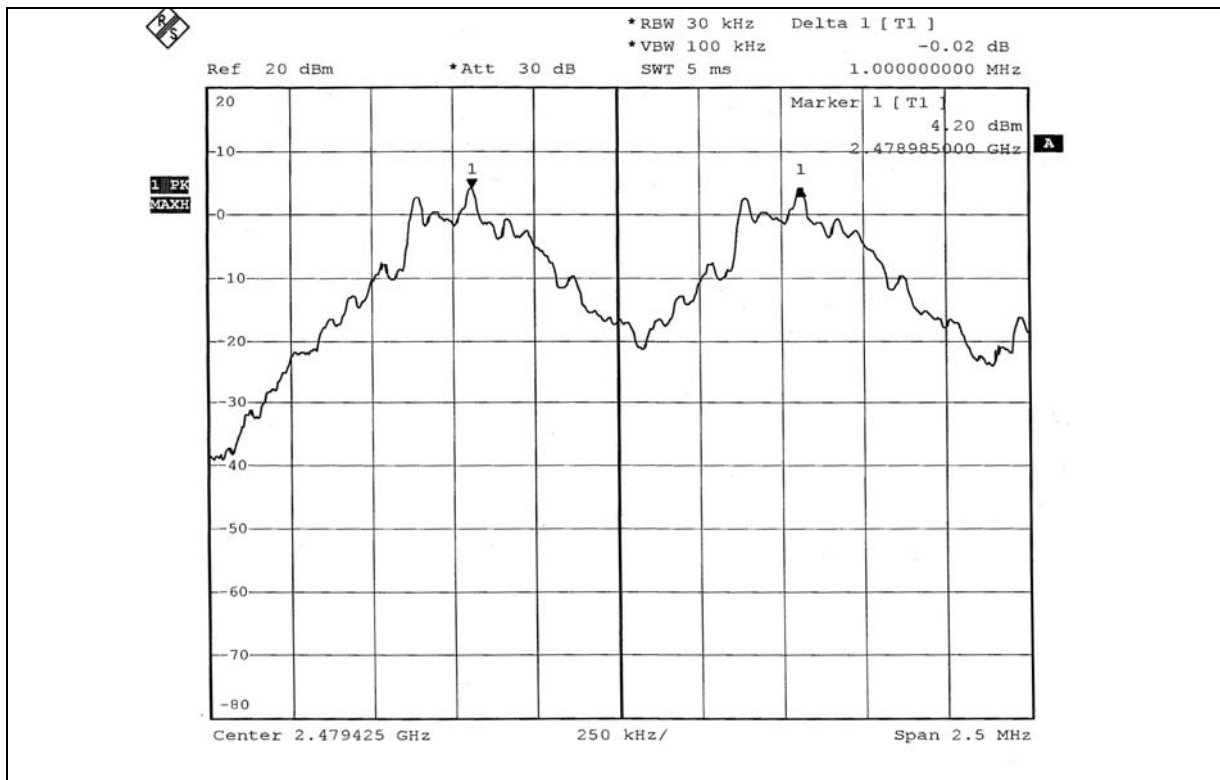
### 3.8.6 TEST RESULTS

<b>EUT</b>	Wireless Plug-in Car Handsfree	<b>MODEL</b>	HF-6W
<b>MODULATION TYPE</b>	GFSK	<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 70%RH, 1008hPa
<b>INPUT POWER</b>	12Vdc	<b>TESTED BY</b>	Jamison Chan

Channel	Frequency (MHz)	Adjacent Channel Separation	Minimum Limit (kHz)	Pass / Fail
0	2402	1.005MHz	524	PASS
39	2441	1.000MHz	518	PASS
78	2480	1.000MHz	524	PASS

The minimum limit is 20dB bandwidth. Test results please refer to next two pages.

**Channel 0****Channel 39**

**Channel 78**

### 3.9 MAXIMUM PEAK OUTPUT POWER

#### 3.9.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 30dBm.

#### 3.9.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20. 2006

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

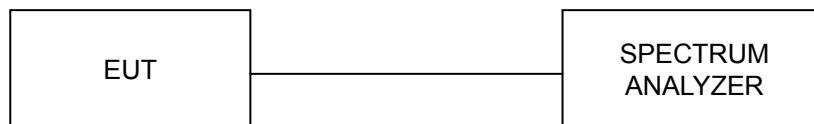
#### 3.9.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 3 MHz VBW.
4. Measure the captured power within the band and recoding the plot.
5. Repeat above procedures until all frequencies required were complete.

### **3.9.4 DEVIATION FROM TEST STANDARD**

No deviation

### **3.9.5 TEST SETUP**



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

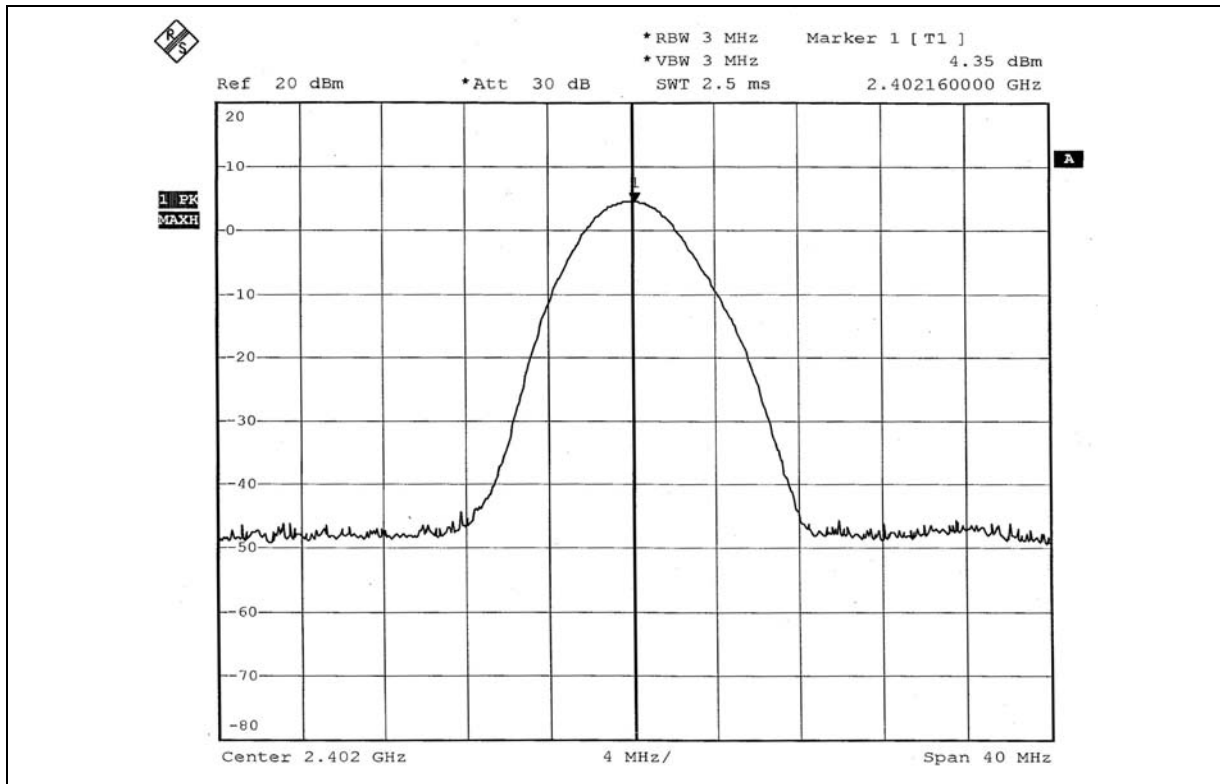
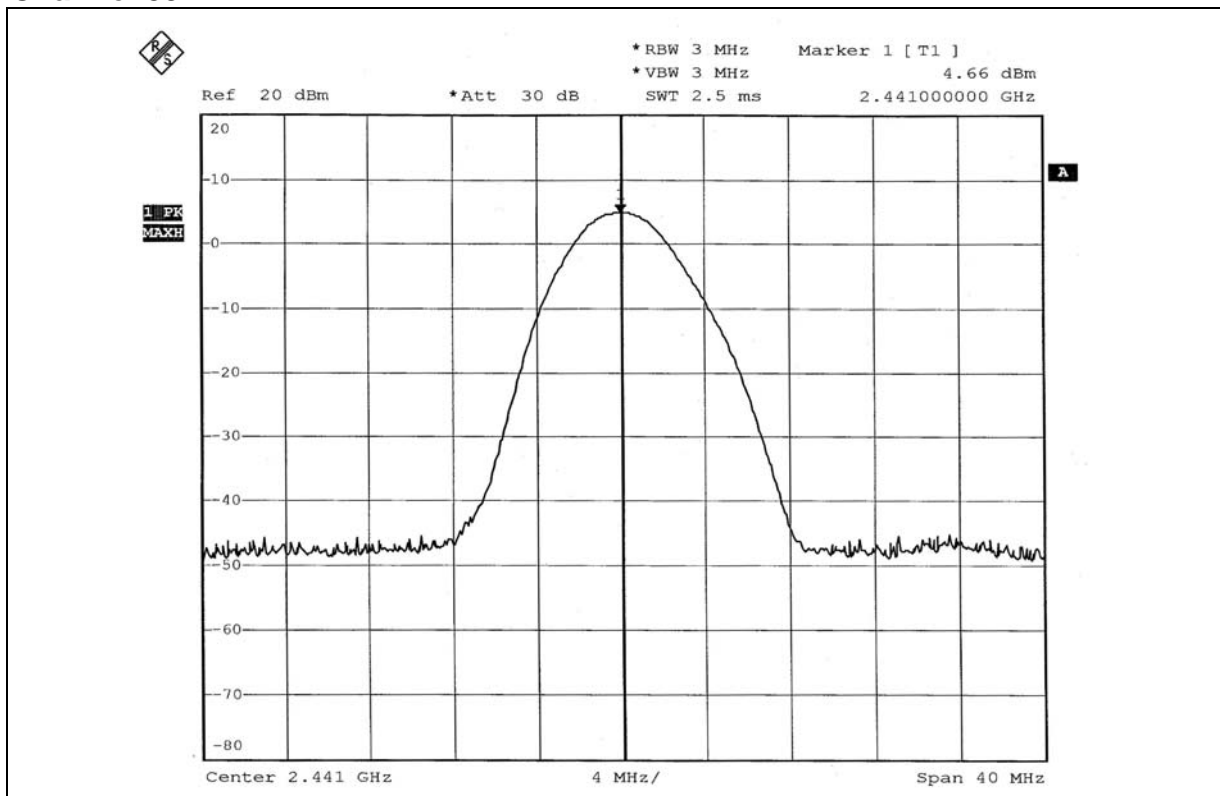
### **3.9.6 EUT OPERATING CONDITION**

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

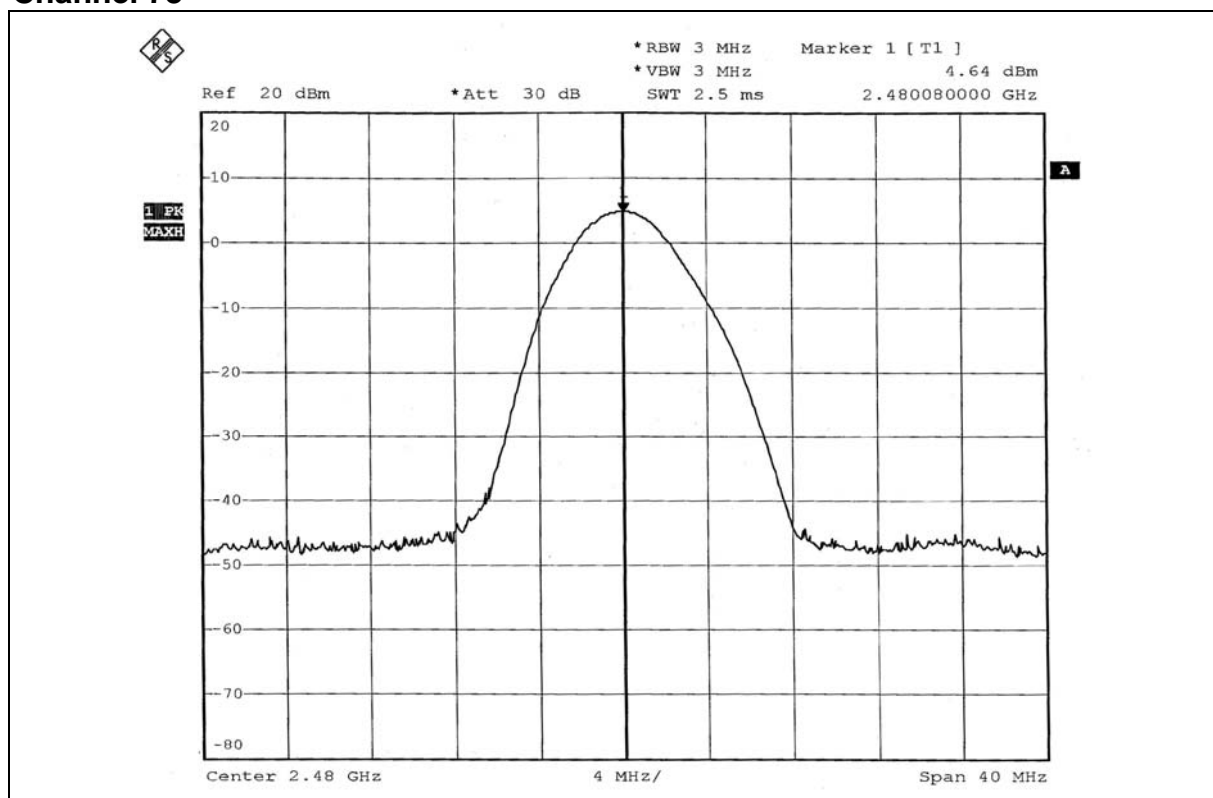
### 3.9.7 TEST RESULTS

<b>EUT</b>	Wireless Plug-in Car Handsfree	<b>MODEL</b>	HF-6W
<b>MODULATION TYPE</b>	GFSK	<b>ENVIRONMENTAL CONDITIONS</b>	25deg. C, 70%RH, 1008hPa
<b>INPUT POWER</b>	12Vdc	<b>TESTED BY</b>	Jamison Chan

<b>CHANNEL</b>	<b>CHANNEL FREQUENCY (MHz)</b>	<b>PEAK POWER OUTPUT (mW)</b>	<b>PEAK POWER OUTPUT (dBm)</b>	<b>PEAK POWER LIMIT (dBm)</b>	<b>PASS/FAIL</b>
0	2402	2.723	4.35	30	PASS
39	2441	2.924	4.66	30	PASS
78	2480	2.911	4.64	30	PASS

**Channel 0****Channel 39**



**Channel 78**

### 3.10 RADIATED EMISSION MEASUREMENT

#### 3.10.1 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:** The limit for radiated test was performed according to CISPR 22: 1997, which was specified in FCC PART 15B 15.109(g). Also the limits of ICES-003: 2004 and CISPR 22: 1997 are same.

### 3.10.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	Jun. 3, 2005
HP Preamplifier	8449B	3008A01924	Sep. 19, 2005
HP Preamplifier	8449B	3008A01638	Sep. 30, 2005
SCHWARZBECK Tunable Dipole Antenna	VHA 9103	NA	Oct. 29, 2005
SCHWARZBECK Tunable Dipole Antenna	UHA 9105	977	
ROHDE & SCHWARZ TEST RECEIVER	ESI7	836697/012	Nov. 05, 2005
Schwarzbeck Antenna	VULB 9168	137	Feb. 27, 2006
Schwarzbeck Antenna	VHBA 9123	480	Apr. 11, 2006
EMCO Horn Antenna	3115	6714	Oct. 28, 2005
EMCO Horn Antenna	3115	9312-4192	Feb. 28, 2006
ADT. Turn Table	TT100	0306	NA
ADT. Tower	AT100	0306	NA
Software	ADT_Radiated_V6	NA	NA
TIMES RF cable	LL142	CABLE-CH6-01	Dec. 19, 2005

- 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 and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
  3. The test was performed in ADT Chamber No. 6.
  4. The Industry Canada Reference No. IC 3789-6.

### 3.10.3 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.

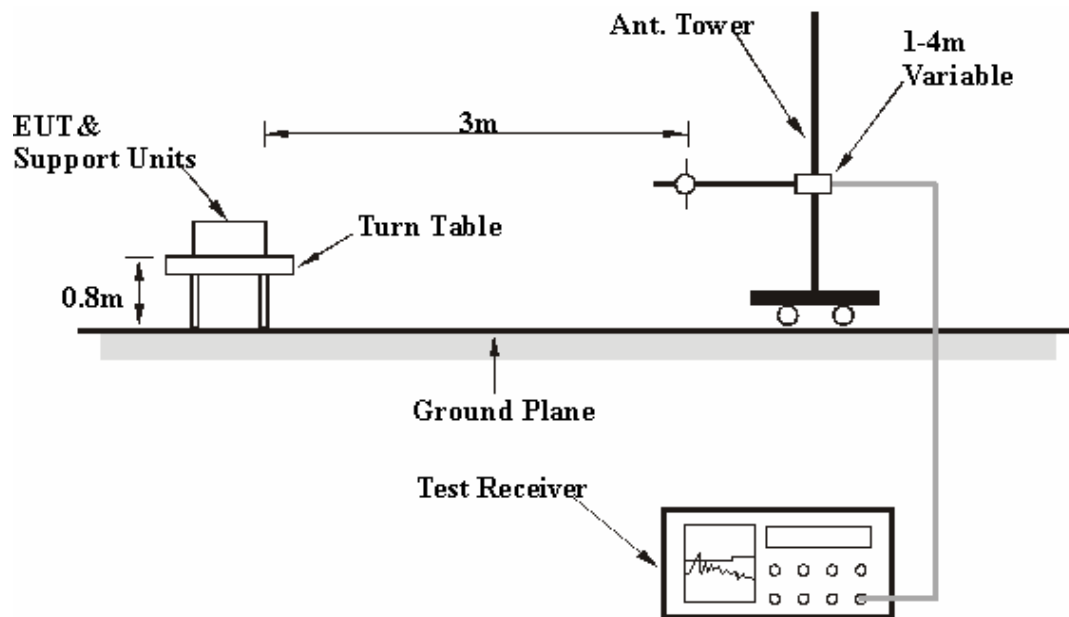
**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.

### 3.10.4 DEVIATION FROM TEST STANDARD

No deviation.

### 3.10.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

### 3.10.6 EUT OPERATING CONDITIONS

#### For Mode A:

- Set the EUT under transmitting condition.
- Set the EUT under charge mode.

#### For Mode B:

Set the EUT under transmitting condition.

### 3.10.7 TEST RESULTS

#### Below 1GHz Worst-Case Data (power by battery)

EUT	Wireless Plug-in Car Handsfree	MEASUREMENT DETAIL	
MODEL	HF-6W	FREQUENCY RANGE	Below 1 GHz
CHANNEL	78	MODULATION TYPE	GFSK
INPUT POWER	12Vdc	DETECTOR FUNCTION	Quasi-Peak
TEST MODE	A	ENVIRONMENTAL CONDITIONS	25 deg. C, 65% RH, 1008 hPa
TESTED BY	Jamison Chan		

#### 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	68.88	23.92 QP	40.00	-16.08	2.77 H	163	11.70	12.22
2	760.90	23.61 QP	46.00	-22.39	2.59 H	241	-1.10	24.70
3	825.05	25.67 QP	46.00	-20.33	1.59 H	43	0.10	25.57
4	869.76	24.58 QP	46.00	-21.42	2.28 H	286	-1.63	26.21
5	916.41	24.66 QP	46.00	-21.34	2.86 H	64	-1.76	26.42
6	949.46	25.29 QP	46.00	-20.71	3.04 H	117	-1.96	27.25

#### 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	<b>68.88</b>	<b>25.53 QP</b>	<b>40.00</b>	<b>-14.47</b>	<b>1.97 V</b>	<b>277</b>	<b>13.31</b>	<b>12.22</b>
2	212.73	21.21 QP	43.50	-22.29	1.05 V	118	10.44	10.77
3	842.55	24.92 QP	46.00	-21.08	1.07 V	238	-1.19	26.11
4	877.54	25.62 QP	46.00	-20.38	1.22 V	244	-0.53	26.16
5	908.64	24.14 QP	46.00	-21.86	1.12 V	19	-2.09	26.23
6	949.46	26.53 QP	46.00	-19.47	1.38 V	40	-0.71	27.25

- 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.

**Below 1GHz Worst-Case Data (power by battery)**

EUT	Wireless Plug-in Car Handsfree	MEASUREMENT DETAIL	
MODEL	HF-6W	FREQUENCY RANGE	Below 1 GHz
CHANNEL	78	MODULATION TYPE	GFSK
INPUT POWER	12Vdc	DETECTOR FUNCTION	Quasi-Peak
TEST MODE	B	ENVIRONMENTAL CONDITIONS	25 deg. C, 65% RH, 1008 hPa
TESTED BY	Jamison Chan		

**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	716.19	23.48 QP	46.00	-22.52	3.06 H	271	-0.37	23.85
2	762.85	23.68 QP	46.00	-22.32	2.93 H	217	-1.03	24.71
3	788.12	23.90 QP	46.00	-22.10	1.98 H	169	-0.87	24.76
4	830.88	25.12 QP	46.00	-20.88	2.58 H	83	-0.62	25.75
5	869.76	25.16 QP	46.00	-20.84	2.07 H	85	-1.05	26.21
6	947.52	27.11 QP	46.00	-18.89	1.13 H	271	-0.08	27.20

**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	74.71	22.92 QP	40.00	-17.08	1.50 V	229	12.07	10.85
2	725.91	23.04 QP	46.00	-22.96	3.00 V	88	-1.05	24.09
3	768.68	23.68 QP	46.00	-22.32	3.00 V	19	-1.04	24.72
4	842.55	24.93 QP	46.00	-21.07	2.00 V	52	-1.18	26.11
5	873.65	24.96 QP	46.00	-21.04	2.50 V	121	-1.23	26.18
6	947.52	25.37 QP	46.00	-20.63	2.00 V	199	-1.83	27.20

- 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.

**1 ~ 25GHz Worst-Case Data (power by battery)**

EUT	Wireless Plug-in Car Handsfree	MEASUREMENT DETAIL	
MODEL	HF-6W	FREQUENCY RANGE	1 ~ 25 GHz
CHANNEL	0	MODULATION TYPE	GFSK
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak(PK) Average (AV)
TEST MODE	A	ENVIRONMENTAL CONDITIONS	25 deg. C, 65% RH, 1008 hPa
TESTED BY	Jamison Chan		

**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	1200.00	39.49 PK	74.00	-34.51	1.05 H	321	12.25	27.24
1	1200.00	28.71 AV	54.00	-25.29	1.05 H	321	1.47	27.24
2	2390.00	42.75 PK	74.00	-31.25	1.47 H	143	12.00	30.75
2	2390.00	32.75 AV	54.00	-21.25	1.47 H	143	2.00	30.75
3	*2402.00	95.90 PK			1.47 H	143	65.10	30.80
3	*2402.00	65.90 AV			1.47 H	143	35.10	30.80
4	4804.00	45.17 PK	74.00	-28.83	1.24 H	155	8.94	36.23
4	4804.00	15.17 AV	54.00	-38.83	1.24 H	155	-21.06	36.23

**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	1200.00	39.65 PK	74.00	-34.35	1.00 V	22	12.41	27.24
1	1200.00	29.02 AV	54.00	-24.98	1.00 V	22	1.78	27.24
2	2390.00	41.51 PK	74.00	-32.49	1.00 V	198	10.76	30.75
2	2390.00	31.51 AV	54.00	-22.49	1.00 V	198	0.76	30.75
3	*2402.00	94.66 PK			1.00 V	198	63.86	30.80
3	*2402.00	64.66 AV			1.00 V	198	33.86	30.80
4	4804.00	44.57 PK	74.00	-29.43	1.26 V	261	8.34	36.23
4	4804.00	14.57 AV	54.00	-39.43	1.26 V	261	-21.66	36.23

**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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. 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 247 ms per channel. Therefore, the duty cycle be equal to:  $20\log(3.125/100) = -30$  dB
6. Average value = peak reading  $-20\log(\text{duty cycle})$



EUT	Wireless Plug-in Car Handsfree	MEASUREMENT DETAIL	
MODEL	HF-6W	FREQUENCY RANGE	1 ~ 25 GHz
CHANNEL	39	MODULATION TYPE	GFSK
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak(PK) Average (AV)
TEST MODE	A	ENVIRONMENTAL CONDITIONS	25 deg. C, 65% RH, 1008 hPa
TESTED BY	Jamison Chan		

#### 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	1219.50	39.13 PK	74.00	-34.87	1.02 H	313	11.84	27.29
1	1219.50	28.14 AV	54.00	-25.86	1.02 H	313	0.85	27.29
2	*2441.00	93.93 PK			1.19 H	128	62.96	30.97
2	*2441.00	63.93 AV			1.19 H	128	32.96	30.97
3	4882.00	45.73 PK	74.00	-28.27	1.51 H	303	9.38	36.35
3	4882.00	15.73 AV	54.00	-38.27	1.51 H	303	-20.62	36.35

#### 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	1219.50	38.15 PK	74.00	-35.85	1.00 V	258	10.86	27.29
1	1219.50	27.86 AV	54.00	-26.14	1.00 V	258	0.57	27.29
2	*2441.00	93.60 PK			1.25 V	198	62.63	30.97
2	*2441.00	63.60 AV			1.25 V	198	32.63	30.97
3	4882.00	44.97 PK	74.00	-29.03	1.23 V	305	8.62	36.35
3	4882.00	14.97 AV	54.00	-39.03	1.23 V	305	-21.38	36.35

#### 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. 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 247 ms per channel. Therefore, the duty cycle be equal to:  $20\log(3.125/100) = -30$  dB
6. Average value = peak reading  $-20\log(\text{duty cycle})$

EUT	Wireless Plug-in Car Handsfree	MEASUREMENT DETAIL	
MODEL	HF-6W	FREQUENCY RANGE	1 ~ 25 GHz
CHANNEL	78	MODULATION TYPE	GFSK
INPUT POWER	12Vdc	DETECTOR FUNCTION	Peak(PK) Average (AV)
TEST MODE	A	ENVIRONMENTAL CONDITIONS	25 deg. C, 65% RH, 1008 hPa
TESTED BY	Jamison Chan		

#### 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	1239.00	38.14 PK	74.00	-35.86	1.00 H	88	10.79	27.35
1	1239.00	27.77 AV	54.00	-26.23	1.00 H	88	0.42	27.35
2	*2480.00	93.48 PK			1.36 H	199	62.35	31.13
2	*2480.00	63.48 AV			1.36 H	199	32.35	31.13
3	2483.50	40.27 PK	74.00	-33.73	1.36 H	199	9.12	31.15
3	2483.50	30.27 AV	54.00	-23.73	1.36 H	199	-0.88	31.15
4	4960.00	47.33 PK	74.00	-26.67	1.58 H	0	10.85	36.48
4	4960.00	17.33 AV	54.00	-36.67	1.58 H	0	-19.15	36.48

#### 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	1239.00	37.93 PK	74.00	-36.07	1.00 V	153	10.58	27.35
1	1239.00	27.69 AV	54.00	-26.31	1.00 V	153	0.34	27.35
2	*2480.00	92.34 PK			1.08 V	300	61.21	31.13
2	*2480.00	62.34 AV			1.08 V	300	31.21	31.13
3	2483.50	39.13 PK	74.00	-34.87	1.08 V	300	7.98	31.15
3	2483.50	29.13 AV	54.00	-24.87	1.08 V	300	-2.02	31.15
4	4960.00	46.07 PK	74.00	-27.93	1.47 V	13	9.59	36.48
4	4960.00	16.07 AV	54.00	-37.93	1.47 V	13	-20.41	36.48

- 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. 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 247 ms per channel. Therefore, the duty cycle be equal to:  $20\log(3.125/100)=-30$  dB
  6. Average value = peak reading  $-20\log(\text{duty cycle})$

### 3.11 BAND EDGES MEASUREMENT

#### 4.8.1 LIMITS OF BAND EDGES MEASUREMENT

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

#### 4.8.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar 20. 2006

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

#### 4.8.3 TEST PROCEDURE

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

#### 4.8.4 DEVIATION FROM TEST STANDARD

No deviation.

#### 4.8.5 EUT OPERATING CONDITION

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

#### 4.8.6 TEST RESULTS

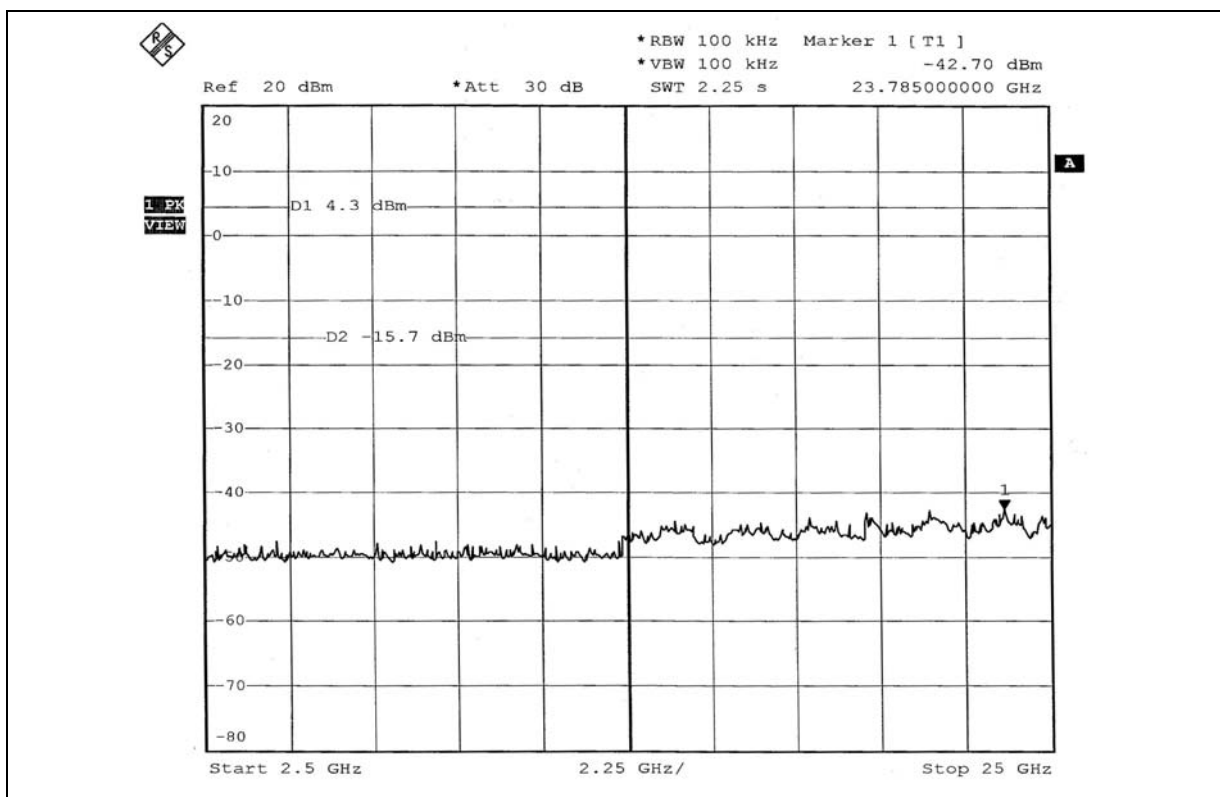
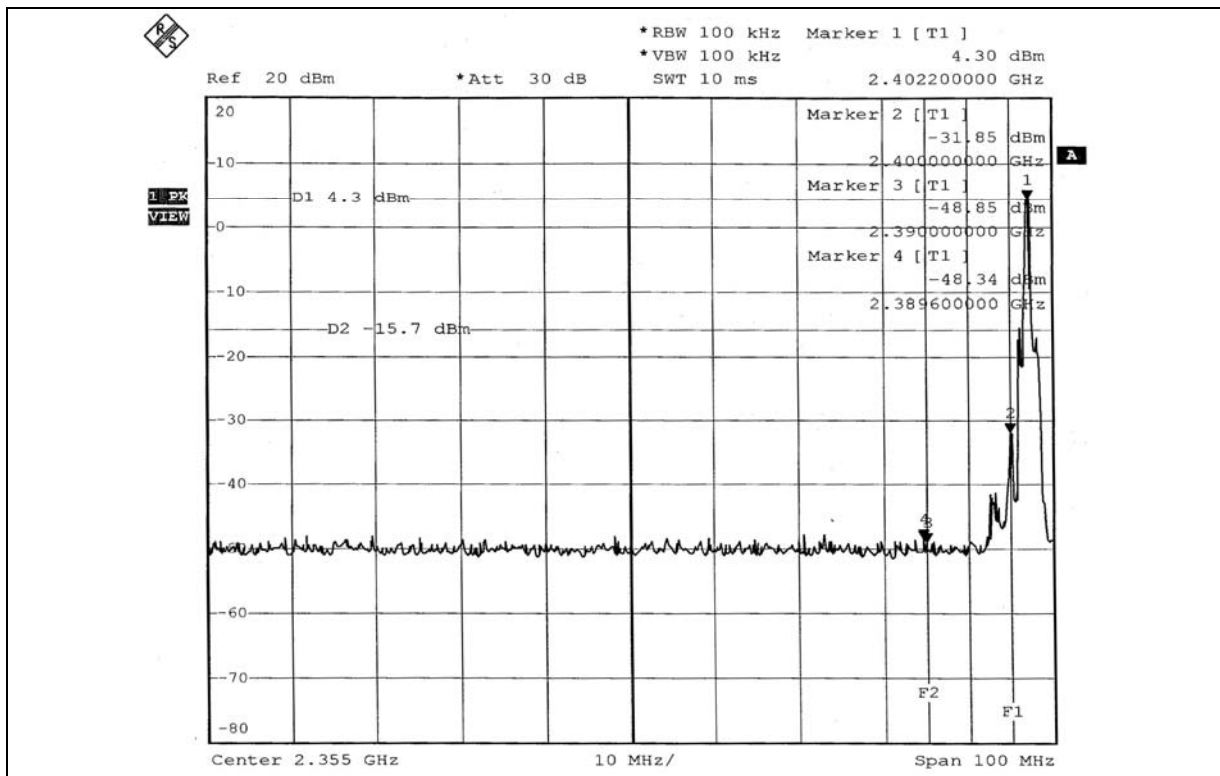
The spectrum plots are attached on the following 4 images. D2 line indicates the highest level, D1 line indicates the 20dB offset below D2. It shows compliance with the requirement in part 15.247(d).

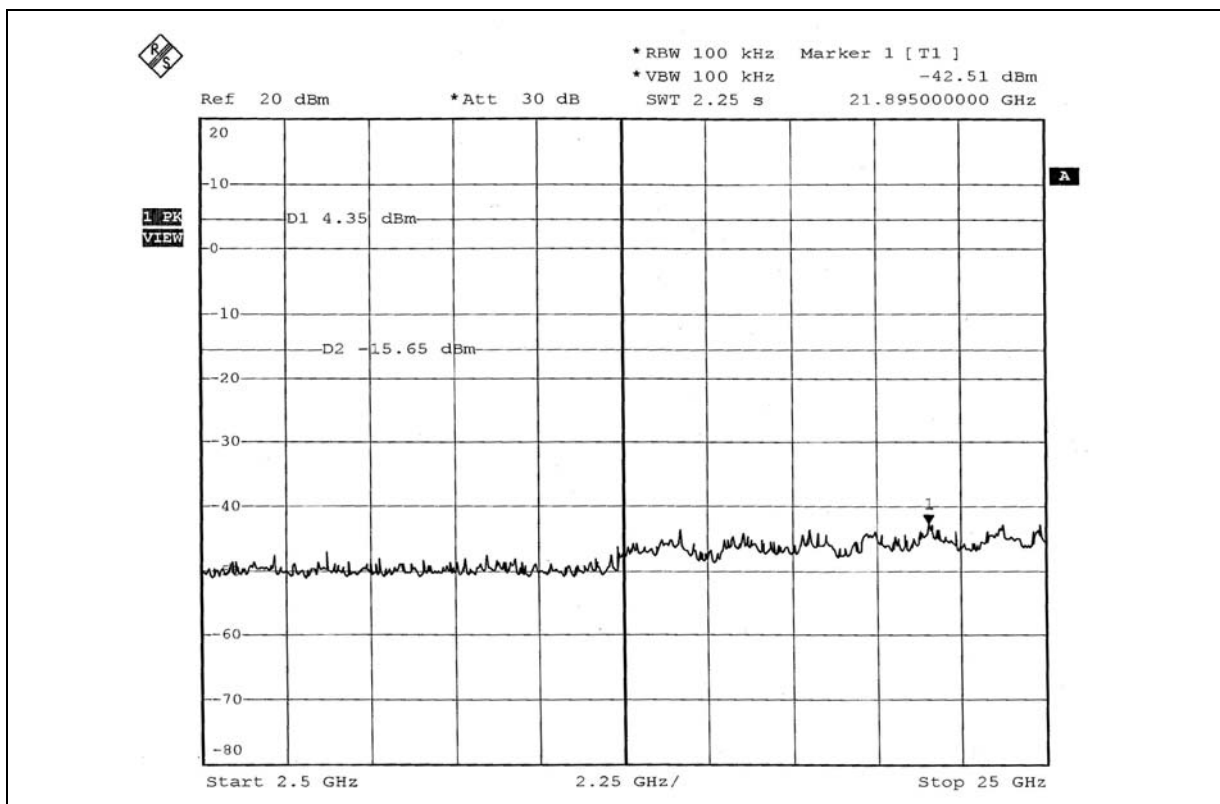
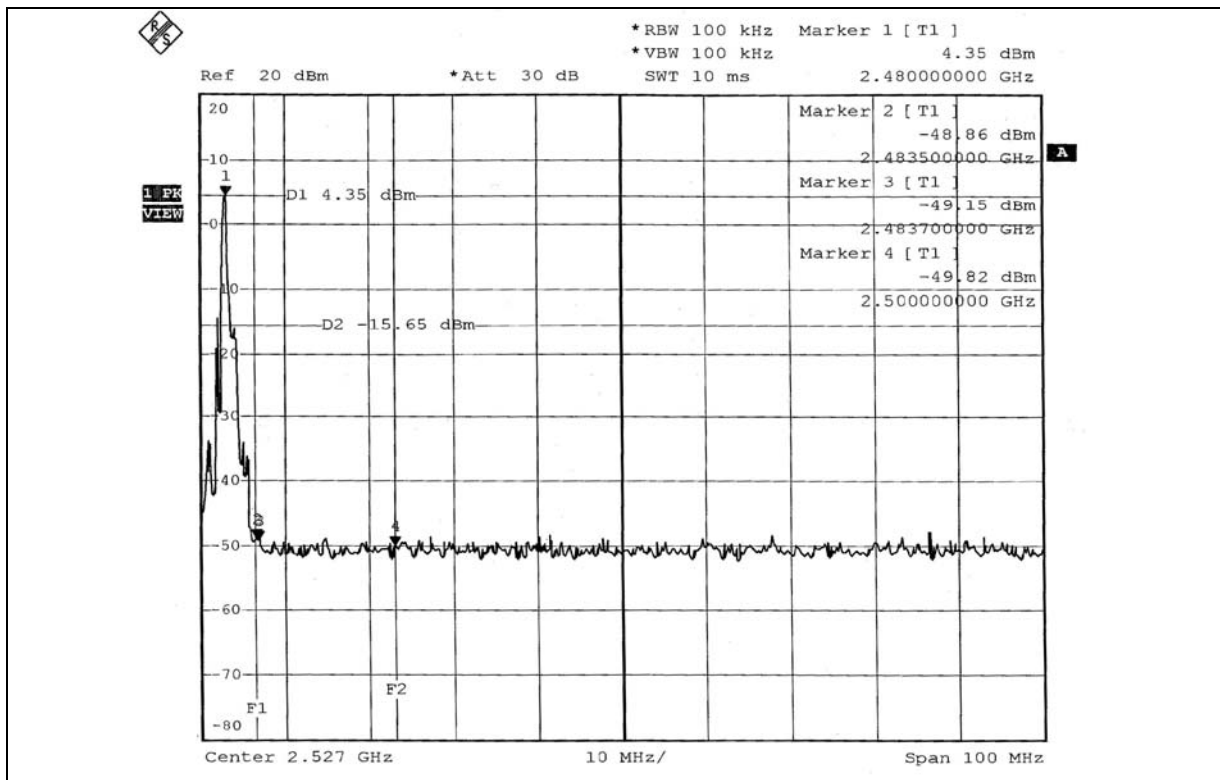
**NOTE 1:** The band edge emission plot on page 45 shows 52.64dBc between carrier maximum power and local maximum emission in restrict band (2.3896GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.7.7 is 95.90dBuV/m (Peak), so the maximum field strength in restrict band is  $95.90 - 52.64 = 43.26$  dBuV/m which is under 74 dBuV/m limit.

The band edge emission plot on page 61 shows 45.64dBc between carrier maximum power and local maximum emission in restrict band (2.3896GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.7.7 is 65.90dBuV/m (Average), so the maximum field strength in restrict band is  $65.90 - 52.64 = 13.26$  dBuV/m which is under 54 dBuV/m limit.

**NOTE 2:** The band edge emission plot on page 46 shows 53.21dBc between carrier maximum power and local maximum emission in restrict band (2.4835GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.7.7 is 93.48dBuV/m (Peak), so the maximum field strength in restrict band is  $93.48 - 53.21 = 40.27$  dBuV/m which is under 74 dBuV/m limit.

The band edge emission plot on page 46 shows 53.21dBc between carrier maximum power and local maximum emission in restrict band (2.4835GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.7.7 is 63.48dBuV/m (Average), so the maximum field strength in restrict band is  $63.48 - 53.21 = 10.27$  dBuV/m which is under 54 dBuV/m limit.





## **4.9 ANTENNA REQUIREMENT**

### **4.9.1 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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **4.9.2 ANTENNA CONNECTED CONSTRUCTION**

The antenna used in this product is PIFA antenna without antenna connector, and the maximum gain of this antenna is 0dBi.



## 4 PHOTOGRAPHS OF THE TEST CONFIGURATION

RADIATED EMISSION TEST (Test mode A)





### RADIATED EMISSION TEST (Test mode B)



## 5 INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., 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, UL, A2LA
<b>Germany</b>	TUV Rheinland
<b>Japan</b>	VCCI
<b>Norway</b>	NEMKO
<b>Canada</b>	INDUSTRY CANADA , CSA
<b>R.O.C.</b>	CNLA, BSMI, DGT
<b>Netherlands</b>	Telefication
<b>Singapore</b>	PSB , 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: 886-2-26052943

**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

**Linko RF Lab.**

Tel: 886-3-3270910

Fax: 886-3-3270892

**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.