

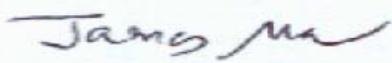


## FCC PART 15.247

### EMI MEASUREMENT AND TEST REPORT For CCT R&D LIMITED

18/F., CCT Telecom Building, 11 Wo Shing Street, Fo Tan, Shatin, N.T.

**FCC ID: NC8MD2400  
Model: MD2400/MD2401/MD2420**

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> 2.4GHz Cordless phone
<b>Test Engineer:</b> Oscar Au 	
<b>Report No.:</b> R0605012	
<b>Report Date:</b> 2006-06-05	
<b>Reviewed By:</b> James Ma 	
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## **GENERAL INFORMATION**

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### **Product Description for Equipment Under Test (EUT)**

The *CCT R&D LIMITED*, FCC ID: *NC8MD2400* or the “EUT” as referred to in this report is a 2.4Ghz Cordless phone. Approximately measures are Handset, 160mmL x 50mm W x 30mm H and Base, 150 mmL x 90 mmW x 70 mmH.

The EUT is a frequency-hopping device, which operates at the frequency range of 2401.80–2478.51, with the maximum conducted output power of 14.7dBm (29.51mW) for Handset, and 15.76dBm (37.67mW) for Base.

*\* The test data gathered are from a production sample, S/N: HANDSET: 2401A-USA GAI 076, BASE: 2401A-USA-GAI 167, provided by the manufacturer.*

### **EUT Photo**



*Handset (EUT)*



*Base (EUT)*

*Additional photos please refer to Exhibit C*

## **Objective**

This type approval report is prepared on behalf of *CCT R&D LIMITED* in accordance with Part 2, Subpart J, Part 15, Subparts A, B, and C.

## **Related Submittal(s)/Grant(s)**

No Related Submittals

## **Test Methodology**

All measurements contained in this report were conducted in accordance with ANSI C63.4-2003.

## **Test Facility**

The semi-anechoic chambers used by BACL to collect radiated and conducted emissions measurement data is located at it's facility in Sunnyvale, California, USA.

BACL's test sites have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and is listed under FCC registration number: 90464 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at  
<http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

## **SYSTEM TEST CONFIGURATION**

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### **Justification**

The EUT was configured for testing according to ANSI C63.4-2003.

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

### **Special Accessories**

As shown in following test block diagram, all interface cables used for compliance testing are shielded.

### **Equipment Modifications**

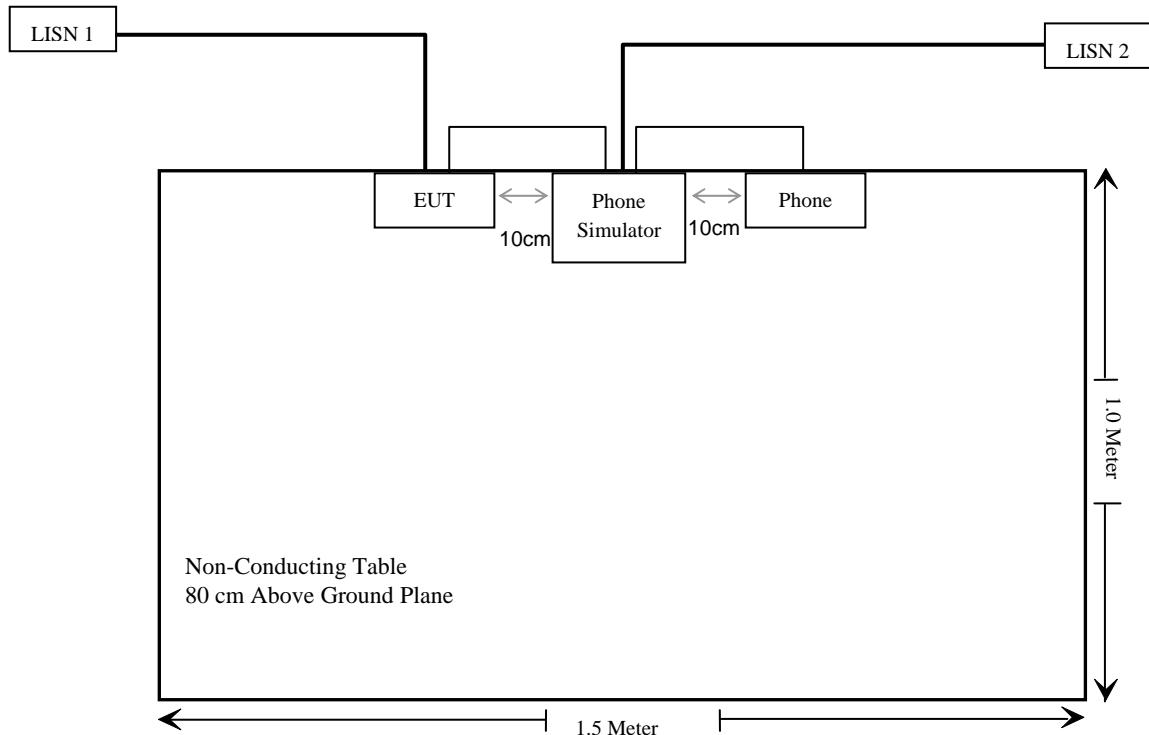
No modifications were made to the EUT.

### **Local Support Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>
Southern Telecom	Telephone	None	None
Teltone Corp	Phone Simulator	TLS-3B-01	80071

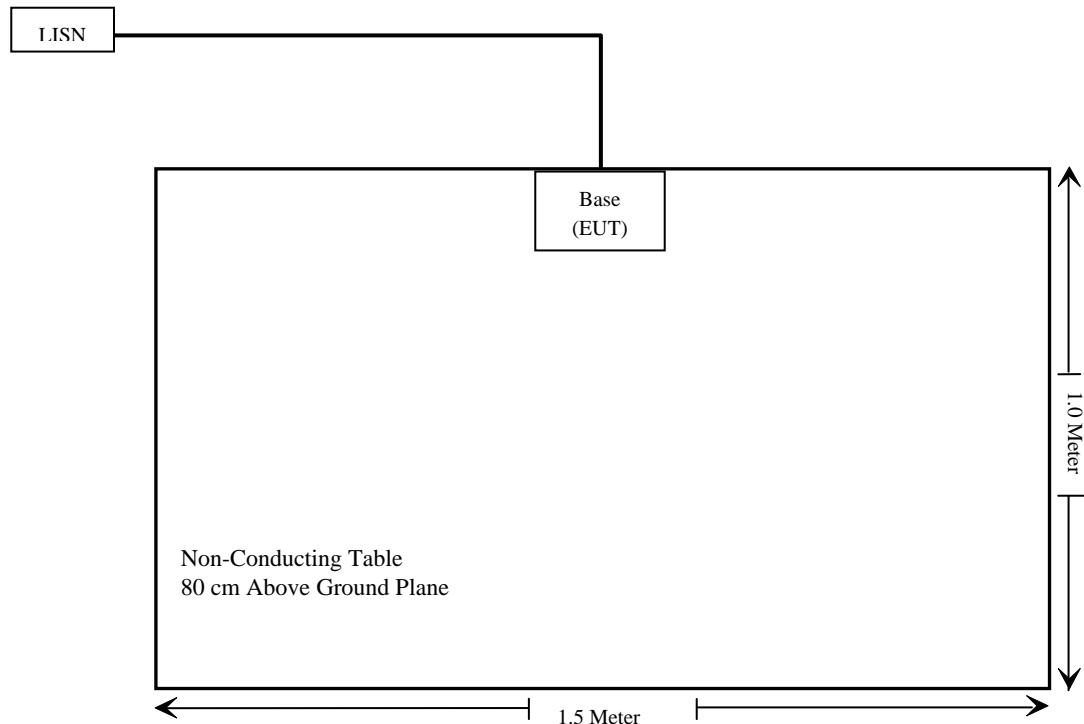
## Test Setup Block Diagram

### Conducted Emissions

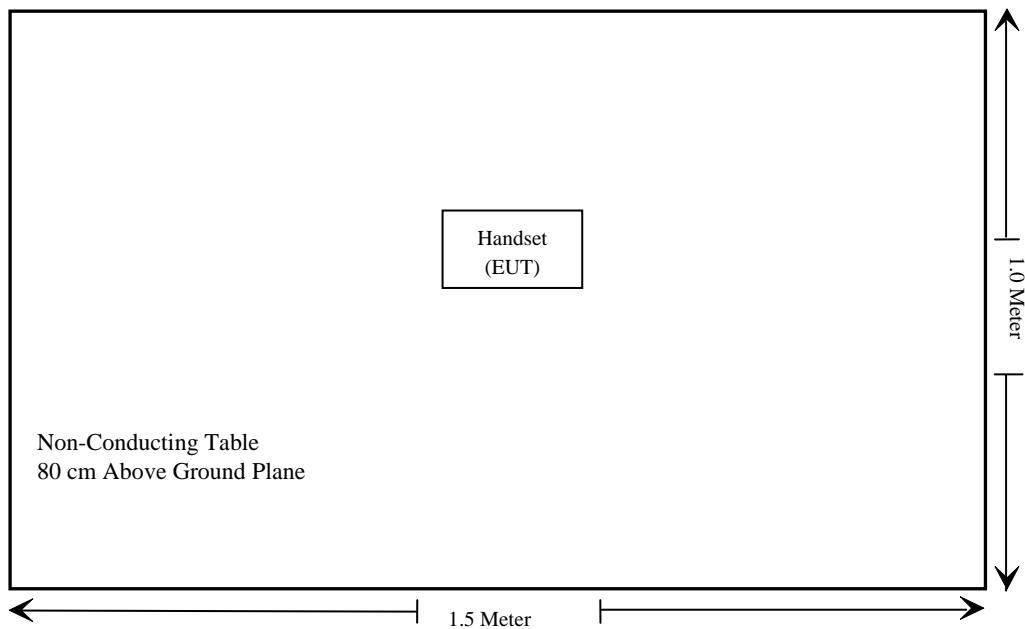


### Radiated Emissions

#### Base (EUT)



Handset (EUT)



## **SUMMARY OF TEST RESULTS FOR FCC PART 15**

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FCC RULES	DESCRIPTION OF TEST	RESULT
§15.247(e)(i) §2.1091	RF Exposure	Compliant
§15.203	Antenna Requirement	Compliant
§ 15.207 (a)	Conducted Emissions	Compliant
§2.1051 & §15.247(d)	Spurious Emissions at Antenna Port	Compliant
§15.205, §15.209 & §15.247(c)	Radiated Emissions	Compliant
§15.247 (a) (1)	Hopping Channel Separation	Compliant
§15.247 (a) (1)	Channel Bandwidth	Compliant
§15.247 (a) (1) (i)	Number of Hopping Frequencies Used	Compliant
§15.247 (a) (1) (i)	Dwell Time of Each Frequency	Compliant
§15.247 (b)(2)	Maximum Peak Output Power	Compliant
§ 15.247 (c)	100 kHz Bandwidth of Frequency Band Edge	Compliant

## **§ 15.247 (e)(i) and § 2.1091 - RF EXPOSURE**

According to §15.247(e)(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1091 RF exposure is calculated.

### **Limits for General Population/Uncontrolled Exposure**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

### **MPE Prediction**

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Base:

Maximum peak output power at antenna input terminal: 15.76 (dBm)

Maximum peak output power at antenna input terminal: 37.67 (mW)

Predication distance: 20 (cm)

Predication frequency: 2400 (MHz)

Antenna Gain (typical): 0 (dBi)

Maximum antenna gain: 1 (numeric)

Power density at predication frequency at 20 cm: 0.0075(mW/cm<sup>2</sup>)

MPE limit for uncontrolled exposure at predication frequency: 1.0 (mW/cm<sup>2</sup>)

### **Test Result**

The predicted power density level at 20 cm is 0.0075 mW/cm<sup>2</sup>. This is below the uncontrolled exposure limit of 1mW/cm<sup>2</sup> at 2400 MHz. The EUT is used at least 20cm away from user's body. It is determined as mobile equipment.

## TCB Exclusions List for Portable Device

According to §1.1310 and §2.1093 RF exposure is calculated.

Exposure category	<u>low threshold</u>	<u>high threshold</u>
general population	$(60/f_{\text{GHz}})$ mW, $d < 2.5$ cm $(120/f_{\text{GHz}})$ mW, $d \geq 2.5$ cm	$(900/f_{\text{GHz}})$ mW, $d < 20$ cm
occupational	$(375/f_{\text{GHz}})$ mW, $d < 2.5$ cm $(900/f_{\text{GHz}})$ mW, $d \geq 2.5$ cm	$(2250/f_{\text{GHz}})$ mW, $d < 20$ cm

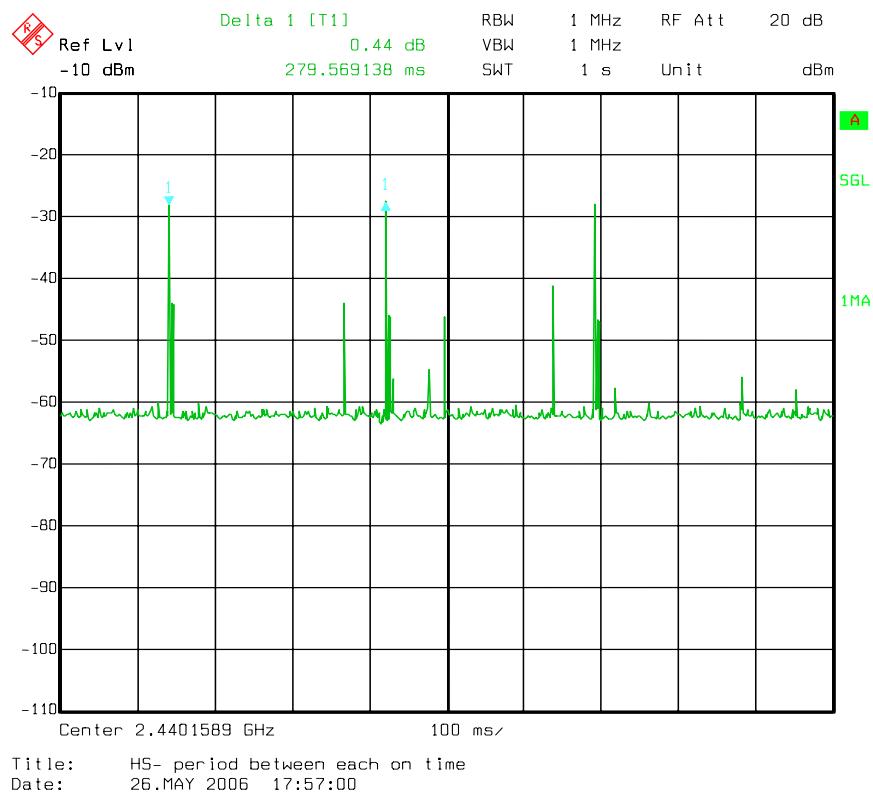
For 2.4GHz device, Low Threshold = 25 mw, High Threshold = 375mW

Duty cycle = On time / period

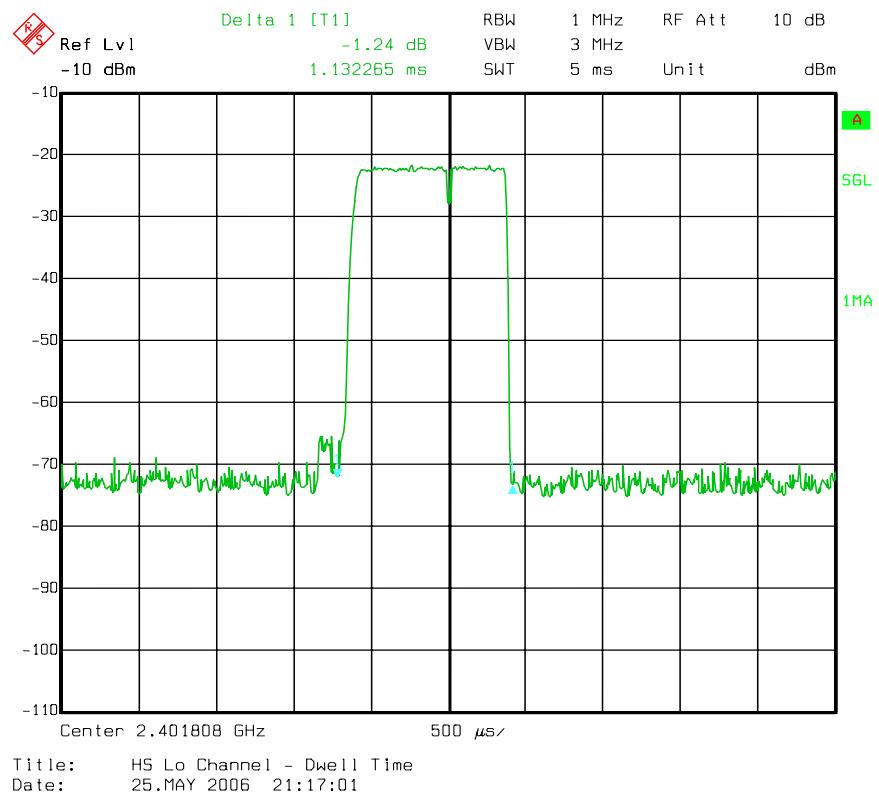
$$= 1.1323 \text{ ms} / 279.57 \text{ ms}$$
$$= 0.00405$$

EUT Average output power = Peak power \* Duty Cycle =  $29.51 * 0.00405 = 0.1195$  mw.

Therefore, EUT is not subject to any SAR evaluation.



Plot showing period between each On time



Plot showing On time duration

## **§ 15.203 ANTENNA REQUIREMENTS**

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According to § 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 § 15.247 (b)(4), 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.

The antenna for the EUT is an integrated antenna with 0dBi gain.

## **§15.207 (a) - CONDUCTED EMISSIONS**

### **Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are receiver, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is ±2.4 dB.

### **Test Setup**

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2003 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with LISN-1.

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-11-14
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2006-03-13
Agilent	AC Power source generator	6812B	US38390366	N/A

\* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Test Procedure**

During the conducted emissions test, the power cord of the EUT was connected to the mains outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Quasi-Peak readings are distinguished with a “QP”. Average readings are distinguished with an “Ave”.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

\*The testing was performed by Oscar Au on 2006-05-29.

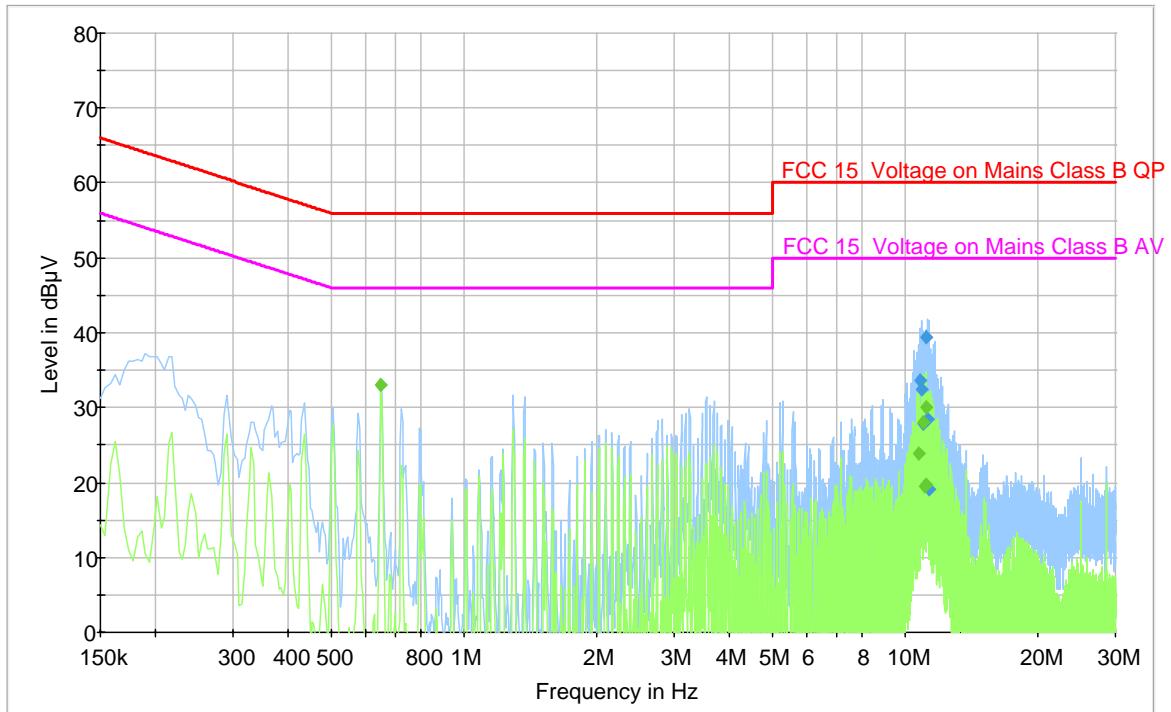
## Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Conducted limits for a Class B device, with the *worst* margin reading of:

**-12.2 dB at 0.242 MHz** in the **Neutral** conductor

## Conducted Emissions Test Data

### 120V/60Hz - Line



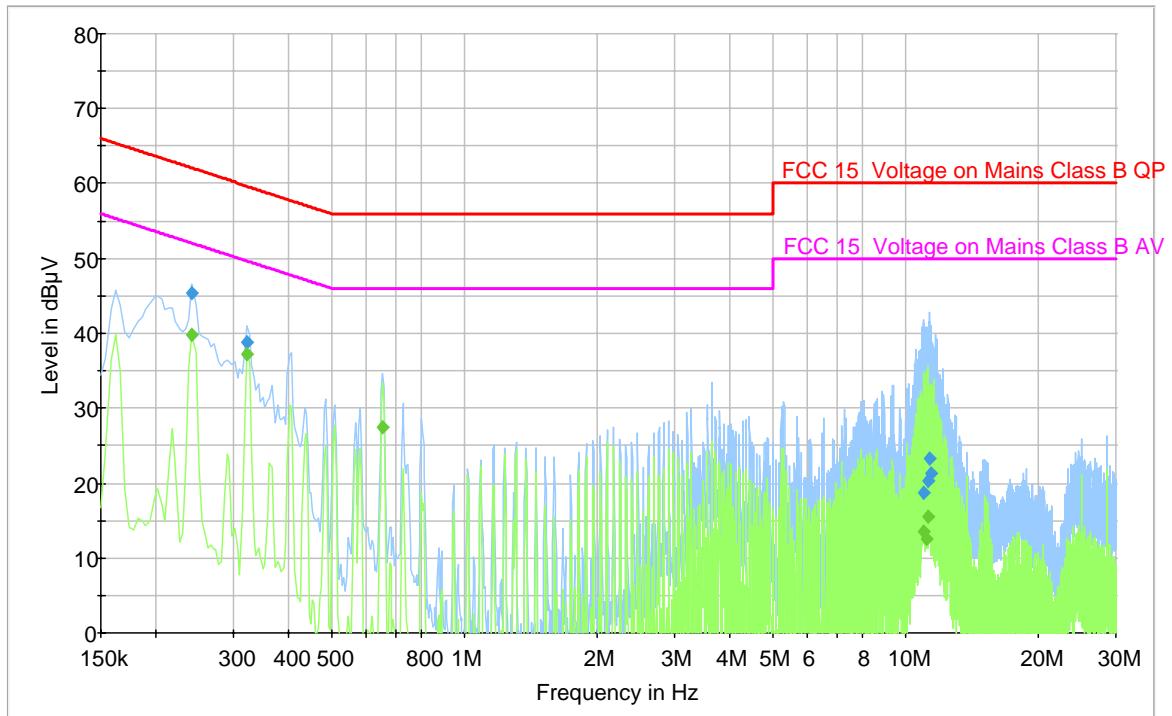
## QP Measurements

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Line	Corr. (dB)	Limit (dB $\mu$ V)	Margin (dB)
11.126000	39.5	L1	0.4	60.0	-20.5
10.846000	33.6	L1	0.4	60.0	-26.4
10.918000	32.4	L1	0.4	60.0	-27.6
11.282000	28.5	L1	0.4	60.0	-31.5
10.982000	27.9	L1	0.4	60.0	-32.1
11.358000	19.0	L1	0.4	60.0	-41.0

## Average Measurements

Frequency (MHz)	Average (dB $\mu$ V)	Line	Corr. (dB)	Limit (dB $\mu$ V)	Margin (dB)
0.650000	33.1	L1	0.3	46.0	-12.9
11.198000	30.0	L1	0.4	50.0	-20.0
10.982000	28.1	L1	0.4	50.0	-21.9
10.766000	23.9	L1	0.4	50.0	-26.1
11.126000	19.8	L1	0.4	50.0	-30.2
11.054000	19.6	L1	0.4	50.0	-30.4

## 120V/60Hz - Neutral



## QP Measurements

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)
0.242000	45.4	N	0.2	62.0	-16.7
0.322000	38.8	N	0.2	59.7	-20.9
11.342000	23.3	N	0.4	60.0	-36.7
11.406000	21.3	N	0.4	60.0	-38.7
11.254000	20.2	N	0.4	60.0	-39.8
10.978000	18.8	N	0.4	60.0	-41.2

## Average Measurements

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Limit (dBµV)	Margin (dB)
0.242000	39.8	N	0.2	52.0	-12.2
0.322000	37.2	N	0.2	49.7	-12.4
0.654000	27.6	N	0.3	46.0	-18.5
11.254000	15.5	N	0.4	50.0	-34.6
11.038000	13.5	N	0.4	50.0	-36.5
11.182000	12.6	N	0.4	50.0	-37.4

## **§2.1051 & 15.247 (d) SPURIOUS EMISSIONS AT ANTENNA PORT**

### **Applicable Standard**

According to §15.209 (f) and §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emissions limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emissions being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit.

### **Measurement Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 Max-Hold Mode, and then keep the EUT in transmitting 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.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

**\* Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020mbar

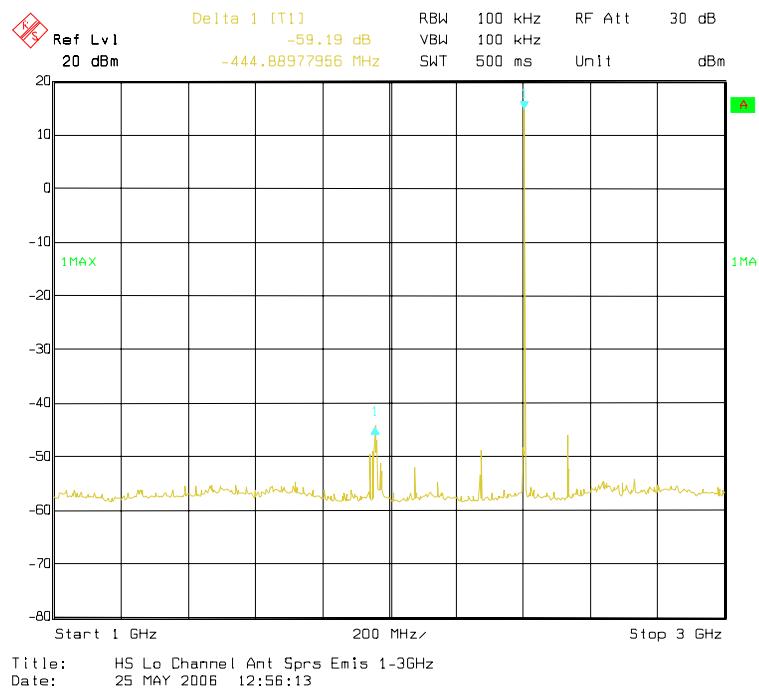
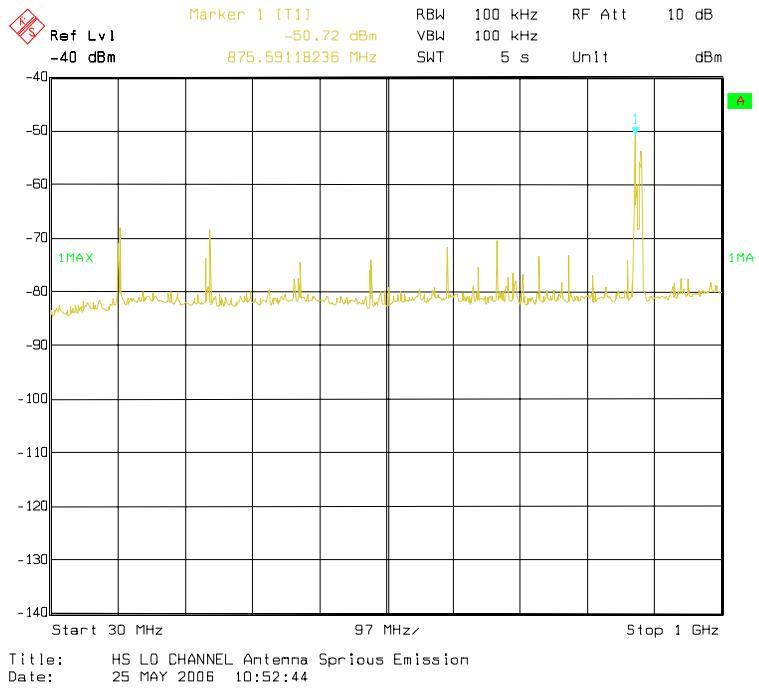
*\*The testing was performed by Oscar Au on 2006-05-29.*

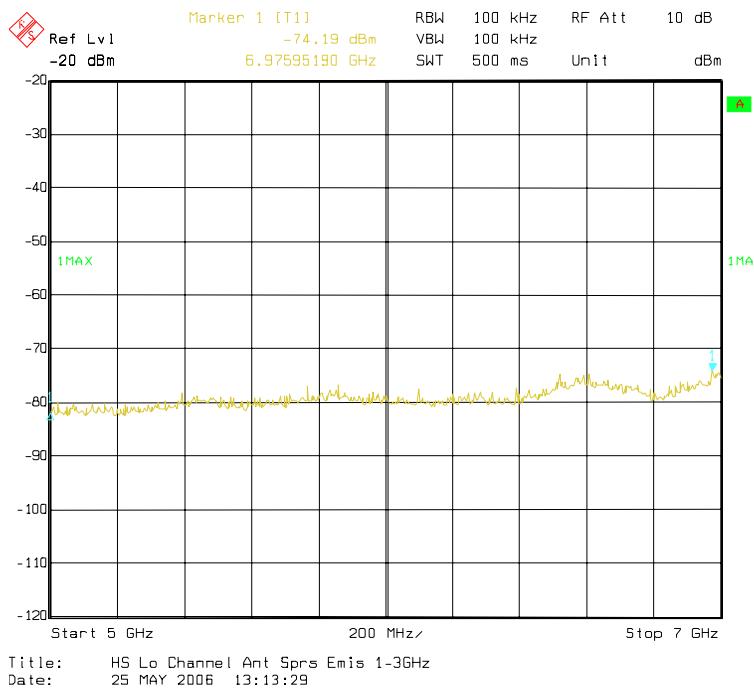
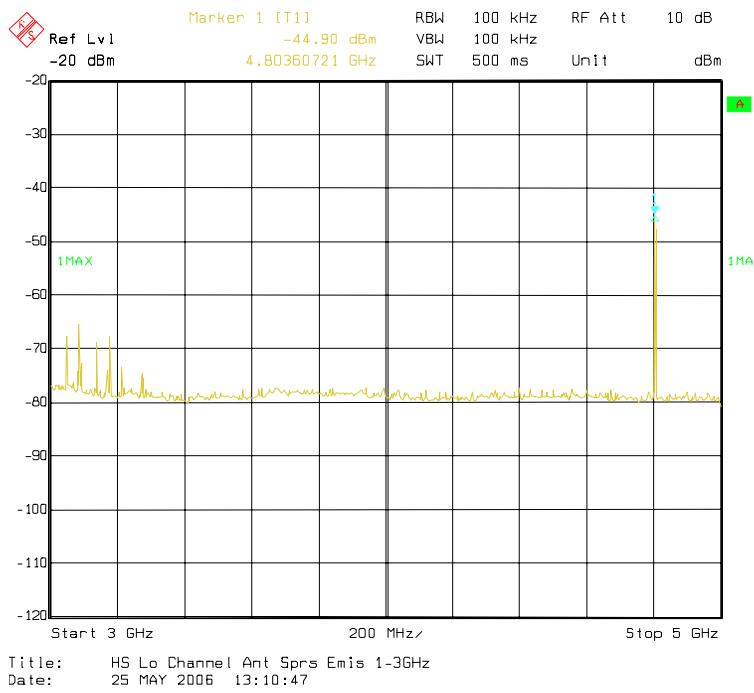
### **Measurement Results**

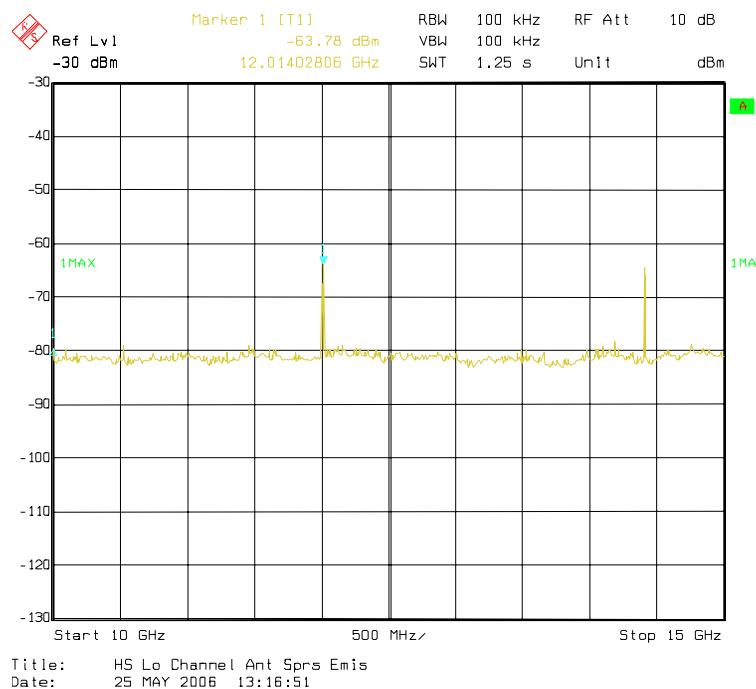
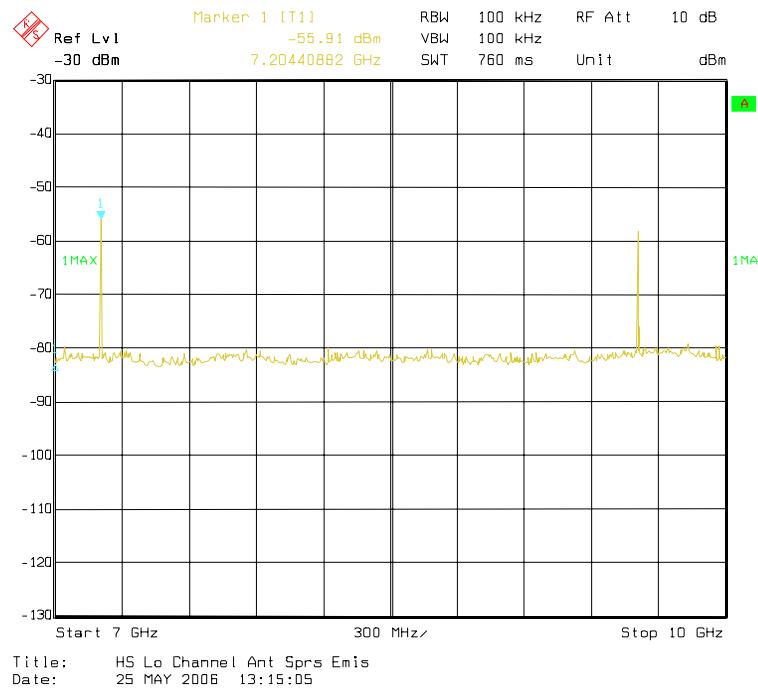
Please refer to the following plots.

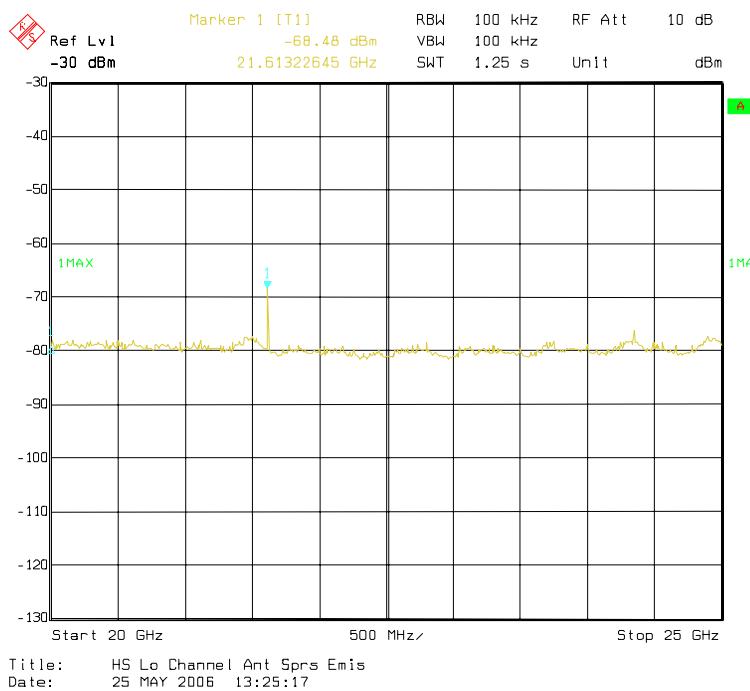
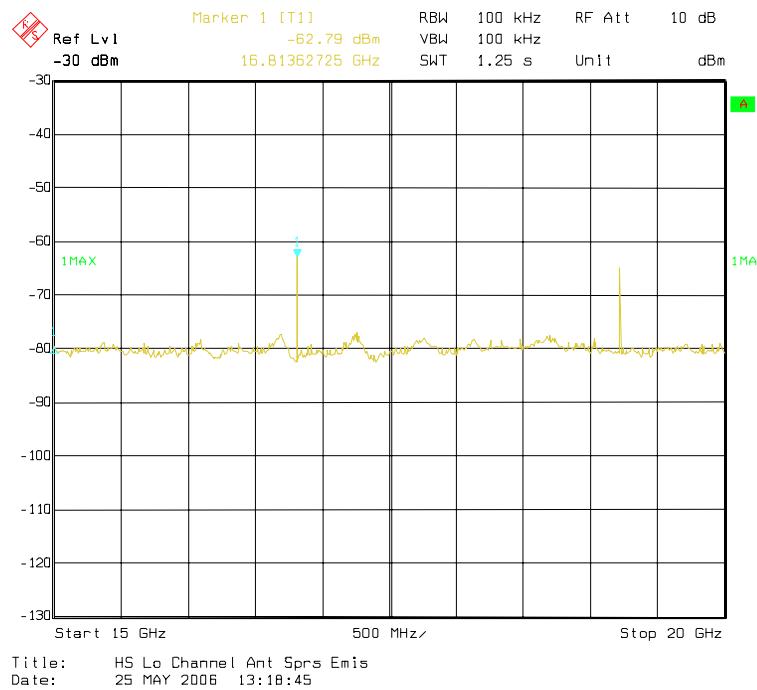
## For Handset (EUT)

### Low Channel

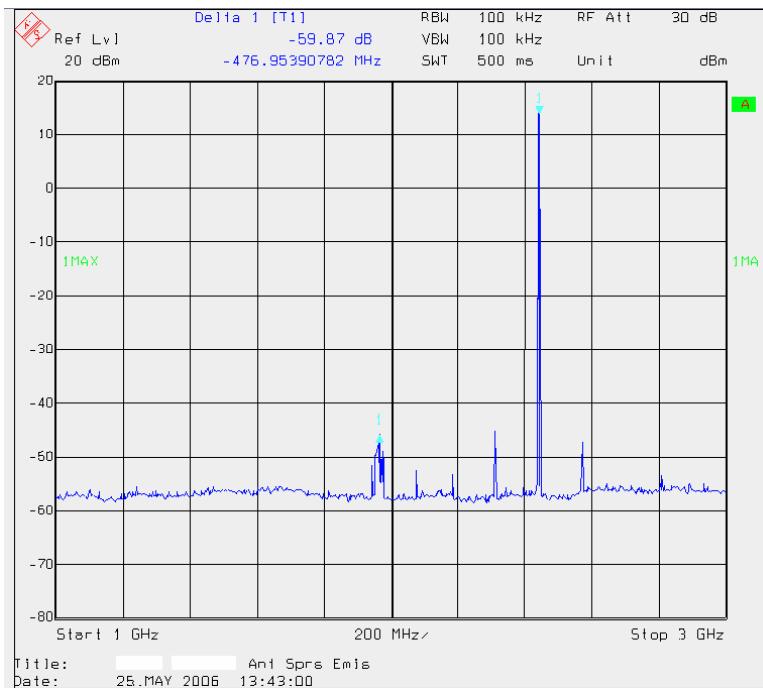
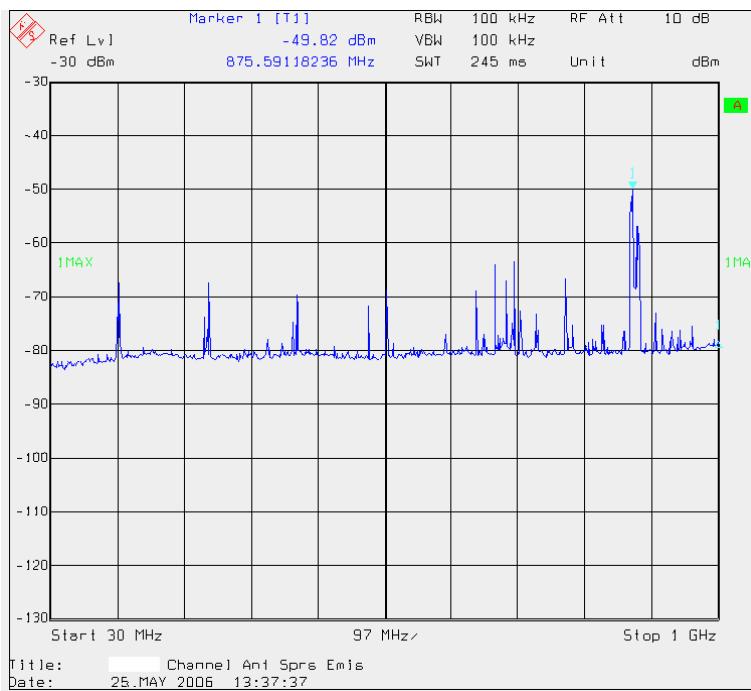


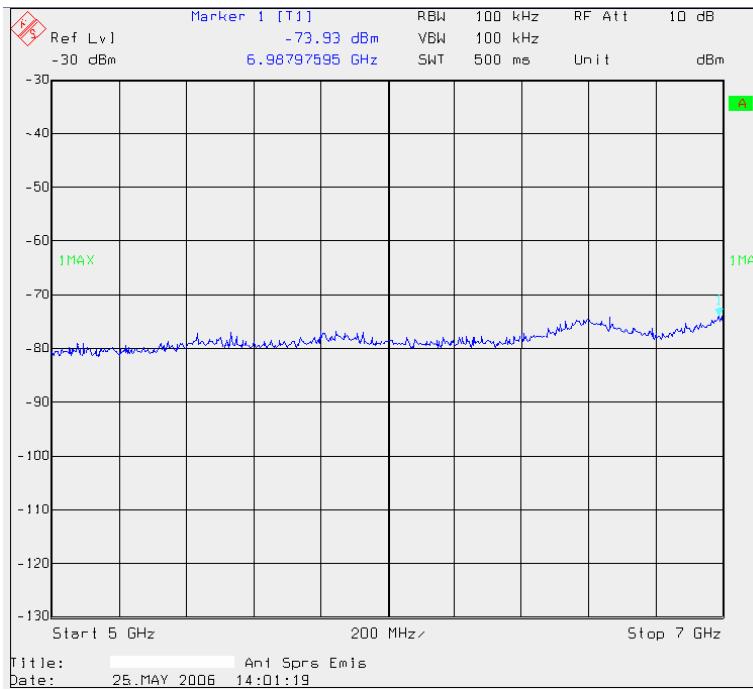
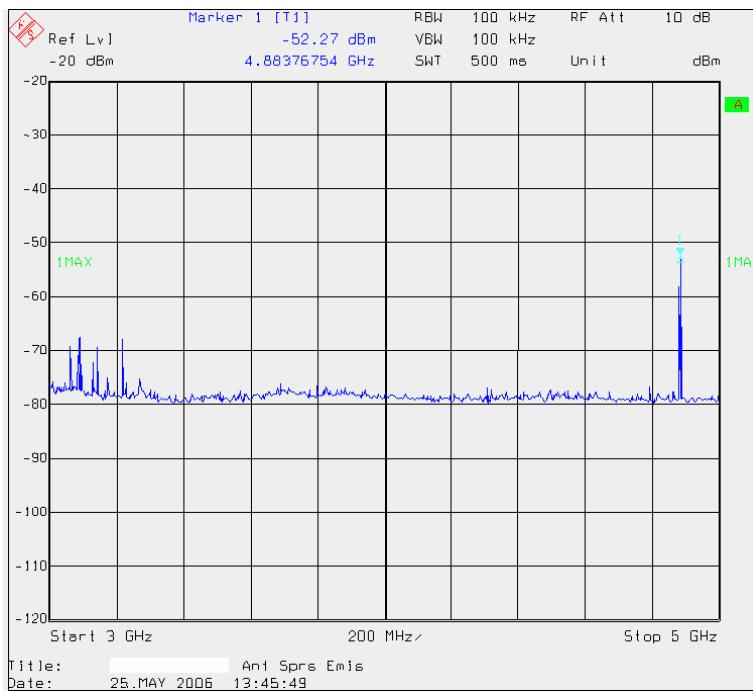


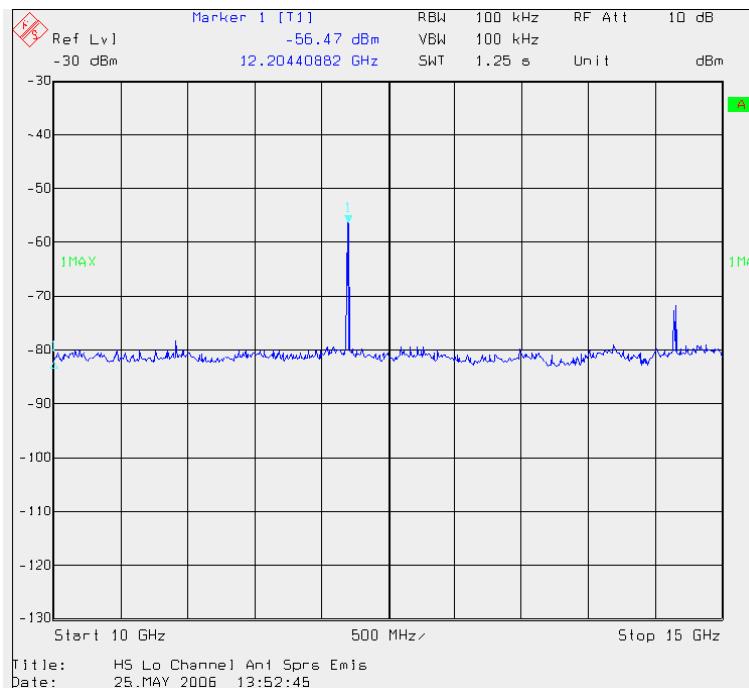
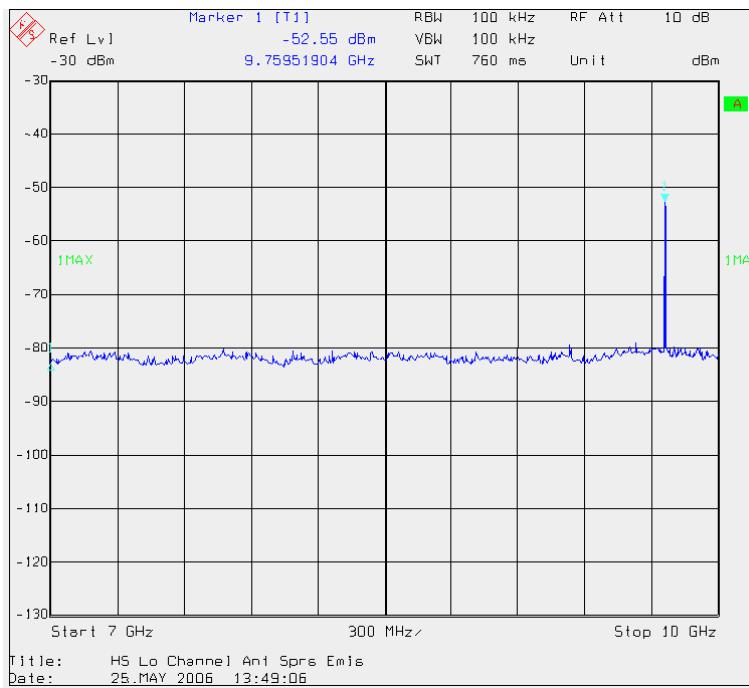


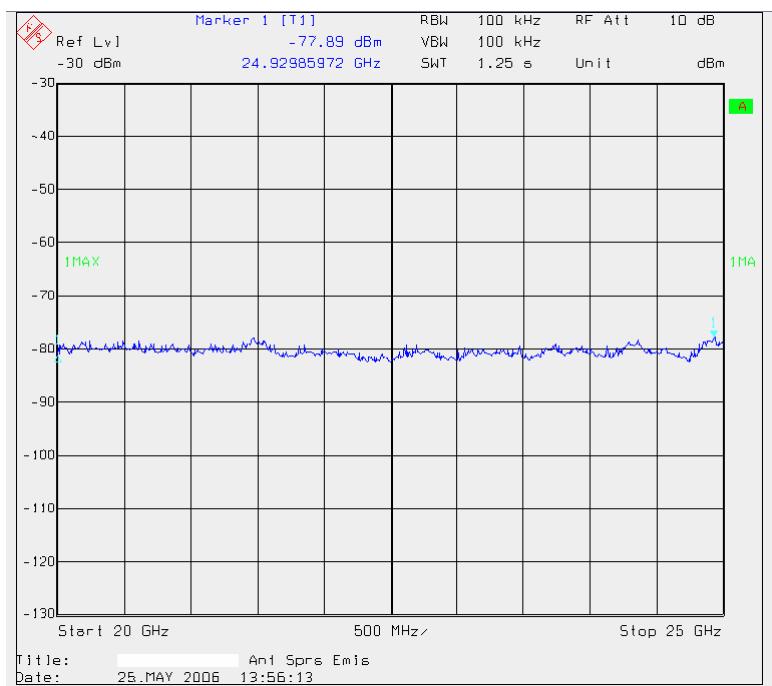
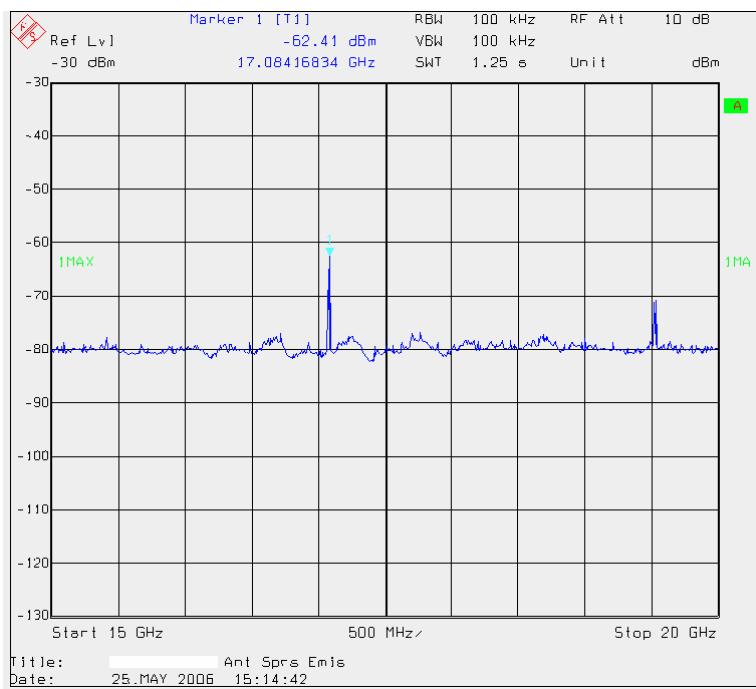


## Mid Channel

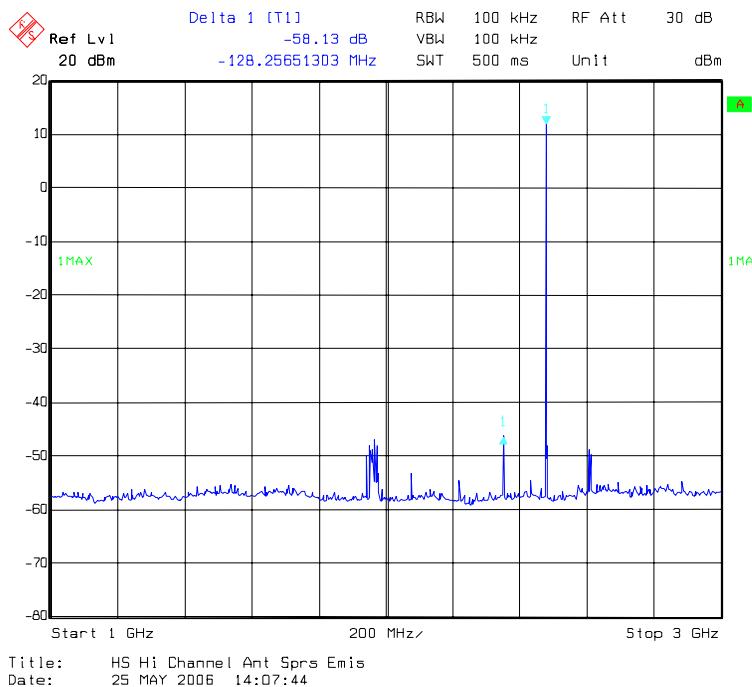
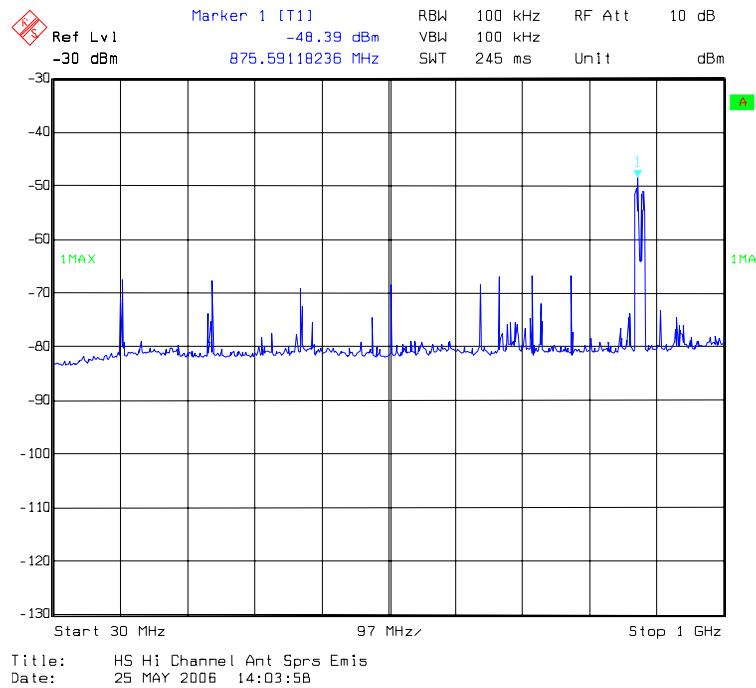


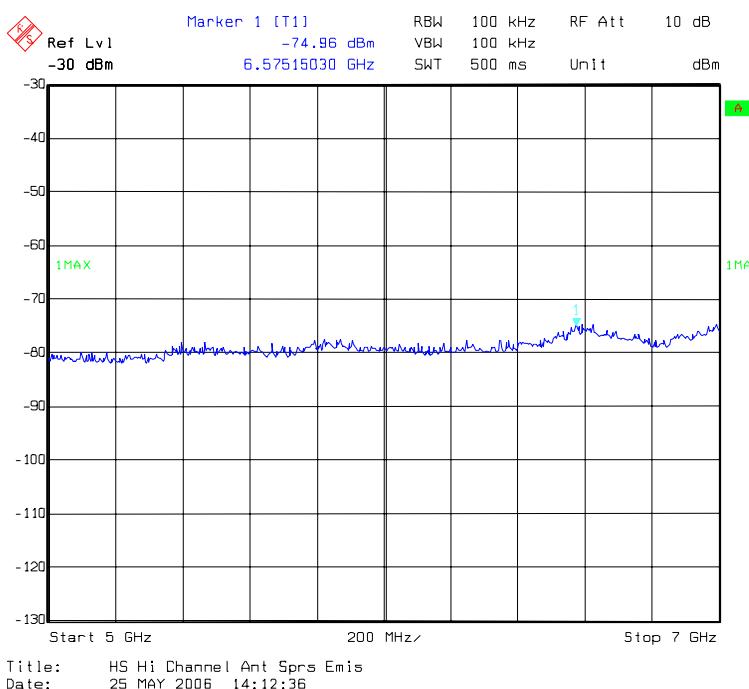
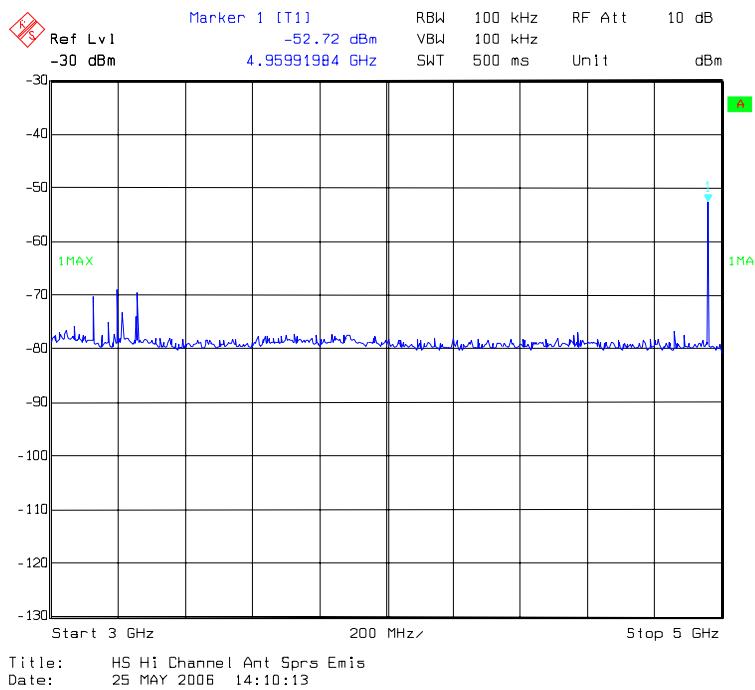


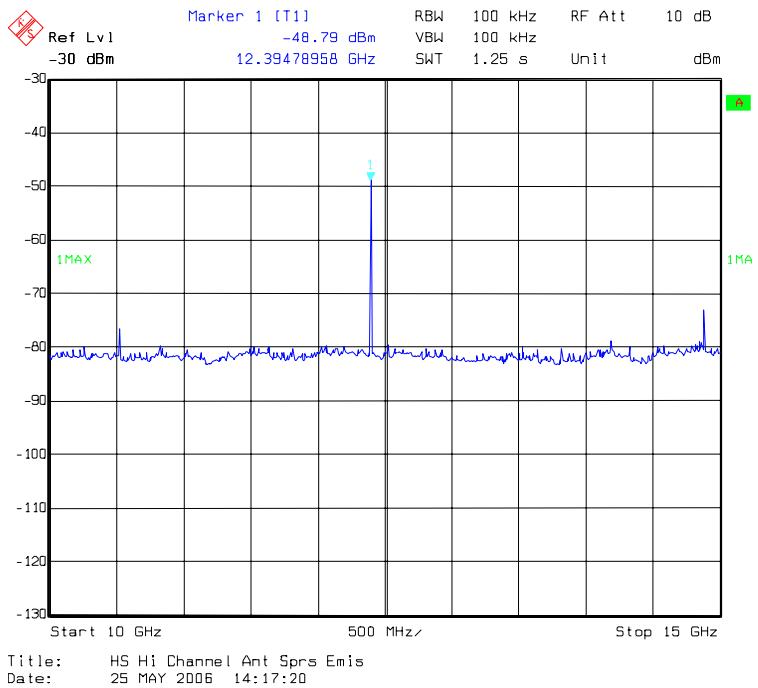
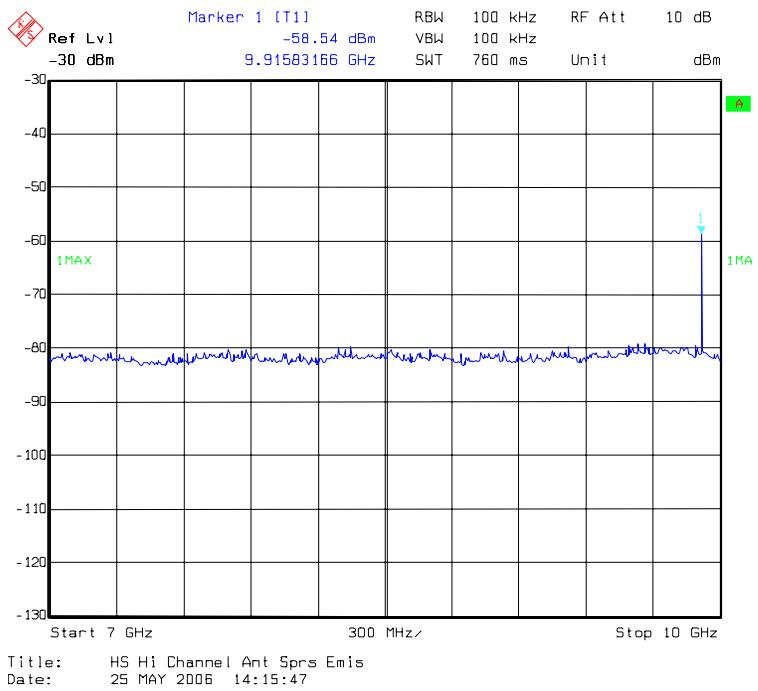


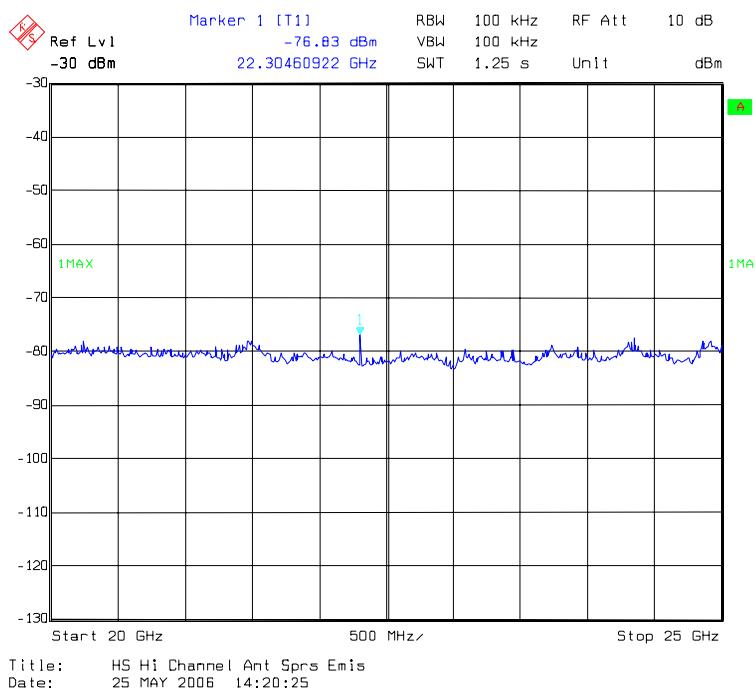
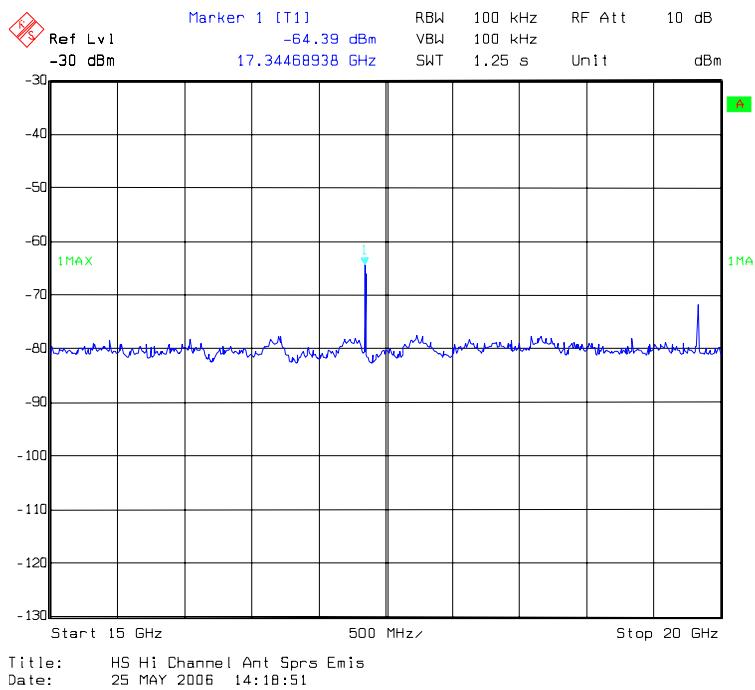


## High Channel









## **§15.205, §15.209 & §15.247(c) - RADIATED EMISSIONS**

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### **Measurement Uncertainty**

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

### **Test Setup**

The radiated emissions tests were performed in the shield room, using the setup in accordance with ANSI C63.4-2003. The specification used was the FCC 15 Subpart C limits.

### **Test Equipment List and Details**

<b>Manufacturer</b>	<b>Description</b>	<b>Model</b>	<b>Serial Number</b>	<b>Cal. Date</b>
Sonoma Instruments	Pre amplifier	317	260406	2006-02-03
Agilent	Pre amplifier	8449B	3008A01978	2005-08-10
Sunol Science Corp	Combination Antenna	JB3 Antenna	A013105	2006-02-11
DRG	Horn Antenna	SAS-200/571	261	2006-04-20
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.595 0K03	100044	2005-12-14
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Rohde & Schwarz	Artificial-Mains Network	ESH2-Z5	871884/039	2005-11-14

**\* Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## Environmental Conditions

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

\*The testing was performed by Oscar Au on 2006-05-29.

## Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data were recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limits), and are distinguished with a "QP" in the data table.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emissions are 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Class B Limit}$$

## Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247, and had the worst margin of:

For 30-1000MHZ (RX Spurious Emissions)

**-37.2 dB at 94.868750 MHz in the Vertical polarization, Handset (EUT)**

**-18.4 dB at 69.220000 MHz in the Vertical polarization, Base (EUT)**

For 30-1000MHZ (TX Spurious Emissions)

**-7.5 dB at 988.2388 MHz in the Vertical polarization, Handset (EUT)**

**-62.3 dB at 76.3175 MHz in the Vertical polarization, Base (EUT)**

Radiated spurious emissions above 1GHz (Handset)

**-12.6 dB at 9607.2000 MHz** in the **Horizontal** polarization, **Low Channel**

**-11.6 dB at 3151.5000 MHz** in the **Horizontal** polarization, **Middle Channel**

**-10.2 dB at 4957.0200 MHz** in the **Horizontal** polarization, **High Channel**

Radiated spurious emissions above 1GHz (Base)

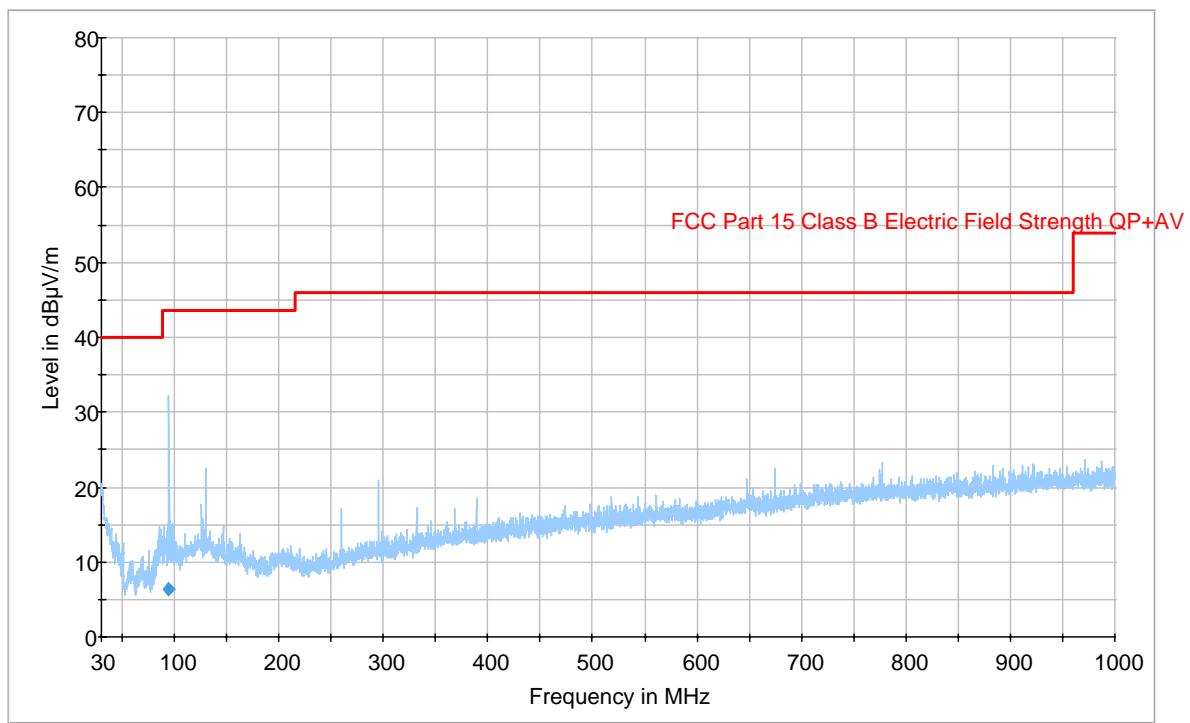
**-11.4 dB at 2401.8000 MHz** in the **Vertical** polarization, **Low Channel**

**-9.8 dB at 7320.4800 MHz** in the **Vertical** polarization, **Middle Channel**

**-9.5 dB at 7435.5300 MHz** in the **Vertical** polarization, **High Channel**

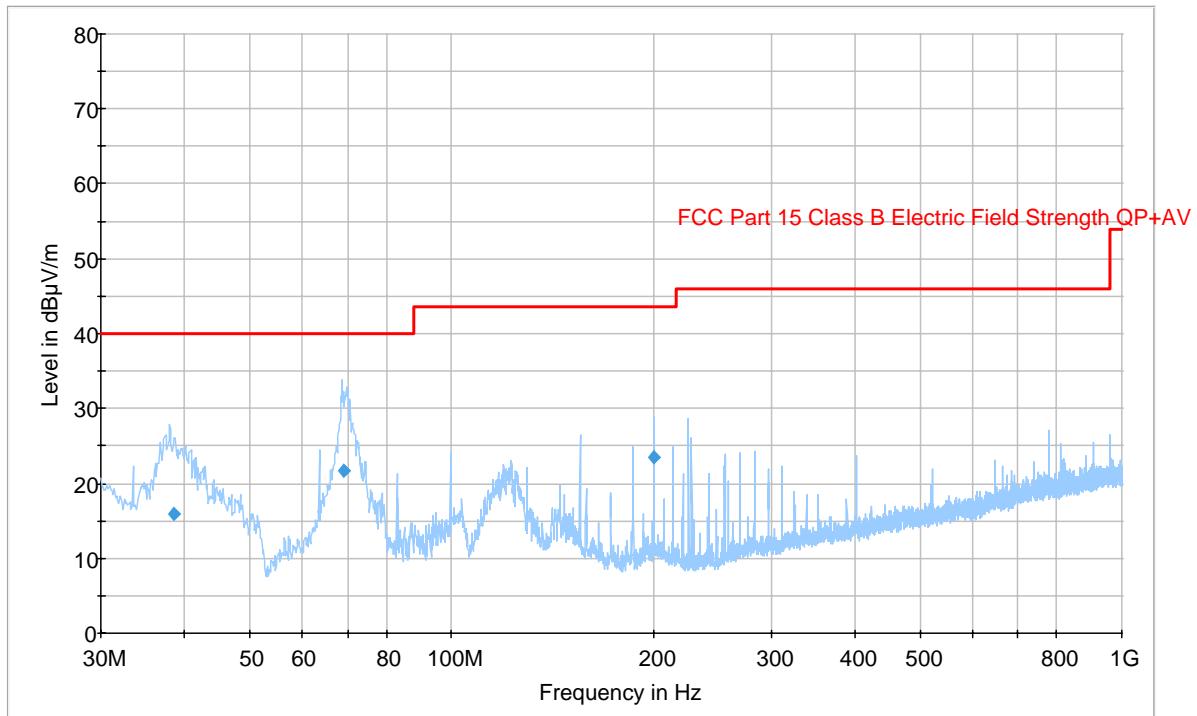
## Radiated Emissions Test Data @ 3 meter

30-1000MHZ (RX Spurious Emissions for Handset)



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
94.868750	6.3	400.4	V	23.0	-26.8	43.5	-37.2

30-1000MHZ (RX Spurious Emissions for Base)



Frequency (MHz)	QuasiPeak (dB $\mu$ V/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Limit (dB $\mu$ V/m)	Margin (dB)
69.220000	21.6	101.2	V	6.0	-28.9	40.0	-18.4
200.477500	23.5	124.0	H	128.0	-23.9	43.5	-20.0
38.602500	15.8	196.7	V	29.0	-22.3	40.0	-24.2

TX mode spurious emissions test result (30-1000MHz)

Handset (EUT)

Frequency MHz	Corrected Reading dBuV	Height m	Polar H / V	Azimuth Degrees	Corr. dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin
988.2388	46.5	100	V	92	-12.5	54	-7.5
707.1813	67.8	100	V	275	-15.2	93	-25.2
690.3275	52.0	100	V	112	-15.6	93	-41
694.9350	49.2	100	V	182	-15.4	93	-43.8
687.9025	47.4	200	V	205	-15.7	93	-45.6
688.8725	46.8	100	V	359	-15.6	93	-46.2

Base (EUT)

Frequency MHz	Corrected Reading dBuV	Height m	Polar H / V	Azimuth Degrees	Corr. dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin
76.3175	30.7	396	H	104	-27.9	93	-62.3
45.6413	27.0	101	V	1	-26.0	93	-66
77.8938	27.0	199	H	119	-27.8	93	-66
691.6613	32.3	396	H	358	-15.5	93	-60.7
707.0600	30.7	396	V	304	-15.2	93	-62.3
688.9938	26.9	396	H	333	-15.6	93	-66.1

Radiated spurious emissions above 1GHZ (Handset)

Low Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2401.8000	121.1	260	1.3	V	28.7	1.5	35.8	115.4			Fund/Peak
2401.8000	58.6	260	1.3	V	28.7	1.5	35.8	52.9			Ave
2401.8000	119.2	190	1.4	H	28.7	1.5	35.8	113.5			Fund/Peak
2401.8000	68.6	180	2.3	H	28.7	1.5	35.8	62.9			Ave
9607.2000	53.8	210	1.5	H	38.1	3.7	34.2	61.4	74.0	-12.6	Peak
3108.6000	84.7	140	1.1	H	29.8	1.4	35.2	80.8	93.5	-12.7	Peak
3108.6000	84.5	130	1.3	V	29.8	1.4	35.2	80.6	95.4	-14.8	Peak
9607.2000	51.3	200	1.3	V	38.1	3.7	34.2	58.9	74.0	-15.1	Peak
9607.2000	31.2	210	1.5	H	38.1	3.7	34.2	38.8	54.0	-15.2	Ave
9607.2000	30.2	200	1.3	V	38.1	3.7	34.2	37.8	54.0	-16.2	Ave
3108.6000	41.7	140	1.1	H	29.8	1.4	35.2	37.8	54.0	-16.2	Ave
3108.6000	41.6	130	1.3	V	29.8	1.4	35.2	37.7	54.0	-16.3	Ave
7205.4000	50.2	160	1.5	H	36.7	4.2	34.7	56.4	74.0	-17.6	Peak
7205.4000	30.1	160	1.5	H	36.7	4.2	34.7	36.3	54.0	-17.7	Ave
4803.6000	36.3	210	1.6	H	32.5	1.9	34.8	35.9	54.0	-18.1	Ave
4803.6000	36.0	205	1.2	V	32.5	1.9	34.8	35.6	54.0	-18.4	Ave
7205.4000	49.4	120	1.2	V	36.7	4.2	34.7	55.6	74.0	-18.4	Peak
7205.4000	28.7	120	1.2	V	36.7	4.2	34.7	34.9	54.0	-19.1	Ave
4803.6000	54.4	210	1.6	H	32.5	1.9	34.8	54.0	74.0	-20.0	Peak
4803.6000	51.2	205	1.2	V	32.5	1.9	34.8	50.8	74.0	-23.2	Peak

Middle Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2440.1600	118.7	260	1.3	V	28.7	1.5	35.8	113.0			Fund/Peak
2440.1600	68.2	260	1.3	V	28.7	1.5	35.8	62.5			Ave
2440.1600	118.1	160	1.3	H	28.7	1.5	35.8	112.4			Fund/Peak
2440.1600	68.3	180	2.3	H	28.7	1.5	35.8	62.6			Ave
3151.5000	84.7	140	1.1	H	29.8	1.4	35.2	80.8	92.4	-11.6	Peak
9760.6400	54.7	320	1.4	H	38.1	3.7	34.2	62.3	74.0	-11.7	Peak
3151.5000	84.2	60	1.2	V	29.8	1.4	35.2	80.3	93.0	-12.7	Peak
9760.6400	51.2	210	1.6	V	38.1	3.7	34.2	58.8	74.0	-15.2	Peak
9760.6400	31.0	320	1.4	H	38.1	3.7	34.2	38.6	54.0	-15.4	Ave
9760.6400	30.5	210	1.6	V	38.1	3.7	34.2	38.1	54.0	-15.9	Ave
3151.5000	41.0	140	1.1	H	29.8	1.4	35.2	37.1	54.0	-16.9	Ave
7320.4800	50.3	350	1.8	H	36.7	4.2	34.7	56.5	74.0	-17.5	Peak
7320.4800	30.2	350	1.8	H	36.7	4.2	34.7	36.4	54.0	-17.6	Ave
3151.5000	40.1	60	1.2	V	29.8	1.4	35.2	36.2	54.0	-17.8	Ave
7320.4800	29.8	200	1.5	V	36.7	4.2	34.7	36.0	54.0	-18.0	Ave
7320.4800	49.6	200	1.5	V	36.7	4.2	34.7	55.8	74.0	-18.2	Peak
4880.3200	55.3	200	1.7	H	32.5	1.9	34.8	54.9	74.0	-19.1	Peak
4880.3200	32.3	200	1.7	H	32.5	1.9	34.8	31.9	54.0	-22.1	Ave
4880.3200	31.7	160	1.4	V	32.5	1.9	34.8	31.3	54.0	-22.7	Ave
4880.3200	51.3	160	1.4	V	32.5	1.9	34.8	50.9	74.0	-23.1	Peak

High Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2478.5100	119.5	270	1.1	V	28.7	1.5	35.8	113.8			Fund/Peak
2478.5100	55.6	270	1.1	V	28.7	1.5	35.8	49.9			Ave
2478.5100	115.7	40	1.6	H	28.7	1.5	35.8	110.0			Fund/Peak
2478.5100	65.8	40	1.6	H	28.7	1.5	35.8	60.1			Ave
4957.0200	64.2	320	1.0	H	32.5	1.9	34.8	63.8	74	-10.2	Peak
9914.0400	53.7	90	1.4	H	38.1	3.7	34.2	61.3	74	-12.7	Peak
7435.5300	54.7	100	1.0	H	36.7	4.2	34.7	60.9	74	-13.1	Peak
9914.0400	51.8	140	1.3	V	38.1	3.7	34.2	59.4	74	-14.6	Peak
7435.5300	52.2	70	1.0	V	36.7	4.2	34.7	58.4	74	-15.6	Peak
4957.0200	58.3	75	1.1	V	32.5	1.9	34.8	57.9	74	-16.1	Peak
9914.0400	30.1	90	1.4	H	38.1	3.7	34.2	37.7	54	-16.3	Ave
9914.0400	30.0	140	1.3	V	38.1	3.7	34.2	37.6	54	-16.4	Ave
7435.5300	30.4	100	1.0	H	36.7	4.2	34.7	36.6	54	-17.4	Ave
7435.5300	30.1	70	1.0	V	36.7	4.2	34.7	36.3	54	-17.7	Ave
4957.0200	34.5	320	1.0	H	32.5	1.9	34.8	34.1	54	-19.9	Ave
4957.0200	33.4	75	1.1	V	32.5	1.9	34.8	33.0	54	-21.0	Ave

Radiated spurious emissions above 1GHZ (Base)

Low Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2401.8000	112.7	200	1.6	H	28.7	1.5	35.8	107.0			Fund/Peak
2401.8000	117.2	80	1.4	V	28.7	1.5	35.8	111.5			Fund/Peak
2401.8000	67.6	200	1.6	H	28.7	1.5	35.8	61.9			Ave
2401.8000	68.3	80	1.4	V	28.7	1.5	35.8	62.6	74.0	-11.4	Ave
7205.4000	56.6	190	1.7	V	36.7	4.2	34.7	62.8	74.0	-11.2	Peak
4803.6000	60.7	330	1.4	V	32.5	1.9	34.8	60.3	74.0	-13.7	Peak
9607.2000	52.3	150	1.3	V	38.1	3.7	34.2	59.9	74.0	-14.1	Peak
9607.2000	31.0	150	1.3	V	38.1	3.7	34.2	38.6	54.0	-15.4	Ave
7205.4000	31.2	100	1.5	V	36.7	4.2	34.7	37.4	54.0	-16.6	Ave
7205.4000	50.9	100	1.5	H	36.7	4.2	34.7	57.1	74.0	-16.9	Peak
9607.2000	29.4	150	1.3	H	38.1	3.7	34.2	37.0	54.0	-17.0	Ave
7205.4000	30.2	100	1.5	H	36.7	4.2	34.7	36.4	54.0	-17.6	Ave
1698.4000	66.5	220	1.6	V	24.8	1.4	36.3	56.3	74.0	-17.7	Peak
4803.6000	55.1	150	1.6	H	32.5	1.9	34.8	54.7	74.0	-19.3	Peak
9607.2000	46.8	200	1.4	H	38.1	3.7	34.2	54.4	74.0	-19.6	Peak
4803.6000	33.7	330	1.4	V	32.5	1.9	34.8	33.3	54.0	-20.7	Ave
1698.4000	62.7	160	1.1	H	24.8	1.4	36.3	52.5	74.0	-21.5	Peak
4803.6000	32.2	330	1.4	H	32.5	1.9	34.8	31.8	54.0	-22.2	Ave
3107.3000	34.2	280	1.0	H	29.8	1.4	35.2	30.3	54.0	-23.7	Ave
3107.3000	33.1	280	1.0	V	29.8	1.4	35.2	29.2	54.0	-24.8	Ave
3107.3000	62.5	280	1.0	H	29.8	1.4	35.2	58.6	87.0	-28.4	Peak
1698.4000	34.9	180	2.0	V	24.8	1.4	36.3	24.7	54.0	-29.3	Ave
1698.4000	34.6	90	2.0	H	24.8	1.4	36.3	24.4	54.0	-29.6	Ave
3107.3000	58.9	160	1.7	V	29.8	1.4	35.2	55.0	91.5	-36.5	Peak

Middle Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2440.1600	115.3	270	1.6	H	28.7	1.5	35.8	109.6			Fund/Peak
2440.1600	120.2	220	1.6	V	28.7	1.5	35.8	114.5			Fund/Peak
2440.1600	58.1	270	1.6	H	28.7	1.5	35.8	52.4			Ave
2440.1600	66.2	220	1.6	V	28.7	1.5	35.8	60.5			Ave
7320.4800	58.0	200	1.3	V	36.7	4.2	34.7	64.2	74.0	-9.8	Peak
4880.3200	63.2	320	1.1	V	32.5	1.9	34.8	62.8	74.0	-11.2	Peak
7320.4800	53.6	110	1.6	H	36.7	4.2	34.7	59.8	74.0	-14.2	Peak
7320.4800	32.1	200	1.5	V	36.7	4.2	34.7	38.3	54.0	-15.7	Ave
7320.4800	31.3	350	1.8	H	36.7	4.2	34.7	37.5	54.0	-16.5	Ave
4880.3200	57.2	150	1.6	H	32.5	1.9	34.8	56.8	74.0	-17.2	Peak
4880.3200	35.1	160	1.4	V	32.5	1.9	34.8	34.7	54.0	-19.3	Ave
4880.3200	33.1	200	1.7	H	32.5	1.9	34.8	32.7	54.0	-21.3	Ave
3150.8000	33.8	90	2.0	H	29.8	1.4	35.2	29.9	54.0	-24.1	Ave
3150.8000	32.9	180	2.0	V	29.8	1.4	35.2	29.0	54.0	-25.0	Ave
1729.9000	35.5	60	1.2	V	24.8	1.5	36.3	25.4	54.0	-28.6	Ave
1729.9000	35.5	140	1.1	H	24.8	1.5	36.3	25.4	54.0	-28.6	Ave
3150.8000	64.9	130	2.0	H	29.8	1.4	35.2	61.0	89.6	-28.6	Peak
1729.9000	68.4	260	1.0	H	24.8	1.5	36.3	58.3	89.6	-31.3	Peak
1729.9000	70.3	70	1.3	V	24.8	1.5	36.3	60.2	94.5	-34.3	Peak
3150.8000	60.5	70	1.0	V	29.8	1.4	35.2	56.6	94.5	-37.9	Peak

High Channel:

Frequency MHz	Reading dBuV	Azimuth Degrees	Height m	Polar H / V	Antenna Loss dB	Cable loss dB	Amplifier dB	Corrected Reading dBuV/m	FCC15 Limit (dBuV/m)	FCC15 Margin	Comments
2478.5100	111.1	160	1.6	H	28.7	1.5	35.8	105.4			Fund/Peak
2478.5100	118.8	230	1.4	V	28.7	1.5	35.8	113.1			Fund/Peak
2478.5100	61.5	160	1.6	H	28.7	1.5	35.8	55.8			Ave
2478.5100	64.8	270	1.1	V	28.7	1.5	35.8	59.1			Ave
7435.5300	58.3	270	1.5	V	36.7	4.2	34.7	64.5	74	-9.5	Peak
7435.5300	54.2	290	1.4	H	36.7	4.2	34.7	60.4	74	-13.6	Peak
4957.0200	59.1	230	1.5	V	32.5	1.9	34.8	58.7	74	-15.3	Peak
7435.5300	32.1	70	1.0	V	36.7	4.2	34.7	38.3	54	-15.7	Ave
7435.5300	31.1	100	1.0	H	36.7	4.2	34.7	37.3	54	-16.7	Ave
4957.0200	56.3	230	1.3	H	32.5	1.9	34.8	55.9	74	-18.1	Peak
4957.0200	34.0	75	1.5	V	32.5	1.9	34.8	33.6	54	-20.4	Ave
4957.0200	33.9	320	1.0	H	32.5	1.9	34.8	33.5	54	-20.5	Ave

## **§15.247 (a) (1) - HOPPING CHANNEL SEPARATION**

### **Applicable Standard**

According to §15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

### **Measurement Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on a bench without connection to measurement instrument. 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 Max-Hold 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.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

\* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

\*The testing was performed by Oscar Au on 2006-05-29.

### **Measurement Results**

#### **Handset**

Channel	Frequency MHz	Channel Separation (KHz)	Limit > KHz
Low	2401.808	889.78	499.67
Mid	2440.159	889.78	505.01
High	2478.509	889.78	491.65

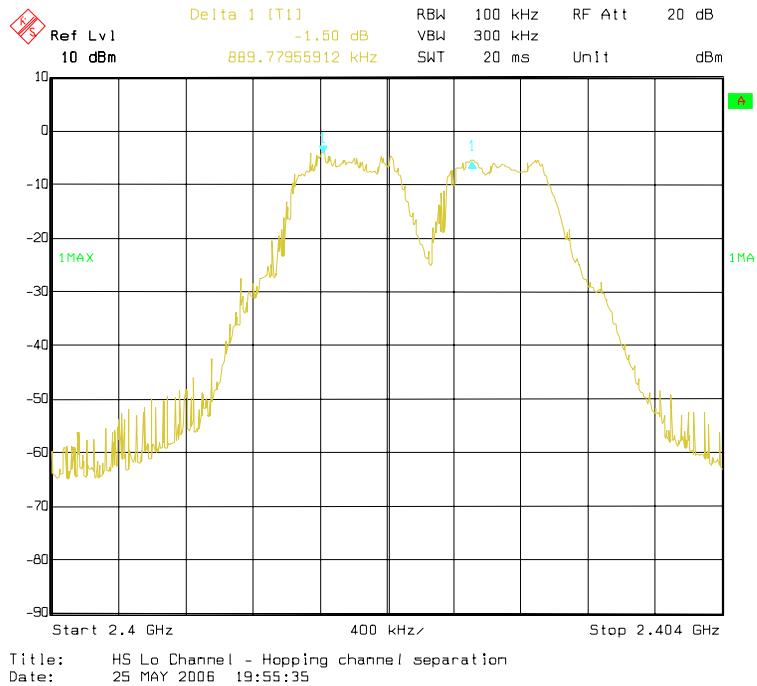
## Base

Channel	Frequency MHz	Channel Separation (KHz)	Limit > KHz
Low	2401.808	897.80	480.96
Mid	2440.159	893.80	468.94
High	2478.509	895.80	476.95

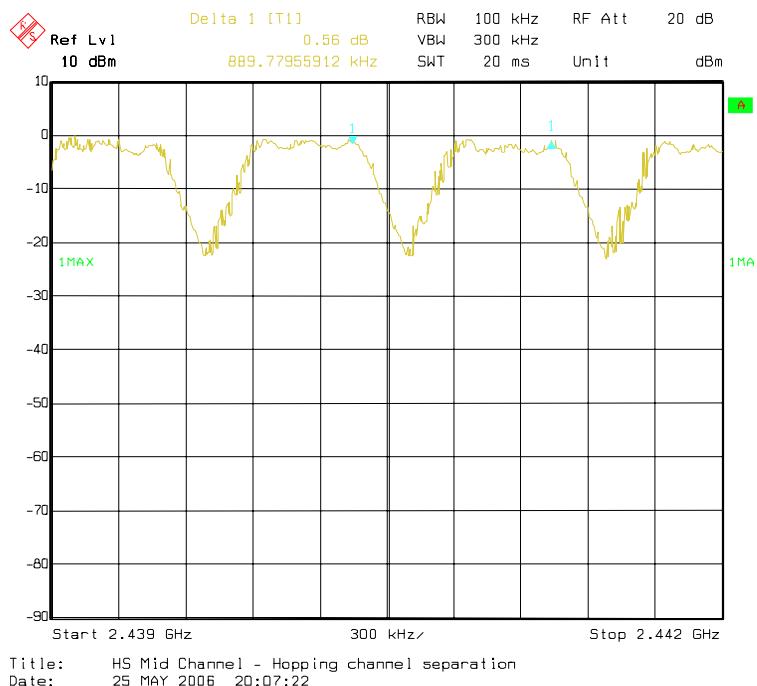
Please refer to the following plots.

## For Handset (EUT)

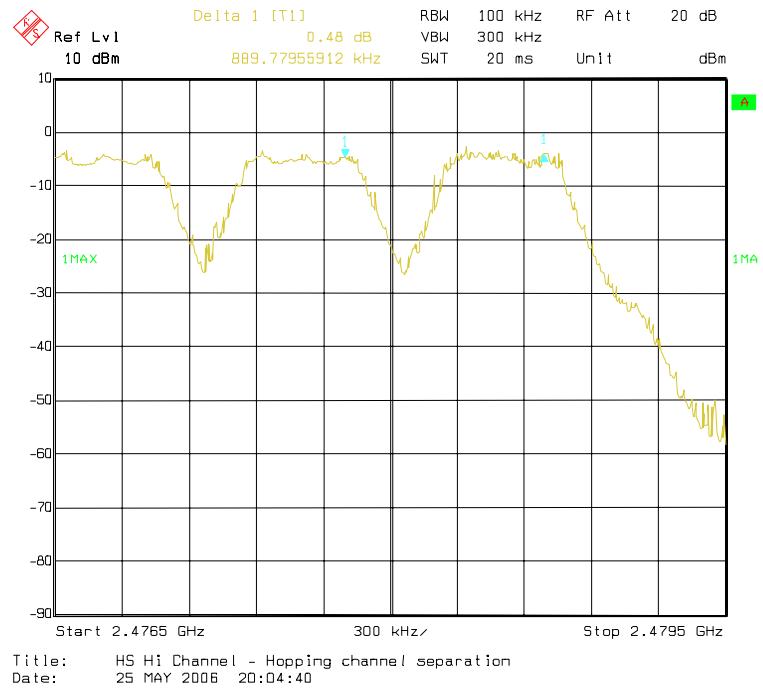
## Low Channel



## Middle Channel

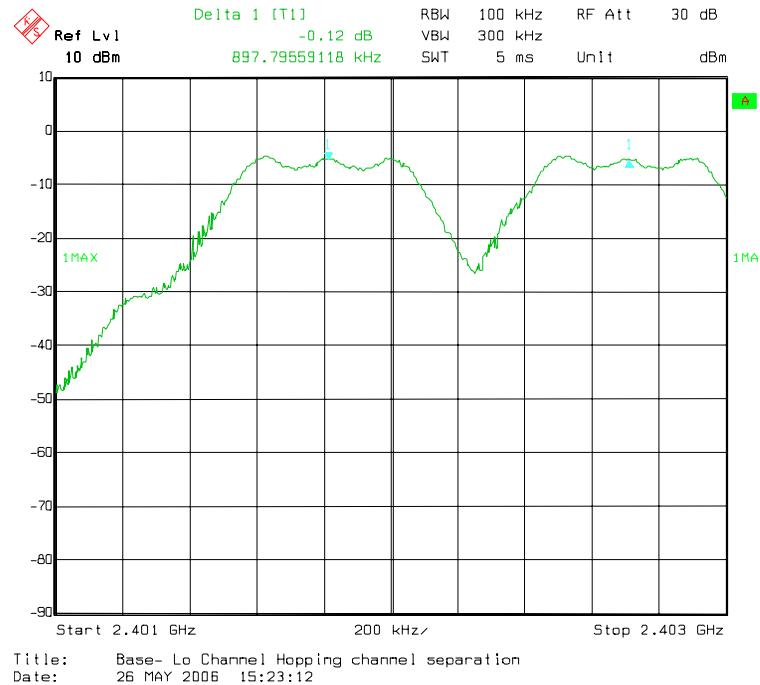


## High Channel

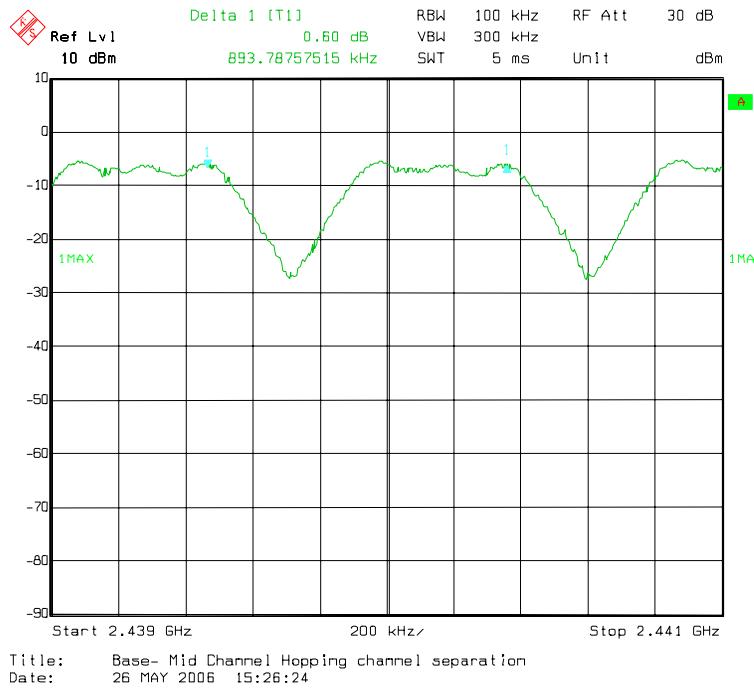


## For Base (EUT)

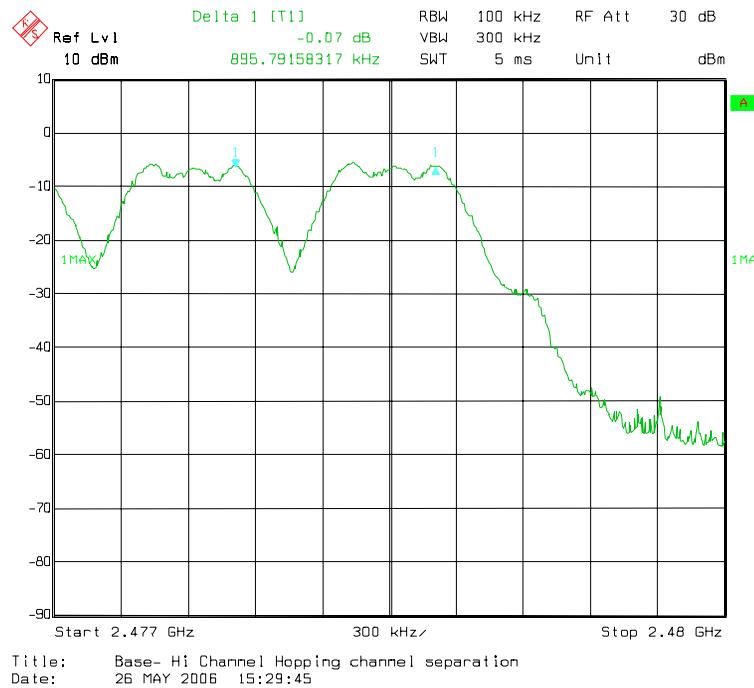
### Low Channel



## Middle Channel



## High Channel



## **§15.247 (a) (1) - CHANNEL BANDWIDTH**

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### **Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. 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 20 dB from the reference level. Record the frequency difference as the emissions bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

\* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

\*The testing was performed by Oscar Au on 2006-05-29.

### **Measurement Result**

Please see the following plots

#### **Handset**

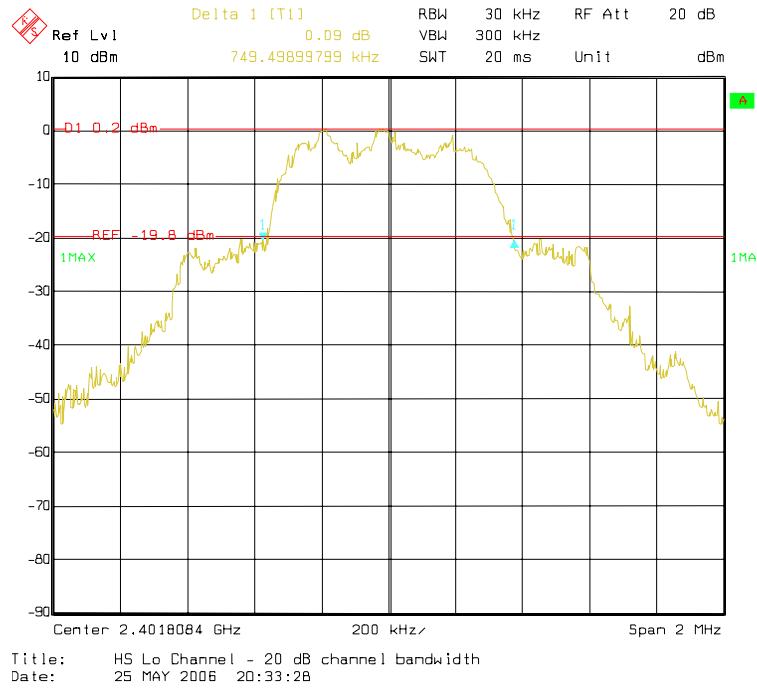
Channel	Frequency MHz	Channel Bandwidth (KHz)
Low	2401.808	749.50
Mid	2440.159	757.52
High	2478.509	737.47

**Base**

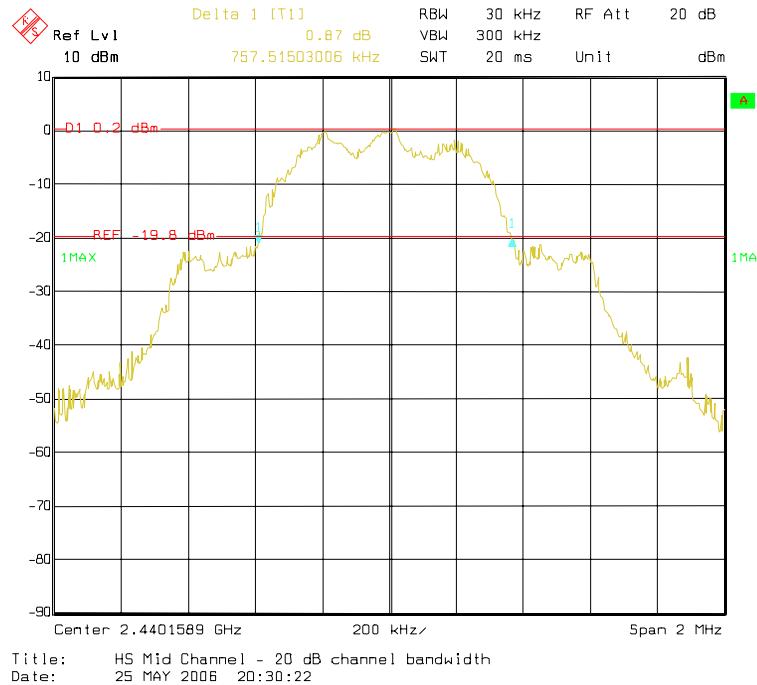
Channel	Frequency MHz	Channel Bandwidth (KHz)
Low	2401.808	721.44
Mid	2440.159	703.41
High	2478.509	715.43

For Handset (EUT)

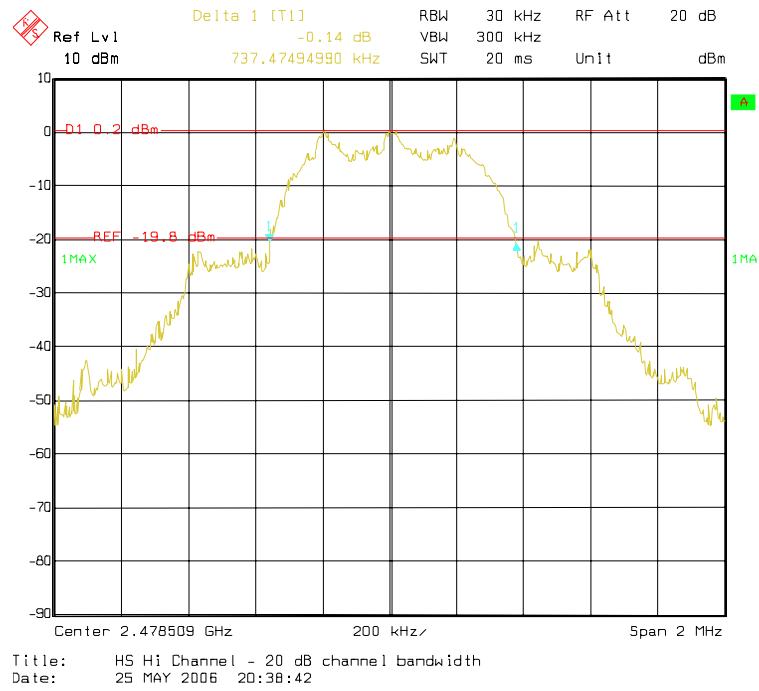
Low Channel



Middle Channel

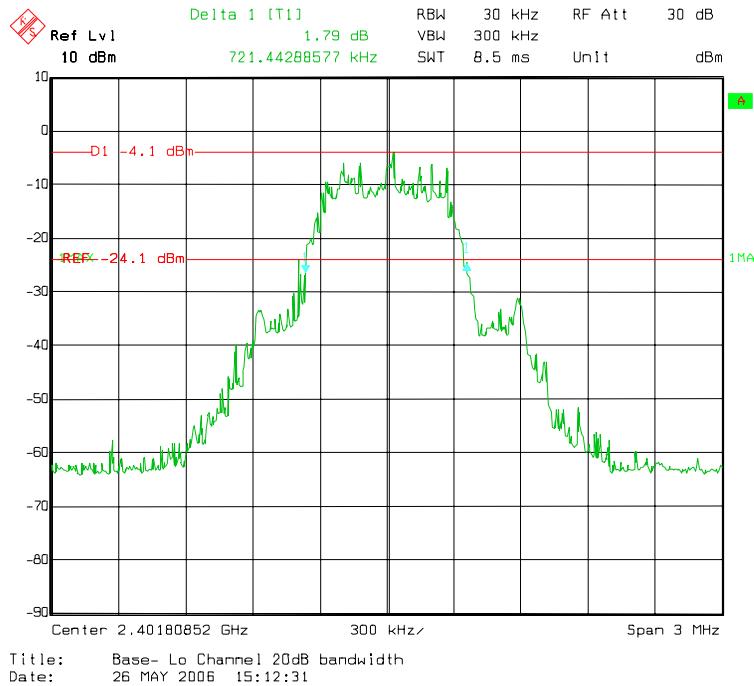


## High Channel

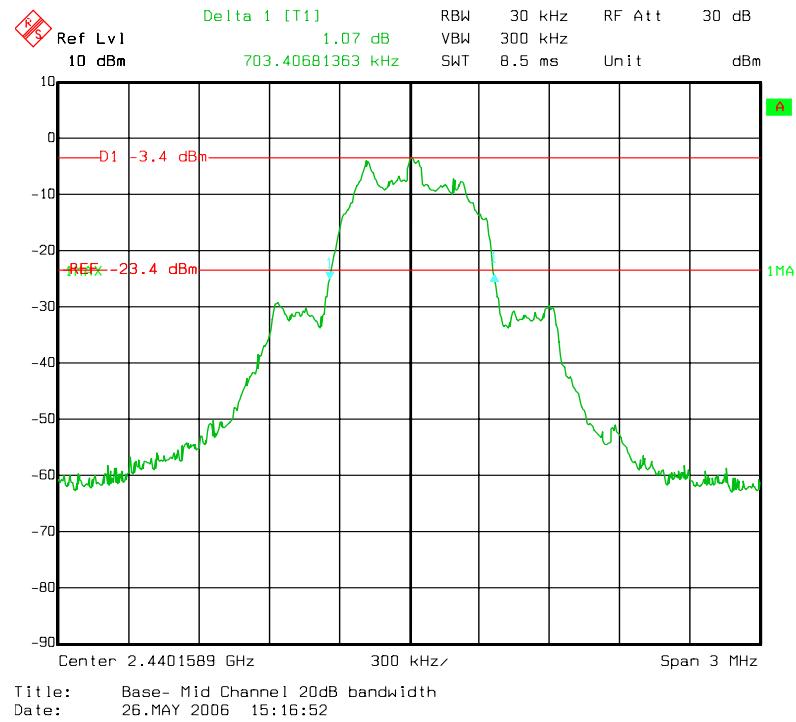


## For Base (EUT)

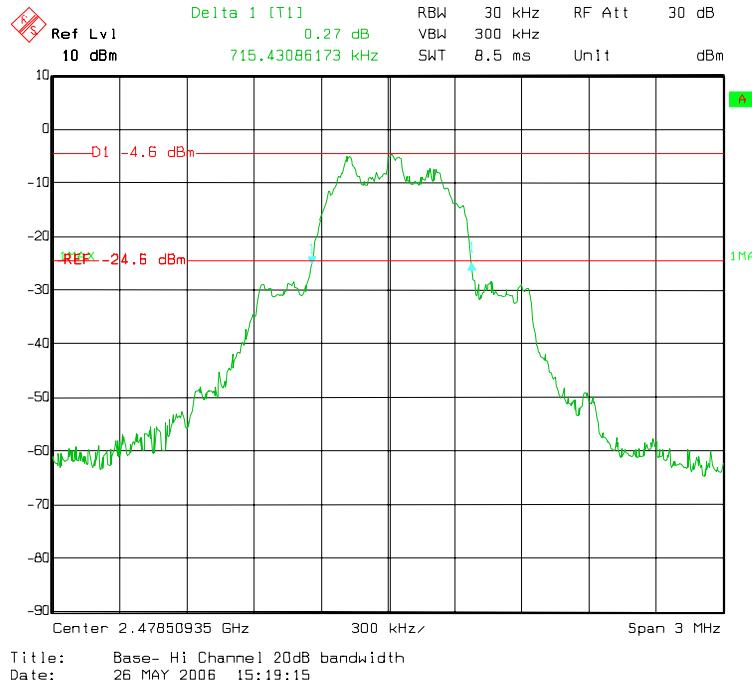
### Low Channel



## Middle Channel



## High Channel



## **§15.247 (a) (1) (i) - NUMBER OF HOPPING FREQUENCIES USED**

### **Applicable Standard**

According to §15.247(a)(1)(iii), for Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Measurement Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the bench without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 Max-Hold 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.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

\* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

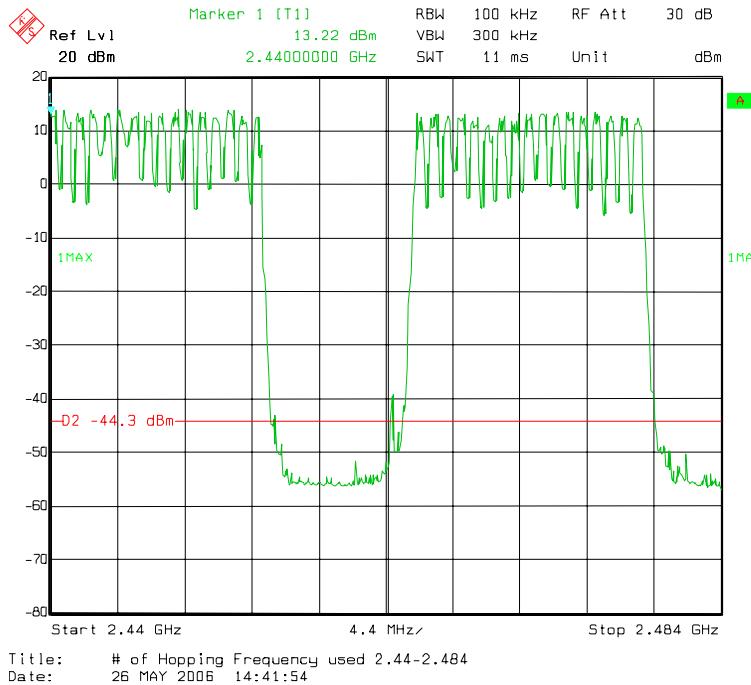
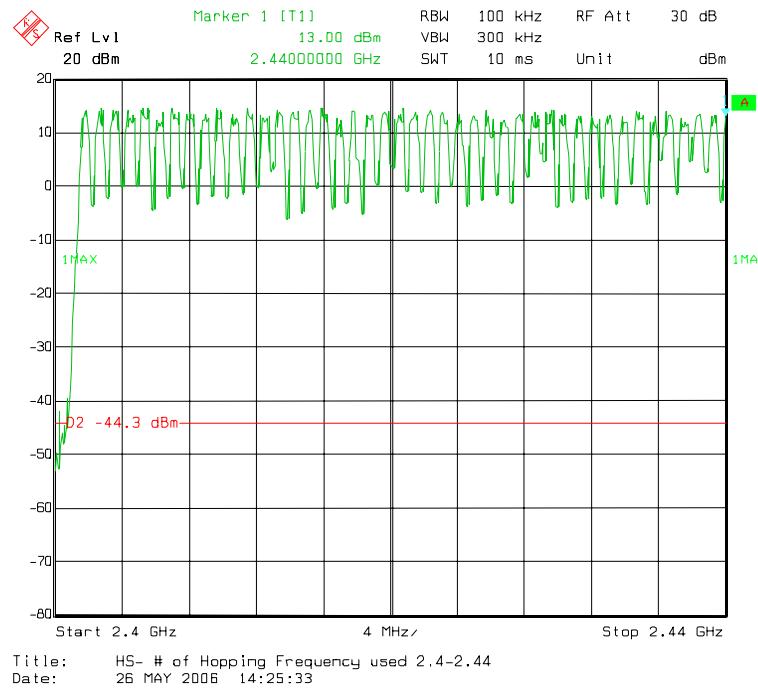
Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

\*The testing was performed by Oscar Au on 2006-05-29.

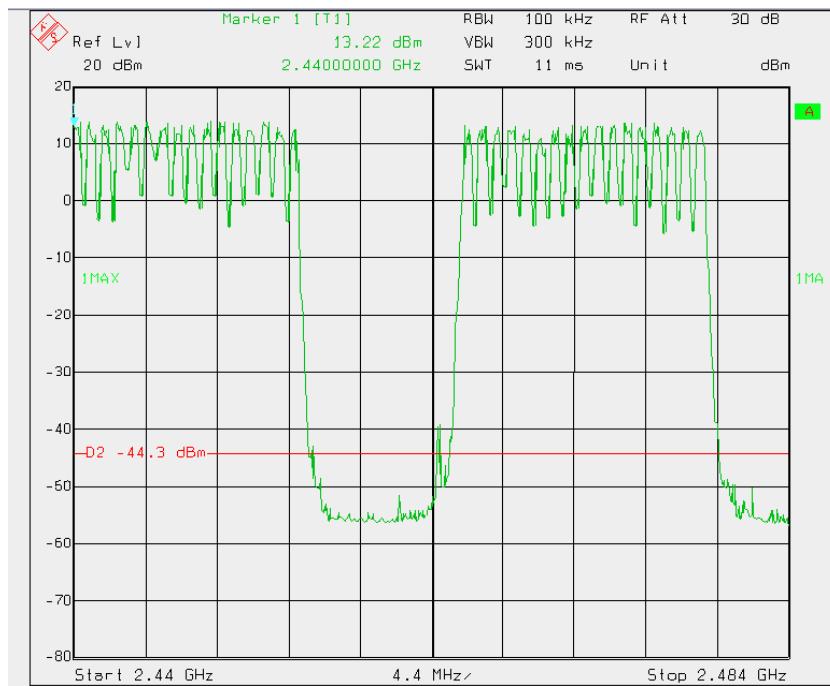
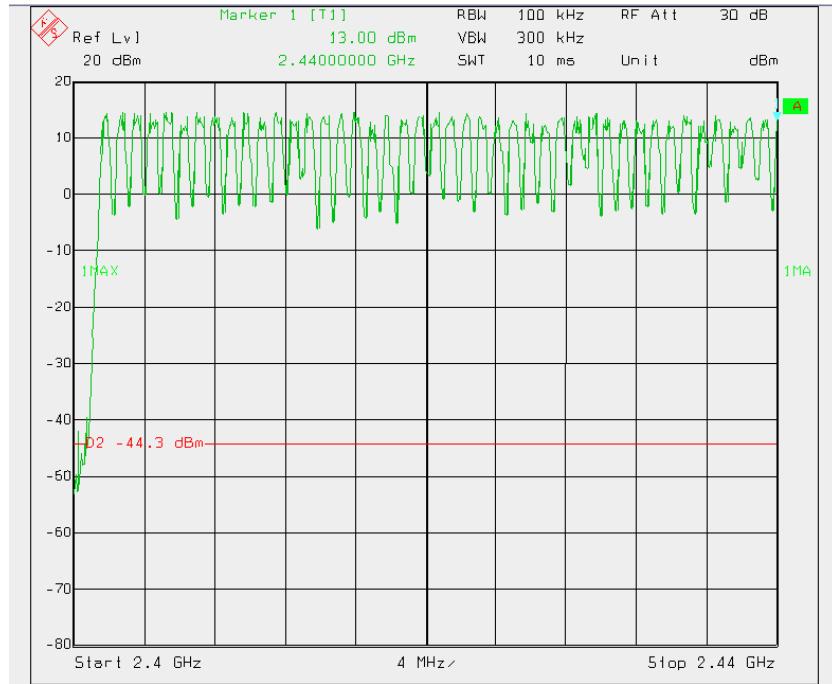
**Measurement Results:** 76 Channels

Please refer to the attached plots.

For Handset (EUT)



For Base (EUT)



## **§15.247(a)(1)(iii) - DWELL TIME**

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### **Applicable Standard**

According to §15.247(a)(1)(iii), for Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 frequencies measured were complete.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

\* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	20° C
Relative Humidity:	60%
ATM Pressure:	1022 mbar

*\*The testing was performed by Oscar Au on 2006-05-29.*

**Measurement Results:****For Handset (EUT)**

Channel	Frequency MHz	Pulse Wide msec	Occupied time	Dwell Time Sec	Limit Sec
Low	2401.808	1.1323	41	0.046	0.4
Mid	2440.159	1.1323	45	0.051	0.4
High	2478.509	1.1022	56	0.062	0.4

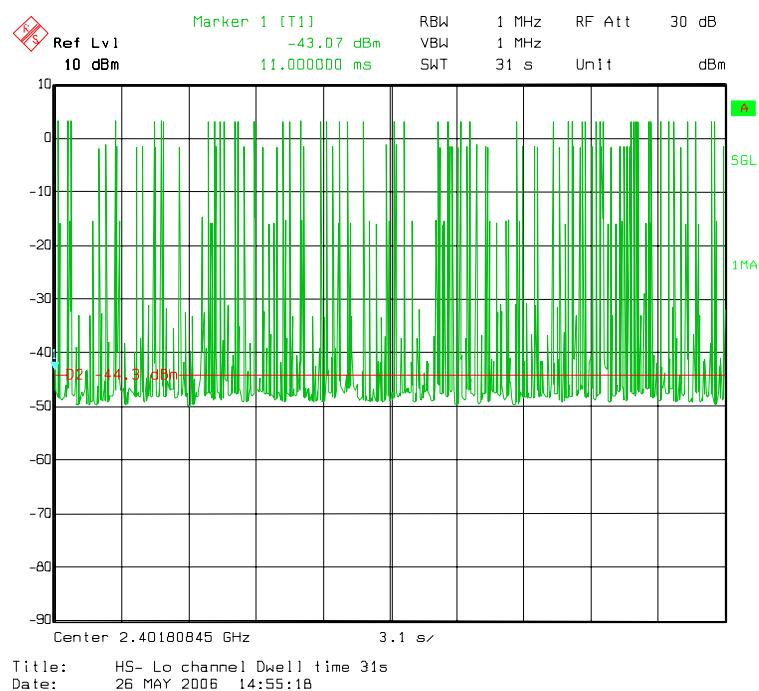
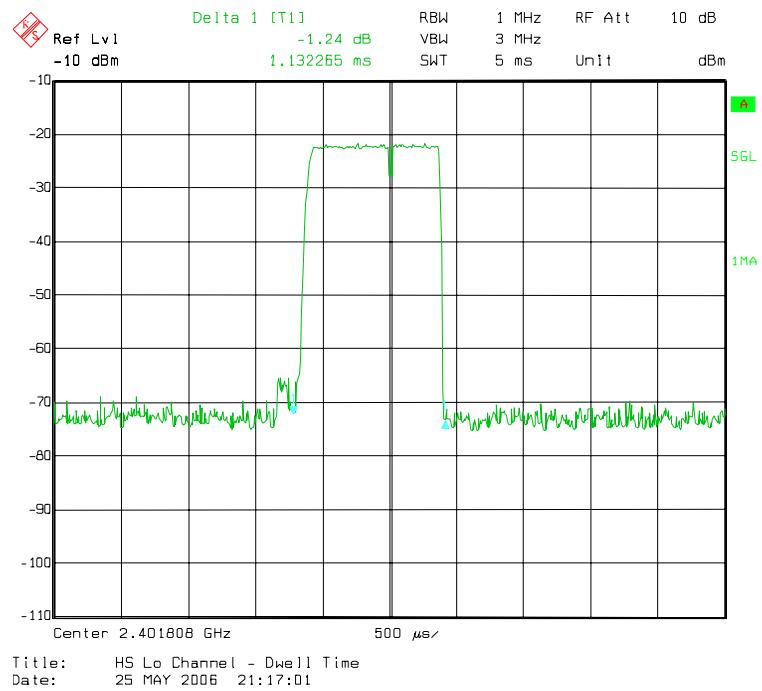
**For Base (EUT)**

Channel	Frequency MHz	Pulse Wide msec	Occupied time	Dwell Time Sec	Limit Sec
Low	2401.808	1.1022	77	0.085	0.4
Mid	2440.159	1.0922	95	0.104	0.4
High	2478.509	1.1222	90	0.101	0.4

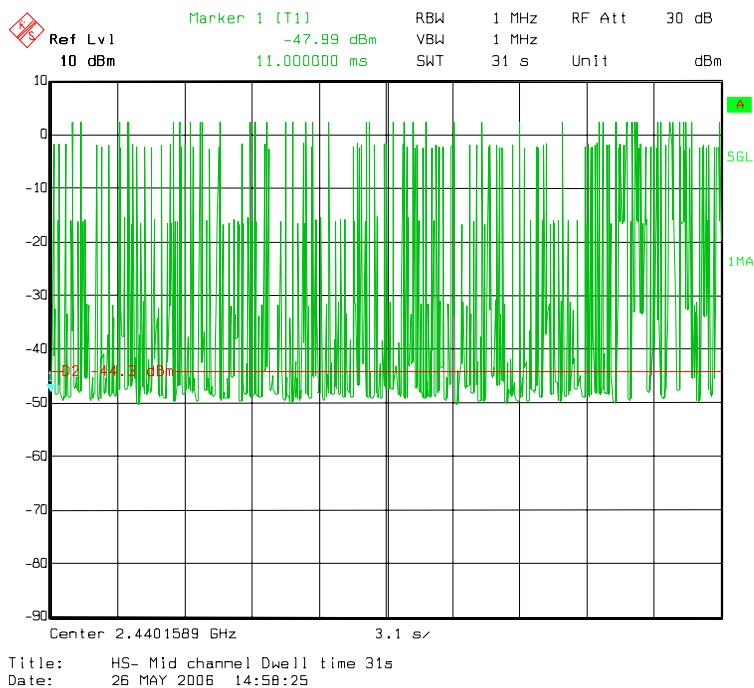
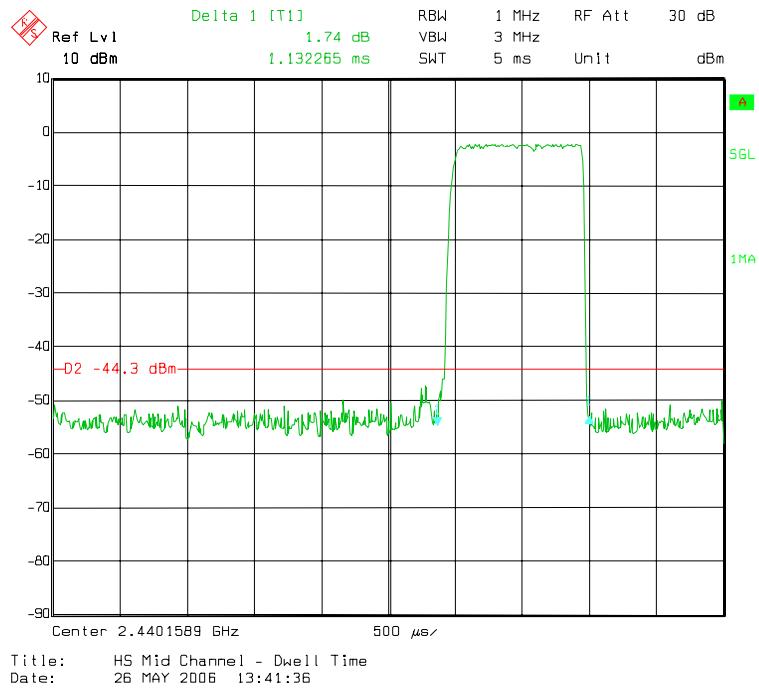
Please refer the following plots.

For Handset (EUT)

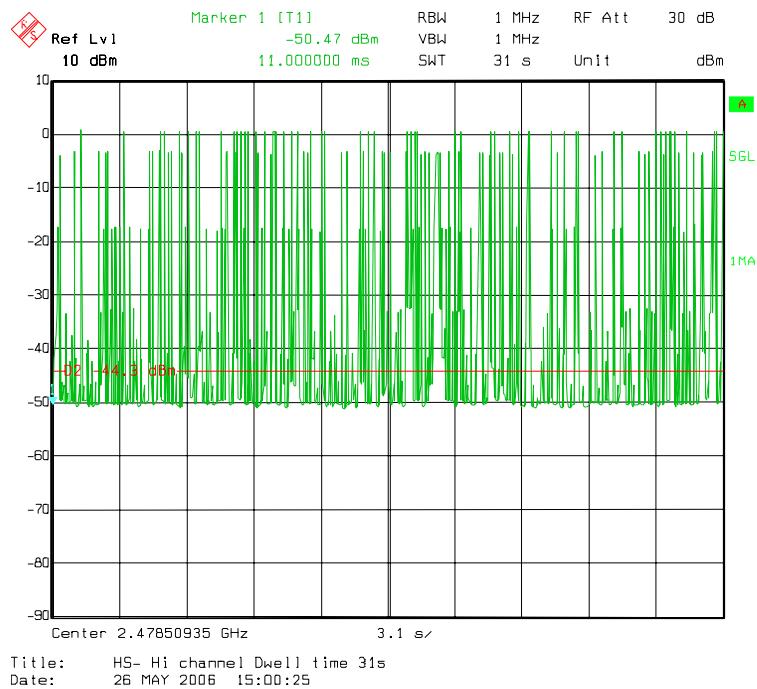
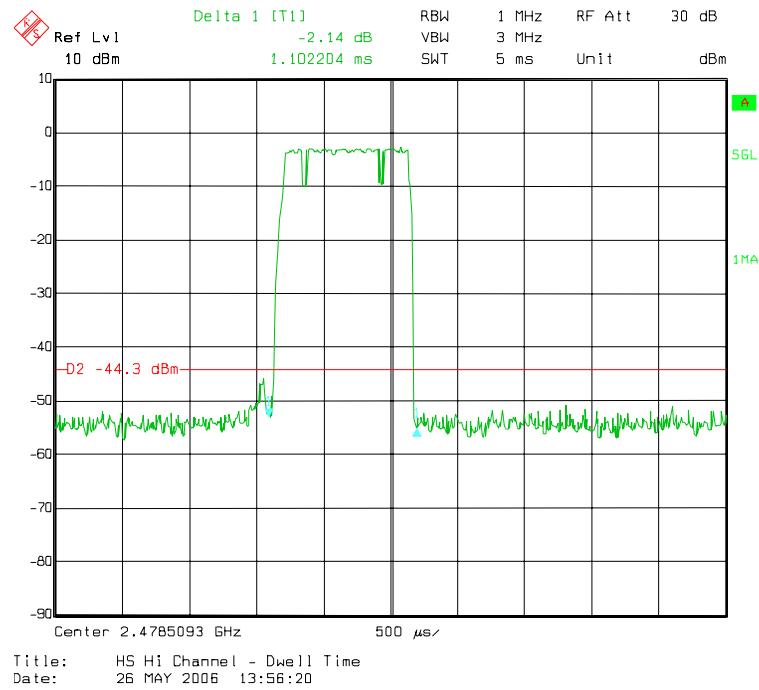
Low Channel:



Middle Channel:

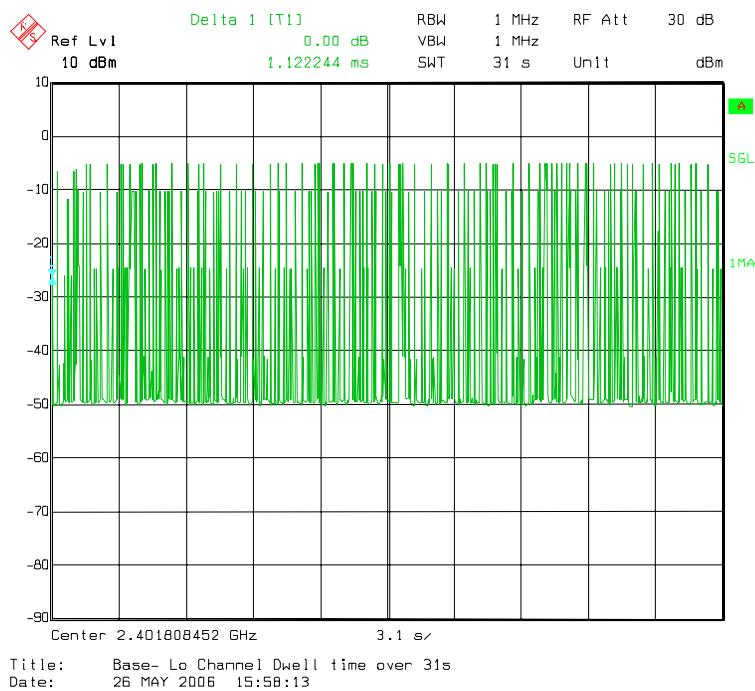
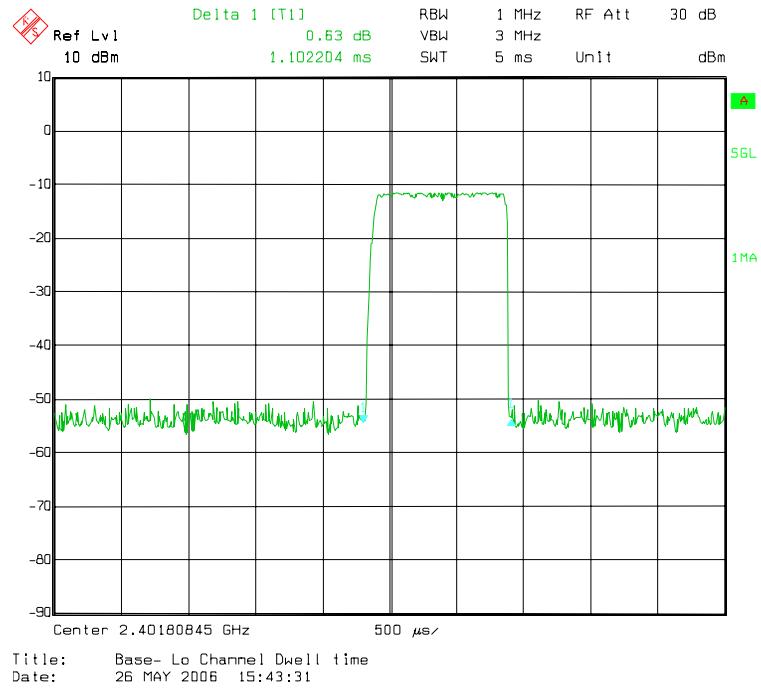


## High Channel:

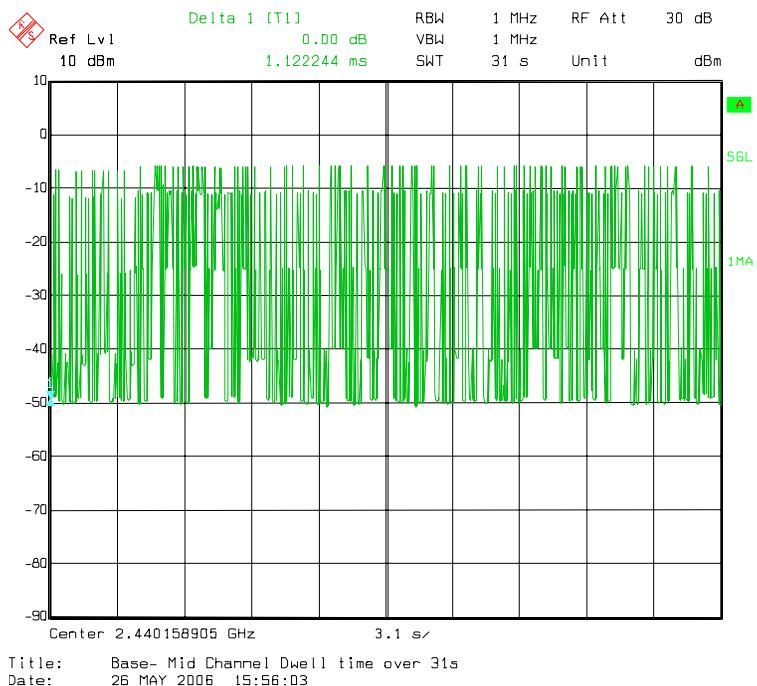
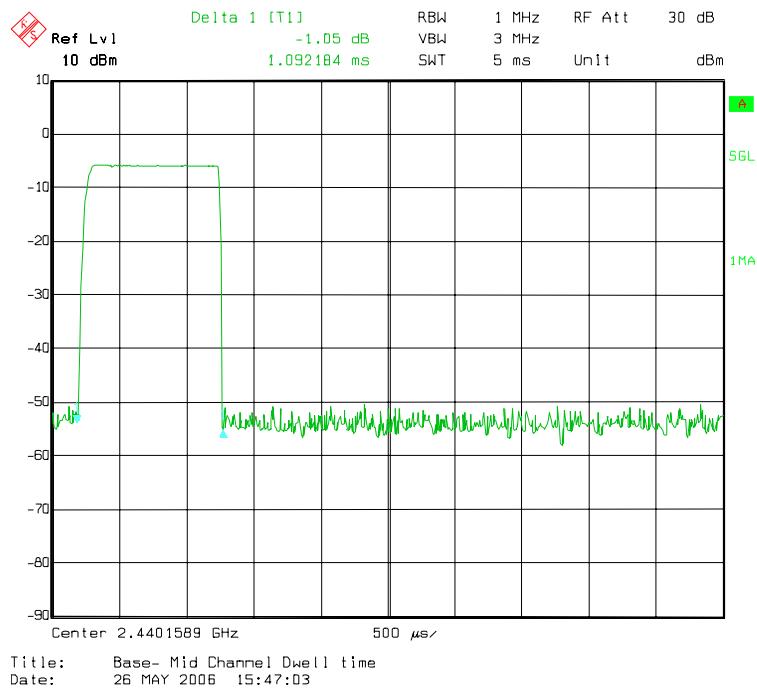


For Base (EUT)

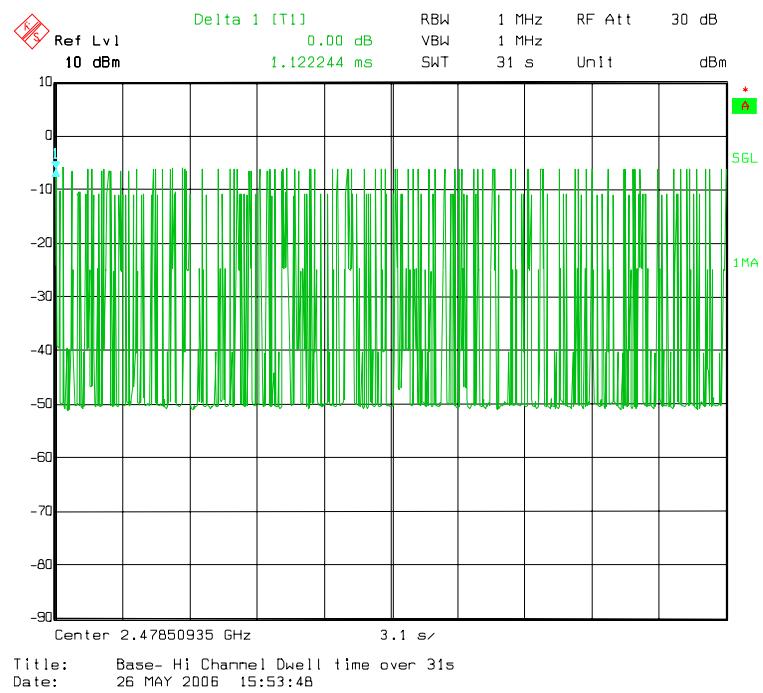
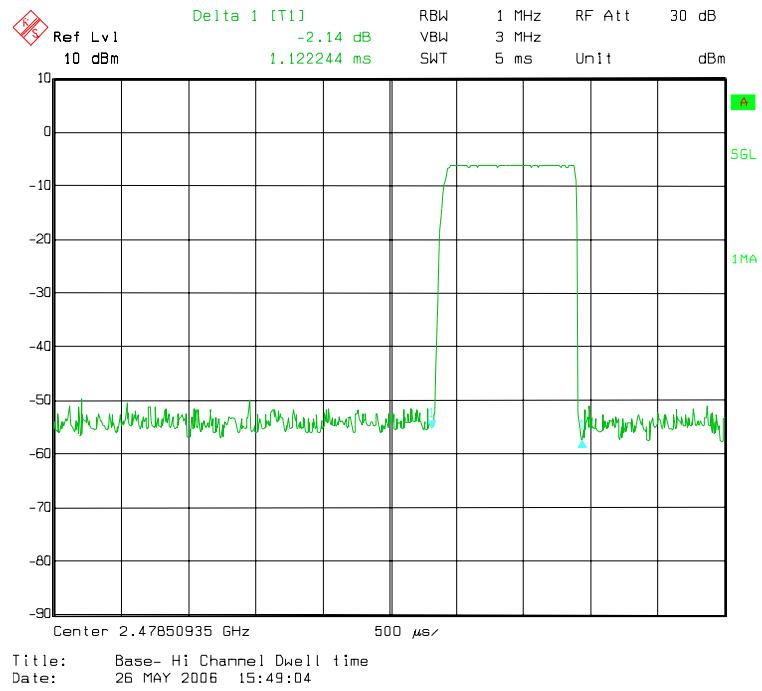
Low Channel



## Middle Channel



## High Channel



## **§15.247(b)(2) - MAXIMUM PEAK OUTPUT POWER**

### **Applicable Standard**

According to §15.247(b) (2), For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

### **Measurement Procedure**

1. Place the EUT on the turntable and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

\* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

*\*The testing was performed by Oscar Au on 2006-05-29.*

## Measurement Result

For Handset (EUT)

Channel	Frequency MHz	Max Peak Output Power (dBm) (mW)		Limit (mW)	Result
Low	2401.808	14.7	29.51	1000	pass
Mid	2440.159	13.99	25.06	1000	pass
High	2478.509	13.5	22.39	1000	pass

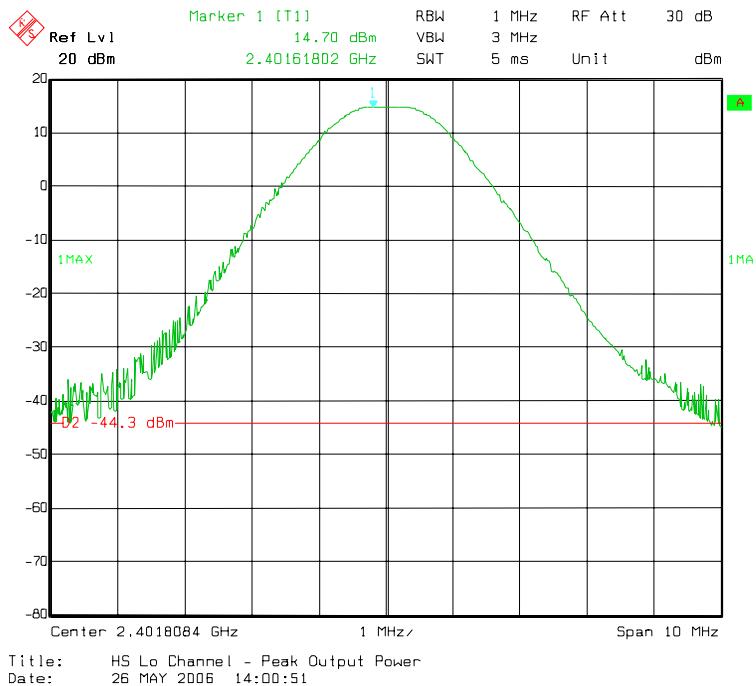
For Base (EUT)

Channel	Frequency MHz	Max Peak Output Power (dBm) (mW)		Limit (mW)	Result
Low	2401.808	15.76	37.67	1000	pass
Mid	2440.159	15.69	37.07	1000	pass
High	2478.509	15.2	33.11	1000	pass

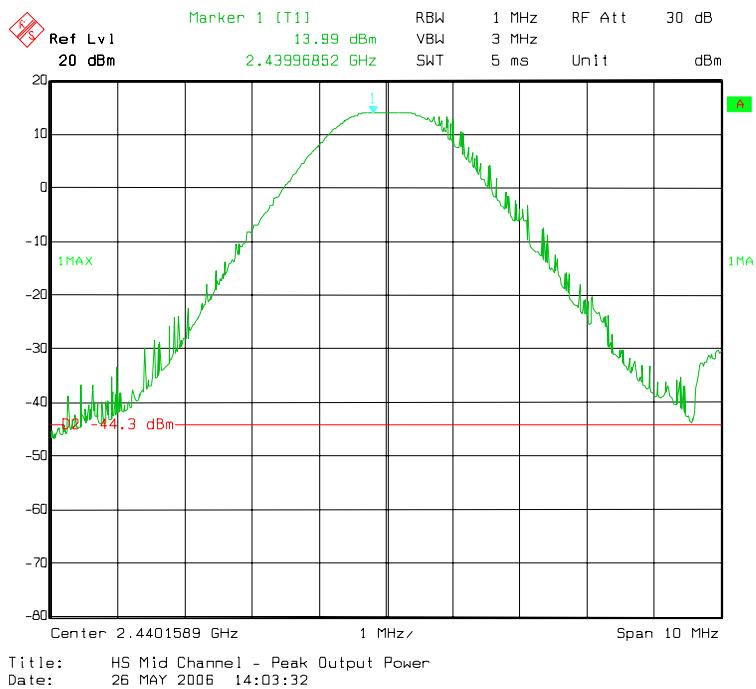
## Plots of Maximum Peak Output Power

Please see the following plots

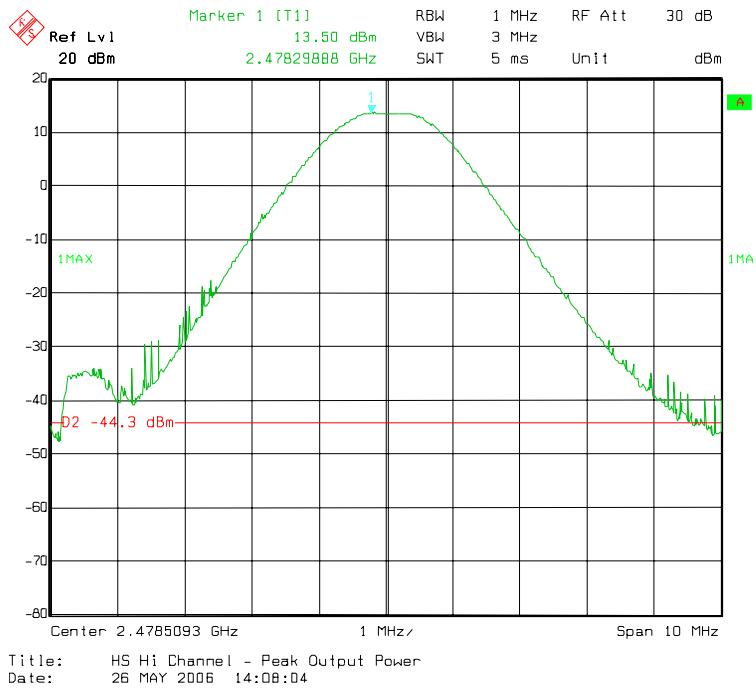
## Low Channel



## Middle Channel

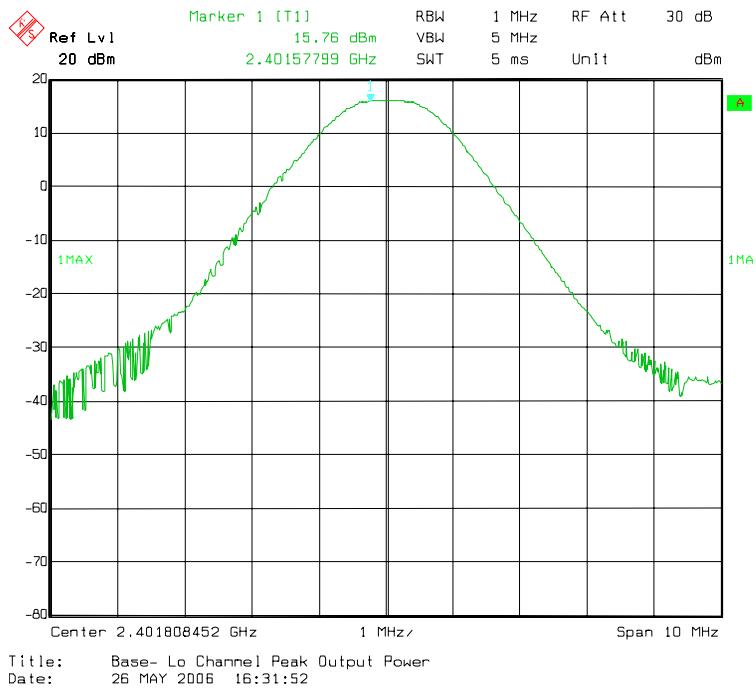


## High Channel

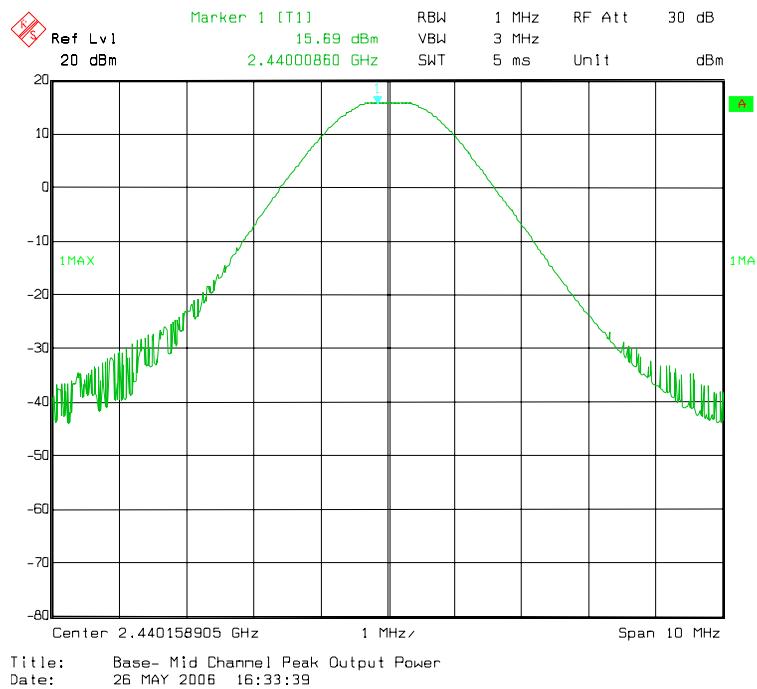


## For Base (EUT)

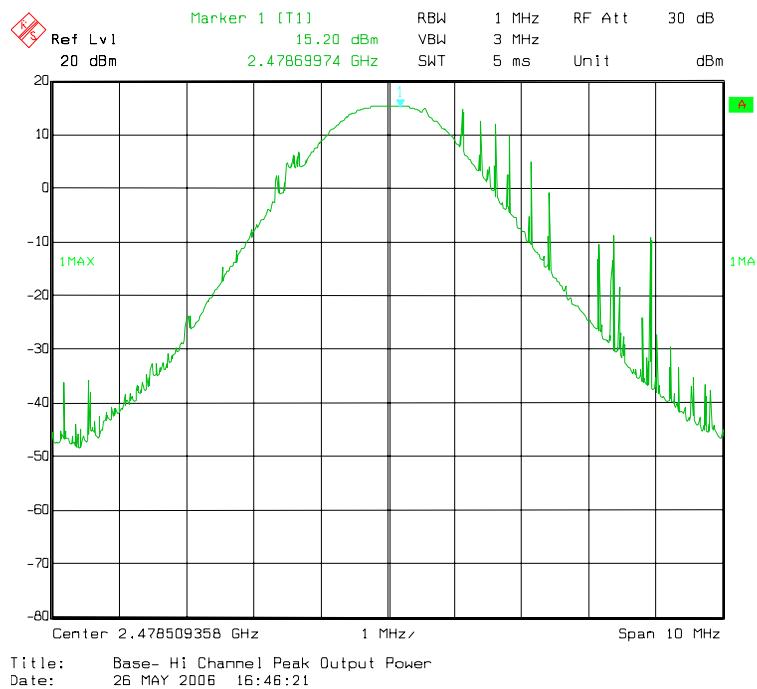
### Low Channel



## Middle Channel



## High Channel



## **§15.247 (c) - 100 KHz BANDWIDTH OF BAND EDGES**

### **Applicable Standard**

According to §15.247(c), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required.

### **Measurement Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### **Test Equipment**

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Rohde & Schwarz	Spectrum analyzer	FSEM	DE23840	2005-12-21

**\* Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

### **Environmental Conditions**

Temperature:	24° C
Relative Humidity:	45%
ATM Pressure:	1020 mbar

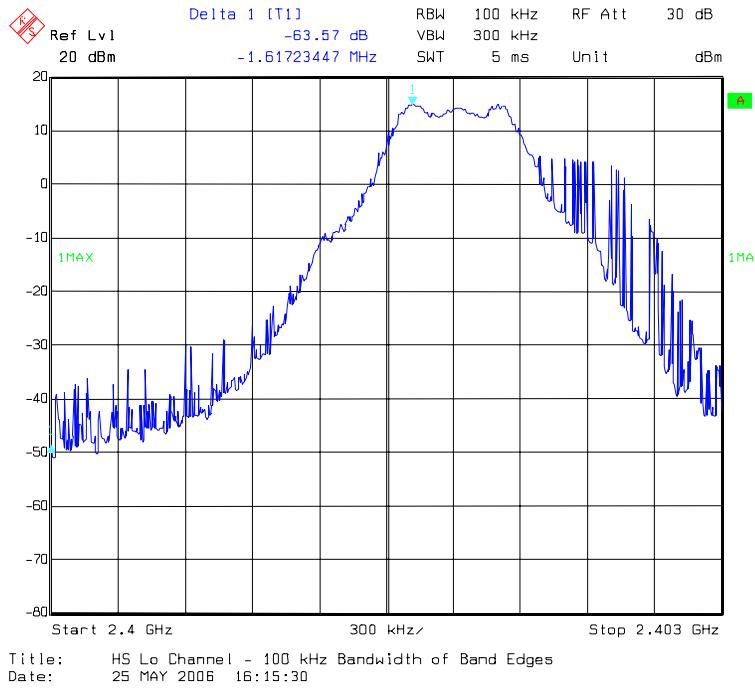
*\*The testing was performed by Oscar Au on 2006-05-29.*

### **Plots of 100kHz Bandwidth of Band Edge**

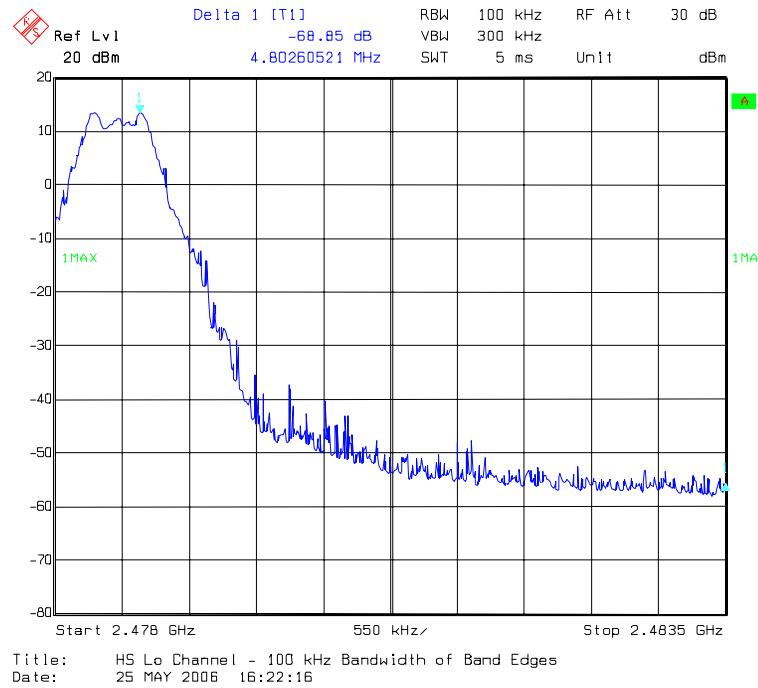
**Please refer the following plots.**

For Handset (UET)

### Low Channel

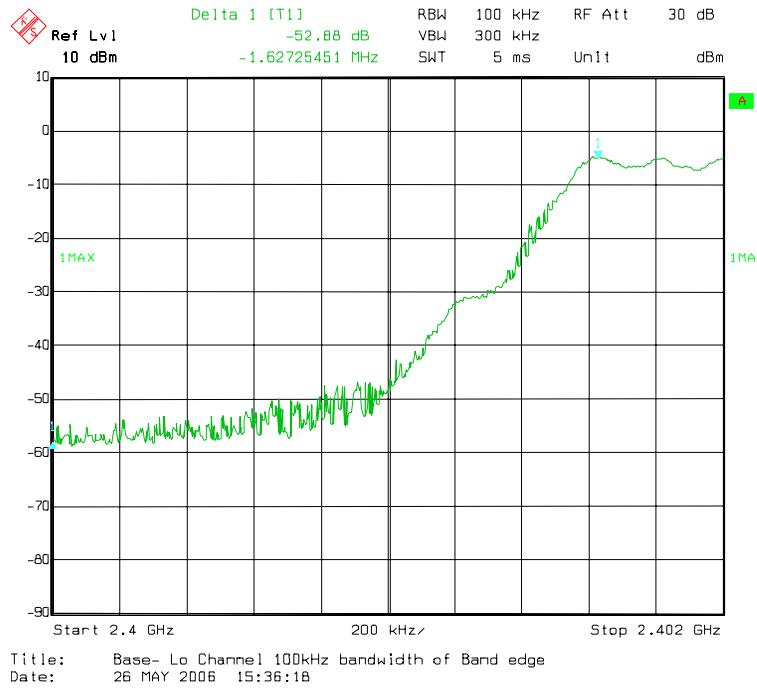


### High Channel



For Base (EUT)

Low Channel



High Channel

