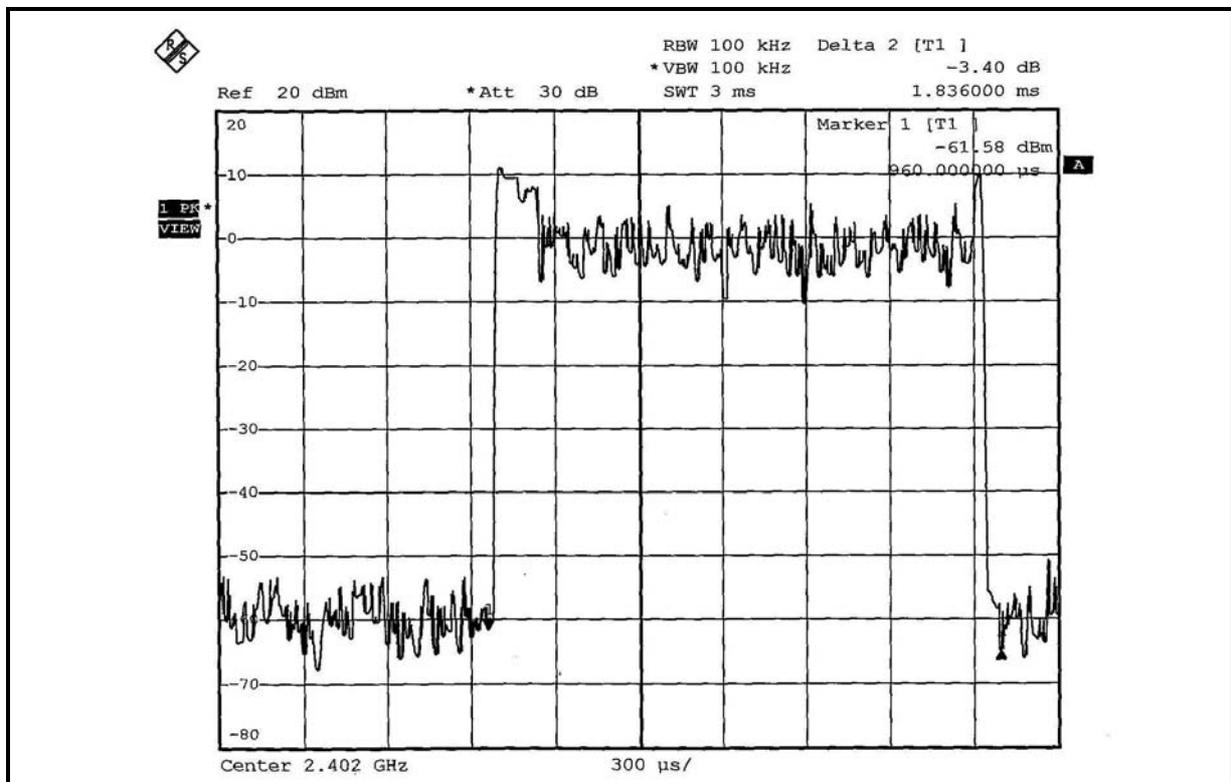
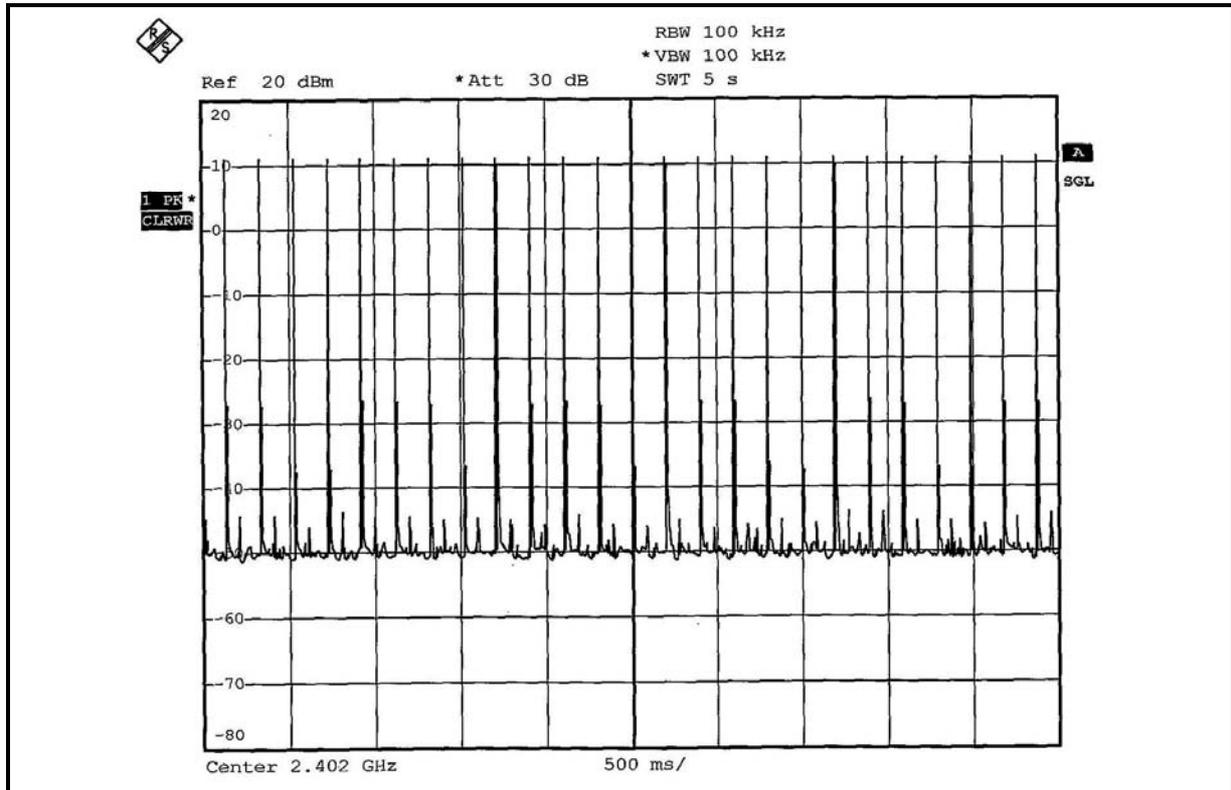
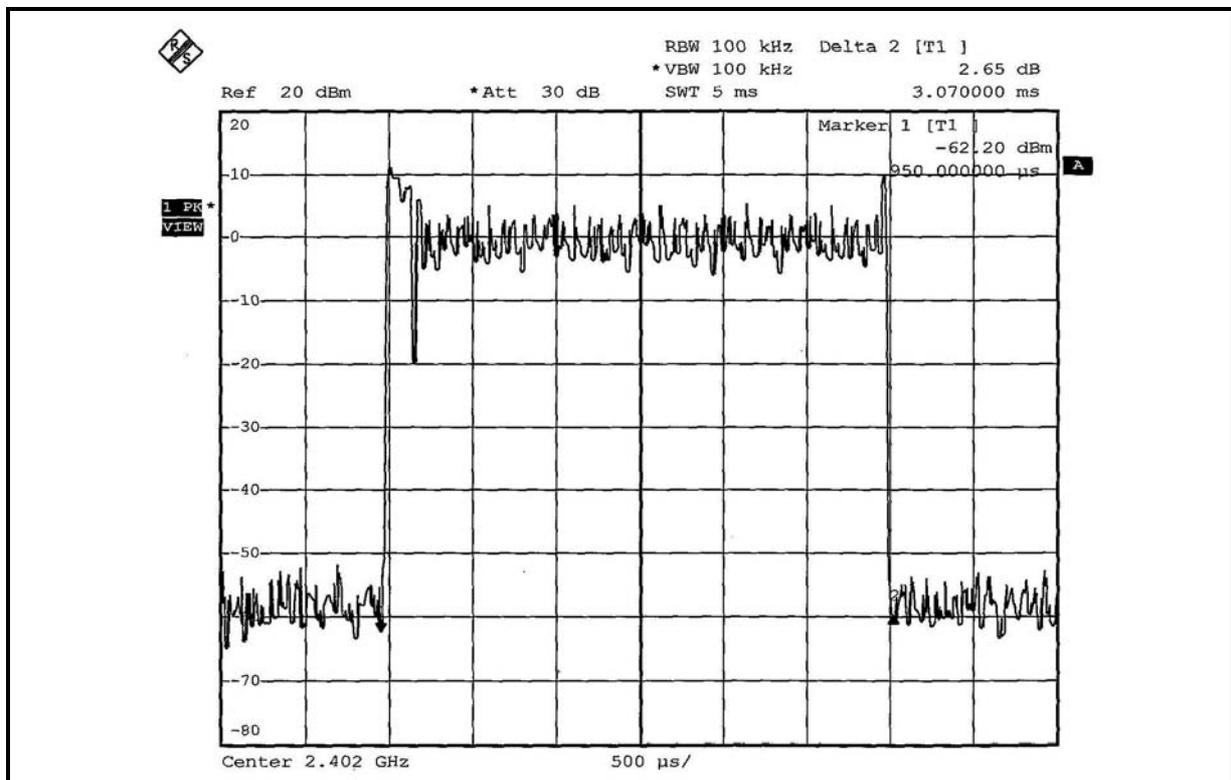
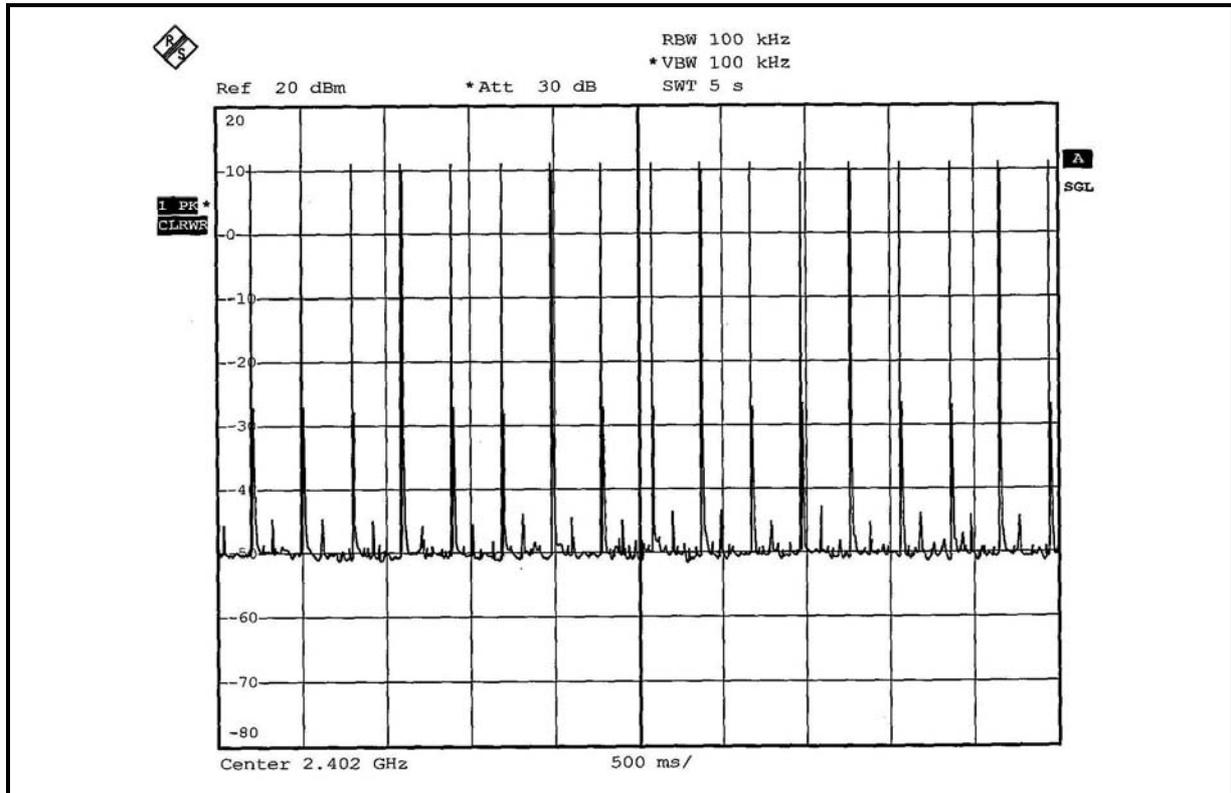


DH3



DH5





4.5 CHANNEL BANDWIDTH

4.5.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

4.5.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED UNTIL |
|----------------------------|-----------|------------|------------------|
| SPECTRUM ANALYZER | FSP40 | 100040 | Jun. 07, 2007 |

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

4.5.3 TEST PROCEDURE

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. Repeat above procedures until all frequencies measured were complete.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITION

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

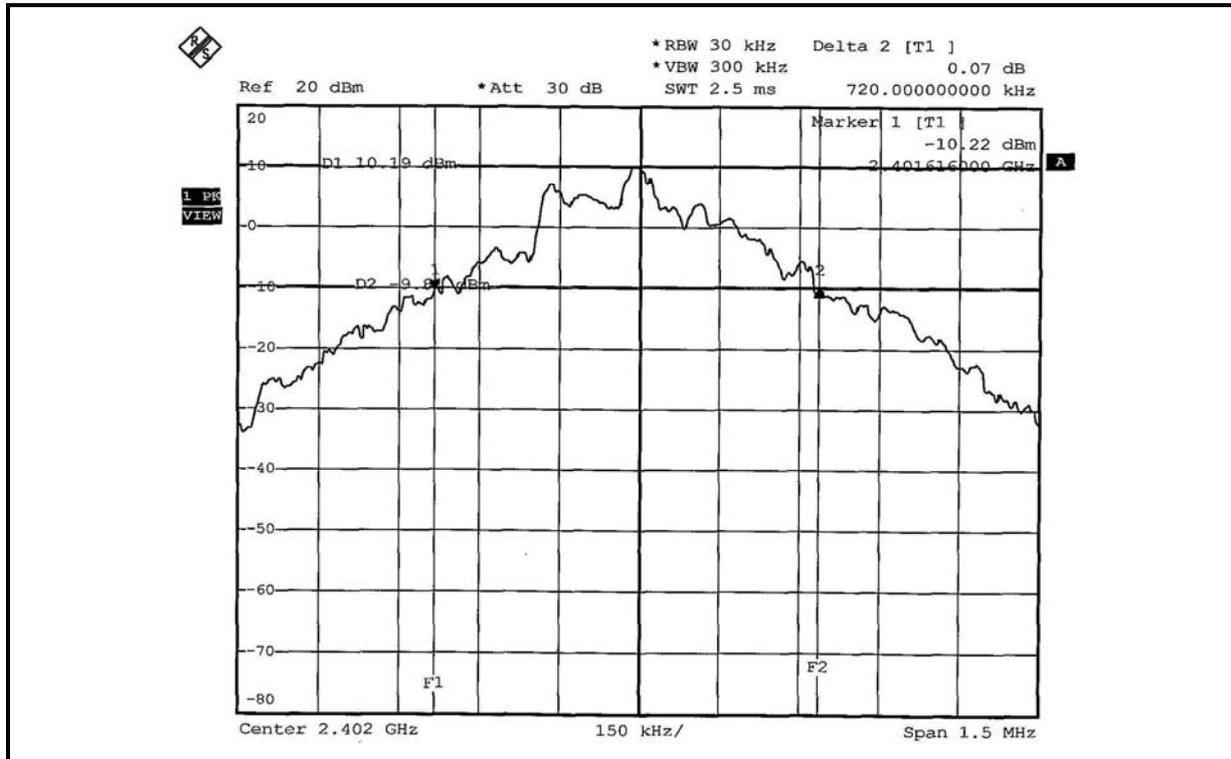
4.5.7 TEST RESULTS

FOR GFSK

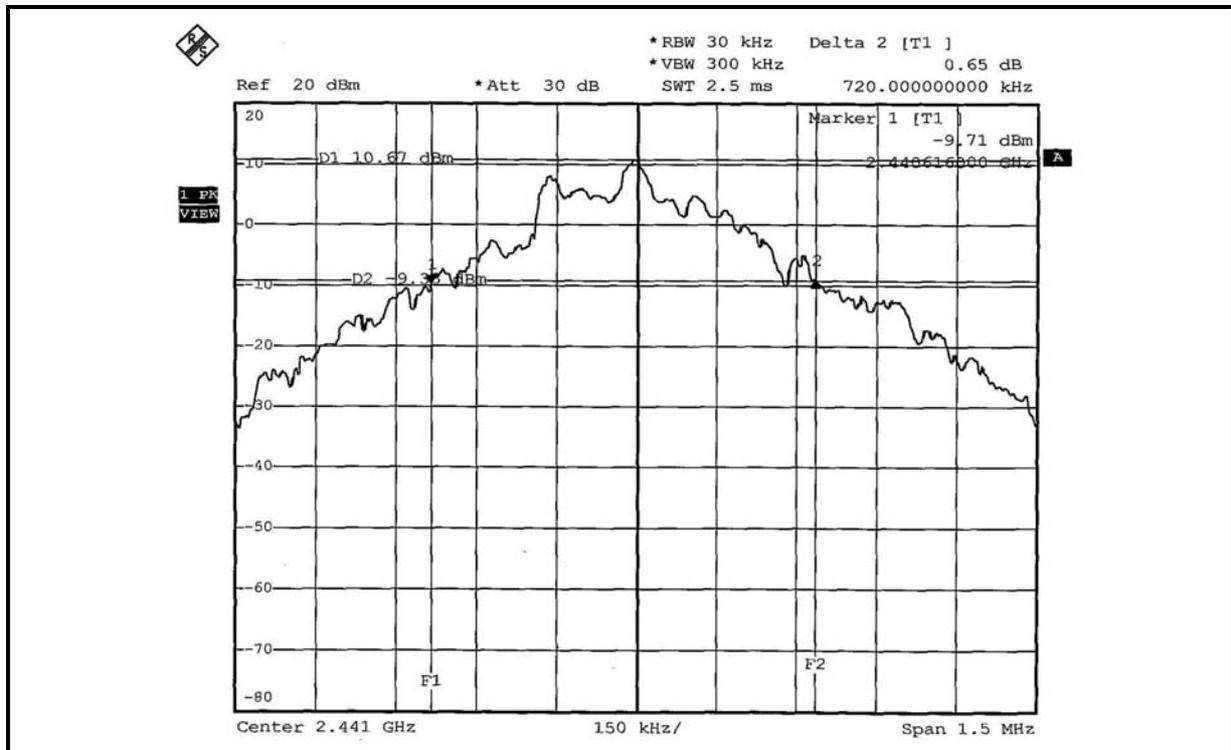
| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | GFSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

| CHANNEL | CHANNEL FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) |
|---------|-------------------------|----------------------|
| 0 | 2402 | 0.720 |
| 39 | 2441 | 0.720 |
| 78 | 2480 | 0.726 |

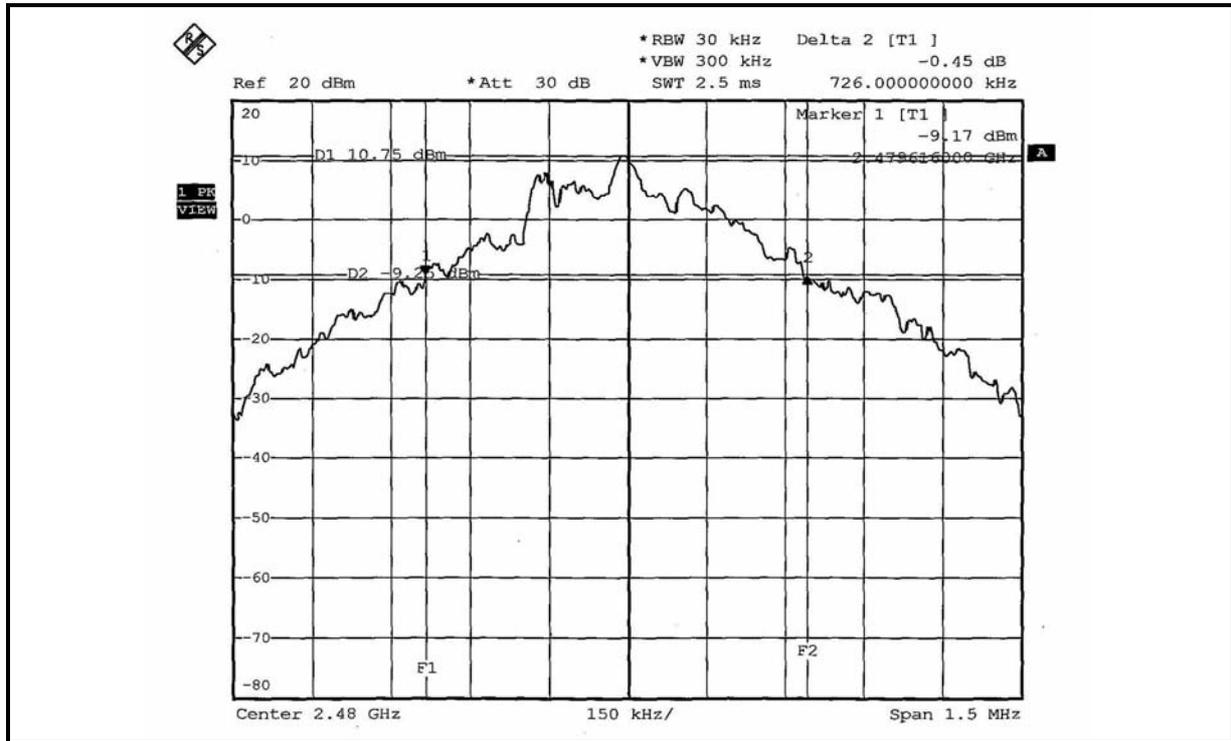
CH 0



CH 39



CH 78



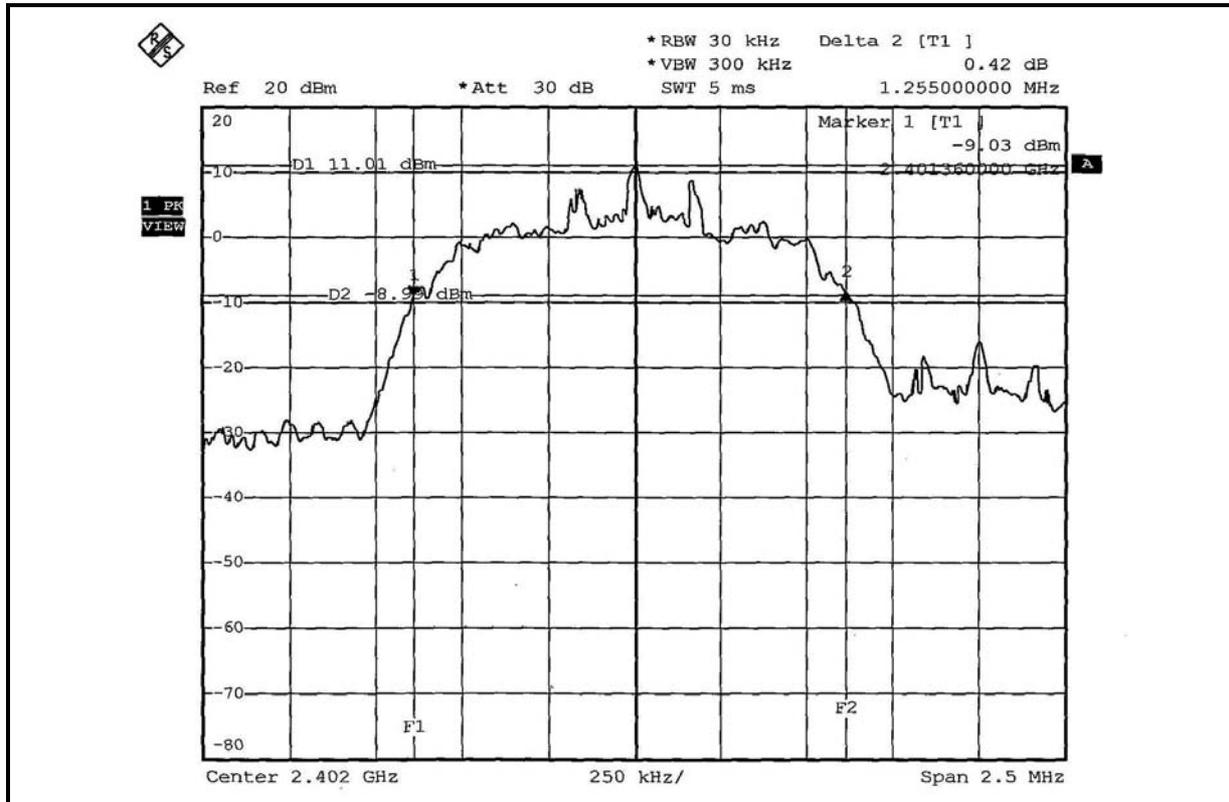


FOR 8DPSK

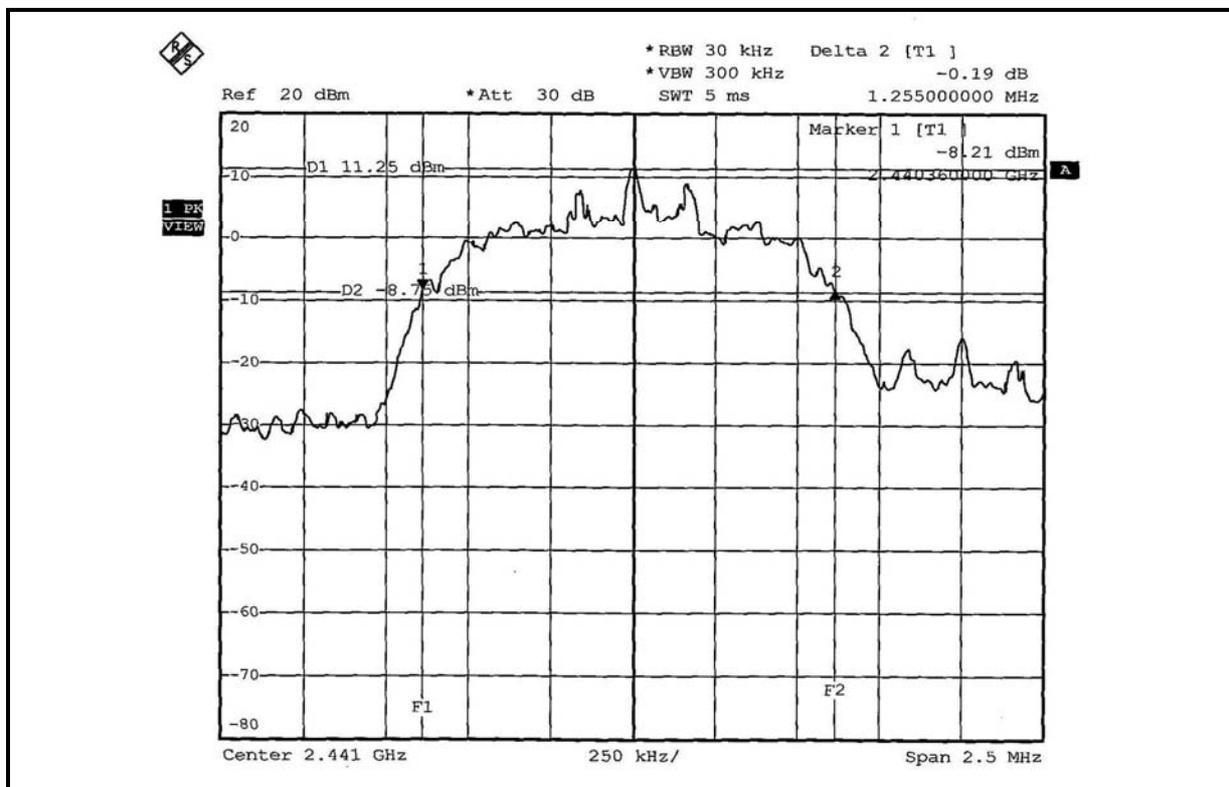
| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | 8DPSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

| CHANNEL | CHANNEL FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) |
|----------------|--------------------------------|-----------------------------|
| 0 | 2402 | 1.255 |
| 39 | 2441 | 1.255 |
| 78 | 2480 | 1.260 |

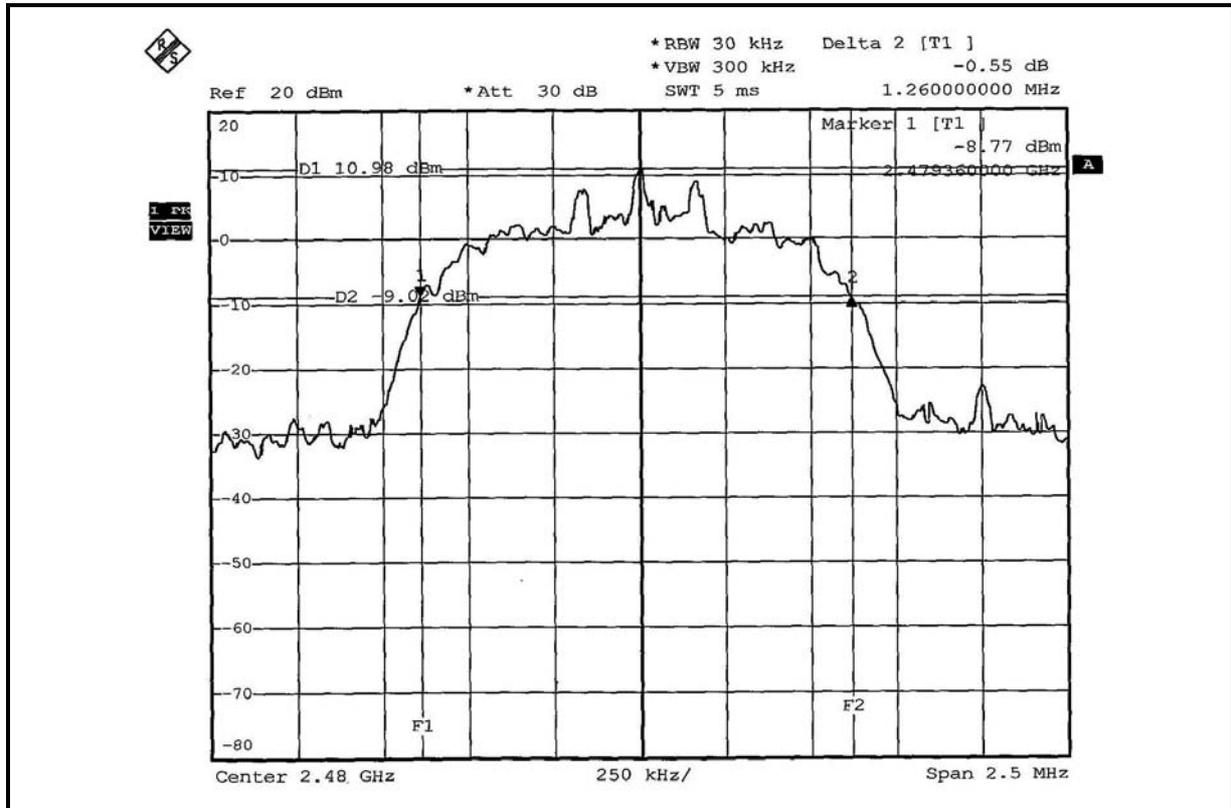
CH 0



CH 39



CH 78





4.6 HOPPING CHANNEL SEPARATION

4.6.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.6.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED UNTIL |
|----------------------------|-----------|------------|------------------|
| SPECTRUM ANALYZER | FSP40 | 100040 | Jun. 07, 2007 |

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

4.6.3 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.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation.

4.6.5 TEST SETUP



4.6.6 TEST RESULTS

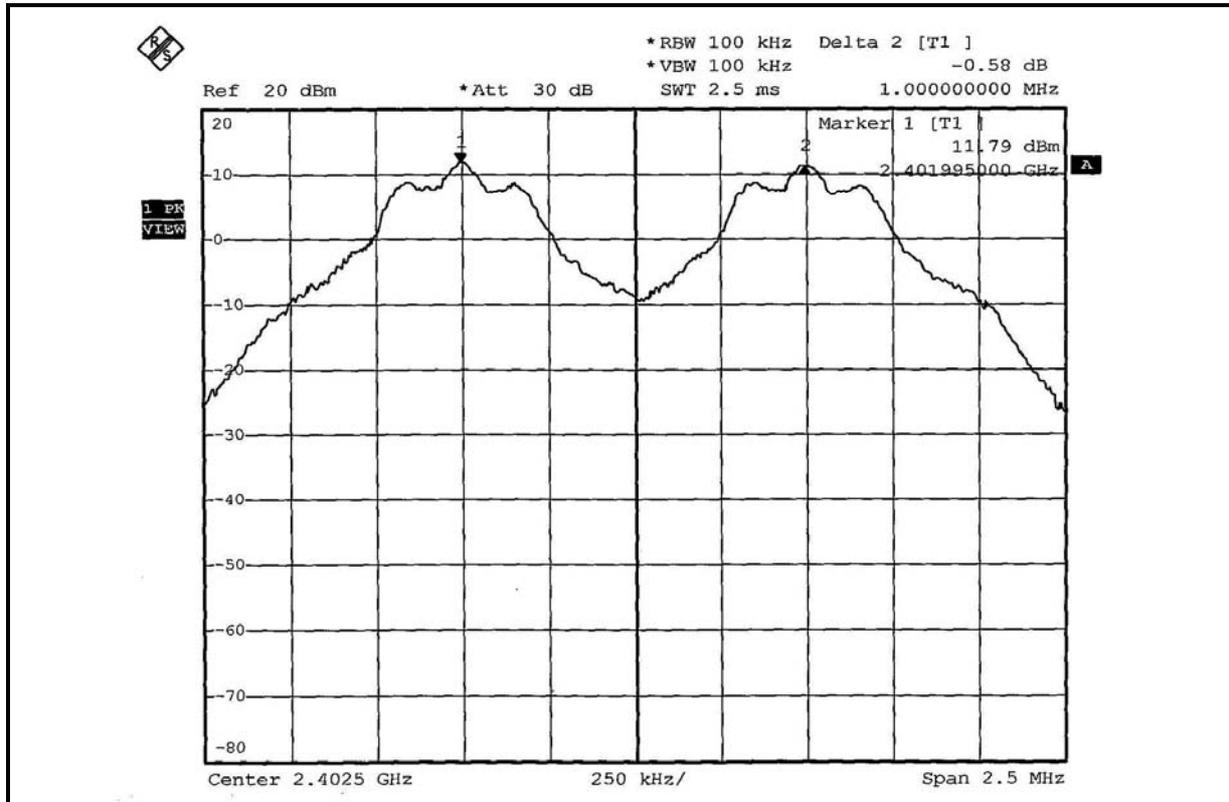
FOR GFSK

| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | GFSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

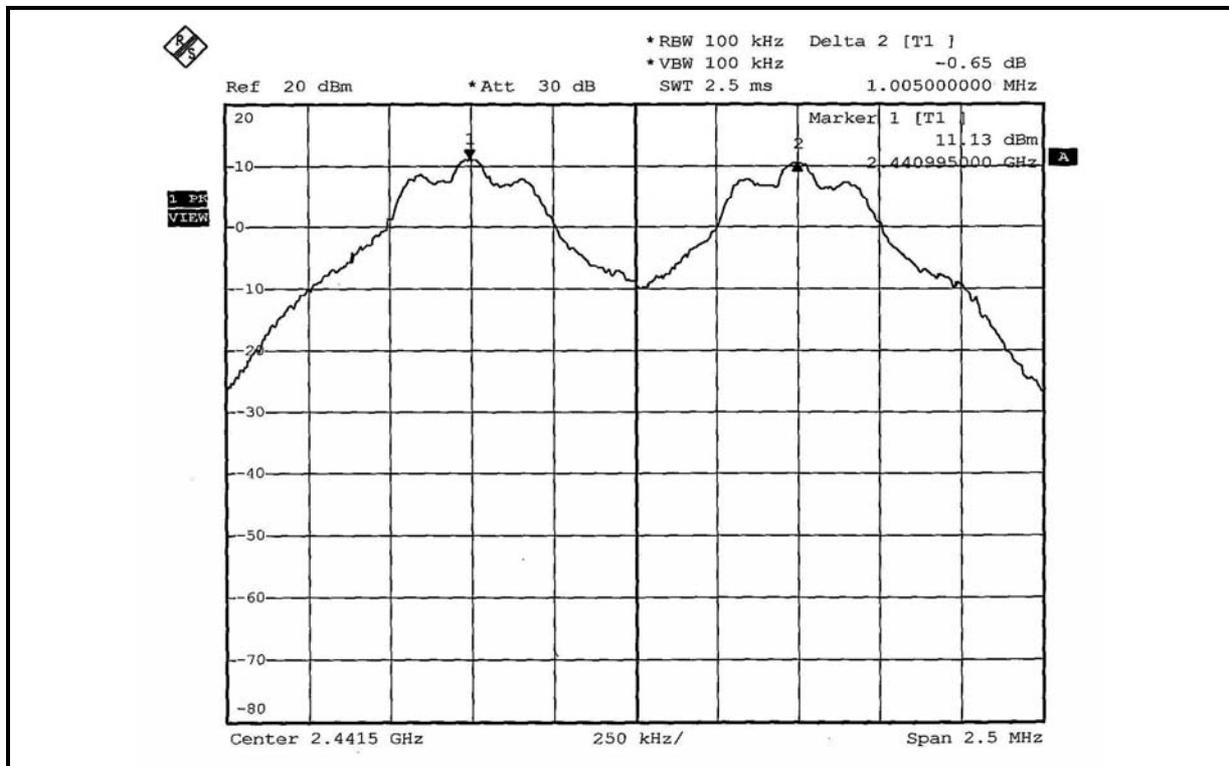
| CHANNEL | FREQUENCY (MHz) | ADJACENT CHANNEL SEPARATION (MHz) | 20dB BANDWIDTH (MHz) | MINIMUM LIMIT (MHz) | PASS / FAIL |
|---------|-----------------|-----------------------------------|----------------------|---------------------|-------------|
| 0 | 2402 | 1.000 | 0.720 | 0.480 | PASS |
| 39 | 2441 | 1.005 | 0.720 | 0.480 | PASS |
| 78 | 2480 | 1.000 | 0.726 | 0.484 | PASS |

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

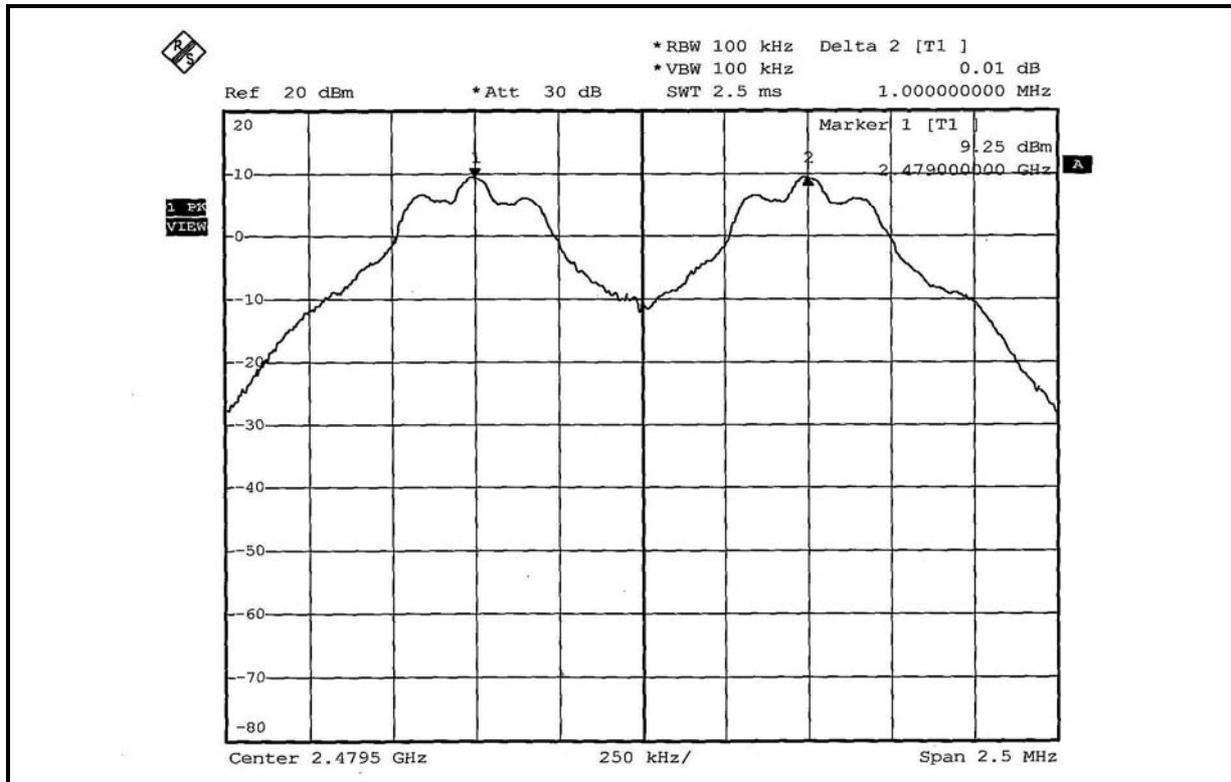
CH 0



CH 39



CH 78





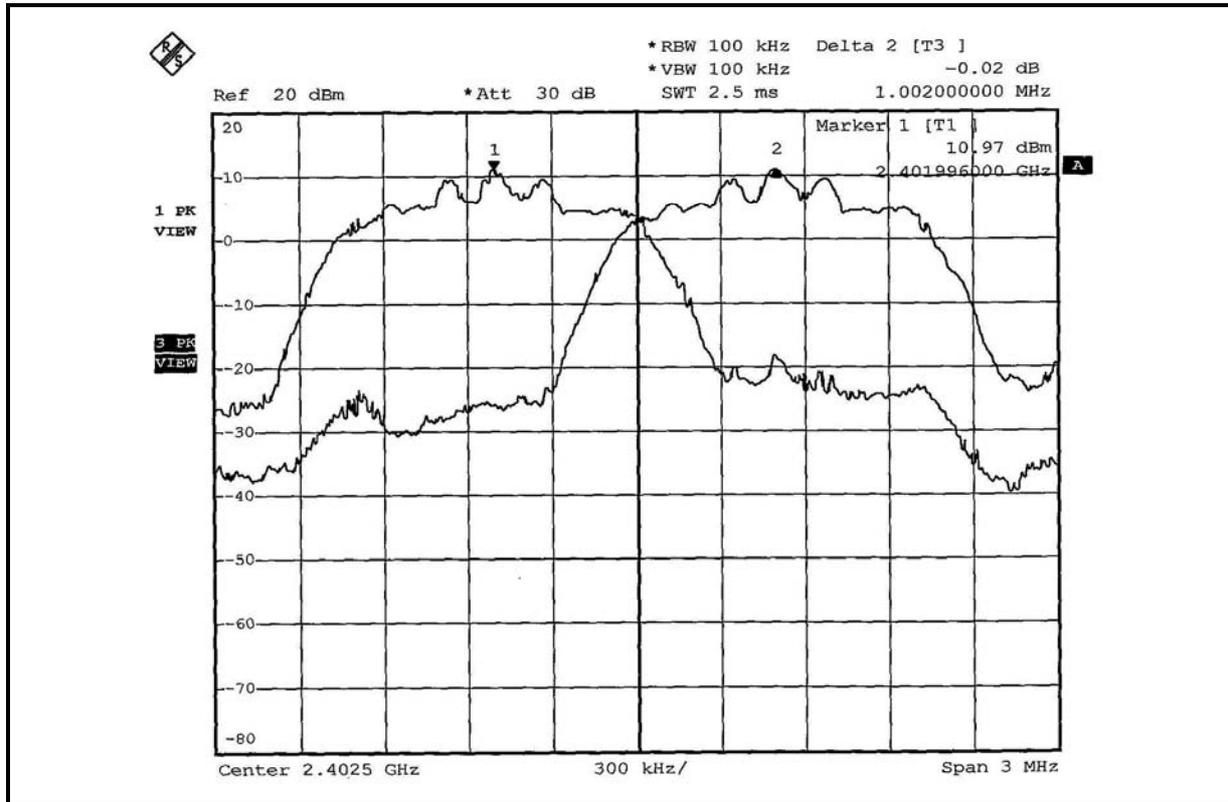
FOR 8DPSK

| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | 8DPSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

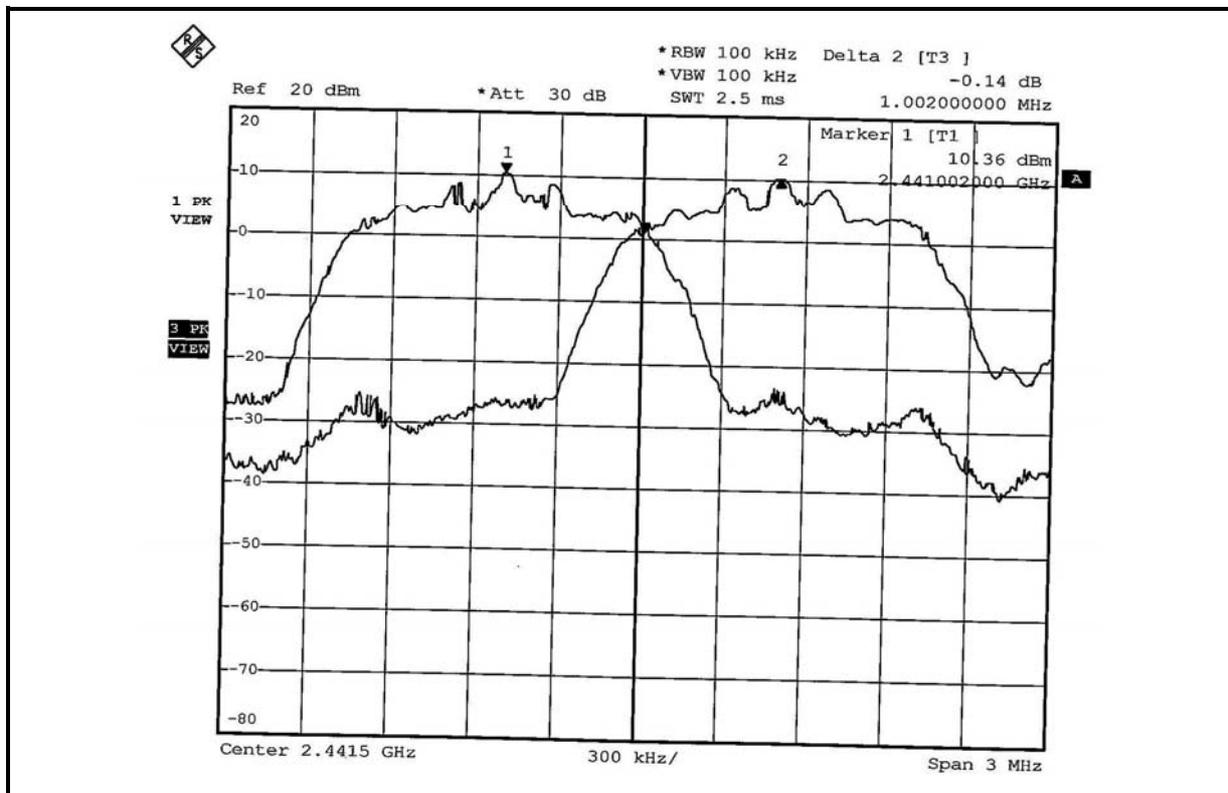
| CHANNEL | FREQUENCY (MHz) | ADJACENT CHANNEL SEPARATION (MHz) | 20dB BANDWIDTH (MHz) | MINIMUM LIMIT (MHz) | PASS / FAIL |
|----------------|------------------------|--|-----------------------------|----------------------------|--------------------|
| 0 | 2402 | 1.002 | 1.255 | 0.837 | PASS |
| 39 | 2441 | 1.002 | 1.255 | 0.837 | PASS |
| 78 | 2480 | 1.002 | 1.260 | 0.840 | PASS |

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

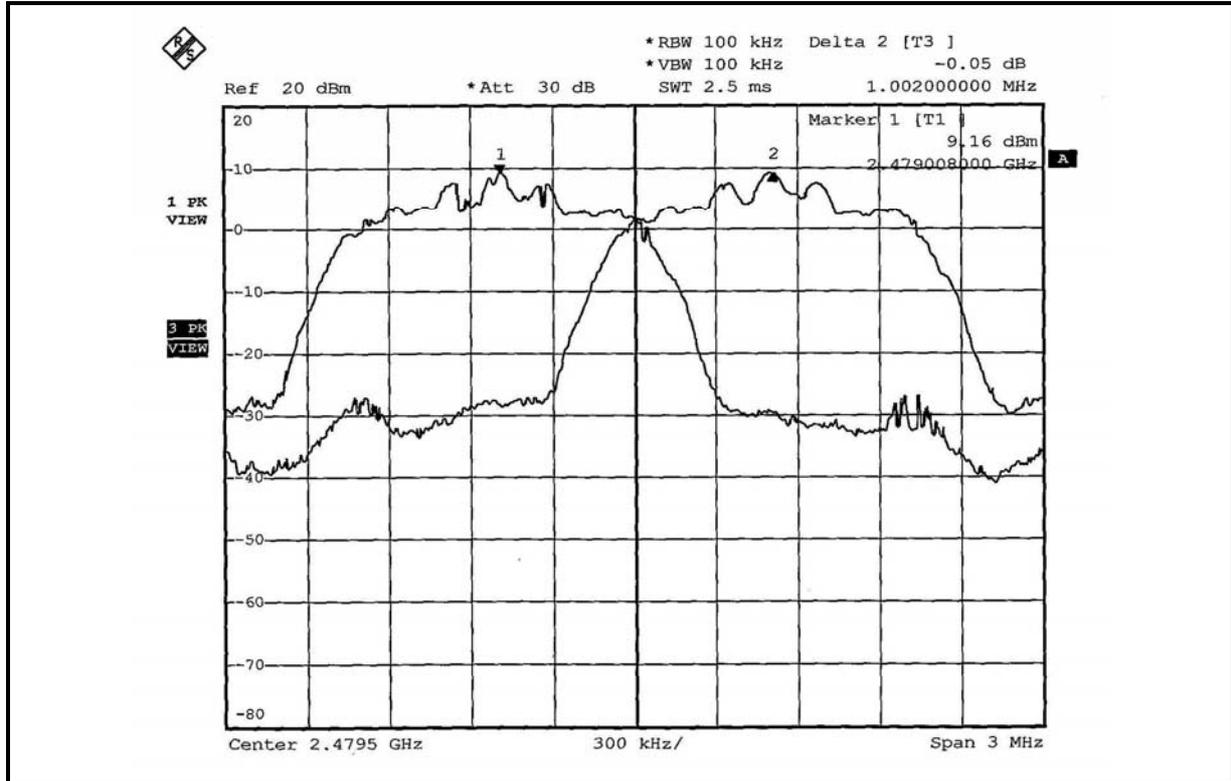
CH 0



CH 39



CH 78





4.7 MAXIMUM PEAK OUTPUT POWER

4.7.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 125mW.

4.7.2 TEST INSTRUMENTS

| DESCRIPTION & MANUFACTURER | MODEL NO. | SERIAL NO. | CALIBRATED UNTIL |
|----------------------------|-----------|------------|------------------|
| SPECTRUM ANALYZER | FSP40 | 100040 | Jun. 07, 2007 |

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

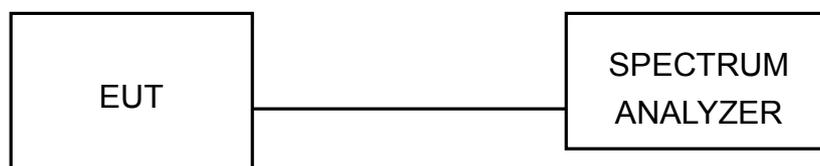
4.7.3 TEST PROCEDURES

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation

4.7.5 TEST SETUP



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

4.7.6 EUT OPERATING CONDITION

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

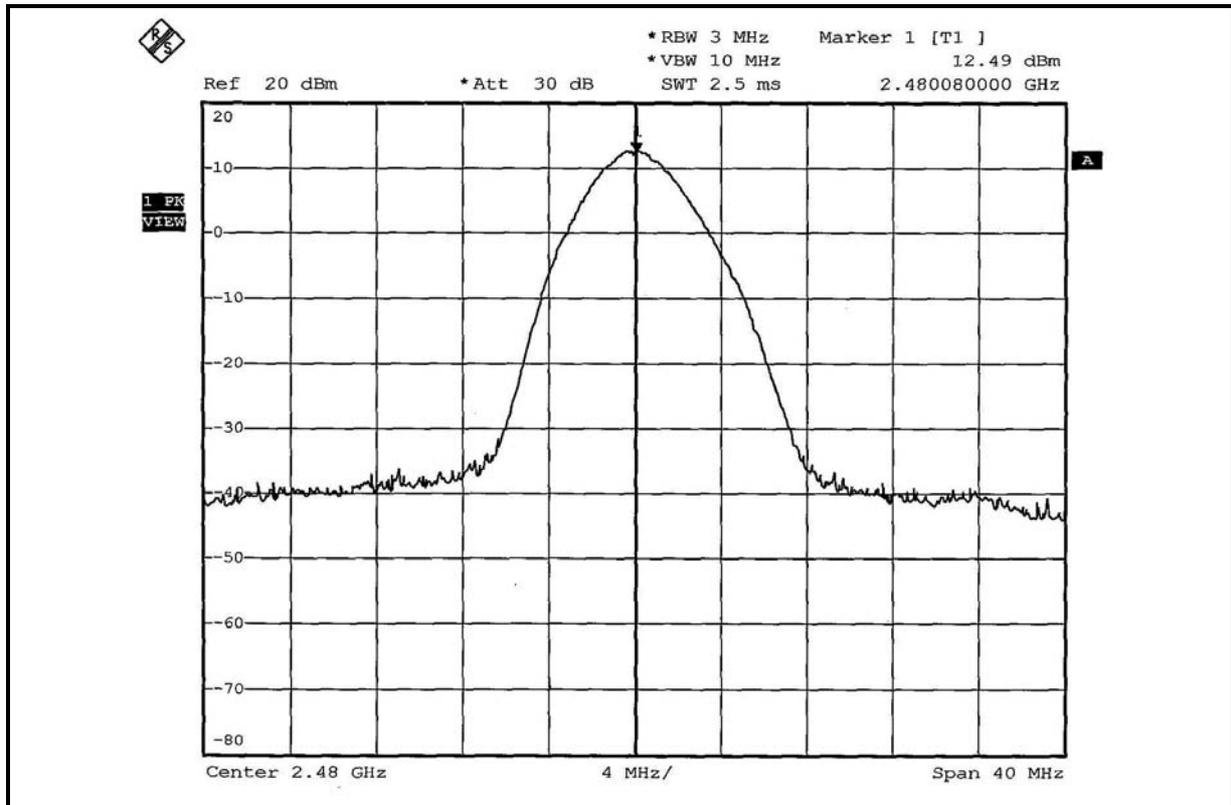
4.7.7 TEST RESULTS

FOR GFSK

| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | GFSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

| CHANNEL | CHANNEL FREQUENCY (MHz) | PEAK POWER OUTPUT (mW) | PEAK POWER OUTPUT (dBm) | PEAK POWER LIMIT (mW) | PASS/FAIL |
|---------|-------------------------|------------------------|-------------------------|-----------------------|-----------|
| 0 | 2402 | 17.498 | 12.43 | 125 | PASS |
| 39 | 2441 | 17.620 | 12.46 | 125 | PASS |
| 78 | 2480 | 17.742 | 12.49 | 125 | PASS |

CH 78



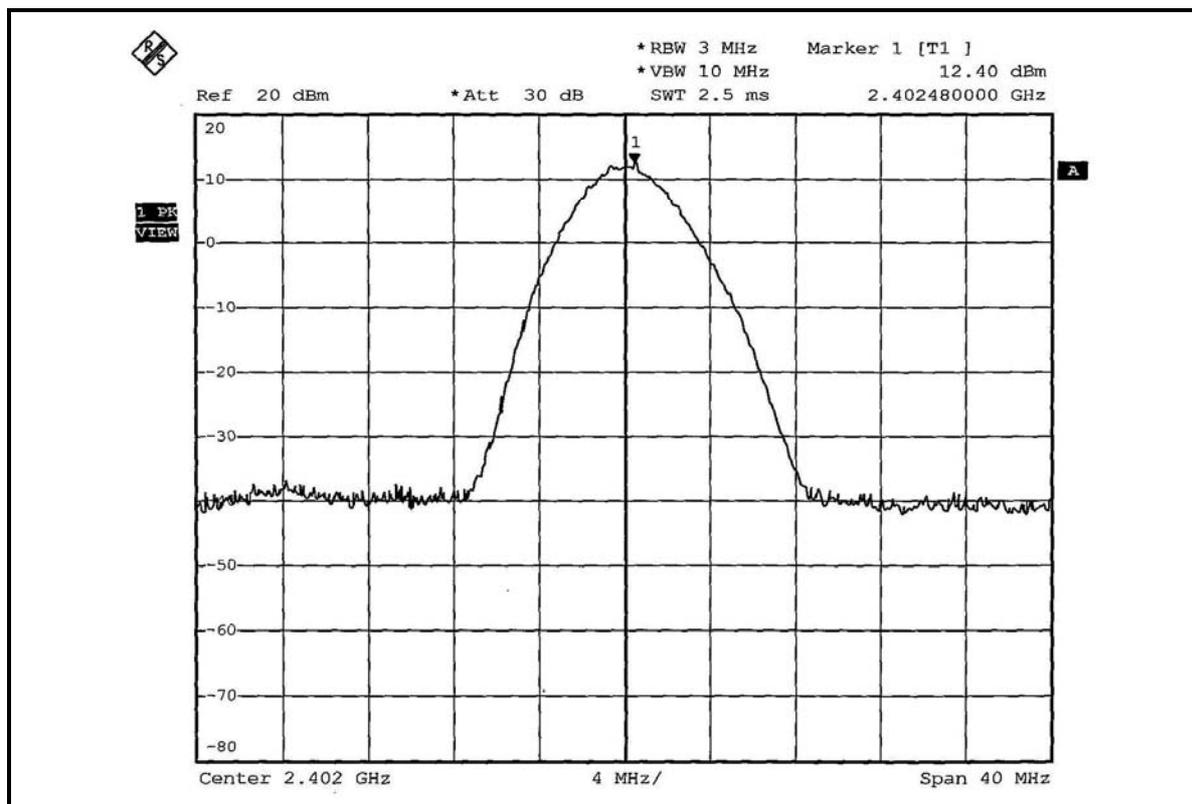


FOR 8DPSK

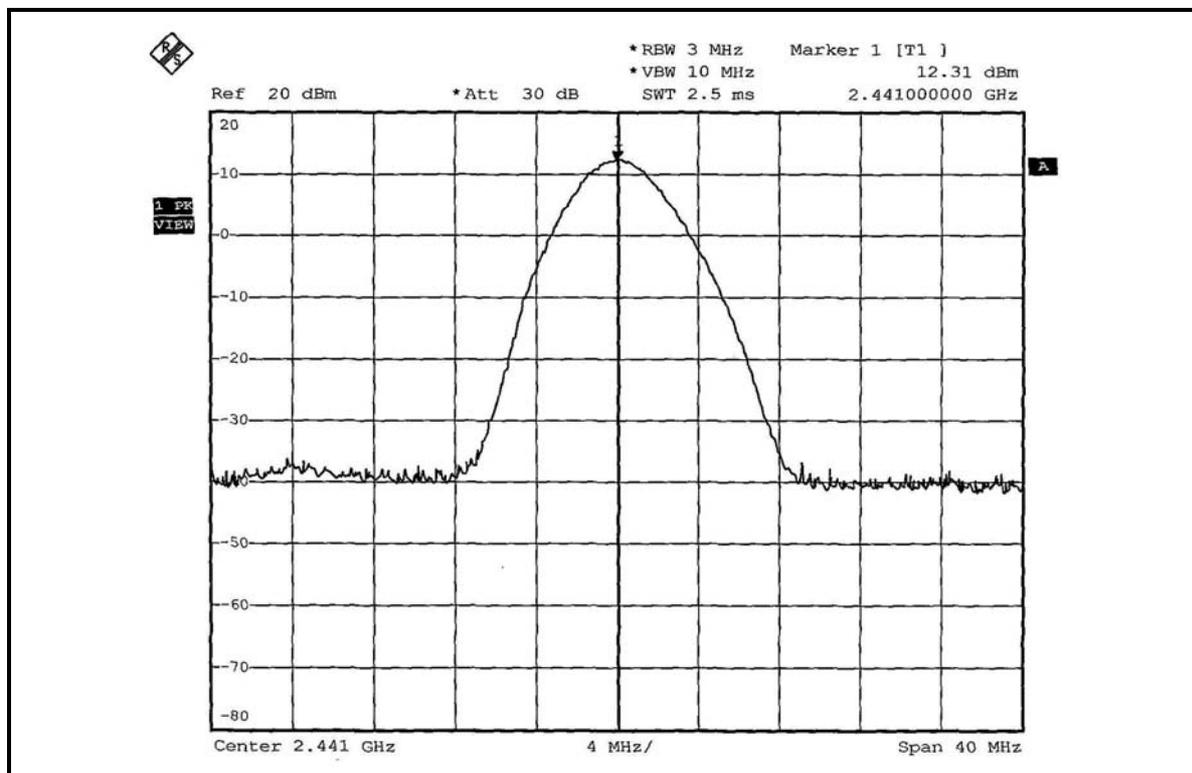
| | | | |
|-----------------------------|---------------|---------------------------------|--------------------------|
| MODULATION TYPE | 8DPSK | ENVIRONMENTAL CONDITIONS | 25 deg. C, 65%RH, 991hPa |
| INPUT POWER (SYSTEM) | 120Vac, 60 Hz | TESTED BY | Long Chen |

| CHANNEL | CHANNEL FREQUENCY (MHz) | PEAK POWER OUTPUT (mW) | PEAK POWER OUTPUT (dBm) | PEAK POWER LIMIT (mW) | PASS/FAIL |
|----------------|--------------------------------|-------------------------------|--------------------------------|------------------------------|------------------|
| 0 | 2402 | 17.378 | 12.40 | 125 | PASS |
| 39 | 2441 | 17.022 | 12.31 | 125 | PASS |
| 78 | 2480 | 16.672 | 12.22 | 125 | PASS |

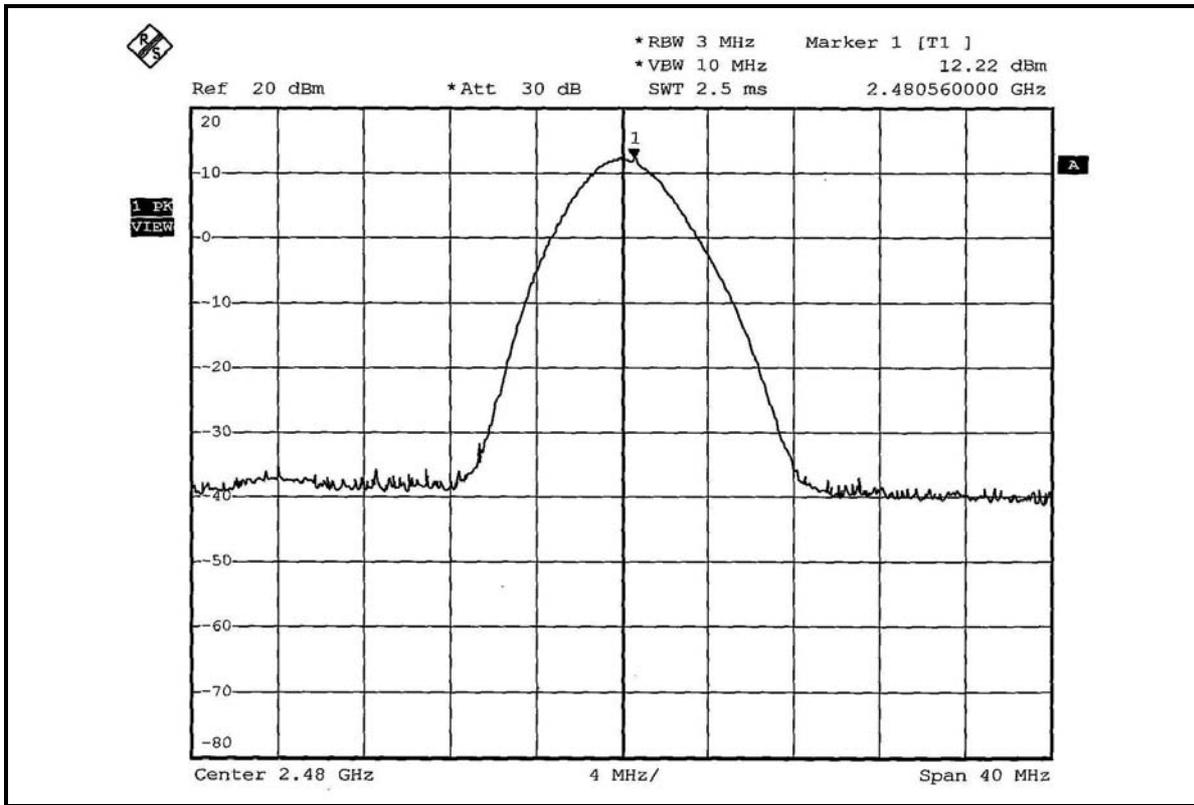
CH 0



CH 39



CH 78





4.8 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 | FSP40 | 100040 | Jun. 07, 2007 |

NOTES: 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, middle and highest channel frequencies individually.

4.8.6 TEST RESULTS

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

FOR GFSK

NOTE 1:

The band edge emission plot on the next page shows 58.87dBc between carrier maximum power and local maximum emission in restrict band (2.30608GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.2.7 is 105.47dBuV/m (Peak), so the maximum field strength in restrict band is $105.47 - 58.87 = 46.60$ dBuV/m, which is under 74 dBuV/m limit.

Average value = $46.60 - 30.00 = 16.60$ dBuV/m, which is under 54dBuV/m limit.

*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle be equal to: $20\log(3.125/100) = -30$ dB.

Average value = peak reading -30.00 .

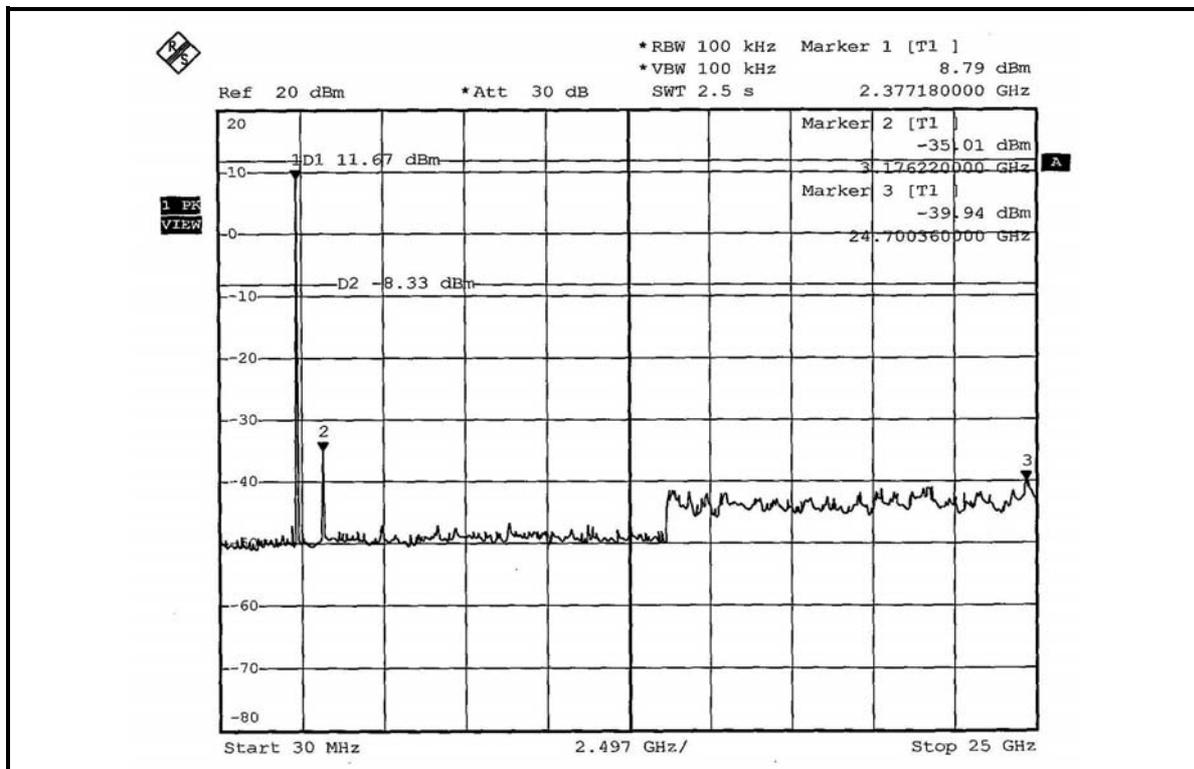
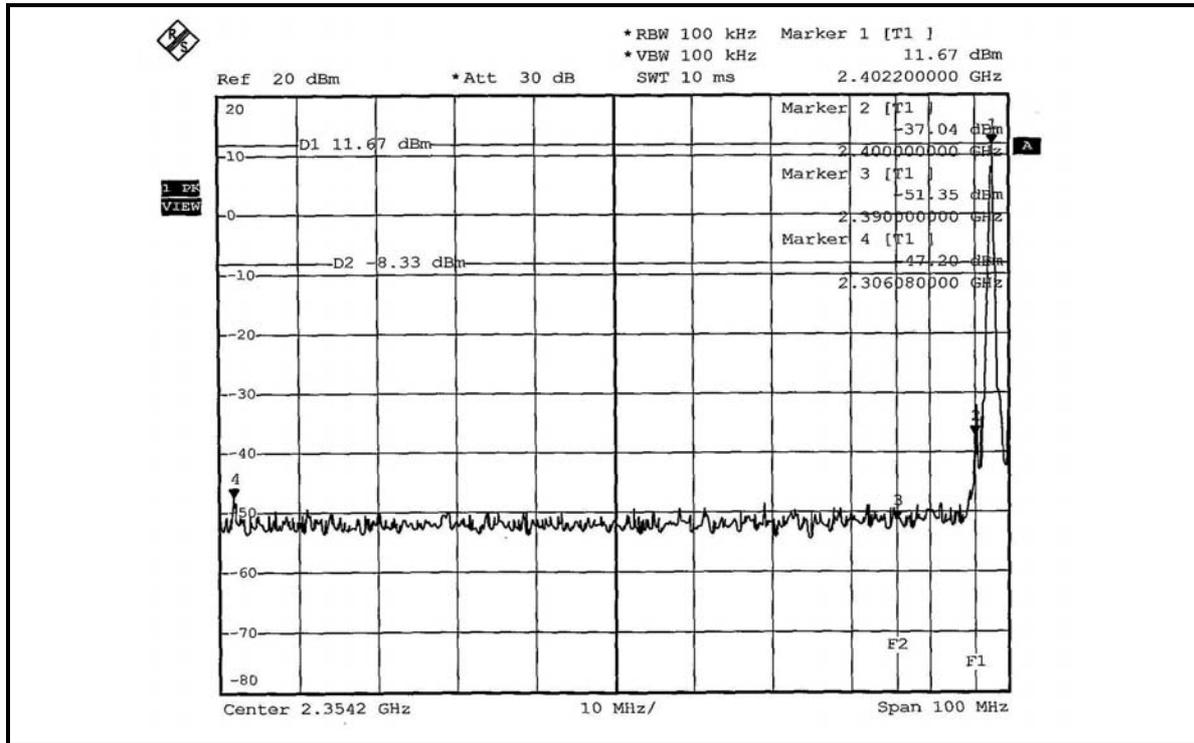
NOTE 2:

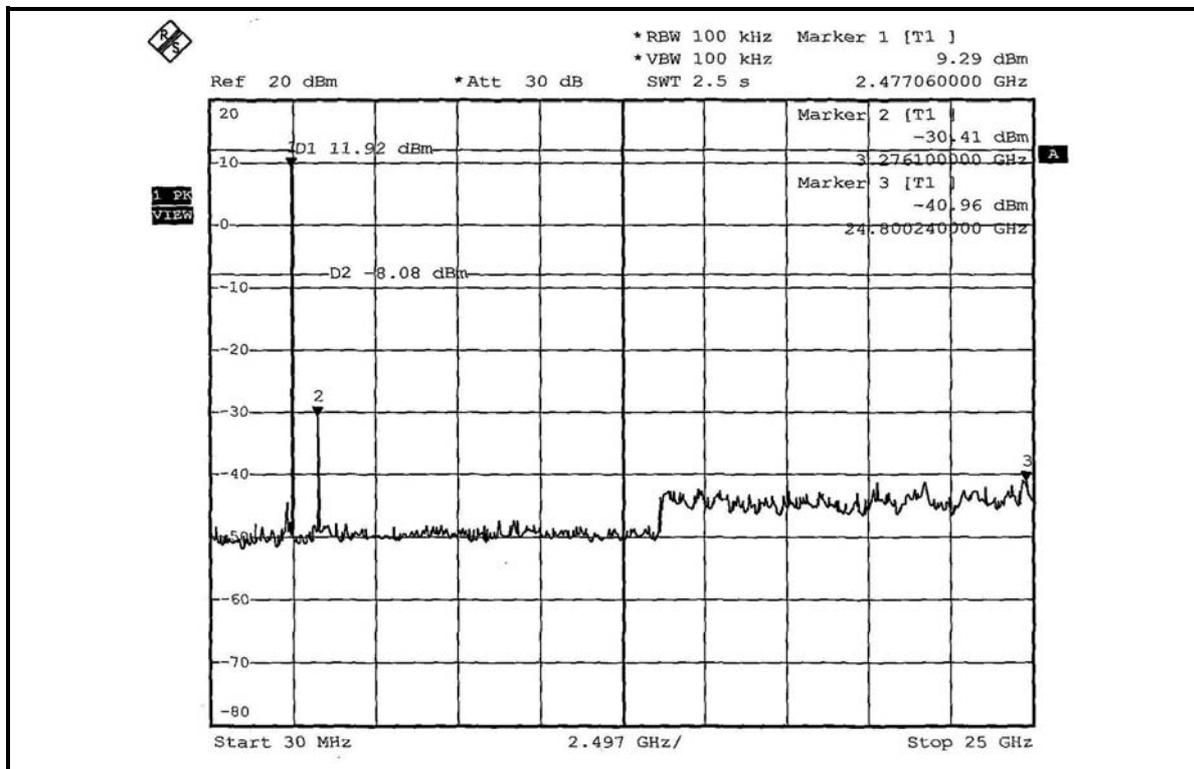
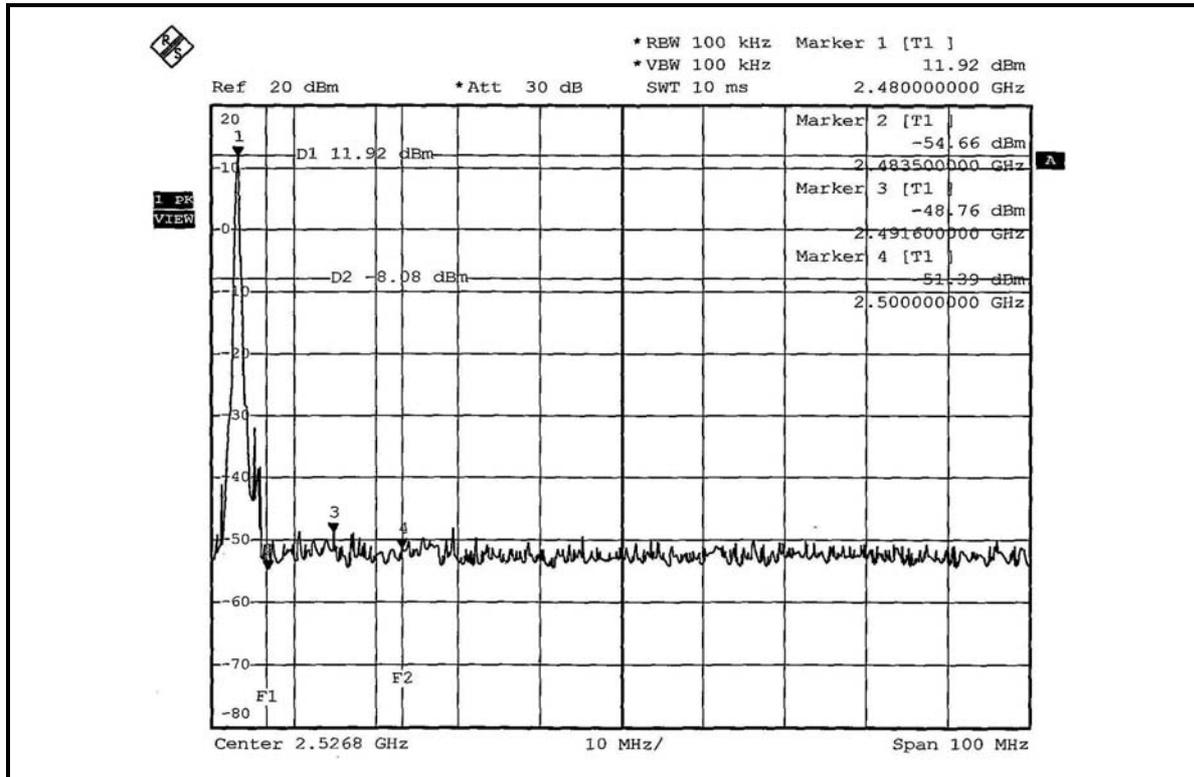
The band edge emission plot on the next second page shows 60.68dBc between carrier maximum power and local maximum emission in restrict band (2.49160GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.2.7 is 105.32dBuV/m (Peak), so the maximum field strength in restrict band is $105.32 - 60.68 = 44.64$ dBuV/m, which is under 74 dBuV/m limit.

Average value = $44.64 - 30.00 = 14.64$ dBuV/m, which is under 54dBuV/m limit.

*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle be equal to: $20\log(3.125/100) = -30$ dB.

Average value = peak reading -30.00 .





FOR 8DPSK

NOTE 1:

The band edge emission plot on the next page shows 54.30dBc between carrier maximum power and local maximum emission in restrict band (2.38628GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.2.7 is 104.38dBuV/m (Peak), so the maximum field strength in restrict band is $104.38 - 54.30 = 50.08$ dBuV/m, which is under 74 dBuV/m limit.

Average value = $50.08 - 30.00 = 20.08$ dBuV/m, which is under 54dBuV/m limit.

*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle be equal to: $20\log(3.125/100) = -30$ dB.

Average value = peak reading -30.00 .

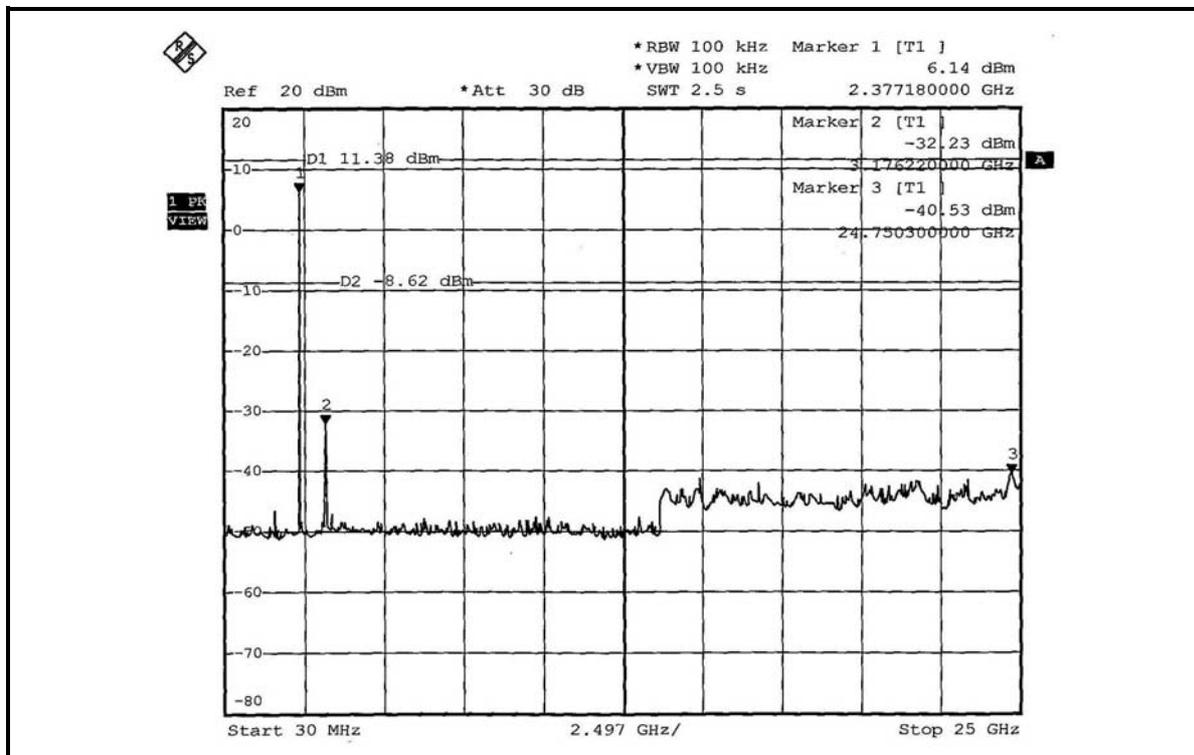
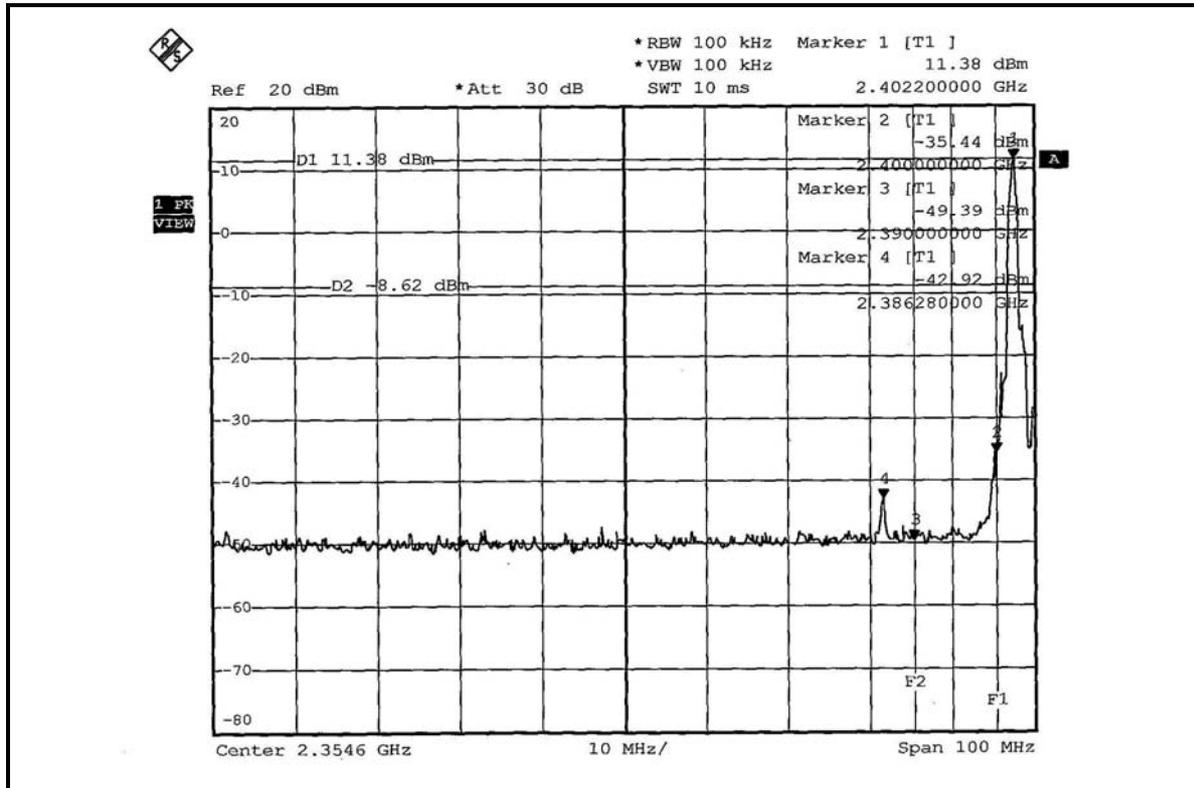
NOTE 2:

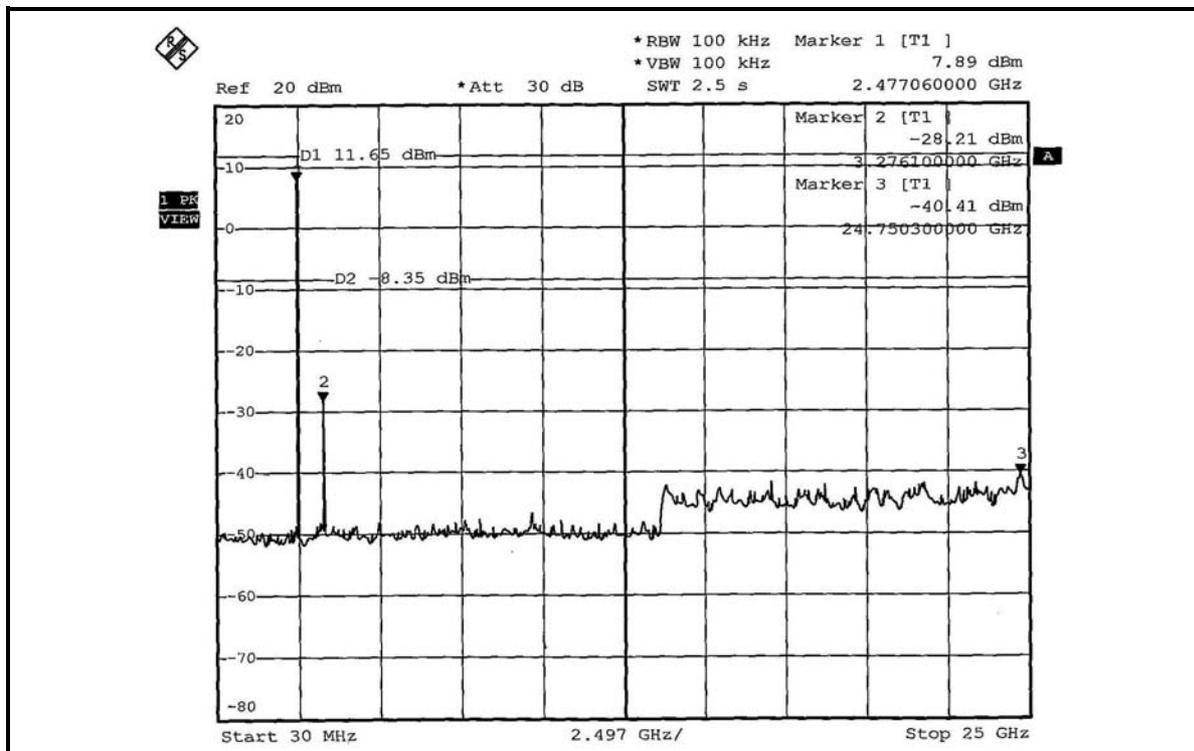
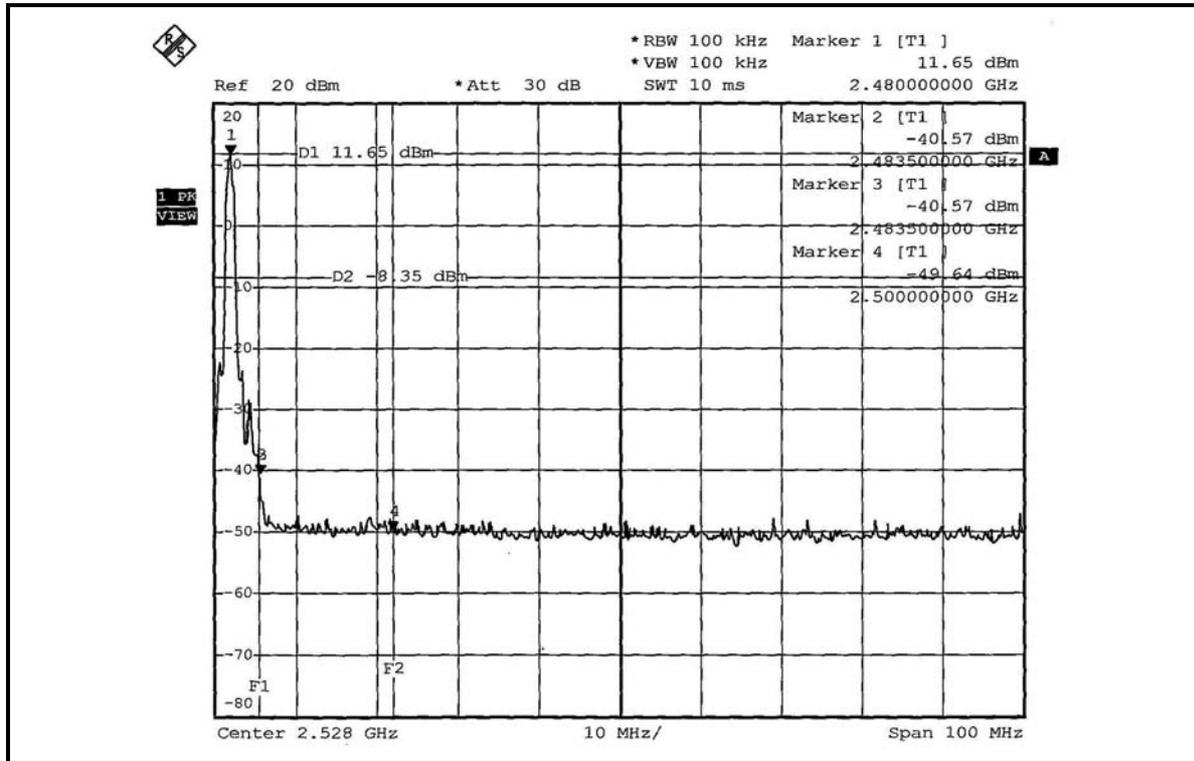
The band edge emission plot on the next second page shows 52.22dBc between carrier maximum power and local maximum emission in restrict band (2.48350GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.2.7 is 104.06dBuV/m (Peak), so the maximum field strength in restrict band is $104.06 - 52.22 = 51.84$ dBuV/m, which is under 74 dBuV/m limit.

Average value = $51.84 - 30.00 = 21.84$ dBuV/m, which is under 54dBuV/m limit.

*The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 5$ per 296.25 ms per channel. Therefore, the duty cycle be equal to: $20\log(3.125/100) = -30$ dB.

Average value = peak reading -30.00 .







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 Printed antenna without antenna connector. The maximum gain of this antenna is 0.2dBi.



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.

| | |
|--------------------|-----------------------|
| USA | FCC, UL, A2LA |
| Germany | TUV Rheinland |
| Japan | VCCI |
| Norway | NEMKO |
| Canada | INDUSTRY CANADA , CSA |
| R.O.C. | CNLA, BSMI, NCC |
| Netherlands | Telefication |
| Singapore | PSB , GOST-ASIA(MOU) |
| Russia | 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. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Web Site: www.adt.com.tw

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



APPENDIX-A

MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

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