

## 6. Band Edge

### 6.1. Test Equipment

The following test equipments are used during the band edge tests:

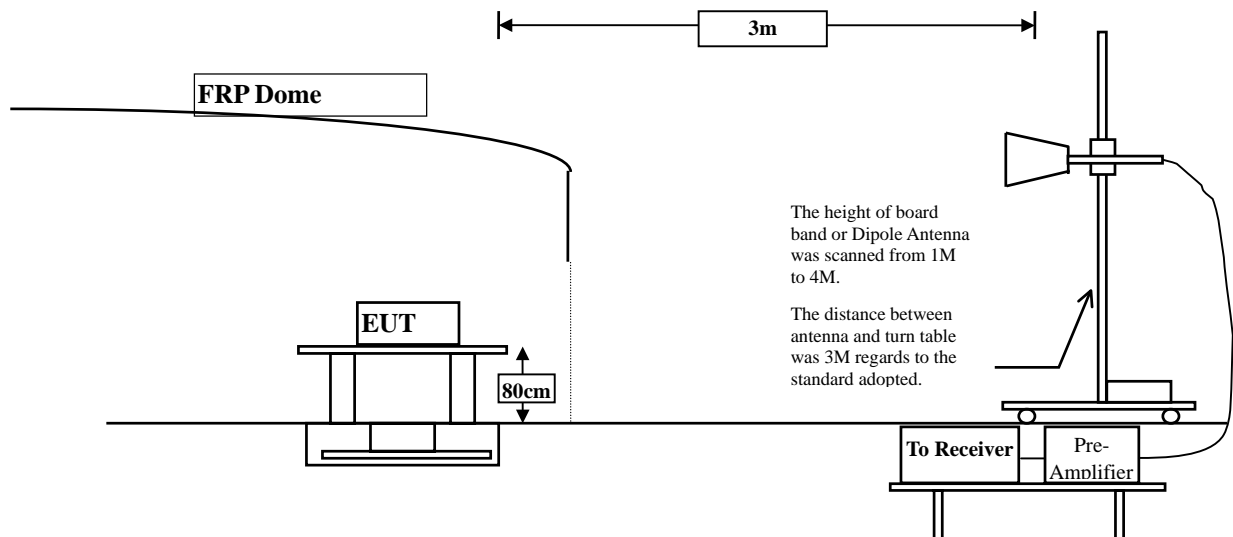
| Test Site  |   | Equipment         | Manufacturer    | Model No./Serial No.  | Last Cal.  |
|------------|---|-------------------|-----------------|-----------------------|------------|
| ☒ Site # 3 | X | Bilog Antenna     | Schaffner Chase | CBL6112B/2673         | Sep., 2009 |
|            | X | Pre-Amplifier     | HP              | 8447D/2944A09549      | Sep., 2009 |
|            | X | Test Receiver     | R & S           | ESCS 30/ 825442/018   | Sep., 2009 |
|            | X | Spectrum Analyzer | Agilent         | E4407B / US39440758   | May, 2009  |
|            | X | Coaxial Cable     | Quietek         | QTK-CABLE/ CAB5       | Feb., 2009 |
|            | X | Controller        | Quietek         | QTK-CONTROLLER/ CTRL3 | N/A        |
|            | X | Coaxial Switch    | Anritsu         | MP59B/6200265729      | N/A        |

- Note:
1. All equipments are calibrated every one year.
  2. The test instruments marked by “X” are used to measure the final test results.

### 6.2. Test Setup

#### RF Radiated Measurement:

Above 1GHz



### **6.3. Limit**

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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### **6.4. Test Procedure**

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz. The EUT was setup to ANSI C63.4, 2003; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

### **6.5. Uncertainty**

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

## 6.6. Test Result of Band Edge

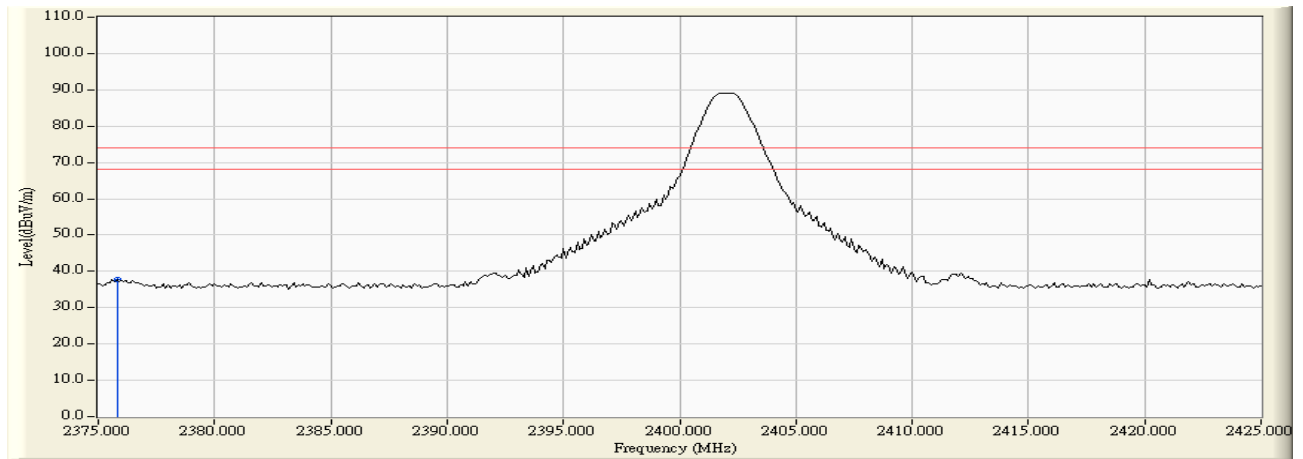
Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

### RF Radiated Measurement (Horizontal):

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|-------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 00 (Peak)   | 2375.800        | -2.444              | 40.337               | 37.893                  | 74.00               | 54.00                  | Pass   |

Figure Channel 00:

Horizontal (Peak)



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

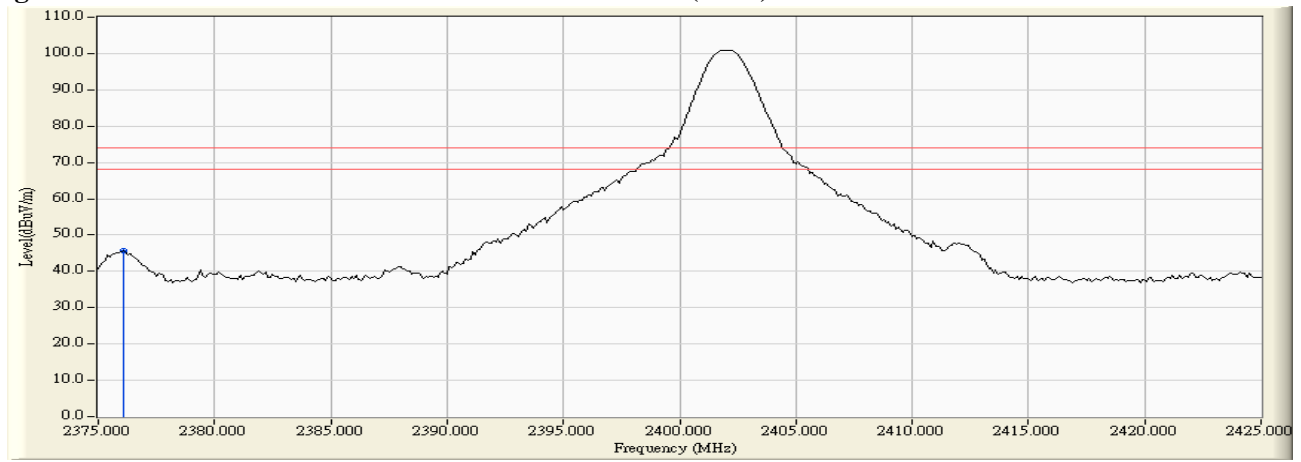
Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

**RF Radiated Measurement (Vertical):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|-------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 00 (Peak)   | 2376.100        | -2.442              | 48.061               | 45.618                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 00:**

**Vertical (Peak)**



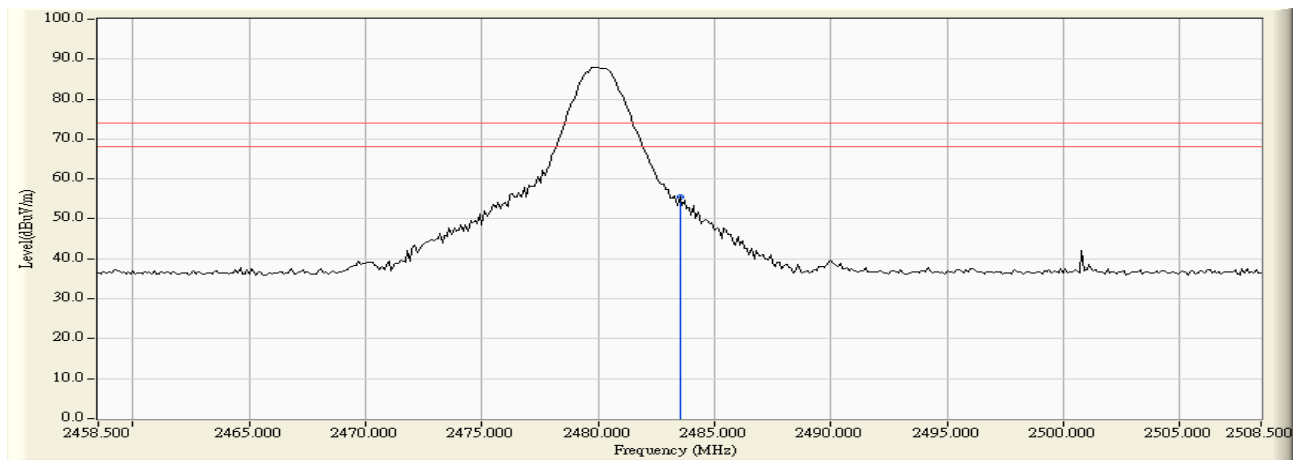
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

**RF Radiated Measurement (Horizontal):**

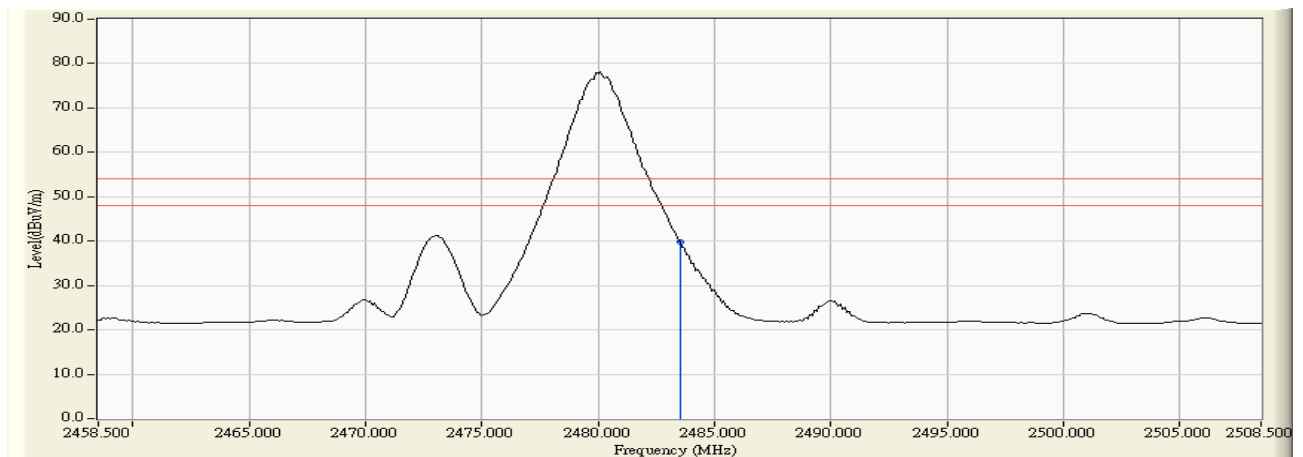
| Channel No.  | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|--------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 78 (Peak)    | 2483.500        | -1.937              | 57.560               | 55.623                  | 74.00               | 54.00                  | Pass   |
| 78 (Average) | 2483.500        | -1.937              | 41.811               | 39.874                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 78: Horizontal (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

**Figure Channel 78: Horizontal (Average)**



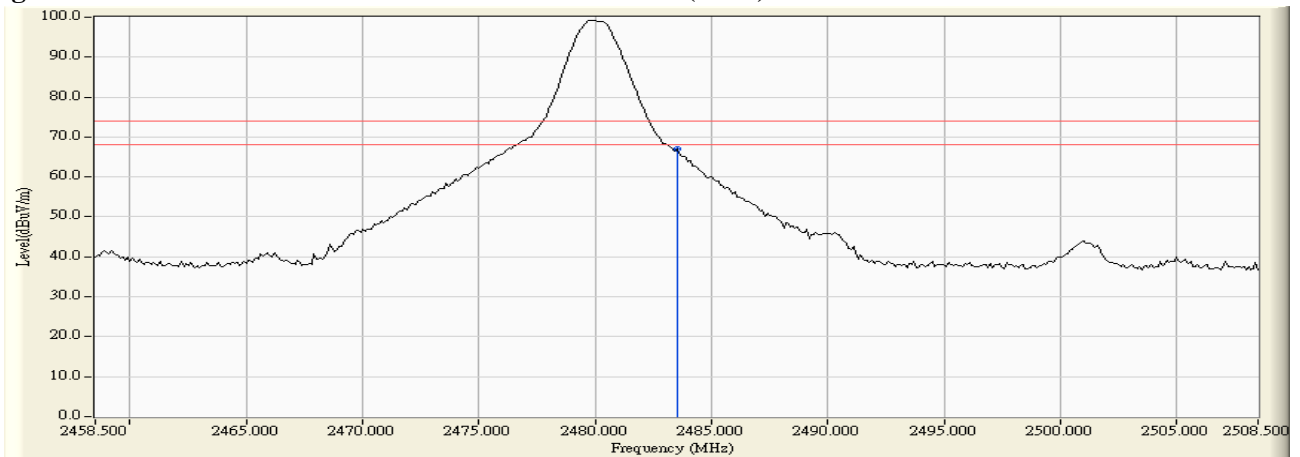
Note: RBW=1MHz, VBW=10Hz, Sweep=5s

Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

**RF Radiated Measurement (Vertical):**

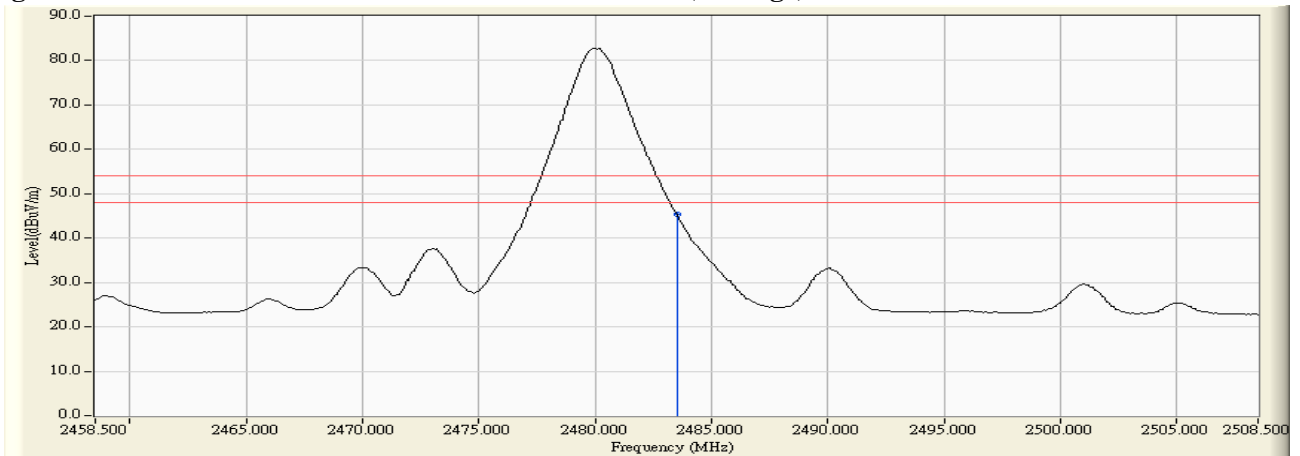
| Channel No.  | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|--------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 78 (Peak)    | 2483.500        | -1.937              | 68.911               | 66.974                  | 74.00               | 54.00                  | Pass   |
| 78 (Average) | 2483.500        | -1.937              | 47.239               | 45.302                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 78: Vertical (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

**Figure Channel 78: Vertical (Average)**



Note: RBW=1MHz, VBW=10Hz, Sweep=5s

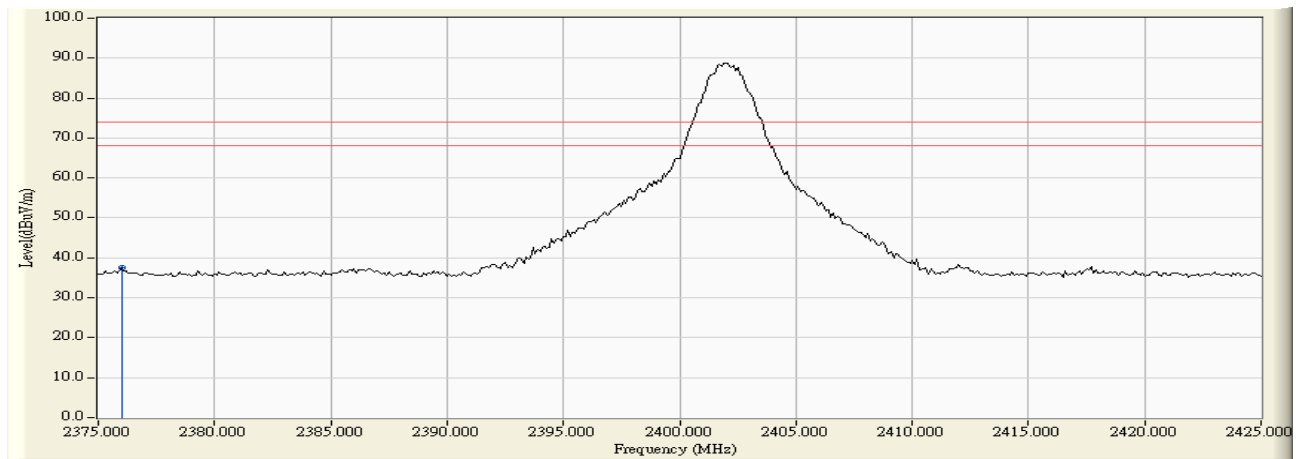
Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

**RF Radiated Measurement (Horizontal):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|-------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 00 (Peak)   | 2376.000        | -2.442              | 39.900               | 37.457                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 00:**

**Horizontal (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

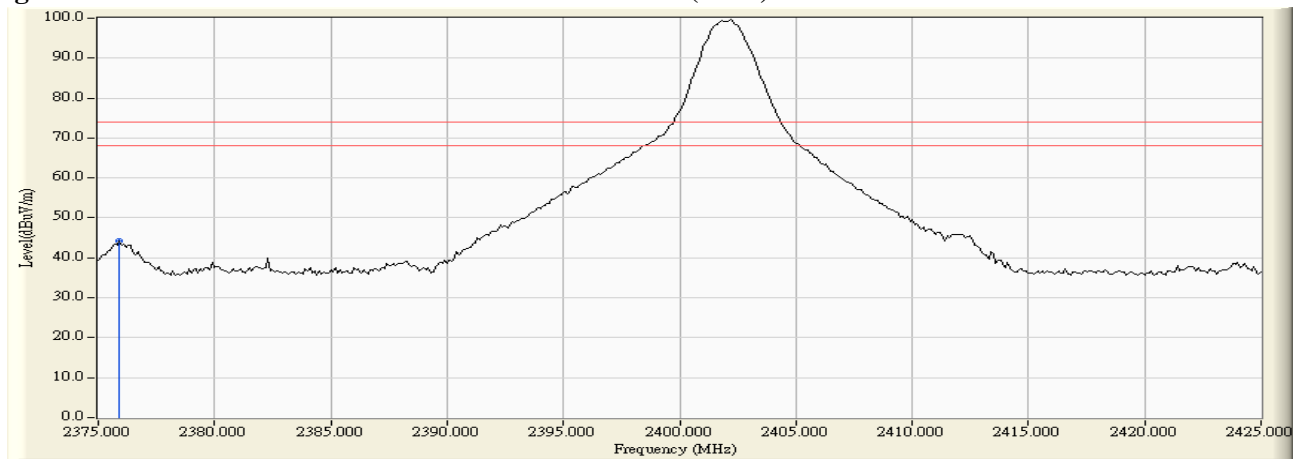
Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

**RF Radiated Measurement (Vertical):**

| Channel No. | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|-------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 00 (Peak)   | 2375.900        | -2.444              | 46.638               | 44.195                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 00:**

**Vertical (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

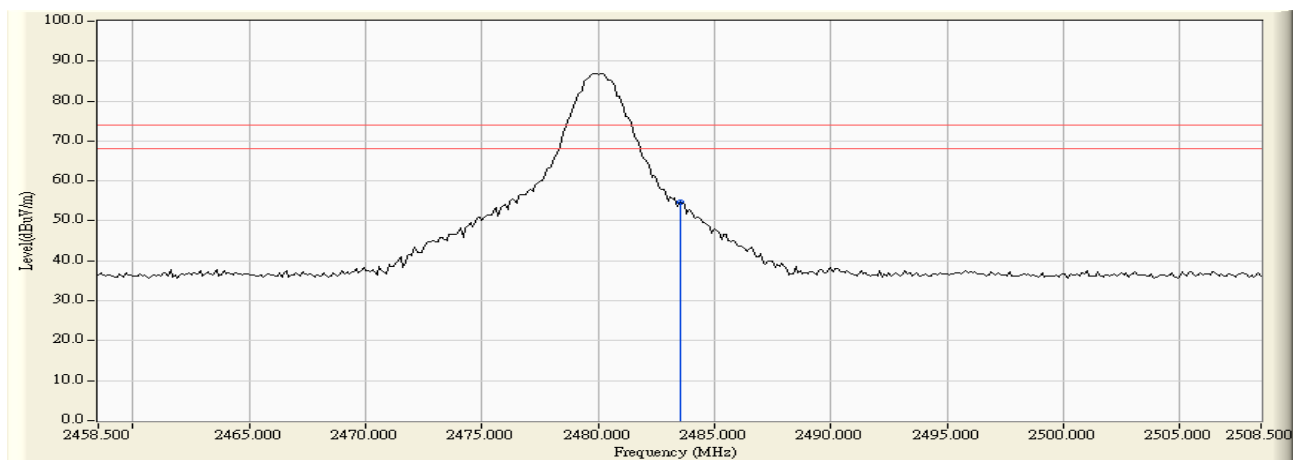


Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

**RF Radiated Measurement (Horizontal):**

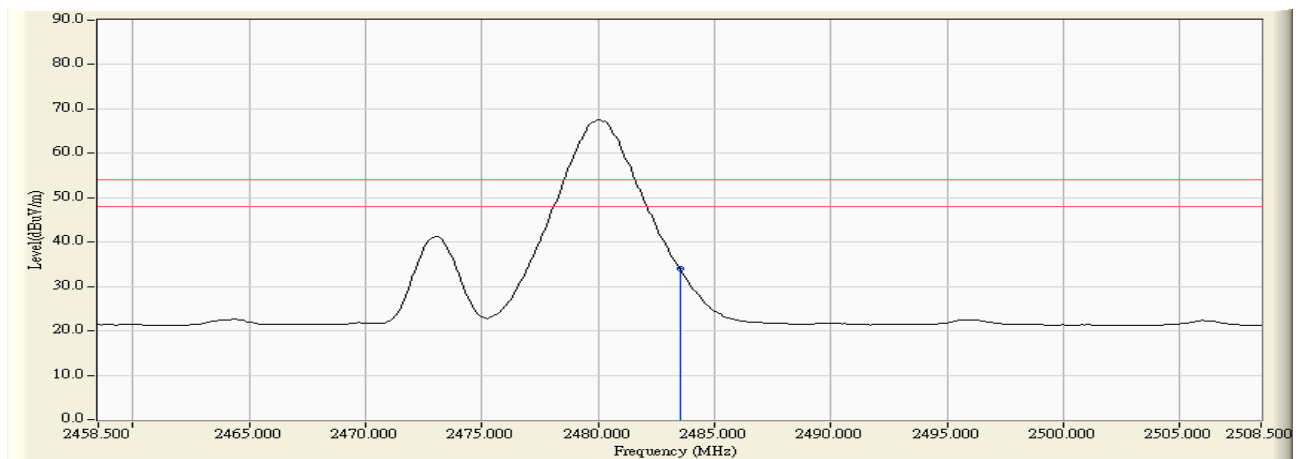
| Channel No.  | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|--------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 78 (Peak)    | 2483.500        | -1.937              | 56.508               | 54.571                  | 74.00               | 54.00                  | Pass   |
| 78 (Average) | 2483.500        | -1.937              | 35.885               | 33.948                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 78: Horizontal (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

**Figure Channel 78: Horizontal (Average)**



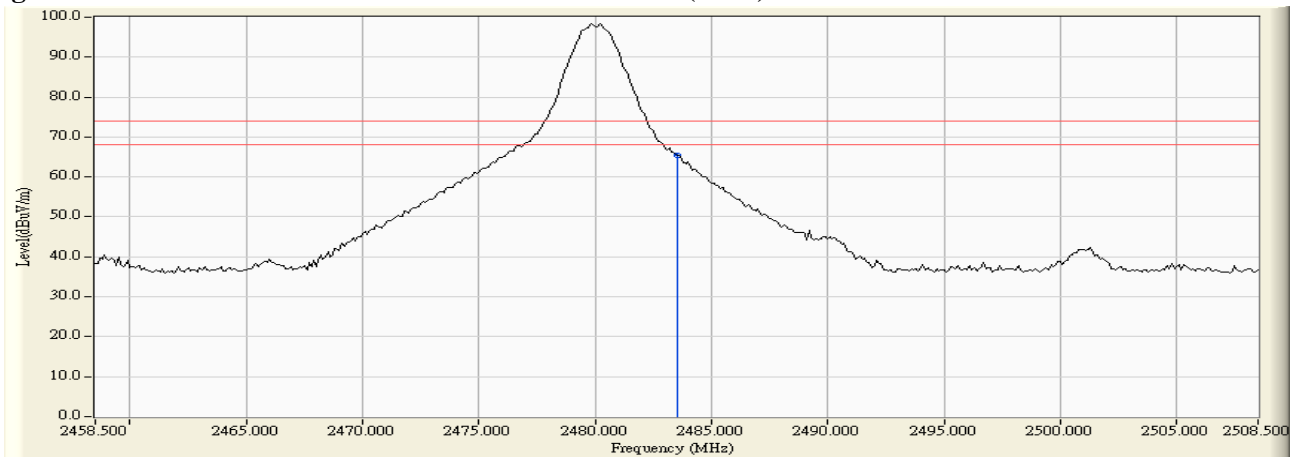
Note: RBW=1MHz, VBW=10Hz, Sweep=5s

Product : Personal Navigation Device  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

**RF Radiated Measurement (Vertical):**

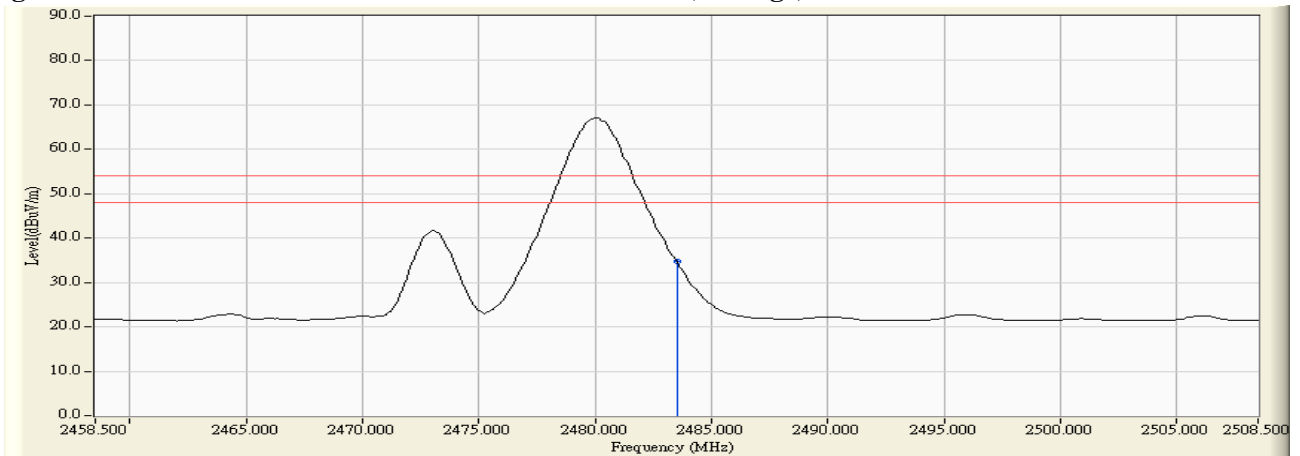
| Channel No.  | Frequency (MHz) | Correct Factor (dB) | Reading Level (dBuV) | Emission Level (dBuV/m) | Peak Limit (dBuV/m) | Average Limit (dBuV/m) | Result |
|--------------|-----------------|---------------------|----------------------|-------------------------|---------------------|------------------------|--------|
| 78 (Peak)    | 2483.500        | -1.937              | 67.252               | 65.315                  | 74.00               | 54.00                  | Pass   |
| 78 (Average) | 2483.500        | -1.937              | 36.619               | 34.682                  | 74.00               | 54.00                  | Pass   |

**Figure Channel 78: Vertical (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

**Figure Channel 78: Vertical (Average)**



Note: RBW=1MHz, VBW=10Hz, Sweep=5s

## 7. Channel Number

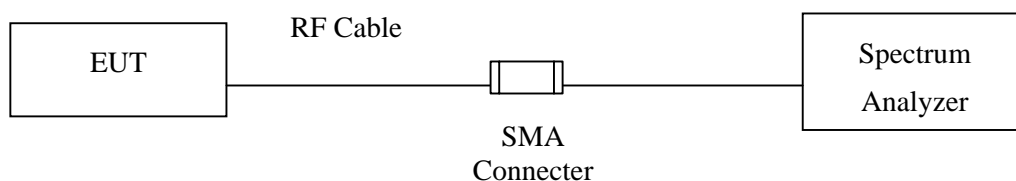
### 7.1. Test Equipment

The following test equipments are used during the radiated emission tests:

|   | Equipment         | Manufacturer | Model No./Serial No. | Last Cal.  |
|---|-------------------|--------------|----------------------|------------|
|   | Spectrum Analyzer | R&S          | FSP40 / 100339       | Jun, 2009  |
|   | Spectrum Analyzer | Agilent      | E4407B / US39440758  | Jun, 2009  |
| X | Spectrum Analyzer | Agilent      | N9010A / MY48030495  | Apr., 2009 |

Note: 1. All equipments are calibrated every one year.  
2. The test instruments marked by "X" are used to measure the final test results.

### 7.2. Test Setup



### 7.3. Limit

Frequency hopping systems operating in the 2400-2483.5 MHz bands shall use at least 75 hopping frequencies.

### 7.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

### 7.5. Uncertainty

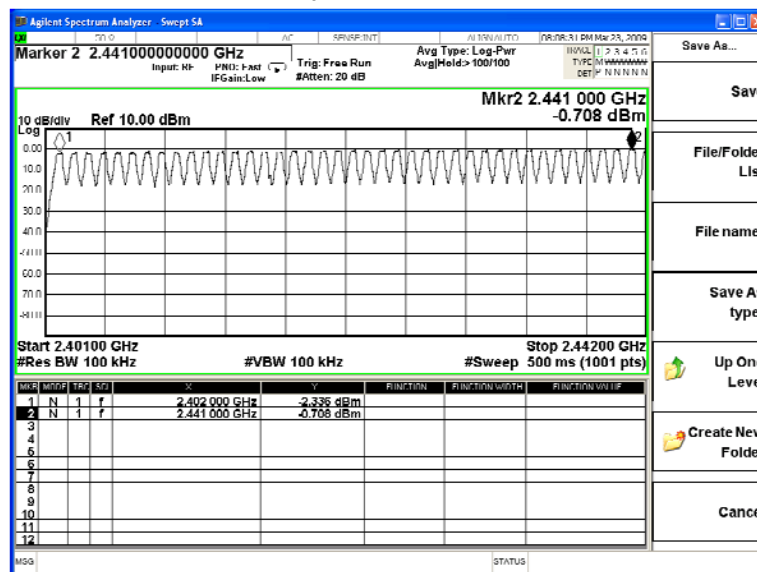
N/A

## 7.6. Test Result of Channel Number

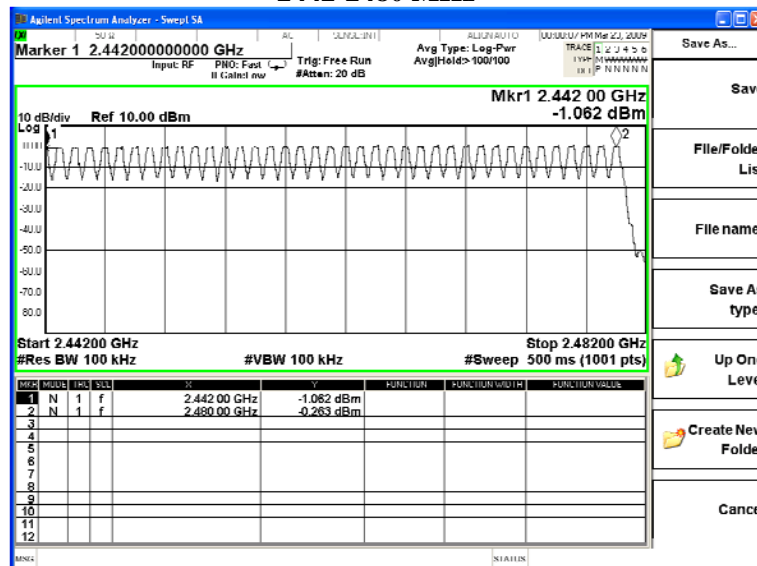
Product : Personal Navigation Device  
 Test Item : Channel Number  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

| Frequency Range<br>(MHz) | Measurement<br>(Hopping Channel) | Required Limit<br>(Hopping Channel) | Result |
|--------------------------|----------------------------------|-------------------------------------|--------|
| 2402 ~ 2480              | 79                               | >75                                 | Pass   |

### 2401-2442 MHz



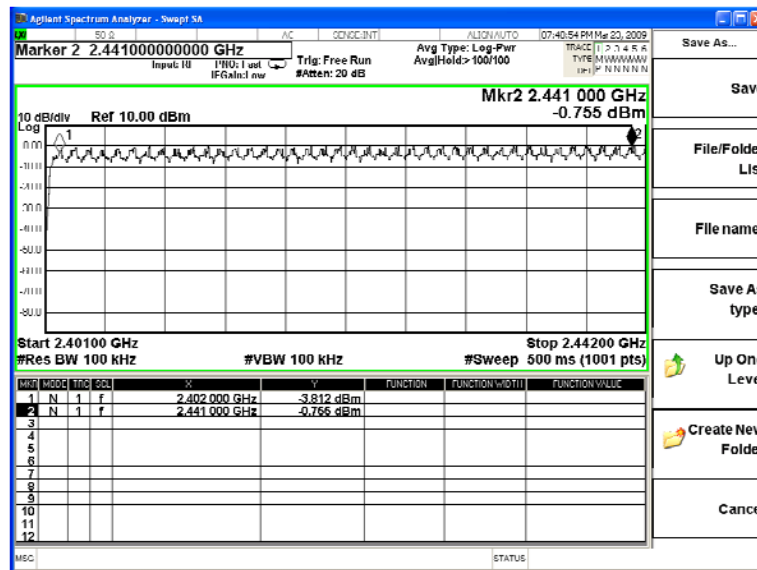
### 2442-2480 MHz



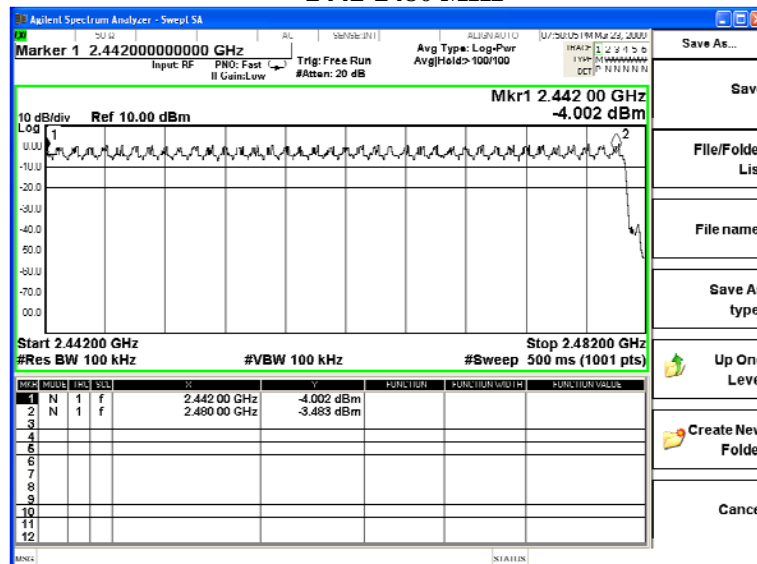
Product : Personal Navigation Device  
 Test Item : Channel Number  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

| Frequency Range<br>(MHz) | Measurement<br>(Hopping Channel) | Required Limit<br>(Hopping Channel) | Result |
|--------------------------|----------------------------------|-------------------------------------|--------|
| 2402 ~ 2480              | 79                               | >75                                 | Pass   |

### 2401-2442 MHz



### 2442-2480 MHz



## 8. Channel Separation

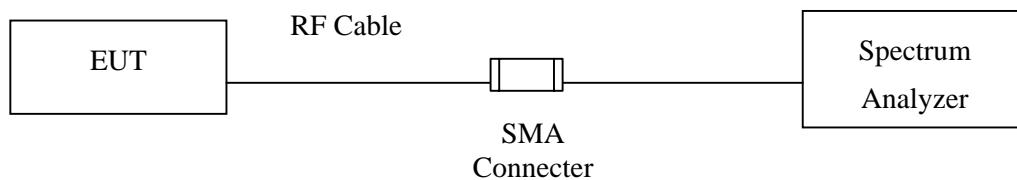
### 8.1. Test Equipment

The following test equipments are used during the radiated emission tests:

|   | Equipment         | Manufacturer | Model No./Serial No. | Last Cal.  |
|---|-------------------|--------------|----------------------|------------|
|   | Spectrum Analyzer | R&S          | FSP40 / 100339       | Jun, 2009  |
|   | Spectrum Analyzer | Agilent      | E4407B / US39440758  | Jun, 2009  |
| X | Spectrum Analyzer | Agilent      | N9010A / MY48030495  | Apr., 2009 |

Note: 1. All equipments are calibrated every one year.  
2. The test instruments mark by "X" are used to measure the final test results.

### 8.2. Test Setup



### 8.3. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the  $\frac{2}{3} \times (20 \text{ dB bandwidth})$  of the hopping channel, whichever is greater.

### 8.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

### 8.5. Uncertainty

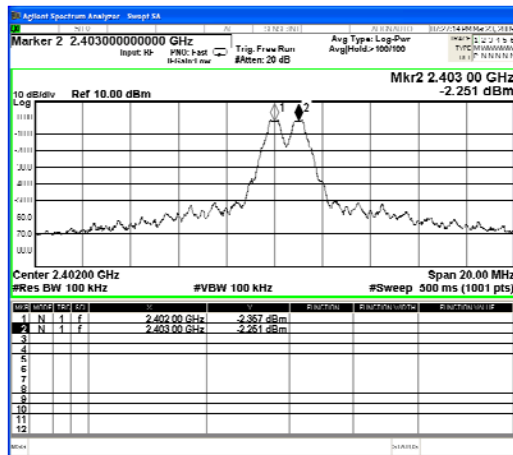
$\pm 150\text{Hz}$

## 8.6. Test Result of Channel Separation

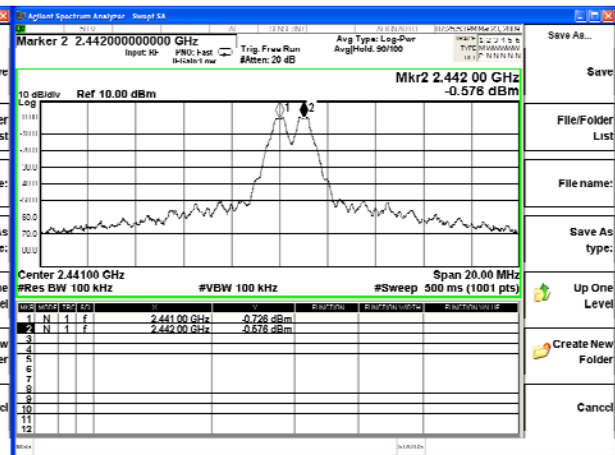
Product : Personal Navigation Device  
 Test Item : Channel Separation  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)

| Frequency (MHz) | Measurement Level (kHz) | Limit (kHz) | Limit of (2/3)*20dB Bandwidth (kHz) | Result |
|-----------------|-------------------------|-------------|-------------------------------------|--------|
| 2402            | 1000                    | >25 kHz     | 807.07                              | Pass   |
| 2441            | 1000                    | >25 kHz     | 780.39                              | Pass   |
| 2480            | 1000                    | >25 kHz     | 773.72                              | Pass   |

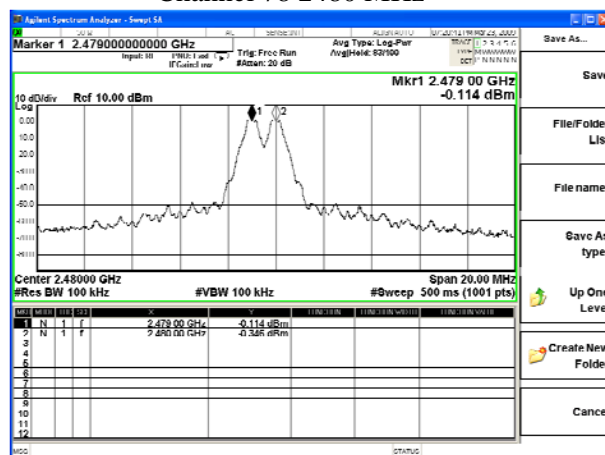
Channel 00 2402MHz



Channel 39 2441MHz



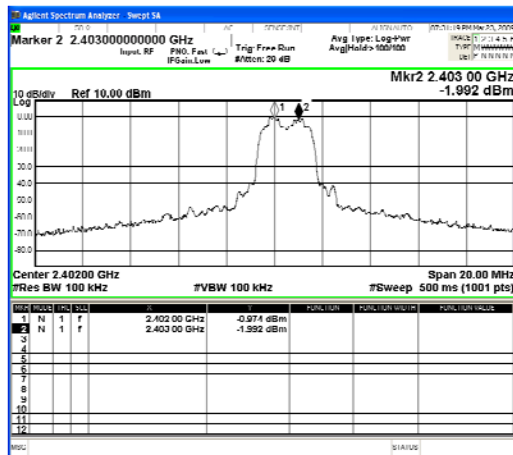
Channel 78 2480 MHz



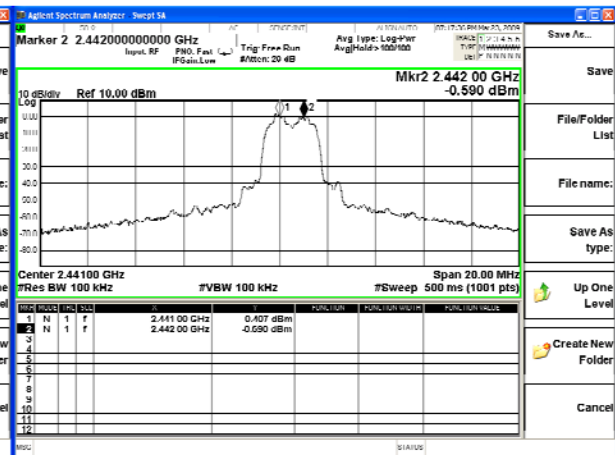
Product : Personal Navigation Device  
 Test Item : Channel Separation  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)

| Frequency (MHz) | Measurement Level (kHz) | Limit (kHz) | Limit of (2/3)*20dB Bandwidth (kHz) | Result |
|-----------------|-------------------------|-------------|-------------------------------------|--------|
| 2402            | 1000                    | >25 kHz     | 933.80                              | Pass   |
| 2441            | 1000                    | >25 kHz     | 940.47                              | Pass   |
| 2480            | 1000                    | >25 kHz     | 933.80                              | Pass   |

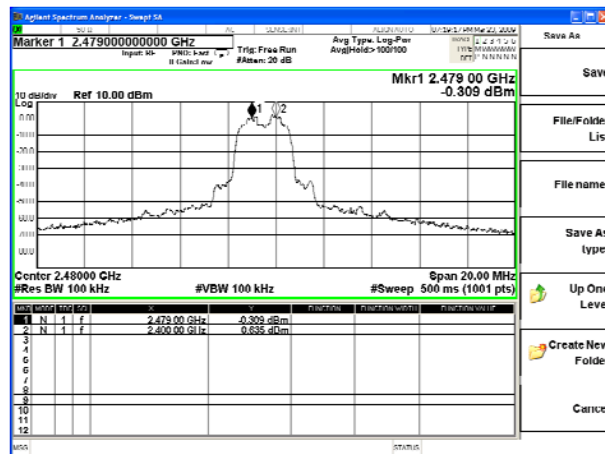
Channel 00 2402MHz



Channel 39 2441MHz



Channel 78 2480 MHz





## 9. Dwell Time

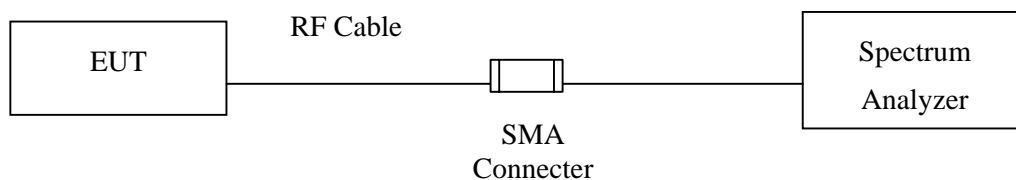
### 9.1. Test Equipment

The following test equipments are used during the radiated emission tests:

|   | Equipment         | Manufacturer | Model No./Serial No. | Last Cal.  |
|---|-------------------|--------------|----------------------|------------|
|   | Spectrum Analyzer | R&S          | FSP40 / 100339       | Jun, 2009  |
|   | Spectrum Analyzer | Agilent      | E4407B / US39440758  | Jun, 2009  |
| X | Spectrum Analyzer | Agilent      | N9010A / MY48030495  | Apr., 2009 |

Note: 1. All equipments are calibrated every one year.  
2. The test instruments marked by “X” are used to measure the final test results.

### 9.2. Test Setup



### 9.3. Limit

The dwell time shall be the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

### 9.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

### 9.5. Uncertainty

± 25msec

## 9.6. Test Result of Dwell Time

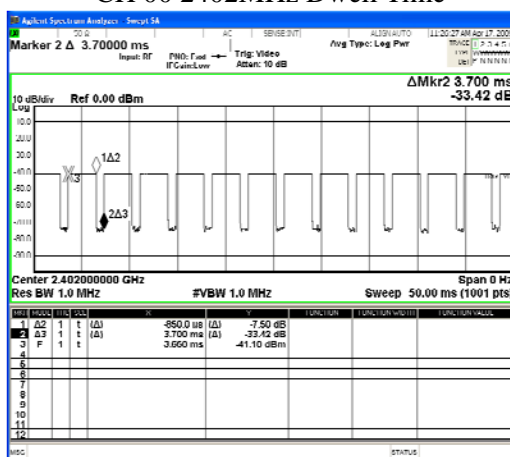
Product : Personal Navigation Device  
 Test Item : Dwell Time  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK) (Channel 00,39,78 –DH5)

| Channel No. | Frequency (MHz) | Time slot length (ms) | Hopping of Number | Sweep time (ms) | Duty cycle | Dwell Time (Sec) | Limit (Sec) | Result |
|-------------|-----------------|-----------------------|-------------------|-----------------|------------|------------------|-------------|--------|
| 00          | 2402            | 2.850                 | 13.0              | 50.0            | 0.74       | 0.296            | 0.4         | Pass   |
| 39          | 2441            | 2.850                 | 13.0              | 50.0            | 0.74       | 0.296            | 0.4         | Pass   |
| 78          | 2480            | 2.850                 | 13.0              | 50.0            | 0.74       | 0.296            | 0.4         | Pass   |

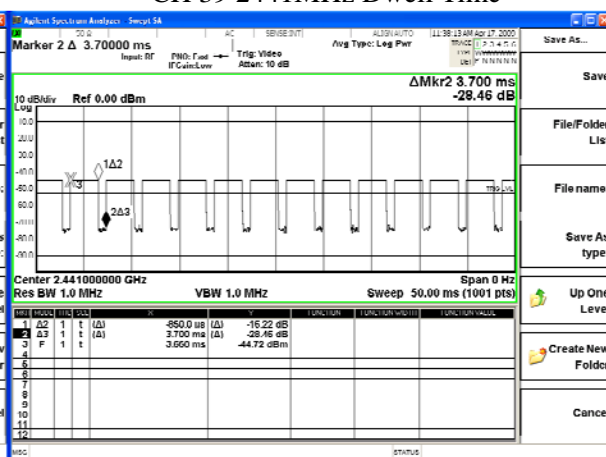
Note: Duty cycle = ((Time slot length(ms)\*Hopping of Number) / Sweep time (ms))

Dwell time = (Duty cycle /79) \* (79\*0.4)

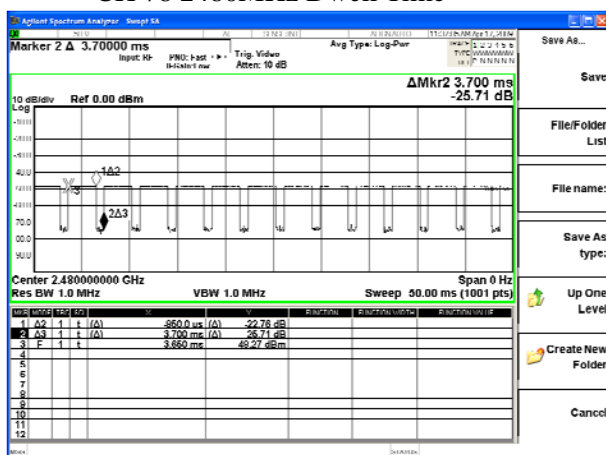
CH 00 2402MHz Dwell Time



CH 39 2441MHz Dwell Time



CH 78 2480MHz Dwell Time



Note: The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.

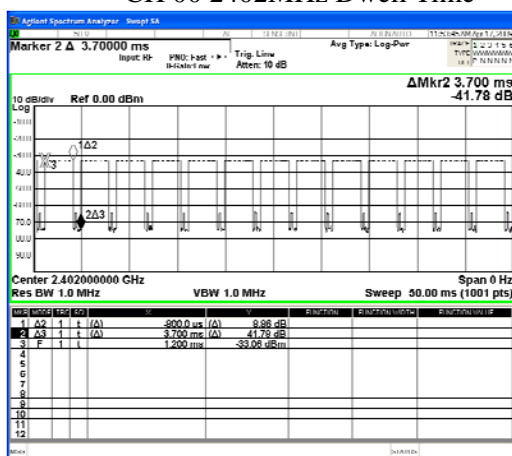
Product : Personal Navigation Device  
 Test Item : Dwell Time  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK) (Channel 00,39,78 –DH5)

| Channel No. | Frequency (MHz) | Time slot length (ms) | Hopping of Number | Sweep time (ms) | Duty cycle | Dwell Time (Sec) | Limit (Sec) | Result |
|-------------|-----------------|-----------------------|-------------------|-----------------|------------|------------------|-------------|--------|
| 00          | 2402            | 2.90                  | 13                | 50              | 0.75       | 0.302            | 0.4         | Pass   |
| 39          | 2441            | 2.90                  | 13                | 50              | 0.75       | 0.302            | 0.4         | Pass   |
| 78          | 2480            | 2.90                  | 13                | 50              | 0.75       | 0.302            | 0.4         | Pass   |

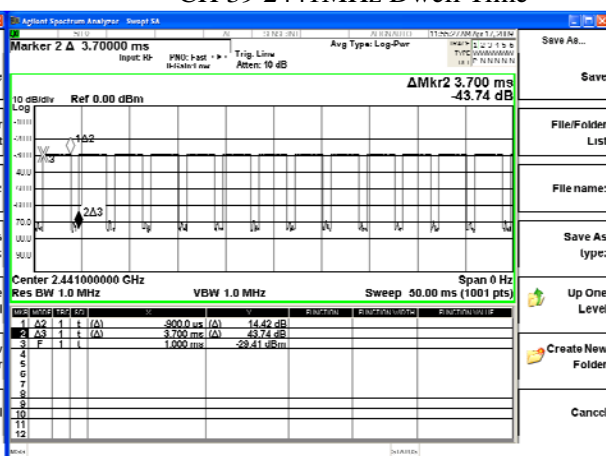
Note: Duty cycle = ((Time slot length(ms)\*Hopping of Number) / Sweep time (ms))

Dwell time = (Duty cycle /79) \* (79\*0.4)

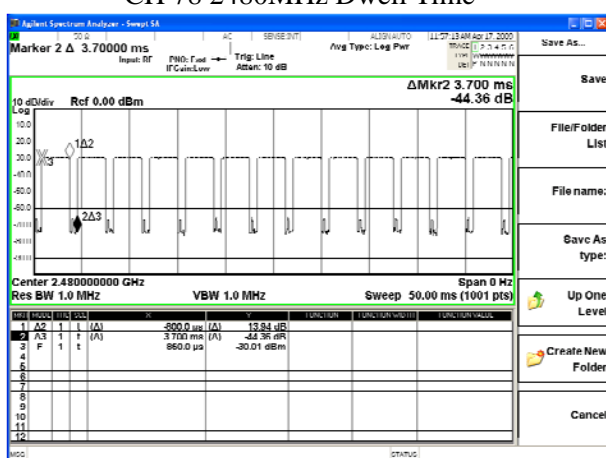
CH 00 2402MHz Dwell Time



CH 39 2441MHz Dwell Time



CH 78 2480MHz Dwell Time



Note: The dwell times of the packet type of DH1, DH3, and DH5 are tested. Only the worst case is shown on the report.

## 10. Occupied Bandwidth

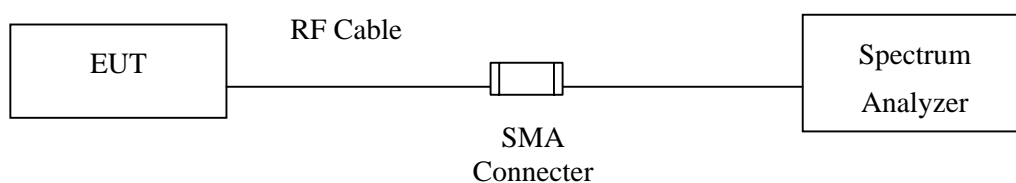
### 10.1. Test Equipment

The following test equipments are used during the radiated emission tests:

|   | Equipment         | Manufacturer | Model No./Serial No. | Last Cal.  |
|---|-------------------|--------------|----------------------|------------|
|   | Spectrum Analyzer | R&S          | FSP40 / 100339       | Jun, 2009  |
|   | Spectrum Analyzer | Agilent      | E4407B / US39440758  | Jun, 2009  |
| X | Spectrum Analyzer | Agilent      | N9010A / MY48030495  | Apr., 2009 |

Note: 1. All equipments are calibrated every one year.  
2. The test instruments marked by “X” are used to measure the final test results.

### 10.2. Test Setup



### 10.3. Limits

N/A

### 10.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003; tested to FHSS test procedure of FCC Public Notice DA 00-705 for compliance to FCC 47CFR 15.247 requirements.

### 10.5. Uncertainty

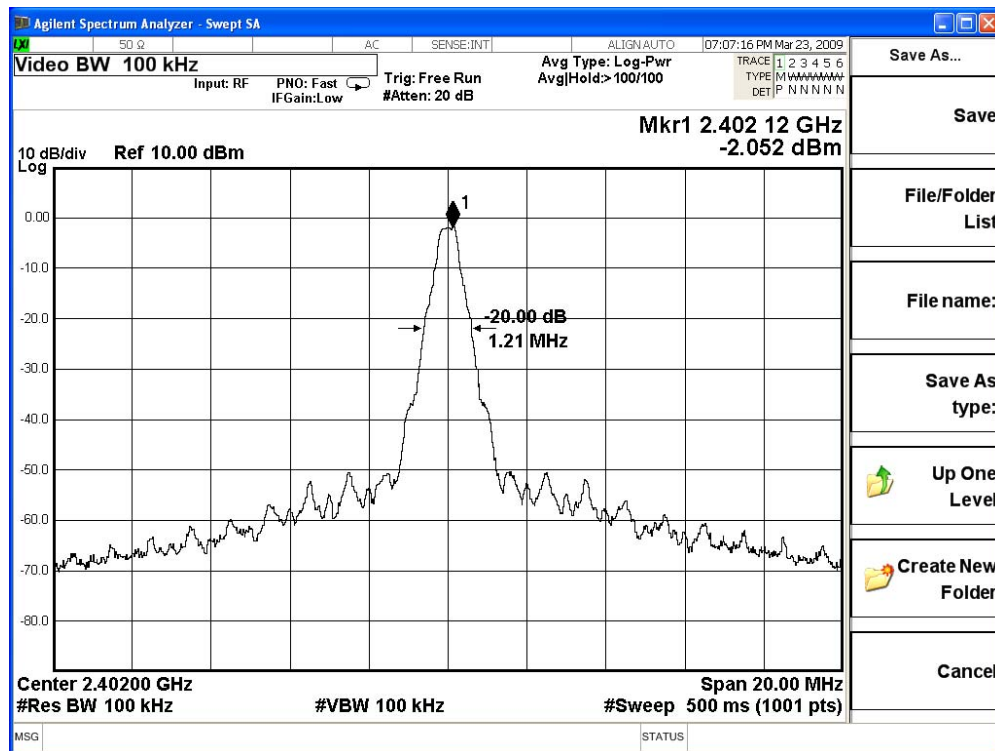
$\pm 150\text{Hz}$

## 10.6. Test Result of Occupied Bandwidth

Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)(2402MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 00          | 2402            | 1210                    | --                   | NA     |

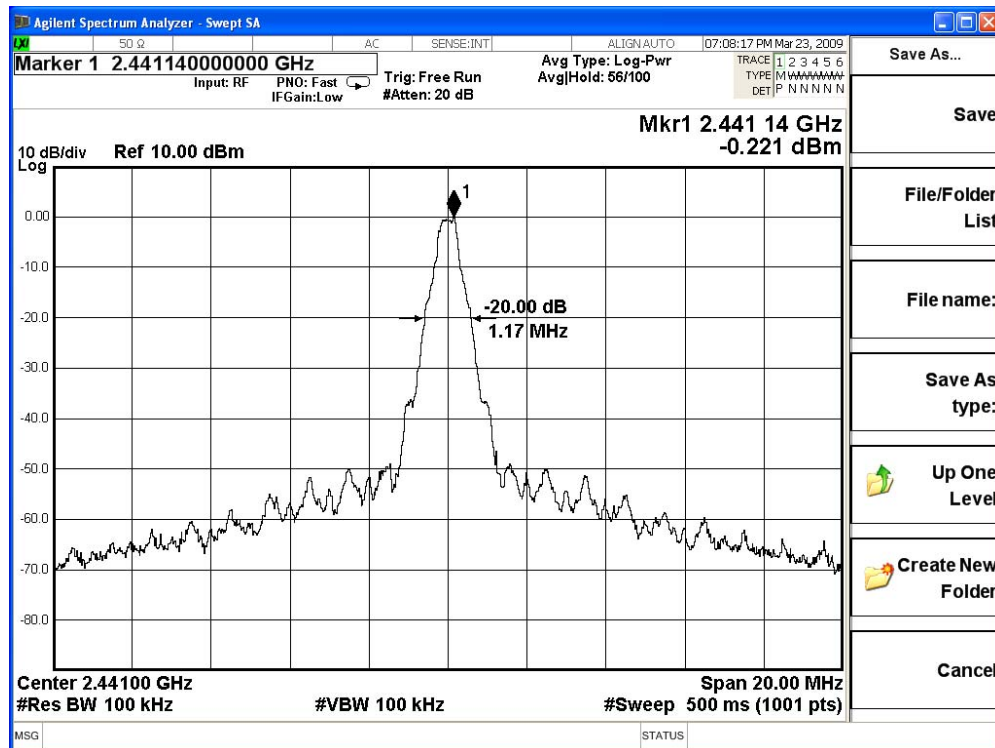
Figure Channel 00:



Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)(2441MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 39          | 2441            | 1170                    | --                   | NA     |

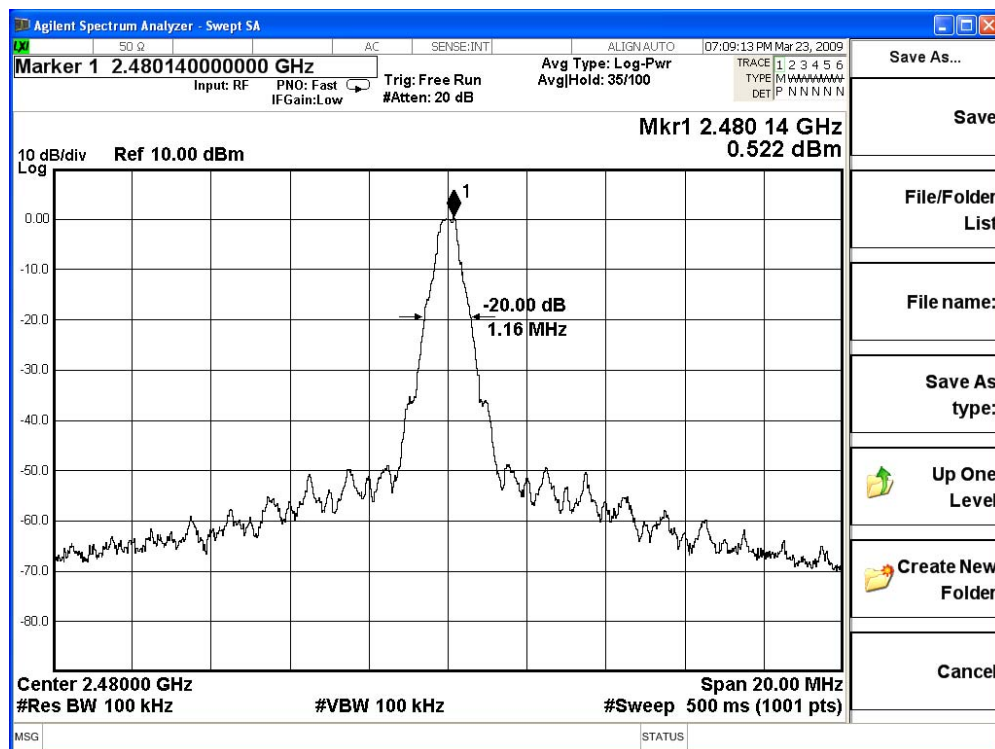
Figure Channel 39:



Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter - 1Mbps (GFSK)(2480MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 78          | 2480            | 1160                    | --                   | NA     |

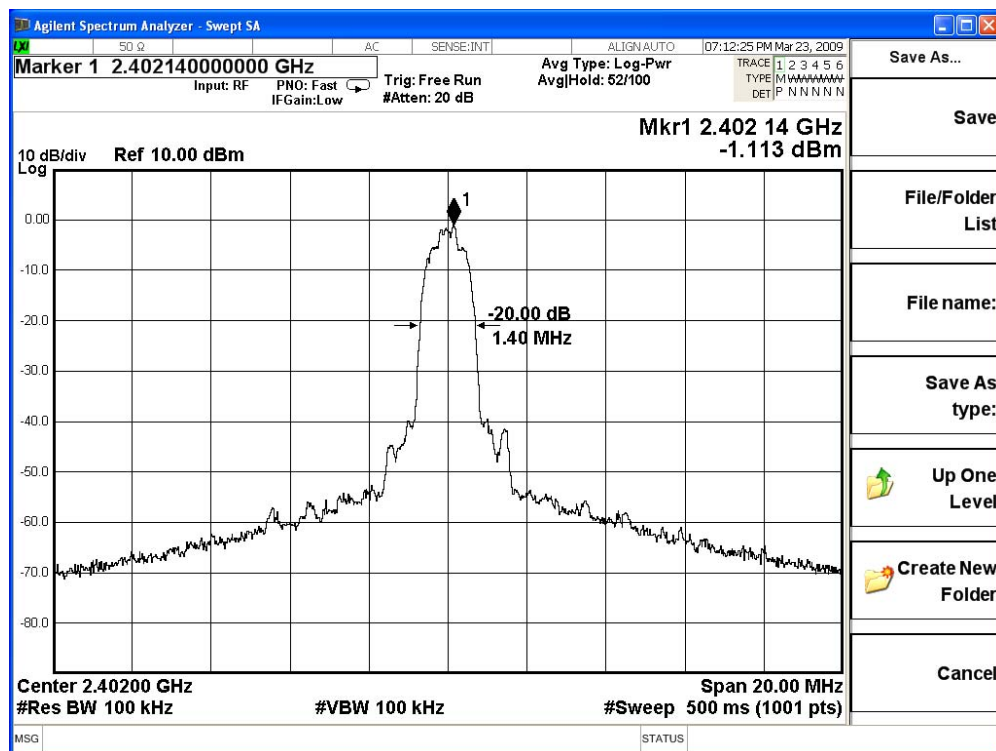
Figure Channel 78:



Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK) (2402MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 00          | 2402            | 1400                    | --                   | NA     |

**Figure Channel 00:**

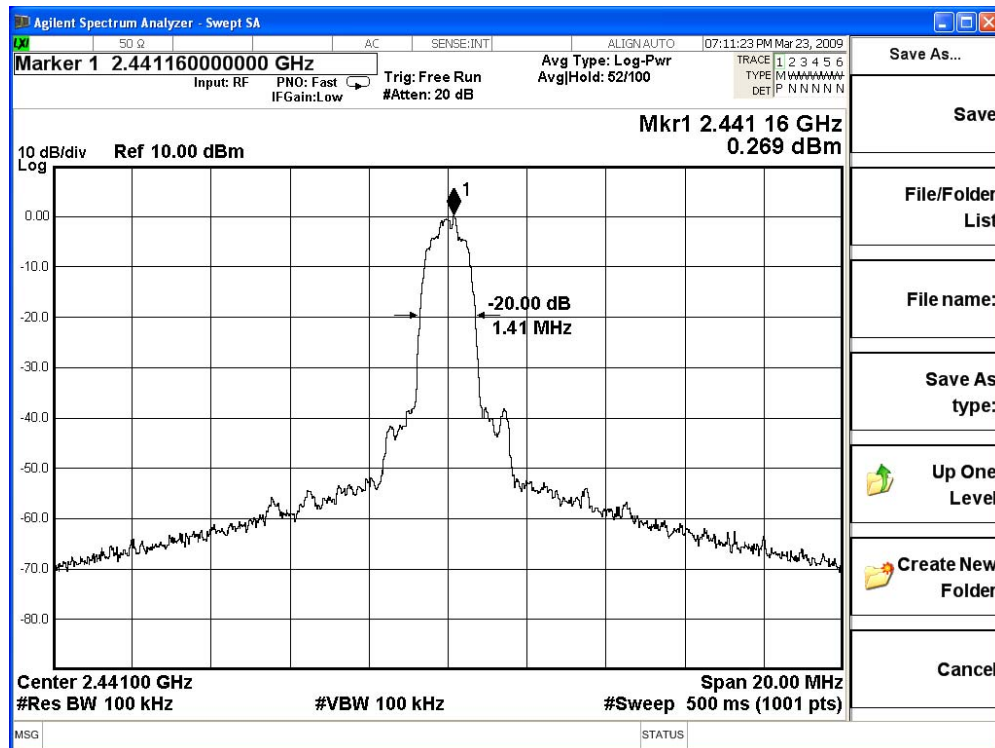




Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK) (2441MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 39          | 2441            | 1410                    | --                   | NA     |

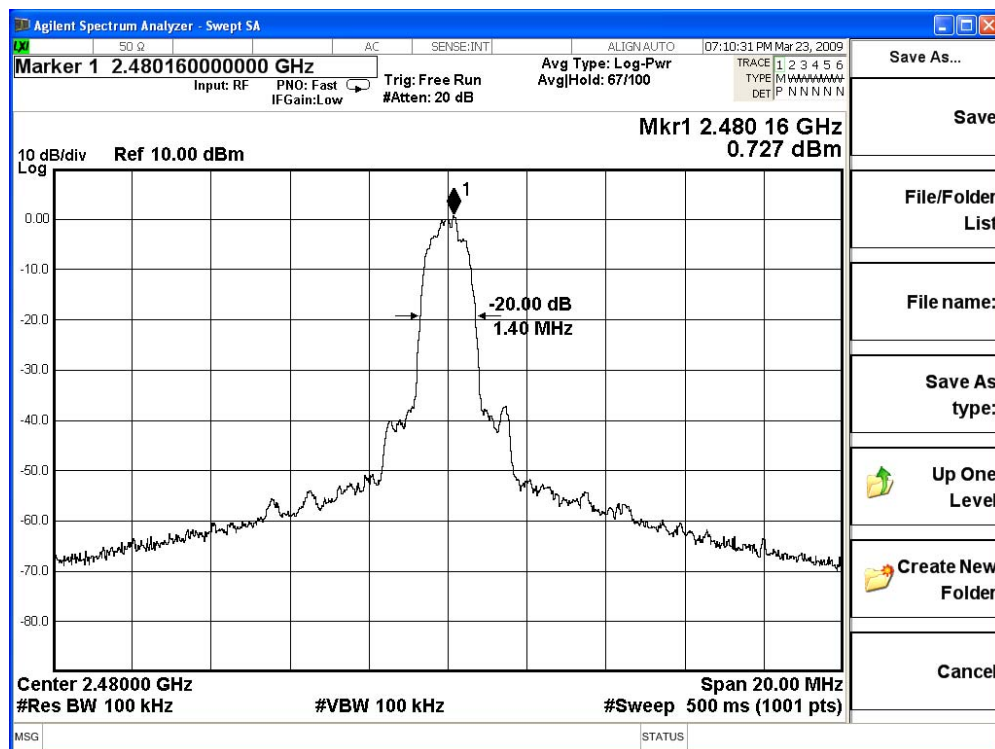
Figure Channel 39:



Product : Personal Navigation Device  
 Test Item : Occupied Bandwidth Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 2: Transmitter - 3Mbps (8DPSK)(2480MHz)

| Channel No. | Frequency (MHz) | Measurement Level (kHz) | Required Limit (kHz) | Result |
|-------------|-----------------|-------------------------|----------------------|--------|
| 78          | 2480            | 1400                    | --                   | NA     |

Figure Channel 78:



## **11. EMI Reduction Method During Compliance Testing**

No modification was made during testing.