



**HCT CO., LTD.**

Product Compliance Division

TEL : +82 31 639 8518 FAX : +82 31 639 8525

## **CERTIFICATE OF COMPLIANCE**

**FCC PART 15.247 & IC Certification**

**Applicant Name:**

HYUNDAI MOBIS CO., LTD.

**Address:**

80-9, MABOOK-RI, GUSEONG-EUP,  
YONGIN-SHI, GYUNGGI-DO, 449-912 SOUTH KOREA

**HYUNDAI MOBIS FRN:** 0014195663

**Date of Testing:**

April 08, 2010

**Test Site/Location:**

HCT CO., LTD. SAN136-1, AMI-RI, BUBAL-EUP, ICHEON-SI, KYOUNGKI-DO, 467-701 SOUTH KOREA

**Test Report No.:** HCTR1004FR11

**HCT FRN:** 0005866421

**IC Recognition No.:** 5944A-1

**FCC ID:** **TQ8-AVN-200TFU**

**IC:** **5074A-AVN200TFCA**

**APPLICANT:** **HYUNDAI MOBIS CO., LTD.**

**FCC Model(s):** AVN-200TFU

**IC Model(s):** AVN-200TFCA

**EUT Type:** AVN SYSTEM

**Max. RF Output Power:** 2.14 dBm(1.64 mW)

**Frequency Range:** 2402 - 2480 MHz (Bluetooth)

**Modulation type** GFSK, PSK

**FCC Classification:** FCC Part 15 Frequency Hopping Spread Spectrum Transceiver

**FCC Rule Part(s):** Part 15 subpart C 15.247

**IC Rule :** RSS-210, RSS-GEN

**IC Registration No. :** 5944A-1

**Engineering Statement:**

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

HCT CO., LTD. Certifies that no party to this application has been denied FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998, 21 U.S.C. 862

Hyo Sun Kwak

**Report prepared by**

**: Hyo Sun Kwak**

**Test engineer of RF Team**

Sang Jun Lee

**Approved by**

**: Sang Jun Lee**

**Manager of RF Team**

| <b>FCC PT.15.247<br/>TEST REPORT</b> |                               | <b>FCC &amp; IC CERTIFICATION REPORT</b> |                           |                         |  | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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## 1. GENERAL INFORMATION

**Applicant:** HYUNDAI MOBIS CO., LTD.  
80-9, MABOOK-RI, GUSEONG-EUP,  
YONGIN-SHI, GYUNGGI-DO, 449-912 SOUTH KOREA

**FCC ID:** TQ8-AVN-200TFU  
**IC:** 5074A-AVN200TFCA  
**EUT:** AVN SYSTEM  
**FCC Model(s):** AVN-200TFU  
**IC Model(s):** AVN-200TFCA  
**Date of Test:** February 06, 2010  
**Contact person:** Name: Seok Soo, Jeong  
Phone #: +82-31-288-5232/ Fax #: +82-31-899-1788

**Place of Tests:** HCT CO.,LTD.  
SAN136-1,AMI-RI,BUBAL-EUP,  
ICHEON-SI,KYOUNGKI-DO,467-701 South Korea  
(IC Recognition No. : 5944A-1)

## 2. EUT DESCRIPTION

|                              |  |
|------------------------------|--|
| <b>Product</b>               | AVN SYSTEM   |
| <b>FCC Model Name</b>        | AVN-200TFU   |
| <b>IC Model Name</b>         | AVN-200TFCA  |
| <b>Power Supply</b>          | DC 12 V  |
| <b>Frequency Range</b>       | 2402 ~ 2480 MHz  |
| <b>Transmit Power</b>        | 2.14 dBm(1.64 mW)  |
| <b>Modulation Type</b>       | GFSK(Normal), PSK(EDR)   |
| <b>Modulation Technique</b>  | FHSS   |
| <b>Number of Channels</b>    | 79 Channels  |
| <b>Antenna Specification</b> | Manufacturer: AUTO INDUSTRIAL<br>Antenna type: CHIP Antenna<br>Peak Gain : -0.04 dBi |

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### 3. TEST METHODOLOGY

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz(ANSI C63.4-2003) and FCC Public Notice DA 00-705 dated March 30, 2000 entitled "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems" were used in the measurement of the **HYUNDAI MOBIS CO., LTD. AVN SYSTEM FCC ID: TQ8-AVN-200TFU IC ID: 5074A-AVN200TFCA**

#### 3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

#### 3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

#### 3.3 GENERAL TEST PROCEDURES

##### Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version :2003) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

##### Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4. (Version: 2003)

#### 3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

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### 3.5 STANDARD

| Description of Test                 | FCC Rule Parts             | IC Standard Sections                    | Results   |
|-------------------------------------|----------------------------|---|-----------|
| Carrier Frequency Separation        | §15.247(a)(1)              | RSS-210, A8.1(b)                        | Compliant |
| 20 dB Bandwidth                     | §15.247(a)(1)(ii) or (iii) | RSS-210, A8.1(a)                        | Compliant |
| Number of Hopping Frequencies       | §15.247(a)(1)(ii) or (iii) | RSS-210, A8.1(d)                        | Compliant |
| Time of Occupancy                   | §15.247(a)(1)(ii) or (iii) | RSS-210, A8.1(d)                        | Compliant |
| Conducted Maximum Peak Output Power | §15.247(b)(1)              | RSS-210, A8.4(2)                        | Compliant |
| Spurious RF Conducted Emissions     | §15.247(d)                 | RSS-210, A8.5<br>RSS-GEN, Section 7.2.3 | Compliant |
| Spurious Radiated Emissions         | §15.247(d), 15.209         | RSS-210, A2.9<br>RSS-GEN, Section 7.2.3 | Compliant |
| Receiver Spurious Emissions         | -                          | RSS-GEN, Setion 4.10                    | Compliant |
| Out-of- Band Emissions              | §15.247(d)                 | RSS-210, A8.5                           | Compliant |
| OCCUPIED BANDWIDTH                  |                            | RSS-210, A1.1                           | Compliant |

| FCC PT.15.247 TEST REPORT       | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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## 4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

## 5. FACILITIES AND ACCREDITATIONS

### 5.1 FACILITIES

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1, Maekok-Ri, Hobup-Myun, Ichon-Si, Kyoungki-Do, 467-701, KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2003) and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 10, 2009 (Registration Number: 90661)

### 5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## 6. ANTENNA REQUIREMENTS

### According to FCC 47 CFR §15.203:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

\* The antennas of this E.U.T are permanently attached.

\*The E.U.T Complies with the requirement of §15.203

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## 7. FCC PART 15.247 REQUIREMENTS

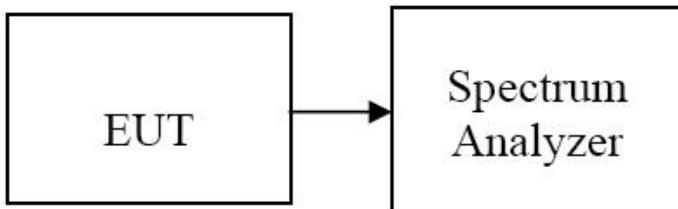
### 7.1 PEAK POWER

#### LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. For systems using digital modulation in the bands of 902 ~ 928 MHz, 2400 ~ 2483.5 MHz, and 5725 ~ 5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### Test Configuration



#### TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak detector mode.

1. Span = 2 MHz (GFSK) / 5 MHz (8DPSK)
2. RBW = 1 MHz (GFSK) / 3 MHz (8DPSK)
3. VBW = 1 MHz (GFSK) / 3 MHz (8DPSK)
4. Sweep = auto
5. Packet type= DH5 (GFSK) / 3-DH5 (8DPSK)

#### TEST RESULTS

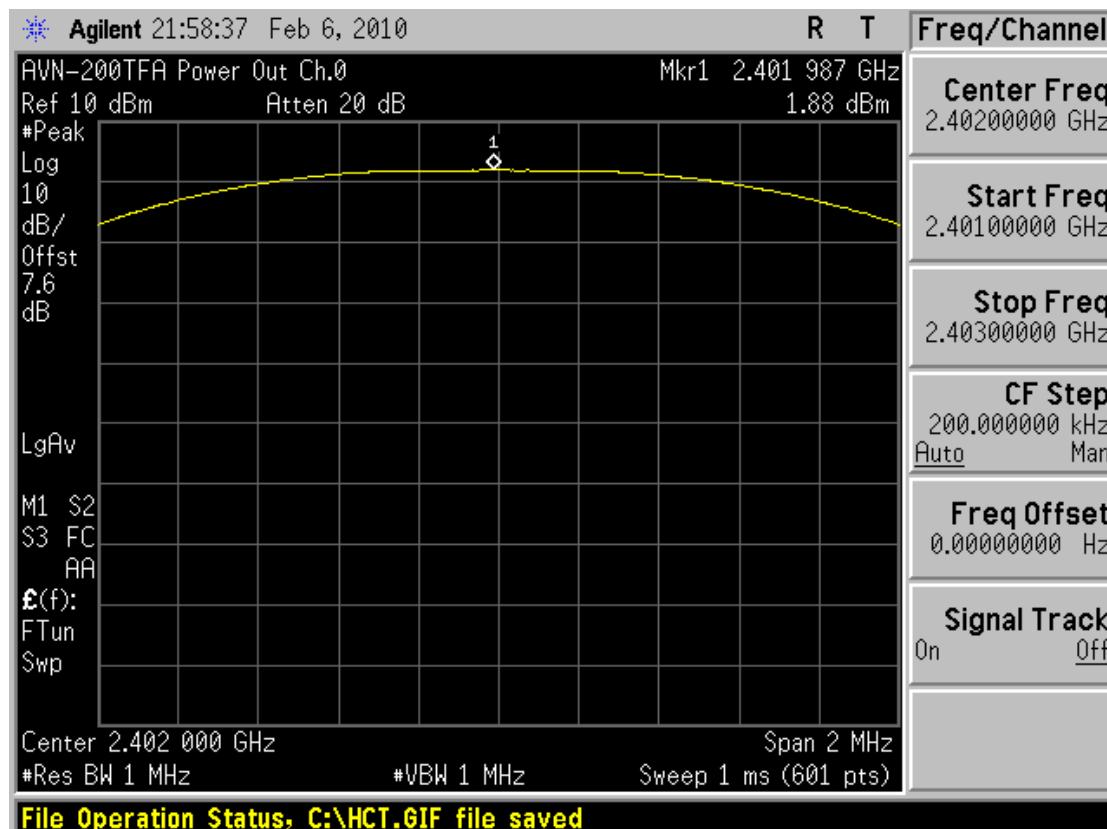
No non-compliance noted

#### Test Data

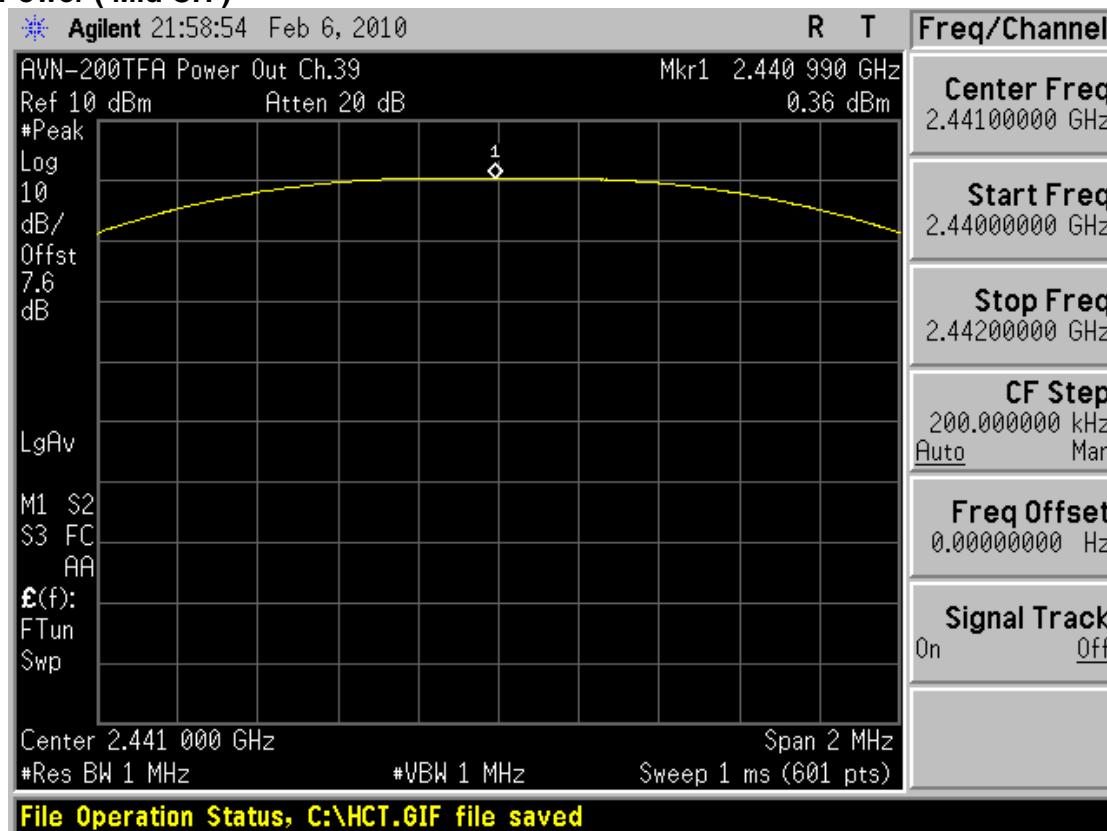
| Channel | Frequency<br>(MHz) | Output Power(GFSK) |      | Output Power(8DPSK) |      | Limit<br>(W) | Result |
|---------|--------------------|--------------------|------|---------------------|------|--------------|--------|
|         |                    | (dBm)              | (mW) | (dBm)               | (mW) |              |        |
| Low     | 2402               | 1.88               | 1.54 | 2.14                | 1.64 | 1            | PASS   |
| Mid     | 2441               | 0.36               | 1.09 | 0.67                | 1.17 |              | PASS   |
| High    | 2480               | -1.65              | 0.68 | -1.25               | 0.75 |              | PASS   |

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Test Plots  
(GFSK)  
Peak Power ( Low CH )

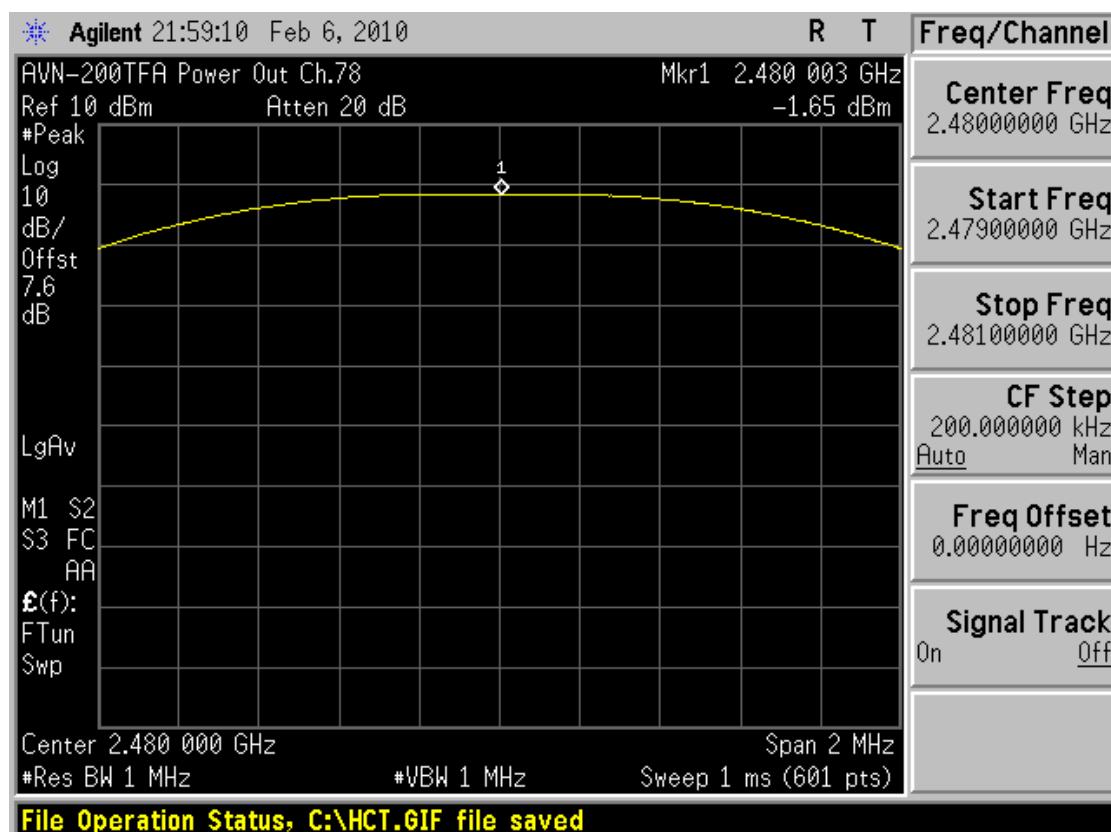


Peak Power ( Mid CH )



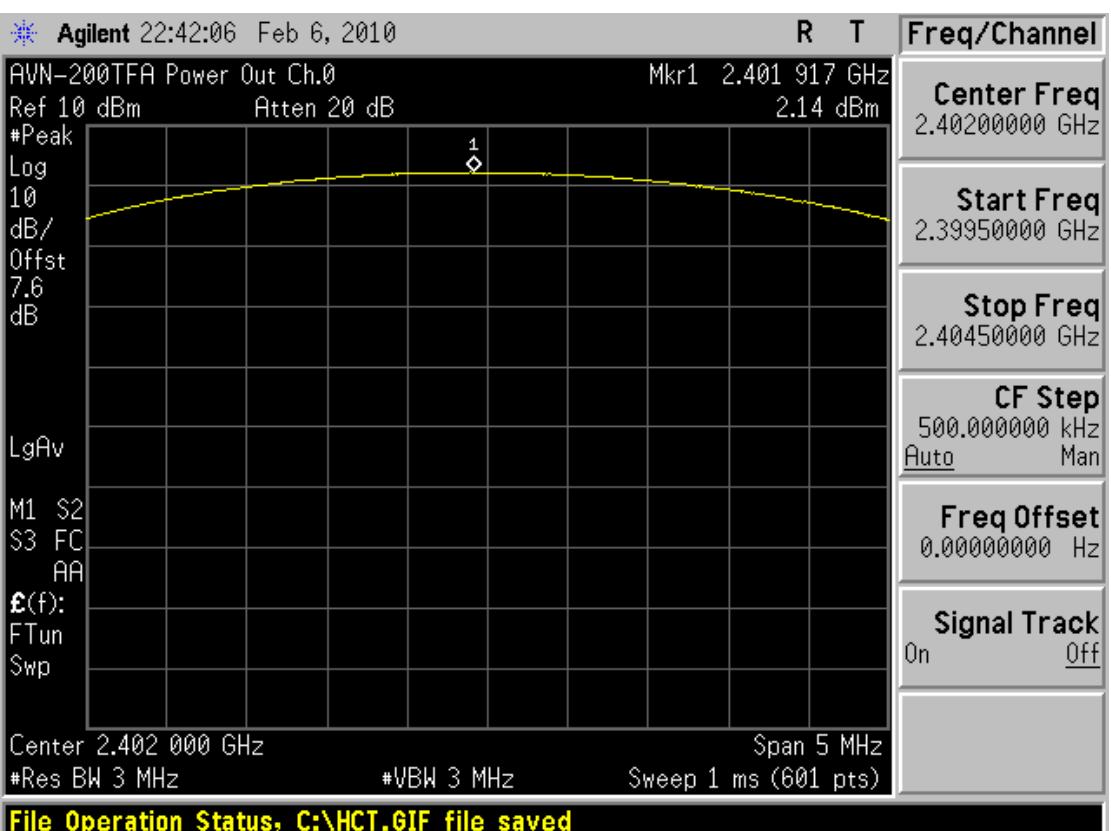
| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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### Peak Power ( High CH )



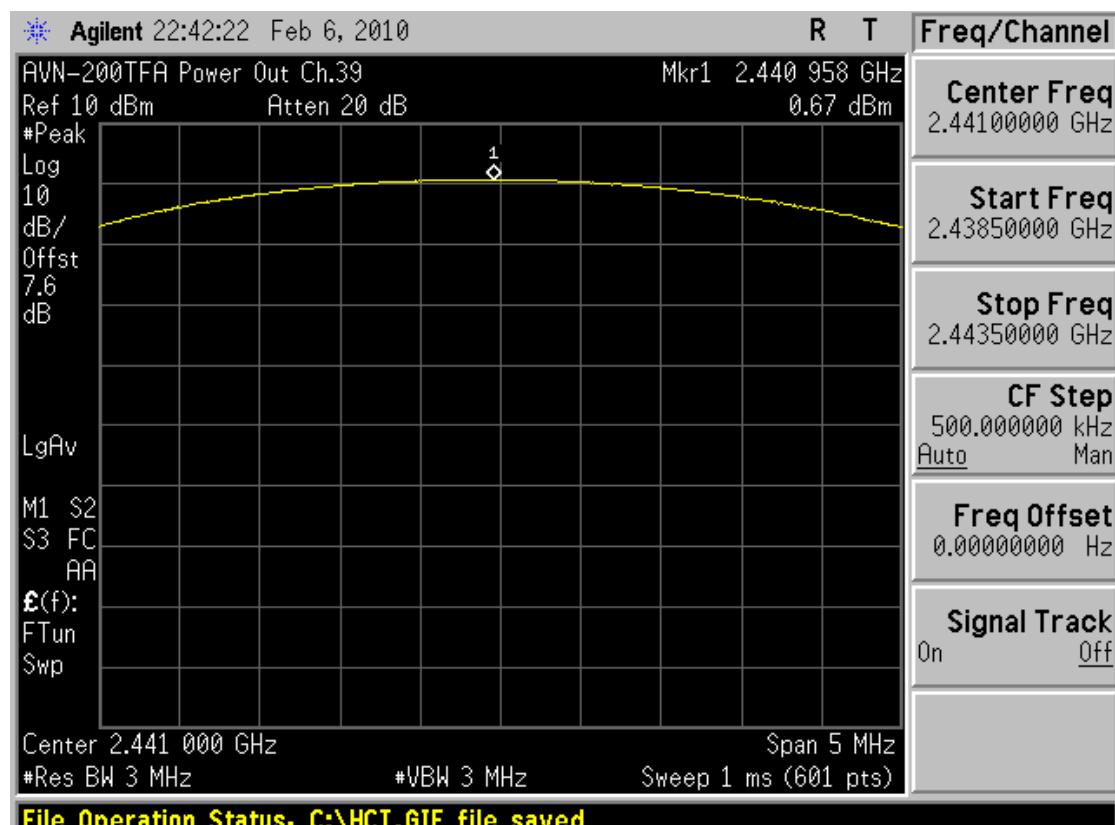
### (8DPSK)

### Peak Power ( Low CH )

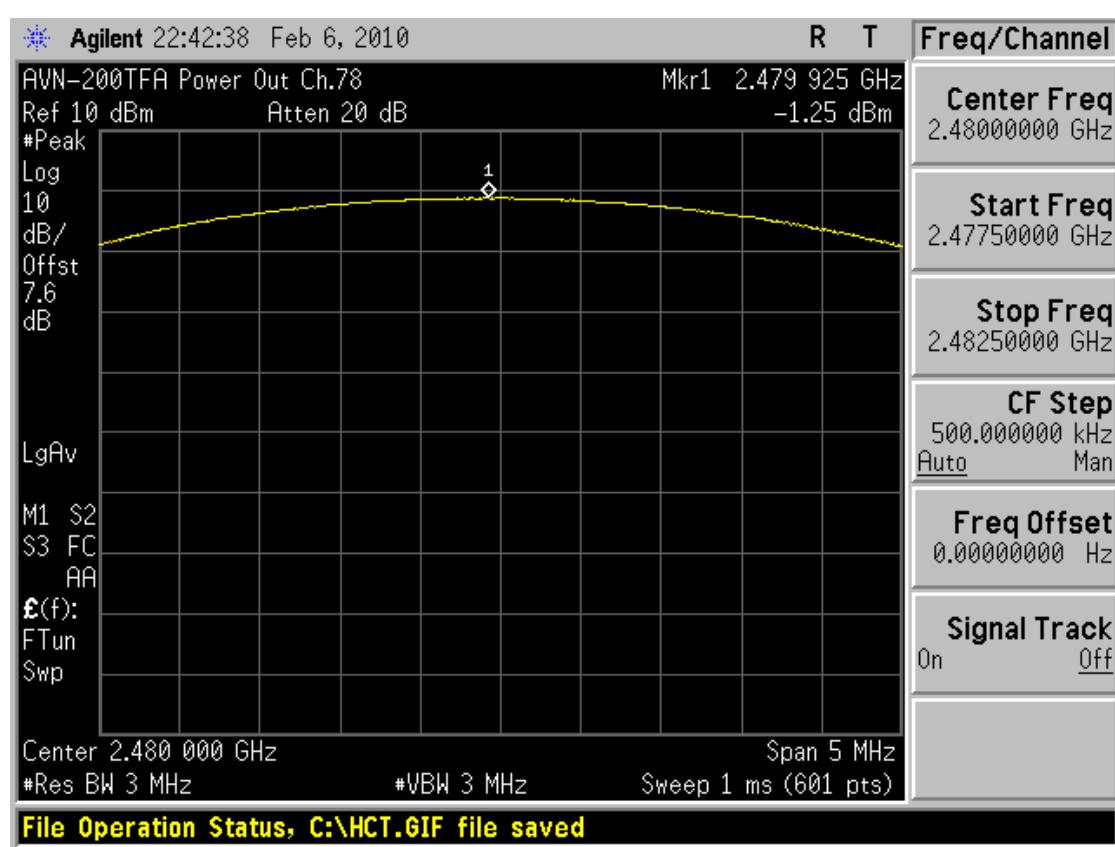


| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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### Peak Power ( Mid CH )



### Peak Power ( High CH )



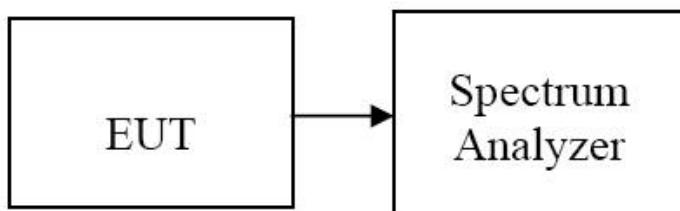
| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | www.hct.co.kr |
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## 7.2 BAND EDGES MEASUREMENT

### LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

### Test Configuration



### TEST PROCEDURE

The spectrum analyzer is set to :

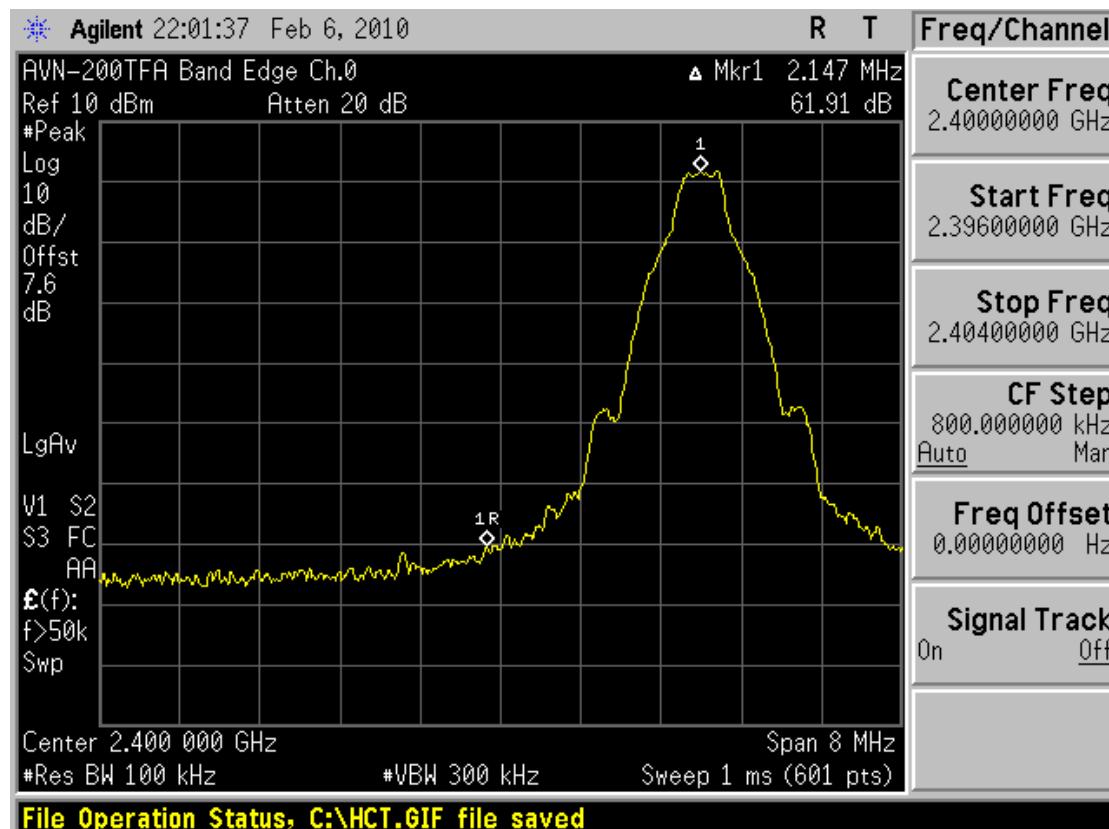
1. Span = 8 MHz
2. RBW = 100 kHz
3. VBW = 300 kHz
4. Sweep = auto
5. Detector Mode = Peak

### TEST RESULTS

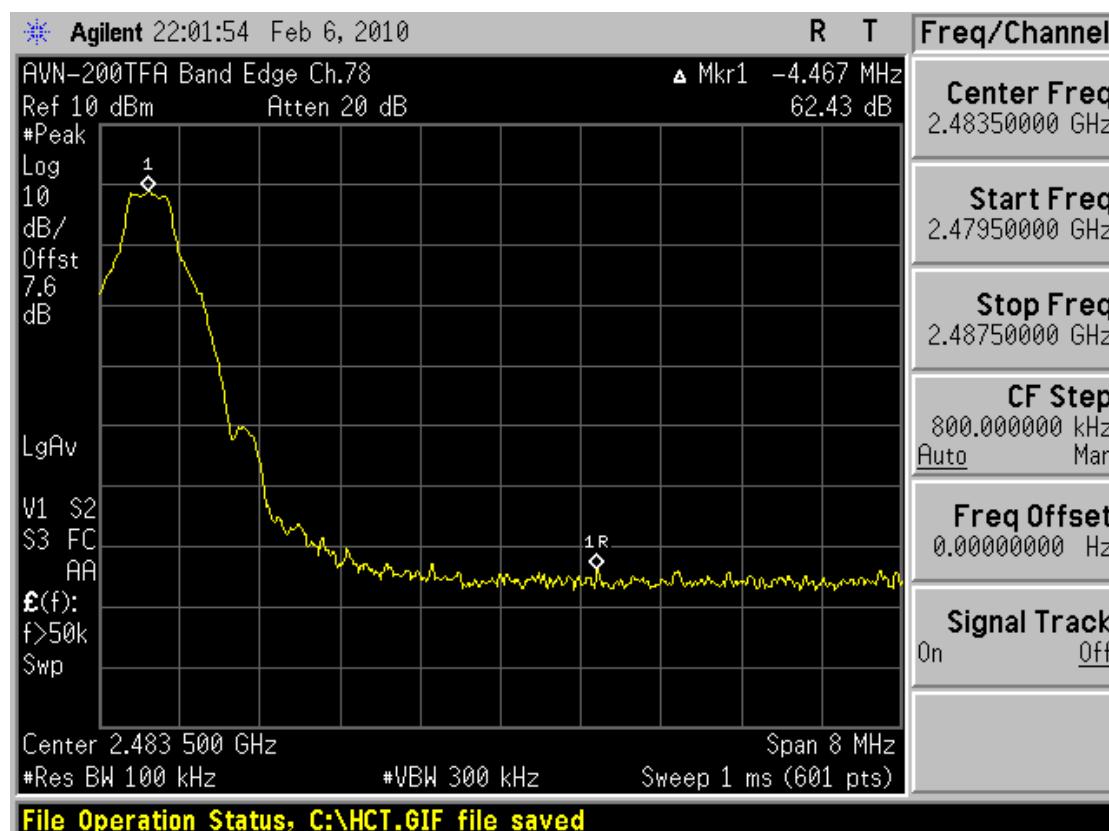
See attached.

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### Test Data (GFSK) Band Edges (Low- CH)

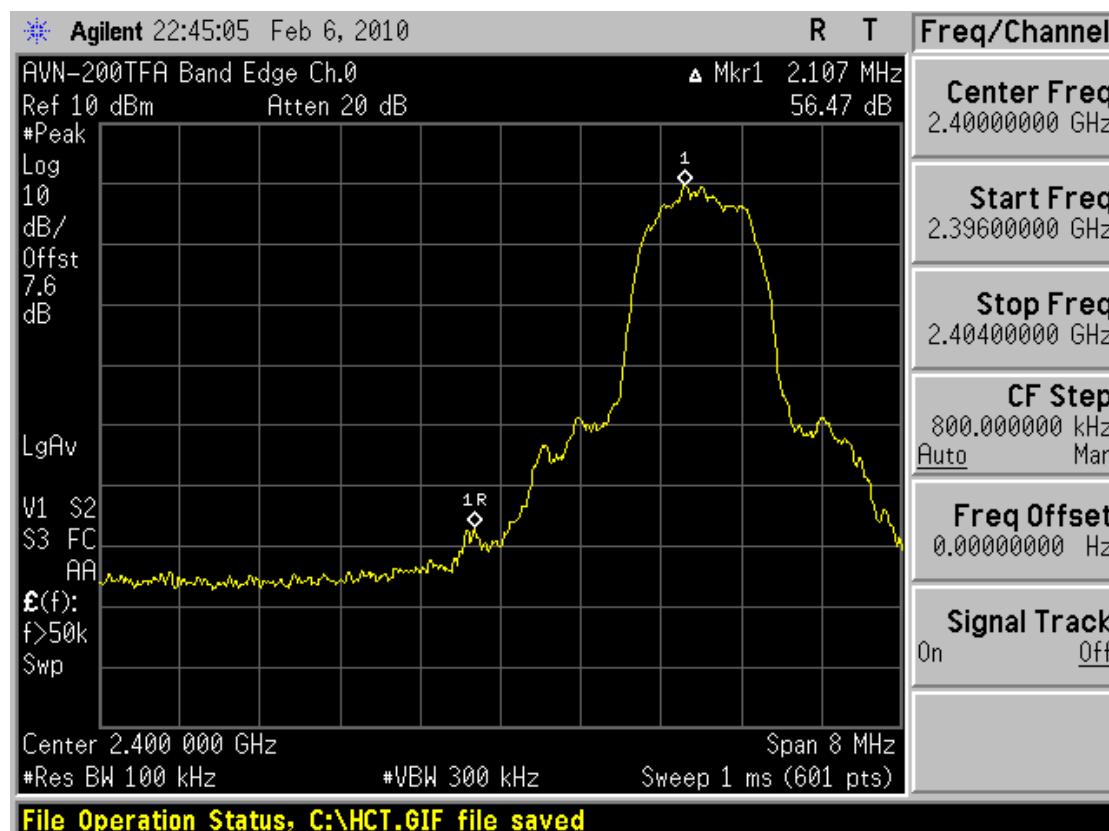


### Band Edges (High-CH)

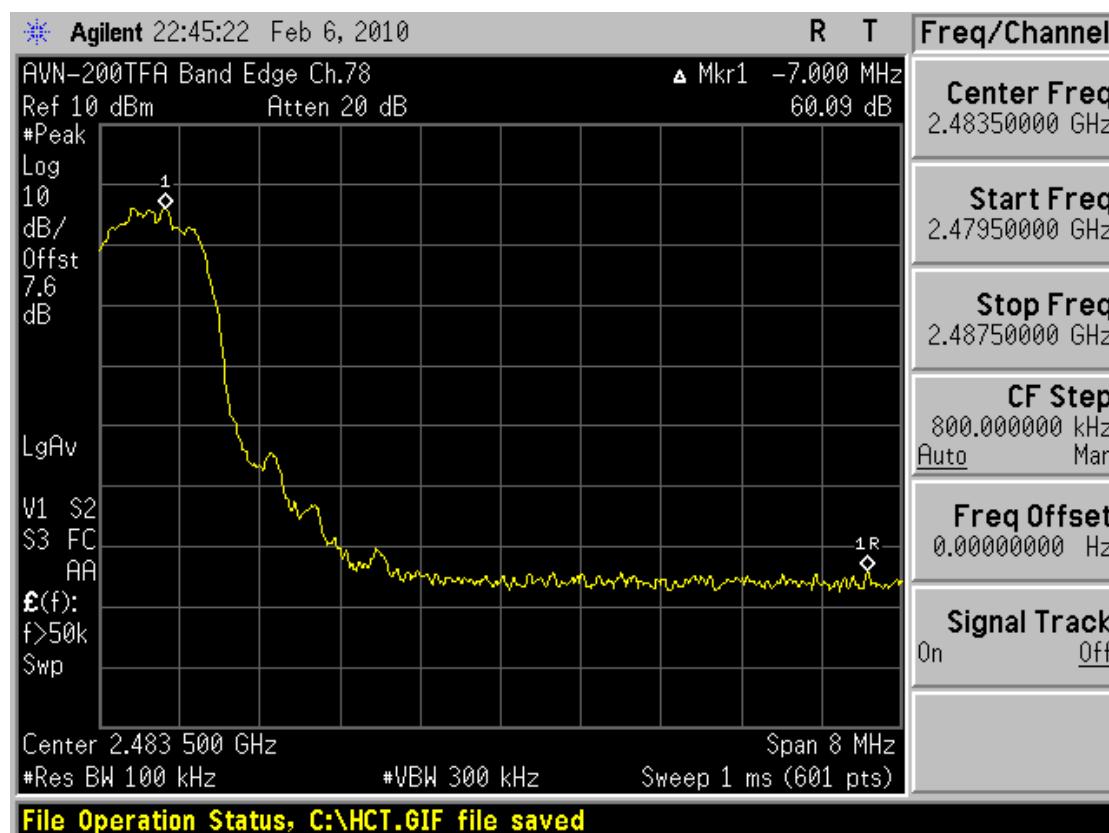


| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                          |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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### Test Data (8DPSK) Band Edges (Low- CH)



### Band Edges (High-CH)

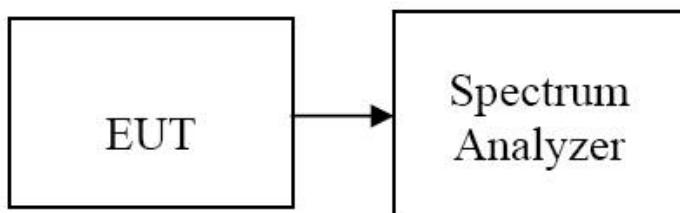


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## 7.3 FREQUENCY SEPARATION / OCCUPIED BANDWIDTH (99% BW) LIMIT

According to §15.247(a)(1), Frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

### Test Configuration



### TEST PROCEDURE

The spectrum analyzer is set to :

1. Span = 3 MHz
2. RBW = 30 kHz
3. VBW = 100 kHz
4. Sweep = auto

The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

### TEST RESULTS

No non-compliance noted

#### Test Data

| Channel Separation (kHz) |       | 20dB Bandwidth (kHz) |        |          | Limit (kHz)                      | Result |
|--------------------------|-------|----------------------|--------|----------|----------------------------------|--------|
| GFSK                     | 8DPSK | Channel              | GFSK   | 8DPSK    |                                  |        |
| 995                      | 1000  | Low CH               | 928.52 | 1,277.09 | >25 or<br>>2/3 of the<br>20dB BW | Pass   |
|                          |       | Middle CH            | 930.25 | 1,274.47 |                                  |        |
|                          |       | High CH              | 931.92 | 1,276.72 |                                  |        |

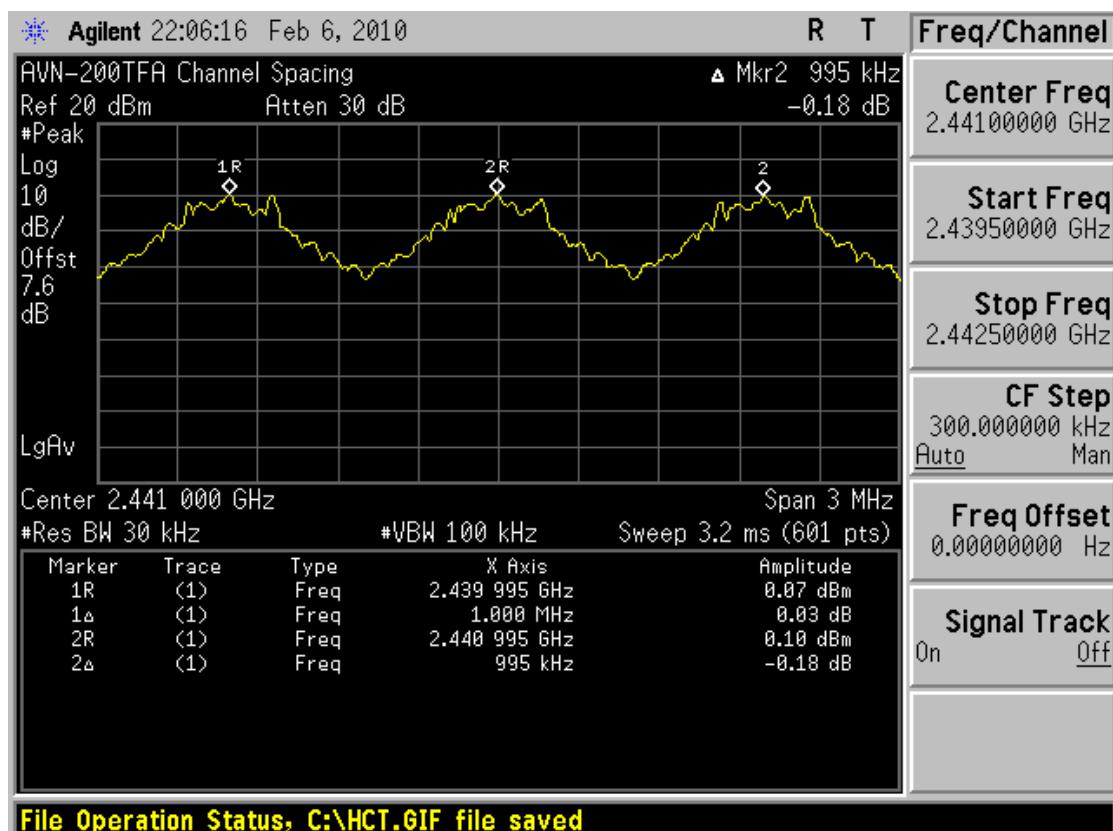
#### Occupied Bandwidth (99% BW )

| 99% BW (kHz) |        |          | Result |
|--------------|--------|----------|--------|
| Channel      | GFSK   | 8DPSK    |        |
| Low CH       | 849.98 | 1,167.85 | Pass   |
| Middle CH    | 845.39 | 1,165.30 |        |
| High CH      | 854.46 | 1,166.21 |        |

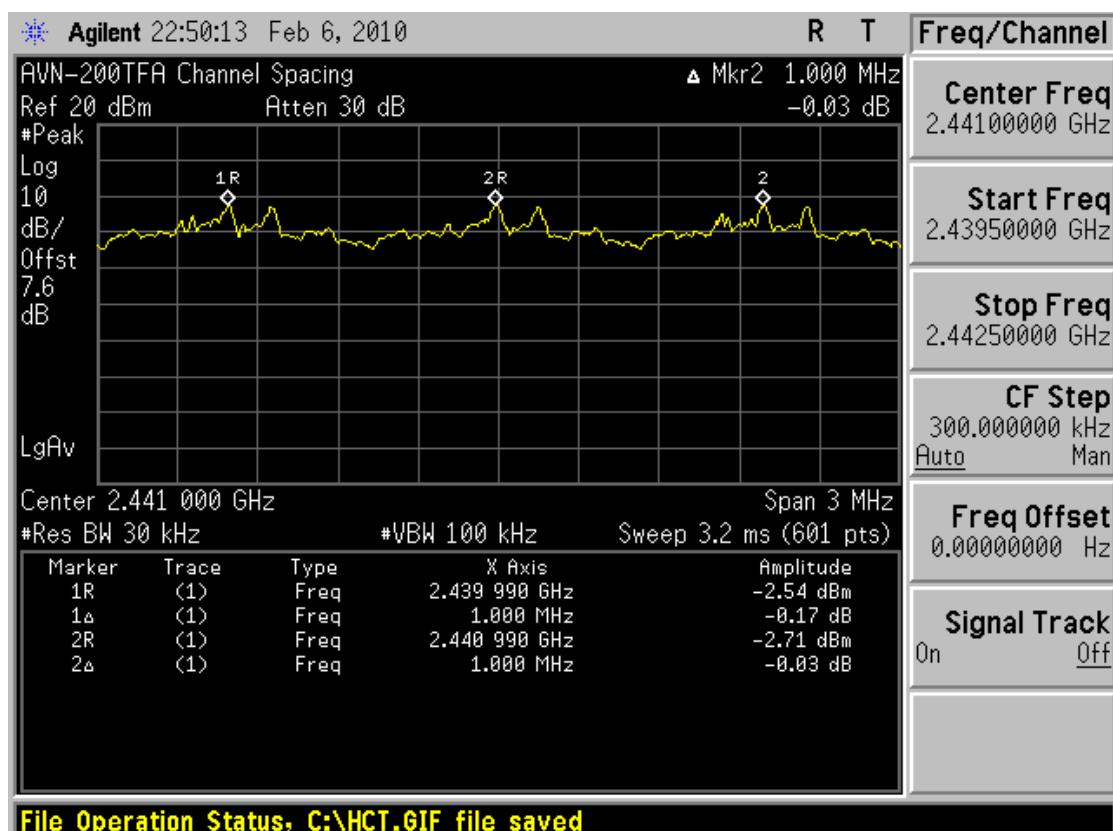
| FCC PT.15.247 TEST REPORT | FCC & IC CERTIFICATION REPORT |            |                |                  | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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## Test Plot

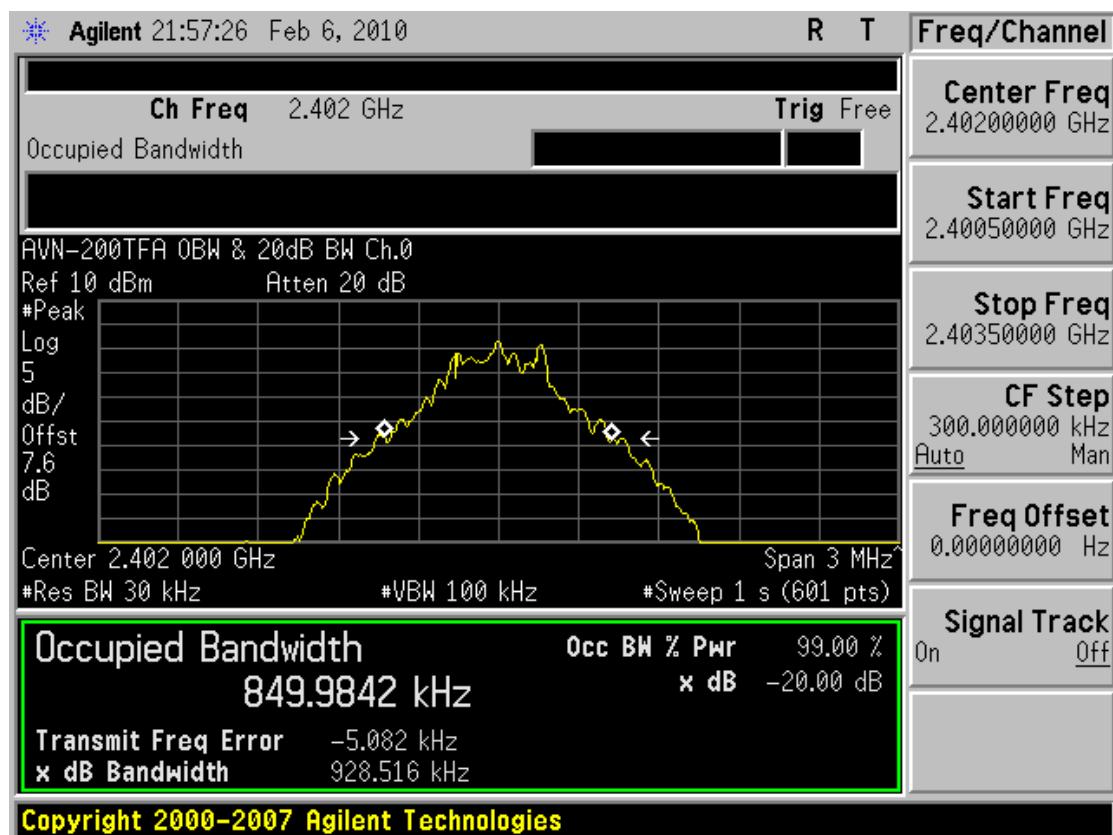
### Measurement of Channel Separation(GFSK)



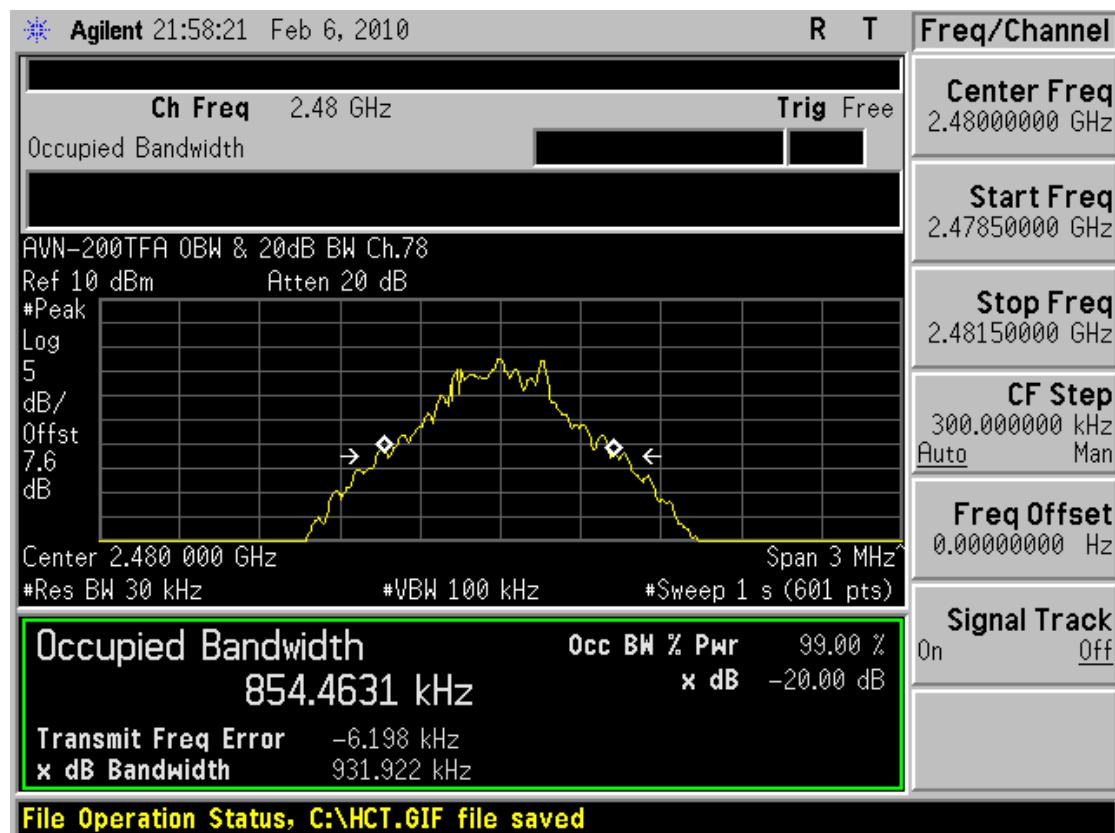
### Measurement of Channel Separation(8DPSK)



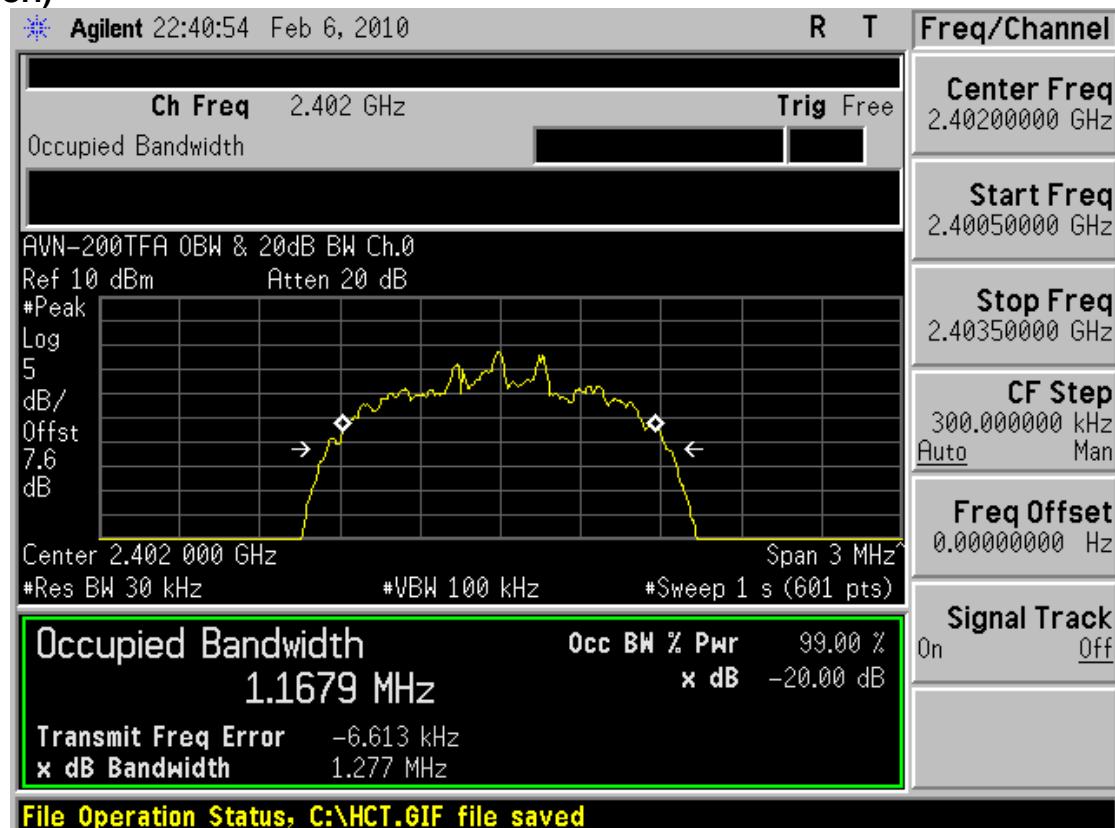
| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 15 of 44                                    |

**Test Plot (GFSK)**
**20 dB bandwidth & Measurement of Occupied Bandwidth  
(Low CH)**

**( Mid CH)**


| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 16 of 44                                    |

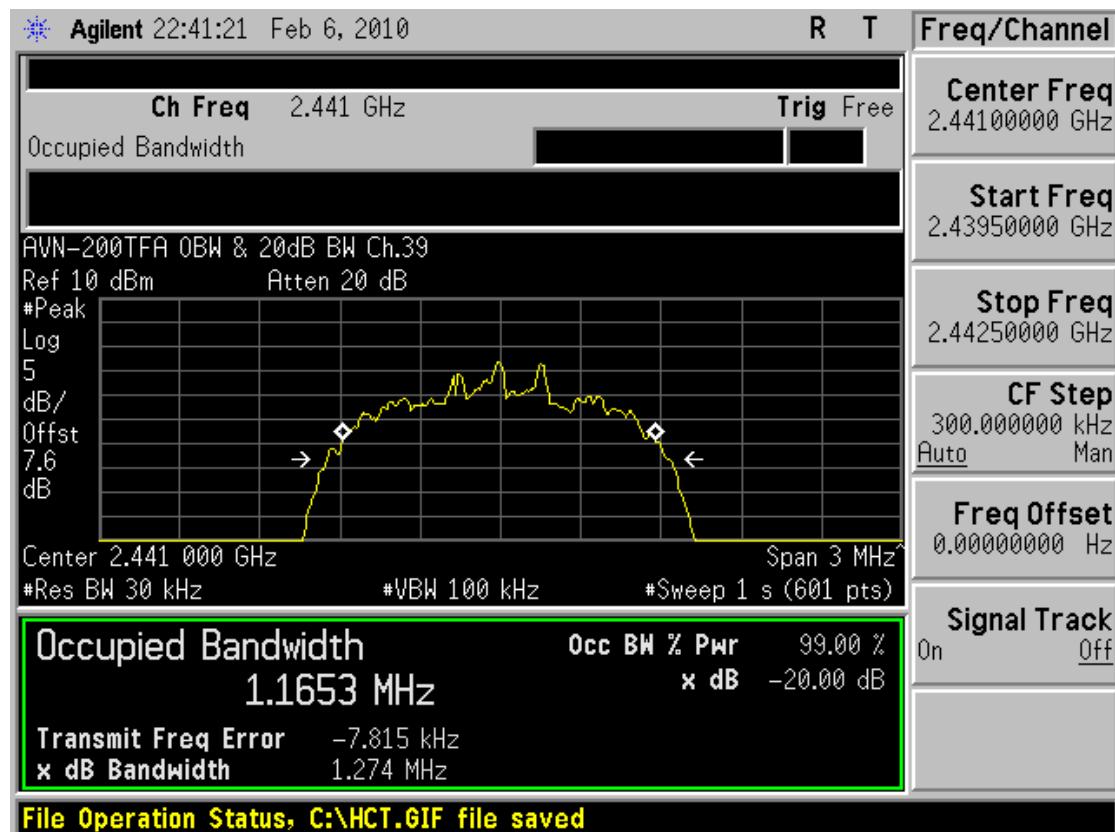
**(High CH)**

**Test Plot (8DPSK)**

20 dB bandwidth &amp; Measurement of Occupied Bandwidth

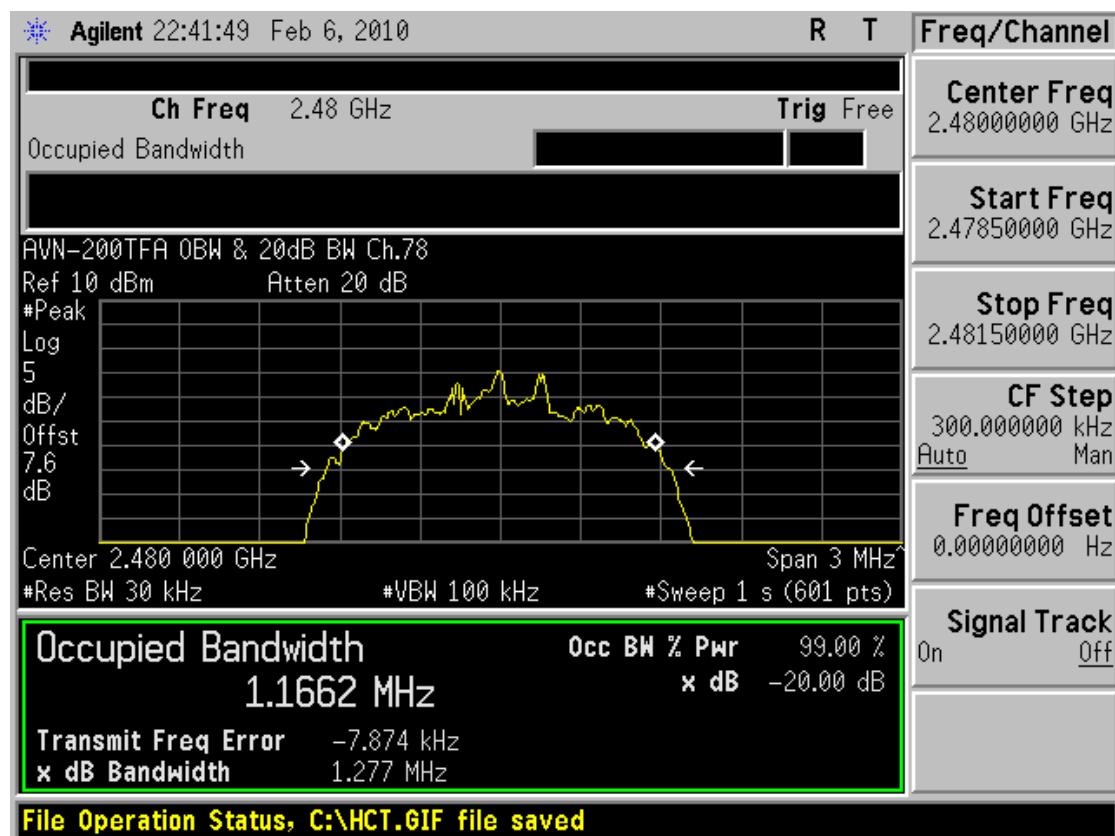
**(Low CH)**


| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                          | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|--------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN-200TFCA | Page 17 of 44                                    |

( Mid CH)



(High CH)



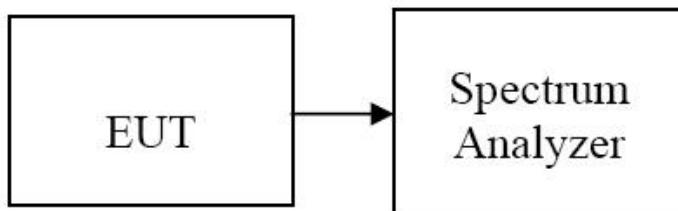
| FCC PT.15.247 TEST REPORT    |                            | FCC & IC CERTIFICATION REPORT |                        |                      | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|------------------------------|----------------------------|-------------------------------|------------------------|----------------------|--|
| Test Report No. HCTR1004FR11 | Test Dates: April 08, 2010 | EUT Type: AVN SYSTEM          | FCC ID: TQ8-AVN-200TFU | IC: 5074A-AVN200TFCA | Page 18 of 44                                    |

## 7.4 NUMBER OF HOPPING FREQUENCY

### LIMIT

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands shall use at least 15 hopping frequencies.

### Test Configuration



### TEST PROCEDURE

The Bluetooth frequency hopping function of the EUT was enabled. The spectrum analyzer was set to :

1. Span = the frequency band of operation ( Start = 2400 MHz, Stop = 2483.5 MHz )
2. RBW = 300 kHz
3. VBW = 300 kHz
4. Sweep = auto

The trace was allowed to stabilize.

### TEST RESULTS

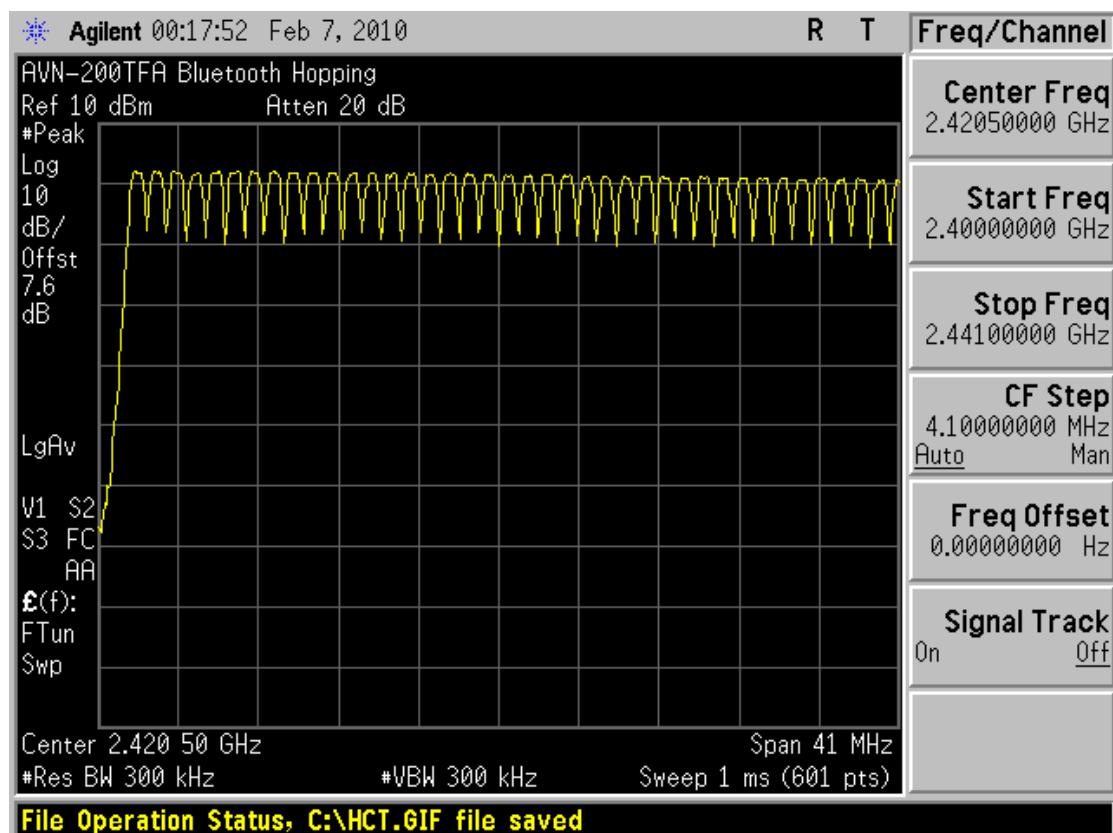
No non-compliance noted

### Test Data

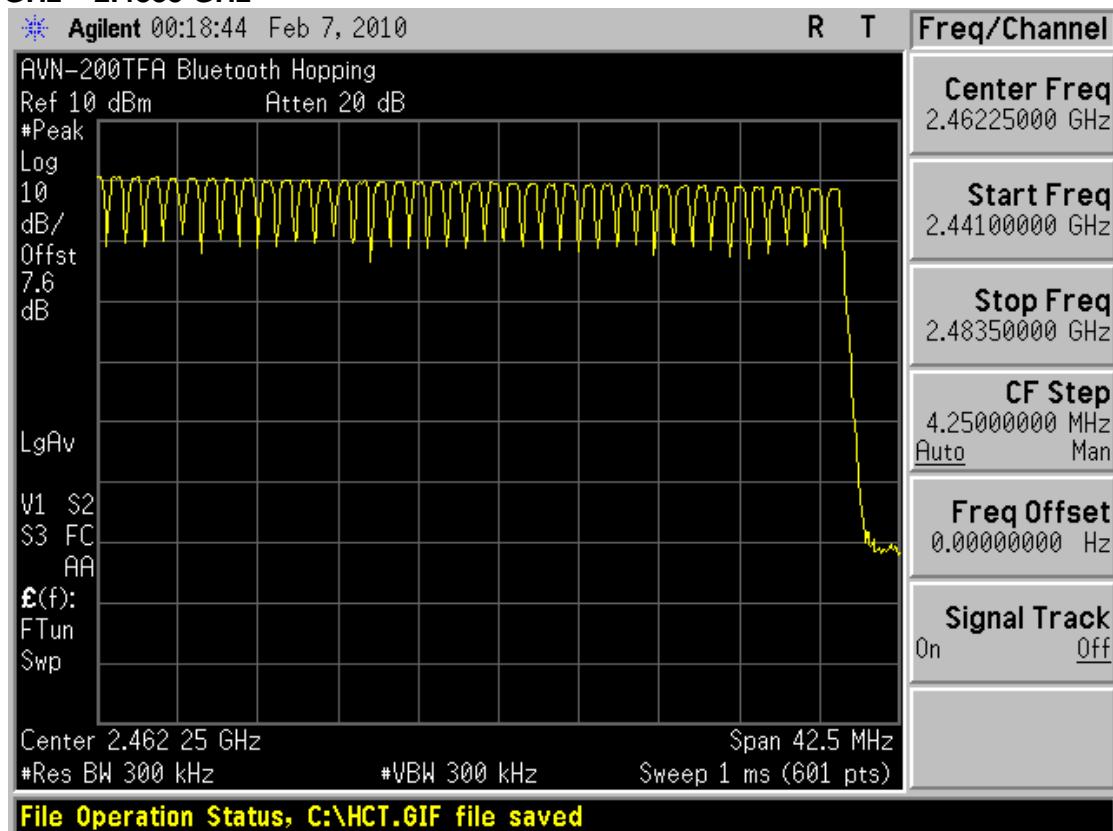
| Result (No. of CH) | Limit (No. of CH) | Result |
|--------------------|-------------------|--------|
| 79                 | >15               | Pass   |

|                                 |                               |                         |                           |                         |  |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 19 of 44                                    |

**Test Plot**  
**Number of Channels (GFSK)**  
**2.4 GHz – 2.441 GHz**



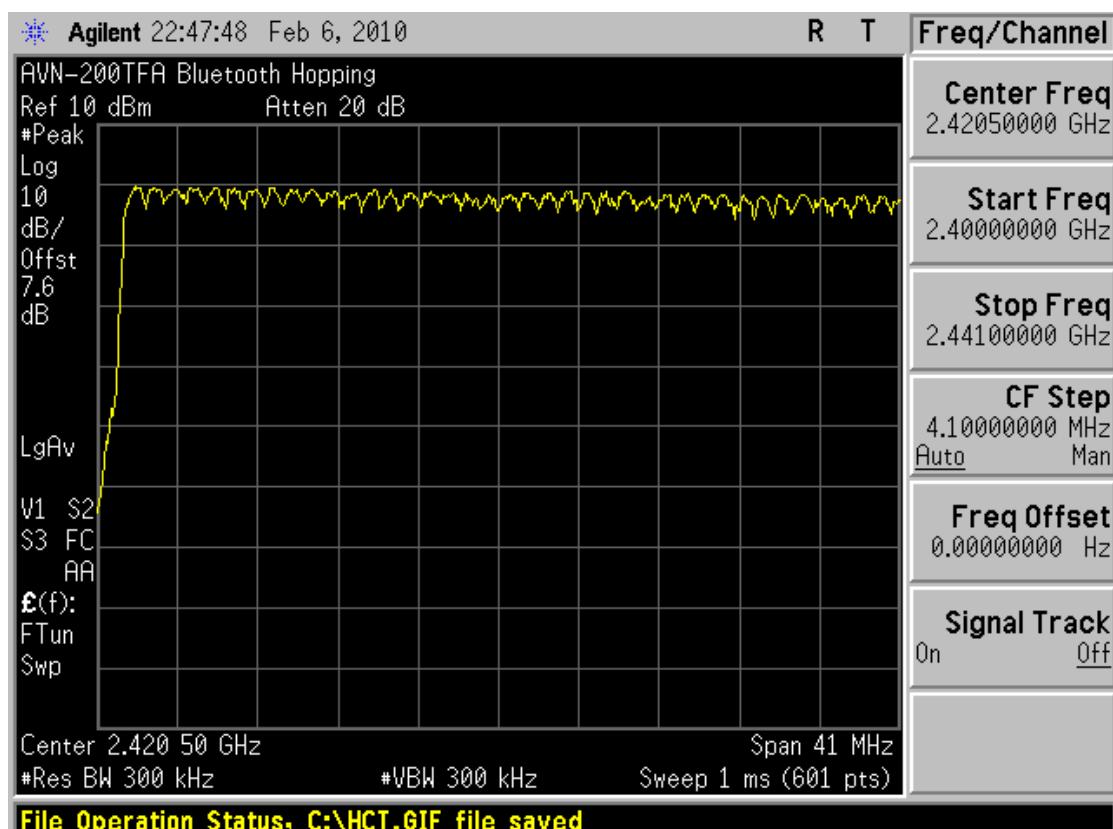
**2.441 GHz – 2.4835 GHz**



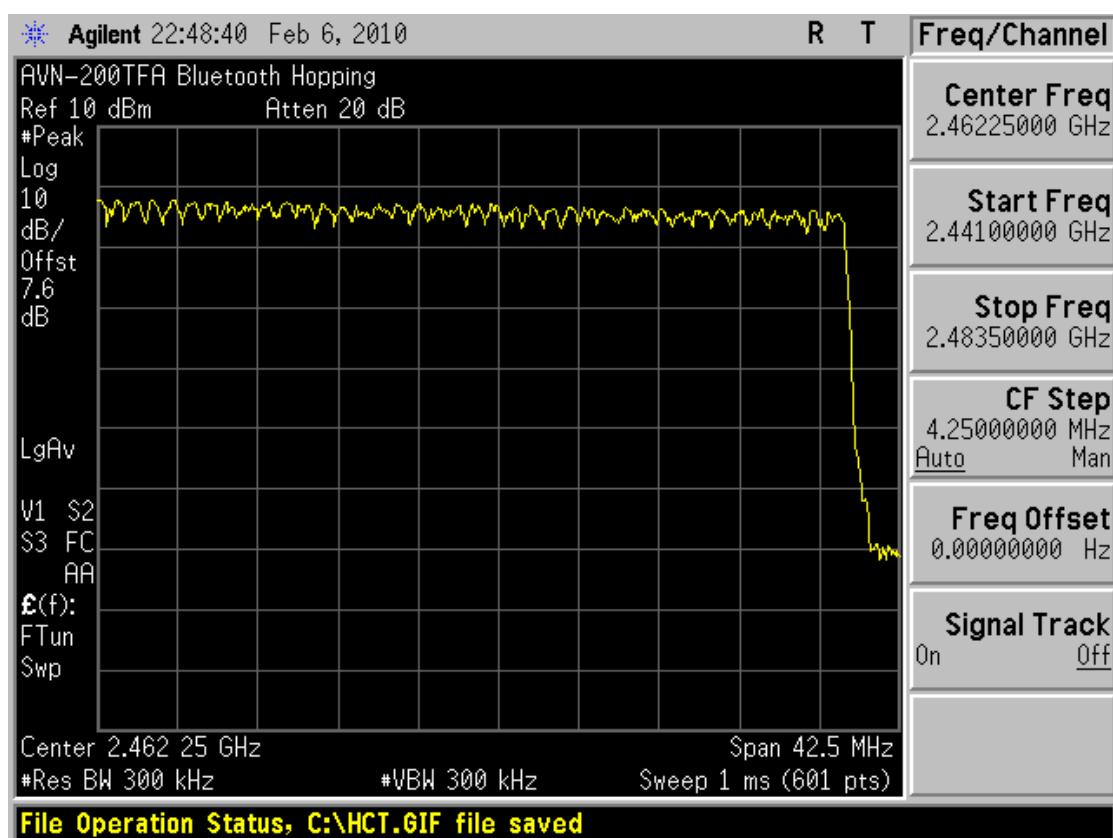
| FCC PT.15.247 TEST REPORT       | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 20 of 44                                    |

## Number of Channels (8DPSK)

2.4 GHz – 2.441 GHz



## 2.441 GHz – 2.4835 GHz



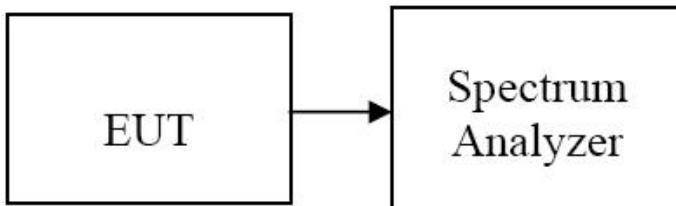
| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 21 of 44                                    |

## 7.5 TIME OF OCCUPANCY (DWELL TIME)

### LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### Test Configuration



### TEST PROCEDURE

EUT was set to transmit the longest packet type (DH5)

1. Span = zero span
2. RBW = 1 MHz
3. VBW = 1 MHz
4. Sweep = as necessary to capture the entire dwell time per channel

The marker-delta function was used to determine the dwell time.

### TEST RESULTS

See the table.

#### DH 5(The longest packet type for GFSK)

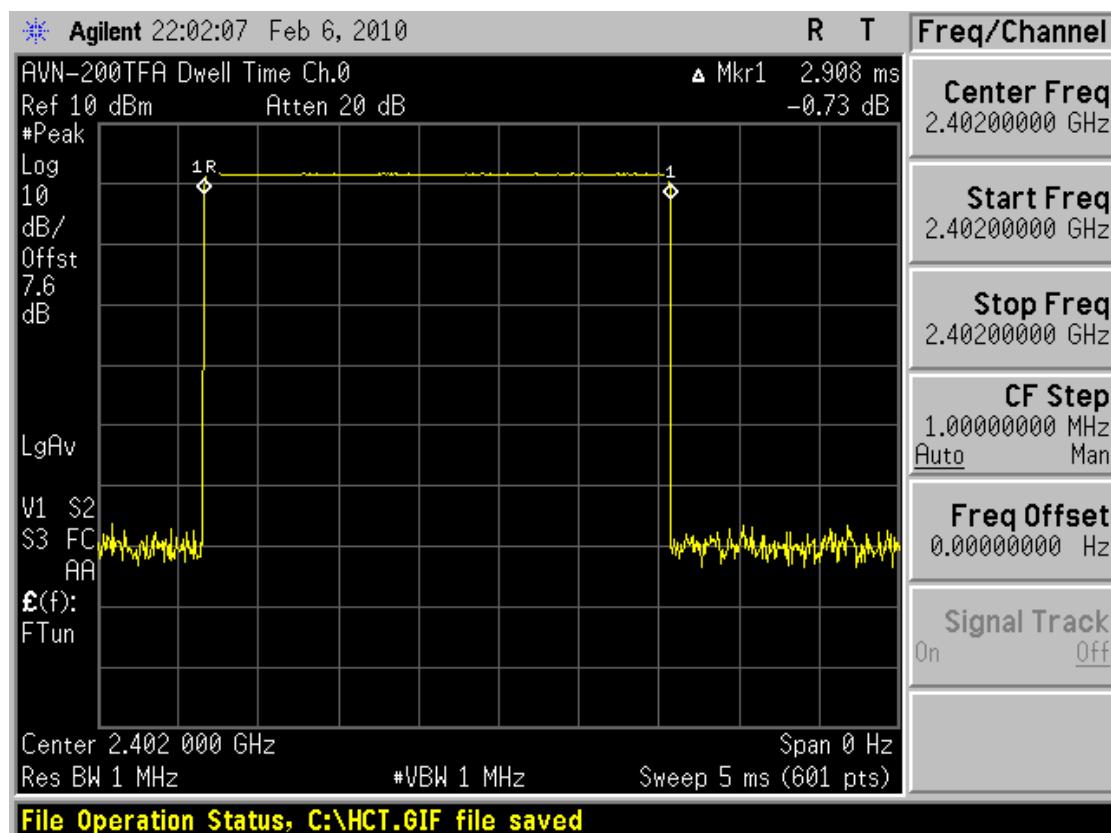
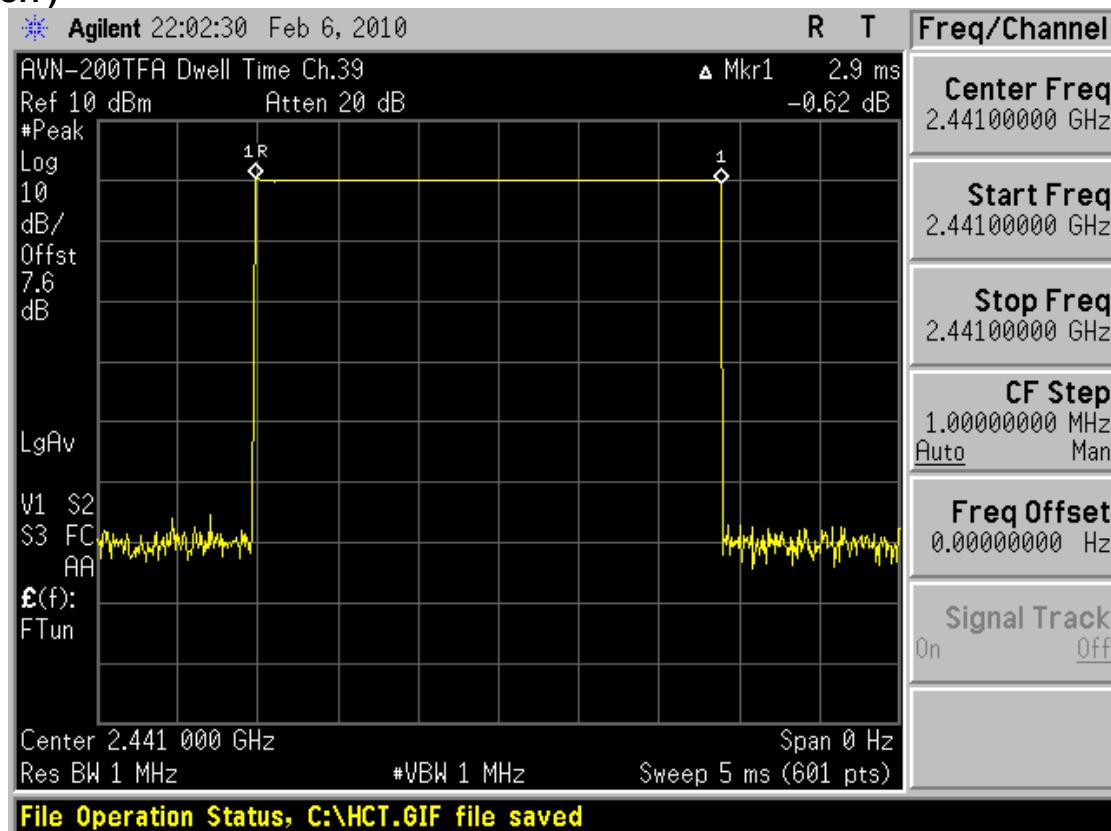
CH Mid :  $2.90 * (1600/6)/79 * 31.6 = 309.33$  (ms)

#### 3-DH 5(The longest packet type for 8DPSK)

CH Mid :  $2.91 * (1600/6)/79 * 31.6 = 310.40$  (ms)

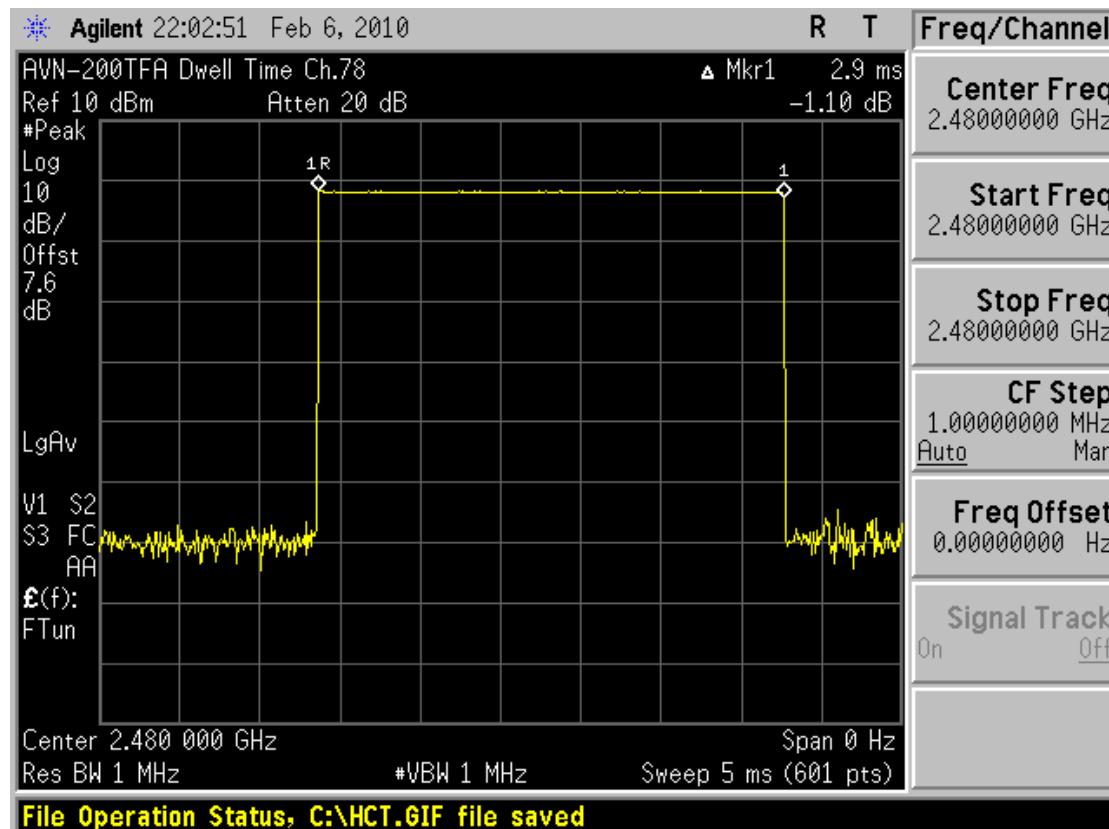
| Channel | Pulse Time (ms) |       | Total of Dwell (ms) |        | Period Time (s) | Limit (ms) | Result |
|---------|-----------------|-------|---------------------|--------|-----------------|------------|--------|
|         | GFSK            | 8DPSK | GFSK                | 8DPSK  |                 |            |        |
| Low     | 2.91            | 2.91  | 310.40              | 310.40 | 31.6            | 400        | PASS   |
| Mid     | 2.90            | 2.91  | 309.33              | 310.40 | 31.6            |            | PASS   |
| High    | 2.90            | 2.91  | 309.33              | 310.40 | 31.6            |            | PASS   |

| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 22 of 44                                    |

**Test Plots (GFSK)**
**DH 5**
**( Low CH )**

**( Mid CH )**


| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 23 of 44                                    |

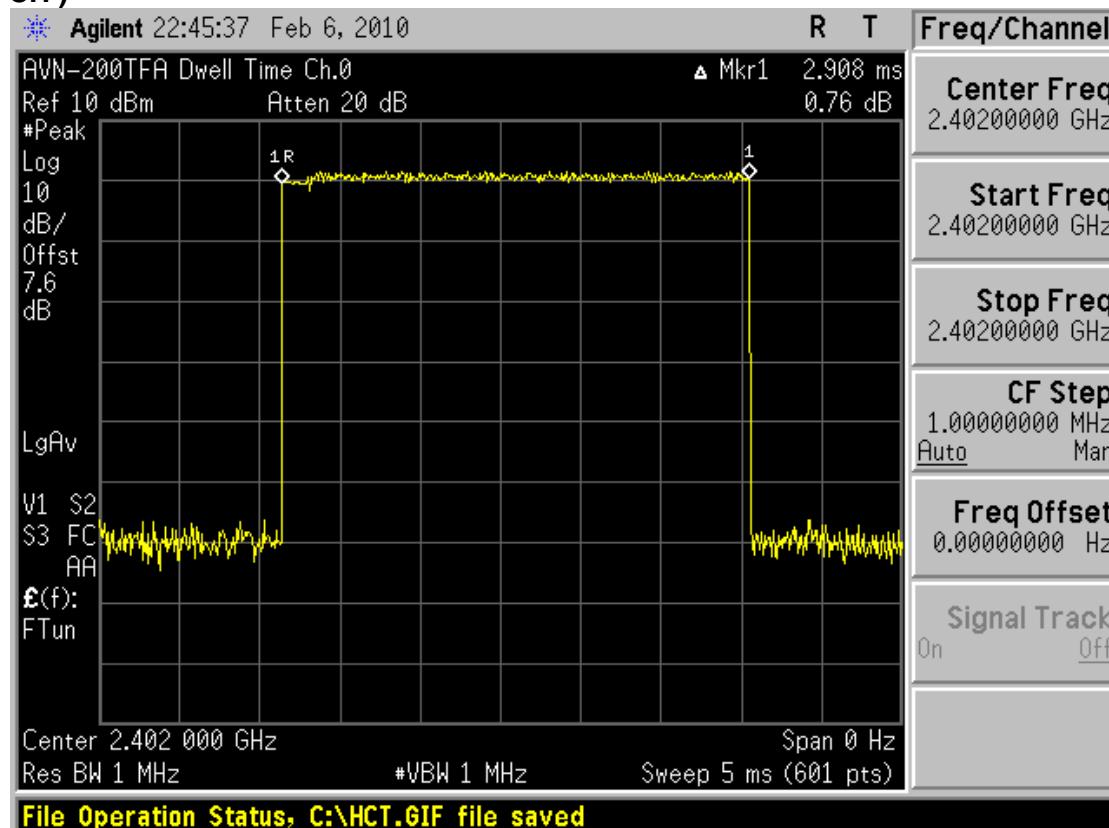
(CH High)



### Test Plots (8DPSK)

3-DH 5

( Low CH )



| FCC PT.15.247 TEST REPORT    |
|------------------------------|
| Test Report No. HCTR1004FR11 |

FCC & IC CERTIFICATION REPORT

[www.hct.co.kr](http://www.hct.co.kr)

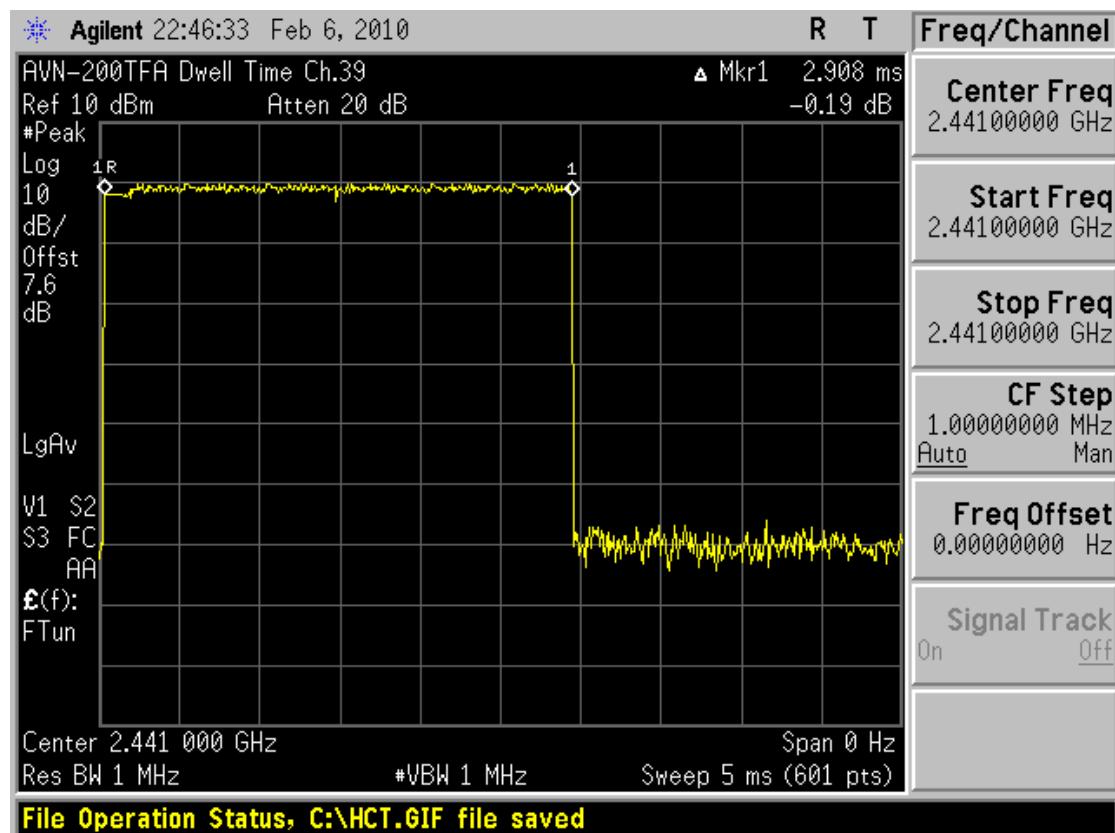
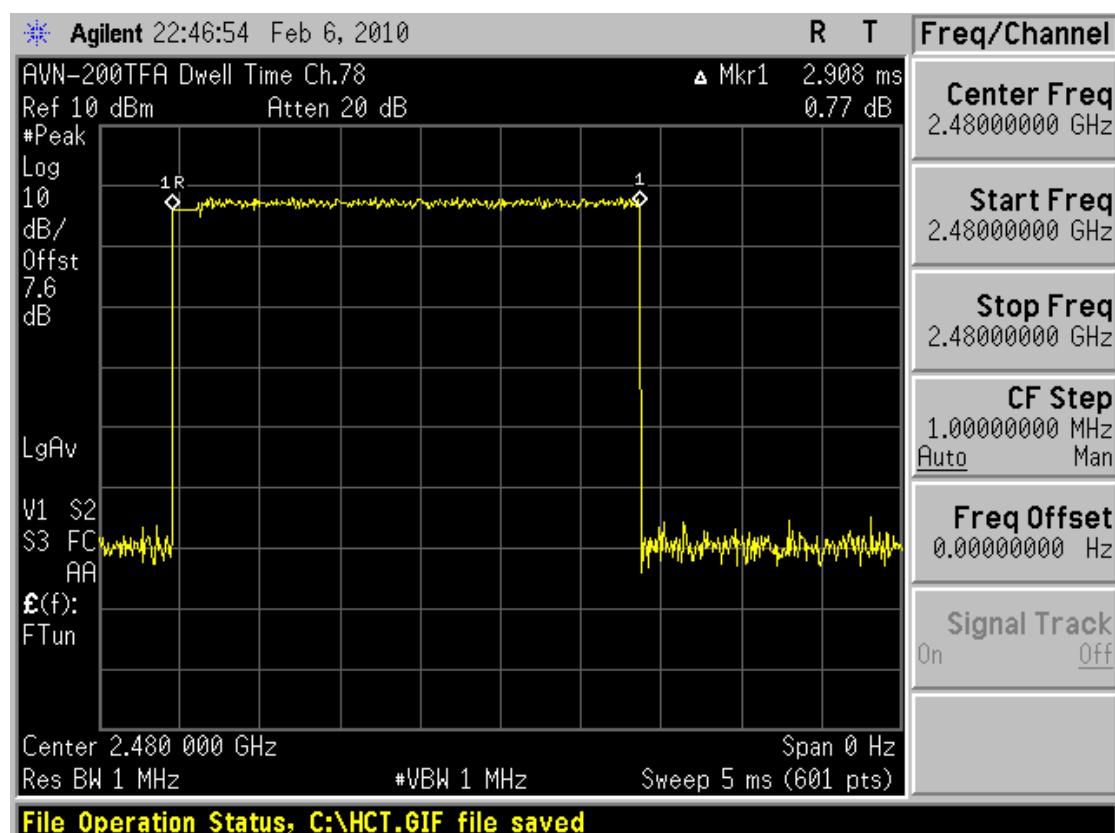
Test Dates: April 08, 2010

EUT Type: AVN SYSTEM

FCC ID: TQ8-AVN-200TFU

IC: 5074A-AVN200TFCA

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**( Mid CH )**

**(CH High)**


| FCC PT.15.247 TEST REPORT    | FCC & IC CERTIFICATION REPORT |                      |                        |                      | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|------------------------------|-------------------------------|----------------------|------------------------|----------------------|--|
| Test Report No. HCTR1004FR11 | Test Dates: April 08, 2010    | EUT Type: AVN SYSTEM | FCC ID: TQ8-AVN-200TFU | IC: 5074A-AVN200TFCA | Page 25 of 44                                    |

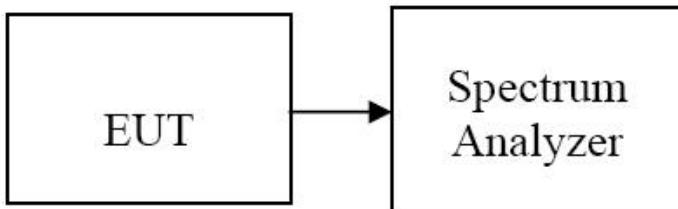
## 7.6 SPURIOUS EMISSIONS

### 7.6.1 CONDUCTED SPURIOUS MEASUREMENT

#### LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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)).

#### Test Configuration



#### TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

Detector Mode is set to a peak detector Mode.

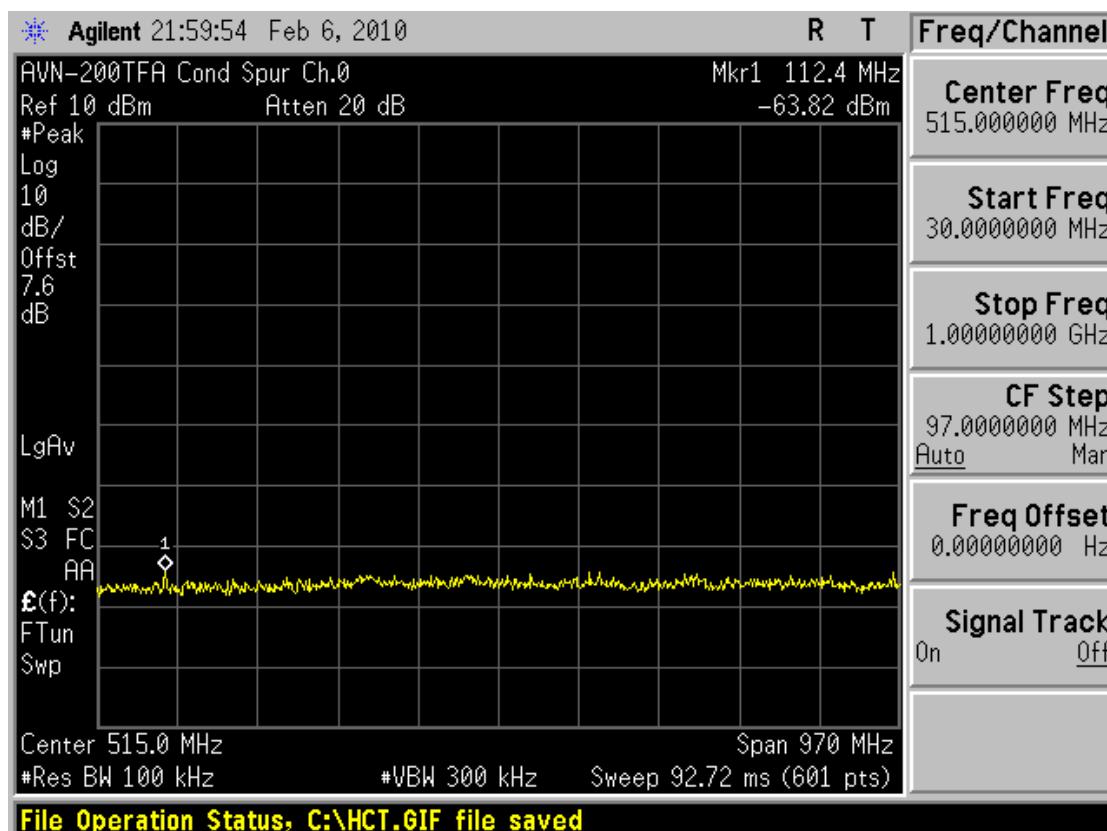
Measurements are made over the 30 MHz to 26 GHz range with the transmitter set to the lowest, middle, and highest channels.

#### TEST RESULTS

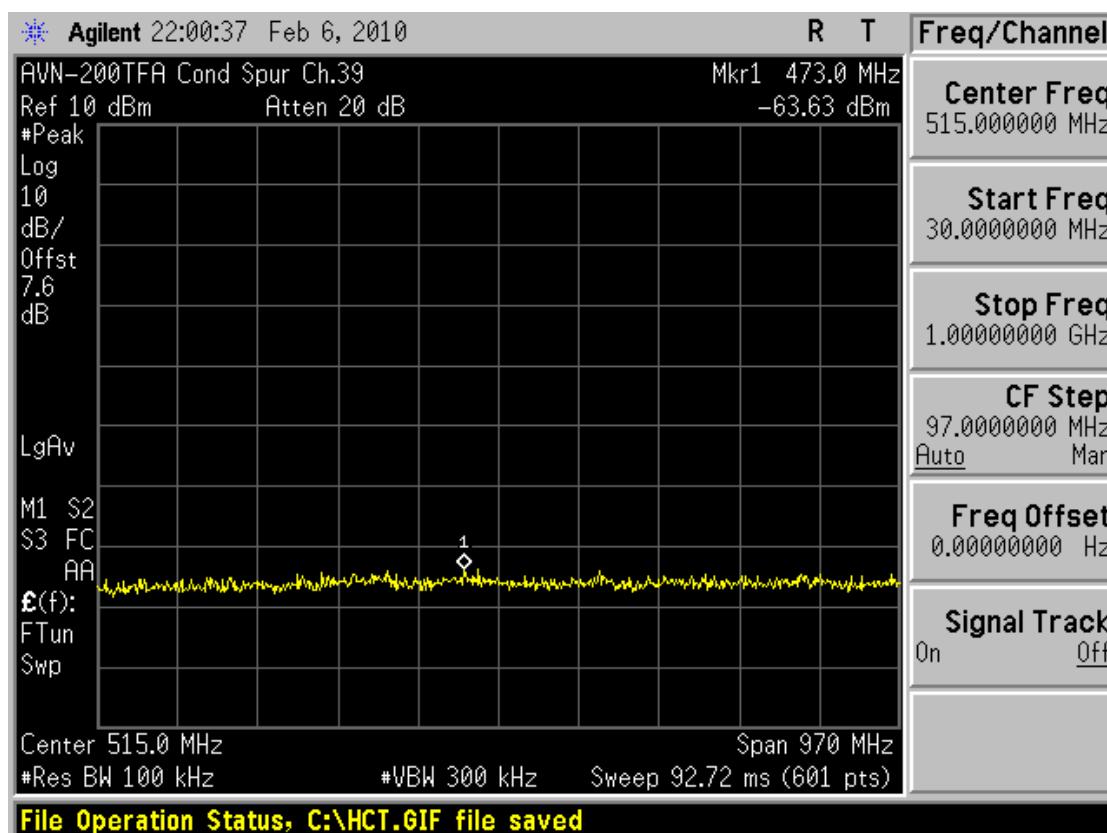
No non-compliance noted

| FCC PT.15.247<br>TEST REPORT    |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 26 of 44                                    |

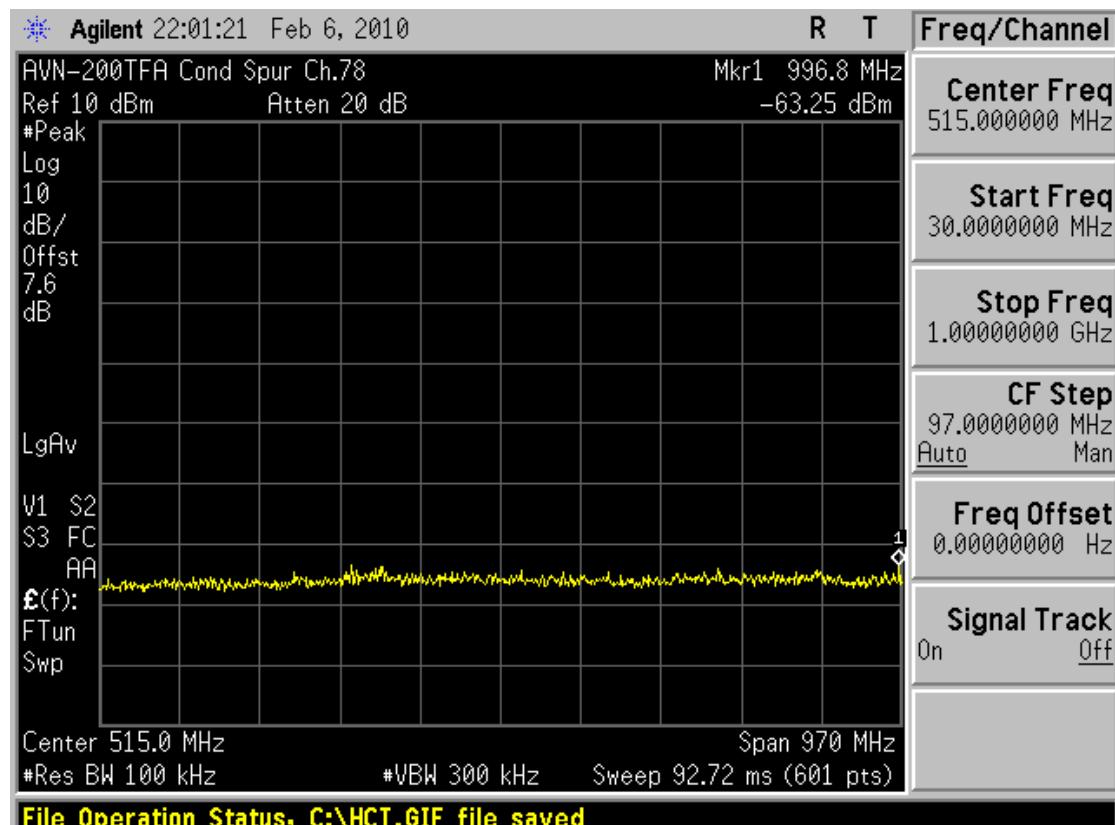
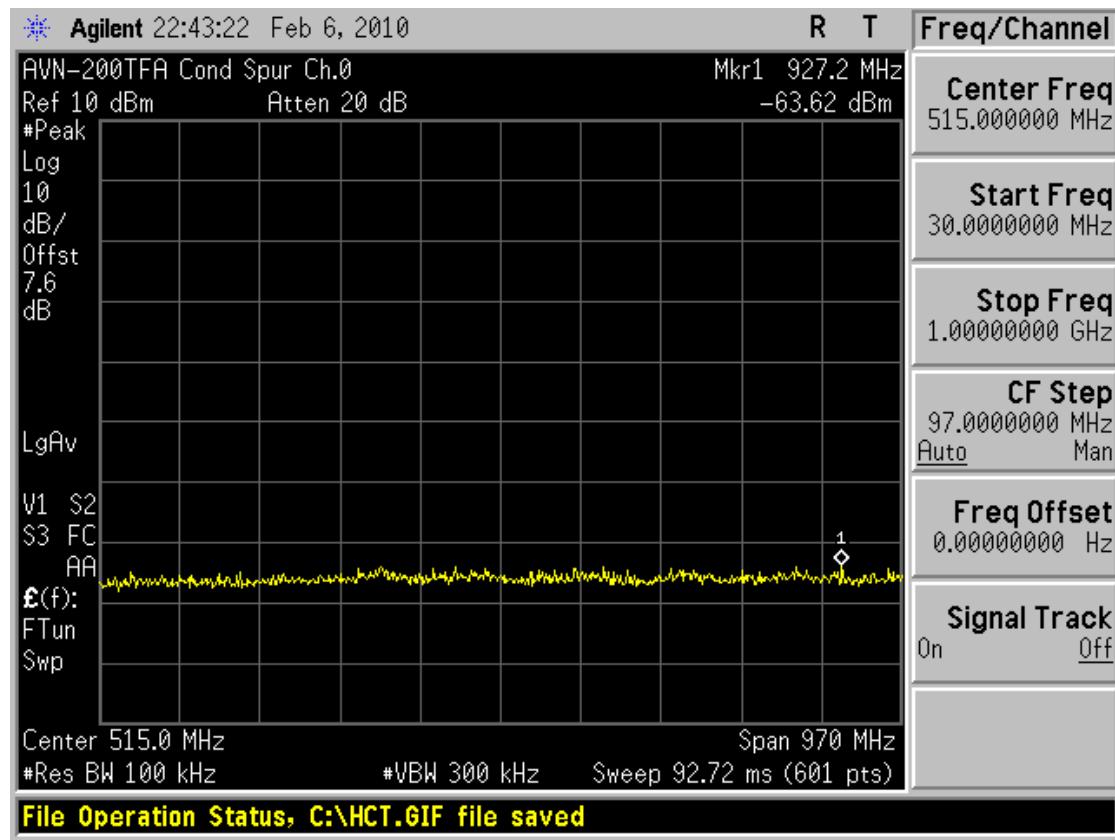
Test Plots(GFSK) – 30 MHz ~ 1 GHz(RBW:100 kHz, VBW: 300 kHz)  
 ( Low CH )



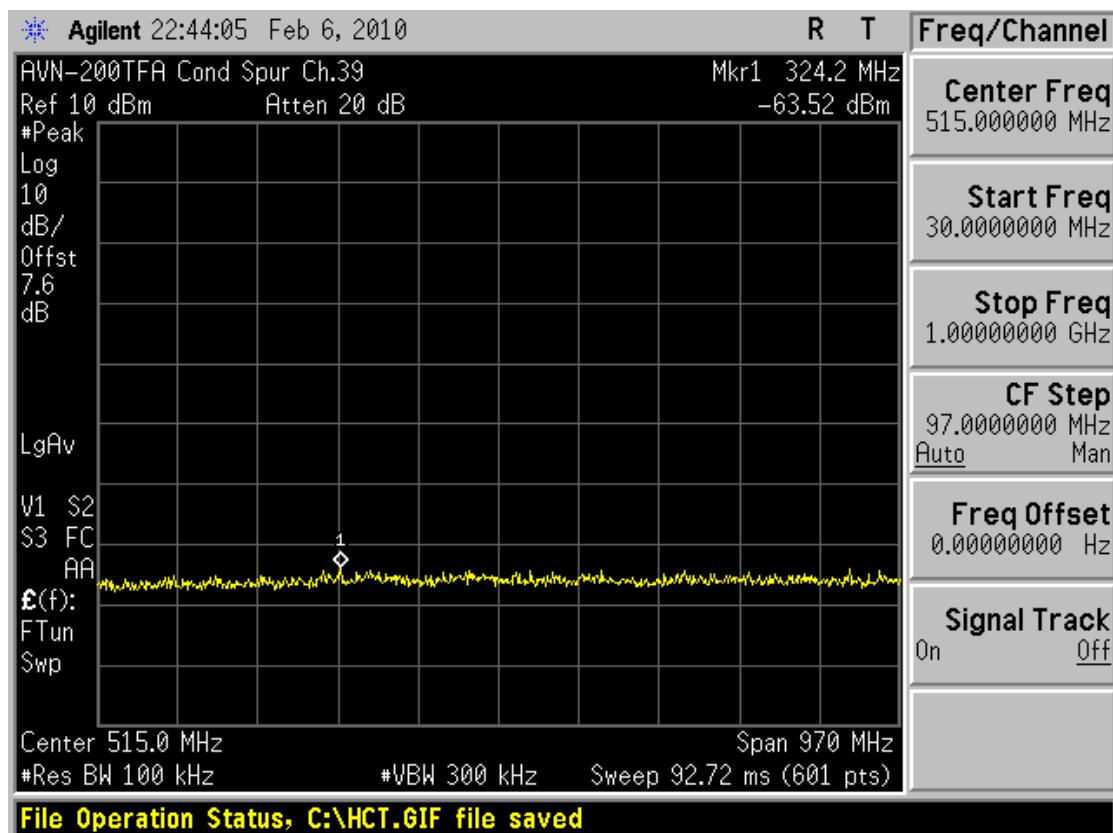
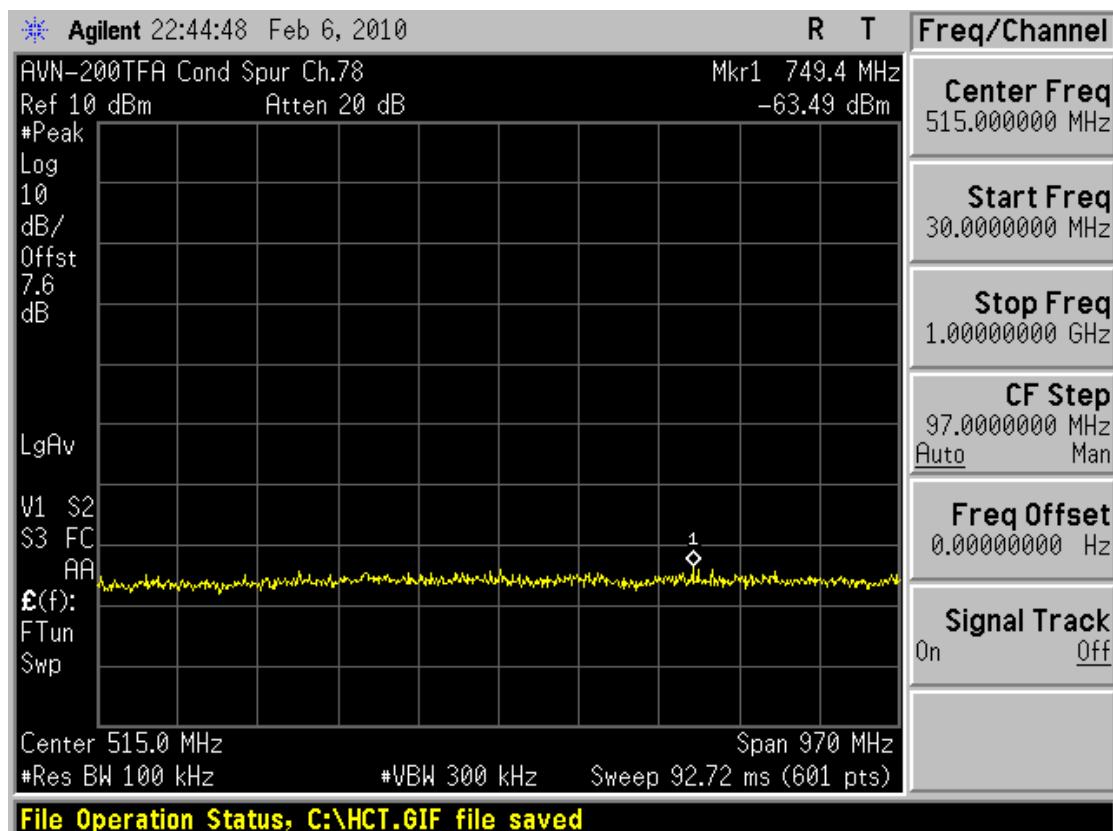
(Mid CH )



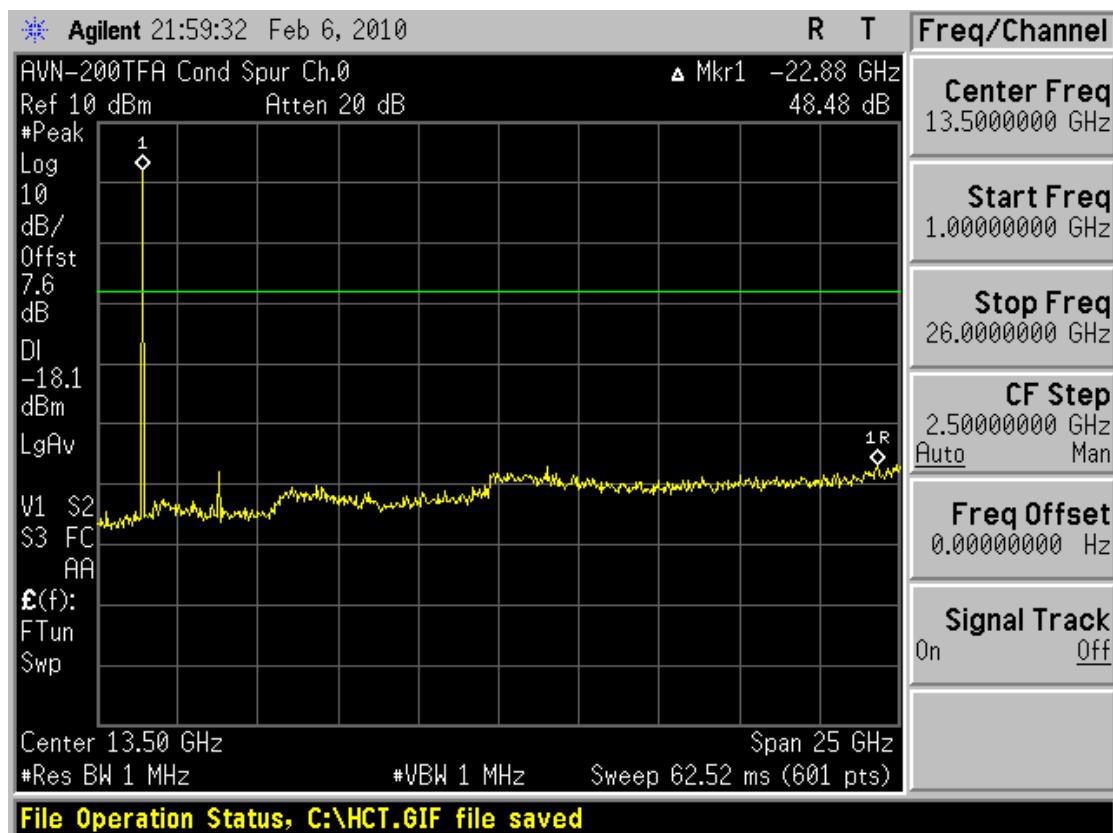
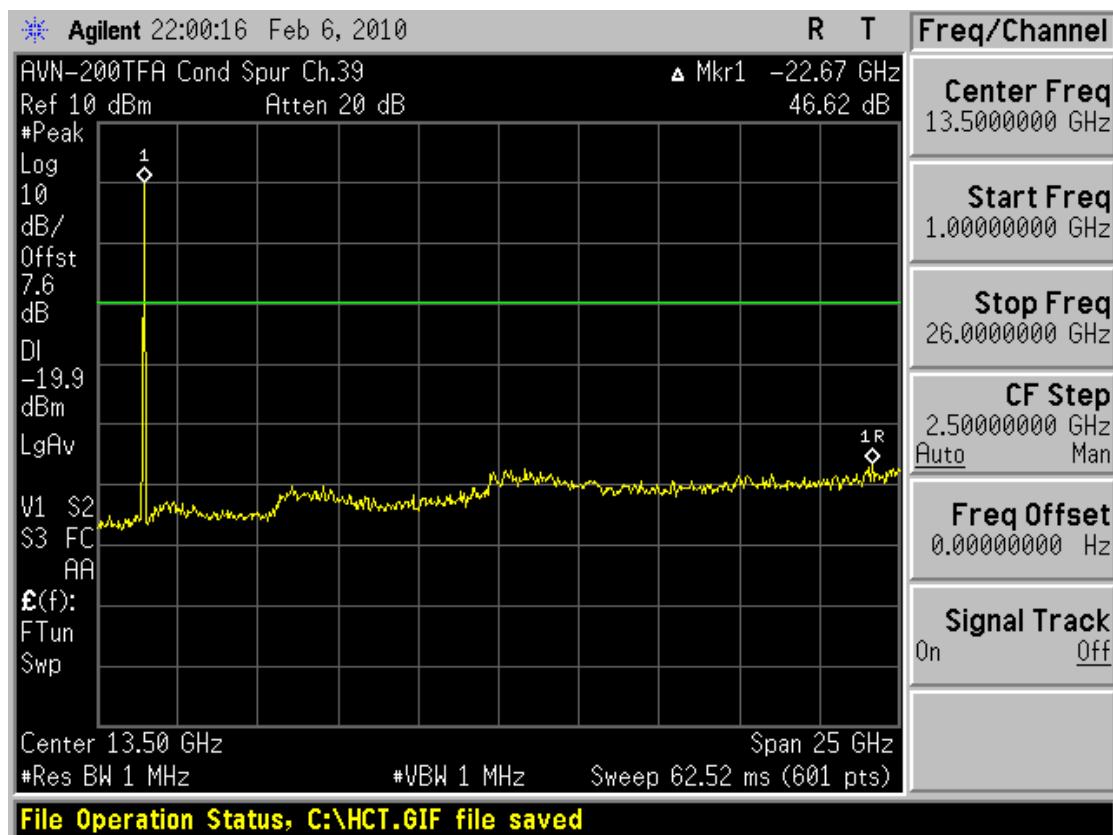
| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 27 of 44                                    |

**( High CH )**

**Test Plots(8DPSK) – 30 MHz ~ 1 GHz(RBW:100 kHz, VBW: 300 kHz)**
**( Low CH )**


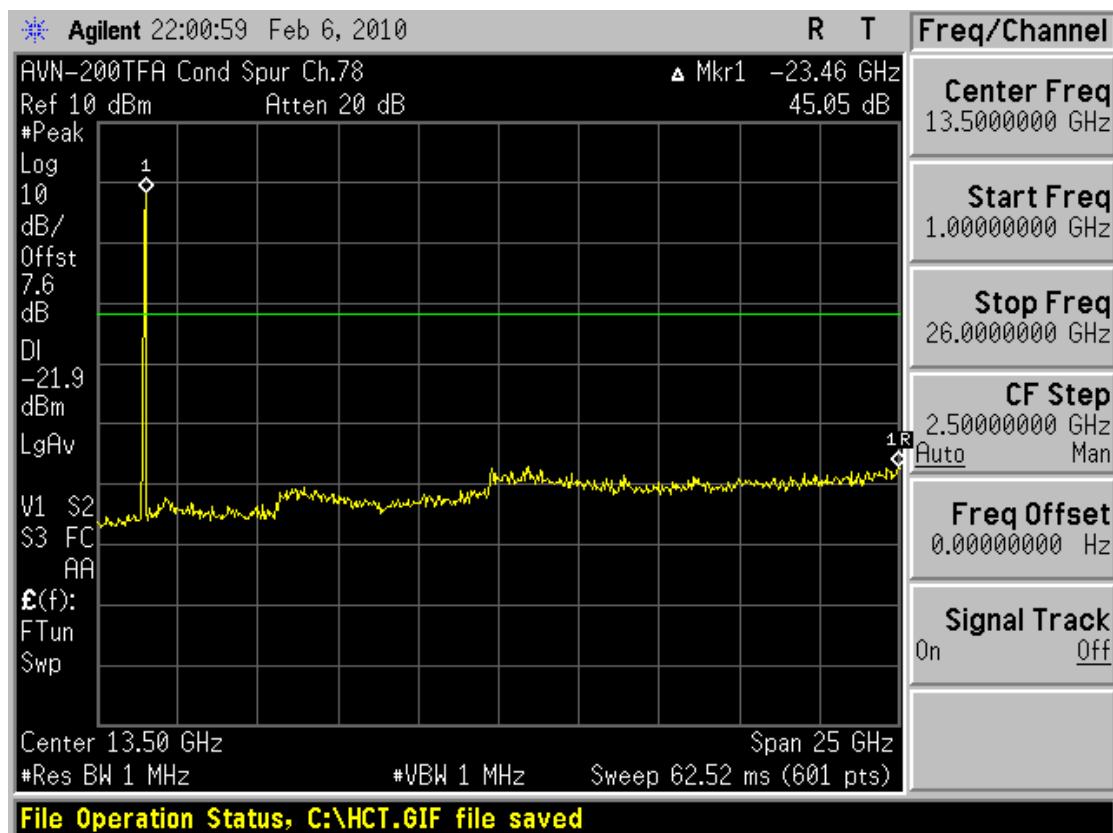
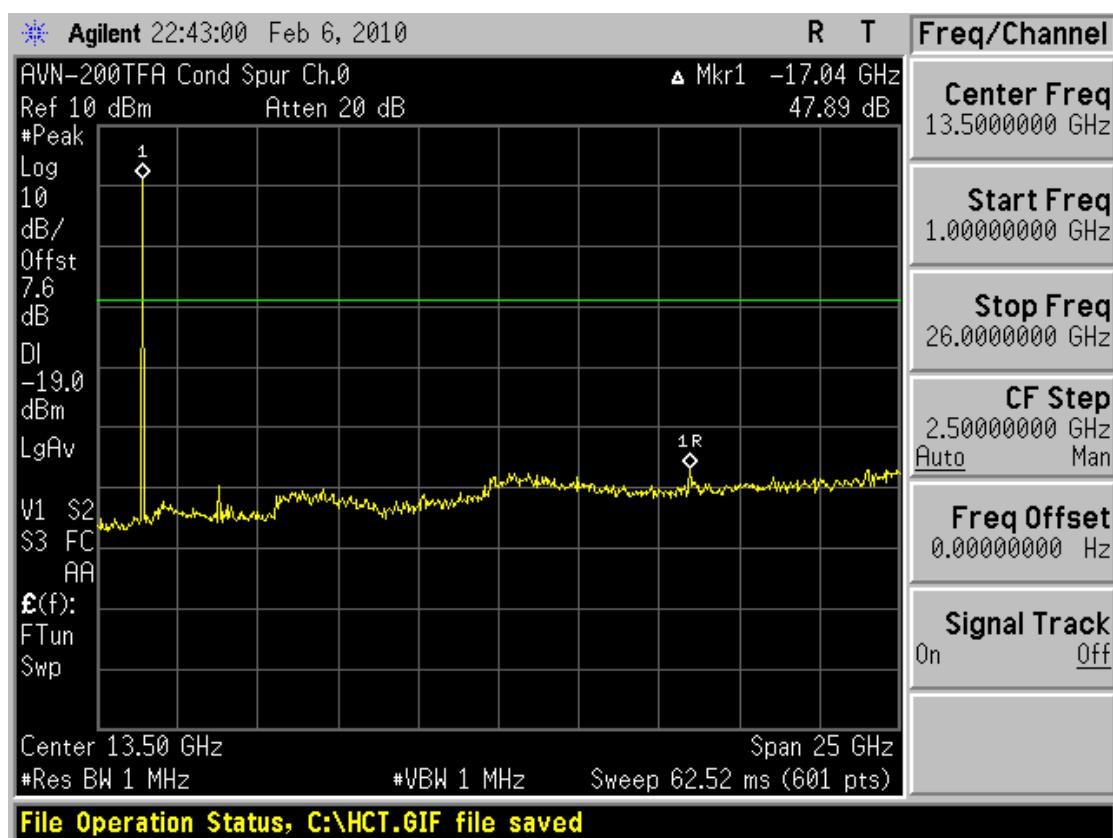
| FCC PT.15.247 TEST REPORT       | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 28 of 44                                    |

**(Mid CH )**

**( High CH )**

**Test Plots(GFSK) -1 GHz ~ 26 GHz (RBW: 1 MHz, VBW: 1 MHz)**

| FCC PT.15.247 TEST REPORT    | FCC & IC CERTIFICATION REPORT |                      |                        |                      | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|------------------------------|-------------------------------|----------------------|------------------------|----------------------|--|
| Test Report No. HCTR1004FR11 | Test Dates: April 08, 2010    | EUT Type: AVN SYSTEM | FCC ID: TQ8-AVN-200TFU | IC: 5074A-AVN200TFCA | Page 29 of 44                                    |

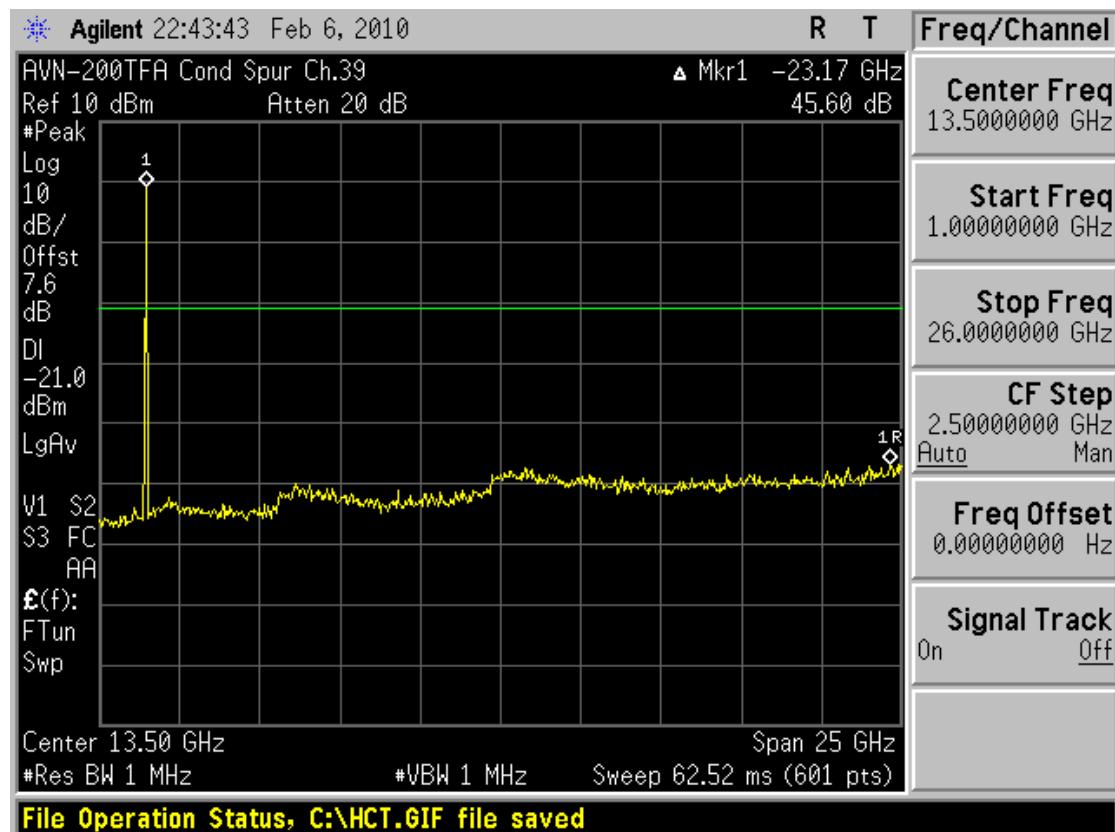
**( Low CH )**

**( Mid CH )**


| FCC PT.15.247 TEST REPORT    | FCC & IC CERTIFICATION REPORT |                      |                        |                      | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|------------------------------|-------------------------------|----------------------|------------------------|----------------------|--|
| Test Report No. HCTR1004FR11 | Test Dates: April 08, 2010    | EUT Type: AVN SYSTEM | FCC ID: TQ8-AVN-200TFU | IC: 5074A-AVN200TFCA | Page 30 of 44                                    |

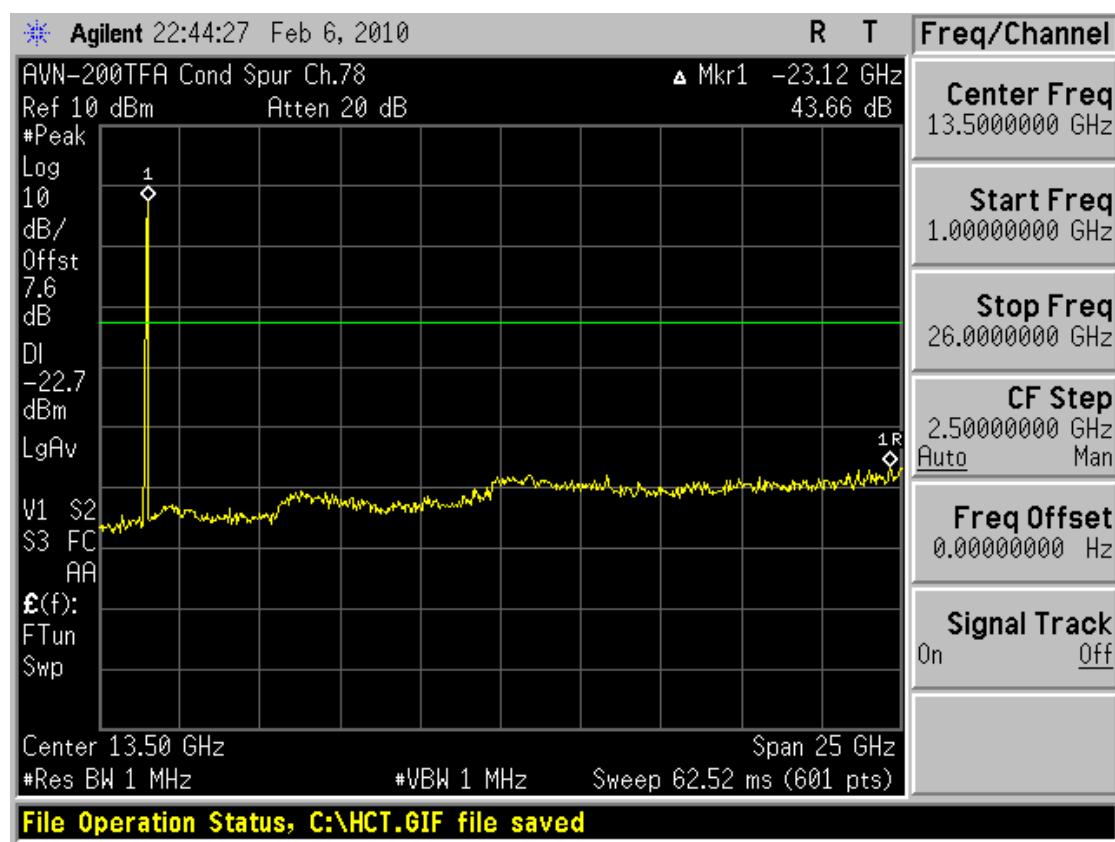
**( High CH )**

**Test Plots(8DPSK) -1 GHz ~ 26 GHz (RBW: 1 MHz, VBW: 1 MHz)**
**( Low CH )**


| FCC PT.15.247 TEST REPORT       |                               | FCC & IC CERTIFICATION REPORT |                            |                          | www.hct.co.kr |
|---------------------------------|-------------------------------|-------------------------------|----------------------------|--------------------------|---------------|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFCA | IC:<br>5074A-AVN-200TFCA | Page 31 of 44 |

(Mid CH )



( High CH )



| FCC PT.15.247 TEST REPORT    | FCC & IC CERTIFICATION REPORT |                      |                        |                      | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|------------------------------|-------------------------------|----------------------|------------------------|----------------------|--|
| Test Report No. HCTR1004FR11 | Test Dates: April 08, 2010    | EUT Type: AVN SYSTEM | FCC ID: TQ8-AVN-200TFU | IC: 5074A-AVN200TFCA | Page 32 of 44                                    |



## 7.6.2 RADIATED SPURIOUS EMISSIONS

### LIMIT

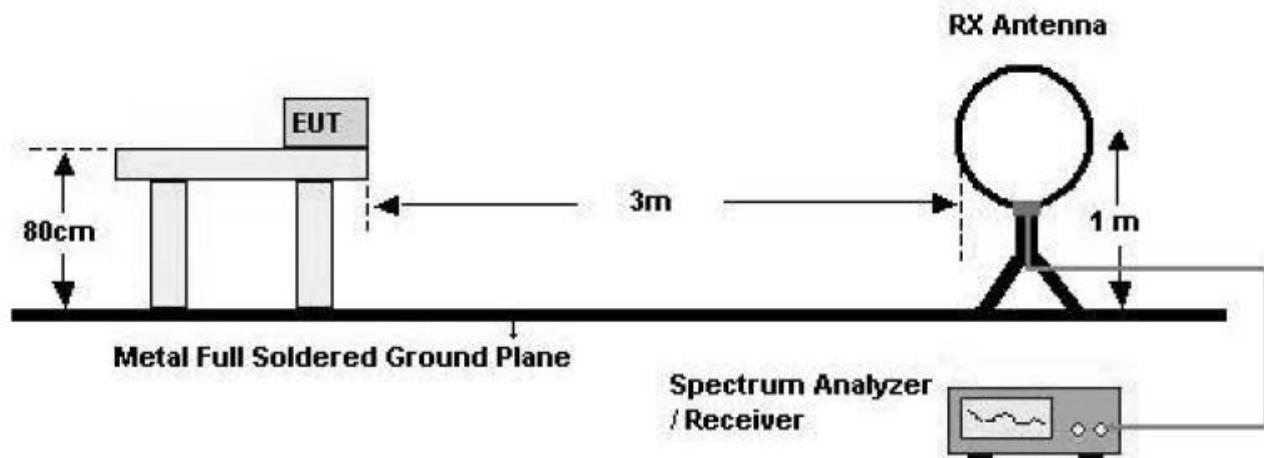
1. 20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed

| Frequency (MHz) | Field Strength (uV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 0.009 – 0.490   | 2400/F(kHz)           | 300                      |
| 0.490 – 1.705   | 24000/F(kHz)          | 30                       |
| 1.705 – 30      | 30                    | 30                       |
| 30-88           | 100                   | 3                        |
| 88-216          | 150                   | 3                        |
| 216-960         | 200                   | 3                        |
| Above 960       | 500                   | 3                        |

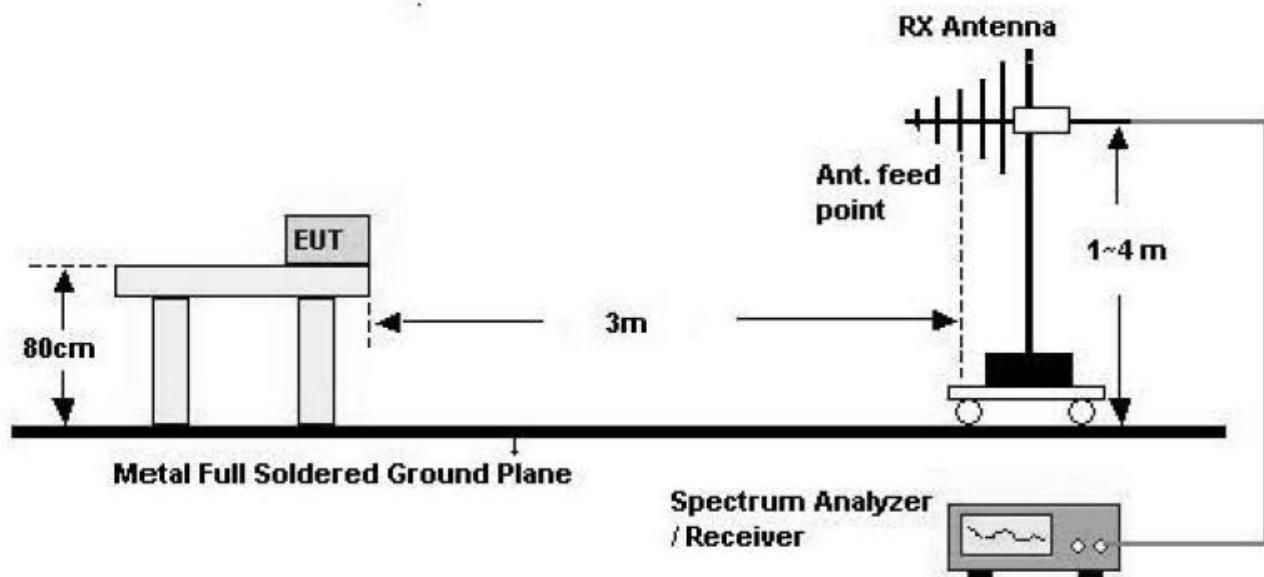
| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 33 of 44                                    |

## Test Configuration

### Below 30 MHz

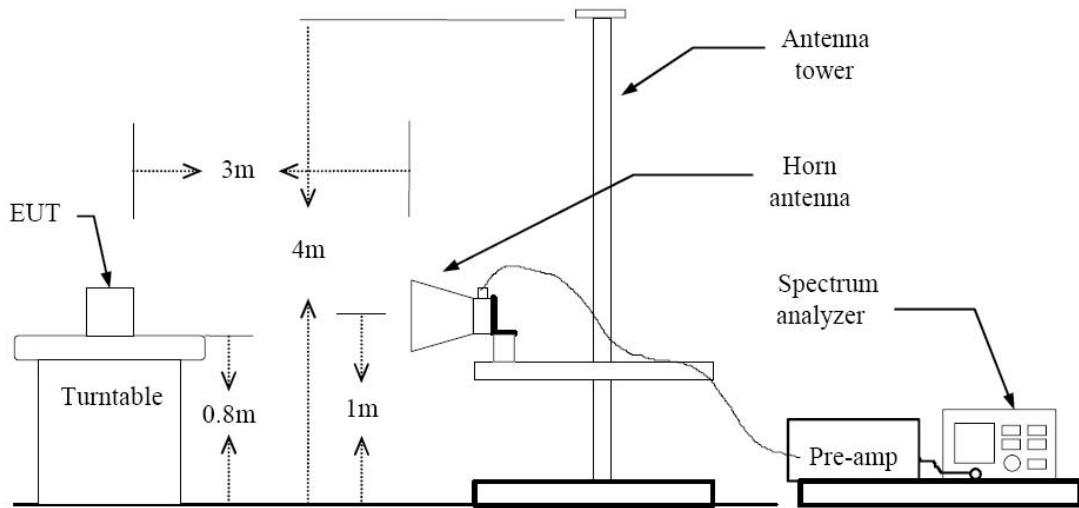


### 30 MHz - 1 GHz



| FCC PT.15.247<br>TEST REPORT    |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 34 of 44                                    |

## Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

| FCC PT.15.247<br>TEST REPORT    |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM       | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 35 of 44                                    |



## TEST RESULTS

9 kHz – 30MHz

**Operation Mode:** Normal Link

| Frequency               | Reading    | Ant. factor | Cable loss | Ant. POL | Total        | Limit        | Margin |
|-------------------------|------------|-------------|------------|----------|--------------|--------------|--------|
| MHz                     | dB $\mu$ V | dB /m       | dB         | (H/V)    | dB $\mu$ V/m | dB $\mu$ V/m | dB     |
| No Critical peaks found |            |             |            |          |              |              |        |

### Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB)
4. Limit line = specific Limits (dB $\mu$ V) + Distance extrapolation factor
5. Detector : Qusi-peak
6. Preliminary Test performed the both normal & EDR and three channels(Low, Mid, High).  
The final test performed the worst case mode only.

| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
|---------------------------------|-------------------------------|-------------------------|---------------------------|-------------------------|--|
| Test Report No.<br>HCTR1004FR11 | Test Dates:<br>April 08, 2010 | EUT Type:<br>AVN SYSTEM | FCC ID:<br>TQ8-AVN-200TFU | IC:<br>5074A-AVN200TFCA | Page 36 of 44                                    |



## TEST RESULTS

### Below 1 GHz

**Operation Mode:** Normal Link

| Frequency<br>MHz | Reading<br>dBuV | Ant.<br>Factor<br>dB/m | Cable<br>Loss<br>dB | ANT POL<br>(H/V) | Total<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|------------------|-----------------|------------------------|---------------------|------------------|-----------------|-----------------|--------------|
| 113.42           | 14.2            | 10.2                   | 1.2                 | H                | 25.62           | 43.5            | 17.9         |
| 784.66           | 11.1            | 22.2                   | 3.1                 | V                | 36.43           | 46.0            | 9.6          |

**Notes:**

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. RBW: 120 kHz, VBW: 300 kHz
4. Preliminary Test performed the both normal & EDR and three channels(Low, Mid, High).  
The final test performed the worst case mode only.

| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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## Above 1 GHz

**Operation Mode:** CH Low(GFSK)

| Frequency<br>[MHz] | Reading<br>dBuV | ※ A.F+CL-AMP<br>GAIN<br>[dB] | ANT. POL<br>[H/V] | Total<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Detect |
|--------------------|-----------------|------------------------------|-------------------|-------------------|-------------------|----------------|--------|
| 4804               | 54.88           | -6.32                        | V                 | 48.56             | 74                | 25.44          | PK     |
| 4804               | 49.57           | -6.32                        | V                 | 43.25             | 54                | 10.75          | AV     |
| 7206               | 51.12           | 1.21                         | V                 | 52.33             | 74                | 21.67          | PK     |
| 7206               | 38.12           | 1.21                         | V                 | 39.33             | 54                | 14.67          | AV     |
| 4804               | 54.93           | -6.32                        | H                 | 48.61             | 74                | 25.39          | PK     |
| 4804               | 49.94           | -6.32                        | H                 | 43.62             | 54                | 10.38          | AV     |
| 7206               | 49.37           | 1.21                         | H                 | 50.58             | 74                | 23.42          | PK     |
| 7206               | 38.26           | 1.21                         | H                 | 39.47             | 54                | 14.53          | AV     |

※ A-F: ANTENNA FACTOR

C-L: CABLE LOSS

AMP GAIN: AMPLIFIER GAIN

### Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
  - b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 10 Hz.
5. All (GFSK, 8DPSK) modes were tested, and the worst data was recorded in this test report.

| FCC PT.15.247<br>TEST REPORT |                | FCC & IC CERTIFICATION REPORT |                |                  |               | www.hct.co.kr |
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**Operation Mode:** CH Mid(GFSK)

| Frequency<br>[MHz] | Reading<br>dBuV | ※ A.F+CL-AMP<br>GAIN.<br>[dB] | ANT. POL<br>[H/V] | Total<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Detect |
|--------------------|-----------------|-------------------------------|-------------------|-------------------|-------------------|----------------|--------|
| 4882               | 55.19           | -6.07                         | V                 | 49.12             | 74                | 24.88          | PK     |
| 4882               | 50.13           | -6.07                         | V                 | 44.06             | 54                | 9.94           | AV     |
| 7323               | 50.88           | 1.62                          | V                 | 52.50             | 74                | 21.50          | PK     |
| 7323               | 38.14           | 1.62                          | V                 | 39.76             | 54                | 14.24          | AV     |
| 4882               | 55.27           | -6.07                         | H                 | 49.20             | 74                | 24.80          | PK     |
| 4882               | 50.94           | -6.07                         | H                 | 44.87             | 54                | 9.13           | AV     |
| 7323               | 51.45           | 1.62                          | H                 | 53.07             | 74                | 20.93          | PK     |
| 7323               | 38.05           | 1.62                          | H                 | 39.67             | 54                | 14.33          | AV     |

※ A-F: ANTENNA FACTOR

C-L: CABLE LOSS

AMP GAIN: AMPLIFIER GAIN

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
  - b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 10 Hz.
5. All (GFSK, 8DPSK) modes were tested, and the worst data was recorded in this test report.

| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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**Operation Mode:** CH High(GFSK)

| Frequency<br>[MHz] | Reading<br>dBuV | ※ A.F+CL-AMP<br>GAIN<br>[dB] | ANT. POL<br>[H/V] | Total<br>[dBuV/m] | Limit<br>[dBuV/m] | Margin<br>[dB] | Detect |
|--------------------|-----------------|------------------------------|-------------------|-------------------|-------------------|----------------|--------|
| 4960               | 60.90           | -6.07                        | V                 | 54.83             | 74                | 19.17          | PK     |
| 4960               | 55.21           | -6.07                        | V                 | 49.14             | 54                | 4.86           | AV     |
| 7440               | 51.61           | 1.62                         | V                 | 53.23             | 74                | 20.77          | PK     |
| 7440               | 38.80           | 1.62                         | V                 | 40.42             | 54                | 13.58          | AV     |
| 4960               | 60.07           | -6.07                        | H                 | 54.00             | 74                | 20.00          | PK     |
| 4960               | 55.97           | -6.07                        | H                 | 49.90             | 54                | 4.10           | AV     |
| 7440               | 51.31           | 1.62                         | H                 | 52.93             | 74                | 21.07          | PK     |
| 7440               | 38.24           | 1.62                         | H                 | 39.86             | 54                | 14.14          | AV     |

※ A-F: ANTENNA FACTOR

C-L: CABLE LOSS

AMP GAIN: AMPLIFIER GAIN

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
  - b. AV Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 10 Hz.
5. All (GFSK, 8DPSK) modes were tested, and the worst data was recorded in this test report.

| FCC PT.15.247<br>TEST REPORT    |                               | FCC & IC CERTIFICATION REPORT |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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### 7.6.3 RECEIVER SPURIOUS EMISSIONS

**FCC Rule(s)** §15.109 (see Table Below)  
**Test Requirements:** Emission Level shall not exceed §15.109 limits  
**Operating conditions:** Under normal test conditions  
**Method of testing:** Radiated

**S/A. Settings:** F < 1 GHz: RBW: 120 kHz, VBW: 120 kHz (Quasi Peak)  
F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)  
**Mode of operation:** Receive

| Frequency (MHz) | Field Strength (mV/m) | Measurement Distance (m) |
|-----------------|-----------------------|--------------------------|
| 30 – 88         | 100 (40 dBuV)         | 3                        |
| 88 - 216        | 150 (43.5 dBuV))      | 3                        |
| 216 – 960       | 200 (46 dBuV)         | 3                        |
| Above 960       | 500 (54 dBuV)         | 3                        |

| FCC PT.15.247<br>TEST REPORT    | FCC & IC CERTIFICATION REPORT |                         |                           |                         | <a href="http://www.hct.co.kr">www.hct.co.kr</a> |
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**Operation Mode: Receive:**

30 MHz ~ 1 GHz

| Frequency<br>MHz | Reading<br>dBuV | Ant.<br>Factor<br>dB/m | Cable<br>Loss<br>dB | ANT POL<br>(H/V) | Total<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|------------------|-----------------|------------------------|---------------------|------------------|-----------------|-----------------|--------------|
| 323.1            | 23.7            | 13.5                   | 1.9                 | H                | 39.12           | 46.0            | 6.9          |

Above 1 GHz

| Frequency<br>MHz        | Reading<br>dBuV | Ant. Factor<br>dB/m | Cable Loss<br>dB | ANT POL<br>(H/V) | Total<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|-------------------------|-----------------|---------------------|------------------|------------------|-----------------|-----------------|--------------|
| No Critical peaks found |                 |                     |                  |                  |                 |                 |              |

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#### 7.6.4 RADIATED RESTRICTED BAND EDGE MEASUREMENT

##### Test Requirements and limit, §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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)).

|                     |                    |
|---------------------|--------------------|
| Operation Mode:     | 8DPSK(EDR)         |
| Operating Frequency | 2402 MHz, 2480 MHz |
| Channel No.         | CH 0, CH 78        |

| Frequency [MHz] | Reading dBuV | AN.+CL-AMP G [dB] | ANT. POL [H/V] | Total [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Detect |
|-----------------|--------------|-------------------|----------------|----------------|----------------|-------------|--------|
| 2323.44         | 51.15        | -12.65            | H              | 38.50          | 74             | 35.50       | PK     |
| 2323.44         | 39.75        | -12.65            | H              | 27.10          | 54             | 26.90       | AV     |
| 2390.00         | 51.57        | -12.37            | V              | 39.20          | 74             | 34.80       | PK     |
| 2390.00         | 38.37        | -12.37            | V              | 26.00          | 54             | 28.00       | AV     |
| 2492.87         | 50.40        | -11.93            | H              | 38.47          | 74             | 35.53       | PK     |
| 2492.87         | 37.66        | -11.93            | H              | 25.73          | 54             | 28.27       | AV     |
| 2493.96         | 50.49        | -11.93            | V              | 38.56          | 74             | 35.44       | PK     |
| 2493.96         | 37.89        | -11.93            | V              | 25.96          | 54             | 28.04       | AV     |

##### Notes:

1. Spectrum setting:
  - a. Peak Setting 1 GHz – 26 GHz, RBW = 1 MHz, VBW = 1 MHz.
  - b. AV Setting 1 GHz – 26 GHz, RBW=1 MHz, VBW= 10 Hz.
2. All (GFSK, 8DPSK) modes were tested, and the worst data was recorded in this test report.

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## 8. LIST OF TEST EQUIPMENT

| Manufacturer          | Model / Equipment                  | Cal Interval | Calibration Date | Serial No.         |
|-----------------------|------------------------------------|--------------|------------------|--------------------|
| Rohde & Schwarz       | ESH2-Z5/ LISN                      | Annual       | 04/10/2009       | 861741/013         |
| Rohde & Schwarz       | ESH3-Z6/ LISN                      | Annual       | 06/13/2009       | 100329             |
| Schwarzbeck           | VULB 9160/ TRILOG Antenna          | Biennial     | 12/18/2008       | 9160-3150          |
| HD                    | MA240/ Antenna Position Tower      | N/A          | N/A              | 556                |
| EMCO                  | 1050/ Turn Table                   | N/A          | N/A              | 114                |
| HD GmbH               | HD 100/ Controller                 | N/A          | N/A              | 13                 |
| HD GmbH               | KMS 560/ SlideBar                  | N/A          | N/A              | 12                 |
| Rohde & Schwarz       | ESH3-Z2/ PULSE LIMITER             | Annual       | 10/30/2009       | 375.8810.352       |
| MITEQ                 | AMF-60-0010 1800-35-20P/AMP        | Annual       | 05/20/2009       | 1200937            |
| Schwarzbeck           | BBHA 9120D/ Horn Antenna           | Biennial     | 09/23/2009       | 147                |
| Rohde & Schwarz       | FSP30 / Spectrum Analyzer          | Annual       | 07/31/2009       | 839117/011         |
| Agilent               | E4440A / Spectrum Analyzer         | Annual       | 12/23/2009       | US45303008         |
| Agilent               | E4416A /Power Meter                | Annual       | 01/14/2010       | GB41291412         |
| Wainwright Instrument | WHF3.3/18G-10EF / High Pass Filter | Annual       | 06/29/2009       | 1                  |
| Hewlett Packard       | 11636B/Power Divider               | Annual       | 12/24/2009       | 11377              |
| DIGITAL               | EP-3010 /DC POWER SUPPLY           | Annual       | 01/08/2010       | 3110117            |
| ITECH                 | IT6720 / DC POWER SUPPLY           | Annual       | 12/01/2009       | 010002156287001199 |
| TESCOM                | TC-3000A / BLUETOOTH TESTER        | Annual       | 01/11/2010       | 3000A490112        |
| Rohde & Schwarz       | CBT / BLUETOOTH TESTER             | Annual       | 06/22/2009       | 100422             |
| EMCO                  | 6502.LOOP ANTENNA                  | Biennial     | 01/13/2010       | 9009-2536          |

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