



# FCC TEST REPORT

|                  |   |
|------------------|---|
| Prepared For :   | Hopeful Electric CO., LTD   |
| Product Name:    | MID   |
| Model :          | MID770-RK88-PR, K7, PTAB782, MID770STM-RK88-PR,<br>MID770STM-RK88, MID770-RK88, MID770A-RK88  |
| Prepared By :    | Shenzhen BATT Testing Technology Co., Ltd.<br>11F, Bldg.B, Xinbaoyuan, Xinnanhu Commercial city, Bao'an<br>District, Shenzhen, Guangdong, China.<br>Tel: 86-755-27753991 Fax: 86-755-27754182 |
| Test Date:       | May 05, 2014 to May 24, 2014  |
| Date of Report : | May 24, 2014  |
| Report No.:      | BATT201405059-02FCC   |

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# 1 TEST CERTIFICATION

|   |   |
|---|---|
| <b>Product:</b>                             | MID   |
| <b>Model:</b>                               | MID770-RK88-PR, K7, PTAB782, MID770STM-RK88-PR,<br>MID770STM-RK88, MID770-RK88, MID770A-RK88  |
| <b>Applicant:</b>                           | Hopeful Electric CO., LTD<br>22 Floor, Changhong Building, Hi-Tech Park, Nanshan District, Shenzhen City,<br>P.R.China  |
| <b>Factory:</b>                             | Hopeful Electric CO., LTD / Guangdong Changhong Digital Technology Co., LTD<br>148, Ronggui Road (Mid), Ronggui Town, Shunde District, Foshan City, Guangdong<br>Prov., China / Via Gramsci 19, 20881 Bernareggio (MB), Italy/ 1,Xingye Road<br>(North), Nantou Town, Zhongshan City, Guangdong Prov. |
| <b>Trade Mark:</b>                          | N/A   |
| <b>Tested:</b>                              | May 05, 2014 to May 24, 2014  |
| <b>Test Voltage:</b>                        | DC5V Powered by power supply  |
| <b>Operational<br/>Frequency<br/>Range:</b> | 2402-2480MHz  |
| <b>Modulation<br/>Type:</b>                 | GFSK, $\pi/4$ QPSK, 8DPSK   |
| <b>Number of<br/>Channel</b>                | 79  |
| <b>Frequency<br/>Selection</b>              | By software   |
| <b>Antenna:</b>                             | Integral antenna with Gain 2.0 dBi  |
| <b>Power Supply:</b>                        | Model No.: HP0520D2-NA<br>Input:100-240V, 0.3A, 50/60Hz; Output: +5V, 1.5A Max  |
| <b>FCC ID:</b>                              | 2AAQZMID770-RK88T   |
| <b>Applicable<br/>Standards:</b>            | FCC Part 15.247   |

The test report was prepared by Shenzhen BATT Testing Technology Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Prepared by :

*Hellen Xiao*

Hellen Xiao Assistant

Reviewer :

*Mike Yong*

Mike Yong/Supervisor

Approved & Authorized Signer :

*Jones Song*

Jones Song/ Manager



## 2.0 Test Equipments

| Instrument Type    | Manufacturer      | Model        | Serial No.   | Date of Cal. | Due Date   |
|--------------------|-------------------|--------------|--------------|--------------|------------|
| ESPI Test Receiver | ROHDE&SCHWA<br>RZ | ESPI 3       | 100379       | 2013-08-27   | 2014-08-26 |
| EMI Test Receiver  | Rohde & Schwarz   | ESU          | 1302.6005.26 | 2013-08-27   | 2014-08-26 |
| Impuls-Begrenzer   | ROHDE&SCHWA<br>RZ | ESH3-Z2      | 100281       | 2013-08-27   | 2014-08-26 |
| Loop Antenna       | EMCO              | 6502         | 00042960     | 2013-06-25   | 2014-06-24 |
| ESPI Test Receiver | ROHDE&SCHWA<br>RZ | ESI26        | 838786/013   | 2013-08-27   | 2014-08-26 |
| Horn Antenna       | SCHWARZBECK       | BBHA<br>9170 | BBHA9170399  | 2013-09-15   | 2014-09-14 |
| Horn Antenna       | SCHWARZBECK       | BBHA<br>9120 | D143         | 2013-09-15   | 2014-09-14 |
| Power meter        | Anritsu           | ML2487A      | 6K00003613   | 2013-08-27   | 2014-08-26 |
| Power sensor       | Anritsu           | MA2491A      | 32263        | 2013-08-27   | 2014-08-26 |
| Bilog Antenna      | Schwarebeck       | VULB916<br>3 | 9163/142     | 2013-12-13   | 2014-12-12 |
| LISN (Three Phase) | Schwarebeck       | NSLK<br>8126 | 8126453      | 2013-08-27   | 2014-08-26 |
| 9*6*6 Anechoic     | --                | --           | N/A          | 2013-08-27   | 2014-08-26 |
| EMI Test Receiver  | RS                | ESCS30       | 100139       | 2013-08-27   | 2014-08-26 |
| LISN               | RS                | ESH2-Z5      | 100225       | 2013-08-27   | 2014-08-26 |
| Pre-Amplifier      | A.H.              | PAM-0126     | 1415261      | 2013-07-25   | 2014-07-24 |



### 3.0 Technical Details

#### 3.1 Summary of test results

**The EUT has been tested according to the following specifications:**

| Requirement  | CFR 47 Section                            | Result | Notes    |
|--|---|--------|----------|
| Antenna Requirement                                | 15.203, 15.247(b)(4)                      | PASS   | Complies |
| Maximum Peak Out Power                             | 15.247 (b)(1), (4)                        | PASS   | Complies |
| Carrier Frequency Separation                       | 15.247(a)(1)                              | PASS   | Complies |
| 20dB Channel Bandwidth                             | 15.247 (a)(1)                             | PASS   | Complies |
| Number of Hopping Channels                         | 15.247(a)(iii), 15.247(b)(1)              | PASS   | Complies |
| Time of Occupancy (Dwell Time)                     | 15.247(a)(iii)                            | PASS   | Complies |
| Spurious Emission, Band Edge, and Restricted bands | 15.247(d),15.205(a),<br>15.209 (a),15.109 | PASS   | Complies |
| Conducted Emissions                                | 15.207(a), 15.107                         | PASS   | Complies |
| RF Exposure  | 15.247(i), 1.1307(b)(1)                   | PASS   | Complies |

### 4.0 Test LAB Details

All Tests Performed at

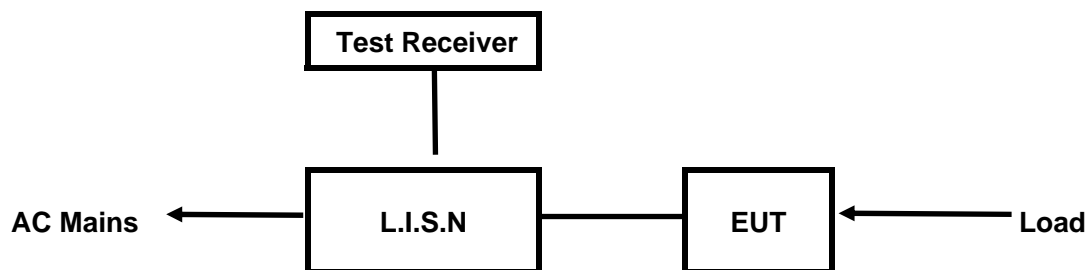
Name: Shenzhen Emtek Co., Ltd.

Address: Bldg. 69, Majialong Industry Zone,,Nanshan District,Shenzhen, Guangdong, 518052China

FCC Registration Number: 406365

## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test

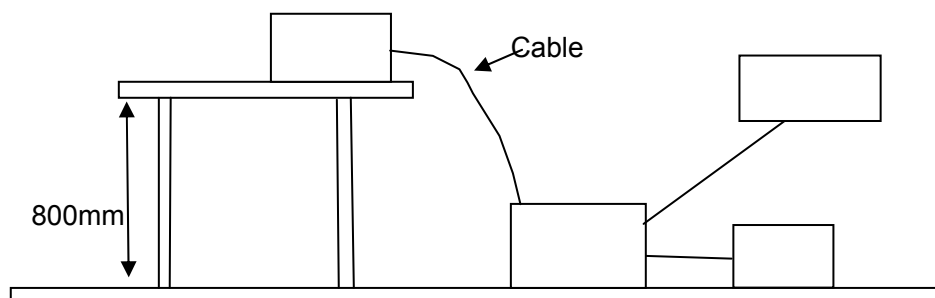


EUT: Equipment Under Test

### 5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2003. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4 –2003.

Block diagram of Test setup



### 5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.4-2003. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

79 channels are provided to the EUT



#### A. EUT

| Device | Manufacturer   | Model  | FCC ID            |
|--------|--|--|-------------------|
| MID    | Hopeful Electric CO., LTD<br>/ Guangdong Changhong<br>Digital Technology Co.,LTD | MID770-RK88-PR, K7, PTAB782,<br>MID770STM-RK88-PR,<br>MID770STM-RK88, MID770-RK88,<br>MID770A-RK88 | 2AAQZMID770-RK88T |

#### B. Internal Device

| Device | Manufacturer | Model | FCC ID/DOC |
|--------|--------------|-------|------------|
| N/A    |              |       |            |

#### C. Peripherals

| Device | Manufacturer | Model | FCC ID/DOC | Cable |
|--------|--------------|-------|------------|-------|
| --     | --           | --    | --         | --    |

#### 5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4 -2003.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

#### 5.5 Power line conducted Emission Limit according to Paragraph 15.107, 15.207

| Frequency (MHz) | Class A Limits (dBμV) |               | Class B Limits (dBμV) |               |
|-----------------|-----------------------|---------------|-----------------------|---------------|
|                 | Quasi-peak Level      | Average Level | Quasi-peak Level      | Average Level |
| 0.15 ~ 0.50     | 79.0                  | 66.0          | 66.0~56.0*            | 56.0~46.0*    |
| 0.50 ~ 5.00     | 73.0                  | 60.0          | 56.0                  | 46.0          |
| 5.00 ~ 30.00    | 73.0                  | 60.0          | 60.0                  | 50.0          |

Notes: 1. \*Decreasing linearly with logarithm of frequency.

2. The tighter limit shall apply at the transition frequencies

#### 5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.



**A: Conducted Emission on Live Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

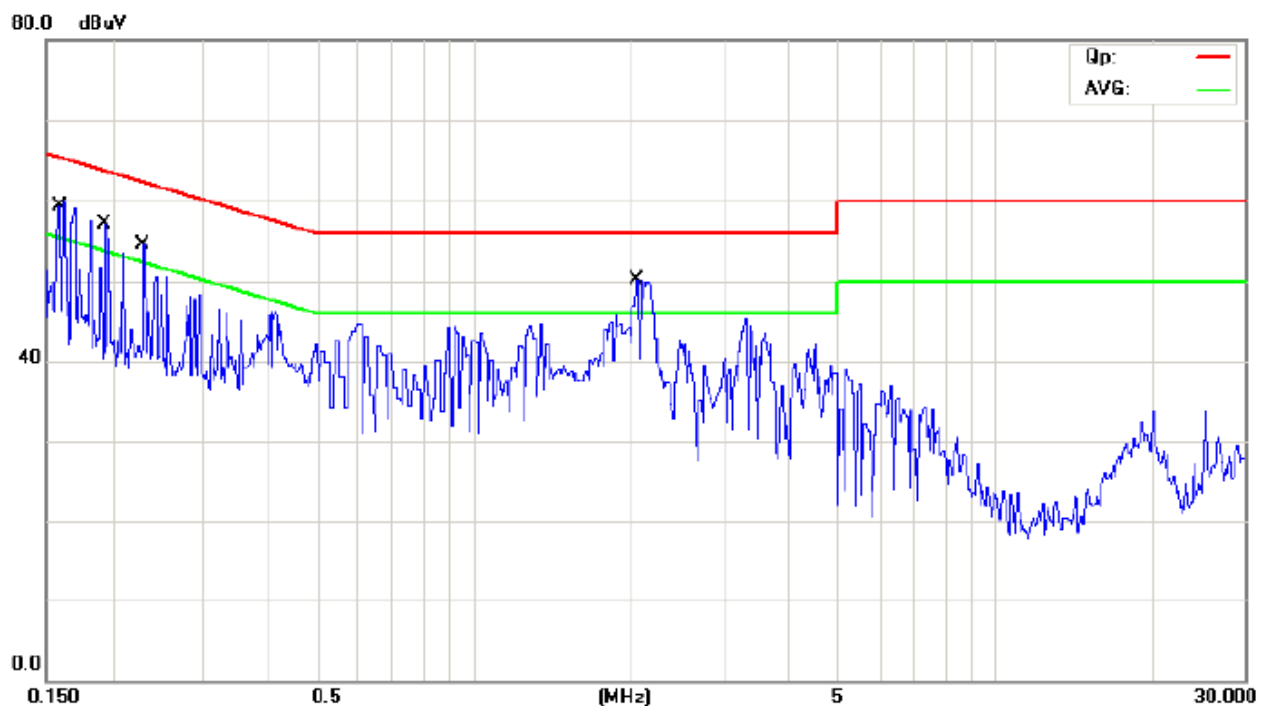
Temperature: 25°C Humidity: 75%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



| No. | Mk. | Freq.  | Reading | Correct | Measure- | Limit | Over   |          |         |
|-----|-----|--------|---------|---------|----------|-------|--------|----------|---------|
|     |     | MHz    | Level   | Factor  | ment     |       |        | Detector | Comment |
|     |     |        | dBuV    | dB      | dBuV     | dBuV  | dB     |          |         |
| 1   |     | 0.1601 | 33.70   | 11.01   | 44.71    | 65.46 | -20.75 | QP       |         |
| 2   |     | 0.1601 | 6.30    | 11.01   | 17.31    | 55.46 | -38.15 | AVG      |         |
| 3   |     | 0.1920 | 27.70   | 11.04   | 38.74    | 63.95 | -25.21 | QP       |         |
| 4   |     | 0.1920 | 0.10    | 11.04   | 11.14    | 53.95 | -42.81 | AVG      |         |
| 5   |     | 0.2326 | 27.60   | 11.09   | 38.69    | 62.36 | -23.67 | QP       |         |
| 6   |     | 0.2326 | 4.10    | 11.09   | 15.19    | 52.36 | -37.17 | AVG      |         |
| 7   | *   | 2.0521 | 28.70   | 12.32   | 41.02    | 56.00 | -14.98 | QP       |         |
| 8   |     | 2.0521 | 13.00   | 12.32   | 25.32    | 46.00 | -20.68 | AVG      |         |

**B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

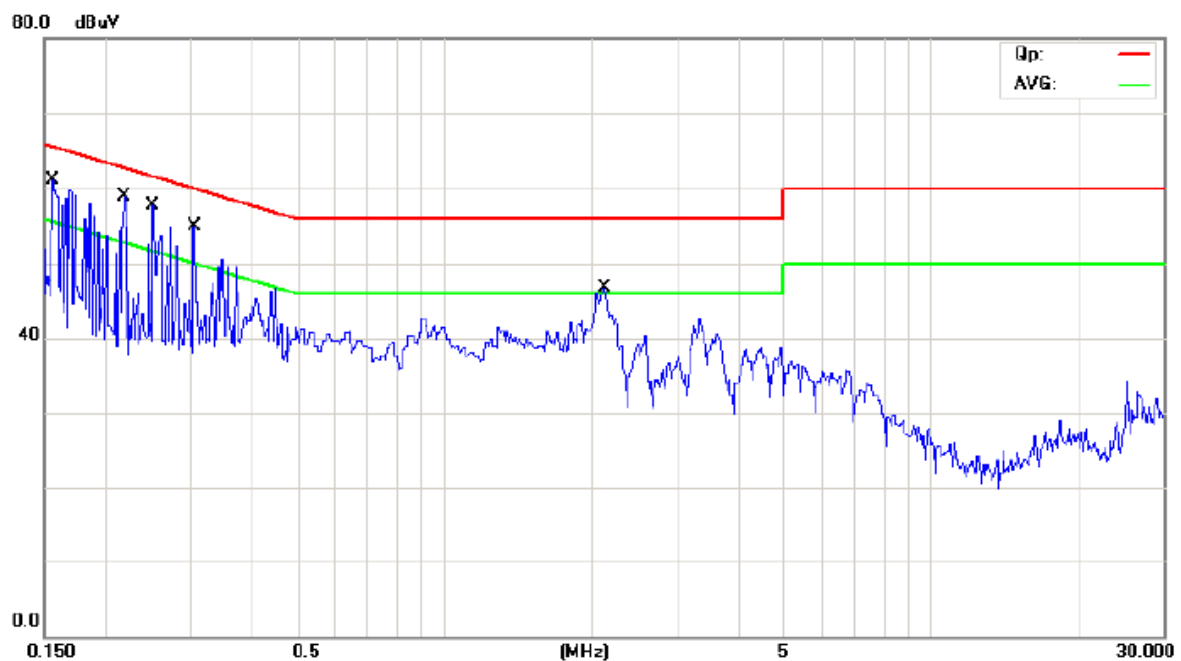
Temperature: 25°C Humidity: 75%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



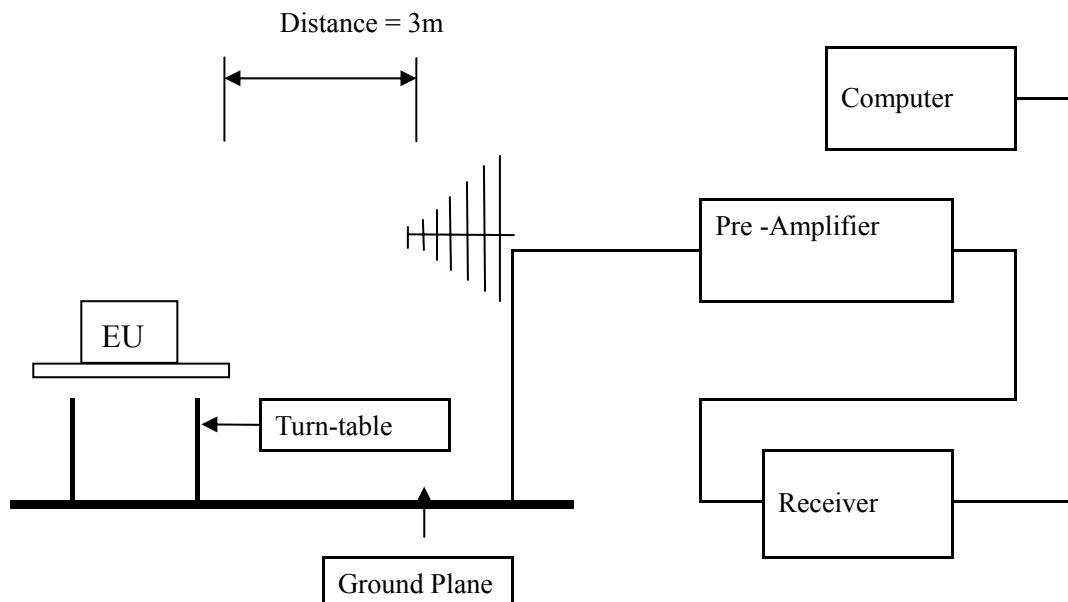
| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.1540       | 34.50                    | 11.00                   | 45.50                    | 65.78         | -20.28     | QP       |         |
| 2   |     | 0.1540       | 15.80                    | 11.00                   | 26.80                    | 55.78         | -28.98     | AVG      |         |
| 3   |     | 0.2162       | 26.20                    | 11.07                   | 37.27                    | 62.96         | -25.69     | QP       |         |
| 4   |     | 0.2162       | 7.30                     | 11.07                   | 18.37                    | 52.96         | -34.59     | AVG      |         |
| 5   |     | 0.2484       | 25.00                    | 11.10                   | 36.10                    | 61.81         | -25.71     | QP       |         |
| 6   |     | 0.2484       | 10.00                    | 11.10                   | 21.10                    | 51.81         | -30.71     | AVG      |         |
| 7   |     | 0.3048       | 20.90                    | 11.16                   | 32.06                    | 60.11         | -28.05     | QP       |         |
| 8   |     | 0.3048       | 6.30                     | 11.16                   | 17.46                    | 50.11         | -32.65     | AVG      |         |
| 9   |     | 2.1183       | 30.90                    | 12.35                   | 43.25                    | 56.00         | -12.75     | QP       |         |
| 10  | *   | 2.1183       | 24.50                    | 12.35                   | 36.85                    | 46.00         | -9.15      | AVG      |         |

## 6 Radiated Emission Test

### 6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.4 –2003. The radiated test was performed at Timeway Laboratory. This site is on file with the FCC laboratory division, Registration No.899988
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.4-2003.
- (3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "QP" in the data table.
- (6) The antenna polarization : Vertical polarization and Horizontal polarization.

#### Block diagram of Test setup



### 6.2 Configuration of The EUT

Same as section 5.3 of this report

### 6.3 EUT Operating Condition

Same as section 5.4 of this report.

#### 6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

**Frequencies in restricted band are complied to limit on Paragraph 15.209 and 15.109**

| Frequency Range (MHz) | Distance (m) | Field strength (dB $\mu$ V/m) |
|-----------------------|--------------|-------------------------------|
| 30-88                 | 3            | 40.0                          |
| 88-216                | 3            | 43.5                          |
| 216-960               | 3            | 46.0                          |
| Above 960             | 3            | 54.0                          |

- Note:
1. RF Voltage (dBuV) = 20 log RF Voltage ( $\mu$ V)
  2. In the Above Table, the higher limit applies at the band edges.
  3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
  4. This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.
  4. Worse case was recorded (GFSK was the worst case)

## Test result

### General Radiated Emission Data and Harmonics Radiated Emission Data

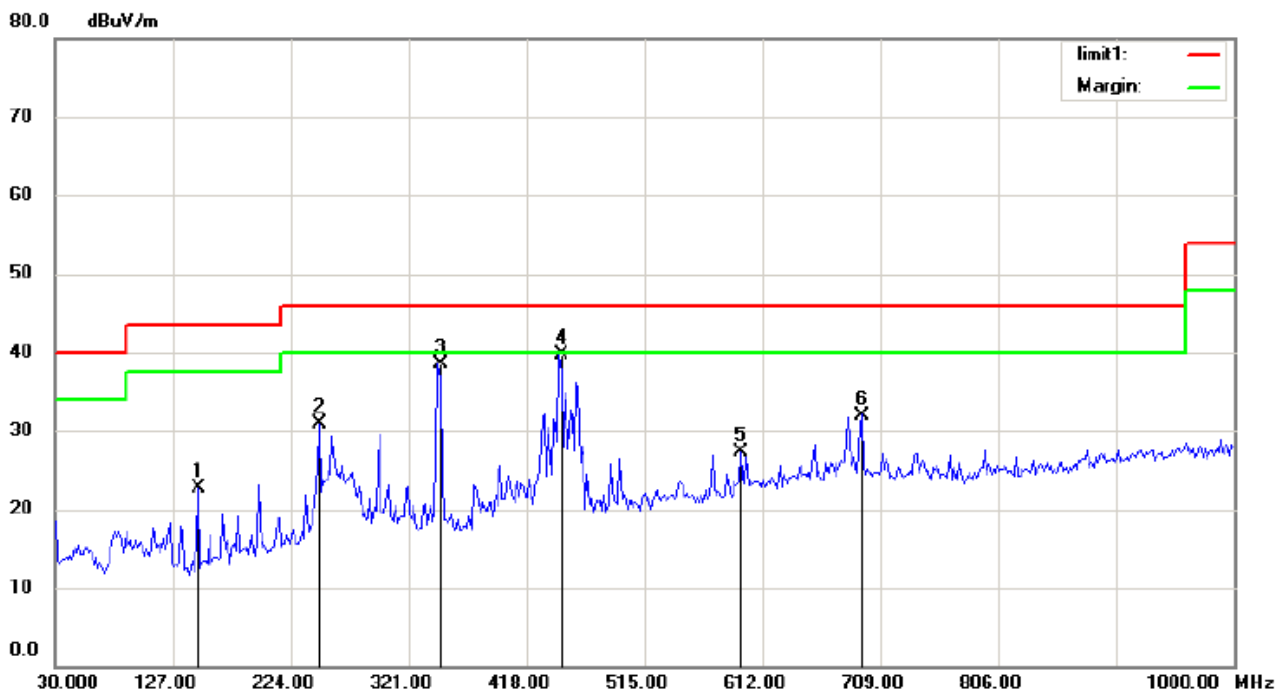
#### Radiated Emission In Horizontal (30MHz---1000MHz)

EUT set Condition: Video on and Keep Bluetooth Transmitting

Results: Pass

Test Figure:

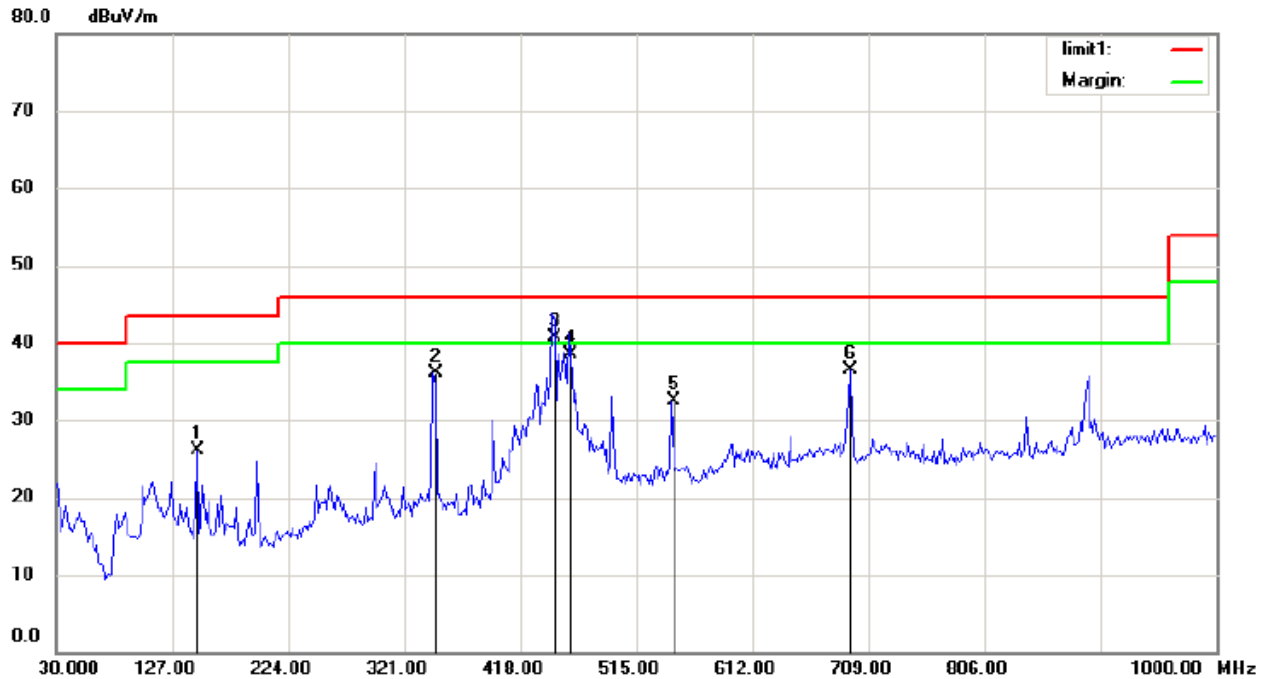
H



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Antenna<br>Height<br>cm | Table<br>Degree<br>degree | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|----------|-------------------------|---------------------------|---------|
| 1   |     | 148.1410     | 11.96                    | 10.72                   | 22.68                      | 43.50           | -20.82     | QP       |                         |                           |         |
| 2   |     | 247.6282     | 15.98                    | 14.89                   | 30.87                      | 46.00           | -15.13     | QP       |                         |                           |         |
| 3   |     | 345.5610     | 20.57                    | 17.85                   | 38.42                      | 46.00           | -7.58      | QP       |                         |                           |         |
| 4   | *   | 445.0481     | 19.63                    | 19.99                   | 39.62                      | 46.00           | -6.38      | QP       |                         |                           |         |
| 5   |     | 594.2788     | 5.17                     | 22.19                   | 27.36                      | 46.00           | -18.64     | QP       |                         |                           |         |
| 6   |     | 693.7660     | 7.54                     | 24.46                   | 32.00                      | 46.00           | -14.00     | QP       |                         |                           |         |

Test Figure:

V



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Antenna<br>Height<br>cm | Table<br>Degree<br>degree | Comment |
|-----|-----|--------------|--------------------------|-------------------------|----------------------------|-----------------|------------|-------------------------|---------------------------|---------|
| 1   |     | 148.1410     | 15.36                    | 10.70                   | 26.06                      | 43.50           | -17.44     | QP                      |                           |         |
| 2   |     | 345.5610     | 18.15                    | 17.86                   | 36.01                      | 46.00           | -9.99      | QP                      |                           |         |
| 3   | *   | 445.0481     | 20.80                    | 19.94                   | 40.74                      | 46.00           | -5.26      | QP                      |                           |         |
| 4   |     | 459.0385     | 18.80                    | 19.66                   | 38.46                      | 46.00           | -7.54      | QP                      |                           |         |
| 5   |     | 544.5353     | 10.85                    | 21.59                   | 32.44                      | 46.00           | -13.56     | QP                      |                           |         |
| 6   |     | 693.7660     | 12.03                    | 24.44                   | 36.47                      | 46.00           | -9.53      | QP                      |                           |         |

**Operation Mode: Transmitting under Low Channel (2402MHz)**

| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Antenna Polarity | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|------------------|-------------------------|
| 2402            | 92.42 ( PK )            | H                | Fundamental Frequency   |
| 2402            | 92.37 ( PK )            | V                |                         |
| 4804            | --                      | H                | 74(Peak)/ 54(AV)        |
| 4804            | --                      | V                | 74(Peak)/ 54(AV)        |
| 7206            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 9608            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 12010           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 14412           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 16814           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 19216           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 21618           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 24020           | --                      | H/V              | 74(Peak)/ 54(AV)        |

Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark “---” means that the emissions level is too low to be measured

**Operation Mode: Transmitting g under Middle Channel (2441MHz)**

| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Antenna Polarity | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|------------------|-------------------------|
| 2441            | 91.36 ( PK )            | H                | Fundamental Frequency   |
| 2441            | 90.86 ( PK )            | V                |                         |
| 4882            | --                      | H                | 74(Peak)/ 54(AV)        |
| 4882            | --                      | V                | 74(Peak)/ 54(AV)        |
| 7323            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 9764            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 12205           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 14646           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 17087           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 19528           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 21969           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 24410           | --                      | H/V              | 74(Peak)/ 54(AV)        |



Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark "---" means that the emissions level is too low to be measured

**Operation Mode: Transmitting under High Channel (2480MHz)**

| Frequency<br>(MHz) | Level@3m (dB $\mu$<br>V/m) | Antenna<br>Polarity | Limit@3m (dB $\mu$<br>V/m) |
|--------------------|----------------------------|---------------------|----------------------------|
| 2480               | 93.48 (PK)                 | H                   | Fundamental<br>Frequency   |
| 2480               | 93.32 (PK)                 | V                   |                            |
| 4960.              | --                         | H                   | 74(Peak)/ 54(AV)           |
| 4960.              | --                         | V                   | 74(Peak)/ 54(AV)           |
| 7440               | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 9920               | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 12400              | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 14880              | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 17360              | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 19840              | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 22320              | --                         | H/V                 | 74(Peak)/ 54(AV)           |
| 24800              | --                         | H/V                 | 74(Peak)/ 54(AV)           |

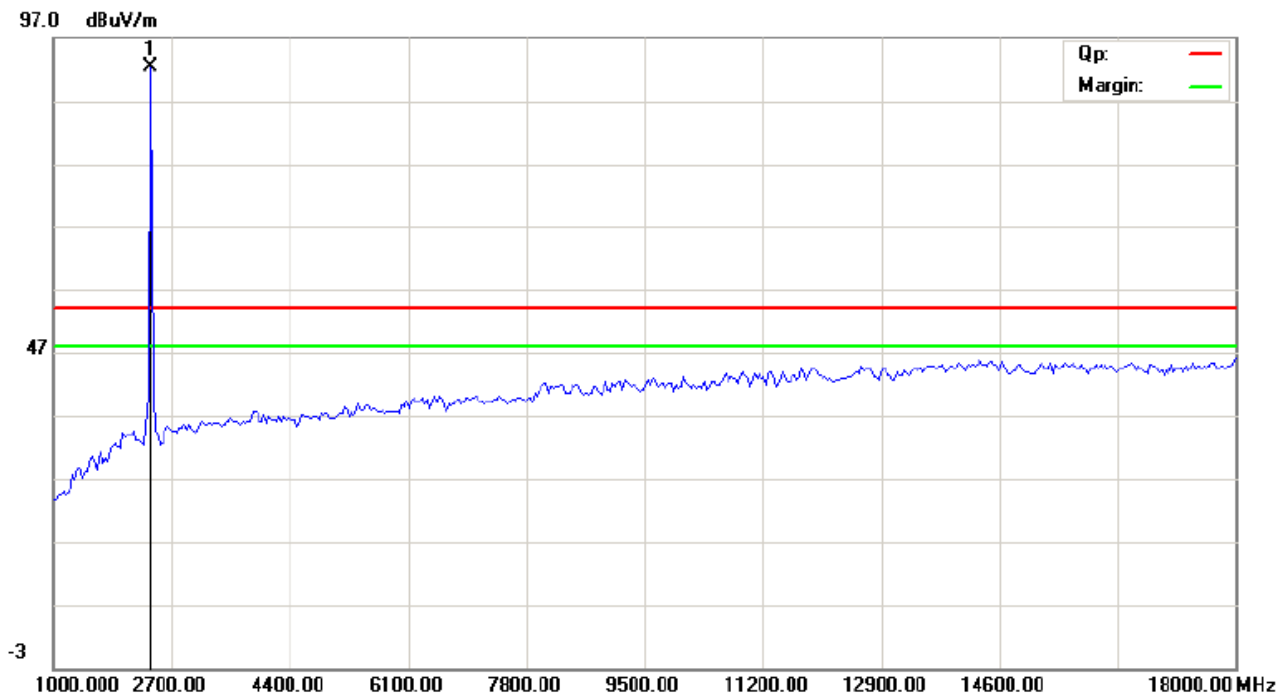
Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit

2. Remark "---" means that the emissions level is too low to be measured

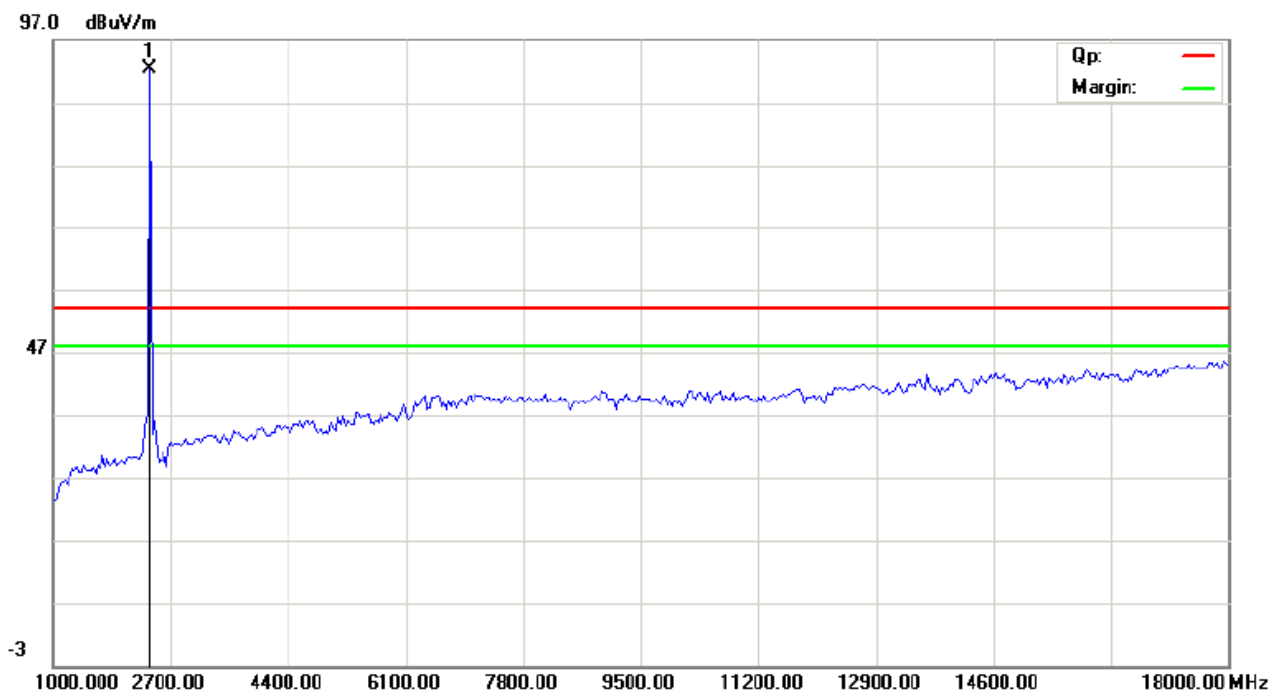


Please refer to the following test plots for details:

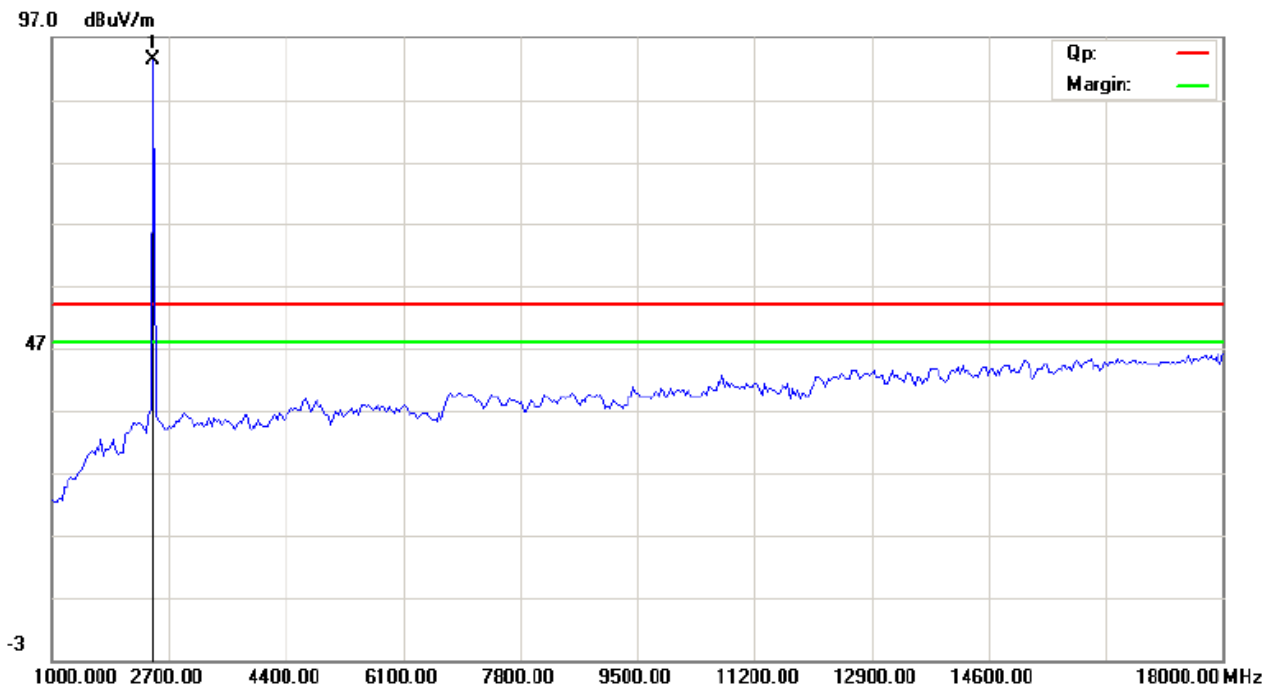
### Low Channel: Horizontal



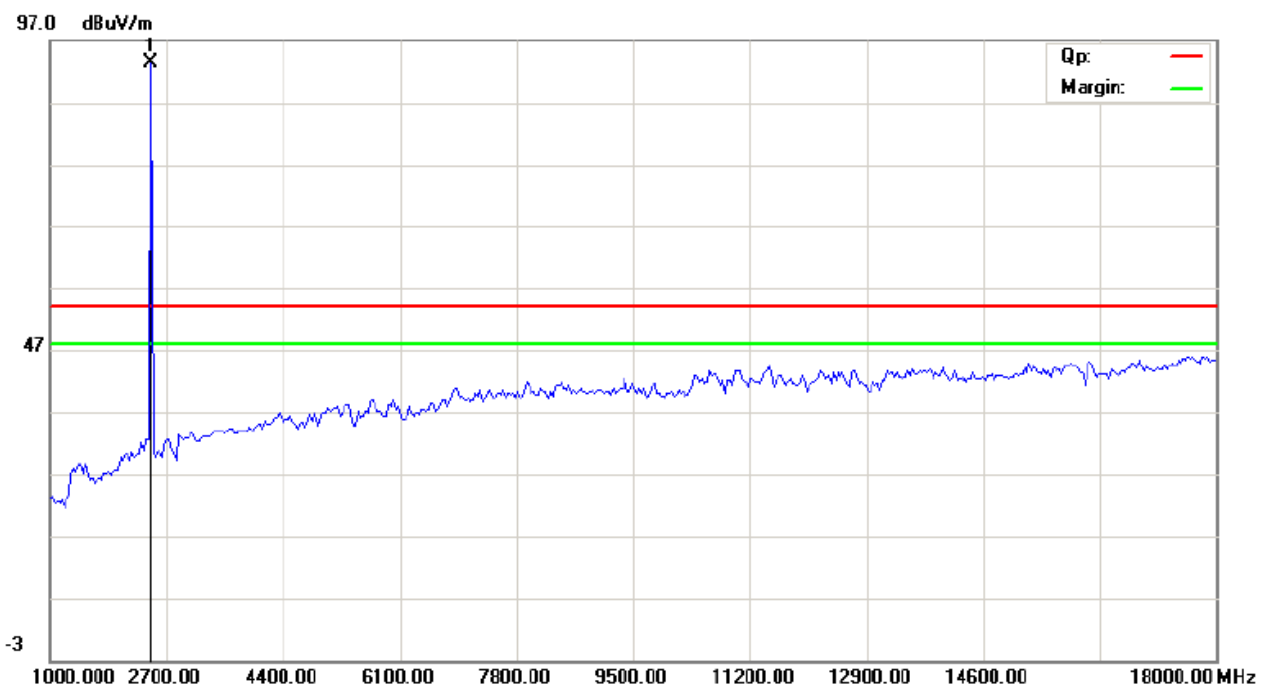
### Low Channel : Vertical



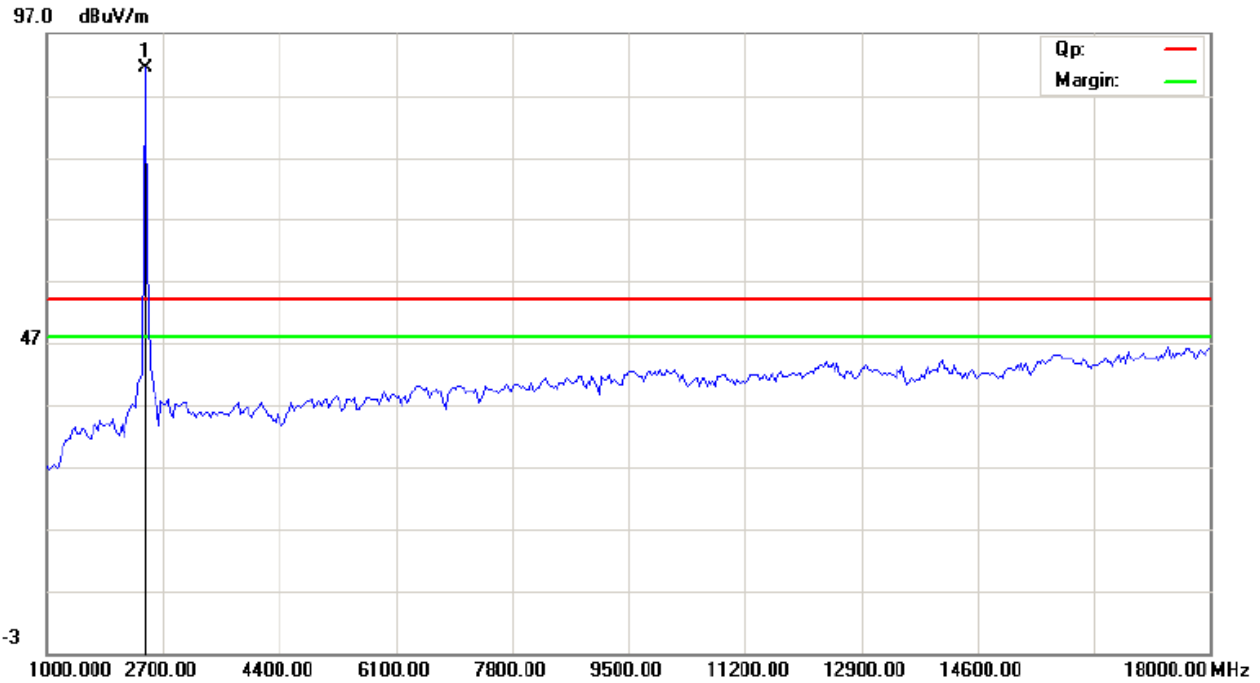
### Middle Channel : Horizontal



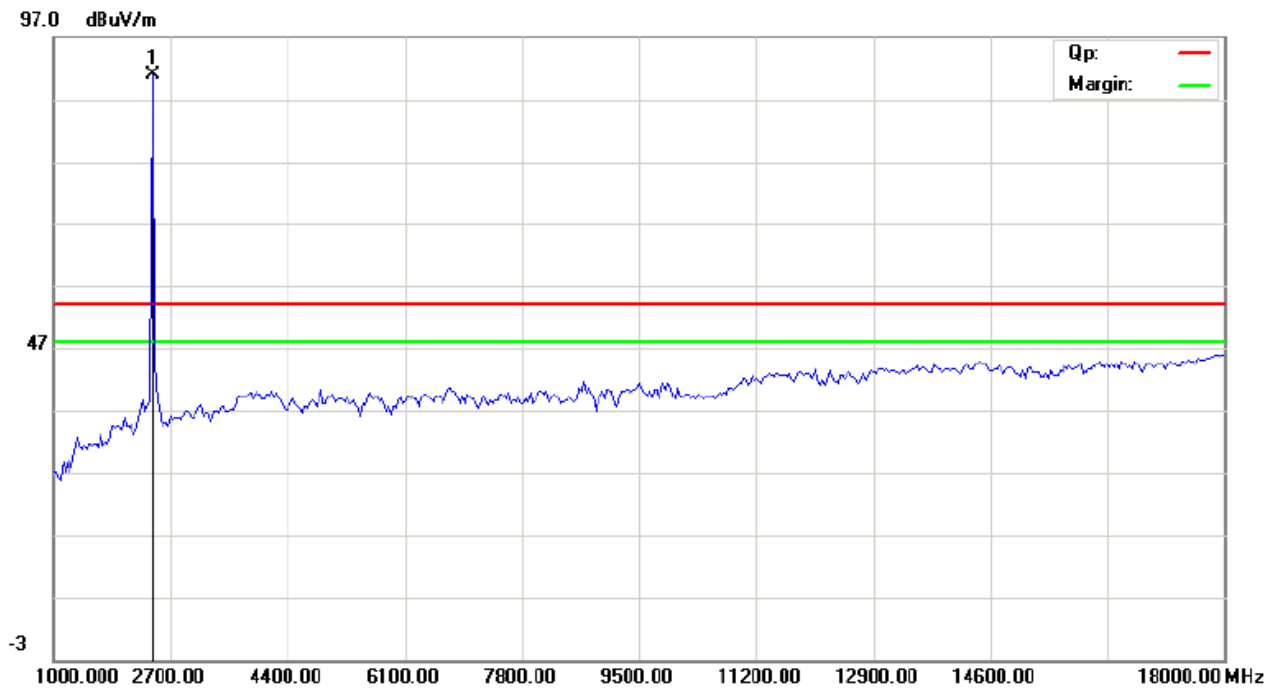
### Middle Channel :: Vertical



## High Channel : Horizontal



## High Channel : Vertical



Note: for the radiated emissions above 18G, it is the floor noise.



## 7.0 20dB Bandwidth Measurement

### 7.1 Regulation

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 7.2 Limits of 20dB Bandwidth Measurement

N/A

### 7.3 Test Procedure.

1. Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span =5MHz, VBW =30 kHz, RBW=100 kHz, Sweep = auto Detector function = peak, Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results. 6. Repeat above procedures until all frequencies measured were complete.

### 7.4 Test Result

#### Type of Modulation: GFSK

| EUT         | MID                     |                       | Model               | MID770-RK88-PR |
|-------------|-------------------------|-----------------------|---------------------|----------------|
| Mode        | Keep Transmitting       |                       | Input Voltage       | DC3.7V         |
| Temperature | 24 deg. C,              |                       | Humidity            | 56% RH         |
| Channel     | Channel Frequency (MHz) | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/ Fail     |
| Low         | 2402                    | 750                   | --                  | Pass           |
| Middle      | 2441                    | 846                   | --                  | Pass           |
| High        | 2480                    | 852                   | --                  | Pass           |

Test Figure:

### 1. Condition: Low Channel



MARKER 1

2.402018 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

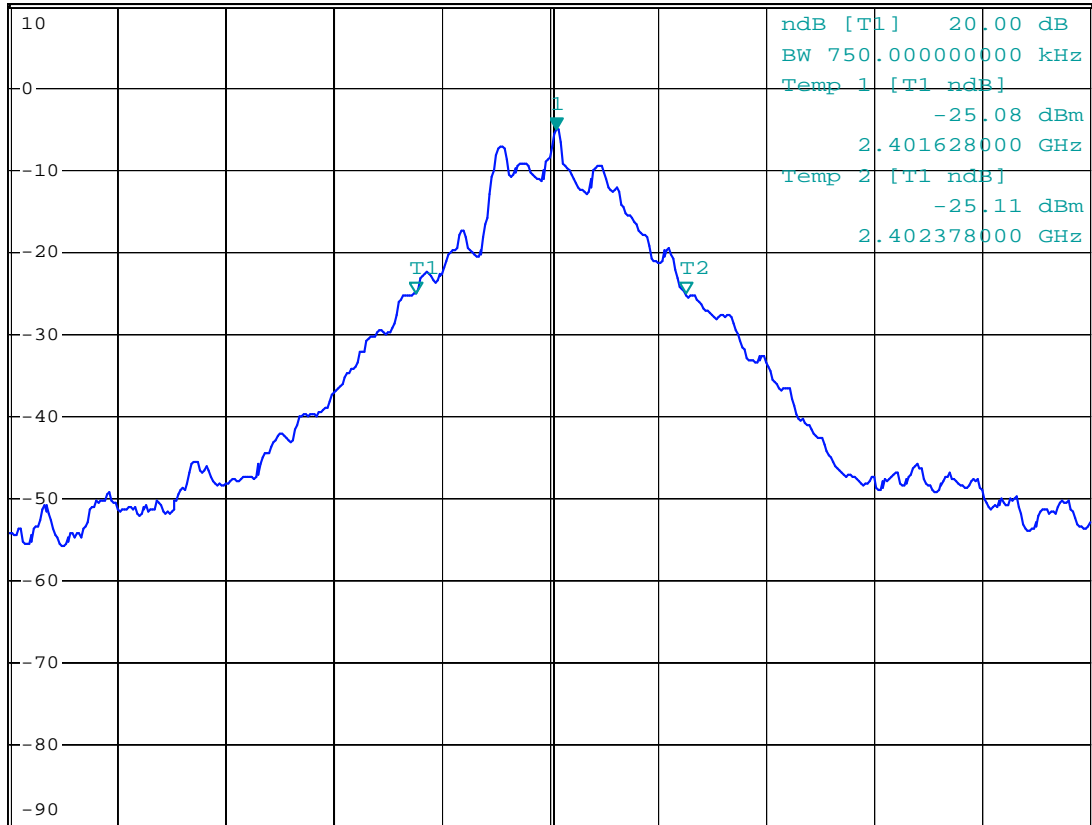
SWT 5 ms

Marker 1 [T1 ]

-5.03 dBm

2.402018000 GHz

1 PK  
MAXH



Center 2.402 GHz

300 kHz/

Span 3 MHz

## 2. Condition: Middle Channel



MARKER 1

2.441006 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

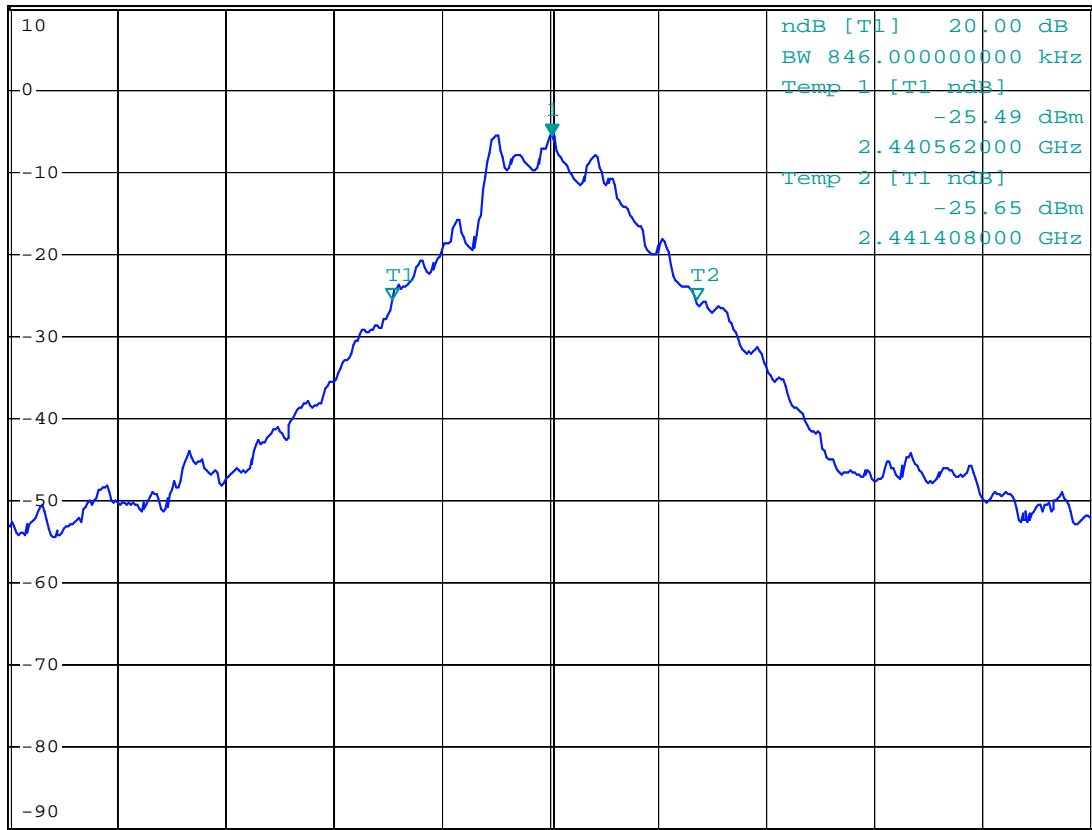
SWT 5 ms

Marker 1 [T1 ]

-5.60 dBm

2.441006000 GHz

1 PK  
MAXH



Center 2.441 GHz

300 kHz/

Span 3 MHz

### 3. High Channel



MARKER 1

2.480006 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

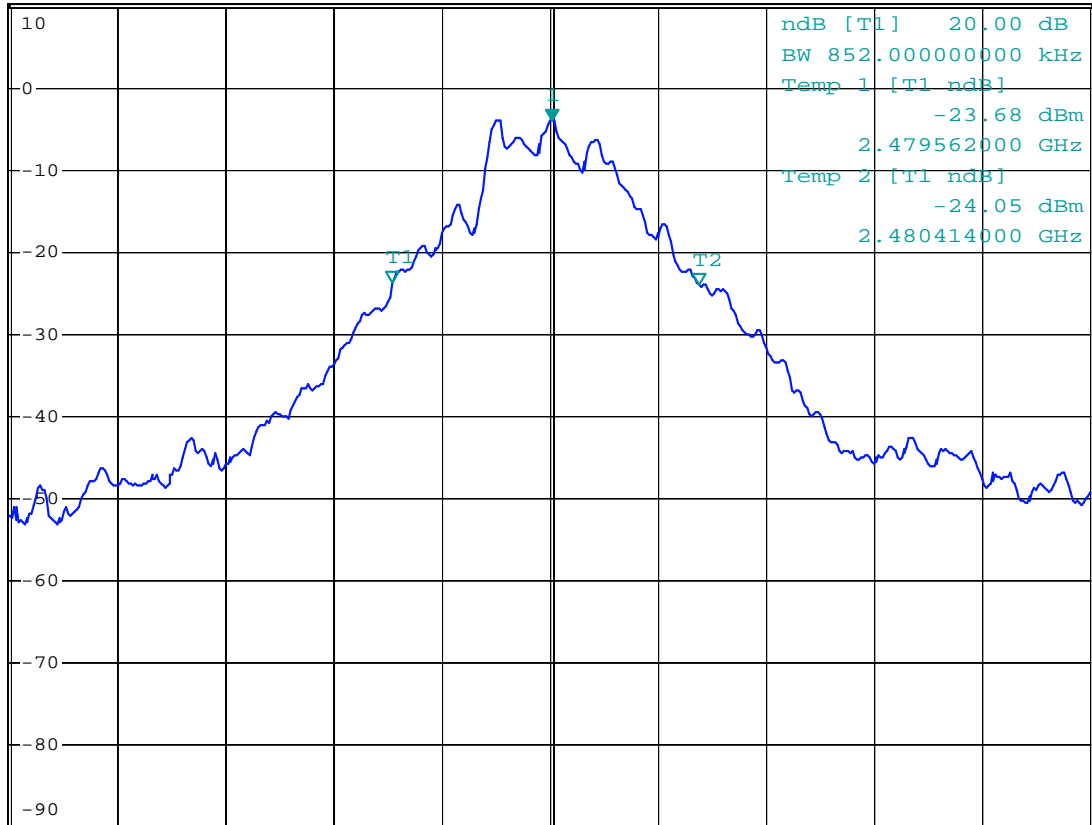
SWT 5 ms

Marker 1 [T1]

-3.92 dBm

2.480006000 GHz

1 PK  
MAXH



Center 2.48 GHz

300 kHz/

Span 3 MHz

**Test Result****Type of Modulation:**  $\pi/4$ QPSK

|             |                         |                       |                     |               |                |
|-------------|-------------------------|-----------------------|---------------------|---------------|----------------|
| EUT         |                         | MID                   |                     | Model         | MID770-RK88-PR |
| Mode        |                         | Keep Transmitting     |                     | Input Voltage | DC3.7V         |
| Temperature |                         | 24 deg. C,            |                     | Humidity      | 56% RH         |
| Channel     | Channel Frequency (MHz) | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/ Fail    |                |
| Low         | 2402                    | 1212                  | --                  | Pass          |                |
| Middle      | 2441                    | 1212                  | --                  | Pass          |                |
| High        | 2480                    | 1218                  | --                  | Pass          |                |







## 2. Condition: Middle Channel



MARKER 1

2.441006 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

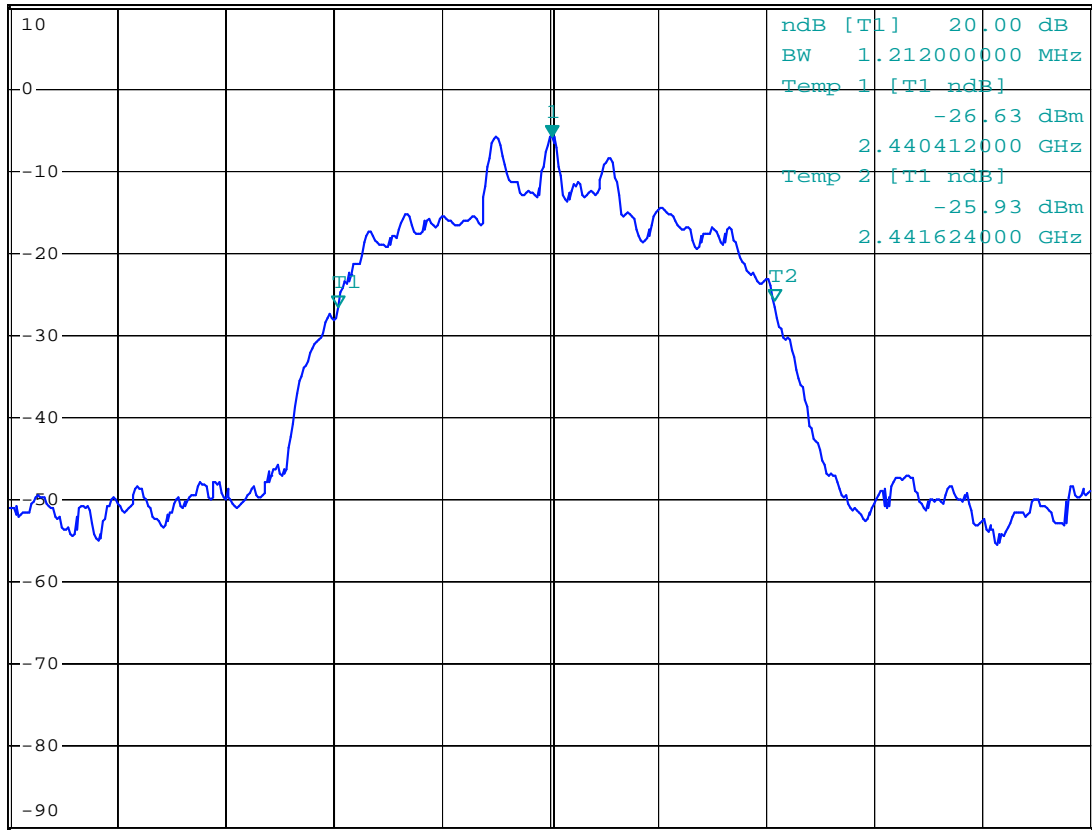
\* SWT 5 ms

Marker 1 [T1]

-5.89 dBm

2.441006000 GHz

1 PK  
MAXH



Center 2.441 GHz

300 kHz/

Span 3 MHz



### 3. High Channel



MARKER 1

2.480024 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

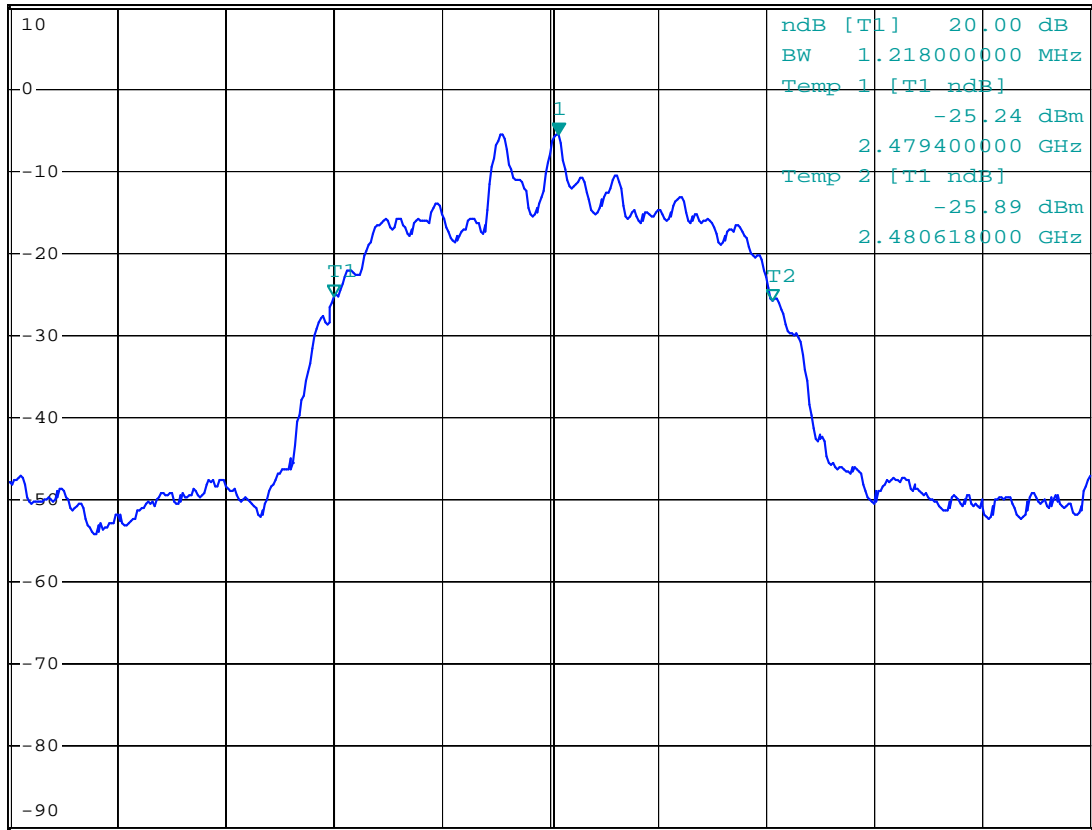
SWT 5 ms

Marker 1 [T1]

-5.61 dBm

2.480024000 GHz

1 PK  
MAXH



Center 2.48 GHz

300 kHz/

Span 3 MHz

**Test Result****Type of Modulation: 8DPSK**

|             |                         |                       |                     |                |
|-------------|-------------------------|-----------------------|---------------------|----------------|
| EUT         | MID                     |                       | Model               | MID770-RK88-PR |
| Mode        | Keep Transmitting       |                       | Input Voltage       | DC3.7V         |
| Temperature | 24 deg. C,              |                       | Humidity            | 56% RH         |
| Channel     | Channel Frequency (MHz) | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/ Fail     |
| Low         | 2402                    | 1212                  | --                  | Pass           |
| Middle      | 2441                    | 1218                  | --                  | Pass           |
| High        | 2480                    | 1212                  | --                  | Pass           |

Test Figure:

### 1. Condition: Low Channel



MARKER 1

2.401868 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

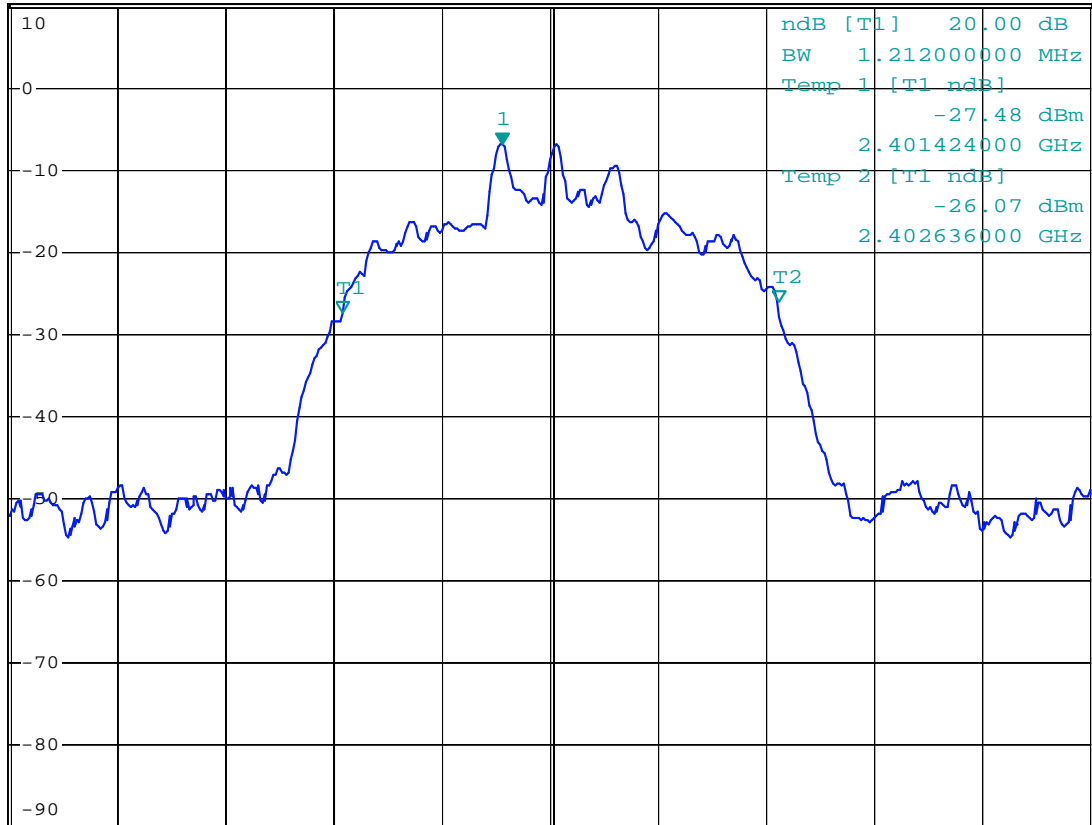
SWT 5 ms

Marker 1 [T1 ]

-6.94 dBm

2.401868000 GHz

1 PK  
MAXH



Center 2.402 GHz

300 kHz/

Span 3 MHz

3DB

## 2. Condition: Middle Channel



MARKER 1

2.440868 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

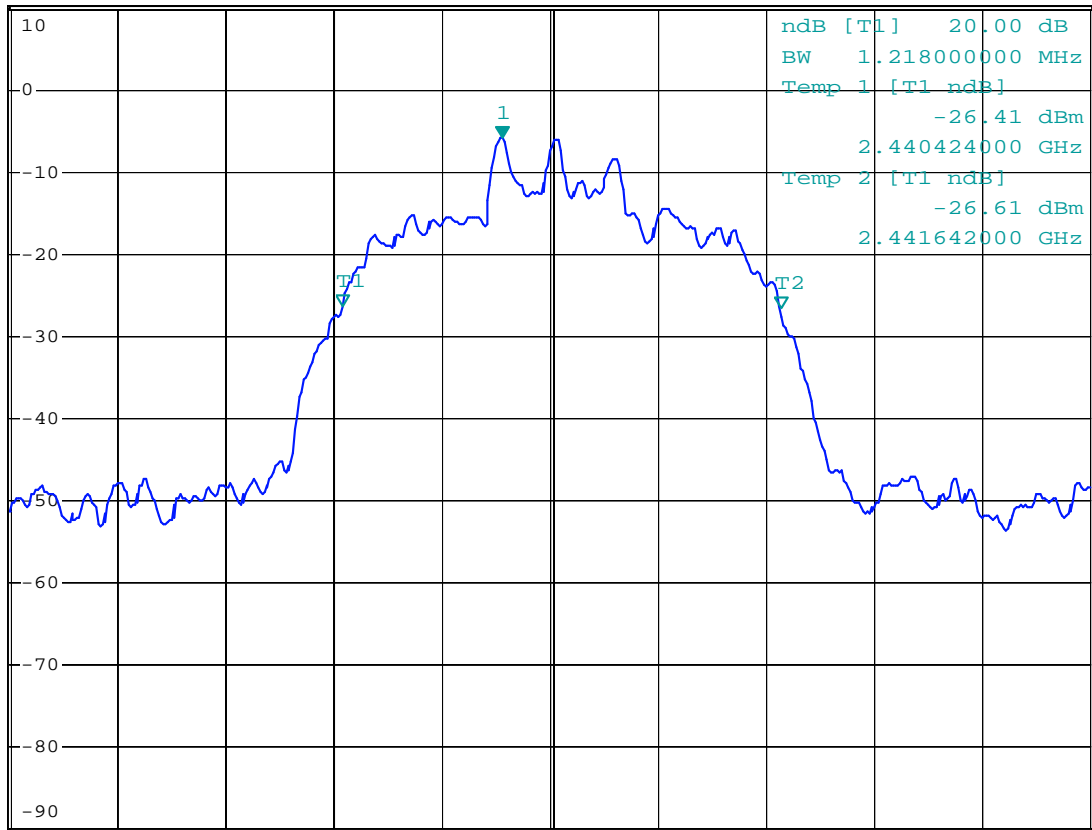
SWT 5 ms

Marker 1 [T1 ]

-5.94 dBm

2.440868000 GHz

1 PK  
MAXH



Center 2.441 GHz

300 kHz/

Span 3 MHz

### 3. High Channel



MARKER 1

2.480018 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 30 kHz

\* VBW 100 kHz

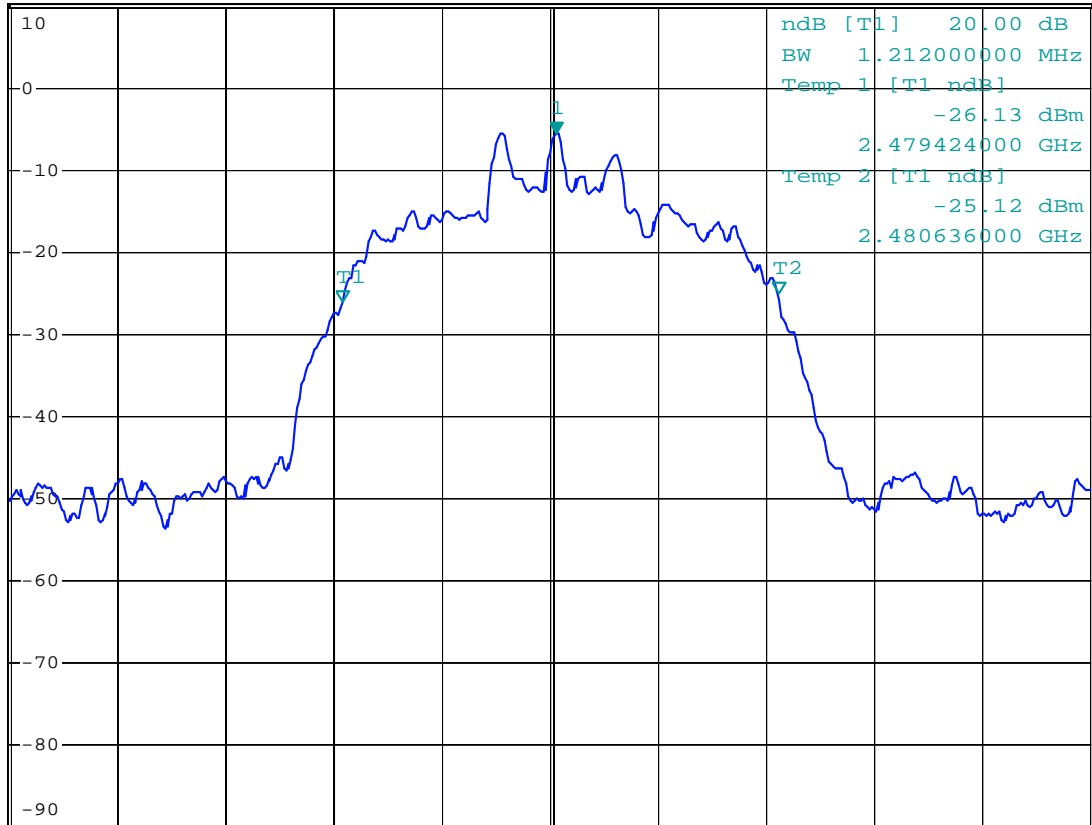
SWT 5 ms

Marker 1 [T1]

-5.55 dBm

2.480018000 GHz

1 PK  
MAXH



Center 2.48 GHz

300 kHz/

Span 3 MHz



## **8. Maximum Peak Output Power**

### **8.1 Regulation**

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5MHz band:0.125 watts. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **8.2 Limits of Maximum Peak Output Power**

The Maximum Peak Output Power Measurement is 30dBm.

### **8.3 Test Procedure**

1. Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel ; RBW > the 20 dB bandwidth of the emission being measured ; VBW = RBW=3MHz ; Sweep = auto ; Detector function = peak ; Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
4. Repeat above procedures until all frequencies measured were complete.



**8.4 Test Results****Type of Modulation: GFSK**

|             |                         |                         |                        |                |
|-------------|-------------------------|-------------------------|------------------------|----------------|
| EUT         | MID                     |                         | Model                  | MID770-RK88-PR |
| Mode        | Keep Transmitting       |                         | Input Voltage          | AC120V         |
| Temperature | 24 deg. C,              |                         | Humidity               | 56% RH         |
| Channel     | Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Limit (dBm) | Pass/ Fail     |
| Low         | 2402                    | -4.27                   | 30                     | Pass           |
| Middle      | 2441                    | <b>-2.30</b>            | 30                     | Pass           |
| High        | 2480                    | -3.16                   | 30                     | Pass           |

Note: 1. the result basic equation calculation as follow:

$$\text{Peak Power Output} = \text{Peak Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded

**Type of Modulation: 16QPSK**

|             |                         |                         |                        |                |
|-------------|-------------------------|-------------------------|------------------------|----------------|
| EUT         | MID                     |                         | Model                  | MID770-RK88-PR |
| Mode        | Keep Transmitting       |                         | Input Voltage          | AC120V         |
| Temperature | 24 deg. C,              |                         | Humidity               | 56% RH         |
| Channel     | Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Limit (dBm) | Pass/ Fail     |
| Low         | 2402                    | -5.38                   | 30                     | Pass           |
| Middle      | 2441                    | -3.52                   | 30                     | Pass           |
| High        | 2480                    | -3.67                   | 30                     | Pass           |

Note: 1. the result basic equation calculation as follow:

$$\text{Peak Power Output} = \text{Peak Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded

**Type of Modulation: 8DPSK**

| EUT         | MID                     |                         | Model                  | MID770-RK88-PR |
|-------------|-------------------------|-------------------------|------------------------|----------------|
| Mode        | Keep Transmitting       |                         | Input Voltage          | AC120V         |
| Temperature | 24 deg. C,              |                         | Humidity               | 56% RH         |
| Channel     | Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Limit (dBm) | Pass/ Fail     |
| Low         | 2402                    | -4.96                   | 30                     | Pass           |
| Middle      | 2441                    | -3.68                   | 30                     | Pass           |
| High        | 2480                    | -3.53                   | 30                     | Pass           |

Note: 1. the result basic equation calculation as follow:

$$\text{Peak Power Output} = \text{Peak Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded



## **9. Carrier Frequency Separation**

### **9.1 Regulation**

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

### **9.2 Limits of Carrier Frequency Separation**

The Maximum Power Spectral Density Measurement is 25kHz or two-thirds of the 20dB bandwidth of the hopping Channel which is great.

### **9.3 Test Procedure**

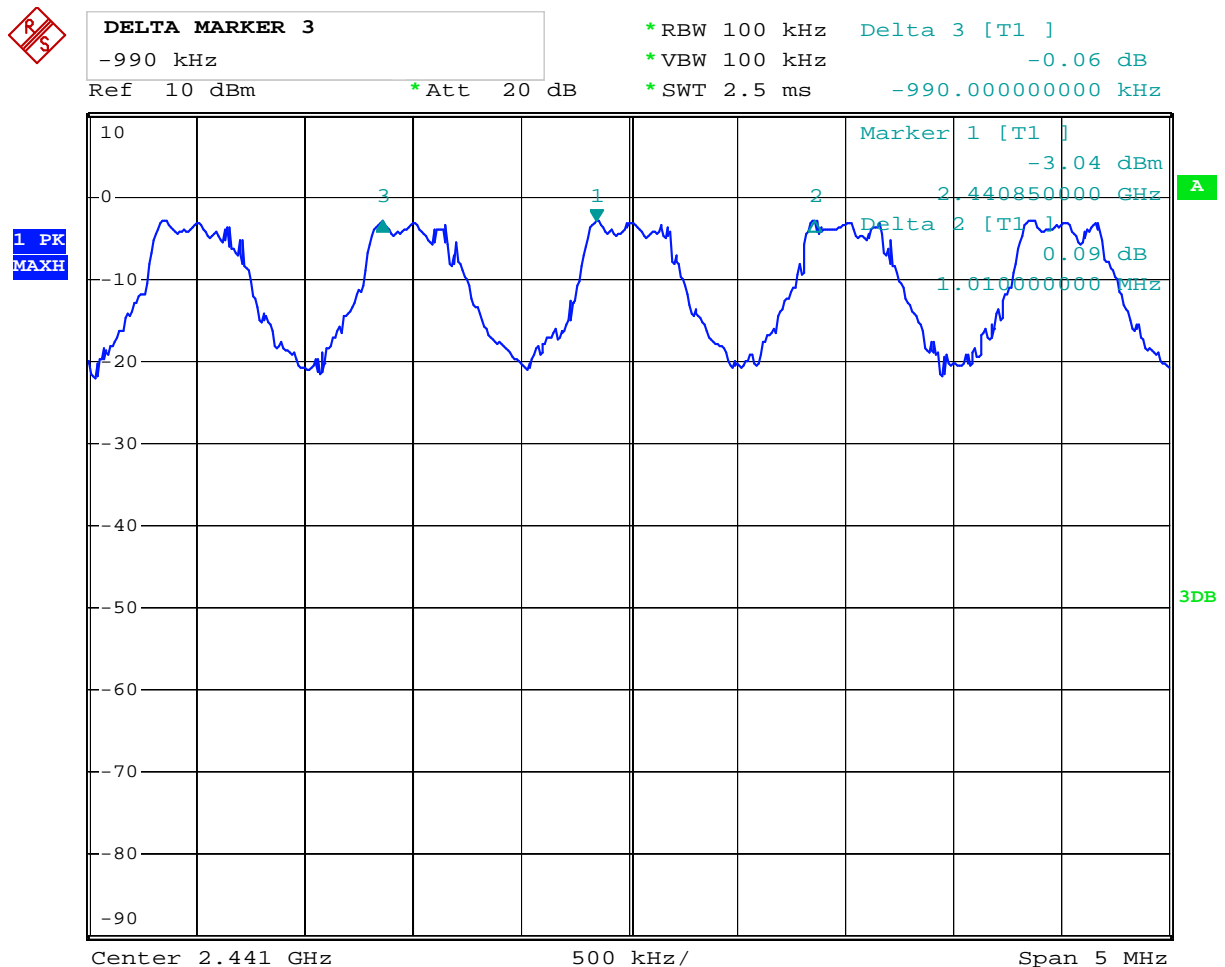
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = wide enough to capture the peaks of two adjacent channels: Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span; Video (or Average) Bandwidth (VBW)  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold
3. Measure the separation between the peaks of the adjacent channels using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.

## 9.4 Test Result

### Type of Modulation: GFSK

|                              |   |               |                |
|------------------------------|---|---------------|----------------|
| EUT                          | MID                                     | Model         | MID770-RK88-PR |
| Mode                         | Hopping On                              | Input Voltage | DC3.7V         |
| Temperature                  | 24 deg. C,                              | Humidity      | 56% RH         |
| Carrier Frequency Separation | Limit                                   |               | Pass/ Fail     |
| 1.010MHz                     | $\geq 25$ kHz or 2/3 of 20 dB bandwidth |               | Pass           |

## Test Plots



**Type of Modulation:**  $\pi/4$ QPSK

|                              |            |   |                |
|------------------------------|------------|---|----------------|
| EUT                          | MID        | Model                                   | MID770-RK88-PR |
| Mode                         | Hopping On | Input Voltage                           | DC3.7V         |
| Temperature                  | 24 deg. C, | Humidity                                | 56% RH         |
| Carrier Frequency Separation |            | Limit                                   | Pass/ Fail     |
| 1.010MHz                     |            | $\geq 25$ kHz or 2/3 of 20 dB bandwidth | Pass           |

**Test Plots**



**DELTA MARKER 1**

2.02 MHz

Ref 10 dBm

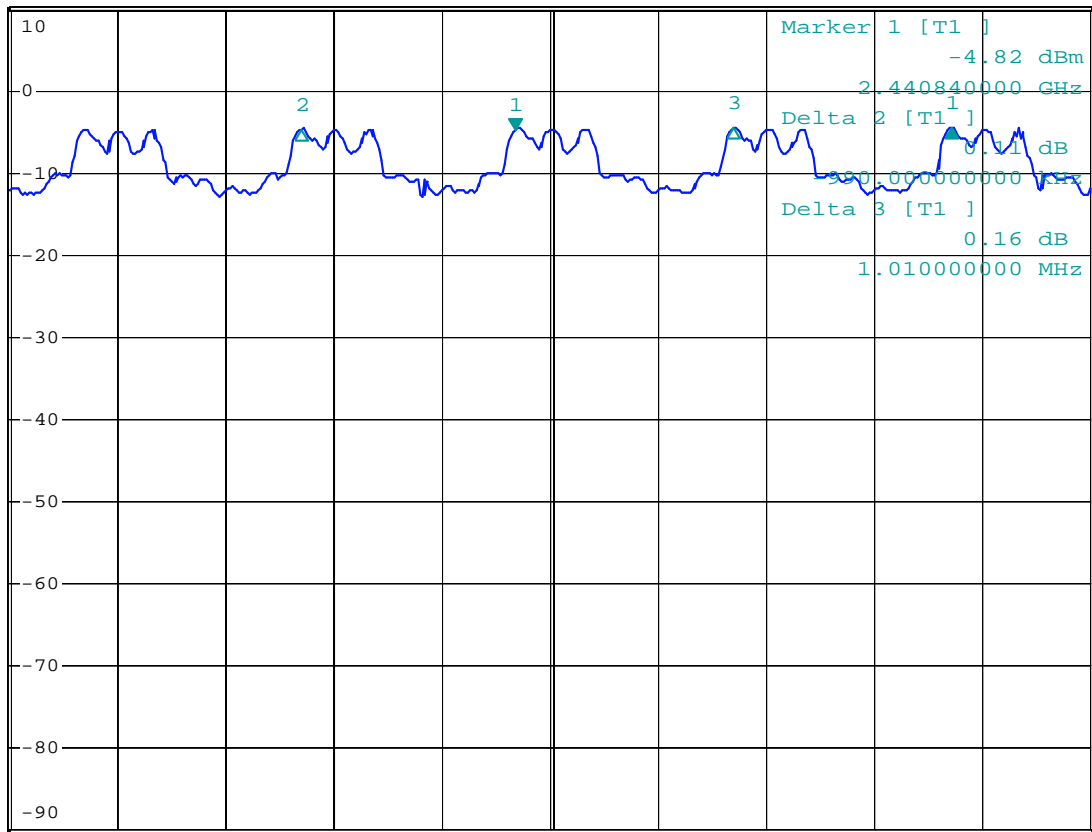
\* Att 20 dB

\* RBW 100 kHz Delta 1 [T1 ]

\* VBW 100 kHz 0.27 dB

\* SWT 10 ms 2.020000000 MHz

1 PK  
MAXH



Center 2.441 GHz

500 kHz/

Span 5 MHz

**Type of Modulation: 8DPSK**

|                              |   |               |                |
|------------------------------|---|---------------|----------------|
| EUT                          | MID                                     | Model         | MID770-RK88-PR |
| Mode                         | Hopping On                              | Input Voltage | DC3.7V         |
| Temperature                  | 24 deg. C,                              | Humidity      | 56% RH         |
| Carrier Frequency Separation | Limit                                   |               | Pass/ Fail     |
| 1.000MHz                     | $\geq 25$ kHz or 2/3 of 20 dB bandwidth |               | Pass           |

**Test Plots****DELTA MARKER 3**

-1.01 MHz

Ref 10 dBm

\* Att 20 dB

\* RBW 100 kHz

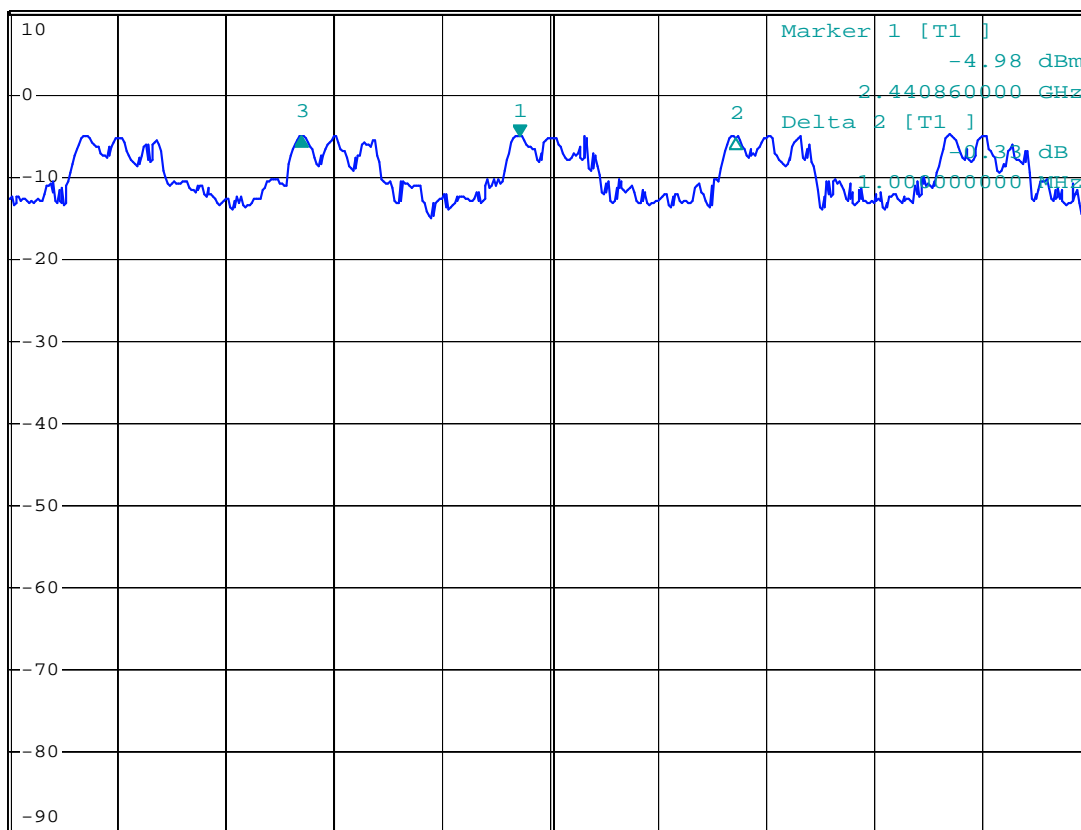
Delta 3 [T1 ]

\* VBW 100 kHz

-0.04 dB

SWT 2.5 ms

-1.010000000 MHz

1 PK  
MAXH

Center 2.441 GHz

500 kHz/

Span 5 MHz



## **10. Number of Hopping Channels**

### **10.1 Regulation**

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

### **10.2 Limits of Number of Hopping Channels**

The frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

### **10.3 Test Procedure**

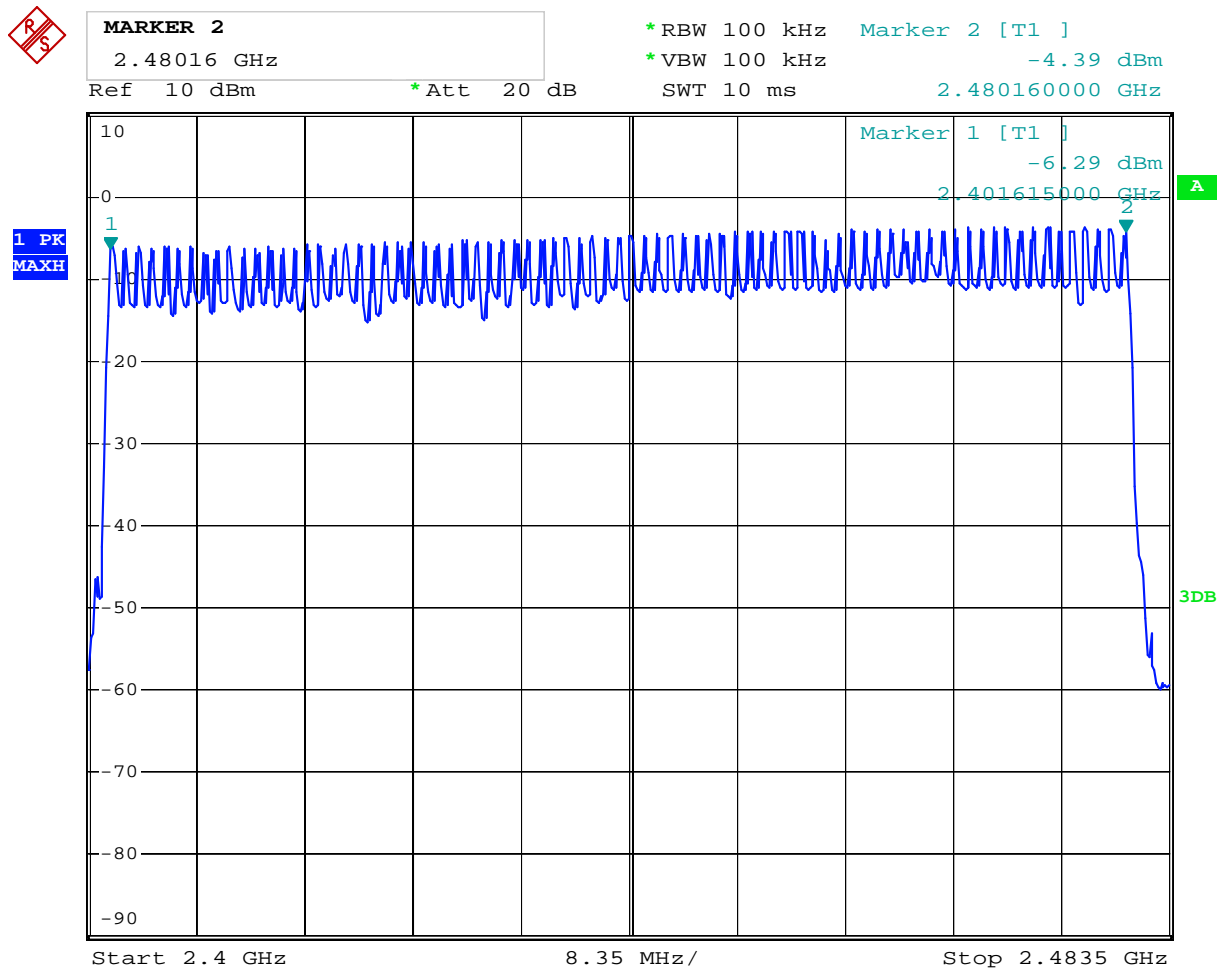
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = the frequency band of operation; RBW=VBW=100 kHz;  
Sweep = auto; Detector function = peak; Trace = max hold
3. Record the number of hopping channels.

## 10.4 Test Result

### Type of Modulation: GFSK

|                     |                            |               |                |            |
|---------------------|----------------------------|---------------|----------------|------------|
| EUT                 | MID                        | Model         | MID770-RK88-PR |            |
| Mode                | Hopping On                 | Input Voltage | DC3.7V         |            |
| Temperature         | 24 deg. C,                 | Humidity      | 56% RH         |            |
| Operating Frequency | Number of hopping channels |               | Limit          | Pass/ Fail |
| 2402-2480MHz        | 79                         |               | ≥ 15           | Pass       |

## Test Plot





**Type of Modulation:  $\pi/4$ QPSK**

|                     |                            |               |                |
|---------------------|----------------------------|---------------|----------------|
| EUT                 | MID                        | Model         | MID770-RK88-PR |
| Mode                | Hopping On                 | Input Voltage | DC3.7V         |
| Temperature         | 24 deg. C,                 | Humidity      | 56% RH         |
| Operating Frequency | Number of hopping channels | Limit         | Pass/ Fail     |
| 2402-2480MHz        | 79                         | $\geq 15$     | Pass           |

**Test Plot****MARKER 1**

2.402004 GHz

Ref 10 dBm

\* Att 20 dB

\* RBW 100 kHz

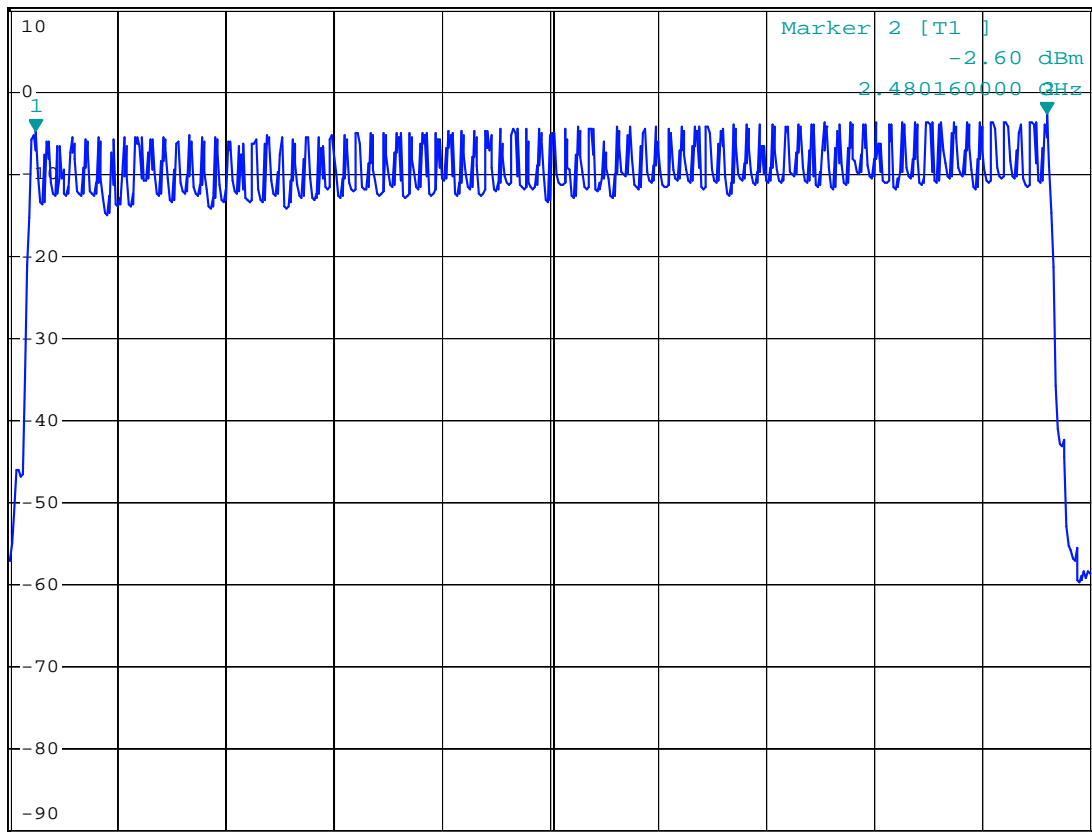
Marker 1 [T1 ]

\* VBW 100 kHz

-4.79 dBm

\* SWT 10 ms

2.402004000 GHz

1 PK  
MAXH

Start 2.4 GHz

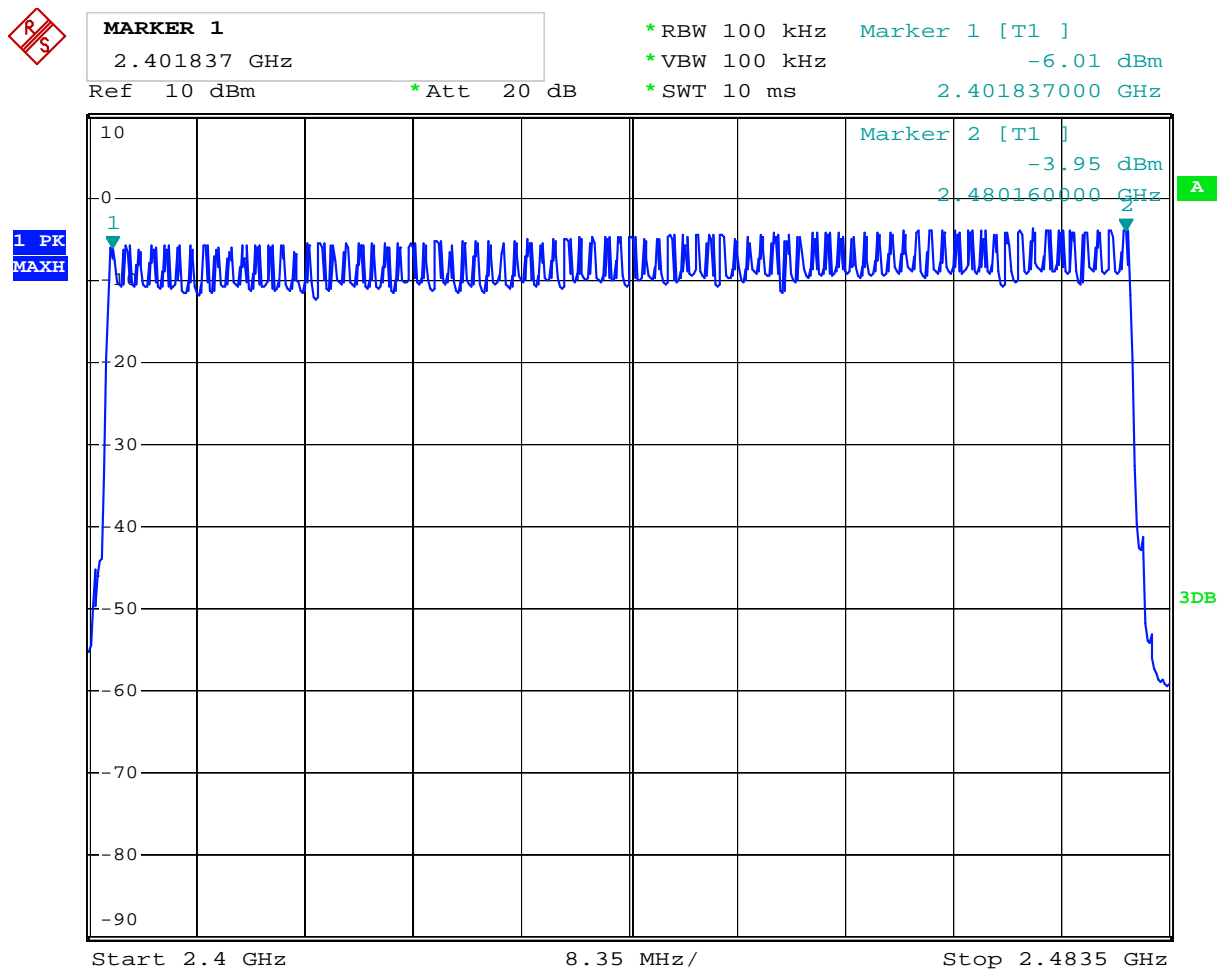
8.35 MHz/

Stop 2.4835 GHz

### Type of Modulation: 8DPSK

|                     |                            |               |                |
|---------------------|----------------------------|---------------|----------------|
| EUT                 | MID                        | Model         | MID770-RK88-PR |
| Mode                | Hopping On                 | Input Voltage | DC3.7V         |
| Temperature         | 24 deg. C,                 | Humidity      | 56% RH         |
| Operating Frequency | Number of hopping channels | Limit         | Pass/ Fail     |
| 2402-2480MHz        | 79                         | $\geq 15$     | Pass           |

### Test Plot





## **11. Time of Occupancy (Dwell Time)**

### **11.1 Regulation**

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **11.2 Limits of Carrier Frequency Separation**

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

### **11.3 Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW  $\geq$  RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold
3. Measure the dwell time using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.
5. Repeat this test for different modes of operation (e.g., data rate, modulation format, etc.), if applicable.

## 11.4 Test Result

### Type of Modulation: GFSK

|             |                   |               |               |                |
|-------------|-------------------|---------------|---------------|----------------|
| EUT         | MID               |               | Model         | MID770-RK88-PR |
| Mode        | Keep Transmitting |               | Input Voltage | DC3.7V         |
| Temperature | 24 deg. C,        |               | Humidity      | 56% RH         |
| Channel     | Reading           | Hopping Rate  | Actual        | Limit          |
| Low         | 2.97              | 266.667 hop/s | 0.317         | 0.4s           |
| Middle      | 2.96              | 266.667 hop/s | 0.316         | 0.4s           |
| High        | 2.97              | 266.667 hop/s | 0.317         | 0.4s           |

Actual = Reading  $\times$  (Hopping rate / Number of channels)  $\times$  Test period, Test period = 0.4 [seconds / channel]  $\times$  79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625 $\mu$ s with 79 channels. A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

**Note: DH5 was the worse case**

Test Plots:

Low Channel:



MARKER 1

2.0712 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

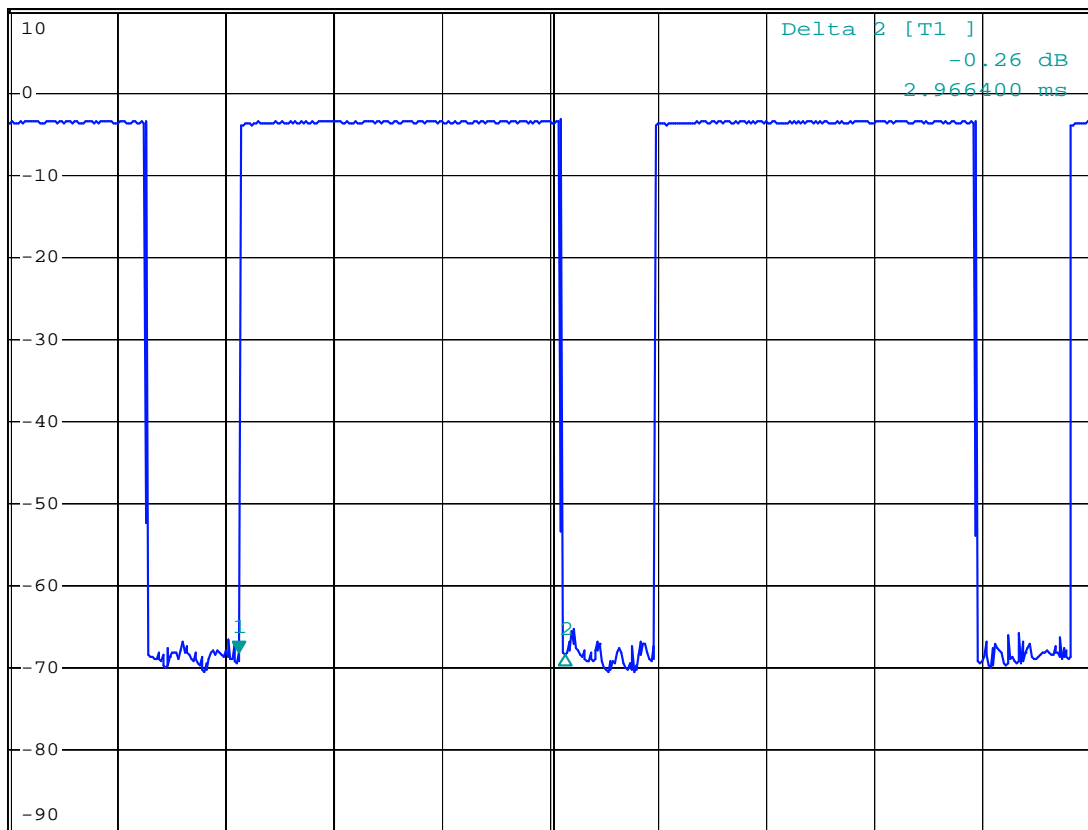
SWT 9.8 ms

Marker 1 [T1]

-67.96 dBm

2.071200 ms

1 PK  
MAXH



Center 2.402 GHz

980  $\mu$ s/

Middle Channel:



DELTA MARKER 2

2.96 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

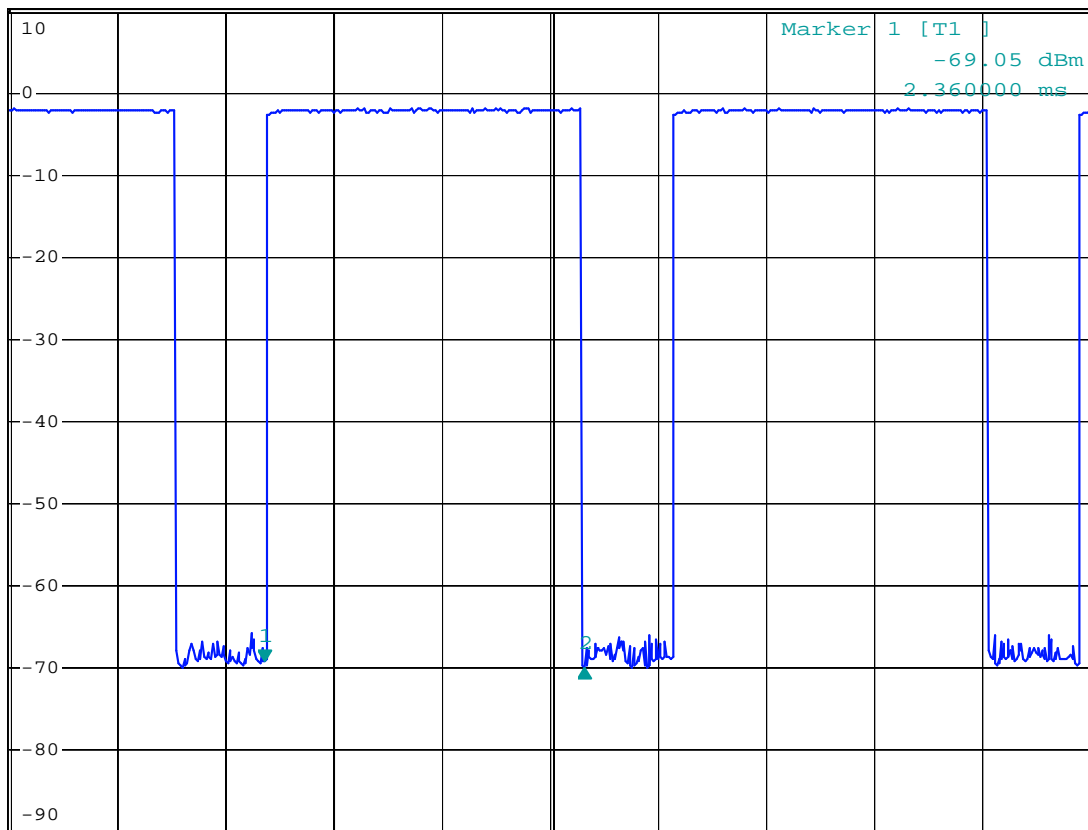
SWT 10 ms

Delta 2 [T1 ]

-0.77 dB

2.960000 ms

1 PK  
MAXH



Center 2.441 GHz

1 ms/

## High Channel



MARKER 1

3.6 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

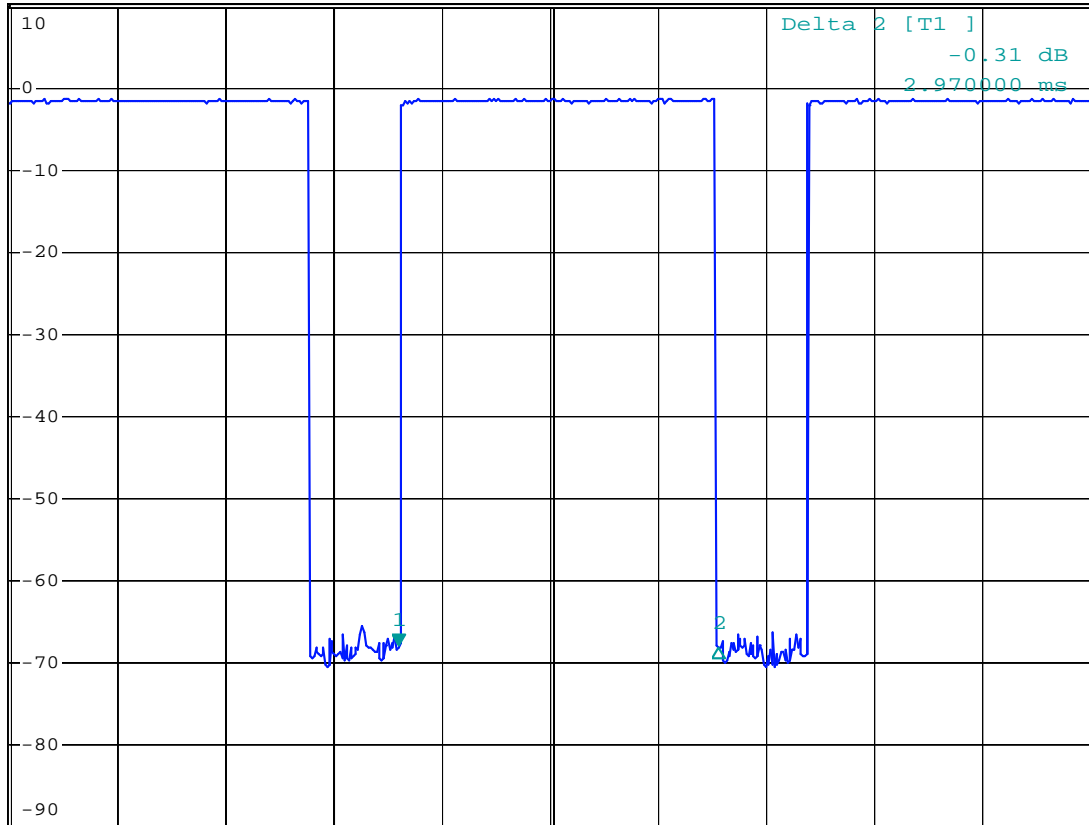
SWT 10 ms

Marker 1 [T1 ]

-67.77 dBm

3.600000 ms

1 PK  
MAXH



A  
SGL

3DB

Center 2.48 GHz

1 ms/

## Test Result

**Type of Modulation:**  $\pi/4$ QPSK

|             |                   |               |               |                |  |
|-------------|-------------------|---------------|---------------|----------------|--|
| EUT         | MID               |               | Model         | MID770-RK88-PR |  |
| Mode        | Keep Transmitting |               | Input Voltage | DC3.7V         |  |
| Temperature | 24 deg. C,        |               | Humidity      | 56% RH         |  |
| Channel     | Reading           | Hopping Rate  | Actual        | Limit          |  |
| Low         | 2.97              | 266.667 hop/s | 0.317         | 0.4s           |  |
| Middle      | 3.02              | 266.667 hop/s | 0.322         | 0.4s           |  |
| High        | 2.96              | 266.667 hop/s | 0.316         | 0.4s           |  |

Actual = Reading  $\times$  (Hopping rate / Number of channels)  $\times$  Test period, Test period = 0.4 [seconds / channel]  $\times$  79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625 $\mu$ s with 79 channels. A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

**Note: DH5 was the worse case**



Test Plots:

Low Channel:



DELTA MARKER 2

2.972 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

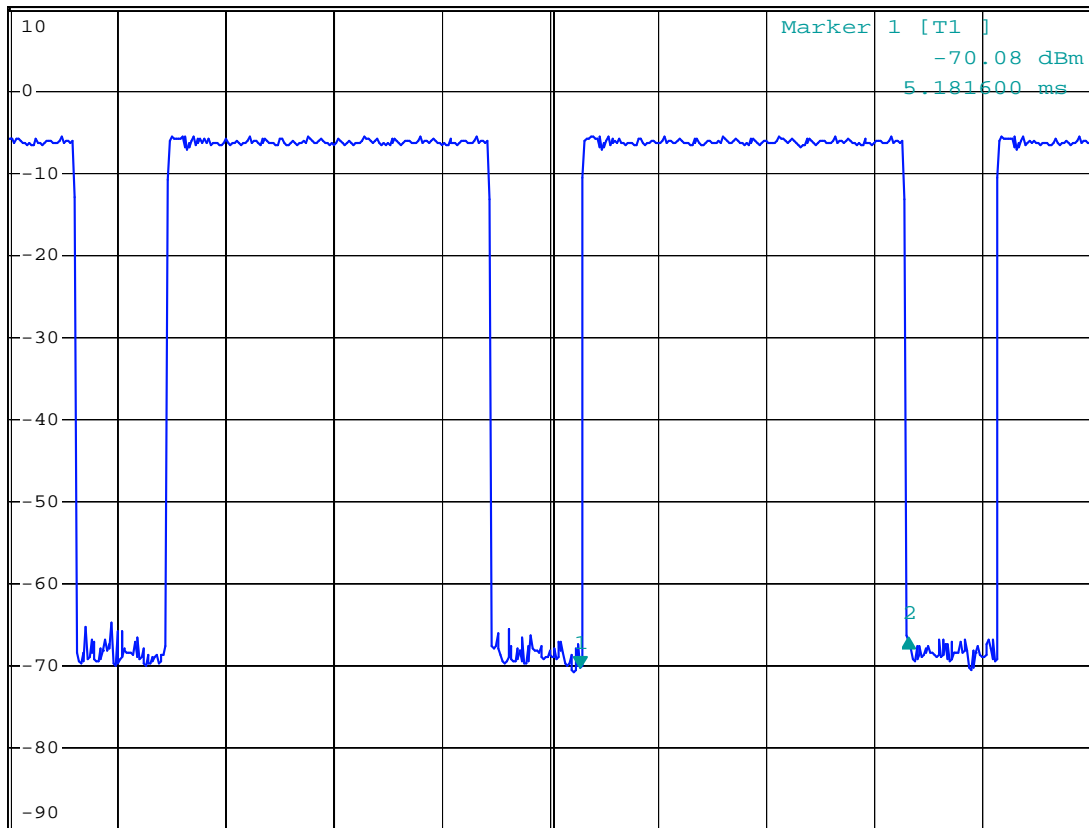
SWT 9.8 ms

Delta 2 [T1 ]

3.45 dB

2.972000 ms

1 PK  
MAXH



Center 2.402 GHz

980  $\mu$ s/

Middle Channel:



MARKER 1

2.9766 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

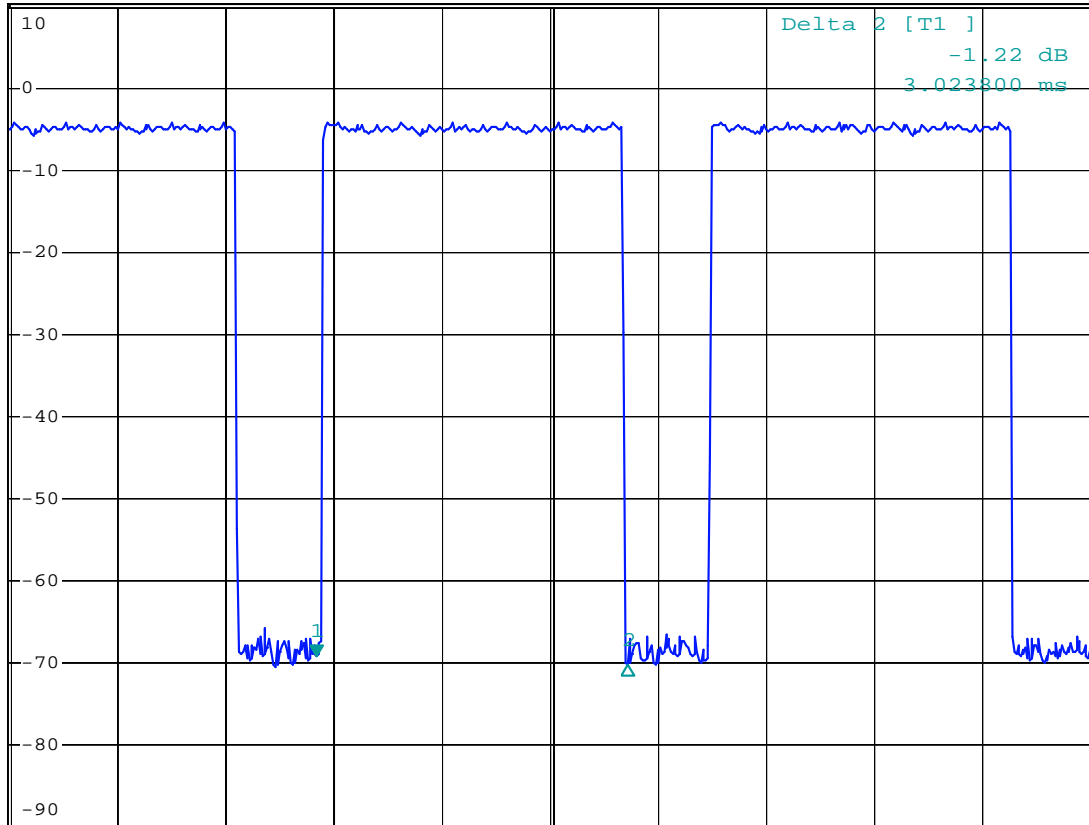
SWT 10.5 ms

Marker 1 [T1]

-69.03 dBm

2.976600 ms

1 PK  
MAXH



Center 2.441 GHz

1.05 ms/



## High Channel



### DELTA MARKER 2

2.96 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

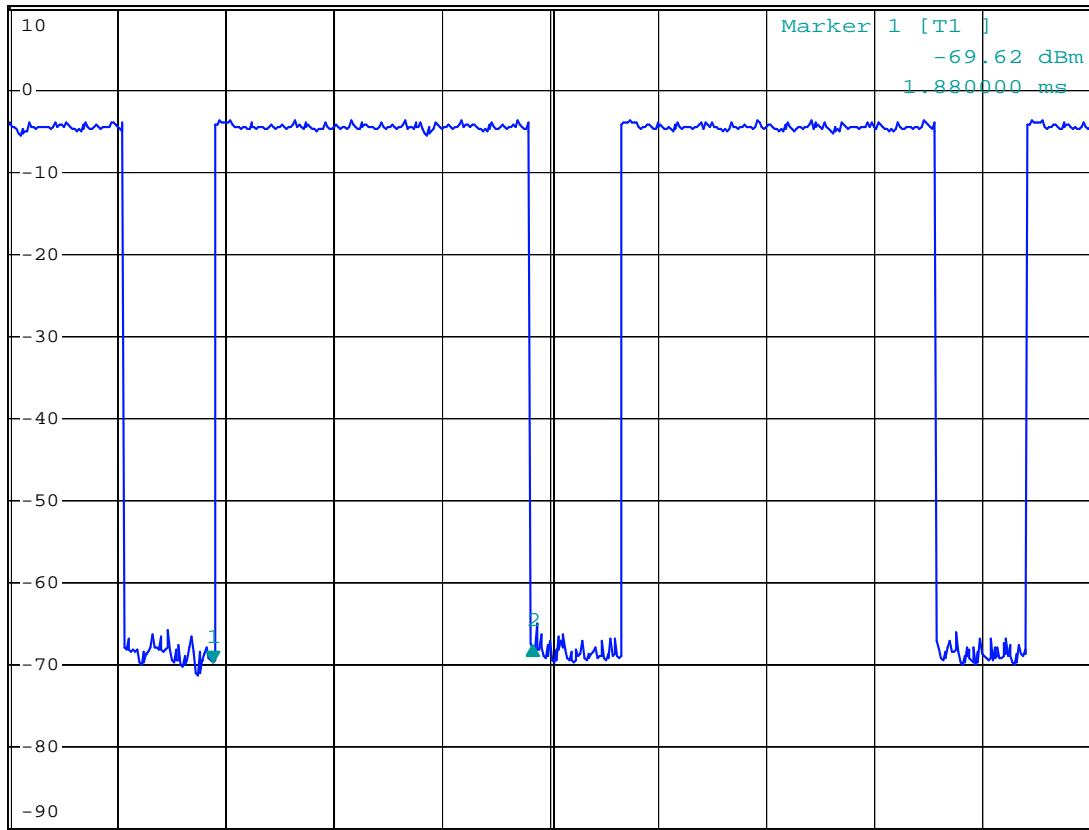
SWT 10 ms

Delta 2 [T1 ]

1.97 dB

2.960000 ms

1 PK  
MAXH



**Type of Modulation: 8DPSK**

|             |                   |               |               |                |  |
|-------------|-------------------|---------------|---------------|----------------|--|
| EUT         | MID               |               | Model         | MID770-RK88-PR |  |
| Mode        | Keep Transmitting |               | Input Voltage | DC3.7V         |  |
| Temperature | 24 deg. C,        |               | Humidity      | 56% RH         |  |
| Channel     | Reading           | Hopping Rate  | Actual        | Limit          |  |
| Low         | 2.98              | 266.667 hop/s | 0.318         | 0.4s           |  |
| Middle      | 3.02              | 266.667 hop/s | 0.322         | 0.4s           |  |
| High        | 3.00              | 266.667 hop/s | 0.320         | 0.4s           |  |

Actual = Reading  $\times$  (Hopping rate / Number of channels)  $\times$  Test period, Test period = 0.4 [seconds / channel]  $\times$  79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625 $\mu$ s with 79 channels. A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

**Note: DH5 was the worse case**



Low Channel:



# High Channel



MARKER 1

1.68 ms

Ref 10 dBm

\* Att 20 dB

RBW 1 MHz

\* VBW 1 MHz

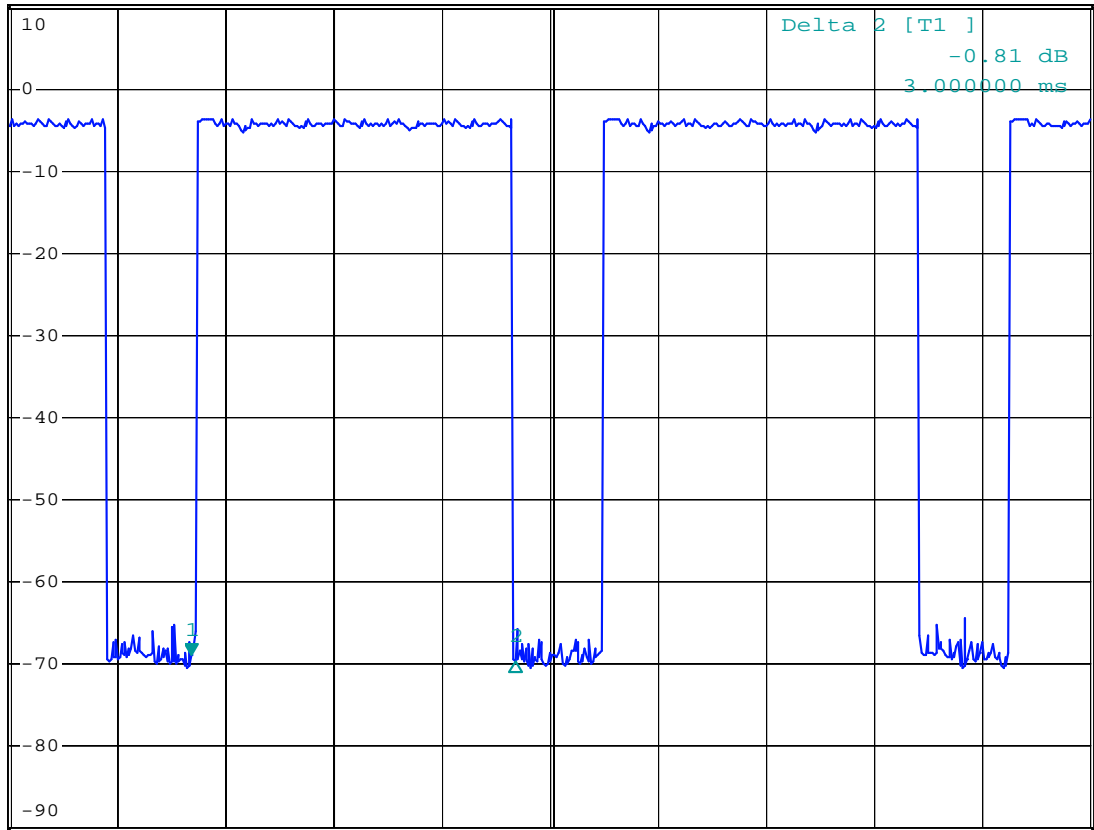
SWT 10 ms

Marker 1 [T1 ]

-68.92 dBm

1.680000 ms

1 PK  
MAXH

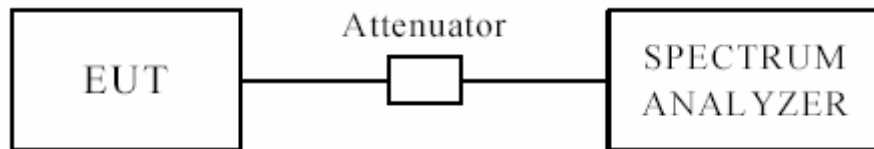


Center 2.48 GHz

1 ms/

### 1.1.1. 12 Out of Band Measurement

#### 12.1 Test Setup



**The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup**

#### 12.2 Limits of Out of Band Emissions Measurement

1. Below  $-20\text{dB}$  of the highest emission level of operating band (in  $100\text{kHz}$  Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

#### 12.3 Test Procedure

For signals in the restricted bands above and below the  $2.4\text{-}2.483\text{GHz}$  allocated band a measurement was made of

radiated emission test. Peak values with  $\text{RBW}=\text{VBW}=1\text{MHz}$  and PK detector.

For bandage test, the spectrum set as follows:  $\text{RBW}=100$ ,  $\text{VBW}=300\text{ kHz}$ . A conducted measurement used

Note: 1. For band-edge measurement, the frequency from  $30\text{MHz}$ - $25\text{GHz}$  was tested. And It met the FCC rule.

2. 4. This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.

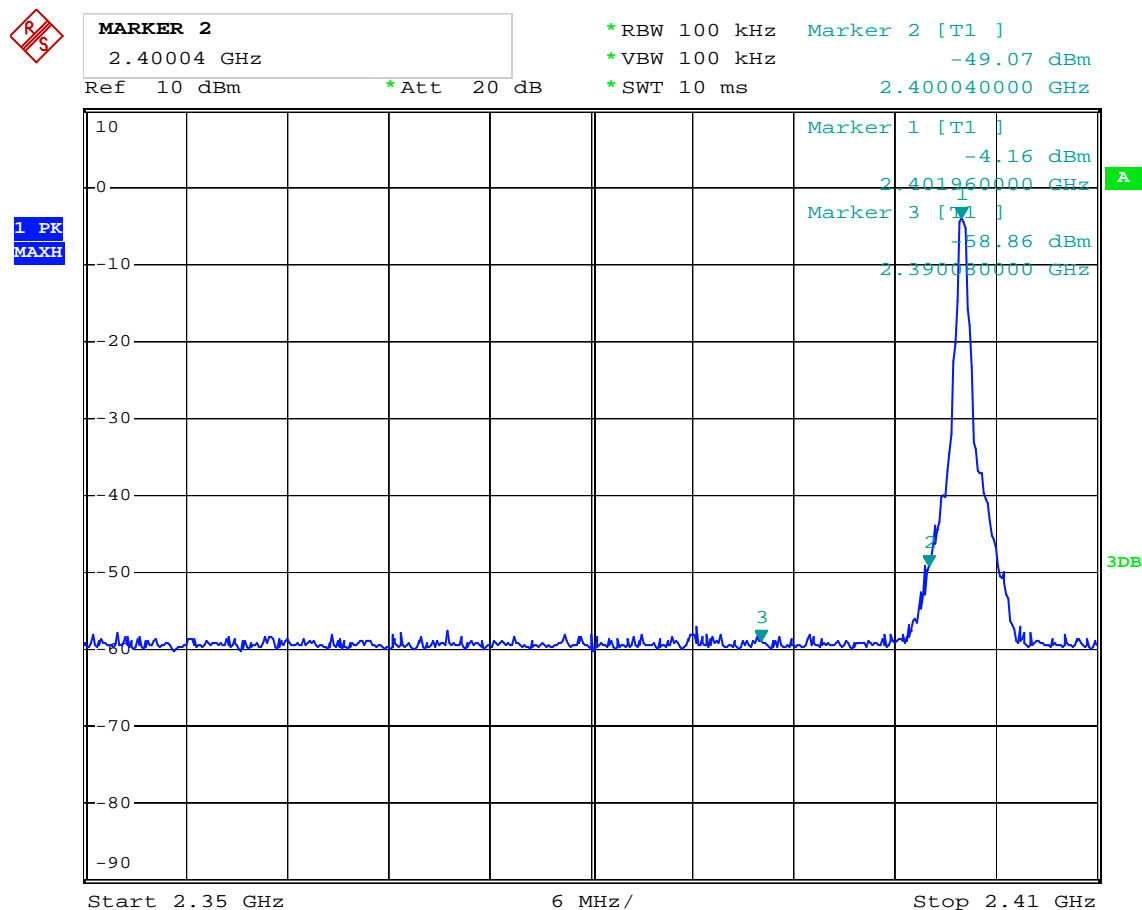


## Type of Modulation: GFSK

### 12.4 Out of Band Test Result

|                                      |                      |      |               |             |
|--------------------------------------|----------------------|------|---------------|-------------|
| Product:                             | MID                  |      | Test Mode:    | Low Channel |
| Mode                                 | Keeping Transmitting |      | Input Voltage | DC3.7V      |
| Temperature                          | 24 deg. C            |      | Humidity      | 56% RH      |
| Test Result:                         | Pass                 |      | Detector      | PK          |
| The Max. FS in Restrict Band 2390MHz | PK (dBμV/m)          | 37.9 | Limit         | 74(dBμV/m)  |
|                                      | AV(dBμV/m)           | --   |               | 54(dBμV/m)  |

#### Test Figure:

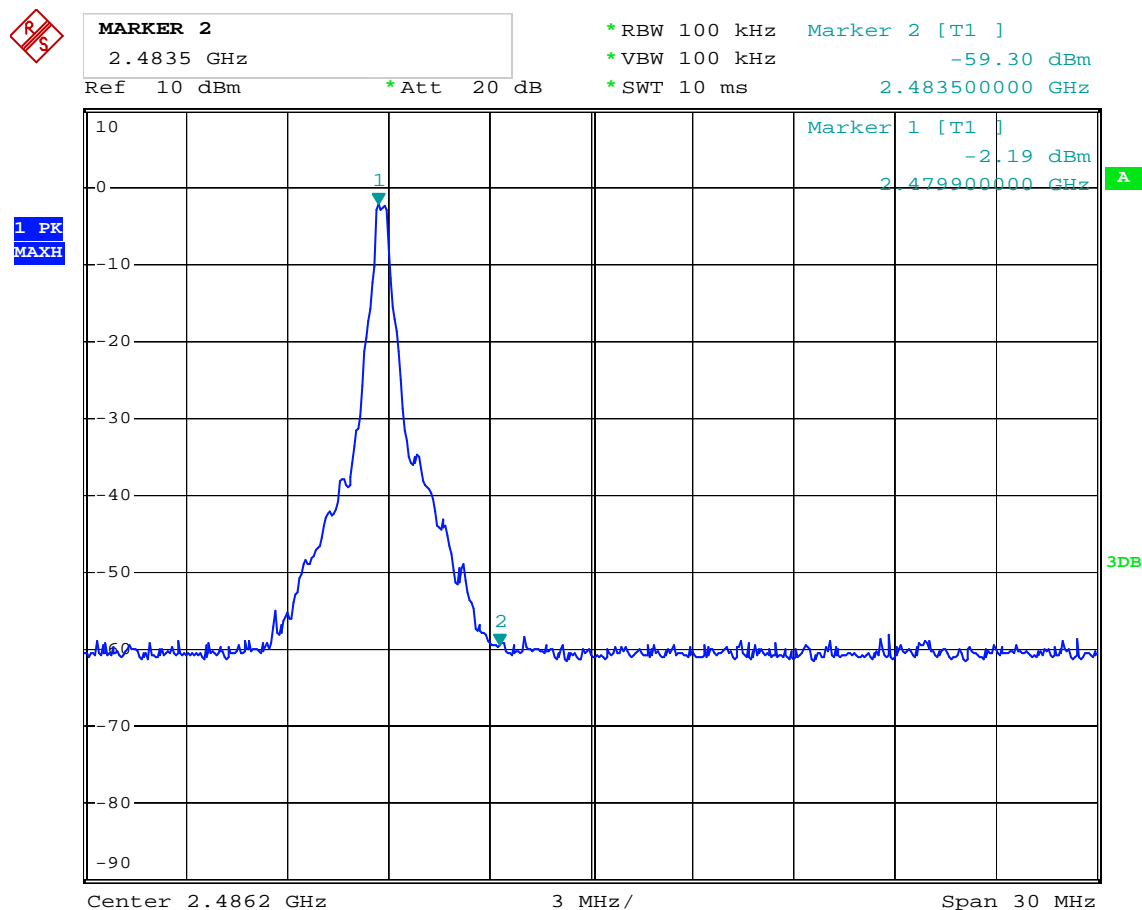


## Type of Modulation: GFSK

### 12.4 Out of Band Test Result

|   |                      |      |               |              |
|---|----------------------|------|---------------|--------------|
| Product:                                  | MID                  |      | Test Mode:    | High Channel |
| Mode                                      | Keeping Transmitting |      | Input Voltage | DC3.7V       |
| Temperature                               | 24 deg. C,           |      | Humidity      | 56% RH       |
| Test Result:                              | Pass                 |      | Detector      | PK           |
| The Max. FS in Restrict Band<br>2483.5MHz | PK (dBμV/m)          | 38.5 | Limit         | 74(dBμV/m)   |
|   | AV(dBμV/m)           | --   |               | 54(dBμV/m)   |

### Test Figure:



**Type of Modulation: GFSK****12.4 Out of Band Test Result**

|                                      |             |      |               |              |
|--------------------------------------|-------------|------|---------------|--------------|
| Product:                             | MID         |      | Test Mode:    | Hopping mode |
| Mode                                 | Hopping On  |      | Input Voltage | DC3.7V       |
| Temperature                          | 24 deg. C,  |      | Humidity      | 56% RH       |
| Test Result:                         | Pass        |      | Detector      | PK           |
| The Max. FS in Restrict Band 2390MHz | PK (dBμV/m) | 37.2 | Limit         | 74(dBμV/m)   |
|                                      | AV(dBμV/m)  | --   |               | 54(dBμV/m)   |

**Test Figure:****MARKER 1**

2.40592 GHz

Ref 10 dBm

\*Att 20 dB

\*RBW 100 kHz

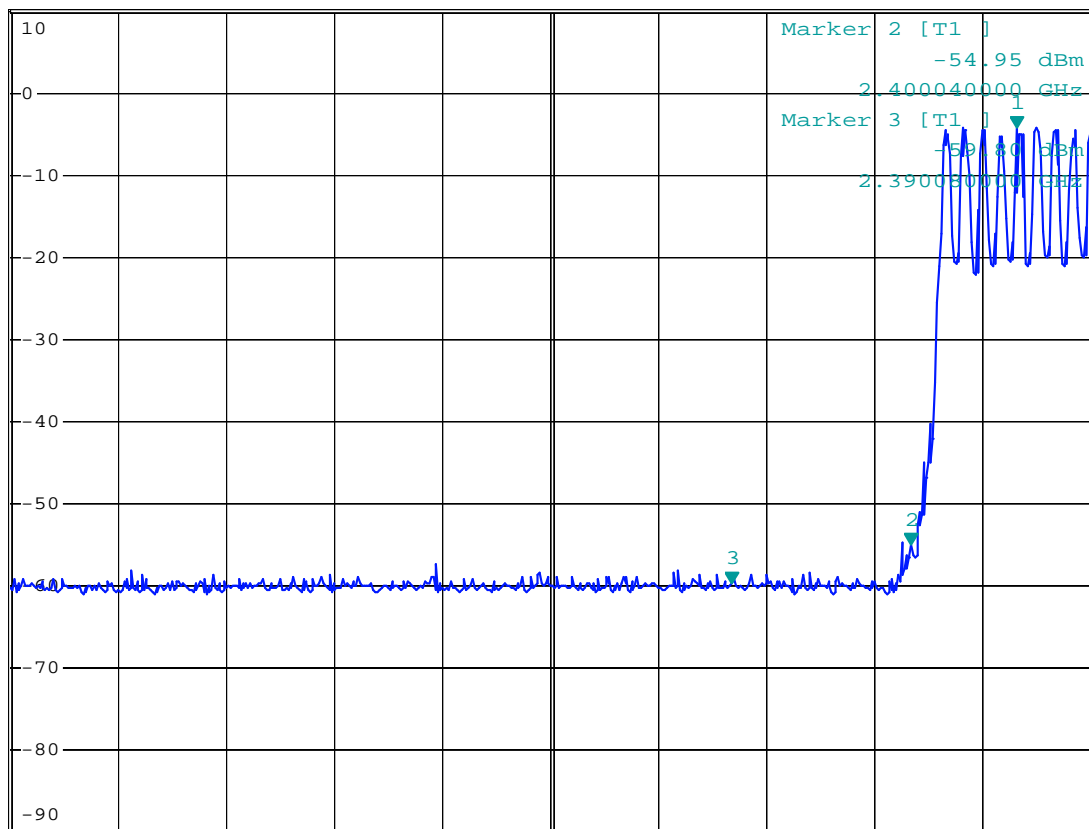
\*VBW 100 kHz

\*SWT 15 ms

Marker 1 [T1]

-4.21 dBm

2.405920000 GHz

1 PK  
MAXH

Start 2.35 GHz

6 MHz/

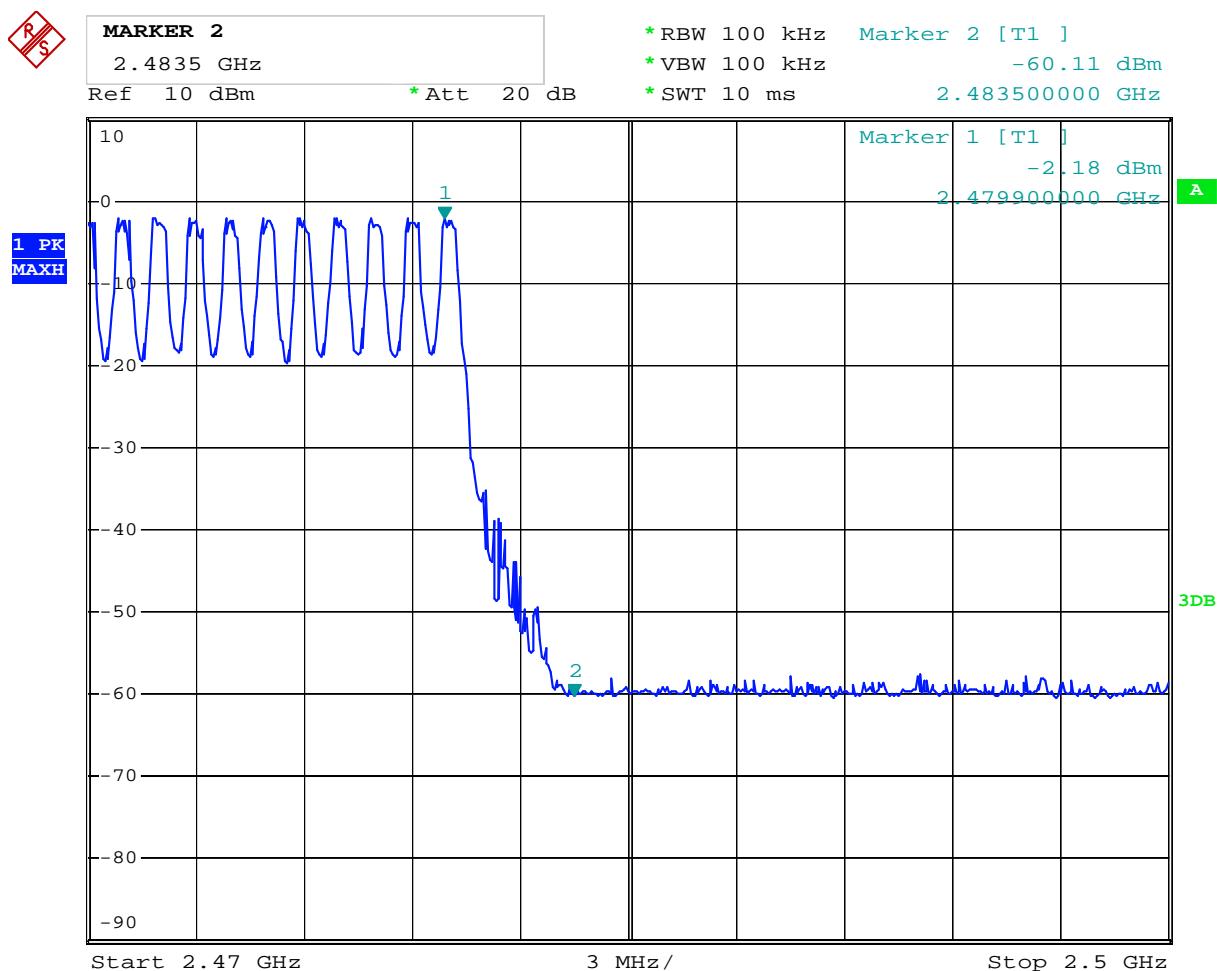
Stop 2.41 GHz

## Type of Modulation: GFSK

### 12.4 Out of Band Test Result

|  |             |      |               |              |
|--|-------------|------|---------------|--------------|
| Product:                               | MID         |      | Test Mode:    | Hopping mode |
| Mode                                   | Hopping On  |      | Input Voltage | DC3.7V       |
| Temperature                            | 24 deg. C,  |      | Humidity      | 56% RH       |
| Test Result:                           | Pass        |      | Detector      | PK           |
| The Max. FS in Restrict Band 2483.5MHz | PK (dBμV/m) | 38.9 | Limit         | 74(dBμV/m)   |
|  | AV(dBμV/m)  | --   |               | 54(dBμV/m)   |

#### Test Figure:

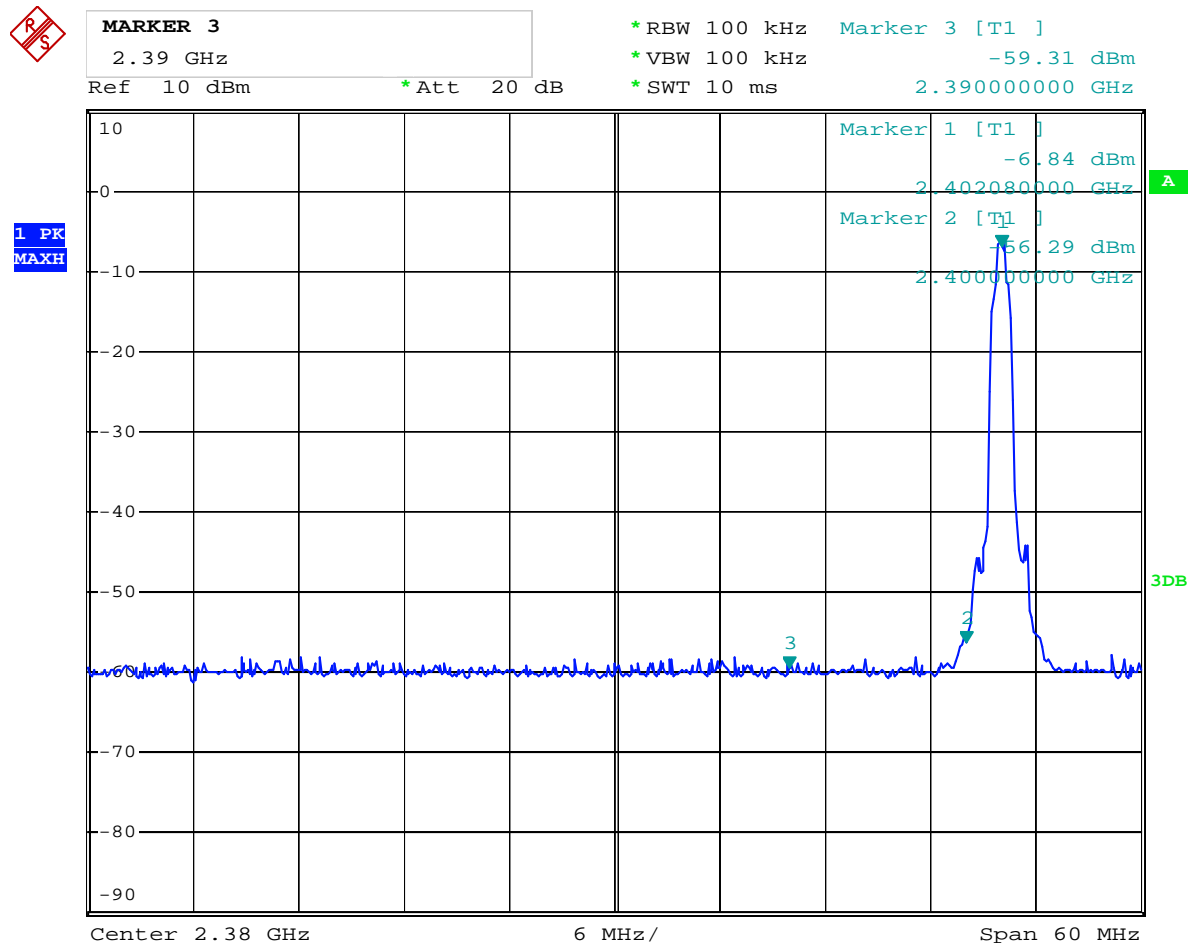


## Type of Modulation: $\pi/4$ QPSK

### 12.4 Out of Band Test Result

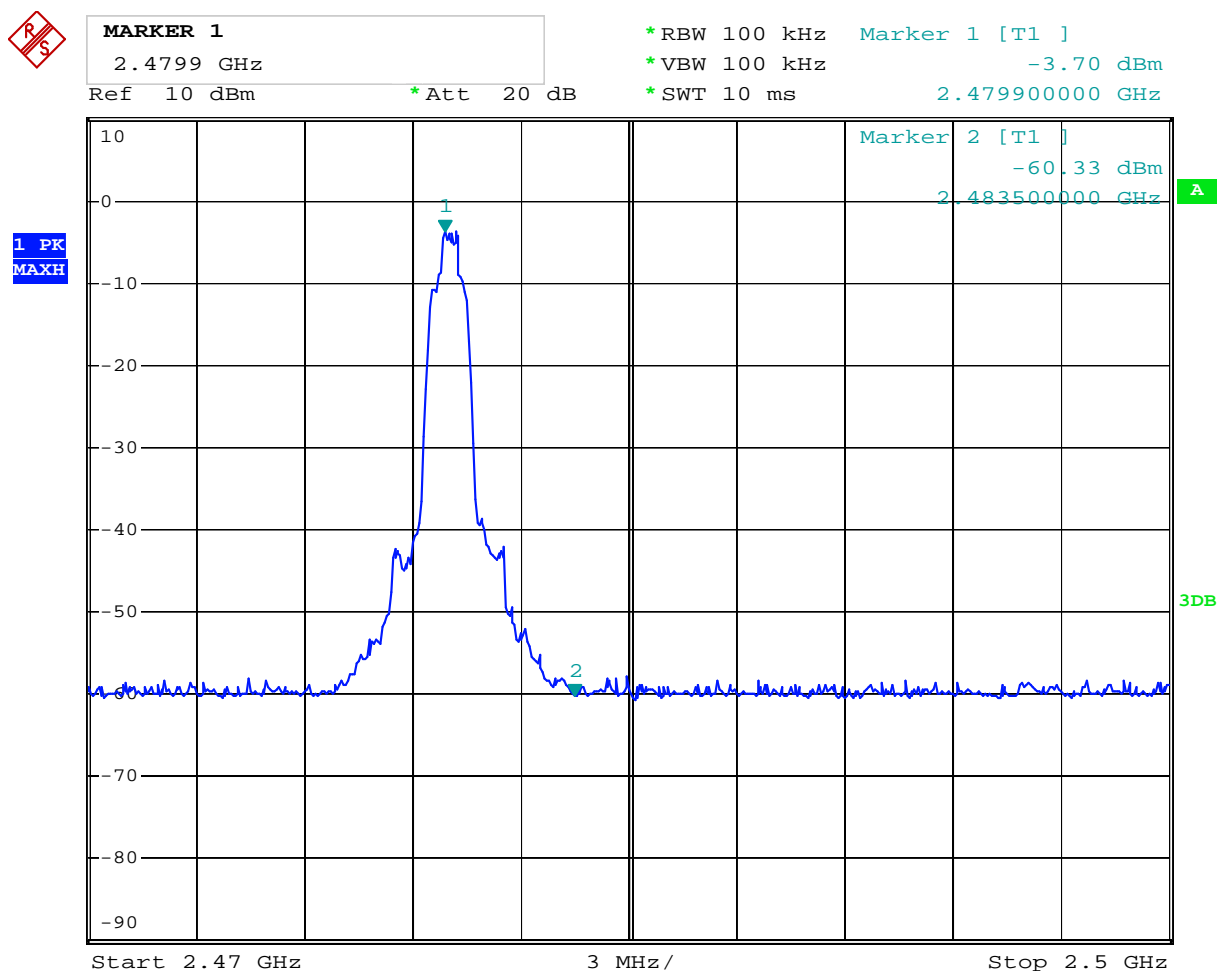
|                                      |                      |      |               |                  |
|--------------------------------------|----------------------|------|---------------|------------------|
| Product:                             | MID                  |      | Test Mode:    | Low Channel      |
| Mode                                 | Keeping Transmitting |      | Input Voltage | DC3.7V           |
| Temperature                          | 24 deg. C            |      | Humidity      | 56% RH           |
| Test Result:                         | Pass                 |      | Detector      | PK               |
| The Max. FS in Restrict Band 2390MHz | PK (dB $\mu$ V/m)    | 37.9 | Limit         | 74(dB $\mu$ V/m) |
|                                      | AV(dB $\mu$ V/m)     | --   |               | 54(dB $\mu$ V/m) |

#### Test Figure:



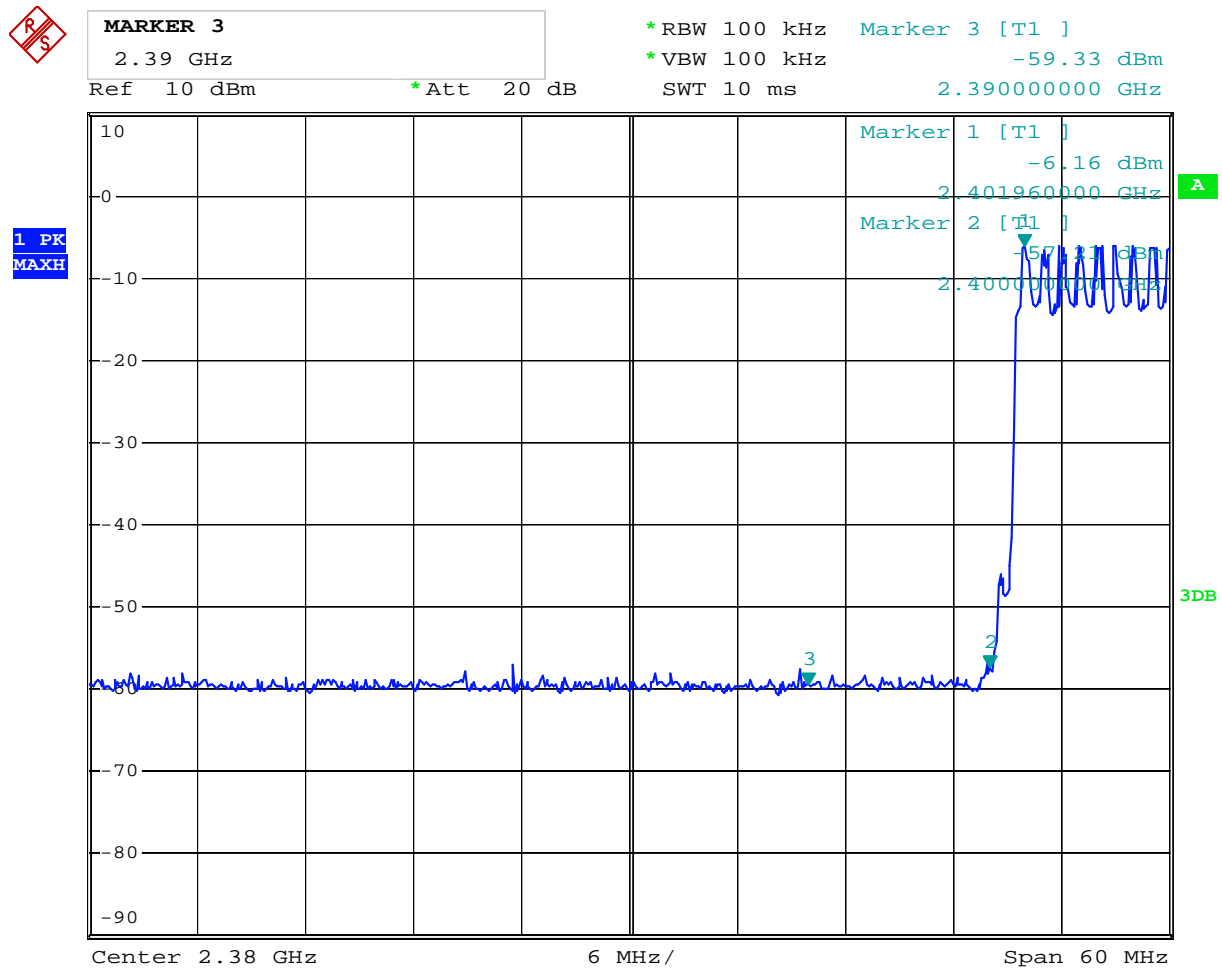
**Type of Modulation:  $\pi/4$ QPSK****12.4 Out of Band Test Result**

|  |                      |      |               |                  |
|--|----------------------|------|---------------|------------------|
| Product:                               | MID                  |      | Test Mode:    | High Channel     |
| Mode                                   | Keeping Transmitting |      | Input Voltage | DC3.7V           |
| Temperature                            | 24 deg. C,           |      | Humidity      | 56% RH           |
| Test Result:                           | Pass                 |      | Detector      | PK               |
| The Max. FS in Restrict Band 2483.5MHz | PK (dB $\mu$ V/m)    | 39.0 | Limit         | 74(dB $\mu$ V/m) |
|  | AV(dB $\mu$ V/m)     | --   |               | 54(dB $\mu$ V/m) |

**Test Figure:**

**Type of Modulation:  $\pi/4$ QPSK****12.4 Out of Band Test Result**

|                                      |                   |      |               |                  |
|--------------------------------------|-------------------|------|---------------|------------------|
| Product:                             | MID               |      | Test Mode:    | Hopping mode     |
| Mode                                 | Hopping On        |      | Input Voltage | DC3.7V           |
| Temperature                          | 24 deg. C,        |      | Humidity      | 56% RH           |
| Test Result:                         | Pass              |      | Detector      | PK               |
| The Max. FS in Restrict Band 2390MHz | PK (dB $\mu$ V/m) | 37.6 | Limit         | 74(dB $\mu$ V/m) |
|                                      | AV(dB $\mu$ V/m)  | --   |               | 54(dB $\mu$ V/m) |

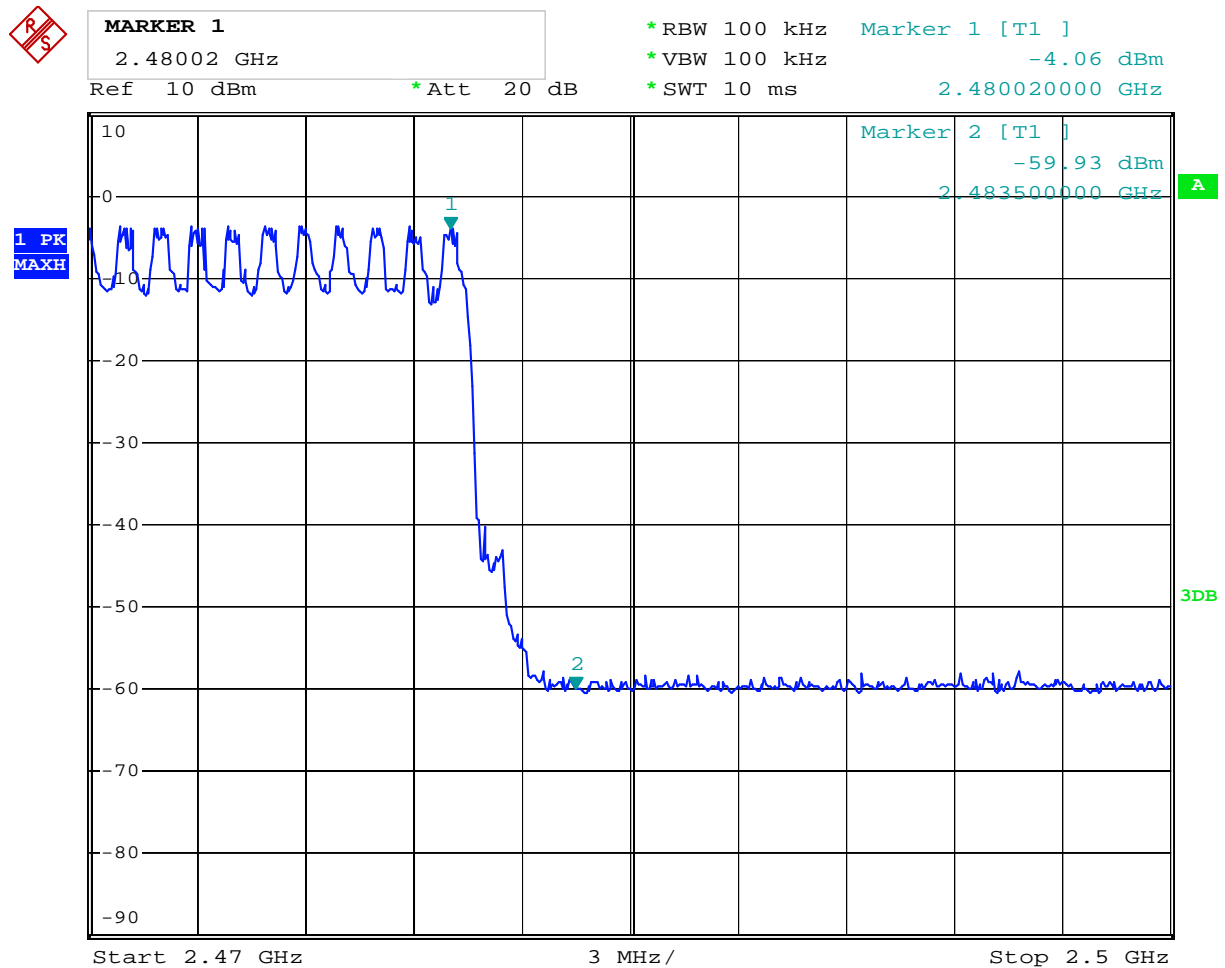
**Test Figure:**

## Type of Modulation: $\pi/4$ QPSK

### 12.4 Out of Band Test Result

|  |                   |      |               |                  |
|--|-------------------|------|---------------|------------------|
| Product:                               | MID               |      | Test Mode:    | Hopping mode     |
| Mode                                   | Hopping On        |      | Input Voltage | DC3.7V           |
| Temperature                            | 24 deg. C,        |      | Humidity      | 56% RH           |
| Test Result:                           | Pass              |      | Detector      | PK               |
| The Max. FS in Restrict Band 2483.5MHz | PK (dB $\mu$ V/m) | 39.4 | Limit         | 74(dB $\mu$ V/m) |
|  | AV(dB $\mu$ V/m)  | --   |               | 54(dB $\mu$ V/m) |

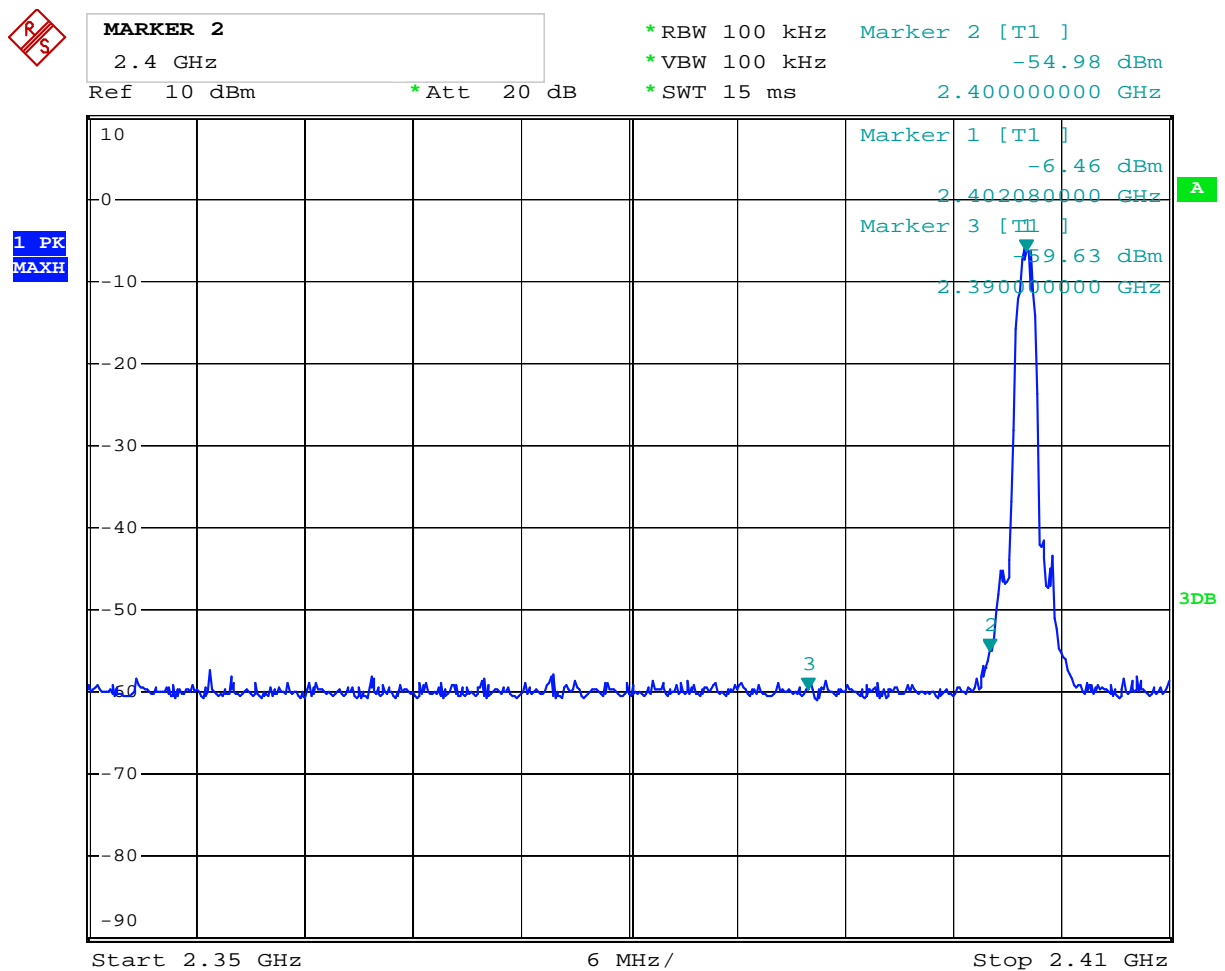
#### Test Figure:





**Type of Modulation: 8DPSK****12.4 Out of Band Test Result**

|                                      |                      |      |               |                  |
|--------------------------------------|----------------------|------|---------------|------------------|
| Product:                             | MID                  |      | Test Mode:    | Low Channel      |
| Mode                                 | Keeping Transmitting |      | Input Voltage | DC3.7V           |
| Temperature                          | 24 deg. C            |      | Humidity      | 56% RH           |
| Test Result:                         | Pass                 |      | Detector      | PK               |
| The Max. FS in Restrict Band 2390MHz | PK (dB $\mu$ V/m)    | 37.8 | Limit         | 74(dB $\mu$ V/m) |
|                                      | AV(dB $\mu$ V/m)     | --   |               | 54(dB $\mu$ V/m) |

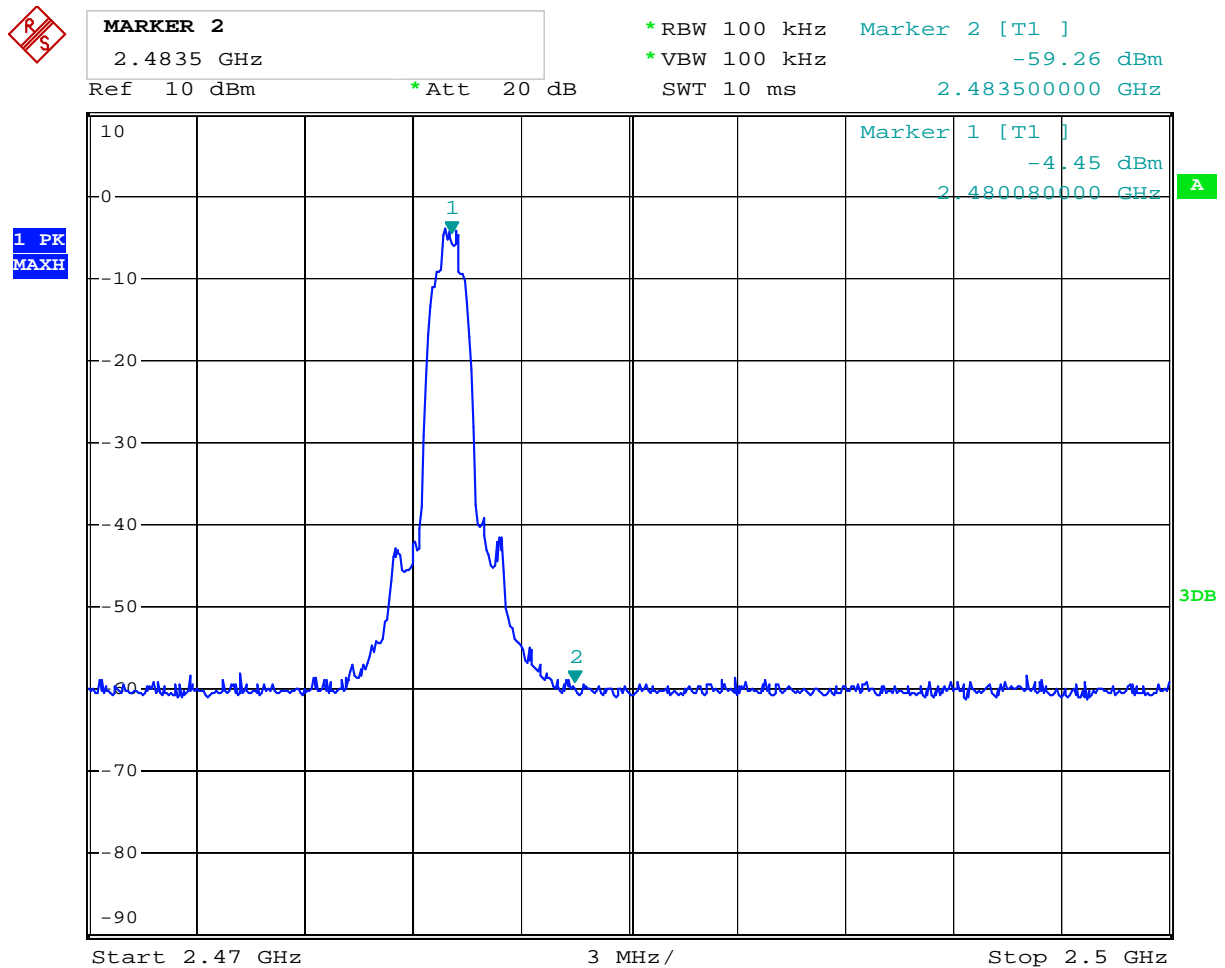
**Test Figure:**

## Type of Modulation: 8DPSK

### 12.4 Out of Band Test Result

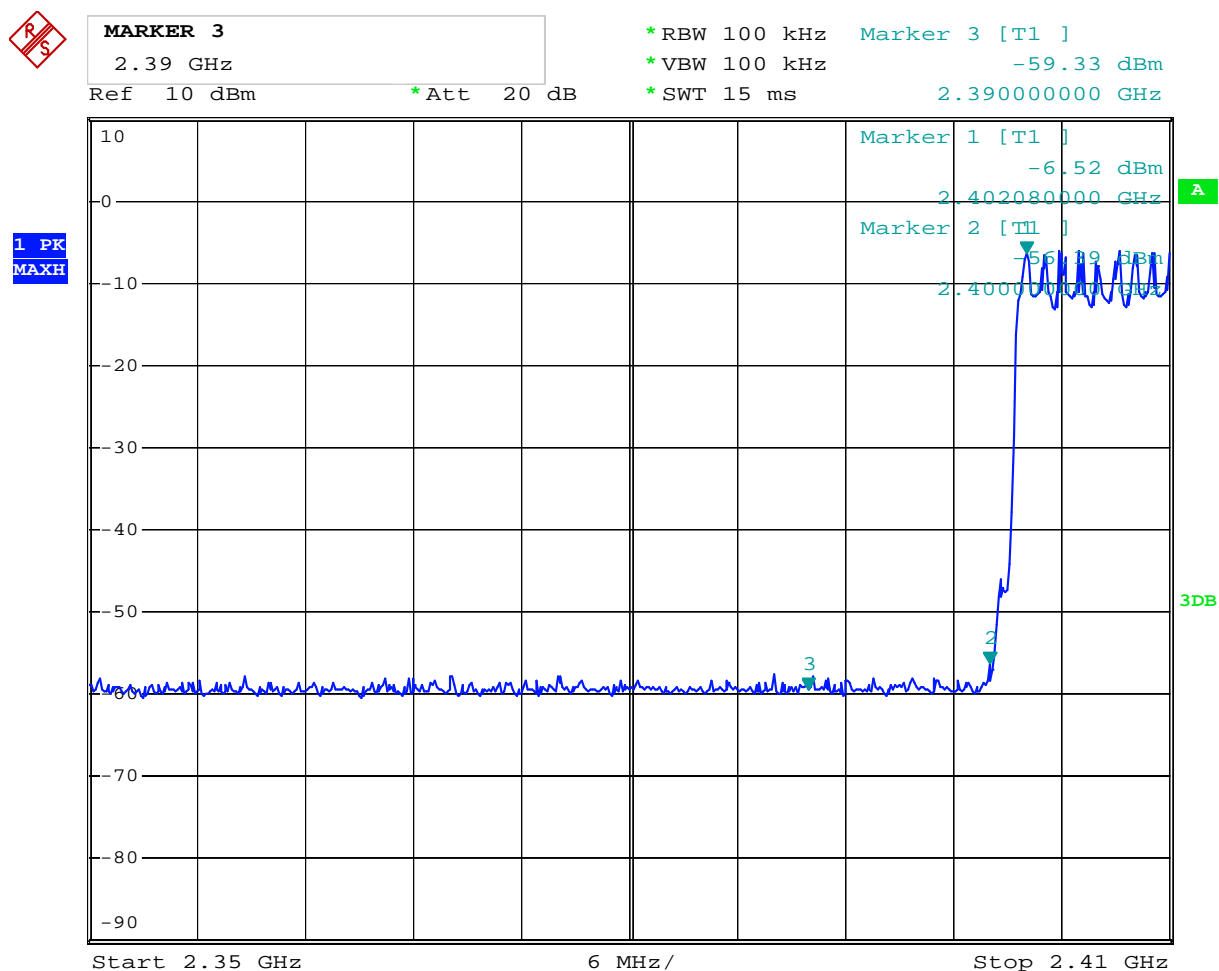
|  |                      |      |               |              |
|--|----------------------|------|---------------|--------------|
| Product:                               | MID                  |      | Test Mode:    | High Channel |
| Mode                                   | Keeping Transmitting |      | Input Voltage | DC3.7V       |
| Temperature                            | 24 deg. C,           |      | Humidity      | 56% RH       |
| Test Result:                           | Pass                 |      | Detector      | PK           |
| The Max. FS in Restrict Band 2483.5MHz | PK (dBμV/m)          | 39.1 | Limit         | 74(dBμV/m)   |
|  | AV(dBμV/m)           | --   |               | 54(dBμV/m)   |

#### Test Figure:



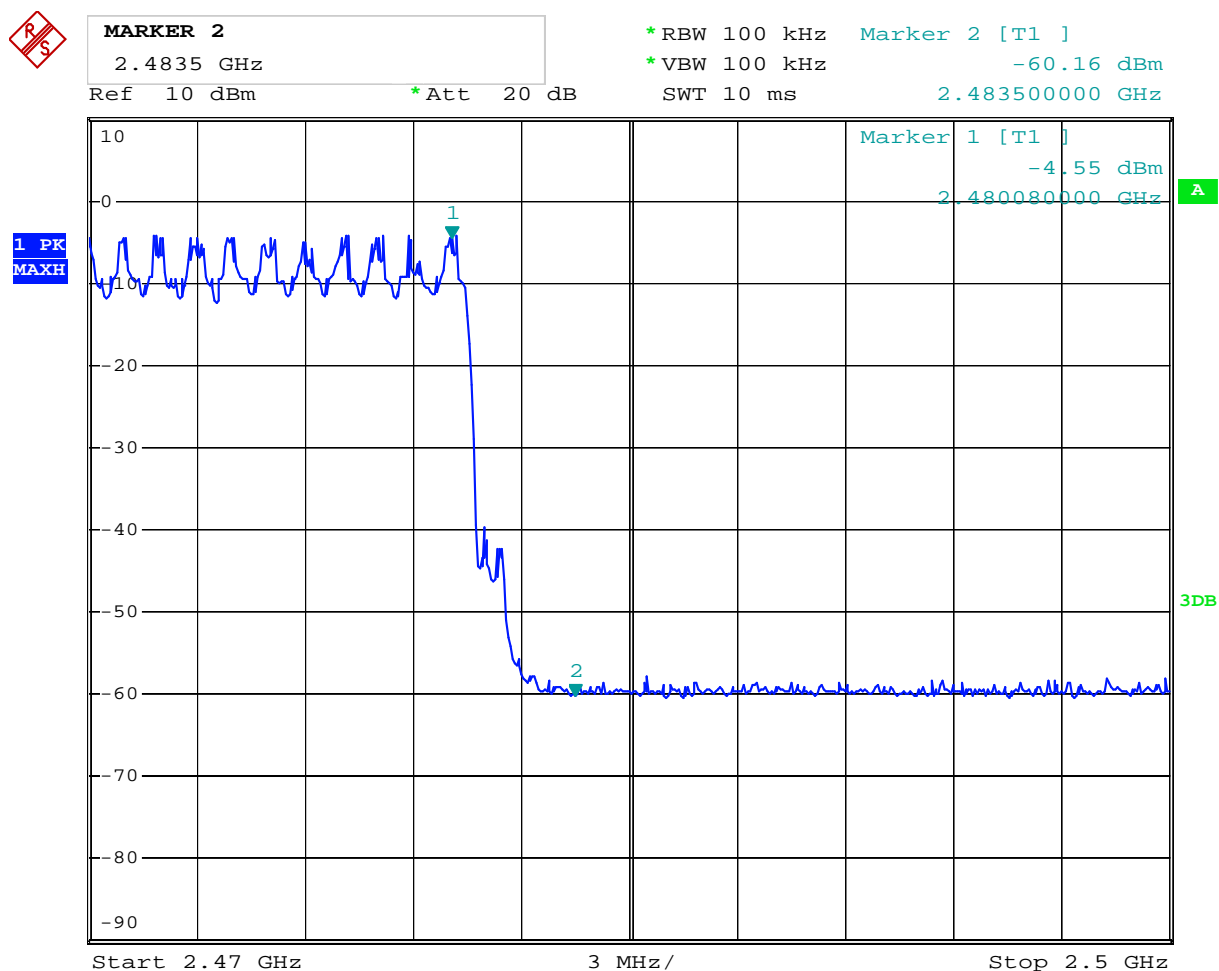
**Type of Modulation: 8DPSK****12.4 Out of Band Test Result**

|                                      |             |      |               |              |
|--------------------------------------|-------------|------|---------------|--------------|
| Product:                             | MID         |      | Test Mode:    | Hopping mode |
| Mode                                 | Hopping On  |      | Input Voltage | DC3.7V       |
| Temperature                          | 24 deg. C,  |      | Humidity      | 56% RH       |
| Test Result:                         | Pass        |      | Detector      | PK           |
| The Max. FS in Restrict Band 2390MHz | PK (dBμV/m) | 36.9 | Limit         | 74(dBμV/m)   |
|                                      | AV(dBμV/m)  | --   |               | 54(dBμV/m)   |

**Test Figure:**

**Type of Modulation: 8DPSK****12.4 Out of Band Test Result**

|  |             |      |               |              |
|--|-------------|------|---------------|--------------|
| Product:                               | MID         |      | Test Mode:    | Hopping mode |
| Mode                                   | Hopping On  |      | Input Voltage | DC3.7V       |
| Temperature                            | 24 deg. C,  |      | Humidity      | 56% RH       |
| Test Result:                           | Pass        |      | Detector      | PK           |
| The Max. FS in Restrict Band 2483.5MHz | PK (dBμV/m) | 38.7 | Limit         | 74(dBμV/m)   |
|  | AV(dBμV/m)  | --   |               | 54(dBμV/m)   |

**Test Figure:**



### 13.0 Antenna Requirement

#### 13.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 13.2 Antenna Connected constructions

The antenna is integral antenna. The maximum Gain of this antenna is 2.0dBi

## 14.0 FCC ID Label

### FCC ID: 2AAQZMID770-RK88T

**This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

#### Mark Location:



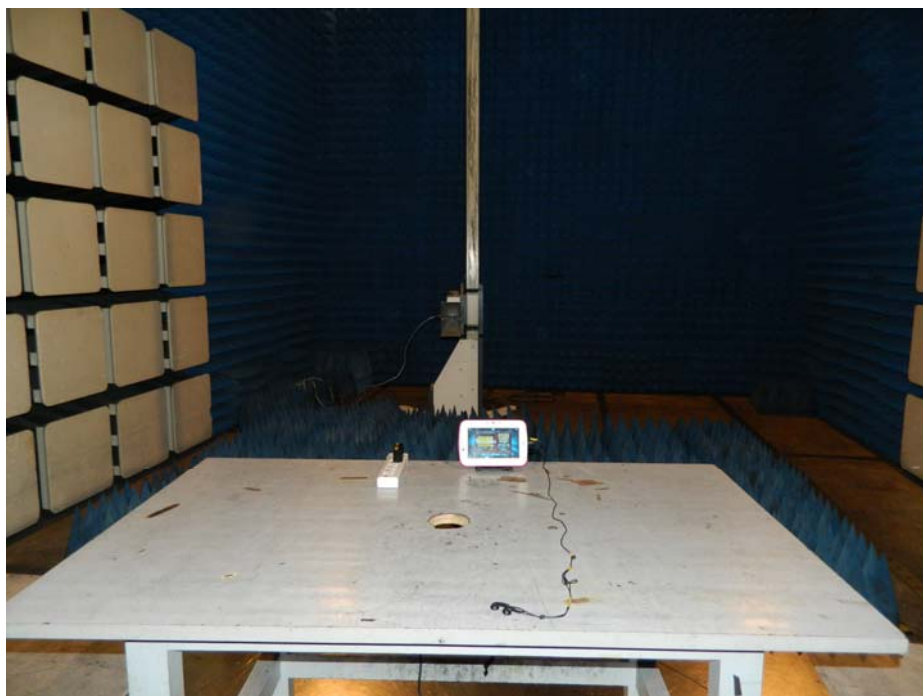
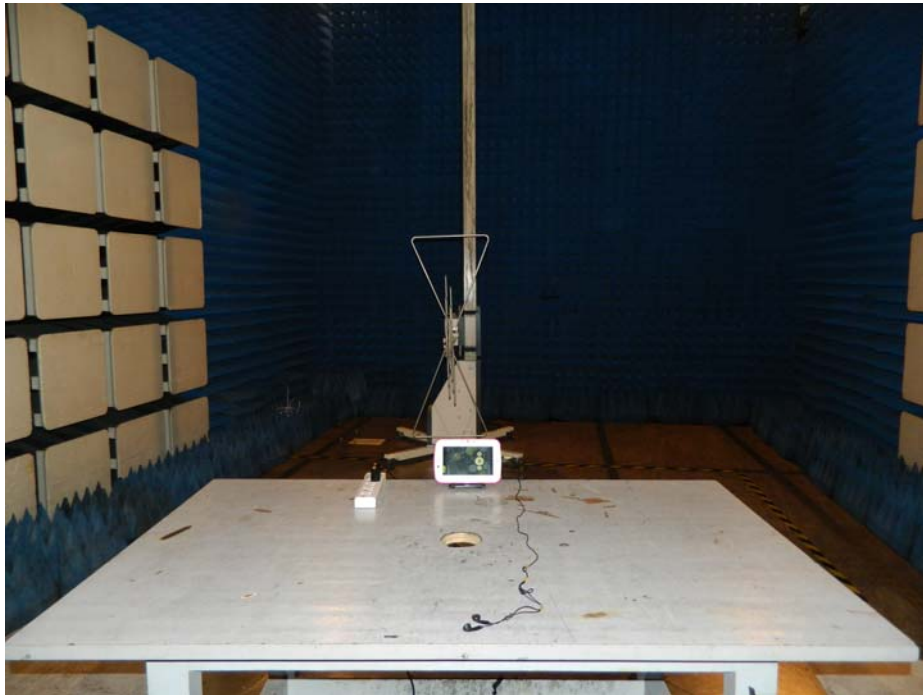
FCC Label Location

## 15 PHOTOGRAPHS OF THE TEST CONFIGURATION

### Conducted Emissions



## Radiated Emissions





## PHOTOGRAPHS OF EUT



Photo 1



Photo 2





Photo 3



Photo 4





Photo 5



Photo 6



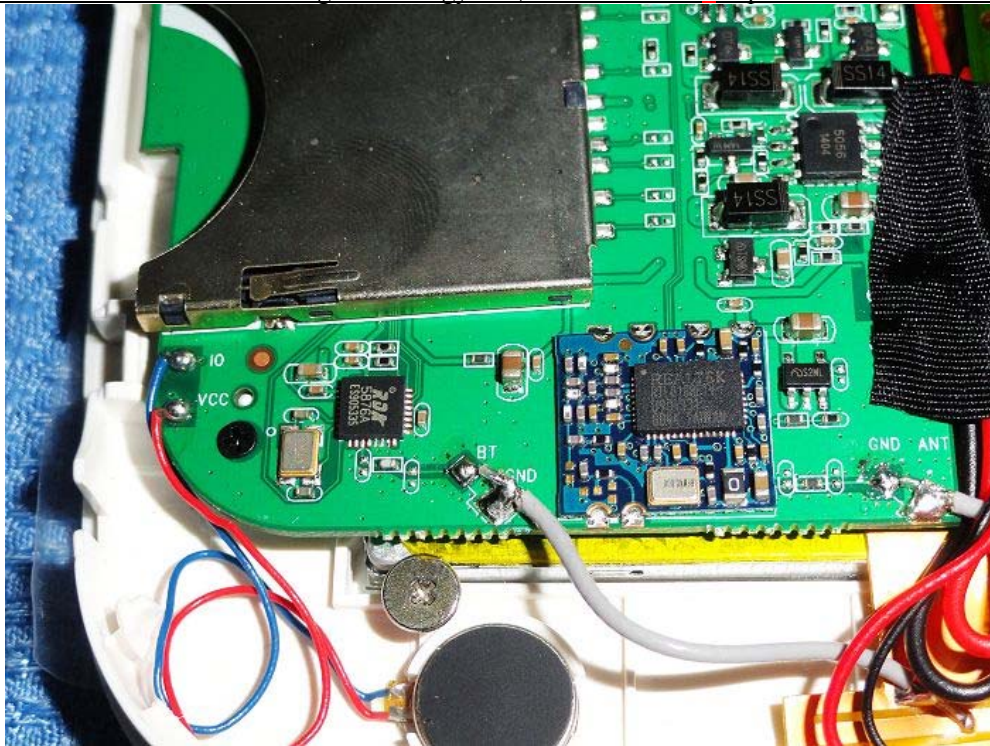


Photo 7



Photo 8



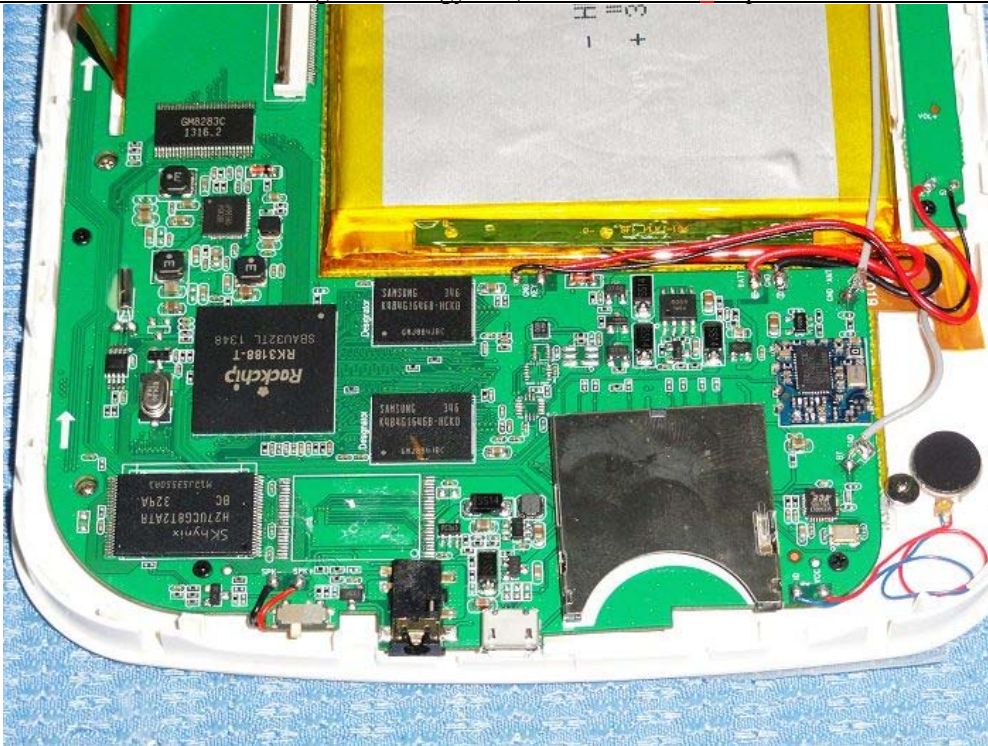


Photo 9

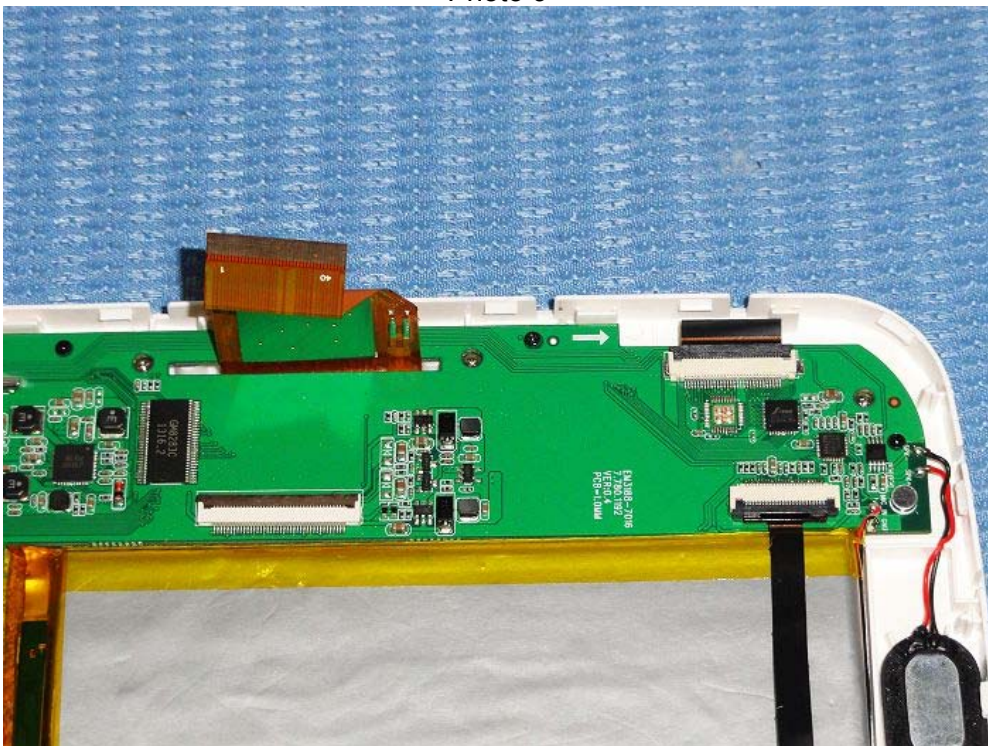


Photo 10



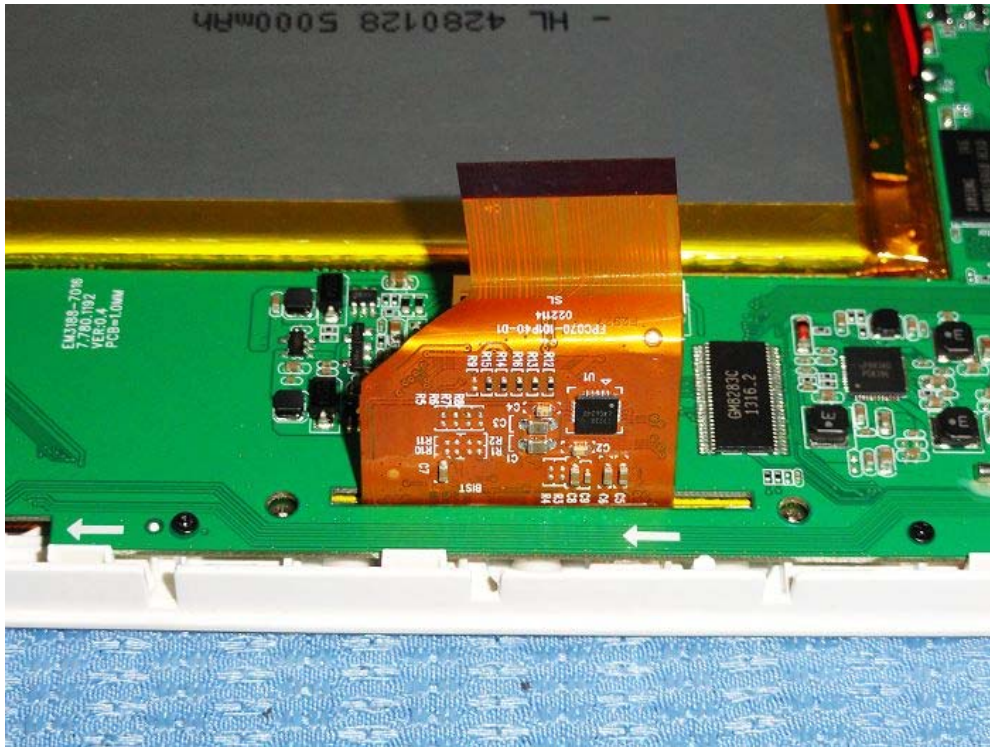


Photo 11



Photo 12



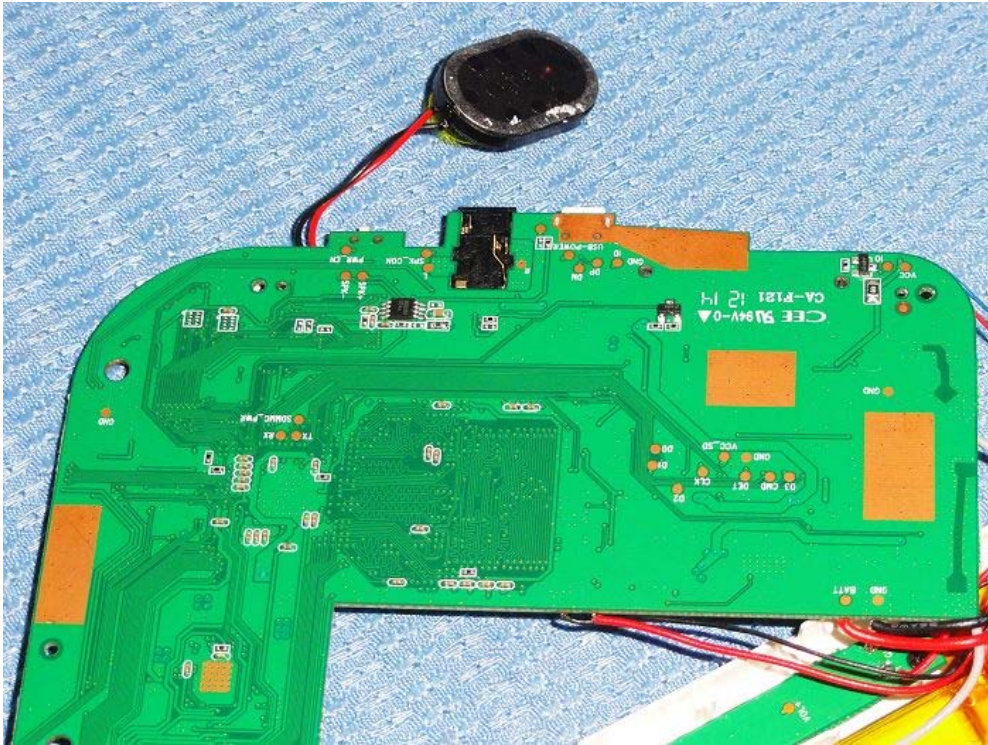


Photo 13

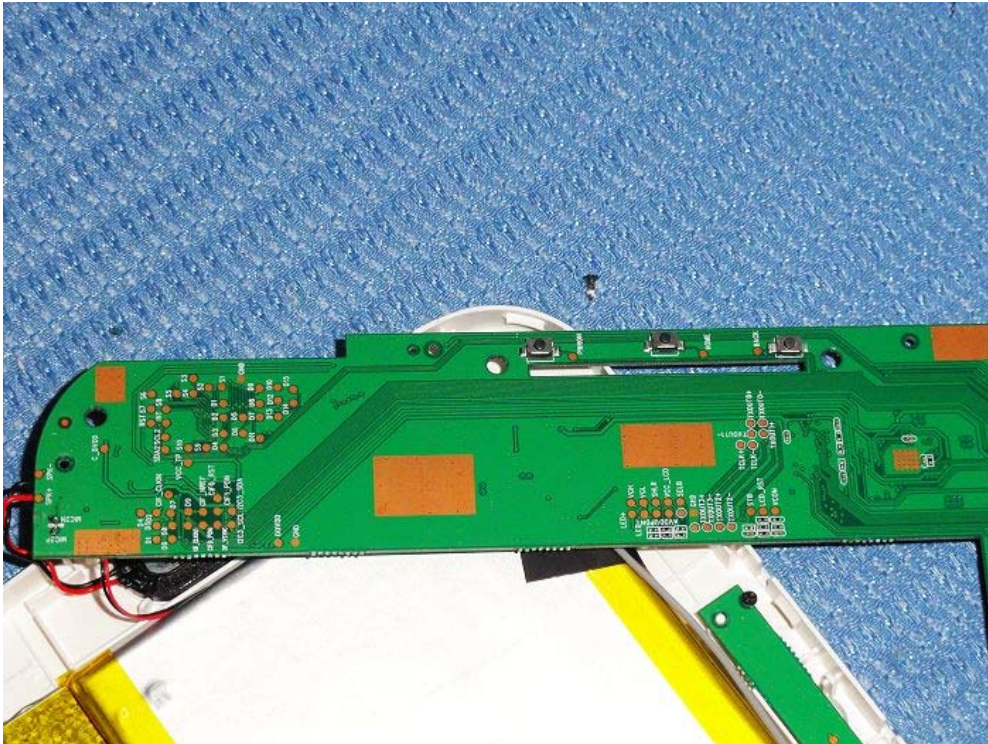


Photo 14



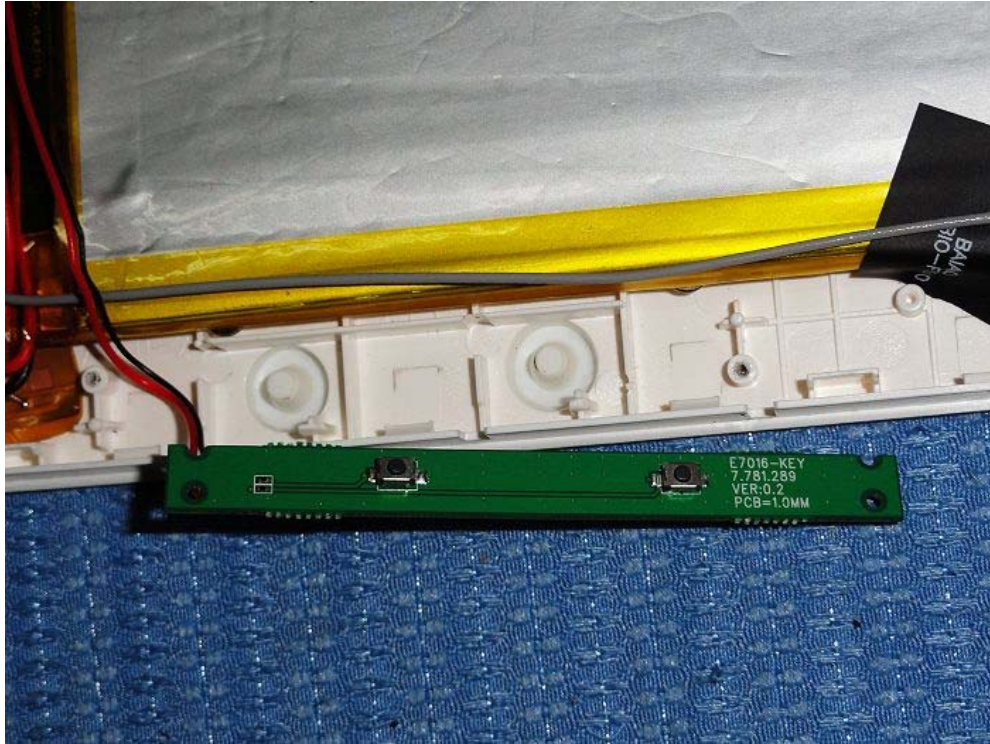


Photo 15



Photo 16





Photo 17



Photo 18 (Alternative Battery)

**The Report End**