



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

# TEST REPORT For FCC

## FCC Standards : FCC 47CFR part 15 subpart C

Test Report No. : CTK-2015-00353  
Date of Issue : 2015-03-16  
FCC ID : U5MIFJ-B  
Basic Model/Type No. : IFJ-B  
Kind of Product : BLUETOOTH INTERFACE  
Applicant : BIXOLON Co., Ltd.  
Applicant Address : 7th-8th FL, Miraeasset Venture Tower, 20, Pangyoyeok-ro  
241beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea  
Manufacturer : BIXOLON Co., Ltd.  
Manufacturer Address : 7th-8th FL, Miraeasset Venture Tower, 20, Pangyoyeok-ro  
241beon-gil, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea  
Contact Person : Shin Ji Sung / Assistant Manager  
Telephone : +82-31-218-5582  
Received Date : 2015-01-27  
Test period : Start : 2015-02-03 End : 2015-02-26  
Test Results : ☒ In Compliance ☐ Not in Compliance

The test results presented in this report relate only to the object tested.

Tested by

Y. T. Lee

Young-taek Lee  
Test Engineer  
Date: 2015-03-16

Reviewed by

Y. J. Park

Young-Joon, Park  
Technical Manager  
Date: 2015-03-16



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### REPORT REVISION HISTORY

| Date       | Revision                | Page No |
|------------|-------------------------|---------|
| 2015-03-16 | Issued (CTK-2015-00353) | All     |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |
|            |                         |         |

***This report shall not be reproduced except in full, without the written approval of CTK Co., Ltd. This document may be altered or revised by CTK Co., Ltd. personnel only, and shall be noted in the revision section of the document. Any alteration of this document not carried out by CTK Co., Ltd. will constitute fraud and shall nullify the document.***



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### TABLE OF CONTENTS

|                                                                         |    |
|-------------------------------------------------------------------------|----|
| REPORT REVISION HISTORY .....                                           | 2  |
| 1.0 General Product Description .....                                   | 4  |
| 1.1 Tested Frequency.....                                               | 4  |
| 1.2 Tested Mode.....                                                    | 4  |
| 1.3 Model Differences .....                                             | 5  |
| 1.4 Device Modifications.....                                           | 5  |
| 1.5 Peripheral Devices .....                                            | 5  |
| 1.6 Calibration Details of Equipment Used for Measurement .....         | 5  |
| 1.7 Test Facility.....                                                  | 5  |
| 1.8 Laboratory Accreditations and Listings.....                         | 6  |
| 2.0 Summary of tests .....                                              | 7  |
| 2.1 Transmitter Requirements.....                                       | 8  |
| 2.1.1 Carrier Frequency Separation .....                                | 8  |
| 2.1.2 Number of Hopping Frequencies .....                               | 10 |
| 2.1.4 Time of Occupancy (Dwell Time).....                               | 19 |
| 2.1.5 Maximum peak Conducted Output Power .....                         | 25 |
| 2.1.6 RF Conducted Emissions.....                                       | 33 |
| 2.1.7 Other requirements Frequency Hopping Spread Spectrum System ..... | 44 |
| 2.1.8 Field Strength of Emissions .....                                 | 45 |
| 2.1.9 AC Conducted Emissions.....                                       | 54 |
| APPENDIX A – Test Equipment Used For Tests .....                        | 57 |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

## 1.0 General Product Description

|                         |                                                                                                                |
|-------------------------|----------------------------------------------------------------------------------------------------------------|
| Equipment model name    | IFJ-B                                                                                                          |
| Serial number           | Prototype                                                                                                      |
| EUT condition           | Pre-production, not damaged                                                                                    |
| Antenna type            | Chip antenna Gain -0.28 dBi                                                                                    |
| Frequency Range         | 2402 MHz - 2480 MHz                                                                                            |
| RF power                | 8.74 dBm Peak Conducted (GFSK)<br>7.02 dBm Peak Conducted ( $\pi/4$ DQPSK)<br>7.04 dBm Peak Conducted (8-DPSK) |
| Type of Modulation      | Frequency Hopping Spread Spectrum                                                                              |
| Number of channels      | 79                                                                                                             |
| Channel Spacing         | 1 MHz                                                                                                          |
| Channel Access Protocol | Frequency Hopping                                                                                              |
| Type of Modulation      | GFSK(1Mbps), DQPSK(2Mbps), 8-DPSK(3Mbps)                                                                       |
| Power Source            | DC 3.3 V                                                                                                       |

## 1.1 Tested Frequency

|                 | LOW  | MID  | HIGH |
|-----------------|------|------|------|
| Frequency (MHz) | 2402 | 2441 | 2480 |

## 1.2 Tested Mode

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

| Tested Ch      | Modulation Technology | Modulation Type | Packet Type |
|----------------|-----------------------|-----------------|-------------|
| Low, Mid, High | FHSS                  | GFSK            | DH5         |
| Low, Mid, High | FHSS                  | 8-DPSK          | 3-DH5       |



### 1.3 Model Differences

The following modifications were necessary for compliance:

Not applicable

### 1.4 Device Modifications

The following modifications were necessary for compliance:

Not applicable

### 1.5 Peripheral Devices

| Device            | Manufacturer                 | Model No. | Serial No.      |
|-------------------|------------------------------|-----------|-----------------|
| Personal Computer | Samsung Electronics Co.,Ltd. | DM-Z48    | 399F96BL503602X |
| LCD Monitor       | Samsung Electronics Co.,Ltd. | LS19A350  | -               |

### 1.6 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

### 1.7 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### 1.8 Laboratory Accreditations and Listings

| Country | Agency | Scope of Accreditation                                                                           | Registration Number                | Logo                                                                                |
|---------|--------|--------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------|
| USA     | FCC    | FCC Part 15 & 18<br>EMI (Electromagnetic Interference / Emission)                                | 805871                             |  |
| JAPAN   | VCCI   | VCCI V-3<br>EMI (Electromagnetic Interference / Emission)                                        | C-986<br>T-1843<br>R-3627<br>G-387 |  |
| KOREA   | MSIP   | EMI (Electromagnetic Interference / Emission)<br>EMS (Electromagnetic Susceptibility / Immunity) | KR0025                             |  |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## 2.0 Summary of tests

| FCC Part Section(s) | Parameter                     | Limit         | Test Condition | Status (note 1) |
|---------------------|-------------------------------|---------------|----------------|-----------------|
| 15.247(a)           | Carrier Frequency Separation  | > 25 kHz      | Conducted      | C               |
| 15.247(a)           | Number of Hopping Frequencies | > 15 hops     |                | C               |
| 15.247(a)           | 20 dB Bandwidth               | NA            |                | C               |
| 15.247(a)           | Dwell Time                    | < 0.4 seconds |                | C               |
| 15.247(b)           | Transmitter Output Power      | < 0.125 Watts |                | C               |
| 15.247(d)           | Conducted Spurious emission   | > 20 dBc      |                | C               |
| 15.247(d)           | Band Edge                     | > 20 dBc      |                | C               |
| 15.209              | Field Strength of Harmonics   | 15.209(a)     | Radiated       | C               |
| 15.207              | AC Conducted Emissions        | 15.207(a)     | Line Conducted | C               |

The sample was tested according to the following specification:  
- FCC Part 15.247, ANSI C63.4-2009

The tests were performed according to the method of measurements prescribed in DA 00-705.

## 2.1 Transmitter Requirements

### 2.1.1 Carrier Frequency Separation

#### Test Location

RF Test Room

#### Test Procedures

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker-delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = 5 MHz (wide enough to capture the peaks of two adjacent channels)

RBW = 30 kHz ( $\geq 1\%$  of the span) Sweep = auto

VBW = 30 kHz ( $\geq$  RBW) Detector function = peak

Trace = max hold

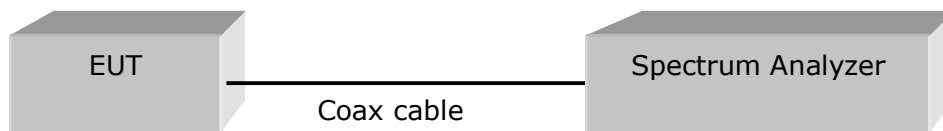


Figure 1 : Measurement setup for the carrier frequency separation

#### Limit

§15.247(a)(1) Frequency hopping system operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-third of 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### Test Results

##### Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Channel | Adjacent Hopping Channel Separation (kHz) | Two-third of 20dB bandwidth (kHz) | Minimum Bandwidth (kHz) | Result   |
|---------|-------------------------------------------|-----------------------------------|-------------------------|----------|
| 2441MHz | 993.6                                     | 625.0                             | 25                      | Complies |

##### Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Channel | Adjacent Hopping Channel Separation (kHz) | Two-third of 20dB bandwidth (kHz) | Minimum Bandwidth (kHz) | Result   |
|---------|-------------------------------------------|-----------------------------------|-------------------------|----------|
| 2441MHz | 1003.2                                    | 842.9                             | 25                      | Complies |

See next pages for actual measured spectrum plots.



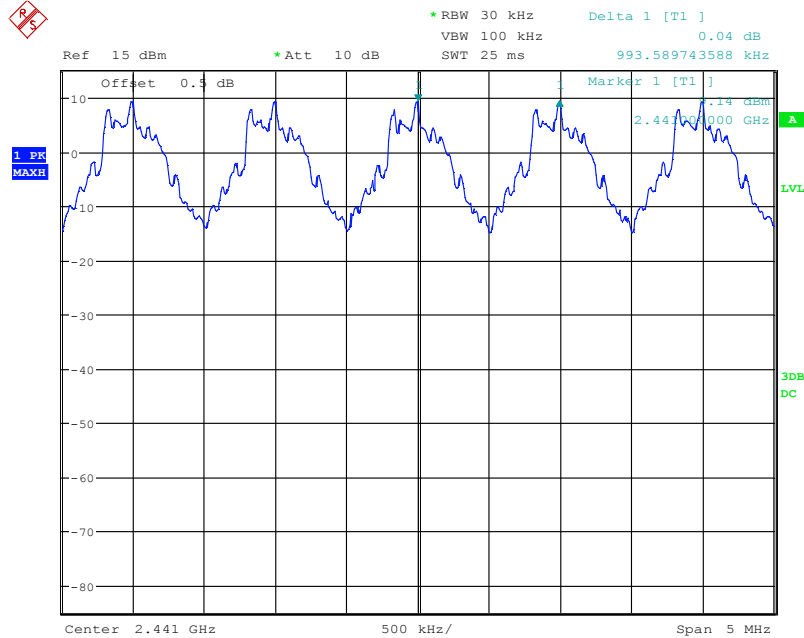
CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

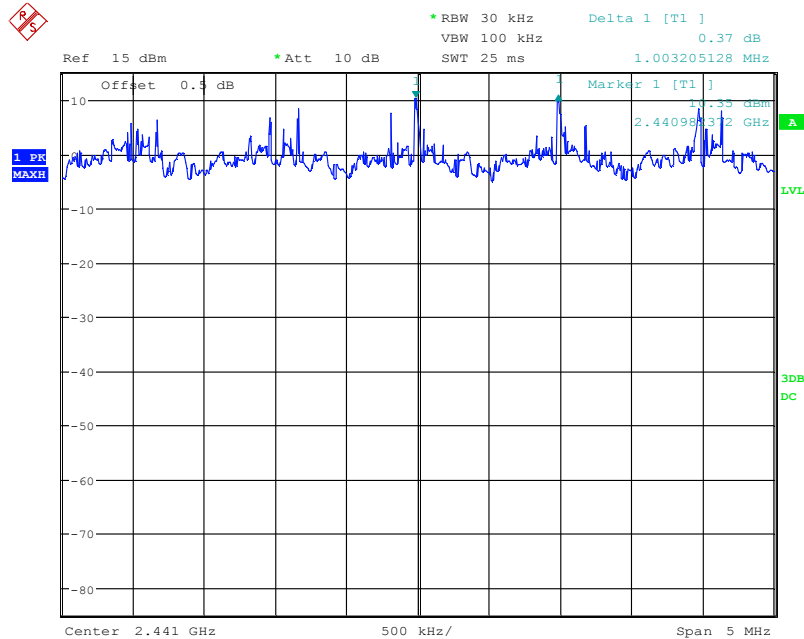
### Carrier Frequency Separation

#### Test mode : GFSK



Date: 24.FEB.2015 16:29:19

#### Test mode : 8-DPSK



Date: 24.FEB.2015 16:55:42

## 2.1.2 Number of Hopping Frequencies

### Test Location

RF Test Room

### Test Procedures

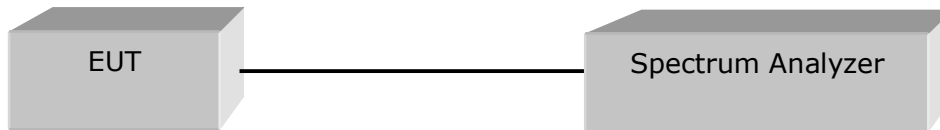
The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

Frequency range      1: Start = 2389.5 MHz, Stop = 2439.5 MHz  
                                 2: Start = 2439.5 MHz, Stop = 2489.5 MHz

RBW = 300 kHz ( $\geq$  1% of the span)  
VBW = 300 kHz ( $\geq$  RBW)  
Trace = max hold

Sweep = auto  
Detector function = peak



### Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5 MHz band shall use at least 15 hopping frequencies.

### Test Results

**Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

| Total number of Hopping Channels | Result   |
|----------------------------------|----------|
| 79                               | Complies |

**Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

| Total number of Hopping Channels | Result   |
|----------------------------------|----------|
| 79                               | Complies |

See next pages for actual measured spectrum plots.



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

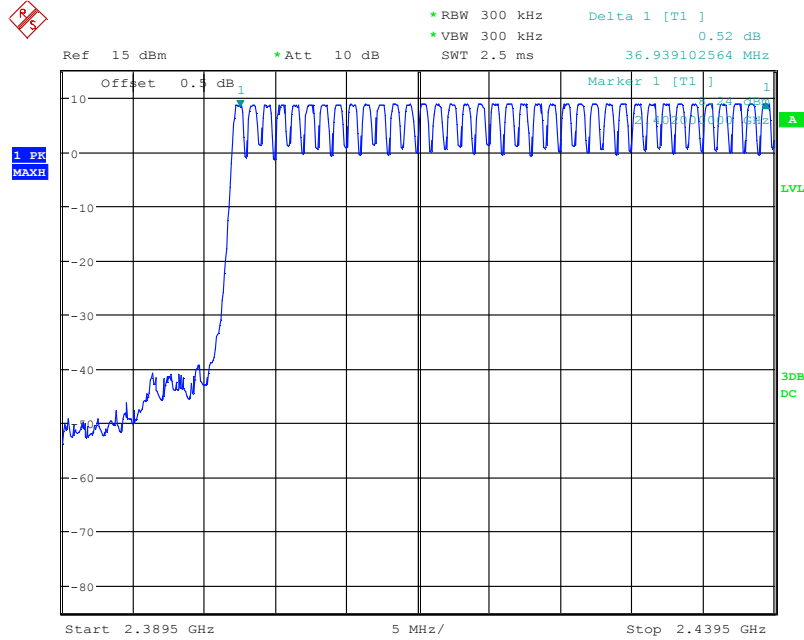
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

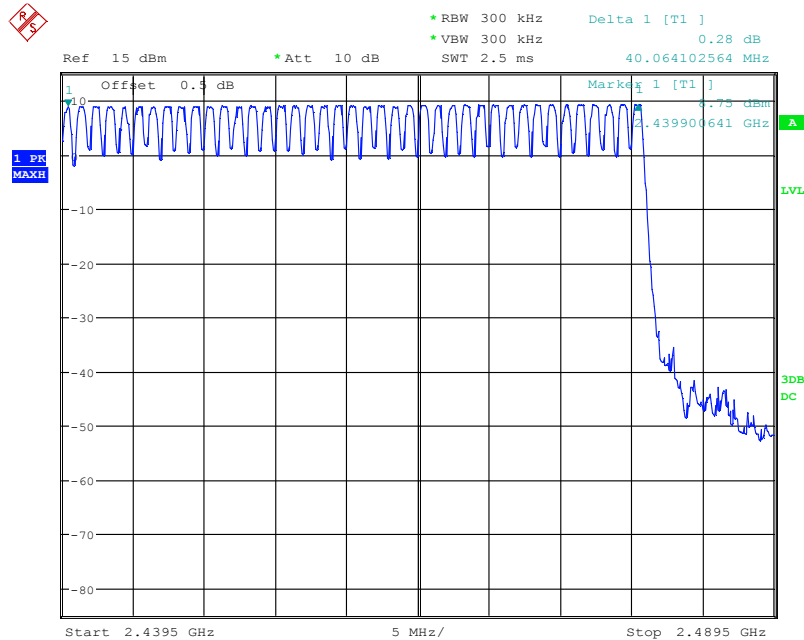
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

## Number of Hopping Frequencies(GFSK)



Date: 24.FEB.2015 16:33:33



Date: 24.FEB.2015 16:35:09



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

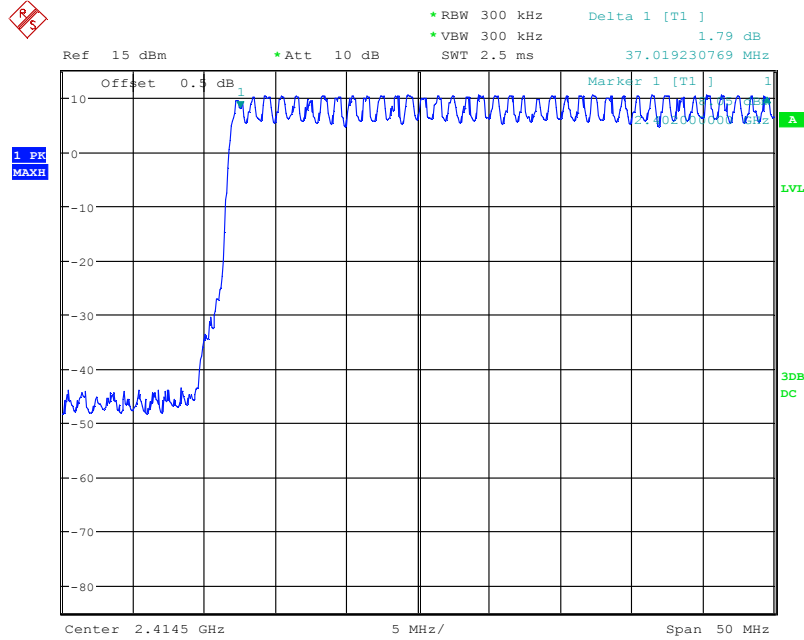
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

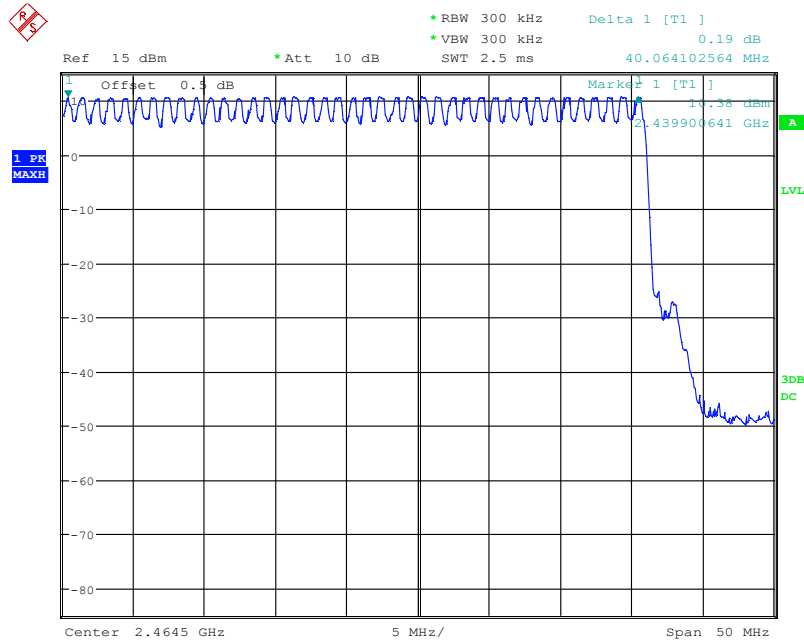
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

## Number of Hopping Frequencies(8-DPSK)



Date: 24.FEB.2015 16:50:15



Date: 24.FEB.2015 16:54:13

### 2.1.3 20 dB bandwidth

#### Test Location

RF Test Room

#### Test Procedures

The bandwidth at 20 dB below the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels. After the trace being stable, Use the marker-to peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

The spectrum analyzer is set to:

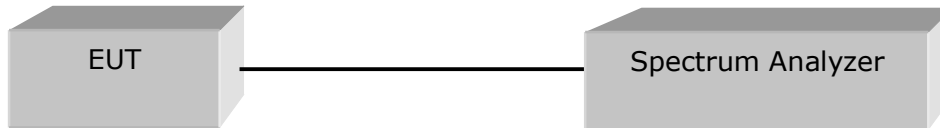
Center frequency = the highest, middle and the lowest channels

Span = approximately 2 or 3 times of the 20 dB bandwidth

RBW = 30 kHz ( $\geq 1\%$  of the 20 dB bandwidth) Sweep = auto

VBW = 30 kHz ( $\geq$  RBW) Detector function = peak

Trace = max hold



#### Limit

Limit : N/A



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### Test Results

#### Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency (MHz) | Channel Number. | Measured Bandwidth (MHz) | Result   |
|-----------------|-----------------|--------------------------|----------|
| 2402            | 0               | 0.933                    | Complies |
| 2441            | 39              | 0.937                    | Complies |
| 2480            | 78              | 0.933                    | Complies |

#### Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency (MHz) | Channel Number. | Measured Bandwidth (MHz) | Result   |
|-----------------|-----------------|--------------------------|----------|
| 2402            | 0               | 1.250                    | Complies |
| 2441            | 39              | 1.264                    | Complies |
| 2480            | 78              | 1.250                    | Complies |

See next pages for actual measured spectrum plots.

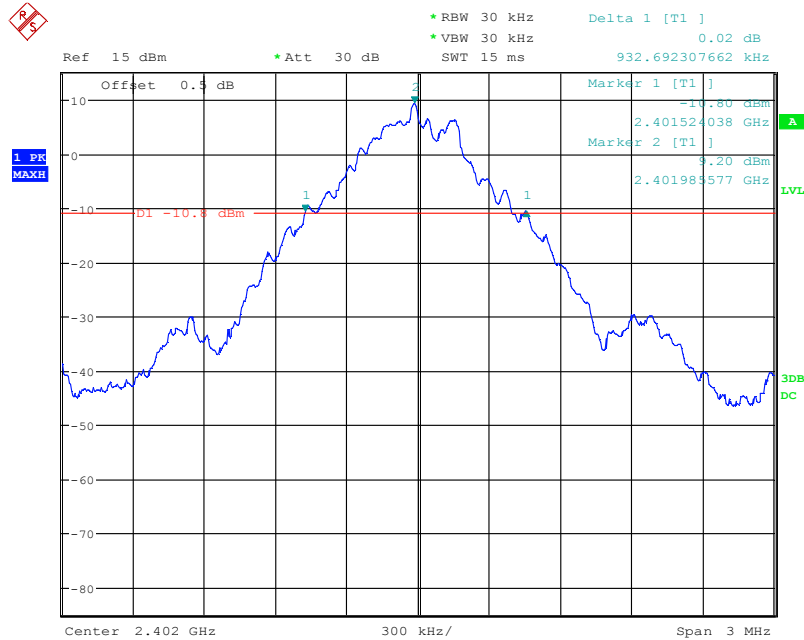


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

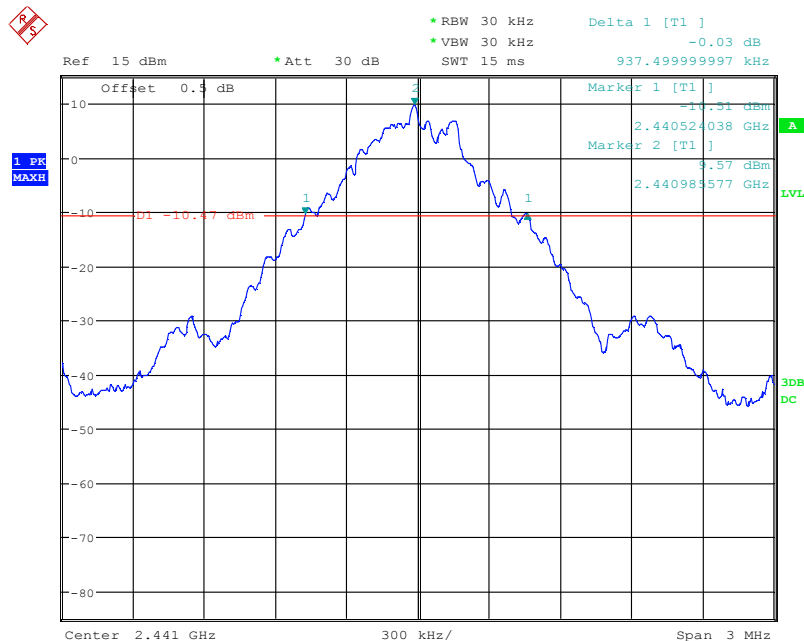
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## 20 dB Bandwidth - GFSK



Date: 24.FEB.2015 15:47:31



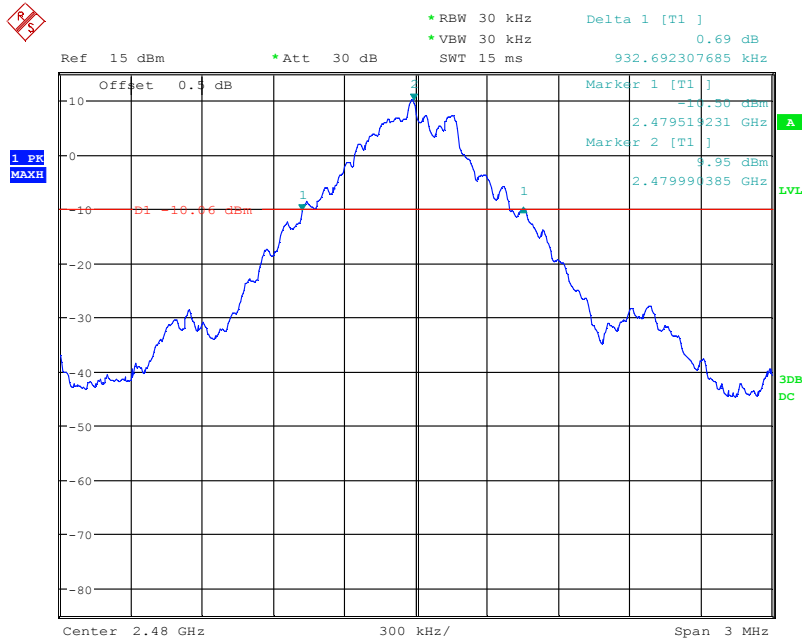
Date: 24.FEB.2015 15:45:59



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com



Date: 24.FEB.2015 15:44:47

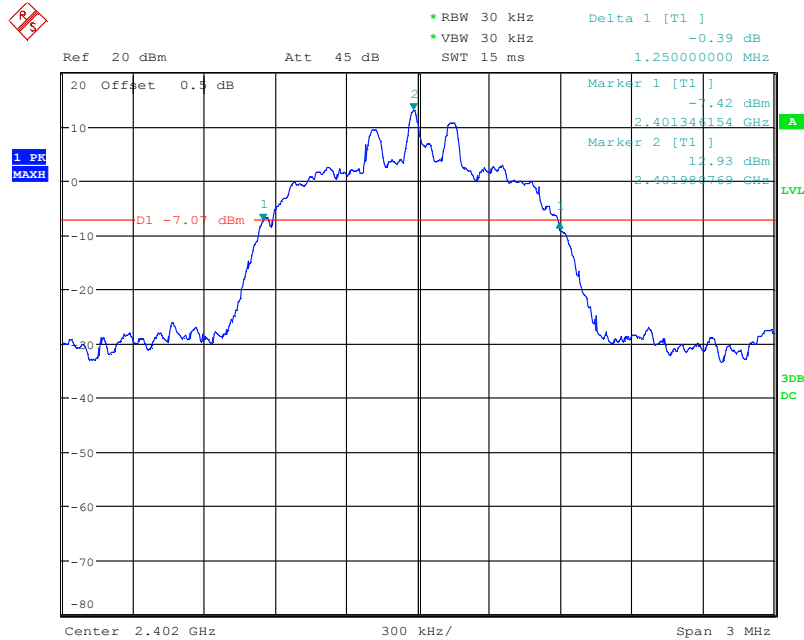


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

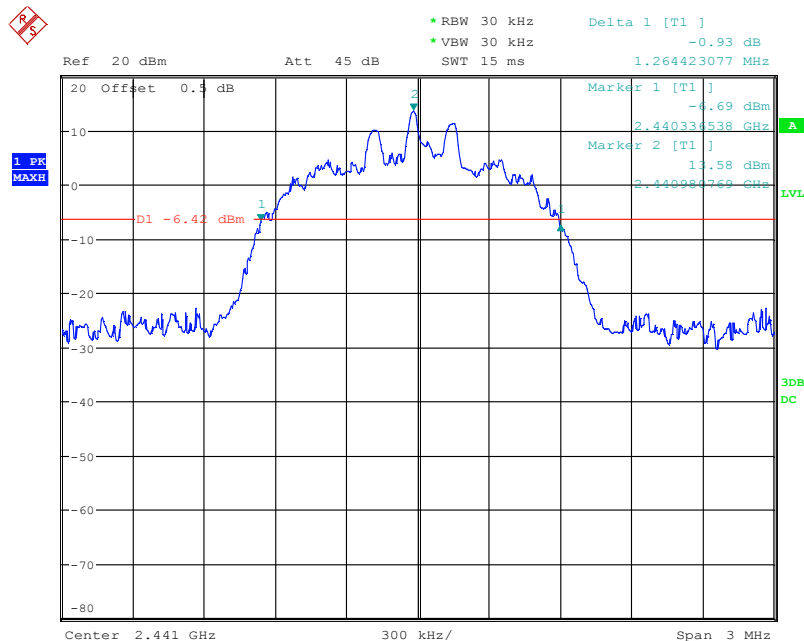
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## 20 dB Bandwidth - 8-DPSK



Date: 24.FEB.2015 17:05:51



Date: 24.FEB.2015 17:06:54



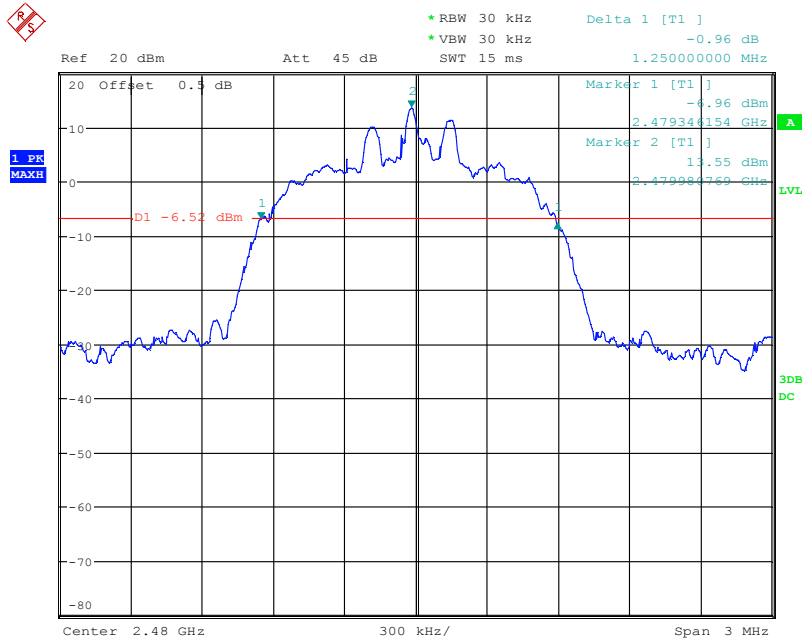
CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com



Date: 24.FEB.2015 17:08:06

## 2.1.4 Time of Occupancy (Dwell Time)

### Test Location

RF Test Room

### Test Procedures

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function enabled.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.
6. The IFJ-B has 3 type of payload, DH1, DH3, DH5. The hopping rate is 1600 per second.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = zero

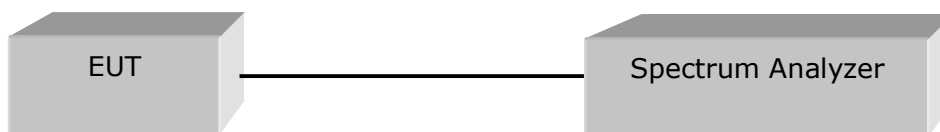
RBW = 1 MHz

Trace = max hold

VBW = 1 MHz ( $\geq$  RBW)

Detector function = peak

Sweep = as necessary to capture the entire dwell time per hopping channel



### Limit

§15.247(a)(1)(iii) For frequency hopping system operating in 2400-2483.5 MHz band, 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.

## Test Results

Time of occupancy on the TX channel in 31.6 sec = time domain slot length × hop rate ÷  
number of hop per channel × 31.6

### Test mode : GFSK

| Channel Frequency (MHz) | Packet Type | Dwell Time (ms) | Test Results                                        |          |
|-------------------------|-------------|-----------------|-----------------------------------------------------|----------|
|                         |             |                 | Time of occupancy on the TX channel in 31.6sec (ms) | Result   |
| 2402                    | DH 1        | 0.441           | 141.12                                              | Complies |
|                         | DH 3        | 1.707           | 273.12                                              | Complies |
|                         | DH 5        | 2.957           | 315.41                                              | Complies |

DH1 Dwell time =  $0.441 \text{ ms} \times (1600 \div 2) \div 79 \times 31.6 = 141.12 \text{ ms}$

DH3 Dwell time =  $1.707 \text{ ms} \times (1600 \div 4) \div 79 \times 31.6 = 273.12 \text{ ms}$

DH5 Dwell time =  $2.957 \text{ ms} \times (1600 \div 6) \div 79 \times 31.6 = 315.41 \text{ ms}$

### Test mode : 8-DPSK

| Channel Frequency (MHz) | Packet Type | Dwell Time (ms) | Test Results                                        |          |
|-------------------------|-------------|-----------------|-----------------------------------------------------|----------|
|                         |             |                 | Time of occupancy on the TX channel in 31.6sec (ms) | Result   |
| 2480                    | 3DH 1       | 0.457           | 146.24                                              | Complies |
|                         | 3DH 3       | 1.707           | 273.12                                              | Complies |
|                         | 3DH 5       | 2.941           | 313.71                                              | Complies |

DH1 Dwell time =  $0.457 \text{ ms} \times (1600 \div 2) \div 79 \times 31.6 = 146.24 \text{ ms}$

DH3 Dwell time =  $1.707 \text{ ms} \times (1600 \div 4) \div 79 \times 31.6 = 273.12 \text{ ms}$

DH5 Dwell time =  $2.941 \text{ ms} \times (1600 \div 6) \div 79 \times 31.6 = 313.71 \text{ ms}$

See next pages for actual measured spectrum plots.

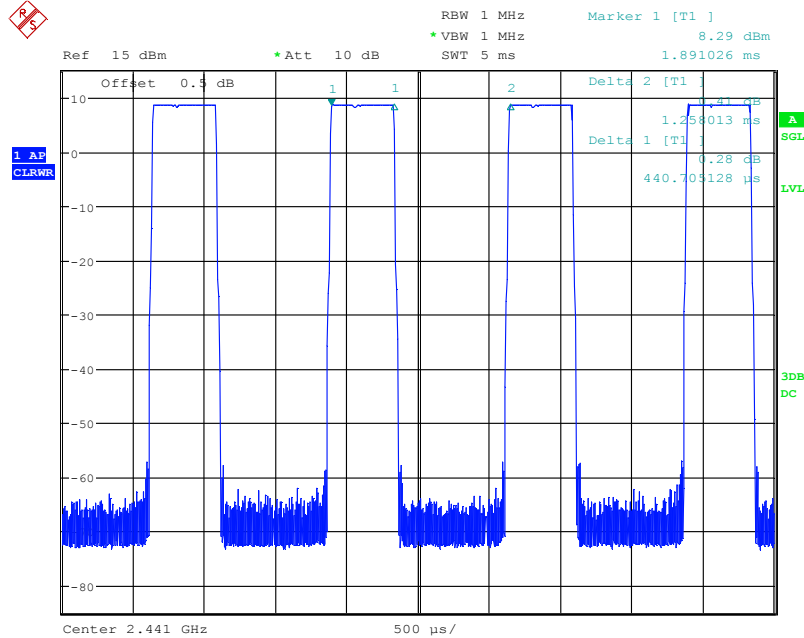


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

# CTK Co., Ltd.

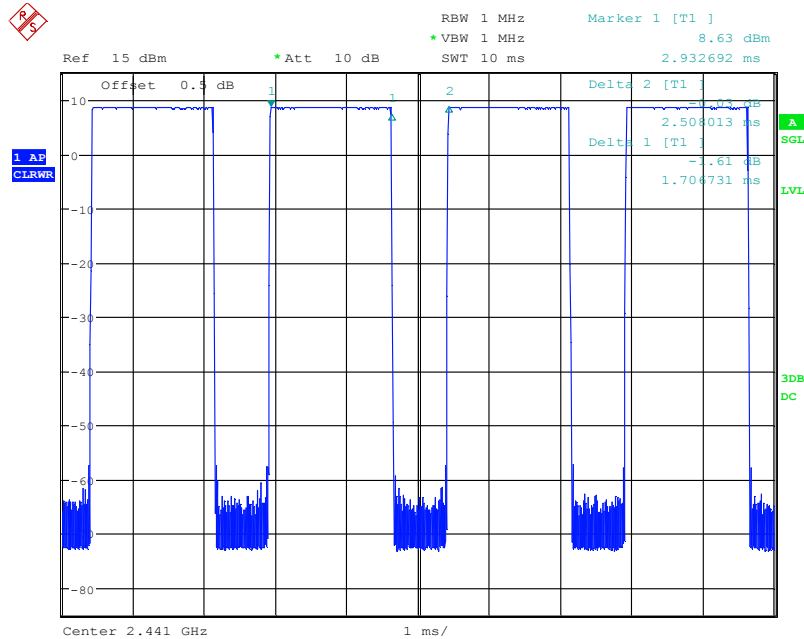
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Time of Occupancy for PACKET Type DH1(GFSK)



Date: 24.FEB.2015 16:40:56

## Time of Occupancy for PACKET Type DH3(GFSK)



Date: 24.FEB.2015 16:42:00



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

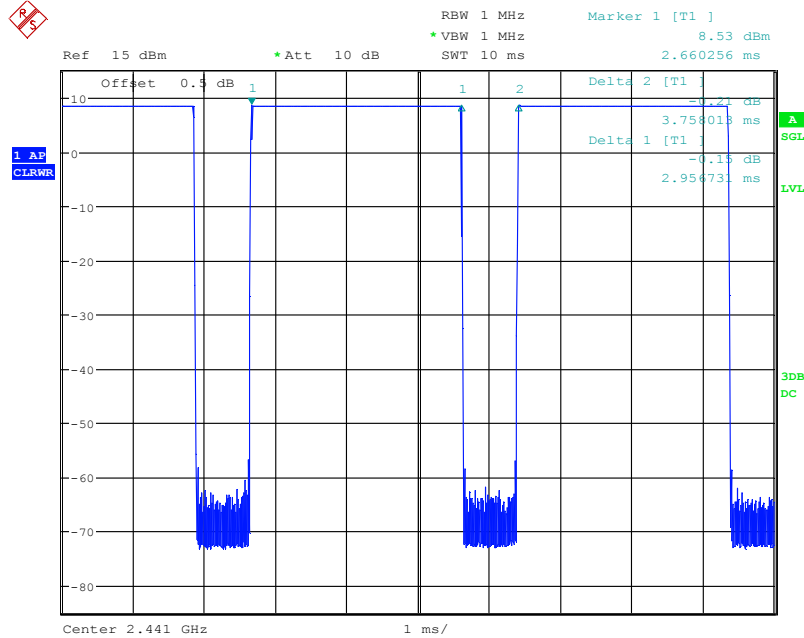
## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### Time of Occupancy for PACKET Type DH5(GFSK)



Date: 24.FEB.2015 16:42:37



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

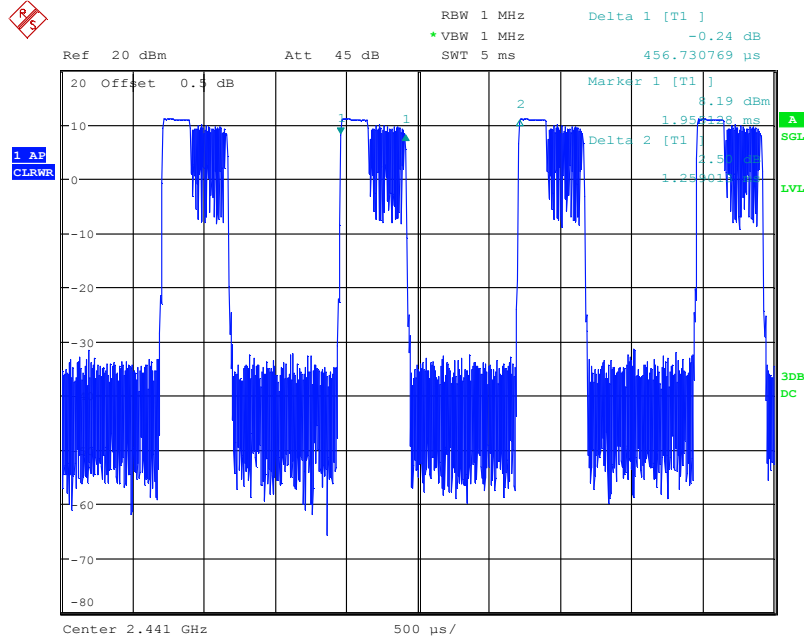
## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

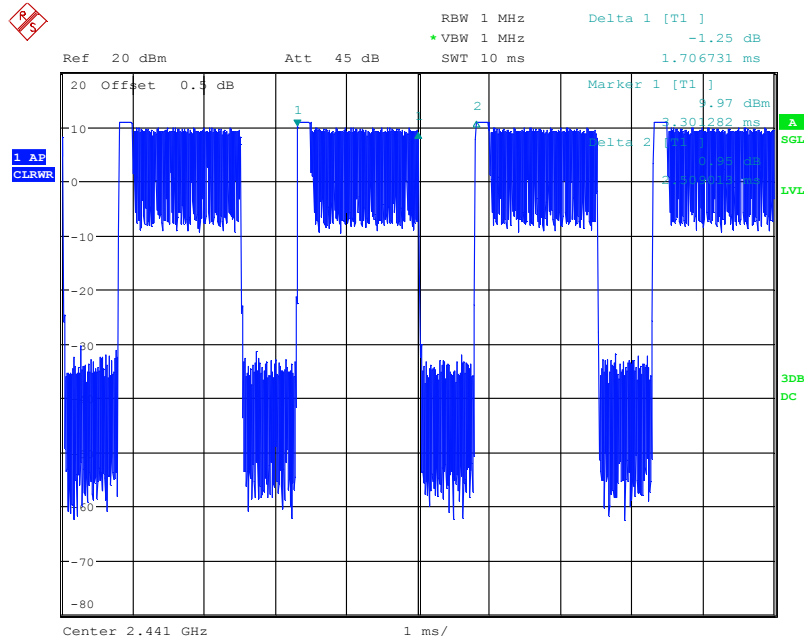
www.e-ctk.com

### Time of Occupancy for PACKET Type 3DH1(8-DPSK)



Date: 26.FEB.2015 17:34:24

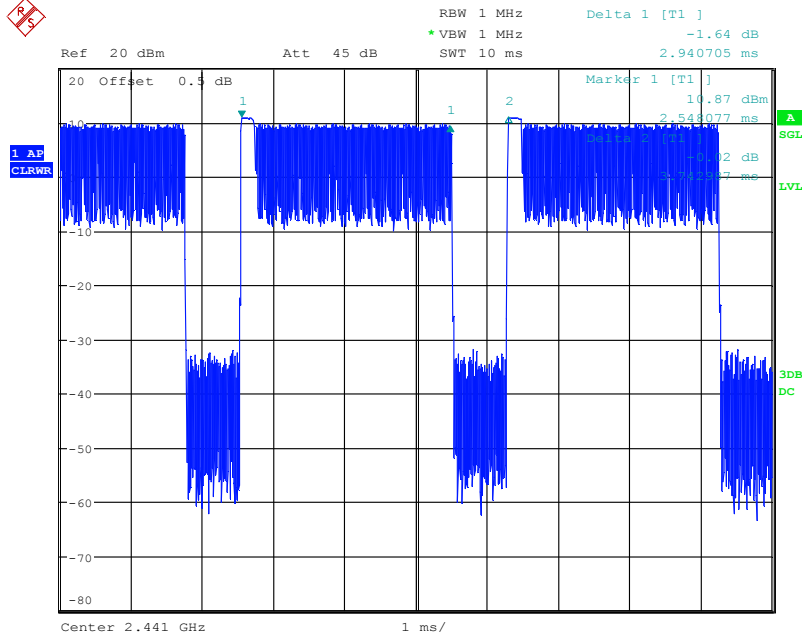
### Time of Occupancy for PACKET Type 3DH3(8-DPSK)



Date: 26.FEB.2015 17:35:55



**(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea**  
**Tel: +82-31-339-9970 Fax: +82-31-624-9501**  
**www.e-ctk.com**



## 2.1.5 Maximum peak Conducted Output Power

### Test Location

RF Test Room

### Test Procedures

The maximum peak conducted output power was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

Span = approximately 5 times of the 20 dB bandwidth

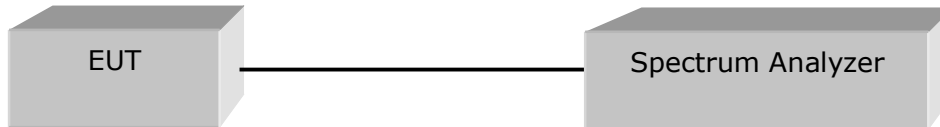
RBW = 1 MHz (greater than the 20 dB bandwidth of the emission being measured)

VBW = 1 MHz ( $\geq$  RBW)

Detector function = peak

Trace = max hold

Sweep = auto



### Note:

The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.

The RF output of EUT was connected to the spectrum analyzer by low loss cable.

### Limit

§5.247(b)(1) The Maximum Peak Output Power Measurement is 0.125 Watts for frequency hopping system operating in 2400-2483.5 MHz employing at least 15 Hopping channels.



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### Test Results

#### Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result   |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402            | 0           | 7.54                   | 5.675                 | Complies |
| 2441            | 39          | 8.10                   | 6.457                 | Complies |
| 2480            | 78          | 8.74                   | 7.482                 | Complies |

#### Test mode : $\pi/4$ DQPSK, CFG PKT Packet Type : 30 Packet Size : 679(2DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result   |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402            | 0           | 6.59                   | 4.560                 | Complies |
| 2441            | 39          | 7.01                   | 5.023                 | Complies |
| 2480            | 78          | 7.02                   | 5.035                 | Complies |

#### Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency (MHz) | Channel No. | Peak output power(dBm) | Peak output power(mW) | Result   |
|-----------------|-------------|------------------------|-----------------------|----------|
| 2402            | 0           | 6.57                   | 4.539                 | Complies |
| 2441            | 39          | 6.99                   | 5.000                 | Complies |
| 2480            | 78          | 7.04                   | 5.058                 | Complies |

See next pages for actual measured spectrum plots.

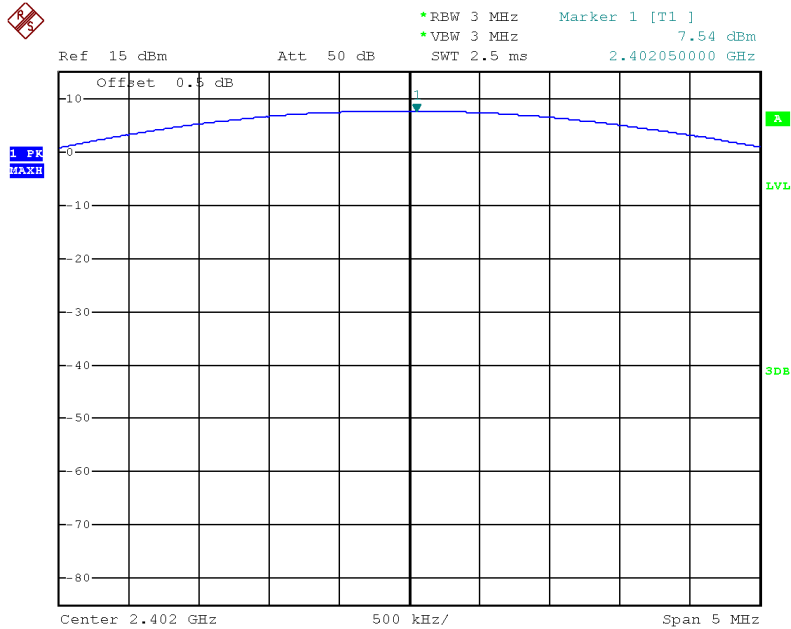


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

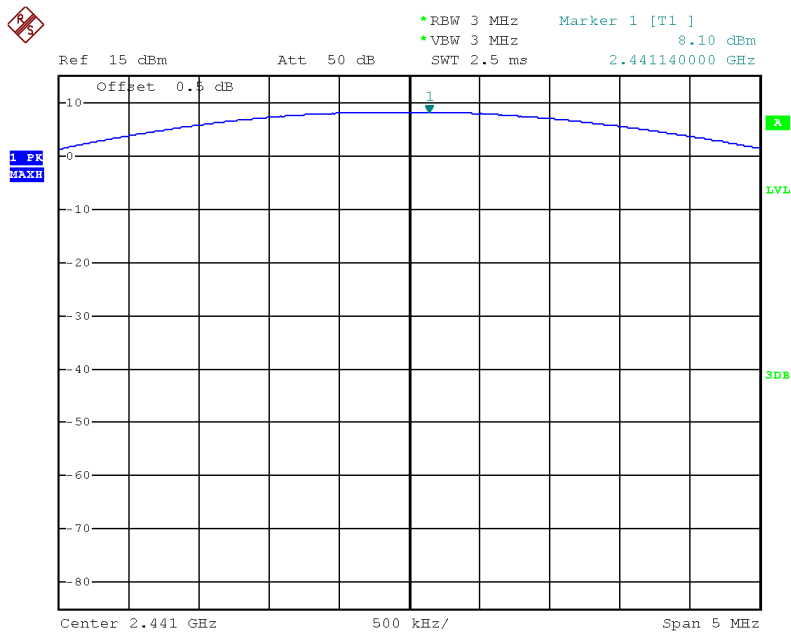
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Maximum peak Conducted Output Power - GFSK



Date: 17.MAR.2015 13:07:49



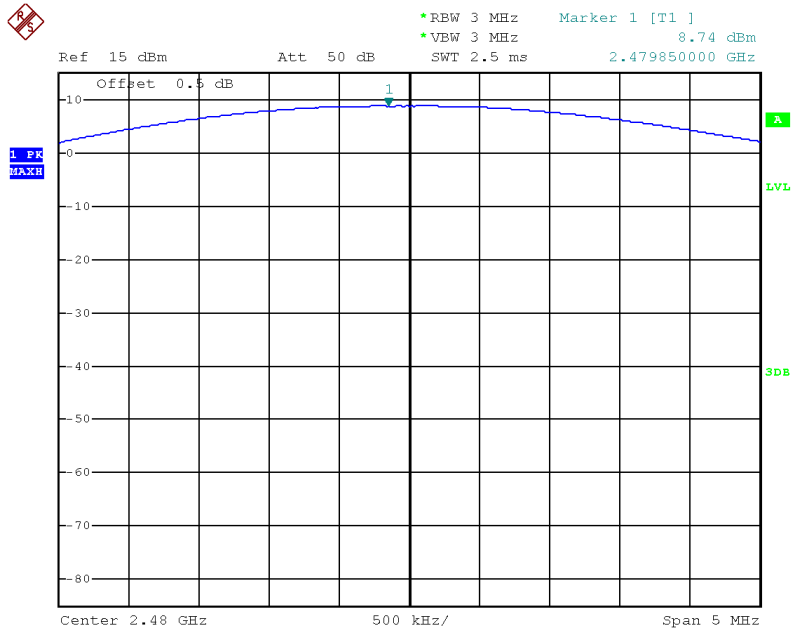
Date: 17.MAR.2015 13:08:23



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com



Date: 17.MAR.2015 13:08:48



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

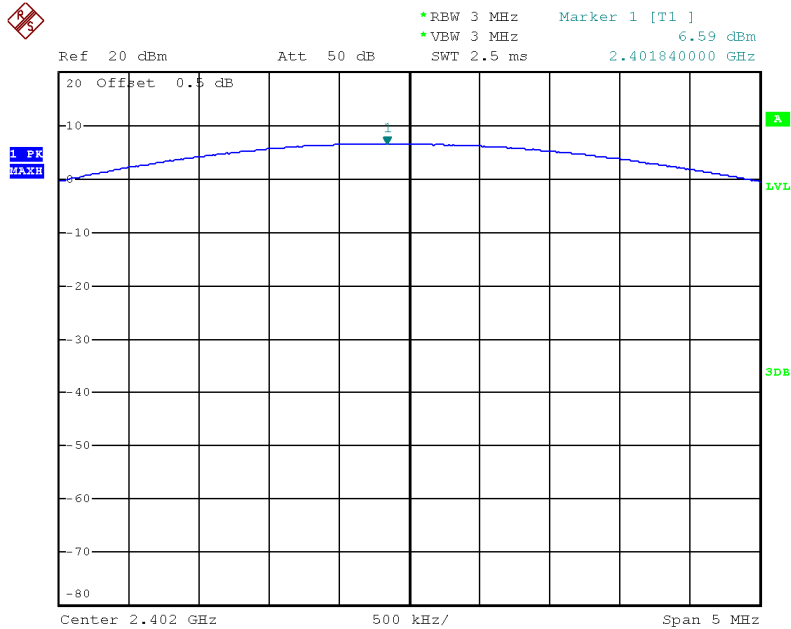
## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

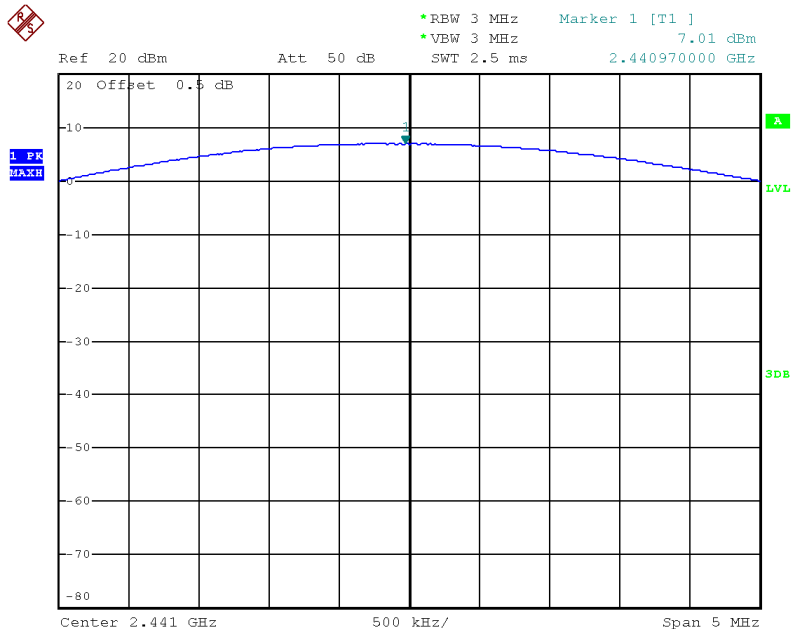
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### Maximum peak Conducted Output Power - $\pi/4$ DQPSK



Date: 17.MAR.2015 20:54:46



Date: 17.MAR.2015 20:54:18



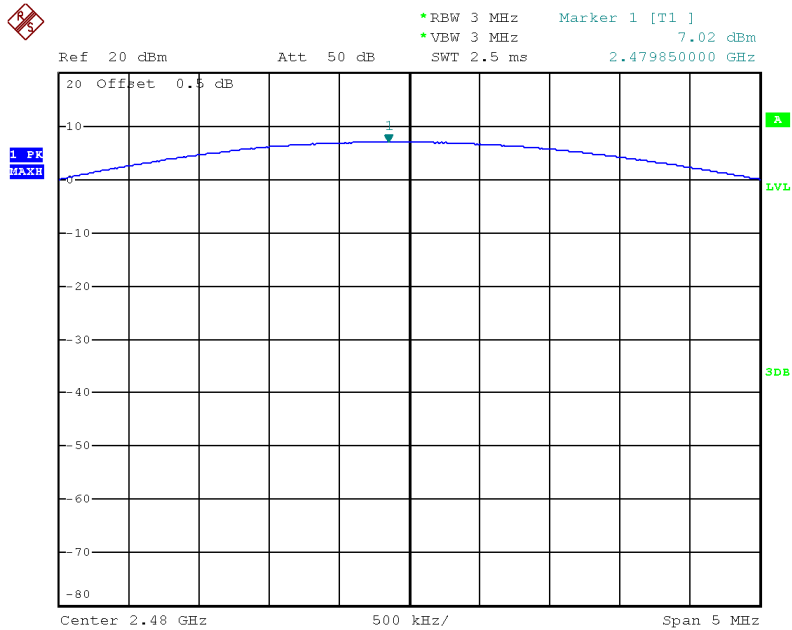
CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com



Date: 17.MAR.2015 20:53:55

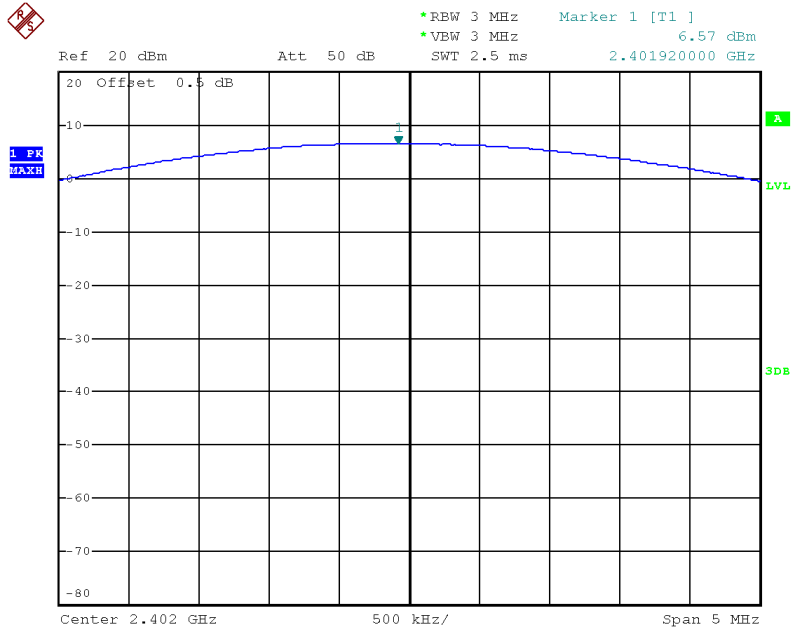


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

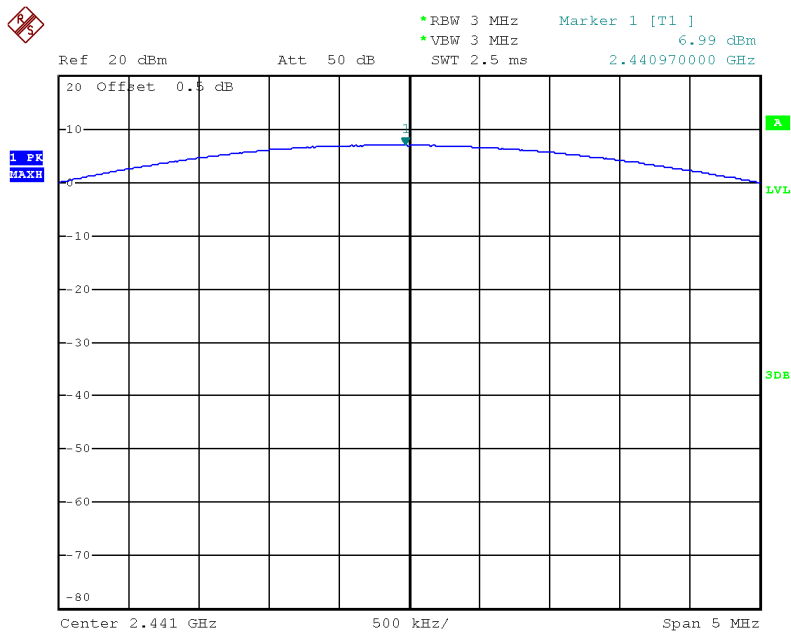
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Maximum peak Conducted Output Power - 8-DPSK



Date: 17.MAR.2015 20:52:26



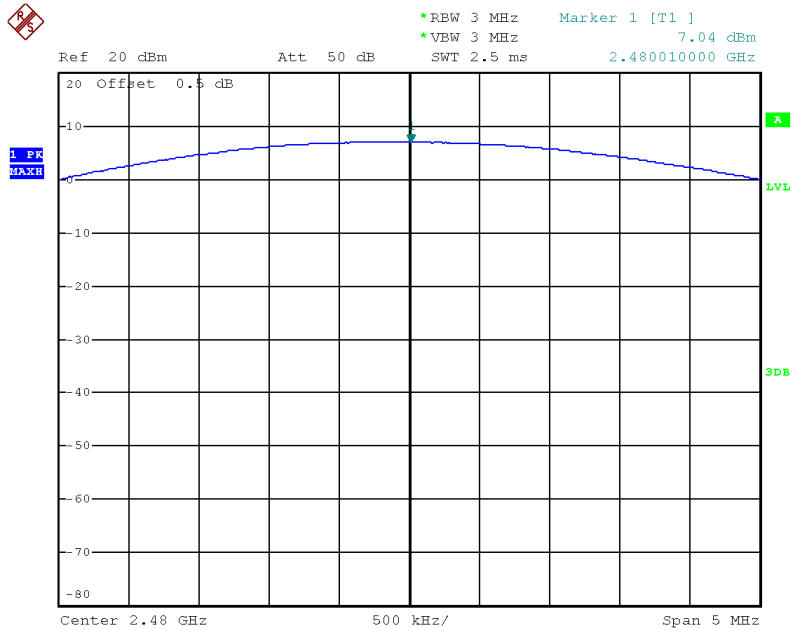
Date: 17.MAR.2015 20:53:01



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com



Date: 17.MAR.2015 20:53:19

## 2.1.6 RF Conducted Emissions

### Test Location

RF Test Room

### Test Procedures

The bandwidth at 20 dB down from the highest inband spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT has its hopping function disabled at the highest, middle and the lowest available channels.

The spectrum analyzer is set to:

Center frequency = the highest, middle, and the lowest channels

RBW = 100 kHz

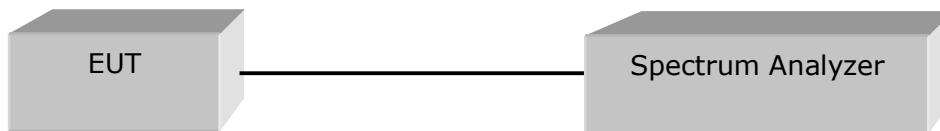
VBW = 100 kHz ( $\geq$  RBW)

Span = 10 MHz

Trace = max hold

Detector function = peak

Sweep = auto



### Limit

> 20 dBc

### Test Results

All conducted emission in any 100 kHz bandwidth outside of the spectrum band was at least 20 dB lower than the highest level of the inband spectral density. Therefore the applying equipment meets the requirement.

See next pages for actual measured spectrum plots.



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

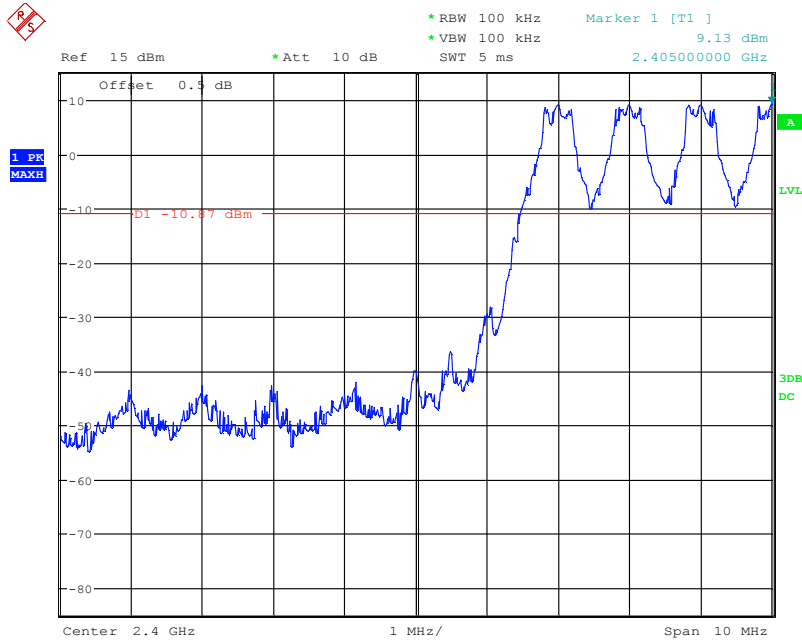
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

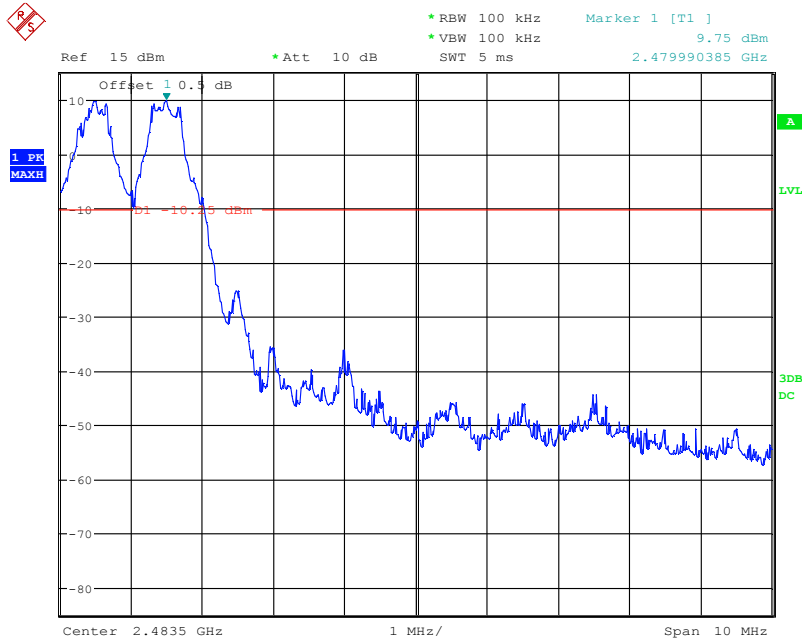
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

## Band - edge (Hopping mode) - GFSK



Date: 24.FEB.2015 16:24:50



Date: 24.FEB.2015 16:26:11

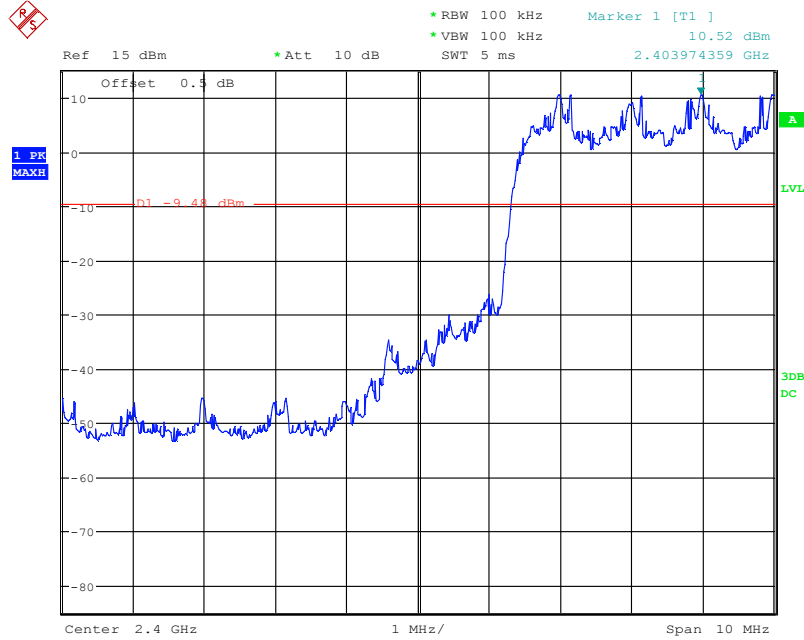


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

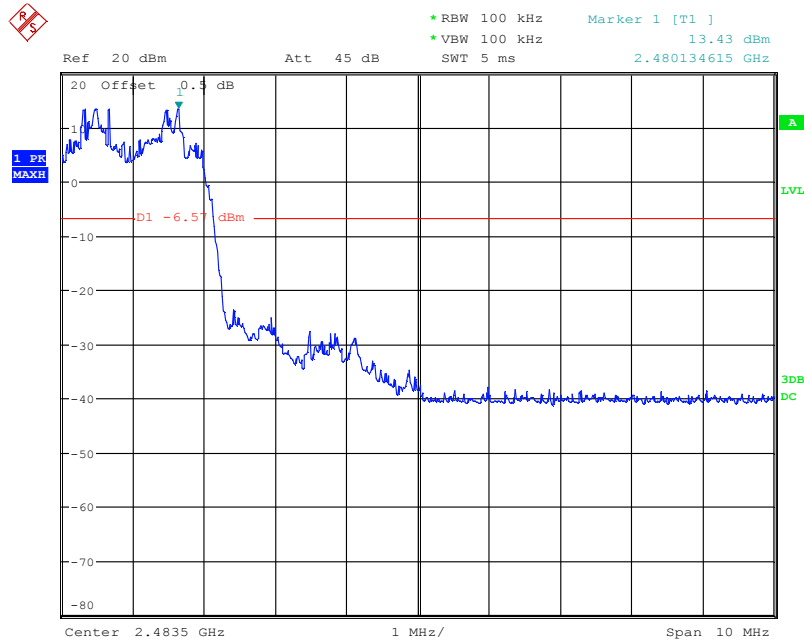
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Band - edge (Hopping mode) - 8-DPSK



Date: 24.FEB.2015 16:57:59



Date: 24.FEB.2015 17:01:55



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

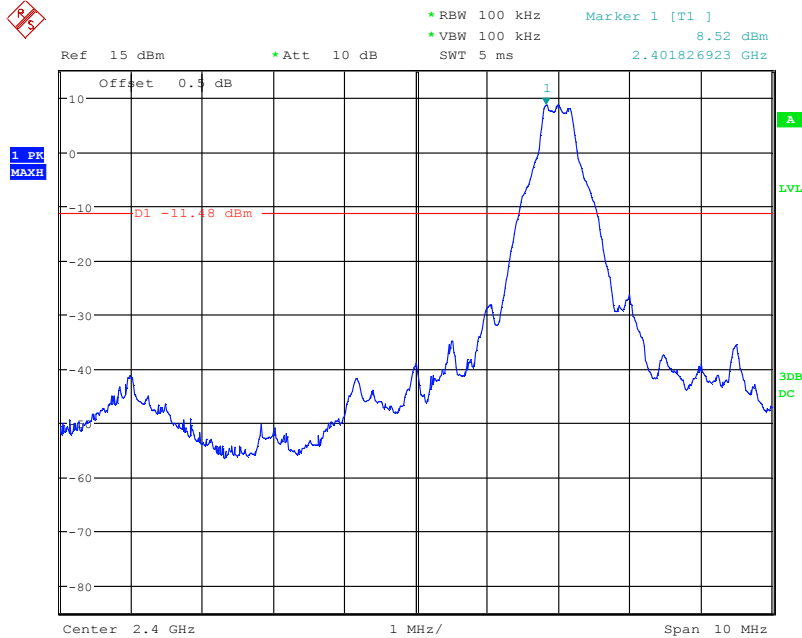
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

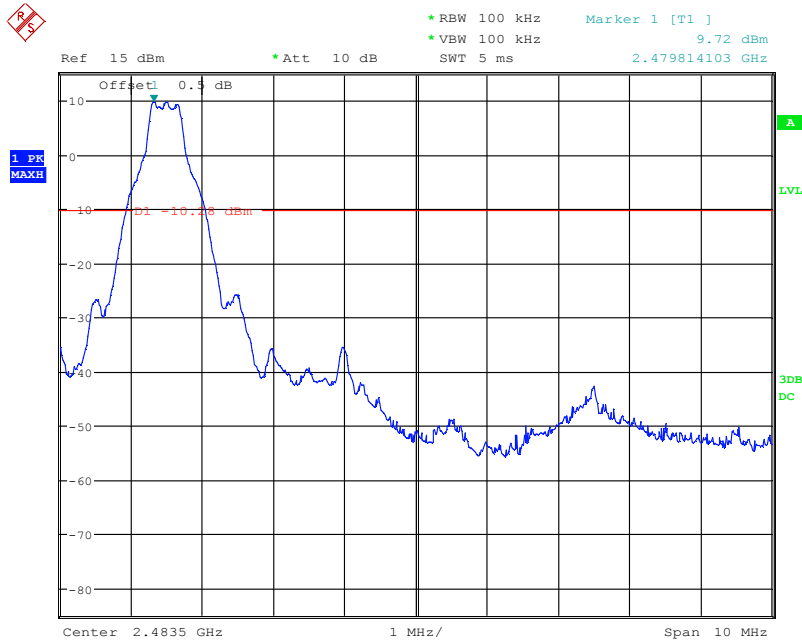
Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

## Band – edge (Non-Hopping mode) - GFSK



Date: 24.FEB.2015 16:23:18



Date: 24.FEB.2015 16:27:12

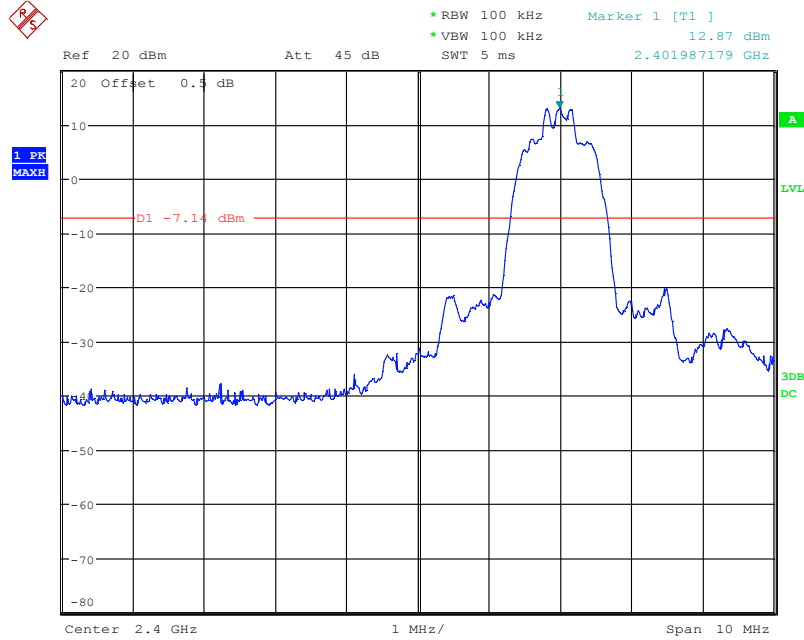


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

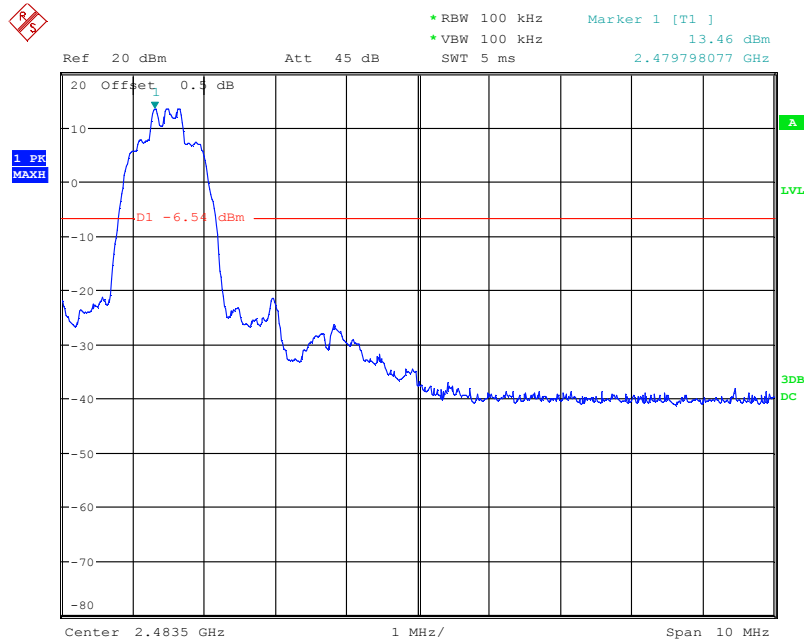
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Band – edge (Non-Hopping mode) - 8-DPSK



Date: 24.FEB.2015 16:59:23



Date: 24.FEB.2015 17:00:31

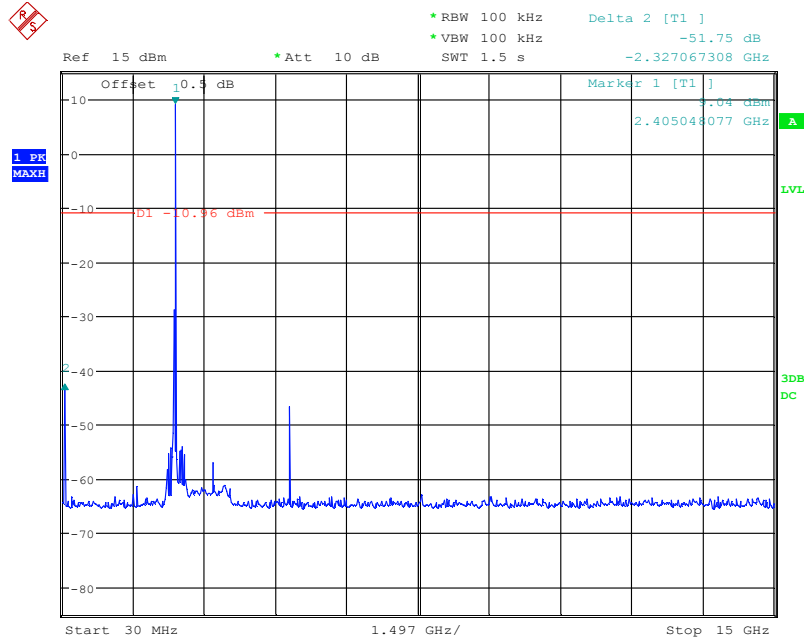


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

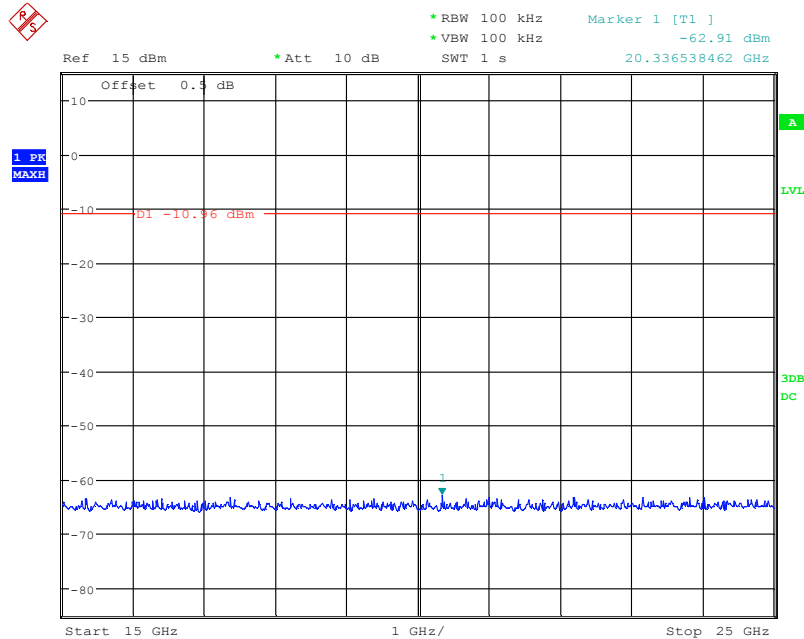
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : GFSK)



Date: 24.FEB.2015 15:51:52



Date: 24.FEB.2015 15:52:51

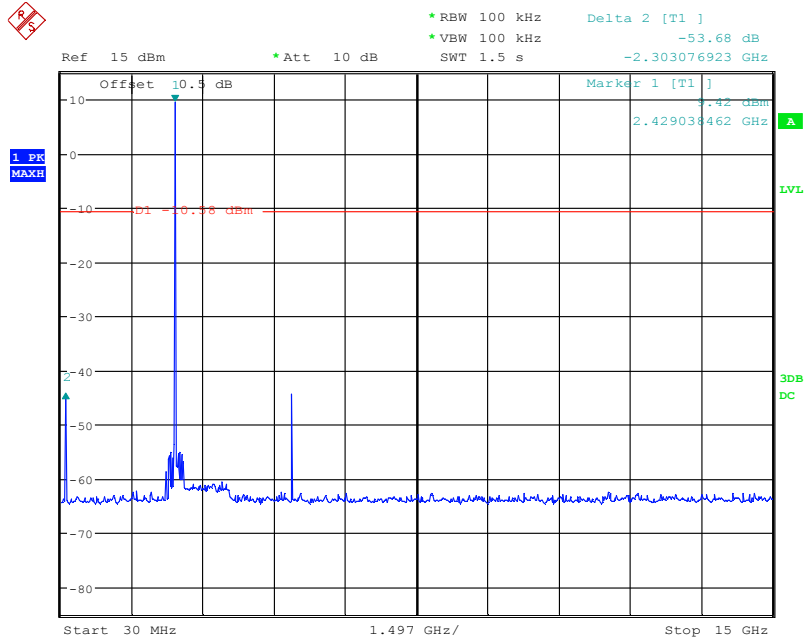


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

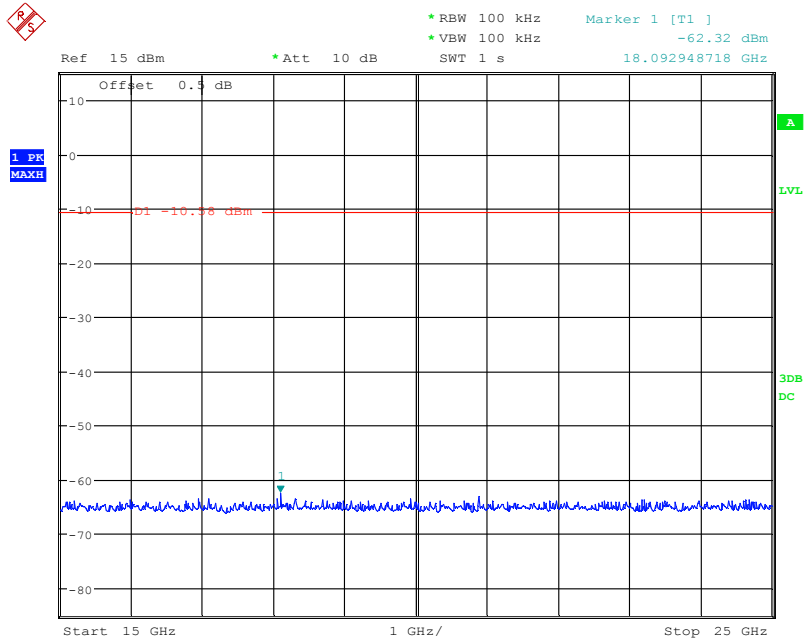
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : GFSK)



Date: 24.FEB.2015 16:13:58



Date: 24.FEB.2015 16:14:35

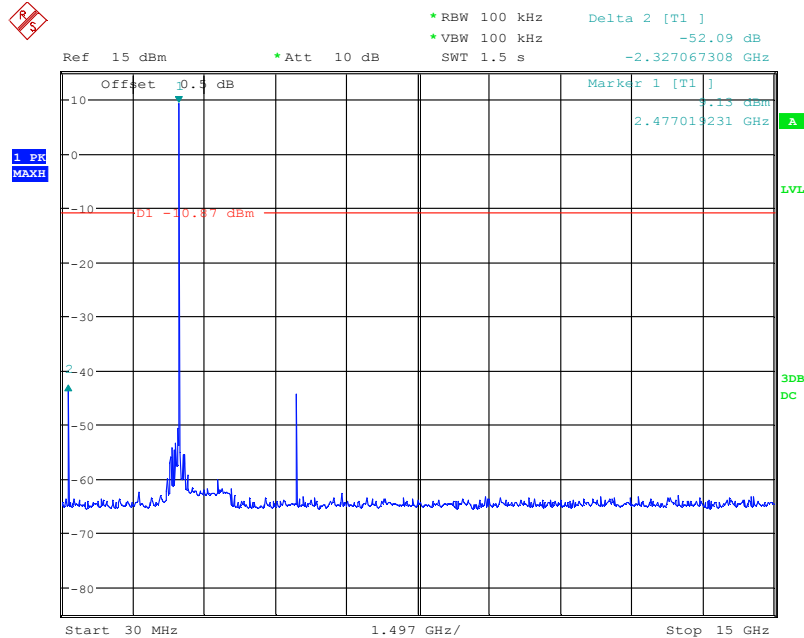


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

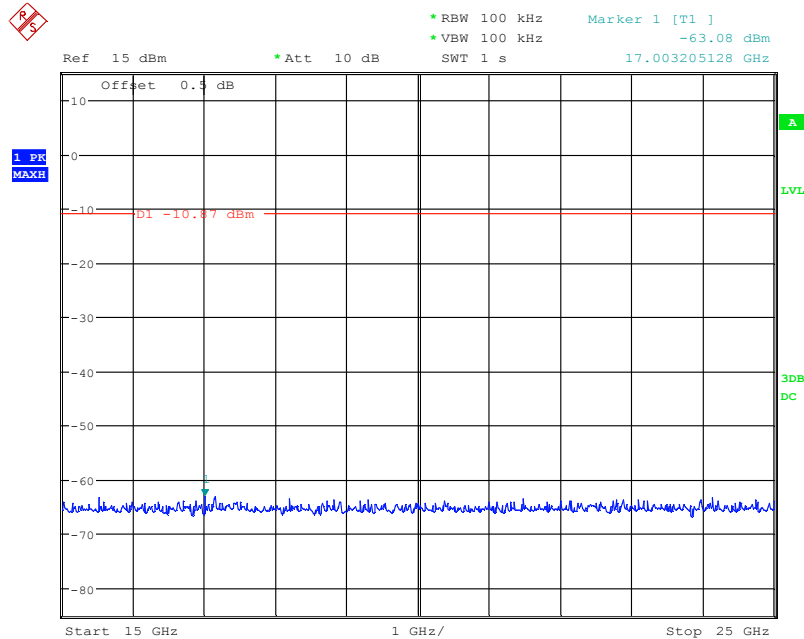
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : GFSK)



Date: 24.FEB.2015 16:16:53



Date: 24.FEB.2015 16:17:34

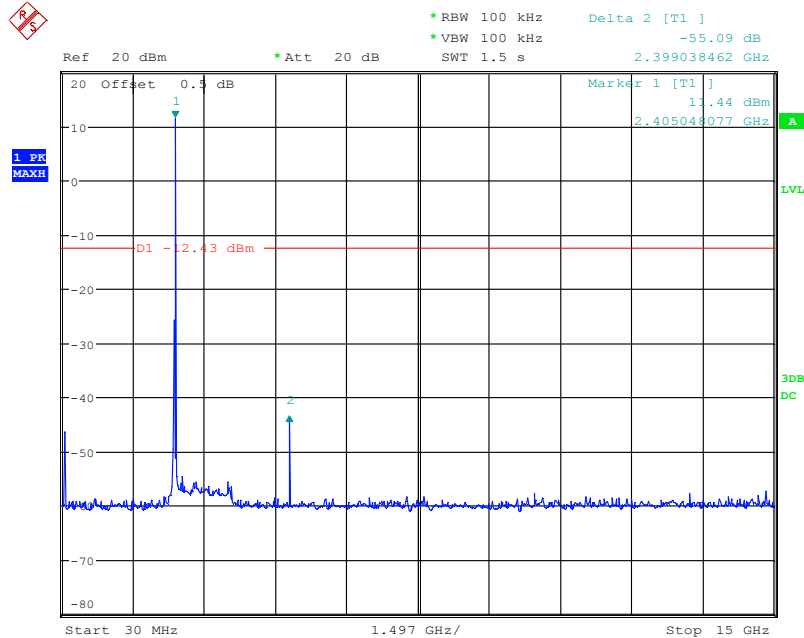


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

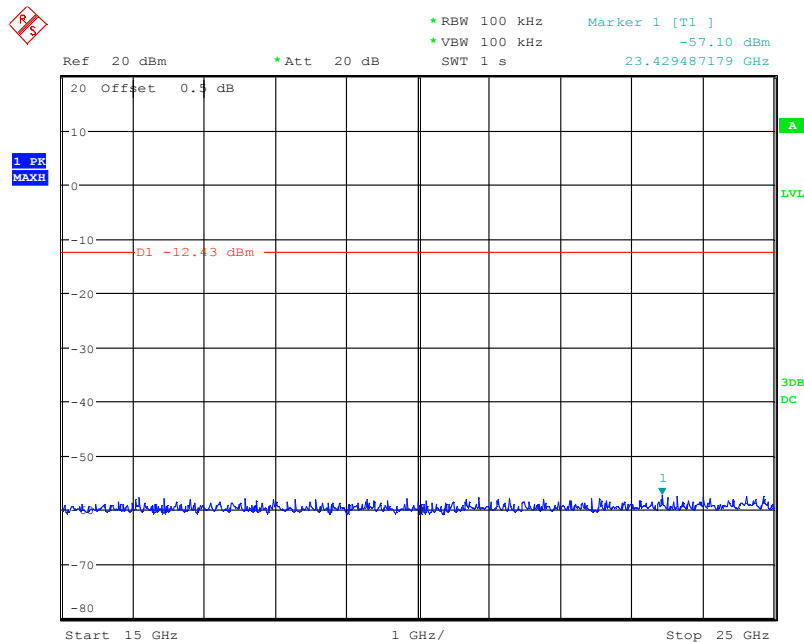
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : 8-DPSK)



Date: 24.FEB.2015 17:16:07



Date: 24.FEB.2015 17:16:41

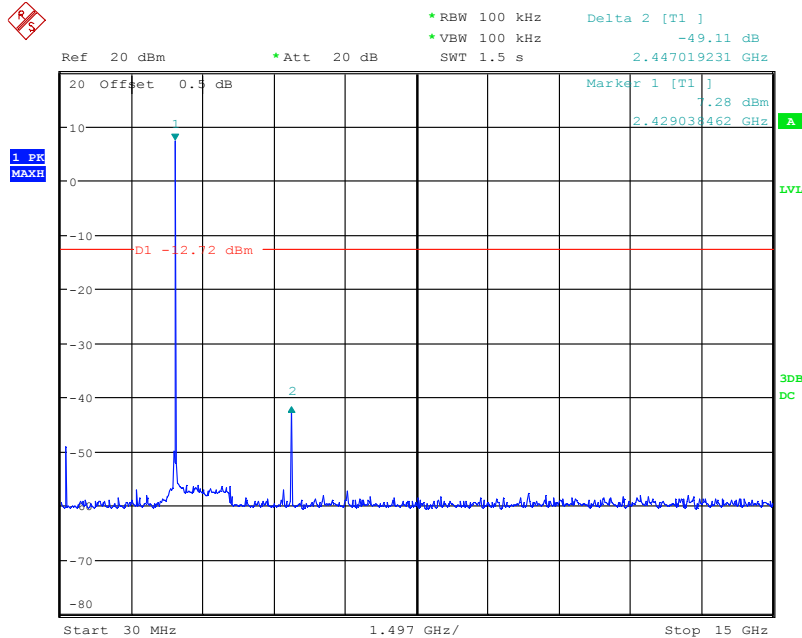


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

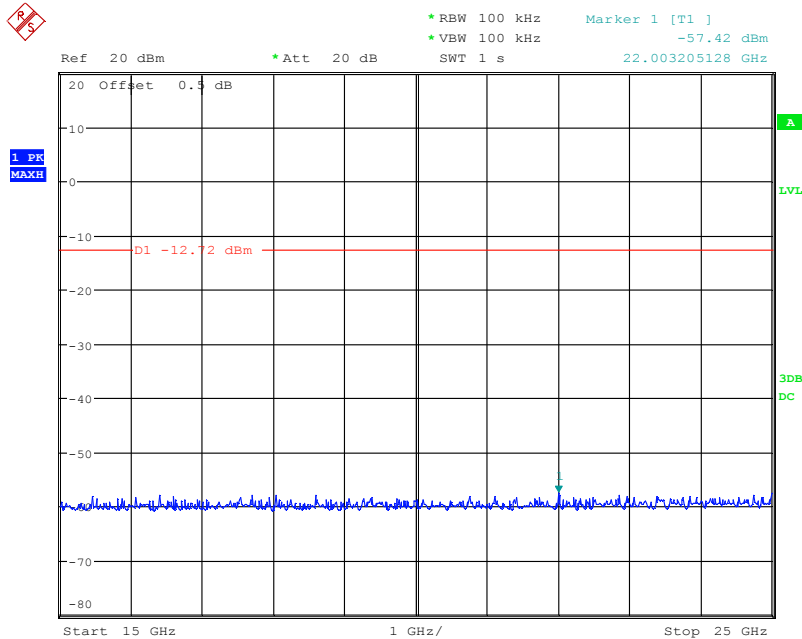
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : 8-DPSK)



Date: 24.FEB.2015 17:13:19



Date: 24.FEB.2015 17:13:51

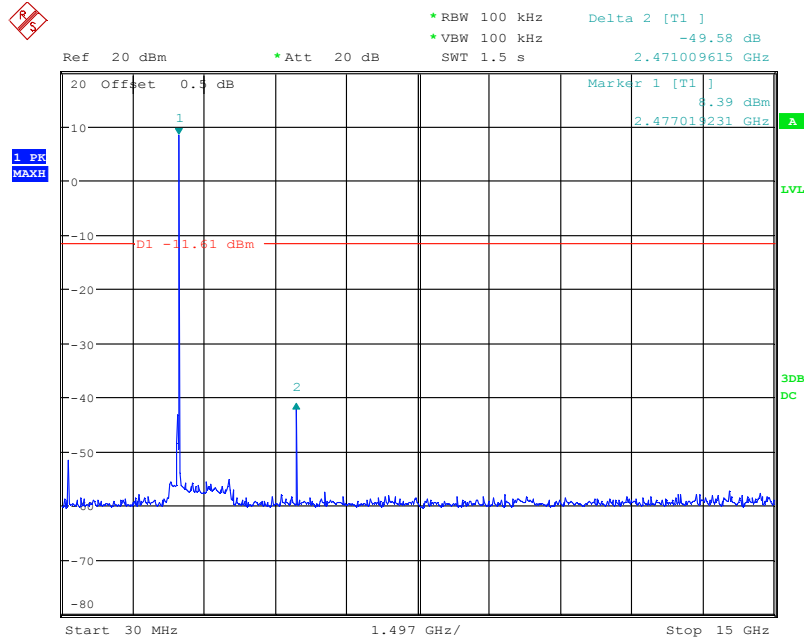


CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

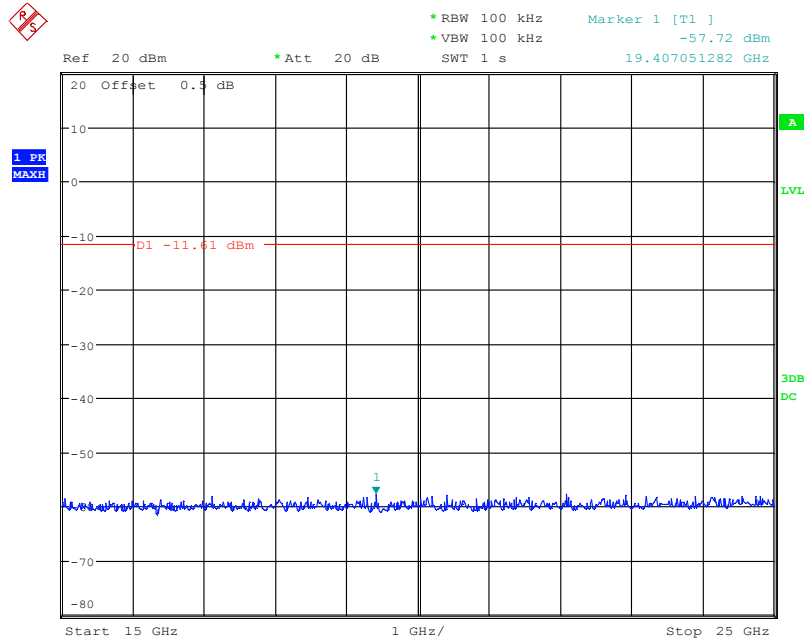
# CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

## Spurious (at 20 dB blow) – High channel Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic (Test mode : 8-DPSK)



Date: 24.FEB.2015 17:11:33



Date: 24.FEB.2015 17:12:00



## 2.1.7 Other requirements Frequency Hopping Spread Spectrum System

### Test Requirement : 47 CFR Part 15C Section 15.247 (a)(1), (h) requirement :

The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidth of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Example of a 79 hopping sequence in data mode:

|    |    |    |    |  |   |    |  |   |    |  |    |    |   |
|----|----|----|----|--|---|----|--|---|----|--|----|----|---|
| 20 | 62 | 46 | 77 |  | 7 | 64 |  | 8 | 73 |  | 16 | 75 | 1 |
|    |    |    |    |  |   |    |  |   |    |  |    |    |   |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### 2.1.8 Field Strength of Emissions

#### Test Location

- ☒ 10 m SAC (test distance : ☐ 10 m, ☒ 3 m)  
☒ 3 m SAC (test distance : 3 m)

#### Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10<sup>th</sup> harmonic)

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz, 9 kHz for  $f < 30$  MHz

VBW  $\geq$  RBW

Sweep = auto



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### Limit

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                      | MHz               | MHz                 | MHz           | MHz         | GHz                     |
|--------------------------|-------------------|---------------------|---------------|-------------|-------------------------|
| 0.09-0.11                | 8.37626-8.38675   | 73-74.6             | 399.9-410     | 2690-2900   | 10.6-12.7               |
| <sup>1</sup> 0.495-0.505 | 8.41425-8.41475   | 74.8-75.2           | 608-614       | 3260-3267   | 13.25-13.4              |
| 2.1735-2.1905            | 12.29-12.293      | 108-121.94          | 960-1240      | 3332-3339   | 14.47-14.5              |
| 4.125-4.128              | 12.51975-12.52025 | 123-138             | 1300-1427     | 3345.8-3358 | 15.35-16.2              |
| 4.17725-4.17775          | 12.57675-12.57725 | 149.9-150.05        | 1435-1626.5   | 3600-4400   | 17.7-21.4               |
| 4.20725-4.20775          | 13.36-13.41       | 156.52475-156.52525 | 1645.5-1646.5 | 4500-5150   | 22.01-23.12             |
| 6.215-6.218              | 16.42-16.423      | 156.7-156.9         | 1660-1710     | 5350-5460   | 23.6-24                 |
| 6.26775-6.26825          | 16.69475-16.69525 | 162.0125-167.17     | 1718.8-1722.2 | 7250-7750   | 31.2-31.8               |
| 6.31175-6.31225          | 16.80425-16.80475 | 167.72-173.2        | 2200-2300     | 8025-8500   | 36.43-36.5              |
| 8.291-8.294              | 25.5-25.67        | 240-285             | 2310-2390     | 9000-9200   | <sup>2</sup> Above 38.6 |
| 8.362-8.366              | 37.5-38.25        | 322-335.4           | 2483.5-2500   | 9300-9500   |                         |

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

| Frequency(MHz) | Field Strength<br>uV/m@3m | Field Strength<br>dBuV/m@3m | Deasurement<br>Distance (meters) |
|----------------|---------------------------|-----------------------------|----------------------------------|
| 0.009-0.490    | 2400/F(kHz)               | -                           | 300                              |
| 0.490-1.705    | 24000/F(kHz)              | -                           | 30                               |
| 1.705-30       | 30                        | -                           | 30                               |
| 30-88          | 100**                     | 40                          | 3                                |
| 88-216         | 150**                     | 43.5                        | 3                                |
| 216-960        | 200**                     | 46                          | 3                                |
| Above 960      | 500                       | 54                          | 3                                |

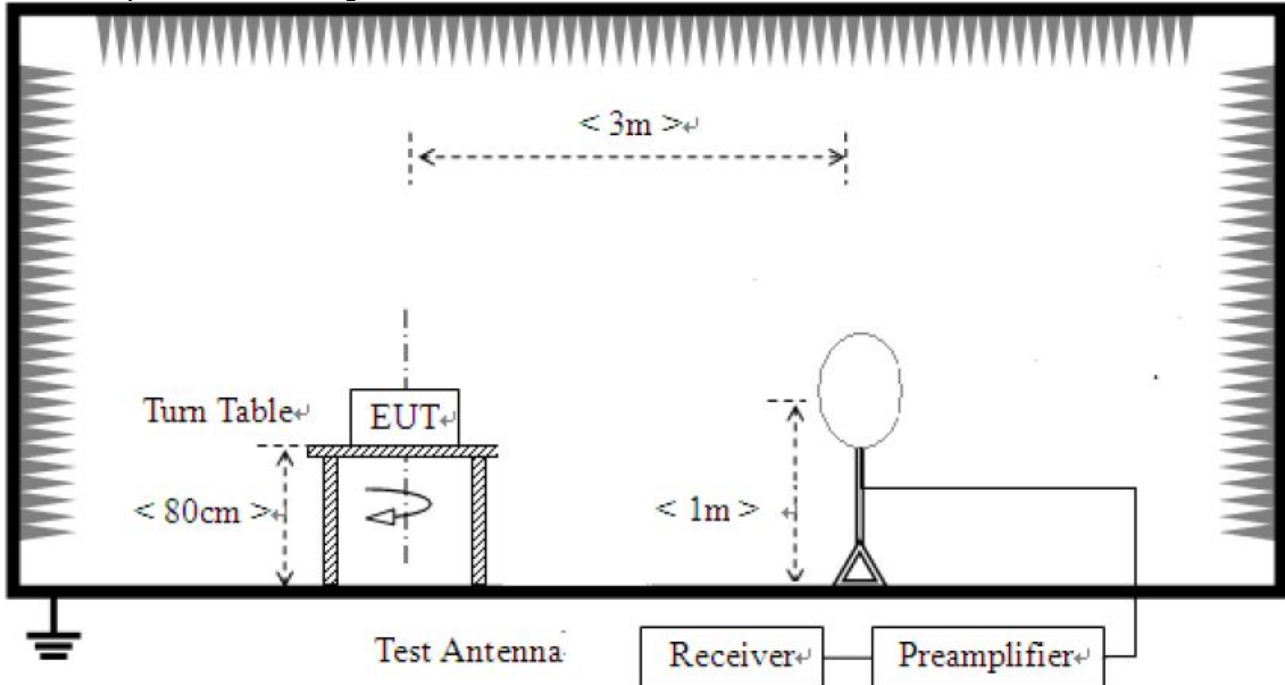
\*\* Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

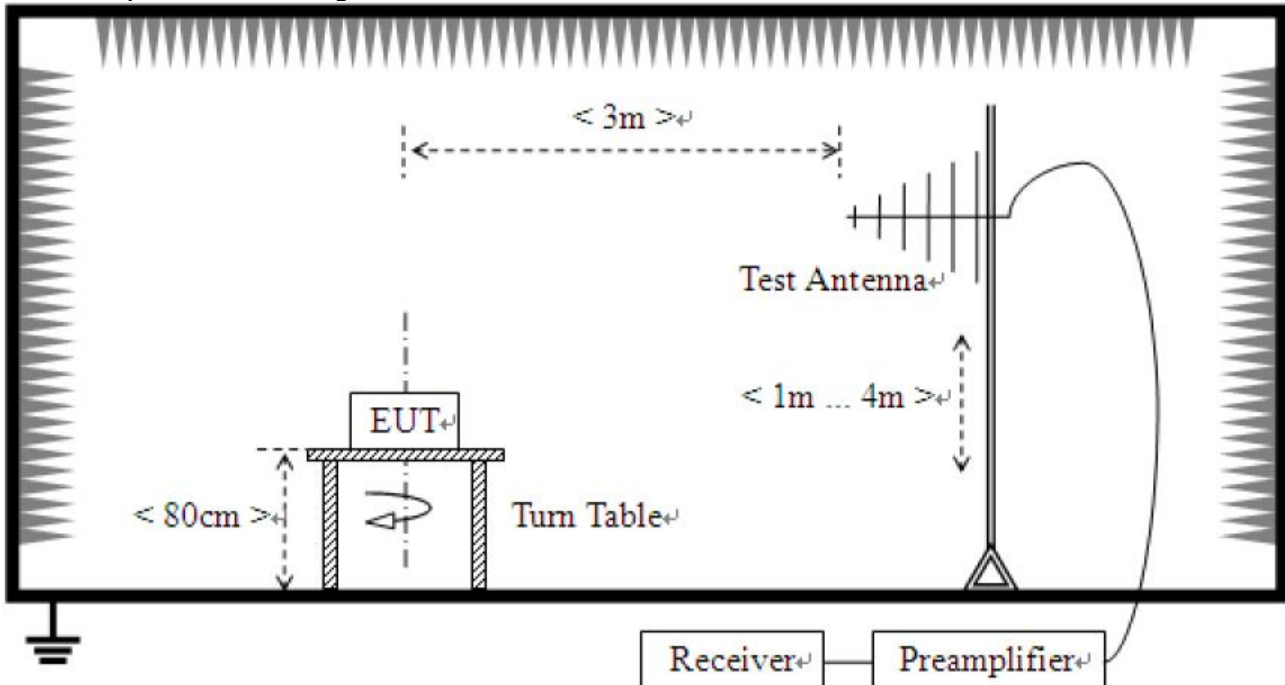
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)
- 3) For measurement above 1GHz, the resolution bandwidth is set to 1 MHz and video bandwidth is set to 1 MHz for peak measurement and 10 Hz for average measurement.

### Test Setup:

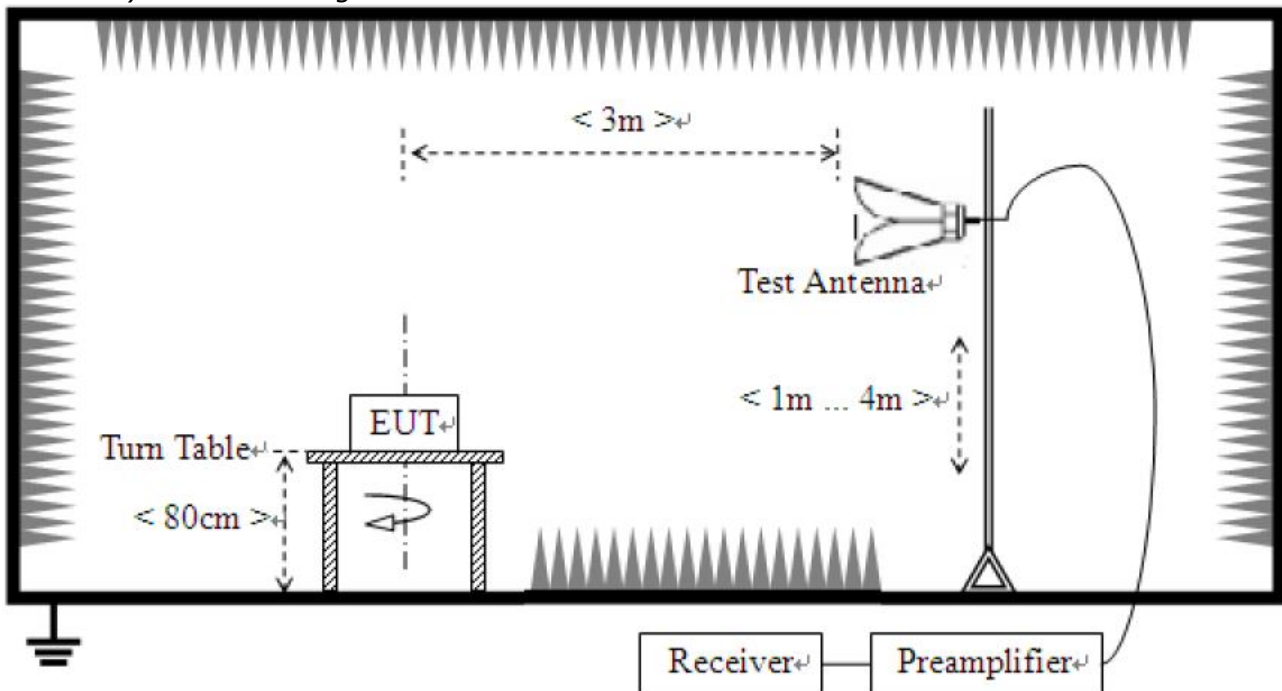
1) For field strength of emissions from 9 kHz to 30 MHz



2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



**Test Results**

**1) 9 kHz to 30 MHz**

|                 |                     |                    |            |
|-----------------|---------------------|--------------------|------------|
| EUT             | BLUETOOTH INTERFACE | Measurement Detail |            |
| Frequency Range |                     | 9 kHz – 30 MHz     |            |
| Test mode       | GFSK (Worst case)   | Detector function  | Quasi-Peak |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark   |
|-----------------|------------------------|-------------|----------|
| -               | -                      | -           | See note |

**Note :**

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB)

## 2) 30 MHz to 1 GHz

**Test mode : Hopping(8DPSK), CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

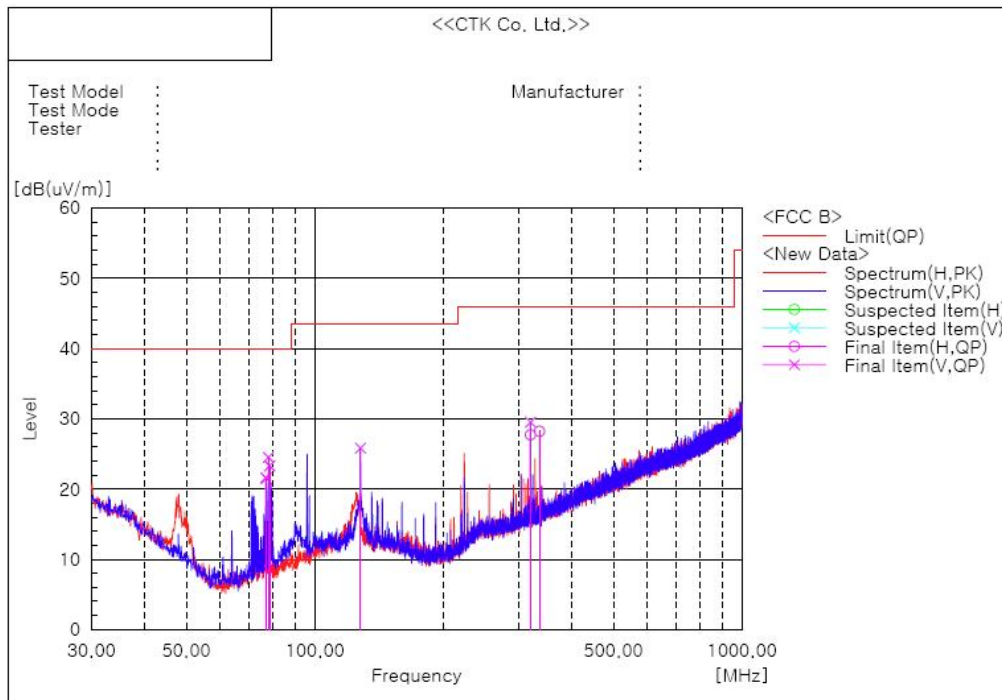
|                 |                     |                              |
|-----------------|---------------------|------------------------------|
| EUT             | BLUETOOTH INTERFACE | Measurement Detail           |
| Frequency Range | Below 1000MHz       |                              |
| Test mode       | GFSK (Worst case)   | Detector function Quasi-Peak |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark     |
|-----------------|------------------------|-------------|------------|
| 77.894          | 24.5                   | 15.5        | Quasi-Peak |

### Test Data



#### Final Result

| No. | Frequency (P) | Reading  | c.f       | Result     | Limit      | Margin | Height | Angle |
|-----|---------------|----------|-----------|------------|------------|--------|--------|-------|
|     | [MHz]         | [dB(uV)] | [dB(1/m)] | [dB(uV/m)] | [dB(uV/m)] | [dB]   | [cm]   | [deg] |
| 1   | 76.803        | V 38.6   | -17.0     | 21.6       | 40.0       | 18.4   | 194.0  | 351.0 |
| 2   | 77.045        | V 38.5   | -17.0     | 21.5       | 40.0       | 18.5   | 100.0  | 0.0   |
| 3   | 77.894        | V 41.4   | -16.9     | 24.5       | 40.0       | 15.5   | 194.0  | 351.0 |
| 4   | 78.379        | V 40.1   | -16.8     | 23.3       | 40.0       | 16.7   | 100.0  | 0.0   |
| 5   | 127.970       | V 37.9   | -12.1     | 25.8       | 43.5       | 17.7   | 100.0  | 195.0 |
| 6   | 320.030       | V 37.9   | -8.4      | 29.5       | 46.0       | 16.5   | 100.0  | 307.0 |
| 7   | 320.030       | H 36.1   | -8.4      | 27.7       | 46.0       | 18.3   | 100.0  | 53.0  |
| 8   | 336.035       | H 36.0   | -7.8      | 28.2       | 46.0       | 17.8   | 100.0  | 240.0 |

#### Remark :

1. The field strength of spurious emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Z axis) and the worst case was recorded.

2. Result = Reading + Correction factor

3. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp Gain



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### 3) above 1 GHz

|         |                     |                    |         |
|---------|---------------------|--------------------|---------|
| EUT     | BLUETOOTH INTERFACE | Measurement Detail |         |
| Model   | IFJ-B               | Frequency Range    | 1-25GHz |
| Channel | Channel 0           | Detector function  | Peak    |

#### Remarks

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark  |
|--------------------|---------------------------|----------------|---------|
| 4804               | 49.1                      | 4.9            | Average |

#### Test Data

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 4804.00            | 34.6 : 43.3                      | V    | 1.0           | 13.9                        | 54.0 : 74.0                     | 48.5 : 57.2                     | 5.5 : 16.8                  |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 4804.00            | 35.2 : 48.4                      | V    | 1.0           | 13.9                        | 54.0 : 74.0                     | 49.1 : 62.3                     | 4.9 : 11.7                  |

#### Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 2390.00            | 26.5 : 40.1                      | V    | 1.0           | 7.1                         | 54.0 : 74.0                     | 33.6 : 47.2                     | 20.4 : 26.8                 |

Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 2390.00            | 26.6 : 40.2                      | V    | 1.0           | 7.1                         | 54.0 : 74.0                     | 33.7 : 47.3                     | 20.3 : 26.7                 |



CTK Co., Ltd.

The Prime Leader of Global Regulatory Compliance

**CTK Co., Ltd.**

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

**Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

|         |                     |                    |         |
|---------|---------------------|--------------------|---------|
| EUT     | BLUETOOTH INTERFACE | Measurement Detail |         |
| Model   | IFJ-B               | Frequency Range    | 1-25GHz |
| Channel | Channel 39          | Detector function  | Peak    |

**Remarks**

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark  |
|--------------------|---------------------------|----------------|---------|
| 4882               | 52.8                      | 1.2            | Average |

**Test Data****Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak |      | Pol. | Height<br>[m] | Correction<br>Factor | Limits<br>[dBuV/m]<br>AV / Peak |      | Result<br>[dBuV/m]<br>AV / Peak |      | Margin<br>[dB]<br>AV / Peak |     |
|--------------------|----------------------------------|------|------|---------------|----------------------|---------------------------------|------|---------------------------------|------|-----------------------------|-----|
|                    | Antenna + Amp. Gain + Cable      |      |      |               |                      |                                 |      |                                 |      |                             |     |
| 4882.00            | 38.9                             | 51.0 | V    | 1.0           | 13.9                 | 54.0                            | 74.0 | 52.8                            | 64.9 | 1.2                         | 9.1 |

**Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak |      | Pol. | Height<br>[m] | Correction<br>Factor | Limits<br>[dBuV/m]<br>AV / Peak |      | Result<br>[dBuV/m]<br>AV / Peak |      | Margin<br>[dB]<br>AV / Peak |     |
|--------------------|----------------------------------|------|------|---------------|----------------------|---------------------------------|------|---------------------------------|------|-----------------------------|-----|
|                    | Antenna + Amp. Gain + Cable      |      |      |               |                      |                                 |      |                                 |      |                             |     |
| 4882.00            | 37.2                             | 50.2 | V    | 1.0           | 13.9                 | 54.0                            | 74.0 | 51.1                            | 64.1 | 2.9                         | 9.9 |

**Restricted band edge test data**

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

**Test mode : GPSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

| Frequency<br>[MHz]                                                   | Reading<br>[dBuV/m] | Pol. | Height<br>[m] | Correction<br>Factor |           |       | Limits<br>[dBuV/m] | Result<br>[dBuV/m] | Margin<br>[dB] |
|----------------------------------------------------------------------|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
|                                                                      |                     |      |               | Antenna              | Amp. Gain | Cable |                    |                    |                |
| No emissions were detected at a level greater than 20dB below limit. |                     |      |               |                      |           |       |                    |                    |                |

**Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

| Frequency<br>[MHz]                                                   | Reading<br>[dBuV/m] | Pol. | Height<br>[m] | Correction<br>Factor |           |       | Limits<br>[dBuV/m] | Result<br>[dBuV/m] | Margin<br>[dB] |
|----------------------------------------------------------------------|---------------------|------|---------------|----------------------|-----------|-------|--------------------|--------------------|----------------|
|                                                                      |                     |      |               | Antenna              | Amp. Gain | Cable |                    |                    |                |
| No emissions were detected at a level greater than 20dB below limit. |                     |      |               |                      |           |       |                    |                    |                |



CTK Co., Ltd.

The Prime Leader of Global Regulatory Compliance

**CTK Co., Ltd.**

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

**Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

|         |                     |                    |         |
|---------|---------------------|--------------------|---------|
| EUT     | BLUETOOTH INTERFACE | Measurement Detail |         |
| Model   | IFJ-B               | Frequency Range    | 1-25GHz |
| Channel | Channel 78          | Detector function  | Peak    |

**Remarks**

We have tested three mode (X, Y, Z). The worst mode (Z axis) for final test.

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark  |
|--------------------|---------------------------|----------------|---------|
| 2483.5             | 47.9                      | 6.1            | Average |

**Test Data****Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 4960.00            | 34.0 : 43.9                      | V    | 1.0           | 13.9                        | 54.0 : 74.0                     | 47.9 : 57.8                     | 6.1 : 16.2                  |

**Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 4960.00            | 26.7 : 41.6                      | V    | 1.0           | 13.9                        | 54.0 : 74.0                     | 40.6 : 55.5                     | 13.4 : 18.5                 |

**Restricted band edge test data**

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

**Test mode : GFSK, CFG PKT Packet Type : 15 Packet Size : 339(DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 2483.50            | 27.0 : 39.8                      | V    | 1.0           | 7.1                         | 54.0 : 74.0                     | 34.1 : 46.9                     | 19.9 : 27.1                 |

**Test mode : 8-DPSK, CFG PKT Packet Type : 31 Packet Size : 1021(3DH5)**

| Frequency<br>[MHz] | Reading<br>[dBuV/m]<br>AV / Peak | Pol. | Height<br>[m] | Correction<br>Factor        | Limits<br>[dBuV/m]<br>AV / Peak | Result<br>[dBuV/m]<br>AV / Peak | Margin<br>[dB]<br>AV / Peak |
|--------------------|----------------------------------|------|---------------|-----------------------------|---------------------------------|---------------------------------|-----------------------------|
|                    |                                  |      |               | Antenna + Amp. Gain + Cable |                                 |                                 |                             |
| 2483.50            | 28.2 : 42.0                      | V    | 1.0           | 7.1                         | 54.0 : 74.0                     | 35.3 : 49.1                     | 18.7 : 24.9                 |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea  
Tel: +82-31-339-9970 Fax: +82-31-624-9501  
www.e-ctk.com

### 2.1.9 AC Conducted Emissions

#### Test Location

Shielded Room

#### Frequency Range of Measurement

150 kHz to 30 MHz

#### Instrument Settings

IF Band Width: 9 kHz

#### Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

#### Limit

- 15.207(a)

| Frequency (MHz) | Conducted Limit (dBuV) |           |
|-----------------|------------------------|-----------|
|                 | Quasi-peak             | Average   |
| 0.15 ~ 0.5      | 66 to 56*              | 56 to 46* |
| 0.5 ~ 5         | 56                     | 46        |
| 5 ~ 30          | 60                     | 50        |

\* Decreases with the logarithm of the frequency.

#### Test Results

The requirements are:

☒ Complies

**Test mode : Hopping(GFSK), CFG PKT Packet Type : 15, Packet Size : 339(DH5)**

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark  |
|-----------------|------------------------|-------------|---------|
| 24.117          | 14.8                   | 35.2        | Average |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

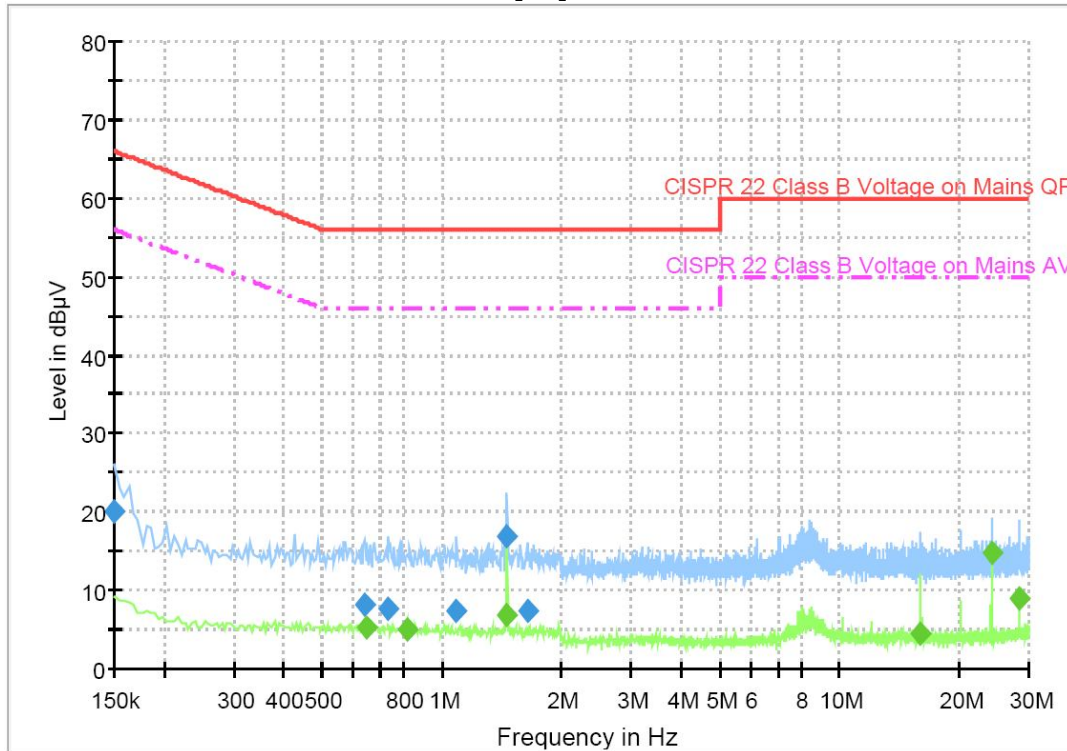
(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### Test Data\_Hopping(GFSK)

[L1]



#### Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.150000        | 20.2             | 1000.0          | 9.000           | On     | L1   | 9.7        | 45.8        | 66.0         |
| 0.640500        | 8.1              | 1000.0          | 9.000           | On     | L1   | 9.9        | 47.9        | 56.0         |
| 0.735000        | 7.8              | 1000.0          | 9.000           | On     | L1   | 9.8        | 48.2        | 56.0         |
| 1.090500        | 7.5              | 1000.0          | 9.000           | On     | L1   | 9.8        | 48.5        | 56.0         |
| 1.455000        | 16.8             | 1000.0          | 9.000           | On     | L1   | 9.7        | 39.2        | 56.0         |
| 1.639500        | 7.4              | 1000.0          | 9.000           | On     | L1   | 9.7        | 48.6        | 56.0         |

#### Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.645000        | 5.2             | 1000.0          | 9.000           | On     | L1   | 9.9        | 40.8        | 46.0         |
| 0.816000        | 5.1             | 1000.0          | 9.000           | On     | L1   | 9.8        | 40.9        | 46.0         |
| 1.459500        | 6.8             | 1000.0          | 9.000           | On     | L1   | 9.7        | 39.2        | 46.0         |
| 15.999000       | 4.6             | 1000.0          | 9.000           | On     | L1   | 9.9        | 45.4        | 50.0         |
| 24.117000       | 14.8            | 1000.0          | 9.000           | On     | L1   | 10.0       | 35.2        | 50.0         |
| 28.261500       | 9.1             | 1000.0          | 9.000           | On     | L1   | 10.0       | 40.9        | 50.0         |



CTK Co., Ltd.  
The Prime Leader of Global Regulatory Compliance

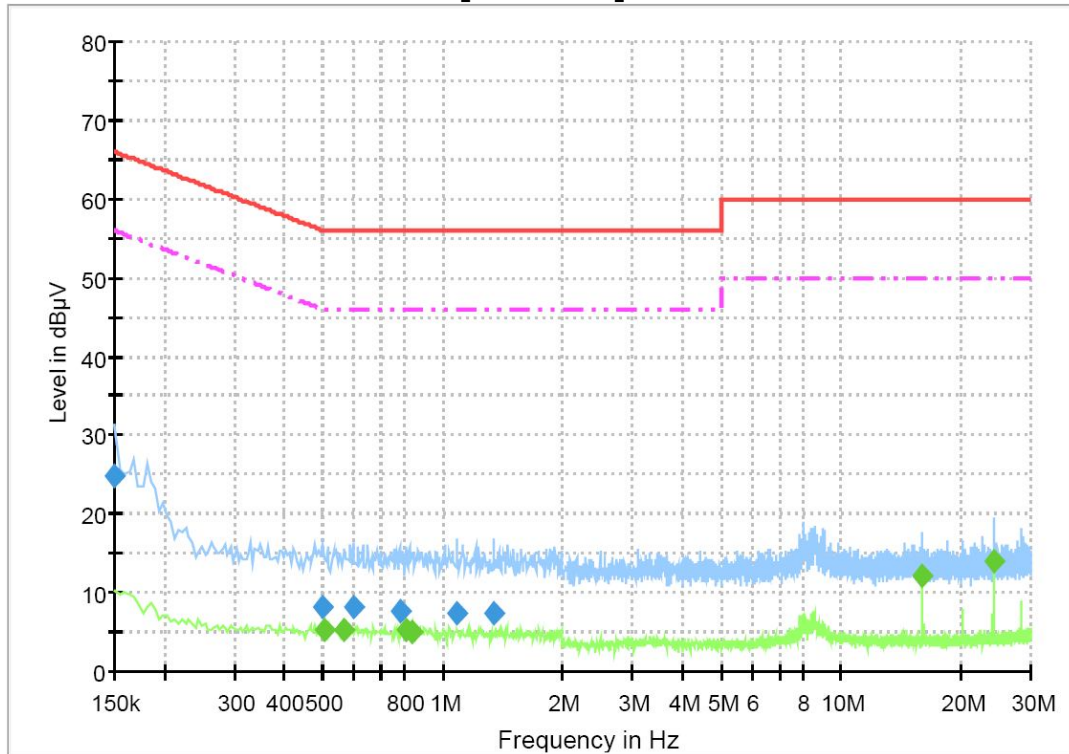
## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### [NEUTRAL]



### Final Result 1

| Frequency (MHz) | QuasiPeak (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.150000        | 24.9             | 1000.0          | 9.000           | On     | N    | 9.7        | 41.1        | 66.0         |
| 0.501000        | 8.1              | 1000.0          | 9.000           | On     | N    | 9.9        | 47.9        | 56.0         |
| 0.595500        | 8.1              | 1000.0          | 9.000           | On     | N    | 9.9        | 47.9        | 56.0         |
| 0.780000        | 7.8              | 1000.0          | 9.000           | On     | N    | 9.8        | 48.2        | 56.0         |
| 1.086000        | 7.3              | 1000.0          | 9.000           | On     | N    | 9.7        | 48.7        | 56.0         |
| 1.347000        | 7.4              | 1000.0          | 9.000           | On     | N    | 9.7        | 48.6        | 56.0         |

### Final Result 2

| Frequency (MHz) | CAverage (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|-----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.505500        | 5.4             | 1000.0          | 9.000           | On     | N    | 9.9        | 40.6        | 46.0         |
| 0.564000        | 5.2             | 1000.0          | 9.000           | On     | N    | 9.9        | 40.8        | 46.0         |
| 0.807000        | 5.2             | 1000.0          | 9.000           | On     | N    | 9.8        | 40.8        | 46.0         |
| 0.834000        | 5.1             | 1000.0          | 9.000           | On     | N    | 9.8        | 40.9        | 46.0         |
| 16.003500       | 12.1            | 1000.0          | 9.000           | On     | N    | 9.9        | 37.9        | 50.0         |
| 24.117000       | 14.0            | 1000.0          | 9.000           | On     | N    | 10.0       | 36.0        | 50.0         |



CTK Co., Ltd.

The Prime Leader of Global Regulatory Compliance

## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea

Tel: +82-31-339-9970 Fax: +82-31-624-9501

www.e-ctk.com

### APPENDIX A – Test Equipment Used For Tests

|    | Name of Equipment           | Manufacturer                          | Model No.                                    | Serial No.    | Date of Calibration | Due Date   |
|----|-----------------------------|---------------------------------------|----------------------------------------------|---------------|---------------------|------------|
| 1  | Spectrum Analyzer           | Rohde & Schwarz                       | FSP-30                                       | 100994        | 2014-11-07          | 2015-11-07 |
| 2  | Spectrum Analyzer           | Rohde & Schwarz                       | FSP                                          | 100401        | 2014-09-12          | 2015-09-12 |
| 3  | EMI Test Receiver           | Rohde & Schwarz                       | ESCI7                                        | 100814        | 2014-12-05          | 2015-12-05 |
| 4  | EMI Test Receiver           | Rohde & Schwarz                       | ESCI7                                        | 100816        | 2014-12-05          | 2015-12-05 |
| 5  | EMI Test Receiver           | Rohde & Schwarz                       | ESU40                                        | 100336        | 2014-05-15          | 2015-05-15 |
| 6  | Bilog Antenna               | Schaffner                             | CBL6111C                                     | 2551          | 2014-05-08          | 2016-05-08 |
| 7  | Double Ridged Guide Antenna | ETS-Lindgren                          | 3117                                         | 00154525      | 2013-07-03          | 2015-07-03 |
| 8  | Double Ridged Guide Antenna | ETS-Lindgren                          | 3116                                         | 00062916      | 2013-03-20          | 2015-03-20 |
| 9  | Active Loop Antenna         | SCHWARZBECK                           | FMZB 1513                                    | 1513-126      | 2014-05-19          | 2016-05-19 |
| 10 | Attenuator                  | Rohde & Schwarz                       | DNF                                          | 272.4110.50-2 | 2014-11-07          | 2015-11-07 |
| 11 | PREAMPLIFIER                | Agilent                               | 8449B                                        | 3008A02307    | 2014-10-24          | 2015-10-24 |
| 12 | AMPLIFIER                   | Sonoma Instrument Co.                 | 310                                          | 291721        | 2015-02-02          | 2016-02-02 |
| 13 | Band Reject Filter          | Wainwright Instruments GmbH           | WRCGV<br>2400/2483-<br>2375/2505-<br>50/10EE | 2             | 2014-08-25          | 2015-08-25 |
| 14 | Signal Generator            | Rohde & Schwarz                       | SMB100A                                      | 175528        | 2015-01-19          | 2016-01-19 |
| 15 | LISN                        | Rohde & Schwarz                       | ENV216                                       | 101236        | 2014-07-30          | 2015-07-30 |
| 16 | LISN                        | Rohde & Schwarz                       | ENV216                                       | 101235        | 2014-07-30          | 2015-07-30 |
| 17 | DC Power Supply             | Topward Electric Instruments Co.,Ltd. | 6303D                                        | 666421        | 2015-02-03          | 2016-02-03 |
| 18 | DC Power Supply             | Agilent                               | E3632A                                       | MY40011638    | 2014-11-07          | 2015-11-07 |