

## TEST REPORT For FCC

Test Report No. : CTK-2014-01104  
Date of Issue : 2014-09-30  
FCC ID : P4YSHN-WDD510  
Model/Type No. : SHN-WDD510K/EN  
Kind of Product : Digital door lock  
Applicant : Samsung SDS Co., Ltd.  
Applicant Address : 125, Olympic-ro 35-gil, Songpa-gu, Seoul, Korea  
Manufacturer : Meta Networks Co. Ltd.  
Manufacturer Address : 55, Galmachi-ro 281beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do  
Contact Person : Yu Seungkwan / Advisory Engineer  
Telephone : +82-6155-5105  
Received Date : 2014-09-04  
Test period : Start : 2014-09-04 End : 2014-09-30  
Test Results : ☒ **In Compliance** ☐ **Not in Compliance**

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

Tested by



Young-taek Lee  
Test Engineer  
Date: 2014-09-30

Reviewed by



Young-Joon, Park  
Technical Manager  
Date: 2014-09-30



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 |
|------------|-------------------------|---------|
| 2014-09-30 | Issued (CTK-2014-01104) | 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 Power 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 .....                                     | 4  |
| 1.4 Duty Cycle .....                                            | 5  |
| 1.5 Device Modifications.....                                   | 5  |
| 1.6 Peripheral Devices .....                                    | 5  |
| 1.7 Calibration Details of Equipment Used for Measurement ..... | 6  |
| 1.8 Test Facility.....                                          | 6  |
| 1.9 Laboratory Accreditations and Listings.....                 | 6  |
| 2.0 Summary of tests .....                                      | 7  |
| 2.1 Technical Characteristic Test .....                         | 8  |
| 2.1.1 6 dB Bandwidth .....                                      | 8  |
| 2.1.2 Maximum peak Conducted Output Power .....                 | 12 |
| 2.1.3 Power Spectral Density .....                              | 16 |
| 2.1.4 Band - edge .....                                         | 20 |
| 2.1.5 Field Strength of Emissions .....                         | 25 |
| 2.1.6 AC Conducted Emissions.....                               | 37 |
| APPENDIX A – Test Equipment Used For Tests .....                | 40 |

## 1.0 General Product Description

|                      |                                                   |
|----------------------|---------------------------------------------------|
| Equipment model name | SHN-WDD510K/EN                                    |
| Serial number        | Prototype                                         |
| EUT condition        | Pre-production, not damaged                       |
| Frequency Range      | 2405 MHz - 2480 MHz                               |
| RF output power      | 18.16 dBm                                         |
| Number of channels   | 16                                                |
| Transfer Rate        | 250 Kbps                                          |
| Type of Modulation   | DSSS                                              |
| Channel Spacing      | 5 MHz                                             |
| Duty cycle TX power  | 1.0                                               |
| Power Source         | 6 Vdc (4 AA Alkaline 1.5 V Batteries (LR6))       |
| Antenna Type         | Wire antenna                      Gain : 3.14 dBi |

## 1.1 Tested Frequency

| Channel         | CH11 | CH15 | CH19 | CH20 | CH25 | CH26 |
|-----------------|------|------|------|------|------|------|
| Frequency (MHz) | 2405 | 2425 | 2445 | 2450 | 2475 | 2480 |

## 1.2 Tested Mode

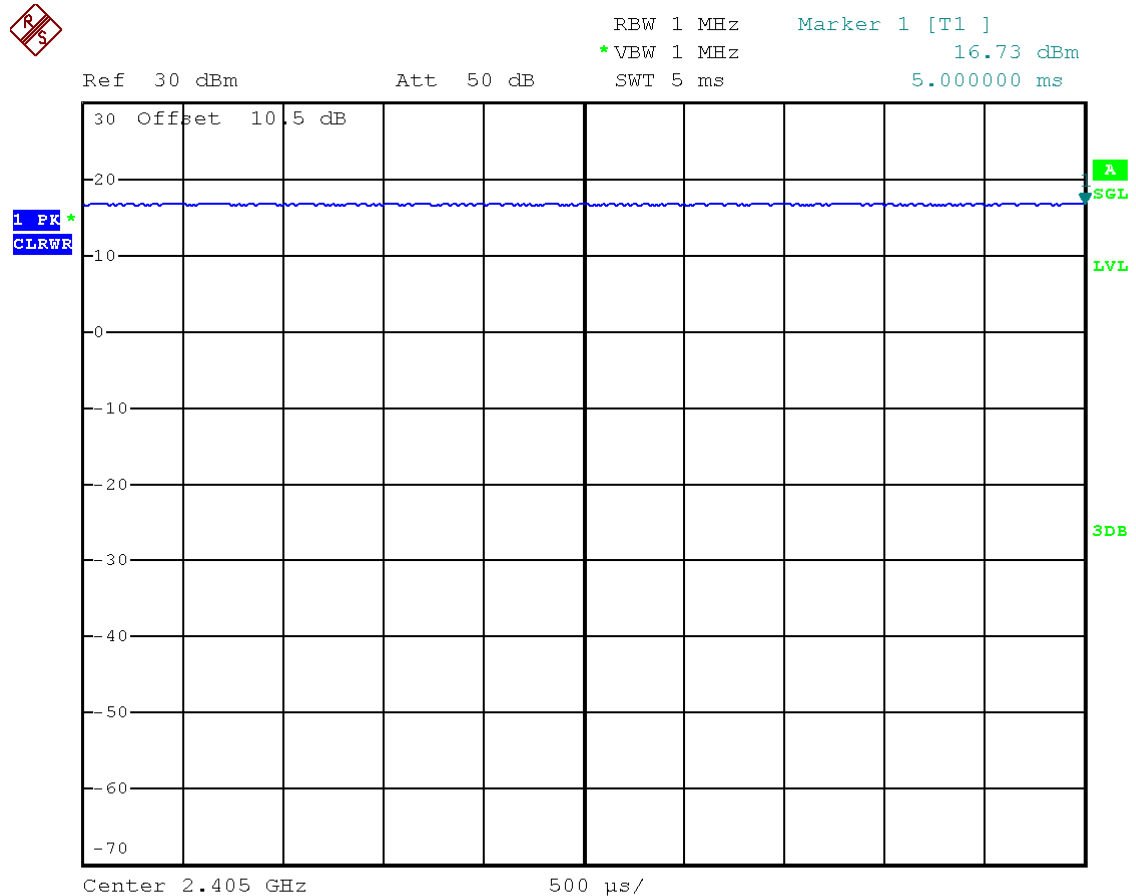
| Channel               | CH11                                 | CH15 | CH19 | CH20 | CH25 | CH26 |
|-----------------------|--------------------------------------|------|------|------|------|------|
| TX Power factor (dBm) | -4                                   | -4   | -4   | -4   | -4   | -f   |
| TX Power Mode         | I p => 1 1 : Boost-mode, PA-External |      |      |      |      |      |

## 1.3 Model Differences

Not applicable

## 1.4 Duty Cycle

Duty Cycle : 100%



Date: 26.SEP.2014 16:34:43

## 1.5 Device Modifications

The following modifications were necessary for compliance:

Not applicable

## 1.6 Peripheral Devices

| Device             | Manufacturer                    | Model No.     | Serial No. |
|--------------------|---------------------------------|---------------|------------|
| Note Computer      | DELL INC.                       | Inspiron 6400 | -          |
| Switching Adapter2 | DDongguang Lite Power 2nd Plant | LA65NS0-00    | -          |

## 1.7 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.

## 1.8 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## 1.9 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 Power 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)           | 6 dB Bandwidth                     | > 500 kHz       | Conducted      | C               |
| 15.247(b)           | Maximum Output Power               | < 1 Watt        |                | C               |
| 15.247(d)           | Conducted Spurious emission        | > 20 dBc        |                | C               |
| 15.247(d)           | Band Edge                          | > 20 dBc        |                | C               |
| 15.247(e)           | Transmitter Power Spectral Density | < 8 dBm @ 3 kHz |                | C               |
|                     |                                    |                 |                | C               |
| 15.209              | Field Strength of Harmonics        | 15.209(a)       | Radiated       | C               |
| 15.207              | AC Conducted Emissions             | 15.207(a)       | Line Conducted | NA              |

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

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  
558074 D01 DTS Meas Guidance v03r02.

## 2.1 Technical Characteristic Test

### 2.1.1 6 dB Bandwidth

**Procedure:**

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

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 6 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 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 10 MHz

VBW = 3 x RBW)

Sweep = auto

Trace = max hold

Detector function = peak

**Measurement Data:**

| Frequency<br>(MHz) | Channel<br>No. | Test Results        |          |
|--------------------|----------------|---------------------|----------|
|                    |                | 6dB Bandwidth (MHz) | Result   |
| 2405               | 11             | 1.64                | Complies |
| 2425               | 15             | 1.60                | Complies |
| 2445               | 19             | 1.60                | Complies |
| 2450               | 20             | 1.60                | Complies |
| 2475               | 25             | 1.62                | Complies |
| 2480               | 26             | 1.62                | Complies |

**Minimum Standard:**

6 dB Bandwidth > 500 kHz

See next pages for actual measured spectrum plots.



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

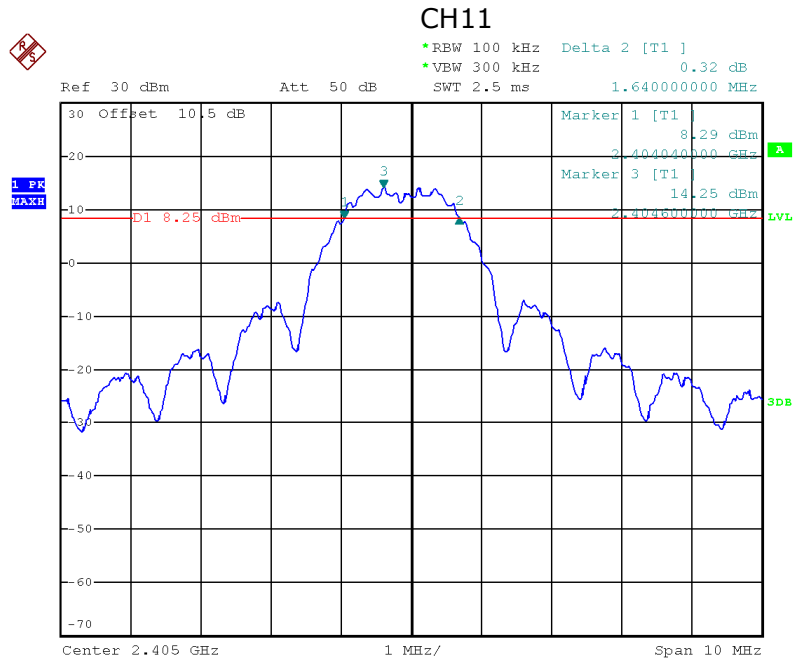
# CTK Co., Ltd.

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

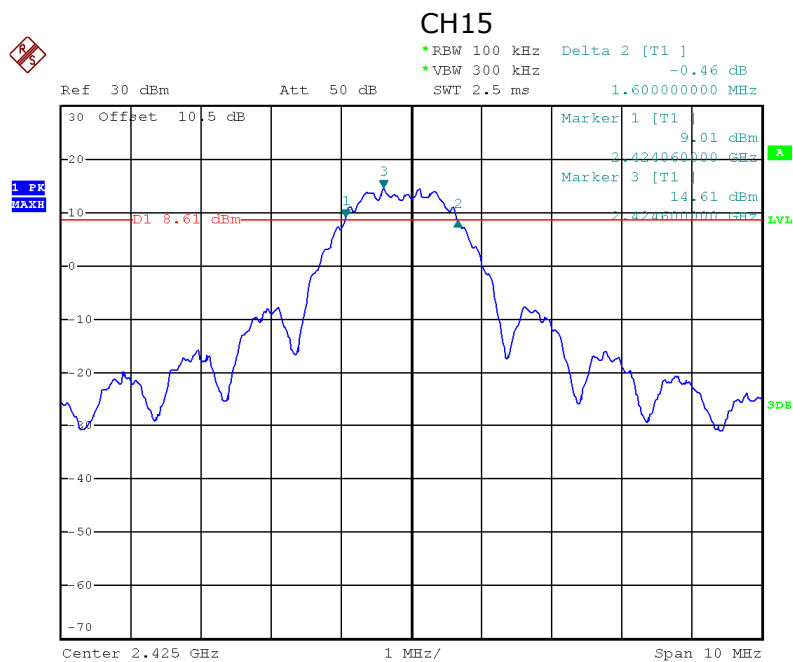
Tel: +82-31-339-9970

Fax: +82-31-624-9501

www.e-ctk.com



Date: 26.SEP.2014 15:58:46

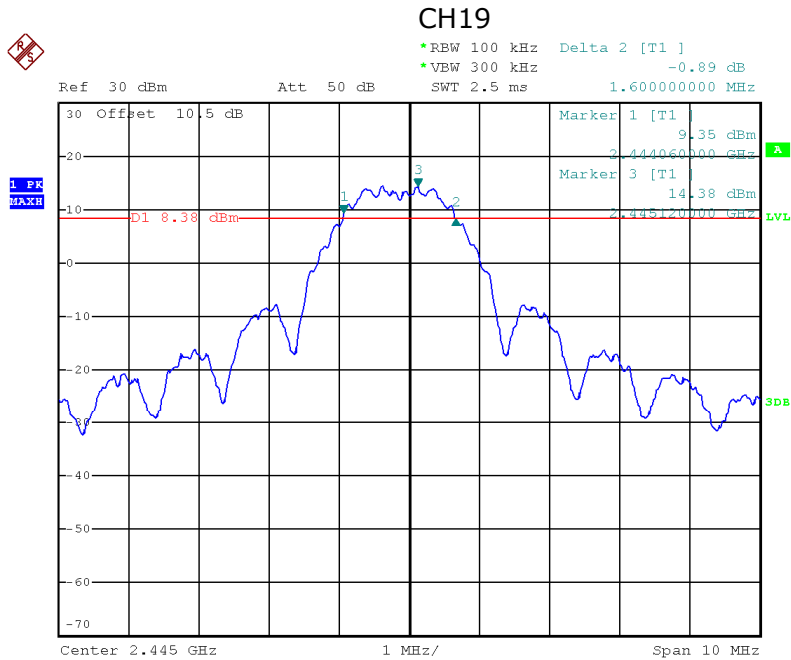


Date: 26.SEP.2014 16:02:20

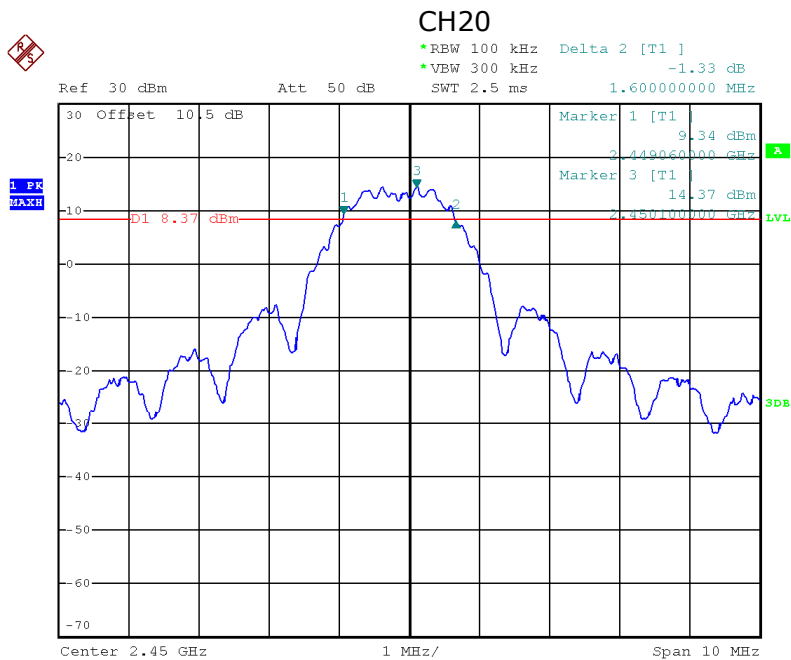


CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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: 26.SEP.2014 16:04:14

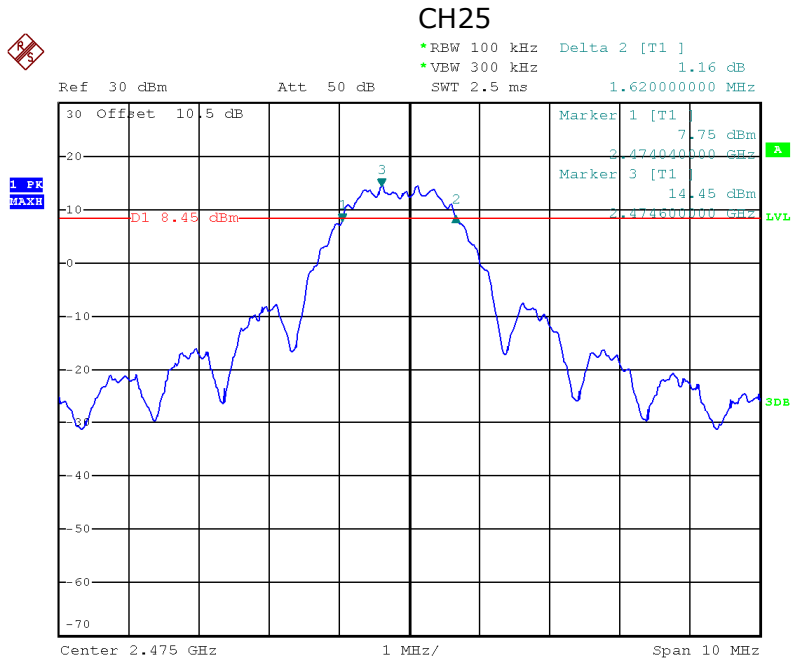


Date: 26.SEP.2014 16:05:42

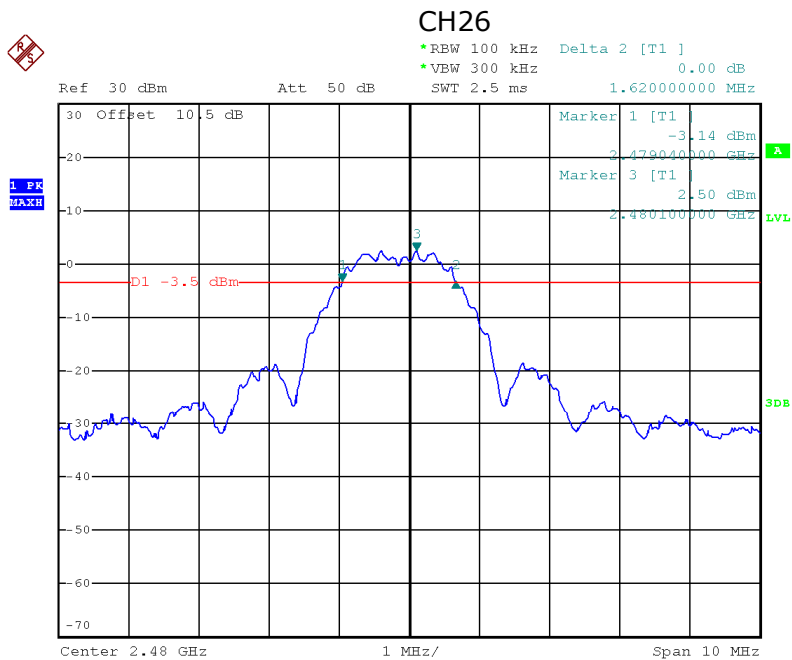


CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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: 26.SEP.2014 16:08:08



Date: 26.SEP.2014 16:12:26

## 2.1.2 Maximum peak Conducted Output Power

### Test Location

RF Test Room

### Test Procedures

Maximum Peak Output Power from the EUT were measured according to the dictates power measurement procedure in section 9.1.1 of KDB 558074.

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- a) Set the RBW  $\geq$  DTS bandwidth
- b) Set the VBW  $\geq 3 \times$  RBW
- c) Set the span  $\geq 3 \times$  RBW
- d) Sweep time = auto couple
- e) Detector = peak
- e) Trace mode= max hold
- f) Allow trace to fully stabilize.
- g) Use peak marker function to determine the peak amplitude level.

### Limit

< 1 W

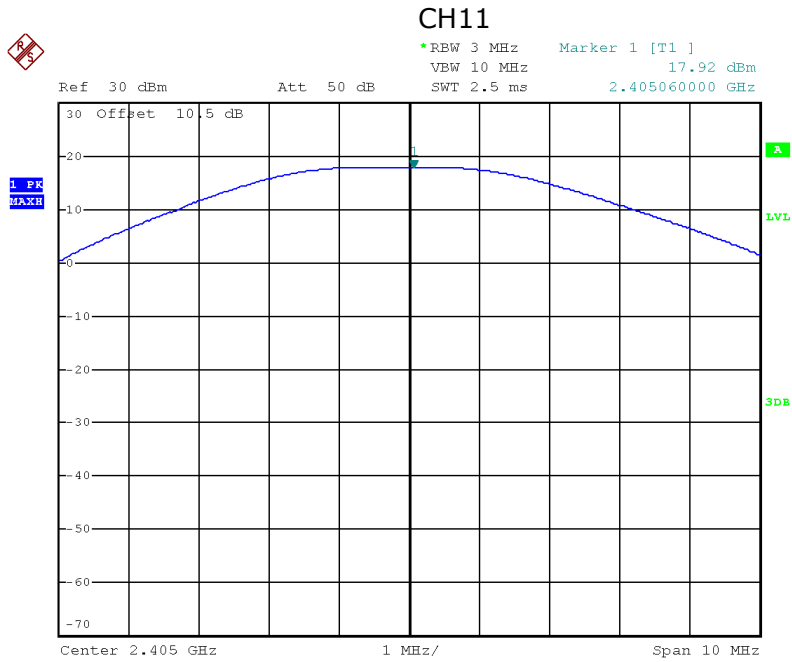
### Test Results

| Frequency (MHz) | Channel No. | Measurement Power (dBm) | Limit  | Result   |
|-----------------|-------------|-------------------------|--------|----------|
| 2405            | 11          | 17.92                   | 30 dBm | Complies |
| 2425            | 15          | 18.04                   |        | Complies |
| 2445            | 19          | 18.16                   |        | Complies |
| 2450            | 20          | 18.13                   |        | Complies |
| 2475            | 25          | 18.13                   |        | Complies |
| 2480            | 26          | 6.60                    |        | Complies |

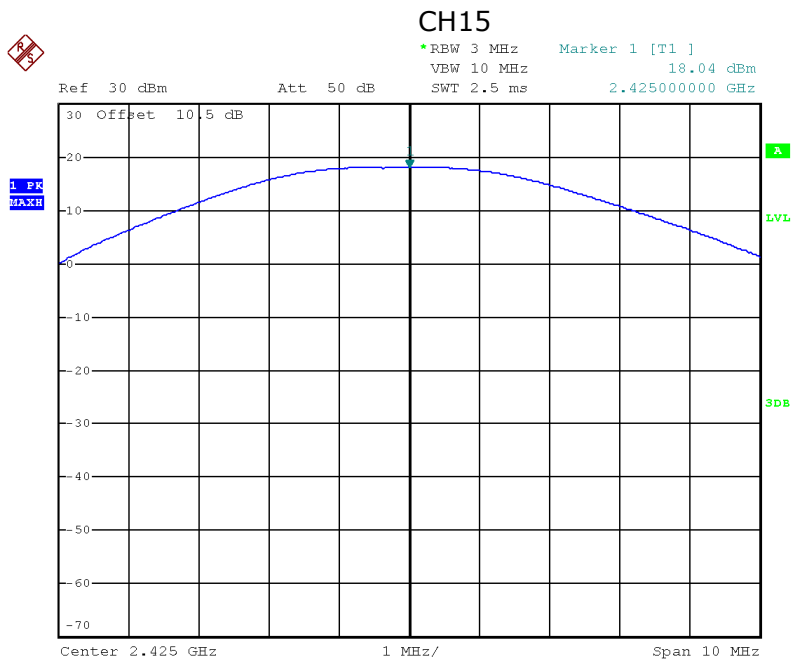


CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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: 26.SEP.2014 15:28:37

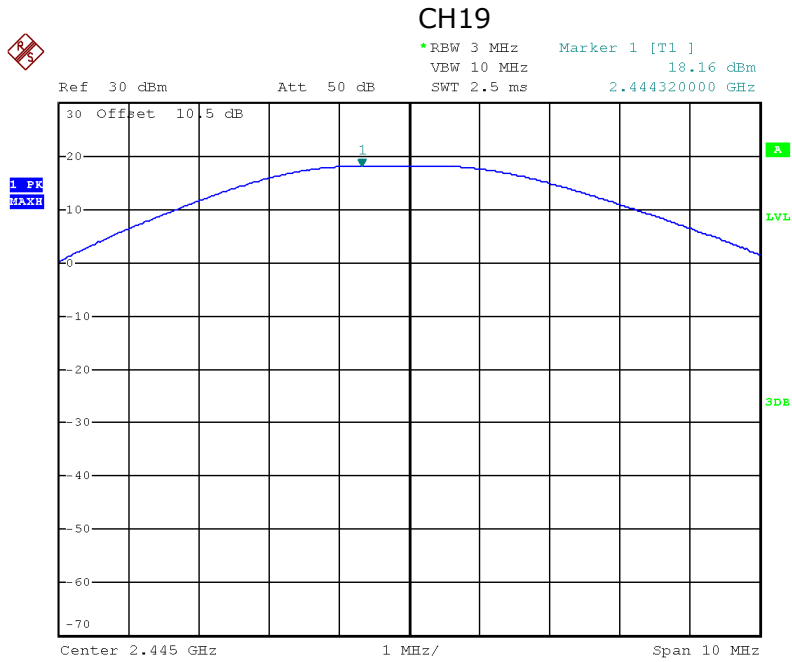


Date: 26.SEP.2014 15:29:34

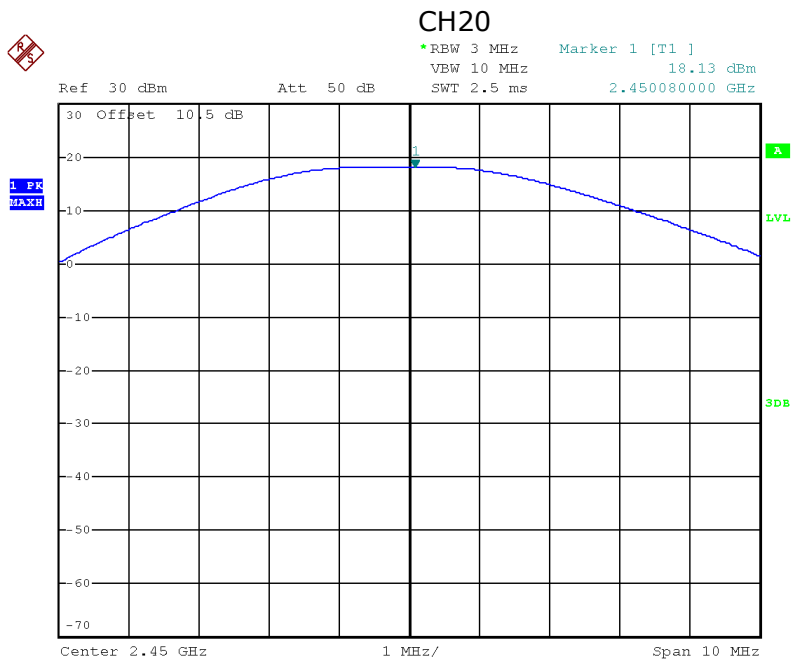


CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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: 26.SEP.2014 15:30:36

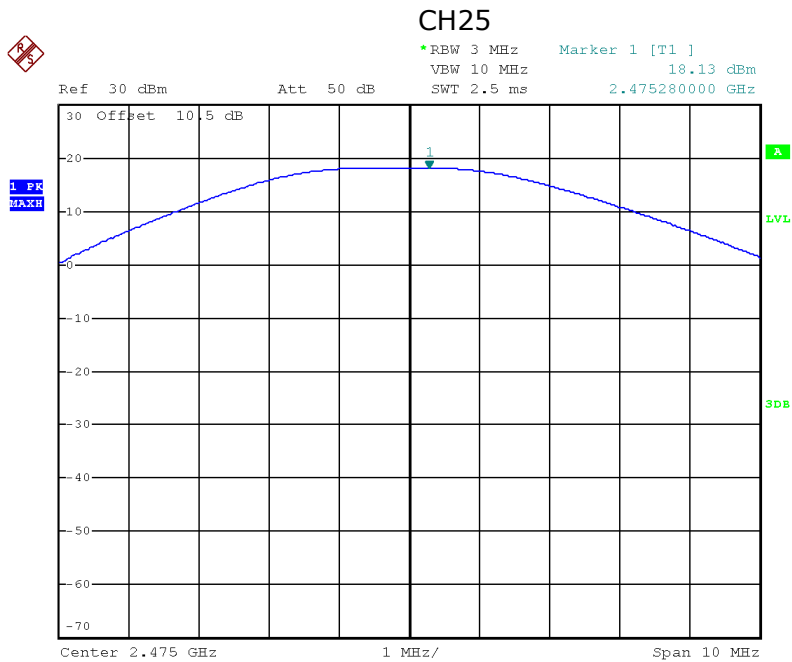


Date: 26.SEP.2014 15:31:25

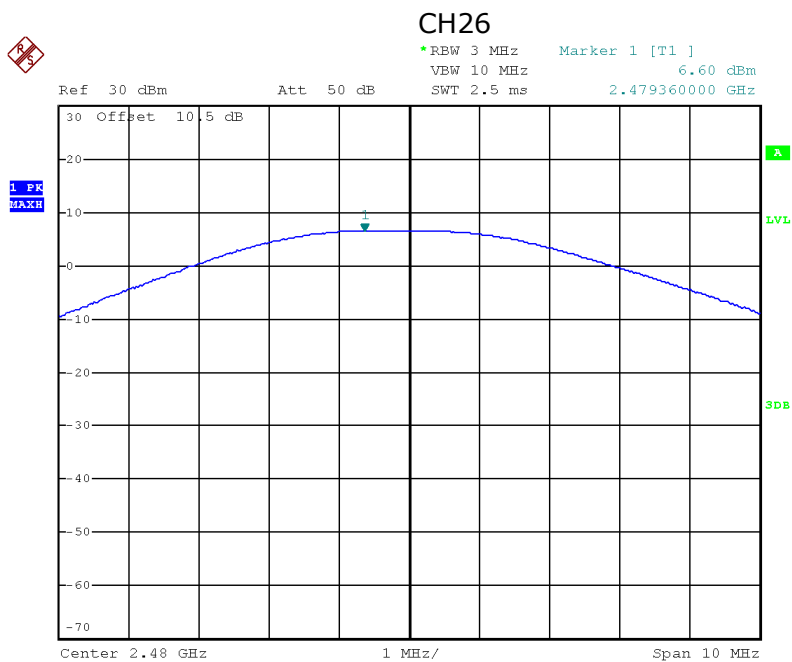


CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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: 26.SEP.2014 15:32:17



Date: 26.SEP.2014 15:34:14

### 2.1.3 Power Spectral Density

#### Procedure:

Power Spectral Density from the EUT were measured according to the dictates PKPSD measurement procedure in section 10.2 of KDB 558074.

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to :  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
- d) Set the VBW  $\geq 3 \times \text{RBW}$
- e) Detector = peak
- f) Sweep time = auto couple
- g) Trace mode = max hold
- h) Allow trace to fully stabilize
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceed limit, reduce RBW(no less than 3 kHz) and repeat.

#### Test Results

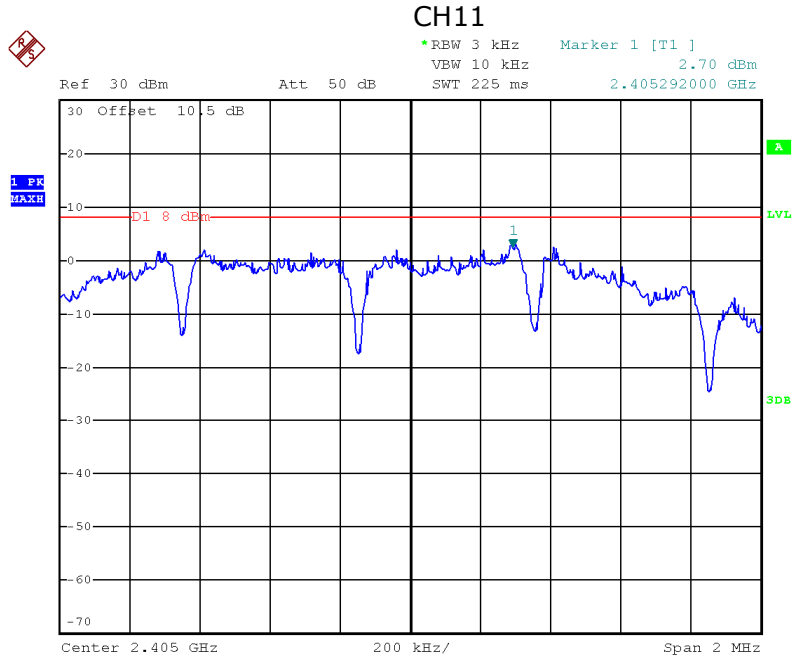
| Frequency (MHz) | Channel No. | Test Results |          |
|-----------------|-------------|--------------|----------|
|                 |             | dBm          | Result   |
| 2405            | 11          | 2.70         | Complies |
| 2425            | 15          | 2.32         | Complies |
| 2445            | 19          | 2.65         | Complies |
| 2450            | 20          | 2.69         | Complies |
| 2475            | 25          | 2.62         | Complies |
| 2480            | 26          | -8.93        | Complies |

#### Minimum Standard:

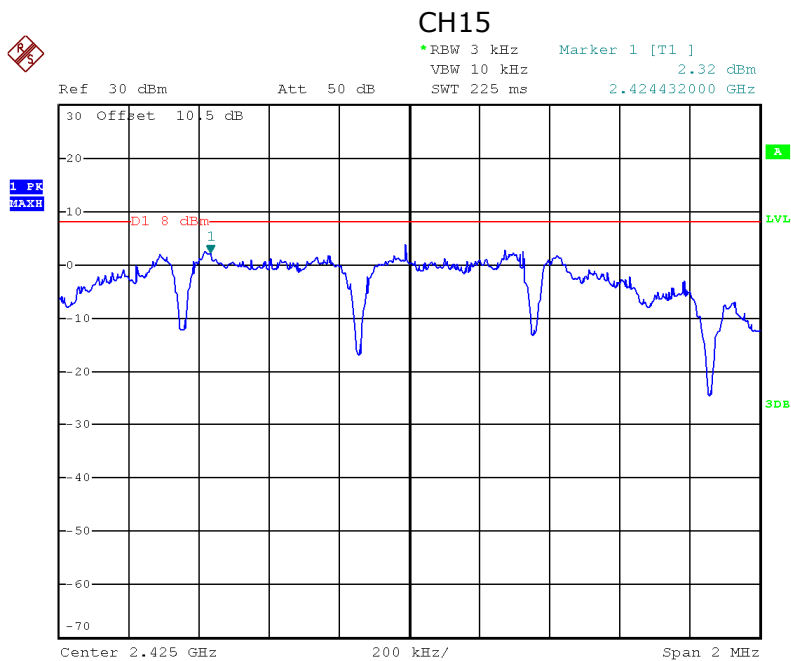
|                        |                    |
|------------------------|--------------------|
| Power Spectral Density | < 8 dBm @ 3 kHz BW |
|------------------------|--------------------|

See next pages for actual measured spectrum plots.

## Power Spectral Density Measurement



Date: 26.SEP.2014 15:45:06



Date: 26.SEP.2014 15:44:19



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

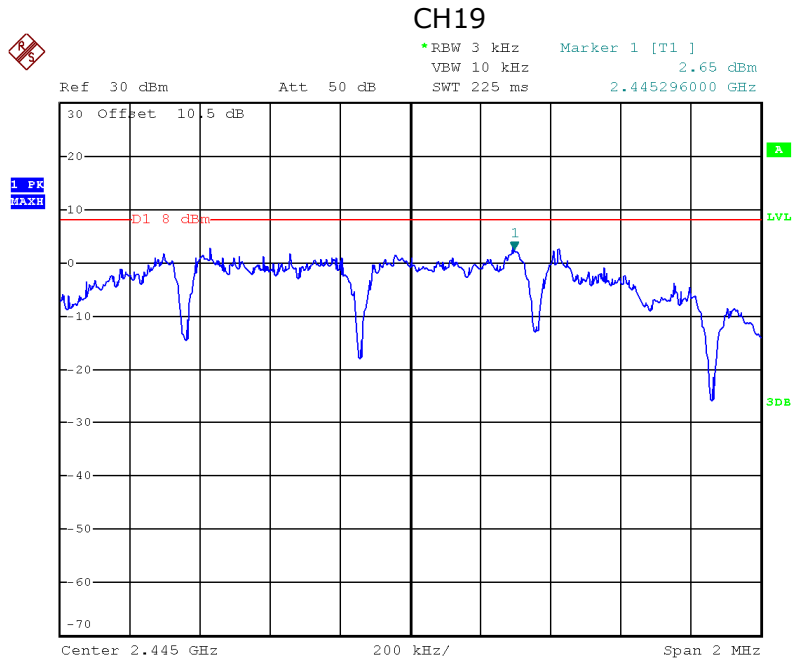
## CTK Co., Ltd.

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

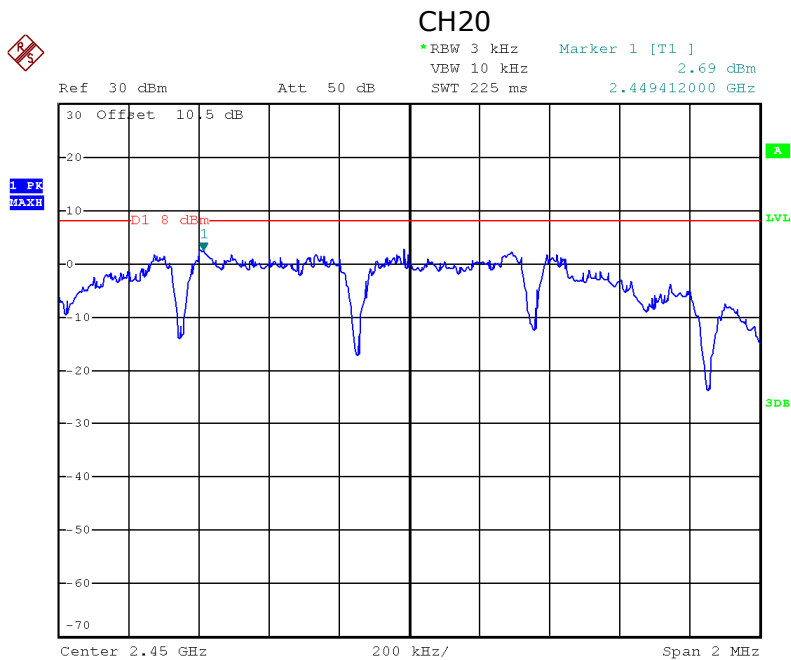
Tel: +82-31-339-9970

Fax: +82-31-624-9501

www.e-ctk.com



Date: 26.SEP.2014 15:42:07



Date: 26.SEP.2014 15:40:30



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

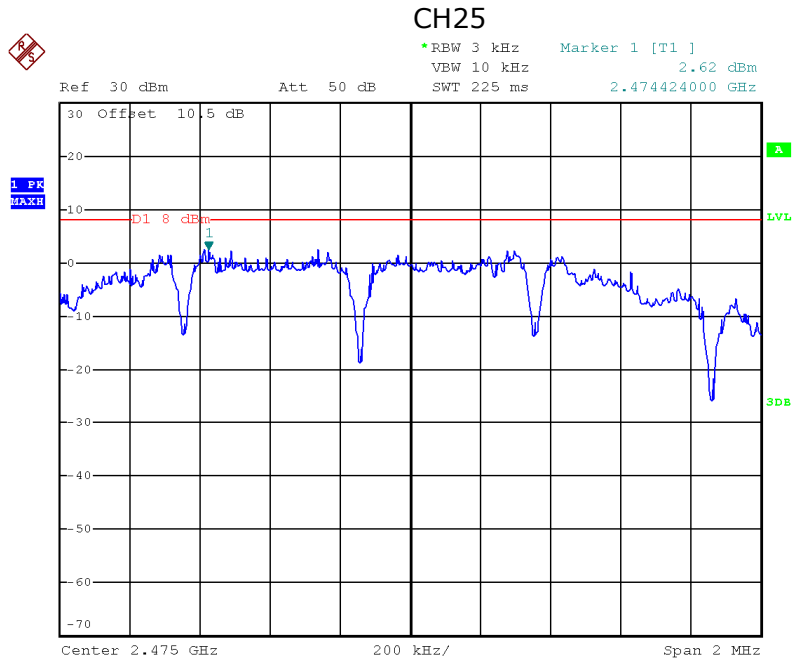
## CTK Co., Ltd.

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

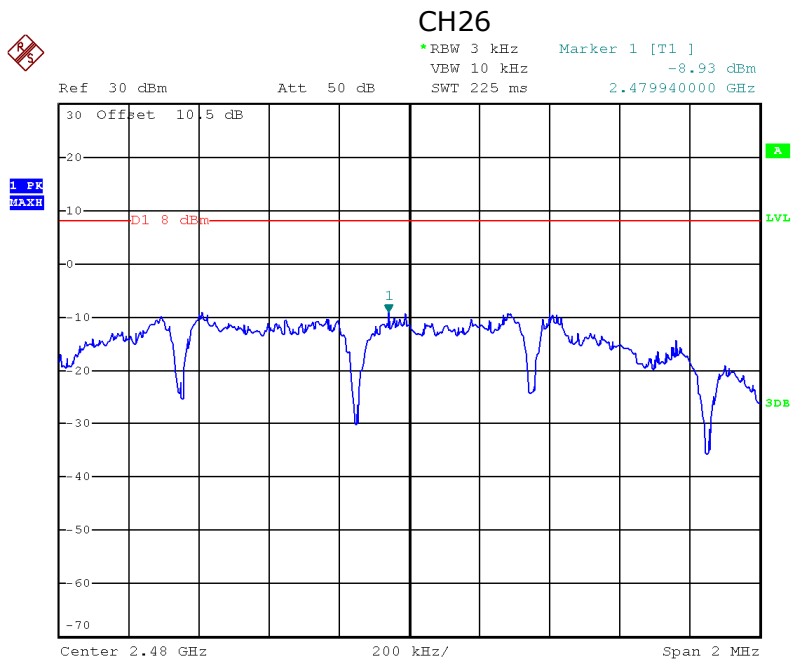
Tel: +82-31-339-9970

Fax: +82-31-624-9501

www.e-ctk.com



Date: 26.SEP.2014 15:38:33



Date: 26.SEP.2014 15:36:58



CTK Co., Ltd.  
The Power 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

### 2.1.4 Band - edge

#### Procedure:

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 300 kHz ( $VBW \geq 3 \times RBW$ )

Span = 50 MHz

Detector function = peak

Trace = Max hold

Sweep = auto

#### Measurement Data: Complies

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

|                          |          |
|--------------------------|----------|
| <b>Minimum Standard:</b> | > 20 dBc |
|--------------------------|----------|

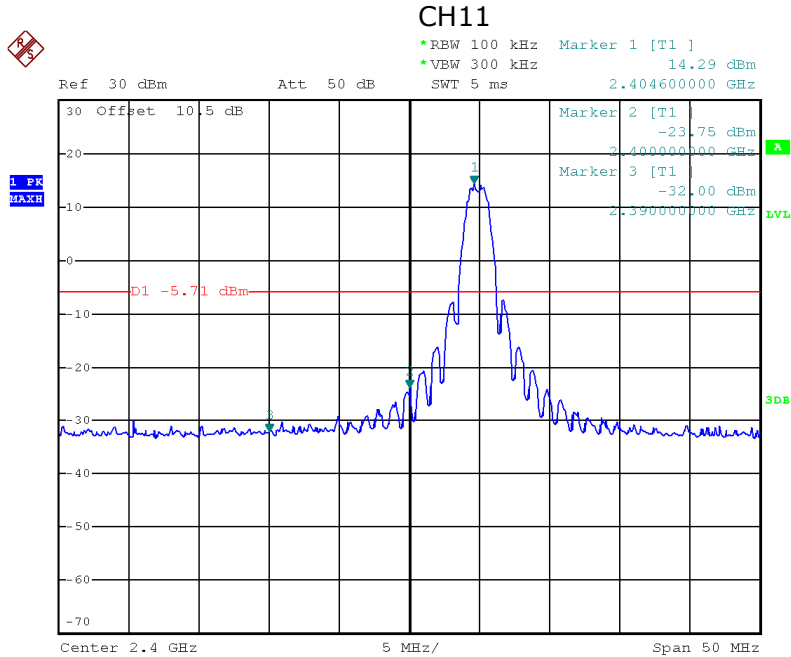
See next pages for actual measured spectrum plots.



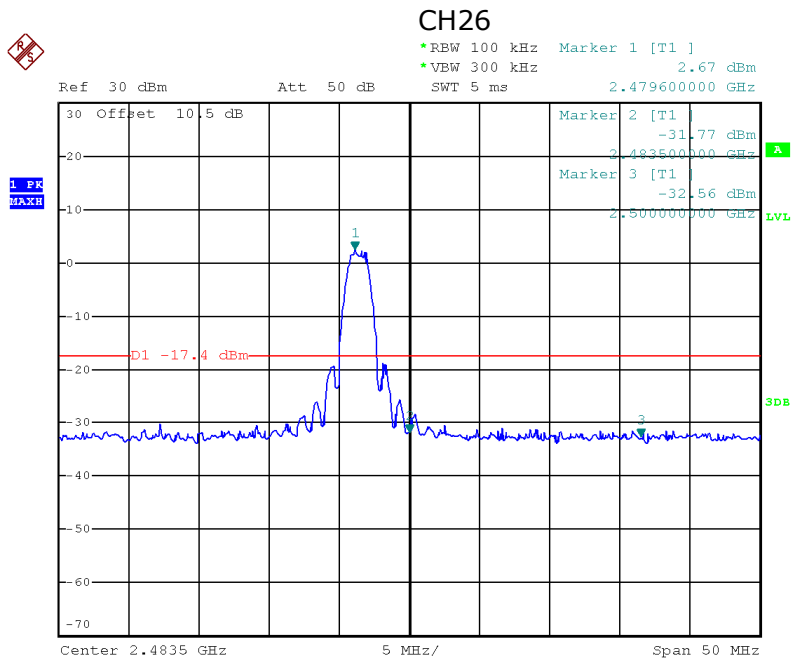
CTK Co., Ltd.  
The Power Leader of Global Regulatory Compliance

**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 Measurements

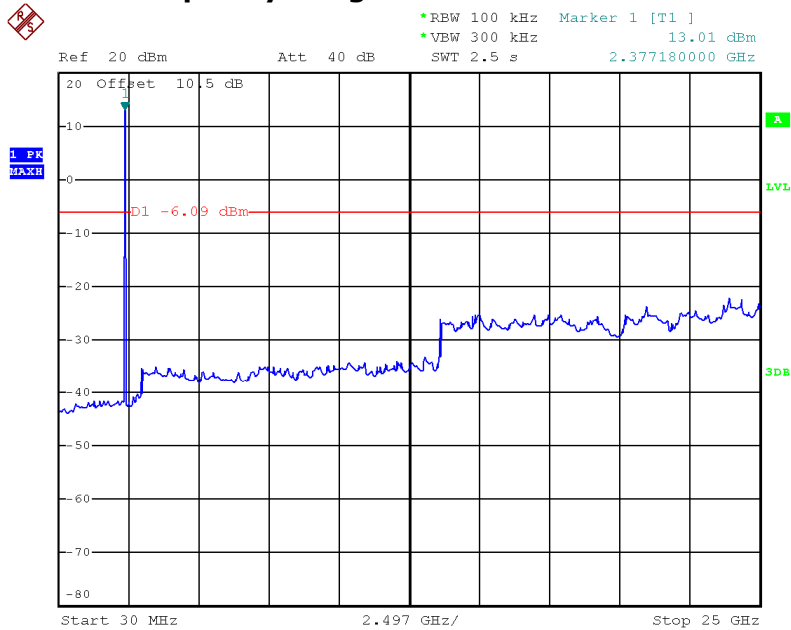


Date: 26.SEP.2014 16:19:51



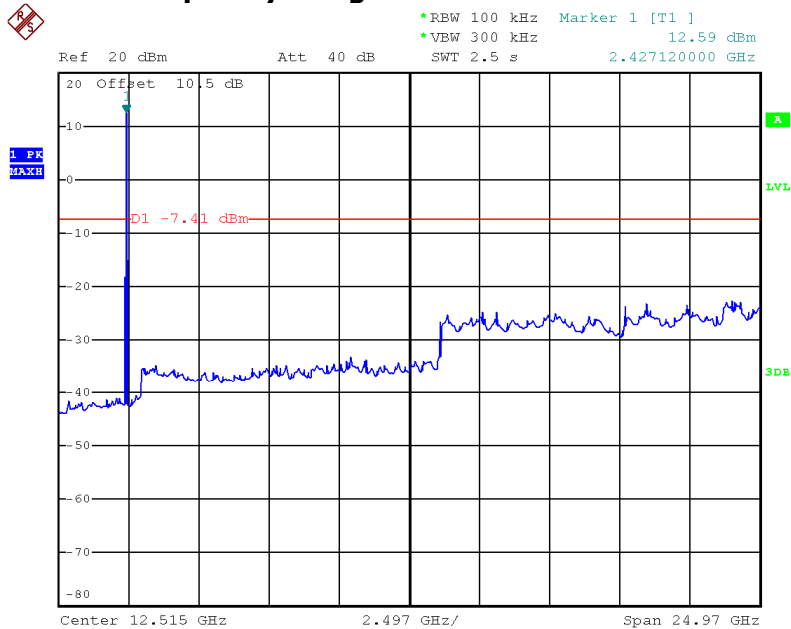
Date: 26.SEP.2014 16:17:01

**Band – edge (at 20 dB below) – CH11**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



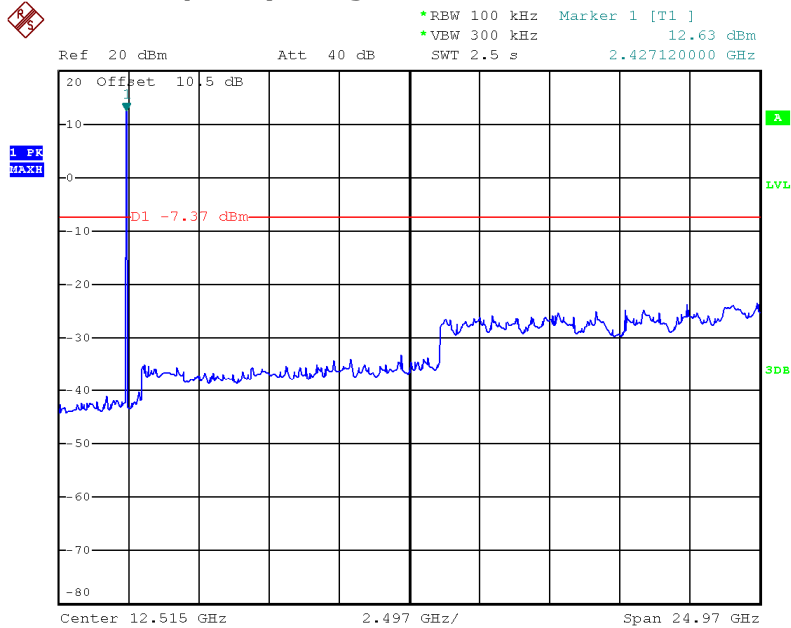
Date: 26.SEP.2014 16:22:07

**Band – edge (at 20 dB below) – CH15**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



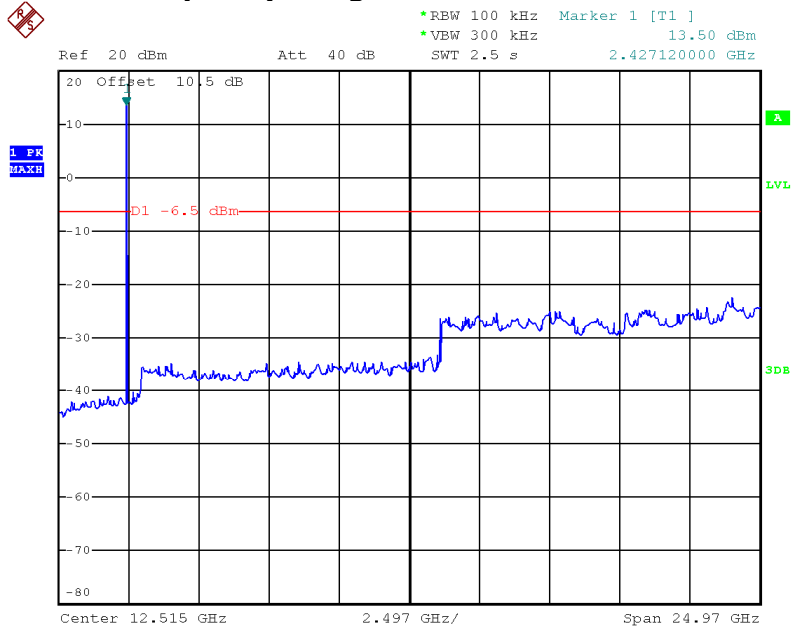
Date: 26.SEP.2014 16:24:08

**Band – edge (at 20 dB below) – CH19**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



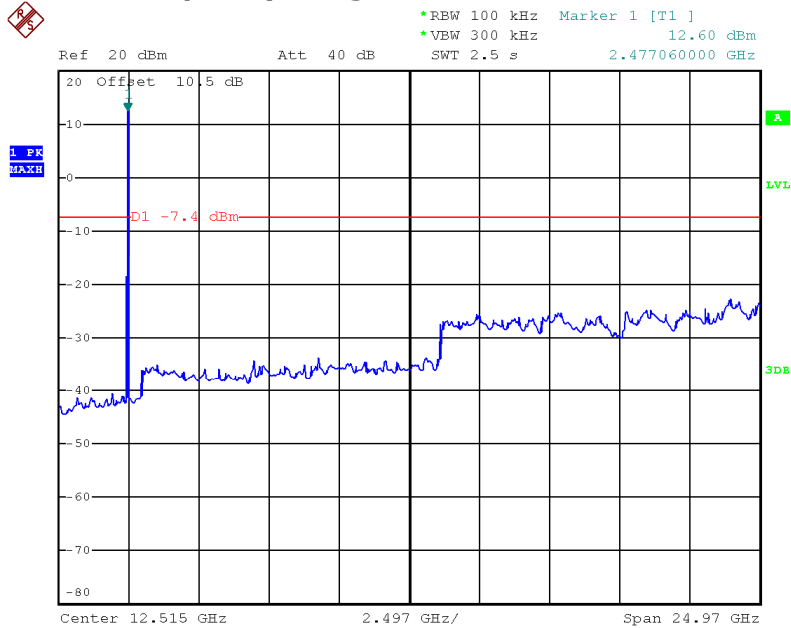
Date: 26.SEP.2014 16:25:05

**Band – edge (at 20 dB below) – CH20**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



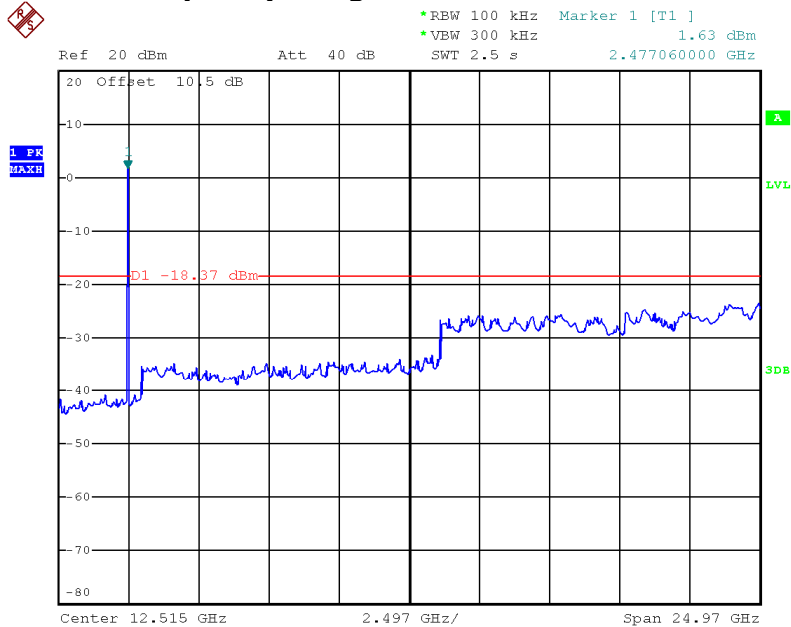
Date: 26.SEP.2014 16:26:17

**Band – edge (at 20 dB below) – CH25**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



Date: 26.SEP.2014 16:27:45

**Band – edge (at 20 dB below) – CH26**  
**Frequency Range = 30 MHz ~ 10<sup>th</sup> harmonic**



Date: 26.SEP.2014 16:29:30



CTK Co., Ltd.  
The Power 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

### 2.1.5 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

## 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.

§ 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 uV/m @ 3 m | Field Strength dBuV/m @ 3 m | Measurement 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                             |

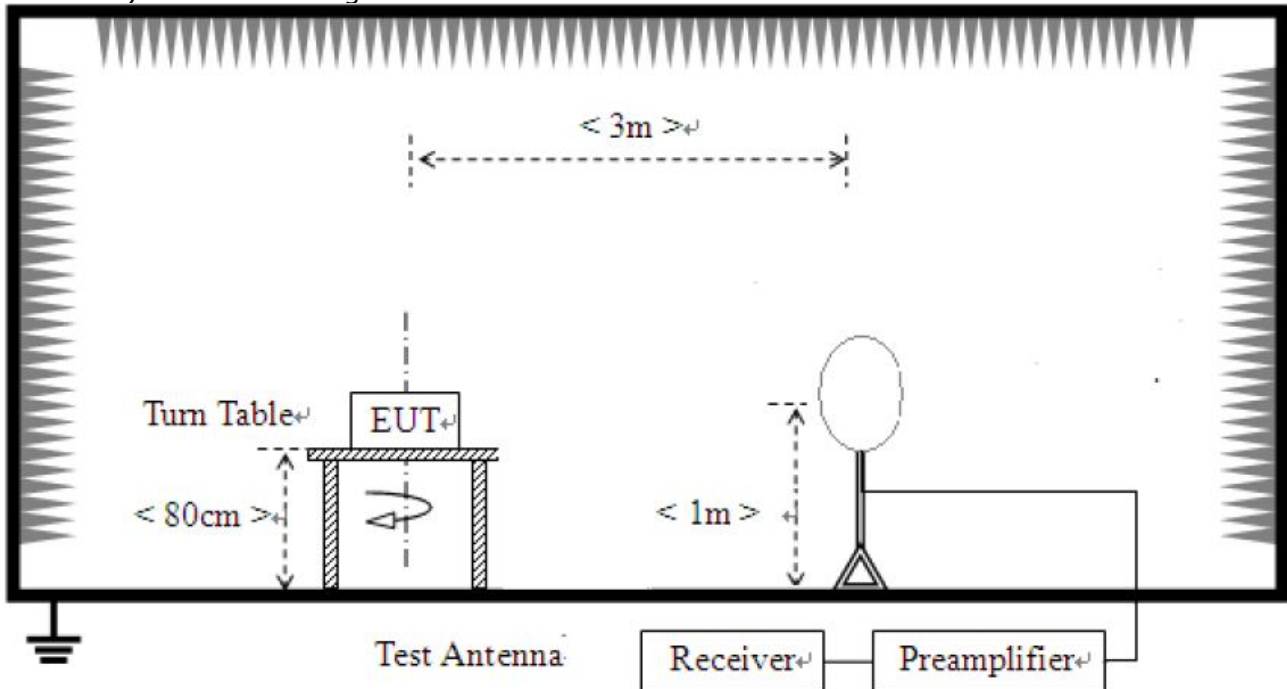
\*\* Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz, 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part,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

Note :

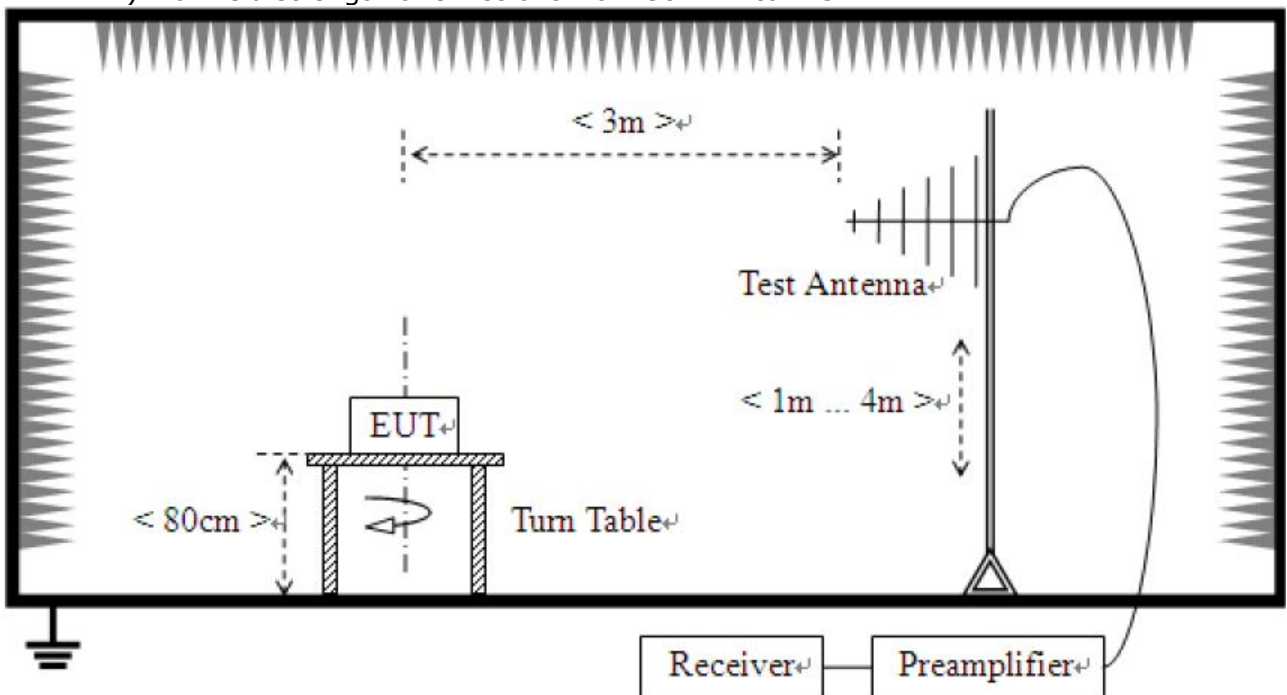
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength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

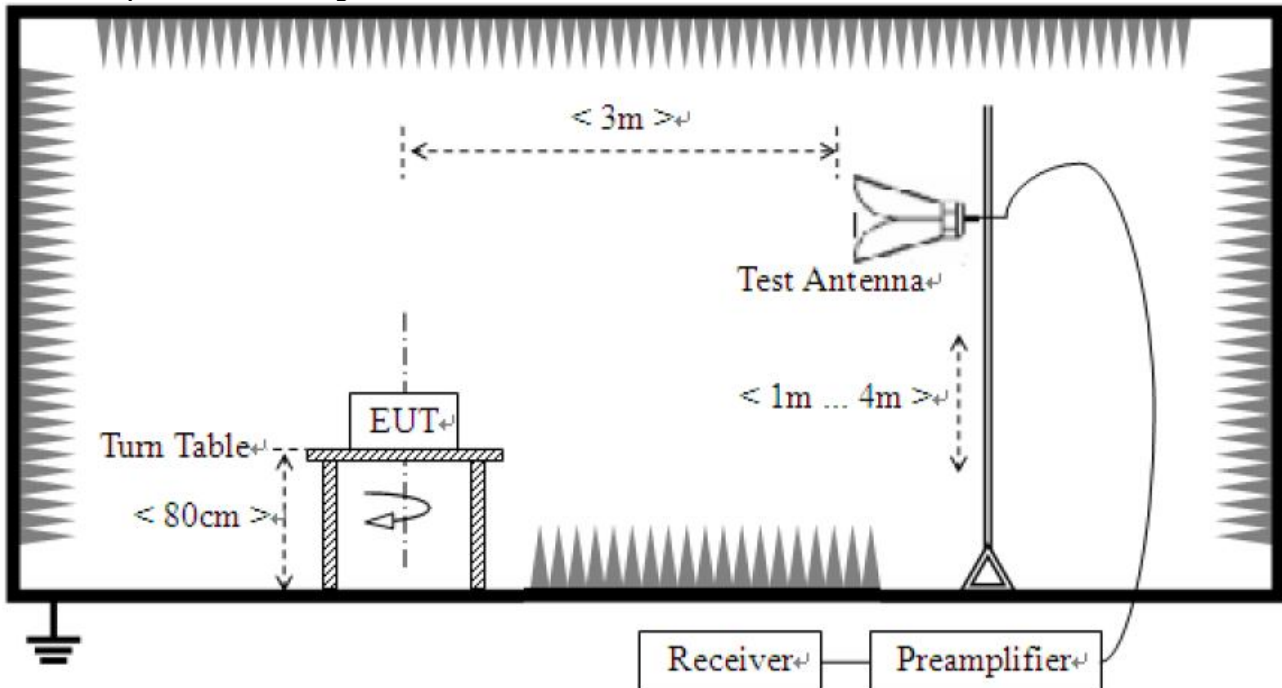
- 1) For field strength of emissions from 9 kHz to 30 MHz



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



3) For field strength of emissions above 1 GHz



**Test Results**

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

**1) 9 kHz to 30 MHz**

|           |                              |                    |                |
|-----------|------------------------------|--------------------|----------------|
| EUT       | Digital door lock            | Measurement Detail |                |
| Model     | SHN-WDD510K/EN               | Frequency Range    | 9 kHz – 30 MHz |
| Test mode | Continuous modulated carrier | 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)



CTK Co., Ltd.  
The Power 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) 30 MHz to 1 GHz

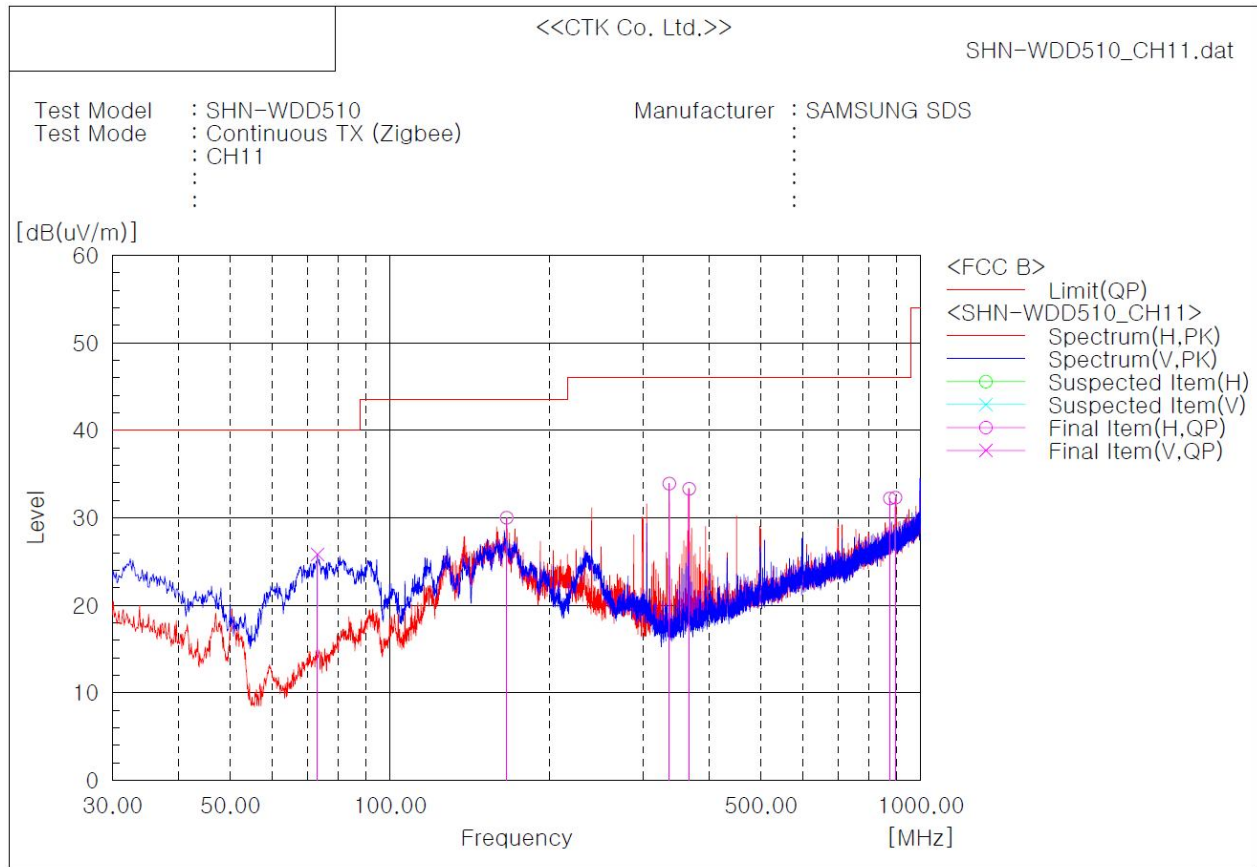
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH11              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark     |
|-----------------|------------------------|-------------|------------|
| 336.053         | 33.9                   | 12.1        | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(uV)] | c.f [dB(1/m)] | Result QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1   | 73.044          | V   | 43.1                | -17.3         | 25.8                 | 40.0                | 14.2           | 100.0       | 165.0       |
| 2   | 165.921         | H   | 43.4                | -13.4         | 30.0                 | 43.5                | 13.5           | 207.0       | 89.0        |
| 3   | 336.035         | H   | 41.6                | -7.7          | 33.9                 | 46.0                | 12.1           | 100.0       | 6.0         |
| 4   | 366.348         | H   | 40.0                | -6.7          | 33.3                 | 46.0                | 12.7           | 100.0       | 233.0       |
| 5   | 875.112         | H   | 27.8                | 4.4           | 32.2                 | 46.0                | 13.8           | 100.0       | 309.0       |
| 6   | 896.210         | H   | 27.6                | 4.7           | 32.3                 | 46.0                | 13.7           | 100.0       | 309.0       |



CTK Co., Ltd.  
The Power 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

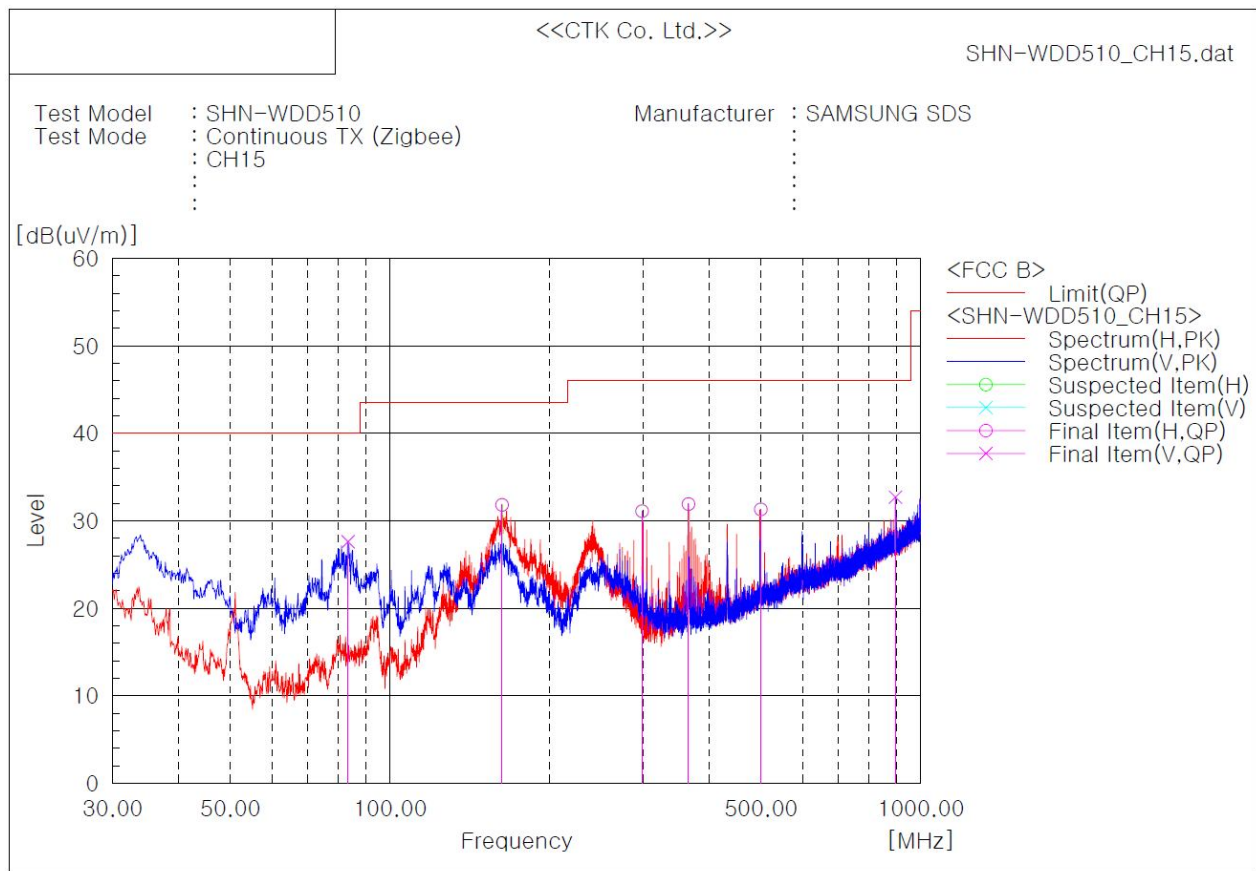
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH15              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark     |
|--------------------|---------------------------|----------------|------------|
| 162.648            | 31.8                      | 11.7           | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|
| 1   | 83.350             | V   | 43.6                      | -16.0            | 27.6                       | 40.0                      | 12.4                 | 100.0          | 48.0           |
| 2   | 162.648            | H   | 45.0                      | -13.2            | 31.8                       | 43.5                      | 11.7                 | 192.0          | 48.0           |
| 3   | 298.690            | H   | 40.0                      | -8.9             | 31.1                       | 46.0                      | 14.9                 | 100.0          | 89.0           |
| 4   | 365.135            | H   | 38.6                      | -6.7             | 31.9                       | 46.0                      | 14.1                 | 100.0          | 237.0          |
| 5   | 499.722            | H   | 34.1                      | -2.8             | 31.3                       | 46.0                      | 14.7                 | 192.0          | 85.0           |
| 6   | 896.089            | V   | 28.0                      | 4.7              | 32.7                       | 46.0                      | 13.3                 | 100.0          | 10.0           |



CTK Co., Ltd.  
The Power 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

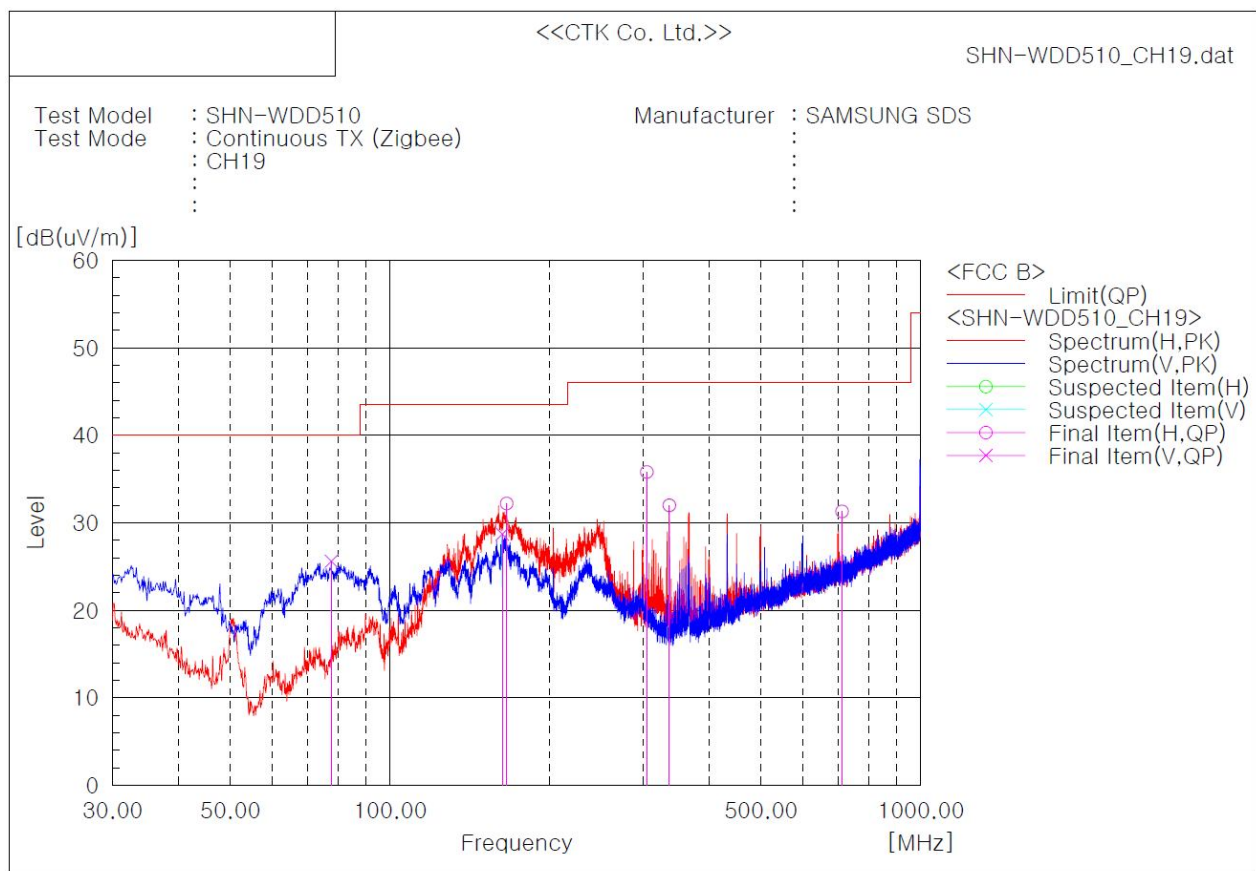
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH19              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark     |
|--------------------|---------------------------|----------------|------------|
| 304.753            | 35.8                      | 10.2           | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|
| 1   | 77.530             | V   | 42.5                      | -16.9            | 25.6                       | 40.0                      | 14.4                 | 100.0          | 203.0          |
| 2   | 162.769            | V   | 41.9                      | -13.2            | 28.7                       | 43.5                      | 14.8                 | 100.0          | 165.0          |
| 3   | 165.921            | H   | 45.6                      | -13.4            | 32.2                       | 43.5                      | 11.3                 | 207.0          | 89.0           |
| 4   | 304.753            | H   | 44.4                      | -8.6             | 35.8                       | 46.0                      | 10.2                 | 100.0          | 45.0           |
| 5   | 336.035            | H   | 39.7                      | -7.7             | 32.0                       | 46.0                      | 14.0                 | 100.0          | 8.0            |
| 6   | 711.183            | H   | 30.5                      | 0.8              | 31.3                       | 46.0                      | 14.7                 | 207.0          | 89.0           |



CTK Co., Ltd.  
The Power 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

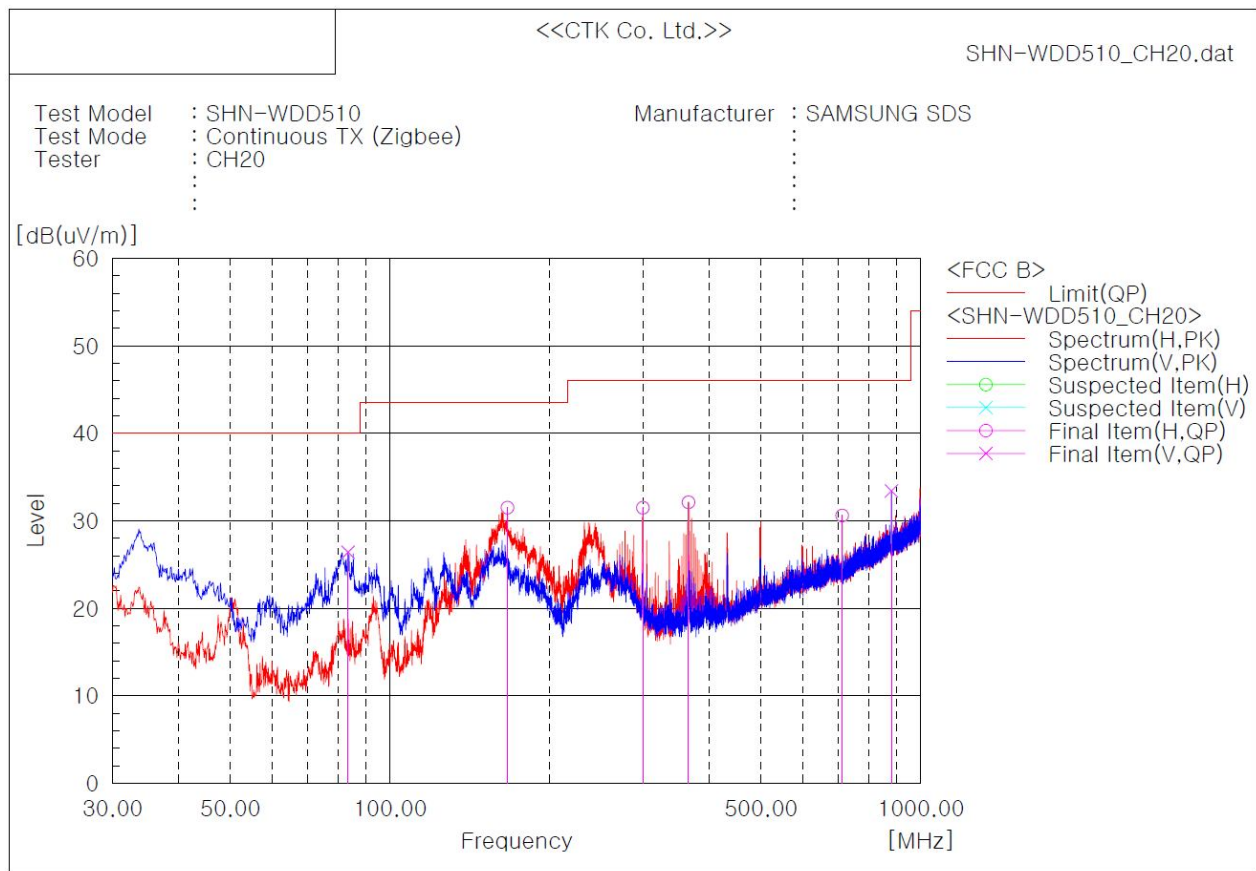
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH20              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark     |
|-----------------|------------------------|-------------|------------|
| 166.528         | 31.5                   | 12.0        | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(uV)] | c.f [dB(1/m)] | Result QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|
| 1   | 83.350          | V   | 42.4                | -16.0         | 26.4                 | 40.0                | 13.6           | 100.0       | 308.0       |
| 2   | 166.528         | H   | 44.9                | -13.4         | 31.5                 | 43.5                | 12.0           | 191.0       | 47.0        |
| 3   | 299.660         | H   | 40.4                | -8.9          | 31.5                 | 46.0                | 14.5           | 100.0       | 89.0        |
| 4   | 365.135         | H   | 38.8                | -6.7          | 32.1                 | 46.0                | 13.9           | 100.0       | 238.0       |
| 5   | 711.304         | H   | 29.8                | 0.8           | 30.6                 | 46.0                | 15.4           | 100.0       | 89.0        |
| 6   | 880.447         | V   | 28.9                | 4.5           | 33.4                 | 46.0                | 12.6           | 100.0       | 85.0        |



CTK Co., Ltd.  
The Power 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

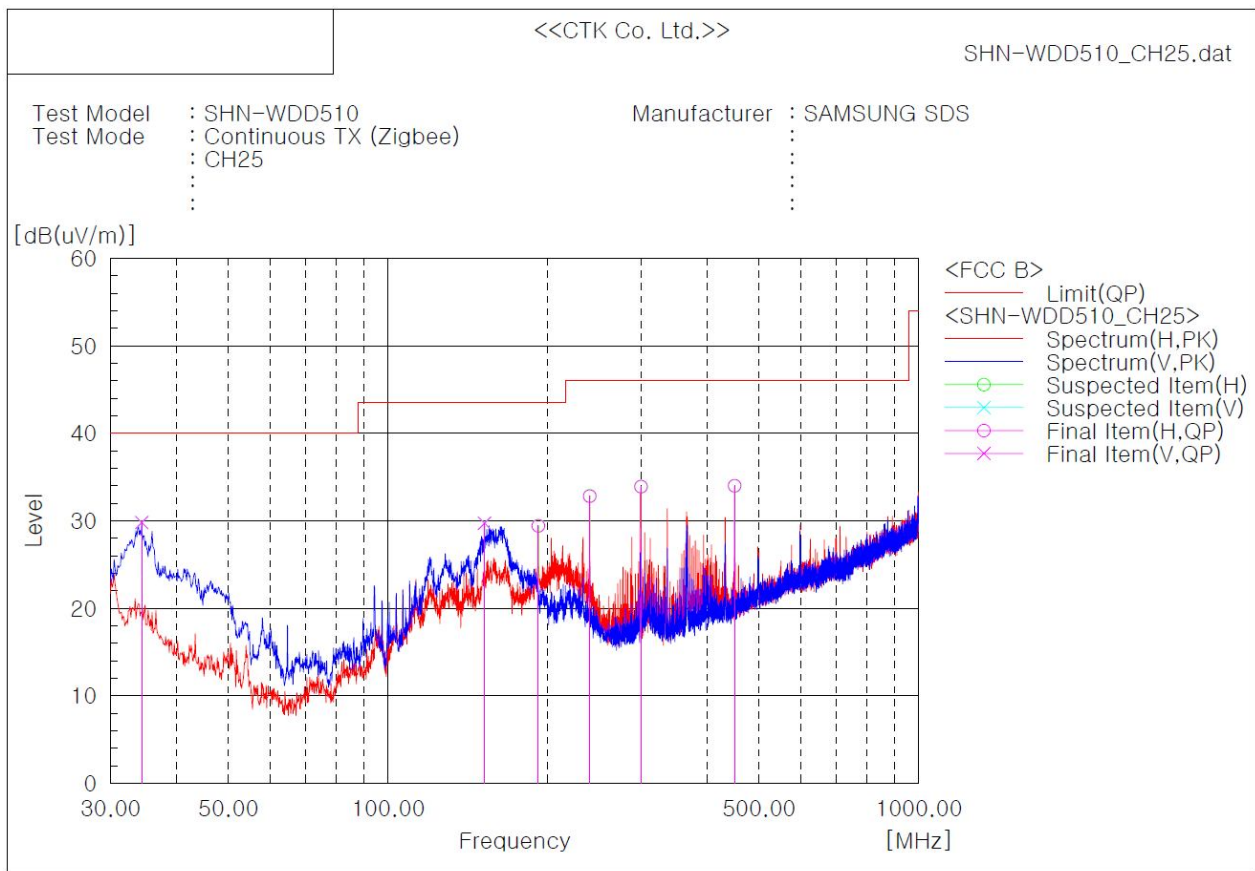
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH25              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark     |
|--------------------|---------------------------|----------------|------------|
| 34.365             | 29.8                      | 10.2           | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|
| 1   | 34.365             | V   | 38.1                      | -8.3             | 29.8                       | 40.0                      | 10.2                 | 100.0          | 200.0          |
| 2   | 151.978            | V   | 42.2                      | -12.5            | 29.7                       | 43.5                      | 13.8                 | 100.0          | 50.0           |
| 3   | 191.990            | H   | 43.7                      | -14.3            | 29.4                       | 43.5                      | 14.1                 | 100.0          | 46.0           |
| 4   | 240.005            | H   | 43.1                      | -10.3            | 32.8                       | 46.0                      | 13.2                 | 100.0          | 46.0           |
| 5   | 299.781            | H   | 42.8                      | -8.9             | 33.9                       | 46.0                      | 12.1                 | 100.0          | 9.0            |
| 6   | 450.010            | H   | 38.4                      | -4.4             | 34.0                       | 46.0                      | 12.0                 | 100.0          | 309.0          |



CTK Co., Ltd.  
The Power 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

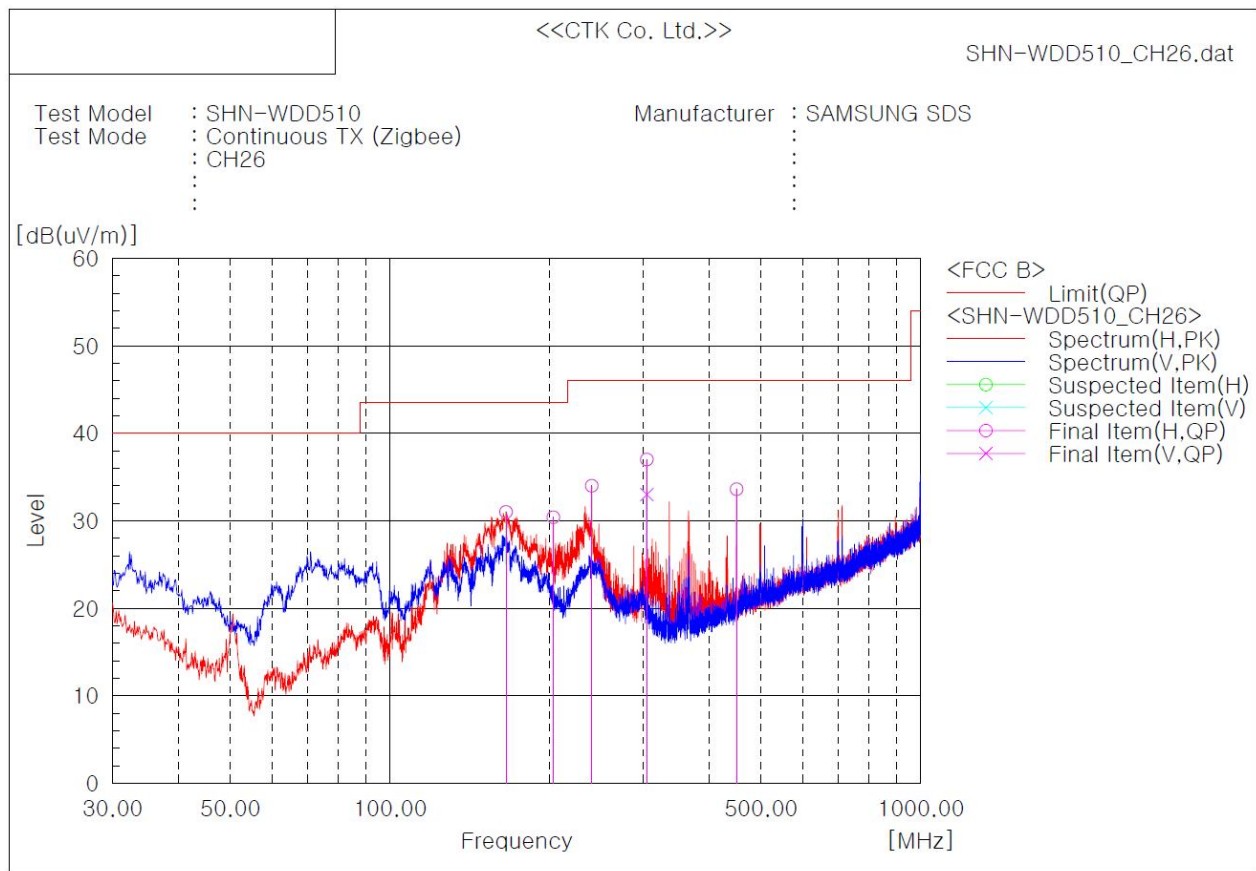
|         |                   |                    |             |
|---------|-------------------|--------------------|-------------|
| EUT     | Digital door lock | Measurement Detail |             |
| Model   | SHN-WDD510K/EN    | Frequency Range    | Below 1 GHz |
| Channel | CH26              | Detector function  | Quasi-Peak  |

The requirements are:

☒ Complies

| Frequency<br>(MHz) | Measured Data<br>(dBuV/m) | Margin<br>(dB) | Remark     |
|--------------------|---------------------------|----------------|------------|
| 304.753            | 37.0                      | 9.0            | Quasi-peak |

### Test Data



### Final Result

| No. | Frequency<br>[MHz] | (P) | Reading<br>QP<br>[dB(uV)] | c.f<br>[dB(1/m)] | Result<br>QP<br>[dB(uV/m)] | Limit<br>QP<br>[dB(uV/m)] | Margin<br>QP<br>[dB] | Height<br>[cm] | Angle<br>[deg] |
|-----|--------------------|-----|---------------------------|------------------|----------------------------|---------------------------|----------------------|----------------|----------------|
| 1   | 165.436            | H   | 44.3                      | -13.3            | 31.0                       | 43.5                      | 12.5                 | 207.0          | 89.0           |
| 2   | 203.145            | H   | 44.6                      | -14.2            | 30.4                       | 43.5                      | 13.1                 | 100.0          | 45.0           |
| 3   | 240.005            | H   | 44.3                      | -10.3            | 34.0                       | 46.0                      | 12.0                 | 100.0          | 8.0            |
| 4   | 304.753            | H   | 45.6                      | -8.6             | 37.0                       | 46.0                      | 9.0                  | 100.0          | 45.0           |
| 5   | 304.753            | V   | 41.6                      | -8.6             | 33.0                       | 46.0                      | 13.0                 | 100.0          | 352.0          |
| 6   | 450.010            | H   | 38.0                      | -4.4             | 33.6                       | 46.0                      | 12.4                 | 100.0          | 309.0          |

### 3) above 1 GHz

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

|       |                   |                    |                |
|-------|-------------------|--------------------|----------------|
| EUT   | Digital door lock | Measurement Detail |                |
| Model | SHN-WDD510K/EN    | Frequency Range    | 1-25GHz        |
|       |                   | Detector function  | Average / Peak |

The requirements are:

☒ Complies

| Frequency (MHz) | Measured Data (dBuV/m) | Margin (dB) | Remark  |
|-----------------|------------------------|-------------|---------|
| 4810.72         | 52.18                  | 1.82        | Average |

### Test Data

|      | Frequency [MHz] | Reading [dBuV/m]<br>AV/Peak |       | Pol. | Correction Factor [dB] |        | Limits [dBuV/m]<br>AV / Peak |       | Result [dBuV/m]<br>AV / Peak |       | Margin [dB]<br>AV / Peak |       |
|------|-----------------|-----------------------------|-------|------|------------------------|--------|------------------------------|-------|------------------------------|-------|--------------------------|-------|
|      |                 |                             |       |      | Ant                    | CL+Amp |                              |       |                              |       |                          |       |
| CH11 | 4808.68         | 38.80                       | 46.80 | H    | 34.00                  | -21.12 | 54.00                        | 74.00 | 51.68                        | 59.68 | 2.32                     | 14.32 |
| CH11 | 4810.72         | 39.30                       | 46.80 | V    | 34.00                  | -21.12 | 54.00                        | 74.00 | 52.18                        | 59.68 | 1.82                     | 14.32 |
| CH15 | 4850.84         | 36.90                       | 44.70 | H    | 34.00                  | -21.12 | 54.00                        | 74.00 | 49.78                        | 57.58 | 4.22                     | 16.42 |
| CH15 | 4850.84         | 38.30                       | 45.90 | V    | 34.00                  | -21.12 | 54.00                        | 74.00 | 51.18                        | 58.78 | 2.82                     | 15.22 |
| CH19 | 4888.24         | 36.60                       | 44.80 | H    | 34.00                  | -21.12 | 54.00                        | 74.00 | 49.48                        | 57.68 | 4.52                     | 16.32 |
| CH19 | 4890.28         | 38.10                       | 46.10 | V    | 34.00                  | -21.12 | 54.00                        | 74.00 | 50.98                        | 58.98 | 3.02                     | 15.02 |
| CH20 | 4898.44         | 37.30                       | 45.00 | H    | 34.00                  | -21.12 | 54.00                        | 74.00 | 50.18                        | 57.88 | 3.82                     | 16.12 |
| CH20 | 4899.80         | 38.40                       | 46.00 | V    | 34.00                  | -21.12 | 54.00                        | 74.00 | 51.28                        | 58.88 | 2.72                     | 15.12 |
| CH25 | 4948.76         | 36.00                       | 44.10 | H    | 34.00                  | -21.19 | 54.00                        | 74.00 | 48.81                        | 56.91 | 5.19                     | 17.09 |
| CH25 | 4948.76         | 38.50                       | 46.00 | V    | 34.00                  | -21.19 | 54.00                        | 74.00 | 51.31                        | 58.81 | 2.69                     | 15.19 |
| CH26 | 4958.96         | 25.60                       | 37.00 | H    | 34.00                  | -21.19 | 54.00                        | 74.00 | 38.41                        | 49.81 | 15.59                    | 24.19 |
| CH26 | 4960.32         | 26.80                       | 38.00 | V    | 34.00                  | -21.19 | 54.00                        | 74.00 | 39.61                        | 50.81 | 14.39                    | 23.19 |

### Restricted band edge test data

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

|      | Frequency [MHz] | Reading [dBuV/m]<br>AV/Peak |       | Pol. | Correction Factor [dB] |        | Limits [dBuV/m]<br>AV / Peak |       | Result [dBuV/m]<br>AV / Peak |       | Margin [dB]<br>AV / Peak |       |
|------|-----------------|-----------------------------|-------|------|------------------------|--------|------------------------------|-------|------------------------------|-------|--------------------------|-------|
|      |                 |                             |       |      | Ant                    | CL+Amp |                              |       |                              |       |                          |       |
| CH11 | 2389.92         | 28.60                       | 41.40 | H    | 31.90                  | -23.89 | 54.00                        | 74.00 | 36.61                        | 49.41 | 17.39                    | 24.59 |
| CH11 | 2389.78         | 28.20                       | 41.00 | V    | 31.90                  | -23.89 | 54.00                        | 74.00 | 36.21                        | 49.01 | 17.79                    | 24.99 |
| CH26 | 2483.56         | 42.60                       | 52.60 | H    | 32.00                  | -23.82 | 54.00                        | 74.00 | 50.78                        | 60.78 | 3.22                     | 13.22 |
| CH26 | 2483.53         | 40.40                       | 50.70 | V    | 32.00                  | -23.82 | 54.00                        | 74.00 | 48.58                        | 58.88 | 5.42                     | 15.12 |

## 2.1.6 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 0.8 m above the metallic, grounded floor and 0.4 m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8 m.

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:

☒ **Not Applicable (Battery Power)**

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



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

[HOT]

Not Applicable

Not Applicable

[NEUTRAL]

Not Applicable

Not Applicable



CTK Co., Ltd.  
The Power 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  | Signal Analyzer             | Agilent                     | N9020A                                       | MY48011598  | 2013-11-08          | 2014-11-08 |
| 2  | EMI Test Receiver           | Rohde & Schwarz             | ESCI7                                        | 100814      | 2013-12-14          | 2014-12-06 |
| 3  | EMI Test Receiver           | Rohde & Schwarz             | ESCI7                                        | 100816      | 2013-12-14          | 2014-12-06 |
| 4  | EMI Test Receiver           | Rohde & Schwarz             | ESU40                                        | 100336      | 2014-05-15          | 2015-05-15 |
| 5  | Bilog Antenna               | Schaffner                   | CBL6111C                                     | 2551        | 2014-05-08          | 2016-05-08 |
| 6  | Double Ridged Guide Antenna | ETS-Lindgren                | 3117                                         | 00154525    | 2013-07-03          | 2015-07-03 |
| 7  | Double Ridged Guide Antenna | ETS-Lindgren                | 3116                                         | 00062916    | 2013-03-20          | 2015-03-20 |
| 8  | Active Loop Antenna         | SCHWARZBECK                 | FMZB 1513                                    | 1513-126    | 2014-05-19          | 2016-05-19 |
| 9  | Attenuator                  | Rohde & Schwarz             | DNF                                          | 272.4110.50 | 2013-11-12          | 2014-11-12 |
| 10 | PREAMPLIFIER                | Agilent                     | 8449B                                        | 3008A02307  | 2013-11-08          | 2014-11-08 |
| 11 | AMPLIFIER                   | Sonoma Instrument Co.       | 310                                          | 291721      | 2013-02-06          | 2015-02-06 |
| 12 | Band Reject Filter          | Wainwright Instruments GmbH | WRCGV<br>2400/2483-<br>2375/2505-<br>50/10EE | 2           | 2013-08-25          | 2015-08-25 |
| 13 | Signal Generator            | Agilent                     | E4432B                                       | US40054094  | 2013-11-08          | 2014-11-08 |
| 14 | Signal Generator            | HP                          | 8341B                                        | 2819A01563  | 2013-11-08          | 2014-11-08 |
| 15 | DC Power Supply             | Topward                     | 6303D                                        | 711196      | 2014-03-20          | 2015-03-20 |