

# TEST REPORT

of

FCC Part 15 Subpart C §15.247  
IC RSS-247 Issue 3 and RSS-Gen Issue 5

FCC ID: MZR-YRD510  
IC Certification: 2676A-YRD510

Equipment Under Test : Smart Lock

Model Name : YRD510-MT1

Variant Model Name(s) : -

FCC Applicant : Master Lock Company

IC Applicant : Master Lock Company LLC

Manufacturer : Master Lock Company

Date of Receipt : 2023.03.24

Date of Test(s) : 2023.03.27 ~ 2023.11.16

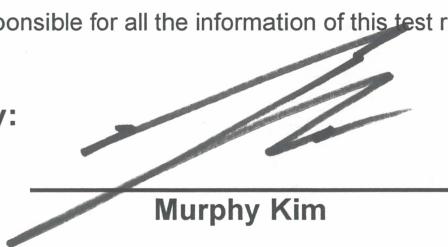
Date of Issue : 2023.12.19

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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- 2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
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Tested by:



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Technical Manager:



Inho Park

**SGS Korea Co., Ltd. Gunpo Laboratory**

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## 1. General Information

### 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

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- Designation number: KR0150

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### 1.2. Details of Applicant

FCC Applicant : Master Lock Company  
FCC Address : 6744 South Howell Avenue, Oak Creek, WI 53154, Milwaukee, Wisconsin, United States  
IC Applicant : Master Lock Company LLC  
IC Address : 6744 South Howell Avenue, Oak Creek, WI 53154, United States Of America (Excluding The States Of Alaska)  
Contact Person : Sidnei Stifelmann  
Phone No. : +1 847 250 7896

### 1.3. Details of Manufacturer

Company : Master Lock Company  
Address : Lot A10 Ba Thien II Industrial Park Thien Ke Ward Vinh Phuc Province Vietnam

### 1.4. Description of EUT

|                                 |   |
|---------------------------------|---|
| <b>Kind of Product</b>          | Smart Lock  |
| <b>Model Name</b>               | YRD510-MT1  |
| <b>Variant Model Names</b>      | -   |
| <b>Serial Number</b>            | Conducted Sample: 027VN100029<br>Radiated Sample: 027VN100030 |
| <b>Power Supply</b>             | DC 6.0 V  |
| <b>Frequency Range</b>          | 2 405 MHz ~ 2 480 MHz (Thread)                                |
| <b>Modulation Technique</b>     | DSSS  |
| <b>Number of Channels</b>       | 16 channels (Thread)  |
| <b>Antenna Type</b>             | 2 Port Inverted F Antenna                                     |
| <b>Antenna Gain<sup>*</sup></b> | 3.37 dB i   |
| <b>H/W Version</b>              | V3.0  |
| <b>S/W Version</b>              | BLE part: V1.2, MATTER part: V1.0.0                           |
| <b>FVIN</b>                     | N/A   |

## 1.5. Test Equipment List

| Equipment                | Manufacturer                | Model                                | S/N                       | Cal. Date     | Cal. Interval | Cal. Due      |
|--------------------------|-----------------------------|--------------------------------------|---------------------------|---------------|---------------|---------------|
| Signal Generator         | R&S                         | SMA100B                              | 106887                    | Oct. 06, 2023 | Annual        | Oct. 06, 2024 |
| Spectrum Analyzer        | R&S                         | FSV30                                | 103210                    | Dec. 07, 2022 | Annual        | Dec. 07, 2023 |
| Spectrum Analyzer        | R&S                         | FSW43                                | 100637                    | Apr. 06, 2023 | Annual        | Apr. 06, 2024 |
| Spectrum Analyzer        | Agilent                     | N9020A                               | MY53421758                | Sep. 01, 2023 | Annual        | Sep. 01, 2024 |
| Attenuator               | AEROFLEX / INMET            | 40AH2W-10                            | 40G-1                     | Jun. 14, 2023 | Annual        | Jun. 14, 2024 |
| High Pass Filter         | Wainwright Instrument GmbH  | WHKX3.0/18G-10SS                     | 21                        | Jun. 01, 2023 | Annual        | Jun. 01, 2024 |
| High Pass Filter         | Wainwright Instrument GmbH  | WHNX7.5/26.5G-6SS                    | 15                        | Jun. 02, 2023 | Annual        | Jun. 02, 2024 |
| Low Pass Filter          | Mini-Circuits               | NLP-1200+                            | V<br>8979400903-2         | Feb. 09, 2023 | Annual        | Feb. 09, 2024 |
| Power Sensor             | R&S                         | NRP-Z81                              | 100669                    | May 16, 2023  | Annual        | May 16, 2024  |
| DC Power Supply          | R&S                         | HMP2020                              | 102130                    | Apr. 27, 2023 | Annual        | Apr. 27, 2024 |
| Preamplifier             | H.P.                        | 8447F                                | 2944A03909                | Aug. 04, 2023 | Annual        | Aug. 04, 2024 |
| Signal Conditioning Unit | R&S                         | SCU-18                               | 10117                     | Jun. 15, 2023 | Annual        | Jun. 15, 2024 |
| Preamplifier             | TESTEK                      | TK-PA1840H                           | 130016                    | Jan. 11, 2023 | Annual        | Jan. 11, 2024 |
| Loop Antenna             | Schwarzbeck Mess-Elektronik | FMZB 1519                            | 1519-039                  | Aug. 21, 2023 | Biennial      | Aug. 21, 2025 |
| Bilog Antenna            | Schwarzbeck Mess-Elektronik | VULB 9163                            | 01126                     | Feb. 09, 2023 | Annual        | Feb. 09, 2024 |
| Horn Antenna             | R&S                         | HF906                                | 100326                    | Feb. 28, 2023 | Annual        | Feb. 28, 2024 |
| Horn Antenna             | Schwarzbeck Mess-Elektronik | BBHA 9170                            | 9170-540                  | Nov. 30, 2022 | Annual        | Nov. 30, 2023 |
| EMI Test Receiver        | R&S                         | ESU26                                | 100109                    | Jan. 18, 2023 | Annual        | Jan. 18, 2024 |
| Turn Table               | Innco systems GmbH          | DS 1200 S                            | N/A                       | N.C.R.        | N/A           | N.C.R.        |
| Controller               | Innco systems GmbH          | CONTROLLER CO3000-4P                 | CO3000/963/38<br>330516/L | N.C.R.        | N/A           | N.C.R.        |
| Antenna Mast             | Innco systems GmbH          | MA4640-XP-ET                         | MA4640/536/38<br>330516/L | N.C.R.        | N/A           | N.C.R.        |
| Anechoic Chamber         | SY Corporation              | L x W x H<br>(9.6 m x 6.4 m x 6.6 m) | N/A                       | N.C.R.        | N/A           | N.C.R.        |
| Coaxial Cable            | RFONE                       | MWX221-NMSNMS (4 m)                  | J1023142                  | Oct. 04, 2023 | Semi-Annual   | Apr. 04, 2024 |
| Coaxial Cable            | Qualwave Inc.               | QA500-18-NN-10 (10 m)                | 22200114                  | Oct. 04, 2023 | Semi-Annual   | Apr. 04, 2024 |
| Coaxial Cable            | RFONE                       | PL360P-292M292M-1.5 M-A              | 20200324002               | Oct. 14, 2023 | Semi-Annual   | Apr. 14, 2024 |

**Note:**

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date

## 1.6. Declaration by Manufacturer

- Thread operates on the antenna 2 port of MATTER part.

## 1.7. Summary of Test Results

The EUT has been tested according to the following specifications:

| <b>APPLIED STANDARD: FCC Part 15 Subpart C, RSS-247 Issue 3 and RSS-Gen Issue 5</b> |   |  |                   |
|---|---|--|-------------------|
| <b>Section in FCC</b>   | <b>Section in IC</b>                                | <b>Test Item(s)</b>  | <b>Result</b>     |
| 15.205(a)<br>15.209<br>15.247(d)  | RSS-247 Issue 3<br>5.5<br>RSS-Gen Issue 5<br>8.9    | Transmitter Radiated Spurious Emissions and<br>Conducted Spurious Emission | Complied          |
| 15.247(a)(2)  | RSS-247 Issue 3<br>5.2(a)<br>RSS-Gen Issue 5<br>6.7 | 6 dB Bandwidth & 99 % Bandwidth  | Complied          |
| 15.247(b)(3)  | RSS-247 Issue 3<br>5.4(d)                           | Maximum Peak Conducted Output Power  | Complied          |
| 15.247(e)   | RSS-247 Issue 3<br>5.2(b)                           | Power Spectral Density   | Complied          |
| 15.207  | RSS-Gen Issue 5<br>8.8                              | AC Power Line Conducted Emission   | N/A <sup>1)</sup> |

**Note:**

- 1) The AC power line test was not performed because the EUT use battery power for operation and which do not operate from the AC power lines.

## 1.8. Test Procedure(s)

The measurement procedures described in the American National Standard of Procedure for Compliance Testing of unlicensed Wireless Devices (ANSI C63.10-2013) and the guidance provided in KDB 558074 D01 15.247 Meas Guidance v05r02 were used in the measurement of the DUT.

## 1.9. Sample Calculation

Where relevant, the following sample calculation is provided:

### 1.9.1. Conducted Test

Offset value (dB) = Attenuator (dB) + Cable loss (dB)

### 1.9.2. Radiation Test

Field strength level (dB $\mu$ V/m) = Measured level (dB $\mu$ V) + Antenna factor (dB/m) + Cable loss (dB) - Amplifier gain (dB) + Duty factor (dB)

## 1.10. Information of software for test

- Using the software of CAE BLE FCC Mobile phone application(v1.0.0) to test for the thread.

## 1.11. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter                           | Uncertainty |         |
|-------------------------------------|-------------|---------|
| Maximum Peak Conducted Output Power | 0.33 dB     |         |
| Power Spectral Density              | 0.64 dB     |         |
| 99 % Bandwidth                      | 0.01 MHz    |         |
| 6 dB Bandwidth                      | 0.01 MHz    |         |
| Conducted Spurious Emission         | 0.79 dB     |         |
| Radiated Emission, 9 kHz to 30 MHz  | H           | 3.60 dB |
|                                     | V           | 3.60 dB |
| Radiated Emission, below 1 GHz      | H           | 4.60 dB |
|                                     | V           | 4.90 dB |
| Radiated Emission, above 1 GHz      | H           | 3.90 dB |
|                                     | V           | 3.80 dB |

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicate a 95 % level of confidence.

## 1.12. Test Report Revision

| Revision | Report number          | Date of Issue | Description                         |
|----------|------------------------|---------------|-------------------------------------|
| 0        | F690501-RF-RTL004564   | 2023.11.16    | Initial                             |
| 1        | F690501-RF-RTL004564-1 | 2023.12.05    | Corrected typo                      |
| 2        | F690501-RF-RTL004564-2 | 2023.12.19    | Changed the name of Kind of Product |

### 1.13. EUT worst case configuration

| Channel No. | Frequency[MHz] | Maximum Peak Conducted output power [dB m] |
|-------------|----------------|--|
| 11          | 2 405          | 16.77                                      |
| 12          | 2 410          | <b><u>19.73</u></b>                        |
| 18          | 2 440          | 19.32                                      |
| 25          | 2 475          | 18.59                                      |
| 26          | 2 480          | 4.23                                       |

Radiated emission below 1 GHz was performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Radiated emission above 1 GHz and conducted test items were performed with the EUT set to transmit Channel 11, 12, 18, 25 and 26.

## 1.14. Duty Cycle of EUT

Regarding to KDB 558074 D01 15.247 Meas Guidance v05r02, 6, the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below;

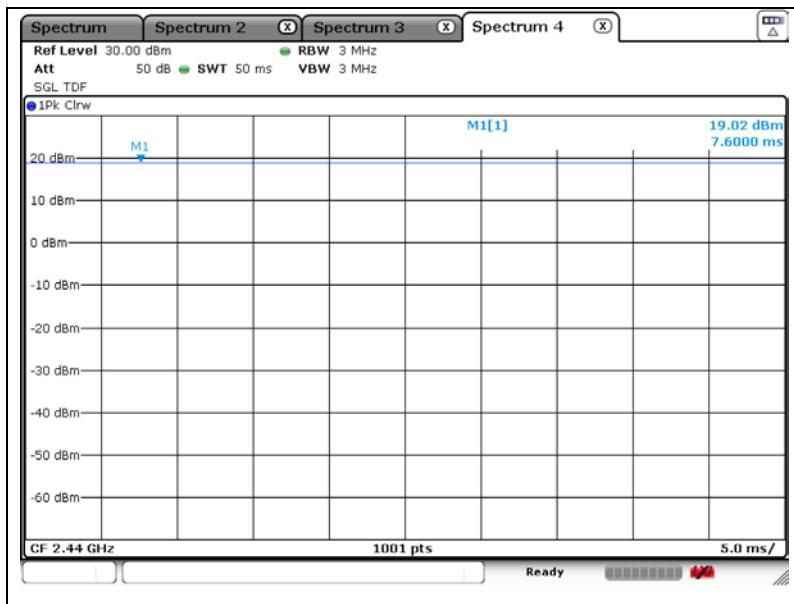
Set RBW  $\geq$  OBW if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$  and the number of sweep points across duration T exceeds 100.

| Duty Cycle (%) | Correction factor (dB) |
|----------------|------------------------|
| 100            | -                      |

### Remark;

1. Duty Cycle (%) =  $(\text{Tx on time} / (\text{Tx on time} + \text{off time})) \times 100$
2. Correction Factor (dB) =  $10 \log (1 / \text{Duty Cycle})$

### - Test plots

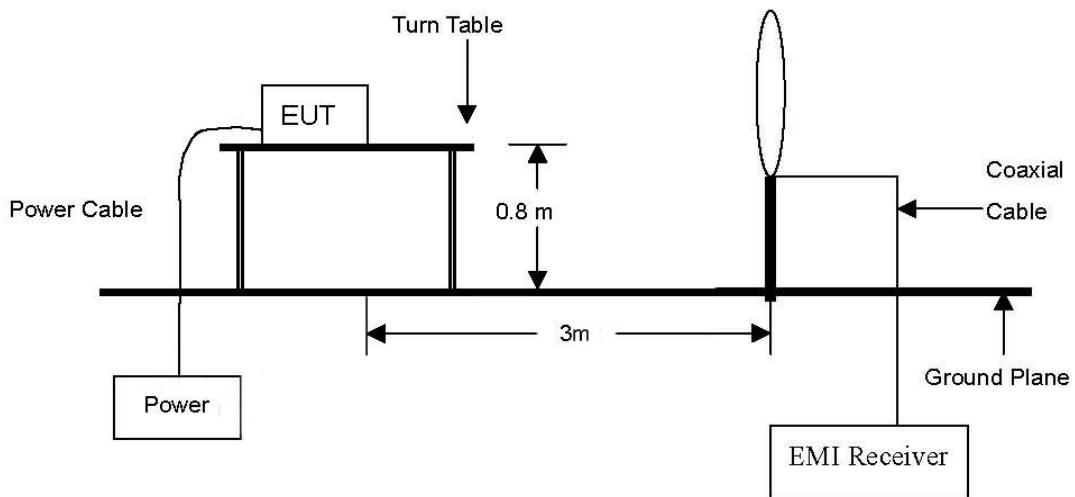


## 2. Transmitter Radiated Spurious Emissions and Conducted Spurious Emissions

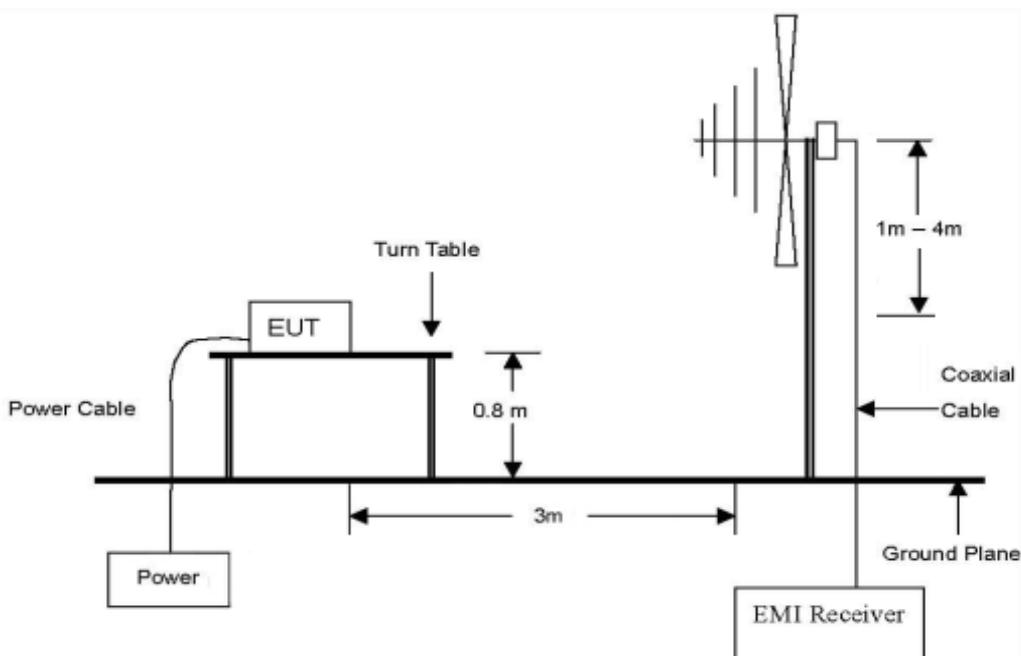
### 2.1. Test Setup

#### 2.1.1. Transmitter Radiated Spurious Emissions

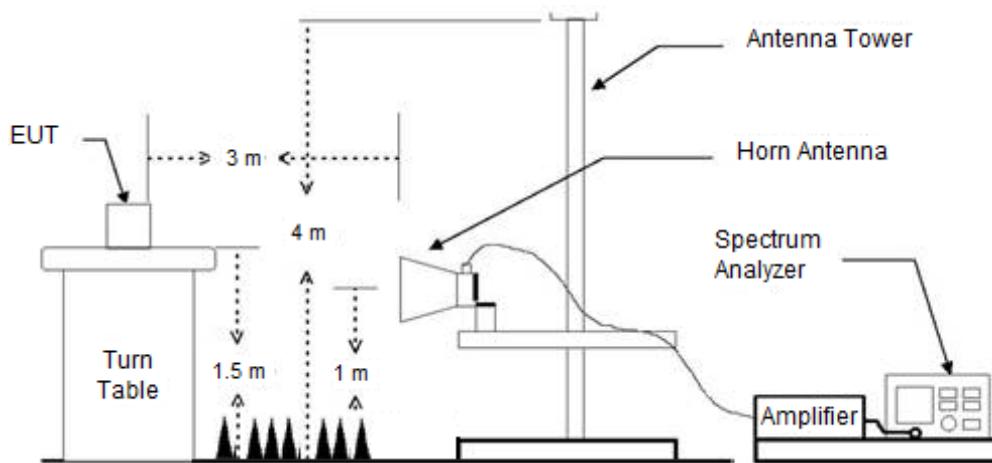
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



### 2.1.2. Conducted Spurious Emissions



## 2.2. Limit

### 2.2.1. FCC

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

According to §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 ( $\mu$ V/m) | Measurement Distance (Meters) |
|-----------------|-----------------------------|-------------------------------|
| 0.009-0.490     | $2\ 400/F(\text{kHz})$      | 300                           |
| 0.490-1.705     | $24\ 000/F(\text{kHz})$     | 30                            |
| 1.705-30.0      | 30                          | 30                            |
| 30-88           | 100**                       | 3                             |
| 88-216          | 150**                       | 3                             |
| 216-960         | 200**                       | 3                             |
| Above 960       | 500                         | 3                             |

\*\* Except as provided in paragraph (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 or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

### 2.2.2. IC

According to RSS-247 Issue 3, 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen Issue 5, 8.9, except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

**Table 5 – General Field Strength Limits at frequencies above 30 MHz**

| Frequency (MHz) | Field Strength ( $\mu$ N/m at 3 m) |
|-----------------|------------------------------------|
| 30-88           | 100                                |
| 88-216          | 150                                |
| 216-960         | 200                                |
| Above 960       | 500                                |

**Table 6 – General Field Strength Limits at frequencies below 30 MHz**

| Frequency              | Magnetic Field Strength (H-Field) ( $\mu$ A/m) | Measurement Distance (meters) |
|------------------------|--|-------------------------------|
| 9-490 kHz <sup>1</sup> | 6.37/F (F in kHz)                              | 300                           |
| 490-1 705 kHz          | 63.7/F (F in kHz)                              | 30                            |
| 1.705-30 MHz           | 0.08   | 30                            |

**Note<sup>1</sup>:** The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 11.11 & 11.12 of ANSI C63.10-2013.

### 2.3.1. Test Procedures for emission below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
4. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum Hold Mode.

### 2.3.2. Test Procedures for emission from above 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site below 1 GHz and 1.5 meters above the ground at a 3 meter anechoic chamber test site above 1 GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a bi-log antenna, a horn antenna and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. For measurements below 1 GHz resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.
6. For measurements Above 1 GHz resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements.

### 2.3.3. Test Procedures for Radiated Spurious Emissions

#### 1. Unwanted Emissions into Non-Restricted Frequency Bands

- The Reference Level Measurement refer to section 11.11.2

Set analyzer center frequency to DTS channel center frequency, SPAN  $\geq$  1.5 times the DTS bandwidth, the RBW = 100 kHz and VBW  $\geq$  3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold.

- Unwanted Emissions Level Measurement refer to section 11.11.3

Set the center frequency and span to encompass frequency range to be measured, the RBW = 100 kHz and VBW  $\geq$  3 x RBW, Detector = Peak, Sweep time = Auto couple, Trace = Max hold.

#### 2. Unwanted Emissions into Restricted Frequency Bands

- Peak Power measurement procedure refer to section 11.12.2.4

Set RBW = as specified in Table 9, VBW  $\geq$  3 x RBW, Detector = Peak, Sweep time = auto, Trace = Max hold.

**Table 9 – RBW as a function of frequency**

| Frequency           | RBW                |
|---------------------|--------------------|
| 9 kHz to 150 kHz    | 200 Hz to 300 Hz   |
| 0.15 MHz to 30 MHz  | 9 kHz to 10 kHz    |
| 30 MHz to 1 000 MHz | 100 kHz to 120 kHz |
| > 1 000 MHz         | 1 MHz              |

If the peak – detected amplitude can be shown to comply with the average limit, then it is not necessary to perform a separate average measurement.

- Average Power measurements procedure refer to section 11.12.2.5.2

The EUT shall be configured to operate at the maximum achievable duty cycle.

Measure the duty cycle D of the transmitter output signal as described in section 11.6.

Set RBW = 1 MHz, VBW  $\geq$  3 x RBW, Detector = RMS, if span / (# of points in sweep)  $\leq$  (RBW/2).

Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied then the detector mode shall be set to peak.

Averaging type = power (i.e., RMS).

As an alternative the detector and averaging type may be set for linear voltage averaging.

Some instruments require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used. Sweep time = auto, Perform a trace average of at least 100 traces.

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

- 1) If power averaging (rms) mode was used in step f), then the applicable correction factor is  $[10 \log (1 / D)]$ , where D is the duty cycle.
- 2) If a specific emission is demonstrated to be continuous ( $D \geq 98\%$ ) rather than turning ON and OFF with the transmit cycle, then no duty cycled correction is required for that emission.

#### 3. Definition of DUT Axis.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z described in the test setup photo. All radiated testing of EUT was performed with worst case asix.

### **2.3.4. Test Procedures for Conducted Spurious Emissions**

Per the guidance of ANSI C63.10-2013, section 11.11.1 & 11.11.2 & 11.11.3, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100  $\text{kHz}$ . This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 20 dB below the fundamental emission level measured in a 100  $\text{kHz}$  bandwidth.

#### **1. Conducted Emissions at Band Edge**

- The Measurement refer to section 11.11.3

Set the center frequency and span to encompass frequency range to be measured, the RBW = 100  $\text{kHz}$  and  $\text{VBW} \geq 3 \times \text{RBW}$ , Detector = Peak, Sweep time = Auto couple, Trace mode = Max hold, The trace was allowed to stabilize.

#### **2. Conducted Spurious Emissions**

- The Measurement refer to section 11.11.3

Start frequency was set to 9  $\text{kHz}$  and stop frequency was set to 25  $\text{GHz}$  (separated into two plots per channel), RBW = 1  $\text{MHz}$ ,  $\text{VBW} \geq 3 \times \text{RBW}$ , Detector = Peak, Sweep time = Auto couple, Trace = Max hold, The trace was allowed to stabilize.

#### **3. TDF function**

- For plots showing conducted spurious emissions from 9  $\text{kHz}$  to 25  $\text{GHz}$ , all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.  
So, the reading values shown in plots were final result.

## 2.4. Test Results

Ambient temperature :  $(23 \pm 1)^\circ\text{C}$   
Relative humidity : 47 % R.H.

### 2.4.1. Radiated Spurious Emissions below 1 000 MHz

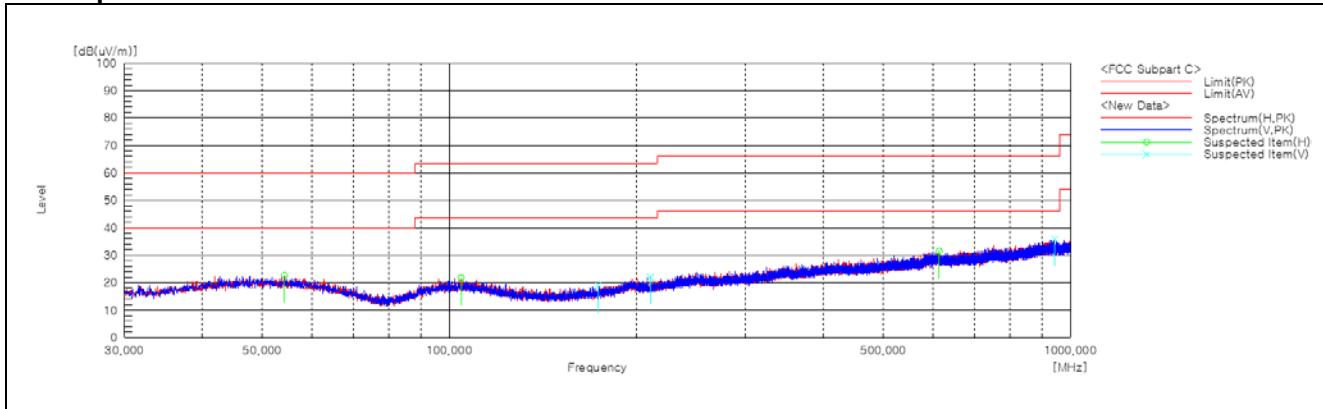
The frequency spectrum from 9 kHz to 1 000 MHz was investigated. All reading values are peak values.

| Radiated Emissions |                      |             | Ant  | Correction Factors |               | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|---------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP + CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| 54.25              | 30.60                | Peak        | H    | 19.35              | -27.26        | 22.69                 | 40.00                | 17.31       |
| 615.03             | 31.90                | Peak        | H    | 25.20              | -25.62        | 31.48                 | 46.00                | 14.52       |
| 943.82             | 32.20                | Peak        | V    | 28.00              | -24.38        | 35.82                 | 46.00                | 10.18       |

#### Remark;

1. Spurious emissions for all channels were investigated and almost the same below 1 GHz.
2. Test from 30 MHz to 1 000 MHz was performed using the software of EP5RE(V5.3.70) from TOYO.
3. Reported spurious emissions are in **Channel 12** as worst case among other channels.
4. Radiated spurious emission measurement as below.  
(Actual = Reading + AF + AMP + CL)
5. According to §15.31(o), emission levels are not report much lower than the limits by over 20 dB.

#### - Test plot



#### 2.4.2. Radiated Spurious Emissions above 1 000 MHz

The frequency spectrum above 1 000 MHz was investigated. All reading values are peak and average values.

Channel 11(2 405 MHz)

| Radiated Emissions |                      |             | Ant. | Correction Factors |         | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *2 310.00          | 25.70                | Peak        | V    | 28.04              | 5.99    | 59.73                 | 74.00                | 14.27       |
| *2 310.00          | 12.12                | Average     | V    | 28.04              | 5.99    | 46.15                 | 54.00                | 7.85        |
| *2 389.54          | 27.46                | Peak        | V    | 28.28              | 6.20    | 61.94                 | 74.00                | 12.06       |
| *2 389.10          | 15.16                | Average     | V    | 28.28              | 6.20    | 49.64                 | 54.00                | 4.36        |
| *2 390.00          | 26.97                | Peak        | V    | 28.28              | 6.20    | 61.45                 | 74.00                | 12.55       |
| *2 390.00          | 14.60                | Average     | V    | 28.28              | 6.20    | 49.08                 | 54.00                | 4.92        |

| Radiated Emissions |                      |             | Ant. | Correction Factors |             | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *4 808.96          | 55.21                | Peak        | V    | 32.74              | -35.85      | 52.10                 | 74.00                | 21.90       |
| 7 216.78           | 48.88                | Peak        | H    | 36.13              | -33.94      | 51.07                 | 74.00                | 22.93       |
| 9 622.22           | 46.58                | Peak        | H    | 37.60              | -31.95      | 52.23                 | 74.00                | 21.77       |
| Above 9 700.00     | Not detected         | -           | -    | -                  | -           | -                     | -                    | -           |

Channel 12(2 410 MHz)

| Radiated Emissions |                      |             | Ant. | Correction Factors |         | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *2 310.00          | 27.24                | Peak        | V    | 28.04              | 5.99    | 61.27                 | 74.00                | 12.73       |
| *2 310.00          | 13.69                | Average     | V    | 28.04              | 5.99    | 47.72                 | 54.00                | 6.28        |
| *2 346.53          | 31.44                | Peak        | V    | 28.19              | 6.39    | 66.02                 | 74.00                | 7.98        |
| *2 378.39          | 16.62                | Average     | V    | 28.26              | 6.18    | <u>51.06</u>          | 54.00                | 2.94        |
| *2 390.00          | 28.99                | Peak        | V    | 28.28              | 6.20    | 63.47                 | 74.00                | 10.53       |
| *2 390.00          | 14.65                | Average     | V    | 28.28              | 6.20    | 49.13                 | 54.00                | 4.87        |

| Radiated Emissions |                      |             | Ant. | Correction Factors |             | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *4 819.26          | 50.55                | Peak        | V    | 32.78              | -35.82      | 47.51                 | 74.00                | 26.49       |
| 7 228.66           | 53.50                | Peak        | H    | 36.16              | -33.80      | 55.86                 | 74.00                | 18.14       |
| 9 642.16           | 48.72                | Peak        | H    | 37.60              | -32.14      | 54.18                 | 74.00                | 19.82       |
| Above 9 700.00     | Not detected         | -           | -    | -                  | -           | -                     | -                    | -           |

Channel 18(2 440 MHz)

| Radiated Emissions |                      |             | Ant. | Correction Factors |             | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *4 881.24          | 51.83                | Peak        | V    | 33.09              | -35.10      | 49.82                 | 74.00                | 24.18       |
| *7 318.68          | 48.87                | Peak        | H    | 36.14              | -34.60      | 50.41                 | 74.00                | 23.59       |
| 9 762.54           | 47.77                | Peak        | H    | 37.65              | -32.12      | 53.30                 | 74.00                | 20.70       |
| Above 9 800.00     | Not detected         | -           | -    | -                  | -           | -                     | -                    | -           |

Channel 25(2 475 MHz)

| Radiated Emissions |                      |             | Ant. | Correction Factors |         | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *2 483.50          | 26.60                | Peak        | V    | 28.27              | 6.40    | 61.27                 | 74.00                | 12.73       |
| *2 483.50          | 15.84                | Average     | V    | 28.27              | 6.40    | 50.51                 | 54.00                | 3.49        |
| *2 483.60          | 27.78                | Peak        | V    | 28.27              | 6.40    | 62.45                 | 74.00                | 11.55       |
| *2 483.80          | 15.78                | Average     | V    | 28.27              | 6.40    | 50.45                 | 54.00                | 3.55        |
| *2 500.00          | 21.21                | Peak        | V    | 28.30              | 6.19    | 55.70                 | 74.00                | 18.30       |
| *2 500.00          | 9.44                 | Average     | V    | 28.30              | 6.19    | 43.93                 | 54.00                | 10.07       |

| Radiated Emissions |                      |             | Ant. | Correction Factors |             | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *4 949.06          | 52.78                | Peak        | V    | 33.20              | -35.77      | 50.21                 | 74.00                | 23.79       |
| *7 423.78          | 43.46                | Peak        | H    | 36.20              | -33.95      | 45.71                 | 74.00                | 28.29       |
| 9 902.24           | 48.87                | Peak        | H    | 37.60              | -32.12      | 54.35                 | 74.00                | 19.65       |
| Above 10 000.00    | Not detected         | -           | -    | -                  | -           | -                     | -                    | -           |

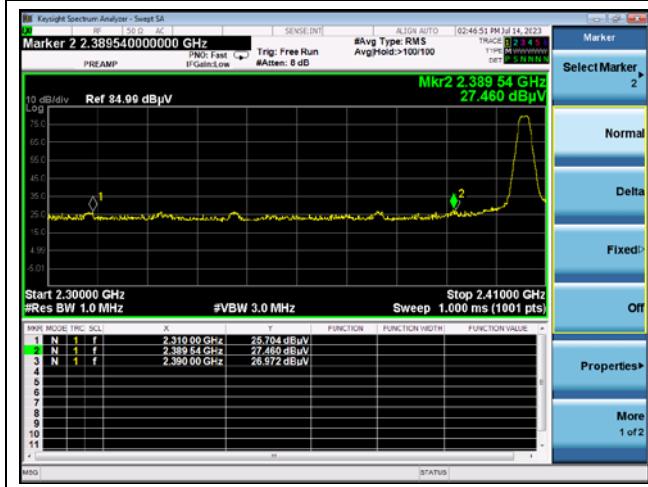
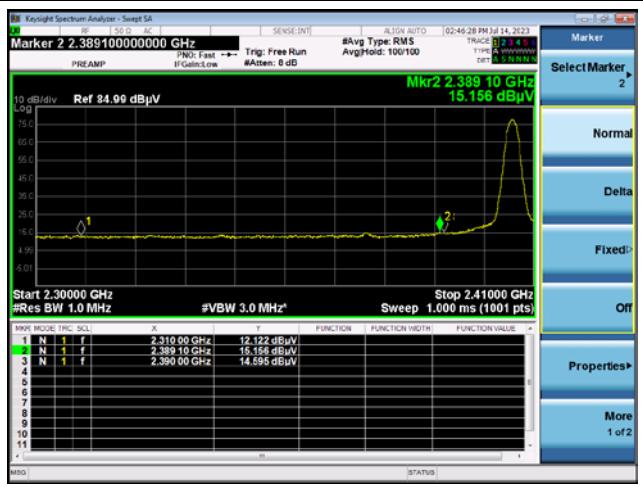
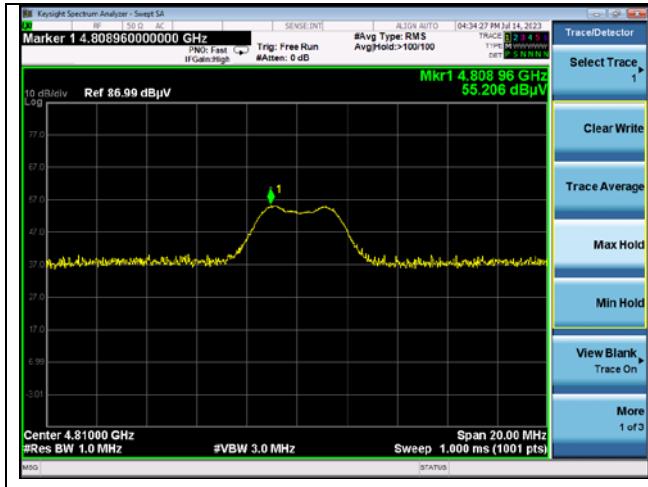
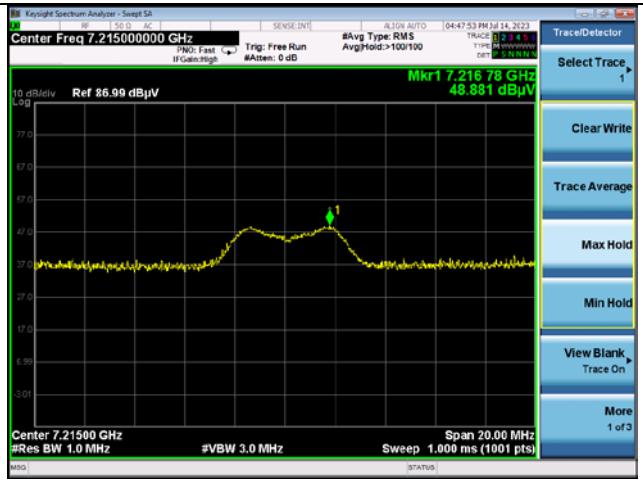
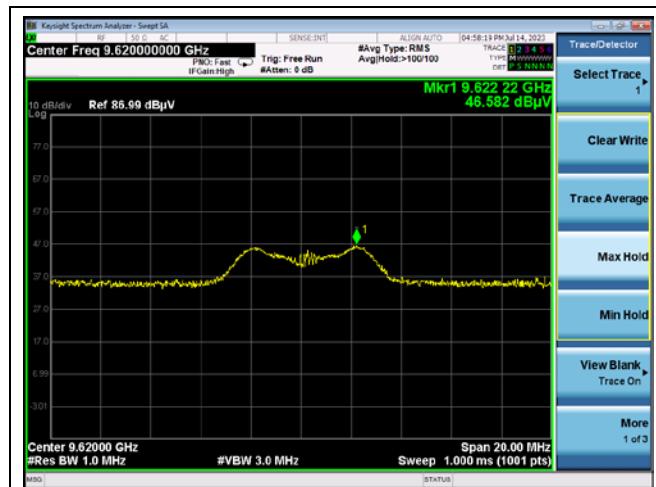
Channel 26(2 480 MHz)

| Radiated Emissions |                      |             | Ant. | Correction Factors |         | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|---------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *2 483.50          | 26.29                | Peak        | V    | 28.27              | 6.40    | 60.96                 | 74.00                | 13.04       |
| *2 483.50          | 16.20                | Average     | V    | 28.27              | 6.40    | 50.87                 | 54.00                | 3.13        |
| *2 485.19          | 25.53                | Peak        | V    | 28.27              | 6.38    | 60.18                 | 74.00                | 13.82       |
| *2 483.58          | 15.93                | Average     | V    | 28.27              | 6.40    | 50.60                 | 54.00                | 3.40        |
| *2 500.00          | 22.69                | Peak        | V    | 28.30              | 6.19    | 57.18                 | 74.00                | 16.82       |
| *2 500.00          | 12.46                | Average     | V    | 28.30              | 6.19    | 46.95                 | 54.00                | 7.05        |

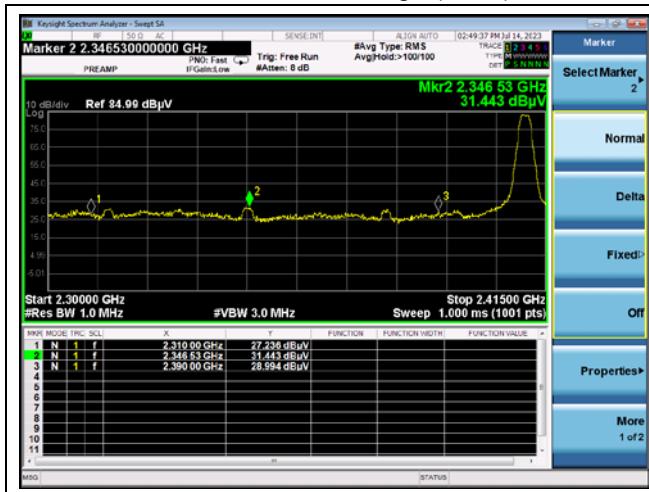
| Radiated Emissions |                      |             | Ant. | Correction Factors |             | Total                 | Limit                |             |
|--------------------|----------------------|-------------|------|--------------------|-------------|-----------------------|----------------------|-------------|
| Frequency (MHz)    | Reading (dB $\mu$ V) | Detect Mode | Pol. | AF (dB/m)          | AMP+CL (dB) | Actual (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
| *4 961.14          | 53.20                | Peak        | V    | 33.20              | -35.53      | 50.87                 | 74.00                | 23.13       |
| *7 441.92          | 42.31                | Peak        | H    | 36.20              | -34.12      | 44.39                 | 74.00                | 29.61       |
| 9 918.06           | 44.28                | Peak        | H    | 37.60              | -31.80      | 50.08                 | 74.00                | 23.92       |
| Above 10 000.00    | Not detected         | -           | -    | -                  | -           | -                     | -                    | -           |

**Remarks:**

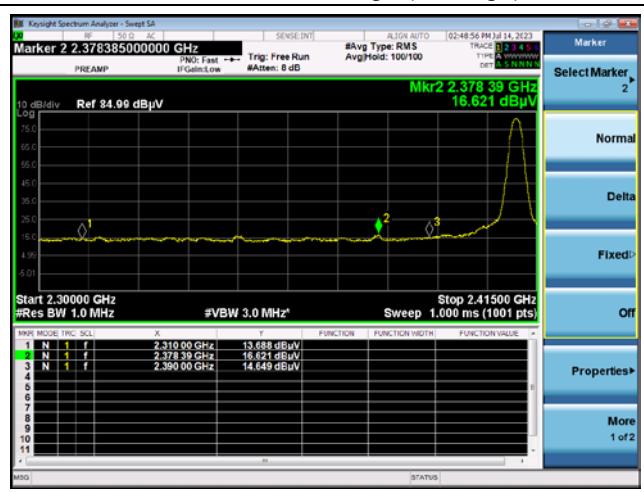
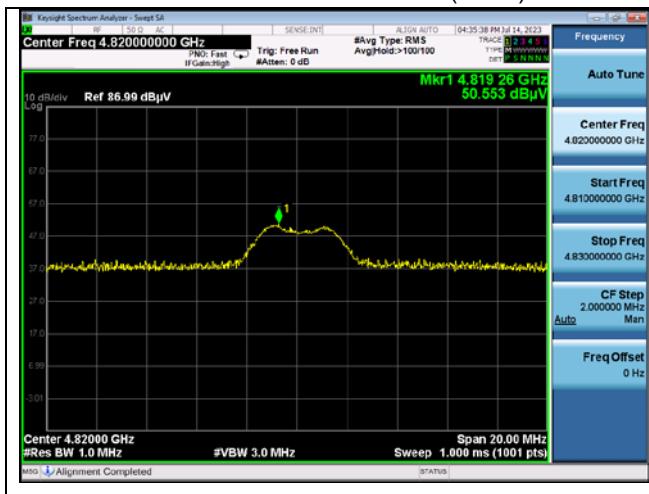
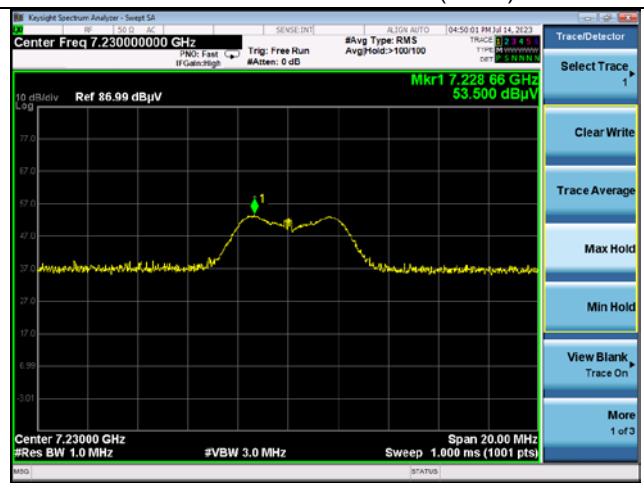
- “\*” means the restricted band.
- Measuring frequencies from 1 GHz to the 10<sup>th</sup> harmonic of highest fundamental frequency.
- Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
- Actual = Reading + AF + CL or Reading + AF + AMP + CL.
- According to § 15.31(o), emission levels are not reported much lower than the limits by over 20 dB.
- The maximized peak measured value complies with the average limit, to perform an average measurement is unnecessary.
- AF = Antenna Factor, CL = Cable Loss.

**- Test plots**
**Channel 11 band edge (Peak)**

**Channel 11 band edge (Average)**

**Channel 11 2<sup>nd</sup> Harmonic (Peak)**

**Channel 11 3<sup>rd</sup> Harmonic (Peak)**

**Channel 11 4<sup>th</sup> Harmonic (Peak)**


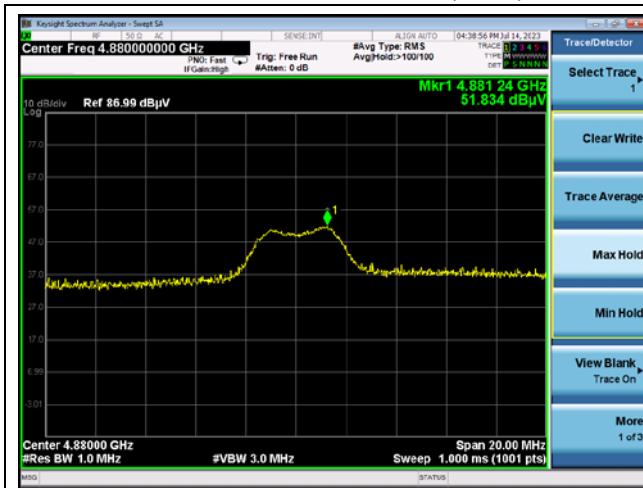
Channel 12 band edge (Peak)



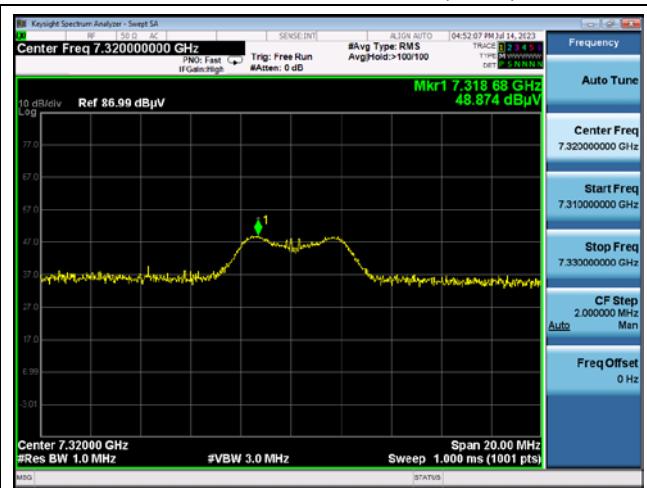
Channel 12 band edge (Average)


 Channel 12 2<sup>nd</sup> Harmonic (Peak)

 Channel 12 3<sup>rd</sup> Harmonic (Peak)

 Channel 12 4<sup>th</sup> Harmonic (Peak)

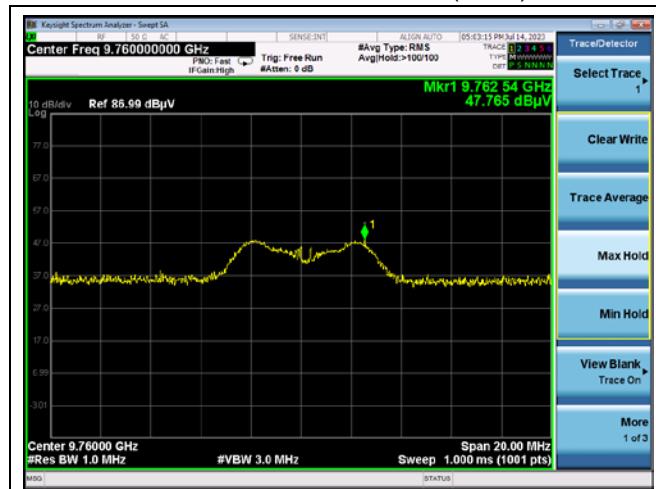

Channel 18 2<sup>nd</sup> Harmonic (Peak)



Channel 18 3<sup>rd</sup> Harmonic (Peak)



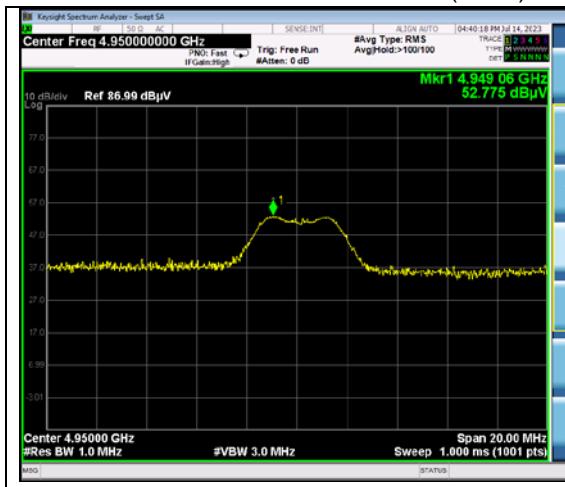
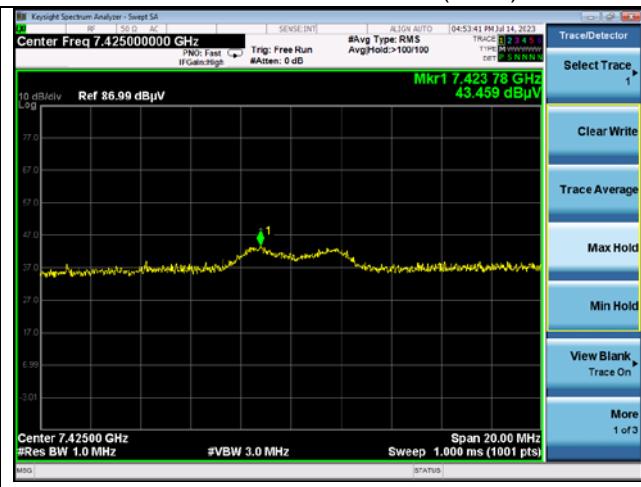
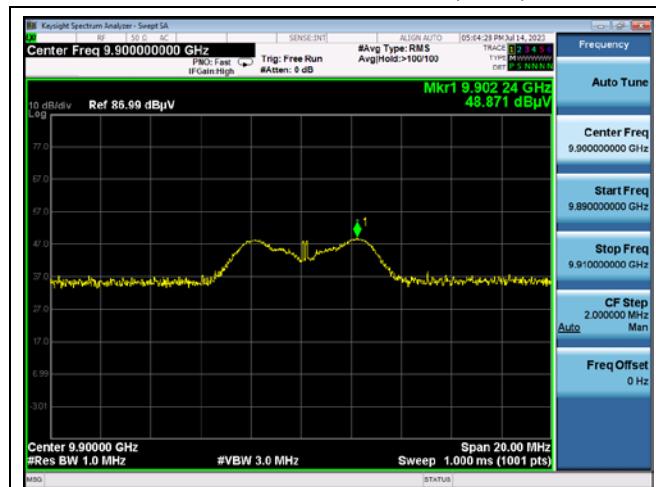
Channel 18 4<sup>th</sup> Harmonic (Peak)



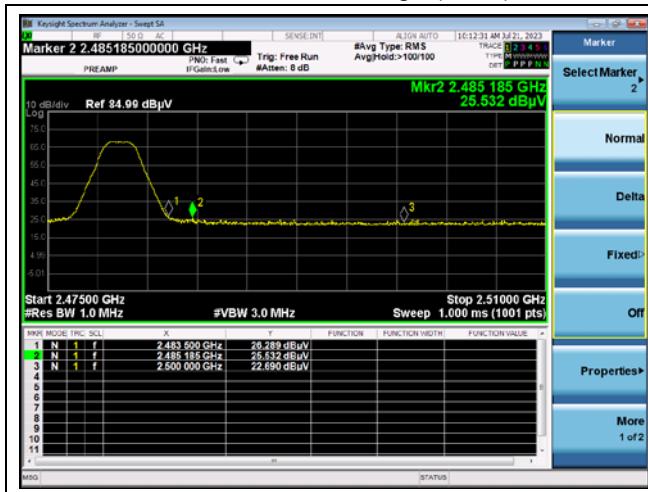
Channel 25 band edge (Peak)



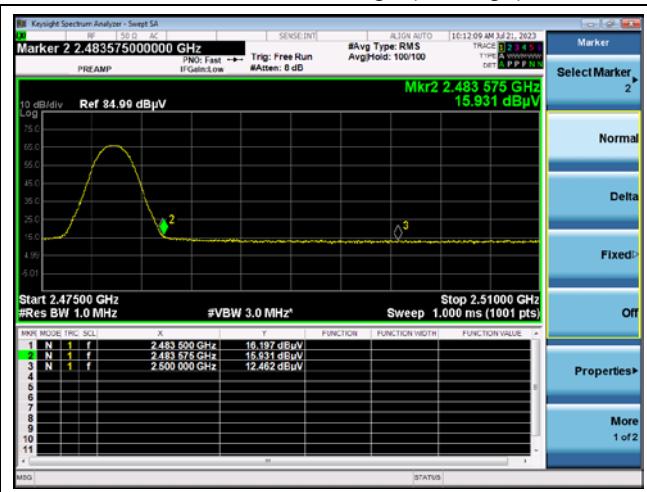
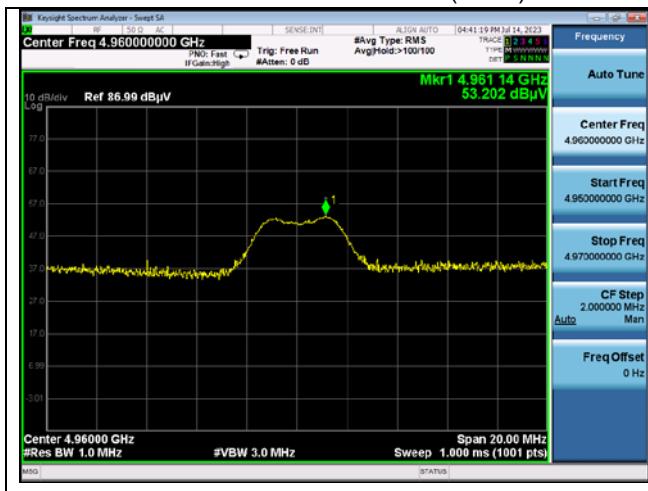
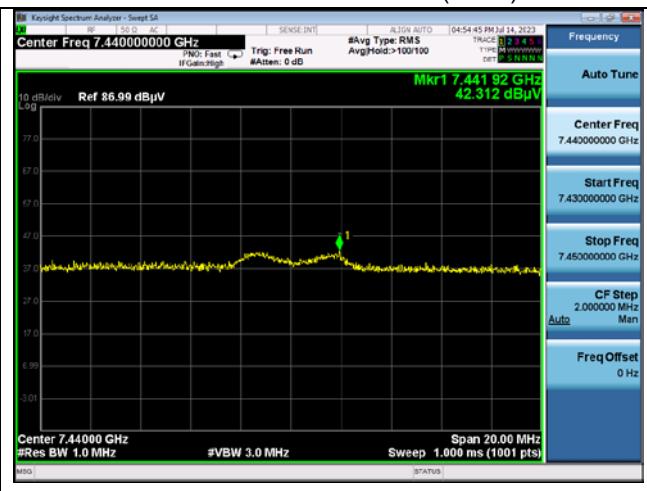
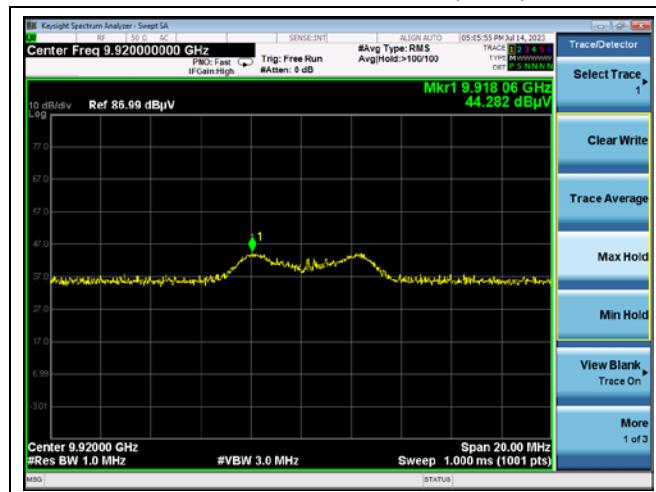
Channel 25 band edge (Average)


 Channel 25 2<sup>nd</sup> Harmonic (Peak)

 Channel 25 3<sup>rd</sup> Harmonic (Peak)

 Channel 25 4<sup>th</sup> Harmonic (Peak)


Channel 26 band edge (Peak)

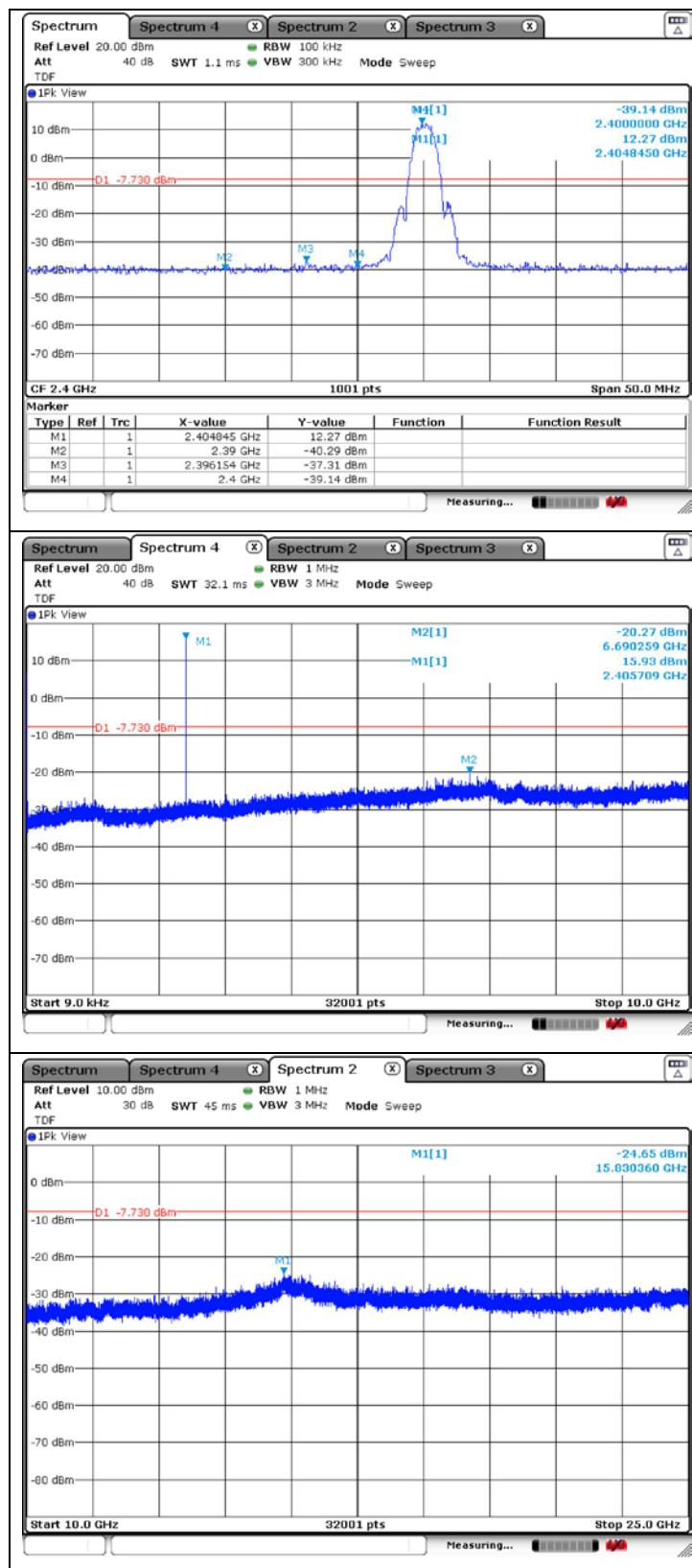


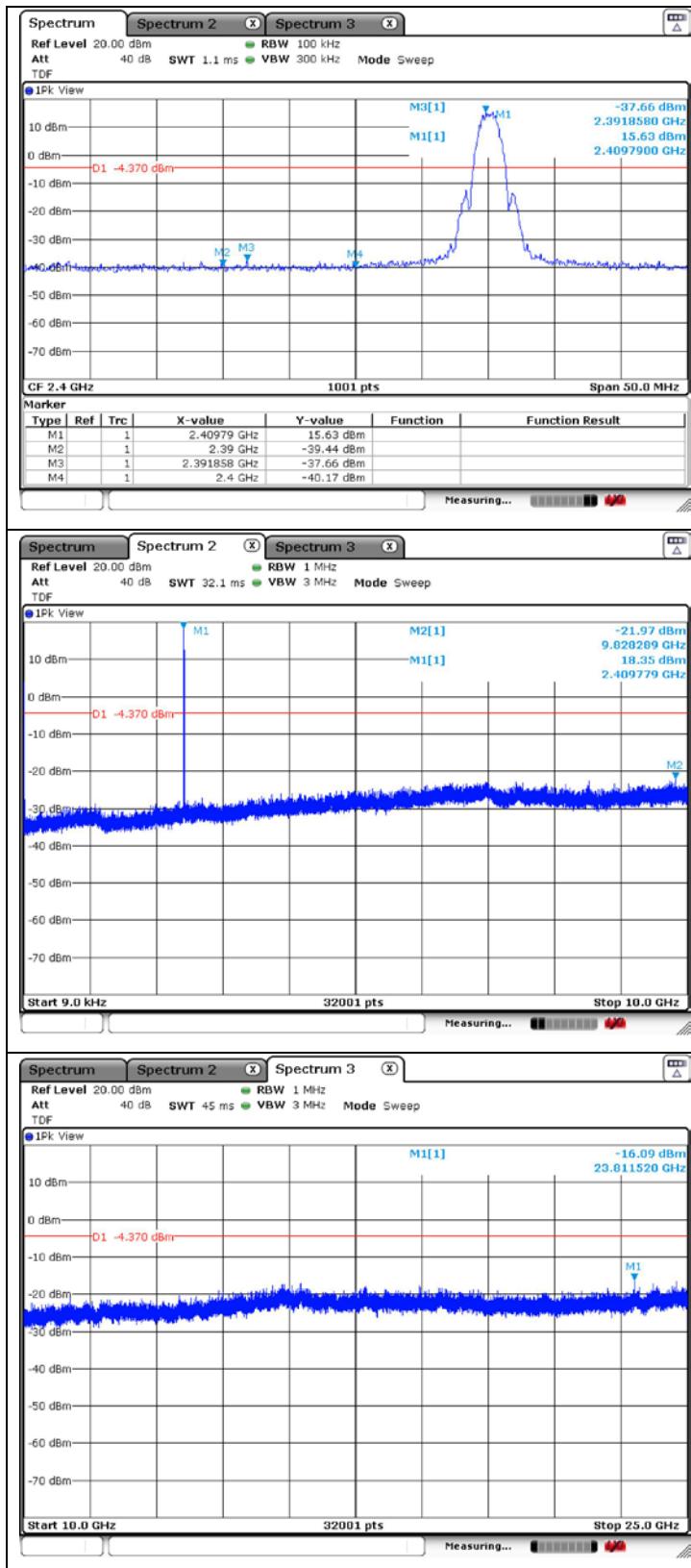
Channel 26 band edge (Average)


 Channel 26 2<sup>nd</sup> Harmonic (Peak)

 Channel 26 3<sup>rd</sup> Harmonic (Peak)

 Channel 26 4<sup>th</sup> Harmonic (Peak)


### 2.4.3. Plot of Conducted Spurious Emissions

#### Channel 11



**Channel 12**

**Channel 18**