

# TEST REPORT

OF

FCC Part 15 Subpart C §15.209, §15.231  
IC RSS-210 Issue 9, RSS-Gen Issue 4

FCC ID : TQ8-RKE-4F37  
IC Certification : 5074A-RKE4F37

Equipment Under Test : Remote Keyless Entry  
Model Name : RKE-4F37  
Applicant : Hyundai Mobis Co., Ltd.  
Manufacturer : SeoyonElectornics Co., Ltd.  
Date of Receipt : 2017.05.19  
Date of Test(s) : 2017.05.31 ~ 2017.06.30  
Date of Issue : 2017.06.30

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Brant Jang

Date:

2017.06.30

Technical  
Manager:



Hyunchae You

Date:

2017.06.30

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A4(210 mm x 297 mm)

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## 1. General Information

### 1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx>.

Telephone : +82 31 688 0901

FAX : +82 31 688 0921

### 1.2. Details of applicant

Applicant : Hyundai Mobis Co., Ltd.

Address : 203, Teheran-ro, Gangnam-gu, Seoul, Republic of Korea

Contact Person : Choi, Seung-Hoon

Phone No. : +82 31 260 0098

### 1.3. Description of EUT

|                   |                                    |
|-------------------|------------------------------------|
| Kind of Product   | Remote Keyless Entry               |
| Model Name        | RKE-4F37                           |
| Power Supply      | DC 3.0 V (Lithium type of battery) |
| Frequency Range   | Tx: 433.92 MHz                     |
| Modulation Type   | FSK                                |
| Number of Channel | 1                                  |
| Antenna Type      | PCB Antenna                        |

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## 1.4. Test Equipment List

| Equipment                | Manufacturer                | Model                                | S/N                    | Cal. Date     | Cal. Interval | Cal. Due      |
|--------------------------|-----------------------------|--------------------------------------|------------------------|---------------|---------------|---------------|
| Signal Generator         | R&S                         | SMBV100A                             | 255834                 | Jun. 15, 2017 | Annual        | Jun. 15, 2018 |
| Spectrum Analyzer        | Agilent                     | N9020A                               | MY53421758             | Sep. 23, 2016 | Annual        | Sep. 23, 2017 |
| Spectrum Analyzer        | R&S                         | FSV30                                | 103454                 | Dec. 01, 2016 | Annual        | Dec. 01, 2017 |
| Test Receiver            | R&S                         | ESU26                                | 100109                 | Feb. 17, 2017 | Annual        | Feb. 17, 2018 |
| DC Power Supply          | Agilent                     | U8002A                               | MY50060028             | Mar. 16, 2017 | Annual        | Mar. 16, 2018 |
| Preamplifier             | H.P.                        | 8447F                                | 2944A03909             | Aug. 11, 2016 | Annual        | Aug. 11, 2017 |
| Preamplifier             | R&S                         | SCU-18                               | 10117                  | Apr. 08, 2017 | Annual        | Apr. 08, 2018 |
| High Pass Filter         | Wainwright Instrument GmbH  | WHKX10-900-1000-18 000-40SS          | 7                      | Mar. 30, 2017 | Annual        | Mar. 30, 2018 |
| Loop Antenna             | Schwarzbeck Mess-Elektronik | FMZB 1519                            | 1519-0399              | Aug. 19, 2015 | Biennial      | Aug. 19, 2017 |
| Trilog Broadband Antenna | Schwarzbeck Mess-Elektronik | VULB9163                             | 437                    | Oct. 18, 2016 | Biennial      | Oct. 18, 2018 |
| Horn Antenna             | R&S                         | HF906                                | 100326                 | Feb. 01, 2016 | Biennial      | Feb. 01, 2018 |
| Controller               | Innco systems GmbH          | CONTROLLER CO3000-4P                 | CO3000/963/3 8330516/L | N.C.R.        | N/A           | N.C.R.        |
| Turn Table               | Innco systems GmbH          | DS 1200 S                            | N/A                    | N.C.R.        | N/A           | N.C.R.        |
| Antenna Mast             | Innco systems GmbH          | MA4640-XP-ET                         | MA4640/536/3 8330516/L | N.C.R.        | N/A           | N.C.R.        |
| Anechoic Chamber         | SY Corporation              | L × W × H<br>(9.6 m × 6.4 m × 6.6 m) | N/A                    | N.C.R.        | N/A           | N.C.R.        |

- The Signal generator was used before calibration due date.

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## 1.5. Summary of Test Results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD       |                                                        |                                                                        |          |
|------------------------|--------------------------------------------------------|------------------------------------------------------------------------|----------|
| Section in FCC Part 15 | Section in RSS-210, RSS-Gen                            | Test Item                                                              | Result   |
| 15.209(a)<br>15.231(b) | RSS-210 Issue 9, A.1, Table A1<br>RSS-Gen Issue 4, 8.9 | Radiated emission, Spurious Emission and Field Strength of Fundamental | Complied |
| 15.231©                | -                                                      | Bandwidth of Operation Frequency                                       | Complied |
| 15.231(a)              | RSS-210 Issue 9, A1.1                                  | Transmission Time                                                      | Complied |
| -                      | RSS-210 Issue 9, A1.3<br>RSS-Gen Issue 4, 6.6          | Occupied Bandwidth                                                     | Complied |

## 1.6. Test Report Revision

| Revision | Report number          | Date of issue | Description                                                       |
|----------|------------------------|---------------|-------------------------------------------------------------------|
| 0        | F690501/RF-RTL011418   | 2017.06.07    | Initial                                                           |
| 1        | F690501/RF-RTL011418-1 | 2017.06.29    | Changed the duty cycle of EUT and retested all of the test items. |

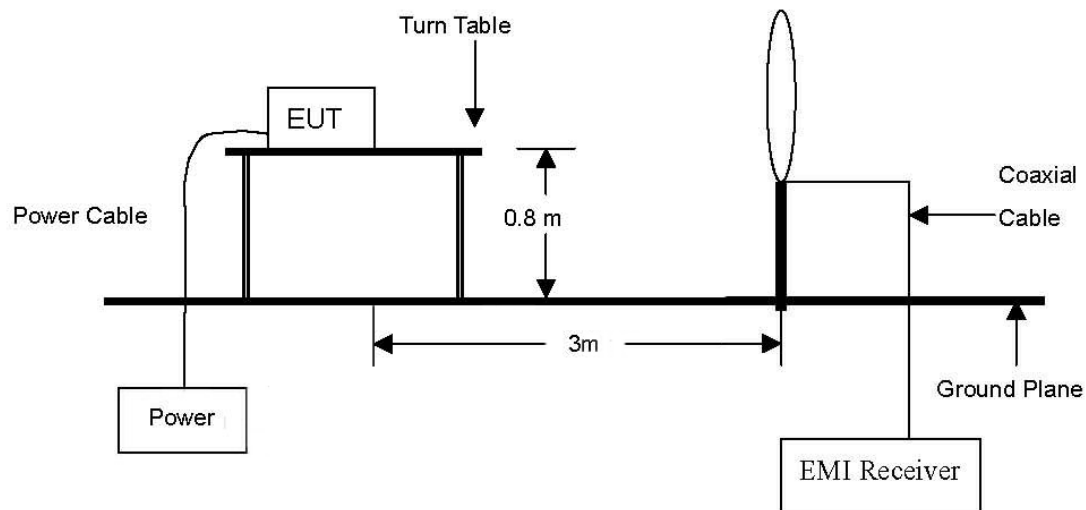
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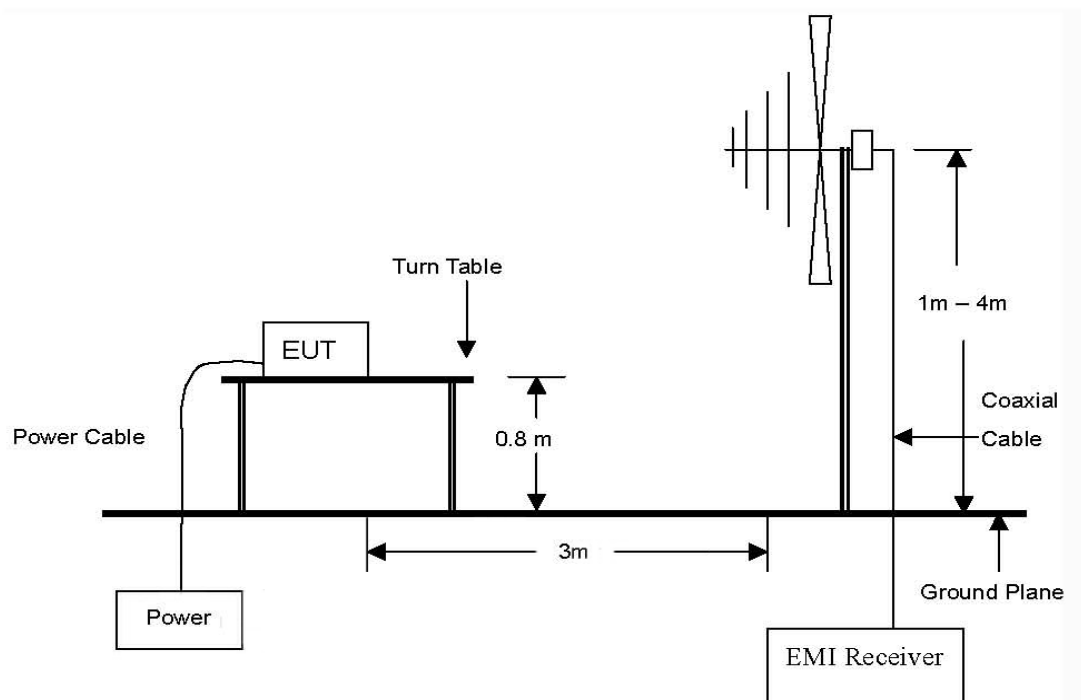
## 2. Field Strength of Fundamental and Spurious Emission

### 2.1. Test Setup

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



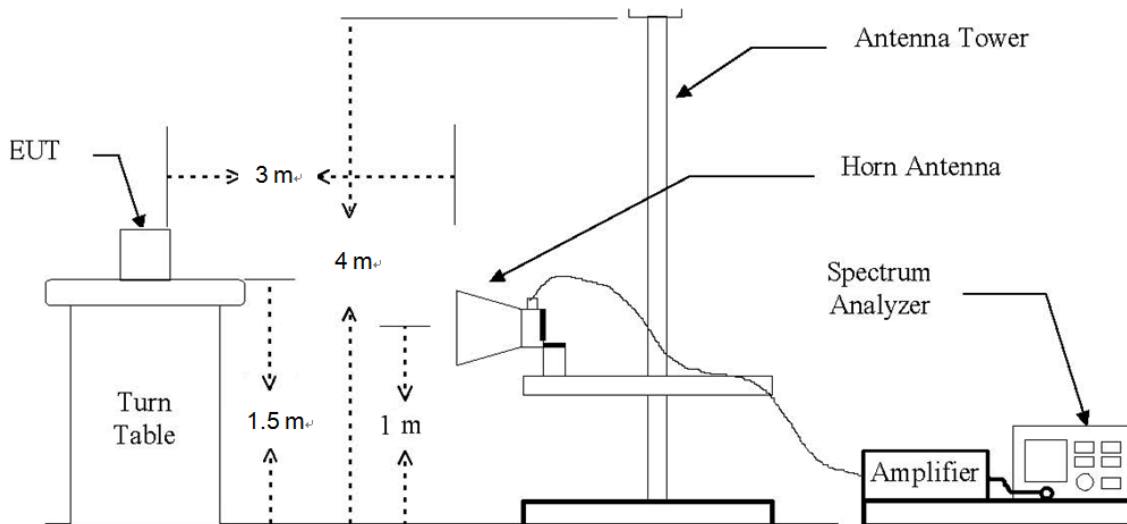
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



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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.



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## 2.2. Limit

### 2.2.1. FCC limits

#### 2.2.1.1. Radiated emission limits; general requirements.

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 (microvolts/meter) | Measurement Distance (meter) |
|-----------------|-----------------------------------|------------------------------|
| 0.009-0.490     | 2 400/F(kHz)                      | 300                          |
| 0.490-1.705     | 24 000/F(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.

#### 2.2.1.2. Periodic operation in the band 40.66-40.70 MHz and above 70 MHz

According to § 15.231(b), in addition to the provisions of Section § 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (microvolts/meter) | Field Strength of Spurious Emissions (microvolts/meter) |
|-----------------------------|--------------------------------------------------|---------------------------------------------------------|
| 40.66-40.70                 | 2,250                                            | 225                                                     |
| 70-130                      | 1,250                                            | 125                                                     |
| 130-174                     | <sup>1</sup> 1,250 to 3,750 **                   | <sup>1</sup> 125 to 375 **                              |
| 174-260                     | 3,750                                            | 375                                                     |
| 260-470                     | <sup>1</sup> 3,750 to 12,500 **                  | <sup>1</sup> 375 to 1,250 **                            |
| Above 470                   | 12,500                                           | 1,250                                                   |

<sup>1</sup>linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz,  $\mu V/m$  at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz,  $\mu V/m$  at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

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## 2.2.2. IC limits

### 2.2.2.1. Transmitter Emission Limits for Licence-Exempt Radio Apparatus

According to RSS-Gen Issue 4, Section 8.9, except when the requirements applicable to a given device state otherwise, the emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

**Table 4- General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz**

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

\* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

**Note:** Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

**Table 5- General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Below 30 MHz**

| Frequency      | Electric Field Strength ( $\mu V/m$ ) | Magnetic Field Strength (H-Field) ( $\mu A/m$ ) | Measurement Distance (metres) |
|----------------|---------------------------------------|-------------------------------------------------|-------------------------------|
| 9-490 kHz      | 2,400/F (F in kHz)                    | 2,400/377F (F in kHz)                           | 300                           |
| 490-1,705 kHz  | 24,000/F (F in kHz)                   | 24,000/377F (F in kHz)                          | 30                            |
| 1,705 - 30 MHz | 30                                    | N/A                                             | 30                            |

**Note:** The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector. Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the relevant RSS.

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### 2.2.2.2. Momentarily Operated Devices

According to A.1 of RSS-210 Issue 9, the frequency bands and field strength limits in tables A1 and A2 of this annex are reserved exclusively for the transmission of a control signal, such as that used with alarm systems, door openers, remote switches, etc. Data may be sent with a control signal. Radio control of toys or model aircraft, as well as continuous transmissions, such as voice or video, are not permitted, except as provided in Section A.1.4 below.

**Table A1— Permissible Field Strength Limits for Momentarily Operated Devices**

| Fundamental Frequency (MHz),<br>Excluding Restricted Frequency<br>Bands Specified in RSS-Gen | Field Strength of the<br>Fundamental Emissions<br>( $\mu\text{V/m}$ at 3 m) |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 70-130                                                                                       | 1,250                                                                       |
| 130-174                                                                                      | 1,250 to 3,750                                                              |
| 174-260 <sup>(Note 1)</sup>                                                                  | 3,750                                                                       |
| 260-470 <sup>(Note 1)</sup>                                                                  | 3,750 to 12,500                                                             |
| Above 470                                                                                    | 12,500                                                                      |

\* Linear interpolation with frequency, f, in MHz:

For 130-174 MHz: Frequency Strength ( $\mu\text{V/m}$ ) =  $(56.82 \times f) - 6136$

For 260-470 MHz: Frequency Strength ( $\mu\text{V/m}$ ) =  $(41.67 \times f) - 7083$

**Note 1:** Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

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## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.10:2013

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

- 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.
- 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

#### Note;

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site.

Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

### 2.3.2. Test Procedures for emission from 30 MHz to 1 000 MHz

- 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.
- 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.
- The antenna is a broadband 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.
- 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

### 2.3.3. Test Procedures for emission above 1 GHz

- The EUT was placed on the top of a rotating table 1.5 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.
- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1 GHz.

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## 2.4. Test Result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

### 2.4.1. Field Strength of Fundamental

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

| Freq. (MHz) | Detector | Ant. Pol. | Reading (dB $\mu$ V) | Antenna Factor (dB) | Cable Loss (dB) | Result (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) |
|-------------|----------|-----------|----------------------|---------------------|-----------------|-----------------------|----------------------|-------------|
| 433.88      | Peak     | H         | 61.30                | 16.06               | 2.95            | 80.31                 | 100.83               | 20.52       |
| 433.88      | Average  | H         | 59.79                | 16.06               | 2.95            | 78.80                 | 80.83                | 2.03        |

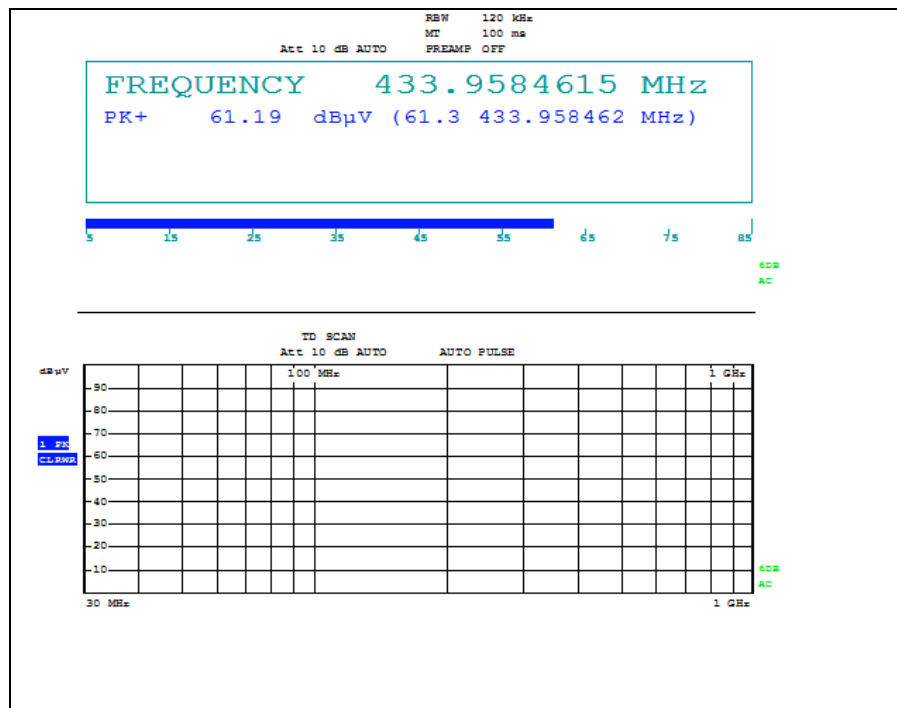
#### Remark:

To get a maximum emission level from the EUT, the EUT was moved throughout the X-axis, Y-axis and Z-axis. Worst case is **X-axis**.

Definition of DUT for three orthogonal planes is described in the test setup photos.

#### Note:

- 3 m Limit (dB $\mu$ V/m) =  $20\log[41.67(F_{MHz}) - 7083] = 80.83$
- Result = Reading + Antenna Factor + Cable Loss
- Average Result = The average result was investigated due to Pulse train over 100 ms.
- Duty Cycle Correction Factor :  $20\log(T_{on} / 100 \text{ ms}) = 20\log(84.06 / 100) = -1.51$   
 -  $T_{on}$  time = 84.06 ms  
 -  $T_{on+off}$  time = 100.00 ms (The EUT has only one burst of transmission.)



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## 2.4.2. Spurious Emission

The following table shows the highest levels of radiated emissions on polarizations of horizontal. The frequency spectrum from 9 kHz to 4 500 MHz was investigated.

| Radiated Emissions |                |             | Ant. | Correction Factors |                    | Total           | Limit          |             |
|--------------------|----------------|-------------|------|--------------------|--------------------|-----------------|----------------|-------------|
| Frequency (MHz)    | Reading (dBμV) | Detect Mode | Pol. | AF (dB/m)          | Amp Gain + CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
| *1 301.70          | 57.79          | Peak        | V    | 24.58              | -32.58             | 49.79           | 74.00          | 24.21       |
| *1 301.70          | 56.28          | Average     | V    | 24.58              | -32.58             | 48.28           | 54.00          | 5.72        |
| 1 735.62           | 57.37          | Peak        | V    | 26.32              | -31.49             | 52.20           | 80.83          | 28.63       |
| 1 735.62           | 55.86          | Average     | V    | 26.32              | -31.49             | 50.69           | 60.83          | 10.14       |
| 2 169.68           | 54.85          | Peak        | V    | 27.92              | -30.75             | 52.02           | 80.83          | 28.81       |
| 2 169.68           | 53.34          | Average     | V    | 27.92              | -30.75             | 50.51           | 60.83          | 10.32       |
| 2 603.23           | 49.72          | Peak        | V    | 28.59              | -29.41             | 48.90           | 80.83          | 31.93       |
| 2 603.23           | 48.21          | Average     | V    | 28.59              | -29.41             | 47.39           | 60.83          | 13.44       |
| 3 037.88           | 48.40          | Peak        | V    | 29.93              | -29.07             | 49.26           | 80.83          | 31.57       |
| 3 037.88           | 46.89          | Average     | V    | 29.93              | -29.07             | 47.75           | 60.83          | 13.08       |
| 3 471.57           | 53.45          | Peak        | V    | 30.98              | -28.56             | 55.87           | 80.83          | 24.96       |
| 3 471.57           | 51.94          | Average     | V    | 30.98              | -28.56             | 54.36           | 60.83          | 6.47        |
| *3 905.62          | 46.08          | Peak        | V    | 31.91              | -28.07             | 49.92           | 74.00          | 24.08       |
| *3 905.62          | 44.57          | Average     | V    | 31.91              | -28.07             | 48.41           | 54.00          | 5.59        |
| *4 339.51          | 50.47          | Peak        | V    | 31.93              | -28.33             | 54.07           | 74.00          | 19.93       |
| *4 339.51          | 48.96          | Average     | V    | 31.93              | -28.33             | 52.56           | 54.00          | 1.44        |
| Above 4 400.00     | Not detected   | -           | -    | -                  | -                  | -               | -              | -           |

### Remark:

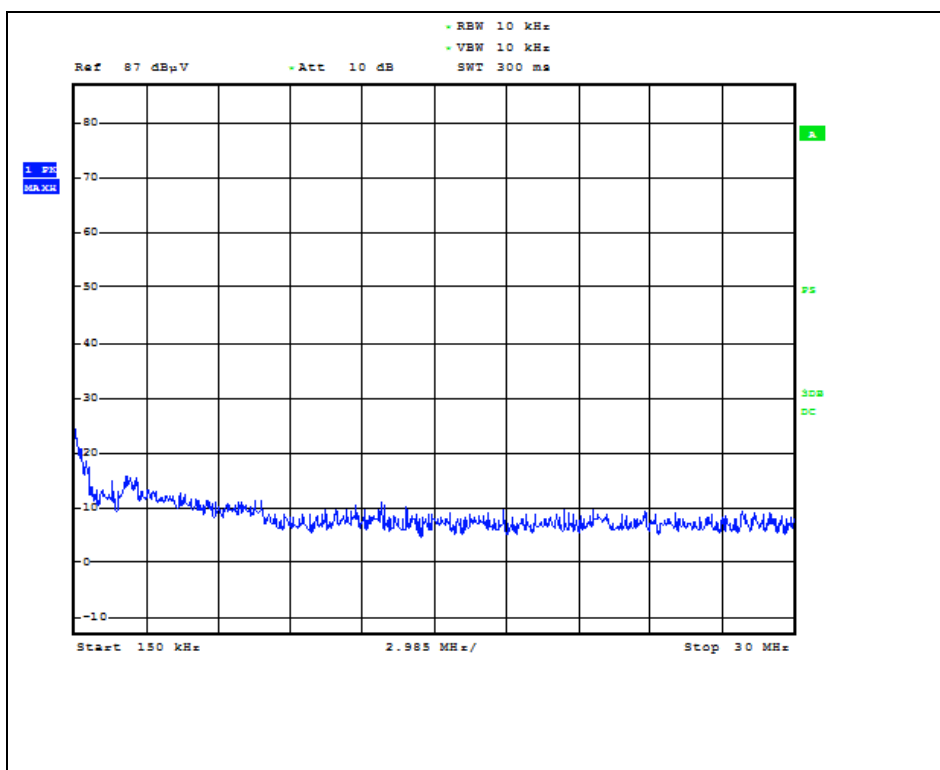
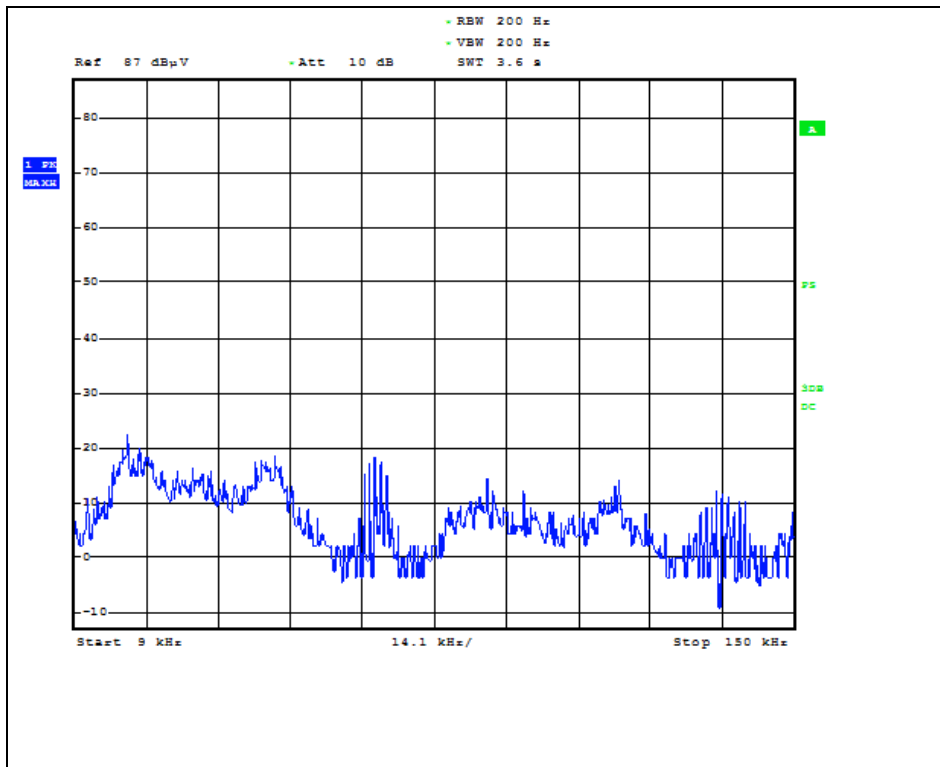
- To get a maximum emission level from the EUT, the EUT was moved throughout the X-axis, Y-axis and Z-axis. Worst Case is **Y-axis**.  
Definition of DUT for three orthogonal planes is described in the test setup photos.
- 3 m Limit (dBμV/m) =  $20\log[41.67(F_{\text{MHz}}) - 7083] - 20$  dBμV/m = 60.83 dBμV/m
- Correction Factors = AF + Amp Gain + CL
- Actual = Reading + AF + Amp Gain + CL
- Average Reading = Peak Reading + Duty Cycle Correction Factor
- Duty Cycle Correction Factor :  $20\log(T_{\text{on}} / 100 \text{ ms}) = 20\log(84.06 / 100) = -1.51$   
-  $T_{\text{on}}$  time = 84.06 ms  
-  $T_{\text{on+off}}$  time = 100.00 ms (The EUT has only one burst of transmission)
- "\*" means the restricted band.
- According to § 15.31(o), Emission levels are not reported much lower than the limits by over 20 dB.

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## The Plots of Spurious Emission

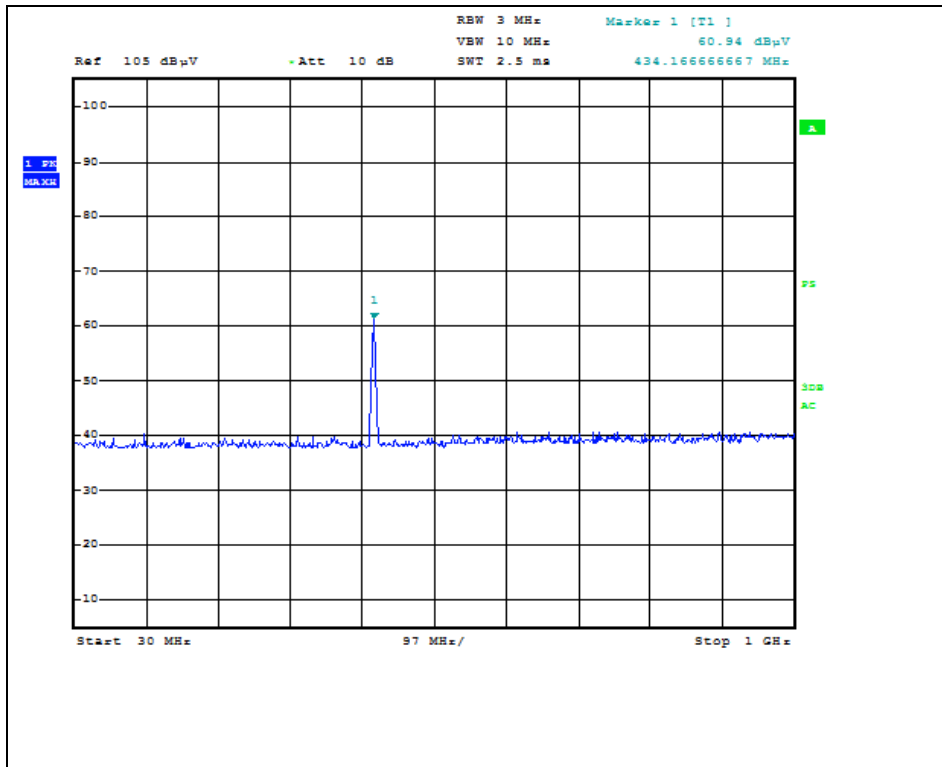
Scanning plots below 30 MHz



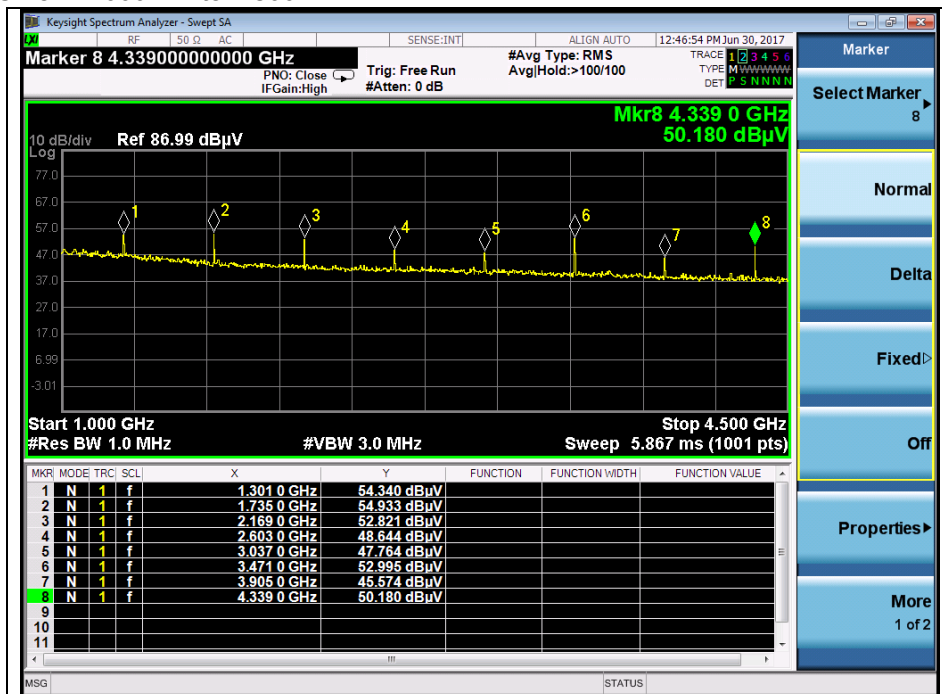
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Scanning plots from 30 MHz to 1 000 MHz



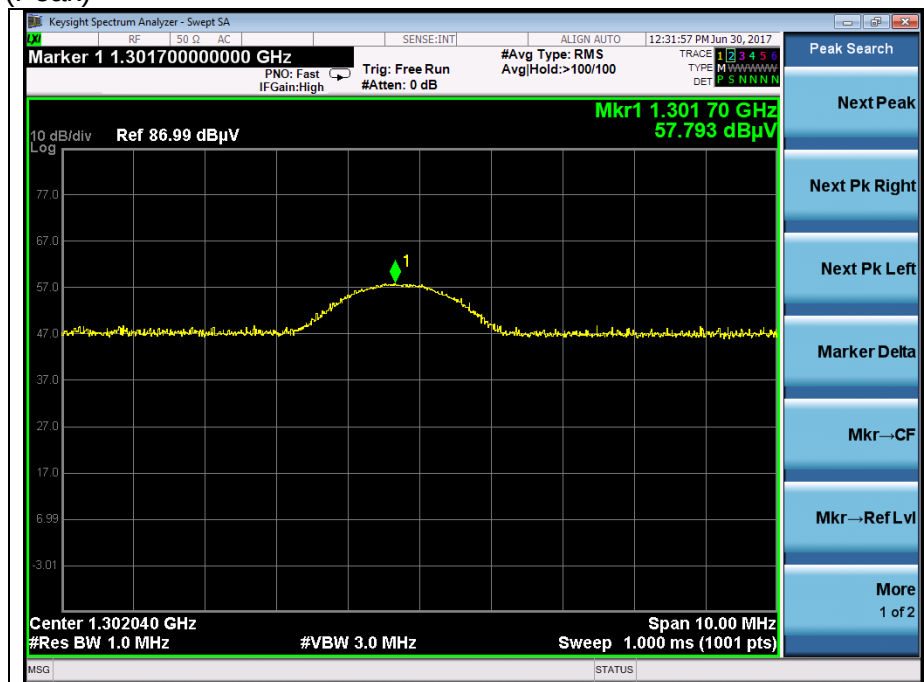
Scanning plots from 1 000 MHz to 4 500 MHz



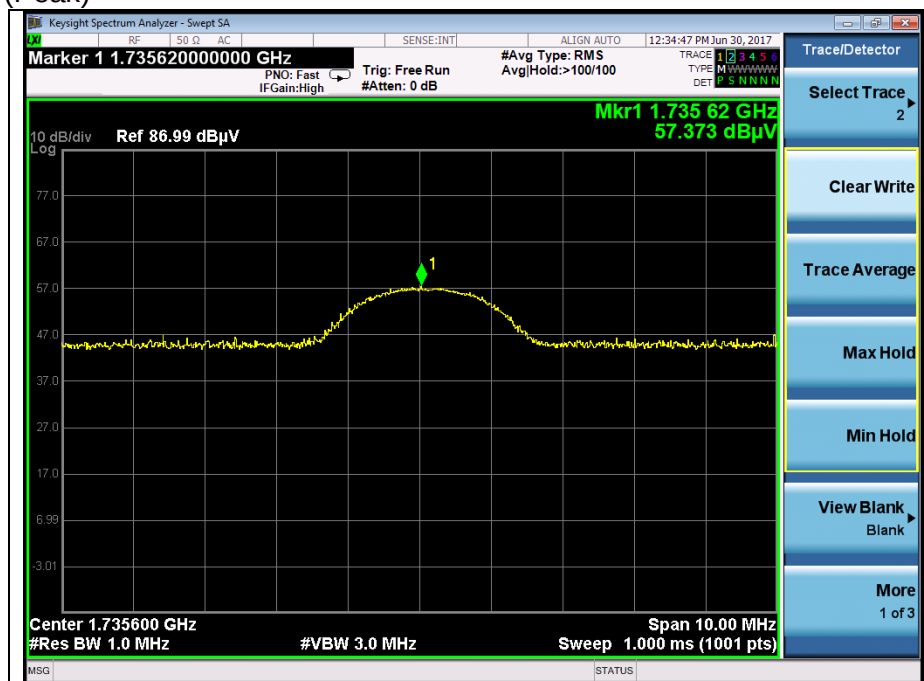
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## 3<sup>rd</sup> Harmonic (Peak)



## 4<sup>th</sup> Harmonic (Peak)



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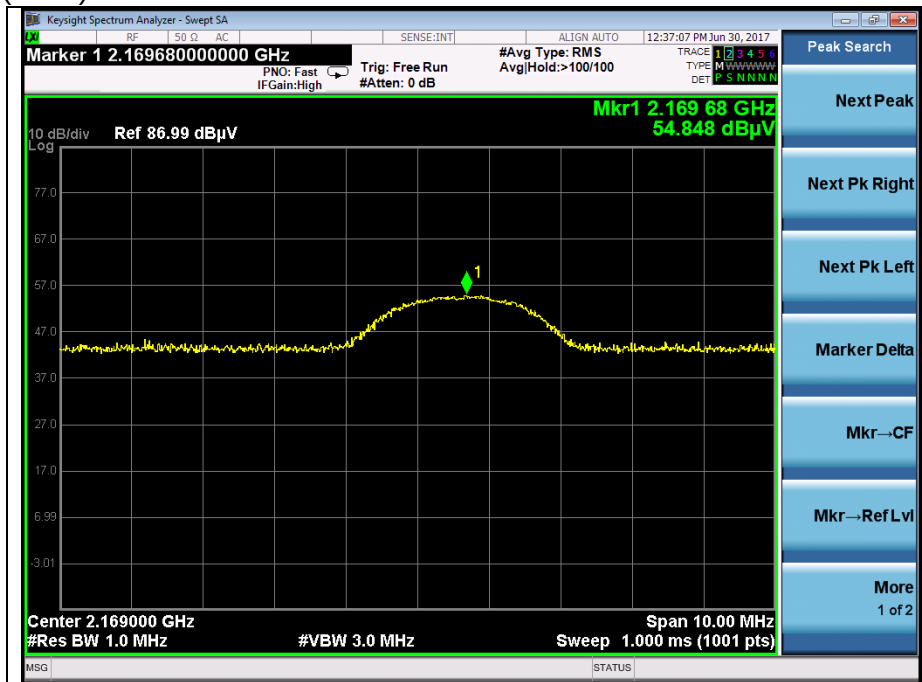
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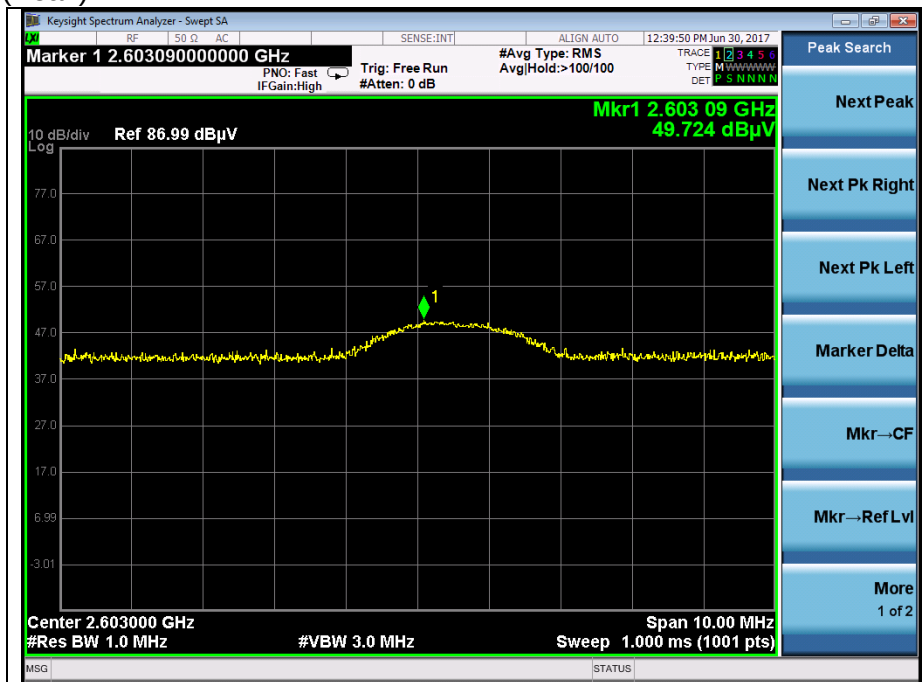
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A4(210 mm x 297 mm)

## 5<sup>th</sup> Harmonic (Peak)



## 6<sup>th</sup> Harmonic (Peak)



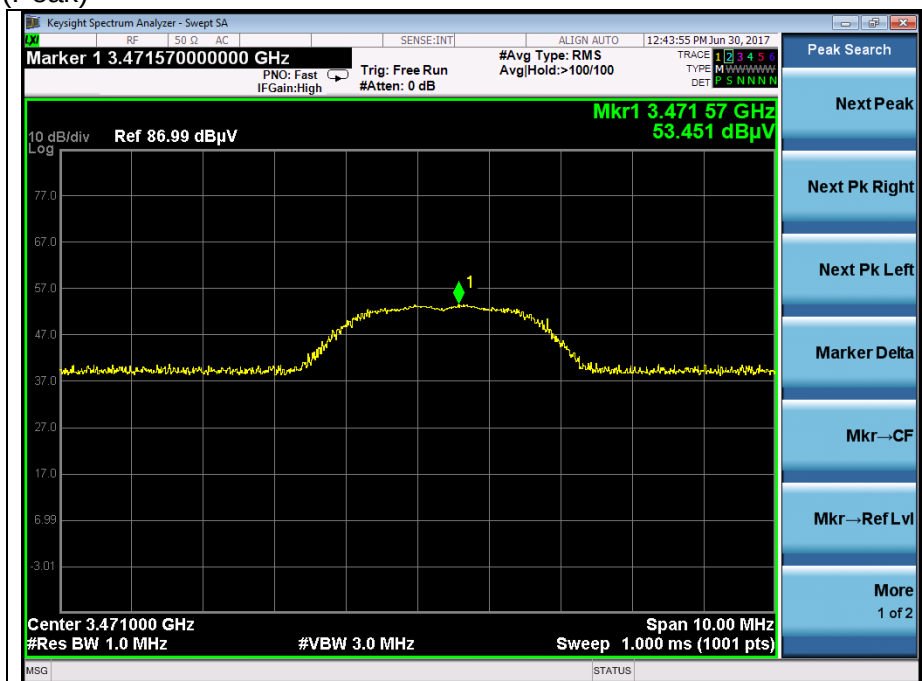
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## 7<sup>th</sup> Harmonic (Peak)



## 8<sup>th</sup> Harmonic (Peak)



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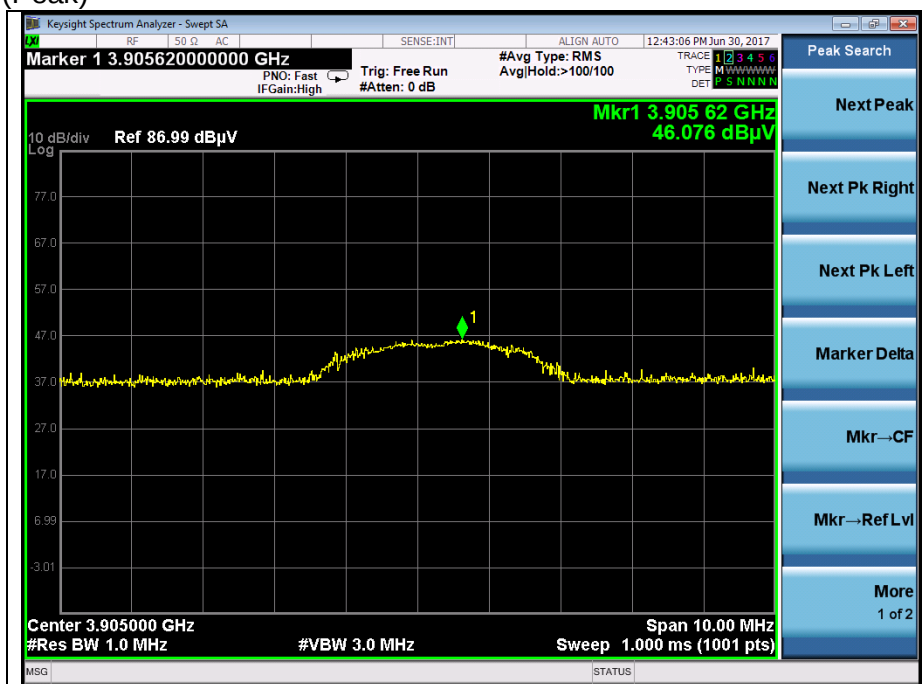
SGS Korea Co., Ltd. (Gunpo Laboratory) 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807 <http://www.sgsgroup.kr>

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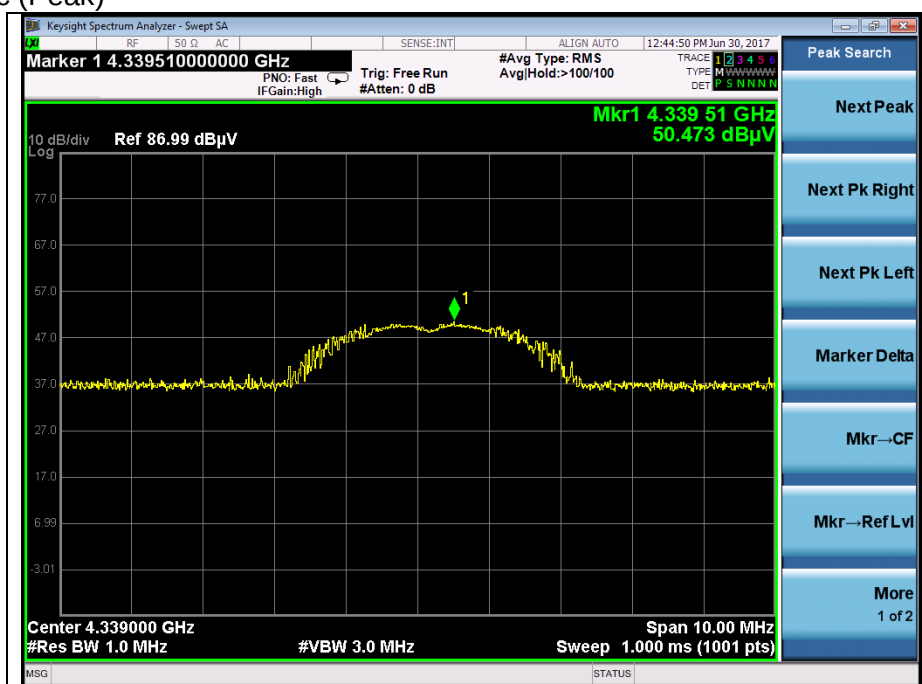
Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

## 9<sup>th</sup> Harmonic (Peak)



## 10<sup>th</sup> Harmonic (Peak)



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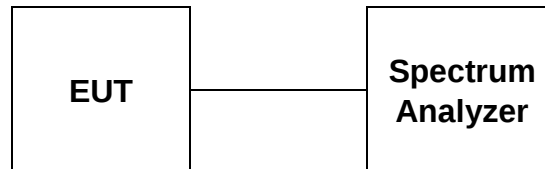
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Tel. +82 31 428 5700 / Fax. +82 31 427 2370

A4(210 mm x 297 mm)

### 3. Bandwidth of Operation Frequency

#### 3.1. Test Setup



#### 3.2. Limit

According to § 15.231(c), the bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### 3.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 10 kHz, VBW = 10 kHz and Span = 1 MHz.
3. The bandwidth of fundamental frequency was measured and recorded.

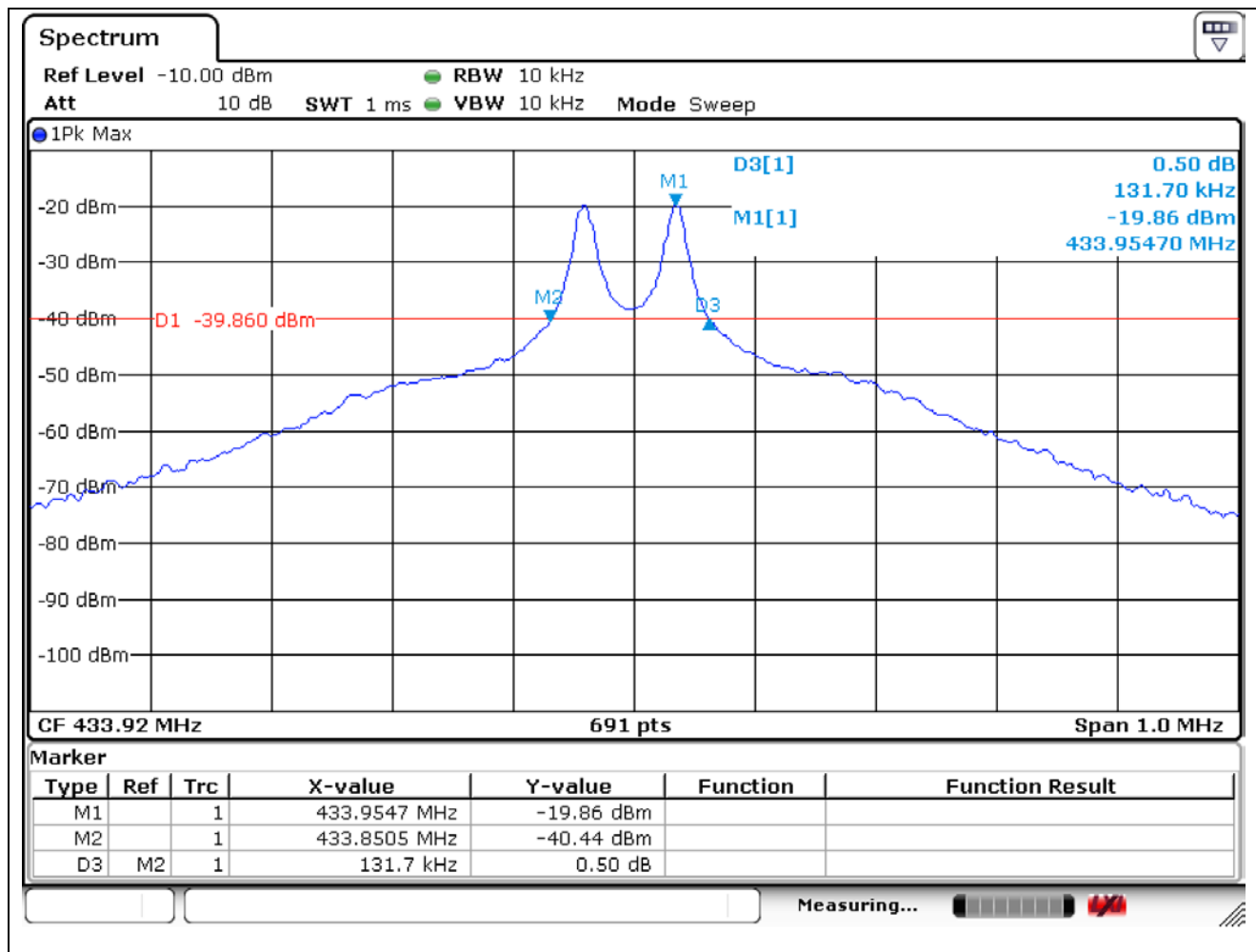
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## 3.4. Test Result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

| Carrier Frequency (MHz) | Bandwidth of Operation Frequency (kHz) | Limit (kHz) | Remark                                          |
|-------------------------|----------------------------------------|-------------|-------------------------------------------------|
| 433.92                  | 131.70                                 | 1 084.80    | The point 20 dB down from the modulated carrier |

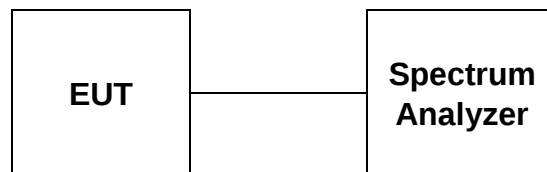


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## 4. Occupied Bandwidth

### 4.1. Test Setup



### 4.2. Limit

According to A.1.3 of RSS-210 Issue 9, the 99 % bandwidth of momentarily operated devices shall be less or equal to 0.25 % of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the 99 % bandwidth shall be less or equal to 0.5 % of the centre frequency.

### 4.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3 x RBW.
3. The bandwidth of fundamental frequency was measured and recorded.

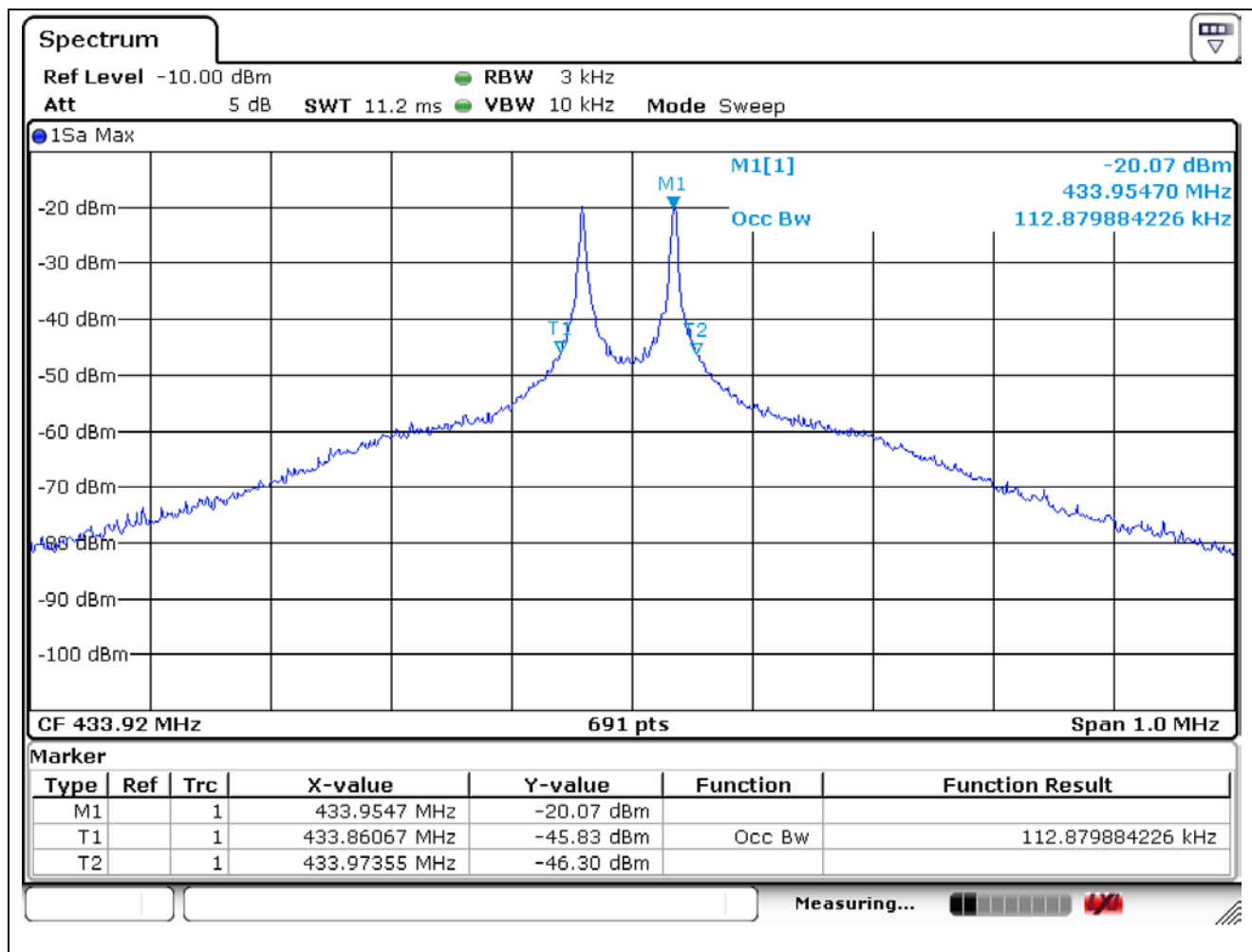
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## 4.4. Test Result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

| Carrier Frequency (MHz) | Occupied Bandwidth (kHz) | Limit (kHz) | Remark                  |
|-------------------------|--------------------------|-------------|-------------------------|
| 433.92                  | 112.88                   | 1 084.80    | 99 % Occupied bandwidth |

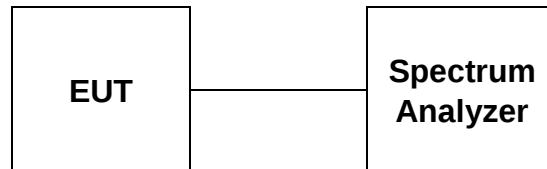


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## 5. Transmission Time

### 5.1. Test Setup



### 5.2. Limit

#### 5.2.1. FCC Limit

According to § 15.231(a)(1), a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

#### 5.2.2. IC Limit

According to A1.1 (a) of RSS-210 Issue 9, a manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.

### 5.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 1 MHz, VBW = Auto, Span = 0 Hz, Sweep Time = 10 sec.
3. The bandwidth of fundamental frequency was measured and recorded.

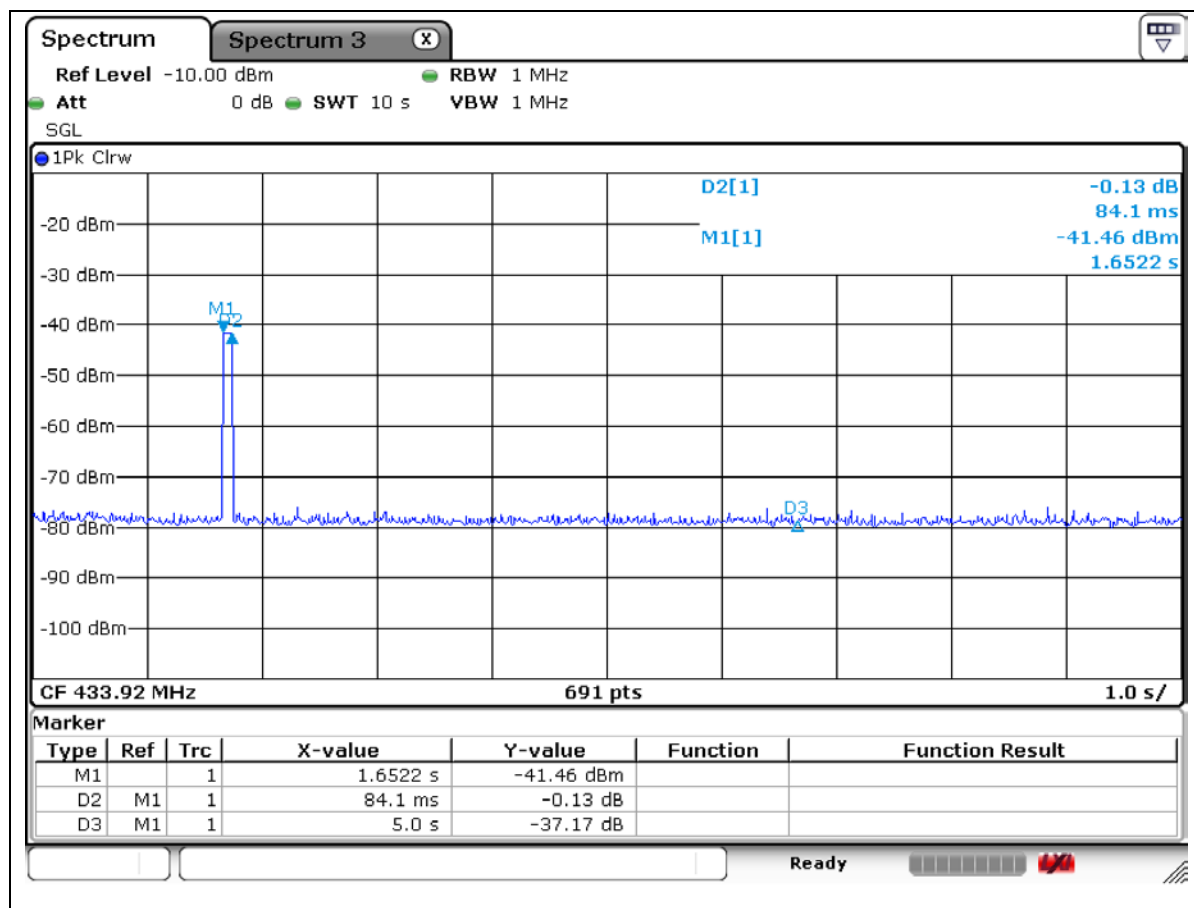
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## 5.4. Test Result

Ambient temperature : (23 ± 1) °C  
Relative humidity : 47 % R.H.

| Carrier Frequency<br>(MHz) | Transmission Time<br>(sec) | Limit<br>(sec)      | Remark |
|----------------------------|----------------------------|---------------------|--------|
| 433.92                     | 0.84                       | Same or less than 5 | Pass   |

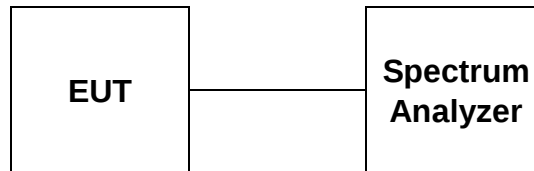


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## 6. Duty Cycle Correction Factor

### 6.1. Test Setup



### 6.2. Limit

None (No dedicated Limit specified in the Rules)

### 6.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW = 1 MHz, VBW = Auto, Span = 0 Hz, Sweep Time = 1 s.

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## 6.4. Test Result

Ambient temperature : (23 ± 1) °C

Relative humidity : 47 % R.H.

CALCULATION :

Average Reading = Peak Reading (dB $\mu$ V/m) + 20log(Duty Cycle)

In order to determine possible Maximum Modulation percentage, alternations are made to the EUT.  
We measured;

| $T_{on+off}$ | $T_{on}$ | $M \% = (T_{on} / T_{on+off}) * 100 \%$ | Duty Cycle Correction Factor |
|--------------|----------|-----------------------------------------|------------------------------|
| 100 ms       | 84.06 ms | 0.84                                    | -1.51                        |

$T_{on+off} = 100$  ms

$T_{on} = 84.06$  ms

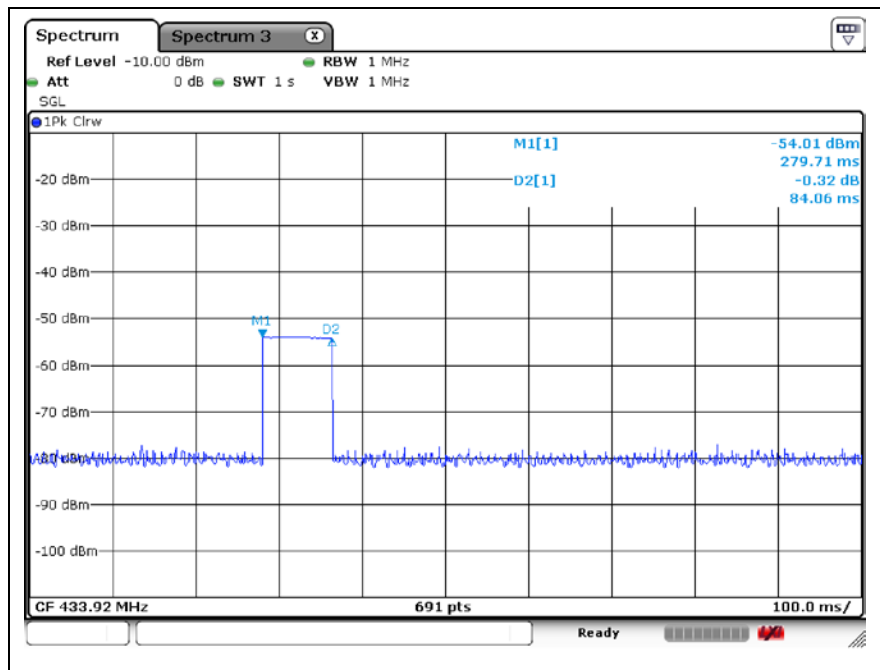
Duty Cycle Correction Factor = 20log( $T_{on} / T_{on+off}$ ) = 20log(0.84) = -1.51

**Remark:**

- The EUT has only one burst of transmission. Use 100 ms for calculation

## 6.5. Test Plot

-Duty Cycle of EUT



- End of the Test Report -

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