

# CFR 47 FCC Part 15.231

## TEST REPORT

Product : **TPMS**

Trade Name : N/A

Model Number : TX-U001; TX-S028; TX-S007; TX-S030; TX-S008; TX-S031; TX-S009;  
TX-S035; TX-S010; TX-S036; TX-S011; TX-S040; TX-S012; TX-S042;  
TX-S013; TX-S043; TX-S014; TX-S044; TX-S015; TX-S046; TX-S016;  
TX-S048; TX-S017; TX-S050; TX-S019; TX-S051; TX-S020; TX-S072;  
TX-S021; TX-S073; TX-S022; TX-S074; TX-S023; TX-S075; TX-S024;  
TX-S076; TX-S025; TX-S002; TX-S027; TX-S077; TX-S078; TX-S079;  
TX-S080; TX-S081; TX-S082; TX-S083; TX-S084; TX-S085; TX-S086;  
TX-S087; TX-S088; TX-S089; TX-S090; TX-S091; TX-S092; TX-S093;  
TX-S094; TX-S095; TX-S096; TX-S097; TX-S098; TX-S099; TX-S100;  
TX-S101; TX-S102; TX-S103; TX-S104; TX-S105; TX-S106; TX-S107;  
TX-S108; TX-S109; TX-S110; TX-S111; TX-S112; TX-S113; TX-S114;  
TX-S115; TX-S116; TX-S117; TX-S118; TX-S119; TX-S120; TX-S121;  
TX-S122; TX-S123; TX-S124; TX-S125; TX-S126; TX-S127; TX-S128;  
TX-S129; TX-S130; TX-S131; TX-S132; TX-S133; TX-S134; TX-S135;  
TX-S136; TX-U003

FCC ID : ULZ-TXU01

Prepared for

### **MOBILETRON ELECTRONICS CO., LTD.**

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Prepared by

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#### **Remark:**

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The test result in the report is only subjected to the test sample.

# Statement of Compliance

**Applicant:** MOBILETRON ELECTRONICS CO., LTD.  
**Manufacturer:** MOBILETRON ELECTRONICS CO., LTD.  
**Product:** TPMS  
**Model No.:** TX-U001; TX-S028; TX-S007; TX-S030; TX-S008; TX-S031;  
TX-S009; TX-S035; TX-S010; TX-S036; TX-S011; TX-S040;  
TX-S012; TX-S042; TX-S013; TX-S043; TX-S014; TX-S044;  
TX-S015; TX-S046; TX-S016; TX-S048; TX-S017; TX-S050;  
TX-S019; TX-S051; TX-S020; TX-S072; TX-S021; TX-S073;  
TX-S022; TX-S074; TX-S023; TX-S075; TX-S024; TX-S076;  
TX-S025; TX-S002; TX-S027; TX-S077; TX-S078; TX-S079;  
TX-S080; TX-S081; TX-S082; TX-S083; TX-S084; TX-S085;  
TX-S086; TX-S087; TX-S088; TX-S089; TX-S090; TX-S091;  
TX-S092; TX-S093; TX-S094; TX-S095; TX-S096; TX-S097;  
TX-S098; TX-S099; TX-S100; TX-S101; TX-S102; TX-S103;  
TX-S104; TX-S105; TX-S106; TX-S107; TX-S108; TX-S109;  
TX-S110; TX-S111; TX-S112; TX-S113; TX-S114; TX-S115;  
TX-S116; TX-S117; TX-S118; TX-S119; TX-S120; TX-S121;  
TX-S122; TX-S123; TX-S124; TX-S125; TX-S126; TX-S127;  
TX-S128; TX-S129; TX-S130; TX-S131; TX-S132; TX-S133;  
TX-S134; TX-S135; TX-S136; TX-U003

**Tested Power Supply:** 3Vdc Battery

**Date of Final Test:** Jul. 15, 2014

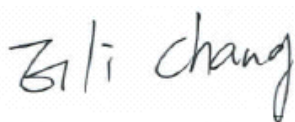
**Configuration of Measurements and Standards Used :**

FCC Rules and Regulations Part 15 Subpart C

1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of IETC.

Report Issued: 2014/09/03

Project Engineer:



Elli Chang

Approved:



Jerry Liu

# Table of Contents

|          |                                        |           |
|----------|----------------------------------------|-----------|
| <b>1</b> | <b>Summary of Measurement</b>          | <b>4</b>  |
| <b>2</b> | <b>General Information</b>             | <b>5</b>  |
| 2.1      | Description of Equipment Under Test    | 5         |
| 2.2      | Details of tested peripheral equipment | 6         |
| 2.3      | Test Facility                          | 7         |
| <b>3</b> | <b>Test specifications</b>             | <b>8</b>  |
| 3.1      | Test standard                          | 8         |
| 3.2      | Operation Mode                         | 8         |
| 3.3      | Test Step of EUT                       | 8         |
| 3.4      | Test Equipment                         | 8         |
| <b>4</b> | <b>Radiated emission test</b>          | <b>9</b>  |
| 4.1      | Limits                                 | 9         |
| 4.2      | Calculation of Average Factor          | 10        |
| 4.3      | Configuration of Measurement           | 14        |
| 4.4      | Test Procedure                         | 14        |
| 4.5      | Test Result                            | 14        |
| <b>5</b> | <b>Emission bandwidth</b>              | <b>18</b> |
| 5.1      | Limits                                 | 18        |
| 5.2      | Test Result                            | 18        |
| <b>6</b> | <b>Photographs of Test</b>             | <b>21</b> |
| 6.1      | Radiated Emission Measurement          | 21        |
| <b>7</b> | <b>Photographs of EUT</b>              | <b>23</b> |

## 1 Summary of Measurement

| Report Clause | Test Parameter     | Reference Document<br>CFR47 Part15 | Results |
|---------------|--------------------|------------------------------------|---------|
| 4             | Timing requirement | §15.231(a)                         | Pass    |
| 4             | Radiated Emission  | §15.231(b), 15.209                 | Pass    |
| 5             | Emission bandwidth | §15.231(c)                         | Pass    |

## 2 General Information

### 2.1 Description of Equipment Under Test

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Product</b>                | : TPMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Model Number</b>           | : TX-U001; TX-S028; TX-S007; TX-S030; TX-S008; TX-S031;<br>TX-S009; TX-S035; TX-S010; TX-S036; TX-S011; TX-S040;<br>TX-S012; TX-S042; TX-S013; TX-S043; TX-S014; TX-S044;<br>TX-S015; TX-S046; TX-S016; TX-S048; TX-S017; TX-S050;<br>TX-S019; TX-S051; TX-S020; TX-S072; TX-S021; TX-S073;<br>TX-S022; TX-S074; TX-S023; TX-S075; TX-S024; TX-S076;<br>TX-S025; TX-S002; TX-S027; TX-S077; TX-S078; TX-S079;<br>TX-S080; TX-S081; TX-S082; TX-S083; TX-S084; TX-S085;<br>TX-S086; TX-S087; TX-S088; TX-S089; TX-S090; TX-S091;<br>TX-S092; TX-S093; TX-S094; TX-S095; TX-S096; TX-S097;<br>TX-S098; TX-S099; TX-S100; TX-S101; TX-S102; TX-S103;<br>TX-S104; TX-S105; TX-S106; TX-S107; TX-S108; TX-S109;<br>TX-S110; TX-S111; TX-S112; TX-S113; TX-S114; TX-S115;<br>TX-S116; TX-S117; TX-S118; TX-S119; TX-S120; TX-S121;<br>TX-S122; TX-S123; TX-S124; TX-S125; TX-S126; TX-S127;<br>TX-S128; TX-S129; TX-S130; TX-S131; TX-S132; TX-S133;<br>TX-S134; TX-S135; TX-S136; TX-U003 |
| <b>Applicant</b>              | : <b>MOBILETRON ELECTRONICS CO., LTD.</b><br>No. 85, Sec. 4, Chung-Ching Rd., Ta-Ya District, Taichung, 428,<br>Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Manufacturer</b>           | : <b>MOBILETRON ELECTRONICS CO., LTD.</b><br>No. 85, Sec. 4, Chung-Ching Rd., Ta-Ya District, Taichung, 428,<br>Taiwan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Power Supply</b>           | : 3Vdc Battery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Operating Frequency</b>    | : 315MHz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Type of Modulation</b>     | : ASK & FSK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Antenna description</b>    | : This device uses Monopole antenna.<br><br>The antenna is integral to the device, thereby meeting the<br>requirement of FCC 15.203.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Antenna Gain</b>           | : 0 dBi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Date of Test</b>           | : May 23 ~ Jul. 17, 2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Additional Description</b> | : 1) The Model Number “ <b>TX-U001</b> ” is representative selected in<br>the test and included in this report.<br>2) The difference for all models included in this report is only for<br>software.<br>3) For more detail specification about EUT, please refer to the<br>user's manual.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## **2.2 Details of tested peripheral equipment**

N/A

## 2.3 Test Facility

- Site Description** : ☒OATS 1
- Name of Firm** : Interocean EMC Technology Corp.
- Company web** : <http://www.ietc.com.tw>
- Location** : No. 5-2, Lin 1, Tin-Fu, Lin-Kou Dist., New Taipei City, Taiwan 244, R.O.C.
- Site Filing** :
- Federal Communication Commissions – USA  
Registration No.: 96399 (OATS 1, 2, 3 & Chamber 3)  
Designation No.: TW1020
  - Industry Canada (IC)  
OUR FILE: 46405-4437  
Registration No. (OATS 1): Site# 4437A-1  
Registration No. (OATS 3): Site# 4437A-3  
Registration No. (Chamber 3): Site# 4437A-5  
Registration No. (OATS 5): Site# 4437A-6
  - Voluntary Control Council for Interference by Information Technology Equipment (VCCI) – Japan  
Member No.: 1349  
Registration No. (Conducted Room): C-1094  
Registration No. (Conducted Room): T-1562  
Registration No. (OATS 1): R-1040; G-274  
Registration No. (OATS 2): R-1041
- Site Accreditation** :
- Bureau of Standards and Metrology and Inspection (BSMI) – Taiwan, R.O.C.  
Accreditation No.:  
SL2-IN-E-0026 for CNS13438 / CISPR 22  
SL2-IN-E-0026 for CNS14757-2 / IEC 62040-2  
SL2-R1-E-0026 for CNS13439 / CISPR 13  
SL2-R2-E-0026 for CNS13439 / CISPR 13  
SL2-A1-E-0026 for CNS13783-1 / CISPR 14-1  
SL2-L1-E-0026 for CNS 14115 / CISPR 15
  - Taiwan Accreditation Foundation (TAF)  
Accreditation No.: 1113
  - Vehicle Safety Certification Center (VSCC)  
Approval No.: TW16-11-0
  - TÜV NORD  
Certificate No: TNTW0801R-04
  - Nemko  
Authorisation No: AeLA 011  
Authorisation No: ELA 181

### 3 Test specifications

#### 3.1 Test standard

The EUT was performed according to FCC Part 15 Subpart C Section 15.231 procedure and setup followed by ANSI C63.4, 2003 requirements.

#### 3.2 Operation Mode

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report

The EUT was operated in continuous transmission mode during all of the tests.



**X axis mode**



**Y axis mode**



**Z axis mode**

#### 3.3 Test Step of EUT

- 3.3.1 Setup the fixture to EUT for power supplying.
- 3.3.2 Turn on the power of all equipment.
- 3.3.3 Let the EUT continuous transmission. Executed the test.

#### 3.4 Test Equipment

| Instrument        | Manufacturer    | Model             | Serial No.    | Next Cal. Date |
|-------------------|-----------------|-------------------|---------------|----------------|
| Spectrum Analyzer | R&S             | FSP40             | 100478        | 2015/06/02     |
| Preamplifier      | Agilent         | 8449B             | 3008A01434    | 2015/05/07     |
| Preamplifier      | Agilent         | 83050A            | 3950A00225    | 2014/09/08     |
| Horn Antenna      | Schwarzbeck     | BBHA 9120         | 9120D-583     | 2015/05/13     |
| Horn Antenna      | Schwarzbeck     | BBHA 9170         | 213           | 2014/07/24     |
| Cable             | HARBOUR         | 27478LL142        | CBL22         | 2015/01/01     |
| EMI Test Receiver | Rohde & Schwarz | ESVS10            | 826148/011    | 2014/11/04     |
| Biconical Antenna | Schwarzbeck     | BBA 9106          | VHA 9103-2418 | 2015/01/18     |
| Log Antenna       | Schwarzbeck     | UHALP 9108 A      | 0738          | 2015/01/18     |
| Pre-Amplifier     | Agilent         | 8447D             | 2944A09703    | 2015/04/29     |
| RF Cable          | EMCI            | EMC8D-NM-NM-25000 | 140105        | 2015/02/16     |
| RF Cable          | Mini-Circuits   | CBL-3FL-NMNM      | CBL56         | 2014/08/30     |
| RF Cable          | Insulated Wire  | CBL59             | CBL59         | 2015/01/22     |

Note: The above equipments are within the valid calibration period.

## 4 Radiated emission test

### 4.1 Limits

According to FCC 15.231(b) requirement:

In addition to the provisions of §15.205, the field strength of emissions from intentional radiator operated under this section shall not exceed the following:

#### Fundamental and harmonics emission limits

| Frequency | Field Strength of Fundamental |                   | Field Strength of Harmonics |                   |
|-----------|-------------------------------|-------------------|-----------------------------|-------------------|
| (MHz)     | ( $\mu$ V/m@3m)               | (dB $\mu$ V/m@3m) | ( $\mu$ V/m@3m)             | (dB $\mu$ V/m@3m) |
| 315       | 6041.68                       | 75.6              | 604.168                     | 55.6              |

#### General Radiated emission Limit

Spurious Emission tested through until 10<sup>th</sup> harmonic. Radiated emissions, which fall in the restricted bands, as defined in §15.205 (a), comply with the radiated emission limits specified in §15.209 (a).

| Frequency | 15.209 Limits   |                   |
|-----------|-----------------|-------------------|
| (MHz)     | ( $\mu$ V/m@3m) | (dB $\mu$ V/m@3m) |
| 30-88     | 100             | 40                |
| 88-216    | 150             | 43.5              |
| 216-960   | 200             | 46                |
| Above 960 | 500             | 54                |

Remark :

1. The table above tighter limit applies at the band edges.
2. The measurement distance in meters, which that between form closest point of EUT to instrument antenna.

## 4.2 Calculation of Average Factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

(From ASK)

Averaging factor in dB =  $20 \log (\text{duty cycle})$

The duration of one cycle = 420ms

The duty cycle is simply the on-time divided by 100ms

Duty Cycle =  $(8.8\text{ms} \times 1) = 8.8 \text{ ms} / 100\text{ms}$

Therefore, the averaging factor is found by  $20 \log 0.088 = -21.11\text{dB}$

(From FSK)

Averaging factor in dB =  $20 \log (\text{duty cycle})$

The duration of one cycle = 419.88ms

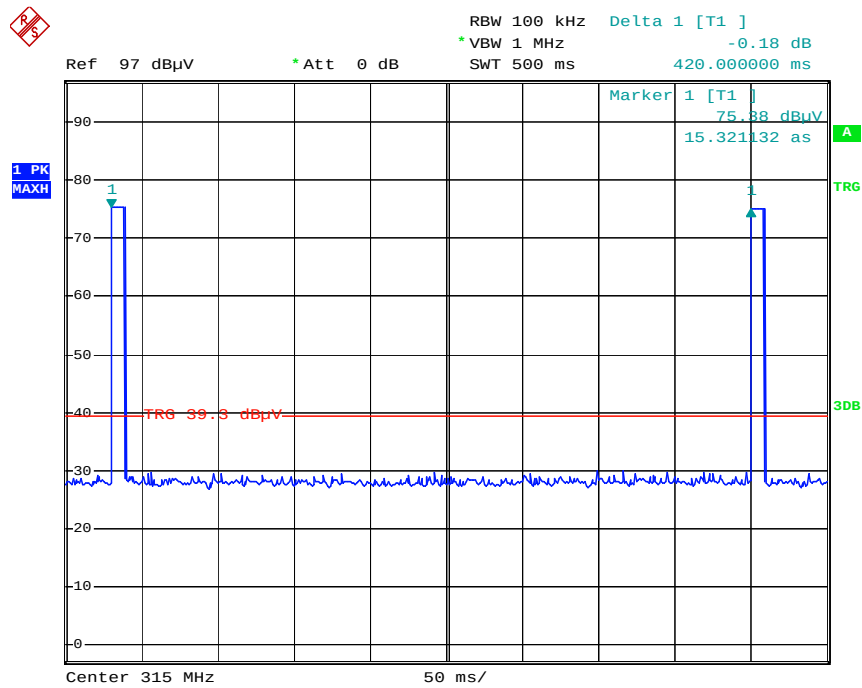
The duty cycle is simply the on-time divided by 100ms

Duty Cycle =  $(8.84\text{ms} \times 1) = 8.84 \text{ ms} / 100\text{ms}$

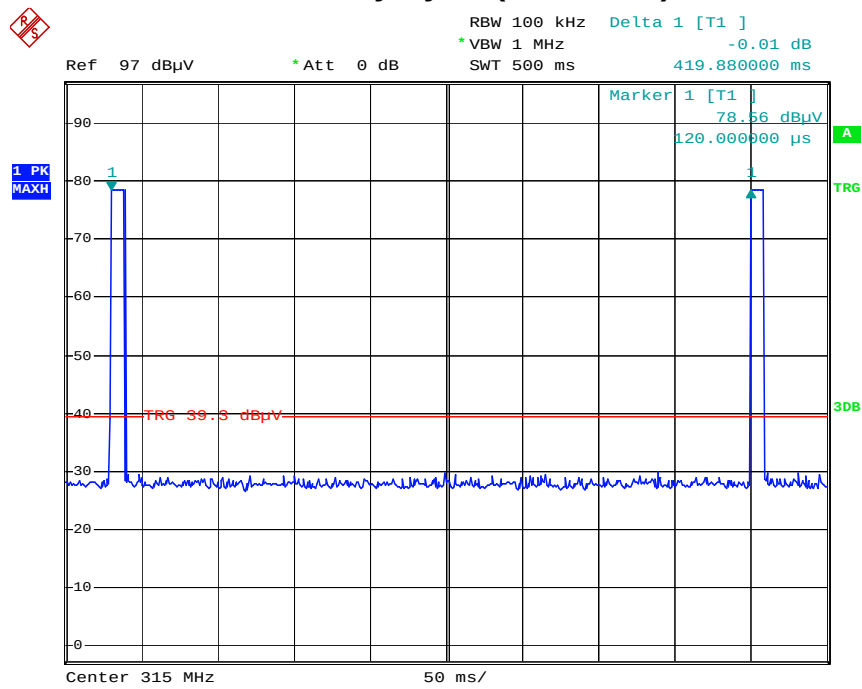
Therefore, the averaging factor is found by  $20 \log 0.0884 = -21.07\text{dB}$

Please see the diagrams below.

Duty Cycle

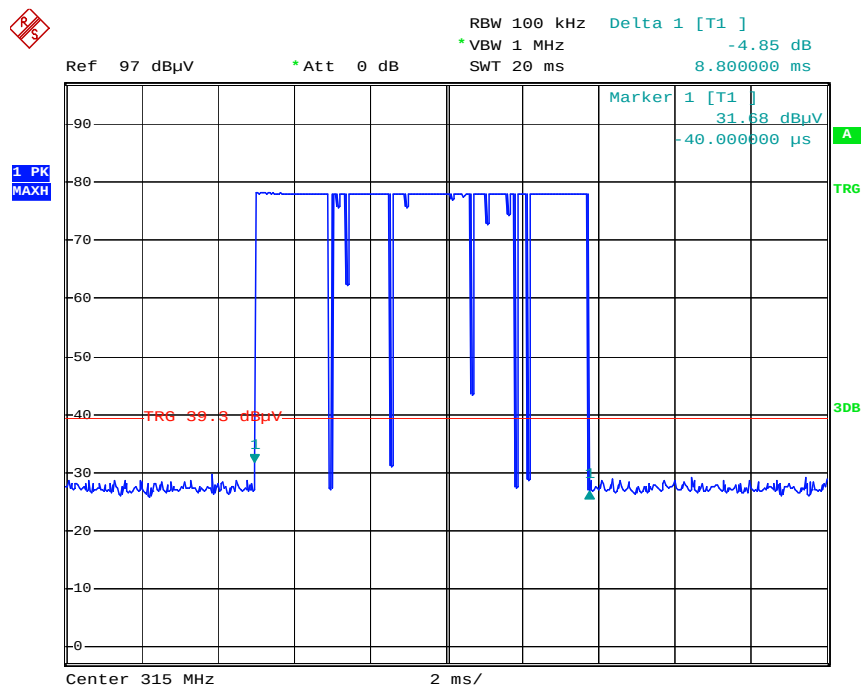


Duty Cycle (From ASK)

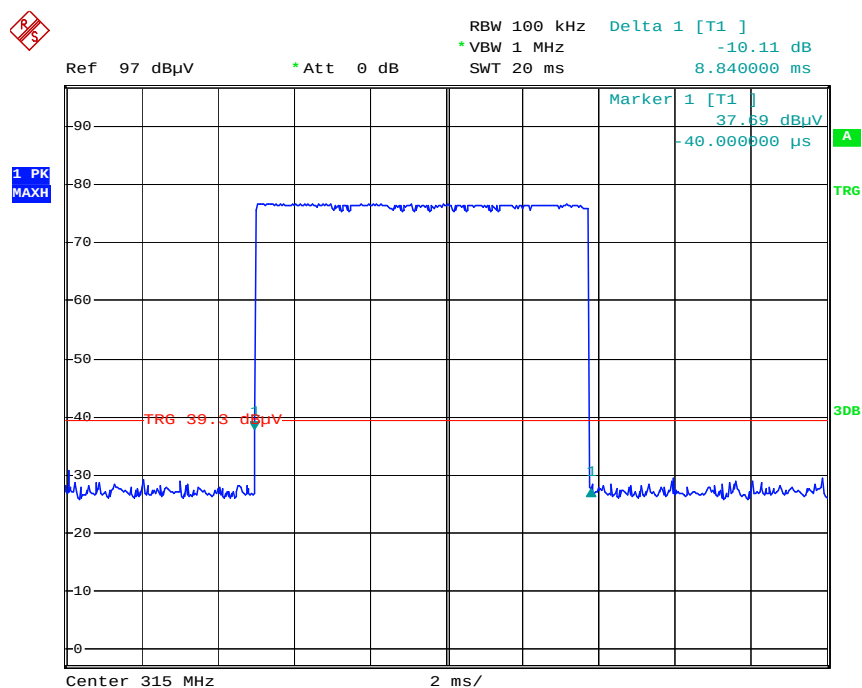


Duty Cycle (From FSK)

Time Slot

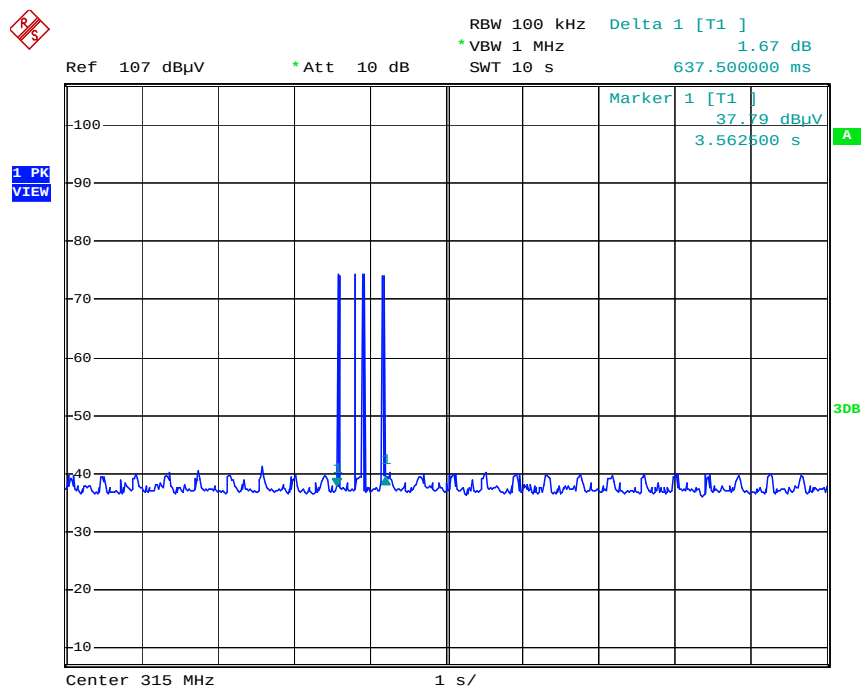


Time Slot (From ASK)

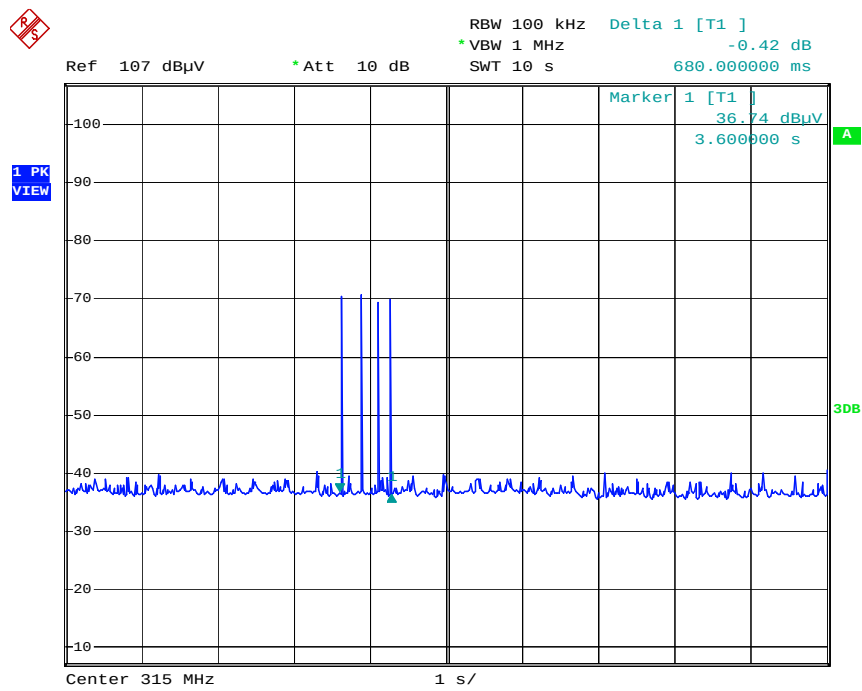


Time Slot (From FSK)

The EUT was complied with the requirement of FCC 15.231 (a)(2), A transmitter activated automatically shall cease transmission within 5 seconds after activation.



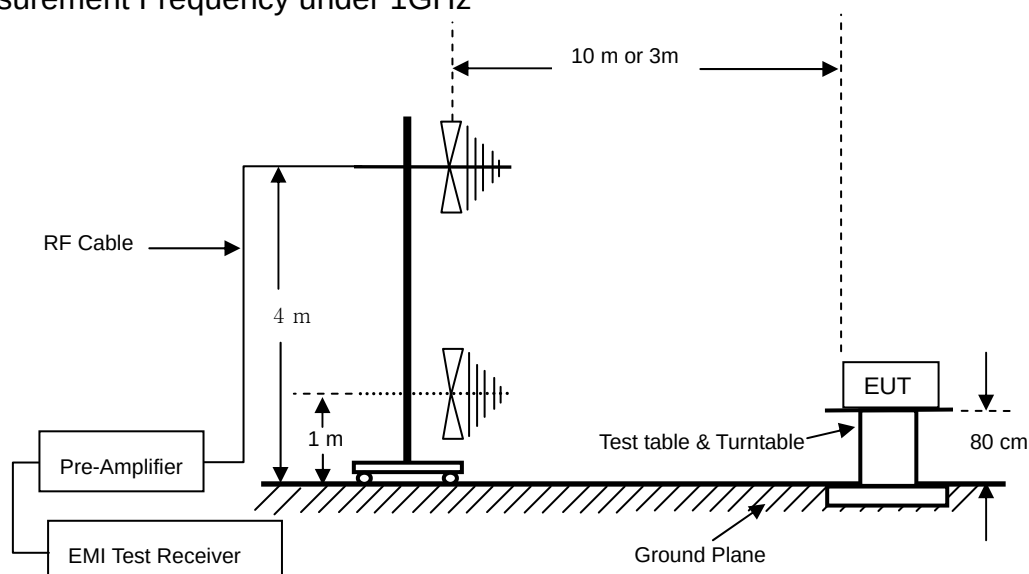
Deactivation (From ASK)



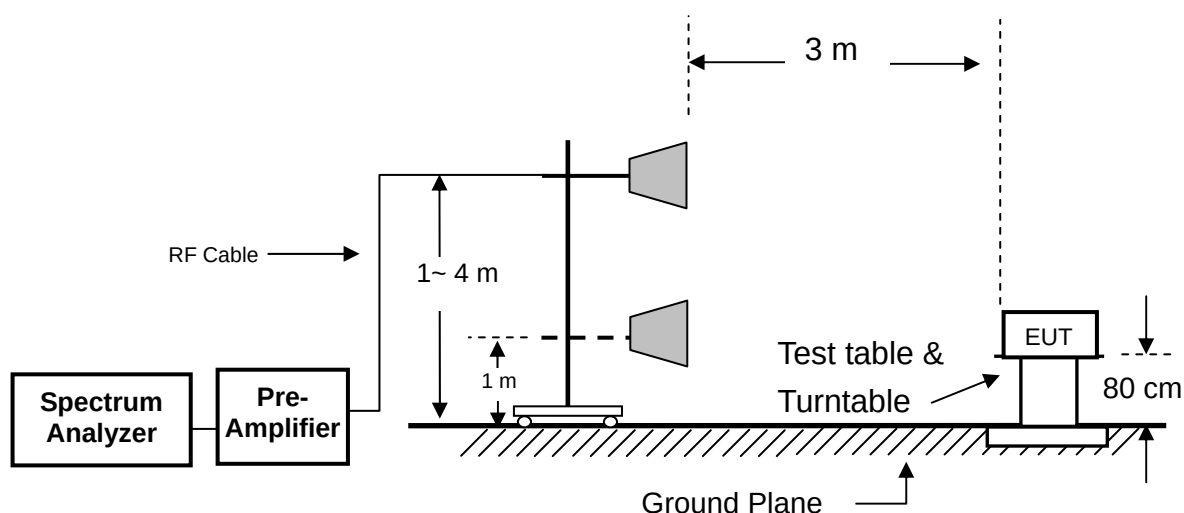
Deactivation (From FSK)

### 4.3 Configuration of Measurement

#### Measurement Frequency under 1GHz



#### Measurement Frequency above 1GHz



### 4.4 Test Procedure

Radiated emission measurements frequency range were performed from 30MHz to 4GHz. Spectrum Analyzer Resolution Bandwidth set to 100kHz or greater for frequencies from 30MHz to 1GHz, and set 1MHz Resolution Bandwidth for frequencies above 1GHz.

The EUT is place on non-conductive turntable for the test. If peripheral devices apply to the EUT, the peripheral devices will be connected to EUT and whole system. During the emission test, the signal is maximized through rotation and all cables were present worst-case emissions. The height of antenna and polarization is constantly changed for exploring maximum signal reading. The height of antenna can be up form reference ground to 4 meter and down to 1 meter.

### 4.5 Test Result

**PASS.**

The final test emission data is shown as following tables.

### Radiated Emission below 1GHz (From Worse: ASK Modulation)

| Frequency | Antenna      | Reading | Preamp | Correction Factor | Corrected Level | Limits   | Margin | Det  |
|-----------|--------------|---------|--------|-------------------|-----------------|----------|--------|------|
| (MHz)     | Polarization | (dBuV)  | (dB)   | (dB/m)            | (dBuV/m)        | (dBuV/m) | (dB)   | Mode |
| 138.320   | H            | 43.03   | 30.75  | 16.35             | 28.63           | 43.52    | -14.89 | PK   |
| 180.300   | H            | 39.75   | 29.84  | 18.44             | 28.35           | 43.52    | -15.17 | PK   |
| 273.400   | H            | 40.67   | 29.57  | 22.03             | 33.13           | 46.02    | -12.89 | PK   |
| 289.600   | H            | 40.10   | 29.85  | 20.77             | 31.02           | 46.02    | -15.00 | PK   |
| 467.740   | H            | 40.22   | 30.39  | 22.24             | 32.07           | 46.02    | -13.95 | PK   |
| 625.320   | H            | 37.58   | 29.73  | 25.17             | 33.02           | 46.02    | -13.00 | PK   |
| 115.790   | V            | 46.26   | 29.97  | 14.62             | 30.91           | 43.52    | -12.61 | PK   |
| 196.500   | V            | 42.33   | 29.98  | 19.93             | 32.28           | 43.52    | -11.24 | PK   |
| 247.780   | V            | 41.03   | 29.66  | 21.46             | 32.83           | 46.02    | -13.19 | PK   |
| 305.800   | V            | 43.86   | 29.39  | 17.79             | 32.26           | 46.02    | -13.76 | PK   |
| 415.330   | V            | 39.86   | 29.77  | 20.86             | 30.95           | 46.02    | -15.07 | PK   |
| 587.100   | V            | 36.90   | 29.65  | 24.28             | 31.53           | 46.02    | -14.49 | PK   |

Remark : Corrected Level = Reading – Preamp + Correction Factor  
Correction Factor = Antenna Factor + Cable Loss

**Fundamental and harmonics emissions (From ASK)**

| Freq.       | Antenna      | Reading | Preamp | Correction Factor | Average Factor | Corrected Level | Limits   | Margin | Det  |
|-------------|--------------|---------|--------|-------------------|----------------|-----------------|----------|--------|------|
| (MHz)       | Polarization | (dBuV)  | (dB)   | (dB/m)            | (dB)           | (dBuV/m)        | (dBuV/m) | (dB)   | Mode |
| 315(X Axis) | H            | 56.53   | 0.00   | 17.97             |                | 74.50           | 95.6     | -21.10 | PK   |
| 315(X Axis) | H            | 56.53   | 0.00   | 17.97             | -21.11         | 53.39           | 75.6     | -22.21 | AV   |
| 315(Y Axis) | H            | 62.55   | 0.00   | 17.97             |                | 80.52           | 95.6     | -15.08 | PK   |
| 315(Y Axis) | H            | 62.55   | 0.00   | 17.97             | -21.11         | 59.41           | 75.6     | -16.19 | AV   |
| 315(Z Axis) | H            | 65.58   | 0.00   | 17.97             |                | 83.55           | 95.6     | -12.05 | PK   |
| 315(Z Axis) | H            | 65.58   | 0.00   | 17.97             | -21.11         | 62.44           | 75.6     | -13.16 | AV   |
| 630.00      | H            | 58.28   | 29.77  | 25.15             |                | 53.66           | 75.6     | -21.94 | PK   |
| 630.00      | H            | 58.28   | 29.77  | 25.15             | -21.11         | 32.55           | 55.6     | -23.05 | AV   |
| 945.00      | H            | 54.84   | 29.43  | 30.31             |                | 55.72           | 75.6     | -19.88 | PK   |
| 945.00      | H            | 54.84   | 29.43  | 30.31             | -21.11         | 34.61           | 55.6     | -20.99 | AV   |
| 1260.00     | H            | 55.98   | 27.32  | 27.97             |                | 56.63           | 75.6     | -18.97 | PK   |
| 1260.00     | H            | 55.98   | 27.32  | 27.97             | -21.11         | 35.52           | 55.6     | -20.08 | AV   |
| 1575.00     | H            | 57.62   | 27.58  | 28.93             |                | 58.97           | 74.0     | -15.03 | PK   |
| 1575.00     | H            | 57.62   | 27.58  | 28.93             | -21.11         | 37.86           | 54.0     | -16.14 | AV   |
| 1890.00     | H            | 64.00   | 27.75  | 29.66             |                | 65.91           | 75.6     | -9.69  | PK   |
| 1890.00     | H            | 64.00   | 27.75  | 29.66             | -21.11         | 44.80           | 55.6     | -10.80 | AV   |
| 2205.00     | H            | 60.49   | 27.80  | 30.69             |                | 63.38           | 74.0     | -10.62 | PK   |
| 2205.00     | H            | 60.49   | 27.80  | 30.69             | -21.11         | 42.27           | 54.0     | -11.73 | AV   |
| 2520.00     | H            | 68.40   | 27.80  | 31.88             |                | 72.48           | 75.6     | -3.12  | PK   |
| 2520.00     | H            | 68.40   | 27.80  | 31.88             | -21.11         | 51.37           | 55.6     | -4.23  | AV   |
| 2835.00     | H            | 53.32   | 27.92  | 32.83             |                | 58.23           | 74.0     | -15.77 | PK   |
| 2835.00     | H            | 53.32   | 27.92  | 32.83             | -21.11         | 37.12           | 54.0     | -16.88 | AV   |
| 3150.00     | H            | 47.20   | 27.92  | 33.44             |                | 52.72           | 75.6     | -22.88 | PK   |
| 3150.00     | H            | 47.20   | 27.92  | 33.44             | -21.11         | 31.61           | 55.6     | -23.99 | AV   |
| 315(X Axis) | V            | 58.11   | 0.00   | 17.77             |                | 75.88           | 95.6     | -19.72 | PK   |
| 315(X Axis) | V            | 58.11   | 0.00   | 17.77             | -21.11         | 54.77           | 75.6     | -20.83 | AV   |
| 315(Y Axis) | V            | 57.91   | 0.00   | 17.77             |                | 75.68           | 95.6     | -19.92 | PK   |
| 315(Y Axis) | V            | 57.91   | 0.00   | 17.77             | -21.11         | 54.57           | 75.6     | -21.03 | AV   |
| 315(Z Axis) | V            | 53.81   | 0.00   | 17.77             |                | 71.58           | 95.6     | -24.02 | PK   |
| 315(Z Axis) | V            | 53.81   | 0.00   | 17.77             | -21.11         | 50.47           | 75.6     | -25.13 | AV   |
| 630.00      | V            | 54.49   | 29.77  | 25.05             |                | 49.77           | 75.6     | -25.83 | PK   |
| 630.00      | V            | 54.49   | 29.77  | 25.05             | -21.11         | 28.66           | 55.6     | -26.94 | AV   |
| 945.00      | V            | 46.68   | 29.43  | 29.81             |                | 47.06           | 75.6     | -28.54 | PK   |
| 945.00      | V            | 46.68   | 29.43  | 29.81             | -21.11         | 25.95           | 55.6     | -29.65 | AV   |
| 1260.00     | V            | 56.30   | 27.32  | 27.97             |                | 56.95           | 75.6     | -18.65 | PK   |
| 1260.00     | V            | 56.30   | 27.32  | 27.97             | -21.11         | 35.84           | 55.6     | -19.76 | AV   |
| 1575.00     | V            | 60.70   | 27.58  | 28.93             |                | 62.05           | 74.0     | -11.95 | PK   |
| 1575.00     | V            | 60.70   | 27.58  | 28.93             | -21.11         | 40.94           | 54.0     | -13.06 | AV   |
| 1890.00     | V            | 60.79   | 27.75  | 29.66             |                | 62.70           | 75.6     | -12.90 | PK   |
| 1890.00     | V            | 60.79   | 27.75  | 29.66             | -21.11         | 41.59           | 55.6     | -14.01 | AV   |
| 2205.00     | V            | 63.66   | 27.80  | 30.69             |                | 66.55           | 74.0     | -7.45  | PK   |
| 2205.00     | V            | 63.66   | 27.80  | 30.69             | -21.11         | 45.44           | 54.0     | -8.56  | AV   |
| 2520.00     | V            | 64.95   | 27.80  | 31.88             |                | 69.03           | 75.6     | -6.57  | PK   |
| 2520.00     | V            | 64.95   | 27.80  | 31.88             | -21.11         | 47.92           | 55.6     | -7.68  | AV   |
| 2835.00     | V            | 54.60   | 27.92  | 32.83             |                | 59.51           | 74.0     | -14.49 | PK   |
| 2835.00     | V            | 54.60   | 27.92  | 32.83             | -21.11         | 38.40           | 54.0     | -15.60 | AV   |
| 3150.00     | V            | 46.85   | 27.92  | 33.44             |                | 52.37           | 75.6     | -23.23 | PK   |
| 3150.00     | V            | 46.85   | 27.92  | 33.44             | -21.11         | 31.26           | 55.6     | -24.34 | AV   |

**Fundamental and harmonics emissions (From FSK)**

| Freq.       | Antenna      | Reading | Preamp | Correction Factor | Average Factor | Corrected Level | Limits   | Margin | Det  |
|-------------|--------------|---------|--------|-------------------|----------------|-----------------|----------|--------|------|
| (MHz)       | Polarization | (dBuV)  | (dB)   | (dB/m)            | (dB)           | (dBuV/m)        | (dBuV/m) | (dB)   | Mode |
| 315(X Axis) | H            | 56.55   | 0.00   | 17.97             |                | 74.52           | 95.6     | -21.08 | PK   |
| 315(X Axis) | H            | 56.55   | 0.00   | 17.97             | -21.07         | 53.45           | 75.6     | -22.15 | AV   |
| 315(Y Axis) | H            | 62.19   | 0.00   | 17.97             |                | 80.16           | 95.6     | -15.44 | PK   |
| 315(Y Axis) | H            | 62.19   | 0.00   | 17.97             | -21.07         | 59.09           | 75.6     | -16.51 | AV   |
| 315(Z Axis) | H            | 65.55   | 0.00   | 17.97             |                | 83.52           | 95.6     | -12.08 | PK   |
| 315(Z Axis) | H            | 65.55   | 0.00   | 17.97             | -21.07         | 62.45           | 75.6     | -13.15 | AV   |
| 630.00      | H            | 57.72   | 29.77  | 25.15             |                | 53.10           | 75.6     | -22.50 | PK   |
| 630.00      | H            | 57.72   | 29.77  | 25.15             | -21.07         | 32.03           | 55.6     | -23.57 | AV   |
| 945.00      | H            | 54.35   | 29.43  | 30.31             |                | 55.23           | 75.6     | -20.37 | PK   |
| 945.00      | H            | 54.35   | 29.43  | 30.31             | -21.07         | 34.16           | 55.6     | -21.44 | AV   |
| 1260.00     | H            | 56.07   | 27.32  | 27.97             |                | 56.72           | 75.6     | -18.88 | PK   |
| 1260.00     | H            | 56.07   | 27.32  | 27.97             | -21.07         | 35.65           | 55.6     | -19.95 | AV   |
| 1575.00     | H            | 57.13   | 27.58  | 28.93             |                | 58.48           | 74.0     | -15.52 | PK   |
| 1575.00     | H            | 57.13   | 27.58  | 28.93             | -21.07         | 37.41           | 54.0     | -16.59 | AV   |
| 1890.00     | H            | 63.82   | 27.75  | 29.66             |                | 65.73           | 75.6     | -9.87  | PK   |
| 1890.00     | H            | 63.82   | 27.75  | 29.66             | -21.07         | 44.66           | 55.6     | -10.94 | AV   |
| 2205.00     | H            | 60.60   | 27.80  | 30.69             |                | 63.49           | 74.0     | -10.51 | PK   |
| 2205.00     | H            | 60.60   | 27.80  | 30.69             | -21.07         | 42.42           | 54.0     | -11.58 | AV   |
| 2520.00     | H            | 68.35   | 27.80  | 31.88             |                | 72.43           | 75.6     | -3.17  | PK   |
| 2520.00     | H            | 68.35   | 27.80  | 31.88             | -21.07         | 51.36           | 55.6     | -4.24  | AV   |
| 2835.00     | H            | 52.39   | 27.92  | 32.83             |                | 57.30           | 74.0     | -16.70 | PK   |
| 2835.00     | H            | 52.39   | 27.92  | 32.83             | -21.07         | 36.23           | 54.0     | -17.77 | AV   |
| 3150.00     | H            | 46.61   | 27.92  | 33.44             |                | 52.13           | 75.6     | -23.47 | PK   |
| 3150.00     | H            | 46.61   | 27.92  | 33.44             | -21.07         | 31.06           | 55.6     | -24.54 | AV   |
| 315(X Axis) | V            | 57.72   | 0.00   | 17.77             |                | 75.49           | 95.6     | -20.11 | PK   |
| 315(X Axis) | V            | 57.72   | 0.00   | 17.77             | -21.07         | 54.42           | 75.6     | -21.18 | AV   |
| 315(Y Axis) | V            | 57.83   | 0.00   | 17.77             |                | 75.60           | 95.6     | -20.00 | PK   |
| 315(Y Axis) | V            | 57.83   | 0.00   | 17.77             | -21.07         | 54.53           | 75.6     | -21.07 | AV   |
| 315(Z Axis) | V            | 53.69   | 0.00   | 17.77             |                | 71.46           | 95.6     | -24.14 | PK   |
| 315(Z Axis) | V            | 53.69   | 0.00   | 17.77             | -21.07         | 50.39           | 75.6     | -25.21 | AV   |
| 630.00      | V            | 53.62   | 29.77  | 25.05             |                | 48.90           | 75.6     | -26.70 | PK   |
| 630.00      | V            | 53.62   | 29.77  | 25.05             | -21.07         | 27.83           | 55.6     | -27.77 | AV   |
| 945.00      | V            | 46.80   | 29.43  | 29.81             |                | 47.18           | 75.6     | -28.42 | PK   |
| 945.00      | V            | 46.80   | 29.43  | 29.81             | -21.07         | 26.11           | 55.6     | -29.49 | AV   |
| 1260.00     | V            | 56.48   | 27.32  | 27.97             |                | 57.13           | 75.6     | -18.47 | PK   |
| 1260.00     | V            | 56.48   | 27.32  | 27.97             | -21.07         | 36.06           | 55.6     | -19.54 | AV   |
| 1575.00     | V            | 61.57   | 27.58  | 28.93             |                | 62.92           | 74.0     | -11.08 | PK   |
| 1575.00     | V            | 61.57   | 27.58  | 28.93             | -21.07         | 41.85           | 54.0     | -12.15 | AV   |
| 1890.00     | V            | 59.92   | 27.75  | 29.66             |                | 61.83           | 75.6     | -13.77 | PK   |
| 1890.00     | V            | 59.92   | 27.75  | 29.66             | -21.07         | 40.76           | 55.6     | -14.84 | AV   |
| 2205.00     | V            | 64.01   | 27.80  | 30.69             |                | 66.90           | 74.0     | -7.10  | PK   |
| 2205.00     | V            | 64.01   | 27.80  | 30.69             | -21.07         | 45.83           | 54.0     | -8.17  | AV   |
| 2520.00     | V            | 65.59   | 27.80  | 31.88             |                | 69.67           | 75.6     | -5.93  | PK   |
| 2520.00     | V            | 65.59   | 27.80  | 31.88             | -21.07         | 48.60           | 55.6     | -7.00  | AV   |
| 2835.00     | V            | 54.29   | 27.92  | 32.83             |                | 59.20           | 74.0     | -14.80 | PK   |
| 2835.00     | V            | 54.29   | 27.92  | 32.83             | -21.07         | 38.13           | 54.0     | -15.87 | AV   |
| 3150.00     | V            | 47.23   | 27.92  | 33.44             |                | 52.75           | 75.6     | -22.85 | PK   |
| 3150.00     | V            | 47.23   | 27.92  | 33.44             | -21.07         | 31.68           | 55.6     | -23.92 | AV   |

Remark :

1. Corrected Level = Reading – Preamp + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “ \* ” Mark indicated Background Noise Level
4. The signal bandwidth was measured and less then 100KHz RBW so PDCF factor is not required to correct the fundamental signal peak result.

## **5 Emission bandwidth**

### **5.1 Limits**

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

B.W (20dBc) Limit =  $0.25\% * f(\text{MHz}) = 0.25\% * 315\text{MHz} = 787.5\text{kHz}$

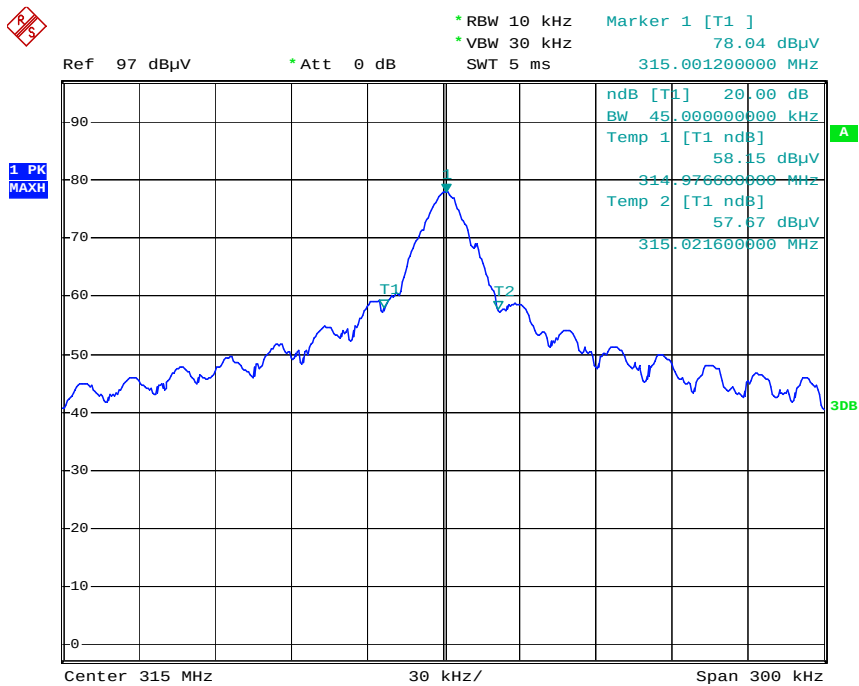
### **5.2 Test Result**

**PASS.**

The final test data is shown as following.

20dB Bandwidth (From ASK)

| Channel Frequency (MHz) | Measured 20dB Bandwidth (kHz) | Limit (kHz) | Result |
|-------------------------|-------------------------------|-------------|--------|
| 315                     | 45                            | 787.5       | PASS   |



20dB Bandwidth (From FSK)

| Channel Frequency (MHz) | Measured 20dB Bandwidth (kHz) | Limit (kHz) | Result |
|-------------------------|-------------------------------|-------------|--------|
| 315                     | 121.8                         | 787.5       | PASS   |

