

# TEST REPORT

of

## FCC Part 15 Subpart C AND CANADA RSS-210

☒ New Application; ☐ Class I PC; ☐ Class II PC

**Product :** TIRE PRESSURE MONITOR SENSOR- C(433MHZ)  
**Brand:** Cub  
**Model:** UNI-SENSOR  
**Model Difference:** N/A  
**FCC ID:** ZPNUNI-SENSOR  
**IC:** 9959A-UNISENSOR  
**FCC Rule Part:** §15.231 (e)  
**IC Rule Part:** RSS-210 issue 8:Dec. 2010, Annex 1.1  
**Applicant:** CUB ELECPARTS INC.  
**Address:** No.6, Lane 546, Sec.6, Changlu Road, Fuhsin Township  
Changhua County, Taiwan

### Test Performed by:

#### International Standards Laboratory

<Lung-Tan LAB>

\*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3;

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Report No.: **ISL-15LR339FC**

Issue Date : **2015/12/23**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

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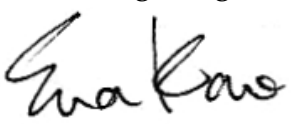
## VERIFICATION OF COMPLIANCE

**Applicant:** CUB ELECPARTS INC.  
**Product Description:** TIRE PRESSURE MONITOR SENSOR- C(433MHZ)  
**Brand Name:** Cub  
**FCC ID:** ZPNUNI-SENSOR  
**IC:** 9959A-UNISENSOR  
**FCC Rule Part:** §15.231 (e)  
**IC Rule Part:** RSS-210 issue 8:2010, Annex 1.1  
**Model No.:** UNI-SENSOR  
**Model Difference:** N/A  
**Date of test:** 2015/12/09 ~ 2015/12/11  
**Date of EUT Received:** 2015/12/09

### We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

|                     |                                                                                                                                       |              |                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------|
| <b>Test By:</b>     | <br>_____<br><b>Dion Chang / Engineer</b>          | <b>Date:</b> | 2015/12/23<br>_____ |
| <b>Prepared By:</b> | <br>_____<br><b>Eva Kao / Technical Supervisor</b> | <b>Date:</b> | 2015/12/23<br>_____ |
| <b>Approved By:</b> | <br>_____<br><b>Vincent Su / Technical Manager</b> | <b>Date:</b> | 2015/12/23<br>_____ |

## Version

| Version No. | Date       | Description                  |
|-------------|------------|------------------------------|
| 00          | 2015/12/23 | Initial creation of document |
|             |            |                              |

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## 1. GENERAL INFORMATION

### 1.1 Product Description

|                                  |                                         |
|----------------------------------|-----------------------------------------|
| Product Name                     | TIRE PRESSURE MONITOR SENSOR- C(433MHZ) |
| Brand Name                       | Cub                                     |
| Model Name                       | UNI-SENSOR                              |
| Model Difference                 | N/A                                     |
| Power Supply                     | 3.0V from battery                       |
| Device type                      | safety applications                     |
| Product & Radio Hardware version | 10562U005010RA                          |
| Product & Radio Software version | 80262U005010RA                          |

### TX:

|                            |                                                                         |
|----------------------------|-------------------------------------------------------------------------|
| Operating Frequency        | 433.92 MHz                                                              |
| Transmit Power             | 75.02dBuV/m at 3m                                                       |
| Modulation Technique       | FSK & ASK                                                               |
| Number of Channels         | 1                                                                       |
| Operating Mode             | Point-to-Point                                                          |
| Periodic Transmission Time | Transmission period every 14s,<br>Total Transmission Time <1 s per hour |
| Antenna Type               | Wire Antenna                                                            |

## 1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **ZPNUNI-SENSOR** filing to comply with Section 15.231 (e) of the FCC Part 15, Subpart C Rules and **IC: 9959A-UNISENSOR** filing to comply with Industry Canada RSS-210 issue 8:2010 Annex 1.1.

## 1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in C63.10: 2013 and RSS-Gen Issue 4: 2014. Radiated testing was performed at an antenna to EUT distance 3 meters.

## 1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.10: 2013. FCC Registration Number is: 872200; Designation Number is: TW1036, Canada Registration Number: 4067B-3.

## 1.5 Special Accessories

Not available for this EUT intended for grant.

## 1.6 Equipment Modifications

Not available for this EUT intended for grant.

## **2. SYSTEM TEST CONFIGURATION**

### **2.1 EUT Configuration**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### **2.2 EUT Exercise**

The EUT (Transmitter) was tested with a test program to fix the Tx frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

### **2.3 Test Procedure**

#### **2.3.1 Conducted Emissions (Not apply in the report)**

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10: 2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR 16-1-1 Quasi-Peak and Average detector mode.

#### **2.3.2 Radiated Emissions**

The EUT is a placed on as turn table which is 0.8 m/1.5m(Frequency above 1GHz) above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 6 and 11 of ANSI C63.10: 2013.

## 2.4 Limitation

### (1) Conducted Emission

According to section RSS-Gen §8.8 Conducted Emission Limits is as following.

| Frequency range<br>MHz                                                                                | Limits<br>dB (uV) |          |
|-------------------------------------------------------------------------------------------------------|-------------------|----------|
|                                                                                                       | Quasi-peak        | Average  |
| 0.15 to 0.50                                                                                          | 66 to 56          | 56 to 46 |
| 0.50 to 5                                                                                             | 56                | 46       |
| 5 to 30                                                                                               | 60                | 50       |
| Note                                                                                                  |                   |          |
| 1.The lower limit shall apply at the transition frequencies                                           |                   |          |
| 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. |                   |          |

## (2) Radiated Emission

According to (e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emission (microvolts/meter) |
|-----------------------------|--------------------------------------------------|--------------------------------------------------------|
| 40.66-40.70                 | 1,000                                            | 100                                                    |
| 70-130                      | 500                                              | 50                                                     |
| 130-174                     | 500 to 1,500 <sup>1</sup>                        | 50 to 150 <sup>1</sup>                                 |
| 174-260                     | 1,500                                            | 150                                                    |
| 260-470                     | 1,500 to 5,000 <sup>1</sup>                      | 150 to 500 <sup>1</sup>                                |
| Above 470                   | 5,000                                            | 500                                                    |

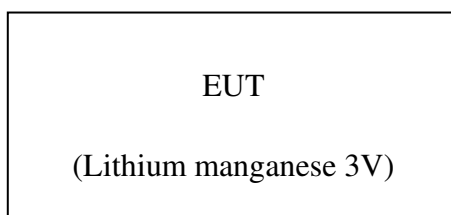
<sup>1</sup>Linear interpolations.

- Remark:
1. Emission level in dBuV/m =  $20 \log (uV/m)$
  2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
  3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205
  4. Emission spurious frequency which appearing within the Restricted Bands specified in provision of § 15.205, then the general radiated emission limits in § 15.209 apply.
  5. For the band 130-174MHz,  $uV/m$  at 3meters =  $22.72727 * F(MHz) - 2454.545$ ;  
For the band 260-470MHz  $uV/m$  at 3meters =  $16.6667 * F(MHz) - 2833.333$ ;  
Where F is the frequency in MHz.
  6.  $433.92MHz$  AV limit =  $16.6667 * 433.92(MHz) - 2833.333 = 4398.68 uV/m$   
=  $72.86dBuV/m$
  7.  $433.92MHz$  Peak limit = AV Limit + 20dB = 92.86MHz

## 2.5 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**

**TX**



**Table 2-1 Equipment Used in Tested System**

| Item | Equipment | Mfr/Brand | Model/<br>Type No. | Series No. | Data Cable | Power<br>Cord |
|------|-----------|-----------|--------------------|------------|------------|---------------|
| 1.   | N/A       |           |                    |            |            |               |

### 3. SUMMARY OF TEST RESULTS

| FCC /IC Rules                                    | Description Of Test                | Result    |
|--------------------------------------------------|------------------------------------|-----------|
| § 15.207<br>RSS-Gen §7.2.2                       | Conducted Emission                 | N/A       |
| § 15.231(e)<br>RSS-Gen §<br>RSS-210 A1.1 Table B | Radiated Emission                  | Compliant |
| § 15.231(c)<br>RSS-Gen §<br>RSS-210 A1.1         | 20dB Bandwidth                     | Compliant |
| RSS-Gen §4.6.1<br>RSS-210 A1.1.3( c)             | 99% Power Bandwidth                | Compliant |
|                                                  | Duty Cycle Test (Pulse Modulation) | Compliant |
| § 15.231(e)<br>RSS-210 A1.1.5( 2)                | transmission time, silent period   | Compliant |
| § 15.203                                         | Antenna Requirement                | Compliant |

### 4. Description of test modes

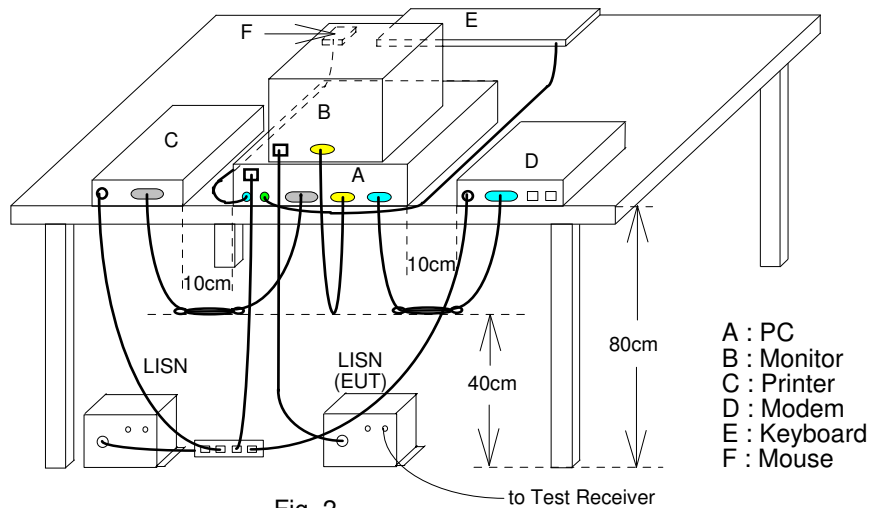
The EUT has been tested under engineering test mode condition. and the EUT staying in continuous transmitting mode. The Frequency 433.92 MHz is chosen for testing.

## 5. AC CONDUCTED EMISSIONS TEST

### 5.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

### 5.2 Test SET-UP (Block Diagram of Configuration)



### 5.3 Measurement Equipment Used:

| Conducted Emission Test Site |                 |                       |                  |            |            |
|------------------------------|-----------------|-----------------------|------------------|------------|------------|
| EQUIPMENT TYPE               | MFR             | MODEL NUMBER          | SERIAL NUMBER    | LAST CAL.  | CAL DUE.   |
| Conduction 04-3 Cable        | WOKEN           | CFD 300-NL            | Conduction 04 -3 | 07/28/2015 | 07/27/2016 |
| EMI Receiver 17              | Rohde & Schwarz | ESCI 7                | 100887           | 09/08/2015 | 09/07/2016 |
| LISN 18                      | ROHDE & SCHWARZ | ENV216                | 101424           | 02/11/2015 | 02/10/2016 |
| LISN 19                      | ROHDE & SCHWARZ | ENV216                | 101425           | 03/12/2015 | 03/11/2016 |
| Test Software                | Farad           | EZEMC<br>Ver:ISL-03A2 | N/A              | N/A        | N/A        |

### 5.4 Measurement Result:

N/A

## 6. RADIATED EMISSION TEST

15.231 (e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this section, except the field strength table in paragraph (b) of this section is replaced by the following:

### RSS 210 A1.1.5

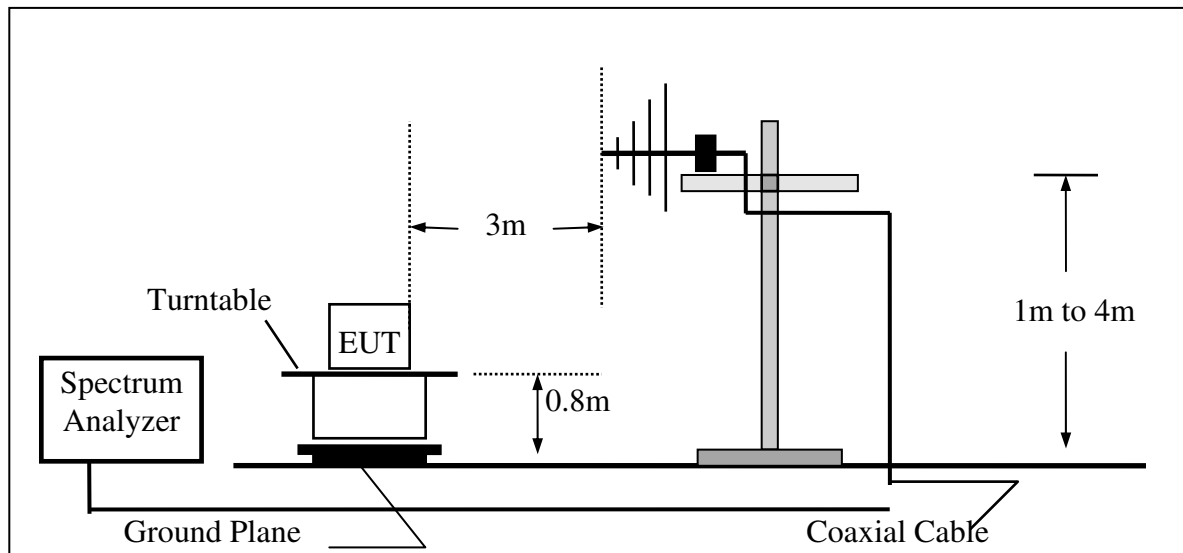
(1) Devices may be employed for any type of operation, including operation prohibited in Section A1.1.1, provided that the device complies with the requirements of sections A1.1.2 through A1.1.4 and that the field strength meets the limits in Table B of this annex.

### 6.1 Measurement Procedure

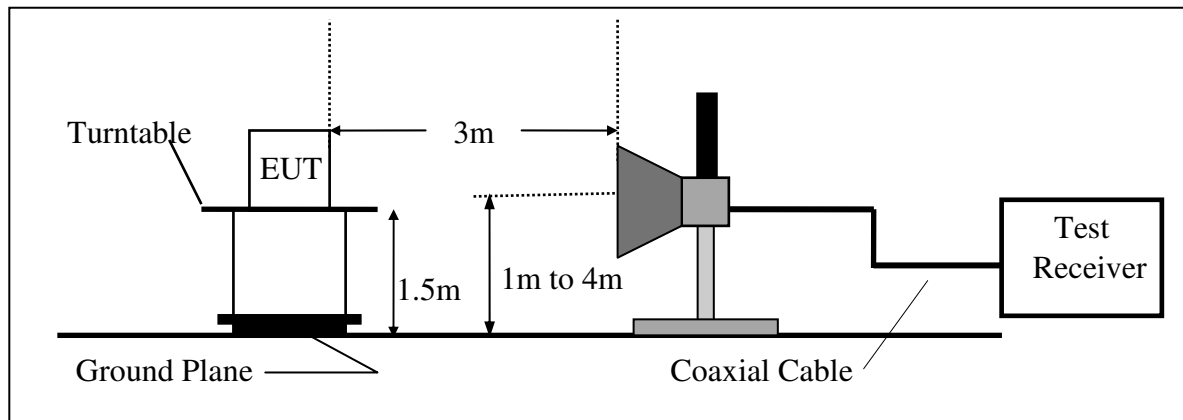
1. The EUT was placed on a turn table which is 0.8/1.5m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

## 6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Over 1 GHz



### 6.3 Measurement Equipment Used:

| Chamber 14                    |              |                              |                 |            |            |
|-------------------------------|--------------|------------------------------|-----------------|------------|------------|
| EQUIPMENT TYPE                | MFR          | MODEL NUMBER                 | SERIAL NUMBER   | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer 21(26.5GHz) | Agilent      | N9010A                       | MY49060537      | 07/30/2015 | 07/29/2016 |
| Spectrum Analyzer 20(6.5GHz)  | Agilent      | E4443A                       | MY48250315      | 05/21/2015 | 05/20/2016 |
| Loop Antenna9K-30M            | A.H.SYSTEM   | SAS-564                      | 294             | 06/17/2015 | 06/16/2017 |
| Bilog Antenna30-1G            | Schaffner    | CBL 6112D                    | 37873           | 06/16/2015 | 06/15/2016 |
| Horn antenna1-18G             | ETS          | 3117                         | 00066665        | 11/27/2015 | 11/26/2016 |
| Horn antenna18-26G(04)        | Com-power    | AH-826                       | 081001          | 07/24/2015 | 07/23/2017 |
| PREAMPLIFIER9-1000M           | HP           | 8447D                        | NA              | 03/12/2015 | 03/11/2016 |
| Preamplifier1-18G             | MITEQ        | AFS44-001018<br>00-25-10P-44 | 1329256         | 07/28/2015 | 07/27/2016 |
| Preamplifier1-26G             | EM           | EM01M26G                     | NA              | 03/11/2015 | 03/10/2016 |
| Cable1-18G                    | HUBER SUHNER | Sucoflex 106                 | NA              | 12/02/2015 | 12/01/2016 |
| Cable UP to 1G                | HUBER SUHNER | RG 214/U                     | NA              | 10/02/2015 | 10/01/2016 |
| SUCOFLEX 1GHz~40GHz CABLE     | HUBER SUHNER | SUCOFLEX 102                 | 27963/2&37421/2 | 11/03/2015 | 11/02/2017 |

### 6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Average Value = Peak Value + 20 Log (Ton/Tp) .....Pulse Modulation Duty Cycle Correction Factor

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

## 6.5 Measurement Result

### Fundamental Measurement Result

|                        |                   |            |            |
|------------------------|-------------------|------------|------------|
| Operation Mode:        | Transmitting Mode | Test Date: | 2015/12/11 |
| Fundamental Frequency: | 433.92MHz         | Test By:   | Dino       |
| Temp:                  | 25 °C             | Hum.:      | 60%        |

### FSK Mode:

| Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|-------------|-----------------|--------------|-----------------|-----------------|---------------------|--------|------------|
| 433.92      | 77.02           | -8.56        | 68.46           | 92.86           | -24.40              | Peak   | VERTICAL   |
| 433.92      | 83.58           | -8.56        | 75.02           | 92.86           | -17.84              | Peak   | HORIZONTAL |
| 433.92      | 72.74           | -8.56        | 64.18           | 72.86           | -8.68               | AV     | HORIZONTAL |

### ASK Mode:

| Freq<br>MHz | Reading<br>dBuV | Factor<br>dB | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|-------------|-----------------|--------------|-----------------|-----------------|---------------------|--------|------------|
| 433.92      | 75.15           | -8.26        | 66.89           | 92.86           | -25.97              | Peak   | VERTICAL   |
| 433.92      | 79.09           | -8.26        | 70.83           | 92.86           | -22.03              | Peak   | HORIZONTAL |

### Remark:

- 1 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 2 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.
- 3 Average Value = Peak Value + 20 Log (Ton/Tp) .....Pulse Modulation Duty Cycle Correction Factor

### Radiated Spurious Emission Measurement Result (below 1GHz) (FSK Mode)

Operation Mode: Transmitting Mode

Test Date: 2015/12/11

Fundamental Frequency: 433.92MHz

Test By: Dino

Temperature : 25 °C

Humidity : 60 %

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|---------------------|--------|------------|
| 1  | 578.05      | 28.06           | -6.24          | 21.82           | 46.00           | -24.18              | Peak   | VERTICAL   |
| 2  | 666.32      | 27.28           | -4.78          | 22.50           | 46.00           | -23.50              | Peak   | VERTICAL   |
| 3  | 765.26      | 26.78           | -2.82          | 23.96           | 46.00           | -22.04              | Peak   | VERTICAL   |
| 4  | 838.98      | 27.87           | -1.94          | 25.93           | 46.00           | -20.07              | Peak   | VERTICAL   |
| 5  | 867.84      | 32.81           | -1.44          | 31.37           | 52.86           | -21.49              | Peak   | VERTICAL   |
| 6  | 908.82      | 31.36           | -0.67          | 30.69           | 46.00           | -15.31              | Peak   | VERTICAL   |
|    |             |                 |                |                 |                 |                     |        |            |
| 1  | 610.06      | 26.60           | -5.55          | 21.05           | 46.00           | -24.95              | Peak   | HORIZONTAL |
| 2  | 674.08      | 26.19           | -4.66          | 21.53           | 46.00           | -24.47              | Peak   | HORIZONTAL |
| 3  | 744.89      | 25.90           | -3.07          | 22.83           | 46.00           | -23.17              | Peak   | HORIZONTAL |
| 4  | 825.40      | 26.34           | -2.15          | 24.19           | 46.00           | -21.81              | Peak   | HORIZONTAL |
| 5  | 867.84      | 39.01           | -1.44          | 37.57           | 52.86           | -15.29              | Peak   | HORIZONTAL |
| 6  | 951.50      | 26.41           | 0.15           | 26.56           | 46.00           | -19.44              | Peak   | HORIZONTAL |

#### Remark:

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

# **Radiated Spurious Emission Measurement Result (above 1GHz) (FSK Mode)**

Operation Mode: Transmitting Mode

Test Date: 2015/12/11

Fundamental Frequency: 433.92MHz

Test By: Dino

Temperature : 25 °C

Humidity : 60 %

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|---------------------|--------|------------|
| 1  | 3471.36     | 50.23           | -7.25          | 42.98           | 74.00           | -31.02              | Peak   | VERTICAL   |
| 2  | 3905.28     | 46.44           | -5.36          | 41.08           | 74.00           | -32.92              | Peak   | VERTICAL   |
|    |             |                 |                |                 |                 |                     |        |            |
| 1  | 3471.36     | 54.64           | -7.25          | 47.39           | 74.00           | -26.61              | Peak   | HORIZONTAL |
| 2  | 3905.28     | 49.10           | -5.36          | 43.74           | 74.00           | -30.26              | Peak   | HORIZONTAL |
| 3  | 4339.20     | 48.34           | -3.68          | 44.66           | 74.00           | -29.34              | Peak   | HORIZONTAL |

## **Remark:**

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.
- 4 Measurement of data within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

# **Radiated Spurious Emission Measurement Result (below 1GHz) (ASK Mode)**

Operation Mode: Transmitting Mode

Test Date: 2015/12/11

Fundamental Frequency: 433.92MHz

Test By: Dino

Temperature : 25 °C

Humidity : 60 %

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|---------------------|--------|------------|
| 1  | 89.17       | 45.49           | -18.52         | 26.97           | 43.50           | -16.53              | Peak   | VERTICAL   |
| 2  | 106.63      | 45.06           | -15.99         | 29.07           | 43.50           | -14.43              | Peak   | VERTICAL   |
| 3  | 206.54      | 53.37           | -14.69         | 38.68           | 43.50           | -4.82               | Peak   | VERTICAL   |
| 4  | 389.87      | 34.65           | -9.23          | 25.42           | 46.00           | -20.58              | Peak   | VERTICAL   |
| 5  | 515.97      | 28.49           | -7.10          | 21.39           | 46.00           | -24.61              | Peak   | VERTICAL   |
| 6  | 867.84      | 26.68           | -1.05          | 25.63           | 46.00           | -20.37              | Peak   | VERTICAL   |
|    |             |                 |                |                 |                 |                     |        |            |
| 1  | 96.93       | 40.83           | -17.59         | 23.24           | 43.50           | -20.26              | Peak   | HORIZONTAL |
| 2  | 106.63      | 43.85           | -15.99         | 27.86           | 43.50           | -15.64              | Peak   | HORIZONTAL |
| 3  | 211.39      | 39.11           | -14.58         | 24.53           | 43.50           | -18.97              | Peak   | HORIZONTAL |
| 4  | 293.84      | 31.66           | -11.11         | 20.55           | 46.00           | -25.45              | Peak   | HORIZONTAL |
| 5  | 364.65      | 29.85           | -9.75          | 20.10           | 46.00           | -25.90              | Peak   | HORIZONTAL |
| 6  | 867.84      | 31.73           | -1.05          | 30.68           | 46.00           | -15.32              | Peak   | HORIZONTAL |

## **Remark:**

- 1 No further spurious emissions detected from the lowest internal frequency and 30MHz.
- 2 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 4 Measurement result within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

# **Radiated Spurious Emission Measurement Result (above 1GHz) (ASK Mode)**

Operation Mode: Transmitting Mode

Test Date: 2015/12/11

Fundamental Frequency: 433.92MHz

Test By: Dino

Temperature : 25 °C

Humidity : 60 %

| No | Freq<br>MHz | Reading<br>dBuV | Factor<br>dB/m | Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark | Pol<br>V/H |
|----|-------------|-----------------|----------------|-----------------|-----------------|---------------------|--------|------------|
| 1  | 1301.76     | 50.11           | -15.49         | 34.62           | 74.00           | -39.38              | Peak   | VERTICAL   |
| 2  | 1735.68     | 48.15           | -13.56         | 34.59           | 74.00           | -39.41              | Peak   | VERTICAL   |
| 3  | 2169.60     | 48.49           | -11.55         | 36.94           | 74.00           | -37.06              | Peak   | VERTICAL   |
| 4  | 2603.52     | 49.26           | -10.12         | 39.14           | 74.00           | -34.86              | Peak   | VERTICAL   |
| 5  | 3037.44     | 47.71           | -9.15          | 38.56           | 74.00           | -35.44              | Peak   | VERTICAL   |
| 6  | 3471.36     | 54.48           | -7.98          | 46.50           | 74.00           | -27.50              | Peak   | VERTICAL   |
| 7  | 3905.28     | 46.55           | -6.14          | 40.41           | 74.00           | -33.59              | Peak   | VERTICAL   |
| 8  | 4339.20     | 48.76           | -4.53          | 44.23           | 74.00           | -29.77              | Peak   | VERTICAL   |
|    |             |                 |                |                 |                 |                     |        |            |
| 1  | 1301.76     | 49.87           | -15.49         | 34.38           | 74.00           | -39.62              | Peak   | HORIZONTAL |
| 2  | 1735.68     | 48.22           | -13.56         | 34.66           | 74.00           | -39.34              | Peak   | HORIZONTAL |
| 3  | 2169.60     | 50.23           | -11.55         | 38.68           | 74.00           | -35.32              | Peak   | HORIZONTAL |
| 4  | 2603.52     | 48.78           | -10.12         | 38.66           | 74.00           | -35.34              | Peak   | HORIZONTAL |
| 5  | 3037.44     | 48.15           | -9.15          | 39.00           | 74.00           | -35.00              | Peak   | HORIZONTAL |
| 6  | 3471.36     | 54.84           | -7.98          | 46.86           | 74.00           | -27.14              | Peak   | HORIZONTAL |
| 7  | 3905.28     | 47.33           | -6.14          | 41.19           | 74.00           | -32.81              | Peak   | HORIZONTAL |
| 8  | 4339.20     | 50.31           | -4.53          | 45.78           | 74.00           | -28.22              | Peak   | HORIZONTAL |

## Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency
- 2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.
- 3 "F" denotes fundamental frequency; "H" denotes harmonics frequency. "S" denotes spurious frequency.
- 4 Measurement of data within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.
- 6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

## 7. 20DB / 99% OCCUPIED BANDWIDTH

### RSS 210 A1.1.3 Bandwidth of Momentary Signals

For the purpose of Section A1.1, the 99% bandwidth shall be no wider than 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency.

#### 7.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW= 10KHz, VBW= 30KHz, Span =3MHz.
4. Set SPA Max hold. Mark peak, -20dB. 99% Bandwidth

#### 7.2 Test SET-UP (Block Diagram of Configuration)

Same as 6.2 Radiated Emission Measurement.

#### 7.3 Measurement Equipment Used:

Same as 6.3 Radiated Emission Measurement.

#### 7.4 Measurement Results

Refer to attached data chart.

The center frequency  $f_c$  is **433.92MHz**, according to the Rules, section 15.231(C), the Bandwidth of Center Frequency at-20dB should be calculated as following:

$$433.92 \times 0.0025 = 1.0848(\text{MHz})$$

So, the Uper/Lower frequencies limit should be specified as:

$$f_{(U)} = f_c + \Delta f/2 = 433.92 + 0.5424 = 434.46(\text{MHz})$$

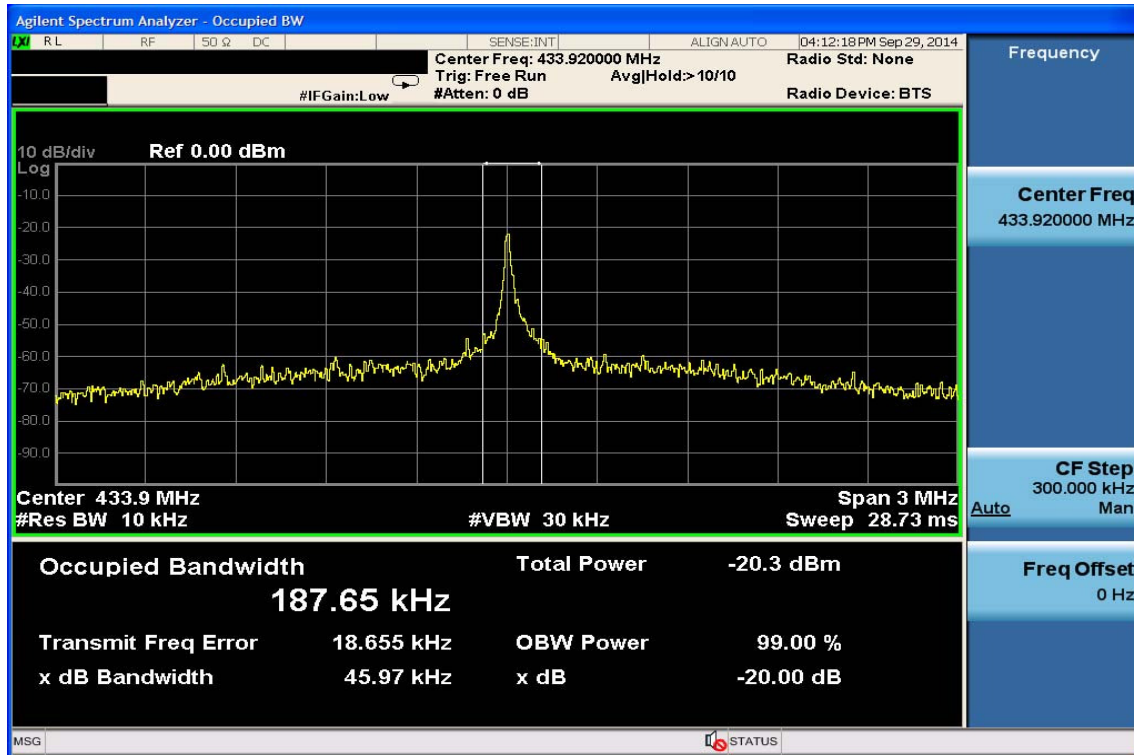
$$f_{(L)} = f_c - \Delta f/2 = 433.92 - 0.5424 = 433.377 (\text{MHz})$$

#### 7.5 Measurement Result:

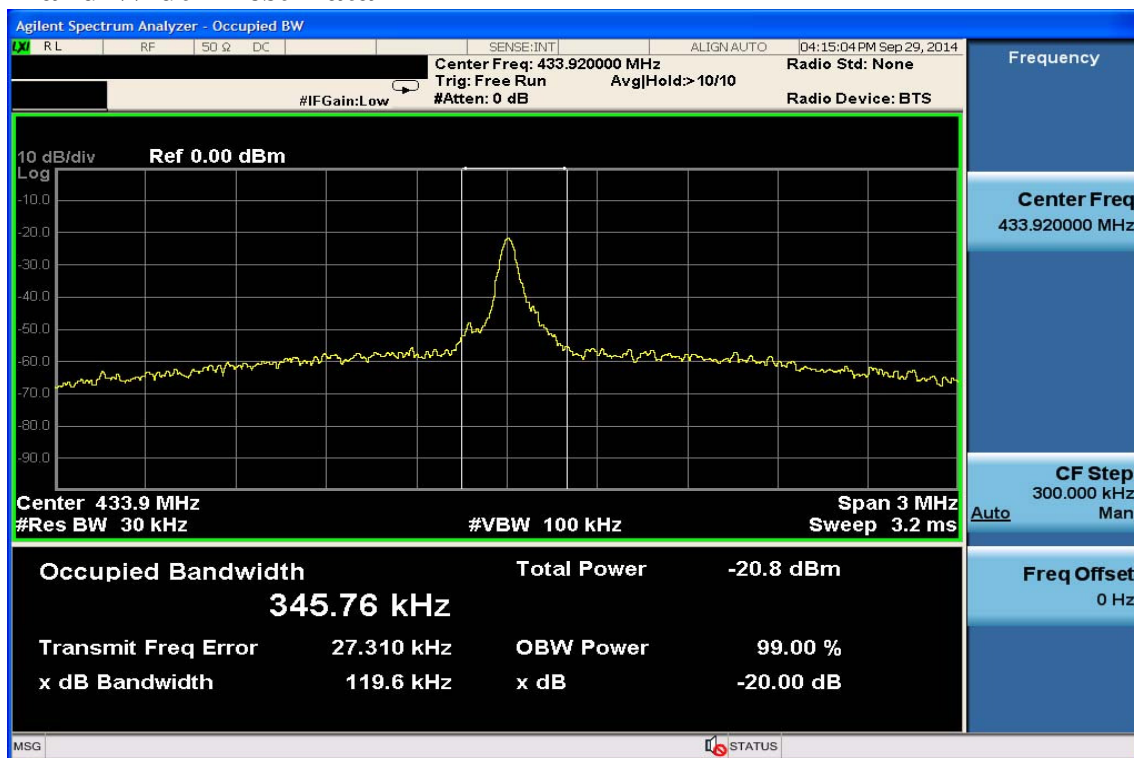
|                       | FSK Mode | ASK Mode | limit (MHz)                    | result |
|-----------------------|----------|----------|--------------------------------|--------|
| -20dB Bandwidth (kHz) | 45.97    | 56.98    | within allowed frequency range | PASS   |
| 99% Bandwidth (kHz)   | 345.76   | 86.228   | <1.0848                        | PASS   |

## FSK Mode

### 20dB Band Width Test Data

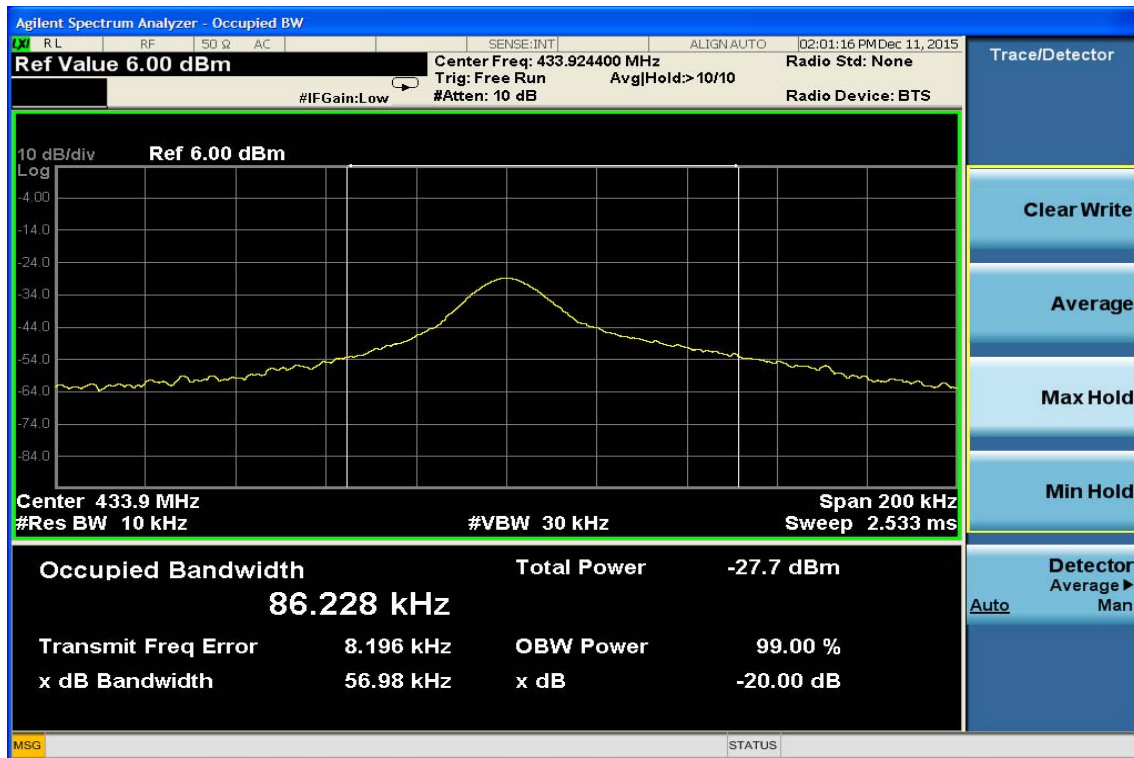


### 99% Band Width Test Data



## ASK Mode

### 20dB & 99% Band Width Test Data



## **8. DUTY CYCLE (AVERAGE CORRECTION FACTOR) MEASUREMENT**

### **8.1 Measurement Procedure**

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set ETU normal operating mode.
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 1.0MHz, Span =0 Hz. Adjacent sweep.
4. Set SPA View. Mark delta.

### **8.2 Test SET-UP (Block Diagram of Configuration)**

Same as 6.2 Radiated Emission Measurement.

### **8.3 Measurement Equipment Used:**

Same as 6.3 Radiated Emission Measurement.

### **8.4 Measurement Results:**

FSK Mode:

$T_{on} = 28.70(\text{ms})$

$T_p > 100(\text{ms})$ ,

Average Correction Factory =  $20\log(T_{on}/T_p) = 20\log(28.70/100) = -10.84\text{ dB}$

ASK Mode:

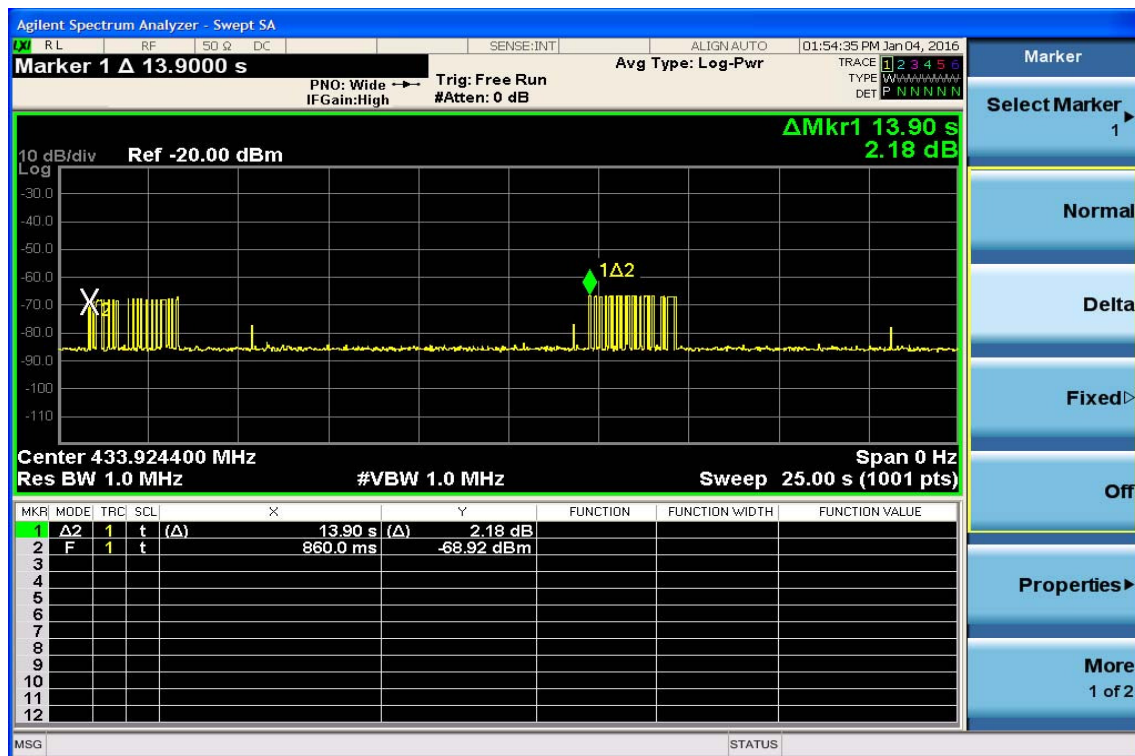
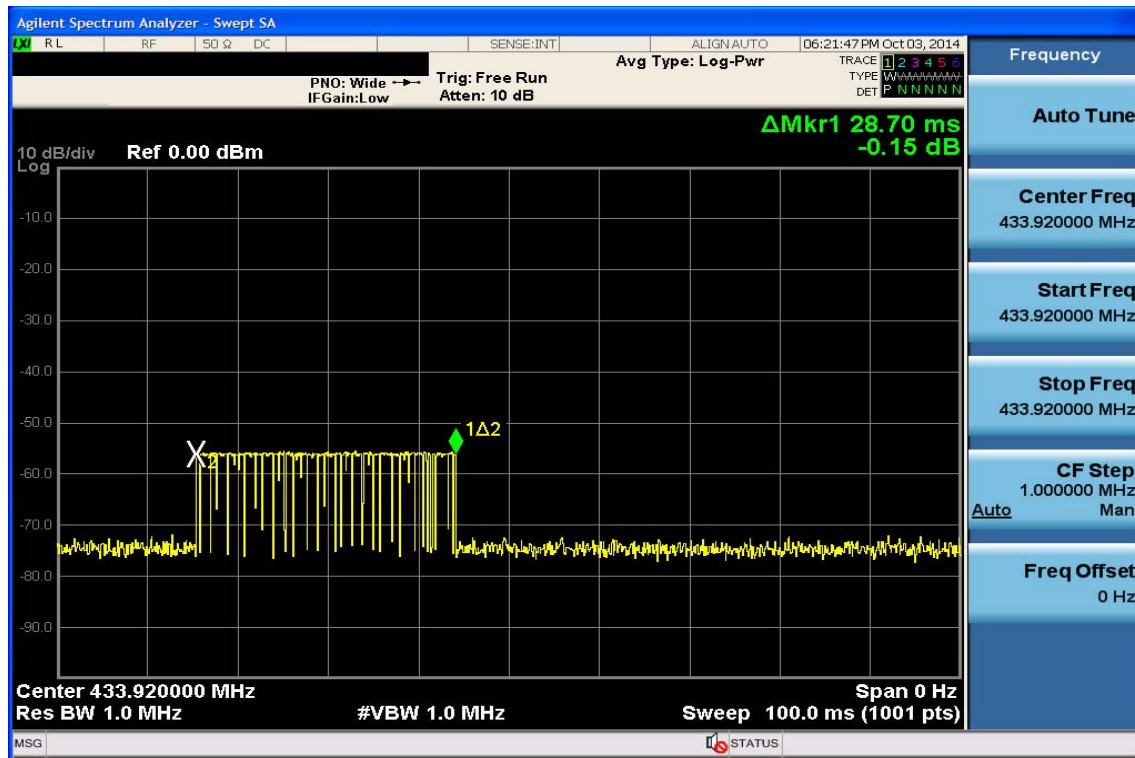
$T_{on} = 16.5(\text{ms})$

$T_p > 100(\text{ms})$ ,

Average Correction Factory =  $20\log(T_{on}/T_p) = 20\log(16.5/100) = -15.65\text{ dB}$

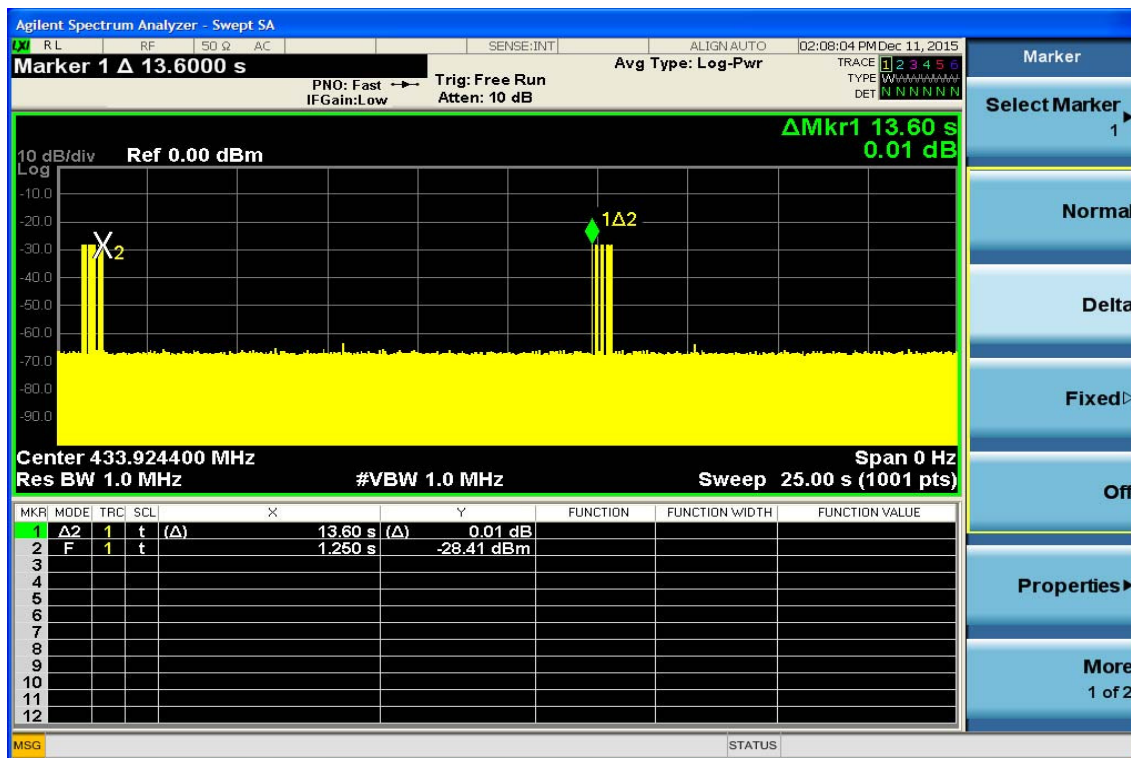
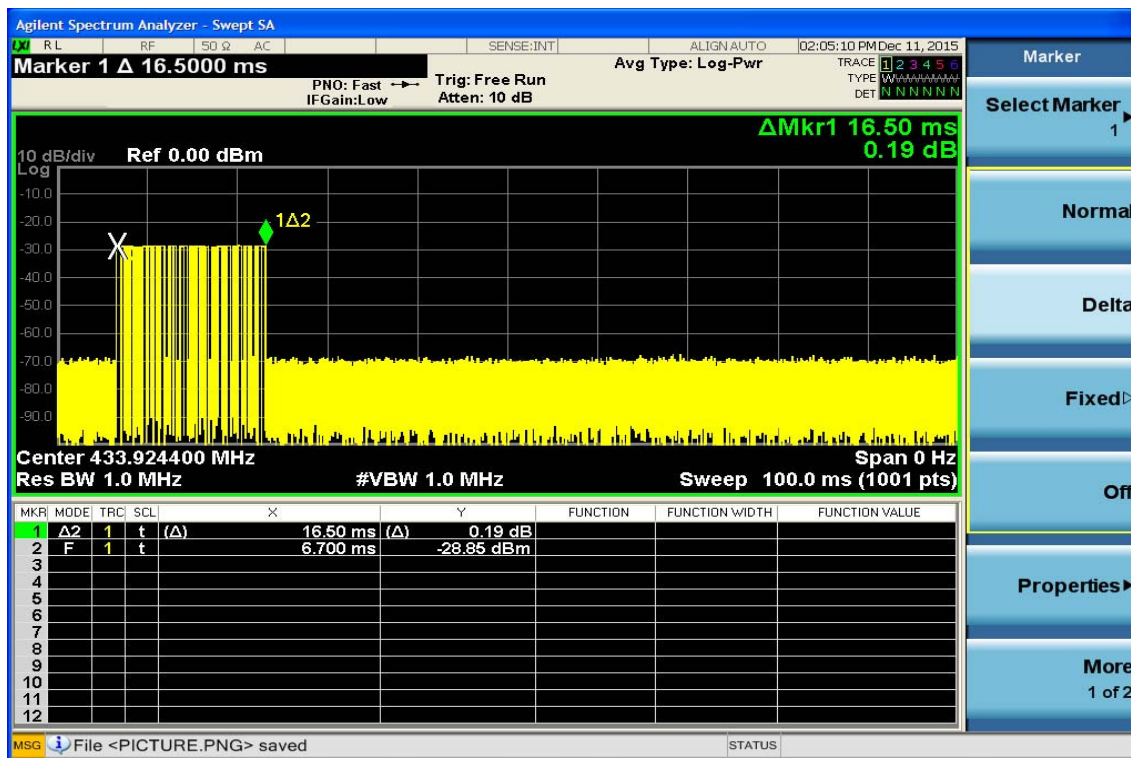
## FSK Mode

Ton Measurement:  $T_p > 100\text{ms}$



## ASK Mode

Ton Measurement:  $T_p > 100\text{ms}$



## **9. SILENT PERIOD TIME MEASUREMENT:**

15.231 (e)

devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

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(2) In addition, devices operated under the provisions of this section (A1.1.5) shall be capable of automatically limiting their operation so that the duration of each transmission shall not be greater than 1 second and the silent period between transmissions shall be at least 30 times the duration of the transmission, but in no case less than 10 seconds. However, devices that are designed for limited

use for the purpose of initial programming, reprogramming or installation, and not for regular operations, may operate up to 5 seconds provided that such devices are used only occasionally in connection with each unit being programmed or installed.

### **9.1 Measurement Procedure**

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 1MHz, Span =0Hz
3. Set EUT Power on as normal operation
4. Set SPA Max hold. Delta Mark.

### **9.2 Test SET-UP (Block Diagram of Configuration)**

Same as 6.2 Radiated Emission Measurement.

### **9.3 Measurement Equipment Used:**

Same as 6.3 Radiated Emission Measurement.

#### 9.4 Measurement Results

Total transmission time of transmissions calculation:

FSK Mode:

Ton: 28.70 ms,

Tp: 13.9s

silent period limit(which one is lower): 10s or  $28.7(\text{ms}) * 30 = 861(\text{mS})$ ,

T silent period =  $13.9\text{s} - 28.70\text{ms} = 13.613\text{s} > 10\text{s}$

ASK Mode:

Ton: 16.5 ms,

Tp: 13.6s

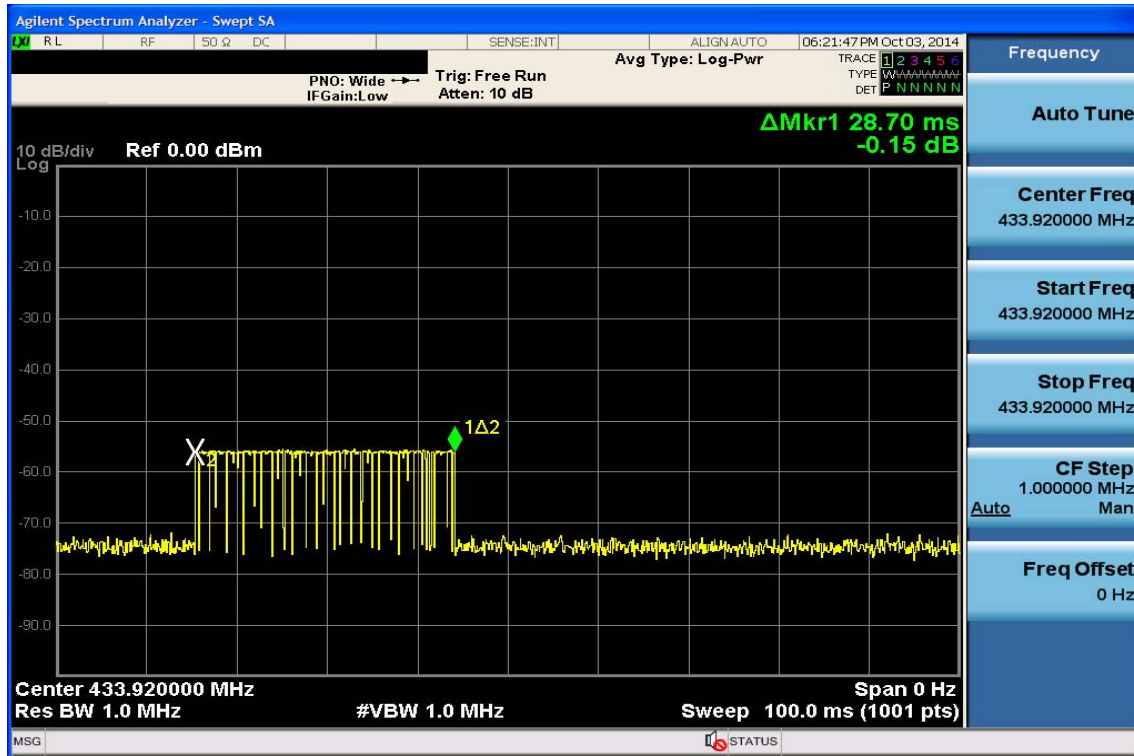
silent period limit(which one is lower): 10s or  $16.5(\text{ms}) * 30 = 495(\text{mS})$ ,

T silent period =  $13.6\text{s} > 10\text{s}$

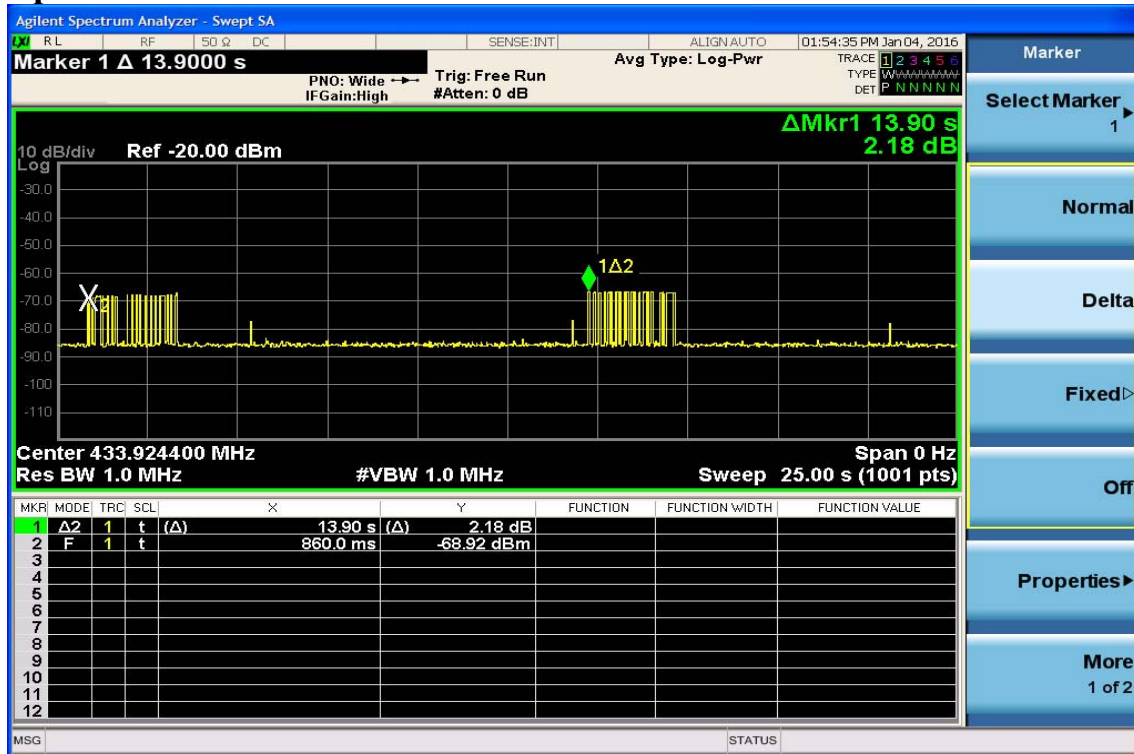
The result : PASS.

## FSK Mode

### Ton:

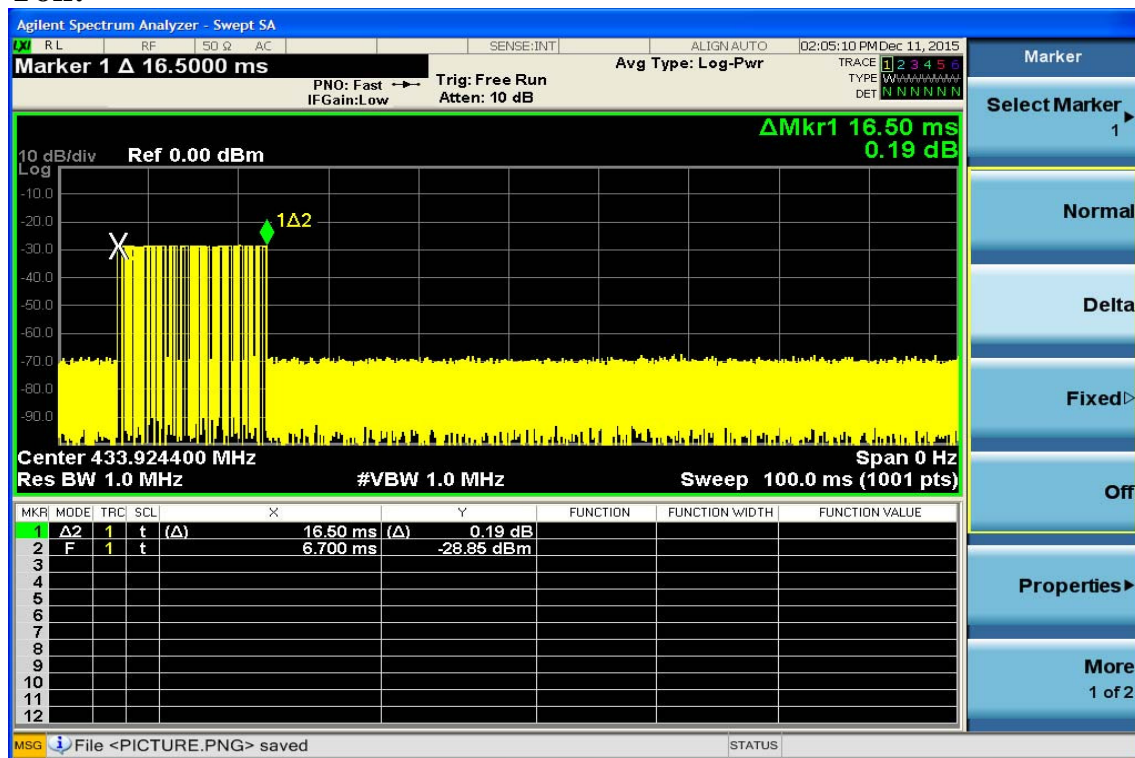


### Tp:



## ASK Mode

### Ton:



### Tp:

