

# FCC Part 15C

## Measurement and Test Report

For

**Smart Technologies & Investment Ltd.**

**21/F., Fun Tower, No. 35 Hung To Road, Kwun Tong, Kowloon, Hong Kong**

**FCC ID: N9KSMARTRF1277**

|                                      |                                 |
|--------------------------------------|---------------------------------|
| <b>FCC Rule(s):</b>                  | <u>FCC Part 15.231</u>          |
| <b>Product Description:</b>          | <u>WS135 Remote</u>             |
| <b>Tested Model:</b>                 | <u>WS135TX</u>                  |
| <b>Report No.:</b>                   | <u>STR15128153I</u>             |
| <b>Tested Date:</b>                  | <u>2015-12-18 to 2016-01-04</u> |
| <b>Issued Date:</b>                  | <u>2016-01-04</u>               |
| <b>Tested By:</b>                    | <u>Jason Su / Engineer</u>      |
| <b>Reviewed By:</b>                  | <u>Silin Chen / EMC Manager</u> |
| <b>Approved &amp; Authorized By:</b> | <u>Jandy so / PSQ Manager</u>   |
| <b>Prepared By:</b>                  |                                 |

*Jason Su*  
*Silin Chen*  
*Jandyso*

**Shenzhen SEM.Test Technology Co., Ltd.**

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,  
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: [www.semtest.com.cn](http://www.semtest.com.cn)

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

**TABLE OF CONTENTS**

|                                                             |           |
|-------------------------------------------------------------|-----------|
| <b>1. GENERAL INFORMATION.....</b>                          | <b>3</b>  |
| 1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)..... | 3         |
| 1.2 TEST STANDARDS.....                                     | 4         |
| 1.3 TEST METHODOLOGY.....                                   | 4         |
| 1.4 TEST FACILITY.....                                      | 4         |
| 1.5 EUT SETUP AND TEST MODE.....                            | 5         |
| 1.6 TEST EQUIPMENT LIST AND DETAILS.....                    | 5         |
| <b>2. SUMMARY OF TEST RESULTS.....</b>                      | <b>6</b>  |
| <b>3. ANTENNA REQUIREMENT.....</b>                          | <b>7</b>  |
| 3.1 STANDARD APPLICABLE.....                                | 7         |
| 3.2 TEST RESULT.....                                        | 7         |
| <b>4. RADIATED EMISSIONS.....</b>                           | <b>8</b>  |
| 4.1 MEASUREMENT UNCERTAINTY.....                            | 8         |
| 4.2 STANDARD APPLICABLE.....                                | 8         |
| 4.3 TEST PROCEDURE.....                                     | 9         |
| 4.4 CORRECTED AMPLITUDE & MARGIN CALCULATION.....           | 10        |
| 4.5 ENVIRONMENTAL CONDITIONS.....                           | 10        |
| 4.6 SUMMARY OF TEST RESULTS/PLOTS.....                      | 10        |
| <b>5. 20DB BANDWIDTH.....</b>                               | <b>13</b> |
| 5.1 STANDARD APPLICABLE.....                                | 13        |
| 5.1 TEST PROCEDURE.....                                     | 13        |
| 5.2 ENVIRONMENTAL CONDITIONS.....                           | 13        |
| 5.3 SUMMARY OF TEST RESULTS/PLOTS.....                      | 13        |
| <b>6. TRANSMISSION TIME.....</b>                            | <b>15</b> |
| 6.1 STANDARD APPLICABLE.....                                | 15        |
| 6.2 TEST PROCEDURE.....                                     | 15        |
| 6.3 ENVIRONMENTAL CONDITIONS.....                           | 15        |
| 6.4 SUMMARY OF TEST RESULTS/PLOTS.....                      | 15        |
| <b>7. DUTY CYCLE.....</b>                                   | <b>17</b> |
| 7.1 STANDARD APPLICABLE.....                                | 17        |
| 7.2 TEST PROCEDURE.....                                     | 17        |
| 7.3 ENVIRONMENTAL CONDITIONS.....                           | 17        |
| 7.4 SUMMARY OF TEST RESULTS/PLOTS.....                      | 17        |

## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Smart Technologies & Investment Ltd.  
Address of applicant: 21/F., Fun Tower, No. 35 Hung To Road, Kwun Tong, Kowloon, Hong Kong  
Manufacturer: Smart Electronic Industrial (Dong Guan) Co., Ltd.  
Address of manufacturer: Qing Long Road, Long Jian Tian-Cun, Huang Jiang-Zhen, Dong Guan, Guang Dong, China

| General Description of EUT                                                              |               |
|-----------------------------------------------------------------------------------------|---------------|
| Product Name:                                                                           | WS135 Remote  |
| Trade Name:                                                                             | /             |
| Model No.:                                                                              | WS135TX       |
| Adding Model(s):                                                                        | /             |
| Rated Voltage:                                                                          | Battery DC 3V |
| Note: The test data is gathered from a production sample, provided by the manufacturer. |               |

| Technical Characteristics of EUT  |                               |
|-----------------------------------|-------------------------------|
| Frequency Range:                  | 433.92 MHz                    |
| Max. Field Strength:              | 74.20 dBuV/m (at 3m distance) |
| Modulation:                       | FSK                           |
| Antenna Type:                     | PCB Antenna                   |
| Antenna Gain:                     | 0dBi                          |
| Lowest Internal Frequency of EUT: | 16MHz                         |
| Device Category:                  | Portable Device               |

## 1.2 Test Standards

The following report is prepared on behalf of the Smart Technologies & Investment Ltd. in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

## 1.4 Test Facility

### **FCC – Registration No.: 934118**

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

### **Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

### **CNAS Registration No.: L4062**

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2<sup>nd</sup> Road, Bao'an District, Shenzhen, P.R.C (518101).

## 1.5 EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| Test Mode List |              |                 |
|----------------|--------------|-----------------|
| Test Mode      | Description  | Remark          |
| TM1            | Transmitting | With modulation |

| EUT Cable List and Details |            |                     |                        |
|----------------------------|------------|---------------------|------------------------|
| Cable Description          | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| /                          | /          | /                   | /                      |

| Special Cable List and Details |            |                     |                        |
|--------------------------------|------------|---------------------|------------------------|
| Cable Description              | Length (m) | Shielded/Unshielded | With / Without Ferrite |
| /                              | /          | /                   | /                      |

| Auxiliary Equipment List and Details |              |       |               |
|--------------------------------------|--------------|-------|---------------|
| Description                          | Manufacturer | Model | Serial Number |
| /                                    | /            | /     | /             |

## 1.6 Test Equipment List and Details

| Description       | Manufacturer    | Model     | Serial Number | Cal Date   | Due Date   |
|-------------------|-----------------|-----------|---------------|------------|------------|
| Spectrum Analyzer | Agilent         | E4407B    | MY41440400    | 2015-06-17 | 2016-06-16 |
| Spectrum Analyzer | Rohde & Schwarz | FSP       | 836079/035    | 2015-06-17 | 2016-06-16 |
| EMI Test Receiver | Rohde & Schwarz | ESVB      | 825471/005    | 2015-06-17 | 2016-06-16 |
| Amplifier         | Agilent         | 8447F     | 3113A06717    | 2015-06-17 | 2016-06-16 |
| Amplifier         | C&D             | PAP-1G18  | 2002          | 2015-06-17 | 2016-06-16 |
| Broadband Antenna | Schwarz beck    | VULB9163  | 9163-333      | 2015-06-17 | 2016-06-16 |
| Horn Antenna      | ETS             | 3117      | 00086197      | 2015-06-17 | 2016-06-16 |
| Loop Antenna      | Schwarz beck    | FMZB 1516 | 9773          | 2015-06-17 | 2016-06-16 |
| EMI Test Receiver | Rohde & Schwarz | ESPI      | 101611        | 2015-06-17 | 2016-06-16 |
| L.I.S.N           | Schwarz beck    | NSLK8126  | 8126-224      | 2015-06-17 | 2016-06-16 |
| Pulse Limiter     | Rohde & Schwarz | ESH3-Z2   | 100911        | 2015-06-17 | 2016-06-16 |

## 2. SUMMARY OF TEST RESULTS

| FCC Rules   | Description of Test Item     | Result    |
|-------------|------------------------------|-----------|
| § 15.203    | Antenna Requirement          | Compliant |
| §15.205     | Restricted Band of Operation | Compliant |
| § 15.207(a) | Conducted Emission           | Compliant |
| § 15.209    | Radiated Spurious Emissions  | Compliant |
| §15.231(a)  | Deactivation Testing         | Compliant |
| §15.231(b)  | Radiated Emissions           | Compliant |
| §15.231(c)  | 20dB Bandwidth Testing       | Compliant |

### **3. Antenna Requirement**

---

#### **3.1 Standard Applicable**

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

#### **3.2 Test Result**

This product has a PCB antenna, fulfill the requirement of this section.

## 4. Radiated Emissions

### 4.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is  $\pm 5.10$  dB.

### 4.2 Standard Applicable

According to §15.231(b), 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                   | 1,250 to 3,750 **                                | 125 to 375 **                                           |
| 174 - 260                   | 3,750                                            | 375                                                     |
| 260 - 470                   | 3,750 to 12,500 **                               | 375 to 1,250 **                                         |
| Above 470                   | 12,500                                           | 1,250                                                   |

\*\* linear interpolations

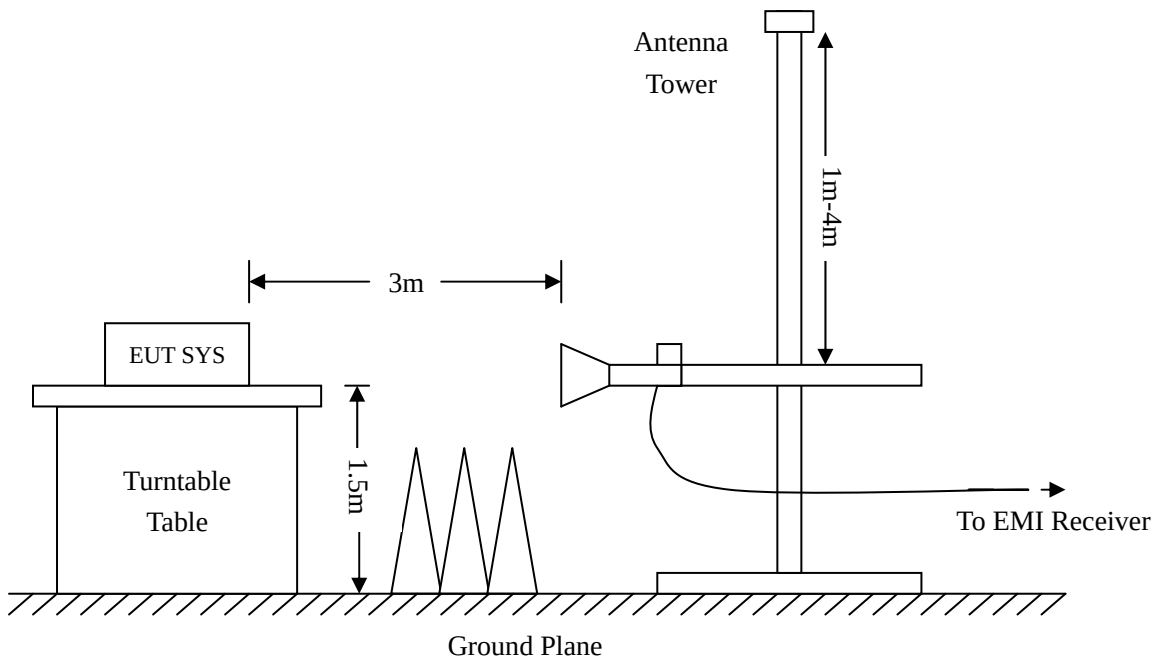
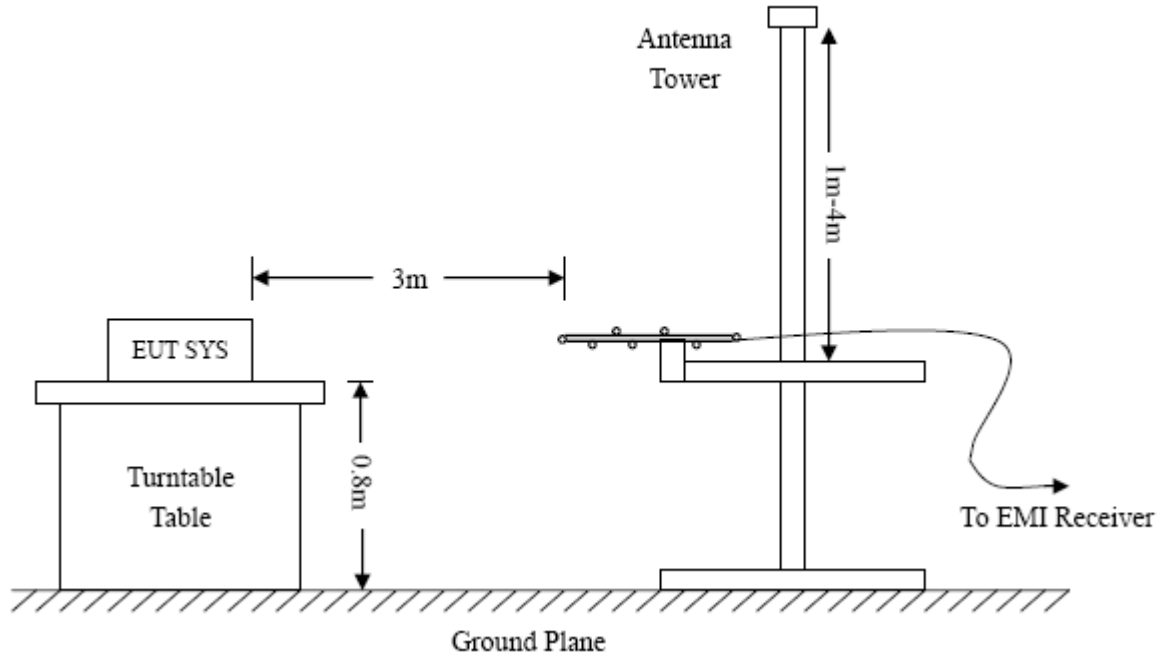
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

### 4.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.



#### 4.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB $\mu$ V means the emission is 6dB $\mu$ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

#### 4.5 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 21° C     |
| Relative Humidity: | 50%       |
| ATM Pressure:      | 1011 mbar |

#### 4.6 Summary of Test Results/Plots

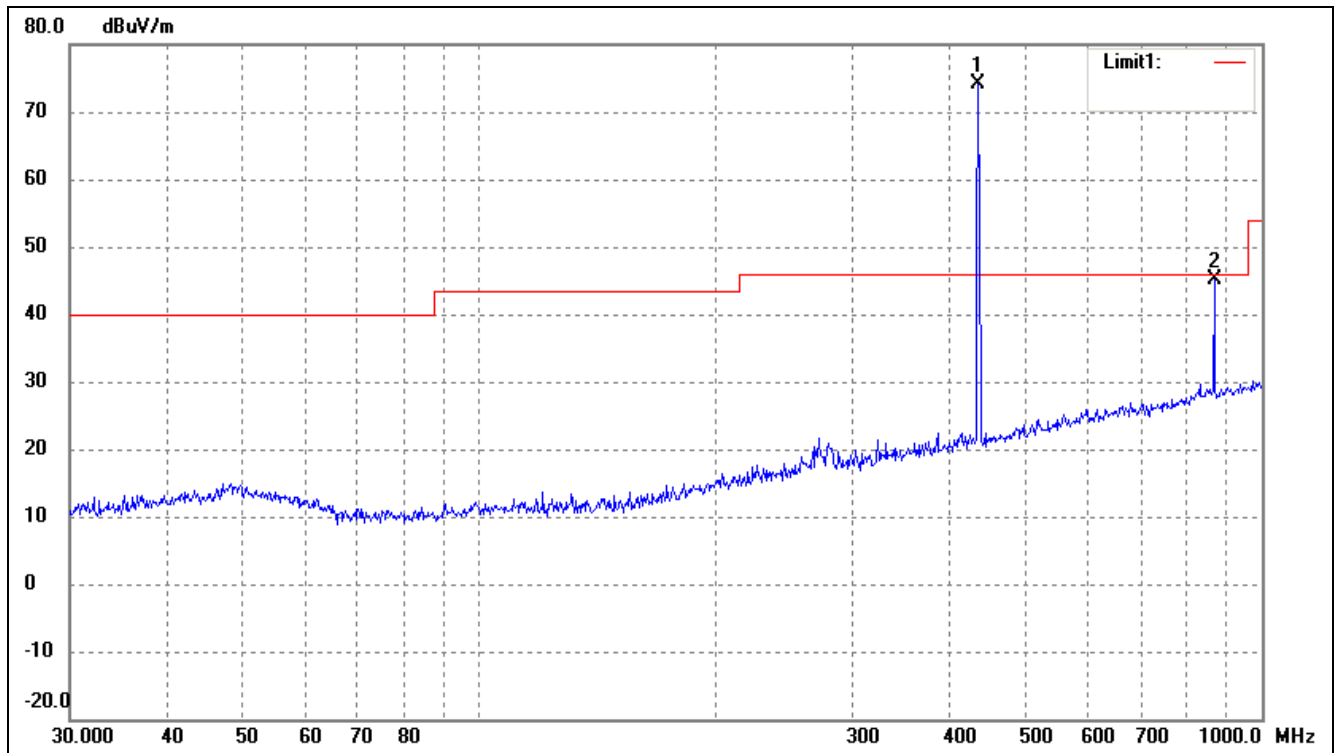
According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

**-26.09 dB at 1301.760 MHz in the Horizontal polarization, Peak Detector, 9 kHz to 5 GHz, 3 Meters**

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

### Plot of Radiated Emissions Test Data

EUT: WS135TX Remote  
 Tested Model: WS135TX  
 Operating Condition: Transmitting  
 Comment: Battery DC3V  
 Test Specification: Horizontal

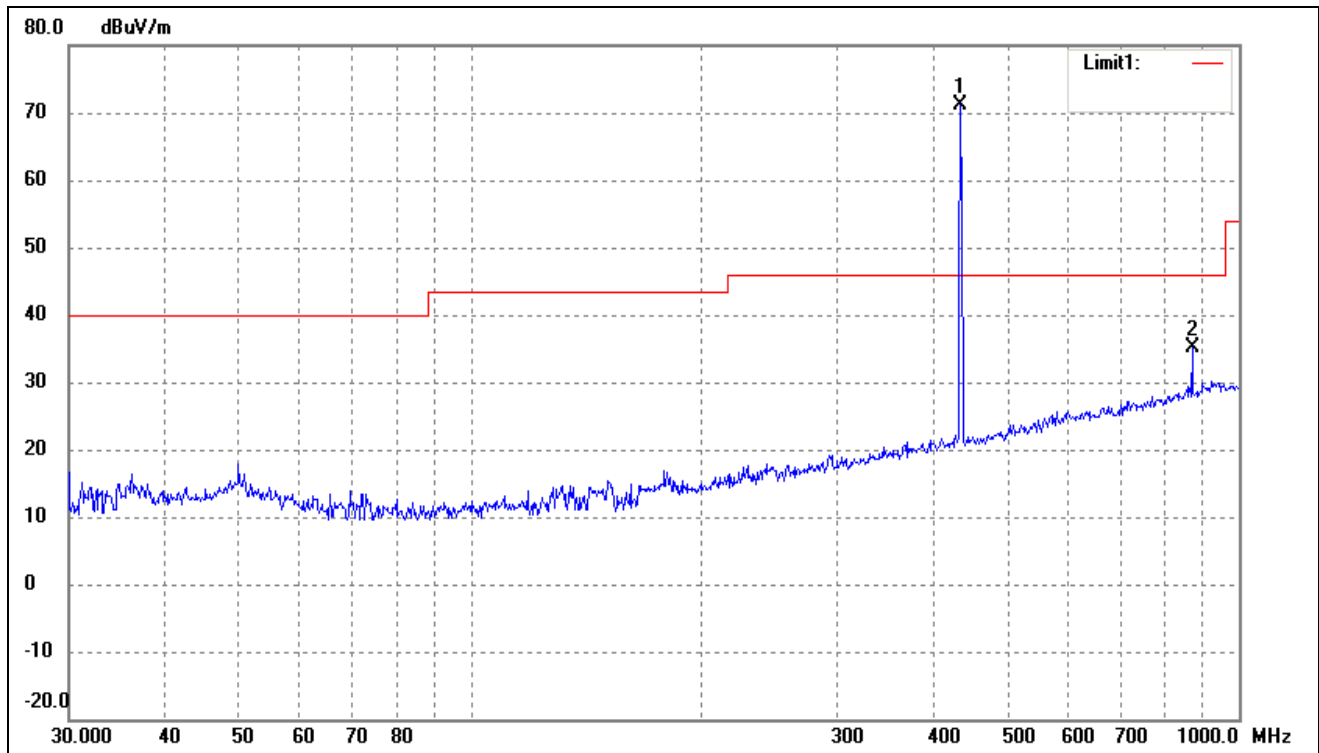


| No. | Frequency<br>MHz | Reading<br>dBuV/m | Corr.<br>Factor<br>(dB) | Dutycycle<br>Factor<br>(dB) | Result<br>dBuV/m | Limit<br>dBuV/m | Margin<br>(dB) | Deg.<br>( ° ) | Height<br>(cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|----------------|---------------|----------------|--------|
| 1   | 433.9200         | 76.39             | -2.19                   | N/A                         | 74.20            | 100.83          | -26.63         | 187           | 100            | peak   |
|     | 433.9200         | /                 | /                       | -20.28                      | 53.92            | 80.83           | -26.91         | 54            | 100            | Ave    |
| 2   | 867.8400         | 40.51             | 4.63                    | N/A                         | 45.14            | 80.83           | -35.69         | 126           | 100            | peak   |
|     | 867.8400         | /                 | /                       | -20.28                      | 24.86            | 60.83           | -35.97         | 54            | 100            | Ave    |

#### Above 1GHz

| No. | Frequency<br>MHz | Reading<br>dBuV/m | Corr.<br>Factor<br>(dB) | Dutycycle<br>Factor<br>(dB) | Result<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Deg.<br>( ° ) | Height<br>(cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|--------------|---------------|----------------|--------|
| 1   | 1301.760         | 60.82             | -12.91                  | N/A                         | 47.91            | 74.00           | -26.09       | 122           | 100            | Peak   |
| 2   | 1735.680         | 54.99             | -9.20                   | N/A                         | 45.79            | 74.00           | -28.21       | 156           | 100            | Peak   |
|     | 1301.760         | /                 | /                       | -20.28                      | 27.63            | 54.00           | -26.37       | 65            | 100            | Ave    |
|     | 1735.680         | /                 | /                       | -20.28                      | 25.51            | 54.00           | -28.49       | 197           | 100            | Ave    |

Test Specification: Vertical



| No. | Frequency<br>MHz | Reading<br>dBuV/m | Corr.<br>Factor<br>(dB) | Dutycycle<br>Factor<br>(dB) | Result<br>dBuV/m | Limit<br>dBuV/m | Margin<br>(dB) | Deg.<br>( ° ) | Height<br>(cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|----------------|---------------|----------------|--------|
| 1   | 433.9200         | 75.42             | -2.19                   | N/A                         | 73.23            | 100.83          | -27.60         | 325           | 100            | peak   |
|     | 433.9200         | /                 | /                       | -20.28                      | 52.95            | 80.83           | -27.88         | 65            | 100            | Ave    |
| 2   | 867.8400         | 34.85             | 4.57                    | N/A                         | 39.42            | 80.83           | -41.41         | 144           | 100            | peak   |
|     | 867.8400         | /                 | /                       | -20.28                      | 19.14            | 60.83           | -41.69         | 78            | 100            | Ave    |

Above 1GHz

| No. | Frequency<br>MHz | Reading<br>dBuV/m | Corr.<br>Factor<br>(dB) | Dutycycle<br>Factor<br>(dB) | Result<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Deg.<br>( ° ) | Height<br>(cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|--------------|---------------|----------------|--------|
| 1   | 1301.760         | 60.82             | -12.91                  | N/A                         | 47.91            | 74.00           | -26.09       | 142           | 100            | Peak   |
|     | 1735.680         | 50.99             | -9.20                   | N/A                         | 41.79            | 74.00           | -32.21       | 16            | 100            | Peak   |
|     | 1301.760         | /                 | /                       | -20.28                      | 27.63            | 54.00           | -26.37       | 87            | 100            | Ave    |
|     | 1735.680         | /                 | /                       | -20.28                      | 21.51            | 54.00           | -32.49       | 65            | 100            | Ave    |

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5<sup>th</sup> Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz.

The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.92MHz.

## 5. 20dB Bandwidth

### 5.1 Standard Applicable

According to FCC Part 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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 5.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

### 5.2 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 21° C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1011 mbar |

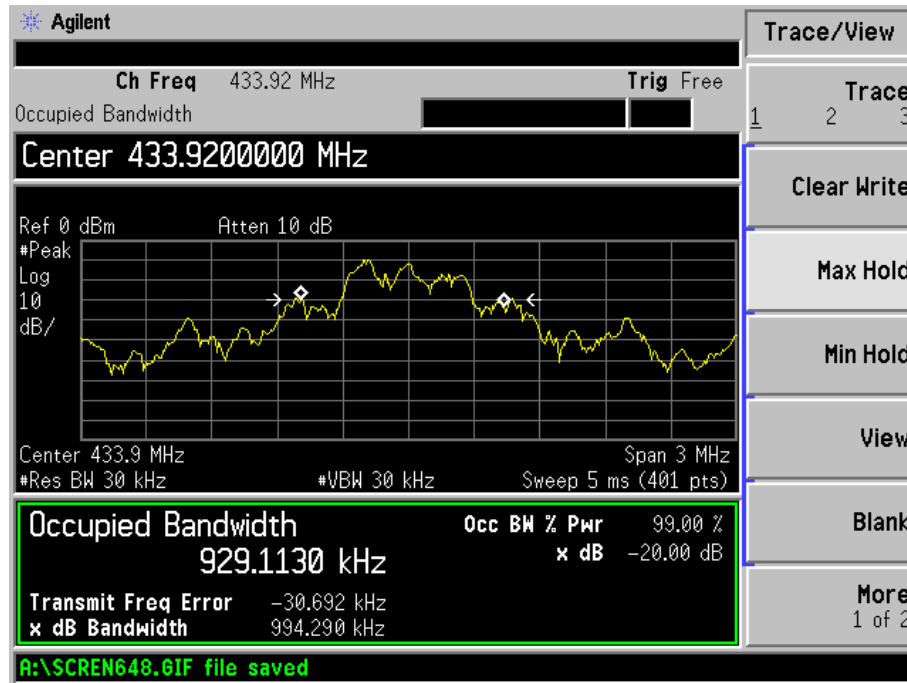
### 5.3 Summary of Test Results/Plots

| Test Frequency<br>MHz | 20dB Bandwidth<br>kHz | Limit<br>kHz | Result |
|-----------------------|-----------------------|--------------|--------|
| 433.92                | 994.290               | 1084         | Pass   |

Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084 kHz

*Please refer to the attached plots.*

20dB Bandwidth Test Plot



## 6. Transmission Time

### 6.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:

- 1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

### 6.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

### 6.3 Environmental Conditions

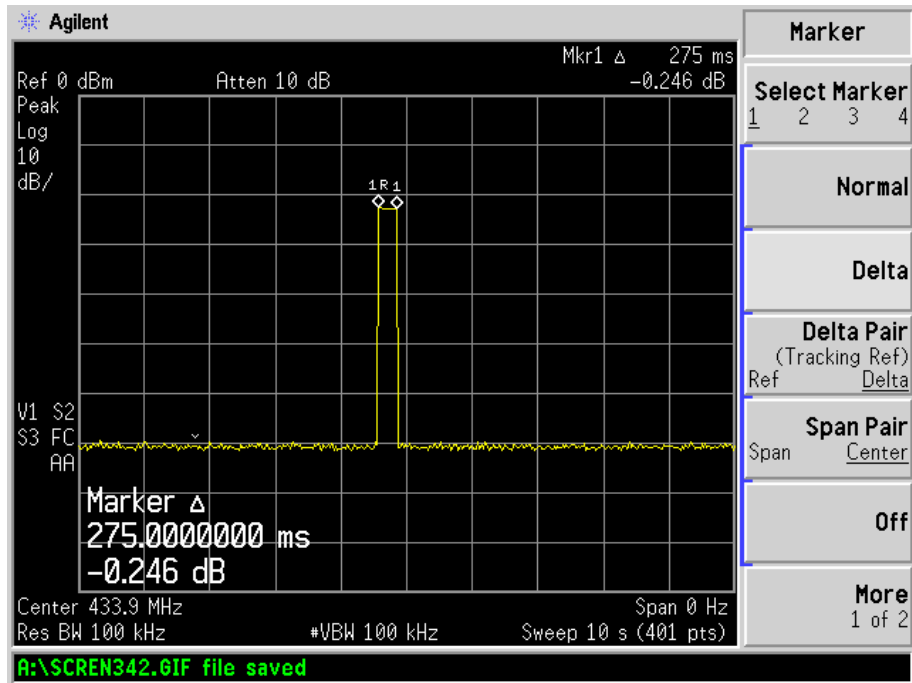
|                    |           |
|--------------------|-----------|
| Temperature:       | 20° C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1011 mbar |

### 6.4 Summary of Test Results/Plots

| Transmission Type | Test Frequency<br>MHz | Transmission Time<br>seconds | Limit<br>s | Result |
|-------------------|-----------------------|------------------------------|------------|--------|
| Manually          | 433.92                | 0.275                        | 5          | Pass   |

*Please refer to the attached plots.*

## Transmission Time



## 7. Duty Cycle

### 7.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

### 7.2 Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

### 7.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 20° C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1011 mbar |

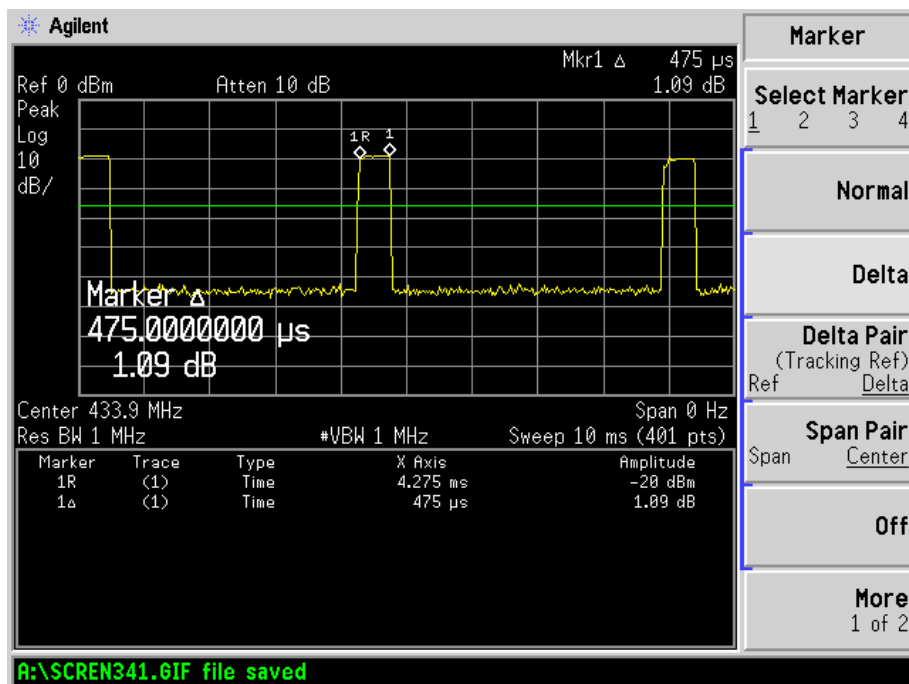
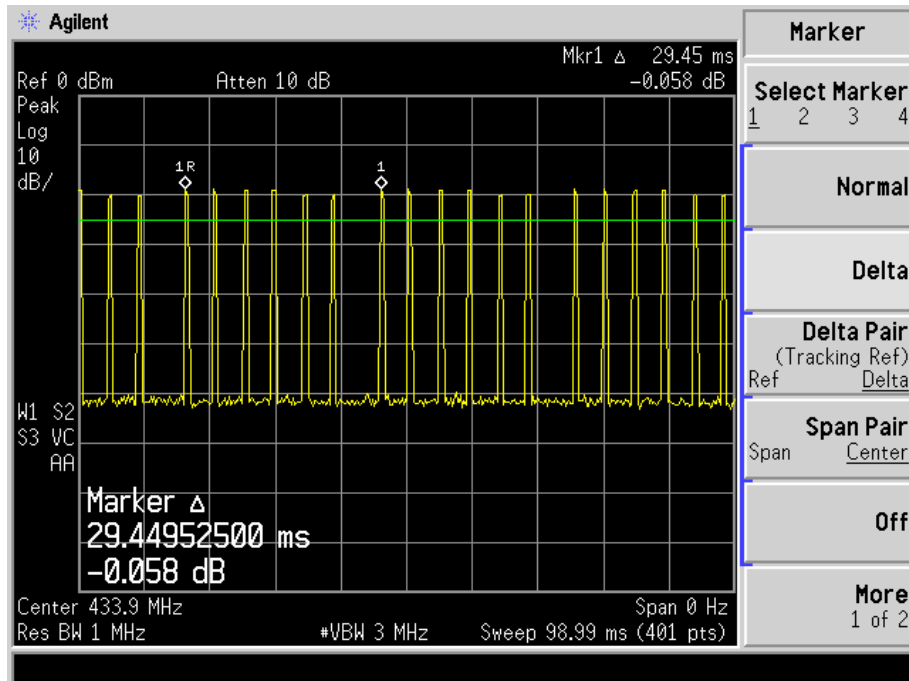
### 7.4 Summary of Test Results/Plots

| Type of Pulse | Width of Pulse<br>ms | Quantity of Pulse | Transmission Time<br>ms | Total Time (T <sub>on</sub> )<br>ms |
|---------------|----------------------|-------------------|-------------------------|-------------------------------------|
| Pulse 1       | 0.475                | 6                 | 2.85                    | 2.85                                |

| Test Period (T <sub>p</sub> )<br>ms | Total Time (T <sub>on</sub> )<br>ms | Duty Cycle<br>% | Duty Cycle Factor<br>dB |
|-------------------------------------|-------------------------------------|-----------------|-------------------------|
| 29.45                               | 2.85                                | 9.68            | -20.28                  |

*Please refer to the attached test plots*

## Width of Pulse



\*\*\*\*\* END OF REPORT \*\*\*\*\*