

FCC PART 15.231
MEASUREMENT AND TEST REPORT
FOR

Lok8u Limited

Vally Farm, Hanbury Road, Hanbury, Worcs, B604HJ, United Kingdom

FCC ID: XYALOK8UFRWATCH

| | |
|--|---|
| Report Concerns: Original Report | Equipment Type: FREEDOM-WATCH |
| Model: | <u>FREEDOM-WATCH001</u> |
| Report No.: | <u>STR11108078I-2</u> |
| Test Date: | <u>2011-11-25 to 2011-12-13</u> |
| Issue Date: | <u>2012-02-15</u> |
| Tested By: | <u>Seven Song / Engineer</u> <i>Seven Song</i> |
| Reviewed By: | <u>Lahm Peng / EMC Manager</u> <i>Lahm peng</i> |
| Approved & Authorized By: | <u>Jandy so / PSQ Manager</u> <i>Jandyso</i> |
| Prepared By: | SEM.Test Compliance Service Co., Ltd 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen, P.R.C. (518101) Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: 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 SEM.Test Compliance Service Co., Ltd.

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Lok8u Limited
Address of applicant: Vally Farm, Hanbury Road, Hanbury, Worcs, B604HJ, United Kingdom

Manufacturer: China 2 West Group
Address of manufacturer: 201 Xin Yi Fa Shang Mao Da Sha, #63 of Ji Da Road, Xiangzhou Distrcit, Zhu Hai, GD PRC

General Description of E.U.T

| Items | Description |
|---|------------------------------------|
| EUT Description: | FREEDOM-WATCH |
| Trade Name: | Lok8u |
| Model No.: | FREEDOM-WATCH001 |
| Rated Voltage: | Operating: DC 3.7V Charging: DC 5V |
| Frequency Range: | 433.92MHz |
| Antenna Type: | Integral Antenna |
| Comment: | Auto Operated Device |
| For more information refer to the circuit diagram form and the user's manual. | |

The test data is gathered from a production sample, provided by the manufacturer,

1.2 Test Standards

The following report is prepared on behalf of the Lok8u Limited 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 C63.4-2003, 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.

The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions. The EUT was set to keep transmitting during the test.

1.4 Test Facility

- **FCC – Registration No.: 994117**

SEM.Test Compliance Services 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 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

- **CNAS Registration No.: L4062**

Shenzhen SEM.Test Electronics Service 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 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen, P.R.C (518101)

1.5 EUT Exercise Software

The EUT exercise program used during the testing was designed to exercise the system components. The test software, provided by the customer, is started while the whole system is running.

1.6 Accessories Equipment List and Details

| Description | Manufacturer | Model | Serial Number |
|-------------|--------------|-------|---------------|
| / | / | / | / |
| / | / | / | / |

1.7 EUT Cable List and Details

| Cable Description | Length (M) | Shielded/Unshielded | With Core/Without Core |
|-------------------|------------|---------------------|------------------------|
| DC Power Cable | 1.8 | Unshielded | Without Core |
| | | | |

2. SUMMARY OF TEST RESULTS

| Description of Test | Result |
|-------------------------------------|-----------|
| §15.203 Antenna Requirement | Compliant |
| §15.205 Restricted Band | Compliant |
| §15.207 Conducted Emission | Compliant |
| §15.209 General Requirement | Compliant |
| §15.231 (a) Deactivation Testing | Compliant |
| §15.231 (c) 20dB Band Width Testing | Compliant |
| §15.231 (b) Radiated Emission | Compliant |

3. §15.203 ANTENNA REQUIREMENT

3.1 Standard Applicable

According to FCC 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 an Integral antenna, fulfill the requirement of this section.

4. §15.207 (a) CONDUCTED EMISSION

4.1 Measurement Uncertainty

Base on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement is ± 2.88 dB.

4.2 Test Equipment List and Details

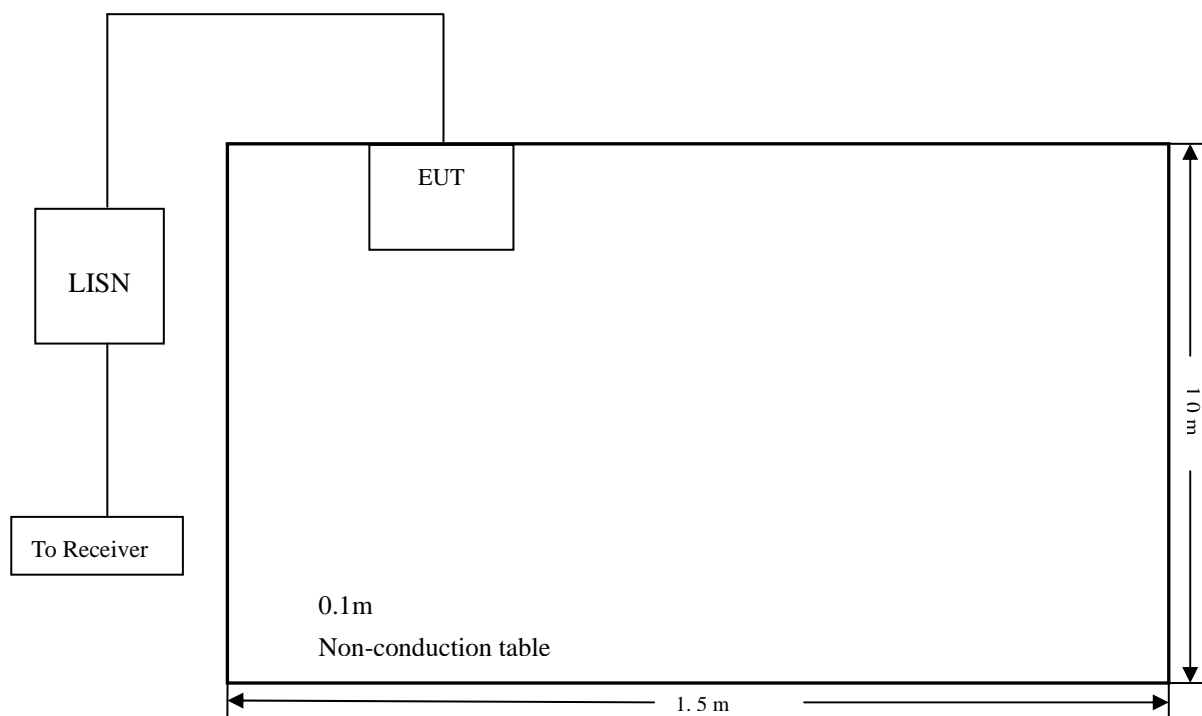
| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|-------------------|-----------------|----------|---------------|------------|------------|
| EMI Test Receiver | Rohde & Schwarz | ESPI | 101611 | 2010-12-20 | 2011-12-19 |
| L.I.S.N | Schwarz beck | NSLK8126 | 8126-224 | 2010-12-20 | 2011-12-19 |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100911 | 2010-12-20 | 2011-12-19 |
| AMN | EMCO | 3825/2 | 11967C | 2010-12-20 | 2011-12-19 |
| Power Divider | Weinschel | 1506A | PM204 | 2010-12-20 | 2011-12-19 |
| Current Probe | FCC | F-33-4 | 091684 | 2010-12-20 | 2011-12-19 |

4.3 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

4.4 Basic Test Setup Block Diagram



4.5 Environmental Conditions

| | |
|--------------------|-----------|
| Temperature: | 25 °C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1012 mbar |

4.6 Summary of Test Results/Plots

According to the data in section 4.7, the EUT complied with the FCC Part 15.207 Conducted margin for a Class B device, with the *worst* margin reading of:

-7.61 dB μ V at 0.214 MHz in the Line mode, Peak detector, 0.15-30MHz

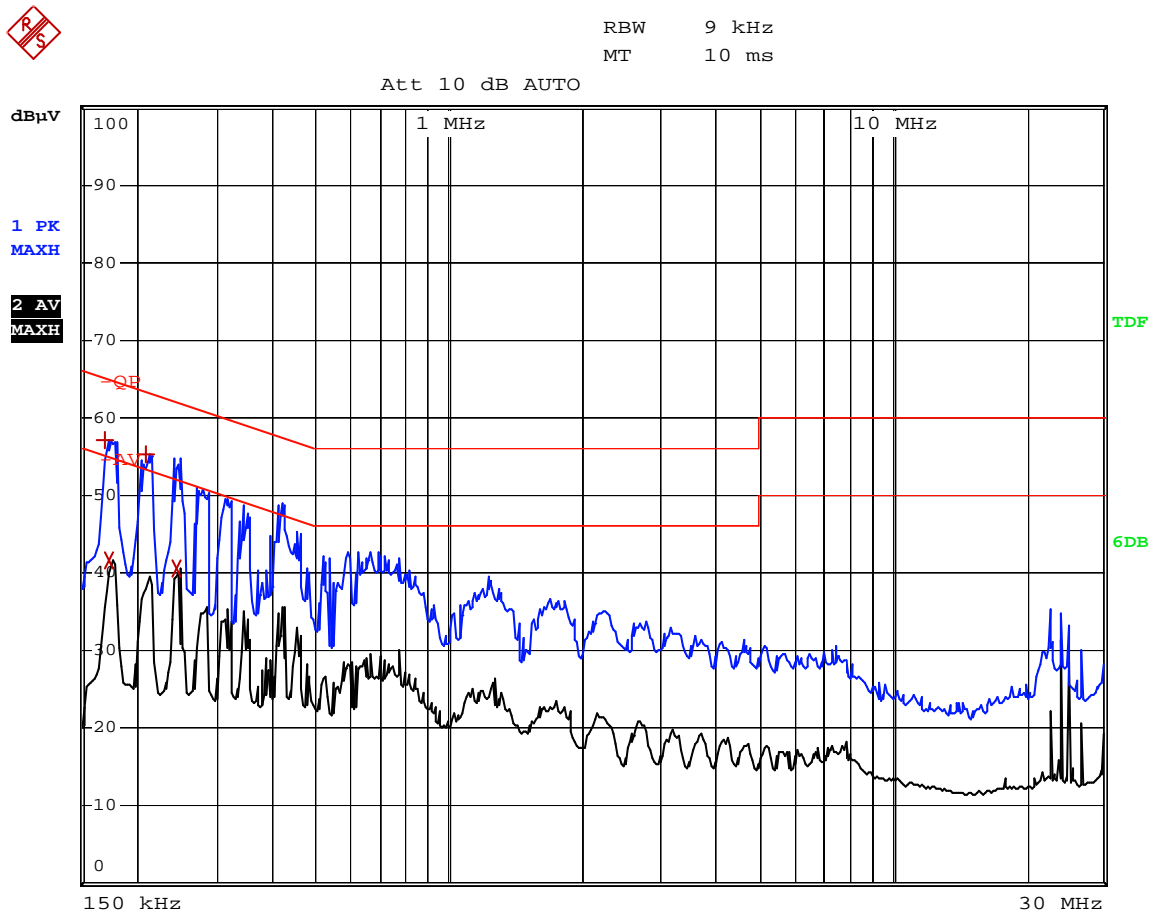
4.7 Conducted Emissions Test Data

| LINE CONDUCTED EMISSIONS | | | | FCC PART 15.207 | |
|--------------------------|------------|-----------|--------------|-----------------|--------|
| Frequency | Amplitude | Detector | Phase | Limit | Margin |
| MHz | dB μ V | QP/Ave/Pk | Line/Neutral | dB μ V | dB |
| 0.214 | 55.44 | Peak | Line | 63.05 | -7.61 |
| 0.170 | 57.16 | Peak | Neutral | 64.96 | -7.80 |
| 0.210 | 55.14 | Peak | Neutral | 63.21 | -8.07 |
| 0.178 | 56.32 | Peak | Line | 64.58 | -8.26 |
| 0.246 | 40.53 | Ave | Neutral | 51.89 | -11.36 |
| 0.218 | 40.51 | Ave | Line | 52.89 | -12.38 |
| 0.174 | 41.72 | Ave | Neutral | 54.77 | -13.05 |
| 0.178 | 40.96 | Ave | Line | 54.58 | -13.62 |

Note: Emission attenuated more than 20dB is not reported.

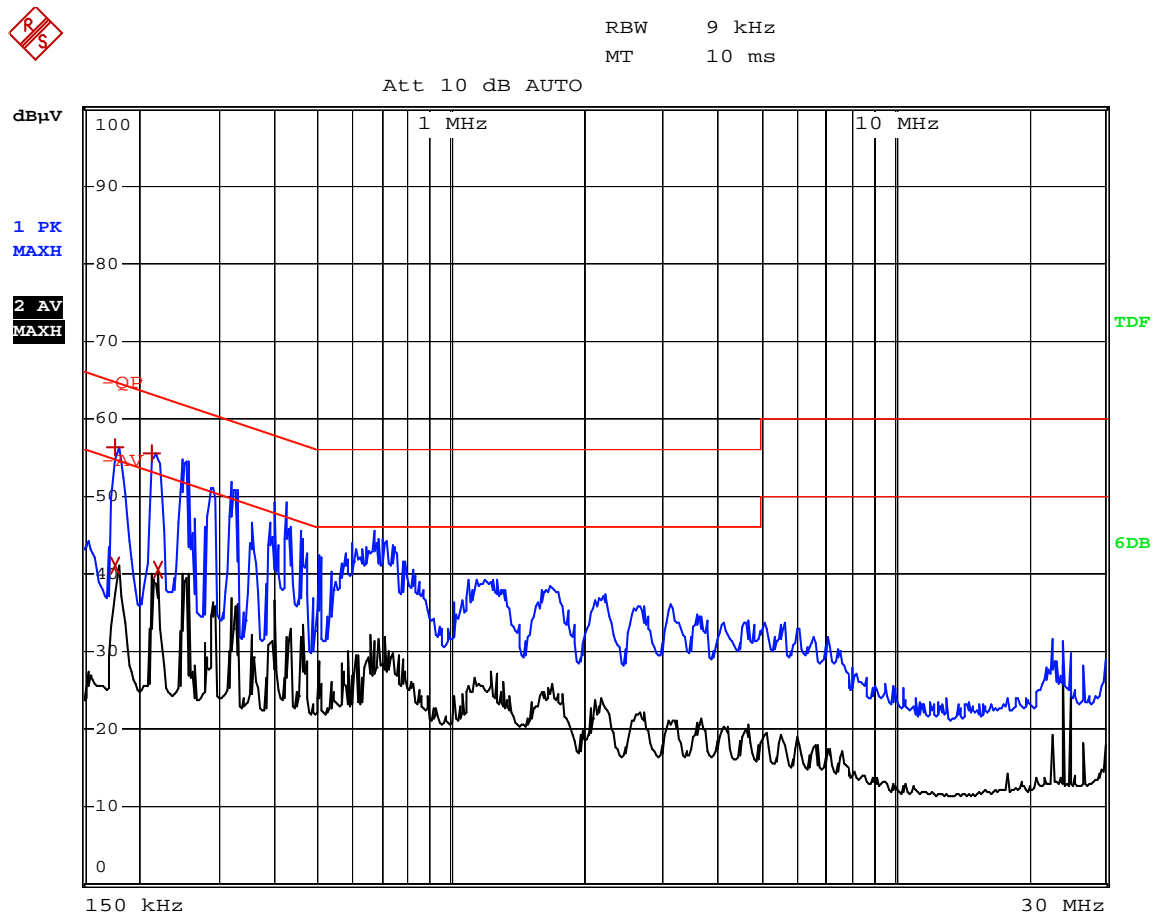
Plot of Conducted Emissions Test Data

Conducted Disturbance
EUT: FREEDOM-WATCH
M/N: FREEDOM-WATCH001
Operating Condition: Charging
Test Specification: N
Comment: AC 120V/60Hz; DC 5V adapter



Plot of Conducted Emissions Test Data

Conducted Disturbance
EUT: FREEDOM-WATCH
M/N: FREEDOM-WATCH001
Operating Condition: Charging
Test Specification: L
Comment: AC 120V/60Hz; DC 5V adapter



5. §15.205, §15.209, §15.231 (b) RADIATED EMISSION

5.1 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 ± 5.10 dB.

5.2 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\ 1,250 to 3,750 | \1\ 125 to 375 |
| 174-260..... | 3,750..... | 375 |
| 260-470..... | \1\ 3,750 to 12,500 | \1\ 375 to 1,250 |
| Above 470..... | 12,500..... | 1,250 |

\1\ 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.

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

Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

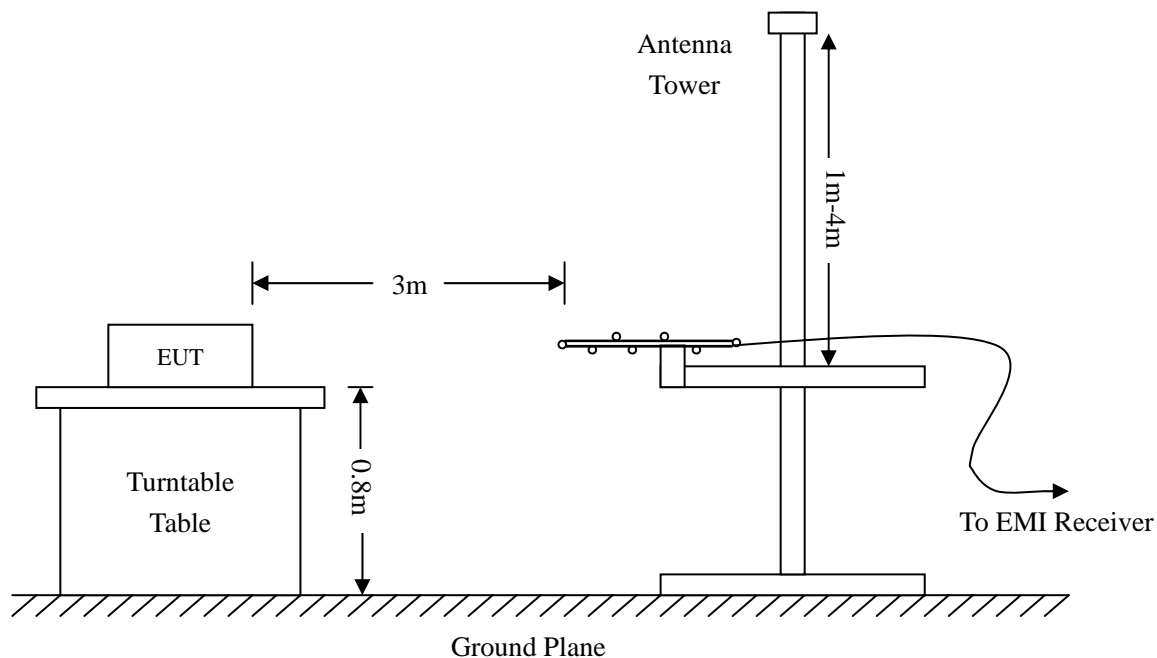
5.3 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|--------------------------|----------------------|-----------|---------------|------------|------------|
| Spectrum Analyzer | R&S | FSP | 836079/035 | 2010-12-20 | 2011-12-19 |
| EMI Test Receiver | R&S | ESVB | 825471/005 | 2010-12-20 | 2011-12-19 |
| Positioning Controller | C&C | CC-C-1F | N/A | 2010-12-20 | 2011-12-19 |
| RF Switch | EM | EMSW18 | SW060023 | 2010-12-20 | 2011-12-19 |
| Pre-amplifier | Agilent | 8447F | 3113A06717 | 2010-12-20 | 2011-12-19 |
| Pre-amplifier | Compliance Direction | PAP-0118 | 24002 | 2010-12-20 | 2011-12-19 |
| Trilog Broadband Antenna | SCHWARZBECK | VULB9163 | 9163-333 | 2010-12-20 | 2011-12-19 |
| Horn Antenna | ETS | 3117 | 00086197 | 2011-01-20 | 2012-01-19 |
| Loop Antenna | SCHWARZECK | HFRA 5165 | 9365 | 2011-01-09 | 2012-01-08 |

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

5.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.



5.5 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 -6dBμV means the emission is 6dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15.231 Limit}$$

5.6 Environmental Conditions

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

5.7 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:

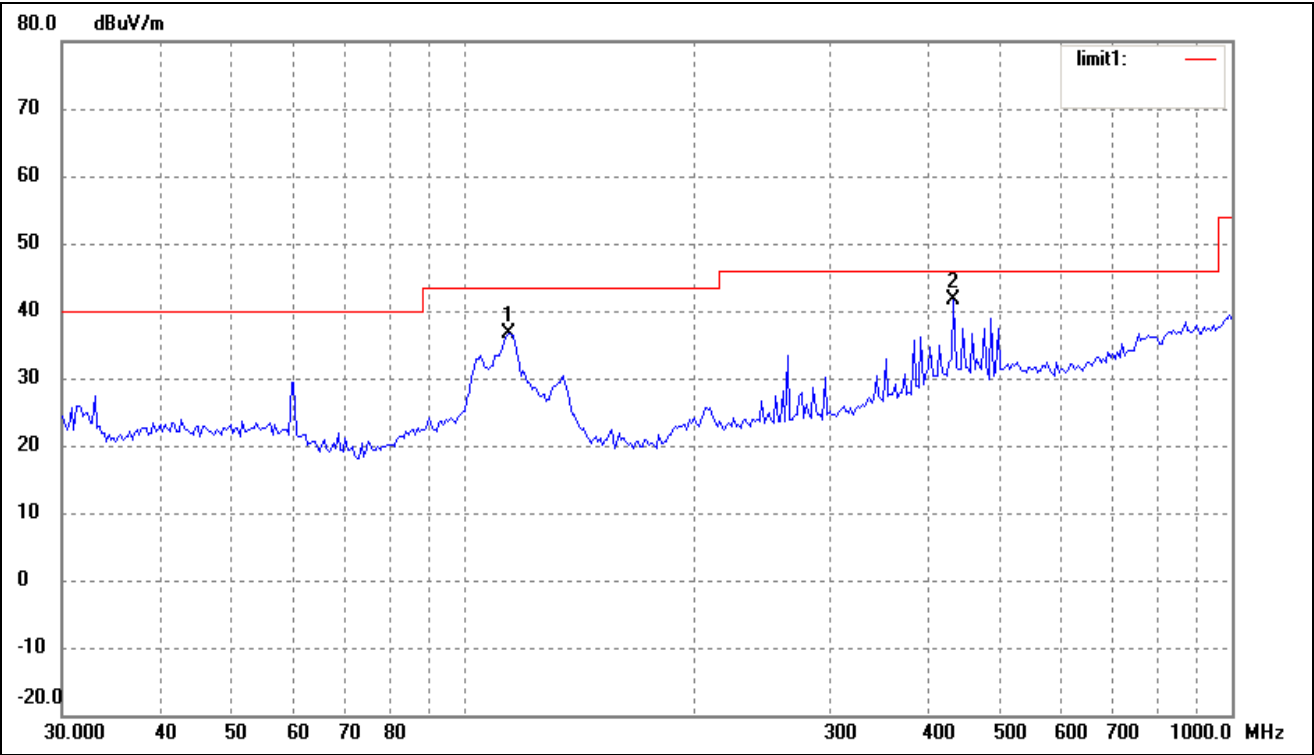
**-3.60 dBμV at 59.6492 MHz in the Vertical, Peak Detector polarization Charging Mode, 9 kHz to 1GHz,
3Meters**

**-17.07 dBμV at 433.9200 MHz in the Horizontal, Ave Detector polarization Transmitting Mode, 9 kHz to
5GHz, 3Meters**

Plot of Radiation Emissions Test Data

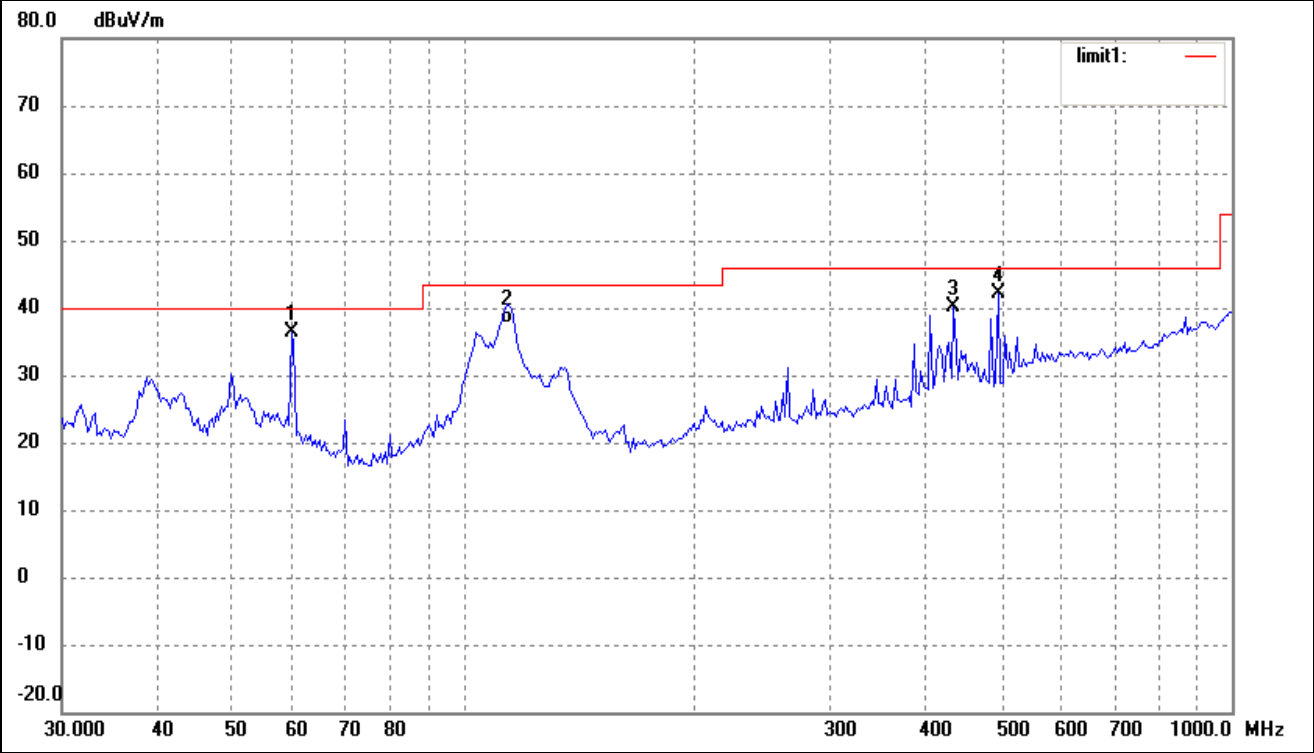
Radiated Disturbance
EUT: FREEDOM-WATCH
M/N: FREEDOM-WATCH001
Operating Condition: Charging
Test Specification: Horizontal & Vertical
Comment:

Horizontal



| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|-----|-----------|----------|---------|----------|----------|--------|--------|--------|--------|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (°) | (cm) | |
| 1 | 114.5146 | 29.84 | 6.85 | 36.69 | 43.50 | -6.81 | 224 | 100 | peak |
| 2 | 434.0649 | 29.81 | 11.93 | 41.74 | 46.00 | -4.26 | 140 | 100 | peak |

Vertical

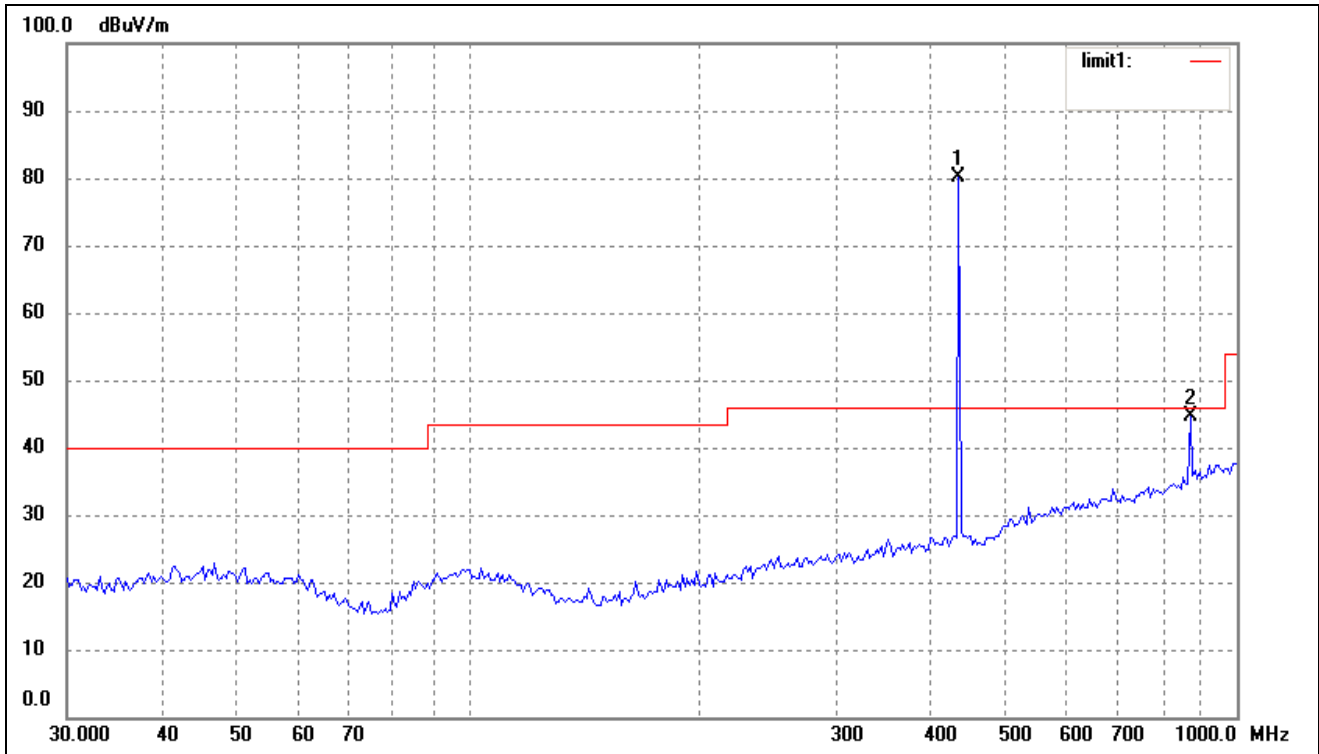


| No. | Frequency | Reading | Correct | Result | Limit | Margin | Degree | Height | Remark |
|-----|-----------|----------|---------|----------|----------|--------|--------|--------|--------|
| | (MHz) | (dBuV/m) | dB/m | (dBuV/m) | (dBuV/m) | (dB) | (°) | (cm) | |
| 1 | 59.6492 | 28.85 | 7.55 | 36.40 | 40.00 | -3.60 | 31 | 100 | peak |
| 2 | 113.7142 | 30.75 | 6.98 | 37.73 | 43.50 | -5.77 | 226 | 100 | QP |
| 3 | 434.0649 | 28.31 | 11.93 | 40.24 | 46.00 | -5.76 | 180 | 100 | peak |
| 4 | 495.9343 | 28.13 | 14.01 | 42.14 | 46.00 | -3.86 | 102 | 100 | peak |

Plot of Radiation Emissions Test

Transmitting Mode

Horizontal:

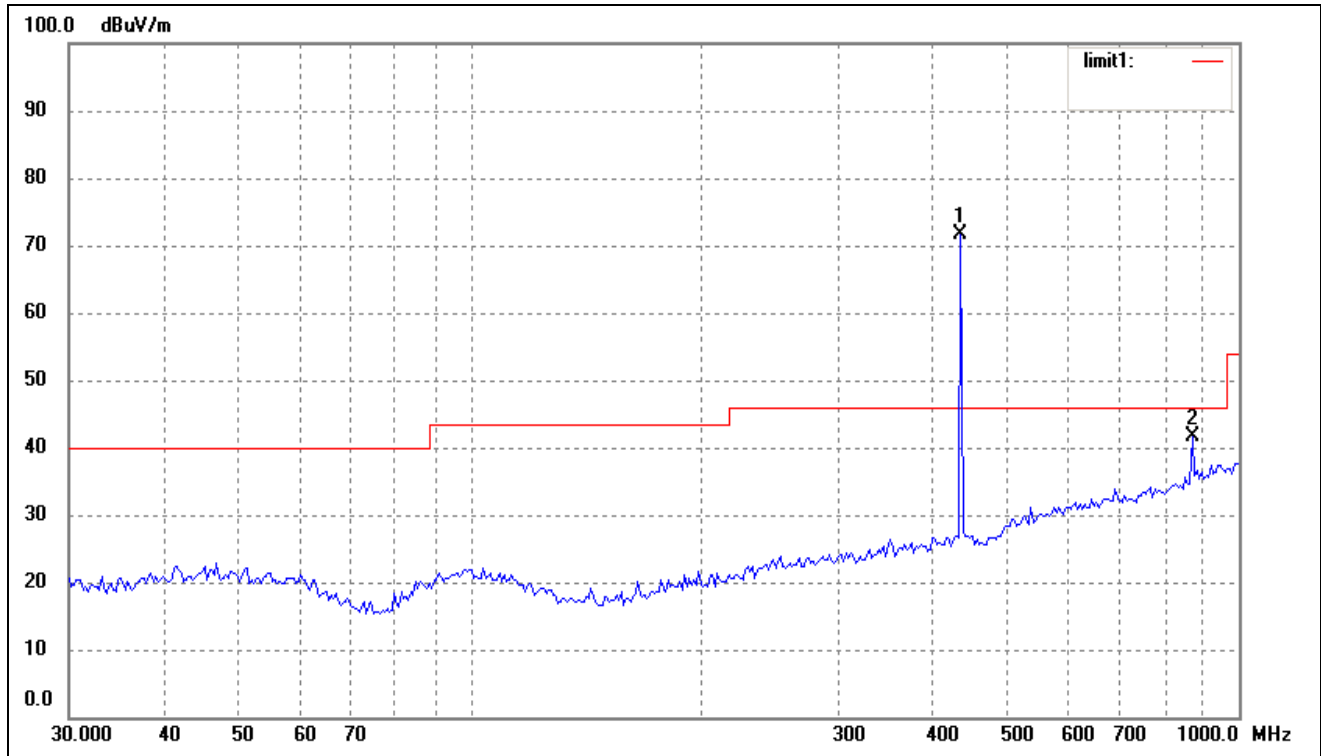


| No. | Frequency MHz | Reading dBuV/m | Corr. Factor (dB) | Dutycycle Factor (dB) | Result dBuV/m | Limit dBuV/m | Margin (dB) | Deg. (°) | Height (cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|----------------|---------------|----------------|--------|
| 1 | 433.9200 | 68.13 | 11.93 | N/A | 80.06 | 100.80 | -20.74 | 360 | 100 | peak |
| 2 | 869.1299 | 24.43 | 20.32 | N/A | 44.75 | 80.80 | -36.05 | 270 | 100 | peak |
| | 433.9200 | / | / | -16.33 | 63.73 | 80.80 | -17.07 | 360 | 100 | Ave |
| | 867.7850 | / | / | -16.33 | 28.42 | 60.80 | -32.38 | 270 | 100 | Ave |

Above 1GHz

| No. | Frequency MHz | Reading dBuV/m | Corr. Factor (dB) | Dutycycle Factor (dB) | Result dBuV/m | Limit dBuV/m | Margin dB | Deg. (°) | Height (cm) | Remark |
|-----|------------------|-------------------|-------------------------|-----------------------------|------------------|-----------------|--------------|---------------|----------------|--------|
| 1 | 1301.6775 | 21.35 | 26.95 | N/A | 46.31 | 74.00 | -27.69 | 360 | 100 | peak |
| 2 | 1735.5700 | 16.83 | 27.77 | N/A | 42.12 | 74.00 | -31.88 | 360 | 100 | peak |
| | 1301.6775 | / | / | -16.33 | 29.98 | 54.00 | -24.02 | 180 | 100 | Ave |
| | 1735.5700 | / | / | -16.33 | 25.79 | 54.00 | -28.21 | 180 | 100 | Ave |

Vertical:



| No. | Frequency | Reading | Corr. | Dutycycle | Result | Limit | Margin | Deg. | Height | Remark |
|-----|-----------|---------|-------------|-------------|--------|--------|--------|-------|--------|--------|
| | MHz | dBuV/m | Factor (dB) | Factor (dB) | dBuV/m | dBuV/m | (dB) | (°) | (cm) | |
| 1 | 433.9200 | 59.63 | 11.93 | N/A | 71.56 | 100.80 | -29.24 | 360 | 100 | peak |
| 2 | 869.1299 | 21.43 | 20.32 | N/A | 41.75 | 80.80 | -39.05 | 176 | 100 | peak |
| | 433.9200 | / | / | -16.33 | 55.23 | 80.80 | -25.57 | 360 | 100 | Ave |
| | 867.7850 | / | / | -16.33 | 25.42 | 60.80 | -35.38 | 176 | 100 | Ave |

Above 1GHz

| No. | Frequency | Reading | Corr. | Dutycycle | Result | Limit | Margin | Deg. | Height | Remark |
|-----|-----------|---------|-------------|-------------|--------|--------|--------|-------|--------|--------|
| | MHz | dBuV/m | Factor (dB) | Factor (dB) | dBuV/m | dBuV/m | dB | (°) | (cm) | |
| 1 | 1301.6775 | 21.35 | 26.95 | N/A | 50.32 | 74.00 | -23.68 | 360 | 100 | peak |
| 2 | 1735.5700 | 16.83 | 27.77 | N/A | 46.50 | 74.00 | -27.50 | 360 | 100 | peak |
| | 1301.6775 | / | / | -16.33 | 33.99 | 54.00 | -20.01 | 180 | 100 | Ave |
| | 1735.5700 | / | / | -16.33 | 30.17 | 54.00 | -23.83 | 180 | 100 | Ave |

Note: The EUT was tested in all three orthogonal planes and frequency rang 9 kHz to the tenth harmonics.

Emissions attenuated closely to the noise base are not reported. The fundamental frequency is 433.9200MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.9200MHz.

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

6. §15.231(c) 20dB BANDWIDTH TESTING

6.1 Standard Applicable

According to FCC 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.

6.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|-------------------|--------------|---------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-12-20 | 2011-12-19 |
| Attenuator | ATTEN | DC-4GHz | ATS100-4-20 | 2010-12-20 | 2011-12-19 |

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

6.3 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.

6.4 Environmental Conditions

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

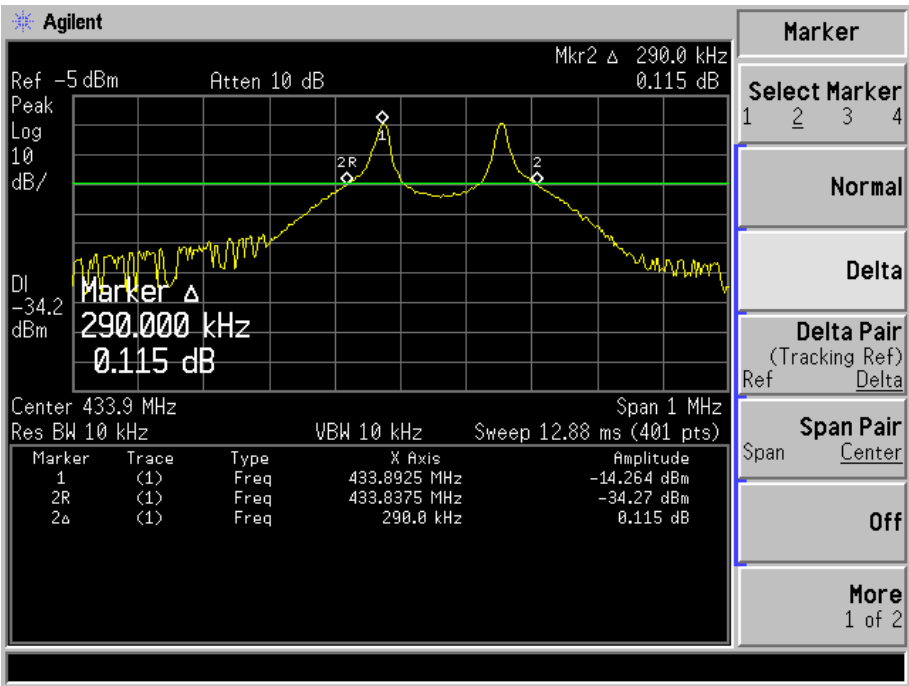
6.5 Summary of Test Results/Plots

| Frequency MHz | 20dB Bandwidth KHz | Limit kHz |
|------------------|-----------------------|--------------|
| 433.9200 | 290 | 1084.7 |

Limit=Fundamental Frequency \times 0.25%=433.9200 \times 0.25%=1084.7 kHz

Test Result Pass

Refer to the attached plots.



7. §15.231(a) DEACTIVATION TESTING

7.1 Standard Applicable

According to FCC 15.231 (a)(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.

7.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|-------------------|--------------|---------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-12-20 | 2011-12-19 |
| Attenuator | ATTEN | DC-4GHz | ATS100-4-20 | 2010-12-20 | 2011-12-19 |

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

7.3 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 433.9200MHz, 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.

7.4 Environmental Conditions

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

7.5 Summary of Test Results/Plots

$T_{\text{period}} = 32 \text{ seconds}$

Number of pulse per hour = $3600 \text{ seconds} / 32 \text{ seconds} = 113$

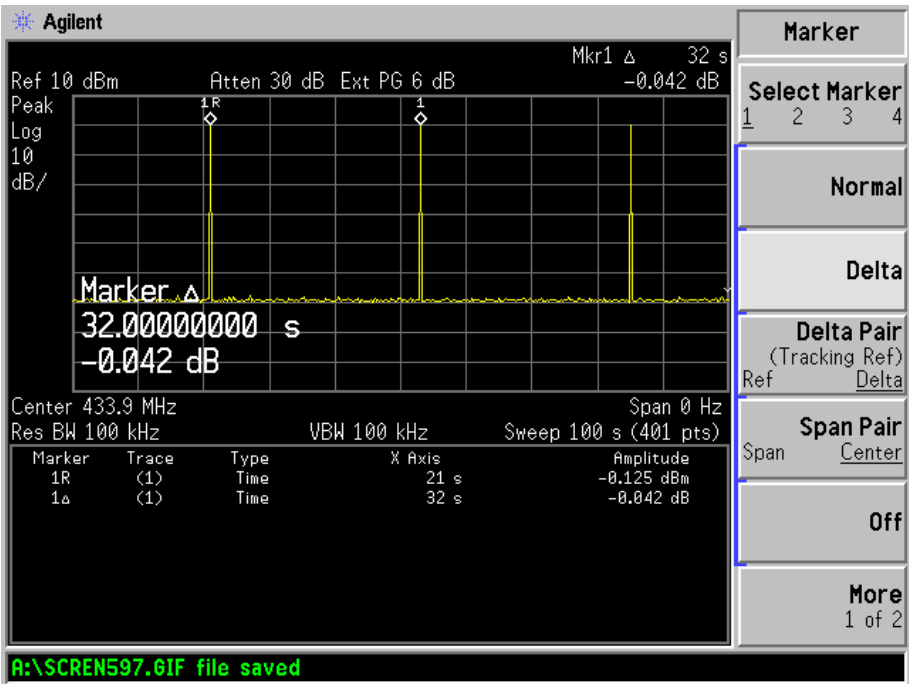
$T_{\text{on}} = \text{width of pulse} * \text{number of pulse} = 15.25 \text{ ms} * 113 = 1723.25 \text{ ms}$

So the total duration of transmissions does not exceed more than two seconds per hour

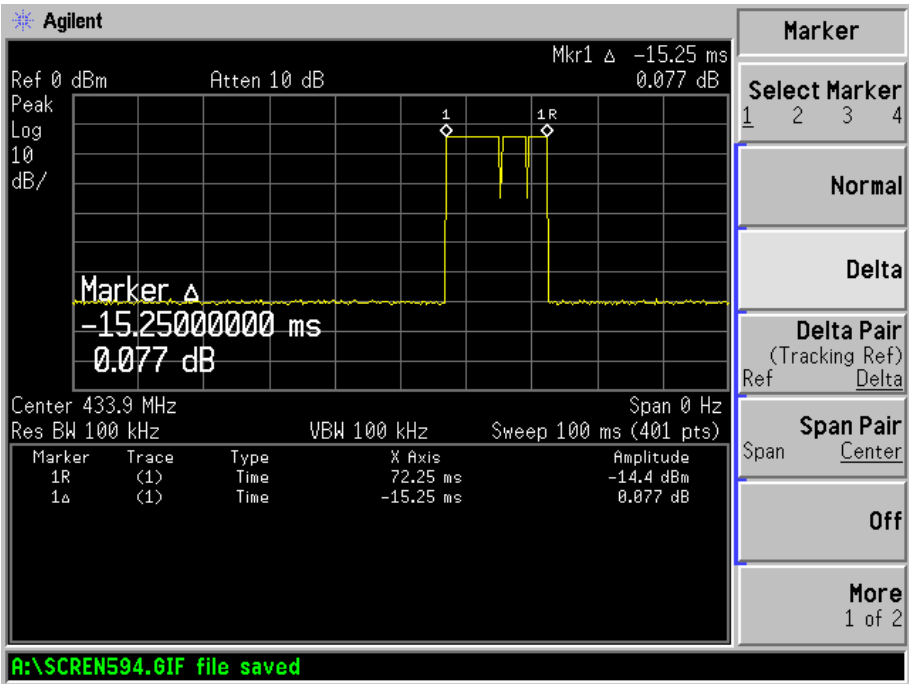
Test Result: Pass

Please refer to the following test plots.

Period of Pulse



Width of Pulse



8. §15.231(b) Duty Cycle

8.1 Standard Applicable

According to FCC 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.

8.2 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Cal. Date | Due. Date |
|-------------------|--------------|---------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4402B | US41192821 | 2010-12-20 | 2011-12-19 |
| Attenuator | ATTEN | DC-4GHz | ATS100-4-20 | 2010-12-20 | 2011-12-19 |

Statement of Traceability: All calibrations have been performed per the NVLAP requirements traceable to the NIST.

8.3 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.

8.4 Environmental Conditions

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

8.5 Summary of Test Results/Plots

$T_p = 56.5s > 100ms$ (max. pulse train measure time)

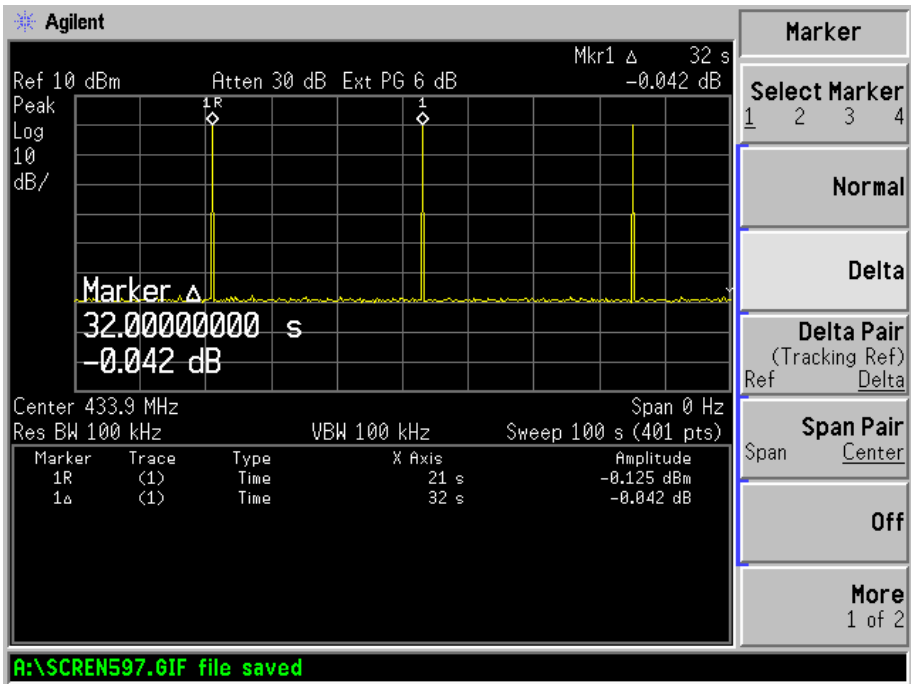
$T_{on} = 15.25ms$

Duty Cycle = T_{on} / T_p or $100ms$ (whichever is less) * 100% = $15.25/100=15.25\%$

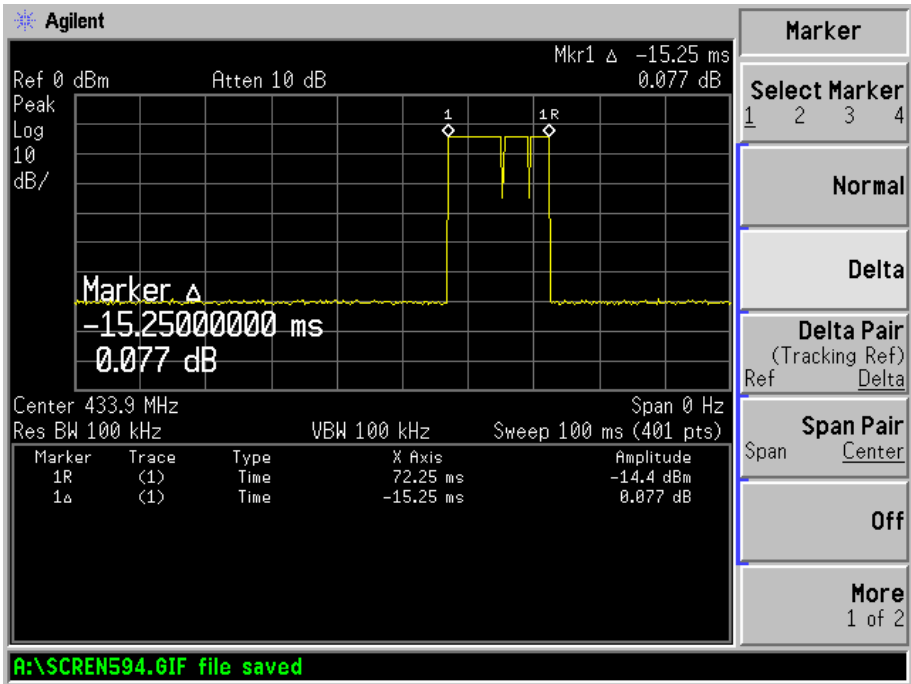
Factor (average value) = $20 * \log (T_{on}/T_p) = -16.33dB$

Refer to the attached plots.

Period of Pulse



Width of Pulse



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