
FCC Part 15C

Measurement and Test Report

For

FUZHOU ESUN ELECTRONIC CO.,LTD

FCC ID: 2APN2-EN2053

| | |
|--------------------------------------|----------------------------------|
| FCC Rule(s): | <u>FCC Part 15.231(e)</u> |
| Product Description: | <u>Wireless Meat Thermometer</u> |
| Tested Model: | <u>EN2053</u> |
| Report No.: | <u>BSL85194A01RF</u> |
| Tested Date: | <u>September 25~26, 2018</u> |
| Issued Date: | <u>September 26, 2018</u> |
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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: FUZHOU ESUN ELECTRONIC CO.,LTD
Address of applicant: D Third Floor Industrial Factory Juyuan Zhou Park 32 Jinshan Industrial Zone Jinshan Avenue 618 Jianxin Town Cangshan District Fuzhou Fujian China
Manufacturer: FUZHOU ESUN ELECTRONIC CO.,LTD
Address of manufacturer: D Third Floor Industrial Factory Juyuan Zhou Park 32 Jinshan Industrial Zone Jinshan Avenue 618 Jianxin Town Cangshan District Fuzhou Fujian China

| General Description of EUT | |
|----------------------------|----------------------------|
| Product Name: | Wireless Meat Thermometer |
| Trade Name: | ESUN |
| Model No.: | EN2053 |
| Adding Model(s): | N/A |
| Rated Voltage: | DC 3.0V Form 2*AAA Battery |
| Power Adapter Model: | N/A |
| | |
| | |

| Technical Characteristics of EUT | |
|----------------------------------|---------------------------------|
| Frequency Range: | 433.92 MHz |
| Max. Field Strength: | 86.2dBuV/m(@1m,peak,Horizontal) |
| Data Rate: | N/A |
| Modulation: | ASK |
| Antenna Type: | Spring antenna |
| Antenna Gain: | 0dBi |

1.2 Test Standards

The following report is prepared on behalf of the Shenzhen Petwant Pet Products Co.,Ltd. in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commission's 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 Commission's 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

BSL Testing Co.,LTD.

NO. 24, ZH Park, Nantou, Shenzhen, 518000 China

Designation Number : CN1217

Test Firm Registration Number: 866035

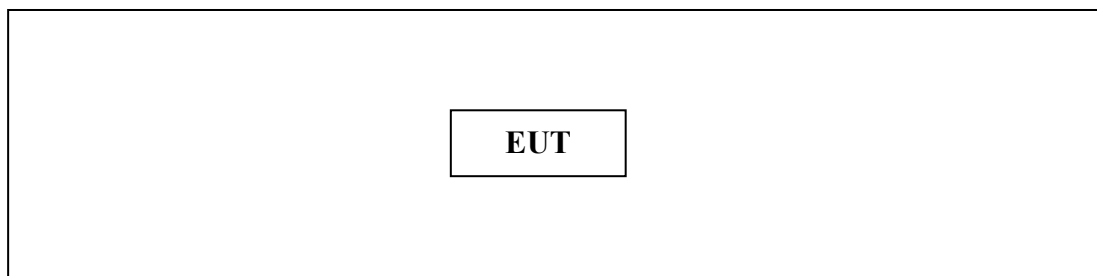
Tel: 86- 755-26508703

Fax: 86- 755-26508703

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency 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:

TX Mode



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 | Modulation |
| TM2 | | |
| TM3 | | |

| 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 Measurement Uncertainty

| Measurement uncertainty | | |
|--------------------------------|------------|---------------------|
| Parameter | Conditions | Uncertainty |
| Occupied Bandwidth | Conducted | $\pm 1.5\%$ |
| Conducted Spurious Emission | Conducted | $\pm 2.17\text{dB}$ |
| Transmission Time | Conducted | $\pm 5\%$ |
| Conducted Emissions | Conducted | $\pm 2.88\text{dB}$ |
| Transmitter Spurious Emissions | Radiated | $\pm 5.1\text{dB}$ |

1.7 Test Equipment List and Details

| Description | Manufacturer | Model | Serial No. | Cal Date | Due. Date |
|-------------------------------------|------------------|--------------------|------------|------------|------------|
| Communication Tester | Rohde & Schwarz | CMW500 | 100358 | 2017-10-21 | 2018-10-20 |
| Spectrum Analyzer | R&S | FSP40 | 100550 | 2017-10-21 | 2018-10-20 |
| Test Receiver | R&S | ESCI7 | US47140102 | 2017-10-21 | 2018-10-20 |
| Signal Generator | HP | 83630B | 3844A01028 | 2017-10-22 | 2018-10-21 |
| Test Receiver | R&S | ESPI-3 | 100180 | 2017-10-21 | 2018-10-20 |
| Amplifier | Agilent | 8449B | 4035A00116 | 2017-10-22 | 2018-10-21 |
| Amplifier | HP | 8447E | 2945A02770 | 2017-10-22 | 2018-10-21 |
| Signal Generator | IFR | 2023A | 202307/242 | 2017-10-22 | 2018-10-21 |
| Broadband Antenna | SCHAFFNER | 2774 | 2774 | 2017-10-17 | 2018-10-16 |
| Biconical and log periodic antennas | ELECTRO-METRIC | EM-6917B-1 | 171 | 2017-10-17 | 2018-10-16 |
| Horn Antenna | R&S | HF906 | 100253 | 2017-10-17 | 2018-10-16 |
| Horn Antenna | EM | EM-6961 | 6462 | 2017-10-17 | 2018-10-16 |
| LISN | R&S | ESH3-Z5 | 100196 | 2017-10-17 | 2018-10-16 |
| LISN | COM-POWER | LI-115 | 02027 | 2017-10-17 | 2018-10-16 |
| 3m Semi-Anechoic Chamber | Chengyu Electron | 9 (L)*6 (W)* 6 (H) | BSL086 | 2017-10-21 | 2018-10-20 |
| Horn Antenna | A-INFOMW | LB-180400KF | BSL088 | 2017-10-21 | 2018-10-20 |

2. SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test Item | Result |
|------------------|---------------------------------|---------------|
| § 15.203 | Antenna Requirement | Compliant |
| § 15.207(e) | Conducted Emission | N/A |
| §15.231(e) | Release Time | Compliant |
| | Radiation Emission | Compliant |
| | 20 dB Bandwidth | Compliant |
| | Duty Cycle | Compliant |

Note: PASS: applicable, N/A: not applicable.

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 permanent antenna, fulfill the requirement of this section.

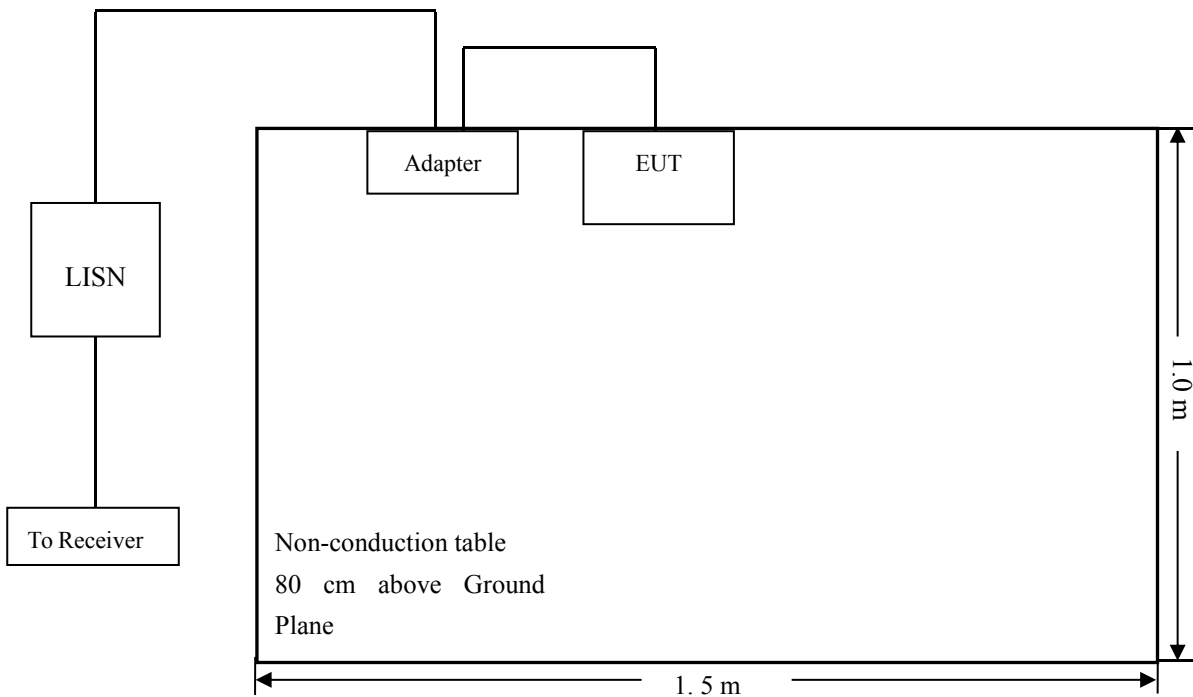
4. Conducted Emissions

4.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

4.2 Basic Test Setup Block Diagram



4.3 Environmental Conditions

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

4.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

| | |
|-----------------------------------|---------|
| Start Frequency..... | 150 kHz |
| Stop Frequency..... | 30 MHz |
| Sweep Speed..... | Auto |
| IF Bandwidth..... | 10 kHz |
| Quasi-Peak Adapter Bandwidth..... | 9 kHz |

Quasi-Peak Adapter Mode.....Normal

4.5 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:

-12.74 dB at 1.462 MHz in the **Neutral** mode, **Average** detector, 0.15-30MHz

4.6 Conducted Emissions Test Data

The test not applicable.

5. Radiated Emissions

5.1 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

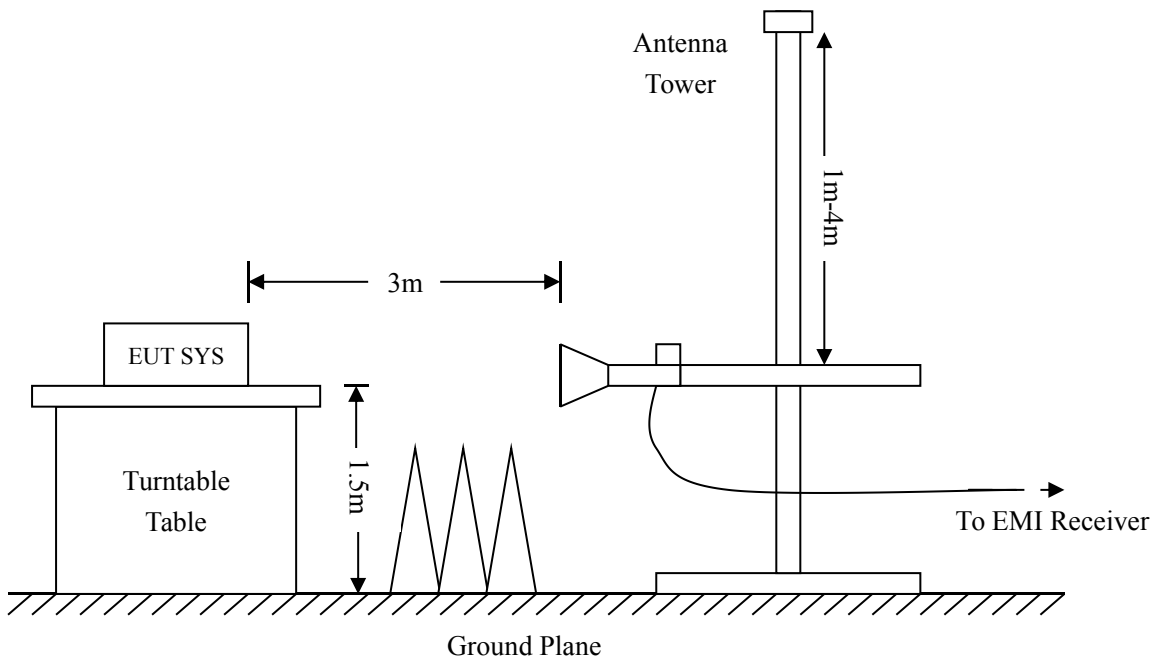
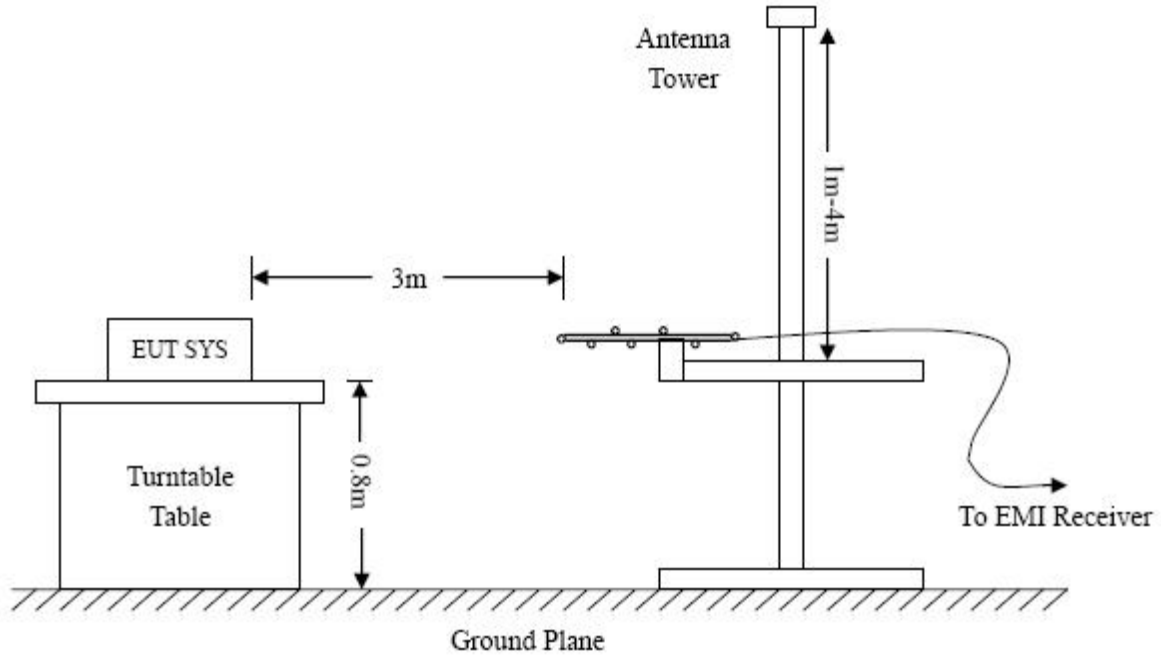
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209,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

5.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.



5.3 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 $-6\text{dB}\mu\text{V}$ means the emission is $6\text{dB}\mu\text{V}$ below the maximum limit. The equation for margin calculation is as follows:

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

5.4 Environmental Conditions

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

5.5 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:

-4.63 dB at 433.92 MHz in the Horizontal polarization, Peak Detector, 9 kHz to 5 GHz, 1 Meters

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

Horizontal

| Below 1GHz | | | | | | | | |
|------------|---------|-------------|--------|--------|--------|-------|--------|--------|
| Frequency | Reading | Duty cycle | Result | Limit | Margin | Deg. | Height | Remark |
| MHz | dBuV/m | Factor (dB) | dBuV/m | dBuV/m | (dB) | (°) | (cm) | |
| 433.9200 | 80.15 | N/A | 76.03 | 100.83 | -24.8 | 212 | 100 | peak |
| 433.9200 | / | -9.63 | 66.40 | 80.83 | -14.43 | 15 | 100 | Ave |
| 867.8400 | 47.24 | N/A | 50.02 | 80.83 | -30.81 | 63 | 100 | peak |
| 867.8400 | / | -9.63 | 40.39 | 60.83 | -20.44 | 156 | 100 | Ave |
| Above 1GHz | | | | | | | | |
| 1301.760 | 54.82 | N/A | 53.57 | 74.00 | -20.43 | 134 | 100 | Peak |
| 1735.680 | 41.99 | N/A | 45.63 | 74.00 | -18.37 | 241 | 100 | Peak |
| 1301.760 | / | -9.63 | 36.00 | 54.00 | -18.00 | 25 | 100 | Ave |
| 1735.680 | / | -9.63 | 43.94 | 54.00 | -10.06 | 51 | 100 | Ave |

Vertical

| Below 1GHz | | | | | | | | |
|------------|---------|-------------|--------|--------|--------|-------|--------|--------|
| Frequency | Reading | Duty cycle | Result | Limit | Margin | Deg. | Height | Remark |
| MHz | dBuV/m | Factor (dB) | dBuV/m | dBuV/m | (dB) | (°) | (cm) | |
| 433.9200 | 81.94 | N/A | 77.82 | 100.83 | -23.01 | 223 | 100 | peak |
| 433.9200 | / | -9.63 | 68.19 | 80.83 | -12.64 | 12 | 100 | Ave |
| 867.8400 | 44.34 | N/A | 47.12 | 80.83 | -33.71 | 224 | 100 | peak |
| 867.8400 | / | -9.63 | 37.49 | 60.83 | -23.34 | 32 | 100 | Ave |
| Above 1GHz | | | | | | | | |
| 1301.760 | 52.95 | N/A | 51.70 | 74.00 | -22.3 | 15 | 100 | Peak |
| 1735.680 | 45.57 | N/A | 49.21 | 74.00 | -24.79 | 141 | 100 | Peak |
| 1301.760 | / | -9.63 | 42.07 | 54.00 | -11.93 | 213 | 100 | Ave |
| 1735.680 | / | -9.63 | 39.58 | 54.00 | -14.42 | 251 | 100 | Ave |

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5th 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.

6. 20dB Bandwidth

6.1 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.

6.1 Test Procedure

With the EUT's antenna attached, the EUT's 20dBc 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.

6.2 Environmental Conditions

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

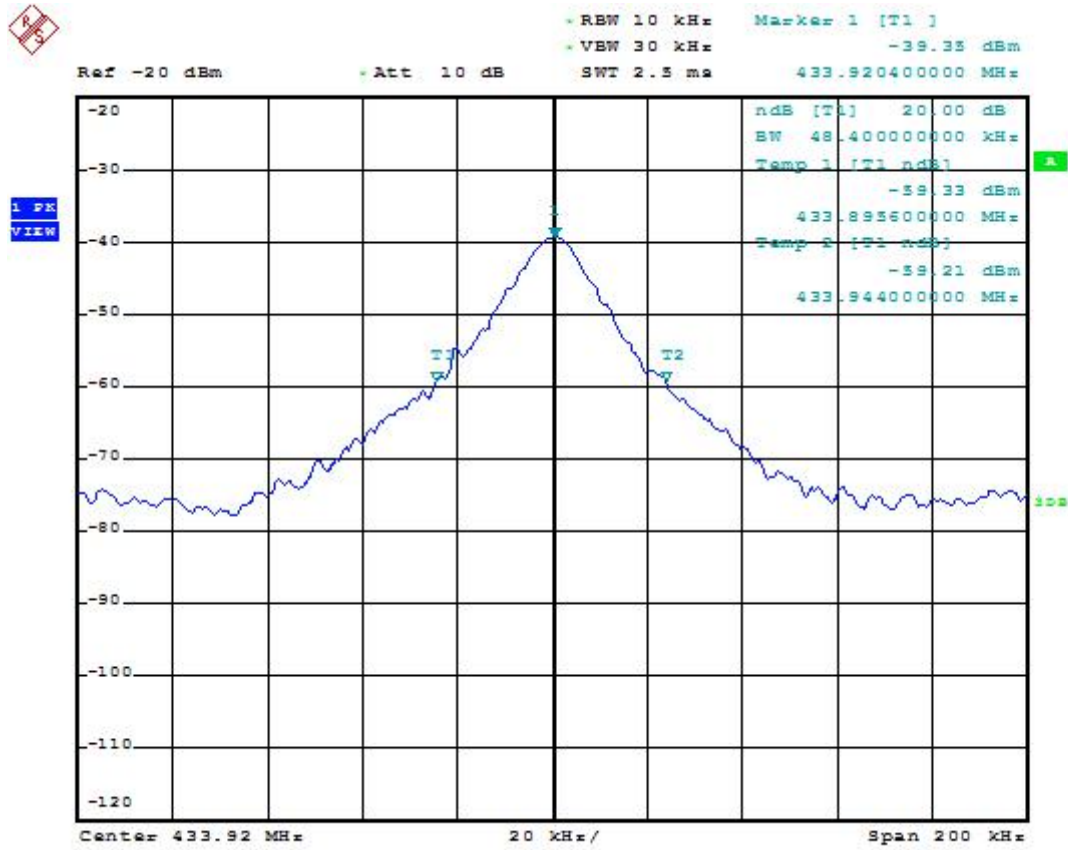
6.3 Summary of Test Results/Plots

| Test Frequency MHz | 20dBc Bandwidth kHz | Limit kHz | Result |
|-----------------------|------------------------|--------------|--------|
| 433.92 | 48.4 | 1084 | Pass |

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

Please refer to the attached plots.

20dBc Bandwidth Test Plot



7. Transmission Time

7.1 Standard Applicable

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

- 1) According to FCC Part 15.231 (e), 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.

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

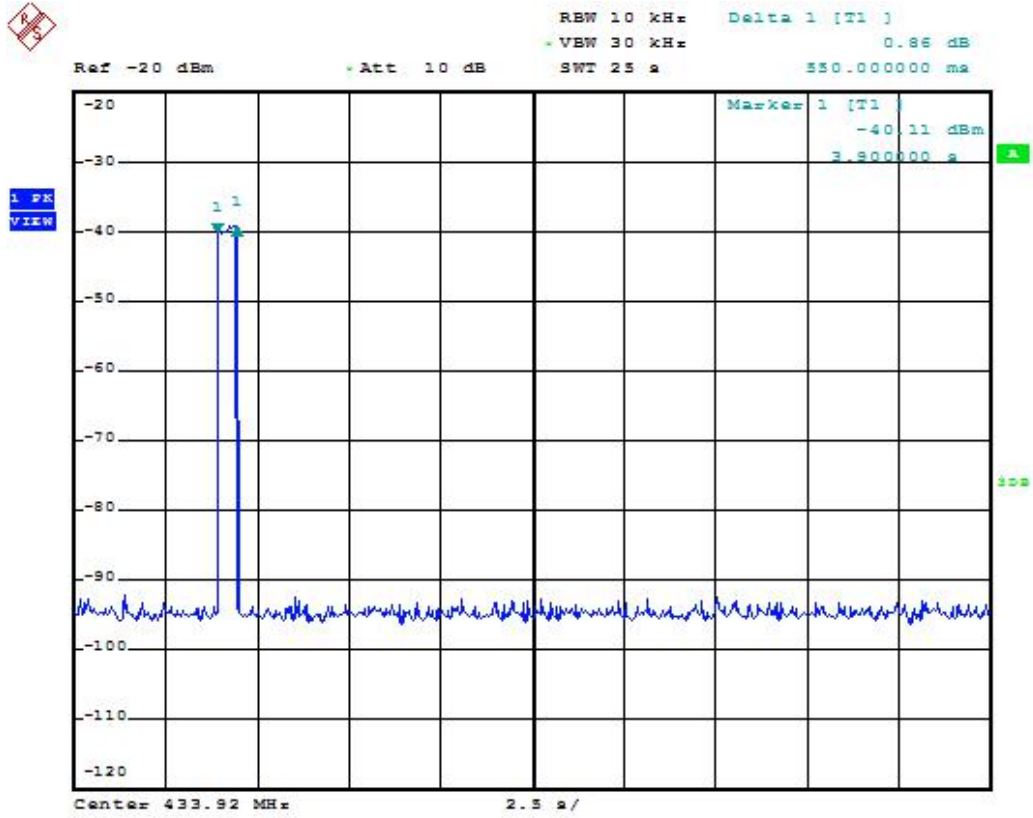
| | |
|--------------------|-----------|
| Temperature: | 20° C |
| Relative Humidity: | 52% |
| ATM Pressure: | 1011 mbar |

7.4 Summary of Test Results/Plots

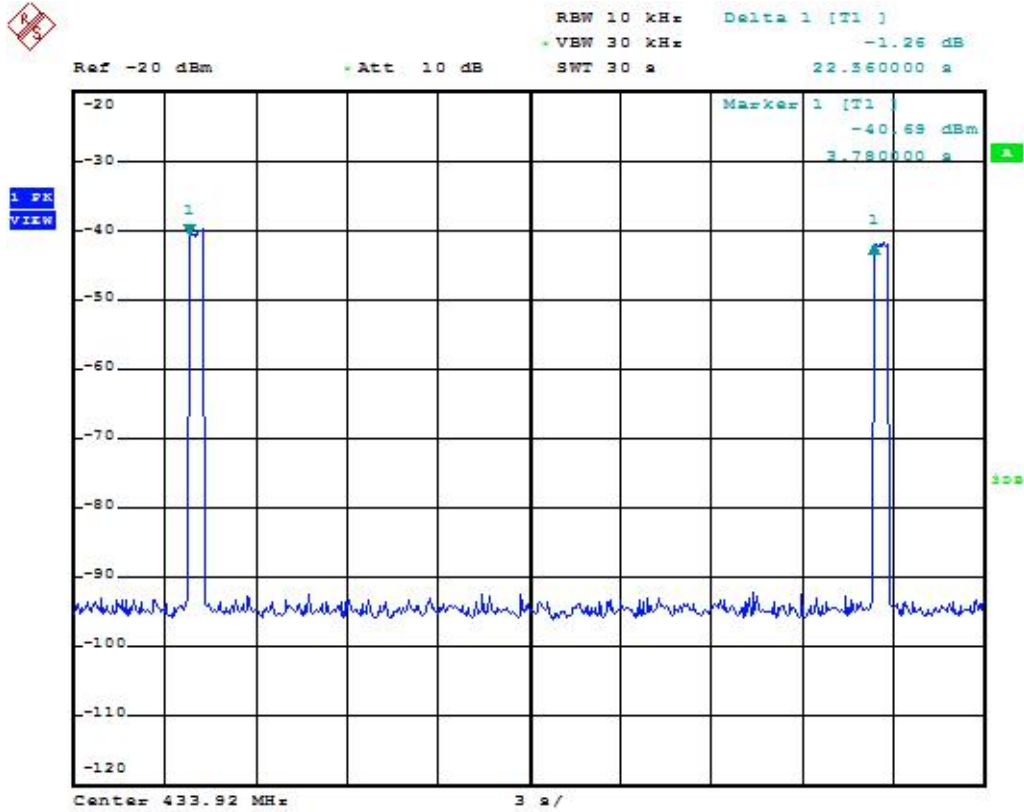
| Release Time(s) | Limit(s) | Result |
|------------------------------------|---------------------------|--------|
| 0.55 | 1 | PASS |
| Silent period(s) | Limit(s) | Result |
| 22.56 | >10s >30* Release Time | PASS |
| Note: 30* Release Time=16.5 | | |

Please refer to the attached plots.

Transmission Time:



Silent period:



8. Duty Cycle

8.1 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.

8.2 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.

8.3 Environmental Conditions

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

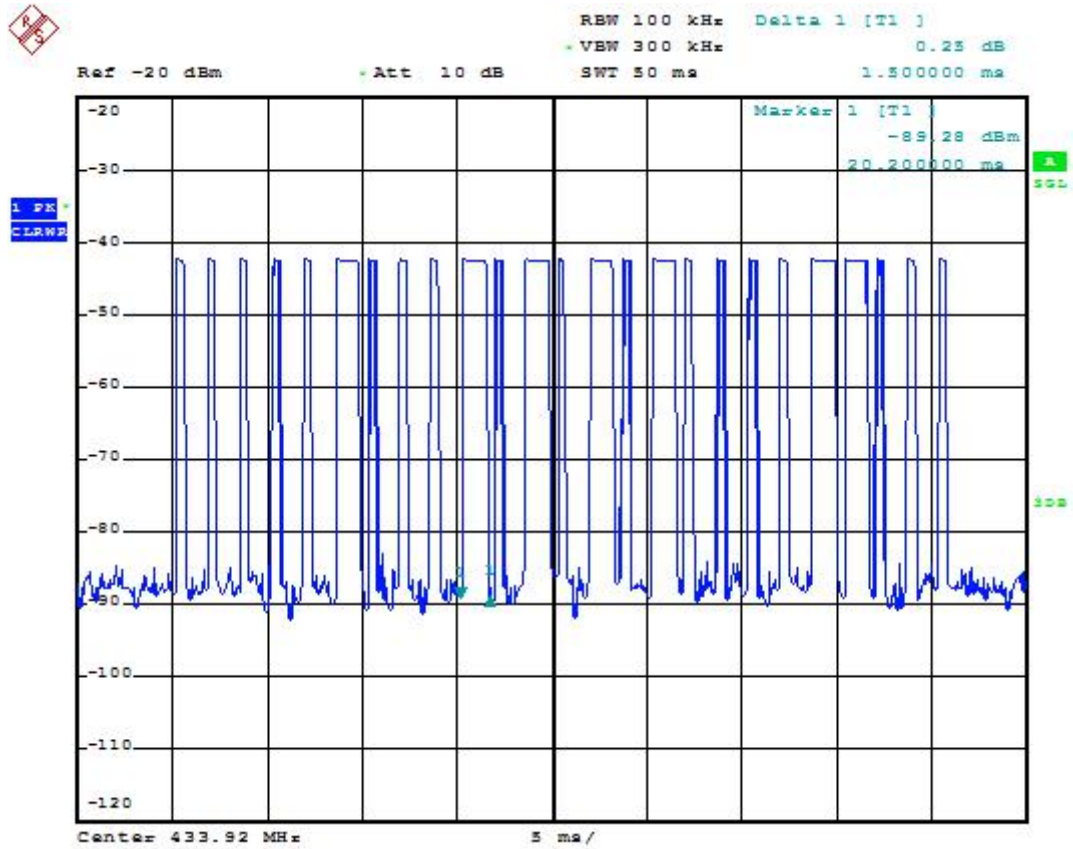
8.4 Summary of Test Results

| Type of Pulse | Width of Pulse ms | Quantity of Pulse | Transmission Time ms | Total Time (T _{on}) ms |
|------------------|----------------------|-------------------|-------------------------|-------------------------------------|
| Pulse 1 (Wide) | 1.5 | 6 | 9 | 17.4 |
| Pulse 2 (Narrow) | 0.7 | 12 | 8.4 | |

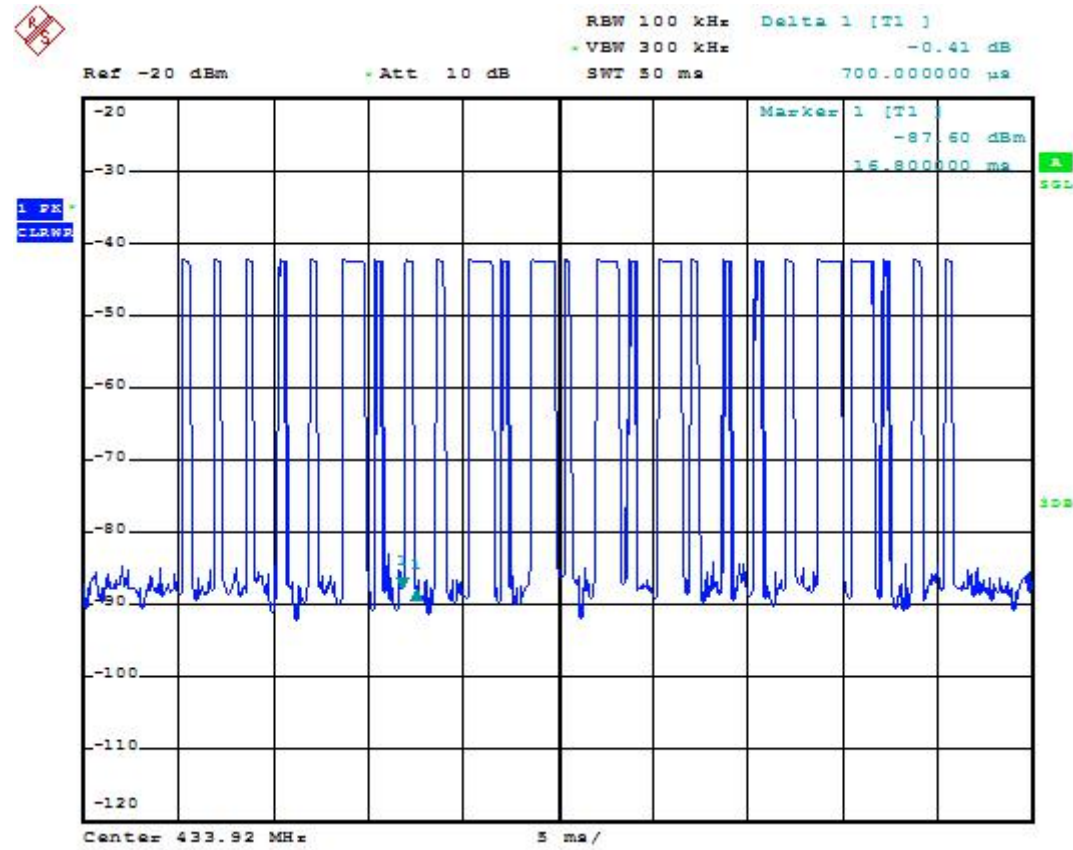
| Test Period (T _p) ms | Total Time (T _{on}) ms | Duty Cycle % | Duty Cycle Factor dB |
|-------------------------------------|-------------------------------------|-----------------|-------------------------|
| 53.5 | 17.4 | 33 | -9.63 |

Please refer to the attached test plots

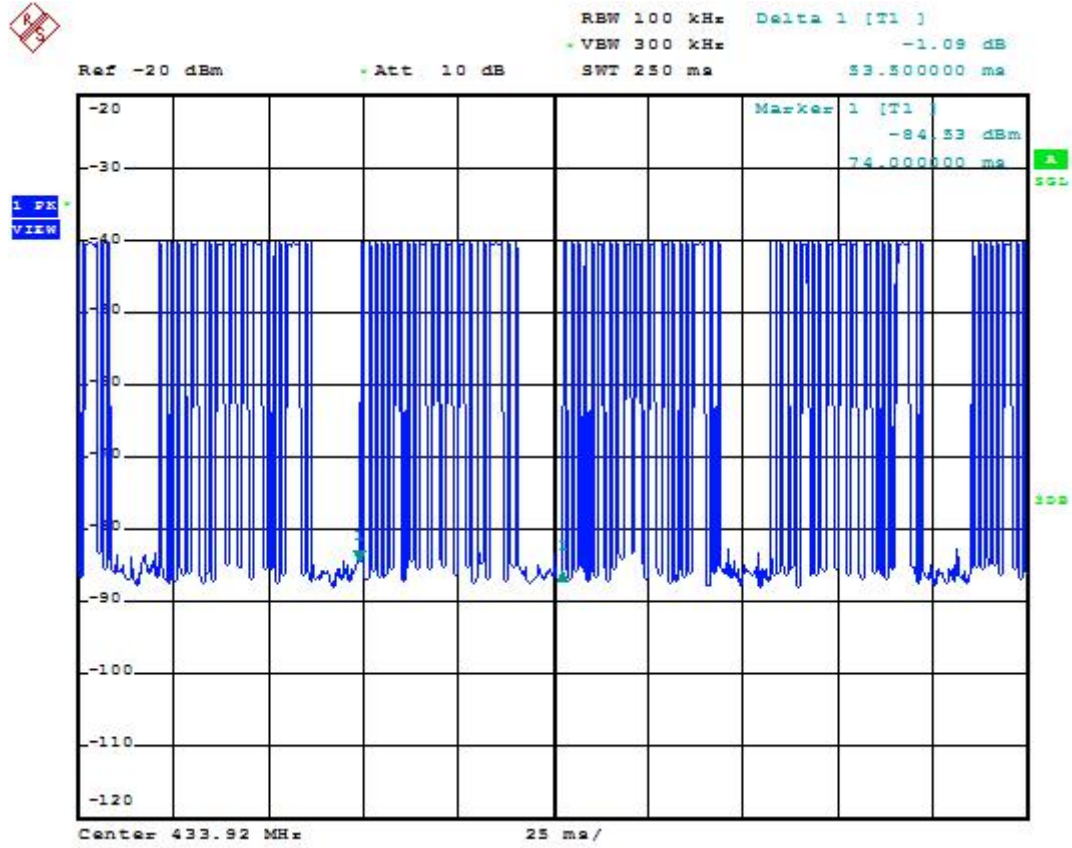
Pulse 1 (Wide):



Pulse 2 (Narrow):



Test Period:



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