

# TEST REPORT

Reference No. .... : WTS20S3011290W001 V1  
FCC ID..... : 2AL7Q-EU1254  
Applicant ..... : ShenZhen EBELONG Technology Co.,Ltd  
Address ..... : ShenZhen Wisdom Innovation Center Suite A.607, QianJin 2nd Road,  
Baoan District, ShenZhen, China  
Manufacturer ..... : The same as above  
Address ..... : The same as above  
Product ..... : Switch  
Model(s)..... : EU1254  
Brand Name..... : EBELONG  
Standards ..... : FCC CFR47 Part 15 Section 15.249: 2019  
Date of Receipt sample.... : 2020-03-13  
Date of Test..... : 2020-04-22 to 2020-06-21  
Date of Issue..... : 2020-11-17  
Test Result ..... : Pass

## Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## Prepared By:

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### 3 Revision History

| Test report No.         | Date of Receipt sample | Date of Test                   | Date of Issue | Purpose   | Comment | Approved |
|-------------------------|------------------------|--------------------------------|---------------|-----------|---------|----------|
| WTS20S3011290W001       | 2020-03-13             | 2020-04-22<br>to<br>2020-06-21 | 2020-06-22    | original  | -       | Replaced |
| WTS20S3011290W001<br>V1 | 2020-03-13             | 2020-04-22<br>to<br>2020-06-21 | 2020-11-17    | Version 1 | Updated | Valid    |

## 4 General Information

### 4.1 General Description of E.U.T.

|                       |                            |
|-----------------------|----------------------------|
| Product:              | Switch                     |
| Model(s):             | EU1254                     |
| Model Description:    | N/A                        |
| Operation Frequency:  | 902.8MHz                   |
| Antenna installation: | internal permanent antenna |
| Antenna Gain:         | 2.0dBi                     |
| Type of Modulation:   | FSK                        |
| Hardware Version:     | V0.6                       |
| Software Version:     | V1.0                       |

### 4.2 Details of E.U.T.

|          |              |
|----------|--------------|
| Ratings: | DC 3.3V 10mA |
|----------|--------------|

### 4.3 Channel List

| Channel No. | Frequency (MHz) |
|-------------|-----------------|
| 1           | 902.80          |

### 4.4 Standards Applicable for Testing

The tests were performed according to following standards:

|                                        |                                                                                                                                                             |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR47 Part 15 Section 15.249: 2019 | Telecommunication-RADIO FREQUENCY DEVICES-Intentional Radiators-Operation within the bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz. |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests.

And according to FCC 47 CFR Section 15.203(m):

Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Only the one channel was recorded and reported.

| Test mode    | channel   |
|--------------|-----------|
| Transmitting | 902.80MHz |

## 5 Equipment Used during Test

### 5.1 Equipments List

| 3m Semi-anechoic Chamber for Radiation Emissions |                                  |                      |               |            |                       |                      |
|--------------------------------------------------|----------------------------------|----------------------|---------------|------------|-----------------------|----------------------|
| Item                                             | Equipment                        | Manufacturer         | Model No.     | Serial No. | Last Calibration Date | Calibration Due Date |
| 1                                                | Spectrum Analyzer                | R&S                  | FSP30         | 100091     | 2020-04-20            | 2021-04-19           |
| 2                                                | Broad-band Horn Antenna(1-18GHz) | SCHWARZBECK          | BBHA 9120 D   | 667        | 2020-04-25            | 2021-04-24           |
| 3                                                | Broadband Preamplifier           | COMPLIANCE DIRECTION | PAP-1G18      | 2004       | 2020-04-20            | 2021-04-19           |
| 4                                                | Coaxial Cable (above 1GHz)       | Top                  | 1GHz-18GHz    | EW02014-7  | 2020-04-20            | 2021-04-19           |
| 3m Semi-anechoic Chamber for Radiation Emissions |                                  |                      |               |            |                       |                      |
| Item                                             | Equipment                        | Manufacturer         | Model No.     | Serial No  | Last Calibration Date | Calibration Due Date |
| 1                                                | Test Receiver                    | R&S                  | ESCI          | 101296     | 2020-04-20            | 2021-04-19           |
| 2                                                | Trilog Broadband Antenna         | SCHWARZBECK          | VULB9160      | 9160-3325  | 2020-04-25            | 2021-04-24           |
| 3                                                | Active Loop Antenna              | Com-Power Corp.      | AL-130R       | 10160007   | 2020-04-20            | 2021-04-19           |
| 4                                                | Amplifier                        | ANRITSU              | MH648A        | M43381     | 2020-04-20            | 2021-04-19           |
| 5                                                | Cable                            | HUBER+SUHNER         | CBL2          | 525178     | 2020-04-20            | 2021-04-19           |
| RF Conducted Testing                             |                                  |                      |               |            |                       |                      |
| Item                                             | Equipment                        | Manufacturer         | Model No.     | Serial No. | Last Calibration Date | Calibration Due Date |
| 1.                                               | Spectrum Analyzer                | R&S                  | FSL6          | 100959     | 2019-09-07            | 2020-09-06           |
| 2                                                | Coaxial Cable                    | Top                  | 10Hz-30GHz    | -          | 2019-09-17            | 2020-09-16           |
| 3                                                | Antenna Connector*               | Realacc              | 45RSm         | -          | 2019-09-17            | 2020-09-16           |
| 4                                                | DC Block                         | Gwave                | GDCB-3G-N-SMA | 140307001  | 2019-09-17            | 2020-09-16           |

## 5.2 Measurement Uncertainty

| Parameter                        | Uncertainty                                    |
|----------------------------------|------------------------------------------------|
| Radio Frequency                  | $\pm 1 \times 10^{-6}$                         |
| RF Power                         | $\pm 1.0$ dB                                   |
| RF Power Density                 | $\pm 2.2$ dB                                   |
| Radiated Spurious Emissions test | $\pm 5.03$ dB<br>(Bilog antenna 30M~1000MHz)   |
|                                  | $\pm 5.47$ dB<br>(Horn antenna 1000M~25000MHz) |

## 5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO., LTD. address is No.163, Pingyun Rd. West of Huangpu Ave, Tianhe District, Guangzhou, Guangdong, China.

## 6 Test Summary

| Test Items                                                                   | Test Requirement                 | Result |
|------------------------------------------------------------------------------|----------------------------------|--------|
| Conducted Emissions                                                          | 15.207                           | N/A*   |
| Radiated Emission                                                            | 15.249(a)<br>15.209<br>15.205(a) | Pass   |
| Periodic Operation                                                           | 15.35(c)                         | Pass   |
| Band Edge                                                                    | 15.249<br>15.205<br>15.209       | Pass   |
| 20dB Bandwidth                                                               | 15:215(c)                        | Pass   |
| Antenna Requirement                                                          | 15.203                           | Pass   |
| Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable. |                                  |        |
| *: This requirement does not apply for device powered by battery.            |                                  |        |

## 7 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method: ANSI 63.10: 2013

Measurement Distance: 3m

Test Result: ☒ Pass ☐ Fail

15.249(a)Limit:

| Fundamental frequency | Field strength of fundamental |        | Field strength of harmonics |        |
|-----------------------|-------------------------------|--------|-----------------------------|--------|
|                       | mV/m                          | dBuV/m | uV/m                        | dBuV/m |
| 902-928 MHz           | 50                            | 94     | 500                         | 54     |
| 2400-2483.5 MHz       | 50                            | 94     | 500                         | 54     |
| 5725-5875 MHz         | 50                            | 94     | 500                         | 54     |
| 24.0-24.25 GHz        | 250                           | 108    | 2500                        | 68     |

15.209 Limit:

| Frequency<br>(MHz) | Field Strength        |                 | Field Strength Limit at 3m Measurement Dist |                                       |
|--------------------|-----------------------|-----------------|---------------------------------------------|---------------------------------------|
|                    | uV/m                  | Distance<br>(m) | uV/m                                        | dBuV/m                                |
| 0.009 ~ 0.490      | $2400/F(\text{kHz})$  | 300             | $10000 * 2400/F(\text{kHz})$                | $20\log^{(2400/F(\text{kHz}))} + 80$  |
| 0.490 ~ 1.705      | $24000/F(\text{kHz})$ | 30              | $100 * 24000/F(\text{kHz})$                 | $20\log^{(24000/F(\text{kHz}))} + 40$ |
| 1.705 ~ 30         | 30                    | 30              | $100 * 30$                                  | $20\log^{(30)} + 40(29.54+40)$        |
| 30 ~ 88            | 100                   | 3               | 100                                         | $20\log^{(100)} = (40)$               |
| 88 ~ 216           | 150                   | 3               | 150                                         | $20\log^{(150)} = (43.5)$             |
| 216 ~ 960          | 200                   | 3               | 200                                         | $20\log^{(200)} = (46)$               |
| Above 960          | 500                   | 3               | 500                                         | $20\log^{(500)} = (54)$               |

**Note:** RF Voltage(dBuV)= $20 \log_{10}$  RF Voltage(uV)

### 7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

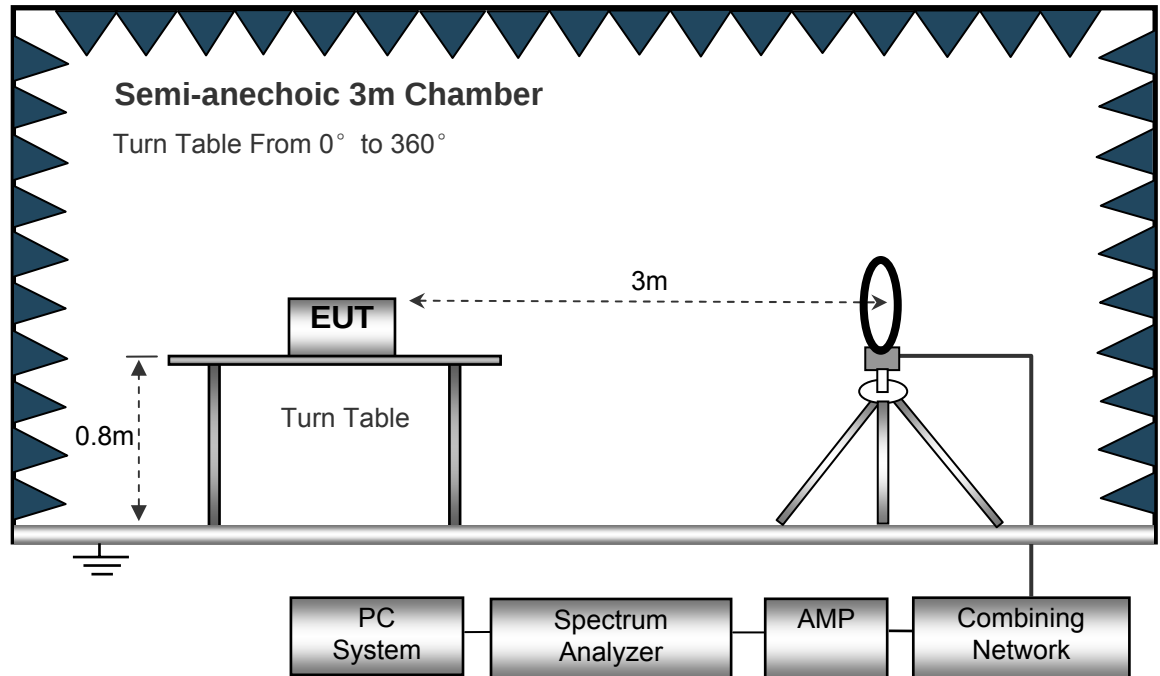
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

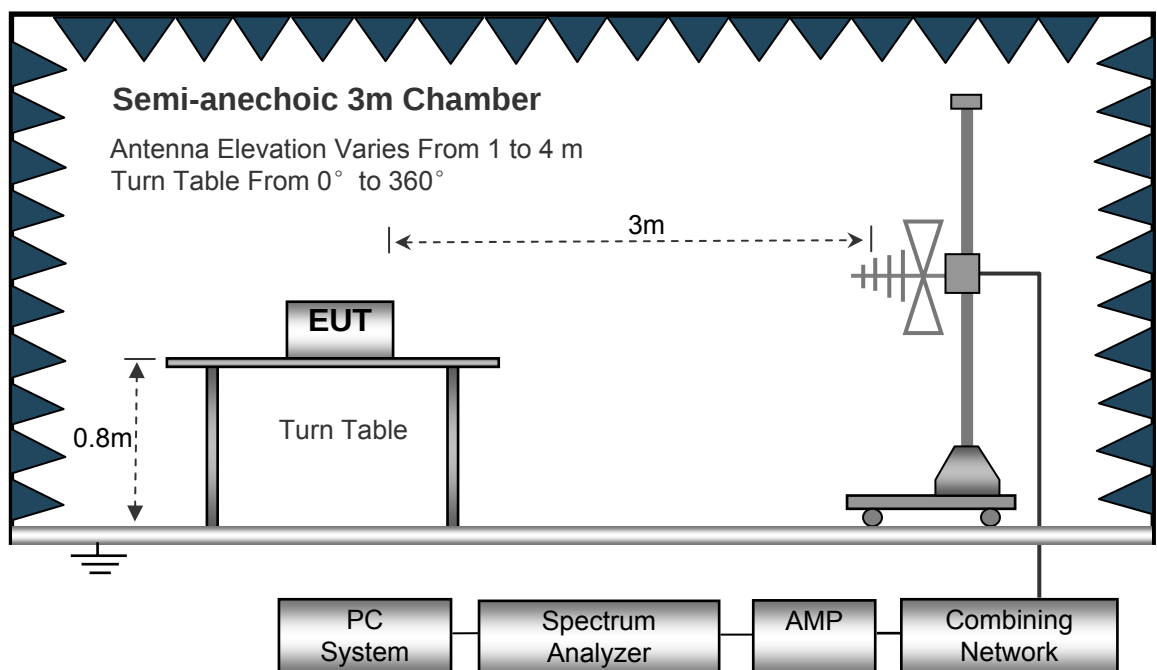
## 7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

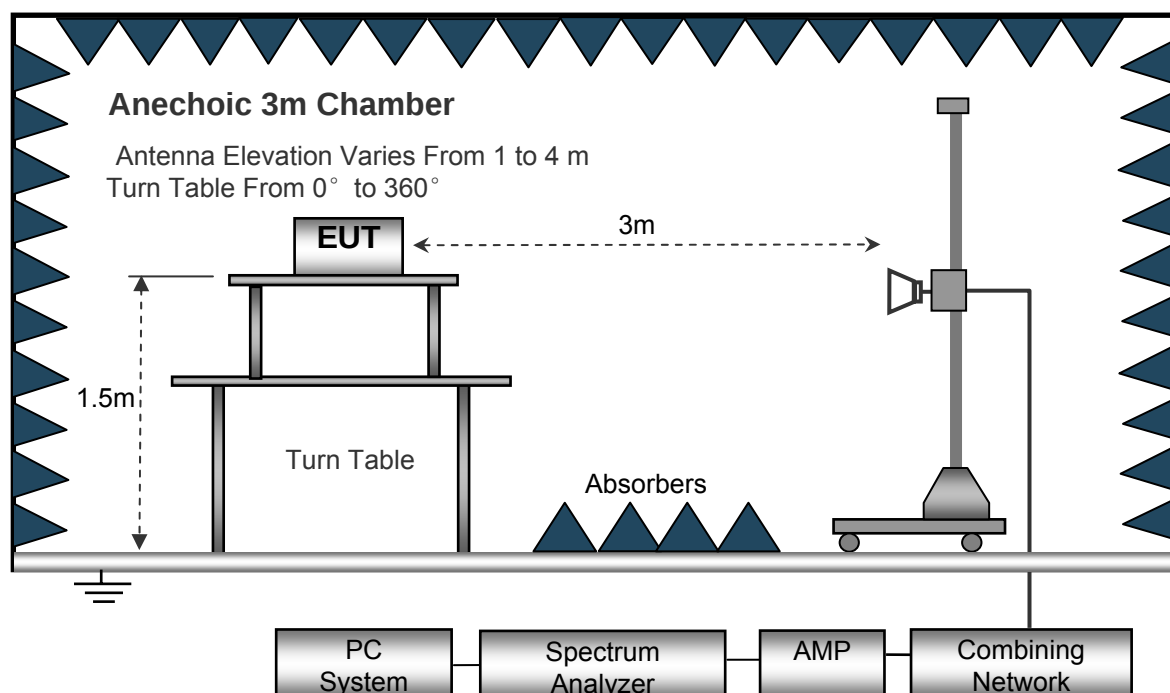
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1 GHz.



### 7.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed .....Auto  
 IF Bandwidth.....10kHz  
 Video Bandwidth .....10kHz  
 Resolution Bandwidth .....10kHz

30MHz ~ 1GHz

Sweep Speed .....Auto  
 Detector .....PK  
 Resolution Bandwidth.....100kHz  
 Video Bandwidth .....300kHz

Above 1GHz

Sweep Speed .....Auto  
 Detector .....PK  
 Resolution Bandwidth.....1MHz  
 Video Bandwidth .....3MHz  
 Detector .....Ave.  
 Resolution Bandwidth.....1MHz  
 Video Bandwidth .....10Hz

## 7.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above 1GHz, the EUT is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

## 7.5 Frequency range of radiated measurements.

According to FCC 47 CFR Section 15.33:

(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:

(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(2) If the intentional radiator operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

(3) If the intentional radiator operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower, unless specified otherwise elsewhere in the rules.

(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.

## 7.6 Test Result

### Test Frequency: 9 kHz ~ 30 MHz

The measurements were more than 20 dB below the limit and not reported.

### Test Frequency: 30MHz ~ 10GHz

| Frequency | Receiver Reading | Detector | Turn table Angle | RX Antenna |       | Corrected Factor | Corrected Amplitude | FCC Part 15.249/209/205 |        |
|-----------|------------------|----------|------------------|------------|-------|------------------|---------------------|-------------------------|--------|
|           |                  |          |                  | Height     | Polar |                  |                     | Limit                   | Margin |
| (MHz)     | (dBμV)           | (PK/QP)  | Degree           | (m)        | (H/V) | (dB/m)           | (dBμV/m)            | (dBμV/m)                | (dB)   |
| 40.23     | 46.41            | QP       | 31               | 2.0        | V     | -14.25           | 32.16               | 40.00                   | -7.84  |
| 902.80    | 89.63            | PK       | 192              | 1.1        | H     | 1.25             | 90.88               | 114.00                  | -23.12 |
| 902.80    | 89.52            | PK       | 149              | 1.8        | V     | 1.25             | 90.77               | 114.00                  | -23.23 |
| 1805.60   | 60.42            | PK       | 85               | 1.4        | H     | -13.21           | 47.21               | 74.00                   | -26.79 |
| 1805.60   | 61.53            | PK       | 139              | 1.4        | V     | -13.21           | 48.32               | 74.00                   | -25.68 |
| 2708.40   | 55.49            | PK       | 27               | 1.3        | H     | -12.35           | 43.14               | 74.00                   | -30.86 |
| 2708.40   | 54.38            | PK       | 91               | 1.8        | V     | -12.35           | 42.03               | 74.00                   | -31.97 |
| 3611.20   | 47.65            | PK       | 244              | 1.1        | H     | -8.95            | 38.70               | 74.00                   | -35.30 |
| 3611.20   | 48.29            | PK       | 155              | 1.6        | V     | -8.95            | 39.34               | 74.00                   | -34.66 |

AV = Peak +20Log10(duty cycle) =PK+(0) [refer to section 8 for more detail]

| Frequency | PK       | RX<br>Antenna<br>Polar | Duty cycle<br>Factor | AV       | FCC Part 15.249/209/205 |        |
|-----------|----------|------------------------|----------------------|----------|-------------------------|--------|
|           |          |                        |                      |          | Limit                   | Margin |
| (MHz)     | (dBμV/m) | (H/V)                  | (dB)                 | (dBμV/m) | (dBμV/m)                | (dB)   |
| 902.80    | 90.88    | H                      | -2.71                | 88.17    | 94.00                   | -5.83  |
| 902.80    | 90.77    | V                      | -2.00                | 88.77    | 94.00                   | -5.23  |
| 1805.60   | 47.21    | H                      | 2.30                 | 49.51    | 54.00                   | -4.49  |
| 1805.60   | 48.32    | V                      | 2.21                 | 50.53    | 54.00                   | -3.47  |
| 2708.40   | 43.14    | H                      | 1.14                 | 44.28    | 54.00                   | -9.72  |
| 2708.40   | 42.03    | V                      | 1.15                 | 43.18    | 54.00                   | -10.82 |
| 3611.20   | 38.70    | H                      | 0.36                 | 39.06    | 54.00                   | -14.94 |
| 3611.20   | 39.34    | V                      | 0.35                 | 39.69    | 54.00                   | -14.31 |

## 8 Periodic Operation

Test Requirement:

15.35(c): when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Test Mode:

Transmitting

The duty cycle was determined by the following equation:

To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train \* %

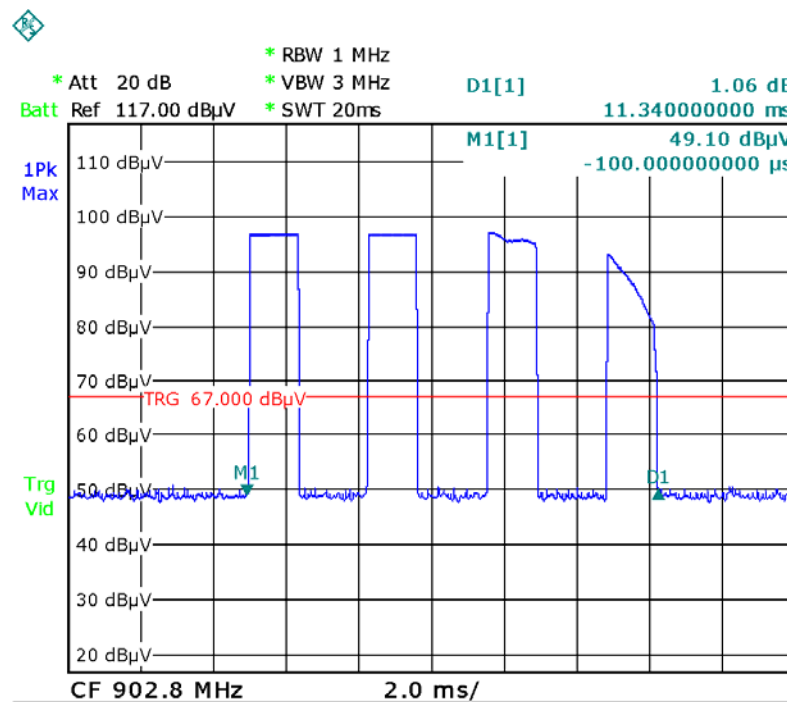
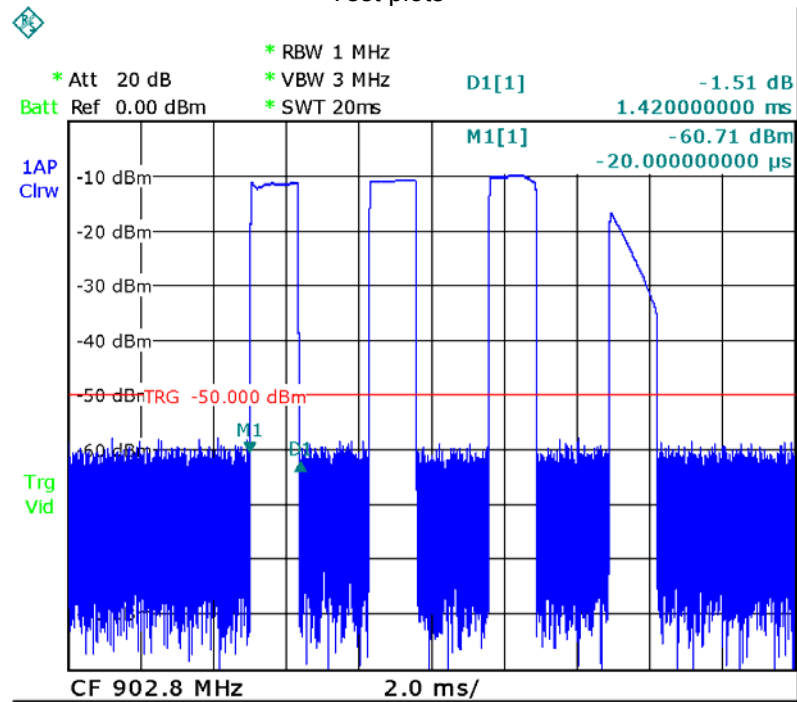
Duty Cycle Correction Factor(dB)=20 \* Log<sub>10</sub>(Duty Cycle)

|                                              |          |
|----------------------------------------------|----------|
| Test channel                                 | 902.8MHz |
| Total transmission time(ms)                  | 5.68     |
| Length of a complete transmission period(ms) | 11.34    |
| Duty Cycle(%)                                | 50.09    |
| Duty Cycle Correction Factor(dB)             | 33.995   |

Refer to the duty cycle plot (as below)

902.8 MHz

Test plots



## 9 Band Edge

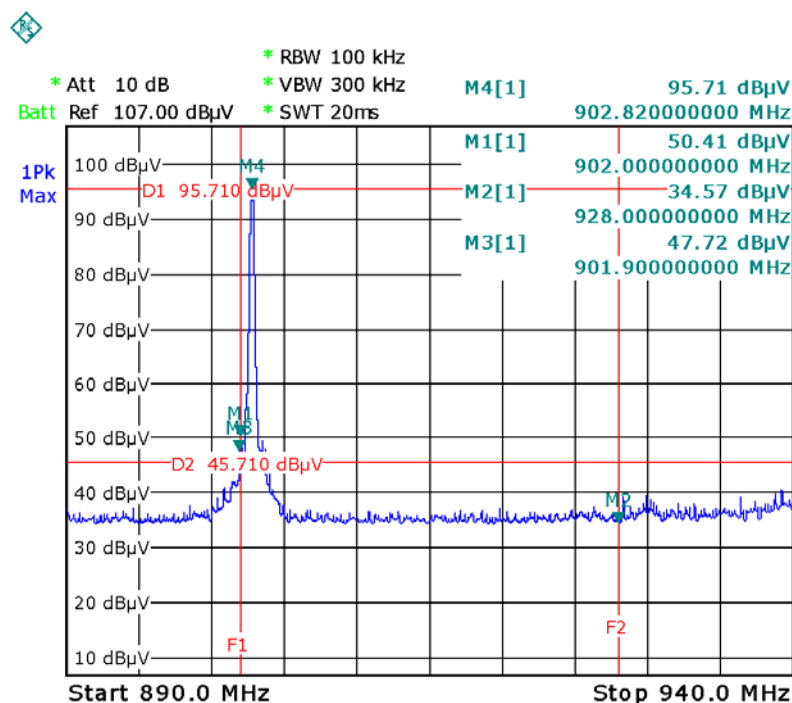
|                   |                                                                                                                                                                                                                                                                   |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation. |
| Test Method:      | ANSI C63.10:2013                                                                                                                                                                                                                                                  |
| Test Mode:        | Transmitting                                                                                                                                                                                                                                                      |

### 9.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto  
Detector function = peak, Trace = max hold

### 9.2 Test Result

Test plots  
902.80MHz



## 10 20 dB Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.215(c)

Test Method:

ANSI C63.10:2013

Test Mode:

Transmitting

### 10.1 Test Procedure

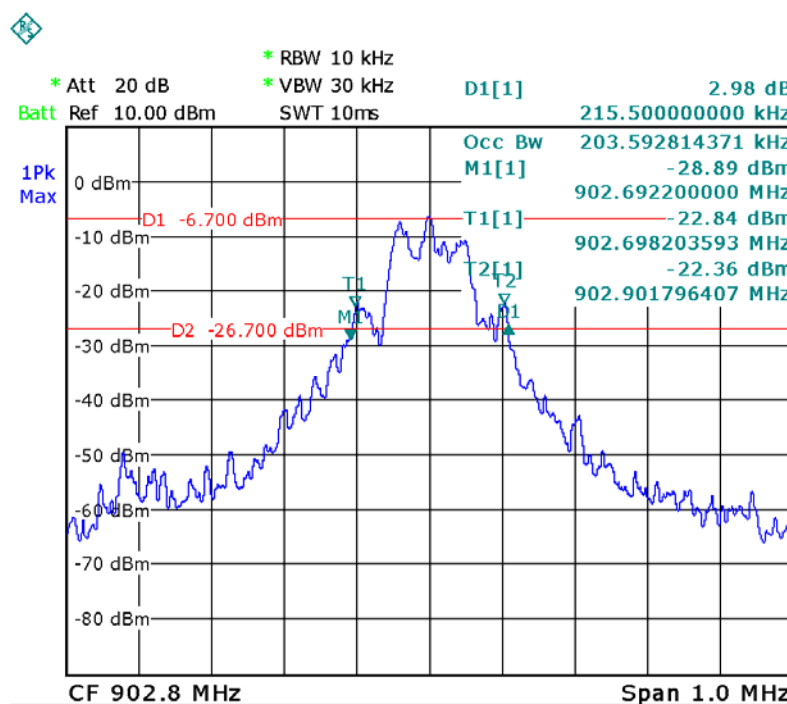
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 3kHz, VBW = 10kHz

### 10.2 Test Result

| Test channel | Frequency (MHz) | 20dB Bandwidth Emission(kHz) |
|--------------|-----------------|------------------------------|
| 902.8MHz     | 902.8MHz        | 215.500                      |

Test plots

902.8MHz



## 11 Antenna Requirement

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 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.

Result:

The EUT has one Integrated Loop Antenna, the gain is 2.0dBi. meets the requirements of FCC 15.203.

=====End of Report=====