# RADIO TEST REPORT

Report No.: STS2108163W40

Issued for

SHENZHEN PUDU TECHNOLOGY CO., LTD.

Room 501, Building A, Block 1, Phase 1, Shenzhen International Inno Valley, Dashi 1st Road, Nanshan District, Shenzhen, China

| | |
|---|---|
| **Product Name:** | FlashBot |
| **Brand Name:** | PUDU |
| **Model Name:** | FBBDR1 |
| **Series Model:** | N/A |
| **FCC ID:** | 2AXDW-FBBDR1 |
| **Test Standard:** | FCC Part 15.247 |



Shenzhen STS Test Services Co., Ltd.
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# TEST RESULT CERTIFICATION

| | |
|---|---|
| Applicant's Name .....: | SHENZHEN PUDU TECHNOLOGY CO., LTD. |
| Address.....: | Room 501, Building A, Block 1, Phase 1, Shenzhen International Inno Valley, Dashi 1st Road, Nanshan District, Shenzhen, China |
| Manufacturer's Name .....: | SHENZHEN PUDU TECHNOLOGY CO., LTD. |
| Address.....: | Room 501, Building A, Block 1, Phase 1, Shenzhen International Inno Valley, Dashi 1st Road, Nanshan District, Shenzhen, China |

**Product Description**

| | |
|---|---|
| Product Name .....: | FlashBot |
| Brand Name .....: | PUDU |
| Model Name.....: | FBBDR1 |
| Series Model .....: | N/A |
| Test Standards .....: | FCC Part15.247 |
| Test Procedure .....: | ANSI C63.10-2013 |

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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**Date of Test**.....:

| | |
|---|---|
| Date of receipt of test item .....: | 25 Aug. 2021 |
| Date (s) of performance of tests : | 25 Aug. 2021 ~ 26 Sept. 2021 |
| Date of Issue .....: | 26 Sept. 2021 |
| Test Result .....: | Pass |

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Vita Li

(Vita Li)

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## Revision History

| Rev. | Issue Date | Report NO. | Effect Page | Contents |
|---|---|---|---|---|
| 00 | 26 Sept. 2021 | STS2108163W40 | ALL | Initial Issue |
| | | | | |

# 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 15.247 Meas Guidance v05r02.

| FCC Part 15.247,Subpart C | | | |
|---|---|---|---|
| Standard Section | Test Item | Judgment | Remark |
| 15.207 | Conducted Emission | PASS | -- |
| 15.247(a)(1) | Hopping Channel Separation | PASS | -- |
| 15.247 (b)(2) | Output Power | PASS | -- |
| 15.209 | Radiated Spurious Emission | PASS | -- |
| 15.247(d) | Conducted Spurious & Band Edge Emission | PASS | -- |
| 15.247(a)(1)(i) | Number of Hopping Frequency | PASS | -- |
| 15.247(a)(1)(i) | Dwell Time | PASS | -- |
| 15.247(a)(1) | 20dB Bandwidth<br>99% Bandwidth | PASS | -- |
| 15.205 | Restricted bands of operation | PASS | -- |
| Part 15.247(d)/part 15.209(a) | Band Edge Emission | PASS | -- |
| 15.203 | Antenna Requirement | PASS | -- |

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.

## 1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
FCC test Firm Registration Number: 625569
IC test Firm Registration Number: 12108A
A2LA Certificate No.: 4338.01

## 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ±**U**, where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

| No. | Item | Uncertainty |
|---|---|---|
| 1 | RF output power, conducted | ±0.68dB |
| 2 | Unwanted Emissions, conducted | ±2.988dB |
| 3 | All emissions, radiated 9K-30MHz | ±2.84dB |
| 4 | All emissions, radiated 30M-1GHz | ±4.39dB |
| 5 | All emissions, radiated 1G-6GHz | ±5.10dB |
| 6 | All emissions, radiated>6G | ±5.48dB |
| 7 | Conducted Emission (9KHz-150KHz) | ±2.79dB |
| 8 | Conducted Emission (150KHz-30MHz) | ±2.80dB |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

| | |
|---|---|
| Product Name | FlashBot |
| Trade Name | PUDU |
| Model Name | FBBDR1 |
| Series Model | N/A |
| Model Difference | N/A |
| Channel List | Please refer to the Note 2. |
| Frequency | 903-927MHz(500KHz) |
| Modulation Type | FSK |
| Antenna | Please refer to the Note 3. |
| Input | DC 29.4V, 3.5A |
| Battery | Rated Voltage: 25.41V<br>Charge Limit Voltage:29.4V<br>Capacity: 15300mAh |
| Hardware version number | V3 |
| Software version number | V8.1.0.12 |
| Connecting I/O Port(s) | Please refer to the Note 1. |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.

2. Channel List:

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|---|---|---|
| 1 | 903 | 32 | 909.2 | 63 | 915.4 | 94 | 921.6 |
| 2 | 903.2 | 33 | 909.4 | 64 | 915.6 | 95 | 921.8 |
| 3 | 903.4 | 34 | 909.6 | 65 | 915.8 | 96 | 922 |
| 4 | 903.6 | 35 | 909.8 | 66 | 916 | 97 | 922.2 |
| 5 | 903.8 | 36 | 910 | 67 | 916.2 | 98 | 922.4 |
| 6 | 904 | 37 | 910.2 | 68 | 916.4 | 99 | 922.6 |
| 7 | 904.2 | 38 | 910.4 | 69 | 916.6 | 100 | 922.8 |
| 8 | 904.4 | 39 | 910.6 | 70 | 916.8 | 101 | 923 |
| 9 | 904.6 | 40 | 910.8 | 71 | 917 | 102 | 923.2 |
| 10 | 904.8 | 41 | 911 | 72 | 917.2 | 103 | 923.4 |
| 11 | 905 | 42 | 911.2 | 73 | 917.4 | 104 | 923.6 |
| 12 | 905.2 | 43 | 911.4 | 74 | 917.6 | 105 | 923.8 |
| 13 | 905.4 | 44 | 911.6 | 75 | 917.8 | 106 | 924 |
| 14 | 905.6 | 45 | 911.8 | 76 | 918 | 107 | 924.2 |
| 15 | 905.8 | 46 | 912 | 77 | 918.2 | 108 | 924.4 |
| 16 | 906 | 47 | 912.2 | 78 | 918.4 | 109 | 924.6 |
| 17 | 906.2 | 48 | 912.4 | 79 | 918.6 | 110 | 924.8 |
| 18 | 906.4 | 49 | 912.6 | 80 | 918.8 | 111 | 925 |
| 19 | 906.6 | 50 | 912.8 | 81 | 919 | 112 | 925.2 |
| 20 | 906.8 | 51 | 913 | 82 | 919.2 | 113 | 925.4 |
| 21 | 907 | 52 | 913.2 | 83 | 919.4 | 114 | 925.6 |
| 22 | 907.2 | 53 | 913.4 | 84 | 919.6 | 115 | 925.8 |
| 23 | 907.4 | 54 | 913.6 | 85 | 919.8 | 116 | 926 |
| 24 | 907.6 | 55 | 913.8 | 86 | 920 | 117 | 926.2 |
| 25 | 907.8 | 56 | 914 | 87 | 920.2 | 118 | 926.4 |
| 26 | 908 | 57 | 914.2 | 88 | 920.4 | 119 | 926.6 |
| 27 | 908.2 | 58 | 914.4 | 89 | 920.6 | 120 | 926.8 |
| 28 | 908.4 | 59 | 914.6 | 90 | 920.8 | 121 | 927 |
| 29 | 908.6 | 60 | 914.8 | 91 | 921 | | |
| 30 | 908.8 | 61 | 915 | 92 | 921.2 | | |
| 31 | 909 | 62 | 915.2 | 93 | 921.4 | | |

3. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|---|---|---|---|---|---|---|
| 1 | PUDU | FBBDR1 | FPC | N/A | 3dBi | ANT |

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.

## 2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

| Worst Mode | Description | Modulation |
|---|---|---|
| Mode 1 | TX CH01 | FSK |
| Mode 2 | TX CH32 | FSK |
| Mode 3 | TX CH65 | FSK |
| Mode 4 | Hopping | FSK |

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report.

(3) The battery is fully-charged during the radited and RF conducted test.

For AC Conducted Emission

| Test Case | |
|---|---|
| AC Conducted Emission | Mode 5: Keeping TX |

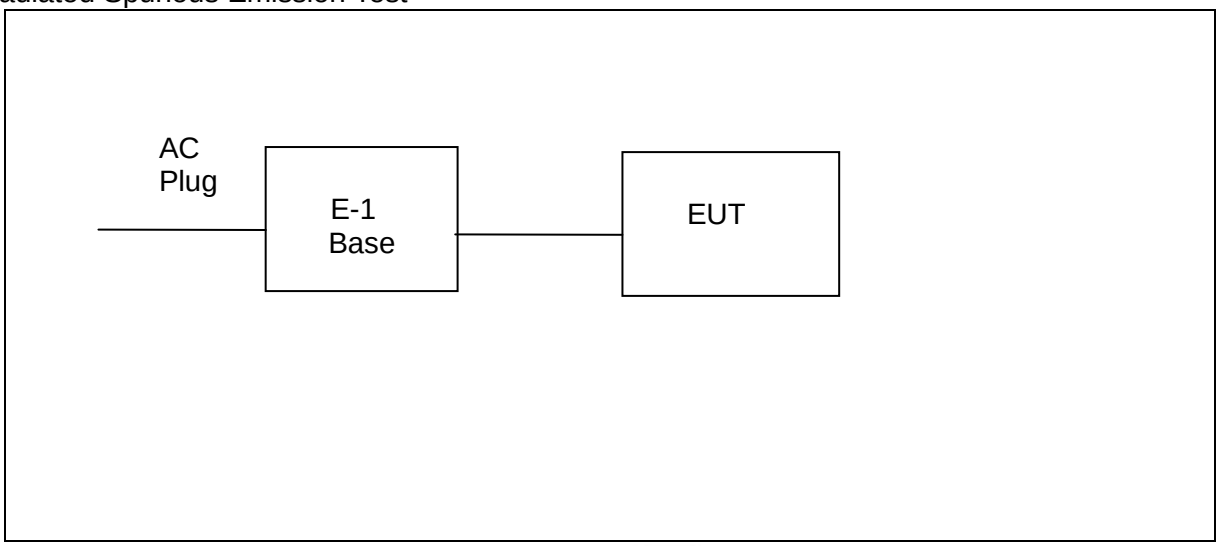
## 2.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

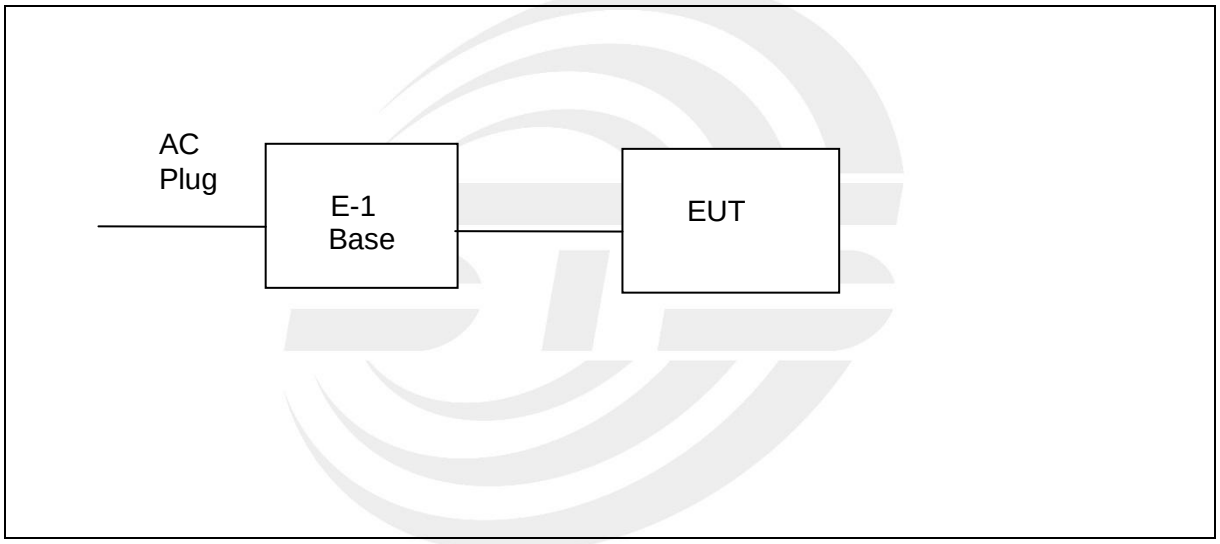
| RF Function | Type | Mode Or Modulation type | Ant Gain (dBi) | Power Class | Software For Testing |
|---|---|---|---|---|---|
| Other SRD | 903MHz/927MHz（125K） | FSK | 3 | 30 | sscom5.13.1 |

## 2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test




Conducted Emission Test



## 2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

| Item | Equipment | Mfr/Brand | Model/Type No. | Length | Note |
|---|---|---|---|---|---|
| E-1 | Base | PUDU Charging Pile | WS1 | N/A | N/A |
| | | | | | |
| | | | | | |
| | | | | | |

Support units

| Item | Equipment | Mfr/Brand | Model/Type No. | Length | Note |
|---|---|---|---|---|---|
| N/A | N/A | N/A | N/A | N/A | N/A |
| | | | | | |
| | | | | | |
| | | | | | |

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
(2) “YES” is means “with core”; “NO” is means “without core”.

## 2.7 EQUIPMENTS LIST

Radiation Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---|---|---|---|---|---|
| Test Receiver | R&S | ESCI | 101427 | 2020.10.12 | 2021.10.11 |
| Signal Analyzer | R&S | FSV 40-N | 101823 | 2020.10.10 | 2021.10.09 |
| Active loop Antenna | ZHINAN | ZN30900C | 16035 | 2021.04.11 | 2023.04.10 |
| Bilog Antenna | TESEQ | CBL6111D | 34678 | 2020.10.12 | 2022.10.11 |
| Horn Antenna | SCHWARZBECK | BBHA 9120D | 02014 | 2019.10.15 | 2021.10.14 |
| SHF-EHF Horn Antenna (18G-40GHz) | A-INFO | LB-180400-KF | J211020657 | 2020.10.12 | 2022.10.11 |
| Pre-Amplifier (0.1M-3GHz) | EM | EM330 | 060665 | 2020.10.12 | 2021.10.11 |
| Pre-Amplifier (1G-18GHz) | SKET | LNPA-01018G-45 | SK2018080901 | 2020.10.12 | 2021.10.11 |
| Pre-Amplifier (18G-40GHz) | SKET | LNPA-1840-50 | SK2018101801 | 2020.10.10 | 2021.10.09 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2020.10.13 | 2021.10.12 |
| Turn table | EM | SC100_1 | 60531 | N/A | N/A |
| Antenna mast | EM | SC100 | N/A | N/A | N/A |
| Test SW | FARAD | EZ-EMC(Ver.STSLAB-03A1 RE) | | | |

Conduction Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---|---|---|---|---|---|
| Test Receiver | R&S | ESCI | 101427 | 2020.10.12 | 2021.10.11 |
| LISN | R&S | ENV216 | 101242 | 2020.10.12 | 2021.10.11 |
| LISN | EMCO | 3810/2NM | 23625 | 2020.10.12 | 2021.10.11 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2020.10.13 | 2021.10.12 |
| Test SW | FARAD | EZ-EMC(Ver.STSLAB-03A1 CE) | | | |

RF Connected Test

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---|---|---|---|---|---|
| Power Sensor | Keysight | U2021XA | MY55520005 | 2020.10.10 | 2021.10.09 |
| | | | MY55520006 | 2020.10.10 | 2021.10.09 |
| | | | MY56120038 | 2020.10.10 | 2021.10.09 |
| | | | MY56280002 | 2020.10.10 | 2021.10.09 |
| Signal Analyzer | Agilent | N9020A | MY51110105 | 2021.03.04 | 2022.03.03 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2020.10.13 | 2021.10.12 |
| Test SW | FARAD | EZ-EMC(Ver.STSLAB-03A1 RE) | | | |

# 3. EMC EMISSION TEST

## 3.1 CONDUCTED EMISSION MEASUREMENT

### 3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

| FREQUENCY (MHz) | Conducted Emissionlimit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 -0.5 | 66 - 56 * | 56 - 46 * |
| 0.50 -5.0 | 56.00 | 46.00 |
| 5.0 -30.0 | 60.00 | 50.00 |

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

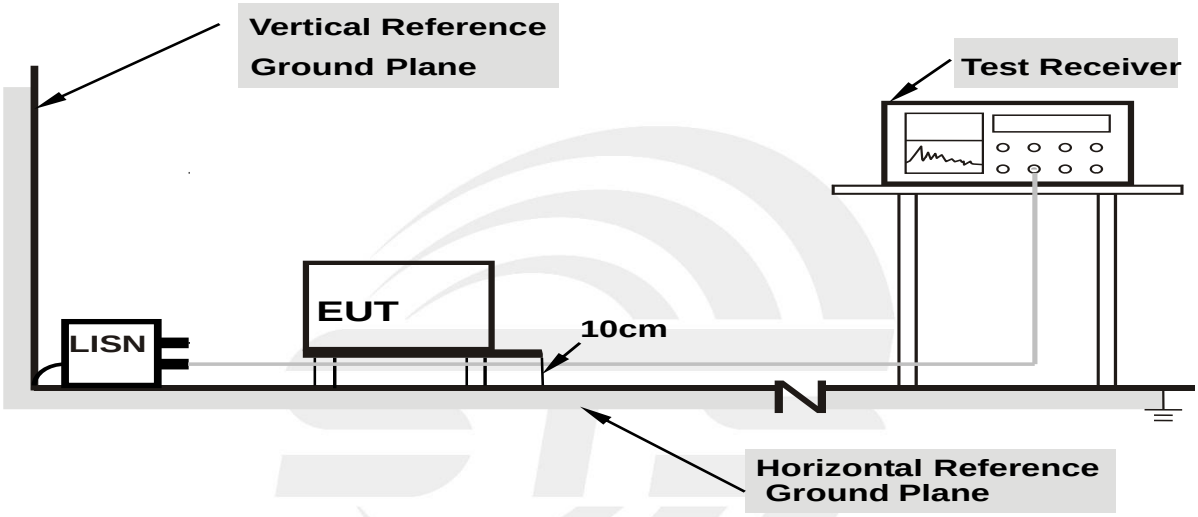
The following table is the setting of the receiver

| **Receiver Parameters** | **Setting** |
|---|---|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

3.1.2 TEST PROCEDURE

a. The EUT is 0.1 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN is at least 80 cm from the nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP




**Note: 1.Support units were connected to second LISN.**
**2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support.**

3.1.4 EUT OPERATING CONDITIONS

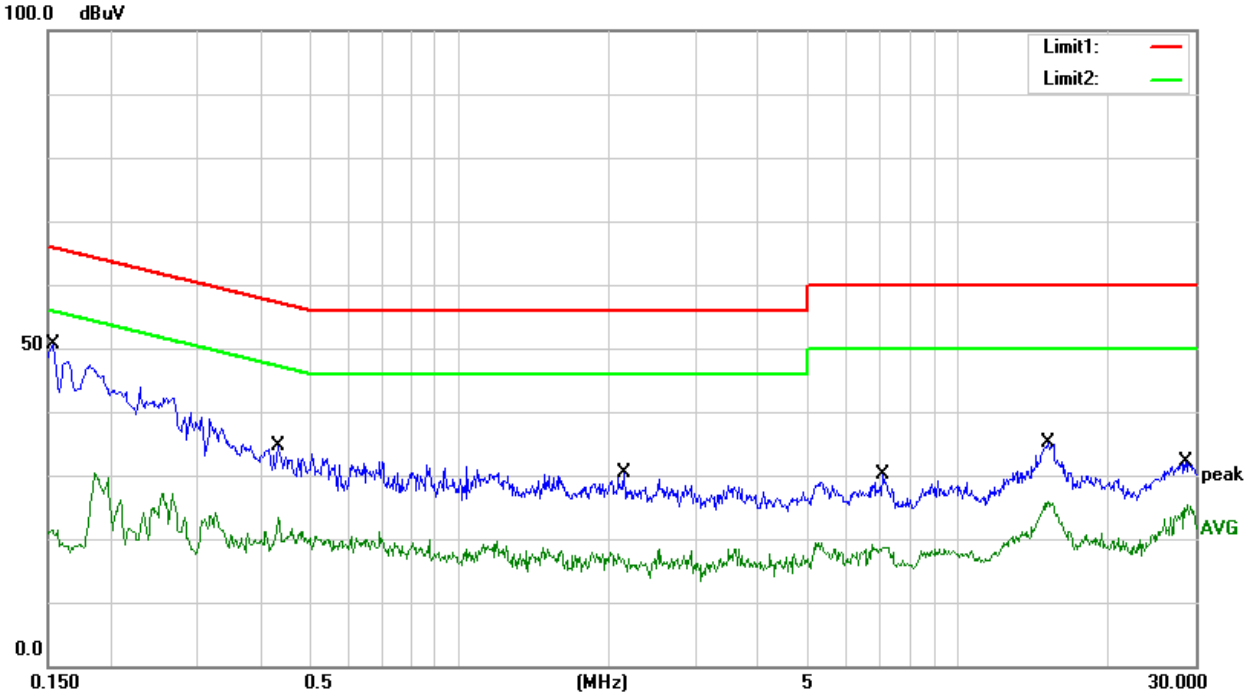
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

3.1.5 TEST RESULT

| | | | |
|---|---|---|---|
| Temperature: | 25.2(C) | Relative Humidity: | 62%RH |
| Test Voltage: | AC 120V/60Hz | Phase: | L |
| Test Mode: | Mode 5 | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1540 | 50.74 | 0.00 | 50.74 | 65.78 | -15.04 | QP |
| 2 | 0.1540 | 21.46 | 0.00 | 21.46 | 55.78 | -34.32 | AVG |
| 3 | 0.4340 | 34.69 | 0.00 | 34.69 | 57.18 | -22.49 | QP |
| 4 | 0.4340 | 20.77 | 0.00 | 20.77 | 47.18 | -26.41 | AVG |
| 5 | 2.1460 | 30.46 | 0.00 | 30.46 | 56.00 | -25.54 | QP |
| 6 | 2.1460 | 16.96 | 0.00 | 16.96 | 46.00 | -29.04 | AVG |
| 7 | 7.0980 | 30.18 | 0.00 | 30.18 | 60.00 | -29.82 | QP |
| 8 | 7.0980 | 18.74 | 0.00 | 18.74 | 50.00 | -31.26 | AVG |
| 9 | 15.1580 | 35.18 | 0.00 | 35.18 | 60.00 | -24.82 | QP |
| 10 | 15.1580 | 25.79 | 0.00 | 25.79 | 50.00 | -24.21 | AVG |
| 11 | 28.7100 | 32.06 | 0.00 | 32.06 | 60.00 | -27.94 | QP |
| 12 | 28.7100 | 25.35 | 0.00 | 25.35 | 50.00 | -24.65 | AVG |

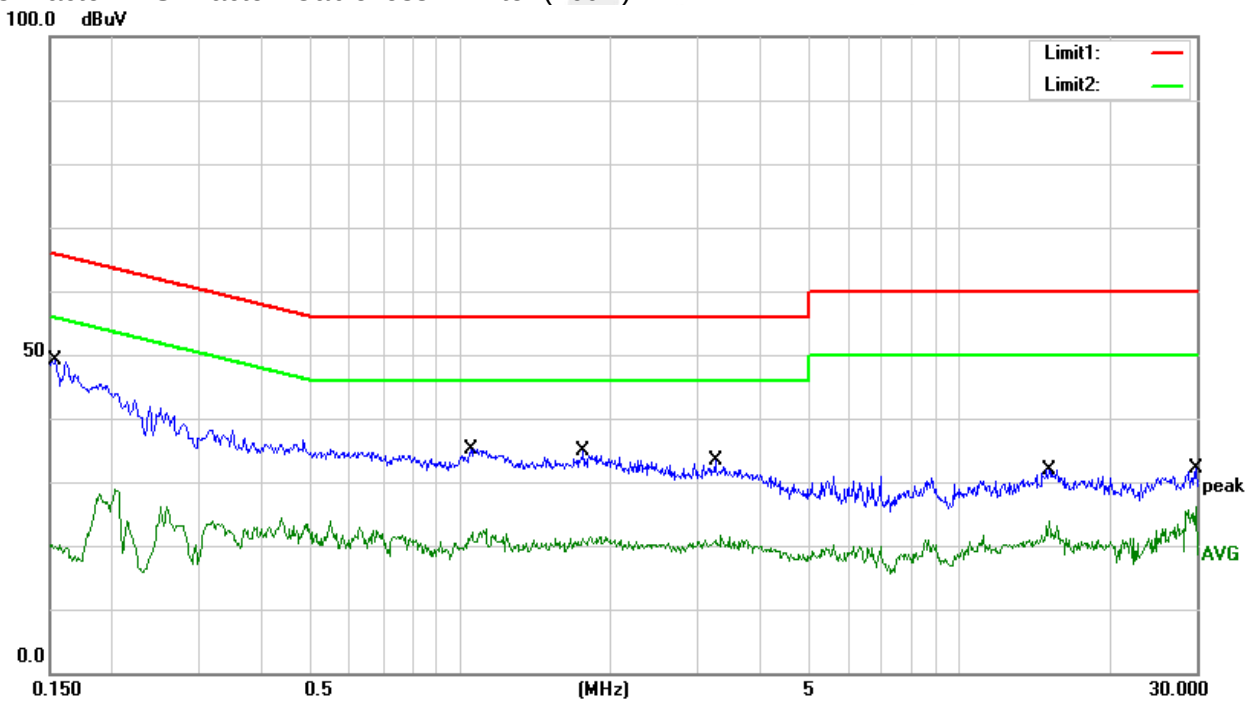
Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor )–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



| | | | |
|---|---|---|---|
| Temperature: | 25.2(C) | Relative Humidity: | 62%RH |
| Test Voltage: | AC 120V/60Hz | Phase: | N |
| Test Mode: | Mode 5 | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 0.1540 | 49.17 | 0.00 | 49.17 | 65.78 | -16.61 | QP |
| 2 | 0.1540 | 20.11 | 0.00 | 20.11 | 55.78 | -35.67 | AVG |
| 3 | 1.0500 | 35.16 | 0.00 | 35.16 | 56.00 | -20.84 | QP |
| 4 | 1.0500 | 22.12 | 0.00 | 22.12 | 46.00 | -23.88 | AVG |
| 5 | 1.7700 | 34.79 | 0.00 | 34.79 | 56.00 | -21.21 | QP |
| 6 | 1.7700 | 21.24 | 0.00 | 21.24 | 46.00 | -24.76 | AVG |
| 7 | 3.2420 | 33.37 | 0.00 | 33.37 | 56.00 | -22.63 | QP |
| 8 | 3.2420 | 21.55 | 0.00 | 21.55 | 46.00 | -24.45 | AVG |
| 9 | 15.2260 | 31.97 | 0.00 | 31.97 | 60.00 | -28.03 | QP |
| 10 | 15.2260 | 23.82 | 0.00 | 23.82 | 50.00 | -26.18 | AVG |
| 11 | 29.9060 | 32.16 | 0.00 | 32.16 | 60.00 | -27.84 | QP |
| 12 | 29.9060 | 26.17 | 0.00 | 26.17 | 50.00 | -23.83 | AVG |

Remark:
1. All readings are Quasi-Peak and Average values
2. Margin = Result (Result =Reading + Factor )–Limit
3. Factor=LISN factor+Cable loss+Limiter (10dB)



## 3.2 RADIATED EMISSION MEASUREMENT

### 3.2.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205 (a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

| FREQUENCY (MHz) | (dBuV/m) (at 3M) | |
|---|---|---|
| | PEAK | AVERAGE |
| Above 1000 | 74 | 54 |

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RESTRICTED FREQUENCY BANDS

| FREQUENCY (MHz) | FREQUENCY (MHz) | FREQUENCY (MHz) | FREQUENCY (GHz) |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

For Radiated Emission

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Detector | Peak/QP/AV |
| Start Frequency | 9 KHz/150KHz(Peak/QP/AV) |
| Stop Frequency | 150KHz/30MHz(Peak/QP/AV) |
| RB / VB (emission in restricted band) | 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz); 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz) |

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Detector | Peak/QP |
| Start Frequency | 30 MHz(Peak/QP) |
| Stop Frequency | 1000 MHz (Peak/QP) |
| RB / VB (emission in restricted band) | 120 KHz / 300 KHz |

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Detector | Peak/AV |
| Start Frequency | 1000 MHz(Peak/AV) |
| Stop Frequency | 10th carrier hamonic(Peak/AV) |
| RB / VB (emission in restricted band) | 1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG) |

For Radited Band edge

| Spectrum Parameter | Setting |
|---|---|
| Detector | Peak/AV |
| Start/Stop Frequency | Lower Band Edge: 900 to 903.7 MHz Upper Band Edge: 926 to 930 MHz |
| RB / VB | 1 MHz / 3 MHz(Peak) 1 MHz/1/T MHz(AVG) |

| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~90kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 90kHz~110kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 110kHz~490kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 490kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

3.2.2 TEST PROCEDURE

a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

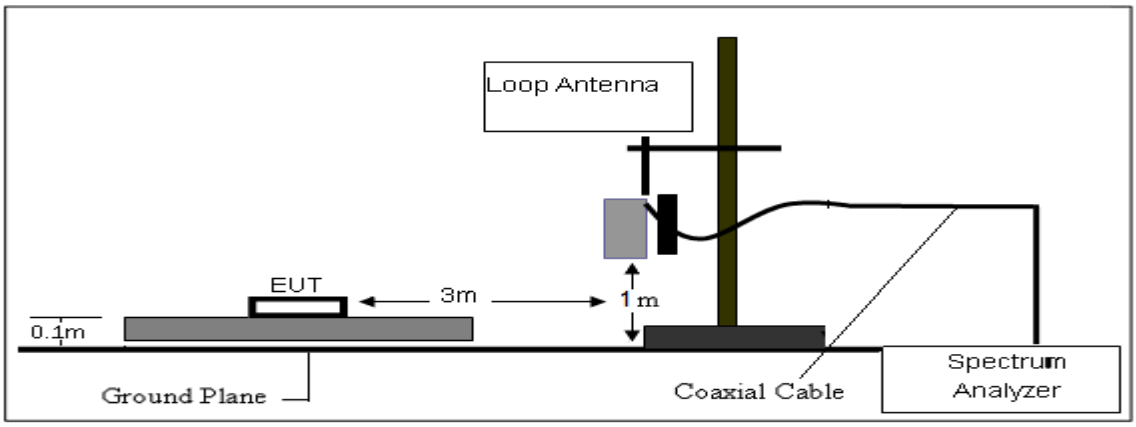
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

3.2.3 DEVIATION FROM TEST STANDARD

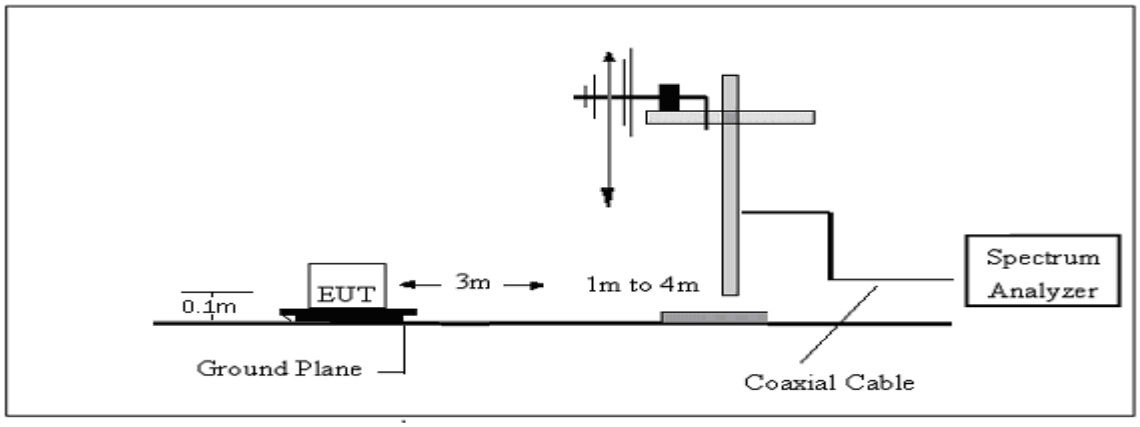
No deviation.

3.2.4 TESTSETUP

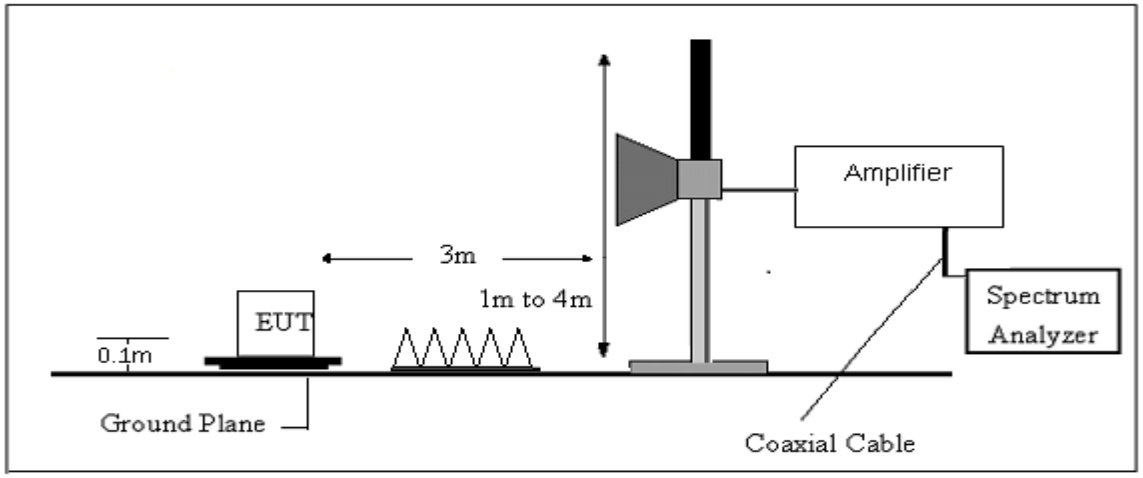
(A) Radiated Emission Test-Up Frequency Below 30MHz




(B) Radiated Emission Test-Up Frequency 30MHz~1GHz




(C) Radiated Emission Test-Up Frequency Above 1GHz




3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 FIELD STRENGTH CALCULATION

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

FS = RA + AF + CL - AG

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

| Frequency | FS | RA | AF | CL | AG | Factor |
|---|---|---|---|---|---|---|
| (MHz) | (dBμV/m) | (dBμV/m) | (dB) | (dB) | (dB) | (dB) |
| 300 | 40 | 58.1 | 12.2 | 1.6 | 31.9 | -18.1 |

Factor=AF+CL-AG

3.2.7 TEST RESULTS

(9KHz-30MHz)

| Temperature: | 23.1(C) | Relative Humidtity: | 60%RH |
|---|---|---|---|
| Test Voltage: | DC 25.41V | Test Mode: | TX Mode |

| Freq. | Reading | Limit | Margin | State | Test Result |
|---|---|---|---|---|---|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB) | P/F | |
| -- | -- | -- | -- | -- | PASS |
| -- | -- | -- | -- | -- | PASS |

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

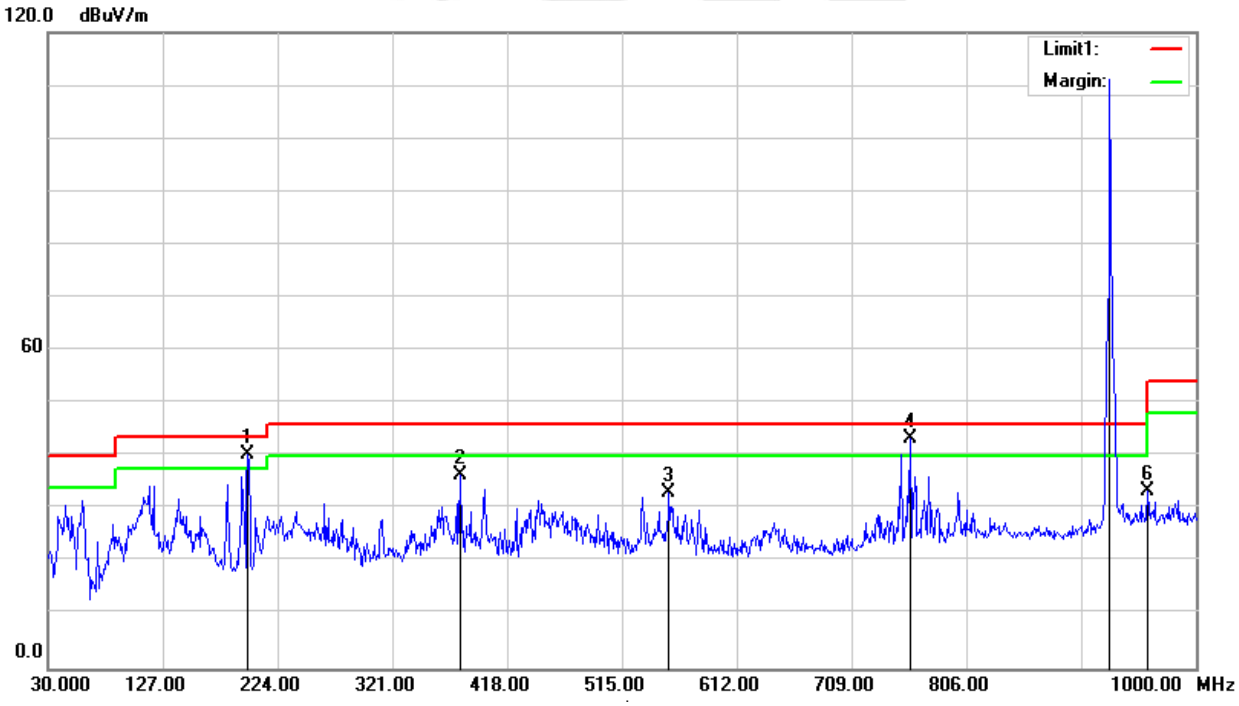
Limit line = specific limits (dBuv) + distance extrapolation factor.

(30MHz-1000MHz)

| | | | |
|---|---|---|---|
| Temperature: | 23.1(C) | Relative Humidtity: | 60%RH |
| Test Voltage: | DC 25.41V | Phase: | Horizontal |
| Test Mode: | Mode 1/2/3 (Mode 1 worst mode) | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 198.7800 | 61.54 | -21.12 | 40.42 | 43.50 | -3.08 | QP |
| 2 | 378.2300 | 48.62 | -12.31 | 36.31 | 46.00 | -9.69 | QP |
| 3 | 554.7700 | 38.92 | -5.63 | 33.29 | 46.00 | -12.71 | QP |
| 4 | 758.4700 | 45.49 | -2.17 | 43.32 | 46.00 | -2.68 | QP |
| 5 | 927.0000 | 110.83 | 0.39 | 111.22 | - | - | peak |
| 6 | 959.2600 | 31.77 | 1.75 | 33.52 | 46.00 | -12.48 | QP |

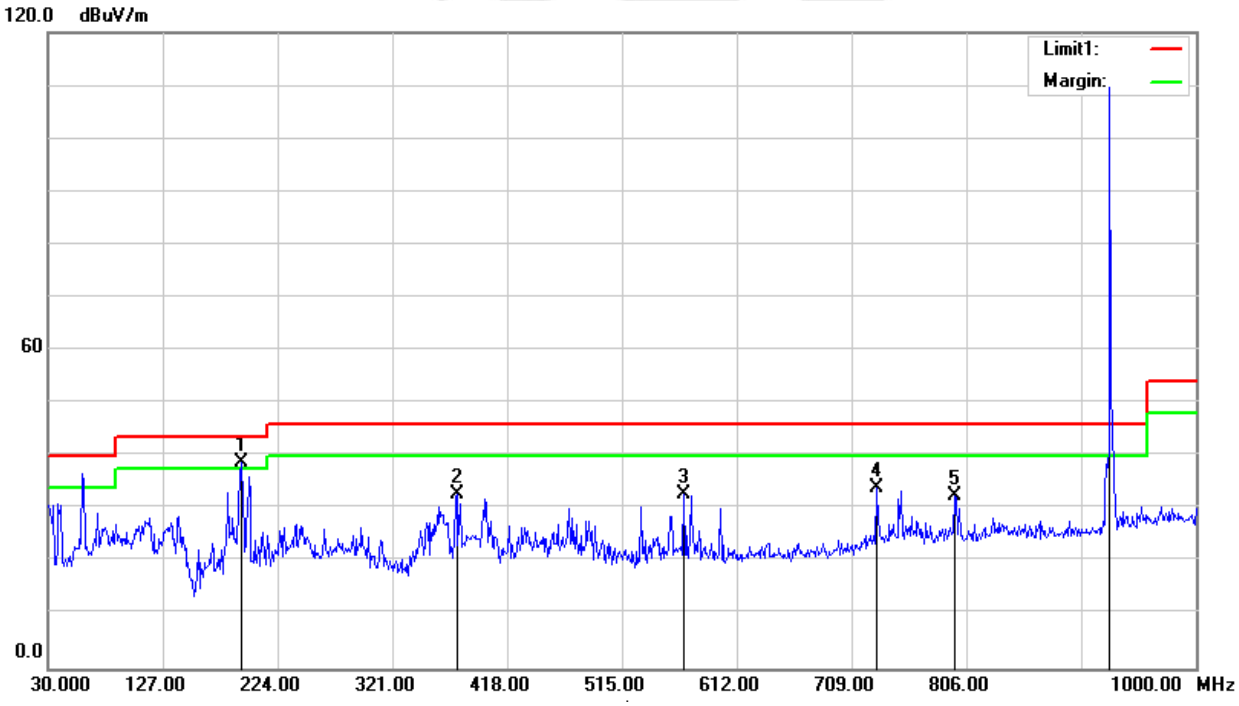
Remark:
1. Margin = Result (Result =Reading + Factor )–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



| | | | |
|---|---|---|---|
| Temperature: | 23.1(C) | Relative Humidity: | 60%RH |
| Test Voltage: | DC 25.41V | Phase: | Vertical |
| Test Mode: | Mode 1/2/3 (Mode 1 worst mode) | | |

| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 192.9600 | 59.96 | -21.08 | 38.88 | 43.50 | -4.62 | QP |
| 2 | 375.3200 | 45.18 | -12.37 | 32.81 | 46.00 | -13.19 | QP |
| 3 | 567.3800 | 38.50 | -5.57 | 32.93 | 46.00 | -13.07 | QP |
| 4 | 730.3400 | 36.45 | -2.46 | 33.99 | 46.00 | -12.01 | QP |
| 5 | 796.3000 | 34.69 | -2.02 | 32.67 | 46.00 | -13.33 | QP |
| 6 | 927.0000 | 109.18 | 0.39 | 109.57 | - | - | peak |

Remark:
1. Margin = Result (Result =Reading + Factor )–Limit
2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



(1GHz~25GHz) Spurious emission Requirements

| Frequency | Meter Reading | Amplifier | Loss | Antenna Factor | Orrected Factor | Emission Level | Limits | Margin | Detector | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | （dB） | （dB） | （dB/m） | （dB） | (dBμV/m) | (dBμV/m) | (dB) | Type | |
| Low Channel (FSK/903 MHz) | | | | | | | | | | |
| 1227.34 | 22.90 | 44.70 | 6.70 | 28.20 | -9.80 | 13.10 | 74.00 | -60.90 | Pk | Vertical |
| 1227.34 | 19.22 | 44.70 | 6.70 | 28.20 | -9.80 | 9.42 | 54.00 | -44.58 | AV | Vertical |
| 1227.38 | 22.97 | 44.70 | 6.70 | 28.20 | -9.80 | 13.17 | 74.00 | -60.83 | Pk | Horizontal |
| 1227.38 | 19.11 | 44.70 | 6.70 | 28.20 | -9.80 | 9.31 | 54.00 | -44.69 | AV | Horizontal |
| 1806.11 | 22.19 | 44.20 | 9.04 | 31.60 | -3.56 | 18.63 | 74.00 | -55.37 | Pk | Vertical |
| 1806.11 | 18.68 | 44.20 | 9.04 | 31.60 | -3.56 | 15.12 | 54.00 | -38.88 | AV | Vertical |
| 1806.15 | 22.27 | 44.20 | 9.04 | 31.60 | -3.56 | 18.71 | 74.00 | -55.29 | Pk | Horizontal |
| 1806.15 | 18.76 | 44.20 | 9.04 | 31.60 | -3.56 | 15.20 | 54.00 | -38.80 | AV | Horizontal |
| 2014.95 | 18.42 | 44.20 | 9.86 | 32.00 | -2.34 | 16.08 | 74.00 | -57.92 | Pk | Vertical |
| 2014.95 | 15.02 | 44.20 | 9.86 | 32.00 | -2.34 | 12.68 | 54.00 | -41.32 | AV | Vertical |
| 2014.89 | 17.81 | 44.20 | 9.86 | 32.00 | -2.34 | 15.47 | 74.00 | -58.53 | Pk | Horizontal |
| 2014.89 | 14.74 | 44.20 | 9.86 | 32.00 | -2.34 | 12.40 | 54.00 | -41.60 | AV | Horizontal |
| 2708.93 | 20.49 | 43.50 | 11.40 | 35.50 | 3.40 | 23.89 | 74.00 | -50.11 | Pk | Vertical |
| 2708.93 | 16.86 | 43.50 | 11.40 | 35.50 | 3.40 | 20.26 | 54.00 | -33.74 | AV | Vertical |
| 2708.95 | 20.61 | 43.50 | 11.40 | 35.50 | 3.40 | 24.01 | 74.00 | -49.99 | Pk | Horizontal |
| 2708.95 | 16.51 | 43.50 | 11.40 | 35.50 | 3.40 | 19.91 | 54.00 | -34.09 | AV | Horizontal |
| Middle Channel (FSK/915 MHz) | | | | | | | | | | |
| 1224.30 | 23.07 | 44.70 | 6.70 | 28.20 | -9.80 | 13.27 | 74.00 | -60.73 | Pk | Vertical |
| 1224.30 | 18.82 | 44.70 | 6.70 | 28.20 | -9.80 | 9.02 | 54.00 | -44.98 | AV | Vertical |
| 1224.21 | 22.87 | 44.70 | 6.70 | 28.20 | -9.80 | 13.07 | 74.00 | -60.93 | Pk | Horizontal |
| 1224.21 | 19.03 | 44.70 | 6.70 | 28.20 | -9.80 | 9.23 | 54.00 | -44.77 | AV | Horizontal |
| 1830.93 | 21.87 | 44.20 | 9.04 | 31.60 | -3.56 | 18.31 | 74.00 | -55.69 | Pk | Vertical |
| 1830.93 | 18.60 | 44.20 | 9.04 | 31.60 | -3.56 | 15.04 | 54.00 | -38.96 | AV | Vertical |
| 1830.98 | 22.26 | 44.20 | 9.04 | 31.60 | -3.56 | 18.70 | 74.00 | -55.30 | Pk | Horizontal |
| 1830.98 | 18.75 | 44.20 | 9.04 | 31.60 | -3.56 | 15.19 | 54.00 | -38.81 | AV | Horizontal |
| 2009.88 | 18.01 | 44.20 | 9.86 | 32.00 | -2.34 | 15.66 | 74.00 | -58.34 | Pk | Vertical |
| 2009.88 | 14.96 | 44.20 | 9.86 | 32.00 | -2.34 | 12.61 | 54.00 | -41.39 | AV | Vertical |
| 2009.94 | 18.04 | 44.20 | 9.86 | 32.00 | -2.34 | 15.70 | 74.00 | -58.30 | Pk | Horizontal |
| 2009.94 | 14.51 | 44.20 | 9.86 | 32.00 | -2.34 | 12.17 | 54.00 | -41.83 | AV | Horizontal |
| 2746.48 | 20.27 | 43.50 | 11.40 | 35.50 | 3.40 | 23.67 | 74.00 | -50.33 | Pk | Vertical |
| 2746.48 | 16.70 | 43.50 | 11.40 | 35.50 | 3.40 | 20.10 | 54.00 | -33.90 | AV | Vertical |
| 2746.40 | 20.16 | 43.50 | 11.40 | 35.50 | 3.40 | 23.56 | 74.00 | -50.44 | Pk | Horizontal |
| 2746.40 | 16.73 | 43.50 | 11.40 | 35.50 | 3.40 | 20.13 | 54.00 | -33.87 | AV | Horizontal |

| High Channel (FSK/927 MHz) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1220.28 | 23.09 | 44.70 | 6.70 | 28.20 | -9.80 | 13.29 | 74.00 | -60.71 | Pk | Vertical |
| 1220.28 | 19.10 | 44.70 | 6.70 | 28.20 | -9.80 | 9.30 | 54.00 | -44.70 | AV | Vertical |
| 1220.31 | 22.87 | 44.70 | 6.70 | 28.20 | -9.80 | 13.07 | 74.00 | -60.93 | Pk | Horizontal |
| 1220.31 | 18.90 | 44.70 | 6.70 | 28.20 | -9.80 | 9.10 | 54.00 | -44.90 | AV | Horizontal |
| 1854.18 | 21.72 | 44.20 | 9.04 | 31.60 | -3.56 | 18.16 | 74.00 | -55.84 | Pk | Vertical |
| 1854.18 | 18.56 | 44.20 | 9.04 | 31.60 | -3.56 | 15.00 | 54.00 | -39.00 | AV | Vertical |
| 1854.18 | 21.99 | 44.20 | 9.04 | 31.60 | -3.56 | 18.43 | 74.00 | -55.57 | Pk | Horizontal |
| 1854.18 | 18.54 | 44.20 | 9.04 | 31.60 | -3.56 | 14.98 | 54.00 | -39.02 | AV | Horizontal |
| 2003.47 | 18.28 | 44.20 | 9.86 | 32.00 | -2.34 | 15.94 | 74.00 | -58.06 | Pk | Vertical |
| 2003.47 | 14.99 | 44.20 | 9.86 | 32.00 | -2.34 | 12.64 | 54.00 | -41.36 | AV | Vertical |
| 2003.45 | 18.06 | 44.20 | 9.86 | 32.00 | -2.34 | 15.71 | 74.00 | -58.29 | Pk | Horizontal |
| 2003.45 | 14.35 | 44.20 | 9.86 | 32.00 | -2.34 | 12.01 | 54.00 | -41.99 | AV | Horizontal |
| 2780.99 | 20.24 | 43.50 | 11.40 | 35.50 | 3.40 | 23.64 | 74.00 | -50.36 | Pk | Vertical |
| 2780.99 | 16.43 | 43.50 | 11.40 | 35.50 | 3.40 | 19.83 | 54.00 | -34.17 | AV | Vertical |
| 2780.87 | 20.33 | 43.50 | 11.40 | 35.50 | 3.40 | 23.73 | 74.00 | -50.27 | Pk | Horizontal |
| 2780.87 | 16.54 | 43.50 | 11.40 | 35.50 | 3.40 | 19.94 | 54.00 | -34.06 | AV | Horizontal |
| 1220.28 | 23.09 | 44.70 | 6.70 | 28.20 | -9.80 | 13.29 | 74.00 | -60.71 | AV | Horizontal |

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

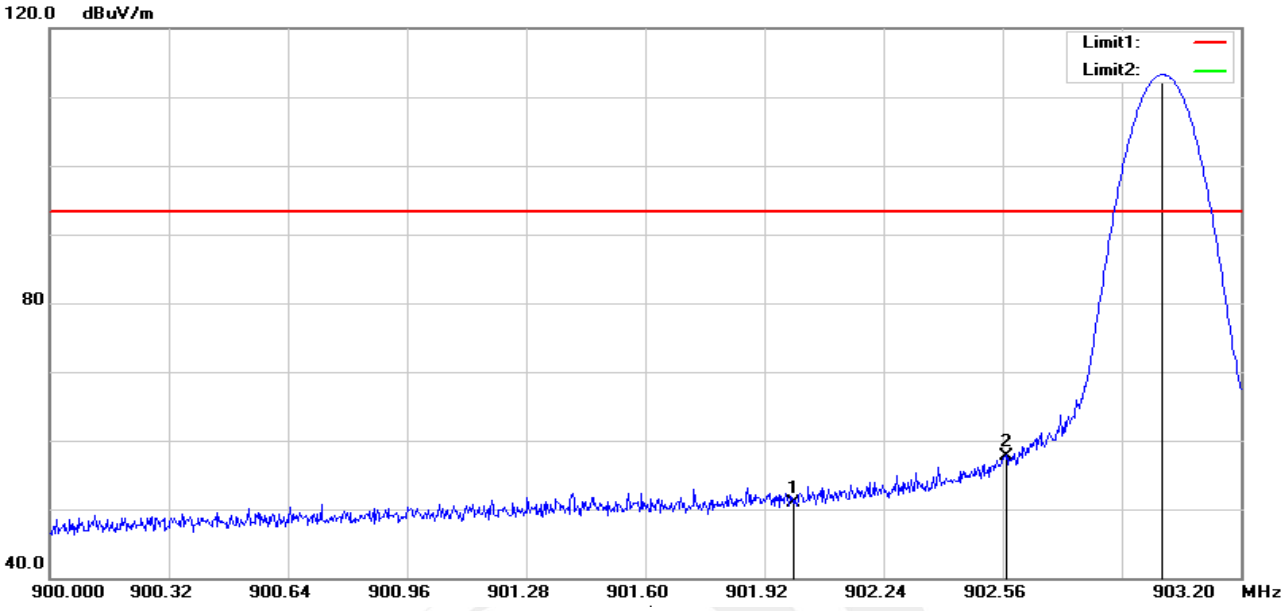
   Emission Level = Reading + Factor

2) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

Radited Band edge Requirements

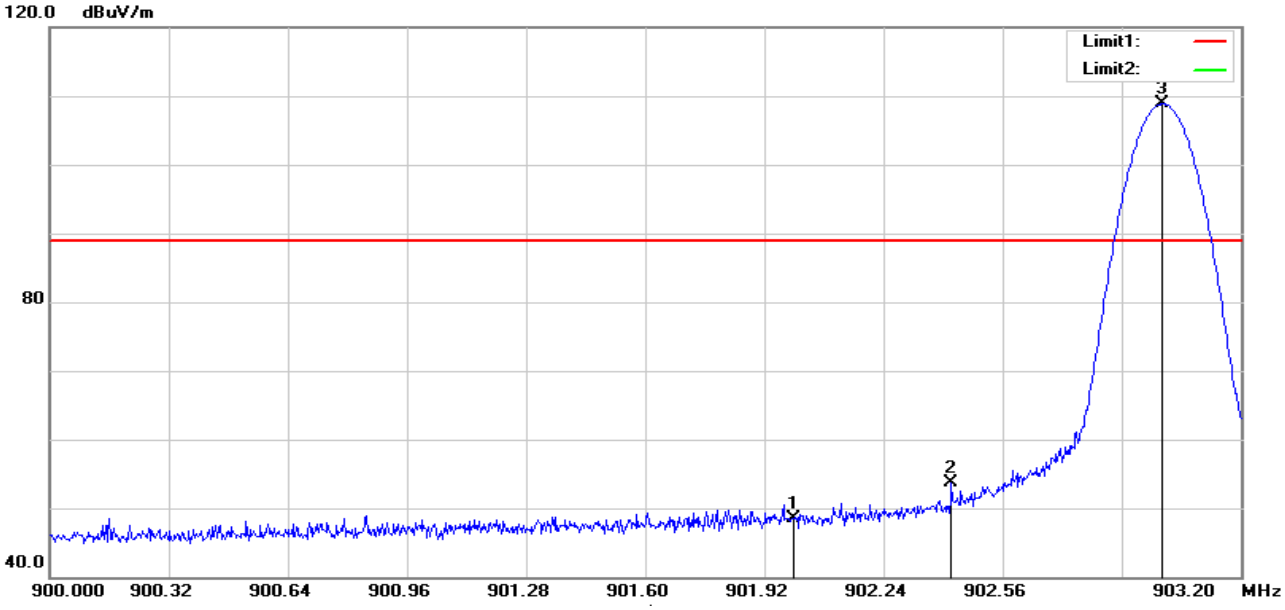
**Low**

Horizontal




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 902.0000 | 51.35 | -0.40 | 50.95 | 93.25 | -42.30 | peak |
| 2 | 902.5696 | 58.18 | -0.38 | 57.80 | 93.25 | -35.45 | peak |
| 3 | 903.0000 | 113.62 | -0.37 | 113.25 | - | - | peak |

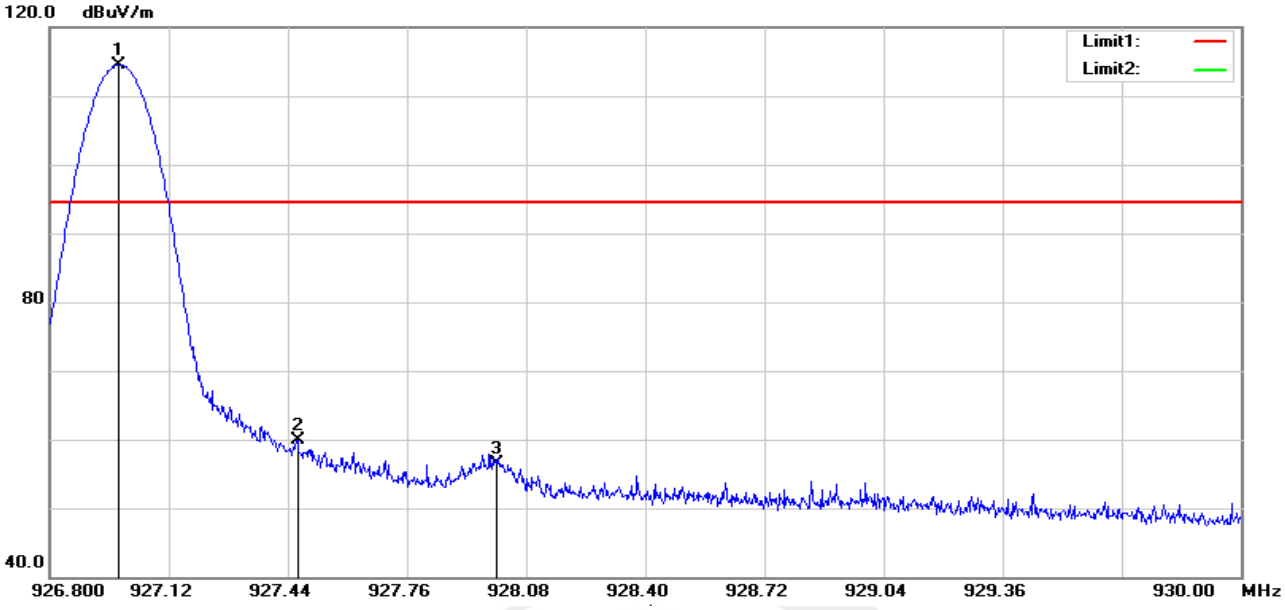
Vertical




| No. | Frequency | Reading | Correct | Result | Limit | Margin | Remark |
|---|---|---|---|---|---|---|---|
| | (MHz) | (dBuV) | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB) | |
| 1 | 902.0000 | 48.88 | -0.40 | 48.48 | 88.83 | -40.35 | peak |
| 2 | 902.4224 | 54.00 | -0.39 | 53.61 | 88.83 | -35.22 | peak |
| 3 | 903.0000 | 109.20 | -0.37 | 108.83 | - | - | peak |

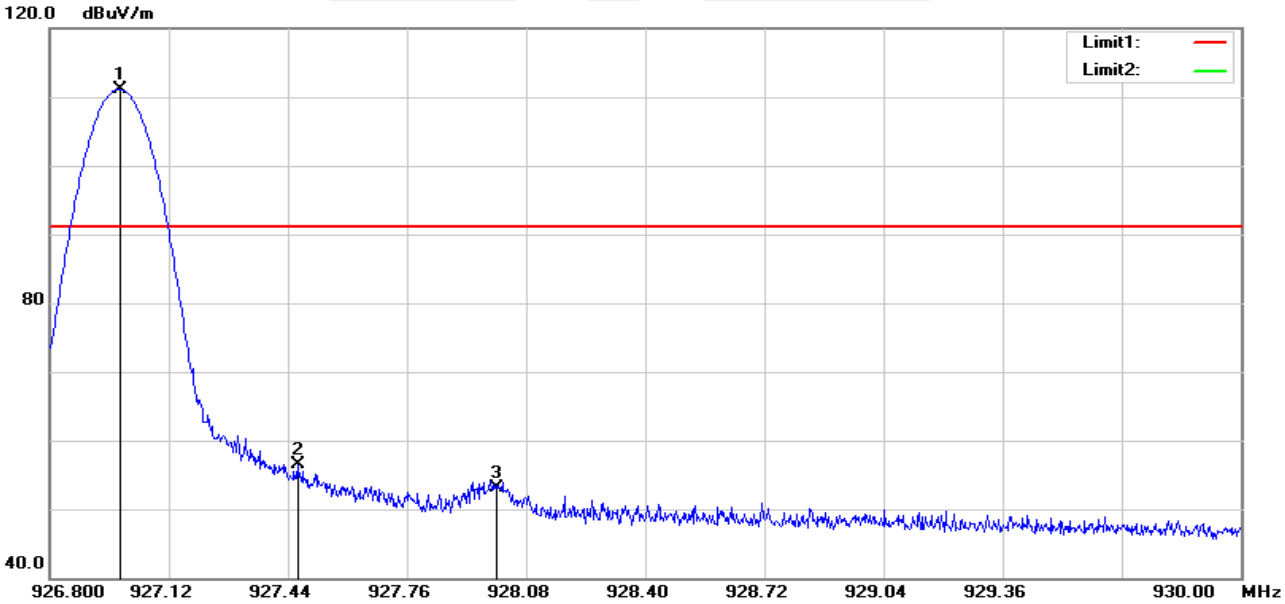
**High**

Horizontal




| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 927.0000 | 114.19 | 0.37 | 114.56 | - | - | peak |
| 2 | 927.4655 | 59.52 | 0.41 | 59.93 | 94.56 | -34.63 | peak |
| 3 | 928.0000 | 56.12 | 0.43 | 56.55 | 94.56 | -38.01 | peak |

Vertical




| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 927.0000 | 110.76 | 0.37 | 111.13 | - | - | peak |
| 2 | 927.4656 | 56.12 | 0.41 | 56.53 | 91.13 | -34.60 | peak |
| 3 | 928.0000 | 52.72 | 0.43 | 53.15 | 91.13 | -37.98 | peak |

Note: FSK of the nohopping and hopping mode all have been test, the worst case is FSK of the nohopping mode, this report only show the worst case.

# 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

## 4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

## 4.2 TEST PROCEDURE

| Spectrum Parameter | Setting |
|---|---|
| Detector | Peak |
| Start/Stop Frequency | 30 MHz to 10th carrier harmonic |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz |
| Trace-Mode: | Max hold |

For Band edge

| Spectrum Parameter | Setting |
|---|---|
| Detector | Peak |
| Start/Stop Frequency | Lower Band Edge: 900 – 903.2 MHz<br>Upper Band Edge: 926.8 – 930 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz |
| Trace-Mode: | Max hold |

For Hopping Band edge

| Spectrum Parameter | Setting |
|---|---|
| Detector | Peak |
| Start/Stop Frequency | Lower Band Edge: 900– 903.2 MHz<br>Upper Band Edge: 926.8 – 930 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz |
| Trace-Mode: | Max hold |

4.3 TEST SETUP


The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

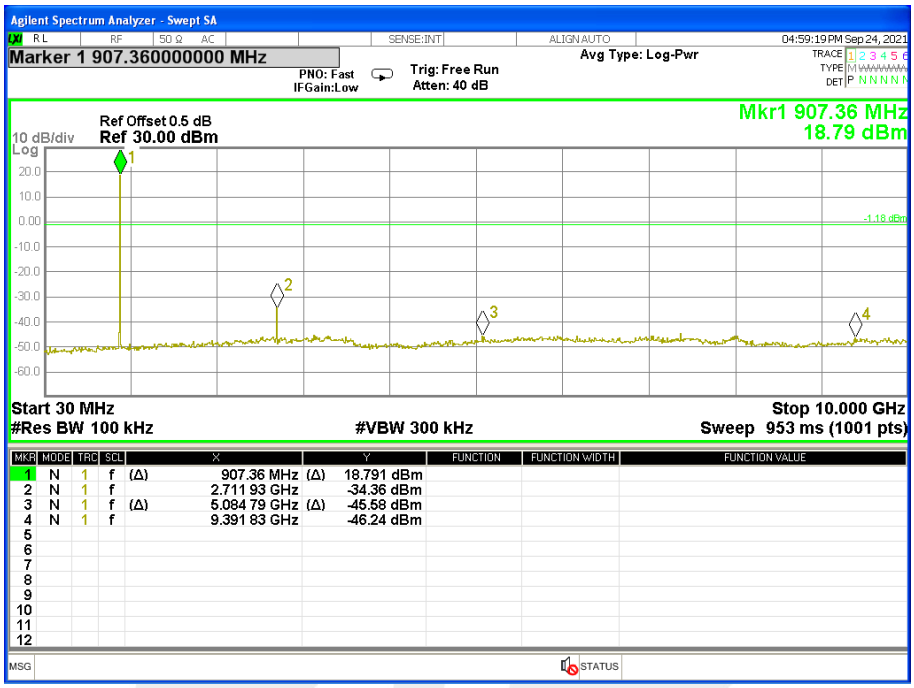
4.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

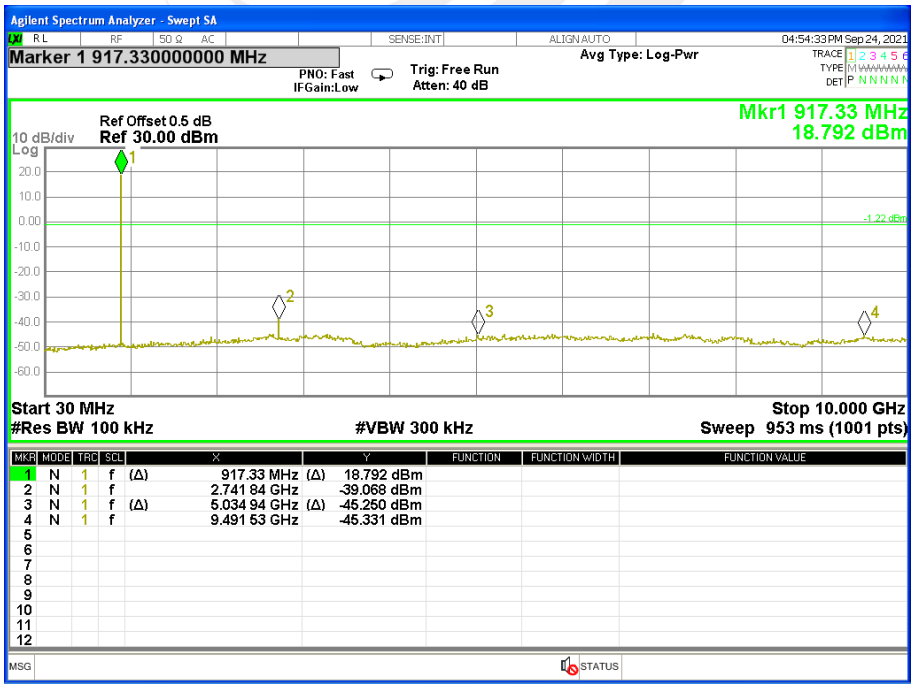
## 4.5 TEST RESULTS

| Temperature: | 25℃ | Relative Humidity: | 50% |
|---|---|---|---|
| Test Mode: | FSK(1Mbps)-01/61/121 CH | Test Voltage: | DC 25.41V |

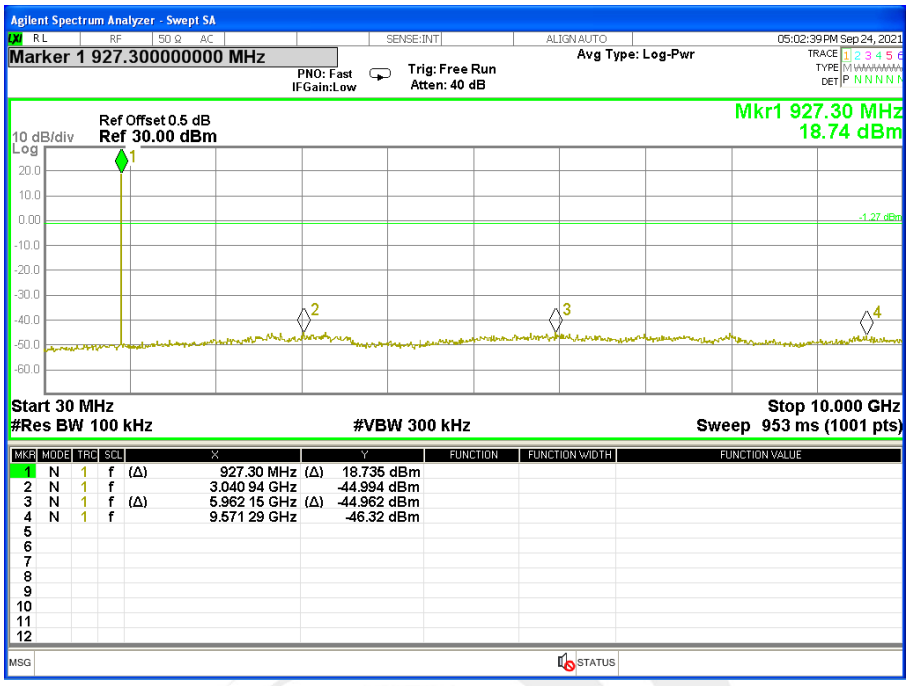
01 CH




61 CH

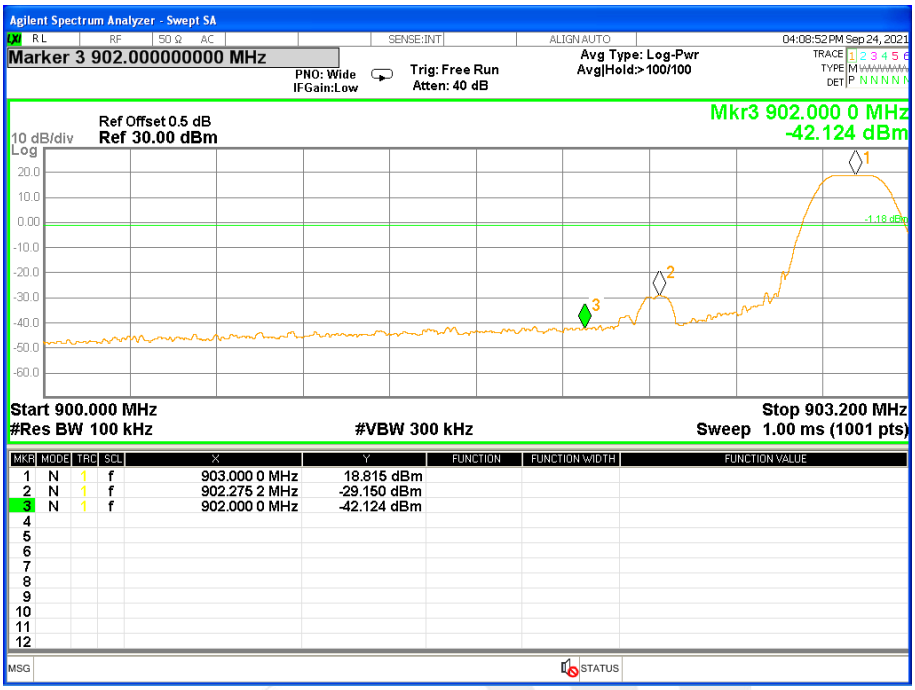


121 CH

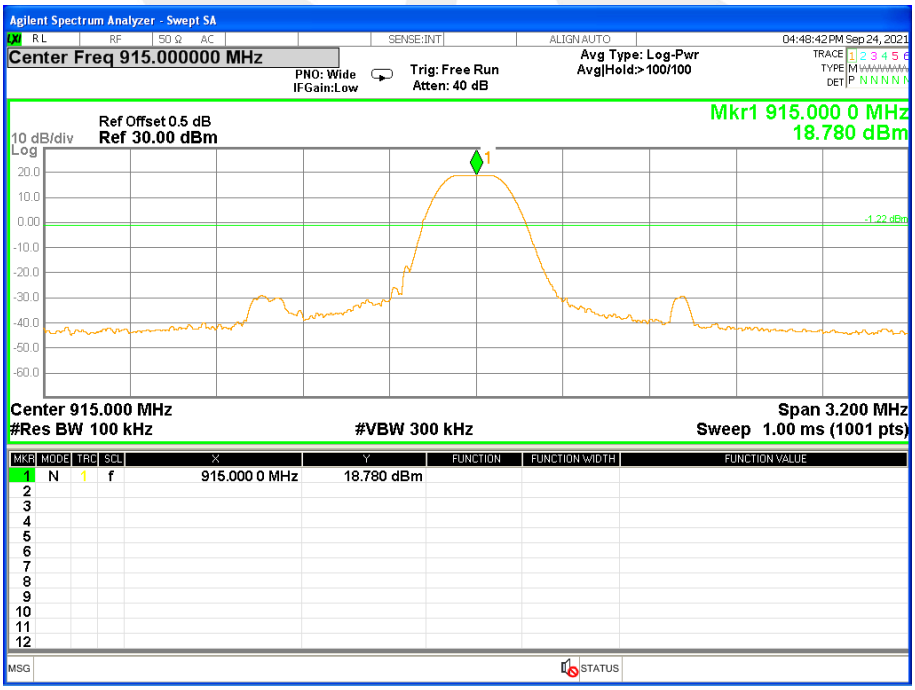

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
05:02:39 PM Sep 24, 2021
Marker 1 927.300000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr1 927.30 MHz
18.74 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-1.27 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 10.000 GHz
Sweep 953 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f (Δ) 927.30 MHz (Δ) 18.735 dBm
2 N 1 f 3.040 94 GHz -44.994 dBm
3 N 1 f (Δ) 5.962 15 GHz (Δ) -44.962 dBm
4 N 1 f 9.571 29 GHz -46.32 dBm
5
6
7
8
9
10
11
12
MSG
STATUS

For Band edge(it's also the reference level for conducted spurious emission)

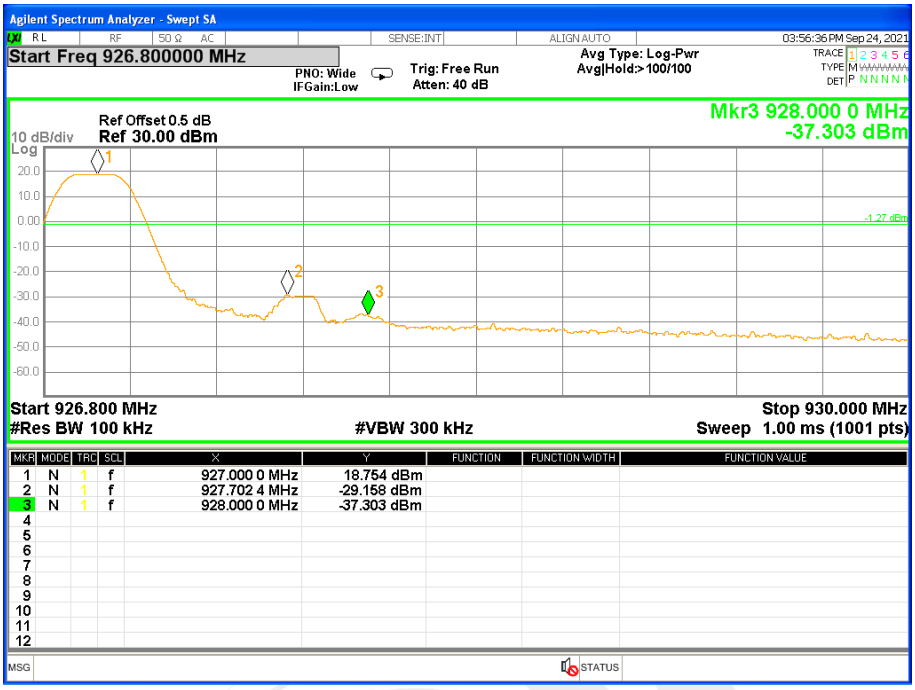
01 CH




61 CH

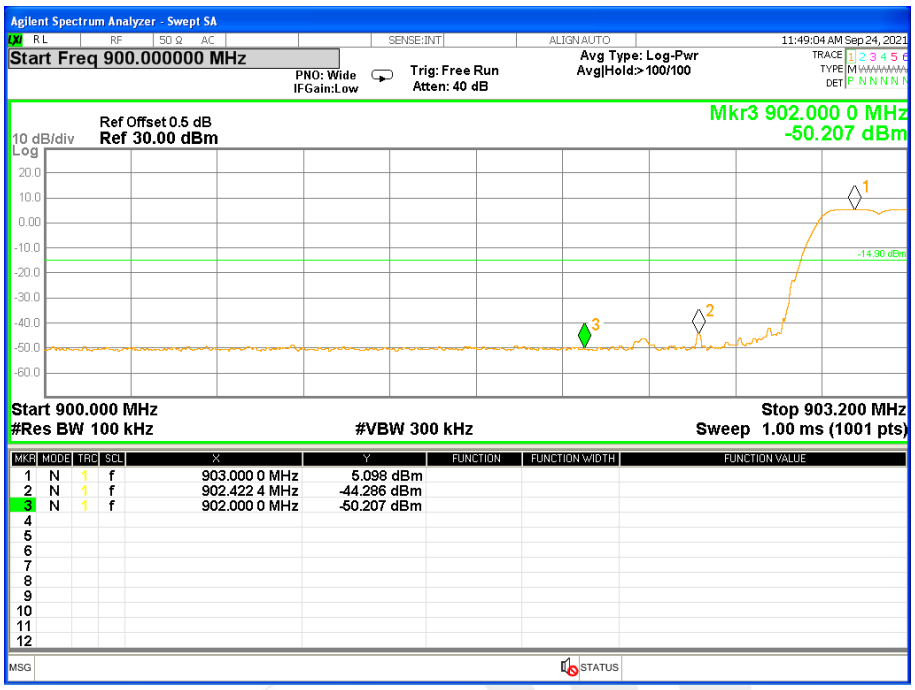


121 CH

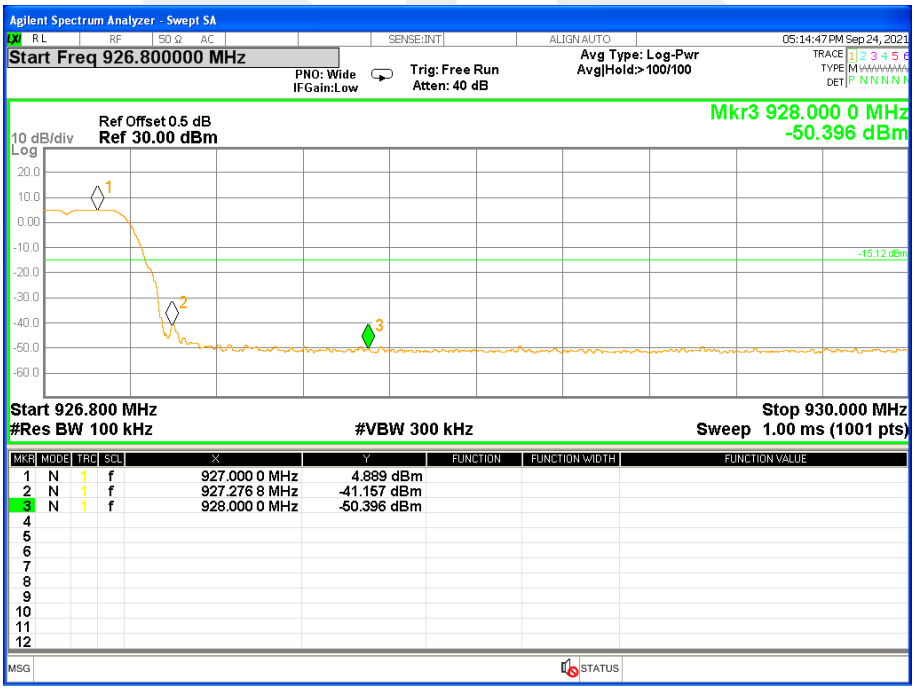

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:56:36 PM Sep 24, 2021
Start Freq 926.800000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
Mkr3 928.000 0 MHz
-37.303 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-1.27 dBm
Start 926.800 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 930.000 MHz
Sweep 1.00 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 927.000 0 MHz 18.754 dBm
2 N 1 f 927.702 4 MHz -29.158 dBm
3 N 1 f 928.000 0 MHz -37.303 dBm
4
5
6
7
8
9
10
11
12
MSG
STATUS

For Hopping Band edge

01 CH




121 CH



# 5. NUMBER OF HOPPING CHANNEL

## 5.1 LIMIT

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

| Spectrum Parameters | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | > Operating Frequency Range |
| RB | 62KHz |
| VB | 62KHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

## 5.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 100KHz, VBW=300KHz, Sweep time = Auto.

## 5.3 TEST SETUP


## 5.4 EUT OPERATION CONDITIONS

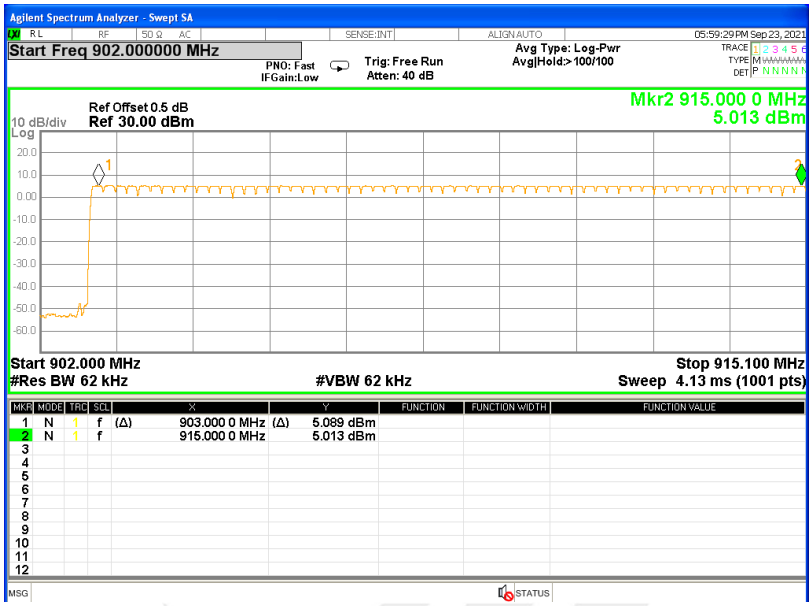
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

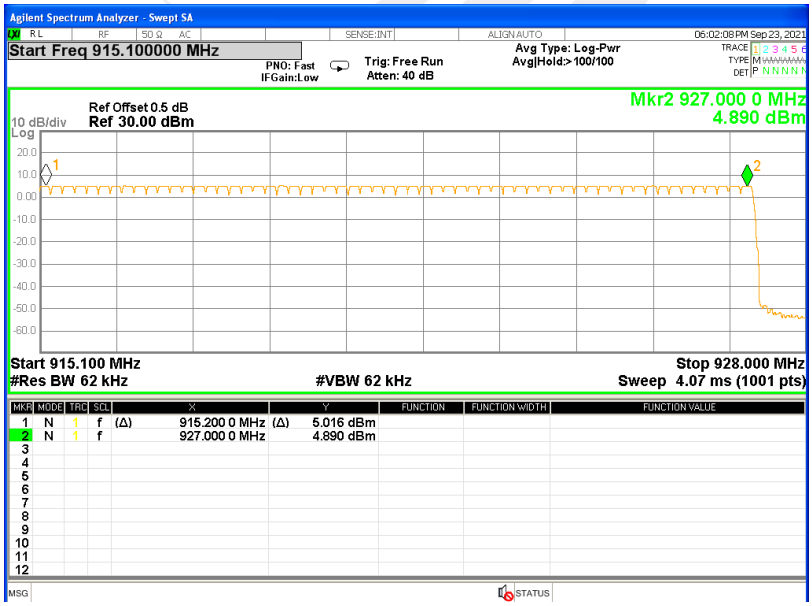
5.5 TEST RESULTS

| Temperature: | 25℃ | Relative Humidity: | 60% |
|---|---|---|---|
| Test Mode: | Hopping Mode -FSK Mode | Test Voltage: | DC 25.41V |

Number of Hopping Channel 121

**Hopping channel**



# 6. AVERAGE TIME OF OCCUPANCY

## 6.1 LIMIT

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 6.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyzer.
b. Set RBW =1MHz/VBW =1MHz.
c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
d. Sweep Time is 0.4* channel number.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.

## 6.3 TEST SETUP


## 6.4 EUT OPERATION CONDITIONS

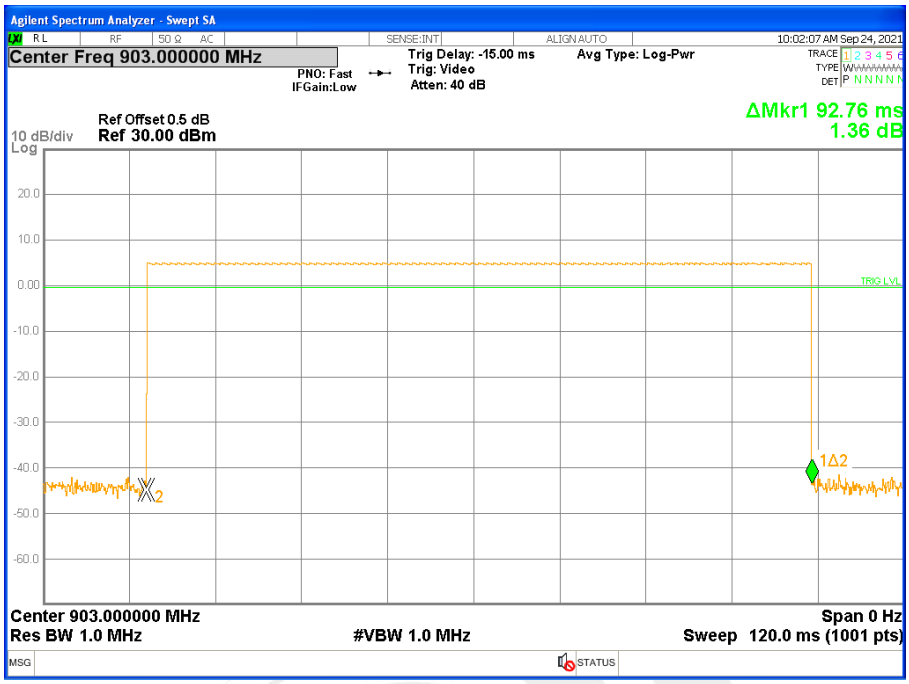
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

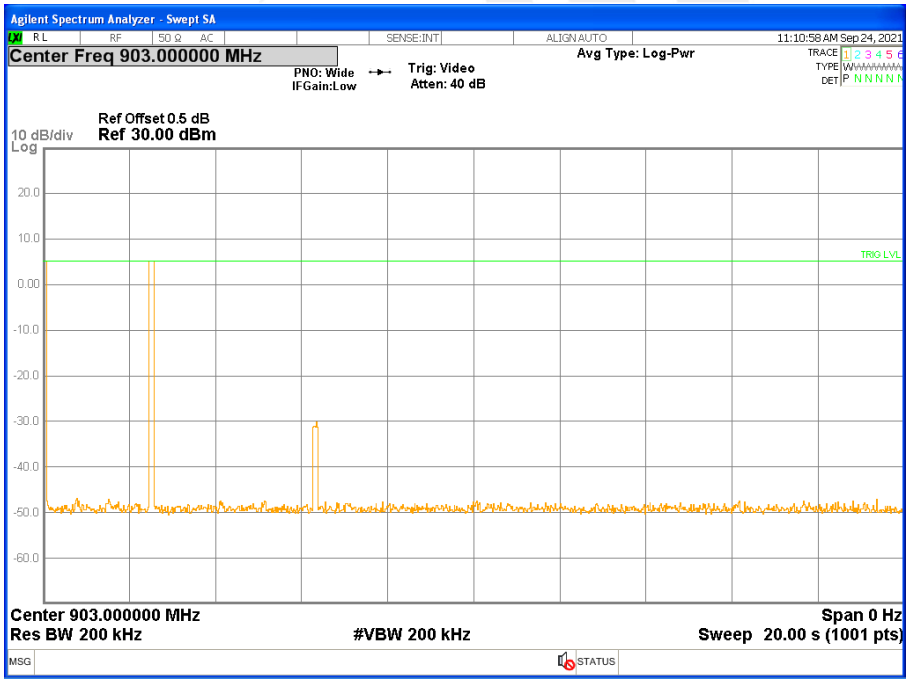
6.5 TEST RESULTS

| Temperature: | 25℃ | Relative Humidity: | 50% |
|---|---|---|---|
| Test Mode: | FSK | Test Voltage: | DC 25.41V |

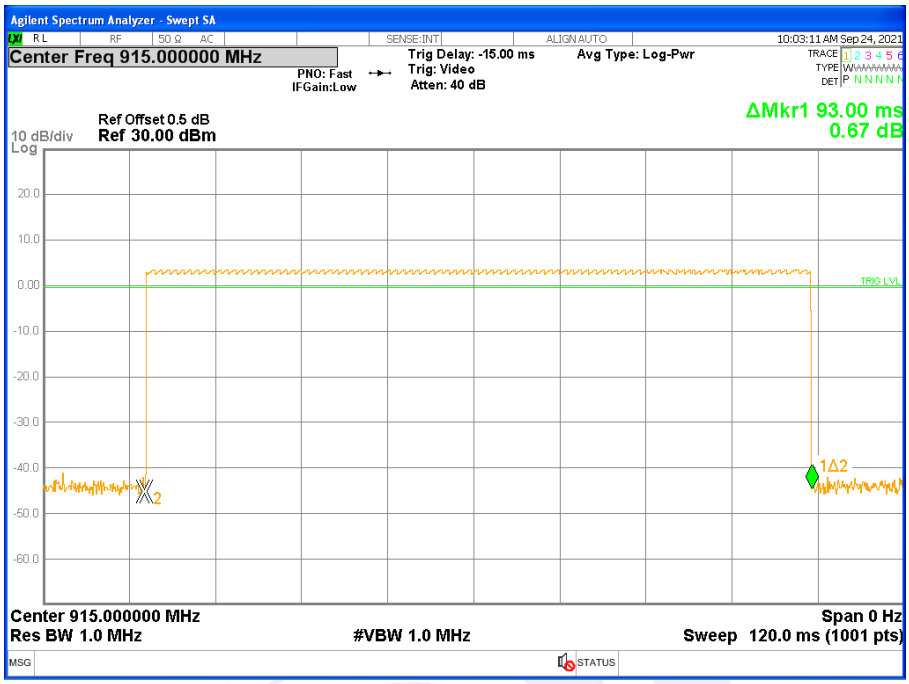
| Modulation | Channel | pulse time(ms) | Burst Number | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|
| FSK | low | 92.760 | 2 | 0.186 | 0.4 |
| | middle | 93.000 | 1 | 0.093 | 1.4 |
| | high | 93.240 | 2 | 0.186 | 2.4 |

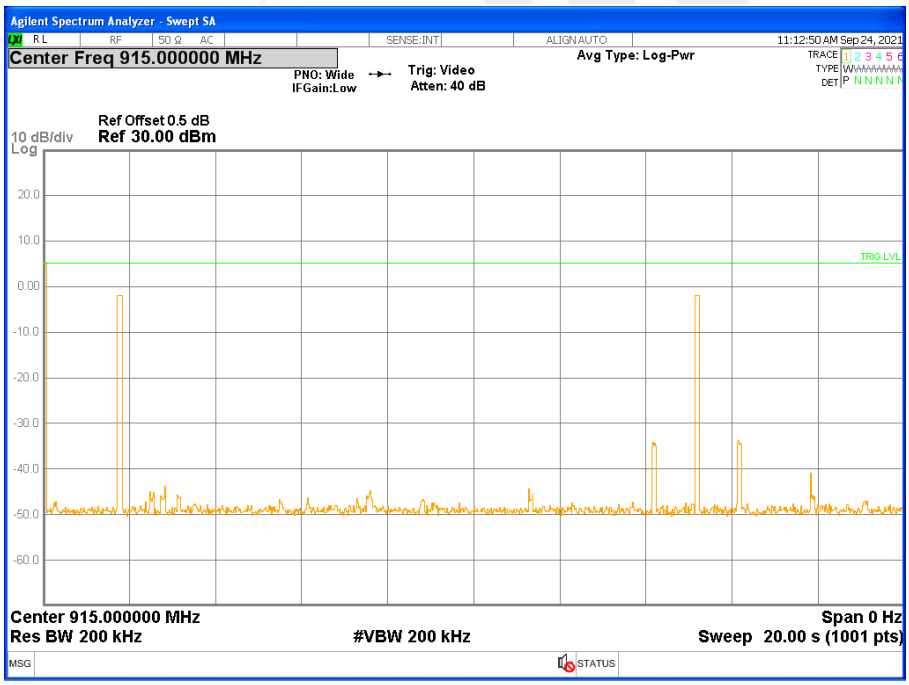
## CH01


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:02:07 AM Sep 24, 2021
Center Freq 903.000000 MHz
PNO: Fast
IFGain:Low
Trig Delay: -15.00 ms
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
ΔMkr1 92.76 ms
1.36 dB
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
TRIG LVL
1Δ2
Center 903.000000 MHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 120.0 ms (1001 pts)
MSG
STATUS

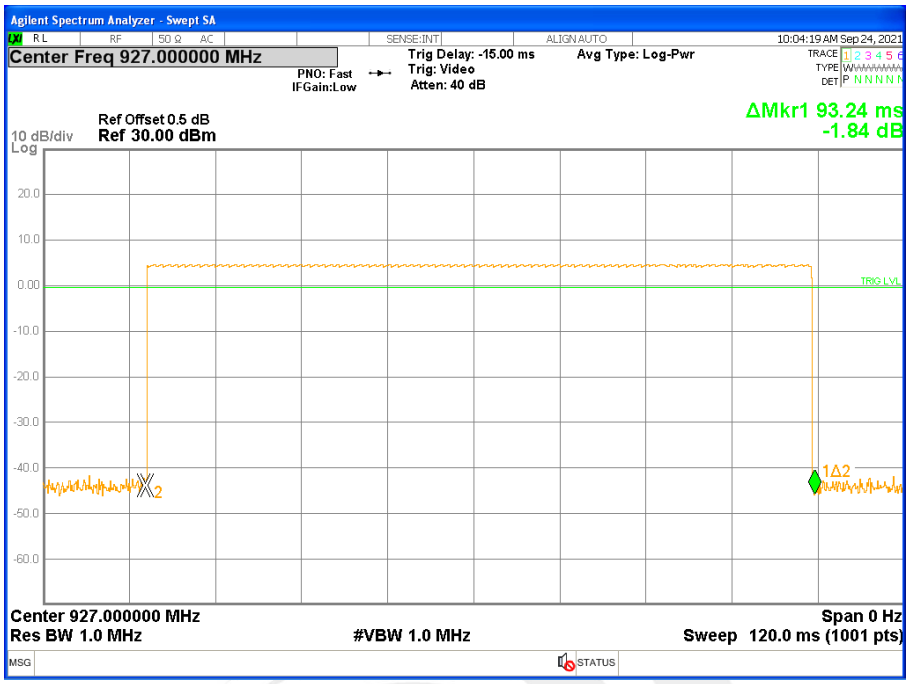

Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:10:58 AM Sep 24, 2021
Center Freq 903.000000 MHz
PNO: Wide
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
TRIG LVL
Center 903.000000 MHz
Res BW 200 kHz
#VBW 200 kHz
Span 0 Hz
Sweep 20.00 s (1001 pts)
MSG
STATUS

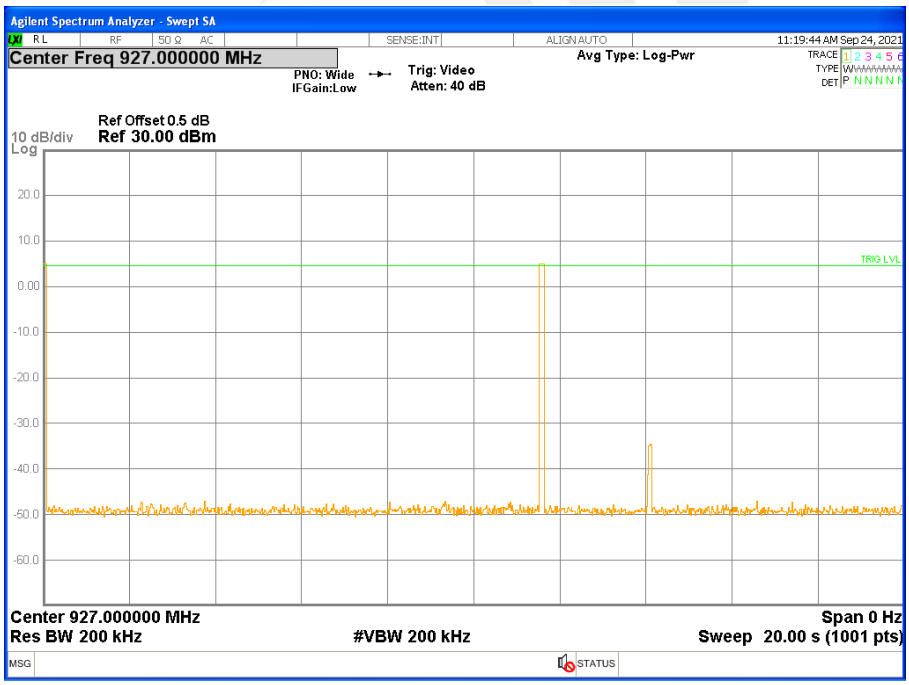
## CH61


Agilent Spectrum Analyzer - Swept SA
RL RF 50 Ω AC SENSE:INT ALIGN AUTO 10:03:11 AM Sep 24, 2021
Center Freq 915.000000 MHz
PNO: Fast IFGain:Low
Trig Delay: -15.00 ms Trig: Video Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6 TYPE W DET P N N N N N
ΔMkr1 93.00 ms 0.67 dB
Ref Offset 0.5 dB
10 dB/div Ref 30.00 dBm
Log
20.0 10.0 0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -60.0
TRIG LVL
1Δ2
Center 915.000000 MHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 120.0 ms (1001 pts)
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
RL RF 50 Ω AC SENSE:INT ALIGN AUTO 11:12:50 AM Sep 24, 2021
Center Freq 915.000000 MHz
PNO: Wide IFGain:Low
Trig: Video Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6 TYPE W DET P N N N N N
Ref Offset 0.5 dB
10 dB/div Ref 30.00 dBm
Log
20.0 10.0 0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -60.0
TRIG LVL
Center 915.000000 MHz
Res BW 200 kHz
#VBW 200 kHz
Span 0 Hz
Sweep 20.00 s (1001 pts)
MSG
STATUS

## CH121


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:04:19 AM Sep 24, 2021
Center Freq 927.000000 MHz
PNO: Fast
IFGain:Low
Trig Delay: -15.00 ms
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
ΔMkr1 93.24 ms
-1.84 dB
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
TRIG LVL
1Δ2
Center 927.000000 MHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 120.0 ms (1001 pts)
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:19:44 AM Sep 24, 2021
Center Freq 927.000000 MHz
PNO: Wide
IFGain:Low
Trig: Video
Atten: 40 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W W W W W W
DET P N N N N N
Ref Offset 0.5 dB
10 dB/div
Log
Ref 30.00 dBm
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
TRIG LVL
Center 927.000000 MHz
Res BW 200 kHz
#VBW 200 kHz
Span 0 Hz
Sweep 20.00 s (1001 pts)
MSG
STATUS

# 7. HOPPING CHANNEL SEPARATION MEASUREMEN

## 7.1 LIMIT

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 500KHz |
| RB | 62 KHz |
| VB | 62 KHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

## 7.2 TEST PROCEDURE

a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
b. Spectrum Setting: RBW= 62KHz, VBW= 62KHz, Sweep time = Auto.

## 7.3 TEST SETUP


## 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.5 TEST RESULTS

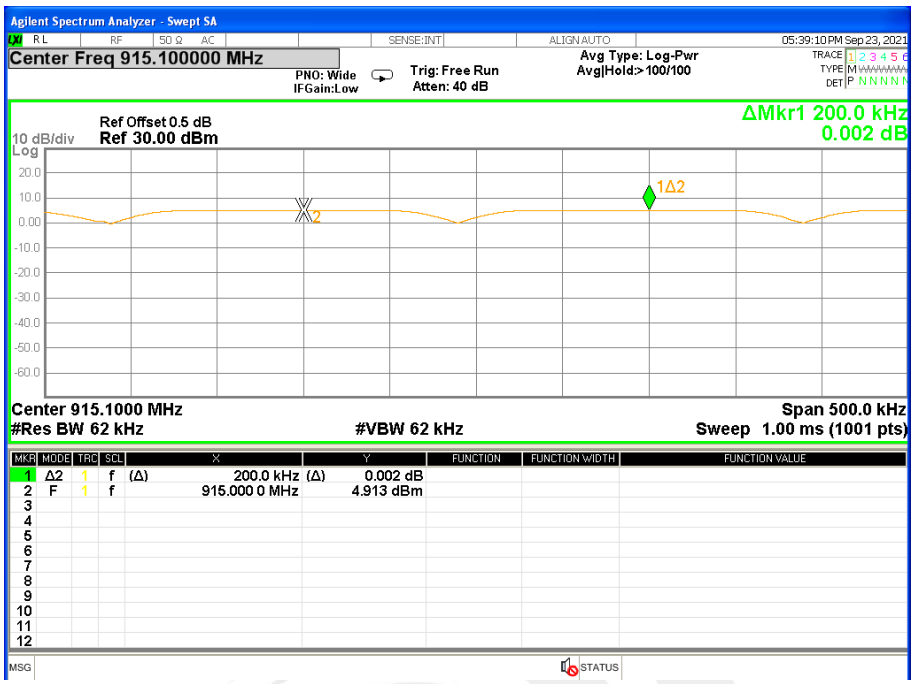
| Temperature: | 25℃ | Relative Humidity: | 50% |
|---|---|---|---|
| Test Mode: | CH01 / CH61 / CH121 (FSK Mode) | Test Voltage: | DC 25.41V |

| Frequency | Mark1 Frequency （MHz） | Mark2 Frequency （MHz） | Ch. Separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| 903 MHz | 2402.098 | 2403.019 | 0.921 | 0.192 | Complies |
| 915 MHz | 2441.101 | 2442.100 | 0.999 | 0.193 | Complies |
| 927 MHz | 2479.098 | 2480.103 | 1.005 | 0.191 | Complies |

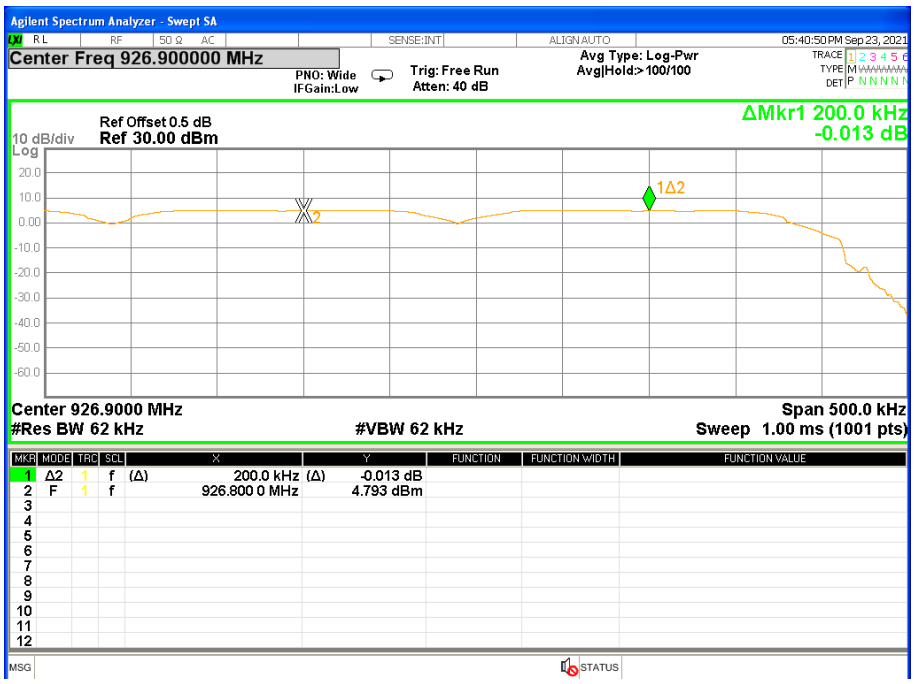
For FSK: Ch. Separation Limits: > 20dB bandwidth

**CH01**

## CH61


Agilent Spectrum Analyzer - Swept SA
Center Freq 915.100000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
05:39:10 PM Sep 23, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 30.00 dBm
ΔMkr1 200.0 kHz
0.002 dB
Center 915.1000 MHz
#Res BW 62 kHz
#VBW 62 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)
1 Δ2 1 f (Δ) 200.0 kHz (Δ) 0.002 dB
2 F 1 f 915.000 0 MHz 4.913 dBm

## CH121


Agilent Spectrum Analyzer - Swept SA
Center Freq 926.900000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
05:40:50 PM Sep 23, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 30.00 dBm
ΔMkr1 200.0 kHz
-0.013 dB
Center 926.9000 MHz
#Res BW 62 kHz
#VBW 62 kHz
Span 500.0 kHz
Sweep 1.00 ms (1001 pts)
1 Δ2 1 f (Δ) 200.0 kHz (Δ) -0.013 dB
2 F 1 f 926.800 0 MHz 4.793 dBm

# 8. BANDWIDTH TEST

## 8.1 LIMIT

| FCC Part15 15.247,Subpart C | | | | |
|---|---|---|---|---|
| Section | Test Item | Limit | FrequencyRange (MHz) | Result |
| 15.247(a)(1)(i) | (20dB bandwidth) | ＜250kHz | 902-928 | PASS |

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 600 KHz |
| RB | 20 kHz |
| VB | 62 kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

## 8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
b. Spectrum Setting: RBW= 20KHz, VBW=62KHz, Sweep time = Auto.

## 8.3 TEST SETUP


## 8.4 EUT OPERATION CONDITIONS

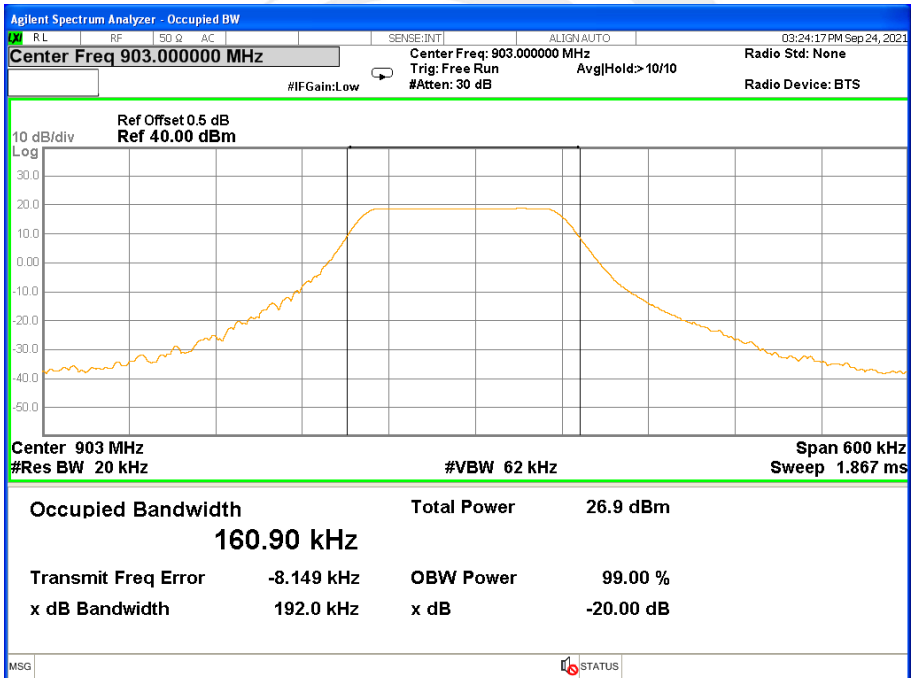
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

## 8.5 TEST RESULTS

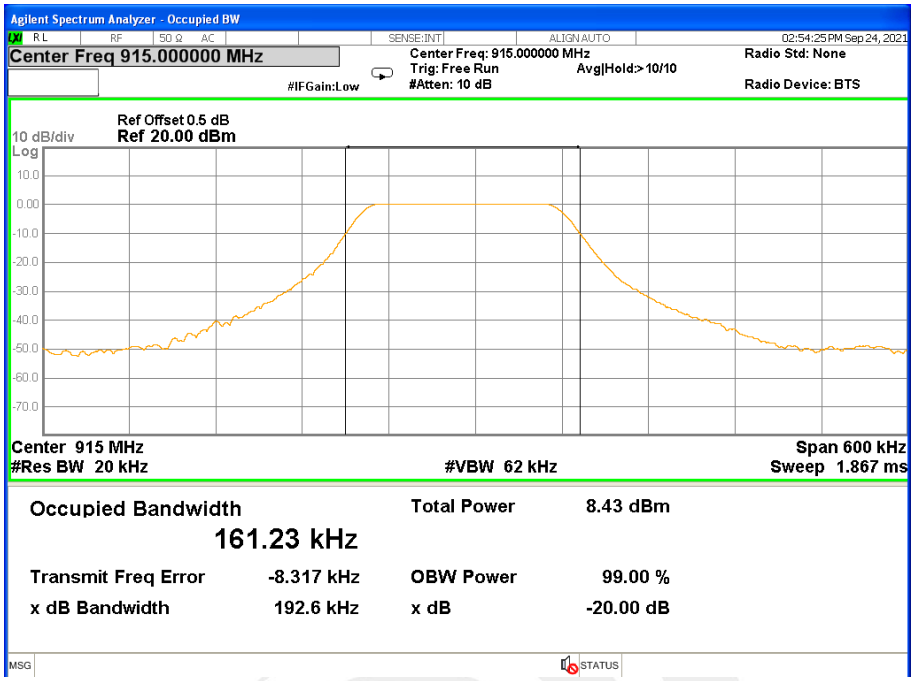
| Temperature: | 25℃ | Relative Humidity: | 50% |
|---|---|---|---|
| Test Mode: | FSK CH01/ CH61 / CH121 | Test Voltage: | DC 25.41V |

| Frequency | 20dB Bandwidth (MHz) | Result |
|---|---|---|
| 903 MHz | 0.1920 | PASS |
| 915 MHz | 0.1926 | PASS |
| 927 MHz | 0.1912 | PASS |

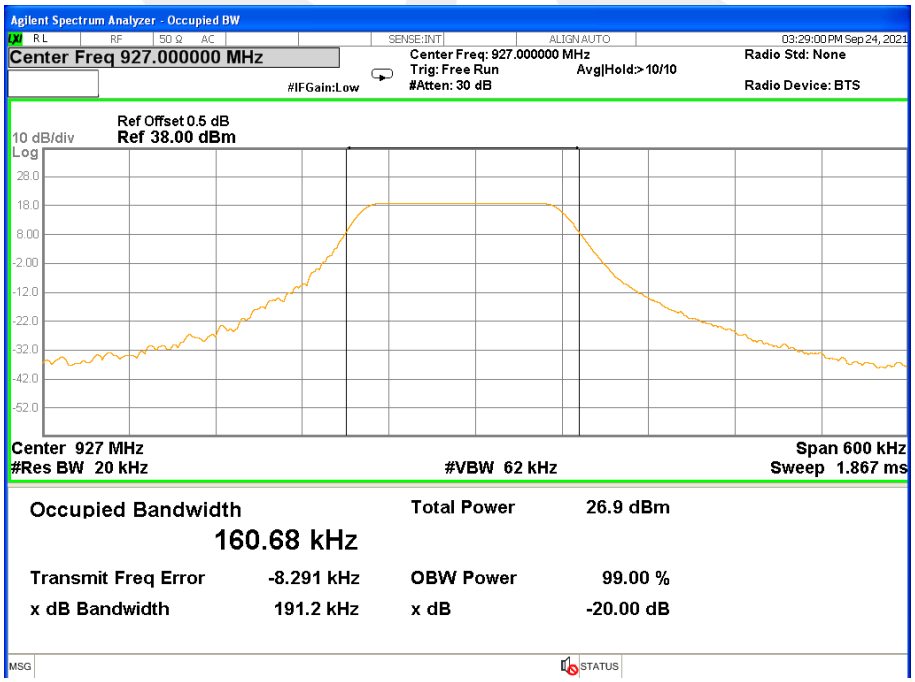
**CH01**



## CH61


Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
02:54:25 PM Sep 24, 2021
Center Freq 915.000000 MHz
Center Freq: 915.000000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 10 dB
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 20.00 dBm
Log
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 915 MHz
#Res BW 20 kHz
#VBW 62 kHz
Span 600 kHz
Sweep 1.867 ms
Occupied Bandwidth
161.23 kHz
Total Power 8.43 dBm
Transmit Freq Error -8.317 kHz
OBW Power 99.00 %
x dB Bandwidth 192.6 kHz
x dB -20.00 dB
MSG
STATUS

## CH121


Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
03:29:00 PM Sep 24, 2021
Center Freq 927.000000 MHz
Center Freq: 927.000000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
Ref Offset 0.5 dB
10 dB/div
Ref 38.00 dBm
Log
28.0
18.0
8.00
-2.00
-12.0
-22.0
-32.0
-42.0
-52.0
Center 927 MHz
#Res BW 20 kHz
#VBW 62 kHz
Span 600 kHz
Sweep 1.867 ms
Occupied Bandwidth
160.68 kHz
Total Power 26.9 dBm
Transmit Freq Error -8.291 kHz
OBW Power 99.00 %
x dB Bandwidth 191.2 kHz
x dB -20.00 dB
MSG
STATUS

# 9. OUTPUT POWER TEST

## 9.1 LIMIT

| FCC Part 15.247,Subpart C | | | | |
|---|---|---|---|---|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247 (b)(2) | Output Power | 1 W | 902-928 | PASS |

## 9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW ≥ RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

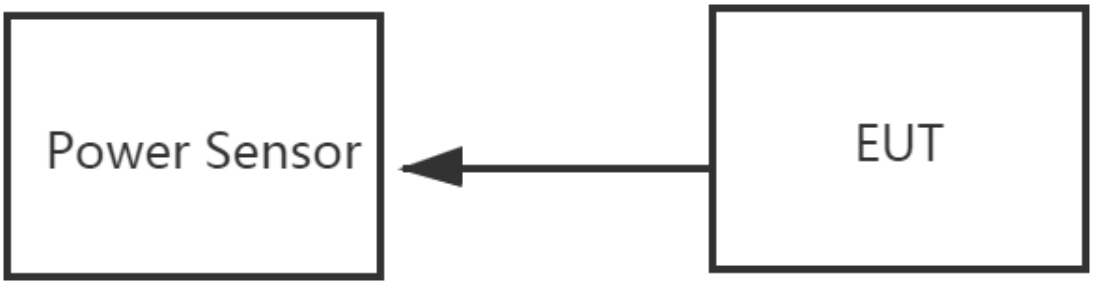
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP




9.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

9.5 TEST RESULTS

| | | | |
|---|---|---|---|
| Temperature: | 25℃ | Relative Humidity: | 60% |
| Test Voltage: | DC 25.41V | | |

| Mode | Channel Number | Frequency (MHz) | Peak Power (dBm) | Average Power (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| FSK | 1 | 903 | 19.13 | 17.06 | 30.00 |
| | 61 | 915 | 18.83 | 16.71 | 30.00 |
| | 121 | 927 | 18.91 | 16.86 | 30.00 |

# 10. ANTENNA REQUIREMENT

## 10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

## 10.2 EUT ANTENNA

The EUT antenna is FPC Antenna. It comply with the standard requirement.

## APPENDIX-PHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※