

# **RADIO TEST REPORT**

S

3

# Report No: STS1908110W01

Issued for

Shenzhen iFree Electronic Technology Co., Ltd

7F A9 Building Tian Rui industrial park No.35 Fu Yuan 1st Road, FuYong Road Bao'an District, Shenzhen, China

| Product Name:  | Bluetooth Earphone                  |
|----------------|-------------------------------------|
| Brand Name:    | N/A                                 |
| Model Name:    | BTW-116                             |
| Series Model:  | BTW-115, GL020, BTW-119, TAGG ZeroG |
| FCC ID:        | 2ADQABTW-116                        |
| Test Standard: | FCC Part 15.247                     |

Any reproduction of this document must be done in full. No single part of this document may be reproduced wi permission from STS, All Test Data Presented in this report is only applicable to presented Test sample VAL





## **TEST RESULT CERTIFICATION**

| Applicant's Name:   | Shenzhen iFree Electronic Technology Co., Ltd   |
|---------------------|---|
| Address             | 7F A9 Building Tian Rui industrial park No.35 Fu Yuan 1st Road,<br>FuYong Road Bao'an District, Shenzhen, China |
| Manufacture's Name: | Shenzhen iFree Electronic Technology Co., Ltd   |
| Address             | 7F A9 Building Tian Rui industrial park No.35 Fu Yuan 1st Road,<br>FuYong Road Bao'an District, Shenzhen, China |
| Product Description |   |
| Product Name        | Bluetooth Earphone  |
| Brand Name          | N/A   |
| Model Name:         | BTW-116   |
| Series Model        | BTW-115, GL020, BTW-119, TAGG ZeroG   |
| 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.

This report shall not be reproduced except in full, without the written approval of STS, this document may be altered or revised by STS, personal only, and shall be noted in the revision of the document...

Date of Test.....

Date (s) of performance of tests : 27 Aug. 2019 ~ 31 Aug. 2019

Date of Issue .....: 04 Sept. 2019

Test Result ..... Pass

Testing Engineer

(Chris Chen)

Technical Manager

ku



Authorized Signatory :

(Sunday Hu)

(Vita Li)

Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755 3688 6288
 Fax:+ 86-755 3688 6277

 Http://www.stsapp.com
 E-mail: sts@stsapp.com

Page 3 of 72 Report No.: STS1908110W01



| Table of Contents   | Page |
|---|------|
| 1. SUMMARY OF TEST RESULTS                                  | 6    |
| 1.1 TEST FACTORY  | 7    |
| 1.2 MEASUREMENT UNCERTAINTY                                 | 7    |
| 2. GENERAL INFORMATION                                      | 8    |
| 2.1 GENERAL DESCRIPTION OF THE EUT                          | 8    |
| 2.2 DESCRIPTION OF THE TEST MODES                           | 10   |
| 2.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING            | 10   |
| 2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED | 11   |
| 2.5 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS  | 12   |
| 2.6 EQUIPMENTS LIST   | 13   |
| 3. EMC EMISSION TEST  | 14   |
| 3.1 CONDUCTED EMISSION MEASUREMENT                          | 14   |
| 3.2 RADIATED EMISSION MEASUREMENT                           | 18   |
| 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION                  | 30   |
| 4.1 LIMIT   | 30   |
| 4.2 TEST PROCEDURE  | 30   |
| 4.3 TEST SETUP  | 30   |
| 4.4 EUT OPERATION CONDITIONS                                | 30   |
| 4.5 TEST RESULTS  | 31   |
| 5. NUMBER OF HOPPING CHANNEL                                | 46   |
| 5.1 LIMIT   | 46   |
| 5.2 TEST PROCEDURE  | 46   |
| 5.3 TEST SETUP  | 46   |
| 5.4 EUT OPERATION CONDITIONS                                | 46   |
| 5.5 TEST RESULTS  | 47   |
| 6. AVERAGE TIME OF OCCUPANCY                                | 48   |
| 6.1 LIMIT   | 48   |
| 6.2 TEST PROCEDURE  | 48   |
| 6.3 TEST SETUP  | 48   |
| 6.4 EUT OPERATION CONDITIONS                                | 48   |
| 6.5 TEST RESULTS  | 49   |
| 7. HOPPING CHANNEL SEPARATION MEASUREMEN                    | 55   |
| 7.1 LIMIT   | 55   |

Ħ

1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: + 86-755 3688 6288 Fax:+ 86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com

Page 4 of 72 Report No.: STS1908110W01



| Table of Contents            | Page |
|------------------------------|------|
| 7.2 TEST PROCEDURE           | 55   |
| 7.3 TEST SETUP               | 55   |
| 7.4 EUT OPERATION CONDITIONS | 55   |
| 7.5 TEST RESULTS             | 56   |
| 8. BANDWIDTH TEST            | 62   |
| 8.1 LIMIT                    | 62   |
| 8.2 TEST PROCEDURE           | 62   |
| 8.3 TEST SETUP               | 62   |
| 8.4 EUT OPERATION CONDITIONS | 62   |
| 8.5 TEST RESULTS             | 63   |
| 9. OUTPUT POWER TEST         | 69   |
| 9.1 LIMIT                    | 69   |
| 9.2 TEST PROCEDURE           | 69   |
| 9.3 TEST SETUP               | 69   |
| 9.4 EUT OPERATION CONDITIONS | 69   |
| 9.5 TEST RESULTS             | 70   |
| 10. ANTENNA REQUIREMENT      | 71   |
| 10.1 STANDARD REQUIREMENT    | 71   |
| 10.2 EUT ANTENNA             | 71   |
|                              |      |

Ħ



Page 5 of 72 Report No.: STS1908110W01

## **Revision History**

| Rev. | Issue Date    | Report NO.    | Effect Page | Contents      |
|------|---------------|---------------|-------------|---------------|
| 00   | 04 Sept. 2019 | STS1908110W01 | ALL         | Initial Issue |
|      |               |               |             |               |



Shenzhen STS Test Services Co., Ltd.

1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: + 86-755 3688 6288 Fax:+ 86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



# 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<br>Section              | Test Item                                  | Judgment | Remark |
| 15.207                           | Conducted Emission                         | PASS     |        |
| 15.247(a)(1)                     | Hopping Channel Separation                 | PASS     |        |
| 15.247(a)(1)&(b)(1)              | Output Power                               | PASS     |        |
| 15.247©                          | Radiated Spurious Emission                 | PASS     |        |
| 15.247(d)                        | Conducted Spurious & Band Edge<br>Emission | PASS     |        |
| 15.247(a)(iii)                   | Number of Hopping Frequency                | PASS     |        |
| 15.247(a)(iii)                   | Dwell Time                                 | PASS     |        |
| 15.247(a)(1)                     | Bandwidth                                  | PASS     |        |
| 15.205                           | Restricted Band Edge Emission              | PASS     |        |
| Part 15.247(d)/part<br>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  $y \pm U$ , 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          | ±0.71dB     |
| 2   | Unwanted Emissions, conducted       | ±0.63dB     |
| 3   | All emissions, radiated 30-200MHz   | ±3.43dB     |
| 4   | All emissions, radiated 200MHz-1GHz | ±3.57dB     |
| 5   | All emissions, radiated>1G          | ±4.13dB     |
| 6   | Conducted Emission (9KHz-150KHz)    | ±3.18dB     |
| 7   | Conducted Emission (150KHz-30MHz)   | ±2.70dB     |



## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

| Product Name            | Bluetooth Earphone  |
|-------------------------|---|
| Trade Name              | N/A   |
| Model Name              | BTW-116   |
| Series Model            | BTW-115, GL020, BTW-119, TAGG ZeroG   |
| Model Difference        | The shell structure is different.   |
| Channel List            | Please refer to the Note 2.   |
| Bluetooth               | Frequency:2402 – 2480 MHz<br>Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps),<br>8DPSK(3Mbps) |
| Bluetooth Version       | 5.0   |
| Bluetooth Configuration | BR+EDR  |
| Charge BOX              | Input: DC 5V 1A<br>Output: DC 5V 1A   |
| Battery                 | Rated Voltage: 3.7V<br>Charge Limit: 5V<br>Capacity: 45mAh                              |
| Hardware version number | V1.0  |
| Software version number | 2.0   |
| Connecting I/O Port(s)  | Please refer to the User's Manual   |

Note:

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

Shenzhen STS Test Services Co., Ltd.





2.

|         |                    | Chanr   | nel List           |         |                    |
|---------|--------------------|---------|--------------------|---------|--------------------|
| Channel | Frequency<br>(MHz) | Channel | Frequency<br>(MHz) | Channel | Frequency<br>(MHz) |
| 00      | 2402               | 27      | 2429               | 54      | 2456               |
| 01      | 2403               | 28      | 2430               | 55      | 2457               |
| 02      | 2404               | 29      | 2431               | 56      | 2458               |
| 03      | 2405               | 30      | 2432               | 57      | 2459               |
| 04      | 2406               | 31      | 2433               | 58      | 2460               |
| 05      | 2407               | 32      | 2434               | 59      | 2461               |
| 06      | 2408               | 33      | 2435               | 60      | 2462               |
| 07      | 2409               | 34      | 2436               | 61      | 2463               |
| 08      | 2410               | 35      | 2437               | 62      | 2464               |
| 09      | 2411               | 36      | 2438               | 63      | 2465               |
| 10      | 2412               | 37      | 2439               | 64      | 2466               |
| 11      | 2413               | 38      | 2440               | 65      | 2467               |
| 12      | 2414               | 39      | 2441               | 66      | 2468               |
| 13      | 2415               | 40      | 2442               | 67      | 2469               |
| 14      | 2416               | 41      | 2443               | 68      | 2470               |
| 15      | 2417               | 42      | 2444               | 69      | 2471               |
| 16      | 2418               | 43      | 2445               | 70      | 2472               |
| 17      | 2419               | 44      | 2446               | 71      | 2473               |
| 18      | 2420               | 45      | 2447               | 72      | 2474               |
| 19      | 2421               | 46      | 2448               | 73      | 2475               |
| 20      | 2422               | 47      | 2449               | 74      | 2476               |
| 21      | 2423               | 48      | 2450               | 75      | 2477               |
| 22      | 2424               | 49      | 2451               | 76      | 2478               |
| 23      | 2425               | 50      | 2452               | 77      | 2479               |
| 24      | 2426               | 51      | 2453               | 78      | 2480               |
| 25      | 2427               | 52      | 2454               |         |                    |
| 26      | 2428               | 53      | 2455               |         |                    |

# 3. Table for Filed Antenna

| Ant. | Brand | Model<br>Name | Antenna Type | Connector | Gain (dBi) | NOTE          |
|------|-------|---------------|--------------|-----------|------------|---------------|
| 1    | N/A   | BTW-116       | ceramics     | N/A       | 0.8 dBi    | BT<br>Antenna |



## 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.

| 1Mbps/GFSK         1Mbps/GFSK         1Mbps/GFSK         2 Mbps/π/4-DQPSK |
|---|
| 1Mbps/GFSK  |
| •   |
| 2 Mbps/π/4-DQPSK  |
|   |
| 2 Mbps/π/4-DQPSK  |
| 2 Mbps/π/4-DQPSK  |
| 3 Mbps/8DPSK  |
| 3 Mbps/8DPSK  |
| 3 Mbps/8DPSK  |
|   |

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

## For AC Conducted Emission

|              | Test Case               |
|--------------|-------------------------|
| AC Conducted | Mode 10 : Keeping BT TX |
| Emission     |                         |

#### 2.3 TABLE OF PARAMETERS OF TEXT 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.

| Test software Version                             | Test program: Bluetooth   |   |  |  |  |
|---|---|---|--|--|--|
| (Power control software)<br>Parameters(1/2/3Mbps) | Power class:<br>DH1 rate:4:27<br>2DH1 rate:20:54<br>3DH1 rate:24:83 | Power class:<br>DH3 rate:11:183<br>2DH3 rate:26:367<br>3DH3 rate:27:552 | Power class:<br>DH5 rate:15:339<br>2DH5 rate:30:679<br>3DH5 rate:31:1021 |  |  |

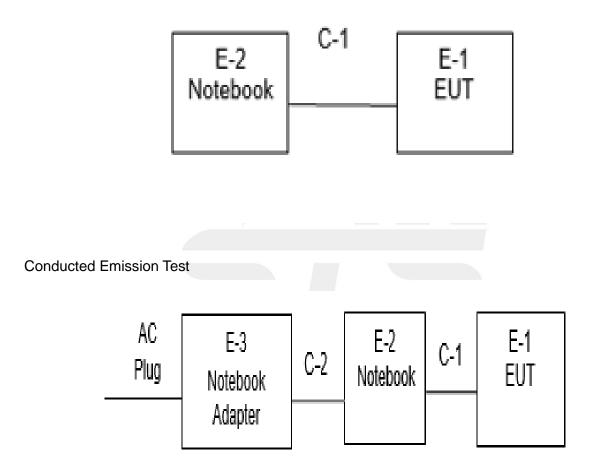


Page 11 of 72 Report No.: STS1908110W01

## 2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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

**Radiated Spurious Emission Test** 



Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755 3688 6288
 Fax:+ 86-755 3688 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



#### 2.5 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 | Mfr/Brand Model/Type No. |     | Note |
|------|-----------|-----------|--------------------------|-----|------|
| E-3  | Adapter   | N/A       | N/A                      | N/A | N/A  |
| C-2  | DC Cable  | N/A       | 110cm                    | N/A | N/A  |
|      |           |           |                          |     |      |
|      |           |           |                          |     |      |

## Support units

| Item | Equipment | Mfr/Brand | Model/Type No. | Serial<br>No. | Note |
|------|-----------|-----------|----------------|---------------|------|
| E-2  | Notebook  | DELL      | VOSTRO.3800    | N/A           | N/A  |
| C-1  | USB Cable | N/A       | 100cm          | N/A           | N/A  |
|      |           |           |                |               |      |
|      |           |           |                |               |      |

#### Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in <sup>r</sup>Length <sup>a</sup> column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".



# 2.6 EQUIPMENTS LIST

#### Radiation Test equipment

| Kind of Equipment                   | Manufacturer | Type No.            | Serial No.       | Last calibration | Calibrated until |
|-------------------------------------|--------------|---------------------|------------------|------------------|------------------|
| Test Receiver                       | R&S          | ESCI                | 101427           | 2018.10.13       | 2019.10.12       |
| Signal Analyzer                     | Agilent      | N9020A              | MY51110105       | 2019.03.02       | 2020.03.01       |
| Active loop Antenna                 | ZHINAN       | ZN30900C            | 16035            | 2018.03.11       | 2021.03.10       |
| Bilog Antenna                       | TESEQ        | CBL6111D            | 34678            | 2017.11.02       | 2020.11.1        |
| Horn Antenna                        | SCHWARZBECK  | BBHA<br>9120D(1201) | 9120D-1343       | 2018.10.19       | 2021.10.18       |
| SHF-EHF Horn<br>Antenna (18G-40GHz) | A-INFO       | LB-180400-KF        | J211020657       | 2018.03.11       | 2021.03.10       |
| Pre-Amplifier(0.1M-3G<br>Hz)        | EM           | EM330               | 060665           | 2018.10.13       | 2019.10.12       |
| Pre-Amplifier<br>(1G-18GHz)         | SKET         | LNPA-01018G-45      | SK201808090<br>1 | 2018.10.13       | 2019.10.12       |
| Temperature &<br>Humidity           | HH660        | Mieo                | N/A              | 2018.10.11       | 2019.10.10       |
| turn table                          | EM           | SC100_1             | 60531            | N/A              | N/A              |
| Antenna mast                        | EM           | SC100               | N/A              | N/A              | N/A              |
| Test SW                             | FARAD        | E                   | Z-EMC(Ver.STS    | LAB-03A1 RE)     |                  |

## Conduction Test equipment

| Kind of Equipment         | Manufacturer | Type No.                   | Serial No. | Last calibration | Calibrated until |
|---------------------------|--------------|----------------------------|------------|------------------|------------------|
| Test Receiver             | R&S          | ESCI                       | 101427     | 2018.10.13       | 2019.10.12       |
| LISN                      | R&S          | ENV216                     | 101242     | 2018.10.11       | 2019.10.10       |
| LISN                      | EMCO         | 3810/2NM                   | 23625      | 2018.10.11       | 2019.10.10       |
| Temperature &<br>Humidity | HH660        | Mieo                       | N/A        | 2018.10.11       | 2019.10.10       |
| Test SW                   | FARAD        | EZ-EMC(Ver.STSLAB-03A1 CE) |            |                  |                  |

## **RF** Connected Test

| Kind of Equipment         | Manufacturer | Type No.        | Serial No.    | Last calibration | Calibrated until |  |
|---------------------------|--------------|-----------------|---------------|------------------|------------------|--|
| USB RF power sensor       | DARE         | RPR3006W        | 15100041SNO03 | 2018.10.13       | 2019.10.12       |  |
| Signal Analyzer           | Agilent      | N9020A          | MY49100060    | 2018.10.13       | 2019.10.12       |  |
| Temperature &<br>Humidity | HH660        | Mieo            | N/A           | 2018.10.11       | 2019.10.10       |  |
| Test SW                   | FARAD        | LZ-RF /LzRf-3A3 |               |                  |                  |  |



## 3. EMC EMISSION TEST

## 3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

|                 | Conducted Emissionlimit (dBuV) |           |  |
|-----------------|--------------------------------|-----------|--|
| FREQUENCY (MHz) | 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.

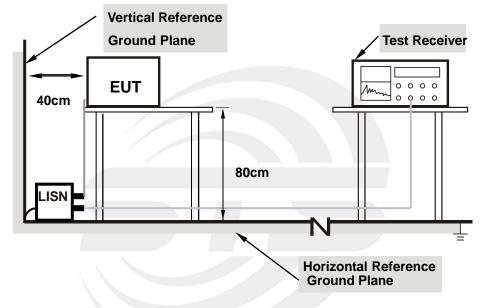
The following table is the setting of the receiver

| 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 was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 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 at least 80 cm from 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 from other units and other metal planes

#### 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:  | 26(C)        | Relative Humidity: | 60%RH |
|---------------|--------------|--------------------|-------|
| Test Voltage: | AC 120V/60Hz | Phase:             | L     |
| Test Mode:    | Mode 10      |                    |       |

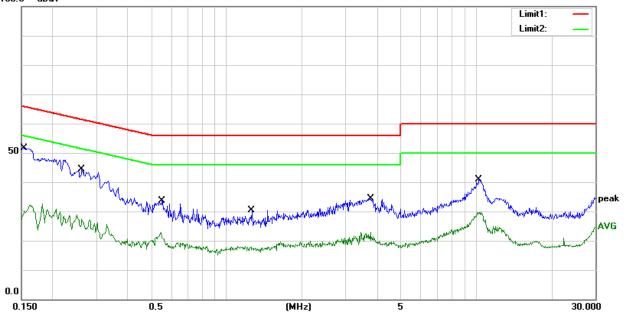
| No. | Frequency | Reading | Correct    | Result | Limit  | Margin | Remark |
|-----|-----------|---------|------------|--------|--------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB) | (dBuV) | (dBuV) | (dB)   |        |
| 1   | 0.1540    | 31.93   | 19.73      | 51.66  | 65.78  | -14.12 | QP     |
| 2   | 0.1540    | 12.84   | 19.73      | 32.57  | 55.78  | -23.21 | AVG    |
| 3   | 0.2620    | 24.18   | 20.09      | 44.27  | 61.37  | -17.10 | QP     |
| 4   | 0.2620    | 8.80    | 20.09      | 28.89  | 51.37  | -22.48 | AVG    |
| 5   | 0.5500    | 13.83   | 19.91      | 33.74  | 56.00  | -22.26 | QP     |
| 6   | 0.5500    | 0.74    | 19.91      | 20.65  | 46.00  | -25.35 | AVG    |
| 7   | 1.2660    | 10.61   | 19.77      | 30.38  | 56.00  | -25.62 | QP     |
| 8   | 1.2660    | -1.54   | 19.77      | 18.23  | 46.00  | -27.77 | AVG    |
| 9   | 3.7700    | 14.56   | 19.87      | 34.43  | 56.00  | -21.57 | QP     |
| 10  | 3.7700    | 3.05    | 19.87      | 22.92  | 46.00  | -23.08 | AVG    |
| 11  | 10.2460   | 20.94   | 19.84      | 40.78  | 60.00  | -19.22 | QP     |
| 12  | 10.2460   | 10.02   | 19.84      | 29.86  | 50.00  | -20.14 | AVG    |

#### Remark:

1. All readings are Quasi-Peak and Average values.

2. Margin = Result (Result = Reading + Factor )-Limit







Page 17 of 72 Report No.: STS1908110W01

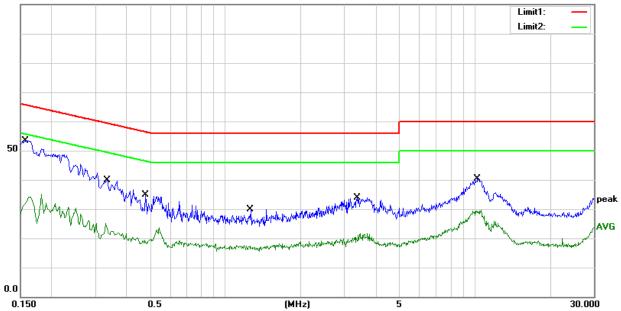
| Temperature:  | 26(C)        | Relative Humidity: | 60%RH |
|---------------|--------------|--------------------|-------|
| Test Voltage: | AC 120V/60Hz | Phase:             | Ν     |
| Test Mode:    | Mode 10      |                    |       |

| No. | Frequency | Reading | Correct    | Result | Limit  | Margin | Remark |
|-----|-----------|---------|------------|--------|--------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB) | (dBuV) | (dBuV) | (dB)   |        |
| 1   | 0.1580    | 33.66   | 19.74      | 53.40  | 65.57  | -12.17 | QP     |
| 2   | 0.1580    | 15.33   | 19.74      | 35.07  | 55.57  | -20.50 | AVG    |
| 3   | 0.3340    | 19.73   | 20.17      | 39.90  | 59.35  | -19.45 | QP     |
| 4   | 0.3340    | 4.93    | 20.17      | 25.10  | 49.35  | -24.25 | AVG    |
| 5   | 0.4780    | 14.98   | 19.96      | 34.94  | 56.37  | -21.43 | QP     |
| 6   | 0.4780    | 3.64    | 19.96      | 23.60  | 46.37  | -22.77 | AVG    |
| 7   | 1.2660    | 10.11   | 19.77      | 29.88  | 56.00  | -26.12 | QP     |
| 8   | 1.2660    | -1.59   | 19.77      | 18.18  | 46.00  | -27.82 | AVG    |
| 9   | 3.3780    | 13.92   | 19.86      | 33.78  | 56.00  | -22.22 | QP     |
| 10  | 3.3780    | 1.84    | 19.86      | 21.70  | 46.00  | -24.30 | AVG    |
| 11  | 10.2460   | 20.44   | 19.84      | 40.28  | 60.00  | -19.72 | QP     |
| 12  | 10.2460   | 9.76    | 19.84      | 29.60  | 50.00  | -20.40 | AVG    |

#### Remark:

1. All readings are Quasi-Peak and Average values.

2. Margin = Result (Result = Reading + Factor )-Limit





## 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 | Field Strength              | Measurement Distance |
|-------------|-----------------------------|----------------------|
| (MHz)       | (micorvolts/meter) (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).

#### For Radiated Emission

| 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)                           | PK=1MHz / 1MHz, AV=1 MHz /10 Hz |

#### For Band edge

| Spectrum Parameter                    | Setting                           |
|---------------------------------------|-----------------------------------|
| Detector                              | Peak/AV                           |
|                                       | Lower Band Edge: 2300 to 2403 MHz |
| Start/Stop Frequency                  | Upper Band Edge: 2479 to 2500 MHz |
| RB / VB (emission in restricted band) | PK=1MHz / 1MHz, AV=1 MHz / 10 Hz  |

Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755
 3688
 6288
 Fax:+ 86-755
 3688
 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



Page 19 of 72 Report No.: STS1908110W01

| 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 of 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 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees 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 polarizations 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 then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement 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

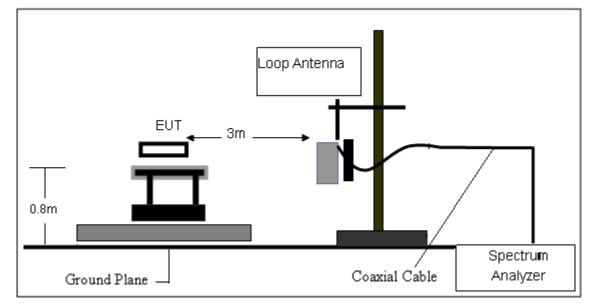
No deviation

Page 20 of 72 Report No.: STS1908110W01

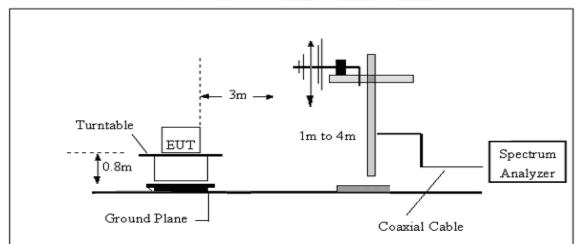


## 3.2.4 TESTSETUP

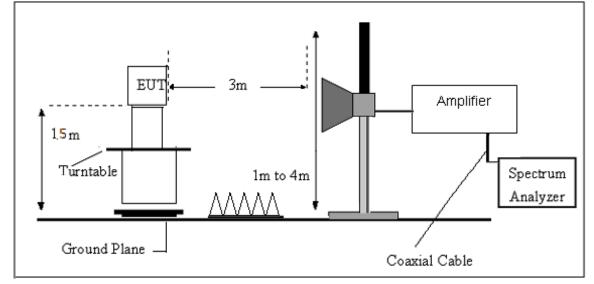
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755
 3688
 6287
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



## 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.



Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755 3688 6288
 Fax:+ 86-755 3688 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



## 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 - AGWhere 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



Shenzhen STS Test Services Co., Ltd.

1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: +86-755 3688 6288 Fax:+86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



## 3.2.7 TEST RESULTS

#### (9KHz-30MHz)

| Temperature:  | 25.0(C)              | Relative Humidity: | 64%RH   |
|---------------|----------------------|--------------------|---------|
| Test Voltage: | DC 3.7V from battery | Test Mode:         | TX Mode |

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





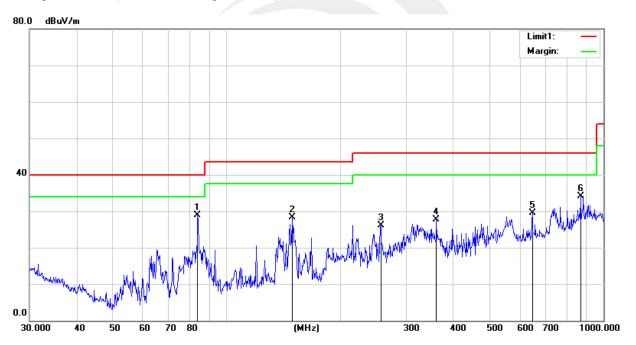
(30MHz-1000MHz)

| Temperature:  | 25.0(C)                                   | Relative Humidity: | 64%RH      |  |
|---------------|---|--------------------|------------|--|
| Test Voltage: | DC 3.7V from battery                      | Phase:             | Horizontal |  |
| Test Mode:    | Mode 1/2/3/4/5/6/7/8/9(Mode 7 worst mode) |                    |            |  |

| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 83.8156   | 51.34   | -22.45       | 28.89    | 40.00    | -11.11 | QP     |
| 2   | 149.4857  | 46.72   | -18.50       | 28.22    | 43.50    | -15.28 | QP     |
| 3   | 256.5211  | 41.30   | -15.18       | 26.12    | 46.00    | -19.88 | QP     |
| 4   | 360.4476  | 40.62   | -12.85       | 27.77    | 46.00    | -18.23 | QP     |
| 5   | 647.3856  | 34.35   | -4.89        | 29.46    | 46.00    | -16.54 | QP     |
| 6   | 869.1302  | 34.70   | -0.52        | 34.18    | 46.00    | -11.82 | QP     |

Remark:

<sup>1.</sup> Margin = Result (Result = Reading + Factor )-Limit



Shenzhen STS Test Services Co., Ltd.

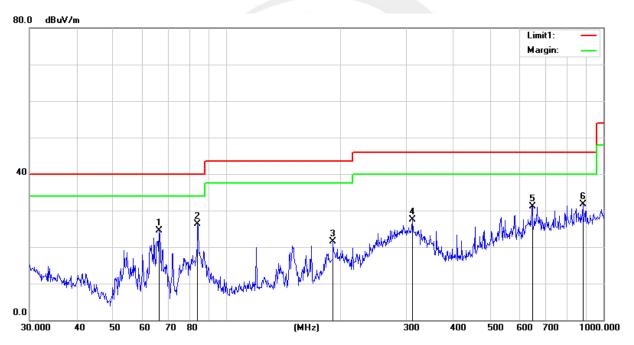


| Temperature:  | 25.0(C)                     | Relative Humidity: | 64%RH    |
|---------------|-----------------------------|--------------------|----------|
| Test Voltage: | DC 3.7V from battery        | Phase:             | Vertical |
| Test Mode:    | Mode 1/2/3/4/5/6/7/8/9(Mode | 7 worst mode)      |          |

| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 66.2661   | 50.03   | -25.55       | 24.48    | 40.00    | -15.52 | QP     |
| 2   | 83.8156   | 48.77   | -22.45       | 26.32    | 40.00    | -13.68 | QP     |
| 3   | 191.7450  | 42.56   | -21.03       | 21.53    | 43.50    | -21.97 | QP     |
| 4   | 311.0867  | 41.96   | -14.41       | 27.55    | 46.00    | -18.45 | QP     |
| 5   | 647.3855  | 36.04   | -4.89        | 31.15    | 46.00    | -14.85 | QP     |
| 6   | 881.4067  | 32.30   | -0.66        | 31.64    | 46.00    | -14.36 | QP     |

Remark:

1. Margin = Result (Result =Reading + Factor )–Limit





## (1GHz~25GHz) Restricted band and Spurious emission Requirements

| Frequency | Meter<br>Reading | Amplifier | Loss  | Antenna<br>Factor | Orrected<br>Factor | Emission<br>Level | Limits   | Margin | Detector | Comment    |
|-----------|------------------|-----------|-------|-------------------|--------------------|-------------------|----------|--------|----------|------------|
| (MHz)     | (dBµV)           | (dB)      | (dB)  | (dB/m)            | (dB)               | (dBµV/m)          | (dBµV/m) | (dB)   | Туре     |            |
|           |                  |           |       | Low C             | hannel (2402       | MHz)              |          |        |          |            |
| 3264.67   | 61.41            | 44.70     | 6.70  | 28.20             | -9.80              | 51.61             | 74.00    | -22.39 | PK       | Vertical   |
| 3264.67   | 50.15            | 44.70     | 6.70  | 28.20             | -9.80              | 40.35             | 54.00    | -13.65 | AV       | Vertical   |
| 3264.65   | 61.09            | 44.70     | 6.70  | 28.20             | -9.80              | 51.29             | 74.00    | -22.71 | PK       | Horizontal |
| 3264.65   | 50.61            | 44.70     | 6.70  | 28.20             | -9.80              | 40.81             | 54.00    | -13.19 | AV       | Horizontal |
| 4804.41   | 58.27            | 44.20     | 9.04  | 31.60             | -3.56              | 54.71             | 74.00    | -19.29 | PK       | Vertical   |
| 4804.41   | 49.92            | 44.20     | 9.04  | 31.60             | -3.56              | 46.36             | 54.00    | -7.64  | AV       | Vertical   |
| 4804.58   | 58.96            | 44.20     | 9.04  | 31.60             | -3.56              | 55.40             | 74.00    | -18.60 | PK       | Horizontal |
| 4804.58   | 50.50            | 44.20     | 9.04  | 31.60             | -3.56              | 46.94             | 54.00    | -7.06  | AV       | Horizontal |
| 5359.89   | 49.04            | 44.20     | 9.86  | 32.00             | -2.34              | 46.70             | 74.00    | -27.30 | PK       | Vertical   |
| 5359.89   | 39.56            | 44.20     | 9.86  | 32.00             | -2.34              | 37.22             | 54.00    | -16.78 | AV       | Vertical   |
| 5359.67   | 47.17            | 44.20     | 9.86  | 32.00             | -2.34              | 44.83             | 74.00    | -29.17 | PK       | Horizontal |
| 5359.67   | 38.10            | 44.20     | 9.86  | 32.00             | -2.34              | 35.76             | 54.00    | -18.24 | AV       | Horizontal |
| 7205.85   | 53.97            | 43.50     | 11.40 | 35.50             | 3.40               | 57.37             | 74.00    | -16.63 | PK       | Vertical   |
| 7205.85   | 43.83            | 43.50     | 11.40 | 35.50             | 3.40               | 47.23             | 54.00    | -6.77  | AV       | Vertical   |
| 7205.72   | 54.55            | 43.50     | 11.40 | 35.50             | 3.40               | 57.95             | 74.00    | -16.05 | PK       | Horizontal |
| 7205.72   | 43.72            | 43.50     | 11.40 | 35.50             | 3.40               | 47.12             | 54.00    | -6.88  | AV       | Horizontal |
|           | •                |           |       | Middle            | Channel (244       | 1 MHz)            |          | •      |          |            |
| 3264.89   | 61.95            | 44.70     | 6.70  | 28.20             | -9.80              | 52.15             | 74.00    | -21.85 | PK       | Vertical   |
| 3264.89   | 51.18            | 44.70     | 6.70  | 28.20             | -9.80              | 41.38             | 54.00    | -12.62 | AV       | Vertical   |
| 3264.56   | 61.61            | 44.70     | 6.70  | 28.20             | -9.80              | 51.81             | 74.00    | -22.19 | PK       | Horizontal |
| 3264.56   | 51.17            | 44.70     | 6.70  | 28.20             | -9.80              | 41.37             | 54.00    | -12.63 | AV       | Horizontal |
| 4882.43   | 58.15            | 44.20     | 9.04  | 31.60             | -3.56              | 54.59             | 74.00    | -19.41 | PK       | Vertical   |
| 4882.43   | 49.85            | 44.20     | 9.04  | 31.60             | -3.56              | 46.29             | 54.00    | -7.71  | AV       | Vertical   |
| 4882.31   | 59.49            | 44.20     | 9.04  | 31.60             | -3.56              | 55.93             | 74.00    | -18.07 | PK       | Horizontal |
| 4882.31   | 49.23            | 44.20     | 9.04  | 31.60             | -3.56              | 45.67             | 54.00    | -8.33  | AV       | Horizontal |
| 5359.81   | 48.14            | 44.20     | 9.86  | 32.00             | -2.34              | 45.80             | 74.00    | -28.20 | PK       | Vertical   |
| 5359.81   | 40.43            | 44.20     | 9.86  | 32.00             | -2.34              | 38.09             | 54.00    | -15.91 | AV       | Vertical   |
| 5359.83   | 47.57            | 44.20     | 9.86  | 32.00             | -2.34              | 45.23             | 74.00    | -28.77 | PK       | Horizontal |
| 5359.83   | 39.40            | 44.20     | 9.86  | 32.00             | -2.34              | 37.06             | 54.00    | -16.94 | AV       | Horizontal |
| 7323.69   | 54.23            | 43.50     | 11.40 | 35.50             | 3.40               | 57.63             | 74.00    | -16.37 | PK       | Vertical   |
| 7323.69   | 43.91            | 43.50     | 11.40 | 35.50             | 3.40               | 47.31             | 54.00    | -6.69  | AV       | Vertical   |
| 7323.78   | 54.12            | 43.50     | 11.40 | 35.50             | 3.40               | 57.52             | 74.00    | -16.48 | PK       | Horizontal |
| 7323.78   | 43.99            | 43.50     | 11.40 | 35.50             | 3.40               | 47.39             | 54.00    | -6.61  | AV       | Horizontal |



## Page 27 of 72 Report No.: STS1908110W01

|         |       |       |       | High C | hannel (248 | 0 MHz) |       |        |    |            |
|---------|-------|-------|-------|--------|-------------|--------|-------|--------|----|------------|
| 3264.75 | 61.90 | 44.70 | 6.70  | 28.20  | -9.80       | 52.10  | 74.00 | -21.90 | PK | Vertical   |
| 3264.75 | 50.20 | 44.70 | 6.70  | 28.20  | -9.80       | 40.40  | 54.00 | -13.60 | AV | Vertical   |
| 3264.75 | 62.06 | 44.70 | 6.70  | 28.20  | -9.80       | 52.26  | 74.00 | -21.74 | PK | Horizontal |
| 3264.75 | 51.12 | 44.70 | 6.70  | 28.20  | -9.80       | 41.32  | 54.00 | -12.68 | AV | Horizontal |
| 4960.50 | 59.40 | 44.20 | 9.04  | 31.60  | -3.56       | 55.84  | 74.00 | -18.16 | PK | Vertical   |
| 4960.50 | 49.77 | 44.20 | 9.04  | 31.60  | -3.56       | 46.21  | 54.00 | -7.79  | AV | Vertical   |
| 4960.41 | 58.40 | 44.20 | 9.04  | 31.60  | -3.56       | 54.84  | 74.00 | -19.16 | PK | Horizontal |
| 4960.41 | 50.11 | 44.20 | 9.04  | 31.60  | -3.56       | 46.55  | 54.00 | -7.45  | AV | Horizontal |
| 5359.83 | 48.73 | 44.20 | 9.86  | 32.00  | -2.34       | 46.39  | 74.00 | -27.61 | PK | Vertical   |
| 5359.83 | 39.43 | 44.20 | 9.86  | 32.00  | -2.34       | 37.09  | 54.00 | -16.91 | AV | Vertical   |
| 5359.73 | 47.58 | 44.20 | 9.86  | 32.00  | -2.34       | 45.24  | 74.00 | -28.76 | PK | Horizontal |
| 5359.73 | 38.03 | 44.20 | 9.86  | 32.00  | -2.34       | 35.69  | 54.00 | -18.31 | AV | Horizontal |
| 7439.86 | 53.83 | 43.50 | 11.40 | 35.50  | 3.40        | 57.23  | 74.00 | -16.77 | PK | Vertical   |
| 7439.86 | 44.65 | 43.50 | 11.40 | 35.50  | 3.40        | 48.05  | 54.00 | -5.95  | AV | Vertical   |
| 7439.91 | 54.29 | 43.50 | 11.40 | 35.50  | 3.40        | 57.69  | 74.00 | -16.31 | PK | Horizontal |
| 7439.91 | 44.25 | 43.50 | 11.40 | 35.50  | 3.40        | 47.65  | 54.00 | -6.35  | AV | Horizontal |

Note:

1) Scan with GFSK,  $\pi/4$ -DQPSK, 8DPSK, the worst case is 8DPSK Mode

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

Emission Level = Reading + Factor

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.

Shenzhen STS Test Services Co., Ltd.

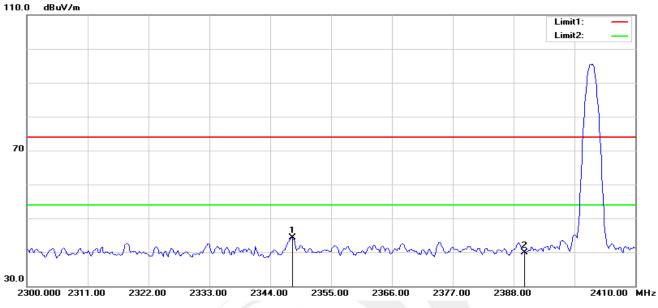
 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755
 3688
 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com

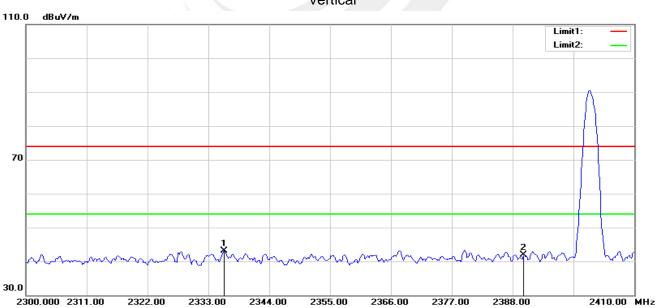


#### **Restricted band Requirements**

8DPSK -Low Horizontal



| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 2347.960  | 40.52   | 3.73         | 44.25    | 74.00    | -29.75 | peak   |
| 2   | 2390.000  | 35.62   | 4.34         | 39.96    | 74.00    | -34.04 | peak   |



| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 2335.860  | 39.42   | 3.66         | 43.08    | 74.00    | -30.92 | peak   |
| 2   | 2390.000  | 37.47   | 4.34         | 41.81    | 74.00    | -32.19 | peak   |

Vertical

Shenzhen STS Test Services Co., Ltd.

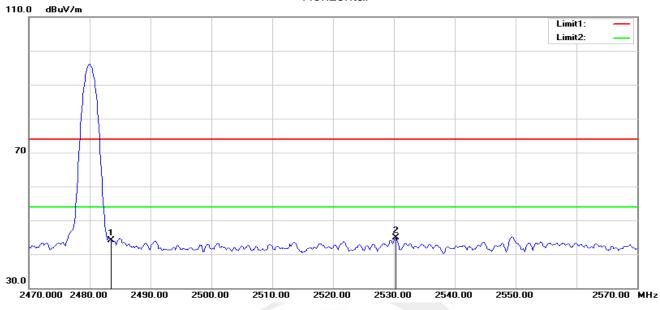
1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: + 86-755 3688 6288 Fax:+ 86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



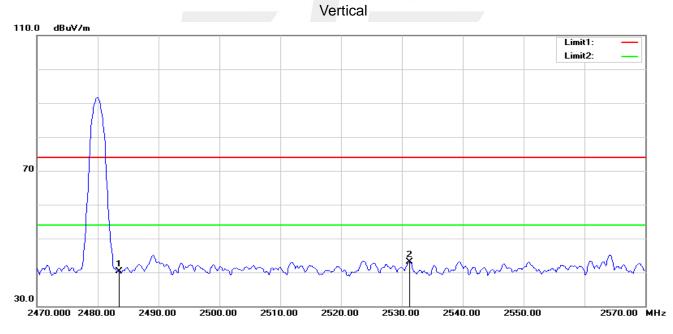
Page 29 of 72

Report No.: STS1908110W01

#### 8DPSK-High Horizontal



| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 2483.500  | 39.57   | 4.60         | 44.17    | 74.00    | -29.83 | peak   |
| 2   | 2530.300  | 39.96   | 4.85         | 44.81    | 74.00    | -29.19 | peak   |



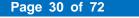
| No. | Frequency | Reading | Correct      | Result   | Limit    | Margin | Remark |
|-----|-----------|---------|--------------|----------|----------|--------|--------|
|     | (MHz)     | (dBuV)  | Factor(dB/m) | (dBuV/m) | (dBuV/m) | (dB)   |        |
| 1   | 2483.500  | 35.62   | 4.60         | 40.22    | 74.00    | -33.78 | peak   |
| 2   | 2531.200  | 38.22   | 4.86         | 43.08    | 74.00    | -30.92 | peak   |

Note: GFSK,  $\pi$ /4-DQPSK, 8DPSK of the nohopping and hopping mode all have been test, the worst case is 8DPSK of the nohopping mode, this report only show the worst case.

Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755
 3688
 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



# 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

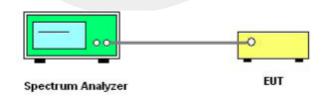
| Spectrum Parameter                    | Setting                         |
|---------------------------------------|---------------------------------|
| Detector                              | Peak                            |
| Start/Stop Frequency                  | 30 MHz to 10th carrier harmonic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

#### For Band edge

| Spectrum Parameter                    | Setting                          |
|---------------------------------------|----------------------------------|
| Detector                              | Peak                             |
| Stort/Stop Eroguopou                  | Lower Band Edge: 2300– 2403 MHz  |
| Start/Stop Frequency                  | Upper Band Edge: 2479 – 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz                  |
| Trace-Mode:                           | Max hold                         |

Remark: Hopping on and Hopping off mode all have been tested, only worst case hopping off is reported.

#### 4.3 TEST SETUP



The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 500hm; 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

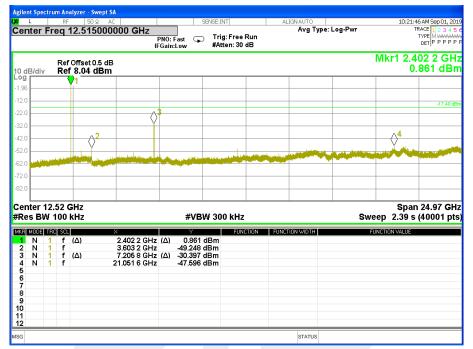
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



## 4.5 TEST RESULTS

| Temperature: | <b>25</b> ℃             | Relative Humidity: | 50%                  |
|--------------|-------------------------|--------------------|----------------------|
| Test Mode:   | GFSK(1Mbps)-00/39/78 CH | Test Voltage:      | DC 3.7V from battery |

## 00 CH



## 39 CH

|             |      | Analyzer - Sv             |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       |  |
|-------------|------|---------------------------|-----------------|-------------------------------|-----------------|-----------------------------|----------------------------------|------|------|------------|--------------------|-------------|---------|----|-----------------------|--|
| nter F      |      |                           | Ω AC<br>0000000 | F                             | PNO: I<br>Gain: |                             | SENSE:INT<br>D Trig: I<br>#Atter |      |      | AL         | IGN AUTO<br>Avg T} | /pe: l      | Log-Pwr |    |                       | 24 AM Sep 01, 2<br>TRACE 1 2 3 4<br>TYPE MWWW<br>DET P P P P |
| dB/div      |      | ef Offset 0<br>ef_11.32   |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    | Mkr1 2.4<br>1         | 140 9 GH<br>.324 dB  |
| 32          |      | 1                         |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       |  |
| 7           |      |                           |                 |                               | 3               |                             |                                  |      |      |            |                    |             |         |    |                       | -18.11   |
| 7           |      |                           |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       | ,  |
| 7           |      | $\Diamond^2$              |                 | Mark Lower                    |                 |                             |                                  |      |      | a bila sel |                    | <b>W</b> ., |         |    | and the second second |  |
| 7           |      |                           |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       |  |
| 7<br>nter 1 | 2.52 | GHz                       |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    | Spa                   | n 24.97 G  |
| es BW       | 10   | 0 kHz                     |                 |                               |                 | #VE                         | W 300                            | kHz  |      |            |                    |             | S       |    | ep 2.39 s             | ; (40001 p   |
|             | 1 1  | CL<br>F (Δ)<br>F<br>F (Δ) | 3.05            | 0 9 GHz<br>1 4 GHz<br>3 1 GHz |                 | 1.324<br>-52.770<br>-31.427 |                                  | FUNC | TION | FUNCT      | ION WIDTH          |             |         | FU | INCTION VALUE         |  |
| N           | 1 1  | 7                         | 24.34           | 8 9 GHz                       |                 | -47.911                     | dBm                              |      |      |            |                    |             |         |    |                       |  |
|             |      |                           |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       |  |
|             |      |                           |                 |                               |                 |                             |                                  |      |      |            |                    |             |         |    |                       |  |
|             |      |                           |                 |                               |                 |                             |                                  |      |      |            | STATUS             |             |         |    |                       |  |



## 78 CH

| L            |     | RF     |                     | Ω AC |                        |     |                      | SENSE:INT         |                    | AL         | IGN AUTO   |           | 10:1            | .9:40 AM Sep 01, 2                        |
|--------------|-----|--------|---------------------|------|------------------------|-----|----------------------|-------------------|--------------------|------------|------------|-----------|-----------------|---|
| nter         | Fre | ed .   | 12.515              | 0000 | 00 GHz                 | PNC | ): Fast ()<br>in:Low | Trig: F<br>#Atten | ree Run<br>: 30 dB |            | Avg Type   | : Log-Pwr |                 | TRACE 1 2 3 4<br>TYPE MWWW<br>DET P P P P |
| dB/di        |     |        | Offset 0<br>[ 11.22 |      |                        |     |                      |                   |                    |            |            |           |                 | .480 2 G<br>1.655 dE                      |
| g<br>22      |     |        | 1                   |      |                        |     |                      |                   |                    |            |            |           |                 |   |
| 18           |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
| .8           |     |        |                     |      | 3                      |     |                      |                   |                    |            |            |           |                 | -18.18                                    |
| 8            |     |        |                     |      | <u> </u>               |     |                      |                   |                    |            |            |           |                 |   |
| 8            |     |        | $\langle$           | 2    |                        |     |                      |                   |                    |            |            |           |                 |   |
| .8           |     |        | and a state         |      |                        | -   | المرجب المراج        |                   | and a star         | Automation |            |           | Second Arth     |   |
| 8            |     | 10.    |                     |      |                        | ~   | Santa Sector         |                   |                    |            |            |           |                 |   |
| .8           |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
| nter<br>es B |     |        |                     |      |                        |     | #V                   | BW 300 k          | Hz                 |            |            | S         | Sp<br>weep 2.39 | an 24.97 G<br>s (40001 p                  |
| R MODE       | TRC |        |                     | ×    |                        |     | Y                    |                   | FUNCTION           | FUNC       | TION WIDTH |           | FUNCTION VALU   | E   |
| N            | 1   | f<br>f | (Δ)                 |      | 2.480 2 G<br>3.719 9 G |     |                      | 5 dBm<br>4 dBm    |                    |            |            |           |                 |   |
| N            | 1   | f<br>f | (Δ)                 |      | 4.960 3 G<br>4.754 7 G |     |                      | 8 dBm<br>9 dBm    |                    |            |            |           |                 |   |
|              | Ľ.  | •      |                     | 2-   | 4.70470                | 112 | -47.02               | JUDIII            |                    |            |            |           |                 |   |
|              |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
|              |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
|              |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
|              |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |
|              |     |        |                     |      |                        |     |                      |                   |                    |            |            |           |                 |   |



П

Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755 3688 6288
 Fax:+ 86-755 3688 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com

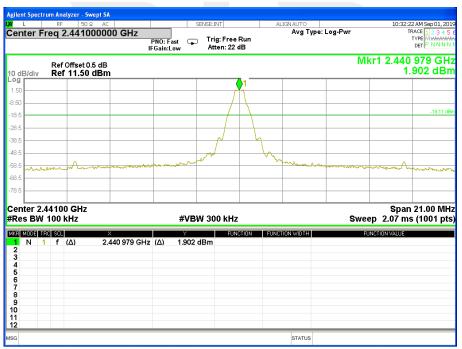


## For Band edge

00 CH

| lgilent Spectrum Analyzer - Swept SA   |                         |   |   |                          |  |
|--|-------------------------|---|---|--------------------------|--|
| 2 RL   RF   50 Ω AC  <br>Center Freq 2.351500000 GHz   | PNO: Fast<br>IFGain:Low | ENSE:INT<br>Trig: Free Run<br>#Atten: 30 dB | ALIGN AUTO<br>Avg Type                          | -                        | 09:23:33 AM Sep 01, 201<br>TRACE 1 2 3 4 5<br>TYPE M WWWW<br>DET P P P P P   |
| Ref Offset 0.5 dB<br>10 dB/div Ref 12.60 dBm   |                         |   |   | M                        | (r1 2.401 867 GH<br>2.603 dBn  |
| 2.60   |                         |   |   |                          |  |
| -7.40  |                         |   |   |                          | -17.40 dB  |
| -27.4  |                         |   |   |                          |  |
| -47.4  |                         |   |   |                          | $\wedge^2$   |
| 57.4 your constant of the strate of the stra | havententorymet         |   | น <sub>เ</sub> ทรมหาศึกษฎในการสุดในการสะเหนือจะ | reflectfally weather the | and a star for the start of the |
| 77.4   |                         |   |   |                          |  |
| Start 2.30000 GHz<br>#Res BW 100 kHz   | #VB\                    | N 300 kHz                                   |   | Swee                     | Stop 2.40300 GH<br>p 9.87 ms (1001 pts   |
| MKG         MODE         TRC         SCL         X           1         N         1         f         2.401 867 GH           2         N         1         f         2.390 022 GH           3         N         1         f         2.399 807 GH           4         6         6         7         8           9         9         9         5         5  | z -59.425 d             | dBm   | FUNCTION WIDTH                                  | FU                       | NCTION VALUE   |
| 8<br>9<br>10<br>11<br>12<br>50   |                         |   | STATUS  |                          |  |
|  |                         |   | STATUS  |                          |  |

39 CH





## 78 CH

| ilent Spect<br>R L | rum Ana<br>RF | lyzer - Swept            |  |                          | SENSE:INT  |  | IGNAUTO   |                      | 00.55.0              | 14 AM Sep 01, 20                              |
|--------------------|---------------|--------------------------|--|--------------------------|--|--|-----------|----------------------|----------------------|---|
|                    |               |                          | 000 GHz  | PNO: Fast G<br>FGain:Low | Tailan France  | Run  | Avg Type: | -                    | Т                    | RACE 1 2 3 4 5<br>TYPE M WANNA<br>DET P P P P |
| ) dB/div           |               | Offset 0.5 d<br>11.82 dE |  |                          |  |  |           | MI                   | (r1 2.479<br>1.      | 987 GH<br>819 dB                              |
| 1.82               |               |                          |  |                          |  |  |           |                      |                      |   |
| 8.2                |               |                          |  |                          |  |  |           |                      |                      | -18.18  |
| B.2                |               |                          |  |                          |  |  |           |                      |                      |   |
| B.2                |               | V.                       | <u>2</u>   |                          | 3  |  |           |                      |                      |   |
| 3.2<br>3.2         |               |                          | mar and a start and a start a st | longrammer and           | the strategies of the second s | and and an and an and an |           | hand have the second | and and a second     | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~       |
| 8.2                |               |                          |  |                          |  |  |           |                      |                      |   |
| art 2.4<br>≀es BW  |               |                          |  | #VE                      | 300 kHz  |  |           | Swee                 | Stop 2.<br>ep 2.07 m | 50000 G<br>s (1001 p                          |
| (R MODE 1          |               | (Δ)                      | ×<br>2.479 987 GHz   | γ<br>(Δ) 1.819           | FUN  | CTION FUNC   | ION WIDTH | FL                   | INCTION VALUE        |   |
| 3 N                | 1 f<br>1 f    |                          | 2.483 998 GHz<br>2.487 967 GHz   |                          |  |  |           |                      |                      |   |
| 4<br>5<br>5        |               |                          |  |                          |  |  |           |                      |                      |   |
| 7<br>3<br>9        |               |                          |  |                          |  |  |           |                      |                      |   |
| D 1                |               |                          |  |                          |  |  |           |                      |                      |   |
| 3                  |               |                          |  |                          |  |  | STATUS    |                      |                      |   |



П

Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

 Tel: + 86-755 3688 6288
 Fax:+ 86-755 3688 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com

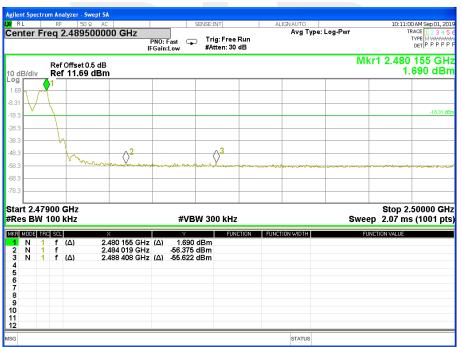


## For Hopping Band edge

00 CH

| gilent Spectr                        | r <mark>um Analyzer - S</mark><br>RF 50  |   |                    | SENSE:INT       | Al        | IGNAUTO     |                         | 10:08:39               | AM Sep 01, 20:                                 |
|--------------------------------------|--|---|--------------------|-----------------|-----------|-------------|-------------------------|------------------------|--|
|                                      |  | 500000 GHz                                      | PNO: Fast Gain:Low | Tailas Faces De | un        | Avg Type: I | -                       | TR<br>T                | ACE 1 2 3 4 5<br>YPE M WAAWAA<br>DET P P P P P |
| 0 dB/div                             | Ref Offset 0<br>Ref 11.58                |   |                    |                 |           |             | М                       | kr1 2.403<br>1.        | 000 GH<br>578 dBr                              |
| <b>og</b><br>1.58                    |  |   |                    |                 |           |             |                         |                        |  |
| 8.42                                 |  |   |                    |                 |           |             |                         |                        | -18.42 d                                       |
| 8.4                                  |  |   |                    |                 |           |             |                         |                        |  |
| 8.4                                  |  |   |                    |                 |           |             |                         |                        |  |
| 8.4                                  |  |   |                    |                 |           |             |                         | $\langle \rangle^2$    | . martin                                       |
| 8.4                                  | an a | Sharen franzis de la filia de la cardera        |                    |                 |           |             | Brooken maar jilina aki |                        |  |
| 8.4                                  |  |   |                    |                 |           |             |                         |                        |  |
|                                      | 0000 GHz<br>100 kHz                      |   | #VB                | W 300 kHz       |           |             | Swe                     | Stop 2.4<br>ep 9.87 ms | 0300 GH<br>(1001 pt                            |
|                                      | RC SCL                                   | ×   | Y                  | FUNCT           | ION FUNCT | ION WIDTH   | F                       | UNCTION VALUE          |  |
| 1 N 1<br>2 N 1<br>3 N 1<br>4<br>5    |  | 2.403 000 GHz<br>2.390 022 GHz<br>2.399 910 GHz | -58.414            | dBm             |           |             |                         |                        |  |
| 4<br>5<br>6<br>7<br>8<br>9<br>0<br>1 |  |   |                    |                 |           |             |                         |                        |  |
| <b>2</b>                             |  |   |                    |                 |           | STATUS      |                         |                        |  |

78 CH





Page 36 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                      | Relative Humidity: | 50%                  |
|--------------|----------------------------------|--------------------|----------------------|
|              | π/4-DQPSK(2Mbps)–<br>00/39/78 CH | Test Voltage:      | DC 3.7V from battery |

| ent Spectrum Analyzer - Swe<br>L RF 50 Ω | AC                              | SENSE:INT  | ALIGN AUTO   | 10:44:04 AM Sep 01, 2  |
|--|---------------------------------|--|--|--|
| nter Freq 12.5150                        | PNO                             | : Fast 😱 Trig: Free Ru<br>n:Low #Atten: 30 dB  | Avg Type: Log-Pw<br>n  | TRACE 1 2 3 4<br>TYPE M WAAA<br>DET P P P  |
| Ref Offset 0.5<br>dB/div Ref 11.65 (     |                                 |  |  | Mkr1 2.402 2 G<br>1.652 dB   |
| 1  |                                 |  |  |  |
| 5  |                                 |  |  |  |
| 4  |                                 |  |  | -17.49   |
| 4  |                                 |  |  |  |
| 4  | Ĭ                               |  |  |  |
| 4  |                                 |  |  |  |
|  | ير الم مركبين الم               | مراجع المراجع والمراجع و | Name and Address of the Owner of | and the second |
| 4  |                                 |  |  |  |
| 4  |                                 |  |  |  |
| nter 12.52 GHz                           |                                 |  |  | Span 24.97 G   |
| es BW 100 kHz                            |                                 | #VBW 300 kHz   |  | Sweep 2.39 s (40001 p  |
| MODE TRC SCL                             | ×                               | Y FUNCTIO  | N FUNCTION WIDTH   | FUNCTION VALUE   |
| N 1 f (Δ)<br>N 1 f                       | 2.402 2 GHz (Δ)<br>3.603 2 GHz  | 1.652 dBm<br>-48.332 dBm   |  |  |
| N 1 f (Δ)<br>N 1 f                       | 7.205 8 GHz (Δ)<br>24.726 6 GHz | -31.406 dBm<br>-47.839 dBm   |  |  |
|  | 24.7200 0112                    | 41.000 0.011   |  |  |
|  |                                 |  |  |  |
|  |                                 |  |  |  |
|  |                                 |  |  |  |
|  |                                 |  |  |  |
|  |                                 |  | STATUS   |  |
|  | 1                               |  |  |  |
|  |                                 | 39 CH  |  |  |
|  |                                 |  |  |  |

#### 00 CH

| 39 | CH |
|----|----|
| ~~ |    |

| L   | RF 50 Ω                            | 2 AC                                      | SE   | ENSE:INT                        | ALIG                        | NAUTO     |         | 10:53:         | 05 AM Sep 01, 2                            |
|---|------------------------------------|---|--|---------------------------------|-----------------------------|-----------|---------|----------------|--|
|   |                                    | 000000 GHz                                | PNO: Fast 🖵<br>-Gain:Low   | Trig: Free Run<br>#Atten: 30 dB | maxa                        | Avg Type: | Log-Pwr |                | TRACE 1 2 3 4<br>TYPE MWWWW<br>DET P P P P |
| ) dB/div  | Ref Offset 0.<br>Ref 8.43 d        |   |  |                                 |                             |           |         | Mkr1 2.4       | 40 9 GH<br>.574 dB                         |
| .57   | <b></b> 1                          |   |  |                                 |                             |           |         |                |  |
| 1.6   |                                    |   |  |                                 |                             |           |         |                | -18.09                                     |
| .6  |                                    | A3  |  |                                 |                             |           |         |                | -10.09                                     |
| .6  |                                    | ()  |  |                                 |                             |           |         |                |  |
| .6  |                                    | <u> </u>                                  |  |                                 |                             |           |         |                |  |
| .6  | and the second second              | and a state of the state                  | يو المراجع   | a                               | and the state of the second |           |         | and the second |  |
| .6  |                                    |   |  |                                 |                             |           |         |                |  |
| 1.6   |                                    |   |  |                                 |                             |           |         |                |  |
| .6  |                                    |   |  |                                 |                             |           |         |                |  |
| enter 12  | 52 CHz                             |   |  |                                 |                             |           |         |                | n 24.97 G                                  |
|   | 100 kHz                            |   | #VBW   | V 300 kHz                       |                             |           | Sw      | eep 2.39 s     | ; (40001 p                                 |
| es BW   | 100 kHz                            | X   | Y  | FUNCTION                        | FUNCTIO                     | N WIDTH   |         | eep 2.39 s     | (40001 p                                   |
| ResBW<br>RMODENE<br>N 1<br>2 N 1  | 100 kHz<br>f (Δ)<br>f              | 2.440 9 GHz<br>3.661 3 GHz                | γ<br>(Δ) -1.574 d<br>-46.351 d   | FUNCTION                        | FUNCTIO                     | N WIDTH   |         |                | : (40001 p                                 |
| Res BW<br>R MODE TE<br>N 1<br>2 N 1<br>3 N 1  | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz                               | γ<br>(Δ) -1.574 d<br>-46.351 d   | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | N WIDTH   |         |                | : (40001 p                                 |
| tes BW<br>E MODE TE<br>N 1<br>N 1<br>N 1<br>N 1<br>N 1  | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz<br>3.661 3 GHz<br>4.882 3 GHz | <ul> <li>(Δ) -1.574 d</li> <li>-46.351 d</li> <li>(Δ) -34.886 d</li> </ul> | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | N WIDTH   |         |                | ; (40001 p                                 |
| Res BW           I         N         1           2         N         1           3         N         1           4         N         1           5         5         5  | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz<br>3.661 3 GHz<br>4.882 3 GHz | <ul> <li>(Δ) -1.574 d</li> <li>-46.351 d</li> <li>(Δ) -34.886 d</li> </ul> | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | N WIDTH   |         |                | (40001 p                                   |
| Res BW           B         MODE         ME           I         N         1           2         N         1           3         N         1           4         N         1           5         7         3           3         9         9                | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz<br>3.661 3 GHz<br>4.882 3 GHz | <ul> <li>(Δ) -1.574 d</li> <li>-46.351 d</li> <li>(Δ) -34.886 d</li> </ul> | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | N WIDTH   |         |                | (40001 p                                   |
| R         MODE         TF           N         1         1           2         N         1           3         N         1           4         N         1           5         5         5           7         3         3           3         0         1 | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz<br>3.661 3 GHz<br>4.882 3 GHz | <ul> <li>(Δ) -1.574 d</li> <li>-46.351 d</li> <li>(Δ) -34.886 d</li> </ul> | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | N WIDTH   |         |                | - (40001 p                                 |
| Res BW<br>R MODE NE<br>N 1<br>2 N 1<br>3 N 1  | 100 kHz<br>f (Δ)<br>f (Δ)<br>f (Δ) | 2.440 9 GHz<br>3.661 3 GHz<br>4.882 3 GHz | <ul> <li>(Δ) -1.574 d</li> <li>-46.351 d</li> <li>(Δ) -34.886 d</li> </ul> | FUNCTION<br>Bm<br>Bm<br>Bm      | FUNCTIO                     | NWIDTH    |         |                | (40001 p                                   |

П



# 78 CH

|                              |                              |                            | AC                            |                    | SE                                 | ENSE:INT                 | AL                | IGN AUTO  |                            |                    | 1 AM Sep 01, 2          |
|------------------------------|------------------------------|----------------------------|-------------------------------|--------------------|------------------------------------|--------------------------|-------------------|-----------|----------------------------|--------------------|-------------------------|
| nter                         | Freq                         | 12.5150                    | 000000 GHz                    | PNO: F<br>IFGain:I | ]<br>ast                           | Trig: Free<br>#Atten: 30 |                   | Avg Type: | Log-Pwr                    |                    | TYPE MWWW<br>DET P P P  |
| dB/div                       |                              | f Offset 0.5<br>ef 9.45 dE |                               |                    |                                    |                          |                   |           |                            | Mkr1 2.4<br>-0.    | 80 2 G<br>548 dE        |
| 6                            |                              | <b>1</b>                   |                               |                    |                                    |                          |                   |           |                            |                    |                         |
| 6                            |                              |                            |                               |                    |                                    |                          |                   |           |                            |                    | -18.24                  |
| 6                            |                              |                            | () <sup>3</sup>               |                    |                                    |                          |                   |           |                            |                    |                         |
|                              |                              | ^2                         | 2                             |                    |                                    |                          |                   |           |                            | 4                  |                         |
| 6                            |                              | - V                        |                               |                    |                                    | 1.1.1.4                  | والمراجع والمراجع |           | و ما دان المار و ما در الم |                    | surged as a line of the |
| 6                            |                              |                            |                               |                    |                                    |                          |                   |           |                            |                    | he have been            |
| 6                            |                              |                            |                               |                    |                                    |                          |                   |           |                            |                    |                         |
|                              |                              |                            |                               |                    |                                    |                          |                   |           |                            |                    | 04.07.0                 |
| nter 7                       | 12.52                        | GHZ                        |                               |                    |                                    |                          |                   |           | 0                          | span<br>eep 2.39 s | 24.97 G                 |
|                              | V 100                        |                            |                               |                    | #VBV                               | V 300 kHz                |                   |           | SWI                        | ceh 2.38.2         | (                       |
| es BV                        | TRC SC                       | ) kHz                      | ×                             |                    | Y                                  | FUNG                     | TION FUNCT        | ION WIDTH |                            | UNCTION VALUE      | (10001)                 |
| es BV<br>Mode<br>N<br>N      | TRC SC<br>1 f<br>1 f         | kHz<br>Δ                   | ×<br>2.480 2 GH<br>3.719 9 GH | z                  | -0.548 d<br>-48.251 d              | FUND<br>Bm<br>Bm         | TION FUNCT        | ION WIDTH |                            | •                  |                         |
| es BV                        | TRC SC<br>1 f                | kHz<br>(Δ)                 |                               | z<br>z (Δ)         | Y<br>-0.548 d                      | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  | (10001)                 |
| es BV<br>NODE<br>N<br>N<br>N | 1780 SO<br>1 f<br>1 f<br>1 f | kHz<br>(Δ)                 | 3.719 9 GH:<br>4.960 3 GH:    | z<br>z (Δ)         | -0.548 d<br>-48.251 d<br>-33.464 d | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  | (10001)                 |
| es BV<br>N<br>N<br>N<br>N    | 1780 SO<br>1 f<br>1 f<br>1 f | kHz<br>(Δ)                 | 3.719 9 GH:<br>4.960 3 GH:    | z<br>z (Δ)         | -0.548 d<br>-48.251 d<br>-33.464 d | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  | (10001)                 |
| es BV<br>N<br>N<br>N<br>N    | 1780 SO<br>1 f<br>1 f<br>1 f | kHz<br>(Δ)                 | 3.719 9 GH:<br>4.960 3 GH:    | z<br>z (Δ)         | -0.548 d<br>-48.251 d<br>-33.464 d | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  | (10001)                 |
| es BV                        | 1780 SO<br>1 f<br>1 f<br>1 f | kHz<br>(Δ)                 | 3.719 9 GH:<br>4.960 3 GH:    | z<br>z (Δ)         | -0.548 d<br>-48.251 d<br>-33.464 d | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  | (10001)                 |
| es BV<br>N<br>N<br>N<br>N    | 1780 SO<br>1 f<br>1 f<br>1 f | kHz<br>(Δ)                 | 3.719 9 GH:<br>4.960 3 GH:    | z<br>z (Δ)         | -0.548 d<br>-48.251 d<br>-33.464 d | FUNC<br>Bm<br>Bm<br>Bm   | TION FUNCT        | ION WIDTH |                            | •                  |                         |



П

Shenzhen STS Test Services Co., Ltd.

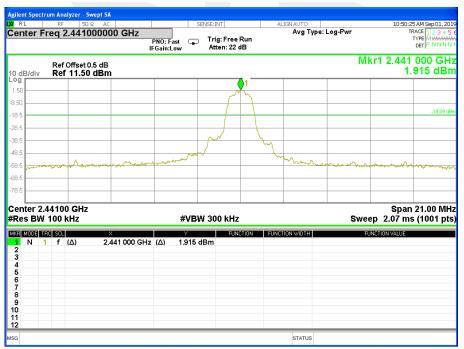


## For Band edge

00 CH

|                       |                          | yzer - Swep                              |                                     |                      |   |               |                      |         |  |              |                      |  |
|-----------------------|--------------------------|--|-------------------------------------|----------------------|---|---------------|----------------------|---------|--|--------------|----------------------|--|
| RL<br>enter F         | <sub>R</sub> ⊧<br>Freq 2 |  | ac<br>)000 GH                       | PNC                  | ): Fast 🔾<br>in:Low                             | SENSE:INT     | Free Run<br>n: 30 dB | ALIG    | Avg Type:                              |              | Т                    | 24 AM Sep 01, 20<br>RACE 1 2 3 4 5<br>TYPE M WARK<br>DET P P P P |
| 0 dB/div              |                          | offset 0.5 d<br>12.51 dE                 |                                     |                      |   |               |                      |         |  | N            | 1kr1 2.401<br>2      | 970 GH<br>513 dB   |
| 2.51                  |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |
| .49<br>7.5            |                          |  |                                     |                      |   |               |                      |         |  |              |                      | -17.49 d   |
| 7.5                   |                          |  |                                     |                      |   |               |                      |         |  |              |                      | 6  |
| 7.5                   |                          |  |                                     |                      |   |               |                      |         |  |              | ^2                   | <u> </u>   |
| 7.5<br>7.5            | warner                   | an a | nton                                | ration of particular | angen na air air air air air air air air air ai | ile connected | -gent-definitions    | morena  | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | manahanahans | approximately and    | photological Physics   |
| 7.5                   |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |
| art 2.30<br>Res BW    |                          |  |                                     |                      | #V  | 3W 300 I      | kHz                  |         |  | Swe          | Stop 2<br>eep 9.87 m | .40300 GI<br>s (1001 pi  |
| R MODE TI             | RC SCL                   |  | ×                                   |                      | Y   |               | FUNCTION             | FUNCTIO | IN WIDTH                               |              | FUNCTION VALUE       |  |
| N 1<br>2 N 1<br>3 N 1 | 1 f                      | Δ)<br>Δ)                                 | 2.401 970<br>2.390 022<br>2.399 704 | GHz                  | -57.93  |               |                      |         |  |              |                      |  |
| 1<br>5<br>7<br>3      |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |
| 3<br>)<br>)           |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |
| 1                     |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |
| 2                     |                          |  |                                     |                      |   |               |                      |         |  |              |                      |  |

39 CH





# 78 CH

| gilent Spectrum An         |                            |                |                          |                                |                  |                   |            |   |  |
|----------------------------|----------------------------|----------------|--------------------------|--------------------------------|------------------|-------------------|------------|---|--|
| RL RF                      |                            |                |                          | SENSE:INT                      | AL               | IGNAUTO Avg Type: |            |   | 5 AM Sep 01, 20<br>RACE 1 2 3 4 5  |
| enter Freq 2               | 2.489500000                |                | PNO: Fast 🕞<br>FGain:Low | ⊃ Trig: Free F<br>#Atten: 30 o |                  | Avg Type:         | Log-Pwr    |   | TYPE MWWWW<br>DET P P P P F  |
| 0 dB/div Ref               | Offset 0.5 dB<br>11.77 dBm |                |                          |                                |                  |                   | MI         | (r1 2.479<br>1.                         | 987 GH<br>765 dBi  |
| og<br>1.77                 |                            |                |                          |                                |                  |                   |            |   |  |
| 3.23                       |                            |                |                          |                                |                  |                   |            |   |  |
| 8.2                        |                            |                |                          |                                |                  |                   |            |   | -18.24 d   |
| 8.2                        | 5                          |                |                          |                                |                  |                   |            |   |  |
| 18.2                       |                            | <mark>2</mark> |                          | <b>∆</b> 3                     |                  |                   |            |   |  |
| 8.2                        | war war                    | mahan          | Martinen                 | how                            | way and flow and | - de antes        | ᠂ᢕᠬᠴᠣᡐᠧᡒᡟᢦ | and | and a state of the |
| 8.2                        |                            |                |                          |                                |                  |                   |            |   |  |
|                            |                            |                |                          |                                |                  |                   |            |   |  |
| tart 2.47900<br>Res BW 100 |                            |                | #VE                      | W 300 kHz                      |                  |                   | Swee       | Stop 2.<br>p 2.07 m                     | 50000 GI<br>s (1001 pi   |
| Krimode Tro Scl<br>1 n 1 f |                            | 79 987 GHz     | (A) 4 705                | FUNC                           | TION FUNCT       | TION WIDTH        | FU         | NCTION VALUE                            |  |
| 2 N 1 f                    | 2.48                       | 34 355 GHz     | -54.439                  | dBm                            |                  |                   |            |   |  |
| 3 N 1 f<br>4<br>5          | (Δ) 2.48                   | 37 484 GHz     | (Δ) -54.091              | авт                            |                  |                   |            |   |  |
| 5<br>7                     |                            |                |                          |                                |                  |                   |            |   |  |
| /<br>B                     |                            |                |                          |                                |                  |                   |            |   |  |
| 8<br>9<br>0                |                            |                |                          |                                |                  |                   |            |   |  |
| 1<br>2                     |                            |                |                          |                                |                  |                   |            |   |  |
| G                          |                            |                |                          |                                |                  | STATUS            |            |   |  |



П

Shenzhen STS Test Services Co., Ltd.



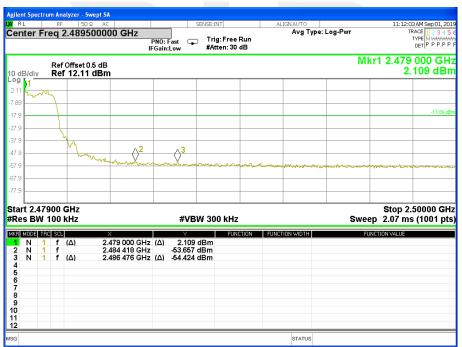


## For Hopping Band edge

00 CH

| ilent Spect<br>R L | rum Analyzer - S<br>RF 50 | wept SA<br>Ω AC                 |   | ENSE:INT                     | A                     | LIGNAUTO                                 |                          | 11:00:41              | LAM Sep 01, 2                              |
|--------------------|---------------------------|---------------------------------|---|------------------------------|-----------------------|--|--------------------------|-----------------------|--|
|                    |                           | 500000 GHz                      | PNO: Fast 😱<br>FGain:Low  | Trig: Free F<br>#Atten: 30 c | Run                   | Avg Type:                                | Log-Pwr                  | TR                    | ACE 1 2 3 4<br>TYPE M WAAAA<br>DET P P P P |
| dB/div             | Ref Offset 0<br>Ref 12.12 |                                 |   |                              |                       |  | Mł                       | (r1 2.401<br>2.       | 970 GI<br>115 dB                           |
| g<br>12            |                           |                                 |   |                              |                       |  |                          |                       |  |
| 88                 |                           |                                 |   |                              |                       |  |                          |                       | -17.88                                     |
| .9                 |                           |                                 |   |                              |                       |  |                          |                       | -11.00                                     |
| .9                 |                           |                                 |   |                              |                       |  |                          |                       |  |
| .9                 |                           |                                 |   |                              |                       |  |                          | <mark>2</mark>        | A not and                                  |
| .9 <b></b> 9       | - Joseph and the          | when the second from the second | - Martine - | al Caladian Carlos           | and the second second | an a | allaget of a strategy at | Xan                   | yr an all the                              |
| .9                 |                           |                                 |   |                              |                       |  |                          |                       |  |
|                    | 0000 GHz<br>100 kHz       |                                 | #VB\  | V 300 kHz                    |                       |  | Swee                     | Stop 2.4<br>p 9.87 ms | 40300 G<br>(1001 p                         |
| R MODE T           | RC SCL<br>1 f (Δ)         | ×<br>2.401 970 GHz              | ×<br>(Δ) 2.115 (  |                              | TION FUNC             | TION WIDTH                               | ÆU                       | NCTION VALUE          |  |
| 2 N *              | 1 f<br>1 f (Δ)            | 2.390 022 GHz<br>2.399 910 GHz  | -57.762 0   | lBm                          |                       |  |                          |                       |  |
|                    |                           |                                 |   |                              |                       |  |                          |                       |  |
| <br>               |                           |                                 |   |                              |                       |  |                          |                       |  |
| i                  |                           |                                 |   |                              |                       |  |                          |                       |  |
| 2                  |                           |                                 |   |                              |                       |  |                          |                       |  |
|                    |                           |                                 |   |                              |                       | STATUS                                   |                          |                       |  |

78 CH





Page 41 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃               | Relative Humidity: | 50%                  |
|--------------|---------------------------|--------------------|----------------------|
| Test Mode:   | 8DPSK(3Mbps) -00/39/78 CH | Test Voltage:      | DC 3.7V from battery |

# 00 CH

| L   |      | RF 5                            | Swept SA<br>D Ω AC    |                        |                     | SE                                   | NSE:INT                  |                 | ALIGN   | AUTO     |           |                 | 11:4          | 44:43 AM Ser               | 01.20    |
|---|------|---------------------------------|-----------------------|------------------------|---------------------|--------------------------------------|--------------------------|-----------------|---------|----------|-----------|-----------------|---------------|----------------------------|----------|
| enter   |      |                                 | 500000                |                        | PNO: Fa<br>FGain:Lo | ist 🗔                                | Trig: Free<br>#Atten: 30 |                 |         | Avg Type | : Log-Pwi | r               |               | TRACE 1<br>TYPE M<br>DET P | 234      |
| ) dB/div  |      | Ref Offset<br>Ref 9.94          |                       |                        |                     |                                      |                          |                 |         |          |           | N               |               | .402 2<br>2.182            |          |
| .06   |      | <b>V</b> 1                      |                       |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            |          |
| D.1   |      |                                 |                       |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            | -17.41 d |
| 0.1<br>0.1  |      |                                 | 3                     |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            |          |
| 0.1   |      | _                               | °,2 ↓                 |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            | -(       |
| 0.1   |      |                                 | Y I                   |                        |                     |                                      | ور الل سرارا درور        | ، بەلەر يىتار ب |         |          |           | والمرابلة والأد | and the first | with a shear the set       |          |
| 0.1 📷   |      |                                 | and the second second |                        | -                   |                                      |                          |                 |         |          |           |                 |               |                            |          |
|   |      |                                 |                       |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            |          |
|   |      |                                 |                       |                        |                     |                                      |                          |                 |         |          |           |                 |               |                            |          |
| 0.1   | 40 5 |                                 |                       |                        |                     |                                      |                          |                 |         |          |           |                 |               | on 24.0                    | 7.01     |
| enter   |      | 2 GHz<br>10 kHz                 |                       |                        |                     | #VBW                                 | / 300 kHz                |                 |         |          |           | Swee            |               | an 24.9<br>s (4000         |          |
| enter<br>Res B  | W 10 | 0 kHz                           |                       |                        |                     | Y                                    | FUN                      |                 | UNCTION | WIDTH    |           |                 |               | s (4000                    |          |
| enter<br>Res Bi   | W 10 | 10 kHz<br>scu<br>f (∆)<br>f     | 2.<br>3.              | 402 2 GHz<br>603 2 GHz | -                   | Y<br>2.182 d<br>45.634 d             | FUN<br>Bm<br>Bm          |                 | UNCTION | WIDTH    |           |                 | p 2.39        | s (4000                    |          |
| enter<br>Res B<br>1 N<br>2 N<br>3 N   | W 10 | 10 kHz<br>501<br>f (Δ)<br>f (Δ) | 2.<br>3.<br>4.        | 603 2 GHz<br>804 3 GHz | (Δ)                 | Y<br>2.182 d<br>45.634 d<br>35.176 d | FUN<br>Bm<br>Bm<br>Bm    |                 | UNCTION | WIDTH    |           |                 | p 2.39        | s (4000                    |          |
| enter<br>Res B<br>Model<br>N<br>N<br>N<br>N<br>N<br>N<br>N<br>N<br>N<br>N     | W 10 | 10 kHz<br>scu<br>f (∆)<br>f     | 2.<br>3.<br>4.        | 603 2 GHz              | (Δ)                 | Y<br>2.182 d<br>45.634 d             | FUN<br>Bm<br>Bm<br>Bm    |                 | UNCTION | WIDTH    |           |                 | p 2.39        | s (4000                    |          |
| enter<br>Res B<br>1 N<br>2 N<br>3 N<br>4 N<br>5<br>5<br>7                     | W 10 | 10 kHz<br>501<br>f (Δ)<br>f (Δ) | 2.<br>3.<br>4.        | 603 2 GHz<br>804 3 GHz | (Δ)                 | Y<br>2.182 d<br>45.634 d<br>35.176 d | FUN<br>Bm<br>Bm<br>Bm    |                 | UNCTION | IWIDTH   |           |                 | p 2.39        | s (4000                    |          |
| enter<br>Res B<br>8 M000<br>1 N<br>2 N<br>3 N<br>4 N<br>5<br>6<br>6<br>7<br>7 | W 10 | 10 kHz<br>501<br>f (Δ)<br>f (Δ) | 2.<br>3.<br>4.        | 603 2 GHz<br>804 3 GHz | (Δ)                 | Y<br>2.182 d<br>45.634 d<br>35.176 d | FUN<br>Bm<br>Bm<br>Bm    |                 | UNCTION | I WIDTH  |           |                 | p 2.39        | s (4000                    |          |
| enter<br>Res B<br>1 N<br>3 N<br>4 N<br>5<br>6<br>8<br>9<br>9<br>0             | W 10 | 10 kHz<br>501<br>f (Δ)<br>f (Δ) | 2.<br>3.<br>4.        | 603 2 GHz<br>804 3 GHz | (Δ)                 | Y<br>2.182 d<br>45.634 d<br>35.176 d | FUN<br>Bm<br>Bm<br>Bm    |                 |         | IWIDTH   |           |                 | p 2.39        | s (4000                    |          |
| Res B<br>1 N<br>2 N<br>3 N  | W 10 | 10 kHz<br>501<br>f (Δ)<br>f (Δ) | 2.<br>3.<br>4.        | 603 2 GHz<br>804 3 GHz | (Δ)                 | Y<br>2.182 d<br>45.634 d<br>35.176 d | FUN<br>Bm<br>Bm<br>Bm    |                 |         | I WIDTH  |           |                 | p 2.39        | s (4000                    |          |

# 39 CH

|              |               | ectrur                                 |          | alyzer - Swe          |                             |              |                        |                          |                |         |          |           |                  |  |
|--------------|---------------|--|----------|-----------------------|-----------------------------|--------------|------------------------|--------------------------|----------------|---------|----------|-----------|------------------|--|
| IXI          |               |  | RF       |                       |                             |              | SE                     | ENSE:INT                 |                | ALIC    | GNAUTO   | : Log-Pwr | 11:5             | 3:11 AM Sep 01, 20:                            |
| Cer          | nter          | Fre                                    | p,       | 12.5150               |                             | PNO:<br>Gain |                        | Trig: Free<br>#Atten: 30 |                |         | AVg Type | : Log-Pwr |                  | TRACE 1 2 3 4 5<br>TYPE MWWWW<br>DET P P P P P |
|              | IB/div        |  |          | Offset 0.5<br>10.07 d |                             |              |                        |                          |                |         |          |           |                  | .440 9 GH<br>1.415 dBr                         |
| Log<br>0.070 |               |  | •        | 1                     |                             |              |                        |                          |                |         |          |           |                  |  |
| -9.93        |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  | -18.12 dB                                      |
| -19.9        | 1             |  |          |                       | ۸3                          |              |                        |                          |                |         |          |           |                  | -10.12 00                                      |
| -29.9        | 1             |  |          |                       |                             |              |                        |                          |                |         |          | _         |                  |  |
| -39.9        | 1             |  |          | $\wedge$              |                             |              |                        |                          |                |         |          |           |                  | $\bigcirc$                                     |
| -59.9        |               | en e fulle                             | الأجرائي | and the second        |                             |              |                        |                          | a la constante |         |          |           |                  |  |
| -69.9        |               | (************************************* |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
| -79.9        | -             |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
|              | nter<br>es Bi |  |          |                       |                             |              | #VBV                   | V 300 kH                 | z              |         |          | S         | Spa<br>weep 2.39 | an 24.97 GH<br>s (40001 pts                    |
| MKR<br>1     | MODE<br>N     | TRC                                    | sa       | (Δ)                   | ×<br>2.440 9 GHz            | (0)          | Y<br>1.415 d           |                          | NCTION         | FUNCTIO | DN WIDTH |           | FUNCTION VALUE   |  |
| 2            | N             | 1                                      | f        |                       | 3.661 3 GHz                 |              | -49.153 d              | Bm                       |                |         |          |           |                  |  |
| 3            | N<br>N        | 1                                      | f<br>f   | (Δ)                   | 4.882 3 GHz<br>24.465 6 GHz | ( <u>(</u> ) | -34.770 d<br>-48.450 d |                          |                |         |          |           |                  |  |
| 5<br>6       |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
|              |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
| 7            |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
| 8<br>9<br>10 |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |
| 8<br>9       |               |  |          |                       |                             |              |                        |                          |                |         |          |           |                  |  |

П



# 78 CH

|              |         | RF |                      | 2 AC         |                |                       | SENSE                  | EINT                   |       | ALI   | GN AUTO             |       |         |      |             | :54 AM Sep 01, 2                          |
|--------------|---------|----|----------------------|--------------|----------------|-----------------------|------------------------|------------------------|-------|-------|---------------------|-------|---------|------|-------------|---|
| nter         | · Fre   | pe | 12.515               | 000000 G     | Р              | 'NO: Fast<br>Gain:Low |                        | rig: Free<br>Atten: 30 |       |       | Avg Ty              | /pe:L | og-Pwr  |      |             | TRACE 1 2 3 4<br>TYPE MWMW<br>DET P P P F |
| dB/di        |         |    | Offset 0.<br>f 11.39 |              |                |                       |                        |                        |       |       |                     |       |         | Ν    |             | 480 2 G<br>I.391 dE                       |
| 9<br>39      |         |    | <b>1</b>             |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| 51           |         |    |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             | -17.81                                    |
| .6           |         |    |                      |              | 0              | 3                     |                        |                        |       |       |                     |       |         |      |             | -17.01                                    |
| 6            |         |    |                      |              | Y              | /                     |                        |                        |       |       |                     |       |         |      |             |   |
| .6           |         |    |                      | 2            |                |                       |                        |                        |       |       | and the state line. |       | L. June |      |             | الالداريس الدر                            |
| 6            | ener di |    |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| .6           |         |    |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| .6           |         |    |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| nter<br>es B |         |    |                      |              |                | :                     | #VBW 3                 | 00 kHz                 |       |       |                     |       |         | Swee |             | n 24.97 G<br>s (40001 p                   |
|              | E  TRC  |    |                      | ×            |                |                       | Y                      |                        | CTION | FUNCT | ION WIDTH           |       |         | FUN  | CTION VALUE |   |
|              | 1       | f  | (Δ)                  |              | 2 GHz<br>3 GHz |                       | l.391 dBn<br>8.194 dBn |                        |       |       |                     |       |         |      |             |   |
| N            |         | f  | (Δ)                  | 7.440 24.722 | 5 GHz          |                       | .044 dBn<br>.157 dBn   |                        |       |       |                     |       |         |      |             |   |
| NNN          | 1       |    |                      |              | o Griz         | -47                   | .157 000               |                        |       |       |                     |       |         |      |             |   |
| NNNN         | 1       | f  |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| N<br>N<br>N  |         | f  |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
|              |         | f  |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
|              |         | f  |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| N            |         | f  |                      |              |                |                       |                        |                        |       |       |                     |       |         |      |             |   |
| N<br>N<br>N  |         | f  |                      |              |                |                       |                        |                        |       |       | STATUS              |       |         |      |             |   |



П

Shenzhen STS Test Services Co., Ltd.

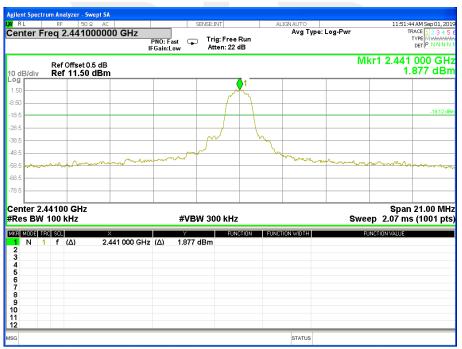


## For Band edge

00 CH

| RL                 |        |                      | rept SA                        |                        |                                  |  |  |                    |  |   |
|--------------------|--------|----------------------|--------------------------------|------------------------|----------------------------------|--|--|--------------------|--|---|
|                    | req 3  |                      |                                | PNO: Fast<br>FGain:Low | SENSE:INT<br>Trig: Fr<br>#Atten: |  | ALIGN AUTO<br>Avg Type   | : Log-Pwr          | TF   | 2 AM Sep 01, 2<br>RACE 1 2 3 4<br>TYPE M WAAAA<br>DET P P P P |
| ) dB/div           |        | Offset 0.<br>f 12.59 |                                |                        |                                  |  |  | N                  | lkr1 2.401<br>2.   | 867 GH<br>588 dB  |
| .59                |        |                      |                                |                        |                                  | _  |  |                    |  |   |
| 41<br>7.4          |        |                      |                                |                        |                                  |  |  |                    |  | -17.41  |
| .4                 |        |                      |                                |                        |                                  |  |  |                    |  |   |
| .4                 |        |                      |                                |                        |                                  |  |  |                    | $\wedge^2$   |   |
| .4                 | otueni | mennentra            | araana sharanga sharan         | aman m                 | wanderstitess worders            | ma and the state of the state o | angleda angleda<br>Angleda angleda | dathan minaidae un | and the state of t |   |
| .4                 |        |                      |                                |                        |                                  |  |  |                    |  |   |
| art 2.30<br>les BW |        |                      |                                | #                      | ¢VBW 300 ki                      | Ηz   |  | Swe                | Stop 2.<br>ep 9.87 ms  | 40300 <b>G</b><br>; (1001 p                                   |
| R MODE TF          |        |                      | X                              |                        |                                  | UNCTION  | FUNCTION WIDTH   |                    | FUNCTION VALUE   |   |
| N 1<br>N 1         | f      | (Δ)                  | 2.401 867 GHz<br>2.390 022 GHz |                        | 588 dBm<br>765 dBm               |  |  |                    |  |   |
| 8 N 1<br>4<br>5    |        | (Δ)                  | 2.399 498 GHz                  |                        | 186 dBm                          |  |  |                    |  |   |
| 7<br>3<br>9        |        |                      |                                |                        |                                  |  |  |                    |  |   |
| 1                  |        |                      |                                |                        |                                  |  |  |                    |  |   |

39 CH





# 78 CH

|                                    | um Analyzer - Sv   |   |               |                     |   |                                    |  |
|------------------------------------|--|---|---------------|---------------------|---|------------------------------------|--|
| enter F                            |  | 2 AC<br>000000 GHz                                | PNO: Fast     | Trig: Free Run      | ALIGN AUTO<br>Avg Type  | : Log-Pwr                          | 11:35:26 AM Sep 01, 2<br>TRACE 1 2 3 4<br>TYPE M WWWW<br>DET P P P P   |
| ) dB/div                           | Ref Offset 0<br>Ref 12.19  | .5 dB   | IFGain:Low    | #Atten: 30 dB       |   | Mkr1                               | 2.479 840 GH<br>2.191 dB   |
| 19<br>81                           | 1  |   |               |                     |   |                                    |  |
| 1.8<br>1.8                         |  |   |               |                     |   |                                    | -17.81   |
| 1.8 <u></u>                        | - Martin - M | 2<br>martan                                       |               | 3                   |   |                                    |  |
| .8                                 |  |   |               | er handerkonservind | and a second and a s | A more the operation of the second | and a star and the star of the |
| art 2.47                           | '900 GHz<br>100 kHz  |   | #VB           | W 300 kHz           |   | Sweep                              | Stop 2.50000 G<br>2.07 ms (1001 p  |
| R MODE TR<br>N 1<br>2 N 1<br>3 N 1 | f (Δ)<br>f   | ×<br>2.479 840 GH<br>2.483 977 GH<br>2.488 009 GH | z -53.355     | dBm                 | FUNCTION WIDTH  | FUNCTIO                            | N VALUE  |
|                                    |  | 2.488 009 GH                                      | 2 (Δ) -52.909 | abm                 |   |                                    |  |
| <br> <br>                          |  |   |               |                     |   |                                    |  |
| 2                                  |  |   |               |                     |   |                                    |  |



П

Shenzhen STS Test Services Co., Ltd.

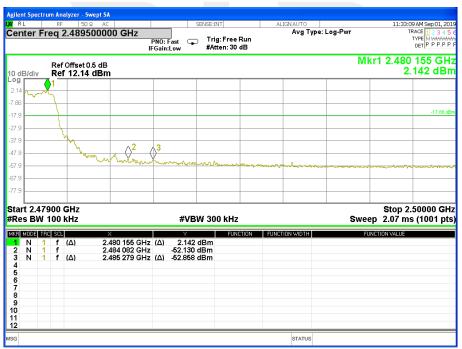


## For Hopping Band edge

00 CH

| gilent Spectrum Analyzer - Swept SA<br>RL RF 50 Ω AC  | SENSE:INT  | ALIGNAUTO  | 11:30:48 AM Sep 01, 20                    |
|---|--|--|---|
| enter Freq 2.351500000 GHz  | PNO: Fast Trig: Free R<br>IFGain:Low #Atten: 30 d  | Avg Type: Log-F<br>tun   | TRACE 12345<br>TYPE MUMANN<br>DET P P P F |
| Ref Offset 0.5 dB<br>0 dB/div Ref 12.35 dBm   |  |  | Mkr1 2.403 000 GH<br>2.346 dBi            |
| <b>0g</b><br>2.35   |  |  |   |
| 7.7   |  |  | -17.65 d                                  |
| 7.7   |  |  |   |
| 7.7   |  |  |   |
| 7.7   | ware at marked and a marked for the marked and the | ฟะตูปเรื่อว่า-นอาตุ(DR)ใจและเป็นจะว่างในจะสาว <sup>มการเร</sup> าด | anon 22 month of A                        |
| 7.7   |  |  |   |
| 7.7   |  |  |   |
| tart 2.30000 GHz<br>Res BW 100 kHz  | #VBW 300 kHz                                       |  | Stop 2.40300 Gi<br>Sweep 9.87 ms (1001 pt |
| KR         MODE         THC         Sci.         X           1         N         1         f         (Δ)         2.403 000 (Δ)         000 (Δ)           2         N         1         f         (Δ)         2.390 022 (Δ)         00 (Δ)           3         N         1         f         (Δ)         2.399 704 (Δ)         00 (Δ)           5         - <t< th=""><th>Hz -58.544 dBm</th><th>ION FUNCTION WIDTH</th><th>FUNCTION VALUE</th></t<> | Hz -58.544 dBm                                     | ION FUNCTION WIDTH   | FUNCTION VALUE                            |
| 1<br>2<br>6   |  | STATUS   |   |

78 CH



Shenzhen STS Test Services Co., Ltd.



# 5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

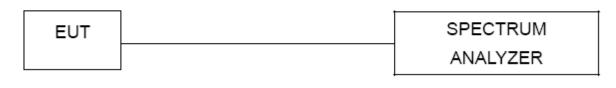
|                       | FCC Part 15.247,Subpart C    |       |                         |        |  |  |  |  |  |  |
|-----------------------|------------------------------|-------|-------------------------|--------|--|--|--|--|--|--|
| Section               | Test Item                    | Limit | FrequencyRange<br>(MHz) | Result |  |  |  |  |  |  |
| 15.247<br>(a)(1)(iii) | Number of Hopping<br>Channel | ≥15   | 2400-2483.5             | PASS   |  |  |  |  |  |  |

| Spectrum Parameters | Setting                    |
|---------------------|----------------------------|
| Attenuation         | Auto                       |
| Span Frequency      | > Operating FrequencyRange |
| RB                  | 300KHz                     |
| VB                  | 300KHz                     |
| 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= 300KHz, 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: | <b>25</b> ℃             | Relative Humidity: | 60%                  |
|--------------|-------------------------|--------------------|----------------------|
| Test Mode:   | Hopping Mode -GFSK Mode | Test Voltage:      | DC 3.7V from battery |

## Number of Hopping Channel

#### 79

## Hopping channel

| RL       |            | RF         | 50                        | DΩ AC           |                            |                        | SEN                | ISE:INT                  |        | AL   | IGN AUTO  |         | 10:06             | :17 AM Sep 01,                               |
|----------|------------|------------|---------------------------|-----------------|----------------------------|------------------------|--------------------|--------------------------|--------|------|-----------|---------|-------------------|--|
| nte      | r F        | req        | 2.441                     | 75000           |                            | PNO: Fast<br>FGain:Low |                    | Trig: Free<br>#Atten: 30 |        |      | Avg Type: | Log-Pwr |                   | TRACE 1 2 3 4<br>TYPE M WARAN<br>DET P P P F |
| dB/c     | liv        |            | Offset<br>f <b>12.0</b> 4 | 0.5 dB<br>4 dBm |                            |                        |                    |                          |        |      |           | Mkı     | 2 2.480           | 160 0 G<br>1.89 dE                           |
| 9<br>34  | ()1<br>IVV | w          | YYYY                      | ww              | www                        | MAAAA                  | m                  | mm                       | ww     | w    | mmm       | www     | www               | WWW  |
| 96       |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |
| .0       |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |
| .0<br>.0 |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |
| .0       |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |
| .0       |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |
|          |            | 000<br>300 | GHz<br>kHz                |                 |                            | i                      | #VBW               | 300 kH:                  | z      |      |           | Swe     | Stop<br>ep 1.13 r | 2.48350 G<br>ns (1001 p                      |
|          |            | ic sa      |                           | >               |                            | (4)                    | Y                  |                          | ICTION | FUNC | ION WIDTH | :       | UNCTION VALUE     |  |
| N        |            |            | (Δ)                       |                 | 2 171 0 GHz<br>0 160 0 GHz |                        | 2.08 dE<br>1.89 dE |                          |        |      |           |         |                   |  |
| ·<br>    |            |            |                           |                 |                            |                        |                    |                          |        |      |           |         |                   |  |

Shenzhen STS Test Services Co., Ltd.



## 6. AVERAGE TIME OF OCCUPANCY

#### 6.1 LIMIT

|                       | FCC Part 15.247,Subpart C    |        |                         |        |  |  |
|-----------------------|------------------------------|--------|-------------------------|--------|--|--|
| Section               | Test Item                    | Limit  | FrequencyRange<br>(MHz) | Result |  |  |
| 15.247<br>(a)(1)(iii) | Average Time<br>of Occupancy | 0.4sec | 2400-2483.5             | PASS   |  |  |

#### 6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer
- b. Set RBW =1MHz/VBW =3MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to e. zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- $\tilde{h}$ . Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). Sothe dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds.
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So he dwell time is the time duration of the pulse times  $5.06 \times 31.6 = 160$  within 31.6 seconds.
- k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the dwell time is the time duration of the pulse times  $10.12 \times 31.6 = 320$  within 31.6 seconds.

#### 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: | <b>25℃</b>              | Relative Humidity: | 50%                  |
|--------------|-------------------------|--------------------|----------------------|
| Test Mode:   | GFSK(1Mbps)-DH1/DH3/DH5 | Test Voltage:      | DC 3.7V from battery |

| Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|-------------|---------|----------------|---------------|-----------|
| DH1         | middle  | 0.385          | 0.123         | 0.4       |
| DH3         | middle  | 1.647          | 0.264         | 0.4       |
| DH5         | middle  | 2.898          | 0.309         | 0.4       |



Shenzhen STS Test Services Co., Ltd.



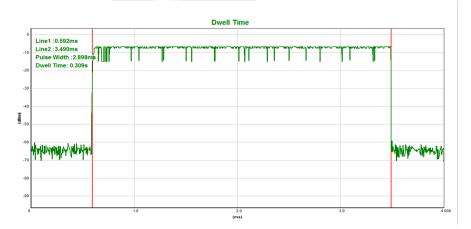
## CH39-DH1



## CH39-DH3



#### CH39-DH5



Shenzhen STS Test Services Co., Ltd.



Page 51 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                         | Relative Humidity: | 50%                  |
|--------------|-------------------------------------|--------------------|----------------------|
|              | π/4-DQPSK(2Mbps)–<br>2DH1/2DH3/2DH5 | Test Voltage:      | DC 3.7V from battery |

| Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|-------------|---------|----------------|---------------|-----------|
| 2DH1        | middle  | 0.396          | 0.127         | 0.4       |
| 2DH3        | middle  | 1.654          | 0.265         | 0.4       |
| 2DH5        | middle  | 2.896          | 0.309         | 0.4       |

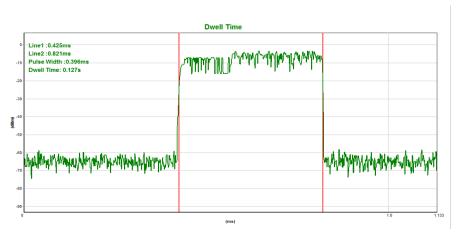


П

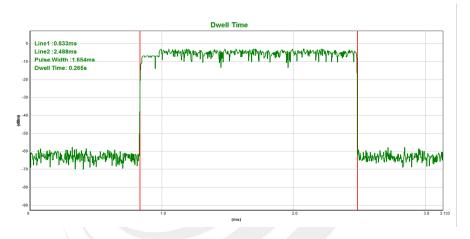
Shenzhen STS Test Services Co., Ltd.



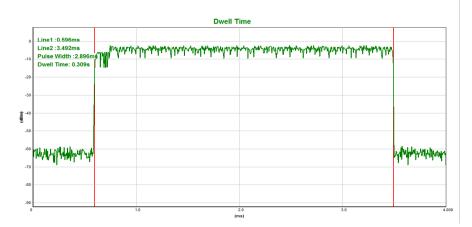
## CH39-2DH1



## CH39-2DH3



## CH39-2DH5





Page 53 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                     | Relative Humidity: | 50%                  |
|--------------|---------------------------------|--------------------|----------------------|
|              | 8DPSK(3Mbps)–<br>3DH1/3DH3/3DH5 | Test Voltage:      | DC 3.7V from battery |

| Data Packet | Channel | pulse time(ms) | Dwell Time(s) | Limits(s) |
|-------------|---------|----------------|---------------|-----------|
| 3DH1        | middle  | 0.397          | 0.127         | 0.4       |
| 3DH3        | middle  | 1.648          | 0.264         | 0.4       |
| 3DH5        | middle  | 2.907          | 0.310         | 0.4       |

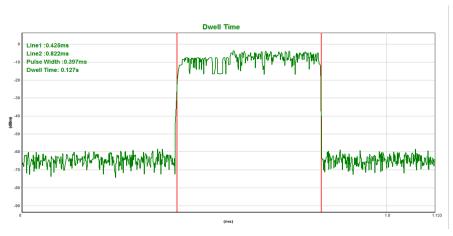


П

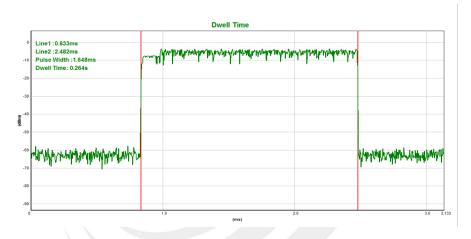
Shenzhen STS Test Services Co., Ltd.



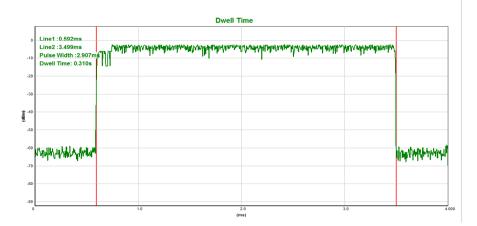
## CH39-3DH1



## CH39-3DH3



## CH39-3DH5





# 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

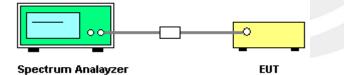
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

| Spectrum Parameter | Setting   |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | > 20 dB Bandwidth or Channel Separation                 |
| RB                 | 30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)   |
| VB                 | 100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation) |
| 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. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
- c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for channel separation measurement.

## 7.3 TEST SETUP



## 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



## 7.5 TEST RESULTS

| Temperature: | <b>25</b> ℃                              | Relative Humidity: | 50%                  |
|--------------|--|--------------------|----------------------|
|              | CH00 / CH39 / CH78<br>(GFSK(1Mbps) Mode) | Test Voltage:      | DC 3.7V from battery |

| Frequency | Mark1<br>Frequency<br>(MHz) | Mark2<br>Frequency<br>(MHz) | Ch.<br>Separation<br>(MHz) | Limit (MHz) | Result   |
|-----------|-----------------------------|-----------------------------|----------------------------|-------------|----------|
| 2402 MHz  | 2401.822                    | 2402.818                    | 0.996                      | 0.923       | Complies |
| 2441 MHz  | 2440.822                    | 2441.821                    | 0.999                      | 0.920       | Complies |
| 2480 MHz  | 2478.819                    | 2479.821                    | 1.002                      | 0.922       | Complies |

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

# CH00 -1Mbps



Shenzhen STS Test Services Co., Ltd.





## CH39 -1Mbps



#### CH78 -1Mbps





Page 58 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                                   | Relative Humidity: | 50%                  |
|--------------|---|--------------------|----------------------|
|              | CH00 / CH39 / CH78<br>(π/4-DQPSK(2Mbps) Mode) | Test Voltage:      | DC 3.7V from battery |

| Frequency | Mark1<br>Frequency<br>(MHz) | Mark2<br>Frequency<br>(MHz) | Ch.<br>Separation<br>(MHz) | Limit (MHz) | Result   |
|-----------|-----------------------------|-----------------------------|----------------------------|-------------|----------|
| 2402 MHz  | 2401.993                    | 2402.983                    | 0.990                      | 0.879       | Complies |
| 2441 MHz  | 2440.993                    | 2441.983                    | 0.990                      | 0.879       | Complies |
| 2480 MHz  | 2478.993                    | 2479.983                    | 0.990                      | 0.879       | Complies |

## For $\pi$ /4-DQPSK(2Mbps): Ch. Separation Limits: > two-thirds 20dB bandwidth

|                  |                        | Ω AC        |                     | SENSE:IN             | IT                      | ALIGN AUTO     |            |                     | AM Sep 01, 2                            |
|------------------|------------------------|-------------|---------------------|----------------------|-------------------------|----------------|------------|---------------------|---|
| enter F          | Freq 2.402             | 500000 GHz  | PNO: Wi<br>IFGain:L |                      | : Free Run<br>en: 30 dB | Avg Typ        | e: Log-Pwr | TRA<br>T'           | ICE 1 2 3 4<br>PE MWWW<br>DET P P P P   |
| dB/div           | Ref Offset<br>Ref 10.0 |             |                     |                      |                         |                | Mk         | r2 2.402 9<br>3.0   | 983 GH<br>)02 dB                        |
| 70               |                        |             | ()1                 |                      |                         | 2              | 2          |                     |   |
|                  |                        | ~~~~        | $\sim 1 \sim$       | $\sim$               | n                       | $\sim$         | V          |                     |   |
| 93               | ~                      |             | -                   |                      |                         |                |            | 5                   |   |
| 9.9              |                        |             |                     |                      |                         |                |            |                     |   |
| 9.9              | _ /                    |             |                     |                      |                         |                |            |                     | $\sim$                                  |
| .9               |                        |             |                     |                      |                         |                |            |                     | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ |
| 9.9              |                        |             |                     |                      |                         |                |            |                     |   |
| 9.9              |                        |             |                     |                      |                         |                |            |                     |   |
| .9               |                        |             |                     |                      |                         |                |            |                     |   |
| 9.9              |                        |             |                     |                      |                         |                |            |                     |   |
|                  |                        |             |                     |                      |                         |                |            |                     |   |
|                  | .402500 GH<br>∮ 30 kHz | lz          |                     | #VBW 10              | ) kHz                   |                | Swee       | Span 3<br>p 3.20 ms | 3.000 M<br>(1001 p                      |
| R MODE           |                        | ×           |                     | Y                    | FUNCTION                | FUNCTION WIDTH | FUN        | ICTION VALUE        |   |
| 1 N<br>2 N       | 1 f (Δ)<br>1 f         | 2.401 993 ( |                     | 0.07 dBm<br>3.00 dBm |                         |                |            |                     |   |
| 3                |                        | 2           |                     | 0.00 42              |                         |                |            |                     |   |
|                  |                        |             |                     |                      |                         |                |            |                     |   |
|                  |                        |             |                     |                      |                         |                |            |                     |   |
| 5                |                        |             |                     |                      |                         |                |            |                     |   |
| 4<br>5<br>7      |                        |             |                     |                      |                         |                |            |                     |   |
| 5<br>5<br>7<br>8 |                        |             |                     |                      |                         |                |            |                     |   |
| 5                |                        |             |                     |                      |                         |                |            |                     |   |

#### CH00 -2Mbps



#### CH39 -2Mbps

|        | RF           | 50 Ω .                   | AC                           |                         | SENSE:INT           |                            | ALIGN AUTO     |           | 10:46:43 AM Sej            |
|--------|--------------|--------------------------|------------------------------|-------------------------|---------------------|----------------------------|----------------|-----------|----------------------------|
| er Fro | eq 2         | .441500                  | 000 GHz                      | PNO: Wide<br>IFGain:Low | Trig: Fr<br>#Atten: | ee Run<br>30 dB            | Avg Type       | : Log-Pwr | TRACE 1<br>TYPE M<br>DET P |
|        |              | Offset 0.5 d<br>9.34 dBn |                              |                         |                     |                            |                | М         | kr2 2.441 983<br>1.696     |
| 418    | Rei          | 3.34 UDI                 |                              | ()1                     |                     |                            | 2              |           |                            |
|        |              |                          |                              |                         | ~ ~ ~               | -                          | $h \wedge$     |           |                            |
|        |              | ~~~                      | $\gamma \sim $               |                         | - man               | $\gamma\gamma\gamma\gamma$ | ~~~            | y when    | $\sim$                     |
|        |              | ~                        |                              |                         |                     |                            |                |           | - <u></u>                  |
|        | _/           |                          |                              |                         |                     |                            |                |           |                            |
| $\sim$ | $\checkmark$ |                          |                              |                         |                     |                            |                |           | $\sim$                     |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
| r 2.4  | 4150         | 00 GHz                   |                              |                         |                     |                            |                |           | Span 3.00                  |
| BW 3   | 10 kł        | Ηz                       |                              | #                       | VBW 100 k           | Hz                         |                | Swe       | ep 3.20 ms (100            |
| DE TRO |              |                          | X                            |                         |                     | UNCTION                    | FUNCTION WIDTH | FU        | UNCTION VALUE              |
| 1      | f<br>f       | ( <u>仏</u> )             | 2.440 993 GH<br>2.441 983 GH | lz (∆) -t<br>iz ∕       | .65 dBm<br>.70 dBm  |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |
|        |              |                          |                              |                         |                     |                            |                |           |                            |

#### CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.



Page 60 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                              | Relative Humidity: | 50%                  |
|--------------|--|--------------------|----------------------|
|              | CH00 / CH39 / CH78<br>(8DPSK(3Mbps)Mode) | Test Voltage:      | DC 3.7V from battery |

| Frequency | Mark1<br>Frequency<br>(MHz) | Mark2<br>Frequency<br>(MHz) | Ch.<br>Separation<br>(MHz) | Limit (MHz) | Result   |
|-----------|-----------------------------|-----------------------------|----------------------------|-------------|----------|
| 2402 MHz  | 2401.990                    | 2402.983                    | 0.993                      | 0.844       | Complies |
| 2441 MHz  | 2440.993                    | 2441.983                    | 0.990                      | 0.845       | Complies |
| 2480 MHz  | 2478.993                    | 2479.983                    | 0.990                      | 0.846       | Complies |

For 8DPSK(3Mbps):Ch. Separation Limits: > two-thirds 20dB bandwidth

CH00 -3Mbps

| RL                                   | RF                     | 50 Ω AC              |                    | SENSE:INT      | ALIGN AUTO                              |           | 11:42:04 AM Sep 01, 2                  |
|--------------------------------------|------------------------|----------------------|--------------------|----------------|---|-----------|--|
| enter                                | Freq 2.40              | 2500000 GHz          | PNO: Wide 🕞        | Trin Free Door | Avg Type:                               | : Log-Pwr | TRACE 1234<br>TYPE MMMM<br>DET P P P P |
| 0 dB/di                              |                        | et 0.5 dB<br>.07 dBm |                    |                |   | Mkr2      | 2.402 983 GI<br>2.379 dB               |
| og<br>070                            |                        |                      | 1                  |                | 2                                       |           |  |
|                                      |                        |                      | $\sim\sim\sim\sim$ |                | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | $\sim$    |  |
| .93                                  |                        | 1                    |                    |                |   |           | m                                      |
| 9.9                                  |                        |                      |                    |                |   |           | ~                                      |
| 9.9                                  | ~ (                    |                      |                    |                |   |           |  |
| 9.9 👡                                |                        |                      |                    |                |   |           | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~       |
| 9.9                                  |                        |                      |                    |                |   |           |  |
| 9.9                                  |                        |                      |                    |                |   |           |  |
| 9.9                                  |                        |                      |                    |                |   |           |  |
| 9.9                                  |                        |                      |                    |                |   |           |  |
|                                      |                        |                      |                    |                |   |           |  |
|                                      | 2.402500 (<br>W 30 kHz | GHz                  | #VB                | W 100 kHz      |   | Sweep     | Span 3.000 M<br>3.20 ms (1001 p        |
| zel woor                             | TRC SCL<br>1 f (Δ)     | ×<br>2.401 990 GH;   | Υ<br>(Δ) 0.07      | FUNCTION       | FUNCTION WIDTH                          | FUNCT     | ON VALUE                               |
|                                      |                        | 2.402 983 GH         |                    |                |   |           |  |
| 1 N<br>2 N                           | 1 f                    | 2.402 300 011        |                    |                |   |           |  |
| 1 N<br>2 N<br>3                      |                        | 2.402 300 011        |                    |                |   |           |  |
| 1 N<br>2 N<br>3<br>4<br>5            |                        | 2.402 300 611        |                    |                |   |           |  |
| 1 N<br>2 N<br>3<br>4<br>5<br>6       |                        | 2.402 300 011        |                    |                |   |           |  |
| 1 N<br>2 N<br>3<br>4<br>5<br>6<br>7  |                        | 2.402 300 011        |                    |                |   |           |  |
| 1 N<br>2 N<br>3 4<br>5 6<br>7 8<br>9 |                        | 2.402 505 611        |                    |                |   |           |  |
| 1 N<br>2 N<br>3<br>4<br>5<br>6<br>7  |                        | 2.402.300 011        |                    |                |   |           |  |

Shenzhen STS Test Services Co., Ltd.



## CH39 -3Mbps

|        |        | RF           | 50 Ω                  | AC       |          |              | SENSE:INT             |                 | ALIGN.   |           |           | 11:4            | 7:37 AM Sep 0                        |
|--------|--------|--------------|-----------------------|----------|----------|--------------|-----------------------|-----------------|----------|-----------|-----------|-----------------|--------------------------------------|
| er     | Fre    | èq 2         | 2.44150               | 0000 GH  | PNO      | :Wide G      | ⊃ Trig: Fi<br>#Atten: | ee Run<br>30 dB |          | Avg Type: | : Log-Pwr |                 | TRACE 1 2 3<br>TYPE MWW<br>DET P P F |
| /div   |        |              | Offset 0.5<br>9.37 dE |          |          |              |                       |                 |          |           | P         | Mkr2 2.44       | l1 983 (<br>1.719 d                  |
| 7411   |        | nei          | 5.01 GE               |          |          | ⊘1           |                       |                 |          | 2         |           |                 |                                      |
|        |        |              |                       |          | $\sim n$ | $\prec \sim$ | -                     |                 |          | $\sim$    | ~ ~       |                 |                                      |
|        |        |              |                       |          | ~ +      |              | $\sim$                | $\sim$          | ~~       | ~         |           | m_              |                                      |
|        |        |              | -                     |          |          |              |                       |                 |          |           |           | \               |                                      |
|        |        | - 1          | 1                     |          |          |              |                       |                 |          |           |           |                 | <u>\</u>                             |
| _      | $\sim$ | $\checkmark$ |                       |          |          |              |                       |                 |          |           |           |                 | $\wedge$                             |
| ~      |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        | 415<br>10 k  | 00 GHz<br>Hz          |          |          | #VE          | 3W 100 k              | Hz              |          |           | Sw        | Sp<br>veep 3.20 | an 3.000<br>ms (1001                 |
|        |        | SCL          |                       | х        |          | Y            |                       | FUNCTION        | FUNCTION | WIDTH     |           | FUNCTION VALU   |                                      |
| N<br>N | 1      | f            | (Δ)                   | 2.440 99 | 3 GHz (Δ |              | dBm<br>dBm            |                 |          |           |           |                 |                                      |
|        | 1      | 1            |                       | 2.441 30 | 0 01 12  | 1.72         |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |
|        |        |              |                       |          |          |              |                       |                 |          |           |           |                 |                                      |

#### CH78 -3Mbps



Shenzhen STS Test Services Co., Ltd.



# 8. BANDWIDTH TEST

## 8.1 LIMIT

|   | FCC Part15 15.247,Subpart C |           |                  |                         |        |  |  |  |
|---|-----------------------------|-----------|------------------|-------------------------|--------|--|--|--|
| Ī | Section                     | Test Item | Limit            | FrequencyRange<br>(MHz) | Result |  |  |  |
|   | 15.247<br>(a)(1)            | Bandwidth | (20dB bandwidth) | 2400-2483.5             | PASS   |  |  |  |

| Spectrum Parameter | Setting   |
|--------------------|---|
| Attenuation        | Auto  |
| Span Frequency     | > Measurement Bandwidth or Channel Separation           |
| RB                 | 30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)   |
| VB                 | 100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation) |
| 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= 30KHz, VBW=100KHz, Sweep time = Auto.

## 8.3 TEST SETUP

| EUT | SPECTRUM |
|-----|----------|
|     | ANALYZER |

## **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.

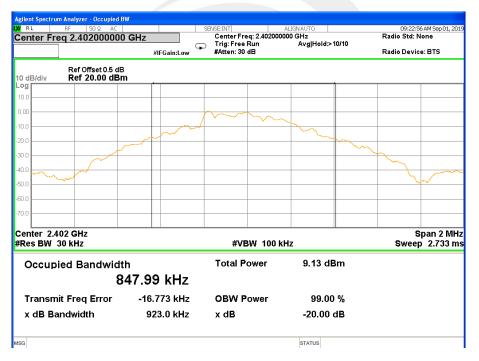


## 8.5 TEST RESULTS

| Temperature: | <b>25</b> ℃                      | Relative Humidity: | 50%                  |
|--------------|----------------------------------|--------------------|----------------------|
|              | GFSK(1Mbps)<br>CH00 / CH39 / C78 | Test Voltage:      | DC 3.7V from battery |

| Frequency | 20dB Bandwidth<br>(MHz) | Result |
|-----------|-------------------------|--------|
| 2402 MHz  | 0.923                   | PASS   |
| 2441 MHz  | 0.92                    | PASS   |
| 2480 MHz  | 0.922                   | PASS   |

## CH00 -1Mbps



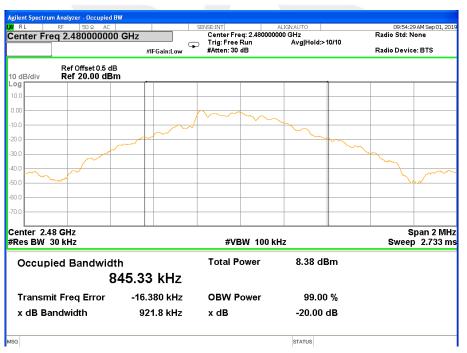
Shenzhen STS Test Services Co., Ltd.



## CH39 -1Mbps



CH78 -1Mbps



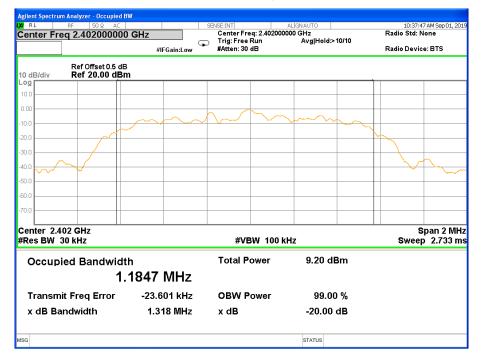


Page 65 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                           | Relative Humidity: | 50%                  |
|--------------|---------------------------------------|--------------------|----------------------|
|              | π/4-DQPSK(2Mbps)<br>CH00 / CH39 / C78 | Test Voltage:      | DC 3.7V from battery |

| Frequency | 20dB Bandwidth<br>(MHz) | Result |
|-----------|-------------------------|--------|
| 2402 MHz  | 1.318                   | PASS   |
| 2441 MHz  | 1.319                   | PASS   |
| 2480 MHz  | 1.319                   | PASS   |

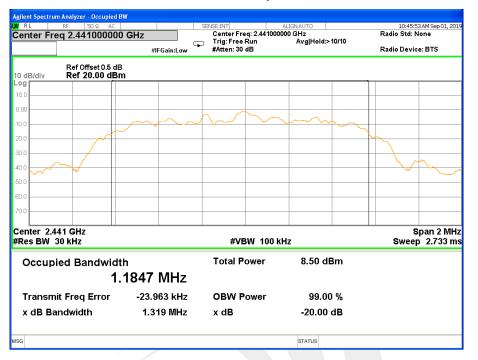
#### CH00 -2Mbps



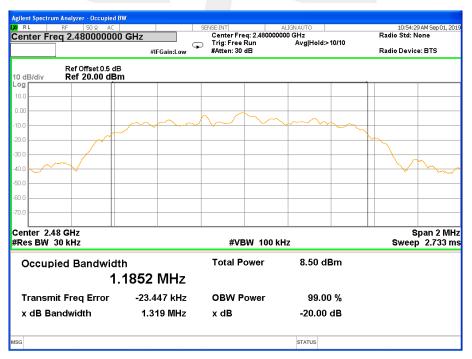
Shenzhen STS Test Services Co., Ltd.



#### CH39 -2Mbps



#### CH78 -2Mbps





Page 67 of 72 Report No.: STS1908110W01

| Temperature: | <b>25</b> ℃                        | Relative Humidity: | 50%                  |
|--------------|------------------------------------|--------------------|----------------------|
|              | 8DPSK(3Mbps)<br>CH00 / CH39 / CH78 | Test Voltage:      | DC 3.7V from battery |

| Frequency | 20dB Bandwidth<br>(MHz) | Result |
|-----------|-------------------------|--------|
| 2402 MHz  | 1.266                   | PASS   |
| 2441 MHz  | 1.268                   | PASS   |
| 2480 MHz  | 1.269                   | PASS   |

## CH00 -3Mbps

|   | GHz               | SENSE:INT<br>Center Freq: 2.402000<br>Trig: Free Run | ALIGN AUTO<br>DOO GHz<br>Avg Hold:>10/10 | 11:39:46 AM Sep 01,<br>Radio Std: None |
|---|-------------------|--|--|--|
|   | با<br>#IFGain:Low | #Atten: 30 dB  | Avginola.> lone                          | Radio Device: BTS                      |
| Ref Offset 0.5 dB<br>dB/div Ref 20.00 dBn |                   |  |  |  |
| 0   |                   |  |  |  |
| 0   |                   | -  |  |  |
|   | ~~~~~~            |  | Ymm_                                     |  |
|   |                   |  |  |  |
|   |                   |  |  |  |
|   |                   |  |  | - Von                                  |
| D   |                   |  |  |  |
| D   |                   |  |  |  |
| )   |                   |  |  |  |
| nter 2.402 GHz<br>es BW 30 kHz            |                   | #VBW 100 k   | Hz                                       | Span 2 M<br>Sweep 2.733                |
| Occupied Bandwidt                         | h                 | Total Power  | 9.48 dBm                                 |  |
| 1.  | 1672 MHz          |  |  |  |
| Transmit Freq Error                       | -8.578 kHz        | OBW Power  | 99.00 %                                  |  |
| x dB Bandwidth                            | 1.266 MHz         | x dB   | -20.00 dB                                |  |
|   |                   |  |  |  |

Shenzhen STS Test Services Co., Ltd.

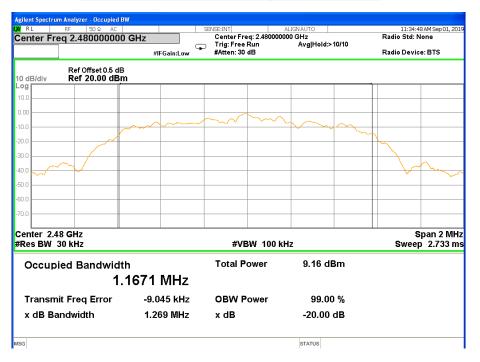
Ħ



## CH39 -3Mbps



#### CH78 -3Mbps



Shenzhen STS Test Services Co., Ltd.



# 9. OUTPUT POWER TEST

## 9.1 LIMIT

| FCC Part 15.247,Subpart C            |  |               |                         |        |  |
|--------------------------------------|--|---------------|-------------------------|--------|--|
| Section                              | Test Item  | Limit         | FrequencyRange<br>(MHz) | Result |  |
| 15.247                               | Output   | 1 W or 0.125W |                         |        |  |
| 15.247 Output<br>(a)(1)&(b)(1) Power | if channel separation ><br>2/3 bandwidthprovided<br>thesystems operatewith an<br>output power no greater<br>than125 mW(20.97dBm) | 2400-2483.5   | PASS                    |        |  |

## 9.2 TEST PROCEDURE

a. The EUT was directly connected to the Power Sensor&PC

## 9.3 TEST SETUP

| EUT Power s | ensor PC |
|-------------|----------|
|-------------|----------|

## 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:  | <b>25℃</b>           | Relative Humidity: | 60% |
|---------------|----------------------|--------------------|-----|
| Test Voltage: | DC 3.7V from battery |                    |     |

| Mode     | Channel      | Frequency | Peak Power | Average<br>Power | Limit |
|----------|--------------|-----------|------------|------------------|-------|
|          | Number (MHz) | (dBm)     | (dBm)      | (dBm)            |       |
|          | 0            | 2402      | 2.68       | 1.43             | 30.00 |
| GFSK(1M) | 39           | 2441      | 2.49       | 1.20             | 30.00 |
|          | 78           | 2480      | 1.85       | 0.26             | 30.00 |

## Note: the channel separation >20dB bandwidth

| Mode Channel Number |        | Peak Power | Average<br>Power | Limit |       |
|---------------------|--------|------------|------------------|-------|-------|
|                     | Number | (MHz)      | (dBm)            | (dBm) | (dBm) |
|                     | 0      | 2402       | 5.17             | 1.35  | 20.97 |
| π/4-DQPSK(<br>2M)   | 39     | 2441       | 4.90             | 1.05  | 20.97 |
| ,                   | 78     | 2480       | 4.93             | 1.26  | 20.97 |

Note: the channel separation >2/3 20dB bandwidth

| Mode       | Channel<br>Number | Frequency<br>(MHz) | Peak Power | Average<br>Power | Limit |
|------------|-------------------|--------------------|------------|------------------|-------|
|            |                   |                    | (dBm)      | (dBm)            | (dBm) |
| 8-DPSK(3M) | 0                 | 2402               | 5.97       | 1.52             | 20.97 |
|            | 39                | 2441               | 5.51       | 1.10             | 20.97 |
|            | 78                | 2480               | 5.72       | 1.12             | 20.97 |

Note: the channel separation >2/3 20dB bandwidth



## 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 ceramics Antenna. It comply with the standard requirement.



Shenzhen STS Test Services Co., Ltd.



## **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 \* \* \* \* \*



Shenzhen STS Test Services Co., Ltd.