# JAPAN TEST REPORT

Report No.:STS2008286W01

Issued for

Shenzhen MegaSig Measurement & Control Technology Co., Ltd.

Room 403, Building 63, Majialong Industrial Park, Nanshan, Shenzhen, China

| | |
|---|---|
| **Product Name:** | Smart Dongle |
| **Brand Name:** | MegaSig |
| **Test Model Name:** | U980 |
| **Series Model:** | N/A |
| **Test Standard:** | Article 2 Paragraph 1 of Item 19, annex 43 and annex 1 |



Shenzhen STS Test Services Co., Ltd.
A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China
TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com

# TEST RESULT CERTIFICATION

| | |
|---|---|
| **Applicant's Name** ..... : | Shenzhen MegaSig Measurement & Control Technology Co., Ltd. |
| Address ..... : | Room 403, Building 63, Majialong Industrial Park, Nanshan, Shenzhen, China |
| **Manufacturer's Name** ..... : | Shenzhen MegaSig Measurement & Control Technology Co., Ltd. |
| Address ..... : | Room 403, Building 63, Majialong Industrial Park, Nanshan, Shenzhen, China |

**Test Specification:**

Standard..... : Article 2 Paragraph 1 of Item 19, annex 43 and annex 1

**Product Description**

Product Name ..... : Smart Dongle

Trade Mark ..... : MegaSig

Test Model Name ..... : U980

Series Model ..... : N/A

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with Article 2 Paragraph 1 of Item 19, annex 43 and annex 1 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.

**Testing**..... :

Date of receipt of test item ..... : 24 Aug. 2020

Date (s) of performance of tests..... : 24 Aug. 2020 ~ 01 Sep. 2020

Date of Issue ..... : 01 Sep. 2020

Test Result ..... : **Pass**

Testing Engineer : Chris Chen

(Chris Chen)

Technical Manager : Sean She

(Sean she)

Authorized Signatory : Vita Li

(Vita Li)

## Table of Contents

## Revision History

| Rev. | Issue Date | Report NO. | Effect Page | Contents |
|---|---|---|---|---|
| 00 | 01 Sep. 2020 | STS2008286W01 | ALL | Initial Issue |
| | | | | |

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards: STD-T66 V3.7.

| Rule Section | Description of Test | jugement |
|---|---|---|
| 3.2(4) | Frequency Error | PASS |
| 3.2(7),(8) | Occupied Bandwidth (99%)<br>Spread-spectrum Bandwidth (90%) | PASS |
| 3.2(6) | Unwanted Emission Intensity | PASS |
| 3.2(3) | Power Error | PASS |
| 3.3 | Limitation of Collateral Emission of Receiver | PASS |
| 3.6 | Transmission Radiation power | PASS |
| 3.6 | Transmission Radiation Angle Width (3DB Beamwidth) | N/A |
| 3.4 | Radio Interference Prevention Capability | PASS |
| 3.2(9) | Spreading Factor | PASS |
| 3.2(11) | Dwell Time | PASS |
| Note(2) | Carrier Sense Capability | N/A |
| 3.7 | Construction Protection Confirmation | PASS |

NOTE:
(1) “N/A” means test is not applicable in this Test Report.
(2) Article 2 Paragraph 1 of Item 19, annex 43 and annex 1.
(3) Section 4.17 Radio Equipment of Radio Stations of a Low-Power Data Communication System (Article 49.20).

## 1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD
Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

## 1.2 MEASUREMENT UNCERTAINTY

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

| No. | Item | Uncertainty |
|---|---|---|
| 1 | RF output power, conducted | ±0.68dB |
| 2 | Unwanted Emissions, conducted | ±2.988dB |

# 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

<table>
<tr><td>Equipment</td><td>Smart Dongle</td></tr>
<tr><td>Band Name</td><td>MegaSig</td></tr>
<tr><td>Model Name</td><td>U980</td></tr>
<tr><td>Series Model</td><td>N/A</td></tr>
<tr><td>Serial model describing</td><td>N/A</td></tr>
<tr><td>Product Description</td><td>The EUT is a Smart Dongle
<table>
<tr><td>Operation Frequency:</td><td>2402~2480 MHz</td></tr>
<tr><td>Modulation Type:</td><td>FHSS</td></tr>
<tr><td>Bit Rate of Transmitter:</td><td>GFSK/π/4-DQPSK/8DPSK</td></tr>
<tr><td>Number Of Channel:</td><td>79 CH</td></tr>
<tr><td>Antenna Designation:</td><td>Please refer to the Note 3.</td></tr>
<tr><td>Antenna Gain(Peak):</td><td>2.5dBi</td></tr>
</table>
Based on the application, features, or specification exhibited in User Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User Manual.</td></tr>
<tr><td>Channel List</td><td>Please refer to the Note 2.</td></tr>
<tr><td>Power Rating</td><td>Input: Power by USB 5V</td></tr>
<tr><td>Hardware version</td><td>V1.3.15</td></tr>
<tr><td>Software version</td><td>V1.3.15</td></tr>
<tr><td>Connecting I/O Port(s)</td><td>Please refer to the Note 1.</td></tr>
</table>

Note:

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

2.

| Channel List | | | | | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 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. | Antenna Brand | Antenna Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|---|---|---|---|---|---|---|
| 1 | EBYTE | TX2400-JK-11 | Rod antenna | N/A | 2.5dBi | BT 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.

| Pretest Mode | Description |
|---|---|
| Mode 1 | GFSK(CH00 CH39 CH78) |
| Mode 2 | π/4-DQPSK (CH00 CH39 CH78) |
| Mode 3 | 8DPSK (CH00 CH39 CH78) |

| **For Conducted Emission** | |
|---|---|
| Final Test Mode | Description |
| Mode 1 | GFSK(CH00 CH39 CH78) |
| Mode 2 | π/4-DQPSK (CH00 CH39 CH78) |
| Mode 3 | 8DPSK (CH00 CH39 CH78) |

## 2.3 TEST CONDITIONS

The BT module was tested while in a continuous transmitter/receiver mode.
The EUT was tuned to a low, middle, and high channel for all tests. For all test case pre/scans were completed in all Modes to determine worst case levels.

Power Supply Voltage Fluctuation Test

| Voltage Fluctuation Test | Normal Voltage | High Voltage +10% of Normal Voltage | Low Voltage -10% of Normal Voltage |
|---|---|---|---|
| Input DC Power(V) | 5 | 5.5 | 4.5 |
| RF Chip Input DC Power(V) | 3.312 | 3.321 | 3.309 |
| Voltage Variation (%) | / | 0.27 | -0.09 |

Note: 1. Voltage Variation (%)
= (RF chip Input high or Low Voltage - RF chip Input Normal Voltage)/ RF chip Input Normal Voltage* 100
2. RF chip Input DC power fluctuation is verified at the power input PIN of the RF chip.

When the input supply voltage to the EUT from the external power source is varied by +/- 10%, the output voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than +/-1%, and the DC power fluctuation at the power input PIN of the RF chip is equal to or less than +/-1%.Exempt extremely high and low supply voltage condition tests, EUT only operated in normal voltage to test all regulations.

## 2.4 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.

| RF Function | Type | Mode Or Modulation type | Ant Gain(dBi) | Power Class | Software For Testing |
|---|---|---|---|---|---|
| BT | BR+EDR | GFSK | 2.5 | 20 | Blue Test3 |
| | | π/4-DQPSK | | 20 | |
| | | 8DPSK | | 20 | |

## 2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Mode 1:

E-1
EUT

## 2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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

Necessary accessories

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

Support units

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

Note:

(1) For detachable type I/O cable should be specified the length in cm in 『Length』 column.

## 2.7 EQUIPMENTS LIST FOR ALL TEST ITEMS

**Test Equipment**

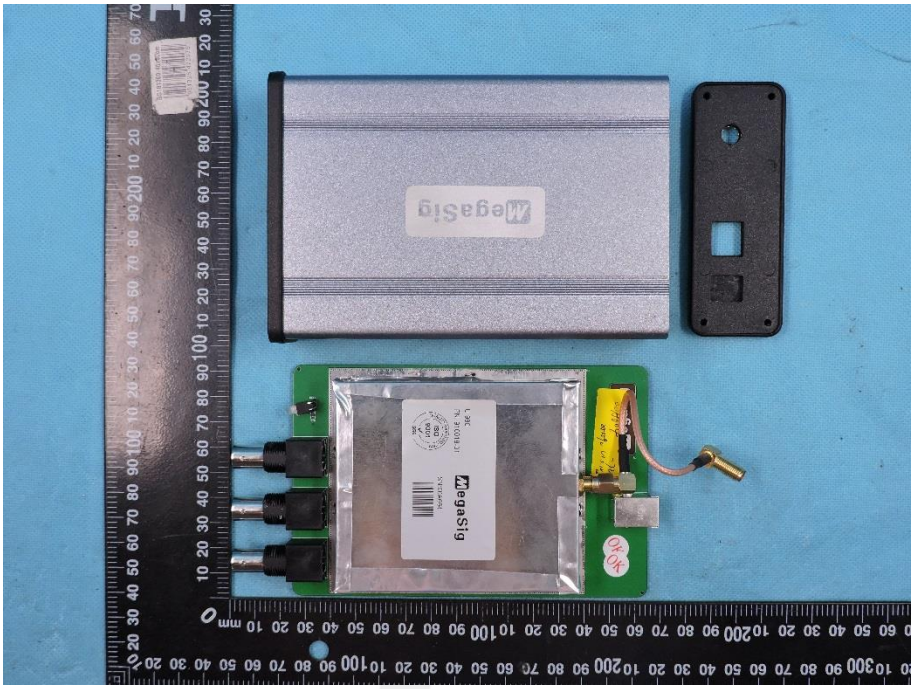
| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---|---|---|---|---|---|
| USB RF power sensor | DARE | RPR3006W | 15I00041SNO03 | 2019.10.09 | 2020.10.08 |
| Signal Generator | Agilent | N5182A | MY46240556 | 2019.10.09 | 2020.10.08 |
| Signal Analyzer | Agilent | N9020A | MY49100060 | 2019.10.09 | 2020.10.08 |
| Wireless Communications Test Set | R&S | CMW 500 | 133884 | 2020.03.05 | 2021.03.04 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2019.10.17 | 2020.10.16 |
| Temperature& Humidity test chamber | Safety test | AG80L | 171200018 | 2020.03.05 | 2021.03.04 |
| programmable power supply | Agilent | E3642A | MY40002025 | 2019.10.11 | 2020.10.10 |
| Attenuator | HP | 8494B | DC-18G | 2020.04.30 | 2021.04.29 |

**Test Equipment Calibration**

All of the test equipment is effective use and calibration certification institution, GRGT, the address is 163 tianhe district in huangpu road xiping cloud road .Guangzhou, China.

## 3. CONSTRUCTION PROTECTION CONFIRMATION

*Our products apply for Japanese radio frequency (rf) certification.* The RF IC is shielded by the shielding cover which is welded on the PCB, it can't be removed easily.



# 4. FREQUENCY ERROR

## 4.1 LIMIT

| Item | Limits |
|---|---|
| Frequency Error | ±50ppm |

## 4.2 TEST PROCEDURES

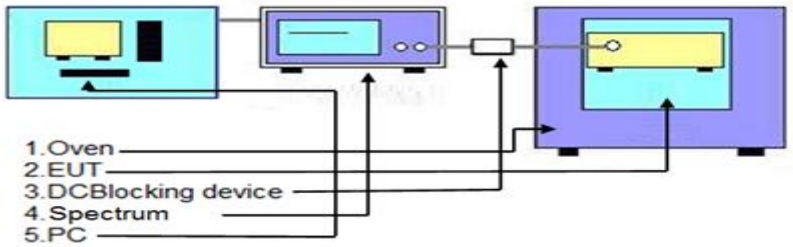
The following table is the setting of Spectrum Analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 10KHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

(1) In the case of unmodulated signal (continuous or continuous burst), measure the frequency directly by a frequency meter.
(2) In the case of burst waves, the measurement shall be done for enough time in order to obtain the enough measuring accuracy, and the average of the measured values becomes the final value.
(3) In the case of a test mode with a specific frequency spectrum, measure the frequency of the specific spectrum by a spectrum analyzer.
(4) In the cases above, if the frequency equivalent to the test frequency is not directly measured in principle, it shall be obtained by necessary calculation.

In the case of modulated signal, if there is no specific spectrum measurable by a spectrum analyzer but a specific dip is observed, it is allowed to measure the frequency with the signal generator (synthesized). That is, observe a signal of the signal generator concurrently (or alternately) with the tested signal using the spectrum analyzer while setting the frequency of the signal generator to the position of the dip on the screen of the spectrum analyzer, and determine the frequency of the signal generator at the time as a measured value.

## 4.3 TEST SETUP

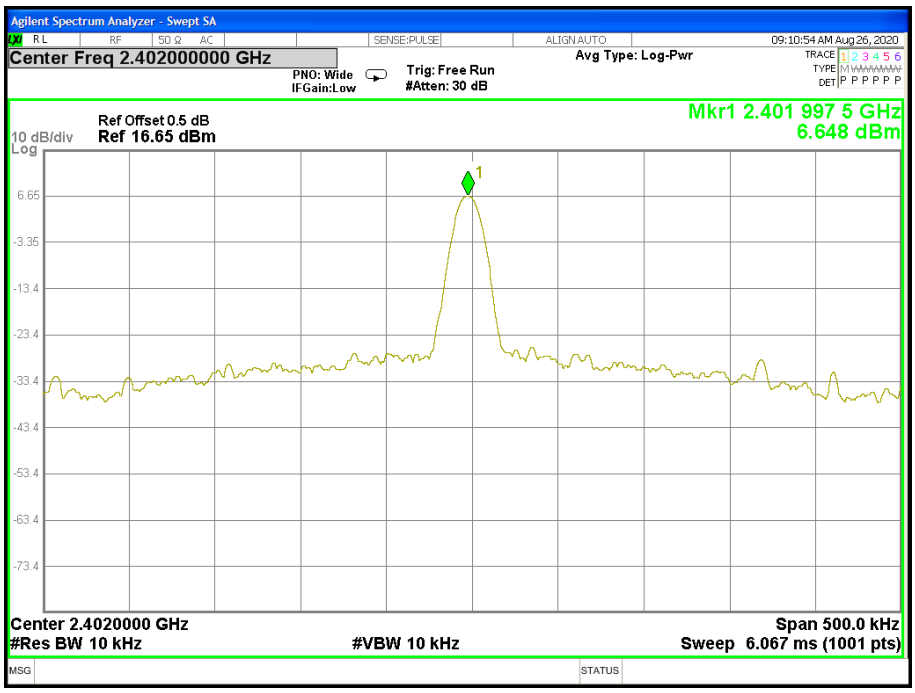


## 4.4 TEST RESULT

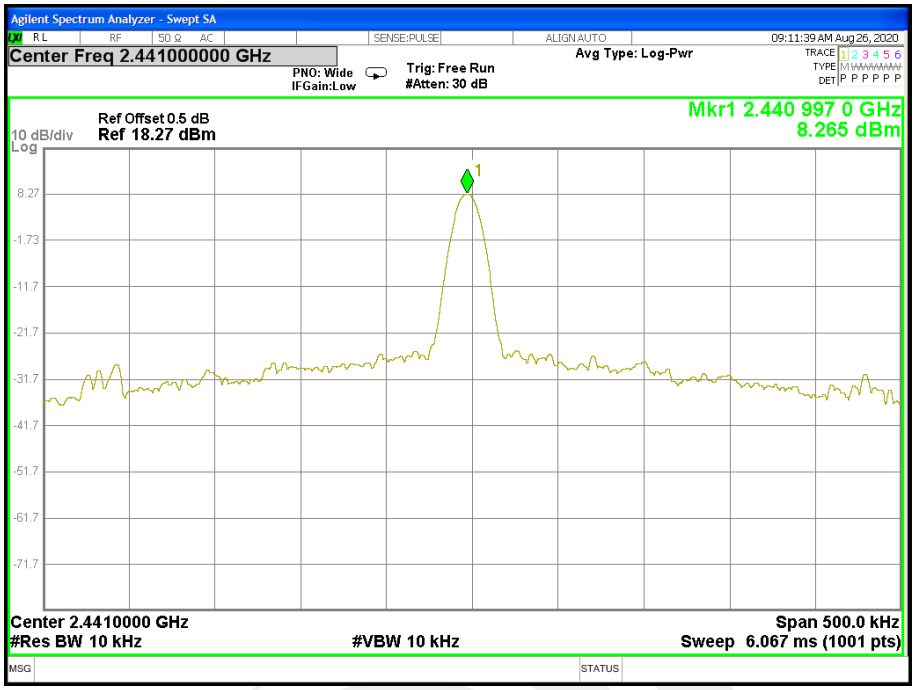
Carrier transmitting mode

| TEST CONDITIONS | | Channel | Reading | Tolerance | Limit |
|---|---|---|---|---|---|
| | | MHz | MHz | ppm | (ppm) |
| Nom (V) | 5.0V | 2402 | 2401.9975 | -1.041 | ±50 |
| | | 2441 | 2440.9970 | -1.229 | ±50 |
| | | 2480 | 2479.9985 | -0.605 | ±50 |

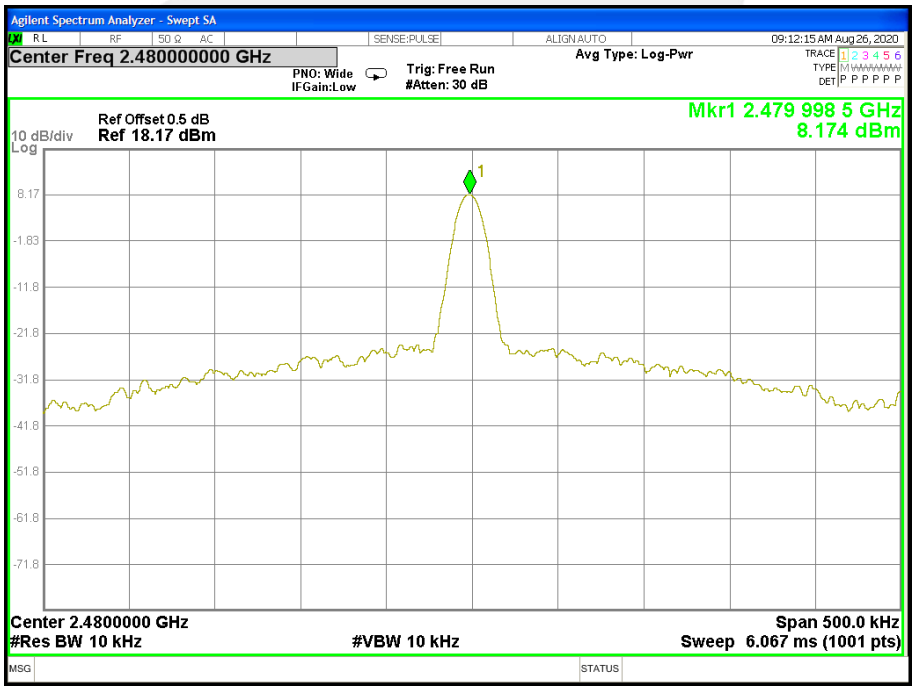
**CH00**



## CH39


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
09:11:39 AM Aug 26, 2020
Ref Offset 0.5 dB
10 dB/div
Log
Ref 18.27 dBm
Mkr1 2.440 997 0 GHz
8.265 dBm
8.27
-1.73
-11.7
-21.7
-31.7
-41.7
-51.7
-61.7
-71.7
Center 2.4410000 GHz
#Res BW 10 kHz
#VBW 10 kHz
Span 500.0 kHz
Sweep 6.067 ms (1001 pts)
MSG
STATUS

## CH78


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.480000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
09:12:15 AM Aug 26, 2020
Ref Offset 0.5 dB
10 dB/div
Log
Ref 18.17 dBm
Mkr1 2.479 998 5 GHz
8.174 dBm
8.17
-1.83
-11.8
-21.8
-31.8
-41.8
-51.8
-61.8
-71.8
Center 2.4800000 GHz
#Res BW 10 kHz
#VBW 10 kHz
Span 500.0 kHz
Sweep 6.067 ms (1001 pts)
MSG
STATUS

# 5. ANTENNA POWER

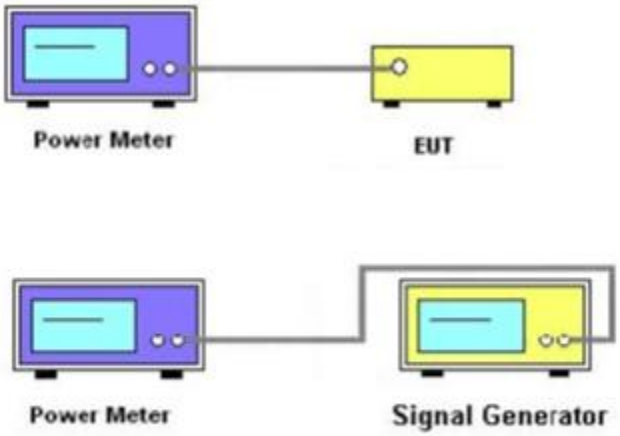
## 5.1 LIMIT

| Item | Limits |
|---|---|
| Antenna Power Density | ≦3mW/MHz (FH form 2400 – 2483.5 MHz)<br>≦10mW/MHz (OFDM,DS from2400~2483.5MHz,802.11b/g/n HT20)<br>≦5mW/MHz (OFDM,DS from2400~2483.5MHz,802.11n HT40)<br>≦10mW (Other from 2400~2483.5MHz) |
| Power Error | +20%, -80% (Base on manufacturer declare power) |

## 5.2 TEST PROCEDURE

1. EUT turn to test frequency channel and keep continuous transmiting.
2. Reading the output power from the Power meter as $P_{EUT.}$
3. Turn the Signal generator to frequency channel the same as the EUT.
4. Turn the level of Signal generator, scan with the power meter until the power equal to $P_{EUT}$, the level of Signal generator recorded as “P”.
5. The antenna power of EUT is “P”.
6. EIRP power=“P”+antenna gain.

## 5.3 TEST SETUP




## 5.3 TEST DEVIATION

There is no deviation with the original standard.

## 5.4 TEST RESULT

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | GFSK(Nor)TX | | |

| Modulation | TEST CONDITIONS | | Channel | Average Burst Power(dBm) | Average Burst Power(mW) | Spread Band Width (MHz) | Test Result for Antenna Power (mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance (%) |
|---|---|---|---|---|---|---|---|---|---|
| GFSK | Nom (V) | 5.0V | Hopping Channel | 6.4700 | 4.4361 | 70.8890 | 0.0626 | 0.0700 | -10.603 |
| Limit : (1) Antenna Power Density Limit (3mW/MHz)<br>(2) Tolerance +20%, -80% (Base on manufacturer declare Antenna Power Density) | | | | | | | | | |

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | π/4-DQPSK(Nor)TX | | |

| Modulation | TEST CONDITIONS | | Channel | Average Burst Power(dBm) | Average Burst Power(mW) | Spread Band Width (MHz) | Test Result for Antenna Power (mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance (%) |
|---|---|---|---|---|---|---|---|---|---|
| π/4-DQPSK | Nom (V) | 5.0V | Hopping Channel | 3.2100 | 2.0941 | 70.9240 | 0.0295 | 0.0300 | -1.580 |
| Limit : (1) Antenna Power Density Limit (3mW/MHz)<br>(2) Tolerance +20%, -80% (Base on manufacturer declare Antenna Power Density) | | | | | | | | | |

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | 8DPSK(Nor)TX | | |

| Modulation | TEST CONDITIONS | | Channel | Average Burst Power(dBm) | Average Burst Power(mW) | Spread Band Width (MHz) | Test Result for Antenna Power (mW/MHz) | Declared Antenna Power (mW/MHz) | Tolerance (%) |
|---|---|---|---|---|---|---|---|---|---|
| 8DPSK | Nom (V) | 5.0V | Hopping Channel | 3.6400 | 2.3121 | 70.4340 | 0.0328 | 0.0400 | -17.935 |
| Limit : (1) Antenna Power Density Limit (3mW/MHz)<br>(2) Tolerance +20%, -80% (Base on manufacturer declare Antenna Power Density) | | | | | | | | | |

# 6. RADIATION POWER

## 6.1 LIMIT

| Item | Limits |
|---|---|
| Radiation power EIRP | FH form 2427 - 2470.75 MHz ,EIRP≦6.91dBm/MHz<br>CCK/OFDM/DBPSK (2400~2483.5MHz)<br>OFDM or DS other than (802.11b/g/n HT20) EIRP≦12.14 dBm/MHz<br>OFDM or DS other than (802.11n HT40) EIRP≦9.13dBm/MHz<br>Other from 2400~2483.5MHz: 12.14 dBm or less |

.

## 6.2 TEST RESULT

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | GFSK(Nor)TX | | |

Antenna Gain=2.5dBi

| TEST CONDITIONS | | Channel (MHz) | Antenna Power Density | | | EIRP output (dBm/MHz) | EIRP output (mW/MHz) |
|---|---|---|---|---|---|---|---|
| | | | (mW/MHz) | (dBm/MHz) | dBi | | |
| Nom (V) | 5.0V | Hopping Channel | 0.0626 | -12.036 | 2.500 | -9.536 | 0.111 |
| Limit : Equivalent Isotropically Radiated Power Limit (6.91dBm/MHz) | | | | | | | |

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | π/4-DQPSK(Nor)TX | | |

Antenna Gain=2.5dBi

| TEST CONDITIONS | | Channel (MHz) | Antenna Power Density | | | EIRP output (dBm/MHz) | EIRP output (mW/MHz) |
|---|---|---|---|---|---|---|---|
| | | | (mW/MHz) | (dBm/MHz) | dBi | | |
| Nom (V) | 5.0V | Hopping Channel | 0.0295 | -15.298 | 2.500 | -12.798 | 0.053 |
| Limit : Equivalent Isotropically Radiated Power Limit (6.91dBm/MHz) | | | | | | | |

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | 8DPSK(Nor)TX | | |

Antenna Gain=2.5dBi

| TEST CONDITIONS | | Channel (MHz) | Antenna Power Density | | | EIRP output (dBm/MHz) | EIRP output (mW/MHz) |
|---|---|---|---|---|---|---|---|
| | | | (mW/MHz) | (dBm/MHz) | dBi | | |
| Nom (V) | 5.0V | Hopping Channel | 0.0328 | -14.838 | 2.500 | -12.338 | 0.058 |
| Limit : Equivalent Isotropically Radiated Power Limit (6.91dBm/MHz) | | | | | | | |

# 7. OCCUPIED BANDWITH (99%)&SPREAD BANDWITH (90%)

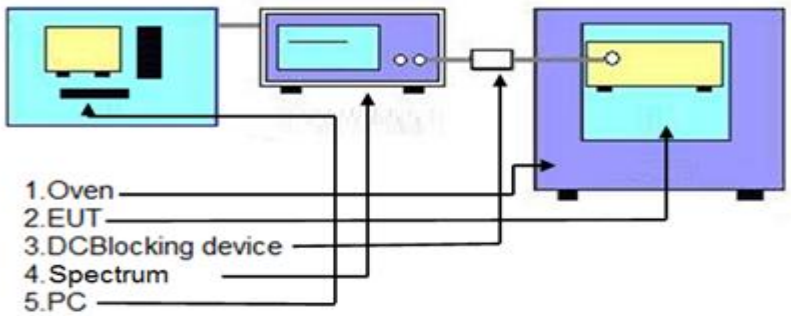
## 7.1 LIMIT

| Item | Limits |
|---|---|
| Occupied Band Width: | ≤83.5MHz（FH;FH+DS;FH+OFDM）<br>≤26MHz（Others） |
| Spreading Bandwidth: | ≧500 kHz |

## 7.2 TEST PROCEDURE

1. Setting of SA is following as: GFSK/π/4-DPSK/8 DPSK RB: 1MHz / VB: 1MHz / SPAN: 83.5MHz / AT: 25dB Ref: 10dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
2. EUT have transmitted the maximum modulation signal and fixed channelize (For DSSS or OFDM Device) or continuous maximum power of hopping mode (For FHSS Device). SA set to 99% of occupied bandwidth to measure occupied bandwidth. The limit is less than 26MHz (ForfFH or OFDM Device) or 83.5MHz (For FHSS Device).
3. SA set to 90% of occupied bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
4. Spread Spectrum Factor = Spread Spectrum Bandwidth / modulation rate of EUT.
5. Spread Spectrum Factor limit is greater than 5.

## 7.3 TEST SETUP




## 7.4 TEST DEVIATION

There is no deviation with the original standard.

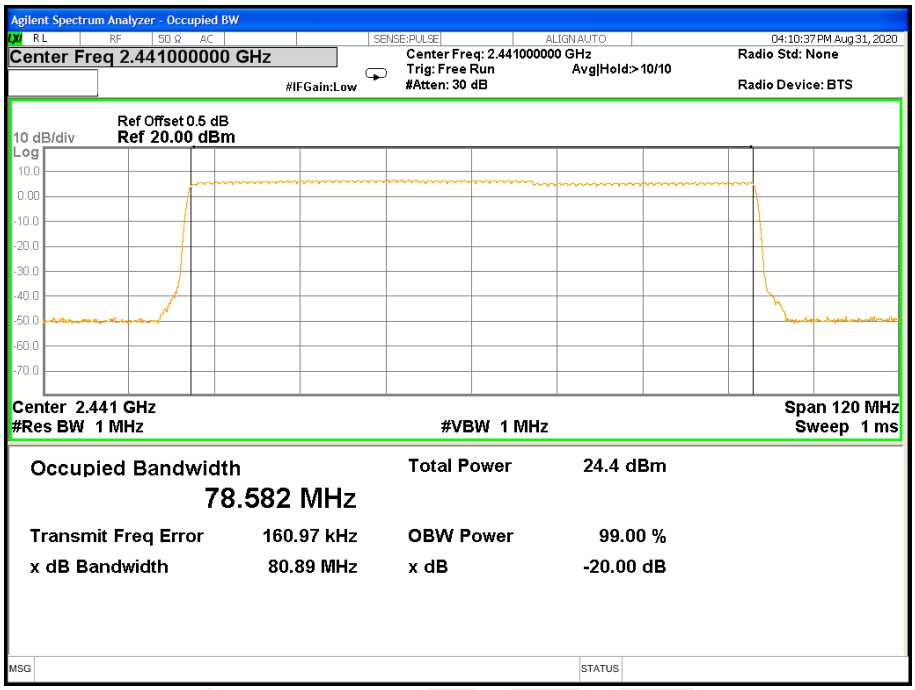
## 7.5 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

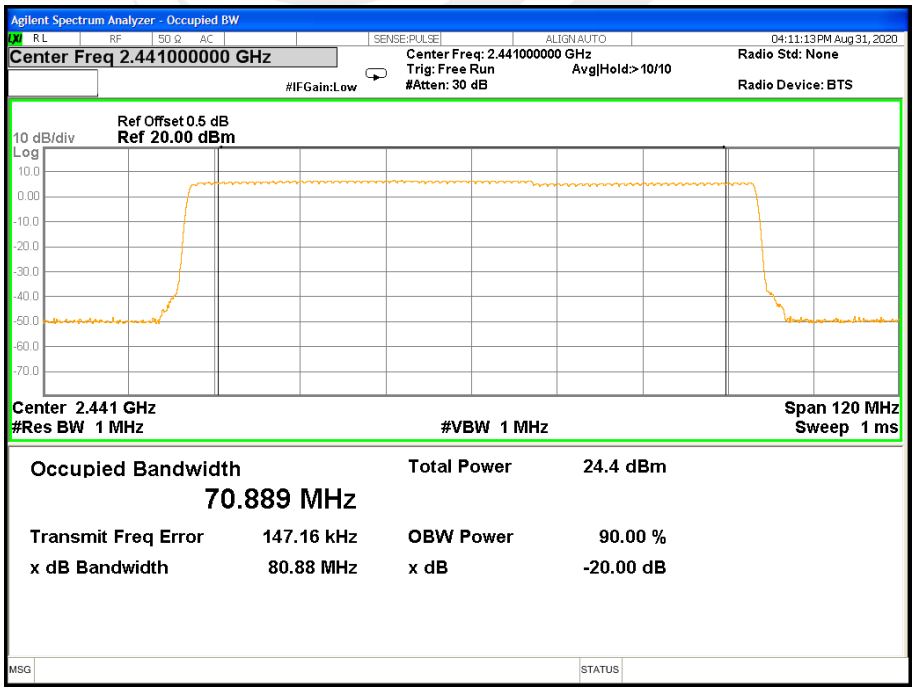
## 7.6 TEST RESULT

| Voltage | OCCUPIED BANDWIDTH (99%)MHz | SPREAD BANDWITH (90%)MHz |
|---|---|---|
| Nor Voltage | 78.582 | 70.889 |

**GFSK-Normal Voltage(99%) /worst mode**

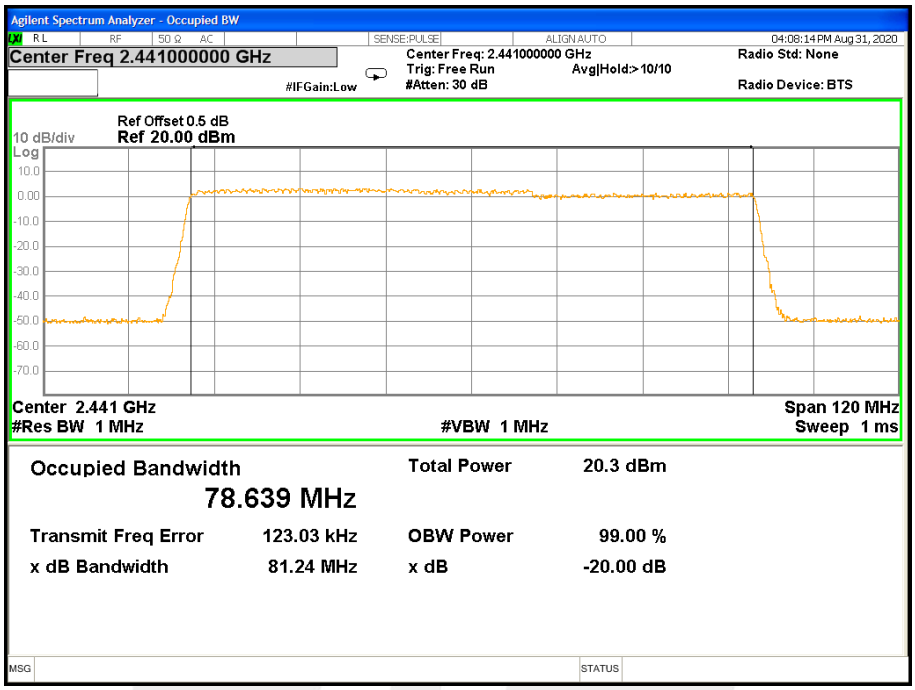



**GFSK-Normal Voltage(90%) /worst mode**

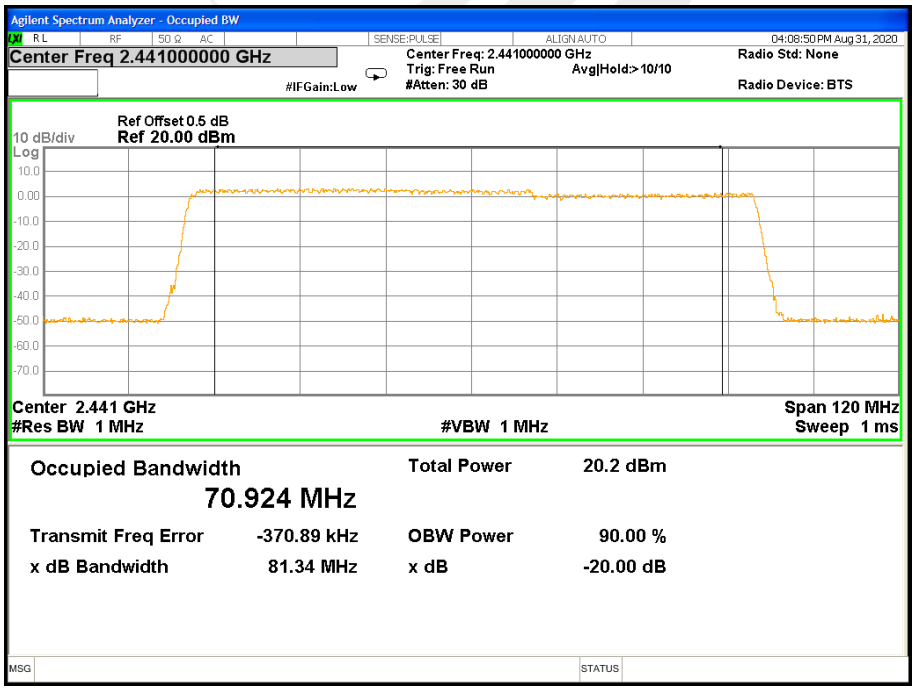


| Voltage | OCCUPIED BANDWIDTH (99%)MHz | SPREAD BANDWITH (90%)MHz |
|---|---|---|
| Nor Voltage | 78.639 | 70.924 |

**π/4-DQPSK- Normal Voltage(99%) /worst mode**

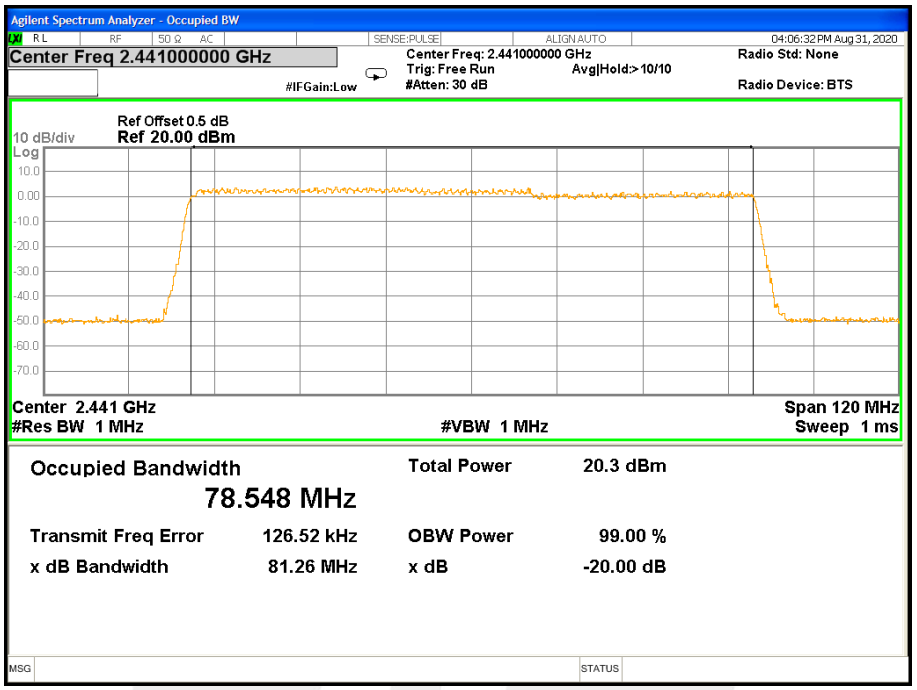



**π/4-DQPSK- Normal Voltage(90%) /worst mode**

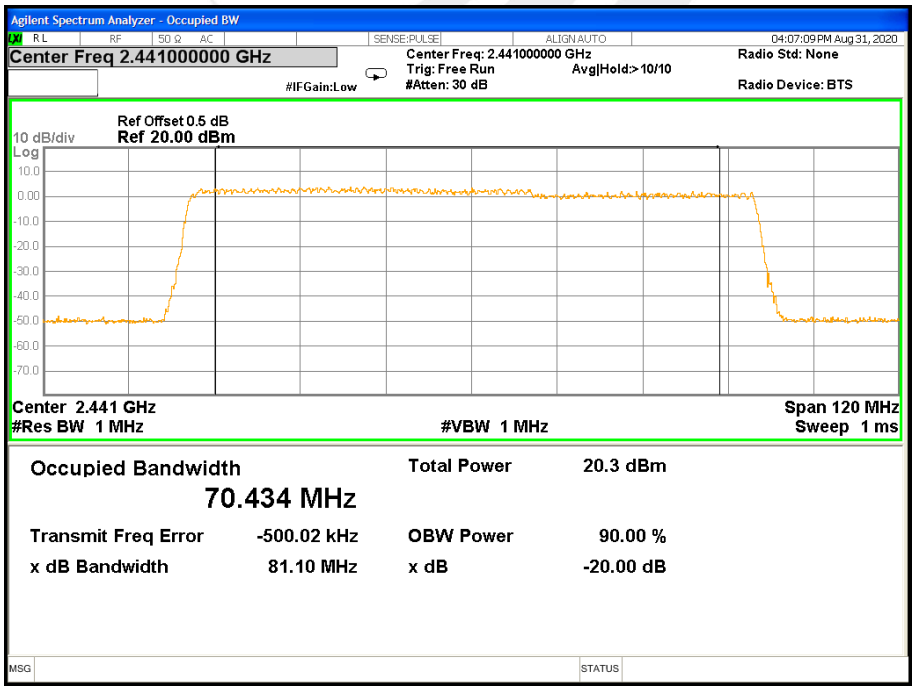


| Voltage | OCCUPIED BANDWIDTH (99%)MHz | SPREAD BANDWITH (90%)MHz |
|---|---|---|
| Nor Voltage | 78.548 | 70.434 |

**8DPSK- Normal Voltage(99%) /worst mode**




**8DPSK- Normal Voltage(90%) /worst mode**



## 7.7 TEST RESULT (SPREADING FACTOR)

Spreading factor=(Spreading bandwidth) / (Frequency corresponding to transmission rate)

GFSK: Frequency corresponding to transmission rate =1M/bps
π/4-DQPSK: Frequency corresponding to transmission rate =2M/bps
8DPSK: Frequency corresponding to transmission rate =3M/bps

GFSK

| Voltage | Data Packet | Spread BW 90% (MHz) | Spread rate | Spreading factor | Limit |
|---|---|---|---|---|---|
| Nor Voltage | DH1 | 70.889 | 1 | 70.889 | ≧ 5 |
| | DH3 | 70.889 | 1 | 70.889 | ≧ 5 |
| | DH5 | 70.889 | 1 | 70.889 | ≧ 5 |

π/4-DQPSK

| Voltage | Data Packet | Spread BW 90% (MHz) | Spread rate | Spreading factor | Limit |
|---|---|---|---|---|---|
| Nor Voltage | DH1 | 70.924 | 2 | 35.462 | ≧ 5 |
| | DH3 | 70.924 | 2 | 35.462 | ≧ 5 |
| | DH5 | 70.924 | 2 | 35.462 | ≧ 5 |

8DPSK

| Voltage | Data Packet | Spread BW 90% (MHz) | Spread rate | Spreading factor | Limit |
|---|---|---|---|---|---|
| Nor Voltage | DH1 | 70.434 | 3 | 23.478 | ≧ 5 |
| | DH3 | 70.434 | 3 | 23.478 | ≧ 5 |
| | DH5 | 70.434 | 3 | 23.478 | ≧ 5 |

# 8. UNWANTED EMISSION INTENSITY MEASUREMENT

## 8.1 LIMIT

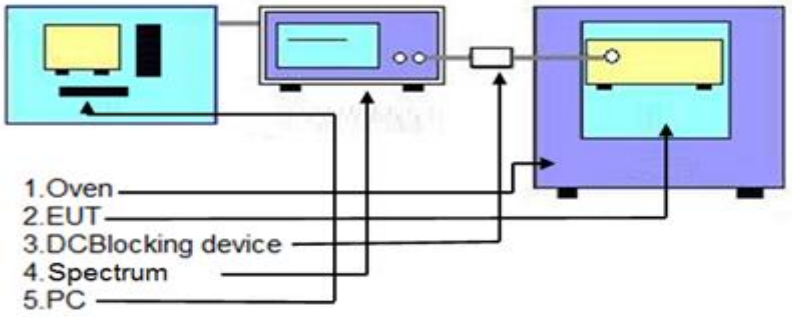
| Item | Limits |
|---|---|
| TX Spurious Emission | ≦2.5 μW/MHz (30MHz≦f≦1000MHz) |
| | ≦ 2.5 μW/MHz (1000MHz<f≦ 2387MHz) |
| | ≦ 25 μW/MHz (2387MHz<f≦ 2400MHz) |
| | ≦ 25 μW/MHz (2483.5MHz≦ f<2496.5MHz) |
| | ≦2.5μW/MHz (2496.5MHz≦f<12500MHz) |

## 8.2 TEST PROCEDURE

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB / VB | 30-1000MHz: 100KHz/100KHz |
| | Above 1GHz: 1 MHz/1 MHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

1. EUT have transmitted the maximum modulation signal and fixed channelize.
2. Setting of SA is following as: Below 1GHz RB: 100KHz / VB: 100KHz, Above 1GHz RB: 1MHz / VB: 1MHz / AT: 10dB Ref: 0dBm / Sweep time: Auto/ Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
3. Setting of SA is following as 30MHz and stop frequency 1000MHz. Then to mark peak reading value + cable loss shall be less than 2.5μW.
4. Setting of SA is following as 1000MHz and stop frequency 2387MHz. Then to mark peak reading value + cable loss shall be less than 2.5μW.
5. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25μW.
6. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz. Then to mark peak reading value + cable loss shall be less than 25μW.
7. SA adjusted to start frequency 2496.5MHz and stop frequency 12750MHz. Then to mark peak reading value + cable loss shall be less than 2.5μW.
8. When we tested 30MHz-1GHz, we used the RB 100KHz setting for the test. The limit on the test chart was converted. The conversion formula: -26dBm+10*log(100K/1M)=-36dBm.
9. If the Result_Value is over the requirement, take total sum of 1MHz band centered at the spur frequency like ACLP measurement as Result_Value.

## 8.3 TEST SETUP



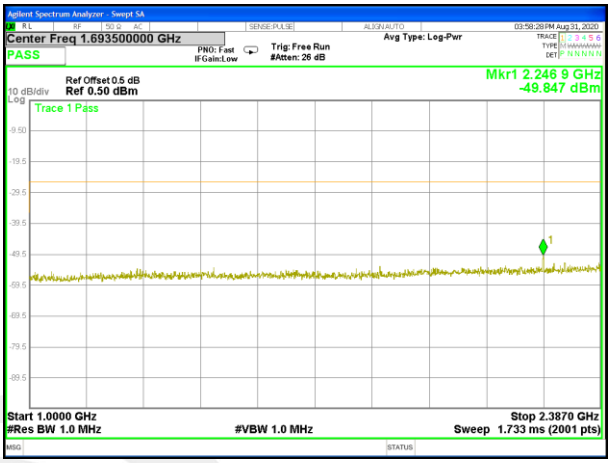

## 8.4 TEST DEVIATION

There is no deviation with the original standard.

## 8.5 TEST RESULT

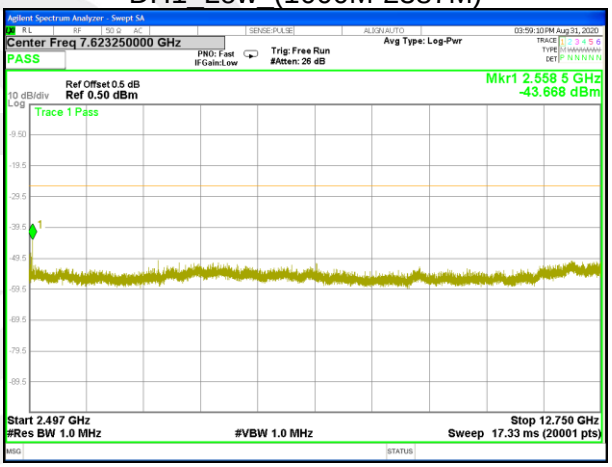
| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | GFSK/π/4-DQPSK/8DPSK TX CH 00/CH 39/CH 78; Normal Voltage | | |


DH1_Low_(30M-1000M)

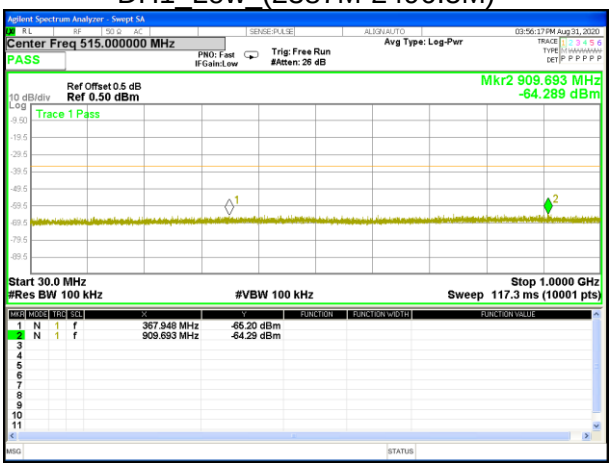



DH1_Low_(1000M-2387M)

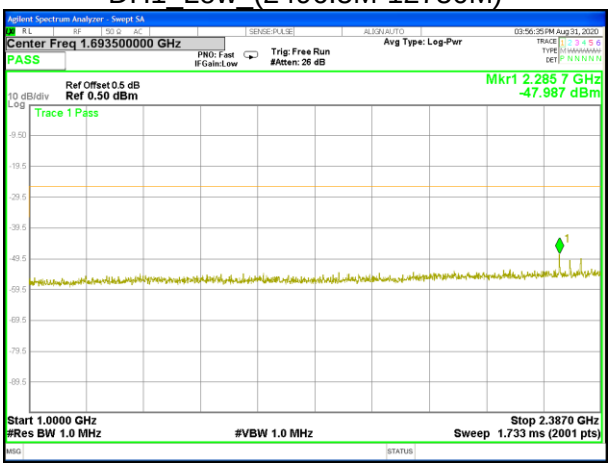

DH1_Low_(2387M-2496.5M)




DH1_Low_(2496.5M-12750M)

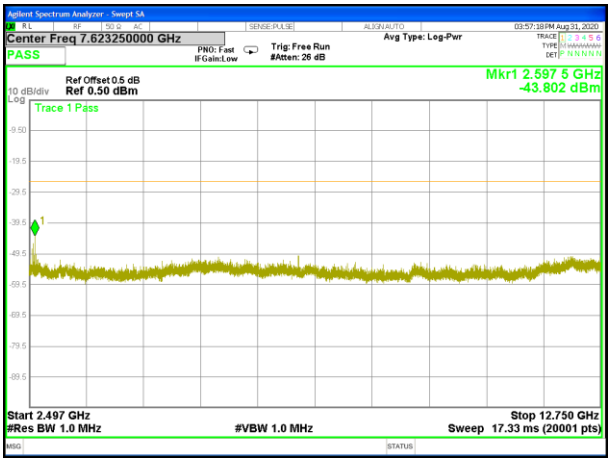



DH1_Middle_(30M-1000M)

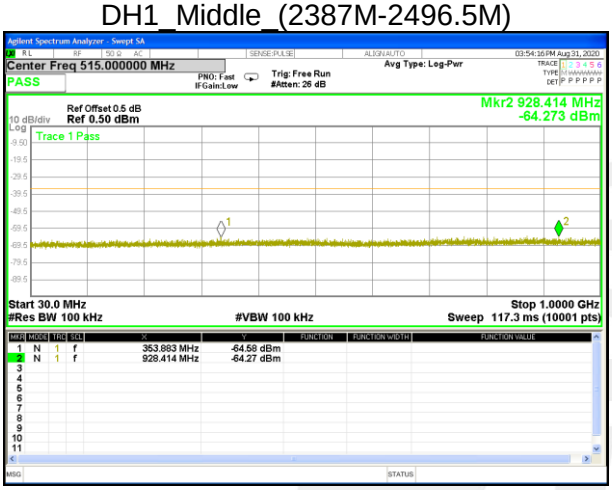



DH1_Middle_(1000M-2387M)

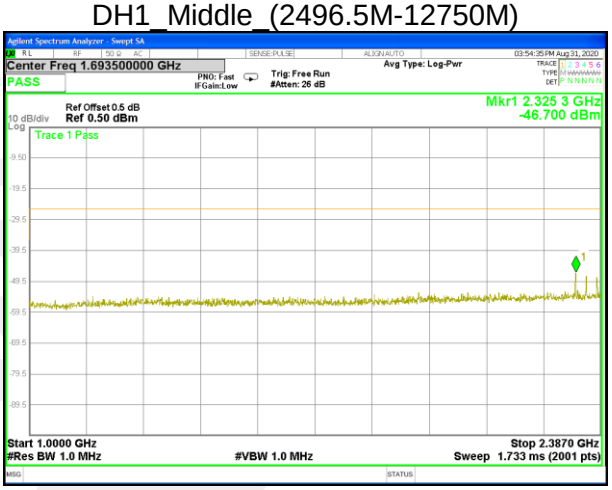

DH1_Middle_(2387M-2496.5M)




DH1_Middle_(2496.5M-12750M)

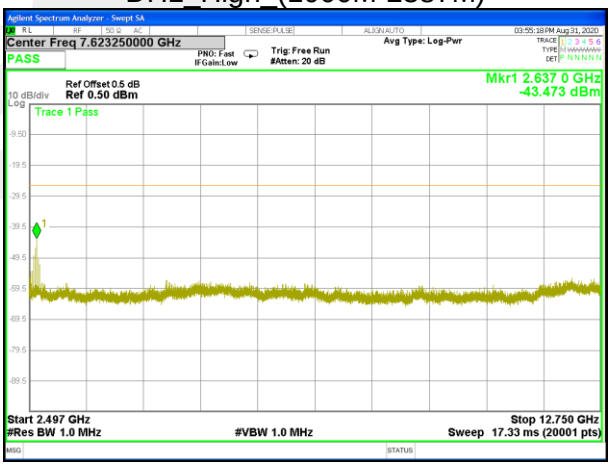



DH1_High_(30M-1000M)



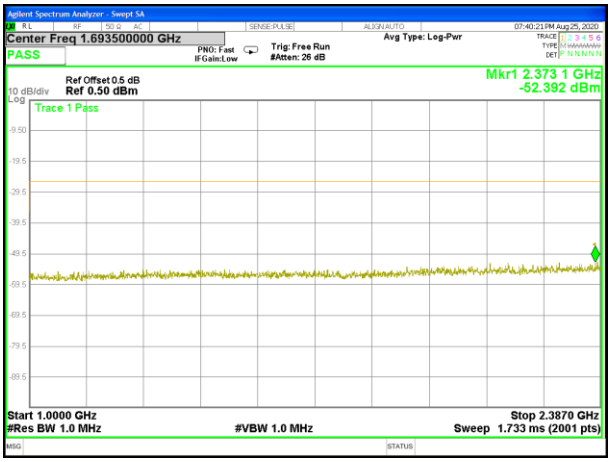

DH1_High_(1000M-2387M)


DH1_High_(2387M-2496.5M)



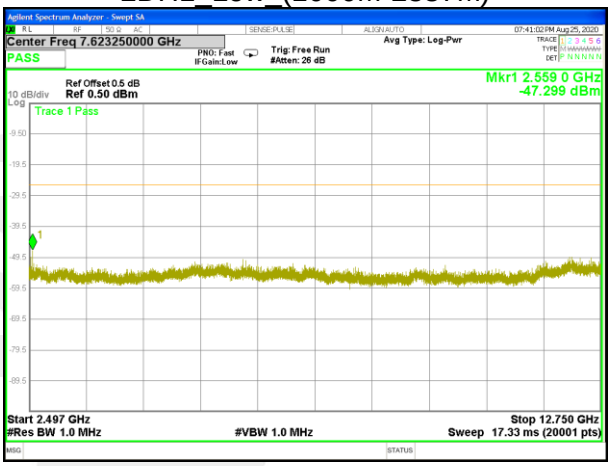

DH1_High_(2496.5M-12750M)


2DH1_Low_(30M-1000M)



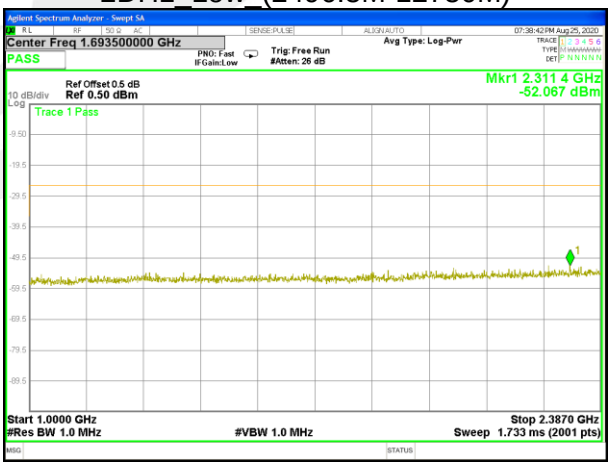

2DH1_Low_(1000M-2387M)


2DH1_Low_(2387M-2496.5M)



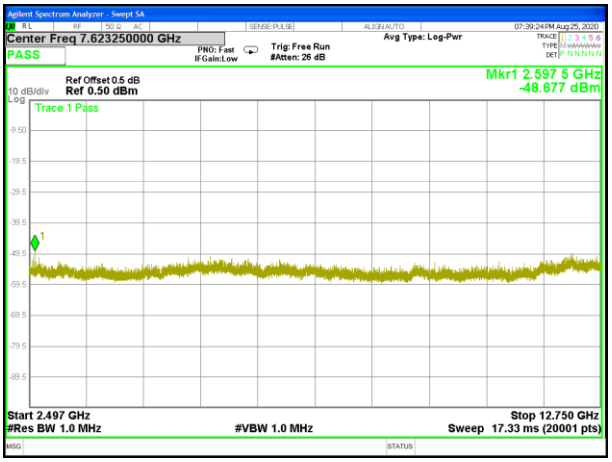

2DH1_Low_(2496.5M-12750M)


2DH1_Middle_(30M-1000M)

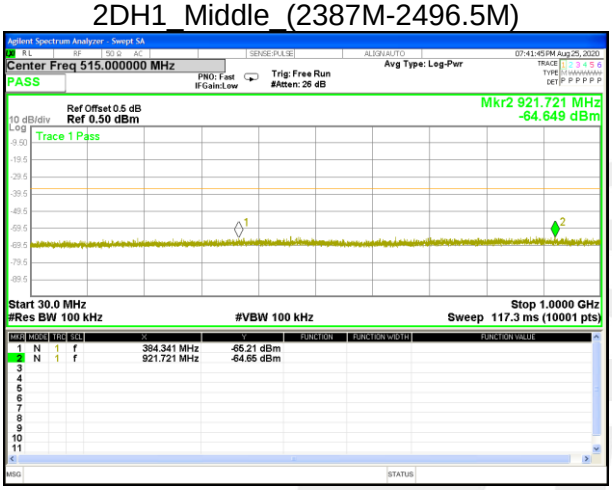



2DH1_Middle_(1000M-2387M)

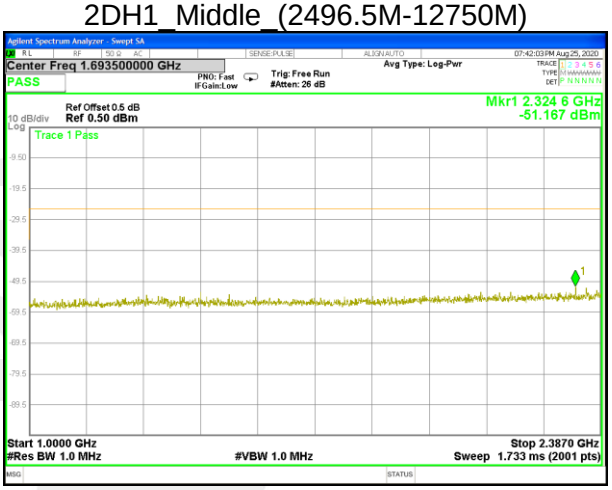

2DH1_Middle_(2387M-2496.5M)




2DH1_Middle_(2496.5M-12750M)

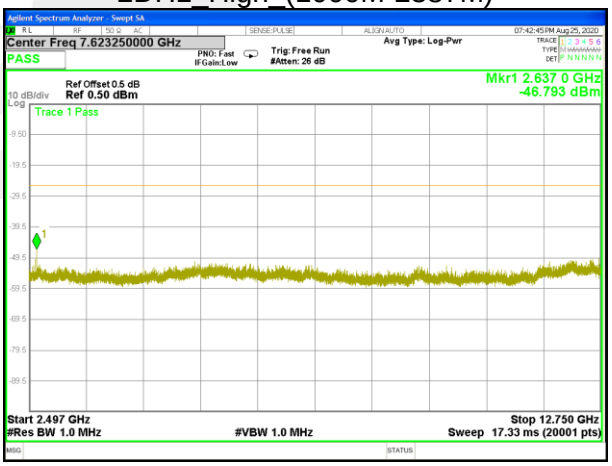



2DH1_High_(30M-1000M)



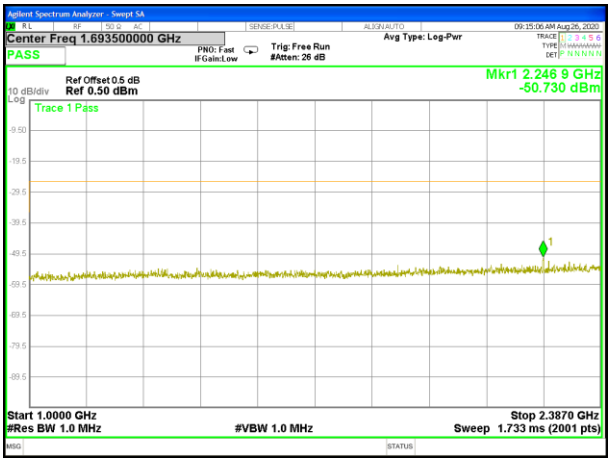

2DH1_High_(1000M-2387M)


2DH1_High_(2387M-2496.5M)

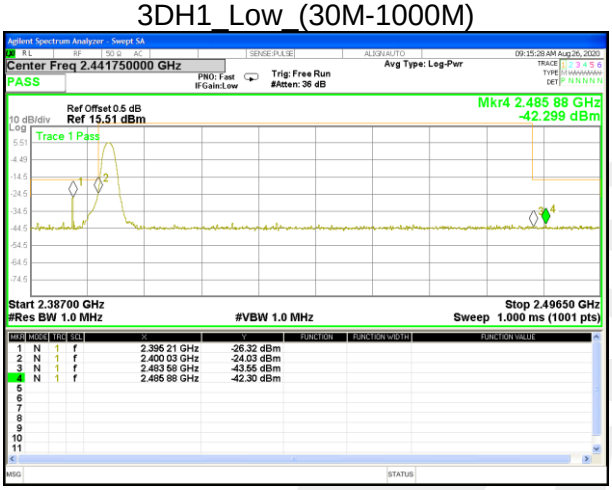



2DH1_High_(2496.5M-12750M)

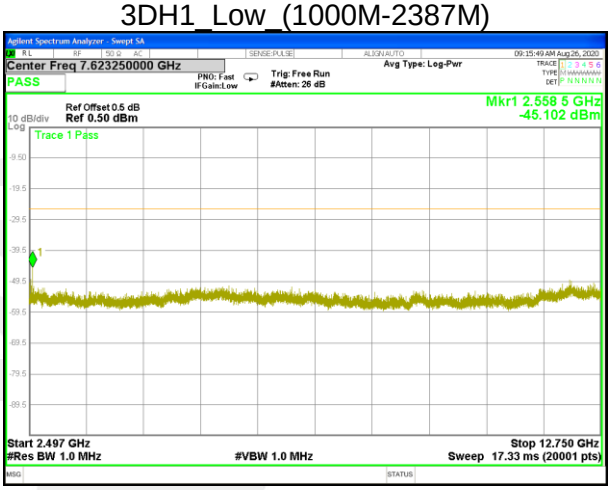

3DH1_Low_(30M-1000M)




3DH1_Low_(1000M-2387M)

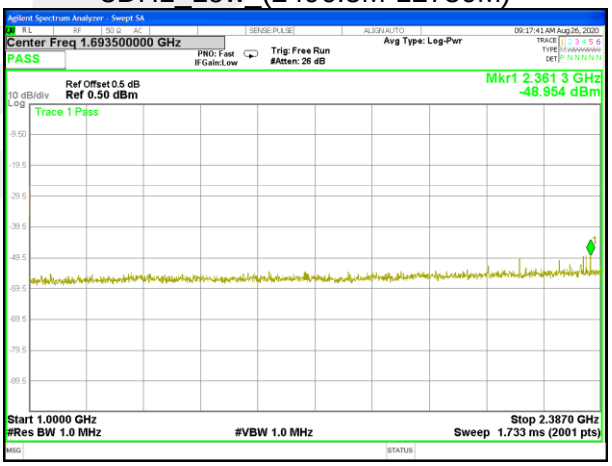



3DH1_Low_(2387M-2496.5M)



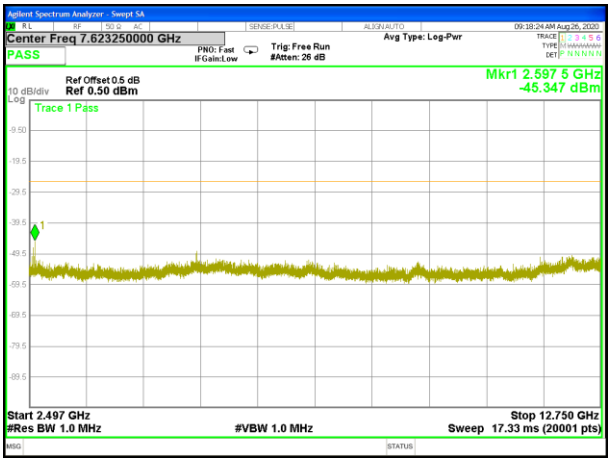

3DH1_Low_(2496.5M-12750M)


3DH1_Middle_(30M-1000M)



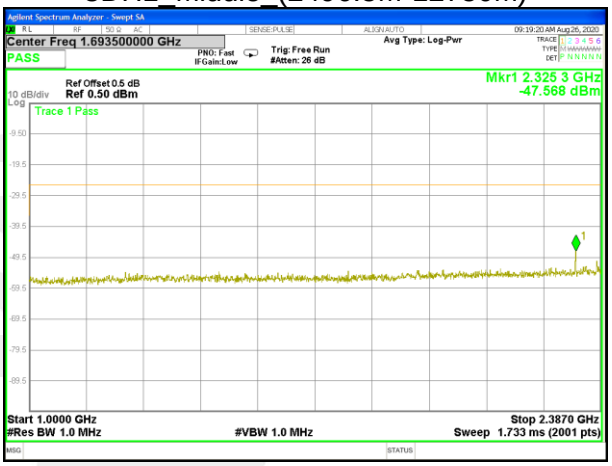

3DH1_Middle_(1000M-2387M)


3DH1_Middle_(2387M-2496.5M)



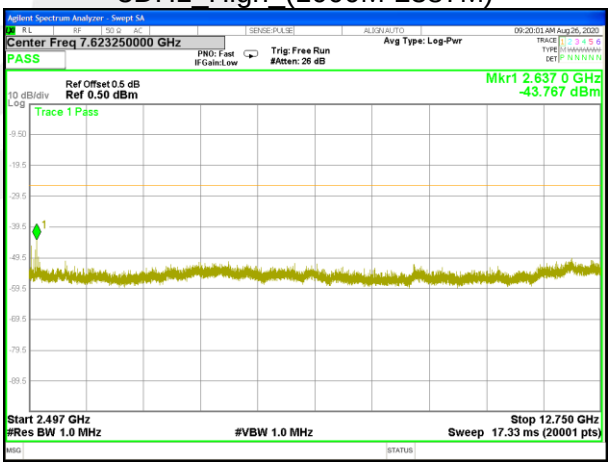

3DH1_Middle_(2496.5M-12750M)


3DH1_High_(30M-1000M)




3DH1_High_(1000M-2387M)


3DH1_High_(2387M-2496.5M)




3DH1_High_(2496.5M-12750M)

# 9. DWELL TIME

## 9.1 LIMIT

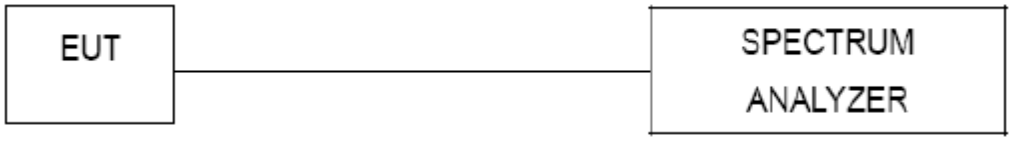
| Item | Limits |
|---|---|
| Hopping Freq. Dwell Time | ≦ 0.4 sec (In 0.4 sec × spreading rate) |

## 9.2 TEST PROCEDURES

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 0 MHz |
| RB | 1 MHz |
| VB | 1 MHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep | Continuous |

a. The transmitter output (antenna port) was connected to the spectrum analyzer.
b. Set RBW of spectrum analyzer to 1MHz and VBW to 1MHz.
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.
e. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
f. Measure the maximum time duration of one single pulse.
g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
h. Measure the maximum time duration of one single pulse.
i. Dwell time = [spreading rate/79] x duty-cycle x 0.4 seconds. (to be determined for each mode, DH1, DH3, DH5)

## 9.3 TEST SETUP

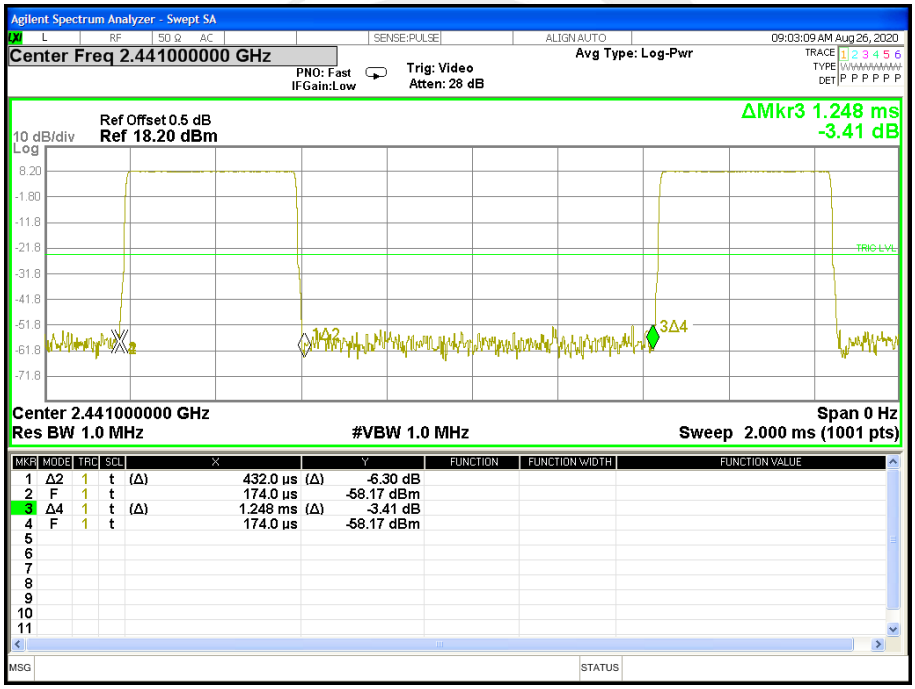


## 9.4 TEST RESULT

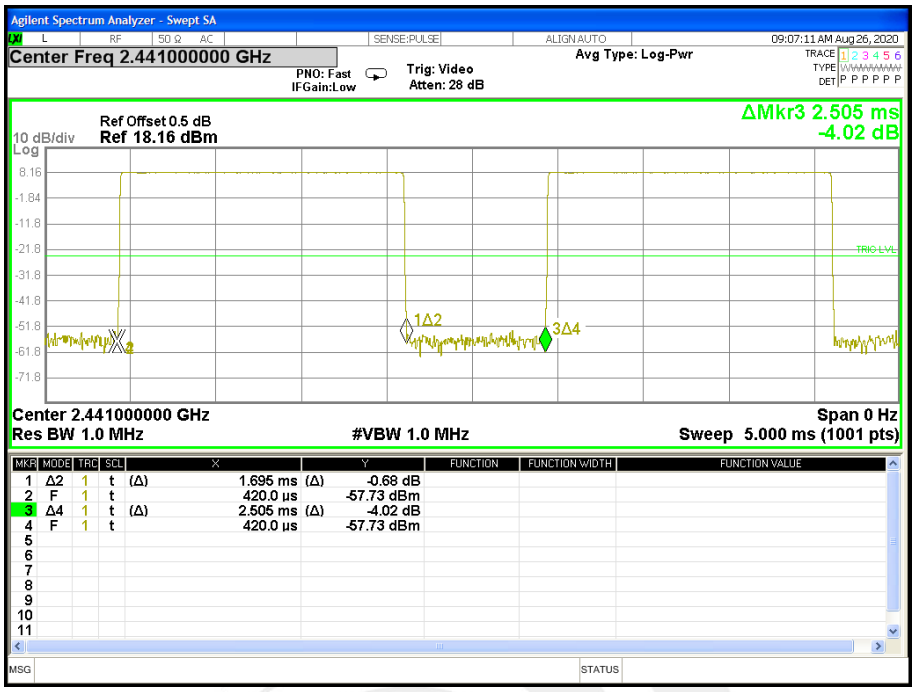
| Temperature: | 25$^0$C | Humidity: | 55 % RH |
|---|---|---|---|
| Test Mode: | GFSK | | |

| Modulation | TEST CONDITIONS | | Channel | Spread Factor | Ton | Tp | Duty cycle | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|---|---|---|---|
| GFSK | Nom (V) | 5.0V | DH1 | 70.889 | 0.432 | 1.248 | 34.62% | 0.124 | 0.4 |
| | | | DH3 | 70.889 | 1.695 | 2.505 | 67.66% | 0.243 | 0.4 |
| | | | DH5 | 70.889 | 2.968 | 3.760 | 78.94% | 0.283 | 0.4 |

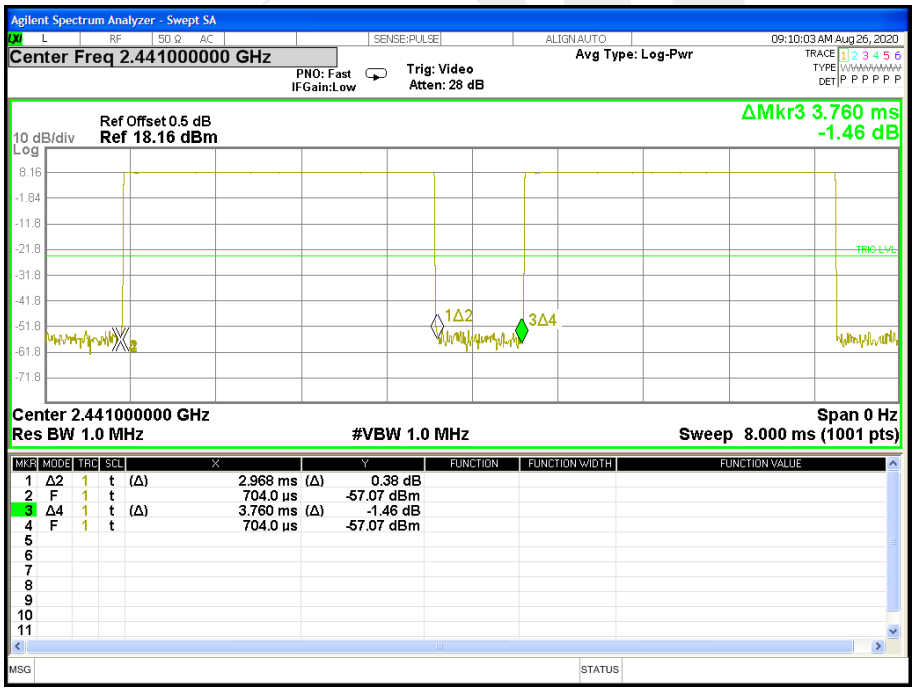
**Channel 39/GFSK/DH1 /Worst Mode**



## Channel 39/GFSK/DH3 /Worst Mode




## Channel 39/GFSK/DH5 /Worst Mode

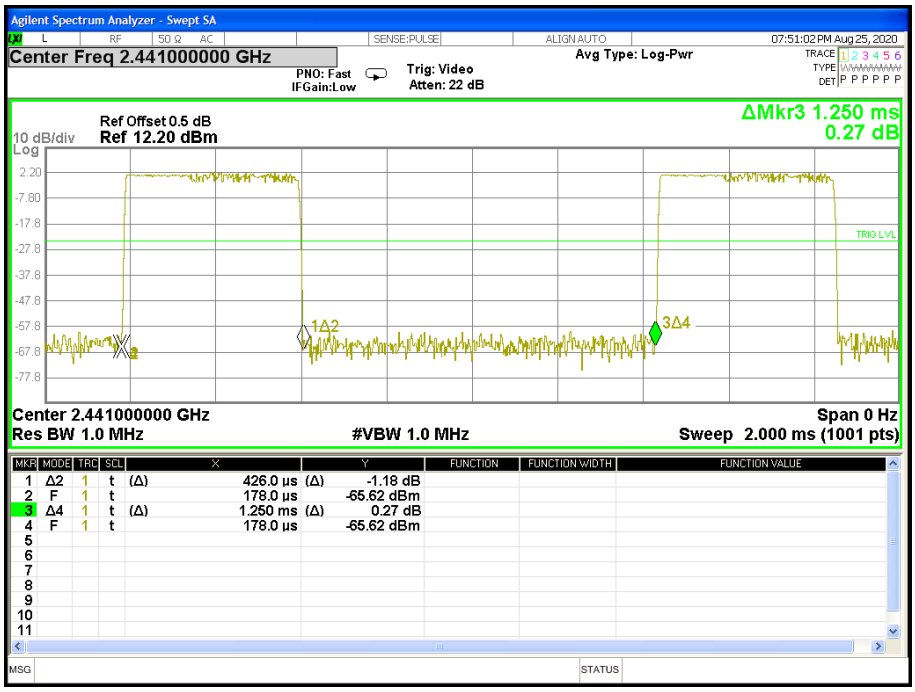



Duty-cycle = [on time/total time] x 100%
Dwell time = [spreading rate/79] x duty-cycle x 0.4 seconds

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Test Mode: | π/4-DQPSK | | |

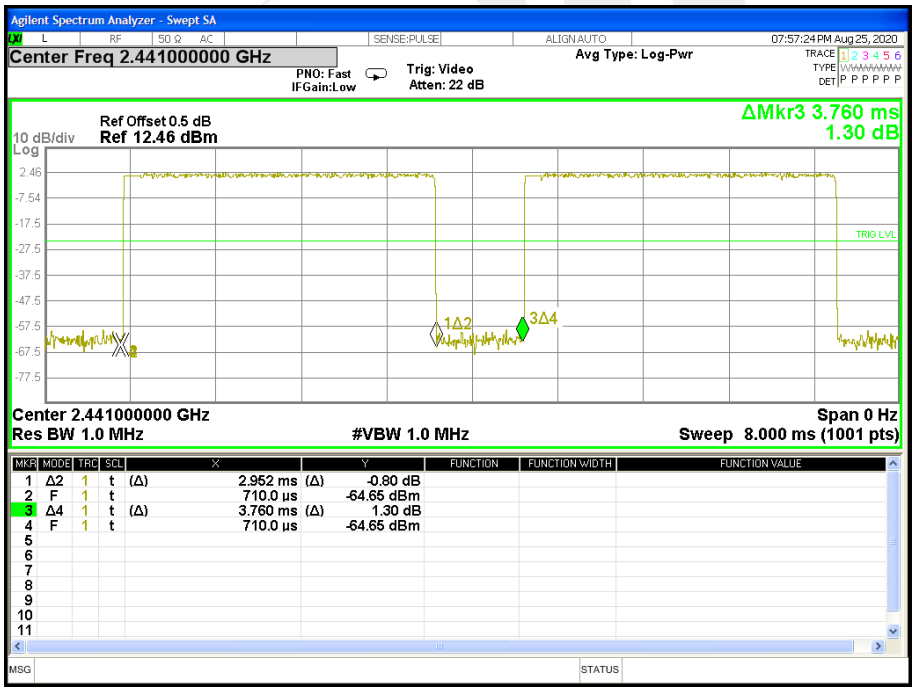
| Modulation | TEST CONDITIONS | | Channel | Spread Factor | Ton | Tp | Duty cycle | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|---|---|---|---|
| π/4DQPSK | Nom (V) | 5.0V | 2DH1 | 35.462 | 0.426 | 1.250 | 34.08% | 0.061 | 0.4 |
| | | | 2DH3 | 35.462 | 1.695 | 2.495 | 67.94% | 0.122 | 0.4 |
| | | | 2DH5 | 35.462 | 2.952 | 3.760 | 78.51% | 0.141 | 0.4 |

**Channel 39/π/4-DQPSK/2DH1 /Worst Mode**



## Channel 39/π/4-DQPSK/2DH3 /Worst Mode


## Channel 39/π/4-DQPSK/2DH5 /Worst Mode

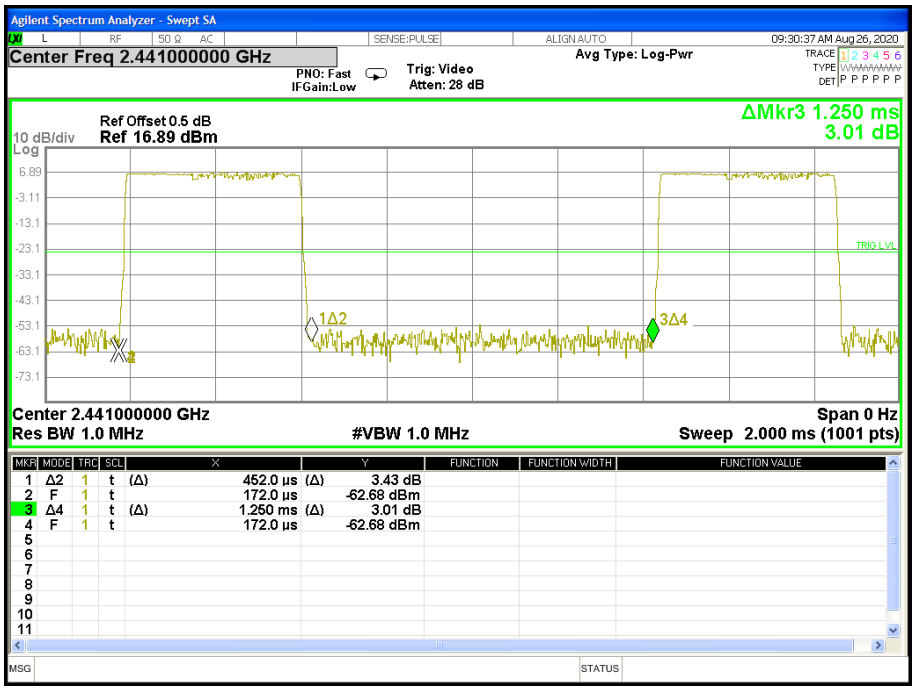



Duty-cycle = [on time/total time] x 100%
Dwell time = [spreading rate/79] x duty-cycle x 0.4 seconds

| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Test Mode: | 8DPSK | | |

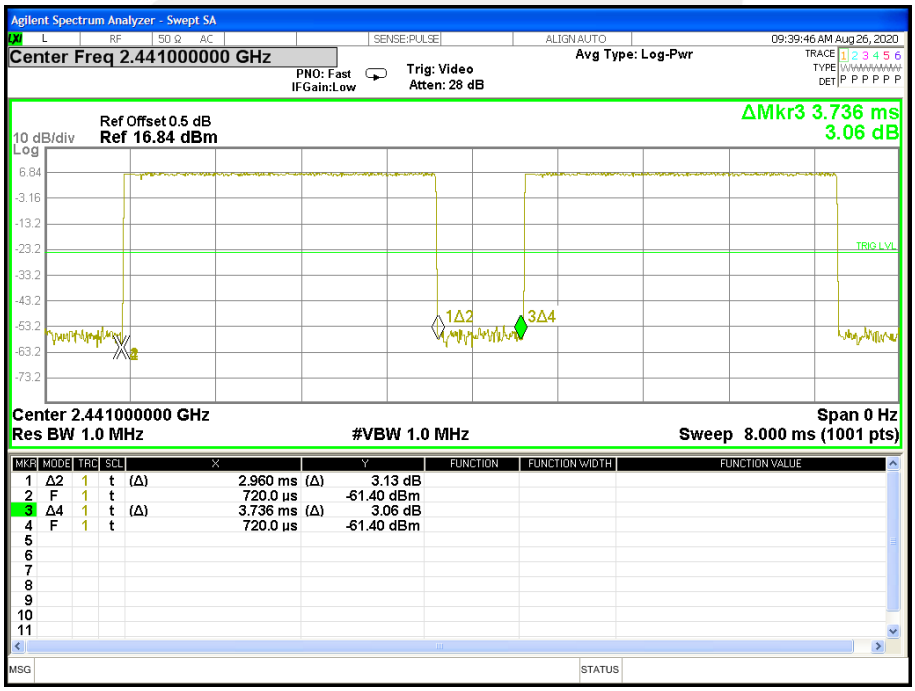
| Modulation | TEST CONDITIONS | | Channel | Spread Factor | Ton | Tp | Duty cycle | Dwell Time(s) | Limits(s) |
|---|---|---|---|---|---|---|---|---|---|
| 8DPSK | Nom (V) | 5.0V | 3DH1 | 23.478 | 0.452 | 1.250 | 36.16% | 0.043 | 0.4 |
| | | | 3DH3 | 23.478 | 1.705 | 2.500 | 68.20% | 0.081 | 0.4 |
| | | | 3DH5 | 23.478 | 2.960 | 3.736 | 79.23% | 0.094 | 0.4 |

**Channel 39/8PSK/3DH1 /Worst Mode**



## Channel 39/8PSK/3DH3 /Worst Mode


## Channel 39/8PSK/3DH5 /Worst Mode




Duty-cycle = [on time/total time] x 100%
Dwell time = [spreading rate/79] x duty-cycle x 0.4 seconds

# 10. IMITATION OF COLLATERAL EMISSION OF RECEIVER MEASUREMENT

## 10.1 LIMIT

| Item | Limits |
|---|---|
| RX Spurious Emission: | ≦ 4nW (f<1GHz) |
| | ≦ 20nW (1GHz≦ f) |

## 10.2 TEST PROCEDURES

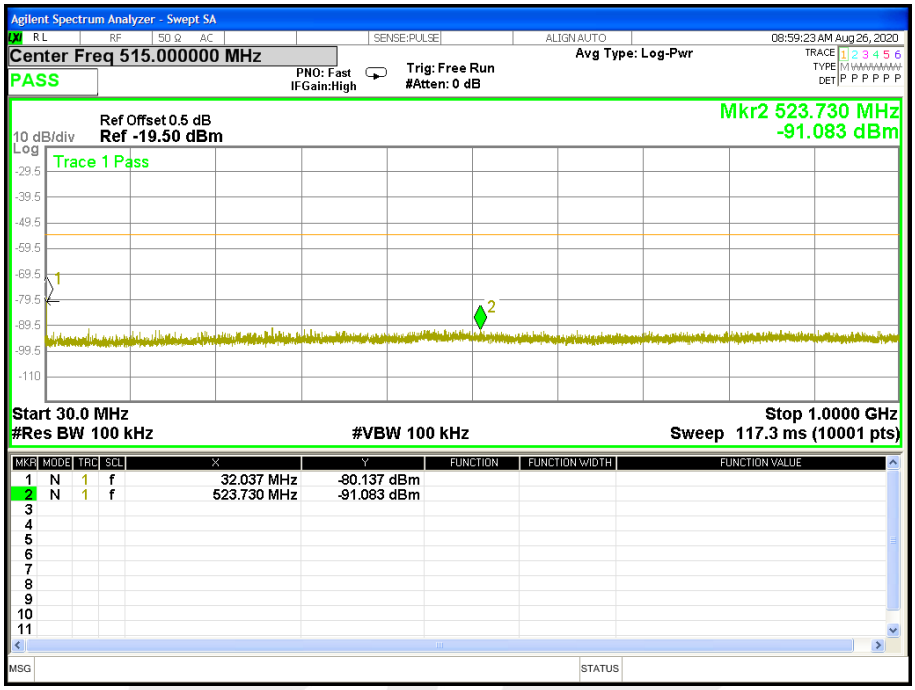
| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| RB | 100 kHz (below 1GHz emissions)<br>1 MHz (above 1GHz emissions) |
| VB | 100 kHz (below 1GHz emissions)<br>1 MHz (above 1GHz emissions) |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

1. EUT have the continuous reception mode and fixed only one channelize.
2. Setting of SA is following as RB / VB: 100 kHz (below 1GHz emissions) / 1 MHz (above 1GHz emissions) / AT: 10dB / Ref: 0dBm / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
3. SA set RB: 100kHz and VB: 100kHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW
4. SA set RB: 1MHz and VB: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW
5. If power level of lower emissions are more than 1/10 of limit (.0.4nW for f < 1GHz, 2nW for f >= 1GHz), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated.

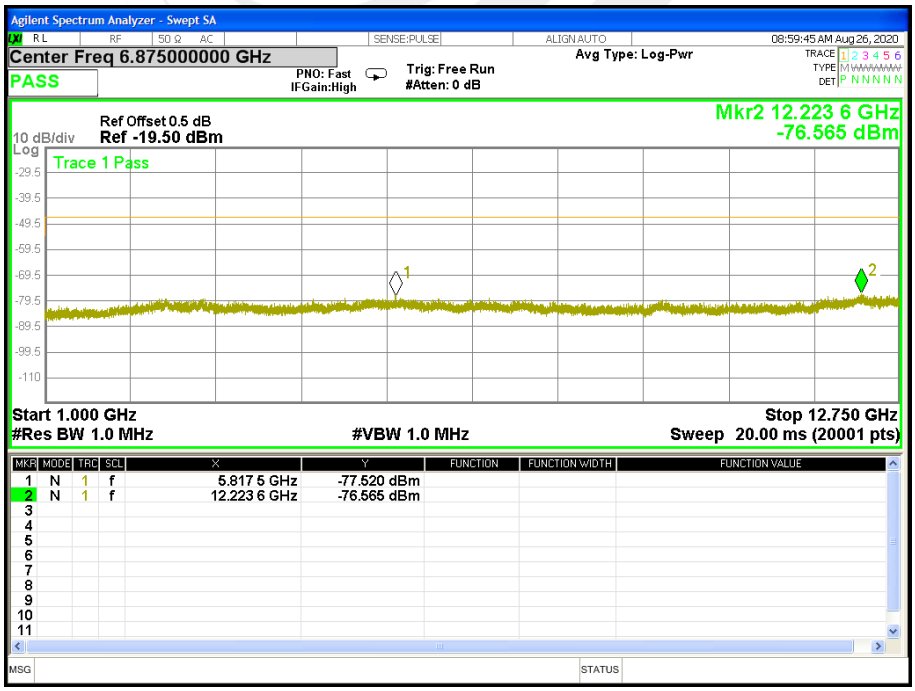
## 10.3 TEST RESULT

| Temperature: | 25$^0$C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | GFSK (Nor) | | |

**RX-CH00 (30 MHz ≦ f < 1000 MHz) Worst Mode**

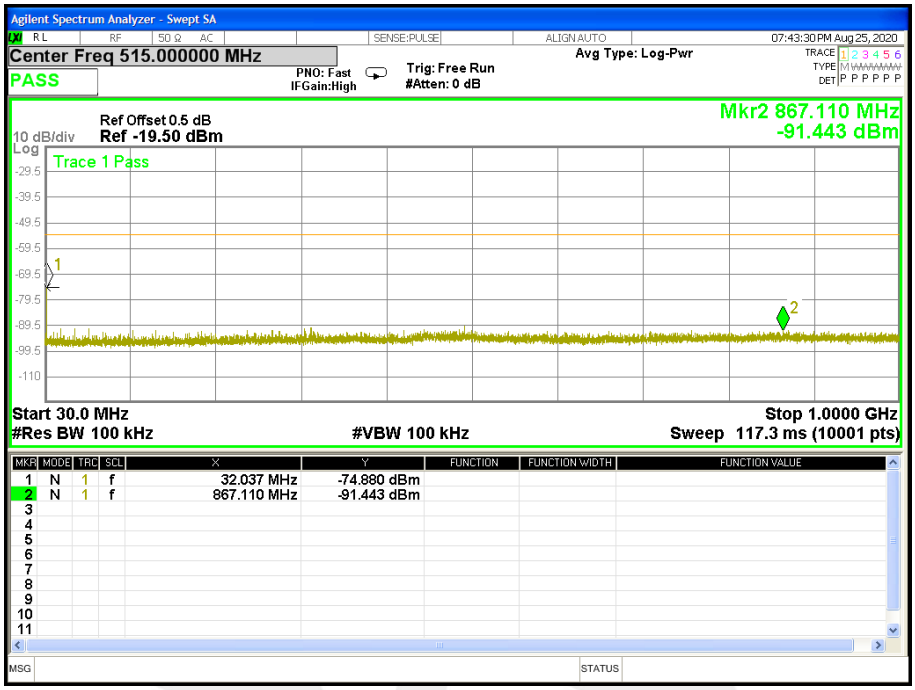



**RX-CH00 (1000 MHz ≦ f < 12750MHz) Worst Mode**

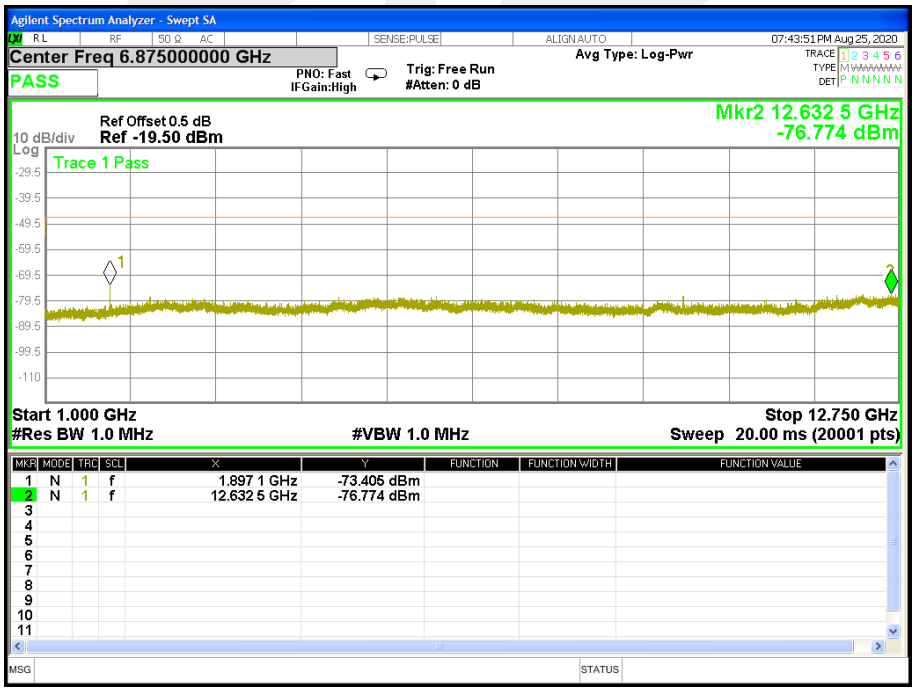


| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | π/4-DQPSK(Nor) | | |

**RX-CH00 (30 MHz ≦ f < 1000 MHz) Worst Mode**

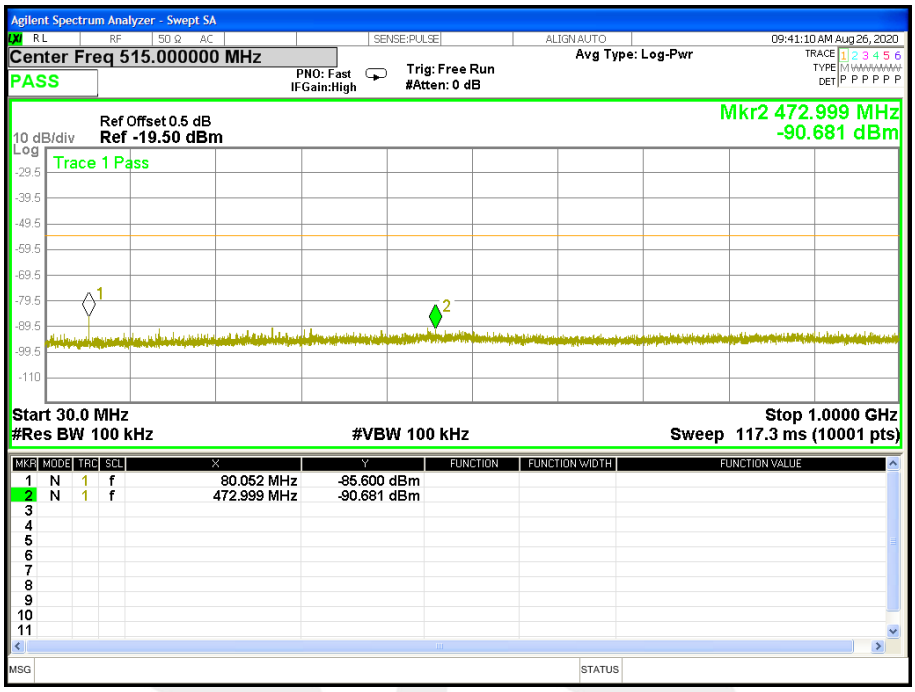



**RX-CH00 (1000 MHz ≦ f < 12750 MHz) Worst Mode**

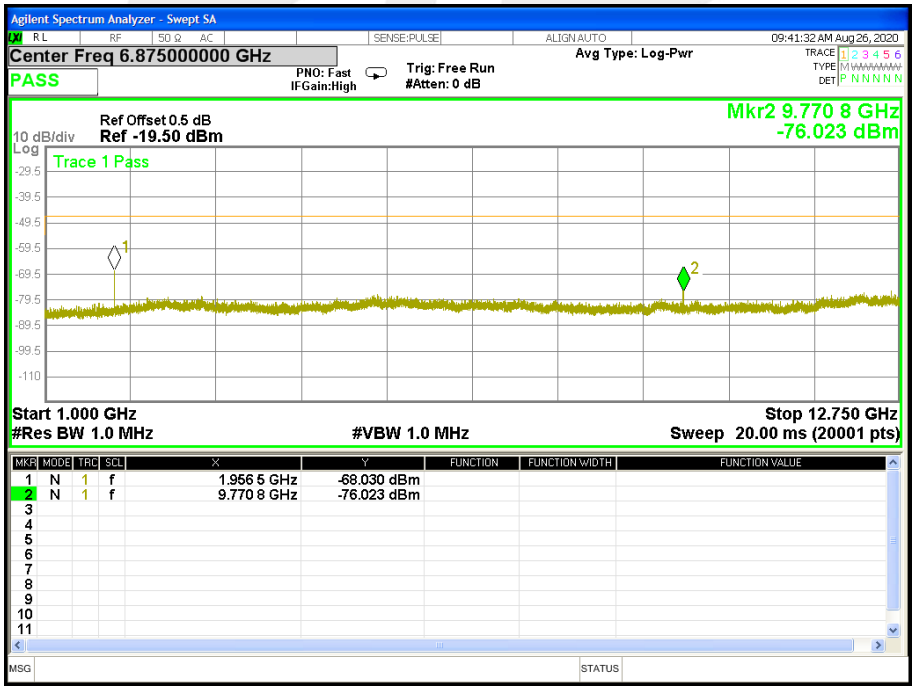


| Temperature: | 25°C | Humidity: | 55 % RH |
|---|---|---|---|
| Operation Mode: | 8DPSK(Nor) | | |

**RX-CH00 (30 MHz ≦ f < 1000 MHz) Worst Mode**




**RX-CH00 (1000 MHz ≦ f < 12750 MHz) Worst Mode**



# 11. TRANSMISSION RADIATION ANGLE WIDTH (3DB BEAMWIDTH) MEASUREMENT

## 11.1 LIMIT

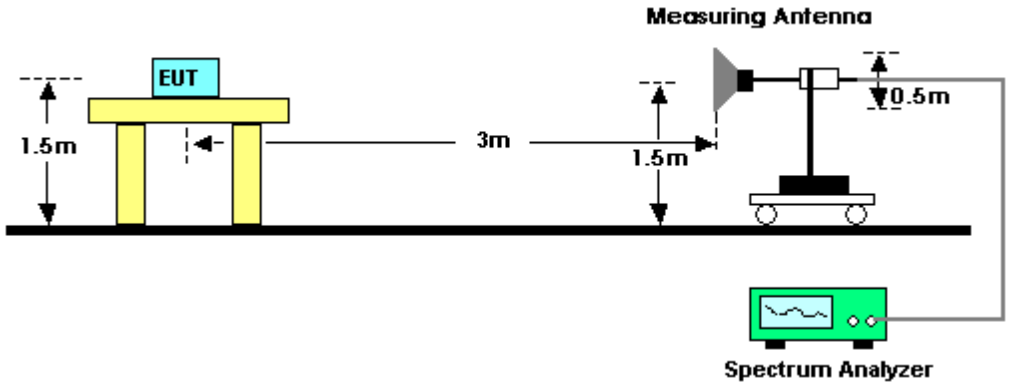
| Item | Limits |
|---|---|
| 3dB antenna beam width | e ≦ 360/A (The A is 10 in maximum)<br>A = {EIRP Power [mW/MHz] /{2.14dBi+output power (10mW /MHz, 3mW/MHz)}<br>Shall be 1 when A is lower than 1 |
| Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less | |

## 11.2 TEST PROCEDURES

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 0 MHz |
| RB | 1 MHz |
| VB | 1 kHz |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

1. Set EUT and measuring antenna at the same height and roughly facing each other.
2. Set spectrum analyzer with condition in section 11.2 and tune reference level to observe receving signal position.
3. Rotate directions of the EUT horizontally and ertically to find the maximum receiving power.
4. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuing antenna. “E” is the half-power beam width (angle between two points at which radiated power becomes 1/2)
5. Caluate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
6. Calculate 3dB antenna beam width by the formula below 360/A (If A<1; then A=1).
   A = {EIRP Power [mW/MHz] /{2.14dBi+output power (10mW /MHz, 3mW/MHz)}
   Shall be 1 when A is lower than 1

## 11.3 TEST SETUP




## 11.4 TEST DEVIATION

There is no deviation with the original standard.

## 11.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

## 11.7 TEST RESULT

Note: The Max EIRP is less than 6.91dBm/MHz, not apply.

# 12. RADIO INTERFERENCE PREVENTION CAPABILITY MEASUREMENT

## 12.1 LIMIT

| Item | Limits |
|---|---|
| Identification code | ≧ 48 bits |

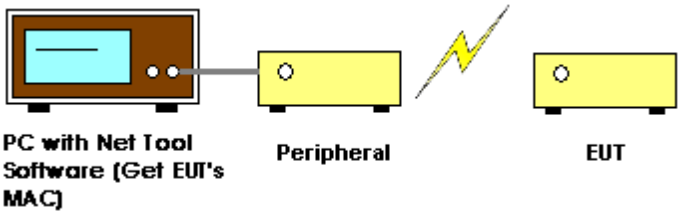
## 12.2 MEASURING ID CODE SOFTWARE

| Item | Limits |
|---|---|
| MAC IP List | MAC Scan |

## 12.3 TEST PROCEDURES

1. In the case that the EUT has the function of automatically transmitting the identification code:
   a. Transmit the predetermined identification codes form EUT.
   b. Check the transmitted identification codes with the demodulator.
2. In the case of receiving the identification ocde:
   a. Transmit the predetermined identification codes form the counterpart.
   b. Check if communication is normal.
   c. Transmit the signals other than predetermined ID codes form the counterpart.
   d. check if the EUT stops the transmission, or if it displays that idnetification codes are different from the predetermined ones.

## 12.4 TEST SETUP



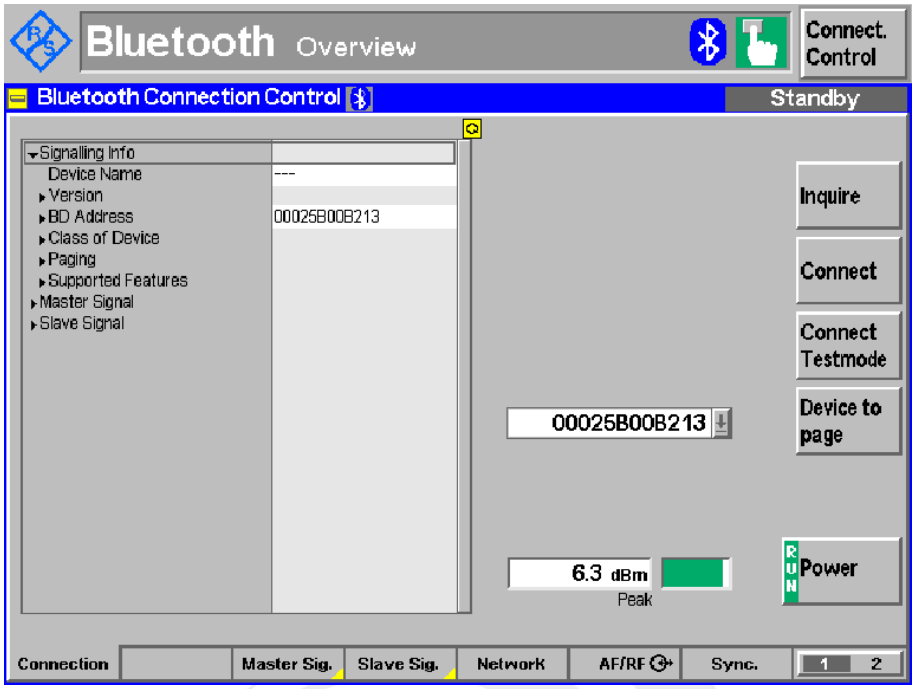

## 12.5 TEST DEVIATION

There is no deviation with the original standard.

## 12.6 EUT OPERATION DURING TEST

The EUT was programmed to be in normal transmitting mode.

## 12.7 TEST RESULT OF RADIO INTERFERENCE PREVENTION CAPABILIT




Note: The MAC Address is 00025B00B213.

## 13. EUT TEST PHOTO

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

※※※※END OF THE REPORT※※※※※