

Project No.: TM-2207000499P  
Report No.: TMTN2207001067NR

FCC ID: 2A8XN-CS529

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Rev.: 02

## FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013 TEST REPORT

For

**Fully Automatic Belt Drive Turntable**

**Model: CS 529**

**Data Applies To: N/A**

**Brand Name: Dual**

Issued for

**Dual GmbH**

**Hauptstrasse 1, 86925 Fuchstal, Germany**

Issued By

**Compliance Certification Services Inc.**

**Tainan Lab.**

**No.8, Jiucengling, Xinhua Dist.,  
Tainan City, Taiwan**

**Issued Date: December 08, 2022**

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.  
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### REVISION HISTORY

| Rev. | Issue Date        | Revisions                     | Effect Page              | Revised By |
|------|-------------------|-------------------------------|--------------------------|------------|
| 00   | November 21, 2022 | Initial Issue                 | ALL                      | Gina Lin   |
| 01   | November 30, 2022 | See the following note rev.01 | Page 87,<br>88, 101, 102 | Gina Lin   |
| 02   | December 08, 2022 | See the following note rev.02 | Page 77,<br>78, 87, 88   | Gina Lin   |
|      |                   |                               |                          |            |

**Note:**

- ✧ Rev.01 Issue Date: November 30, 2022  
Update test data of radiated emission & conducted emissions.
- ✧ Rev.02 Issue Date: December 08, 2022  
Correct wrongly transplanted test data.



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## 1. TEST REPORT CERTIFICATION

|                             |   |                                                             |
|-----------------------------|---|-------------------------------------------------------------|
| <b>Applicant</b>            | : | <b>Dual GmbH</b><br>Hauptstrasse 1, 86925 Fuchstal, Germany |
| <b>Manufacturer</b>         | : | <b>Dual GmbH</b><br>Hauptstrasse 1, 86925 Fuchstal, Germany |
| <b>Equipment Under Test</b> | : | Fully Automatic Belt Drive Turntable                        |
| <b>Model Number</b>         | : | CS 529                                                      |
| <b>Data Applies To</b>      | : | N/A                                                         |
| <b>Brand Name</b>           | : | Dual                                                        |
| <b>Date of Test</b>         | : | August 17, 2022 ~ September 14, 2022<br>November 29, 2022   |

| APPLICABLE STANDARD                                                                                                                                  |             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| STANDARD                                                                                                                                             | TEST RESULT |
| FCC Part 15 Subpart C AND<br>ANSI C63.10: 2013                                                                                                       | PASS        |
| Statements of Conformity                                                                                                                             |             |
| Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty. |             |

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.10: 2013** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:



**John Chen**  
Supervisor



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## 2. TEST RESULT SUMMARY

| FCC Standard Section | Report Section | Test Item                        | Result |
|----------------------|----------------|----------------------------------|--------|
| 15.203               | 3              | ANTENNA REQUIREMENT              | Pass   |
| 15.247(a)(1)         | 8.1            | 20dB BANDWIDTH                   | Pass   |
| 15.247(b)(1)         | 8.2            | MAXIMUM PEAK OUTPUT POWER        | Pass   |
| 15.247(a)(1)         | 8.3            | HOPPING CHANNEL SEPARATION       | Pass   |
| 15.247(a)(1)(iii)    | 8.4            | NUMBER OF HOPPING FREQUENCY USED | Pass   |
| 15.247(a)(1)(iii)    | 8.5            | DWELL TIME                       | Pass   |
| -                    | 8.6            | DUTY CYCLE                       | -      |
| 15.247(d)            | 8.7            | CONDUCTED SPURIOUS EMISSION      | Pass   |
| 15.247(d)            | 8.8            | RADIATED EMISSIONS               | Pass   |
| 15.207(a)            | 8.9            | POWERLINE CONDUCTED EMISSIONS    | Pass   |

### 3. EUT DESCRIPTION

#### 3.1 DESCRIPTION OF EUT & POWER

|                     |                                                                                 |
|---------------------|---------------------------------------------------------------------------------|
| Product             | Fully Automatic Belt Drive Turntable                                            |
| Model Number        | CS 529                                                                          |
| Data Applies To     | N/A                                                                             |
| Brand Name          | Dual                                                                            |
| Received Date       | August 01, 2022                                                                 |
| Reported Date       | August 31, 2022                                                                 |
| Frequency Range     | 2402MHz ~ 2480MHz                                                               |
| Transmit Peak Power | GFSK : -1.08dBm / 0.78mW<br>8DPSK: -1.01dBm / 0.793mW                           |
| Channel Spacing     | 1MHz                                                                            |
| Transmit Data Rate  | GFSK Mode : 1 Mbps<br>4/πDQPSK Mode : 2Mbps<br>8DPSK Mode : 3Mbps               |
| Modulation Type     | GFSK 、π/4DQPSK 、8DPSK                                                           |
| Number of Channels  | 79 Channels                                                                     |
| EUT Power Supply    | DC 12V (Powered by adapter)                                                     |
| Antenna Type        | Manufacturer: Sunitec<br>Type: Layout Antenna<br>Model: CS 529<br>Gain: 2.2 dBi |
| Firmware Version    | V1.0                                                                            |
| Software Version    | V1.0                                                                            |

#### Power Adapter :

| Manufacturer                     | Model No.     | Power Input                 | Power Output   |
|----------------------------------|---------------|-----------------------------|----------------|
| SHENZHEN FUJIA APPLIANCE CO.,LTD | FJ-SW1202000N | 100-240Vac 50/60Hz 0.6A Max | 12Vdc 2.0A 24W |

#### Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for **FCC ID: 2A8XN-CS529** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.

## 4. DESCRIPTION OF TEST MODES

The EUT had been tested under operating condition.

There are three channels have been tested as following :

| Channel | Frequency (MHz) |
|---------|-----------------|
| Low     | 2402            |
| Middle  | 2441            |
| High    | 2480            |

### Radiated Emission Test (Below 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

Normal Operation

### Radiated Emission Test (Above 1 GHz):

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|----------------|-----------------------|-----------------|-------------|
| Low, Mid, High | FHSS                  | GFSK            | DH5         |
| Low, Mid, High | FHSS                  | 8-DPSK          | 3-DH5       |

### **Bandedge Measurement :**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|----------------|-----------------------|-----------------|-------------|
| Low, High      | FHSS                  | GFSK            | DH5         |
| Low, High      | FHSS                  | 8-DPSK          | 3-DH5       |

### **Antenna Port Conducted Measurement :**

- ☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

| Tested Channel | Modulation Technology | Modulation Type | Packet Type |
|----------------|-----------------------|-----------------|-------------|
| Low, Mid, High | FHSS                  | GFSK            | DH5         |
| Low, Mid, High | FHSS                  | 8-DPSK          | 3-DH5       |



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## **5. TEST METHODOLOGY**

The tests documented in this report were performed in accordance with ANSI C63.10 : 2013 and FCC CFR 47 15.207, 15.209 and 15.247.

## 6. FACILITIES AND ACCREDITATIONS

### 6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

- ☐ No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
- ☒ No. 168, Ln. 523, Sec. 3, Zhongzheng Rd., Rende Dist., Tainan City 717017, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

### 6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 6.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).



## 6.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

|               |     |
|---------------|-----|
| <b>Taiwan</b> | TAF |
|---------------|-----|

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

|                |                                |
|----------------|--------------------------------|
| <b>Canada</b>  | Industry Canada (ISED#: 2324H) |
| <b>Germany</b> | TUV NORD                       |
| <b>Taiwan</b>  | BSMI                           |
| <b>USA</b>     | FCC                            |

## 6.5 MEASUREMENT EQUIPMENT USED

### For §8.8.2~8.8.3

| Chamber Room #1166 (Radiation Test) |                                         |              |                    |                  |                 |
|-------------------------------------|-----------------------------------------|--------------|--------------------|------------------|-----------------|
| Name of Equipment                   | Manufacturer                            | Model        | Serial Number      | Calibration Date | Calibration Due |
| Active Loop Antenna                 | ETS-LINDREN                             | 6502         | 8905-2356          | 09/06/2021       | 09/05/2022      |
| Attenuator                          | MCL                                     | BW-S15W5     | 0535               | 01/28/2022       | 01/27/2023      |
| Band Reject Filter                  | MICRO-TRONICS                           | HPM13525     | 006                | 01/28/2022       | 01/27/2023      |
| Band Reject Filter                  | MICRO-TRONICS                           | HP50107-01   | 001                | 01/28/2022       | 01/27/2023      |
| Bilog Antenna With 6dB Attenuator   | SUNOL SCIENCES & EMC                    | JB1 & N-6-06 | A021306 & AT-N0682 | 10/07/2021       | 10/06/2022      |
| Cable                               | EMCI                                    | EM102-KMKM   | CB1166-01          | 06/20/2022       | 06/19/2023      |
| Double Ridged Guide Horn Antenna    | ETS-LINDGREN                            | 3116         | 00078900           | 03/18/2022       | 03/17/2023      |
| EMI Test Receiver                   | R&S                                     | ESCI 7       | 100856             | 06/21/2022       | 06/20/2023      |
| EXA Spectrum Analyzer               | KEYSIGHT                                | N9010A       | MY54430216         | 08/11/2022       | 08/10/2023      |
| Double Ridged Guide Horn Antenna    | SCHWARZBECK                             | BBHA 9120D   | 9120D-788(98006)   | 04/19/2022       | 04/18/2023      |
| Notch Filter                        | MICRO-TRONICS                           | BRM50702-01  | 018                | 01/28/2022       | 01/27/2023      |
| Pre-Amplifier                       | EMCI                                    | EMC012645    | 980098             | 01/28/2022       | 01/27/2023      |
| Pre-Amplifier                       | Com-Power                               | PAM-840A     | 461378             | 06/28/2022       | 06/27/2023      |
| Software                            | Excel(ccs-o6-2020 v1.1) , e3(v6.101222) |              |                    |                  |                 |

### For §8.1~8.7 8.8.4

| Chamber Room #1166 (Conducted Test) |                         |              |               |                  |                 |
|-------------------------------------|-------------------------|--------------|---------------|------------------|-----------------|
| Name of Equipment                   | Manufacturer            | Model        | Serial Number | Calibration Date | Calibration Due |
| EXA Spectrum Analyzer               | KEYSIGHT                | N9010A       | MY54430216    | 08/11/2022       | 08/10/2023      |
| SMA Cable+10dB Attenuator           | CCS                     | SMA+10dB ATT | SMA/10dB      | 01/28/2022       | 01/27/2023      |
| Software                            | Excel(ccs-o6-2020 v1.1) |              |               |                  |                 |

### For §8.9

| Conducted Emission room #1 |               |                  |               |                  |                 |
|----------------------------|---------------|------------------|---------------|------------------|-----------------|
| Name of Equipment          | Manufacturer  | Model            | Serial Number | Calibration Date | Calibration Due |
| BNC Coaxial Cable          | CCS           | BNC50            | 11            | 01/20/2022       | 01/19/2023      |
| EMI Test Receiver          | R&S           | ESCS 30          | 100348        | 02/24/2022       | 02/23/2023      |
| LISN                       | FCC           | FCC-LISN-50-32-2 | 08009         | 07/15/2022       | 07/14/2023      |
| LISN                       | SCHWARZBECK   | NNLK8130         | 8130124       | 01/14/2022       | 01/13/2023      |
| Pulse Limiter              | R&S           | ESH3-Z2          | 100116        | 01/20/2022       | 01/19/2023      |
| Test S/W                   | e3(v6.101222) |                  |               |                  |                 |

## 6.6 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 6.7 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

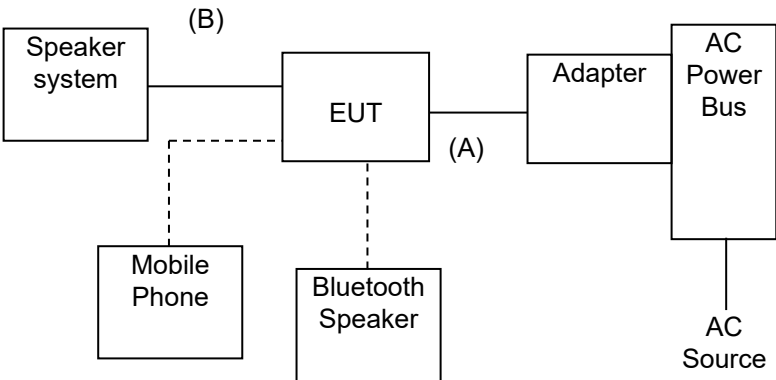
| PARAMETER                                             | UNCERTAINTY            |
|-------------------------------------------------------|------------------------|
| Radiated Emission, 9kHz~30MHz<br>Test Site : CB1166   | $\pm 2.7\text{dB}$     |
| Radiated Emission, 30 MHz ~1GHz<br>Test Site : CB1166 | $\pm 3.76\text{dB}$    |
| Radiated Emission, 1GHz ~18GHz<br>Test Site : CB1166  | $\pm 4.43\text{dB}$    |
| Radiated Emission, 18GH~26.5GHz<br>Test Site : CB1166 | $\pm 4.79\text{dB}$    |
| Radiated Emission, 26.5GH~40GHz<br>Test Site : CB1166 | $\pm 4.72\text{dB}$    |
| Power Line Conducted Emission,<br>9kHz~30MHz          | $\pm 1.83\text{dB}$    |
| Band Width                                            | 0.025%                 |
| Peak Output Power MU                                  | $\pm 1.9\text{dB}$     |
| Band Edge MU                                          | $\pm 0.264\text{dBuV}$ |
| Channel Separation MU                                 | $\pm 361.69\text{Hz}$  |
| Duty Cycle MU                                         | $\pm 0.2\%$            |
| Frequency Stability MU                                | $\pm 0.493\text{Hz}$   |
| Temperature                                           | $\pm 0.5$              |
| Humidity                                              | $\pm 3\%$              |

This measurement uncertainty is confidence of approximately 95%, k=2

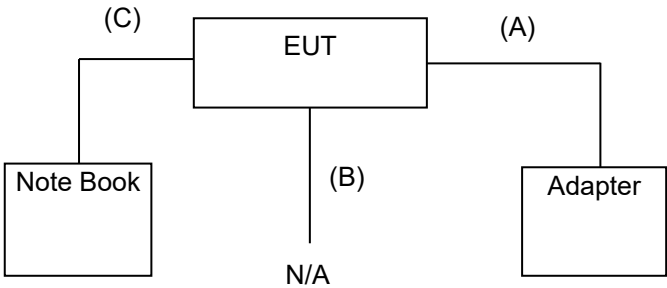
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

EMI



RF



## 7.2 SUPPORT EQUIPMENT

### For EMI test

| No. | Product          | Manufacturer | Model No. | Certify No.        | Signal cable |
|-----|------------------|--------------|-----------|--------------------|--------------|
| 1   | Wireless Speaker | PHILIPS      | TAS1505   | N/A                | N/A          |
| 2   | Speaker System   | infotec      | SP-102    | DOC                | N/A          |
| 3   | Mobile Phone     | realme       | RMX2020   | CCAF204G0<br>210T5 | N/A          |

| No. | Signal cable description |                                     |
|-----|--------------------------|-------------------------------------|
| A   | DC Power Cable           | Unshielded, 1.5m 1 pcs. with 1 core |
| B   | Audio                    | Shielded, 1.0m 1 pcs.               |

### For RF test

| No. | Product   | Manufacturer | Model No. | Certify No. | Power cable                                                           |
|-----|-----------|--------------|-----------|-------------|-----------------------------------------------------------------------|
| 1   | Note Book | Acer         | Z5WEI     | N/A         | AC power: Unshielded, 1.0m<br>DC power: Unshielded, 1.5m, with 1 core |

| No. | Signal cable description |                                      |
|-----|--------------------------|--------------------------------------|
| A   | Power                    | Unshielded, 1.5m 1 pcs. with 1 core. |
| B   | Audio                    | Unshielded, 1.0m 1 pcs.              |
| C   | USB                      | Shielded, 1.2m 1 pcs.                |

#### Note:

- 1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3) shd. = shielded; unshd. = unshielded

## **EUT OPERATING CONDITION**

### **RF Setup**

1. Set up all computers like the setup diagram.
2. The “Blue Test 3 V3.3.9.1137” software was used for testing
3. Choose Transport “DEBUG” and Device “USB DBG(106)”

### **BT1.0 、 3.0**

#### **TX Mode:**

PACKET TX

Channel 1~5: 0,39,78

GFSK(DH1):

Packet Type:DH1 > Packet Length 27

Power(0-9) : 6

GFSK(DH3):

Packet Type:DH3 > Packet Length 183

Power(0-9) : 6

GFSK(DH5):

Packet Type:DH5 > Packet Length 339

Power(0-9) : 6

8-DPSK(3DH1):

Packet Type:3DH1 > Packet Length 83

Power(0-9) : 6

8-DPSK(3DH3):

Packet Type:3DH3 > Packet Length 552

Power(0-9) : 6

8-DPSK(3DH5):

Packet Type:3DH5 > Packet Length 1021

Power(0-9) : 6

#### **RX Mode:**

PACKET TX

### **BT4.0 、 5.0**

#### **TX Mode:**

BLE TEST TX

Channel : 0,20,39 (0-39)

Length : 37

Bit pattern : Pseudo-rdm 9

PHY : 1M (2M)



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**RX Mode:**

BLE TEST RX

Channel : 0 (0-39)

PHY : 1M (2M)

4. All of the function are under run.
5. Start test.

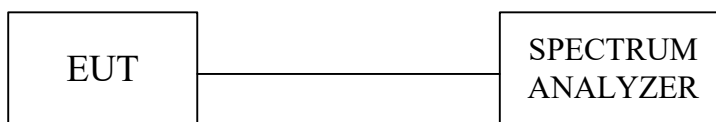
## 8. APPLICABLE LIMITS AND TEST RESULTS

### 8.1 20dB BANDWIDTH FOR HOPPING

#### LIMIT

None; for reporting purposes only.

#### TEST SETUP



#### TEST PROCEDURE

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

## TEST RESULTS

|                            |             |                  |            |
|----------------------------|-------------|------------------|------------|
| <b>Model Name</b>          | CS 529      | <b>Test By</b>   | Ted Huang  |
| <b>Temp &amp; Humidity</b> | 26.2°C, 55% | <b>Test Date</b> | 08/17/2022 |

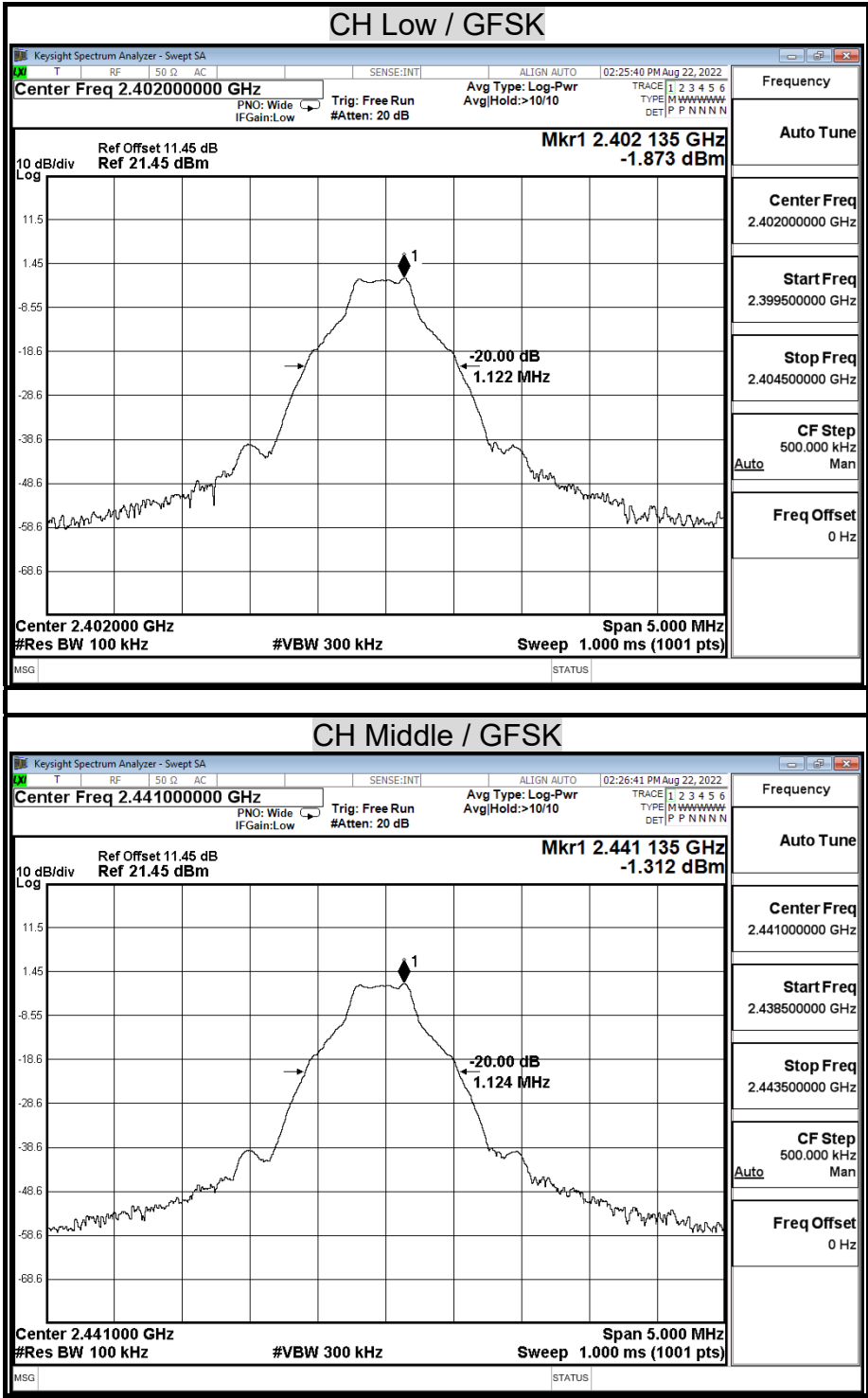
### Modulation Type: GFSK / DH5

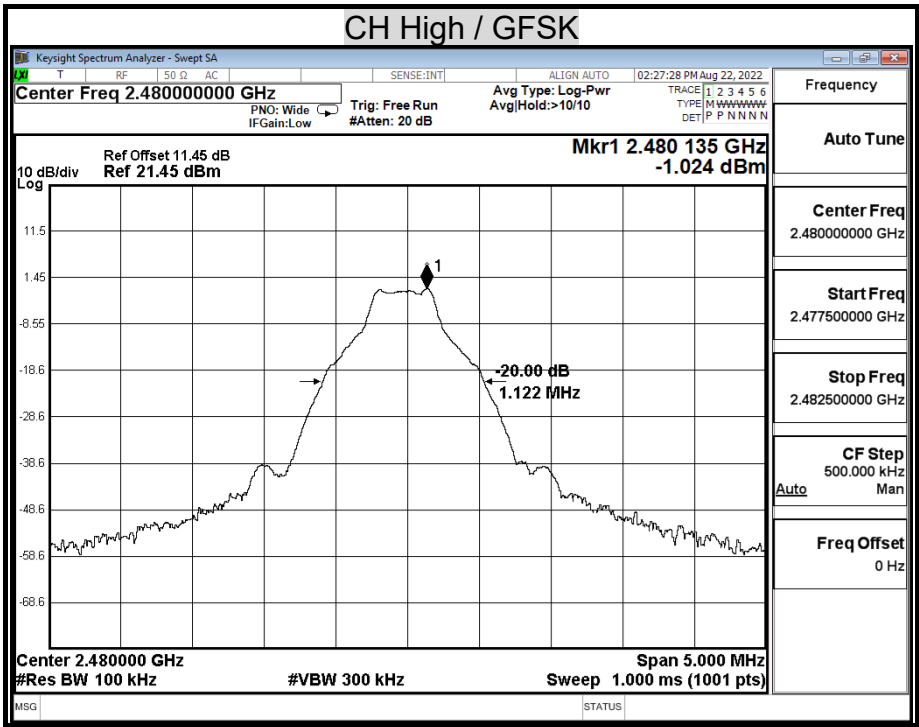
| Channel | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Two-third of 20dB Bandwidth (MHz) | Pass / Fail |
|---------|-------------------------|----------------------|-----------------------------------|-------------|
| Low     | 2402                    | 1222.00              | 0.81                              | PASS        |
| Middle  | 2441                    | 1124.00              | 0.75                              | PASS        |
| High    | 2480                    | 1122.00              | 0.75                              | PASS        |

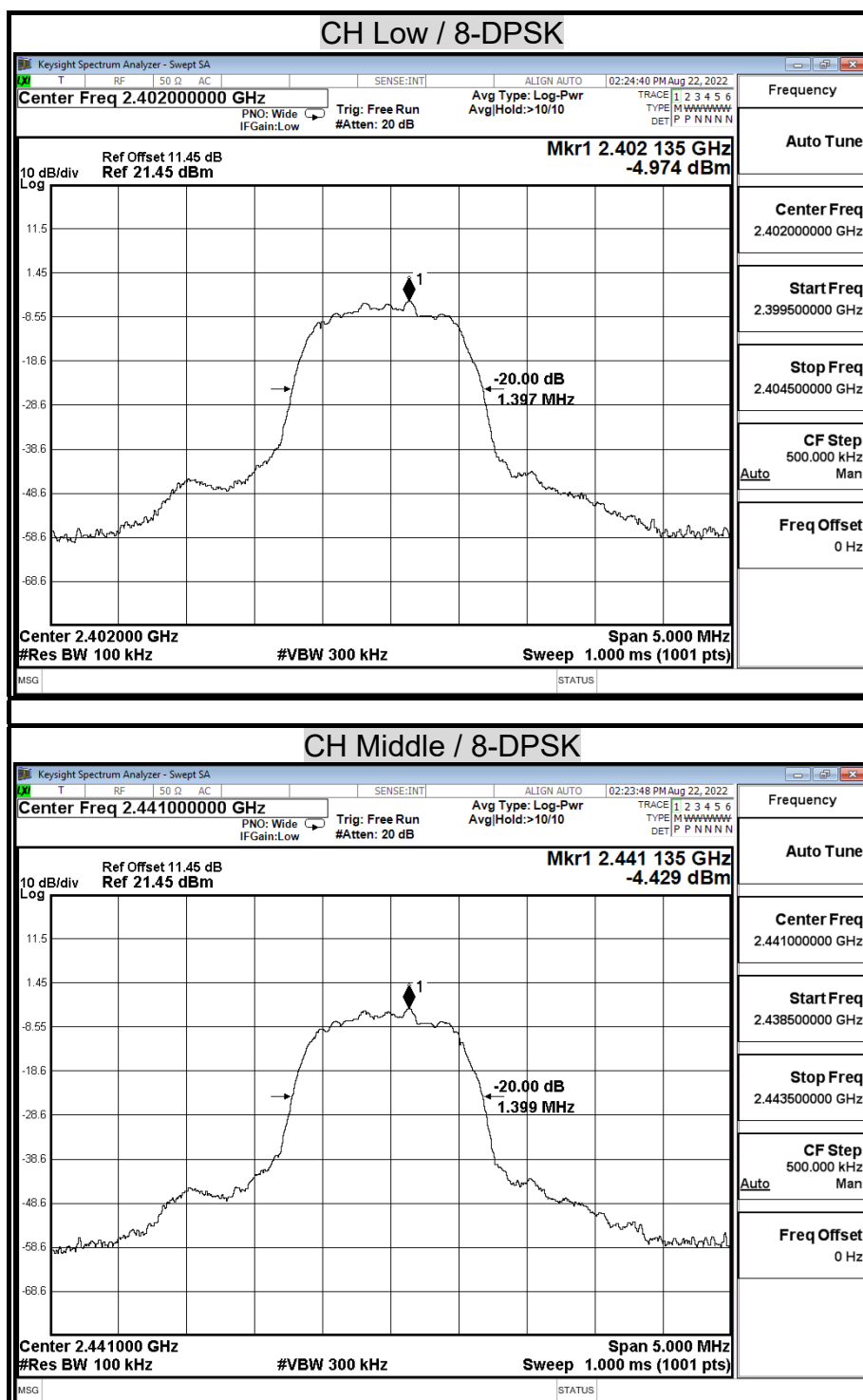
### Modulation Type: 8-DPSK / 3-DH5

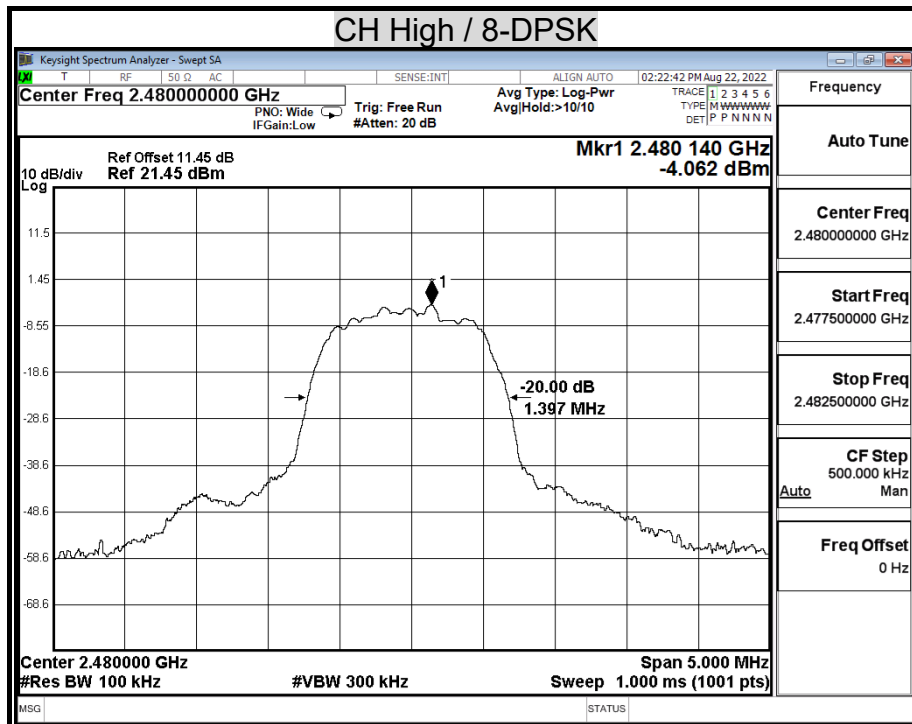
| Channel | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Two-third of 20dB Bandwidth (MHz) | Pass / Fail |
|---------|-------------------------|----------------------|-----------------------------------|-------------|
| Low     | 2402                    | 1397.00              | 0.93                              | PASS        |
| Middle  | 2441                    | 1399.00              | 0.93                              | PASS        |
| High    | 2480                    | 1397.00              | 0.93                              | PASS        |

20dB BANDWIDTH









## 8.2 MAXIMUM PEAK OUTPUT POWER

### LIMIT

§15.247(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

### Test Configuration



### TEST PROCEDURE

The RF power output was measured with a Spectrum Analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Peak Power set:

1. Set the RBW =  $\geq$  DTS bandwidth.
2. Set the VBW  $\geq$   $[3 \times \text{RBW}]$ .
3. Set the span  $\geq$   $[1.5 \times \text{DTS bandwidth}]$ .
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector). If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.

Average power set:

1. Measure the duty cycle  $D$  of the transmitter output signal
2. Set span to at least 1.5 times the OBW.
3. Set the RBW =  $\geq$  DTS bandwidth
4. Set VBW  $\geq [3 \times \text{RBW}]$ .
5. Number of points in sweep  $\geq [2 \times \text{span} / \text{RBW}]$ . (This gives bin-to-bin spacing  $\leq \text{RBW} / 2$ , so that narrowband signals are not lost between frequency bins.)
6. Manually set sweep time  $\geq [10 \times (\text{number of points in sweep}) \times (\text{total ON/OFF period of the transmitted signal})]$ .
7. Set detector = RMS (power averaging).
8. Perform a single sweep.
9. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW.
10. Add  $[10 \log (1 / D)]$ , where  $D$  is the duty cycle, to the measured power to compute the average power during the actual transmission times.



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## TEST RESULTS

|                 |             |           |            |
|-----------------|-------------|-----------|------------|
| Model Name      | CS 529      | Test By   | Ted Huang  |
| Temp & Humidity | 26.2°C, 55% | Test Date | 08/17/2022 |

### Modulation Type: GFSK / DH5

| Channel | Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Output (mW) | Limit (mW) | Result |
|---------|-------------------------|-------------------------|------------------------|------------|--------|
| Low     | 2402                    | -1.94                   | 0.64003                | 125        | PASS   |
| Mid     | 2441                    | -1.92                   | 0.64343                |            | PASS   |
| High    | 2480                    | -1.08                   | 0.77983                |            | PASS   |

### Modulation Type: 8-DPSK / 3-DH5

| Channel | Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Output (mW) | Limit (mW) | Result |
|---------|-------------------------|-------------------------|------------------------|------------|--------|
| Low     | 2402                    | -2.42                   | 0.57227                | 125        | PASS   |
| Mid     | 2441                    | -1.71                   | 0.67499                |            | PASS   |
| High    | 2480                    | -1.01                   | 0.79250                |            | PASS   |



## Average Power Data

### Modulation Type: GFSK / DH5

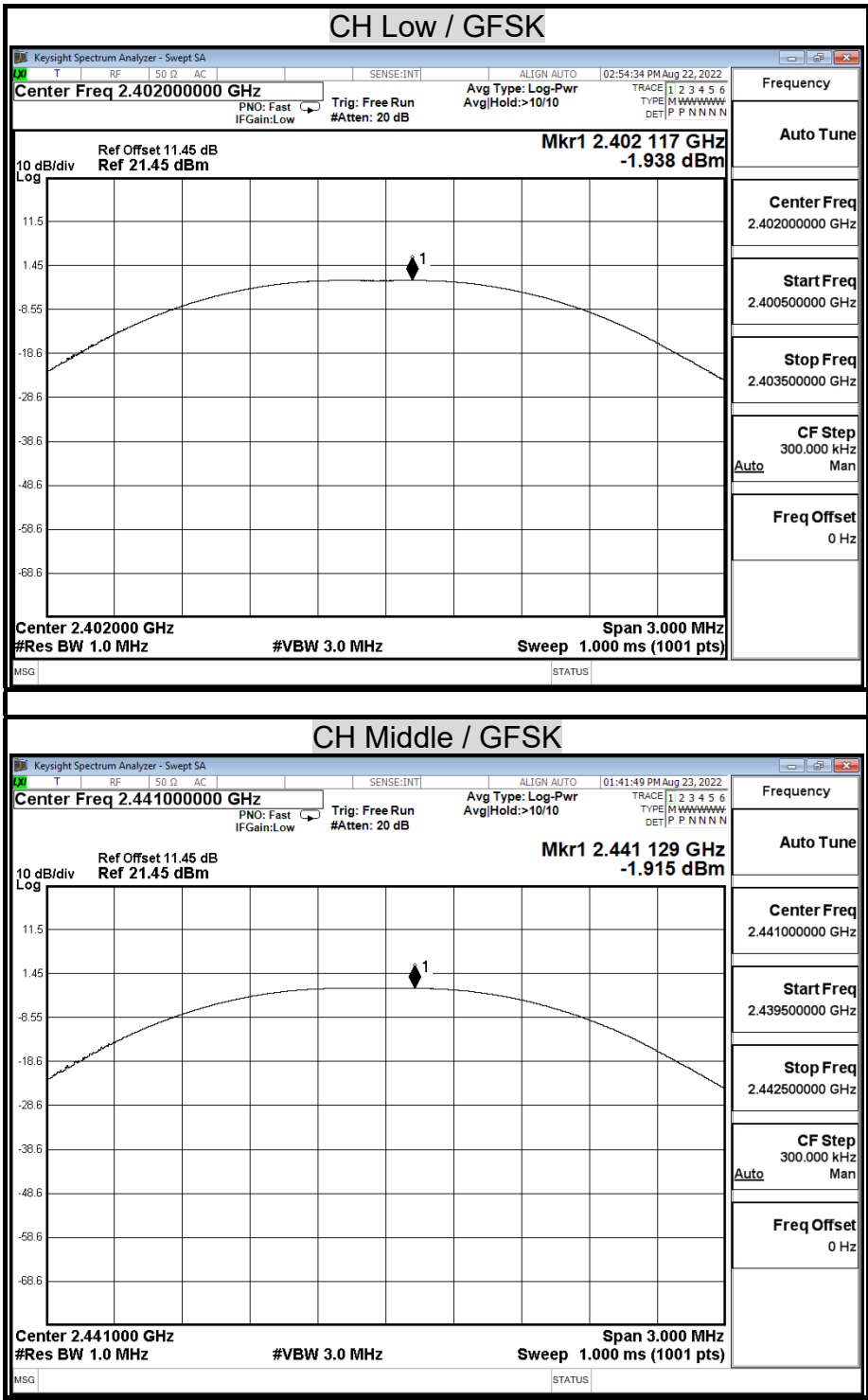
| Channel | Channel Frequency (MHz) | Measure Power (dBm) | 10 log (1 / D) | Average Power (dBm) |
|---------|-------------------------|---------------------|----------------|---------------------|
| Low     | 2402                    | -4.037              | 1.10474        | -2.93               |
| Middle  | 2441                    | -3.263              | 1.10474        | -2.16               |
| High    | 2480                    | -2.522              | 1.10474        | -1.42               |

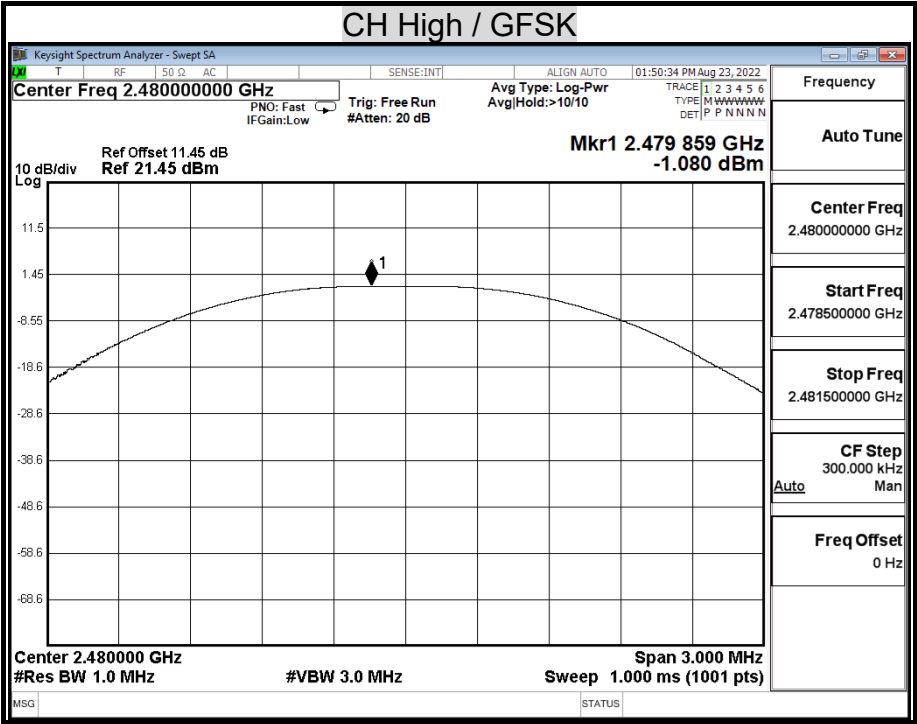
### Modulation Type: 8-DPSK / 3-DH5

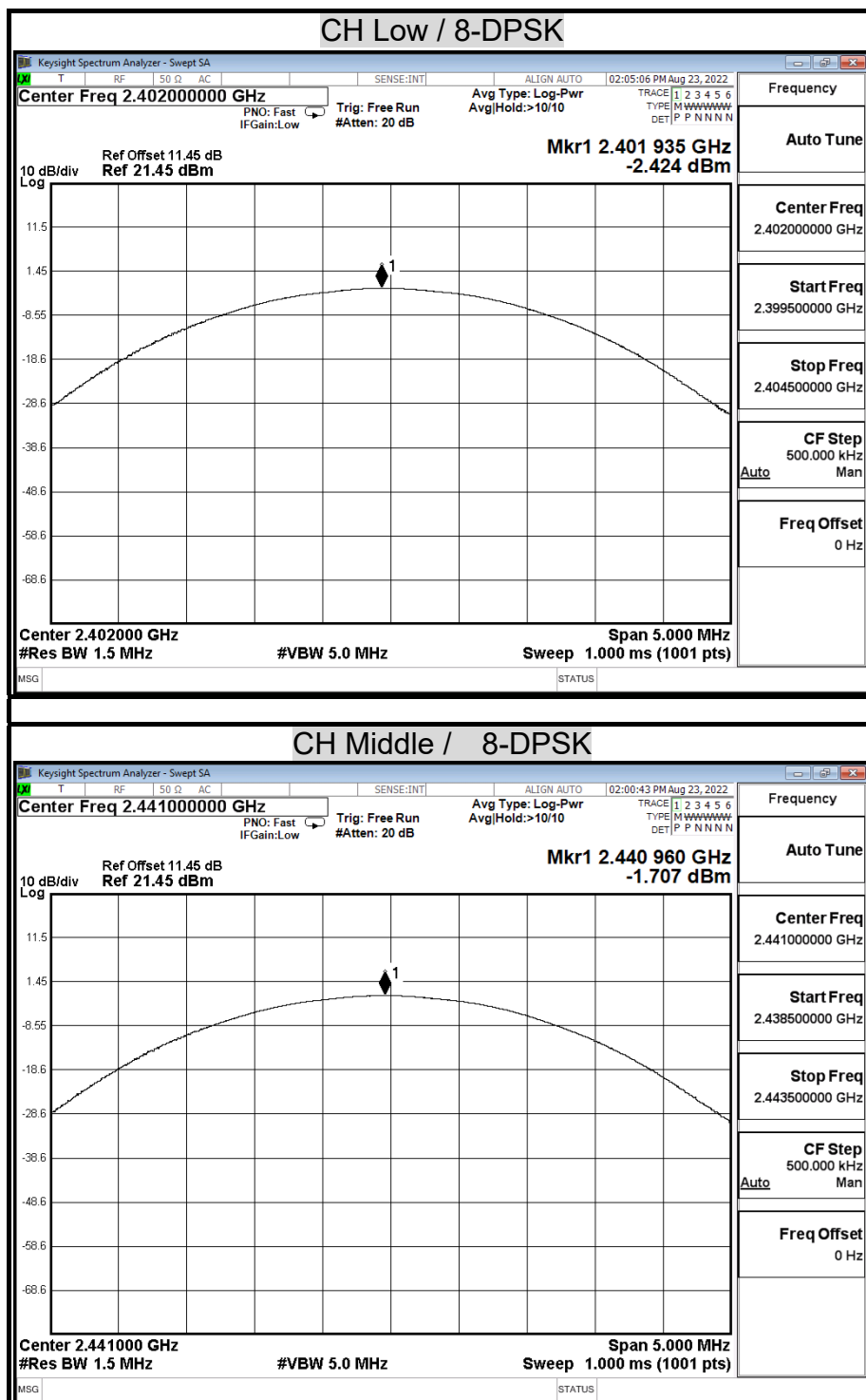
| Channel | Channel Frequency (MHz) | Measure Power (dBm) | 10 log (1 / D) | Average Power (dBm) |
|---------|-------------------------|---------------------|----------------|---------------------|
| Low     | 2402                    | -7.021              | 1.10474        | -5.92               |
| Middle  | 2441                    | -6.251              | 1.10474        | -5.15               |
| High    | 2480                    | -5.737              | 1.10474        | -4.63               |

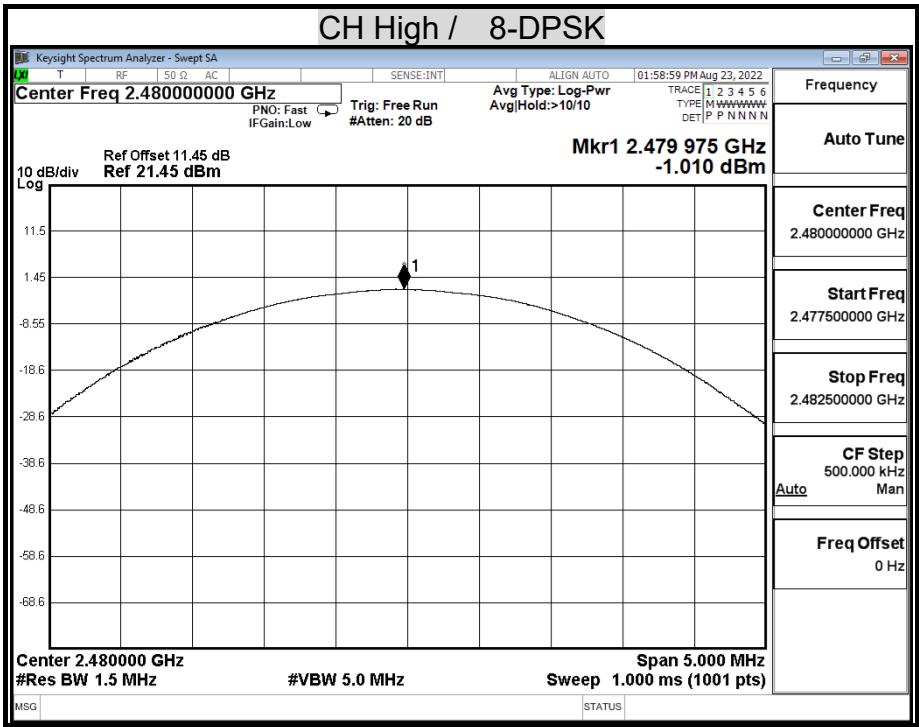


MAXIMUM PEAK OUTPUT POWER

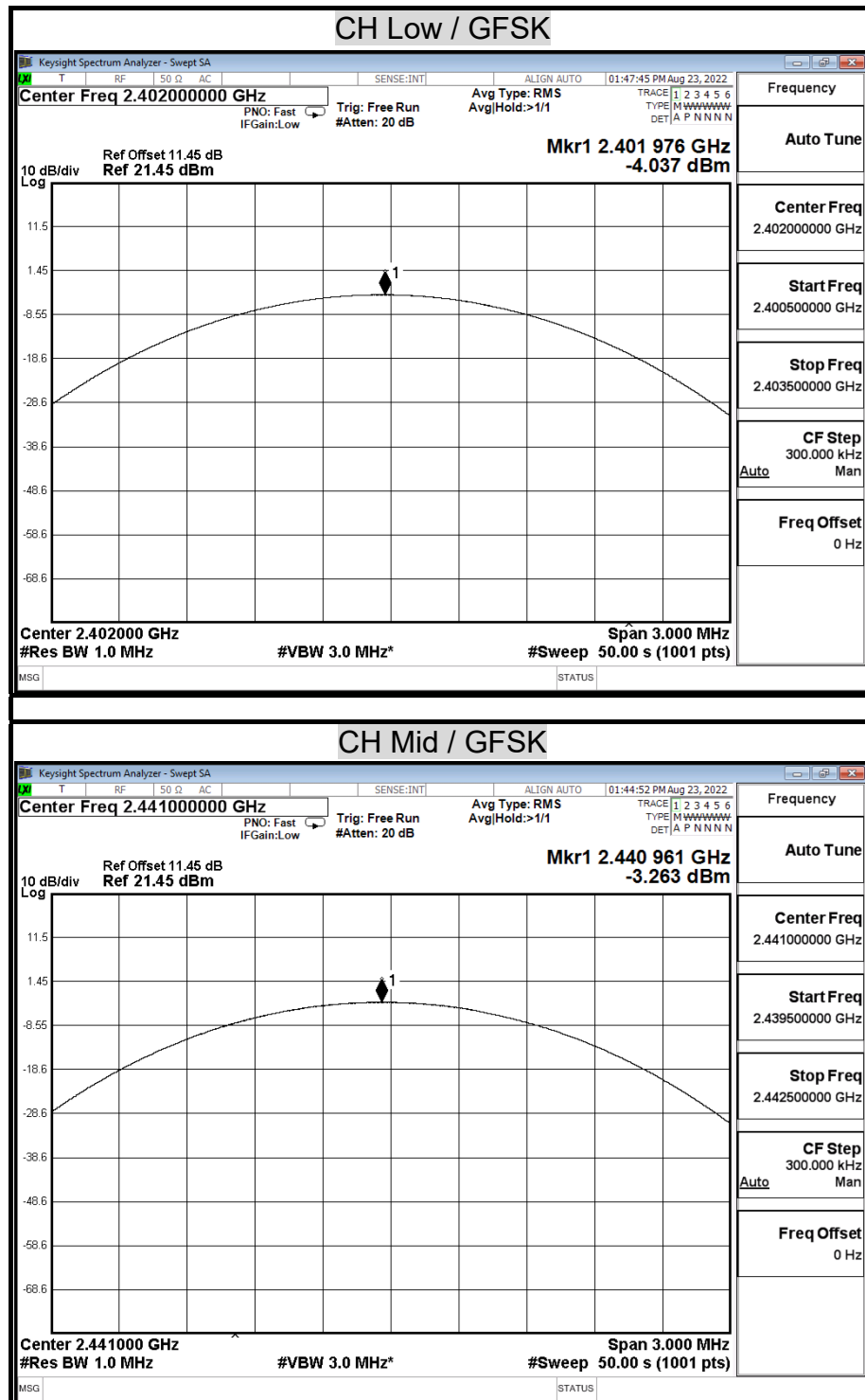


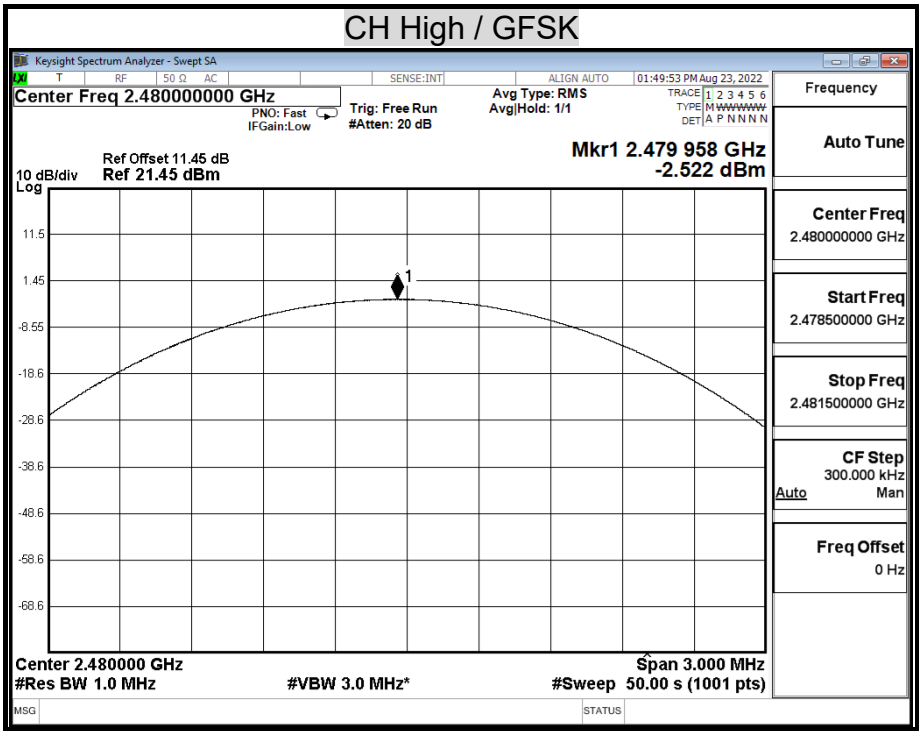


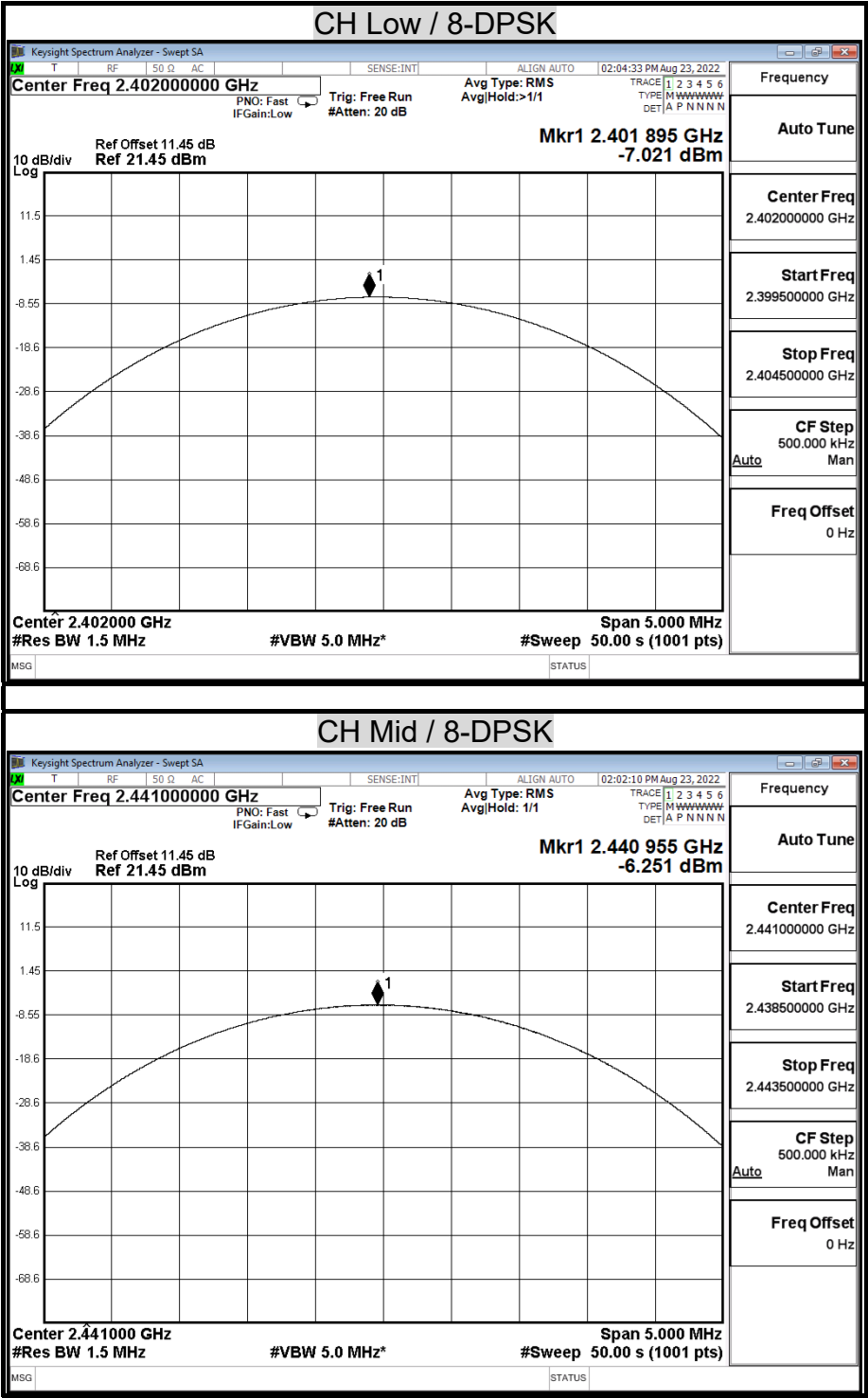


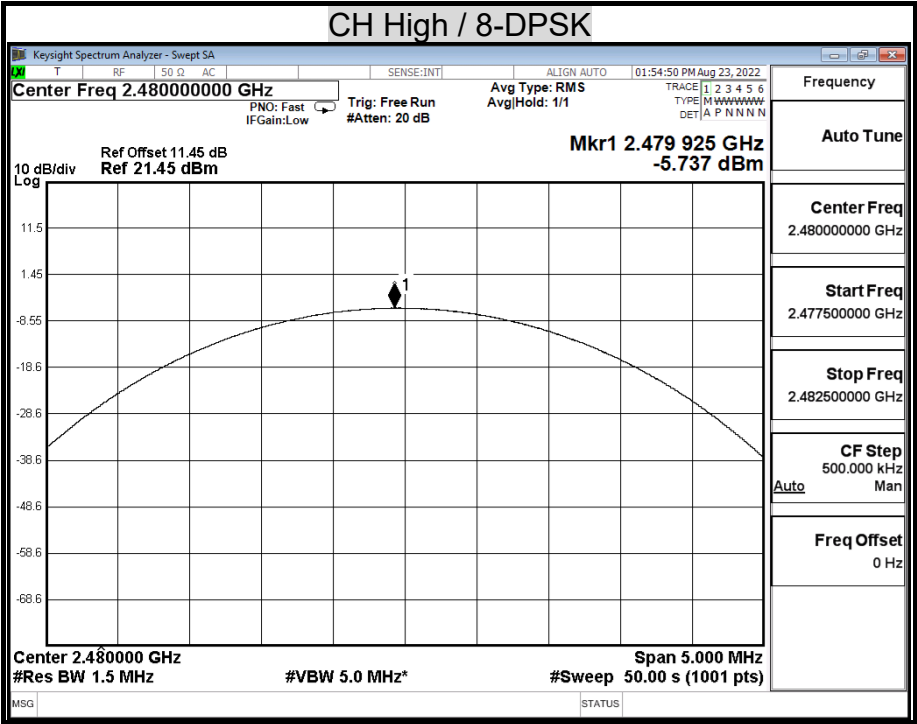


## AVERAGE POWER







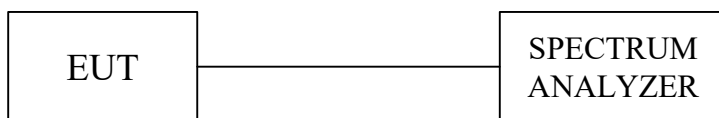


## 8.3 HOPPING CHANNEL SEPARATION

### LIMIT

§15.247(a)(1) 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### TEST SETUP



### TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.

## TEST RESULTS

Refer to section 8.1, 20dB bandwidth measurement, the measured channel separation should be greater than two-third of 20dB bandwidth or Minimum bandwidth.

|                            |             |                  |            |
|----------------------------|-------------|------------------|------------|
| <b>Model Name</b>          | CS 529      | <b>Test By</b>   | Ted Huang  |
| <b>Temp &amp; Humidity</b> | 26.2°C, 55% | <b>Test Date</b> | 08/17/2022 |

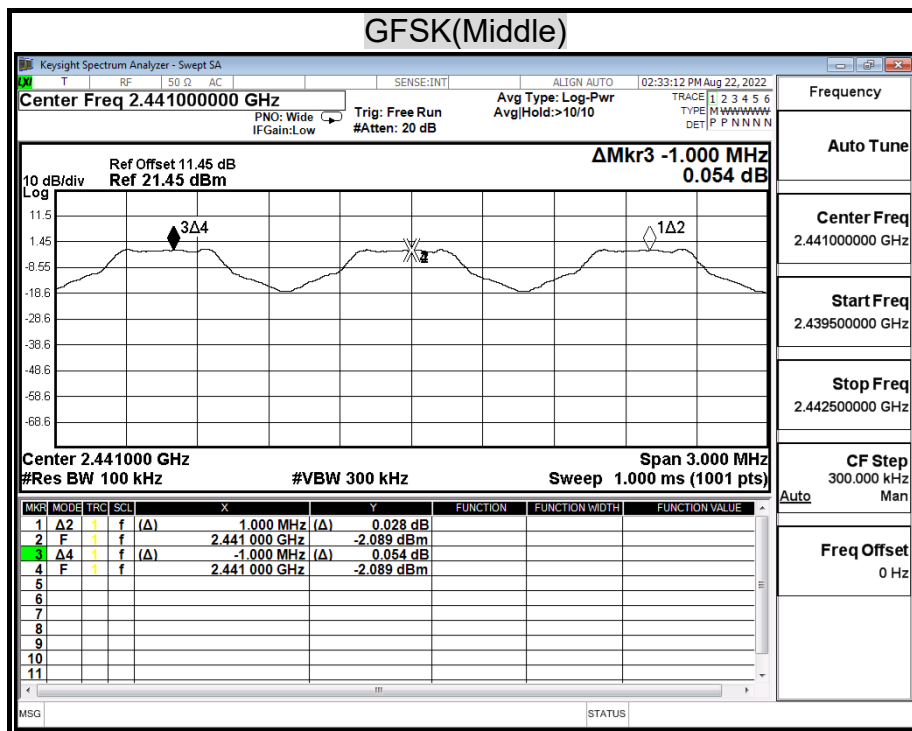
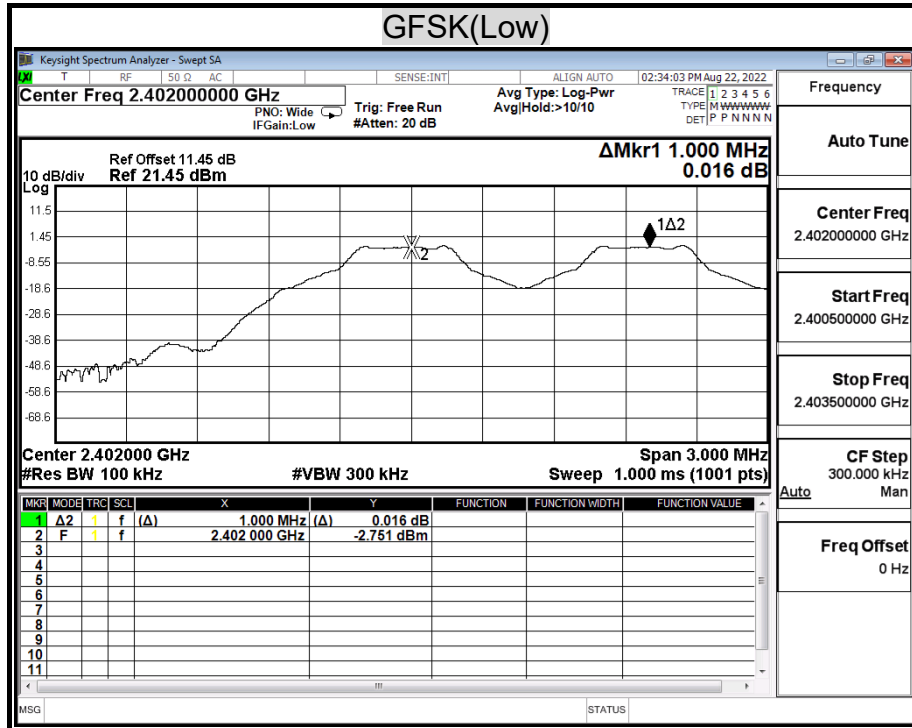
### Modulation Type: GFSK / DH5

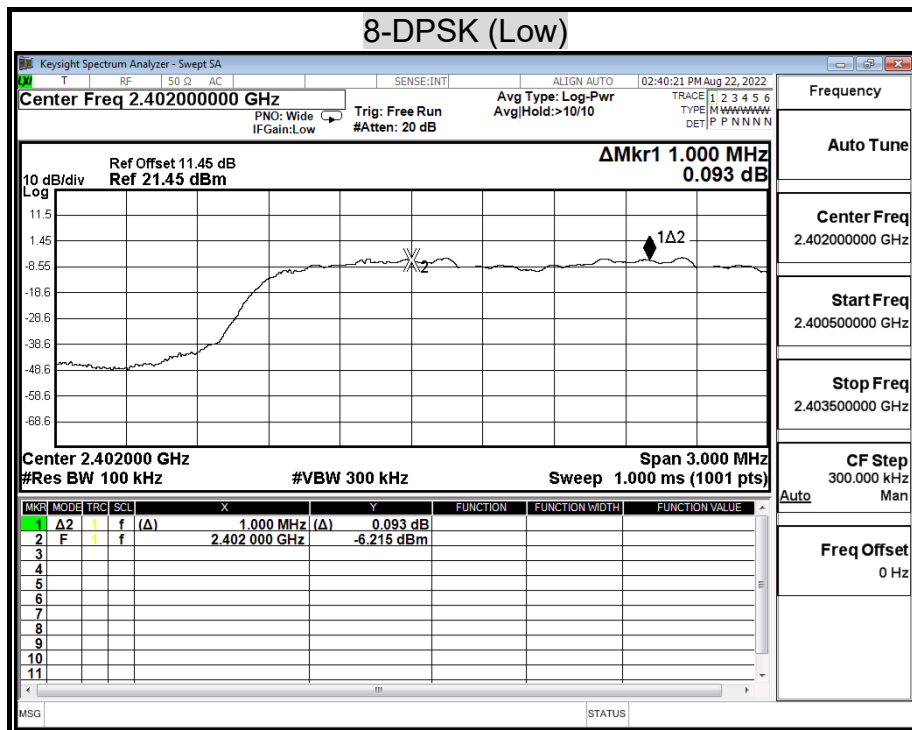
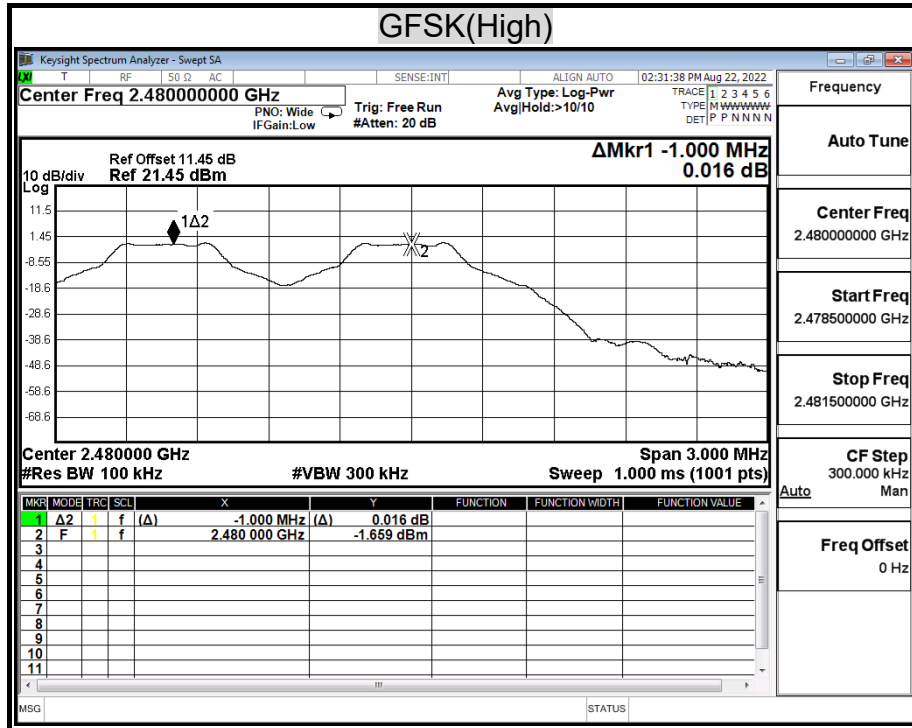
| Channel | Adjacent Hopping Channel Separation (MHz) | Two -third of 20dB bandwidth (MHz) | Minimum Bandwidth (kHz) | Result |
|---------|-------------------------------------------|------------------------------------|-------------------------|--------|
| 2402MHz | 1.00                                      | 0.81                               | 25 kHz                  | PASS   |
| 2441MHz | 1.00                                      | 0.75                               | 25 kHz                  | PASS   |
| 2480MHz | 1.00                                      | 0.75                               | 25 kHz                  | PASS   |

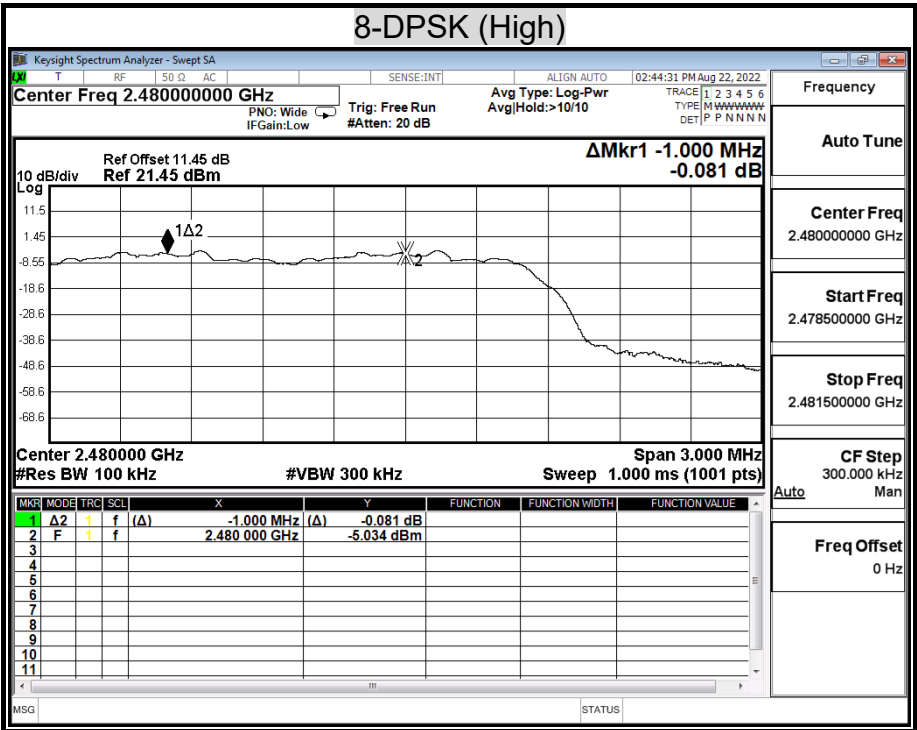
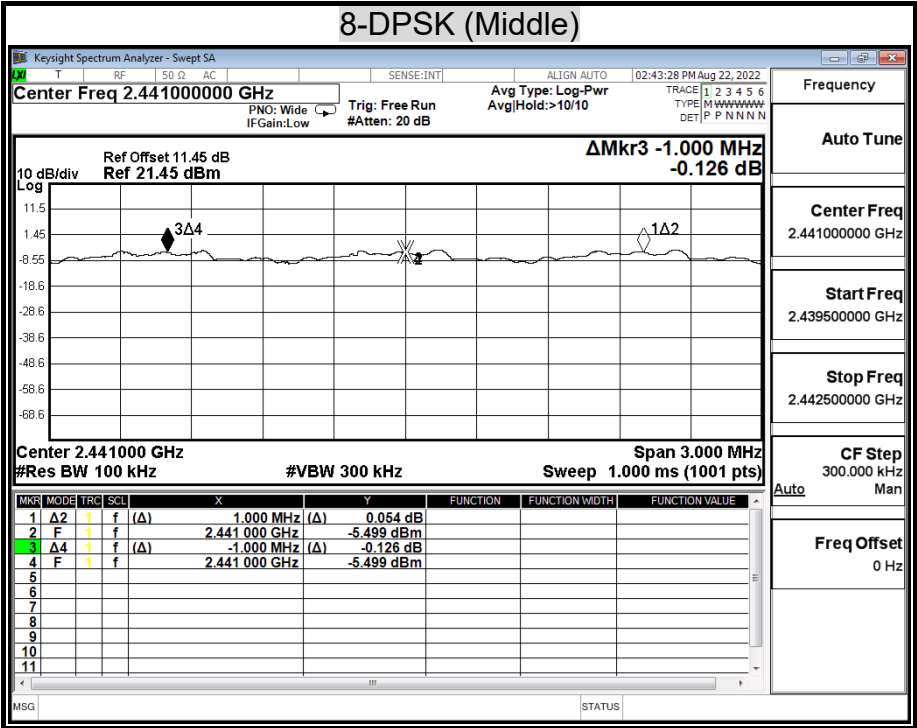
### Modulation Type: 8-DPSK / 3-DH5

| Channel | Adjacent Hopping Channel Separation (MHz) | Two -third of 20dB bandwidth (kHz) | Minimum Bandwidth (kHz) | Result |
|---------|-------------------------------------------|------------------------------------|-------------------------|--------|
| 2402MHz | 1.00                                      | 0.93                               | 25 kHz                  | PASS   |
| 2441MHz | 1.00                                      | 0.93                               | 25 kHz                  | PASS   |
| 2480MHz | 1.00                                      | 0.93                               | 25 kHz                  | PASS   |

## HOPPING CHANNEL SEPARATION





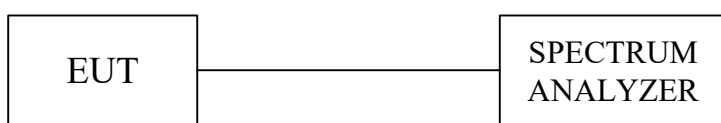


## 8.4 NUMBER OF HOPPING FREQUENCY USED

### LIMIT

§15.247(a)(1)(iii) For frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### TEST SETUP



### TEST PROCEDURE

- 1 Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
- 2 Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- 3 Set the spectrum analyzer on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- 4 Set the spectrum analyzer on View mode and then plot the result on spectrum analyzer screen.
- 5 Repeat above procedures until all frequencies measured were complete.



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## **TEST RESULTS**

|                            |             |                  |            |
|----------------------------|-------------|------------------|------------|
| <b>Model Name</b>          | CS 529      | <b>Test By</b>   | Ted Huang  |
| <b>Temp &amp; Humidity</b> | 26.2°C, 55% | <b>Test Date</b> | 08/17/2022 |

### **Modulation Type: GFSK / DH5**

| <b>Result(No.of CH)</b> | <b>Limit(No.of CH)</b> | <b>Result</b> |
|-------------------------|------------------------|---------------|
| 79                      | >15                    | PASS          |

### **Modulation Type: 8-DPSK / 3-DH5**

| <b>Result(No.of CH)</b> | <b>Limit(No.of CH)</b> | <b>Result</b> |
|-------------------------|------------------------|---------------|
| 79                      | >15                    | PASS          |

## NUMBER OF HOPPING FREQUENCY USED

