

TECHNICAL REPORT



Report No.: FCC 1901184-03  
File reference No.: 2019-02-21

Applicant: GLORY STAR TECHNICS (SHENZHEN) CO., LTD.

Product: 21.5' Advertising Displayer

Model No.: ULT215

Trademark: N/A

Test Standards: FCC Part 15.247

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15.247 for the evaluation of electromagnetic compatibility

Approved By

*Jack Chung*

---

Jack Chung

Manager

Dated: February 21,2019

**Results appearing herein relate only to the sample tested**

**The technical reports is issued errors and omissions exempt and is subject to withdrawal at**

**SHENZHEN TIMEWAY TESTING LABORATORIES**

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



### **Special Statement:**

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

#### **CNAS-LAB Code: L2292**

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

#### **FCC-Registration No.: 744189**

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

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Test Report Conclusion

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## 1.0 General Details

### 1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.  
Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China  
Telephone: (755) 83448688  
Fax: (755) 83442996

### 1.2 Applicant Details

Applicant: GLORY STAR TECHNICS (SHENZHEN) CO., LTD.  
Address: 4/Floor,west block,Longzhu Road,Xin WuCun Industry Building,NanShan District,ShenZhen  
Telephone: (755)-26001808-305  
Fax: (755)-26002933

### 1.3 Description of EUT

Product: 21.5' Advertising Displayer  
Manufacturer: GLORY STAR TECHNICS (SHENZHEN) CO., LTD.  
Address: 4/Floor,west block,Longzhu Road,Xin WuCun Industry Building,NanShan District,ShenZhen  
Brand Name: N/A  
Model Number: ULT215  
Additional Model Number: N/A  
Type of Modulation GFSK, 11/4DQPSK, 8DPSK for Bluetooth  
Frequency range 2402-2480MHz for Bluetooth  
Channel Spacing 1MHz for Bluetooth  
Frequency Selection By software  
Channel Number 79 channel for Bluetooth  
Antenna: Dipole antenna. The gain of the antennas is 2.0dBi.  
Power Supply: Model: SUN-1200500; Rating: Input:100-240V~, 50/60Hz, 1.7A;  
Output:DC12V,5A

### 1.4 Submitted Sample: 2 Samples

### 1.5 Test Duration

2019-01-21 to 2019-02-21

### 1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB  
Radiated Emissions below 1GHz Uncertainty =4.7dB

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Radiated Emissions above 1GHz Uncertainty =6.0dB  
Conducted Power Uncertainty =6.0dB  
Occupied Channel Bandwidth Uncertainty =5%

1.7 Test Engineer

*Terry Tang*

The sample tested by \_\_\_\_\_

Print Name: Terry Tang

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| <b>2.0 Test Equipment</b> |              |                      |              |              |            |
|---------------------------|--------------|----------------------|--------------|--------------|------------|
| Instrument Type           | Manufacturer | Model                | Serial No.   | Date of Cal. | Due Date   |
| ESPI Test Receiver        | R&S          | ESPI 3               | 100379       | 2018-06-22   | 2019-06-21 |
| TWO<br>Line-V-NETW        | R&S          | EZH3-Z5              | 100294       | 2018-06-22   | 2019-06-21 |
| TWO<br>Line-V-NETW        | R&S          | EZH3-Z5              | 100253       | 2018-06-22   | 2019-06-21 |
| Ultra Broadband<br>ANT    | R&S          | HL562                | 100157       | 2018-06-18   | 2019-06-17 |
| Impuls-Begrenzer          | R&S          | ESH3-Z2              | 100281       | 2018-06-22   | 2019-06-21 |
| Loop Antenna              | EMCO         | 6507                 | 00078608     | 2018-06-25   | 2019-06-24 |
| Spectrum                  | R&S          | FSIQ26               | 100292       | 2018-06-22   | 2019-06-21 |
| Horn Antenna              | A-INFO       | LB-180400-KF         | J211060660   | 2018-06-25   | 2019-06-24 |
| Horn Antenna              | R&S          | BBHA 9120D           | 9120D-631    | 2018-08-24   | 2019-08-23 |
| Power meter               | Anritsu      | ML2487A              | 6K00003613   | 2018-08-22   | 2019-08-21 |
| Power sensor              | Anritsu      | MA2491A              | 32263        | 2018-08-22   | 2019-08-21 |
| Bilog Antenna             | Schwarebeck  | VULB9163             | 9163/340     | 2018-07-04   | 2019-07-03 |
| 9*6*6 Anechoic            | --           | --                   | N/A          | 2018-02-07   | 2021-02-06 |
| EMI Test Receiver         | RS           | ESVB                 | 826156/011   | 2018-06-22   | 2019-06-21 |
| EMI Test Receiver         | RS           | ESH3                 | 860904/006   | 2018-06-22   | 2019-06-21 |
| Spectrum                  | HP/Agilent   | ESA-L1500A           | US37451154   | 2018-06-22   | 2019-06-21 |
| Spectrum                  | HP/Agilent   | E4407B               | MY50441392   | 2018-03-27   | 2019-03-26 |
| Spectrum                  | RS           | FSP                  | 1164.4391.38 | 2019-01-20   | 2020-01-19 |
| RF Cable                  | Zhengdi      | ZT26-NJ-NJ-8<br>M/FA | --           | 2018-05-24   | 2019-05-23 |
| RF Cable                  | Zhengdi      | 7m                   | --           | 2018-03-17   | 2019-03-16 |
| RF Switch                 | EM           | EMSW18               | 060391       | 2018-06-22   | 2019-06-21 |
| Pre-Amplifier             | Schwarebeck  | BBV9743              | #218         | 2018-06-22   | 2019-06-21 |
| Pre-Amplifier             | HP/Agilent   | 8449B                | 3008A00160   | 2018-08-05   | 2019-08-04 |
| LISN                      | SCHAFFNER    | NNB42                | 00012        | 2019-01-08   | 2020-01-07 |

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### 3.0 Technical Details

#### 3.1 Summary of test results

| <b>The EUT has been tested according to the following specifications:</b> |   |               |                 |
|---|---|---------------|-----------------|
| <b>Requirement</b>  | <b>CFR 47 Section</b>                         | <b>Result</b> | <b>Notes</b>    |
| <b>Antenna Requirement</b>  | <b>15.203, 15.247(b)(4)</b>                   | <b>PASS</b>   | <b>Complies</b> |
| <b>Maximum Peak Out Power</b>   | <b>15.247 (b)(1), (4)</b>                     | <b>PASS</b>   | <b>Complies</b> |
| <b>Carrier Frequency Separation</b>                                       | <b>15.247(a)(1)</b>                           | <b>PASS</b>   | <b>Complies</b> |
| <b>20dB Channel Bandwidth</b>   | <b>15.247 (a)(1)</b>                          | <b>PASS</b>   | <b>Complies</b> |
| <b>Number of Hopping Channels</b>   | <b>15.247(a)(iii), 15.247(b)(1)</b>           | <b>PASS</b>   | <b>Complies</b> |
| <b>Time of Occupancy (Dwell Time)</b>                                     | <b>15.247(a)(iii)</b>                         | <b>PASS</b>   | <b>Complies</b> |
| <b>Spurious Emission, Band Edge, and Restricted bands</b>                 | <b>15.247(d),15.205(a), 15.209 (a),15.109</b> | <b>PASS</b>   | <b>Complies</b> |
| <b>Conducted Emissions</b>  | <b>15.207(a), 15.107</b>                      | <b>PASS</b>   | <b>Complies</b> |
| <b>RF Exposure</b>  | <b>15.247(i), 1.1307(b)(1)</b>                | <b>PASS</b>   | <b>Complies</b> |

#### 3.2 Test Standards

**FCC Part 15 Subpart & Subpart C, Paragraph 15.247**

#### 4.0 EUT Modification

**No modification by SHENZHEN TIMEWAY TESTING LABORATORIES.**

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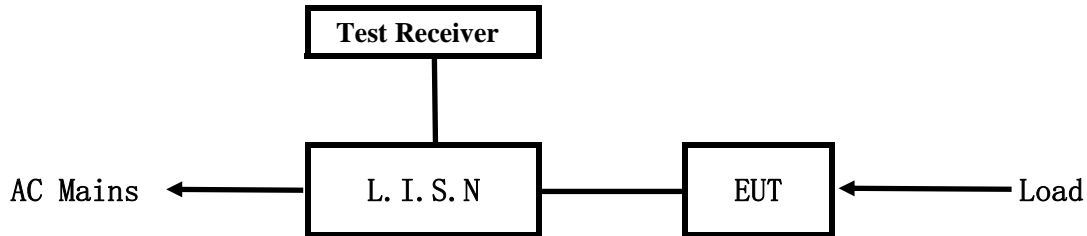
This report is issued in confidence to the client and it will be strictly treated as such by the SHENZHEN TIMEWAY TESTING LABORATORIES. It may not be reproduced rather in its entirety or in part and it may not be used for advertising. The client to whom the report is issued may, however, show or send it or a certified copy thereof prepared by the SHENZHEN TIMEWAY TESTING LABORATORIES to his customer. Supplier or others persons directly concerned. SHENZHEN TIMEWAY TESTING LABORATORIES will not, without the consent of the client enter into any discussion of correspondence with any third party concerning the contents of the report.

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## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test



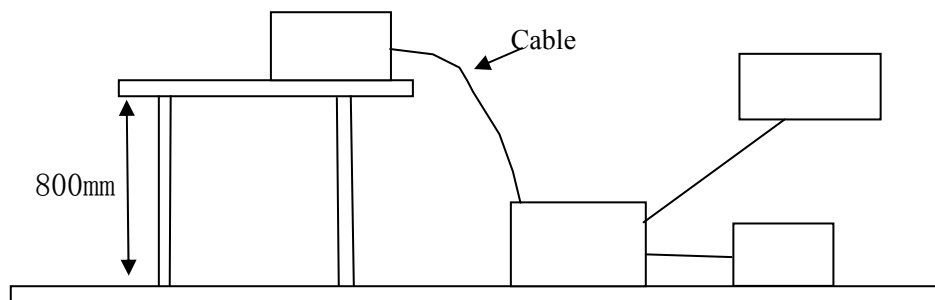
EUT: Equipment Under Test

### 5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2013. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.10-2013.

Test Voltage: 120V~60Hz

Block diagram of Test setup



### 5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.10-2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

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A. EUT

| Device                      | Manufacturer                                | Model  | FCC ID       |
|-----------------------------|---|--------|--------------|
| 21.5' Advertising Displayer | GLORY STAR TECHNICS<br>(SHENZHEN) CO., LTD. | ULT215 | 2AACS-ULT215 |

B. Internal Device

| Device | Manufacturer | Model | Rating |
|--------|--------------|-------|--------|
|        |              |       |        |

C. Peripherals

| Device | Manufacturer | Model | Rating |
|--------|--------------|-------|--------|
|        |              |       |        |

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.10-2013.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.107 ,15.207

| Frequency<br>(MHz) | Class A Limits (dB $\mu$ V) |               | Class B Limits (dB $\mu$ V) |               |
|--------------------|-----------------------------|---------------|-----------------------------|---------------|
|                    | Quasi-peak Level            | Average Level | Quasi-peak Level            | Average Level |
| 0.15 ~ 0.50        | 79.0                        | 66.0          | 66.0~56.0*                  | 56.0~46.0*    |
| 0.50 ~ 5.00        | 73.0                        | 60.0          | 56.0                        | 46.0          |
| 5.00 ~ 30.00       | 73.0                        | 60.0          | 60.0                        | 50.0          |

- Notes: 1. \*Decreasing linearly with logarithm of frequency.  
2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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**A: Conducted Emission on Live Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

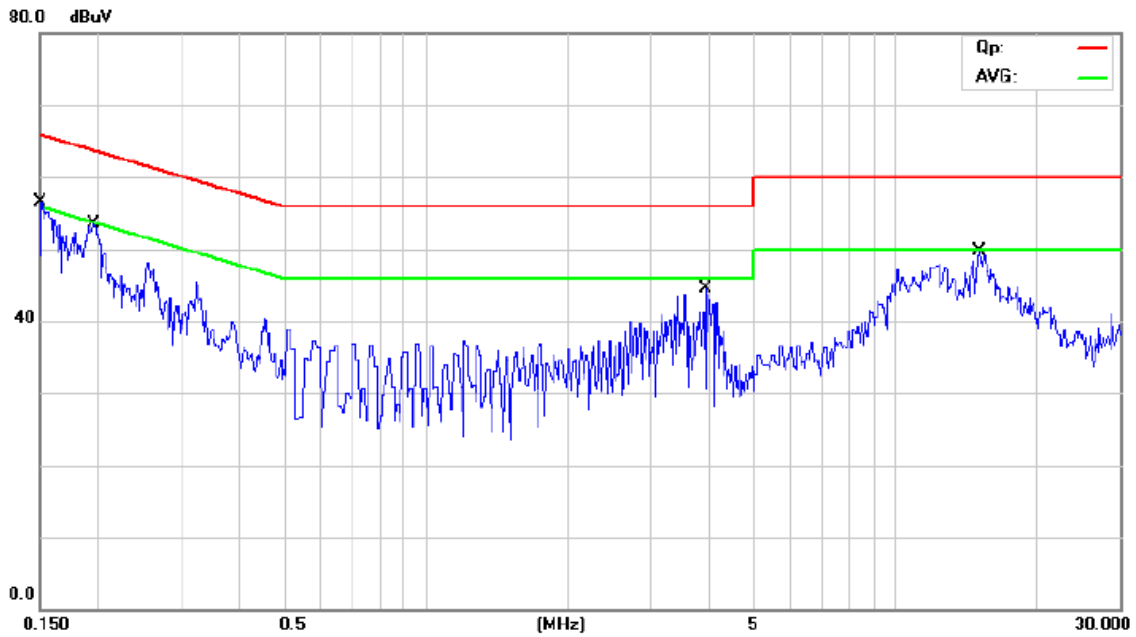
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: PASS**

Please refer to following diagram for individual



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   | Detector | Comment |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     |          |         |
| 1   |     | 0.1517  | 34.60         | 9.78           | 44.38       | 65.91 | -21.53 | QP       |         |
| 2   |     | 0.1517  | 2.50          | 9.78           | 12.28       | 55.91 | -43.63 | AVG      |         |
| 3   |     | 0.1945  | 40.90         | 9.75           | 50.65       | 63.84 | -13.19 | QP       |         |
| 4   |     | 0.1945  | 26.30         | 9.75           | 36.05       | 53.84 | -17.79 | AVG      |         |
| 5   | *   | 3.9433  | 33.20         | 9.88           | 43.08       | 56.00 | -12.92 | QP       |         |
| 6   |     | 3.9433  | 4.20          | 9.88           | 14.08       | 46.00 | -31.92 | AVG      |         |
| 7   |     | 15.0220 | 32.10         | 10.38          | 42.48       | 60.00 | -17.52 | QP       |         |
| 8   |     | 15.0220 | 4.80          | 10.38          | 15.18       | 50.00 | -34.82 | AVG      |         |

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**B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)**

**EUT Operating Environment**

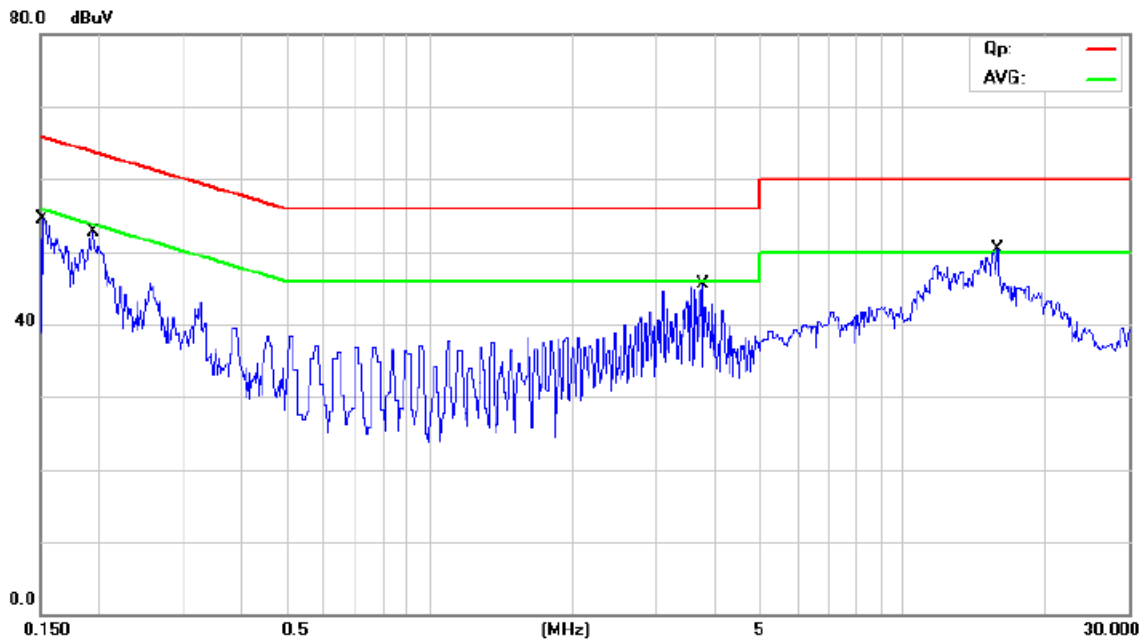
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



| No. | Mk. | Freq.   | Reading Level | Correct Factor | Measurement | Limit | Over   | Detector | Comment |
|-----|-----|---------|---------------|----------------|-------------|-------|--------|----------|---------|
|     |     | MHz     | dBuV          | dB             | dBuV        | dBuV  | dB     |          |         |
| 1   |     | 0.1512  | 33.50         | 9.78           | 43.28       | 65.93 | -22.65 | QP       |         |
| 2   |     | 0.1512  | 0.30          | 9.78           | 10.08       | 55.93 | -45.85 | AVG      |         |
| 3   |     | 0.1935  | 39.40         | 9.75           | 49.15       | 63.88 | -14.73 | QP       |         |
| 4   |     | 0.1935  | 23.80         | 9.75           | 33.55       | 53.88 | -20.33 | AVG      |         |
| 5   | *   | 3.7505  | 31.40         | 9.88           | 41.28       | 56.00 | -14.72 | QP       |         |
| 6   |     | 3.7505  | 3.00          | 9.88           | 12.88       | 46.00 | -33.12 | AVG      |         |
| 7   |     | 15.7660 | 33.30         | 10.43          | 43.73       | 60.00 | -16.27 | QP       |         |
| 8   |     | 15.7660 | 8.70          | 10.43          | 19.13       | 50.00 | -30.87 | AVG      |         |

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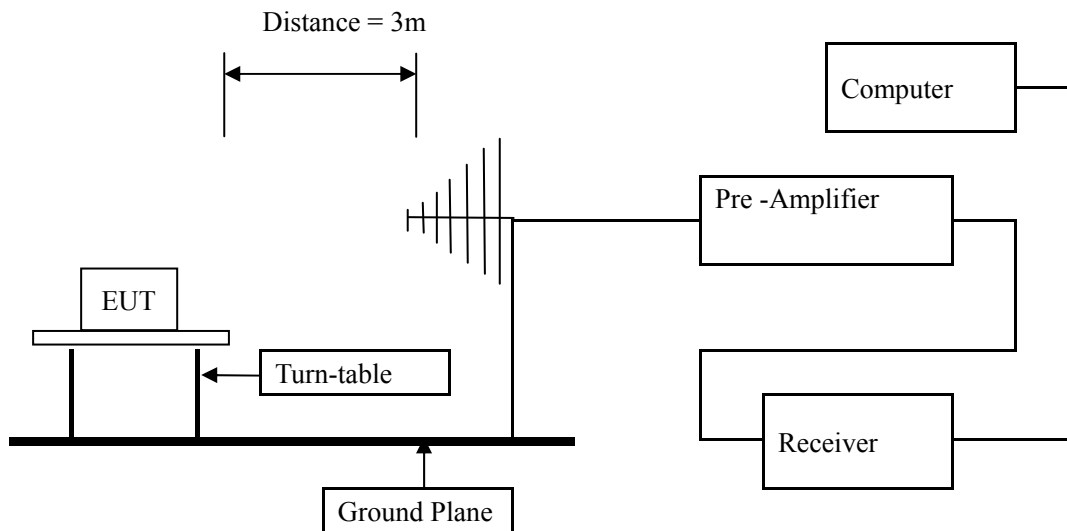


## 6 Radiated Emission Test

### 6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at Timeway EMC Laboratory. This site is on file with the FCC laboratory division, Registration No. 744189
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.
- (3) The frequency spectrum from 30 MHz to 25GHz was investigated. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=VBW=1MHz and PK detector. AV value with RBW=1MHz, VBW=10Hz and PK detector. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "QP" in the data table.
- (6) The antenna polarization : Vertical polarization and Horizontal polarization.

### Block diagram of Test setup



6.2 Configuration of The EUT  
Same as section 5.3 of this report

6.3 EUT Operating Condition  
Same as section 5.4 of this report.

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6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

**Frequencies in restricted band are complied to limit on Paragraph 15.209 and RSS-247**

| Frequency Range (MHz) | Distance (m) | Field strength (dB $\mu$ V/m) |
|-----------------------|--------------|-------------------------------|
| 30-88                 | 3            | 40.0                          |
| 88-216                | 3            | 43.5                          |
| 216-960               | 3            | 46.0                          |
| Above 960             | 3            | 54.0                          |

- Note:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
  2. In the Above Table, the higher limit applies at the band edges.
  3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
  4. GFSK was the worse case because it has highest output power



**Test result**

**General Radiated Emission Data and Harmonics Radiated Emission Data**

**Radiated Emission In Horizontal/Vertical (30MHz----1000MHz)**

EUT set Condition:       Keep Bluetooth Transmitting

**Results:**               **Pass**

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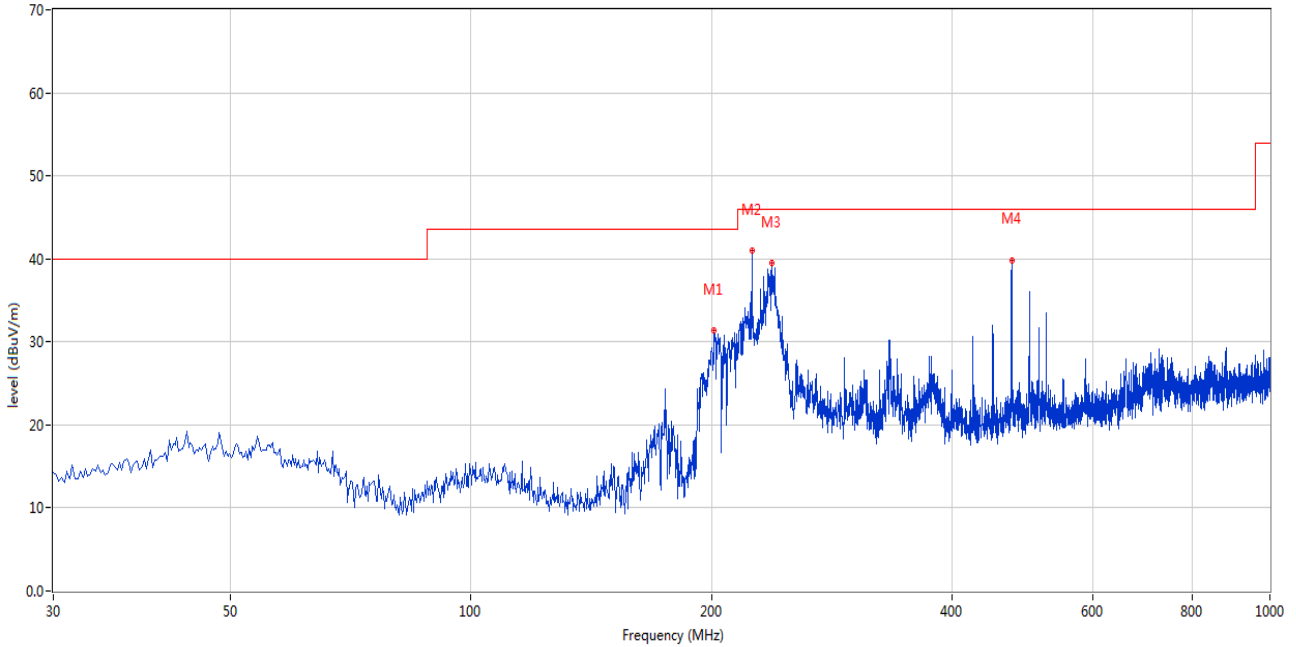
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Test Figure:

**H**

FCC\_FCC Part 15B Class B 30MHz-1GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 201.405         | 31.37            | -13.42      | 43.5           | -12.13          | Peak     | 9.00      | 100         | H   | Pass    |
| 2   | 224.921         | 40.99            | -12.93      | 46.0           | -5.01           | Peak     | 0.00      | 100         | H   | Pass    |
| 3   | 237.771         | 39.46            | -12.44      | 46.0           | -6.54           | Peak     | 0.00      | 100         | H   | Pass    |
| 4   | 475.119         | 39.86            | -7.41       | 46.0           | -6.14           | Peak     | 0.00      | 100         | H   | Pass    |

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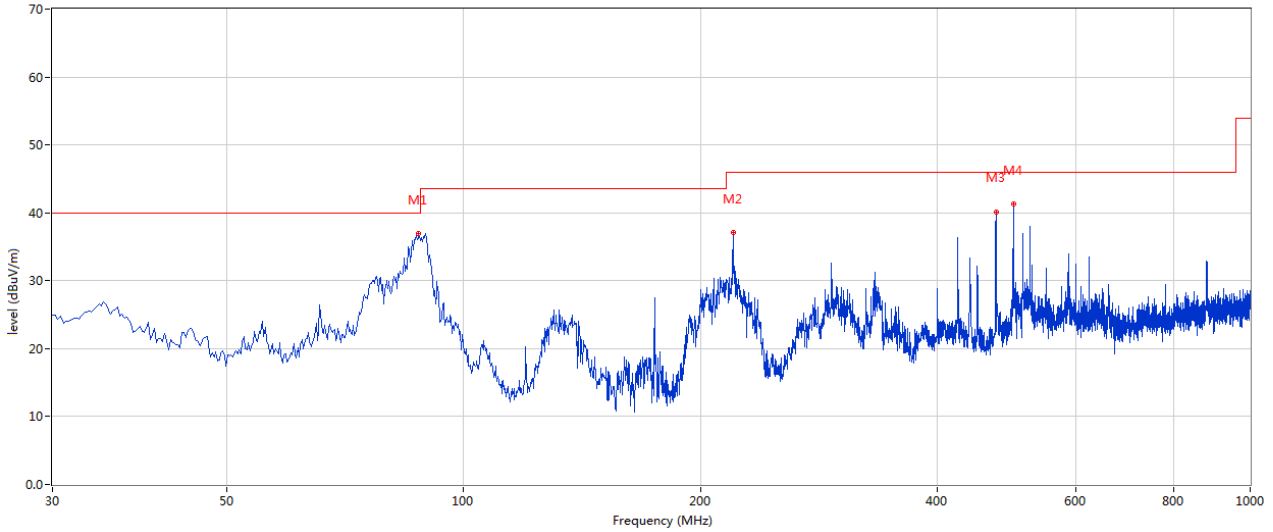
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Test Figure:

V

FCC\_FCC Part 15B Class B 30MHz-1GHz



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 87.701          | 36.90            | -15.67      | 40.0           | -3.10           | Peak     | 360.00    | 100         | V   | Pass    |
| 2   | 220.072         | 37.11            | -13.32      | 46.0           | -8.89           | Peak     | 356.00    | 100         | V   | Pass    |
| 3   | 475.119         | 40.16            | -7.41       | 46.0           | -5.84           | Peak     | 330.00    | 100         | V   | Pass    |
| 4   | 500.090         | 41.27            | -6.91       | 46.0           | -4.73           | Peak     | 330.00    | 100         | V   | Pass    |

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**Operation Mode: Transmitting under Low Channel (2402MHz)**

| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Antenna Polarity | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|------------------|-------------------------|
| 4804            | --                      | H                | 74(Peak)/ 54(AV)        |
| 4804            | --                      | V                | 74(Peak)/ 54(AV)        |
| 7206            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 9608            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 12010           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 14412           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 16814           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 19 16           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 21618           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 24020           | --                      | H/V              | 74(Peak)/ 54(AV)        |

- Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit  
2. Remark "---" means that the emissions level is too low to be measured

**Operation Mode: Transmitting under Middle Channel (2441MHz)**

| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Antenna Polarity | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|------------------|-------------------------|
| 4882            | --                      | H                | 74(Peak)/ 54(AV)        |
| 4882            | --                      | V                | 74(Peak)/ 54(AV)        |
| 7323            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 9764            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 12205           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 14646           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 17087           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 1952            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 21969           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 24410           | --                      | H/V              | 74(Peak)/ 54(AV)        |

- Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit  
2. Remark "---" means that the emissions level is too low to be measured

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**Operation Mode: Transmitting under High Channel (2480MHz)**

| Frequency (MHz) | Level@3m (dB $\mu$ V/m) | Antenna Polarity | Limit@3m (dB $\mu$ V/m) |
|-----------------|-------------------------|------------------|-------------------------|
| 4960            | --                      | H                | 74(Peak)/ 54(AV)        |
| 4960            | --                      | V                | 74(Peak)/ 54(AV)        |
| 7440            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 9920            | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 12400           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 14880           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 17360           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 19840           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 22320           | --                      | H/V              | 74(Peak)/ 54(AV)        |
| 24800           | --                      | H/V              | 74(Peak)/ 54(AV)        |

- Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit  
2. Remark “---” means that the emissions level is too low to be measured

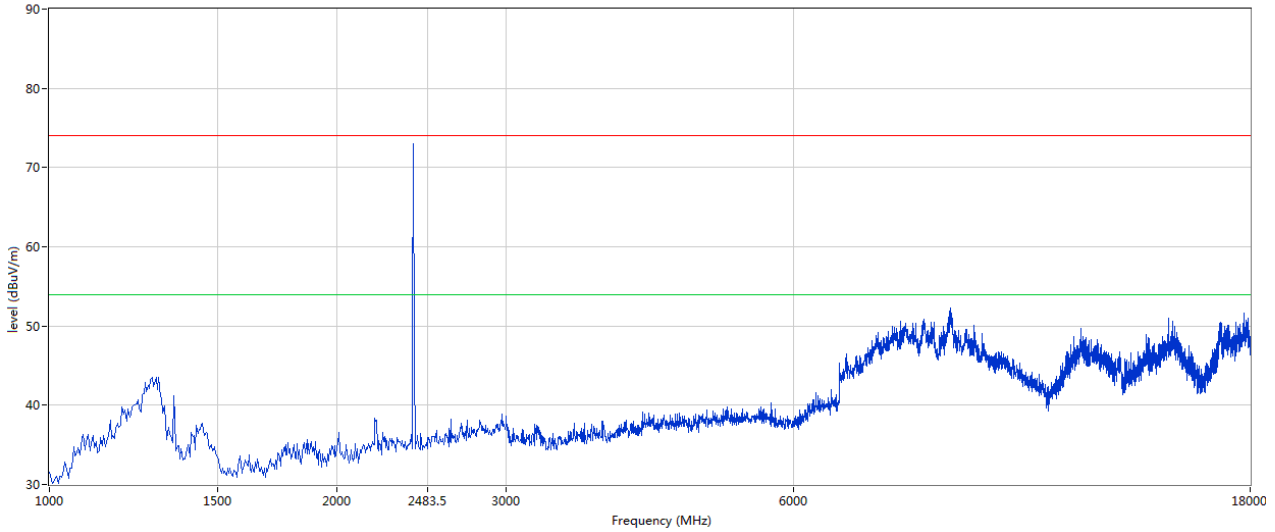
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Please refer to the following test plots for details:

**Low Channel: Vertical**

FCC Part 15B Class B 1GHz-18GHz - 2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4804.048        | 37.87            | 3.13        | 74.0           | -36.13          | Peak     | 45.00     | 100         | V   | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

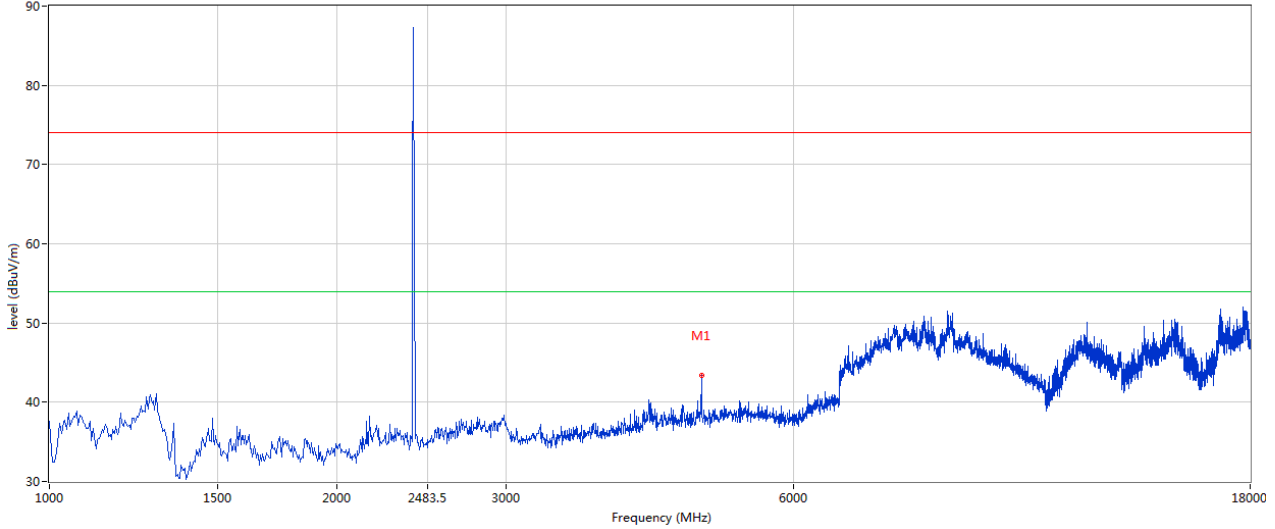
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**Low Channel : Horizontal**

FCC Part 15B Class B 1GHz-18GHz - 2



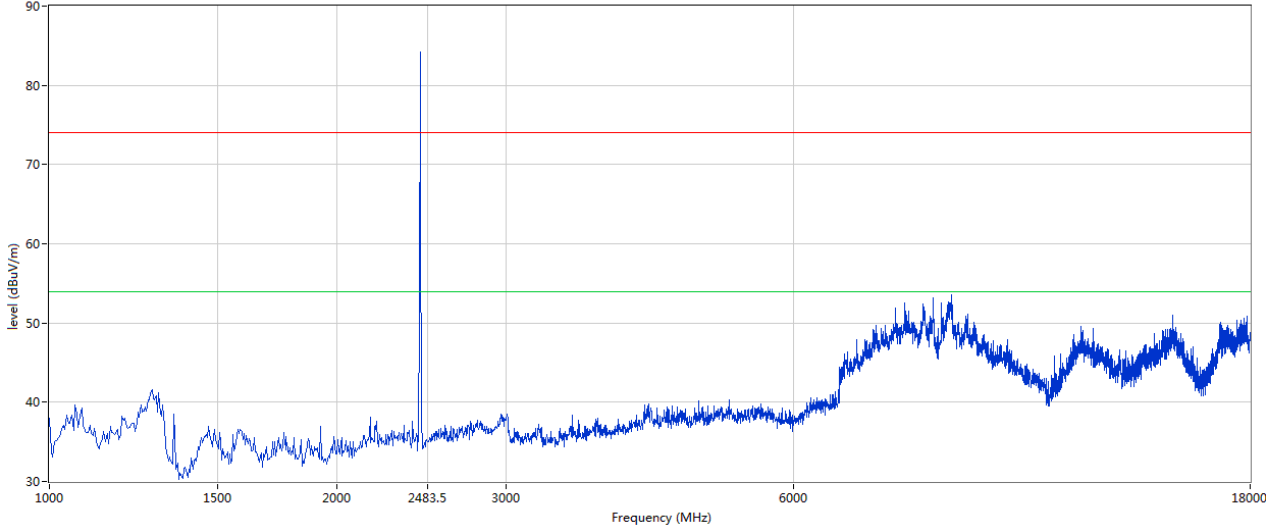
| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4802.799        | 43.42            | 3.12        | 74.0           | -30.58          | Peak     | 179.00    | 100         | H   | Pass    |

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**Middle Channel : Horizontal**

FCC Part 15B Class B 1GHz-18GHz - 2



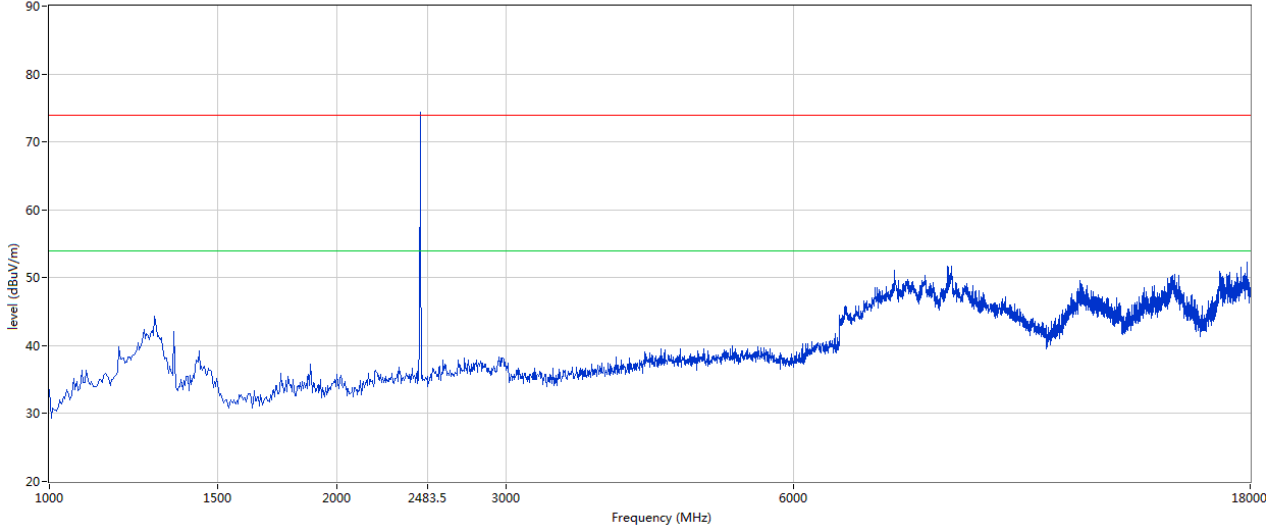
| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4822.044        | 39.43            | 3.14        | 74.0           | -34.57          | Peak     | 117.00    | 100         | H   | Pass    |

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**Middle Channel : Vertical**

FCC Part 15B Class B 1GHz-18GHz - 2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4882.529        | 39.18            | 3.20        | 74.0           | -34.82          | Peak     | 10.00     | 100         | V   | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

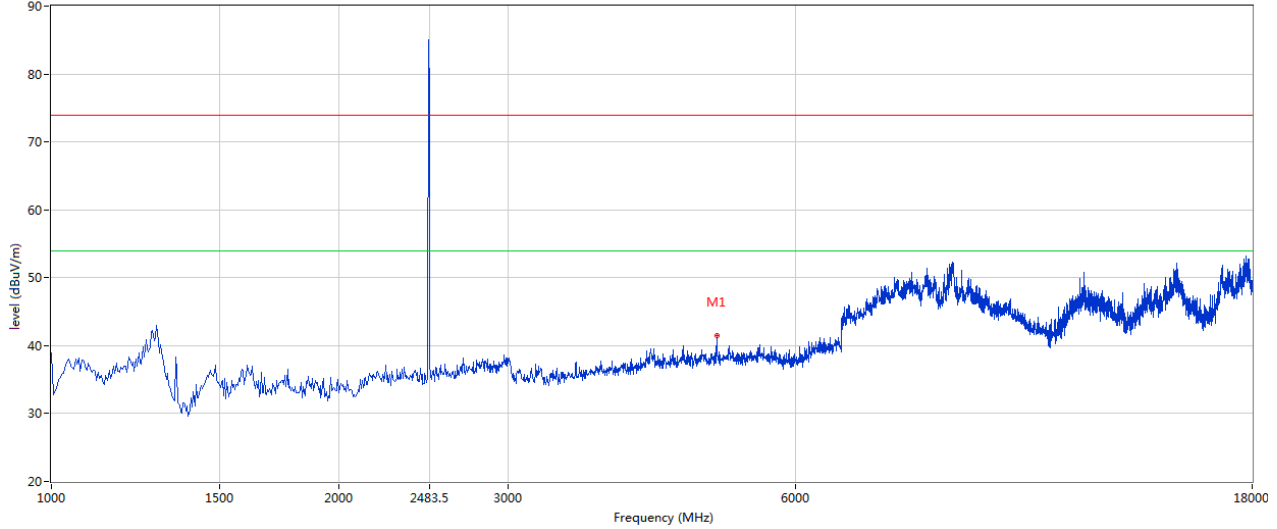
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**High Channel : Horizontal**

FCC Part 15B Class B 1GHz-18GHz - 2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4960.010        | 41.47            | 3.36        | 74.0           | -32.53          | Peak     | 187.00    | 100         | H   | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

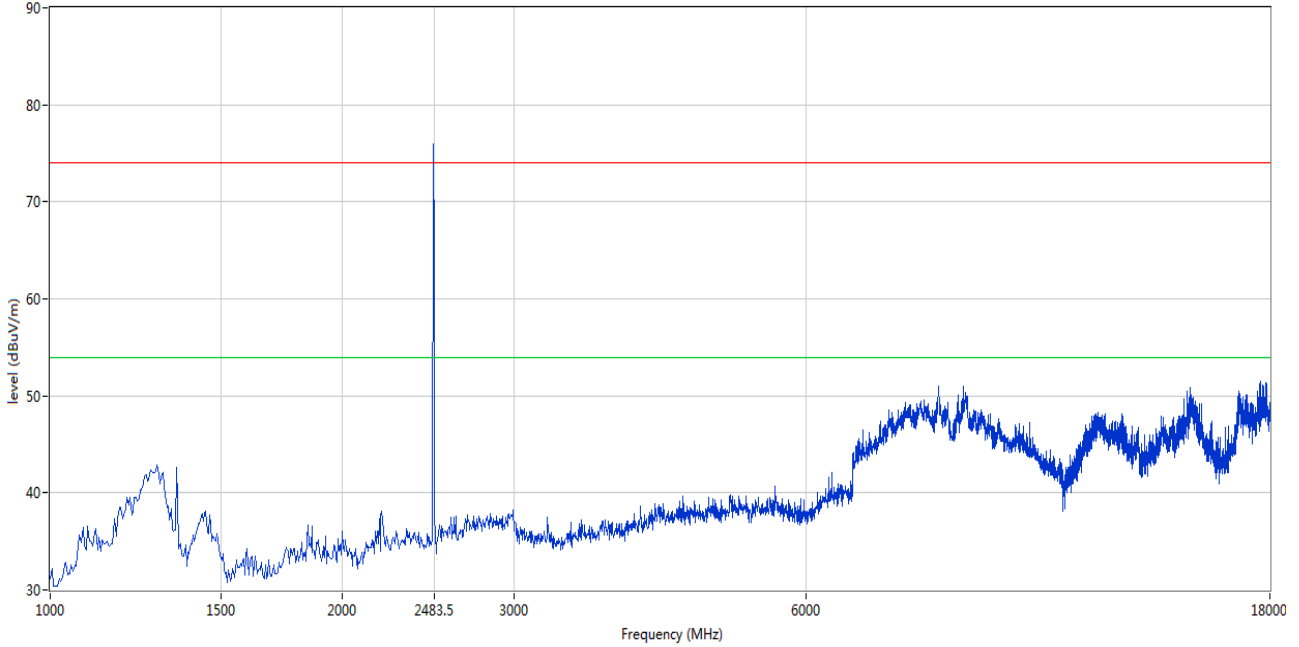
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**High Channel : Vertical**

FCC Part 15B Class B 1GHz-18GHz - 2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 4960.263        | 38.37            | 3.33        | 74.0           | -35.63          | Peak     | 351.00    | 100         | V   | Pass    |

**Note: for the radiated emissions above 18G, it is the floor noise.**

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## 7.0 20dB Bandwidth Measurement

### 7.1 Regulation

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 7.2 Limits of 20dB Bandwidth Measurement

N/A

### 7.3 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. Set the spectrum analyzer as follows: Span = 3MHz, RBW = 30 kHz, VBW = 100 kHz, Sweep = auto Detector function = peak, Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results. 6. Repeat above procedures until all frequencies measured were complete.

### 7.4 Test Result

#### Type of Modulation: GFSK

| EUT         | 21.5' Advertising Displayer |                       | Model               | ULT215     |
|-------------|-----------------------------|-----------------------|---------------------|------------|
| Mode        | Keep Transmitting           |                       | Input Voltage       | 120V~      |
| Temperature | 24 deg. C,                  |                       | Humidity            | 56% RH     |
| Channel     | Channel Frequency (MHz)     | 20 dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass/ Fail |
| Low         | 2402                        | 878                   | --                  | Pass       |
| Middle      | 2441                        | 872                   | --                  | Pass       |
| High        | 2480                        | 854                   | --                  | Pass       |

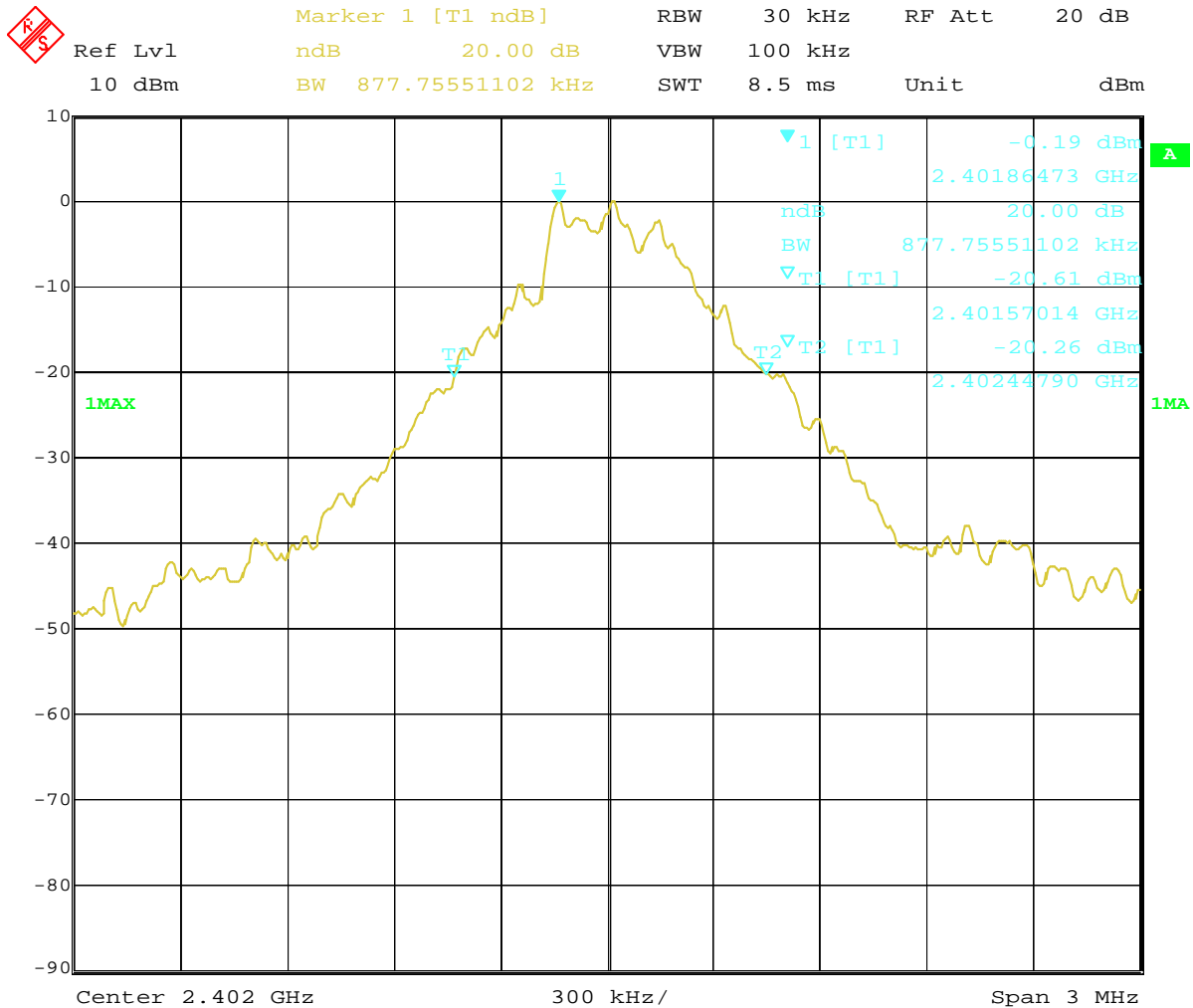
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Test Figure:

**1. Condition: Low Channel**

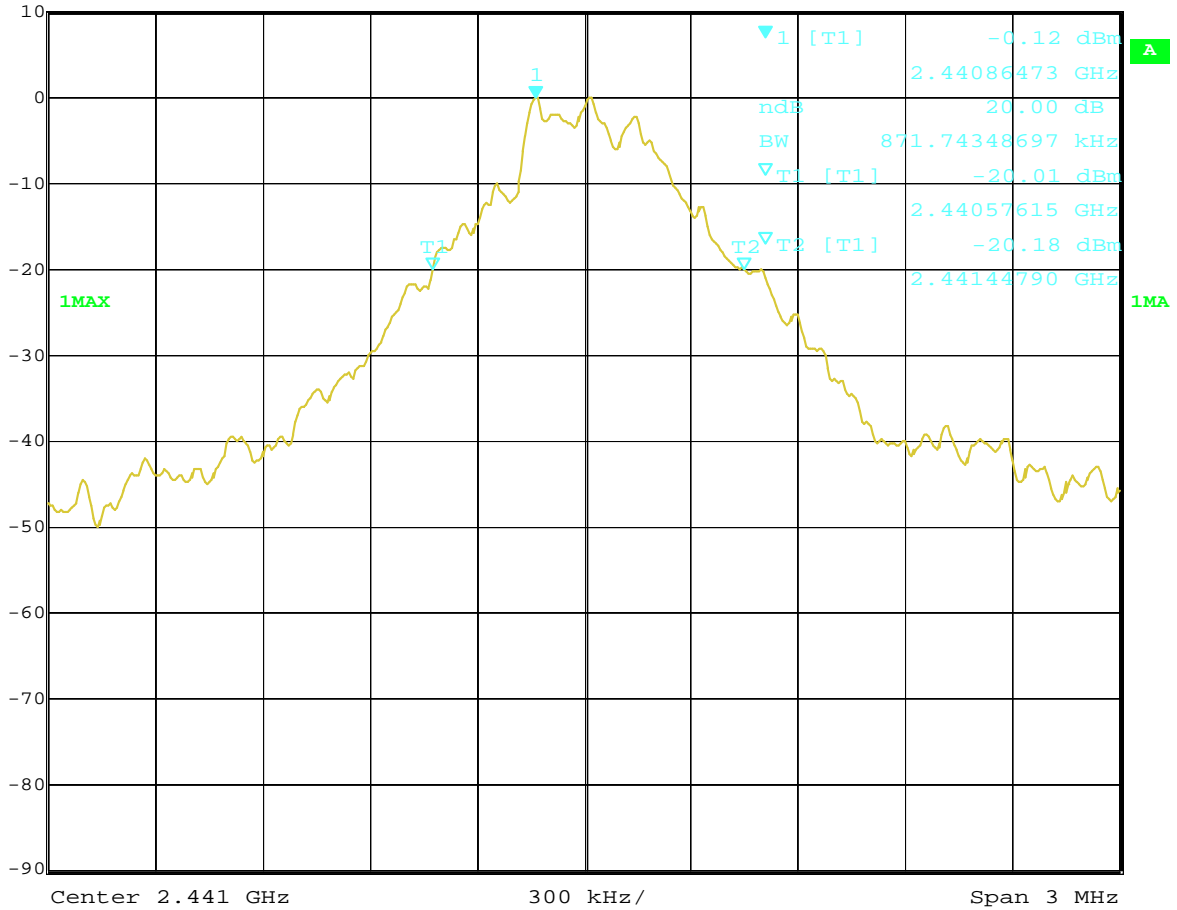


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**2. Condition: Middle Channel**

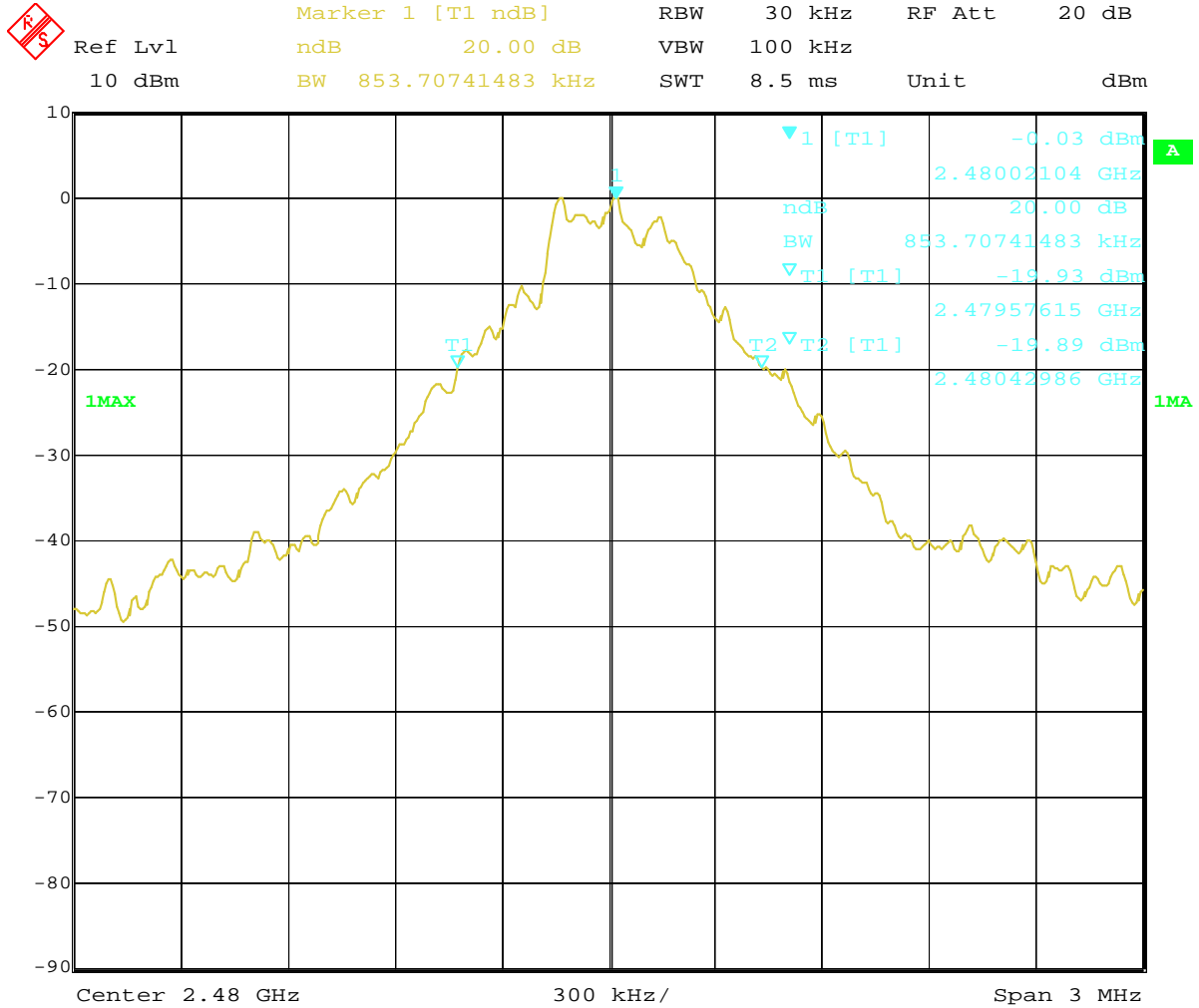
|  |                   |     |                  |        |         |      |
|--|-------------------|-----|------------------|--------|---------|------|
|  | Marker 1 [T1 ndB] | RBW | 30 kHz           | RF Att | 20 dB   |      |
|  | Ref Lvl           | ndB | 20.00 dB         | VBW    | 100 kHz |      |
|  | 10 dBm            | BW  | 871.74348697 kHz | SWT    | 8.5 ms  | Unit |



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### 3. High Channel



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**Test Result**

**Type of Modulation:**  $\pi/4$ DQPSK

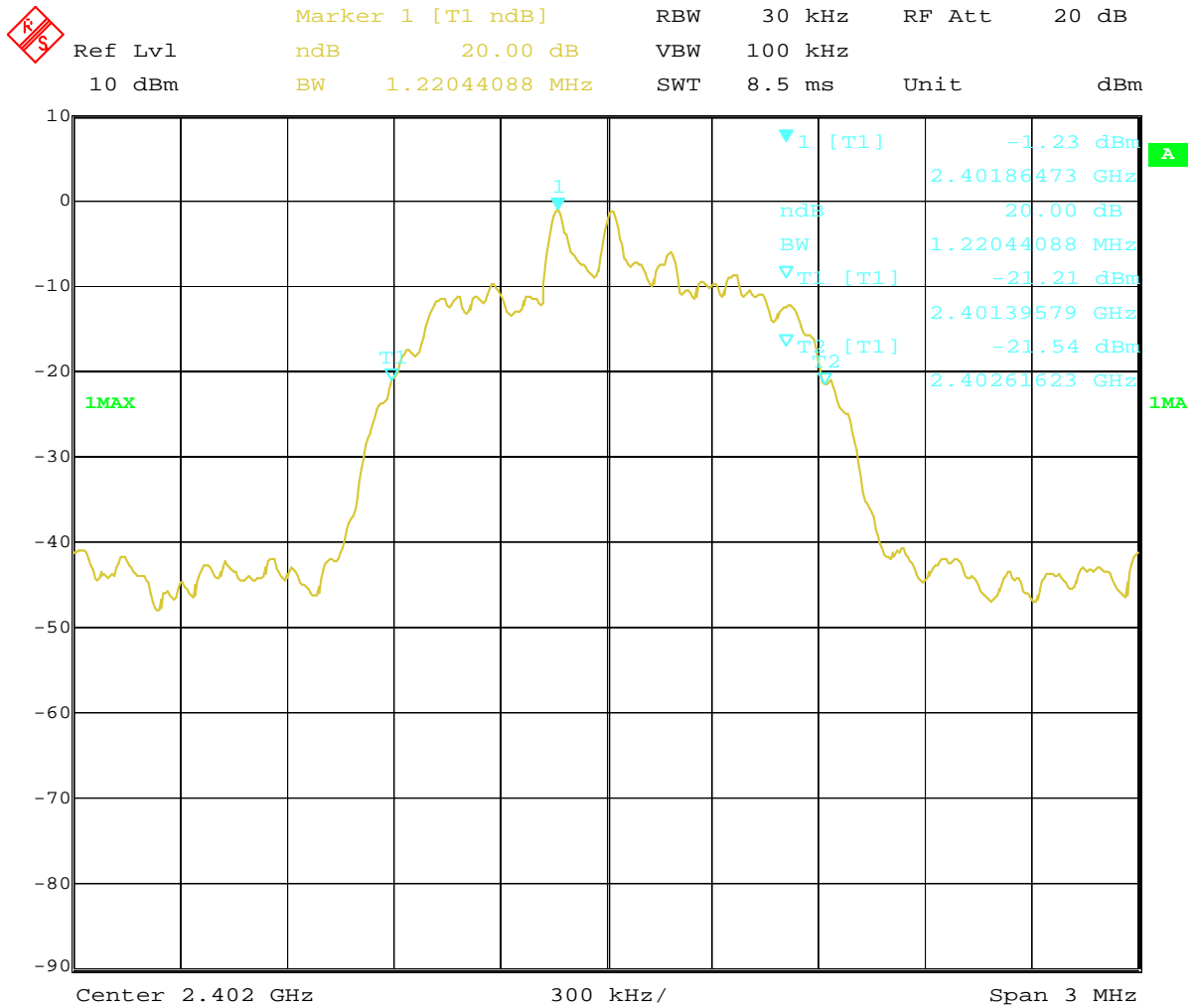
| EUT         | 21.5' Advertising Displayer |                       | Model               | ULT215     |
|-------------|-----------------------------|-----------------------|---------------------|------------|
| Mode        | Keep Transmitting           |                       | Input Voltage       | 120V~      |
| Temperature | 24 deg. C,                  |                       | Humidity            | 56% RH     |
| Channel     | Channel Frequency (MHz)     | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/ Fail |
| Low         | 2402                        | 1220                  | --                  | Pass       |
| Middle      | 2441                        | 1220                  | --                  | Pass       |
| High        | 2480                        | 1220                  | --                  | Pass       |

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Test Figure:

**1. Condition: Low Channel**



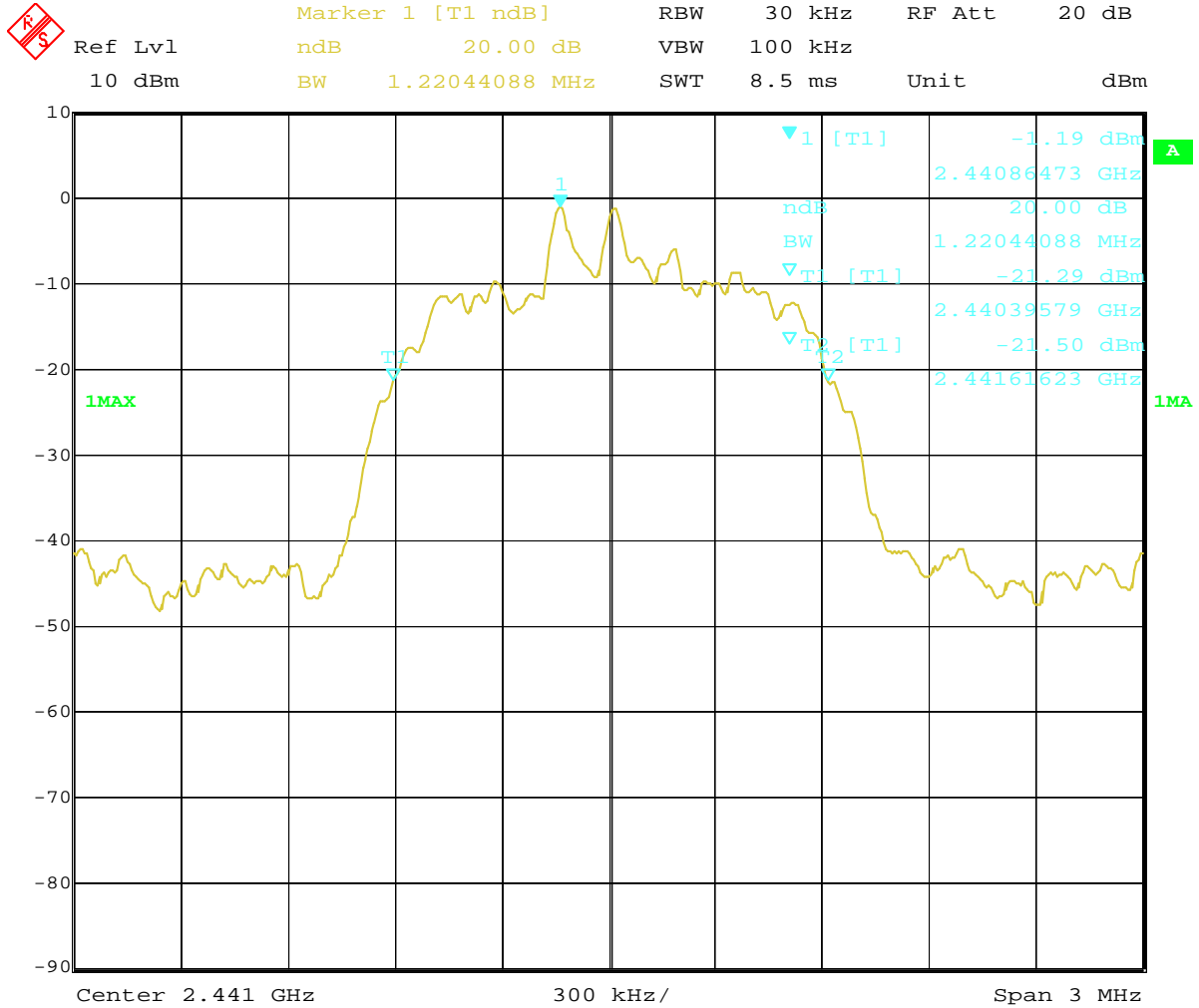
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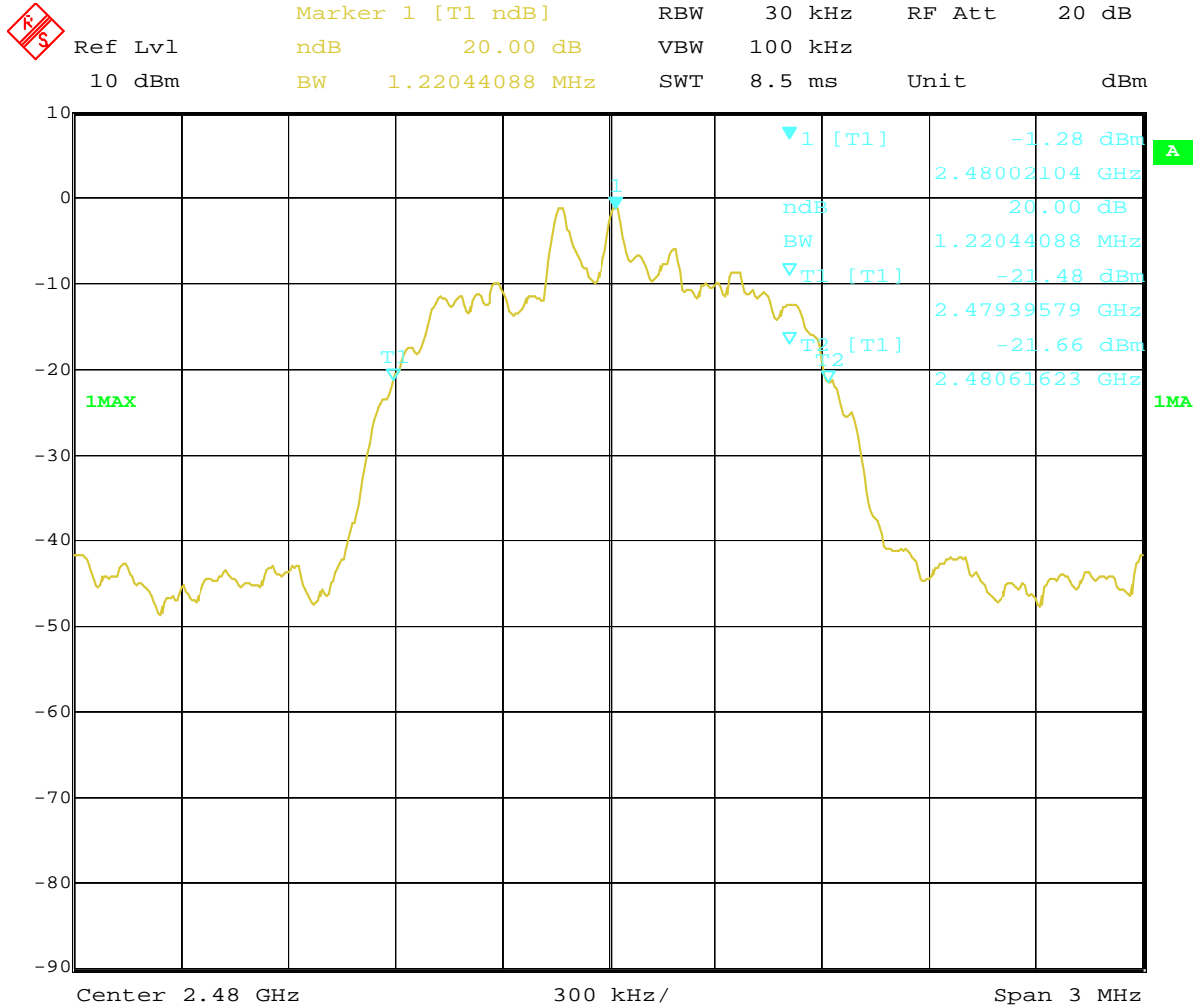
2. Condition: Middle Channel



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3. High Channel



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**Test Result**

**Type of Modulation: 8DPSK**

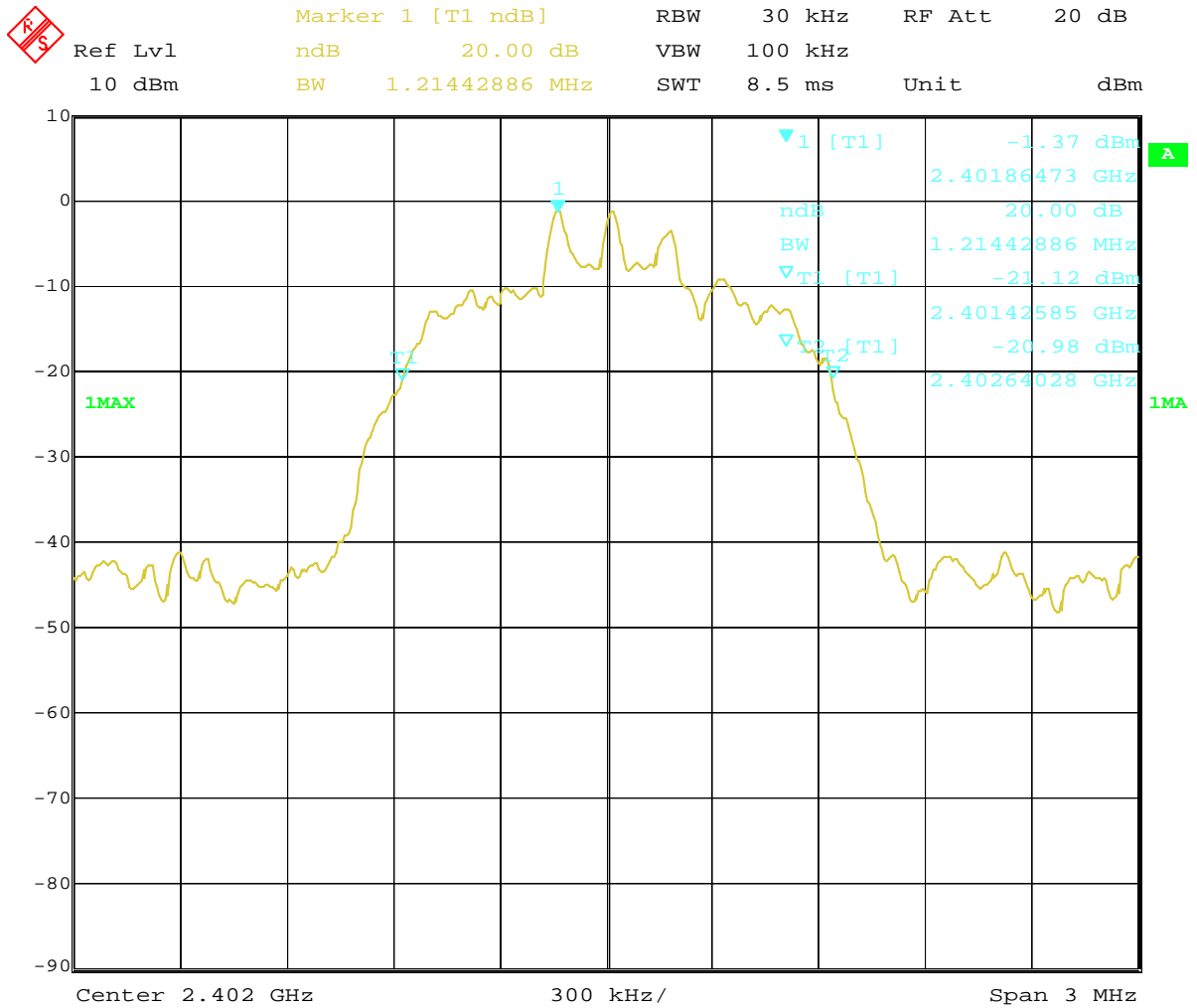
| EUT         | 21.5' Advertising Displayer |                       | Model               | ULT215     |
|-------------|-----------------------------|-----------------------|---------------------|------------|
| Mode        | Keep Transmitting           |                       | Input Voltage       | 120V~      |
| Temperature | 24 deg. C,                  |                       | Humidity            | 56% RH     |
| Channel     | Channel Frequency (MHz)     | 20 dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass/ Fail |
| Low         | 2402                        | 1214                  | --                  | Pass       |
| Middle      | 2441                        | 1214                  | --                  | Pass       |
| High        | 2480                        | 1214                  | --                  | Pass       |

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Test Figure:

**1. Condition: Low Channel**

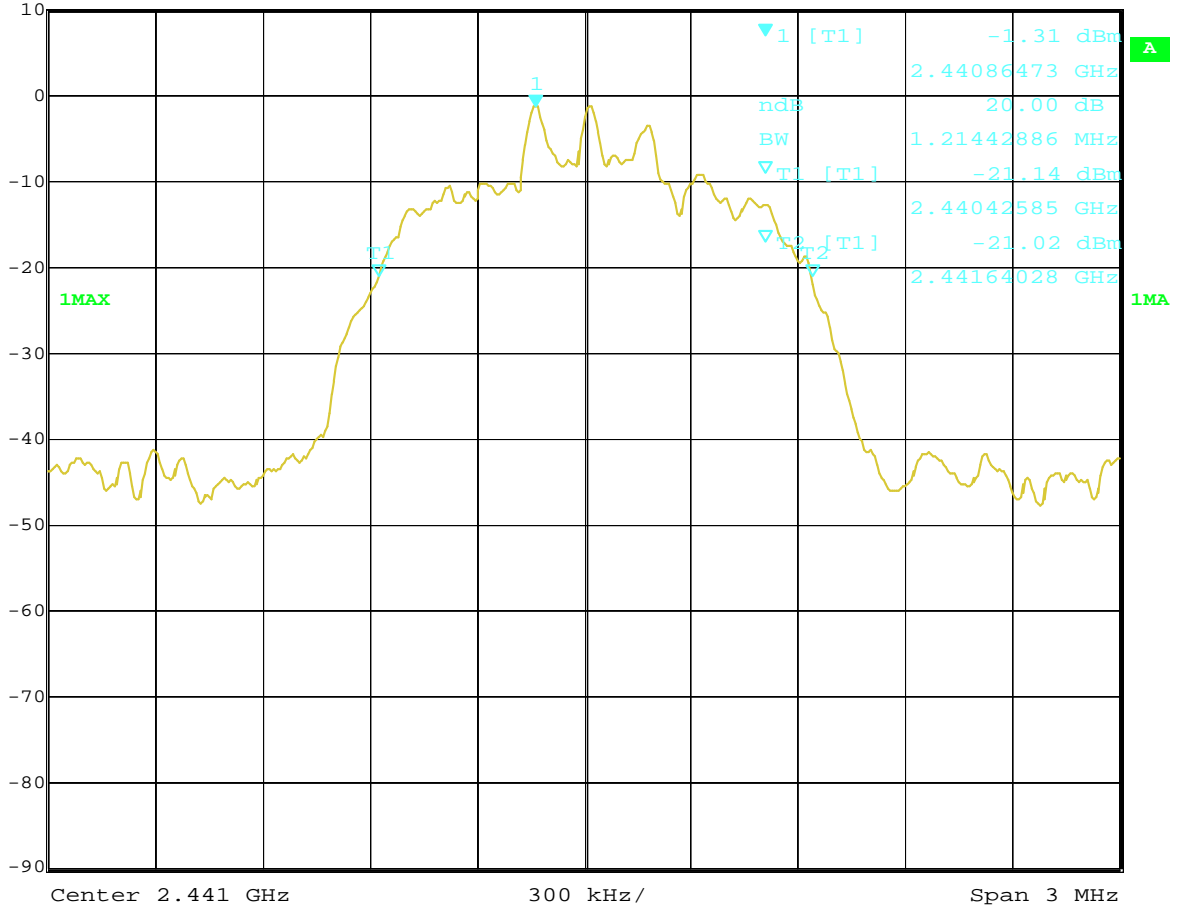


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**2. Condition: Middle Channel**

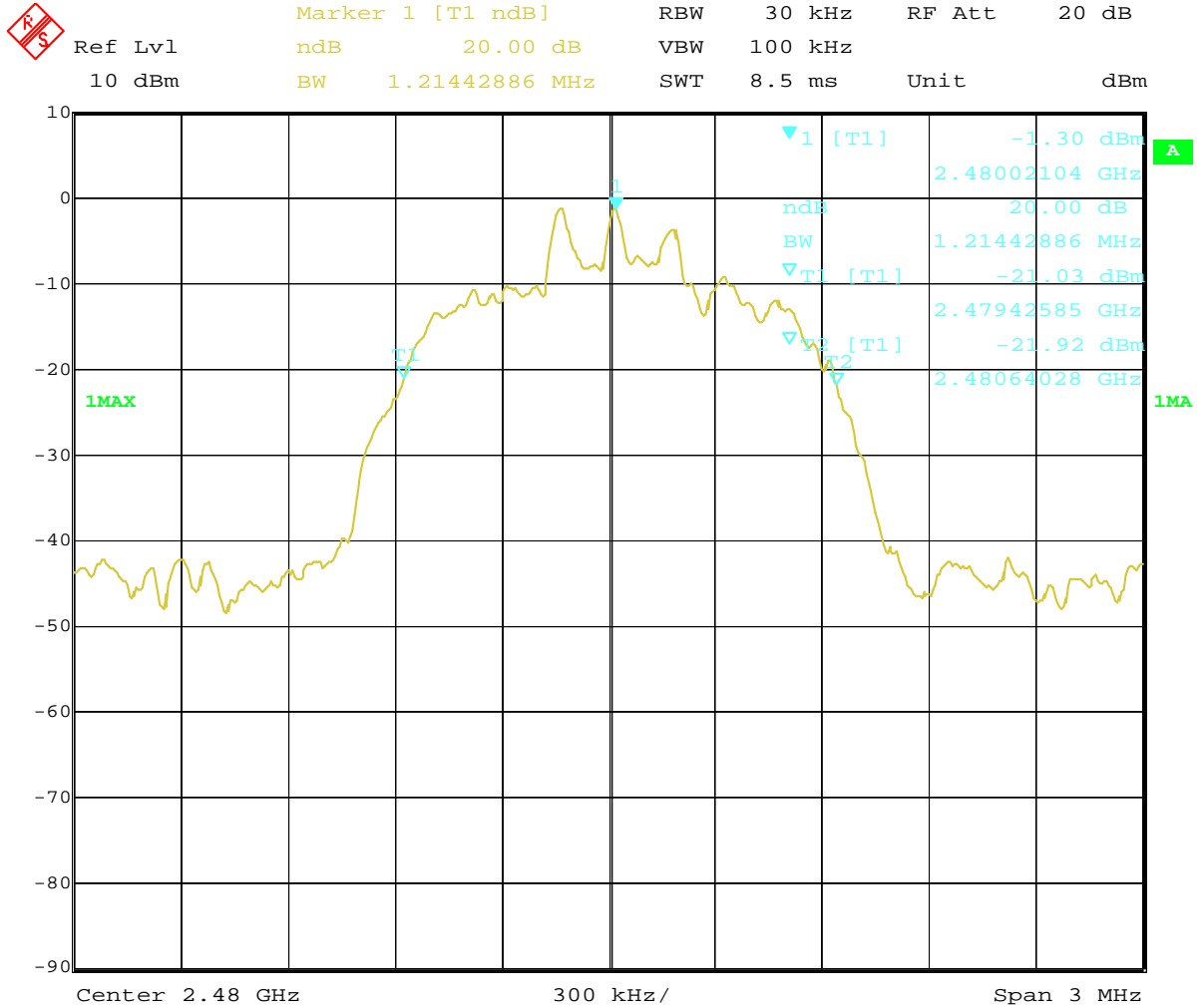
|  |                   |     |                |        |         |      |
|--|-------------------|-----|----------------|--------|---------|------|
|  | Marker 1 [T1 ndB] | RBW | 30 kHz         | RF Att | 20 dB   |      |
|  | Ref Lvl           | ndB | 20.00 dB       | VBW    | 100 kHz |      |
|  | 10 dBm            | BW  | 1.21442886 MHz | SWT    | 8.5 ms  | Unit |



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3. High Channel



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## **8. Maximum Output Power**

### **8.1 Regulation**

According to §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 2400-2483.5MHz band:0.125 watts. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **8.2 Limits of Maximum Output Power**

The Maximum Output Power Measurement is 30dBm.

### **8.3 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. Set the spectrum analyzer as follows: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel; RBW > the 20 dB bandwidth of the emission being measured; VBW = RBW=3MHz; Sweep = 60s; Detector function = PK; Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
4. Repeat above procedures until all frequencies measured were complete.

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**8.4 Test Results**

**Type of Modulation: GFSK**

| EUT         | 21.5' Advertising Displayer |                         | Model                  | ULT215     |
|-------------|-----------------------------|-------------------------|------------------------|------------|
| Mode        | Keep Transmitting           |                         | Input Voltage          | 120V~      |
| Temperature | 24 deg. C,                  |                         | Humidity               | 56% RH     |
| Channel     | Channel Frequency (MHz)     | Max. Power Output (dBm) | Peak Power Limit (dBm) | Pass/ Fail |
|             |                             | Peak                    |                        |            |
| Low         | 2402                        | 1.33                    | 30                     | Pass       |
| Middle      | 2441                        | 1.44                    | 30                     | Pass       |
| High        | 2480                        | 1.33                    | 30                     | Pass       |

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded
3. The Peak power was measured

**Type of Modulation:  $\pi/4$ DQPSK**

| EUT         | 21.5' Advertising Displayer |                         | Model                  | ULT215     |
|-------------|-----------------------------|-------------------------|------------------------|------------|
| Mode        | Keep Transmitting           |                         | Input Voltage          | 120V~      |
| Temperature | 24 deg. C,                  |                         | Humidity               | 56% RH     |
| Channel     | Channel Frequency (MHz)     | Max. Power Output (dBm) | Peak Power Limit (dBm) | Pass/ Fail |
|             |                             | Peak                    |                        |            |
| Low         | 2402                        | 0.25                    | 30                     | Pass       |
| Middle      | 2441                        | 0.38                    | 30                     | Pass       |
| High        | 2480                        | 0.25                    | 30                     | Pass       |

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded
3. The Peak power was measured

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**Type of Modulation: 8DPSK**

| EUT         | 21.5' Advertising Displayer |                         | Model         | ULT215                 |            |
|-------------|-----------------------------|-------------------------|---------------|------------------------|------------|
| Mode        | Keep Transmitting           |                         | Input Voltage | 120V~                  |            |
| Temperature | 24 deg. C,                  |                         | Humidity      | 56% RH                 |            |
| Channel     | Channel Frequency (MHz)     | Max. Power Output (dBm) |               | Peak Power Limit (dBm) | Pass/ Fail |
|             |                             | <b>Peak</b>             |               |                        |            |
| Low         | 2402                        | 0.51                    |               | 30                     | Pass       |
| Middle      | 2441                        | 0.51                    |               | 30                     | Pass       |
| High        | 2480                        | 0.51                    |               | 30                     | Pass       |

Note: 1. the result basic equation calculation as follow:

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded
3. The Peak power was measured

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## 9. Carrier Frequency Separation

### 9.1 Regulation

According to §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.

### 9.2 Limits of Carrier Frequency Separation

The Maximum Power Spectral Density Measurement is 25kHz or two-thirds of the 20dB bandwidth of the hopping Channel which is great.

### 9.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = wide enough to capture the peaks of two adjacent channels: Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span; Video (or Average) Bandwidth (VBW)  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold
3. Measure the separation between the peaks of the adjacent channels using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.

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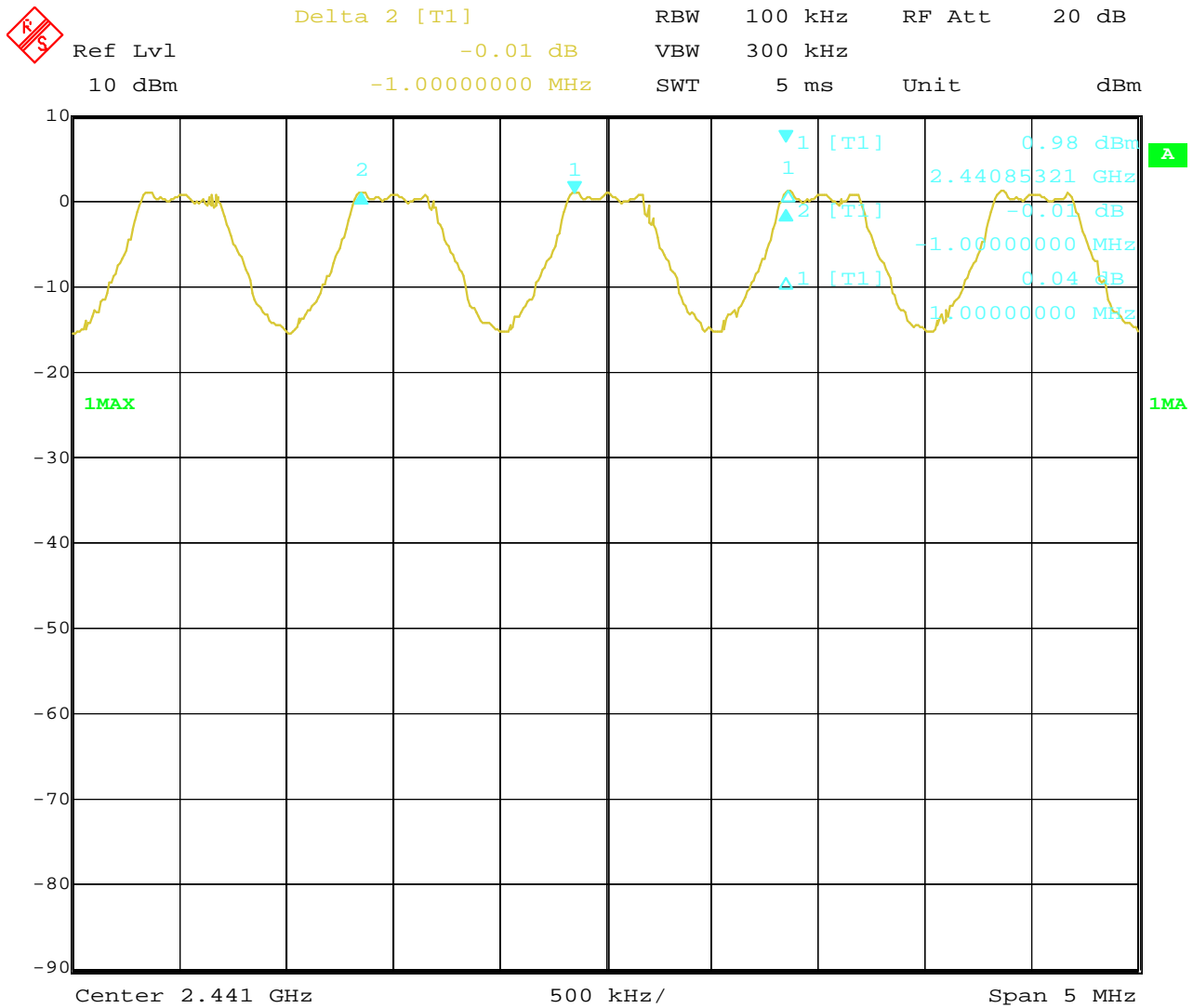


**9.4 Test Result**

**Type of Modulation: GFSK**

|                              |                             |  |            |
|------------------------------|-----------------------------|--|------------|
| EUT                          | 21.5' Advertising Displayer | Model                                  | ULT215     |
| Mode                         | Hopping On                  | Input Voltage                          | 120V~      |
| Temperature                  | 24 deg. C,                  | Humidity                               | 56% RH     |
| Carrier Frequency Separation |                             | Limit                                  | Pass/ Fail |
| 1.000MHz                     |                             | ≥ 25 kHz or 2/3 of the 20 dB bandwidth | Pass       |

**Test Plots**



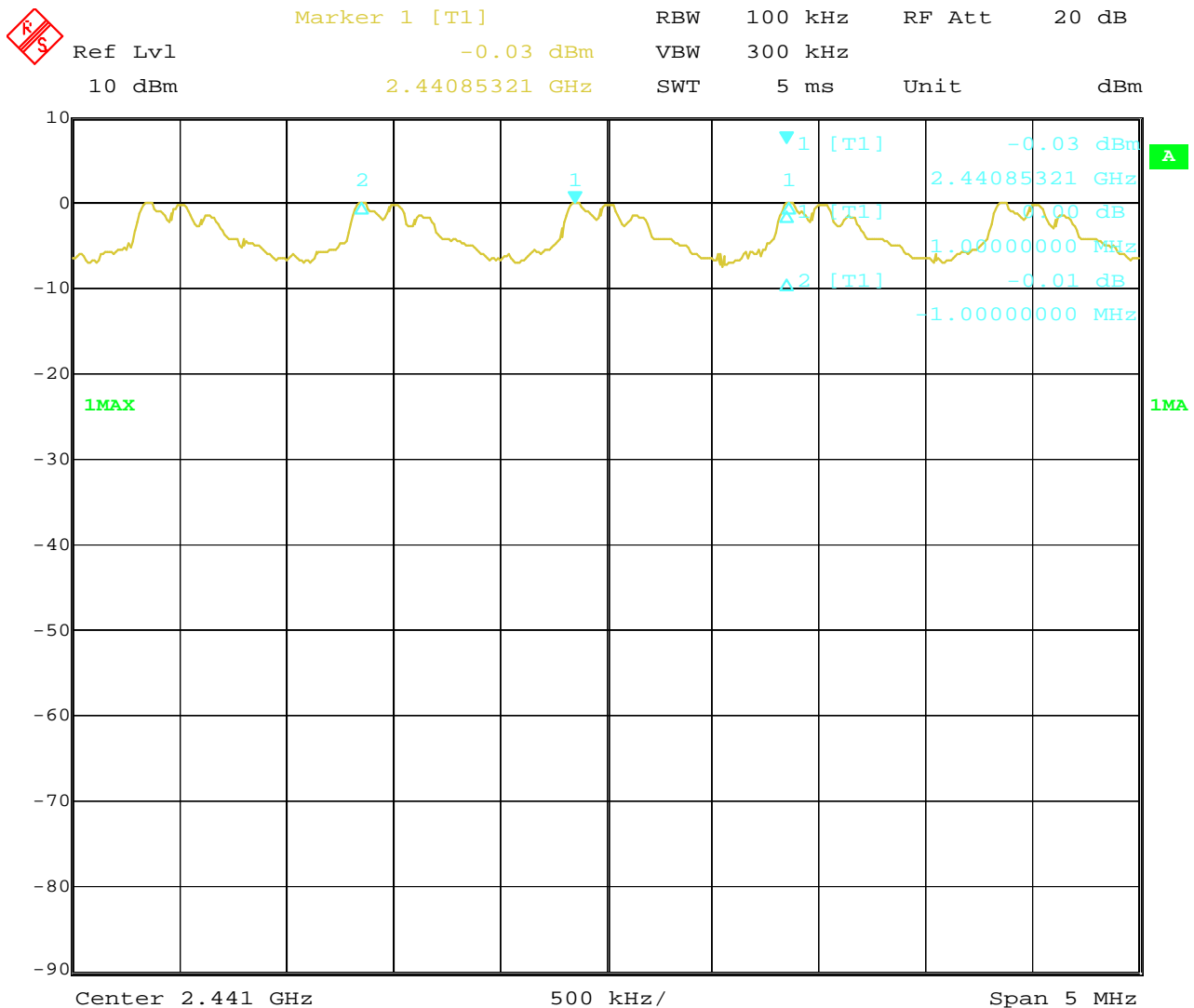
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**Type of Modulation:  $\pi/4$ DQPSK**

|                              |                             |   |            |
|------------------------------|-----------------------------|---|------------|
| EUT                          | 21.5' Advertising Displayer | Model                                   | ULT215     |
| Mode                         | Hopping On                  | Input Voltage                           | 120V~      |
| Temperature                  | 24 deg. C,                  | Humidity                                | 56% RH     |
| Carrier Frequency Separation |                             | Limit                                   | Pass/ Fail |
| 1.000MHz                     |                             | $\geq 25$ kHz or 2/3 of 20 dB bandwidth | Pass       |

**Test Plots**



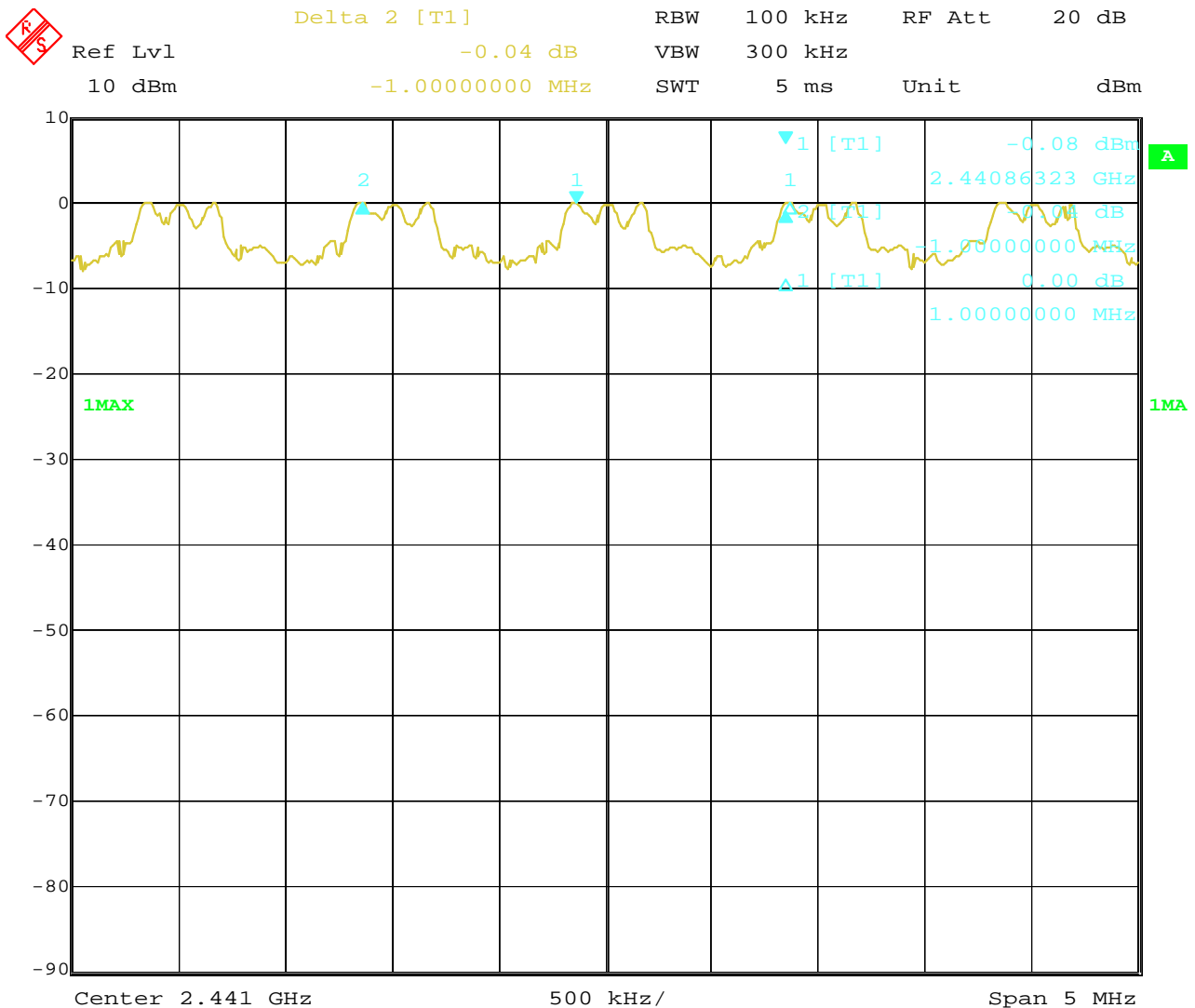
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**Type of Modulation: 8DPSK**

|                              |                             |                                    |            |
|------------------------------|-----------------------------|------------------------------------|------------|
| EUT                          | 21.5' Advertising Displayer | Model                              | ULT215     |
| Mode                         | Hopping On                  | Input Voltage                      | 120V~      |
| Temperature                  | 24 deg. C,                  | Humidity                           | 56% RH     |
| Carrier Frequency Separation |                             | Limit                              | Pass/ Fail |
| 1.000MHz                     |                             | ≥ 25 kHz or 2/3 of 20 dB bandwidth | Pass       |

**Test Plots**



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## **10. Number of Hopping Channels**

### **10.1 Regulation**

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. According to §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.

### **10.2 Limits of Number of Hopping Channels**

The frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

### **10.3 Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = the frequency band of operation; RBW=100 kHz, VBW=300 kHz; Sweep = auto; Detector function = peak; Trace = max hold
3. Record the number of hopping channels.

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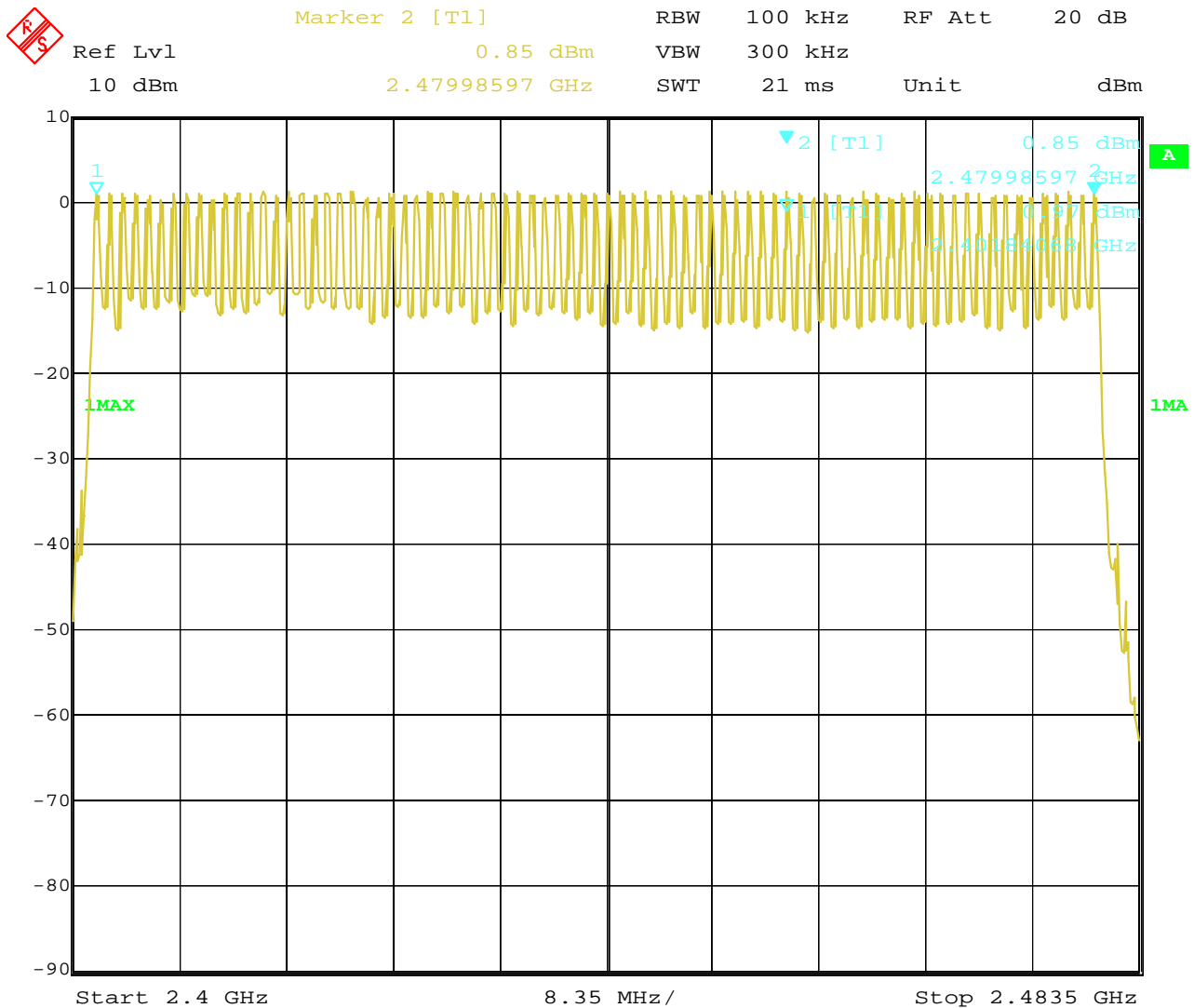


**10.4 Test Result**

**Type of Modulation: GFSK**

|                     |                             |               |            |  |
|---------------------|-----------------------------|---------------|------------|--|
| EUT                 | 21.5' Advertising Displayer | Model         | ULT215     |  |
| Mode                | Hopping On                  | Input Voltage | 120V~      |  |
| Temperature         | 24 deg. C,                  | Humidity      | 56% RH     |  |
| Operating Frequency | Number of hopping channels  | Limit         | Pass/ Fail |  |
| 2402-2480MHz        | 79                          | ≥ 15          | Pass       |  |

**Test Plot**



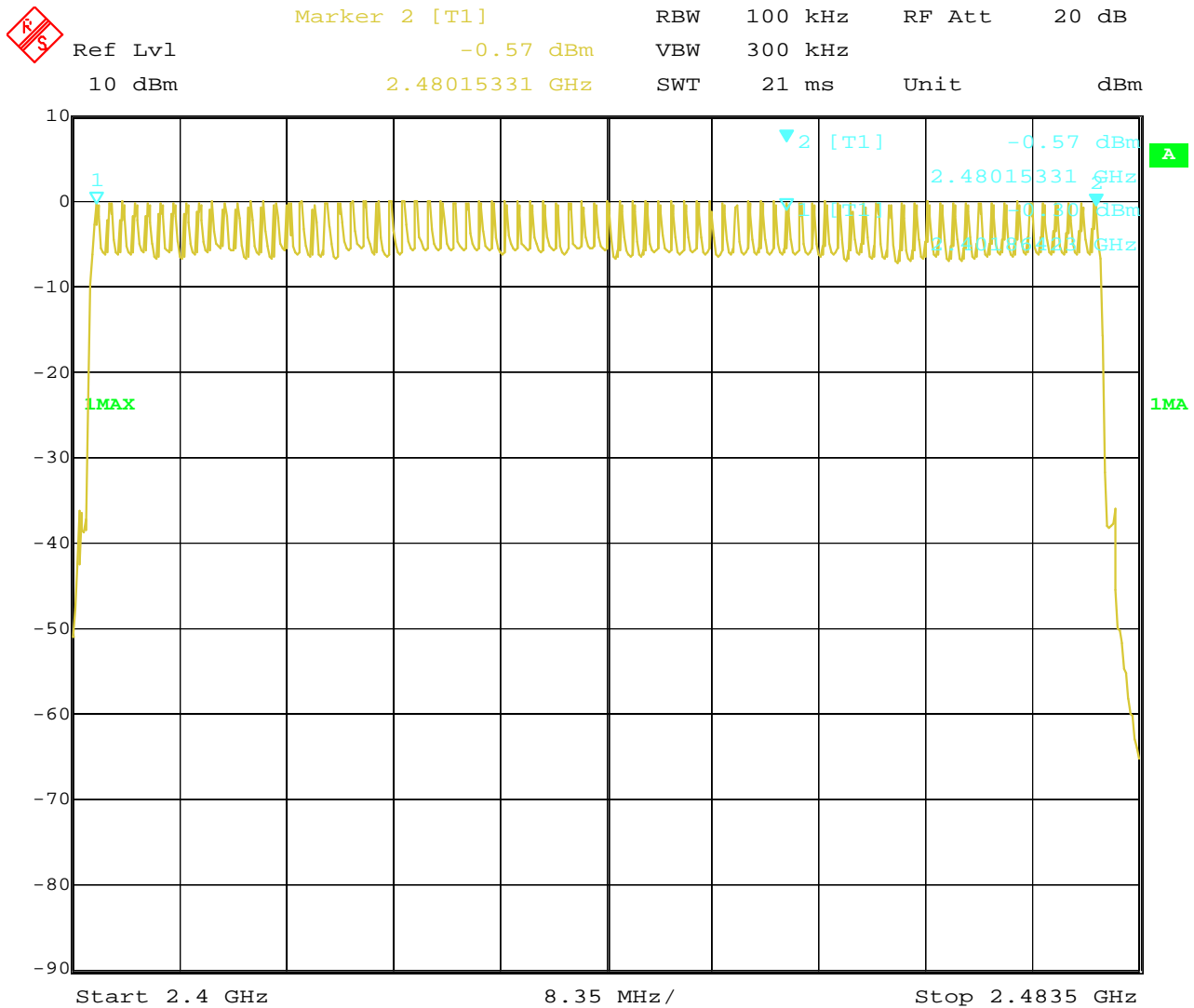
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**Type of Modulation:  $\pi/4$ DQPSK**

|                     |                             |               |            |
|---------------------|-----------------------------|---------------|------------|
| EUT                 | 21.5' Advertising Displayer | Model         | ULT215     |
| Mode                | Hopping On                  | Input Voltage | 120V~      |
| Temperature         | 24 deg. C,                  | Humidity      | 56% RH     |
| Operating Frequency | Number of hopping channels  | Limit         | Pass/ Fail |
| 2402-2480MHz        | 79                          | $\geq 15$     | Pass       |

**Test Plot**



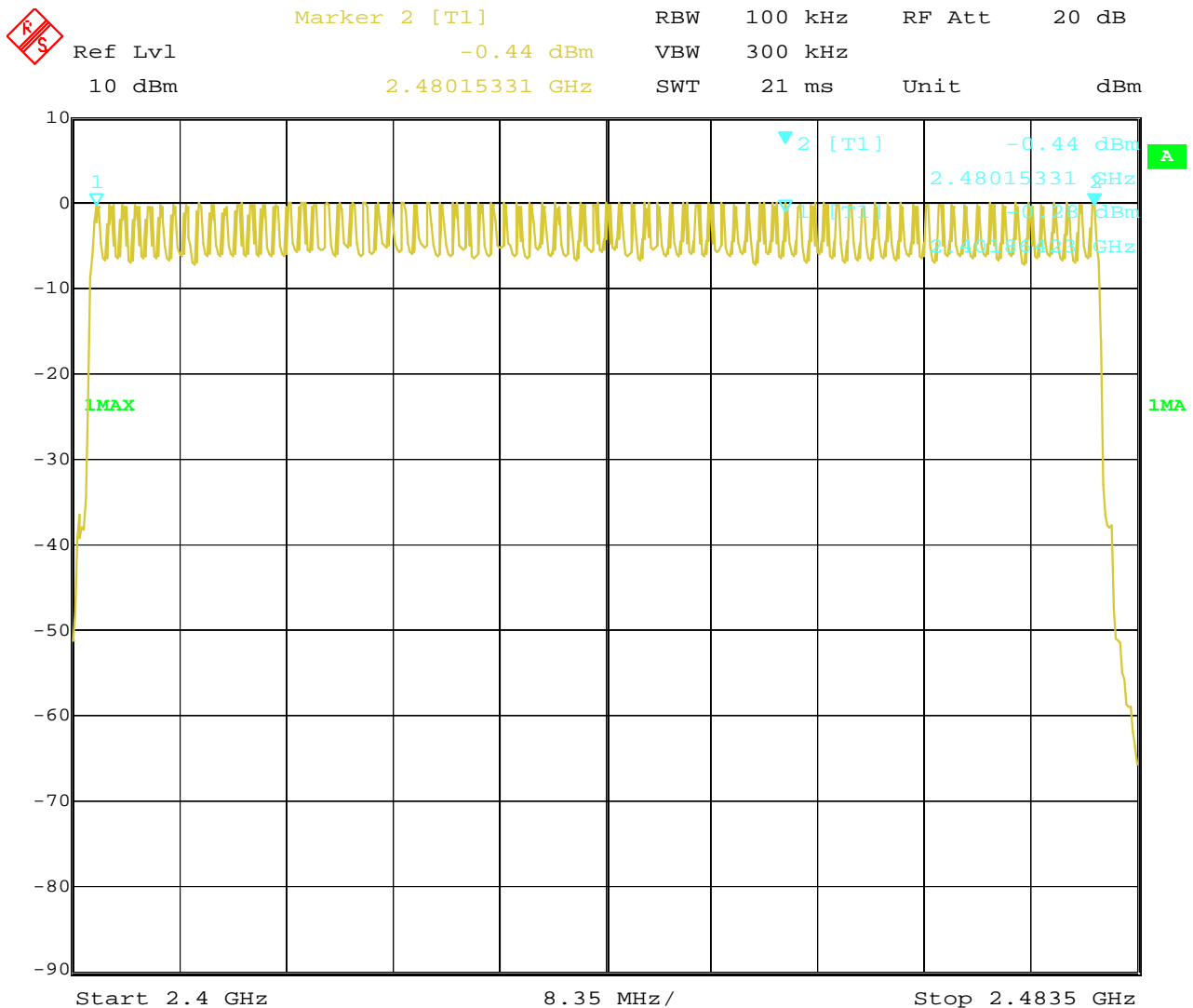
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**Type of Modulation: 8DPSK**

|                     |                             |               |            |
|---------------------|-----------------------------|---------------|------------|
| EUT                 | 21.5' Advertising Displayer | Model         | ULT215     |
| Mode                | Hopping On                  | Input Voltage | 120V~      |
| Temperature         | 24 deg. C,                  | Humidity      | 56% RH     |
| Operating Frequency | Number of hopping channels  | Limit         | Pass/ Fail |
| 2402-2480MHz        | 79                          | ≥ 15          | Pass       |

**Test Plot**



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## **11. Time of Occupancy (Dwell Time)**

### **11.1 Regulation**

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

### **11.2 Limits of Carrier Frequency Separation**

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed

### **11.3 Test Procedure**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW  $\geq$  RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold
3. Measure the dwell time using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.
5. Repeat this test for different modes of operation (e.g., data rate, modulation format, etc.), if applicable.

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**11.4 Test Result**

**Type of Modulation: GFSK**

|             |                             |               |               |        |       |
|-------------|-----------------------------|---------------|---------------|--------|-------|
| EUT         | 21.5' Advertising Displayer |               | Model         | ULT215 |       |
| Mode        | Keep Transmitting           |               | Input Voltage | 120V~  |       |
| Temperature | 24 deg. C,                  |               | Humidity      | 56% RH |       |
| Channel     | Reading                     | Hoping Rate   |               | Actual | Limit |
| DH5         |                             |               |               |        |       |
| Middle      | 2.946ms                     | 266.667 hop/s |               | 0.314s | 0.4s  |

Actual = Reading × (Hopping rate / Number of channels) × Test period, Test period = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625µs with 79 channels.

A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

A DH3 Packet needs 3 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 400 hops per second with 79 channels.

A DH1 Packet needs 1 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 800 hops per second with 79 channels.

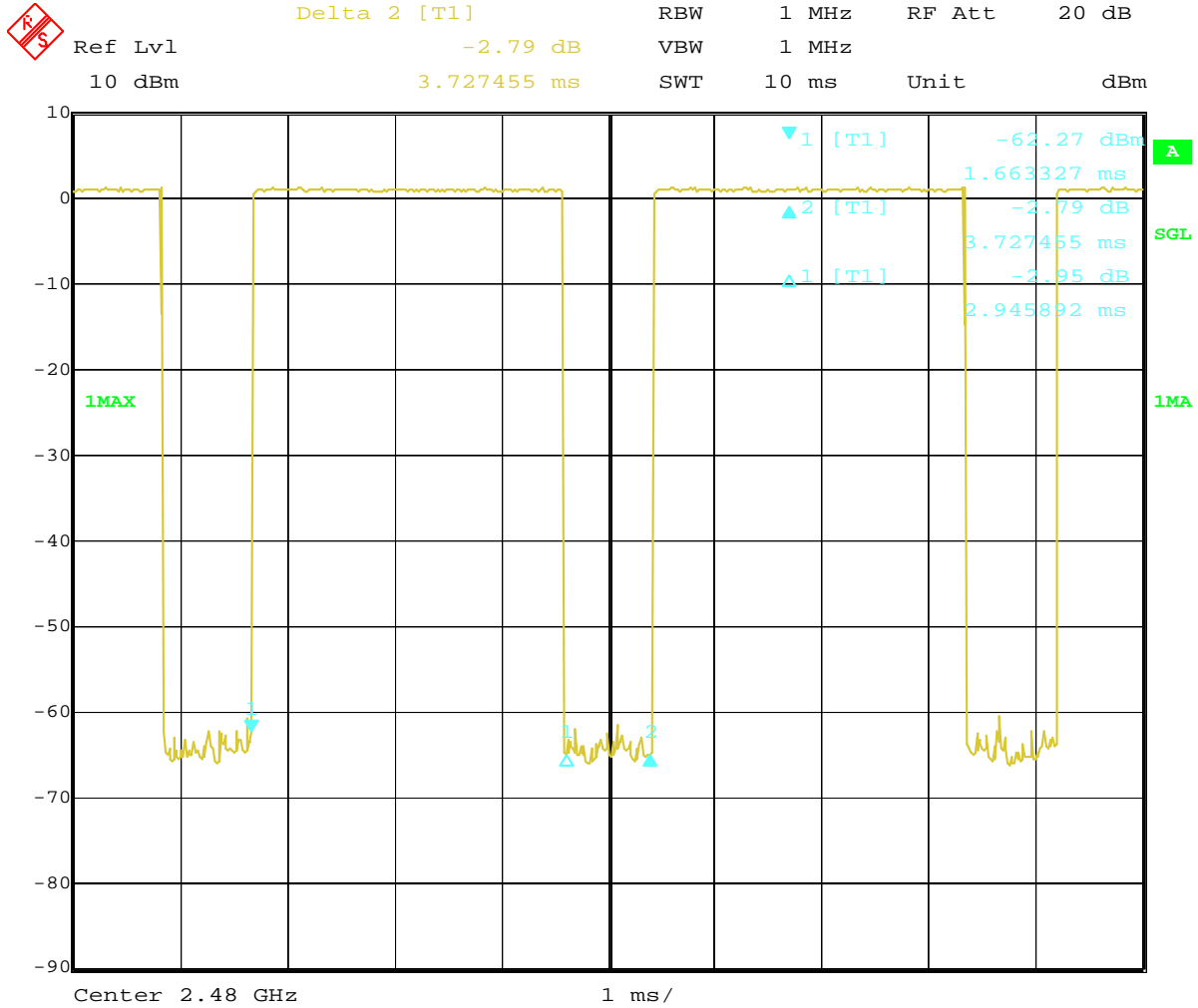
**Note: DH5 was the worst case.**

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Test Plots:

**DH5**



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**Test Result**

**Type of Modulation:**  $\pi/4$ DQPSK

|             |                             |               |               |        |       |
|-------------|-----------------------------|---------------|---------------|--------|-------|
| EUT         | 21.5' Advertising Displayer |               | Model         | ULT215 |       |
| Mode        | Keep Transmitting           |               | Input Voltage | 120V~  |       |
| Temperature | 24 deg. C,                  |               | Humidity      | 56% RH |       |
| Channel     | Reading                     | Hoping Rate   |               | Actual | Limit |
| DH5         |                             |               |               |        |       |
| Middle      | 2.986ms                     | 266.667 hop/s |               | 0.318s | 0.4s  |

Actual = Reading × (Hopping rate / Number of channels) × Test period, Test period = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625μs with 79 channels.

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A DH3 Packet needs 3 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 400 hops per second with 79 channels.

A DH1 Packet needs 1 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 800 hops per second with 79 channels.

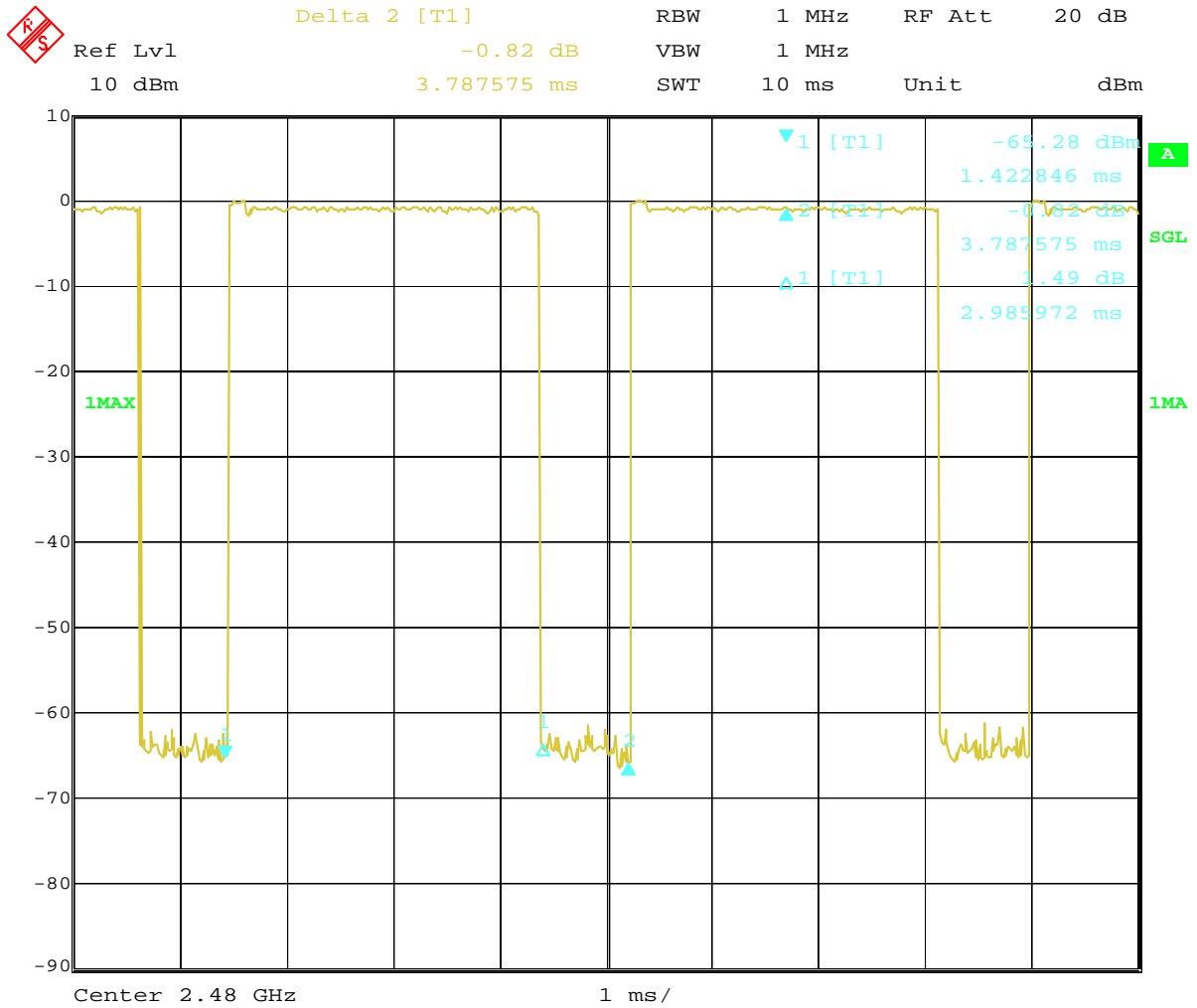
**Note: 2DH5 was the worst case.**

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Test Plots:

**2DH5**



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**Type of Modulation: 8DPSK**

|             |                             |               |               |        |       |
|-------------|-----------------------------|---------------|---------------|--------|-------|
| EUT         | 21.5' Advertising Displayer |               | Model         | ULT215 |       |
| Mode        | Keep Transmitting           |               | Input Voltage | 120V~  |       |
| Temperature | 24 deg. C,                  |               | Humidity      | 56% RH |       |
| Channel     | Reading                     | Hoping Rate   |               | Actual | Limit |
| DH5         |                             |               |               |        |       |
| Middle      | 2.986ms                     | 266.667 hop/s |               | 0.318s | 0.4s  |

Actual = Reading × (Hopping rate / Number of channels) × Test period, Test period = 0.4 [seconds / channel] × 79 [channel] = 31.6 [seconds] NOTE: The EUT makes worst case 1600 hops per second or 1 time slot has a length of 625μs with 79 channels.

A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

A DH3 Packet needs 3 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 400 hops per second with 79 channels.

A DH1 Packet needs 1 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 800 hops per second with 79 channels.

**Note: 3DH5 was the worst case.**

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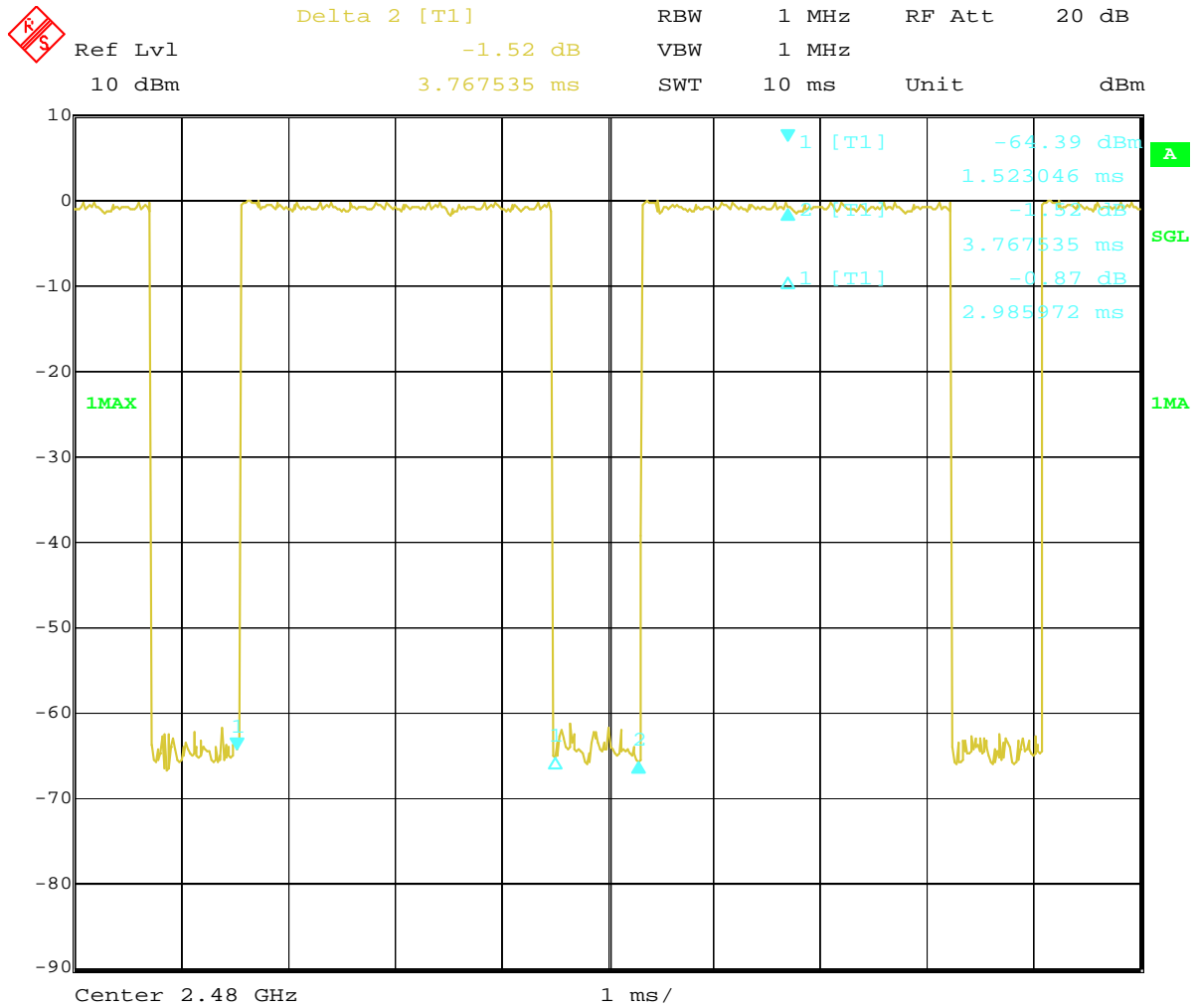
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Test Plots:

**3DH5**

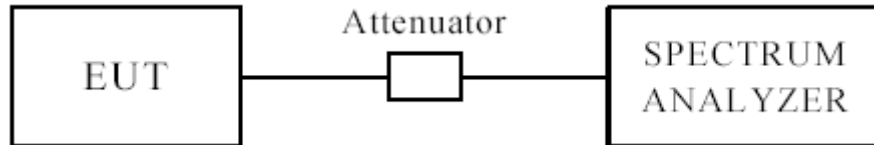


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## 12 Out of Band Measurement

### 12.1 Test Setup



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

### 12.2 Limits of Out of Band Emissions Measurement

1. Below  $-20\text{dB}$  of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

### 12.3 Test Procedure

For signals in the restricted bands above and below the 2.4-2.483GHz allocated band a measurement was made of radiated emission test. Peak values with  $\text{RBW}=\text{VBW}=1\text{MHz}$  and PK detector.

For bandage test, the spectrum set as follows:  $\text{RBW}=100\text{kHz}$ ,  $\text{VBW}=300\text{kHz}$ . A conducted measurement used

Note: 1. For band-edge measurement, the frequency from 30MHz-25GHz was tested. And It met the FCC rule.

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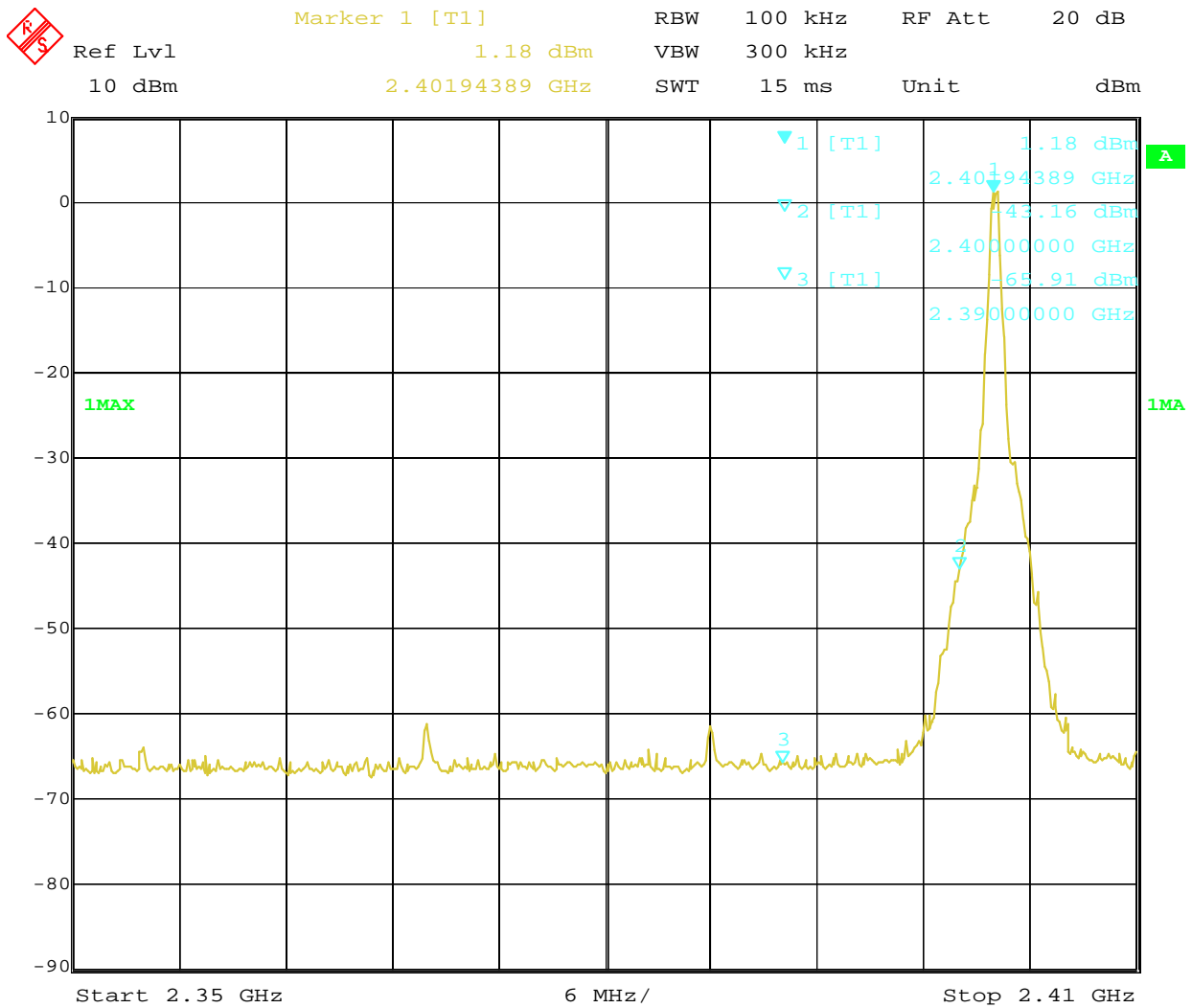


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

|              |                             |               |             |
|--------------|-----------------------------|---------------|-------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Low Channel |
| Mode         | Keeping Transmitting        | Input Voltage | 120V~       |
| Temperature  | 24 deg. C                   | Humidity      | 56% RH      |
| Test Result: | Pass                        | Detector      | PK          |

**Test Figure:**



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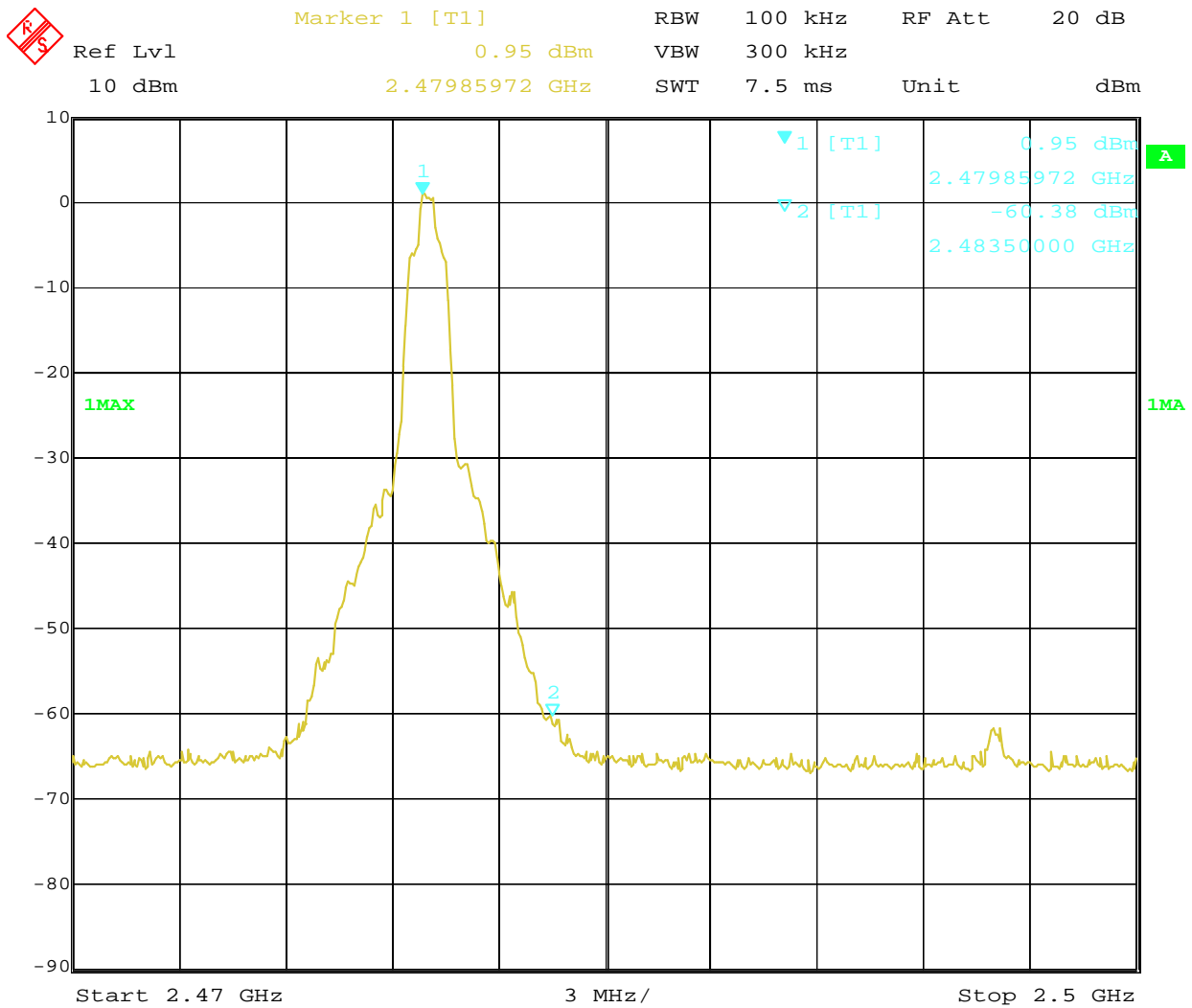


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | High Channel |
| Mode         | Keeping Transmitting        | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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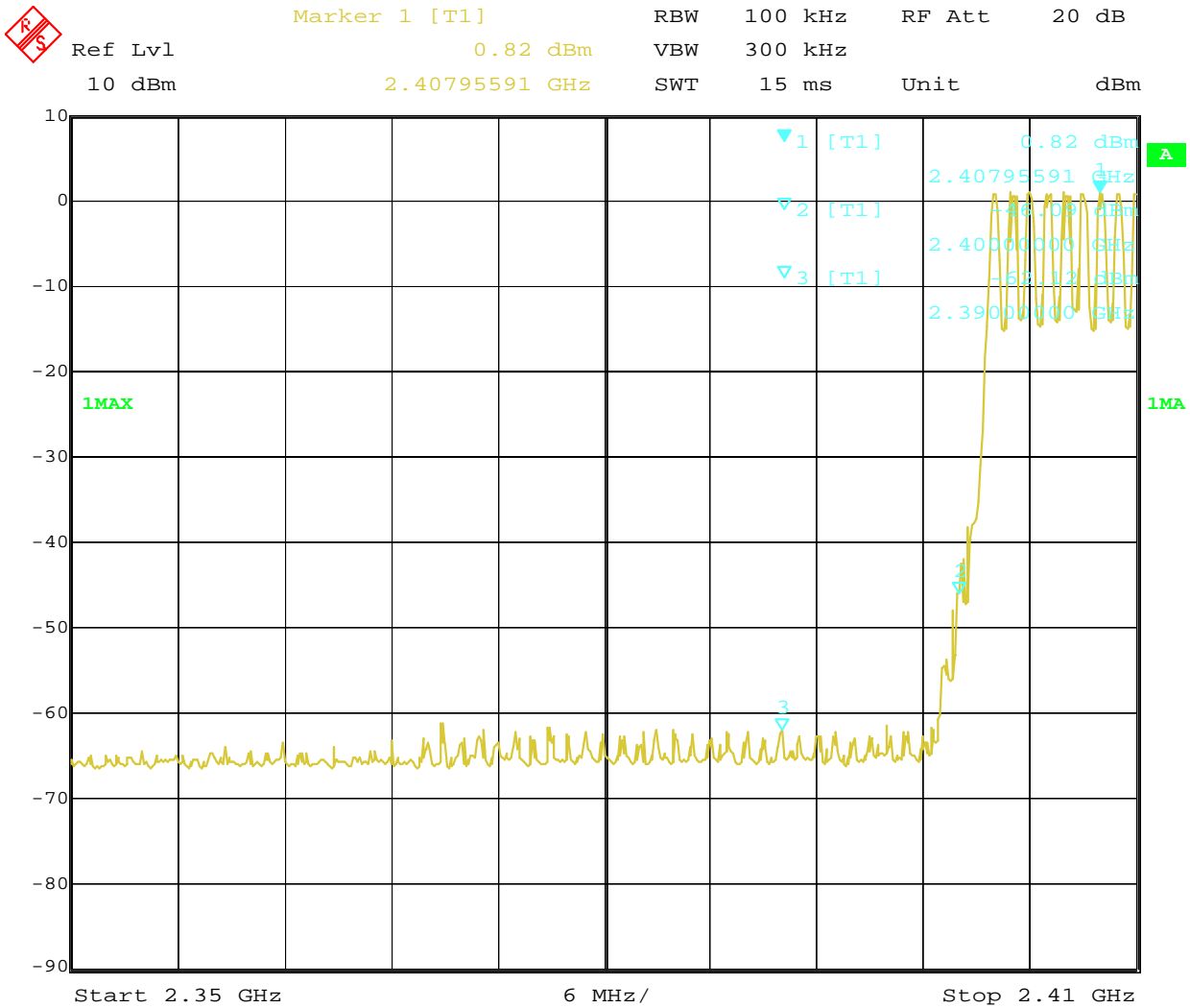


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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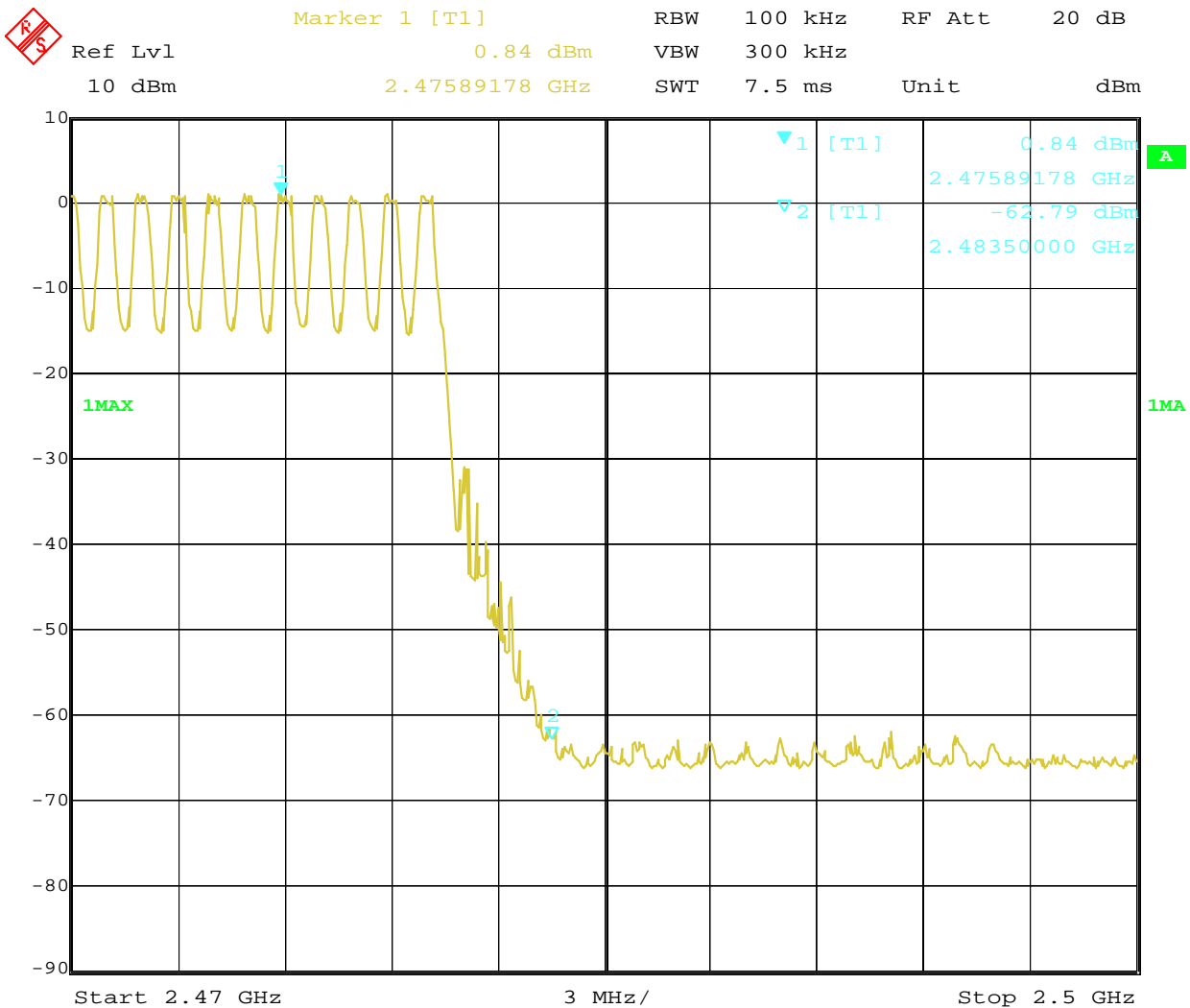


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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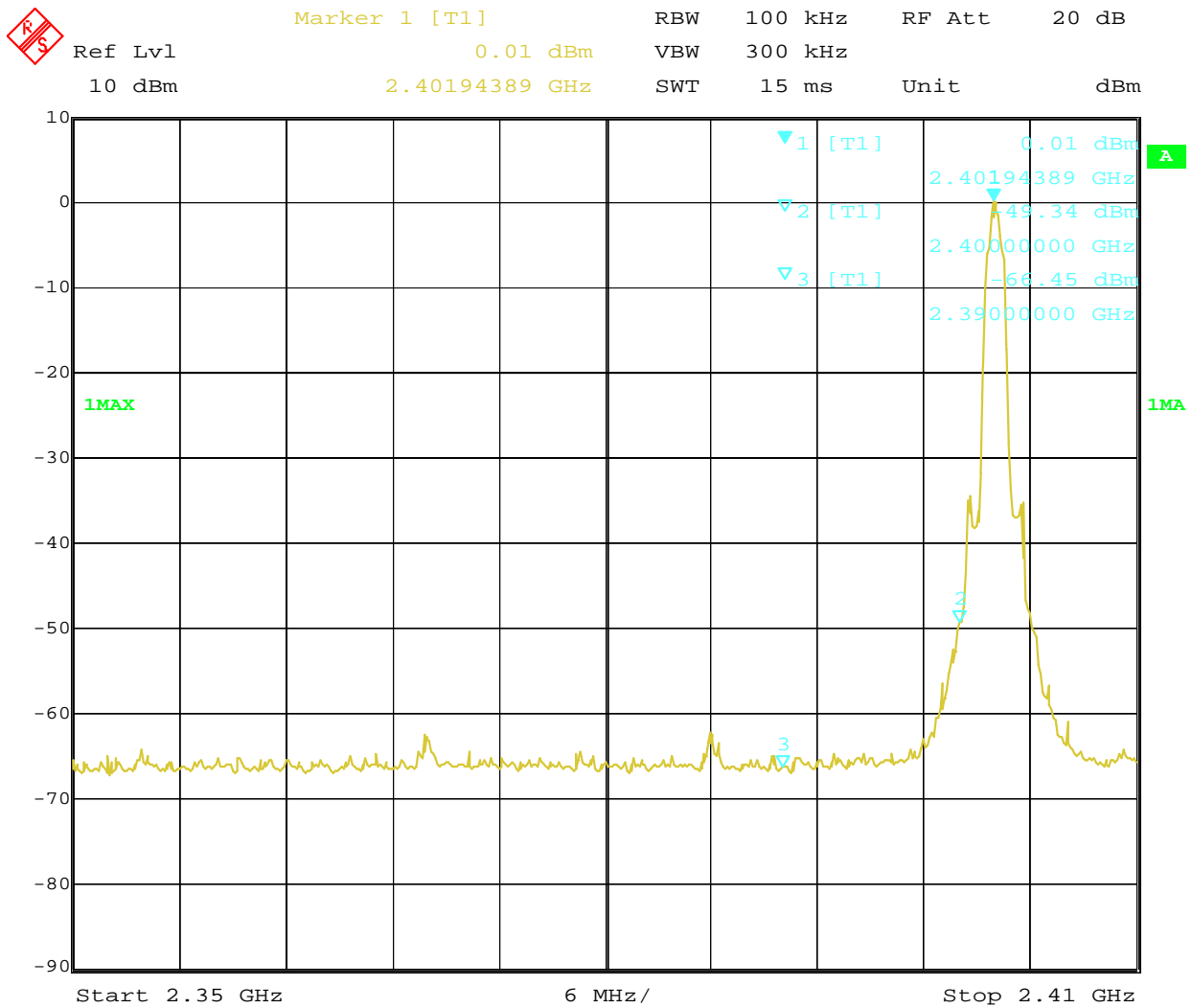


**Type of Modulation:**  $\pi/4$ DQPSK

**12.4 Out of Band Test Result**

|              |                             |               |             |
|--------------|-----------------------------|---------------|-------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Low Channel |
| Mode         | Keeping Transmitting        | Input Voltage | 120V~       |
| Temperature  | 24 deg. C                   | Humidity      | 56% RH      |
| Test Result: | Pass                        | Detector      | PK          |

**Test Figure:**



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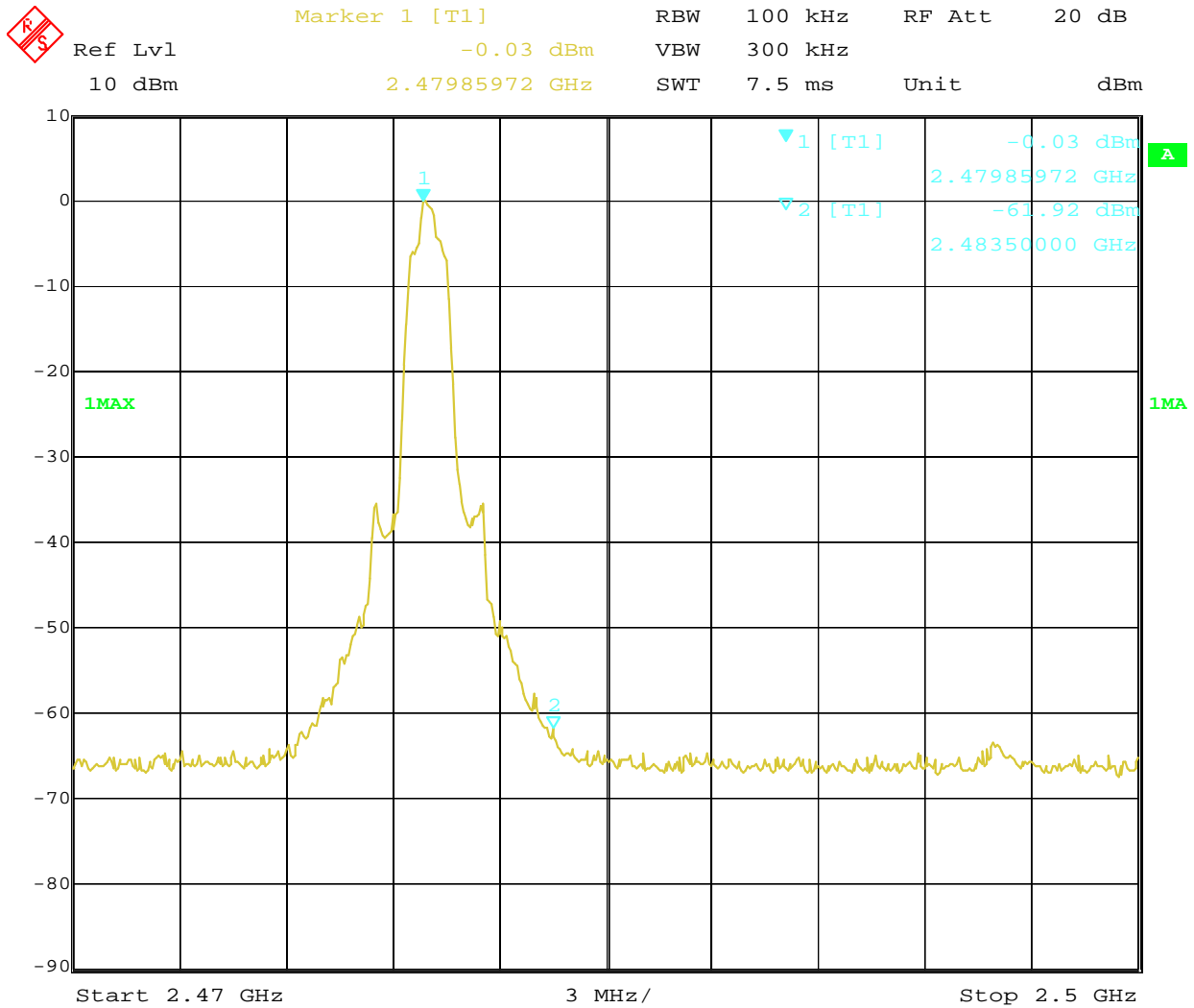


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | High Channel |
| Mode         | Keeping Transmitting        | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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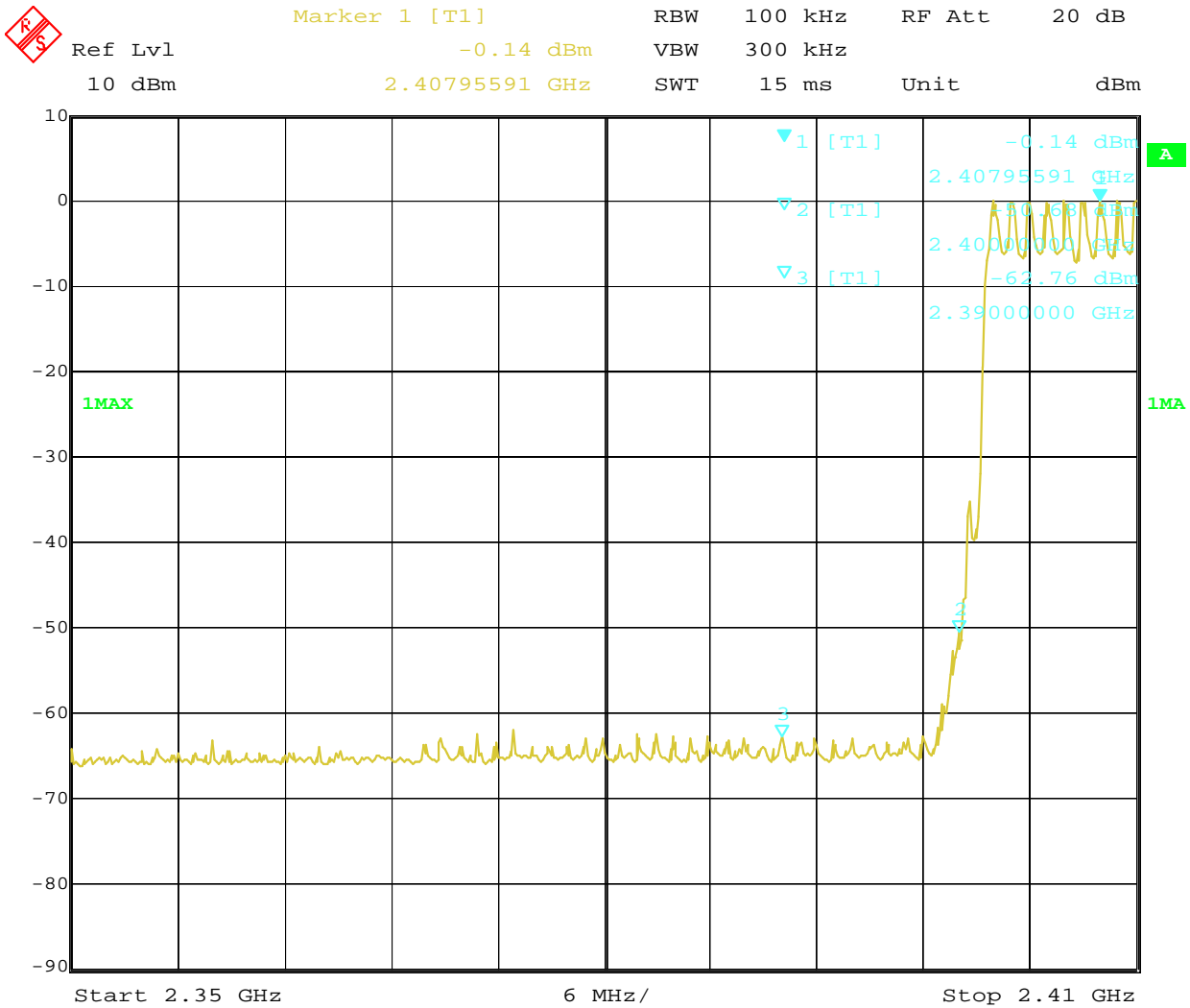


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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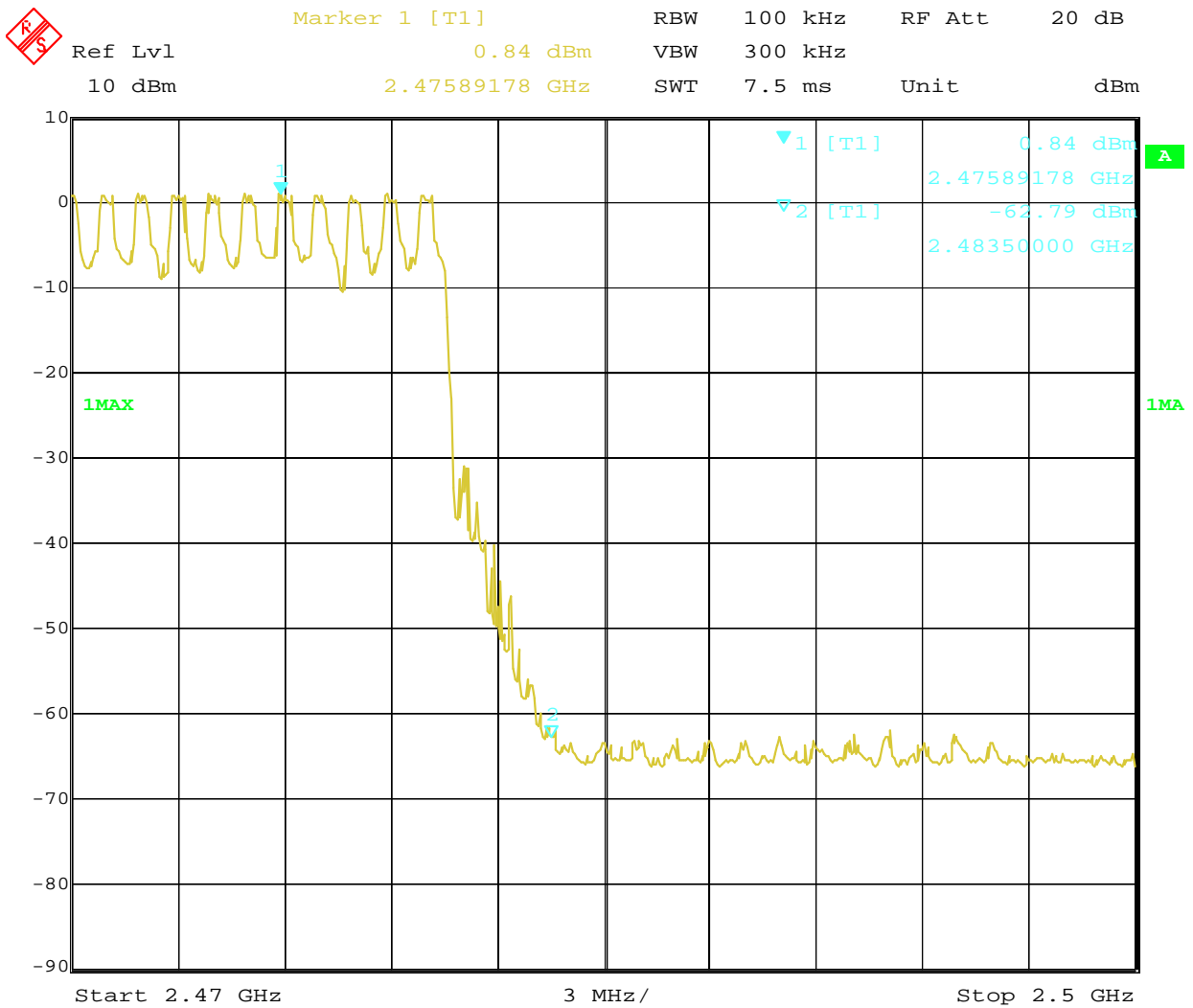


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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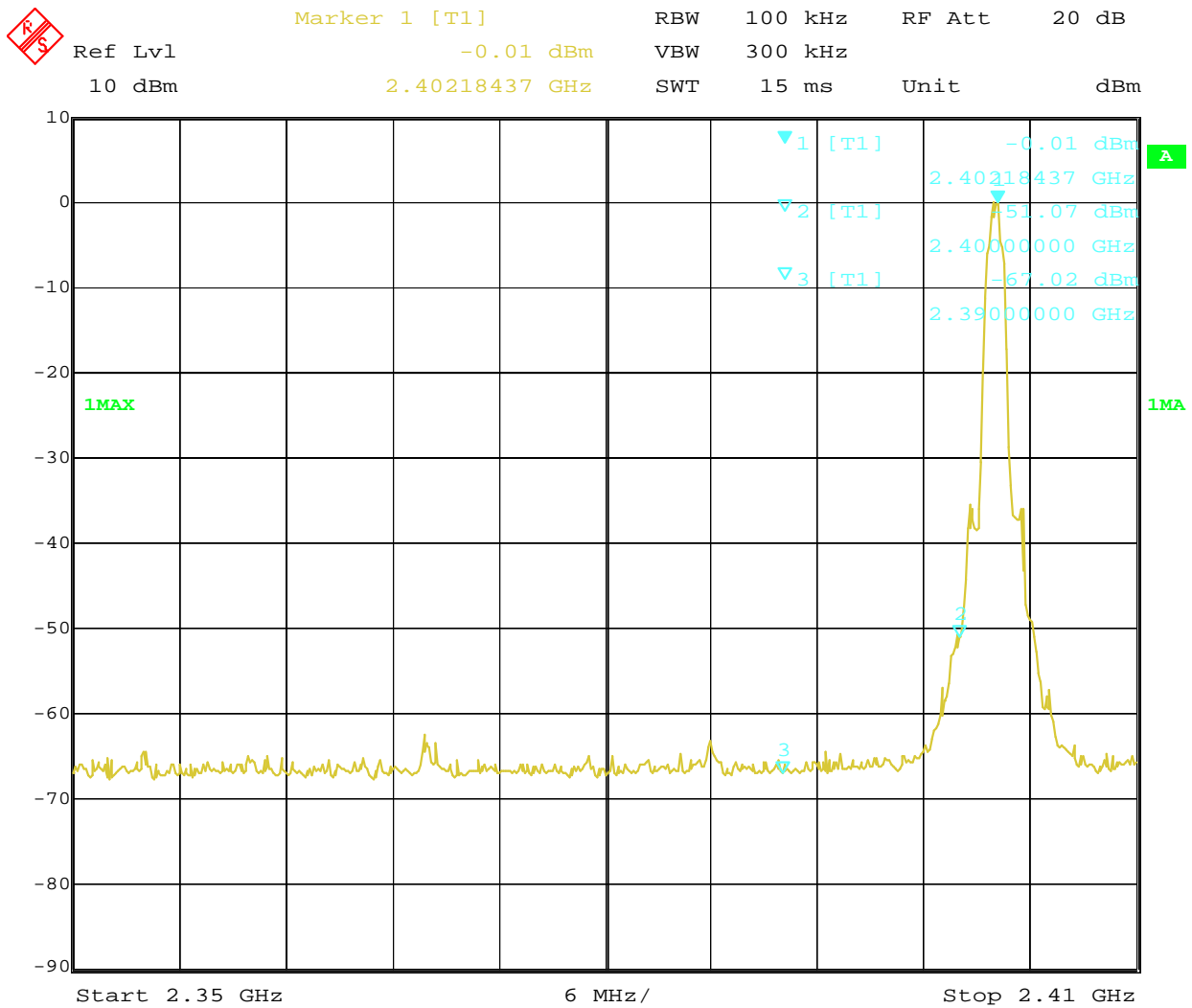


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

|              |                             |               |             |
|--------------|-----------------------------|---------------|-------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Low Channel |
| Mode         | Keeping Transmitting        | Input Voltage | 120V~       |
| Temperature  | 24 deg. C                   | Humidity      | 56% RH      |
| Test Result: | Pass                        | Detector      | PK          |

**Test Figure:**



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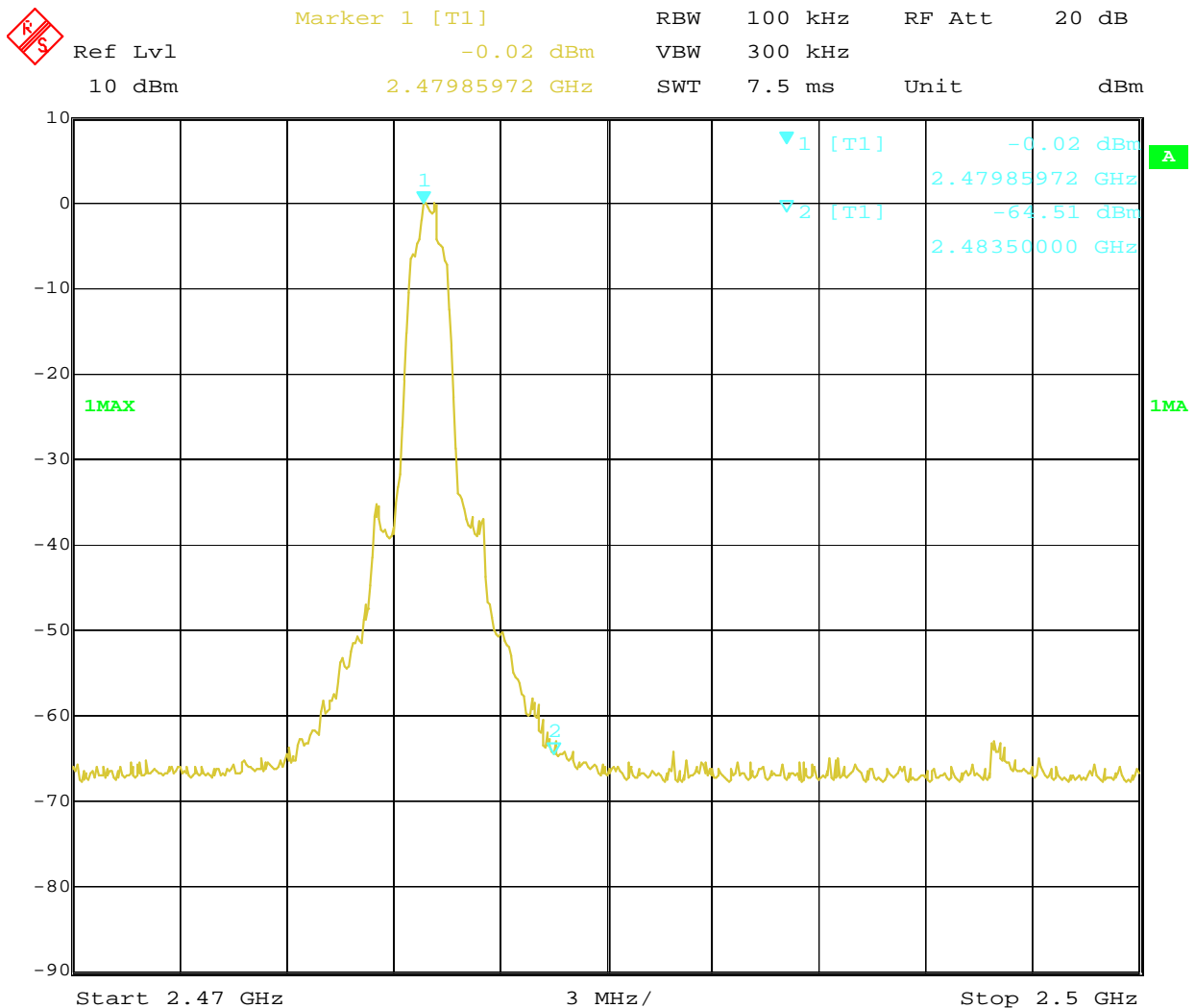


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

|  |                             |      |               |              |
|--|-----------------------------|------|---------------|--------------|
| Product:                               | 21.5' Advertising Displayer |      | Test Mode:    | High Channel |
| Mode                                   | Keeping Transmitting        |      | Input Voltage | 120V~        |
| Temperature                            | 24 deg. C,                  |      | Humidity      | 56% RH       |
| Test Result:                           | Pass                        |      | Detector      | PK           |
| The Max. FS in Restrict Band 2483.5MHz | PK (dBμV/m)                 | 44.8 | Limit         | 74(dBμV/m)   |
|  | AV(dBμV/m)                  | --   |               | 54(dBμV/m)   |

**Test Figure:**



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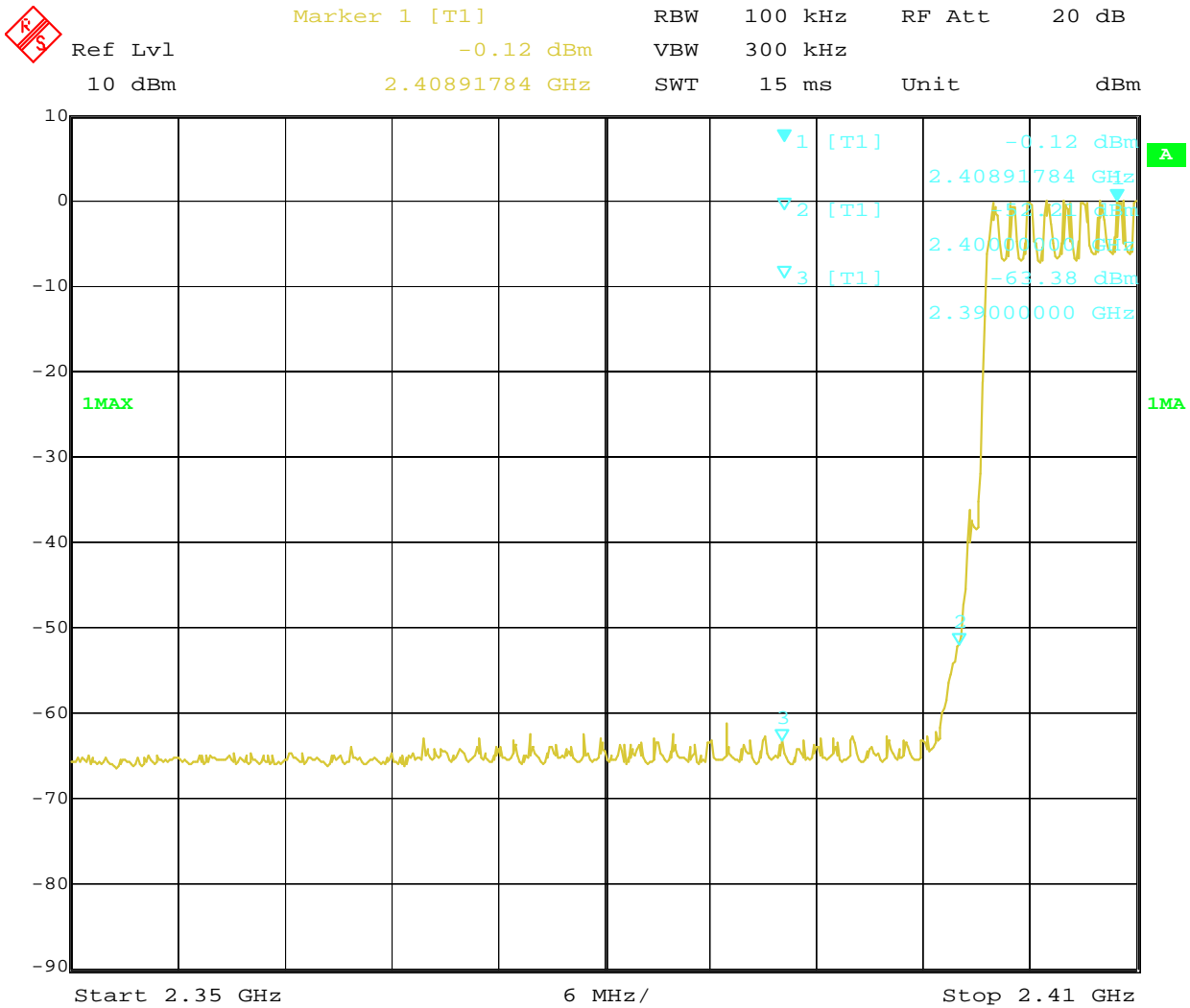


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**



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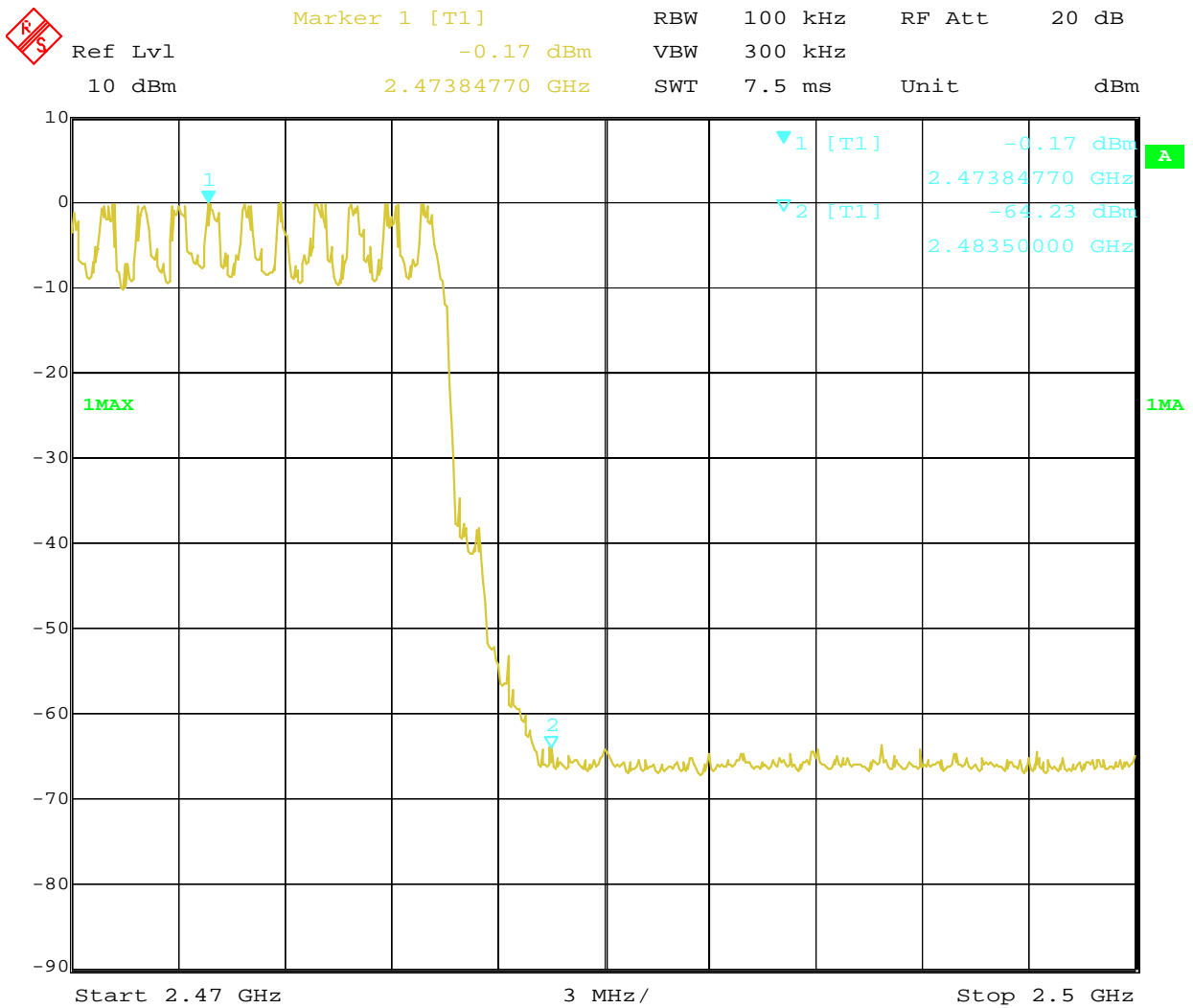


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

|              |                             |               |              |
|--------------|-----------------------------|---------------|--------------|
| Product:     | 21.5' Advertising Displayer | Test Mode:    | Hopping mode |
| Mode         | Hopping On                  | Input Voltage | 120V~        |
| Temperature  | 24 deg. C,                  | Humidity      | 56% RH       |
| Test Result: | Pass                        | Detector      | PK           |

**Test Figure:**

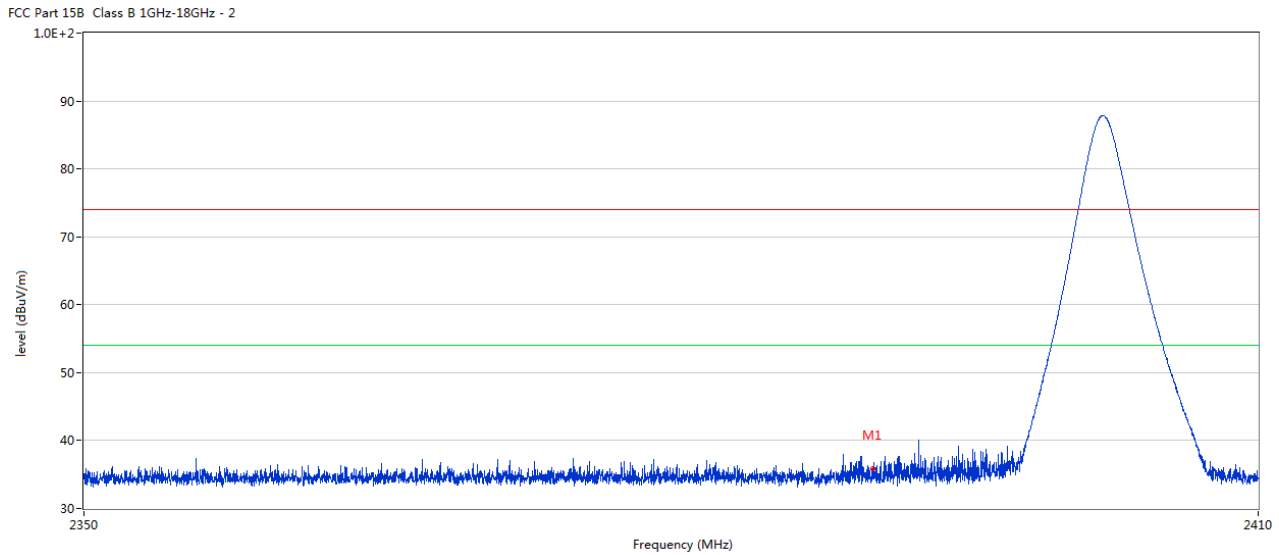


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**12.4 Restrict Band Measurement**

|              |                             |                 |        |
|--------------|-----------------------------|-----------------|--------|
| EUT          | 21.5' Advertising Displayer | Model           | ULT215 |
| Mode         | Keep Transmitting           | Input Voltage   | 120V~  |
| Temperature  | 24 deg. C,                  | Humidity        | 56% RH |
| Test Result: | Pass                        | Modulation Type | GFSK   |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 2390.000        | 35.92            | -3.53       | 74.0           | -38.08          | Peak     | 252.00    | 100         | H   | Pass    |

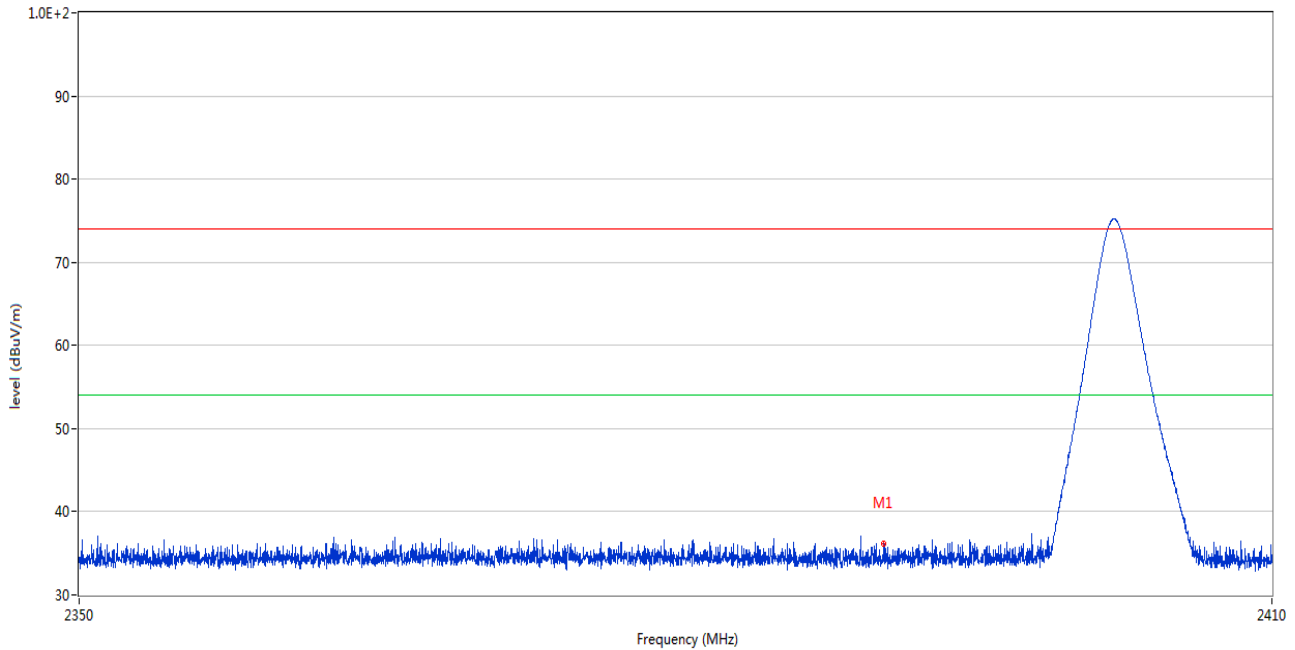
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**12.4 Restrict Band Measurement**

|              |                             |                 |        |
|--------------|-----------------------------|-----------------|--------|
| EUT          | 21.5' Advertising Displayer | Model           | ULT215 |
| Mode         | Keep Transmitting           | Input Voltage   | 120V~  |
| Temperature  | 24 deg. C,                  | Humidity        | 56% RH |
| Test Result: | Pass                        | Modulation Type | GFSK   |

FCC Part 15B Class B 1GHz-18GHz - 2



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 2390.000        | 36.23            | -3.53       | 74.0           | -37.77          | Peak     | 270.00    | 100         | V   | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

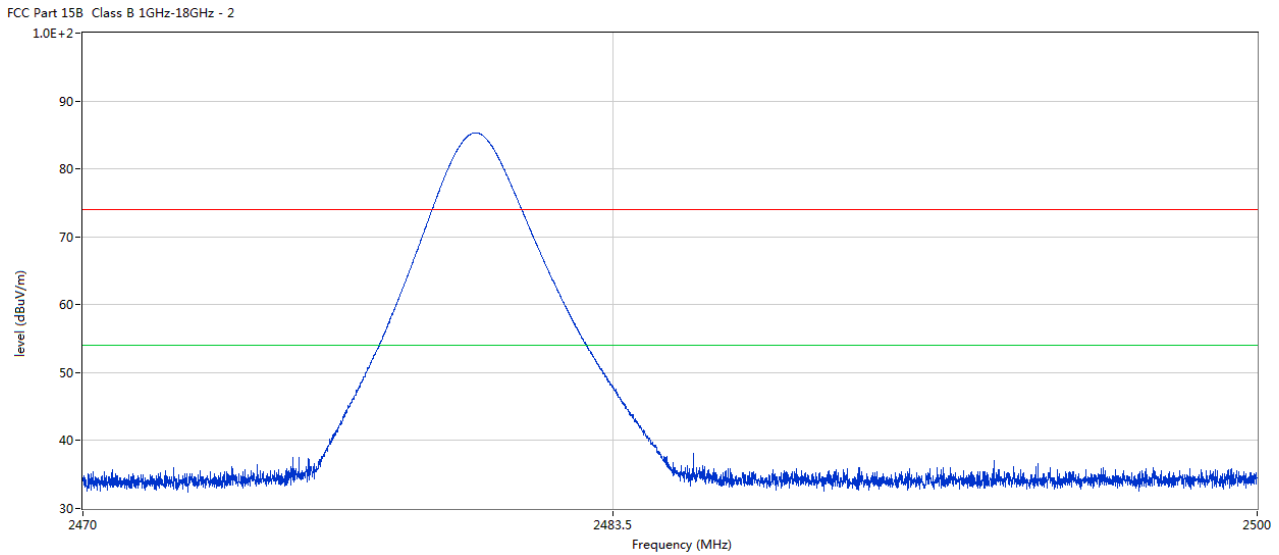
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**12.4 Restrict Band Measurement**

|              |                             |                 |        |
|--------------|-----------------------------|-----------------|--------|
| EUT          | 21.5' Advertising Displayer | Model           | ULT215 |
| Mode         | Keep Transmitting           | Input Voltage   | 120V~  |
| Temperature  | 24 deg. C,                  | Humidity        | 56% RH |
| Test Result: | Pass                        | Modulation Type | GFSK   |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 2483.500        | 47.62            | -3.57       | 74.0           | -26.38          | Peak     | 187.00    | 100         | H   | Pass    |

The report refers only to the sample tested and does not apply to the bulk.

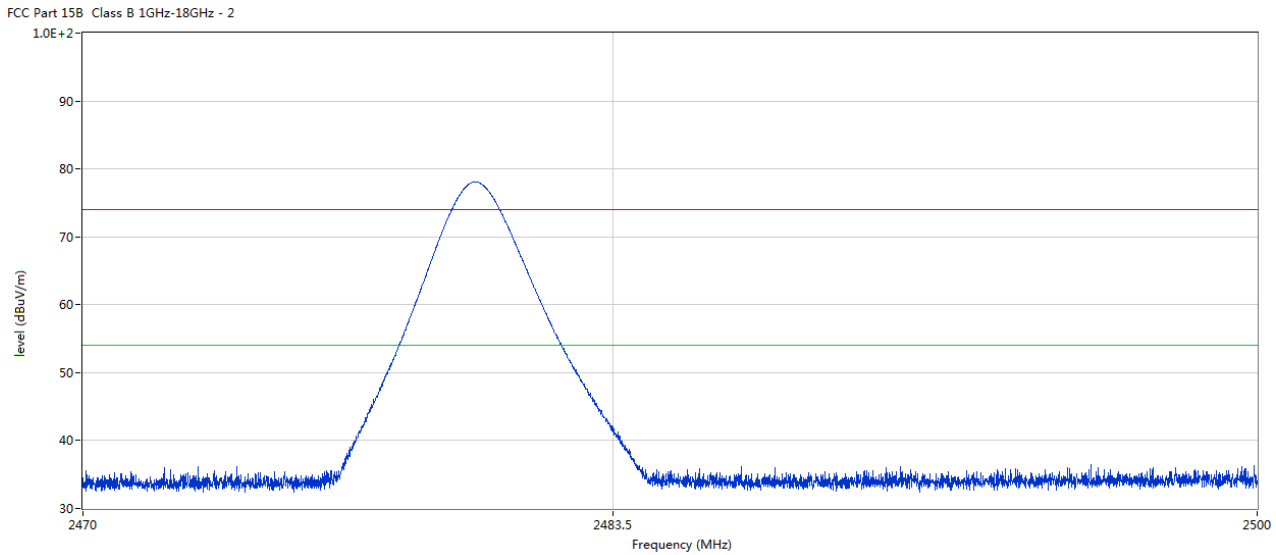
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**12.4 Restrict Band Measurement**

|              |                             |                 |        |
|--------------|-----------------------------|-----------------|--------|
| EUT          | 21.5' Advertising Displayer | Model           | ULT215 |
| Mode         | Keep Transmitting           | Input Voltage   | 120V~  |
| Temperature  | 24 deg. C,                  | Humidity        | 56% RH |
| Test Result: | Pass                        | Modulation Type | GFSK   |



| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Over Limit (dB) | Detector | Table (o) | Height (cm) | ANT | Verdict |
|-----|-----------------|------------------|-------------|----------------|-----------------|----------|-----------|-------------|-----|---------|
| 1   | 2483.500        | 42.12            | -3.57       | 74.0           | -31.88          | Peak     | 323.00    | 100         | V   | Pass    |

**Note: For Restricted band test, only the worst case GFSK was reported.**

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### **13.0 Antenna Requirement**

#### 13.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 13.2 Antenna Connected constructions

Dipole antenna used. The gain of the antennas is 2.0dBi.

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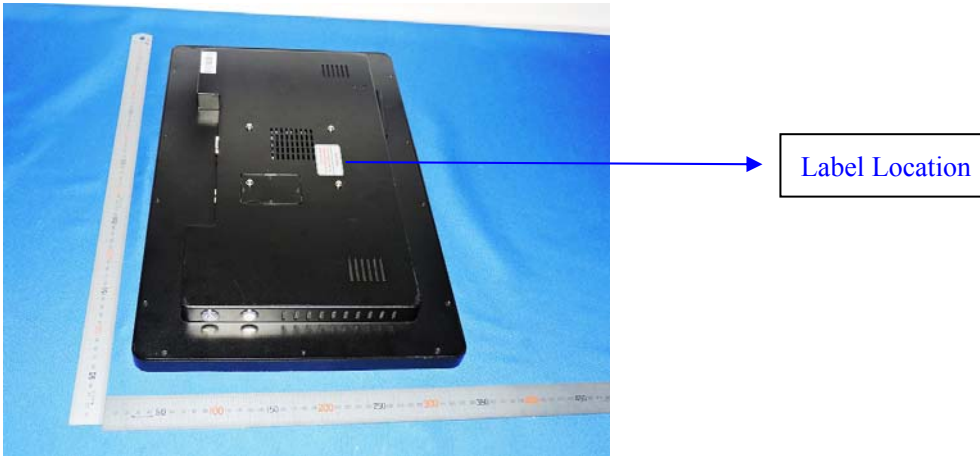
**14.0 FCC ID Label**

**FCC ID: 2AACS-ULT215**

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

**Mark Location:**

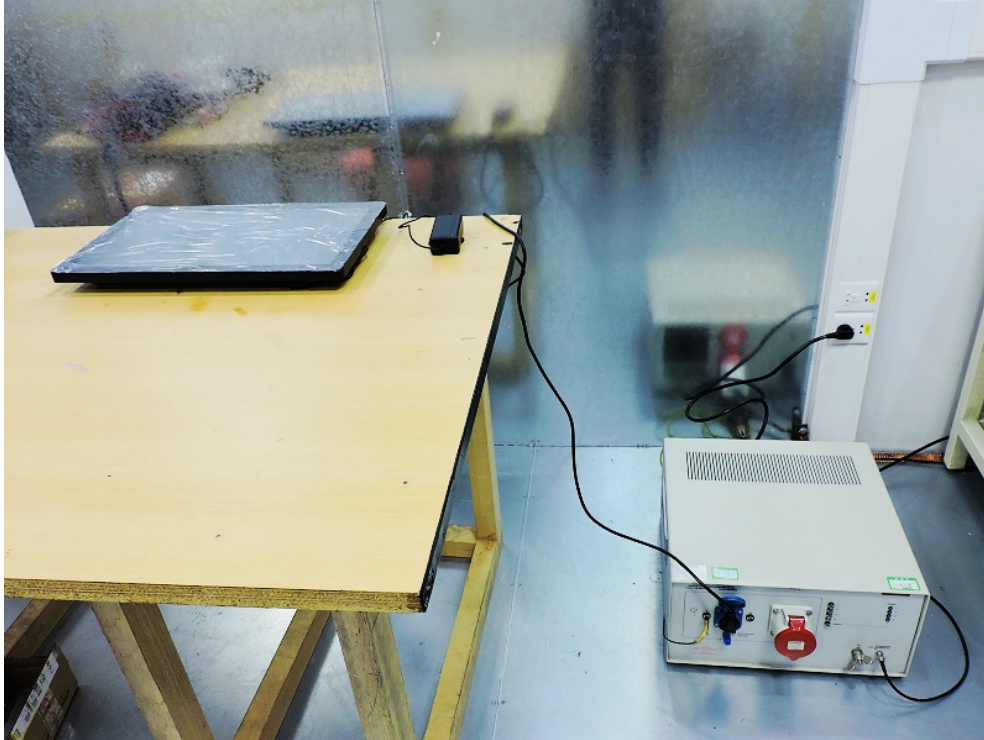


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### 15.0 Photo of testing

Conducted Emission Test Setup:

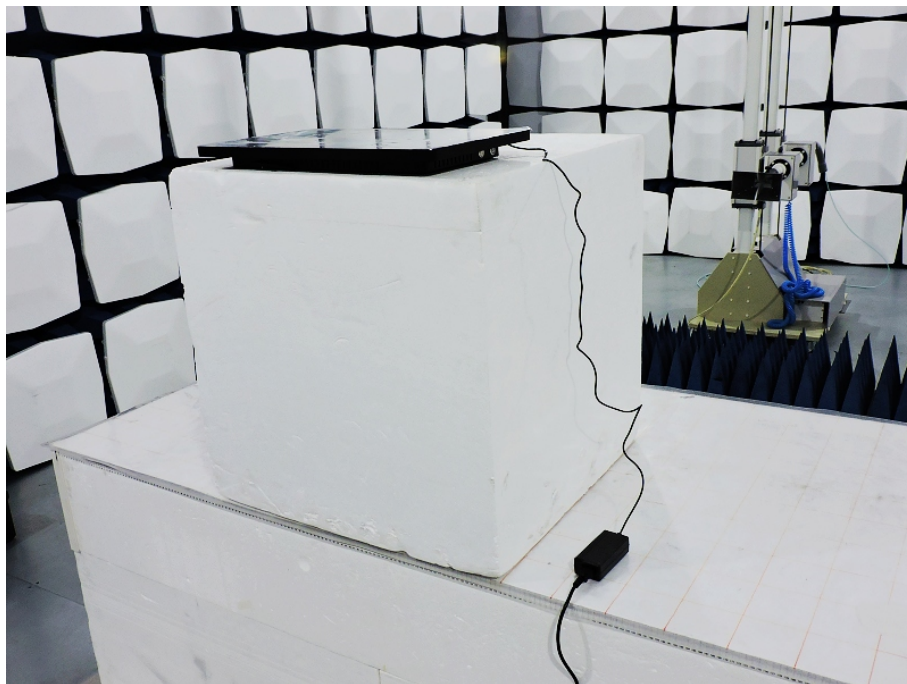
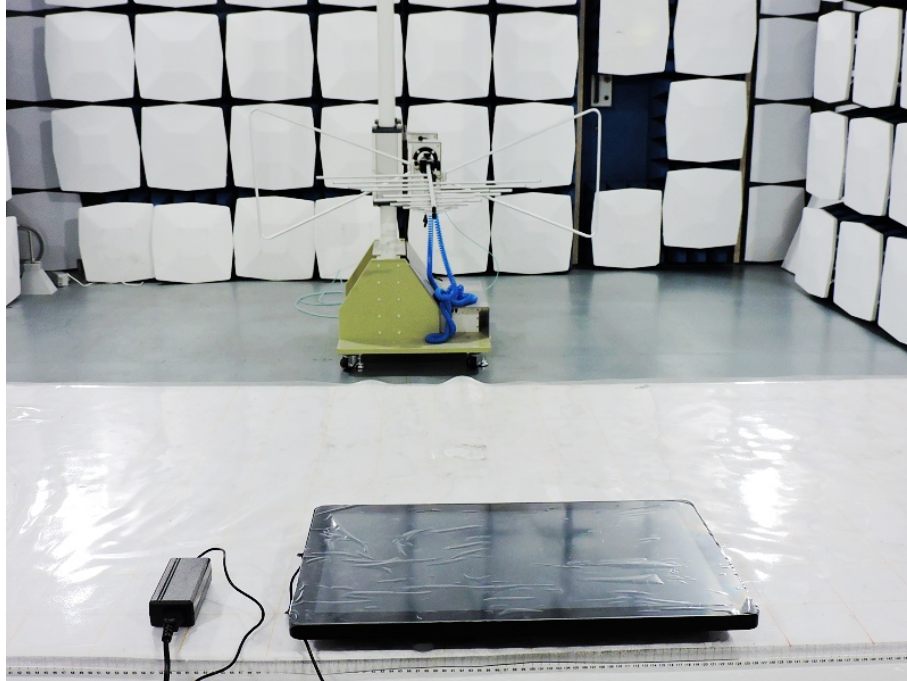


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Radiated Emission Test Setup:



**Photographs – EUT**

Please see test report EMC1901184-01

**End of Report**

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