

TECHNICAL REPORT



Report No: FCC 1705096-02  
File reference No: 2017-06-28

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

Product: 31.5' Advertising Displayer

Model No: JAR321

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: June 28, 2017

**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**

Room 512-519, 5/F., East Tower, Building 4, Anhua Industrial Zone, Futian District, Shenzhen, Guangdong, 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.: 899988**

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.:899988.

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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: Room 512-519,5/F., East Tower,Building 4, Anhua Industrial Zone, Futian District,Shenzhen, Guangdong China  
Telephone: (755) 83448688  
Fax: (755) 83442996  
Site on File with the Federal Communications Commission – United States  
Registration Number: 899988  
For 3m & 10 m OATS  
Site Listed with Industry Canada of Ottawa, Canada  
Registration Number: IC: 5205A-02  
For 3m & 10 m OATS

### 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: 31.5' 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: JAR321  
Additional Model Number: N/A  
Power Adapter Model No.: SUN-1200500;  
Input: 100-240V, 50/60Hz, Max 1.7A; Output: 12V, 5A  
Type of Modulation GFSK,  $\pi/4$ DQPSK, 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: Integral Antenna and the maximum Gain of this antenna is 2.0dBi;

### 1.4 Submitted Sample: 2 Samples

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1.5 Test Duration

2017-05-16 to 2017-06-28

1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions Uncertainty =4.7dB

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	2016-08-22	2017-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100294	2016-08-22	2017-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2016-08-22	2017-08-21
Ultra Broadband ANT	R&S	HL562	100157	2016-08-23	2017-08-22
ESDV Test Receiver	R&S	ESDV	100008	2016-08-22	2017-08-21
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2016-08-22	2017-08-21
System Controller	CT	SC100	-	--	--
Printer	EPSON	PHOTO EX3	CFNH234850	--	--
Computer	IBM	8434	1S8434KCE99BLXLO*	-	-
Loop Antenna	EMCO	6502	00042960	2016-08-23	2017-08-22
ESPI Test Receiver	R&S	ESI26	838786/013	2016-08-22	2017-08-21
3m OATS	--	--	N/A	2016-08-24	2017-08-23
Horn Antenna	R&S	BBHA 9170	BBHA9170265	2016-08-24	2017-08-23
Horn Antenna	R&S	BBHA 9120D	9120D-631	2016-08-24	2017-08-23
Power meter	Anritsu	ML2487A	6K00003613	2016-08-22	2017-08-21
Power sensor	Anritsu	MA2491A	32263	2016-08-22	2017-08-21
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2016-08-23	2017-08-21
LISN	AFJ	LS16C	10010947251	2016-08-22	2017-08-21
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2016-08-23	2017-08-22
9*6*6 Anechoic	--	--	N/A	2016-08-24	2017-08-23
EMI Test Receiver	RS	ESCS30	100139	2016-08-22	2017-08-21
RF Cable	SCHWARZBEC K	--	--	2016-08-23	2017-08-22
Pre-Amplifier	HP	8447D	2727A05017	2016-08-05	2017-08-04
Pre-Amplifier	EM	EM30265	--	2016-08-05	2017-08-04

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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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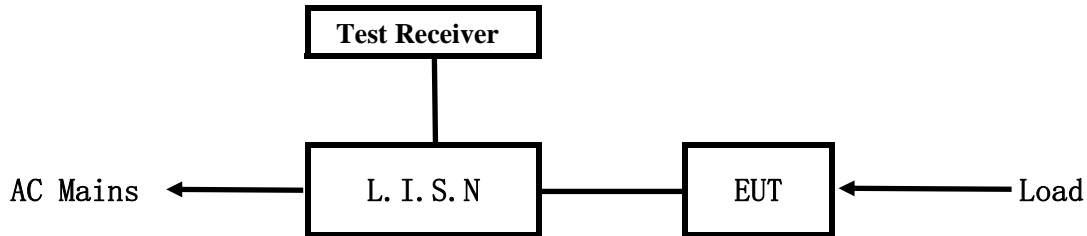
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## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test



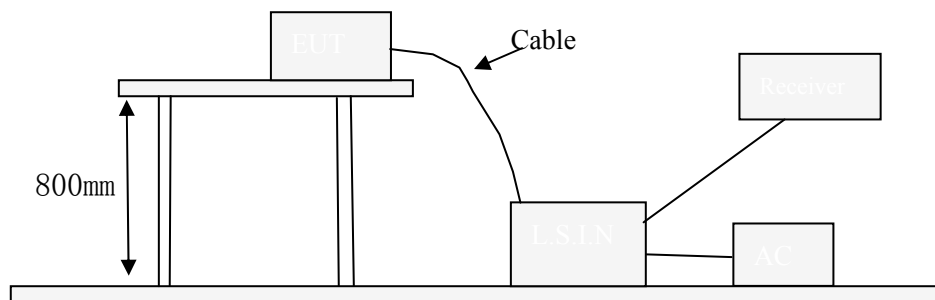
EUT: Equipment Under Test

### 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
31.5' Advertising Displayer	GLORY STAR TECHNICS (SHENZHEN) CO., LTD.	JAR321	2AACS-JAR321

B. Internal Device

Device	Manufacturer	Model	Rating

C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
--	--	--	--	--

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 (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**

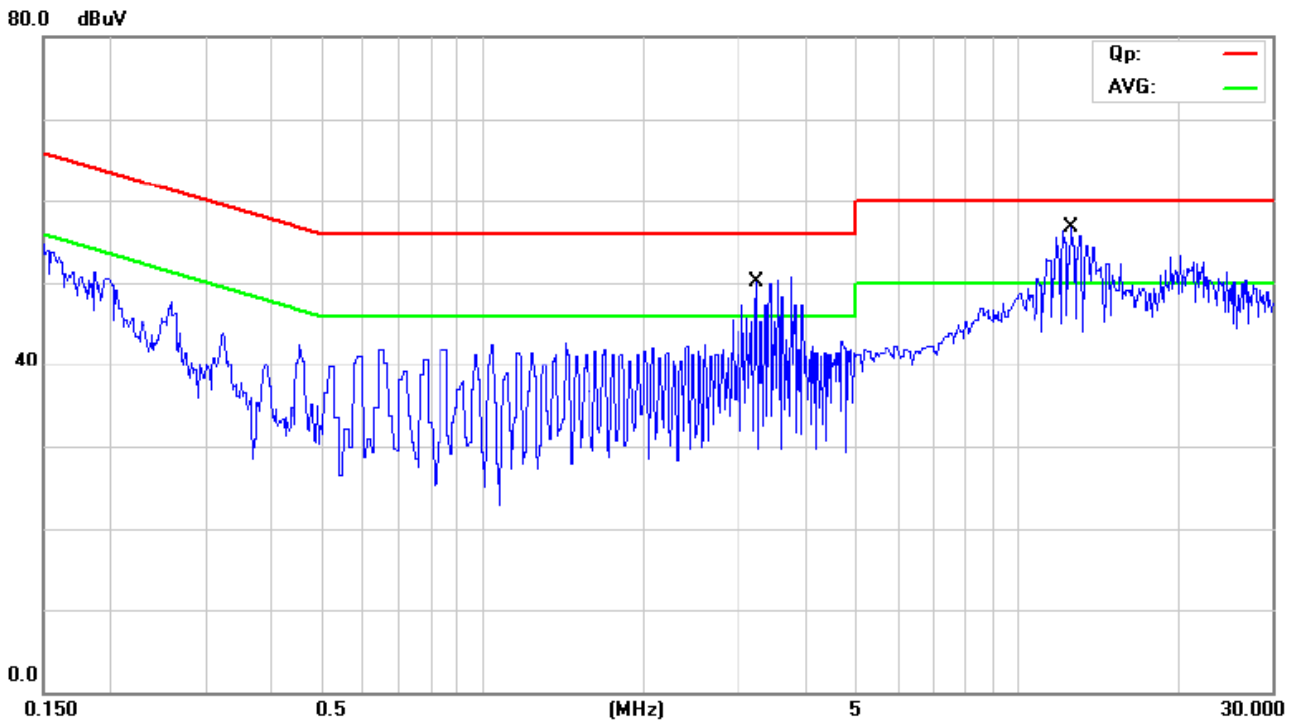
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Charging and Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: PASS**

Please refer to following diagram for individual



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		3.2401	33.90	10.86	44.76	56.00	-11.24	QP	
2		3.2401	23.80	10.86	34.66	46.00	-11.34	AVG	
3	*	12.6250	45.28	11.35	56.63	60.00	-3.37	QP	
4		12.6250	25.18	11.35	36.53	50.00	-13.47	AVG	

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

**EUT Operating Environment**

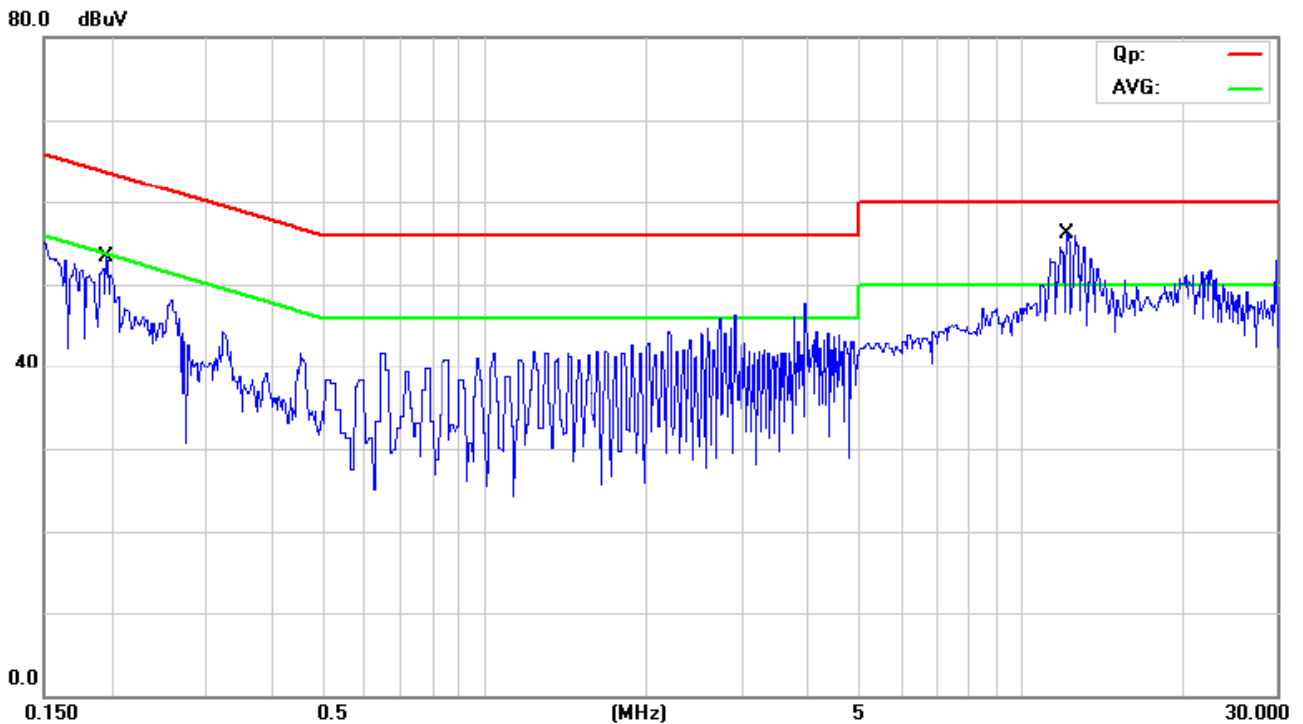
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Charging and Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1952	37.30	9.90	47.20	63.81	-16.61	QP	
2		0.1952	16.70	9.90	26.60	53.81	-27.21	AVG	
3		12.2274	26.70	11.36	38.06	60.00	-21.94	QP	
4		12.2274	19.90	11.36	31.26	50.00	-18.74	AVG	

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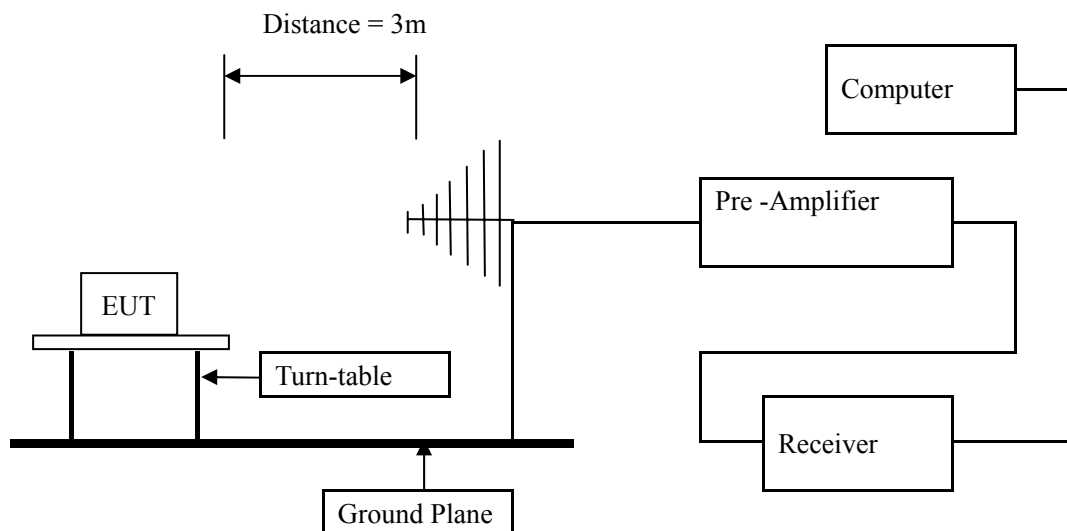


## 6 Radiated Emission Test

### 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. 8999988
- (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 15.109 and RSS-210**

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. 8-DPSK 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**

Frequency (MHz)	Level@3m (dB $\mu$ V/m)	Antenna Polarity	Limit@3m (dB $\mu$ V/m)
48.520	34.87	H	40.00
875.040	40.08	H	46.00
312.040	40.11	H	46.00
125.000	41.37	H	43.50
125.000	35.90	V	43.50
919.760	39.08	V	46.00
375.360	37.28	V	46.00
32.360	37.01	V	40.00

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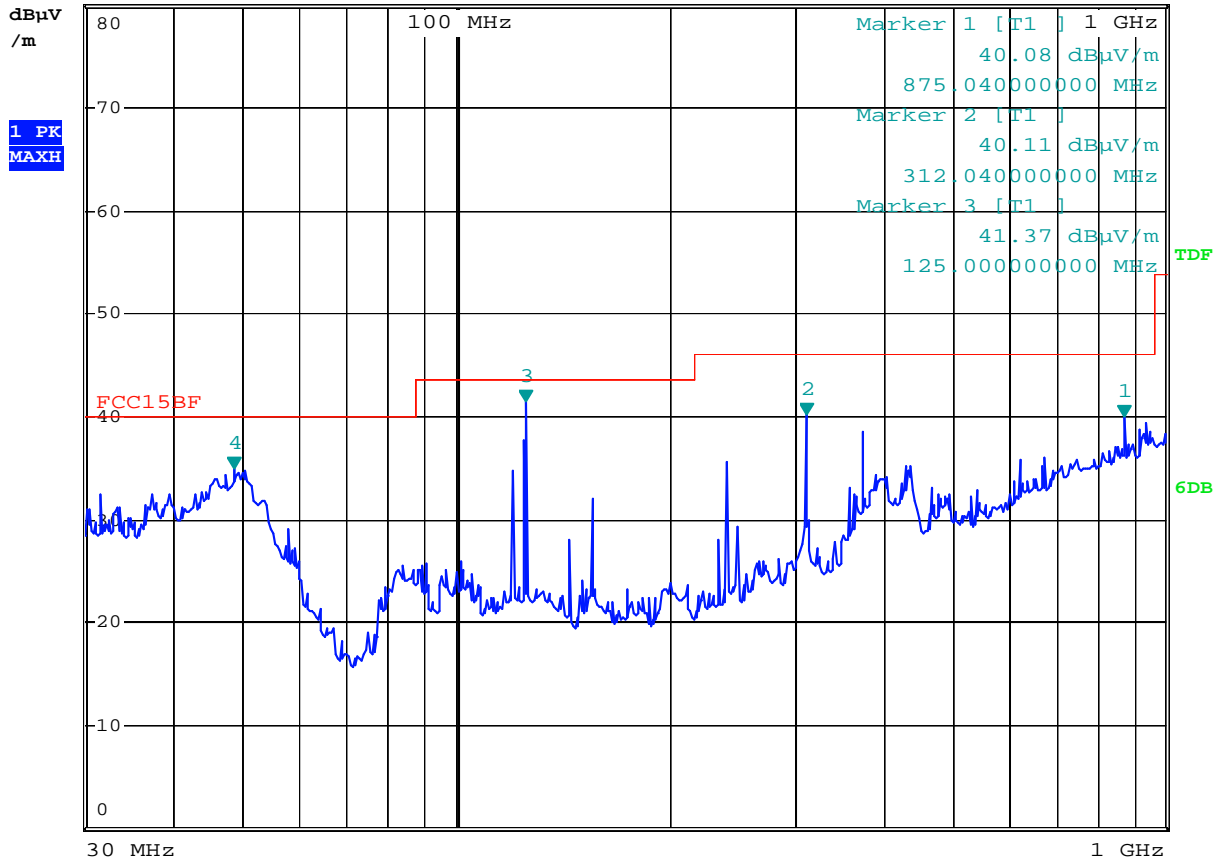
Test Figure:

H



**MARKER 4**  
 48.52 MHz  
 Att 10 dB

RBW 120 kHz Marker 4 [T1 ]  
 MT 50 μs 34.87 dBμV/m  
 PREAMP ON 48.52000000 MHz



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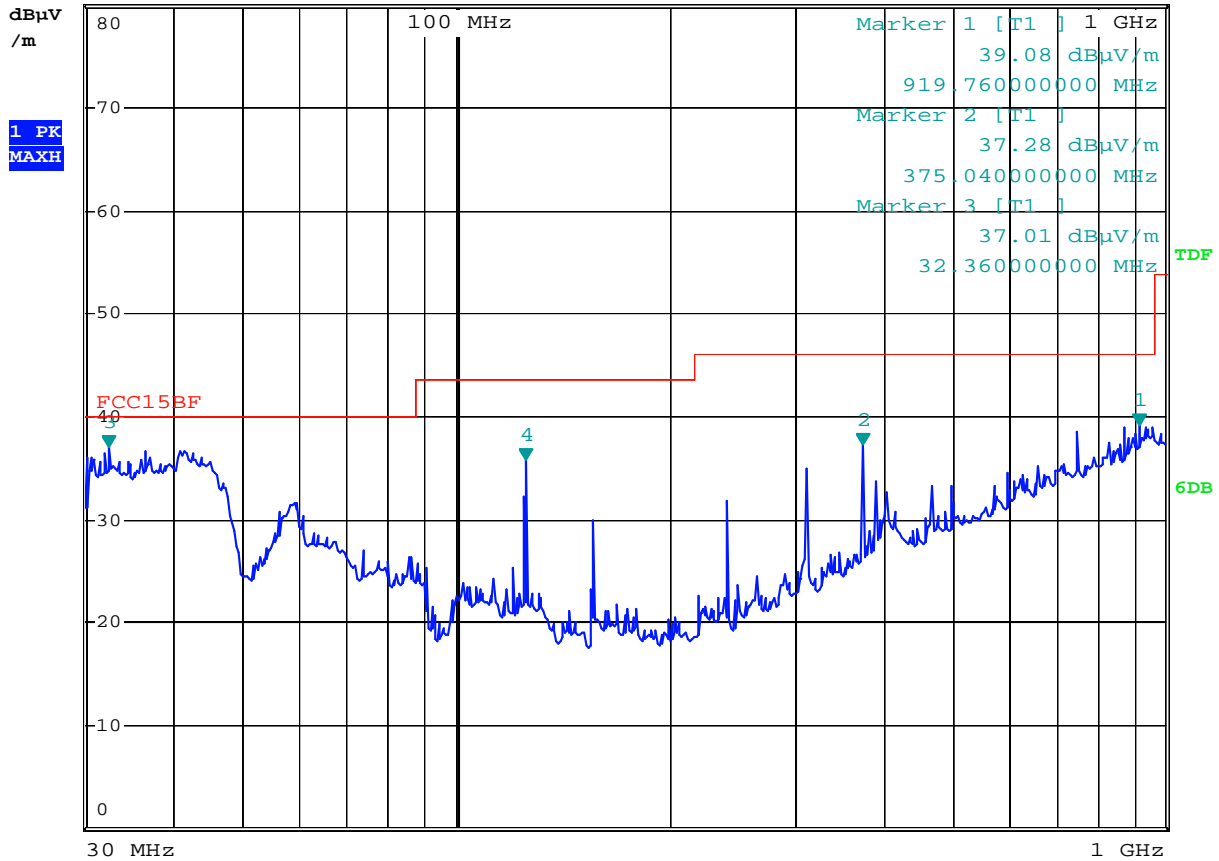
Test Figure:

V



**MARKER 4**  
 125 MHz  
 Att 10 dB

RBW 120 kHz Marker 4 [T1 ]  
 MT 50 μs 35.90 dBμV/m  
 PREAMP ON 125.00000000 MHz



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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)
19216	--	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 g 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)
19528	--	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)

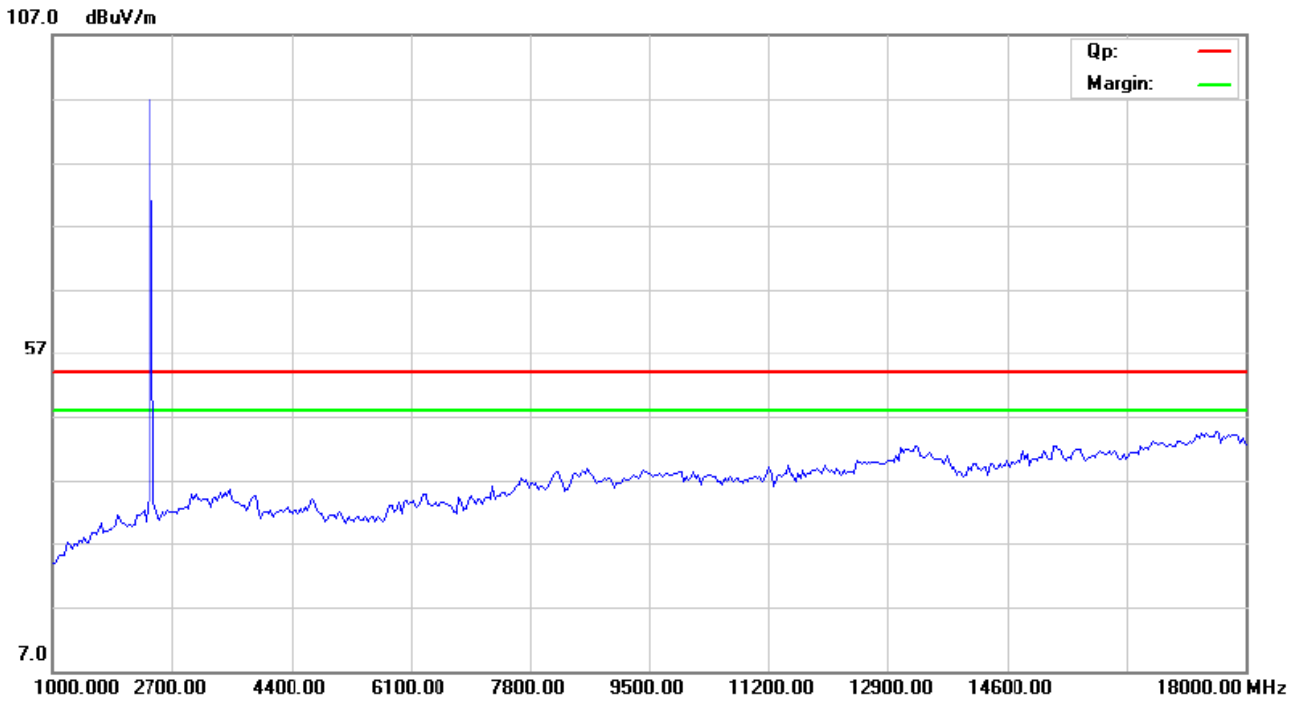
- Note: 1. Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level - Limit  
2. Remark “---” means that the emissions level is too low to be measured

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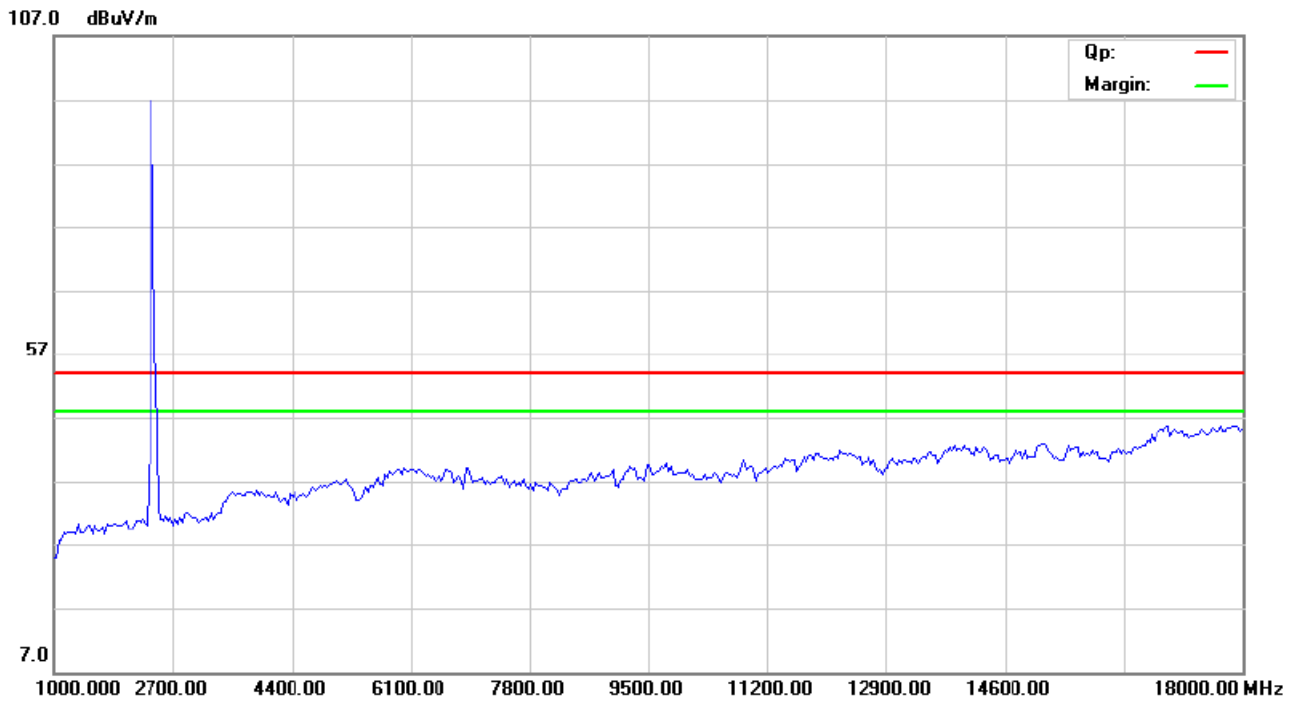


Please refer to the following test plots for details:

**Low Channel: Horizontal**



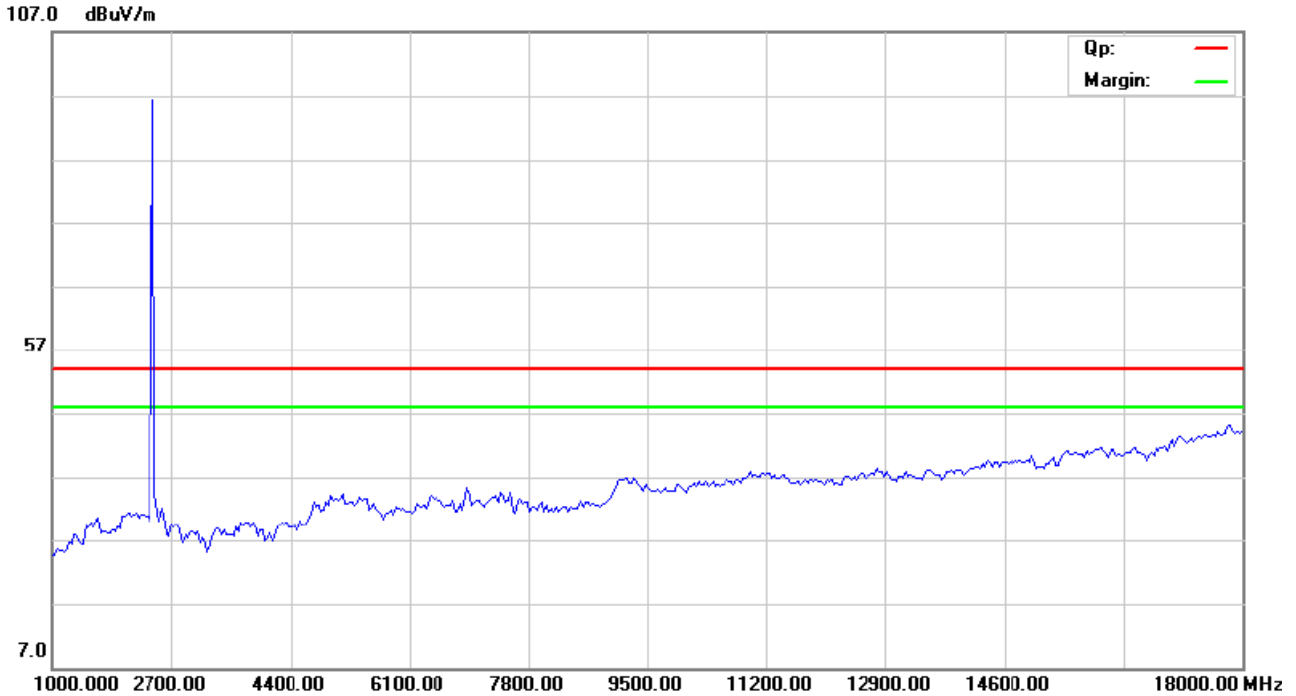
**Low Channel : Vertical**



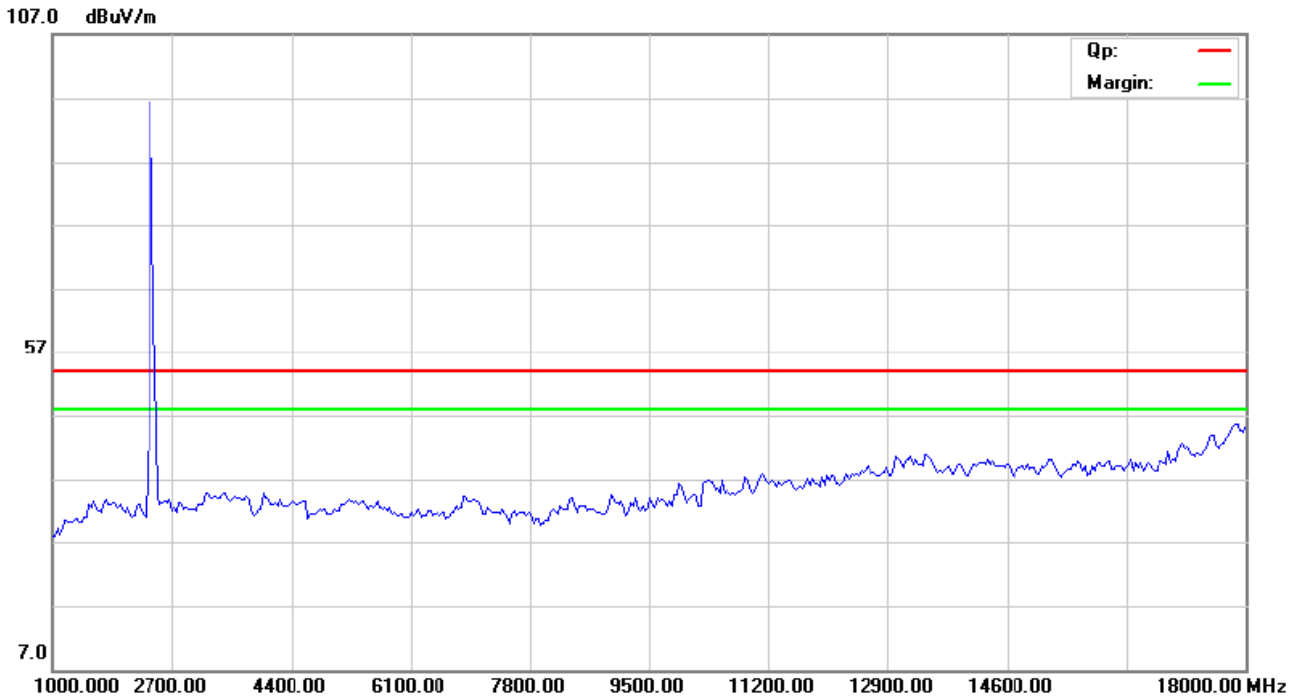
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### Middle Channel : Horizontal



### Middle Channel : Vertical



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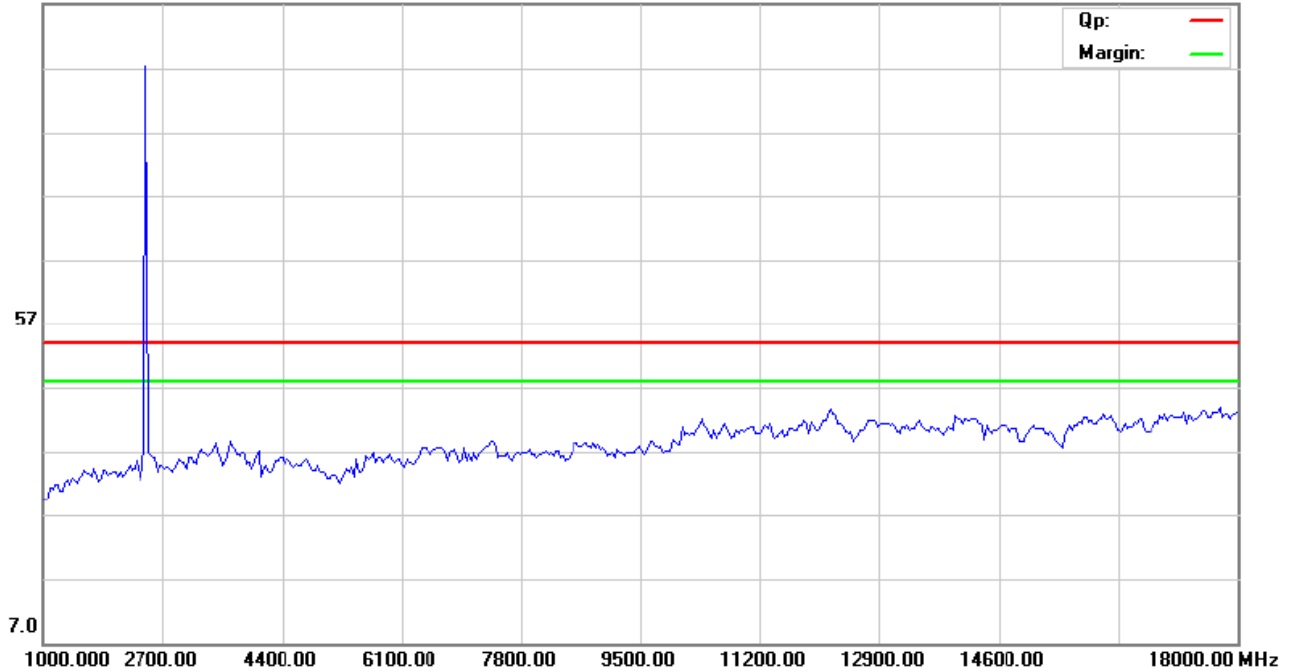
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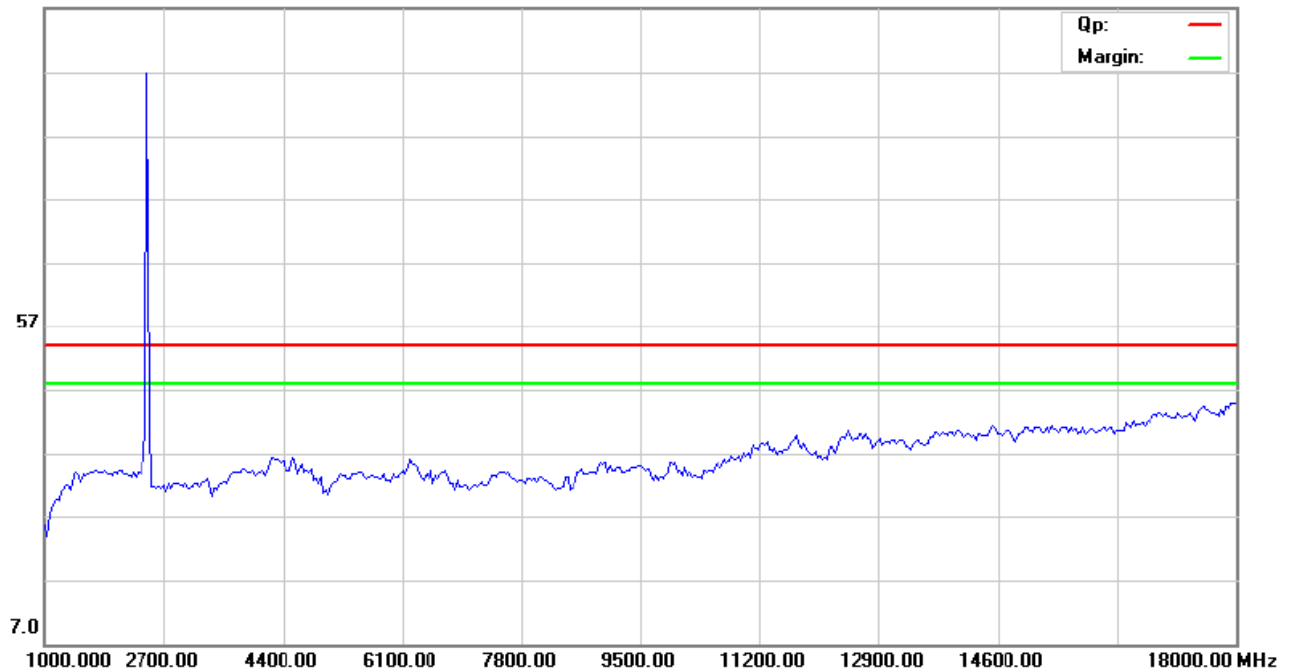
### High Channel : Horizontal

107.0 dBuV/m



### High Channel : Vertical

107.0 dBuV/m



**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	31.5' Advertising Displayer		Model	JAR321
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	1040	--	Pass
Middle	2441	1040	--	Pass
High	2480	1040	--	Pass

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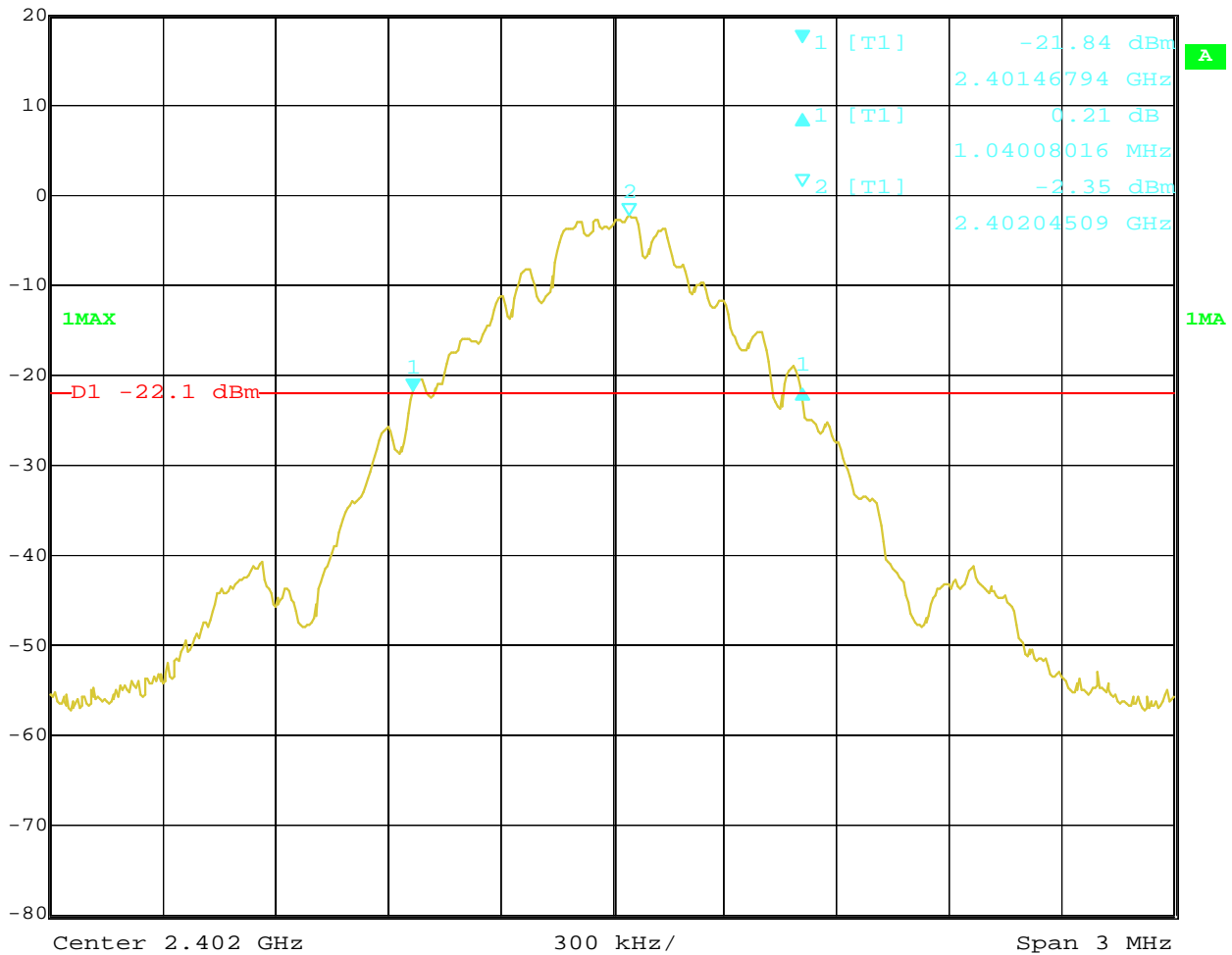
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Test Figure:

**1. Condition: Low Channel**

	Delta 1 [T1]	RBW	30 kHz	RF Att	30 dB
	Ref Lvl	0.21 dB	VBW	100 kHz	
	20 dBm	1.04008016 MHz	SWT	8.5 ms	Unit dBm



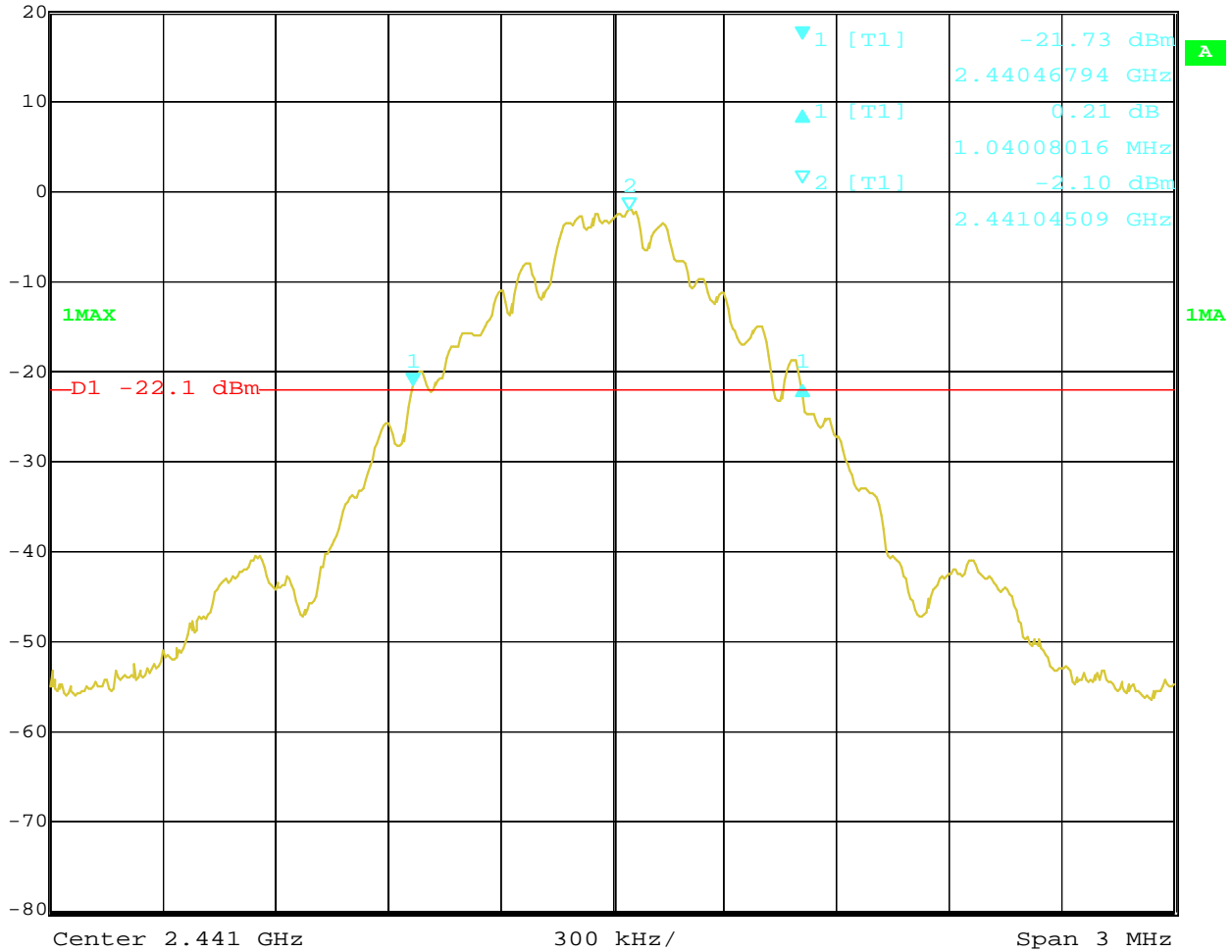
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**2. Condition: Middle Channel**



	Delta 1 [T1]	RBW	30 kHz	RF Att	30 dB
Ref Lvl	0.21 dB	VBW	100 kHz		
20 dBm	1.04008016 MHz	SWT	8.5 ms	Unit	dBm



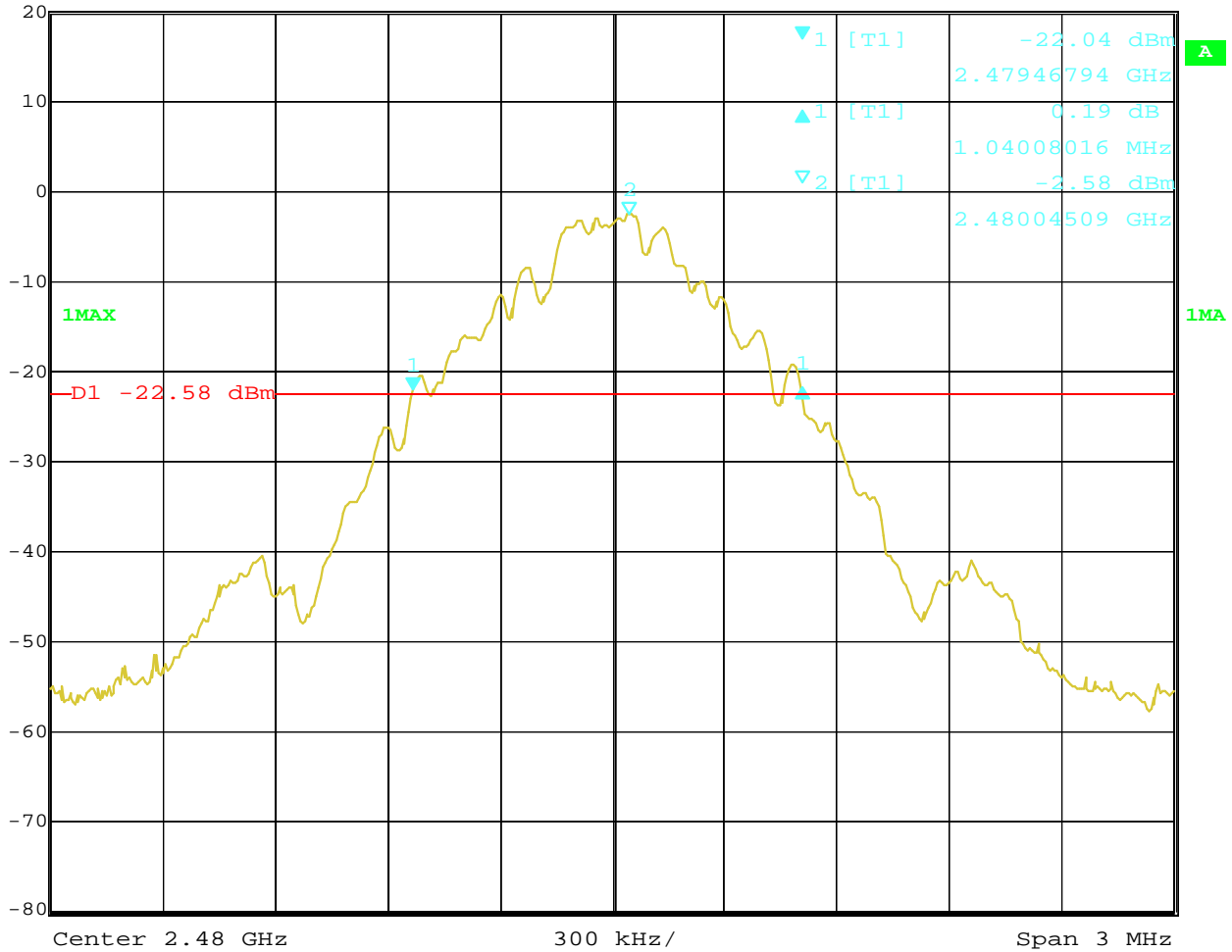
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### 3. High Channel


Delta 1 [T1]
RBW 30 kHz
RF Att 30 dB  
Ref Lvl 0.19 dB
VBW 100 kHz  
20 dBm
1.04008016 MHz
SWT 8.5 ms
Unit dBm



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**Test Result**

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

EUT	31.5' Advertising Displayer		Model	JAR321
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	1353	--	Pass
Middle	2441	1353	--	Pass
High	2480	1353	--	Pass

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

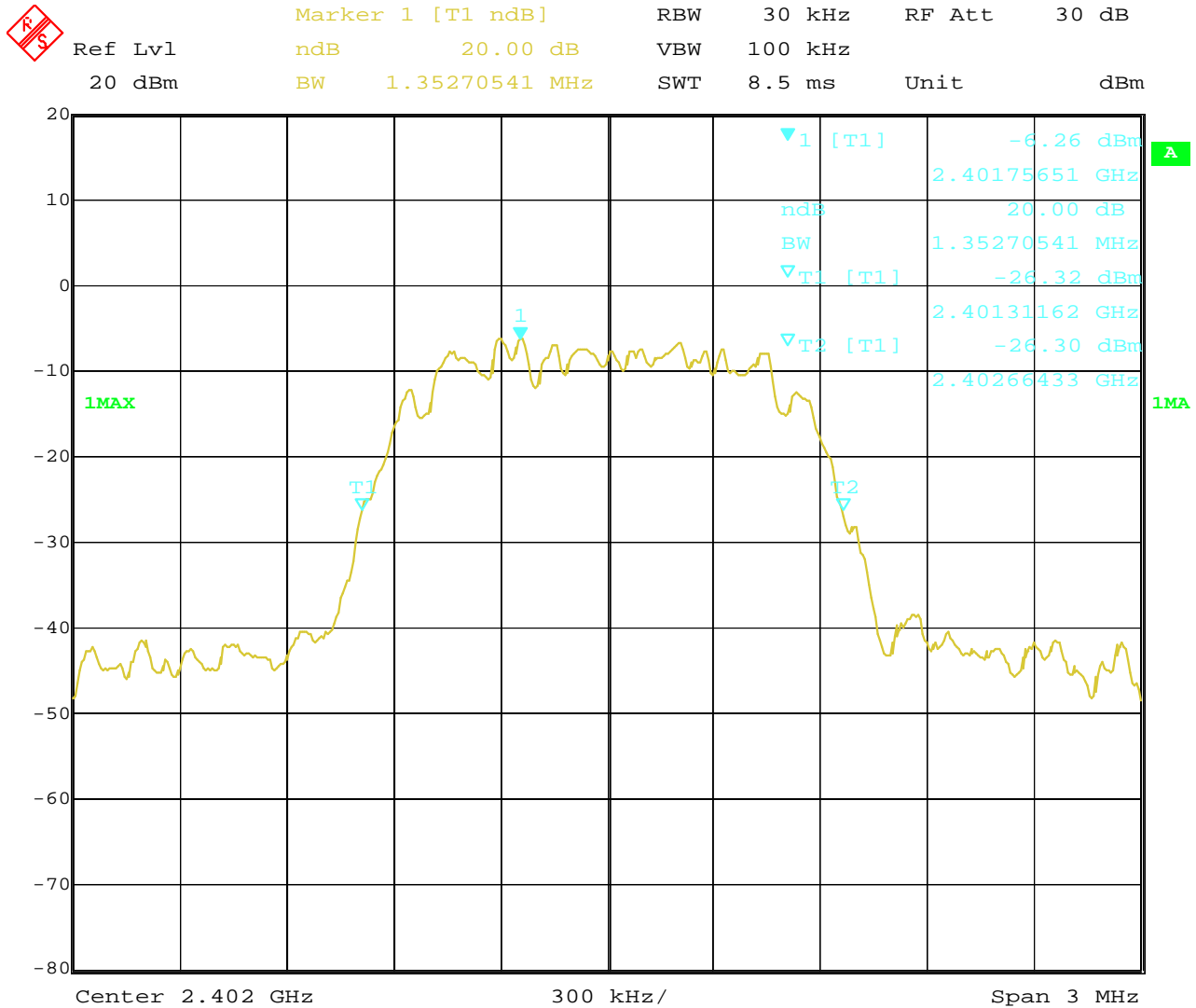
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Test Figure:

**1. Condition: Low Channel**



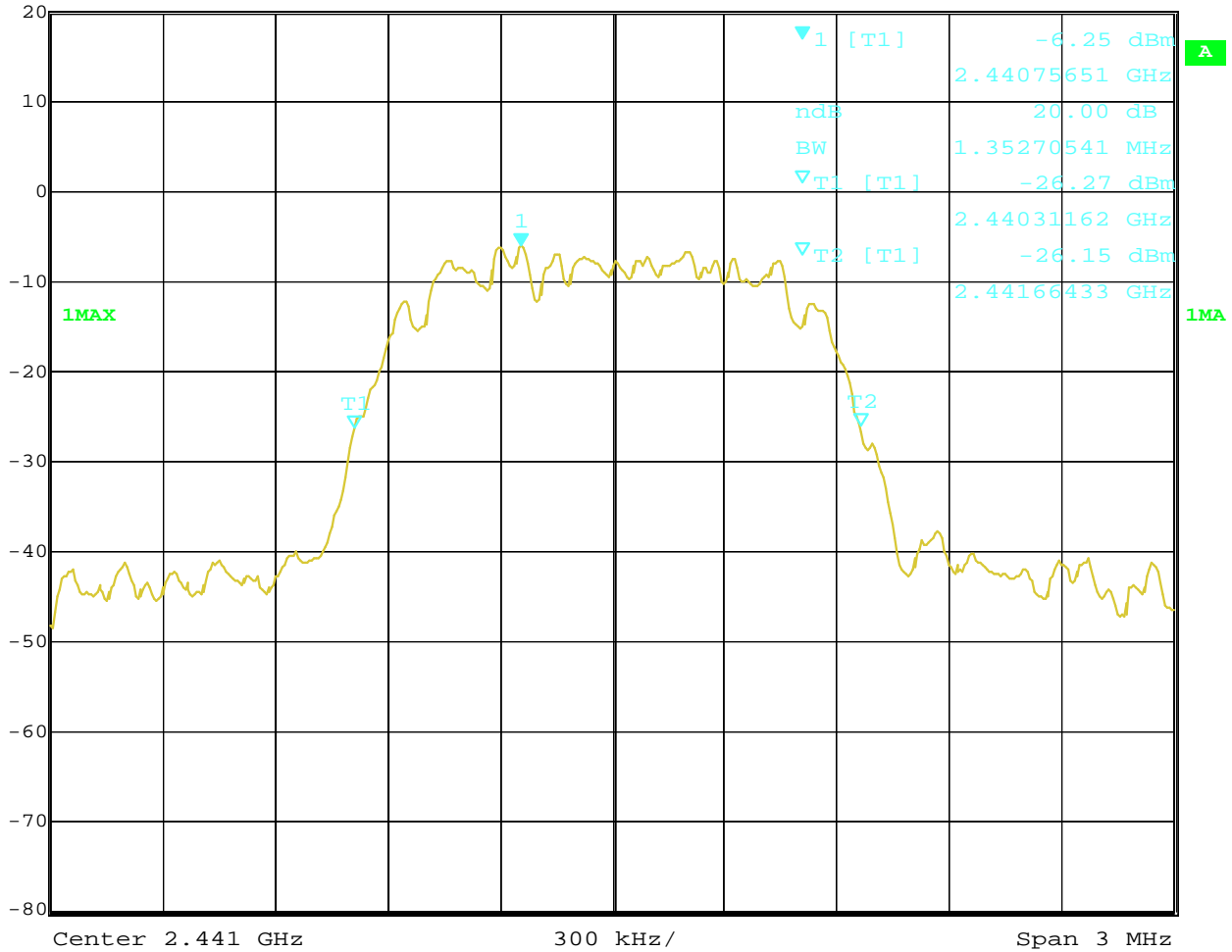
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2. Condition: Middle Channel



Ref Lvl	20 dBm	Marker 1 [T1 ndB]	20.00 dB	RBW	30 kHz	RF Att	30 dB
		BW	1.35270541 MHz	VBW	100 kHz	Unit	dBm
		SWT	8.5 ms				



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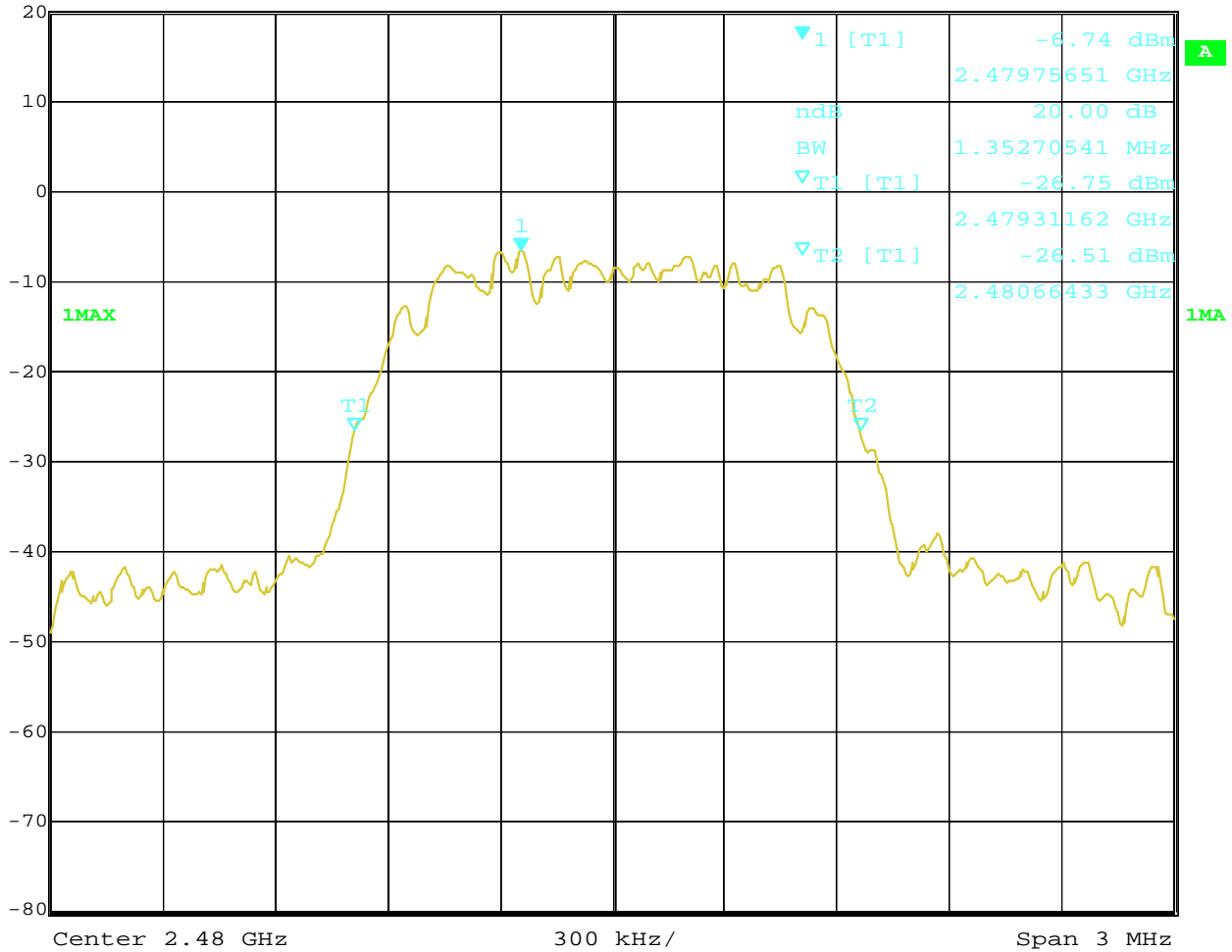
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### 3. High Channel



Ref Lvl	20 dBm	Marker 1 [T1 ndB]	ndB	20.00 dB	RBW	30 kHz	RF Att	30 dB
		BW	1.35270541 MHz		VBW	100 kHz	Unit	dBm
					SWT	8.5 ms		



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**Test Result**

**Type of Modulation: 8DPSK**

EUT	31.5' Advertising Displayer		Model	JAR321
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	1383	--	Pass
Middle	2441	1383	--	Pass
High	2480	1383	--	Pass

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

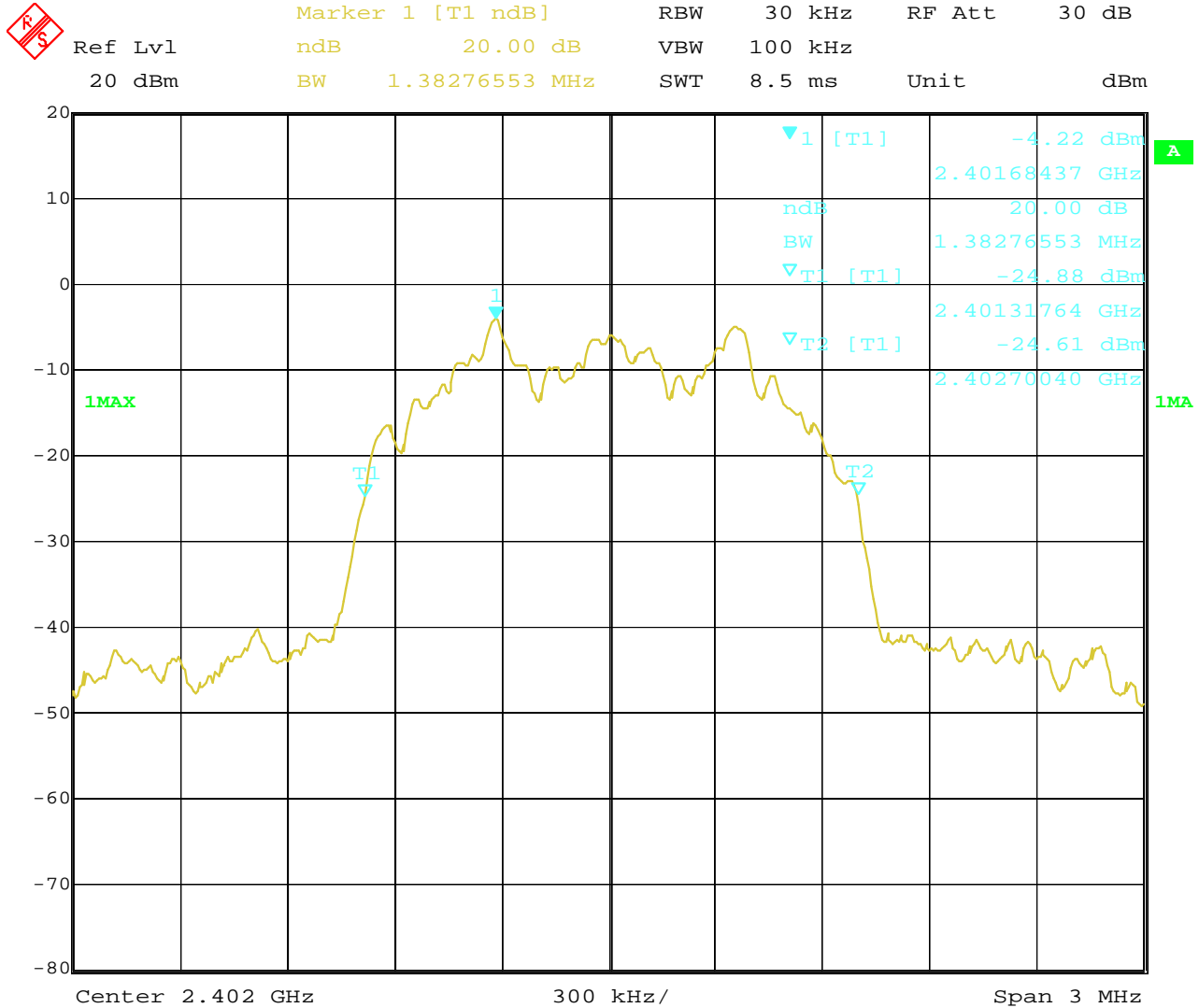
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Test Figure:

**1. Condition: Low Channel**



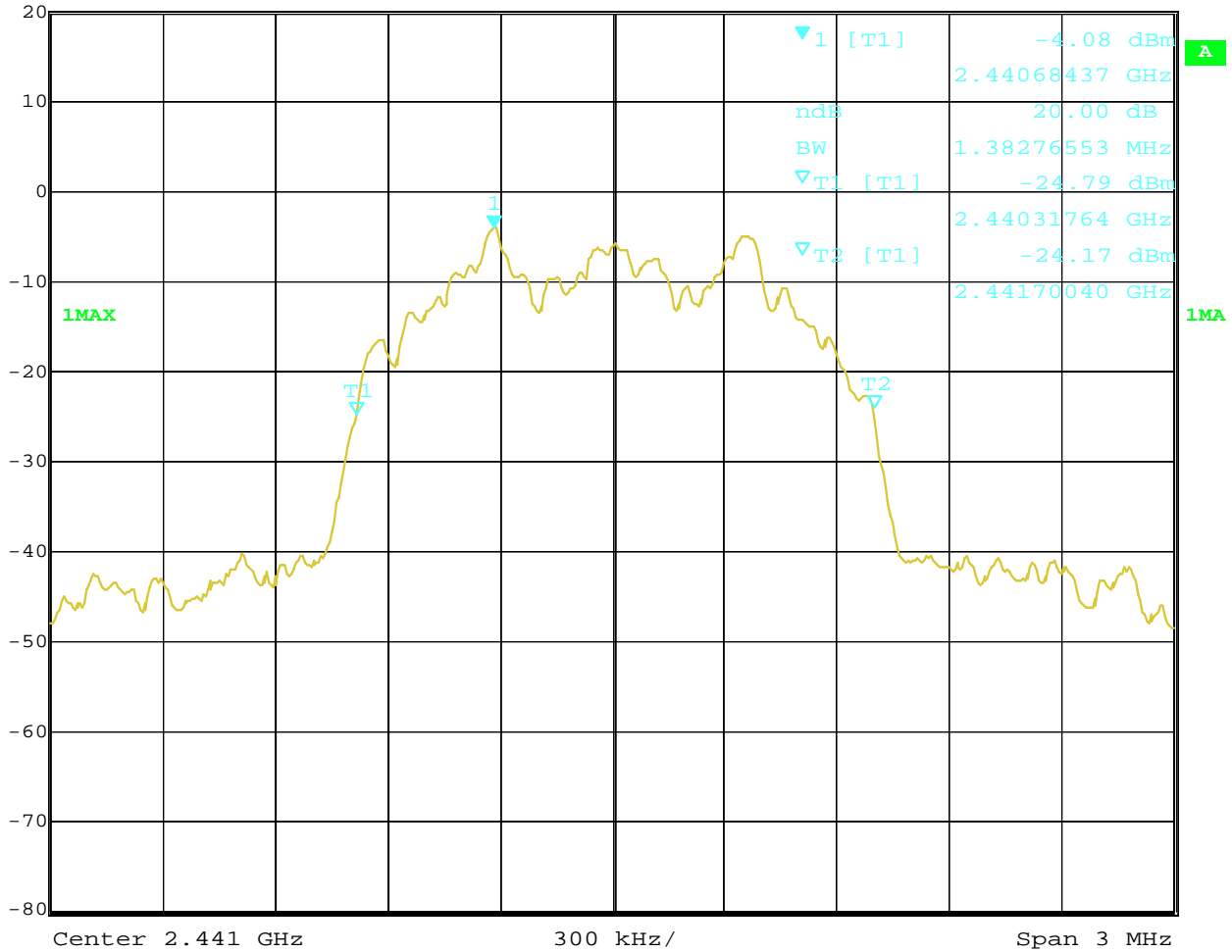
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2. Condition: Middle Channel



Ref Lvl	Marker 1 [T1 ndB]	RBW	30 kHz	RF Att	30 dB
20 dBm	ndB 20.00 dB	VBW	100 kHz		
	BW 1.38276553 MHz	SWT	8.5 ms	Unit	dBm



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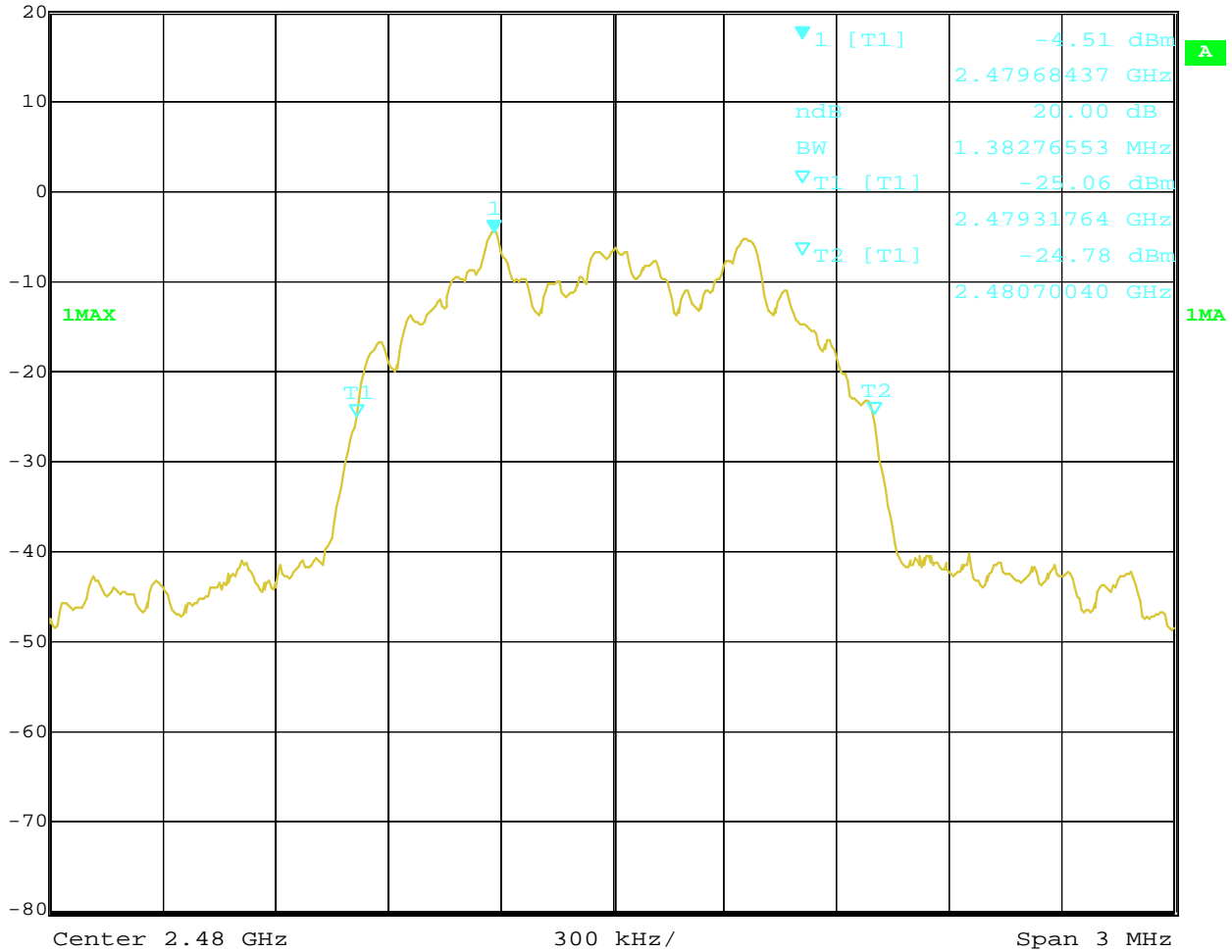




### 3. High Channel



Ref Lvl	20 dBm	Marker 1 [T1 ndB]	ndB	20.00 dB	RBW	30 kHz	RF Att	30 dB
		BW	1.38276553 MHz		VBW	100 kHz	Unit	dBm
					SWT	8.5 ms		



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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.

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

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### 8.4 Test Results

#### Type of Modulation: GFSK

EUT	31.5' Advertising Displayer		Model	JAR321
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	7.20	30	Pass
Middle	2441	7.56	30	Pass
High	2480	7.28	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 and Average power was measured

#### Type of Modulation: 16QAM

EUT	31.5' Advertising Displayer		Model	JAR321
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	6.52	30	Pass
Middle	2441	7.40	30	Pass
High	2480	7.27	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 and Average power was measured

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**Type of Modulation: 8DPSK**

EUT	31.5' Advertising Displayer		Model	JAR321
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	6.96	30	Pass
Middle	2441	7.82	30	Pass
High	2480	7.63	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 and Average 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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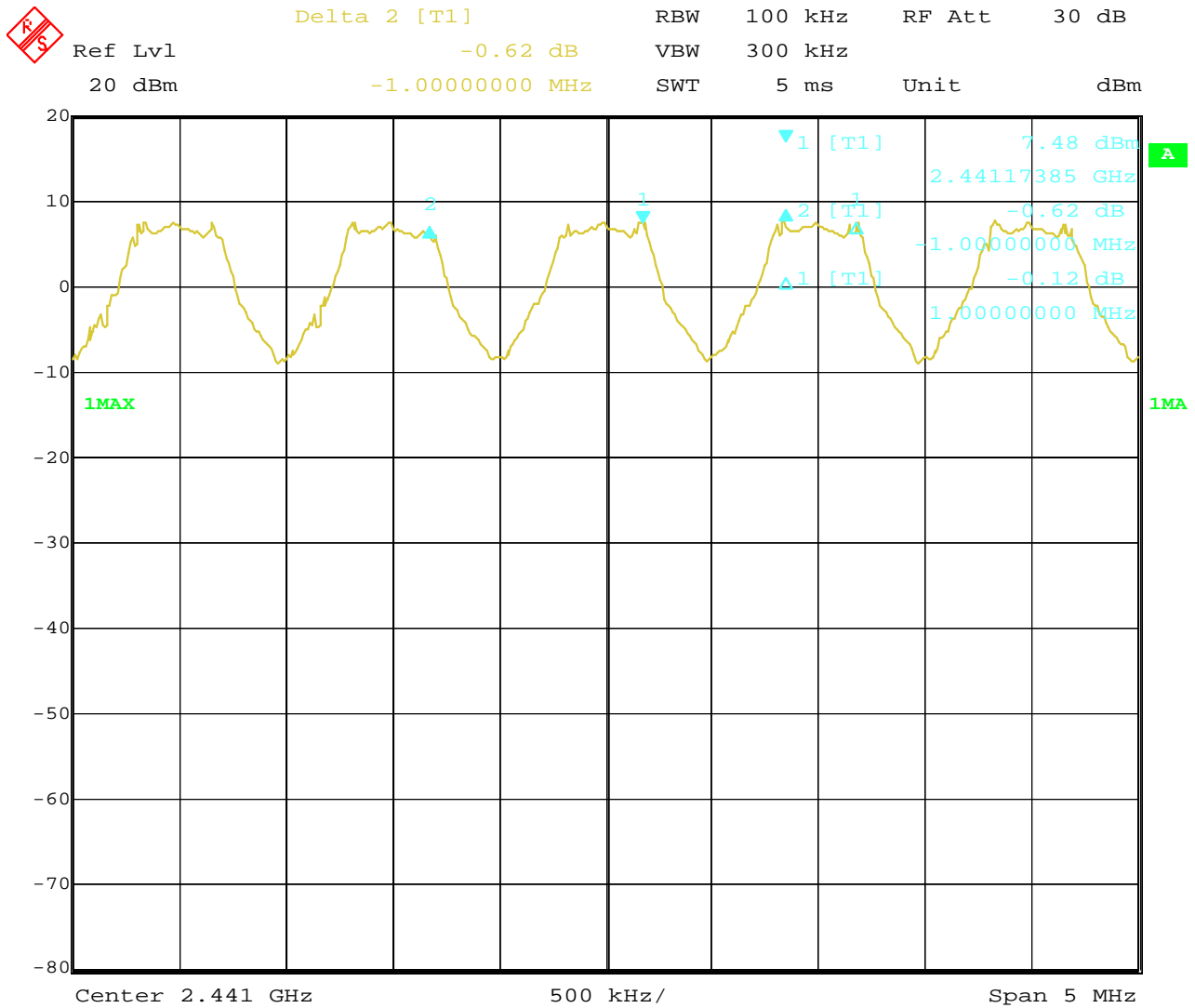


**9.4 Test Result**

**Type of Modulation: GFSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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**



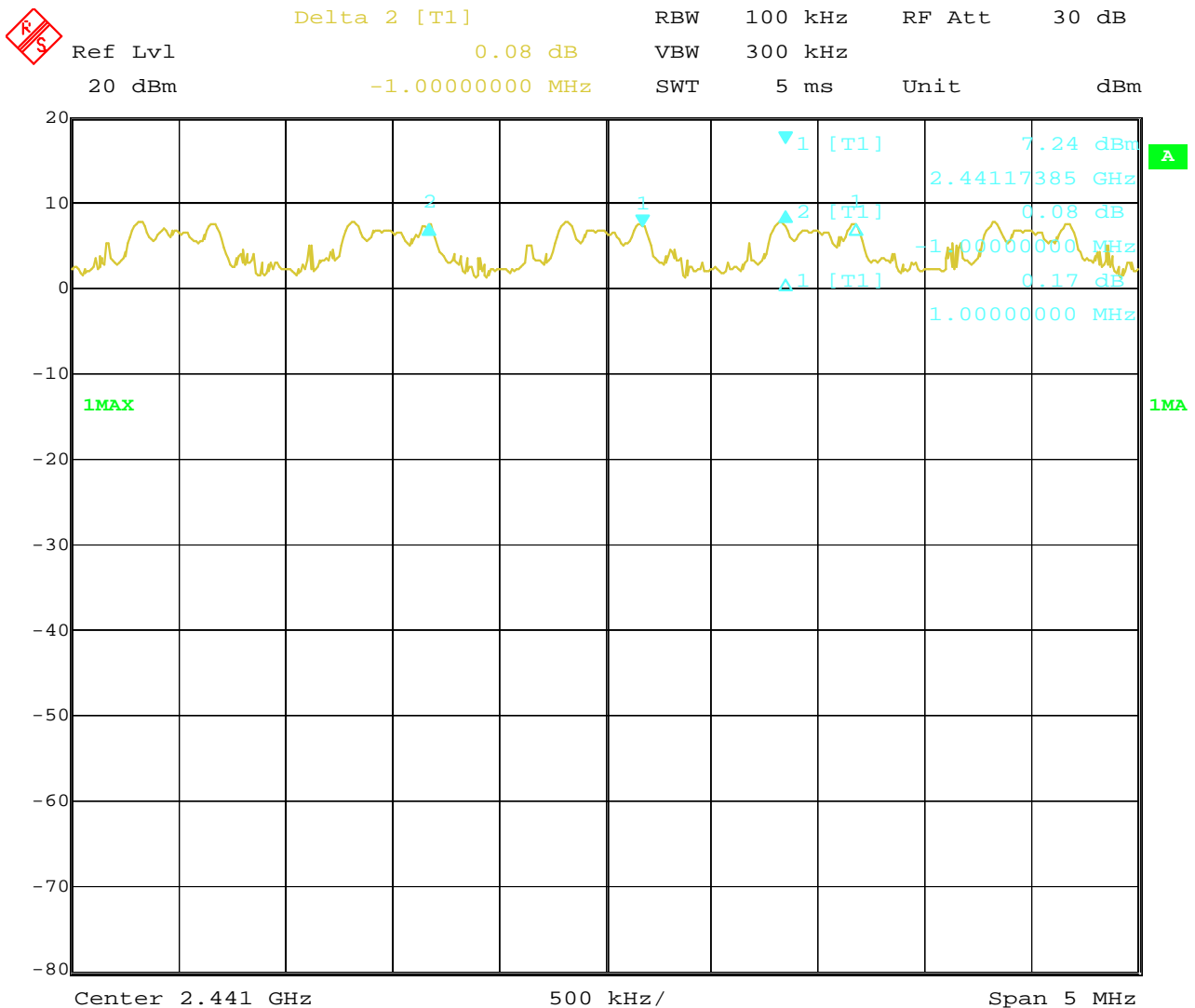
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**Type of Modulation:  $\pi/4$ DQPSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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**



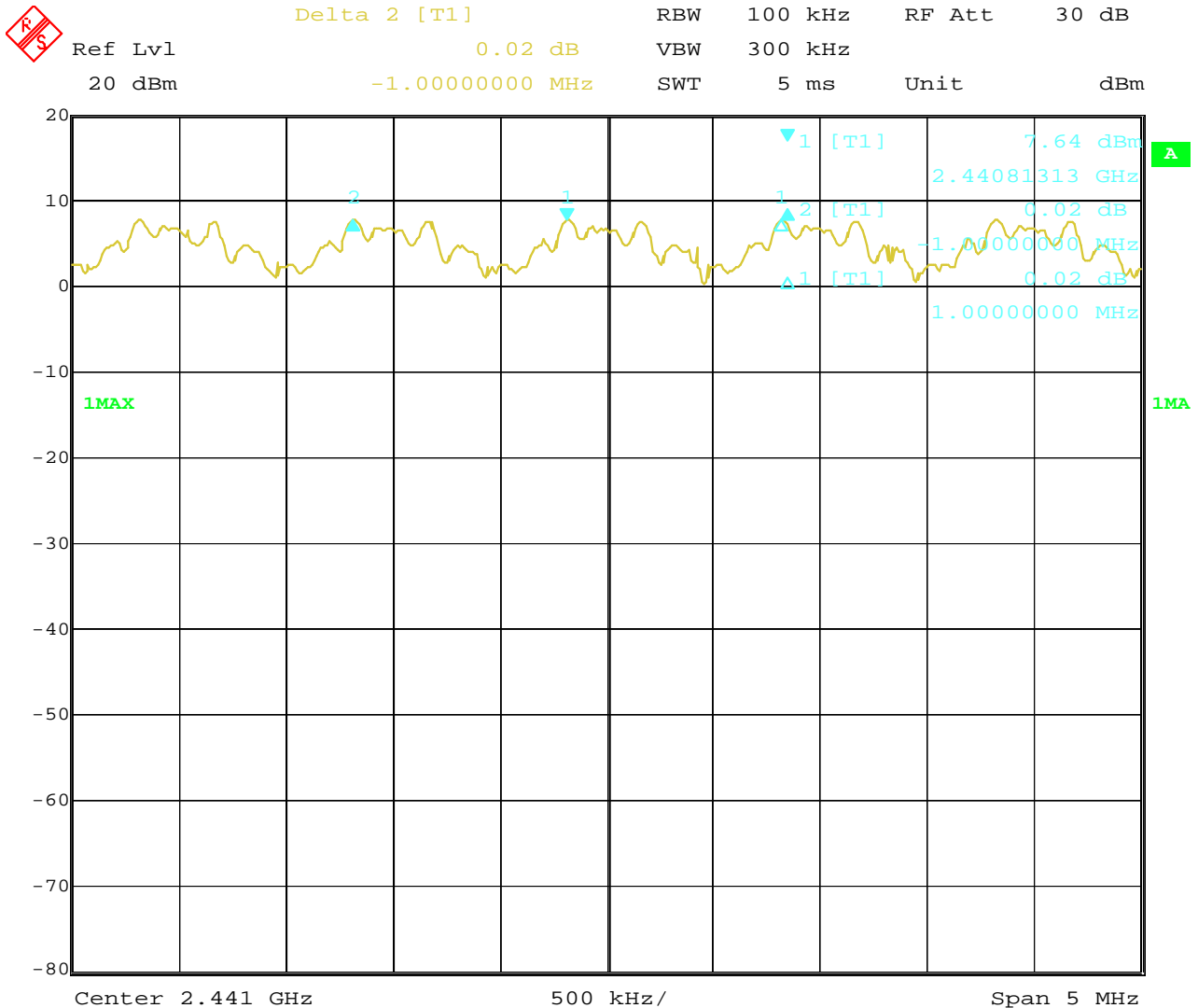
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**Type of Modulation: 8DPSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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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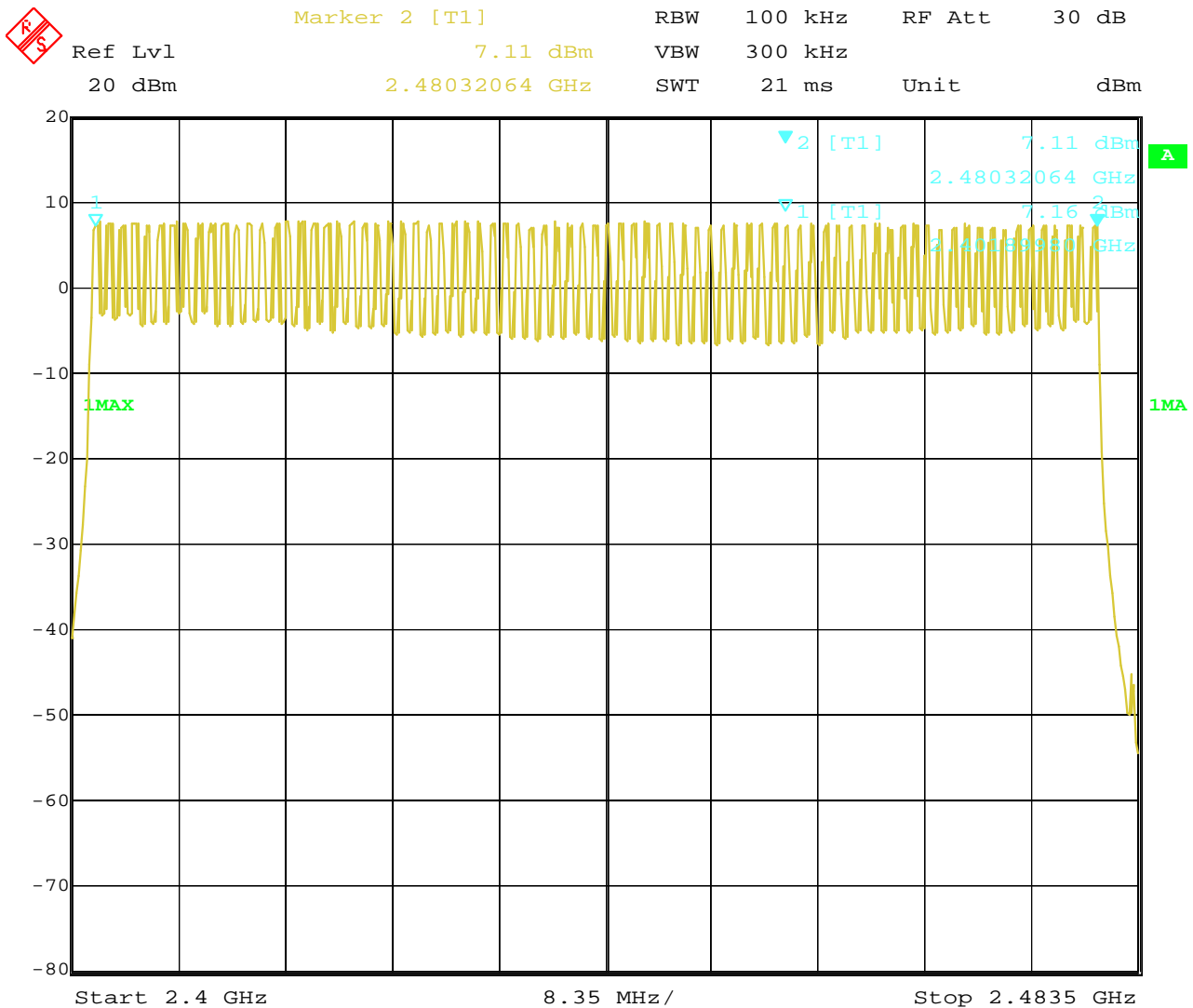


**10.4 Test Result**

**Type of Modulation: GFSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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**



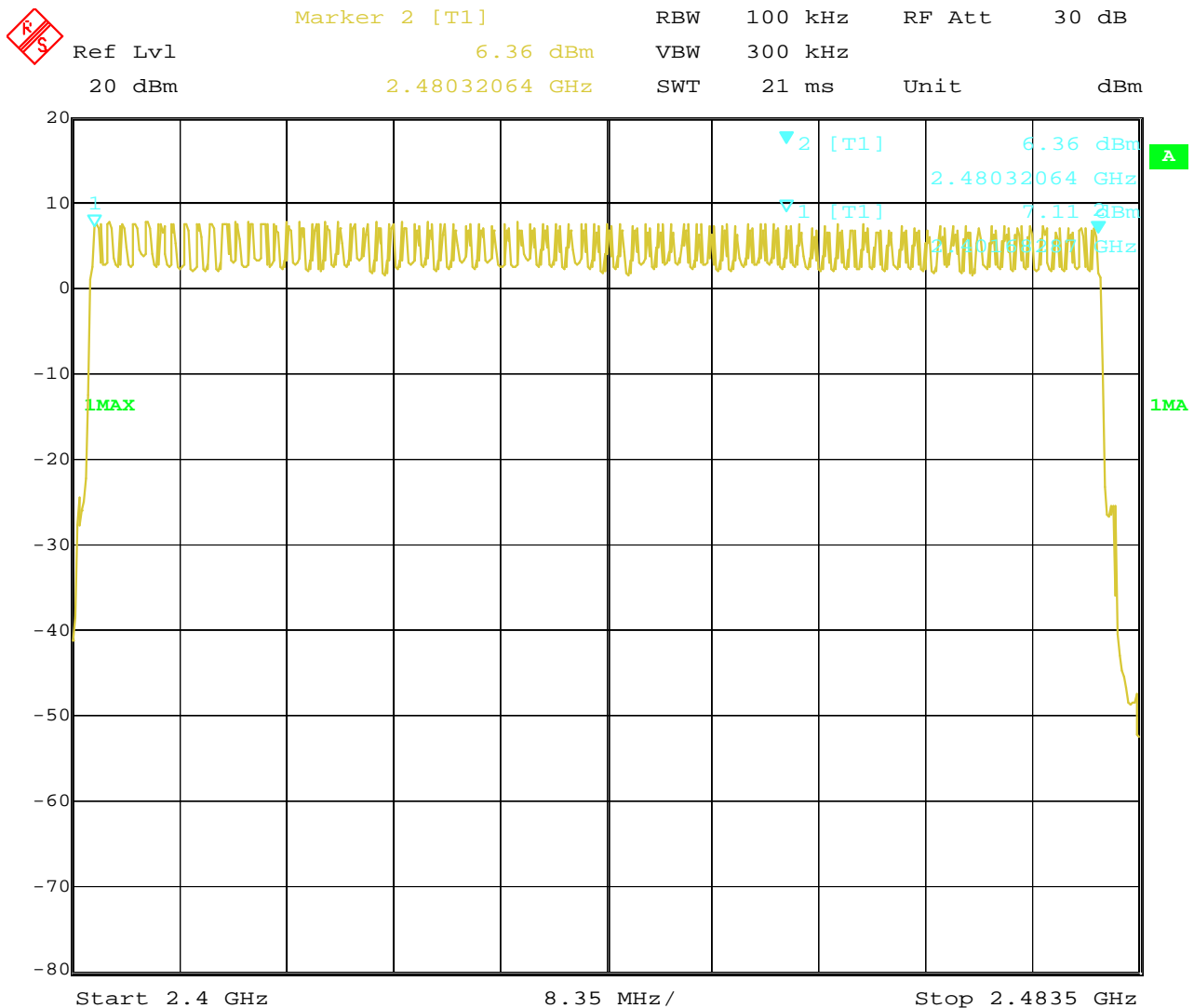
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**Type of Modulation:  $\pi/4$ DQPSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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**



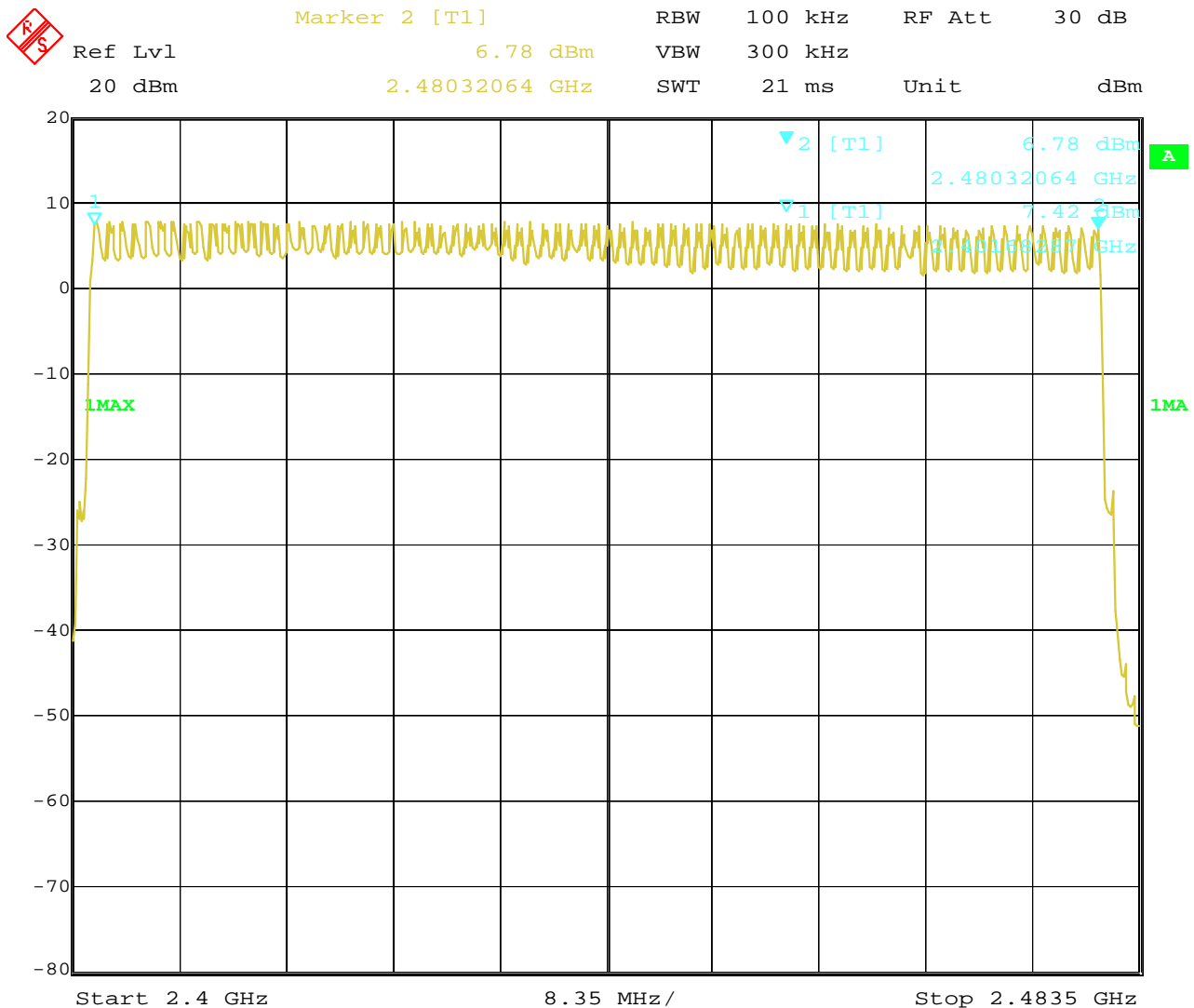
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**Type of Modulation: 8DPSK**

EUT	31.5' Advertising Displayer	Model	JAR321
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	31.5' Advertising Displayer		Model	JAR321	
Mode	Keep Transmitting		Input Voltage	120V~	
Temperature	24 deg. C,		Humidity	56% RH	
Channel	Reading	Hoping Rate		Actual	Limit
DH5					
High	2.91ms	266.667 hop/s		0.310s	0.4s
DH5					
Middle	2.93ms	266.667 hop/s		0.313s	0.4s
DH5					
Low	2.93ms	266.667 hop/s		0.313s	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.

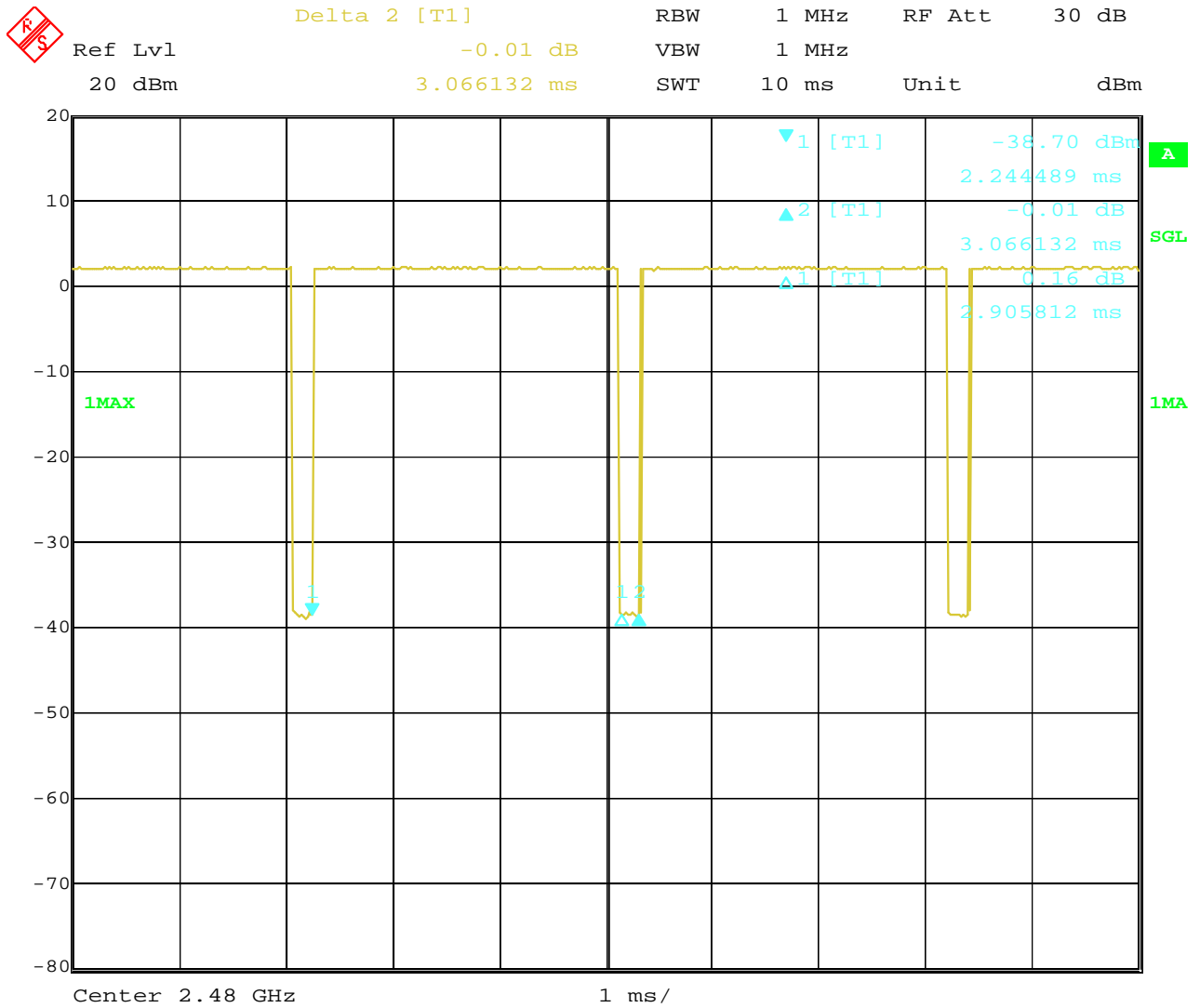
**Note: DH5 was the worst case.**

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Test Plots:

High Channel:



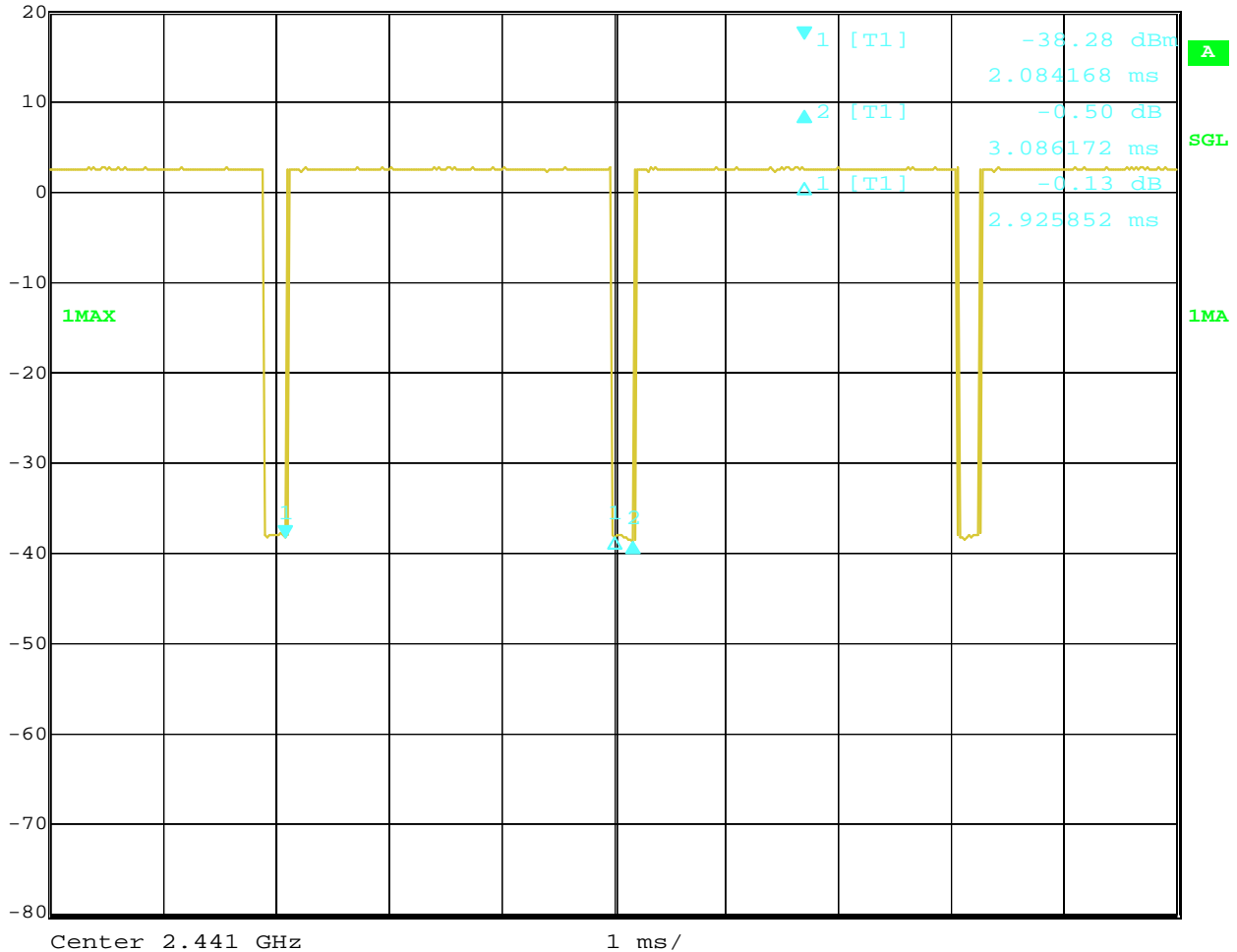
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**Middle Channel**



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	-0.50 dB	VBW	1 MHz		
20 dBm	3.086172 ms	SWT	10 ms	Unit	dBm



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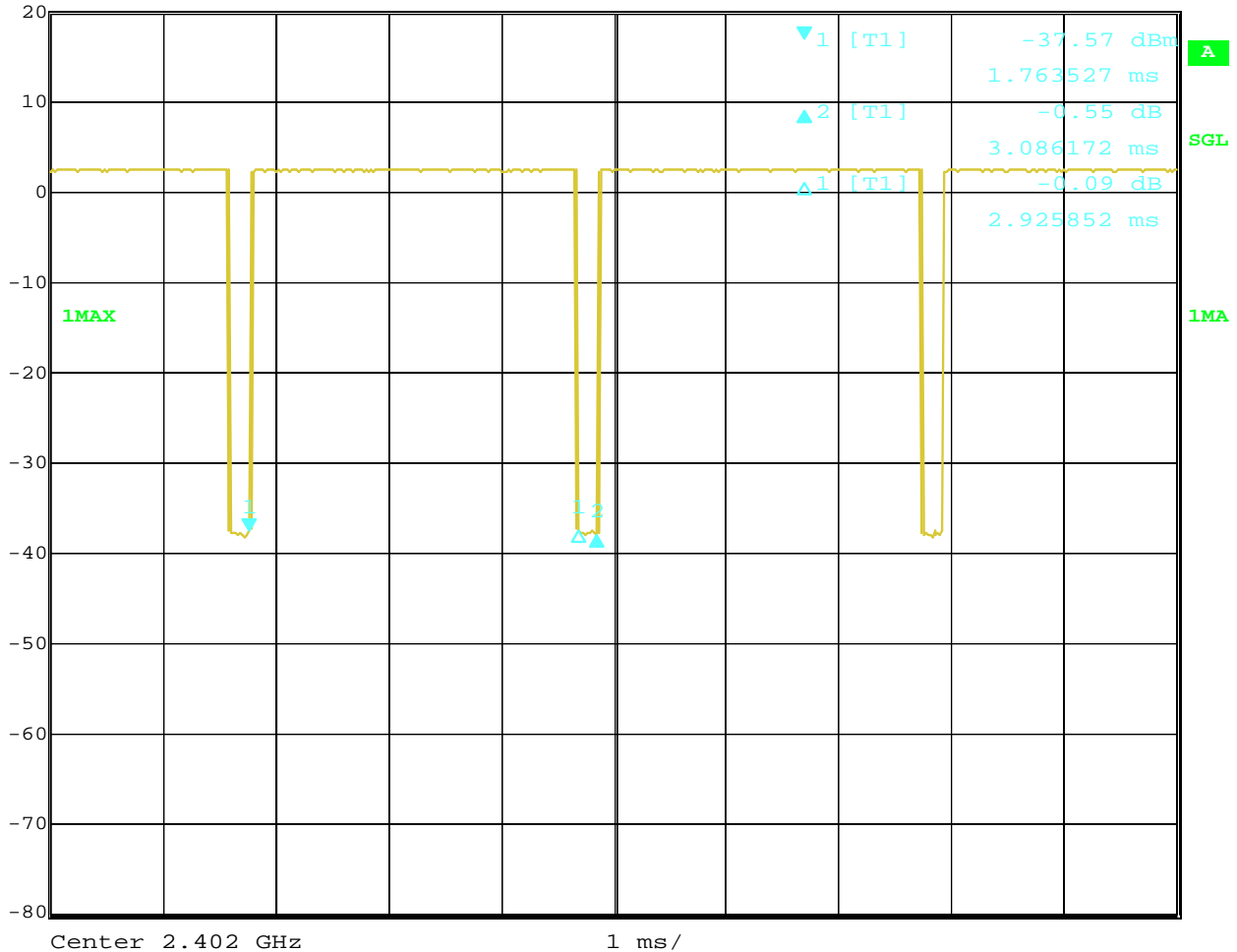




**Low Channel**



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	-0.55 dB	VBW	1 MHz		
20 dBm	3.086172 ms	SWT	10 ms	Unit	dBm



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**Test Result**

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

EUT	31.5' Advertising Displayer		Model	JAR321
Mode	Keep Transmitting		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Channel	Reading	Hopping Rate	Actual	Limit
2DH5				
High	2.95ms	266.667 hop/s	0.315s	0.4s
2DH5				
Middle	2.93ms	266.667 hop/s	0.313s	0.4s
2DH5				
Low	2.93ms	266.667 hop/s	0.313s	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: 2DH5 was the worst case.**

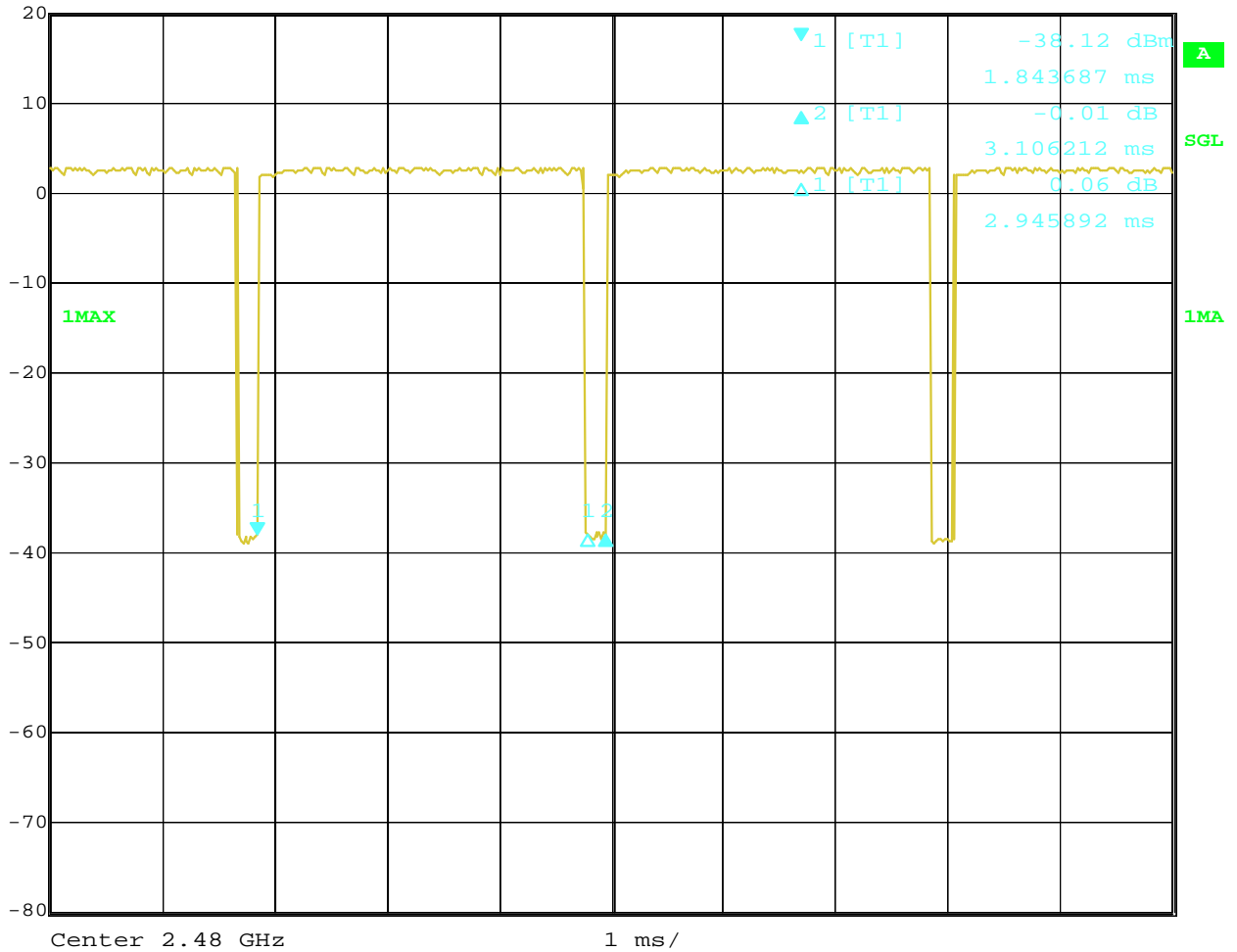
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Test Plots:

**High Channel**

	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
	Ref Lvl	-0.01 dB	VBW	1 MHz	
	20 dBm	3.106212 ms	SWT	10 ms	Unit dBm



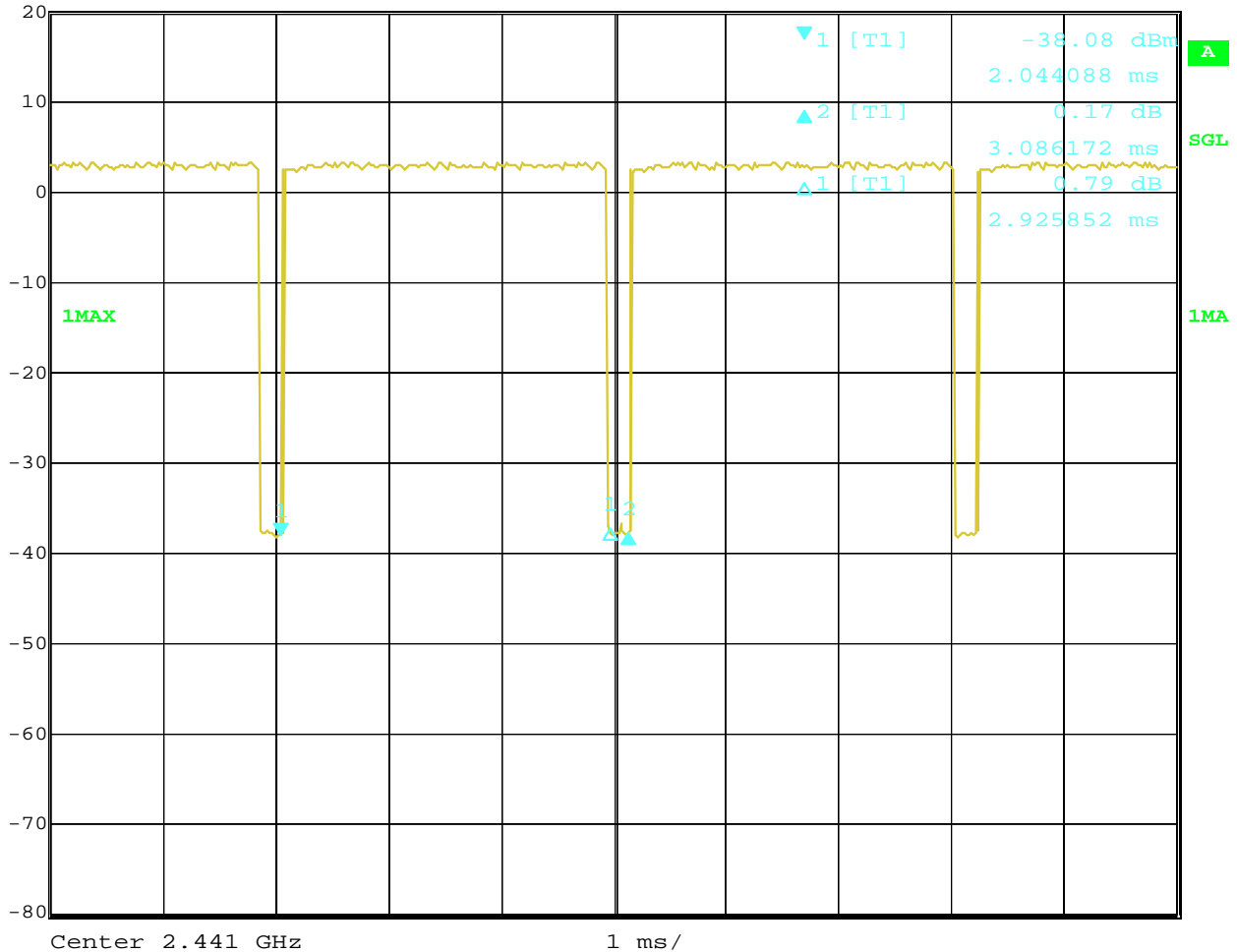
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**Middle Channel**



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	0.17 dB	VBW	1 MHz		
20 dBm	3.086172 ms	SWT	10 ms	Unit	dBm



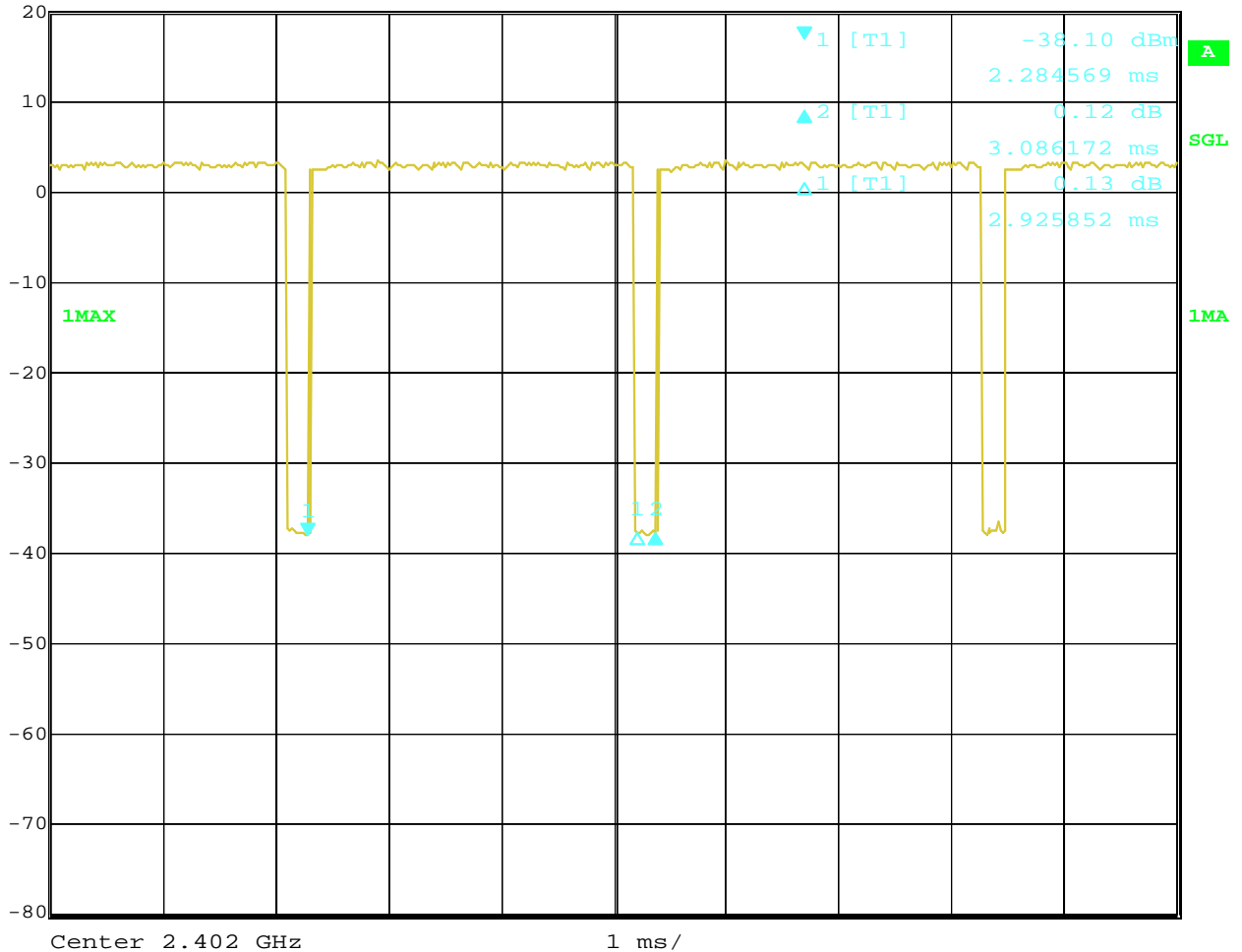
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Low Channel



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	0.12 dB	VBW	1 MHz		
20 dBm	3.086172 ms	SWT	10 ms	Unit	dBm



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**Type of Modulation: 8DPSK**

EUT	31.5' Advertising Displayer		Model	JAR321	
Mode	Keep Transmitting		Input Voltage	120V~	
Temperature	24 deg. C,		Humidity	56% RH	
Channel	Reading	Hoping Rate		Actual	Limit
3DH5					
High	2.93ms	266.667 hop/s		0.313s	0.4s
3DH5					
Middle	2.95ms	266.667 hop/s		0.315s	0.4s
3DH5					
Low	2.93ms	266.667 hop/s		0.313s	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.

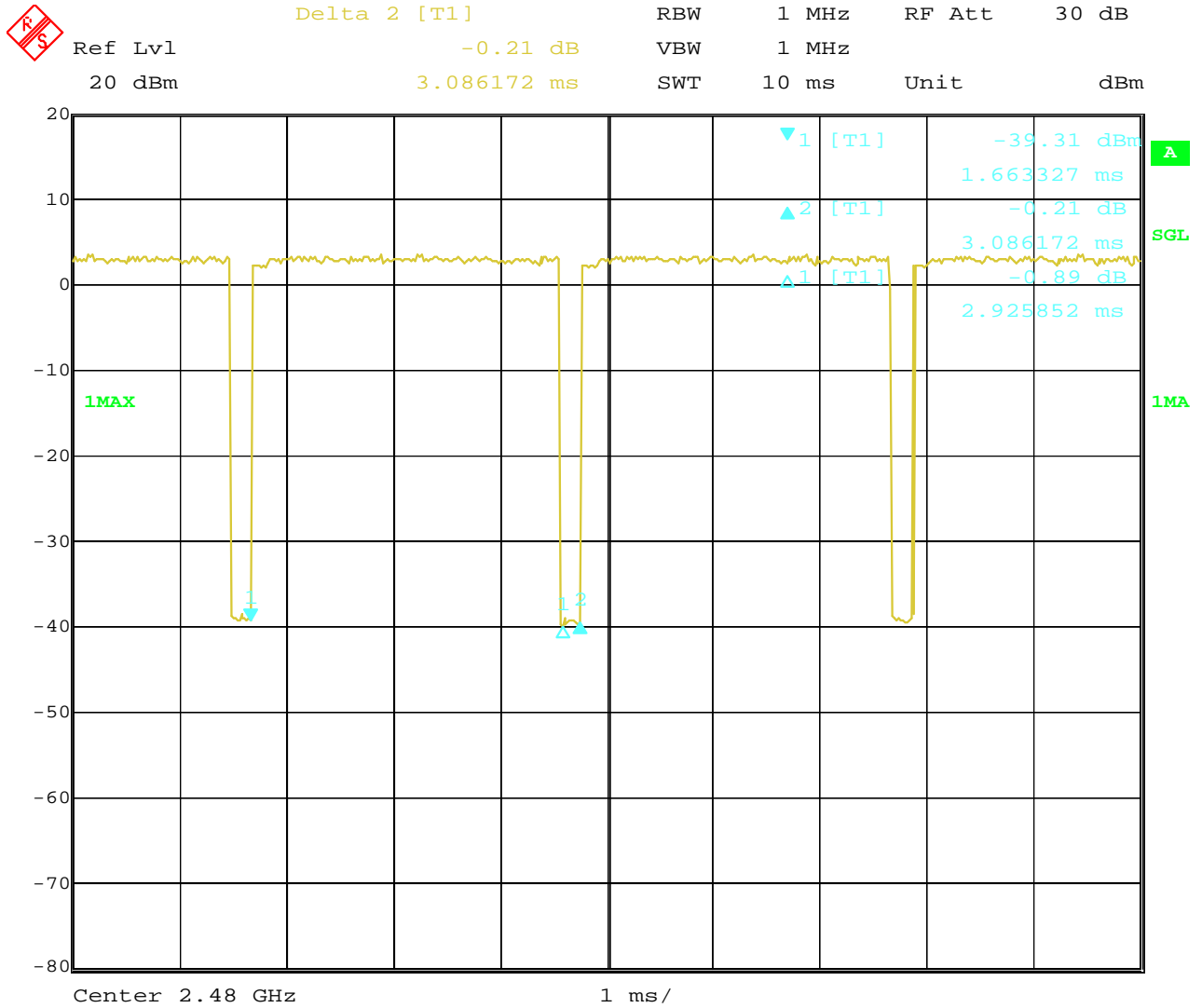
**Note: 3DH5 was the worst case.**

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Test Plots:

**High Channel**



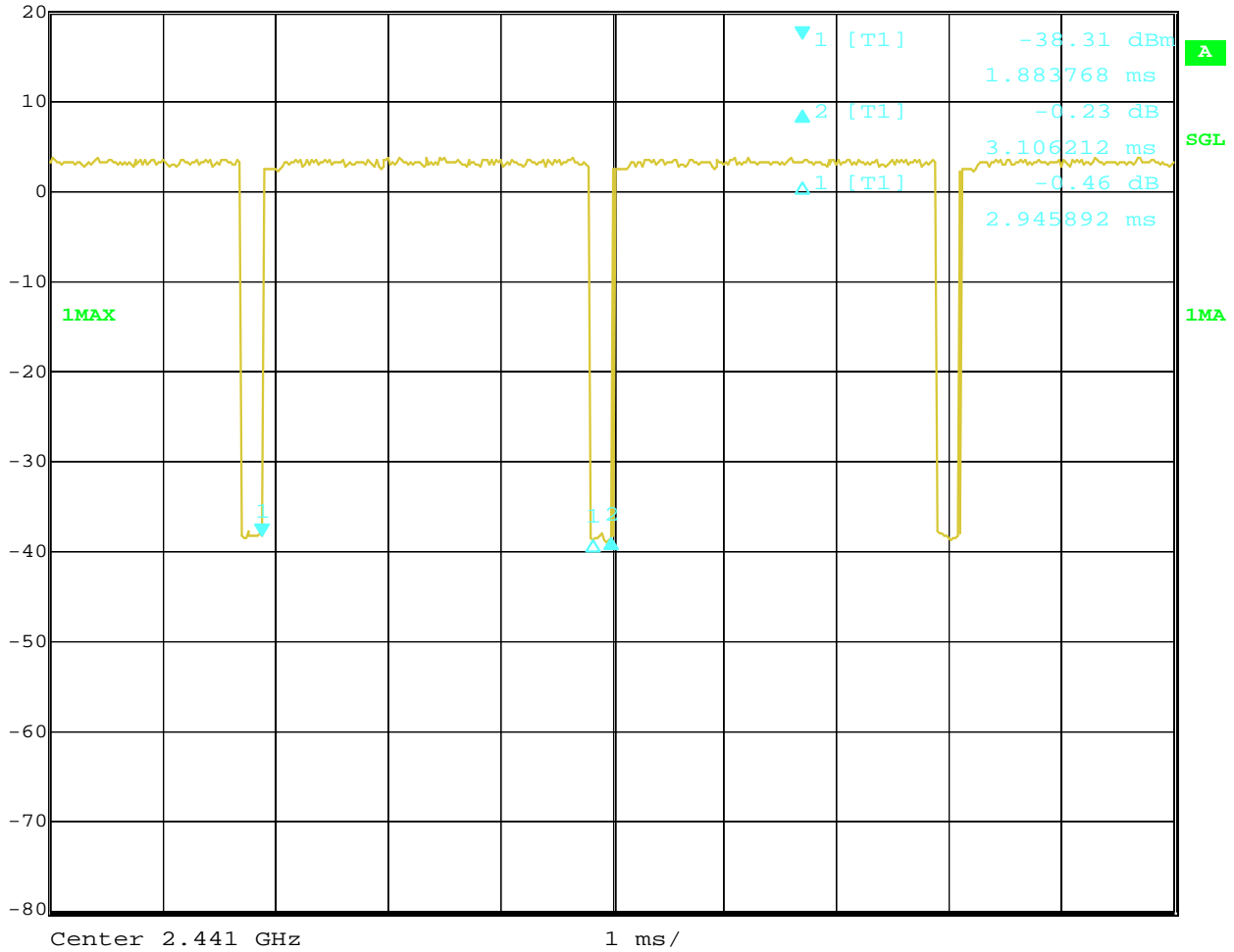
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**Middle Channel**



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	-0.23 dB	VBW	1 MHz		
20 dBm	3.106212 ms	SWT	10 ms	Unit	dBm



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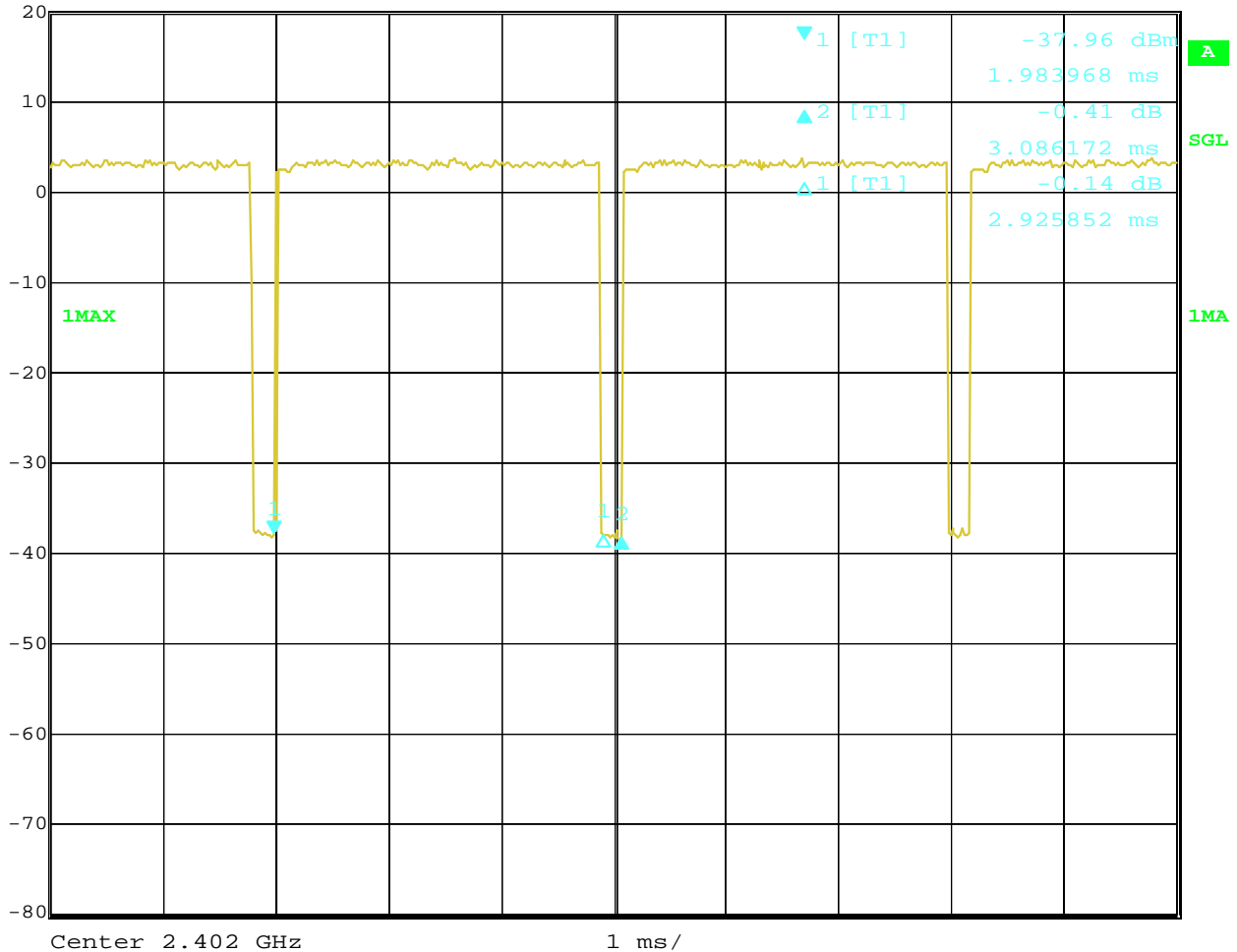




**Low Channel**



	Delta 2 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	-0.41 dB	VBW	1 MHz		
20 dBm	3.086172 ms	SWT	10 ms	Unit	dBm



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

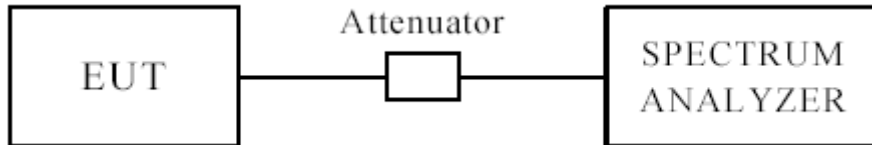
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## 12 Out of Band Measurement

### 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: This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.

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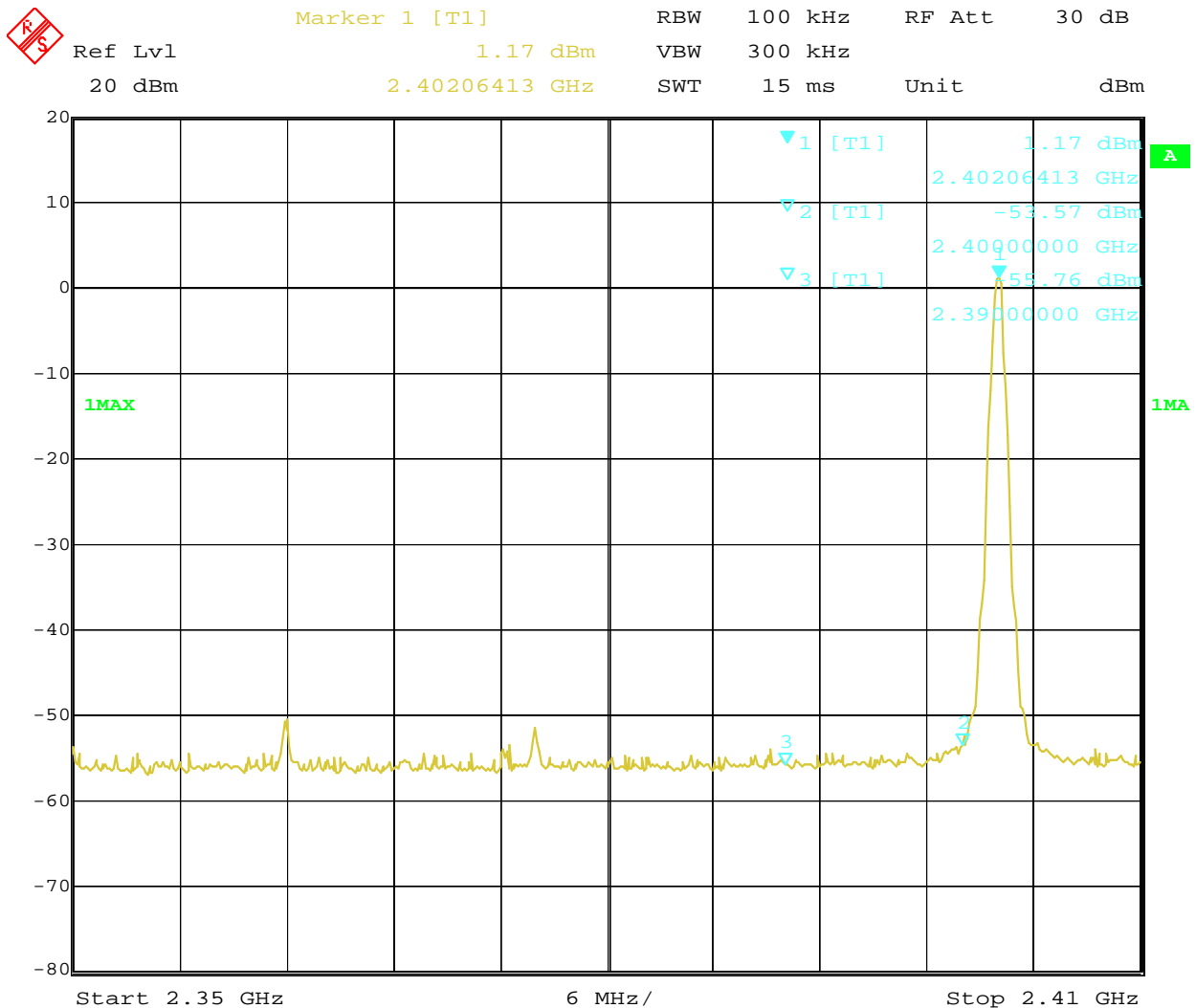


**Type of Modulation: GFSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Low Channel
Mode	Keeping Transmitting		Input Voltage	120V~
Temperature	24 deg. C		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dBμV/m)	45.6	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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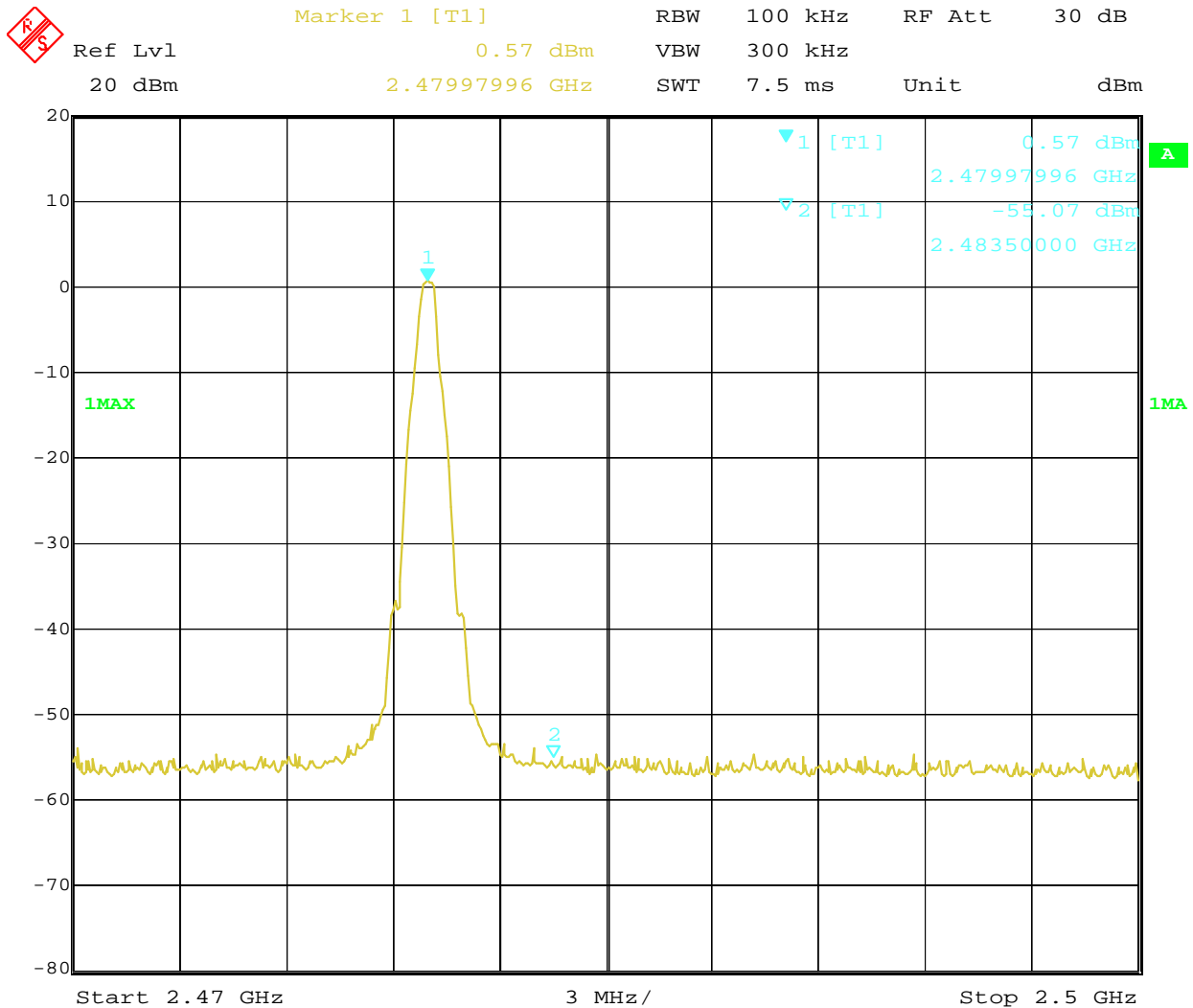


**Type of Modulation: GFSK**

**12.4 Out of Band Test Result**

Product:	31.5' 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)	41.7	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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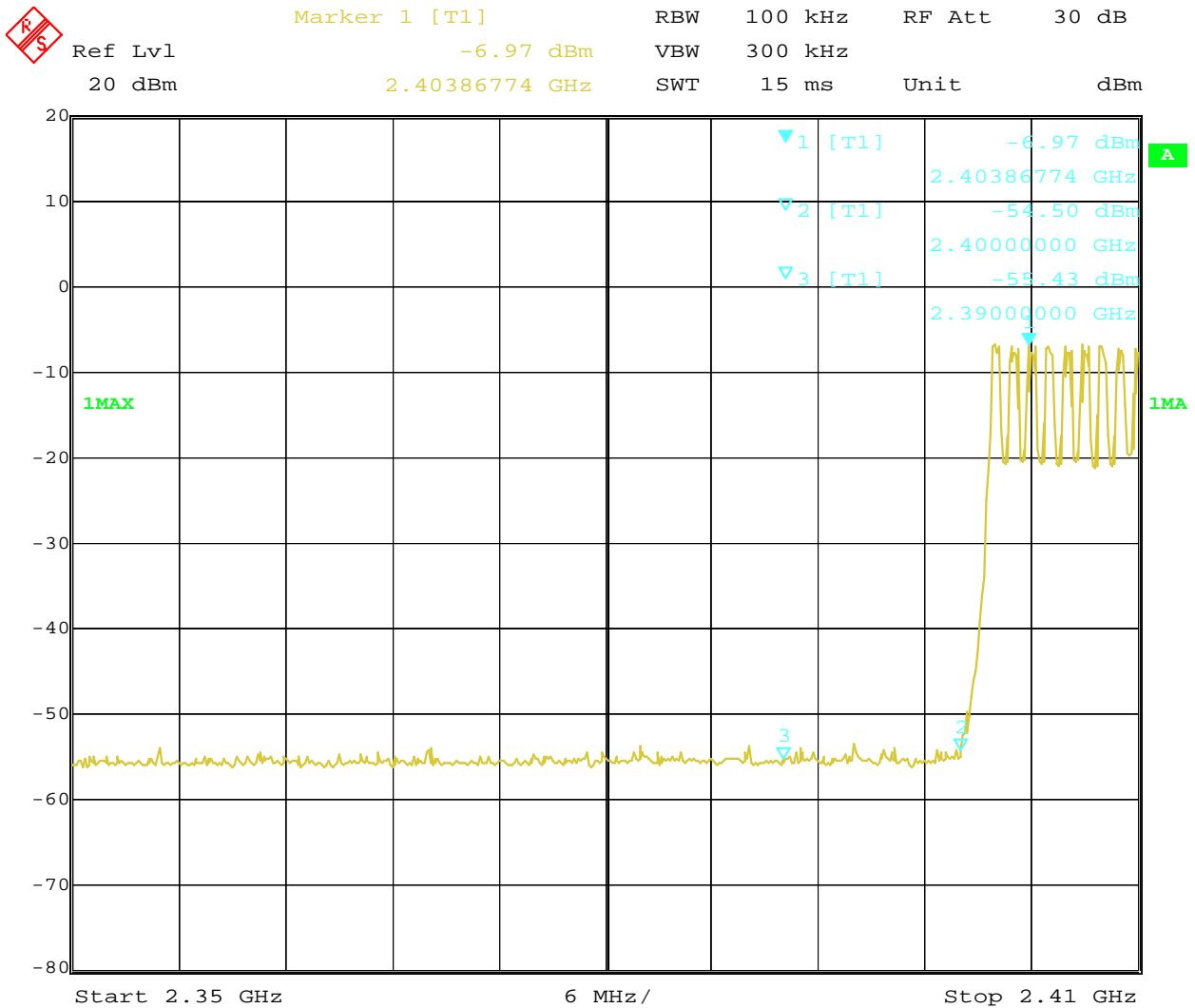


**Type of Modulation: GFSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dBμV/m)	44.3	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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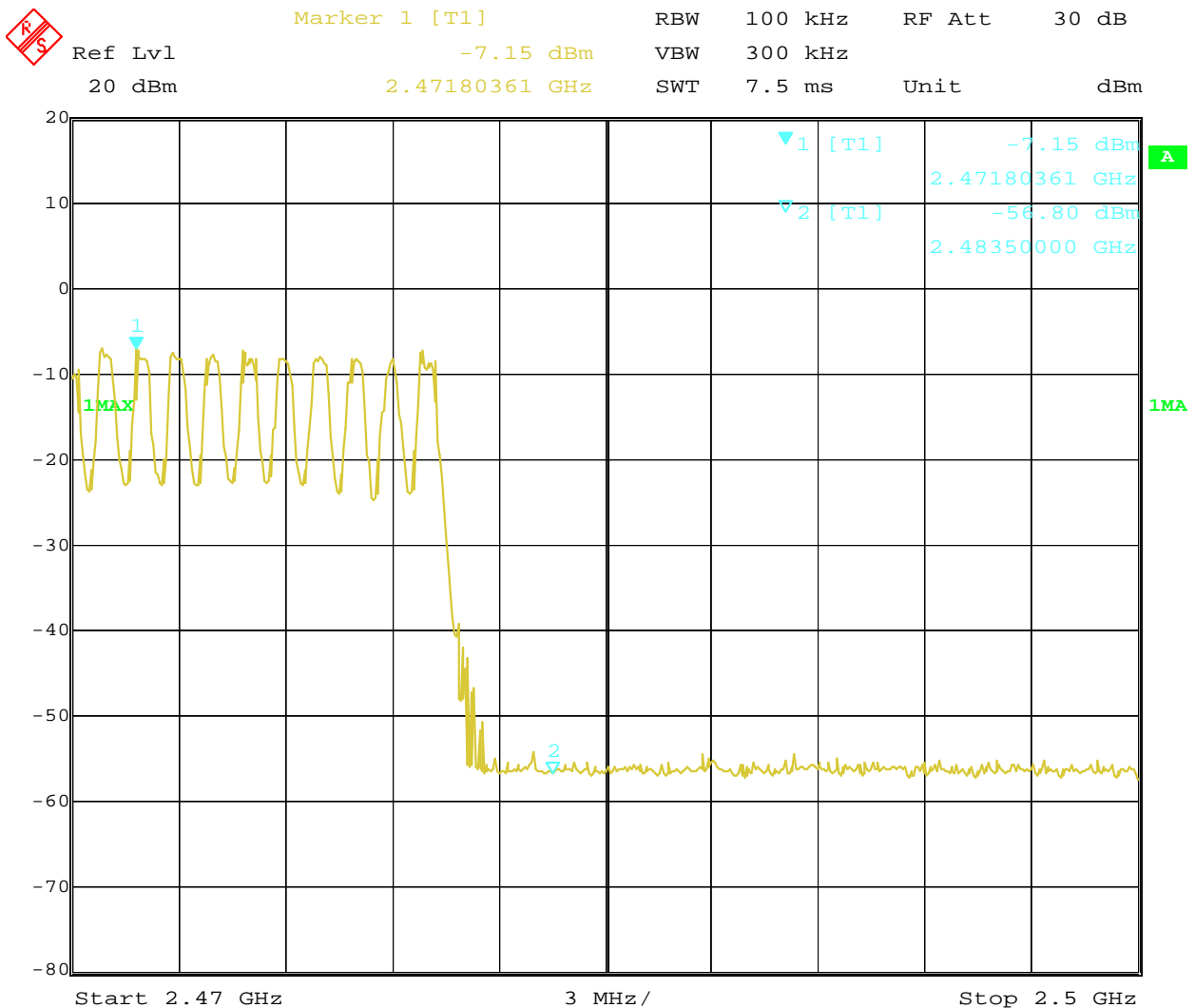


**Type of Modulation: GFSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dBμV/m)	42.1	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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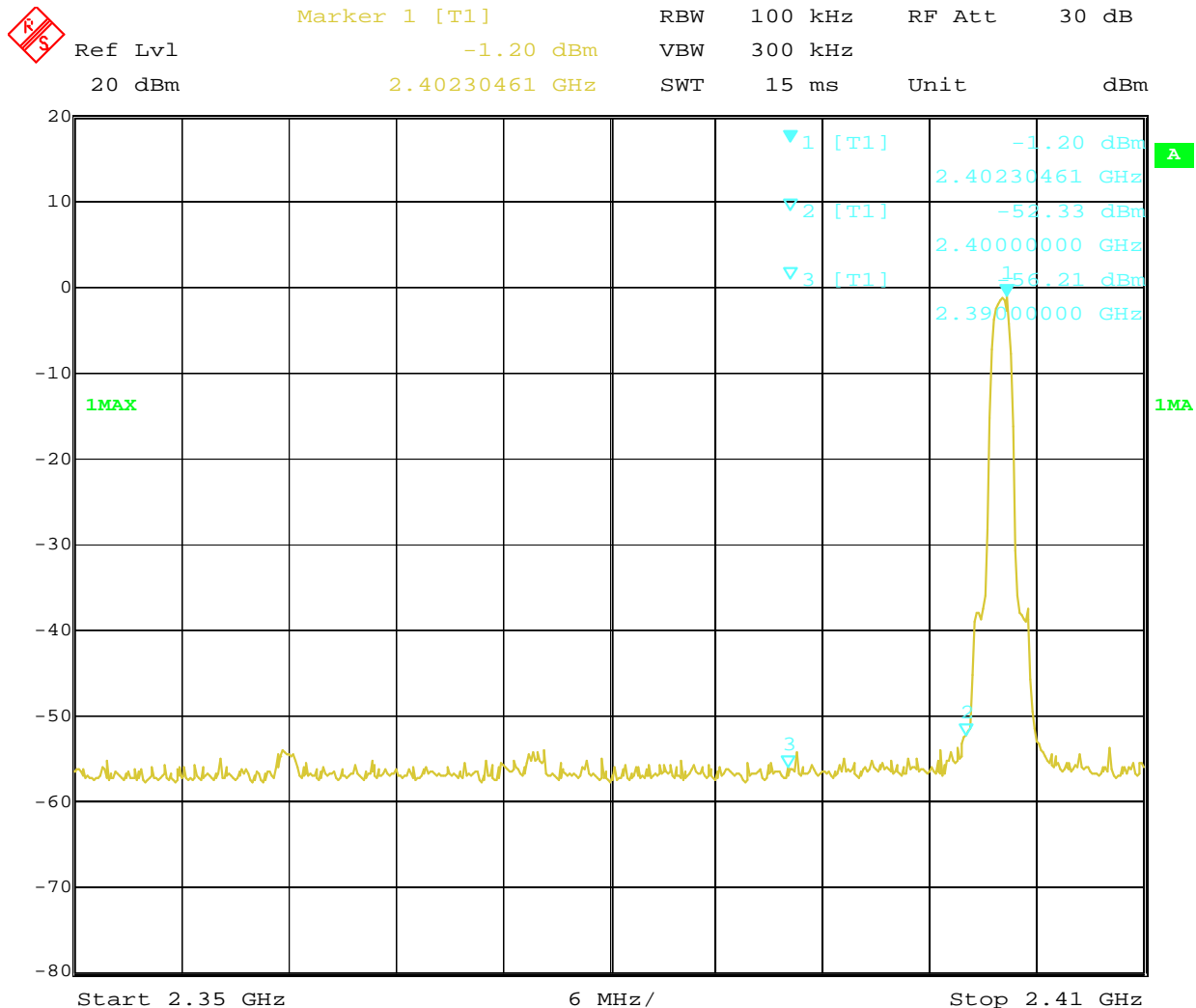


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Low Channel
Mode	Keeping Transmitting		Input Voltage	120V~
Temperature	24 deg. C		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dB $\mu$ V/m)	45.4	Limit	74(dB $\mu$ V/m)
	AV(dB $\mu$ V/m)	--		54(dB $\mu$ V/m)

**Test Figure:**



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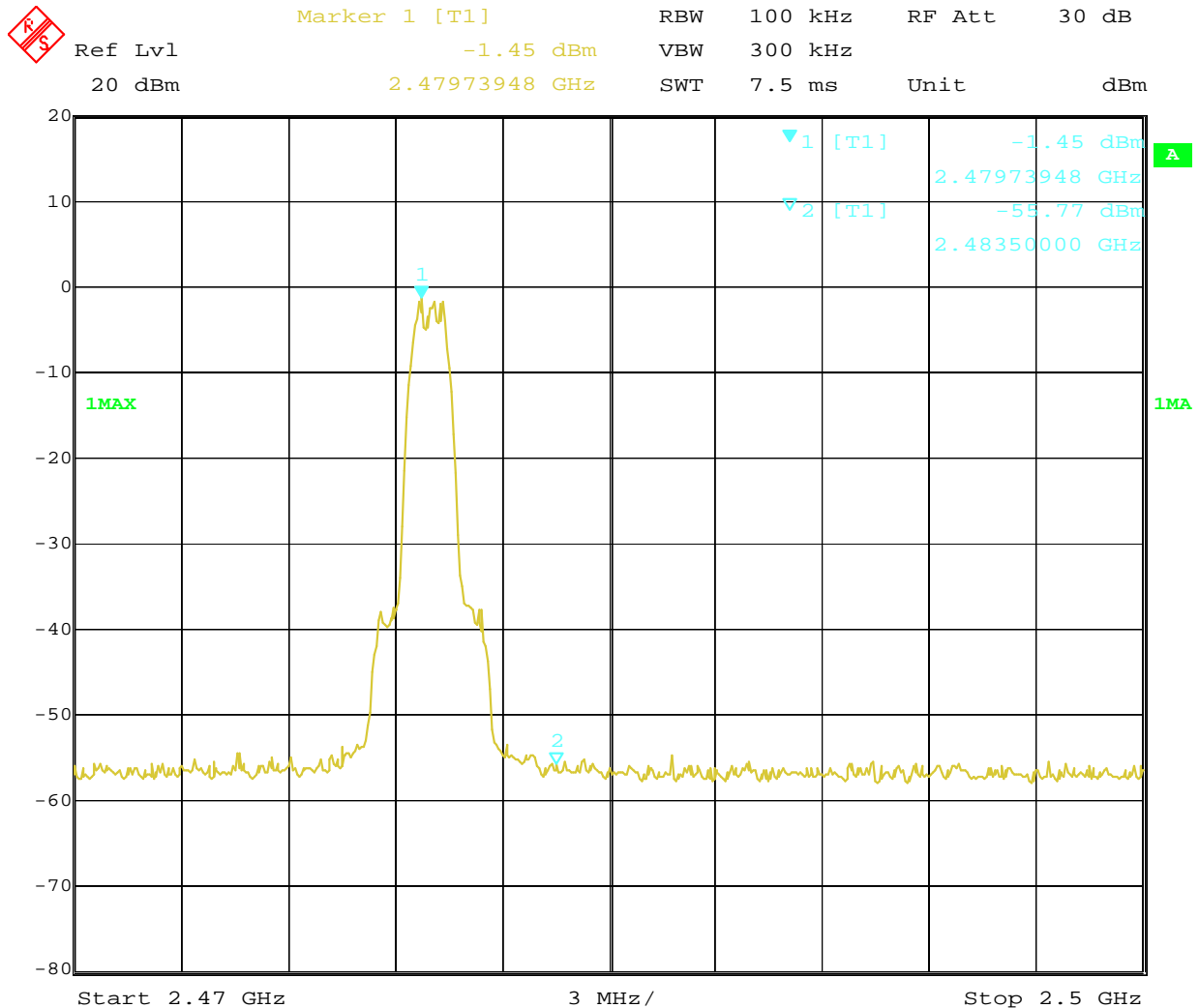


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

Product:	31.5' 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 (dB $\mu$ V/m)	41.9	Limit	74(dB $\mu$ V/m)
	AV(dB $\mu$ V/m)	--		54(dB $\mu$ V/m)

**Test Figure:**



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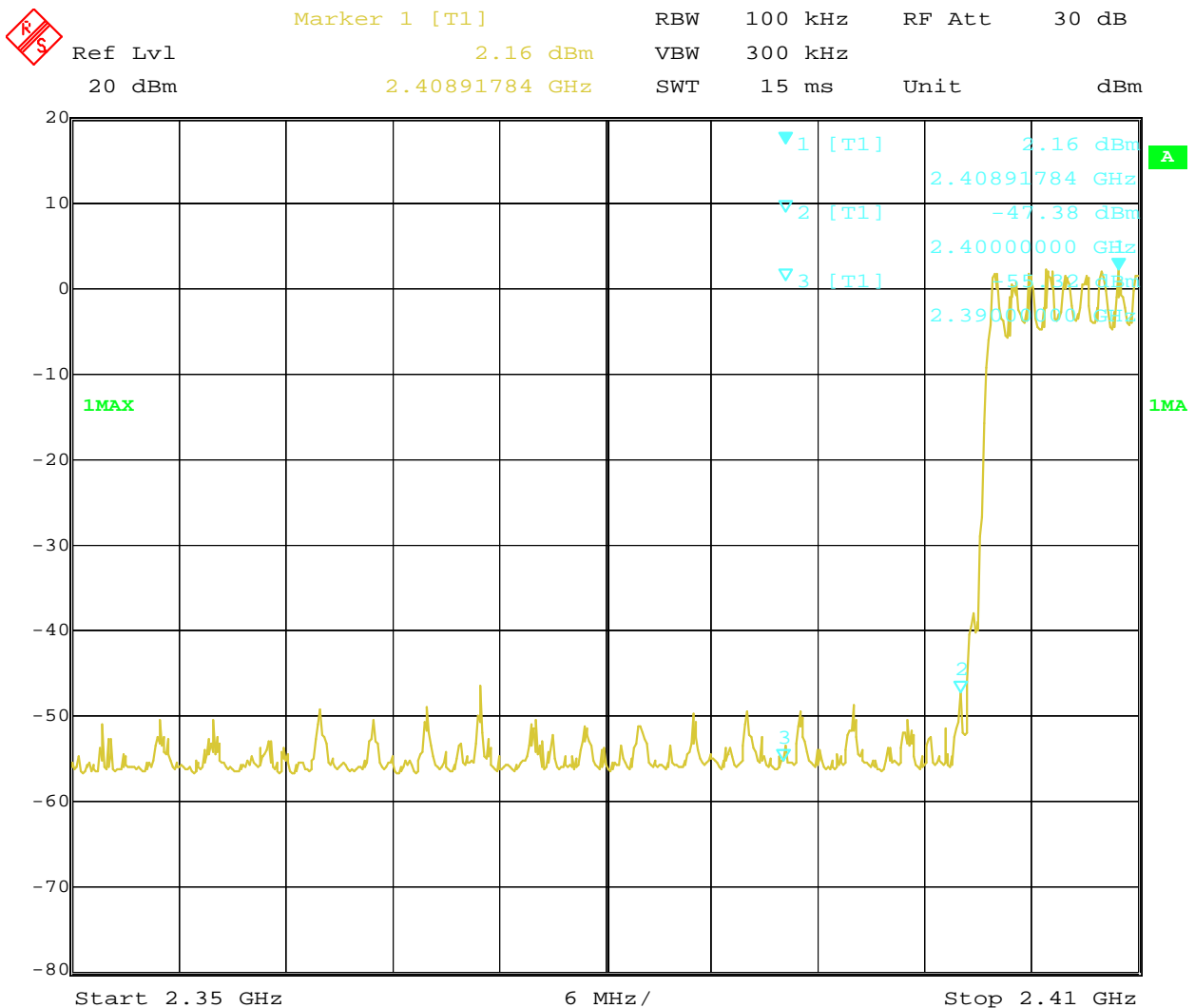


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dB $\mu$ V/m)	46.0	Limit	74(dB $\mu$ V/m)
	AV(dB $\mu$ V/m)	--		54(dB $\mu$ V/m)

**Test Figure:**



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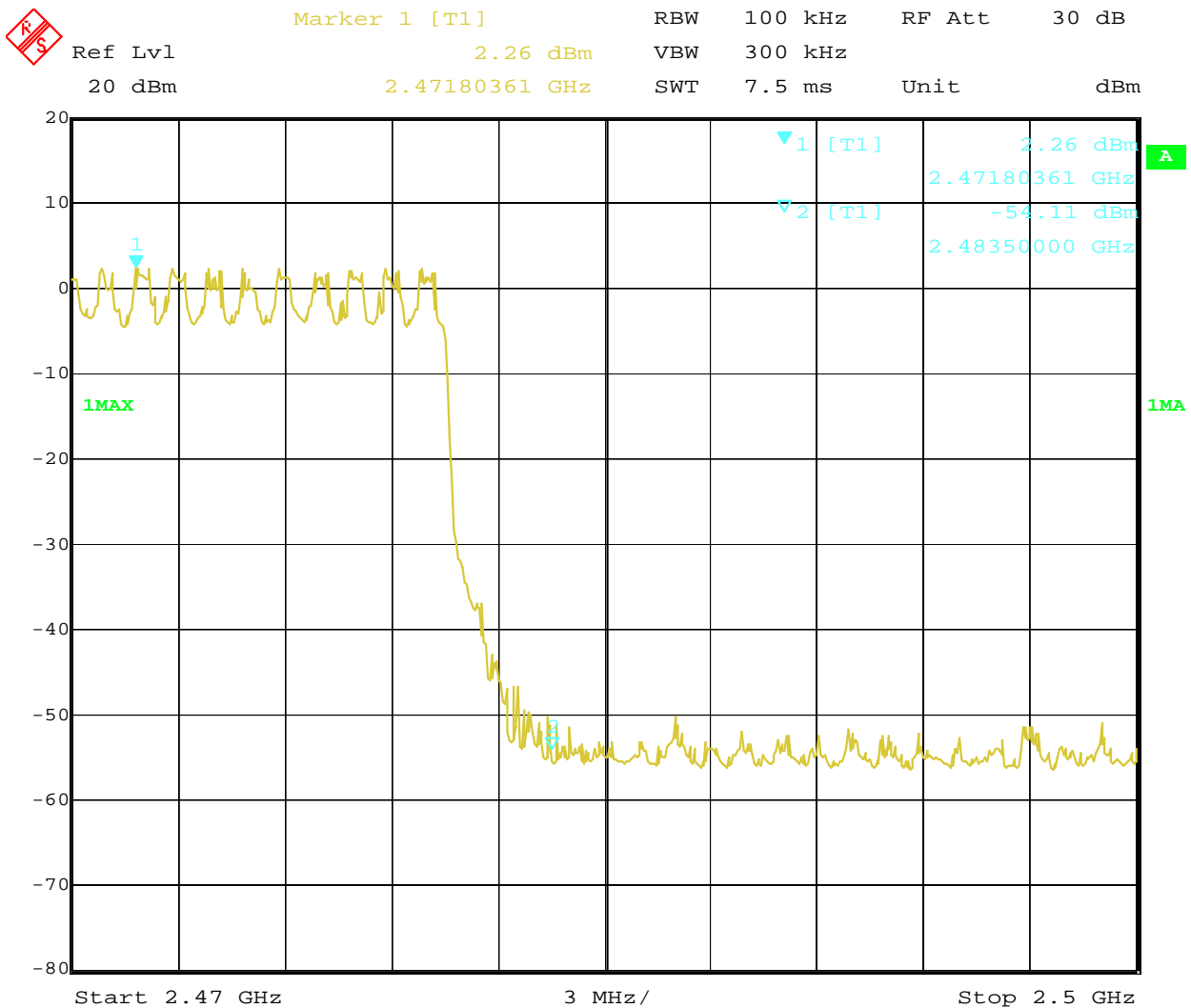


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dB $\mu$ V/m)	42.8	Limit	74(dB $\mu$ V/m)
	AV(dB $\mu$ V/m)	--		54(dB $\mu$ V/m)

**Test Figure:**



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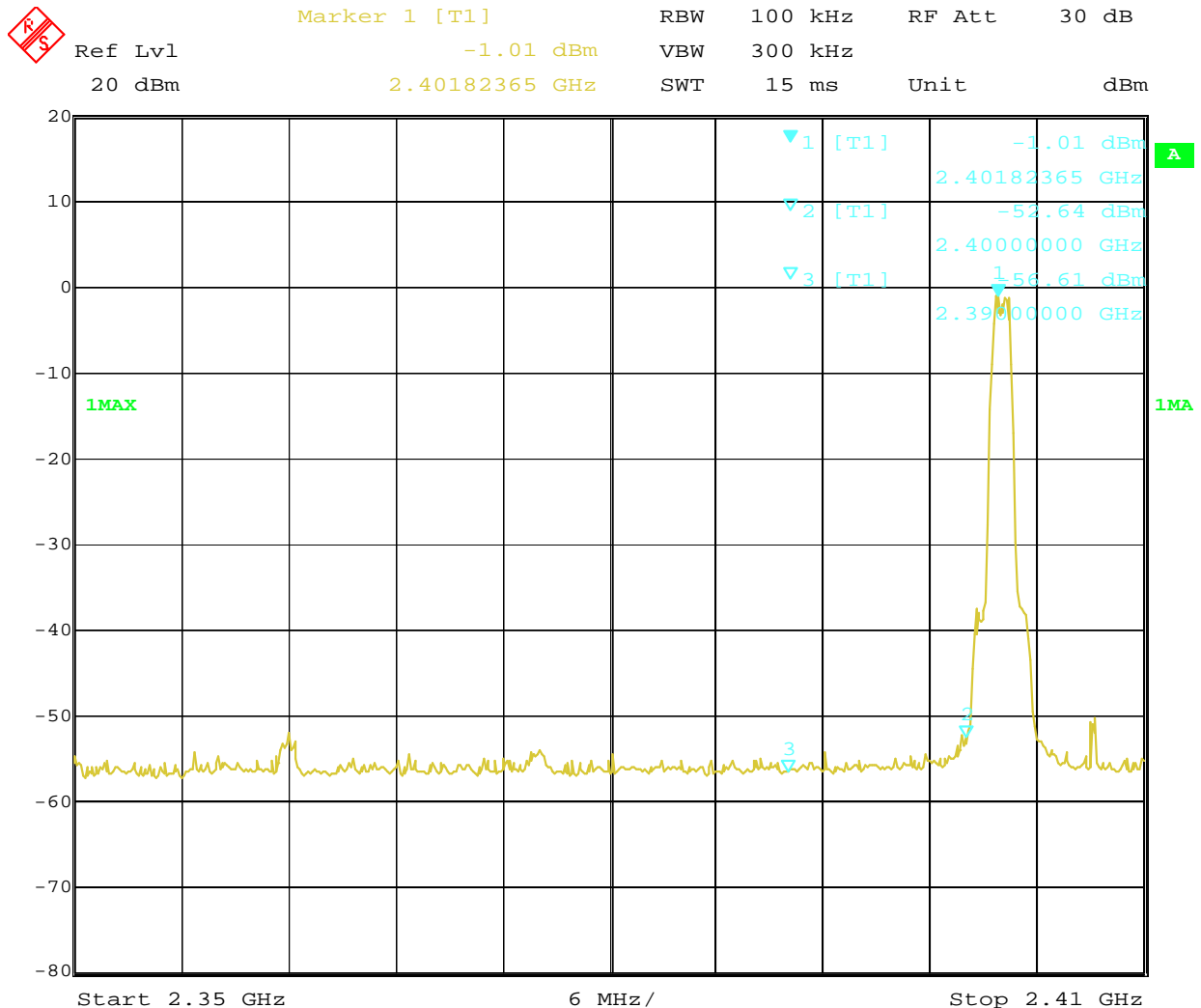


**Type of Modulation: 8DPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Low Channel
Mode	Keeping Transmitting		Input Voltage	120V~
Temperature	24 deg. C		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dBμV/m)	45.3	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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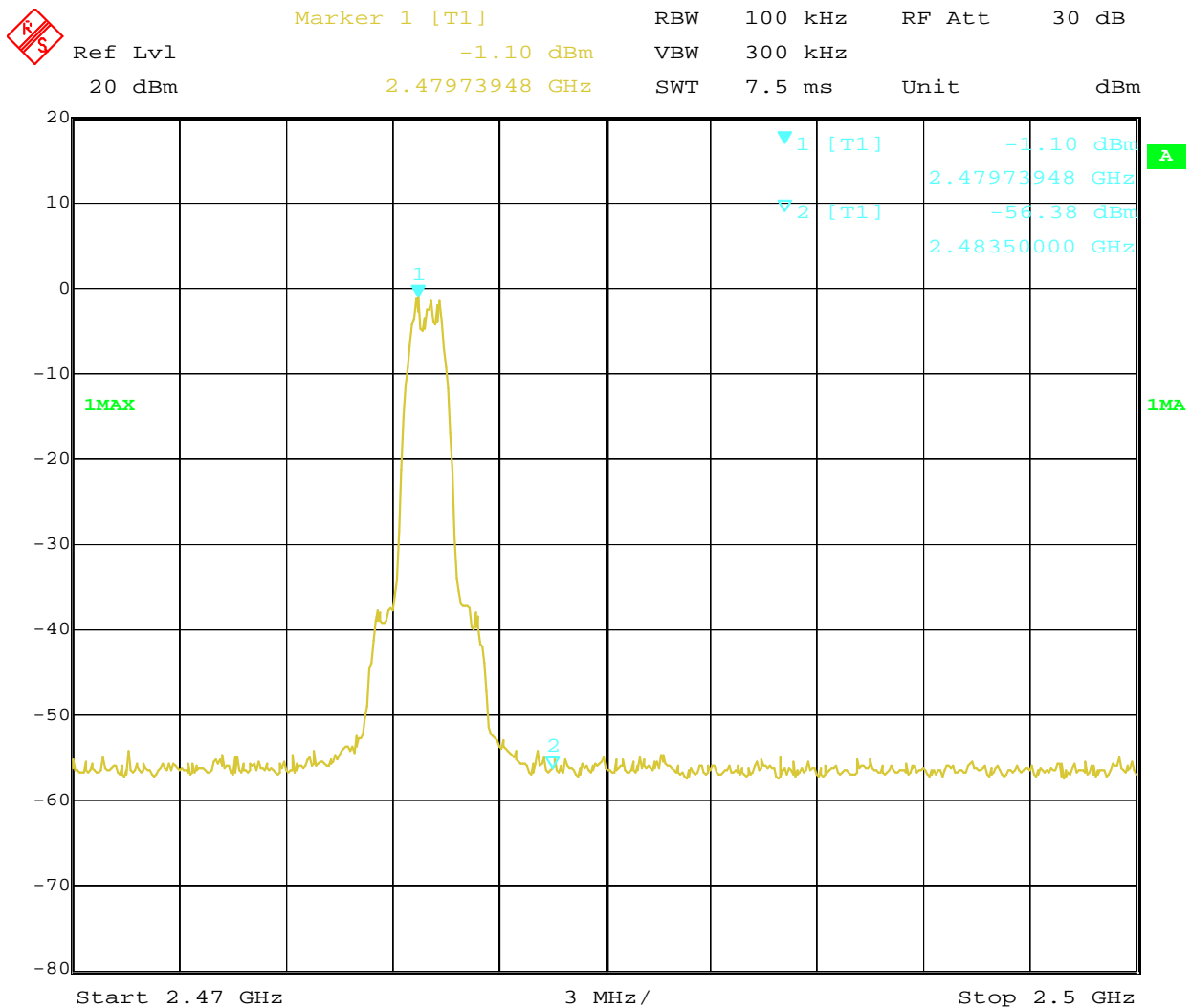


**Type of Modulation: 8DPSK**

**12.4 Out of Band Test Result**

Product:	31.5' 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)	42.6	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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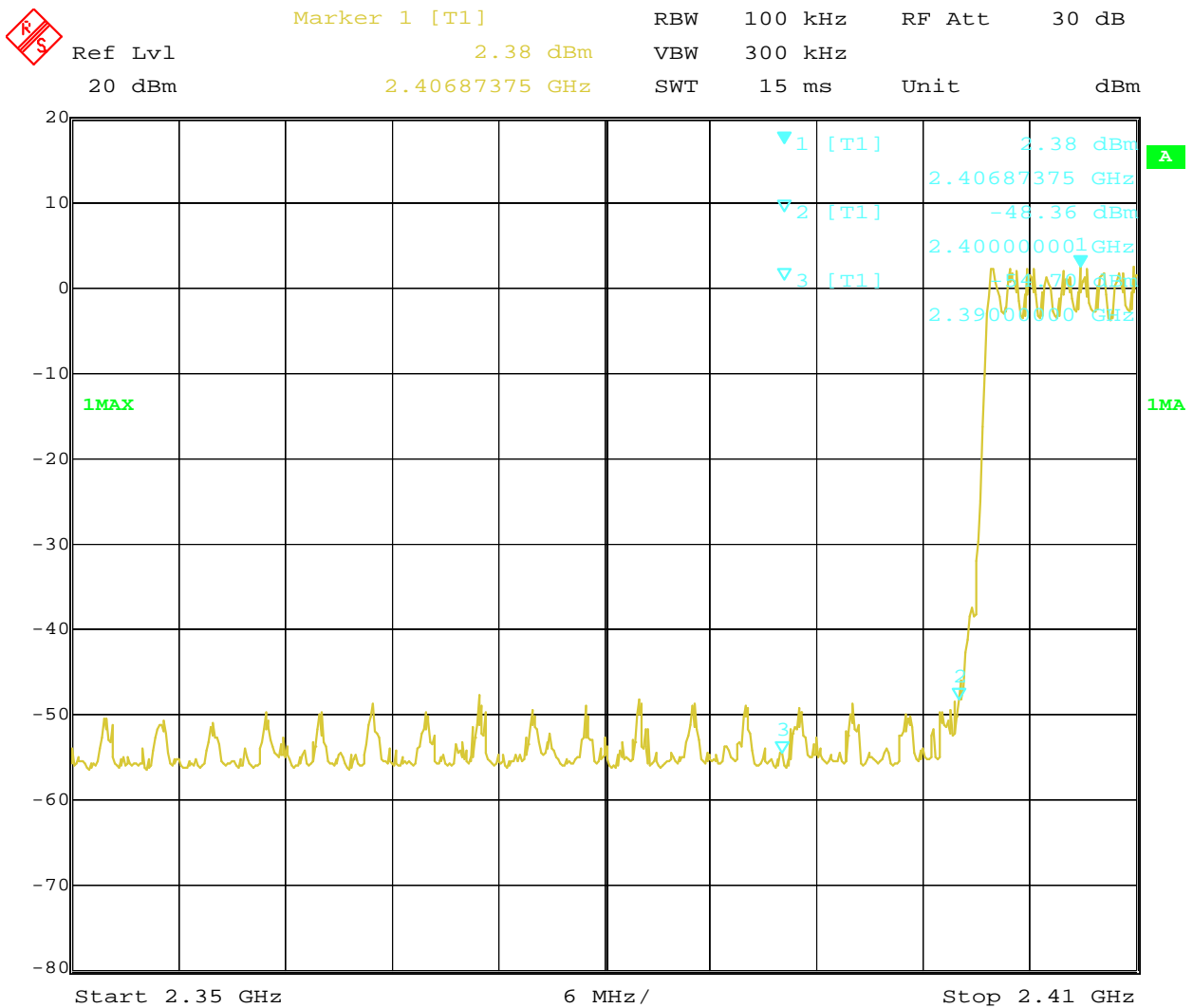


**Type of Modulation: 8DPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2390MHz	PK (dBμV/m)	46.0	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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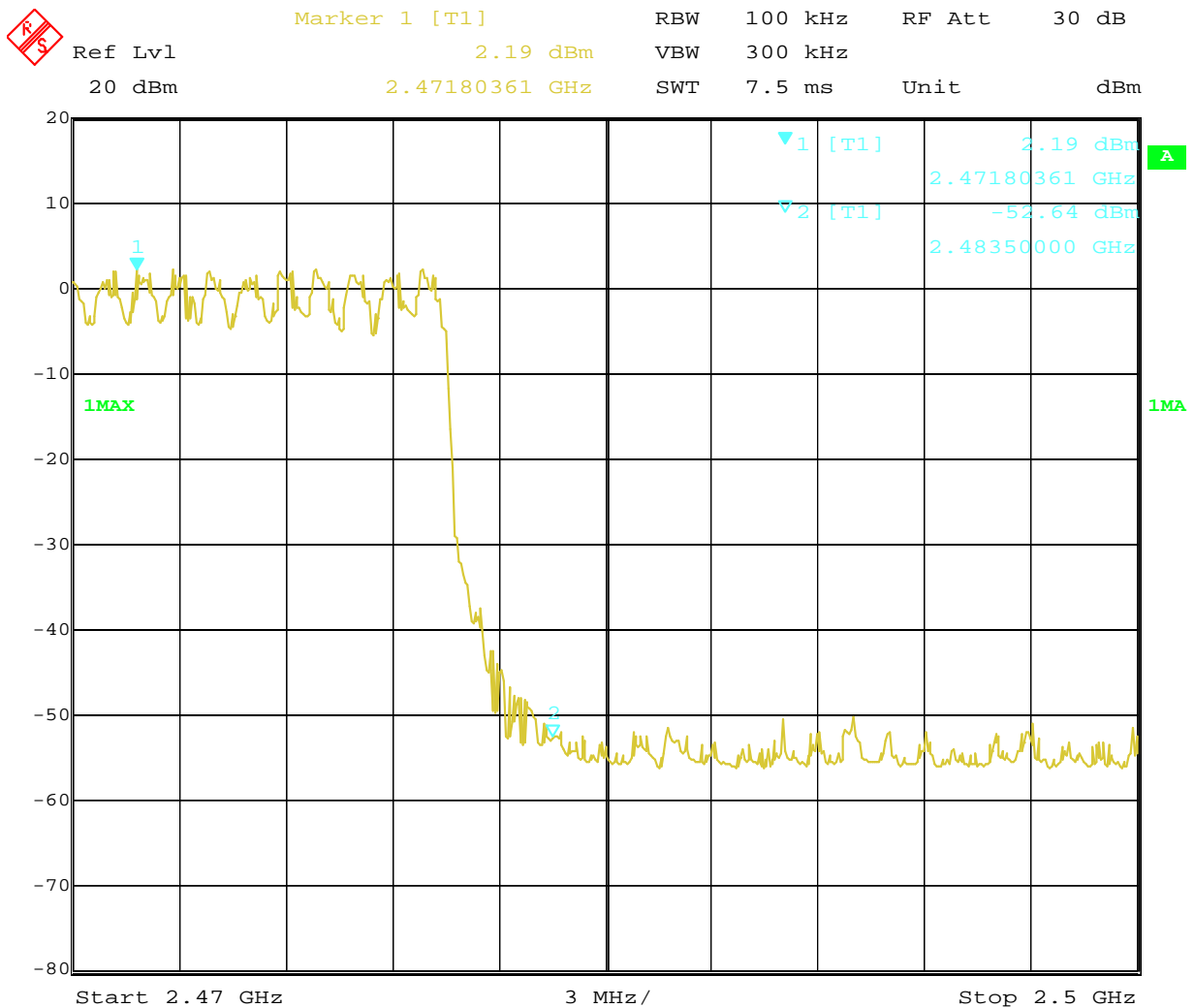


**Type of Modulation: 8DPSK**

**12.4 Out of Band Test Result**

Product:	31.5' Advertising Displayer		Test Mode:	Hopping mode
Mode	Hopping On		Input Voltage	120V~
Temperature	24 deg. C,		Humidity	56% RH
Test Result:	Pass		Detector	PK
The Max. FS in Restrict Band 2483.5MHz	PK (dBμV/m)	42.1	Limit	74(dBμV/m)
	AV(dBμV/m)	--		54(dBμV/m)

**Test Figure:**



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

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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

Integral antenna used. The maximum Gain of the antennas is 2.0dBi.

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#### 14.0 FCC ID Label

##### FCC ID: 2AACS-JAR321

**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:



Label Location

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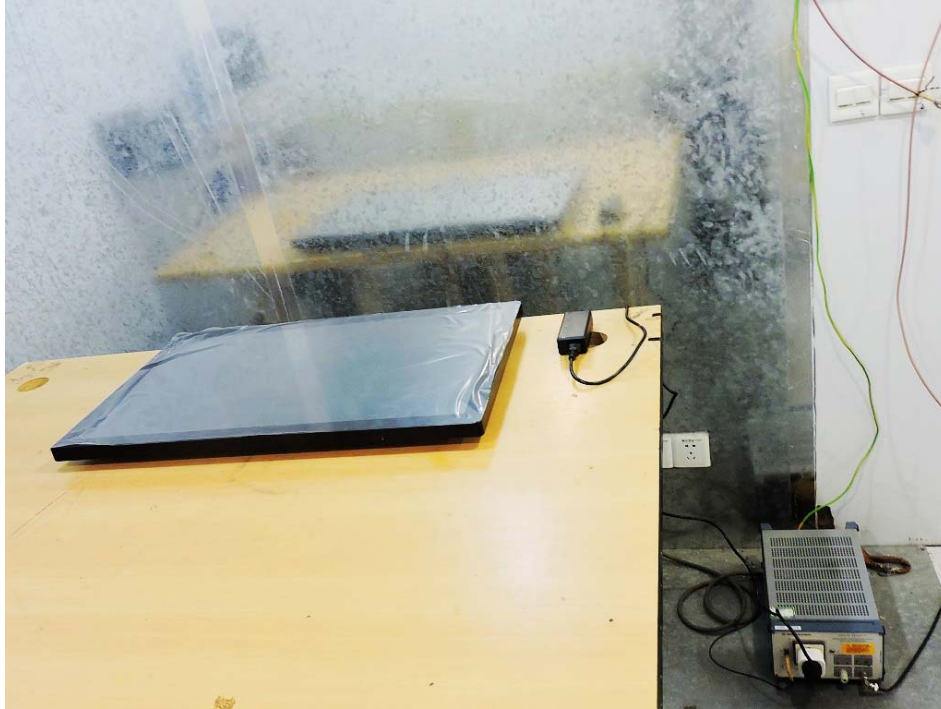
In the event of the improper use of the report. The SHENZHEN TIMEWAY TESTING LABORATORIES, reserves the rights to withdraw it and to adopt any other remedies which may be appropriate.



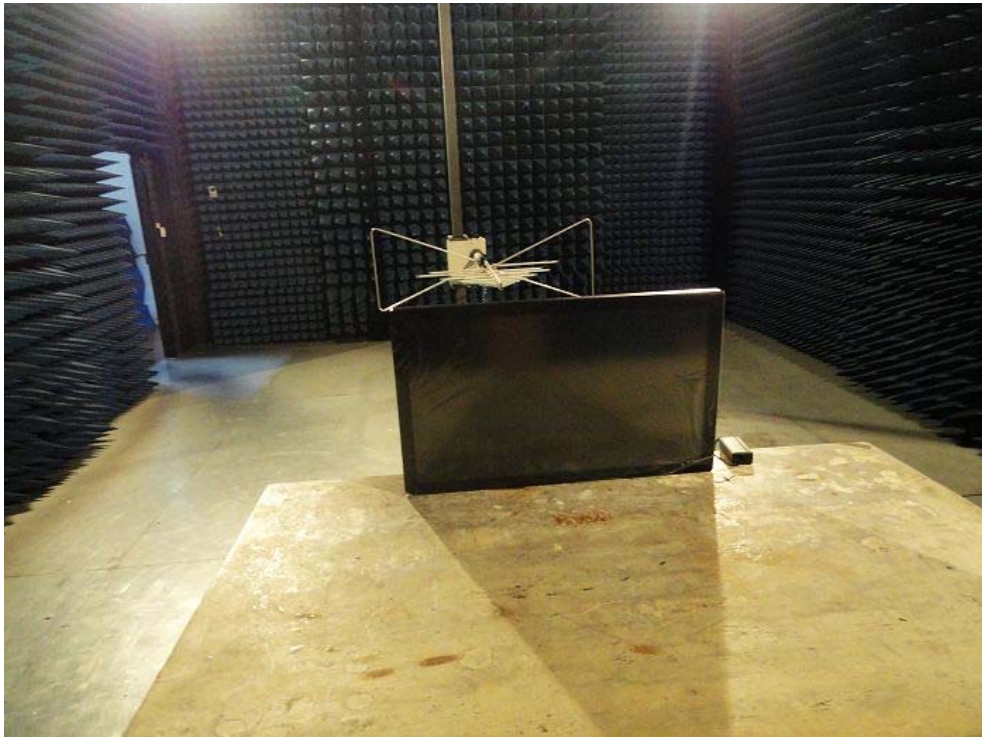


### 15.0 Photo of testing

Conducted Emission Test Setup:



Radiated Emission Test Setup:



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**Photographs – EUT**

Please see test report FCC1705096-01

**End of the report**

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