



Report No.:  
File reference No.:

FCC 1903224-03  
2019-04-10

Applicant: Shenzhen Geniatech Inc., Ltd.

Product: Developer Board

Model No.: DB8,DB8WL,DB9,DB7,DB5,DB4,XPI,XPI-S905X,GTW390R,  
GTW350,GTW410,GTW389,GTW360

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: April 10, 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  
Site Listed with Federal Communications commission (FCC)  
Registration Number: 744189  
For 3m Anechoic Chamber  
Site Listed with Industry Canada of Ottawa, Canada  
Registration Number: IC: 5205A-02  
For 3m Anechoic Chamber

### 1.2 Applicant Details

Applicant: Shenzhen Geniatech Inc., Ltd.  
Address: 18F, GDC Building, No 9th, Gaoxin Middle 3rd Road, Nanshan, Shenzhen, China  
Telephone: --  
Fax: --

### 1.3 Description of EUT

Product: Developer Board  
Manufacturer: Shenzhen Geniatech Inc., Ltd.  
Address: 18F, GDC Building, No 9th, Gaoxin Middle 3rd Road, Nanshan, Shenzhen, China  
Brand Name: N/A  
Model Number: DB8  
Additional Model Number: DB8WL, DB9, DB7, DB5, DB4, XPI, XPI-S905X, GTW390R, GTW350, GTW410, GTW389, GTW360  
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: External antenna with reversed polarity non standard unique antenna port.  
Antenna gain: 2.0dBi  
Input: DC12V, 1.5A  
Power Supply: Model: FJ-SW1201500E; Input: 100-240V, 50/60HZ, 0.6A Max;  
Output: DC12V , 1500mA

### 1.4 Submitted Sample: 1 Samples

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1.5 Test Duration

2019-03-05 to 2019-04-09

1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions below 1GHz Uncertainty =4.7dB

Radiated Emissions above 1GHz Uncertainty =6.0dB

Conducted Power Uncertainty =6.0dB

Occupied Channel Bandwidth Uncertainty =5%

1.7 Test Engineer

A handwritten signature in black ink that reads "Terry Tang". The signature is written in a cursive, flowing style.

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 Line-V-NETW	R&S	EZH3-Z5	100294	2018-06-22	2019-06-21
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2018-06-22	2019-06-21
Ultra Broadband 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 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

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

Note:Test according to ANSI C63.10-2013

#### 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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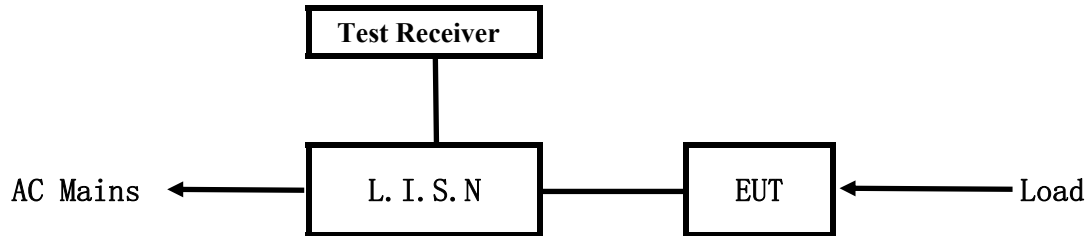
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## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test



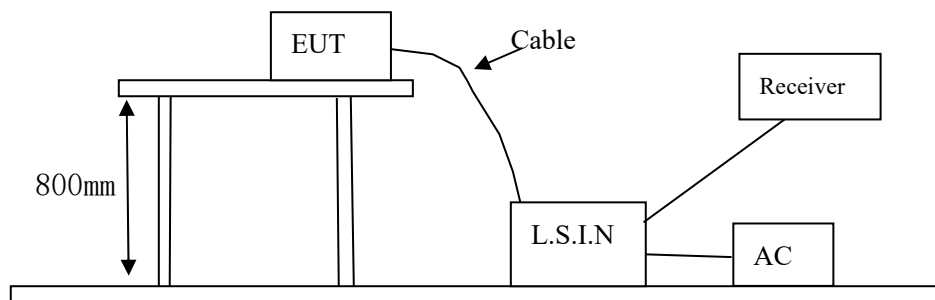
EUT: Equipment Under Test

### 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
Developer Board	Shenzhen Geniatech Inc., Ltd.	DB8,DB8WL,DB9,DB7,DB5,DB4,XPI, XPI-S905X,GTW390R,GTW350, GTW410,GTW389,GTW360	ZJU-D19EC5

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 (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**

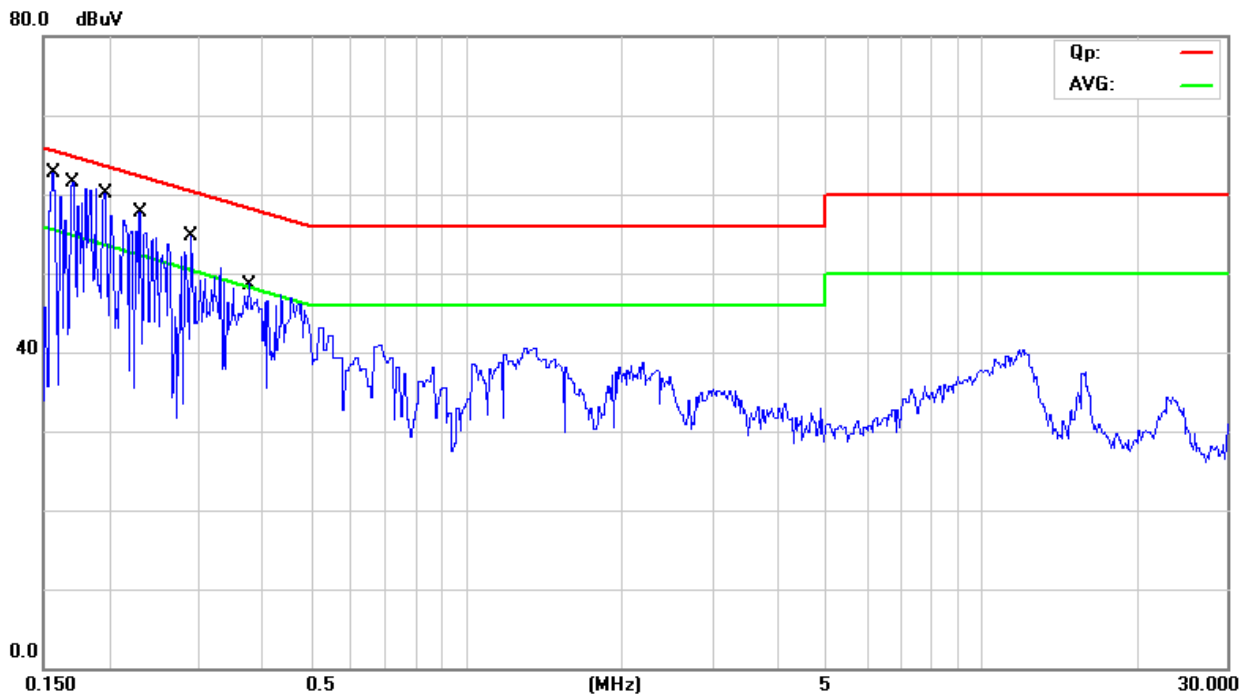
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: PASS**

Please refer to following diagram for individual



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1561	50.98	9.78	60.76	65.67	-4.91	QP	
2		0.1561	20.34	9.78	30.12	55.67	-25.55	AVG	
3	*	0.1718	51.72	9.77	61.49	64.87	-3.38	QP	
4		0.1718	21.33	9.77	31.10	54.87	-23.77	AVG	
5		0.2304	48.03	9.75	57.78	62.44	-4.66	QP	
6		0.2304	8.16	9.75	17.91	52.44	-34.53	AVG	
7		0.1972	37.32	9.75	47.07	63.73	-16.66	QP	
8		0.1972	13.55	9.75	23.30	53.73	-30.43	AVG	
9		0.2900	31.21	9.76	40.97	60.52	-19.55	QP	
10		0.2900	10.64	9.76	20.40	50.52	-30.12	AVG	
11		0.3766	27.84	9.76	37.60	58.35	-20.75	QP	
12		0.3766	4.69	9.76	14.45	48.35	-33.90	AVG	

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

**EUT Operating Environment**

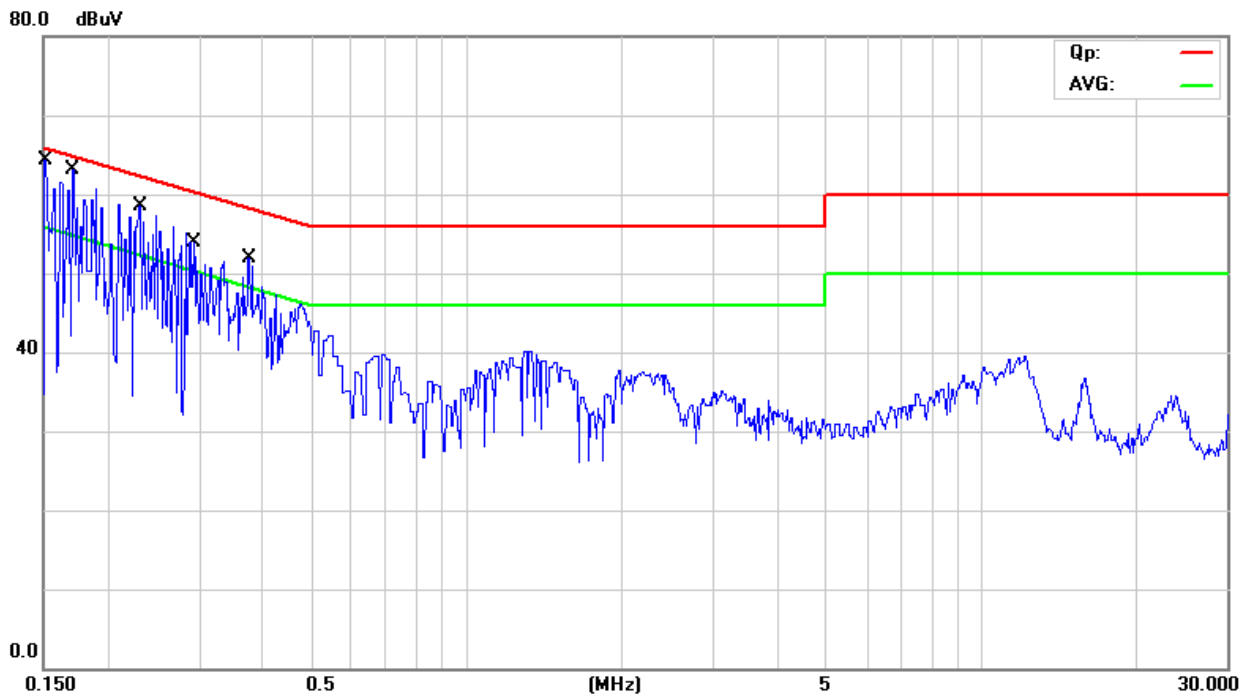
Temperature: 26°C Humidity: 65%RH Atmospheric Pressure: 101 KPa

**EUT set Condition: Keep Bluetooth Transmitting**

**Equipment Level: Class B**

**Results: Pass**

Please refer to following diagram for individual



No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV	dBuV	dB		
1		0.1505	37.50	9.78	47.28	65.97	-18.69	QP	
2		0.1505	8.70	9.78	18.48	55.97	-37.49	AVG	
3		0.1703	35.40	9.77	45.17	64.95	-19.78	QP	
4		0.1703	4.80	9.77	14.57	54.95	-40.38	AVG	
5	*	0.2305	36.81	9.75	46.56	62.43	-15.87	QP	
6		0.2305	10.34	9.75	20.09	52.43	-32.34	AVG	
7		0.2935	33.16	9.76	42.92	60.42	-17.50	QP	
8		0.2935	9.61	9.76	19.37	50.42	-31.05	AVG	
9		0.3758	30.08	9.76	39.84	58.37	-18.53	QP	
10		0.3758	8.64	9.76	18.40	48.37	-29.97	AVG	

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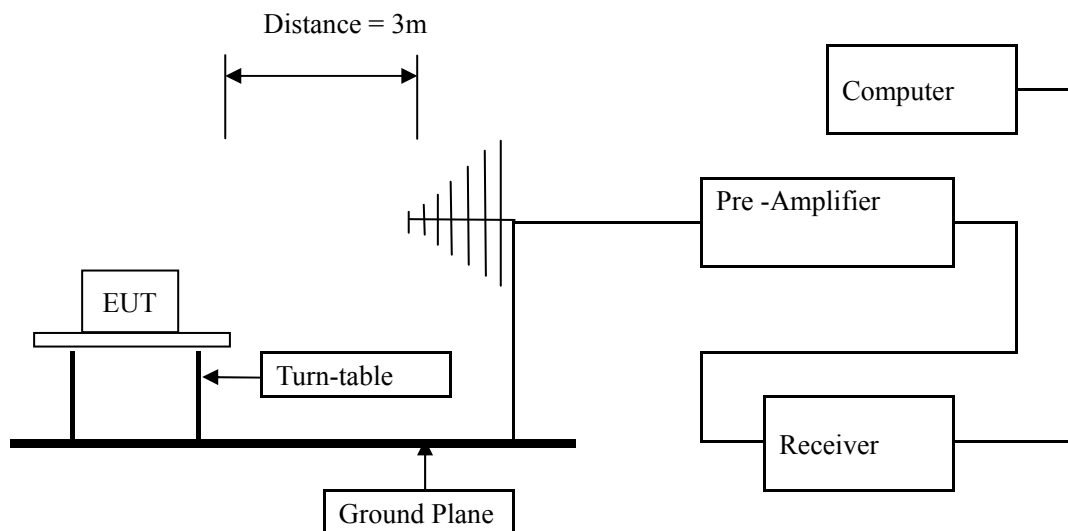


## 6 Radiated Emission Test

### 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 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 ( $\mu$ V)
  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

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**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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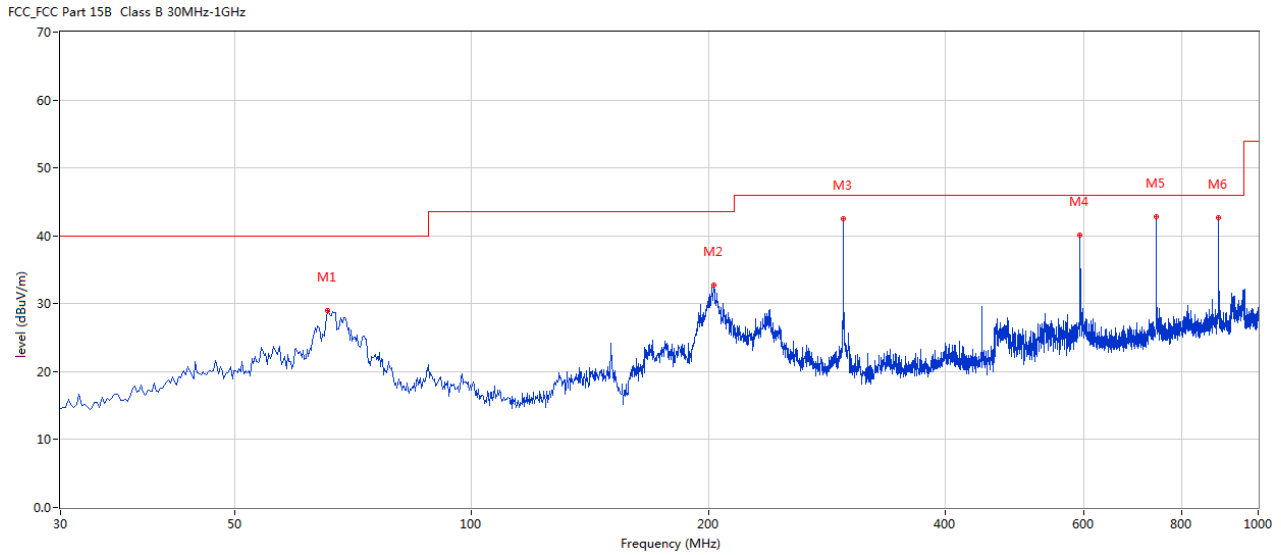
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Test Figure:

H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	65.639	28.93	-13.79	40.0	-11.07	Peak	38.00	100	H	Pass
2	203.344	32.67	-13.46	43.5	-10.83	Peak	360.00	100	H	Pass
3	296.926	42.50	-11.07	46.0	-3.50	Peak	122.00	100	H	Pass
4	593.914	40.07	-5.25	46.0	-5.93	Peak	150.00	100	H	Pass
5	742.529	42.81	-3.47	46.0	-3.19	Peak	360.00	100	H	Pass
6	890.902	42.69	-1.91	46.0	-3.31	Peak	222.00	100	H	Pass

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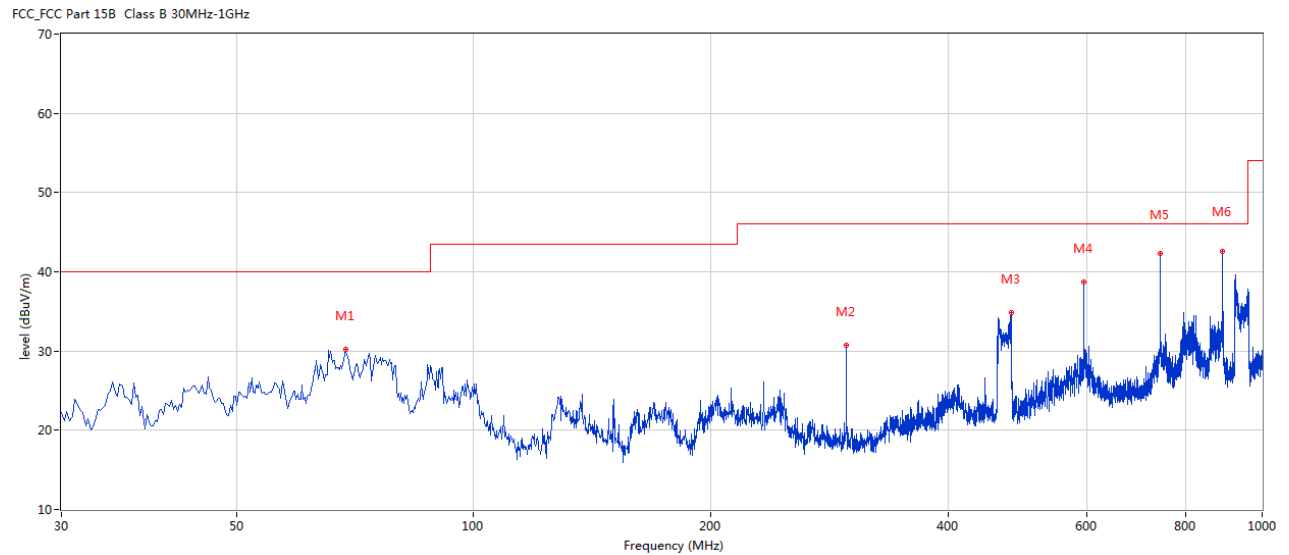
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Test Figure:

V



No.	Frequen cy (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	68.790	30.27	-15.10	40.0	-9.73	Peak	0.00	100	V	Pass
2	296.926	30.67	-11.07	46.0	-15.33	Peak	289.00	100	V	Pass
3	480.210	34.79	-7.38	46.0	-11.21	Peak	143.00	100	V	Pass
4	593.914	38.71	-5.25	46.0	-7.29	Peak	118.00	100	V	Pass
5	742.529	42.35	-3.47	46.0	-3.65	Peak	175.00	100	V	Pass
6	890.902	42.58	-1.91	46.0	-3.42	Peak	147.00	100	V	Pass

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

Frequency (MHz)	Level@3m (dBμV/m)	Antenna Polarity	Limit@3m (dB μ 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 μ V/m)	Antenna Polarity	Limit@3m (dB μ 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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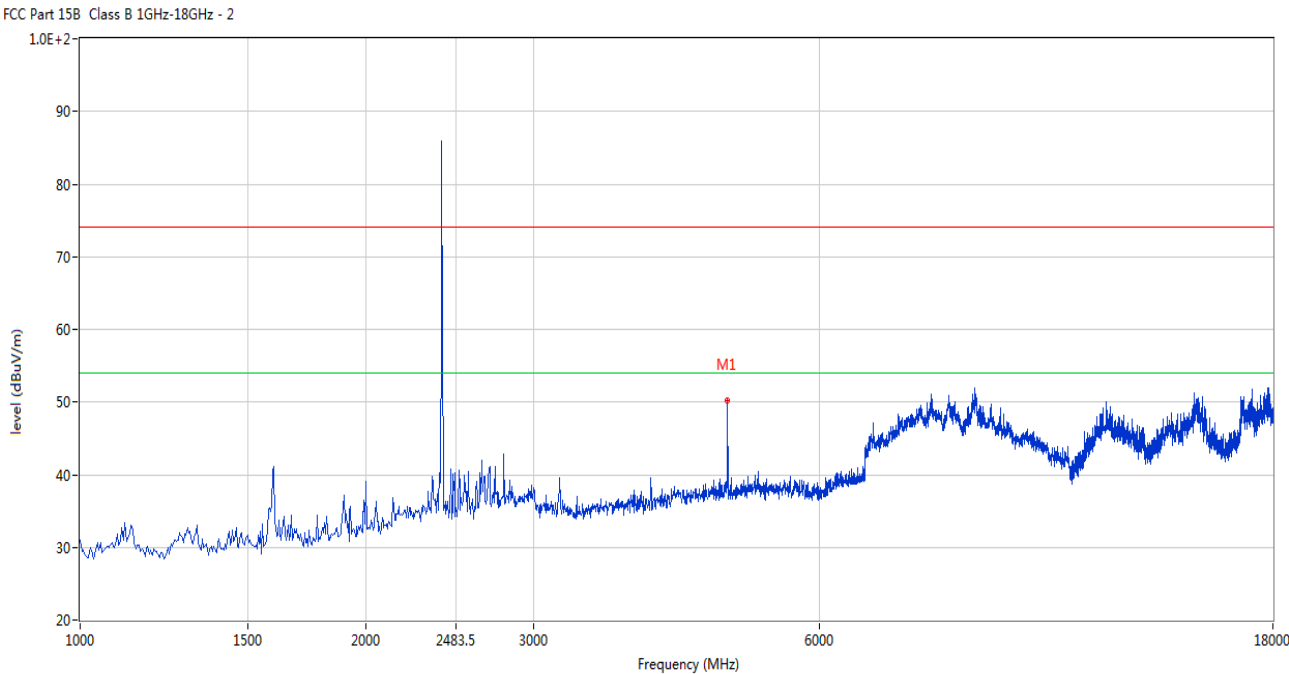
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Please refer to the following test plots for details:

**Low Channel: Vertical**

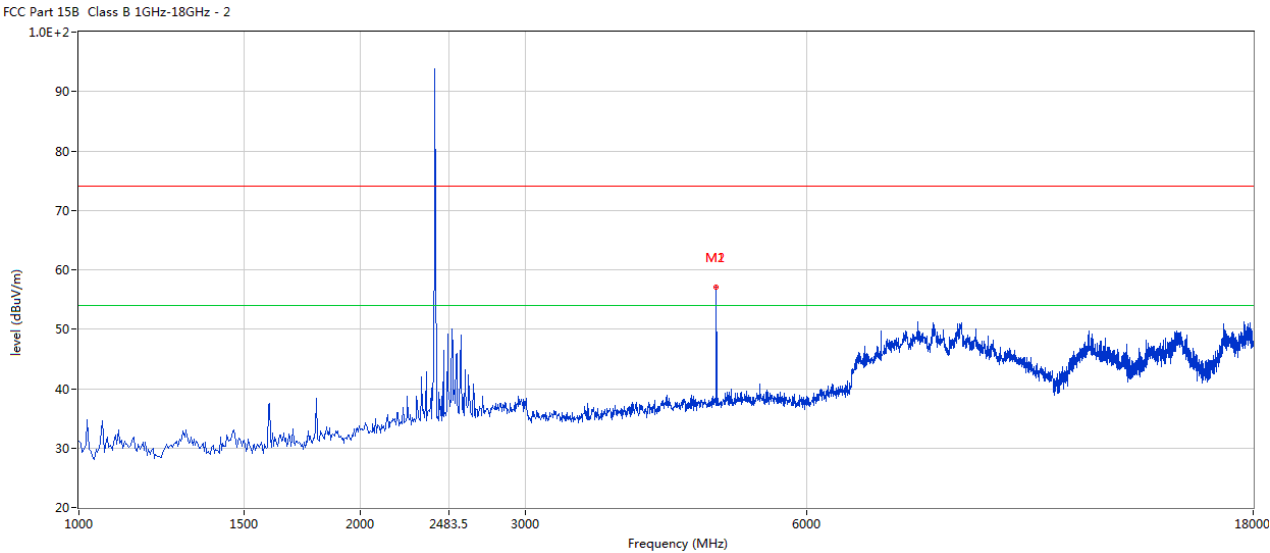


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4802.799	50.14	3.12	74.0	-23.86	Peak	195.00	100	V	Pass

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Low Channel : Horizontal



No.	Frequency (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4802.799	57.05	3.12	74.0	-16.95	Peak	307.00	100	H	Pass
2	4802.799	45.83	3.12	54.0	-8.17	Peak	307.00	100	H	Pass

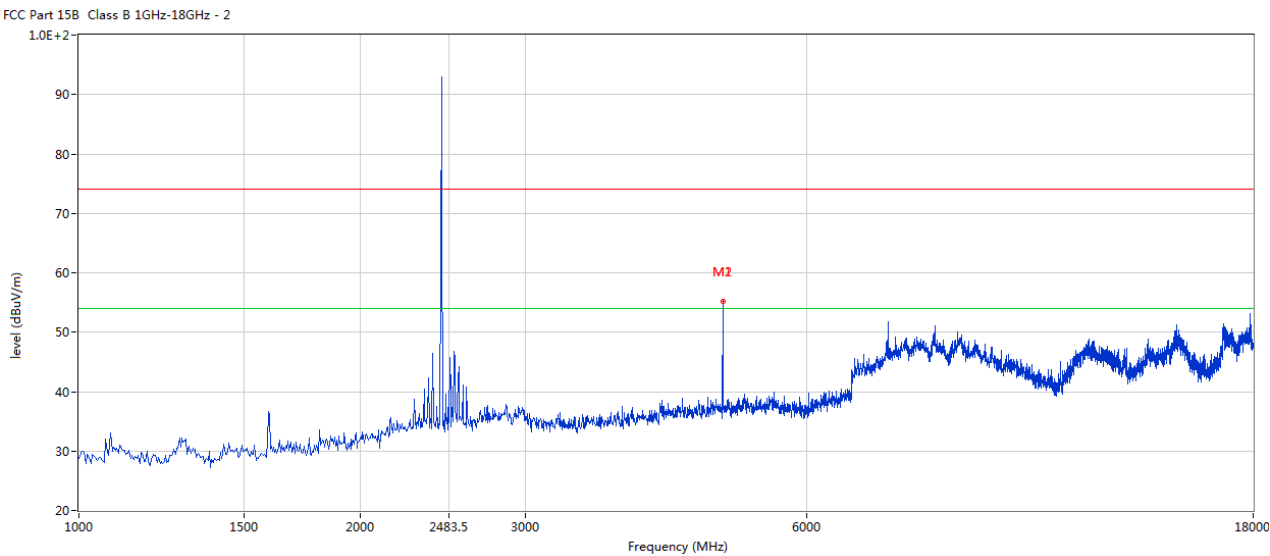
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Middle Channel : Horizontal



No.	Frequency (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4883.529	55.23	3.20	74.0	-18.77	Peak	342.00	100	H	Pass
2	4883.529	44.06	3.20	54.0	-9.94	Peak	342.00	100	H	Pass

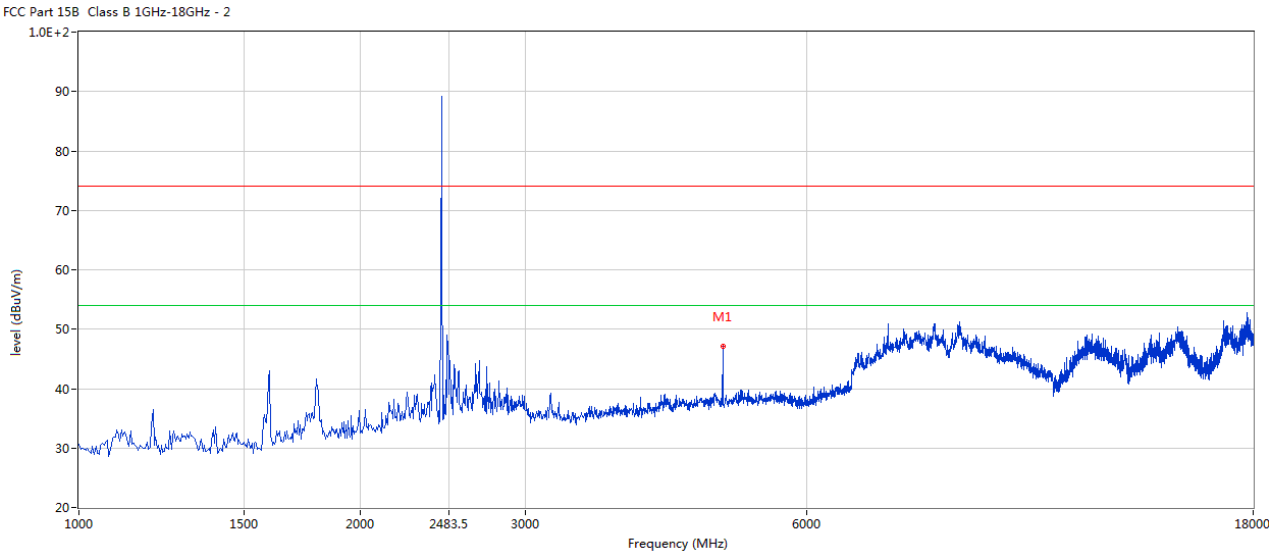
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Middle Channel : Vertical

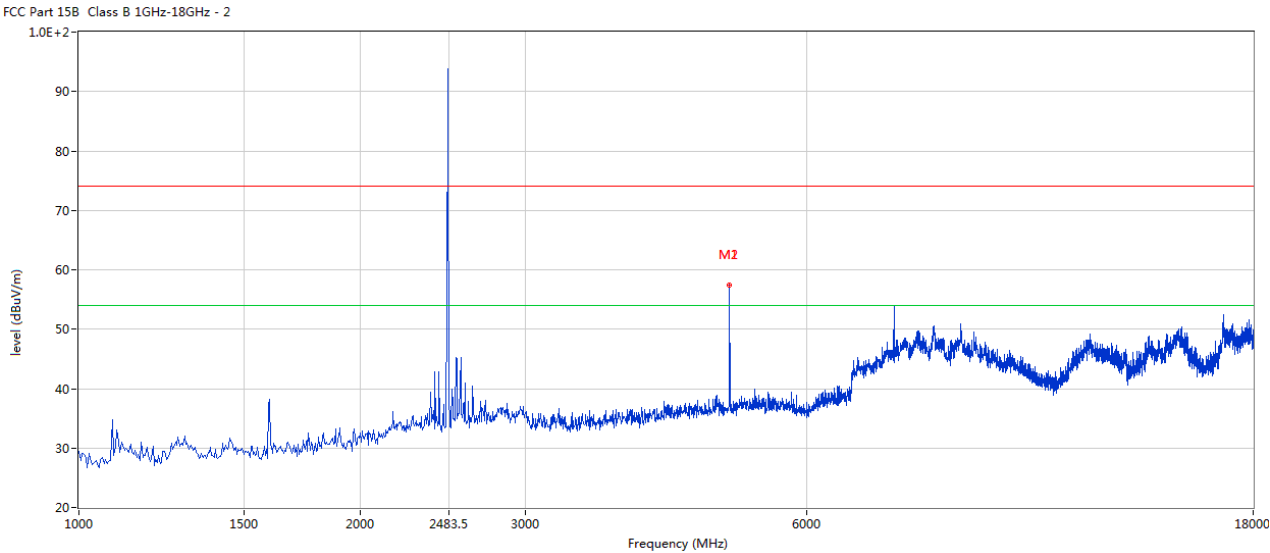


No.	Frequency (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4879.280	47.08	3.20	74.0	-26.92	Peak	129.00	100	V	Pass

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High Channel : Horizontal



No.	Frequency (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4960.010	57.51	3.36	74.0	-16.49	Peak	333.00	100	H	Pass
2	4960.010	46.32	3.36	54.0	-7.68	AV	333.00	100	H	Pass

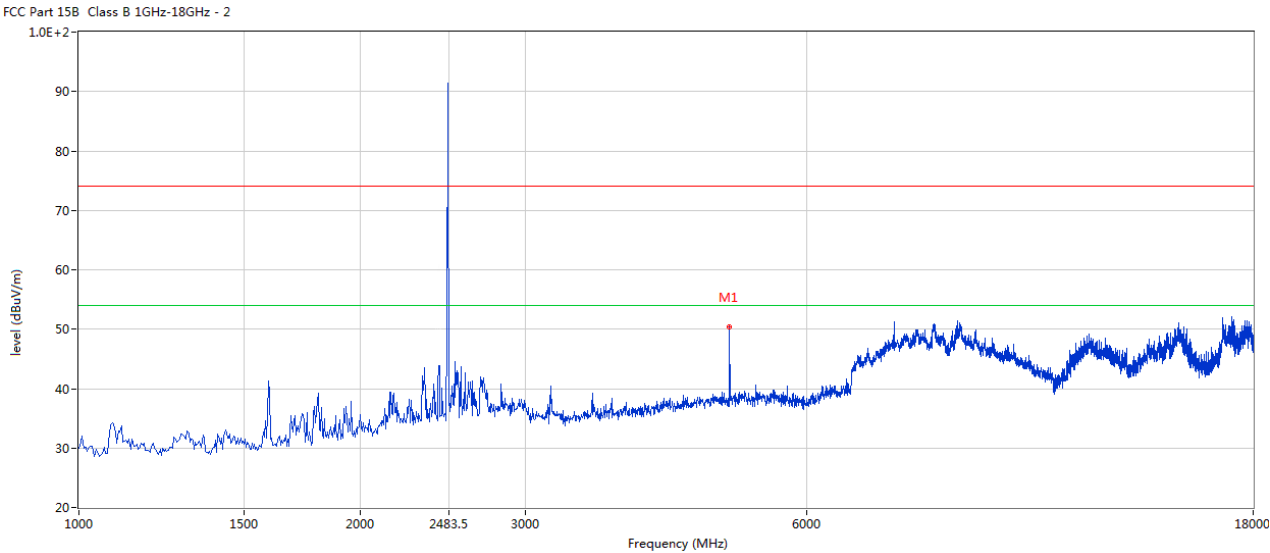
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High Channel : Vertical



No.	Frequency (MHz)	Results (dBuV/m )	Factor (dB)	Limit (dBuV/m )	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	4960.010	50.36	3.36	74.0	-23.64	Peak	115.00	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	Developer Board		Model	DB8
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	860	--	Pass

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

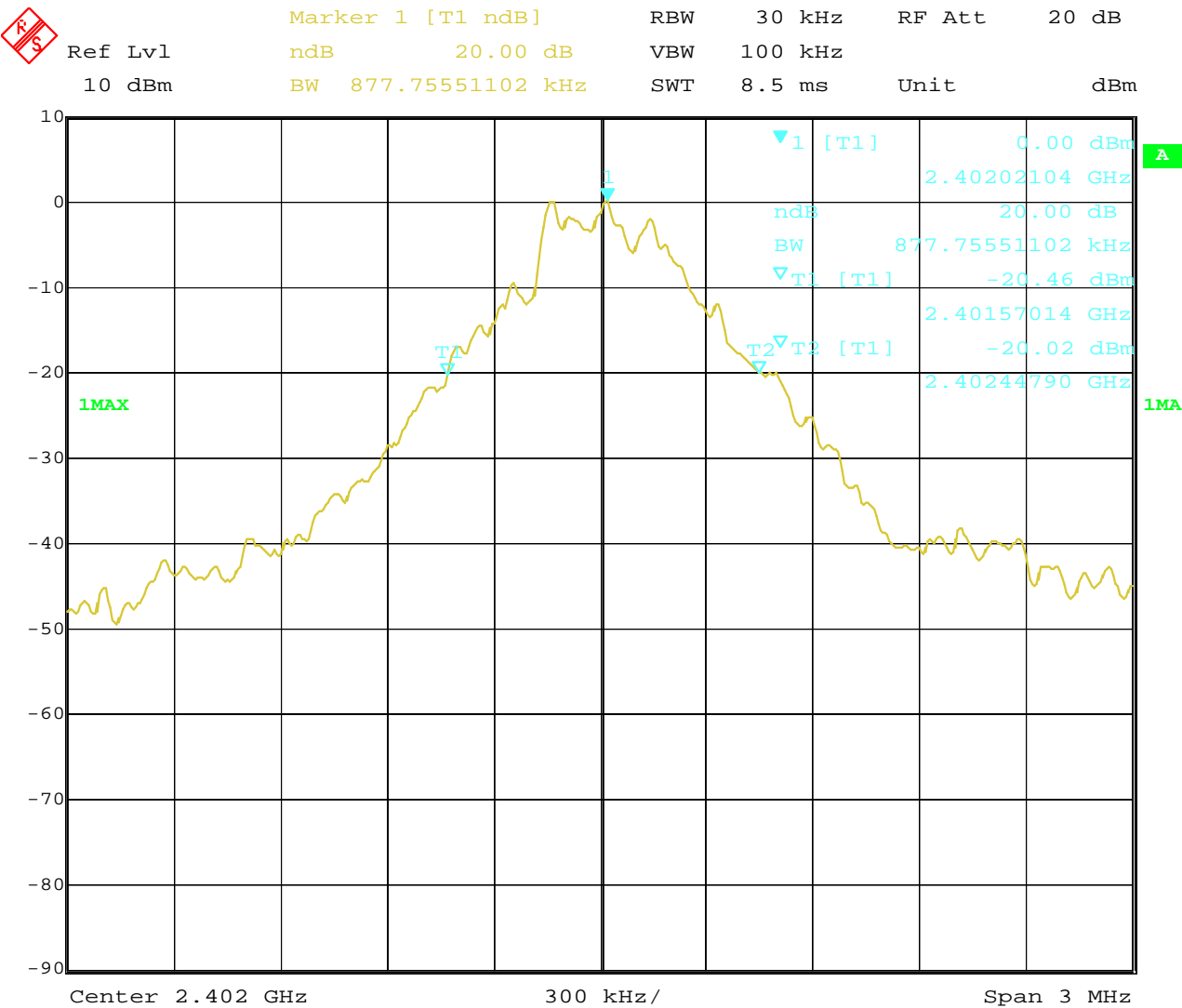
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Test Figure:

1. Condition: Low Channel

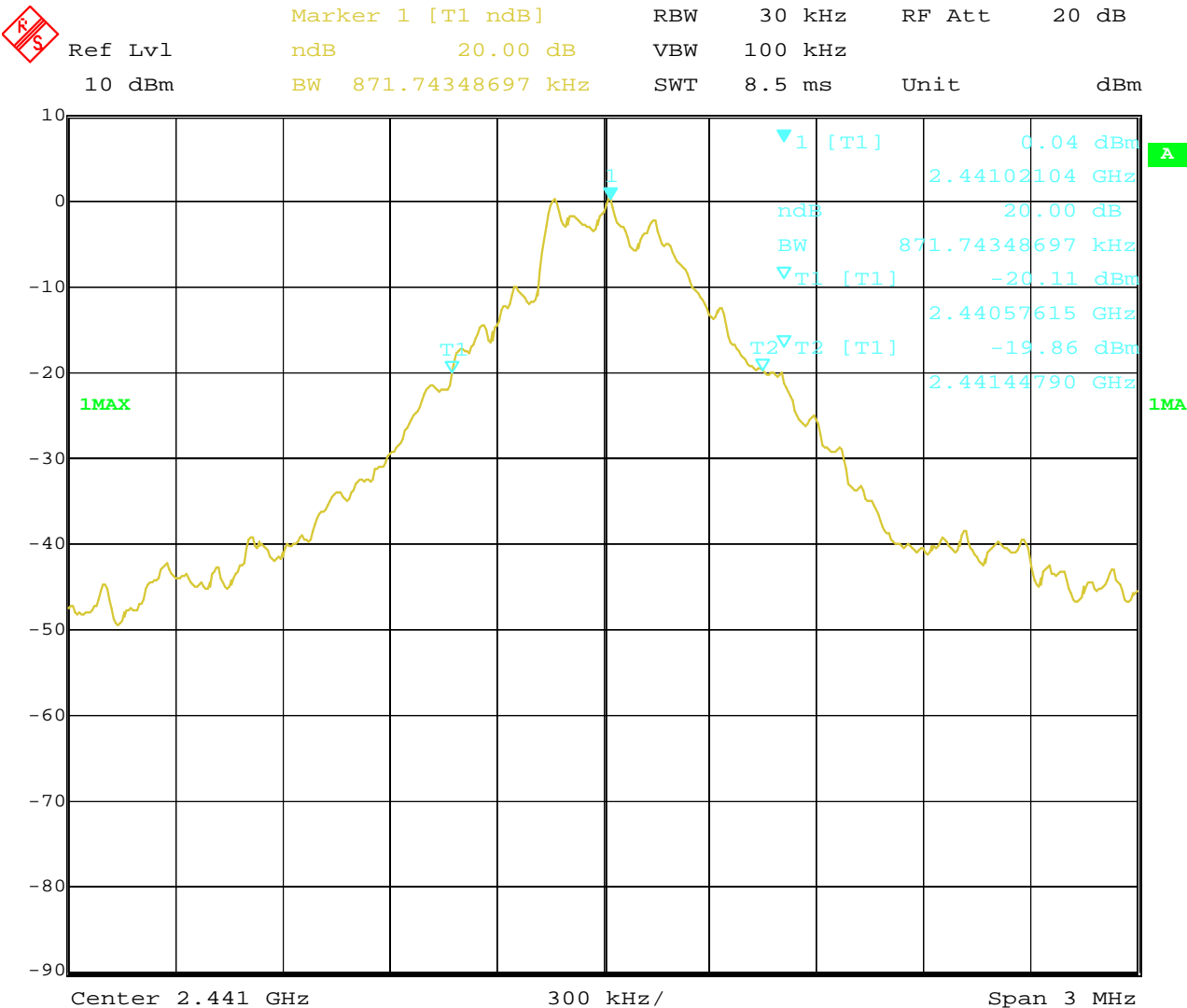


Date: 29.MAR.2019 11:03:02

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2. Condition: Middle Channel

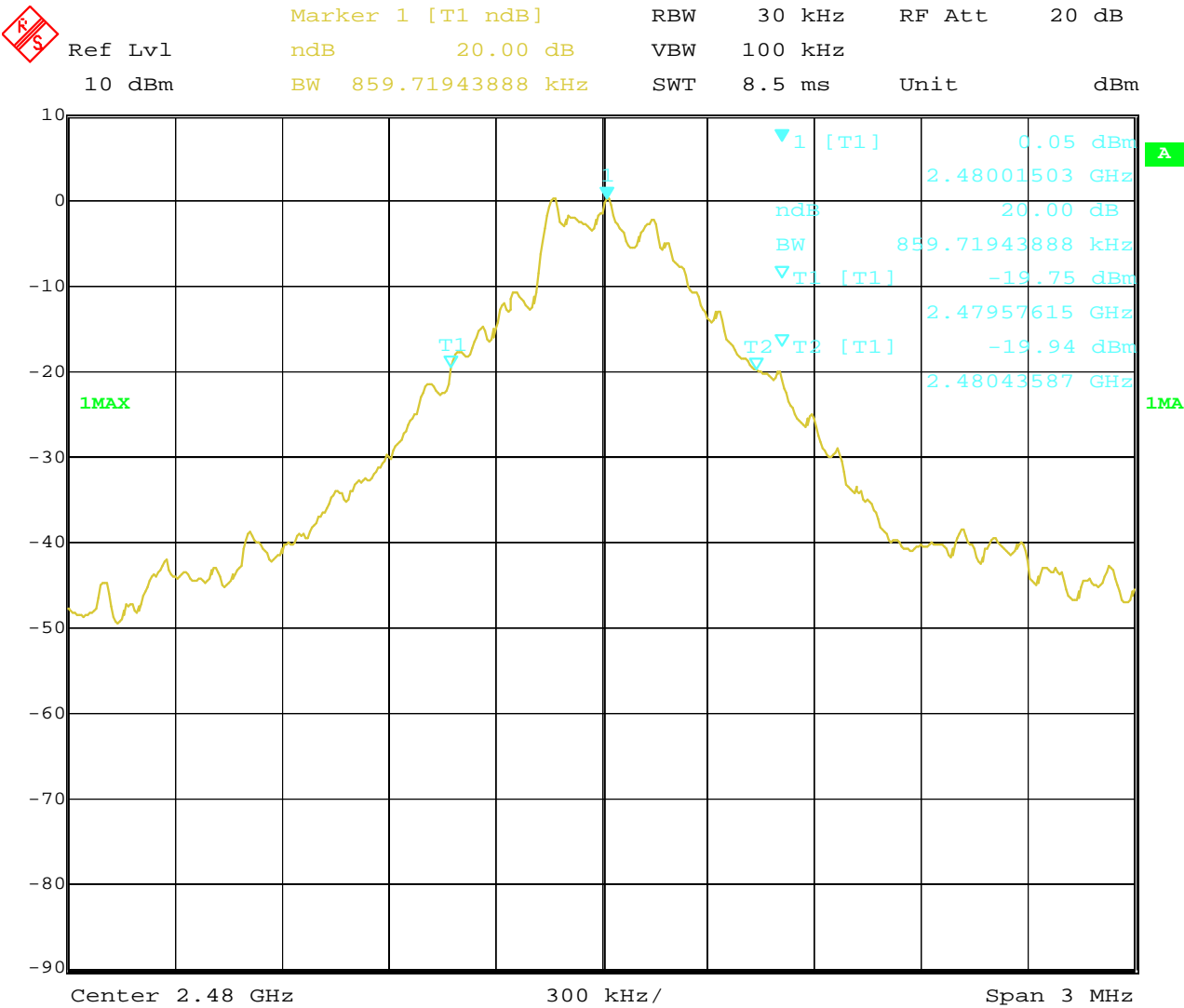


Date: 29.MAR.2019 11:04:05

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3. High Channel



Date: 29.MAR.2019 11:05:35

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## Test Result

Type of Modulation:  $\pi/4$ DQPSK

EUT	Developer Board		Model	DB8
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

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

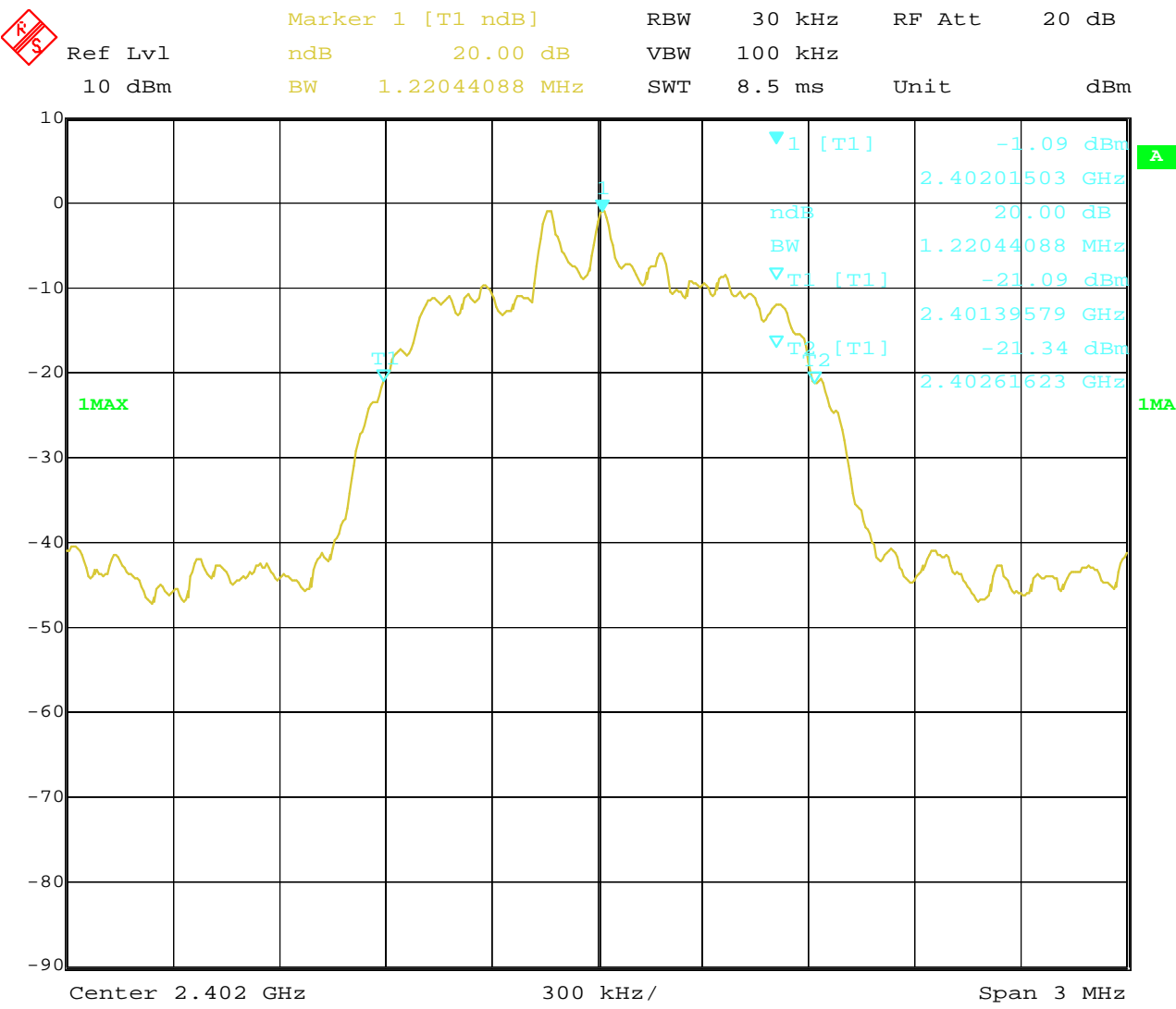
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Test Figure:

1. Condition: Low Channel



Center 2.402 GHz

300 kHz/

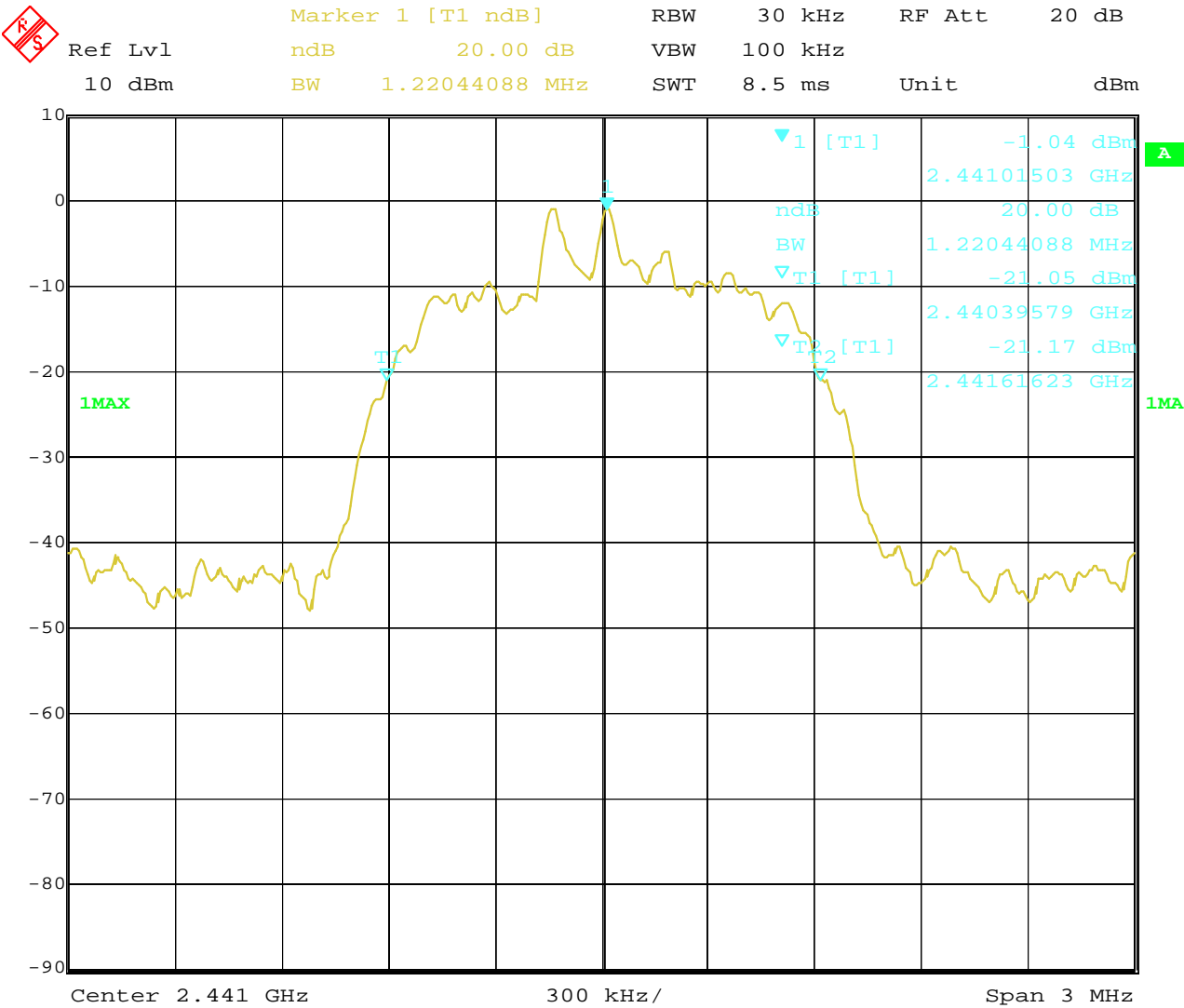
Span 3 MHz

Date: 29.MAR.2019 10:58:40

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2. Condition: Middle Channel



Center 2.441 GHz

300 kHz/

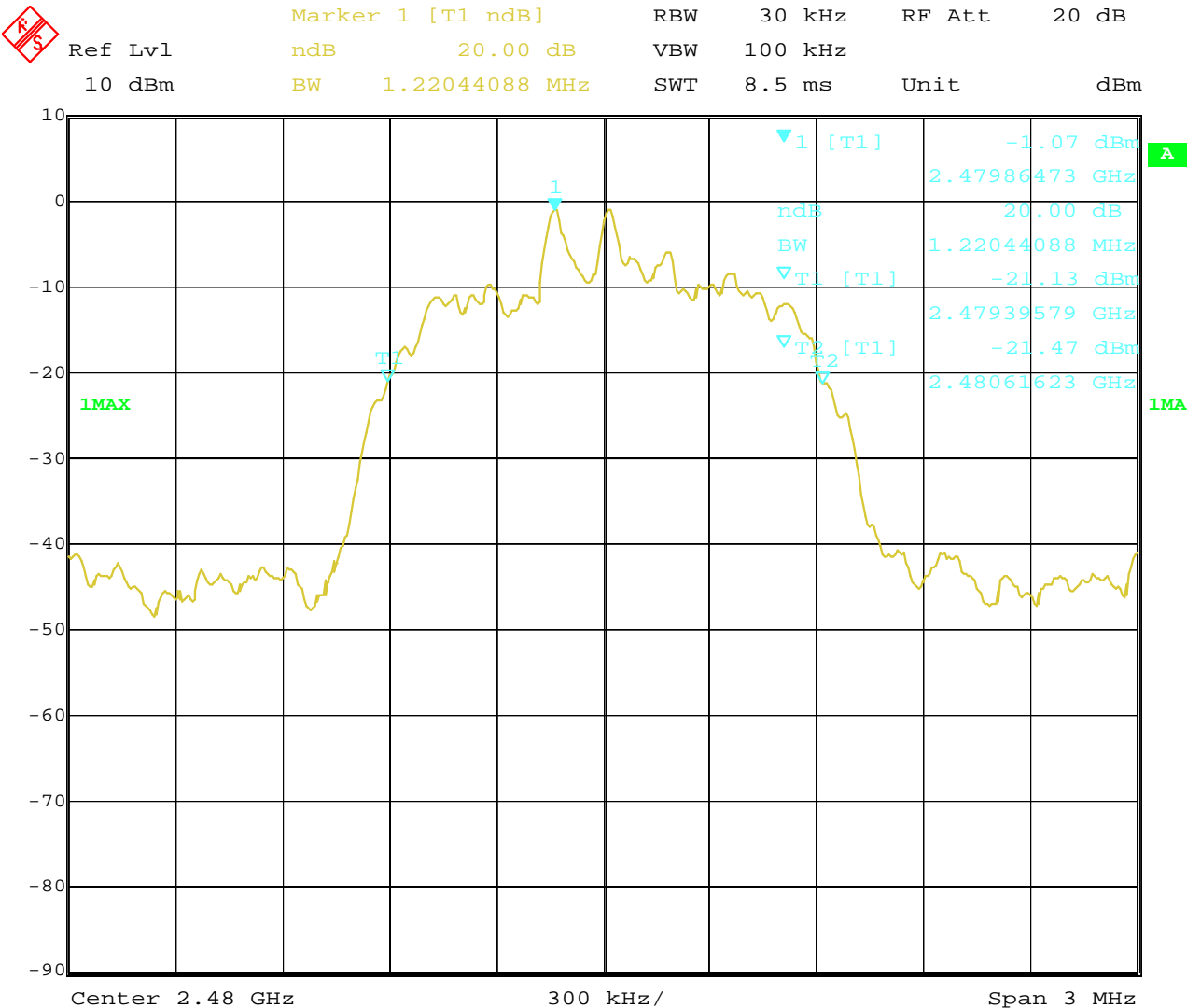
Span 3 MHz

Date: 29.MAR.2019 10:55:56

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3. High Channel



Date: 29.MAR.2019 10:54:41

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## Test Result

Type of Modulation: 8DPSK

EUT	Developer Board		Model	DB8
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

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

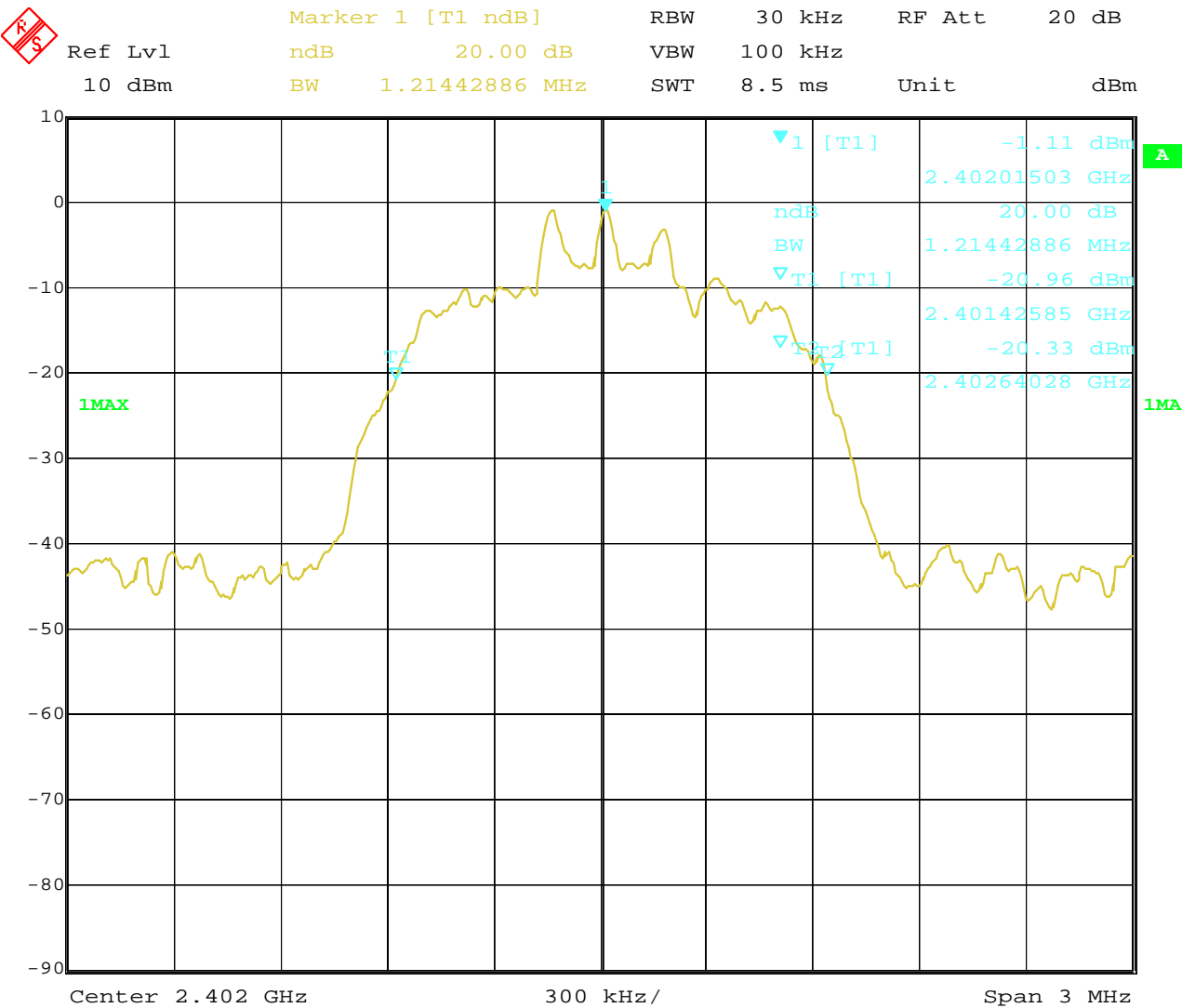
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Test Figure:

1. Condition: Low Channel

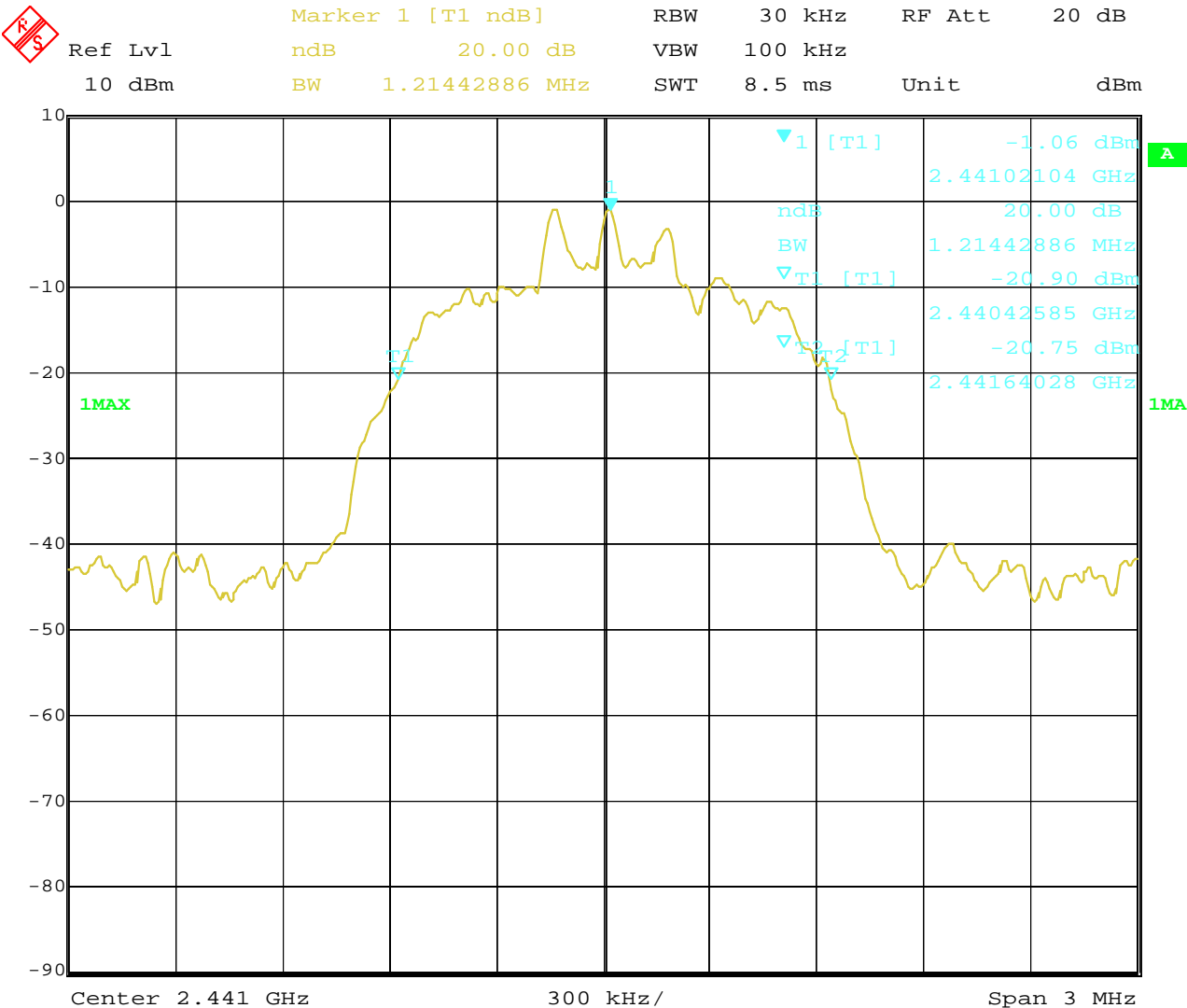


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2. Condition: Middle Channel

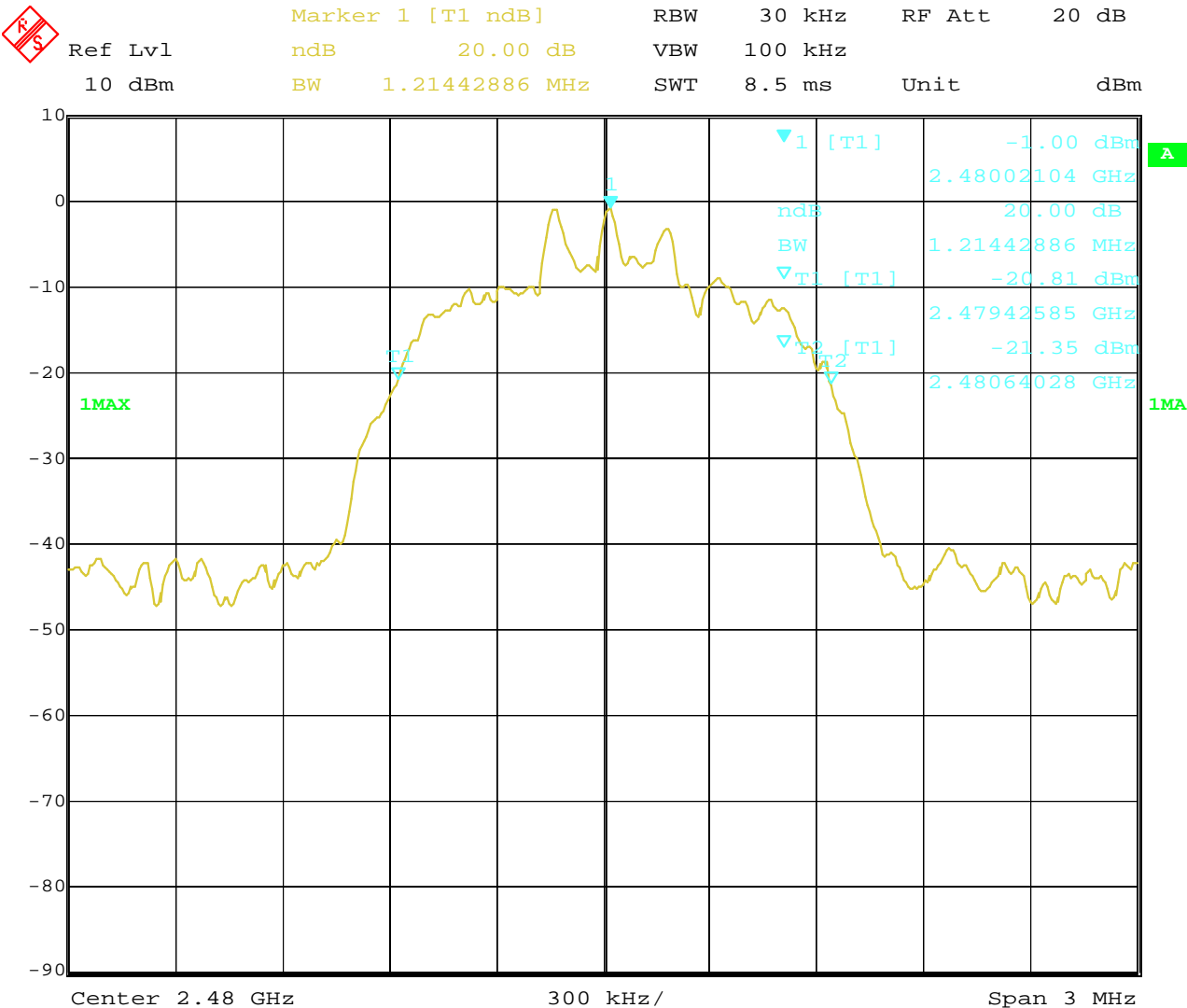


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3. High Channel



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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	Developer Board		Model	DB8
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	2.51	30	Pass
Middle	2441	2.67	30	Pass
High	2480	2.67	30	Pass

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

Max. Power Output = Power Reading + Cable loss + Attenuator

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

##### Type of Modulation: 16QAM

EUT	Developer Board		Model	DB8
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	1.60	30	Pass
Middle	2441	1.71	30	Pass
High	2480	1.71	30	Pass

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

Max. Power Output = Power Reading + Cable loss + Attenuator

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

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**Type of Modulation: 8DPSK**

EUT	Developer Board		Model	DB8
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	1.85	30	Pass
Mid	2441	1.99	30	Pass
High	2480	1.85	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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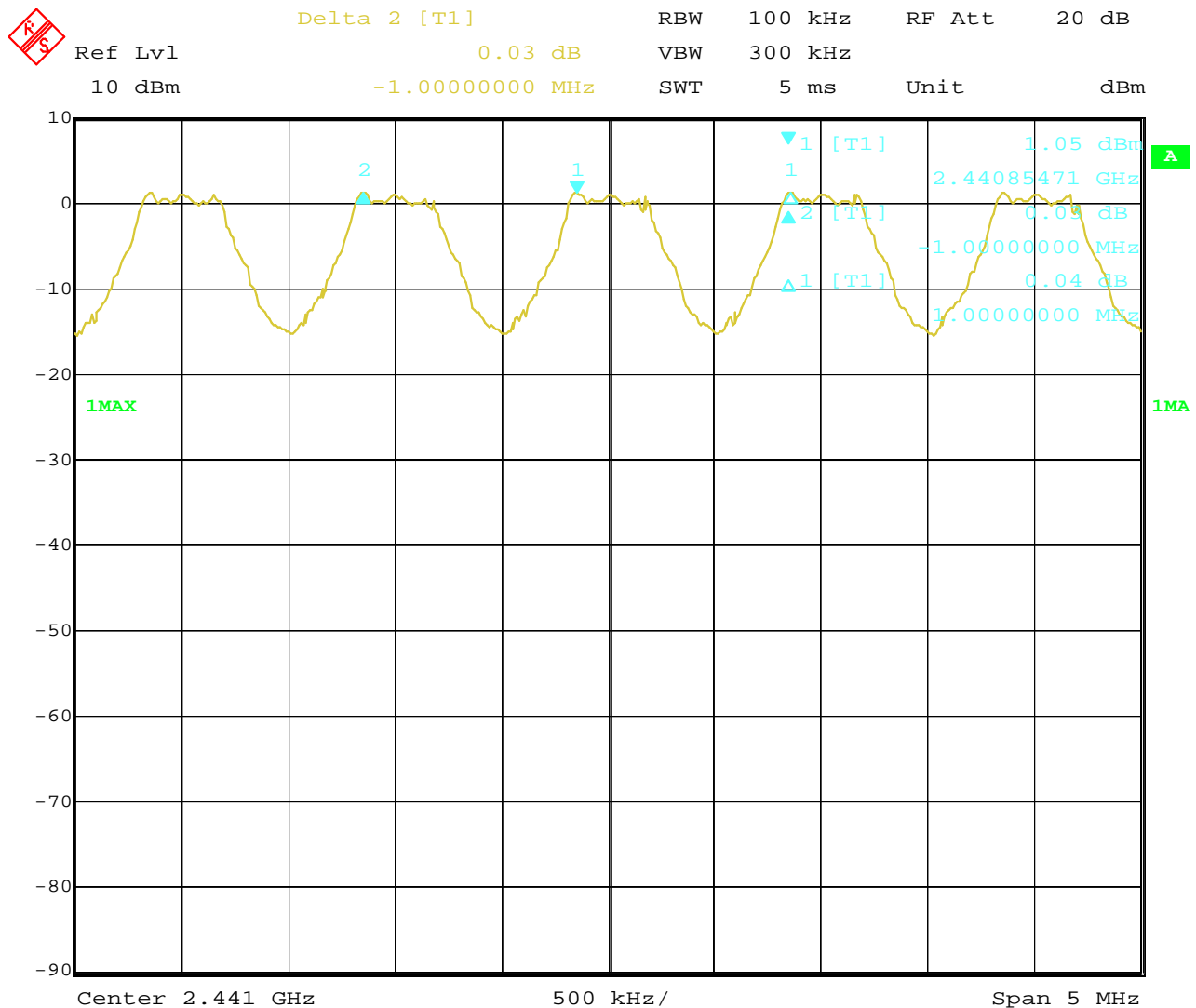


## 9.4 Test Result

### Type of Modulation: GFSK

EUT	Developer Board	Model	DB8
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



Date: 28.MAR.2019 13:47:40

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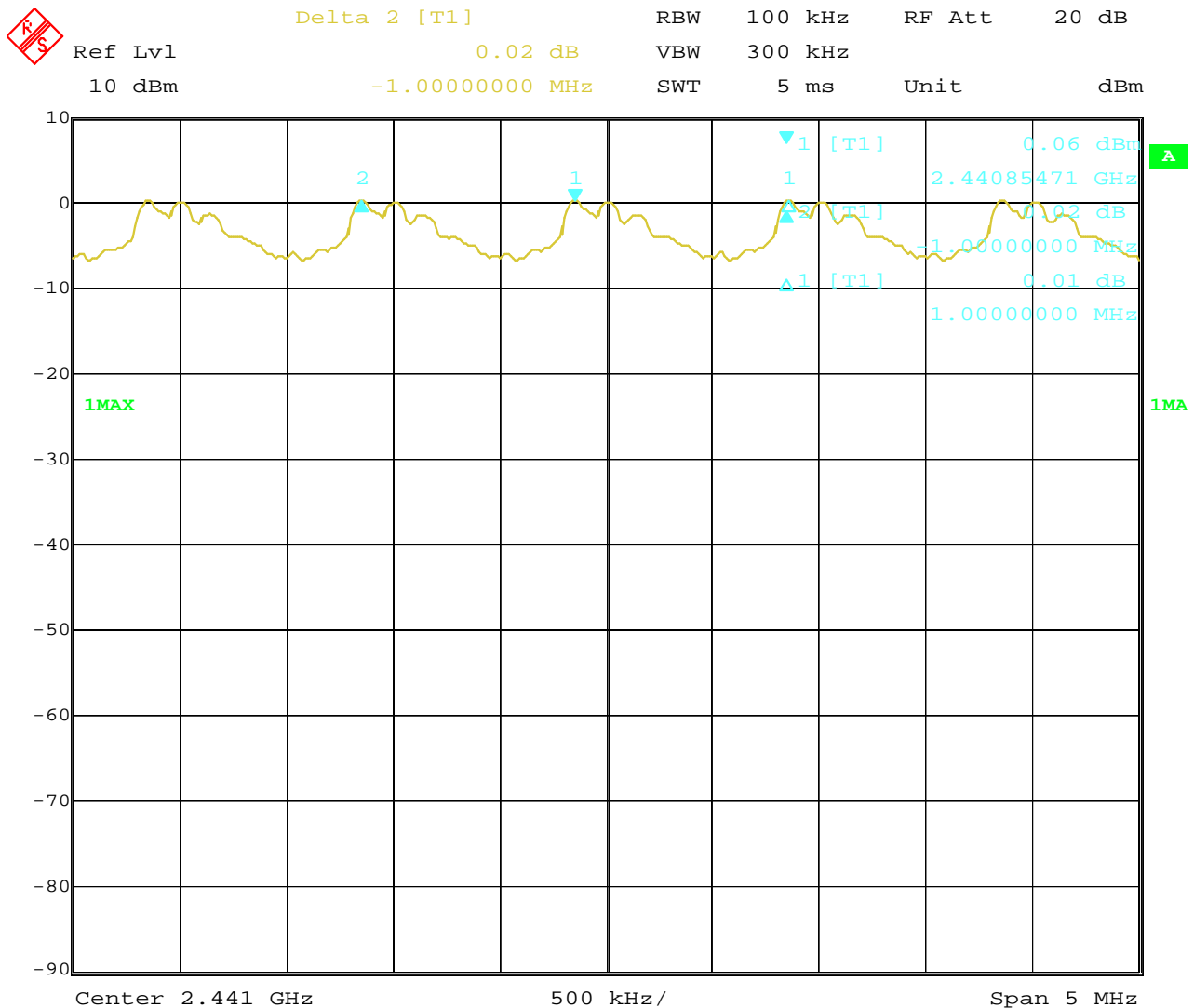
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**Type of Modulation:  $\pi/4$ DQPSK**

EUT	Developer Board	Model	DB8
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**



Date: 28.MAR.2019 16:17:03

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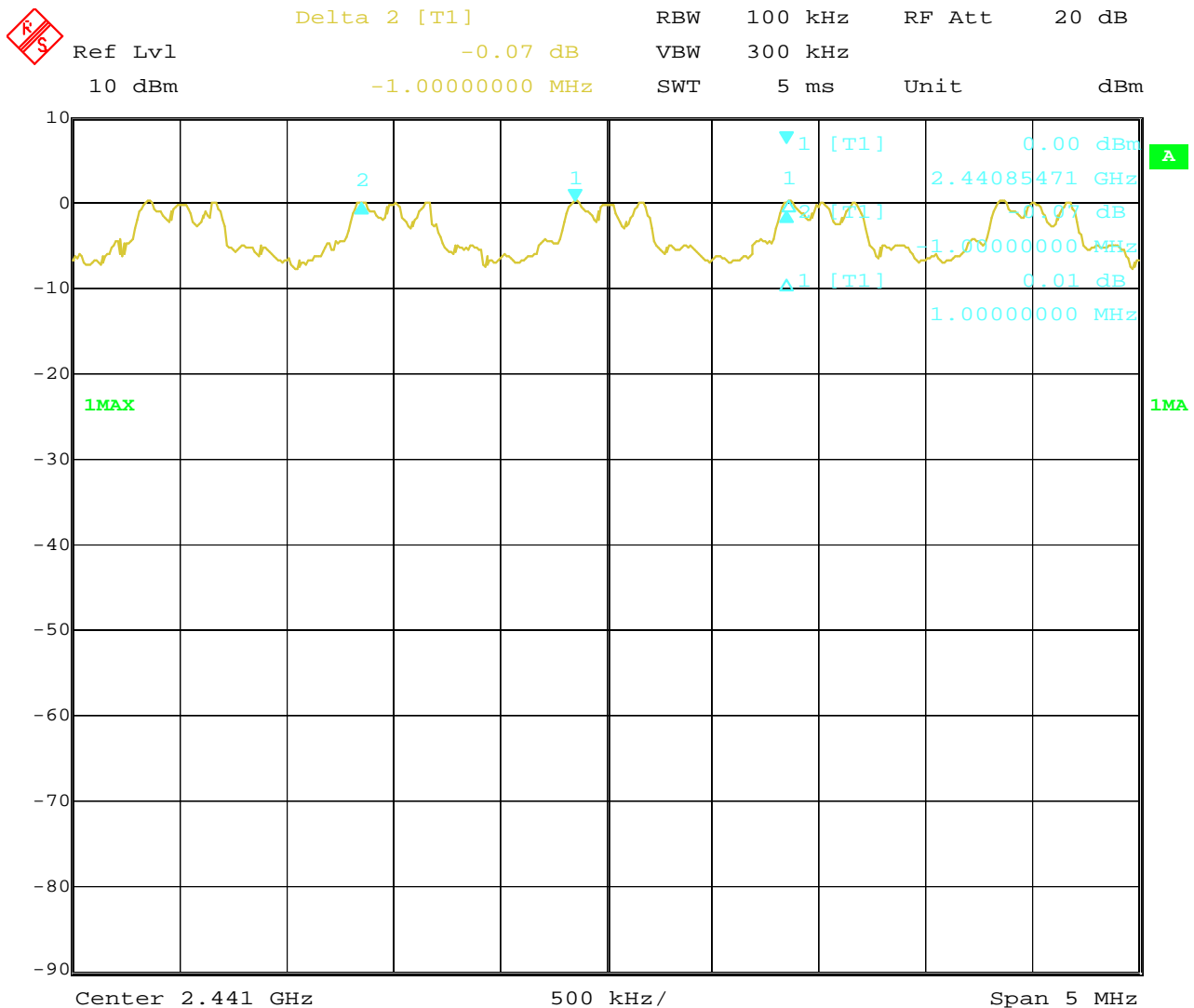
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**Type of Modulation: 8DPSK**

EUT	Developer Board	Model	DB8
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**



Date: 28.MAR.2019 17:27:26

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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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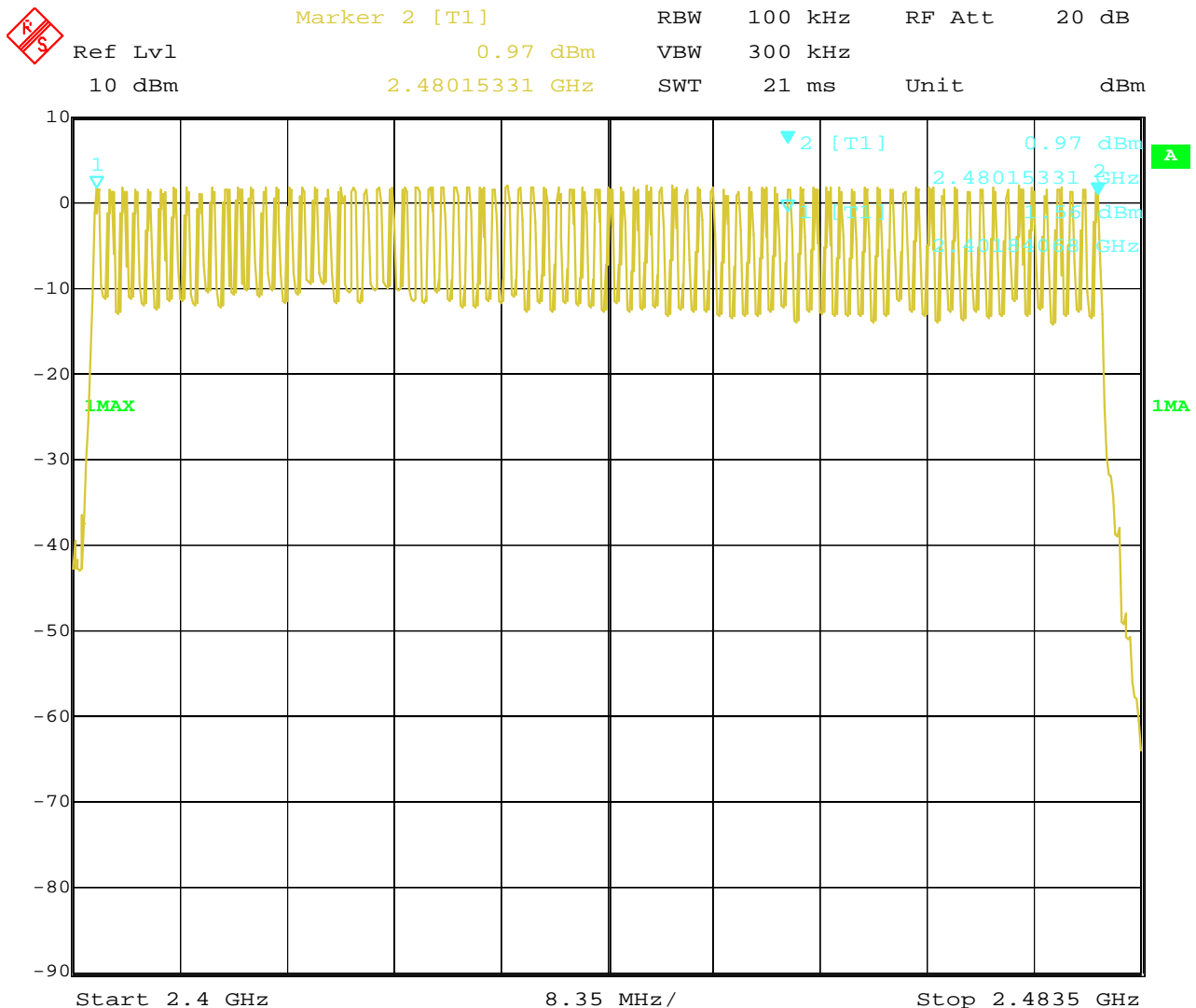


#### 10.4 Test Result

##### Type of Modulation: GFSK

EUT	Developer Board	Model	DB8
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



Date: 28.MAR.2019 13:17:12

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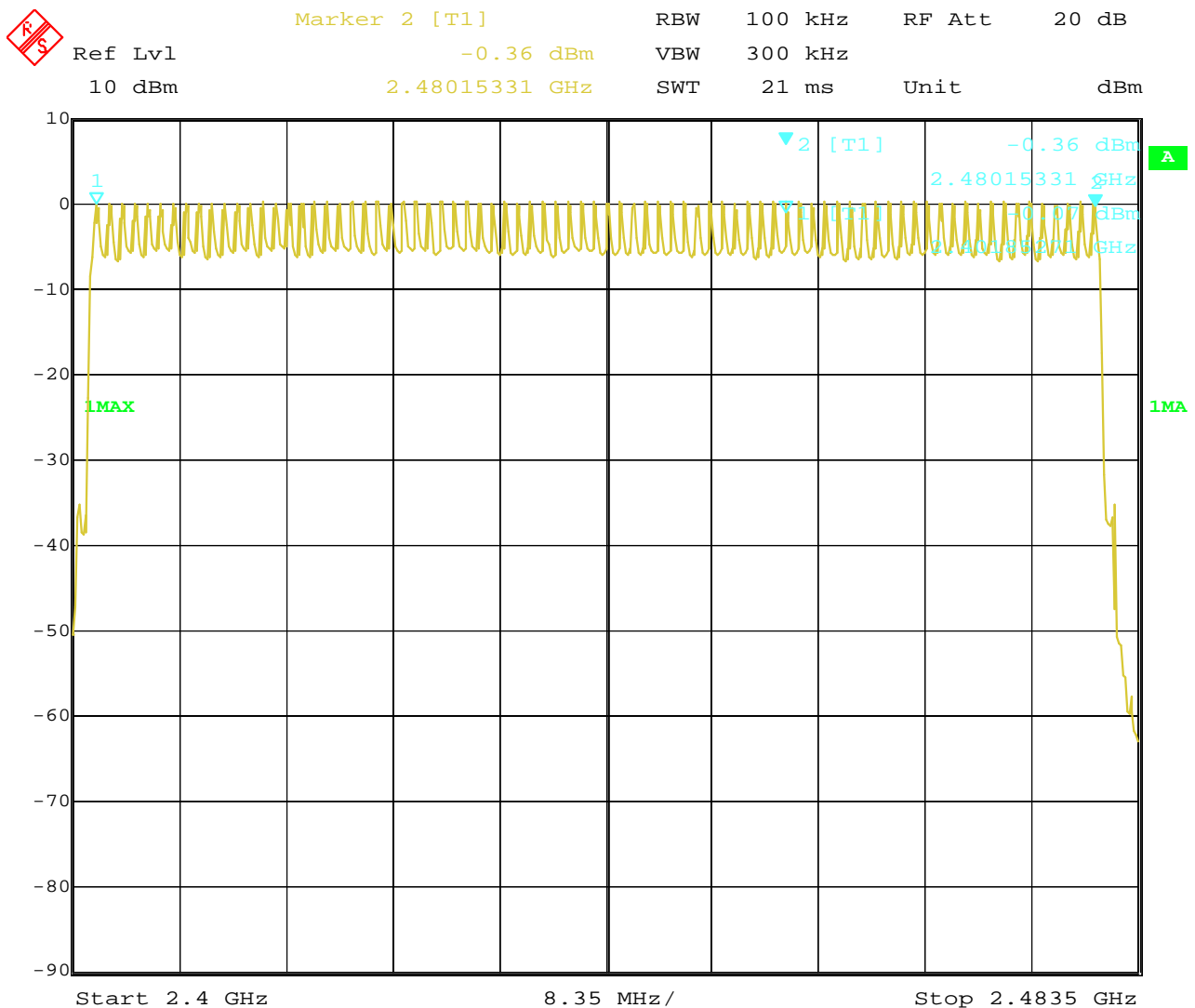
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**Type of Modulation:  $\pi/4$ DQPSK**

EUT	Developer Board	Model	DB8
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**



Date: 28.MAR.2019 16:42:10

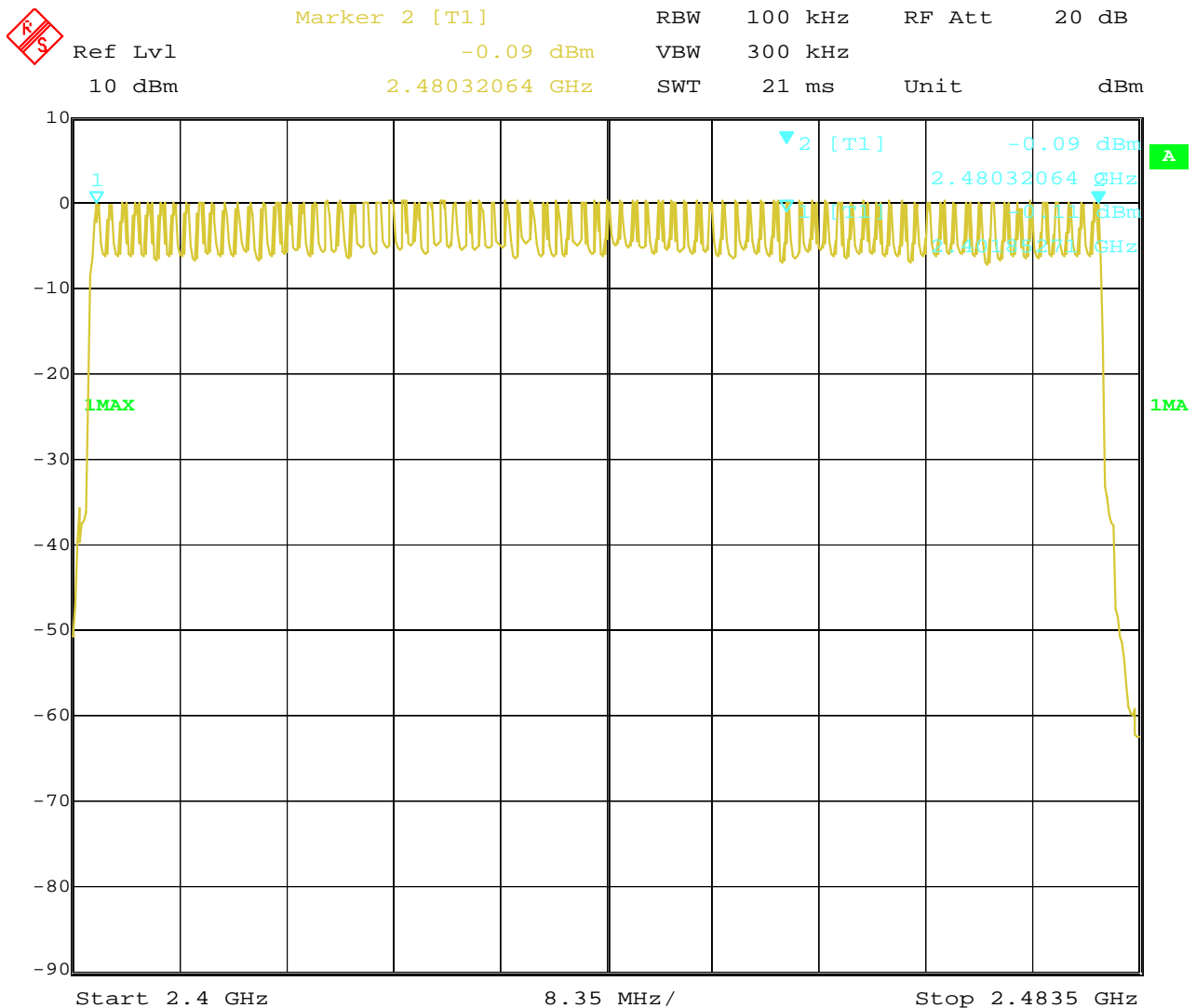
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**Type of Modulation: 8DPSK**

EUT	Developer Board	Model	DB8
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**



Date: 28.MAR.2019 16:50:35

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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		Developer Board		Model	DB8	
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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**DH5**

Date: 29.MAR.2019 11:21:26

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## Test Result

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

EUT		Developer Board		Model		DB8	
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			0.319s	0.4s

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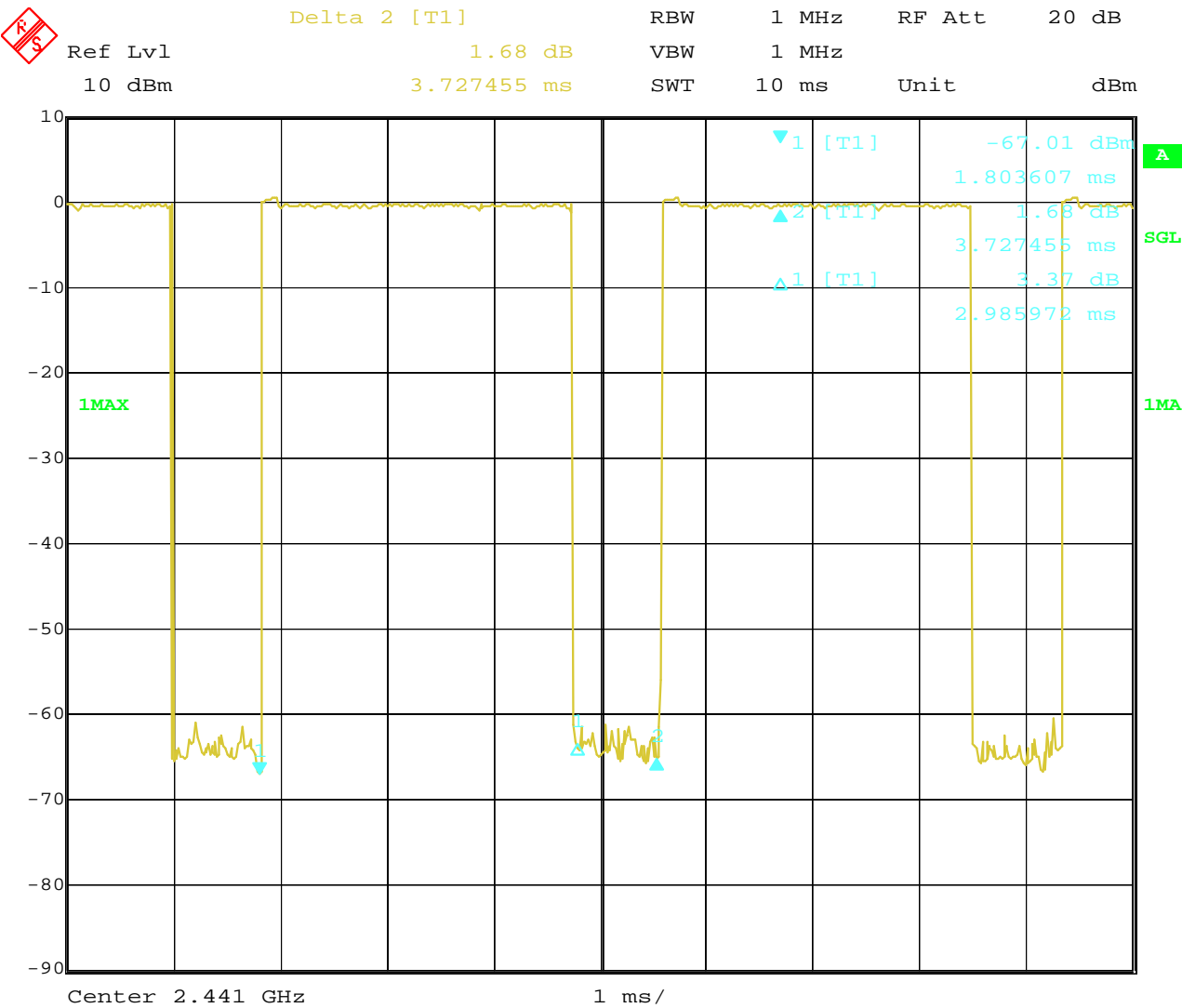
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Test Plots:

2DH5



Date: 29.MAR.2019 11:19:20

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**Type of Modulation: 8DPSK**

EUT		Developer Board		Model		DB8	
Mode		Keep Transmitting		Input Voltage		120V~	
Temperature		24 deg. C,		Humidity		56% RH	
Channel	Reading		Hoping Rate			Actual	Limit
DH5							
Middle	2.966ms		266.667 hop/s			0.316s	0.4s

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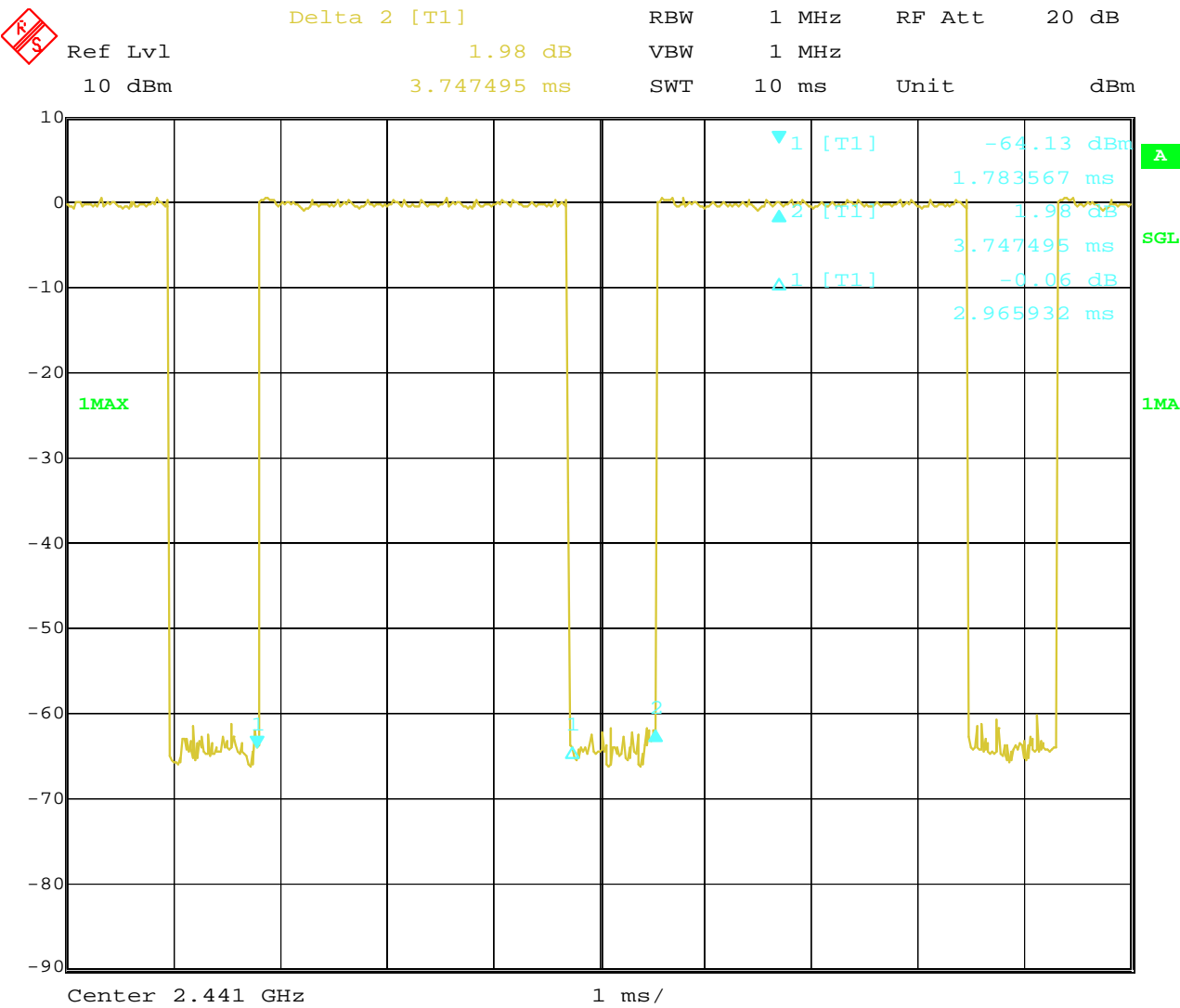
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Test Plots:

3DH5



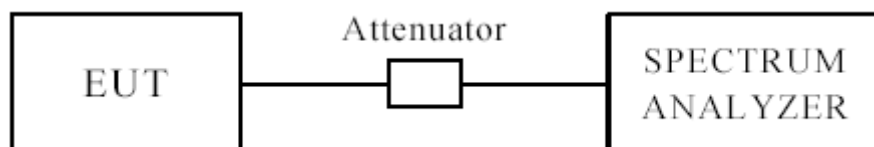
Date: 29.MAR.2019 11:15:24

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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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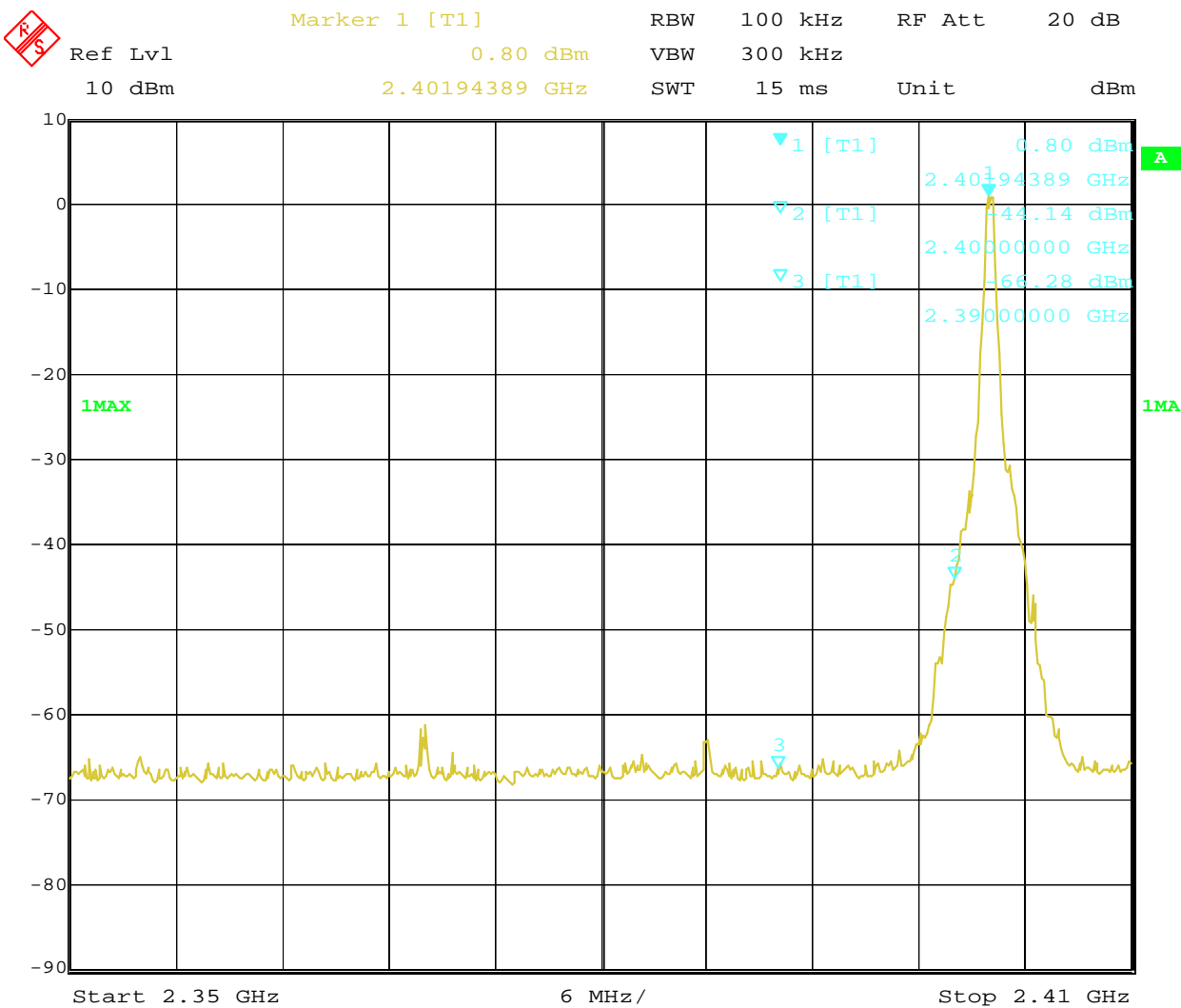
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Type of Modulation: GFSK  
12.4 Band Edge Test Result

Product:	Developer Board	Test Mode:	Low Channel
Mode	Keeping Transmitting	Input Voltage	120V~
Temperature	24 deg. C	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 29.MAR.2019 10:38:05

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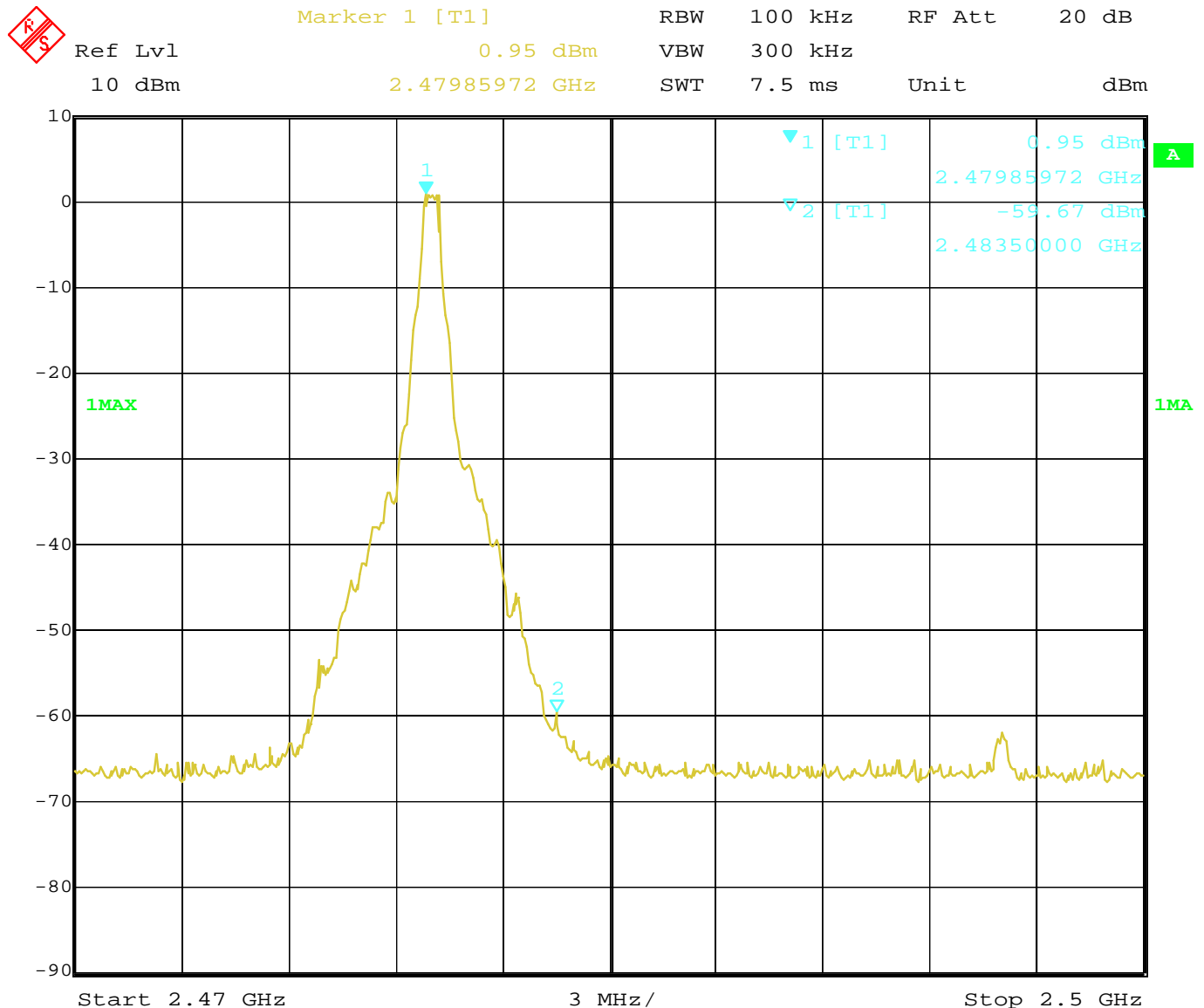


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	High Channel
Mode	Keeping Transmitting	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:37:14

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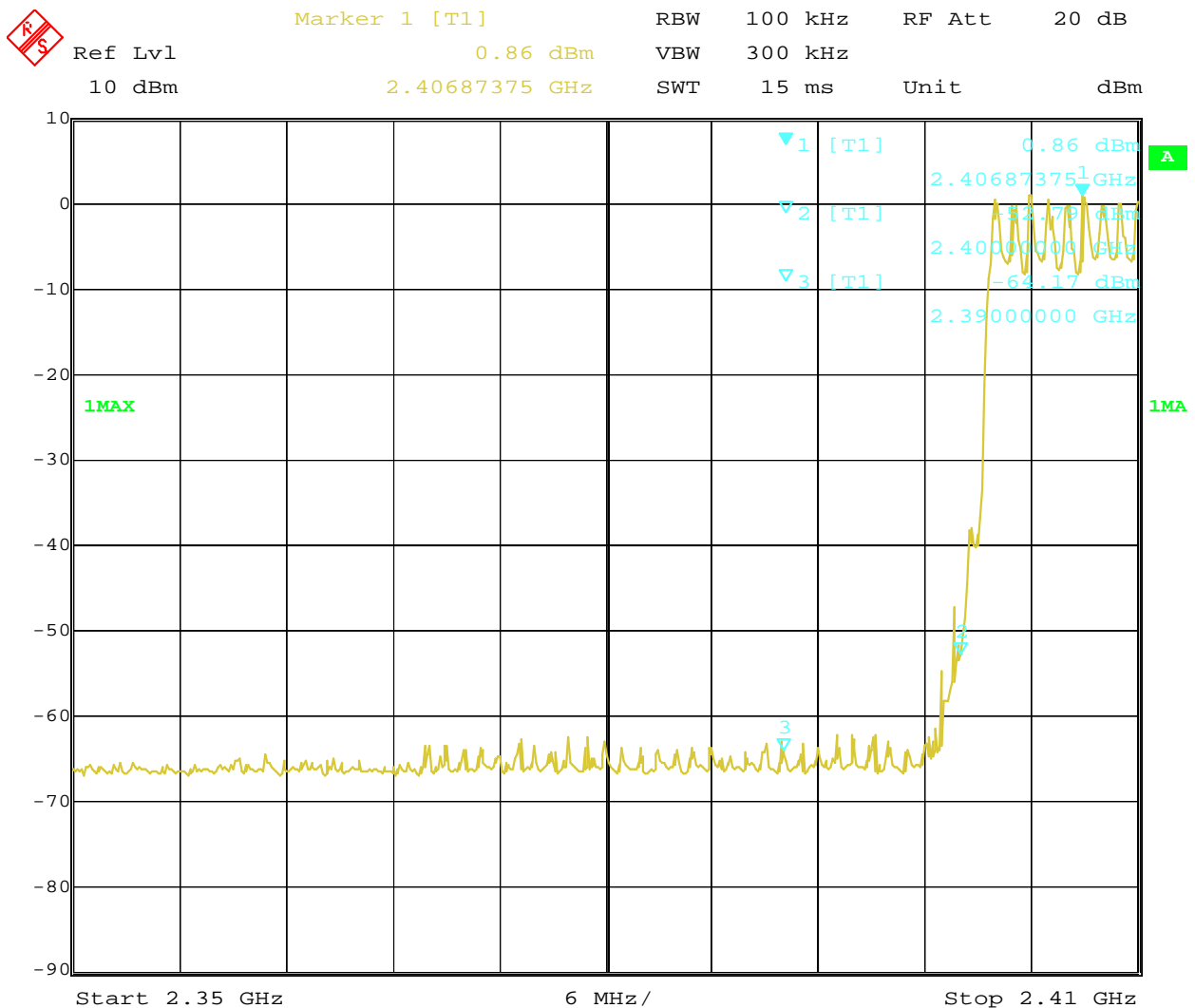


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:12:41

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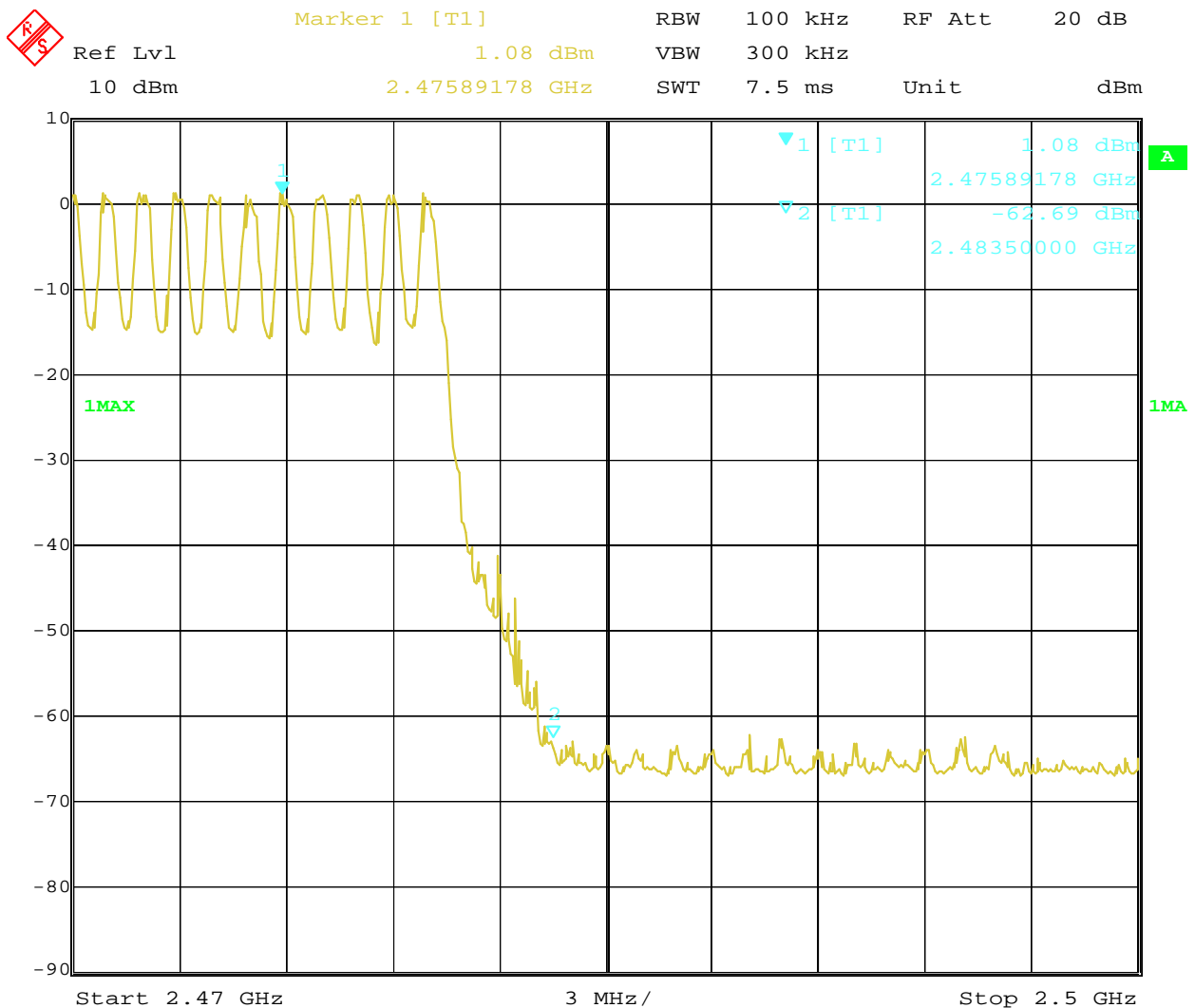


**Type of Modulation: GFSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:16:43

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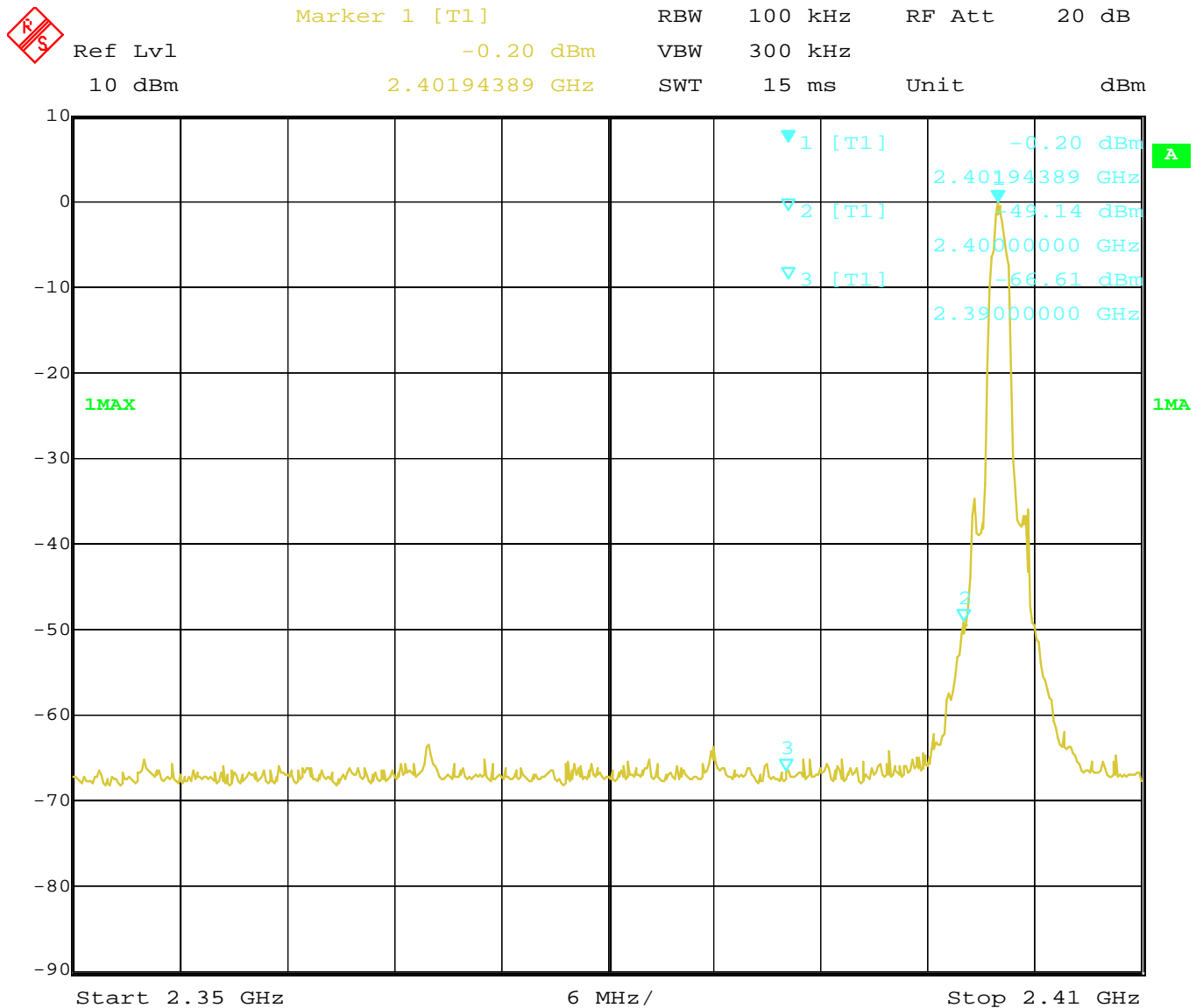


**Type of Modulation:**  $\pi/4$ QPSK

**12.4 Out of Band Test Result**

Product:	Developer Board	Test Mode:	Low Channel
Mode	Keeping Transmitting	Input Voltage	120V~
Temperature	24 deg. C	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:38:35

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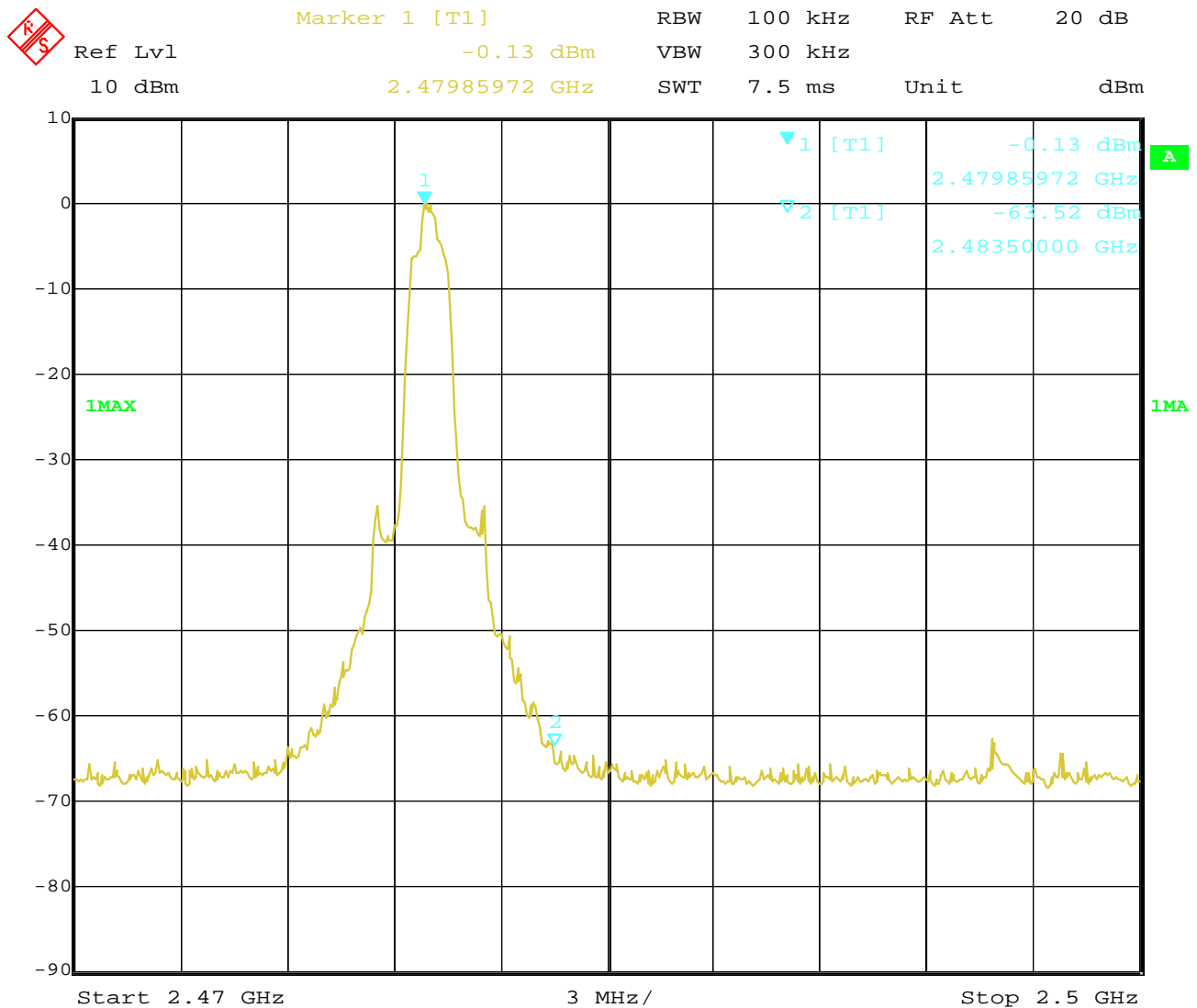


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	High Channel
Mode	Keeping Transmitting	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:35:51

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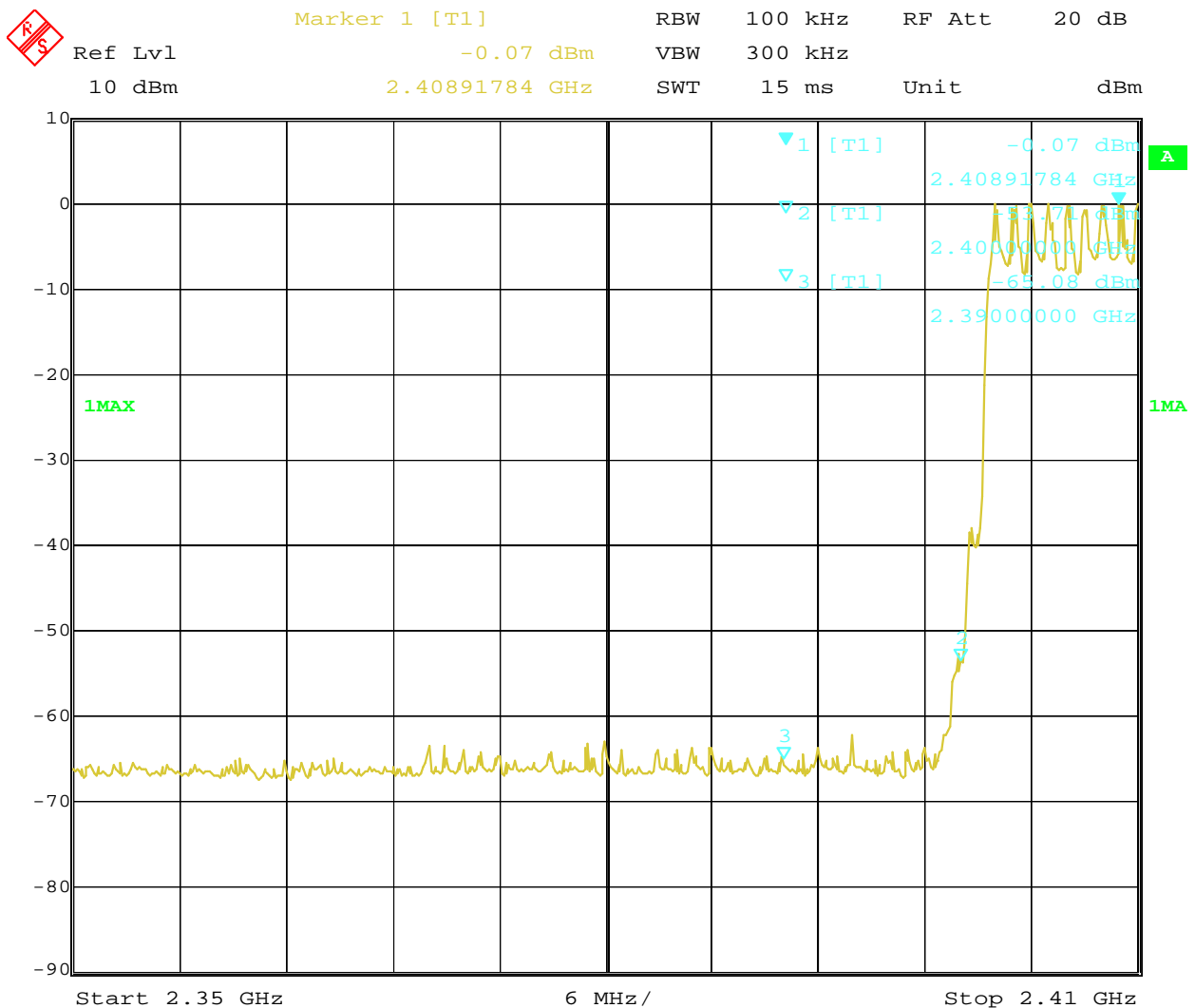


**Type of Modulation:  $\pi/4$ DQPSK**

**12.4 Out of Band Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:11:42

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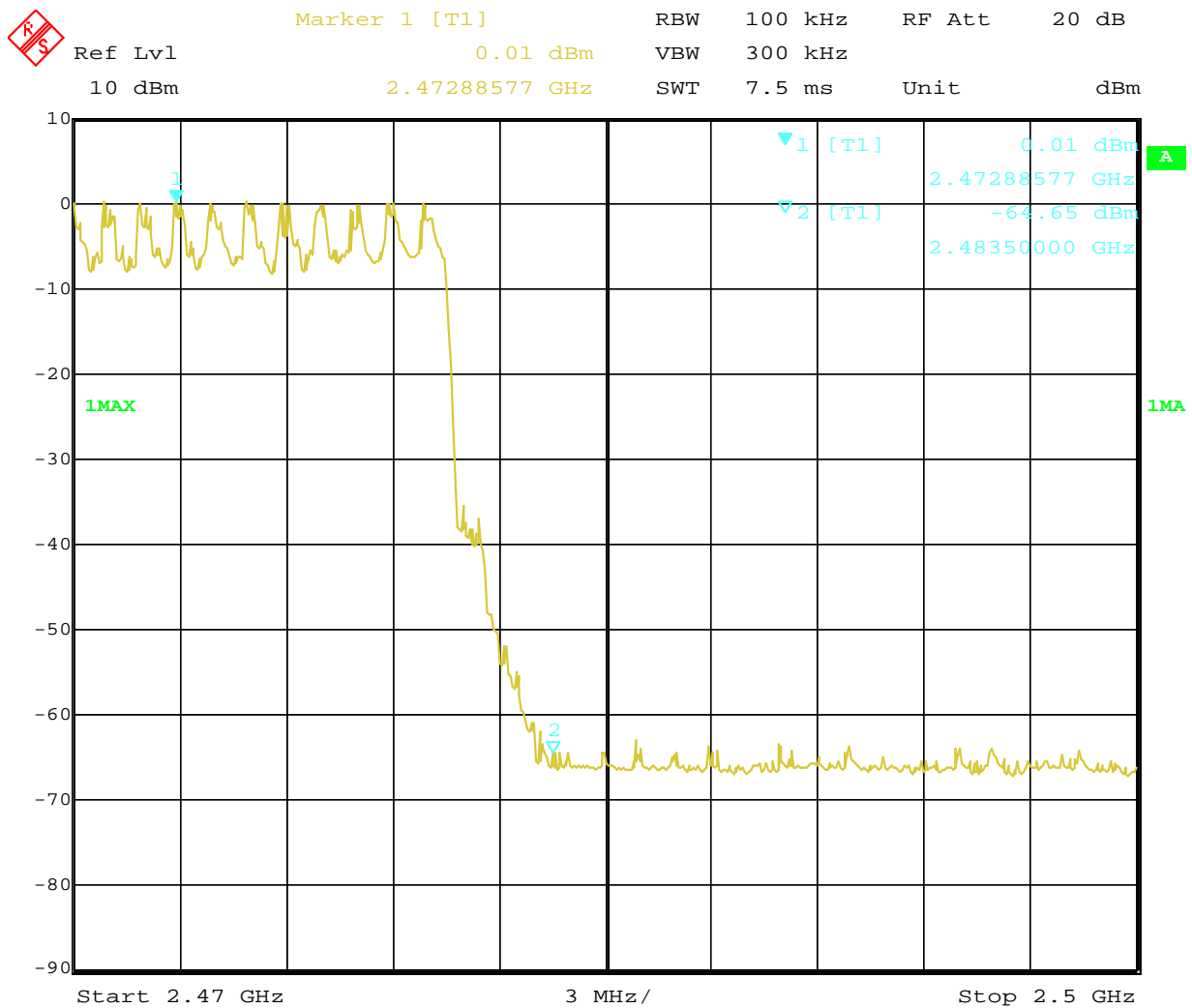


**Type of Modulation:  $\pi/4$ QPSK**

**12.4 Out of Band Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:20:06

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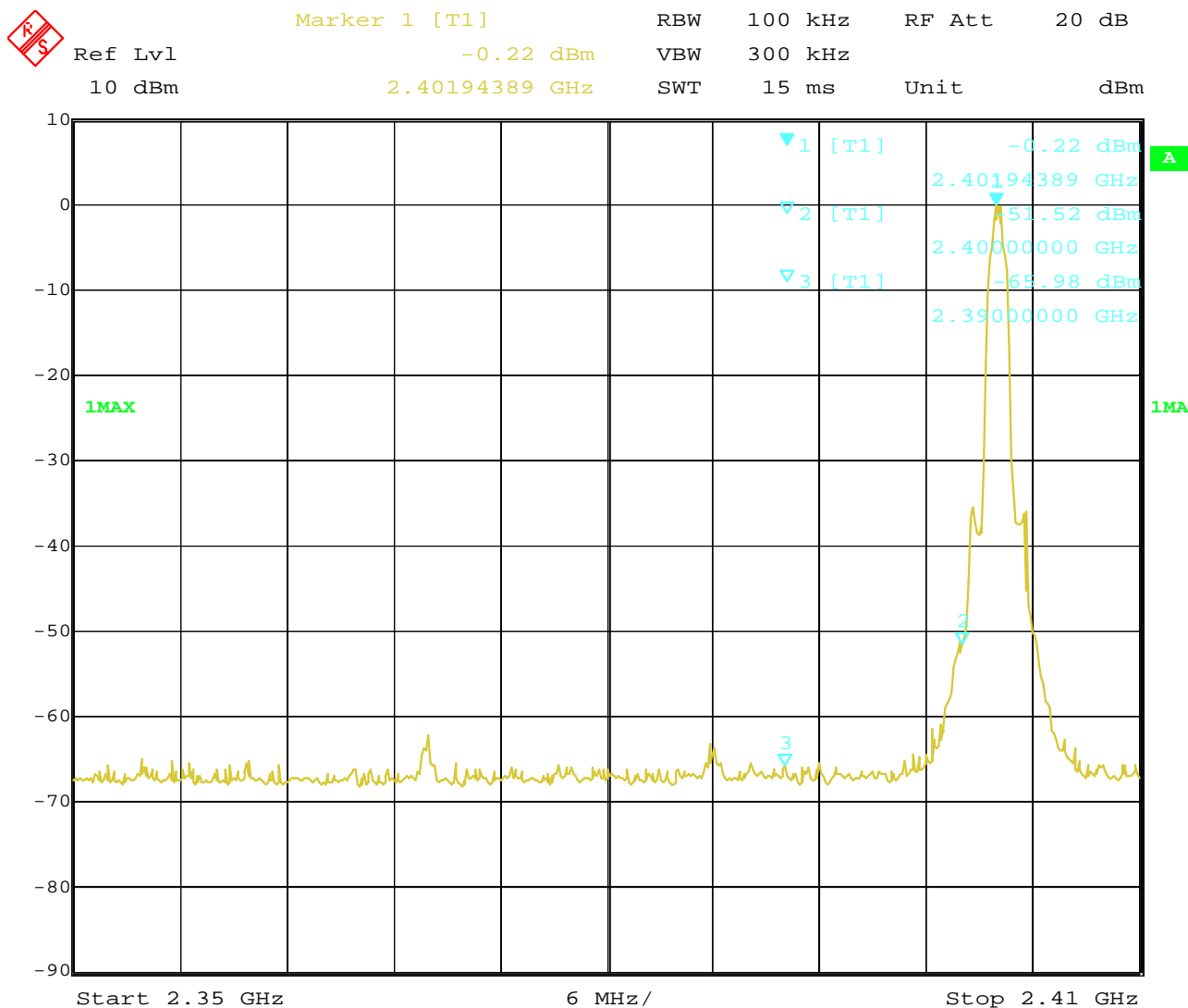


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	Low Channel
Mode	Keeping Transmitting	Input Voltage	120V~
Temperature	24 deg. C	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:39:07

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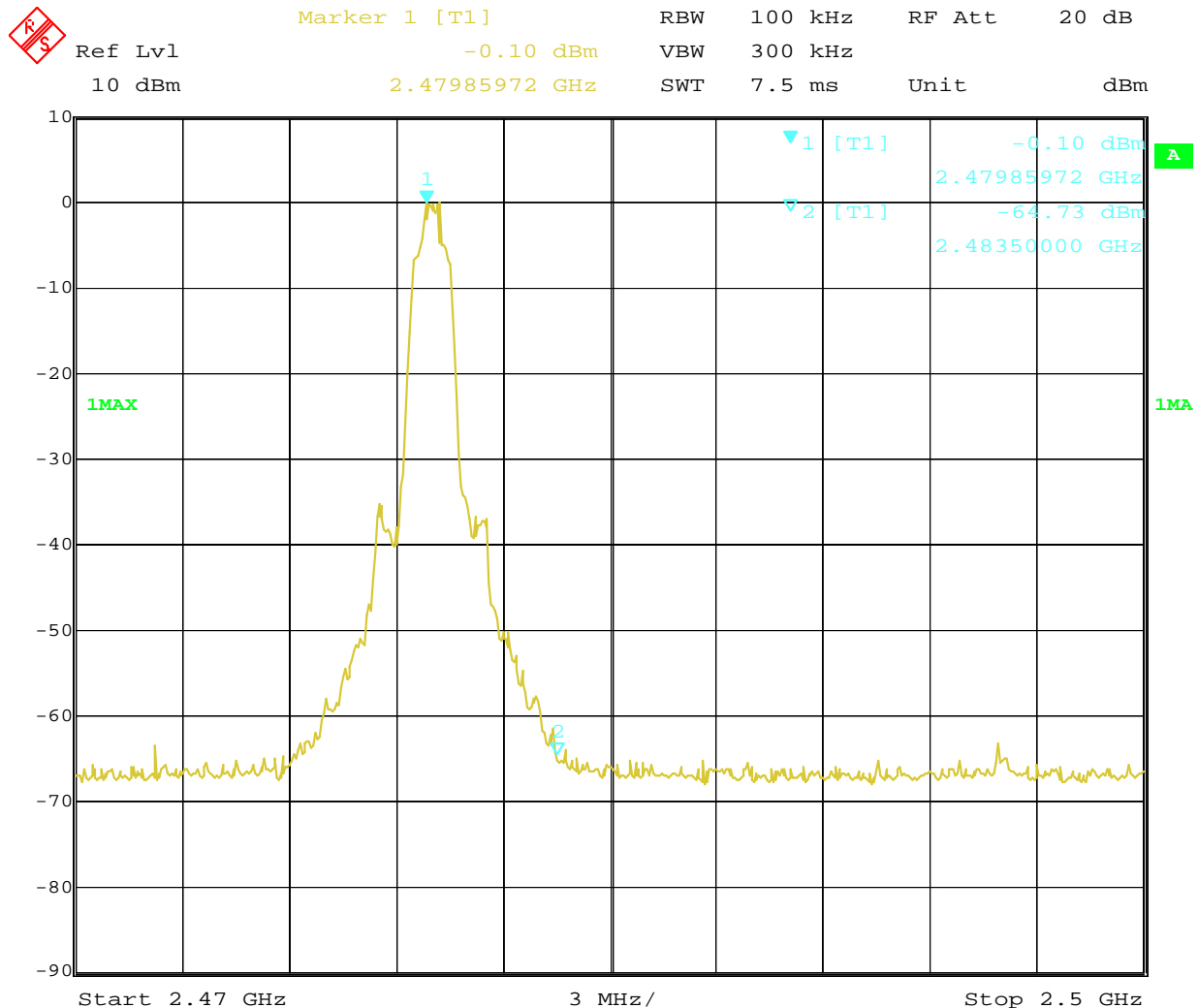


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

Product:	Developer Board		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:**



Date: 29.MAR.2019 10:35:13

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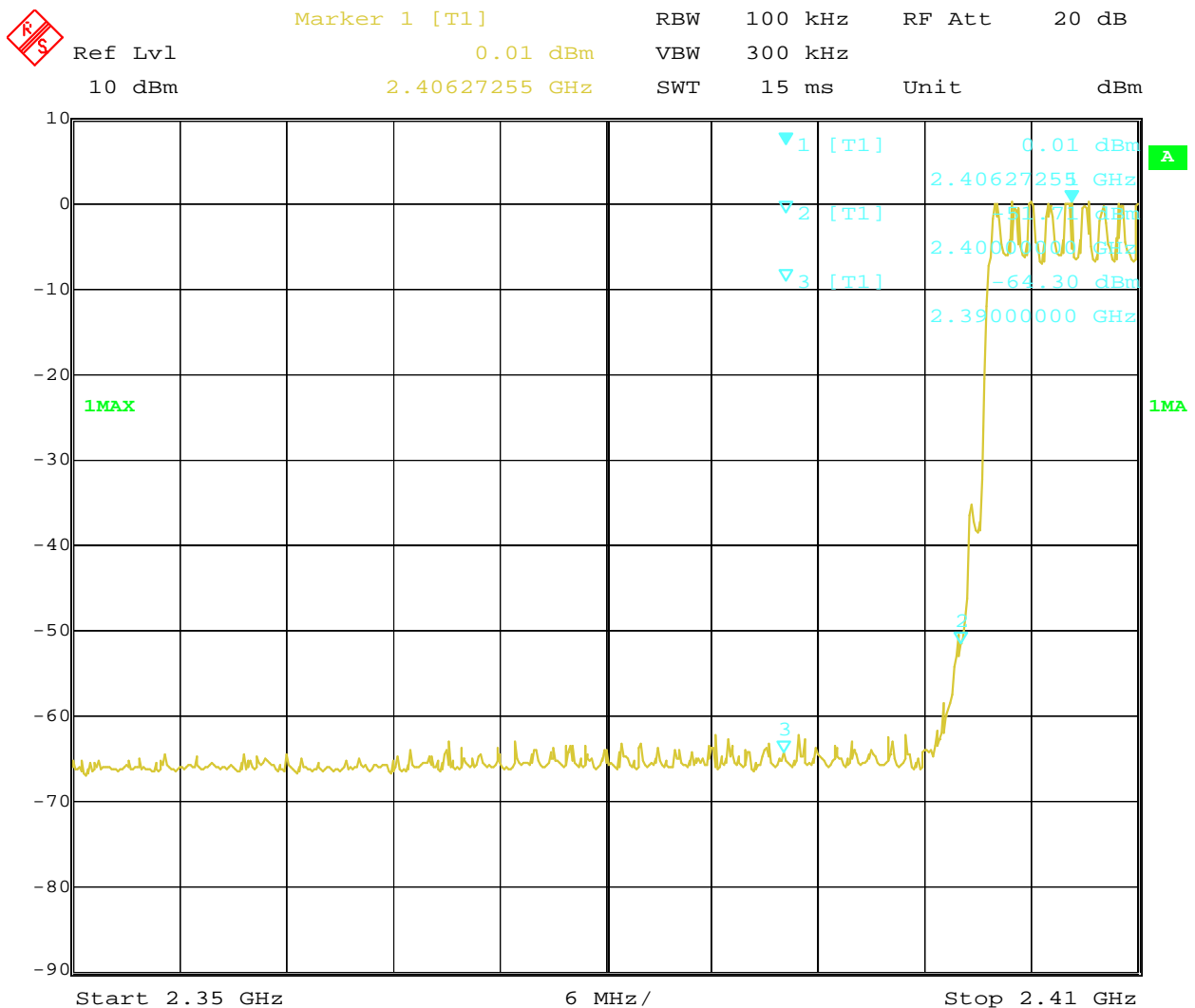


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 29.MAR.2019 10:10:08

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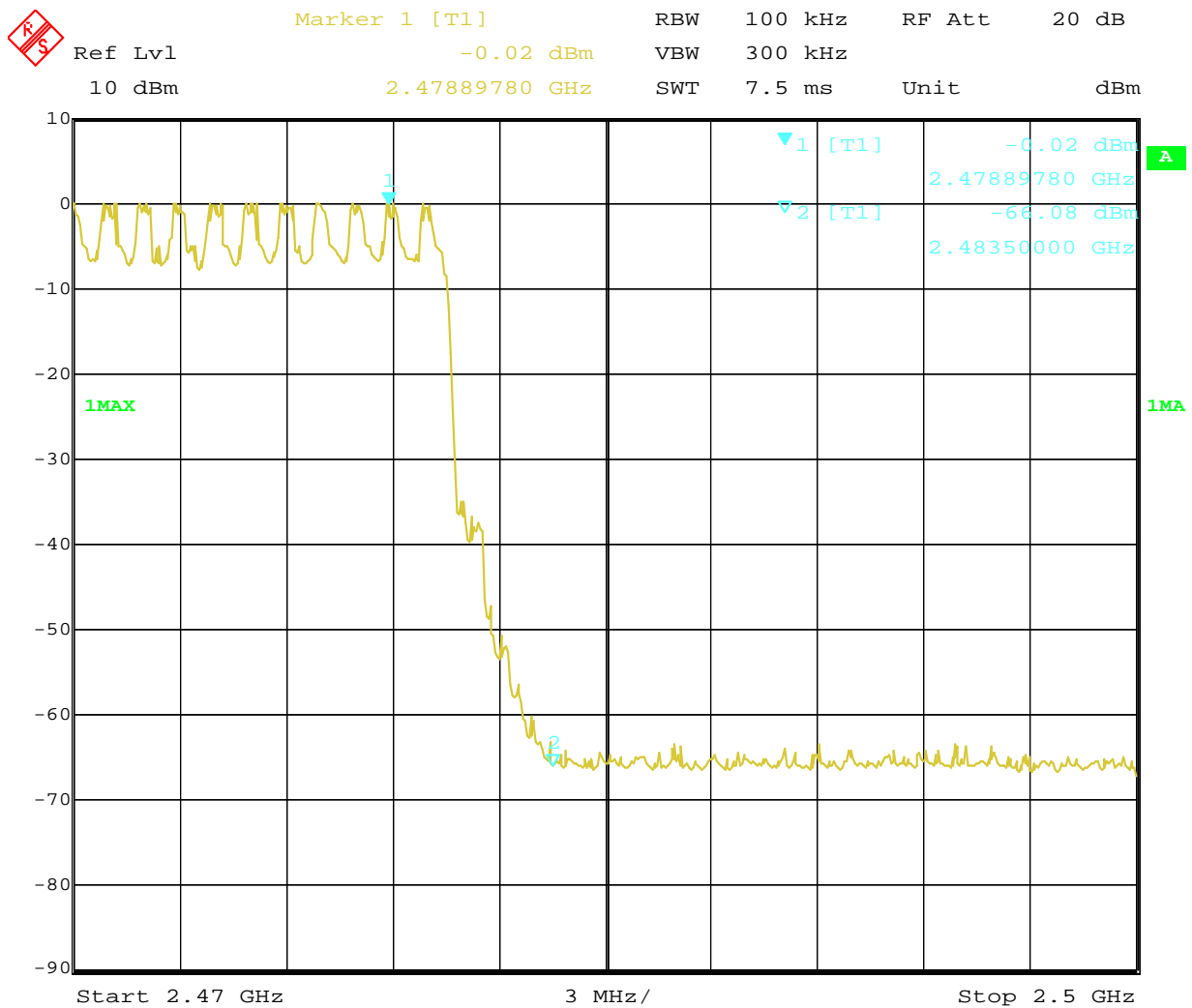


**Type of Modulation: 8DPSK**

**12.4 Band Edge Test Result**

Product:	Developer Board	Test Mode:	Hopping mode
Mode	Hopping On	Input Voltage	120V~
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

**Test Figure:**



Date: 28.MAR.2019 17:59:20

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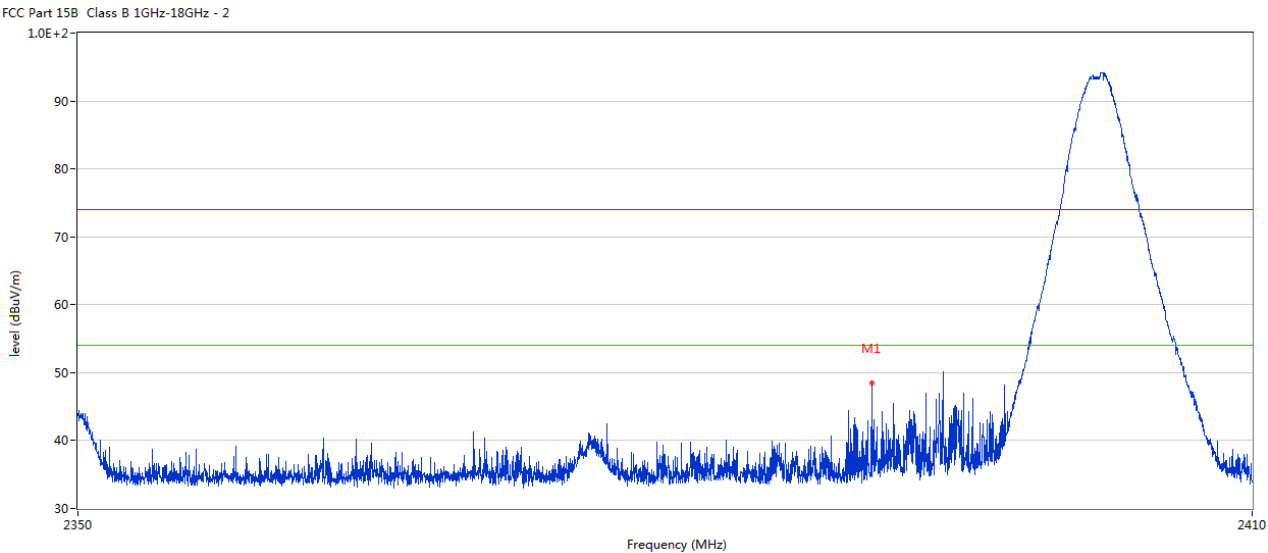
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12.4 Restrict Band Measurement

EUT	Developer Board	Model	DB8
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	48.53	-3.53	74.0	-25.47	Peak	166.00	100	H	Pass

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

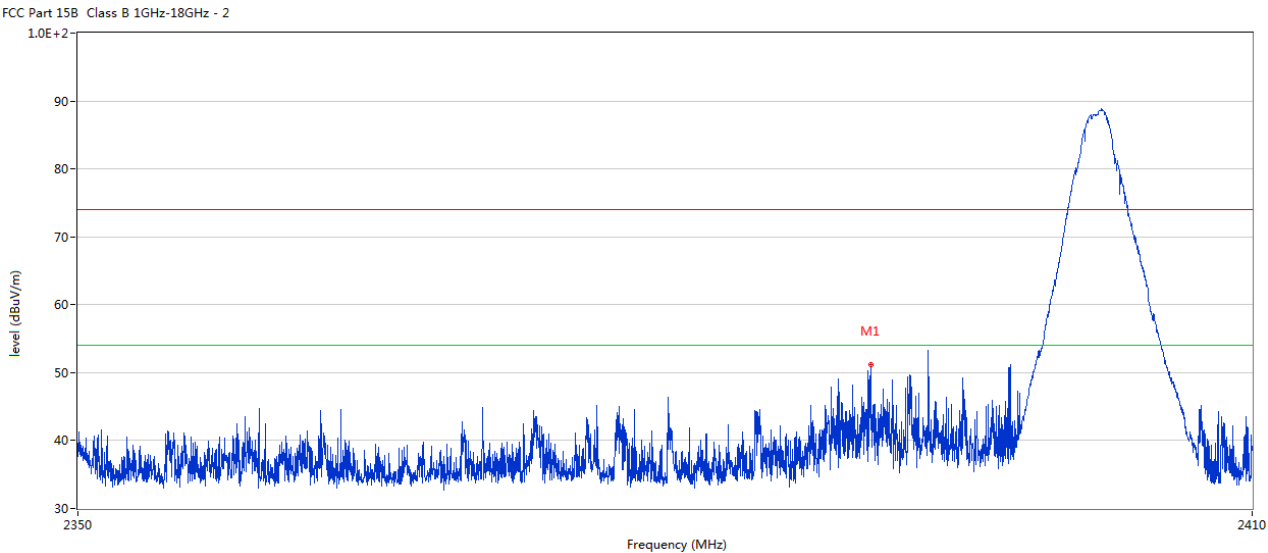
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12.4 Restrict Band Measurement

EUT	Developer Board	Model	DB8
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	51.14	-3.53	74.0	-22.86	Peak	112.00	100	V	Pass

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

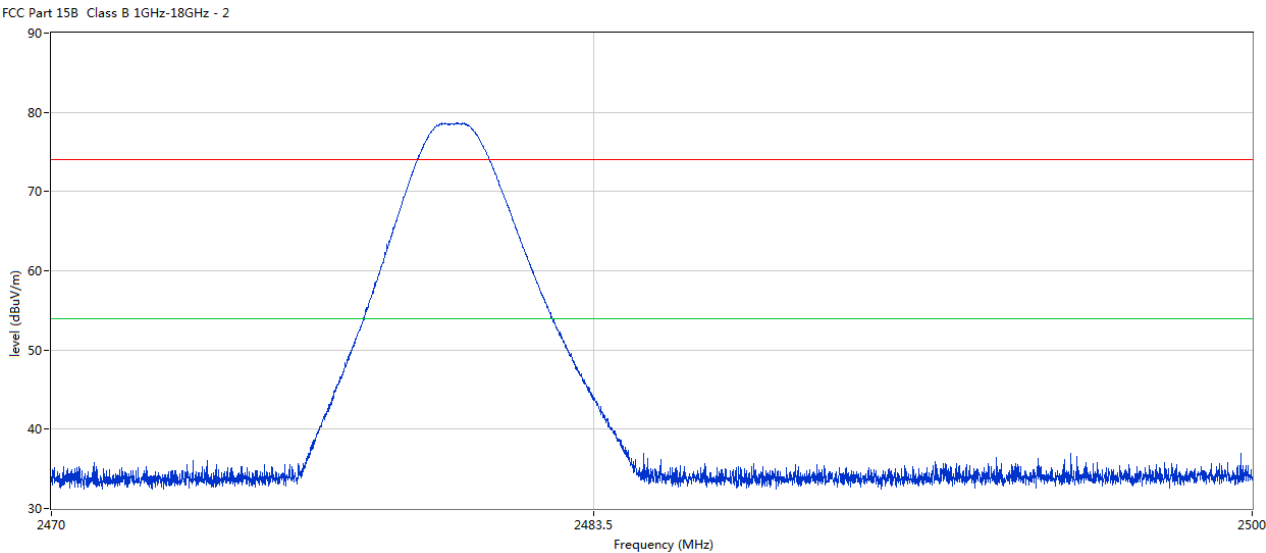
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12.4 Restrict Band Measurement

EUT	Developer Board	Model	DB8
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	2483.5	44.19	-3.57	74.0	-29.81	Peak	62.00	100	H	Pass

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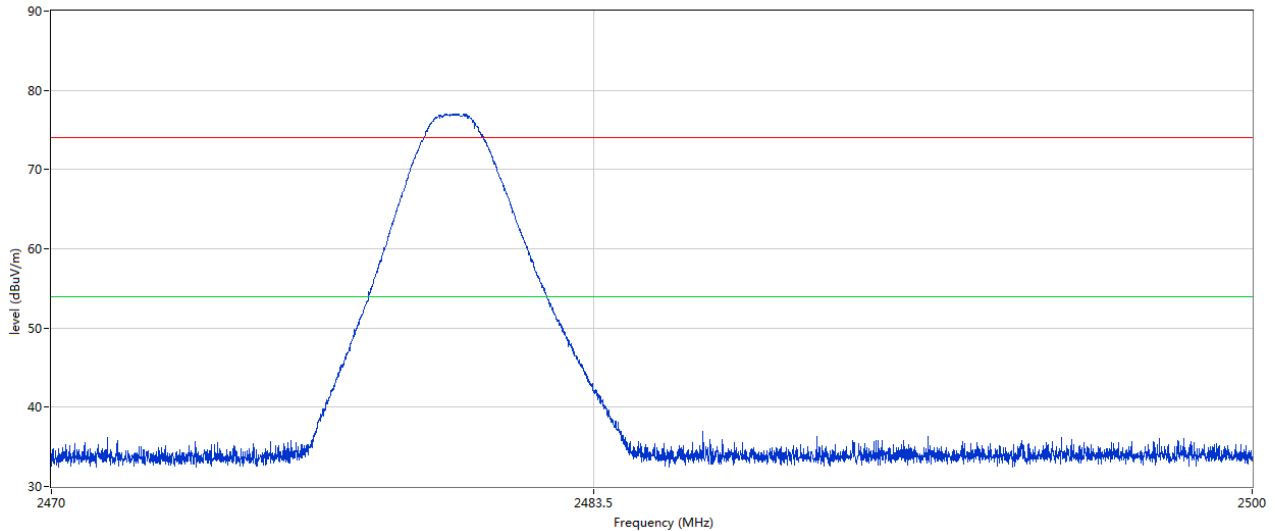
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#### 12.4 Restrict Band Measurement

EUT	Developer Board	Model	DB8
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	2483.5	42.56	-3.57	54.0	-31.44	Peak	269.00	100	V	Pass

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

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**

One External antenna with reversed polarity non standard unique antenna port. The gain of the antennas is 2.0dBi .

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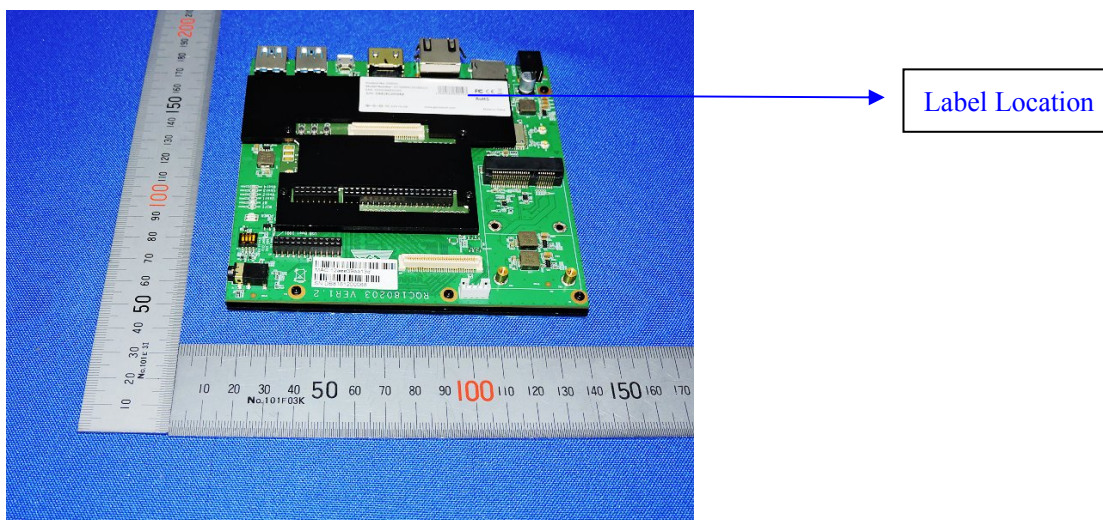
#### 14.0 FCC ID Label

##### FCC ID: ZJU-D19EC5

**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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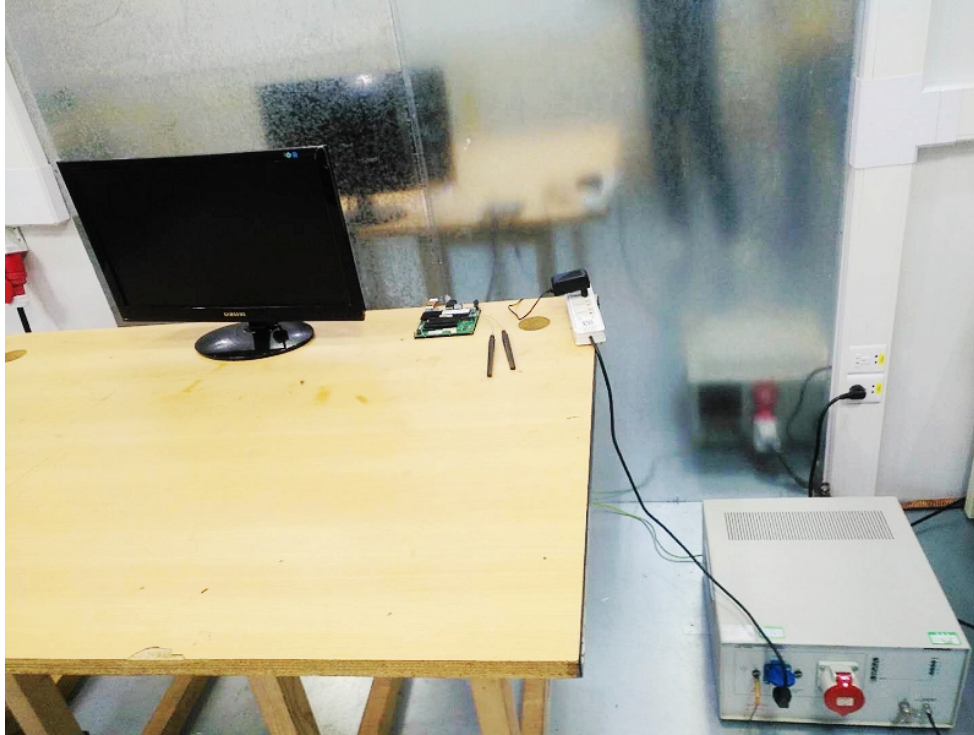
This report is issued in confidence to the client and it will be strictly treated as such by the SHENZHEN TIMEWAY TESTING LABORATORIES. It may not be reproduced rather in its entirety or in part and it may not be used for advertising. The client to whom the report is issued may, however, show or send 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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## 15.0 Photo of testing

Conducted Emission Test Setup:



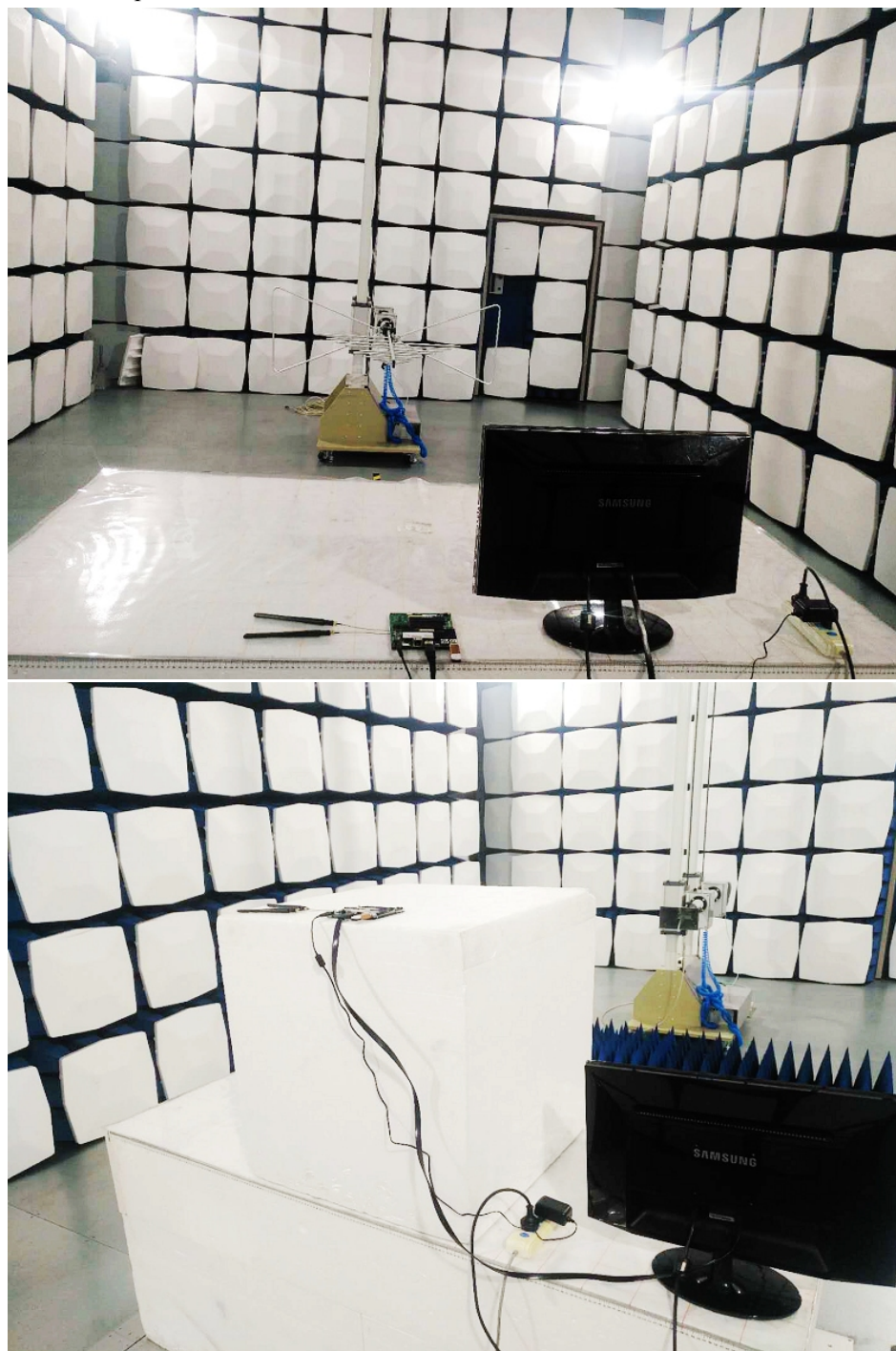
The report refers only to the sample tested and does not apply to the bulk.

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**Radiated Emission Test Setup:**



**Photographs – EUT**

Please see test report EMC1903224-01

**End of Report**

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