



# FCC PART 15.247 TEST REPORT

For

## CROSBY LIMITED

Room 201B Floor 2, Lee Wai Commercial Building, 1-3 Hart Avenue, T.S.T., Kowloon,  
Hong Kong

**FCC ID: 2AFBHSP821**

<b>Report Type:</b> Original Report	<b>Product Name:</b> Bluetooth Speaker
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<b>Report Number:</b> <u>RDG161024801</u>	
<b>Report Date:</b> <u>2016-11-04</u>	
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## GENERAL INFORMATION

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### Product Description for Equipment under Test (EUT)

The **CROSBY LIMITED**'s product, model number: **IQ-1418BTL (FCC ID:2AFBHSP821)** (the "EUT") in this report was a **Bluetooth Speaker**, which was measured approximately: 25.5 cm (L) x 12.8 cm (W) x 13.6 cm (H), rated input voltage: DC3.8V from battery.

*Note: The series product, model IQ-1418BTL, CR-S16586BT, SA-S16586BT are electrically identical, the difference between them is the model name, we selected IQ-1418BTL for fully testing, the details was explained in the attached declaration letter.*

*\*All measurement and test data in this report was gathered from final production sample, serial number: 161024801 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2016-10-24, and EUT conformed to test requirement.*

### Objective

This report is prepared on behalf of **CROSBY LIMITED** in accordance with Part 2, Subpart J, Part 15, Subparts A, B and C of the Federal Communications Commission's rules

The tests were performed in order to determine the Bluetooth BDR and EDR mode of EUT compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

N/A

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Chengdu). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

The uncertainty of any RF tests which use conducted method measurement is  $\pm 3.17$  dB, the uncertainty of any radiation on emissions measurement is:

30M~200MHz:  $\pm 4.7$  dB;  
200M~1GHz:  $\pm 6.0$  dB;  
1G-6GHz:  $\pm 5.13$  dB;  
6G~25GHz:  $\pm 5.47$  dB;

And the uncertainty will not be taken into consideration for all test data recorded in the report.

## **Test Facility**

The test site used by BACL to collect test data is located in the 5040, HuiLongWan Plaza, No. 1, ShaWan Road, JinNiu District, ChengDu, China

Test site at BACL has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on April 24, 2015. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 560332. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in engineering mode.

The device only support Bluetooth BDR(GFSK) and EDR( $\pi/4$ -DQPSK) mode, EDR(8DPSK) can't support.

### EUT Exercise Software

The software ' FCCAssit 1.5' was used during testing, the system configured maximum output power as default setting. The software is only for changing channel and modes.

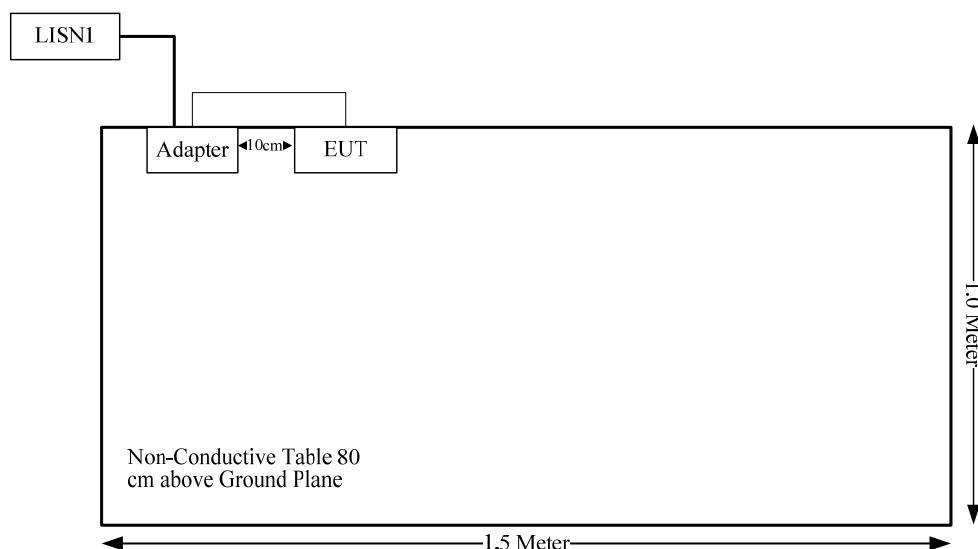
### Equipment Modifications

No modification was made to the EUT.

### External Cable

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	Yes	No	0.85	USB Port of Adapter	EUT

### Block Diagram of Test Setup



## **SUMMARY OF TEST RESULTS**

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<b>FCC Rules</b>	<b>Description of Test</b>	<b>Result</b>
FCC §15.247 (i) & §1.1310 & §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	Conducted Emissions	Compliance
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(1)	20 dB Bandwidth	Compliance
§15.247(a)(1)	Channel Separation Test	Compliance
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliance
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliance
§15.247(b)(1)	Peak Output Power Measurement	Compliance
§15.247(d)	Band Edges	Compliance

## **FCC §15.247 (i) & §1.1310 & §2.1093- RF EXPOSURE**

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### **Applicable Standard**

According to §15.247(i) and §1.1310, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

### **Measurement Result**

The maximum tune-up power including tolerance is -2.0 dBm(0.63mW).

$[(\text{max. power of channel, mW})/(\text{min. test separation distance, mm})][\sqrt{f(\text{GHz})}]$   
 $= 0.63/5 \cdot (\sqrt{2.480}) = 0.2 < 3.0$

**So the SAR evaluation is not necessary.**



## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to FCC § 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### **Antenna Connector Construction**

The EUT has one internal antenna arrangement for buletooth and the antenna gain is -3.0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

## **FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS**

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### **Applicable Standard**

FCC§15.207

### **Measurement Uncertainty**

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

–non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit;

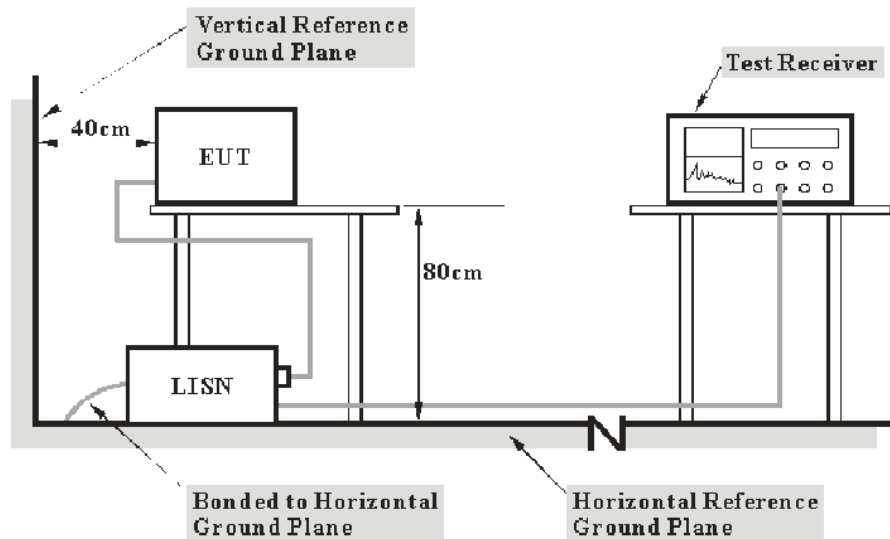
–non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2:2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Chengdu) is  $\pm 3.17$  dB (150 kHz to 30 MHz).

Table 1 – Values of  $U_{cisp}$

Measurement	$U_{cisp}$
Conducted disturbance at mains port using AMN (150 kHz to 30 MHz)	3.4 dB

## EUT Setup



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

The adapter was connected to a 120 V/60 Hz AC power source.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

## Test Procedure

During the conducted emission test, the adapter was connected to the outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

## Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

Herein,

$V_C$ : corrected voltage amplitude

$V_R$ : reading voltage amplitude

$A_C$ : attenuation caused by cable loss

VDF: voltage division factor of AMN or ISN

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS 30	836858/0016	2015-12-02	2016-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2015-10-31	2016-10-30
Rohde & Schwarz	L.I.S.N.	ENV216	3560.6550.06	2015-12-02	2016-12-01
N/A	Conducted Cable	NO.5	N/A	2015-11-10	2016-11-09
N/A	Coaxial Cable	1.8m	N/A	2016-05-06	2017-05-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

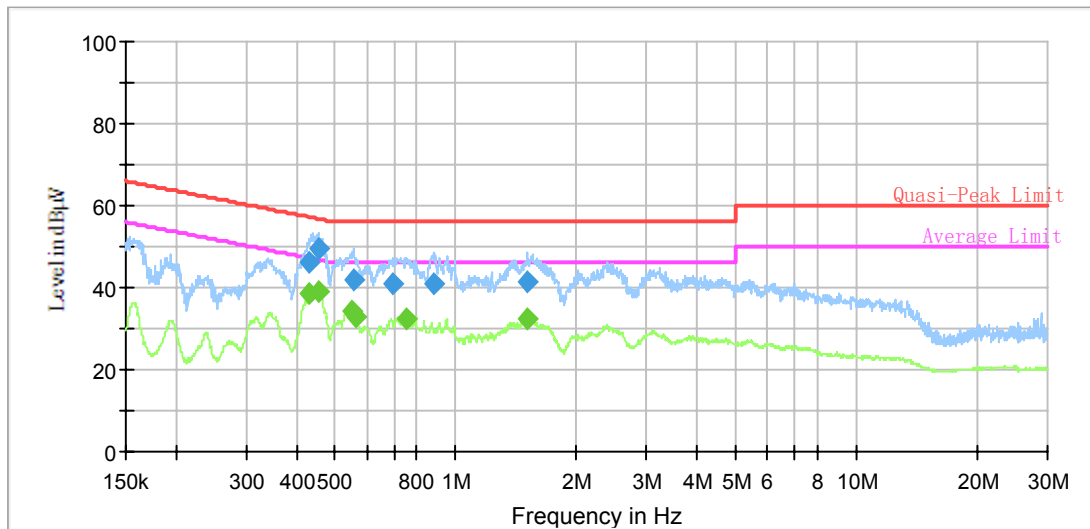
### Environmental Conditions

Temperature:	26.7 °C
Relative Humidity:	45 %
ATM Pressure:	101.5 kPa

*The testing was performed by Kevin Hu on 2016-10-29.*

Test Mode: Transmitting

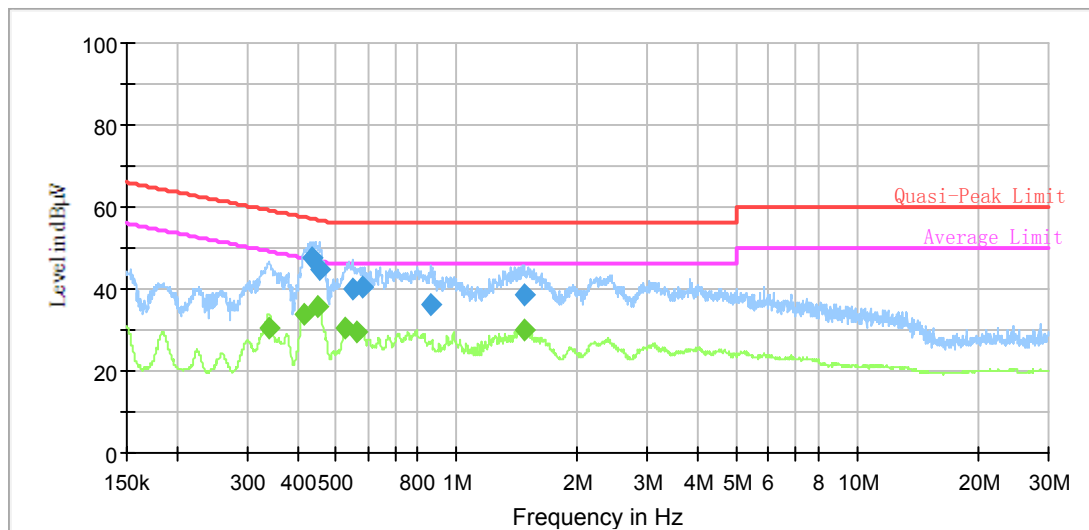
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.430773	46.3	9.000	L1	19.9	11.1	57.2	Compliance
0.453742	49.3	9.000	L1	19.9	7.5	56.8	Compliance
0.556310	41.8	9.000	L1	20.0	14.2	56.0	Compliance
0.695828	41.0	9.000	L1	20.0	15.0	56.0	Compliance
0.884358	40.8	9.000	L1	19.9	15.2	56.0	Compliance
1.507683	41.2	9.000	L1	20.0	14.8	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.431635	38.4	9.000	L1	19.9	8.8	47.2	Compliance
0.452837	39.3	9.000	L1	19.9	7.5	46.8	Compliance
0.550780	34.3	9.000	L1	20.0	11.7	46.0	Compliance
0.565274	32.7	9.000	L1	20.0	13.3	46.0	Compliance
0.755228	32.4	9.000	L1	19.9	13.6	46.0	Compliance
1.513719	32.6	9.000	L1	20.0	13.4	46.0	Compliance

**AC120 V, 60 Hz, Neutral:**



Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.432498	47.8	9.000	N	19.9	9.4	57.2	Compliance
0.453742	44.6	9.000	N	19.9	12.2	56.8	Compliance
0.549681	40.0	9.000	N	19.9	16.0	56.0	Compliance
0.578990	40.4	9.000	N	19.9	15.6	56.0	Compliance
0.861684	36.2	9.000	N	19.9	19.8	56.0	Compliance
1.466094	38.4	9.000	N	20.0	17.6	56.0	Compliance

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.338939	30.5	9.000	N	19.7	18.7	49.2	Compliance
0.416387	33.9	9.000	N	19.9	13.6	47.5	Compliance
0.451031	35.6	9.000	N	19.9	11.3	46.9	Compliance
0.527094	30.6	9.000	N	19.9	15.4	46.0	Compliance
0.565274	29.5	9.000	N	19.9	16.5	46.0	Compliance
1.469026	30.1	9.000	N	20.0	15.9	46.0	Compliance

## FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS

### Applicable Standard

FCC §15.247 (d); §15.209; §15.205;

### Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cisp}$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

–non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cisp}$  of Table 1, then:

–compliance is deemed to occur if no measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit;

–non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{lab} - U_{cisp})$ , exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:

30M~200MHz: ±4.7 dB ;

200M~1GHz: ±6.0 dB ;

1G-6GHz: ±5.13dB;

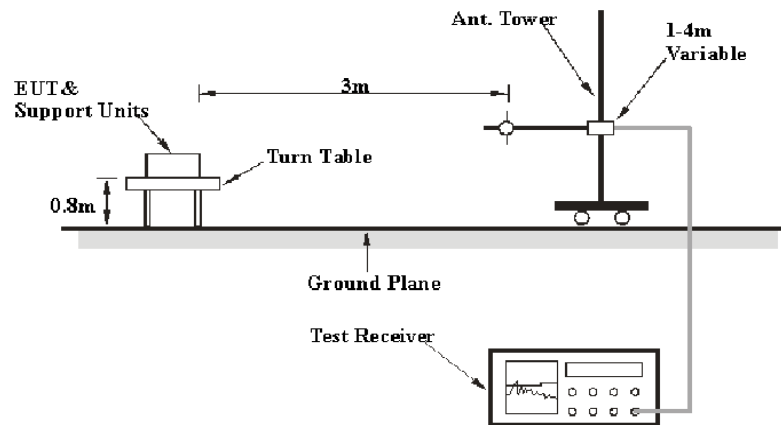
6G~25GHz: ±5.47 dB;

Table 1 – Values of  $U_{cisp}$

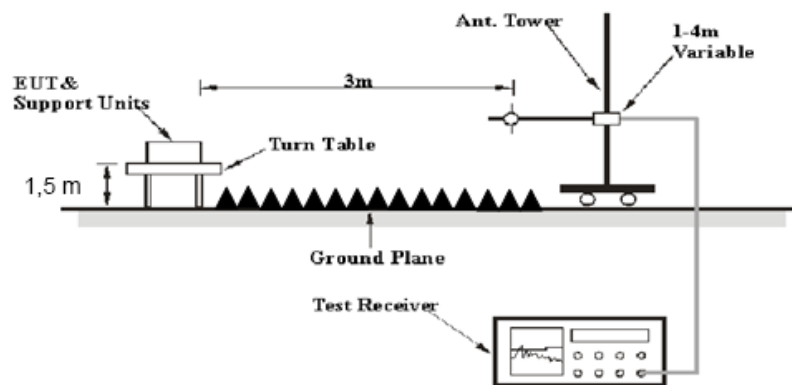
Measurement	$U_{cisp}$
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

## EUT Setup

### Below 1GHz:



### Above 1GHz:



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.



## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz - 1 GHz, peak and average detection modes for frequencies above 1 GHz.

## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Agilent	Amplifier	8447D	2944A10442	2015-12-02	2016-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2015-12-02	2016-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
EM TEST	Horn Antenna	3115	003-6076	2015-12-02	2016-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-213-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2015-12-02	2016-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2015-11-10	2016-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2015-11-10	2016-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2015-11-10	2016-11-09

**\* Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Data

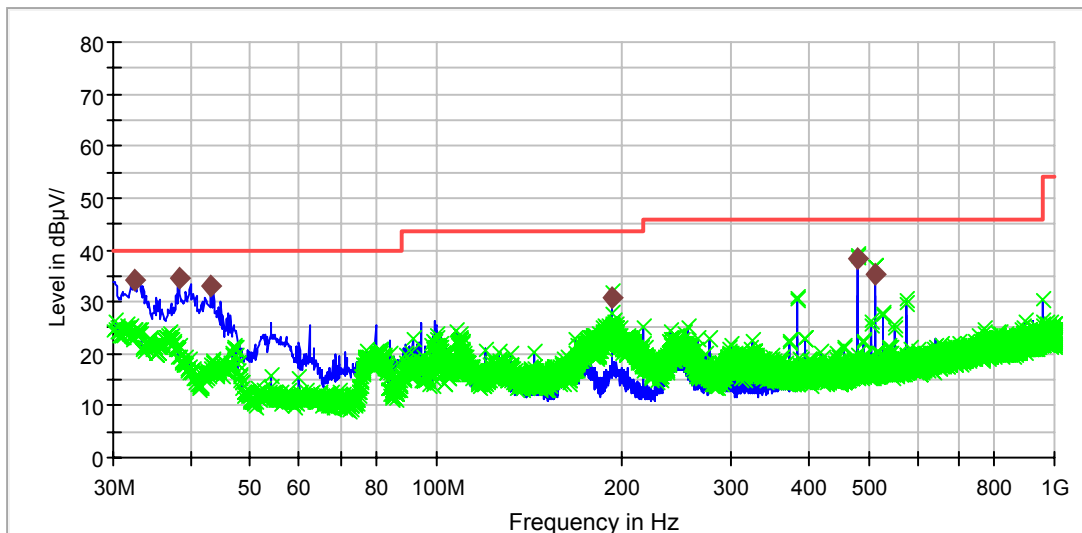
### Environmental Conditions

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4 kPa

*\* The testing was performed by Kevin Hu on 2016-11-01.*

Test Mode: Transmitting

1) 30 MHz to 1 GHz (BDR Middle channel is worst case)



Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
32.425000	34.2	100.0	V	356.0	-7.1	5.8	40.0
38.366250	34.6	200.0	V	92.0	-11.6	5.4	40.0
43.095000	33.1	200.0	V	92.0	-15.4	6.9	40.0
191.990000	30.8	200.0	H	216.0	-14.7	12.7	43.5
480.080000	38.2	100.0	H	58.0	-8.8	7.8	46.0
512.090000	35.4	200.0	H	62.0	-9.0	10.6	46.0

## 2) 1 GHz to 25 GHz:

BDR Mode (GFSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	60.25	PK	H	23.53	3.00	0.00	86.78	N/A	N/A
2402	49.01	AV	H	23.53	3.00	0.00	75.54	N/A	N/A
2402	59.74	PK	V	23.53	3.00	0.00	86.27	N/A	N/A
2402	48.6	AV	V	23.53	3.00	0.00	75.13	N/A	N/A
2400	43.87	PK	H	23.54	3.00	0.00	70.41	74.00	3.59
2400	20.52	AV	H	23.54	3.00	0.00	47.06	54.00	6.94
4804	39.62	PK	H	30.77	5.12	26.87	48.64	74.00	25.36
4804	25.94	AV	H	30.77	5.12	26.87	34.96	54.00	19.04
7206	31.67	PK	H	34.71	6.16	26.35	46.19	74.00	27.81
7206	19.24	AV	H	34.71	6.16	26.35	33.76	54.00	20.24
3507	35.02	PK	H	27.03	4.19	26.59	39.65	74.00	34.35
3507	22.17	AV	H	27.03	4.19	26.59	26.80	54.00	27.20
Middle Channel: 2441 MHz									
2441	60.99	PK	H	23.40	3.00	0.00	87.39	N/A	N/A
2441	49.8	AV	H	23.40	3.00	0.00	76.20	N/A	N/A
2441	60.52	PK	V	23.40	3.00	0.00	86.92	N/A	N/A
2441	49.17	AV	V	23.40	3.00	0.00	75.57	N/A	N/A
4882	40.2	PK	H	31.02	5.09	26.87	49.44	74.00	24.56
4882	26.49	AV	H	31.02	5.09	26.87	35.73	54.00	18.27
7323	32.13	PK	H	34.95	6.22	26.40	46.90	74.00	27.10
7323	19.7	AV	H	34.95	6.22	26.40	34.47	54.00	19.53
3507	35.06	PK	H	27.03	4.19	26.59	39.69	74.00	34.31
3507	22.24	AV	H	27.03	4.19	26.59	26.87	54.00	27.13
4584	34.84	PK	H	30.07	5.23	26.86	43.28	74.00	30.72
4584	22.06	AV	H	30.07	5.23	26.86	30.50	54.00	23.50
High Channel: 2480 MHz									
2480	61.47	PK	H	23.27	2.99	0.00	87.73	N/A	N/A
2480	50.25	AV	H	23.27	2.99	0.00	76.51	N/A	N/A
2480	60.95	PK	V	23.27	2.99	0.00	87.21	N/A	N/A
2480	49.71	AV	V	23.27	2.99	0.00	75.97	N/A	N/A
2483.5	30.95	PK	H	23.26	2.99	0.00	57.20	74.00	16.80
2483.5	15.41	AV	H	23.26	2.99	0.00	41.66	54.00	12.34
4960	40.76	PK	H	31.27	5.05	26.88	50.20	74.00	23.80
4960	27.01	AV	H	31.27	5.05	26.88	36.45	54.00	17.55
7440	32.59	PK	H	35.18	6.27	26.45	47.59	74.00	26.41
7440	20.12	AV	H	35.18	6.27	26.45	35.12	54.00	18.88
3507	35.23	PK	H	27.03	4.19	26.59	39.86	74.00	34.14
3507	22.46	AV	H	27.03	4.19	26.59	27.09	54.00	26.91

EDR Mode ( $\pi/4$ -DQPSK):

Frequency	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
(MHz)	Reading (dBμV)	Detector (PK/QP/AV)	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	60.64	PK	H	23.53	3.00	0.00	87.17	N/A	N/A
2402	47.65	AV	H	23.53	3.00	0.00	74.18	N/A	N/A
2402	60.07	PK	V	23.53	3.00	0.00	86.60	N/A	N/A
2402	47.11	AV	V	23.53	3.00	0.00	73.64	N/A	N/A
2400	44.11	PK	H	23.54	3.00	0.00	70.65	74.00	3.35
2400	21.43	AV	H	23.54	3.00	0.00	47.97	54.00	6.03
4804	40.39	PK	H	30.77	5.12	26.87	49.41	74.00	24.59
4804	26.75	AV	H	30.77	5.12	26.87	35.77	54.00	18.23
7206	32.24	PK	H	34.71	6.16	26.35	46.76	74.00	27.24
7206	19.73	AV	H	34.71	6.16	26.35	34.25	54.00	19.75
3507	35.13	PK	H	27.03	4.19	26.59	39.76	74.00	34.24
3507	22.37	AV	H	27.03	4.19	26.59	27.00	54.00	27.00
Middle Channel: 2441 MHz									
2441	61.28	PK	H	23.40	3.00	0.00	87.68	N/A	N/A
2441	48.44	AV	H	23.40	3.00	0.00	74.84	N/A	N/A
2441	60.98	PK	V	23.40	3.00	0.00	87.38	N/A	N/A
2441	47.88	AV	V	23.40	3.00	0.00	74.28	N/A	N/A
4882	40.87	PK	H	31.02	5.09	26.87	50.11	74.00	23.89
4882	27.18	AV	H	31.02	5.09	26.87	36.42	54.00	17.58
7323	32.69	PK	H	34.95	6.22	26.40	47.46	74.00	26.54
7323	20.2	AV	H	34.95	6.22	26.40	34.97	54.00	19.03
3507	35.51	PK	H	27.03	4.19	26.59	40.14	74.00	33.86
3507	22.36	AV	H	27.03	4.19	26.59	26.99	54.00	27.01
4584	34.58	PK	H	30.07	5.23	26.86	43.02	74.00	30.98
4584	22.02	AV	H	30.07	5.23	26.86	30.46	54.00	23.54
High Channel: 2480 MHz									
2480	61.8	PK	H	23.27	2.99	0.00	88.06	N/A	N/A
2480	48.9	AV	H	23.27	2.99	0.00	75.16	N/A	N/A
2480	61.56	PK	V	23.27	2.99	0.00	87.82	N/A	N/A
2480	48.59	AV	V	23.27	2.99	0.00	74.85	N/A	N/A
2483.5	30.66	PK	H	23.26	2.99	0.00	56.91	74.00	17.09
2483.5	15.41	AV	H	23.26	2.99	0.00	41.66	54.00	12.34
4960	41.29	PK	H	31.27	5.05	26.88	50.73	74.00	23.27
4960	27.6	AV	H	31.27	5.05	26.88	37.04	54.00	16.96
7440	33.15	PK	H	35.18	6.27	26.45	48.15	74.00	25.85
7440	20.65	AV	H	35.18	6.27	26.45	35.65	54.00	18.35
3507	35.23	PK	H	27.03	4.19	26.59	39.86	74.00	34.14
3507	22.16	AV	H	27.03	4.19	26.59	26.79	54.00	27.21

## **FCC §15.247(a) (1) - CHANNEL SEPARATION TEST**

### **Applicable Standard**

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.50 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Procedure**

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 30 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another trace.
3. Measure the channel separation.

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4 kPa

\* The testing was performed by Kevin Hu on 2016-11-01.

**Test Result:** Compliance.

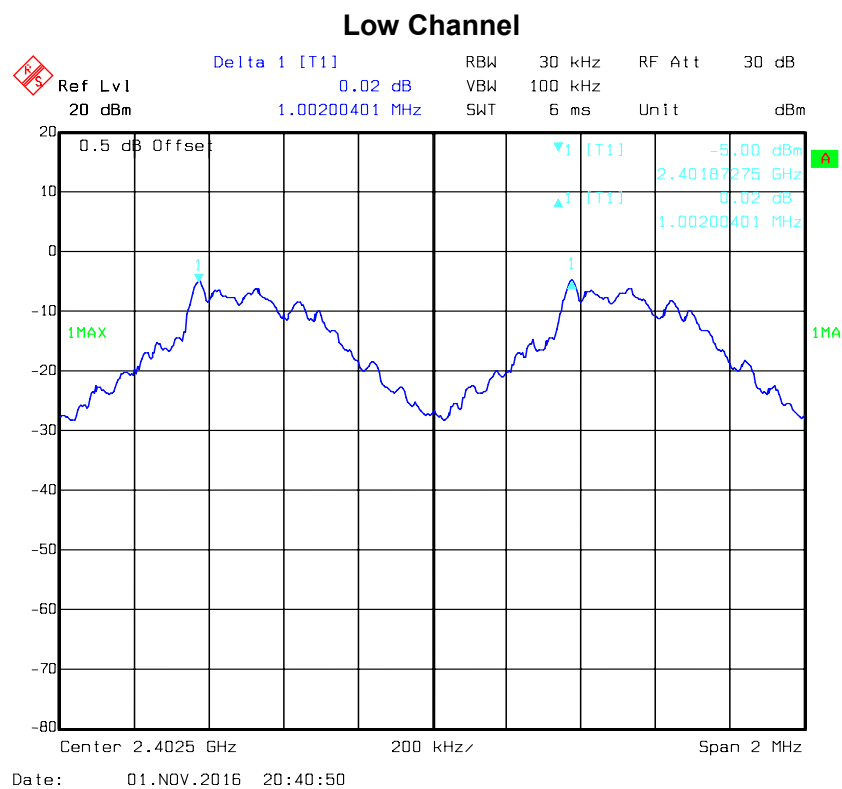
Please refer to following tables and plots

Test Mode: Transmitting

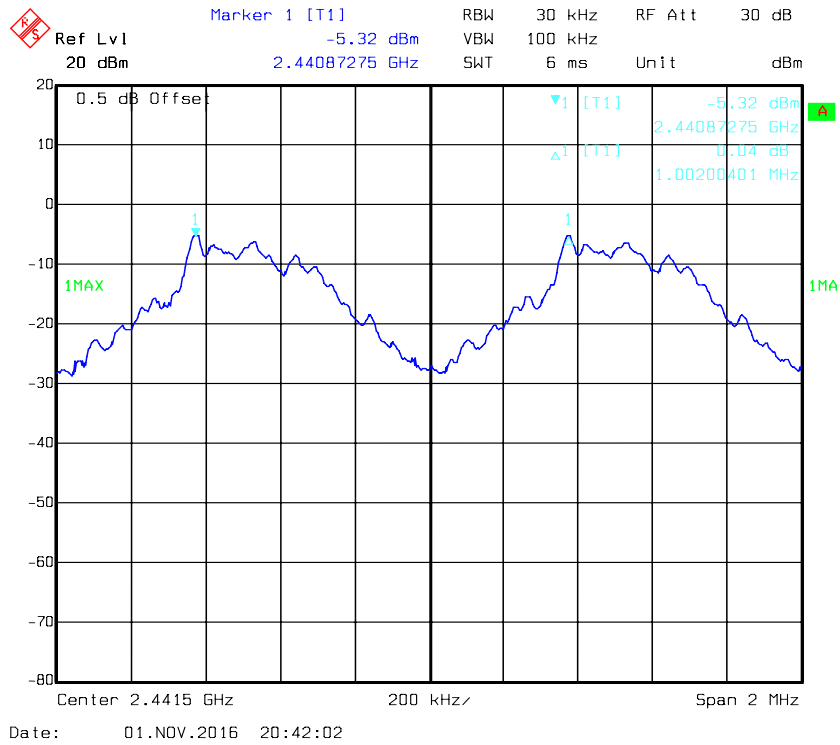
Mode	Channel	Frequency	Channel Separation	Limit
		MHz	MHz	MHz
BDR (GFSK)	Low	2402	1.002	0.58
	Middle	2441	1.002	0.57
	High	2480	1.006	0.58
EDR ( $\pi/4$ -DQPSK)	Low	2402	1.002	0.83
	Middle	2441	1.002	0.83
	High	2480	1.002	0.82

Note: Limit= (2/3)× 20dB bandwidth

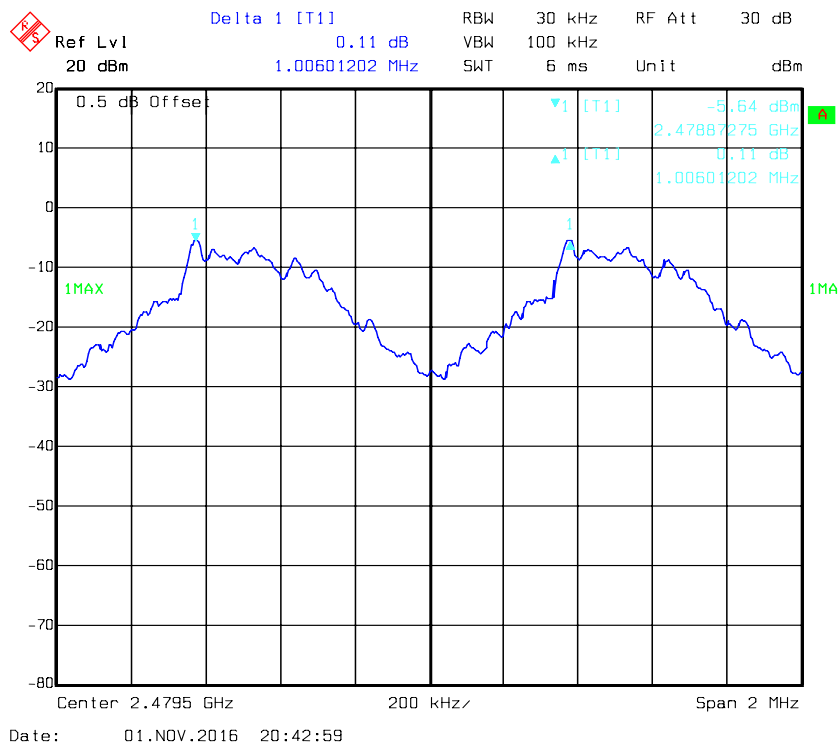
BDR Mode (GFSK):



### Middle Channel



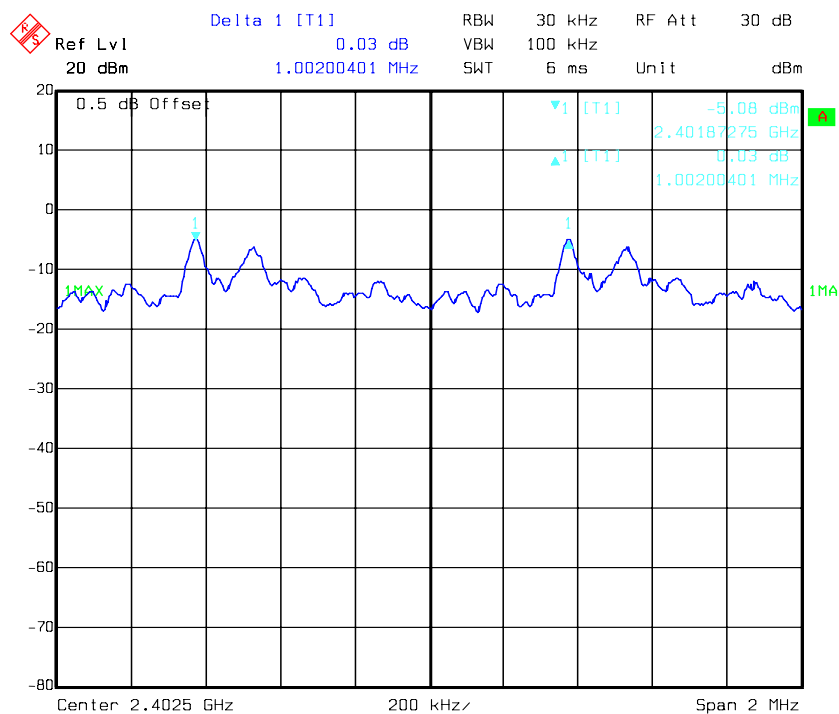
### High Channel





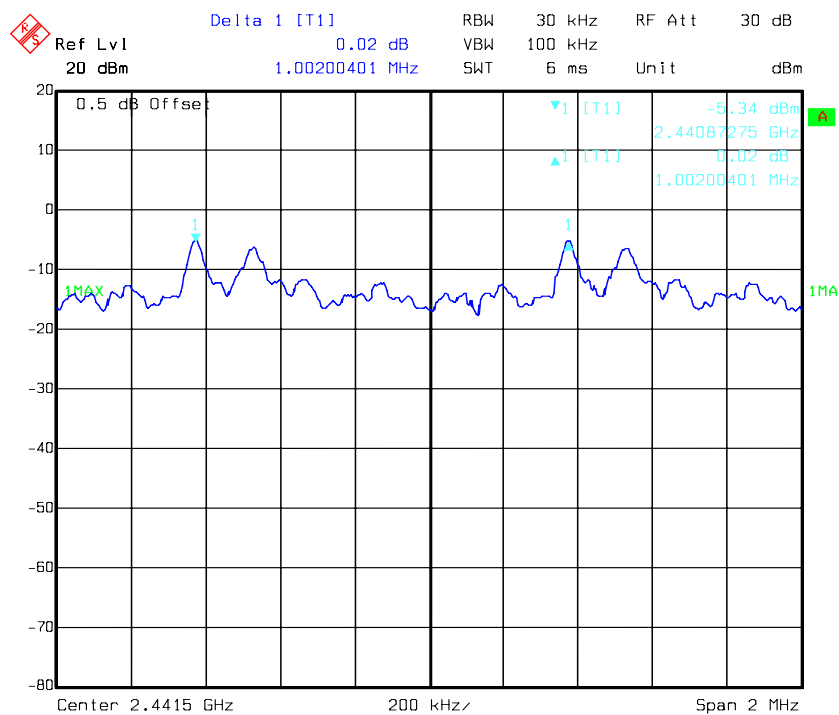
EDR Mode ( $\pi/4$ -DQPSK):

Low Channel



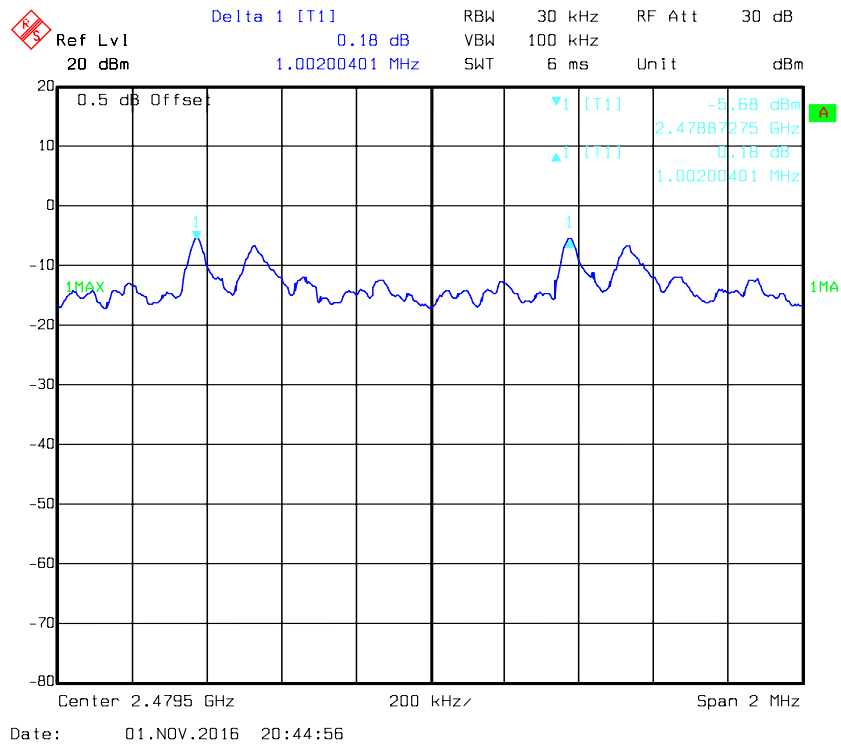
Date: 01.NOV.2016 20:47:11

Middle Channel



Date: 01.NOV.2016 20:46:13

### High Channel



## FCC §15.247(a) (1) – 20 dB BANDWIDTH TESTING

### Applicable Standard

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.

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4 kPa

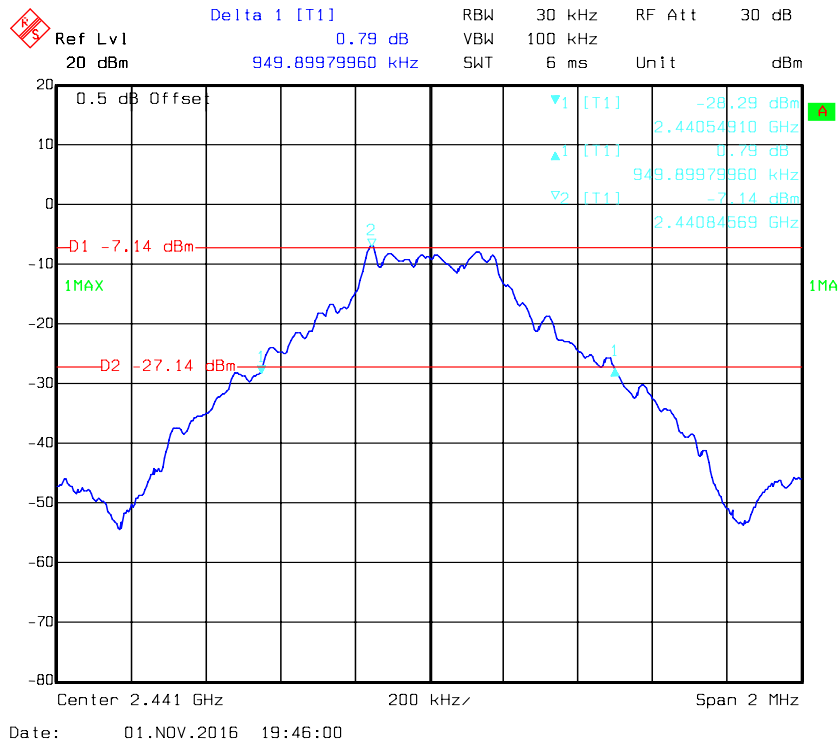
\* The testing was performed by Kevin Hu on 2016-11-01.

**Test Result:** Compliance.

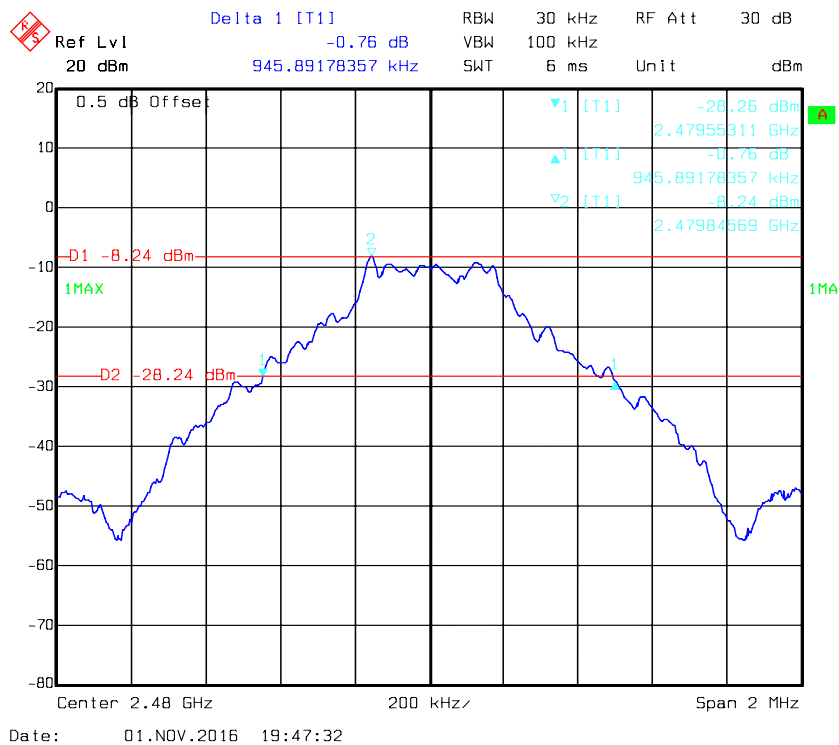
Please refer to following tables and plots



### Middle Channel

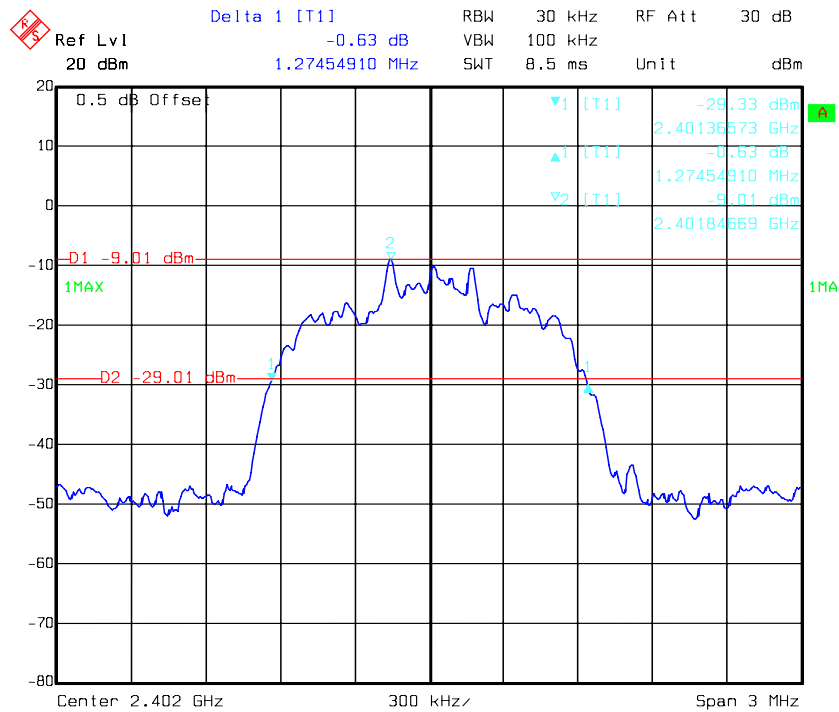


### High Channel

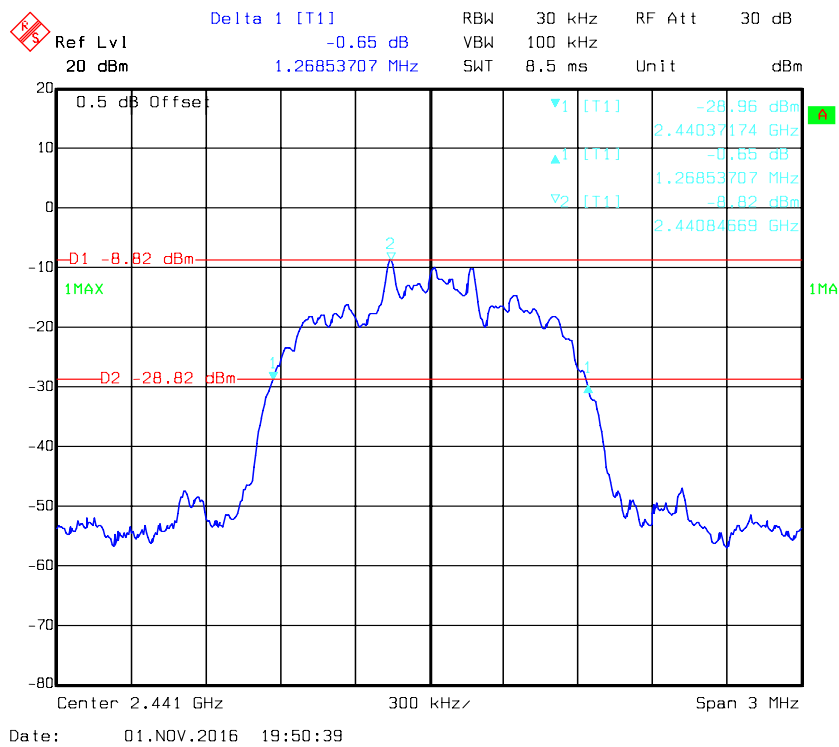


EDR Mode ( $\pi/4$ -DQPSK):

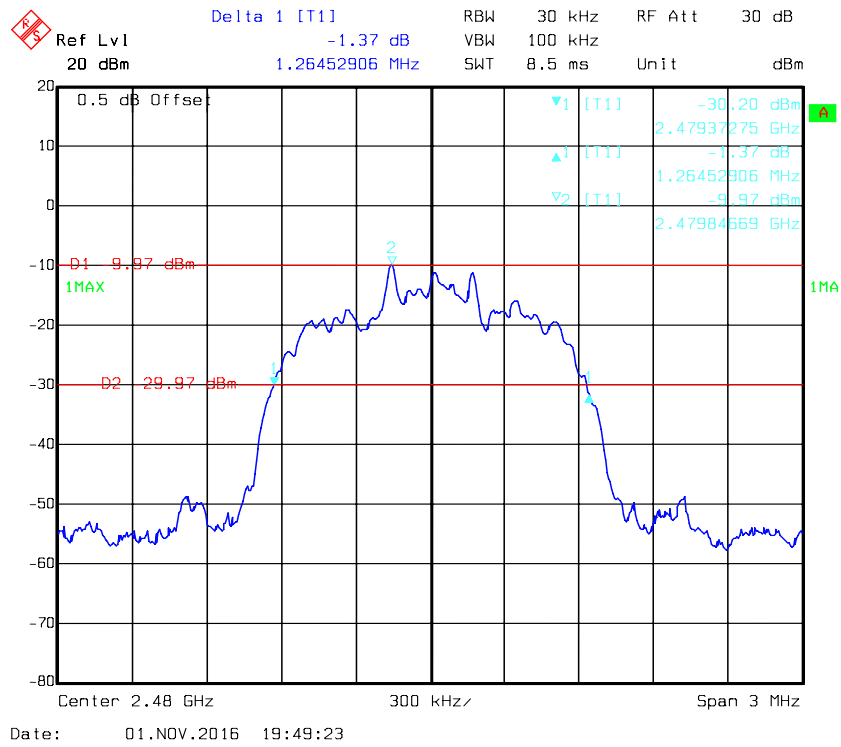
Low Channel



Middle Channel



# High Channel



## **FCC §15.247(a) (1) (iii) - QUANTITY OF HOPPING CHANNEL TEST**

### **Applicable Standard**

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.

### **Test Procedure**

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Data**

#### **Environmental Conditions**

<b>Temperature:</b>	24.1 °C
<b>Relative Humidity:</b>	32 %
<b>ATM Pressure:</b>	101.4 kPa

\* *The testing was performed by Kevin Hu on 2016-11-01.*

**Test Result:** Compliance.

Please refer to following tables and plots

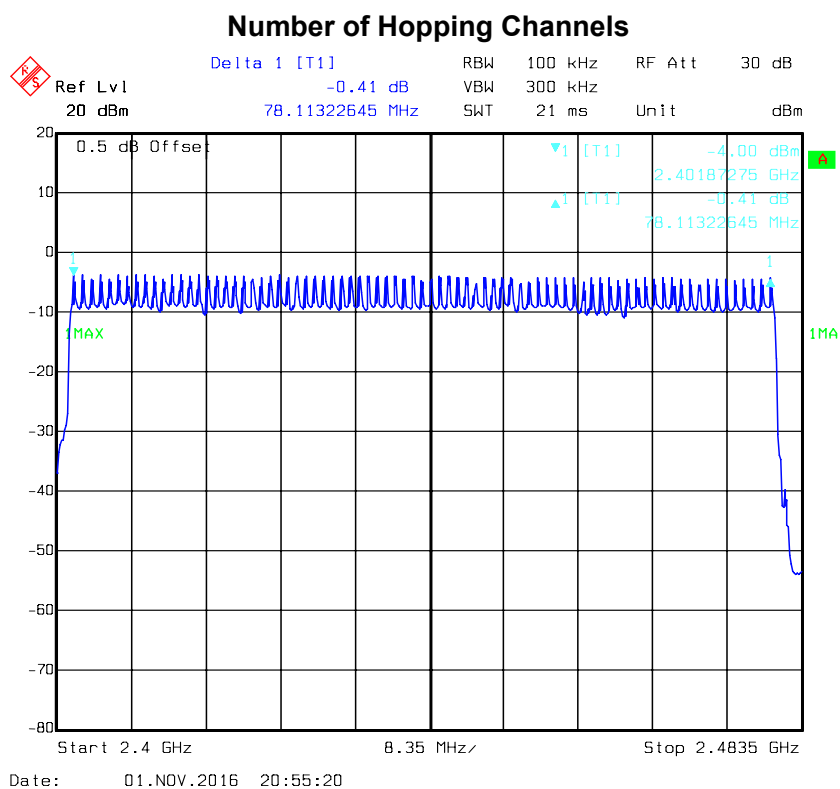
*Test Mode: Transmitting*





EDR Mode ( $\pi/4$ -DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	$\geq 15$



## **FCC §15.247(a) (1) (iii) - TIME OF OCCUPANCY (DWELL TIME)**

### **Applicable Standard**

Frequency hopping systems in the 2400-2483.5 MHz 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.

### **Test Procedure**

The EUT was worked in channel hopping; Spectrum SPAN was set as 0. Sweep was set as 0.4 \* channel no. (s), the quantity of pulse was get from single sweep. In addition, the time of single pulses was tested.

Dwell Time= time slot length \* hope rate/ number of hopping channels \* 31.6s  
Hop rate=1600/s

### **Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### **Test Data**

#### **Environmental Conditions**

Temperature:	24.1 °C
Relative Humidity:	32 %
ATM Pressure:	101.4 kPa

\* The testing was performed by Kevin Hu on 2016-11-01.

**Test Result:** Compliance.

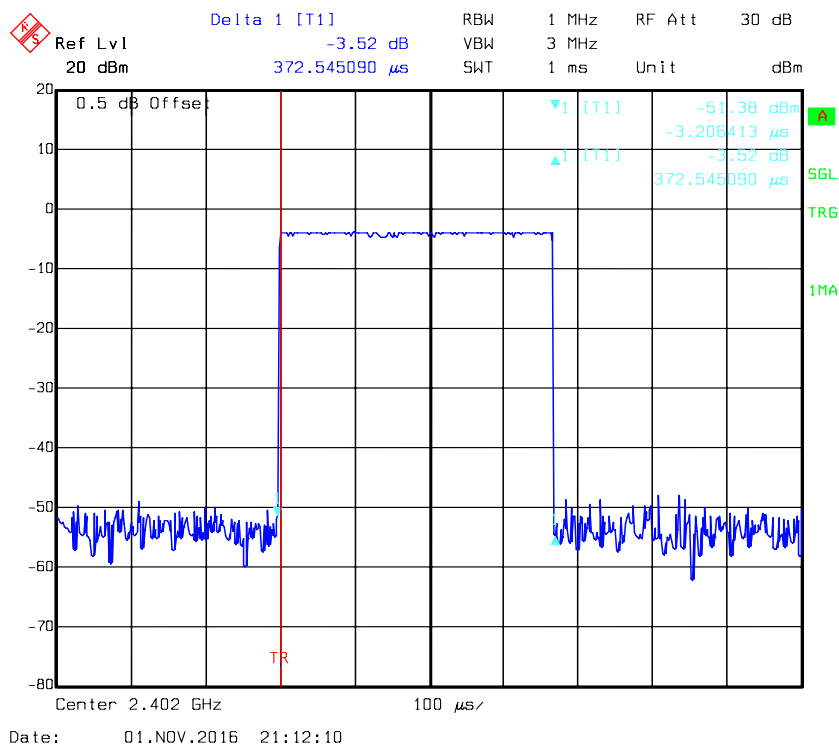
Please refer to following tables and plots

Test Mode: Transmitting

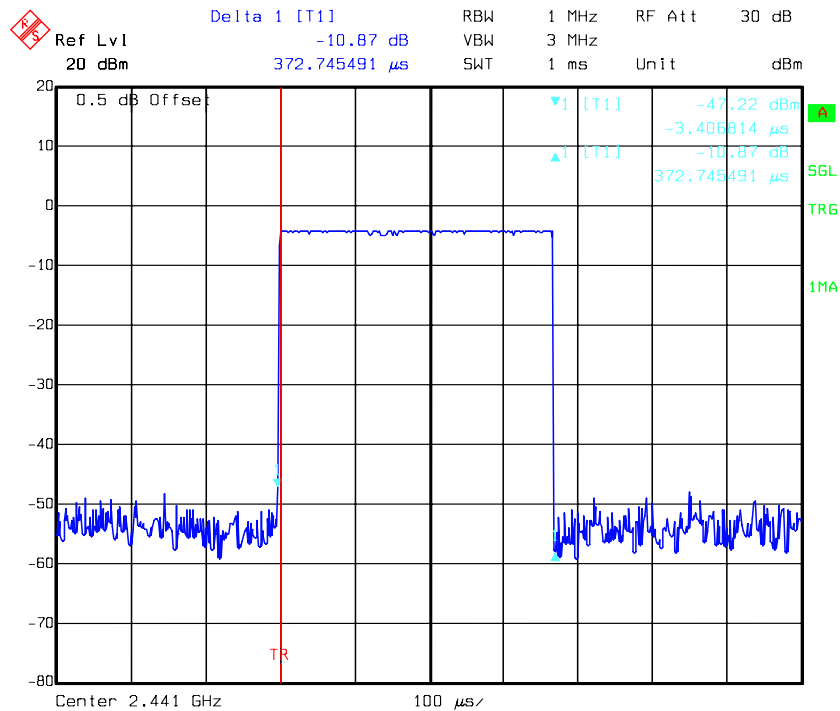
BDR Mode (GFSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.373	0.119	0.4	Compliance
	Middle	0.373	0.119	0.4	Compliance
	High	0.373	0.119	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.641	0.263	0.4	Compliance
	Middle	1.641	0.263	0.4	Compliance
	High	1.641	0.263	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.894	0.309	0.4	Compliance
	Middle	2.894	0.309	0.4	Compliance
	High	2.894	0.309	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

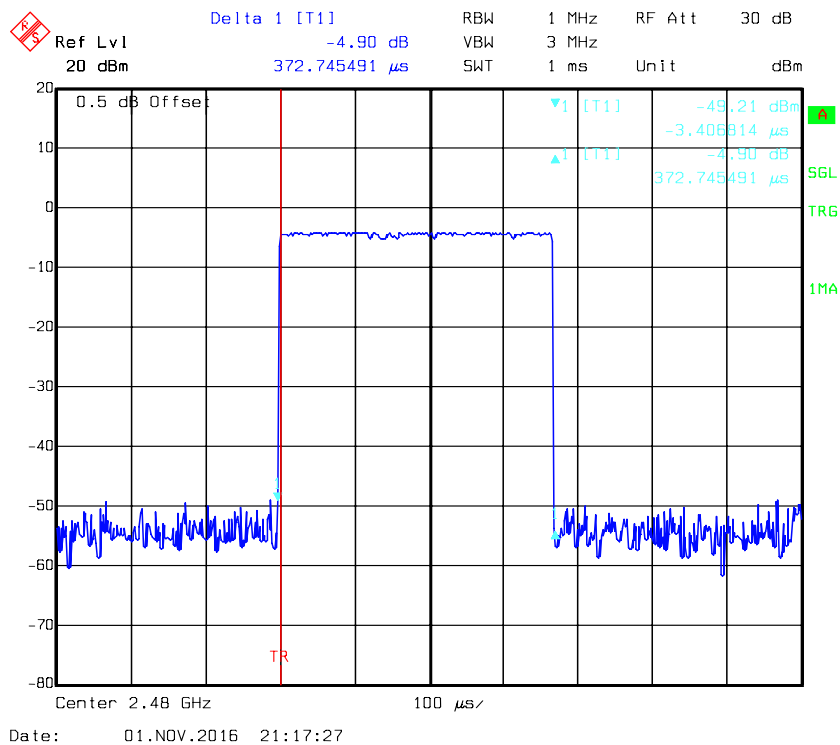
### DH1: Low Channel



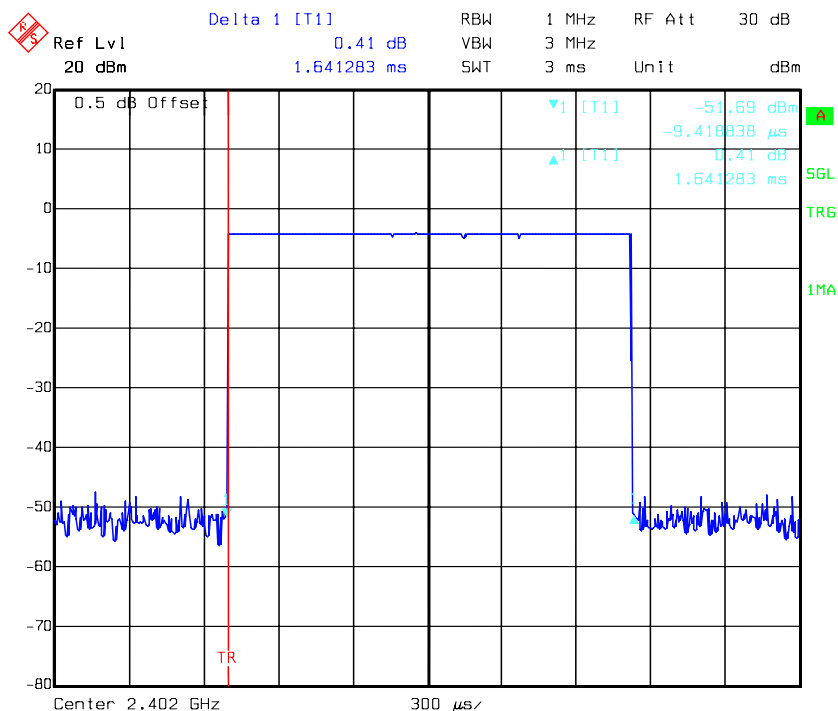
### DH1: Middle Channel



### DH1: High Channel

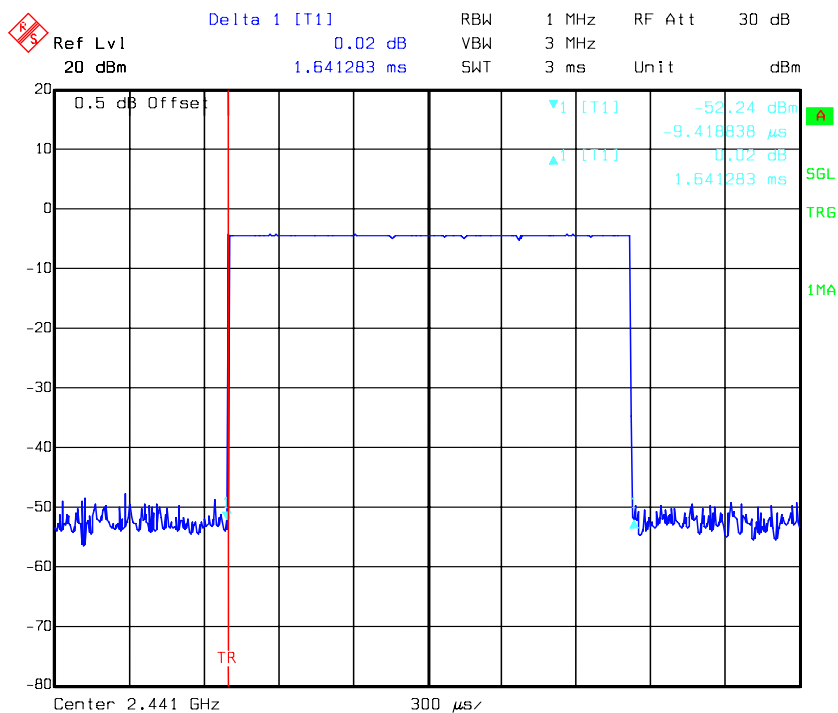


### DH3: Low Channel



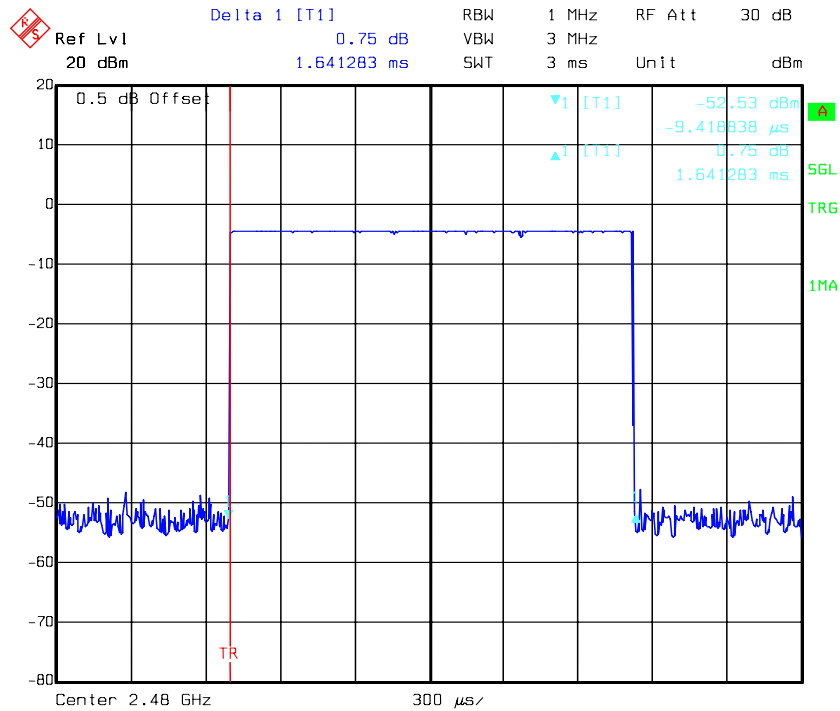
Date: 01.NOV.2016 21:20:30

### DH3: Middle Channel

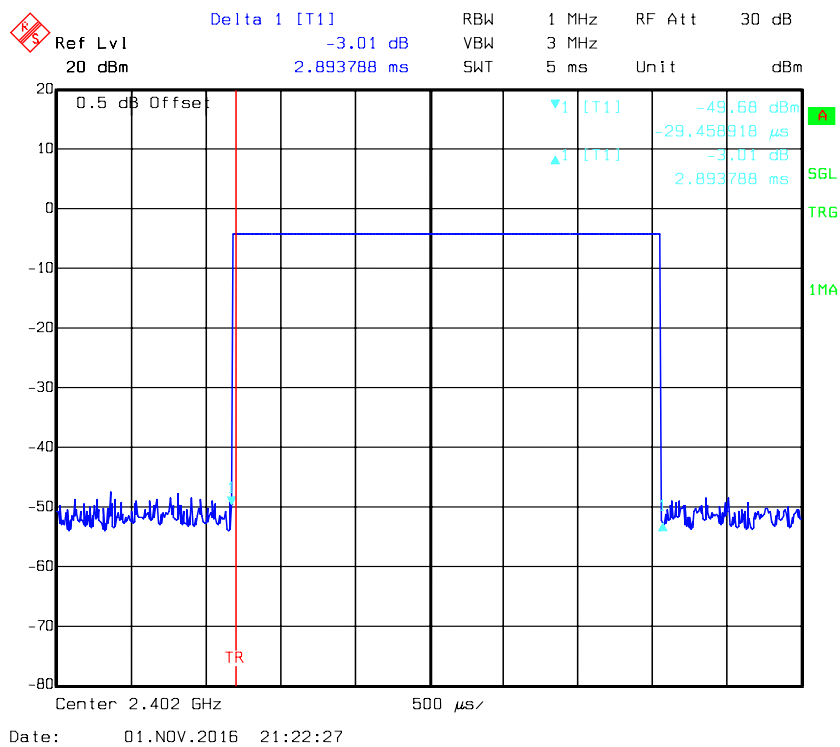


Date: 01.NOV.2016 21:20:14

### DH3: High Channel



### DH5: Low Channel



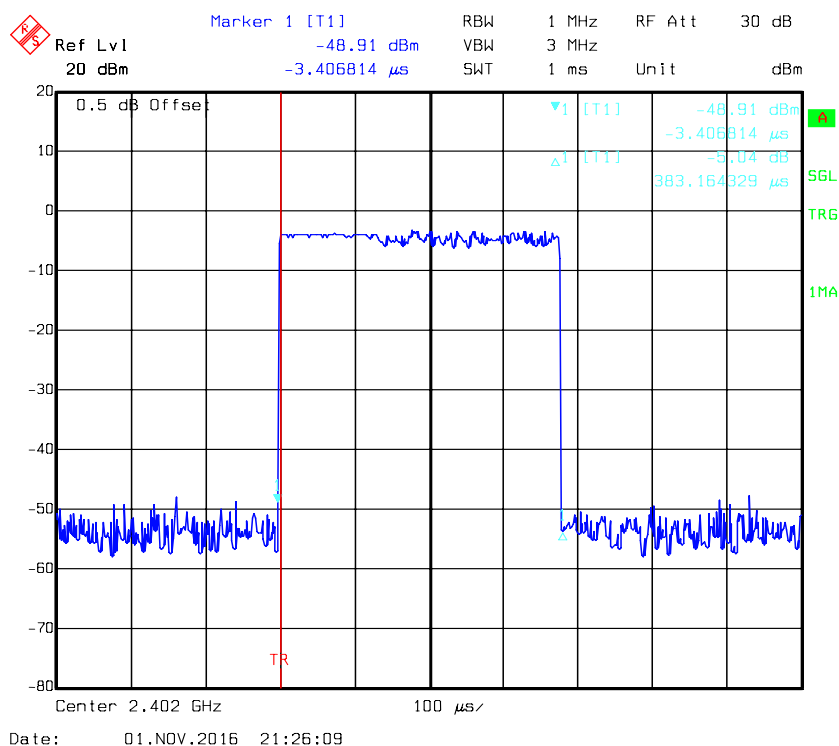




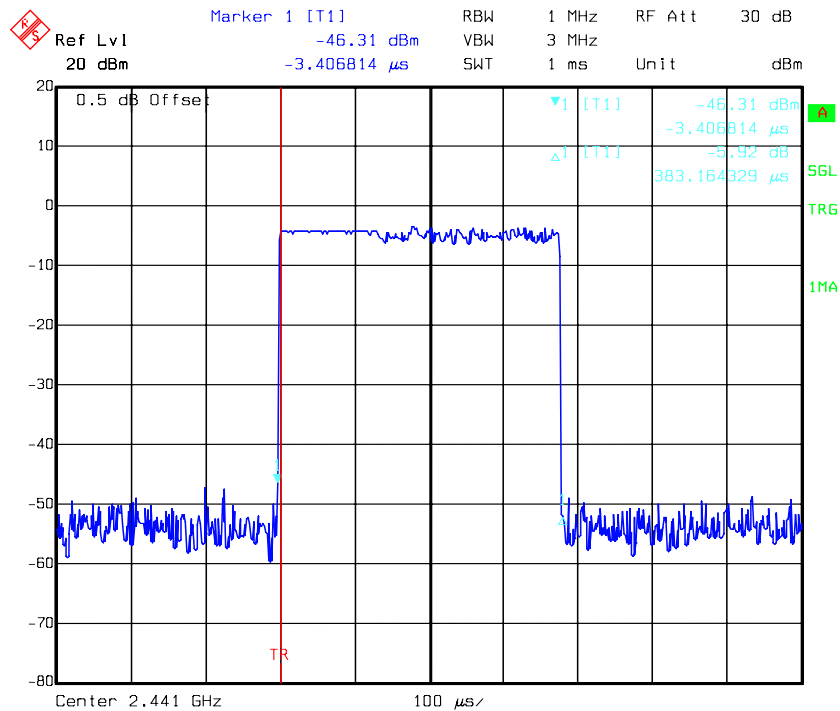
EDR Mode ( $\pi/4$ -DQPSK):

Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.383	0.123	0.4	Compliance
	Middle	0.383	0.123	0.4	Compliance
	High	0.383	0.123	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/2/79) $\times$ 31.6 s				
2DH3	Low	1.646	0.263	0.4	Compliance
	Middle	1.646	0.263	0.4	Compliance
	High	1.646	0.263	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/4/79) $\times$ 31.6 s				
2DH5	Low	2.908	0.310	0.4	Compliance
	Middle	2.908	0.310	0.4	Compliance
	High	2.908	0.310	0.4	Compliance
	Note: Dwell time=Pulse time (ms) $\times$ (1600/6/79) $\times$ 31.6 s				

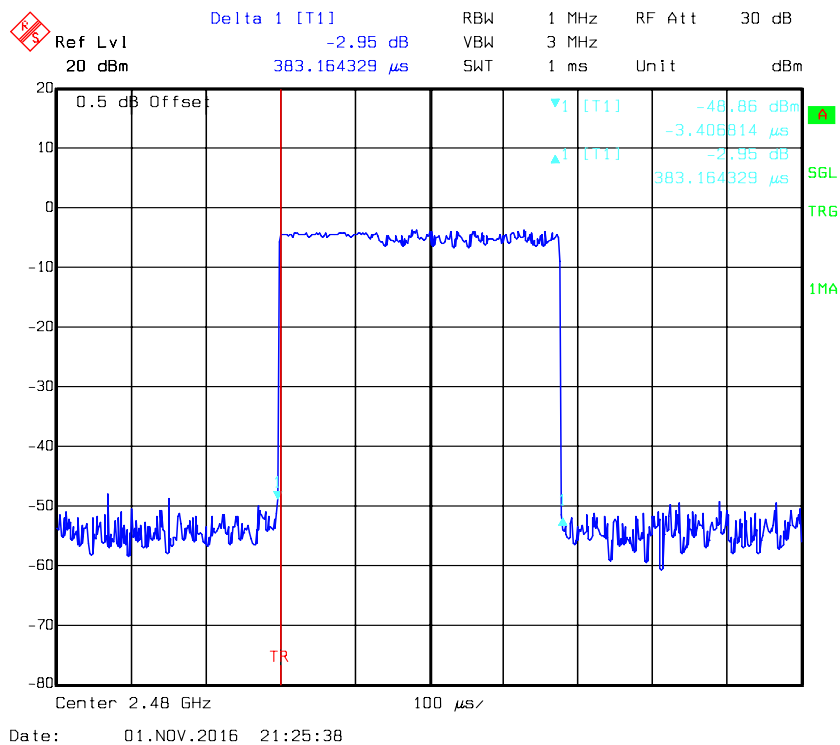
2DH1: Low Channel



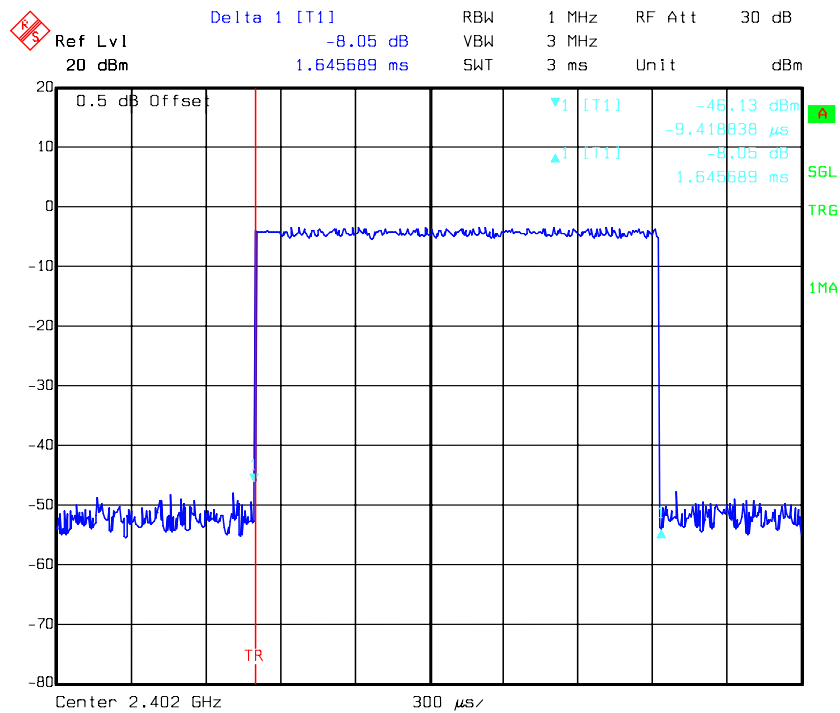
### 2DH1: Middle Channel



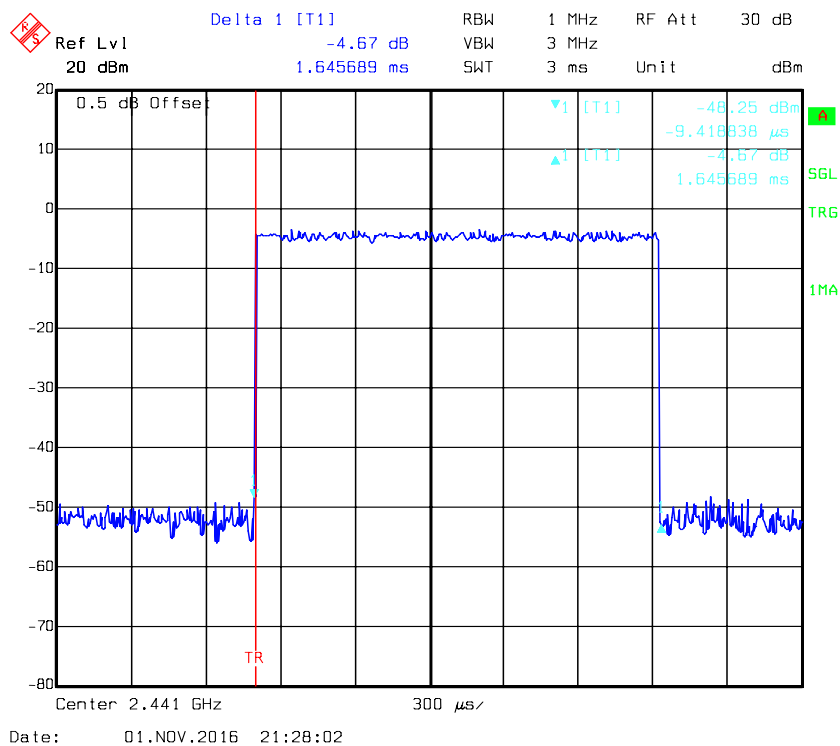
### 2DH1: High Channel



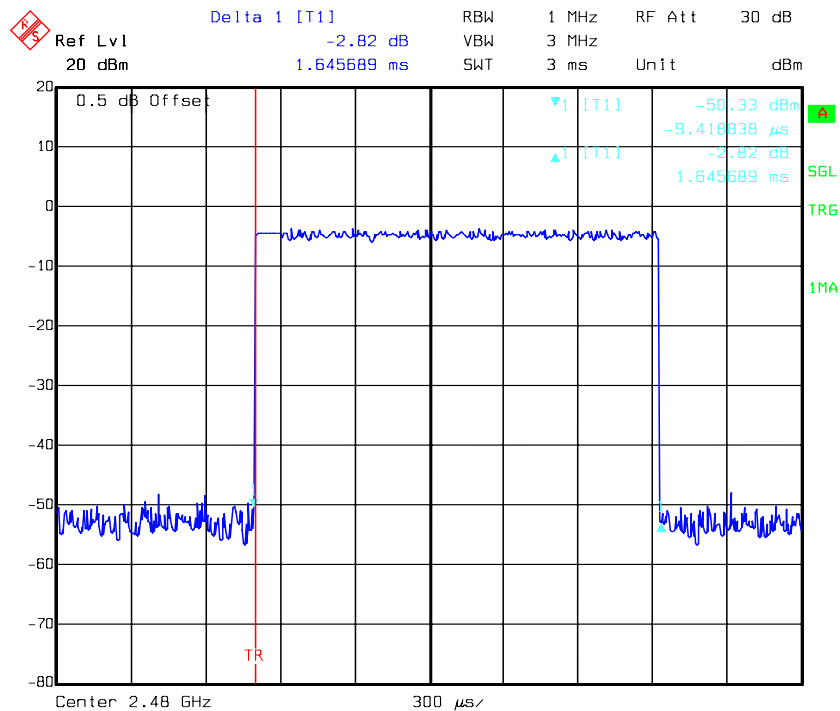
### 2DH3: Low Channel



### 2DH3: Middle Channel

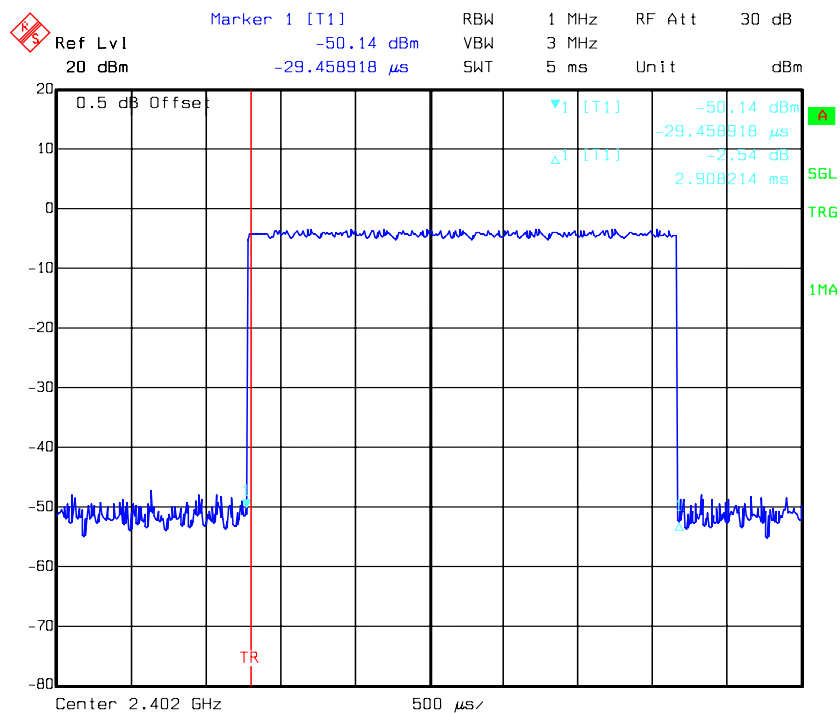


### 2DH3: High Channel



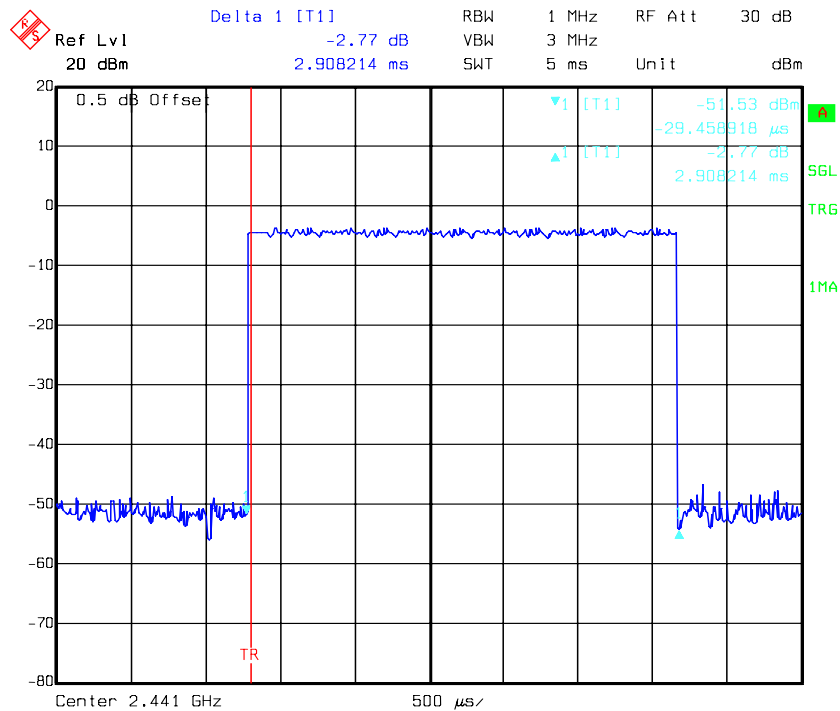
Date: 01.NOV.2016 21:28:13

### 2DH5: Low Channel

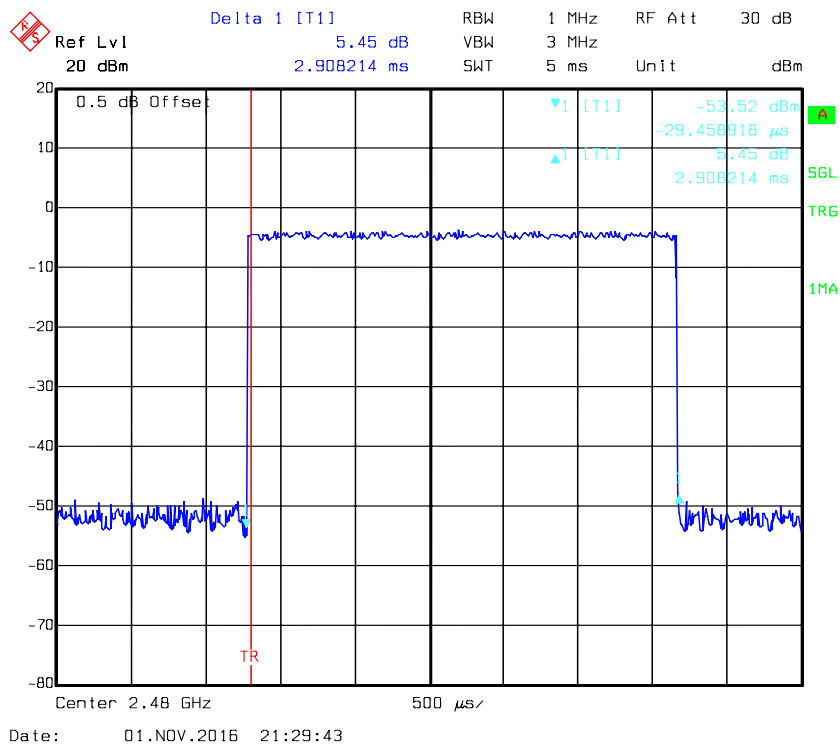


Date: 01.NOV.2016 21:30:52

### 2DH5: Middle Channel



### 2DH5: High Channel



## FCC §15.247(b) (1) - PEAK OUTPUT POWER MEASUREMENT

### Applicable Standard

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

### Test Procedure

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

### Test Data

#### Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	32 %
ATM Pressure:	101.4 kPa

\* The testing was performed by Kevin Hu on 2016-11-01.

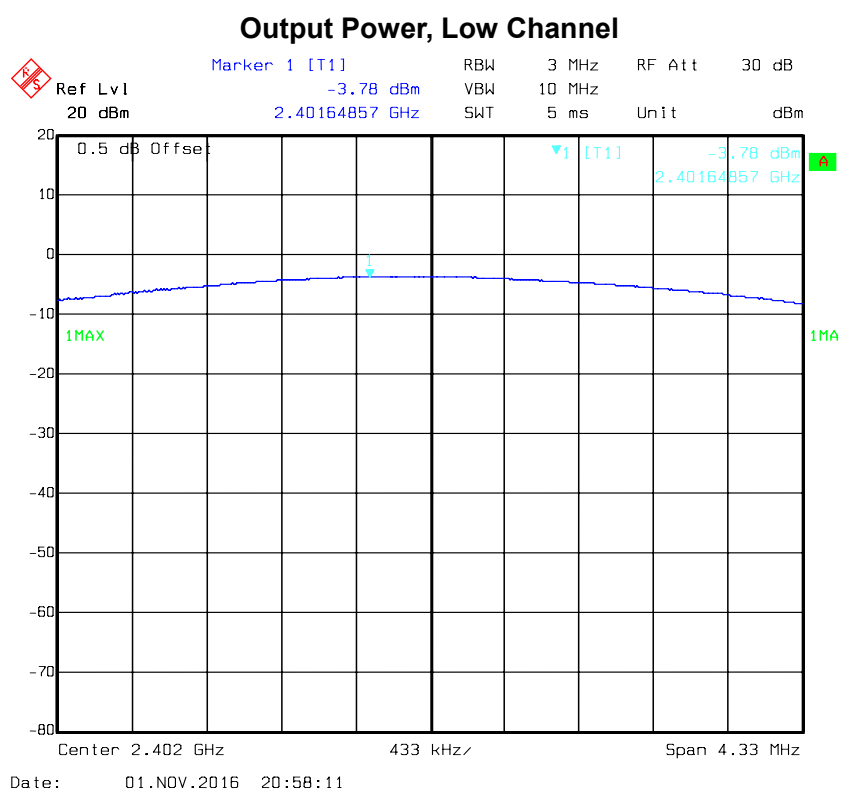
**Test Result:** Compliance.

*Test Mode: Transmitting*

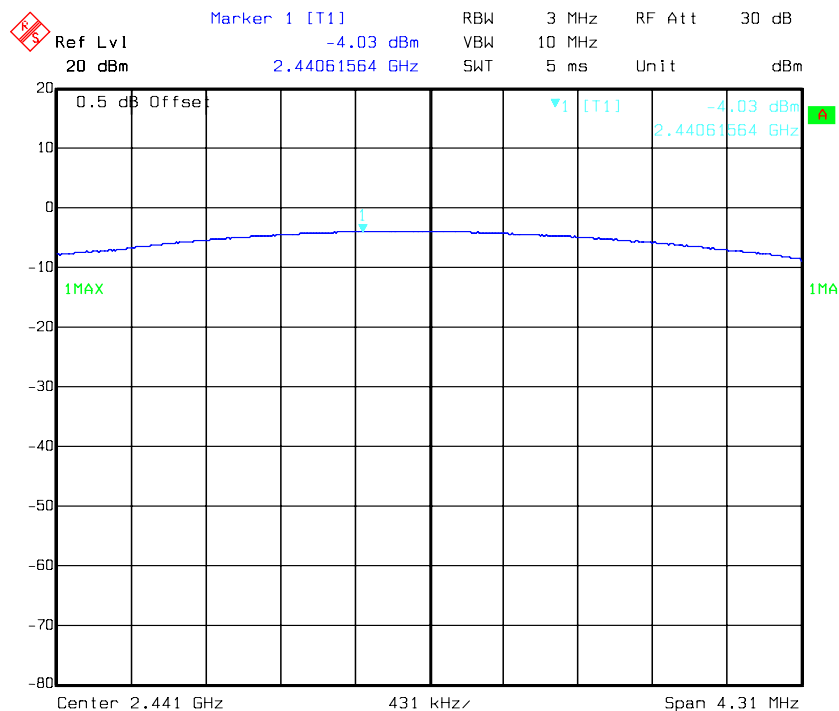
Mode	Channel	Frequency (MHz)	Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	Low	2402	-3.78	30
	Middle	2441	-4.03	30
	High	2480	-4.16	30
EDR Mode ( $\pi/4$ -DQPSK)	Low	2402	-2.9	30
	Middle	2441	-3.14	30
	High	2480	-3.27	30

Note: The data above was tested in conducted mode.

*BDR Mode (GFSK):*

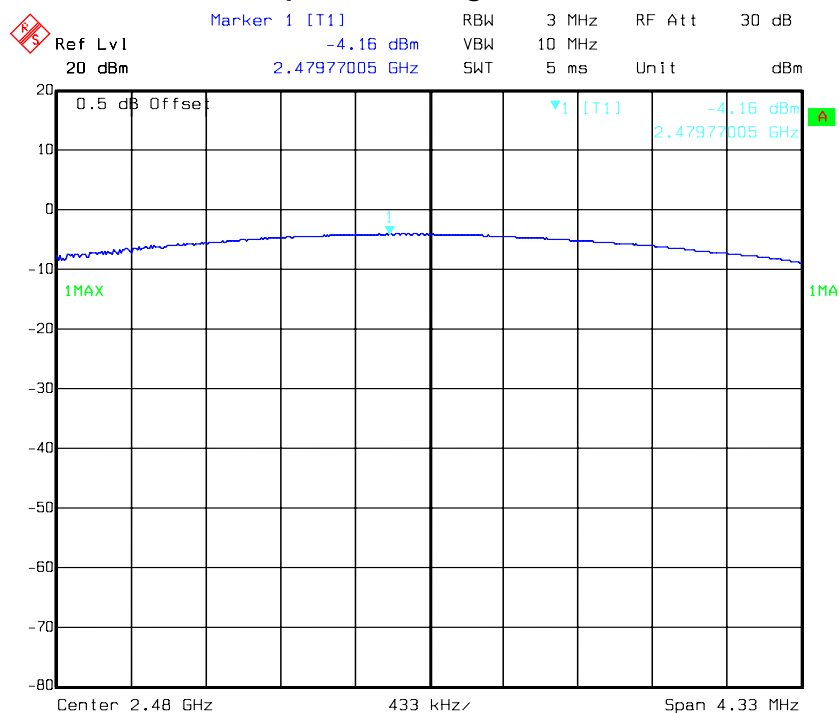


### Output Power, Middle Channel



Date: 01.NOV.2016 20:59:19

### Output Power, High Channel

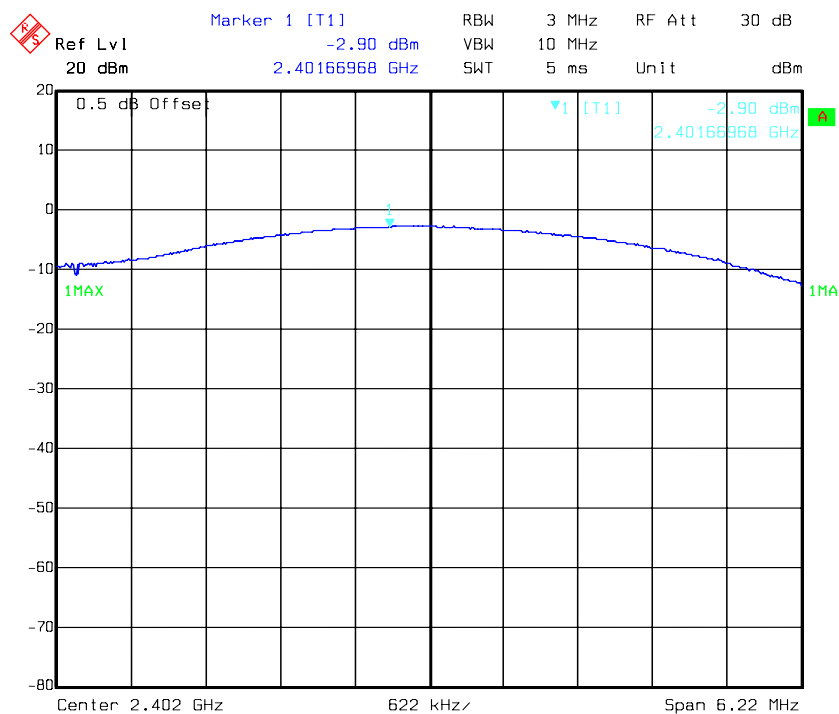


Date: 01.NOV.2016 21:00:27



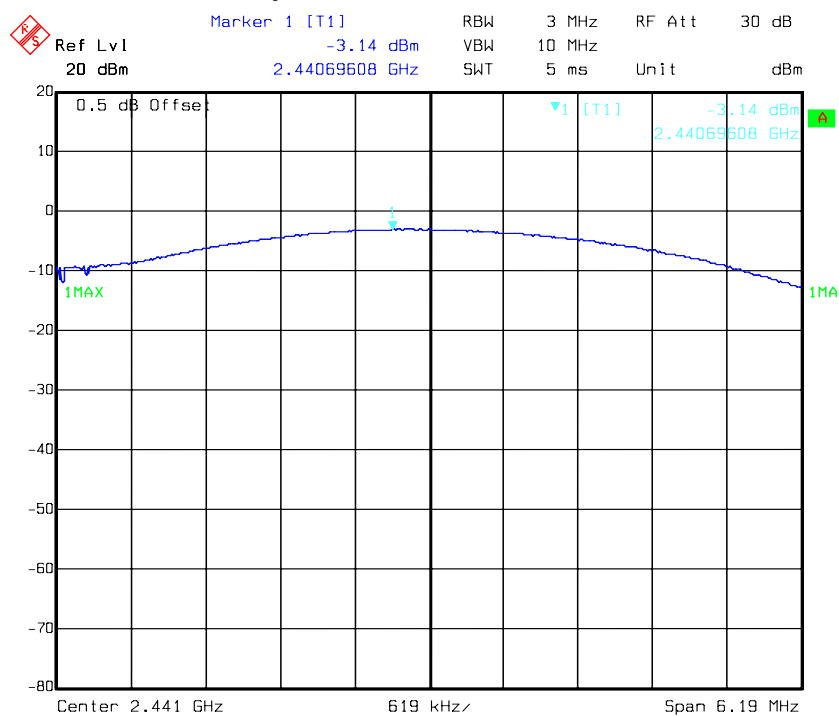
EDR Mode ( $\pi/4$ -DQPSK):

### Output Power, Low Channel



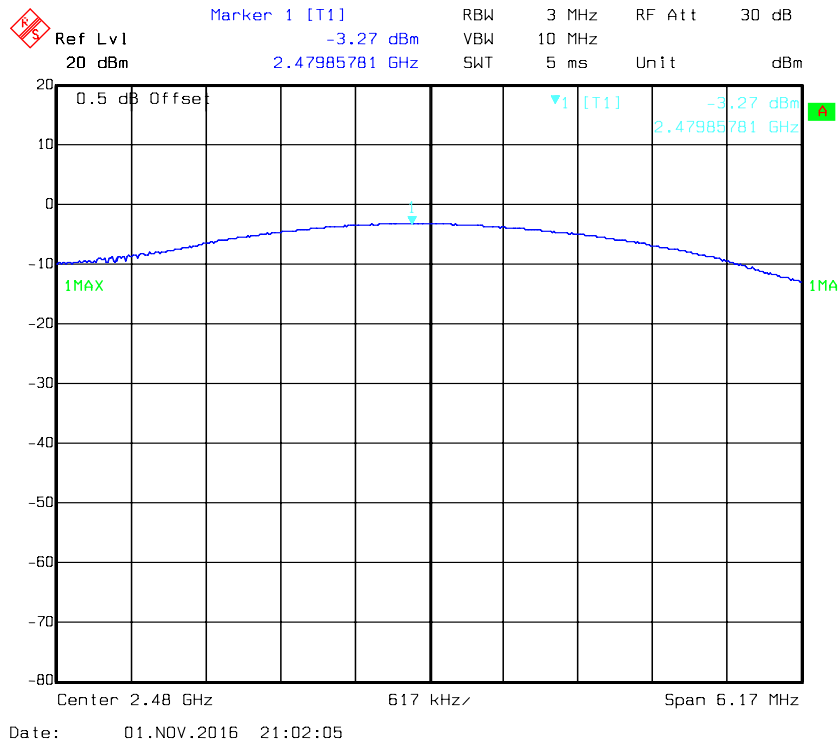
Date: 01.NOV.2016 21:03:54

### Output Power, Middle Channel



Date: 01.NOV.2016 21:03:03

### Output Power, High Channel



## FCC §15.247(d) - BAND EDGES TESTING

### Applicable Standard

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2015-12-02	2016-12-01
N/A	RF Cable	N/A	N/A	Each Time	/

\* **Statement of Traceability:** BACL (Chengdu) attested that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

## Test Data

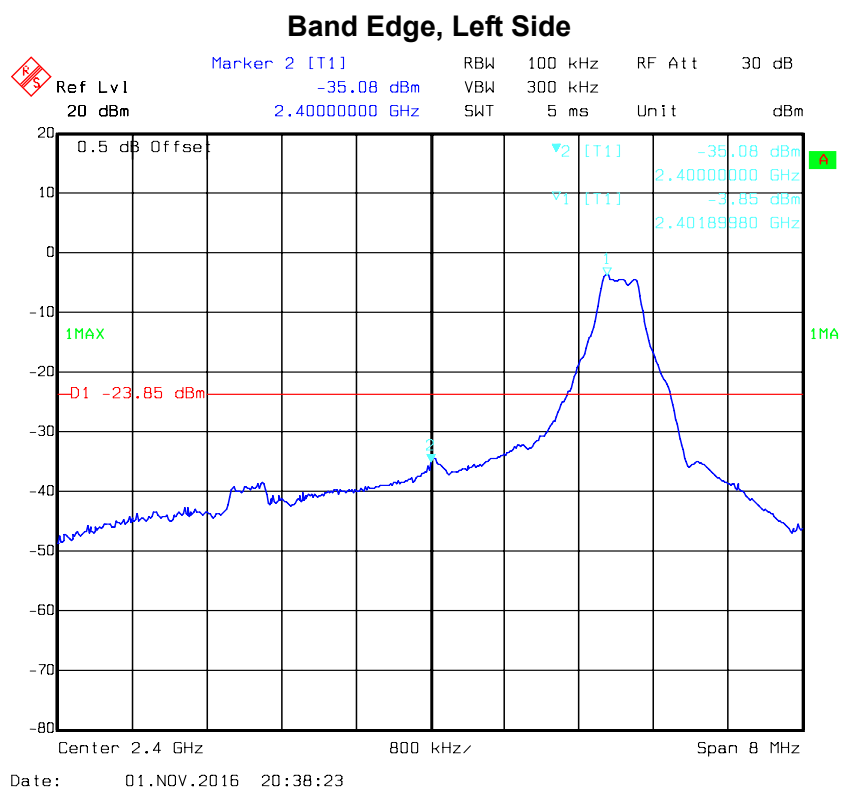
### Environmental Conditions

Temperature:	24.1 °C
Relative Humidity:	32 %
ATM Pressure:	101.4 kPa

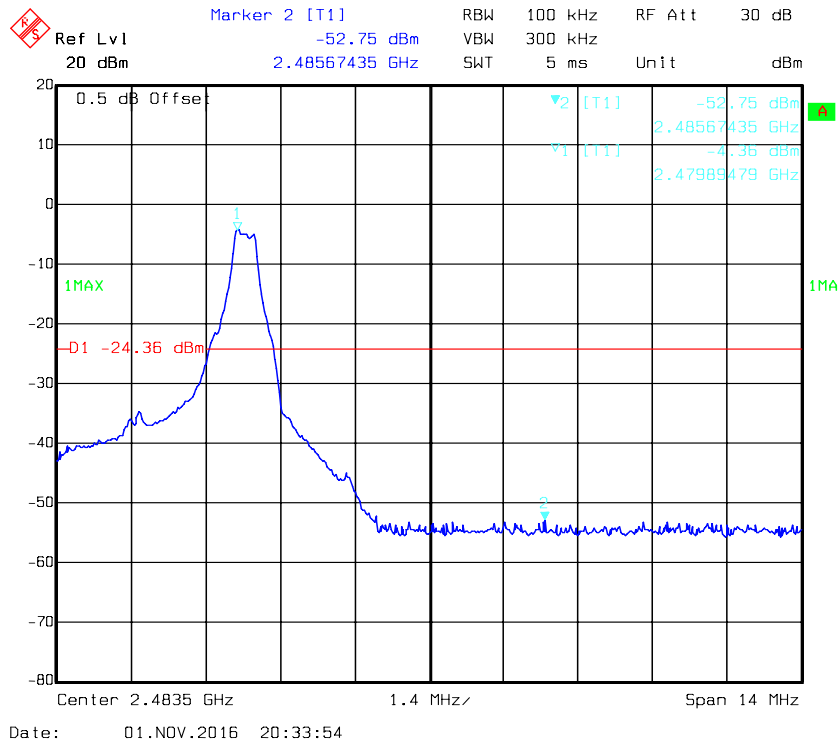
\* The testing was performed by Kevin Hu on 2016-11-01.

**Test Result:** Compliance

*BDR Mode (GFSK):*

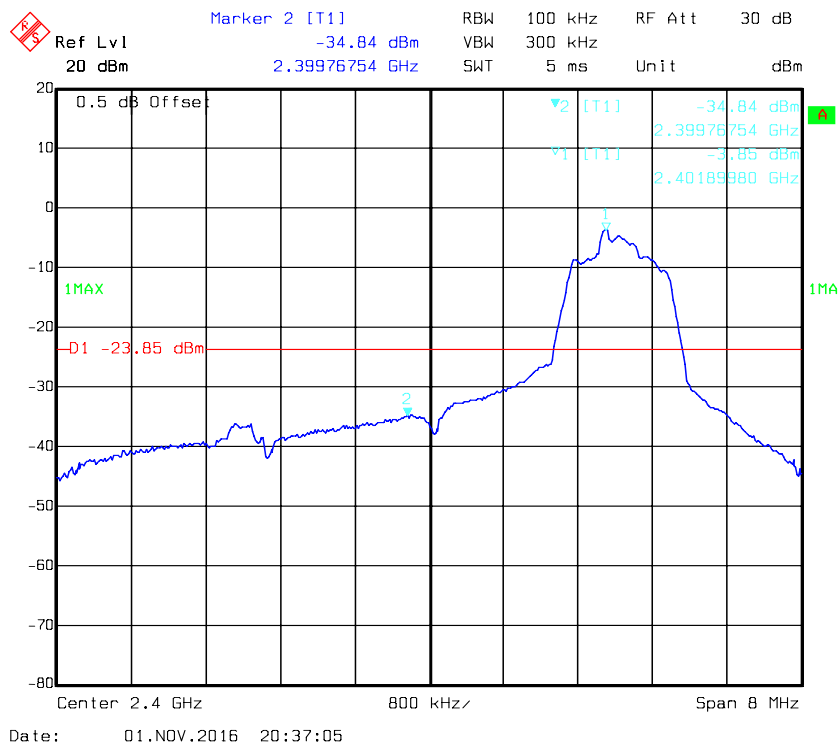


### Band Edge, Right Side

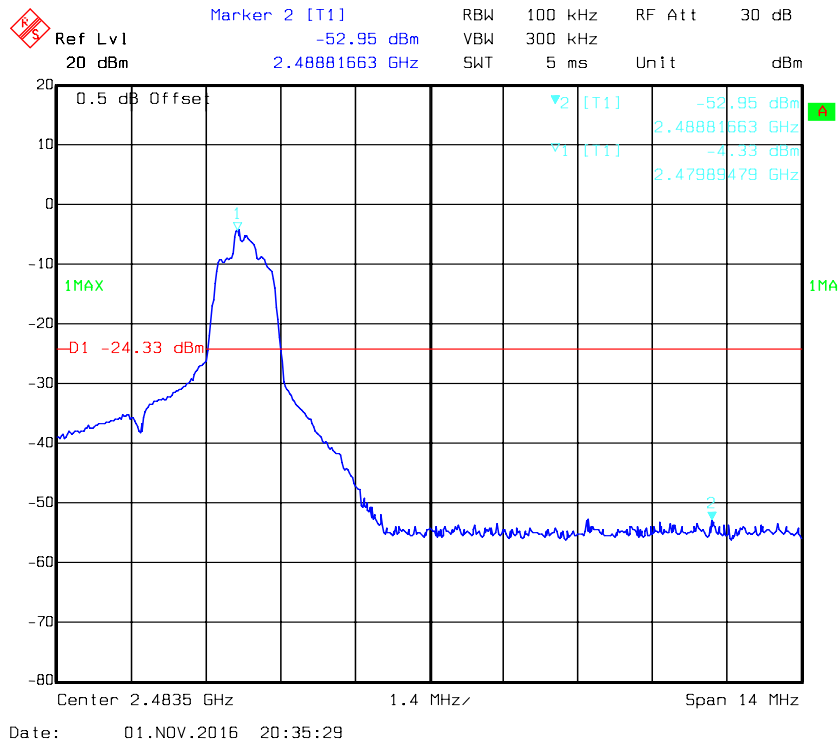


EDR Mode ( $\pi/4$ -DQPSK):

### Band Edge, Left Side



### Band Edge, Right Side



\*\*\*\*\*END OF REPORT\*\*\*\*\*