FCC PART 15.247

TEST REPORT

For

Hantat Technology Ltd.

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FCC ID: V3NHB111

Report Type:	**Product Name:**
Original Report	Bluetooth speaker

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Report Number:	RDG170310801A
Report Date:	2017-04-10
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The ***Hantat Technology Ltd.***'s product, model number: ***HB111 (FCC ID: V3NHB111)*** (the "EUT") in this report was a ***Bluetooth speaker*** *,* which was measured approximately: 17.9 cm (L) x 6.2 cm (W) x 8 cm (H), rated input voltage: DC3.6V from battery or DC 5V from USB port.

**All measurement and test data in this report was gathered from final production sample, serial number: 170310801 (assigned by the BACL, Chengdu). It may have deviation from any other sample. The EUT supplied by the applicant was received on 2017-03-13, and EUT conformed to test requirement.*

Objective

This report is prepared on behalf of ***Hantat Technology Ltd.*** 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)

FCC Part 15C DTS submissions with FCC ID: V3NHB111.

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.

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.62dB
Unwanted Emissions, radiated	30M~200MHz: 4.7 dB for Horizontal, 4.7 dB for Vertical 200M~1GHz:6.0 dB for Horizontal, 6.0 for Vertical 1G~6GHz: 5.13 dB, 6G~18GHz: 5.47 dB
Temperature	±1℃
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.17 dB (150 kHz to 30 MHz)

Test Facility

The test site used by BACL to collect test data is located in the No.5040, Huilongwan Plaza, No.1, Shawan Road, Jinniu District, Chengdu, Sichuan, 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.

EUT Exercise Software

The software “Blutetooth MP Tool V1.06” was used for testing, which was provided by manufacturer. The maximum power was configured by system default setting.

Equipment Modifications

No modification was made to the EUT.

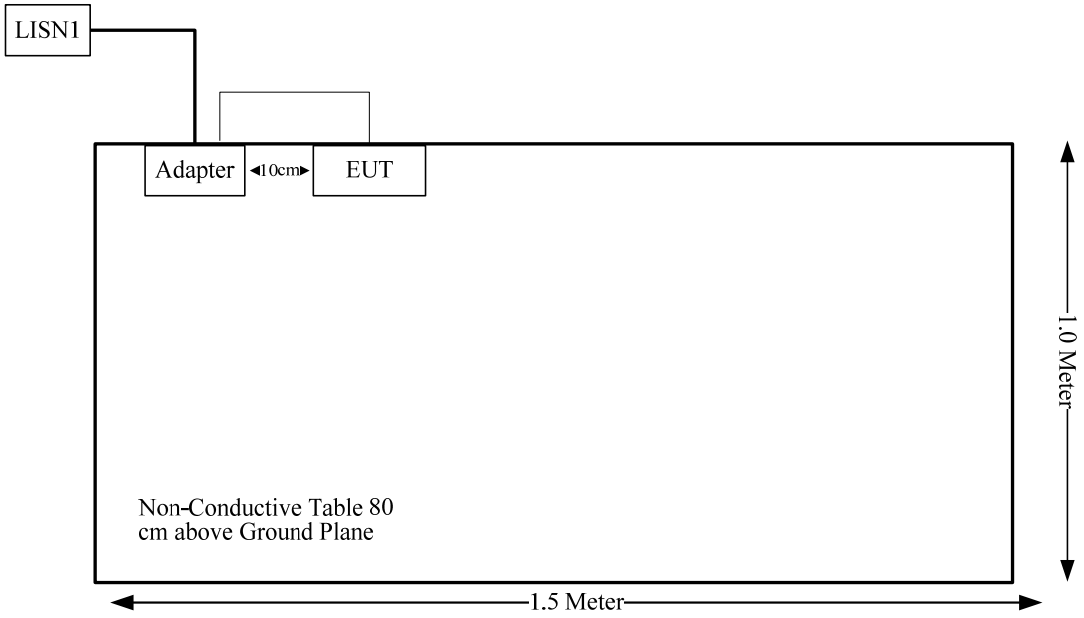
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Baijunda	Power Supply	UT-115E-5010	/

External Cable

Cable Description	Shielding Type	Ferrite Core	Length (cm)	From Port	To
USB Cable	NO	NO	82	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
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

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 ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

- f(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 ≤ 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 max conducted power including tune-up tolerance is 6.0dBm (3.98mW).
[(max. power of channel, mW)/(min. test separation distance, mm)][√f(GHz)]
= 3.98/5*(√2.480) = 1.3< 3.0

So the stand-alone SAR evaluation is not necessary.

FCC §15.203 - ANTENNA REQUIREMENT

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 BT, and the antenna gain is 0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

FCC §15.207 (a) – AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

Measurement Uncertainty

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

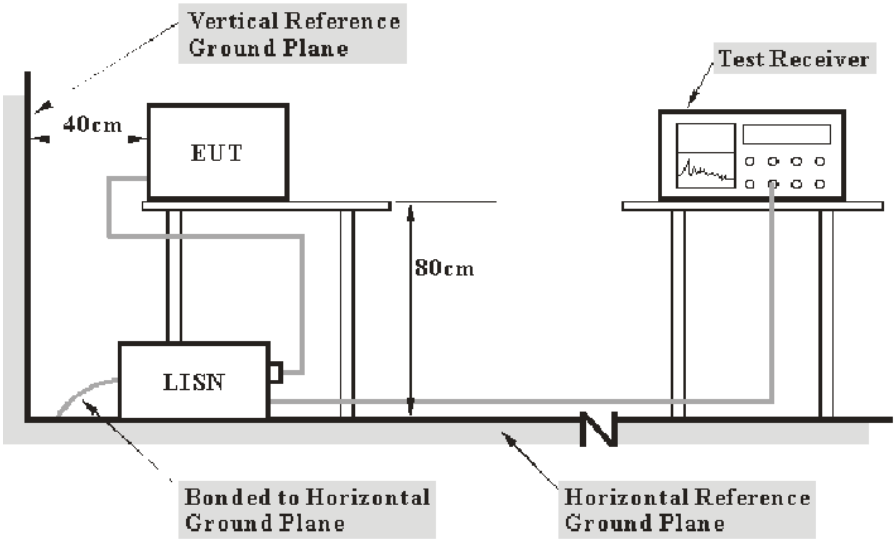
If U_{lab} is less than or equal to U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.
If U_{lab} is greater than U_{cispr} of Table 1, then:
–compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), 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 ±3.17 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
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:

Margin = Limit – 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	2016-12-02	2017-12-01
Rohde & Schwarz	L.I.S.N.	ENV216	3560.6550.06	2016-12-02	2017-12-01
Rohde & Schwarz	PULSE LIMITER	ESH3Z2	357.8810.52	2016-10-31	2017-10-30
N/A	Conducted Cable	NO.5	N/A	2016-11-10	2017-11-09
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

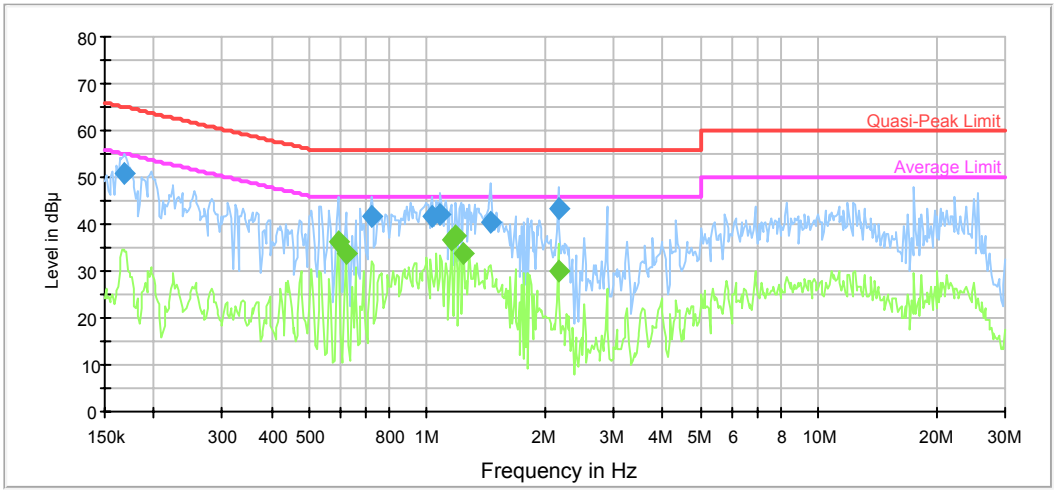
Environmental Conditions

Temperature:	25.2 °C
Relative Humidity:	53 %
ATM Pressure:	98.5 kPa

The testing was performed by Kevin Hu on 2017-04-01.

Test Mode: Transmitting

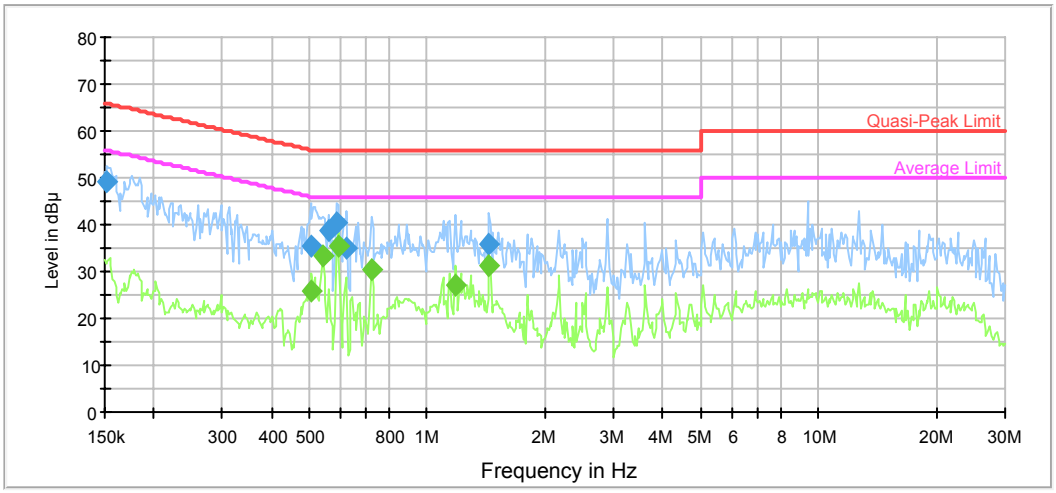
AC120 V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.169044	50.7	9.000	L1	19.7	14.3	65.0	Compliance
0.720803	41.6	9.000	L1	19.7	14.4	56.0	Compliance
1.031669	41.6	9.000	L1	19.7	14.4	56.0	Compliance
1.082190	42.3	9.000	L1	19.7	13.7	56.0	Compliance
1.453260	40.4	9.000	L1	19.7	15.6	56.0	Compliance
2.164561	43.2	9.000	L1	19.8	12.8	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.590613	36.3	9.000	L1	19.8	9.7	46.0	Compliance
0.619536	33.9	9.000	L1	19.7	12.1	46.0	Compliance
1.153421	36.6	9.000	L1	19.7	9.4	46.0	Compliance
1.181325	37.6	9.000	L1	19.7	8.4	46.0	Compliance
1.239175	33.7	9.000	L1	19.7	12.3	46.0	Compliance
2.164561	30.0	9.000	L1	19.8	16.0	46.0	Compliance

AC120 V, 60 Hz, Neutral:



Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152410	49.3	9.000	N	19.7	16.6	65.9	Compliance
0.503608	35.3	9.000	N	19.6	20.7	56.0	Compliance
0.558572	38.9	9.000	N	19.6	17.1	56.0	Compliance
0.585926	40.5	9.000	N	19.6	15.5	56.0	Compliance
0.624492	35.0	9.000	N	19.6	21.0	56.0	Compliance
1.441726	36.0	9.000	N	19.7	20.0	56.0	Compliance

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.507637	25.7	9.000	N	19.6	20.3	46.0	Compliance
0.541050	33.1	9.000	N	19.6	12.9	46.0	Compliance
0.590613	35.4	9.000	N	19.6	10.6	46.0	Compliance
0.720803	30.4	9.000	N	19.6	15.6	46.0	Compliance
1.181325	26.9	9.000	N	19.6	19.1	46.0	Compliance
1.441726	31.1	9.000	N	19.7	14.9	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_{cispr} of Table 2, 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_{cispr} of Table 2, then:
–compliance is deemed to occur if no measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit;
–non - compliance is deemed to occur if any measured disturbance level, increased by ($U_{lab} - U_{cispr}$), exceeds the disturbance limit.

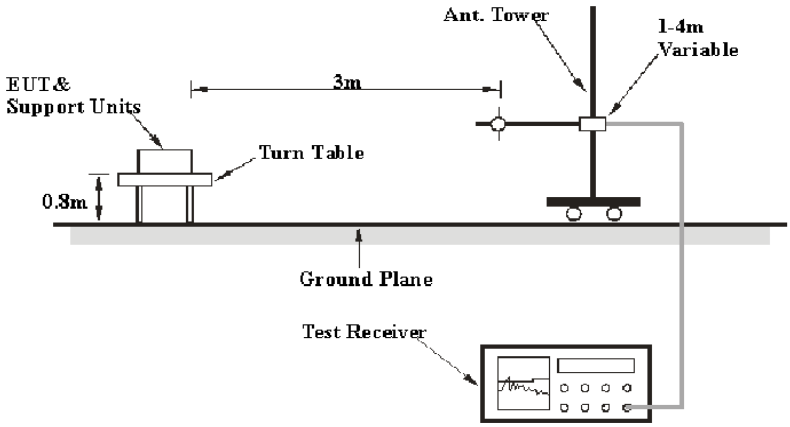
Based on CISPR 16-4-2-2011, measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Chengdu) is:
30M~200MHz: ±4.7 dB;
200M~1GHz: ±6.0 dB;
1G~6GHz: ±5.13dB;
6G~25GHz: ±5.47 dB;

Table 2 – Values of U_{cispr}

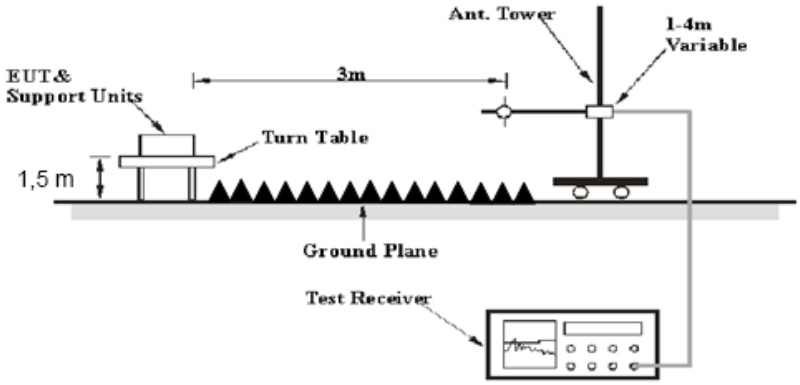
Measurement	U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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	2016-12-02	2017-12-01
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
Sunol Sciences	Broadband Antenna	JB3	A101808	2016-04-10	2019-04-09
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2016-12-02	2017-12-01
ETS	Horn Antenna	3115	003-6076	2016-12-02	2017-12-01
Ducommun Technologies	Horn Antenna	ARH-4223-02	1007726-0113024	2014-06-16	2017-06-15
Mini-circuits	Amplifier	ZVA-183-S+	771001215	2016-05-20	2017-05-19
HP	Amplifier	8449B	3008A00277	2016-12-02	2017-12-01
EMCT	Semi-Anechoic Chamber	966	N/A	2015-04-24	2018-04-23
N/A	RF Cable (below 1GHz)	NO.1	N/A	2016-11-10	2017-11-09
N/A	RF Cable (below 1GHz)	NO.4	N/A	2016-11-10	2017-11-09
N/A	RF Cable (above 1GHz)	NO.2	N/A	2016-11-10	2017-11-09

* **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:

Corrected Amplitude = Meter Reading + Antenna Factor + Cable Loss - 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:

Margin = Limit – Corrected Amplitude

Test Data

Environmental Conditions

Temperature:	17.5 °C
Relative Humidity:	51 %
ATM Pressure:	95.6 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Mode: Transmitting

30MHz-25GHz:

BDR Mode (GFSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	71.81	PK	H	23.53	3.00	0.00	98.34	N/A	N/A
2402	67.58	AV	H	23.53	3.00	0.00	94.11	N/A	N/A
2402	59.15	PK	V	23.53	3.00	0.00	85.68	N/A	N/A
2402	54.5	AV	V	23.53	3.00	0.00	81.03	N/A	N/A
2390	28.03	PK	H	23.57	3.00	0.00	54.60	74.00	19.40
2390	15.35	AV	H	23.57	3.00	0.00	41.92	54.00	12.08
4804	40.48	PK	H	30.77	5.12	26.87	49.50	74.00	24.50
4804	33.57	AV	H	30.77	5.12	26.87	42.59	54.00	11.41
7206	33.64	PK	H	34.71	6.16	26.35	48.16	74.00	25.84
7206	22.55	AV	H	34.71	6.16	26.35	37.07	54.00	16.93
1614	32.42	PK	H	24.28	2.76	26.44	33.02	74.00	40.98
1614	21.14	AV	H	24.28	2.76	26.44	21.74	54.00	32.26
45.15	48.7	QP	H	11.40	0.35	28.51	31.94	40.00	8.06
71.34	52.3	QP	H	7.70	0.55	28.42	32.13	40.00	7.87
Middle Channel: 2441 MHz									
2441	70.7	PK	H	23.40	3.00	0.00	97.10	N/A	N/A
2441	67.14	AV	H	23.40	3.00	0.00	93.54	N/A	N/A
2441	57.78	PK	V	23.40	3.00	0.00	84.18	N/A	N/A
2441	53.63	AV	V	23.40	3.00	0.00	80.03	N/A	N/A
4882	39.52	PK	H	31.02	5.09	26.87	48.76	74.00	25.24
4882	32.75	AV	H	31.02	5.09	26.87	41.99	54.00	12.01
7323	34.55	PK	H	34.95	6.22	26.40	49.32	74.00	24.68
7323	23.6	AV	H	34.95	6.22	26.40	38.37	54.00	15.63
1643	32.39	PK	H	24.33	2.78	26.47	33.03	74.00	40.97
1643	21.15	AV	H	24.33	2.78	26.47	21.79	54.00	32.21
2127	32.86	PK	H	24.47	3.03	26.84	33.52	74.00	40.48
2127	21.45	AV	H	24.47	3.03	26.84	22.11	54.00	31.89
45.15	48.5	QP	H	11.40	0.35	28.51	31.74	40.00	8.26
71.34	52.3	QP	H	7.70	0.55	28.42	32.13	40.00	7.87
High Channel: 2480 MHz									
2480	69.72	PK	H	23.27	2.99	0.00	95.98	N/A	N/A
2480	65.34	AV	H	23.27	2.99	0.00	91.60	N/A	N/A
2480	57	PK	V	23.27	2.99	0.00	83.26	N/A	N/A
2480	52.92	AV	V	23.27	2.99	0.00	79.18	N/A	N/A
2483.5	28.75	PK	H	23.26	2.99	0.00	55.00	74.00	19.00
2483.5	15.99	AV	H	23.26	2.99	0.00	42.24	54.00	11.76
4960	40.35	PK	H	31.27	5.05	26.88	49.79	74.00	24.21
4960	33.77	AV	H	31.27	5.05	26.88	43.21	54.00	10.79
7440	35.79	PK	H	35.18	6.27	26.45	50.79	74.00	23.21
7440	24.67	AV	H	35.18	6.27	26.45	39.67	54.00	14.33
1678	31.74	PK	H	24.38	2.81	26.50	32.43	74.00	41.57
1678	21.56	AV	H	24.38	2.81	26.50	22.25	54.00	31.75
45.15	48.6	QP	H	11.40	0.35	28.51	31.84	40.00	8.16
71.34	52.2	QP	H	7.70	0.55	28.42	32.03	40.00	7.97

EDR Mode (π/4-DQPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	73.1	PK	H	23.53	3.00	0.00	99.63	N/A	N/A
2402	59.88	AV	H	23.53	3.00	0.00	86.41	N/A	N/A
2402	60.45	PK	V	23.53	3.00	0.00	86.98	N/A	N/A
2402	48.08	AV	V	23.53	3.00	0.00	74.61	N/A	N/A
2390	28.29	PK	H	23.57	3.00	0.00	54.86	74.00	19.14
2390	16.05	AV	H	23.57	3.00	0.00	42.62	54.00	11.38
4804	42.08	PK	H	30.77	5.12	26.87	51.10	74.00	22.90
4804	30.76	AV	H	30.77	5.12	26.87	39.78	54.00	14.22
7206	35.76	PK	H	34.71	6.16	26.35	50.28	74.00	23.72
7206	23.53	AV	H	34.71	6.16	26.35	38.05	54.00	15.95
1614	32.84	PK	H	24.28	2.76	26.44	33.44	74.00	40.56
1614	21.13	AV	H	24.28	2.76	26.44	21.73	54.00	32.27
45.15	48.5	QP	H	11.40	0.35	28.51	31.74	40.00	8.26
71.34	52.3	QP	H	7.70	0.55	28.42	32.13	40.00	7.87
Middle Channel: 2441 MHz									
2441	72.05	PK	H	23.40	3.00	0.00	98.45	N/A	N/A
2441	59.3	AV	H	23.40	3.00	0.00	85.70	N/A	N/A
2441	59.92	PK	V	23.40	3.00	0.00	86.32	N/A	N/A
2441	47.06	AV	V	23.40	3.00	0.00	73.46	N/A	N/A
4882	41.41	PK	H	31.02	5.09	26.87	50.65	74.00	23.35
4882	30.55	AV	H	31.02	5.09	26.87	39.79	54.00	14.21
7323	36.39	PK	H	34.95	6.22	26.40	51.16	74.00	22.84
7323	24.07	AV	H	34.95	6.22	26.40	38.84	54.00	15.16
1643	32.13	PK	H	24.33	2.78	26.47	32.77	74.00	41.23
1643	20.89	AV	H	24.33	2.78	26.47	21.53	54.00	32.47
2127	32.98	PK	H	24.47	3.03	26.84	33.64	74.00	40.36
2127	21.13	AV	H	24.47	3.03	26.84	21.79	54.00	32.21
45.15	48.4	QP	H	11.40	0.35	28.51	31.64	40.00	8.36
71.34	52.4	QP	H	7.70	0.55	28.42	32.23	40.00	7.77
High Channel: 2480 MHz									
2480	71.03	PK	H	23.27	2.99	0.00	97.29	N/A	N/A
2480	57.71	AV	H	23.27	2.99	0.00	83.97	N/A	N/A
2480	57.98	PK	V	23.27	2.99	0.00	84.24	N/A	N/A
2480	45.73	AV	V	23.27	2.99	0.00	71.99	N/A	N/A
2483.5	29.22	PK	H	23.26	2.99	0.00	55.47	74.00	18.53
2483.5	16.44	AV	H	23.26	2.99	0.00	42.69	54.00	11.31
4960	40.8	PK	H	31.27	5.05	26.88	50.24	74.00	23.76
4960	28.51	AV	H	31.27	5.05	26.88	37.95	54.00	16.05
7440	36.57	PK	H	35.18	6.27	26.45	51.57	74.00	22.43
7440	24.19	AV	H	35.18	6.27	26.45	39.19	54.00	14.81
1678	32.07	PK	H	24.38	2.81	26.50	32.76	74.00	41.24
1678	20.49	AV	H	24.38	2.81	26.50	21.18	54.00	32.82
45.15	48.8	QP	H	11.40	0.35	28.51	32.04	40.00	7.96
71.34	52.3	QP	H	7.70	0.55	28.42	32.13	40.00	7.87

EDR Mode (8-DPSK):

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	FCC 15.247	
	Reading (dBμV)	Detector	Polar (H/V)	Factor (dB)				Limit (dBμV/m)	Margin (dB)
Low Channel: 2402 MHz									
2402	73.18	PK	H	23.53	3.00	0.00	99.71	N/A	N/A
2402	59.99	AV	H	23.53	3.00	0.00	86.52	N/A	N/A
2402	60.87	PK	V	23.53	3.00	0.00	87.40	N/A	N/A
2402	48.05	AV	V	23.53	3.00	0.00	74.58	N/A	N/A
2390	28.29	PK	H	23.57	3.00	0.00	54.86	74.00	19.14
2390	15.56	AV	H	23.57	3.00	0.00	42.13	54.00	11.87
4804	41.85	PK	H	30.77	5.12	26.87	50.87	74.00	23.13
4804	30.26	AV	H	30.77	5.12	26.87	39.28	54.00	14.72
7206	35.9	PK	H	34.71	6.16	26.35	50.42	74.00	23.58
7206	23.74	AV	H	34.71	6.16	26.35	38.26	54.00	15.74
1614	32.68	PK	H	24.28	2.76	26.44	33.28	74.00	40.72
1614	20.92	AV	H	24.28	2.76	26.44	21.52	54.00	32.48
45.15	48.6	QP	H	11.40	0.35	28.51	31.84	40.00	8.16
71.34	52.6	QP	H	7.70	0.55	28.42	32.43	40.00	7.57
Middle Channel: 2441 MHz									
2441	71.73	PK	H	23.40	3.00	0.00	98.13	N/A	N/A
2441	59.15	AV	H	23.40	3.00	0.00	85.55	N/A	N/A
2441	59.61	PK	V	23.40	3.00	0.00	86.01	N/A	N/A
2441	47.2	AV	V	23.40	3.00	0.00	73.60	N/A	N/A
4882	41.69	PK	H	31.02	5.09	26.87	50.93	74.00	23.07
4882	30.72	AV	H	31.02	5.09	26.87	39.96	54.00	14.04
7323	36.12	PK	H	34.95	6.22	26.40	50.89	74.00	23.11
7323	23.93	AV	H	34.95	6.22	26.40	38.70	54.00	15.30
1643	32.89	PK	H	24.33	2.78	26.47	33.53	74.00	40.47
1643	21.18	AV	H	24.33	2.78	26.47	21.82	54.00	32.18
2127	32.72	PK	H	24.47	3.03	26.84	33.38	74.00	40.62
2127	20.94	AV	H	24.47	3.03	26.84	21.60	54.00	32.40
45.15	48.8	QP	H	11.40	0.35	28.51	32.04	40.00	7.96
71.34	52.1	QP	H	7.70	0.55	28.42	31.93	40.00	8.07
High Channel: 2480 MHz									
2480	70.58	PK	H	23.27	2.99	0.00	96.84	N/A	N/A
2480	57.45	AV	H	23.27	2.99	0.00	83.71	N/A	N/A
2480	57.83	PK	V	23.27	2.99	0.00	84.09	N/A	N/A
2480	45.21	AV	V	23.27	2.99	0.00	71.47	N/A	N/A
2483.5	29.56	PK	H	23.26	2.99	0.00	55.81	74.00	18.19
2483.5	16.35	AV	H	23.26	2.99	0.00	42.60	54.00	11.40
4960	40.9	PK	H	31.27	5.05	26.88	50.34	74.00	23.66
4960	28.61	AV	H	31.27	5.05	26.88	38.05	54.00	15.95
7440	36.77	PK	H	35.18	6.27	26.45	51.77	74.00	22.23
7440	24.58	AV	H	35.18	6.27	26.45	39.58	54.00	14.42
1678	32.12	PK	H	24.38	2.81	26.50	32.81	74.00	41.19
1678	20.54	AV	H	24.38	2.81	26.50	21.23	54.00	32.77
45.15	48.8	QP	H	11.40	0.35	28.51	32.04	40.00	7.96
71.34	52.3	QP	H	7.70	0.55	28.42	32.13	40.00	7.87

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

Applicable Standard

Frequency hopping systems shall have hoping 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	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
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

Temperature:	19.8 °C
Relative Humidity:	52 %
ATM Pressure:	95.8 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Result: Compliance.

Please refer to following tables and plots

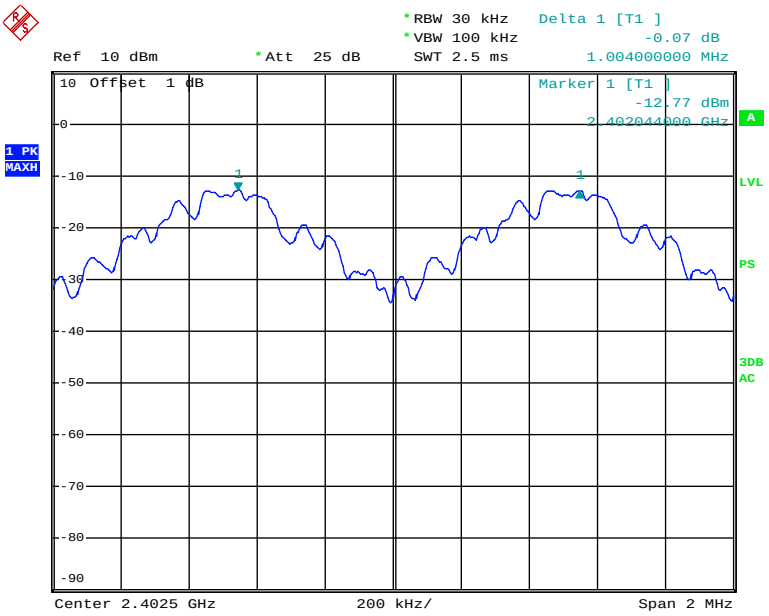
Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
BDR (GFSK)	Low	2402	1.004	0.69
	Middle	2441	1.004	0.69
	High	2480	1.000	0.69
EDR (π/4-DQPSK)	Low	2402	1.000	0.91
	Middle	2441	1.000	0.91
	High	2480	1.000	0.91
EDR (8DPSK)	Low	2402	0.996	0.87
	Middle	2441	1.000	0.87
	High	2480	1.004	0.87

Note: Limit= (2/3) × 20dB bandwidth

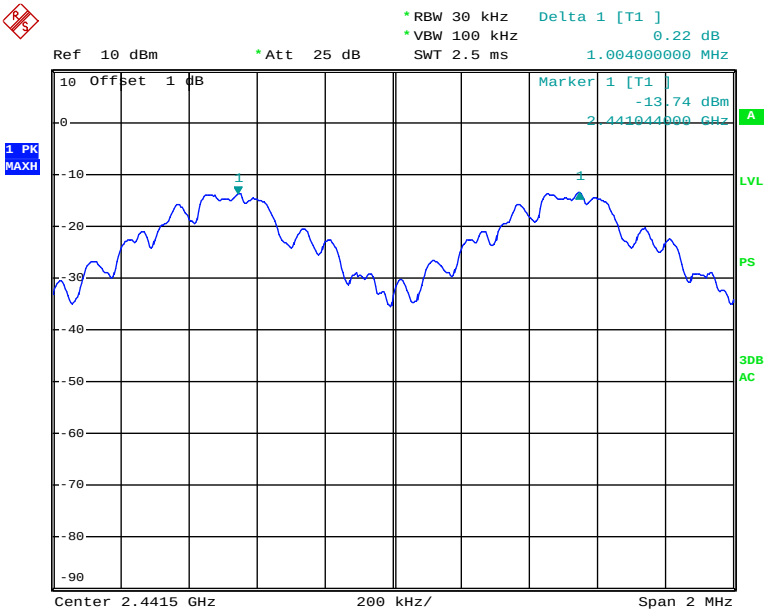
BDR Mode (GFSK):

Low Channel



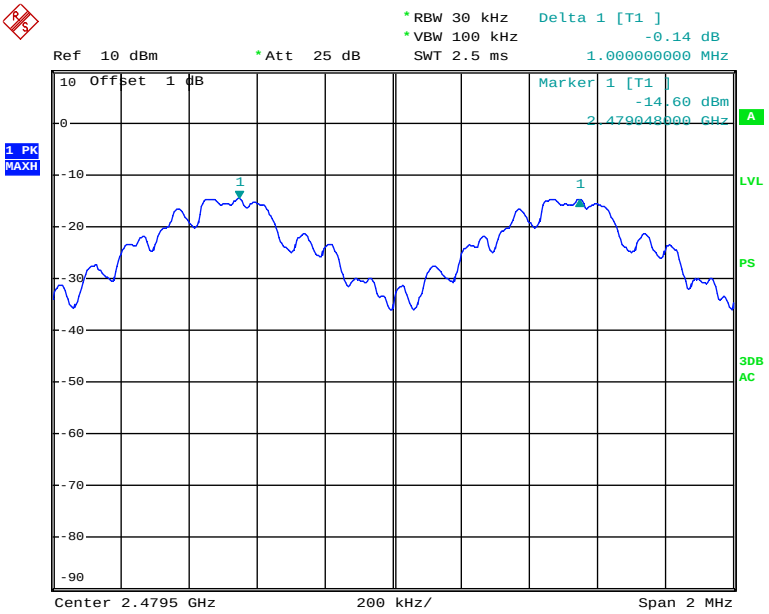
Date: 6.APR.2017 16:29:18

Middle Channel



Date: 6.APR.2017 16:28:45

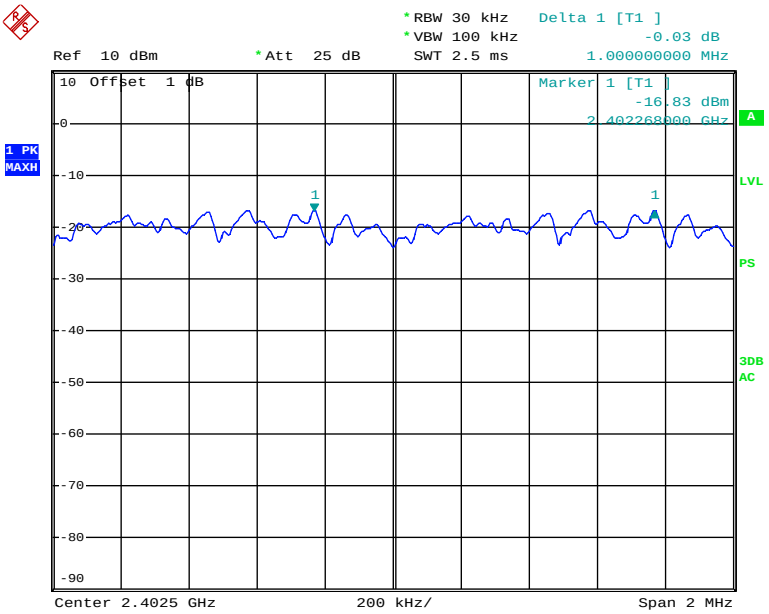
High Channel



Date: 6.APR.2017 16:28:12

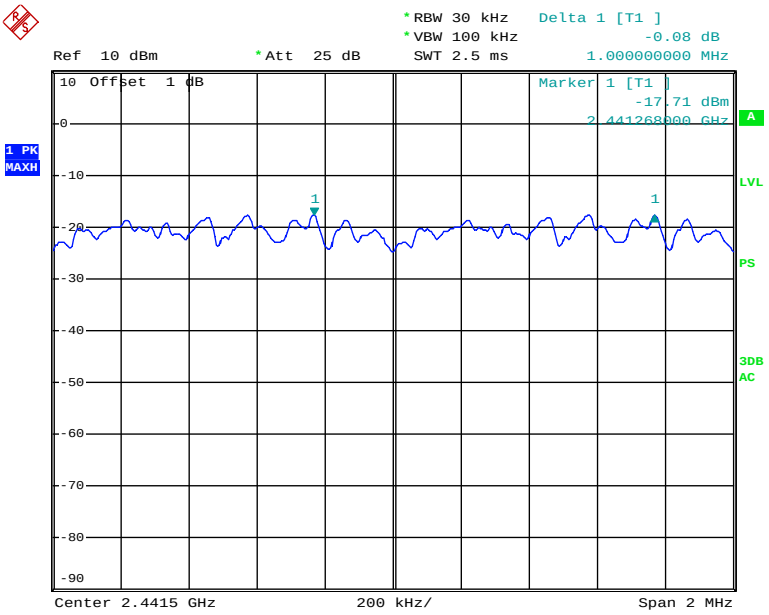
EDR Mode (π/4-DQPSK):

Low Channel



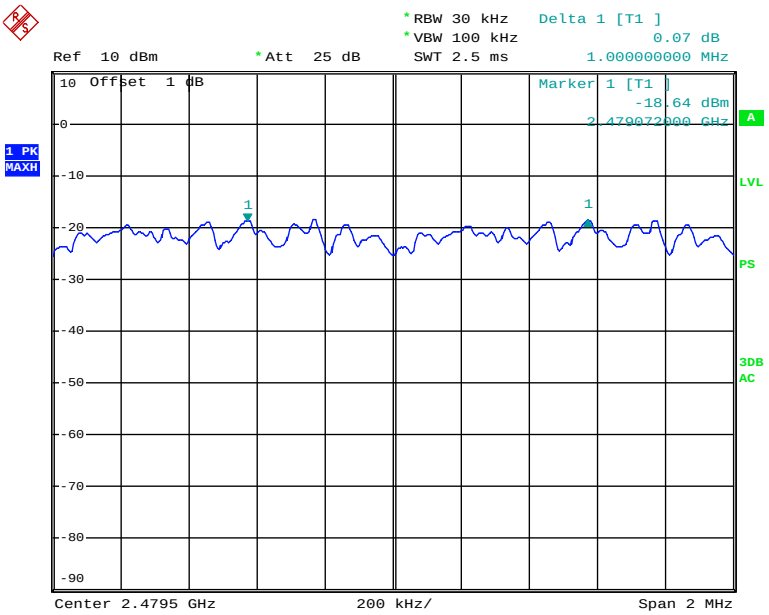
Date: 6.APR.2017 16:26:04

Middle Channel



Date: 6.APR.2017 16:26:46

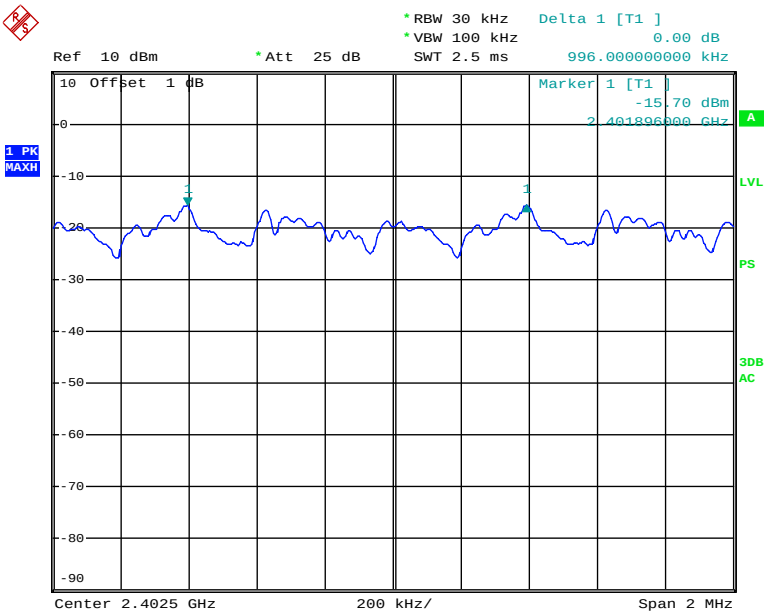
High Channel



Date: 6.APR.2017 16:27:27

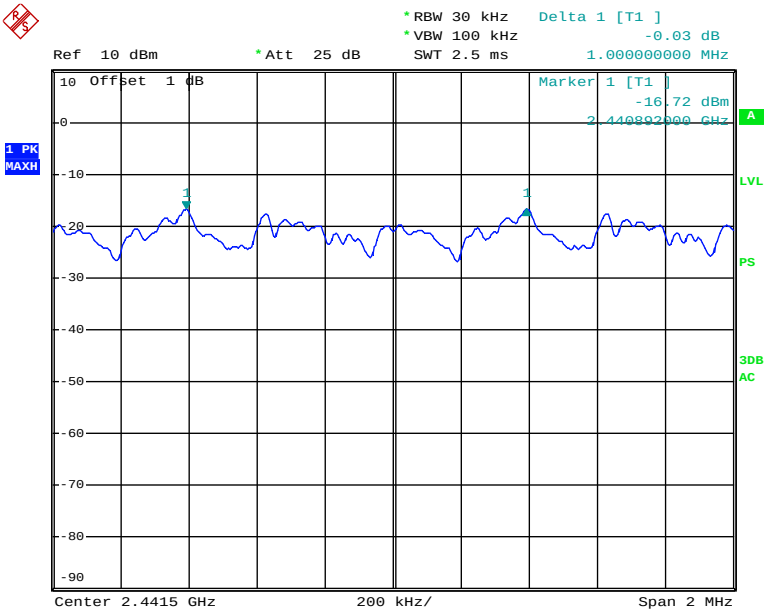
EDR Mode (8-DPSK):

Low Channel



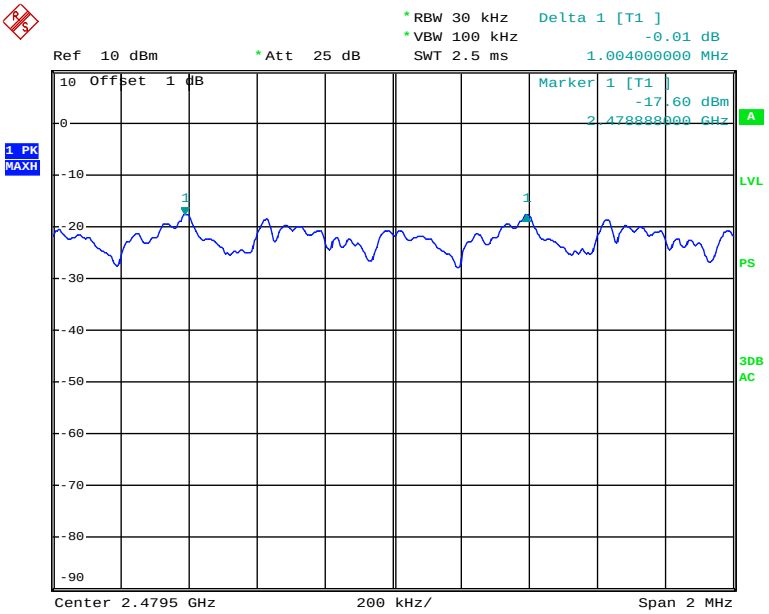
Date: 6.APR.2017 16:25:19

Middle Channel



Date: 6.APR.2017 16:24:37

High Channel



Date: 6.APR.2017 16:24:04

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	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
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:	19.8 °C
Relative Humidity:	52 %
ATM Pressure:	95.8 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Result: Compliance.

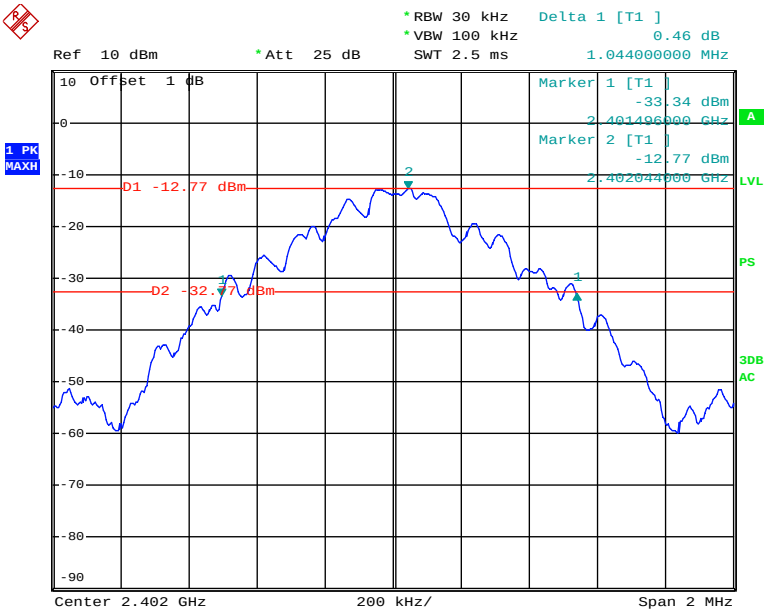
Please refer to following tables and plots

Test Mode: Transmitting

Mode	Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
BDR Mode (GFSK)	Low	2402	1.04
	Middle	2441	1.04
	High	2480	1.04
EDR Mode (π/4-DQPSK)	Low	2402	1.37
	Middle	2441	1.36
	High	2480	1.37
EDR Mode (8-DPSK)	Low	2402	1.30
	Middle	2441	1.30
	High	2480	1.30

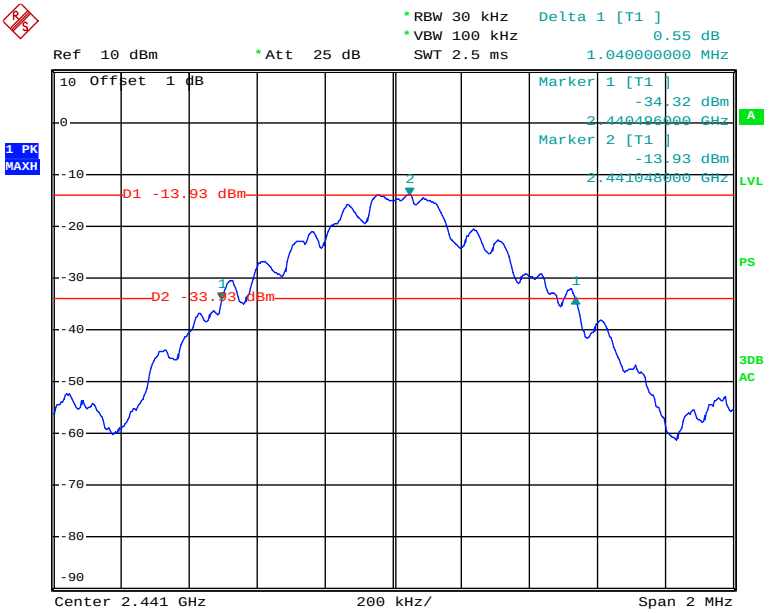
BDR Mode (GFSK):

Low Channel



Date: 6.APR.2017 16:07:32

Middle Channel



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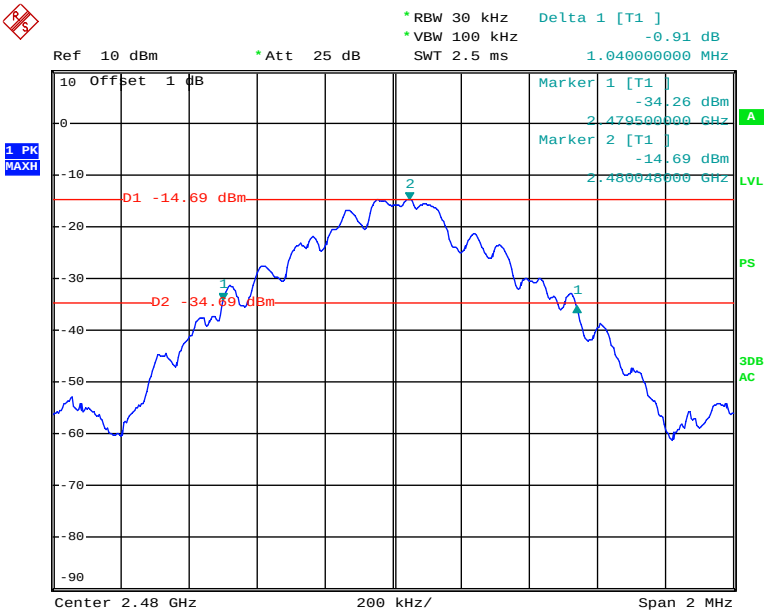
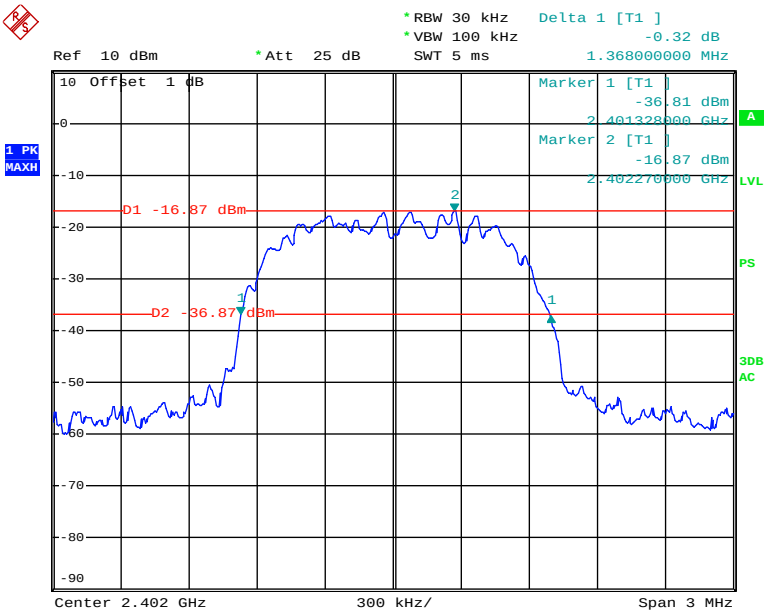
High Channel



Date: 6.APR.2017 16:09:38

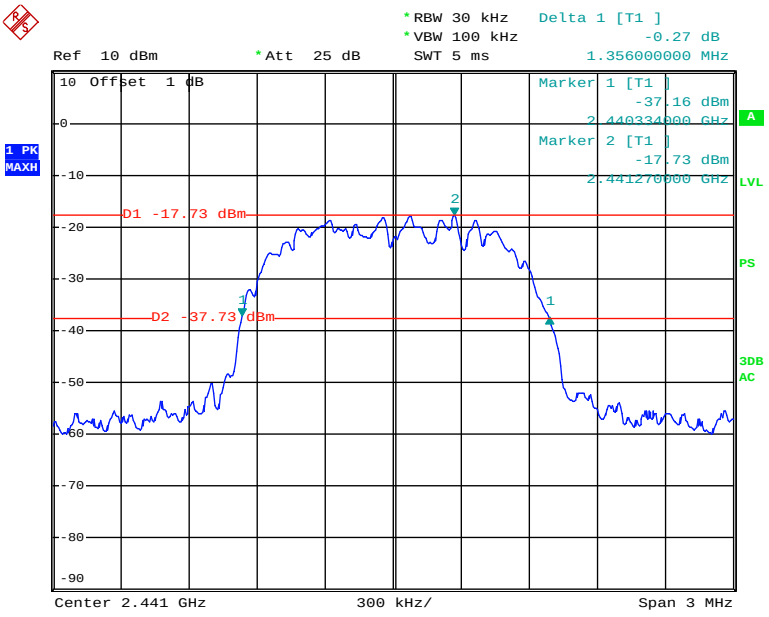
EDR Mode (π/4-DQPSK):

Low Channel



Date: 6.APR.2017 16:19:04

Middle Channel



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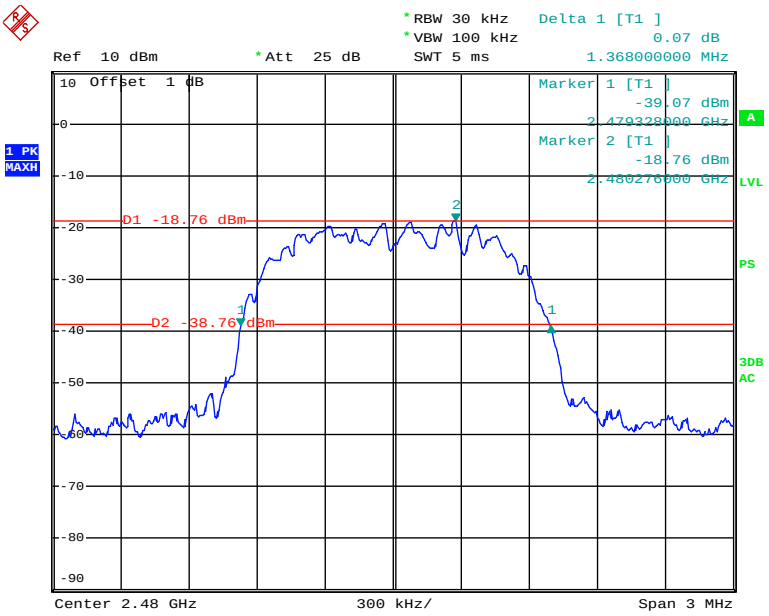
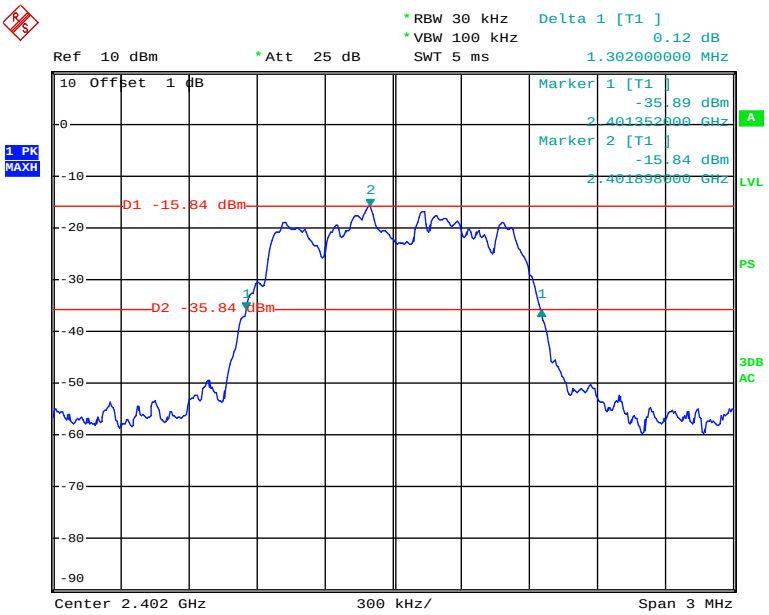
High Channel



Date: 6.APR.2017 16:10:54

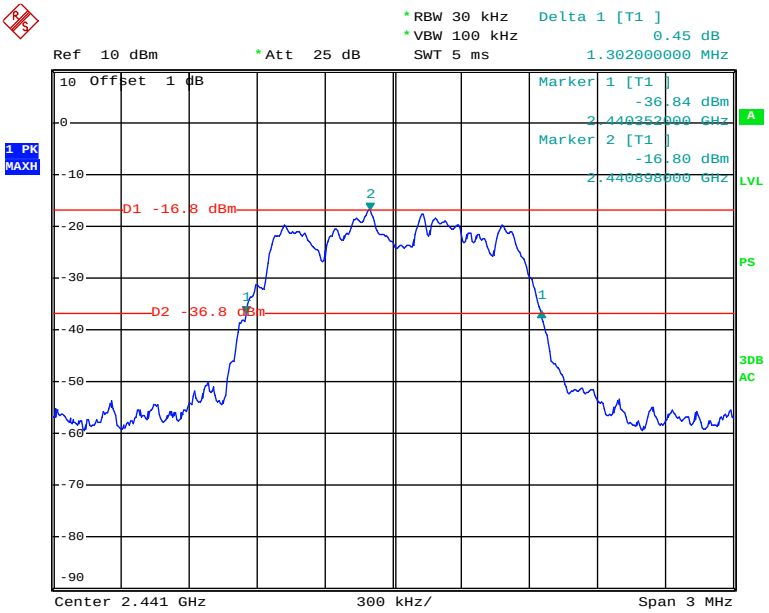
EDR Mode (8-DPSK):

Low Channel



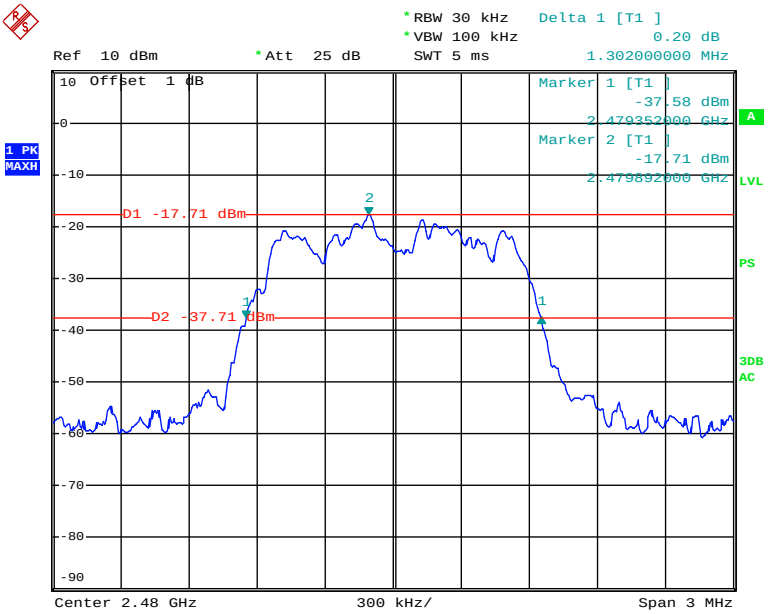
Date: 6.APR.2017 16:20:25

Middle Channel



Date: 6.APR.2017 16:21:37

High Channel



Date: 6.APR.2017 16:22:30

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	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
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:	19.8 °C
Relative Humidity:	52 %
ATM Pressure:	95.8 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Result: Compliance.

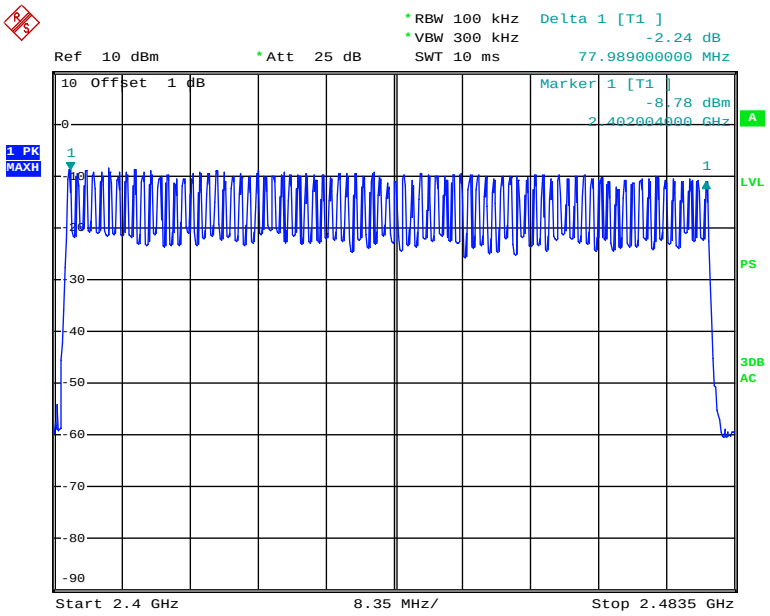
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

Number of Hopping Channels

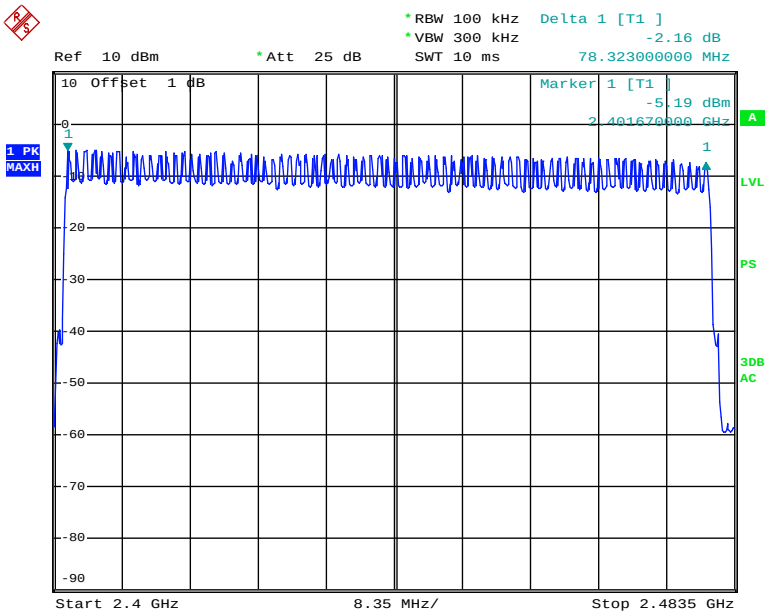


Date: 6.APR.2017 16:31:25

EDR Mode (π/4-DQPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

Number of Hopping Channels

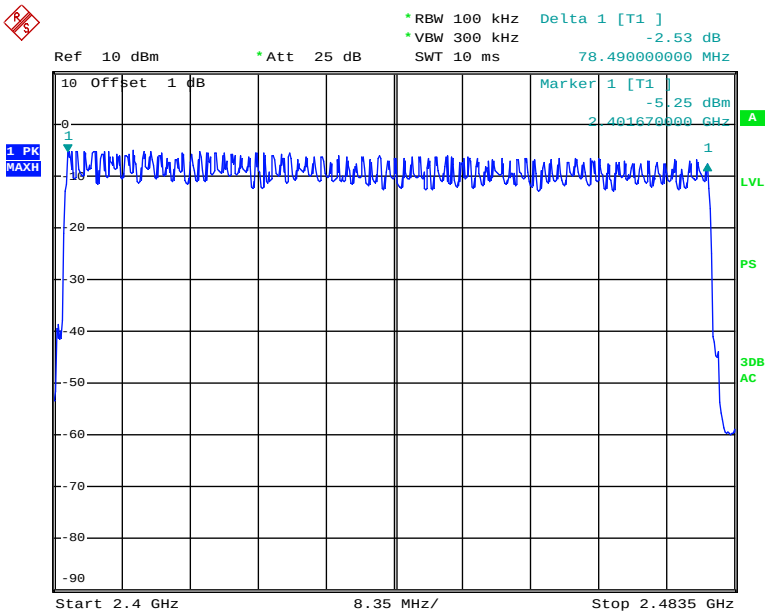


Date: 6.APR.2017 16:37:35

EDR Mode (8-DPSK):

Frequency Range (MHz)	Number of Hopping Channel	Limit
2400-2483.5	79	≥15

Number of Hopping Channels



Date: 6.APR.2017 16:41:25

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.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
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:	19.8 °C
Relative Humidity:	52 %
ATM Pressure:	95.8 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Result: Compliance.

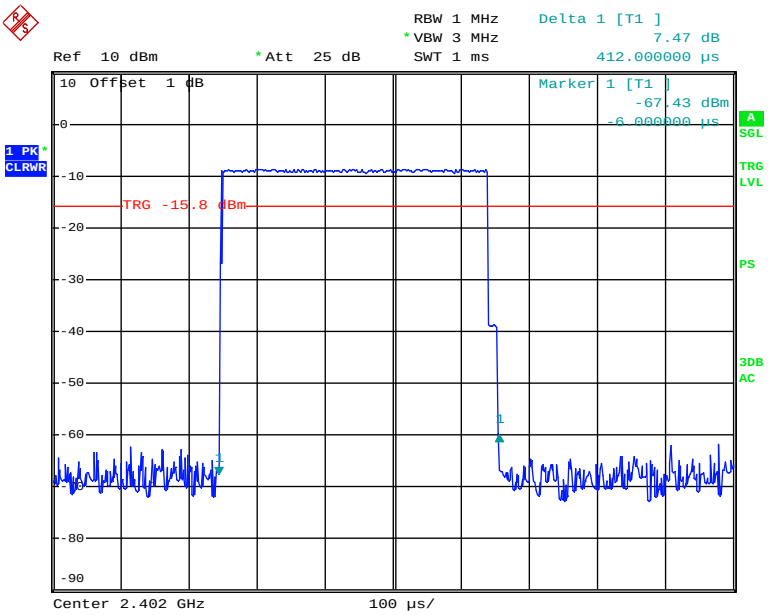
Please refer to following tables and plots

Test Mode: Transmitting

BDR Mode (GFSK):

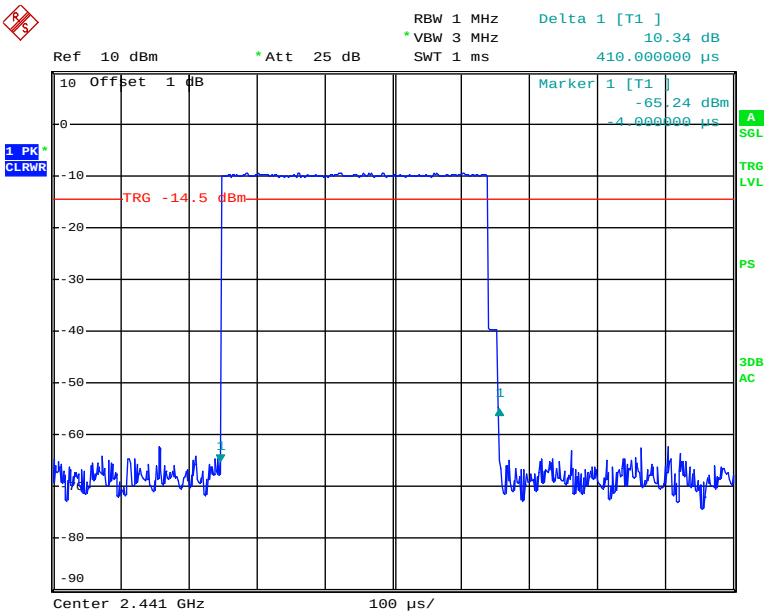
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
DH1	Low	0.412	0.132	0.4	Compliance
	Middle	0.410	0.131	0.4	Compliance
	High	0.412	0.132	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
DH3	Low	1.680	0.269	0.4	Compliance
	Middle	1.680	0.269	0.4	Compliance
	High	1.680	0.269	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
DH5	Low	2.940	0.314	0.4	Compliance
	Middle	2.940	0.314	0.4	Compliance
	High	2.930	0.313	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

DH1: Low Channel



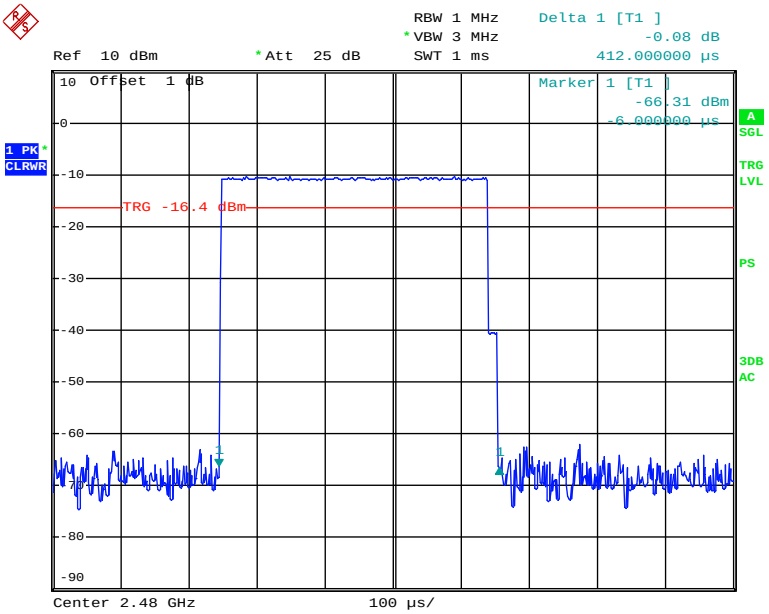
Date: 6.APR.2017 16:50:45

DH1: Middle Channel



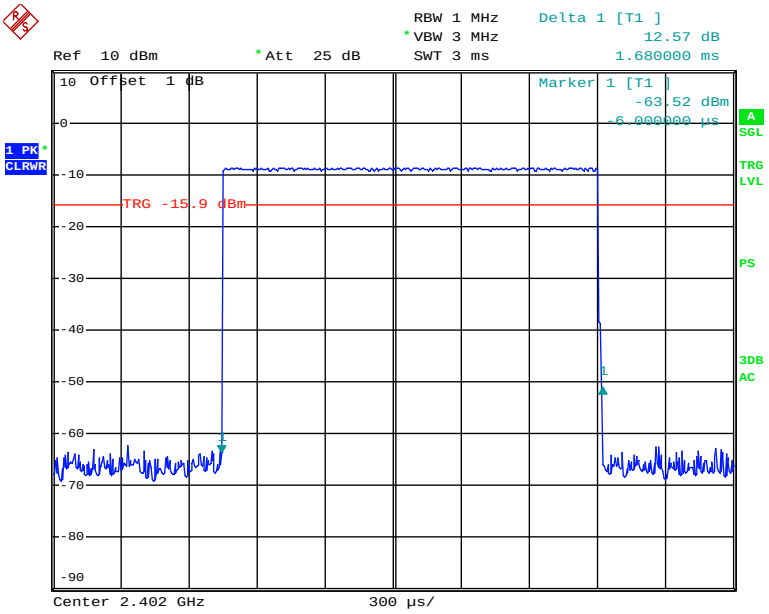
Date: 6.APR.2017 16:50:51

DH1: High Channel



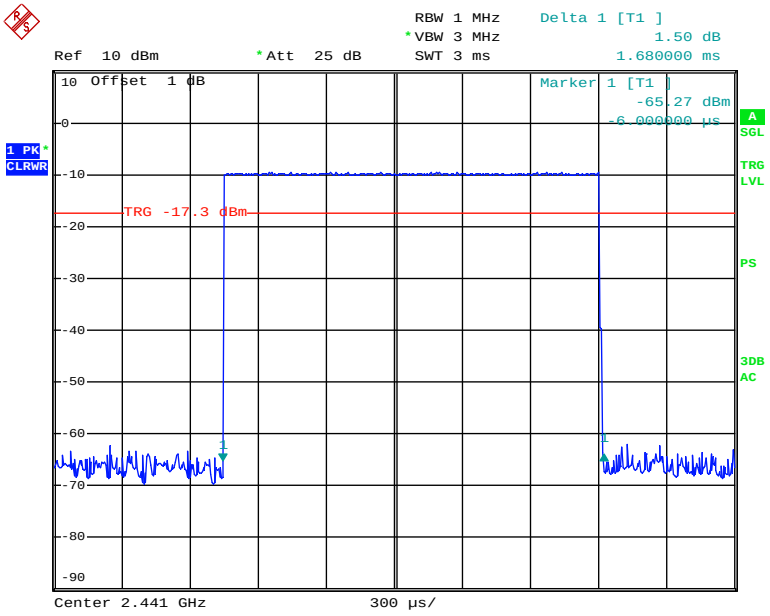
Date: 6.APR.2017 16:50:58

DH3: Low Channel



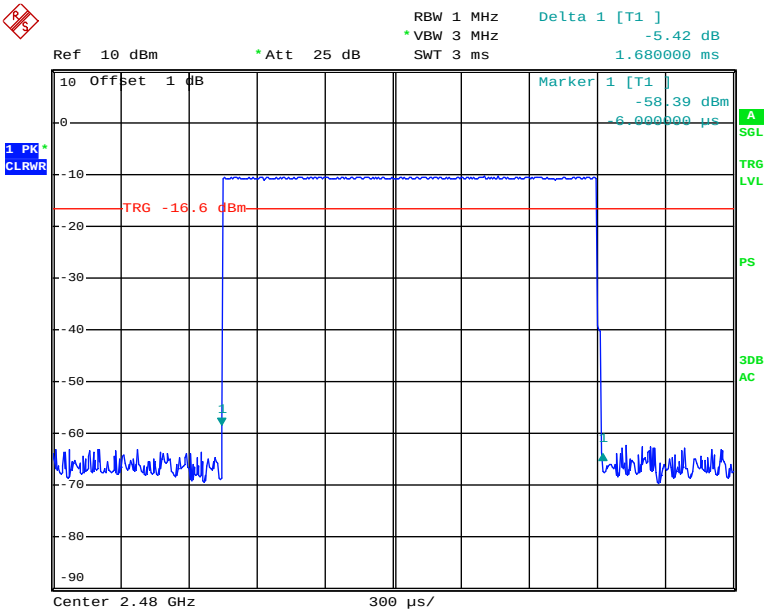
Date: 6.APR.2017 16:50:05

DH3: Middle Channel



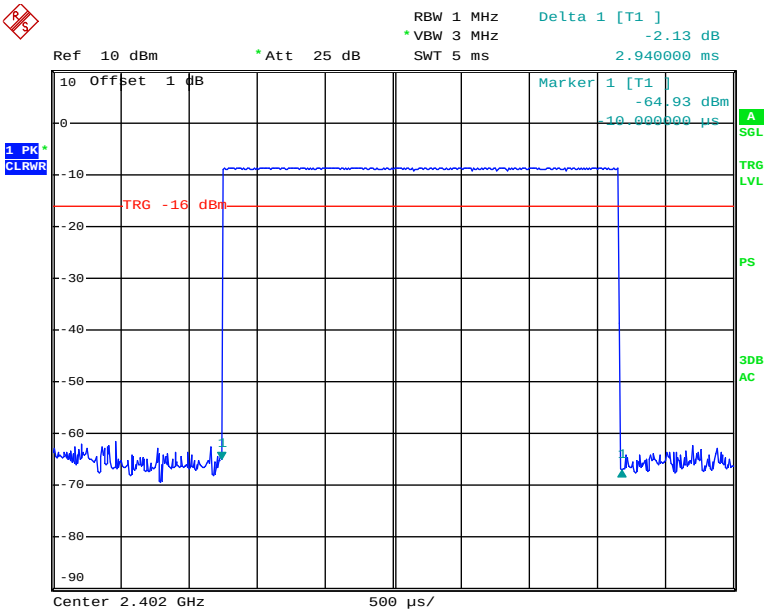
Date: 6.APR.2017 16:50:13

DH3: High Channel



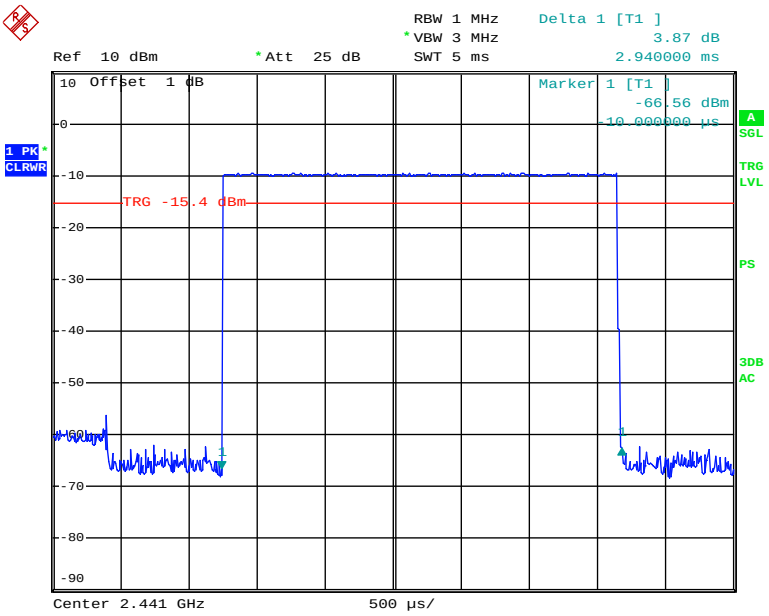
Date: 6.APR.2017 16:50:20

DH5: Low Channel



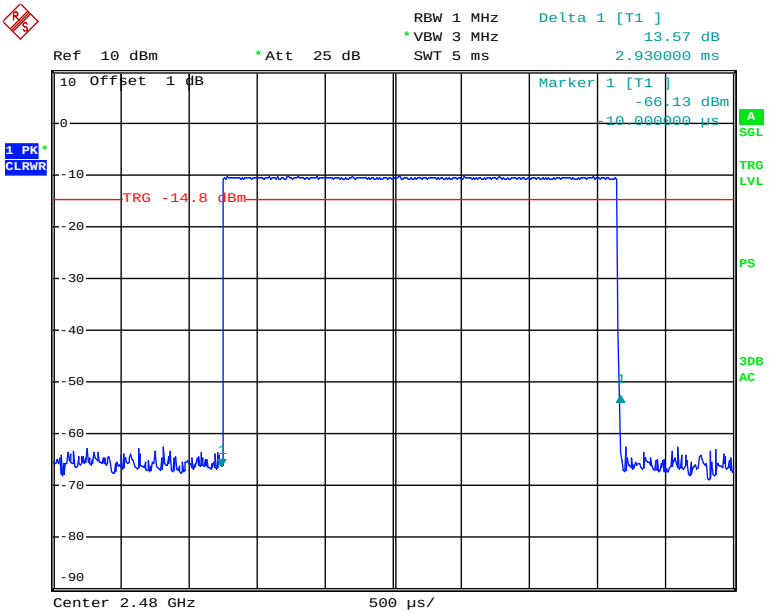
Date: 6.APR.2017 16:49:24

DH5: Middle Channel



Date: 6.APR.2017 16:49:31

DH5: High Channel

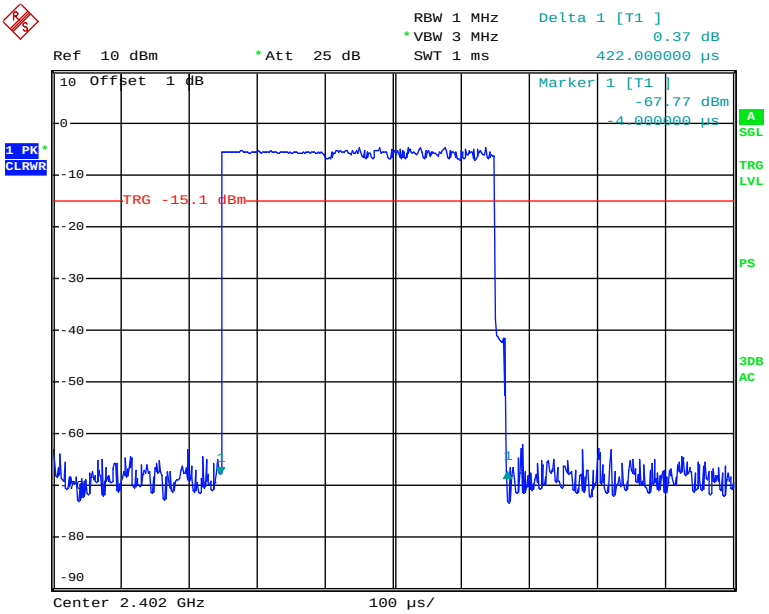


Date: 6.APR.2017 16:49:40

EDR Mode (π/4-DQPSK):

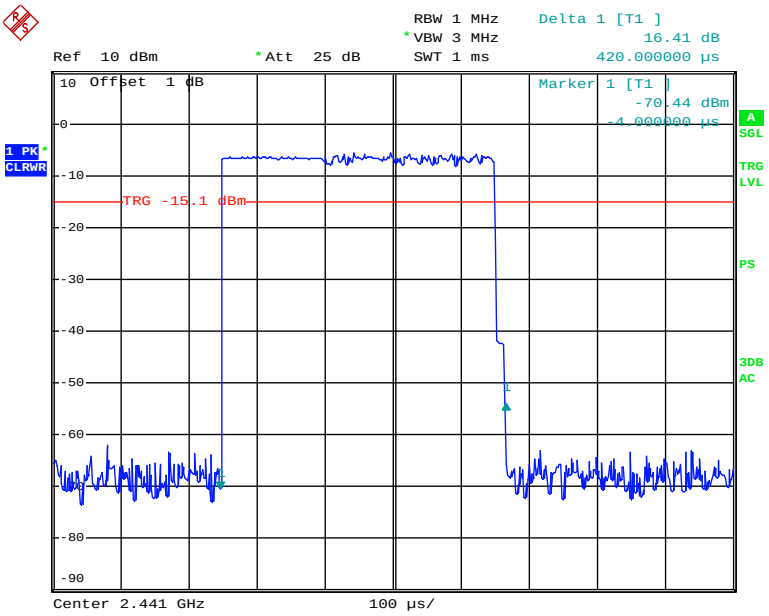
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
2DH1	Low	0.422	0.135	0.4	Compliance
	Middle	0.420	0.134	0.4	Compliance
	High	0.420	0.134	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
2DH3	Low	1.692	0.271	0.4	Compliance
	Middle	1.692	0.271	0.4	Compliance
	High	1.686	0.270	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
2DH5	Low	2.930	0.313	0.4	Compliance
	Middle	2.930	0.313	0.4	Compliance
	High	2.950	0.315	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

2DH1: Low Channel



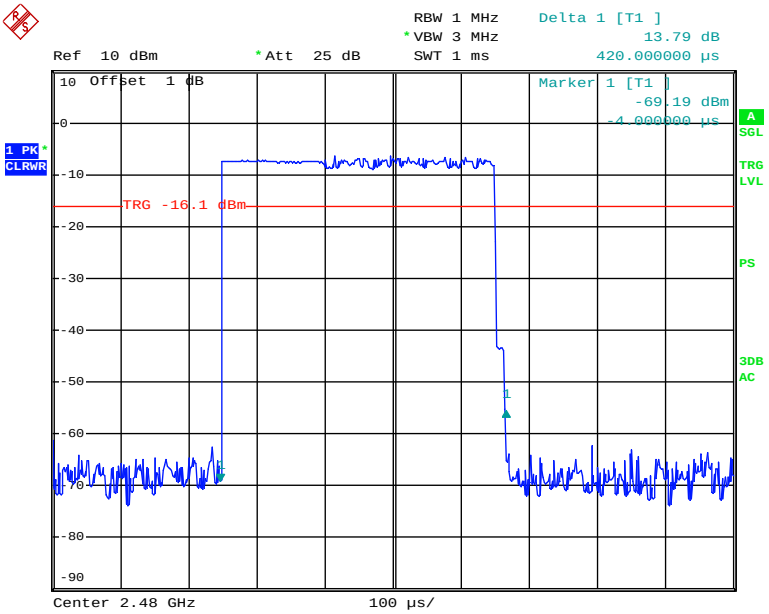
Date: 6.APR.2017 16:45:03

2DH1: Middle Channel



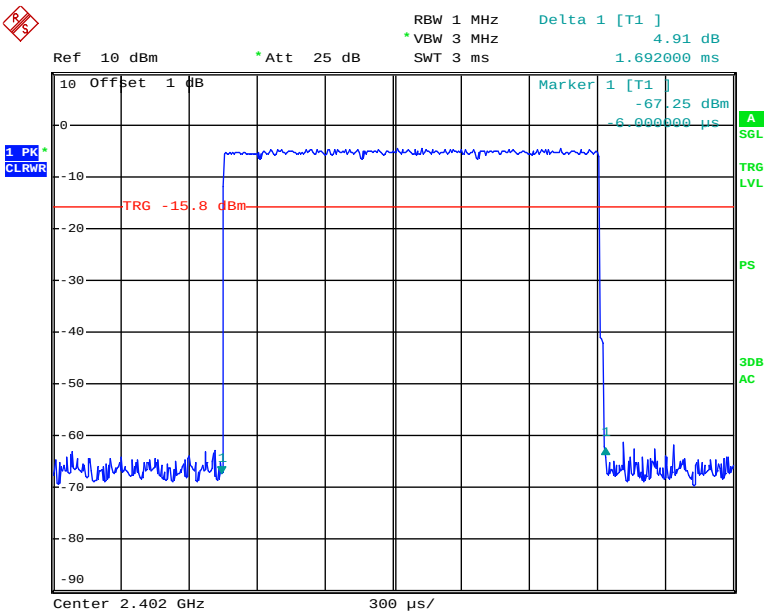
Date: 6.APR.2017 16:45:13

2DH1: High Channel



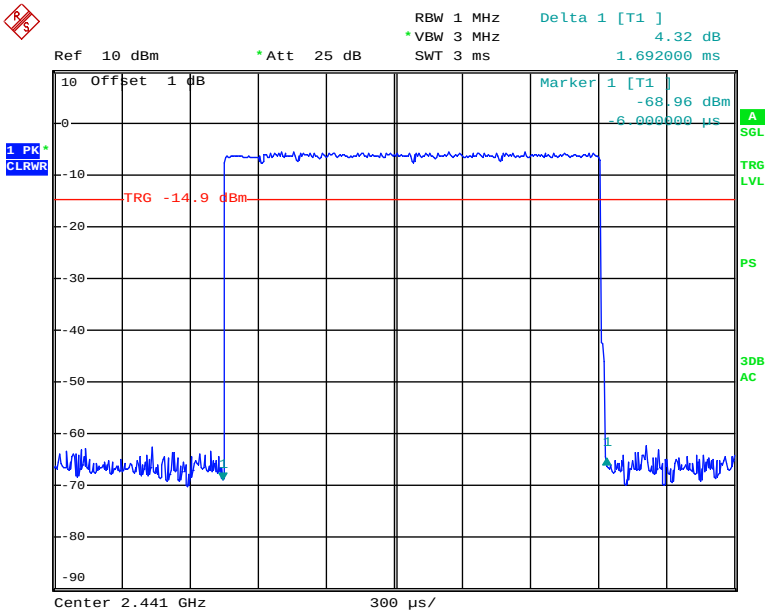
Date: 6.APR.2017 16:45:35

2DH3: Low Channel



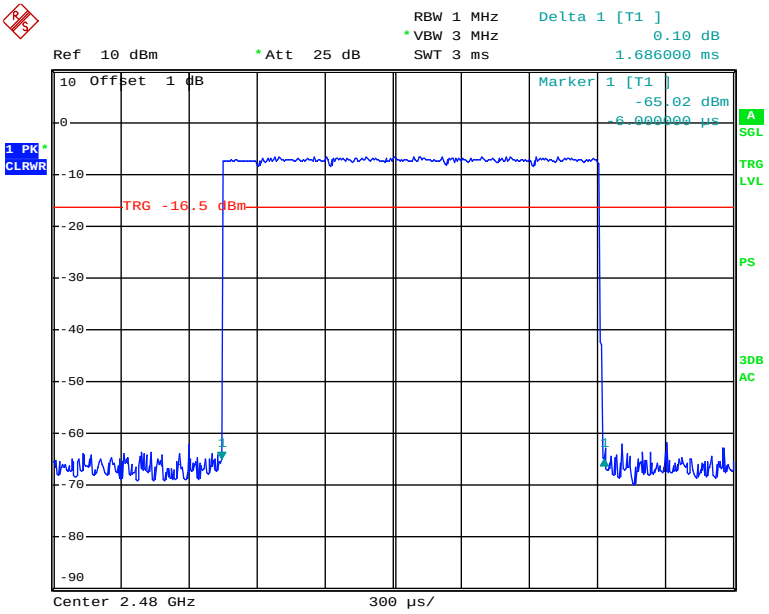
Date: 6.APR.2017 16:46:41

2DH3: Middle Channel



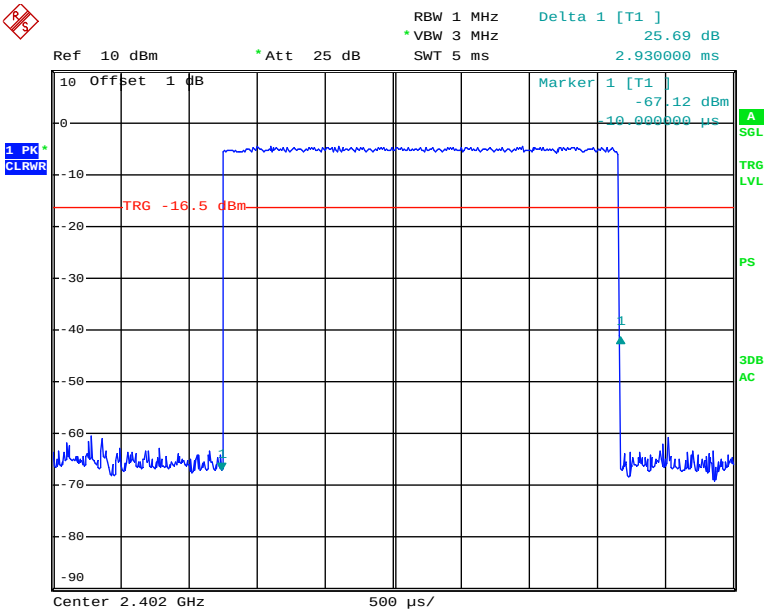
Date: 6.APR.2017 16:47:30

2DH3: High Channel



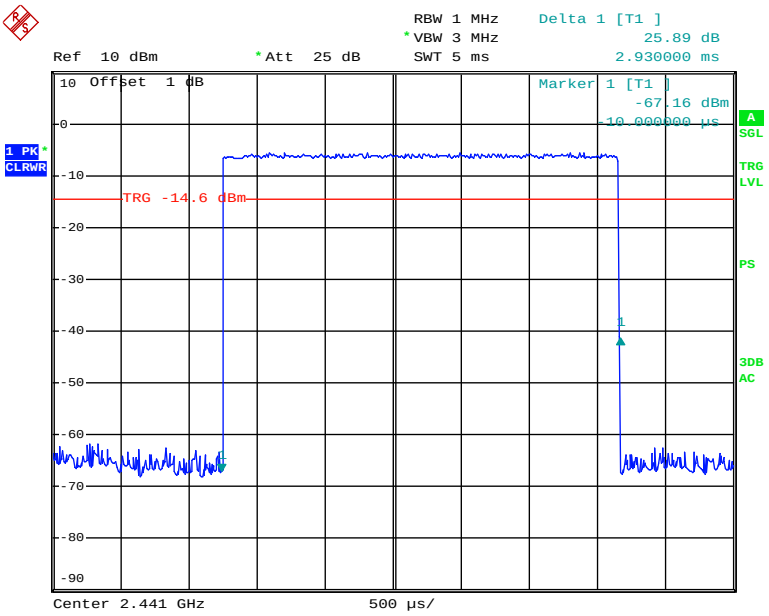
Date: 6.APR.2017 16:47:37

2DH5: Low Channel



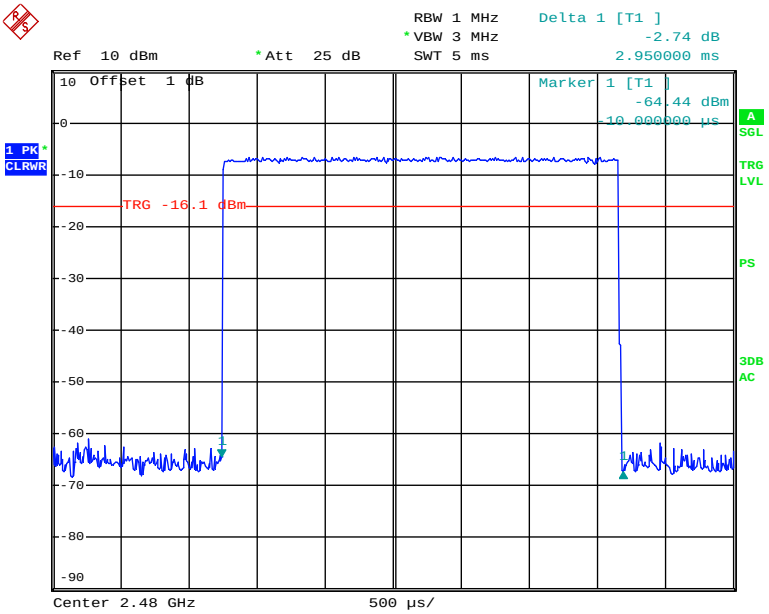
Date: 6.APR.2017 16:48:29

2DH5: Middle Channel



Date: 6.APR.2017 16:48:52

2DH5: High Channel

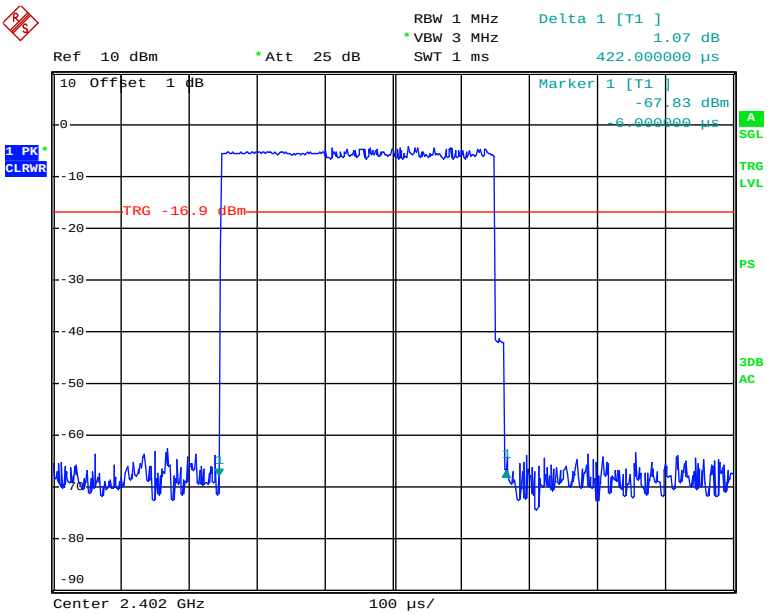


Date: 6.APR.2017 16:48:59

EDR Mode (8-DPSK):

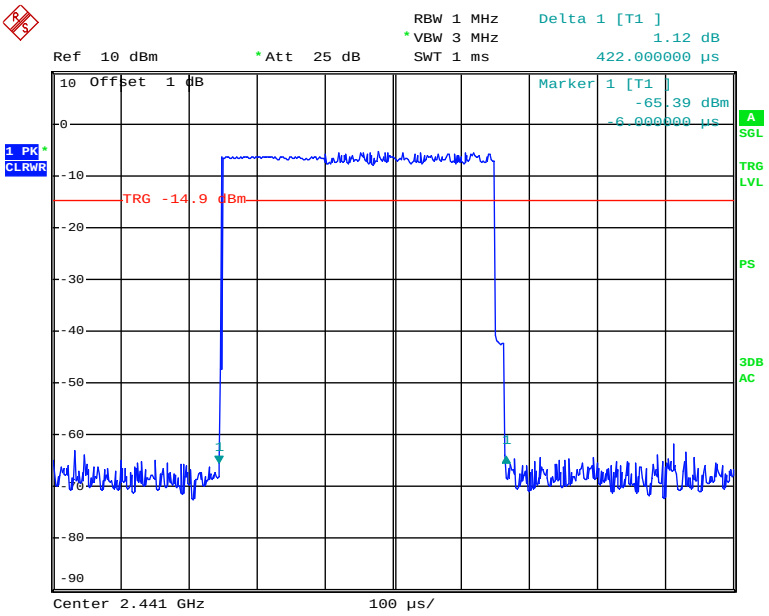
Mode	Channel	Pulse Width (ms)	Dwell Time (s)	Limit (s)	Result
3DH1	Low	0.422	0.135	0.4	Compliance
	Middle	0.422	0.135	0.4	Compliance
	High	0.420	0.134	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s				
3DH3	Low	1.686	0.270	0.4	Compliance
	Middle	1.674	0.268	0.4	Compliance
	High	1.686	0.270	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s				
3DH5	Low	2.950	0.315	0.4	Compliance
	Middle	2.940	0.314	0.4	Compliance
	High	2.940	0.314	0.4	Compliance
	Note: Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s				

3DH1: Low Channel



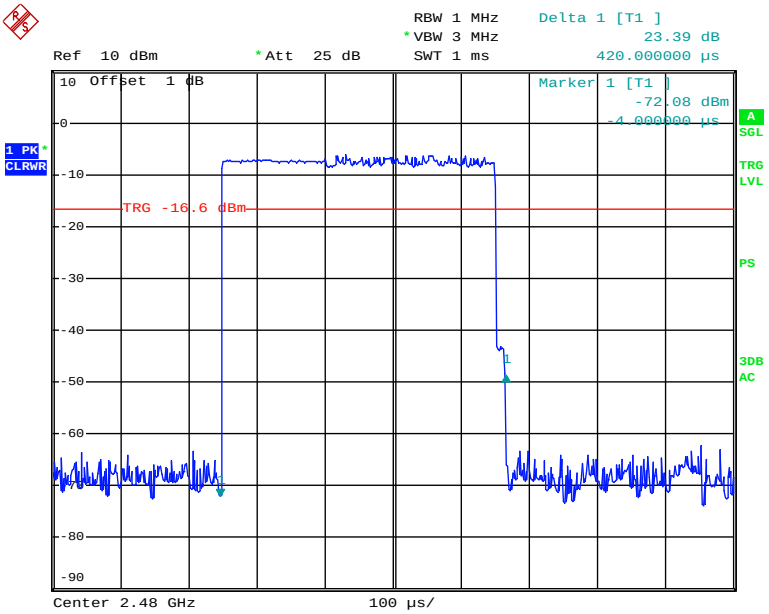
Date: 6.APR.2017 16:41:50

3DH1: Middle Channel



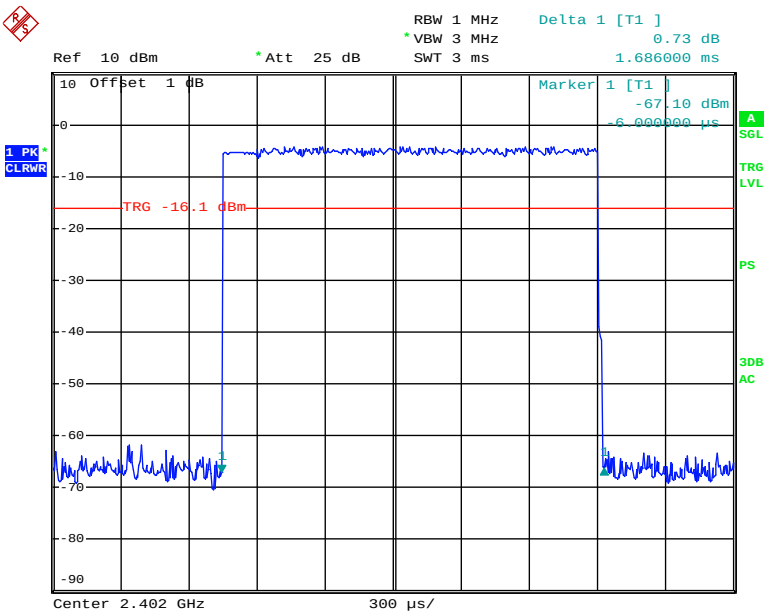
Date: 6.APR.2017 16:41:57

3DH1: High Channel



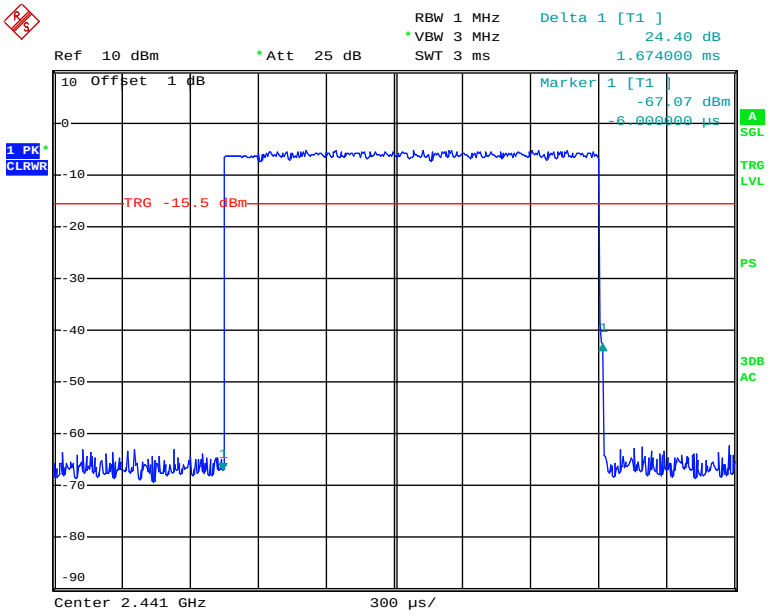
Date: 6.APR.2017 16:42:26

3DH3: Low Channel



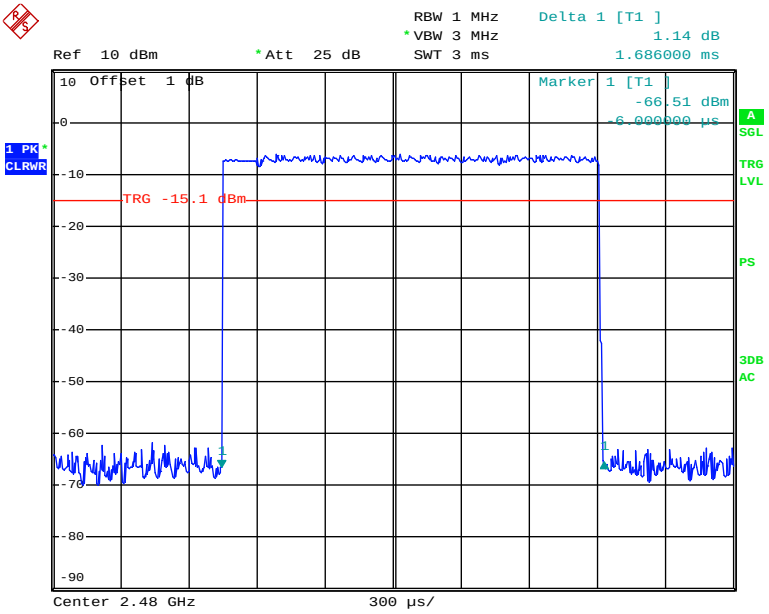
Date: 6.APR.2017 16:42:54

3DH3: Middle Channel



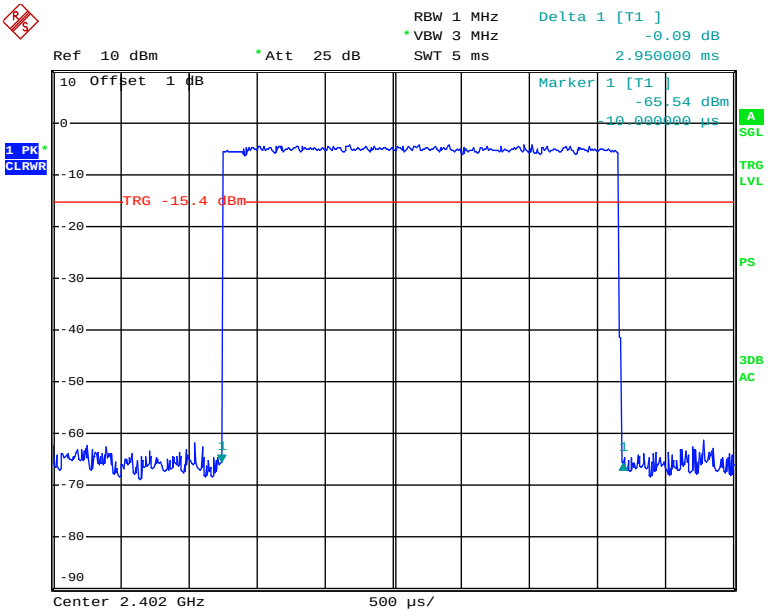
Date: 6.APR.2017 16:43:07

3DH3: High Channel



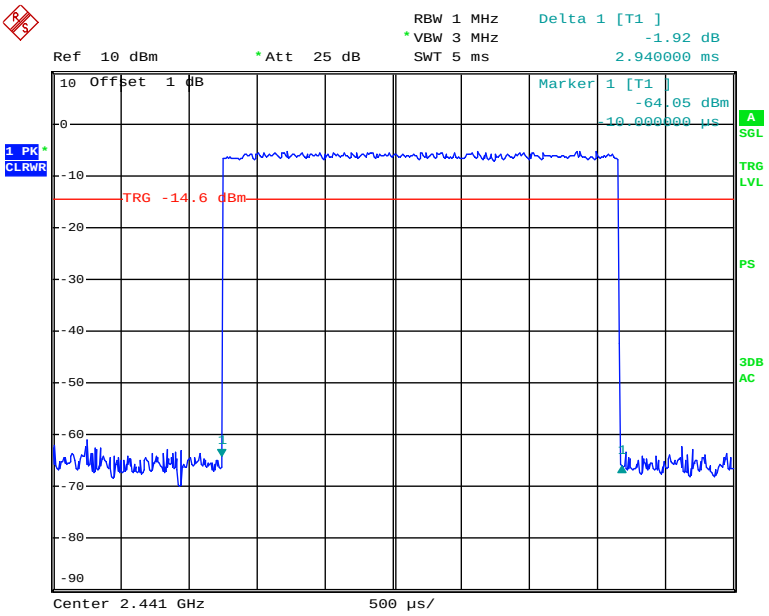
Date: 6.APR.2017 16:43:13

3DH5: Low Channel



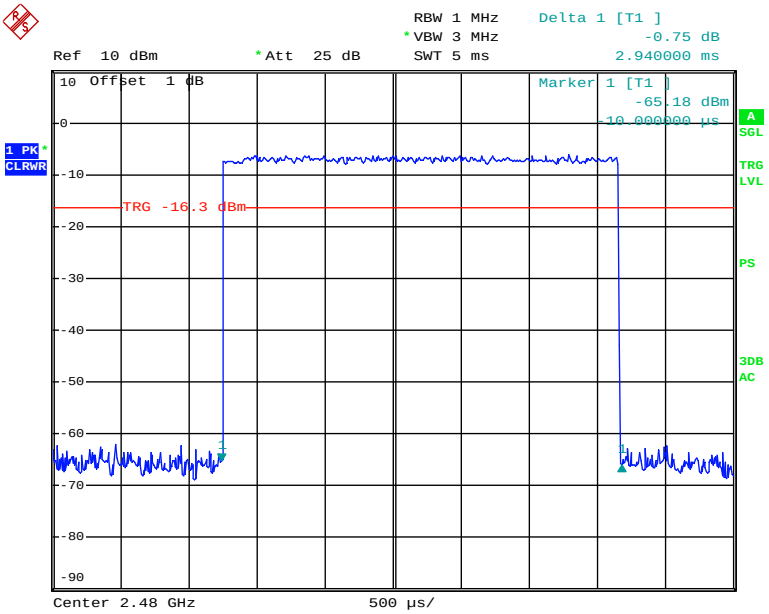
Date: 6.APR.2017 16:43:57

3DH5: Middle Channel



Date: 6.APR.2017 16:44:16

3DH5: High Channel



Date: 6.APR.2017 16:44:22

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
Agilent	Wideband Power Sensor	N1921A	MY54170074	2017-01-03	2018-01-03
Agilent	P-Series Power Meter	N1912A	MY5000798	2017-01-03	2018-01-03
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:	19.3 °C
Relative Humidity:	56 %
ATM Pressure:	95.4 kPa

** The testing was performed by Kevin Hu on 2017-03-14.*

Test Result: Compliance.

Test Mode: Transmitting

Mode	Frequency (MHz)	Peak Output power (dBm)	Limit (dBm)
BDR Mode (GFSK)	2402	5.08	30
	2441	4.58	30
	2480	4.95	30
EDR Mode (π/4-DQPSK)	2402	5.69	30
	2441	5.31	30
	2480	5.82	30
EDR Mode (8-DPSK)	2402	5.69	30
	2441	5.31	30
	2480	5.85	30

Note: The data above was tested in conducted mode.

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	EMI Test Receiver	ESCI	100028	2016-12-02	2017-12-01
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

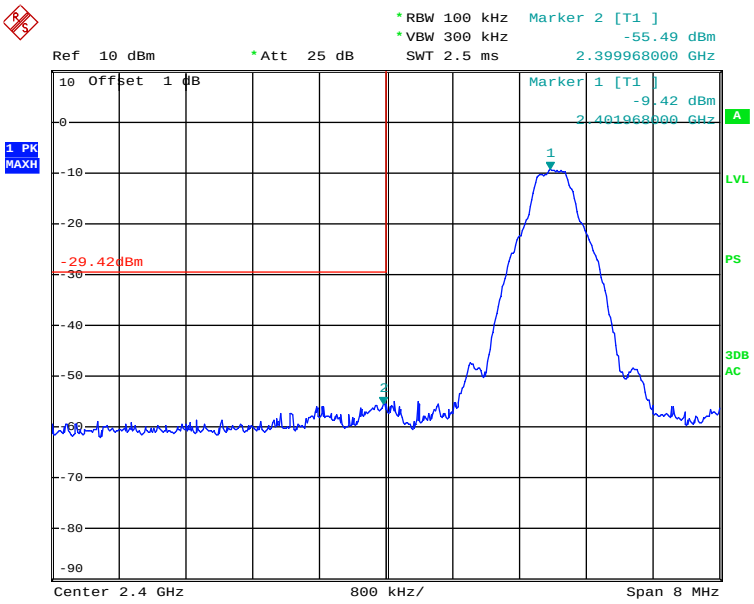
Temperature:	19.8 °C
Relative Humidity:	52 %
ATM Pressure:	95.8 kPa

** The testing was performed by Kevin Hu on 2017-04-06.*

Test Result: Compliance

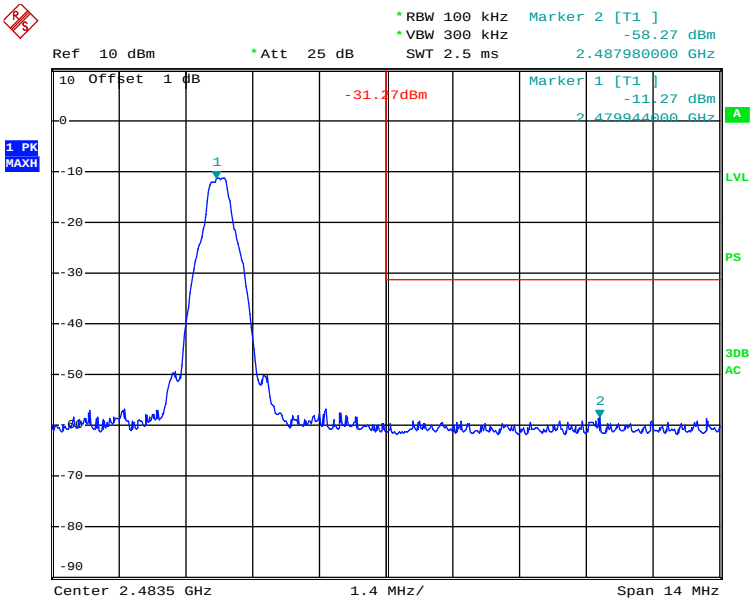
BDR Mode (GFSK):

Band Edge, Left Side



Date: 6.APR.2017 16:08:22

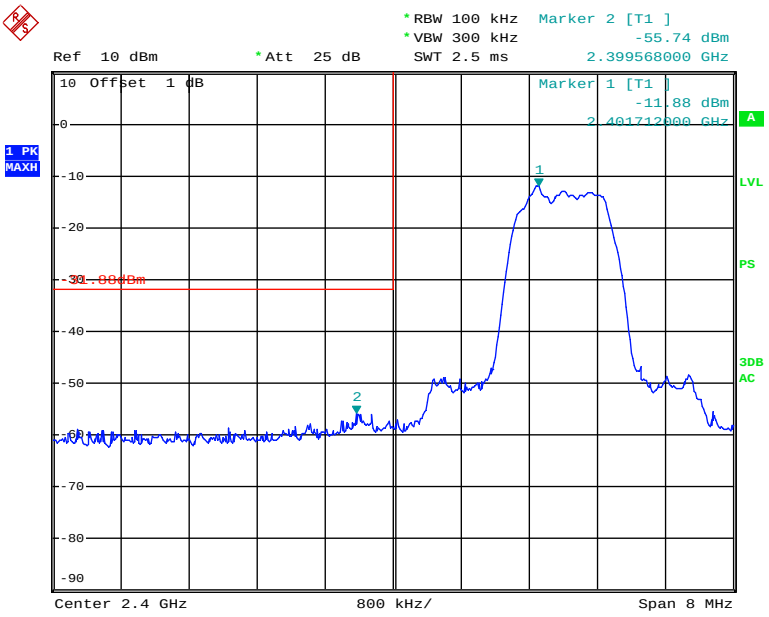
Band Edge, Right Side



Date: 6.APR.2017 16:10:21

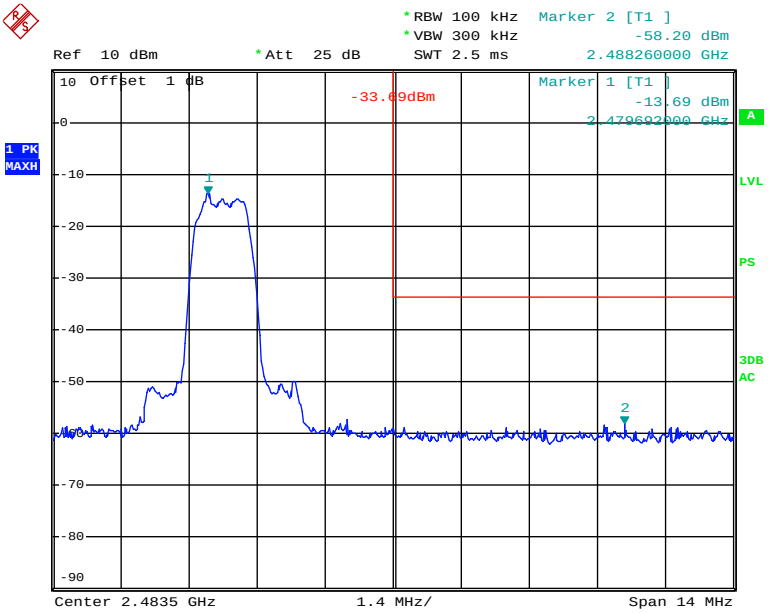
EDR Mode (π/4-DQPSK):

Band Edge, Left Side



Date: 6.APR.2017 16:19:46

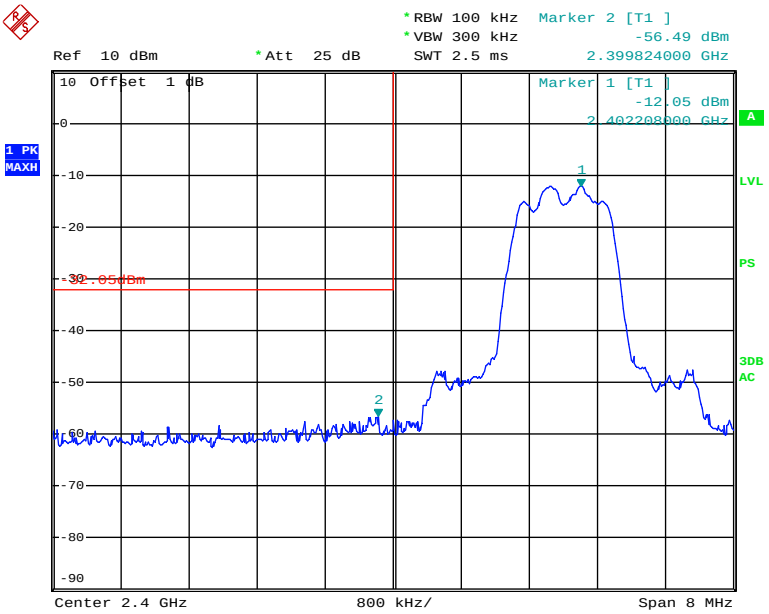
Band Edge, Right Side



Date: 6.APR.2017 16:11:42

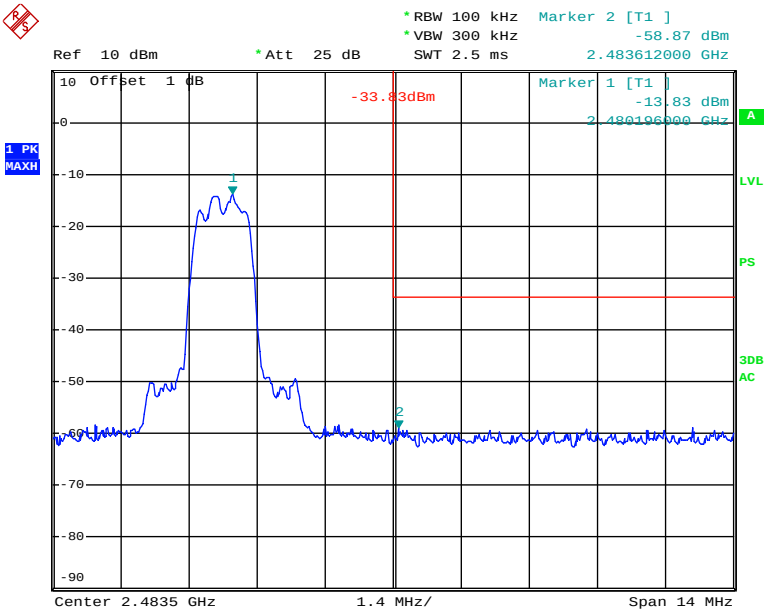
EDR Mode (8-DPSK):

Band Edge, Left Side



Date: 6.APR.2017 16:21:01

Band Edge, Right Side



Date: 6.APR.2017 16:23:05

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