


JAPAN MIC TEST REPORT

For

House of Marley, LLC

3000 Pontiac Trail, Commerce Township, Oakland MI 48390 United States of America

Model: EM-FE063

Report Type: Original Report	Product Type: Sport Bluetooth Ear Bud
Report Number: RSZ180124801-07A	
Report Date: 2018-03-20	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Shenzhen).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The EUT (model name: EM-FE063) is a Sport Bluetooth Ear Bud which is powered by internal polymer lithium battery with 3.7Vdc nominal output voltage. It can be recharged through the micro-USB port located in outer of enclosure by external power supply with rated 5Vdc output voltage.

** All measurement and test data in this report was gathered from production sample serial number: 180124801 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-01-12.*

Objective

The objective of the manufacturer is to demonstrate compliance with Radio Law of Japan item 19 of Article 2 Paragraph 1, rules and limits for this device including:

- Frequency Error
- Occupied Bandwidth and Spreading Bandwidth
- Transmitter Spurious Emission and Unwanted Emission Intensity
- Antenna Output Power And Output Power Tolerance
- Receiver Spurious Emission Strength
- Frequency Hopping Dwell Time
- Construction Protection Confirmation

Related Submittal(s)/Grant(s)

Item 19 of Article 2 Paragraph 1 for BT 4.0

Test Methodology

All measurements contained in this report were conducted with technical regulations of the Radio Law of Japan.

EUT TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a testing mode by software. For Bluetooth BDR and EDR mode, EUT was tested with Channel 2402MHz, 2441MHz, 2480MHz.

Test voltage:

Normal voltage: 3.7 V_{DC}

Low voltage: 3.5 V_{DC}

High voltage: 4.1 V_{DC}

EUT Exercise Software

“Airoha.AB152x_verC_LabTestTool.exe” software was used, and the power level was default.

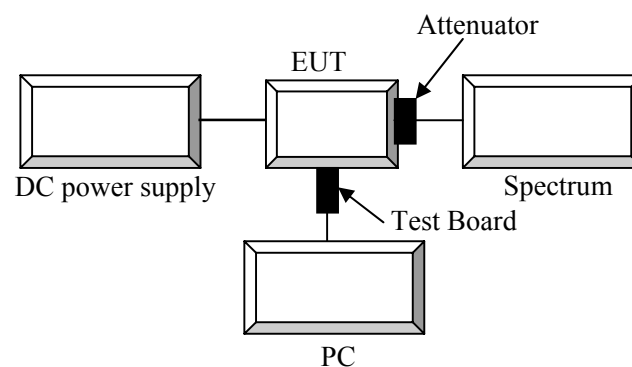
Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Long Wei	DC Power Supply	TPR-6420D	398363
N/A	Test Board	N/A	N/A
HP	PC	Compaq CQ45	5CG33407QL

Configuration of Test Setup



SUMMARY OF TEST RESULTS

MIC Notice No.88 Appendix No.43 Article 2, Paragraph 1, Item 19 Rules Section	Description of Test	Result
3	Frequency Error	Compliance
4	Occupied Bandwidth and Spreading Bandwidth	Compliance
5	Transmitter Spurious Emission and Unwanted Emission Intensity	Compliance
6	Antenna Output Power and Output Power Tolerance	Compliance
7	Receiver Spurious Emission and Unwanted Emission Intensity	Compliance
8	Transmission Antenna Gain	Not Applicable
9	Transmission Radiation Angle Width	Not Applicable
10	Frequency Hopping Dwell Time	Compliance
11	Interference Prevention Function	Compliance
Note 1	Construction Protection Confirmation	Compliance

Not Applicable - This test item was not required for the output power less than 6.91 dBm/MHz (E.I.R.P)

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
HP	Signal Generator	8648C	3426A01345	2017-04-19	2018-04-19
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2017-12-05	2018-12-05
Agilent	P-Series Power Meter	N1912A	MY5000448	2017-12-05	2018-12-05
Agilent	Wideband Power Sensor	N1921A	MY54210016	2017-12-05	2018-12-05
Long Wei	DC Power Supply	TPR-6420D	398363	NCR	NCR
Fluke	Digital Multimeter	287	19000011	2017-04-09	2018-04-19

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

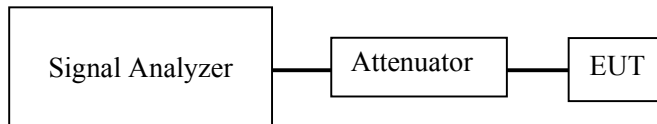
FREQUENCY ERROR

Limit

50 ppm or below

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- Set the application equipment (EUT) to the measurement frequency.
- The modulation state shall be “continuous carrier wave without modulation” by stopping frequency-hopping mode.

Spectrum Analyzer Conditions

- Center Frequency: Frequency to measure (2402 MHz, 2441MHz, and 2480MHz)
- RBW: 1 kHz, VBW: 30 kHz
- Span: 300kHz
- Sweep time: Auto
- Log scale: 10dB/Div, Data points: 400 points or more
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak
- Sweep mode: Single Sweep
- Marker: Spot

If the EUT can't set at un-modulation mode, measure the 10dBc center frequency.

Test Data**Environmental Conditions**

Temperature:	24 °C
Relative Humidity:	50 %
ATM Pressure:	100.0 kPa

The testing was performed by Tracy Hu on 2018-02-02.

Test Result: Compliant

Test Mode: Transmitting (Un-modulation mode)

Normal Voltage

Frequency (MHz)	Measure frequency (MHz)	Frequency tolerance (ppm)	Limit (ppm)
2402	2402.01154	4.80	< 50
2441	2441.01202	4.92	
2480	2480.01202	4.85	

High Voltage

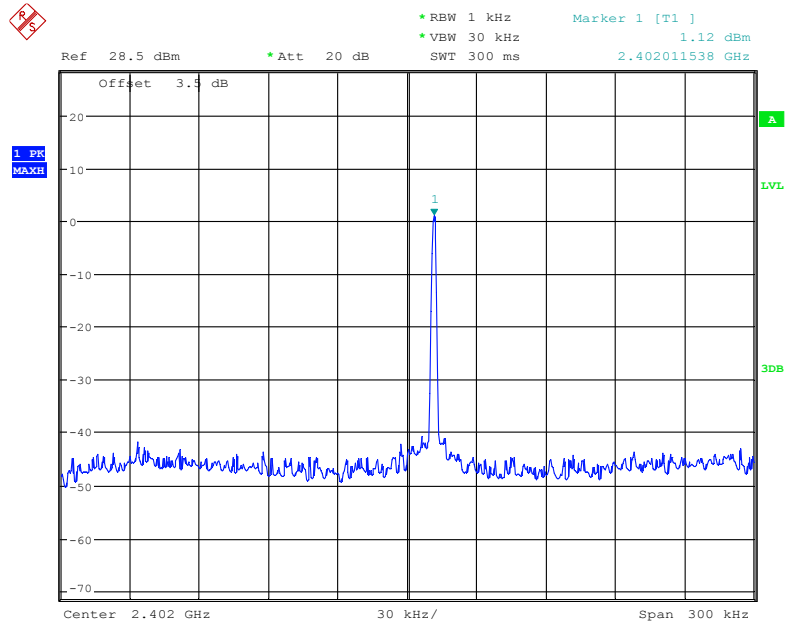
Frequency (MHz)	Measure frequency (MHz)	Frequency tolerance (ppm)	Limit (ppm)
2402	2402.01294	5.39	< 50
2441	2441.01272	5.21	
2480	2480.01108	4.47	

Low Voltage

Frequency (MHz)	Measure frequency (MHz)	Frequency tolerance (ppm)	Limit (ppm)
2402	2402.01576	6.56	< 50
2441	2441.01275	5.22	
2480	2480.01198	4.83	

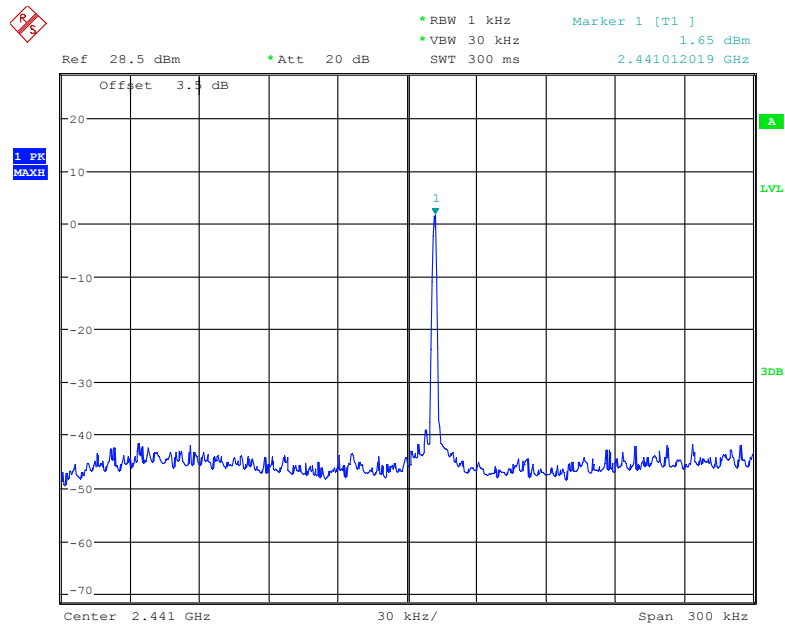
Please refer to the plots for normal voltage test.

Low Channel



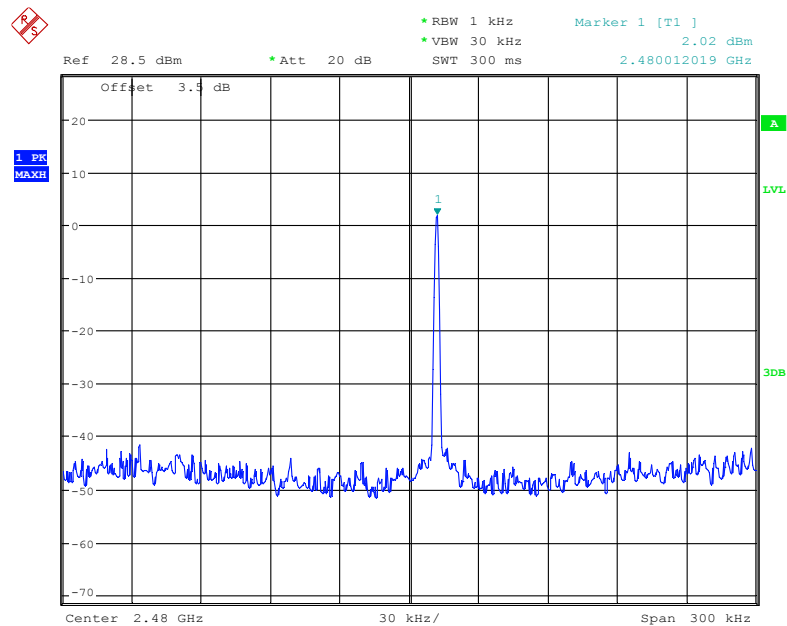
Date: 2.FEB.2018 21:38:41

Middle Channel



Date: 2.FEB.2018 21:38:02

High Channel



Date: 2.FEB.2018 21:37:05

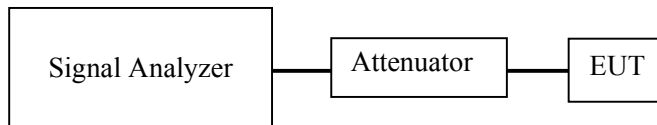
OCCUPIED BANDWIDTH AND SPREADING BANDWIDTH

Limit

- Occupied bandwidth: FH \leq 83.5 MHz; OFDM, DS \leq 26 MHz; Others \leq 26 MHz
- Spread Bandwidth: \geq 500 kHz(FH,DS), Spread factor $>$ 5.

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- The modulation state shall be “continuous frequency-hopping mode” by spread spectrum.

Spectrum Analyzer Conditions

- Span: (OBW limit * 3) MHz (example; 200MHz)
- RBW: 300 kHz
- VBW: 300 kHz
- Sweep time: Auto(Minimum time to ensure measurement accuracy.)
- Log scal : 10dB/Div
- Data points : 400 points or more
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak, Sweep mode: Continuous

Test Data

Environmental Conditions

Temperature:	24°C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Tracy Hu on 2018-02-02.

Test Result: Compliant

Test Mode: Transmitting

Normal Voltage

Modulation mode	Occupied bandwidth (MHz)	Spread bandwidth (MHz)	Spread factor
BDR(GFSK)	78.846	71.154	71.154
EDR($\pi/4$ -DQPSK)	78.846	71.635	71.635
EDR(8DPSK)	78.846	71.635	71.635
Limit	<83.5	> 0.5	>5

High Voltage

Modulation mode	Occupied bandwidth (MHz)	Spread bandwidth (MHz)	Spread factor
BDR(GFSK)	78.745	71.216	71.216
EDR($\pi/4$ -DQPSK)	78.745	71.607	71.607
EDR(8DPSK)	78.745	71.609	71.609
Limit	<83.5	> 0.5	>5

Low Voltage

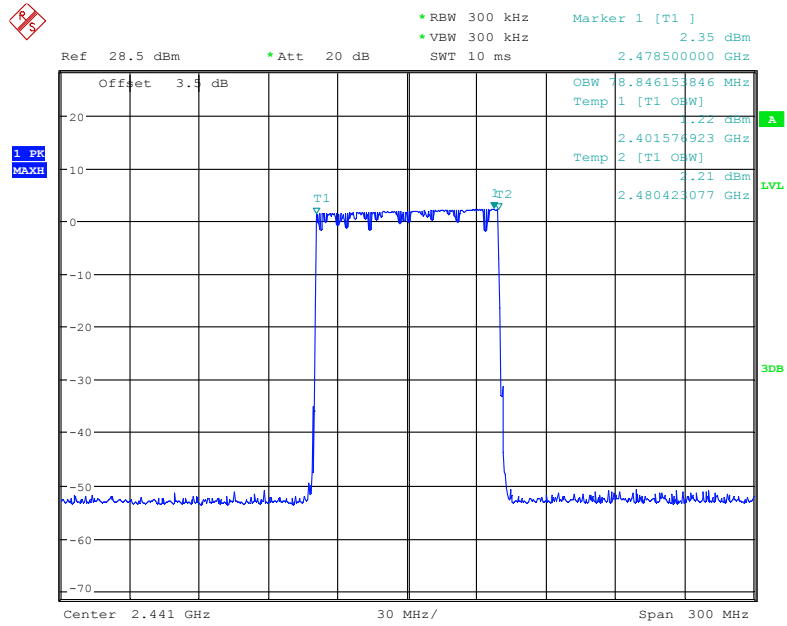
Modulation mode	Occupied bandwidth (MHz)	Spread bandwidth (MHz)	Spread factor
BDR(GFSK)	78.837	71.218	71.218
EDR($\pi/4$ -DQPSK)	78.837	71.618	71.618
EDR(8DPSK)	78.837	71.618	71.618
Limit	<83.5	> 0.5	>5

NOTE: the modulation rate of Bluetooth is 1MHz.

Please refer to the below plots for normal voltage test.

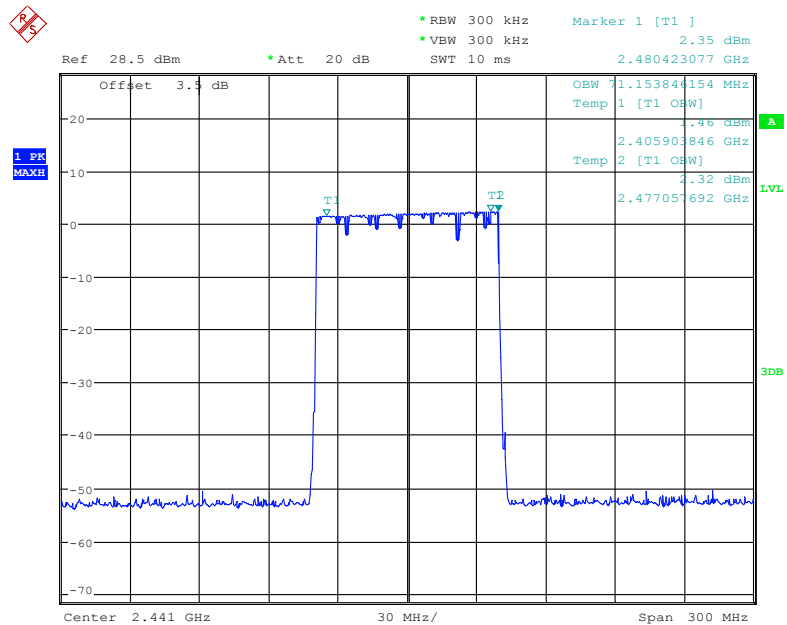
BDR Mode (GFSK):

Occupied Bandwidth



Date: 2.FEB.2018 21:50:45

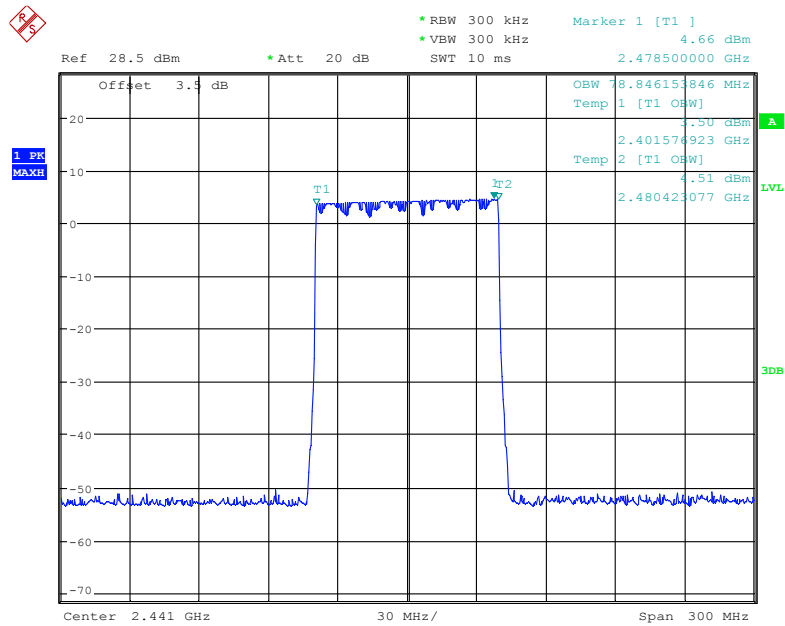
Spreading Bandwidth



Date: 2.FEB.2018 21:52:43

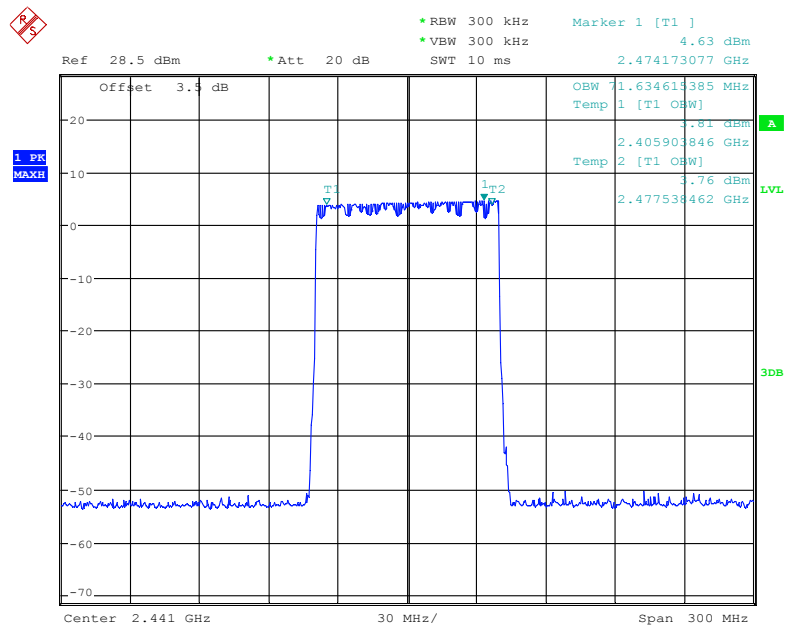
EDR Mode ($\pi/4$ -DQPSK):

Occupied Bandwidth



Date: 2.FEB.2018 21:56:00

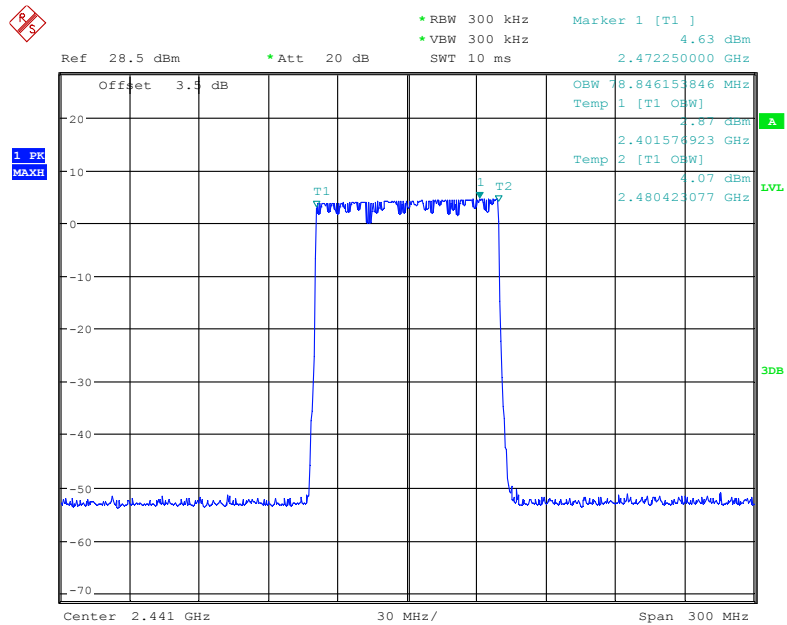
Spreading Bandwidth



Date: 2.FEB.2018 21:54:12

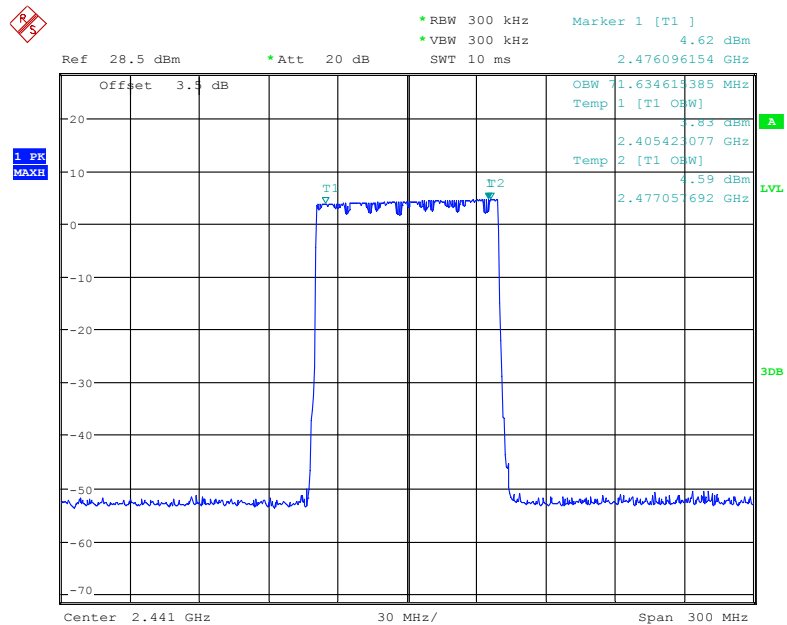
EDR Mode (8DPSK):

Occupied Bandwidth



Date: 2.FEB.2018 21:57:27

Spreading Bandwidth



Date: 2.FEB.2018 21:59:21

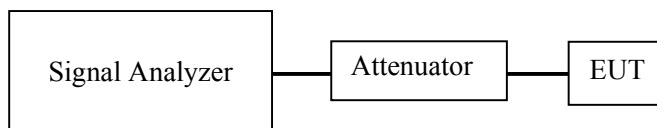
TRANSMITTER SPURIOUS EMISSION STRENGTH AND UNWANTED EMISSION INTENSITY

Limit

- $f < 2387 \text{ MHz}, f > 2496.5 \text{ MHz}: \leq 2.5 \mu\text{W/MHz}$
- $2387 \text{ MHz} \leq f \leq 2400 \text{ MHz}; 2483.5 \text{ MHz} < f \leq 2496.5 \text{ MHz}: \leq 25 \mu\text{W/MHz}$

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- The modulation state shall be in continuously transmitting mode.

Spectrum Analyzer Conditions

- Span: Measuring Frequency Range
- RBW: 1MHz (frequency range; 1GHz over), 100kHz (frequency range; 30MHz to 1GHz)
- VBW: Same as RBW (1MHz or 100kHz)
- Sweep time: Auto (Minimum time to ensure measurement accuracy.)
- Data points : 400 points or more
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak

If the measured value is under the technical standard value, do not need to measure more detail.

Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-02-02.

Test Result: Compliant

Test Mode: Transmitting

Normal Voltage

GFSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-62.78	-59.47	-60.27	-36
	Band II (dBm/MHz)	-54.56	-55.94	-56.21	-26
	Band III (dBm/MHz)	-23.43	-55.50	-56.87	-16
	Band IV (dBm/MHz)	-56.09	-55.70	-30.12	-16
	Band V (dBm/MHz)	-47.30	-41.93	-40.45	-26

High Voltage

GFSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-63.89	-59.45	-59.76	-36
	Band II (dBm/MHz)	-52.94	-56.21	-56.79	-26
	Band III (dBm/MHz)	-23.40	-54.59	-55.47	-16
	Band IV (dBm/MHz)	-56.27	-55.63	-28.70	-16
	Band V (dBm/MHz)	-47.1	-41.32	-40.23	-26

Low Voltage

GFSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-63.33	-58.52	-62.18	-36
	Band II (dBm/MHz)	-55.94	-54.55	-56.63	-26
	Band III (dBm/MHz)	-24.08	-55.96	-56.93	-16
	Band IV (dBm/MHz)	-55.64	-55.15	-31.05	-16
	Band V (dBm/MHz)	-46.81	-42.65	-41.73	-26

Normal Voltage

$\pi/4$ -DQPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-59.06	-55.48	-56.03	-36
	Band II (dBm/MHz)	-55.77	-55.89	-56.17	-26
	Band III (dBm/MHz)	-16.13	-55.68	-56.52	-16
	Band IV (dBm/MHz)	-56.34	-55.10	-26.94	-16
	Band V (dBm/MHz)	-36.81	-35.02	-34.55	-26

High Voltage

$\pi/4$ -DQPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-57.80	-56.13	-55.30	-36
	Band II (dBm/MHz)	-56.18	-56.92	-57.46	-26
	Band III (dBm/MHz)	-16.92	-56.58	-57.32	-16
	Band IV (dBm/MHz)	-56.77	-53.39	-26.96	-16
	Band V (dBm/MHz)	-38.57	-34.80	-34.44	-26

Low Voltage

$\pi/4$ -DQPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-59.72	-56.39	-55.12	-36
	Band II (dBm/MHz)	-56.77	-55.05	-56.53	-26
	Band III (dBm/MHz)	-16.79	-55.95	-57.16	-16
	Band IV (dBm/MHz)	-55.24	-54.73	-26.46	-16
	Band V (dBm/MHz)	-36.66	-35.71	-36.12	-26

Normal Voltage

8DPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-57.58	-55.98	-53.95	-36
	Band II (dBm/MHz)	-52.56	-55.39	-55.87	-26
	Band III (dBm/MHz)	-17.32	-55.07	-57.00	-16
	Band IV (dBm/MHz)	-55.66	-54.57	-26.87	-16
	Band V (dBm/MHz)	-37.51	-34.17	-35.70	-26

High Voltage

8DPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-55.87	-55.54	-54.28	-36
	Band II (dBm/MHz)	-52.57	-55.68	-57.53	-26
	Band III (dBm/MHz)	-17.87	-54.34	-57.11	-16
	Band IV (dBm/MHz)	-56.00	-53.93	-27.99	-16
	Band V (dBm/MHz)	-37.46	-34.81	-34.80	-26

Low Voltage

8DPSK	Frequency Band	2402MHz	2441MHz	2480MHz	Limited
Raw data	Band I (dBm/100kHz)	-58.30	-55.86	-54.83	-36
	Band II (dBm/MHz)	-52.62	-54.70	-56.12	-26
	Band III (dBm/MHz)	-17.20	-54.38	-56.58	-16
	Band IV (dBm/MHz)	-55.56	-54.82	-25.11	-16
	Band V (dBm/MHz)	-37.25	-34.22	-36.90	-26

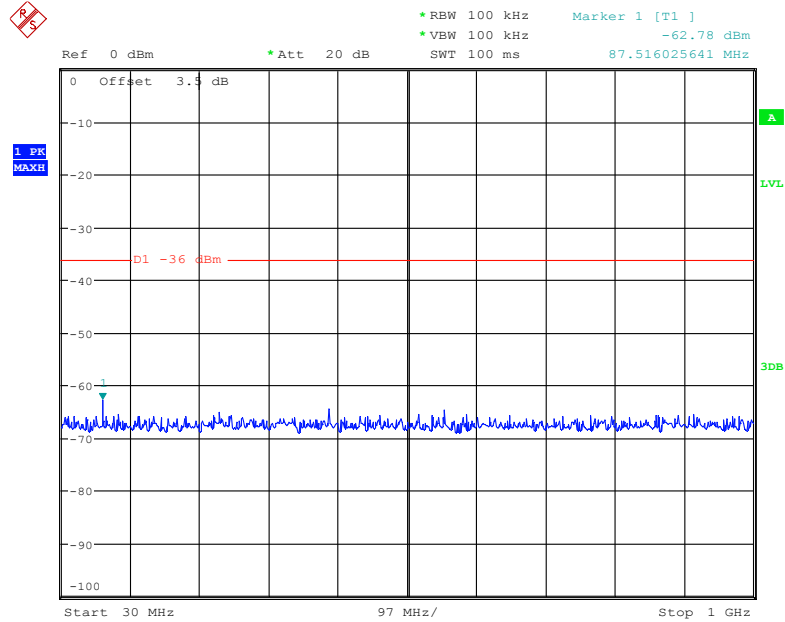
Note: $2.5 \mu\text{W/MHz} = -26 \text{ dBm/MHz} = -36 \text{ dBm/100kHz}$ $25 \mu\text{W/MHz} = -16 \text{ dBm/MHz}$ **Band I : 30MHz-1000MHz****Band II : 1000MHz-2387MHz****Band III:2387MHz-2400MHz****Band IV:2483.5MHz-2496.5MHz****Band V: 2496.5MHz-12500MHz**

If searched value is under the technical standard value, do not need to measure more detail.

Please refer to the below plots under normal conditions.

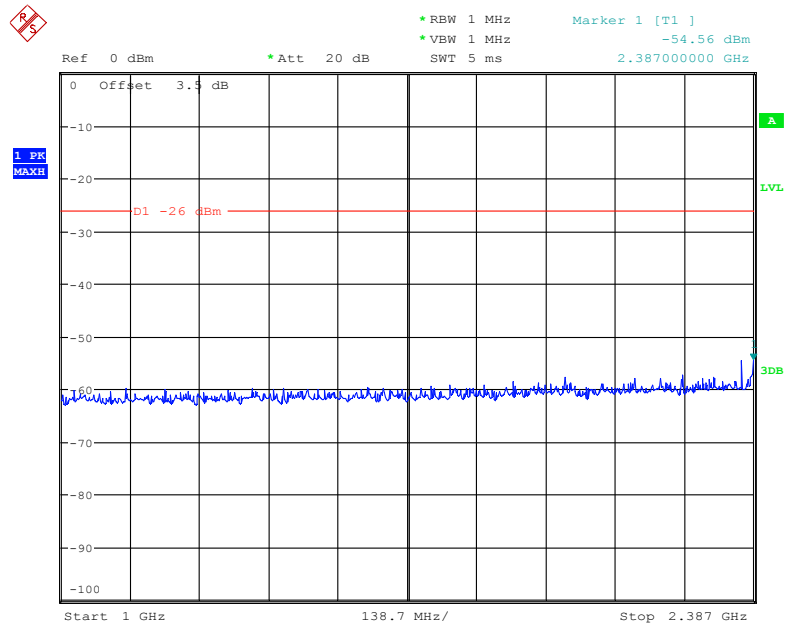
BDR Mode (GFSK)
2402 MHz:

30 MHz~1 GHz



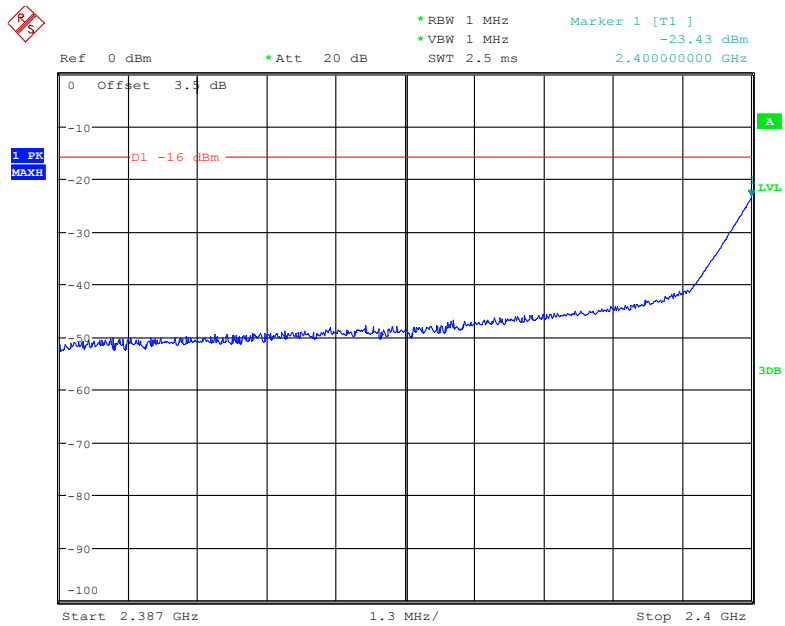
Date: 2.FEB.2018 22:53:16

1 GHz ~2.387 GHz



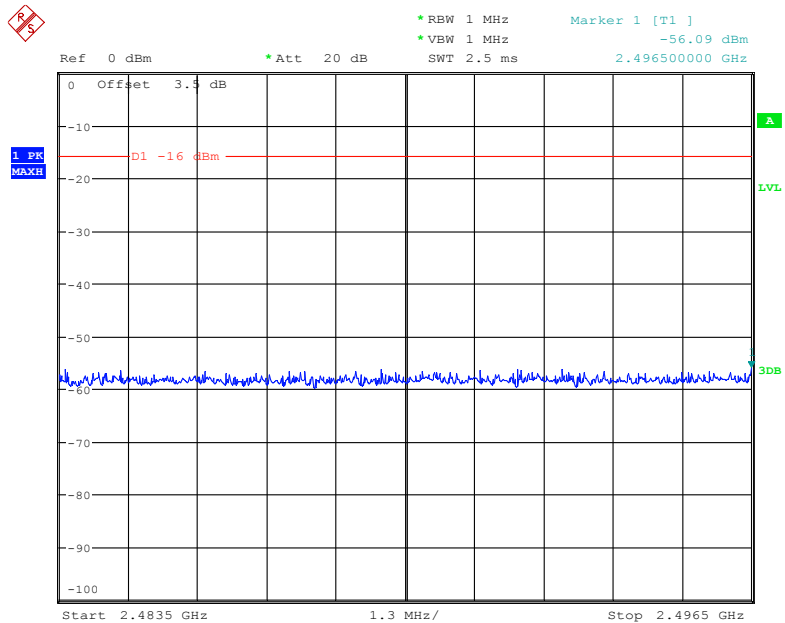
Date: 2.FEB.2018 22:57:10

2.387 GHz~2.4 GHz



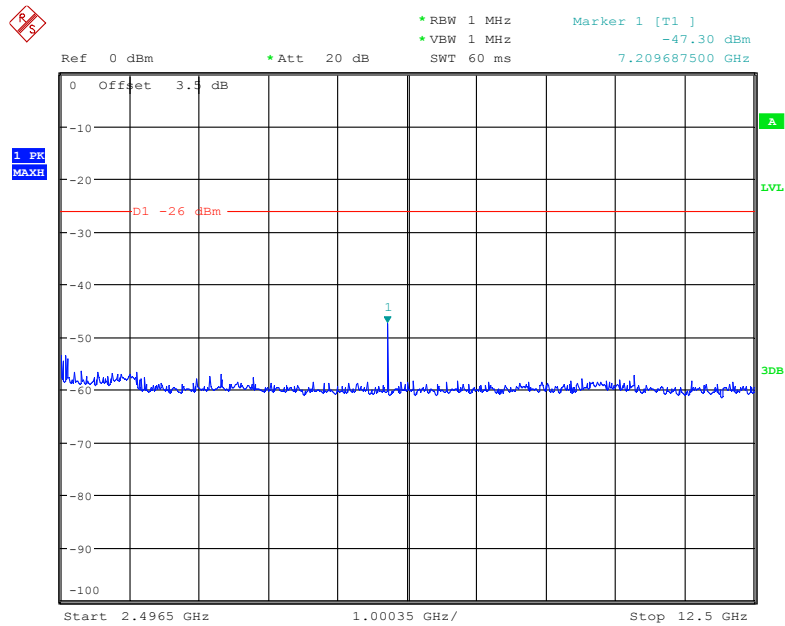
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2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:04:56

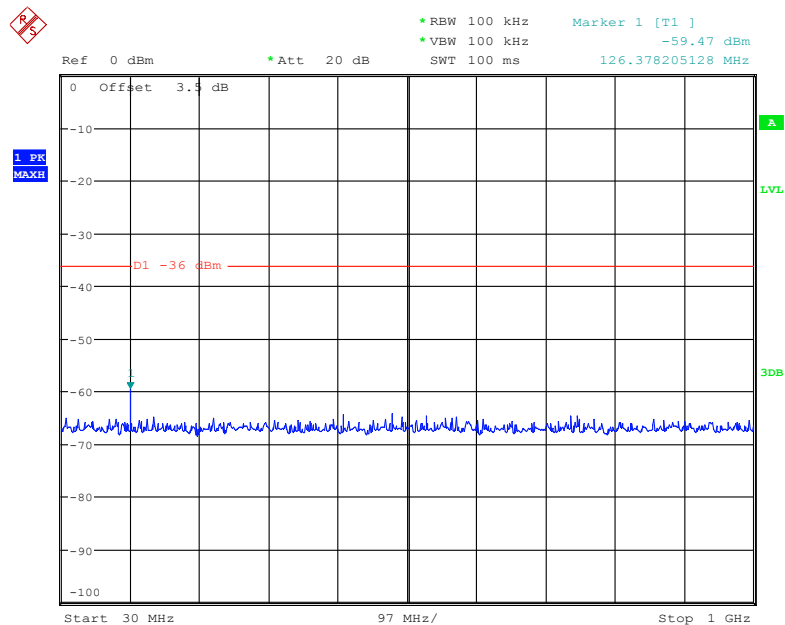
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:13:53

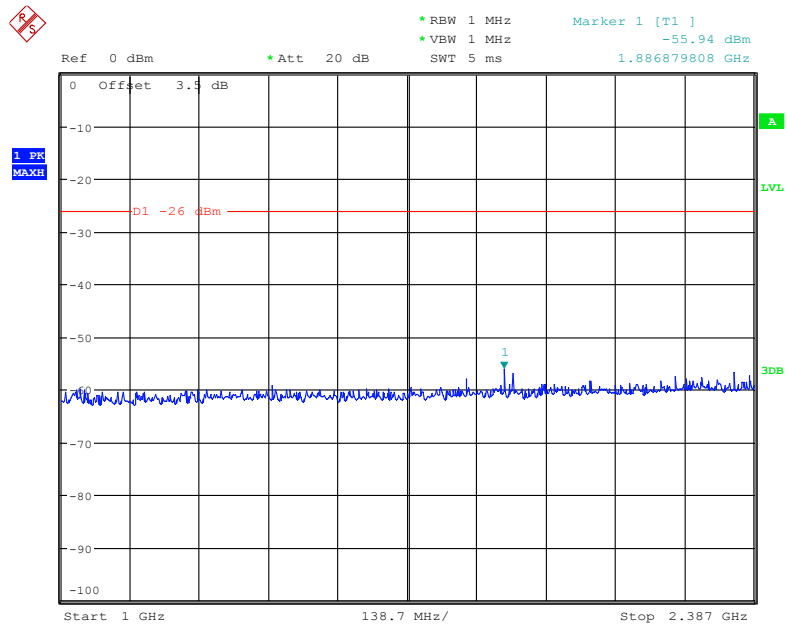
2441 MHz:

30 MHz~1 GHz



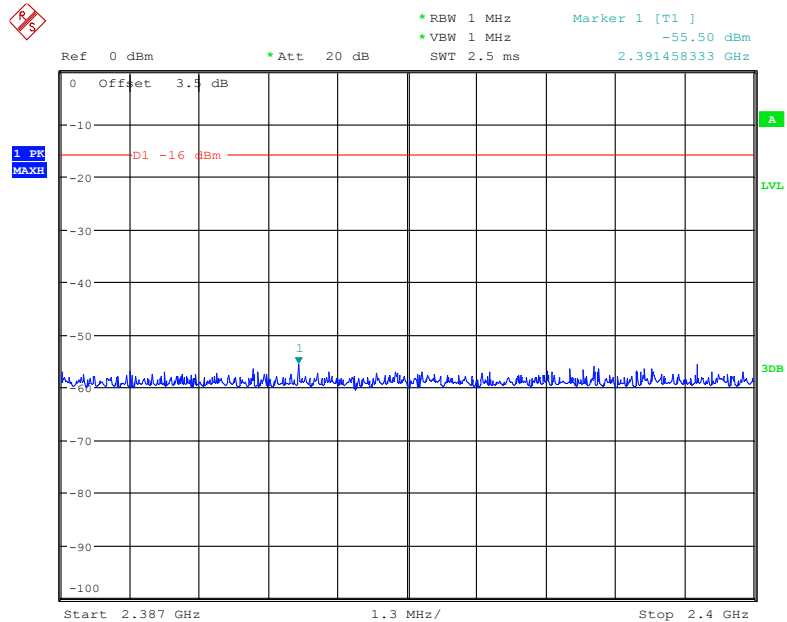
Date: 2.FEB.2018 22:52:53

1 GHz ~2.387 GHz



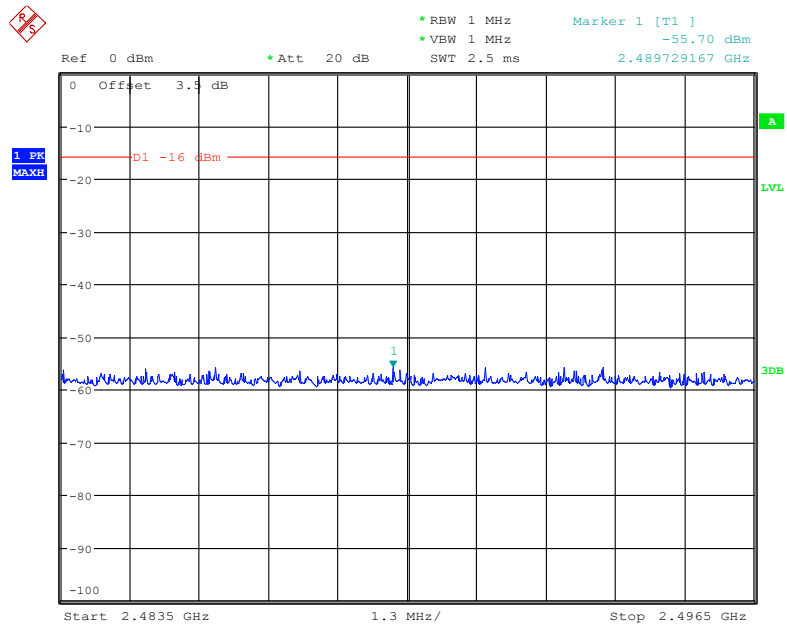
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2.387 GHz~2.4 GHz



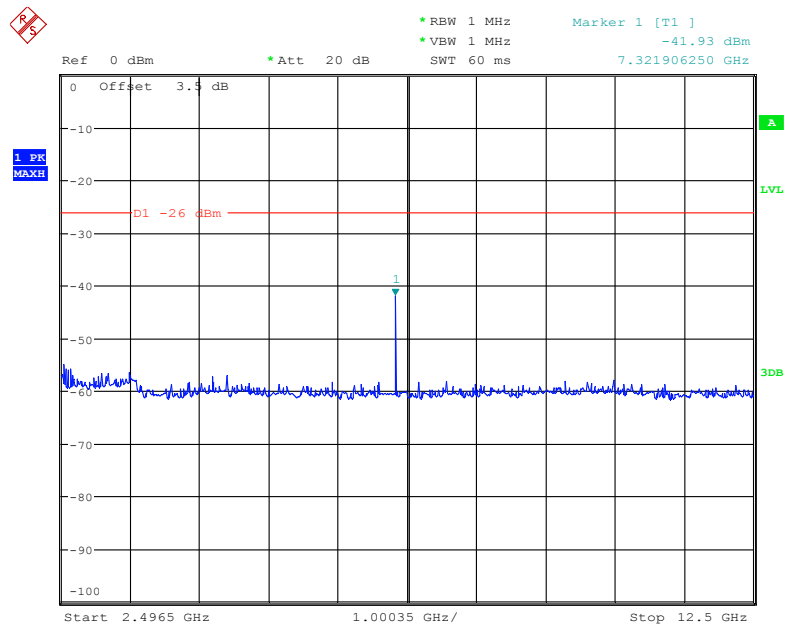
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2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:06:21

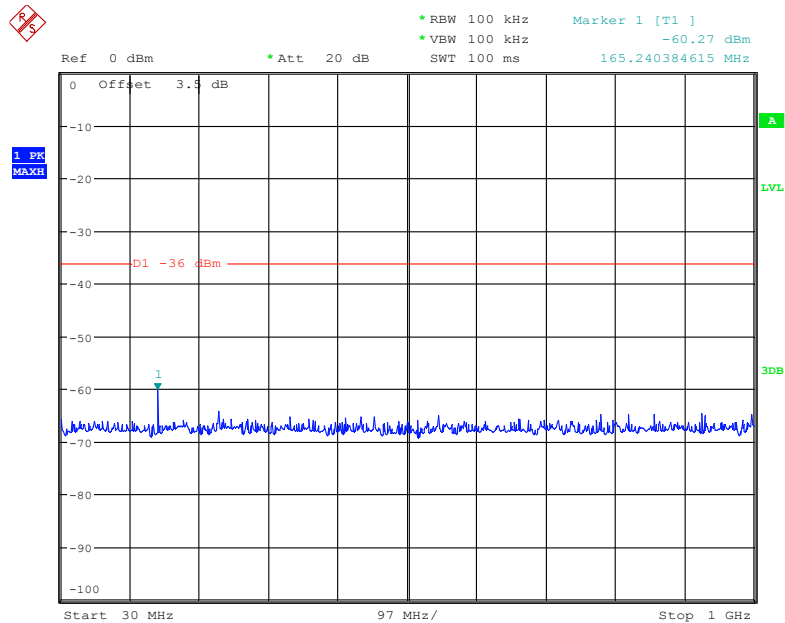
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:13:34

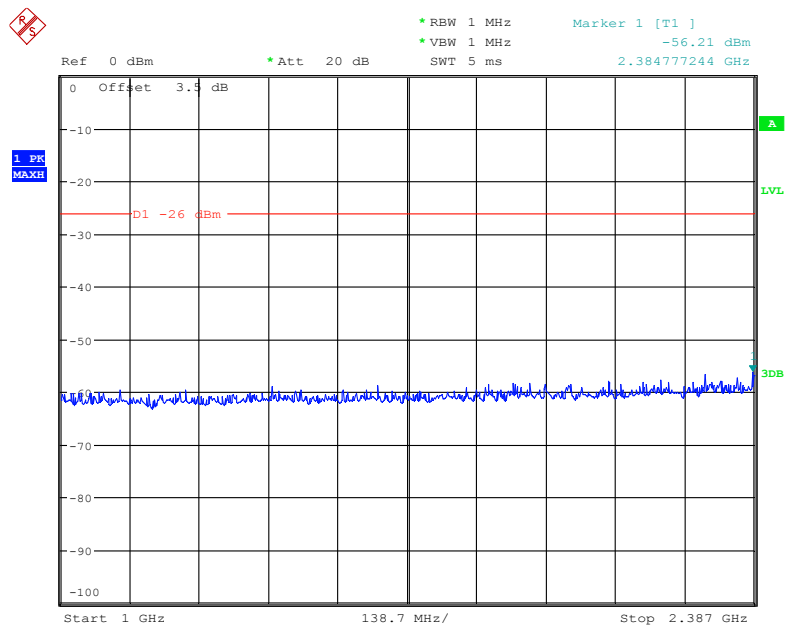
2480 MHz:

30 MHz~1 GHz



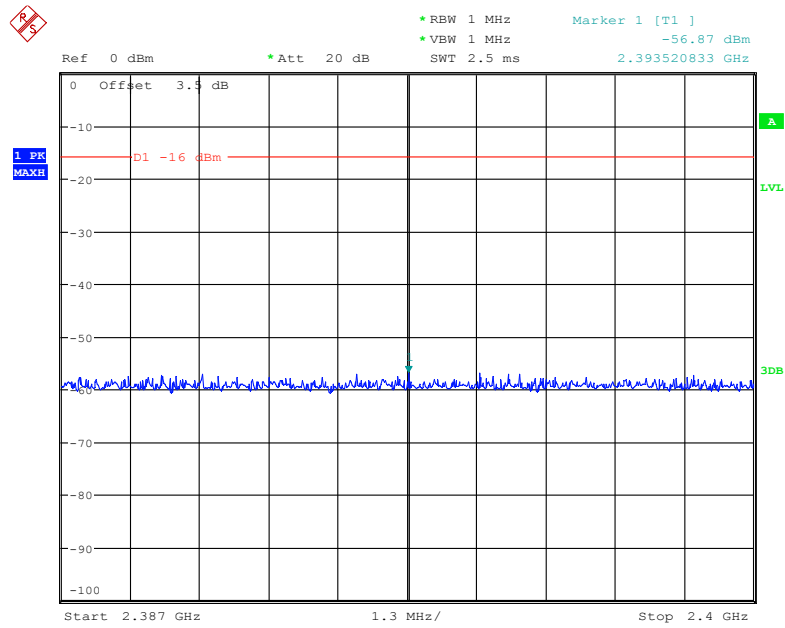
Date: 2.FEB.2018 22:52:10

1 GHz ~2.387 GHz



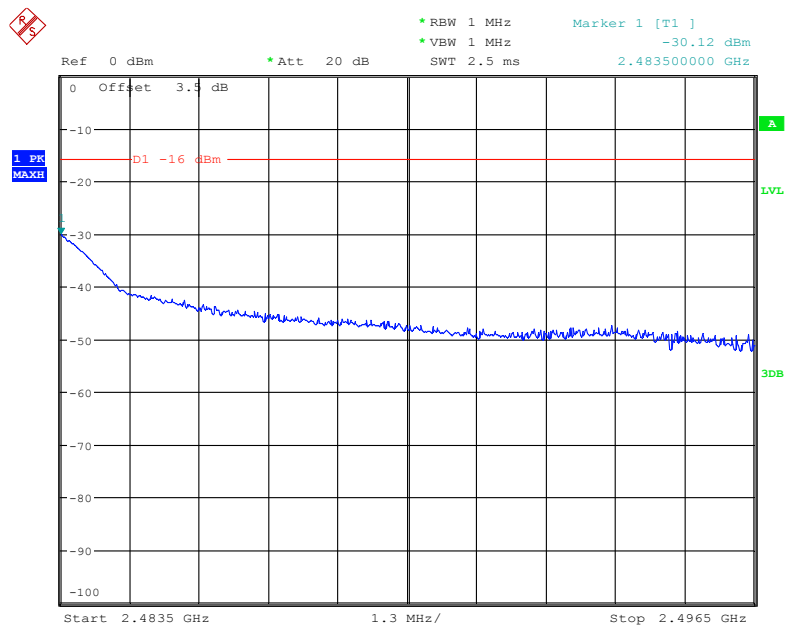
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2.387 GHz~2.4 GHz



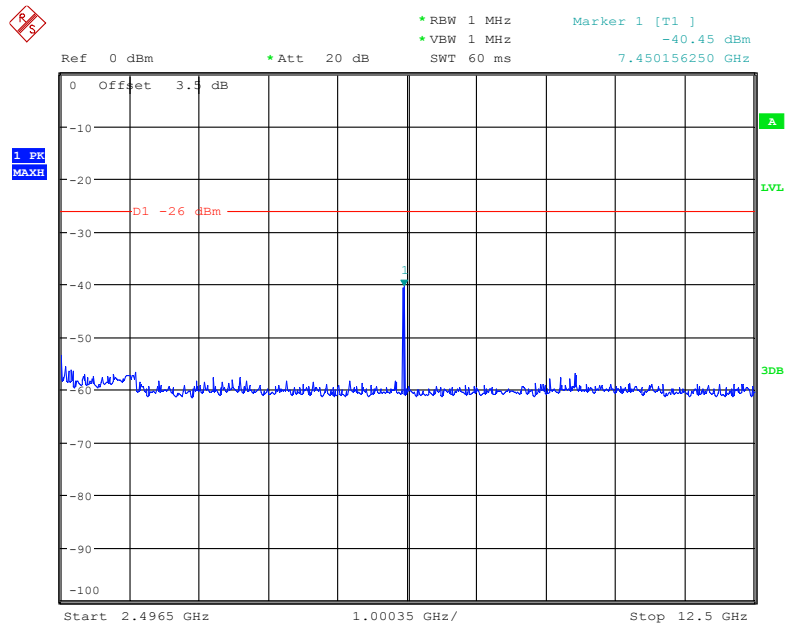
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2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:07:53

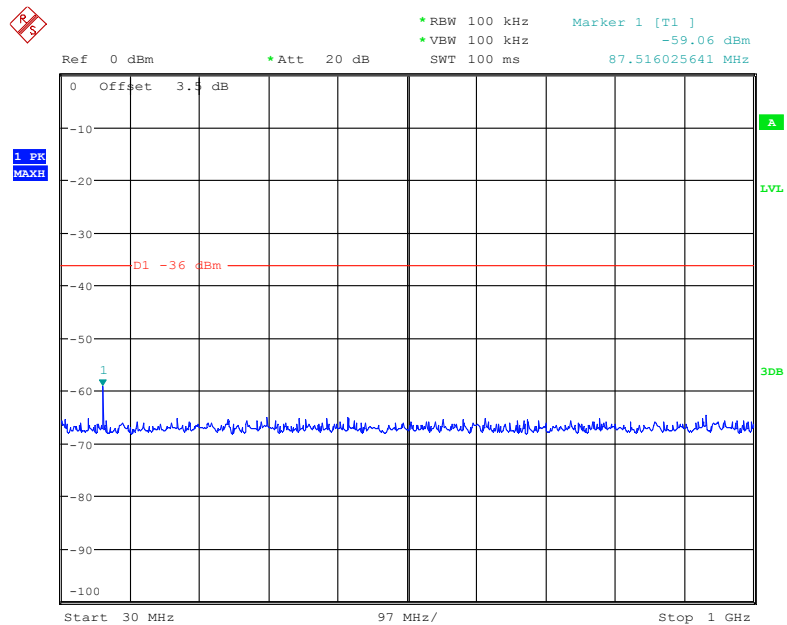
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:10:57

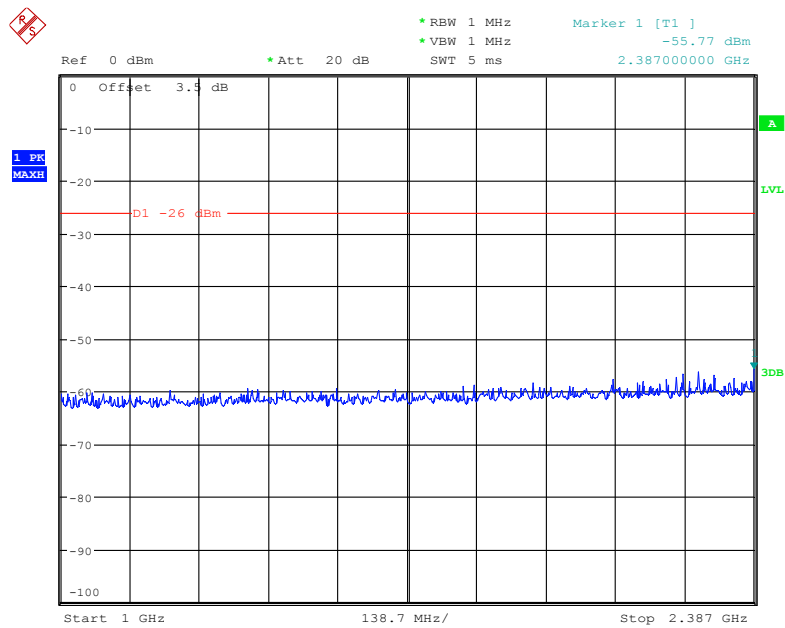
EDR Mode ($\pi/4$ -DQPSK): 2402 MHz:

30 MHz~1 GHz



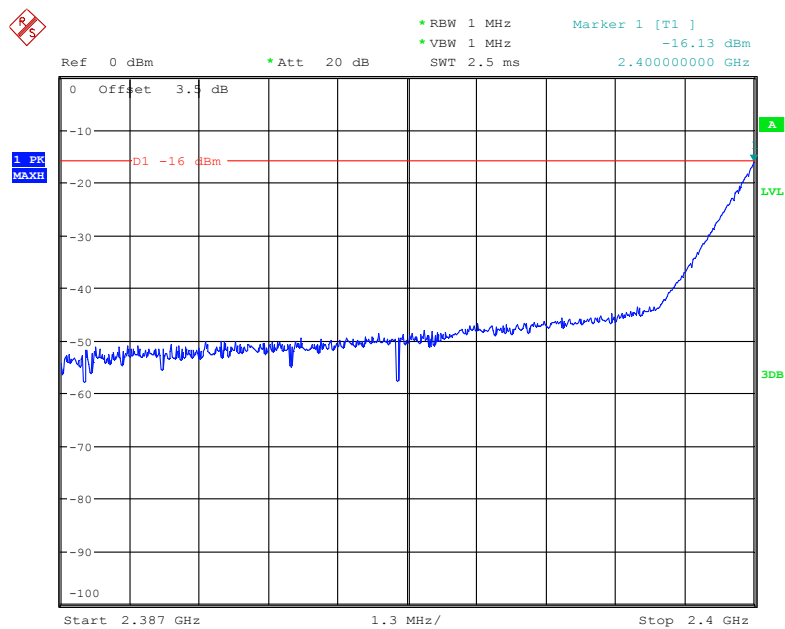
Date: 2.FEB.2018 22:53:55

1 GHz ~2.387 GHz



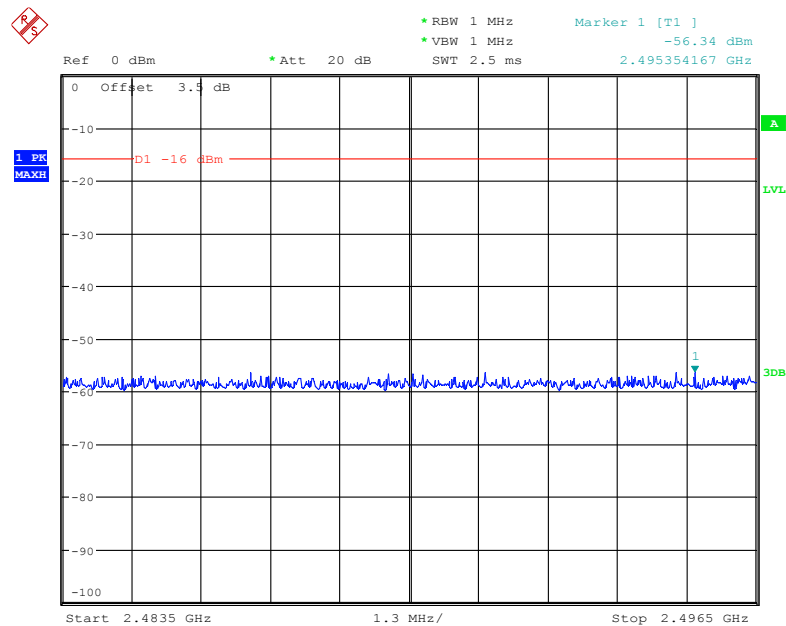
Date: 2.FEB.2018 22:57:37

2.387 GHz~2.4 GHz



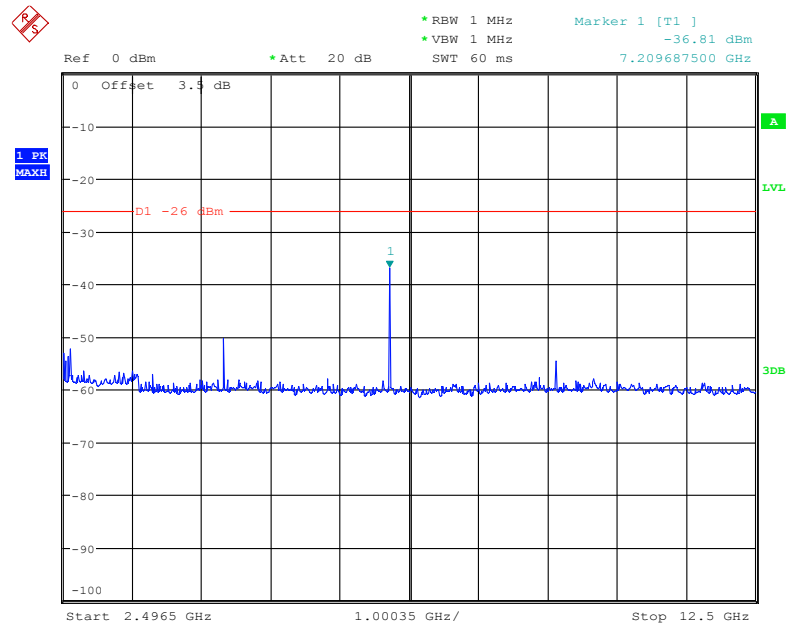
Date: 2.FEB.2018 23:02:57

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:05:15

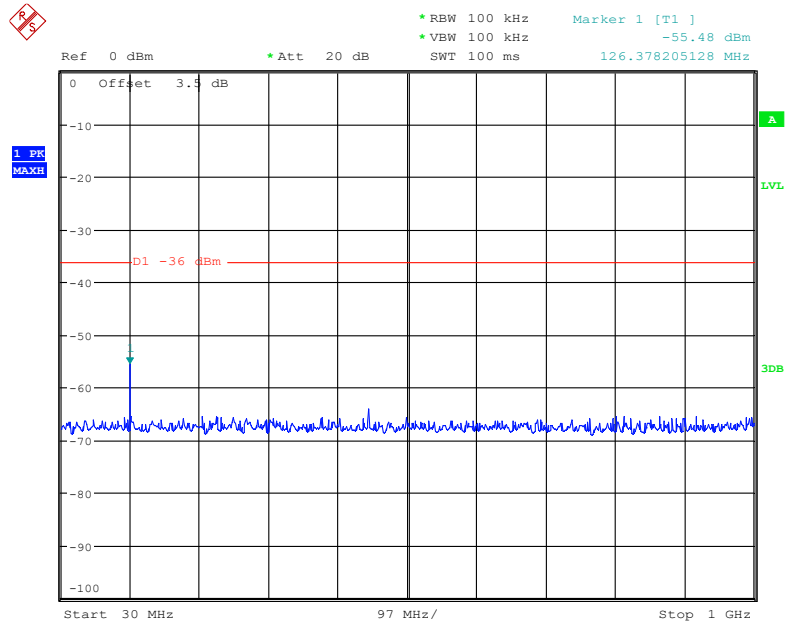
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:14:11

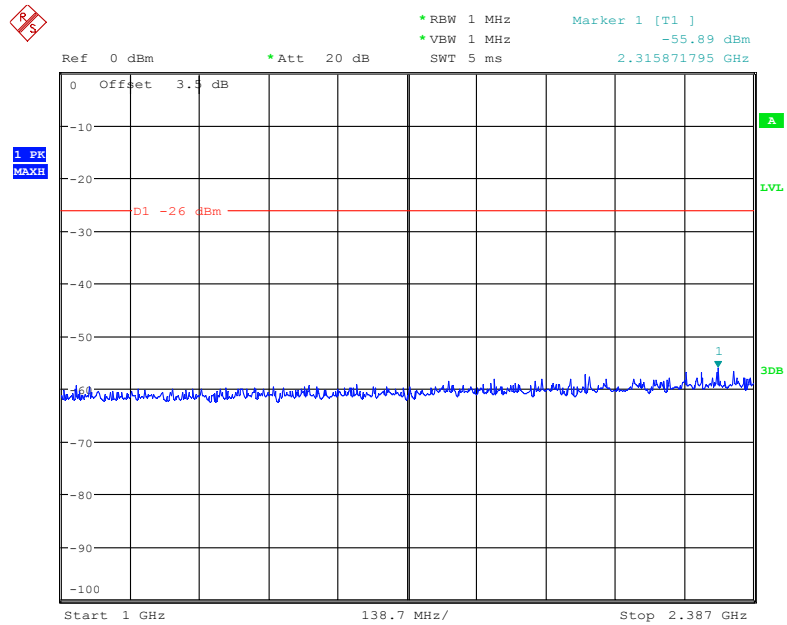
2441 MHz:

30 MHz~1 GHz



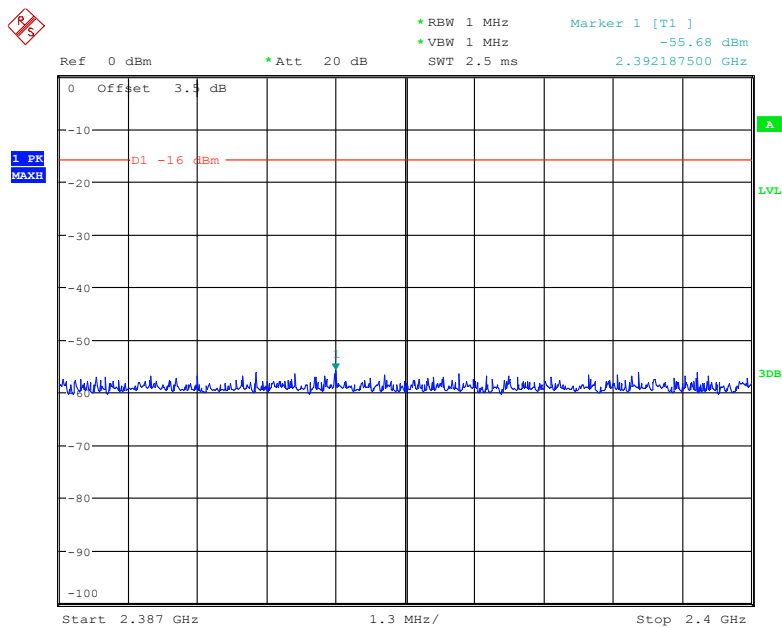
Date: 2.FEB.2018 22:54:15

1 GHz~2.387 GHz



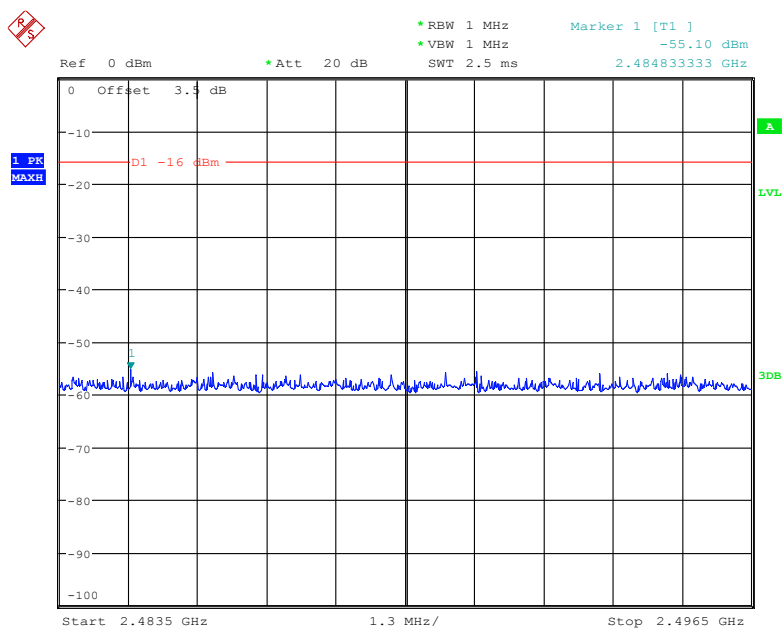
Date: 2.FEB.2018 22:58:30

2.387 GHz~2.4 GHz



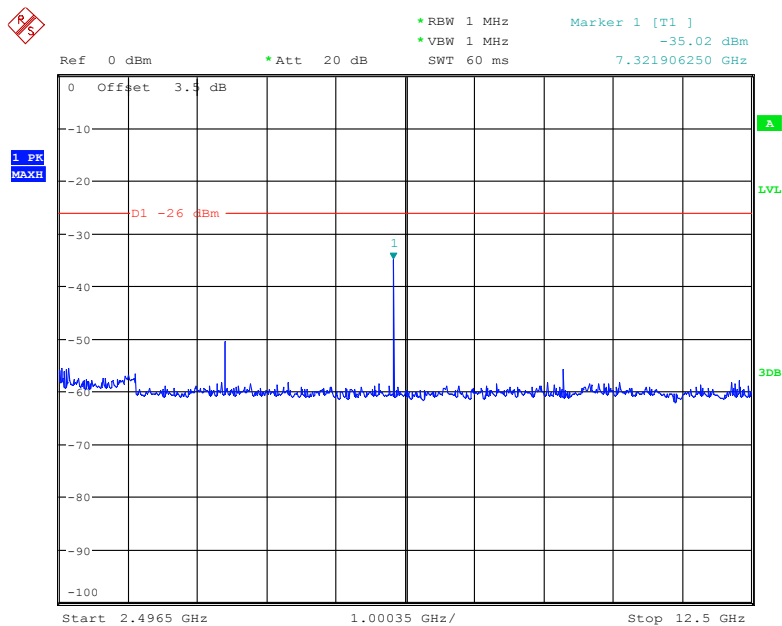
Date: 2.FEB.2018 23:01:57

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:06:04

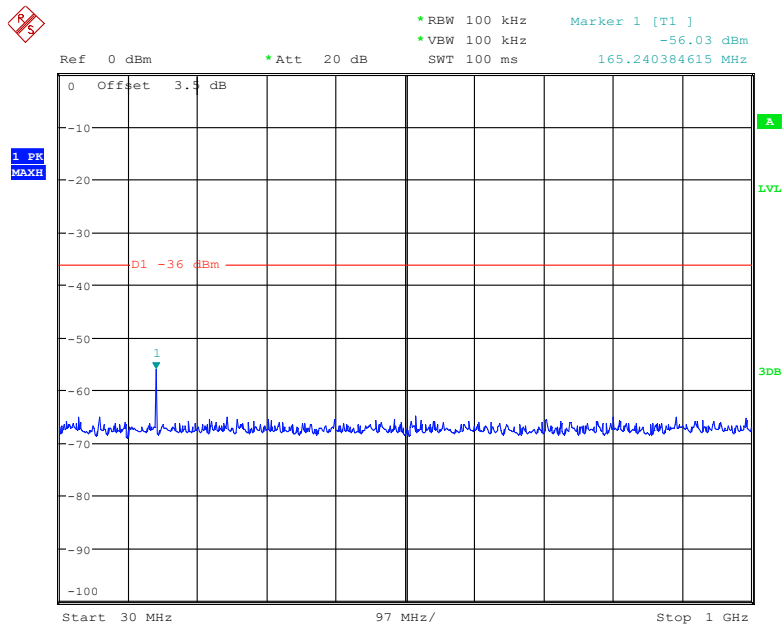
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:13:21

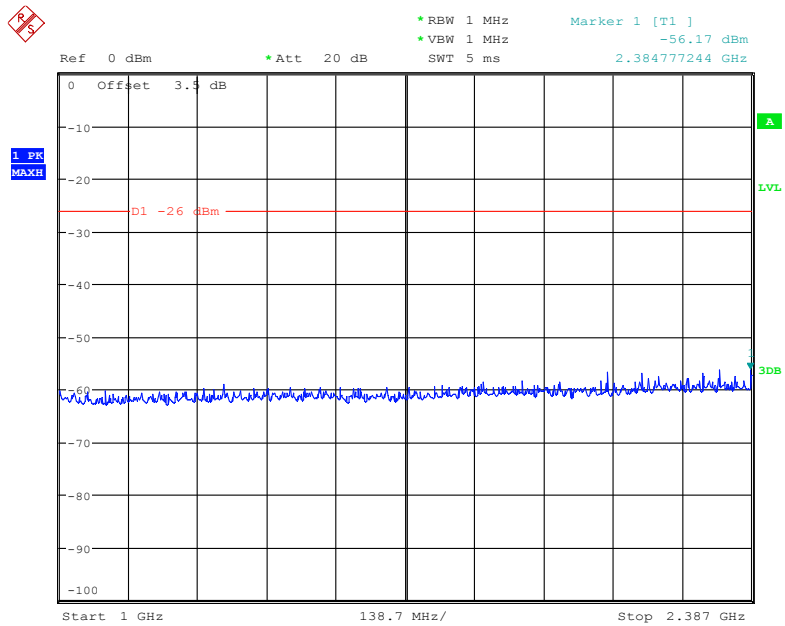
2480 MHz:

30 MHz~1 GHz



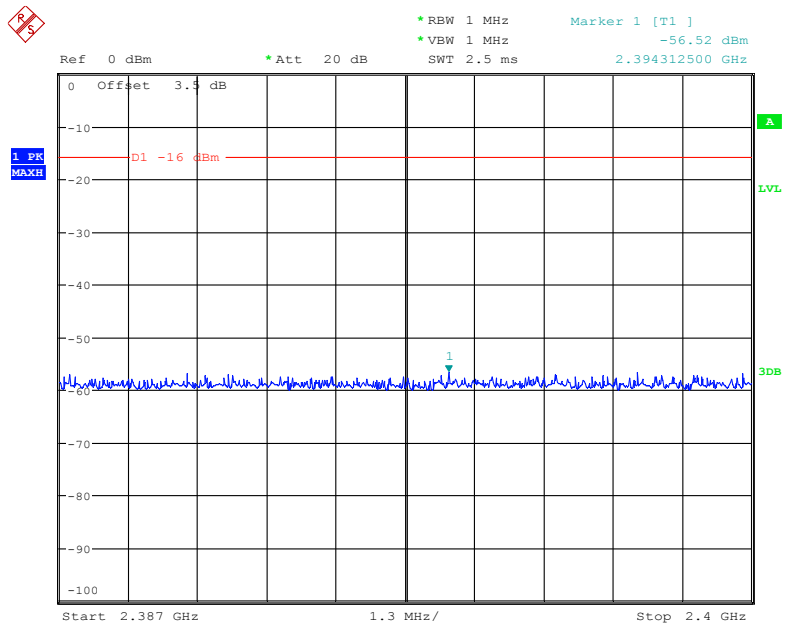
Date: 2.FEB.2018 22:54:32

1 GHz ~2.387 GHz



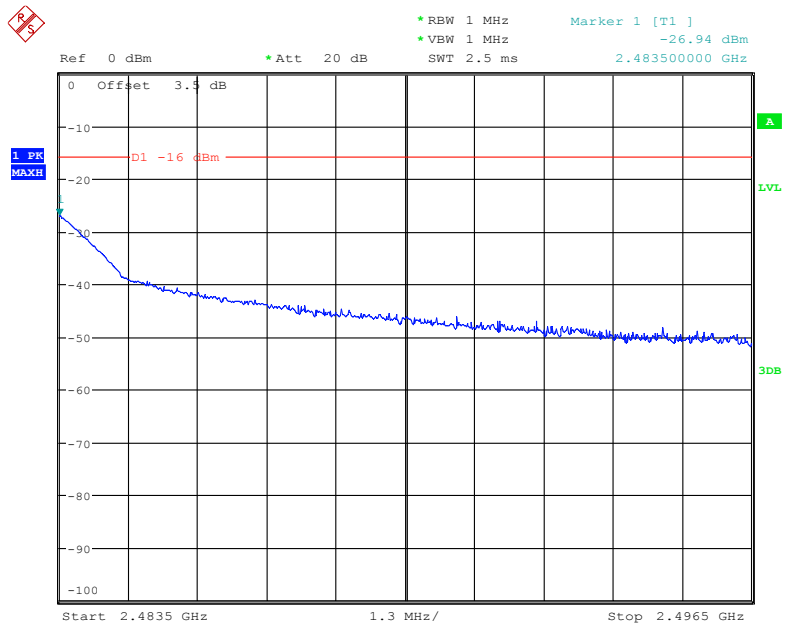
Date: 2.FEB.2018 22:59:27

2.387 GHz~2.4 GHz



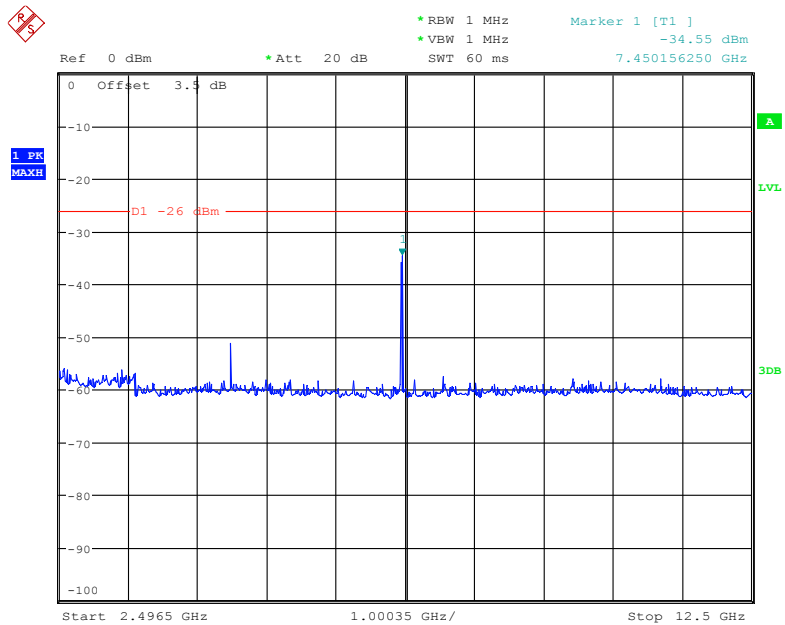
Date: 2.FEB.2018 23:01:10

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:08:45

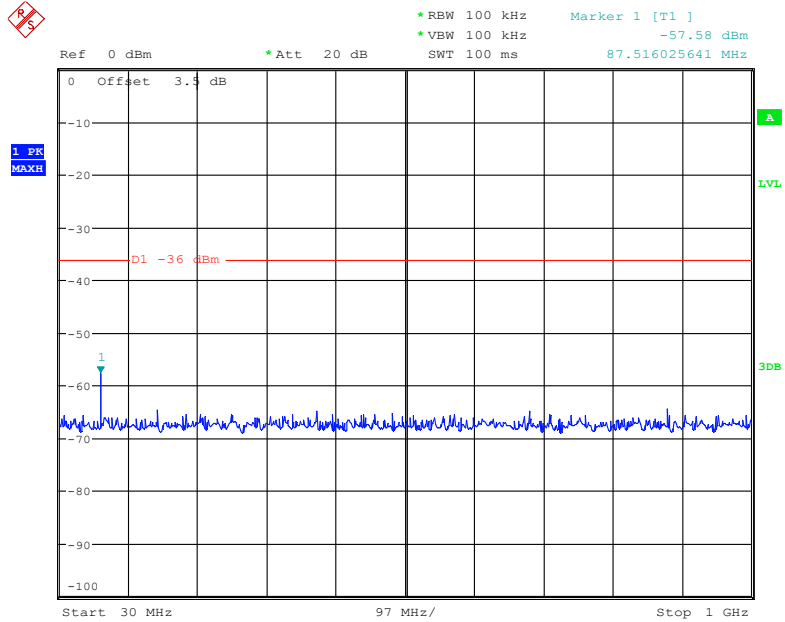
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:11:24

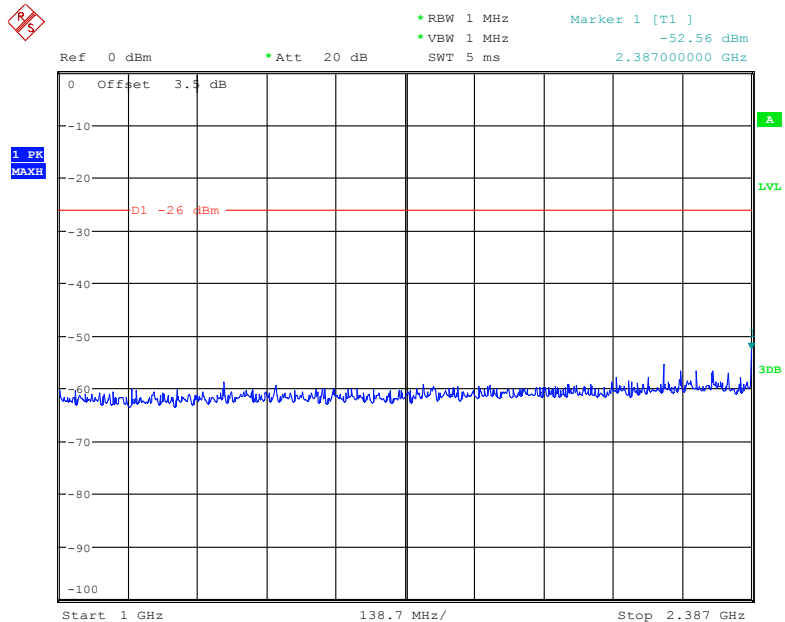
**EDR Mode (8DPSK):
2402 MHz:**

30 MHz~1 GHz



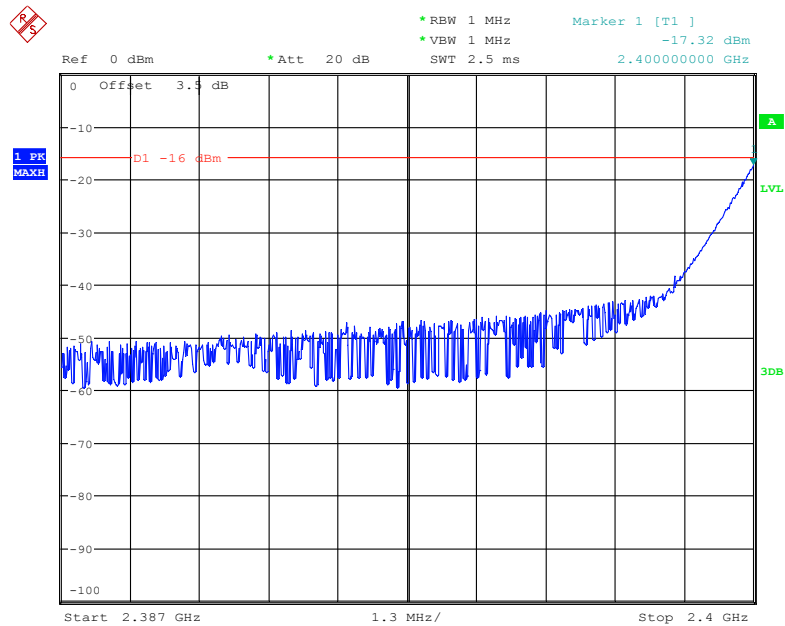
Date: 2.FEB.2018 22:55:32

1 GHz ~2.387 GHz



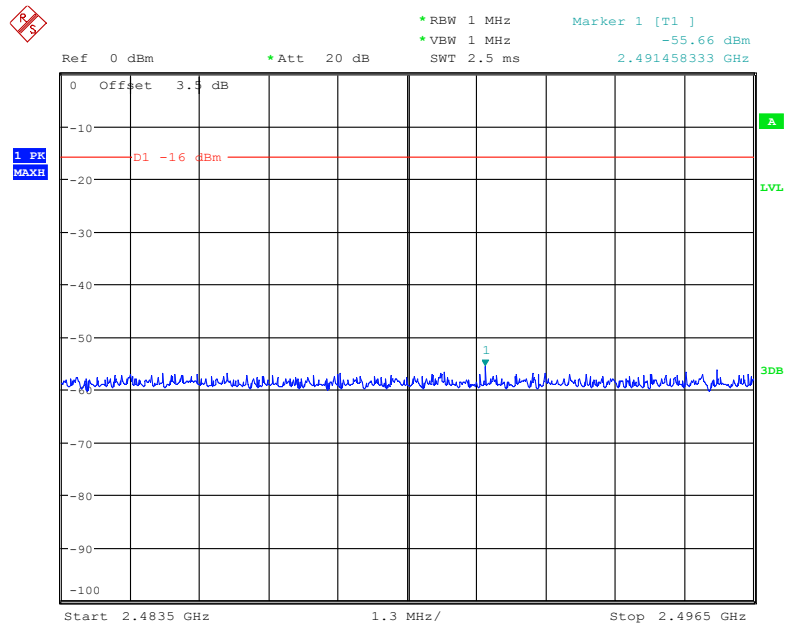
Date: 2.FEB.2018 22:57:51

2.387 GHz~2.4 GHz



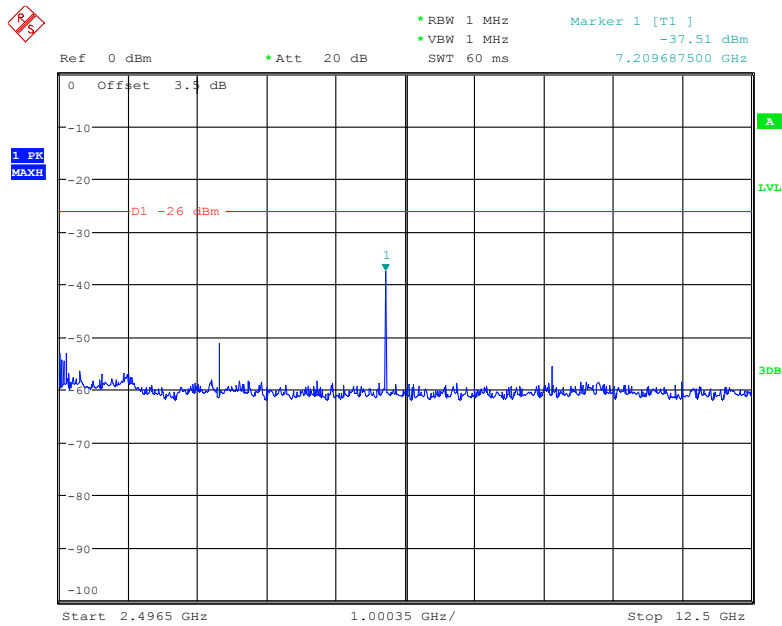
Date: 2.FEB.2018 23:02:31

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:05:28

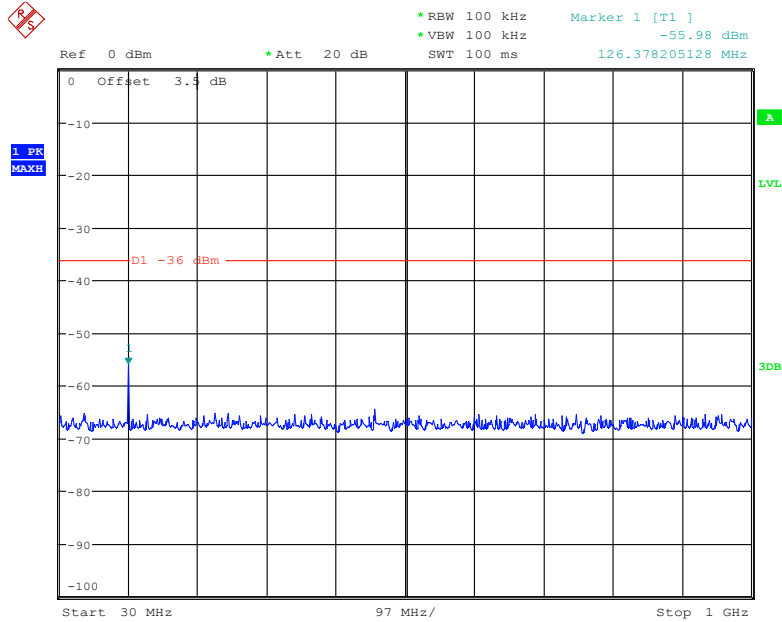
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:14:24

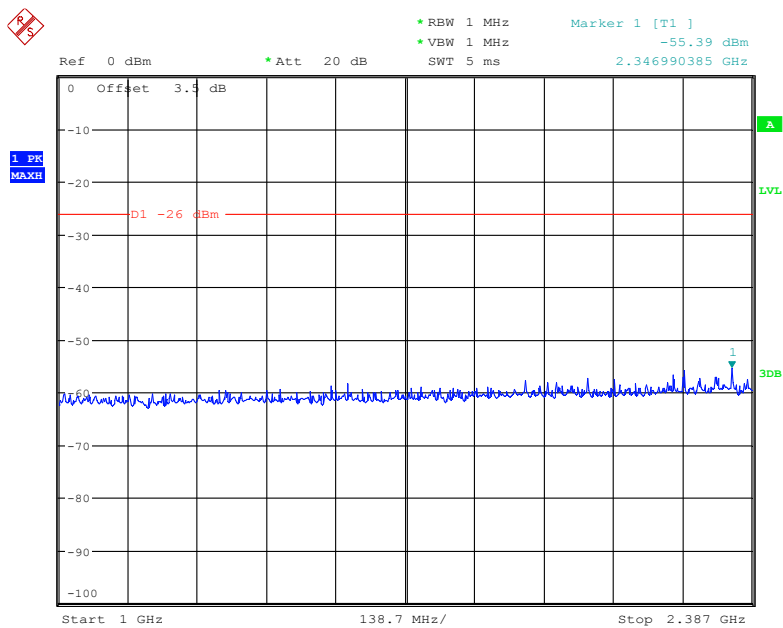
2441 MHz:

30 MHz~1 GHz



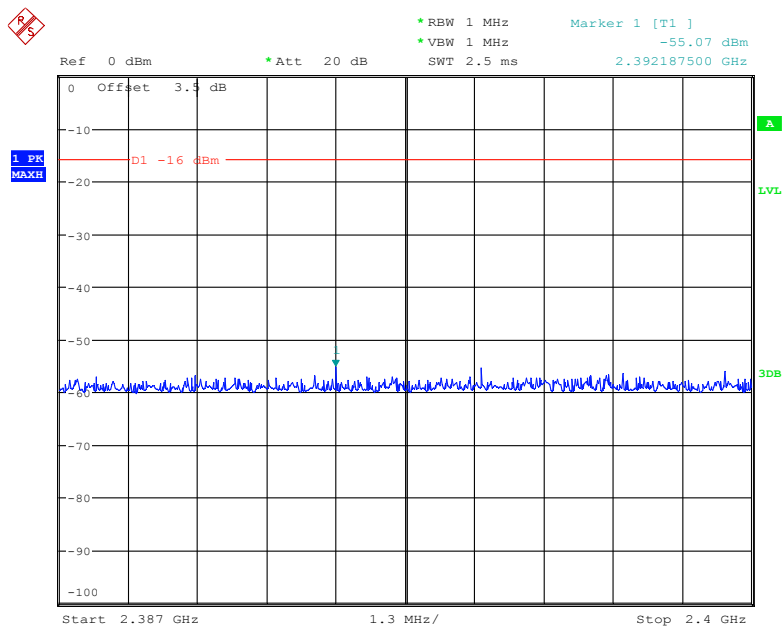
Date: 2.FEB.2018 22:55:15

1 GHz ~2.387 GHz



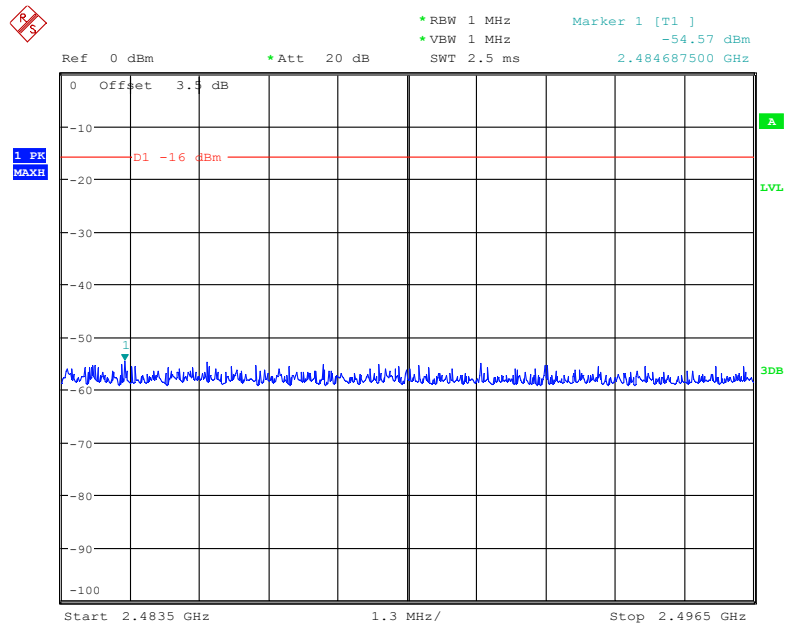
Date: 2.FEB.2018 22:58:09

2.387 GHz~2.4 GHz



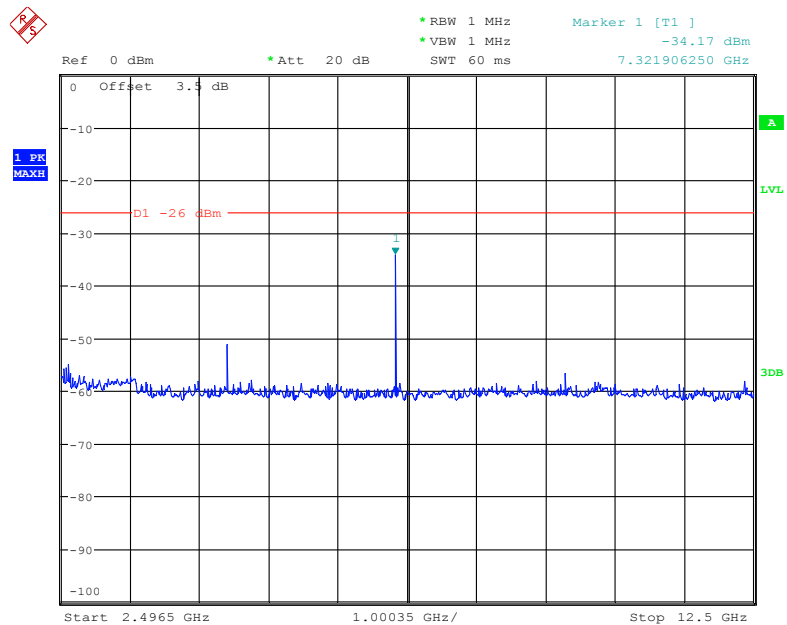
Date: 2.FEB.2018 23:02:10

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:05:49

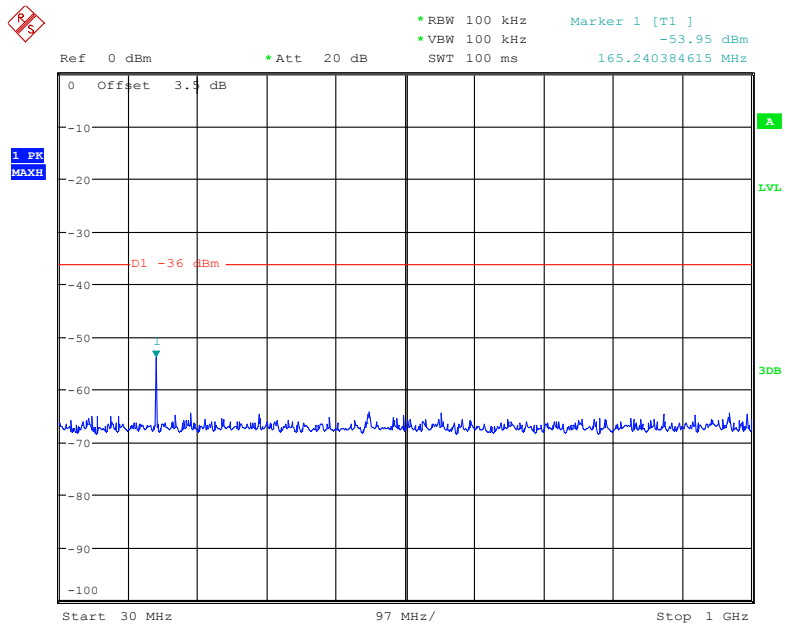
2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:13:09

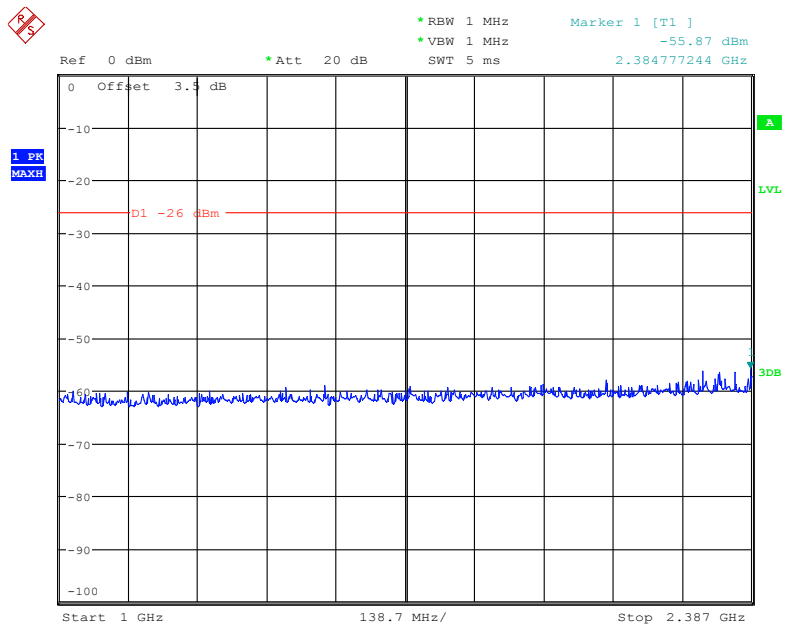
2480 MHz:

30 MHz~1 GHz



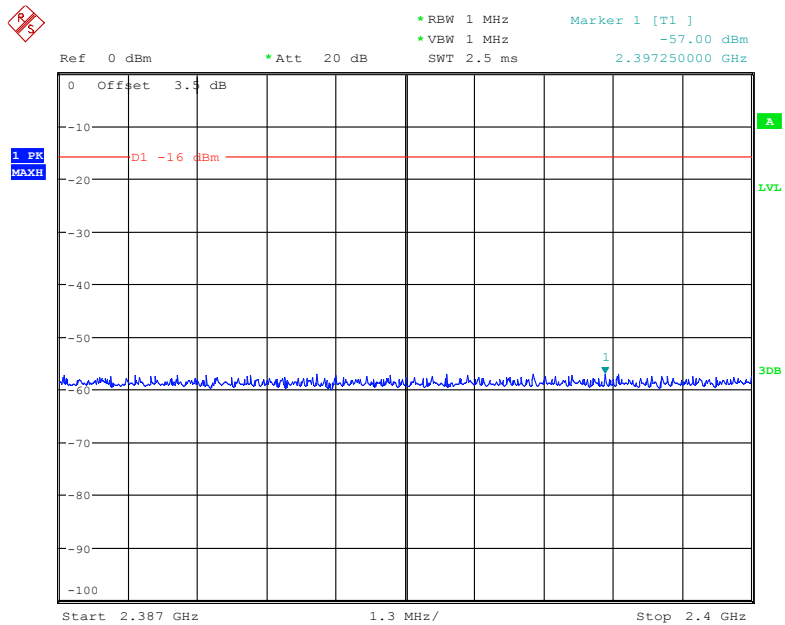
Date: 2.FEB.2018 22:54:51

1 GHz ~2.387 GHz



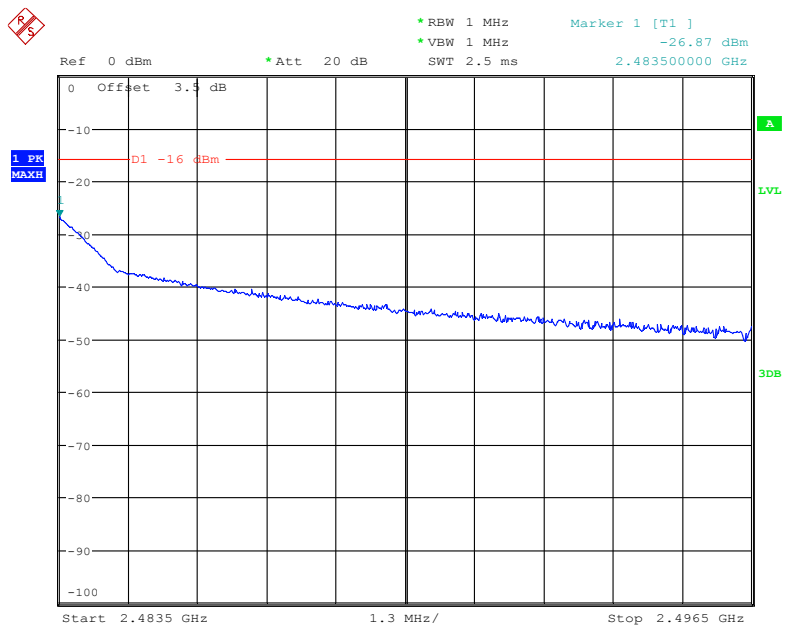
Date: 2.FEB.2018 22:59:41

2.387 GHz~2.4 GHz



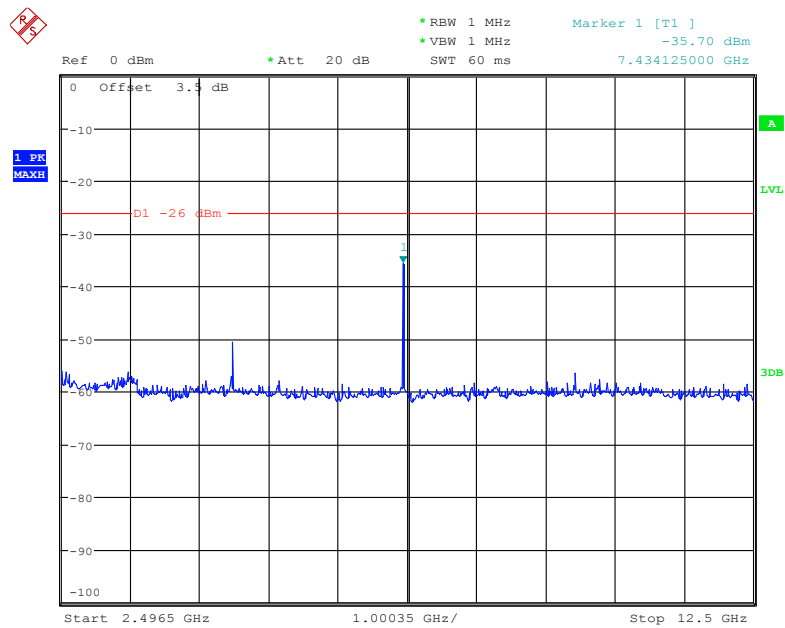
Date: 2.FEB.2018 23:00:35

2.4835 GHz~2.4965 GHz



Date: 2.FEB.2018 23:09:25

2.4965 GHz~12.5 GHz



Date: 2.FEB.2018 23:11:37

ANTENNA OUTPUT POWER AND ANTENNA POWER TOLERANCE

Limit

- $\leq 3 \text{ mW /MHz}$ (FHSS from 2402-2480 MHz)
- $\leq 10 \text{ mW/MHz}$ (OFDM, DSSS from 2400-2483.5 MHz)
- $\leq 10 \text{ mW}$ (other from 2400-2483.5 MHz)

The Output Power Tolerance must be within +20%, -80%.

Test Procedure

For HFSS UUT:

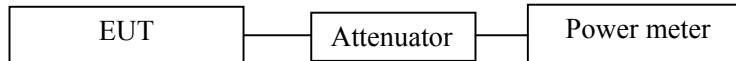
Step 1: Measure the total power by Power Meter in a state of hopping mode (with Average Sensor)

Step 2: If it's the burst wave, please measure the burst ratio. Then calculate the real total power by burst ratio.

Step 3: Calculate the mean power per 1MHz by dividing the total power by spread bandwidth.

Output Power Density (mW/MHz) = Total Output Power (mW) / Burst Ratio / Spread Bandwidth (MHz)

Test Setup Block diagram



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-02-02.

Test Result: Compliant

Test Mode: Transmitting

Normal

BDR Mode (GFSK):

Declared power=0.1mW/MHz

Frequency	Normal voltage	Low voltage	High voltage	Limit
Antenna Output Power (dBm)	2.76	2.58	2.59	
Antenna Output Power (mW)	1.888	1.811	1.816	
Spread Bandwidth (MHz)	71.154	71.218	71.216	
Duty cycle (%)	35.92	36.25	35.85	
Antenna Output Power (mW/MHz)	0.074	0.070	0.071	3
Antenna Output Power Tolerance (%)	-26	-30	-29	-80 ~ +20
EIRP(dBm/MHz)	-10.51	-10.75	-10.69	6.91

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

Declared power=0.15mW/MHz

Frequency	Normal voltage	Low voltage	High voltage	Limit
Antenna Output Power (dBm)	5.26	5.84	5.98	
Antenna Output Power (mW)	3.357	3.837	3.963	
Spread Bandwidth (MHz)	71.635	71.618	71.607	
Duty cycle (%)	35.28	35.82	34.89	
Antenna Output Power (mW/MHz)	0.133	0.150	0.159	3
Antenna Output Power Tolerance (%)	-11.33	0	6	-80 ~ +20
EIRP(dBm/MHz)	-7.96	-7.44	-7.19	6.91

EDR Mode (8DPSK):

Declared power=0.15mW/MHz

Frequency	Normal voltage	Low voltage	High voltage	Limit
Antenna Output Power (dBm)	5.19	5.25	5.21	
Antenna Output Power (mW)	3.304	3.350	3.319	
Spread Bandwidth (MHz)	71.635	71.618	71.609	
Duty cycle (%)	35.28	35.65	35.25	
Antenna Output Power (mW/MHz)	0.131	0.131	0.131	3
Antenna Output Power Tolerance (%)	-12.67	-12.67	-12.67	-80 ~ +20
EIRP(dBm/MHz)	-8.03	-8.03	-8.03	6.91

Note:

- 1) Antenna output power(mW/MHz) = Antenna output power (mW)/duty cycle(%)/spread bandwidth (MHz)
- 2) Antenna output power tolerance = (Antenna output power - declared power)/declared power*100%
- 3) Antenna gain is 0.8 dBi

Duty cycle Please refer to the Item “frequency hopping dwell time”.

Spread bandwidth refer to the Item “Occupied bandwidth and Spread Bandwidth”.

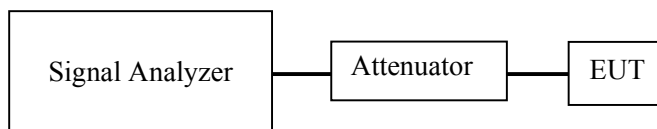
RECEIVER SPURIOUS EMISSION AND UNWANTED EMISSION INTENSITY

Limit

- $\leq 4 \text{ nW}$ ($30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$)
- $\leq 20 \text{ nW}$ ($1 \text{ GHz} \leq f \leq 12.5 \text{ GHz}$)

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- The modulation state shall be “continuous receiving mode”.

Spectrum Analyzer Conditions

- Start Frequency: Start Frequency of frequency range to measure (30MHz or 1GHz)
- Stop Frequency: Stop Frequency of frequency range to measure (1GHz or 12.75GHz)
- Span: AUTO (Measurement Range)
- RBW: 100 kHz, VBW: 100 kHz for Frequency < 1 GHz
- RBW: 1MHz, VBW: 1MHz for Frequency > 1 GHz
- Sweep time: AUTO or more
- Sweep mode: Auto Sweep
- Detection: Positive Peak
- Reference Level: Enough level for maximum dynamic range

Test Data

Environmental Conditions

Temperature:	23 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Tracy Hu on 2018-02-02.

Test Result: Compliant, please see the below tables and plots

BDR (GFSK)	Frequency Band	2402MHz	2441MHz	2480MHz	Limit
Normal Voltage	Band VI (dBm)	-68.44	-68.58	-67.04	-54
	Band VII(dBm)	-56.09	-56.37	-55.19	-47
High Voltage	Band VI (dBm)	-68.41	-68.79	-65.54	-54
	Band VII(dBm)	-55.33	-57.02	-56.03	-47
Low Voltage	Band VI (dBm)	-68.09	-68.58	-66.87	-54
	Band VII(dBm)	-54.80	-55.65	-54.18	-47

EDR ($\pi/4$-DQPSK)	Frequency Band	2402MHz	2441MHz	2480MHz	Limit
Normal	Band VI (dBm)	-67.50	-68.38	-68.27	-54
	Band VII(dBm)	-55.96	-56.81	-55.89	-47
High Voltage	Band VI (dBm)	-68.22	-68.88	-69.01	-54
	Band VII(dBm)	-57.20	-55.65	-54.98	-47
Low Voltage	Band VI (dBm)	-68.72	-66.83	-69.65	-54
	Band VII(dBm)	-56.85	-58.25	-54.97	-47

EDR (8DPSK)	Frequency Band	2402MHz	2441MHz	2480MHz	Limit
Normal Voltage	Band VI (dBm)	-67.84	-68.04	-68.41	-54
	Band VII(dBm)	-56.40	-56.32	-55.86	-47
High Voltage	Band VI (dBm)	-68.27	-67.98	-66.99	-54
	Band VII(dBm)	-55.92	-56.92	-57.06	-47
Low Voltage	Band VI (dBm)	-68.66	-68.44	-66.92	-54
	Band VII(dBm)	-58.17	-55.94	-55.48	-47

Note:

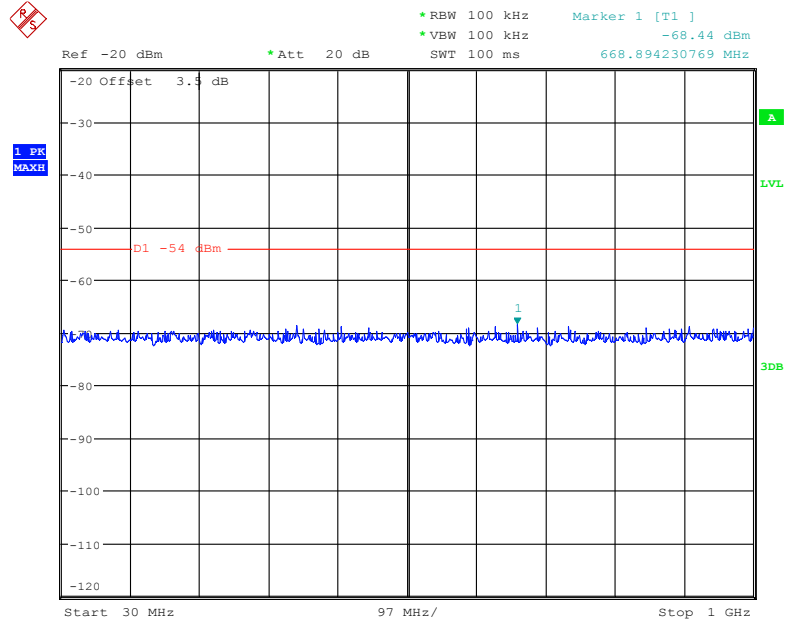
Band VI : 30MHz-1GHz, Limit is 4 nW = -54 dBm;

Band VII : 1GHz- 12.75GHz, Limit is 20 nW = -47 dBm;

Normal Condition Test Data as below:

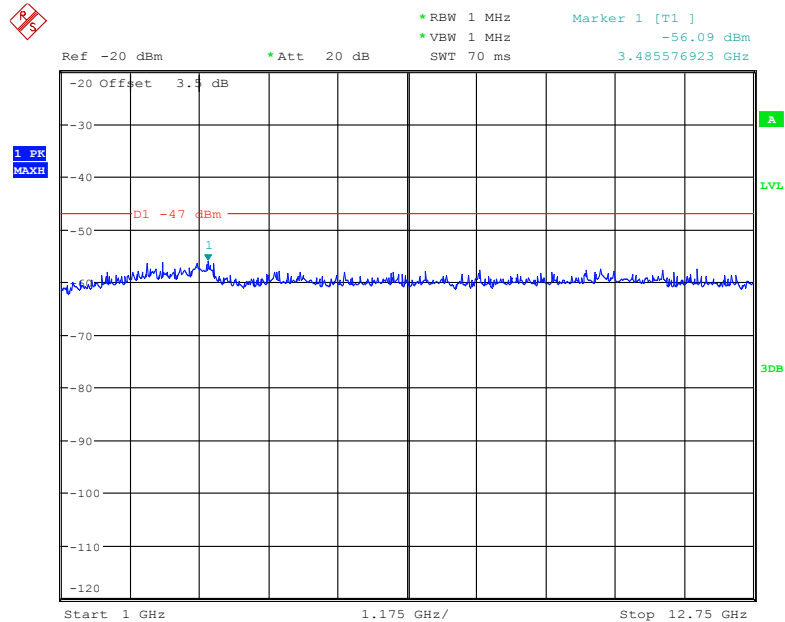
BDR Mode (GFSK)
2402 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:24:27

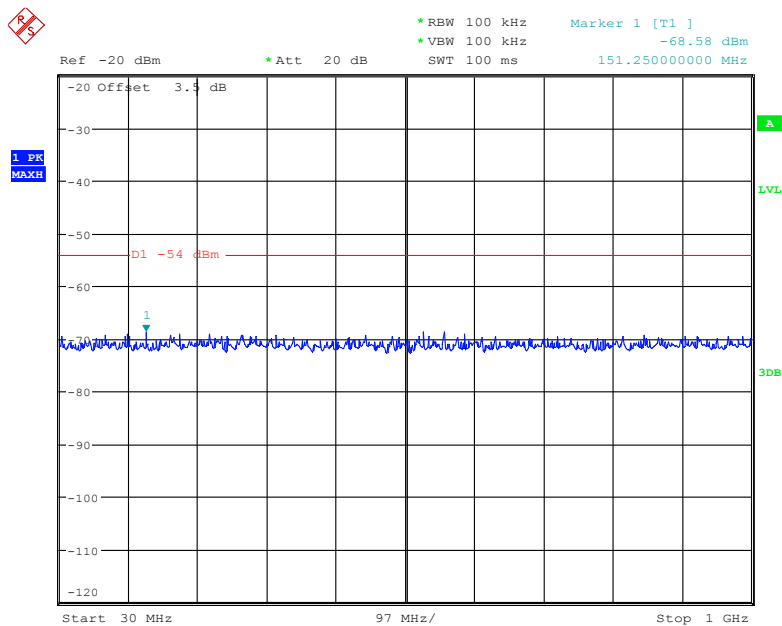
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:31:03

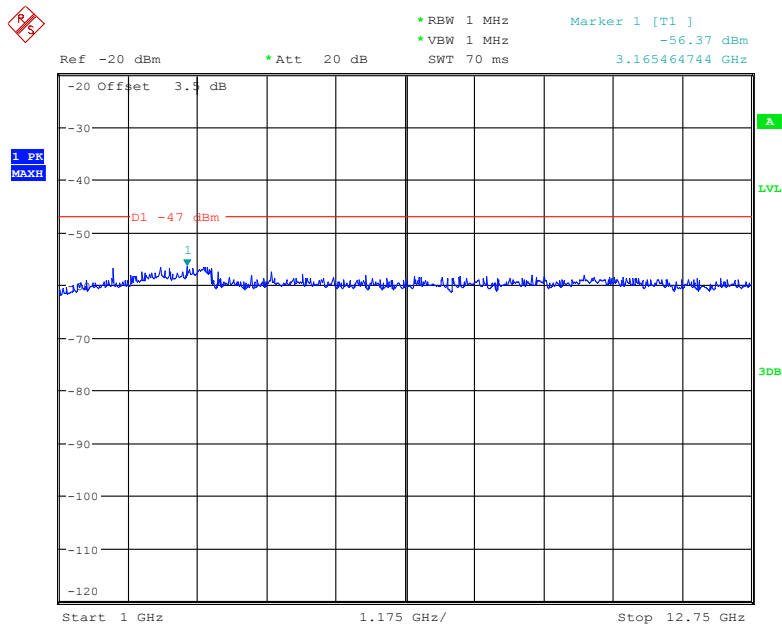
2441 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:24:17

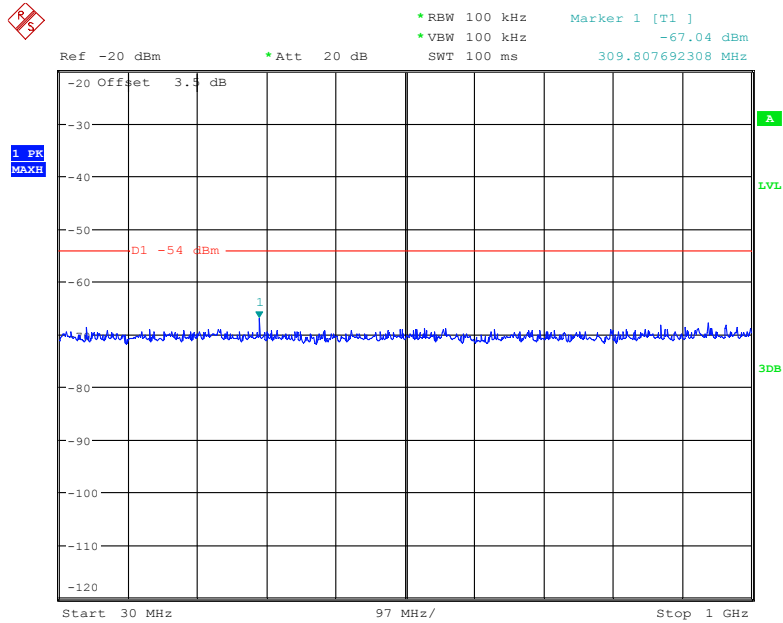
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:32:00

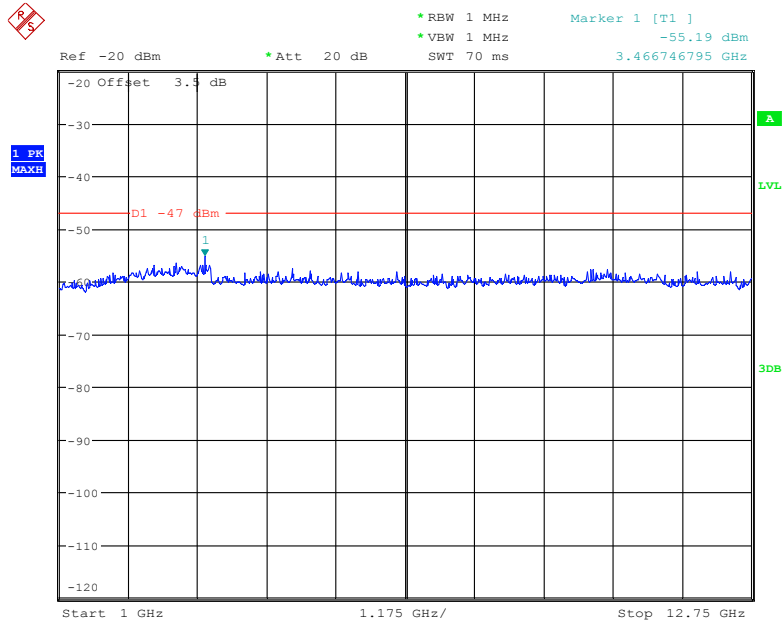
2480 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:23:51

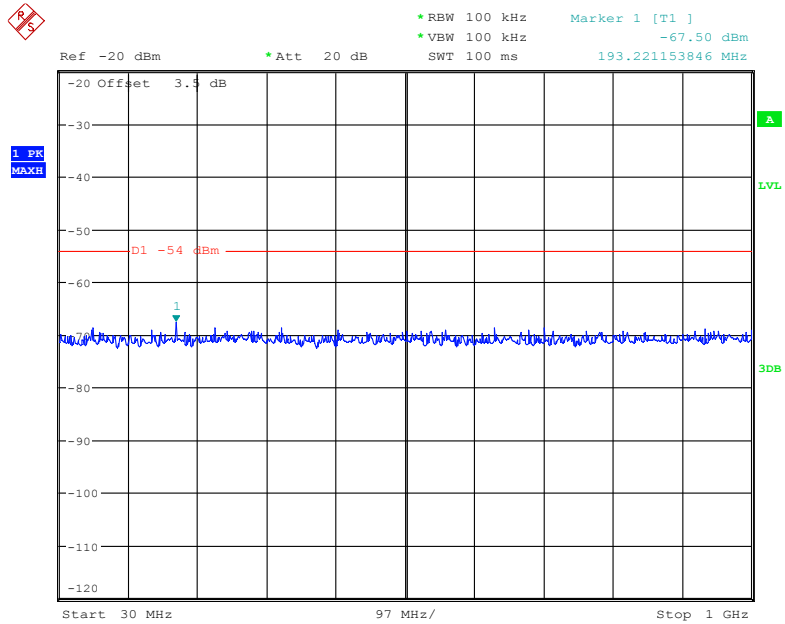
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:32:17

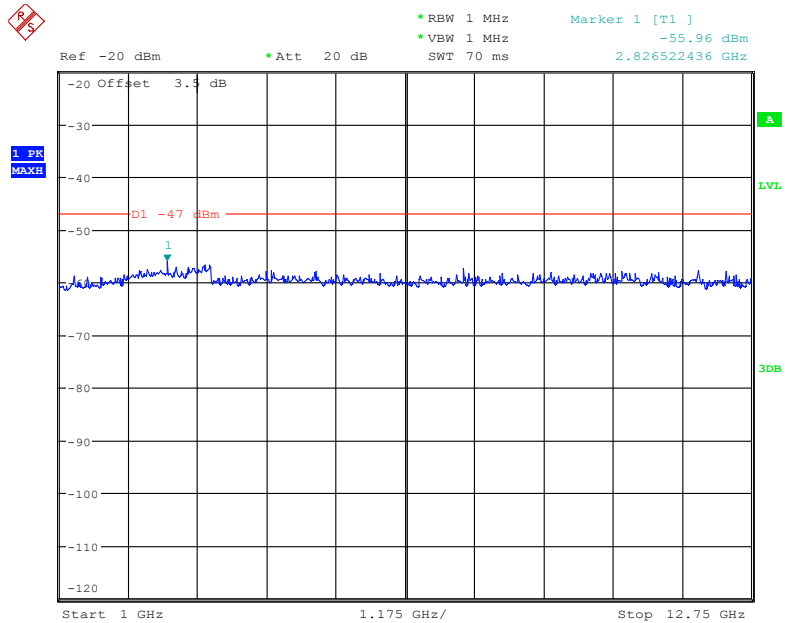
**EDR Mode ($\pi/4$ -DQPSK):
2402 MHz:**

30 MHz~1 GHz



Date: 2.FEB.2018 22:25:43

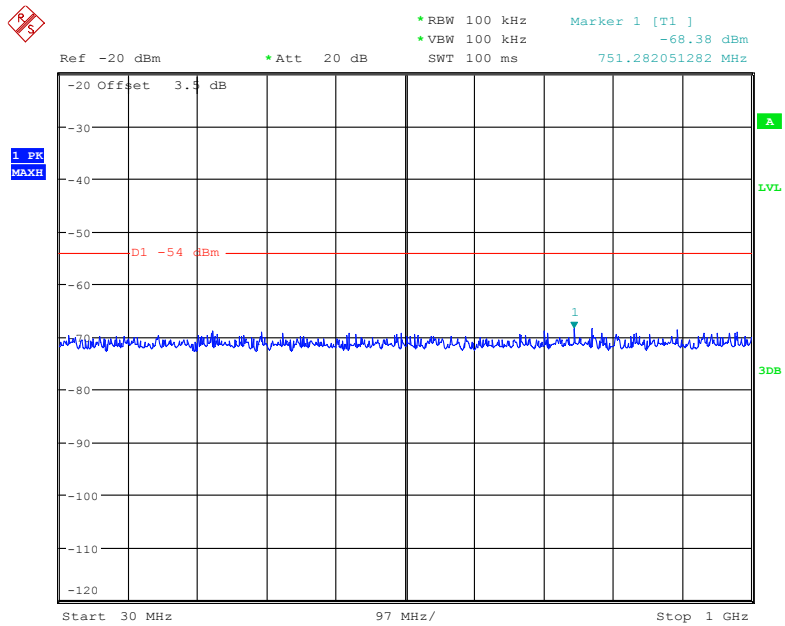
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:33:07

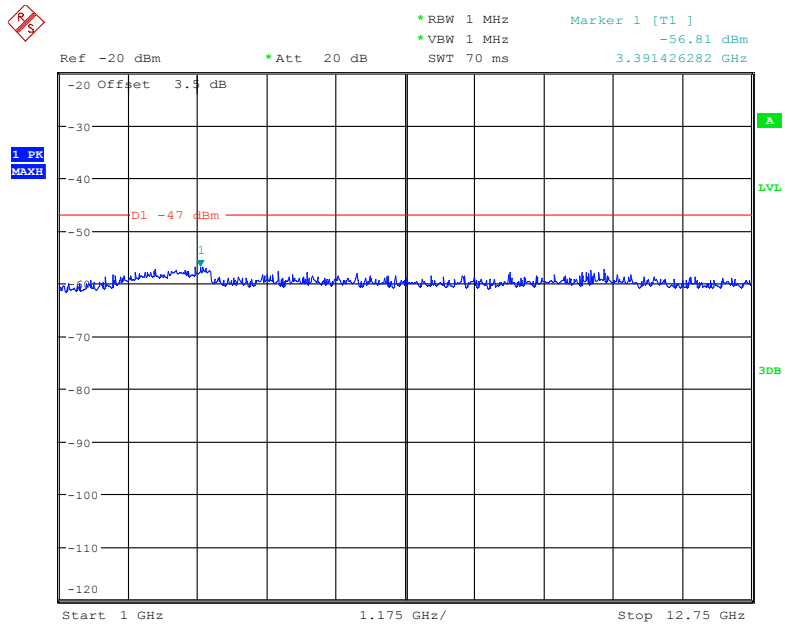
2441 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:25:54

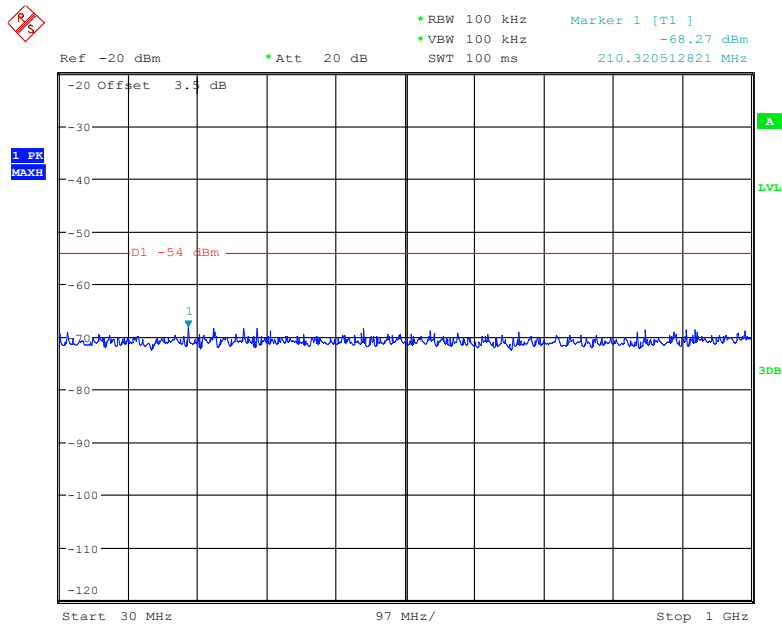
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:32:52

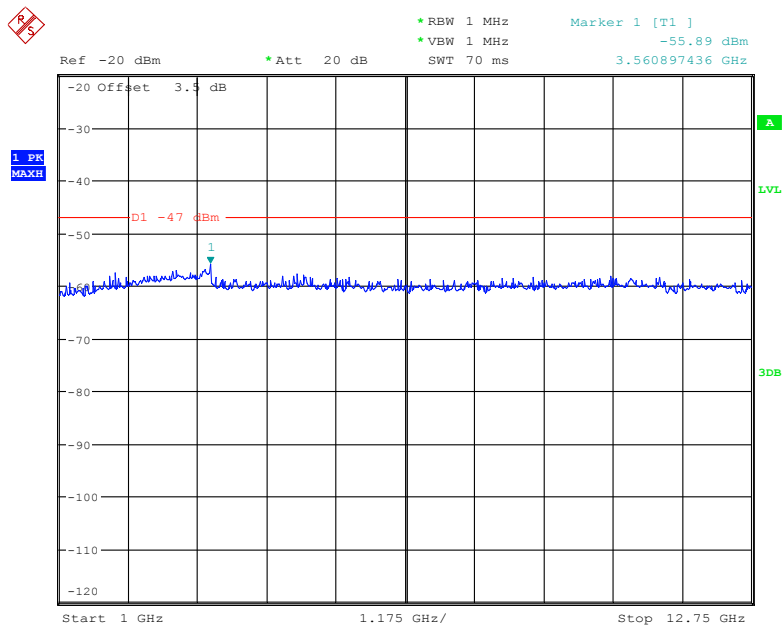
2480 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:26:31

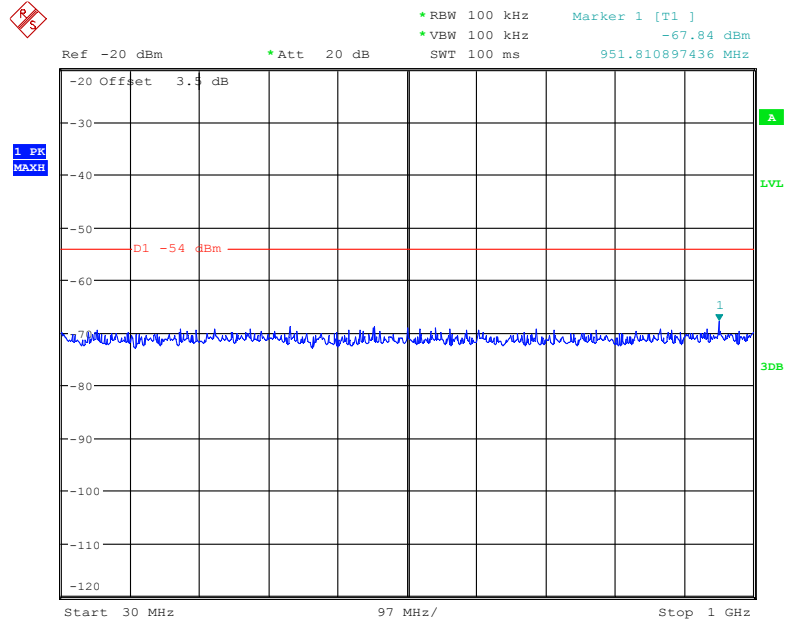
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:32:37

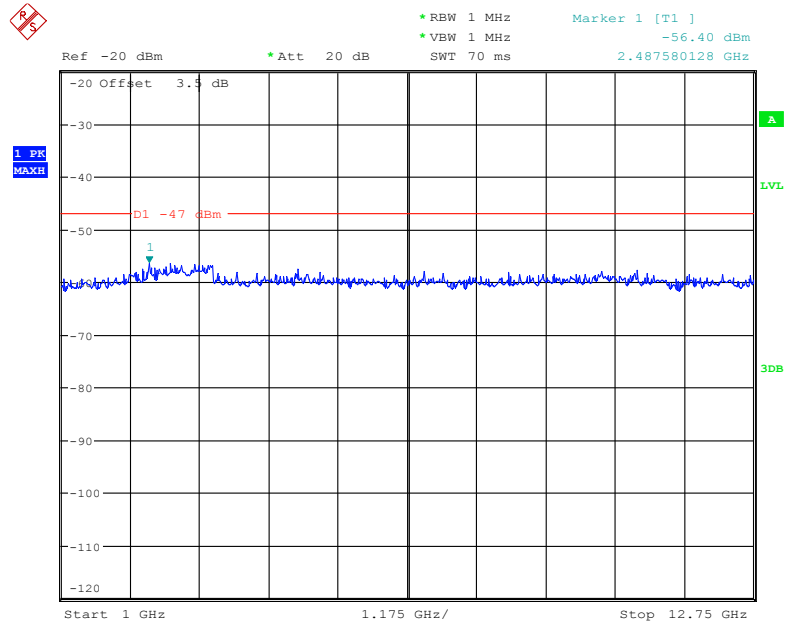
EDR Mode (8DPSK):
2402 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:27:08

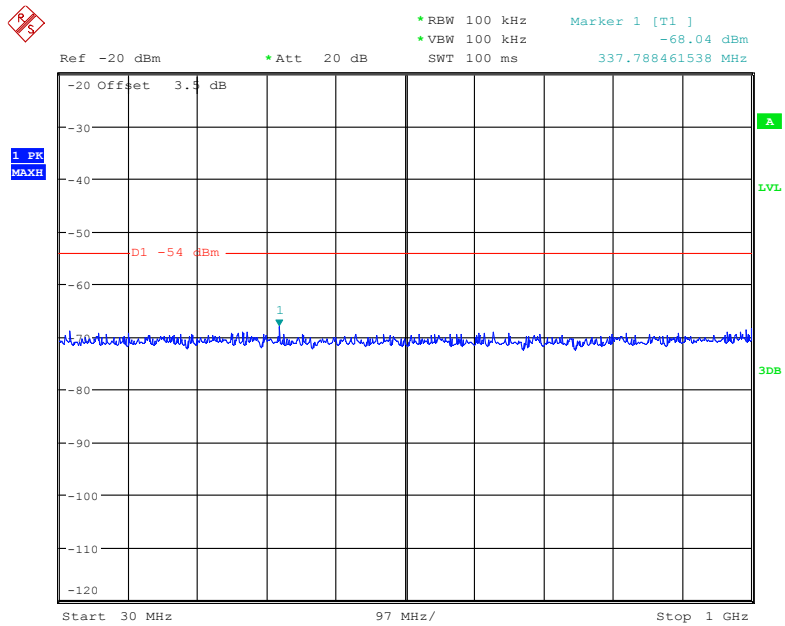
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:33:34

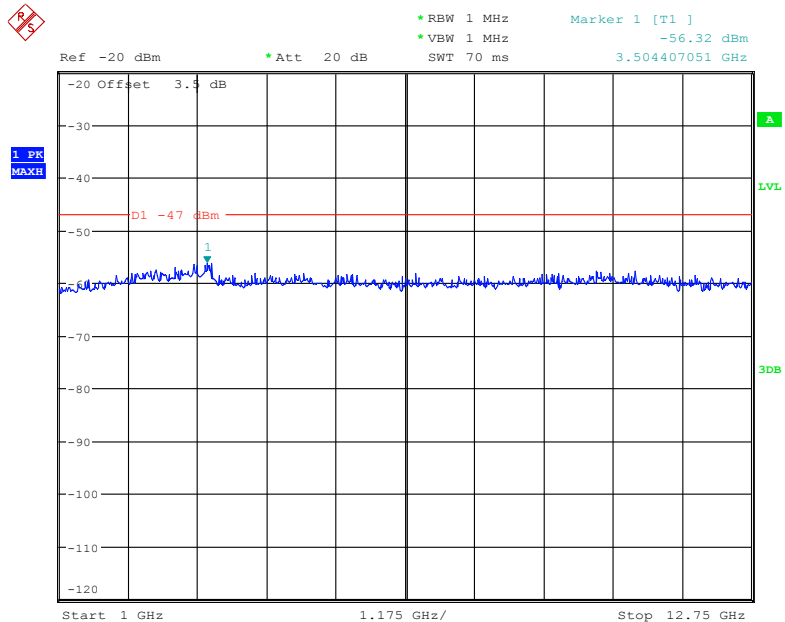
2441 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:26:59

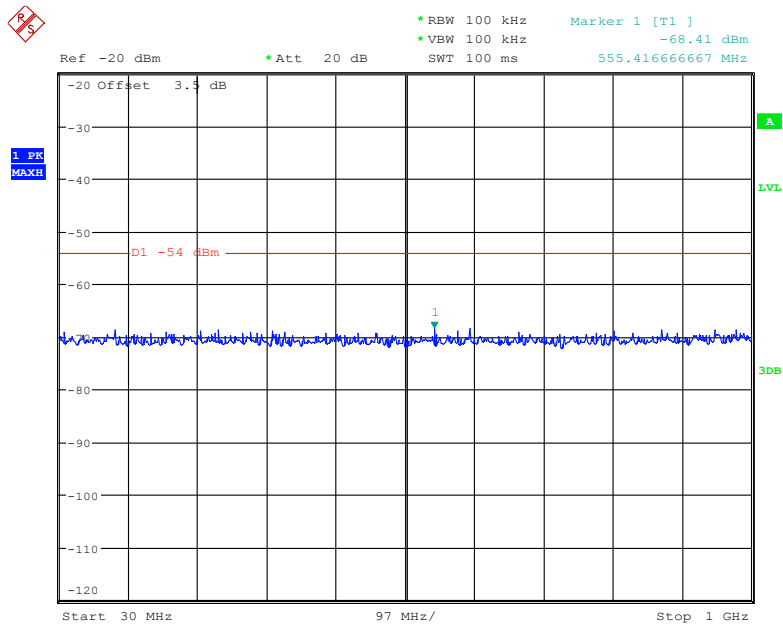
1 GHz~12.75 GHz



Date: 2.FEB.2018 22:33:43

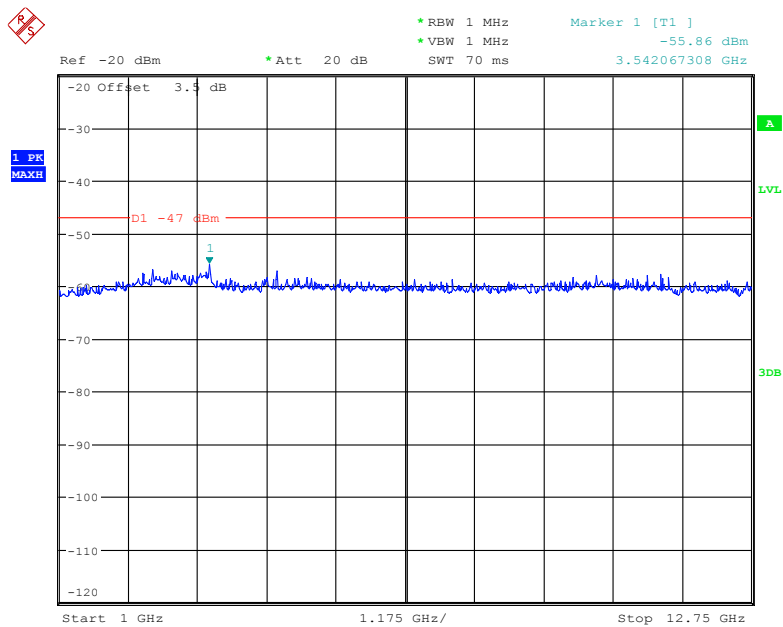
2480 MHz:

30 MHz~1 GHz



Date: 2.FEB.2018 22:26:46

1 GHz~12.75 GHz



Date: 2.FEB.2018 22:33:53

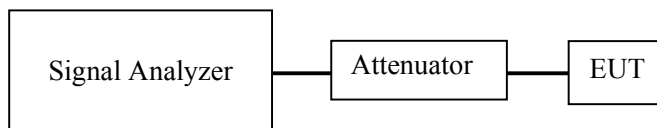
FREQUENCY HOPPING DWELL TIME

Applicable Standard

According to Radio Law Radio Equipment Regulations Article 49-20, frequency dwell time is 0.4 seconds or below.

Test Procedure

Measurement System Diagram



Conditions of Application Equipment (EUT)

- Set the application equipment (EUT) to the measurement frequency.
- The modulation state shall be “continuous (burst) transmission mode”. If impossible, it shall be “continuous frequency-hopping mode”.

Spectrum Analyzer Conditions

Step 1:

- Center Frequency: 2441.0 MHz
- Span: ZERO SPAN
- RBW: 1MHz, VBW: 1MHz
- Log scale: 10dB/Div, Data points: 601points (400 points or more)
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak,
- Sweep mode: Continuous
- Duty cycle= Ton/(Ton+Toff)

Step 2:

- Center Frequency: 2441.0 MHz
- RBW: 1MHz, VBW: 1MHz
- Span: ZERO SPAN
- Reference level: Enough level for maximum dynamic range
- Detection: Positive Peak,
- Sweep mode: Continuous
- Sweep time: $0.4 * SBW[\text{second}]$

Dwell time = Time per one hopping (On time) * hopping numbers

Test Data**Environmental Conditions**

Temperature:	24 – 26 °C
Relative Humidity:	48 – 55 %
ATM Pressure:	100.0 – 100.1 kPa

The testing was performed by Tracy Hu on 2018-02-02 and 2018-03-19.

Test Result: Compliant

Time of Occupancy

Normal Voltage:

BDR Mode (GFSK)

Mode		DH1	DH3	DH5
BDR(GFSK)	Ton(ms)	0.449	1.707	2.957
	Ton+Toff(ms)	1.25	2.5	3.75
	Duty cycle (%)	35.92	68.28	78.85
	Hopping numbers	283	158	96
	Dwell time(s)	0.127	0.27	0.284
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

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

Mode		2DH1	2DH3	2DH5
EDR($\pi/4$ -DQPSK)	Ton(ms)	0.441	1.691	2.957
	Ton+Toff(ms)	1.25	2.5	3.75
	Duty cycle (%)	35.28	67.64	78.85
	Hopping numbers	314	149	93
	Dwell time(s)	0.138	0.252	0.275
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

EDR Mode (8DPSK)

Mode		3DH1	3DH3	3DH5
EDR(8DPSK)	Ton(ms)	0.441	1.691	2.957
	Ton+Toff(ms)	1.25	2.5	3.75
	Duty cycle (%)	35.28	67.64	78.85
	Hopping numbers	294	148	96
	Dwell time(s)	0.13	0.25	0.284
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

Low Voltage:

BDR Mode (GFSK)

Mode		DH1	DH3	DH5
BDR(GFSK)	Ton(ms)	0.452	1.713	2.962
	Ton+Toff(ms)	1.247	2.504	3.745
	Duty cycle (%)	36.25	68.41	79.09
	Hopping numbers	282	158	96
	Dwell time(s)	0.127	0.271	0.284
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

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

Mode		2DH1	2DH3	2DH5
EDR($\pi/4$ -DQPSK)	Ton(ms)	0.447	1.691	2.961
	Ton+Toff(ms)	1.248	2.499	3.756
	Duty cycle (%)	35.82	67.67	78.83
	Hopping numbers	314	149	93
	Dwell time(s)	0.14	0.252	0.275
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

EDR Mode (8DPSK)

Mode		3DH1	3DH3	3DH5
EDR(8DPSK)	Ton(ms)	0.446	1.69	2.959
	Ton+Toff(ms)	1.251	2.492	3.752
	Duty cycle (%)	35.65	67.82	78.86
	Hopping numbers	294	147	97
	Dwell time(s)	0.131	0.248	0.287
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

High Voltage:

BDR Mode (GFSK)

Mode		DH1	DH3	DH5
BDR(GFSK)	Ton(ms)	0.446	1.707	2.957
	Ton+Toff(ms)	1.244	2.501	3.756
	Duty cycle (%)	35.85	68.25	78.73
	Hopping numbers	284	159	95
	Dwell time(s)	0.127	0.271	0.281
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

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

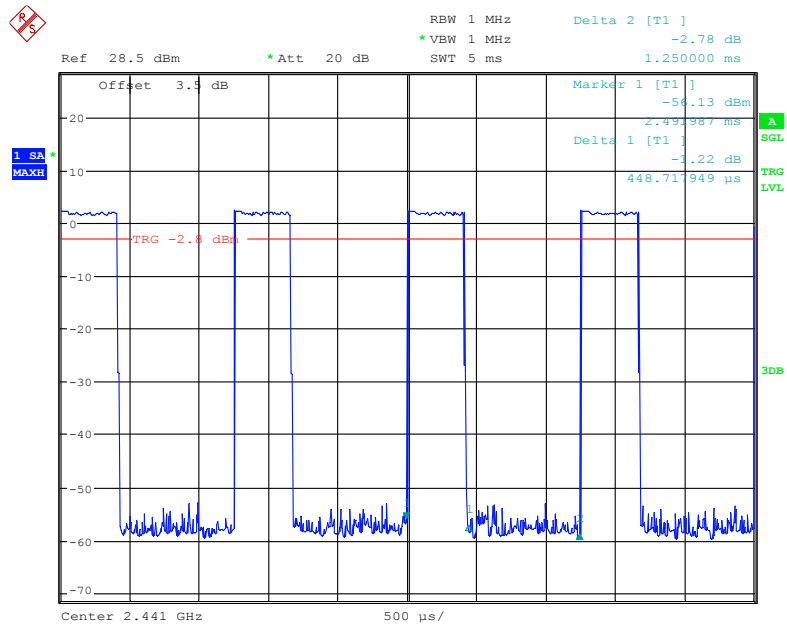
Mode		2DH1	2DH3	2DH5
EDR($\pi/4$ -DQPSK)	Ton(ms)	0.433	1.694	2.959
	Ton+Toff(ms)	1.241	2.495	3.745
	Duty cycle (%)	34.89	67.9	79.01
	Hopping numbers	315	150	93
	Dwell time(s)	0.136	0.254	0.275
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

EDR Mode (8DPSK)

Mode		3DH1	3DH3	3DH5
EDR(8DPSK)	Ton(ms)	0.442	1.694	2.955
	Ton+Toff(ms)	1.254	2.498	3.752
	Duty cycle (%)	35.25	67.81	78.76
	Hopping numbers	295	150	94
	Dwell time(s)	0.13	0.254	0.278
	Limit(s)	0.4	0.4	0.4
	result	pass	pass	pass

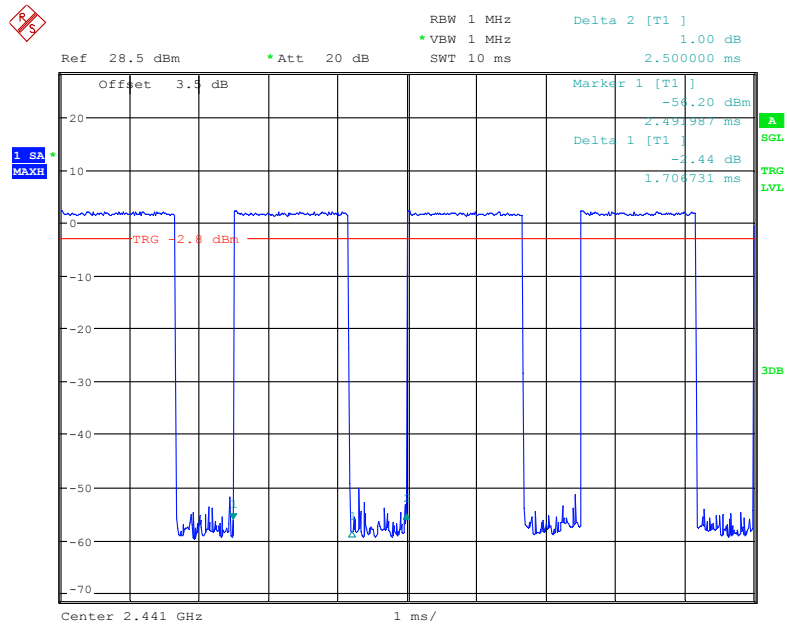
Spread Bandwidth refer to the Item “Occupied bandwidth and Spread Bandwidth”.

Duty cycle, DH1



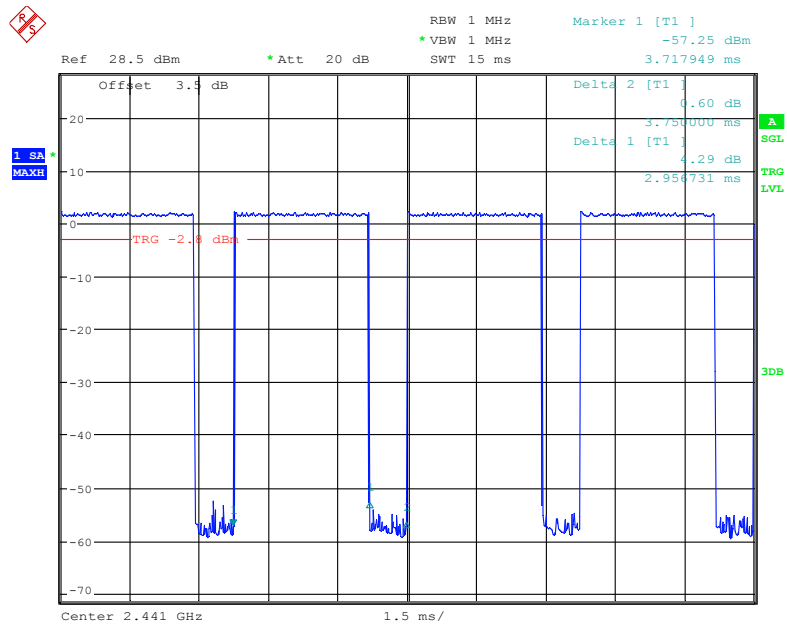
Date: 2.FEB.2018 23:26:35

Duty cycle, DH3



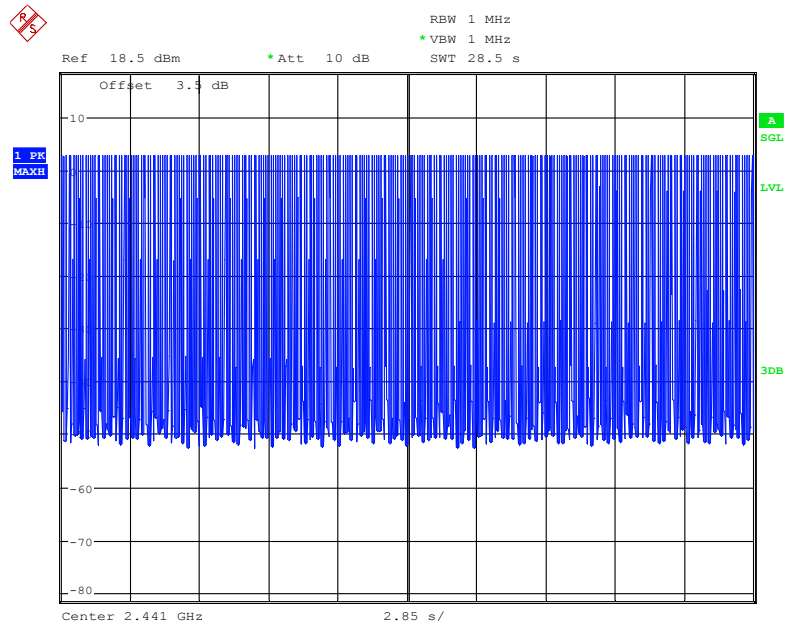
Date: 2.FEB.2018 23:30:11

Duty cycle, DH5



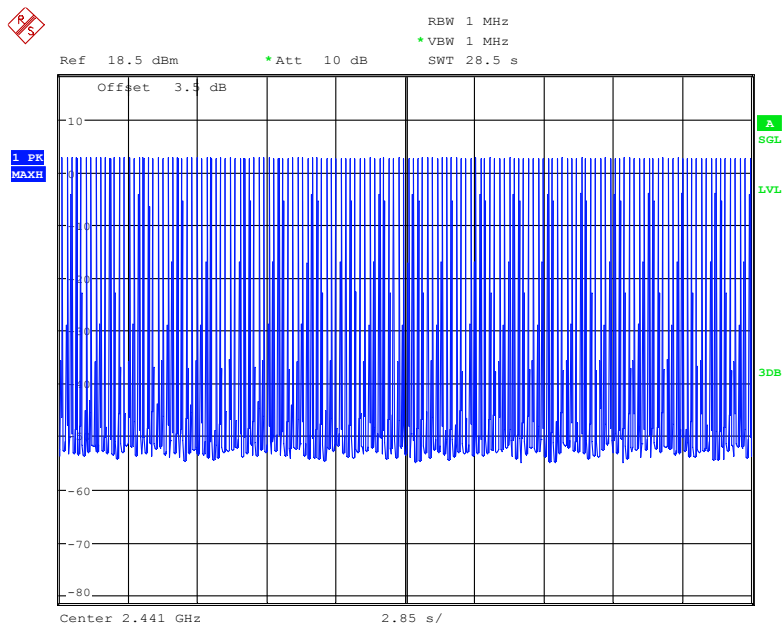
Date: 2.FEB.2018 23:30:56

Hopping numbers, DH1



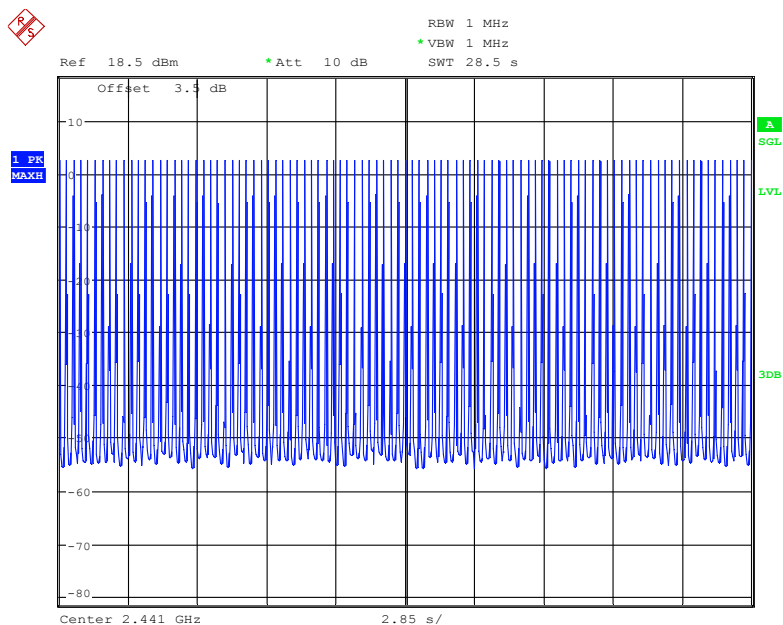
Date: 19.MAR.2018 20:09:19

Hopping numbers, DH3



Date: 19.MAR.2018 20:14:55

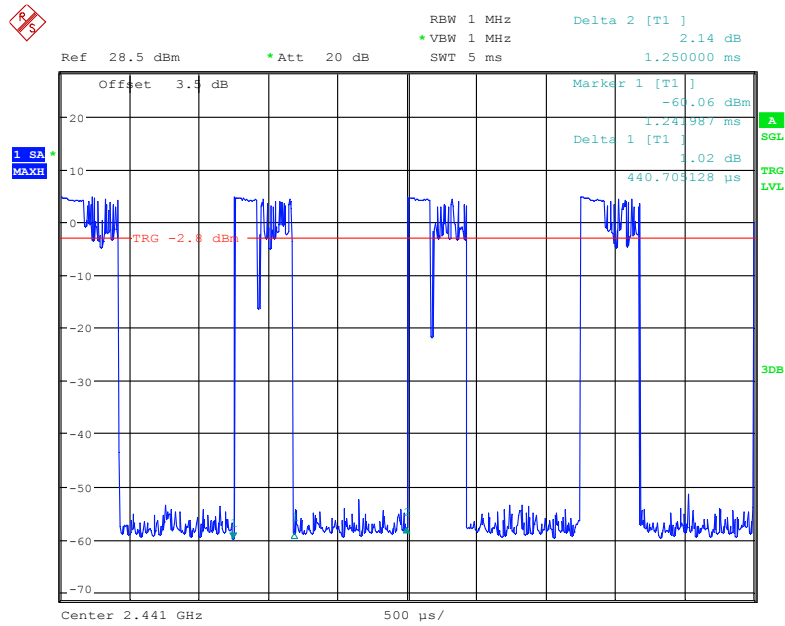
Hopping numbers, DH5



Date: 19.MAR.2018 20:15:39

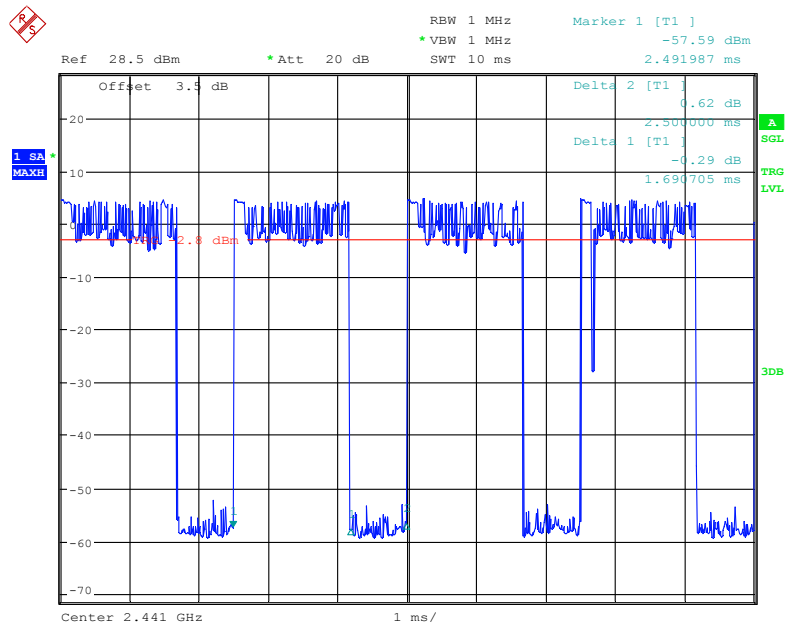
EDR Mode ($\pi/4$ -DQPSK):

Duty cycle, 2DH1



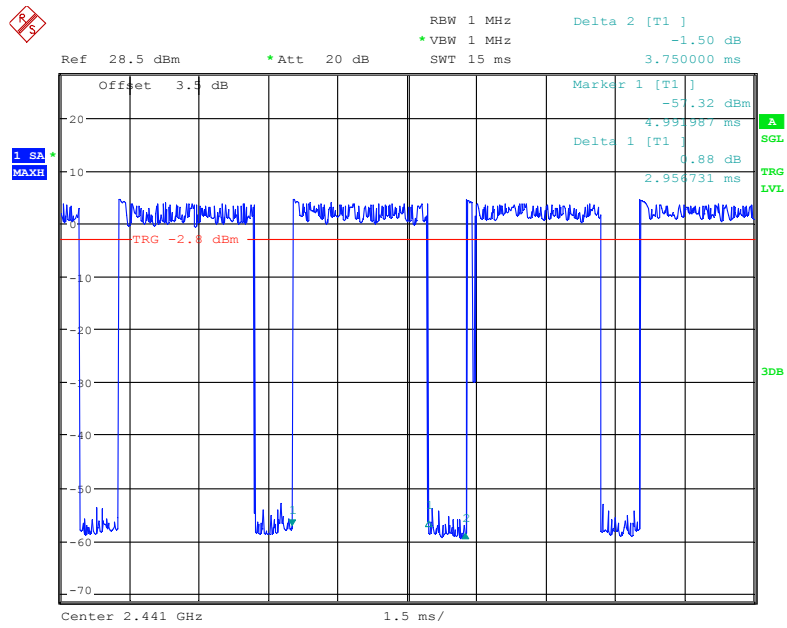
Date: 2.FEB.2018 23:27:37

Duty cycle, 2DH3



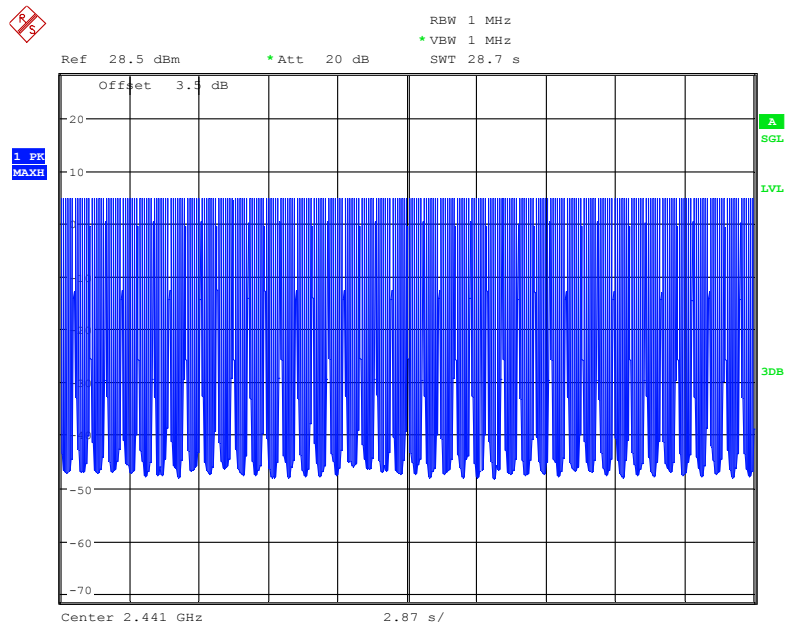
Date: 2.FEB.2018 23:29:40

Duty cycle, 2DH5



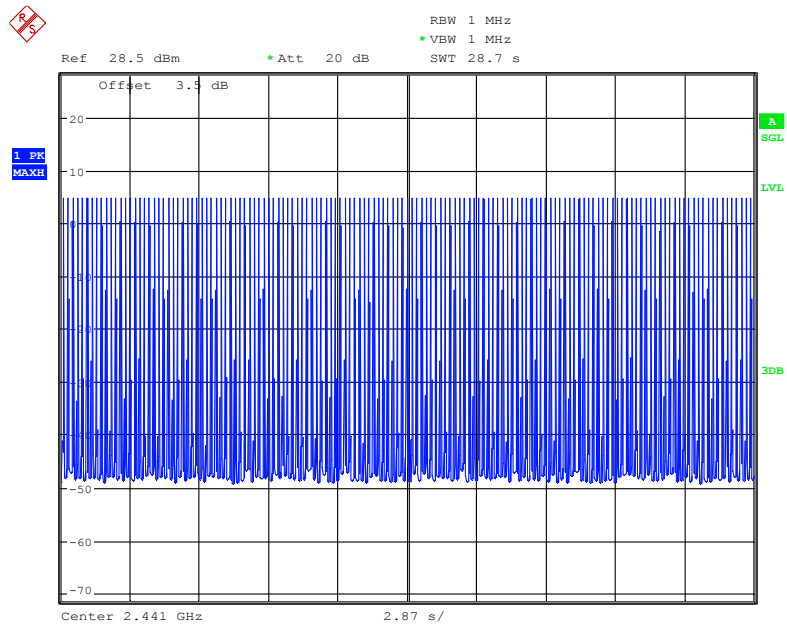
Date: 2.FEB.2018 23:31:38

Hopping numbers, 2DH1



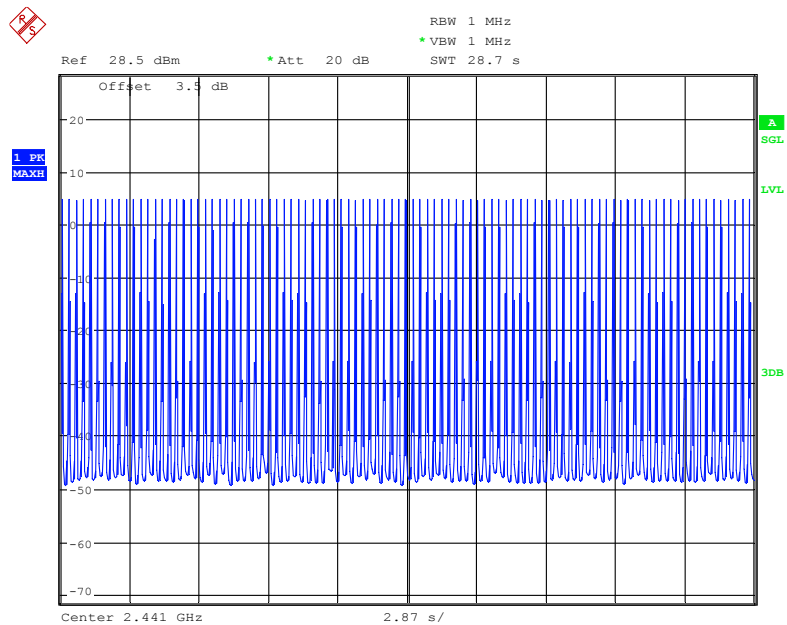
Date: 2.FEB.2018 23:34:32

Hopping numbers, 2DH3



Date: 2.FEB.2018 23:36:43

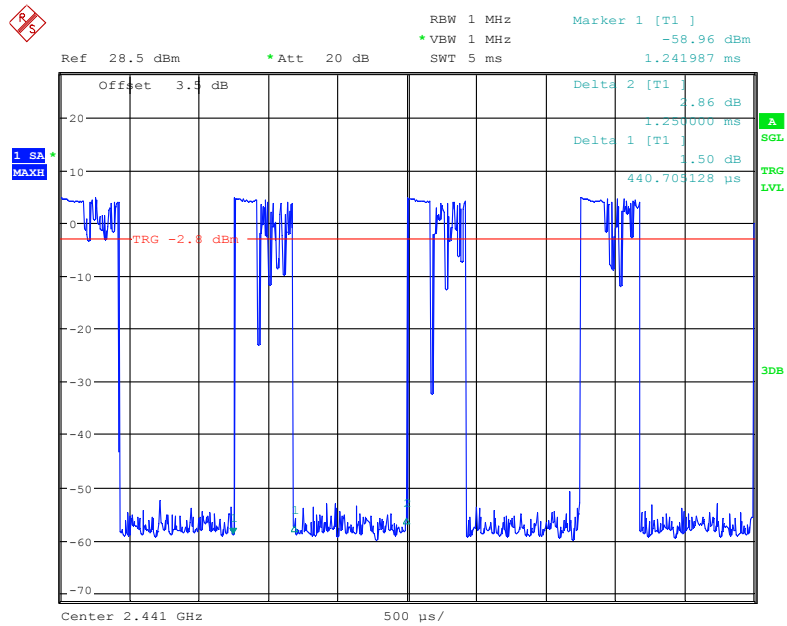
Hopping numbers, 2DH5



Date: 2.FEB.2018 23:38:54

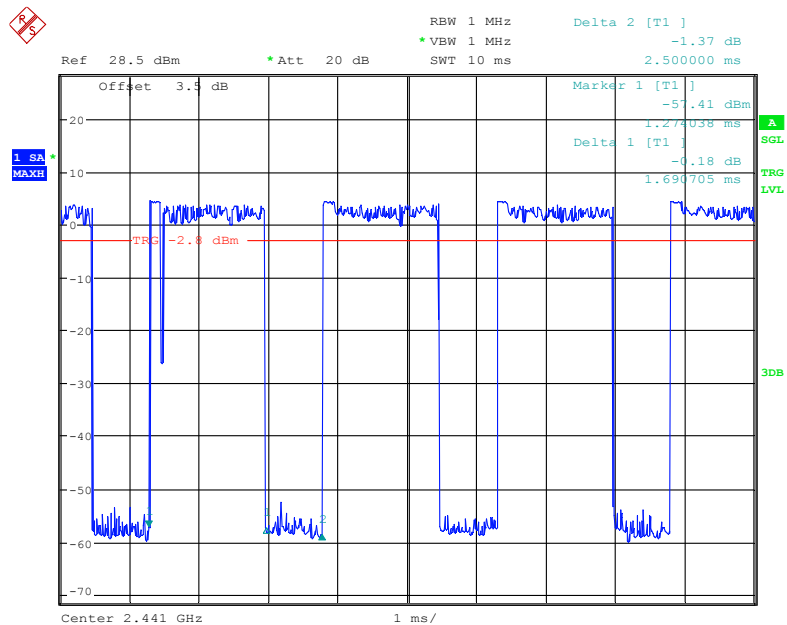
EDR Mode (8DPSK):

Duty cycle, 3DH1



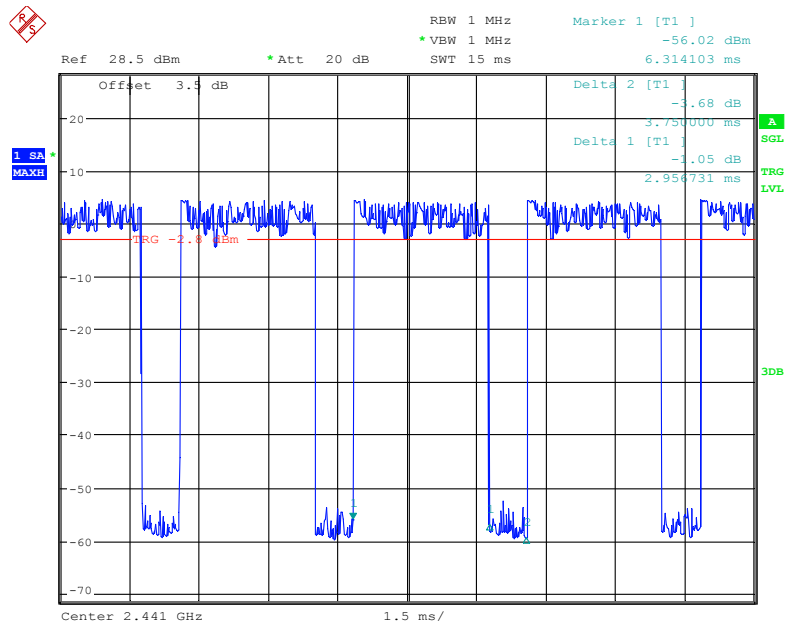
Date: 2.FEB.2018 23:28:31

Duty cycle, 3DH3



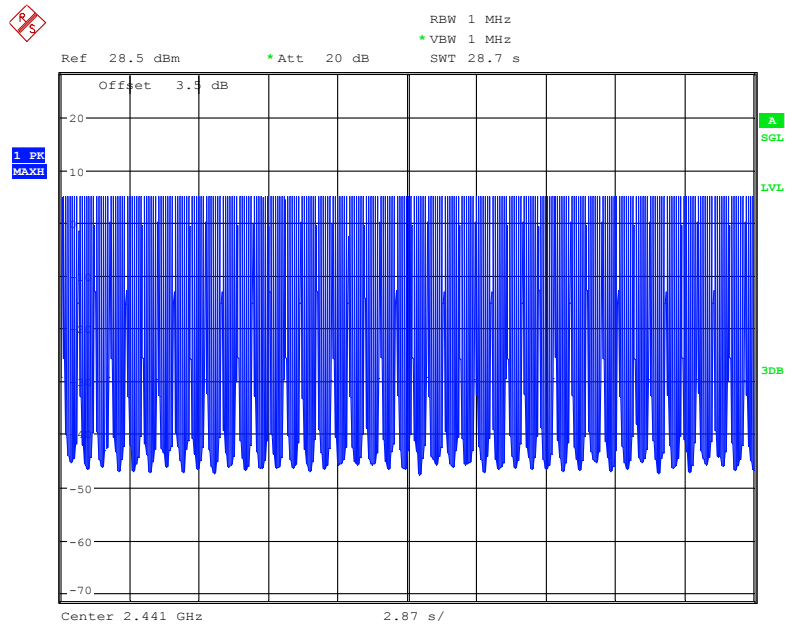
Date: 2.FEB.2018 23:29:07

Duty cycle, 3DH5



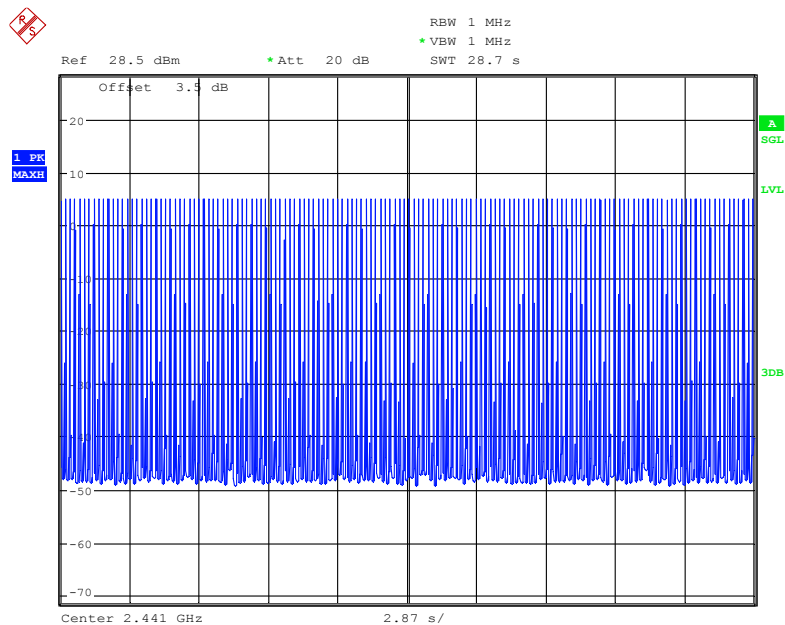
Date: 2.FEB.2018 23:32:08

Hopping numbers, 3DH1



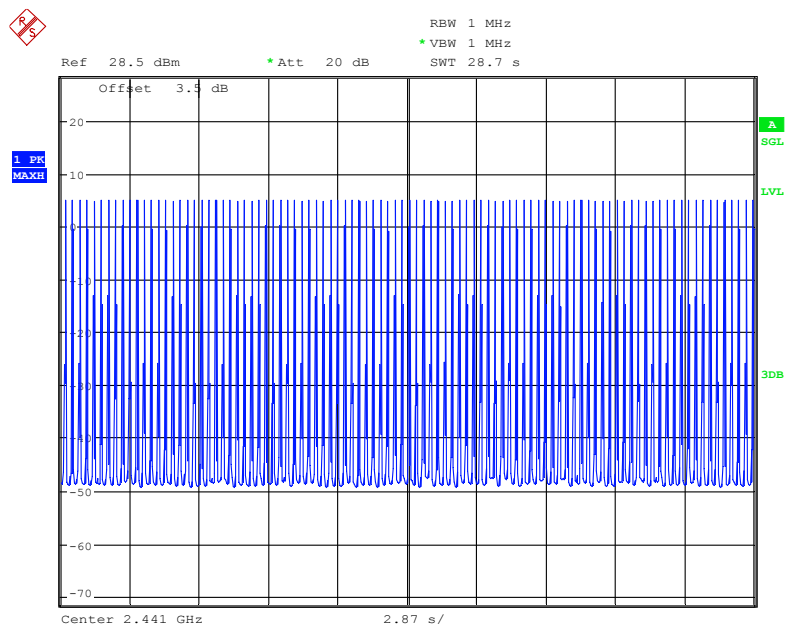
Date: 2.FEB.2018 23:35:18

Hopping numbers, 3DH3



Date: 2.FEB.2018 23:36:01

Hopping numbers, 3DH5



Date: 2.FEB.2018 23:39:50

INTERFERENCE PREVENTION FUNCTION

Requirement

The EUT shall have the interference prevention capability to transmit or to receive the identification automatically, so that sender and receiver shall exclude other equipment.

Test Procedure

In the case that the EUT has the function of automatically transmitting the identification code:

1. Transmit the predetermined identification codes from EUT
2. Check the transmitted identification codes with the demodulator.

In the case of receiving the identification codes:

1. Transmit the predetermined identification codes from the counterpart.
2. Check if communication is normal
3. Transmit the signal other than predetermined ID codes from the counterpart.
4. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

Test Data

Environmental Conditions

Temperature:	24°C
Relative Humidity:	55 %
ATM Pressure:	100.0 kPa

The testing was performed by Tracy Hu on 2018-02-04.

Test Result: Good

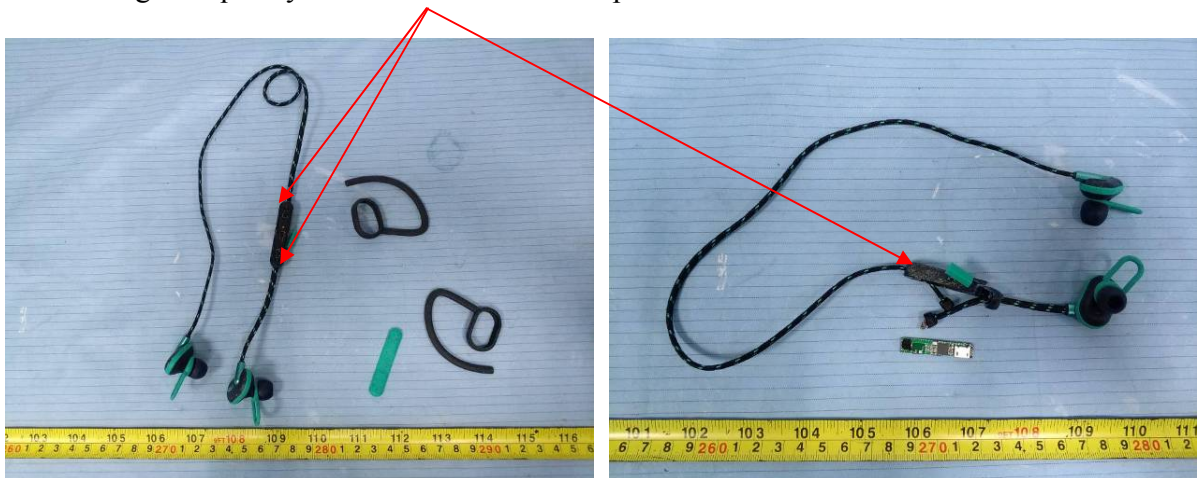
CONSTRUCTION PROTECTION CONFIRMATION

Limit

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

Confirmation Method

The EUT has some buckles on the edge of the housing that can't be opened easily and shielding cover the high-frequency section. Please refer the photos below.



END OF REPORT