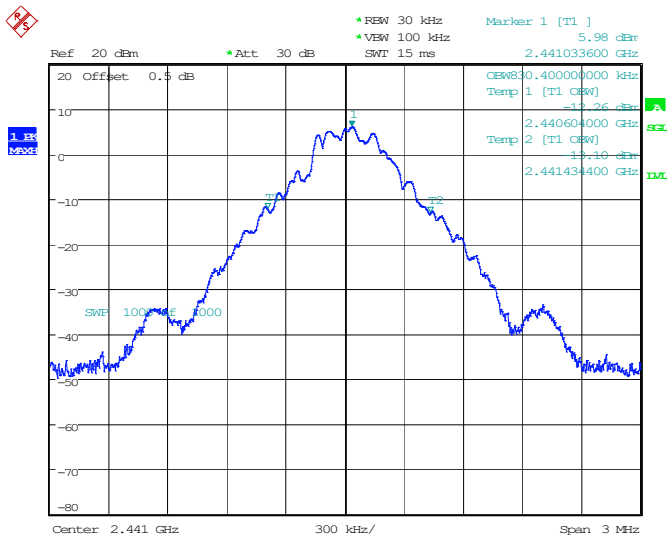
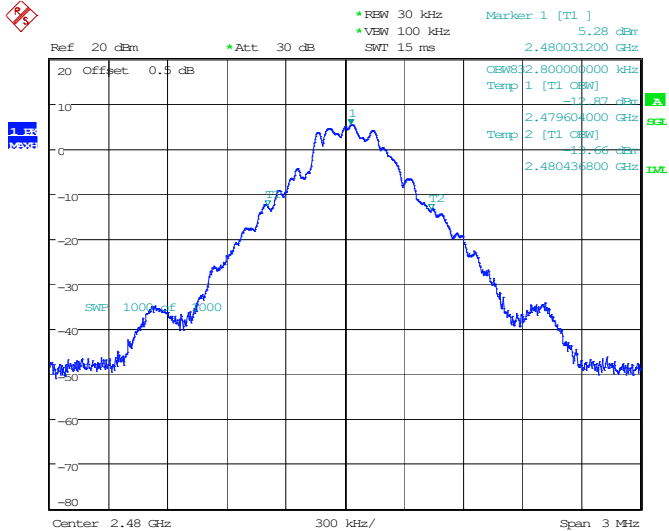


BDR (GFSK): Middle Channel



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 14:42:39

BDR (GFSK): High Channel



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 14:45:05

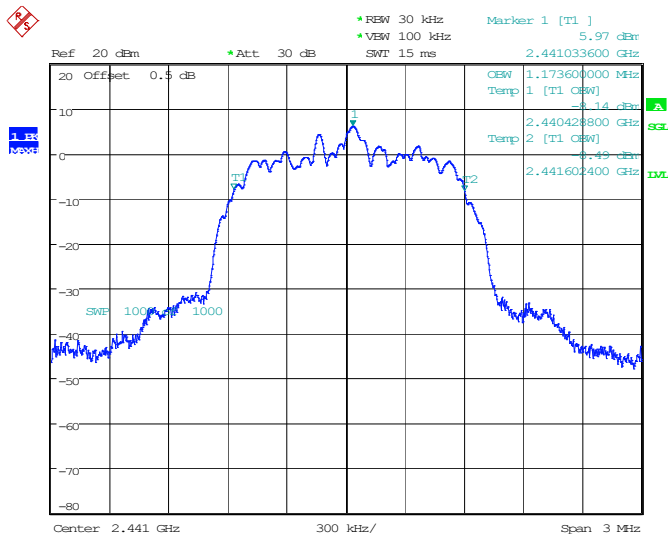
* RESW 30 kHz
 * VIEW 100 kHz
 * Att. 30 dB
 SWT 15 ms
 Marker 1 [T1]
 6.09 dBm
 2.402036000 GHz

Ref 20 dBm
 Offset 0.5 dB
 CEN 1.171200000 MHz
 Temp 1 [T1 CEN]
 7.01 dBm
 2.401428800 GHz
 Temp 2 [T1 CEN]
 17.17 dBm
 2.402600000 GHz

SWE 1000
 1000

Center 2.402 GHz
 300 kHz/
 Span 3 MHz

EDR ($\pi/4$ -DQPSK): Middle Channel



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 14:52:48

*RESW 30 kHz
 *VIEW 100 kHz
 SWT 15 ms
 Marker 1 [T1]
 5.31 dBm
 2.480031200 GHz

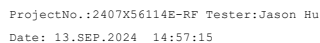
Ref 20 dBm
 Offset 0.5 dB
 Att 30 dB

2.473600000 MHz
 Temp 1 [T1 CERN]
 5.67 dBm
 2.479428800 GHz
 Temp 2 [T1 CERN]
 3.36 dBm
 2.480602400 GHz

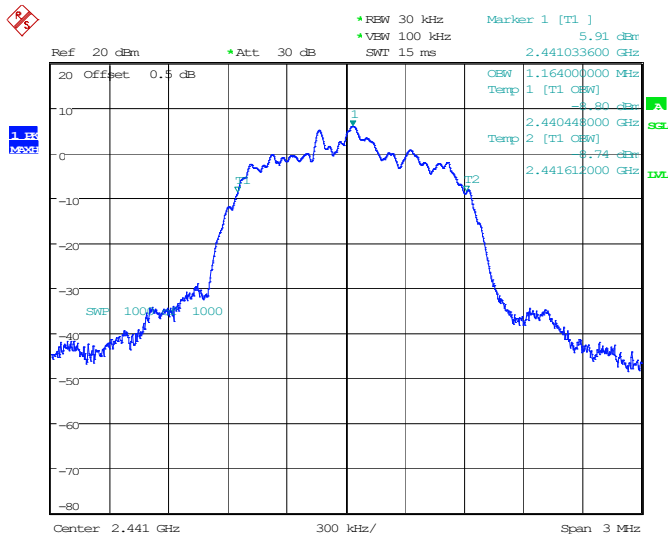
SWE 1000
 1000

Center 2.48 GHz
 300 kHz/
 Span 3 MHz

EDR (8DPSK):Low Channel

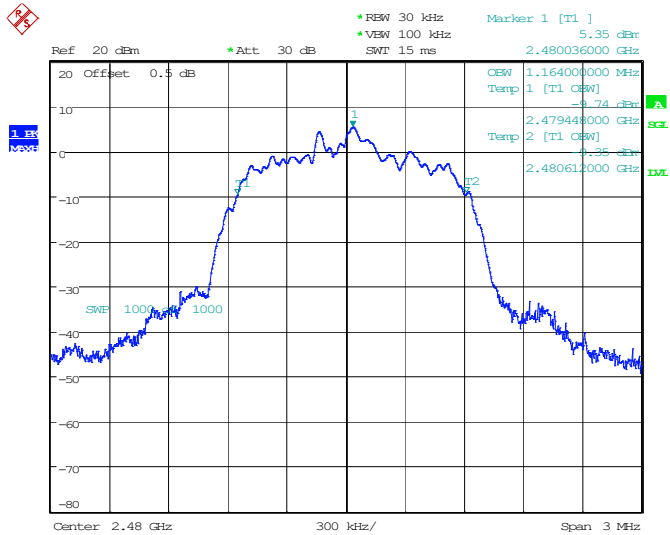


EDR (8DPSK):Middle Channel



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 14:59:23

EDR (8DPSK):High Channel



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:01:23

FCC §15.247(a) (1) (iii) & RSS-247 Clause 5.1 d) -QUANTITY OF HOPPING CHANNEL TEST

Applicable Standard

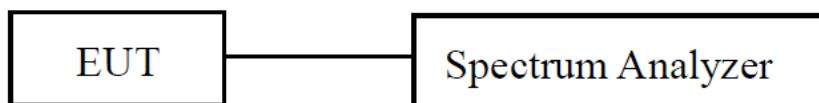
FCC §15.247(a) (1) (iii)

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

RSS-247 Clause 5.1 d)

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.

EUT Setup



Test Procedure

According to ANSI C63.10-2013 Section 7.8.3

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

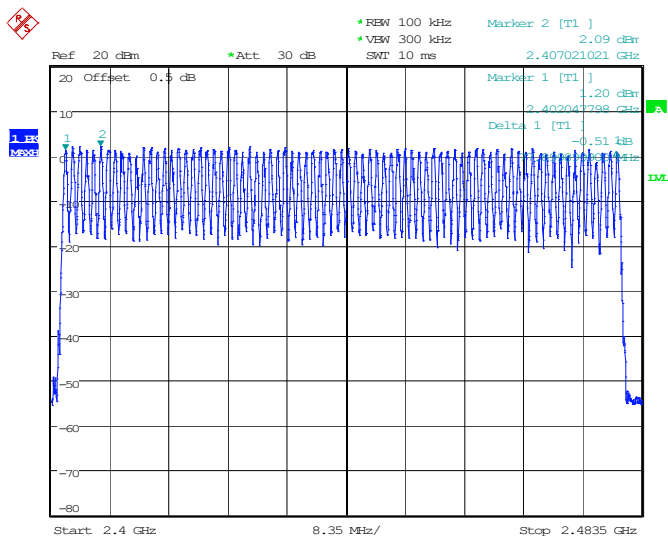
- a. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
- b. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
- c. VBW $\geq$ RBW.
- d. Sweep: Auto.
- e. Detector function: Peak.
- f. Trace: Max hold.
- g. Allow the trace to stabilize.

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

Test Data

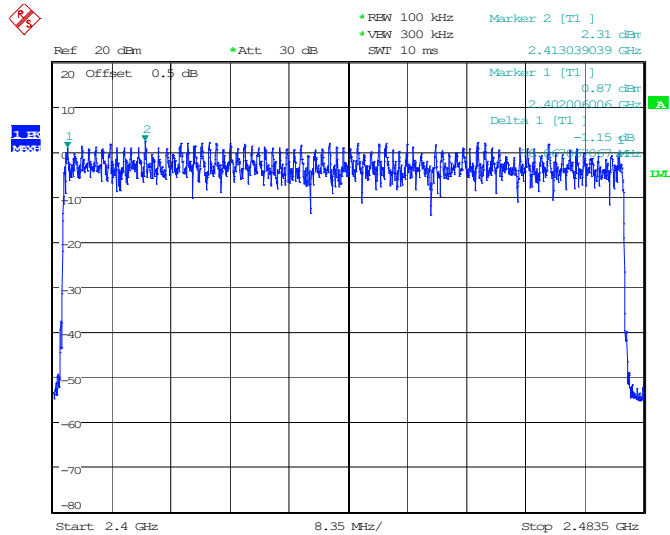
Test Mode:	Transmitting	Test Engineer:	Jason Hu
Test Date:	2024-09-13	Environment:	Temp.: 25.9°C Humi.: 60% Atm :100.2kPa
Mode	Frequency Range (MHz)	Number of Hopping Channel (CH)	Limit (CH)
BDR (GFSK)	2400-2483.5	79	≥15
EDR (π/4-DQPSK)	2400-2483.5	79	≥15
EDR (8DPSK)	2400-2483.5	79	≥15

BDR (GFSK): Number of Hopping Channels



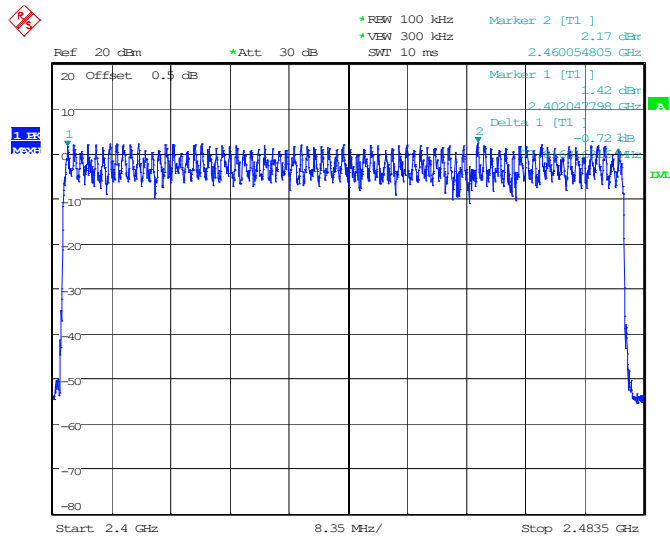
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:10:55

EDR ($\pi/4$ -DQPSK): Number of Hopping Channels



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:13:22

EDR (8DPSK): Number of Hopping Channels



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:17:45

FCC §15.247(a) (1) (iii) & RSS-247 ISSUE 3 Clause 5.1 d)- TIME OF OCCUPANCY (DWELL TIME)

Applicable Standard

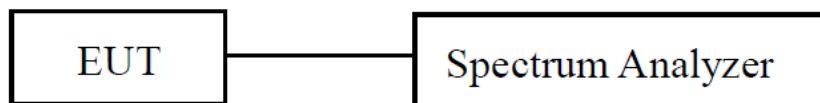
FCC §15.247(a) (1) (iii)

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.

RSS-247 ISSUE 3 Clause 5.1 d)

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.

EUT Setup



Test Procedure

According to ANSI C63.10-2013 Section 7.8.4

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

- a) Span: Zero span, centered on a hopping channel.
- b) RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
- c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
- d) Detector function: Peak.
- e) Trace: Max hold.

Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

$$(\text{Number of hops in the period specified in the requirements}) = (\text{number of hops on spectrum analyzer}) \times (\text{period specified in the requirements} / \text{analyzer sweep time})$$

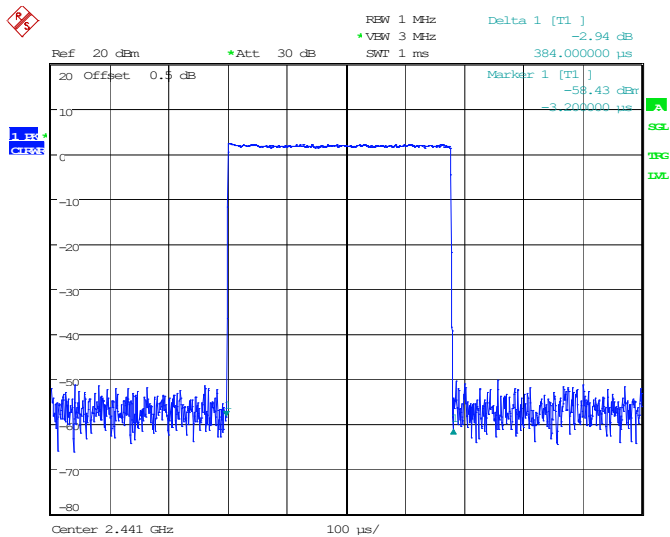
The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements. If the number of hops in a specific time varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation.

The measured transmit time and time between hops shall be consistent with the values described in the operational description for the EUT.

Test Data

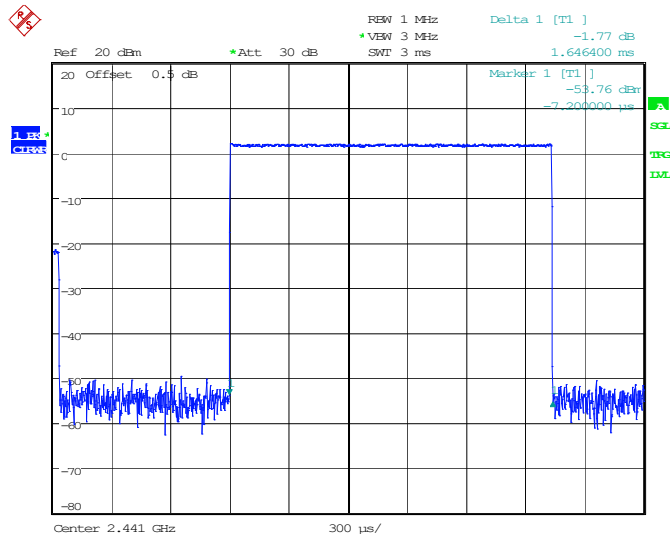
Test Mode:		Transmitting		Test Engineer:		Jason Hu	
Test Date:		2024-09-13		Environment:		Temp.: 25.9℃ Humi.: 60% Atm :100.2kPa	
Test Modes	Packet Type	Test Frequency (MHz)	Pulse width (ms)	Dwell times (s)	Limit (s)		
BDR Mode (GFSK)	DH1	2441	0.384	0.123	0.400		
	DH3	2441	1.646	0.263	0.400		
	DH5	2441	2.900	0.309	0.400		
EDR Mode (π/4-DQPSK)	2DH1	2441	0.397	0.127	0.400		
	2DH3	2441	1.654	0.265	0.400		
	2DH5	2441	2.908	0.310	0.400		
EDR Mode (8DPSK)	3DH1	2441	0.397	0.127	0.400		
	3DH3	2441	1.654	0.265	0.400		
	3DH5	2441	2.908	0.310	0.400		
DH1/2DH1/3DH1:Dwell time=Pulse time (ms) × (1600/2/79) ×31.6 s DH3/2DH3/3DH3:Dwell time=Pulse time (ms) × (1600/4/79) ×31.6 s DH5/2DH5/3DH5:Dwell time=Pulse time (ms) × (1600/6/79) ×31.6 s							

BDR (GFSK)_Hopping_DH1



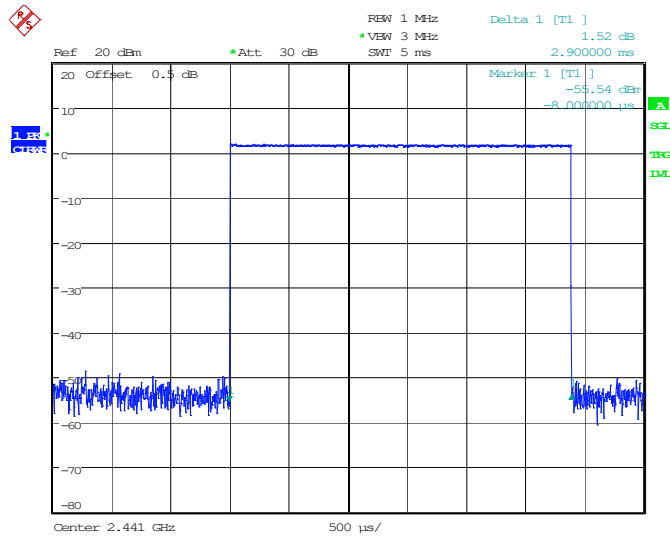
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:00:52

BDR (GFSK)_Hopping_DH3



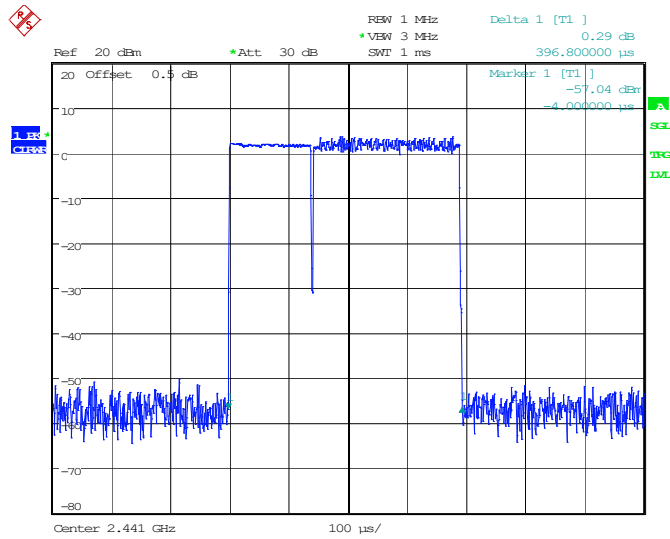
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:01:23

BDR (GFSK)_Hopping_DH5



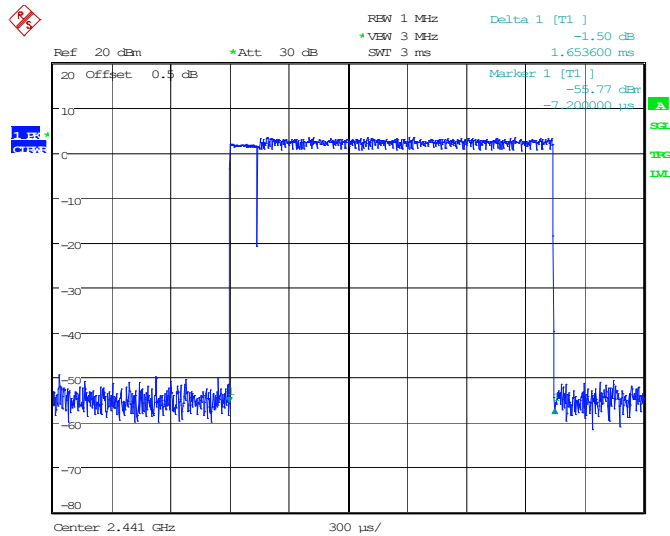
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:01:52

EDR ($\pi/4$ -DQPSK)_Hopping_2DH1



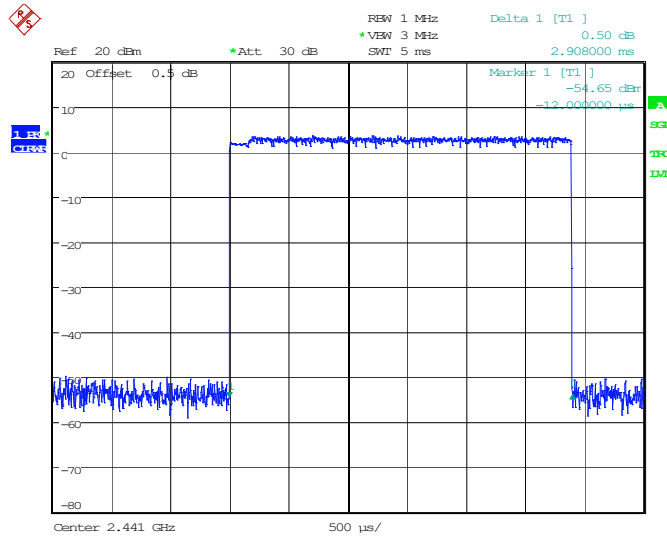
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:02:54

EDR ($\pi/4$ -DQPSK)_Hopping_2DH3



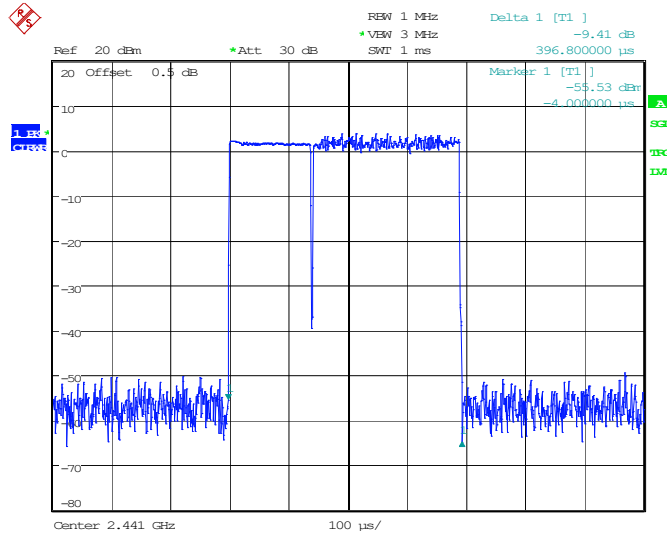
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:03:30

EDR ($\pi/4$ -DQPSK)_Hopping_2DH5



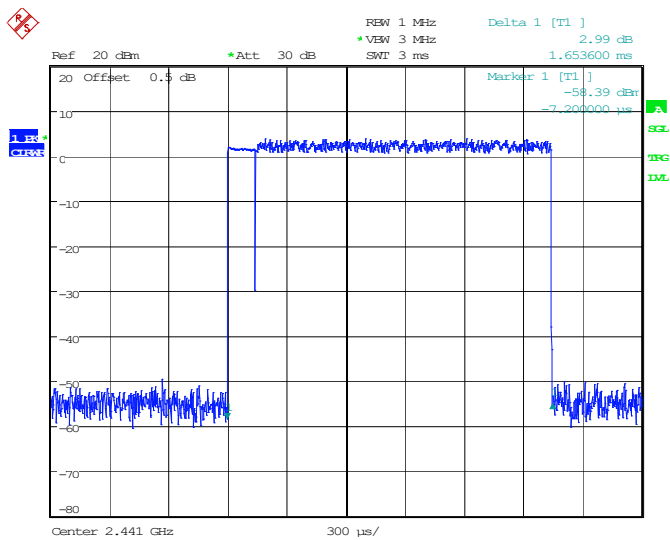
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:05:08

EDR (8DPSK)_Hopping_3DH1



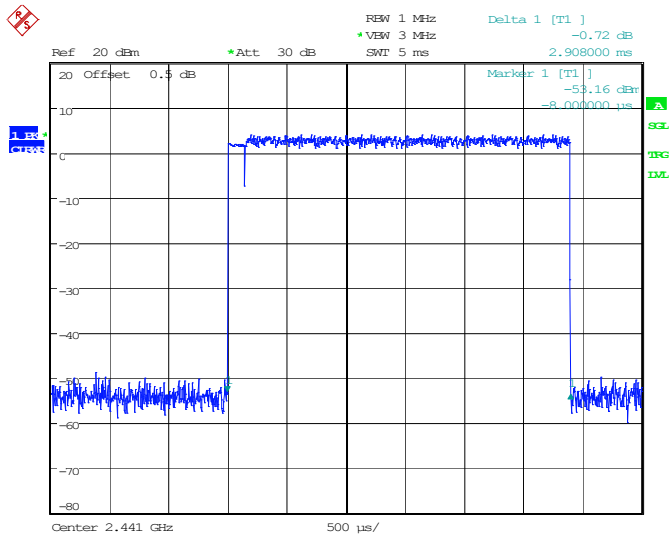
ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 16:05:47

EDR (8DPSK)_Hopping_3DH3



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:07:05

EDR (8DPSK)_Hopping_3DH5



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 16:08:19

FCC §15.247(b) (1) & RSS-247 ISSUE 3 Clause 5.4 b) - PEAK OUTPUT POWER MEASUREMENT

Applicable Standard

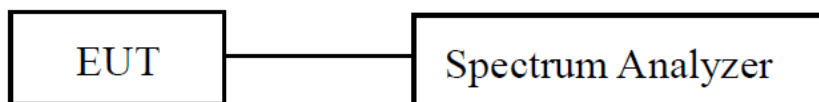
FCC§15.247(b) (1)

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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

According to RSS-247 ISSUE 3 Clause 5.4 b)

For FHSs operating in the band 2400–2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

EUT Setup



Test Procedure

According to ANSI C63.10-2013 Section 7.8.5

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation, Offset the Insertion loss of the RF cable, DC Block/ Attenuator into the spectrum analyzer. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW $\geq$ RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

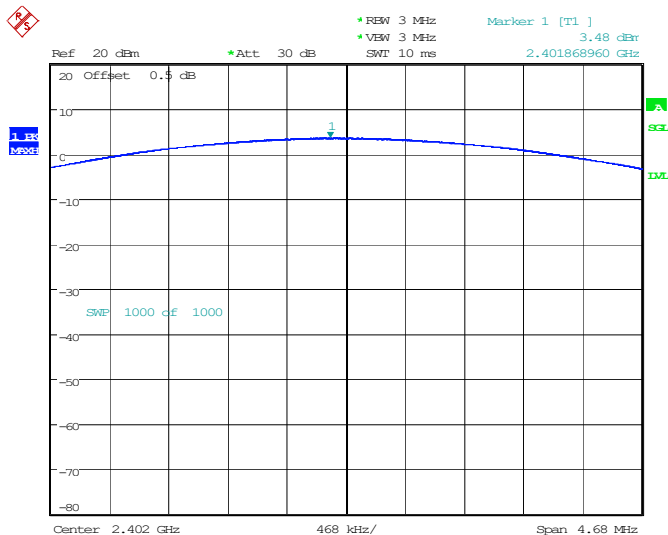
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer..

Test Data

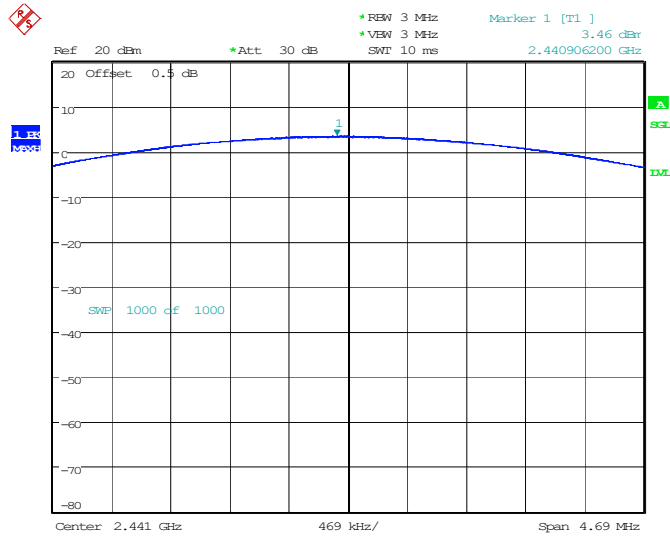
Test Mode:	Transmitting	Test Engineer:	Jason Hu
Test Date:	2024-09-13	Environment:	Temp.: 25.9°C Humi.: 60% Atm :100.2kPa
Mode	Frequency (MHz)	Peak Conducted Output Power (dBm)	Limit (dBm)
BDR (GFSK)	2402	3.48	21
	2441	3.46	21
	2480	2.84	21
EDR ($\pi/4$-DQPSK)	2402	5.52	21
	2441	5.46	21
	2480	4.84	21
EDR (8DPSK)	2402	6.02	21
	2441	5.9	21
	2480	5.16	21
Antenna Gain(dBi):	3.71	Max.EIRP(dBm):	9.73
EIRP Limit for RSS-247: 36 dBm			

BDR(GFSK): 2402MHz



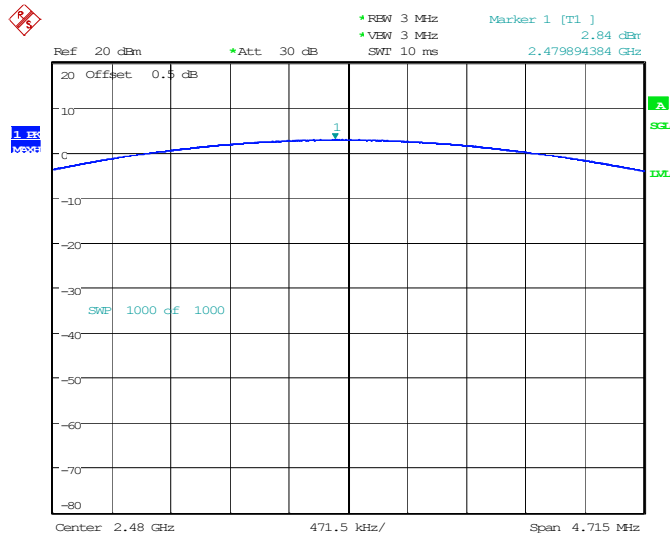
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:07:36

BDR(GFSK): 2441MHz



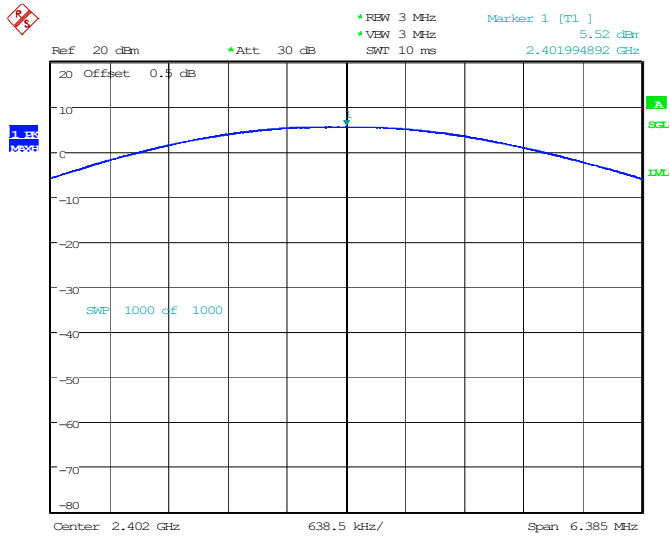
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:08:47

BDR(GFSK): 2480MHz



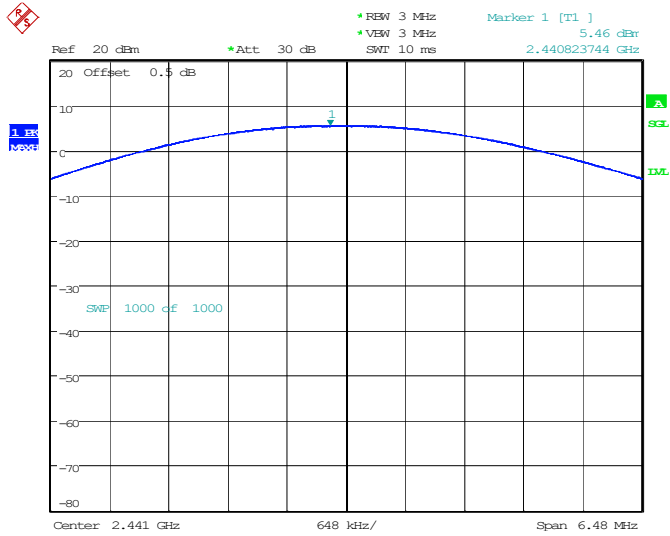
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:10:52

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



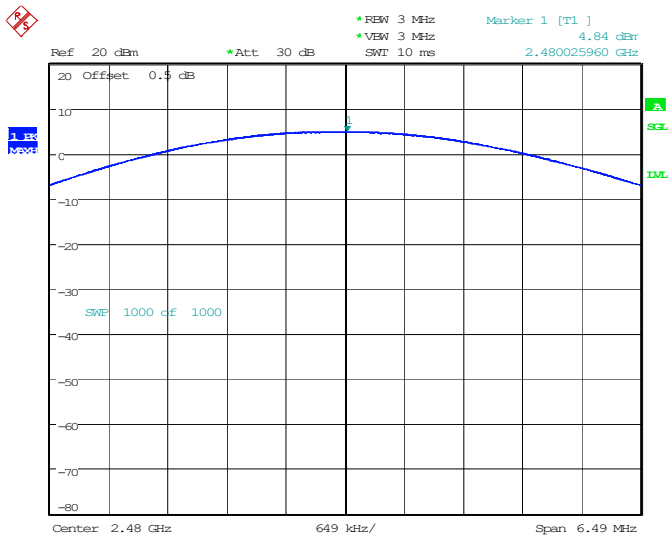
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:13:03

EDR($\pi/4$ -DQPSK): 2441MHz



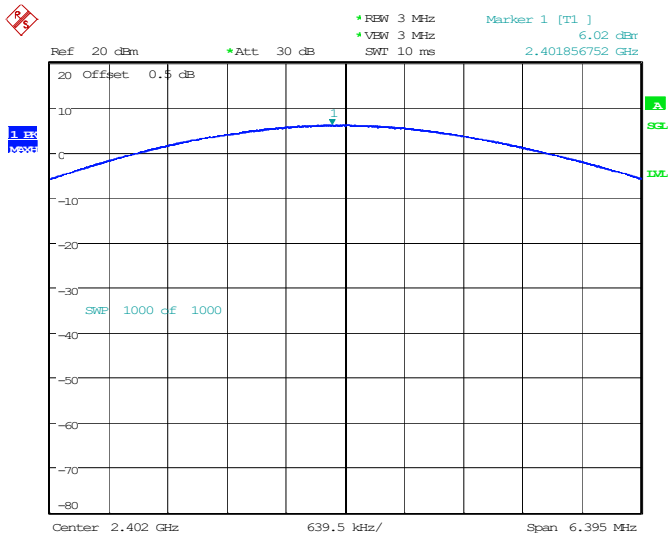
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:15:09

EDR($\pi/4$ -DQPSK): 2480MHz



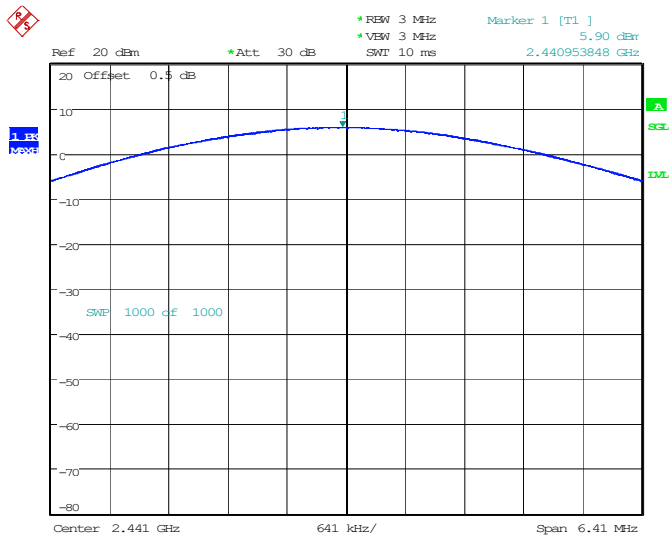
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:16:07

EDR(8DPSK): 2402MHz



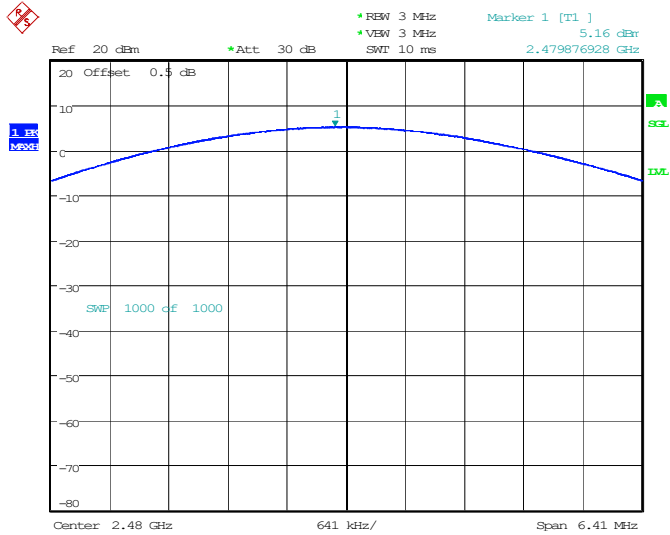
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:17:11

EDR(8DPSK): 2441MHz



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:21:54

EDR(8DPSK): 2480MHz



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:24:00

FCC §15.247(d) & RSS-247 ISSUE 3 Clause 5.5- BAND EDGES TESTING

Applicable Standard

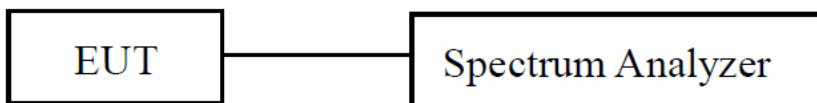
FCC §15.247 (d)

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)).

According to RSS-247 ISSUE 3 Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below general field strength limits specified in RSS-Gen is not required.

EUT Setup



Test Procedure

According to ANSI C63.10-2013 Section 7.8.6

For band-edge measurements, use the band-edge procedure in 6.10. Band-edge measurements shall be tested both on single channels, and with the EUT hopping.

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW $\geq [3 \times \text{RBW}]$.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements.

Report the three highest emissions relative to the limit.

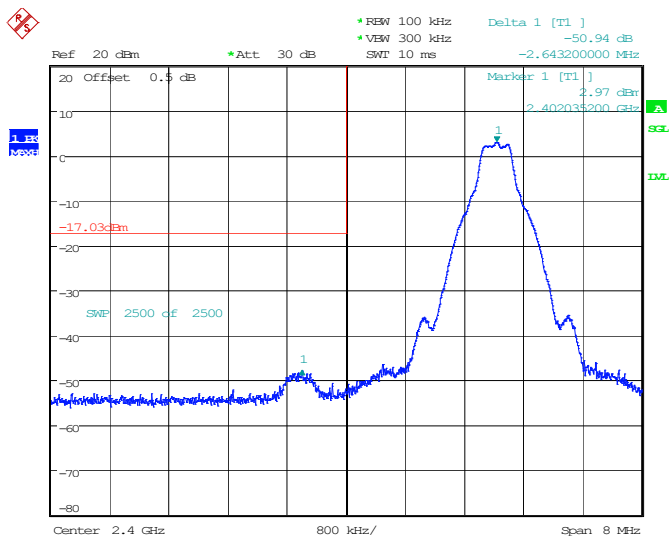
Test Data

Test Mode:	Transmitting	Test Engineer:	Jason Hu
Test Date:	2024-09-13	Environment:	Temp.: 25.9°C Humi.: 60% Atm :100.2kPa

Please refer to the below plots:

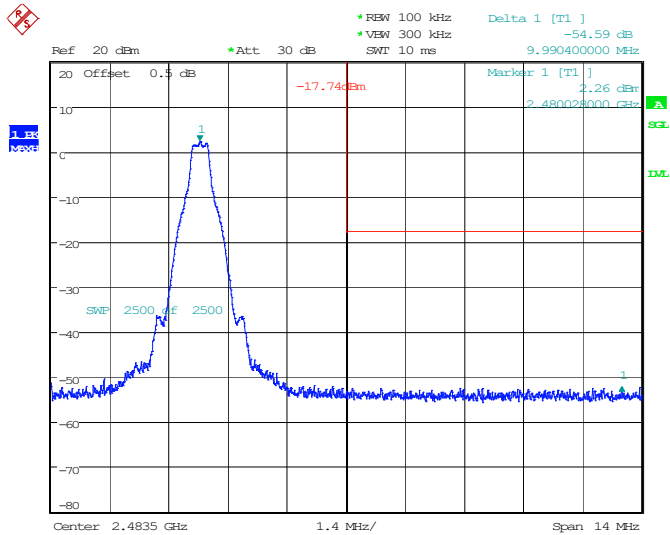
Band Edge

BDR (GFSK): Left Side



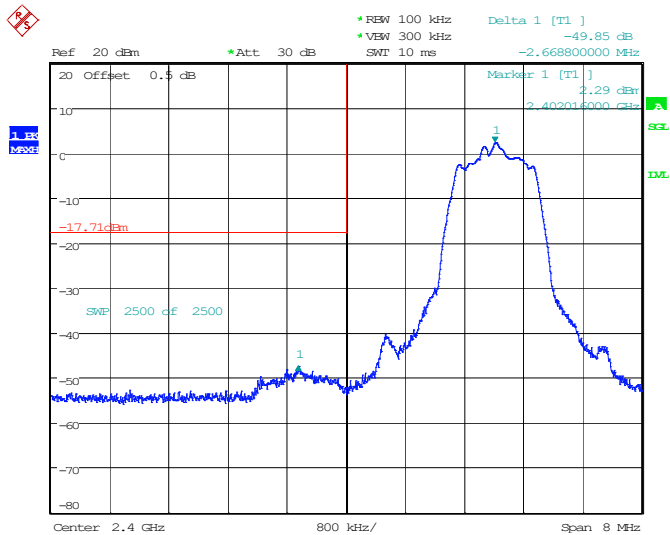
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:31:26

BDR (GFSK): Right Side



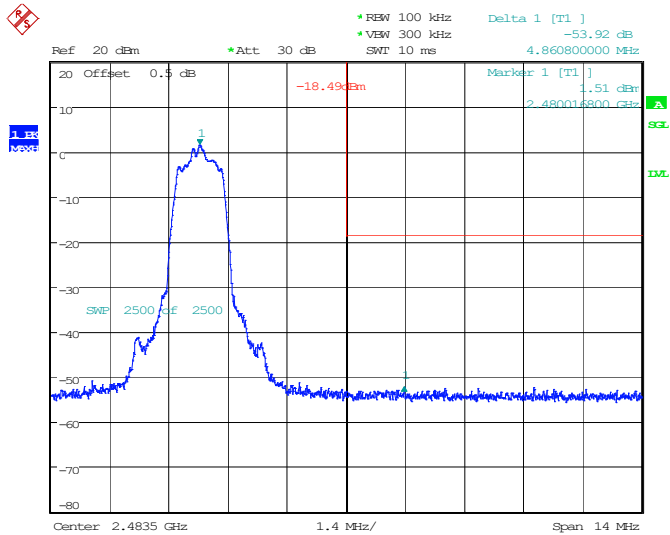
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:36:26

EDR ($\pi/4$ -DQPSK): Left Side



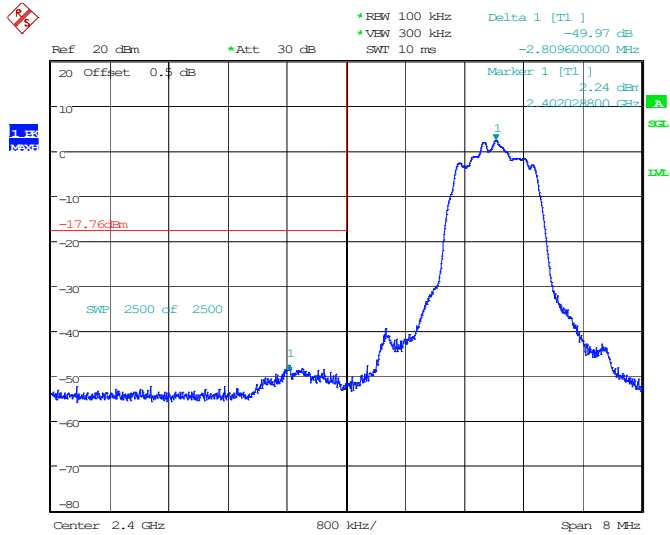
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:45:22

EDR ($\pi/4$ -DQPSK): Right Side



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:47:58

EDR (8DPSK): Left Side



ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:54:54

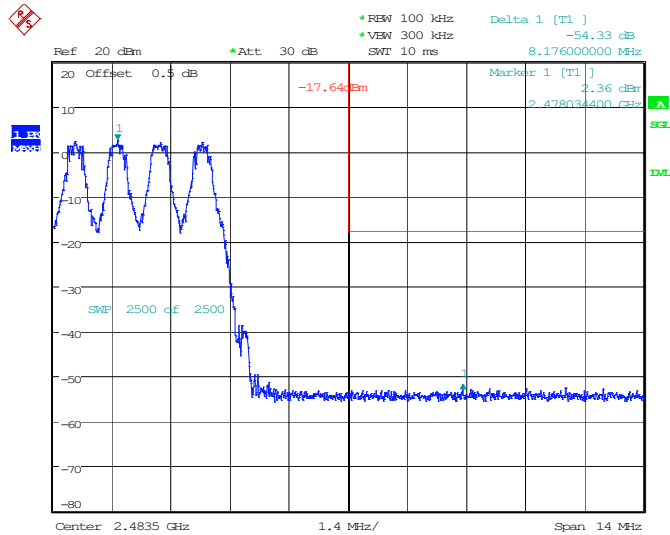
Delta 1 [T1]
 -53.38 dB
 4.155200000 Mhz
 Ref 20 dBm
 Att 30 dB
 SWT 10 ms
 20 Offset 0.5 dB
 -18.51 dBm
 Marker 1 [T1]
 2.483500000 GHz
 1.49 dBm
 2.480250000 GHz
 SWE 2500 kHz
 Center 2.4835 GHz
 1.4 Mhz/
 Span 14 Mhz

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Date: 13.SEP.2024 15:57:31

[illegible]

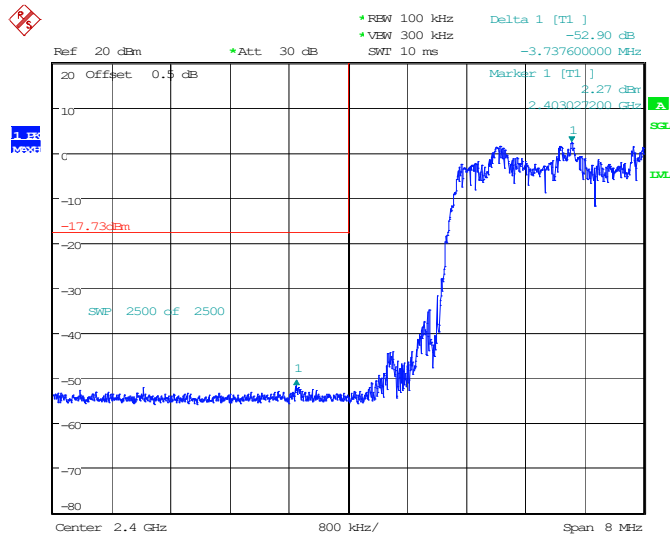
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:26:32

BDR (GFSK): Right Side - Hopping



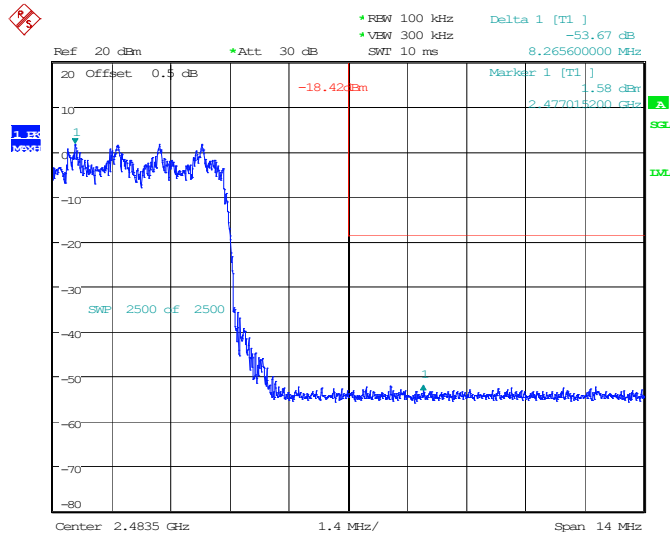
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:29:23

EDR ($\pi/4$ -DQPSK): Left Side - Hopping



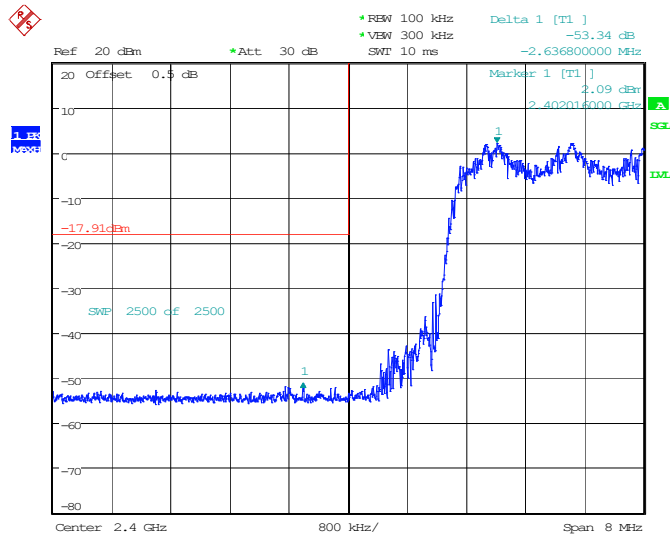
ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:39:41

EDR ($\pi/4$ -DQPSK): Right Side - Hopping



ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 15:43:15

EDR (8DPSK): Left Side - Hopping



ProjectNo.:2407X56114E-RF Tester:Jason Hu
 Date: 13.SEP.2024 15:50:11

Ref 20 dBm Att 30 dB REW 100 kHz VIEW 300 kHz SWF 10 ms Delta 1 [T1] -53.44 dB 3.886400000 MHz

20 Offset 0.5 dB -18.72 dBm Marker 1 [T1] 1.28 dB 2.48005600 GHz

SWE 2500 of 2500

Center 2.4835 GHz 1.4 MHz/ Span 14 MHz

ProjectNo.:2407X56114E-RF Tester:Jason Hu
Date: 13.SEP.2024 15:52:50

EUT PHOTOGRAPHS

Please refer to the attachment 2407X56114E-RF-EXP EUT EXTERNAL PHOTOGRAPHS and 2407X56114E-RF-INP EUT INTERNAL PHOTOGRAPHS.

TEST SETUP PHOTOGRAPHS

Please refer to the attachment 2407X56114E-RF-TSP_TEST SETUP PHOTOGRAPHS.

Declarations

1. Bay Area Compliance Laboratories Corp. (Xiamen) is not responsible for authenticity of any information provided by the applicant. Information from the applicant that may affect test results are marked with an asterisk “★”.
2. Unless otherwise stated, the results shown in this test report refer only to the sample(s) tested.
3. Unless required by the rule provided by the applicant or product regulations, then decision rule in this report did not consider the uncertainty.
4. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor $k=2$ with the 95% confidence interval.
5. This report cannot be reproduced except in full, without prior written approval of Bay Area Compliance Laboratories Corp. (Xiamen).
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******* END OF REPORT *******