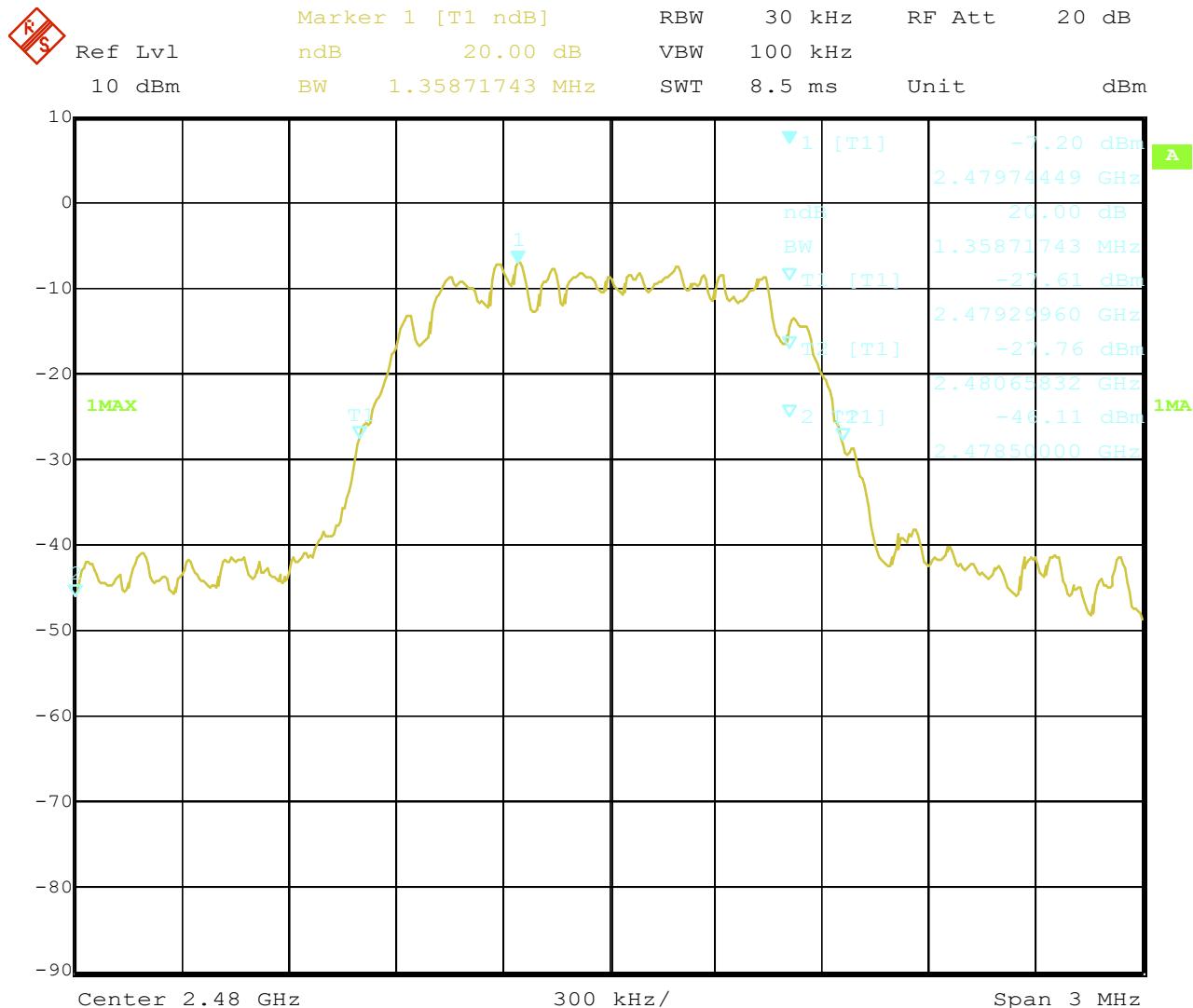




3. High Channel



Date: 26.NOV.2020 10:59:14

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Test Result

Type of Modulation: 8DPSK

EUT		Laptop		Model	NP11A-C
Mode		Keep Transmitting		Test Voltage	DC7.6V
Temperature		24 deg. C,		Humidity	56% RH
Channel	Channel Frequency (MHz)	20 dB Bandwidth (kHz)		Maximum Limit (kHz)	Pass/ Fail
Low	2402	1377		--	Pass
Middle	2441	1377		--	Pass
High	2480	1377		--	Pass

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

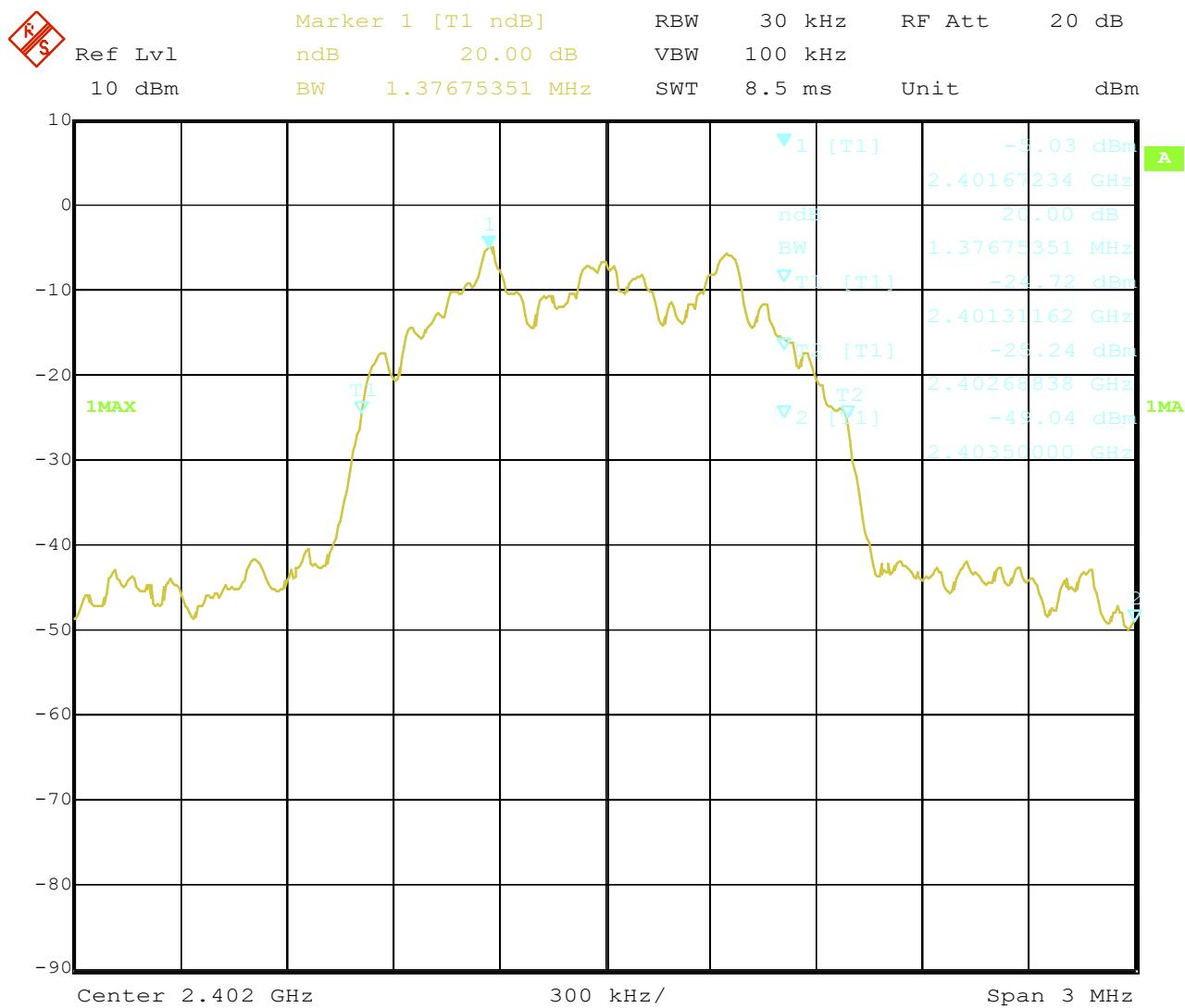
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Test Figure:

1. Condition: Low Channel



Date: 26.NOV.2020 10:52:24

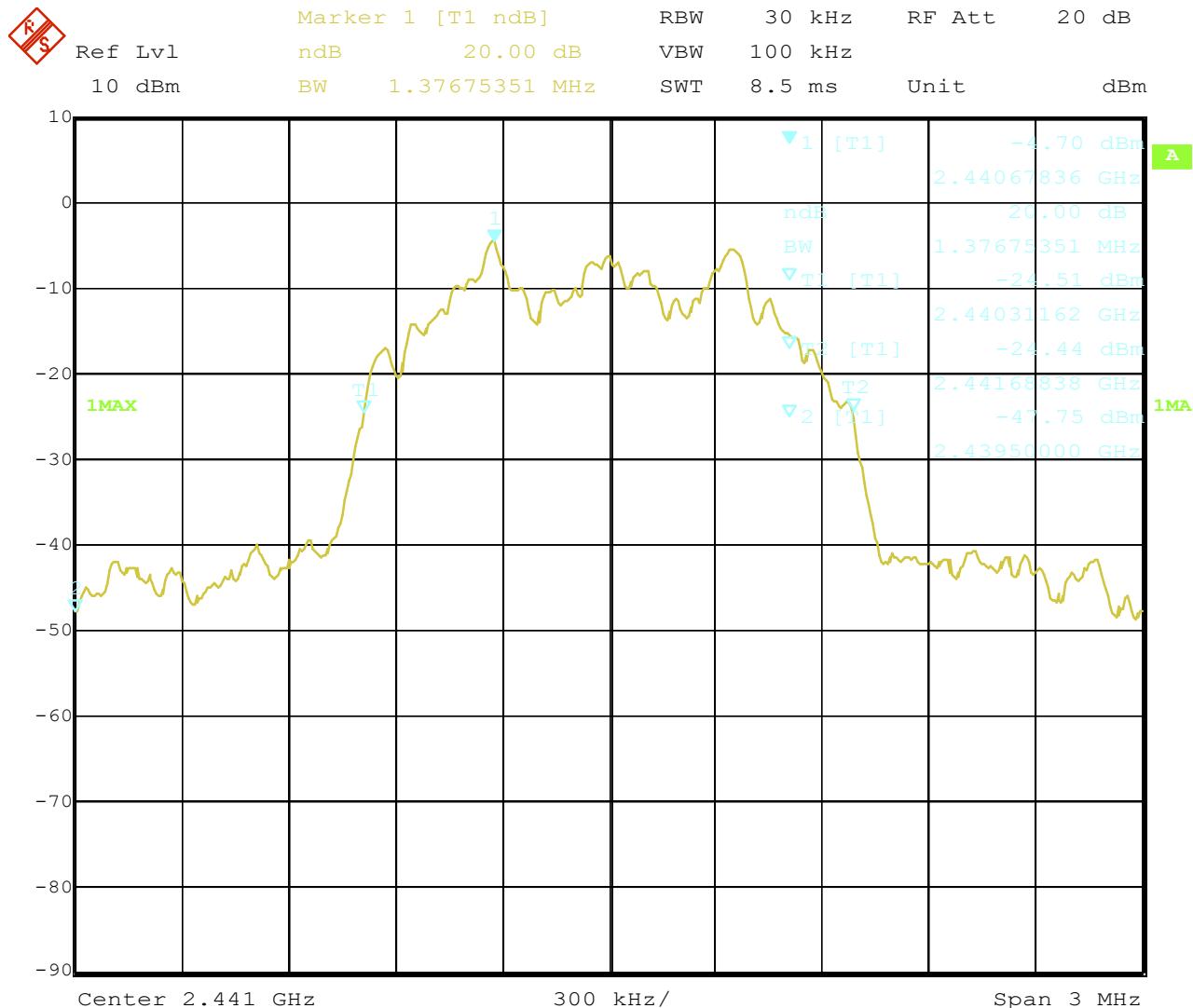
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2. Condition: Middle Channel



Date: 26.NOV.2020 10:57:23

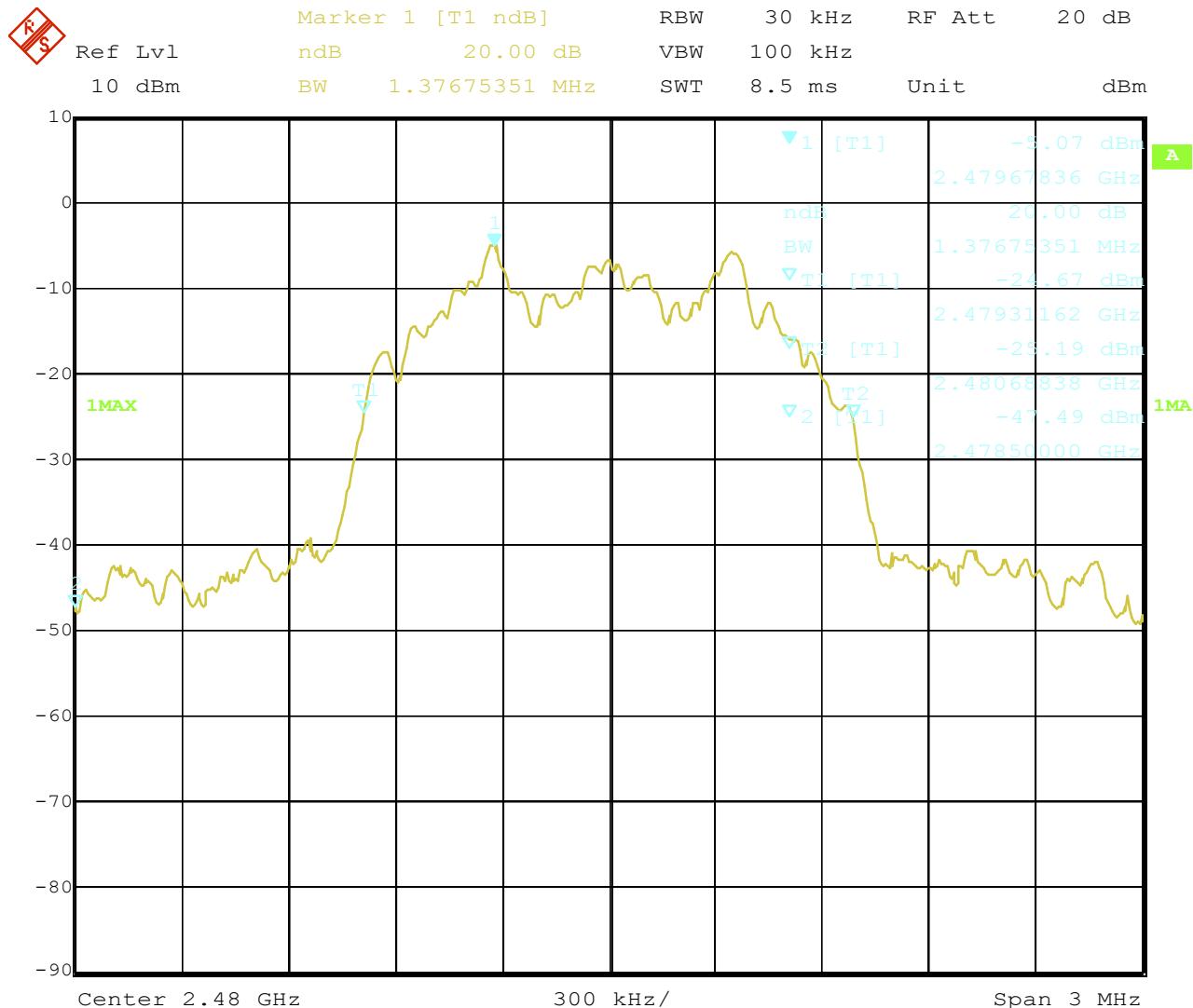
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3. High Channel



Date: 26.NOV.2020 10:57:55

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8. Maximum Output Power

8.1 Regulation

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5MHz band:0.125 watts. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

8.3 Test Procedure

1. Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel; RBW > the 20 dB bandwidth of the emission being measured; VBW = RBW=3MHz; Sweep = 60s; Detector function = PK; Trace = max hold
3. Measure the highest amplitude appearing on spectral display and record the level to calculate results.
4. Repeat above procedures until all frequencies measured were complete.

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8.4 Test Results

Type of Modulation: GFSK

EUT	Laptop		Model	NP11A-C	
Mode	Keep Transmitting		Test Voltage	DC7.6V	
Temperature	24 deg. C,		Humidity	56% RH	
Channel	Channel Frequency (MHz)	Max. Power Output (dBm)		Peak Power Limit (dBm)	
		Peak			
Low	2402	2.16		30	Pass
Middle	2441	3.28		30	Pass
High	2480	4.21		30	Pass

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

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

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

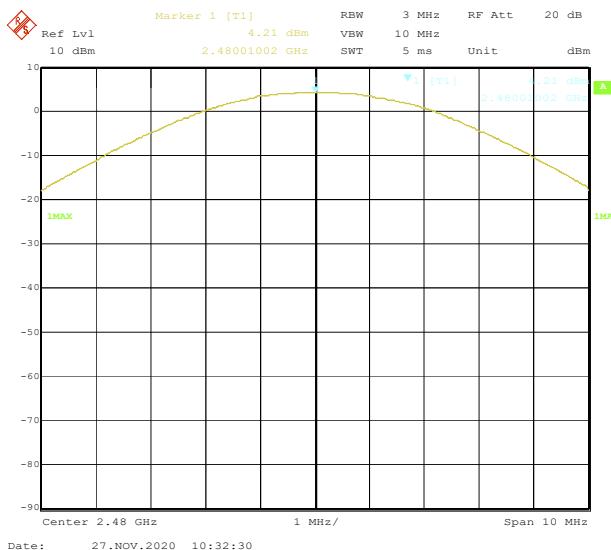
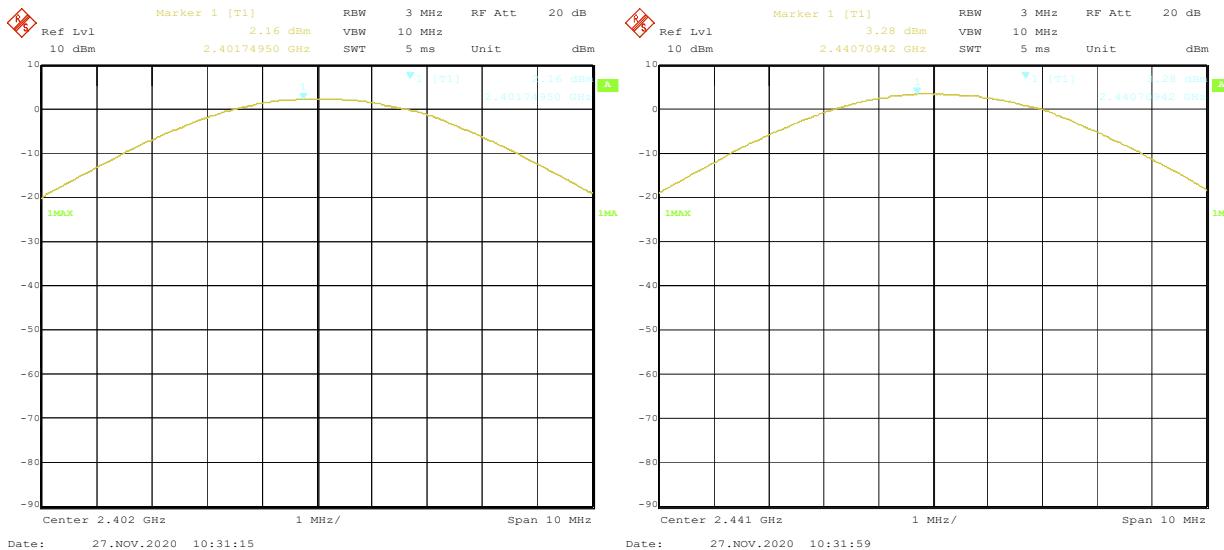
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Test Plots:



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Type of Modulation: $\pi/4$ DQPSK

EUT	Laptop		Model	NP11A-C
Mode	Keep Transmitting		Test Voltage	DC7.6V
Temperature	24 deg. C,		Humidity	56% RH
Channel	Channel Frequency (MHz)	Max. Power Output (dBm)		Peak Power Limit (dBm)
		Peak		
Low	2402	2.76		30
Middle	2441	2.98		30
High	2480	2.49		30

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

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded

3. The Peak power was measured

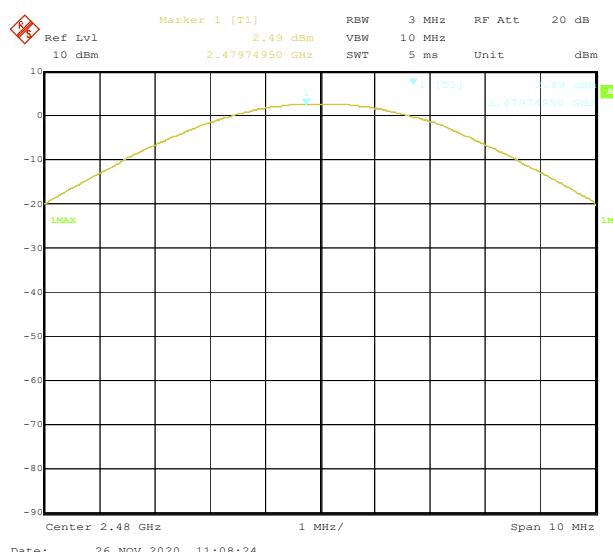
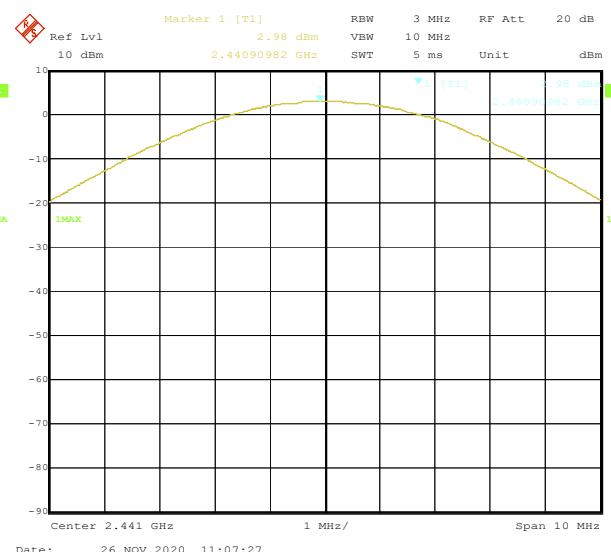
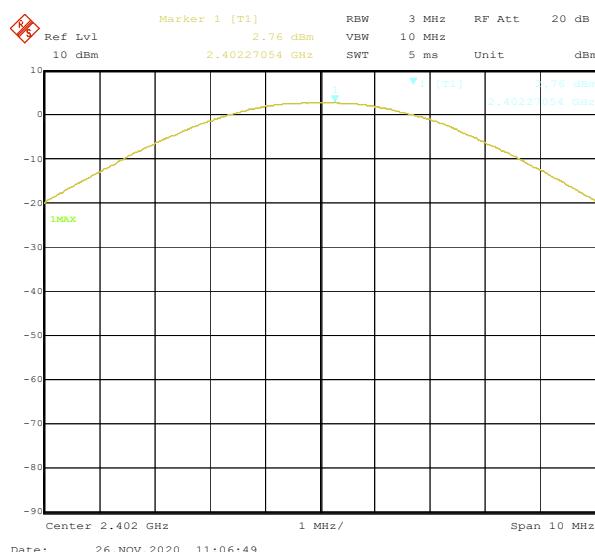
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Test Plots:



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Type of Modulation: 8DPSK

EUT	Laptop		Model	NP11A-C
Mode	Keep Transmitting		Test Voltage	DC7.6V
Temperature	24 deg. C,		Humidity	56% RH
Channel	Channel Frequency (MHz)	Max. Power Output (dBm)	Peak Power Limit (dBm)	Pass/ Fail
		Peak		
Low	2402	3.66	30	Pass
Middle	2441	3.94	30	Pass
High	2480	3.75	30	Pass

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

$$\text{Max. Power Output} = \text{Power Reading} + \text{Cable loss} + \text{Attenuator}$$

2. The worse case was recorded

3. The Peak power was measured

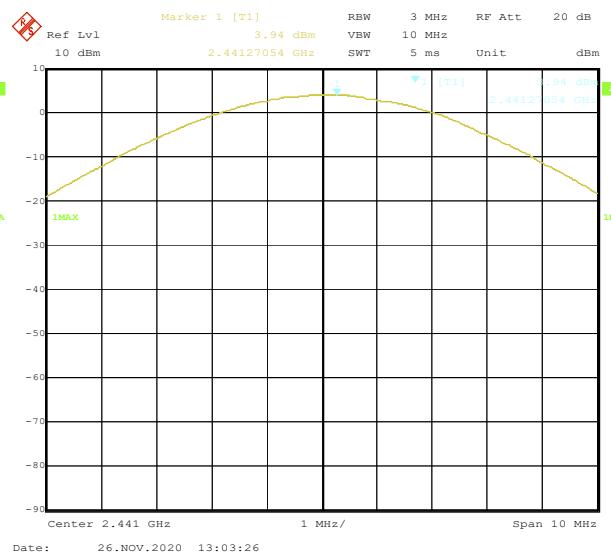
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Test Plots:



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9. Carrier Frequency Separation

9.1 Regulation

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

9.2 Limits of Carrier Frequency Separation

The Maximum Power Spectral Density Measurement is 25kHz or two-thirds of the 20dB bandwidth of the hopping Channel which is great.

9.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = wide enough to capture the peaks of two adjacent channels; Resolution (or IF) Bandwidth (RBW) $\geq 1\%$ of the span; Video (or Average) Bandwidth (VBW) \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold
3. Measure the separation between the peaks of the adjacent channels using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.

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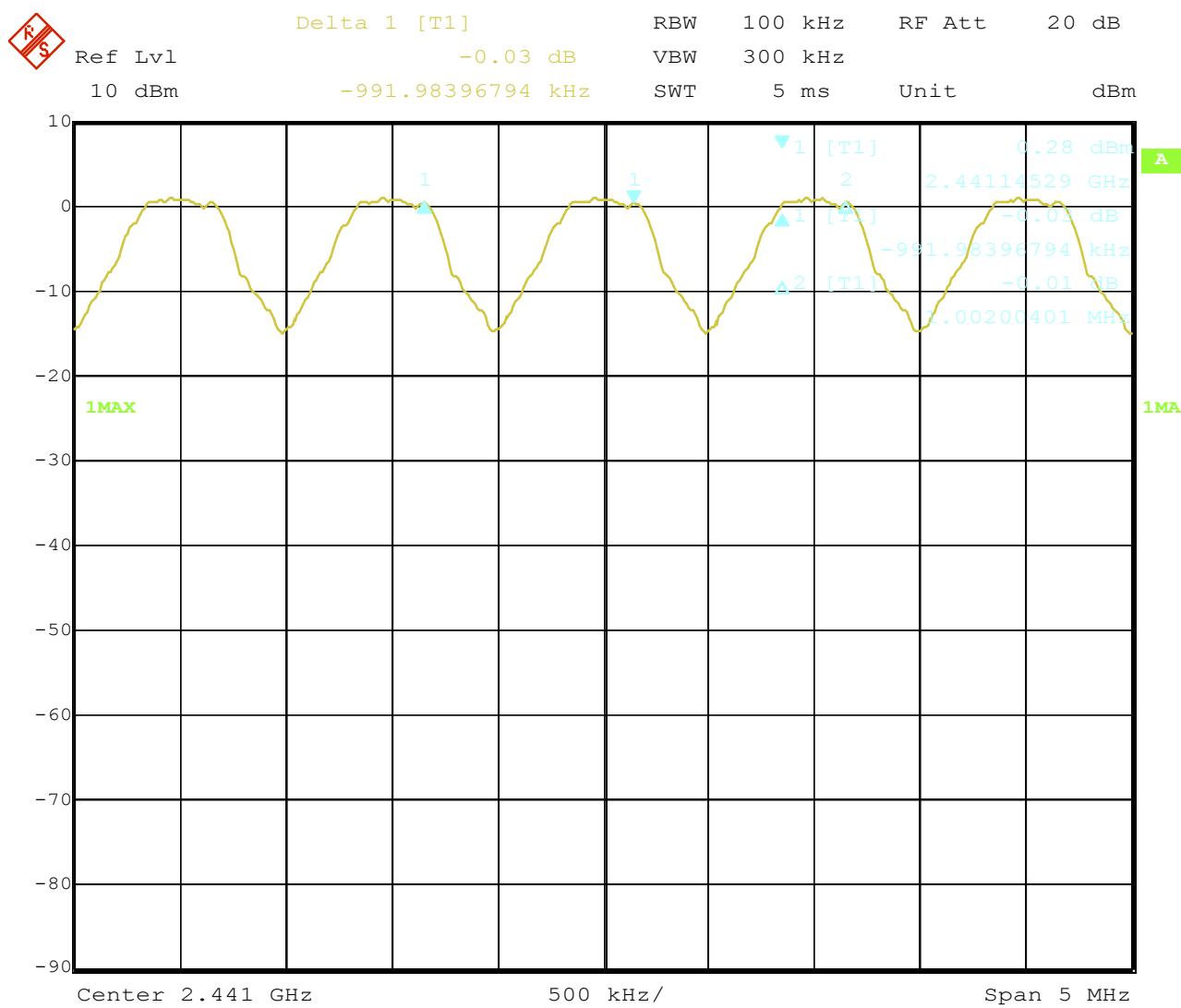


9.4 Test Result

Type of Modulation: GFSK

EUT	Laptop	Model	NP11A-C
Mode	Hopping On	Test Voltage	DC7.6V
Temperature	24 deg. C,	Humidity	56% RH
Carrier Frequency Separation		Limit	Pass/ Fail
1.000MHz		≥ 25 kHz or 2/3 of the 20 dB bandwidth	Pass

Test Plots



Date: 26.NOV.2020 10:21:04

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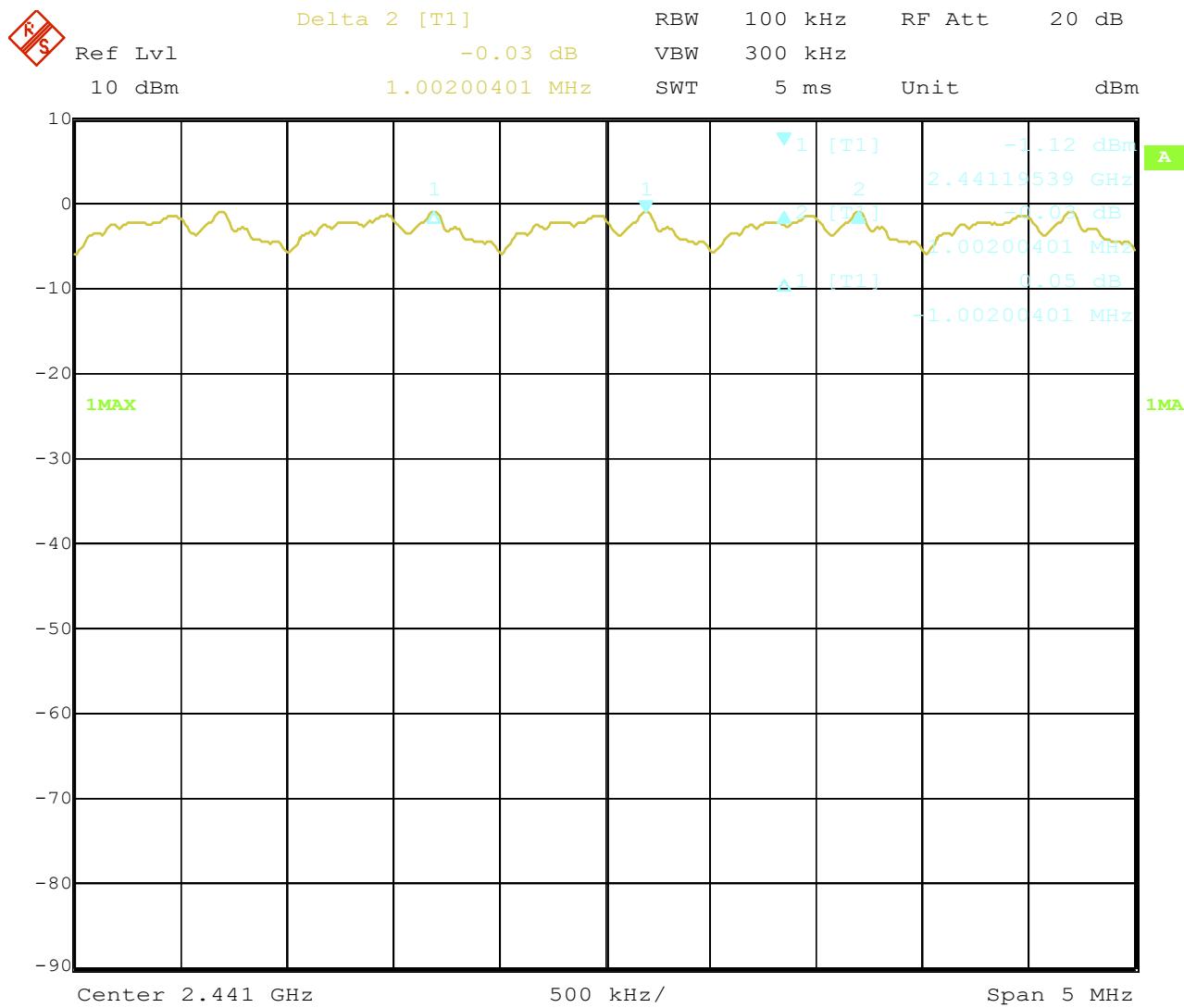
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Type of Modulation: $\pi/4$ DQPSK

EUT	Laptop	Model	NP11A-C
Mode	Hopping On	Test Voltage	DC7.6V
Temperature	24 deg. C,	Humidity	56% RH
Carrier Frequency Separation		Limit	Pass/ Fail
1.000MHz		≥ 25 kHz or 2/3 of 20 dB bandwidth	Pass

Test Plots



Date: 26.NOV.2020 10:11:46

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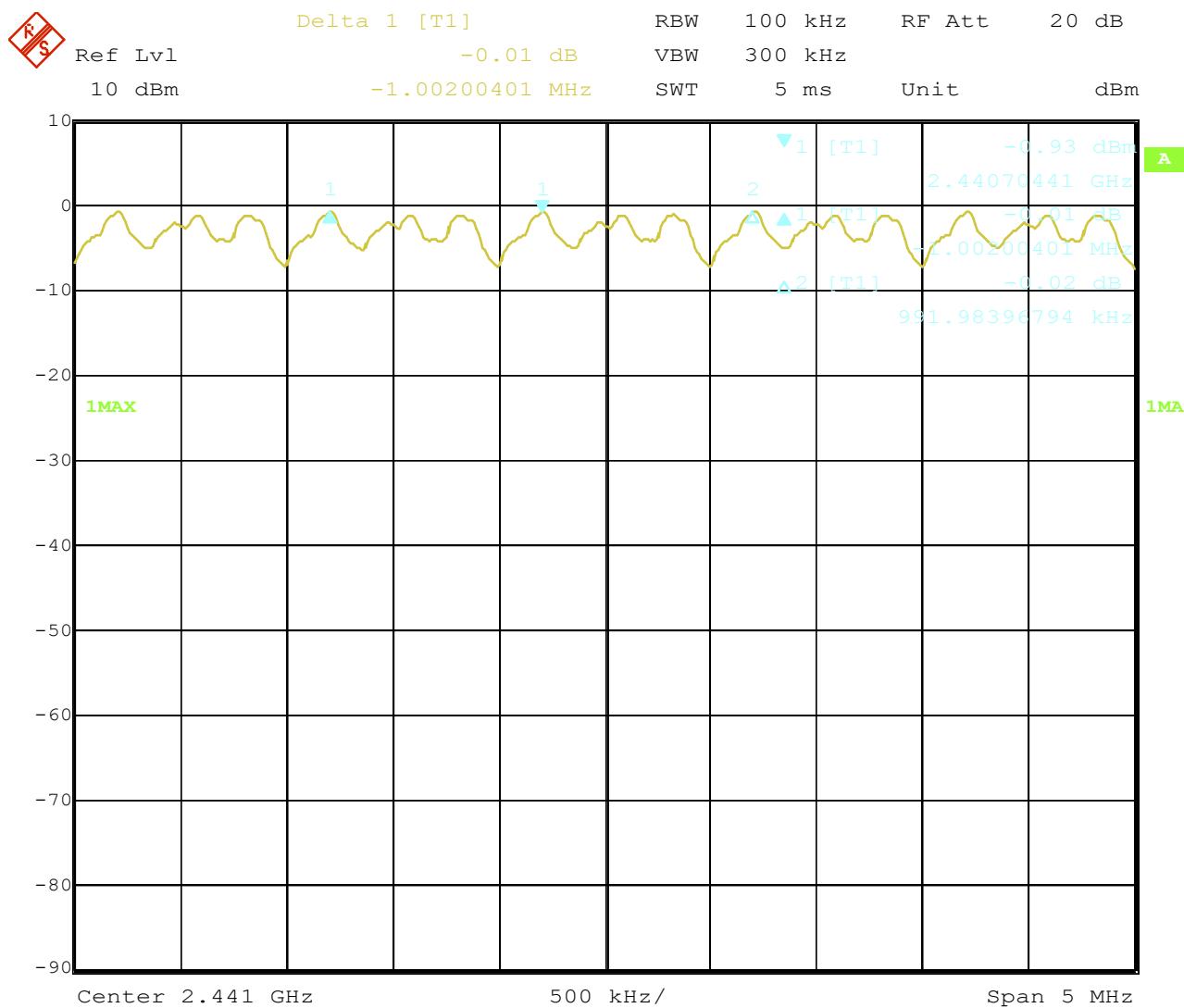
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Type of Modulation: 8DPSK

EUT	Laptop		Model	NP11A-C
Mode	Hopping On		Test Voltage	DC7.6V
Temperature	24 deg. C,		Humidity	56% RH
Carrier Frequency Separation		Limit		Pass/ Fail
1.000MHz		≥ 25 kHz or 2/3 of 20 dB bandwidth		Pass

Test Plots



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10. Number of Hopping Channels

10.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used. According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

10.2 Limits of Number of Hopping Channels

The frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

10.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = the frequency band of operation; RBW=100 kHz, VBW=300 kHz; Sweep = auto; Detector function = peak; Trace = max hold
3. Record the number of hopping channels.

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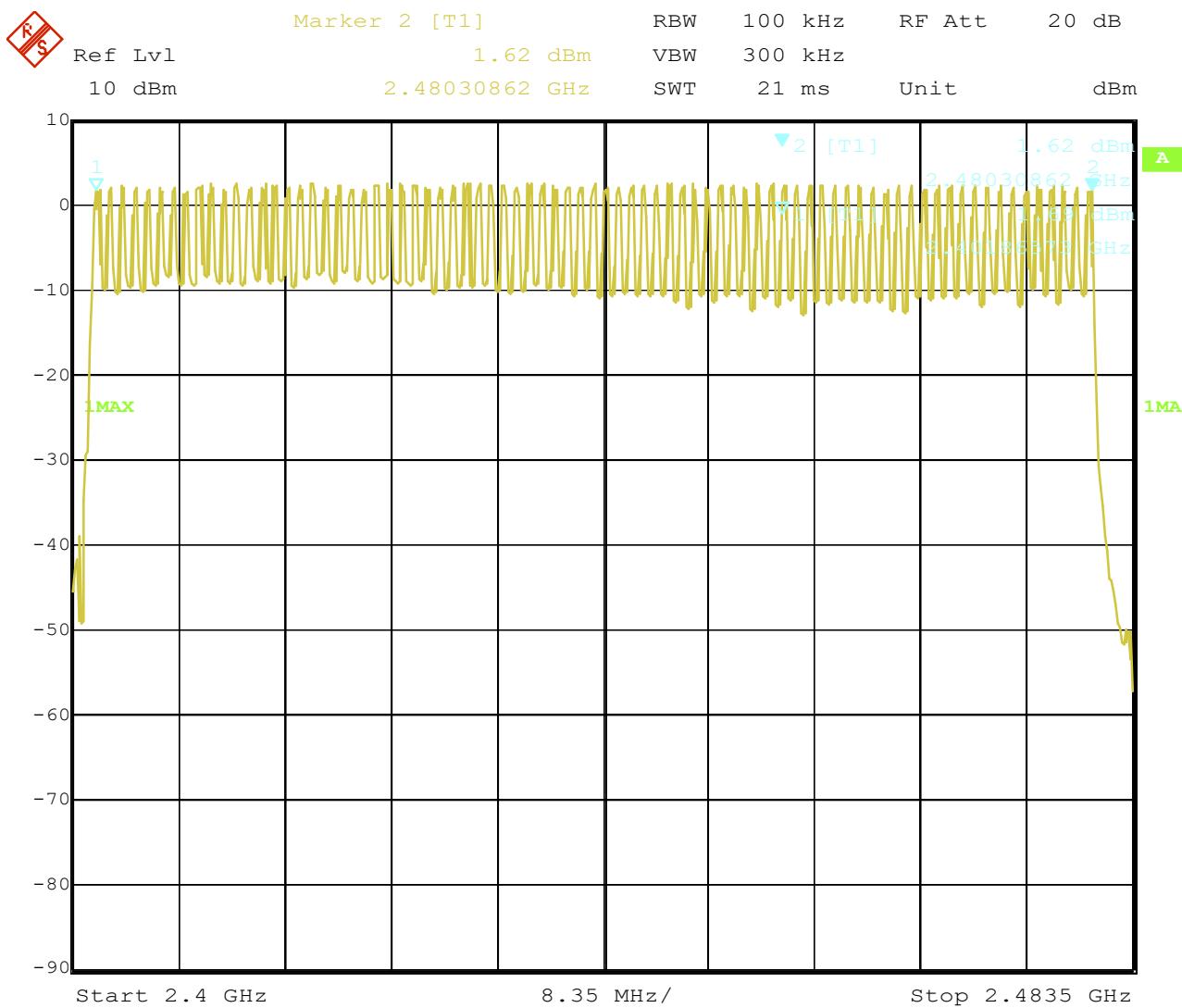


10.4 Test Result

Type of Modulation: GFSK

EUT	Laptop	Model	NP11A-C
Mode	Hopping On	Test Voltage	DC7.6V
Temperature	24 deg. C,	Humidity	56% RH
Operating Frequency	Number of hopping channels	Limit	Pass/ Fail
2402-2480MHz	79	≥ 15	Pass

Test Plot



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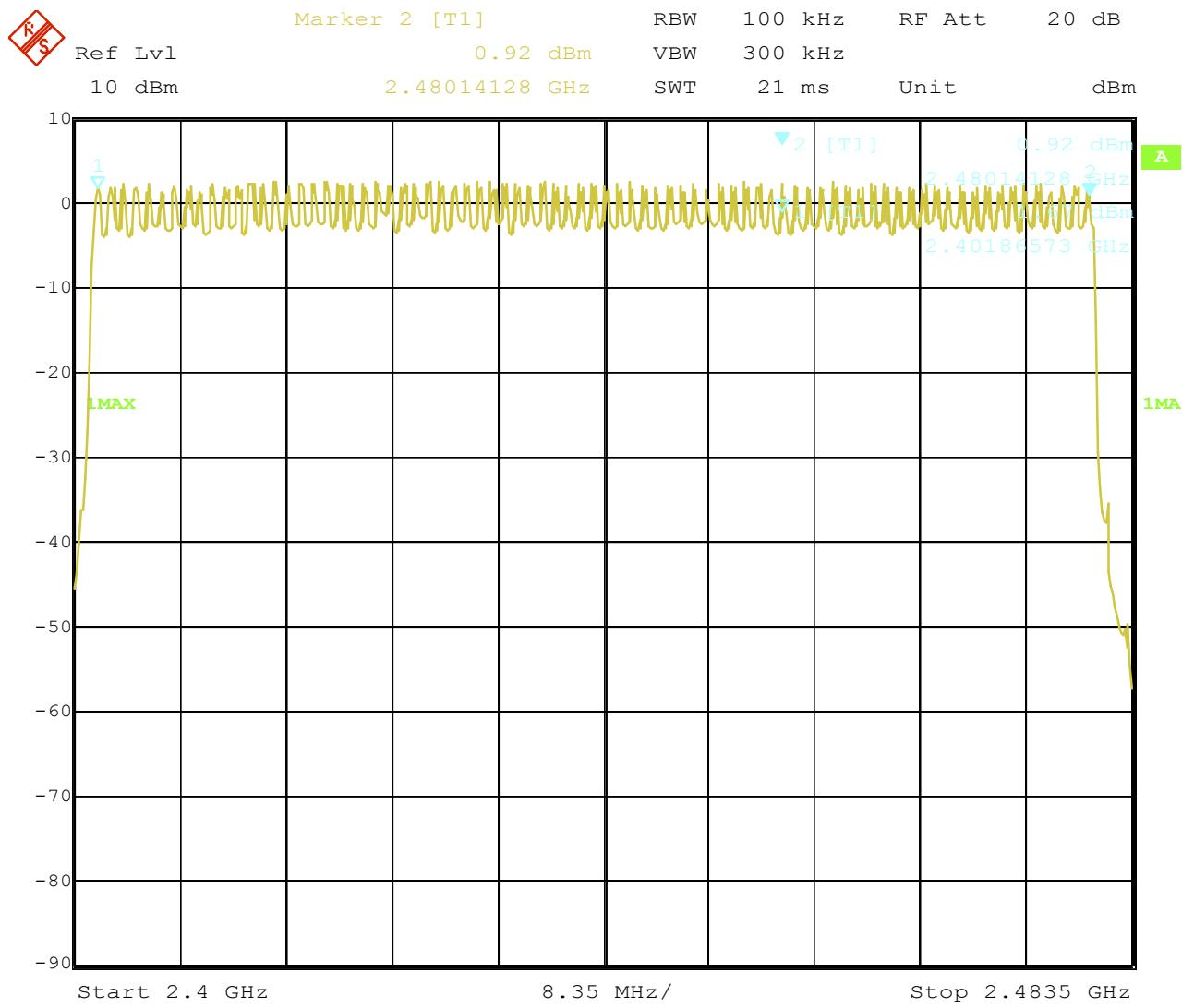
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Type of Modulation: Λ/4DQPSK

EUT	Laptop	Model	NP11A-C
Mode	Hopping On	Test Voltage	DC7.6V
Temperature	24 deg. C,	Humidity	56% RH
Operating Frequency	Number of hopping channels	Limit	Pass/ Fail
2402-2480MHz	79	≥ 15	Pass

Test Plot



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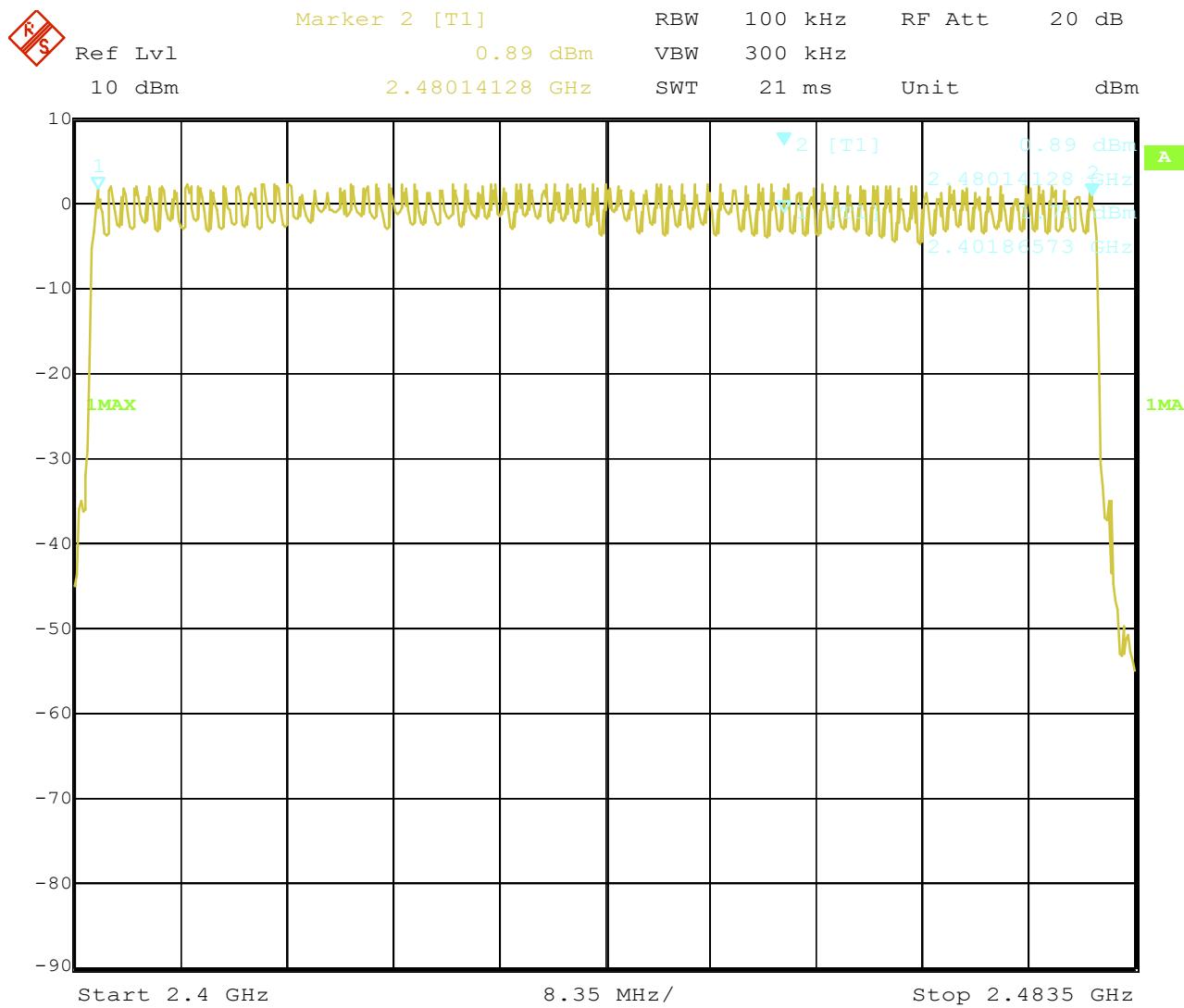
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Type of Modulation: 8DPSK

EUT	Laptop	Model	NP11A-C
Mode	Hopping On	Test Voltage	DC7.6V
Temperature	24 deg. C,	Humidity	56% RH
Operating Frequency	Number of hopping channels	Limit	Pass/ Fail
2402-2480MHz	79	≥ 15	Pass

Test Plot



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11. Time of Occupancy (Dwell Time)

11.1 Regulation

According to §15.247(a)(1)(iii), frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Limits of Carrier Frequency Separation

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed

11.3 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Set the spectrum analyzer as follows: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW \geq RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold
3. Measure the dwell time using the marker-delta function.
4. Repeat above procedures until all frequencies measured were complete.
5. Repeat this test for different modes of operation (e.g., data rate, modulation format, etc.), if applicable.

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11.4 Test Result

Type of Modulation: GFSK

EUT	BLUETOOTH SPEAKER		Model	AE0146	
Mode	Keep Transmitting		Input Voltage	DC3.7V	
Temperature	24 deg. C,		Humidity	56% RH	
Channel	Reading	Hopping Rate	Actual	Limit	
DH5					
Middle	2.886ms	266.667 hop/s	0.308s	0.4s	
DH3					
Middle	1.663ms	400 hop/s	0.266s	0.4s	
DH1					
Middle	0.381ms	800 hop/s	0.122s	0.4s	

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

A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

A DH3 Packet needs 3 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 400 hops per second with 79 channels.

A DH1 Packet needs 1 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 800 hops per second with 79 channels.

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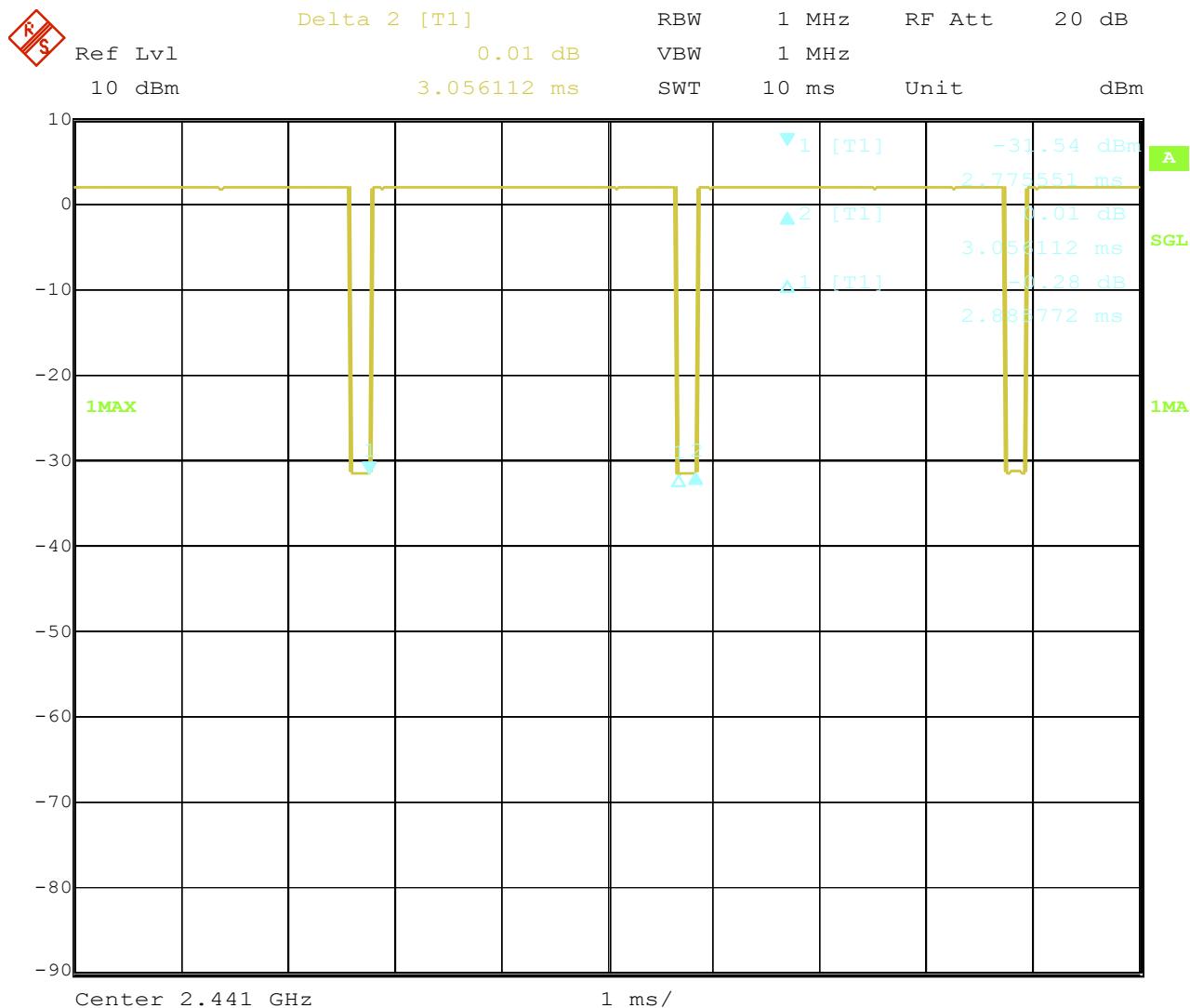
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Test Plots:

DH5



Date: 26.NOV.2020 13:10:46

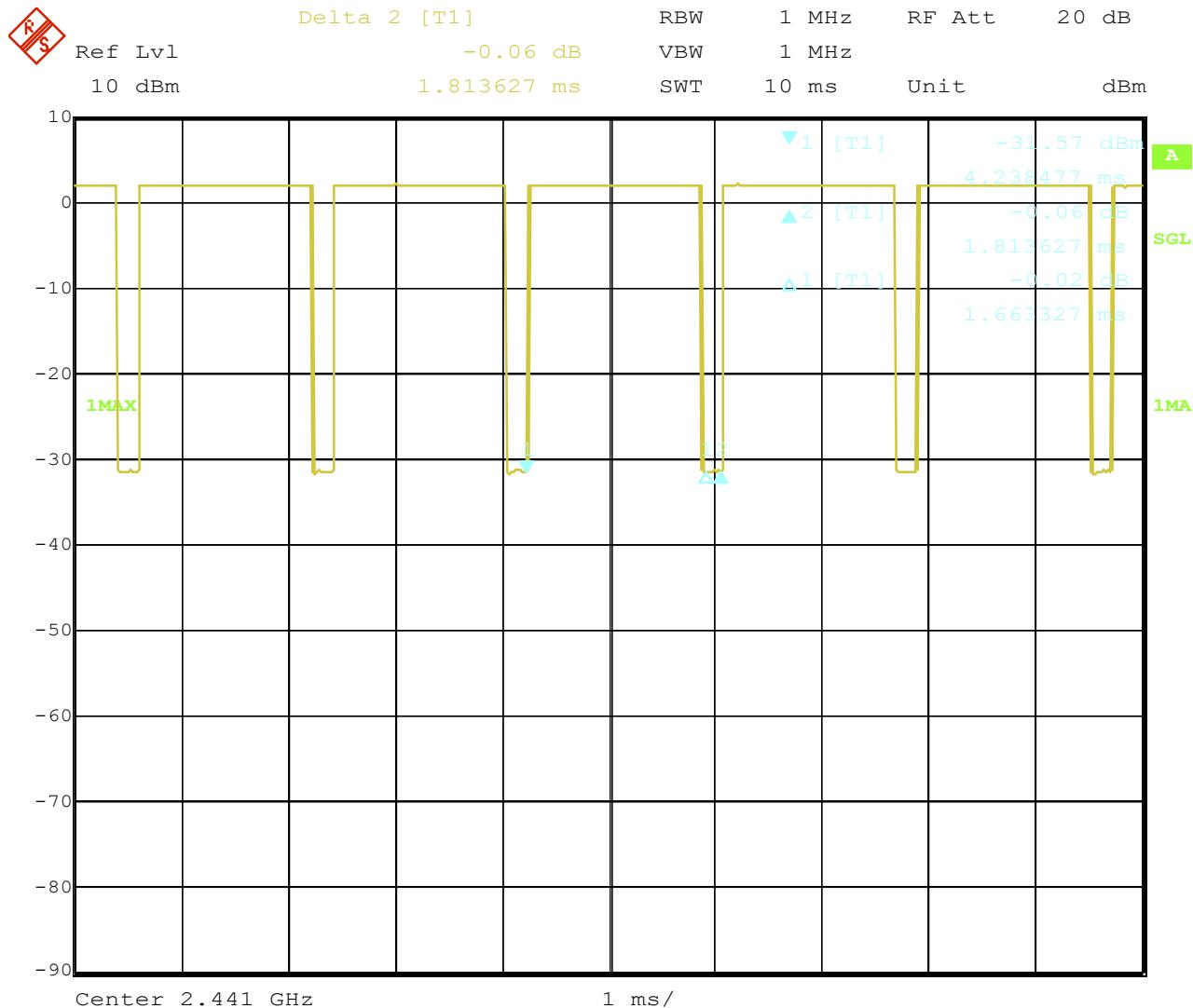
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DH3



Date: 26.NOV.2020 13:09:49

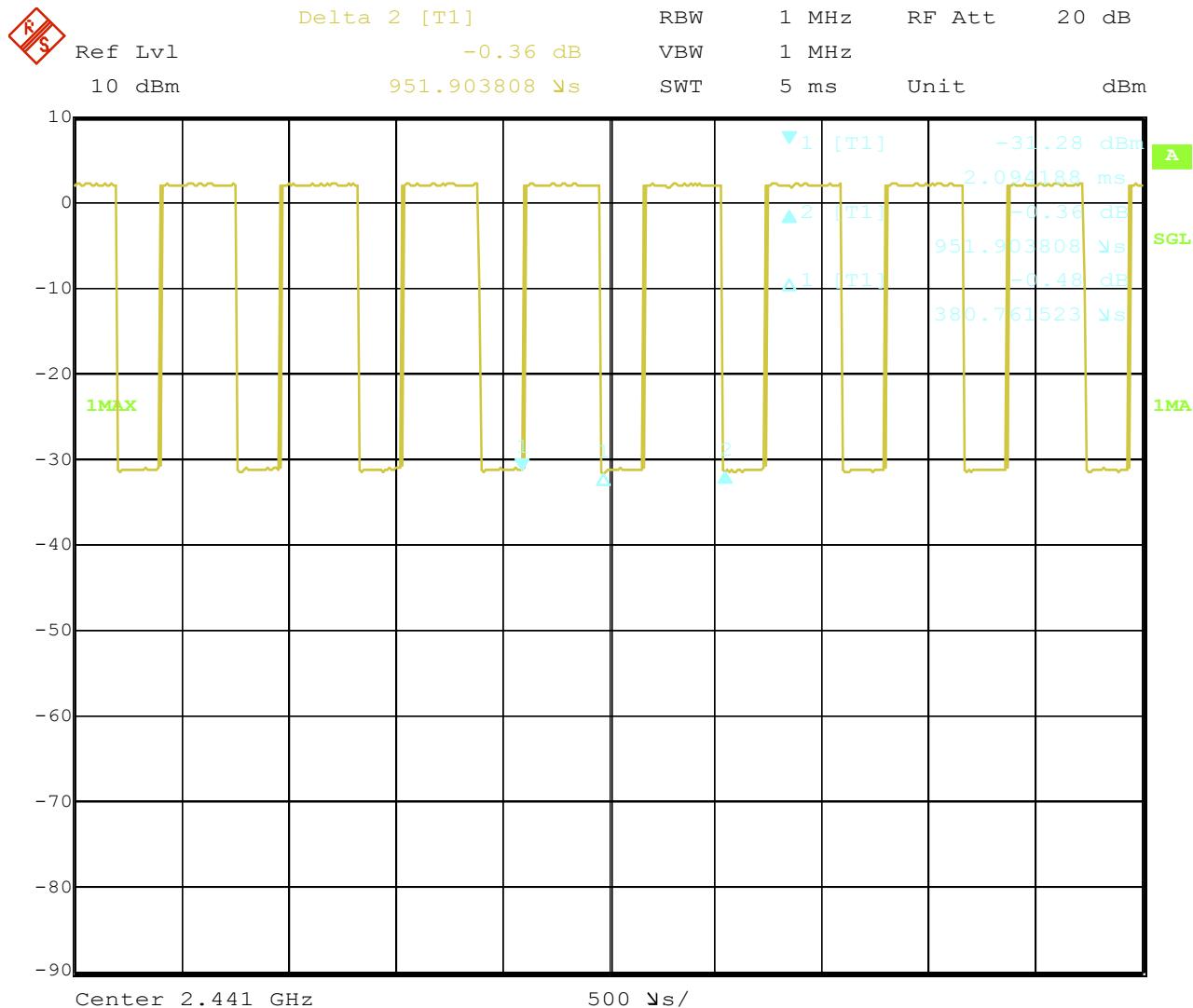
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DH1



Date: 26.NOV.2020 13:08:54

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Test Result

Type of Modulation: π/4DQPSK

EUT		BLUETOOTH SPEAKER		Model	AE0146	
Mode		Keep Transmitting		Input Voltage	DC3.7V	
Temperature		24 deg. C,		Humidity	56% RH	
Channel	Reading	Hopping Rate		Actual	Limit	
2DH5						
Middle	2.926ms	266.667 hop/s		0.312s	0.4s	
2DH3						
Middle	1.683ms	400 hop/s		0.269s	0.4s	
2DH1						
Middle	0.401ms	800 hop/s		0.128s	0.4s	

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

A DH5 Packet needs 5 time slot for transmitting and 1 time slot for receiving. Then the EUT makes worst case 266.667 hops per second with 79 channels.

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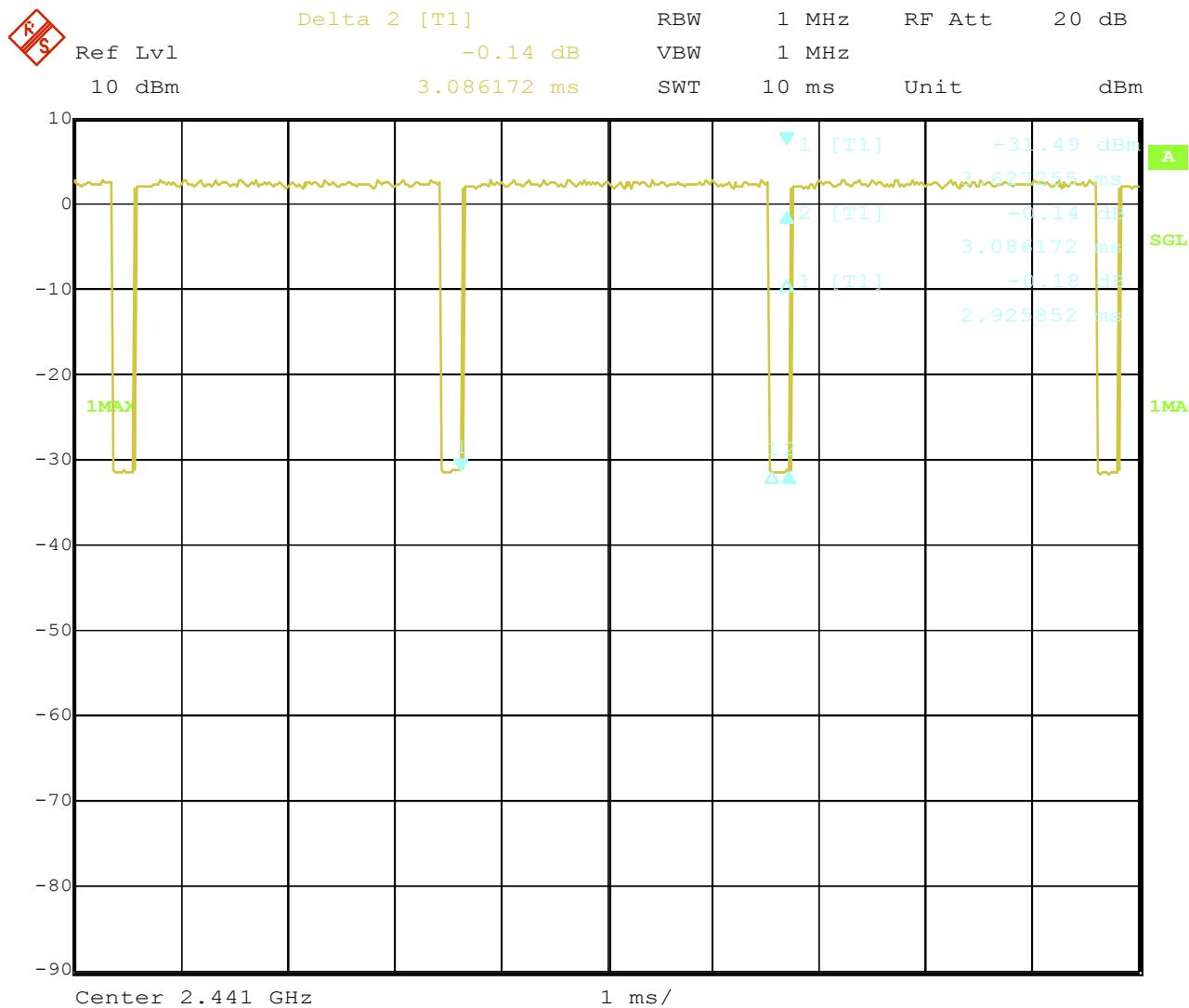
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Test Plots:

2DH5



Date: 26.NOV.2020 13:13:24

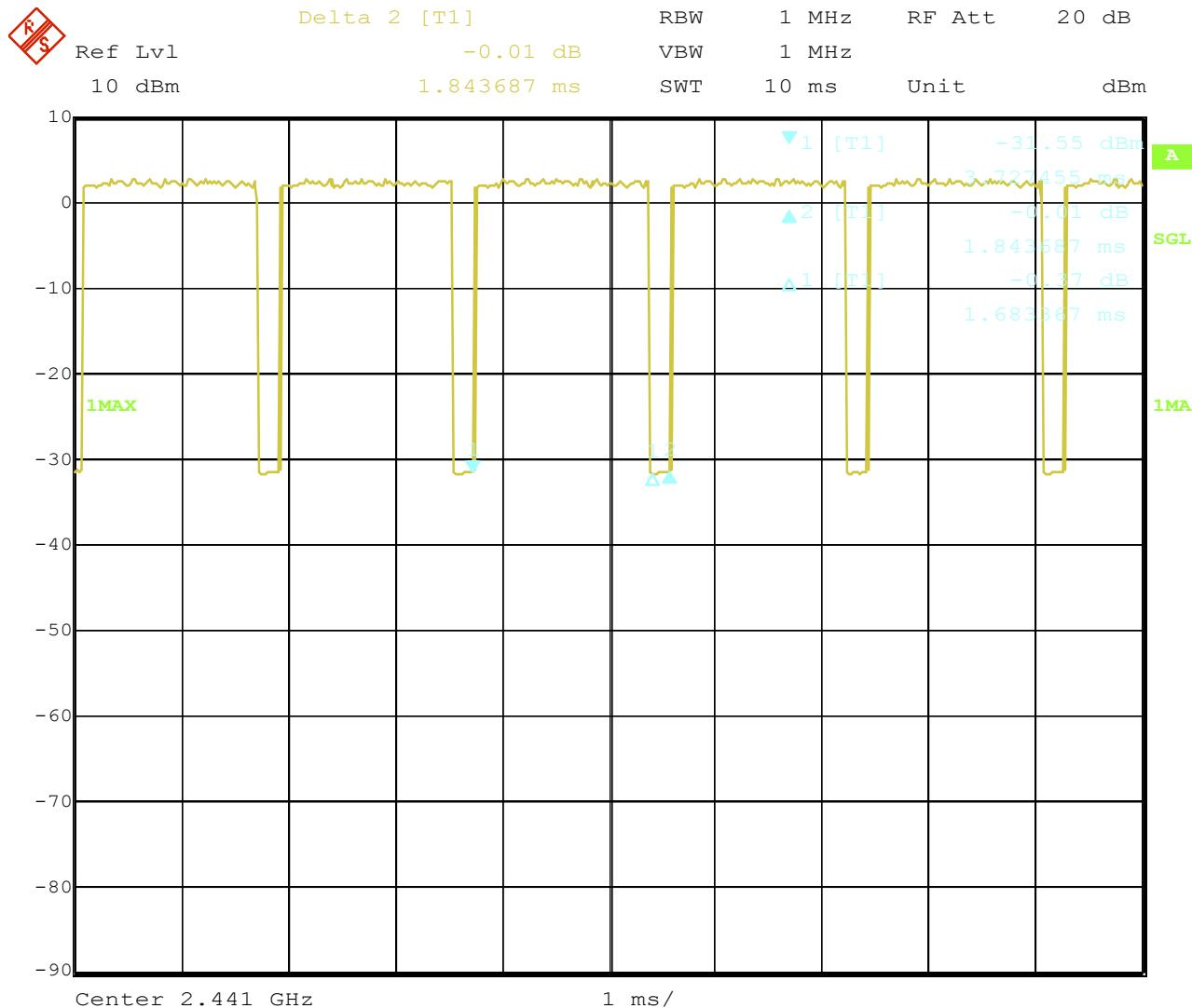
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2DH3



Date: 26.NOV.2020 13:12:50

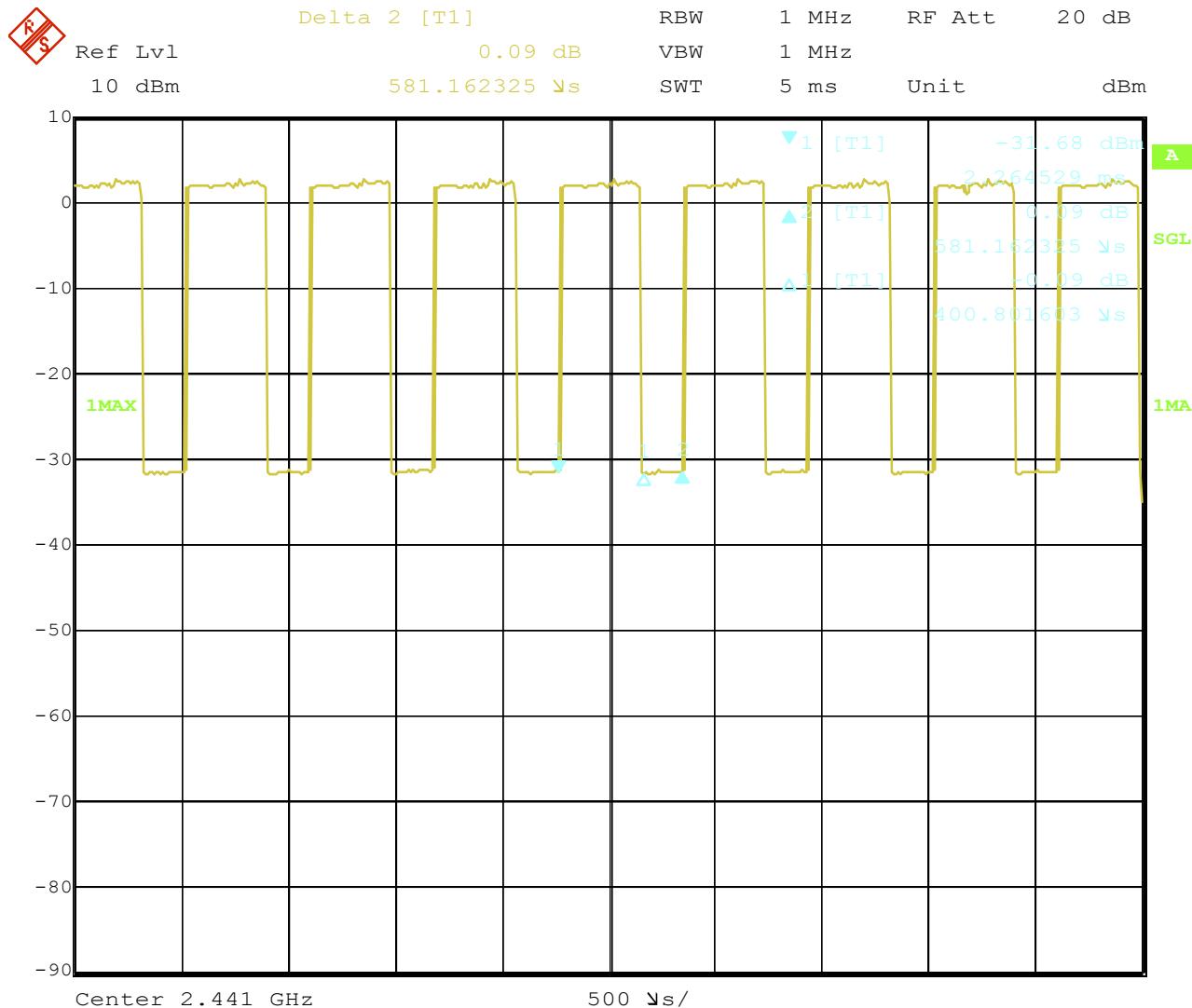
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2DH1



Date: 26.NOV.2020 13:11:56

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Type of Modulation: 8DPSK

EUT		BLUETOOTH SPEAKER		Model	AE0146	
Mode		Keep Transmitting		Input Voltage	DC3.7V	
Temperature		24 deg. C,		Humidity	56% RH	
Channel	Reading	Hoping Rate		Actual	Limit	
3DH5						
Middle	2.926ms	266.667 hop/s		0.312s	0.4s	
3DH3						
Middle	1.683ms	400 hop/s		0.269s	0.4s	
3DH1						
Middle	0.401ms	800 hop/s		0.129s	0.4s	

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

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