

8.5 Test Result

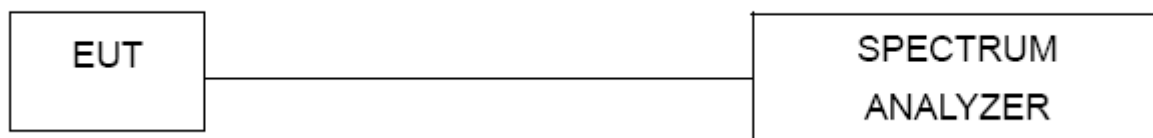
	Polar (H/V)	Frequency (MHz)	Reading Level (dBuV/m)	Correct Factor (dB)	Measure- ment (dBuV/m)	Limits (dBuV/m)		Result
					PK	PK	AV	
GFSK	Low Channel 2402MHz							
	H	2390.00	56.65	-6.70	49.95	74.00	54.00	PASS
	H	2400.00	48.46	-6.71	41.75	74.00	54.00	PASS
	V	2390.00	56.63	-6.70	49.93	74.00	54.00	PASS
	V	2400.00	47.68	-6.71	40.97	74.00	54.00	PASS
	High Channel 2480MHz							
	H	2483.50	56.16	-6.79	49.37	74.00	54.00	PASS
	H	2485.00	48.65	-6.81	41.84	74.00	54.00	PASS
	V	2483.50	55.76	-6.79	48.97	74.00	54.00	PASS
	V	2485.00	46.99	-6.81	40.18	74.00	54.00	PASS
π /4DQPSK	Low Channel 2402MHz							
	H	2390.00	56.72	-6.70	50.02	74.00	54.00	PASS
	H	2400.00	48.32	-6.71	41.61	74.00	54.00	PASS
	V	2390.00	56.38	-6.70	49.68	74.00	54.00	PASS
	V	2400.00	48.13	-6.71	41.42	74.00	54.00	PASS
	High Channel 2480MHz							
	H	2483.50	55.15	-6.79	48.36	74.00	54.00	PASS
	H	2485.00	49.71	-6.81	42.90	74.00	54.00	PASS
	V	2483.50	55.30	-6.79	48.51	74.00	54.00	PASS
	V	2485.00	47.18	-6.81	40.37	74.00	54.00	PASS
8DPSK	Low Channel 2402MHz							
	H	2390.00	57.68	-6.70	50.98	74.00	54.00	PASS
	H	2400.00	48.83	-6.71	42.12	74.00	54.00	PASS
	V	2390.00	57.16	-6.70	50.46	74.00	54.00	PASS
	V	2400.00	48.86	-6.71	42.15	74.00	54.00	PASS
	High Channel 2480MHz							
	H	2483.50	57.05	-6.79	50.26	74.00	54.00	PASS
	H	2485.00	49.96	-6.81	43.15	74.00	54.00	PASS
	V	2483.50	57.41	-6.79	50.62	74.00	54.00	PASS
	V	2485.00	49.84	-6.81	43.03	74.00	54.00	PASS

Remark:

- Emission Level = Meter Reading + Factor,
Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Over= Emission Level - Limit
- If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
- In restricted bands of operation, The spurious emissions below the permissible value more than 20dB
- The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

9. CONDUCTED EMISSION

9.1 Block Diagram Of Test Setup



9.2 Limit

Regulation 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))

9.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;

2. Set the spectrum analyzer:

Below 1GHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 1GHz:

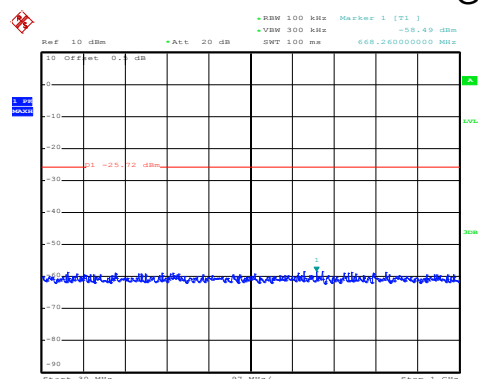
RBW = 1MHz, VBW = 3MHz, Sweep = auto

Detector function = peak, Trace = max hold

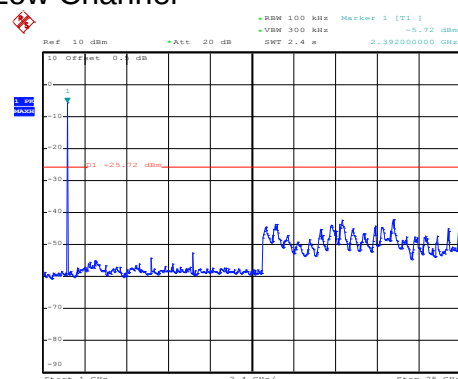
9.4 Test Result

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark:	N/A

30MHz – 25GHz GFSK Low Channel

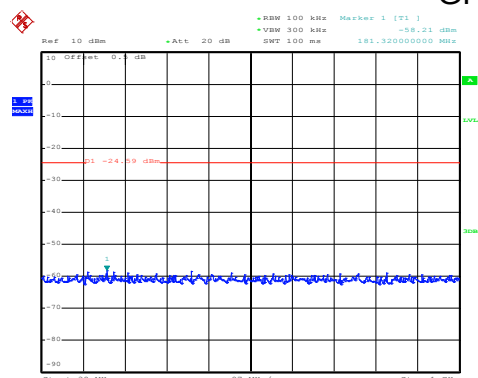


Date: 3.AUG.2021 15:08:50

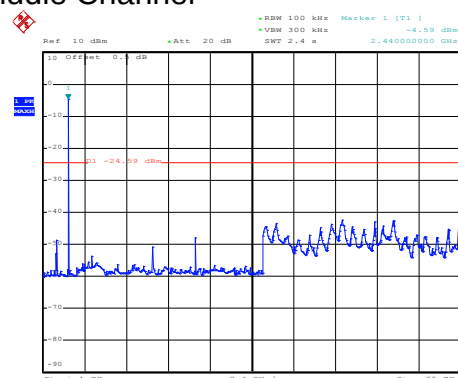


Date: 3.AUG.2021 15:08:36

GFSK Middle Channel

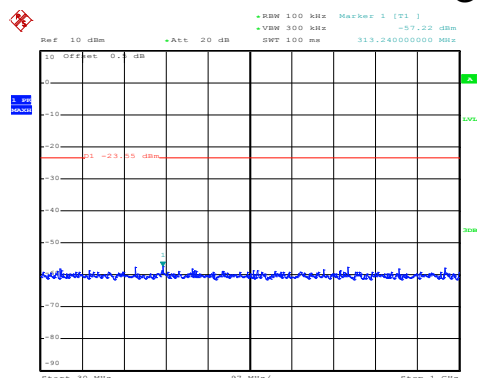


Date: 3.AUG.2021 15:07:38

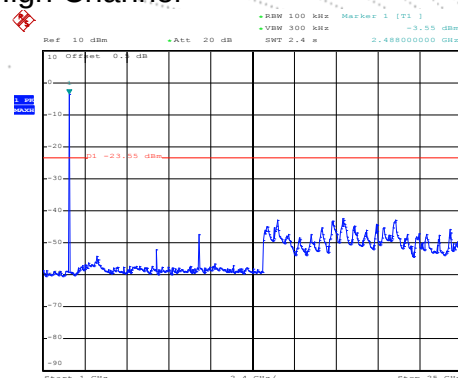


Date: 3.AUG.2021 15:07:28

GFSK High Channel

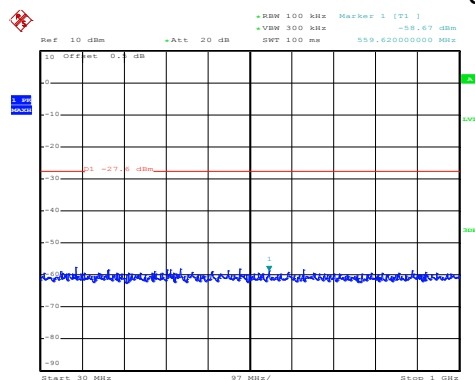


Date: 3.AUG.2021 15:10:49

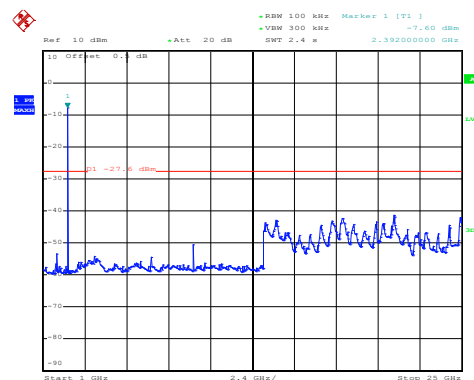


Date: 3.AUG.2021 15:10:16

$\pi/4$ DQPSK Low Channel

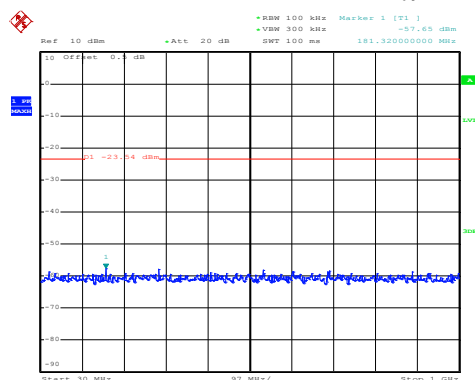


Date: 3.AUG.2021 15:14:09

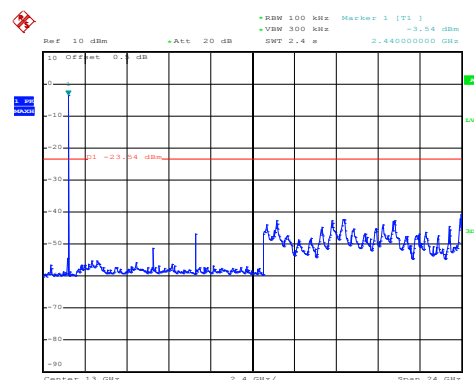


Date: 3.AUG.2021 15:14:01

$\pi/4$ DQPSK Middle Channel

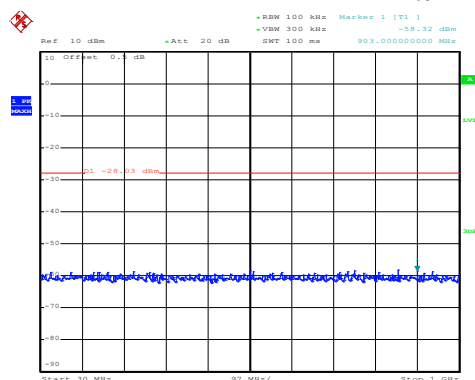


Date: 3.AUG.2021 15:15:10

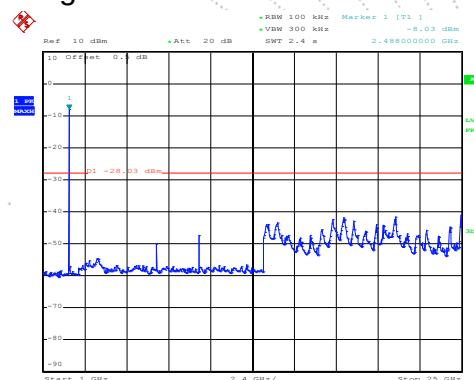


Date: 3.AUG.2021 15:14:59

$\pi/4$ DQPSK High Channel

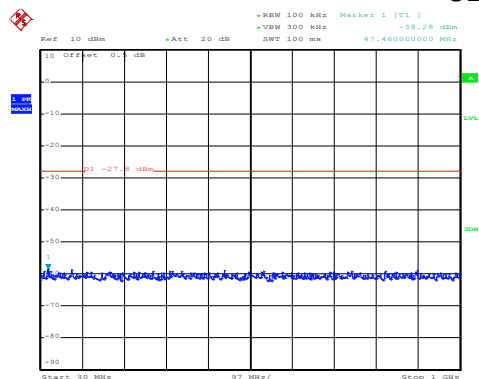


Date: 3.AUG.2021 15:17:39

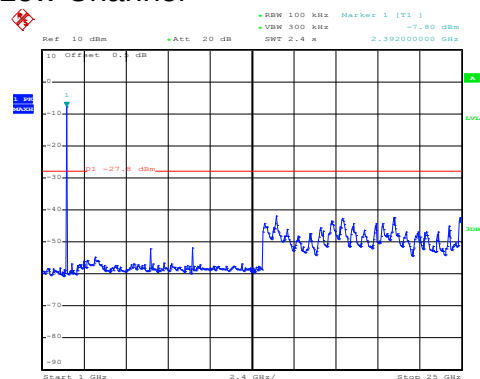


Date: 3.AUG.2021 15:16:54

8DPSK Low Channel

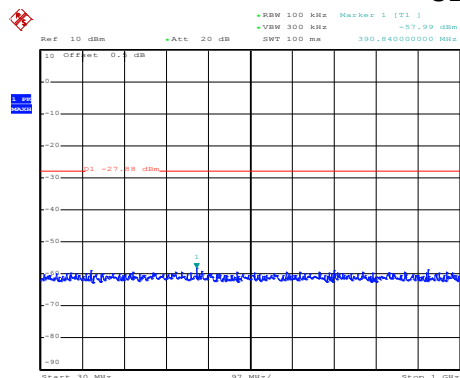


Date: 3.AUG.2021 15:19:20

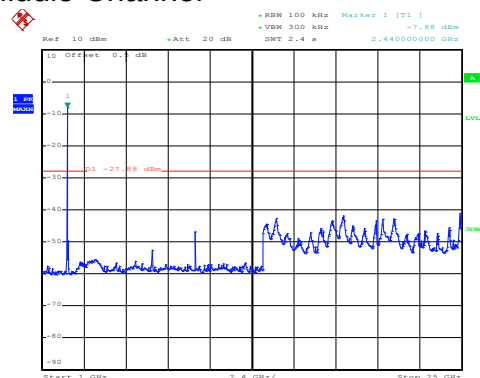


Date: 3.AUG.2021 15:19:11

8DPSK Middle Channel

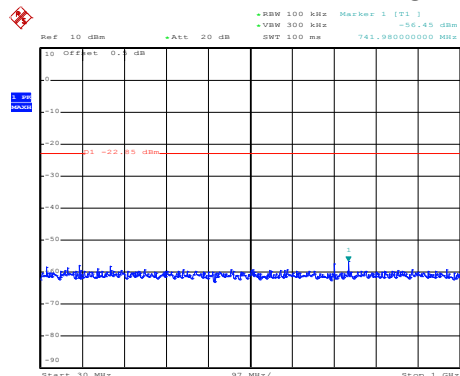


Date: 3.AUG.2021 15:20:13

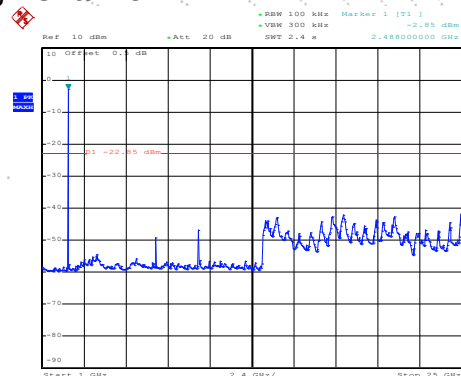


Date: 3.AUG.2021 15:20:04

8DPSK High Channel

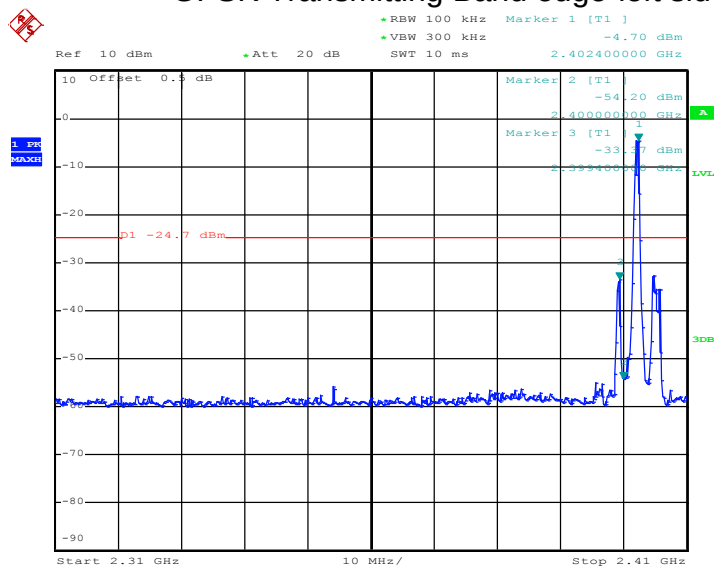


Date: 3.AUG.2021 15:21:42



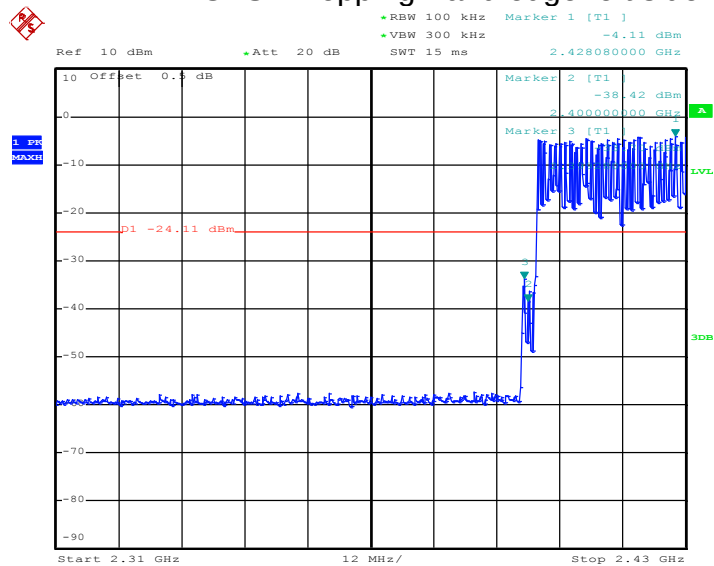
Date: 3.AUG.2021 15:21:31

GFSK Transmitting Band edge-left side



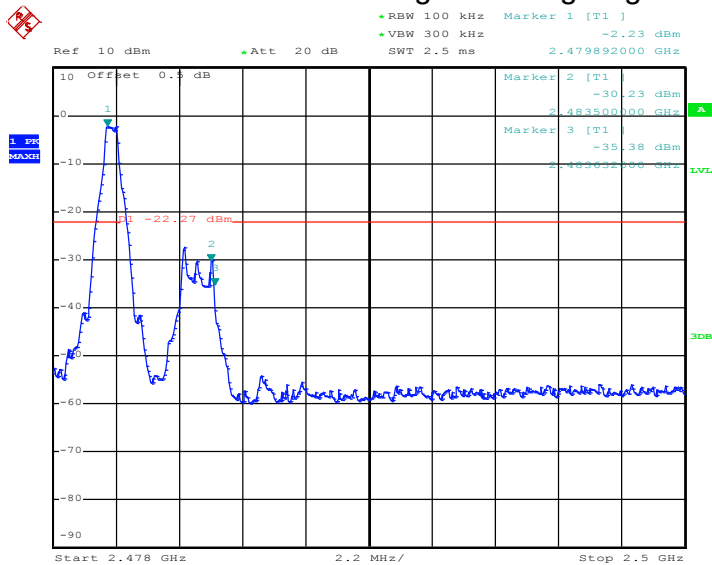
Date: 3.AUG.2021 15:39:56

GFSK Hopping Band edge-left side



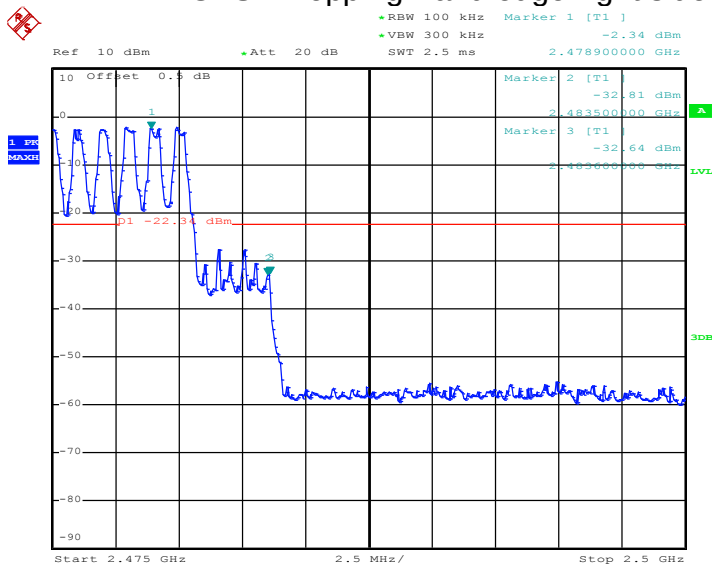
Date: 3.AUG.2021 15:49:28

GFSK Transmitting Band edge-right side



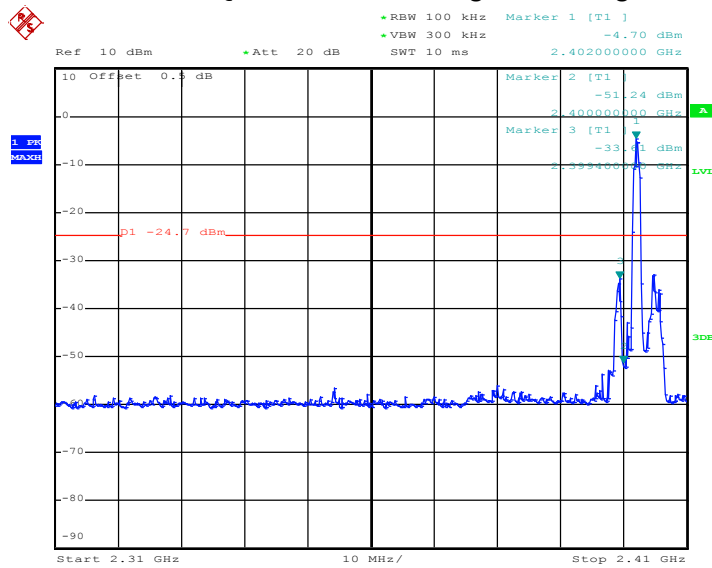
Date: 3.AUG.2021 15:41:13

GFSK Hopping Band edge-right side



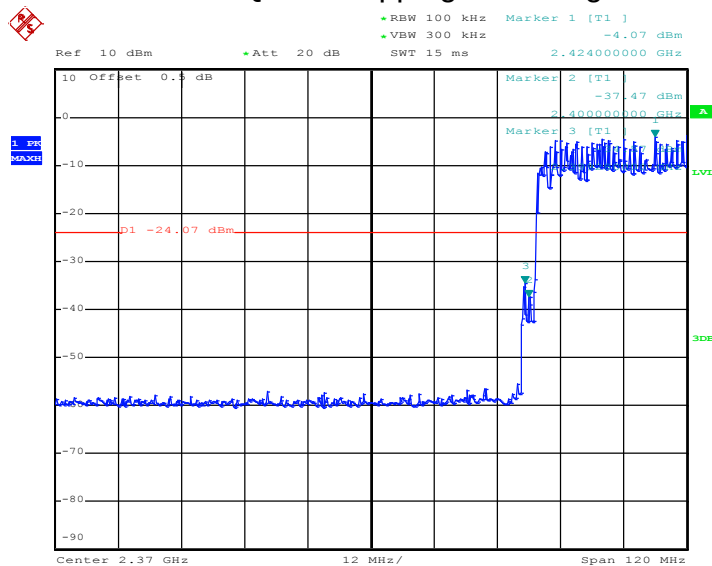
Date: 3.AUG.2021 15:52:25

$\pi/4$ DQPSK Transmitting Band edge-left side



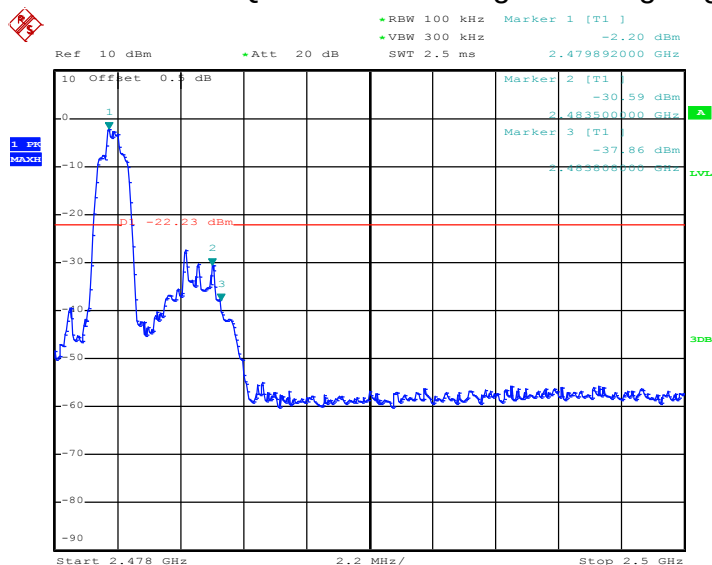
Date: 3.AUG.2021 15:42:46

$\pi/4$ DQPSK Hopping Band edge-left side



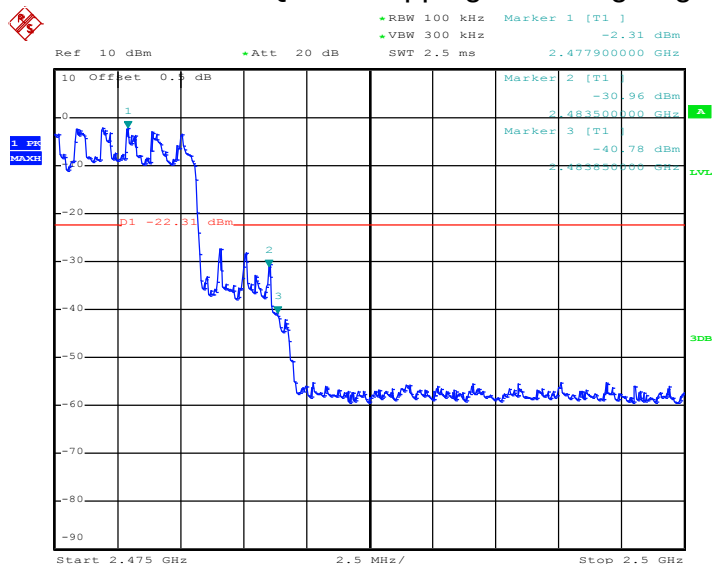
Date: 3.AUG.2021 15:57:39

$\pi/4$ DQPSK Transmitting Band edge-right side



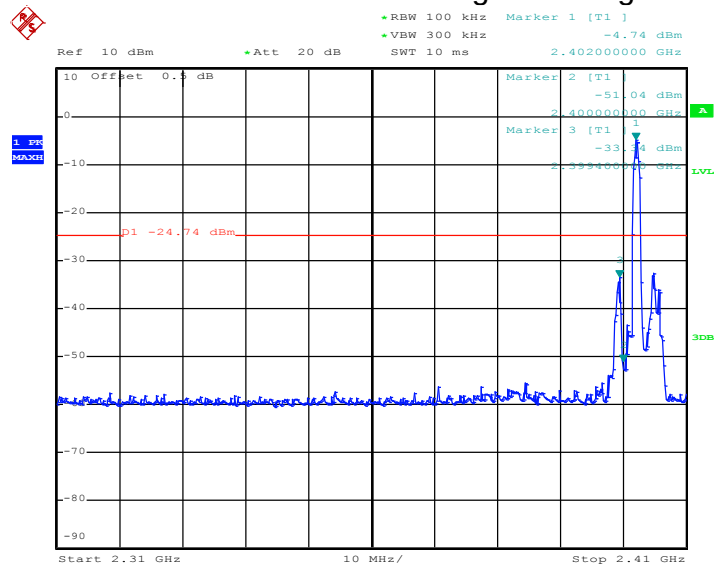
Date: 3.AUG.2021 15:44:16

$\pi/4$ DQPSK Hopping Band edge-right side



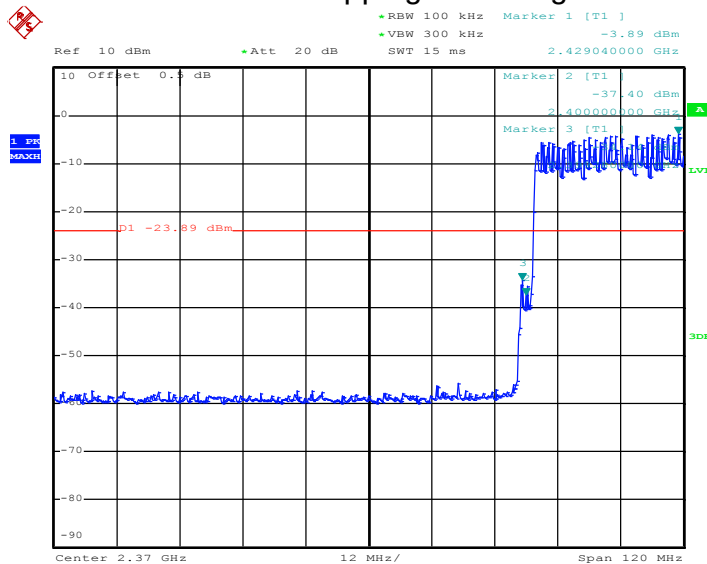
Date: 3.AUG.2021 15:56:00

8DPSK Transmitting Band edge-left side



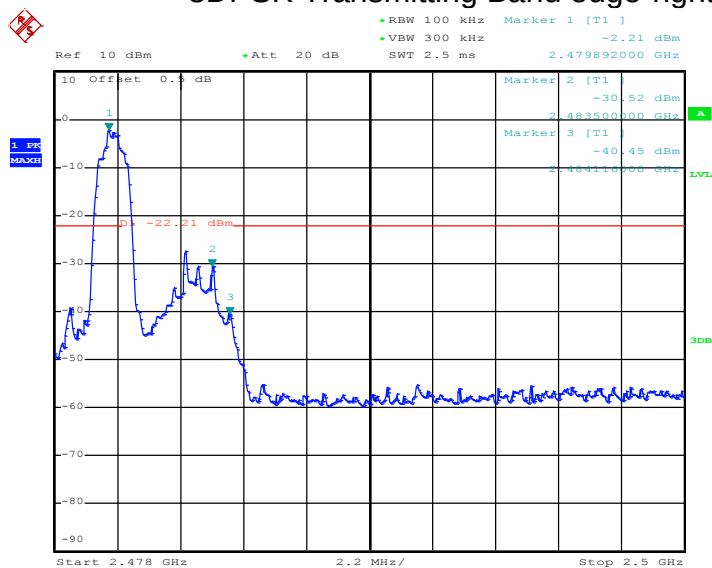
Date: 3.AUG.2021 15:47:24

8DPSK Hopping Band edge-left side



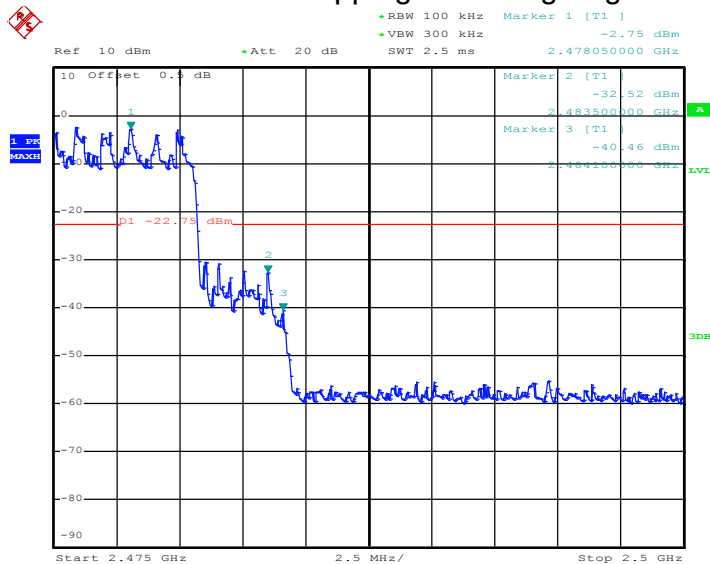
Date: 3.AUG.2021 16:00:52

8DPSK Transmitting Band edge-right side



Date: 3.AUG.2021 15:45:22

8DPSK Hopping Band edge-right side



Date: 3.AUG.2021 16:03:19

10. 20 DB BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limit

N/A

10.3 Test procedure

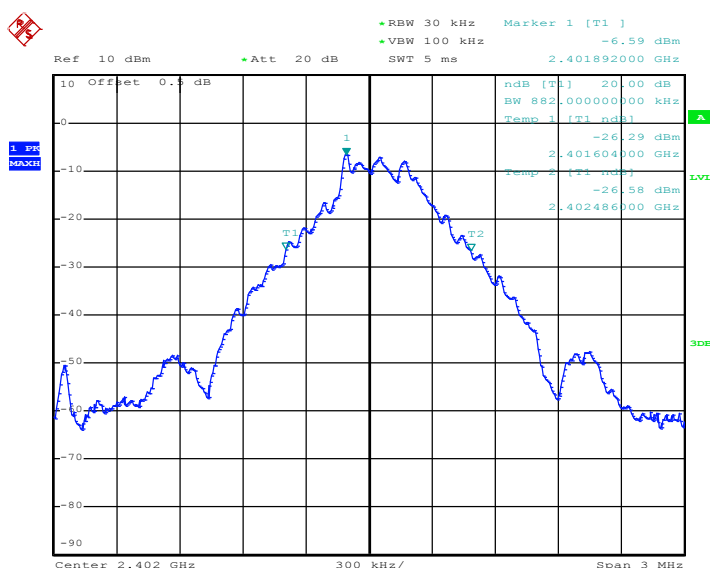
1. Set RBW = 30kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. .

10.4 Test Result

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark	N/A

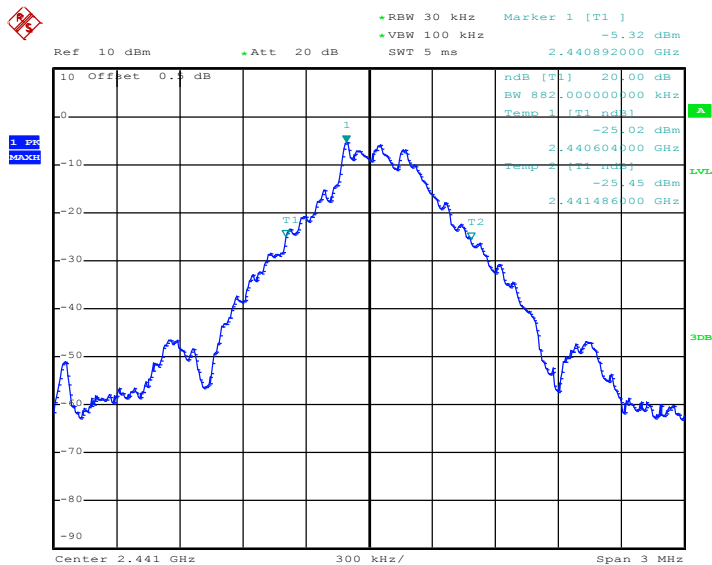
Modulation	Test Channel	Bandwidth(MHz)
GFSK	Low	0.882
GFSK	Middle	0.882
GFSK	High	0.882
$\pi/4$ DQPSK	Low	1.254
$\pi/4$ DQPSK	Middle	1.254
$\pi/4$ DQPSK	High	1.254
8DPSK	Low	1.224
8DPSK	Middle	1.224
8DPSK	High	1.224

Test plots GFSK Low Channel



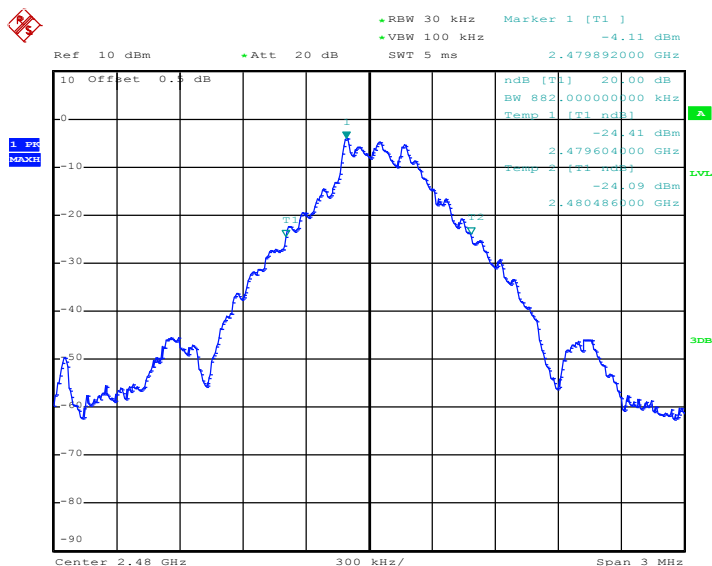
Date: 3.AUG.2021 15:23:16

GFSK Middle Channel



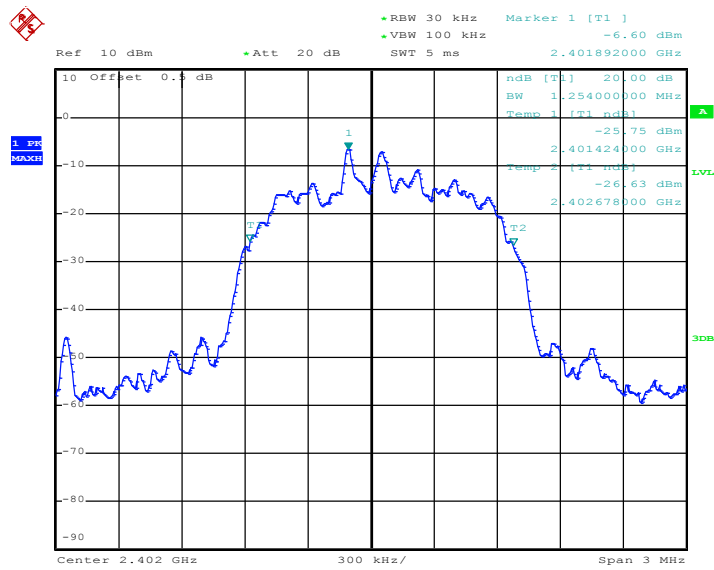
Date: 3.AUG.2021 15:23:41

GFSK High Channel



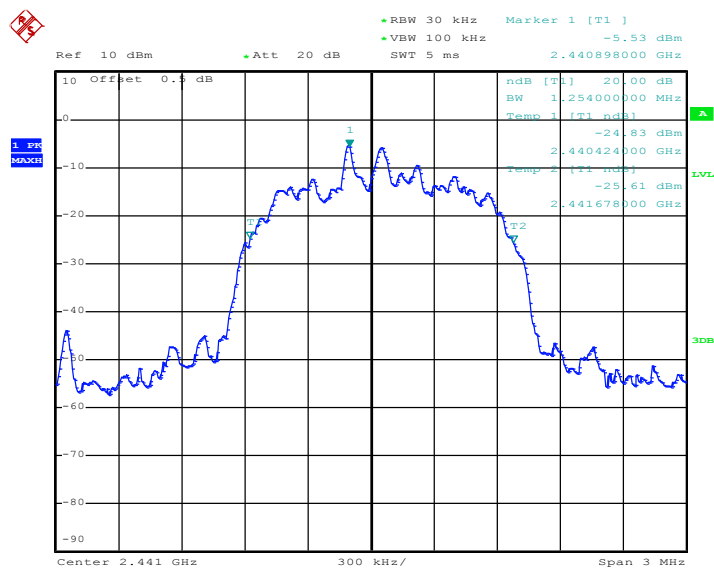
Date: 3.AUG.2021 15:24:05

π /4DQPSK Low Channel



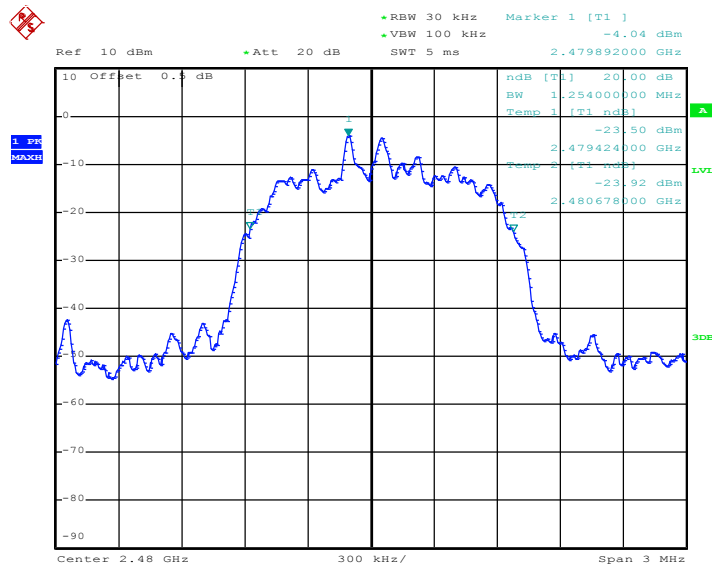
Date: 3.AUG.2021 15:24:46

π /4DQPSK Middle Channel



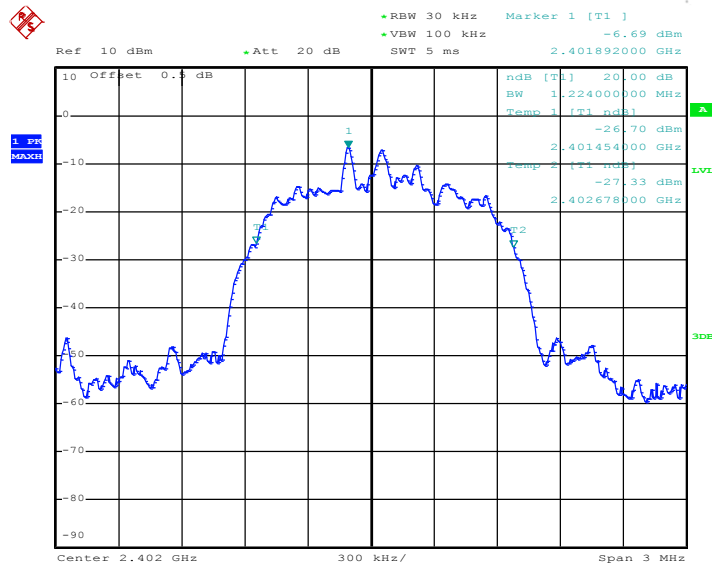
Date: 3.AUG.2021 15:25:12

π /4DQPSK High Channel



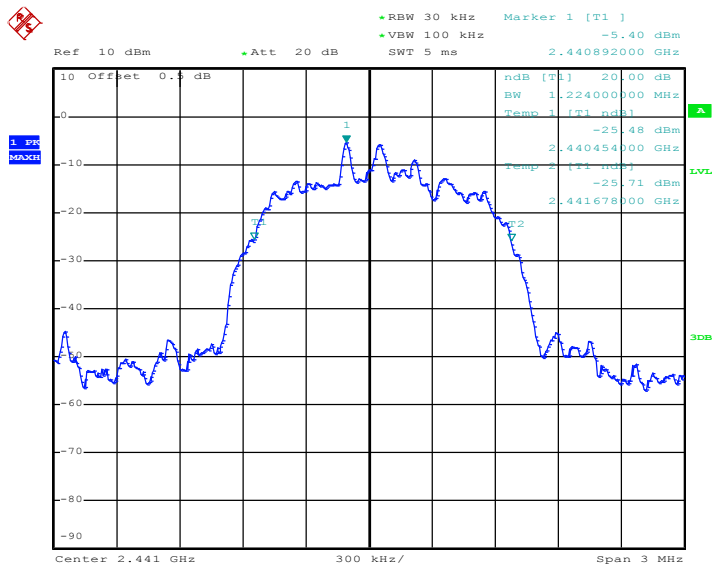
Date: 3.AUG.2021 15:26:01

8DPSK Low Channel



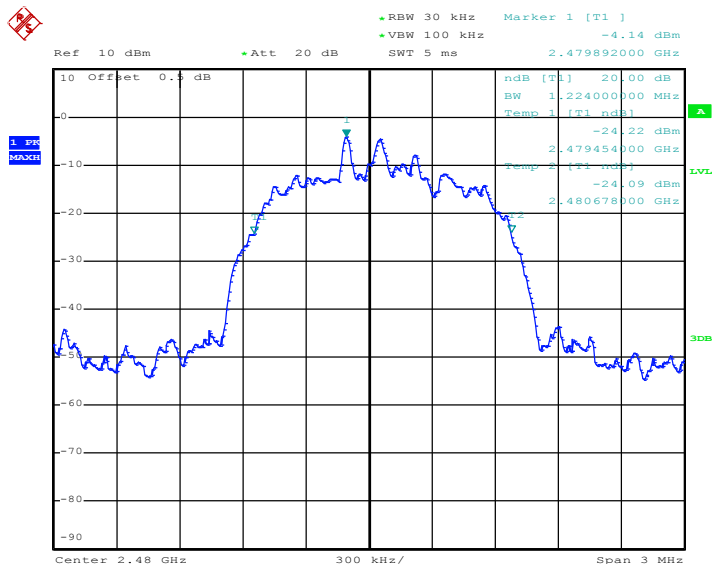
Date: 3.AUG.2021 15:26:34

8DPSK Middle Channel



Date: 3.AUG.2021 15:27:09

8DPSK High Channel



Date: 3.AUG.2021 15:27:33

11. MAXIMUM PEAK OUTPUT POWER

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247), Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(1)	Peak Output Power	0.125 watt or 21dBm	2400-2483.5	PASS

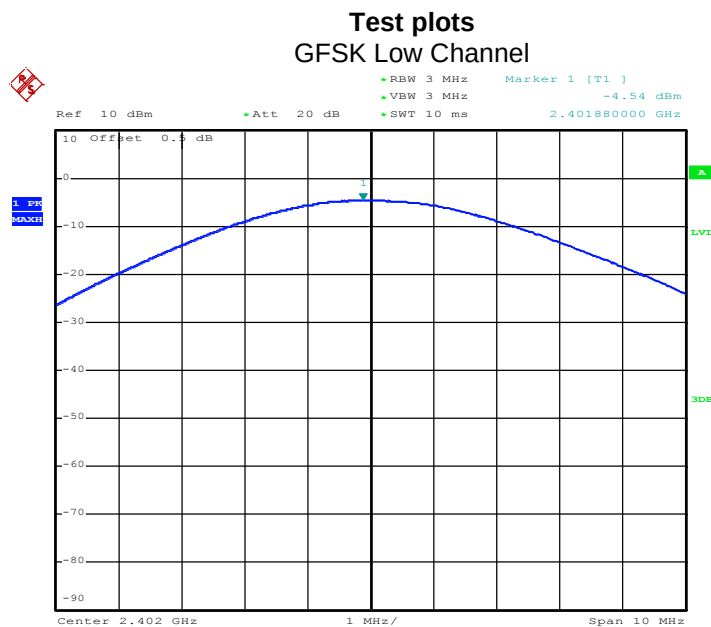
11.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

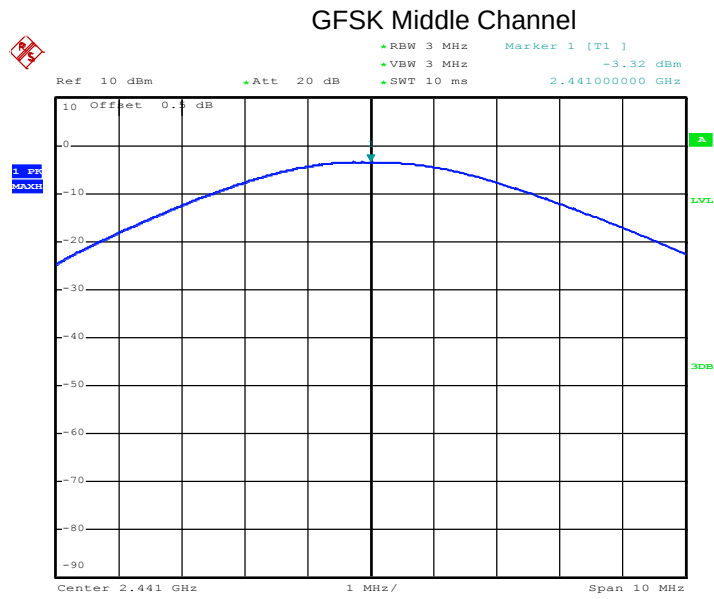
11.4 Test Result

Temperature :	26°C	Relative Humidity :	54%
Test Voltage :	DC 3.7V	Remark:	N/A

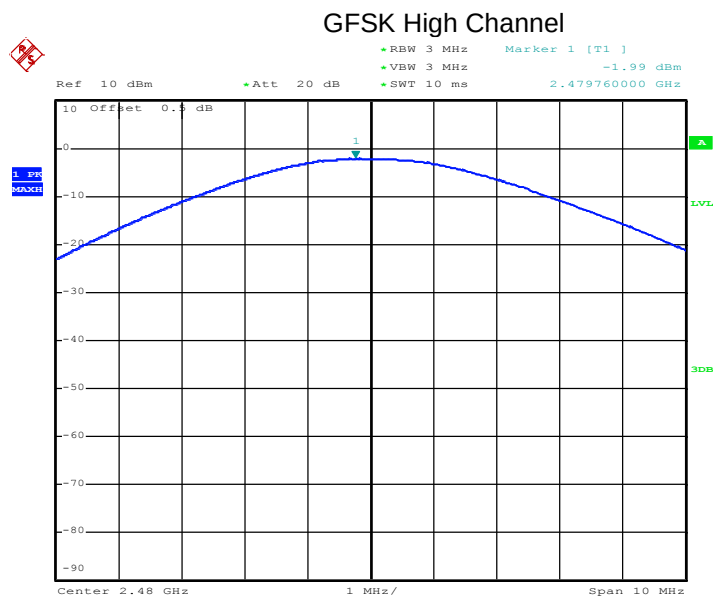
Modulation	Test Channel	Output Power (dBm)	Limit (dBm)
GFSK	Low	-4.54	21
GFSK	Middle	-3.32	21
GFSK	High	-1.99	21
$\pi/4$ DQPSK	Low	-3.89	21
$\pi/4$ DQPSK	Middle	-2.49	21
$\pi/4$ DQPSK	High	-1.34	21
8DPSK	Low	-3.28	21
8DPSK	Middle	-1.97	21
8DPSK	High	-0.85	21



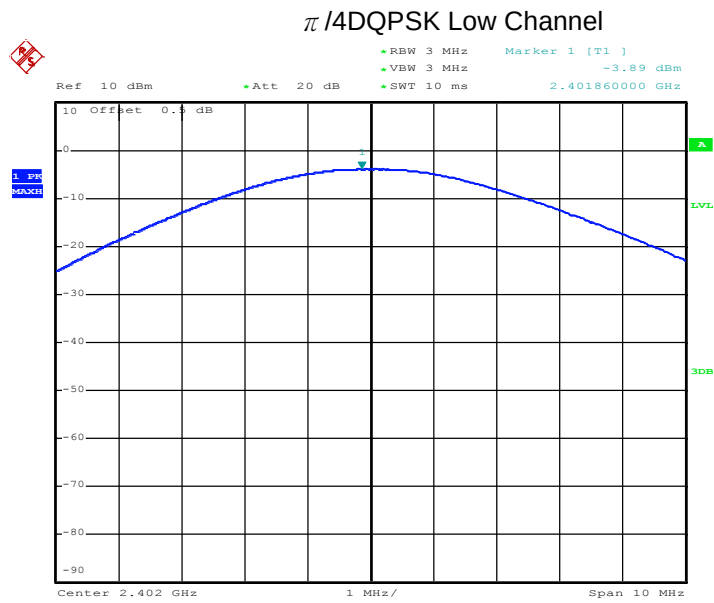
Date: 3.AUG.2021 14:54:16



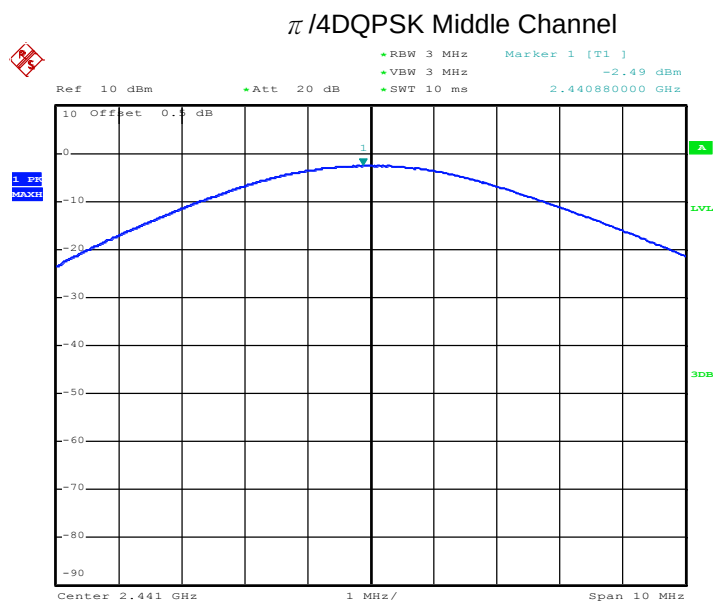
Date: 3.AUG.2021 14:54:40



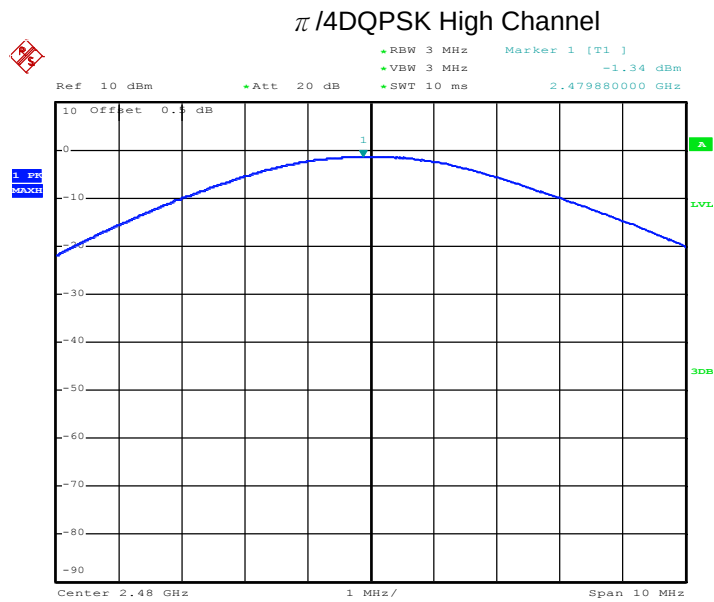
Date: 3.AUG.2021 14:54:58



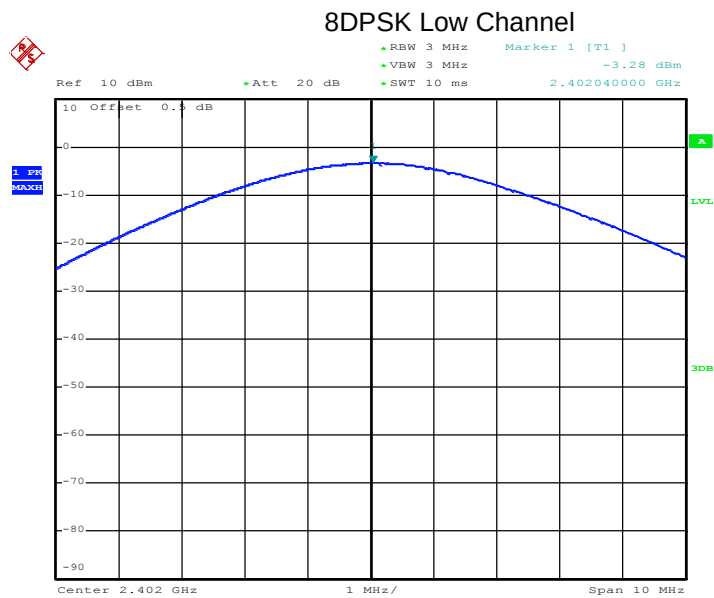
Date: 3.AUG.2021 14:55:23



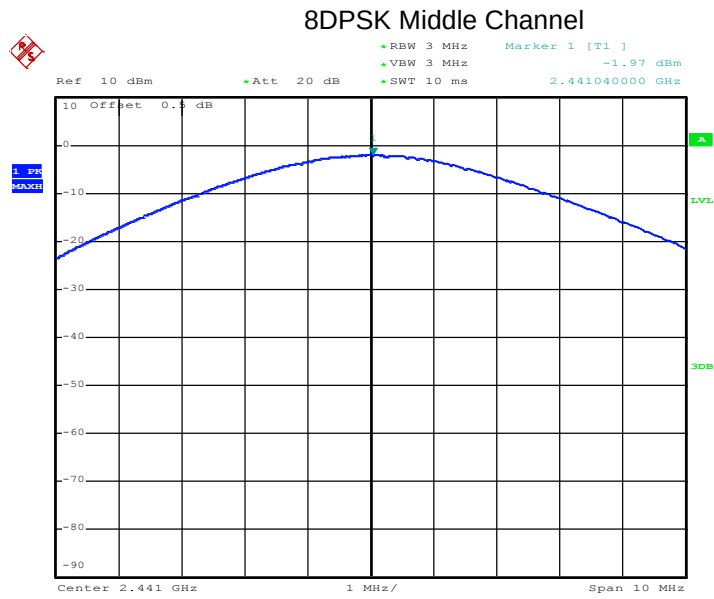
Date: 3.AUG.2021 14:55:46



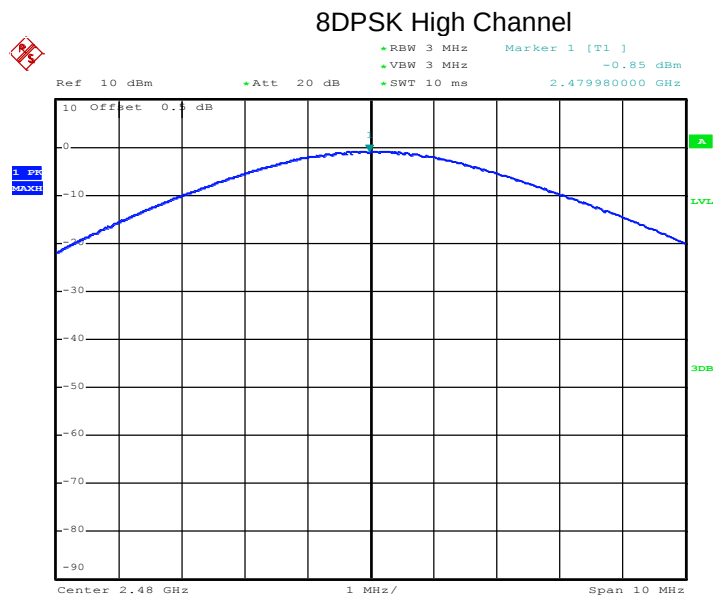
Date: 3.AUG.2021 14:56:06



Date: 3.AUG.2021 14:57:54



Date: 3.AUG.2021 14:57:01



Date: 3.AUG.2021 14:56:26

12. HOPPING CHANNEL SEPARATION

12.1 Block Diagram Of Test Setup



12.2 Limit

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 0.125W.

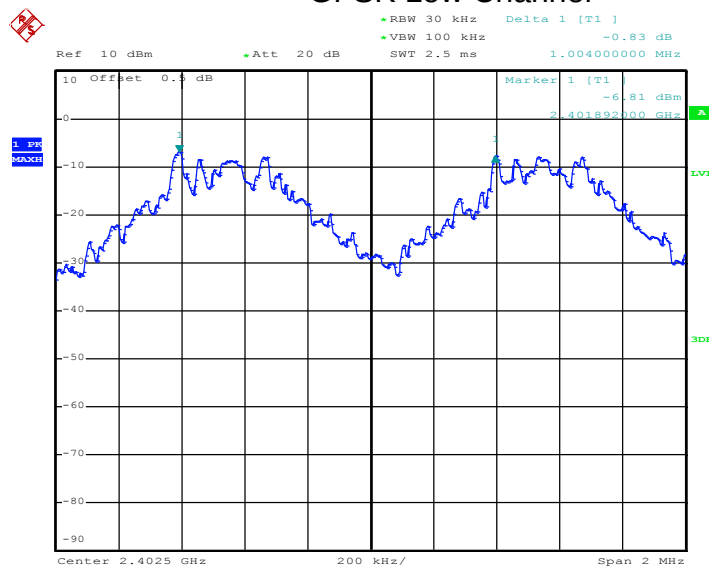
12.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

12.4 Test Result

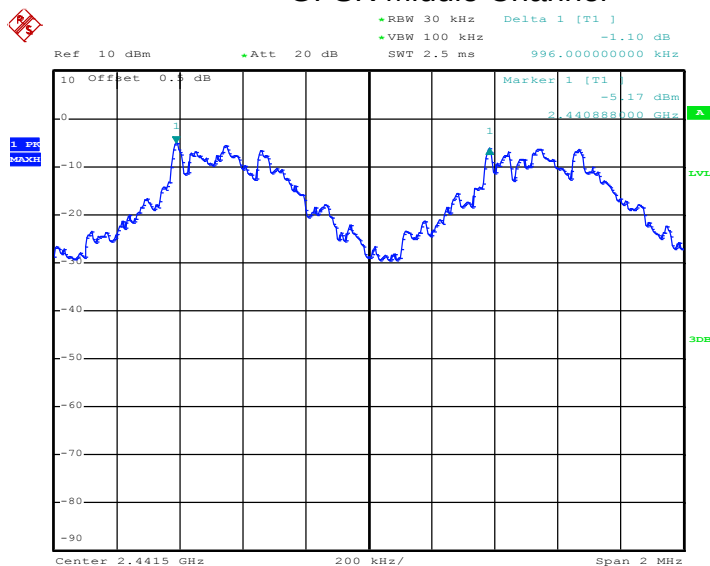
Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.004	0.588	PASS
GFSK	Middle	0.996	0.588	PASS
GFSK	High	1.004	0.588	PASS
$\pi/4$ DQPSK	Low	1.000	0.836	PASS
$\pi/4$ DQPSK	Middle	1.000	0.836	PASS
$\pi/4$ DQPSK	High	0.996	0.836	PASS
8DPSK	Low	1.004	0.816	PASS
8DPSK	Middle	1.004	0.816	PASS
8DPSK	High	1.000	0.816	PASS

Test plots GFSK Low Channel



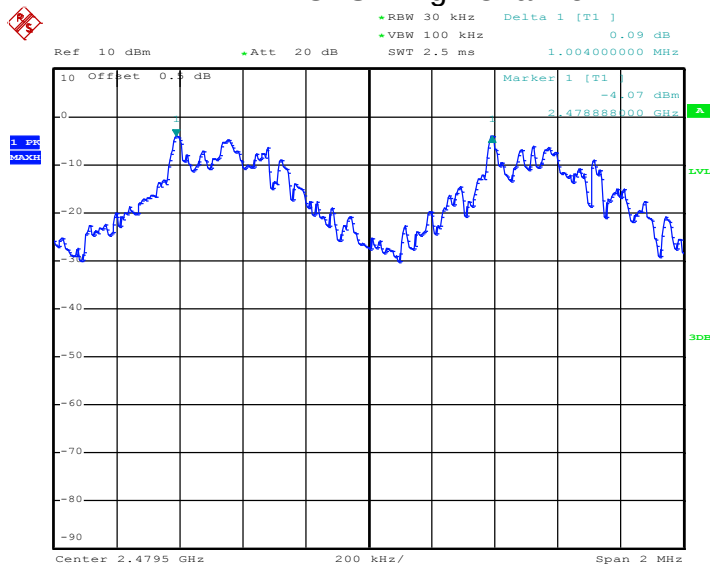
Date: 3.AUG.2021 16:14:58

GFSK Middle Channel



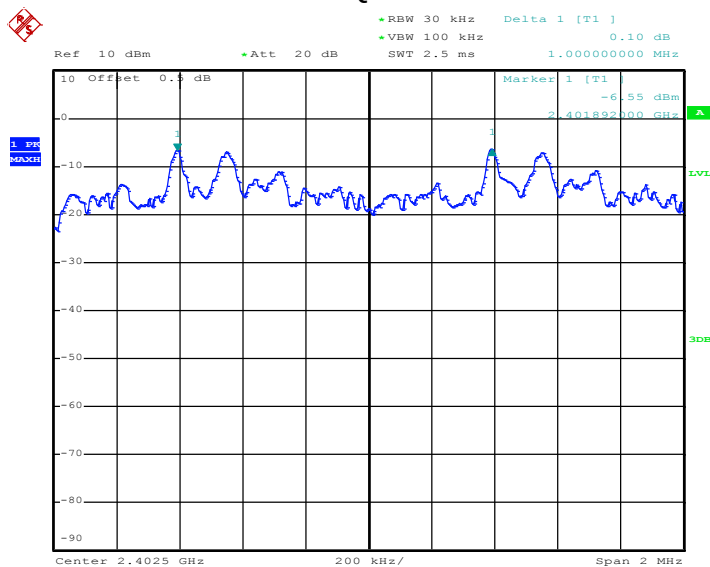
Date: 3.AUG.2021 16:17:14

GFSK High Channel



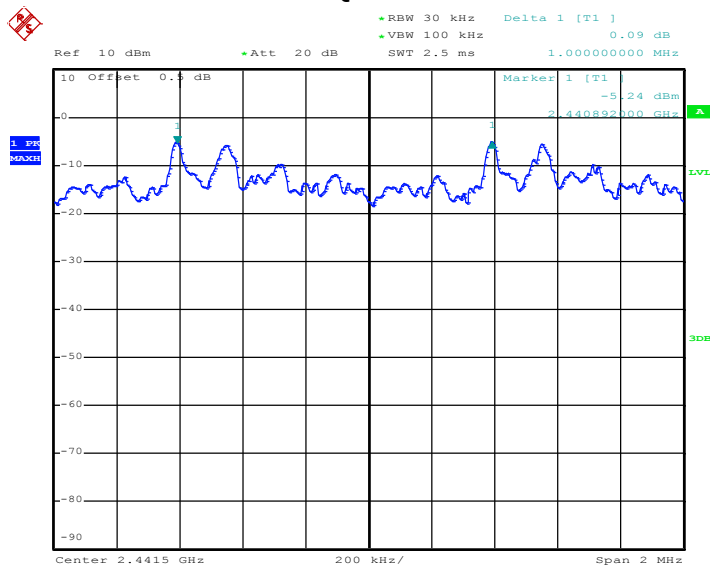
Date: 3.AUG.2021 16:18:23

$\pi/4$ DQPSK Low Channel



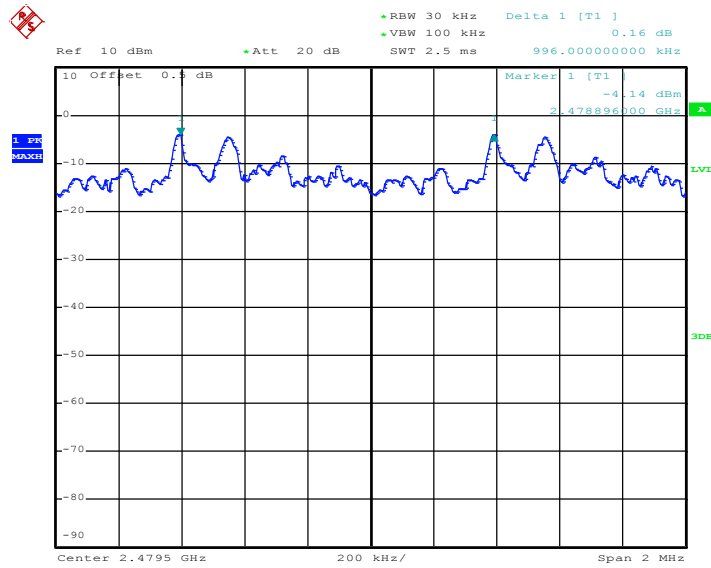
Date: 3.AUG.2021 16:36:40

$\pi/4$ DQPSK Middle Channel



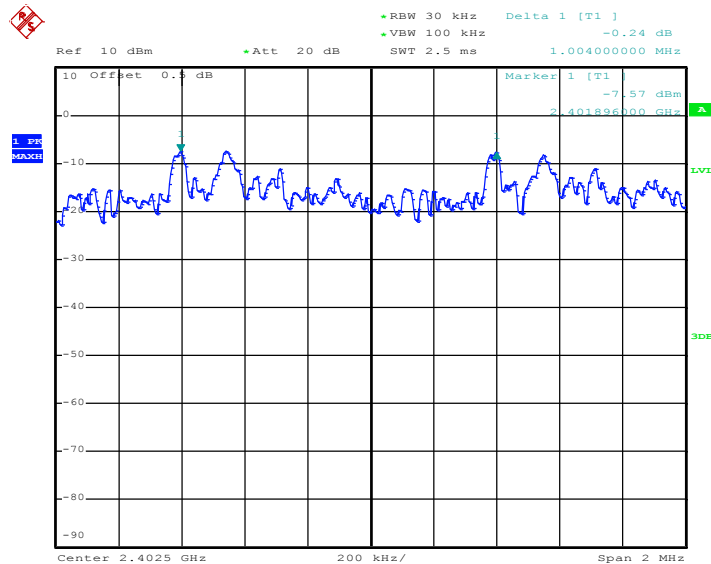
Date: 3.AUG.2021 16:31:35

π /4DQPSK High Channel



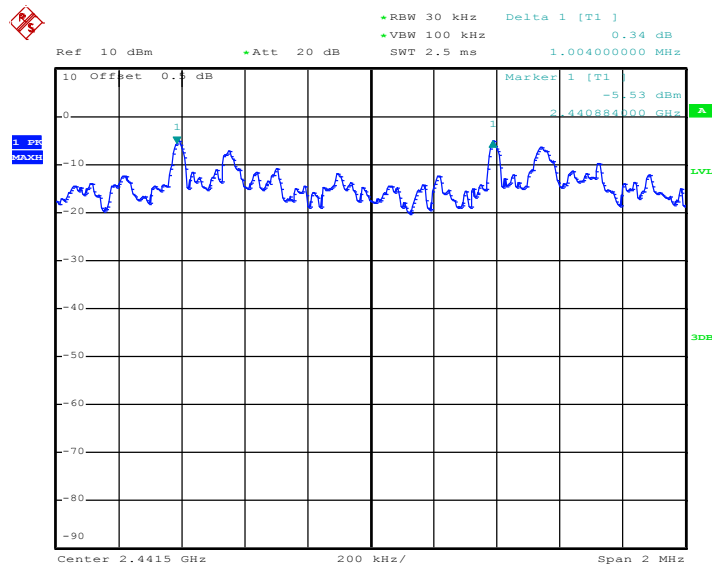
Date: 3.AUG.2021 16:26:16

8DPSK Low Channel



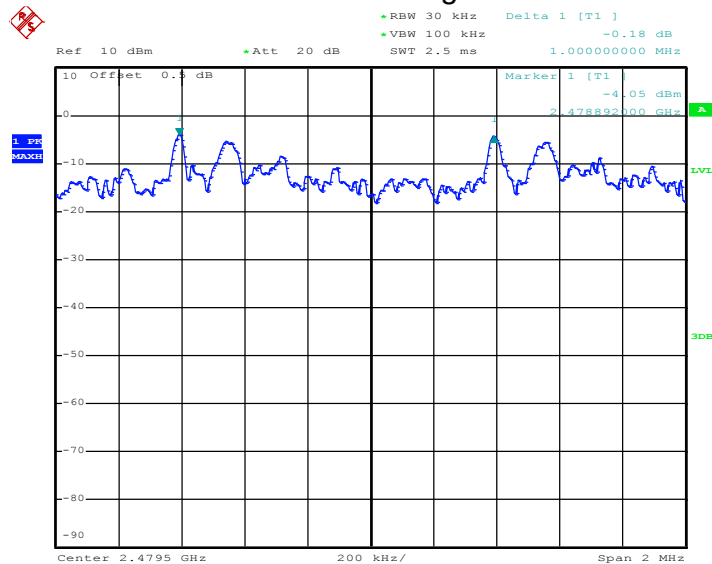
Date: 3.AUG.2021 16:38:51

8DPSK Middle Channel



Date: 3.AUG.2021 16:40:44

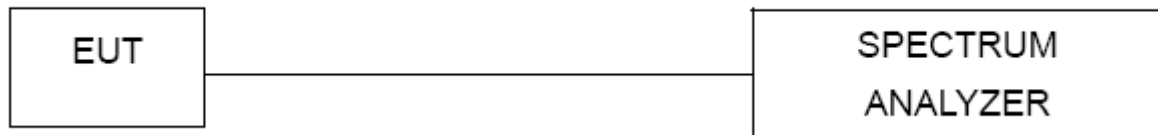
8DPSK High Channel



Date: 3.AUG.2021 16:47:17

13. NUMBER OF HOPPING FREQUENCY

13.1 Block Diagram Of Test Setup



13.2 Limit

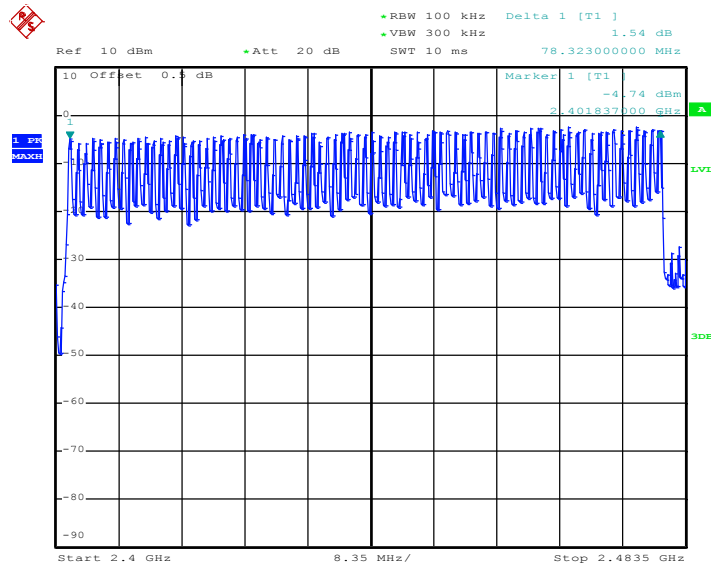
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

13.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

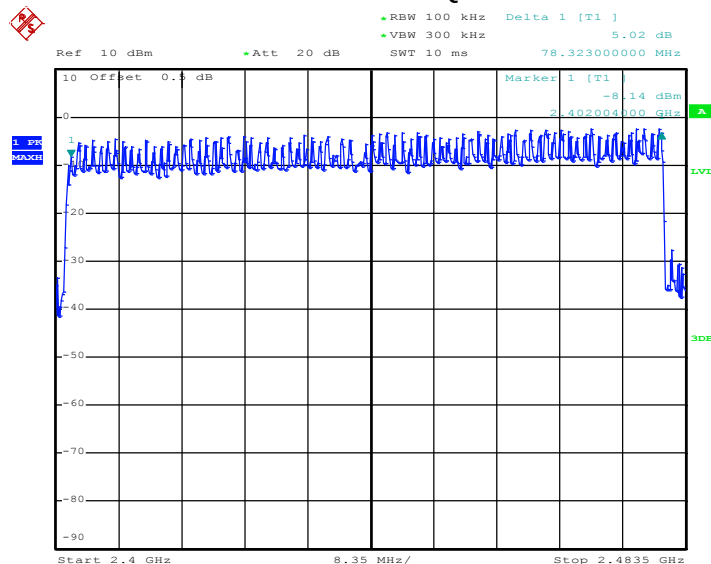
13.4 Test Result

Test Plots: 79 Channels in total GFSK

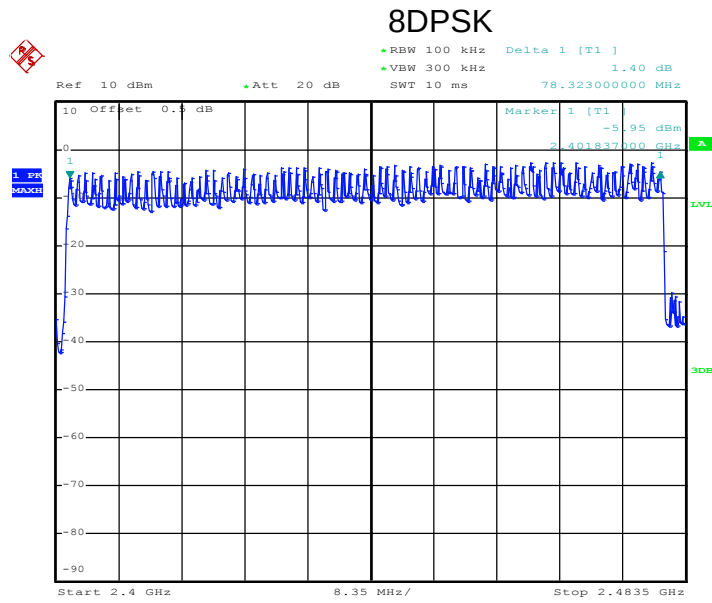


Date: 3.AUG.2021 16:05:47

$\pi/4$ DQPSK



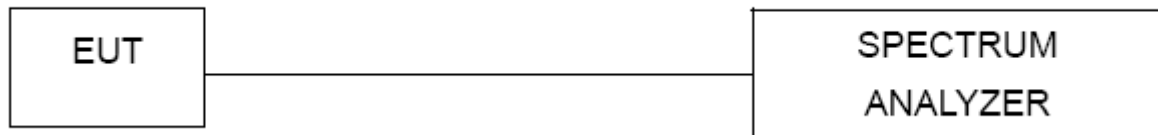
Date: 3.AUG.2021 16:08:42



Date: 3.AUG.2021 16:11:12

14. DWELL TIME

14.1 Block Diagram Of Test Setup



14.2 Limit

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.

14.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

14.4 Test Result

DH5 Packet permit maximum 1600 / 79 / 6 hops per second in each channel (5 time slots RX, 1 time slot TX).

DH3 Packet permit maximum 1600 / 79 / 4 hops per second in each channel (3 time slots RX, 1 time slot TX).

DH1 Packet permit maximum 1600 / 79 / 2 hops per second in each channel (1 time slot RX, 1 time slot TX). So, the Dwell Time can be calculated as follows:

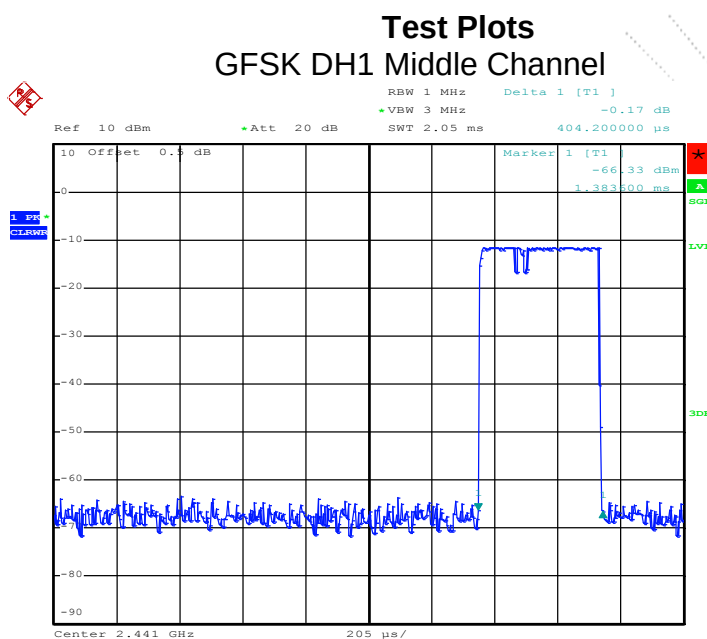
DH5: $1600/79/6 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

DH3: $1600/79/4 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

DH1: $1600/79/2 \times 0.4 \times 79 \times (\text{MkrDelta})/1000$

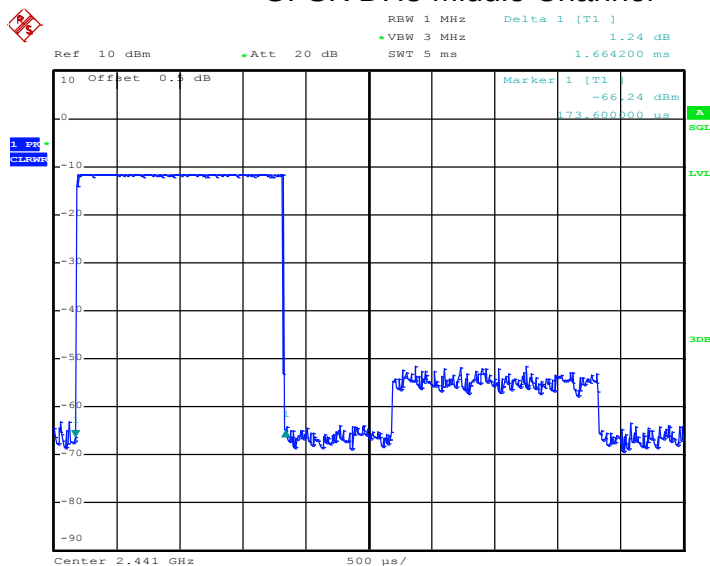
Remark: Mkr Delta is once pulse time.

Modulation	Channel Data	Packet	pulse time(ms)	Dwell Time(s)	Limits(s)
GFSK	Middle	DH1	0.404	0.129	0.4
		DH3	1.664	0.266	0.4
		DH5	2.962	0.316	0.4
$\pi/4$ DQPSK	Middle	2DH1	0.408	0.131	0.4
		2DH3	1.680	0.269	0.4
		2DH5	2.968	0.317	0.4
8DPSK	Middle	3DH1	0.412	0.132	0.4
		3DH3	1.670	0.267	0.4
		3DH5	2.944	0.314	0.4



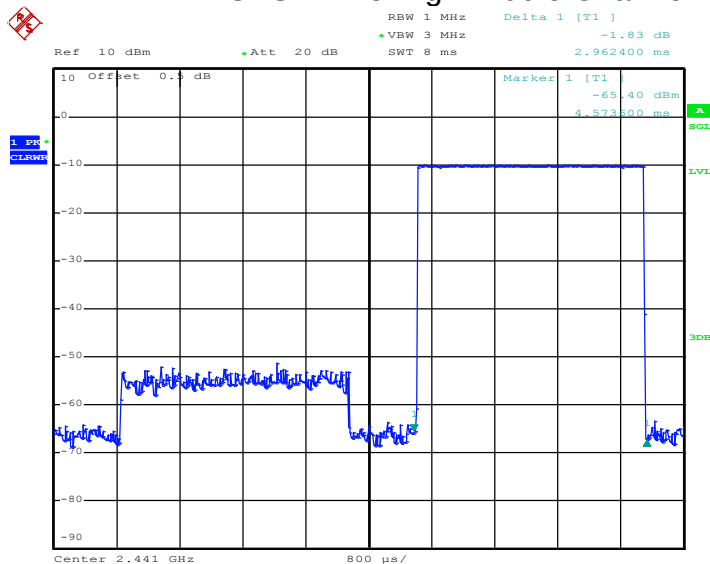
Date: 3.AUG.2021 16:50:39

GFSK DH3 Middle Channel



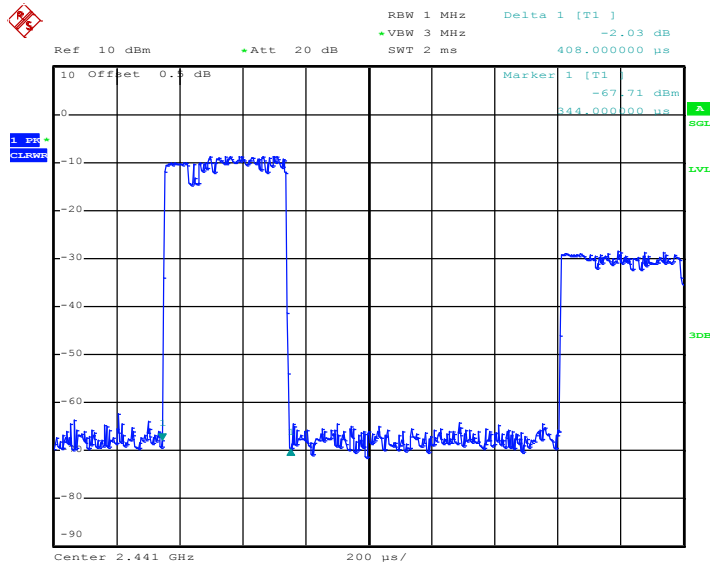
Date: 3.AUG.2021 16:51:26

GFSK DH5 High Middle Channel



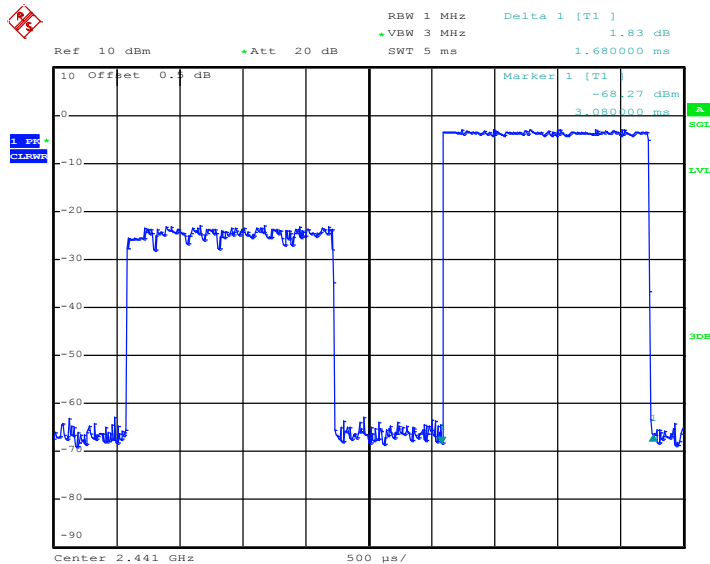
Date: 3.AUG.2021 16:52:32

$\pi/4$ DQPSK DH1 Middle Channel



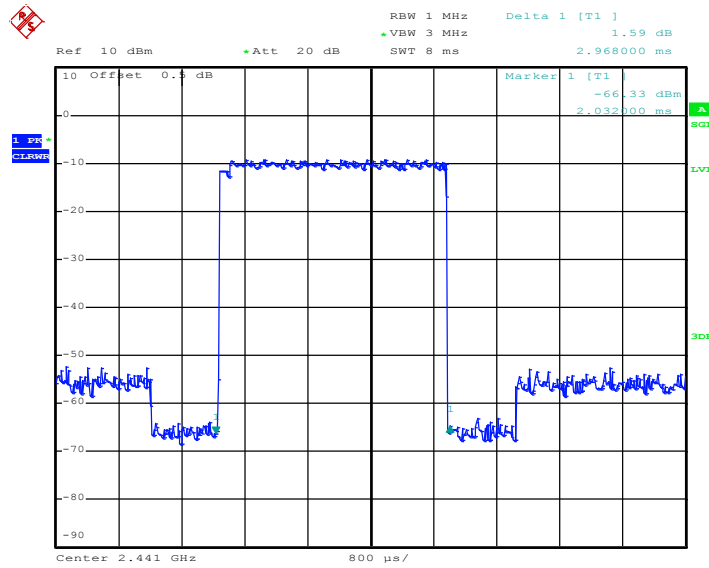
Date: 3.AUG.2021 16:53:14

$\pi/4$ DQPSK DH3 Middle Channel



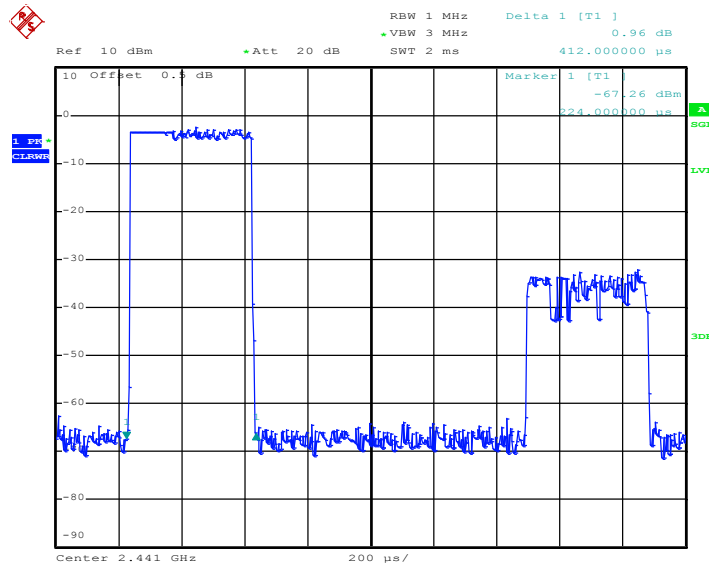
Date: 3.AUG.2021 16:54:00

$\pi/4$ DQPSK DH5 Middle Channel



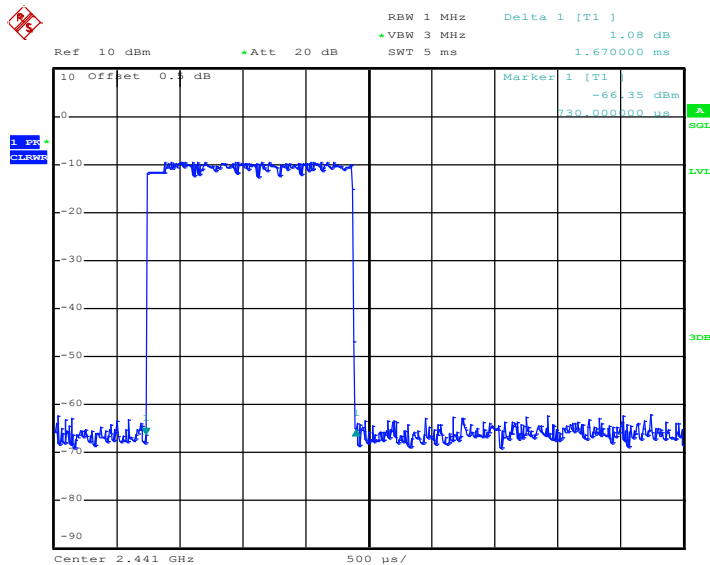
Date: 3.AUG.2021 16:54:56

8DPSK DH1 Middle Channel



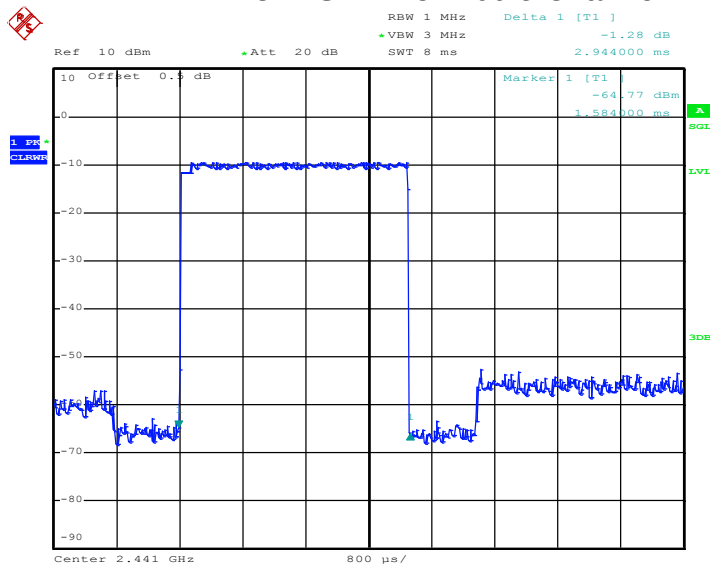
Date: 3.AUG.2021 16:56:13

8DPSK DH3 Middle Channel



Date: 3.AUG.2021 16:56:44

8DPSK DH5 Middle Channel



Date: 3.AUG.2021 16:57:41

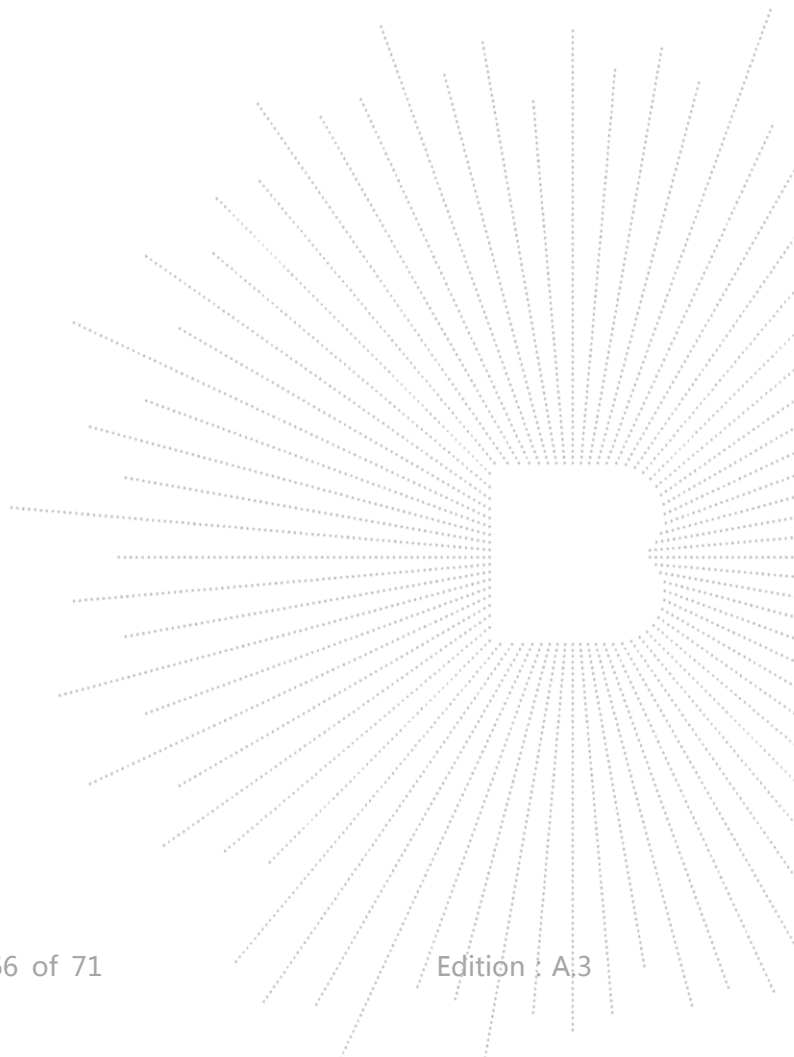
15. ANTENNA REQUIREMENT

15.1 Limit

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.2 Test Result

The EUT antenna is CHIP antenna, fulfill the requirement of this section.



16. EUT PHOTOGRAPHS

EUT Photo 1



EUT Photo 2



EUT Photo 3



EUT Photo 4



17. EUT TEST SETUP PHOTOGRAPHS

Conducted emissions



Radiated Measurement Photos





STATEMENT

- 1.The equipment lists are traceable to the national reference standards.
- 2.The test report can not be partially copied unless prior written approval is issued from our lab.
- 3.The test report is invalid without stamp of laboratory.
- 4.The test report is invalid without signature of person(s) testing and authorizing.
- 5.The test process and test result is only related to the Unit Under Test.
- 6.The quality system of our laboratory is in accordance with ISO/IEC17025.
- 7.If there is any objection to report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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FAX : 0755-33229357

Website : <http://www.chnbctc.com>

E-Mail : bctc@bctc-lab.com.cn

***** END *****