



# 中认信通

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)

## JAPAN MIC

## TEST REPORT

**Applicant:** SUZHOU ZWO CO., LTD.

Address: Building 2, Peninsula Life Plaza, Moon bay road 6 SuZhou Industrial Park, JiangSu, China

**Product Name:** Smart telescope

**Model Number:** Seestar S50

**Standard(s):** Radio Law of Japan item 19 of Article 2 Paragraph 1

The above equipment has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

**Report Number:** CR230737963-07B

**Date Of Issue:** 2023/8/8

**Reviewed By:** Calvin Chen

Title: RF Engineer

**Approved By:** Sun Zhong

Title: Manager

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**Test Facility**

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

**Declarations**

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	CR230737963-07B	Original Report	2023/8/8

## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>	Smart telescope
<b>Trade Name:</b>	Seestar
<b>EUT Model:</b>	Seestar S50
<b>Frequency Range:</b>	2402-2480 MHz
<b>Nominal RF Output Power (Conducted):</b>	GFSK: 0.239mW/MHz; $\pi/4$ -DQPSK: 0.147mW/MHz; 8DPSK: 0.141mW/MHz
<b>Number of TX Chain(s):</b>	1
<b>Number of RX Chain(s):</b>	1
<b>Antenna Gain (dBi)▲:</b>	3.07
<b>Modulation Type:</b>	GFSK, $\pi/4$ -DQPSK, 8DPSK
<b>Rated Input Voltage:</b>	3.7V from battery
<b>Serial Number:</b>	2703-5
<b>EUT Received Date:</b>	2023/7/5
<b>EUT Received Status:</b>	Good

#### Operation Frequency Detail:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	40	2442
1	2403	41	2443
...	...	...	...
...	...	...	...
..	...	78	2480
39	2441	/	/
The test frequencies were performed the test as below:			
Test Channel		Frequency (MHz)	
Lowest		2402	
Middle		2441	
Highest		2480	

#### Accessory Information:

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/

## 1.2 Description of Test Configuration

### 1.2.1 EUT Operation Condition:

<b>EUT Operation Mode:</b>	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.		
<b>Equipment Modifications:</b>	No		
<b>EUT Exercise Software:</b>	MobaXterm-Personal-22.0.exe		
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer ▲ :			
Test Modes	Power Level Setting		
	Lowest	Middle	Highest
GFSK	Default	Default	Default
$\pi/4$ -DQPSK	Default	Default	Default
8DPSK	Default	Default	Default
The extreme voltage test conditions which were declared by the manufacturer and the normal conditions are as below:			
NV, Normal Voltage (Vdc):3.7			
LV, Low Voltage (Vdc): 3.2			
HV, High Voltage (Vdc): 4.2			

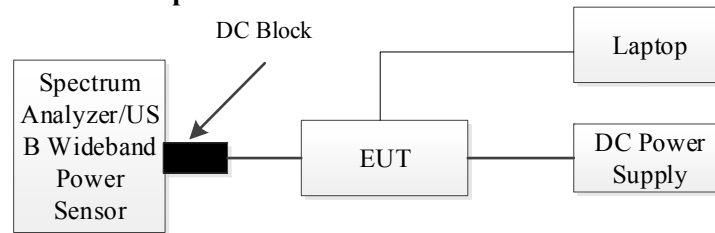
### 1.2.2 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Laptop	T460S	60PDTEK8
ZHAOXIN	DC Power Supply	RXN-6010D	21R6010D0912386

### 1.2.3 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
USB Cable	No	No	1	EUT	Laptop
Power Cable	No	No	1.5	EUT	DC Power Supply

### 1.2.4 Block Diagram of Test Setup



### 1.3 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Frequency Error	$\pm 0,5$ ppm
Occupied bandwidth and spreading bandwidth	$\pm 5$ %
RF output power, conducted	$\pm 0.61$ dB
Unwanted Emissions (TX&RX), conducted	$\pm 2.47$ dB
Temperature	$\pm 1$ °C
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 0.4$ %
Duty Cycle	1 %

## 2. 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	Compliant
4	Occupied Bandwidth and Spreading Bandwidth	Compliant
5	Transmitter Spurious Emission and Unwanted Emission Intensity	Compliant
6	Antenna Output Power and Output Power Tolerance	Compliant
7	Receiver Spurious Emission and Unwanted Emission Intensity	Compliant
8	Carrier sense capability (1)	Not Applicable*
9	Carrier sense capability (2)	Not Applicable**
10	Transmission Antenna Gain	Not Applicable***
11	Transmission Radiation Angle Width	Not Applicable***
12	Interference Prevention Function	Compliant
13	Frequency Hopping Dwell Time	Compliant
Note 1	Construction Protection Confirmation	Compliant

**Note:**

*Not Applicable\*:* Only required for OBW between 26MHz and 40MHz with OFDM modulation type.

*Not Applicable\*\*:* Only required for outdoor use radio control of model airplanes.

*Not Applicable\*\*\*:* This item not applicable when the EIRP less than the limit.



### 3. REQUIREMENTS AND TEST PROCEDURES

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#### 3.1 Frequency Error

##### 3.1.1 Limit

Within  $\pm 50\text{ppm}$ .

##### 3.1.2 Test Procedure

Set the EUT to the measurement frequency without modulation.

Setting of SA is following as: Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode:

Positive peak / Trace mode: Max hold.

Record the peak spot frequency.

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

#### 3.2 Occupied Bandwidth and Spreading Bandwidth

##### 3.2.1 Limit

- Occupied bandwidth:  $\leq 83.5\text{ MHz}$
- Spread Bandwidth:  $\geq 500\text{ kHz}$ , Spread factor  $\geq 5$ .

##### 3.2.2 Test Procedure

- ❖ Conditions of Application Equipment (EUT)
  - The modulation state shall be "continuous frequency-hopping mode" by spread spectrum.
- ❖ Spectrum Analyzer Conditions
  - RBW: 300 kHz
  - VBW: 300 kHz
  - Sweep time: Auto, Marker: Marker Off
  - Log scale: 10dB/Div, Data points: 501points (400 points or more)
  - Detection: Positive Peak, Sweep mode: Continuous

### 3.3 Transmitter Spurious Emission Strength and Unwanted Emission Intensity

#### 3.3.1 Limit

- $f < 1000 \text{ MHz}$ :  $\leq 0.25 \mu\text{W}/100\text{kHz}$
- $f < 2387 \text{ MHz}$ ,  $f > 2496.5 \text{ MHz}$ :  $\leq 2.5 \mu\text{W}/\text{MHz}$
- $2387 \text{ MHz} \leq f \leq 2400 \text{ MHz}$ ;  $2483.5 \text{ MHz} < f \leq 2496.5 \text{ MHz}$ :  $\leq 25 \mu\text{W}/\text{MHz}$

#### 3.3.2 Test Procedure

❖ Conditions of Application Equipment (EUT)

- The modulation state shall be in continuously transmitting mode.

❖ Spectrum Analyzer Conditions

Step1:

- Setting of SA start 30MHz and stop frequency 1000MHz, RB:100kHz/VB:100kHz, Sweep time: Auto. Sweep mode: continuous sweep. Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $0.25 \mu\text{W}/100\text{kHz}$ .
- Setting of SA start 1000MHz and stop frequency 2387MHz, RBW: 1MHz/VBW: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep. Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. Reading value + cable loss shall be less than  $2.5 \mu\text{W}/\text{MHz}$ .
- Setting of SA start 2387MHz and stop frequency 2400MHz, RBW: 1MHz/VBW: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep. Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. Reading value + cable loss shall be less than  $25 \mu\text{W}/\text{MHz}$ .
- Setting of SA start 2483.5MHz and stop frequency 2496.5MHz, RBW: 1MHz/VBW: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep. Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. Reading value + cable loss shall be less than  $25 \mu\text{W}/\text{MHz}$ .
- Setting of SA start 2496.5MHz and stop frequency 12500MHz, RBW: 1MHz/VBW: 1MHz, Sweep time: Auto. Sweep mode: continuous sweep. Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. Reading value + cable loss shall be less than  $2.5 \mu\text{W}/\text{MHz}$ .

Step 2:

Center frequency: Searched Frequency

Span: 0Hz

RBW:1MHz (Above 1GHz), 100 kHz(30MHz-1GHz). VBW: Same as RBW.

Sweep time: Auto (Minimum time to ensure measurement accuracy. \*In case of burst wave, one burst shall be included per data point) Data points: 400 points or more. Sweep mode: Single Sweep.

Detection Mode: Sample

### 3.4 Antenna Output Power and Antenna Power Tolerance

#### 3.4.1 Limit

- $\leq 3 \text{ mW /MHz}$
- The Output Power Tolerance must be within +20% ~ -80%.
- $\text{EIRP} \leq 6.91 \text{ dBm/MHz}$

#### 3.4.2 Test Procedure

For FHSS UUT:

Connect the UUT to the power meter in a state of hopping mode.

### 3.5 Receiver Spurious Emission and Unwanted Emission Intensity

#### 3.5.1 Limit

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

#### 3.5.2 Test Procedure

❖ 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 12.5GHz)
- 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

### 3.6 Interference Prevention Function

#### 3.6.1 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.

#### 3.6.2 Test Procedure

Measurement System Diagram:



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.

#### 3.6.3 Measurement Result

**Test Result:** Good

### 3.7 Frequency Hopping Dwell Time

#### 3.7.1 Applicable Standard

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

#### 3.7.2 Test Procedure

❖ 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”.

### 3.8 Note 1 - Construction Protection Confirmation

#### 3.8.1 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.

#### 3.8.2 Confirmation Method

The RF part (include antenna) covered by EUT case with metal screw, it can't be opened easily. Please refer the EUT photo.

## 4. TEST DATA AND RESULTS

### 4.1 Test Environmental Conditions & Test Equipment List and Details

Test Date:		2023/7/24~2023/7/25			
Tester:		LingLing Li			
Environmental Conditions:					
Temperature: (°C)	26.1~26.2	Relative Humidity: (%)	59~60	ATM Pressure: (kPa)	100.2~100.4

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date	Calibration Agency	Calibration Method <sup>Note</sup>
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/03/30	BACL	C
zhuoxiang	Coaxial Cable	SMA-178	211001	Each time	N/A	/	/
Agilent	USB Wideband Power Sensor	U2021XA	MY5000043 2	2023/3/31	2024/3/30	CCIC	C
UNI-T	Multimeter	UT39A+	C210582554	2022/09/29	2023/09/28	CCIC	C
ZHAOXIN	DC Power Supply	RXN-6010D	21R6010D09 12386	N/A	N/A	/	/

\* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Note:

- A. Calibration conducted by the National Institute of Information and Communications Technology (NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1).
- B. Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992).
- C. Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
- D. Calibration conducted by using measuring instruments and other equipment which shall have been given any of calibration, etc. listed above from a) to c)

## 4.2 Frequency Error

**Test Result:** Compliant

*Test Mode: Transmitting*

Mode	Test Condition	Channel	Test Frequency (MHz)	Measured Frequency (MHz)	Result (ppm)	Limit (ppm)
Single Carrier	NV	Low	2402	2401.985577	-6.00	± 50
		Middle	2441	2440.990385	-3.94	
		High	2480	2479.994391	-2.26	
	LV	Low	2402	2401.985588	-6.00	± 50
		Middle	2441	2440.990396	-3.93	
		High	2480	2479.994399	-2.26	
	HV	Low	2402	2401.985571	-6.01	± 50
		Middle	2441	2440.990380	-3.94	
		High	2480	2479.994382	-2.27	

*Note:*

$$Tolerance = (Measured\ Frequency - Test\ Frequency) / Test\ Frequency * 10^6$$

Please refer to the plots for normal voltage test:

Date: 25.JUL.2023 11:50:29

Date: 25.JUL.2023 11:52:45

Date: 25.JUL.2023 11:51:16

### 4.3 Occupied Bandwidth and Spreading Bandwidth

**Test Result: Compliant**

*Test Mode: Transmitting*

Test Condition	Mode	Occupied bandwidth (MHz)		Spreading bandwidth (MHz)		Spreading factor	
		Measured	Limit	Measured	Limit	Measured	Limit
NV	GFSK	78.281	$\leq 83.5$	71.055	$\geq 0.5$	71.055	$\geq 5$
	$\pi/4$ DQPSK	78.549		71.189		71.189	
	8DPSK	78.415		71.055		71.055	
LV	GFSK	78.296	$\leq 83.5$	71.085	$\geq 0.5$	71.085	$\geq 5$
	$\pi/4$ DQPSK	78.558		71.199		71.199	
	8DPSK	78.452		71.087		71.087	
HV	GFSK	78.272	$\leq 83.5$	71.042	$\geq 0.5$	71.042	$\geq 5$
	$\pi/4$ DQPSK	78.533		71.168		71.168	
	8DPSK	78.402		71.041		71.041	

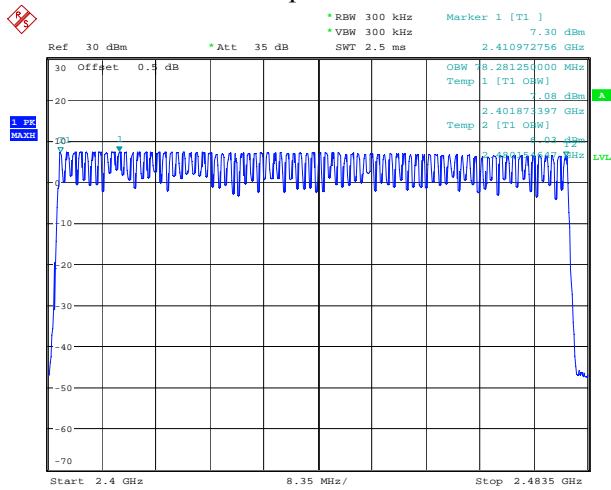
*Note:*

*Spread Factor=Spread Bandwidth/modulation rate. The modulation rate: MR=1.*

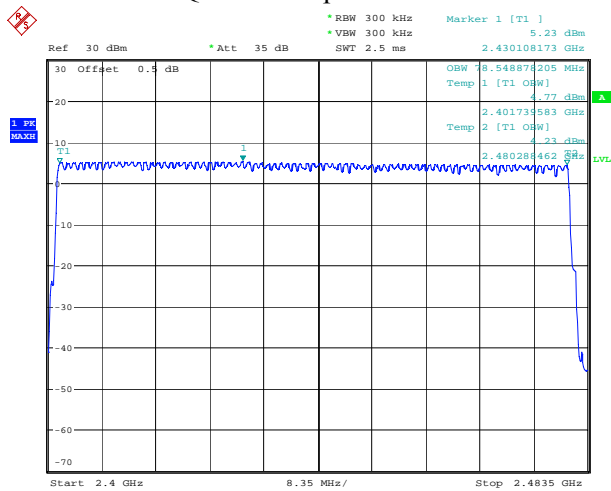
Please refer to the below plots for normal voltage test:



## GFSK Occupied Bandwidth

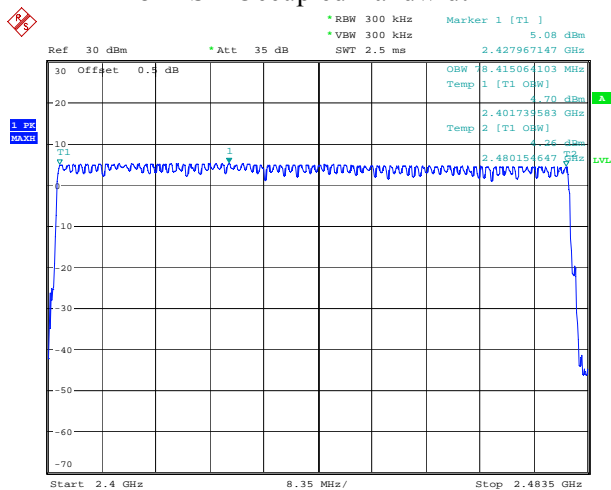


Date: 24.JUL.2023 16:20:13

 $\pi/4$ -DQPSK Occupied Bandwidth

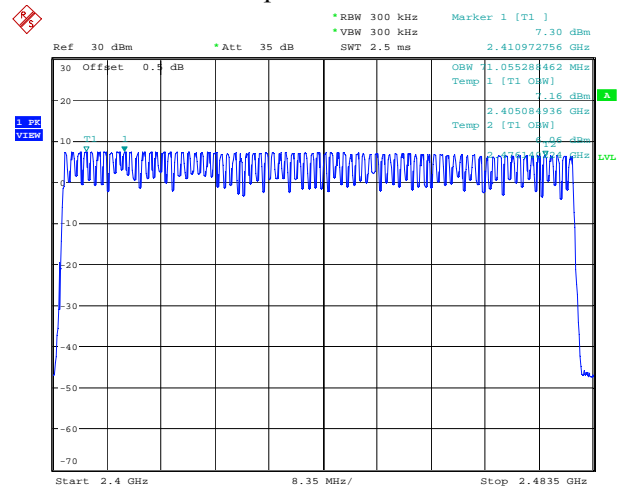
Date: 24.JUL.2023 16:37:03

## 8DPSK Occupied Bandwidth

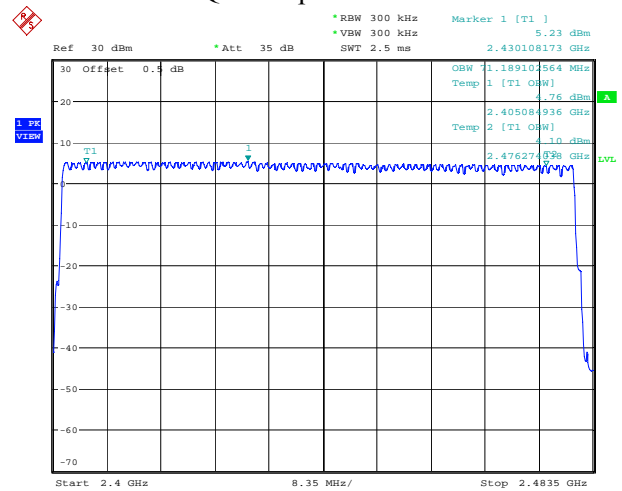


Date: 24.JUL.2023 17:01:10

## GFSK Spread Bandwidth

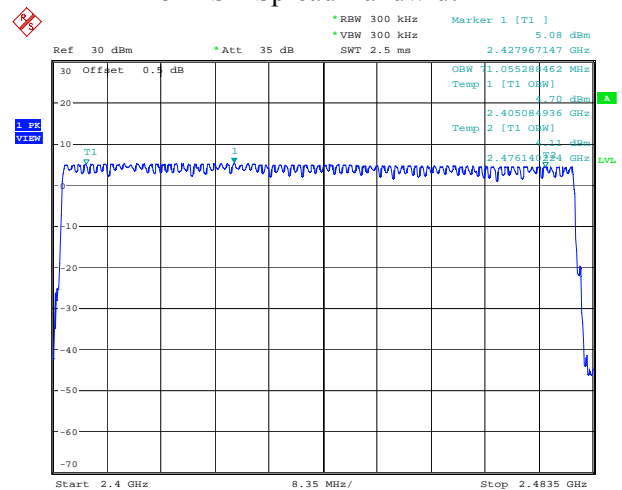


Date: 24.JUL.2023 16:20:14

 $\pi/4$ -DQPSK Spread Bandwidth

Date: 24.JUL.2023 16:37:05

## 8DPSK Spread Bandwidth



Date: 24.JUL.2023 17:01:11

#### 4.4 Transmitter Spurious Emission Strength and Unwanted Emission Intensity

**Test Result: Compliant**

*Test Mode: Transmitting*

Test Condition	Mode	Test Band (RBW)	Result (dBm/RBW)			Limit (dBm/RBW)	Limit (μW/RBW)
			Low Channel	Middle Channel	High Channel		
NV	GFSK	Band I (100kHz)	-55.20	-54.93	-55.39	-36	0.25
		Band II (1MHz)	-44.49	-44.29	-44.38	-26	2.5
		Band III (1MHz)	-16.35	-44.18	-43.71	-16	25
		Band IV (1MHz)	-43.83	-43.10	-36.82	-16	25
		Band V (1MHz)	-32.15	-32.07	-31.52	-26	2.5
	$\pi/4$ DQPSK	Band I (100kHz)	-54.96	-55.49	-54.98	-36	0.25
		Band II (1MHz)	-44.66	-44.63	-44.69	-26	2.5
		Band III (1MHz)	-26.05	-43.96	-44.15	-16	25
		Band IV (1MHz)	-42.87	-42.33	-35.07	-16	25
		Band V (1MHz)	-30.18	-30.41	-31.06	-26	2.5
	8DPSK	Band I (100kHz)	-55.43	-55.32	-55.46	-36	0.25
		Band II (1MHz)	-45.02	-44.59	-44.70	-26	2.5
		Band III (1MHz)	-26.08	-43.13	-44.03	-16	25
		Band IV (1MHz)	-43.30	-43.27	-34.68	-16	25
		Band V (1MHz)	-32.05	-31.86	-32.03	-26	2.5
LV	GFSK	Band I (100kHz)	-54.67	-54.27	-54.50	-36	0.25
		Band II (1MHz)	-43.89	-44.04	-43.68	-26	2.5
		Band III (1MHz)	-16.15	-44.17	-42.82	-16	25
		Band IV (1MHz)	-43.40	-42.64	-35.99	-16	25
		Band V (1MHz)	-31.79	-31.33	-30.70	-26	2.5
	$\pi/4$ DQPSK	Band I (100kHz)	-54.51	-54.99	-54.63	-36	0.25
		Band II (1MHz)	-43.75	-44.07	-44.18	-26	2.5
		Band III (1MHz)	-25.57	-43.32	-44.11	-16	25
		Band IV (1MHz)	-42.65	-41.47	-34.55	-16	25
		Band V (1MHz)	-29.49	-30.08	-30.86	-26	2.5
	8DPSK	Band I (100kHz)	-55.35	-54.33	-55.37	-36	0.25
		Band II (1MHz)	-44.57	-44.30	-44.36	-26	2.5
		Band III (1MHz)	-25.76	-43.04	-43.88	-16	25
		Band IV (1MHz)	-42.40	-42.63	-34.19	-16	25
		Band V (1MHz)	-31.98	-31.39	-31.70	-26	2.5

Test Condition	Mode	Test Band (RBW)	Result (dBm/RBW)			Limit (dBm/RBW)	Limit ( $\mu$ W/RBW)
			Low Channel	Middle Channel	High Channel		
HV	GFSK	Band I (100kHz)	-55.85	-55.30	-56.04	-36	0.25
		Band II (1MHz)	-45.41	-44.80	-45.26	-26	2.5
		Band III (1MHz)	-16.46	-45.00	-43.74	-16	25
		Band IV (1MHz)	-44.15	-43.93	-37.73	-16	25
		Band V (1MHz)	-32.96	-33.06	-31.63	-26	2.5
	$\pi/4$ DQPSK	Band I (100kHz)	-55.75	-56.14	-55.37	-36	0.25
		Band II (1MHz)	-45.28	-44.77	-45.24	-26	2.5
		Band III (1MHz)	-26.38	-44.70	-44.87	-16	25
		Band IV (1MHz)	-43.76	-43.25	-35.95	-16	25
		Band V (1MHz)	-30.82	-30.63	-31.88	-26	2.5
	8DPSK	Band I (100kHz)	-55.49	-56.26	-55.64	-36	0.25
		Band II (1MHz)	-45.29	-44.93	-45.29	-26	2.5
		Band III (1MHz)	-26.37	-43.79	-44.57	-16	25
		Band IV (1MHz)	-44.07	-43.62	-34.87	-16	25
		Band V (1MHz)	-32.15	-32.38	-32.55	-26	2.5

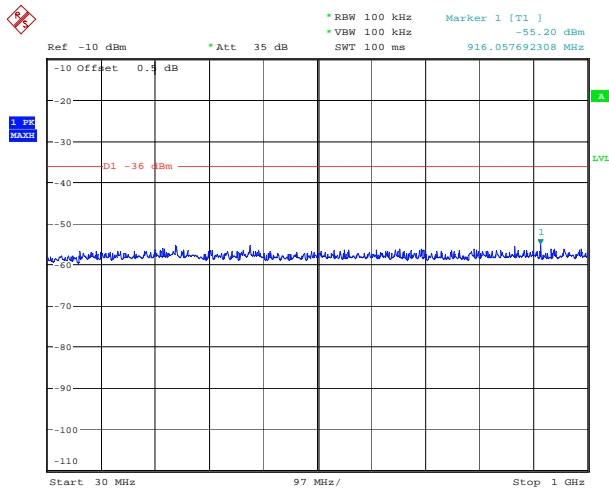
Note:

*Band I: 30MHz ~ 1000MHz*  
*Band II: 1000MHz ~ 2387MHz*  
*Band III: 2387MHz ~ 2400MHz*  
*Band IV: 2483.5MHz ~ 2496.5MHz*  
*Band V: 2496.5MHz ~ 12500MHz*

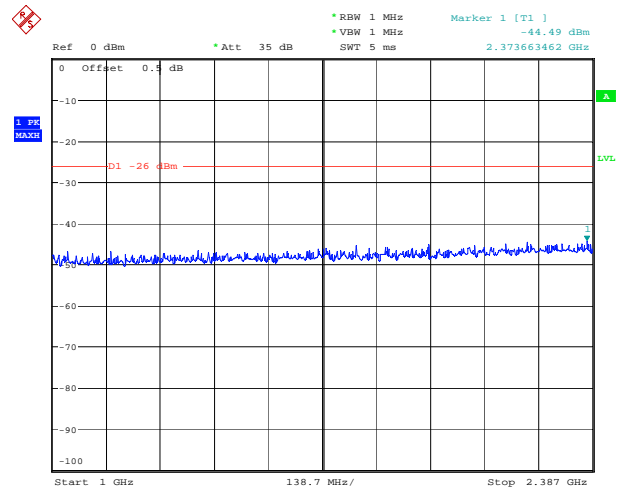
Please refer to the below plots for normal voltage test.

## GFSK:

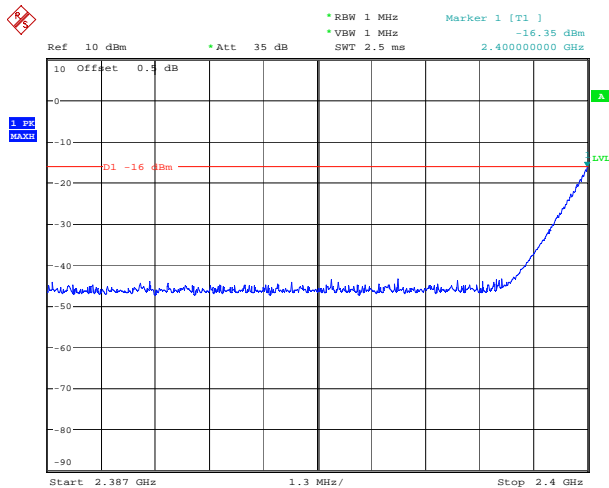
## Low Channel



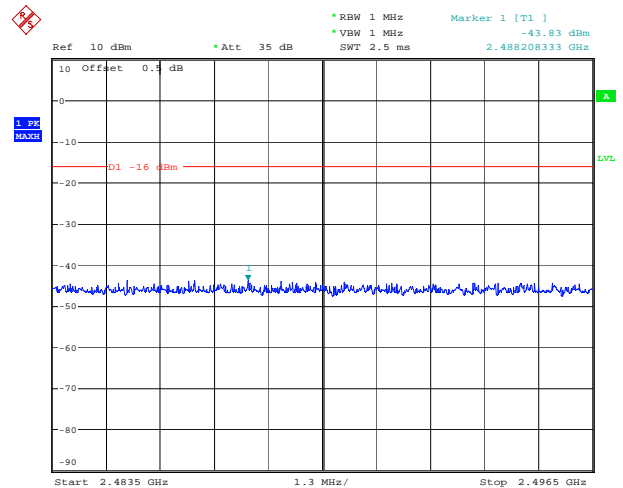
Date: 24.JUL.2023 16:00:06



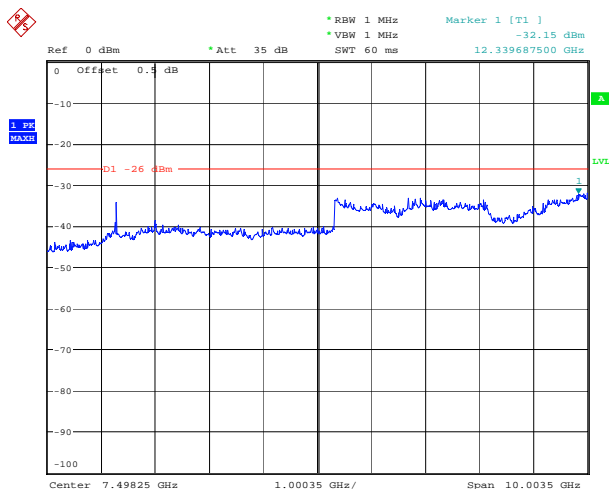
Date: 24.JUL.2023 16:00:19



Date: 24.JUL.2023 16:00:34

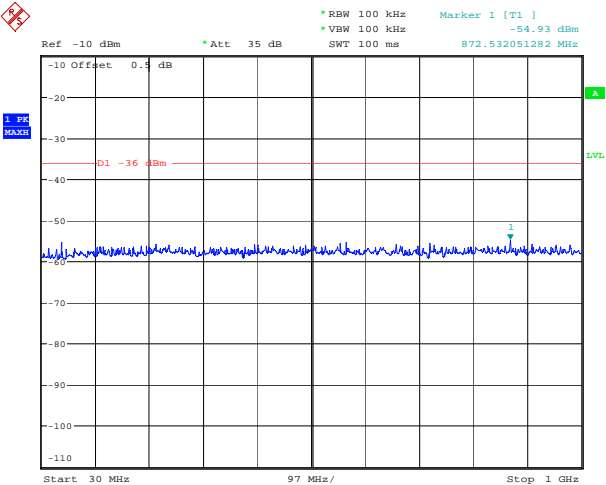


Date: 24.JUL.2023 16:00:45

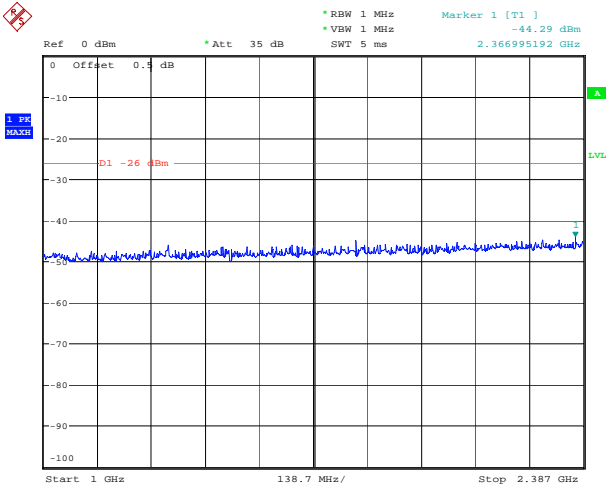


Date: 24.JUL.2023 17:44:51

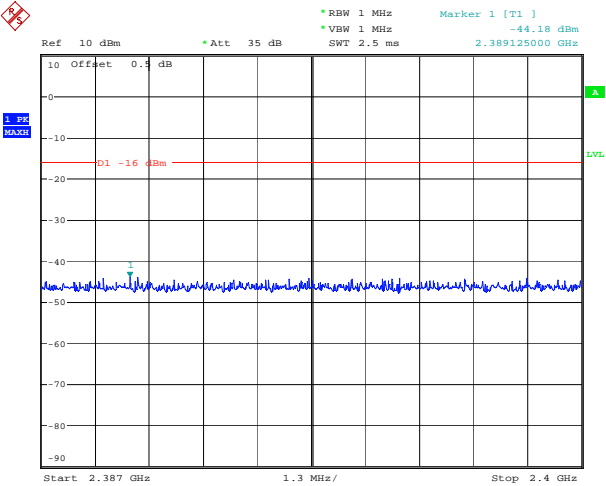
Middle Channel



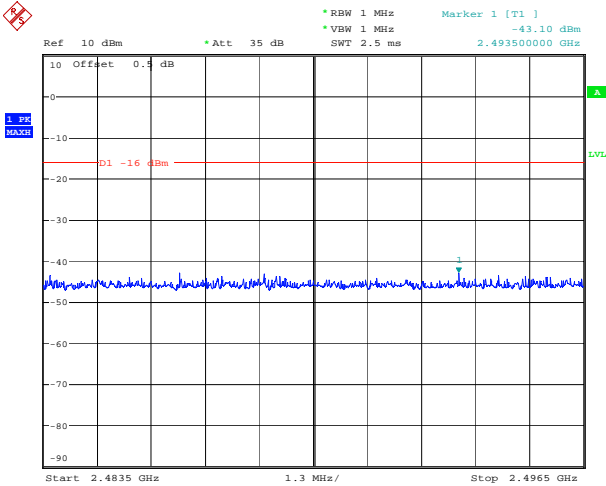
Date: 24.JUL.2023 16:01:23



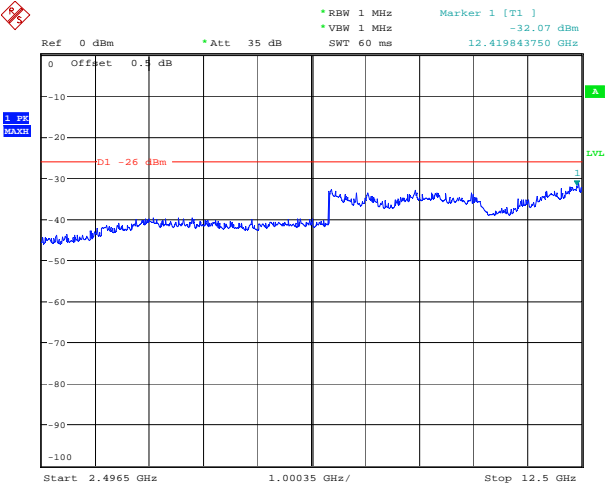
Date: 24.JUL.2023 16:01:38



Date: 24.JUL.2023 16:01:50

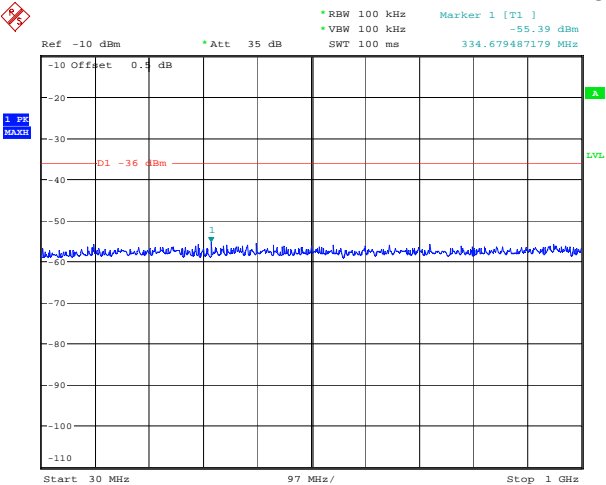


Date: 24.JUL.2023 16:02:04

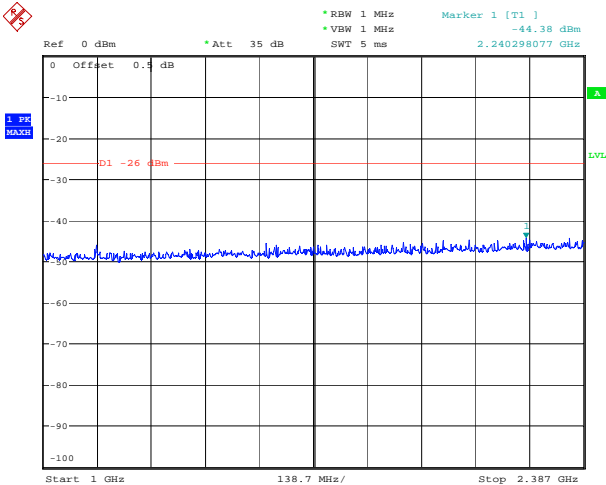


Date: 24.JUL.2023 17:46:02

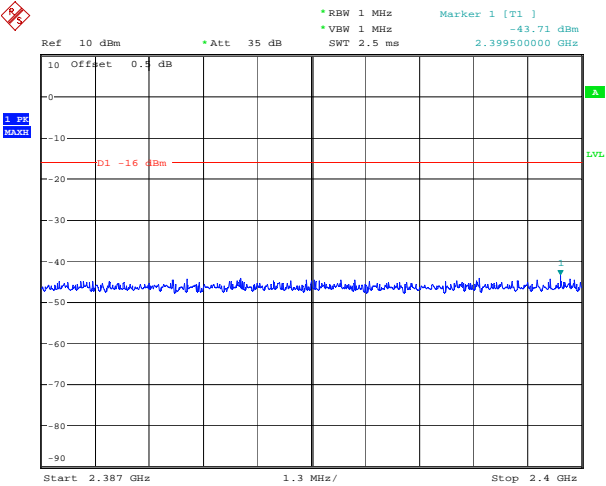
High Channel



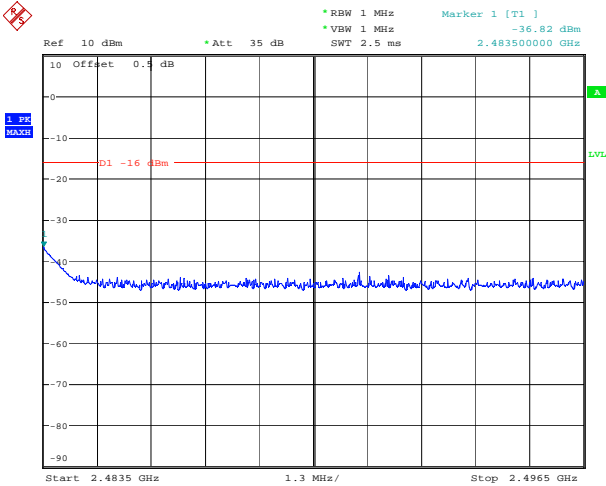
Date: 24.JUL.2023 16:02:48



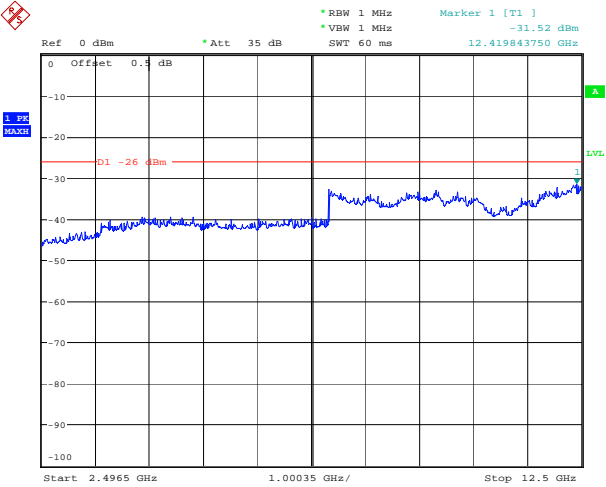
Date: 24.JUL.2023 16:03:02



Date: 24.JUL.2023 16:03:14



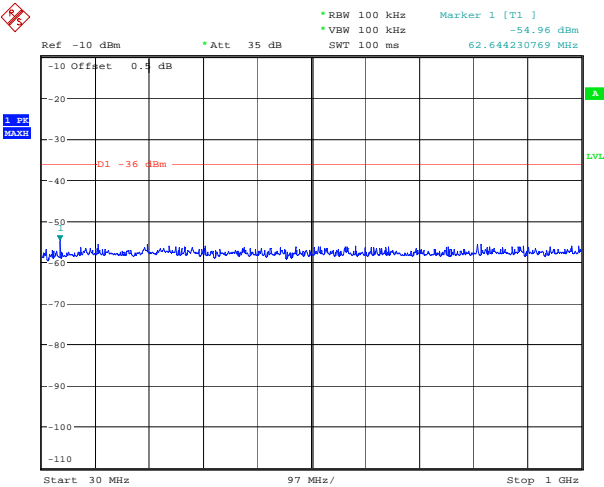
Date: 24.JUL.2023 16:03:29



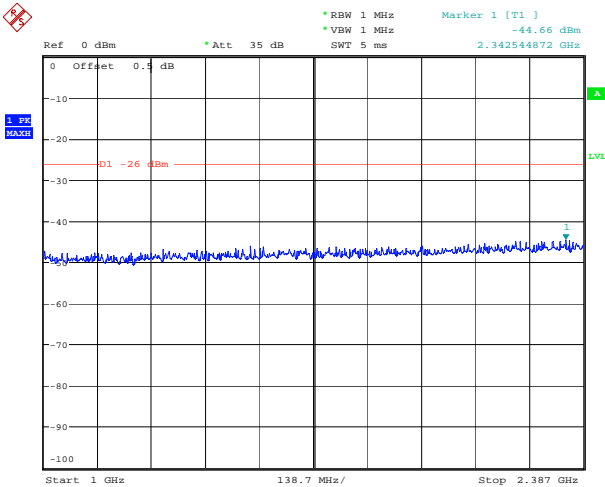
Date: 24.JUL.2023 16:03:40

$\pi/4$ -DQPSK:

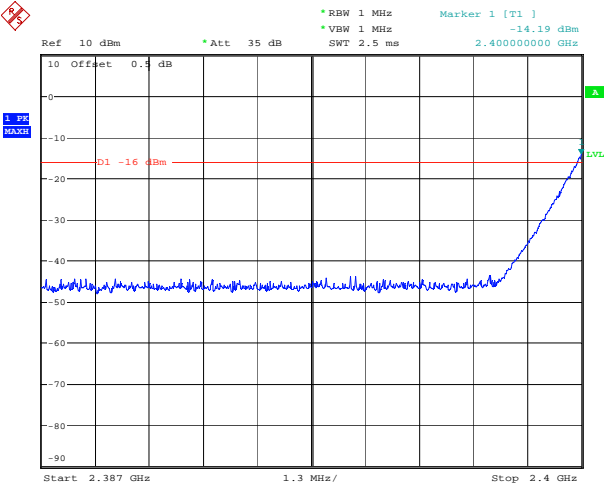
Low Channel



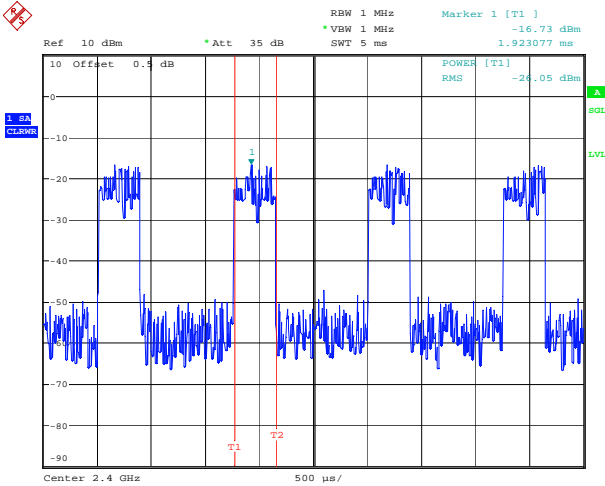
Date: 24.JUL.2023 16:05:33



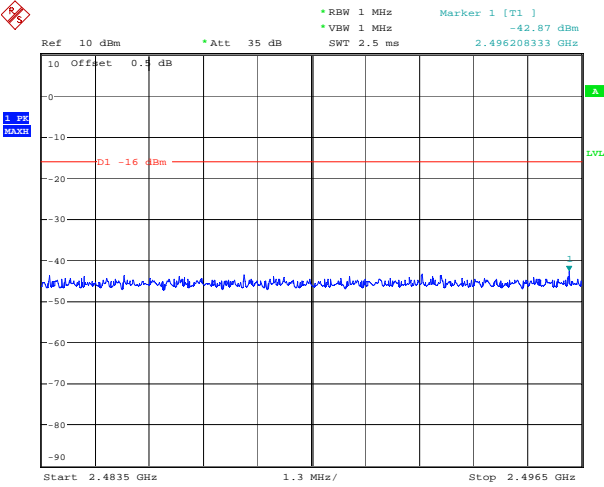
Date: 24.JUL.2023 16:05:45



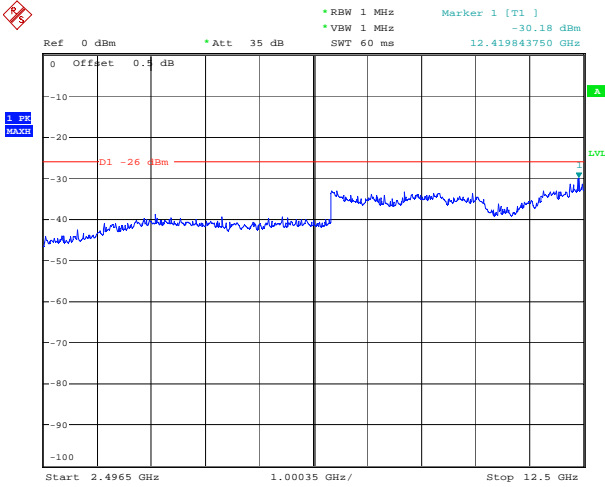
Date: 24.JUL.2023 16:05:56



Date: 24.JUL.2023 17:52:40

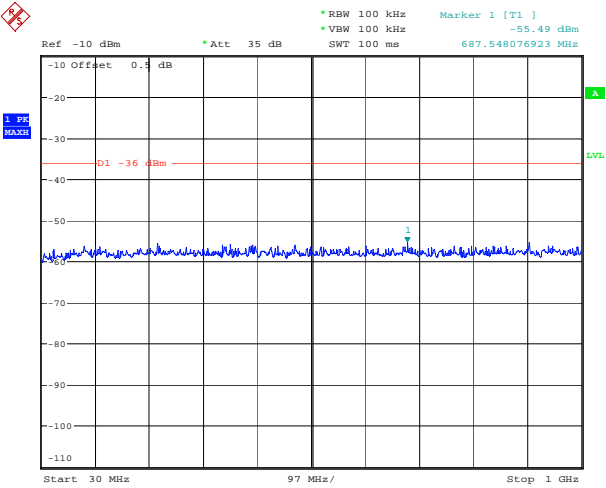


Date: 24.JUL.2023 16:06:14

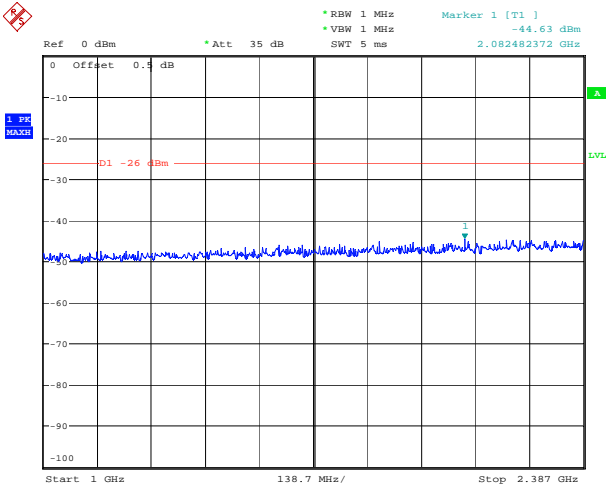


Date: 24.JUL.2023 16:06:26

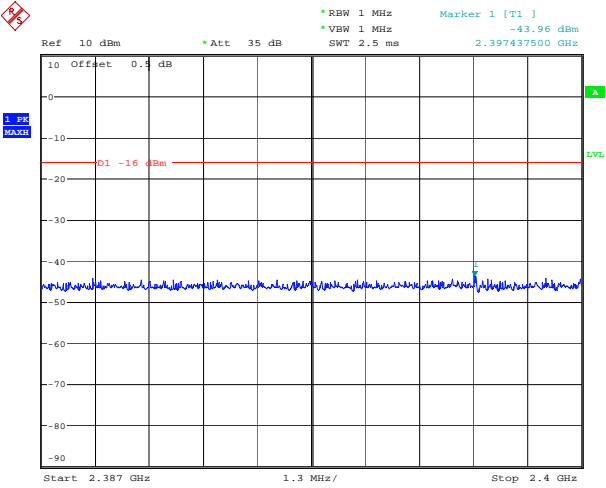
Middle Channel



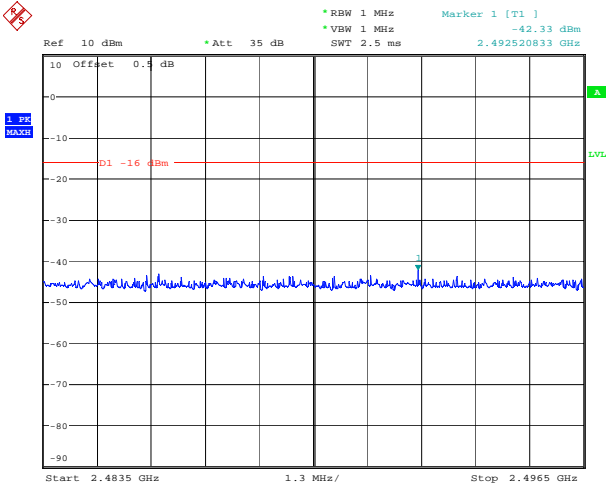
Date: 24.JUL.2023 16:06:56



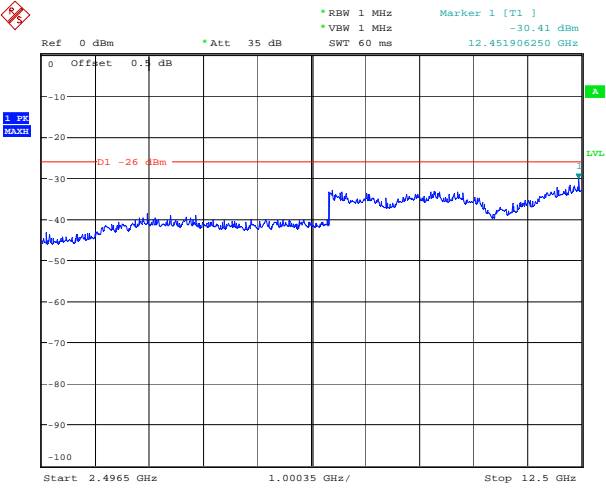
Date: 24.JUL.2023 16:07:10



Date: 24.JUL.2023 16:07:25



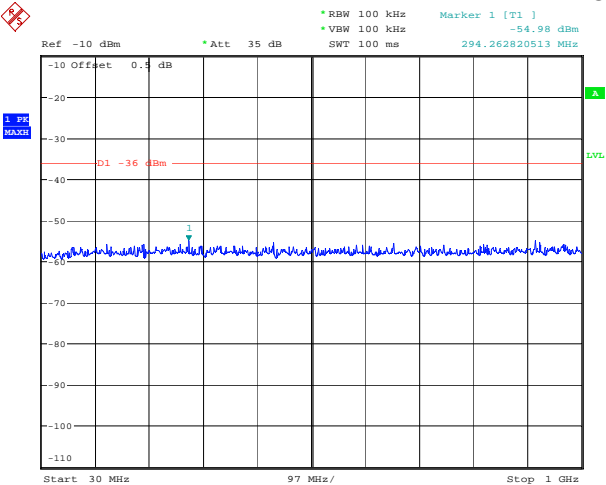
Date: 24.JUL.2023 16:07:40



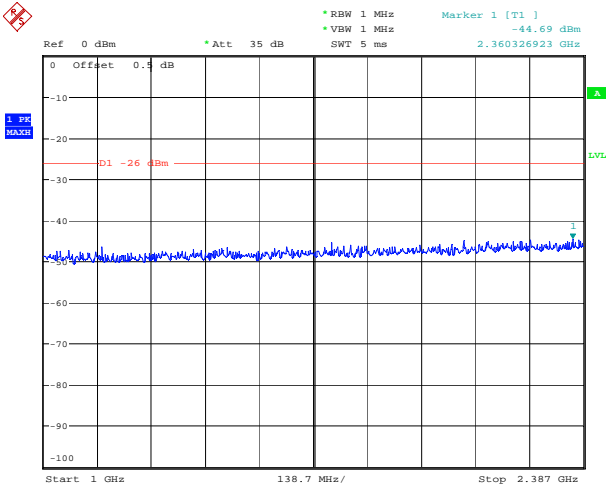
Date: 24.JUL.2023 16:07:51



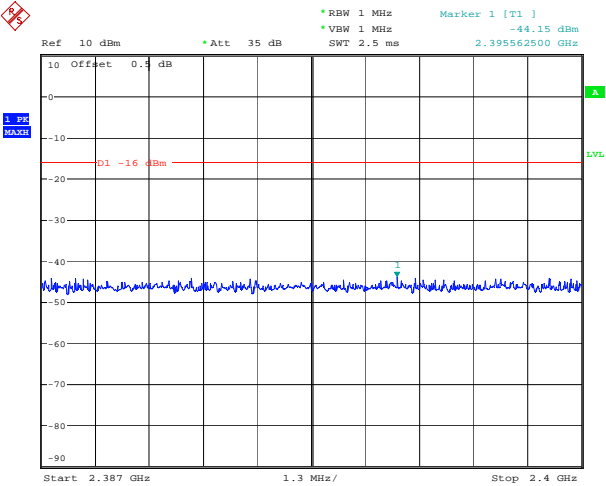
High Channel



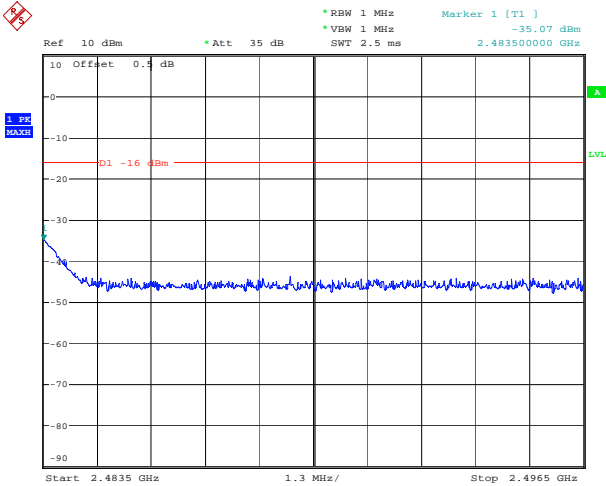
Date: 24.JUL.2023 16:08:26



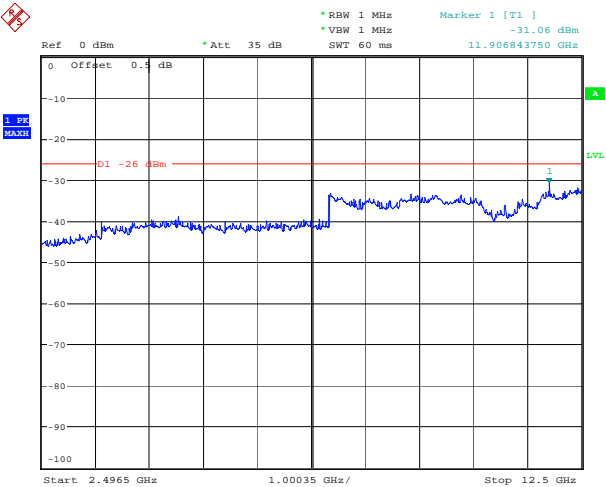
Date: 24.JUL.2023 16:08:37



Date: 24.JUL.2023 16:08:49



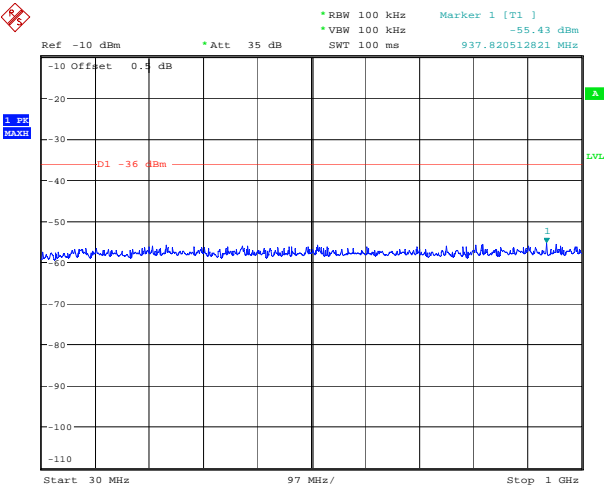
Date: 24.JUL.2023 16:09:01



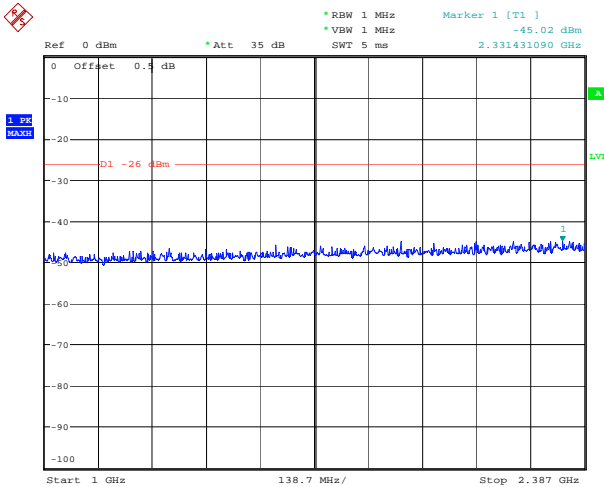
Date: 24.JUL.2023 16:09:12

8DPSK:

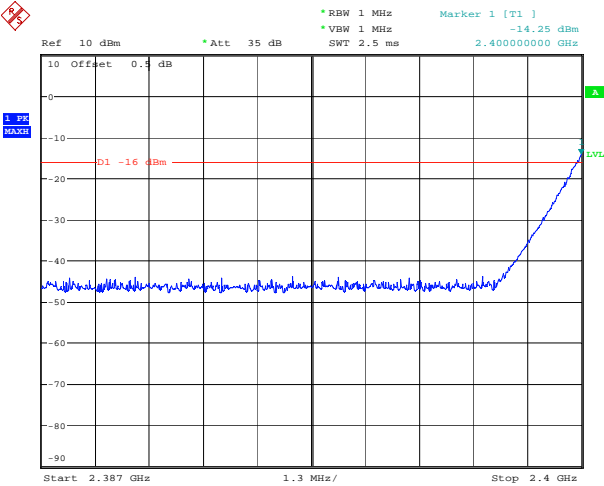
Low Channel



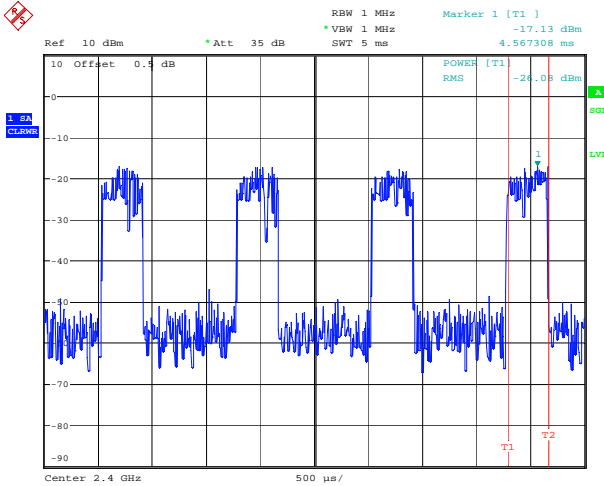
Date: 24.JUL.2023 16:11:13



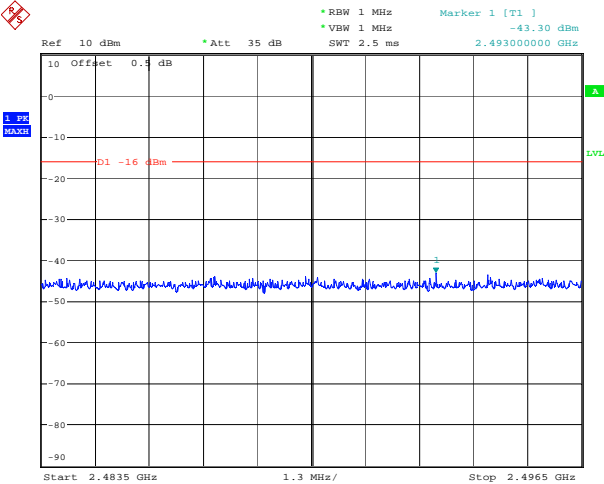
Date: 24.JUL.2023 16:11:25



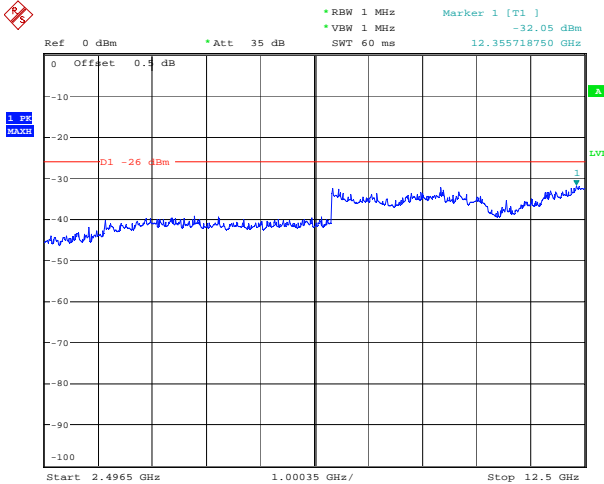
Date: 24.JUL.2023 16:11:36



Date: 24.JUL.2023 17:55:50

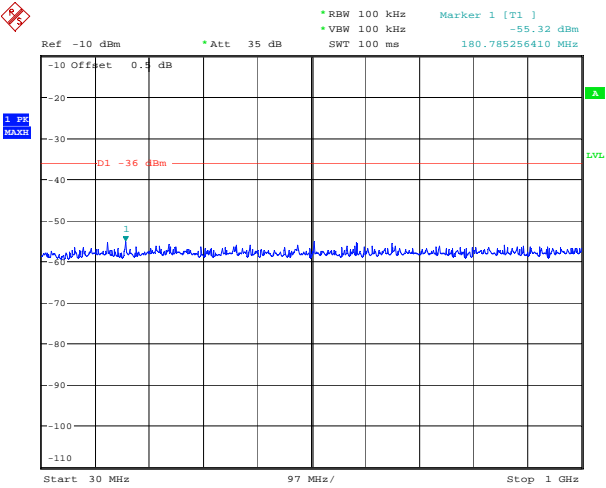


Date: 24.JUL.2023 16:11:48

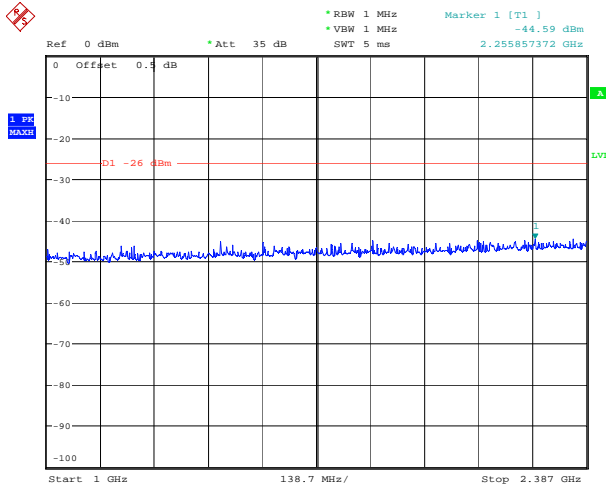


Date: 24.JUL.2023 16:11:59

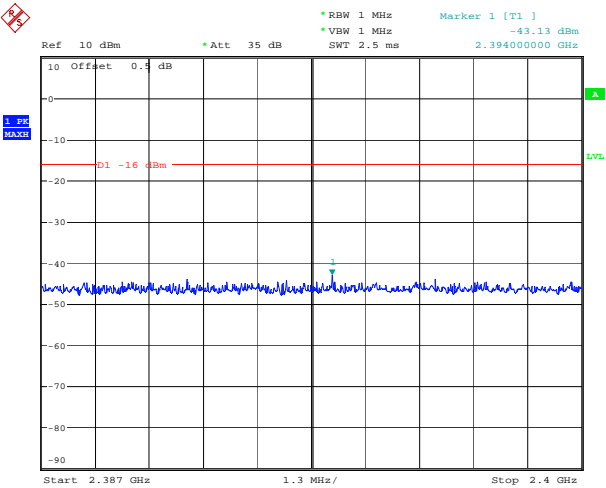
Middle Channel



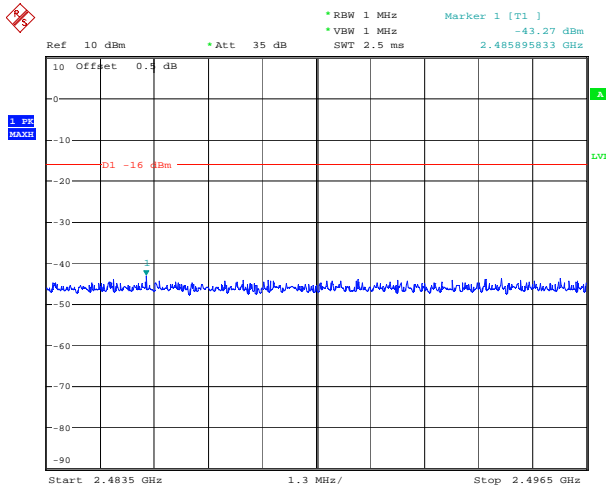
Date: 24.JUL.2023 16:12:52



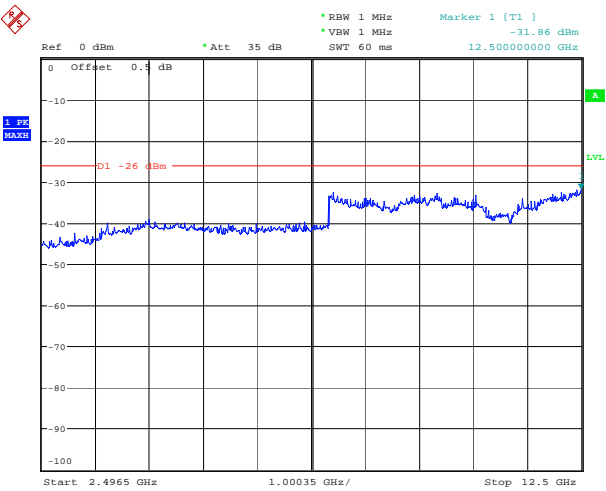
Date: 24.JUL.2023 16:13:07



Date: 24.JUL.2023 16:13:19

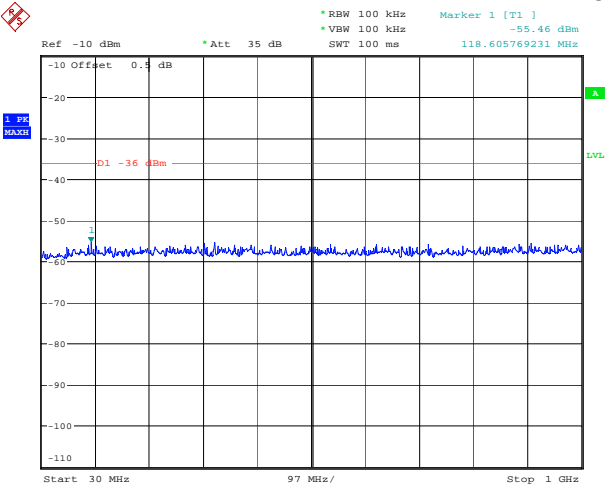


Date: 24.JUL.2023 16:13:30

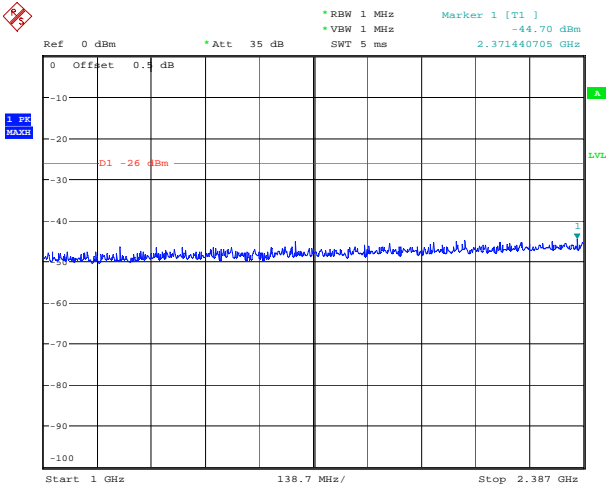


Date: 24.JUL.2023 16:13:42

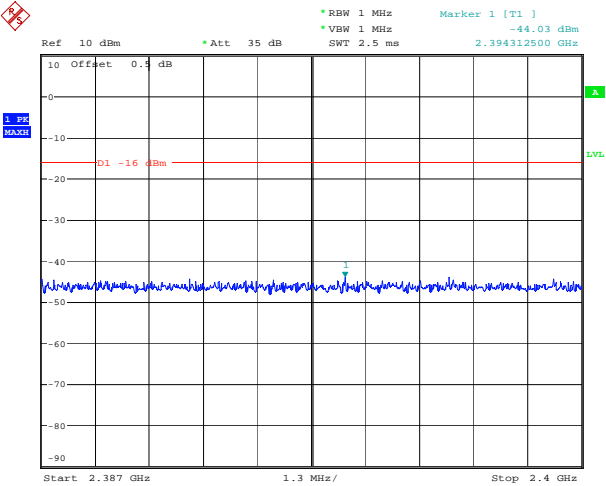
High Channel



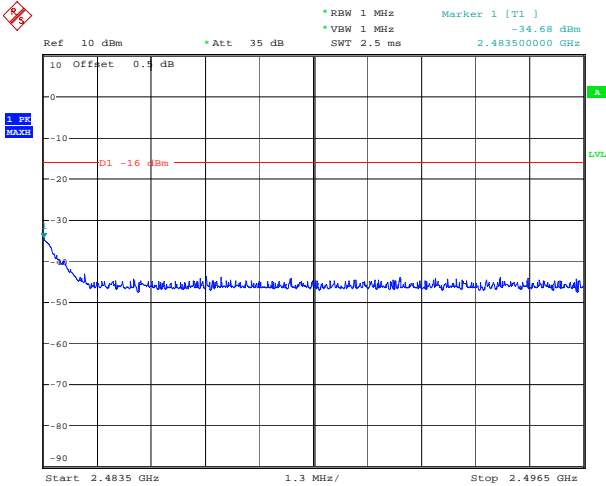
Date: 24.JUL.2023 16:14:08



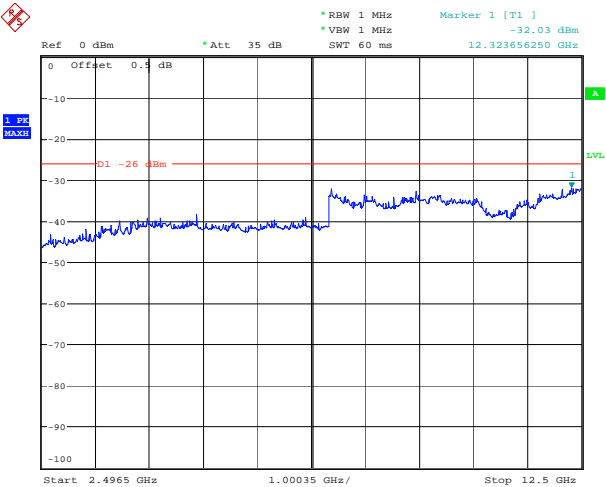
Date: 24.JUL.2023 16:14:20



Date: 24.JUL.2023 16:14:31



Date: 24.JUL.2023 16:14:43



Date: 24.JUL.2023 16:14:54

#### 4.5 Antenna Output Power and Antenna Power Tolerance

**Test Result: Compliant**

*Test Mode: Transmitting*

##### Duty Cycle and Declared Power:

Mode	Ton (ms)	Ton+Toff (ms)	Duty cycle (%)
GFSK	0.417	1.258	33.15
$\pi/4$ DQPSK	0.425	1.258	33.78
8DPSK	0.441	1.266	34.83

Mode	Antenna gain (dBi)	Declared power (mW/MHz)
GFSK	3.07	0.239
$\pi/4$ DQPSK		0.147
8DPSK		0.144

##### Output power

Test Condition	Mode	Conducted Power (dBm)	Spread bandwidth (MHz)	Duty cycle (%)	Antenna Output Power (mW/MHz)		Antenna Power Tolerance (%)		EIRP (dBm/MHz)	
					Result	Limit	Result	Limit	Result	Limit
NV	GFSK	7.34	71.055	33.15	0.230	$\leq 3$	-3.77	-80~+20	-3.31	$\leq 6.91$
	$\pi/4$ DQPSK	5.42	71.189	33.78	0.145		-1.36		-5.32	
	8DPSK	5.39	71.055	34.83	0.140		-2.78		-5.47	
LV	GFSK	7.51	71.085	33.15	0.239		0.00		-3.15	
	$\pi/4$ DQPSK	5.48	71.199	33.78	0.147		0.00		-5.26	
	8DPSK	5.44	71.087	34.83	0.141		-2.08		-5.44	
HV	GFSK	7.14	71.042	33.15	0.220		-7.95		-3.51	
	$\pi/4$ DQPSK	5.33	71.168	33.78	0.142		-3.40		-5.41	
	8DPSK	5.30	71.041	34.83	0.137		-4.86		-5.56	

*Note:*

1. Antenna Output Power Tolerance = (Antenna Output power - Declared Power)/Declared Power\*100%
2. Antenna output power (mW) = Conducted power(mW)/ Spread BW/Duty cycle=  $(10^{(\text{Conducted power(dBm)/10})} / \text{Spread BW/Duty cycle})$
3. EIRP (dBm) =  $10 * \log(\text{Antenna output power (mW)}) + \text{Antenna Gain}$



#### 4.6 Receiver Spurious Emission and Unwanted Emission Intensity

**Test Result: Compliant**

*Test Mode: Receiving*

Test Condition	Mode	Test Band (RBW)	Result (dBm/RBW)			Limit (dBm)	Limit (nW)
			Low Channel	Middle Channel	High Channel		
NV	GFSK	Band I (100kHz)	-74.21	-84.69	-86.51	-54	4
		Band II (1MHz)	-66.35	-64.08	-66.08	-47	20
	$\pi/4$ DQPSK	Band I (100kHz)	-82.56	-85.92	-86.57	-54	4
		Band II (1MHz)	-66.35	-66.99	-67.23	-47	20
	8DPSK	Band I (100kHz)	-82.23	-86.48	-76.86	-54	4
		Band II (1MHz)	-65.39	-65.30	-66.23	-47	20
LV	GFSK	Band I (100kHz)	-74.01	-84.66	-86.35	-54	4
		Band II (1MHz)	-66.25	-64.05	-65.90	-47	20
	$\pi/4$ DQPSK	Band I (100kHz)	-81.87	-85.27	-85.79	-54	4
		Band II (1MHz)	-66.23	-66.57	-67.18	-47	20
	8DPSK	Band I (100kHz)	-81.58	-86.26	-76.43	-54	4
		Band II (1MHz)	-64.91	-65.05	-65.87	-47	20
HV	GFSK	Band I (100kHz)	-75.12	-85.03	-87.10	-54	4
		Band II (1MHz)	-66.97	-64.29	-66.20	-47	20
	$\pi/4$ DQPSK	Band I (100kHz)	-82.69	-86.63	-86.82	-54	4
		Band II (1MHz)	-67.07	-67.49	-68.12	-47	20
	8DPSK	Band I (100kHz)	-82.49	-87.16	-77.69	-54	4
		Band II (1MHz)	-65.91	-65.61	-67.11	-47	20

*Note:*

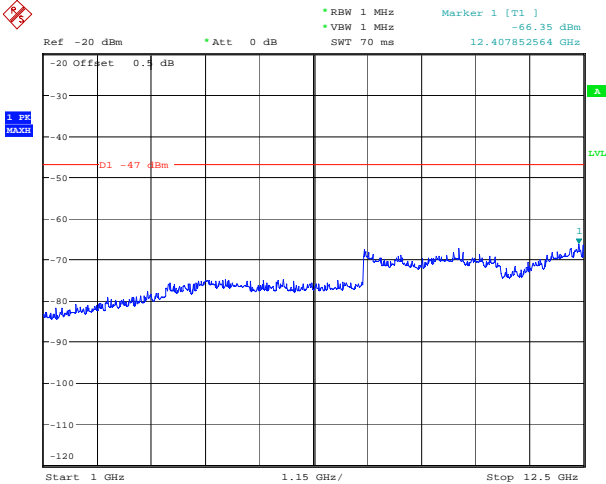
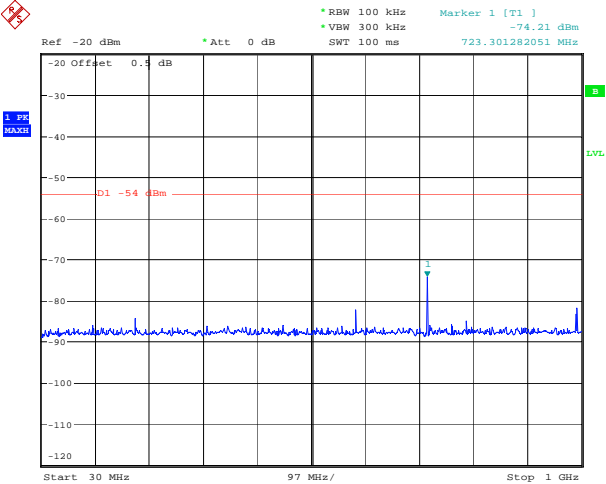
*Band I: 30MHz ~ 1000MHz*

*Band II: 1000MHz ~ 12500MHz*

Please refer to the below plots for normal voltage test.

GFSK:

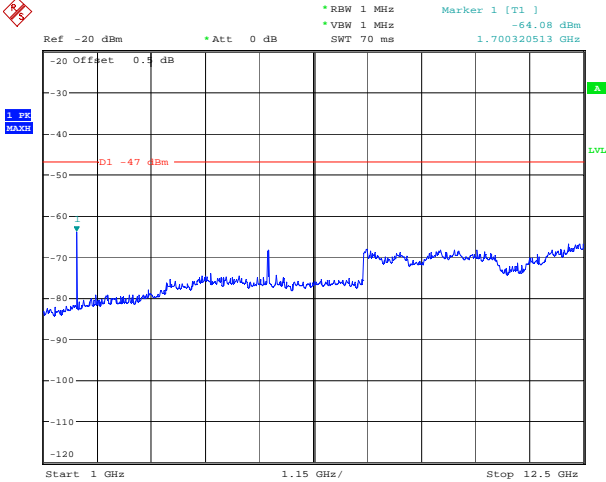
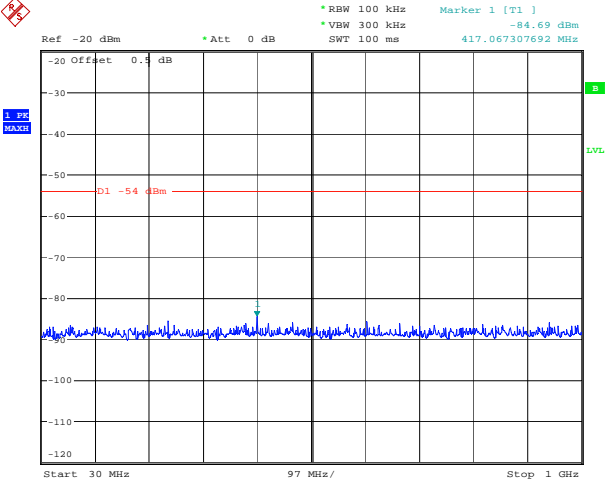
Low Channel



Date: 25.JUL.2023 10:37:24

Date: 25.JUL.2023 11:33:43

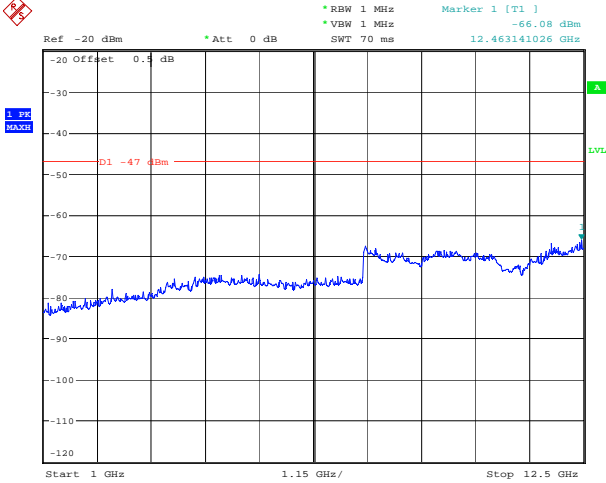
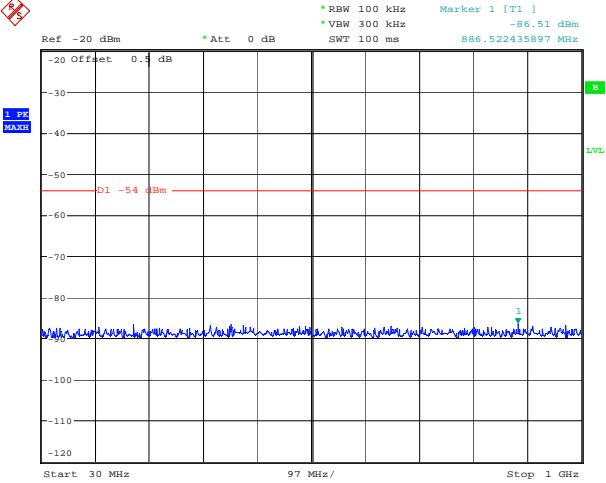
Middle Channel



Date: 25.JUL.2023 11:35:39

Date: 25.JUL.2023 11:36:41

High Channel



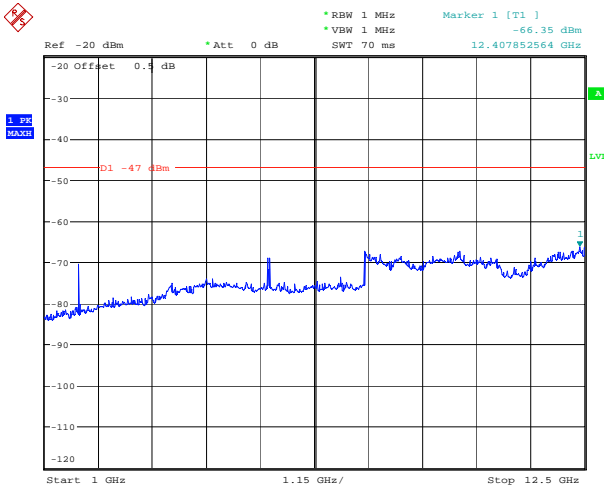
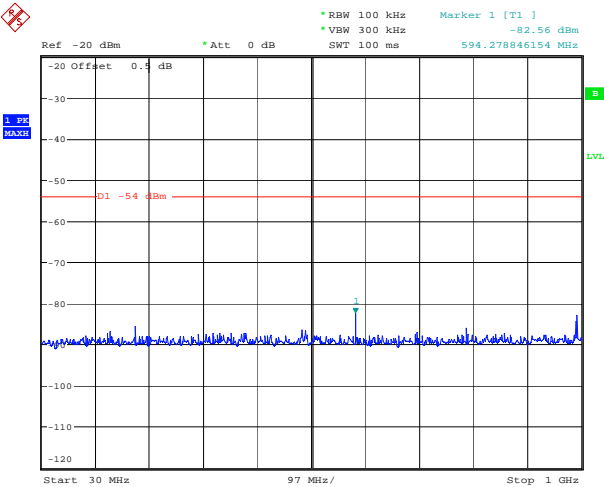
Date: 25.JUL.2023 11:37:26

Date: 25.JUL.2023 11:38:39



$\pi/4$ -DQPSK:

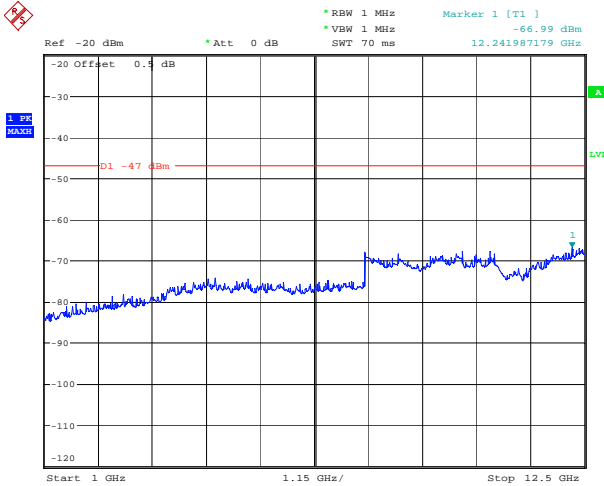
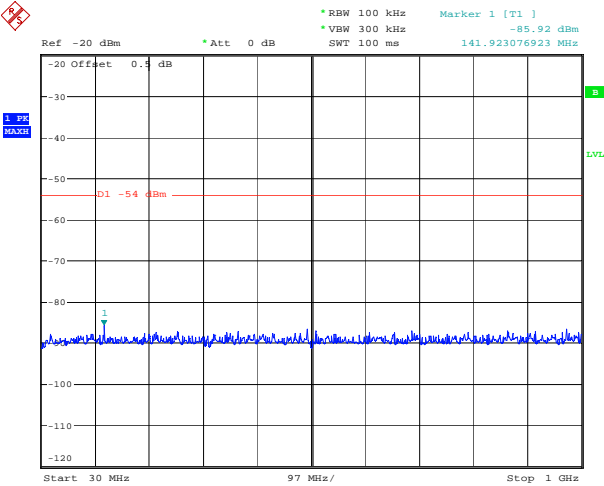
Low Channel



Date: 25.JUL.2023 10:46:02

Date: 25.JUL.2023 11:33:49

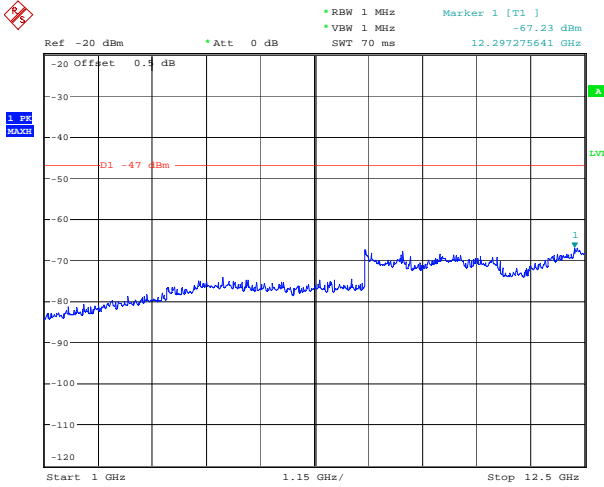
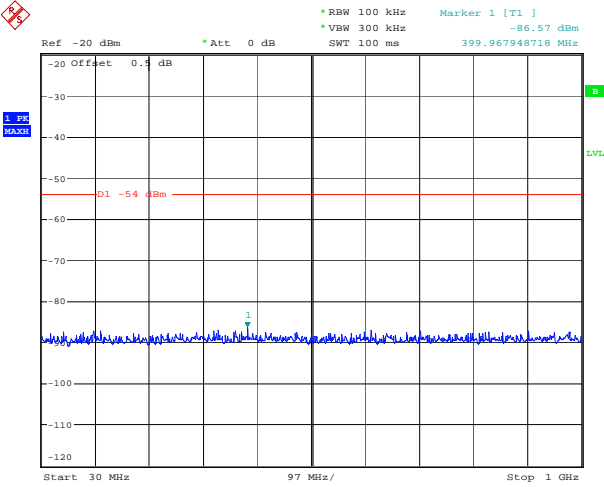
Middle Channel



Date: 25.JUL.2023 11:35:52

Date: 25.JUL.2023 11:36:47

High Channel

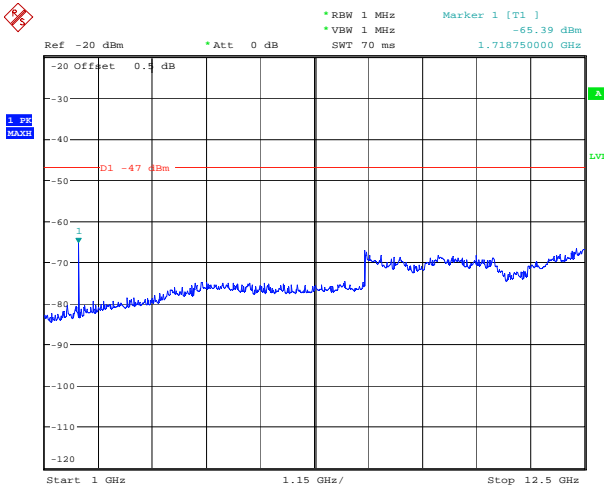
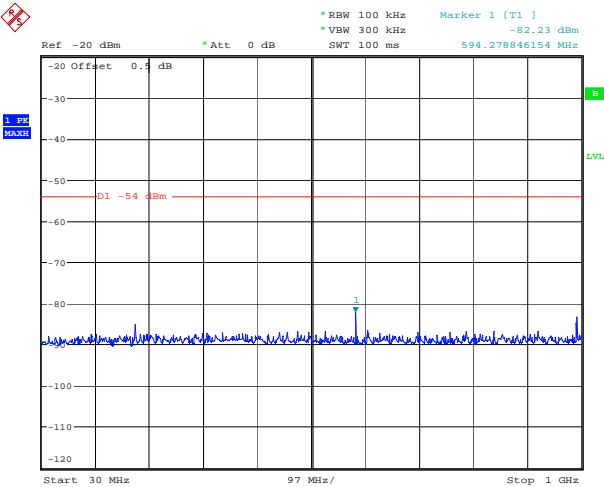


Date: 25.JUL.2023 11:38:00

Date: 25.JUL.2023 11:38:50

8DPSK:

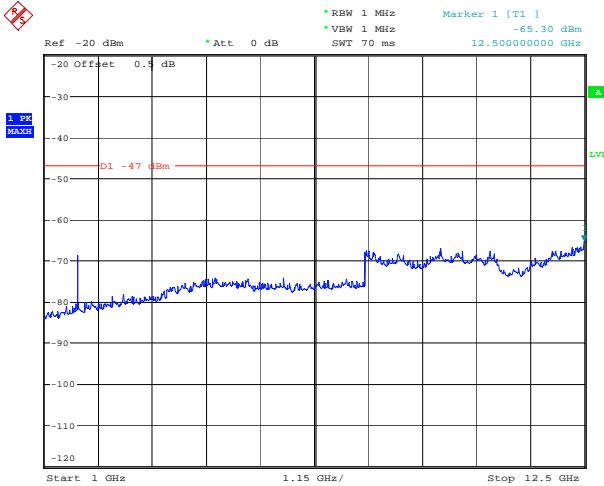
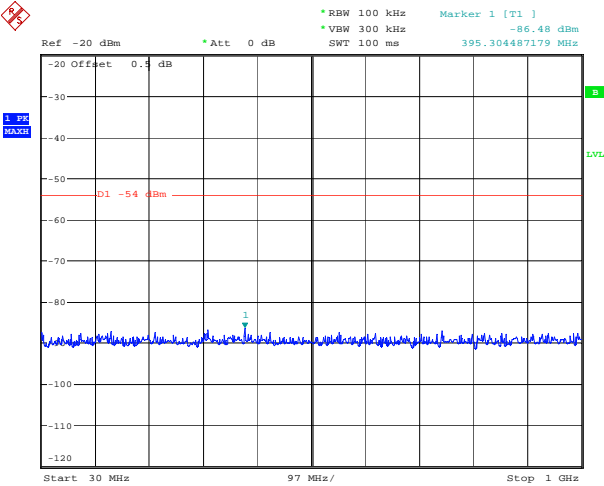
Low Channel



Date: 25.JUL.2023 10:56:02

Date: 25.JUL.2023 11:34:06

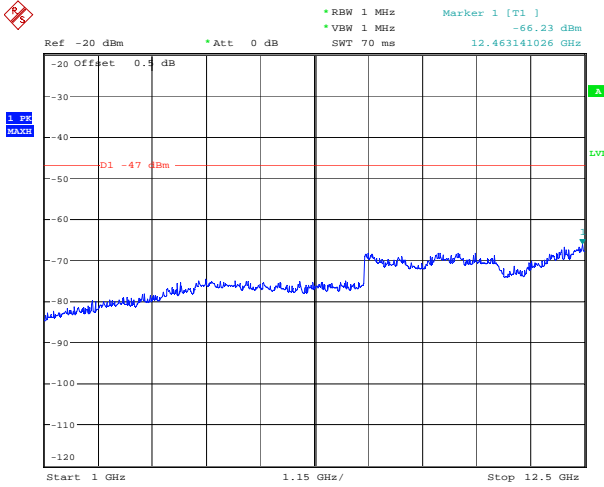
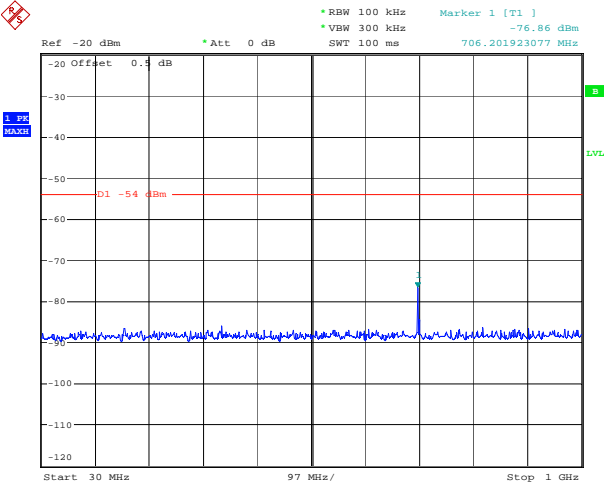
Middle Channel



Date: 25.JUL.2023 11:35:58

Date: 25.JUL.2023 11:36:52

High Channel



Date: 25.JUL.2023 11:37:52

Date: 25.JUL.2023 11:38:57

#### 4.7 Frequency Hopping Dwell Time

**Test Result: Compliant**

*Test Mode: Transmitting*

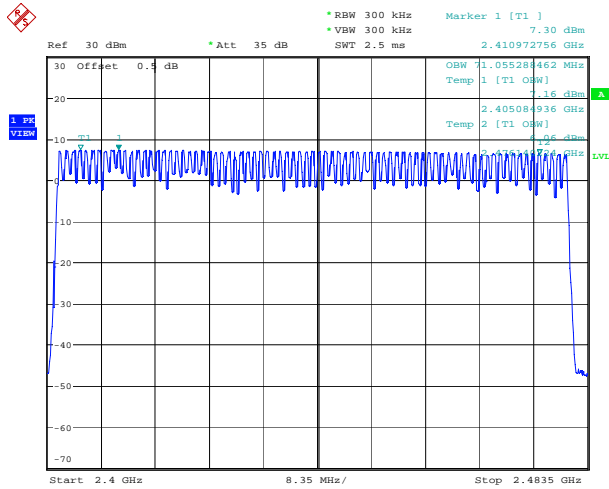
Mode	Packet Type	Spreading bandwidth	Ton (ms)	Observed Period (s)	Hopping Number In Observed Period	Result (s)	Limit(s)
GFSK	DH1	71.055	0.417	28.422	160	0.07	$\leq 0.4$
	DH3	71.055	1.731	28.422	110	0.19	
	DH5	70.921	3.005	28.368	80	0.24	
$\pi/4$ -DQPSK	2DH1	71.189	0.425	28.476	180	0.08	
	2DH3	71.189	1.699	28.476	120	0.20	
	2DH5	71.189	2.957	28.476	80	0.24	
8DPSK	3DH1	71.055	0.441	28.422	170	0.07	
	3DH3	71.189	1.683	28.476	100	0.17	
	3DH5	71.189	2.981	28.476	70	0.21	

*Note:*

- 1, Dwell time = Time per one hopping (On time) \* hopping number (within the time obtained by multiplying the spread rate by 0.4s).
- 2, For Bluetooth device, spread rate equal to spread bandwidth.

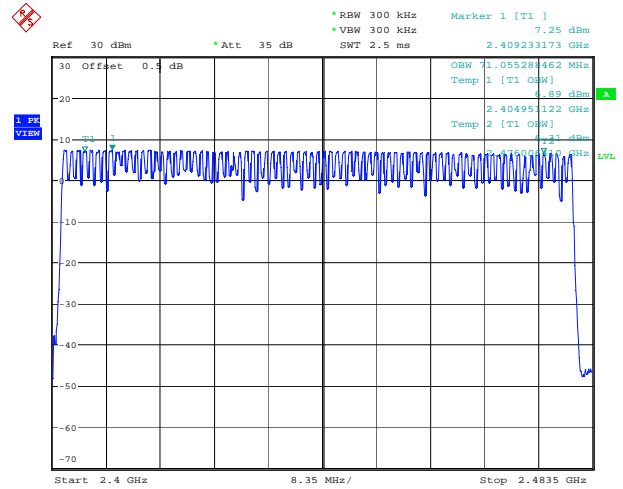
## Spread Bandwidth

## GFSK DH1



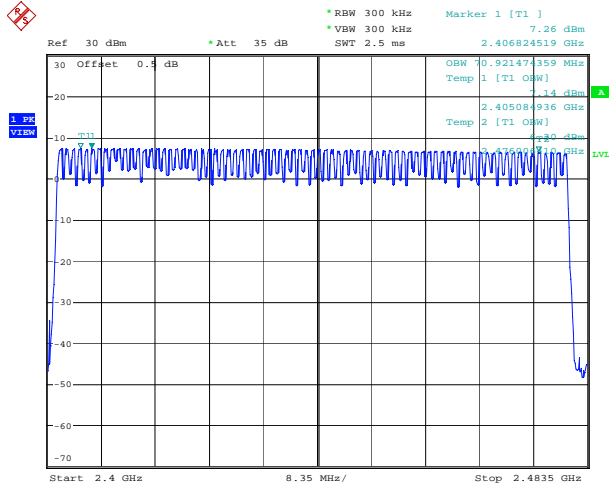
Date: 24.JUL.2023 16:20:14

## GFSK DH3

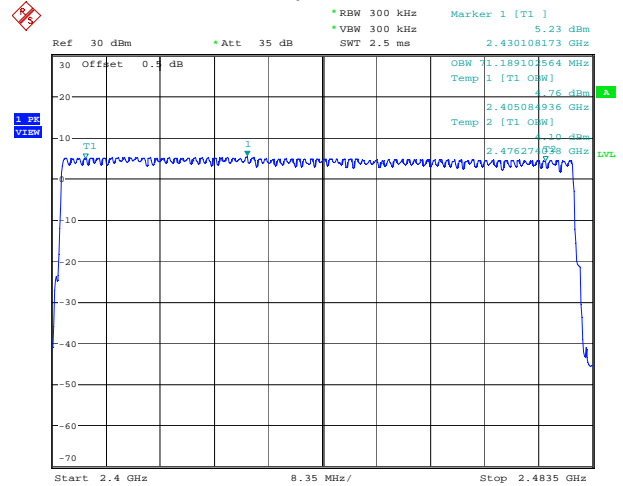


Date: 24.JUL.2023 16:22:16

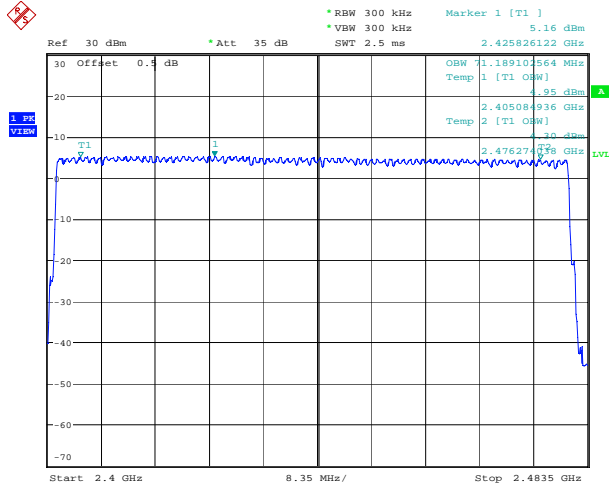
## GFSK DH5



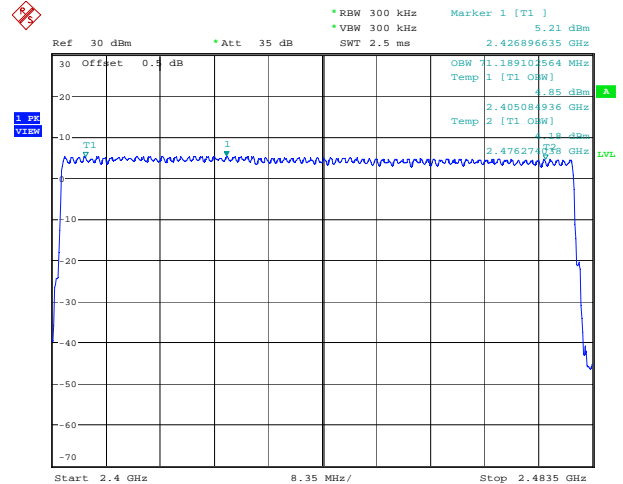
Date: 24.JUL.2023 16:23:26

 $\pi/4$ -DQPSK 2DH1

Date: 24.JUL.2023 16:37:05

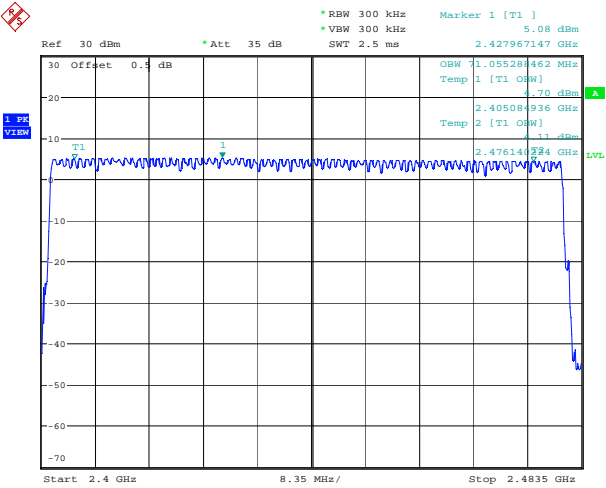
 $\pi/4$ -DQPSK 2DH3

Date: 24.JUL.2023 16:45:58

 $\pi/4$ -DQPSK 2DH5

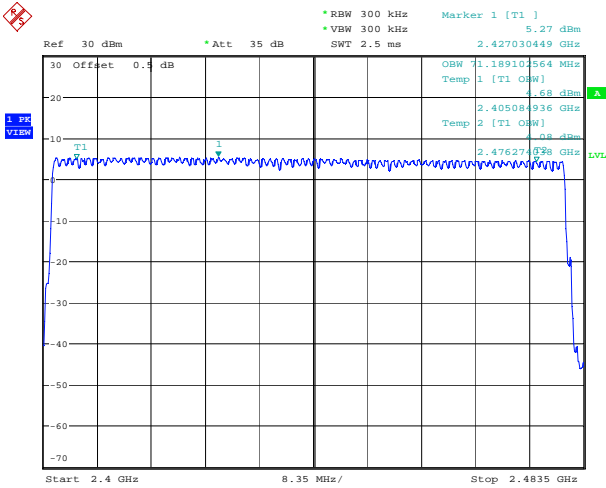
Date: 24.JUL.2023 16:54:41

8DPSK 3DH1



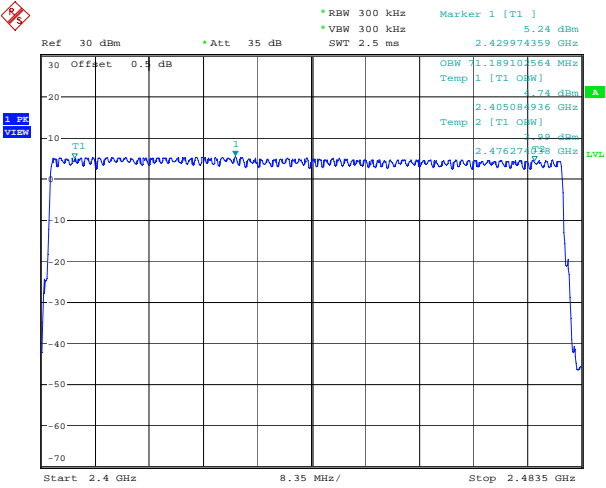
Date: 24.JUL.2023 17:01:11

8DPSK 3DH3



Date: 24.JUL.2023 17:08:34

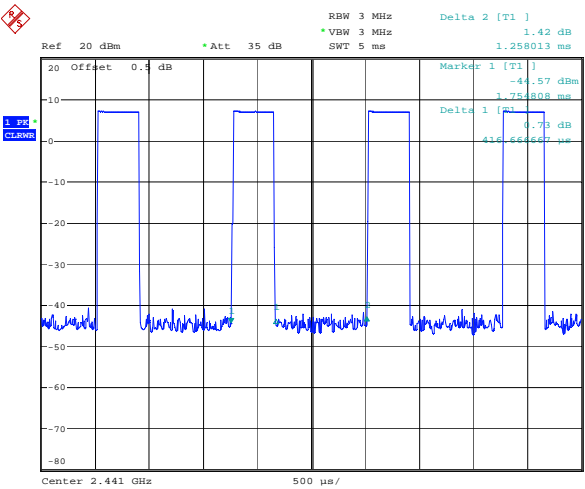
8DPSK 3DH5



Date: 24.JUL.2023 17:14:21

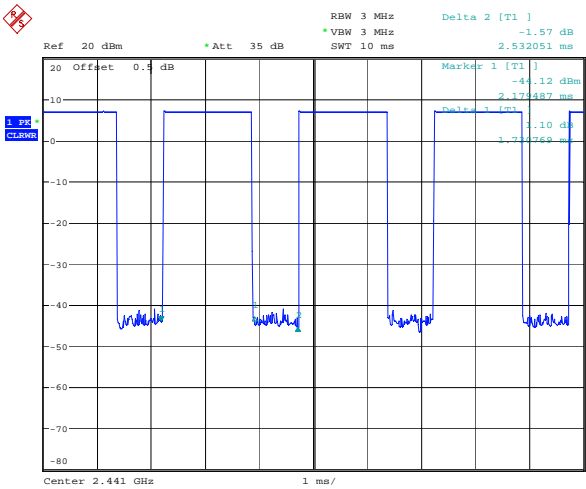
Pulse Ton

GFSK DH1



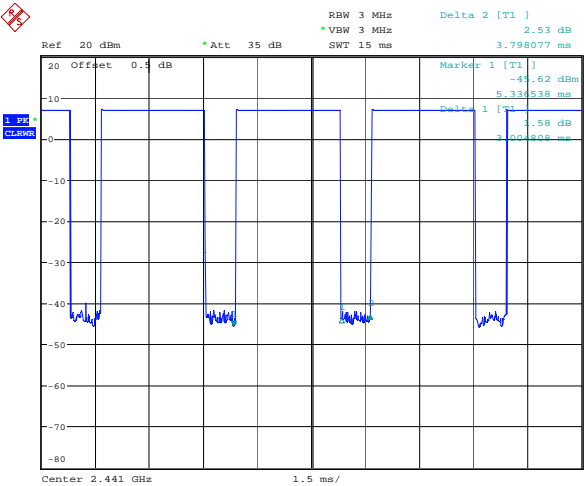
Date: 25.JUL.2023 12:53:06

GFSK DH3



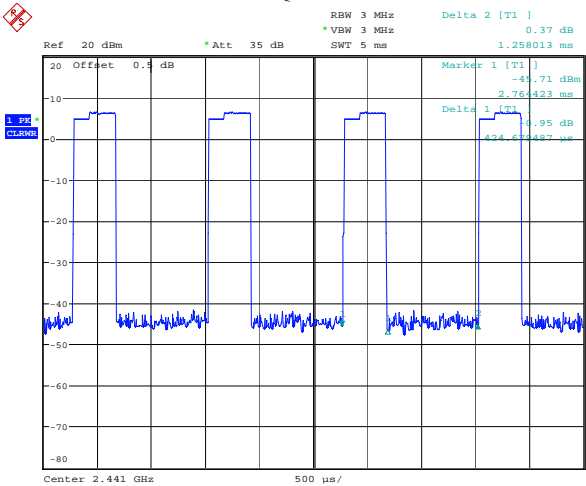
Date: 25.JUL.2023 12:56:40

GFSK DH5



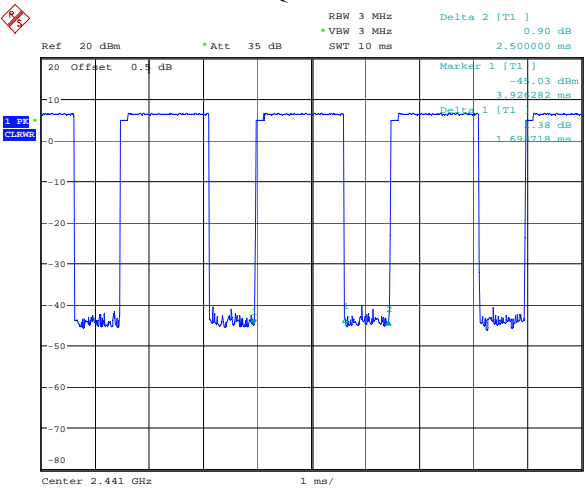
Date: 25.JUL.2023 12:59:06

$\pi$ /4-DQPSK 2DH1



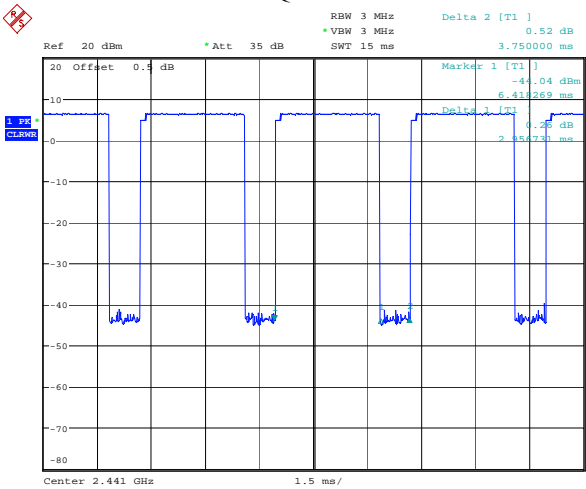
Date: 25.JUL.2023 12:54:09

$\pi$ /4-DQPSK 2DH3



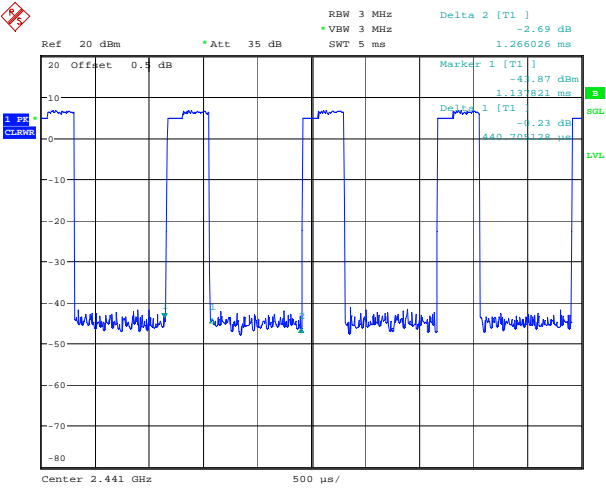
Date: 25.JUL.2023 12:57:29

$\pi$ /4-DQPSK 2DH5

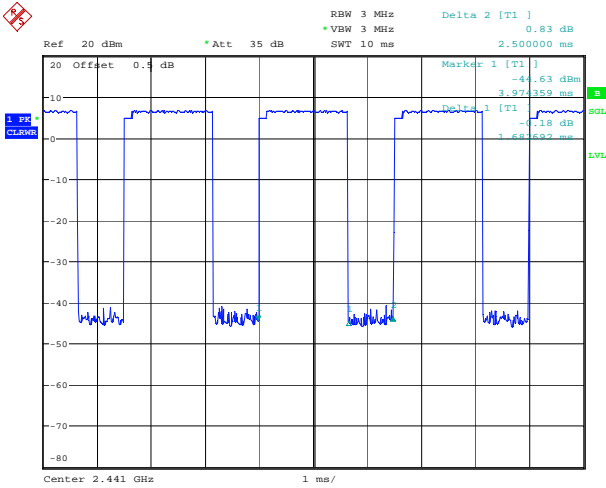


Date: 25.JUL.2023 12:59:58

8DPSK 3DH1

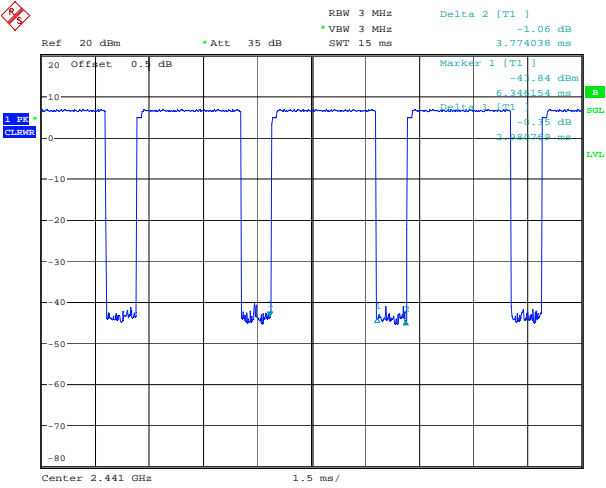


8DPSK 3DH3



Date: 25.JUL.2023 12:55:45

8DPSK 3DH5

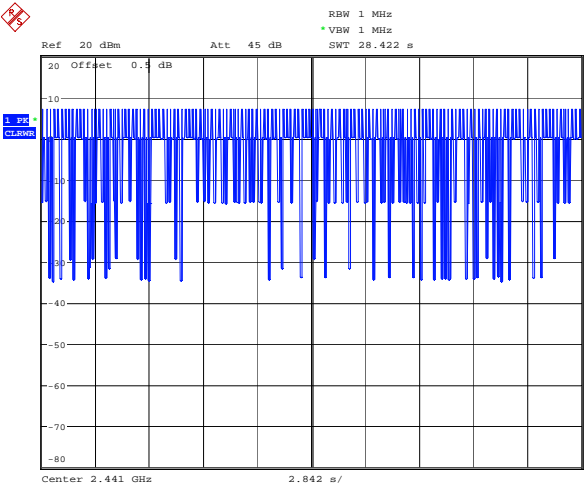


Date: 25.JUL.2023 12:58:15

Date: 25.JUL.2023 13:00:52

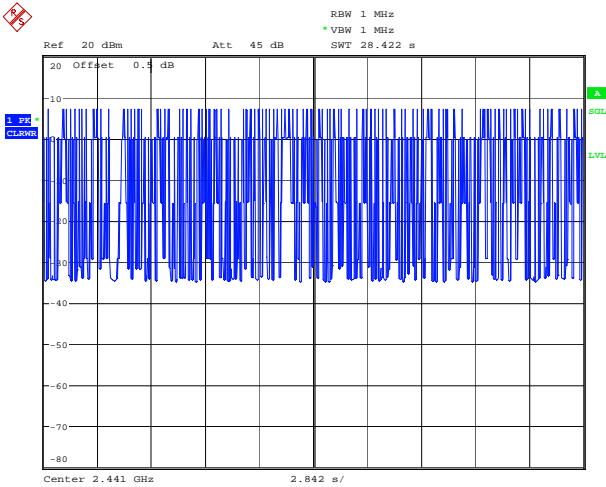
Hops Number In Observed Period

GFSK DH1



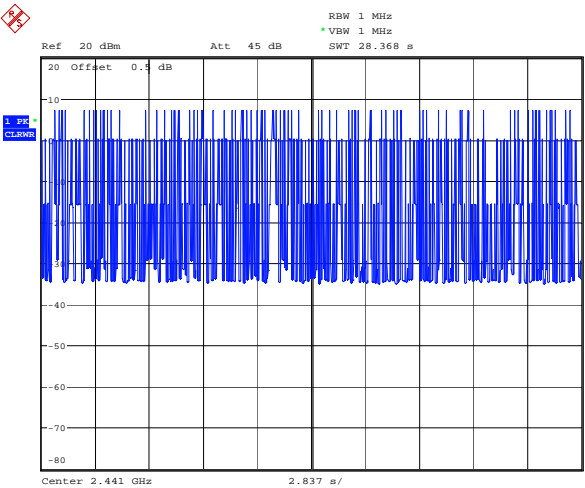
Date: 25.JUL.2023 12:11:04

GFSK DH3



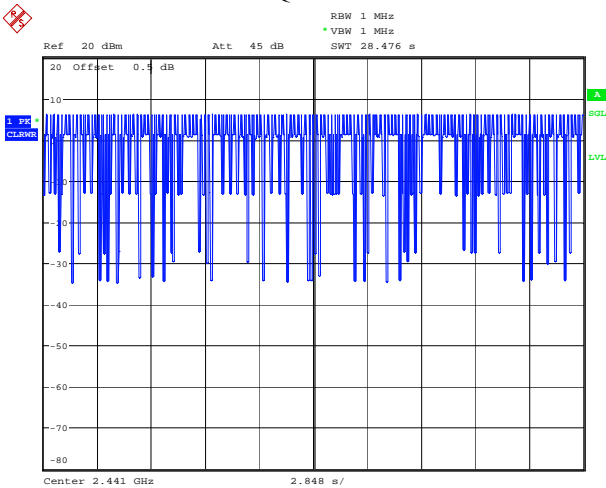
Date: 25.JUL.2023 12:12:20

GFSK DH5



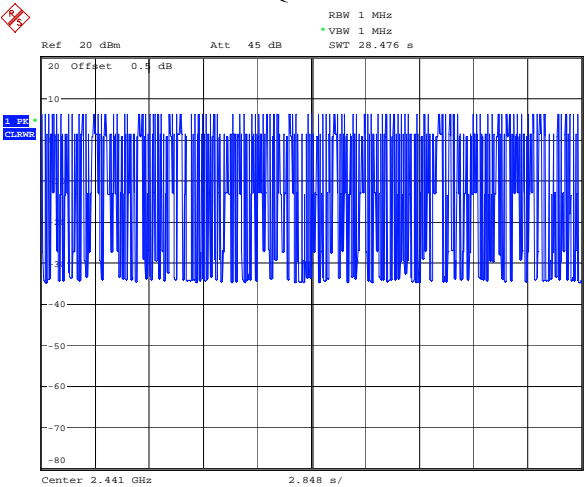
Date: 25.JUL.2023 12:15:09

$\pi/4$ -DQPSK 2DH1



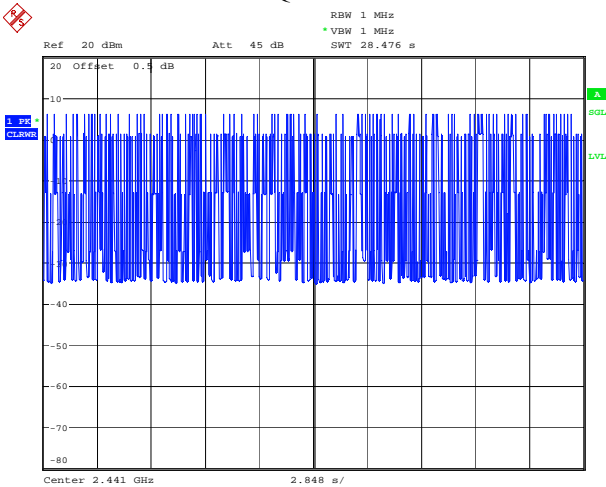
Date: 25.JUL.2023 12:16:22

$\pi/4$ -DQPSK 2DH3



Date: 25.JUL.2023 12:17:43

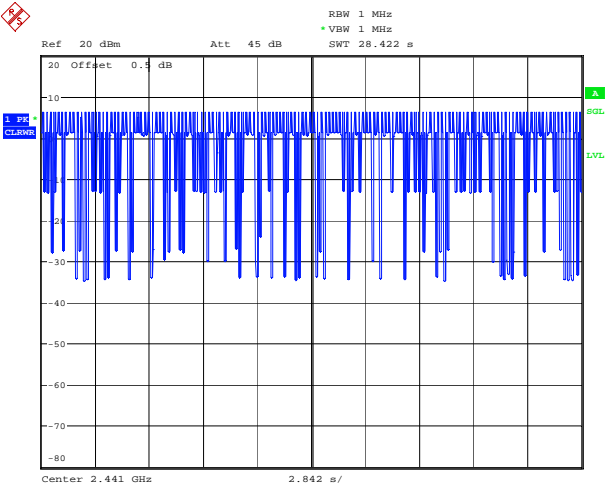
$\pi/4$ -DQPSK 2DH5



Date: 25.JUL.2023 12:19:26

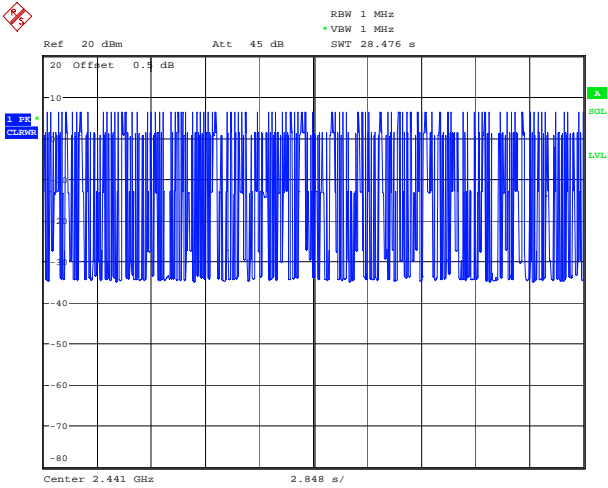


8DPSK 3DH1



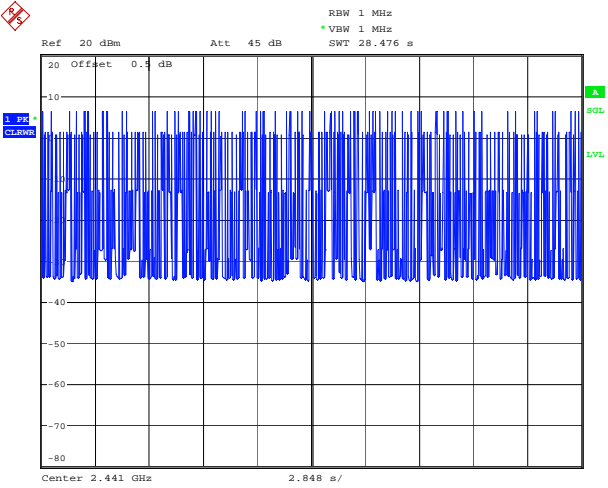
Date: 25.JUL.2023 12:21:47

8DPSK 3DH3



Date: 25.JUL.2023 12:23:34

8DPSK 3DH5



Date: 25.JUL.2023 12:24:54

\*\*\*\*\* END OF REPORT \*\*\*\*\*