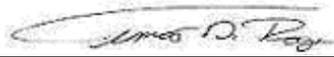


Test Report - FCC Part 15.247
Applicant: ICOM Inc

Signature:



Sr. EMC Engineer
EMC-003838-NE



Name & Title:

Tim Royer, Lab Manager

Date of Signature

01/31/2025

Signature:



Name & Title:

Fouzia Syed, Senior Test engineer.

Date of Signature

01/31/2025

This test report relates only to the items tested as identified and is not valid for any subsequent changes or modifications made to the equipment under test.

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1. Applicant Information

Applicant: Icom Inc.
Address: 1-1-32 Kamiminami Hirano-ku
Osaka Japan 547-0003

1.1 Test Result Summary

The following test procedure and guidance were used for measuring Digital Transmission System (DTS); FCC KDB 558074 D01 DTS Measurement Guidance and ANSI C63.10-2013. Full test results are available in this report.

No additions to the test methods were needed. There were no deviations, or exclusions from the test methods. No test results are from external providers or from the customer. The test results relate only to the items tested. Timco does not offer opinions and interpretations, only a pass/fail statement.

Applicable Clauses from Part 2 or KDB		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
KDB 558074 D01	Duty Cycle	Reported
KDB 558074 D01	99 % Bandwidth	Reported
KDB 558074 D01	Band-edge measurements	Pass

Applicable Clauses from Part 15.247		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
15.247 (a) (1) – (1) (iii)	FHSS hopping requirements (1, i,ii,iii)	Pass
15.247 (a) (1)	FHSS 20dB Bandwidth	Pass
15.247 (a) (2)	DTS 6dB Bandwidth	n/a
15.247 (b) (1) – (4)	Conducted output power	Pass
15.247 (c) (1) – (2)	Operation with directional antenna gains > 6 dBi	n/a
15.247 (d), 15.215 (b)	Conducted Emissions in Non-restricted bands	Pass
15.247 (d), 15.215 (b)	Conducted Emissions at the Band-edge	Pass
15.247 (e)	Power Spectral Density (PSD)	n/a
15.247 (f)	Hybrid system hopping requirements	n/a
15.247 (f)	Hybrid system Power Spectral Density	n/a
15.247 (g)	FHSS System requirements	Pass
15.247 (h)	FHSS spectrum sensing	n/a

Applicable Clauses from Part 2 and Part 15 Subpart C		
FCC Clauses	Description of the requirements	Result: (Pass, Fail, N/A)
15.203	Antenna requirements	Pass
15.205	Restricted bands of operation	Pass
15.207	AC Power Conducted Emissions	n/a
15.209	Radiated Emissions in Restricted bands	Pass
15.211	Tunnel Radio Systems	n/a
15.212 (a)	Single Modular Transmitter	n/a
15.212 (b)	Limited Modular Transmitter	n/a
15.213	Cable Locating Equipment	n/a

2. Location of Testing

2.1 Test Laboratory

Timco Engineering Inc. is a subsidiary of Industrial Inspection & Analysis, Inc. ("IIA").

Testing was performed at IIA's permanent laboratory located at 13146 NW 86th Drive, Suite 400, Alachua, Florida 32615.

FCC test firm # 578780

FCC Designation # US1070

FCC site registration is under A2LA certificate # 0955.01

ISED Canada test site registration # 2056A

EU Notified Body # 1177

For all designations see A2LA scope # 0955.01

3. Test Sample(s) (EUT/DUT)

The test sample was received: 12/13/2024

Dates of Testing: 01/02/2025 – 01/17/2025

3.1 Description of the EUT

A description as well as unambiguous identification of the EUT(s) tested. Where more than one sample is required for technical reasons (such as the use of connected units for the purpose of conducted output power testing where the product units will have integral antennas), each specific test shall identify which unit was tested.

Identification	
FCC ID:	AFJ381510
Certified Module FCC ID:	N/A
Brief Description	Bluetooth module
Model(s) #	UT-136B
Firmware version	2.02
Software version	N/A
Serial Number	0000104

Technical Characteristics	
Frequency Range	2400-2483.5 MHz
RF O/P Power (Max.)	+7 dBm
Modulation	FHSS GFSK, $\pi/4$ DQPSK, 8DPSK
Bandwidth & Emission Class	N/A
Number of Channels	78
Duty Cycle	N/A
Antenna Connector	N/A
Voltage Rating (AC or Batt.)	DC3.3V, no battery included

Note: Information such as antenna gain, firmware/software numbers are provided by manufacturer and cannot be validated by the test lab.

3.2 Configuration of EUT

Test Modes					
Band (MHz)	Mode (#)	Mode (Type)	Test Frequencies (MHz)	Modulation	Number of Antennas
N/A	1	GFSK	2402 MHz-2480 MHz	GFSK (F1D)	1
N/A	2	DQPSK	2402 MHz-2480 MHz	DQPSK	1
N/A	3	8DPSK	2402 MHz-2480 MHz	8DPSK	1

Operating conditions during Testing:

No modifications of the device under test (including firmware, specific software settings, and input/output signal levels to the EUT).

Peripherals used during Testing:

A laptop provided by the manufacturer was used to program the EUT.

3.3 Test Setup of EUT

Equipment, antenna, and cable arrangement. The setup of the equipment and cable or wire placement on the test site that produces the highest radiated and the highest ac power line conducted emissions shall be shown clearly and described. Information on the orientation of portable equipment during testing shall be included. Drawings or photographs may be used for this purpose.

Test Setups are included in the test report.

4. Test methods & Applicable Regulatory Limits

4.1 Test methods/Standards/Guidance:

Test procedures and guidance for measuring Digital Transmission System (DTS) are provided in the FCC KDB 558074 D01 DTS Measurement Guidance and in Clause 11 of ANSI C63.10-2013.

- 1) ANSI C63.10-2013
- 2) FCC KDB 558074 D01

4.2 Applied Limits and Regulatory Limits:

- 3) FCC CFR 47 Part 15.247 (2020)

5. Measurement Uncertainty

Parameter	Uncertainty (dB)
Conducted Emissions	± 3.14 dB
Radiated Emissions (9kHz – 30 MHz)	± 3.08 dB
Radiated Emissions (30 – 200 MHz)	± 2.16 dB
Radiated Emissions (200 – 1000 MHz)	± 2.15 dB
Radiated Emissions (1 GHz – 18 GHz)	± 2.14 dB
Radiated Emissions (18 GHz – 40 GHz)	± 2.31 dB
Note: The uncertainties provided in this table represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of K=2.	

6. Environmental Conditions

6.1 Temperature & Humidity

Measurements performed at the test site did not exceed the following:

Temperature	23 C +/- 5%
Humidity	55% +/- 5%
Barometric pressure	30.05 inHg
Note: Specific environmental conditions that are applicable to a specific test are available in the test result section.	

7. List of Test Equipment and Test Facility

The test equipment used identified by type, manufacturer, serial number, or other identification and the date on which the next calibration or service check is due.

Description of the firmware or software used to operate EUT for testing purposes.

A complete list of all test equipment used shall be included with the test report. The manufacturer’s model and serial numbers, and date of last calibration, and calibration interval shall be included. Measurement cable loss, measuring instrument bandwidth and detector function, video bandwidth, if appropriate, and antenna factors shall also be included where applicable.

7.1 List of Test Equipment

Test Equipment						
Type	Device	Manufacturer	Model	SN#	Current Cal	Cal Due
Antenna	<u>Biconical</u> 1057	Eaton	94455-1	1057	09/01/2024	09/01/2027
Antenna, NSA	Log-Periodic 1243	Eaton	96005	1243	09/01/2024	09/01/2027
Antenna	<u>Double- Ridged Horn/ETS Horn 1</u>	ETS-Lindgren	3117	00035923	5/31/23	5/30/2026
CHAMBER	<u>CHAMBER</u>	Panashield	3M	N/A	12/29/23	12/18/2025
Pre-amp	<u>Pre-amp</u>	RF-LAMBDA	RLNA00M45GA	NA	2/27/22	7/26/2025
Receiver	EMI Test Receiver R&S ESW44	Rohde & Schwarz	ESW44	103049	10/13/22	10/12/2025

Software			
Software	Author	Version	Validation on
ESU Firmware	Rohde & Schwarz	4.43 SP3; BIOS v5.1-24-3	2018
RSCCommander	Rohde & Schwarz	1.6.4	2014
ScopeExplorer	LeCroy	v2.25.0.0	2009
Field Strength	Timco	v4.10.7.0	2016

8. Test Results

The results of the test are usually indicated in the form of tables, spectrum analyzer plots, charts, sample calculations, as appropriate for each test procedure.

A description and/or a block diagram of the test setup is usually provided.

The measurement results, along with the appropriate limits for comparison, may be presented in tabular or graphical form. In addition, any variation in the measurement environment may be reported if applicable (e.g., a significant change of temperature that could affect the cable loss and amplifier response).

Unless noted otherwise in the referenced standard, the measurements of **ac power-line conducted emissions and conducted power output** will be reported in units of dB μ V. Unless noted otherwise in the referenced standard, the measurements of **radiated emissions** will be reported in units of decibels, referenced to one microvolt per meter (dB μ V/m) for electric fields, or to one ampere per meter (dBA/m) for magnetic fields, at the distance specified in the appropriate standards or requirements. The measurements of antenna-conducted power for receivers may be reported in units of dB μ V if the impedance of the measuring instrument is also reported. Otherwise, antenna-conducted power will be reported in units of decibels referenced to one milliwatt (dBm). All formulas for data conversions and conversion factors, if used, will be included in this measurement report.

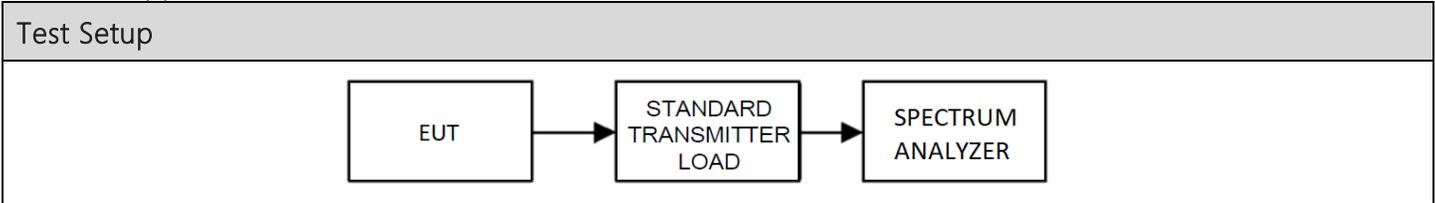
Example:

Freq (MHz)	Meter Reading	+ ACF	+CL	= FS
33	20 dB μ V	+ 10.36 dB/m	+0.40 dB	=30.36 dB μ V/m @ 3m

$$\text{EIRP} = \text{Pcond (dBm)} + \text{dBi}$$

8.1 Conducted Output Power

Limits from FCC Part 15.247 (b) (1) – (4) as applicable, and test procedure from ANSI C63.10-2013 section 7.8 or 11.9 as applicable.



Output Power Test Results

Test Results, GFSK	
Tuned Frequency (MHz)	Power Output (dBm)
2402	8.38
2442	8.44
2480	8.66

- MAXIMUM Conducted Output Power = 8.66dBm

Test Results, DQPSK	
Tuned Frequency (MHz)	Power Output (dBm)
2402	9.62
2442	9.68
2480	9.81

- MAXIMUM Conducted Output Power = 9.81 dBm

Test Results, 8DPSK	
Tuned Frequency (MHz)	Power Output (dBm)
2402	9.64
2442	9.69
2480	9.83

- MAXIMUM Conducted Output Power = 9.83 dBm

Point-to-Point - N/A. The EUT is not a PtP device.

MIMO - N/A. The EUT is not a MIMO device.

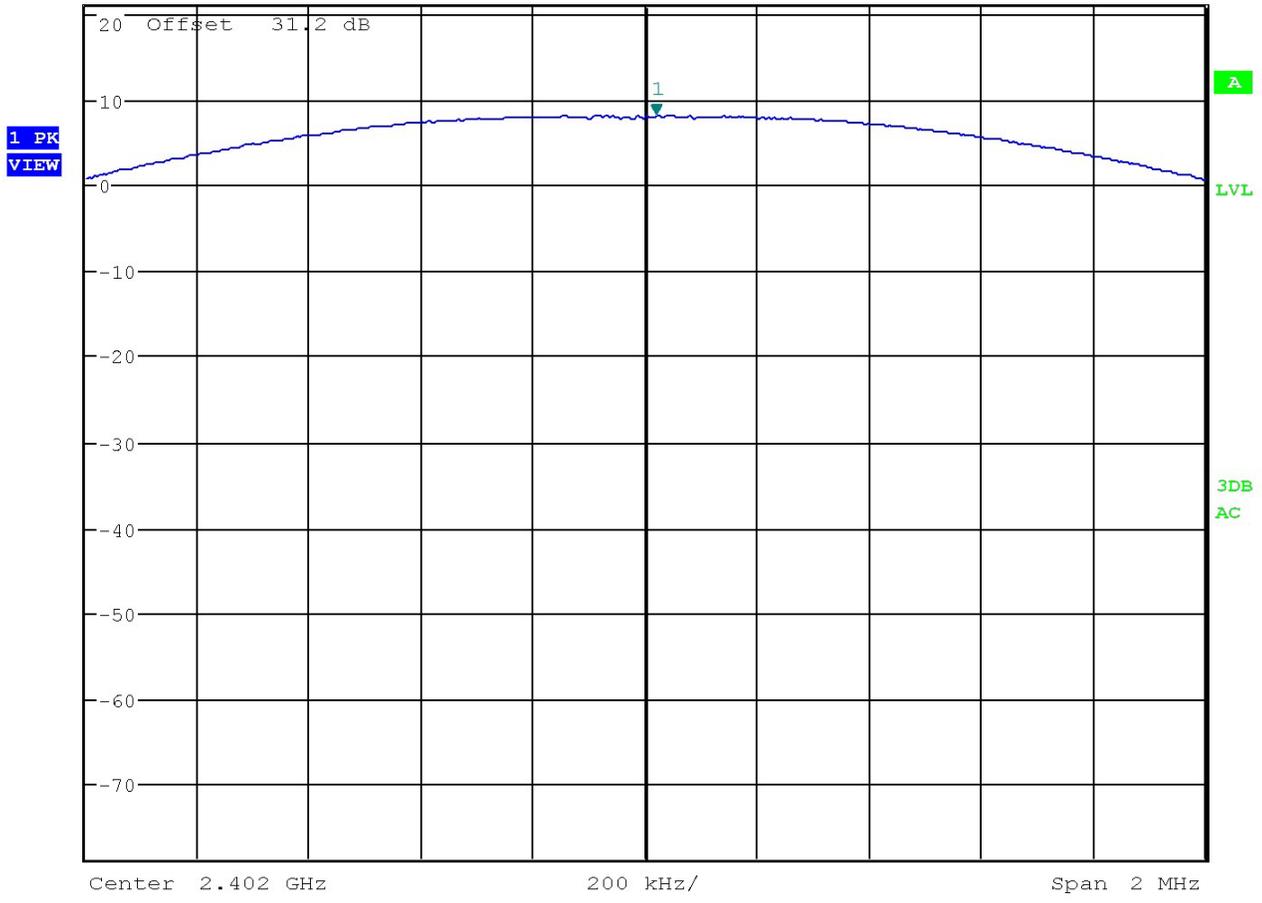
Conducted Output Power, Spectrum Plots

8.1.1 Conducted Output Power, 2402 MHz- GFSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 8.38 dBm
 SWT 2.5 ms 2.402019231 GHz

Ref 21.2 dBm Att 15 dB



Date: 6.JAN.2025 16:24:25

8.1.2 Conducted Output Power, 2442 MHz - GFSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 8.44 dBm
 SWT 2.5 ms 2.441964744 GHz

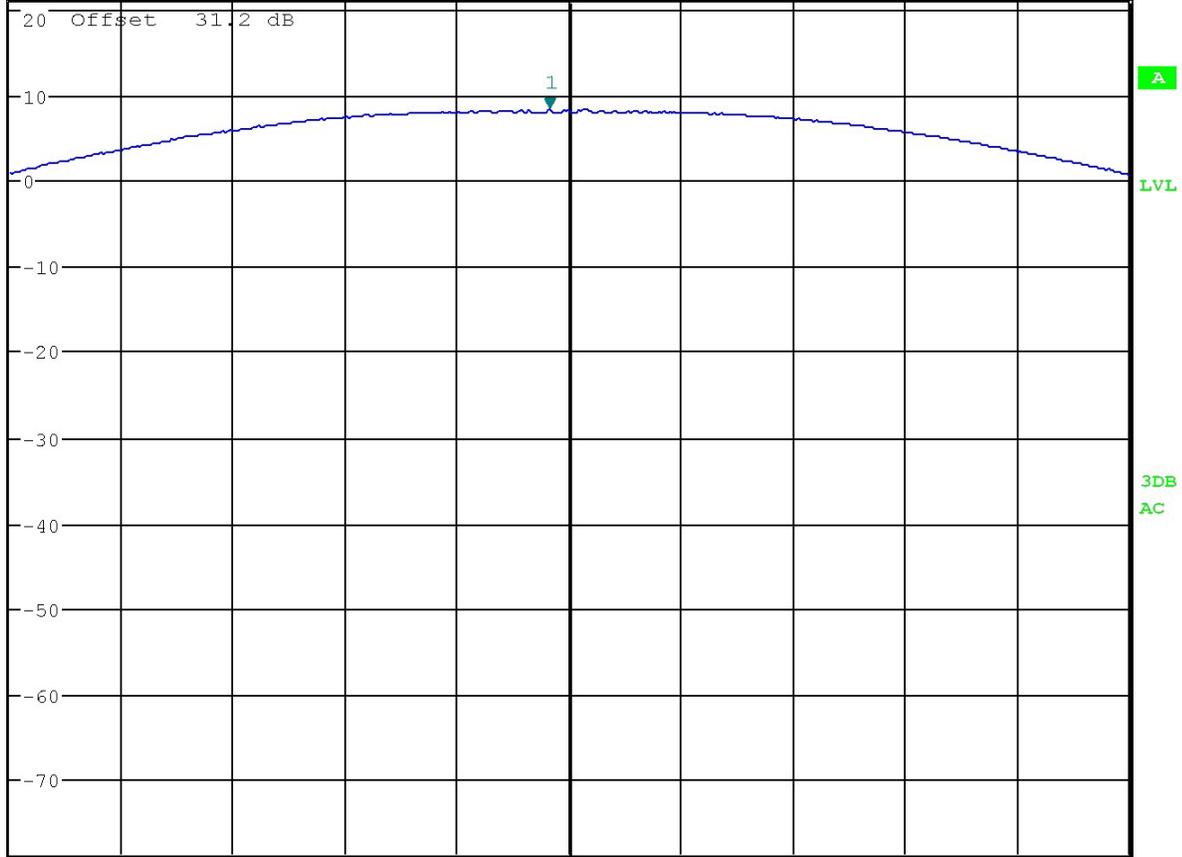
Ref 21.2 dBm

Att 15 dB

SWT 2.5 ms

2.441964744 GHz

1 PK
VIEW



Center 2.442 GHz

200 kHz/

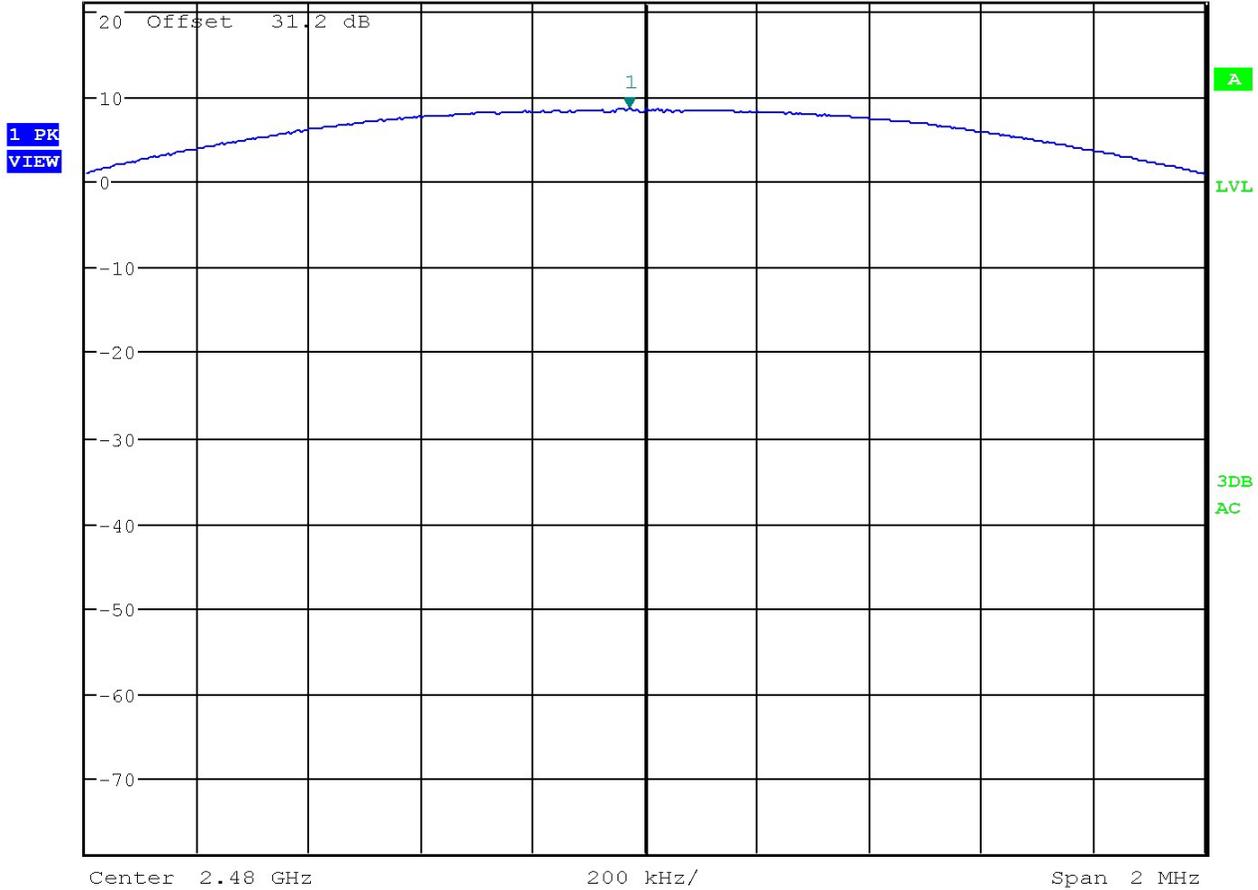
Span 2 MHz

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8.1.3 Conducted Output Power, 2480 MHz- GFSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 8.66 dBm
 Ref 21.2 dBm Att 15 dB SWT 2.5 ms 2.479971154 GHz

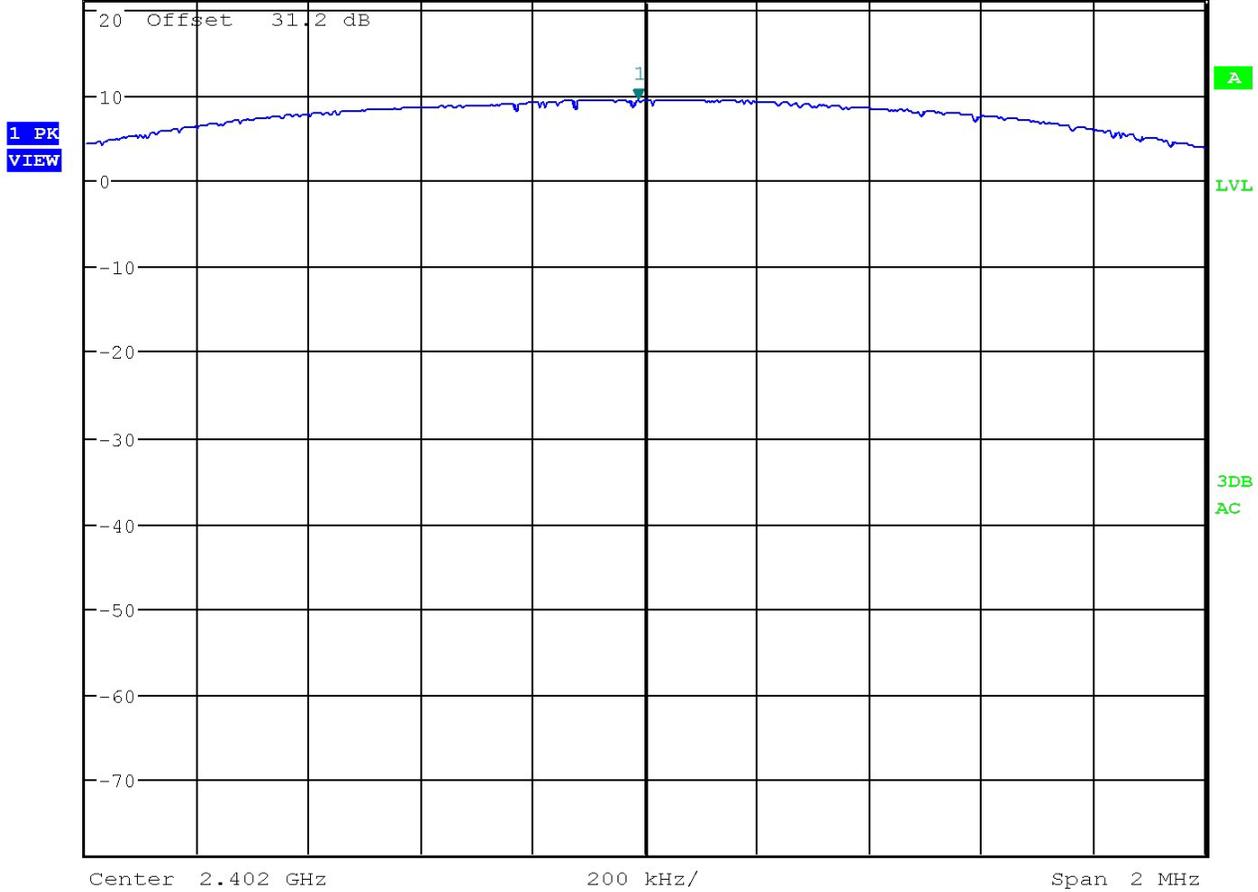


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8.1.4 Conducted Output Power, 2402 MHz- DQPSK



*RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 9.62 dBm
 Ref 21.2 dBm Att 15 dB SWT 2.5 ms 2.401987179 GHz

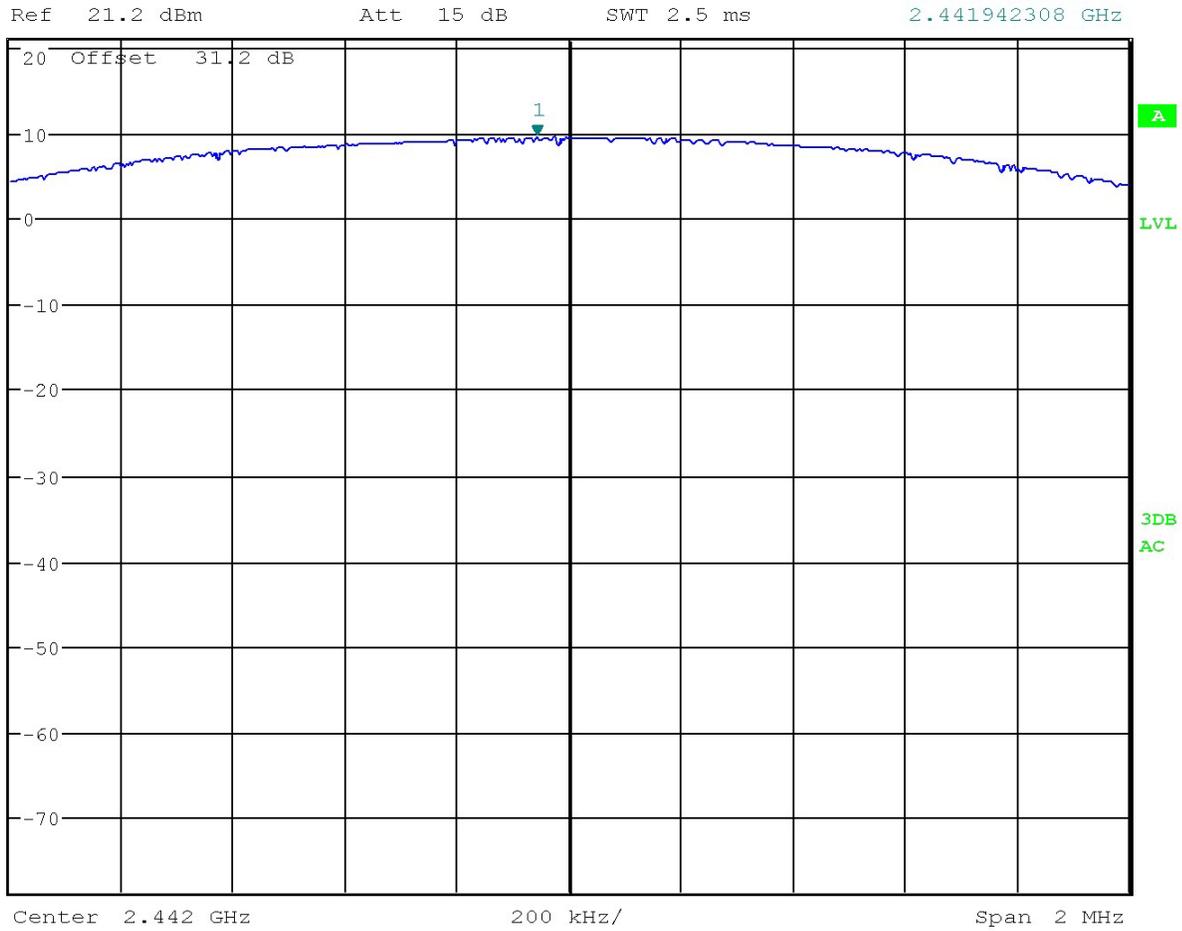


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8.1.5 Conducted Output Power, 2442 MHz- DQPSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 9.68 dBm
 SWT 2.5 ms 2.441942308 GHz

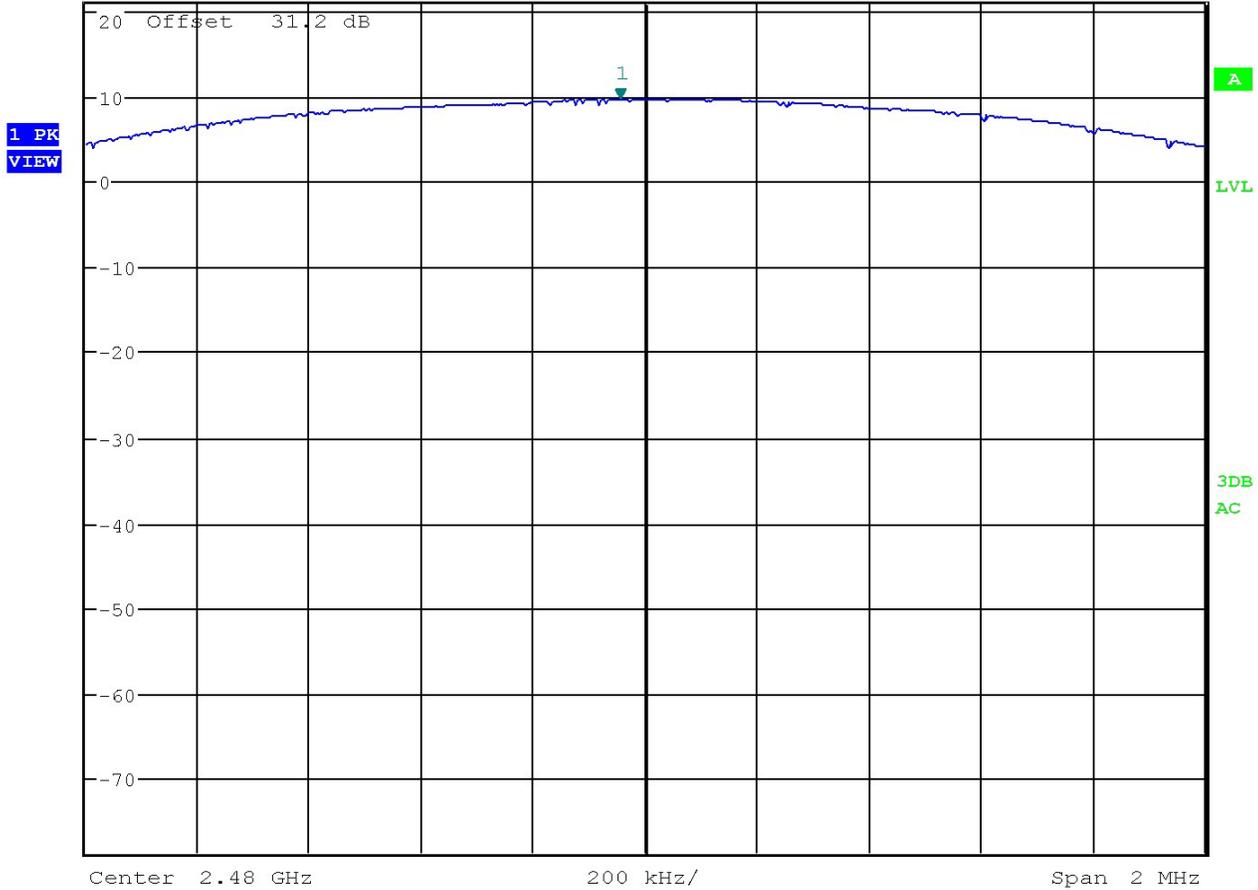


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8.1.6 Conducted Output Power, 2480 MHz- DQPSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 9.81 dBm
 Ref 21.2 dBm Att 15 dB SWT 2.5 ms 2.479955128 GHz

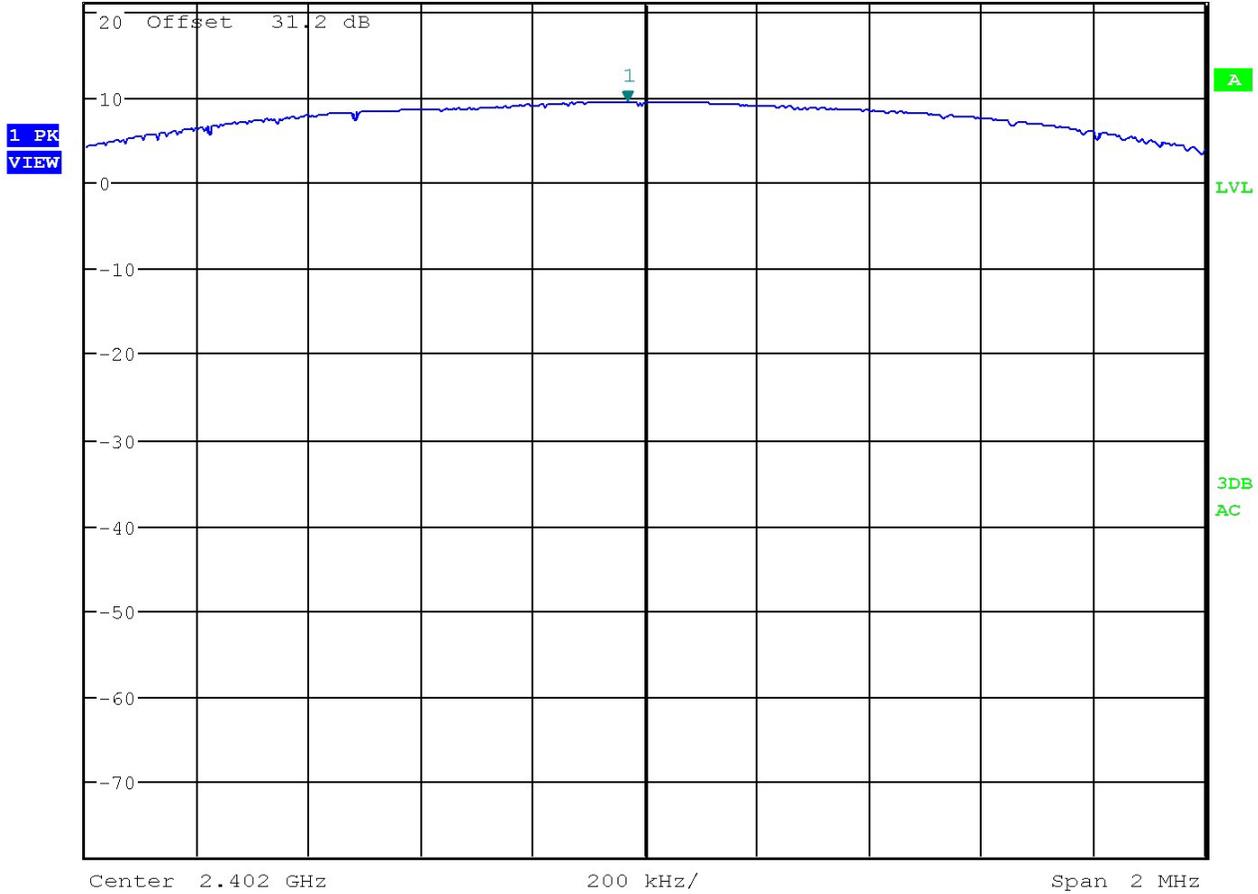


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8.1.7 Conducted Output Power, 2402 MHz- 8DPSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 9.64 dBm
 Ref 21.2 dBm Att 15 dB SWT 2.5 ms 2.401967949 GHz



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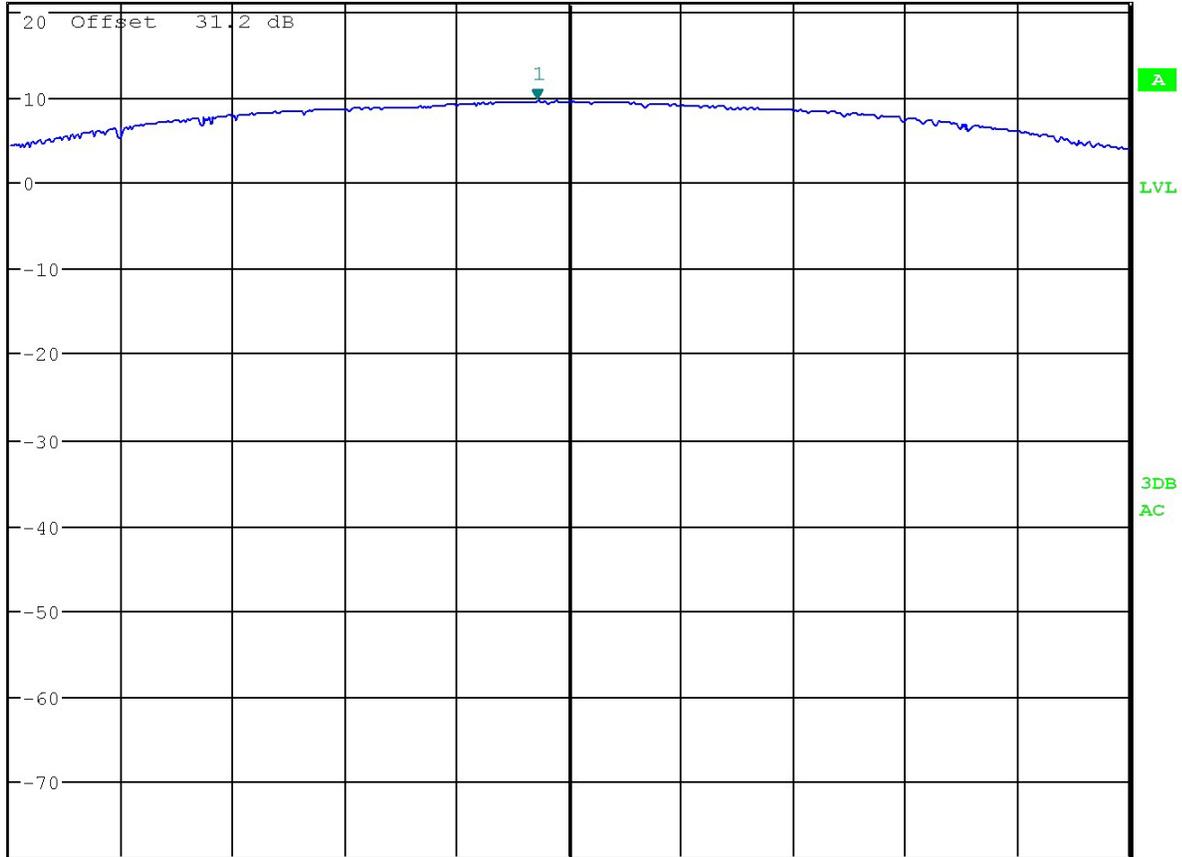
8.1.8 Conducted Output Power, 2442 MHz- 8DPSK



* RBW 1 MHz Marker 1 [T1]
 VBW 3 MHz 9.69 dBm
 SWT 2.5 ms 2.441942308 GHz

Ref 21.2 dBm Att 15 dB

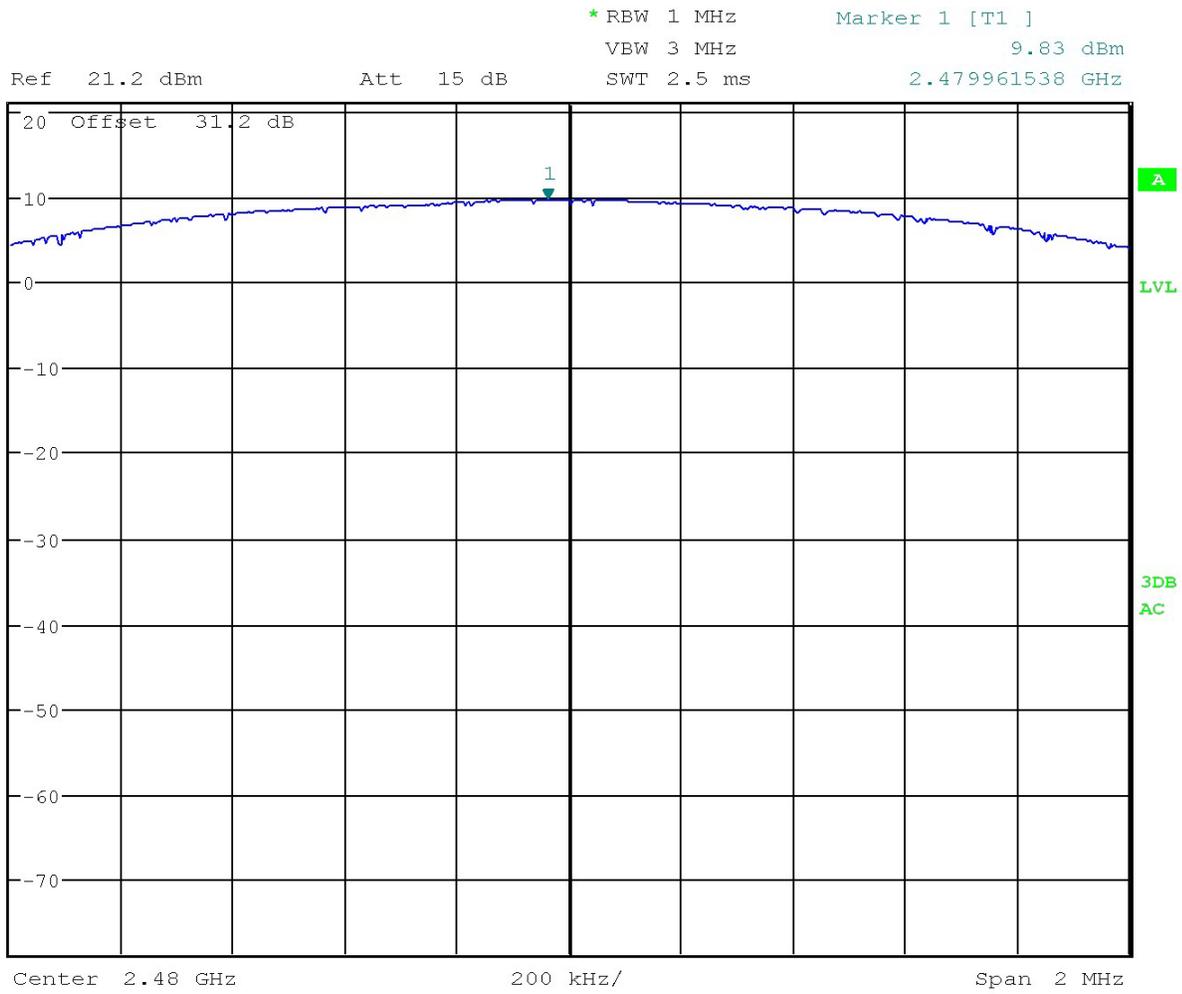
1 PK
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Center 2.442 GHz 200 kHz/ Span 2 MHz

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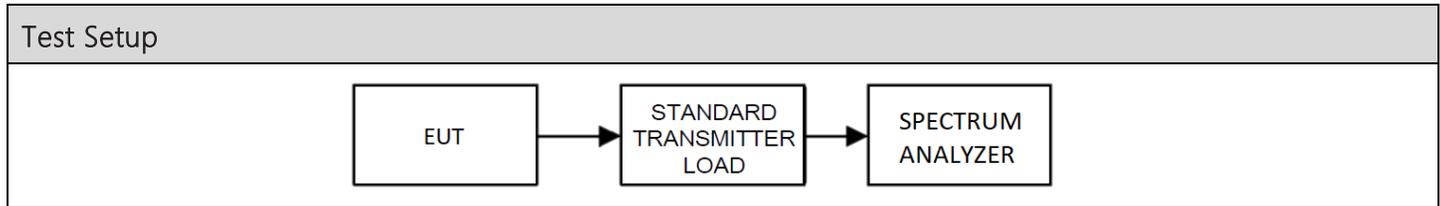
8.1.9 Conducted Output Power, 2480 MHz- 8DPSK



Date: 6.JAN.2025 16:34:49

8.2 Occupied Bandwidth

Requirement from FCC KDB 558074 D01 and test procedure from ANSI C63.10-2013 section 6.9.3



99% BW Test Results

Test Results, Mode 8DPSK		
Tuned Frequency (MHz)	Type of Bandwidth	Occupied Bandwidth (MHz)
2402	20 dB	1.070
2442	20 dB	1.070
2480	20 dB	1.070

Test Results, Mode DQPSK		
Tuned Frequency (MHz)	Type of Bandwidth	Occupied Bandwidth (MHz)
2402	20 dB	1.086
2442	20 dB	1.080
2480	20 dB	1.080

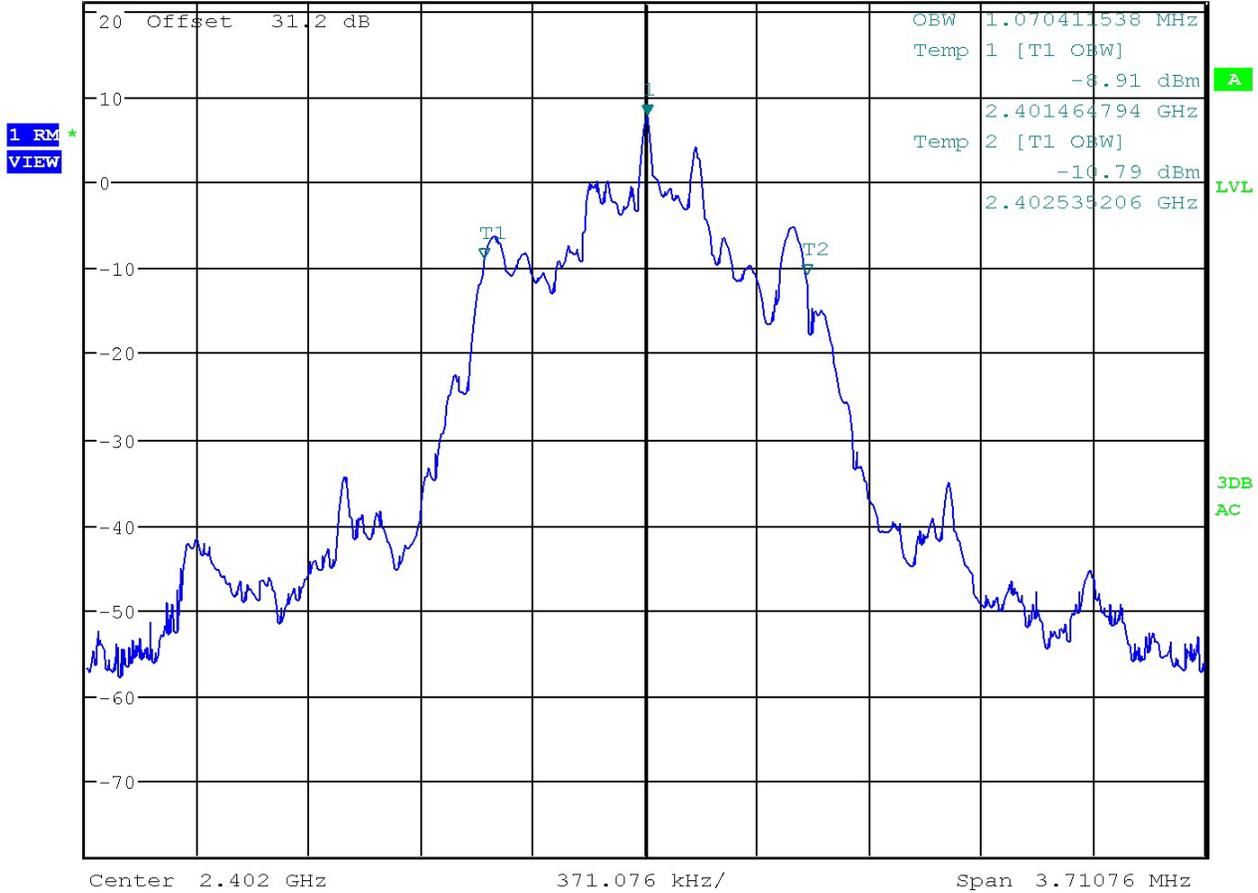
Test Results, Mode GFSK		
Tuned Frequency (MHz)	Type of Bandwidth	Occupied Bandwidth (MHz)
2402	20 dB	0.717
2442	20 dB	0.704
2480	20 dB	0.705

99% Occupied Bandwidth, Spectrum Plots
Occupied Bandwidth Modulation- 8DPSK

8.2.1 99% Occupied Bandwidth Modulation 8DPSK, 2402 MHz

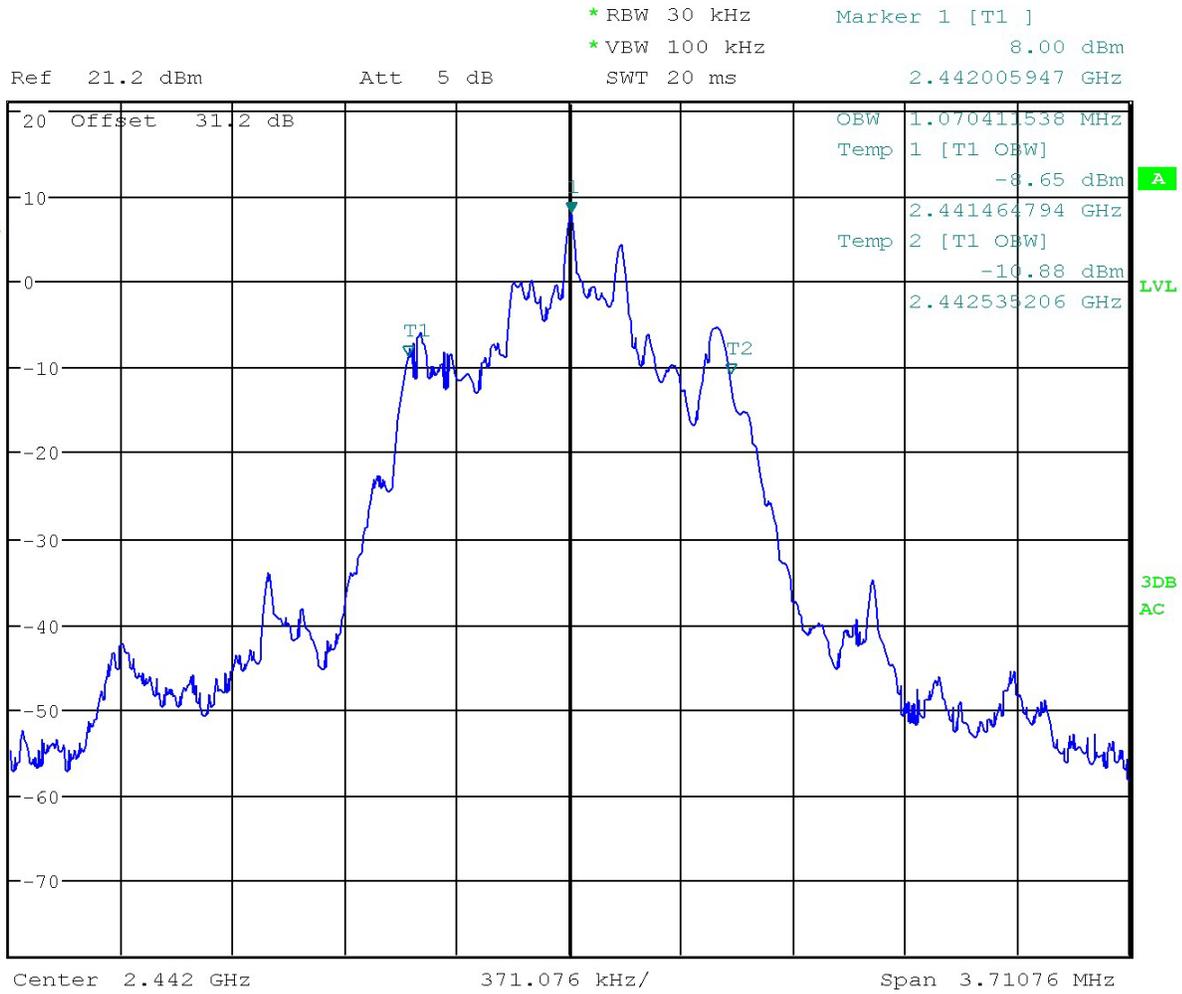


*RBW 30 kHz Marker 1 [T1]
*VBW 100 kHz 7.89 dBm
Ref 21.2 dBm Att 5 dB SWT 20 ms 2.402005947 GHz



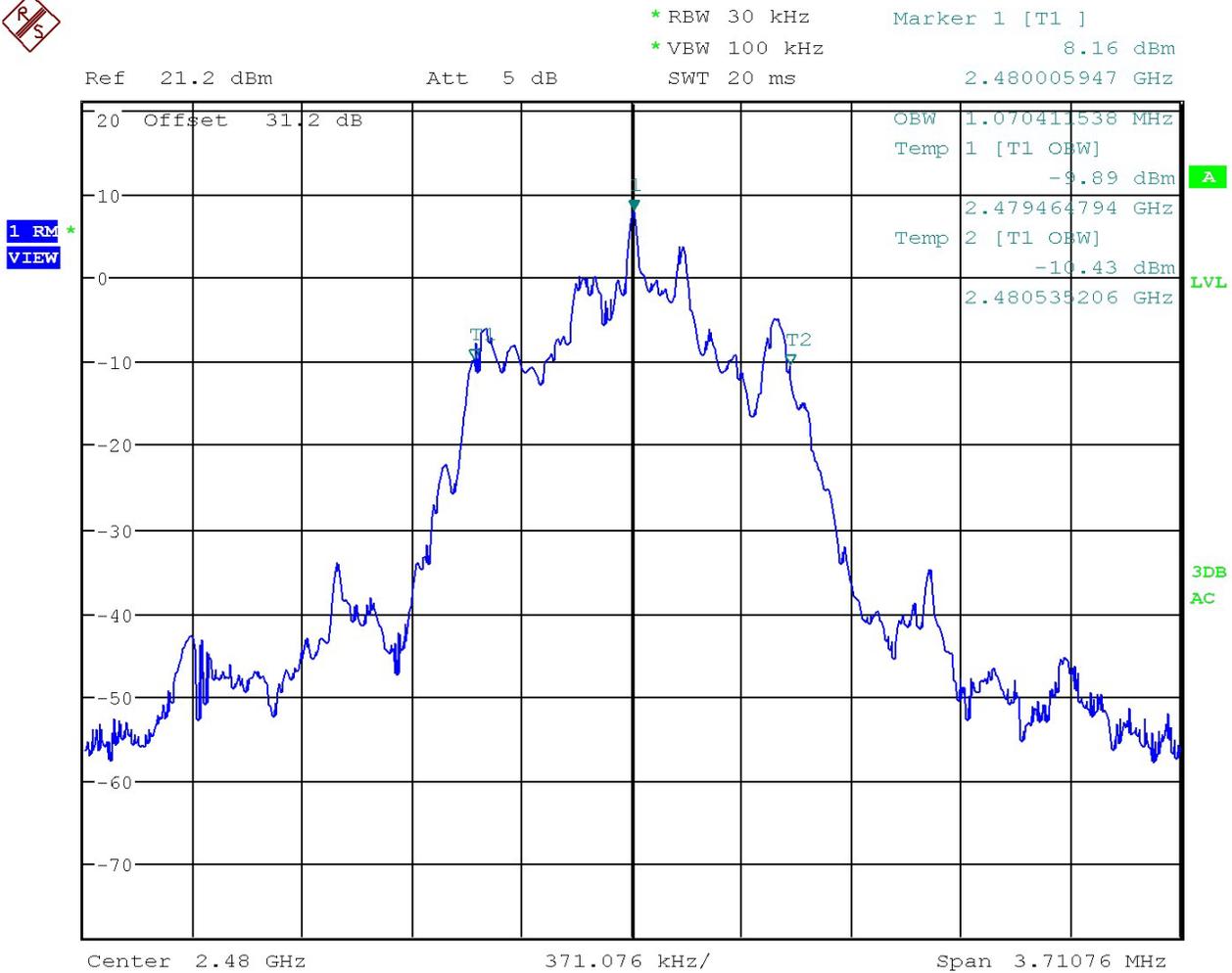
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8.2.2 99% Occupied Bandwidth Modulation 8DPSK, 2442 MHz



Date: 6.JAN.2025 16:40:32

8.2.3 99% Occupied Bandwidth Modulation 8DPSK, 2480 MHz



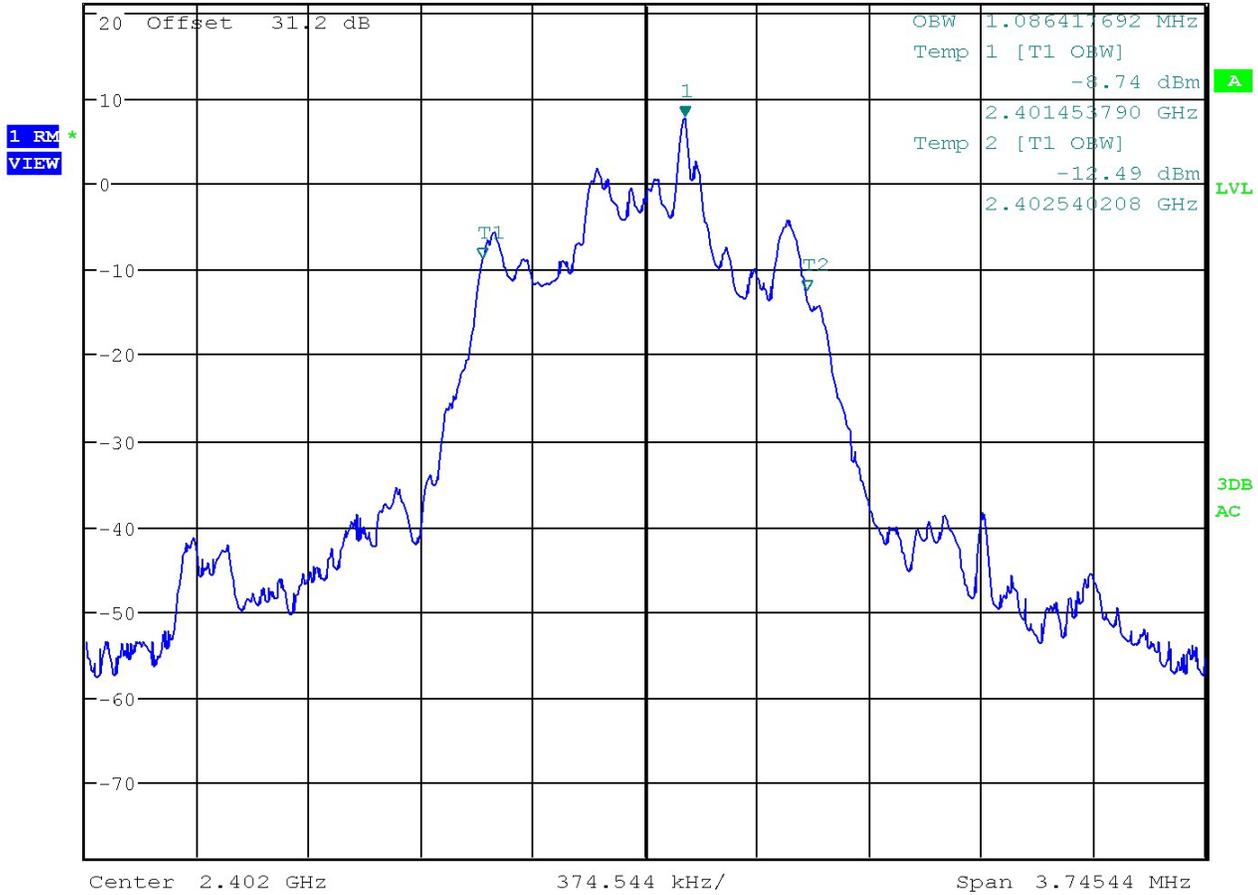
Date: 6.JAN.2025 16:41:58

Occupied Bandwidth Modulation- DQPSK

8.2.4 99% Occupied Bandwidth Modulation DQPSK, 2402 MHz



* RBW 30 kHz Marker 1 [T1]
* VBW 100 kHz 7.85 dBm
Ref 21.2 dBm Att 5 dB SWT 20 ms 2.402132051 GHz



Date: 6.JAN.2025 16:46:29

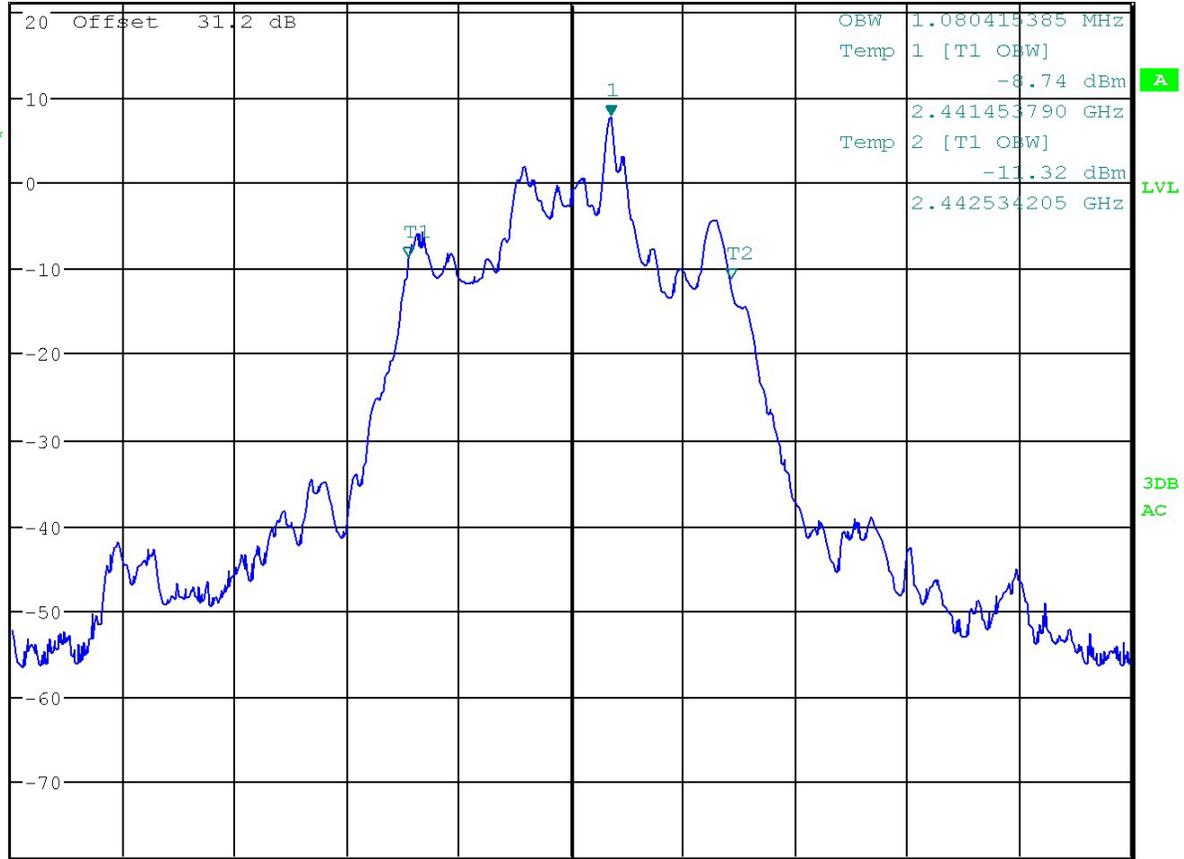
8.2.5 99% Occupied Bandwidth Modulation DQPSK, 2442 MHz



Ref 21.2 dBm Att 5 dB SWT 20 ms

*RBW 30 kHz Marker 1 [T1] 7.94 dBm
*VBW 100 kHz 2.442132051 GHz

1 RM *
VIEW



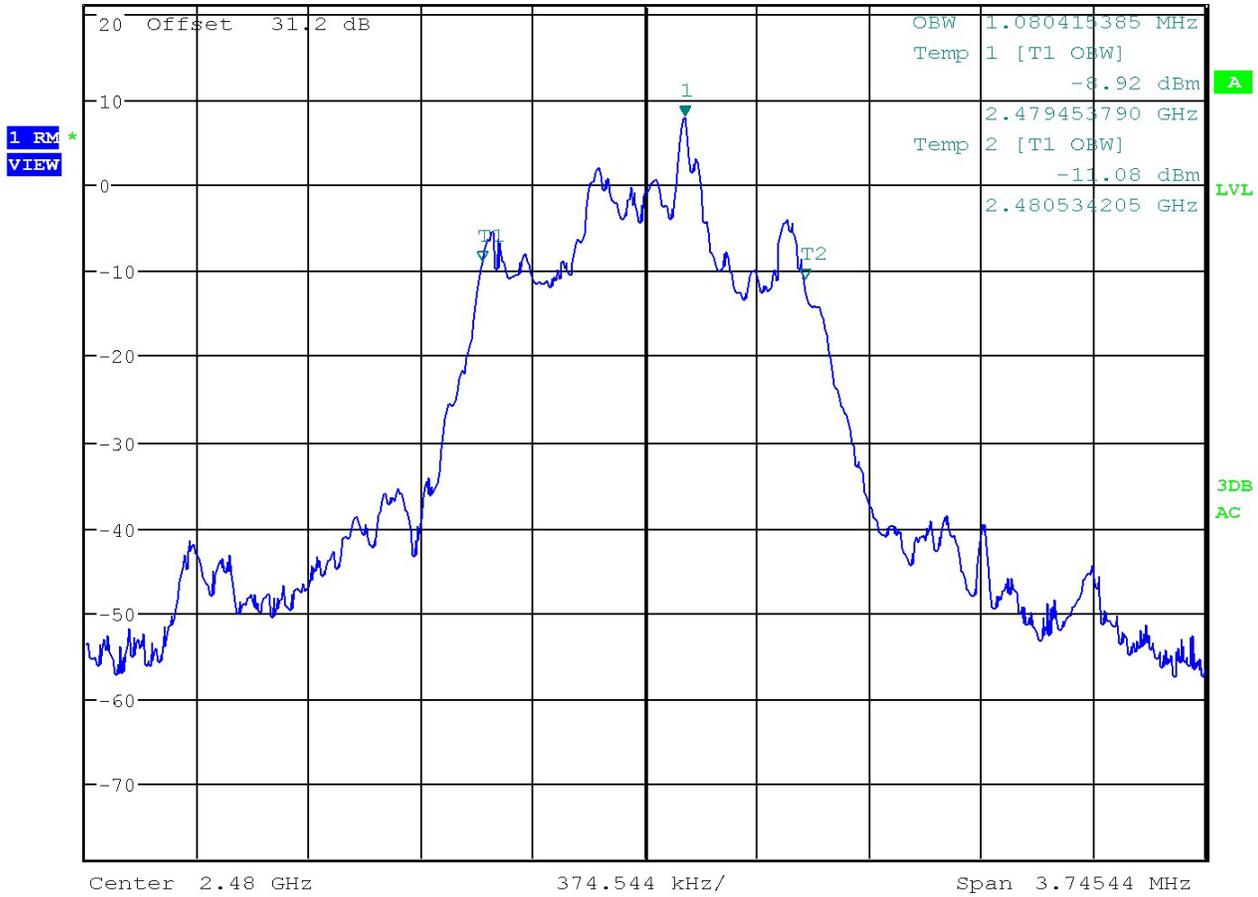
Center 2.442 GHz 374.544 kHz/ Span 3.74544 MHz

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8.2.6 99% Occupied Bandwidth Modulation DQPSK, 2480 MHz



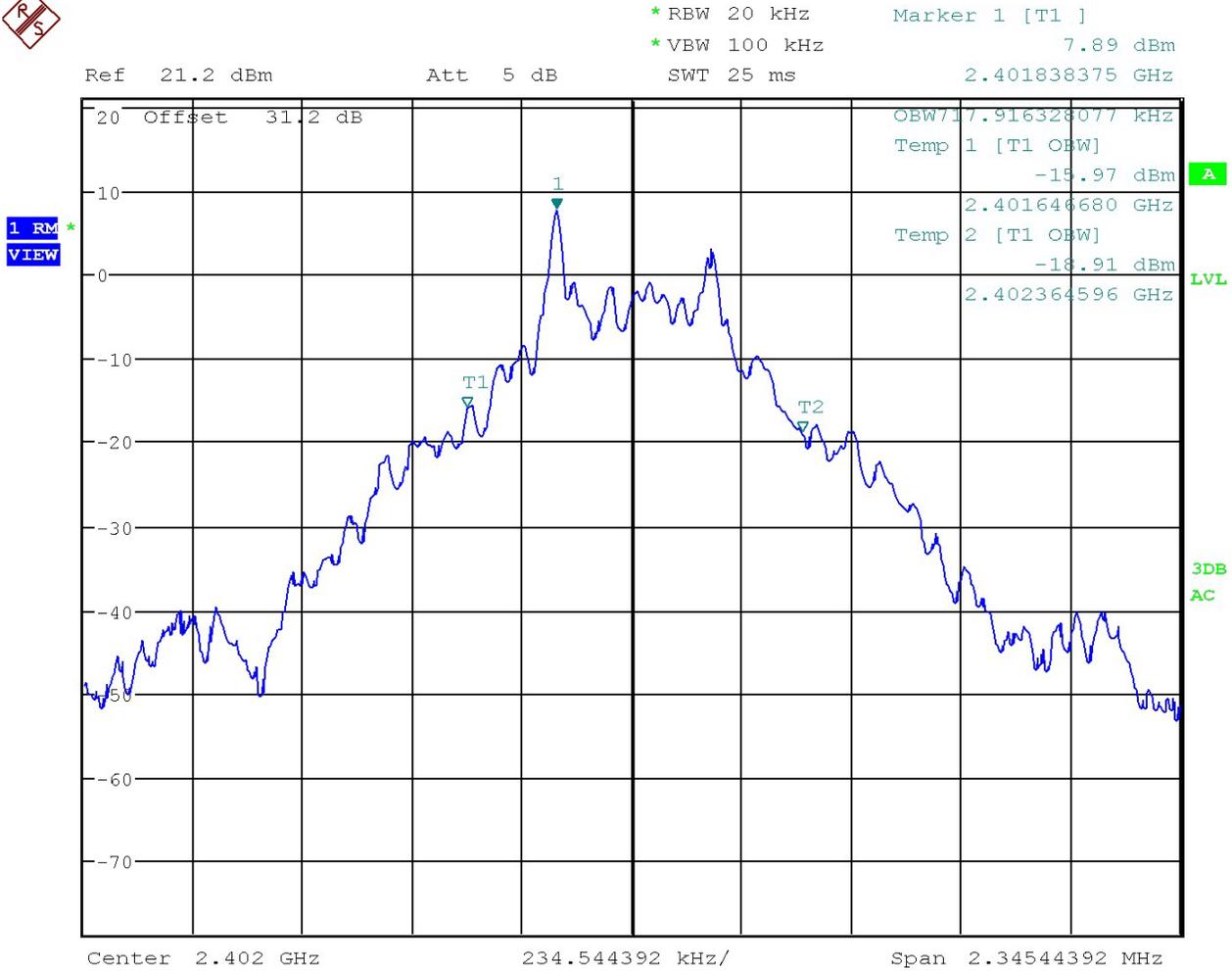
*RBW 30 kHz Marker 1 [T1]
*VBW 100 kHz 8.09 dBm
Ref 21.2 dBm Att 5 dB SWT 20 ms 2.480132051 GHz



Date: 6.JAN.2025 16:49:11

Occupied Bandwidth Modulation- GFSK

8.2.7 99% Occupied Bandwidth Modulation GFSK, 2402 MHz

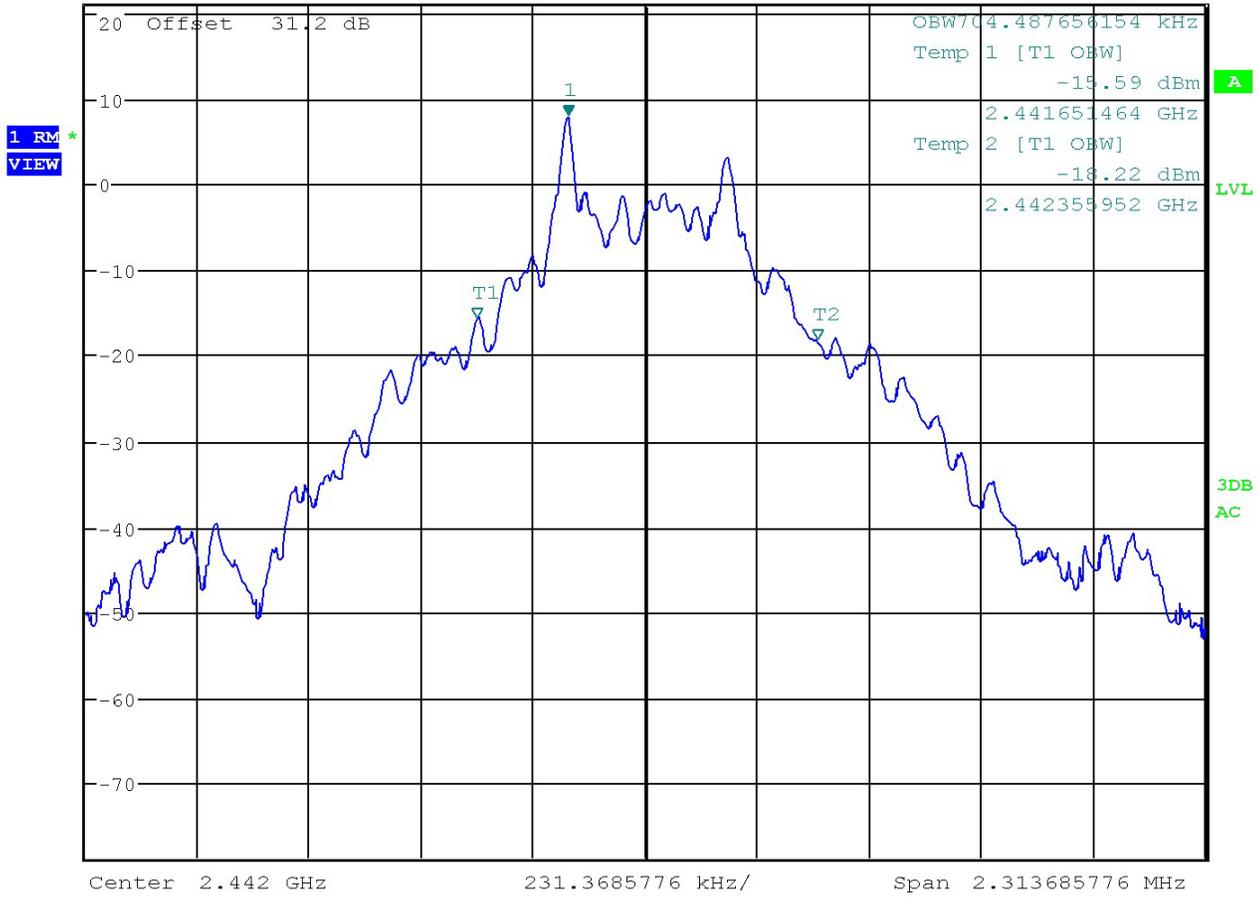


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8.2.8 99% Occupied Bandwidth Modulation GFSK, 2442 MHz



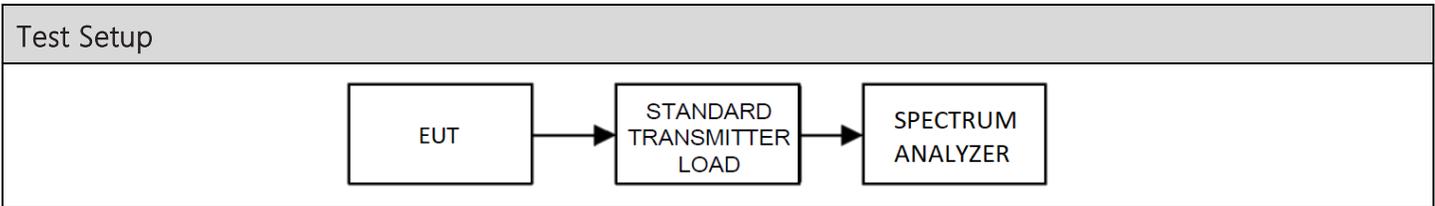
* RBW 20 kHz Marker 1 [T1]
* VBW 100 kHz 7.97 dBm
Ref 21.2 dBm Att 5 dB SWT 25 ms 2.441840563 GHz



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8.3 20dB Bandwidth

Limits from FCC Part 15.247 (a)(1) – (2) as applicable, and test procedure from ANSI C63.10-2013 section 7.8 or 11.8 as applicable.



20dB Bandwidth Test Results

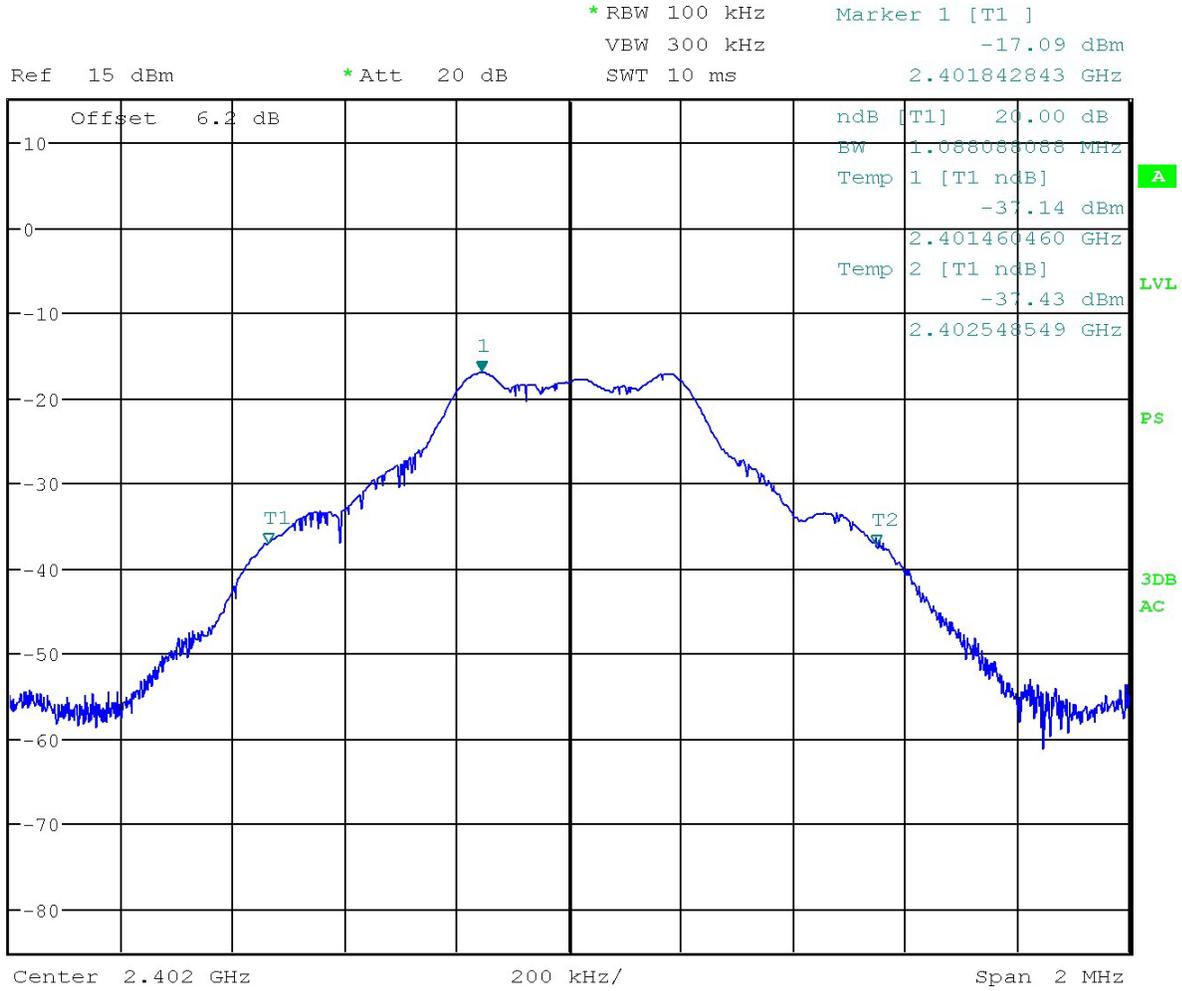
Test Results, GFSK	
Tuned Frequency (MHz)	20dB Bandwidth (kHz)
2402	1080
2442	1080
2480	1077

Test Results, DQPSK	
Tuned Frequency (MHz)	20dB Bandwidth (kHz)
2402	1334
2442	1335
2480	1335

Test Results, 8DPSK	
Tuned Frequency (MHz)	20dB Bandwidth (kHz)
2402	1088
2442	1080
2480	1077

20dB Bandwidth, Spectrum Plots GFSK

8.3.1 20 dB Bandwidth, 2402 MHz- GFSK



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