

## TEST REPORT

100, Jangjateo-ro, Hobeop-myeon, Icheon-si, Gyeonggi-do, 17396, Korea Tel: 031-637-8898 / Fax: 0505-116-8895

1. Client					
• Name	:	Sena Technologies Co	o., Ltd.		
Address.	::	19, Heolleung-ro 569	-gil, Gangna	m-gu, Seoul, Korea	
2. Use of Report FCC Approval					
3. Sample Des	scription				
Product	Name :	Wireless Communicati	on Systems		
<ul> <li>Model Na</li> </ul>	ime:	SHARK BT			
4. Date of Rec	eipt:	2024-07-05			
5. Date of Tes	t :	2024-07-21 ~ 2024-	07-31		
6. Test Method	:	FCC Part 15 Subpart (	C 15.247		
7. Test Results	3 :	Refer to the test res	ults		
<ul> <li>The results shown in this test report are the results of testing the samples provided.</li> <li>This test report is prepared according to the requirements of ISO / IEC 17025.</li> </ul>					
	Tested by	1/	Technical N	Manager mg	
Affirmation	Jong-Myoung	, Shin (Sign)	Kyung-Ta	ek, Lee (Sign)	
				Aug 09, 2024	
EMC Labs Co., Ltd.					

64



## <u>Contents</u>

1.	Applicant & Manufacturer & Test Laboratory Information	4
2.	Equipment under Test(EUT) Information	4
3.	Test Summary	5
4.	Used equipment on test······	7
5.	Antenna Requirement	7
6.	20 dB Bandwidth & Occupied Bandwidth (99%)	9
7.	Number of Hopping Frequencies	13
8.	Time of Occupancy (Dwell Time)·····	16
9.	Carrier Frequencies Separation	18
10.	Peak Output Power ·····	22
11.	TX Radiated Spurious Emission and Conducted Spurious Emission	29
12.	Conducted Emission	59
	APPENDIX	
APP	ENDIX I TEST SETUP	62

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 2 / 65

This test report shall not be reproduced except in full, Without the written approval.

APPENDIX II UNCERTAINTY ······



# <u>Version</u>

TEST REPORT NO.	DATE	DESCRIPTION	
KR0140-RF2408-001	Aug 09, 2024	Initial Issue	

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 3 / 65



## 1. Applicant & Manufacturer & Test Laboratory Information

## 1.1 Applicant Information

Applicant	Sena Technologies Co., Ltd.
Applicant Address 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea	
Contact Person	Seunghyun Kim
Telephone No.	+82-2-573-7772
Fax No.	+82-2-573-7710
E-mail	shkim77@sena.com

## 1.2. Manufacturer Information

Manufacturer	Sena Technologies Co., Ltd.	
Manufacturer Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea	

## 1.3 Test Laboratory Information

Laboratory	EMC Labs Co., Ltd.
Laboratory Address	100, Jangjateo-ro, Hobeop-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Contact Person	Jong-Myoung, Shin
Telephone No.	+82-31-637-8895
Fax No.	+82-505-116-8895
FCC Designation No.	KR0140
FCC Registration No.	580000
IC Site Registration No.	28751



## 2. Equipment under Test(EUT) Information

## 2.1 General Information

Product Name	Wireless Communication Systems	
Model Name SHARK BT		
Variant Model Name N-Com Bluetooth+		
FCC ID	S7A-SP167	
Rated Voltage	DC 3.7 V	

## 2.2 Additional Information

Operating Frequency	2 402 MHz ~ 2 480 MHz
Number of channel	79
Modulation Type	BDR Mode(GFSK), EDR Mode(Pi/4 DQPSK, 8DPSK)
Antenna Type	Chip Antenna
Antenna Gain	0.3 dBi
Firmware Version	1.0
Hardware Version	1.0
Test software	BlueTest3 V3.3.5

#### 2.3 Test Frequency

Test mode	Test Frequency (MHz)				
	Low Frequency	Middle Frequency	High Frequency		
GFSK	2 402	2 480			
Pi/4 DQPSK	2 402 2 441 2 480		2 480		
8DPSK	2 402 2 441 2 480				

#### 2.4 Worst-Case

BDR	GFSK (DH5)
EDR	8DPSK (3-DH5)

Note: The power measurement has been conducted to determine the worst-case mode from all possible Combinations between available modulations, data rates.

#### 2.5 Mode of operation during the test

- The EUT continuous transmission mode during the test with set at Low Channel, Middle Channel, and High Channel. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, YZ, XZ planes.

## 2.6 Modifications of EUT

- None

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 5 / 65



## 3. Test Summary

Applied	FCC Rule	IC Rule	Test Items	Test Condition	Result
$\square$	15.203	-	Antenna Requirement		С
$\square$	15.247(a)	-	20 dB Bandwidth		С
$\square$	_	RSS GEN (6.7)	Occupied Bandwidth (99%)		С
$\square$	15.247(a)	RSS-247 (5.1)	Number of Hopping Frequencies		С
$\square$	15.247(a)	RSS-247 (5.1)	Time of Occupancy (Dwell Time)		С
$\square$	15.247(a)	RSS-247 (5.1)	Carrier Frequencies Separation		С
$\square$	15.247(b)	RSS-247 (5.4)	Peak Output Power		С
$\square$	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emission		С
	15.247(d) 15.205 & 15.209	RSS-247 (5.5) RSS-GEN (8.9 & 8.10)	Radiated Spurious Emission	Radiated	С
	15.207	RSS-GEN (8.8)	Conducted Emissions	AC Line Conducted	С

<u>Note 1</u>: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

The sample was tested according to the following specification: ANSI C63.10:2013.

Compliance was determined by specification limits of the applicable standard according to customer requirements.



## 4. Used equipment on test

Description	Manufacturer	Model Name	Serial Name	Next Cal.
TEMP & HUMID CHAMBER	JFM	JFMA-001	20200929-01	2024.12.07
CONTROLLER	AMWON TECHNOLOGY	TEMI2500	S7800VK191 0707	2024.12.07
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	MY45304057	2024.12.08
MXG ANALOG SIGNAL GENERATOR	AGILENT	N5183A	MY50141890	2024.12.08
SYSTEM DC POWER SUPPLY	AGILENT	6674A	MY53000118	2024.12.11
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	257524	2024.12.08
DIRECTIONAL COUPLER	AGILENT	773D	2839A01855	2024.12.08
ATTENUATOR	AGILENT	8493C	73193	2024.12.08
TERMINATIOM	HEWLETT PACKARD	909D	07492	2024.12.08
POWER DIVIDER	HEWLETT PACKARD	11636A	06916	2024.12.08
SLIDE-AC	DAEKWANG TECH	SV-1023	NONE	2024.11.10
DIGITAL MULTIMETER	HUMANTECHSTORE	15B+	50561541WS	2024.12.08
ATTENUATOR	ACE RF COMM	ATT SMA 20W 20dB 8GHz	A-0820.SM20.2	2025.04.04
DC POWER SUPPLY	AGILENT	E3634A	MY40012120	2025.02.22
USB Peak Power Sensor	Anritsu	MA24408A	12321	2024.11.09
High Pass Filter	WT Microwave INC.	WT-A3314-HS	WT22111804-1	2024.12.08
High Pass Filter	WT Microwave INC.	WT-A1935-HS	WT22111804-2	2024.12.08
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSU26	200444	2025.02.22
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-1	2025.06.28
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-2	2025.06.28
Balanced Temperature and Humidity Control System	ESPEC CORP.	SH-241	92004650	2025.06.13
ACTIVE LOOP ANTENNA	TESEQ	HLA 6121	55685	2024.12.22
Biconilog ANT	Schwarzbeck	VULB 9160	3260	2026.04.01
Biconilog ANT	Schwarzbeck	VULB9168	902	2024.11.30
Horn ANT	Schwarzbeck	BBHA9120D	974	2024.11.30
Horn ANT	Schwarzbeck	BBHA9120D	1497	2025.01.04
Amplifier	TESTEK	TK-PA18H	200104-L	2025.03.14
Horn ANT	Schwarzbeck	BBHA9170	01188	2025.03.19
Horn ANT	Schwarzbeck	BBHA9170	01189	2025.03.19
AMPLIFIER	TESTEK	TK-PA1840H	220105-L	2025.03.14
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101952	2025.03.14
Test Receiver	ROHDE & SCHWARZ	ESR7	101616	2025.06.27
LISN	ROHDE & SCHWARZ	ENV216	100409	2025.01.04
PULSE LIMITER	lignex1	EPL-30	NONE	2025.01.04

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 7 / 65



## 5. Antenna Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to §15.247(b)(4) e conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### 5.1 Result

#### Complies

(The transmitter has a Chip Antenna. The directional peak gain of the antenna is 0.3 dBi.)



## 6. 20 dB Bandwidth & Occupied Bandwidth (99%)

## 6.1 Test Setup

Refer to the APPENDIX I.

## 6.2 Limit

Limit : Not Applicable

## 6.3 Test Procedure

- 1. The 20 dB bandwidth & Occupied bandwidth were measured with a spectrum analyzer connected to RF antenna Connector (conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
- 2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting:

RBW = 1% to 5% of the 20 dB Bandwidth & Occupied Bandwidth  $VBW \ge 3 \times RBW$ Span = between two times and five times the 20 dB Bandwidth & Occupied Bandwidth Sweep = Auto Detector function = Peak Trace = Max Hold

## 6.4 Test Result

Test Mode	Test Frequency	20 dB Bandwidth (MHz)	Occupied Bandwidth (MHz)		
	Low	0.963	0.863		
GFSK	Middle	0.962	0.862		
	High	0.962	0.860		
	Low	1.311	1.188		
8DPSK	Middle	1.312	1.188		
	High	1.311	1.189		

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 9 / 65



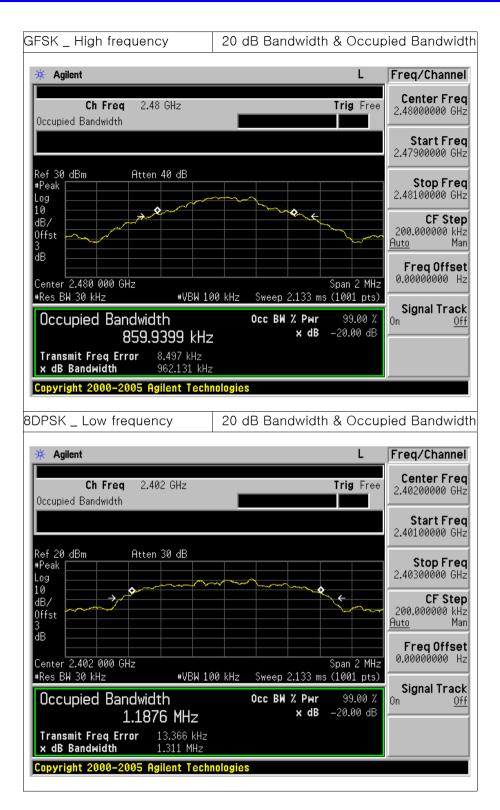


#### 6.5 Test Plot

GFSK \_ Low frequency 20 dB Bandwidth & Occupied Bandwidth 🔆 Agilent Freq/Channel L **Center Freq** Ch Freq 2.402 GHz Trig Free 2.40200000 GHz Occupied Bandwidth Start Freq 2.40100000 GHz Ref 30 dBm Atten 40 dB Stop Freq #Peak 2.40300000 GHz Log 10 ٥ ¢ + ð **CF** Step dB/ 200.000000 kHz Offst <u>Auto</u> ďВ Freq Offset 0.0000000 Hz Center 2.402 000 GHz #Res BW 30 kHz Span 2 MHz #VBW 100 kHz Sweep 2.133 ms (1001 pts) Signal Track Occupied Bandwidth Occ BW % Pwr 99.00 % 0n <u>0ff</u> x dB -20.00 dB 863.0783 kHz 7.863 kHz 963.302 kHz **Transmit Freq Error** x dB Bandwidth Copyright 2000-2005 Agilent Technologies GFSK \_ Middle frequency 20 dB Bandwidth & Occupied Bandwidth 🔆 Agilent L Freq/Channel Center Freq Ch Freq 2.441 GHz Trig Free 2.44100000 GHz Occupied Bandwidth Start Freq 2.44000000 GHz Ref 30 dBm Atten 40 dB Stop Freq #Peak 2.44200000 GHz Log 10 \$ < ٥ **CF** Step dB/ 200.000000 kHz Offst Auto Man ďВ FreqOffset 0.00000000 Hz Center 2.441 000 GHz #Res BW 30 kHz Span 2 MHz #VBW 100 kHz Sweep 2.133 ms (1001 pts) Signal Track Occupied Bandwidth Occ BW % Pwr 99.00 % 0n Off -20.00 dB x dB 862.1025 kHz Transmit Freq Error 8.254 kHz x dB Bandwidth 961.965 kHz Copyright 2000-2005 Agilent Technologies

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 10 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 11 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 12 / 65



## 7. Number of Hopping Frequencies

## 7.1 Test Setup

Refer to the APPENDIX I.

## 7.2 Limit

Limit : >= 15 hops

## 7.3 Test Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, two frequency ranges for FH mode within the 2400  $\sim$  2483.5 MHz were examined.

The spectrum analyzer is set to:

 Span = 50 MHz

 RBW = To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

 VBW ≥ RBW
 Sweep = Auto

 Detector = Peak
 Trace = Max hold

## 7.4 Test Result

Test Mode	Number of Hopping Channels
GFSK	79
8DPSK	79

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 13 / 65



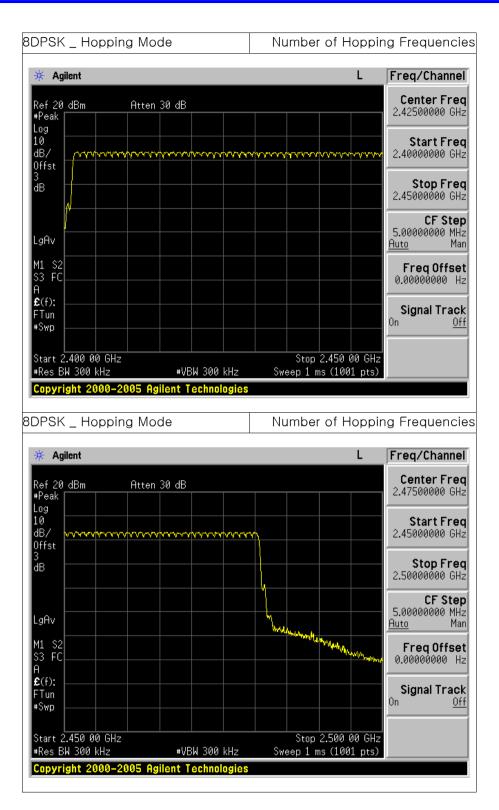


## 7.5 Test Plot

GFSK \_ Hopping Mode Number of Hopping Frequencies 🔆 Agilent Freq/Channel 1 **Center Freq** Ref 30 dBm Atten 40 dB 2.42500000 GHz #Peak Log 10 Start Freq M dB/ Offst 2.40000000 GHz Stop Freq ďВ 2.45000000 GHz **CF** Step 5.00000000 MHz LgAv <u>Auto</u> M1 S2 S3 FC Freq Offset 0.0000000 Hz Ĥ £(f): Signal Track FTun 0n <u>0ff</u> #Ѕ₩р Start 2.400 00 GHz Stop 2.450 00 GHz #Res BW 300 kHz #VBW 300 kHz Sweep 1 ms (1001 pts) Copyright 2000-2005 Agilent Tecl GFSK \_ Hopping Mode Number of Hopping Frequencies 🔆 Agilent Freq/Channel Center Freq 2.47500000 GHz Ref 30 dBm #Peak Atten 40 dB Log 10 dB/ Start Freq W ากกกกกกกก 2.45000000 GHz Offst 3 dB Stop Freq 2.50000000 GHz **CF** Step 5.00000000 MHz LgAv <u>Auto</u> Man M1 S2 S3 FC FreqOffset 0.00000000 Hz ٩ £(f): Signal Track FTun 0n <u>0ff</u> ŧSwp Start 2.450 00 GHz Stop 2.500 00 GHz #Res BW 300 kHz #VBW 300 kHz Sweep 1 ms (1001 pts) Copyright 2000–2005 Agilent Technologies

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 14 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 15 / 65



## 8. Time of Occupancy (Dwell Time)

## 8.1 Test Setup

Refer to the APPENDIX I.

## 8.2 Limit

The maximum permissible time of occupancy is 400 ms within a period of 400 ms multiplied by the number of hopping channels employed.

#### 8.3 Test Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to:

```
Center frequency = 2441 MHz Span = Zero

RBW = 1 MHz (RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T,

where T is the expected dwell time per channel)

VBW ≥ RBW Detector = Peak

Trace = Max hold
```

## 8.4 Test Result

Test Mode	Number of Hopping Channels	Burst On Time (ms)	Result (sec)	Limit (sec)
GFSK (non-AFH)	79	2.880	0.31	0.40
GFSK (AFH)	20	2.880	0.15	0.40
8DPSK (non-AFH)	79	2.888	0.31	0.40
8DPSK (AFH)	20	2.888	0.15	0.40

Note: Dwell Time = 0.4 x Hopping channel x Burst On Time x ((Hopping rate / Time slots) / Hopping channel)

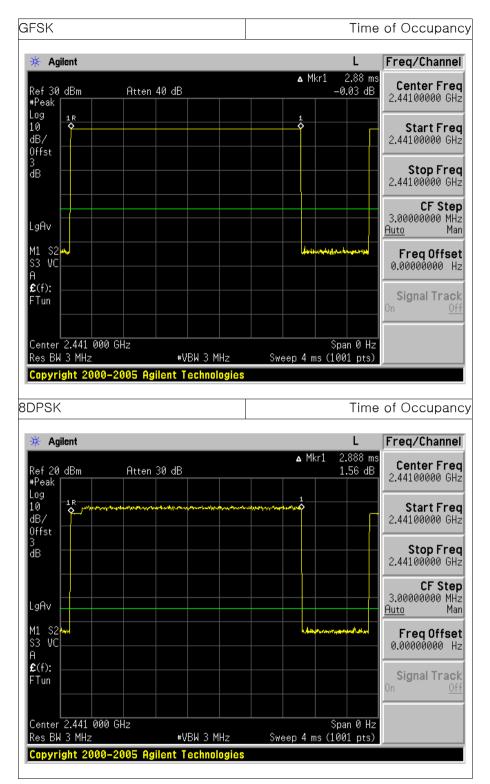
- Time slots for DH5 = 6 slots (TX = 5 slot / RX = 1 slot)

- Hopping Rate = 1600 for FH mode & 800 for AFH mode





#### 8.5 Test Plot



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 17 / 65



## 9. Carrier Frequencies Separation

## 9.1 Test Setup

Refer to the APPENDIX I.

## 9.2 Limit

Limit :  $\geq$  25 kHz or  $\geq$  Two-Thirds of the 20 dB Bandwidth whichever is greater.

## 9.3 Test Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the marker delta function was recorded as the measurement results.

The spectrum analyzer is set to:

Span = wide enough to capture the peaks of two adjacent channelsRBW = Start with the RBW set to approximately 30% of the channel spacing; adjust asnecessary to best identify the center of each individual channel. $VBW \ge RBW$ Sweep = AutoDetector = PeakTrace = Max hold

Test Mode	Test Frequency	Test Frequency (MHz)			
	Low	1.002	0.642		
GFSK	Middle	0.999	0.641		
	High	-0.999	0.641		
	Low	1.002	0.874		
8DPSK	Middle	1.008	0.875		
	High	1.005	0.874		

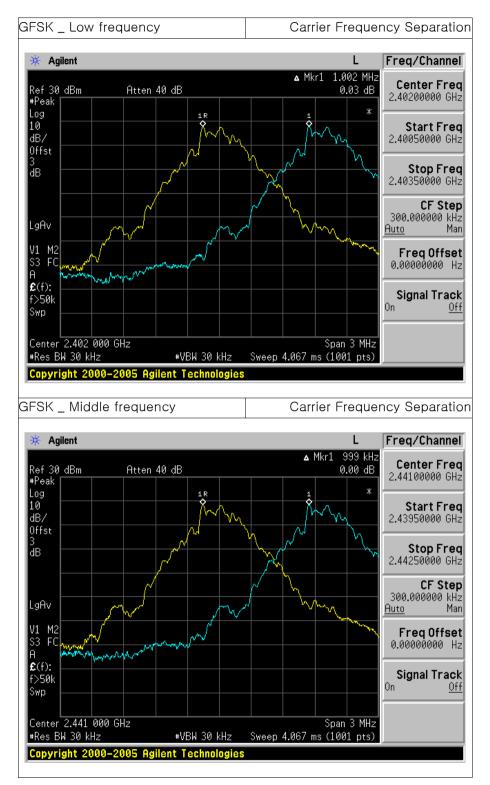
## 9.4 Test Result

Note: Limit(kHz) = Test Result of 20 dB BW \* 2/3



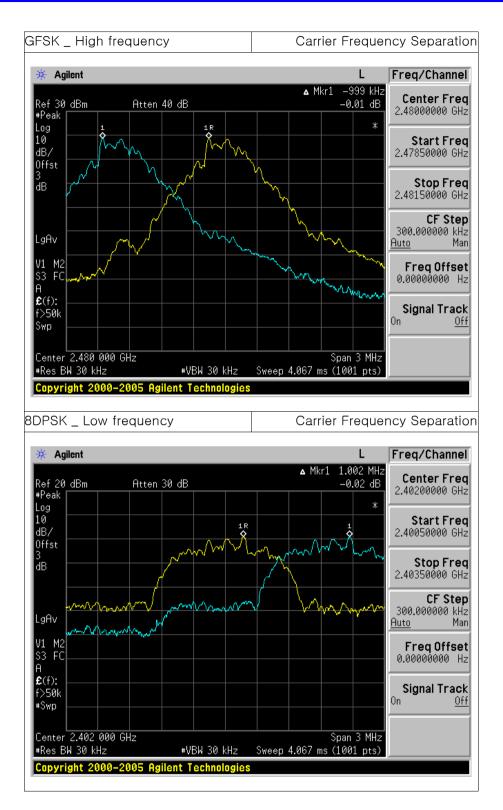


### 9.5 Test Plot



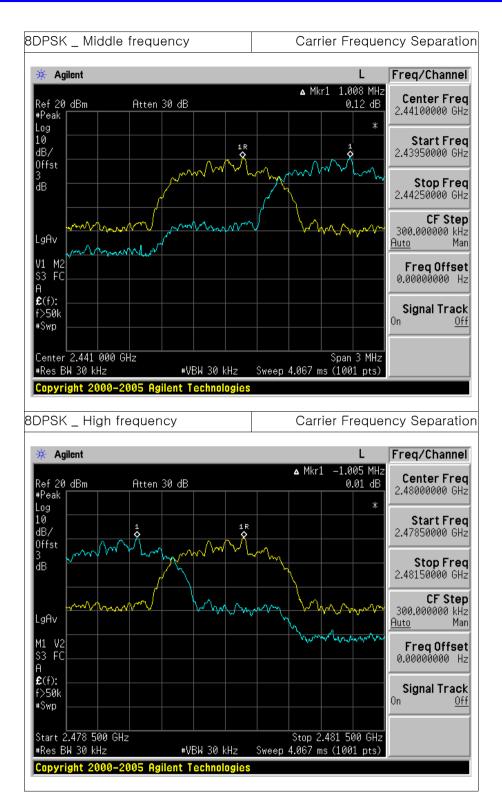
EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 19 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 20 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 21 / 65



## 10. Peak Output Power

## 10.1 Test Setup

Refer to the APPENDIX I.

## 10.2 Limit

■ FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following:

- §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.
- §15.247(b)(1), For frequency hopping systems operating in the 2400 2483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725 5805 MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
- IC Requirements
- RSS-247(5.4) (b), For FHSS operating in the band 2400 2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p shall not exceed 4 W, except as provided in section 5.4(e)

## 10.3 Test Procedure

- 1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, a spectrum analyzer was used to record the shape of the transmit signal.
- 2. The peak output power of the fundamental frequency was measured with the spectrum analyzer using;

Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel

 $RBW \ge 20 dB Bandwidth$   $VBW \ge RBW$  Sweep = Auto Detector function = PeakTrace = Max Hold

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 22 / 65



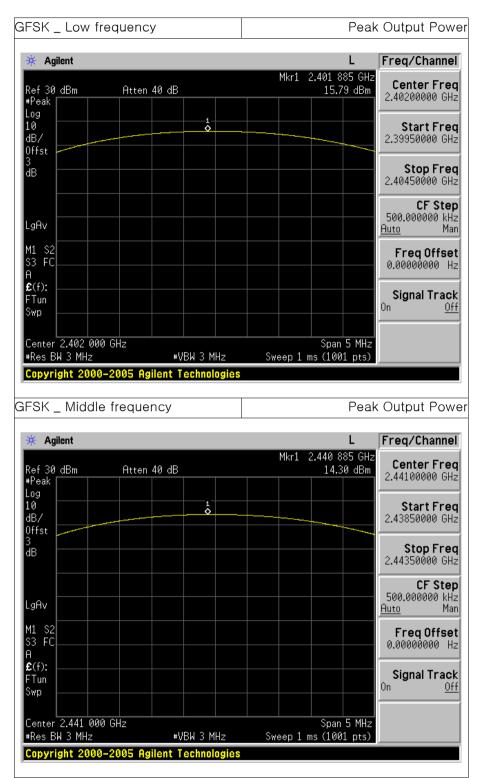
## 10.4 Test Result

Test Mode	Toot Fraguenov	Peak Output Power				
Test Mode	rest Frequency	dBm	mW			
	Low	15.79	37.93			
GFSK	Middle	14.30	26.92			
	High	14.16	26.06			
	Low	6.71	4.69			
Pi/4 DQPSK	Middle	6.59	4.56			
	Middle High Low	6.27	4.24			
	Low	7.29	5.36			
8DPSK	Middle	7.10	5.13			
	High	6.82	4.81			





#### 10.5 Test Plot



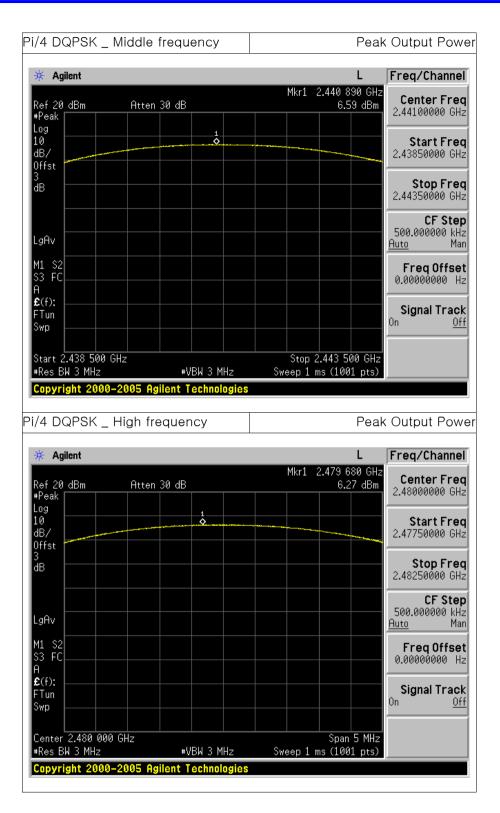
EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 24 / 65



SK _ High f					E
Agilent				L	Freq/Channe
ef 30 dBm Peak	Atten 40	dB	Mkr1	2.479 935 GHz 14.16 dBm	Center Fre 2.48000000 GH
19 ) 3/		1			<b>Start Fre</b> 2.47750000 GH
ifst					<b>Stop Fre</b> 2.48250000 GH
JAv					<b>CF Ste</b> 500.000000 kH Auto Ma
L S2 3 FC					Freq Offse 0.00000000
(f):					Signal Trac On <u>O</u>
enter 2.480 000	0 GHz			Span 5 MHz	
Res BW 3 MHz Dyright 2000 4 DQPSK _		*VBW 3 MHz nt Technologies lency	Sweep 1		Coutput Pov
opyright 2000		nt Technologies	Sweep 1		Coutput Pov
opyright 2000 4 DQPSK _		nt Technologies Jency		Peal	Freq/Channe Center Fre
Agilent Agilent Agilent Agilent Agilent Agilent Agilent Agilent	Low frequ	nt Technologies Jency		Peał L 2.401 625 GHz	Freq/Channe
Agilent A DQPSK _ Agilent f 20 dBm eak g fst	Low frequ	nt Technologies Jency dB		Peał L 2.401 625 GHz	Freq/Channe Center Fre 2.40200000 GH Start Fre 2.39950000 GH Stop Fre
Agilent Agilen	Low frequ	nt Technologies Jency dB		Peał L 2.401 625 GHz	Freq/Channe Center Fre 2.40200000 GH Start Fre 2.39950000 GH Stop Fre 2.40450000 GH CF Ste 500.000000 kH
Agilent Agilen	Low frequ	nt Technologies Jency dB		Peał L 2.401 625 GHz	Freq/Channel Center Fre 2.40200000 GH Start Fre 2.39950000 GH Stop Fre 2.40450000 GH CF Ste 500.000000 kH <u>Auto</u> Ma
Agilent           4 DQPSK _           4 DQPSK _           6 Agilent           9           9           9           3/           1           55           3           1           1           52           3           1           52           3           1           52           3           1           52           3           1           52           4           52           5	Low frequ	nt Technologies Jency dB		Peał L 2.401 625 GHz	Freq/Channel Center Fre 2.40200000 GH Start Fre 2.39950000 GH 2.40450000 GH CF Ste 500.0000000 KH Auto Mi Freq Offse 0.00000000 H
Agilent           Agilent <th< td=""><td>Low freque Atten 30 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2</td><td>nt Technologies Jency dB</td><td></td><td>Peak L 2.401 625 GHz 6.71 dBm</td><td>Freq/Channel           Center Fre           2.40200000 GH           Start Fre           2.39950000 GH           Stop Fre           2.40450000 GH           CF Ste           500.000000 KH           Auto           Freq Offse           0.00000000 H           Signal Trace</td></th<>	Low freque Atten 30 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	nt Technologies Jency dB		Peak L 2.401 625 GHz 6.71 dBm	Freq/Channel           Center Fre           2.40200000 GH           Start Fre           2.39950000 GH           Stop Fre           2.40450000 GH           CF Ste           500.000000 KH           Auto           Freq Offse           0.00000000 H           Signal Trace
opyright 2000 4 DQPSK _ Agilent 9f 20 dBm	Low freque Atten 30 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	nt Technologies Jency dB	Mkr1	Peał L 2.401 625 GHz	Freq/Channel           Center Fre           2.40200000 GH           Start Fre           2.39950000 GH           Stop Fre           2.40450000 GH           CF Ste           500.000000 KH           Auto           Freq Offse           0.00000000 H           Signal Trace

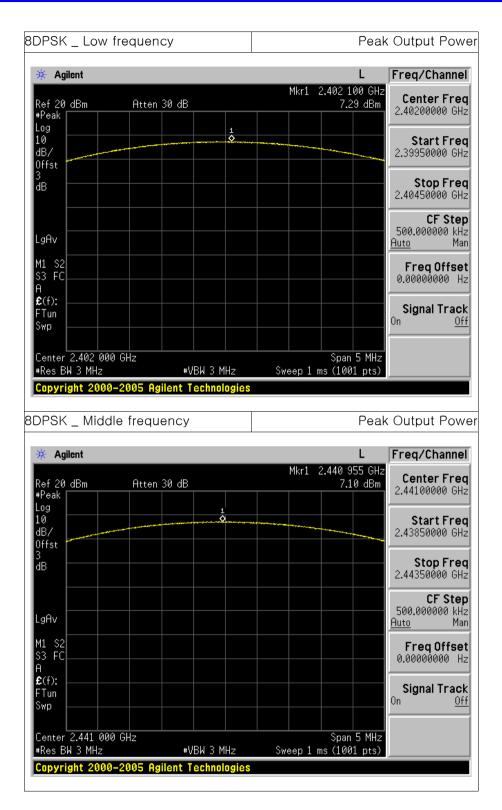
EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 25 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 26 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 27 / 65



PSK _ High freque	ney	1 64	k Output Pow
🗱 Agilent		L	Freq/Channel
Peak	n 30 dB	Mkr1 2.479 970 GHz 6.82 dBm	Center Fred 2.48000000 GHz
.og .0 HB/ Dffst			Start Fred 2.47750000 GHz
IB			<b>Stop Fred</b> 2.48250000 GHz
gAv			<b>CF Step</b> 500.000000 kH; <u>Auto</u> Ma
11 S2 3 FC			Freq Offse 0.00000000 H;
C(f): Tun Wwp			<b>Signal Tracl</b> On <u>Of</u>
Center 2.480 000 GHz Res BW 3 MHz	+VBW 3 MHz	Span 5 MHz Sweep 1 ms (1001 pts)	

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 28 / 65

This test report shall not be reproduced except in full, Without the written approval.



## 11. TX Radiated Spurious Emission and Conducted Spurious Emission

## 11.1 Test Setup

Refer to the APPENDIX I.

## 11.2 Limit

According to §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 section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional

adiator shall her exceed the held strength levels speemed in the following table									
Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)							
0.009 ~ 0.490	2400/F (kHz)	300							
0.490 ~ 1705	24000/F (kHz)	30							
1705 ~ 30.0	30	30							
30 ~ 88	100 **	3							
88 ~ 216	150 **	3							
216 ~ 960	200 **	3							
Above 960	500	3							

radiator shall not exceed the field strength levels specified in the following table

\*\* Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 29 / 65



According to § 15.205(a) and (b), only spurious emissions are permitted in any of The frequency bands listed below:

MHz	MHz	GHz								
16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15								
16.69475 ~ 16.69525	608 ~ 614	5.35 ~ 5.46								
16.80425 ~ 16.80475	960 ~ 1240	7.25 ~ 7.75								
25.5 ~ 25.67	1300 ~ 1427	8.025 ~ 8.5								
37.5 ~ 38.	1435 ~ 1626.5	9.0 ~ 9.2								
25 73 ~ 74.6	1645.5 ~ 1646.5	9.3 ~ 9.5								
74.8 ~ 75.2	1660 ~ 1710	10.6 ~ 12.7								
108 ~ 121.94	1718.8 ~ 1722.2	13.25 ~ 13.4								
149.9 ~ 150.05	2200 ~ 2300	14.47 ~ 14.5								
156.52475 ~ 156.52525	2310 ~ 2390	15.35 ~ 16.2								
156.7 ~ 156.9	2483.5 ~ 2500	17.7 ~ 21.4								
162.0125 ~ 167.17	2690 ~ 2900	22.01 ~ 23.12								
3345.8 ~ 3358	3260 ~ 3267	23.6 ~ 24.0								
3600 ~ 4400	3332 ~ 3339	31.2 ~ 31.8								
3345.8 ~ 3358	240 ~ 285	36.43 ~ 36.5								
3600 ~ 4400	322 ~ 335.4	Above 38.6								
	$\begin{array}{r} \mbox{MHz} \\ 16.42 ~ 16.423 \\ 16.69475 ~ 16.69525 \\ 16.80425 ~ 16.80475 \\ 25.5 ~ 25.67 \\ 37.5 ~ 38. \\ 25.73 ~ 74.6 \\ 74.8 ~ 75.2 \\ 108 ~ 121.94 \\ 149.9 ~ 150.05 \\ 156.52475 ~ 156.52525 \\ 156.7 ~ 156.9 \\ 162.0125 ~ 167.17 \\ 3345.8 ~ 3358 \\ 3600 ~ 4400 \\ 3345.8 ~ 3358 \end{array}$	MHzMHz $16.42 \sim 16.423$ $399.90 \sim 410$ $16.69475 \sim 16.69525$ $608 \sim 614$ $16.80425 \sim 16.80475$ $960 \sim 1240$ $25.5 \sim 25.67$ $1300 \sim 1427$ $37.5 \sim 38.$ $1435 \sim 1626.5$ $25.73 \sim 74.6$ $1645.5 \sim 1646.5$ $74.8 \sim 75.2$ $1660 \sim 1710$ $108 \sim 121.94$ $1718.8 \sim 1722.2$ $149.9 \sim 150.05$ $2200 \sim 2300$ $156.52475 \sim 156.52525$ $2310 \sim 2390$ $156.7 \sim 156.9$ $2483.5 \sim 2500$ $162.0125 \sim 167.17$ $2690 \sim 3267$ $3600 \sim 4400$ $3332 \sim 3339$ $3345.8 \sim 3358$ $240 \sim 285$								

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



### 11.3 Test Procedure for Radiated Spurious Emission

- 1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3.75 meter away from the interference-receiving antenna.
- 3. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
- 4. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then The antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
   (The EUT was pre-tested with three axes (X, Y, Z) and the final test was performed at the worst case.)
- 6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 7. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 31 / 65



#### Measurement Instrument Setting

- Frequency Range: Below 1 GHz RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak
- Frequency Range: Above 1 GHz
   Peak Measurement
   RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto, Trace mode = Max Hold until the trace stabilizes

Average Measurement RBW = 1MHz, VBW ≥ 1/T, Detector = Peak, Sweep Time = Auto, Trace Mode = Max Hold until the trace stabilizes

#### 11.4 Test Procedure for Conducted Spurious Emission

- 1. The transmitter output was connected to the spectrum analyzer.
- The reference level of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
- The conducted spurious emission was tested each ranges were set as below. Frequency range: 30 MHz ~ 26.5 GHz RBW = 100 kHz, VBW = 300 kHz, Sweep Time = Auto, Detector = Peak, Trace = Max Hold

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)



#### 11.5 Test Result

## 9 kHz ~ 25 GHz Data (Modulation: GFSK)

#### • Low frequency

Fraguanay	Rea	ding			0.005	Lin	nits	Re	sult	Ma	rgin		
Frequency	(dBu	(dBuV/m)		T.F (dB)	DCCF (dB)	(dBu	iV/m)	(dBu	IV/m)	(d	B)		
(MHz)	AV /	/ Peak		(00)	(00)	AV / Peak				AV /	Peak	AV /	Peak
2 389.88	N/A	47.97	V	9.00	-24.79	54.0	74.0	32.2	57.0	21.8	17.0		
4 804.37	N/A	52.69	Н	-0.92	-24.79	54.0	74.0	27.0	51.8	27.0	22.2		
7 206.51	N/A	49.79	Н	8.43	-24.79	54.0	74.0	33.4	58.2	20.6	15.8		
9 607.39	N/A	48.13	Н	10.78	-24.79	54.0	74.0	34.1	58.9	19.9	15.1		
12 010.87	N/A	41.08	Н	15.90	-24.79	54.0	74.0	32.2	57.0	21.8	17.0		

#### Middle frequency

Fraguapay	Rea	ding		<b></b>	0.005	Lin	nits	Re	sult	Mai	rgin		
Frequency	(dBuV/m)		(dBuV/m)		Pol.	T.F (dB)	DCCF (dB)	(dBu	IV/m)	(dBu	V/m)	(d	B)
(MHz)	AV ,	<sup>/</sup> Peak		(00)	(00)	AV /	AV / Peak		Peak	AV /	Peak		
4 882.38	N/A	50.14	Н	-0.95	-24.79	54.0	74.0	24.4	49.2	29.6	24.8		
7 322.57	N/A	50.45	Н	8.59	-24.79	54.0	74.0	34.2	59.0	19.8	15.0		
9 764.73	N/A	45.78	Н	11.27	-24.79	54.0	74.0	32.3	57.1	21.7	17.0		
12 204.25	N/A	41.24	Н	16.03	-24.79	54.0	74.0	32.5	57.3	21.5	16.7		

#### High frequency

Fraguanay	Reading			<b></b>	0.005	Lin	nits	Re	sult	Mai	rgin
Frequency	(dBuV/m)		Pol.	T.F (dB)	DCCF (dB)	(dBu	V/m)	(dBu	iV/m)	(d	В)
(MHz)	AV ,	/ Peak				AV / Peak		AV /	Peak	AV /	Peak
2 484.14	N/A	53.19	V	9.84	-24.79	54.0	74.0	38.2	63.0	15.8	11.0
4 960.07	N/A	50.26	Н	-0.82	-24.79	54.0	74.0	24.6	49.4	29.4	24.6
7 439.50	N/A	50.15	Н	8.72	-24.79	54.0	74.0	34.1	58.9	19.9	15.1
9 920.76	N/A	44.53	Н	11.35	-24.79	54.0	74.0	31.1	55.9	22.9	18.1
12 400.86	N/A	36.13	Н	15.50	-24.79	54.0	74.0	26.8	51.6	27.2	22.4

Note 1: The radiated emissions were inverstigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

Note 2: DCCF(Duty Cycle Correction Factor)

- Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels, where T = pulse width = 2.880 ms - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.880 X 20) = 1.74

≒ 2

- The Worst Case Dwell Time = T [ms] x H' = 2.880 ms X 2 = 5.76 ms

- DCCF = 20 x log(The Worst Case Dwell Time / 100 ms) dB = 20 x log( 5.76 / 100 ) = -24.79 dB

Note 3: Sample Calculation.

Margin = Limit - Result / Peak Result = Peak Reading + TF / Average Result = Peak Reading + TF + DCCF TF = Ant factor + Cable Loss + Filter Loss - Amp Gain + Distance Factor

Distance Factor = 20log(applied distance/required distance) = 20log(3.75m/3m) = 1.94



## 9 kHz ~ 25 GHz Data (Modulation: 8DPSK)

#### • Low frequency

Fraguanay	Rea	ding			0.005	Limits		Result		Margin	
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCCF (dB)	(dBu	V/m)	(dBu	ıV/m)	(d	B)
(MHz)	AV ,	<sup>/</sup> Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak
2 389.96	N/A	48.28	V	9.00	-24.77	54.0	74.0	32.5	57.3	21.5	16.7
4 804.06	N/A	45.14	Н	-0.92	-24.77	54.0	74.0	19.5	44.2	34.5	29.8
7 205.95	N/A	43.86	Н	8.43	-24.77	54.0	74.0	27.5	52.3	26.5	21.7

#### • Middle frequency

Fraguanay	Rea	ding		<b></b>	2225	Lin	nits	Re	sult	Mai	rgin
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCCF (dB)	(dBu	V/m)	(dBu	ıV/m)	(d	В)
(MHz)	AV ,	/ Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak
4 882.08	N/A	47.15	Н	-0.95	-24.77	54.0	74.0	21.4	46.2	32.6	27.8
7 323.02	N/A	43.81	Н	8.59	-24.77	54.0	74.0	27.6	52.4	26.4	21.6
9 763.96	N/A	37.92	Н	11.27	-24.77	54.0	74.0	24.4	49.2	29.6	24.8

#### • High frequency

Fraguaday	Rea	ding			2225	Limits		Result		Margin	
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCCF (dB)	(dBu	iV/m)	(dBu	IV/m)	(d	B)
(MHz)	AV ,	/ Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak
2 483.57	N/A	55.40	V	9.84	-24.77	54.0	74.0	40.5	65.2	13.5	8.8
4 959.85	N/A	49.35	Н	-0.82	-24.77	54.0	74.0	23.8	48.5	30.2	25.5
7 440.27	N/A	41.92	Н	8.72	-24.77	54.0	74.0	25.9	50.6	28.1	23.4
9 919.88	N/A	39.94	Н	11.35	-24.77	54.0	74.0	26.5	51.3	27.5	22.7

Note 1: The radiated emissions were inverstigated 9 kHz to 25 GHz.

Note 2: DCCF(Duty Cycle Correction Factor)

- Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels, where T = pulse width = 2.888 ms - 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.888 X 20) = 1.73  $\approx 2$ 

- The Worst Case Dwell Time = T [ms] x H' = 2.888 ms X 2 = 5.78 ms

- DCCF =  $20 \times \log(\text{The Worst Case Dwell Time / 100 ms}) dB = <math>20 \times \log(5.78 / 100) = -24.77 dB$ Note 3: Sample Calculation.

Margin = Limit - Result / Peak Result = Peak Reading + TF / Average Result = Peak Reading + TF + DCCF

TF = Ant factor + Cable Loss + Filter Loss - Amp Gain + Distance Factor

Distance Factor = 20log(applied distance/required distance) = 20log(3.75m/3m) = 1.94

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 34 / 65



## 11.6 Test Plot for Radiated Spurious Emission

#### • GFSK \_ Low frequency

						H	lestricte	ed Band	d - Peak
MultiView 🕀	Spectrum	Spectru	m 2 🕱	Spectrum 3	X Spectru	um 4 🕱	1		
Ref Level 97	7.00 dBuV	= BBV	V 1 MHz		Specar		[	2.21	
<ul> <li>Att Input</li> <li>1 Frequency :</li> </ul>	1 AC PS	1.01 ms ● VBV On Not	n 3 MHZ Miod ch Off	le Auto Sweep			Fr	equency 2.3:	500000 GHz
Trequency	ынсер							M1[1]	47.97 dBμV
90 dBµV								2	2.3898800 GHz
80 dBµV									
00 0004									
70 dBµV									
60 dBµV									
50 dBµV									м
									المد
40 dBμV								Hall Marthand	W. MANAPAR
30 dBµV							and	Holy Walker	W.
And a company	antholder	monum	Minden Menter	Amont March South	an and the second second	www.www.www.www.	walking mere		
20 dBµV									
10 dBμV									
0 dBµV									
2.31 GHz			1001 pt	ls	8	8.0 MHz/			2.39 GHz
							ç	Spuriou	s – Peał
MultiView			ectrum 2	X Spect	rum 3 🛛 🛛				▽
Ref Level 87 Att Input	00 dBµV 0 dB SWT 1 AC PS	● RB₩ 1.01 ms ● VB₩ Off Noto	/1MHz /3MHz Mode h Off	e Auto Sweep			Fr	equency 4.80	040000 GHz
1 Frequency								M1[1]	<ul> <li>1Pk Max</li> <li>52.69 dBµV</li> </ul>
80 dBµV								M1[1] 4.	52.69 авру 80436963 GHz
70 dBµV									
60 dBµV									
во овру					М1				
50 dBµV					- Ind				
						and the second second			
40 dBpV	manuther	contration and the	and the second sec			- Andrewich	hennow	MARINE WAR	man have a
30 dBµV									
20 dBµV									
10 d0.00									
10 dBµV									
0 dBµV									
-10 dBµV			1001 pt			.0 MHz/			pan 10.0 MHz

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 35 / 65



								Spuriou	s – Pea
MultiView	Spectrum	x S	pectrum 2	X Spectr	um 3 🛛 🕱	3			▽
Ref Level 87.0 Att	00 dBµV 0 dB SWT		NI 1 MHz NI 3 MHz Mode	e Auto Sweep		1	Fn	equency 7.2	060000 GHz
Input Frequency S	1 AC PS weep	Off Not	ch Off						• 1Pk Max
30 dBµV								M1[1]	49.79 dBµV .20650949 GHz
10 GDHA									
70 dBµV									
0 dBµV									
0 dBµV					M1 T				
			- Aller	ſ					
0 dBµV			- Andrew Market			and the second second	lun		maphan
0 dBµV	om Honder Lanen	de Marie Madelland a					Matalana	alexanders a server	سرياس وأفرياس صحيه
0 dBµV									
0 dBµV									
dBµV									
10 dBµV									
			1001 pt	ts	1	.0 MHz/			Span 10.0 MHz
			1001 pt	ts	1	.0 MHz/			
			1001 pt		1	.0 MHz/	S		
TO OBHY F 7.206 GHz MultiView			pectrum 2	ts X Spectr		2	<u> </u>		s – Pea
F 7.206 GHz MultiView Ref Level 87.0 Att Input	00 dBµV 0 dB SWT 1 AC PS	• RBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		Spuriou	s - Pea ⊽
F 7.206 GHz AultiView Ref Level 87.0 Att Input	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		Spuriou	s – Pea
F 7.206 GHz MultiView Ref Level 87.0 Att Input Frequency S	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s – Pea 080000 GHz • 1Pk Max
F 7.206 GHz MultiView Ref Level 87.0 Att Input Frequency S 0 dBµV-	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s - Pea 080000 GHz • 1Pk Max 48.13 dByV
F 7.206 GHz MultiView Ref Level 87.0 Att Input Frequency S 0 dBµV-	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s – Pea v 080000 GHz • IPk Max 48.13 dBpV
F 7.206 GHz AultiView Ref Level 87.0 Att Input Frequency S 0 dBµV 0 dBµV	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s - Pea 080000 GHz • 1Pk Max 48.13 dByV
F 7.206 GHz           MultiView           Ref Level 37.0 Att           Input           Input           G d8μV           0 d8μV	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s – Pea v 080000 GHz • IPk Max 48.13 dBpV
F 7.206 GHz  AultiView Ref Level 87.0 Att Input Frequency S 0 dBµV 0 dBµV 0 dBµV	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s - Pea 080000 GHz • 1Pk Max 48.13 dByV
F 7.206 GHz MultiView Ref Level 37.1 Att Input Ггедчелсу S 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV	00 dBµV 0 dB SWT 1 AC PS	● RBW 1.2 ms ● VBW	pectrum 2 1 MHz 3 MHz Mode	X Spectr		2		equency 9.6	s - Pea 080000 GHz • 1Pk Max 48.13 dByV
F 7.206 GHz 4ultiView Ref Level 37.1 Att Input Frequency S 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode h Off	X Spectr		2	Fr	equency 9.6	s - Pea
F 7.206 GHz 4ultiView Ref Level 37.1 Att Input Frequency S 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV	00 dBµV 0 dB SWT 1 AC PS	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s - Pea 080000 GHz • 1Pk Max 48.13 dByV
F 7.206 GHz           MultiView           Ref Level 37.0           Ref Level 37.0           Input           Trequency S           0 d8µV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s – Pea
F 7.206 GHz 4ultiView Ref Level 87.0 Att Input Frequency S 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV 0 dBµV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s - Pea
F 7.206 GHz           HultiView           Ref Level 87.0 Att           Input           Frequency S           0 d8µV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s - Pea
F 7.206 GHz           MultiView           Ref Level 87.0           Ref Level 87.0           0 dBµV           0 dBµV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s – Pea
F 7.206 GHz           MultiView           Ref Level 87.0           Input           Trequency S           0 dBµV	OO dB <sub>H</sub> V O dB SWT IAC PS weep	RBW 1.2 ms = VBW Off Note	pectrum 2 1 MHz 3 MHz Mode Off Off	X Spectr		2	Fr	equency 9.6	s - Pea

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 36 / 65



AultiView 🕀 S		🕱 Spectru	m 2	x Spectr	um 3 🛛 🛛				$\nabla$
Input 1	dB SWT 1.2 m AC PS O	■ RBW 1 MH s ● VBW 3 MH ff Notch 0	Mode Au	to Sweep			Fre	quency 12.0	
Frequency Swee	p							M1[1] 12	● 1Pk Max 41.08 dBµ' .01086913 GH
) dBµV									
Ι dBμV									
I dBµV									
) dBµV			and and a	terre de la constante	MI Y	and the second second			
),d8ну- <del>умал (чалучар</del> о	and a state of the	w. Workey w. W.				~t	Mundwichuren	www.www.w	menderation
) dBµV									
і dBµV									
dBµV									
10 dBµV									

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 37 / 65



### • GFSK \_ Middle frequency

								Spuriou	
MultiView	# Spectrum	xs	pectrum 2	X Spectr	rum 3 🛛 🕱	,			▽
Ref Level 87. Att	.00 dBuV	• RB1	W 1 MHz			1	En		20000 CH-
Input I Frequency S	1 AC PS	Off Not	₩ 3 MHz Mode tch Off	e Huto Sweep			FIG.	equency 4.80	320000 GHz
								M1[1]	50.14 dBµV 88237962 GHz
80 dBµV−−−−									56237 562 GHz
70 dBµV									
60 dBµV									
50 dBµV					M1 <b>Y</b>				
				- and	- mark	New .			
40 dBUV	ton Mproderson	and have the	and and the state of the state			- Marcharter	montan	munna	montente
30 dBµV									
50 00p+									
20 dBµV									
10 dBµV									
0 dBµV									
-10 dBµV									
CE 4.882 GHz			1001 nt	· · · · · · · · · · · · · · · · · · ·	1	.0 MHz/			Snan 10.0 MHz
CF 4.882 GHz			1001 pt	S	1	.0 MHz/			pan 10.0 MHz
CF 4.882 GHz			1001 pt	S S	1	.0 MHz/	ç		
	~	x S	1001 pt	s X Spectr			Č		
	Spectrum	• RB	pectrum 2	X Spectr				Spuriou	s – Pea
MultiView Ref Level 87. Att Input	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou	s – Pea
MultiView Ref Level 87: Att Input I Frequency S	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Pea 230000 GHz 1Pk Max 50.45 dBµV
MultiView Ref Level 87. Att Input I Frequency S	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s - Pea v 230000 GHz • 1Pk Max
MultiView Ref Level 87. Att Input I Frequency 9 80 dBµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Pea 230000 GHz 1Pk Max 50.45 dBµV
MultiView Ref Level 87. Att Input I Frequency S 80 dBµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Pea 230000 GHz 1Pk Max 50.45 dBµV
MultiView Ref Level 87. Att Input I Frequency S 80 dBµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Peal 230000 GHz 1Pk Max 50.45 dBµV
MultiView           Ref Level 87           Att           Input           Input           I Frequency S           80 dbµV           70 dbµV           60 dbµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Peal 230000 GHz 1Pk Max 50.45 dBµV
MultiView           Ref Level 87           Att           Input           Input           I Frequency S           80 dbµV           70 dbµV           60 dbµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	• RB	pectrum 2	X Spectr				Spuriou: equency 7.32 M1[1]	s – Pea 230000 GHz 1Pk Max 50.45 dBµV
MultiView           Ref Level 57.           Att           Input           Input           Infrequency S           80 dBµV           60 dBµV           50 dBµV           50 dBµV           40 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	s − Pea v 230000 GHz • 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           60 dBµV           50 dBµV           50 dBµV           40 dBµV	Spectrum     00 dBμV     0 dB SWT     1 AC PS	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	Spuriou: equency 7.32 M1[1]	s − Pea v 230000 GHz • 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           60 dBµV           50 dBµV           50 dBµV           40 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	s − Pea v 230000 GHz • 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           60 dBµV           50 dBµV           60 dBµV           40 dBµV           40 dBµV           40 dBµV           30 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	s − Pea v 230000 GHz • 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           1Frequency 5           60 dBµV           50 dBµV           40 dBµV           40 dBµV           20 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	s − Pea v 230000 GHz • 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           1Frequency 5           60 dBµV           50 dBµV           40 dBµV           40 dBµV           20 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	x − Peal x 30000 GHz 1Pk Max 50.45 dBµV 92257043 GHz
Ref Level         87.           Att         Input           Input         Input           0         dBµV           70         dBµV           60         dBµV           50         dBµV           40         dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	x − Peal x 30000 GHz 1Pk Max 50.45 dBµV 92257043 GHz
MultiView           Ref Level 37.           Att           Input           Input           10 dBµV           50 dBµV           50 dBµV           40 dBµV           40 dBµV           20 dBµV           20 dBµV           10 dBµV	Spectrum     Od Bulv     odb SWT     1AC PS     Sweep	e RB 1.01 ms = VB Off Not	pectrum 2 W 1 MHz W 3 MHz Mode	X Spectr			Fre	equency 7.32	x − Peal x 30000 GHz 1Pk Max 50.45 dBµV 92257043 GHz

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 38 / 65



▼ <b>40000 GH:</b> • 1Pk Max <b>45</b> ,78 dby <b>6</b> 472927 GH;
• 1Pk Max 45.78 dBµ\
45.78 dBµ\
www.
oan 10.0 MHz
s – Pea
▽
50000 GH:
41.24 dBµ\ 0425075 GH:
is the state of the
www.
int Marine
un Marianan
www.hikawa

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 39 / 65



#### • GFSK \_ High frequency

						F	Restricte	ed Band	d - Peal
MultiView 🗄	Spectrum	Spectrur	n 2 🕱	Spectrum 3	X Spectru	um 4 🕱	1		▽
Ref Level 97 Att	0 dB SWT	1.01 ms ⊕ VBV		e Auto Sweep			Fn	equency 2.49	917500 GHz
Input 1 Frequency S	1 AC PS Sweep	On Not	ch Off						● 1Pk Max
90 dBµV							N	1[1]	53.19 dBµV 2.4841350 GHz
80 dBµV									
70 dBµV									
60 dBµV									
50 dBµV	www.www	and the other	ula						
ч.	a second state	adi calandi.	nt.MANN	umulululurry	showing warman a	s can Alita a tal.N	undumn t. s		
40 dBµV						and the day	A.C. I. A MAN	Above born	Maryanna
30 dBµV									
20 dBµV									
20 овру ———									
10 dBµV									
0 dBµV									
2,4835 GHz			1001 pt	s	1	.65 MHz/			2.5 GHz
							ç	Spuriou	s – Peal
	~					_			
MultiView Ref Level 87.			ectrum 2	X Spect	rum 3 🛛 🛛				$\nabla$
Att Input	0 dB SWT 1 AC PS	1.01 ms ● VBW Off Note	3 MHz Mode	e Auto Sweep			Fn	equency 4.96	500000 GHz
1 Frequency S	sweep							M1[1]	<ul> <li>1Pk Max</li> <li>50.26 dBµV</li> </ul>
80 dBµV								4.	96006993 GHz
70 dBµV									
60 dBµV									
50 dBµV				- Mark Maler	M1				
				- and the state	ma	making			
40 dBµV	en an all second	dentroper Marchal	and the construction			annan	had a state of the	winniher where	and M.M. and an
30 dBµV									
20 dBµV									
20 00µ1									
10 dBµV									
0 dBµV									
6 dbp 1									
-10 dBµV			1001 pt			.0 MHz/			pan 10.0 MHz

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 40 / 65



							S	Spuriou	s – Peal
MultiView	# Spectrum	x Sp	pectrum 2	X Spectr	.um 3 🛛 🔉				▽
Ref Level 87. Att Input	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV Off Not		e Auto Sweep		_	Fr	equency 7.4	400000 GHz
1 Frequency S								M1[1]	<ul> <li>1Pk Max</li> <li>50.15 dBµV</li> </ul>
80 dBµV								7	43950050 GHz
70 dBµV									
60 dBµV									
ы авру				M1					
50 dBµV				, i					
40 dBµV						- North			
undernundern 30 dBµV	Muhahaman	n Martin	e and the			~~	Unudbriedoug	moliverterve	mpohintentit
20 dBµV									
10 dBµV									
0 dBµV									
-10 dBµV									
-то выло CF 7.44 GHz			1001 pt	S	1	1.0 MHz/		Ś	Span 10.0 MHz
							ç	Spuriou	s – Pea
MultiView	Spectrum	x Sr	pectrum 2	X Spectr	rum 3 🛛 🔉	7			▽
Ref Level 87. Att	.00 dBµV	• RBW				<u> </u>	Fn	equency 9.9	200000 GHz
Input 1 Frequency S	1 AC PS Sweep	Off Notch	h Off						● 1Pk Max 44.53 dBµV
80 dBµV								M1[1] 9	92075924 GHz
70 dBµV									
60 dBµV									
50 dBµV					M1				
40 dBµV					manut	and the second second			
<del>голуминиции</del> 30 dвµV	mondan	American	Alexander			See for the second s	Whentohentrik	howardown	andownau
20 UDH4									
20 dBµV									
20 dBµV 10 dBµV 0 dBµV									

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 41 / 65



MultiView 🗄 S	·	Spectrum 2	X Spect	rum 3 🛛 🛛				
Input 1/	dB SWT 1.2 ms ⊜ M AC PS Off M	NBW 1 MHz /BW 3 MHz Mode Notch Off	Auto Sweep			Free	quency 12.4	000000 GH
Frequency Sweet	p						M1[1] 12	● 1Pk Max 36,13 dBµ\ :.40085914 GH:
0 dBµV								
0 dBµV								
0 dBµV								
0 dBµV			monauter	MI MI	and i			
O dBUV		how I want when a			- Marriel	Mulming	and market	houndar
0 dBµV								
) dBµV								
dBµV								
10 dBµV								

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 42 / 65



# • 8DPSK \_ Low frequency

						R	lestricte	ed Band	d - Peak
MultiView =	Spectrum	Spectrur	n 2 🕱	Spectrum 3	X Spectru	um 4 🕅 🕱			▽
Ref Level 97 Att			/ 1 MHz	e Auto Sweep			Fre	equency 2.35	500000 GHz
Input 1 Frequency S	1 AC PS	On Note	ch Off						• 1Pk Max
90 dBµV								M1[1]	48.28 dBµV 2.3899600 GHz
80 dBµV									
70 dBµV									
50 In									
60 dBµV									
50 dBµV									MI
40 dBµV									the state of the s
								monthe	
30 dBµV	mulunaline	ununuh	- Alar Marker	horn-raharashi	Walippathing	WWW.wan.wheer	www.		
20 dBµV									
10 dBµV									
10 0001									
0 dBµV			1001 pt:			.0 MHz/			2.39 GHz
2.51 012			1001 pt	3		10 141127			
							2	spuriou	s – Peak
	Spectrum		ectrum 2	X Spectr	rum 3 🛛 🛛 🔊				▽
Ref Level 87. Att Input	00 dBµV 0 dB SWT 1 AC PS	● RB₩ 1.01 ms ● VBW Off Notd	1 MHz 3 MHz Mode h Off	Auto Sweep			Fre	equency 4.80	)40000 GHz
1 Frequency S	Sweep							M1[1]	<ul> <li>1Pk Max</li> <li>45.14 dBμV</li> </ul>
80 dBµV								4.	80405994 GHz
70 dBµV									
60 dBµV									
50 dBµV					M1				
40 dBµV			- Longhan Marchan	When all making	Munerburgen	entryman			
provension and the second s	inn der Merrin Merrikken	an the state of the second					a a manuful di Andrey	wraphydrawry	and a state of the second
30 dBµV									
20 dBµV									
10 dBµV									
0 dBµV									
0 dBµV									

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 43 / 65



MultiView 🗄 Spe	ctrum 🕱 Sp	ectrum 2	X Spectr	um 3 🛛 🛛	< )			$\nabla$
Input 1 AC	SWT 1.01 ms  WBW		Auto Sweep			Fn	equency 7.2	2060000 GH
Frequency Sweep							M1[1]	● 1Pk Max 43.86 dBµ 7.20595005 GH
) dBµV								
I dBµV								
0 dBµV			M)					
1 dBW	ante-manya Masalim	Weather Incomentation	- Andrew Colorenter		A. A. Jon W. Same and a second	molenam	bushne	der and an an an
) dBµV								
dвµv								
10 dBuV								

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 44 / 65



# • 8DPSK \_ Middle frequency

							S	Spuriou	s – Peak
MultiView	Spectrum	x Sp	ectrum 2	X Spectr	um 3 🛛	ว			▽
Ref Level 87 Att	.00 dBuV	BBW	1 MHz			<u>`</u>	Fn	aquancy A 88	320000 GHz
Input 1 Frequency S	1 AC PS	Off Notd	3 MHz Mode h Off	nato onecp				equency 4.00	• 1Pk Max
								M1[1] 4;	47.15 dBµV 88207992 GHz
80 dBµV									
70 dBµV									
60 dBµV									
50 dBµV					M1				
40 dBµV			agundarium	and have the the the	and the second second	and and and a second			
we will the	Muna	Van sold stown					multipertection	annan-Maraachid	and the second s
30 dBµV									
20 dBµV									
10 dBµV									
0 dBµV									
-10 dBµV CF 4.882 GHz	,		1001 pt		1	.0 MHz/			pan 10.0 MHz
01 11002 0112			1001 pt	3				0	pun 1010 minz
							ç	Spuriou	s – Peak
MultiView	Spectrum	x) Sp	ectrum 2	x Spectr	um 3 🛛		S	Spuriou	s - Peak
Ref Level 87. Att	.00 dBµV 0 dB <b>SWT</b>	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 🛛 🗴	x]			
Ref Level 87	.00 dBµV 0 dB SWT 1 AC PS	● RBW	1 MHz 3 MHz Mode		um 3 🛛 🛛	5		equency 7.32	⊽ 230000 GHz ● 1Pk Max
Ref Level 87. Att Input	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 🛛 🗴			equency 7.32	
Ref Level 87. Att Input I Frequency S	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 (x			equency 7.32	▼ 230000 GHz ● 1Pk Max 43.81 dBµV
Ref Level 87. Att Input 1 Frequency S	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 🛛 🗴			equency 7.32	▼ 230000 GHz ● 1Pk Max 43.81 dBµV
Ref Level 87. Att Input I Frequency S	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 (x	2		equency 7.32	▼ 230000 GHz ● 1Pk Max 43.81 dBµV
Ref Level 87. Att Input           80 dBµV           70 dBµV           60 dBµV	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode		um 3 (2	۲]		equency 7.32	▼ 230000 GHz ● 1Pk Max 43.81 dBµV
Ref Level 87.           Att           Input           I Frequency S           80 dBµV           70 dBµV	.00 dBµV 0 dB SWT 1 AC PS	● RBW 1.01 ms ● VBW	1 MHz 3 MHz Mode	Auto Sweep	um 3 (2			equency 7.32	▼ 230000 GHz ● 1Pk Max 43.81 dBµV
Ref Level 87.         Att           Input         Input           1 Frequency S         80 dBµV           70 dBµV         60 dBµV           50 dBµV         50 dBµV	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off		um 3 (2		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµV           70 dBµV         60 dBµV           50 dBµV         50 dBµV           40 dBµV	.00 dBµV 0 dB SWT 1 AC PS	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 🛛 🛛		Fr	equency 7.32	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency S         80 dBµV           70 dBµV         60 dBµV           50 dBµV         50 dBµV	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 (2		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµV           70 dBµV         60 dBµV           50 dBµV         50 dBµV           40 dBµV	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 🛛 🛛		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµV           70 dBµV         60 dBµV           50 dBµV         9           40 dBµV         9           30 dBµV         9           20 dBµV         9	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 🛛 🗴		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµV           70 dBµV         60 dBµV           50 dBµV         90 dBµV           40 dBµV         90 dBµV	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 2		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµV           70 dBµV         60 dBµV           50 dBµV         9           40 dBµV         9           30 dBµV         9           20 dBµV         9	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 🛛 🛛		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz
Ref Level 87.         Att           Input         Input           1 Frequency 5         80 dBµv           70 dBµv         60 dBµv           50 dBµv         9           40 dBµv         9           20 dBµv         10 dBµv	.00 dBµV 0 dB SWT 1 AC PS Sweep	BBW     Off Notd	1 1 MHz 3 MHz Mode h Off	Auto Sweep	um 3 (2		Fr	equency <b>7.32</b>	v           230000 GHz           • 1Pk Max           43.81 dByV           32201998 GHz

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 45 / 65



MultiView	Spectrum	x Sp	ectrum 2	X Spectr	um 3 🛛 🛛	2			▽
Ref Level 87.0 Att Input		● RBW 1.2 ms ● VBW Off Notch	3 MHz Mode	Auto Sweep		_	Fn	equency 9.3	7640000 GH
Frequency S								M1[1]	• 1Pk Max 37.92 dBµ 9.76396004 GH
) dBµV									
I dBµ∀									
I dBµV									
) dBµV			allalangulyuku	M Namuruluran	charlan Mar	makalakanaka	Madada		maham
) dBµV	an a	anapuloida da.						hanger Merindah	Man Manager and Mana
0 dBµV									
і dBµV									
dBµV									
10 dBµV									

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 46 / 65



# • 8DPSK \_ High frequency

				H	estricte	ed Band	i – Pear
MultiView 🗄 Spectrum	Spectrum 2	Spectrum 3	Spectru	um 4 🕅 🕱			$\nabla$
Ref Level 97.00 dBµV	• RBW 1 MHz	Node Auto Sweep			Fre	equency 2.49	917500 GHz
Input 1 AC PS 1 Frequency Sweep	On Notch Off						•1Pk Max
90 dBµV					×	(1[1] 2	55.40 dBµV .4835740 GHz
80 dBµV							
70 dBµV		_					
60 dBµV							
50 dBpv-	Marthe maketing and a second and	Withmander					
40 dBµV		munumun	marchandreak	multina	mundun	willing the auto	
						An I Ad	n an
30 dBµV							
20 dBµV							
10 dBµV							
0 dBµV							
2.4835 GHz	1001	. pts	1.	.65 MHz/			2.5 GHz
					ç	Spuriou	s – Peak
( )		Con a sha		7			
MultiView 🗄 Spectrum	n 🛛 🗶 Spectrum 2	X Spectr	'um 3 🛛 🛛 🛛	· I			$\nabla$
Ref Level 87.00 dBµV           Att         0 dB SWT	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M		um 3 🕺		Fre	equency 4.96	
Ref Level 87.00 dBµV	RBW 1 MHz		um 3 🛛 🔊		Fre		500000 GHz
Ref Level 87.00 dBμV           Att         0 dB         SWT           Input         1 AC         PS	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M				Fre	M1[1]	600000 GHz
Ref Level 87.00 dBµV           Att         0 dB sWT           Input         1 AC         PS           1 Frequency Sweep         80 dBµV         80 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M				Fra	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level         87.00 dBµV           Att         0 dB         SWT           Input         1 AC         PS           1 Frequency Sweep         1	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M				Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB sWT           Input         1 AC         PS           1 Frequency Sweep         80 dBµV         80 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M				Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB sWT           Input         1 AC PS           1 Frequency Sweep           80 dBµV           70 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M		um 3 (x		Fra	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB           Input         1 AC           I Frequency Sweep           80 dBµV           70 dBµV           60 dBµV           50 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB           Input         1 AC           PS         1 Frequency Sweep           80 dBµV         70 dBµV           60 dBµV         60 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep		have being have	Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB SWT           Input         1 AC PS           1 Frequency Sweep           80 dBµV           70 dBµV           60 dBµV           50 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB           Input         0 dB           SWT         1 AC           Input         1 AC           SU dBµV         0           60 dBµV         0           50 dBµV         0           40 dBµV         0           30 dBµV         0	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB           Input         1 AC           Input         1 AC           I Frequency Sweep         80 dBµV           80 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV           Att         0 dB           Input         0 dB           SWT         1 AC           Input         1 AC           SU dBµV         0           60 dBµV         0           50 dBµV         0           40 dBµV         0           30 dBµV         0	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fre	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV Att         0 dB         SWT           Input         0 dB         SWT           1 Frequency Sweep         80 dBµV         90 dBµV           80 dBµV         90 dBµV         90 dBµV           60 dBµV         90 dBµV         90 dBµV           50 dBµV         90 dBµV         90 dBµV           40 dBµV         90 dBµV         90 dBµV           20 dBµV         90 dBµV         90 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep			Fra	M1[1]	500000 GHz • 1Pk Max 49.35 dBµV
Ref Level 87.00 dBµV Att         0 dB         SWT           Input         1 AC         PS           I Frequency Sweep         80 dBµV         90 dBµV           80 dBµV         90 dBµV         90 dBµV           60 dBµV         90 dBµV         90 dBµV           50 dBµV         90 dBµV         90 dBµV           40 dBµV         90 dBµV         90 dBµV           10 dBµV         10 dBµV         10 dBµV	● RBW 1 MHz 1.01 ms ● VBW 3 MHz M	ode Auto Sweep				M1[1]	500000 GHz • 1Pk Max 49.35 dBµV

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 47 / 65



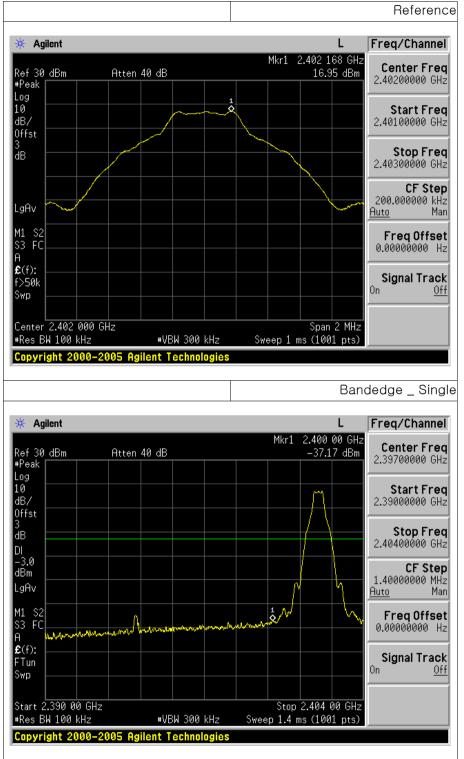
				opuno	us – Pea
IultiView E Spectrum	Spectrum 2     BBW 1 MHz	X Spectrum 3	X		⊽
Input 1 AC PS	1.01 ms ● VBW 3 MHz Mod Off Notch Off	e Auto Sweep		Frequency 7.	4400000 GH
Frequency Sweep				M1[1]	• 1Pk Max 41.92 dBµ 7.44026973 GH
) dBµV					
) dBµV					
0 dBµV					
) dBµV		MI	Bassand days		
windhare manded and a showing	hannennennen		and we have been and and and and and and and and and an	Monumation	hannandm
) dBµV					
) dBµV					
d8µV					
dBµV					
0 dBµV					
F 7.44 GHz	1001 p	te l	1.0 MHz/		Span 10.0 MH

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 48 / 65



## 11.7 Test Plot for Conducted Spurious Emission

• GFSK \_ Low frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 49 / 65

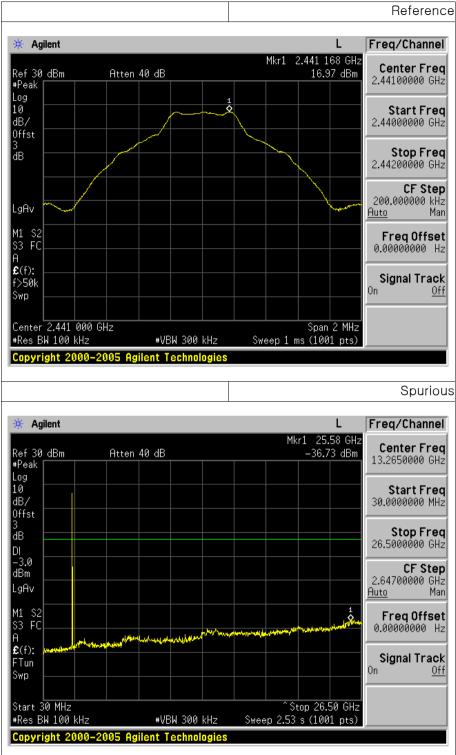


			Bande	dge _ Hopping
* Agilent			L	Freq/Channel
Ref 30 dBm Atten #Peak	40 dB	Mkr1	2.400 00 GHz -39.47 dBm	Center Freq 2.39700000 GHz
Log 10 dB/				<b>Start Freq</b> 2.39000000 GHz
0ffst 3 dB DI				<b>Stop Freq</b> 2.40400000 GHz
-3.0 dBm LgAv				<b>CF Step</b> 1.40000000 MHz <u>Auto</u> Man
M1 S2 S3 FC A ML MANAMEN JUNI	and the for the stand of the st	United and a start of the second start of the		FreqOffset 0.00000000 Hz
£(f): FTun Swp				<b>Signal Track</b> On <u>Off</u>
Start 2.390 00 GHz #Res BW 100 kHz	#VBW 300 kHz	Stop 2 Sweep 1.4 ms	2.404 00 GHz s (1001 pts)	
Copyright 2000-2005 Ag	ilent Technologies			
				Spurious
* Agilent			L	Freq/Channel
Ref 30 dBm Atten #Peak	40 dB	Mkr	1 25.55 GHz -36.41 dBm	Center Freq 13.2650000 GHz
Log 10 dB/ Offst				Start Freq 30.0000000 MHz
3 dB DI				<b>Stop Freq</b> 26.5000000 GHz
-3.0 dBm LgAv				<b>CF Step</b> 2.64700000 GHz <u>Auto</u> Man
M1 S2 S3 FC A	ward and the development of a reason	المتحاصر والمعادير والمعالية والمحافظ	with the line of the	Freq Offset 0.00000000 Hz
£(f): FTun Swp				<b>Signal Track</b> On <u>Off</u>
Start 30 MHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 2.53	op 26.50 GHz s (1001 pts)	
Copyright 2000-2005 Ag	ilent Technologies			

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 50 / 65



• GFSK \_ Middle frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 51 / 65

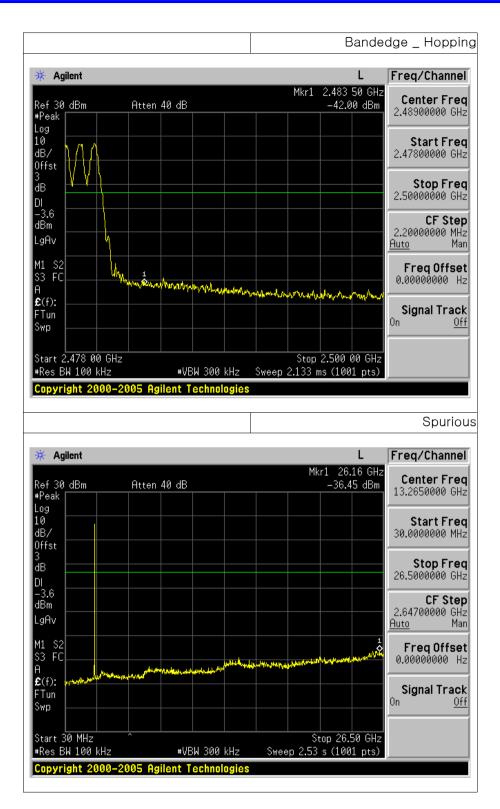


• GFSK \_ High frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 52 / 65

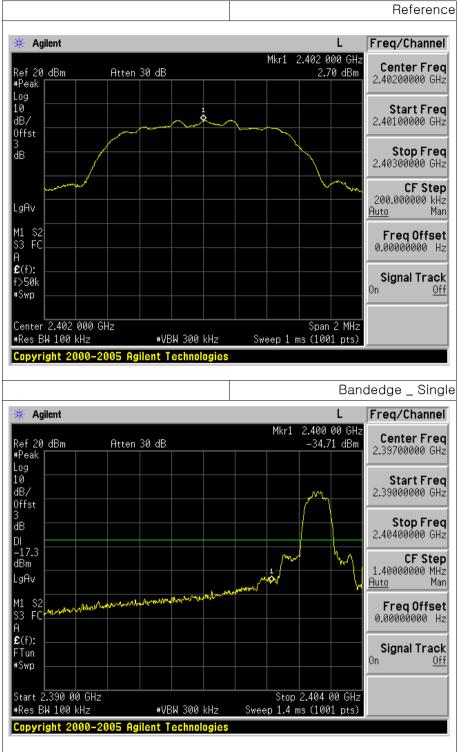




EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 53 / 65

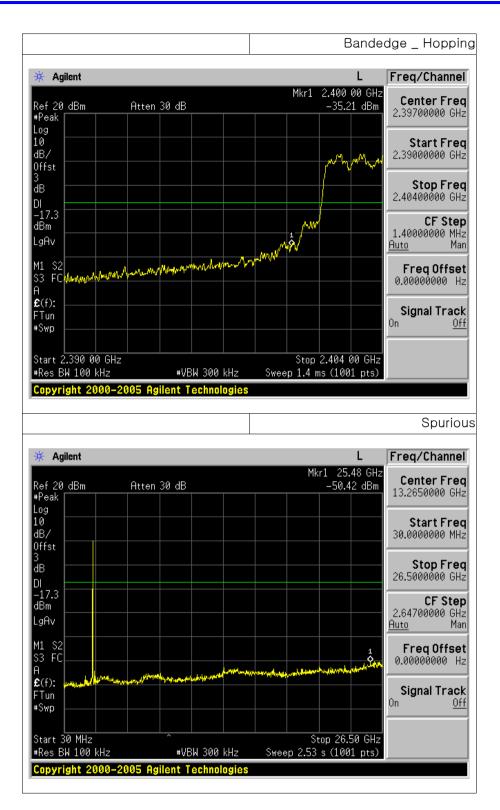


• 8DPSK \_ Low frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 54 / 65

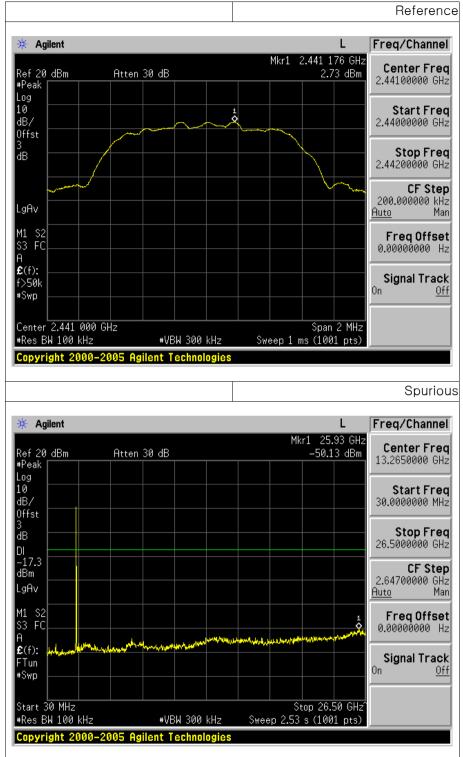




EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 55 / 65



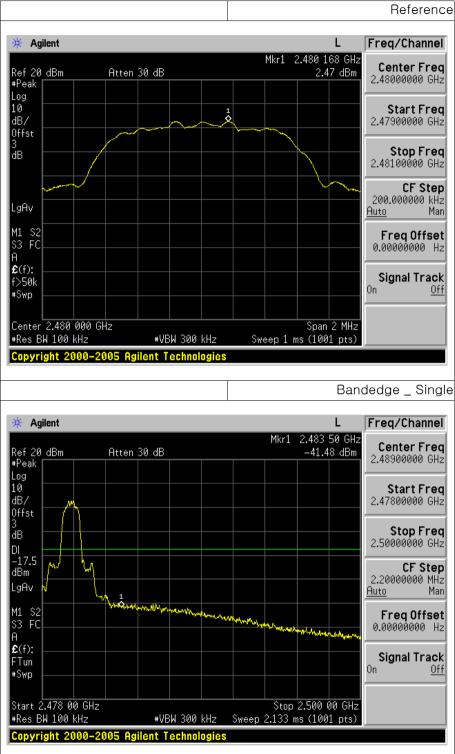
#### • 8DPSK \_ Middle frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 56 / 65

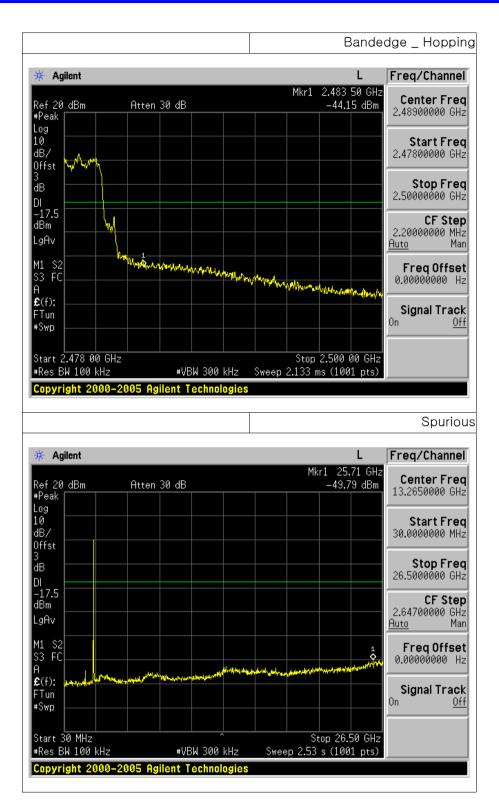


• 8DPSK \_ High frequency



EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 57 / 65





EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 58 / 65



# 12. Conducted Emission

## 12.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

# 12.2 Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)				
Frequency hange (MHZ)	Quasi-Peak	Average			
0.15 ~ 0.5	66 to 56 *	56 to 46 *			
0.5 ~ 5	56	46			
5 ~ 30	60	50			

\* Decreases with the logarithm of the frequency

## 12.3 Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10.

- The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

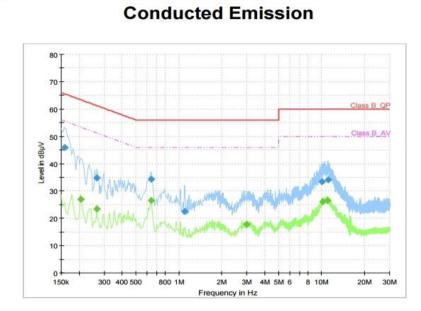
EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 59 / 65



### 12.4 Test Result

• AC Line Conducted Emission (Graph)

SHARK BT\_BT\_L1

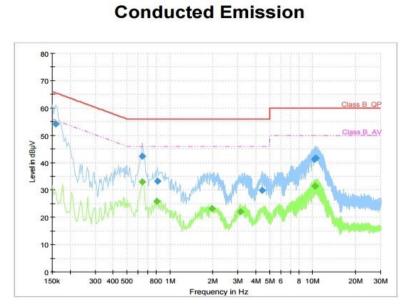


#### Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.158	45.85		65.57	19.72	9	L1	20.7
0.206		27.01	53.37	26.35	9	L1	20.7
0.266		23.34	51.24	27.91	9	L1	20.5
0.266	34.69		61.24	26.55	9	L1	20.5
0.640		26.54	46.00	19.46	9	L1	20.4
0.640	34.38		56.00	21.62	9	L1	20.4
1.100	22.54		56.00	33.46	9	L1	20.0
3.000		17.78	46.00	28.22	9	L1	19.9
10.110	33.36		60.00	26.64	9	L1	20.0
10.220		26.03	50.00	23.97	9	L1	20.0
11.000		26.46	50.00	23.54	9	L1	20.0
11.170	34.18		60.00	25.82		L1	20.0

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 60 / 65





#### Final Result

SHARK BT\_BT\_N

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.158	54.14		65.57	11.42	9	N	20.7
0.640		32.98	46.00	13.02	9	N	20.4
0.640	42.32		56.00	13.68	9	N	20.4
0.810		25.80	46.00	20.20	9	N	19.9
0.820	33.31		56.00	22.69	9	N	19.9
1.980		23.19	46.00	22.81	9	N	19.9
3.140		21.99	46.00	24.01	9	N	19.9
4.440	29.85		56.00	26.15	9	N	19.9
10.300	41.27		60.00	18.73	9	N	20.0
10.370		31.37	50.00	18.63	9	N	20.0
10.400		31.47	50.00	18.53	9	N	20.0
10.590	41.69		60.00	18.31	9	N	20.0

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 61 / 65



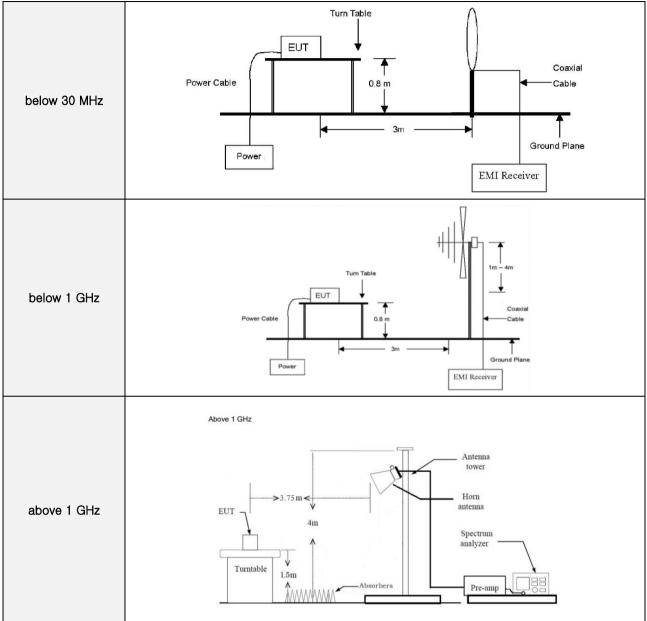
APPENDIX I

TEST SETUP

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 62 / 65



#### • Radiated Measurement



## • Conducted Measurement

		_			
Conducted	EUT		Attenuator	Spectrum Analyzer	

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 63 / 65



APPENDIX II

UNCERTAINTY

EMCLabs-QPF-26-25 [ Revision\_01 / 2024. 04. 15 ] Page 64 / 65



Measurement Item	Expanded Uncertainty U = <i>k</i> Uc ( <i>k</i> =2)		
Conducted RF power	0.34 dB		
Conducted Spurious Emissions	0.34 dB		
Radiated Spurious Emissions	6.34 dB		
Conducted Emissions	1.74 dB		