TEST REPORT

		DT&C Co., Ltd.				
Dt&C	42, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel : 031-321-2664, Fax : 031-321-1664		7042			
1. Report No: DRTFCC2008-026	1. Report No : DRTFCC2008-0264					
2. Customer						
• Name : Daesung Eltec Co., Lto	Ι.					
• Address : 371-6 Gasan Dong k	Kumcheon Ku, 153	3-023, South Korea				
3. Use of Report : FCC Original Gra	ant					
4. Product Name / Model Name : 20 FCC ID : QV3DMN81901)MY BA JD AVN /	′ DM-N81901				
5. Test Method Used : ANSI C63.10 Test Specification : FCC Part 15.		074 D01v05r02				
6. Date of Test : 2020.02.13 ~ 2020	.02.28					
7. Location of Test : I Permanent Testing Lab I On Site Testing						
8. Testing Environment : See apper	8. Testing Environment : See appended test report.					
9. Test Result : Refer to the attache	d test result.					
The results shown in this test report ref	er only to the samp	ele(s) tested unless otherwise stated.				
Affirmation	214-	Reviewed by				
Name : JungWoo Kim	(Suttature)	Name : JaeJin Lee)			
2020 . 08. 26.						
DT&C Co., Ltd.						
Not abided by KS Q ISO / IEC 17025 and KOLAS accreditation.						

If this report is required to confirmation of authenticity, please contact to report@dtnc.net

.



Test Report Version

Test Report No.	Date	Description	Revised By	Reviewed By
DRTFCC2008-0264	Aug. 26, 2020	Initial issue	JungWoo Kim	JaeJin Lee



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1. General Information

1.1 Testing Laboratory

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042. The test site complies with the requirements of § 2.948 according to ANSI C63.4-2014.

- FCC MRA Designation No.: KR0034

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1.2 Testing Environment

Ambient Condition	
Temperature	+20 °C ~ +25 °C
Relative Humidity	34 % ~ 42 %

1.3 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Test items	Measurement uncertainty
Transmitter Output Power	0.9 dB (The confidence level is about 95 %, $k = 2$)
Conducted spurious emission	1.0 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz Below)	5.1 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (1 GHz ~ 18 GHz)	5.4 dB (The confidence level is about 95 %, k = 2)
Radiated spurious emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

1.4 Details of Applicant

Applicant	:	Daesung Eltec Co., Ltd.
Address	:	371-6 Gasan Dong Kumcheon Ku, 153-023, South Korea
Contact person	:	Ju Hyung Lee

1.5 Description of EUT

EUT	20MY BA JD AVN
Model Name	DM-N81901
Add Model Name	NA
Hardware Version	WS1
Software Version	003.0.0810
Serial Number	Identical prototype
Power Supply	DC 12 V
Frequency Range	2402 MHz ~ 2480 MHz
Modulation Technique (Data rate)	GFSK (1Mbps), π/4DQPSK (2Mbps), 8DPSK (3Mbps)
Number of Channels	79
Antenna Type	PCB Pattern Antenna
Antenna Gain	PK : 0.5 dBi

1.6 Declaration by the applicant / manufacturer

- NA

1.7 Information about the FHSS characteristics

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following :
 - A) The hopping sequence is pseudorandom
 - Note 1 : Pseudorandom Frequency Hopping Sequence Table as below:
 - Channel: 08, 24, 40, 56, 42, 54, 72, 09, 01, 11, 33, 41, 34, 42, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 41, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 52, 71, 08, 24, 06, 24, 48, 56, 45, 46, 70, 01, 72, 06, 25, 33, 12, 28, 49, 60, 45, 58, 74, 13, 05, 18, 37, 49 etc

The System receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchroniztation with the transmit ted signals.

- B) All channels are used equally on average
- C) The receiver input bandwidth equals the transmit bandwidth
- D) The receiver hops in sequenc e with the transmit signal
- 15.247(g) : In accordance with the Bluetooth Industry Standard, the system is designed to comply with all
 of the regulations in Section 15.247 when the transmitter is presented with a continuous data
 (or information) system.
- 15.247(h) : In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection / hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

1.8 Test Equipment List

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Dat e (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	19/06/26	20/06/26	US47360812
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48010133
DC Power Supply	Agilent Technologies	66332A	19/06/25	20/06/25	US37473422
DC Power Supply	SM techno	SDP30-5D	19/06/24	20/06/24	305DMG305
Multimeter	FLUKE	17B	19/12/16	20/12/16	26030065WS
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
Thermohygrometer	BODYCOM	BJ5478	19/07/03	20/07/03	N/A
Loop Antenna	ETS-Lindgren	6502	19/09/18	21/09/18	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-Lindgren	3115	19/01/11	21/01/11	9202-3820
Horn Antenna	A.H.Systems Inc.	SAS-574	19/07/03	21/07/03	155
PreAmplifier	tsj	MLA-0118-B01-40	19/12/16	20/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	19/06/27	20/06/27	16966-10728
PreAmplifier	H.P	8447D	19/12/16	20/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000- 15000-40SS	19/06/26	20/06/26	8
High Pass Filter	Wainwright Instruments	WHKX10-2838- 3300-18000-60SS	19/06/26	20/06/26	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	19/06/27	20/06/27	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	19/06/27	20/06/27	16012202
Attenuator	SRTechnology	F01-B0606-01	19/06/27	20/06/27	13092403
Attenuator	Aeroflex/Weinschel	20515	19/06/27	20/06/27	Y2370
Attenuator	SMAJK	SMAJK-2-3	19/06/27	20/06/27	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	19/06/24	20/06/24	1306007 1249001
EMI Receiver	ROHDE&SCHWARZ	ESW44	19/07/30	20/07/30	101645
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-04
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-07
Cable	DT&C	Cable	20/01/13	21/01/13	G-13
Cable	DT&C	Cable	20/01/13	21/01/13	G-14
Cable	HUBER+SUHNER	SUCOFLEX 104	20/01/13	21/01/13	G-15
Cable	Radiall	TESTPRO3	20/01/16	21/01/16	M-01
Cable	Junkosha	MWX315	20/01/16	21/01/16	M-05
Cable	Junkosha	MWX221	20/01/16	21/01/16	M-06
Cable	Radiall	TESTPRO3	20/01/16	21/01/16	RF-92

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017.

Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.



1.9 Summary of Test Results

FCC Part RSS Std.	Parameter	Limit (Using in 2400~ 2483.5 MHz)	Test Condition	Status Note 1
	Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.		с
15.247(a) RSS-247(5.1)	Number of Hopping Frequencies	>= 15 hops		С
	20 dB Bandwidth	N/A		С
	Dwell Time	=< 0.4 seconds		С
15.247(b) RSS-247(5.4)	Transmitter Output Power	For FCC =< 1 Watt , if CHs >= 75 Others =< 0.125 W For IC if CHs >= 75 =< 1 Watt For Conducted Power =< 4 Watt For e.i.r.p, Others =< 0.125 W For Conducted Power. =< 0.5 Watt For e.i.r.p	Conducted	с
15.247(d) RSS-247(5.5)	Conducted Spurious Emissions	The radiated emission to any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density.		с
RSS Gen(6.7)	Occupied Bandwidth (99 %)	N/A		NA
15.247(d) 15.205 & 209 RSS-247(5.5) RSS-Gen (8.9 & 8.10)	Radiated Spurious Emissions	FCC 15.209 Limits	Radiated	с
15.207 RSS-Gen(8.8)	AC Conducted Emissions	FCC 15.207 Limits	AC Line Conducted	NA Note3
15.203	Antenna Requirements	FCC 15.203	-	с

Note 2 : For radiated emission tests below 30 MHz were performed on semi-anechoic chamber which is correlated With OATS.

Note 3 : This device is installed in a car. Therefore the power source is a battery of car.



1.10 Conclusion of worst-case and operation mode

The EUT has three types of modulation (GFSK, π /4DQPSK and 8DPSK). Therefore all applicable requirements were tested with all the modulations.

And packet type was tested at the worst case(DH5).

Tested frequency information,

- Hopping Function : Enable

	TX Frequency (MHz)	RX Frequency (MHz)
Hopping Band	2402 ~ 2480	2402 ~ 2480

- Hopping Function : Disable

	TX Frequency (MHz)	RX Frequency (MHz)
Lowest Channel	2402	2402
Middle Channel	2441	2441
Highest Channel	2480	2480



2. Maximum Peak Output Power Measurement

2.1 Test Setup

Refer to the APPENDIX I.

2.2 Limit

FCC Requirements

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

- 1. §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

1. 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)

2.3 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

 $RBW \ge 20 \text{ dB BW}$ $VBW \ge RBW$ Sweep = auto Detector function = peak Trace = max hold

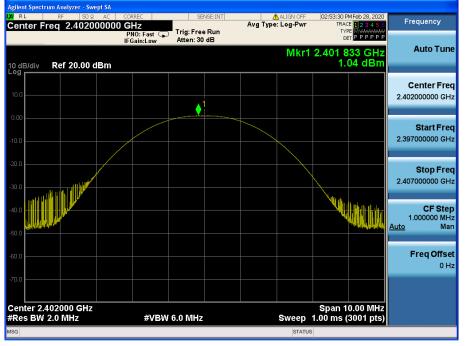
2.4 Test Results

Modulation	Tested Channel		Average Power	Peak Output Power		
Modulation	rested onamier	dBm	mW	dBm	mW	
	Lowest	-0.39	0.91	1.04	1.27	
<u>GFSK</u>	Middle	-0.55	0.88	1.14	1.30	
	Highest	-0.43	0.91	1.75	1.50	
	Lowest	-0.11	0.97	3.78	2.39	
<u>π/4DQPSK</u>	Middle	-0.25	0.94	3.77	2.38	
	Highest	-0.13	0.97	4.42	2.77	
	Lowest	-0.10	0.98	4.18	2.62	
<u>8DPSK</u>	Middle	-0.24	0.95	4.40	2.75	
	Highest	-0.12	0.97	5.01	3.17	

Note 1: The Frame average output power was tested using an average power meter for reference only. Note 2: See next pages for actual measured spectrum plots.

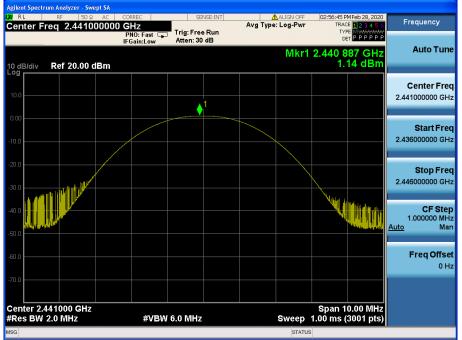


Lowest Channel & Modulation : GFSK



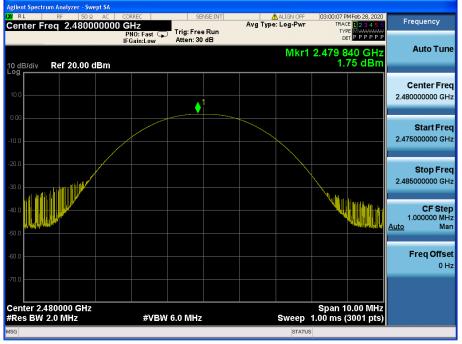
Peak Output Power

Middle Channel & Modulation : GFSK



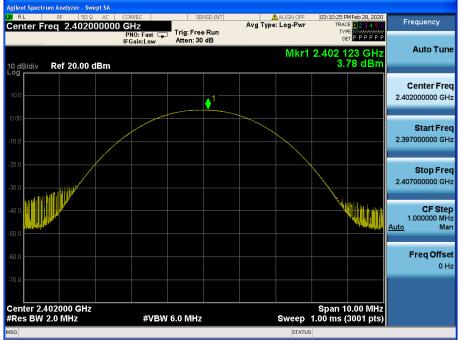


Highest Channel & Modulation : GFSK



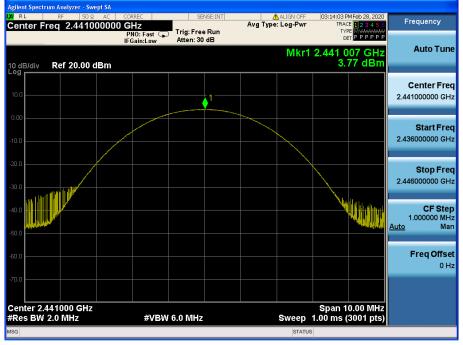
Peak Output Power

Lowest Channel & Modulation : π/4DQPSK



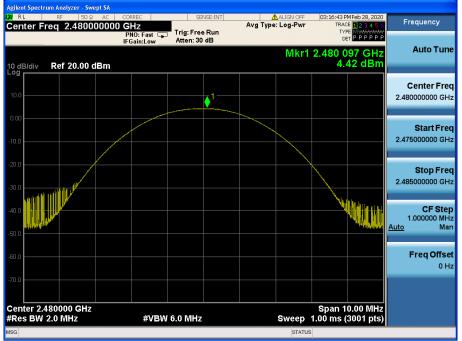


Middle Channel & Modulation : π/4DQPSK



Peak Output Power

Highest Channel & Modulation : π/4DQPSK





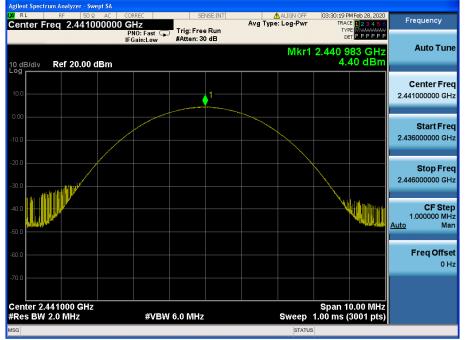






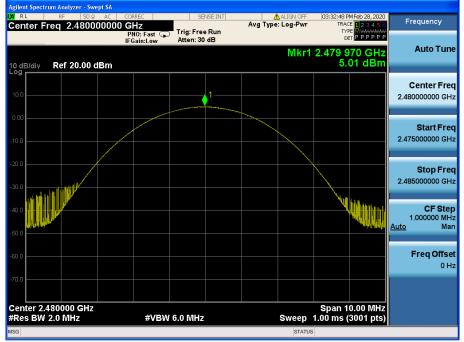
Peak Output Power

Middle Channel & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK



3. 20 dB BW

3.1 Test Setup

Refer to the APPENDIX I.

3.2 Limit

Limit : Not Applicable

3.3 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 BW & Occupied BW

 $VBW \ge 3 \times RBW$

Span = between two times and five times the 20 dB bandwidth & Occupied BW

Sweep = auto

Detector function = peak

Trace = max hold

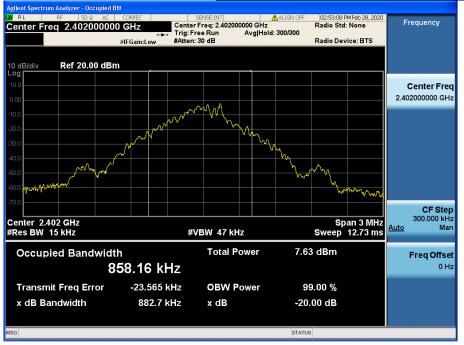
3.4 Test Results

Modulation	Tested Channel	20 dB BW (MHz)
	Lowest	0.883
<u>GFSK</u>	Middle	0.883
	Highest	0.884
	Lowest	1.319
<u>π/4DQPSK</u>	Middle	1.320
	Highest	1.320
	Lowest	1.250
<u>8DPSK</u>	Middle	1.251
	Highest	1.257





Lowest Channel & Modulation : GFSK



20 dB BW

Occupied BV Center Freq: 2.44100000 GHz Trig: Free Run Avg|Hold: 300/300 #Atten: 30 dB 02:56:11 PM Feb 28, 2020 Radio Std: None Frequency Center Freq 2.441000000 GHz Radio Device: BTS #IFGain:Low Ref 20.00 dBm **Center Freq** 2.441000000 GHz CF Step 300.000 kHz Center 2.441 GHz #Res BW 15 kHz Span 3 MHz Sweep 12.73 ms Auto Mar #VBW 47 kHz Total Power 7.77 dBm **Occupied Bandwidth** Freq Offset 861.78 kHz 0 Hz -21.593 kHz **OBW Power** 99.00 % **Transmit Freq Error** x dB Bandwidth 883.0 kHz -20.00 dB x dB STATUS

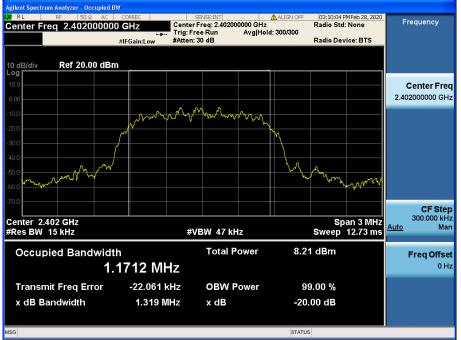
Middle Channel & Modulation : GFSK

Highest Channel & Modulation : GFSK



20 dB BW

Lowest Channel & Modulation : π/4DQPSK





Middle Channel & Modulation : π/4DQPSK



20 dB BW

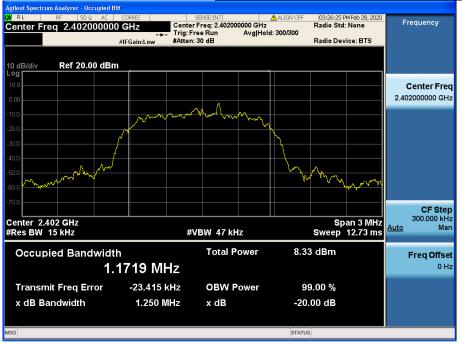
Highest Channel & Modulation : π/4DQPSK







Lowest Channel & Modulation : 8DPSK



20 dB BW

Middle Channel & Modulation : 8DPSK - Occupied BW Center Freq: 2.44100000 GHz Trig: Free Run Avg|Hold: 300/300 #Atten: 30 dB 03:29:04 PM Feb 28, 2020 Radio Std: None Frequency Center Freq 2.441000000 GHz Radio Device: BTS #IFGain:Low Ref 20.00 dBm **Center Freq** 2.441000000 GHz mm A. A.A. CF Step 300.000 kHz Center 2.441 GHz #Res BW 15 kHz Span 3 MHz Sweep 12.73 ms Auto Mar #VBW 47 kHz Total Power 8.45 dBm **Occupied Bandwidth** Freq Offset 1.1702 MHz 0 Hz -23.636 kHz **OBW Power** 99.00 % **Transmit Freq Error** x dB Bandwidth 1.251 MHz -20.00 dB x dB STATUS

Highest Channel & Modulation : 8DPSK





4. Carrier Frequency Separation

4.1 Test Setup

Refer to the APPENDIX I.

4.2 Limit

Limit : ≥ 25 kHz or ≥ Two-Thirds of the 20 dB BW whichever is greater.

4.3 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 markerdelta function was recorded as the measurement results.

The spectrum analyzer is set to :

Span = wide enough to capture the peaks of two adjacent channels

RBW = Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

 $VBW \ge RBW$ Sweep = auto Detector function = peak Trace = max hold

4.4 Test Results

FH mode

Hopping Mode	Modulation	Peak of centerModulationchannel(MHz)		Test Result (MHz)	
	GFSK	2441.134	2442.135	1.001	
Enable	π/4DQPSK	2440.986	2441.987	1.001	
	8DPSK	2441.136	2442.136	1.000	

AFH mode

Hopping Mode	Modulation	Modulation Peak of center (MHz)		Test Result (MHz)	
	GFSK	2441.135	2442.136	1.001	
Enable	π/4DQPSK	2440.969	2441.981	1.012	
	8DPSK	2441.133	2442.138	1.005	

Note 1 : See next pages for actual measured spectrum

- Minimum Standard :

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





Carrier Frequency Separation (FH)

Hopping mode : Enable & GFSK

Agilent Spectrum Analyzer - Swept SA					
α RL RF 50Ω AC Center Freq 2.44100000	0 GHz	Avg Type	Log-Pwr TRA	PM Feb 28, 2020 CE 1 2 3 4 5 6 PE M MANANANA	Frequency
10 dB/div Ref 20.00 dBm	PNO: Far 🖵 Trig: Free IFGain:Low Atten: 30		ΔMkr1 1.0	0.02 dB	Auto Tune
100 -100		X		1Δ2	Center Freq 2.441000000 GHz
-20.0					Start Freq 2.439500000 GHz
-60.0					Stop Freq 2.442500000 GHz
Center 2.441000 GHz #Res BW 51 kHz	#VBW 150 kHz		Span 3 Sweep 1.20 ms (3.000 MHz (3001 pts)	CF Step 300.000 kHz
	1.001 MHz (Δ) 0.02 (11 134 GHz 0.83 dE	dB	NCTION WIDTH FUNCTI	ON VALUE	<u>Auto</u> Man
3					Freq Offset 0 Hz
8 9 10 11 12					
MSG			STATUS		

Carrier Frequency Separation (FH)

Hopping mode : Enable & π/4DQPSK

Agilent Spectrum Analyzer - Swept SA					
LX/ RL RF 50Ω AC	CORREC	SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	03:25:24 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
Center Freq 2.44100000	PNO: Far IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type. Log-Pwr		
10 dB/div Ref 20.00 dBm			ΔN	1kr1 1.001 MHz 0.01 dB	Auto Tune
1000 1000 1000	~~~~	~~X&~~~		1Δ2	Center Freq 2.441000000 GHz
-20.0 -30.0 -40.0 -50.0					Start Freq 2.439500000 GHz
-60.0					Stop Freq 2.442500000 GHz
Center 2.441000 GHz #Res BW 51 kHz	#VBW	150 kHz	-	Span 3.000 MHz 1.20 ms (3001 pts)	CF Step 300.000 kHz
MKR MODE TRC SCL X 1 Δ2 1 f (Δ) 2 F 1 f 2.440	1.001 MHz (Δ) 0 986 GHz	Y FU 0.01 dB 0.52 dBm	NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
3 4 5 6					Freq Offset 0 Hz
7					
MSG			STATUS	3	



Carrier Frequency Separation (FH)

Hopping mode : Enable & 8DPSK

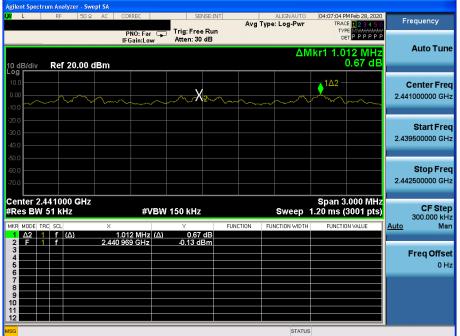
L RF	50 Ω AC CORREC	SENSE:I	ALI Avg Type: L	IGN AUTO 04:08:57 PM Feb og-Pwr TRACE	28,2020 Frequency
	PNO: IFGain:	Far Trig: Free Ru Low Atten: 30 dB		TYPE M	PPPP
0 dB/div Ref 2	0.00 dBm			∆Mkr1 1.000 -0.0	MHz Auto Tune 1 dB
og 10.0 10.0 10.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		X2		Center Free 2.441000000 GH
					Start Fre 2.439500000 G⊢
50.0 50.0 70.0					Stop Fre 2.442500000 GH
enter 2.441000 Res BW 51 kHz		#VBW 150 kHz	S	Span 3.00 weep 1.20 ms (300	1 pts) CF Ste 300.000 kH
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	× 1.000 M 2.441 136 GI	Υ Hz (Δ) -0.01 dB Hz 0.66 dBm	FUNCTION FUNCTI	ION WIDTH FUNCTION VA	LUE <u>Auto</u> Ma
3 4 5 6					Freq Offse 0 H
7 8 9					
1					



Carrier Frequency Separation (AFH) <u>Hopping mode : Enable & GFSK</u>

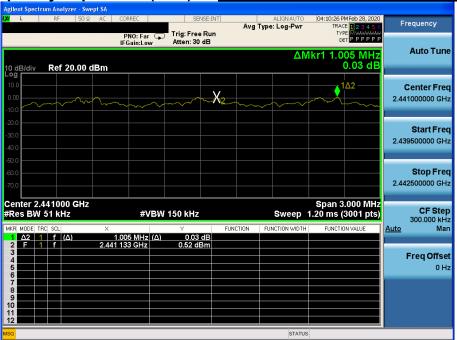


Carrier Frequency Separation (AFH) <u>Hopping mode : Enable & $\pi/4DQPSK$ </u>





Carrier Frequency Separation (AFH) <u>Hopping mode : Enable & 8DPSK</u>





5. Number of Hopping Frequencies

5.1 Test Setup

Refer to the APPENDIX I.

5.2 Limit

Limit : >= 15 hops

5.3 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 ~ 2483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz	Start Frequency = 2391.5 MHz,	Stop Frequency = 2441.5 MHz
	Start Frequency = 2441.5 MHz,	Stop Frequency = 2491.5 MHz
Span for AFH mode = 30 MHz	Start Frequency = 2426.0 MHz,	Stop Frequency = 2456.0 MHz
RBW = To identify clearly the ind	ividual channels, set the RBW to le	ess than 30% of the channel spacing
or the 20 dB bandwidth, v	whichever is smaller.	
VBW ≥ RBW	Sweep = auto	
Detector function = peak	Trace = max hold	

5.4 Test Results

FH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	79
Enable	π/4DQPSK	79
	8DPSK	79

AFH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	20
Enable	π/4DQPSK	20
	8DPSK	20

Note 1 : See next pages for actual measured spectrum plots.

- Minimum Standard :

At least 15 hopes



Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & GFSK

		ctru		alyzer - Sv												
LXI F			RF				IREC		SEI	NSE:INT			ALIGN OFF		M Feb 28, 2020	
Cei	nter	Fre	ea	2.416	5000	00 GI	Ηz				Avg T	Гуре	: Log-Pwr	TRA	°E <mark>1 2 3 4 5</mark> 6	Frequency
						PI	10: Fast	Ģ	Trig: Free					TY	PE MWWWWW ET P P P P P P	
						IFG	iain:Lov	v	Atten: 30	dB						
													Mkr2	2 441 (00 GHz	Auto Tune
													1011112		82 dBm	
10 c	B/di∖	/	Re	f 20.00	dBm									0.	oz ubili	
Log																
10.0					1/1										<u> </u>	Center Freq
0.00					X a	~ ~ ~	~~~	mm	~~~~	anam	nnn	n n	~~~~	mmmom		2.416500000 GHz
					- / // \	/ \/ \/ \	/ V V V	1 V V	'	E V V V V	V V V V	1 1/ 1		W W W W W	* * * * * * *	2.410000000 0112
-10.0					- ĭ 	╎╿╿	4 # 4	I Y Y	1 1 1 1 1 1 1		F ¥ Y ₹		• • • • •	* * * * *	¥ ¥ ¥ ¥ ¥	
-20.0					4											
					1											Start Freq
-30.0																2.391500000 GHz
-40.0					1											2.00100000000112
					1											
-50.0				M.V												
-60.0			1	APRIL OF												Stop Freq
																2.441500000 GHz
-70.0																2.441000000 0112
	rt 2.:														4150 GHz	
#Re	s Bl	W 2	270	kHz			#V	BW	820 kHz				Sweep	1.00 ms (3001 pts)	CF Step
							_									5.000000 MHz
	MODE	_			×				Y		CTION	FUN	NCTION WIDTH	FUNCTI	ON VALUE	<u>Auto</u> Man
1	NN	1	f	(Δ)	2.4	402 000 441 000) GHz	<u>(Δ)</u>	0.69 dl							
2	IN	1	r		2.4	441 000	JGHZ		0.82 dl	sm						
4																Freq Offset
5																0 Hz
6																
7																
8																
9																
10																
11 12		<u> </u>														
12																
MSG													STATUS	5		
	-	-	-	_	_	_	_	-			_	-				

Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & GFSK

gilent Spectrum Analyzer - Swept SA RL RF 50.Ω AC					
RL RF 50 Q AC	CORREC GHZ	SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	03:06:52 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
0 dB/div Ref 20.00 dBm	PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB	Mkr2	2.480 000 GHz 1.51 dBm	Auto Tun
	www				Center Fre 2.466500000 GH
					Start Fre 2.441500000 GH
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0				Marchanovskertoner sonorester ()	Stop Fre 2.491500000 GH
tart 2.44150 GHz Res BW 270 kHz	#VBW	820 kHz		Stop 2.49150 GHz 1.00 ms (3001 pts)	CF Ste 5.000000 Mi Auto Mi
1 N 1 f (Δ) 2.442	2 000 GHz (Δ) 0 000 GHz	0.87 dBm 1.51 dBm			Freq Offs
6 7 8 9 0					
g			STATU	3	



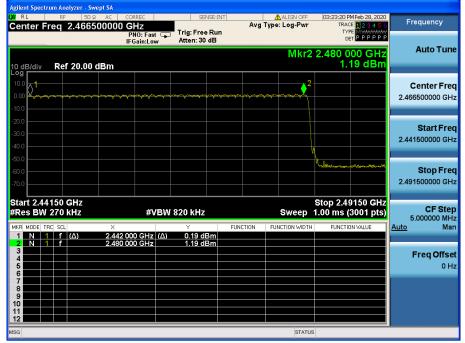
Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & π/4DQPSK

XI RL Center	R Frea		Ω AC	CORREC			E:INT	Avg	ALIGN OFF	TRA	PM Feb 28, 2020	Frequency
10 dB/div			0 dBm	PNO: Fast IFGain:Lov		Trig: Free I Atten: 30 c			Mkr2	2 2.441	000 GHz	Auto Tune
Log 10.0 0.00			2 ¹	~~~~~	,,,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-9-4-4-4-4444	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~	~~v~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Center Fred 2.416500000 GH:
-20.0												Start Freq 2.391500000 GHz
-50.0 -60.0 -70.0	ranan pasa P		γ									Stop Freq 2.441500000 GHz
Start 2.3 #Res B\ MKR MODE	N 270	kHz	×			820 kHz Y		FUNCTION	Sweep	1.00 ms	4150 GHz (3001 pts)	CF Step 5.000000 MHz <u>Auto</u> Mar
1 N 2 N 3 4 5 6	1 f	(Δ) 	2.40	2 000 GHz 1 000 GHz	(<u>(</u>)	0.29 dB 0.35 dB	m m					Freq Offset 0 Hz
7 8 9 10 11 12												
MSG									STATU	IS		

Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & π/4DQPSK





Number of Hopping Frequencies 1(FH)

Hopping mode : Enable & 8DPSK

		ectrur			Swept SA											
LXI			RF		Ω AC	CORREC		SE	NSE:INT			LIGN OFF		MFeb 28, 2020	-	requency
Ce	nter	Fre	eq	2.416	65000C	0 GHz			_	Avg	Type: L	.og-Pwr	TRA	CE 123456 PE M WAAAAAAA	F	requeitcy
						PNO: Fas	ť	Trig: Free Atten: 30					11 D	ET P P P P P P		
						IFGain:Lo	w	Atten: 30	40							Auto Tune
												Mkr2	2.441 0)00 GHz		Auto Tune
10	dB/div		Rei	F 20 0	0 dBm								0.	56 dBm		
Lõg		v		20.0	v ubiii											
10.	o —															Center Freq
0.C																
0.0					- mart	and and a start and a start and a start	- Jan	and and the state of the state		-	And a	and a dear dear	a Marta Andre	- turkenhar - unter	2.41	16500000 GHz
-10.					-											
-20.																
																Start Freq
-30.															2.39	91500000 GHz
-40.	0				1										2.00	
-50.																
	A	-	where	Armell												
-60.																Stop Freq
-70.															2.44	41500000 GHz
Sta	irt 2.	391	50	GHz									Stop 2.4	4150 GHz		
#R	es B	W 2	70	kНz		#\	/BW	820 kHz			s	weep	1.00 ms ((3001 pts)		CF Step
																5.000000 MHz
MKF	MODE				×			Y		NCTION	FUNCT	ION WIDTH	FUNCTI	ON VALUE	<u>Auto</u>	Man
1	N	1	t.	(Δ)	2.4	02 000 GHz 41 000 GHz	<u>(Δ)</u>	0.67 d 0.56 d								
3		Ľ			2.4	41 000 GH2		0.56 0	200							
4																Freq Offset
5																0 Hz
6																
7																
9																
10																
11																
12																
MSG												STATUS	5			
	-															

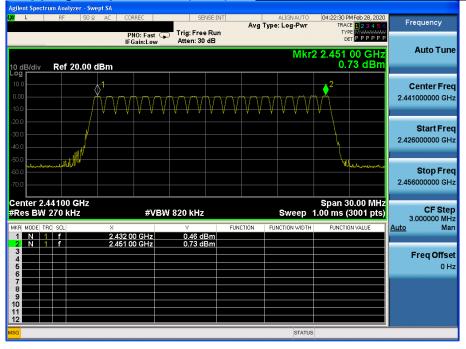
Number of Hopping Frequencies 2(FH)

Hopping mode : Enable & 8DPSK

Agilent Spectrum Analyzer - Swept SA KI RL RF 50 Ω AC	CORREC		A 417011 055		
RL RF 50 Q AC Center Freq 2.46650000	0 GHz	SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	03:40:10 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 20.00 dBm		ig: Free Run ten: 30 dB	Mkr2	2.480 000 GHz 1.33 dBm	Auto Tune
Log 10.0 .00 -10.0			<u>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</u>		Center Free 2.466500000 GH
20.0					Start Fre 2.441500000 GH
-50.0 -60.0 -70.0				Markey, and provide the state of the state o	Stop Fre 2.491500000 GH
Start 2.44150 GHz Res BW 270 kHz	#VBW 82) KHZ Y FUNC	Sweep	Stop 2.49150 GHz 1.00 ms (3001 pts) FUNCTION VALUE	CF Ste 5.000000 MH <u>Auto</u> Ma
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		0.65 dBm 1.33 dBm			Freq Offse 0 H
7 8 9 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10					
SG			STATUS]	

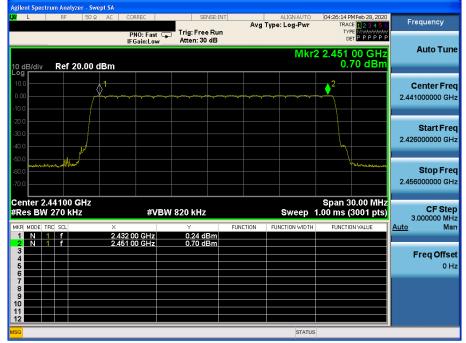


Number of Hopping Frequencies 1(AFH) Hopping mode : Enable & GFSK



Number of Hopping Frequencies 1(AFH)

Hopping mode : Enable & π/4DQPSK





Number of Hopping Frequencies 1(AFH) Hopping mode : Enable & 8DPSK

LR	F 50 Ω AC	CORREC PNO: Fast	SENSE:IN	Avg	ALIGN AUTO	04:28:25 PM Feb 28, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
0 dB/div Re	ef 20.00 dBm	IFGain:Low	Atten: 30 dB		Mkr	DET PPPPP 2 2.451 00 GHz 0.94 dBm	Auto Tun
10.0 10.0 10.0				~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		2	Center Fre 2.441000000 GF
20.0 30.0 40.0 50.0							Start Fre 2.426000000 GH
60.0 70.0	Mhsadili"					Winnerser	Stop Fre 2.456000000 GH
enter 2.441 Res BW 270	kHz	#VBV	V 820 kHz			Span 30.00 MHz 1.00 ms (3001 pts)	CF Ste 3.000000 Mi
IKR MODE TRC SC 1 N 1 f 2 N 1 f 3	2.43	32 00 GHz 51 00 GHz	⊻ 0.57 dBm 0.94 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto Ma Freg Offs
5 6 7 8							01
9 0 1							
G					STATUS		



6. Time of Occupancy (Dwell Time)

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

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

6.3 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 :

Span = zero

Detector function = peak

Center frequency = 2441 MHz 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

Trace = max hold

6.4 Test Results

FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
	DH 5	79	2.880	3.750	0.307
Enable	2 DH 5	79	2.880	3.750	0.307
	3 DH 5	79	2.880	3.750	0.307

AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)	
	DH 5	20	2.880	3.750	0.154	
Enable	2 DH 5	20	2.880	3.750	0.154	
	3 DH 5	20	2.880	3.750	0.154	

Note 1 : Dwell Time = 0.4 × Hopping channel × Burst ON time ×

((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

Note 2 : See next pages for actual measured spectrum plots.



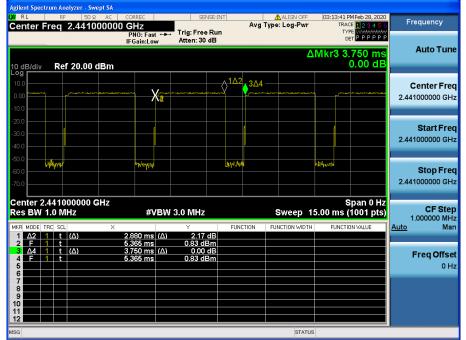
Time of Occupancy (FH)

Avg Type: Log-Pwr Frequency Center Freq 2.441000000 GHz PNO: Fast ↔→ IFGain:Low Atten: 30 dB ΔMkr3 3.750 m 0.00 dE Auto Tune Ref 20.00 dBm **Center Freq** Xz 2.441000000 GHz Start Freq 2.441000000 GHz N.L.N phone **NGA** Stop Freq 2.441000000 GHz Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 15.00 ms (1001 pts) CF Step 1.000000 MHz #VBW 3.0 MHz FUNCTION Auto Mar 0.01 dB 0.97 dBm 0.00 dB 0.97 dBm (A) 4.810 ms 3.750 ms 4.810 ms F ∆4 F ns (∆) (Δ) Freq Offset 0 Hz 10 11 12 STATUS

Hopping mode : Enable & DH5

Time of Occupancy (FH)

Hopping mode : Enable & 2-DH5





Time of Occupancy (FH)

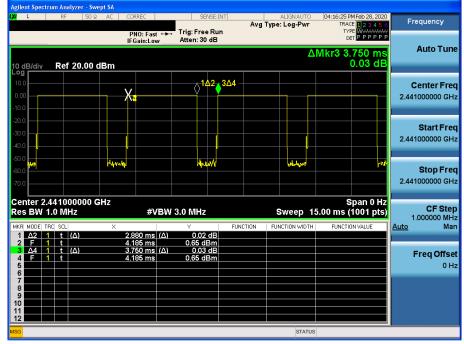
Hopping mode : Enable & 3-DH5

enter Freq 2.441000		SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: Lo	g-Pwr TR	ACE 1 2 3 4 5 6 YPE WWWWWWW DET P P P P P P	Frequency
0 dB/div Ref 20.00 dBr					3.750 ms -0.01 dB	Auto Tun
og 10.00 10.00		1Δ2	3∆4 — hu	internationality		Center Fre 2.441000000 GH
						Start Fre 2.441000000 GH
0.0 44.44.44	(phropol	ในกับไหน ^{ู่ม} ์		ynhwar ^y		Stop Fre 2.441000000 GF
enter 2.441000000 GHz es BW 1.0 MHz		3.0 MHz	Sw	eep 15.00 ms	Span 0 Hz (1001 pts)	CF Ste 1.000000 M
KR MODE TRC SCL 1 Δ2 1 t (Δ) 2 F 1 t	× 2.880 ms (Δ) 5.065 ms	1.49 dB 0.84 dBm	NCTION FUNCTI	ON WIDTH FUNC	TION VALUE	<u>Auto</u> Ma
3 Δ4 1 t (Δ) 4 F 1 t 5 5 5 5 6 7 7 7 <td>3.750 ms (∆) 5.065 ms</td> <td>-0.01 dB 0.84 dBm</td> <td></td> <td></td> <td></td> <td>Freq Offs 0</td>	3.750 ms (∆) 5.065 ms	-0.01 dB 0.84 dBm				Freq Offs 0
7 8 9 0						
2						



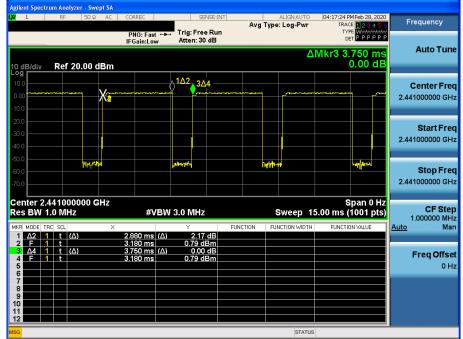
Time of Occupancy (AFH)

Hopping mode : Enable & DH5



Time of Occupancy (AFH)

Hopping mode : Enable & 2-DH5





Time of Occupancy (AFH)

Hopping mode : Enable & 3-DH5

L RF 50Ω AC	CORREC SENSE:INT PNO: Fast ↔ Trig: Free Run IFGain:Low Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr	04:18:09 PM Feb 28, 2020 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P P P P P P	Frequency
0 dB/div Ref 20.00 dBm		ΔΝ	/lkr3 3.750 ms 0.00 dB	Auto Tun
• 0 0 10 0 0.00	Xz	1Δ2 3Δ4	^^~~	Center Fre 2.441000000 GF
				Start Fre 2.441000000 GH
50.0			₩*√γ⁄	Stop Fre 2.441000000 GH
Center 2.441000000 GHz Res BW 1.0 MHz KRI MODE TRC SCL X 1 A2 1 t (A)	#VBW 3.0 MHz	Sweep 15	Span 0 Hz .00 ms (1001 pts) FUNCTION VALUE	CF Ste 1.000000 Mi <u>Auto</u> M
2 F 1 t (Δ) 3 Δ4 1 t (Δ) 4 F 1 t 5 6 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2.80 mS (Δ) 1.51 dB 6.720 mS 0.77 dBm 3.750 mS (Δ) 0.00 dB 6.720 mS 0.77 dBm			Freq Offs 0 F
8				



7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

7.1 Test Setup

Refer to the APPENDIX I.

7.2 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 §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified 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

** 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.

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

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	156.52475 ~ 156.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	156.7 ~ 156.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4400		

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.



7.3. Test Procedures

7.3.1. Test Procedures for Radiated Spurious Emissions

- 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 1 or 3 meter away from the interference-receiving antenna.
- 3. For measurements above 1GHz 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.
- 5. 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.
- 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.

Measurement Instrument Setting

- Frequencies less than or equal to 1000 MHz The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
- Frequencies above 1000 MHz

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.

The result of Average measurement is calculated using PK result and duty correction factor.



7.3.2. Test Procedures for Conducted Spurious Emissions

- 1. The transmitter output was connected to the spectrum analyzer.
- 2. The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
- 3. The conducted spurious emission was tested each ranges were set as below.

```
Frequency range : 9 kHz ~ 30 MHz
RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001
```

Frequency range : 30 MHz ~ 10 GHz, 10 GHz ~ 25 GHz RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40001

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

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.



7.4. Test Results

7.4.1. Radiated Emissions

9 kHz ~ 25 GHz Data (Modulation : <u>GFSK</u>)

Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2389.59	V	Х	PK	50.11	5.24	N/A	N/A	55.35	74.00	18.65
2389.59	V	Х	AV	50.11	5.24	-24.79	N/A	30.56	54.00	23.44
4804.05	Н	Х	PK	50.52	1.47	N/A	N/A	51.99	74.00	22.01
4804.05	Н	Х	AV	50.52	1.47	-24.79	N/A	27.20	54.00	26.80

Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.95	Н	Х	PK	49.80	2.02	N/A	N/A	51.82	74.00	22.18
4881.95	Н	Х	AV	49.80	2.02	-24.79	N/A	27.03	54.00	26.97

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2484.42	V	Х	PK	49.72	5.80	N/A	N/A	55.52	74.00	18.48
2484.42	V	Х	AV	49.72	5.80	-24.79	N/A	30.73	54.00	23.27
4960.42	Н	Х	PK	49.19	2.17	N/A	N/A	51.36	74.00	22.64
4960.42	Н	Х	AV	49.19	2.17	-24.79	N/A	26.57	54.00	27.43

Note.

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = 20 log(1 m / 3 m) = -9.54 dB

When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)

- Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2

- The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms

- D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = <u>-24.79 dB</u>

4. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.



9 kHz ~ 25 GHz Data (Modulation : π /4DQPSK)

Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.56	V	Х	PK	49.19	5.23	N/A	N/A	54.42	74.00	19.58
2388.56	V	Х	AV	49.19	5.23	-24.79	N/A	29.63	54.00	24.37
4804.06	Н	Х	PK	49.15	1.47	N/A	N/A	50.62	74.00	23.38
4804.06	Н	Х	AV	49.15	1.47	-24.79	N/A	25.83	54.00	28.17

Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.69	Н	Х	PK	49.46	2.02	N/A	N/A	51.48	74.00	22.52
4881.69	Н	Х	AV	49.46	2.02	-24.79	N/A	26.69	54.00	27.31

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2484.64	V	Х	PK	49.66	5.80	N/A	N/A	55.46	74.00	18.54
2484.64	V	Х	AV	49.66	5.80	-24.79	N/A	30.67	54.00	23.33
4960.20	Н	Х	PK	49.23	2.17	N/A	N/A	51.40	74.00	22.60
4960.20	Η	Х	AV	49.23	2.17	-24.79	N/A	26.61	54.00	27.39

Note.

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = $20 \log(1 \text{ m / } 3 \text{ m}) = -9.54 \text{ dB}$ When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)

- Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2

- The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms

- D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = -24.79 dB

4. Sample Calculation.

Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.



9 kHz ~ 25 GHz Data (Modulation : <u>8DPSK</u>)

Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.80	V	Х	PK	49.91	5.23	N/A	N/A	55.14	74.00	18.86
2388.80	V	Х	AV	49.91	5.23	-24.79	N/A	30.35	54.00	23.65
4803.64	Н	Х	PK	49.81	1.47	N/A	N/A	51.28	74.00	22.72
4803.64	Н	Х	AV	49.81	1.47	-24.79	N/A	26.49	54.00	27.51

Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.25	Н	Х	PK	49.84	2.03	N/A	N/A	51.87	74.00	22.13
4882.25	Н	Х	AV	49.84	2.03	-24.79	N/A	27.08	54.00	26.92

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2484.32	V	Х	PK	49.72	5.79	N/A	N/A	55.51	74.00	18.49
2484.32	V	Х	AV	49.72	5.79	-24.79	N/A	30.72	54.00	23.28
4960.41	Н	Х	PK	49.57	2.17	N/A	N/A	51.74	74.00	22.26
4960.41	Н	Х	AV	49.57	2.17	-24.79	N/A	26.95	54.00	27.05

Note.

1. The radiated emissions were investigated up to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

2. Information of Distance Factor

For finding emissions, the test distance might be reduced from 3m to 1m. In this case, the distance factor(-9.54dB) is applied to the result.

- Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = <u>-9.54 dB</u> When distance factor is "N/A", the distance is 3 m and distance factor is not applied.

3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)

- Time to cycle through all channels = Δt = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2

- The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms

- D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = -24.79 dB

4. Sample Calculation.

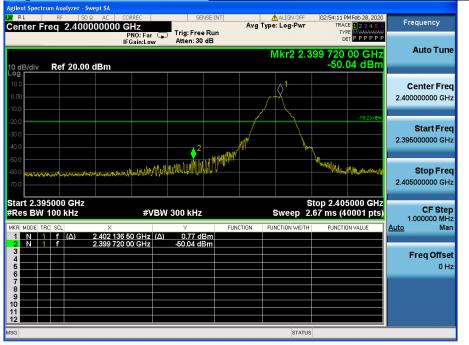
Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain.



Low Band-edge

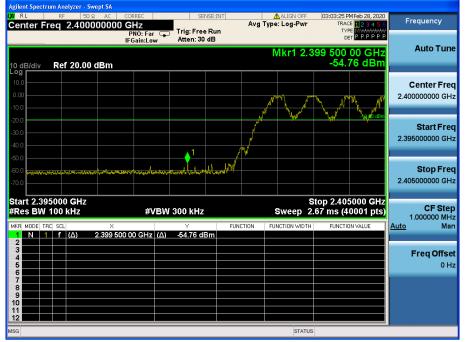
Dt&C



Lowest Channel & Modulation : GFSK

Low Band-edge

Hopping mode & Modulation : GFSK





Lowest Channel & Modulation : GFSK

Agilent Spectr <mark>LXI</mark> RL	RF	50	Ω 🚹 DC	CORF	EC		SEI	VSE:IN	IT			ALIGN OFF			b 28, 2020	Er	equency
Center Fi	req	15.00	4500	PN	D: Fast ain:Low		Trig: Free Atten: 30			Avg	Туре	: Log-Pwr		TYPE M	23456 ////////////////////////////////////		equency
10 dB/div	Rei	20.00	dBm	10								1	/kr1 -4	281.9 6.36	9 kHz dBm		Auto Tune
Log 10.0 0.00 -10.0																	enter Freq .004500 MHz
-20.0 -30.0 -40.0															-19.23 dBm		Start Freq 9.000 kHz
-70.0		than Ingenation for	in en	berthusere t	(*)~*(*,~)***	erstigen	History H	ngalagnya	daastriitti jaa	ni, fisisiliyin ay	n littligh	48.484(8 4 84 0 -0446)			nyanatajiyyati		Stop Freq .000000 MHz
Start 9 kH #Res BW	100	kHz			#V	BW 3	00 kHz					Sweep 5	.33 ms	(4000		2	CF Step .999100 MHz
MKR MODE TF		(Δ)	X) kHz	(Δ)	۲ -46.36 dl	Зm	FUN	CTION	FUN	ICTION WIDTH	FUY	NCTION VA	ALUE	<u>Auto</u>	Man
2 3 4 5 6																F	F req Offset 0 Hz
7 8 9 10																	
11 12 MSG												STATUS	<u>↓</u> DC	Couple	ed.		

Agilent Spectrum Analyz					
Center Freq 5.0	50 Ω AC CORREC	SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	02:54:59 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
Contor rrog c.	PNO: Fast IFGain:Lov	Trig: Free Run Atten: 30 dB	• •	DET P P P P P	
			Mki	5 5.876 91 GHz	Auto Tune
10 dB/div Ref 20	0.00 dBm			-46.68 dBm	
10.0					Center Freq
0.00	Y				5.015000000 GHz
-10.0					
-20.0				-19.23 dBm	Start Freq
-30.0	<u>^2</u>		•5 •4		30.000000 MHz
-40.0		Y Y			
-60.0					Stop Freq
-70.0					10.00000000 GHz
Start 30 MHz				Oton 40 000 Otto	
#Res BW 1.0 MH	z #V	BW 3.0 MHz	Sweep 1	Stop 10.000 GHz 8.7 ms (40001 pts)	CF Step
MKR MODE TRC SCL	X	Y	FUNCTION FUNCTION WIDTH		997.000000 MHz <u>Auto</u> Man
1 N 1 f (Δ 2 N 1 f) 2.402 11 GHz 3.310 13 GHz	(<u>A) 0.99 dBm</u> -45.09 dBm			
3 N 1 f (Δ 4 N 1 f					Freq Offset
5 N 1 f	5.876 91 GHz	-46.68 dBm			0 Hz
7					
8 9					
10					
12					
MSG			STATU	5	



Lowest Channel & Modulation : GFSK

XI RL	um Analyzer - Sv RF 50 req 17.50	Ω AC CO 0000000 (P	RREC GHZ NO: Fast G		Run	ALIGN O g Type: Log-Pv	VIT TRA TY	M Feb 28, 2020 CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P P	Frequency
10 dB/div	Ref 20.00		Sameow			Mkr	3 23.713 (-39.	00 GHz 94 dBm	Auto Tune
10.0 0.00 -10.0									Center Fred 17.500000000 GHz
-20.0			artified and Manager	uity, between the state				-19.23 dBm	Start Fred 10.000000000 GH
-50.0									Stop Free 25.000000000 GH
Start 10.0 #Res BW	1.0 MHz	×		3.0 MHz	FUNCTION	Sweep FUNCTION WI	40.0 ms (4	0000 GHz 0001 pts)	CF Stej 1.500000000 GH <u>Auto</u> Ma
1 N 1 2 N 1 3 N 1 4 5 6	f (Δ) f f (Δ)	24.283 37	5 GHz (Δ) 5 GHz 0 GHz (Δ)	-36.99 dBr -38.02 dBr -39.94 dBr	n				Freq Offse 0 H
7 8 9 9 9 9 10 11 1 1 1 1 1 1 1 1 1 1 1 1 1									
12						STA	TUS		



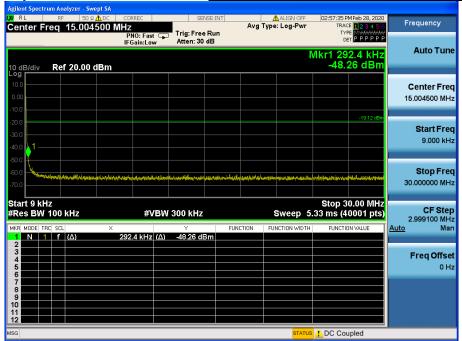
Reference for limit





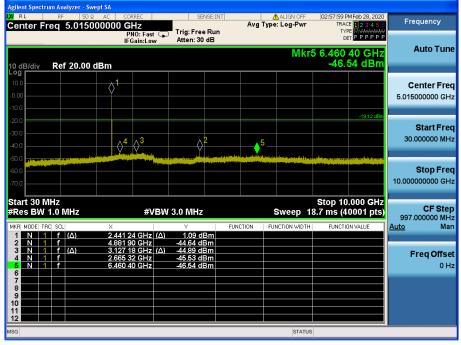
Conducted Spurious Emissions Mid







Middle Channel & Modulation : GFSK

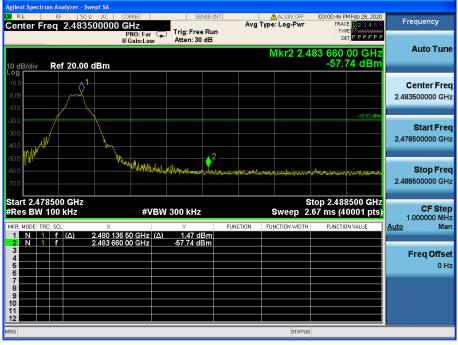


Agilent Spectrum Analyz						
[∭] RL RF Center Freg 17	50 Ω AC CORREG	7		ALIGN OFF	02:59:05 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
eenter req		Fast 🕞 Trig: Free			DET P P P P P	
	ii Gail	1.20w		Mkr3-1	7.028 625 GHz	Auto Tune
10 dB/div Ref 2	0.00 dBm			initia e i	-42.14 dBm	
Log						
						Center Freq 17.50000000 GHz
-10.0						17.500000000 8H2
-20.0					-19.12 dBm	
-30.0		3				Start Freq
-40.0		<u>^</u>		فالربان أنتعر ومطاطعاتهم والمراجع		10.00000000 GHz
-50.0 independent of well						
-60.0						Stop Freq
-70.0						25.00000000 GHz
Start 10.000 GHz					Stop 25.000 GHz	
#Res BW 1.0 MH	z	#VBW 3.0 MHz		Sweep 4	0.0 ms (40001 pts)	CF Step 1.50000000 GHz
MKR MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f (Δ 2 N 1 f	24.319 375 G	Hz -37.86 dl	Bm			
3 Ν 1 f (Δ) 17.028 625 G	iHz (Δ) -42.14 dl	Bm			Freq Offset
5						0 Hz
7						
9						
10						
12						
MSG				STATUS		



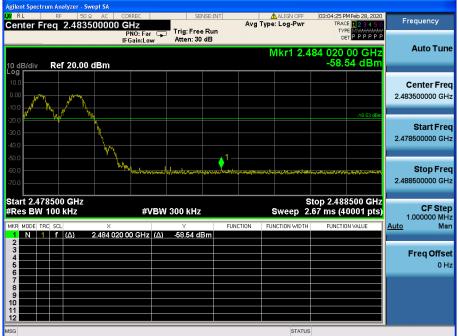
High Band-edge

Highest Channel & Modulation : GFSK



High Band-edge

Hopping mode & Modulation : GFSK





Conducted Spurious Emissions <u>Highest Channel & Modulation : GFSK</u>

Agilent Spectr													
Center F	RF rea		ו <u>0 14500</u> 14500			SENSE:I			ALIGN OFF	TRAC	MFeb 28, 2020 E 1 2 3 4 5 6	Fred	luency
				PNO: Fast IFGain:Lov		Free Run n: 30 dB	1						
_				II Galil.20						// ///////////////////////////////////	8 7 kHz	A	uto Tune
10 dB/div	Re	f 20.00	0 dBm								17 dBm		
Log													
10.0													nter Freq
-10.0												15.0	04500 MHz
											-18.53 dBm		
-20.0												5	Start Freq
-40.0													9.000 kHz
-40.0													
													Stop Freq
-70.0	nersterner	and the second	whether	disdown, whydrope	har an	east and marin	internet from	ainternet thread	والمعالية المعرف المقاولية الم	and the second second	an an the state of		00000 MHz
.70.0													
Start 9 kH											0.00 MHz		CF Step
#Res BW	100	kHz		#V	BW 300	kHz			Sweep 5	.33 ms (4	0001 pts)	2.9	99100 MHz
MKR MODE TF			X	288.7 kHz	Y	17 dBm	FUNCT	rion fu	NCTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u>	Man
2	r			288.7 KHZ	<u>(Δ)</u> -47.	17 aBm							
3 4												Fr	eq Offset
5													0 Hz
7													
8													
10													
11 12													
MSG									STATUS	L DC Cou	pled		

Agilent Spectrum Analyzer - Swe					
RL RF 50 Ω Center Freq 5.0150	AC CORREC	SENSE:INT	ALIGN OFF	03:01:32 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 🧊 IFGain:Low	Trig: Free Run Atten: 30 dB	Mkr		Auto Tune
10 dB/div Ref 20.00 c	dBm			-45.04 dBm	
10.0	1				Center Freq 5.015000000 GHz
-20.0				-18.53 dBm	
-30.0					Start Freq 30.000000 MHz
-40.0	-	5			30.00000 MH2
-50.0				en e	Stop Freq
-60.0					10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 1	Stop 10.000 GHz 8.7 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.480 13 GHz (Δ)	Y FUN 1.73 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f 3 N 1 f (A)	3.157 84 GHz 2.505 80 GHz (Δ)	-44.69 dBm -44.96 dBm			
4 N 1 f	2.673 30 GHz 4.959 92 GHz	-45.01 dBm -45.04 dBm			Freq Offset 0 Hz
6	4.555 52 6112	40.04 dBm			0112
8					
10					
12					
MSG			STATUS		



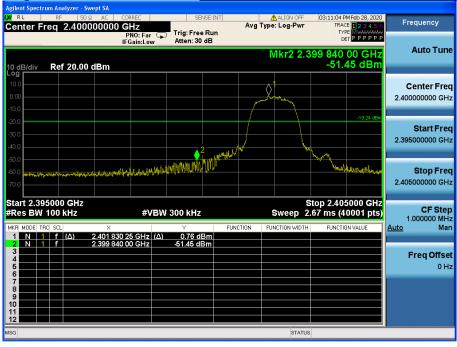
Highest Channel & Modulation : GFSK

gilent Spectro RL Center Fr	RF	50 Ω AC C	ORREC GHZ PNO: Fast G FGain:Low			Avg Ty	ALIGN OFF pe: Log-Pwr	TRAC TYL	M Feb 28, 2020 CE 1 2 3 4 5 6 PE M WWWWW ET P P P P P P	Frequency
I0 dB/div	Ref 20.		FGain:Low	Atten. 30			Mkr3 1		i00 GHz 10 dBm	Auto Tune
- og 10.0 0.00 :10.0										Center Fred 17.500000000 GH
20.0			و این میکند.		3				-18.53 dBm	Start Fre 10.000000000 GH
50.0 60.0 70.0 70.0										Stop Fre 25.000000000 GH
Start 10.0 Res BW	1.0 MHz		#VB\	V 3.0 MHz			Sweep 4	0.0 ms (4		CF Ste 1.500000000 GH
MKR MODE TR 1 N 1 2 N 1 3 N 1 4 5		23.486 1	25 GHz (Δ 25 GHz 00 GHz (Δ	-39.44 dB	m		UNCTION WIDTH	FUNCTI	ON VALUE	<u>Auto</u> Ma FreqOffse 0⊢
6 7 8 9 10 11										
12 1 2							STATUS			



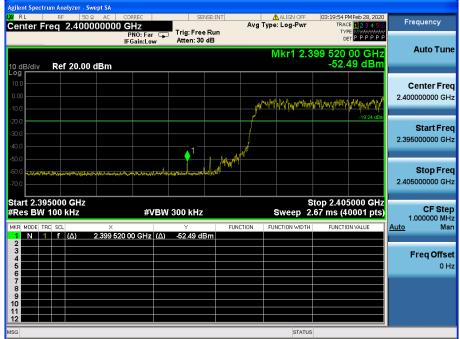
Low Band-edge

Lowest Channel & Modulation : π/4DQPSK



Low Band-edge

Hopping mode & Modulation : π/4DQPSK



Lowest Channel & Modulation : π/4DQPSK

Agilent Spectr															_	
Center Fi	RF eq		Ω <u>Λ</u> DC 4500 Ι	corr MHz	EC			VSE:IN	r	Avg		ALIGN OFF	TF	7 PM Feb 28, 2020 RACE 1 2 3 4 5 6	Fr	equency
				PNC): Fast iin:Low		Trig: Free Atten: 30						Mkr1 2			Auto Tune
10 dB/div Log 10.0	Rei	20.00	dBm										-47	7.62 dBm		Center Freq
0.00 -10.0 -20.0														-19.24 dBm	18	5.004500 MHz
-30.0 -40.0 1 -50.0																Start Freq 9.000 kHz
	levelet fred	and in the second second	historia antico	ntfranski hoffikk	(fortand)	inter antiple	ant set to set of the s	an a	si ali parta pe	hite an a the faile	rinland	nin makadilah	i anterativat de	nydythaantaastatinajijyetiitye	30	Stop Freq
Start 9 kH #Res BW	100	кНz			#V	BW :	300 kHz						.33 ms	30.00 MHz (40001 pts)	2	CF Step 2.999100 MHz
MKR MODE TF 1 N 1 2 3		(Δ)	X	285.7	kHz	(Δ)	ץ -47.62 di	3m	FUNC	TION	FUN	ICTION WIDTH	FUNC	CTION VALUE	<u>Auto</u>	Man
4 5 6 7																Freq Offset 0 Hz
8 9 10 11																
12 MSG												STATUS		Coupled		

RL RF	50 Ω AC	CORREC	SE	NSE:INT		ALIGN OFF e: Log-Pwr		MFeb 28, 2020	Frequency
enter Freq	5.01500000	PNO: Fast	Trig: Free		Avgiyp	e: Log-Pwr	TYP	E MWWWWW F P P P P P P	,
		IFGain:Low	Atten: 30	dB		B.4.Last			Auto Tune
0 dB/div Ref	20.00 dBm					IVIKE	5 3.419 -45.0	05 GHZ 05 dBm	
og 10.0									Center Free
3.00	¥								5.015000000 GH
10.0									
0.0								-19.24 dBm	Start Fre
0.0		A 3 A 4 5							30.000000 MH
0.0									
									Stop Fre
D.0									10.000000000 GH
tart 30 MHz Res BW 1.0 N	1H7	#\/F	W 3.0 MHz			Sweep 1		.000 GHz	CF Ste
KRI MODEL TRCI SCLI	×		Y	ELIN			FUNCTIO		997.000000 MH <u>Auto</u> Ma
1 <u>N 1 f</u>	(Δ) 2.4	02 11 GHz (Δ) 3.16 dl	3m					<u>/////////////////////////////////////</u>
	(Δ) 2.6	03 89 GHz 84 26 GHz (3m					Freq Offse
4 N 1 f 5 N 1 f		78 03 GHz 19 05 GHz	-44.68 di -45.05 di						0 H
6									
9									
0									
2									
G						STATUS			



Conducted Spurious Emissions Lowest

Lowest Channel & Modulation : π/4DQPSK

gilent Spe ØRL Center		RF	50	Ω	AC					SENSE:		Avg		ALIGN OFF		TRACE	eb 28, 2020 1 2 3 4 5 6	Frec	uency
10 dB/div	,	Ref	20.00) dE	Sm		0: Fasi ain:Lov			ree Ru 1:30 dE	n			Mkr3 2		DET	5 GHz 3 dBm	A	uto Tun
og 10.0 0.00 10.0																			nter Fre 00000 GH
20.0			ب ما الدر رما ا		factor and the		an Dag Kon-										-19.24 dBm		Start Fre 00000 G⊢
50.0			aanay																Stop Fre 00000 G⊦
itart 10 Res Bi	W 1	.0 N					#∖	/BW	3.0 M	Hz				Sweep 4	0.0 ms	6 (400			CF Ste 00000 GH
MKR MODE 1 N 2 N 3 N 4 5	TRC 1 1		(Δ) (Δ)	ź	24.264	250	GHz GHz GHz		-37.8	7 dBm 4 dBm 3 dBm	FUN	ICTION	FUN	ICTION WIDTH	FUN	NCTION 1	VALUE	Auto Fr	Ma eq Offs 0 F
6 7 8 9 10																			
12 sg														STATUS					



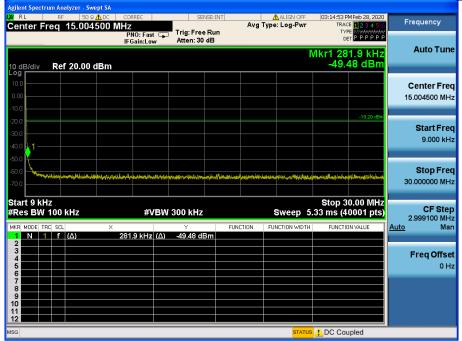
Reference for limit

Middle Channel & Modulation : π/4DQPSK



Conducted Spurious Emissions

Middle Channel & Modulation : π/4DQPSK





Middle Channel & Modulation : π/4DQPSK

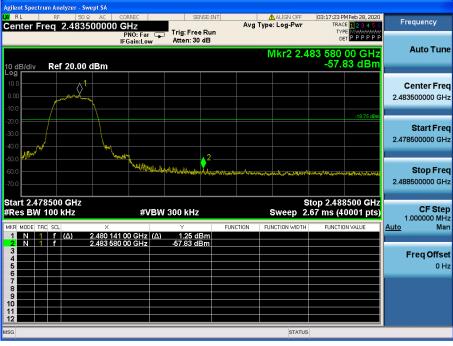


RL	^{RF} 50 reg 17.50			SENSE:		ALIGN OFF	03:15:41 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
enter F	req 17.50	PI	SIFIZ NO: Fast 🖵 Gain:Low	Trig: Free Ru Atten: 30 dB		I Type. Log-F Wi	TYPE MWWWWWW DET P P P P P P	
0 dB/div	Ref 20.00					Mkr3 2	3.604 250 GHz -40.39 dBm	Auto Tun
og 10.00								Center Fre 17.500000000 GH
20.0 30.0 40.0			uslava štiban žutet	وروب وروب والمحالية العربي وروب والمحال	Land our group of the local backborg		-19.20 dBm	Start Fre 10.000000000 G⊦
50.0 1.0.1 50.0 70.0 								Stop Fre 25.000000000 GH
	000 GHz 1.0 MHz		#VBW	3.0 MHz		Sweep 4	Stop 25.000 GHz 0.0 ms (40001 pts)	CF Ste 1.50000000 GI
KR MODE T		× 24.920 50 24.344 50	0 GHz (Δ)	∀ -37.74 dBm -38.46 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
3 N 4 5 6	f (Δ)	23.604 25	0 GHz (Δ)	-40.39 dBm				Freq Offs 0 F
8								
0								



High Band-edge

Highest Channel & Modulation : π/4DQPSK



High Band-edge

Hopping mode & Modulation : π/4DQPSK





<u>Highest Channel & Modulation : π/4DQPSK</u>

Agilent Spectr						1			
Center F		50 Ω <u>A</u> DC 004500 M	CORREC		SENSE:INT		ALIGN OFF Type: Log-Pwr	03:17:46 PM Feb 28, 20 TRACE 1 2 3 4 9	Frequency
			PNO: Fast IFGain:Lov		ree Run 30 dB		ſ	DET P P P P	P Auto Tune
10 dB/div Log	Ref 20.	00 dBm						-47.79 dBi	n
10.0 0.00									Center Fred 15.004500 MH;
-10.0								-18.75 di	9m
-20.0 -30.0 -40.0									Start Freq 9.000 kHz
-50.0 -60.0 -70.0	stratytiketerike), naaraa	unathatina tan baharan sa	ofuture and the second	an filing in the second state of the second st	polisia de Beleron	and the second for	المريد والمحاور المراجع والمراجع	farðiðurfurfurfurfurfurfurfurfurfurfurfurfurfu	Stop Fred 30.000000 MH;
Start 9 k⊦ #Res BW			#V	BW 300 k	łz		Sweep 5	Stop 30.00 MH .33 ms (40001 pt	
MKR MODE TF	RC SCL f (Δ)	Х	284.9 kHz	γ (Δ) -47.79	dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto Mar
2 3 4 5 6									Freq Offset 0 Hz
7 8 9 10									
11 12 MSG							STATUS	L DC Coupled	

Agilent Spectrum Analyzer - Swep					
		SENSE:INT	ALIGN OFF	03:18:09 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 🖵 IFGain:Low	Trig: Free Run Atten: 30 dB		TYPE MWWWWWW DET PPPPP	
	IFGain:LOW	Atten: 00 uB	Mkr	5 6.730 59 GHz	Auto Tune
10 dB/div Ref 20.00 dl	Bm		WIKK	-46.50 dBm	
Log	Δ1				
10.0	_ <u>\</u>				Center Freq
0.00					5.015000000 GHz
-10.0				-18.75 dBm	
-20.0					Start Freq
-30.0	∧2 ∧3	4	▲5		30.000000 MHz
-40.0	Y Y	8			
-50.0					Oten Free
-60.0					Stop Freq 10.000000000 GHz
-70.0					10.0000000000000
Start 30 MHz				Stop 10.000 GHz	0.5.04
#Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 1	8.7 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	×		NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f (Δ) 2 N 1 f	2.480 13 GHz (Δ) 2.663 58 GHz	3.64 dBm -44.70 dBm			
3 N 1 f (Δ)	3.154 85 GHz (∆) 4.959 92 GHz	-45.27 dBm -45.46 dBm			Freq Offset
5 N 1 f	6.730 59 GHz	-46.50 dBm			- 0 Hz
6					
8					
10					
11 12					
MSG			STATUS		



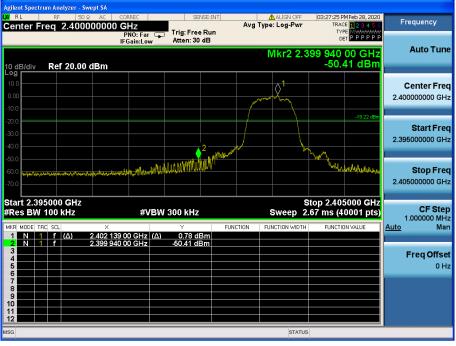
<u>Highest Channel & Modulation : π/4DQPSK</u>

gilent Spectrum Analyzer - Sv RL RF 50 :	wept SA Ω AC CORREC	SENSE:INT	ALIGN OFF	03:18:32 PM Feb 28, 2020	_
enter Freq 17.50	PNO: Fast 🗔	Trig: Free Run	Avg Type: Log-Pwr	TRACE 123456 TYPE MWWWWW DET PPPPP	Frequency
0 dB/div Ref 20.00	IFGain:Low	Atten: 30 dB	Mkr3 2	3.176 000 GHz -39.58 dBm	Auto Tun
0.00 10.0					Center Fre 17.50000000 GF
20.0 30.0 40.0	ي التي من الم			-18.75 dBm	Start Fre 10.000000000 GF
50.0 444 445 446 446 446 446 446 446 446 446					Stop Fro 25.000000000 GI
tart 10.000 GHz Res BW 1.0 MHz	#VBV		Sweep 4	Stop 25.000 GHz 0.0 ms (40001 pts) FUNCTION VALUE	CF Ste 1.50000000 GI <u>Auto</u> M
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	24.915 625 GHz (Δ) 24.347 875 GHz 23.176 000 GHz (Δ)	-37.16 dBm -38.04 dBm -39.58 dBm			Freq Offs 0 I
7 8 9 9 10					
12			STATUS		



Low Band-edge

Lowest Channel & Modulation : 8DPSK



Low Band-edge

Hopping mode & Modulation : 8DPSK





Lowest Channel & Modulation : 8DPSK

Agilent Spectrum A							
	ফ 50 Ջ <u>∧</u> DC 15.004500 N		SENSE	Av	ALIGN OFF	03:27:48 PM Feb 28, 2020 TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast G IFGain:Low	Trig: Free R Atten: 30 di				
10 dB/div Ro	ef 20.00 dBm					-49.44 dBm	
10.0							Center Freq
-10.0							15.004500 MHz
-20.0						-19.22 dBm	Start Freq
-30.0							9.000 kHz
-50.0							
	موروز غالبور وروز وروز وروز وروز وروز وروز وروز و	مى ماھرىيە يەلىر ئىزىنىيە يېرىغۇر قور ي		usternestes, funteralistern	nantarahan na sa	กระกรณ์รูลาศระศรษฐรรม เป _{็น} เป _{็น} เป็นเป็นเป็นเป็นเป็น	Stop Freq 30.000000 MHz
-70.0							
Start 9 kHz #Res BW 100) kHz	#VBV	V 300 kHz		Sweep 5	Stop 30.00 MHz 33 ms (40001 pts).	
MKR MODE TRC SO		281.9 kHz (Δ)	∀ -49.44 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 3							Freq Offset
4 5 6							0 Hz
7 8							
9 10							
11 12							
MSG					STATUS	L DC Coupled	

		RF	50 \$	2 AC	: co	ORREC		SEN	NSE:INT		ALIGN OFF		MFeb 28, 2020	
enter	r Fre	q	5.0150	0000	F	CHZ PNO: Fas Gain:Lo	at⊊⊃ w	Trig: Free Atten: 30		Avg Ty	pe: Log-Pwr	TYE	E 123456 E M WWWWWW F P P P P P P	Frequency
0 dB/di	iv	Ref	20.00	dBm	h						Mkr	5 5.600 -46.	74 GHz 56 dBm	Auto Tun
og 10.0 1.00					^1									Center Fre 5.015000000 GH
20.0 30.0 40.0						3			5	L and the			-19.22 dBm	Start Fre 30.000000 M⊦
50.0 50.0 70.0														Stop Fre 10.00000000 GF
tart 3 Res B			ЛНz			#\	/BW	3.0 MHz			Sweep 1		.000 GHz 0001 pts)	CF Ste 997.000000 MI
		SCL			×			Y		CTION F	FUNCTION WIDTH	FUNCTIO	ON VALUE	<u>Auto</u> Ma
IKR MODE							/ (A)	2.73 dE						
	1	f f		2		13 GHz	-	-44.22 dE	8m					
KR MODE 1 N 2 N 3 N 4 N 5 N	1 1 1 1	f f f f	(Δ) (Δ)		4.804 3.195 2.680		: : (Δ)		3m 3m					Freq Offs 0 ⊦
KR MODE 1 N 2 N 3 N 4 N		f			4.804 3.195 2.680	13 GHz 97 GHz 77 GHz	: : (Δ)	-44.22 dE -45.02 dE -45.34 dE	3m 3m					



Lowest Channel & Modulation : 8DPSK

enter	Fre	RF q 17		AC	000		ist 🕞	Trig: F	SENSE:I		Avg		ALIGN OFF	TR/ T	PM Feb 28, 2020 ACE 1 2 3 4 5 6 YPE M 44444	Frequency
0 dB/div	/	Ref 2	0.00	dBm	IF	Gain:L			: 30 dB				Mkr3 2	0.873	500 GHz 37 dBm	Auto Tun
0.00																Center Fre 17.500000000 G⊦
20.0					مىلەر		alle alle alle a		Trans alfanti	***			3		-19.22 dBm	Start Fre 10.000000000 GF
50.0 4 666 50.0																Stop Fre 25.000000000 Gi
tart 10 Res Bl						#	VBW	3.0 M	Hz			ę	Sweep 4	Stop 2 0.0 ms (5.000 GHz 40001 pts)	CF Ste 1.50000000 GI
IKR MODE	TRC 1	f (∆ f		24.2	329 75 299 12	5 GH:	z	-37.3	3 dBm ∋ dBm	FUN	CTION	FUI	NCTION WIDTH	FUNCT	ION VALUE	Auto Ma
3 N 4 5	1	f (∆	<u>n</u>	20.8	373 50	UGH	z (Δ)	-41.3	7 dBm							Freq Offs 0 H
7 8 9																
10 11 12																
SG													STATUS			



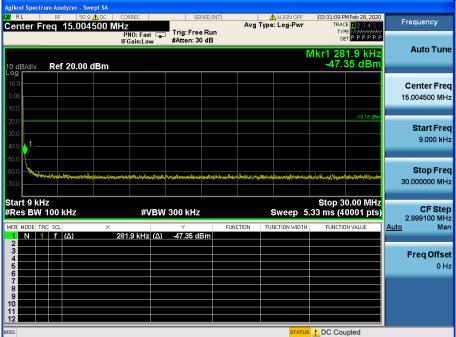
Reference for limit





Conducted Spurious Emissions







Middle Channel & Modulation : 8DPSK

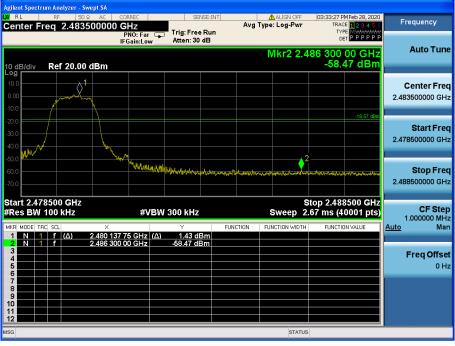


RL	RF			RREC		SENS	E:INT		ALIGN OFF		4Feb 28, 2020	Frequency
enter F	req 1	7.500	000000	GHZ NO: Fast		Trig: Free I	Run	Avg	Гуре: Log-Pwr	TYP	123456 M WWWWW	Frequency
			IF	Gain:Low	+	#Atten: 30	iB				PPPPP	A
0 dB/div	Ref 2	20.00 c	dBm						Mkr3 1	6.997 5 -42.9	00 GHz 94 dBm	Auto Tur
og												Center Fre
).00												17.50000000 G
10.0											-19.18 dBm	
20.0											a 41	Start Fr
10.0						√ 3					$\langle \rangle^2 \langle \rangle$	10.00000000 G
10.0 <mark></mark>						and states in the	And Marian					
0.0												Stop Fr
'0.0												25.00000000 G
tart 10.0	000 GH	z		1							000 GHz	
Res BW	1.0 MI	lz		#VI	зw	3.0 MHz			Sweep 4	0.0 ms (4)	0001 pts)	CF St 1.50000000 G
KR MODE T	RC SCL	••	× 24.274 75	0 CH-	(0)	۲ -37.05 dB		UNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	<u>Auto</u> M
2 N	1 f		23.645 50	0 GHz		-39.97 dB	n					
3 N ·	1 f (/	7)	16.997 50	UGHZ		-42.94 dB	n					Freq Offs
5 6												0
8												
9												
0												
0												



High Band-edge

Highest Channel & Modulation : 8DPSK



High Band-edge

Hopping mode & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK

Agilent Spectro IXI RL Center Fr	RF	50 \$	2 🚹 DC				ENSE:II		Avg		ALIGN OFF Log-Pwr	TR	PM Feb 28, 2020 ACE 1 2 3 4 5 6 YPE M WARANA	F	equency
10 dB/div	Ref	20.00	dBm	PNO: IFGain	Fast ⊂ :Low _	Atten:		1				/kr1 2	96.9 kHz .18 dBm		Auto Tune
10.0															Center Freq 5.004500 MHz
-20.0 -30.0 -40.0													-18.57 dBm		Start Freq 9.000 kHz
-50.0	rickipla	Perfection (ma	geli Malendarda	rutula jihuad	ber han the state of the state	Murialiselyn-skonstantifikierun	and the second second	المظملة م روجونية	timine.	nunsa	isedet Haardshaaree	gestillen finden besterte	4384785344654471678797879	3(Stop Freq 0.000000 MHz
Start 9 kH #Res BW	100	кНz	×		#VB	W 300 KH Y	z	FUN	CTION		weep 5	.33 ms (30.00 MHz 40001 pts)		CF Step 2.999100 MHz Man
1 N 1 2 3 4 5	f	<u>(Δ)</u>		296.9 k	Hz (A	<u>)</u> -48.18	dBm								Freq Offset 0 Hz
6 7 8 9 10 11															
12 MSG											STATUS	L DC C	oupled		

RL	F	RF 50	Ω AC	CORRE	EC	SE	VSE:INT			ALIGN OFF		MFeb 28, 2020	-
enter	Freq	5.015	00000	0 GH	z Fast 🗔	Trig: Free	Run	Avg	Туре	e: Log-Pwr	TYE	E 123456 E M VIIIIIII	Frequency
				IFGai	in:Low	Atten: 30						T P P P P P P	Auto Tui
0 dB/div	R	ef 20.00) dBm							Mkr		65 GHz 37 dBm	Auto Tu
0g				1									
0.00													Center Fre 5.015000000 GI
10.0													3.013000000 GI
20.0												-18.57 dBm	
30.0					•								Start Fre
10.0			_		3		2	4		↓ 5			30.000000 MI
50.0 <mark>arthua</mark>							All sectors and sectors			form Robert Re-			
i0.0		<u>~</u>											Stop Fre
0.0													10.00000000 GI
itart 30	MHz					1						.000 GHz	
Res B	N 1.0	MHz			#VBW	3.0 MHz			Ş	Sweep 1	8.7 ms (4	0001 pts)	CF Ste 997.000000 MI
IKR MODE		CL (A)	X	100 42 4	GHz (Δ)	Y		INCTION	FU	NCTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u> Ma
1 N 2 N	1 f		4.9	960 41 (GHz	4.18 dl -44.84 dl	3m						
3 N 4 N	1 f 1 f	· (Δ)	5.	771 97 (-44.89 dl -47.21 dl	3m						Freq Offs
5 N 6	1 f		7.	790 65 (GHz	-47.37 di	Зm						01
7													
9													
0													
2													
G										STATUS			



Highest Channel & Modulation : 8DPSK

URL					ISE:INT	Avg	ALIGN OFF	03:34:36 PM TRACE	123456	Frequency
10 dB/div	Ref 20.0	P IF	NO: Fast G Gain:Low	Trig: Free Atten: 30			Mkr3 1	DET	0 GHz 7 dBm	Auto Tun
- og 10.0 0.00 10.0										Center Fre 17.500000000 GH
20.0 30.0 40.0	.]			3	anaya Din ya kata				-18.57 dBm	Start Fre 10.000000000 GF
50.0 autorita 50.0 70.0 										Stop Fre 25.00000000 GH
	1.0 MHz		#VB\	W 3.0 MHz				Stop 25.0 0.0 ms (40	001 pts)	CF Ste 1.50000000 G
IKR MODE TF 1 N 1 2 N 1 3 N 1 4		24.262 00	75 GHz (Δ 10 GHz 10 GHz (Δ	-37.35 dE	lm Im	NCTION	FUNCTION WIDTH	FUNCTION	VALUE	Auto Ma Freq Offs
5 6 7 8 9										01
0 11 12 36							STATUS			



8. Transmitter AC Power Line Conducted Emission

8.1 Test Setup

NA

8.2 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.

	Conducted Limit (dBuV)							
Frequency Range (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

8.3 Test Procedures

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.
- 2. 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.

8.4 Test Results

NA



Dt&C

9. Antenna Requirement

Describe how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.

Conclusion: Comply

The antenna is printed on the PCB. (Refer to Internal Photo file.) Therefore this E.U.T Complies with the requirement of §15.203

- Minimum Standard :

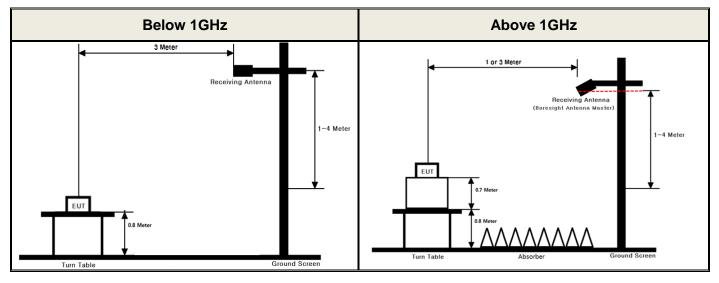
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.



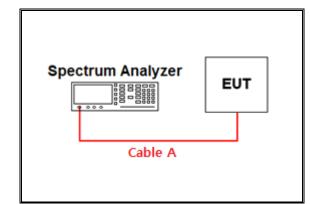
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.03	15	1.08
1	0.28	20	1.33
2.402 & 2.440 & 2.480	0.66	25	1.40
5	0.68	-	-
10	0.73	-	-

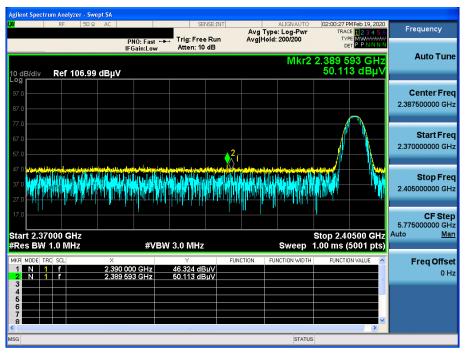
Note 1 : The path loss from EUT to Spectrum analyzer were measured and used for test. Path loss (S/A's Correction factor) = Cable A



APPENDIX II

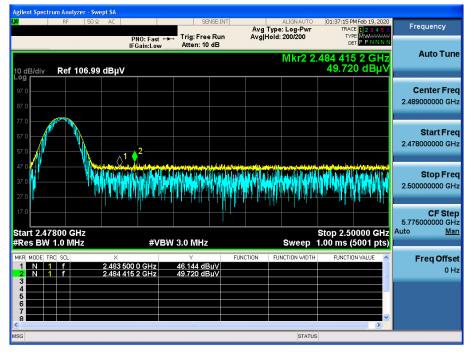
Unwanted Emissions (Radiated) Test Plot

GFSK & Lowest & X & Ver



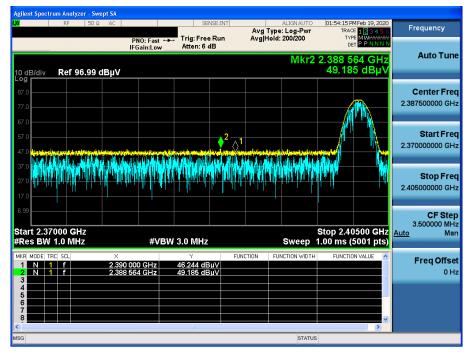
Detector Mode : PK

GFSK & Highest & X & Ver



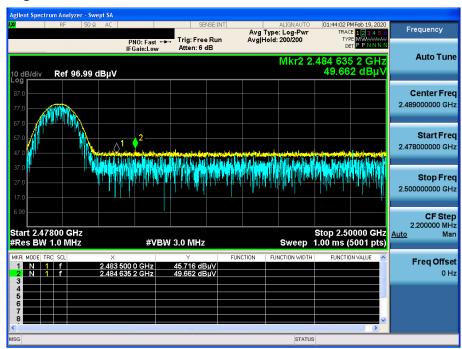


$\pi/4DQPSK$ & Lowest & X & Ver



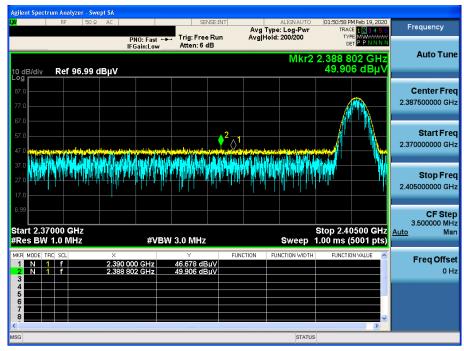
Detector Mode : PK

π /4DQPSK & Highest & X & Ver



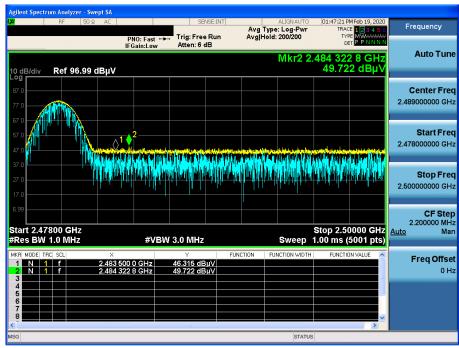


8DPSK & Lowest & X & Ver



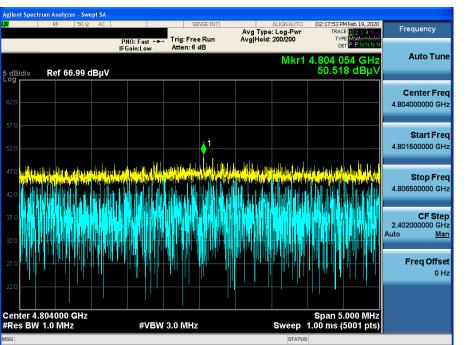
Detector Mode : PK

8DPSK & Highest & X & Ver



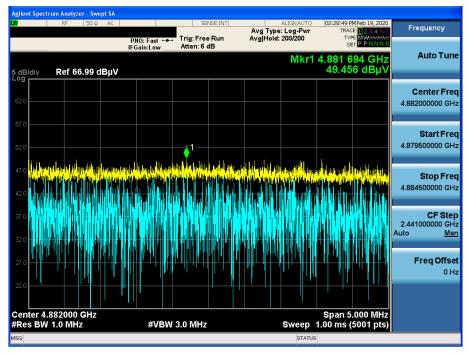


GFSK & Lowest & X & Hor



$\pi/4DQPSK$ & Middle & X & Hor

Detector Mode : PK





8DPSK & Middle & X & Hor

