# **TEST REPORT**

	DT&C Co., Ltd.				
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1. Report No : DRTFCC2106-006	3				
2. Customer					
• Name (FCC) : Audio-Technica C	Corporation / Name (IC) : Audio-Technica Corporation				
• Address (FCC) : 2-46-1 Nishi-na Address (IC) : 2-46-1 Nishi-Naru	ruse, Machida Tokyo Japan se, Machida Tokyo 194-8666 Japan				
3. Use of Report : FCC & IC Certifi	cation				
<ol> <li>4. Product Name / Model Name : V FCC ID : JFZSQ1TWR IC : 1752B-SQ1TWR</li> <li>5. FCC Regulation(s): Part 15.247 IC Standard(s): RSS-247 Issue 2 Test Method used: KDB558074</li> </ol>					
6. Date of Test : 2021.05.07 ~ 202					
7. Location of Test : 🛛 Permanen	t Testing Lab				
8. Testing Environment : See appe	nded test report.				
9. Test Result : Refer to the attache	ed Test Result				
The results shown in this test report re This test report is not related to KOLA	efer only to the sample(s) tested unless otherwise stated. S accreditation.				
Affirmation Tested by Name : ChangWon Lee	(Signature) Reviewed by Name : JaeJin Lee				
2021.06.18.					
	DT&C Co., Ltd.				
If this report is required to c	onfirmation of authenticity, please contact to report@dtnc.net				



## **Test Report Version**

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2106-0063	Jun, 18. 2021	Initial issue	ChangWon Lee	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 Part 2.948 according to ANSI C63.4-2014.

#### - FCC & IC MRA Designation No. : KR0034

#### - ISED#: 5740A

www.dtnc.net		
Telephone	:	+ 82-31-321-2664
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#### **1.2 Testing Environment**

Ambient Condition	
Temperature	+21 ℃ ~ +24 ℃
<ul> <li>Relative Humidity</li> </ul>	38 % ~ 43 %

#### **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
Antenna-port conducted emission	0.9 dB (The confidence level is about 95 %, $k = 2$ )
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, $k = 2$ )
Radiated emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

### **1.4 Details of Applicant**

Applicant Name(FCC)	Audio-Technica Corporation	
Applicant Name(IC)	Audio-Technica Corporation	
Address (FCC)	2-46-1 Nishi-naruse, Machida Tokyo Japan	
Address (IC)	2-46-1 Nishi-Naruse, Machida Tokyo 194-8666 Japan	

#### **1.5 Description of EUT**

Product Name	Wireless Headphones
Model Name	ATH-SQ1TW-R
Add Model Name	-
Firmware Version Identification Number	Ver 1.0
EUT Serial Number	Undesignated
Power Supply	DC 3.7 V
Frequency Range	2 402 MHz ~ 2 480 MHz
Max. RF Output Power	6.53 dBm (0.005 W)
Modulation Technique (Data rate)	GFSK(1 Mbps), π/4DQPSK(2 Mbps), 8DPSK(3 Mbps)
Number of Channels	79
Antenna Specification	Antenna Type: FPCB Antenna Gain: -0.1 dBi (PK)

#### **1.6 Support Equipment**

Equipment	Model Name	Manufacturer	Note
Charging case	ATH-SQ1TW	Audio-Technica Corporation	-

#### 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.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	20/06/24	21/06/24	MY50200834
Spectrum Analyzer	Agilent Technologies	N9020A	20/12/16	21/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	20/06/24	21/06/24	US47360812
DC Power Supply	Agilent Technologies	66332A	20/06/24	21/06/24	US37473305
Multimeter	FLUKE	17B+	20/12/16	21/12/16	3630701WS
Signal Generator	Rohde Schwarz	SMBV100A	20/12/16	21/12/16	255571
Signal Generator	ANRITSU	MG3695C	20/12/16	21/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	20/07/01	21/07/01	N/A
BlueTooth Tester	Tescom	TC-3000C	20/06/24	21/06/24	3000C000563
Power Splitter	Anritsu	K241B	20/12/16	21/12/16	1301183
Loop Antenna	ETS-Lindgren	6502	21/01/28	23/01/28	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	20/12/16	21/12/16	3362
Horn Antenna	ETS-Lindgren	3117	20/10/23	21/10/23	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	20/06/24	21/06/24	155
PreAmplifier	tsj	MLA-0118-B01-40	20/12/16	21/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	20/06/24	21/06/24	16966-10728
PreAmplifier	H.P	8447D	20/12/16	21/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935- 1000-15000-40SS	20/06/24	21/06/24	8
High Pass Filter	Wainwright Instruments	WHKX10-2838- 3300-18000-60SS	20/06/24	21/06/24	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5- 6SS	20/06/24	21/06/24	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	20/06/24	21/06/24	16012202
Attenuator	SRTechnology	F01-B0606-01	20/06/24	21/06/24	13092403
Attenuator	Aeroflex/Weinschel	56-3	20/06/24	21/06/24	Y2370
Attenuator	SMAJK	SMAJK-2-3	20/06/24	21/06/24	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	20/06/24	21/06/24	1306007 1249001
EMI Receiver	ROHDE&SCHWARZ	ESU	20/11/16	21/11/16	100469
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	20/08/25	21/08/25	101333
LISN	SCHWARZBECK	NSLK 8128 RC	20/10/23	21/10/23	8128 RC-387
HYGROMETER	TESTO	608-H1	21/01/19	22/01/19	34862883
Cable	DT&C	Cable	21/01/08	22/01/08	G-1
Cable	DT&C	Cable	21/01/08	22/01/08	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	21/01/08	22/01/08	G-3
Cable	DT&C	Cable	21/01/08	22/01/08	G-4
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-1
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-4
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-02
Cable	JUNFLON	MWX241	21/01/08	22/01/08	M-03
Cable	JUNFLON	J12J101757-00	21/01/08	22/01/08	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	21/01/08	22/01/08	M-09
Cable	DT&C	Cable	21/01/05	22/01/05	RFC-69
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0170

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 Section(s)	RSS Section(s)	Parameter	Limit (Using in 2400~ 2483.5 MHz)	Test Condition	Status Note 1
15.247(b)	RSS-247[5.4]	Maximum Peak Conducted 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. =< 4 Watt For e.i.r.p		С
		20 dB Bandwidth	NA		С
15.247(a) RSS-247[5.2]	Carrier Frequency Separation	>= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.	Conducted	С	
	Number of Hopping Channels	>= 15 hops		С	
		Time of Occupancy	=< 0.4 seconds		С
-	RSS-Gen[6.7]	Occupied Bandwidth (99 %)	NA		с
15.247(d)	RSS-247[5.5]	Unwanted 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
15.247(d) 15.205 & 209	RSS-247[5.5] RSS-Gen [8.9 & 8.10]	Unwanted Emissions	FCC 15.209 Limits (Reference to section 7)	Radiated	C Note3
15.207	RSS-Gen[8.8]	AC Power-Line Conducted Emissions	FCC 15.207 Limits (Reference to section 8)	AC Line Conducted	С
15.203	-	Antenna Requirement	FCC 15.203 (Reference to section 9)	-	С

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

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

Note 3: This test item was performed in three orthogonal EUT positions and the worst case data was reported.

#### 1.10 Conclusion of worst-case and operation mode

The EUT has three types of modulation (GFSK,  $\pi$ /4DQPSK and 8DPSK). Therefore all applicable requirements were tested with all the modulations. And packet type was tested at the worst case(DH5).

#### **EUT Operation test setup**

Bluetooth tester was used to control the transmit parameters during test.

#### Tested frequency information,

- Hopping Function : Enable

	TX Frequency (MHz)	RX Frequency (MHz)
Hopping Band	2 402 ~ 2 480	2 402 ~ 2 480

- Hopping Function : Disable

	TX Frequency (MHz)	RX Frequency (MHz)
Lowest Channel	2 402	2 402
Middle Channel	2 441	2 441
Highest Channel	2 480	2 480



### 2. Maximum Peak Conducted Output Power

### 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 :

- §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 2 400 MHz - 2 483.5 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.
- 2. §15.247(b)(1), For frequency hopping systems operating in the 2 400 2 483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 MHz 5 805 MHz band : 1 Watt. For all other frequency hopping systems in the 2 400 MHz 2 483.5 MHz band: 0.125 watts.

### IC Requirements

 RSS-247(5.4) (b), For FHSS operating in the band 2 400 MHz – 2 483.5 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 ≥ 20 dB BW VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold

#### 2.4 Test Results

Modulation	Tested Channel		Average t Power	Peak Output Power				
Modulation	resteu Granner	dBm	mW	dBm	mW			
	Lowest	4.20	2.63	5.38	3.45			
<u>GFSK</u>	Middle	4.53	2.84	5.84	3.84			
	Highest	3.82	2.41	5.06	3.21			
	Lowest	3.13	2.06	5.97	3.95			
<u>π/4DQPSK</u>	Middle	3.47	2.22	6.32	4.29			
	Highest	2.72	1.87	5.66	3.68			
	Lowest	3.08	2.03	6.19	4.16			
<u>8DPSK</u>	Middle	3.45	2.21	6.53	4.50			
	Highest	2.70	1.86	5.94	3.93			

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







#### **Peak Output Power**

#### Middle Channel & Modulation : GFSK



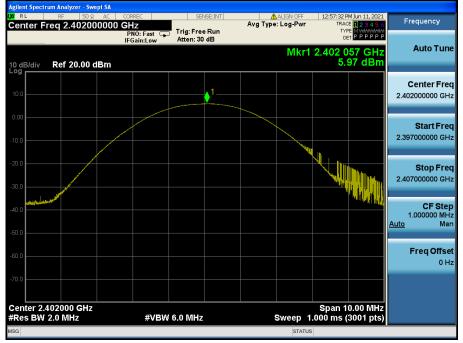


Highest Channel & Modulation : GFSK



#### **Peak Output Power**

#### Lowest Channel & Modulation : π/4DQPSK

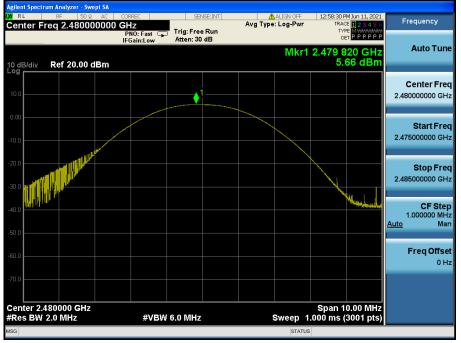


### Middle Channel & Modulation : π/4DQPSK



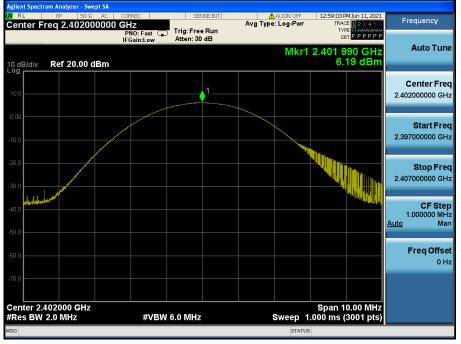
#### **Peak Output Power**

#### Highest Channel & Modulation : π/4DQPSK









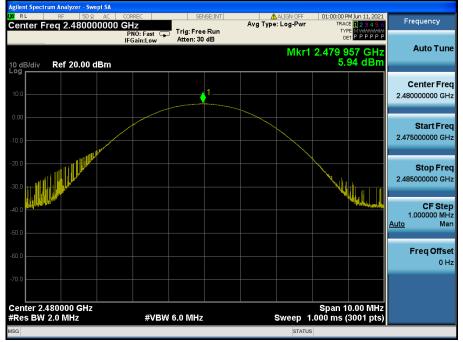
#### **Peak Output Power**

#### Middle Channel & Modulation : 8DPSK





### Highest Channel & Modulation : 8DPSK





### 3. 20 dB BW & Occupied 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 was 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 VBW  $\ge 3 \times RBW$ Span = between two times and five times the 20 dB bandwidth Sweep = auto

Detector function = peak

Trace = max hold

#### 3.4 Test Results

Modulation	Tested Channel	20 dB BW (MHz)	Occupied BW (MHz)				
	Lowest	0.797	0.841				
<u>GFSK</u>	Middle	0.850	0.854				
	Highest	0.798	0.862				
	Lowest	1.198	1.170				
<u>π/4DQPSK</u>	Middle	1.182	1.169				
	Highest	1.181	1.167				
	Lowest	1.189	1.168				
<u>8DPSK</u>	Middle	1.229	1.169				
	Highest	1.228	1.167				



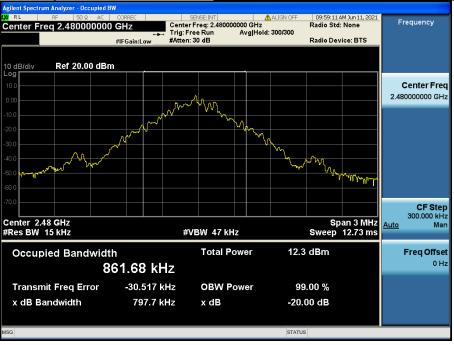


#### 20 dB BW & Occupied BW



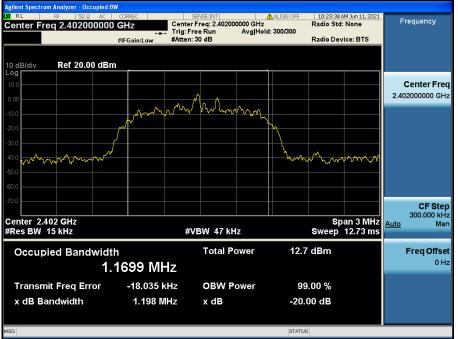




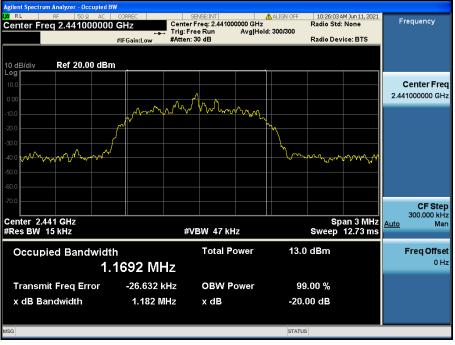


#### 20 dB BW & Occupied BW

#### Lowest Channel & Modulation : π/4DQPSK

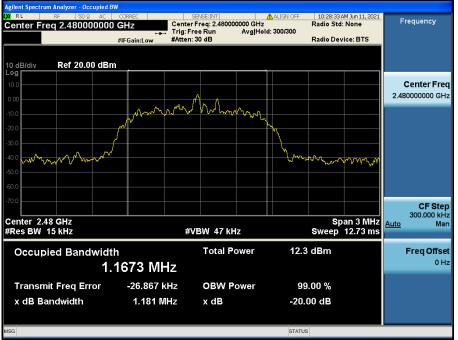


#### Middle Channel & Modulation : π/4DQPSK

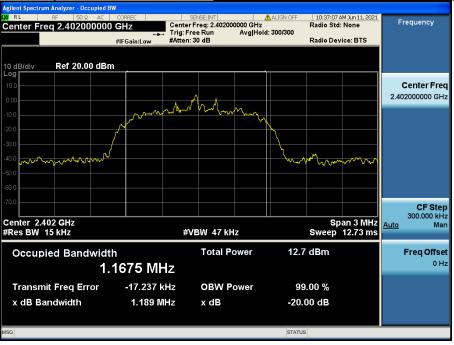


#### 20 dB BW & Occupied BW

#### Highest Channel & Modulation : π/4DQPSK

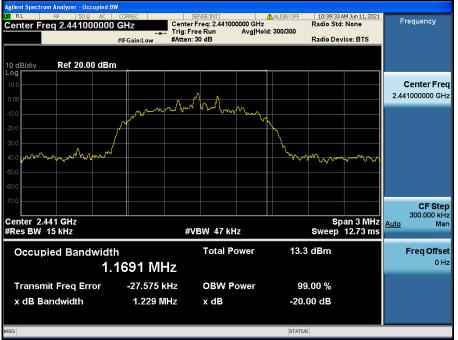




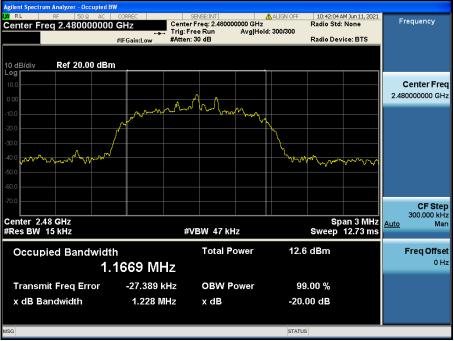


#### 20 dB BW & Occupied BW











### 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 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 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 center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)		
	GFSK	2 440.978	2 441.979	1.001		
Enable	π/4DQPSK	2 440.979	2 441.979	1.000		
	8DPSK	2 440.977	2 441.979	1.002		

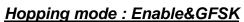
#### AFH mode

Hopping Mode	Modulation	Peak of center channel (MHz)	Peak of adjacent Channel (MHz)	Test Result (MHz)		
	GFSK	2 440.978	2 441.979	1.001		
Enable	π/4DQPSK	2 440.980	2 441.979	0.999		
	8DPSK	2 440.978	2 441.979	1.001		

Note 1 : See next pages for actual measured spectrum



#### Carrier Frequency Separation (FH)



Agilent Spectr												
Center F	RF reg 1			RREC	SEI	JSE:INT		ALIGN OFF		M Jun 11, 2021	Fr	equency
			PI	NO: Wide C Gain:Low	Trig: Free Atten: 30				TY			
10 dB/div	Rei	20.00	dBm					ΔN		01 MHz 0.09 dB		Auto Tune
Log 10.0 0.00		~~~			<b>/~~</b>	2~		~~~				<b>Center Freq</b> 1000000 GHz
-20.0 -30.0 -40.0											2.439	Start Freq 9500000 GHz
-50.0 -60.0 -70.0											2.442	<b>Stop Freq</b> 2500000 GHz
Center 2. #Res BW	51 k		×	#VB	W 150 kHz	FUN		Sweep 1	.200 ms (	.000 MHz 3001 pts)	Auto	CF Step 300.000 kHz Man
<u>1</u> Δ2 1		(Δ)	1.00	1 MHz (Δ	) -0.09	dB	CHON PC	INCTION WIDTH	FUNCTI	JN VALUE		
2 F 1 3 4 5 5	f		2.440 97	8 GHz	6.05 dl	3m					ľ	F <b>req Offset</b> 0 Hz
6 7 8 9 10												
11					Ш					>		
MSG								STATU	S			

#### **Carrier Frequency Separation (FH)**

#### <u>Hopping mode : Enable&π/4DQPSK</u>

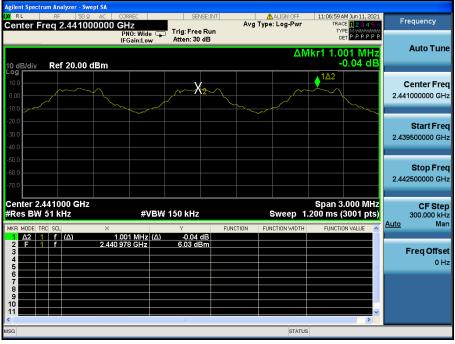


### Carrier Frequency Separation (FH)

#### Hopping mode : Enable&8DPSK

X RL RF 50 Q AC CORREC SENSE:INT ALIGN OFF 10:50:58 AM Jun 11, 2021	
	ncv
Center Fred 2.441000000 GHZ	,
IFGainLow Atten: 30 dB	
ΔMkr1 1.002 MHz	o Tune
10 dB/div Ref 20.00 dBm -0.15 dB	_
	er Freq
2.441000	000 GHz
10.0	
-20.0	at Exam
	rt Freq
-300 2.439500	JOU GHZ
-50.0 Std	p Freq
-60.0	
-70.0	
Center 2.441000 GHz Span 3.000 MHz	_
	F Step
Auto	Man
MKR         MODE         TRC         SCL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION VALUE         Λ           1         Δ2         1         f         (Δ)         -0.15 dB         -0.15 dB<	
2 F 1 f 2.440 977 GHz 6.09 dBm	
3 Free	Offset
	0 Hz
MSG STATUS	

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



#### Carrier Frequency Separation (AFH) <u>Hopping mode : Enable&π/4DQPSK</u>



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

lgilent Spectr	um Analyzer - Sv	<mark>wept SA</mark> Ω AC CORRI	EC	SEN	ISE:INT	ALIGN OFF	11:13:45 A	M Jun 11. 2021	-
Center Fr		00000 GHz			Run	e: Log-Pwr	TRAC	E 123456 E M <del>WWWW</del> T P P P P P P	Frequency
10 dB/div	Ref 20.00		IIII:LOW	Atten. oo	40	ΔN	lkr1 1.0	01 MHz 0.08 dB	Auto Tun
Log 10.0 0.00		·	~~~~	X	2~	 ~~~~			<b>Center Fre</b> 2.441000000 GH
20.0 30.0 40.0									Start Fre 2.439500000 G⊦
50.0 60.0 70.0									<b>Stop Fre</b> 2.442500000 G⊦
Res BW			#VBW	150 kHz			Span 3. .200 ms (3		CF Ste 300.000 kł Auto Ma
MKR MODE TF 1 Δ2 1 2 F 1 3 4 5	f (Δ)	× 1.001 2.440 978	MHz (Δ) GHz	Y -0.08 6.08 dE	dB	NCTION WIDTH	FUNCTIO	N VALUE	Freq Offso 0 ⊦
6 7 8 9 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10									
				Ш				>	
SG						STATUS			

### 5. Number of Hopping Channels

#### 5.1 Test Setup

Refer to the APPENDIX I.

#### 5.2 Limit

Limit : >= 15 hops

#### 5.3 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 2 400 MHz ~ 2 483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz	Start Frequency = 2 391.5 MHz,	Stop Frequency = 2 441 5 MHz						
	• •							
	Start Frequency = 2 441.5 MHz,	Stop Frequency = 2 491.5 MHz						
Span for AFH mode = 30 MHz	Start Frequency = 2 426.0 MHz,	Stop Frequency = 2 456.0 MHz						
RBW = To identify clearly the indi	vidual channels, set the RBW to lea	ss 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	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.

### Number of Hopping Channels 1(FH)

### Hopping mode : Enable & GFSK

	t Spectrum																											
KI RL	ter Fre	RF		2 AI		CORI				_		SENS	E:INT		4	v		ALIGN			10:0		AM Jun CE 💶				reque	ncy
Cerri	lerre	qΖ	4105	000	00 0			ast	Ē		ig: Fi											TY	PE M P	AMARA	nini-			
								Low	-	At	ten:	30 d	в									D	et P F	PPF	-			_
																		N	/kr2	2.2	.44	1 0	000	GH			Aut	o Tun
10 dE	Ridiv	Ref	20.00	dBr	n																		52 (					
Log			20100	A 1											Т					Т					2			
10.0				-0-																							Cent	er Free
0.00				$-\Lambda$	M	M	Αr	W	γA	ΛΛ	AΛ	M	W	M	M	M	ДΛ	AΛ	AΛI	ηn	Ar	ΙΛſ	MΛ	AΛ		2.4	16500	000 GH
-10.0				- J - Y	ΥŸ	ΥY		ΥY	Į I	ίΥĭ	ĮŶ	Υĭ	ΥY	γγ	ΥY	¥ I	ľŸ	1 Y Y	¥ ¥	Y	V V	ΥV	YYY	I V Y		_		
				1																								
-20.0				J																							Sta	rt Free
-30.0				-					_																-1	2.3	91500	000 GH
-40.0		4	Jr WW																									
-50.0		/`	1 v v																									
																											Sto	p Free
-60.0																										2.4		000 GH
-70.0																												
<b>O</b> (1-1-1	4.0.004	50.0	SI I																									
	t 2.391 s BW 2							40./E		820	5 I.I.								ер ′	. 5	top	Z.4	4150	GH	ž			F Step
#Re	S DVV Z	/ U K	ΠZ					# V L	9WW	02	J NI	12						Swe	eh	1.0						Auto	5.0000	000 MH Mai
	MODE TRC				×						Y			FUN	CTION	I I	FUN	ICTION	WIDTH	1	F	UNCTI	ON VAL	UE.	^	Auto		Ind
1	N 1	f			.402						5.22 5.52									+								
3					.441	000					0.02	чDI	"														Freq	Offse
4								_					_							+								0 H
5													+							╈					=			
7																												
8								_					+-							╋								
10																												
11																							1	_	~			
		_	_	_	_	_	_	_		_	111	_	_	_	_	_	_	_		_	_	_		>				
MSG																			STATU	JS								

### Number of Hopping Channels 2(FH)

### Hopping mode : Enable & GFSK

gilent Spectrum Analyzer - Swept SA					
RL RF 50Ω AC Center Freq 2.46650000		SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	10:05:43 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB		TYPE MWWWWW DET PPPPP	Auto Tune
IO dB/div Ref 20.00 dBm			Mkr2	2.480 000 GHz 4.91 dBm	Auto Tun
<b>cog</b> 10.00 0.00 10.00					<b>Center Fre</b> 2.466500000 GH
20.0 				May	<b>Start Fre</b> 2.441500000 GH
50.0 60.0 70.0					<b>Stop Fre</b> 2.491500000 GH
tart 2.44150 GHz Res BW 270 kHz	#VBW	820 kHz	Sweep 1	Stop 2.49150 GHz .000 ms (3001 pts)	CF Ste 5.000000 MH
IN 1 F	42 000 GHz	5.63 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
2 N 1 f 2.4 3 4 5 6	180 000 GHz	4.91 dBm			Freq Offse 0 H
7 8 8 9 10101					
		III		×	
5G			STATUS	3	



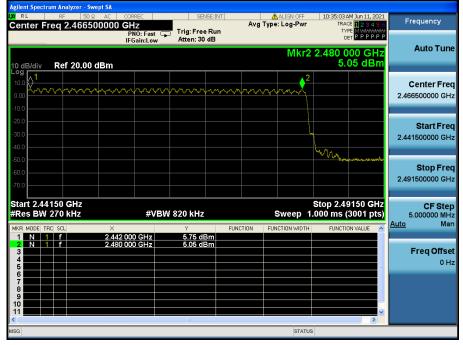
#### Number of Hopping Channels 1(FH)

#### Hopping mode : Enable&π/4DQPSK

enter Fr		500000 GH	REC		E:INT	Avg Ty	ALIGN OFF	TRA	AM Jun 11, 2021 CE <b>1 2 3 4 5 6</b> PE M WAAAAAA	Frequency
0 dB/div	Ref 20.00	IFO	NO: Fast Ģ Gain:Low	Atten: 30 o			Mkr2	c 2.441 0	00 GHz	Auto Tune
		1	ᡔᢩᡘ᠋ᡳ᠕ᡧᠺᢊ	$\phi \sim \gamma \sim $	$\sim \sim \sim \sim$	ᡣᢦ᠊ᠬᢦ	$\gamma \gamma $			<b>Center Fred</b> 2.416500000 GH:
20.0 30.0 40.0	NVW									<b>Start Fre</b> 2.391500000 GH
-50.0 -60.0 -70.0										<b>Stop Free</b> 2.441500000 GH
Start 2.39 Res BW	270 kHz	×		¥ 820 kHz	FUNC	TION	Sweep 1	.000 ms (	4150 GHz 3001 pts) <sup>DN VALUE</sup>	CF Stej 5.000000 MH <u>Auto</u> Ma
1 N 1 2 N 1 3 4 5 5 6 7 8 9 9 9	f f 	2.402 00 2.441 00		5.27 dB 5.75 dB						Freq Offse 0 H
10 11 11 15G				Ш			STATU		>	

#### Number of Hopping Channels 2(FH)

#### Hopping mode : Enable &π/4DQPSK



### Number of Hopping Channels 1(FH)

#### Hopping mode : Enable&8DPSK

			alyzer - S														
LXI RL		RF	50			RREC		SEI	VSE:INT		Aval		ALIGN OFF		AM Jun 11, 2021		Frequency
Cent	ter Fr	eq 2	2.416	30000	JU GF	1Z NO: Fast		Trig: Fre			~rg	ype	. Log-F W	T	PE M WARANA		
						Gain:Low	-	Atten: 30	dB					(	PPPPP		
													Mkr2		000 GHz		Auto Tune
10 dE	3/div	Rei	f 20.00	) dBm										5.	81 dBm		
Log [				. 1											2		
10.0									0.00	мh	MAA.	лm		000000	aaaa		Center Freq
0.00					v. v. y .	4444	Y Y	* * * * *	***		/ * * V			* 4 4 4 4	1 Y Y Y Y I	:	2.416500000 GHz
-10.0				_													
-20.0																	Otherst English
-30.0				N													Start Freq
-40.0																	2.391500000 GHz
			الهم المعلمه														
-50.0	distance and	AL BALLER															Stop Freq
-60.0																	2.441500000 GHz
-70.0																	2.441000000 0112
		150															
	t 2.39 s BW					#1/6	-	320 kHz					Swoon 1	Stop 2.4	4150 GHz (3001 pts)		CF Step
						# V E	<b>5</b> 99 (	520 KHZ							· · · /	Au	5.000000 MHz ito Man
	10DE TR	IC SCL			< 100.00	0 GHz		∀ 3.90 di		FUNC	TION	FUN	CTION WIDTH	FUNCT	ION VALUE	7.00	
	N 1	f			402 00 441 00			5.81 d	Bm Bm								
3																	Freq Offset
4						$\rightarrow$									=		0 Hz
6																	
7																	
9																	
10															~		
<								ш							>		
MSG													STATU	5			

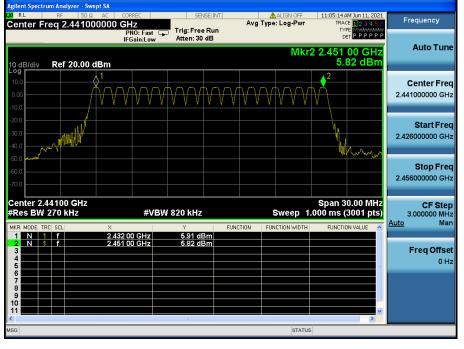
### Number of Hopping Channels 2(FH)

#### Hopping mode : Enable & 8DPSK

gilent Spectrum Analyzer - Swept SA					
RL RF 50 Ω AC Center Freg 2.466500000	CORREC	SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	10:49:13 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: East	Frig: Free Run Atten: 30 dB			
10 dB/div Ref 20.00 dBm			Mkr2	2.480 000 GHz 4.86 dBm	Auto Tune
<b>0 1</b> 10.0 <b>1</b> 0.00 <b>1</b> 10.0 <b>1</b>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	$\sim$	2		Center Freq 2.466500000 GHz
-20.0				Marting and the second second	Start Fred 2.441500000 GHz
-50.0				* 144900 June 1. June	Stop Fred 2.491500000 GHz
Start 2.44150 GHz #Res BW 270 kHz	#VBW 8	20 kHz		Stop 2.49150 GHz .000 ms (3001 pts)	CF Step 5.000000 MH
MKR MODE TRC SCL X	2 000 GHz	5.79 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar
2 N 1 f 2.48 3 4 5 6	0 000 GHz	4.86 dBm		=	<b>Freq Offse</b> 0 H:
7 8 9 10					
		III.		>	
ISG			STATUS		

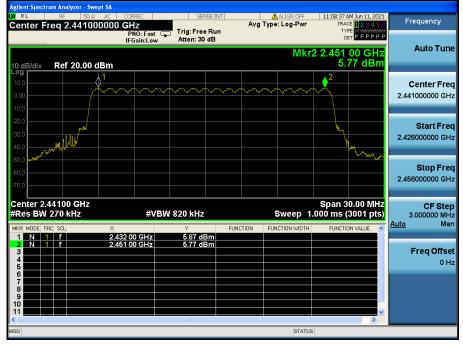
#### Number of Hopping Channels 1(AFH)

#### Hopping mode : Enable & GFSK



#### Number of Hopping Channels 1(AFH)

#### Hopping mode : Enable &π/4DQPSK



#### Number of Hopping Channels 1(AFH)

### Hopping mode : Enable & 8DPSK



### 6. Time of Occupancy

#### 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 :

Center frequency = 2 441 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 function = peak

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 ×

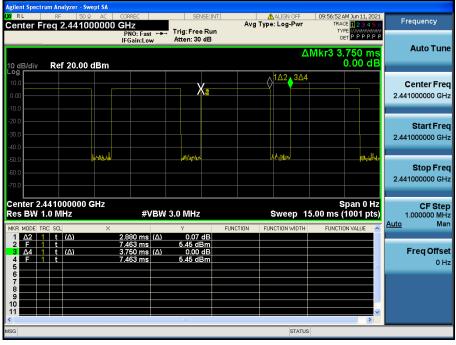
((Hopping rate ÷ Time slots) ÷ Hopping channel)

- Time slots for DH5 = 6 slots (TX = 5 slots / RX = 1 slot)
- Hopping Rate = 1 600 for FH mode & 800 for AFH mode

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

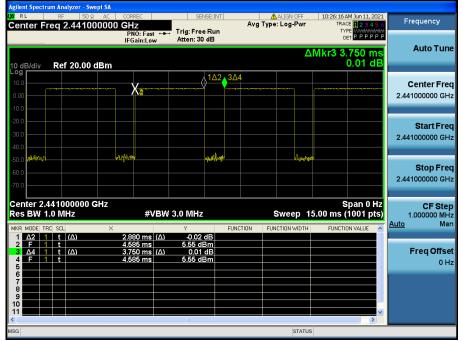


#### Time of Occupancy (FH)



#### Time of Occupancy (FH)

#### Hopping mode : Enable&2-DH5

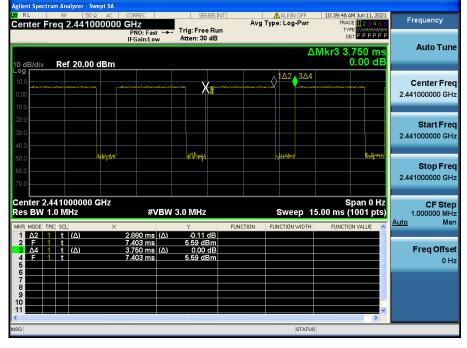


### Hopping mode : Enable&DH5



#### Time of Occupancy (FH)

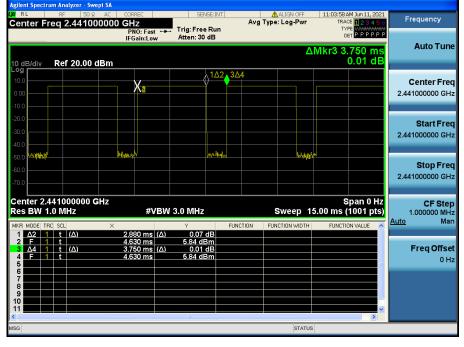
#### Hopping mode : Enable&3-DH5





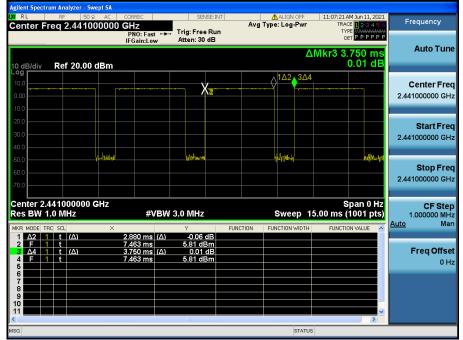
# Time of Occupancy (AFH)

# Hopping mode : Enable&DH5



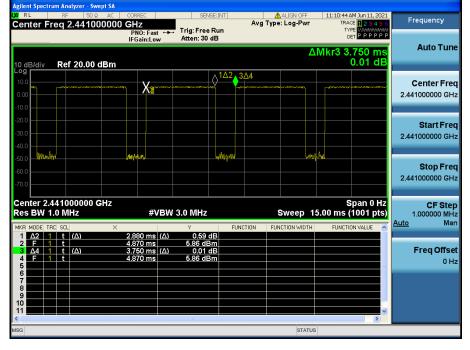
#### Time of Occupancy (AFH)

# Hopping mode : Enable&2-DH5



# Time of Occupancy (AFH)

# Hopping mode : Enable&3-DH5





# 7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

# 7.1 Test Setup

Refer to the APPENDIX I.

# 7.2 Limit

Part 15.247(d), Part 15.205, Part 15.209 & RSS-247 [5.5], RSS-Gen [8.9], RSS-Gen [8.10] 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 Part 15.247 the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (μA/m)	Measurement Distance (m)
0.009 - 0.490	2 400 / F (kHz)	6.37/F (F in kHz)	300
0.490 - 1.705	2 4000 / F (kHz)	63.7/F (F in kHz)	30
1.705 – 30.0	30	0.08	30

#### - Part 15.209 & RSS-GEN[8.9]

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (uV/m)	Measurement Distance (m)
30 ~ 88	100 **	100	3
88 ~ 216	150 **	150	3
216 ~ 960	200 **	200	3
Above 960	500	500	3

\*\*Except as provided in paragraph (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.

#### - Part 15.205(a): Restricted band of operation

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.414 25 ~ 8.414 75	108 ~ 121.94	1 300 ~ 1 427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1 435 ~ 1 626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.173 5 ~ 2.190 5	12.519 75 ~ 12.520 25	149.9 ~ 150.05	1 645.5 ~ 1 646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.576 75 ~ 12.577 25	156.524 75 ~ 156.525 25	1 660 ~ 1 710	8.025 ~ 8.5	22.01 ~ 23.12
4.177 25 ~ 4.177 75	13.36 ~ 13.41	156.7 ~ 156.9	1 718.8 ~ 1 722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.207 25 ~ 4.207 75	16.42 ~ 16.423	162.012 5 ~ 167.17	2 200 ~ 2 300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 310 ~ 2 390	10.6 ~ 12.7	36.43 ~ 36.5
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 483.5 ~ 2 500	13.25 ~ 13.4	Above 38.6
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	2 655 ~ 2 900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 260 ~ 3 267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 332 ~ 3 339		
8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1240	3 345.8 ~ 3 358		
			3 600 ~ 4 400		

#### - RSS-GEN[8.10]: Restricted frequency bands

MHz	MHz	MHz	MHz	MHz	GHz
0.090 ~ 0.110	8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 345.8 ~ 3 358	9.0 ~ 9.2
0.495 ~ 0.505	8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 427	3 500 ~ 4 400	9.3 ~ 9.5
2.173 5 ~ 2.190 5	8.414 25 ~ 8.414 75	108 ~ 138	1 435 ~ 1 626.5	4 500 ~ 5 150	10.6 ~ 12.7
3.020 ~ 3.026	12.29 ~ 12.293	149.9 ~ 150.05	1 645.5 ~ 1 646.5	5 350 ~ 5 460	13.25 ~ 13.4
4.125 ~ 4.128	12.519 75 ~ 12.520 25	156.524 75 ~	1 660 ~ 1 710	7 250 ~ 7 750	14.47 ~ 14.5
4.177 25 ~ 4.177 75	12.576 75 ~ 12.577 25	156.525 25	1 718.8 ~ 1 722.2	8 025 ~ 8 500	15.35 ~ 16.2
4.207 25 ~ 4.207 75	13.36 ~ 13.41	156.7 ~ 156.9	2 200 ~ 2 300		17.7 ~ 21.4
5.677 ~ 5.683	16.42 ~ 16.423	162.01 25 ~ 167.17	2 310 ~ 2 390		22.01 ~ 23.12
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 483.5 ~ 2 500		23.6 ~ 24.0
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 655 ~ 2 900		31.2 ~ 31.8
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	3 260 ~ 3 267		36.43 ~ 36.5
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 332 ~ 3 339		Above 38.6



# 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 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.
- 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 1 000 MHz The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasipeak detection (QP) at frequency below 1 GHz.
- Frequencies above 1 000 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 : 40 001

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 : 40 001

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 = 2 001 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

#### Test Notes.

1. The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found below listed frequencies.

2. Information of Distance Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.

In this case, the distance factor is applied to the result.

- Calculation of distance factor

At frequencies below 30 MHz = 40 log(tested distance / specified distance)

At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied. 3. DCCF Calculation. (DCCF = Duty Cycle Correction Factor)

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

- DCCF = 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+ DCCF + DCF / T.F = AF + CL + HL + AL - AG

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

AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

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

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 387.05	Н	Y	PK	49.77	4.77	N/A	N/A	54.54	74.00	19.46
2 387.05	Н	Y	AV	49.77	4.77	-24.79	N/A	29.75	54.00	24.25
4 803.65	Н	Z	PK	52.96	1.86	N/A	N/A	54.82	74.00	19.18
4 803.65	Н	Z	AV	52.96	1.86	-24.79	N/A	30.03	54.00	23.97

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 882.59	Н	Z	PK	53.14	2.14	N/A	N/A	55.28	74.00	18.72
4 882.59	Н	Z	AV	53.14	2.14	-24.79	N/A	30.49	54.00	23.51

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.58	Н	Y	PK	51.75	5.74	N/A	N/A	57.49	74.00	16.51
2 483.58	Н	Y	AV	51.75	5.74	-24.79	N/A	32.70	54.00	21.30
4 959.92	Н	Z	PK	52.90	2.12	N/A	N/A	55.02	74.00	18.98
4 959.92	Н	Z	AV	52.90	2.12	-24.79	N/A	30.23	54.00	23.77



#### 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)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 387.05	Н	Y	PK	50.36	4.77	N/A	N/A	55.13	74.00	18.87
2 387.05	Н	Y	AV	50.36	4.77	-24.79	N/A	30.34	54.00	23.66
4 804.23	Н	Z	PK	52.82	1.86	N/A	N/A	54.68	74.00	19.32
4 804.23	Н	Z	AV	52.82	1.86	-24.79	N/A	29.89	54.00	24.11
<ul> <li>Middle Ch</li> </ul>	annel	•	·	·						
Middle Ch     Frequency     (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Frequency	ANT	Position								•
Frequency (MHz)	ANT Pol	Position (Axis)	Mode	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

#### Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.69	Н	Y	PK	50.69	5.74	N/A	N/A	56.43	74.00	17.57
2 483.69	Н	Y	AV	50.69	5.74	-24.79	N/A	31.64	54.00	22.36
4 960.02	Н	Z	PK	51.69	2.12	N/A	N/A	53.81	74.00	20.19
4 960.02	Н	Z	AV	51.69	2.12	-24.79	N/A	29.02	54.00	24.98



# 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)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)		
2 388.04	Н	Y	PK	50.71	4.78	N/A	N/A	55.49	74.00	18.51		
2 388.04	Н	Y	AV	50.71	4.78	-24.79	N/A	30.70	54.00	23.30		
4 803.52	Н	Z	PK	52.89	1.85	N/A	N/A	54.74	74.00	19.26		
4 803.52	Н	Z	AV	52.89	1.85	-24.79	N/A	29.95	54.00	24.05		
Middle Channel												
<ul> <li>Middle Ch</li> </ul>	annel											
Middle Ch     Frequency     (MHz)	annel ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)		
Frequency	ANT	Position								•		
Frequency (MHz)	ANT Pol	Position (Axis)	Mode	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		

#### Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.60	Н	Y	PK	51.22	5.74	N/A	N/A	56.96	74.00	17.04
2 483.60	Н	Y	AV	51.22	5.74	-24.79	N/A	32.17	54.00	21.83
4 960.37	Н	Z	PK	51.91	2.13	N/A	N/A	54.04	74.00	19.96
4 960.37	Н	Z	AV	51.91	2.13	-24.79	N/A	29.25	54.00	24.75



#### Low Band-edge

Lowest Channel & Modulation : GFSK



#### Low Band-edge

# Hopping mode & Modulation : GFSK





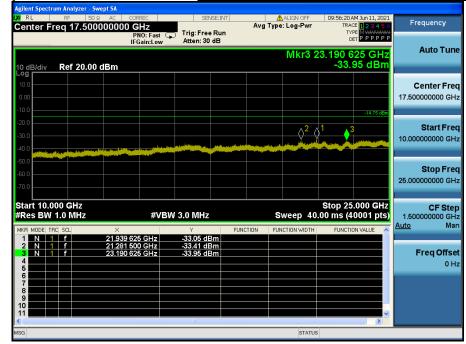
## Lowest Channel & Modulation : GFSK

Agilent Spectr													
Center F	RF	50 Ω 🚹 DC	CORREC		SENSE	INT	Ava	ALIGN			AM Jun 11, 20		Frequency
Center F	req 15.0	JU4300 W	PNO: Fas		rig: Free R			1990. 209		т			
			IFGain:Lo	w A	tten: 30 dE	3							Auto Tune
									n N		19.4 kH		Auto Tune
10 dB/div Log	Ref 20	.00 dBm								-48	.74 dBr	n	
10.0													Center Freq
0.00													15.004500 MHz
-10.0													10.004000 11112
-20.0											-14.75 dE	<u>m</u>	
													Start Freq
-30.0													9.000 kHz
-40.0 1													
-50.0	and at the bound		المراجع المرا		ipid:::alec.matic			ut a little annual		all and the second second	المربعينية		Stop Freq
-60.0		tal aller the strategy of		Angeodrig Breaking allowed	a a difference of a sould	and the second		(Trade to a particular	40(01)	a far a fan de fan de fan de f		<b>*</b>	30.000000 MHz
-70.0													
Start 9 kH	17									Ston	30.00 MH	7	05.04
#Res BW			#	VBW 30	0 kHz			Swee	p 5.3	33 ms (	40001 pt	ŝ	CF Step 2.999100 MHz
MKR MODE T		×		1	Y	FUN	ICTION	FUNCTION	_		ION VALUE		
1 N 1		0	319.4 kHz	z -4	8.74 dBm		CHON	Tonenon	WIDTH	Tones	ION VALUE		
2													Freq Offset
4													0 Hz
5 6												=	
7													
9													
10												~	
<					Ш						>		
									_			_	
ISG									STATUS	🔥 DC Co	oupled		

Agilent Spectrum Analyzer - Swept SA						
M RL RF 50Ω AC C		SENSE:INT	ALIG	g-Pwr TRAG	M Jun 11, 2021	Frequency
	PNO: East 🕟 Trig: I	Free Run : 30 dB		TYF DE	E MWWWWW P P P P P P	
10 dB/div Ref 20.00 dBm				Mkr5 7.137 -40.0	11 GHz 60 dBm	Auto Tune
10.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0					-14.75 dBm	Center Freq 5.015000000 GHz
-20.0 -30.0 -40.0	2 2		45		Ann Report of Manager	Start Freq 30.000000 MHz
-50.0 -60.0 -70.0						<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW 3.0 M	Hz	Swee	Stop 10 p 18.67 ms (4	.000 GHz 0001 pts)	CF Step 997.000000 MHz Auto Man
MKR MODE TRC SCL X	2 36 GHz 5.3	FUN 2 dBm	CTION FUNCTION	WIDTH FUNCTION	IN VALUE	Auto Mari
2 N 1 f 3.068 3 N 1 f 5.628 4 N 1 f 6.349 5 N 1 f 7.137	3 61 GHz -39.00 3 65 GHz -40.30 9 73 GHz -40.31	5 dBm 0 dBm 1 dBm 0 dBm				<b>Freq Offset</b> 0 Hz
6						
MSG				STATUS		



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





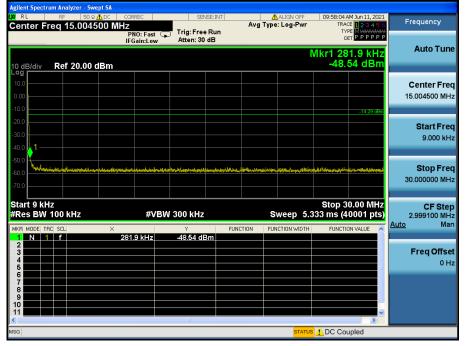
## **Reference for limit**

#### Middle Channel & Modulation : GFSK



#### **Conducted Spurious Emissions**

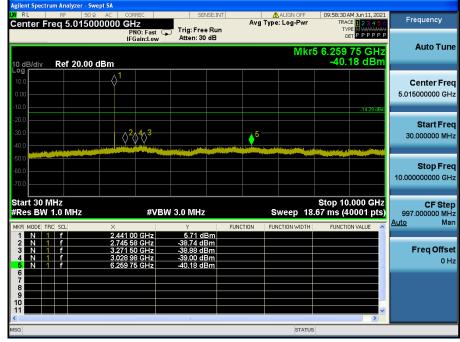
## Middle Channel & Modulation : GFSK



# **Dt&C**

# Conducted Spurious Emissions

# Middle Channel & Modulation : GFSK



Agilent Spectrum Analyzer - Swept SA				
XX RL RF 50.Ω AC Center Freq 17.500000000	PNO: Fast 😱 Trig: Free Run	Avg Type: Log-Pwr	09:58:53 AM Jun 11, 2021 TRACE 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	Frequency
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30 dB	Mkr3 2	2.337 125 GHz -34.20 dBm	Auto Tune
10.0 0.00 -10.0			-14.29 dBm	Center Freq 17.500000000 GHz
-20.0 -30.0				<b>Start Freq</b> 10.000000000 GHz
-50.0 -60.0 -70.0				Stop Freq 25.000000000 GHz
Start 10.000 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 40.	Stop 25.000 GHz 00 ms (40001 pts)	<b>CF Step</b> 1.50000000 GHz <u>Auto</u> Man
1 N 1 f 24.561 2 N 1 f 23.195 3 N 1 f 22.337 4 5	250 GHz -32.98 dBm 875 GHz -34.04 dBm 125 GHz -34.20 dBm			Freq Offset 0 Hz
6 7 8 9 10 11				
K MSG	III III III	STATUS	<u>&gt;</u>	



# High Band-edge

## Highest Channel & Modulation : GFSK



#### **High Band-edge**

## Hopping mode & Modulation : GFSK





# Highest Channel & Modulation : GFSK

Agilent Spect	rum Analy	zer - Swept SA											
L <mark>XI</mark> RL	RF	50 Q Å DC	CORREC		SENSE	EINT			ALIGN OFF		1 AM Jun 11, 202		Frequency
Center F	req 15	.004500	MHz	т.	rig: Free F		Avg	Type:	Log-Pwr	AT .	CACE 12345	6	riequency
			PNO: Fast IFGain:Lov		tten: 30 d						DETPPPP		Auto Tune
10 dB/div	Ref 2	20.00 dBm									81.9 kHz 60 dBm		nato ran
Log													
10.0													Center Free
0.00													15.004500 MH:
-10.0											-15.07 dBn		
-20.0													Start Fred
-30.0													9.000 kH;
-40.0 🔒 1 —													5.000 KH
-50.0													
-60.0	And the states	and the second second second second	Samelistan and frais	and the second second	-	-	-		Analphanstinte				Stop Free
													30.000000 MH:
-70.0													
Start 9 kl	Hz									Stop	30.00 MHz		CF Step
#Res BW		lz	#\	/BW 30	0 kHz			Sv	veep 5.		40001 pts		2.999100 MH:
MKR MODE T	BRISCU	×			Y	FUN	ICTION	ELING	TION WIDTH	FLING	TION VALUE		<u>uto</u> Mar
1 N	1 f		281.9 kHz	-4	8.60 dBn								
2													Freq Offse
4													0 H;
5													
7													
8 9													
10													
11					ш						>		
MSG									STATU	DC C		_	
									STATU	<u> </u>	oupled		

W         RL         RF         50.9         AC         CORREC         SERVESINT         Auton OFF         1000:55.4M Junit, 2021         Frequency           Center Freq 5.015000000 CHz IFGain:Low         Trig: Free Run Atten: 30 dB         Avg Type: Log-Pwr IFGain:Low         Trig: Free Run Atten: 30 dB         Mkr5 9.678 22 GHz -40.85 dBm         Frequency           10 dB/div         Ref 20.00 dBm
Center Fred S.015000000 GHZ         Free Run IFGain:Low         Trig: Free Run Atten: 30 dB         Mkr5 9.678 22 GHZ -40.85 dBm           10 dB/div         Ref 20.00 dBm         -40.85 dBm         Center F         5.015000000 GHZ         Center F           10 dB/div         0         -1
Image: Nikro 9,678 22 GHz         Center F           100         1         1           100         1         1           100         1         1           100         1         1           100         1         1           100         1         1           100         1         1           100         1         1           100         1         1
10 0 1 Center F 0.00
3.000 4.000
-500
Start 30 MHz         Stop 10.000 GHz         CF S           #Res BW 1.0 MHz         #VBW 3.0 MHz         Sweep 18.67 ms (40001 pts)         997.000000 ft
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE ALL
1         N         1         f         2.479.88 GHz         5.00 dBm           2         N         1         f         3.460 19 GHz         3.972 dBm           3         N         1         f         5.007 67 GHz         .39.23 dBm         Freq Off           4         N         1         f         2.639.40 GHz         .39.93 dBm         GMD           5         N         1         f         2.632 40 GHz         .39.93 dBm         GMD
6
MSG STATUS



# Highest Channel & Modulation : GFSK





#### Low Band-edge

## Lowest Channel & Modulation : π/4DQPSK



#### Low Band-edge

## Hopping mode & Modulation : π/4DQPSK





## Lowest Channel & Modulation : π/4DQPSK

Center F		4500 MHz	RREC NO: Fast G Gain:Low				ALIGN OFF	TRA	AM Jun 11, 2021 CE <b>1 2 3 4 5 6</b> PE M WWWWWW ET P P P P P P	Frequency
10 dB/div	Ref 20.0		Gain:Low	Atten: 30 C					1.9 kHz 25 dBm	Auto Tune
Log 10.0 0.00									-14.57 dBm	Center Free 15.004500 MH:
-20.0 -30.0 -40.0									-14.37 000	Start Free 9.000 kH
-50.0 -60.0 -70.0	Hibertfästatheliterse	hadden on or yn dit genel ôfse an d	n <mark>i</mark> firsi-historafikanisikan	agan an a	ikasa, hisionaka ana ana	ann an the state of the state o	al a land to be an a land a land		aduraria intelatora	Stop Free 30.000000 MH
Start 9 kH #Res BW	100 kHz	×		W 300 kHz Y	FUNCT		weep 5.	333 ms (4	0.00 MHz 0001 pts)	CF Step 2.999100 MH Auto Mar
1 N 1 2 3 4 5 6	f	281	.9 kHz	-47.25 dBi	m					Freq Offse 0 H:
7 8 9 10 11									~	
MSG							STATU	DC Co		

Agilent Spectrum Analyzer - Swep					
Center Freg 5.01500		SENSE:INT	ALIGN OFF Avg Type: Log-Pwr	10:25:22 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast G IFGain:Low	Trig: Free Run Atten: 30 dB			
10 dB/div Ref 20.00 d	Bm		Mkr	5 3.596 52 GHz -40.08 dBm	Auto Tune
Log 10.0 0.00 -10.0				-14.57 dBm	Center Freq 5.015000000 GHz
-20.0 -30.0 -40.0				n ffilingen kölningen social forgen kölnigt ten.	Start Freq 30.000000 MHz
-50.0					<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW	( 3.0 MHz	Sweep 18	Stop 10.000 GHz 67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.402 36 GHz	Y FUI 5.82 dBm	NCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	3.141 14 GHz 6.295 40 GHz 5.793 41 GHz 3.596 52 GHz	-39.59 dBm -39.63 dBm -40.08 dBm -40.08 dBm		=	<b>Freq Offset</b> 0 Hz
6 7 8 9 10					
11		ш		×	
MSG			STATUS		

# **Dt&C**

# Conducted Spurious Emissions

# Lowest Channel & Modulation : π/4DQPSK

Agilent Spectrum Analyzer - Swept S	CORREC	SENSE:INT	ALIGN OFF	10:25:46 AM Jun 11, 202: TRACE 1 2 3 4 5	
	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB		TYPE MMMMMM DET P P P P P	Auto Tupo
10 dB/div Ref 20.00 dBn	n		IVIKIS 2	-33.82 dBm	
10.0 0.00					Center Freq 17.500000000 GHz
-20.0		and statistic on the list of the second		-14.57 dBm	Start Freq 10.000000000 GHz
-50.0					<b>Stop Freq</b> 25.000000000 GHz
Start 10.000 GHz #Res BW 1.0 MHz	#VBW :	3.0 MHz	Sweep 40	Stop 25.000 GHz .00 ms (40001 pts	1.500000000 GHz
	× .746 375 GHz	Y FI -33.07 dBm	JNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto Man
2 N 1 f 22	299 625 GHz 220 250 GHz	-33.42 dBm -33.82 dBm			Freq Offset 0 Hz
6 7 8 9					
10 11 <		III.		×	
MSG			STATUS	3	



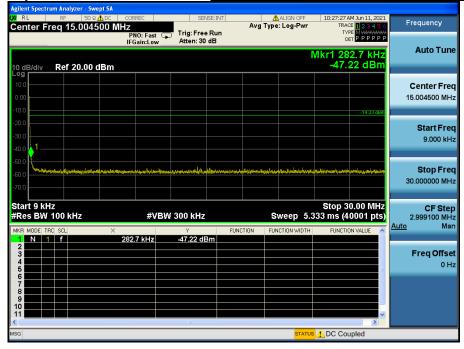
## **Reference for limit**

## Middle Channel & Modulation : π/4DQPSK



#### **Conducted Spurious Emissions**

#### Middle Channel & Modulation : π/4DQPSK



# **Dt&C**

# Conducted Spurious Emissions

# Middle Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Swept SA				
	CORREC SENSE:I		10:28:16 AM Jun 11, 2021	Frequency
Center Freq 17.50000000	PNO: Fast IFGain:Low Atten: 30 dB	Avg Type: Log-Pwr n	TRACE 2 3 4 5 6 TYPE M MANAMAN DET P P P P P P	
10 dB/div Ref 20.00 dBm		Mkr3 2	22.284 250 GHz -33.62 dBm	Auto Tune
10.0 .000 -10.0			-14.23 dbm	Center Freq 17.500000000 GHz
-20.0 -30.0 -40.0				Start Freq 10.000000000 GHz
-60.0 -70.0				<b>Stop Freq</b> 25.00000000 GHz
Start 10.000 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 40	Stop 25.000 GHz .00 ms (40001 pts)	CF Step 1.50000000 GHz
	250 GHz -32.67 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
3 N 1 f 22.284 4 5 9	625 GHz -33.53 dBm 250 GHz -33.62 dBm		=	<b>Freq Offset</b> 0 Hz
6 7 8 9 9 10				
11	III		>	
MSG		STATU	3	



## **High Band-edge**

# Highest Channel & Modulation : π/4DQPSK



#### **High Band-edge**

## Hopping mode & Modulation : π/4DQPSK





# Highest Channel & Modulation : π/4DQPSK

XI RL	rum Analyzer - S RF 50 req 15.004	Ω≜DC CORREI 1500 MHz PNO	Fast 😱	SENSE:	un		ALIGN OFF e: Log-Pwr	TRA	AM Jun 11, 2021 CE 123456 PE MWWWWWW ET PPPPP	Frequency
10 dB/div	Ref 20.00		n:Low	Atten: 30 dE	j			Mkr1 28	1.9 kHz 10 dBm	Auto Tune
10.0										Center Free 15.004500 MH
-20.0 -30.0 -40.0									-14.97 dBm	Start Free 9.000 kH:
-50.0 -60.0 -70.0	nate provident	beineler egenelissier besteler besteler besteler besteler besteler besteler besteler besteler besteler bestele	yahan water (beijsfaad	hadaaniinii väysiiniaaanii	lage inpertained table	alay ta nifi kata ka		sign.gd.hyw.dyt.iu.gab	han ta she ta ta she	Stop Fred 30.000000 MH:
Start 9 kl #Res BW	100 kHz	×	#VBW 3	Y	FUNCT		weep 5.	333 ms (4	0.00 MHz 0001 pts) <sup>DN VALUE</sup>	CF Step 2.999100 MH Auto Mar
2 3 4 5 6	f	281.9		-49.10 dBm						Freq Offse 0 H
7 8 9 10 11									~	
MSG							STATU	DC Co	upled	

Agilent Spectrum Analyzer - Swept S					
RL RF 50 Ω A     Center Freq 5.0150000		SENSE:INT	ALIGN OFF	10:30:17 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
Center Freq 5.0150000	PNO: Fast IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type. Logi wi		
10 dB/div Ref 20.00 dB	m		Mkr	5 4.825 82 GHz -40.48 dBm	Auto Tune
10.0 0.00 -10.0	- ∲ <sup>1</sup>			-14.97 dBm	Center Freq 5.015000000 GHz
-20.0	<sup>2</sup>	5	3 4	entre and a second	Start Freq 30.000000 MHz
-50.0 -60.0 -70.0					<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 18	Stop 10.000 GHz 67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.480 13 GHz	Y FUI 5.56 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	3.057 14 GHz 5.770 73 GHz 6.321 57 GHz 4.825 82 GHz	-39.48 dBm -39.76 dBm -39.78 dBm -40.48 dBm			<b>Freq Offset</b> 0 Hz
				×	
MSG			STATUS		

# Highest Channel & Modulation : π/4DQPSK



#### Low Band-edge

#### Lowest Channel & Modulation : 8DPSK



#### Low Band-edge

#### Hopping mode & Modulation : 8DPSK





# Lowest Channel & Modulation : 8DPSK

RL RF 50 Ω <u>A</u> DO enter Freq 15.004500	MHz PNO: Fast	SENSE:IN	Avg	ALIGN OFF	10:38:27 AM Jun 11, 20 TRACE 1 2 3 4 TYPE M WWWW DET P P P P	Frequency
0 dB/div Ref 20.00 dBr	IFGain:Low	Atten: 30 dB			Mkr1 293.2 kH -48.26 dB	Auto Tun
0.00						Center Fre 15.004500 MH
20.0 30.0 40.0 21					-14.57 dl	Start Free 9.000 kH
50.0 60.0 70.0	star <sup>1</sup> pape sellepting (h-saraheta-saraheta-saraheta	ing and a line of the second	nenskiffskarter for hundt folker	<b>fraði</b> nso), <sub>111</sub> 0, 121, 121, 121, 121, 121, 121, 121, 12	hanakarénakhan ngenatahèn <sup>k</sup> éndékéhanakan iné ké	Stop Free 30.000000 MH
	X	W 300 kHz	FUNCTION	Sweep 5.3	Stop 30.00 MH 333 ms (40001 pt FUNCTION VALUE	
1         N         1         f           2	293.2 kHz	-48.26 dBm				Freq Offse
7 8 9 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10						<u>∞</u>
SG		Ш		STATUS	DC Coupled	

Agilent Spectrum Analyzer - Swept					
XIRL RF 50Ω / Center Freq 5.0150000		SENSE:INT	ALIGN OFF	10:38:52 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
Center Freq 5.0150000	PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB	ing type. Log t in		
10 dB/div Ref 20.00 dB	im		Mkr	5 6.155 07 GHz -40.56 dBm	Auto Tune
10.0 0.00				-14.57 dBm	Center Freq 5.015000000 GHz
-20.0					Start Freq 30.000000 MHz
-50.0 -60.0 -70.0					<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 18.	Stop 10.000 GHz 67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.402 11 GHz	6.16 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	3.166 06 GHz 5.780 20 GHz 7.031 68 GHz 6.155 07 GHz	-40.26 dBm -40.47 dBm -40.54 dBm -40.56 dBm			Freq Offset 0 Hz
7 8 9 10					
()		III		>	
SG			STATUS		

# **Dt&C**

# **Conducted Spurious Emissions**

# Lowest Channel & Modulation : 8DPSK





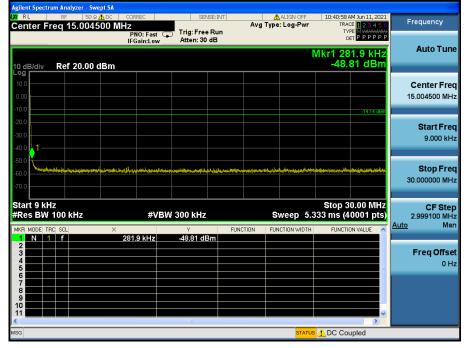
#### **Reference for limit**

# Middle Channel & Modulation : 8DPSK



#### Conducted Spurious Emissions

#### Middle Channel & Modulation : 8DPSK



# **Dt&C**

## **Conducted Spurious Emissions**

# Middle Channel & Modulation : 8DPSK



Agilent Spectrum Analyzer - Swept SA					
LX/RL RF 500 AC				AM Jun 11, 2021	Frequency
Center Freq 17.50000000	0 GHz RNO: Fact Trig: Free	Avg Type: Run	Log-Pwr TRA	CE 123456	riequency
	PNO: Fast Trig: Free IFGain:Low Atten: 30		t.	ETPPPPP	
			Mkr3 24.053		Auto Tune
				16 dBm	
10 dB/div Ref 20.00 dBm			-00.	TO GDII	
10.0					Center Freq
					17.500000000 GHz
0.00					17.50000000 GHz
-10.0				-14.14 dBm	
-20.0				0.01	Start Freq
-30.0					
	the state of the s	المحيد والدير والمتعطية فيطهر والتراري	and the second	and the second second	10.00000000 GHz
-40.0			أرخد أأتكره		
-50.0					01
-60.0					Stop Freq
-70.0					25.000000000 GHz
10.0					
Start 10.000 GHz			Stop 2	5.000 GHz	CF Step
#Res BW 1.0 MHz	#VBW 3.0 MHz	Sv	veep 40.00 ms (4	0001 pts)	1.500000000 GHz
MKR MODE TRC SCL X	Y	FUNCTION FUNC	TION WIDTH FUNCT		<u>uto</u> Man
	000 GHz -32.27 dB		TION WIDTH FONCT	UN VALUE	
2 N 1 f 24.386	5 125 GHz -32.63 dB	m			
3 N 1 f 24.053	3 125 GHz -33.16 dB	m			Freq Offset
5				_	0 Hz
6					
7 8					
9					
10					
11				~	
<			074710		
MSG			STATUS		

## High Band-edge

# Highest Channel & Modulation : 8DPSK



#### **High Band-edge**

#### Hopping mode & Modulation : 8DPSK





# Highest Channel & Modulation : 8DPSK

r spectrum analyzer - Swe R RL RF 50 ຊ. Center Freq 15.0045		SENSE:IN	Avg	ALIGN OFF	10:44:02 AM Jun 11, 202 TRACE 1 2 3 4 5 TYPE M WWWWW	Frequency
10 dB/div Ref 20.00 d	PNO: Fast ( IFGain:Low JBm	Trig: Free Run #Atten: 30 dB			Ukr1 290.9 kHz -47.61 dBm	Auto Tun
Log 10.0 0.00						Center Free 15.004500 MH
-20.0 -30.0 -40.0					-14.93 dBm	Start Free 9.000 kH
-50.0	สรายของได้ระบัง Terrariation ได้และเป็นอาจาร	nigati in in na divide pasaha i Njago ikub	atal, way in blackwords	nteres d'adra gitt da saya ji set travil name	nt in her weigt fan yn alle argent freshen stroe	Stop Free 30.000000 MH:
Start 9 kHz #Res BW 100 kHz	#VB	W 300 kHz	FUNCTION	Sweep 5.3	Stop 30.00 MHz 333 ms (40001 pts	
1 N 1 f 2 3 4 4 5 9	290.9 kHz	-47.61 dBm	TONCHON			Freq Offse 0 H
6 7 8 9 10 11					~	
MSG		Ш		STATUS	DC Coupled	

Agilent Spectrum Analyzer - Swept					
RE RE 50 Ω A     Center Freq 5.0150000		SENSE:INT	ALIGN OFF	10:44:27 AM Jun 11, 2021 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 🖵 IFGain:Low	Trig: Free Run #Atten: 30 dB		TYPE MWWWWW DET PPPPP	
10 dB/div Ref 20.00 dB			Mkr	5 7.135 62 GHz -40.63 dBm	Auto Tune
10.0 0.00 -10.0				-14.93 dBm	Center Freq 5.015000000 GHz
-20.0 -30.0 -40.0			55		Start Freq 30.000000 MHz
-50.0 -60.0 -70.0					<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 18.	Stop 10.000 GHz 67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.480 13 GHz	Y FUNI 5.94 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 F 2 N 1 F 3 N 1 F 4 N 1 F 5 N 1 F	5.759 76 GHz 6.278 70 GHz 3.175 54 GHz 7.135 62 GHz	-39.92 dBm -40.08 dBm -40.14 dBm -40.63 dBm			<b>Freq Offset</b> 0 Hz
6 7 8 9 9					
				~	
MSG			STATUS		



# Highest Channel & Modulation : 8DPSK



# 8. AC Power-Line Conducted Emissions

## 8.1 Test Setup

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

## 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.

Frequency Range (MHz)	Conducted Limit (dBuV)			
	Quasi-Peak	Average		
0.15 ~ 0.50	66 to 56 *	56 to 46 *		
0.5 ~ 5.0	56	46		
5 ~ 30	60	50		

\* Decreases with the logarithm of the frequency

## 8.3 Test Procedure

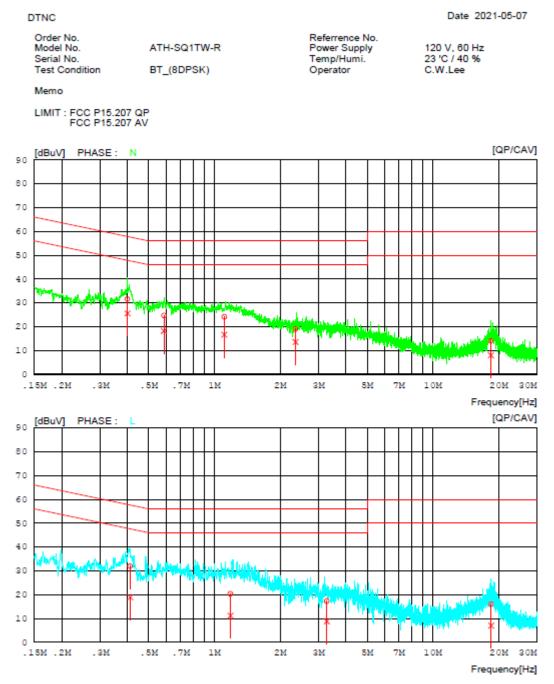
Conducted emissions from the EUT were measured according to the ANSI C63.10.

- 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.
- 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

AC Power-Line Conducted Emissions (Graph) = Modulation : <u>8DPSK</u>

# Results of Conducted Emission



#### AC Power-Line Conducted Emissions (List) = Modulation : <u>8DPSK</u>

# Results of Conducted Emission

DTNC			Date 2021-05-07
Order No. Model No. Serial No. Test Condition	ATH-SQ1TW-R BT_(8DPSK)	Referrence No. Power Supply Temp/Humi. Operator	120 V, 60 Hz 23 'C / 40 % C.W.Lee
Memo			
LIMIT : FCC P15.20 FCC P15.20			
•	READING C.FACTOR QP CAV dBuV][dBuV] [dB]	RESULT LIMIT QP CAV QP CAV [dBuV][dBuV][dBuV]	MARGIN PHASE QP CAV [dBuV][dBuV]
5 18.43214 3 6 0.41116 21 7 1.18427 10 8 3.27037 7	4.72 8.30 9.91 4.07 6.63 10.04 8.88 3.52 10.07 3.53 -2.47 10.45 1.92 8.91 9.92 0.26 1.08 10.05 7.17 -1.38 10.10	31.6025.57       57.86       47.86         24.6318.21       56.00       46.00         24.1116.67       56.00       46.00         18.9513.59       56.00       46.00         13.98       7.98       60.00       50.00         31.8418.83       57.62       47.62         20.3111.13       56.00       46.00         17.27       8.72       56.00       46.00	26.2622.29 N 31.3727.79 N 31.8929.33 N 37.0532.41 N 46.0242.02 N 25.7828.79 L 35.6934.87 L 38.7337.28 L
9 18.47060 5	5.55-3.48 10.38	15.93 6.90 60.00 50.00	44.0743.10 L



# 9. Antenna Requirement

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.

#### **Conclusion: Comply**

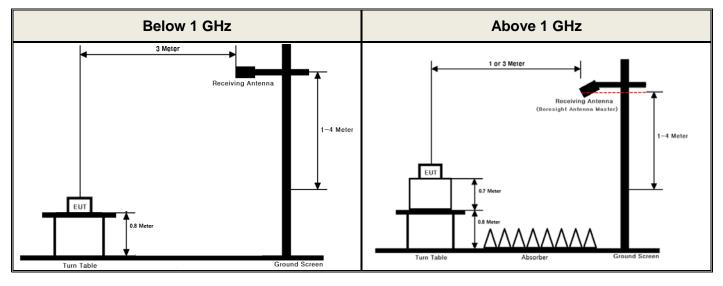
The antenna is attached on the device by means of unique coupling method. Therefore this E.U.T complies with the requirement of Part 15.203.



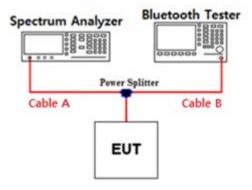
# **APPENDIX I**

#### Test set up diagrams

#### Radiated Measurement



#### Conducted Measurement



#### Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.63	15	6.96
1	6.76	20	7.02
2.402 & 2.441 & 2.480	6.80	25	7.13
5	6.87	-	-
10	6.89	-	-

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

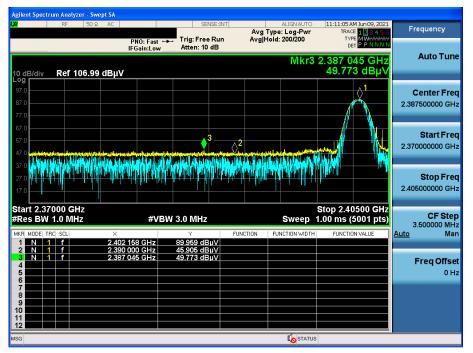


**Detector Mode : PK** 

# **APPENDIX II**

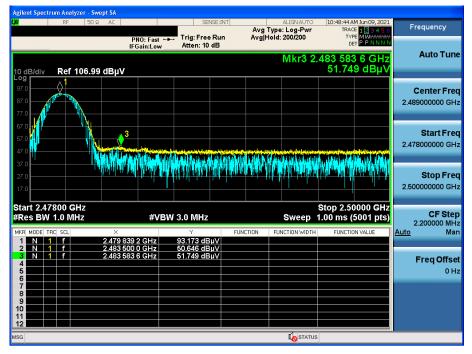
# **Unwanted Emissions (Radiated) Test Plot**

#### GFSK & Lowest & Y & Hor



#### **Detector Mode : PK**

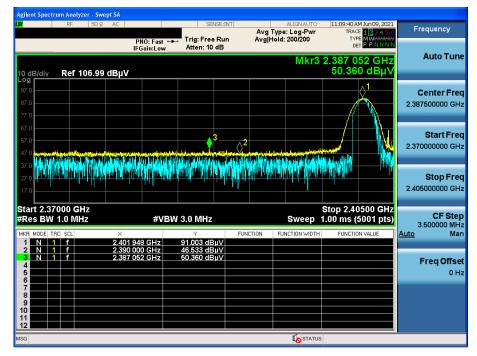
#### GFSK & Highest & Y & Hor





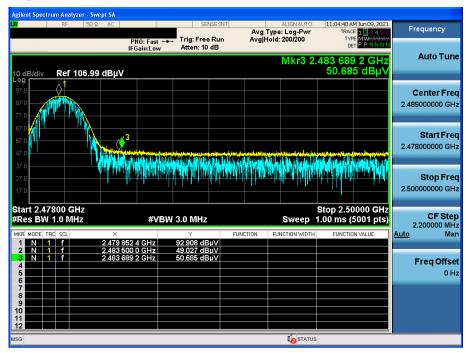
#### Detector Mode : PK

#### $\pi/4DQPSK$ & Lowest & Y & Hor



#### **Detector Mode : PK**

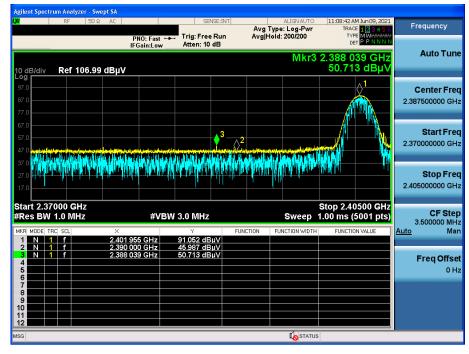
#### $\pi/4DQPSK$ & Highest & Y & Hor





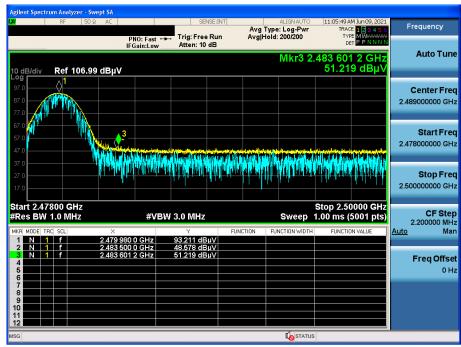
#### **Detector Mode : PK**

#### 8DPSK & Lowest & Y & Hor



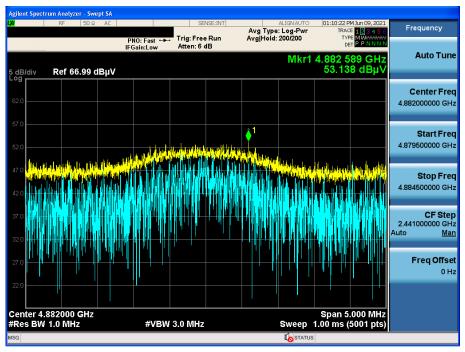
#### **Detector Mode : PK**

# 8DPSK & Highest & Y & Hor





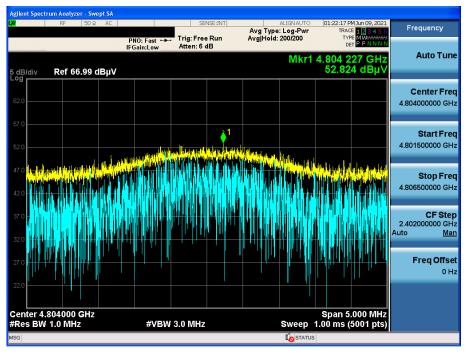
#### GFSK & Middle & Z & Hor



#### $\pi/4DQPSK$ & Lowest & Z & Hor

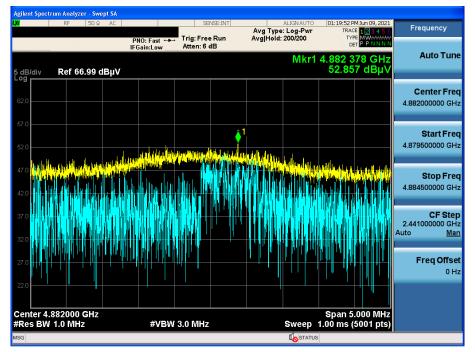
## **Detector Mode : PK**

**Detector Mode : PK** 





#### 8DPSK & Middle & Z & Hor



#### **Detector Mode : PK**