

# Page 39 of 75 Report No.: STS2101092W01

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	DC 3.8V

		Analyzer - Swept SA							
RL	RF	50 Ω AC		S	ENSE:INT	ALIGN A	UTO vg Type: Log-Pv		4 AM Jan 22, 20
enter	Freq	12.5150000	PN	O: Fast 🖵 ain:Low	Trig: Free Run #Atten: 30 dB		vg Type: Log-Pv	vr	TYPE MWWW DET PPPP
dB/di		Offset 4 dB f 16.05 dBm							2.402 GH .053 dB
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art 30									25.00 GH
	0 MHz W 100	kH7		#VBV	V 300 kHz				
les B	W 100			#VBV	V 300 kHz	EUNCTION	ИДТН	Sweep 2.386	
Res B N N N N N N N		×	2.402 GHz 2.552 GHz 4.799 GHz 24.850 GHz		FUNCTIO IBm IBm IBm		MDTH		
es B N N N N	W 100 TRG SCI 1 f 1 f 1 f	×	2.402 GHz 2.552 GHz 4.799 GHz	6.053 c -53.252 c -34.284 c	FUNCTIO IBm IBm IBm		MDTH	Sweep 2.386	
R MODE N N N N N N N	W 100 TRG SCI 1 f 1 f 1 f	×	2.402 GHz 2.552 GHz 4.799 GHz	6.053 c -53.252 c -34.284 c	FUNCTIO IBm IBm IBm		NDTH	Sweep 2.386	
Res B N N N N N N N	W 100 TRG SCI 1 f 1 f 1 f	×	2.402 GHz 2.552 GHz 4.799 GHz	6.053 c -53.252 c -34.284 c	FUNCTIO IBm IBm IBm		MDTH	Sweep 2.386	
Res B N N N N N N N	W 100 TRG SCI 1 f 1 f 1 f	×	2.402 GHz 2.552 GHz 4.799 GHz	6.053 c -53.252 c -34.284 c	FUNCTIO IBm IBm IBm		NDTH	Sweep 2.386	

#### 00 CH

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		nalyzer - Swept SA						1		
enter F	<sub>R</sub> ⊧ req 1	50 Ω AC 2.5150000	PN	IO: Fast	Trig: Free #Atten: 30		ALIGN AUTO Avg Typ	e: Log-Pwr		05 PM Jan 22, 20 TRACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div		Offset 4 dB 16.62 dBm								2.452 GH 6.620 dB
9 52	(	1								
8										
.4										-13.44 (
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art 30 M es BW		kHz		#VB	W 300 kHz			Sw	Sto veep 2.386	p 25.00 G s (1001 p
N 1 N 1 N 1 N 1 N 1	f f	X	2.452 GHz 2.677 GHz 4.874 GHz 24.775 GHz	6.620 -52.499 -35.657 -40.488	dBm dBm dBm	CTION	FUNCTION WIDTH		FUNCTION VALUE	



# 78 CH

		alyzer - Swept SA	•							
RL	RF	50 Ω AC			SENSE:INT		ALIGN AUTO	. <u>.</u>		21 AM Jan 22, 20
enter F	Freq 12	2.5150000	P	PNO: Fast Gain:Low	Trig: Fre #Atten: 3		Avg Type	e: Log-Pwr		TYPE MWWW DET P P P P
dB/div		offset 4 dB 15.57 dBm	n							2.477 GH .569 dBi
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art 30 I										
	/ 100 k		×	#VB	W 300 kH				eep 2.386	
art 30   es BW N N N N	/ 100 k		× 2.477 GHz 3.201 GHz 4.949 GHz 24.800 GHz	#VB 5.569 -53.778 -38.155 -39.179	dBm dBm dBm		FUNCTION WDTH			
art 30 I es BW N N N N	/ 100 k TRC SCL 1 f 1 f 1 f		2.477 GHz 3.201 GHz 4.949 GHz	5.569 -53.778 -38.155	dBm dBm dBm		FUNCTION WIDTH		eep 2.386	
art 30 I les BW R MODE T N 2 N 3 N 5 5 5	/ 100 k TRC SCL 1 f 1 f 1 f		2.477 GHz 3.201 GHz 4.949 GHz	5.569 -53.778 -38.155	dBm dBm dBm		FUNCTION WIDTH		eep 2.386	
art 30   les BW R MODE T N 2 N 3 N	/ 100 k TRC SCL 1 f 1 f 1 f		2.477 GHz 3.201 GHz 4.949 GHz	5.569 -53.778 -38.155	dBm dBm dBm		FUNCTION WIDTH		eep 2.386	o 25.00 GH s (1001 pf



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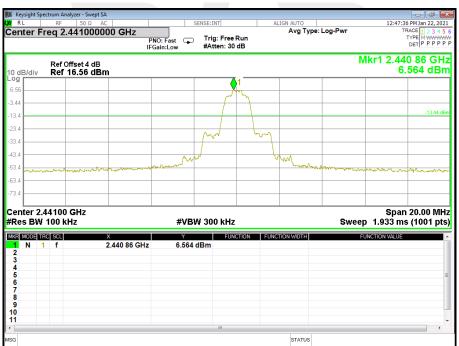


### For Band edge(it's also the reference level for conducted spurious emission)

🊺 Ke	eysight	Spect	rum A	nalyzer - Swept SA									
L <b>XI</b> R			RF	50 Ω AC			SENSE:IN	т	AL	IGN AUTO			16 AM Jan 22, 2021
Cer	nter	Fre	eq 2	2.35350000	0 GHz					Avg Type	: Log-Pwr		TRACE 1 2 3 4 5 6
			· ·			PNO: Fast 🕞		: Free Run en: 30 dB					DET P P P P P
					I	FGain:Low	#Att	en: 30 dB					DEI]: · · · · ·
			Dof	Offset 4 dB								Mkr1 2.40	)1 86 GHz
	B/div			16.25 dBm	ı –							6	.254 dBm
Log													1
6.25													Å
-3.75													
-13.8	-												-13)87 dBm
-23.8													
-33.8													4
-43.8		0	<u>,</u>										
-53.8		$\langle \rangle$	-										w h
-63.8	-		~4LVM	wannedder Lyferthi	have been been	veronerant-organa	en al an	wether and the second second	mound	all and a start of the second s	Josephen and the second s	nasidenti dan mediti	
-73.8													
Sta	rt 2.	300	00	GHz								Stop 2	.40700 GHz
	s B					#VE	SW 300	kHz			Swe		s (1001 pts)
MKR	MODE	TRC	SCL	<b>)</b>	K	Y		FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
1	Ν	1	f		2.401 86 GHz		4 dBm						
2	N	1	f		2.305 56 GHz								
3	N	1	f		2.399 40 GHz								
4	N	1	T	4	2.400 05 GHz	-45.518	aBm						-
6													-
7 8													
8													
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10 11													
1								m					
MSG										STATUS			
										5.A105			

#### 00 CH

39 CH





# 78 CH

		/zer - Swept SA									- ¢
RL	RF	50 Ω AC			SENSE:INT		AL	IGN AUTO Avg Type	log-Pwr	11:36	:52 AM Jan 22, 202 TRACE 1 2 3 4
пцег г	req 2.4	0750000		PNO: Fast C		ree Run		Ang Type	Log-I WI		TYPE M WWW
				IFGain:Low	#Atten	: 30 dB					,
		fset 4 dB							N		9 875 GH
dB/div g	Ref 1	6.10 dBm	າ								6.097 dBr
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	7500 GH				BW 300 k				•		2.50000 GH
		Z		#V							ns (1001 pt
R MODE T	RC SCL		× 479 875 GHz	Y 6.00	97 dBm	FUNCTION	FUNCT	FION WIDTH		FUNCTION VALU	E
N 1	1 f	2.	483 500 GHz	-53.50	2 dBm						
N <sup>·</sup>	1 f 1 f		484 875 GHz 495 825 GHz		9 dBm 5 dBm						
					III			STATUS			۱.



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## For Hopping Band edge

### π/4-DQPSK

	rum Analyzer - Sw								-   7
RL enter Fre	RF 50 Ω	AC 00000 GHz		SENSE:INT	ALIG	AUTO Avg Type:	Log-Pwr	TRA	MJan 22, 202: DE <mark>1 2 3 4 5</mark>
	•		PNO: Fast G	Trig: Free Run #Atten: 30 dB				D	PE M WWWW ET P P P P P
) dB/div	Ref Offset 4 ( Ref 16.13 (						М	kr1 2.401 8 6.1	67 GH 34 dBn
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37									
.9									-13.87 d
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art 2.300 les BW 1			#VB	W 300 kHz			Swee	Stop 2.4 p 9.867 ms (	
R MODE TRC	SCL	X 2.401 867 GH	z 6.134	FUNCTION	FUNCTIO	N WIDTH	F	UNCTION VALUE	
2 N 1 3 N 1 4	f f	2.390 022 GH 2.390 013 GH	z -55.669	dBm					
1				m					•
i						STATUS			

Keysight R L	Spectrum	Analyzer - Swej 50 Ω	AC	SENSE:1	NT	ALIGN AUTO		12:25:5	5 PM Jan 22, 20
enter	Freq	2.48950		O:Fast	g: Free Run iten: 30 dB	Avg Typ	e: Log-Pwr	т	TYPE MWWW DET P P P P
dB/div		f Offset 4 d f 16.03 d					M	kr1 2.479 6	861 GH .029 dBi
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	47900	<u>CH</u> 2						Oton 3	.50000 GI
	47900 W 100			#VBW 30	0 kHz		Swee	p 2.067 m	s (1001 pi
_	TRC SCI	9	X	Y	FUNCTION	FUNCTION WIDTH	ſ	UNCTION VALUE	
N N	1 f 1 f		2.479 861 GHz 2.483 515 GHz	6.029 dBm -52.613 dBm					
N	1 f		2.499 097 GHz	-52.228 dBm					
i i									
3									
)									
									,



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Temperature:	<b>25℃</b>	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	DC 3.8V

	Spectr		alyzer - Swept SA									
RL		RF	50 Ω AC			SENSE:I	NT	AL	IGN AUTO	L	11:44	1:57 AM Jan 22, 20
enter	Fre	q 12	2.5150000	Р	NO: Fast ⊂ Gain:Low		g: Free Run ten: 30 dB		Avg Typ	e: Log-Pwr		TYPE MWWW DET P P P I
			)ffset 4 dB									2.402 GH 3.896 dBi
dB/div	V	Ref	13.90 dBm									3.896 aBI
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art 30 les B			Hz		#V	BW 30	0 kHz			Sw	eep 2.386	op 25.00 GH ð s (1001 pt
R MODE	TRC	SCL	Х		Y		FUNCTION	FUNC	TION WIDTH		FUNCTION VALU	E
N N	1	f		2.402 GHz 2.677 GHz		6 dBm 1 dBm						
Ν	1	f		4.799 GHz	-35.93	8 dBm						
N	1	f		24.800 GHz	-39.74	9 dBm						
							III					Þ
									STATUS			

# 00 CH

## 39 CH

	ht Spect		nalyzer - Swept SA										
RL		RF	50 Ω AC			SE	ENSE:INT		ALIGN				27 AM Jan 22, 202
ente	r Fre	eq 1	2.5150000		PNO: Fast IFGain:Low	Ģ	Trig: Free R #Atten: 30 d			Avg Type	: Log-Pwr		TYPE M WWW DET P P P P
			Offset 4 dB										2.452 GH
) dB/d og 🔽	iv	Ref	14.37 dBm	1								4	.365 dBr
1.37			1										
63													
5.6		_											-13.42 d
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5.6													
art 3 Res E			H7			±\/R\/	V 300 kHz				Sw	Stoj eep 2.386/	p 25.00 GH
					,		FUNC		FUNCTION			FUNCTION VALUE	3 (1001 pt
I N	JE TRC 1	f		2.452 GH	z 4	.365 d		IION	FUNCTION	WUTH		FUNCTION VALUE	
2 N 3 N	1	f		3.176 GH 4.874 GH		.855 d .905 d							
1 N	1	f		24.850 GH		.555 d							
5													
7 3													
ě D													
1													
_							III						Þ
3										STATUS			



# 78 CH

11:49:51 AMJan 22, 20 TRACE 1 2 3 4 TYPE M WWW DET P P P P Ikr1 2.477 GH 3.219 dBi
TYPE MWWW DET P P P P
lkr1 2.477 GH
3.219 dB
-13.95 d
mar hand a serve how
Stop 25.00 GH
2.386 s (1001 pt
ON VALUE
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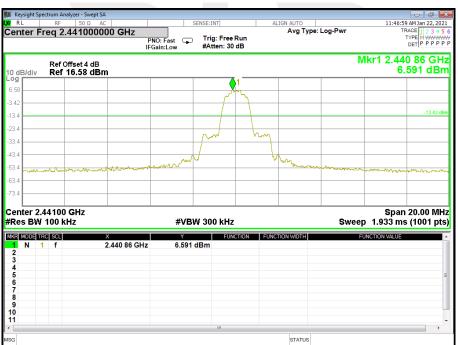


For Band edge(it's also the reference level for conducted spurious emission)

	sight S	pectru		alyzer - Swept SA								
X RL			RF	50 Ω AC			SENSE:INT		ALIGN AUTO			28 AM Jan 22, 2021
Cent	er l	Fred	q 2.	353500000	PN	O: Fast 😱 ain:Low	Trig: Free #Atten: 30		Avg T	/pe: Log-Pwr		TYPE MWWWW DET P P P P I
10 dE	8/div			offset 4 dB 16.25 dBm							Mkr1 2.40 6	01 86 GHz .245 dBm
Log 6.25												<sup>1</sup>
-3.75												$- \wedge$
-13.8												-13 76 dBm
-23.8			_									- N 4
-33.8												/ 4
-43.8		$\langle \rangle^2$										1 1º 1
-63.8	gt an fan s	a Vun	~~~~~	*	an la anter a construction de la construcción de la	e-solor-ageh	ويهونى سريدسى مريعه	himmen	anter antipological and a second	geerlet on Mr.	mentermun	and the second sec
-73.8			_									
 Stari #Res						#VBI	N 300 kHz	:		Swe		2.40700 GHz s (1001 pts)
MKR M	IODE N	TRC S	SCL	× 2.40	1 86 GHz	Y 6.245		ICTION	FUNCTION WIDTH		FUNCTION VALUE	A
3	N N	1	f f	2.39	5 99 GHz 9 30 GHz	-54.244 -52.352	dBm					
4 5 6	N	1	f	2.40	0 05 GHz	-46.160	dBm					
7												
8												
10 11												
∢ ISG	-	-	-				III		STATU	5		•

#### 00 CH

39 CH





## 78 CH





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## For Hopping Band edge

8DPSK

			- Swept SA				SENSE:IN	T		LIGN AUTO				12.2		🖵 💣 📕
enter	Fre	q 2.351		00 GHz		:Fast G	_ Trig	: Free Ru en: 30 dB	n			₋og-Pwr		12.0	TRAC	E 1 2 3 4 5 E M WWWM
dB/div		Ref Offsel Ref 16.1		1									Mk			67 GH 30 dBr
.13																(
87 —															_	
.9															_	-13.87 d
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3.9 <b></b>	national a	tomationalistic	nwww.ueuwa	daaa katalaha	-adolar	yhrahestese	erhentenson	month	-April Marine Starting	be see My Styreds	19-14 <sup>10</sup> /40/90	Malynowllaw	men	mound	have	reden my mit
19																
3.9																
art 2.		00 GHz 00 kHz				#VI	BW 300	kHz				Sw	/eep			0300 GH 1001 pt
art 2. Res B	W 10	00 kHz SCL		×		Y		KHZ	DN FUNC	TION WIDTH	H	Sw			ms (	
art 2. tes B N N N N N N	W 10	00 kHz	2. 2.	x 401 867 G 390 022 G 400 013 G	Hz	4 6.13 -55.53	BW 300 0 dBm 3 dBm 3 dBm		DN FUNC	CTION WIDTH	H	Sw		9.867	ms (	
art 2. Res B N N N N	W 10	00 kHz scl f	2. 2.	401 867 G 390 022 G	Hz	6.13 -55.53	0 dBm 3 dBm		DN FUNC			Sw		9.867	ms (	
art 2. Res B Mode N N N N N N	W 10	00 kHz scl f	2. 2.	401 867 G 390 022 G	Hz	6.13 -55.53	0 dBm 3 dBm		DN FUNC			Sw		9.867	ms (	
art 2. Res B Mode N N N N N N	W 10	00 kHz scl f	2. 2.	401 867 G 390 022 G	Hz	6.13 -55.53	0 dBm 3 dBm		DN FUNC	CTION WIDTH		Sw		9.867	ms (	
art 2. es B N N N	W 10	00 kHz scl f	2. 2.	401 867 G 390 022 G	Hz	6.13 -55.53	0 dBm 3 dBm		DN FUNG	TION WIDT!		Sw		9.867	ms (	

RL	RF	nalyzer - Swept SA 50 Ω AC			SENSE:INT	ALIGN AUTO		12:32:28 PM Jan 22, 20
nter Fi	req 2	.4895000	PI	NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Typ	e: Log-Pwr	TRACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div		Offset 4 dB 16.04 dBn	n				MI	kr1 2.479 861 GI 6.044 dB
4 m	1 V							
								-13.96
	יע							
		hum	$\langle \rangle^2$					
					All a shore a s		Color and a construction	
es BW				#VB	W 300 kHz		Swee	Stop 2.50000 G p   2.067 ms (1001 p
MODE TF	C SCL		X 479 861 GHz	Y 6.044	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE
N 1 N 1	f	2	483 515 GHz 500 000 GHz	-54.545 -53.545	dBm			

A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China Tel: +86-755 3688 6288 Fax:+86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com

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## 5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

	FCC Part 15.247,Subpart C						
Section	Test Item	Limit	FrequencyRange (MHz)	Result			
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS			

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	300KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

### 5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 300KHz, VBW=300KHz, Sweep time = Auto.
- 5.3 TEST SETUP



## 5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### 5.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 3.8V

# Number of Hopping Channel

#### 79

# Hopping channel

			IFGain:Low	#Atten: 3	0 dB				DET P P P P
dB/div	Ref Offset 4 c Ref 16.73 c						MKR	2 2.480 2	43 5 GI 6.19 dB
<sup>9</sup> 73									<b>^</b> 2
	MATATA A	YYYYYYYYY	<u>A A A A A A A A A A A</u>	YVYYYYY	AAAAAAAA	YYYYYYYY	VYYYYYY	www.	MMM
3.3									
.3									
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	00 CH-							Oton 2	19350 0
art 2.400			#VE	3W 300 KH:	z		Swee	Stop 2 p 1.133 m	48350 G s (1001 p
art 2.400 tes BW 3	00 kHz	×	Y	FUI	Z NCTION FUNC	TION WIDTH		Stop 2 p 1.133 ms	48350 G s (1001 p
art 2.400 tes BW 3 R MODE TRO N 1	00 kHz	2.401 920 5 GH	Y 1z 6.25	5 dBm		TION WIDTH		p 1.133 m	48350 G s (1001 p
2 N 1 3	00 kHz		Y 1z 6.25	FUI	_	TION WIDTH		p 1.133 m	48350 G s (1001 p
3 art 2.400 tes BW 3 R MODE TRO N 1 N 1	00 kHz	2.401 920 5 GH	Y 1z 6.25	5 dBm	_	TION WIDTH		p 1.133 m	48350 G s (1001 p
3 art 2.400 kes BW 3 RIMODE ITRO N 1 N 1	00 kHz	2.401 920 5 GH	Y 1z 6.25	5 dBm	_	TION WIDTH		p 1.133 m	48350 G s (1001 p
.3 art 2.400 tes BW 3 R MODE IRC N 1 N 1	00 kHz	2.401 920 5 GH	Y 1z 6.25	5 dBm	_	TION WIDTH		p 1.133 m	48350 G s (1001 p

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# 6. AVERAGE TIME OF OCCUPANCY

### 6.1 LIMIT

	FCC Part 15.247,Subpart C							
Section	Test Item	Limit	FrequencyRange (MHz)	Result				
15.247 (a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS				

#### 6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer.
- b. Set RBW =1MHz/VBW =3MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to e. zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- $\tilde{h}$ . Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is  $3.37 \times 31.6 = 106.6$ .
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is  $5.06 \times 31.6 = 160$ .
- k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 10.12 x 31.6 = 320.

6.3 TEST SETUP



#### 6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



# 6.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	DC 3.8V

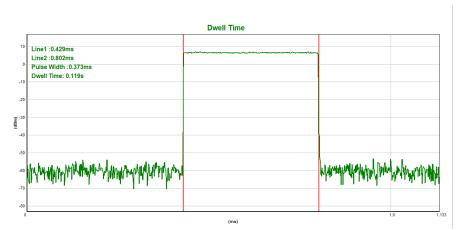
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.373	0.119	0.4
DH3	middle	1.630	0.261	0.4
DH5	middle	2.878	0.307	0.4



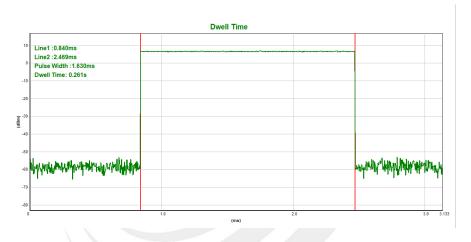
Ш



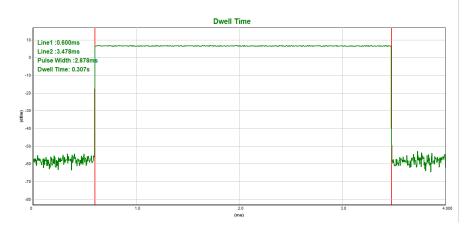
### CH39-DH1



## CH39-DH3







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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 2DH1/2DH3/2DH5	Test Voltage:	DC 3.8V

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.382	0.122	0.4
2DH3	middle	1.638	0.262	0.4
2DH5	middle	2.888	0.308	0.4



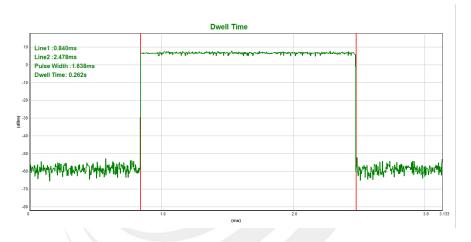
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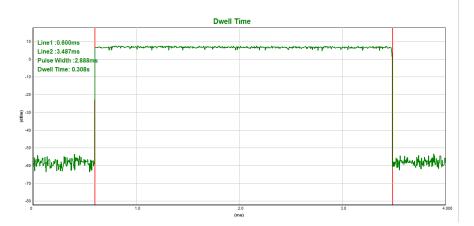
#### CH39-2DH1



### CH39-2DH3



#### CH39-2DH5





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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps)– 3DH1/3DH3/3DH5	Test Voltage:	DC 3.8V

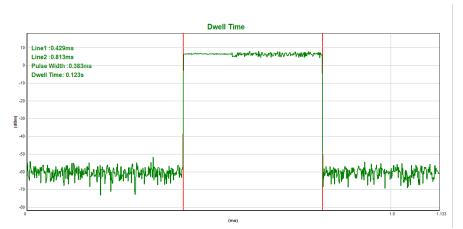
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.383	0.123	0.4
3DH3	middle	1.632	0.261	0.4
3DH5	middle	2.887	0.308	0.4



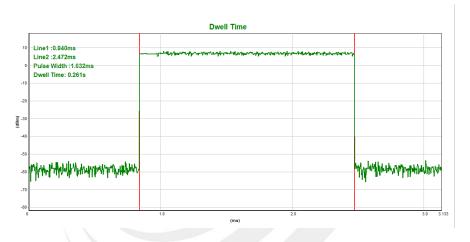
Shenzhen STS Test Services Co., Ltd.



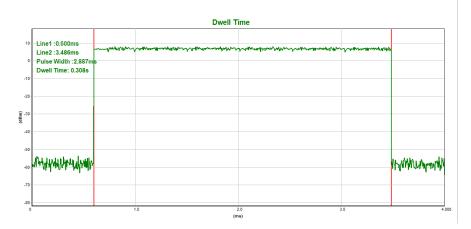
#### CH39-3DH1



### CH39-3DH3







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# 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

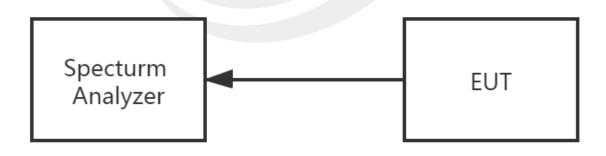
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 20 dB Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

### 7.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
- b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
- c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for channel separation measurement.

## 7.3 TEST SETUP



# 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



## 7.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
LOCT MINDAD.	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	DC 3.8V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.837	2402.836	0.999	0.887	Complies
2441 MHz	2440.834	2441.836	1.002	0.885	Complies
2480 MHz	2478.984	2479.899	0.915	0.887	Complies

For GFSK: Ch. Separation Limits: > 20dB bandwidth

#### CH00 -1Mbps

R L RF	50 Ω AC	SENSE:PULSE	ALI	GNAUTO	08:20:59 AM Feb 02, 20
enter Freq 2.4			Free Run n: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 TYPE MWWWW DET P P P P
dB/div Ref 1	ffset 0.5 dB   <b>5.24 dB</b> m				Mkr2 2.402 836 GF 5.817 dB
24		mannal		2 Maran M	
.8		\/```	man		man
.8	and				
.8 ~~~~~					
.8					
nter 2.402500 es BW 30 kHz		#VBW 100	kHz	Swe	Span 3.000 M eep   3.200 ms (1001 pt
MODE TRC SCL N 1 f N 1 f	× 2.401 837 GHz 2.402 836 GHz	5.24 dBm 5.82 dBm	FUNCTION FUNCT	ON WIDTH	FUNCTION VALUE
					>

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#### CH39 -1Mbps



#### CH78 -1Mbps



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Temperature:	25℃	Relative Humidity:	50%
LOCT IVIODO.	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	DC 3.8V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.837	2402.833	0.996	0.839	Complies
2441 MHz	2440.834	2441.833	0.999	0.837	Complies
2480 MHz	2478.834	2479.833	0.999	0.837	Complies

For  $\pi$ /4-DQPSK(2Mbps): Ch. Separation Limits: > two-thirds 20dB bandwidth

PRU: Wide #Atten: 30 dB 0e IFGain:Low #Atten: 30 dB 0e Ref Offset 0.5 dB Mkr2 2.402 8	M Feb 02, 20
A BIAIV   Ref 12.79 dBm   5.86     99   1   2     72   7   7     7   7   7     7   7   7   7	CE 1 2 3 4 PE MWWW ET P P P P
72 72 72   72 72	133 GH 61 dB
1 1 1 1 1 1   1 1 1 1 1 1 1   1 1 1 1 1 1 1   1 1 1 1 1 1 1   2 1 1 1 1 1 1   2 1 1 1 1 1 1   2 1 1 1 1 1 1   2 1 1 1 1 1 1   3 1 1 1 2.402 833 GHz 5.86 dBm	$\sqrt{m}$
X     X     Y     FUNCTION     FUNCTION	
X2     X2     X2     Span 3/ Sweep 3.200 ms (1       Enter 2.402500 GHz Res BW 30 kHz     #VBW 100 kHz     Sweep 3.200 ms (1       Signade Trac Sci     X     Y     Function       In N     1     f     2.402 833 GHz     4.98 dBm       N     1     f     2.402 833 GHz     5.86 dBm       3     1     f     2.402 833 GHz     5.86 dBm	
X     Y     FUNCTION VALUE       IN     1     f     2.402 833 GHz     4.98 dBm       2     X     f     2.402 833 GHz     FUNCTION VALUE	
Kes BW 30 kHz     #VBW 100 kHz     Sweep     3.200 ms (1       G Model Trig Set     X     Y     Function     Function value       1     N     1     f     2.401 837 GHz     4.98 dBm     Function value       2     N     1     f     2.402 833 GHz     5.86 dBm     Function value       3     4     4     5.86 dBm     5.86 dBm     Function value	
1 N 1 f 2.401 837 GHz 4.98 dBm 2 N 1 f 2.402 833 GHz 5.86 dBm 3 4	.000 MI 1001 pt
5	
	>

#### CH00 -2Mbps



#### CH39 -2Mbps



#### CH78 -2Mbps



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Temperature:	25℃	Relative Humidity:	50%
LOCT MINDAD.	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	DC 3.8V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.837	2402.836	0.999	0.841	Complies
2441 MHz	2441.011	2442.007	0.996	0.841	Complies
2480 MHz	2478.831	2479.848	1.017	0.843	Complies

For 8DPSK(3Mbps):Ch. Separation Limits: > two-thirds 20dB bandwidth

CH00 -3Mbps

RL RF	50 Ω AC	SENSE:PUL:	8	ALIGNAUTO			AM Feb 02, 202
arker 2 2.402	836000000 GHz P IF	NO: Wide 😱 Trig Gain:Low #Att	: Free Run en: 30 dB	Avg Type:	Log-Pwr		ACE 1 2 3 4 5 TYPE M MANANA DET P P P P P
dB/div Ref 1	ffset 0.5 dB I <b>3.14 dBm</b>				Mk	r2 2.402 4.	836 GH 210 dBr
.14	<u>\</u>	2000		2	0.0		<u>^</u>
.86	- my m	- v v hm	$\sim$	mar and a second	Vym	$\sim$	
6.9							
5.9							
5.9							
i.9							
5.9							
5.9							
enter 2.402500 Res BW 30 kH		#VBW 10	) kHz		Sweep	Span 3.200 ms	3.000 MH (1001 pt
r mode tro scl 1 N 1 f	× 2.401 837 GHz	4.04 dBm	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE	
2 N 1 f	2.402 836 GHz	4.21 dBm					
4 5 5							
5 7 3							
9							
í							>
				STATUS			

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#### CH39 -3Mbps

RF	50 Ω AC	SEN	ISE:PULSE	ALIGNAUTO		08:43:55	5 AM Feb 02, 20
ter Freq 2.4	41500000 GHz	PNO: Wide IFGain:Low	Trig: Free Run #Atten: 30 dB	Аvg Туре	: Log-Pwr	T	RACE 1 2 3 4 TYPE MWWWW DET P P P P
	set 0.5 dB 2.71 dBm				MI	(r2 2.442 2.	007 GF 851 dB
		{1		2			
Ima a	0	mon	). (m)	mon	m		
V VV	man man	*	Mar Marine	www.	- Arran	www	
ter 2.441500	CH2					Snan	3.000 MH
s BW 30 kHz	Griz	#VBV	V 100 kHz		Sweep	3.200 ms	
MODE TRC SCL	× 2.441 011 GH	r 1z 3.02	FUNCTION	FUNCTION WIDTH	FL	INCTION VALUE	
N 1 f	2.442 007 GH						

#### CH78 -3Mbps



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# 8. BANDWIDTH TEST

## 8.1 LIMIT

FCC Part15 15.247,Subpart C					
Section	ection Test Item Limit FrequencyRange (MHz) Result				
15.247 (a)(1)	Bandwidth	N/A	2400-2483.5	PASS	

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### 8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

#### 8.3 TEST SETUP



## 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



## **8.5 TEST RESULTS**

Temperature:	25℃	Relative Humidity:	50%
	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	DC 3.8V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8869	PASS
2441 MHz	0.8851	PASS
2480 MHz	0.8865	PASS

### CH00 -1Mbps

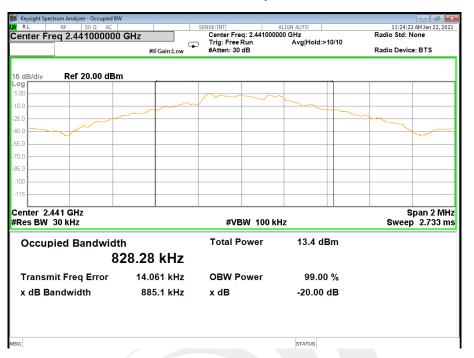
🍺 Keysight Spectrum Analyzer - Occupied BW	1			- 6 -
α RL RF 50 Ω AC			ALIGN AUTO	11:21:39 AM Jan 22, 2021
Center Freq 2.402000000	GHz	Center Freq: 2.402000		Radio Std: None
	#IFGain:Low	─ Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
15 dB/div Ref 20.00 dBm	<u>،</u>			
5.00				
-10.0				
-25.0				~
-40.0				
-55.0				~
-70.0				
-85.0				
-100				
-115				
Center 2.402 GHz				Span 2 MHz
#Res BW 30 kHz		#VBW 100 k	Hz	Sweep 2.733 ms
Occupied Bandwidt	h	Total Power	13.0 dBm	
	 28.23 kHz			
0,	20.25 KHZ			
Transmit Freq Error	14.271 kHz	OBW Power	99.00 %	
x dB Bandwidth	886.9 kHz	x dB	-20.00 dB	
MSG			STATUS	

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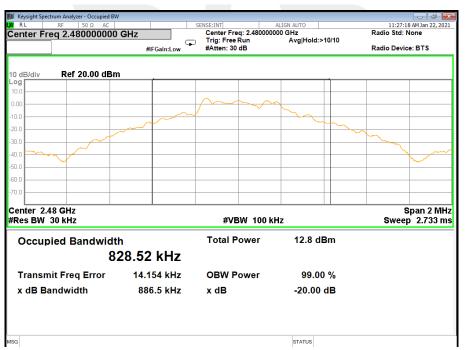


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#### CH39 -1Mbps



#### CH78 -1Mbps



Shenzhen STS Test Services Co., Ltd.



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Temperature:	25℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	DC 3.8V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.258	PASS
2441 MHz	1.255	PASS
2480 MHz	1.256	PASS

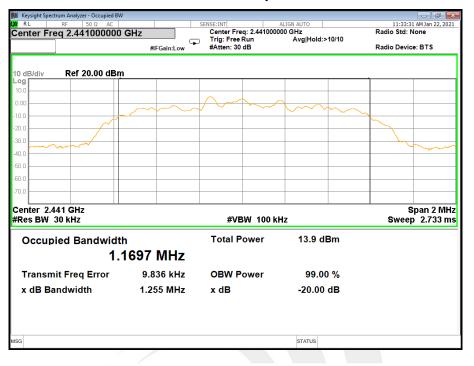
## CH00 -2Mbps

📕 Keysight Spectrum Analyzer - Occupied BW				
X RL RF 50 Ω AC Center Freq 2.402000000 0	20-	SENSE:INT Center Freq: 2.4020000	ALIGN AUTO	11:30:43 AM Jan 22, 2021 Radio Std: None
Center Fred 2.40200000	G	Trig: Free Run	Avg Hold:>10/10	
	#IFGain:Low	#Atten: 30 dB		Radio Device: BTS
15 dB/div Ref 20.00 dBm				
5.00				
-10.0			$\sim\sim\sim\sim$	~
-25.0				
-40.0				
-55.0				
-70.0				
-85.0				
-100				
-115				
Center 2.402 GHz		1		Span 2 MHz
#Res BW 30 kHz		#VBW 100 kl	Hz	Sweep 2.733 ms
Occupied Bandwidth		Total Power	13.5 dBm	
			10.0 0011	
1.1	698 MHz			
Transmit Freq Error	9.983 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.258 MHz	x dB	-20.00 dB	
	1.230 MITZ	X UB	-20.00 UB	
MSG			STATUS	

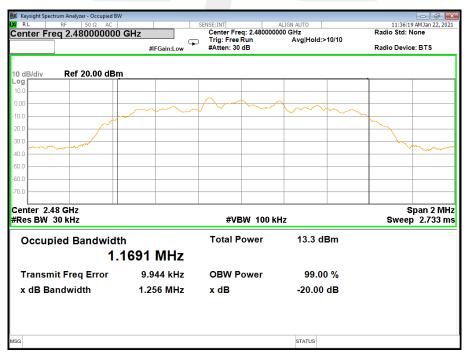
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#### CH39 -2Mbps



#### CH78 -2Mbps





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Temperature:	25℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	DC 3.8V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.262	PASS
2441 MHz	1.261	PASS
2480 MHz	1.264	PASS

### CH00 -3Mbps

Keysight Spectrum Analyzer - Occupier				
RL RF 50 Ω AC Center Freq 2.4020000		SENSE:INT Center Freq: 2.4020000	ALIGN AUTO	11:43:55 AM Jan 22, 2021 Radio Std: None
	#IFGain:Low	<b>T</b> ( <b>C C C C C</b>	Avg Hold:>10/10	Radio Device: BTS
5 dB/div Ref 20.00 d	Bm			
.og 5.00				
10.0			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~
5.0				
0.0				
5.0				
0.0				
5.0				
00				
115				
enter 2.402 GHz				Span 2 MHz
Res BW 30 kHz		#VBW 100 ki	HZ	Sweep 2.733 ms
Occupied Bandwi	dth	Total Power	13.2 dBm	
	1.1643 MHz			
Transmit Freq Error	24.926 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.262 MHz	x dB	-20.00 dB	
G			STATUS	

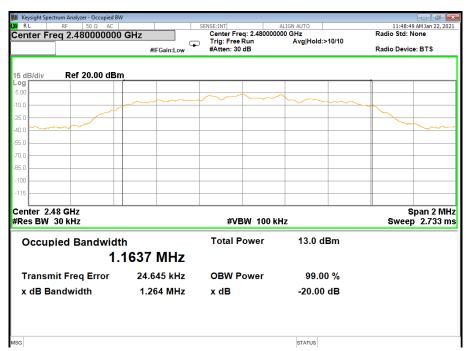
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#### CH39 -3Mbps

	50 Ω AC	CUa	SENSE:INT Center Freg: 2.4410000	ALIGN AUTO	11:46:31 AM Jan 22, 2021 Radio Std: None
enter Freq 2.44	1000000	#IFGain:Low	Talas Francis	Avg Hold:>10/10	Radio Device: BTS
5 dB/div Ref 2	20.00 dBm				-
5.00					
10.0		~~~~~~			
25.0					
10.0					
55.0					
70.0					
35.0					
-100					
-115					
Center 2.441 GHz #Res BW 30 kHz			#VBW 100 k	Hz	Span 2 MHz Sweep 2.733 ms
Occupied Ba	ndwidth		Total Power	13.6 dBm	
		634 MHz			
Transmit Freq	Error	24.409 kHz	OBW Power	99.00 %	
x dB Bandwid	th	1.261 MHz	x dB	-20.00 dB	

#### CH78 -3Mbps



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# 9. OUTPUT POWER TEST

### 9.1 LIMIT

FCC Part 15.247,Subpart C						
Section	Test Item	Limit	Frequency Range (MHz)	Result		
		1 W or 0.125W				
15.247 (a)(1)&(b)(1)	Output Power	if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS		

### 9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

- a) Use the following spectrum analyzer settings:
- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

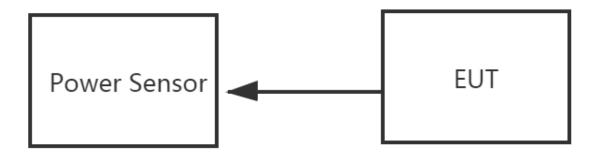
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



## 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

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### 9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 3.8V		

Mode	Channel Frequenc Number (MHz)	Frequency	Peak Power	Average Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
GFSK(1M)	0	2402	6.77	2.81	30.00
	39	2441	6.86	2.76	30.00
	78	2480	6.80	2.89	30.00

Note: the channel separation >20dB bandwidth

Mode	Channel Frequenc Number (MHz)	Frequency	Peak Power	Average Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
π/4-DQPSK( 2M)	0	2402	6.65	2.23	20.97
	39	2441	6.75	2.77	20.97
	78	2480	6.70	2.64	20.97

Note: the channel separation >2/3 20dB bandwidth

	Channel Frequency Number (MHz)		Peak Power	Average Power	Limit
		(dBm)	(dBm)	(dBm)	
8-DPSK(3M)	0	2402	6.65	2.59	20.97
	39	2441	6.73	2.77	20.97
	78	2480	6.67	2.78	20.97

Note: the channel separation >2/3 20dB bandwidth

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## 10. ANTENNA REQUIREMENT

### **10.1 STANDARD REQUIREMENT**

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

### 10.2 EUT ANTENNA

The EUT antenna is PIFA Antenna. It comply with the standard requirement.



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## **APPENDIX-PHOTOS OF TEST SETUP**

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

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



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