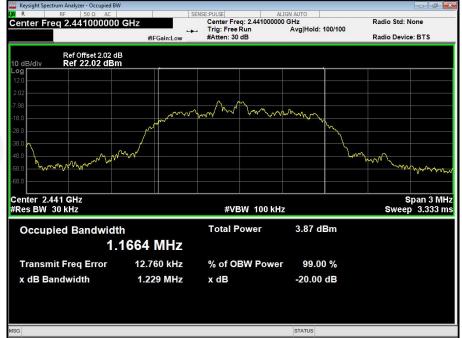


Project No.: ZKT-2111015861E Page 51 of 78

π/4-DQPSK Low Channel



π/4-DQPSK Middle Channel

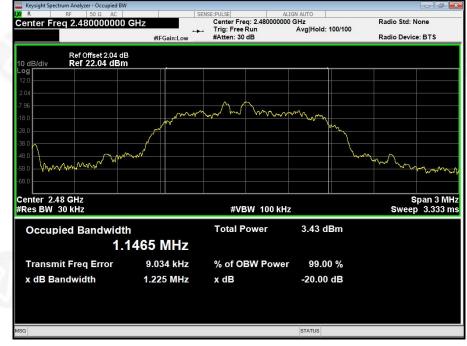








π/4-DQPSK High Channel







8-DPSK Low Channel





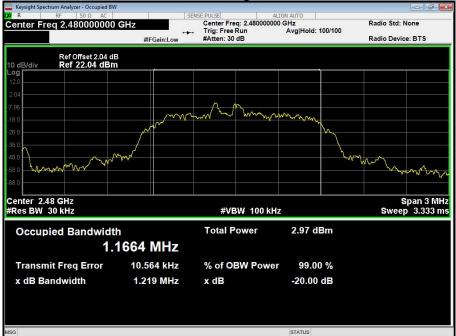


Project No.: ZKT-2111015861E Page 54 of 78

8-DPSK Middle Channel



8-DPSK High Channel









8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	FCC:20.97 dBm

8.1 Block Diagram Of Test Setup



8.2 Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W.

8.3 Test procedure

- 1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
- 2. Set the spectrum analyzer: RBW = 2MHz. VBW =6MHz. Sweep = auto; Detector Function = Peak.
- 3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.4 DEVIATION FROM STANDARD

No deviation.

8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	FCC Limit (dBm)	Result
	Lowest	-1.541		
GFSK	Middle	-1.933	30.00	Pass
55	Highest	-2.661		
	Lowest	-0.634		
π/4-DQPSK	Middle	-1.074	21.00	Pass
	Highest	-1.775		
	Lowest	-1.548		
8-DPSK	Middle	-2.037	21.00	Pass
	Highest	-2.795		

Shenzhen ZKT Technology Co., Ltd.

1/F, No. 101, Building B, No. 6, Tangwel Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

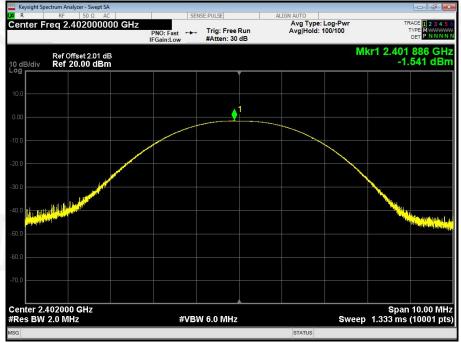
www.zkt-lab.com

F

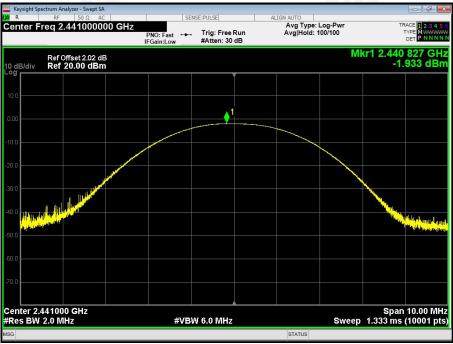


Test plots

GFSK Low Channel



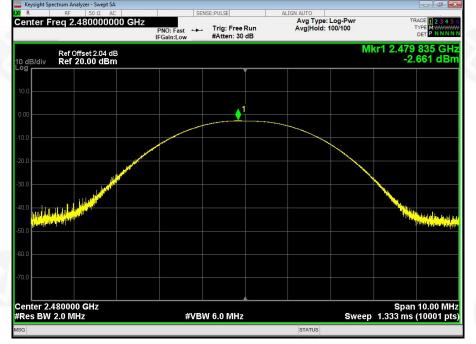
GFSK Middle Channel



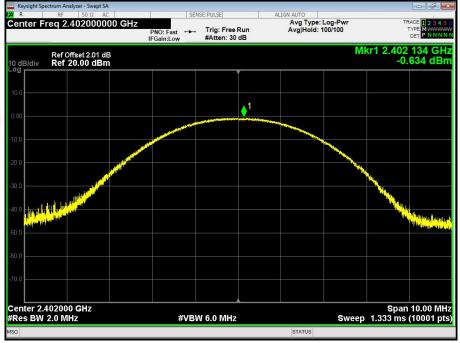




GFSK High Channel



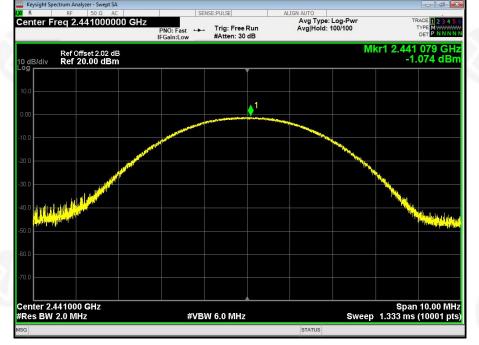
π/4-DQPSK Low Channel



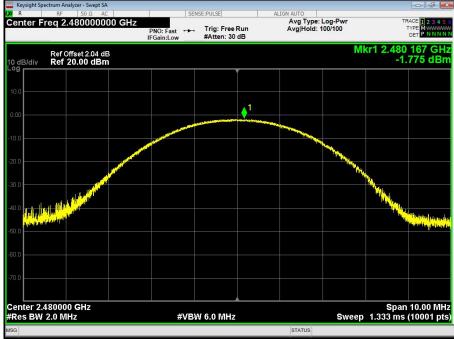




π/4-DQPSK Middle Channel



π/4-DQPSK High Channel



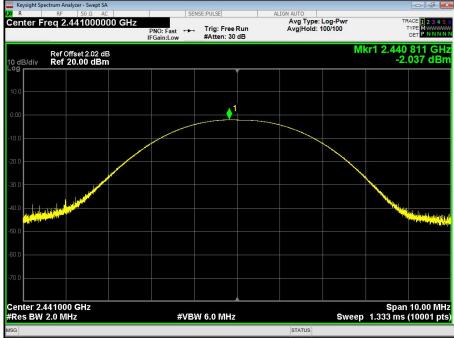




8-DPSK Low Channel



8-DPSK Middle Channel

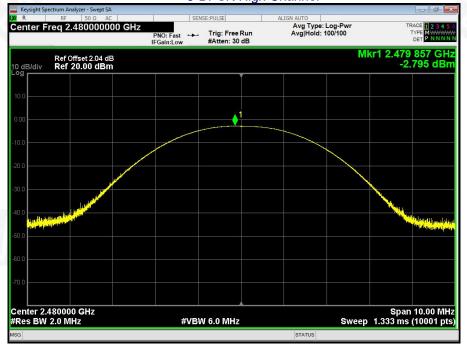


















9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	GFSK: 20dB bandwidth $\pi/4$ -DQPSK & 8DSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

9.1 Test Setup

EUT	SPECTRUM
523-0054 x	ANALYZER

9.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port

to the spectrum.

2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

9.3 DEVIATION FROM STANDARD No deviation.

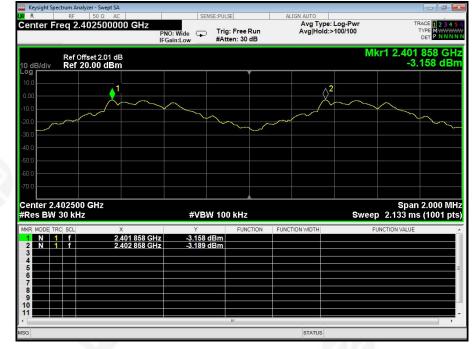






Modulation	Test Channel	Separation (MHz)	Limit(MHz)	Result
GFSK	Low	1.000	0.869	PASS
GFSK	Middle	0.998	0.873	PASS
GFSK	High	1.000	0.853	PASS
π/4-DQPSK	Low	0.998	0.833	PASS
π/4-DQPSK	Middle	0.998	0.819	PASS
π/4-DQPSK	High	1.000	0.817	PASS
8-DPSK	Low	1.000	0.824	PASS
8-DPSK	Middle	0.998	0.838	PASS
8-DPSK	High	1.000	0.813	PASS

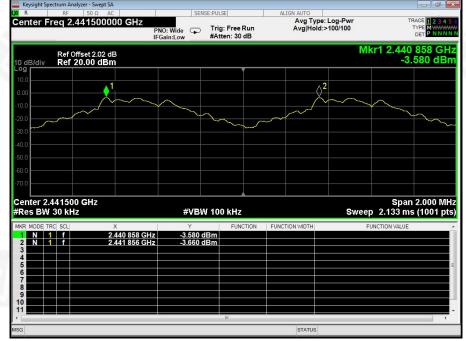
Test plots GFSK Low Channel



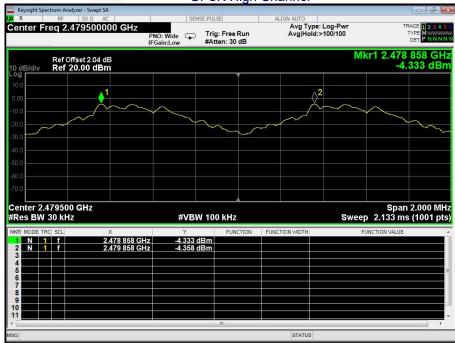




GFSK Middle Channel



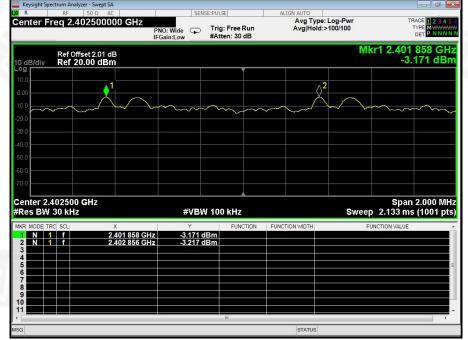
GFSK High Channel



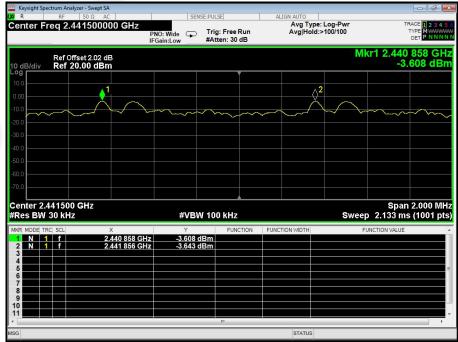




π/4-DQPSK Low Channel



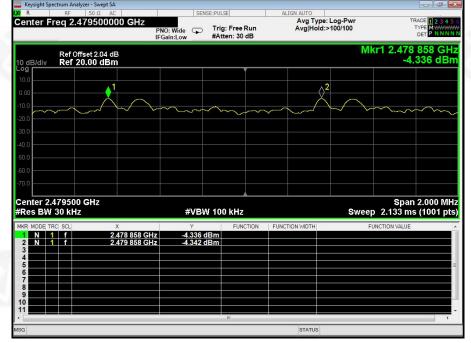
$\pi/4$ -DQPSK Middle Channel



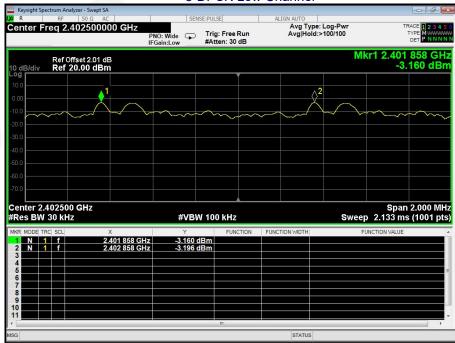




π/4-DQPSK High Channel



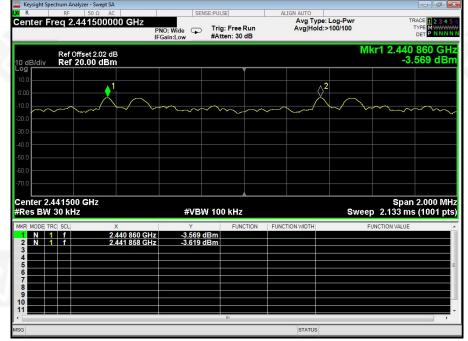
8-DPSK Low Channel



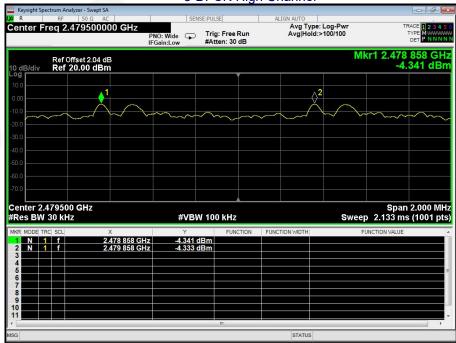




8-DPSK Middle Channel



8-DPSK High Channel







10.NUMBER OF HOPPING FREQUENCY

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels

10.1 Test Setup

EUT	SPECTRUM
	ANALYZER

10.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD

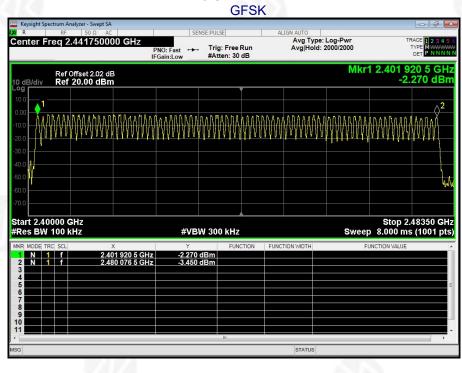
No deviation.







Test Plots: 79 Channels in total











π/4-DQPSK SENSE:PULSE Avg Type: Log-Pwr Avg|Hold: 2000/2000 eq 2.441750000 GH Center F PNO: Fast ↔→ IFGain:Low Trig: Free Run #Atten: 30 dB TYPE Mkr1 2.401 586 5 GHz -7.791 dBm Ref Offset 2.02 dB Ref 20.00 dBm Start 2.40000 GHz #Res BW 100 kHz Stop 2.48350 GHz Sweep 8.000 ms (1001 pts) #VBW 300 kHz 2.401 586 5 GHz 2.480 327 0 GHz -7.791 dBm -7.898 dBm N 1 f N 1 f STATUS

8-DPSK

R RF 50 Ω	AC AC	SENSE:PL	JLSE	ALIGN AUTO		
enter Freq 2.441750	P		ig: Free Run tten: 30 dB		be: Log-Pwr d: 2000/2000	TRACE 1 2 3 4 TYPE M WWW DET P N N N
Ref Offset 2.02 dB/div Ref 20.00 dl					Mkr	1 2.402 004 0 GH -3.274 dB
°g						
a.o	MANNAN	Markelly	hryphyde	MANA MALAN	h hand the	hpharpharry ²
0.0						
0.0						
0.0						4
		#VBW 30	00 kHz		Sweet	Stop 2.48350 GH 8.000 ms (1001 pt
Res BW 100 kHz	X	Y	FUNCTION	FUNCTION WIDTH		Stop 2.48350 GH 8.000 ms (1001 pt UNCTION VALUE
Res BW 100 kHz kr mode trc scl 1 N 1 f 2	X 2.402 004 0 GHz 2.480 494 0 GHz		FUNCTION	FUNCTION WIDTH		o 8.000 ms (1001 pt
2 N 1 f 2 3 4 5 6	2.402 004 0 GHz	-3.274 dBm	FUNCTION	FUNCTION WIDTH		o 8.000 ms (1001 pt
Res BW 100 kHz kr Mode trcl scl 1 N 1 f 2 2 N 1 f 2 3 4 4 5 5 6 6 6 6 6 8 9 6 6 6	2.402 004 0 GHz	-3.274 dBm	FUNCTION	FUNCTION WIDTH		o 8.000 ms (1001 pt
Res BW 100 kHz kr Mode Trcl scl. 1 N 1 f 2 2 N 1 f 2 3 4 5 5 5	2.402 004 0 GHz	-3.274 dBm	FUNCTION	FUNCTION WIDTH		o 8.000 ms (1001 pt

Shenzhen ZKT Technology Co., Ltd. 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

8

+86-755-2233 6688



11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second

11.1 Test Setup

EUT	SPECTRUM
	ANALYZER

11.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set spectrum analyzer span = 0Hz;

3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

11.3 DEVIATION FROM STANDARD

No deviation.







11.4 Test Result

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	125.44	400	Pass
2441MHz	DH3	263.84	400	Pass
2441MHz	DH5	309.65	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2441MHz time slot= $0.392(ms)^{*}(1600/(2^{*}79))^{*}31.6=125.44ms$

CH:2441MHz time slot=1.649(ms)*(1600/ (2*79))*31.6=263.84ms

CH:2441MHz time slot=2.903(ms) (1600/ (4 79)) 31.6=309.65ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	2DH1	127.04	400	Pass
2441MHz	2DH3	264.64	400	Pass
2441MHz	2DH5	309.97	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2441MHz time slot= $0.397(ms)^{*}(1600/(2^{*}79))^{*}31.6=127.04ms$

CH:2441MHz time slot=1.654(ms)*(1600/ (4*79))*31.6=264.64ms

CH:2441MHz time slot=2.906(ms)*(1600/ (6*79))*31.6=309.97ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	3DH1	127.68	400	Pass
2441MHz	3DH3	264.48	400	Pass
2441MHz	3DH5	309.76	400	Pass

Remarks:

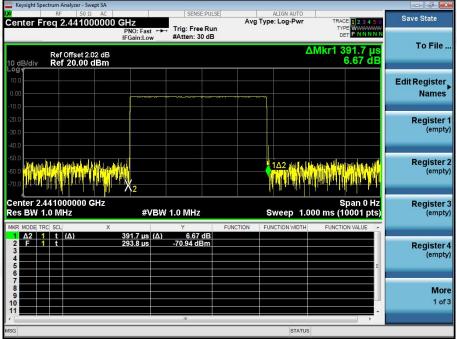
The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2441MHz time slot=0.399(ms)*(1600/ (2*79))*31.6=127.68ms CH:2441MHz time slot=1.653(ms)*(1600/ (4*79))*31.6=264.48ms CH:2441MHz time slot=2.904(ms)*(1600/ (6*79))*31.6=309.76ms





Test Plots

GFSK DH1 2441MHz



GFSK DH3 2441MHz

Keysight Spectrum Anal							- 7 ×
× RF Center Freq 2.4	50 Ω AC 41000000 G	SHz	SENSE:PULS	Avg Type	ALIGN AUTO e: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWW	Frequency
	fset 2.02 dB 0.00 dBm	PNO: Fast ++ IFGain:Low	#Atten: 30 dB		Δ	/kr1 1.649 ms -1.72 dB	Auto Tune
10.0 0.00 -10.0							Center Free 2.441000000 GH
-20.0							Start Fre 2.441000000 GH
-60.0 -60.0 -70.0		X2					Stop Fre 2.441000000 GH
Center 2.441000 Res BW 1.0 MHz		#VBW	/ 1.0 MHz		weep 3.00	Span 0 Hz 00 ms (10001 pts)	CF Ste 1.000000 MH <u>Auto</u> Ma
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.649 ms (Δ) 843.9 μs	-1.72 dB -61.64 dBm			E	Freq Offse 0 H
7 8 9 10							Scale Type
			m				
MSG					STATUS		





GFSK DH5 2441MHz

Keysight Spectrum Analyzer - Swept SA			
Center Freq 2.441000000	PNO: Fast +++ Irig: Free Run	TY	E 123455 WWWWWWW F NNNNN
Ref Offset 2.02 dB 0 dB/div Ref 20.00 dBm	IFGain:Low #Atten: 30 dB	ΔMkr1 2	903 ms 0.23 dB
0.00			Center Fre 2.441000000 GH
20.0			Start Fre 2.441000000 GH
			Stop Fre
enter 2.441000000 GHz les BW 1.0 MHz	#VBW 1.0 MHz	Sweep 4.000 ms (1	pan 0 Hz 0001 pts) NVALUE A
Δ2 1 t (Δ) 2 F 1 t 3 - - - 4 - - - 5 - - - 6 - - -	2.903 ms (Δ) 0.23 dB 302.8 μs -61.73 dBm		Freq Offs
7 8 9 10			Log L
56	UI.	STATUS	

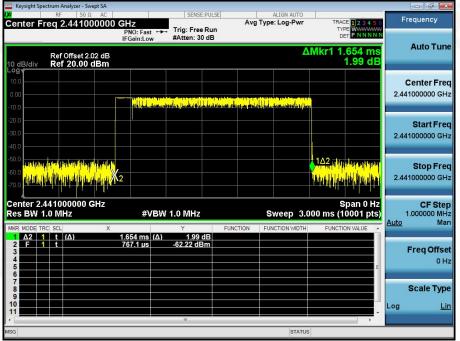
π/4-DQPSK 2DH1 2441MHz

Keysight Spectrum Analyzer - Swept SA				
Center Freq 2.441000000		Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE WWWWWW	Frequency
Ref Offset 2.02 dB	PNO: Fast ++ Trig: Free Run IFGain:Low #Atten: 30 dB	· · · · · · · · · · · · · · · · · · ·	ΔMkr1 396.8 μs 2.35 dB	Auto Tune
10.0 0.00 -10.0		vy dly day water day ye day a say t		Center Fred 2.441000000 GHz
-20.0				Start Free 2.441000000 GH:
-60.0 -60.0 Apply (11) (11) (11) (11) (11) (11) (11) (11		12 		Stop Fred 2.441000000 GH:
Center 2.441000000 GHz Res BW 1.0 MHz MKR MODE TRC SCL X	#VBW 1.0 MHz	Sweep 1.0	Span 0 Hz 000 ms (10001 pts) FUNCTION VALUE	CF Step 1.000000 MH <u>Auto</u> Mar
1 Δ2 1 t (Δ) 2 F 1 t 3 3 - - - - 4 - - - - 5 - - - - - 6 - - - - -	396.8 µs (Δ) 2.35 dB 369.6 µs -65.34 dBm		E	Freq Offse 0 H
7 8 9 10 11				Scale Type Log <u>Li</u> i
MSG		STATUS		

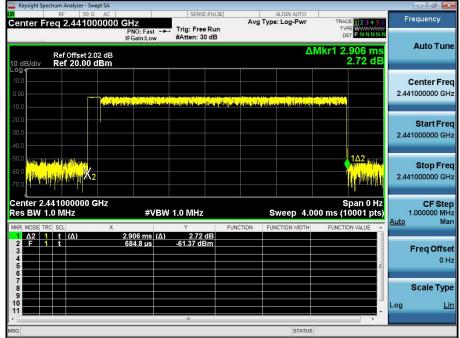




π/4-DQPSK 2DH3 2441MHz



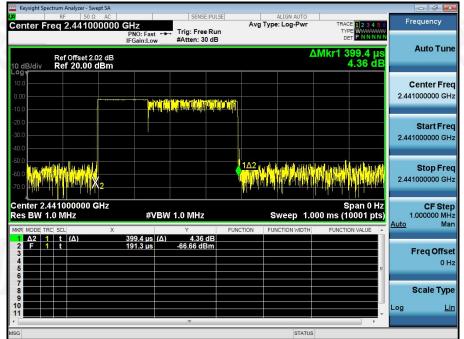
π/4-DQPSK 2DH5 2441MHz







8-DPSK 3DH1 2441MHz



8-DPSK 3DH3 2441MHz

Keysight Spectrum Analyzer - Swept SA			
enter Freg 2.441000000	GHz SENSE:PULS	ALIGN AUTO Avg Type: Log-Pwr	TRACE 2 3 4 5 6 Frequency
Ref Offset 2.02 dB	PNO: Fast +++ Trig: Free Run IFGain:Low #Atten: 30 dB	ΔMkr	TYPE WWWWWWWWW DET PINNNN 1 1.653 ms -3.48 dB
- 0g v 10.0 0.00			Center Fre 2.44100000 GH
20.0 30.0 40.0			Start Fre 2.44100000 GH
			Stop Fre 2.44100000 GF
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 1.0 MHz	Sweep 3.000 m	Span 0 Hz is (10001 pts) UNCTION VALUE
1 Δ2 1 t (Δ) 2 F 1 t 3 3 4 5 5 6 <td>1.653 ms (Δ) -3.48 dB 626.1 μs -61.68 dBm</td> <td></td> <td>Freq Offs</td>	1.653 ms (Δ) -3.48 dB 626.1 μs -61.68 dBm		Freq Offs
7 8 9 10			Scale Typ
<	m	STATUS	Þ

Shenzhen ZKT Technology Co., Ltd. 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

8





8-DPSK 3DH5 2441MHz

RF 50 Ω AC		SENSE:PULSE	ALIGN AUTO		
nter Freg 2.441000000	GHz	[JENSE POLSE]	Avg Type: Log-Pwi	TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast +	Trig: Free Run #Atten: 30 dB	• ,, • •	TYPE WWWWWWW DET P N N N N N	
	IFGain:Low	#Atten: 30 dB			Auto Tun
Ref Offset 2.02 dB				ΔMkr1 2.904 ms	
dB/div Ref 20.00 dBm				2.68 dB	
					Center Fre
					2.441000000 GH
			<mark>Warden bergene bereiten bereiten</mark>		2.44100000 811
				المحدي تقنيحيا و	
					Start Fre
0					2.441000000 GH
0					
				1∆2 <u>1400</u> 00	
					Stop Fre
0 1111 111 X2					2.441000000 GH
nter 2.441000000 GHz				Span 0 Hz	CF Ste
s BW 1.0 MHz	#VBV	V 1.0 MHz	Sweep 4	.000 ms (10001 pts)	1.000000 MH
N MODE TRC SCL X		Y	FUNCTION FUNCTION WIDT	H FUNCTION VALUE	Auto Ma
Δ2 1 t (Δ) F 1 t	2.904 ms (Δ)	2.68 dB			
F 1 t	594.8 µs	-64.03 dBm			Freq Offse
					0 H
					Scale Typ
					ocale Typ
					Log <u>Li</u>
					Log <u>Li</u>
		m	STAT	+ +	Log <u>Li</u>















12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
-----------------------	-------------------------------------

15.203 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

EUT Antenna:

The antenna is PCB permanent antenna, the best case gain of the antennas is 0 dBi, reference to the appendix II for details





Reference to the appendix I for details.

14. EUT Constructional Details

Reference to the appendix II for details.

***** END OF REPORT *****













