

7.3. Test Procedures

7.3.1. Test Procedures for Radiated Spurious Emissions

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

Note: The radiated spurious emission was tested with below settings.

- Frequencies less than or equal to 1000 MHz The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
- Frequencies above 1000 MHz
 The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
 The result of Average measurement is calculated using PK result and duty correction factor.



7.3.2. Test Procedures for Conducted Spurious Emissions

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

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

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

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

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

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



7.4. Test Results

7.4.1. Radiated Emissions

9 kHz ~ 25 GHz Data (Modulation : GFSK)

Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.96	V	Z	PK	49.19	1.70	N/A	N/A	50.89	74.00	23.11
2388.96	V	Z	AV	49.19	1.70	-24.79	N/A	26.10	54.00	27.90
4804.28	Н	Z	PK	45.03	5.45	N/A	N/A	50.48	74.00	23.52
4804.28	Η	Z	AV	45.03	5.45	-24.79	N/A	25.69	54.00	28.31

Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.84	Н	Z	PK	45.63	5.64	N/A	N/A	51.27	74.00	22.73
4881.84	Н	Z	AV	45.63	5.64	-24.79	N/A	26.48	54.00	27.52

Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2488.60	V	Z	PK	51.27	1.83	N/A	N/A	53.10	74.00	20.90
2488.60	V	Z	AV	51.27	1.83	-24.79	N/A	28.31	54.00	25.69
4960.48	Н	Z	PK	45.62	5.76	N/A	N/A	51.38	74.00	22.62
4960.48	Н	Z	AV	45.62	5.76	-24.79	N/A	26.59	54.00	27.41

Note.

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

2. Information of Distance Factor

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

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

When distance factor is "N/A", the distance is 3 m and distance factor is not applied. 3. D.C.F Calculation. (D.C.F = Duty Cycle Correction Factor)

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

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

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

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

4. Sample Calculation.

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

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

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

Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2386.72	Н	Х	PK	49.36	1.70	N/A	N/A	51.06	74.00	22.94
2386.72	Н	Х	AV	49.36	1.70	-24.79	N/A	26.27	54.00	27.73
4804.47	V	Z	PK	44.49	5.45	N/A	N/A	49.94	74.00	24.06
4804.47	V	Z	AV	44.49	5.45	-24.79	N/A	25.15	54.00	28.85

Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4881.70	V	Z	PK	44.75	5.64	N/A	N/A	50.39	74.00	23.61
4881.70	V	Z	AV	44.75	5.64	-24.79	N/A	25.60	54.00	28.40

Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2486.99	Н	Х	PK	53.10	1.82	N/A	N/A	54.92	74.00	19.08
2486.99	Н	Х	AV	53.10	1.82	-24.79	N/A	30.13	54.00	23.87
4960.44	V	Z	PK	44.61	5.76	N/A	N/A	50.37	74.00	23.63
4960.44	V	Z	AV	44.61	5.76	-24.79	N/A	25.58	54.00	28.42

Note.

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

2. Information of Distance Factor

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

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

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

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

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

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

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

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

Sample Calculation.

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

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



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

Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.83	Н	Х	PK	49.01	1.70	N/A	N/A	50.71	74.00	23.29
2388.83	Н	Х	AV	49.01	1.70	-24.79	N/A	25.92	54.00	28.08
4803.67	V	Z	PK	44.61	5.45	N/A	N/A	50.06	74.00	23.94
4803.67	V	Z	AV	44.61	5.45	-24.79	N/A	25.27	54.00	28.73

Middle Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4882.43	V	Z	PK	45.04	5.64	N/A	N/A	50.68	74.00	23.32
4882.43	V	Z	AV	45.04	5.64	-24.79	N/A	25.89	54.00	28.11

Highest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2491.00	Н	Х	PK	51.45	1.84	N/A	N/A	53.29	74.00	20.71
2491.00	Н	Х	AV	51.45	1.84	-24.79	N/A	28.50	54.00	25.50
4960.25	V	Z	PK	44.33	5.76	N/A	N/A	50.09	74.00	23.91
4960.25	V	Z	AV	44.33	5.76	-24.79	N/A	25.30	54.00	28.70

Note.

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

2. Information of Distance Factor

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

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

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

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

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

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

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

- D.C.F = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log(5.76 / 100) = -24.79 dB 4. Sample Calculation.



Low Band-edge



Lowest Channel & Modulation : GFSK

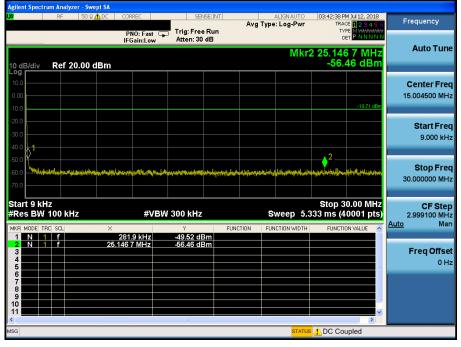
Low Band-edge

Hopping mode & Modulation : GFSK





Lowest Channel & Modulation : GFSK



	٨					
X RF 50Ω A	C CORREC	SENSE:IN		ALIGN AUTO Fype: Log-Pwr	03:43:47 PM Jul 12, 2018 TRACE 1 2 3 4 5	Frequency
	PNO: Fast 🕞 IFGain:Low	Trig: Free Run Atten: 30 dB				Ň
10 dB/div Ref 20.00 dBr	n			Mkr	4 9.639 58 GH: -38.76 dBn	
10.0 .000 .10.0	∆1				-10.71 dB	Center Freq 5.015000000 GHz
-20.0	<u>3</u>		2		4	Start Freq 30.000000 MHz
-50.0 -60.0 -70.0						Stop Fred 10.000000000 GH2
Start 30 MHz #Res BW 1.0 MHz	#VBV	V 3.0 MHz			Stop 10.000 GH .67 ms (40001 pts	CF Step 997.000000 MHz Auto Mar
MKR MODE TRC SCL	× 2.402 11 GHz	⊻ 9.54 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
3 N 1 f 4 N 1 f 5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5.793 41 GHz 3.162 32 GHz 9.639 58 GHz	-36.54 dBm -38.75 dBm -38.76 dBm				Freq Offset 0 Hz
6 7 8 9 10 11						
MSG		m		STATUS		



Lowest Channel & Modulation : GFSK



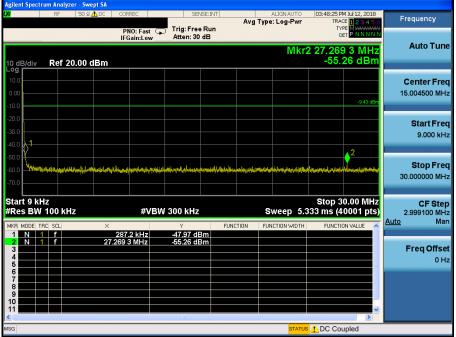
Middle Channel & Modulation : GFSK



Reference for limit

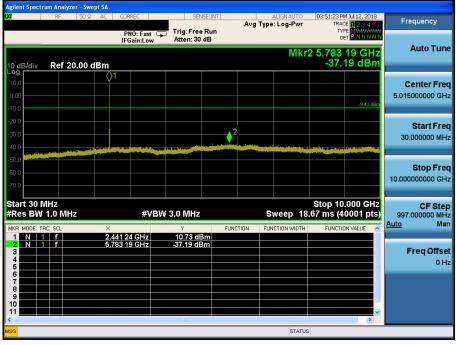
gilent Spectrum Analyzer - Swept SA :16 PM Jul 12, 2018 ALIGN AUTO Avg Type: Log-Pwr Frequency PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB TYPE DE Auto Tune Mkr1 2.441 130 GHz 10.57 dBm Ref 20.00 dBm :B/div **♦**¹ Center Fred 2.441000000 GHz Start Freq 2.439500000 GHz Stop Freq 2.442500000 GHz CF Step 300.000 kHz Auto Man Freq Offset 0 Hz Center 2.441000 GHz #Res BW 100 kHz Span 3.000 MHz Sweep 1.000 ms (3001 pts) #VBW 300 kHz









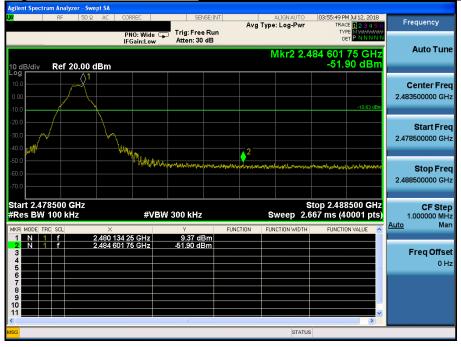






High Band-edge

Highest Channel & Modulation : GFSK



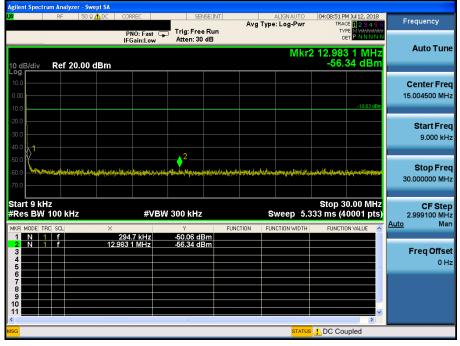
High Band-edge

Hopping mode & Modulation : GFSK





Highest Channel & Modulation : GFSK



Agilent Spectrum Analyzer - S					
LXI RF 50	Ω AC CORREC	SENSE:INT	ALIGNAUTO Avg Type: Log-Pwr	04:09:58 PM Jul 12, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast 🔾	Trig: Free Run Atten: 30 dB			
	IFGain:Low	Atten: 30 dB			Auto Tune
10 dB/div Ref 20.00) dBm		Wikr	4 7.112 94 GHz -38.41 dBm	
Log 10.0					Center Freq
0.00					5.015000000 GHz
-10.0				-10.63 dBm	
-20.0					
-30.0			4		Start Freq
-40.0					30.000000 MHz
-50.0					
-60.0					Stop Freq
-70.0					10.00000000 GHz
10.0					
Start 30 MHz #Res BW 1.0 MHz	#VBV	V 3.0 MHz	Sweep 18	Stop 10.000 GHz 8.67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	×		CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f	2.480 13 GHz 5.720 63 GHz	9.63 dBm -37.01 dBm			
3 N 1 F	5.420 78 GHz 7.112 94 GHz	-37.05 dBm -38.41 dBm			Freq Offset
5	7.112 94 GHZ	-58.41 dBm		=	0 Hz
6					
8					
10					
11				~	
MSG			STATU	5	



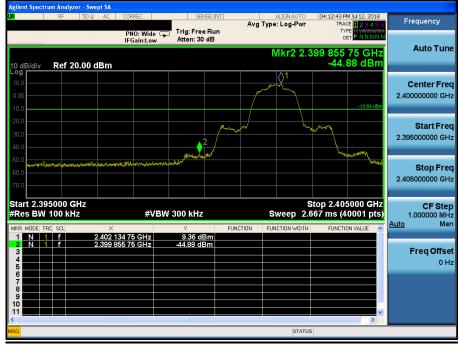
Highest Channel & Modulation : GFSK





Low Band-edge

Lowest Channel & Modulation : π/4DQPSK



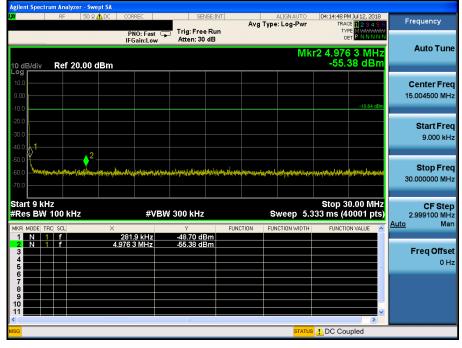
Low Band-edge

Hopping mode & Modulation : π/4DQPSK





Lowest Channel & Modulation : π/4DQPSK



Agilent Spect	rum Analy:	zer - Swep	ot SA										
	RF	50 Ω	AC	CORREC		SEN	ISE:INT	Aura	ALIGN AU Type: Log-P		23 PM Jul 12, 21 TRACE 1234		Frequency
				PNO: I IFGain:	Fast G	Trig: Free Atten: 30		Avg	Type. Log-r	991		WAAN/	
10 dB/div	Ref 2	0.00 d	Bm						N		66 31 G 39.06 dE		Auto Tune
10.0 0.00 -10.0											-10.64	dBm	Center Fred 5.015000000 GH;
-20.0 -30.0 -40.0					3		(2					Start Free 30.000000 MH;
-50.0 -60.0 -70.0													Stop Free 10.000000000 GH
Start 30 I #Res BW	1.0 MH	Iz			#VBV	V 3.0 MHz				18.67 m	o 10.000 G s (40001 p	ots)	CF Step 997.000000 MH Auto Mar
MKR MODE T 1 N 2 2 N 2 3 N 2 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	f f		5.82	02 36 GI 21 57 GI 36 31 GI	-Iz	10.42 dE -36.93 dE -39.06 dE	3m 3m	NCTION	FUNCTION W		UNCTION VALUE	***	Freq Offse
6 7 8 9 10 11													



Lowest Channel & Modulation : π/4DQPSK



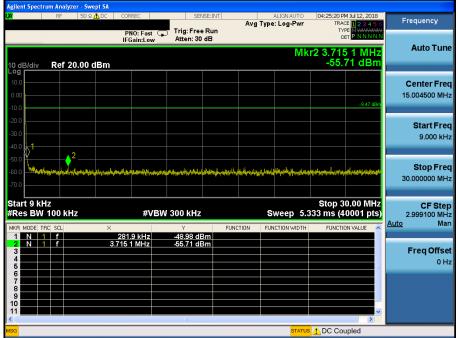


Reference for limit

Middle Channel & Modulation : π/4DQPSK



Conducted Spurious Emissions <u>Middle Channel & Modulation : π/4DQPSK</u>





Middle Channel & Modulation : π/4DQPSK

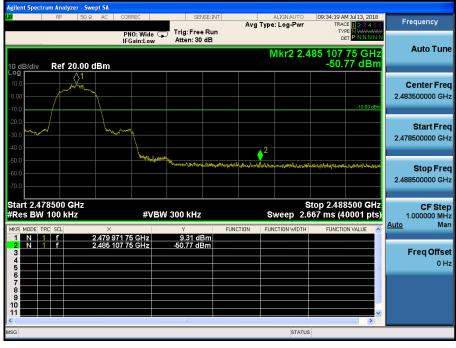


Agilent Sp	ectrur	n Ana	lyzer - Sv	vept S <i>I</i>	l.												
L <mark>XI</mark>		RF	50 \$	2 AC	CO	RREC		SE	NSE:IN	T	Ava		ALIGNAUTO : Log-Pwr		PM Jul 12, 20 ACE <mark>1 2 3 4</mark>		Frequency
					P	NO: Fa	ast 🖕	Trig: Fre			018	iype	. Log-i wi	т		WWW	
	IFGain:Low Atten: 30 db									Auto Tune							
	10 dB/div Ref 20.00 dBm -32.86 dBm -32.86 dBm									Auto Turk							
10 dB/di Log	V	Ref	20.00	dBm	1									-32	86 aB	m	
10.0																	Center Fred
0.00																	17.50000000 GHz
-10.0															-9.47	:IBm	
-20.0													۸4		32	1	
-30.0								5					<u> </u>			Y	Start Fred
						, and the second	and the state	State of State of State								Ē	10.00000000 GHz
-40.0					3												
-50.0																	Stop Fred
-60.0																	25.00000000 GHz
-70.0																	
Start 1	0.00	0 G	Hz											Stop 2	5.000 GI	ΗZ	CF Step
#Res B						#	¢VBW	3.0 MHz				S	weep 40	.00 ms (40001 p	ts)	1.500000000 GHz
MKR MODE	E TRC	SCL			×			Y		FUNC	TION	FUN	CTION WIDTH	FUNCT	ION VALUE	~	<u>Auto</u> Mar
1 N	1	f			805 37			-25.36 d									
2 N 3 N	1	f		23.	310 75 306 87	5 GH	z	-26.15 d -26.45 d	Bm								Freq Offset
4 N 5 N	1	f f		21.	520 75 083 75	O GH	z	-27.20 d -32.86 d									0 Hz
6	1				000 70	0 011	-	-02.00 u	0							-	
7 8																	
9																	
11																~	
<								111				_					
MSG .	STATUS STATUS												STATUS				



High Band-edge

Highest Channel & Modulation : π/4DQPSK



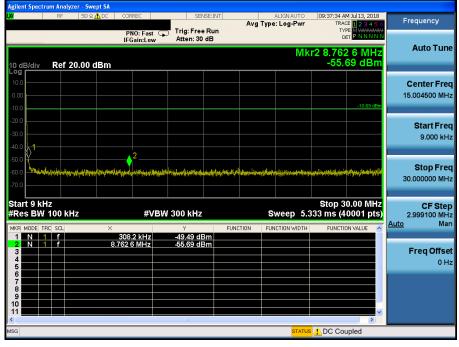
High Band-edge

Hopping mode & Modulation : π/4DQPSK





Highest Channel & Modulation : π/4DQPSK



PF SO S AC CORREC SENSEINT ALIGNANTO (09:39:09 AM M13, 2018) Frequency PN0: Fast Trig: Free Run IF Gaint.ow Trig: Free Run Atten: 30 dB Nkr4 9.805 09 GHz Auto Tune 100	Agilent Spectrum Analyzer - Swept SA										
PR0: Fast Trig: Free Run IFGe incl.ow Mkr4 9.805 09 GHz O (0) (0) (0) (0) (0) (0) (0) (0) (0) (0)	LXI RF	RF 50 Ω AC CORREC								Frequency	
IFGam: tow and the sound of the second of t			PNO: Fast 😱					TYF	E M HARAHARARA		
MKH 9.805 09 CHz Center Freq 0.03 -38.37 dBm 0.00 -38.37 dBm 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 <td< td=""><td></td><td></td><td>IFGain:Low</td><td>Atten: 30 d</td><td>B</td><td></td><td></td><td></td><td></td><td></td></td<>			IFGain:Low	Atten: 30 d	B						
Log Image: Control of the control o		Mkr4 9.805 09 GHz								Auto Tunc	
100 1	10 dB/div Ref 2							-38.4	злавт		
000		\ ¹								Center Fred	
100 103 dt 100 dt	0.00										
300 300 300 300 300 300 300 300 300 300 300 300 300 300 30000000 MHz 30000000 MHz 30000000 MHz 300000000 GHz 30000000 GHz 3000000 GHz 30000000									-10.69 dBm	0.01000000000112	
300 3											
440 40 <t< td=""><td></td><td></td><td></td><td></td><td><u>ہ ۲</u></td><td></td><td></td><td></td><td>4</td><td></td></t<>					<u>ہ ۲</u>				4		
Stop Freq 400 500 500 500 500 500 500 500 500 500 500 500 500 500 500 600 700 <th 700<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>\land</td><td></td><td></td><td>30.000000 MHz</td></th>	<td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>\land</td> <td></td> <td></td> <td>30.000000 MHz</td>							\land			30.000000 MHz
Construction Stop Freq Stop Freq 10.00000000 GHz Stop Stop Stop CF Step 997.0000000 GHz Stop	a supplicing the property of the second state			Charles and the second s				A DESCRIPTION OF THE OWNER OF THE			
Start 30 MHz #VBW 3.0 MHz Stop 10.000 GHz CF Step 10.000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 18.67 ms (40001 pts) 997.000000 GHz MRR MODE TRC: Scl. X Y FUNCTION VIDTH FUNCTION VIDTH FUNCTION VIDTH 1 N 1 f 2.480 13 GHz -38.57 dBm -440 1 N 1 f 5.668 72 GHz -38.57 dBm -440 3 N 1 f 7.687 96 GHz -38.37 dBm -440 -440 5 - - - - - - - 6 - - - - - - - 10 - - - - - - - 3 N 1 f - - - - - 3 N 1 f - - - - - 6 - - - -										Stop Fred	
3 1 f 2.490 13 GHz Stop 10.000 GHz CF Step 997.000000 MHz MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto 1 N 1 f 2.480 13 GHz 10.57 dBm Auto Man 1 N 1 f 2.660 dBm FUNCTION VALUE FUNCTION VALUE Auto 1 N 1 f 7.667 96 GHz -38.37 dBm FUNCTION VALUE FUNCTION VALUE </td <td>-60.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	-60.0										
#Res BW 1.0 MHz #VBW 3.0 MHz Sweep 18.67 ms (40001 pts) 997.000000 MHz MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto Man 1 N 1 f 2.480 13 GHz 10.57 dBm FUNCTION FUNCTION VALUE Auto Man 1 N 1 f 7.687 95 GHz -38.25 dBm FUNCTION FUNCTION VALUE Freq Offset 4 N 1 f 9.805 09 GHz -38.37 dBm FUNCTION FUNCTION FUNCTION FUNCTION VALUE FUNCTION VALUE Freq Offset 5 .	-70.0										
#Res BW 1.0 MHz #VBW 3.0 MHz Sweep 18.67 ms (40001 pts) 997.000000 MHz MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto Man 1 N 1 f 2.480 13 GHz 10.57 dBm FUNCTION FUNCTION VALUE Auto Man 1 N 1 f 7.687 95 GHz -38.25 dBm FUNCTION FUNCTION VALUE Freq Offset 4 N 1 f 9.805 09 GHz -38.37 dBm FUNCTION FUNCTION FUNCTION FUNCTION VALUE FUNCTION VALUE Freq Offset 5 .	Start 30 MHz							Stop 10	000 CHz	0.5.01	
MKR MODEL TRC: ScL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto Man 1 N 1 f 2.480 13 GHz 10.57 dBm		z	#VBW	3.0 MHz		s	weep 18	.67 ms (4	0001 pts)		
1 N 1 f 2.480 13 GHz 10.57 dBm 2 N 1 f 5.680 72 GHz -36.60 dBm 3 N 1 f 7.867 96 GHz -38.25 dBm 4 N 1 f 9.805 09 GHz -38.37 dBm 6 - - - - 0 Hz 7 - - - - 0 Hz 9 - - - - - 0 Hz 10 - - - - - - - 10 - - - - - - - - 11 - - - - - - - - - - -	MKB MODELTBC SCI	¥	1	Ŷ	EUNC		-				
3 N 1 f 7.687.96 GHz -38.25 dBm Freq Offset 0 Hz	1 N 1 f	2.48		10.57 dB	n			Tonene	IT TALEDE		
4 N 1 f 9.805 09 GHz -38.37 dBm 0 Hz 6 - - - - - 0 Hz 7 - - - - - - 0 Hz 9 - - - - - - 0 Hz 10 - - - - - - - 0 Hz 11 - - - - - - - - 0 Hz		5.68	8 72 GHz							Freg Offset	
	4 N 1 f	9.80	5 09 GHz	-38.37 dBr	n						
9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0									=		
9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7										
	<			111					>		
NSG	MSG	SG STATUS									



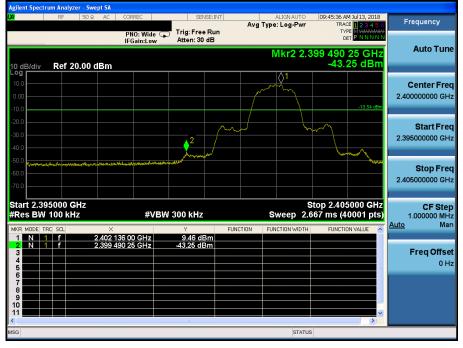
Highest Channel & Modulation : π/4DQPSK





Low Band-edge

Lowest Channel & Modulation : 8DPSK



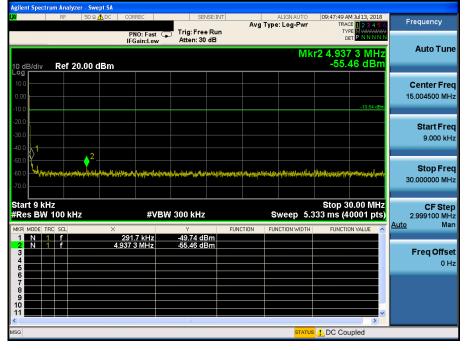
Low Band-edge

Hopping mode & Modulation : 8DPSK





Lowest Channel & Modulation : 8DPSK







Lowest Channel & Modulation : 8DPSK



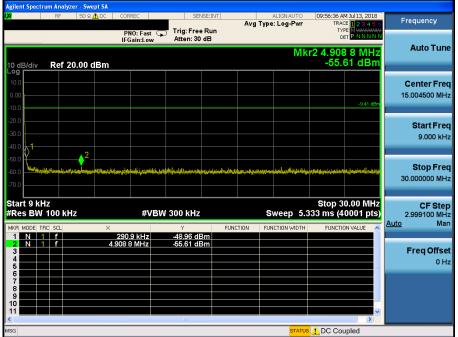


Reference for limit



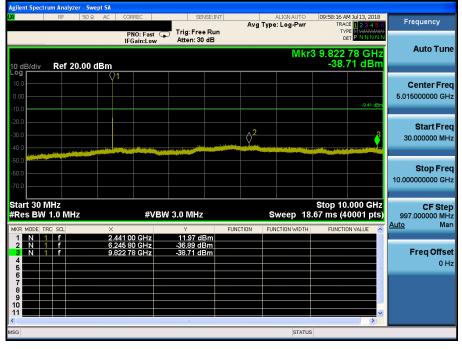


Conducted Spurious Emissions <u>Middle Channel & Modulation : 8DPSK</u>





Middle Channel & Modulation : 8DPSK

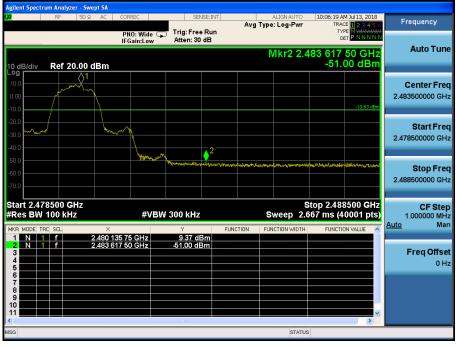






High Band-edge

Highest Channel & Modulation : 8DPSK



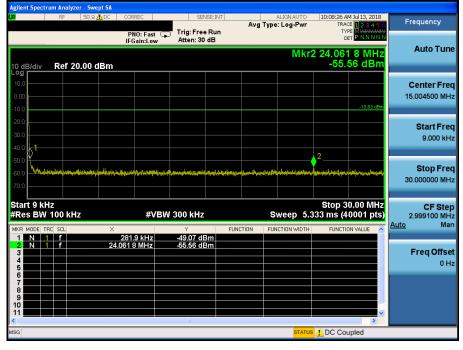
High Band-edge

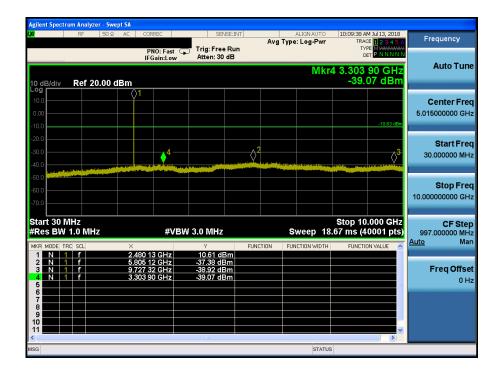
Hopping mode & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK







Highest Channel & Modulation : 8DPSK





8. Transmitter AC Power Line Conducted Emission

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 I	_imit (dBuV)
Frequency Range (Minz)	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

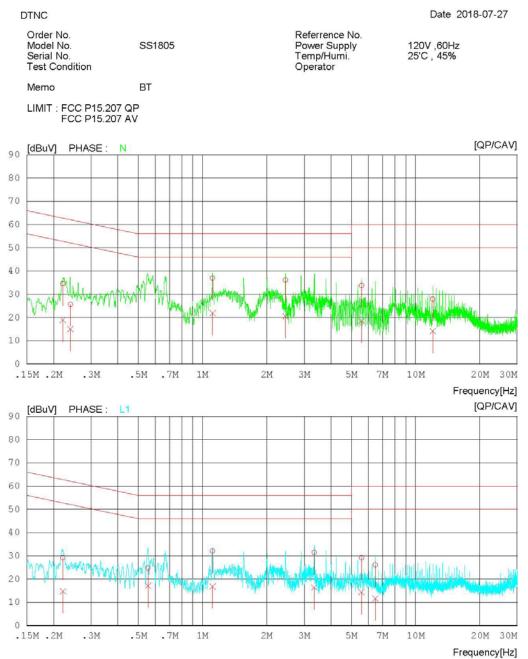
8.3 Test Procedures

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

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

8.4 Test Results

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



Results of Conducted Emission

DTNC

Results of Conducted Emission

Date 2018-07-27	
-----------------	--

Order No. Model No. Serial No. Test Condition	SS1805	Referrence No. Power Supply Temp/Humi. Operator	120V ,60Hz 25'C , 45%	
Memo	BT			
LIMIT : FCC P15.20 FCC P15.20				
NO FREQ [MHz] [c	READING C.FACTOR QP CAV dBuV][dBuV] [dB]	RESULT LIMIT QP CAV QP CAV [dBuV][dBuV] [dBuV][dBuV	MARGIN PHASE QP CAV] [dBuV] [dBuV]	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5.82 5.14 $9.907.0011.93$ $9.936.2010.60$ $9.963.68$ 8.46 $10.067.88$ 4.00 $10.129.24$ 4.89 $9.904.78$ 7.19 $9.912.05$ 6.87 $9.931.41$ 6.34 $9.999.10$ 4.24 10.06	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	28.1933.86 N 36.3837.06 N 19.0724.14 N 19.8425.44 N 26.2631.48 N 33.6337.98 L1 31.3128.90 L1 24.0229.20 L1 24.6029.67 L1 30.8435.70 L1 33.9338.38 L1	



9. Antenna Requirement

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

Conclusion: Comply

The antenna is attached on the device by means of unique coupling method (Spring Tension). Therefore this E.U.T Complies with the requirement of §15.203

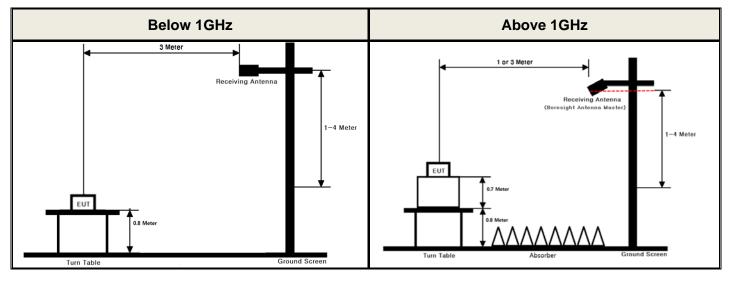
- Minimum Standard :

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

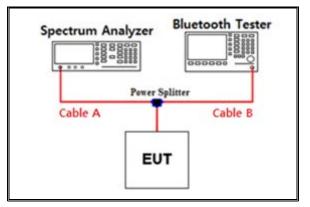
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.47	15	10.19
1	6.99	20	11.66
2.402 & 2.441 & 2.480	7.66	25	12.01
5	8.84	-	-
10	9.07	-	-

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

Detector Mode : PK

APPENDIX II

Unwanted Emissions (Radiated) Test Plot

GFSK & Lowest & Z & Ver

Frequency Avg Type: Log-Pwi Avg|Hold: 200/200 Trig: Free Run Atten: 20 dB TYPI DE PNO: Fast ++++ IFGain:Low Auto Tune Mkr3 2.388 955 GH 49.187 dBµ Ref 116.99 dBµV **Center Freq** 2.390554756 GHz Start Freq 2.377000000 GHz 3 1.15 THE OWNER **Stop Freq** 2.404109512 GHz n ha kanan kana Stop 2.40411 GHz 1.00 ms (5001 pts) 2.37700 GHz CF Step 2.710951 MHz #VBW 3.0 MHz Sweep 0 MHz Mar Auto 98.618 dBµ\ 45.503 dBµ\ 49.187 dBµ\ Freq Offset 0 Hz

GFSK & Highest & Z & Ver

Detector Mode : PK

Frequency Avg Type: Log-Pwi Avg|Hold: 200/200 PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 20 dB TYPI DE Auto Tune Mkr3 .488 596 GH: 51.272 dBµ\ Ref 116.99 dBµV **Center Freq** 2.488686138 GHz Start Freq 2.477372276 GHz Stop Freq 2.50000000 GHz Start 2.47737 GHz #Res BW 1.0 MHz Stop 2.50000 GHz CF Step 2.262772 MHz Man #VBW 3.0 MHz Sweep (5001 pts) Auto Freq Offset 0 Hz

Detector Mode : PK

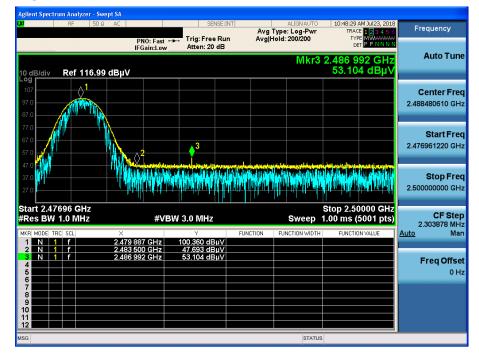


π /4DQPSK & Lowest & X & Hor

Agilent Spectrum Analyzer - Swept SA					
L XI RF 50 Ω AC	SE		ALIGNAUTO 1 e: Log-Pwr	0:46:00 AM Jul 23, 2018 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast +++ Trig: Free IEGain:Low Atten: 20	Run Avg Hold		TYPE MWWWAAAAA DET P P N N N N	
	IFGain:Low Atten: 20	40	Mkr2 0 2	86 721 GHz	Auto Tune
10 dB/div Ref 116.99 dBµV				9.363 dBµV	
107				-2	Center Freq
97.0					2.391039135 GHz
87.0					
77.0					Start Freq
67.0					2.377000000 GHz
57.0	→ ³ → ₀ ²			ma.	
	and the basis want of this same bisance	Acceleration of the state			
37.0				ii	Stop Freq 2.405078270 GHz
27.0	te di sa sharki kali de ka	We with the state of a	1 I I I I I I I I I I I I I I I I I I I		2.405078270 GHz
Start 2.37700 GHz			Sto	p 2.40508 GHz	
#Res BW 1.0 MHz	#VBW 3.0 MHz		Sweep 1.00	ms (5001 pts)	CF Step 2.807827 MHz
MKR MODE TRC SCL X	Y		INCTION WIDTH	FUNCTION VALUE	Auto Man
	832 GHz 100.654 dE 000 GHz 46.378 dE	uV uV			
3 N 1 f 2.386	721 GHz 49.363 dE	μV			Freq Offset
4 5					0 Hz
6					
8					
9					
11					
MSG			STATUS		

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

Detector Mode : PK



Detector Mode : PK

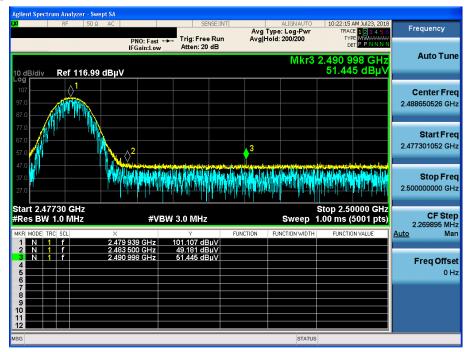


8DPSK & Lowest & X & Hor

Agilent Spectrum Analyzer - Swept SA					
ιχι RF 50.Ω AC	SE		:Log-Pwr TF	13 AM Jul 23, 2018 RACE 1 2 3 4 5 6	Frequency
	PNO: Fast +++ Trig: Free IFGain:Low Atten: 20		200/200	DET P P N N N N	
	IFGain:Low Atten: 20	40	Mkr3 2.388	997 CH-	Auto Tune
10 dB/div Ref 116.99 dBµV				12 dBµV	
Log 107				∧ <u>1</u>	Conton Eng
97.0					Center Freq 2.391039135 GHz
87.0			/ //		2.551055155 6112
77.0			//		
67.0					Start Freq 2.377000000 GHz
57.0	<mark>≬³ ∧2</mark>			—— 	2.377000000 GH2
47.0		a. Annak a BILLINA AL			
37.0 19 / Walter (14, 19, 11, 19, 1 , 19, 19, 19, 19, 19, 19, 19, 19, 19, 19					Stop Freq 2.405078270 GHz
27.0		han di terli d		¹	2.403078270 GH2
Start 2.37700 GHz				40508 GHz	CF Step
#Res BW 1.0 MHz	#VBW 3.0 MHz			(5001 pts)	2.807827 MHz
MKR MODE TRC SCL X	Y 1 832 GHz 101.396 dB		NCTION WIDTH FUNC	TION VALUE	<u>Auto</u> Man
2 N 1 f 2.390	0000 GHz 47.780 dB	μV			
3 N 1 f 2.388	3 827 GHz 49.012 dB	μV			Freq Offset
5					0 Hz
7					
8					
10					
12					
MSG			STATUS		

Detector Mode : PK

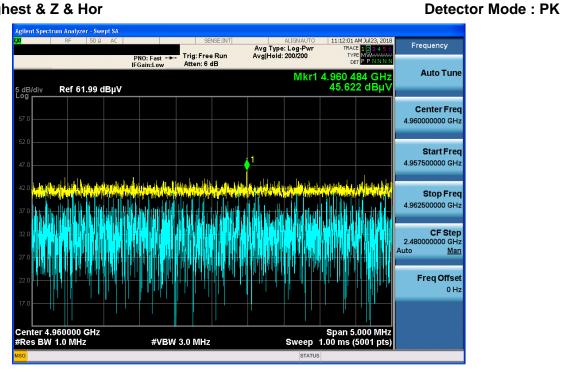
8DPSK & Highest & X & Hor



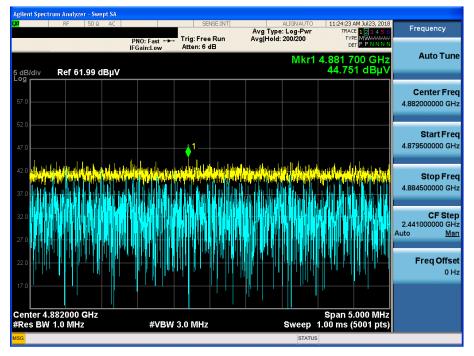


GFSK & Highest & Z & Hor

🛈 Dt&C



$\pi/4DQPSK$ & Middle & Z & Ver



Detector Mode : PK

8DPSK & Middle & Z & Ver

Detector Mode : PK

