

7. Transmitter Radiated Spurious Emissions and Conducted Spurious Emission

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.205(c))

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

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

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

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

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



7.3. Test Procedures

7.3.1. Test Procedures for Radiated Spurious Emissions

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

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 ~ 26.5 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)
2379.34	Н	Х	PK	44.56	0.66	N/A	N/A	45.22	74.00	28.78
2379.34	Н	Х	AV	44.56	0.66	-24.79	N/A	20.43	54.00	33.57
4803.53	Н	Х	PK	45.52	4.77	N/A	N/A	50.29	74.00	23.71
4803.53	Н	Х	AV	45.52	4.77	-24.79	N/A	25.50	54.00	28.50

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)
4882.21	Н	Х	PK	46.00	5.11	N/A	N/A	51.11	74.00	22.89
4882.21	Н	Х	AV	46.00	5.11	-24.79	N/A	26.32	54.00	27.68

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)
2483.75	Н	Х	PK	46.01	0.94	N/A	N/A	46.95	74.00	27.05
2483.75	Н	Х	AV	46.01	0.94	-24.79	N/A	22.16	54.00	31.84
4960.53	Н	Х	PK	45.72	5.35	N/A	N/A	51.07	74.00	22.93
4960.53	Н	Х	AV	45.72	5.35	-24.79	N/A	26.28	54.00	27.72

Note.

1. The radiated emissions were investigated up 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.

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)
2387.63	Н	Х	PK	44.97	0.69	N/A	N/A	45.66	74.00	28.34
2387.63	Н	Х	AV	44.97	0.69	-24.79	N/A	20.87	54.00	33.13
4803.47	Н	Х	PK	45.80	4.77	N/A	N/A	50.57	74.00	23.43
4803.47	Н	Х	AV	45.80	4.77	-24.79	N/A	25.78	54.00	28.22

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)
4881.57	Н	Х	PK	45.69	5.10	N/A	N/A	50.79	74.00	23.21
4881.57	Н	Х	AV	45.69	5.10	-24.79	N/A	26.00	54.00	28.00

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)
2483.61	Н	Х	PK	46.60	0.94	N/A	N/A	47.54	74.00	26.46
2483.61	Н	Х	AV	46.60	0.94	-24.79	N/A	22.75	54.00	31.25
4960.74	Н	Х	PK	45.93	5.35	N/A	N/A	51.28	74.00	22.72
4960.74	Н	Х	AV	45.93	5.35	-24.79	N/A	26.49	54.00	27.51

Note.

1. The radiated emissions were investigated up 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.

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

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



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

Lowest Channel

Frequency (MHz)	ANT Pol	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)
2386.94	Н	Х	PK	45.13	0.69	N/A	N/A	45.82	74.00	28.18
2386.94	Н	Х	AV	45.13	0.69	-24.79	N/A	21.03	54.00	32.97
4804.15	Н	Х	PK	45.63	4.77	N/A	N/A	50.40	74.00	23.60
4804.15	Н	Х	AV	45.63	4.77	-24.79	N/A	25.61	54.00	28.39

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)
4882.75	Н	Х	PK	45.27	5.11	N/A	N/A	50.38	74.00	23.62
4882.75	Н	Х	AV	45.27	5.11	-24.79	N/A	25.59	54.00	28.41

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)
2483.53	Н	Х	PK	48.19	0.94	N/A	N/A	49.13	74.00	24.87
2483.53	H	Х	AV	48.19	0.94	-24.79	N/A	24.34	54.00	29.66
4959.95	Н	Х	PK	45.69	5.34	N/A	N/A	51.03	74.00	22.97
4959.95	Н	Х	AV	45.69	5.34	-24.79	N/A	26.24	54.00	27.76

Note.

1. The radiated emissions were investigated up 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.

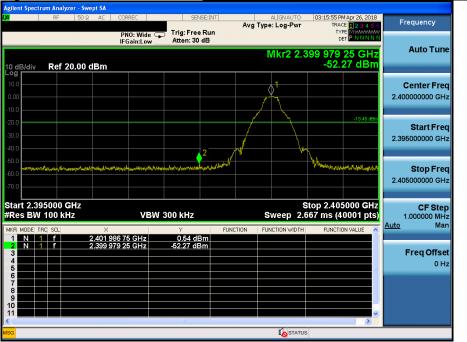
Margin = Limit - Result / Result = Reading + T.F + D.C.F / T.F = AF + CL - AG

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

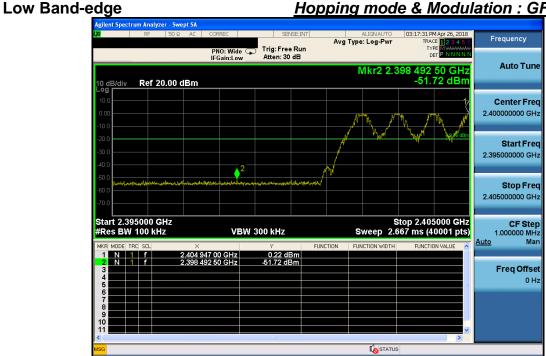




Low Band-edge



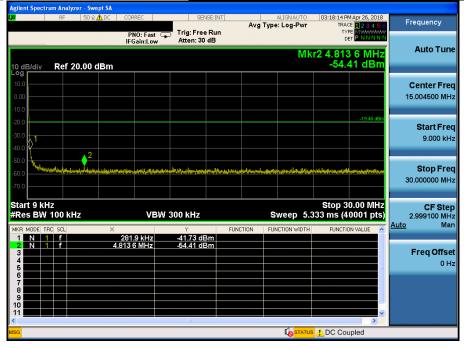
Lowest Channel & Modulation : GFSK



Hopping mode & Modulation : GFSK



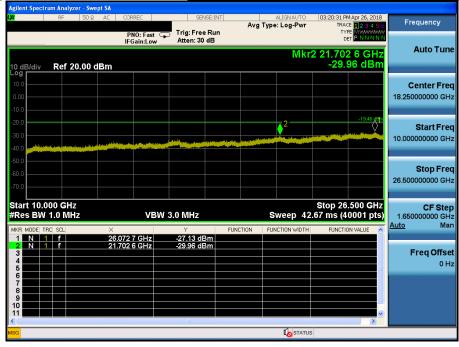
Lowest Channel & Modulation : GFSK



Agilent Spectru														
L <mark>XI</mark>	RF	50 Ω	AC	CORREC		SEN	SE:INT	Ava		LIGNAUTO	TRA	M Apr 26, 2018 CE 12345	6	Frequency
				PNO: Fa	st 😱	Trig: Free Atten: 30					Tì	PE NNNN	÷,	
				IFGain:L	ow	Atten: 30	ав							Auto Tune
										Mkr		90 GH:		riato rano
10 dB/div Log	Ref 2	0.00 d	Bm								-38.	25 dBn		
10.0			1											Center Freq
0.00			<u> </u>											5.015000000 GHz
-10.0														
-20.0												-19.46 dB		
-30.0				. 3/		<u>م 2</u>								Start Freq
														30.000000 MHz
-40.0	and the superior	and a second					Angengen in generati	and the part of the second	and a start of the second s		And in case of the local division of the loc	مى بىر يەر يېچىنى بىرى يەر		
-50.0														Stop Freq
-60.0														10.000000000 GHz
-70.0														
Start 30 IV	187										Stop 1(.000 GH:	,	0.5.01
#Res BW		z		١	/BW 3	.0 MHz			Sw	/eep 18		0000 Gri		CF Step 997.000000 MHz
MKR MODE TR			×		1	Y		FUNCTION		TION WIDTH				<u>Auto</u> Man
1 N 1	f		2.4	02 11 GH		1.09 dB	m	FORCHOR	TONC	HON WIDTH	PONCH	ION VALUE		
2 N 1 3 N 1	f			03 64 GH: 87 25 GH:		-36.40 dB -37.71 dB	m		_					Freq Offset
4 N 1	f		3.3	04 90 GH	z	-38.25 dB	m							0 Hz
5														
7														
8														
10														
11 <u> </u>												>		
MSG										I STATUS				
	_	_	-		_		-		-		1			



Lowest Channel & Modulation : GFSK



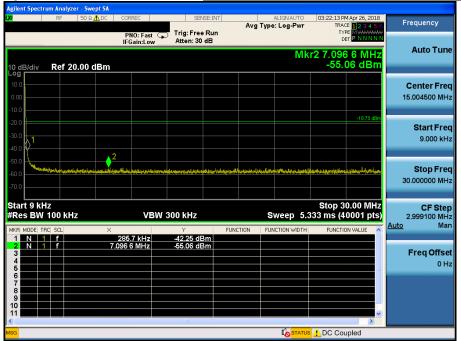
Middle Channel & Modulation : GFSK



Reference for limit

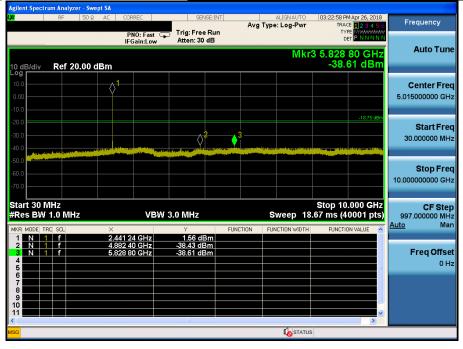
gilent Spectrum Analyzer - Swept SA 03:21:13 PM Apr 26, 2018 ALIGNAUTO Avg Type: Log-Pwr Frequency Trig: Free Run Atten: 30 dB PNO: Wide 🖵 IFGain:Low TYPE DET Auto Tune Mkr1 2.441 144 GHz 1.25 dBm Ref 20.00 dBm :B/div Center Freq 2.441000000 GHz **♦**¹ Start Freq 2.439500000 GHz Stop Freq 2.442500000 GHz MIN. CF Step 300.000 kHz Man ...ስስለ <u>Auto</u> 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 **I** ST

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





Middle Channel & Modulation : GFSK

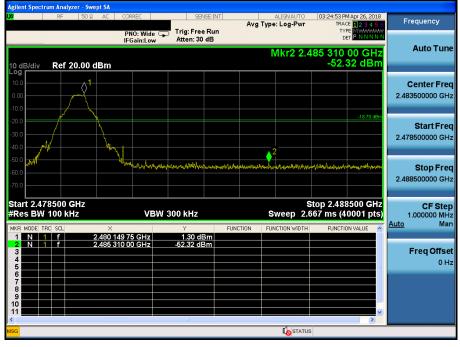


Agilent Spect															
L <mark>XI</mark>	RF	50 Ω	AC	CORREC SENSE:INT			ALIGNAUTO Avg Type: Log-Pwr			03:23:44 PM Apr 26, 2018 TRACE 1 2 3 4 5 6			Frequency		
					Fast G	Trig: Fre		ı –				T	PE MWWWWW		
				IFGain	:Low	Atten: 30									Auto Tune
			_						Mkr2 22.378 7 GHz -30.41 dBm						
10 dB/div Log	Ref	20.00 d	Bm									-30.	41 UBII		
10.0															Center Freq
0.00															18.250000000 GHz
-10.0															
-20.0				_							2		-18.75 dB		Otort From
-30.0											Constant law alor	No. of Street,	L Y		Start Freq 10.00000000 GHz
-40.0	dia anna aile	- and the set	al an la chu		alle outstands										10.00000000 GH2
-50.0	يتر فندخت														
-60.0															Stop Freq
-70.0															26.500000000 GHz
Start 10.0										_			6.500 GHz		CF Step
#Res BW		HZ			VBW	3.0 MHz				SI	weep 42		0001 pts		1.650000000 GHz uto Man
MKR MODE T	RC SCL		×	074 7 G		۲ -27.18 d		FUNC	TION	FUN	CTION WIDTH	FUNCTI	ON VALUE		uto Mari
2 N	f		20.0	3787G	HZ	-27.18 d -30.41 d									
3							\rightarrow								Freq Offset
5													-		0 Hz
6 7															
8															
10															
11													~ >		
MSG							_			_	I STATUS				
	_		_	_	_		_	_	_	_				_	



High Band-edge

Highest Channel & Modulation : GFSK



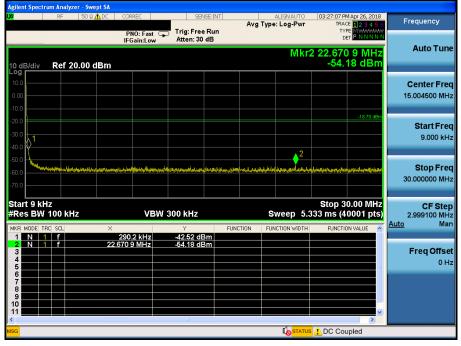
High Band-edge

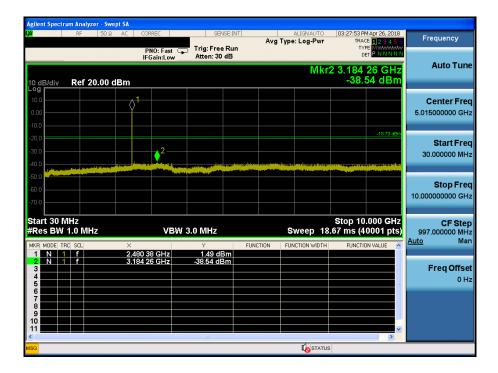
Hopping mode & Modulation : GFSK





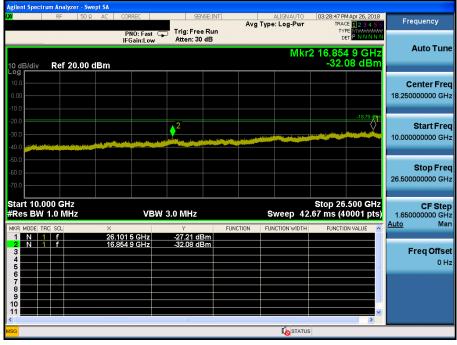
Highest Channel & Modulation : GFSK







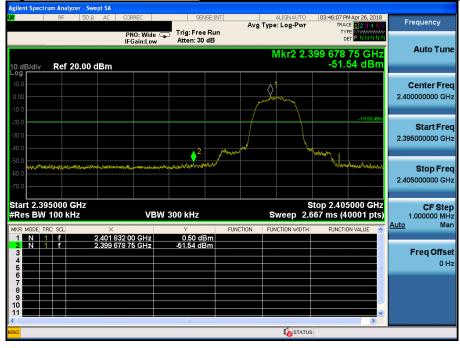
Highest Channel & Modulation : GFSK





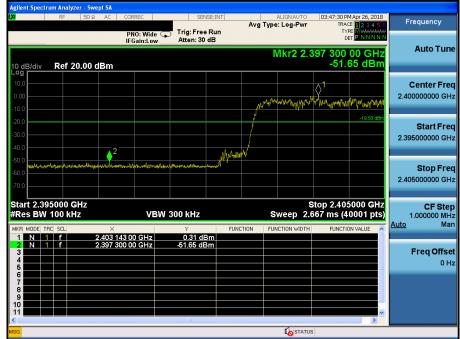
Low Band-edge

Lowest Channel & Modulation : π/4DQPSK



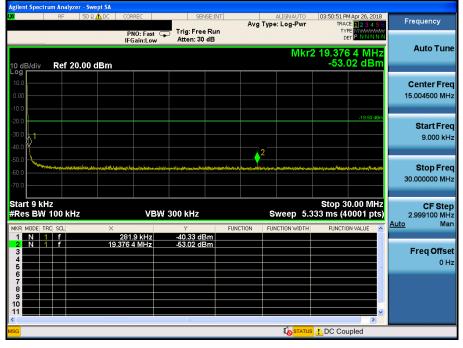
Low Band-edge

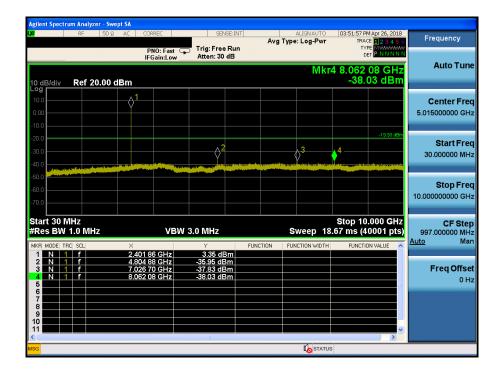
Hopping mode & Modulation : π/4DQPSK





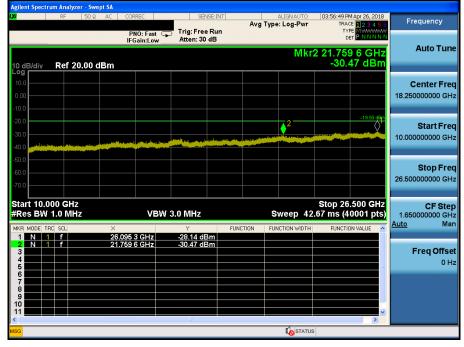
Lowest Channel & Modulation : π/4DQPSK







Lowest Channel & Modulation : π/4DQPSK



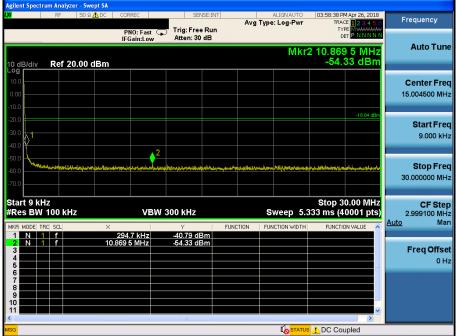


Reference for limit

Middle Channel & Modulation : π/4DQPSK

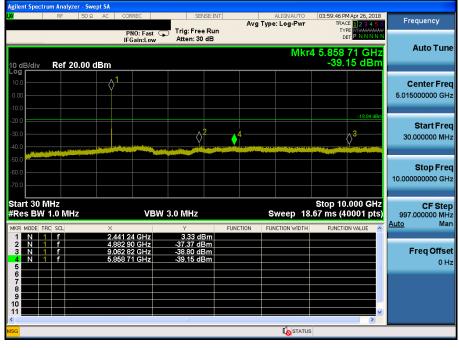


Conducted Spurious Emissions <u>Middle Channel & Modulation : π/4DQPSK</u>





Middle Channel & Modulation : π/4DQPSK

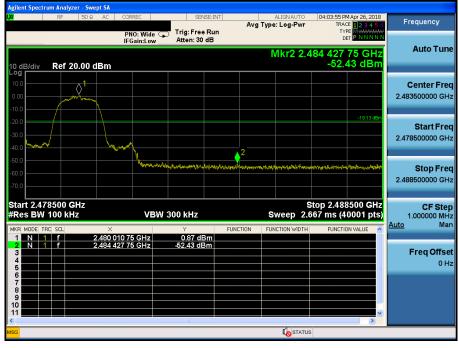


Agilent Spectr			SA								
L <mark>XI</mark>	RF	50 Ω A	AC CORREC		SENS	E:INT	Avg Tvp	e: Log-Pwr		4 Apr 26, 2018 E 1 2 3 4 5 6	Frequency
			PNO: FGain	Fast 🖵	Trig: Free I Atten: 30 d				TYP		
			IFGain	:LOW	Atten: 50 t			Miles	2 24.960		Auto Tune
10 dB/div	Ref 20	.00 dB	m					IVIKI		46 dBm	
Log 10.0											0
0.00											Center Freq 18.25000000 GHz
-10.0											18.230000000 GH2
-20.0										* 2 18.84 dBm	
-30.0										Manual Street	Start Freq
-40.0		and participants and the		and a subject of							10.00000000 GHz
-50.0											
-60.0											Stop Freq
-70.0											26.50000000 GHz
Start 10.0 #Res BW		z		VBW 3	.0 MHz		ę	Sweep 42	Stop 26 .67 ms (4	.500 GHz 0001 pts)	CF Step 1.65000000 GHz
MKR MODE T			X		Y		ICTION FL	INCTION WIDTH	FUNCTIO	IN VALUE	<u>Auto</u> Man
1 N 1 2 N 1	f f		26.027 7 G 24.960 6 G		-26.90 dBr -27.46 dBr	n n					
3											Freq Offset
5										=	0 Hz
6 7											
8											
10											
<					au -					>	
MSG								🚺 STATUS	5		



High Band-edge

Highest Channel & Modulation : π/4DQPSK



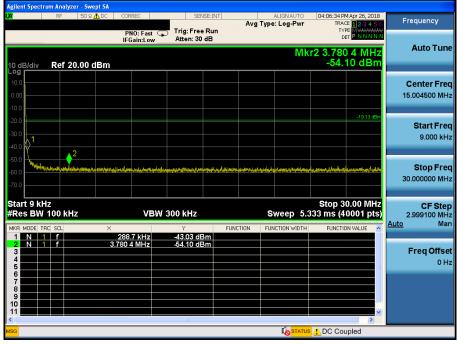
High Band-edge

Hopping mode & Modulation : π/4DQPSK





Highest Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Swe				ALIGNAUTO							
LX/ RF 50 Ω	AC CORREC	AC CORREC SENSE:INT			04:07:21 PM Apr 26, 201 TRACE 1 2 3 4	Frequency					
	PNO: Fast ⊂ IFGain:Low	Trig: Free Run Atten: 30 dB	-								
	Mkr2 3.330 07 GHz										
10 dB/div Ref 20.00 d	n										
Log 10.0	1					Contor From					
0.00	Y					Center Freq 5.015000000 GHz					
-10.0						0.01000000000112					
-20.0					-19.13 df						
-30.0	2-					Start Freq 30.000000 MHz					
-40.0		The second s	an sur le strange (frag tiperet d'alema		and the foregoing states of the local data and the second states of the	30.000000 WH2					
-50.0											
-60.0						Stop Freq					
-70.0						10.00000000 GHz					
Start 30 MHz					Stop 10.000 GH						
#Res BW 1.0 MHz	VBW	3.0 MHz		Sweep 18	.67 ms (40001 pt	CF Step 997.000000 MHz					
MKR MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto Man					
1 N 1 f	2.479 88 GHz 3.330 07 GHz	3.17 dBm -38.32 dBm									
3	0.000 07 0112					Freq Offset					
5						0 Hz					
6											
8											
10											
<					>						
MSG	Lo status										



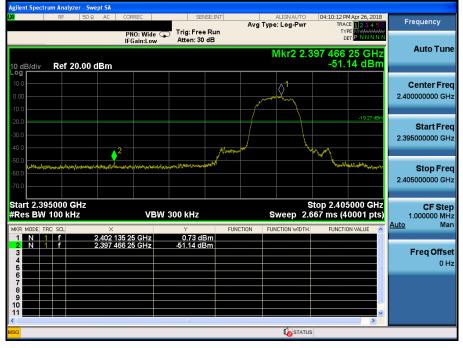
Highest Channel & Modulation : π/4DQPSK





Low Band-edge

Lowest Channel & Modulation : 8DPSK



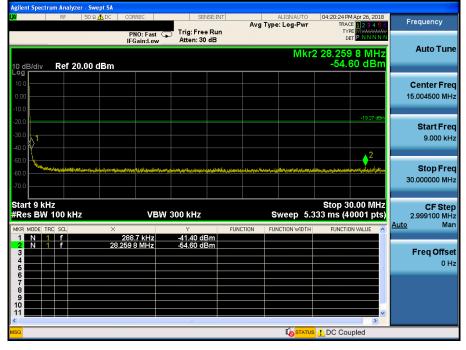
Low Band-edge

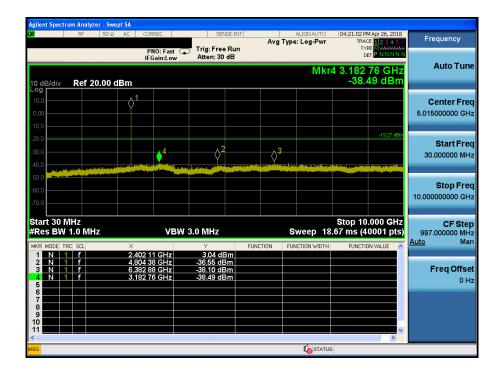
Hopping mode & Modulation : 8DPSK





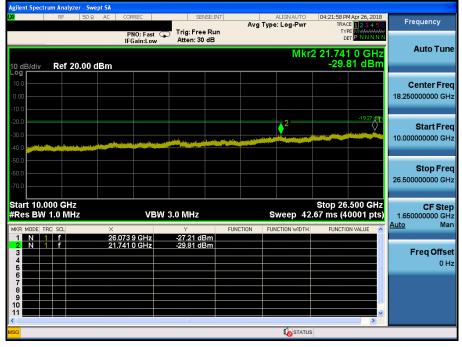
Lowest Channel & Modulation : 8DPSK







Lowest Channel & Modulation : 8DPSK



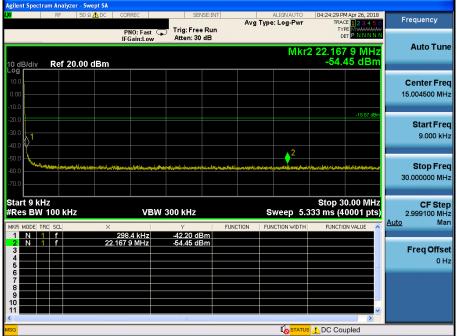


Reference for limit

Middle Channel & Modulation : 8DPSK



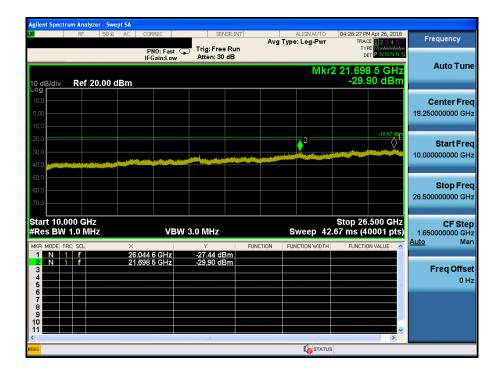
Conducted Spurious Emissions <u>Middle Channel & Modulation : 8DPSK</u>





Middle Channel & Modulation : 8DPSK

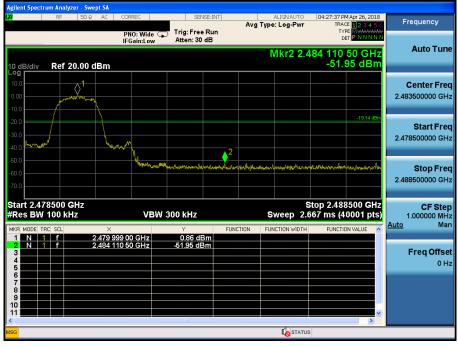






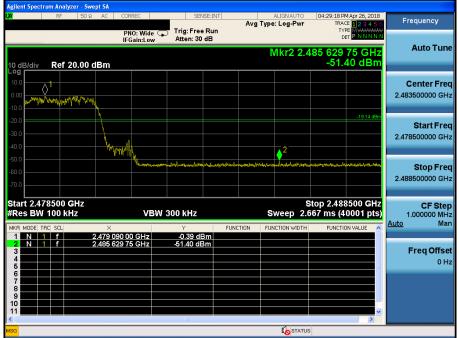
High Band-edge

Highest Channel & Modulation : 8DPSK



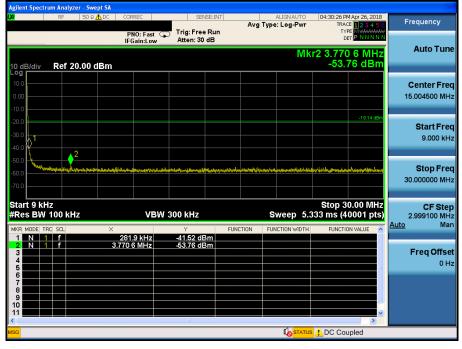
High Band-edge

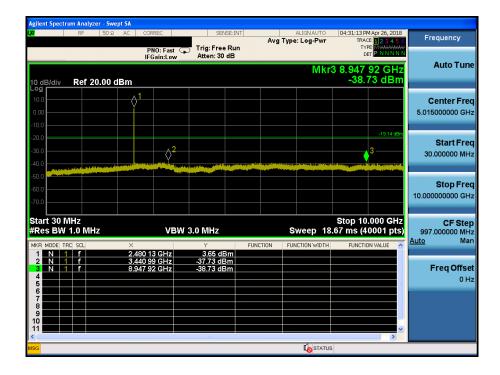
Hopping mode & Modulation : 8DPSK





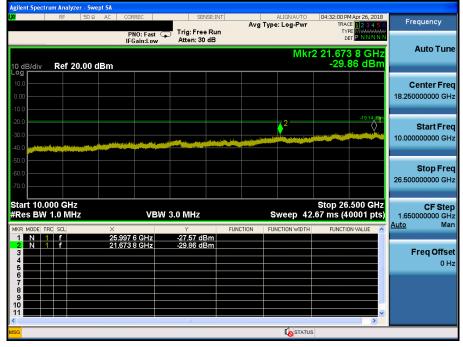
Highest Channel & Modulation : 8DPSK







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.

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

* Decreases with the logarithm of the frequency

8.3 Test Procedures

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

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

8.4 Test Results

NA



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

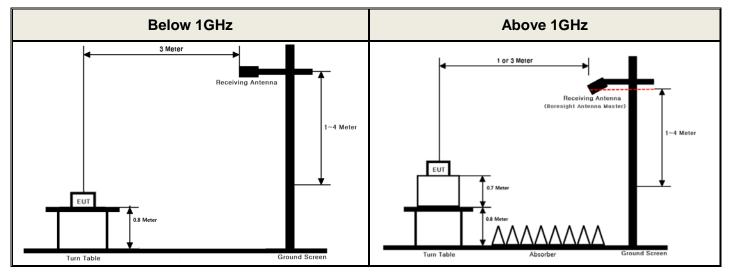
- Minimum Standard :

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

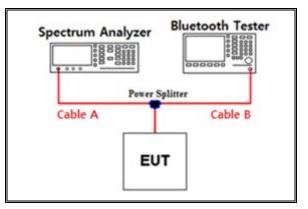
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.52	15	9.50
1	6.62	20	10.31
2.402 & 2.441 & 2.480	7.30	25	10.80
5	8.05	-	-
10	8.66	-	-

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

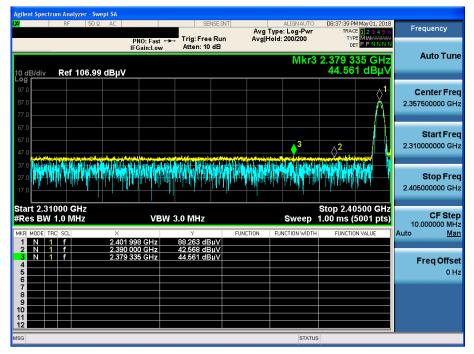


Detector Mode : PK

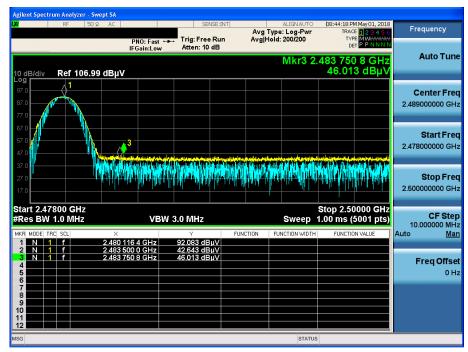
APPENDIX II

Unwanted Emissions (Radiated) Test Plot

GFSK & Lowest & X & Hor



GFSK & Highest & X & Hor





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

	Spectru		alyzer - Sw												
LXI		RF	50 Ω	AC			SE	NSE:INT	Avç		ALIGNAUTO		M May 01, 2018 CE 1 2 3 4 5 6		Frequency
					PNO: Fast IFGain:Lov		Trig: Free Atten: 10		Avg	Hold:	200/200	D			Auto Tune
10 dB/	div	Rei	f 106.99	dBµV							Mkr3		25 GHz 7 dBμV		Auto Tune
Log 97.0 - 87.0 - 77.0 -														2	Center Freq 2.357500000 GHz
67.0 57.0 47.0	-	~~~~	hái leong tro the	de jiel en openheuren	ليدرد بالبعج		er et al de artist		den den er		and an enter of the second	3 2 1000 ↓ 1100		2	Start Freq 2.310000000 GHz
37.0 27.0 17.0		III)		i i na s hi					(††) April (††)						Stop Freq 2.405000000 GHz
Start #Res					VE	3W 3.0) MHz				Sweep		0500 GHz 5001 pts)		CF Step 10.000000 MHz
MKR MO	_	SCL		× 2.402	226 GHz	9	Y 0.503 dE		UNCTION	FUI	NCTION WIDTH	FUNCTI	DN VALUE	Aut	to <u>Man</u>
2 N 3 N 4 5	i 1	f		2.390	000 GHz 625 GHz	4	1.792 dE 4.967 dE	βµ∀							Freq Offset 0 Hz
7 8 9															
10 11 12															
MSG											STATUS	5			

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

Avg Type: Log-Pwr Avg|Hold: 200/200 Frequency Trig: Free Run Atten: 10 dB TYPE MW PNO: Fast +++ IFGain:Low Auto Tune Mkr3 2.483 605 6 GHz 46.603 dBµ√ Ref 106.99 dBµV **Center Freq** 2.489000000 GHz Start Freq 2.478000000 GHz **Stop Freq** 2.500000000 GHz u, ni o Mili da Villidi Start 2.47800 GHz #Res BW 1.0 MHz Stop 2.50000 GHz 1.00 ms (5001 pts) **CF Step** 10.000000 MHz o <u>Man</u> VBW 3.0 MHz Sweep Auto 43.627 dBµ\ 46.603 dBµ\ Freq Offset 0 Hz STATUS

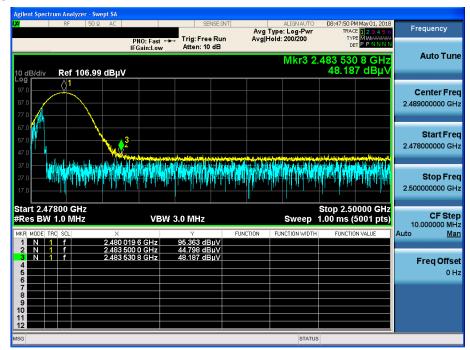
Detector Mode : PK



8DPSK & Lowest & X & Hor

Agilent Spectrum Analyzer - Swept SA							
LXI RF 50Ω AC		SENSE:IN		ALIGN AUTO : Log-Pwr		4 May 01, 2018	Frequency
	PNO: Fast +++ IFGain:Low	Trig: Free Run Atten: 10 dB		: 200/200	TYP DE	E MWWWWW T P P N N N N	Auto Tune
10 dB/div Ref 106.99 dBµV				Mkr3	2.386 9 45.12	41 GHz 5 dBµV	Auto Tune
97.0 87.0 77.0							Center Freq 2.357500000 GHz
67.0 57.0 47.0 37.0	selection at a surface of a		net militarest teach		³ 2		Start Freq 2.310000000 GHz
27.0 11.0 11.0 11.0 11.0 11.0 11.0 11.0 1	WWWW	MAN MANANA ANA ANA ANA ANA ANA ANA ANA A			Y Y Y Y Y	Ni yafan	Stop Freq 2.405000000 GHz
Start 2.31000 GHz #Res BW 1.0 MHz	VBW 3	3.0 MHz			1.00 ms (:	500 GHz 5001 pts)	CF Step 10.000000 MHz
MKR MODE TRC SCL X	2 017 GHz	⊻ 91.413 dBuV	FUNCTION FU	NCTION WIDTH	FUNCTIO	N VALUE	Auto <u>Man</u>
2 N 1 f 2.390 3 N 1 f 2.386 4 5 6 6	0000 GHz 941 GHz	42.566 dBµV 45.125 dBµV					Freq Offset 0 Hz
7 8 9 10 11 12							
MSG				STATUS			

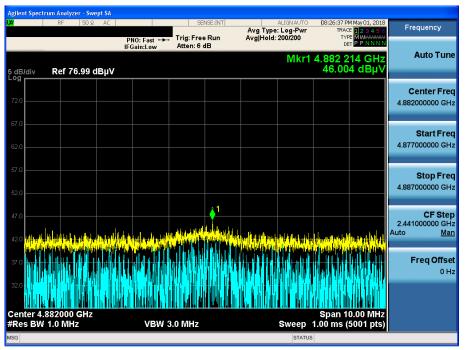
8DPSK & Highest & X & Hor



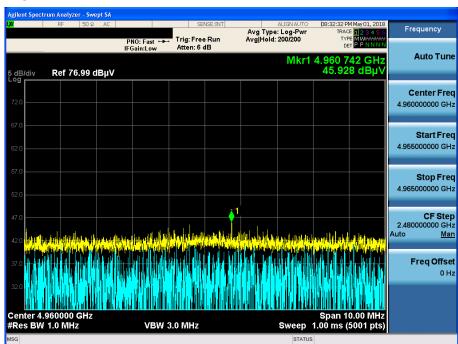
Detector Mode : PK



GFSK & Middle & X & Hor



π/4DQPSK & Highest & X & Hor





Detector Mode : PK

8DPSK & Highest & X & Hor

