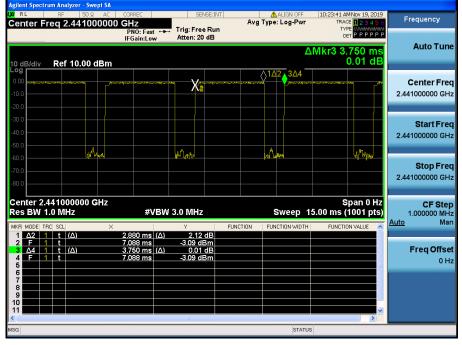


Hopping mode : Enable & 3-DH5

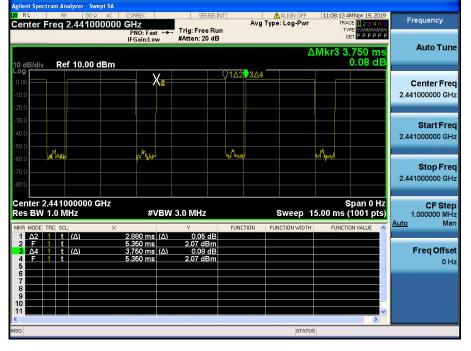
Time of Occupancy (FH)





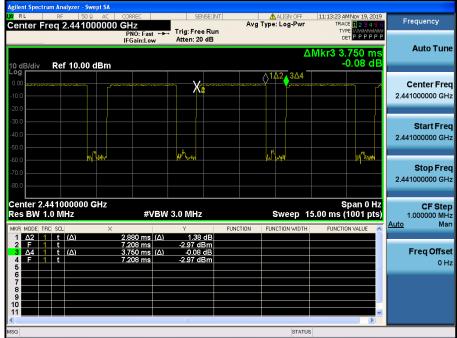
Time of Occupancy (AFH)

Hopping mode : Enable & DH5



Time of Occupancy (AFH)

Hopping mode : Enable & 2-DH5





Time of Occupancy (AFH)

Hopping mode : Enable & 3-DH5

		llyzer - Swept S						
LXI RL	RF	50 Ω A		SENSI		ALIGN OFF	11:16:47 AMNov 19, 2019	Frequency
Center F	req 2	2.4410000	00 GHz			e: Log-Pwr	TRACE 123456	Frequency
			PNO: Fast + IFGain:Low	 Trig: Free F Atten: 20 d 			TYPE WAAWAAAA DET P P P P P P	
						Δ	Mkr3 3.750 ms	Auto Tune
10 dB/div	Dof	10.00 dBr	~			_	0.08 dB	
Log	- NGI	10.00 0.01			_1∆2	244		
0.00						JU4	alaunation and a	Center Freq
-10.0				Xa				2.441000000 GHz
								2.441000000 GHZ
-20.0								
-30.0		[Otart Errar
-40.0								Start Freq
								2.441000000 GHz
-50.0		14		A .	ויידון איי		<u> </u>	
-60.0		In Manual		Jon huse	ար կես		her belle	
-70.0								Stop Freq
								2.441000000 GHz
-80.0								
Contor 2	4440	00000 GHz					On on A Ha	
Res BW 1				W 3.0 MHz		Swaan 4	Span 0 Hz 5.00 ms (1001 pts)	CF Step
Res DW	.U IWI	12	#VD	W 3.0 WHZ		sweep is	5.00 ms (100 i pis)	1.000000 MHz
MKR MODE TH			×	Y		NCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 <u>A2</u> 1	t	(Δ)	2.880 ms (∆					
2 F 1 3 Δ4 1	t	(A)	6.683 ms 3.750 ms (∆	- <u>3.01 dBr</u>) 0.08 di	n			Freq Offset
4 F 1	t		6.683 ms	-3.01 dBr				0 Hz
5							÷	UHZ
6								
8								
9								
10								
							~	
MSG						STATUS		
						314103		



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	GHz
0.009 ~ 0.110	16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15
0.495 ~ 0.505	16.69475 ~ 16.69525	608 ~ 614	5.35 ~ 5.46
2.1735 ~ 2.1905	16.80425 ~ 16.80475	960 ~ 1240	7.25 ~ 7.75
4.125 ~ 4.128	25.5 ~ 25.67	1300 ~ 1427	8.025 ~ 8.5
4.17725 ~ 4.17775	37.5 ~ 38.25	1435 ~ 1626.5	9.0 ~ 9.2
4.20725 ~ 4.20775	73 ~ 74.6	1645.5 ~ 1646.5	9.3 ~ 9.5
6.215 ~ 6.218	74.8 ~ 75.2	1660 ~ 1710	10.6 ~ 12.7
6.26775 ~ 6.26825	108 ~ 121.94	1718.8 ~ 1722.2	13.25 ~ 13.4
6.31175 ~ 6.31225	123 ~ 138	2200 ~ 2300	14.47 ~ 14.5
8.291 ~ 8.294	149.9 ~ 150.05	2310 ~ 2390	15.35 ~ 16.2
8.362 ~ 8.366	156.52475 ~ 156.52525	2483.5 ~ 2500	17.7 ~ 21.4
8.37625 ~ 8.38675	156.7 ~ 156.9	2690 ~ 2900	22.01 ~ 23.12
8.41425 ~ 8.41475	162.0125 ~ 167.17	3260 ~ 3267	23.6 ~ 24.0
12.29 ~ 12.293	167.72 ~ 173.2	3332 ~ 3339	31.2 ~ 31.8
12.51975 ~ 12.52025	240 ~ 285	3345.8 ~ 3358	36.43 ~ 36.5
12.57675 ~ 12.57725	322 ~ 335.4	3600 ~ 4400	Above 38.6
13.36 ~ 13.41			

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.

Measurement Instrument Setting

- 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	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)
2389.75	V	Х	PK	52.85	2.34	N/A	N/A	55.19	74.00	18.81
2389.75	V	Х	AV	52.85	2.34	-24.79	N/A	30.40	54.00	23.60
4804.45	V	Х	PK	50.12	1.87	N/A	N/A	51.99	74.00	22.01
4804.45	V	Х	AV	50.12	1.87	-24.79	N/A	27.20	54.00	26.80

Middle Channel

Frequency (MHz)	ANT Pol	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)
4882.35	V	Х	PK	50.49	2.12	N/A	N/A	52.61	74.00	21.39
4882.35	V	Х	AV	50.49	2.12	-24.79	N/A	27.82	54.00	26.18

Highest Channel

Frequency (MHz)	ANT Pol	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)
2483.78	V	Х	PK	52.43	2.81	N/A	N/A	55.24	74.00	18.76
2483.78	V	Х	AV	52.43	2.81	-24.79	N/A	30.45	54.00	23.55
4960.34	V	Х	PK	49.77	2.11	N/A	N/A	51.88	74.00	22.12
4960.34	V	Х	AV	49.77	2.11	-24.79	N/A	27.09	54.00	26.91

Note.

1. The radiated emissions were investigated up to 25 GHz. 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	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)
2388.47	V	Х	PK	53.77	2.33	N/A	N/A	56.10	74.00	17.90
2388.47	V	Х	AV	53.77	2.33	-24.79	N/A	31.31	54.00	22.69
4804.19	V	Х	PK	50.14	1.87	N/A	N/A	52.01	74.00	21.99
4804.19	V	Х	AV	50.14	1.87	-24.79	N/A	27.22	54.00	26.78

Middle Channel

Frequency (MHz)	ANT Pol	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)
4882.41	V	Х	PK	50.69	2.12	N/A	N/A	52.81	74.00	21.19
4882.41	V	Х	AV	50.69	2.12	-24.79	N/A	28.02	54.00	25.98

Highest Channel

Frequency (MHz)	ANT Pol	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)
2484.49	V	Х	PK	52.95	2.81	N/A	N/A	55.76	74.00	18.24
2484.49	V	Х	AV	52.95	2.81	-24.79	N/A	30.97	54.00	23.03
4959.64	V	Х	PK	49.95	2.11	N/A	N/A	52.06	74.00	21.94
4959.64	V	Х	AV	49.95	2.11	-24.79	N/A	27.27	54.00	26.73

Note.

1. The radiated emissions were investigated up to 25 GHz. 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 : <u>8DPSK</u>)

1	 Lowest Cl 	nannei	EUT	
	Frequency	ANT	Position	Detector

Frequency (MHz)	ANT Pol	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)
2389.64	V	Х	PK	52.95	2.34	N/A	N/A	55.29	74.00	18.71
2389.64	V	Х	AV	52.95	2.34	-24.79	N/A	30.50	54.00	23.50
4803.96	V	Х	PK	49.98	1.87	N/A	N/A	51.85	74.00	22.15
4803.96	V	Х	AV	49.98	1.87	-24.79	N/A	27.06	54.00	26.94

D: /

Middle Channel

Frequency (MHz)	ANT Pol	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	V	Х	PK	50.52	2.12	N/A	N/A	52.64	74.00	21.36
4881.57	V	Х	AV	50.52	2.12	-24.79	N/A	27.85	54.00	26.15

Highest Channel

Frequency (MHz)	ANT Pol	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)
2484.65	V	Х	PK	52.83	2.81	N/A	N/A	55.64	74.00	18.36
2484.65	V	Х	AV	52.83	2.81	-24.79	N/A	30.85	54.00	23.15
4959.92	V	Х	PK	49.63	2.11	N/A	N/A	51.74	74.00	22.26
4959.92	V	Х	AV	49.63	2.11	-24.79	N/A	26.95	54.00	27.05

Note.

1. The radiated emissions were investigated up to 25 GHz. 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

 $\label{eq:Where, T.F = Total Factor, \quad AF = Antenna \ Factor, \quad CL = Cable \ Loss, \quad AG = Amplifier \ Gain.$



Low Band-edge

Lowest Channel & Modulation : GFSK



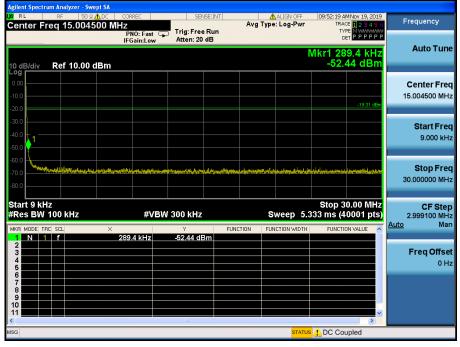
Low Band-edge

Hopping mode & Modulation : GFSK





Lowest Channel & Modulation : GFSK



Agilent Spectrum	RF 50Ω 4	AC COR		SEN:	BE:INT	Avg	ALIGN OFF	TRA	MNov 19, 2019 CE 123456	Frequency
	ef 10.00 dB	PN IFG	IO: Fast G	Trig: Free Atten: 20			Mki	۲۷ ۵ • 5 5.993		Auto Tune
10 dB/div R Log -10.0		m \01						-00.	-19.31 dBm	Center Freq 5.015000000 GHz
-30.0 -40.0 -50.0	ير المحمد المراجع المحمد المراجع الم	S		an a fail a least ann a san a fair an a	a na second	∮ ⁵ ∕	4		di pad para sedar (pa	Start Freq 30.000000 MHz
-60.0 -70.0 -80.0										Stop Freq 10.00000000 GHz
Start 30 MH #Res BW 1.0	O MHZ	×		V 3.0 MHz Y		INCTION	Sweep 18	3.67 ms (4	.000 GHz 0001 pts) N VALUE	CF Step 997.000000 MHz <u>Auto</u> Man
	f f f f f	2.402 1/ 3.214 17 2.827 08 6.490 3/ 5.993 06	7 GHz 3 GHz 1 GHz	0.92 dB -48.10 dB -50.03 dB -50.17 dB -50.31 dB	m m					Freq Offset 0 Hz
8 9 10 11										
MSG							STATU	s		



Lowest Channel & Modulation : GFSK



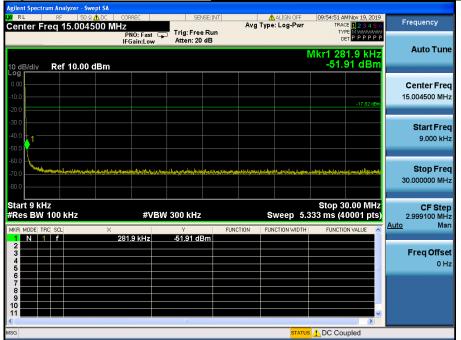


Reference for limit

Middle Channel & Modulation : GFSK



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



Middle Channel & Modulation : GFSK



Agilent Spectr M RL Center Fi	RF 5	0 Ω AC COR			SE:INT	Avg	ALIGN OFF	TRAC	MNov 19, 2019 26 <mark>1 2 3 4 5 6</mark> Pe M WWWWW T P P P P P P	Frequency
10 dB/div	Ref 10.0	IFG	iu: Fast G Gain:Low	Atten: 20			Mkr3 [/]	19.113 6		Auto Tune
Log 0.00 -10.0 -20.0									-17.82 dBm	Center Freq 17.500000000 GHz
-20.0 -30.0 -40.0					gal en gaard tel en fit	33	\$ ²		ð	Start Freq 10.000000000 GHz
-60.0 -70.0 -80.0										Stop Freq 25.000000000 GHz
Start 10.0 #Res BW	1.0 MHz	×		W 3.0 MHz Y		INCTION	Sweep 40	.00 ms (4	.000 GHz 0001 pts) NIVALUE	CF Step 1.50000000 GHz <u>Auto</u> Man
1 N 1 2 N 1 3 N 1 4 5	f	24.784 376 21.617 500 19.113 625) GHz	-41.46 d⊟ -44.29 d⊟ -46.56 d⊟	m					Freq Offset 0 Hz
6 7 8 9 10										
11 KING				Ш			STATU	3	>	



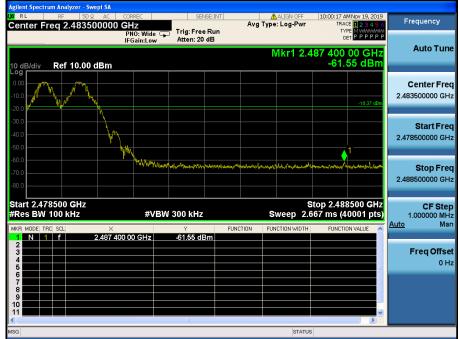
High Band-edge

Highest Channel & Modulation : GFSK



High Band-edge

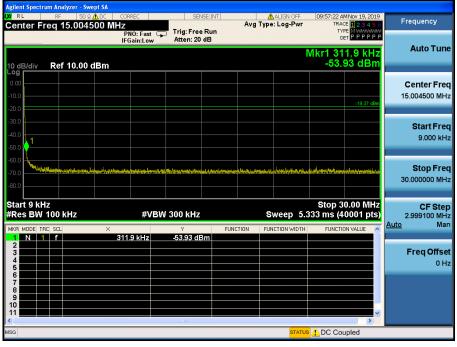
Hopping mode & Modulation : GFSK





Conducted Spurious Emissions <u></u>

Highest Channel & Modulation : GFSK



Agilent Spectrum Analyzer - Swept SA	CORREC	SENSE:INT	ALIGN OFF	09:57:46 AMNov 19, 2019	
Center Freq 5.015000000	OGHZ PNO: Fast C Trig	: Free Run	vg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	Frequency
10 dB/div Ref 10.00 dBm	IFGain:Low Atte	en: 20 dB	Mkr	5 7.395 34 GHz -50.72 dBm	Auto Tune
-10.0				-18.37 dBm	Center Freq 5.015000000 GHz
-30.0 -40.0 -50.0			5	eris fel papager fel bisk and gade it fi layer ave	Start Freq 30.000000 MHz
-60.0					Stop Freq 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBW 3.0 I			Stop 10.000 GHz 67 ms (40001 pts)	CF Step 997.000000 MHz <u>Auto</u> Man
2 N 1 f 3.0 3 N 1 f 3.1 4 N 1 f 5.7	039 94 GHz -48. 173 29 GHz -49. 722 87 GHz -49.	95 dBm 48 dBm 12 dBm 93 dBm 72 dBm			Freq Offset 0 Hz
6 7 8 9 10 11					
MSG		ii	STATUS		

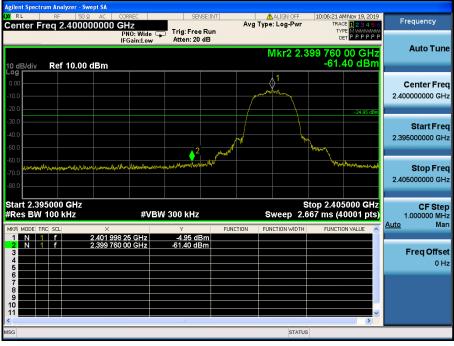
Highest Channel & Modulation : GFSK





Low Band-edge

Lowest Channel & Modulation : π/4DQPSK

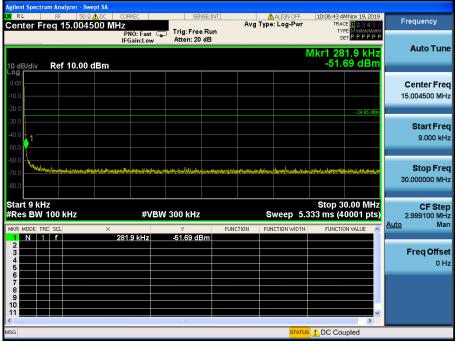


Low Band-edge

Hopping mode & Modulation : π/4DQPSK



Lowest Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Swe					
M RL RF 50Ω Center Freq 5.01500		SENSE:INT	Avg Type: Log-Pwr	10:07:07 AM Nov 19, 2019 TRACE 1 2 3 4 5 6 TYPE Ministration	Frequency
	PNO: Fast C IFGain:Low	Atten: 20 dB			Auto Tune
10 dB/div Ref 10.00 d	dBm		Mkr	5 2.131 18 GHz -50.96 dBm	Auto Tune
10.00 -10.0	1			-24.95 dBm	Center Freq 5.015000000 GHz
-30.0 -40.0 -50.0				-24-50 UDII	Start Freq 30.000000 MHz
-60.0 -70.0 -80.0					Stop Freq 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VB	W 3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz Auto Man
MKR MODE TRC SCL	× 2.402 36 GHz	ү -2.81 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Mari
2 N 1 F 3 N 1 F 4 N 1 F 5 N 1 F	3.290 19 GHz 6.372 91 GHz 2.662 08 GHz 2.131 18 GHz	-49.36 dBm -49.71 dBm -49.89 dBm -50.96 dBm			Freq Offset 0 Hz
6 7 8 9 9					
10 11 <				~	
MSG			STATU	3	

Lowest Channel & Modulation : π/4DQPSK





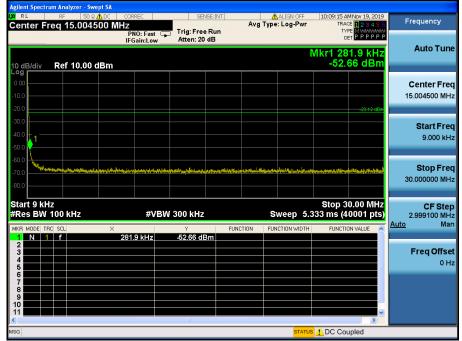
Reference for limit

Middle Channel & Modulation : π/4DQPSK



Conducted Spurious Emissions

Middle Channel & Modulation : π/4DQPSK



Middle Channel & Modulation : π/4DQPSK

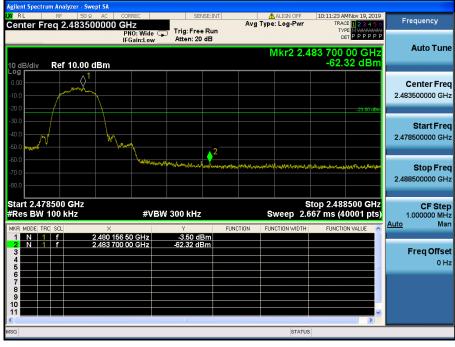


	um Analyzer - S								
Center Fr		Ω AC CORRE	z	SENSE:	Av	ALIGN OFF g Type: Log-Pwr	TRA	MNov 19, 2019 DE 123456	Frequency
		PNO IFGai	:Fast 🖵 in:Low	Trig: Free Ru Atten: 20 dB		Mkr3	D 21.738 2		Auto Tune
10 dB/div Log	Ref 10.00	dBm						09 dBm	
0.00 -10.0 -20.0								-20.12 dDm	Center Freq 17.500000000 GHz
-30.0 -40.0 -50.0	al an antidaškimki	1 for a file range of an 1 a filling state	den al Maria de La Maria da					 	Start Freq 10.000000000 GHz
-60.0									Stop Fred 25.000000000 GHz
Start 10.0 #Res BW			#VBW	3.0 MHz		Sweep 4	Stop 25 0.00 ms (4	.000 GHz 0001 pts)	CF Step 1.500000000 GH: Auto Mar
MKR MODE TF	RC SCL	× 24.896 875 (GHz	∀ -40.97 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO	ON VALUE	<u>Auto</u> Mar
2 N 1 3 N 1 4 5	f	24.145 750 (21.738 250 (GHz	-41.50 dBm -44.09 dBm					Freq Offsel 0 Hz
6 7 8 9									
11				Ш				~	
MSG						STATL	IS		



High Band-edge

Highest Channel & Modulation : π/4DQPSK



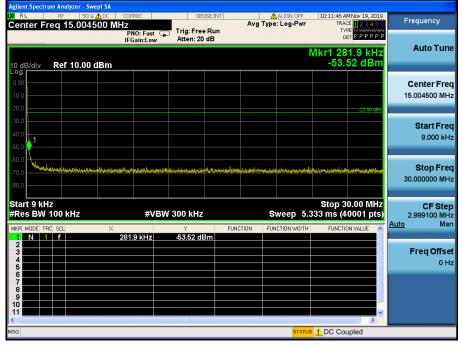
High Band-edge

Hopping mode & Modulation : π/4DQPSK





Highest Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Swept SA						
X RL RF 50 Ω AC Center Freq 5.015000000 AC AC </td <td>CORREC</td> <td>SENSE:INT</td> <td>Avg T</td> <td>ALIGN OFF</td> <td>10:12:09 AM Nov 19, 2019 TRACE 12345 6</td> <td>Frequency</td>	CORREC	SENSE:INT	Avg T	ALIGN OFF	10:12:09 AM Nov 19, 2019 TRACE 12345 6	Frequency
	PNO: East	Trig: Free Run Atten: 20 dB			TYPE M WAAAAAAA DET P P P P P	
	IFGam.cow	TREET. LO WD		Mkr	5 2.643 14 GHz	Auto Tune
10 dB/div Ref 10.00 dBm					-49.44 dBm	
Log 0.00						Center Freq
-10.0						5.015000000 GHz
-20.0					-23.50 dBm	
-30.0						Otent From
-40.0	5 - 32					Start Freq 30.000000 MHz
-50.0		لاهمىر سايانا د	11 and a star of a 12 allocate on a	The section states to a		30.000000 Mil 12
-60.0						
-70.0						Stop Freq
-80.0						10.00000000 GHz
Start 30 MHz					04+++ 40 000 OU	
#Res BW 1.0 MHz	#VBW 3	.0 MHz		Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL X		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
	2 51 GHz	-1.20 dBm -49.27 dBm				
3 N 1 f 3.07	0 85 GHz	-49.27 dBm				Freq Offset
5 N 1 f 2.64		-49.39 dBm -49.44 dBm			=	0 Hz
6						
8						
10						
11 <		III			~	
MSG				STATUS		

<u>Highest Channel & Modulation : π/4DQPSK</u>





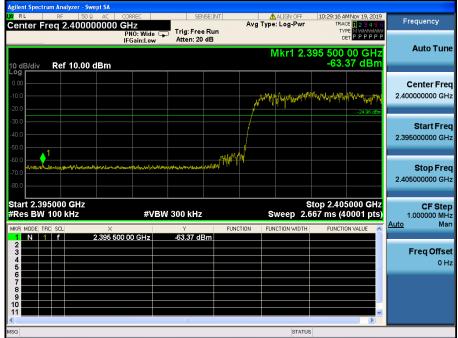
Low Band-edge

Lowest Channel & Modulation : 8DPSK



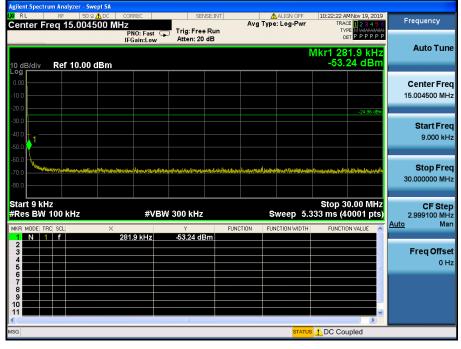
Low Band-edge

Hopping mode & Modulation : 8DPSK





Lowest Channel & Modulation : 8DPSK



		lyzer - Swe												
RL RL	RF Erea f	50 Ω 5.01500		CORREC GH7		SEN	JSE:INT	A		ALIGN OFF e: Log-Pwr	TRA	MNov 19, 2019	Freque	ency
Anton	Troq		0000	PNO: Fa IFGain:Lo		Trig: Free Atten: 20				-	TY D		2	
0 dB/div	v Ref	10.00 d	IBm							Mkr	5 6.379 -50.	64 GHz 53 dBm		o Tun
- og 0.00			1 									-24.96 dBm	Cent 5.015000	er Fre 000 GH
30.0		العام الاست ورايات ، مانت		\rangle^2 $\langle \rangle^3$					5	و المحمد ا	a and a sec y a subleman	-24.30 UDI	St a 30.000	nt Fre DOO MH
60.0 70.0 80.0		yng de Kiefner præsidentik				a de la construcción de la construc							Sto 10.000000	o p Fre 000 G⊢
Start 30 #Res B	0 MHz W 1.0 M	ЛНz		#	VBW :	3.0 MHz			ş	Sweep 18	Stop 10 .67 ms (4	.000 GHz 0001 pts	997.000	
	TRC SCL		× 2.40	2 11 GHz	7	Y -2.90 di		UNCTION	FL	INCTION WIDTH	FUNCTION	ON VALUE	Auto	Ma
2 N 3 N 4 N 5 N	1 f 1 f 1 f 1 f		2.66 3.19 5.82	6 57 GHz 6 57 GHz 8 96 GHz 8 30 GHz 9 64 GHz	z z	-47.86 dE -48.19 dE -50.04 dE -50.53 dE	3m 3m 3m						Fred	Offs or 0 ⊢
6 7 8 9 10														
11						Ш						>		
SG										STATUS				



Lowest Channel & Modulation : 8DPSK





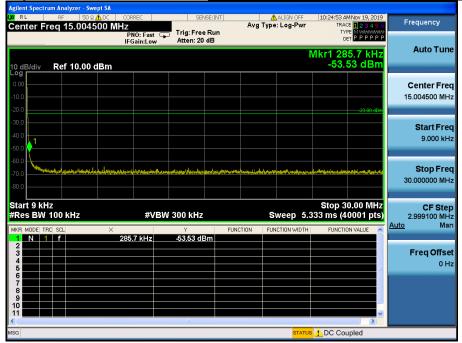
Reference for limit





Conducted Spurious Emissions





Middle Channel & Modulation : 8DPSK



Agilent Spectrum Analyzer - Swept SA					
M RL RF 50Ω AC CC Center Freq 17.5000000000	GHz	Avg Type:	Log-Pwr TRA	AM Nov 19, 2019 ACE 1 2 3 4 5 6	Frequency
	PNO: Fast Trig: Free Gain:Low Atten: 20		T) [
10 dB/div Ref 10.00 dBm			Mkr3 16.966 (000 GHz 08 dBm	Auto Tune
					Center Freq 7.50000000 GHz
-30.0 -40.0 -50.0	3		en an an faith an Anna	1	Start Freq 0.000000000 GHz
-60.0 -70.0 -80.0				2	Stop Freq 5.000000000 GHz
Start 10.000 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz	Sv	Stop 25 veep 40.00 ms (4		CF Step 1.50000000 GHz
MKR MODE TRC SCL X	25 GHz -41.28 dE		CTION WIDTH FUNCT		<u>uto</u> Man
2 N 1 f 24.395 i 3 N 1 f 16.966 00 4 5 6	25 GHz -41.56 dB	3m			Freq Offset 0 Hz
6 7 8 9 10					
<	ш				
MSG			STATUS		



High Band-edge

Highest Channel & Modulation : 8DPSK



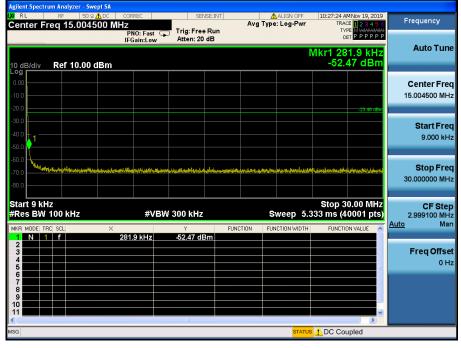
High Band-edge

Hopping mode & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK



	50 Ω AC	CORREC		SENS	E:INT	ALIGN OFF	10:27:47 A	MNov 19, 2019	
Center Freq 5	5.015000000	PNO: F		rig: Free F	Run	be: Log-Pwr	TY	CE 123456 PE MWWWWW FT P P P P P	Frequency
0 dB/div Ref	f 10.00 dBm	IFGain:	Low A	tten: 20 d	B	Mkr	5 2.067	87 GHz 09 dBm	Auto Tun
0.00 10.0 20.0) ¹						-23.48 dBm	Center Fre 5.015000000 GH
30.0 40.0 50.0	5	\Diamond^2	>3			an ing the light light of	and first groups through	ter at your first the second	Start Fre 30.000000 M⊦
60.0 70.0			ALANGE IN CASE		a da	ini di taka manganan	(the Bart of States of Contract of States of		Stop Fre
80.0									10.00000000 GF
	MHz		#VBW 3.0) MHz		 Sweep 18	Stop 10 .67 ms (4	.000 GHz 0001 pts)	CF Ste 997.000000 Mł
80.0 Start 30 MHz	. X) MHz Y 0.76 dBr	FUNC	Sweep 18	.67 ms (4	.000 GHz .0001 pts) DN VALUE	CF Ste 997.000000 MH
80.0 Start 30 MHz #Res BW 1.0 M	. × 2.4 2.5 3.5		Hz - Hz -4 Hz -4 Hz -5	Y	n n n		.67 ms (4	0001 pts)	10.00000000 GF 997.000000 MF Auto Mi Freq Offs 0 F
60.0 Start 30 MHz Res BW 1.0 M KR MODE TRC SCL 1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f	. × 2.4 2.5 3.5	480 38 GI 561 88 GI 333 81 GI 886 88 GI	Hz - Hz -4 Hz -4 Hz -5	Y 0.76 dBr 8.94 dBr 9.12 dBr 0.70 dBr	n n n		.67 ms (4	0001 pts)	CF Ste 997.000000 MF <u>Auto</u> Mi Freq Offs

Highest Channel & Modulation : 8DPSK





8. Transmitter AC Power Line Conducted Emission

8.1 Test Setup

NA

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	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

🛈 Dt&C

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

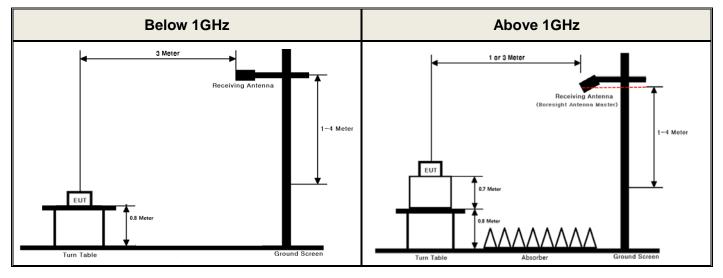
- Minimum Standard :

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.

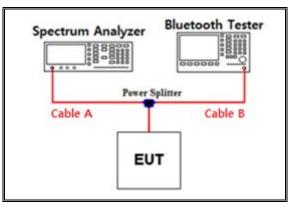
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.35	15	8.19
1	6.76	20	8.27
2.402 & 2.441 & 2.480	7.18	25	8.80
5	7.27	-	-
10	7.40	-	-

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

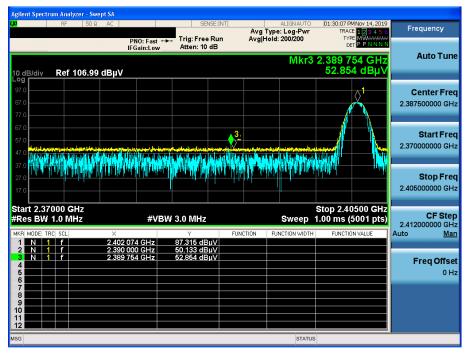




APPENDIX II

Unwanted Emissions (Radiated) Test Plot

GFSK & Lowest & X & Ver



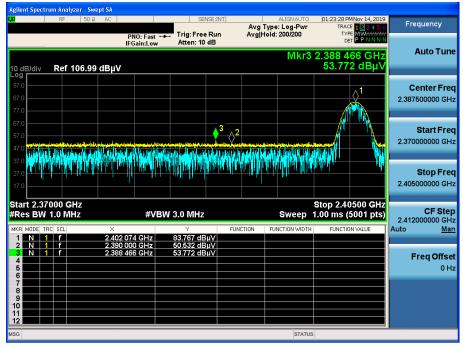
GFSK & Highest & X & Ver

Spectrum Analyzer - Swept SA Frequency Avg Type: Log-Pwi Avg|Hold: 200/200 Trig: Free Run Atten: 10 dB PNO: Fast 🔸 Auto Tune Mkr3 2.483 777 2 GH 52.434 dBµ Ref 106.99 dBµV /div 0 **Center Freq** 2.489000000 GHz 3 Start Fred 2.478000000 GHz hand a state of the nen peritor (residente de periodo de la Stop Freq 2.50000000 GHz Stop 2.50000 GHz 1.00 ms (5001 pts) Start 2.47800 GHz #Res BW 1.0 MHz CF Step 2.412000000 GHz uto <u>Man</u> #VBW 3.0 MHz Sweep uto Freq Offset 0 Hz STATUS

Detector Mode : PK



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



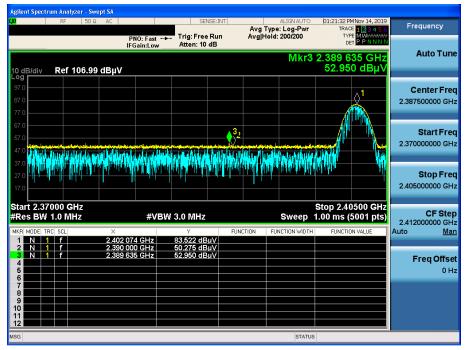
Detector Mode : PK

π /4DQPSK & Highest & X & Ver

Agilent Spectrum Analyzer - Swept SA					
X RF 50 Ω AC			ALIGNAUTO Type: Log-Pwr Hold: 200/200	01:13:31 PMNov 14, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWWWW	Frequency
10 dB/div Ref 106.99 dBµV	IFGain:Low Atten:			^{рет р р н н н н н н н н н н н н н н н н н}	Auto Tune
Log 97.0 87.0 77.0					Center Freq 2.489000000 GHz
	3		A. PLANIN MANY	an in hi akinda hinda	Start Freq 2.478000000 GHz
27.0 17.0 Start 2.47800 GHz	an na an a	ullis Hutallus	ne donne de		Stop Freq 2.500000000 GHz
KIART 2.47800 GHZ #Res BW 1.0 MHz	#VBW 3.0 MH	1z FUNCTION		Stop 2.50000 GHz 1.00 ms (5001 pts)	CF Step 2.412000000 GHz Auto Mar
1 N 1 f 2.480 0 2 N 1 f 2.483 50	59 2 GHz 86.647 00 0 GHz 50.449 90 0 GHz 52.946	dBµV dBµV			Freq Offset
7 8 9 10 11					
MSG			STATUS		

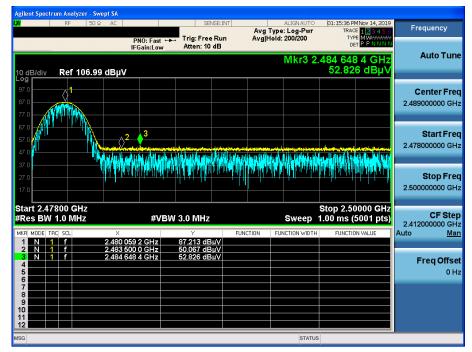


8DPSK & Lowest & X & Ver



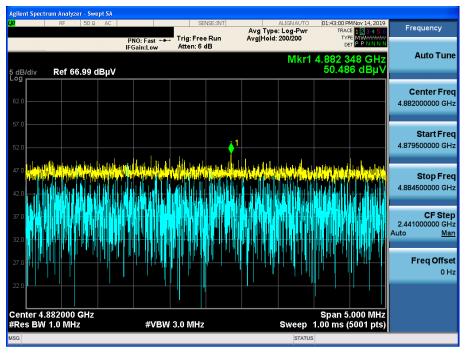
Detector Mode : PK

8DPSK & Highest & X & Ver

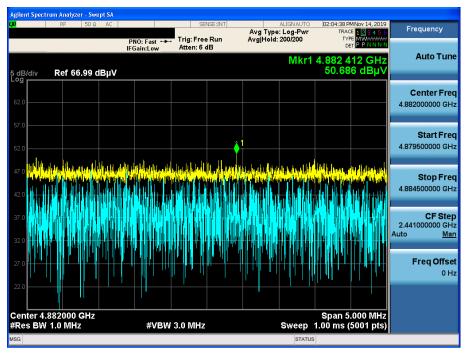




GFSK & Middle & X & Ver



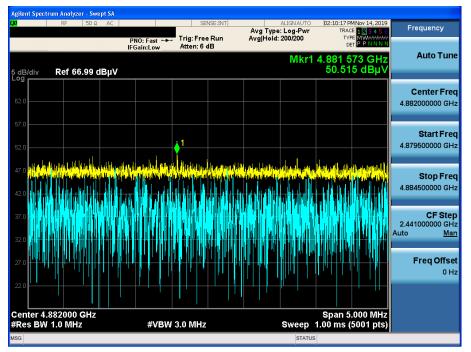
$\pi/4DQPSK$ & Middle & X & Ver



Detector Mode : PK



8DPSK & Middle & X & Ver



Detector Mode : PK