

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)
2387.79	Н	Х	PK	52.61	2.32	N/A	N/A	54.93	74.00	19.07
2389.85	Н	Х	AV	41.59	2.33	-24.79	N/A	19.13	54.00	34.87
4804.36	Н	Z	PK	60.90	0.83	N/A	N/A	61.73	74.00	12.27
4804.06	Н	Z	AV	58.42	0.83	-24.79	N/A	34.46	54.00	19.54
7206.54	V	Х	PK	56.48	7.57	N/A	N/A	64.05	74.00	9.95
7206.06	V	Х	AV	52.44	7.56	-24.79	N/A	35.21	54.00	18.79

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)
4882.36	Н	Z	PK	62.40	0.87	N/A	N/A	63.27	74.00	10.73
4882.03	Н	Z	AV	60.31	0.87	-24.79	N/A	36.39	54.00	17.61
7323.42	V	Х	PK	57.75	7.86	N/A	N/A	65.61	74.00	8.39
7323.06	V	Х	AV	53.96	7.86	-24.79	N/A	37.03	54.00	16.97

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)
2483.50	Н	Х	PK	56.88	2.56	N/A	N/A	59.44	74.00	14.56
2483.50	Н	Х	AV	49.25	2.56	-24.79	N/A	27.02	54.00	26.98
4959.52	Н	Z	PK	61.52	0.99	N/A	N/A	62.51	74.00	11.49
4960.01	Н	Z	AV	59.04	0.99	-24.79	N/A	35.24	54.00	18.76
7439.48	V	Х	PK	57.86	7.42	N/A	N/A	65.28	74.00	8.72
7440.01	V	Х	AV	54.20	7.42	-24.79	N/A	36.83	54.00	17.17

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 dBWhen 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

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



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

 Lowest Channe 	
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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)
2386.89	Н	Х	PK	52.06	2.32	N/A	N/A	54.38	74.00	19.62
2389.65	Н	Х	AV	41.57	2.33	-24.79	N/A	19.11	54.00	34.89
4804.33	Н	Z	PK	57.21	0.83	N/A	N/A	58.04	74.00	15.96
4804.13	Н	Z	AV	50.54	0.83	-24.79	N/A	26.58	54.00	27.42
7205.49	V	Х	PK	53.23	7.56	N/A	N/A	60.79	74.00	13.21
7206.12	V	Х	AV	44.26	7.56	-24.79	N/A	27.03	54.00	26.97

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)
4881.67	Н	Z	PK	60.31	0.87	N/A	N/A	61.18	74.00	12.82
4881.96	Н	Z	AV	54.60	0.87	-24.79	N/A	30.68	54.00	23.32
7323.59	V	Х	PK	55.15	7.86	N/A	N/A	63.01	74.00	10.99
7323.13	V	Х	AV	47.27	7.86	-24.79	N/A	30.34	54.00	23.66

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)
2483.51	Н	Х	PK	56.67	2.56	N/A	N/A	59.23	74.00	14.77
2483.50	Н	Х	AV	46.09	2.56	-24.79	N/A	23.86	54.00	30.14
4959.57	Н	Z	PK	59.41	0.99	N/A	N/A	60.40	74.00	13.60
4959.96	Н	Z	AV	53.43	0.99	-24.79	N/A	29.63	54.00	24.37
7439.43	V	Х	PK	54.13	7.42	N/A	N/A	61.55	74.00	12.45
7439.97	V	Х	AV	46.24	7.42	-24.79	N/A	28.87	54.00	25.13

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

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



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

 Lowest C 	Channel
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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)
2386.96	Н	Х	PK	52.59	2.32	N/A	N/A	54.91	74.00	19.09
2389.76	Н	Х	AV	41.47	2.33	-24.79	N/A	19.01	54.00	34.99
4804.39	Н	Z	PK	57.92	0.83	N/A	N/A	58.75	74.00	15.25
4804.12	Н	Z	AV	50.50	0.83	-24.79	N/A	26.54	54.00	27.46
7206.61	V	Х	PK	52.86	7.57	N/A	N/A	60.43	74.00	13.57
7206.15	V	Х	AV	43.92	7.56	-24.79	N/A	26.69	54.00	27.31

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)
4882.01	Н	Z	PK	60.52	0.87	N/A	N/A	61.39	74.00	12.61
4881.98	Н	Z	AV	54.57	0.87	-24.79	N/A	30.65	54.00	23.35
7322.97	V	Х	PK	55.58	7.86	N/A	N/A	63.44	74.00	10.56
7322.99	V	Х	AV	46.92	7.86	-24.79	N/A	29.99	54.00	24.01

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)
2483.50	Н	Х	PK	56.06	2.56	N/A	N/A	58.62	74.00	15.38
2483.50	Н	Х	AV	45.96	2.56	-24.79	N/A	23.73	54.00	30.27
4959.69	Н	Z	PK	59.34	0.99	N/A	N/A	60.33	74.00	13.67
4960.02	Н	Z	AV	53.34	0.99	-24.79	N/A	29.54	54.00	24.46
7439.79	V	Х	PK	54.46	7.42	N/A	N/A	61.88	74.00	12.12
7439.88	V	Х	AV	45.92	7.42	-24.79	N/A	28.55	54.00	25.45

<u>Note.</u>

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) = $20 \log(1 \text{ m / } 3 \text{ m}) = -9.54 \text{ dB}$ 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

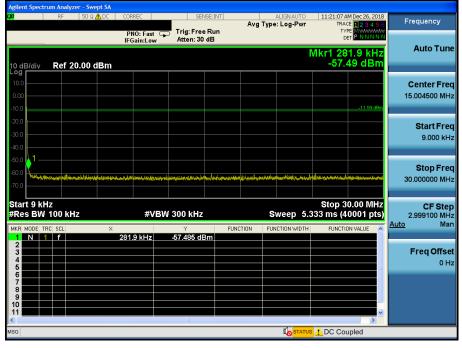
Low Band-edge

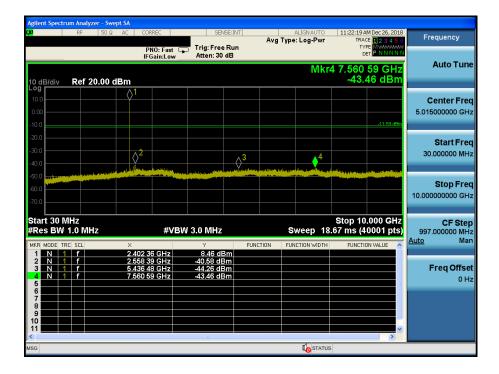
Hopping mode & Modulation : GFSK





Lowest Channel & Modulation : GFSK







Lowest Channel & Modulation : GFSK



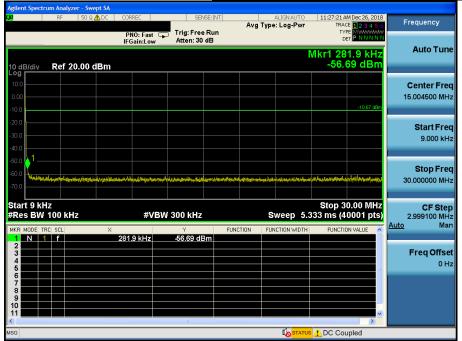


Reference for limit

Middle Channel & Modulation : GFSK

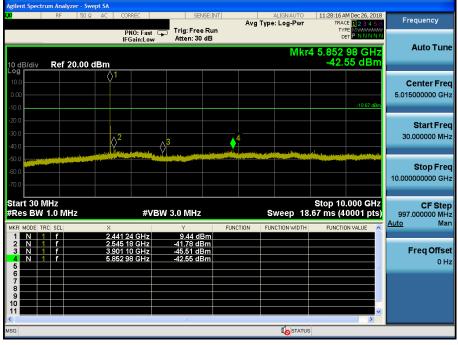


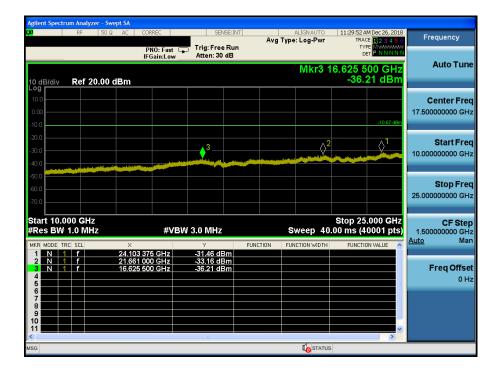
Conducted Spurious Emissions <u>Middle Channel & Modulation : GFSK</u>













High Band-edge

Highest Channel & Modulation : GFSK



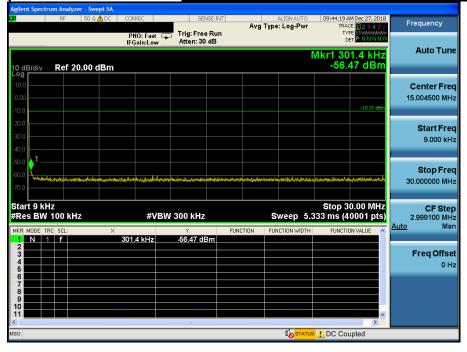
High Band-edge

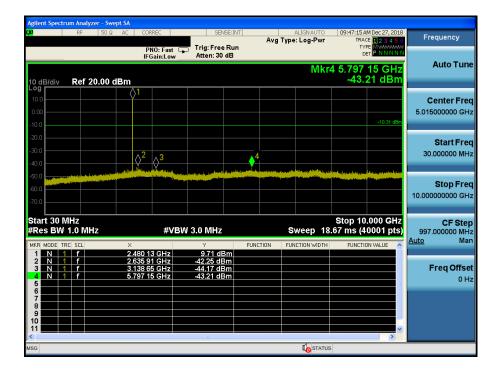
Hopping mode & Modulation : GFSK





Highest Channel & Modulation : GFSK





Conducted Spurious Emissions <u>H</u>

Highest Channel & Modulation : GFSK





Low Band-edge

Lowest Channel & Modulation : π/4DQPSK



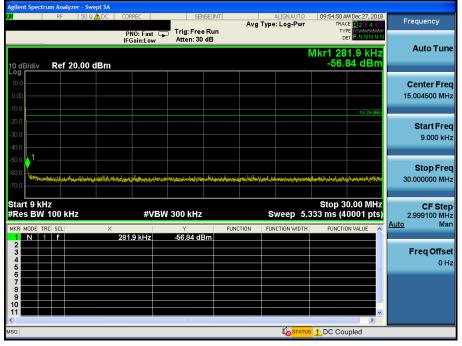
Low Band-edge

Hopping mode & Modulation : π/4DQPSK





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



Agilent Spectrum Analyzer - Swe		SENSE:INT		09:56:38 AM Dec 27, 2018	
Μ KF 50 Ω			ALIGN AUTO Avg Type: Log-Pwr	TRACE 123456	Frequency
	PNO: Fast 🔸 IFGain:Low	Atten: 30 dB		TYPE MUMANANAN DET PNNNNN	Auto Tune
10 dB/div Ref 20.00 c	IBm		Mkr	5 5.808 36 GHz -44.12 dBm	Auto Tune
Log 10.0	1				Center Freq
0.00					5.015000000 GHz
-10.0				-15.29 dBm	
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-40.0				and the second se	
-50.0 -60.0					Stop Freq
-70.0					10.00000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBM	/ 3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.402 36 GHz	Y FL 6.219 dBm	INCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar
2 N 1 F 3 N 1 F	2.506 55 GHz 3.160 08 GHz	-42.34 dBm -43.48 dBm			Freq Offset
4 N 1 f 5 N 1 f	4.755 03 GHz 5.808 36 GHz	-45.17 dBm -44.12 dBm		=	0 Hz
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Conducted Spurious Emissions Lowest C

Lowest Channel & Modulation : π/4DQPSK





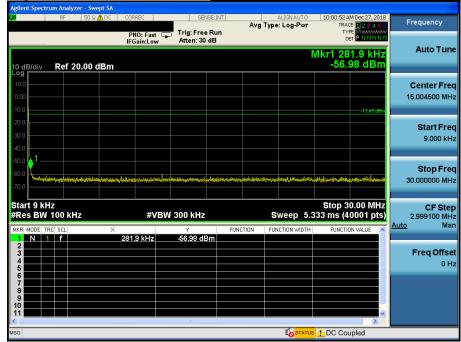
Reference for limit

Middle Channel & Modulation : π/4DQPSK



Conducted Spurious Emissions <u>A</u>

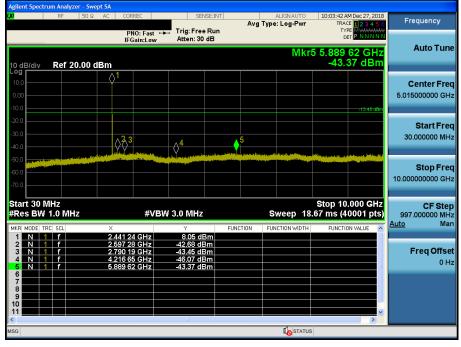
Middle Channel & Modulation : π/4DQPSK

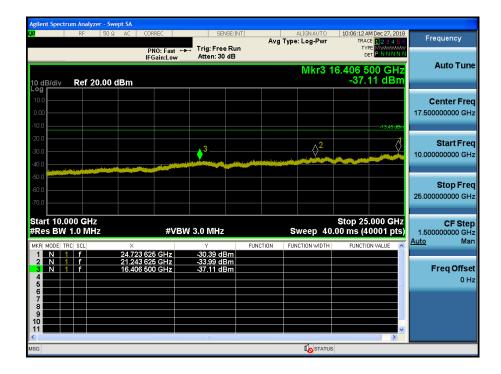






Middle Channel & Modulation : π/4DQPSK







High Band-edge

Highest Channel & Modulation : π/4DQPSK



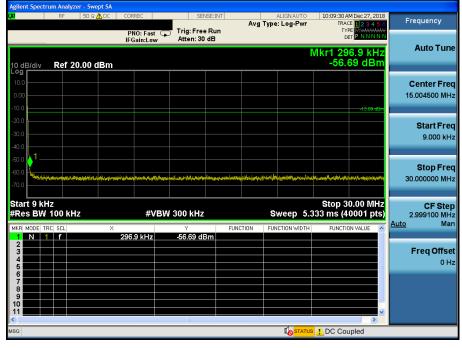
High Band-edge

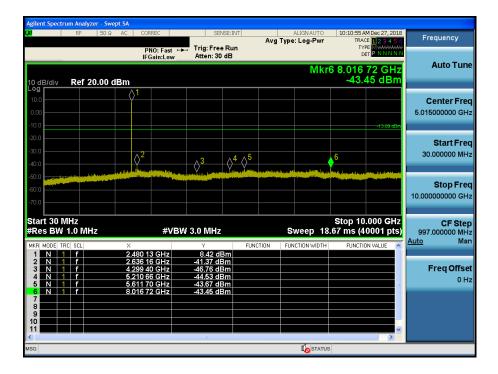
Hopping mode & Modulation : π/4DQPSK





Highest Channel & Modulation : π/4DQPSK







Highest Channel & Modulation : π/4DQPSK





Low Band-edge

Lowest Channel & Modulation : 8DPSK



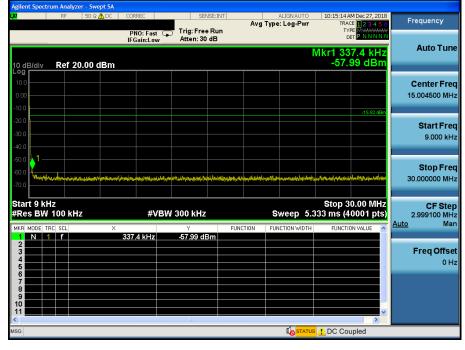
Low Band-edge

Hopping mode & Modulation : 8DPSK





Lowest Channel & Modulation : 8DPSK



Agilent Spectrum Analyzer - Sw					
🗙 RF 50 Ω	AC CORREC PNO: Fast ↔	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	10:16:08 AM Dec 27, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
	IFGain:Low	Atten: 30 dB	Mkr	5 6.869 42 GHz	Auto Tune
10 dB/div Ref 20.00 (dBm		1	-44.63 dBm	
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-10.0				-15.82 dBm	
-30.0	$2^2 \diamond^3$	♦	↓ 5		Start Free 30.000000 MH:
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Start 30 MHz #Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MH: Auto Mar
MKR MODE TRC SCL	× 2.402 11 GHz	Y FUN 6.55 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
2 N 1 f 3 N 1 f 4 N 1 f	2.558 14 GHz 3.161 33 GHz 5.319 58 GHz	-41.73 dBm -44.11 dBm -44.46 dBm			Freq Offse
5 N 1 f 6 7	6.869 42 GHz	-44.63 dBm			0 H:
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Lowest Channel & Modulation : 8DPSK



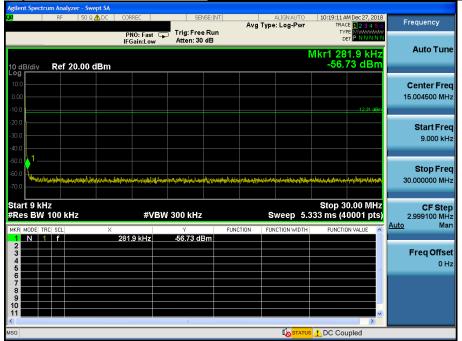


Reference for limit

Middle Channel & Modulation : 8DPSK



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





Middle Channel & Modulation : 8DPSK



Agilent Spectrum Analyz							
XI RF	50 Ω AC CORRE		Avg T	ALIGNAUTO ype: Log-Pwr	TRAC	M Dec 27, 2018 E 1 2 3 4 5 6	Frequency
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				Mkr3 1	6.675 7	50 GHz	Auto Tune
10 dB/div Ref 2	0.00 dBm					78 dBm	
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0.00							17.500000000 GH
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-40.0	القياب ويستشتن وتستعيل الشيور والمتعاد						
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-60.0							Stop Free 25.00000000 GH
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Start 10.000 GHz	2				Stop 25.	.000 GHz	CF Step
#Res BW 1.0 MH		#VBW 3.0 MHz		Sweep 40	.00 ms (4	0001 pts)	1.500000000 GH
MKR MODE TRC SCL	х	Y		FUNCTION WIDTH	FUNCTIO	N VALUE	<u>Auto</u> Mai
1 N 1 f 2 N 1 f	24.740 500 (22.210 375 (GHz -33.29 dBr	n				
3 N 1 f	16.675 750 (GHz -36.78 dBr	n				Freq Offse
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ISG							



High Band-edge

Highest Channel & Modulation : 8DPSK



High Band-edge

Hopping mode & Modulation : 8DPSK



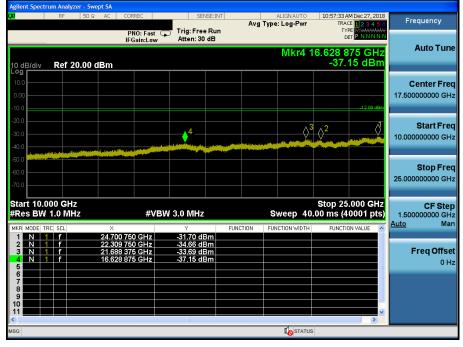


Highest Channel & Modulation : 8DPSK

gilent Spectr	um Analyzer -	Swept SA i0 Ω 🗥 DC	CORREC	G	ENSE:INT		ALIGN AUTO	10:52:34 A	M Dec 27, 2018	
	10		PNO: Fast			Avg	Type: Log-Pwr	TRAC	E 1 2 3 4 5 6	Frequency
0 dB/div	Ref 20.0	0 dBm	IFGain:Low					Mkr1 32	9.9 kHz 26 dBm	Auto Tun
- og 10.0 0.00 -10.0									-12.08 dBm	Center Fre 15.004500 M⊦
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1 N 1 2 3 4 5 6 7	f		329.9 kHz	-58.26 c	Bm					Freq Offs 0 I
8 9 9 10 10 11 10 10 10 10 10 10 10 10 10 10									~	

Agilent Spectrum Analyzer - Swe									
ιχι RF 50 Ω	AC CORREC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	10:56:45 AM Dec 27, 2018 TRACE 1 2 3 4 5 6	Frequency				
	PNO: Fast ↔ IFGain:Low	Trig: Free Run Atten: 30 dB		DET P N N N N					
10 dB/div Ref 20.00 c	IBm		Mkr	5 7.003 27 GHz -44.21 dBm	Auto Tune				
10.0 0.00 -10.0	1				Center Freq 5.015000000 GHz				
-20.0 -30.0 -40.0	$\diamond^2 \diamond^3$	↓ ↓	5	White and the second	Start Freq 30.000000 MHz				
-50.0 -60.0 -70.0					Stop Freq 10.000000000 GHz				
Start 30 MHz #Res BW 1.0 MHz		V 3.0 MHz		Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz Auto Man				
MKR MODE TRC SCL	× 2.480 13 GHz	ץ 8.39 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE					
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	2.610 24 GHz 3.206 44 GHz 4.769 99 GHz 7.003 27 GHz	-42.21 dBm -43.69 dBm -45.32 dBm -44.21 dBm			Freq Offset 0 Hz				
6 7 8 9 10									
11		ш		~					
MSG									

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 Limit (dBuV)					
Trequency Range (wriz)	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

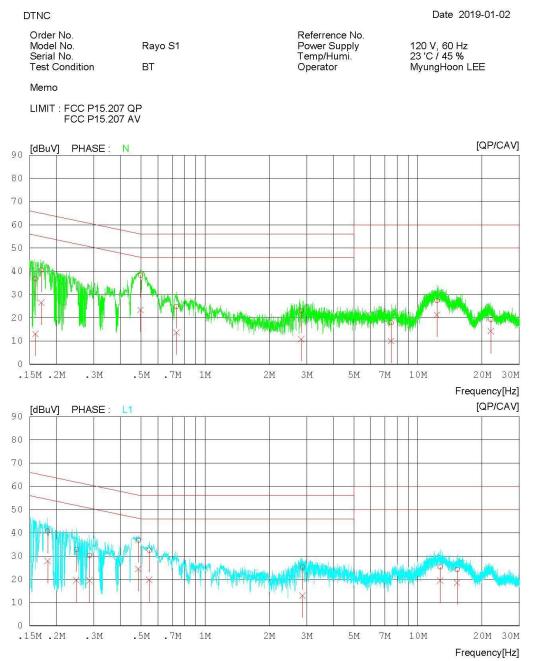
Conducted emissions from the EUT were measured according to the ANSI C63.10.

- 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)



Results of Conducted Emission

AC Line Conducted Emissions (List) = Modulation : <u>GFSK</u>

Results of Conducted Emission

DTNC			Date 2019-01-02
Order No. Model No. Serial No. Test Condition	Rayo S1 BT	Referrence No. Power Supply Temp/Humi. Operator	120 V, 60 Hz 23 'C / 45 % MyungHoon LEE
Memo			
LIMIT : FCC P15 FCC P15			
NO FREQ	READING C.FACTOF QP CAV [dBuV][dBuV] [dB]	R RESULT LIMIT QP CAV QP CA [dBuV][dBuV][dBuV][dB	~~~~
3 0.49750 4 0.73266 5 2.83200 7 12.29520 8 22.02040 9 0.18204 10 0.24848 11 0.28639	$\begin{array}{ccccccc} 30.40 & 16.34 & 10.18 \\ 28.22 & 13.39 & 10.02 \\ 14.86 & 3.66 & 10.05 \\ 12.92 & 0.76 & 10.14 \\ 7.51 & -0.26 & 10.30 \\ 16.96 & 10.91 & 10.42 \\ 8.60 & 3.69 & 10.60 \\ 30.67 & 17.76 & 10.08 \\ 22.87 & 9.54 & 9.97 \\ 20.16 & 9.53 & 9.98 \\ 26.81 & 14.45 & 10.00 \\ 22.51 & 9.76 & 10.00 \\ 15.05 & 2.83 & 10.10 \\ 14.86 & 9.05 & 10.40 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	4 24.3628.42 N 4 17.8022.63 N 0 31.0932.29 N 0 42.1939.96 N 0 42.1939.96 N 0 32.6228.67 N 0 40.8035.71 N 9 23.6426.55 L1 1 28.9732.30 L1 3 30.4931.12 L1 3 19.4221.78 L1 0 32.4926.24 L1 0 34.7430.55 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 permanently attached. (Refer to Internal Photo file.) Therefore this EUT complies with the requirement of §15.203.

- Minimum Standard :

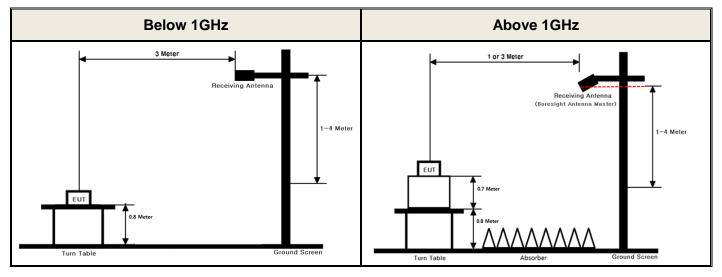
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply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



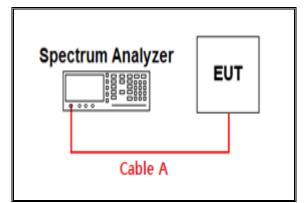
APPENDIX I

Test set up diagrams

Radiated Measurement



Conducted Measurement



Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	0.61	15	5.29
1	1.17	20	7.19
2.402 & 2.441 & 2.480	1.92	25	7.69
5	2.83	-	-
10	4.01	-	-

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



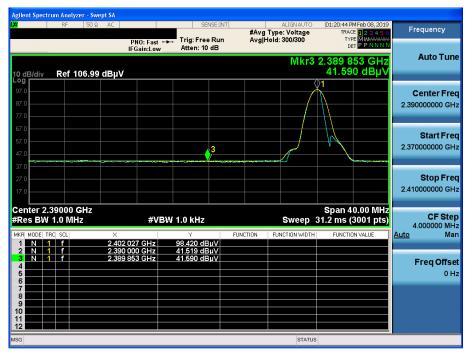
APPENDIX II

Unwanted Emissions (Radiated) Test Plot

GFSK & Lowest & X & Hor

Frequency TRACE 1234 TYPE MWWWW DET PPNN #Avg Type: Log-Pwr Avg|Hold: 300/300 PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 10 dB Auto Tune Mkr1 2.402 133 GH 98.473 dBµ\ Ref 106.99 dBµV 0 **Center Freq** 2.390000000 GHz Start Freq 2.370000000 GHz WWW , MARANA AND A THE AN Stop Freq 2.41000000 GHz Center 2.39000 GHz #Res BW 1.0 MHz Span 40.00 MHz Sweep 1.00 ms (3001 pts) CF Step 4.000000 MHz #VBW 3.0 MHz Auto Mar 98.473 dBµ\ 50.699 dBµ\ 52.614 dBµ\ Ň Freq Offset 0 Hz 10 11 12

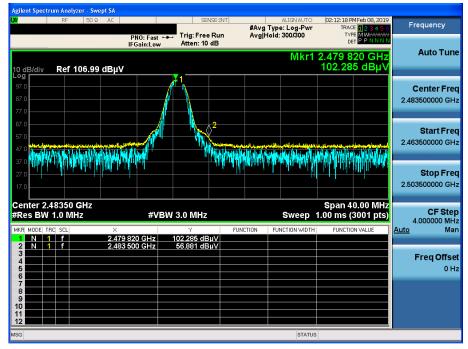
GFSK & Lowest & X & Hor



Detector Mode : AV



GFSK & Highest & X & Hor



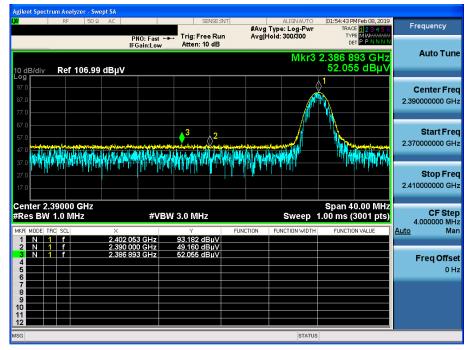
Detector Mode : AV

GFSK & Highest & X & Hor

Agilent Spectrum Analyzer -				TOT LAUTO		
RF 5	DΩ AC	SENSE:INT	#Avg Type: \	Voltage	02:11:58 PM Feb 08, 2019 TRACE 1 2 3 4 5 6 TYPE MW44400	Frequency
	PNO: Fast IFGain:Low	Trig: Free Run Atten: 10 dB	Avg Hold: 30	50/300	DET P P N N N N	
10 dB/div Ref 106.	99 dBµV				.480 007 GHz 02.179 dBµV	Auto Tune
97.0 97.0 77.0						Center Free 2.483500000 GH
67.0 57.0 47.0		2				Start Free 2.463500000 GH
37.0 27.0 17.0						Stop Fre 2.503500000 GH
Center 2.48350 GHz #Res BW 1.0 MHz		3W 1.0 kHz	s		Span 40.00 MHz .2 ms (3001 pts)	CF Stej 4.000000 MH
MKR MODE TRC SCL	× 2.480 007 GHz	۲ 102.179 dBuV	FUNCTION FUNCT	TION WIDTH	FUNCTION VALUE	<u>Auto</u> Ma
2 N 1 f 3 4 5 5 6	2.483 500 GHz	49.249 dBµV				Freq Offse 0 H
7 8 9 10 11						
12				STATUS		
.50				51A105		

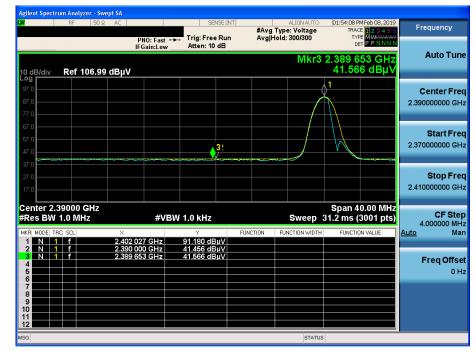


$\pi/4DQPSK$ & Lowest & X & Hor



π /4DQPSK & Lowest & X & Hor

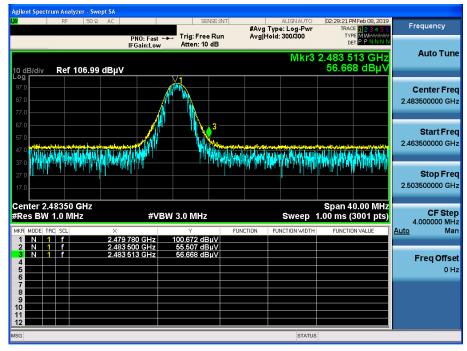
Detector Mode : AV





Detector Mode : AV

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

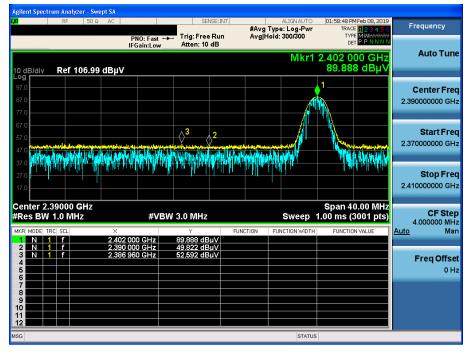


π/4DQPSK & Highest & X & Hor

#Avg Type: Voltage Avg|Hold: 300/300 Frequency TYPE MWA Trig: Free Run Atten: 10 dB PNO: Fast ← IFGain:Low Auto Tune Mkr1 2.480 007 GHz 98.706 dBµV Ref 106.99 dBµV **Center Freq** 2.483500000 GHz Start Freq 2.463500000 GHz Stop Freq 2.503500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 40.00 MHz 31.2 ms (3001 pts) CF Step 4.000000 MHz #VBW 1.0 kHz Sweep Auto FUNCTION Mar FUNCTION 2.480 007 GHz 2.483 500 GHz 98.706 dBµ∨ 46.094 dBµ∨ N 1 Freq Offset 0 Hz STATUS

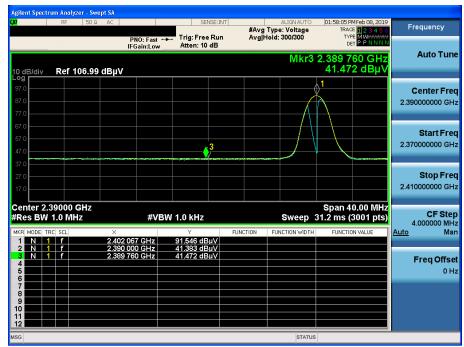


8DPSK & Lowest & X & Hor



Detector Mode : AV

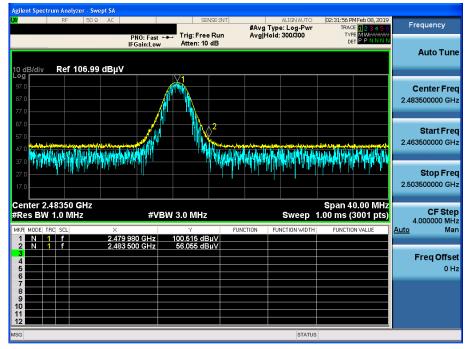
8DPSK & Lowest & X & Hor





8DPSK & Highest & X & Hor

Detector Mode : PK



8DPSK & Highest & X & Hor

#Avg Type: Voltage Avg|Hold: 300/300 Frequency TYPE MWA Trig: Free Run Atten: 10 dB PNO: Fast +++ IFGain:Low Auto Tune Mkr1 2.480 033 GHz 98.754 dBµV Ref 106.99 dBµV **Center Freq** 2.483500000 GHz Start Freq 2.463500000 GHz Stop Freq 2.503500000 GHz Center 2.48350 GHz #Res BW 1.0 MHz Span 40.00 MHz 31.2 ms (3001 pts) CF Step 4.000000 MHz #VBW 1.0 kHz Sweep Auto FUNCTION Mar FUNCTION 98.754 dBµ\ 45.961 dBµ\ 2.480 033 GHz 2.483 500 GHz N 1 Freq Offset 0 Hz STATUS

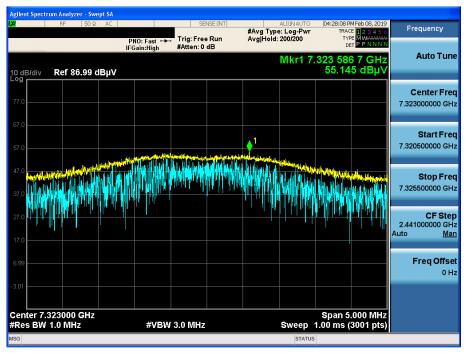
Detector Mode : AV



GFSK & Middle & X & Ver



π /4DQPSK & Middle & X & Ver



Detector Mode : PK



8DPSK & Middle & X & Ver

