### 7.4. Test Results

#### 7.4.1. Radiated Emissions

#### 9 kHz ~ 25 GHz Data (Modulation : GFSK)

Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2388.32	Н	Х	PK	47.42	0.77	N/A	N/A	48.19	74.00	25.81
2388.32	Н	Х	AV	47.42	0.77	-24.79	N/A	23.40	54.00	30.60
4804.02	Н	Х	PK	47.26	7.63	N/A	N/A	54.89	74.00	19.11
4804.02	Н	Х	AV	47.26	7.63	-24.79	N/A	30.10	54.00	23.90

#### 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)
4881.45	Н	Х	PK	44.40	7.30	N/A	N/A	51.70	74.00	22.30
4881.45	Н	Х	AV	44.40	7.30	-24.79	N/A	26.91	54.00	27.09

#### 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	51.76	1.10	N/A	N/A	52.86	74.00	21.14
2483.61	Н	Х	AV	51.76	1.10	-24.79	N/A	28.07	54.00	25.93
4959.67	Н	Х	PK	45.45	7.48	N/A	N/A	52.93	74.00	21.07
4959.67	Н	Х	AV	45.45	7.48	-24.79	N/A	28.14	54.00	25.86

#### 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 =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms /  $\Delta t$  [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 : $\pi$ /4DQPSK)

#### Lowest Channel

Frequency (MHz)	ANT Pol	The worst case EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	D.C.F (dB)	Distance Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2386.92	Н	Х	PK	46.51	0.77	N/A	N/A	47.28	74.00	26.72
2386.92	Н	Х	AV	46.51	0.77	-24.79	N/A	22.49	54.00	31.51
4803.46	Н	Х	PK	45.98	7.63	N/A	N/A	53.61	74.00	20.39
4803.46	Н	Х	AV	45.98	7.63	-24.79	N/A	28.82	54.00	25.18

#### 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)
4882.58	Н	Х	PK	44.84	7.30	N/A	N/A	52.14	74.00	21.86
4882.58	Н	Х	AV	44.84	7.30	-24.79	N/A	27.35	54.00	26.65

#### 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)
2483.55	Н	Х	PK	50.35	1.10	N/A	N/A	51.45	74.00	22.55
2483.55	Н	Х	AV	50.35	1.10	-24.79	N/A	26.66	54.00	27.34
4960.37	Н	Х	PK	45.01	7.48	N/A	N/A	52.49	74.00	21.51
4960.37	Н	Х	AV	45.01	7.48	-24.79	N/A	27.70	54.00	26.30

#### 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 =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74  $\approx$  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 : <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)
2386.80	Н	Х	PK	45.35	0.77	N/A	N/A	46.12	74.00	27.88
2386.80	Н	Х	AV	45.35	0.77	-24.79	N/A	21.33	54.00	32.67
4804.43	Н	Х	PK	47.37	7.63	N/A	N/A	55.00	74.00	19.00
4804.43	Н	Х	AV	47.37	7.63	-24.79	N/A	30.21	54.00	23.79

#### 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)
4882.37	Н	Х	PK	44.00	7.30	N/A	N/A	51.30	74.00	22.70
4882.37	Н	Х	AV	44.00	7.30	-24.79	N/A	26.51	54.00	27.49

#### 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)
2483.52	Н	Х	PK	49.42	1.10	N/A	N/A	50.52	74.00	23.48
2483.52	Н	Х	AV	49.42	1.10	-24.79	N/A	25.73	54.00	28.27
4959.93	Н	Х	PK	45.81	7.48	N/A	N/A	53.29	74.00	20.71
4959.93	Н	Х	AV	45.81	7.48	-24.79	N/A	28.50	54.00	25.50

#### 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 =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms /  $\Delta t$  [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74  $\approx$  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



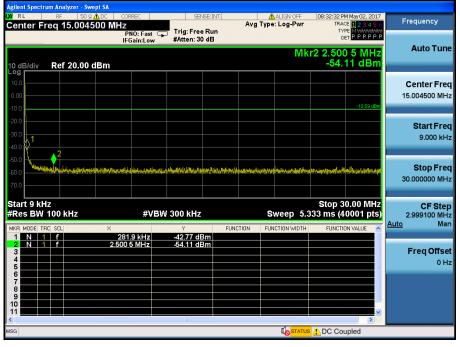
#### Lowest Channel & Modulation : GFSK

#### Low Band-edge

### Hopping mode & Modulation : GFSK



### Lowest Channel & Modulation : GFSK



Agilent Spectrum Analyzer - Swept (X/ RL RF 50 Ω	AC CORREC	SENSE:INT		🛕 ALIGN OFF	08:32:41 PM May 02, 2017	Frequency
Center Freq 5.015000	PNO: Fast G	Trig: Free Run	Avg Ty	oe: Log-Pwr	TRACE 12345 C TYPE MWWWWW DET PPPPP	
10 dB/div Ref 20.00 dE	IFGain:Low	#Atten: 30 dB		Mkr	5 3.381 42 GHz -39.27 dBm	Auto Tune
Log 10.0 -10.0	↓1				-10.59 dBm	Center Freq 5.015000000 GHz
-20.0				4		Start Freq 30.000000 MHz
-50.0 -60.0 -70.0						<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBV	V 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 9.54 dBm	FUNCTION F	UNCTION WIDTH	FUNCTION VALUE	Auto Man
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	6.550 63 GHz 5.894 85 GHz 7.099 73 GHz 3.381 42 GHz	-38.91 dBm -39.21 dBm -39.23 dBm -39.27 dBm				<b>Freq Offset</b> 0 Hz
7						
MSG		10		<b>I</b> STATUS	×	



### Lowest Channel & Modulation : GFSK



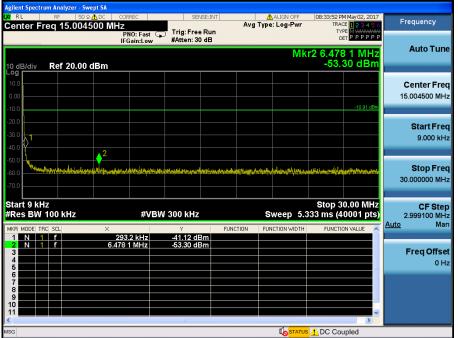


#### Reference for limit

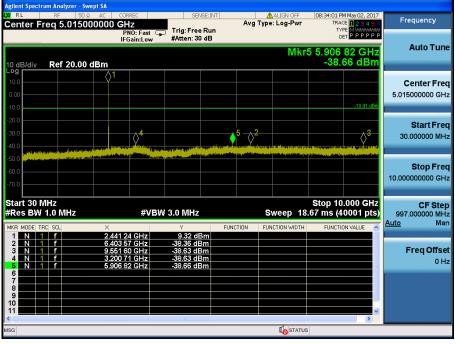




#### Conducted Spurious Emissions <u>Middle Channel & Modulation : GFSK</u>





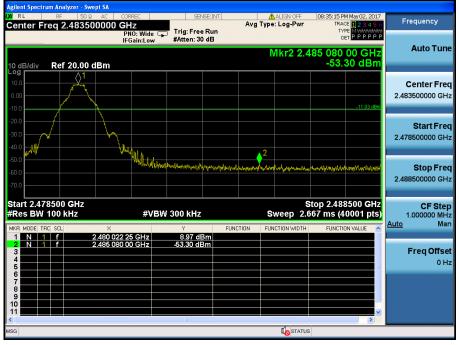


Agilent Spectrum Analyzer - Swept SA				
X RL RF 50 Ω AC CORR Center Freq 17.500000000 GH	Hz	Avg Type: Log-Pwr	08:34:09 PM May 02, 2017 TRACE 1 2 3 4 5 6	Frequency
PN	0: Fast 😱 Trig: Free Ru ain:Low #Atten: 30 dB	n	DET PPPPP	
		Mkr3	24.178 750 GHz	Auto Tune
10 dB/div Ref 20.00 dBm			-30.63 dBm	
Log 10.0				Center Freq
0.00				17.50000000 GHz
-10.0			-10.91 dBm	
-20.0			3 3	Start Freq
-30.0				10.000000000 GHz
-40.0				
-50.0				04 E
-60.0				Stop Freq 25.00000000 GHz
-70.0				23.00000000 6112
Start 10.000 GHz			Stop 25.000 GHz	CF Step
#Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 40	).00 ms (40001 pts)	1.50000000 GHz
MKR MODE TRC SCL X	Y	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f 24.919 375 2 N 1 f 24.819 250	GHz -29.64 dBm			
3 N 1 f 24.178 750	GHz -30.63 dBm			Freq Offset
5			=	0 Hz
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<	III		<b>&gt;</b>	
MSG			S	



### High Band-edge

# Highest Channel & Modulation : GFSK



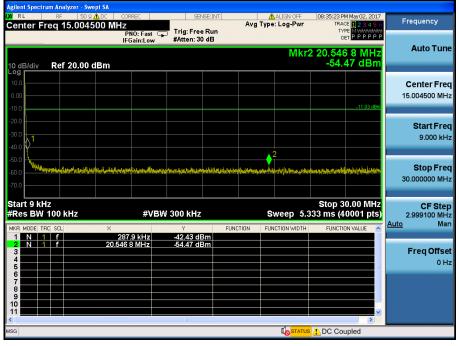
### High Band-edge

### Hopping mode & Modulation : GFSK



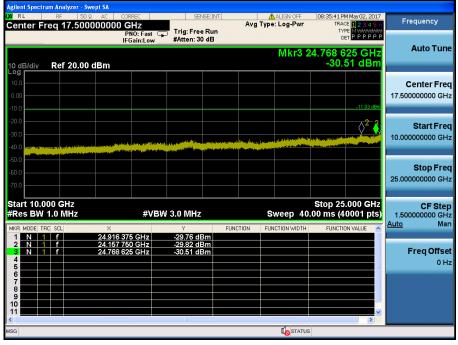
#### Conducted Spurious Emissions <u>Hig</u>

### Highest Channel & Modulation : GFSK



LXI RL	um Analyzer - S RF 50 req 5.0150	Ω AC CORI	Z	SENSE:	Avg		ALIGN OFF	TRAC	M May 02, 2017 26 <b>1 2 3 4 5</b> 6 PE M WWWWW	Frequency
10 dB/div	Ref 20.00	IFG	l0: Fast   Ģ ain:Low	#Atten: 30 dE			Mkr	Di 6.655	07 GHz	Auto Tune
10.0 0.00		1 							-11.03 dBm	Center Freq 5.015000000 GHz
-20.0 -30.0 -40.0		alle Telebole all the factories	¢ <sup>2</sup>	all New York (1) Inc. (1) Press	The prime of a large state	¢ <sup>5</sup>	¢ <sup>4</sup>	ىلىغۇرى بالى <u>غىنىلە</u> بىر	Re and a line and to be a	Start Freq 30.000000 MHz
-50.0 -60.0 -70.0			and the second secon			ile shallout	, déladir i a postafit, sora s	riddfing, <sub>Al-</sub> uniol (n i		<b>Stop Freq</b> 10.000000000 GHz
Start 30 M #Res BW	1.0 MHz	×	#VB\	N 3.0 MHz	FUNCTION		weep 18	.67 ms (4	.000 GHz 0001 pts)	<b>CF Step</b> 997.000000 MHz <u>Auto</u> Man
1 N 1 2 N 1 3 N 1 4 N 1 5 N 1	f f f f	2.480 38 3.181 77 7.583 02 7.076 80 6.655 07	GHz GHz GHz	9.72 dBm -38.62 dBm -38.97 dBm -38.98 dBm -39.00 dBm				FUNCTION		Freq Offset 0 Hz
8 9 10 11										
MSG				Ш						

### Highest Channel & Modulation : GFSK





#### Low Band-edge

# Lowest Channel & Modulation : π/4DQPSK



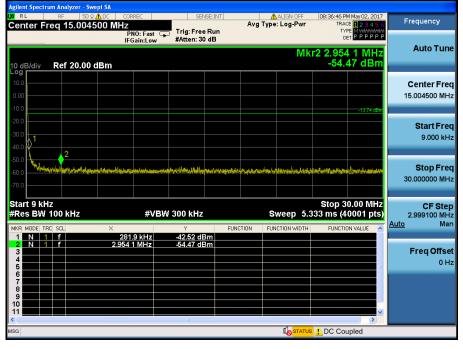
#### Low Band-edge

### Hopping mode & Modulation : π/4DQPSK



#### Conducted Spurious Emissions <u>Lowest C</u>

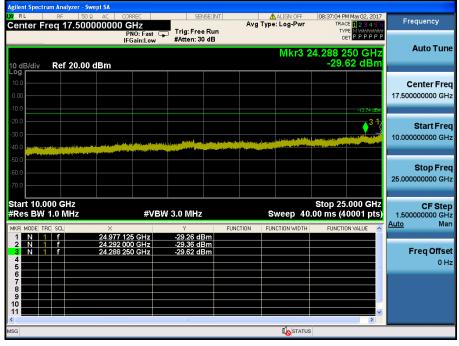
### Lowest Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Sv	Vept SA	SENSE:INT		ALIGN OFF	08:36:56 PM May 02, 2017	
Center Freq 5.0150		Trig: Free Run		pe: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P P	Frequency
10 dB/div Ref 20.00	IFGain:Low	#Atten: 30 dB		Mkr	5 6.204 92 GHz -38.47 dBm	Auto Tune
10.0 0.00 -10.0	1 				-1 3.74 dBm	Center Freq 5.015000000 GHz
-20.0			<b>↓</b> <sup>5</sup> ♦ <sup>4</sup>	¢23	a un de la compañía d	Start Freq 30.000000 MHz
-50.0 -60.0 -70.0	and a state of the state of a state of the s					<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0 MHz	#VBV	V 3.0 MHz		Sweep 18	Stop 10.000 GHz .67 ms (40001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	× 2.402 11 GHz	۲ 8.68 dBm	FUNCTION F	UNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f 6	7.110 94 GHz 7.243 05 GHz 6.527 95 GHz 6.204 92 GHz	-37.67 dBm -37.86 dBm -37.99 dBm -38.47 dBm			=	<b>Freq Offset</b> 0 Hz
7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9						
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MSG						

#### Conducted Spurious Emissions Lowest Cha

#### Lowest Channel & Modulation : π/4DQPSK



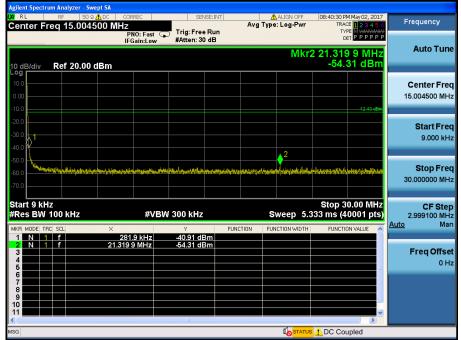
### Reference for limit

### Middle Channel & Modulation : π/4DQPSK

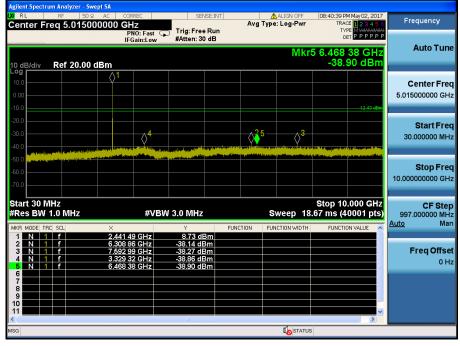


#### Conducted Spurious Emissions

#### Middle Channel & Modulation : π/4DQPSK



#### Middle Channel & Modulation : π/4DQPSK

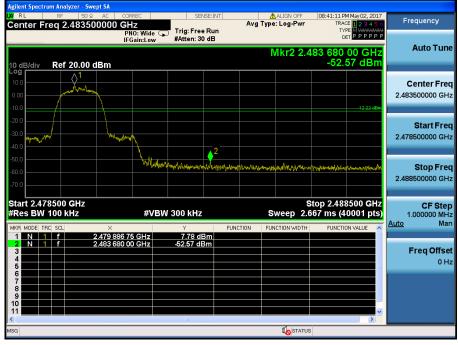


	rum Analyzer - S						-
Center E	RF 50		SENSE:		ALIGN OFF	08:40:47 PM May 02, 20 TRACE 1234	Frequency
Center	169 17.500	PNO: Fast IFGain:Low	Trig: Free Ro #Atten: 30 di	un			
		IFGain:Low	#Atten: 50 di		BALL OF		Auto Tuno
10 dB/div	Ref 20.00	dBm			IVIKES 2	24.713 125 GH -29.93 dBi	
Log	Kel 20.00						
10.0							Center Freq
0.00							17.50000000 GHz
-10.0						-12.43 d	Bin
-20.0						<u> </u>	3 Start Freq
-30.0							10.00000000 GHz
-40.0 retretetere	- And a state of the		and a second state of the second state			and the second	
-50.0							
-60.0							Stop Freq
-70.0							25.00000000 GHz
Start 10.0		<i>10</i> (				Stop 25.000 GH	
#Res BW		#VE	3W 3.0 MHz		Sweep 40	.00 ms (40001 pt	S) 1.500000000 GHz Auto Man
MKR MODE TH	RC SCL	× 24.991 000 GHz	۲ -29.37 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
2 N 1	f	24.908 500 GHz	-29.73 dBm				
3 N 1	1 f	24.713 125 GHz	-29.93 dBm				Freq Offset
5							0 Hz
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MSG							



#### High Band-edge

### Highest Channel & Modulation : π/4DQPSK

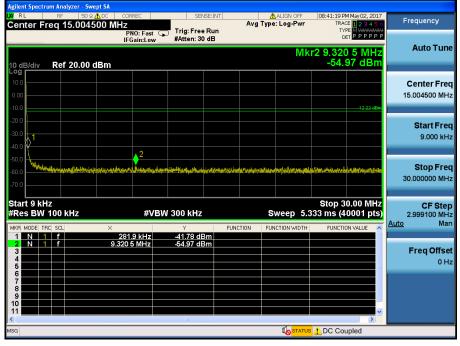


### High Band-edge

### Hopping mode & Modulation : π/4DQPSK

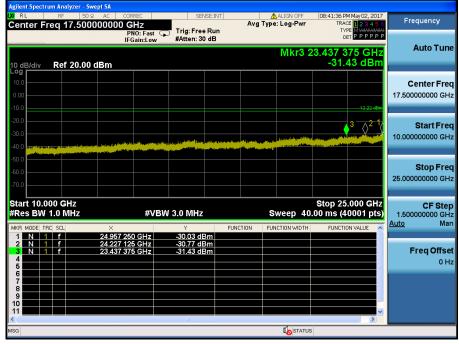


### Highest Channel & Modulation : π/4DQPSK



Agilent Spectrum Analyzer - Sw						
Center Freq 5.01500		SENSE:INT	ALIG	g-Pwr TRACE	May 02, 2017	Frequency
	PNO: Fast G IFGain:Low	Trig: Free Run #Atten: 30 dB		TYPE DE	PPPPP	
	il Galileon			Mkr5 5.840	77 GHz	Auto Tune
10 dB/div Ref 20.00	dBm				2 dBm	
Log 10.0						Center Freq
0.00						5.015000000 GHz
-10.0					-12.22 dBm	
-20.0						Otart Franci
-30.0			<u>5</u> <u>3</u> <u>2</u>			Start Freq 30.000000 MHz
-40.0			<u>, y</u> , y , y ,	فالقطيع فالكلكان فببطيط وفارك مرجمهم	a programme and a start	30.000000 WH2
-50.0	and a second shift of a share of the second s	Ale or well in the local of the little in the second statements	فتزعلت ومعرف فالشأن التعلي كأدكر	and an of the local distribution of the loca		
-60.0						Stop Freq 10.00000000 GHz
-70.0						10.00000000 GHZ
Start 30 MHz				Stop 10.	000 GHz	CE Oton
#Res BW 1.0 MHz	#VBV	V 3.0 MHz	Swee	ep 18.67 ms (40	001 pts)	CF Step 997.000000 MHz
MKR MODE TRC SCL	×		FUNCTION   FUNCTION	WIDTH FUNCTION		<u>Auto</u> Man
1 N 1 f 2 N 1 f	2.480 13 GHz 7.044 64 GHz	8.73 dBm -38.38 dBm				
3 N 1 f	6.402 33 GHz 6.465 88 GHz	-38.86 dBm -38.89 dBm				Freq Offset
5 N 1 f	5.840 77 GHz	-39.02 dBm				0 Hz
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10					~	
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MSG			<b>Q</b>	STATUS		

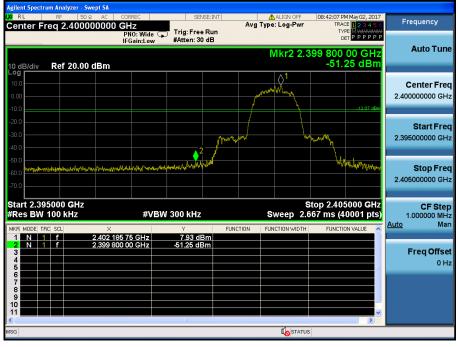
### Highest Channel & Modulation : π/4DQPSK





#### Low Band-edge

### Lowest Channel & Modulation : 8DPSK



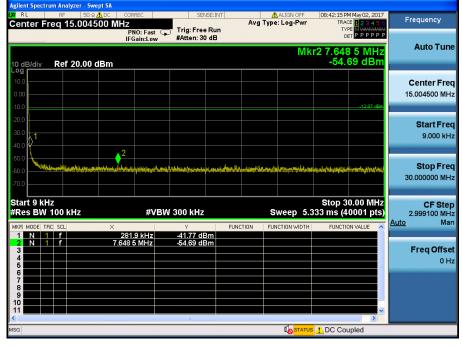
#### Low Band-edge

#### Hopping mode & Modulation : 8DPSK





### Lowest Channel & Modulation : 8DPSK



Agilent Spectru	m Analyzer - Swep RF 50 Ω	AC CORF	EC	SENS	E:INT		ALIGN OFF	08:42:24 PM	1 May 02, 2017	
Center Fre	eq 5.01500		z 0:Fast G	Trig: Free	Run	Avg Typ	e: Log-Pwr	TRAC	123456 MWWWWWW TPPPPP	Frequency
		IFG	ain:Low	#Atten: 30	dB					Auto Tune
10 dB/div	Ref 20.00 di	Bm					Mkr	5 5.294 -39.0	41 GHz )7 dBm	Auto Func
10.0		1								Center Freq
0.00										5.015000000 GHz
-10.0									-12.07 dBm	
-20.0					5 3	^ <u>2</u>				Start Freq
-40.0		THE REPORT OF		المشاور بارينادا المرا				a an an the art from a t	The state of the second state	30.000000 MHz
-50.0	Contraction of the second s	Constant of the local of the lo		an a	and a state of the second s	des and this search			Andreas and a state of the	Stop Freq
-60.0										10.000000000 GHz
-70.0										
Start 30 M #Res BW 1			#VB۱	N 3.0 MHz		s	weep 18		000 GHz 0001 pts)	CF Step 997.000000 MHz
MKR MODE TRO	SCL	×		Y		CTION FU	NCTION WIDTH	FUNCTIO	N VALUE	<u>Auto</u> Man
1 N 1 2 N 1	f f	2.402 36 6.616 18	GHz	8.86 dB -37.70 dB	m					
3 N 1 4 N 1	f f	5.529 20 7.826 29	GHz	-38.79 dB -38.92 dB	m					Freq Offset 0 Hz
5 N 1	f	5.294 41	GHz	-39.07 dB	m				=	
8										
9										
<				Ш					>	
WSG							<b>I</b> STATUS			

# Lowest Channel & Modulation : 8DPSK

Agilent Spectrum Analyzer - So					
Center Freq 17.500		SENSE:INT	ALIGN OFF	08:42:32 PM May 02, 2017 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
10 dB/div Ref 20.00	PNO: Fast ( IFGain:Low	→ Trig: Free Run #Atten: 30 dB	Mkr3 2	23.998 000 GHz -31.12 dBm	Auto Tune
10.0 0.00 -10.0					Center Freq 17.500000000 GHz
-20.0 -30.0 -40.0 and the second state of the	مر من من المراجع والمراجع المراجع			Attion and a second sec	Start Freq 10.000000000 GHz
-50.0 -60.0 -70.0					<b>Stop Freq</b> 25.000000000 GHz
Start 10.000 GHz #Res BW 1.0 MHz	#VB	W 3.0 MHz	Sweep 40	Stop 25.000 GHz 0.00 ms (40001 pts)	CF Step 1.50000000 GHz <u>Auto</u> Man
1 N 1 f 2 N 1 f 3 N 1 f 4 5	24.254 125 GHz 23.681 500 GHz 23.998 000 GHz	-29.95 dBm -30.85 dBm -31.12 dBm			Freq Offset 0 Hz
6 7 8 9 10					
MSG		Ш	STATU	>	

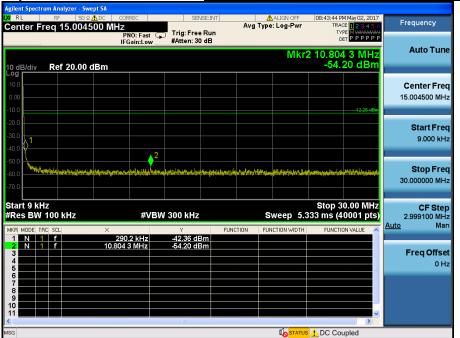


#### **Reference for limit**





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



# Middle Channel & Modulation : 8DPSK



Agilent Spectr	um Analyzer - RF 5		CORDEC	SENSE		ALIGN OFF	08:44:02 PM Ma		
	req 17.50	0000000	PNO: Fast	Trig: Free F	Av Sun	g Type: Log-Pwr		2 3 4 5 6 P P P P P	Frequency
10 dB/div	Ref 20.0		IFGain:Low	#Atten: 30 d	8	Mkr3 2	24.836 500 -30.24	GHz	Auto Tune
10.0 0.00								-12-26-dBm	Center Fred 17.500000000 GH;
-20.0 -30.0			landa datakan petita			ng taolog ky taong sa katang sa katang ng taolog ky taong sa katang sa	a men a su a s	Ø <sup>12</sup> 3	<b>Start Fred</b> 10.000000000 GH
-50.0									<b>Stop Free</b> 25.000000000 GH
Start 10.0 #Res BW	1.0 MHz		#VE	SW 3.0 MHz			Stop 25.00 .00 ms (400)	01 pts)	CF Stej 1.50000000 GH Auto Ma
MKR MODE TI   1 N 1   2 N 1   3 N 1   4 - -   5 - -   6 - -   7 - -	f f	24.270	750 GHz 625 GHz 500 GHz	-29.56 dBn -29.65 dBn -30.24 dBn	1	FUNCTION WIDTH	FUNCTION		Freq Offse 0 H
8 9 10 11 <								~	



### **High Band-edge**

### Highest Channel & Modulation : 8DPSK

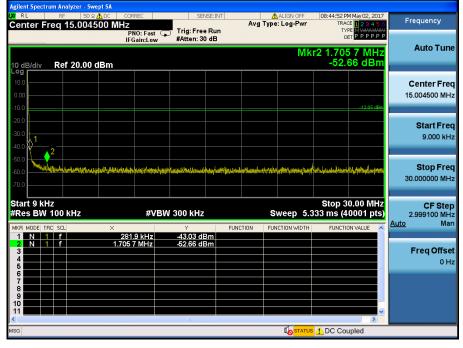


#### High Band-edge

#### Hopping mode & Modulation : 8DPSK



### Highest Channel & Modulation : 8DPSK



Center Freq 5.01	PNO: Fast	SENSE:INT	ALIGN OFF	08:45:01 PM May 02, 2017 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P P P P P P	Frequency
10 dB/div Ref 20.	IFGain:Low	#Atten: 30 dB	Mkı	5 5.828 80 GHz -39.12 dBm	Auto Tune
- <b>og</b> 10.0 	 			-12.05 dBm	Center Free 5.015000000 GH:
-20.0	I hill be build by a straight as a straight				Start Free 30.000000 MH
50.0			delika por statu delikar kata ya ministra kata ya ministra kata ya ministra kata ya ministra kata ya ministra Ministra kata ya ministra k		<b>Stop Free</b> 10.000000000 GH
Start 30 MHz #Res BW 1.0 MHz		BW 3.0 MHz		Stop 10.000 GHz 3.67 ms (40001 pts)	CF Stej 997.000000 MH Auto Ma
MKR MODE TRC SCL 1 N 1 F 2 N 1 F 3 N 1 F 5 N 1 F 6 F 8 F 9 F 10 F 11 F 6 F 8 F 9 F 10 F 11 F 1	× 2.480.38 GHz 5.618.93 GHz 8.264.47 GHz 9.878 12 GHz 5.828 80 GHz	9.19 dBm -38.46 dBm -39.10 dBm -39.12 dBm -39.12 dBm			Freq Offse 0 H

# Highest Channel & Modulation : 8DPSK

Agilent Spectrum	RE 50.9								
Center Fre		00000 G	Hz		SE:INT	ALIGN OFF	TRA	M May 02, 2017 CE <b>1 2 3 4 5 6</b> PE M WWWWWW	Frequency
10 dB/div	Ref 20.00 c	IFG	IO: Fast Ģ ain:Low	Trig: Free #Atten: 30		Mkr3 2	• 23.903 8	75 GHz 49 dBm	Auto Tune
Log 10.0 0.00 -10.0								-12.05 dBm	Center Freq 17.500000000 GHz
-20.0 -30.0 -40.0					e dan sere da babalar e d			<mark>3∧2</mark>	<b>Start Freq</b> 10.000000000 GHz
-50.0 -60.0 -70.0									<b>Stop Freq</b> 25.000000000 GHz
Start 10.000 #Res BW 1.	.0 MHz	×	#VBV	V 3.0 MHz	FUN	weep 40	.00 ms (4	.000 GHz 0001 pts)	<b>CF Step</b> 1.500000000 GHz <u>Auto</u> Man
1 N 1 2 N 1 3 N 1 4 5	f f f	24.841 375 24.379 375 23.903 875	GHz	-29.89 dB -30.24 dB -31.49 dB	m				Freq Offset 0 Hz
6 7 8 9 10									
K MSG				Ш		STATUS		>	



# 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					

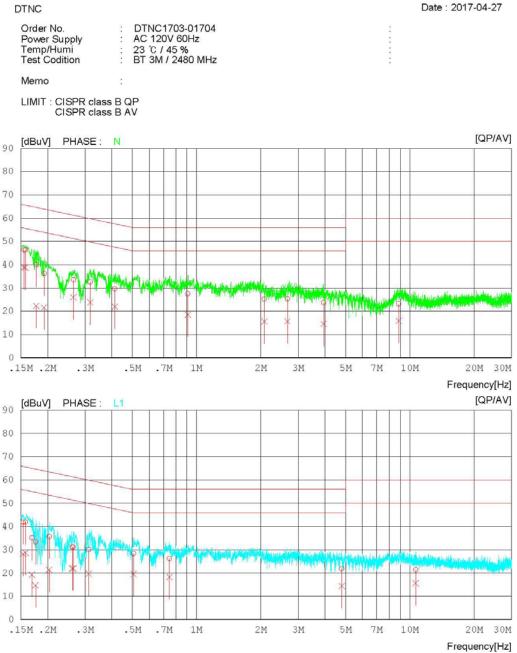
\* Decreases with the logarithm of the frequency

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



# Results of Conducted Emission

Date : 2017-04-27

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

# **Results of Conducted Emission**

DTNC

Order No. Power Supply Temp/Humi Test Codition : DTNC1703-01704 : AC 120V 60Hz : 23 °C / 45 % : BT 3M / 2480 MHz

Memo

LIMIT : CISPR class B QP CISPR class B AV

NC	) FREQ	QP	AV	C.FACTOR [dB]	QP	AV	QP	AV	QP	AV	PHASE	
1	0.15515	36.0	28.7	10.2	46.2	38.9	65.7	55.7	19.5	16.8	N	
2	0.15750	36.1	28.6	10.2	46.3	38.8	65.6	55.6	19.3	16.8	N	
3	0.17702	29.8	12.2	10.2	40.0	22.4	64.6	54.6	24.6	32.2	N	
4	0.19261	26.1	11.5	10.2	36.3	21.7	63.9	53.9	27.6	32.2	N	
5	0.26462		15.7	10.2	33.6		61.3	51.3	27.7	25.4	N	
6	0.31723	22.4	13.6	10.2	32.6	23.8	59.8	49.8	27.2	26.0	N	
7	0.41408	19.5	11.7	10.2	29.7		57.6	47.6	27.9	25.7	N	
8	0.90984		8.3	10.2			56.0	46.0	28.5	27.5	N	
9	2.07760	14.9	5.4	10.3	25.2	15.7	56.0	46.0	30.8	30.3	N	
10	2.66880			10.4		15.7	56.0	46.0	30.6	30.3	N	
11	3.94240		4.2	10.4		14.6	56.0	46.0	32.3		N	
12	8.86160		5.1	10.7	23.2	15.8	60.0	50.0	36.8	34.2	N	
13	0.15348	31.8	18.1	10.1	41.9	28.2	65.8	55.8	23.9	27.6	L1	
14	0.15756	31.8	18.5	10.1	41.9	28.6	65.6	55.6	23.7	27.0	L1	
15	0.16895	24.9	9.2	10.1		19.3	65.0	55.0	30.0	35.7	L1	
16	0.17578	23.2	4.6	10.1	33.3	14.7	64.7	54.7	31.4	40.0	L1	
17	0.20354	25.5	11.2	10.1	35.6		63.5	53.5	27.9	32.2	L1	
18	0.26086		11.8	10.1	31.1	21.9	61.4	51.4	30.3	29.5	L1	
19	0.26430	21.0	11.8	10.1	31.1	21.9	61.3	51.3	30.2	29.4	L1	
20	0.31197	19.7	9.5	10.2	29.9	19.7	59.9	49.9	30.0	30.2	L1	
21	0.50650	18.2	9.4	10.2	28.4	19.6	56.0	46.0	27.6	26.4	L1	
22	0.74581	16.0	8.0	10.2	26.2	18.2	56.0	46.0	29.8	27.8	L1	
23	4.79900	11.4	3.9	10.4	21.8	14.3	56.0	46.0	34.2	31.7	L1	
24	10.66020	10.4	4.6	10.9	21.3	15.5	60.0	50.0	38.7	34.5	L1	



# 9. Antenna Requirement

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

#### Conclusion: Comply

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

#### - Minimum Standard :

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

### 10.1 Test Setup

Refer to the APPENDIX I.

#### 10.2 Limit

Limit : Not Applicable

#### **10.3 Test Procedure**

The 99 % power bandwidth was measured with a calibrated spectrum analyzer.

The resolution bandwidth (RBW) shall be in the range of 1 % to 5 % of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately  $3 \times RBW$ .

Spectrum analyzer plots are included on the following pages.

#### 10.4 Test Results

Modulation	Tested Channel	Test Results (MHz)		
	Lowest	0.853		
<u>GFSK</u>	Middle	0.853		
	Highest	0.856		
	Lowest	1.172		
<u>π/4DQPSK</u>	Middle	1.171		
	Highest	1.174		
	Lowest	1.179		
<u>8DPSK</u>	Middle	1.180		
	Highest	1.178		



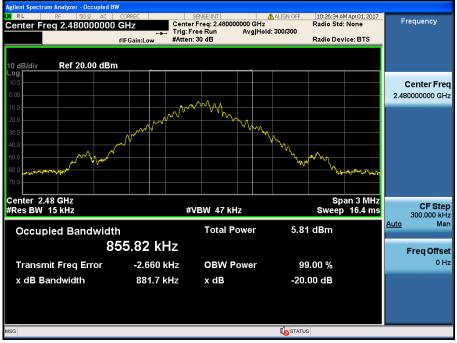
### Occupied Bandwidth (99 %)

### Middle Channel & GFSK

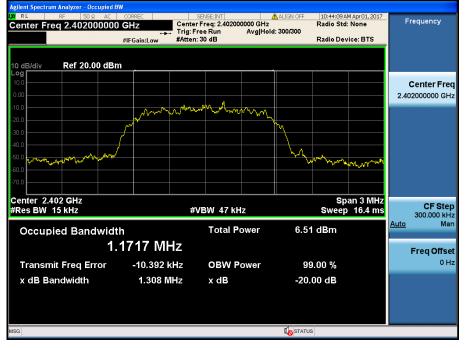


Highest Channel & GFSK

### Occupied Bandwidth (99 %)

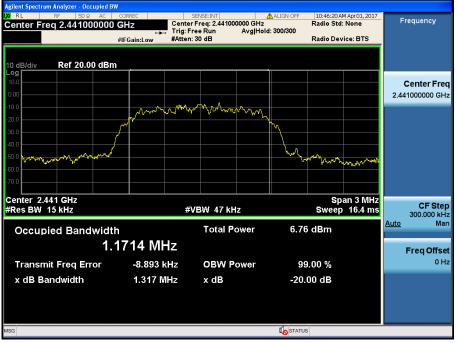


#### TRF-RF-237(05)180118



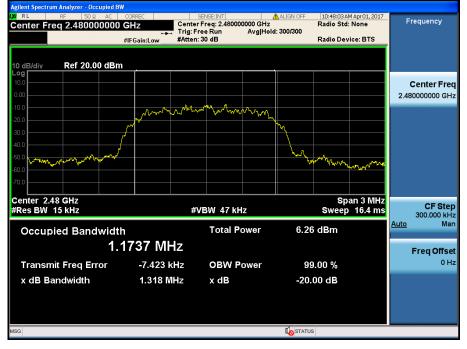
### Occupied Bandwidth (99 %)

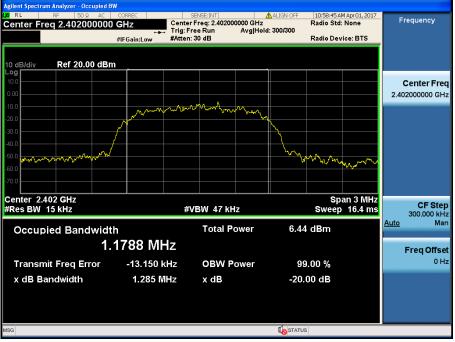
# Middle Channel & π/4 DQPSK



# Lowest Channel & π/4 DQPSK

### Highest Channel & π/4 DQPSK





### Occupied Bandwidth (99 %)

#### SENSE:INT ALIGN OFF Center Freq: 2.441000000 GHz Trig: Free Run Avg|Hold: 300/300 #Atten: 30 dB 11:00:24 AM Apr 01, 2017 Radio Std: None Frequency Center Freq 2.441000000 GHz Radio Device: BTS #IFGain:Low Ref 20.00 dBm /div Center Freq 2.441000000 GHz with VAn A Center 2.441 GHz #Res BW 15 kHz Span 3 MHz Sweep 16.4 ms CF Step 300.000 kHz #VBW 47 kHz Auto Man Occupied Bandwidth Total Power 6.77 dBm 1.1795 MHz Freq Offset **OBW Power** 0 Hz -12.387 kHz 99.00 % Transmit Freq Error x dB Bandwidth 1.303 MHz -20.00 dB x dB

# Middle Channel & 8DPSK

Lowest Channel & 8DPSK

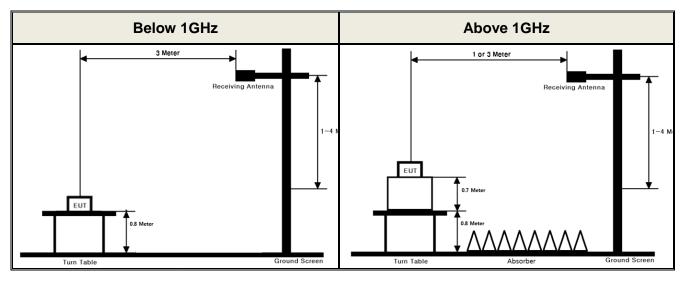


# Highest Channel & 8DPSK

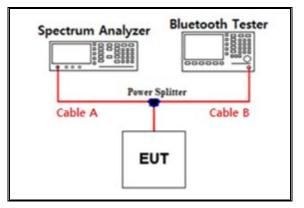
# **APPENDIX I**

#### Test set up diagrams

#### Radiated Measurement



#### Conducted Measurement



#### Path loss information

Frequency (GHz)	Path Loss (dB)	Frequency (GHz)	Path Loss (dB)
0.03	6.07	15	9.88
1	6.75	20	10.85
2.402 & 2.440 & 2.480	7.50	25	11.25
5	8.30	-	-
10	9.03	-	-

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 & Hor

Frequency Avg Type: Log-Pw Avg|Hold: 200/200 TYPE MWA Trig: Free Run Atten: 16 dB PNO: Fast +++ IFGain:Low Auto Tune Mkr3 2.388 47.414 dBµ Ref 111.99 dBµV **Center Freq** 2.382732905 GHz Start Freq 2.361465810 GHz ten hallen stil mellen her Stop Freq 100 i di piru 2.404000000 GHz 2.36147 GHz BW 1.0 MHz Stop 2.40400 GHz CF Step 4.253419 MHz VBW 3.0 MHz 1.00 ms (5001 pts) Sweep Auto Man 45.635 dBμ\ 47.414 dBμ\ Freq Offset 0 Hz 10 11 12

#Avg Type: Log-Pwi Avg|Hold: 200/200

Sweep

Trig: Free Run Atten: 16 dB

48.511 dBµ\ 51.752 dBµ\

VBW 3.0 MHz

PNO: Fast ← IFGain:Low

#### GFSK & Highest & X & Hor

Analyzer - Swept Si

Ref 111.99 dBµV

Start 2.47723 GHz #Res BW 1.0 MHz

#### Frequency TYPE MW Auto Tune Mkr3 2 .483 606 GH 51.752 dBµ'

**Center Freq** 2.488615224 GHz

Start Freq 2.477230448 GHz

Stop Freq

2.500000000 GHz

CF Step 2.276955 MHz

Freq Offset 0 Hz

uto

Mar

Stop 2.50000 GHz

1.00 ms (5001 pts)

**Detector Mode : PK** 

FUNCTION

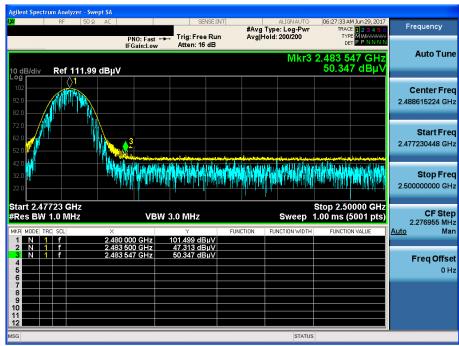


#### π/4DQPSK & Lowest & X & Hor

Agilent Spectrum Analyzer - Swept SA						
LX/ RF 50Ω AC		SENSE:IN		ALIGN AUTO e: Log-Pwr	06:08:05 AM Jun 29, 2017 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast ++ IFGain:Low	. Trig: Free Run Atten: 16 dB	Avg Hold	: 200/200	TYPE MWWWWW DET P P N N N N	Auto Tune
Мкr3 2.386 918 GHz 10 dB/div Ref 111.99 dBµV 46.510 dBµV						Auto Tune
102 92.0 82.0						<b>Center Freq</b> 2.382732905 GHz
72.0 62.0 52.0	ura na sanada kalanda na			ور المحمد الم		<b>Start Freq</b> 2.361465810 GHz
420 32.0 22.0						<b>Stop Freq</b> 2.404000000 GHz
Start 2.36147 GHz #Res BW 1.0 MHz	VBW 3.0 MHz			Sweep 1	Stop 2.40400 GHz 1.00 ms (5001 pts)	<b>CF Step</b> 4.253419 MHz
	000 GHz 000 GHz	Y 102.406 dBµV 44.934 dBµV	FUNCTION FU	NCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
	918 GHz	46.510 dBµV				<b>Freq Offset</b> 0 Hz
7 8 9 10						
12 MSG				STATUS		

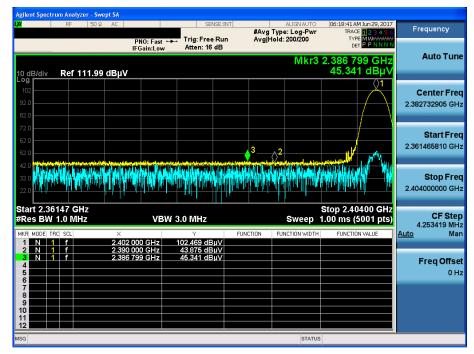
#### **Detector Mode : PK**

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





#### 8DPSK & Lowest & X & Hor



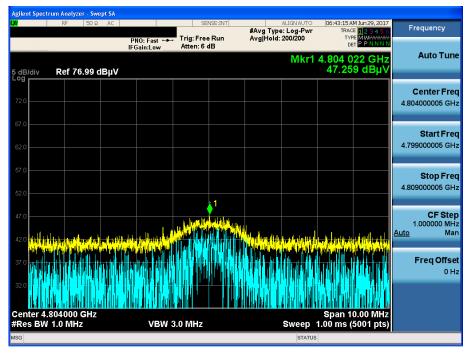
#### **Detector Mode : PK**

#### 8DPSK & Highest & X & Hor

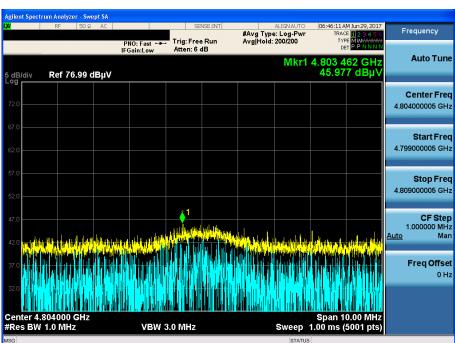




#### GFSK & Lowest & X & Hor



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



#### **Detector Mode : PK**



#### 8DPSK & Lowest & X & Hor

