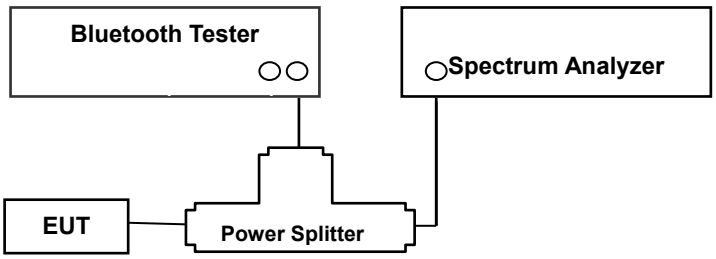
9.4 NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration



TEST PROCEDURE

The Bluetooth frequency hopping function of the EUT was enabled.

The Spectrum Analyzer is set to (7.8.3 in ANSI 63.10-2013)

1) Span: the frequency band of operation
2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3) VBW ≥ RBW
4) Sweep: Auto
5) Detector: Peak
6) Trace: Max hold
7) Allow the trace to stabilize.

TEST RESULTS

No non-compliance noted

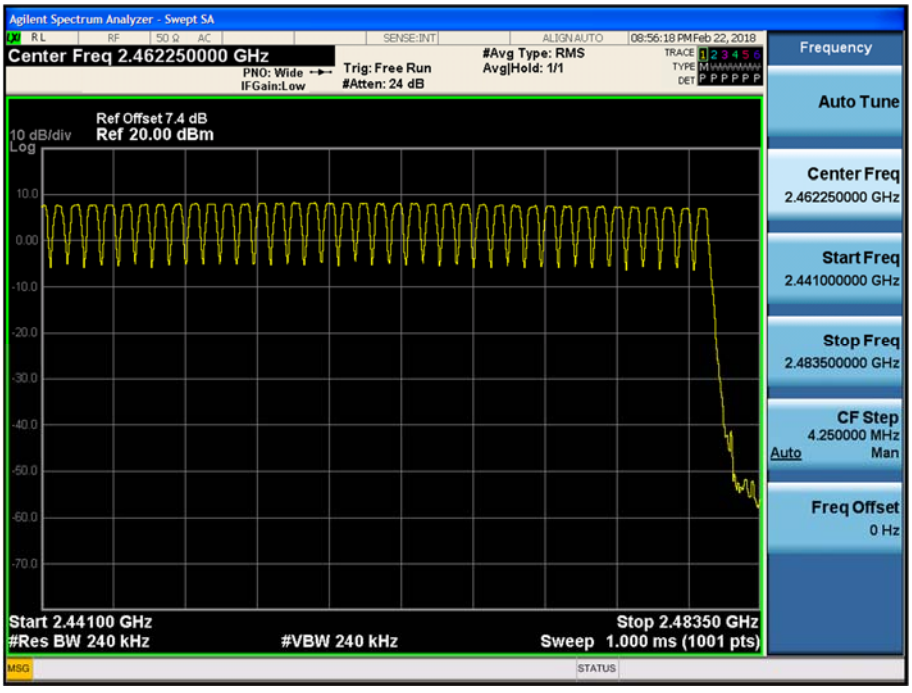
Test Data

Result (No. of CH)			Limit	Result
GFSK	8DPSK	π/4DQPSK		
79	79	79	>15	Pass

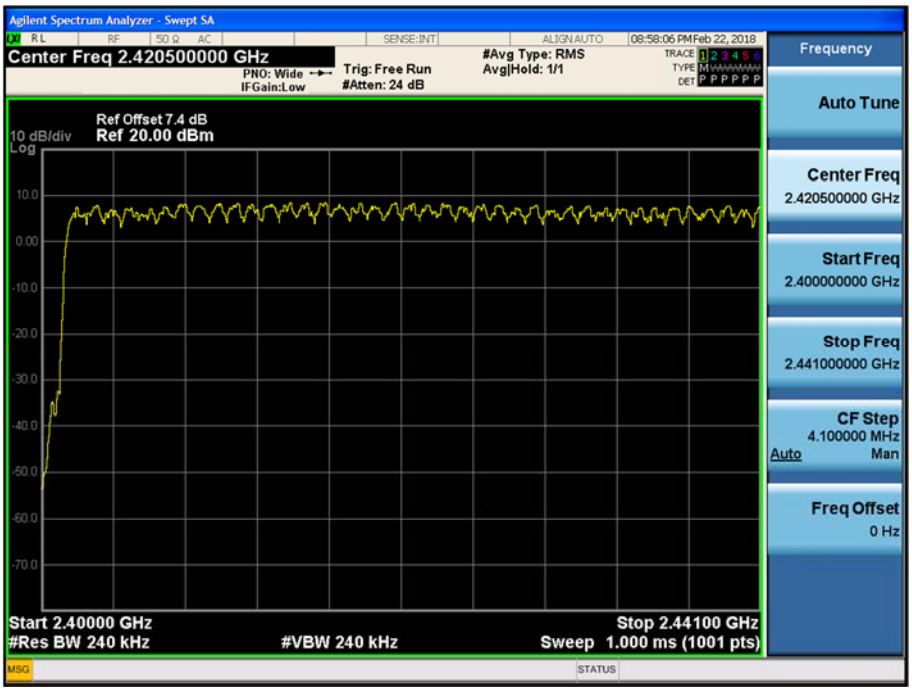
Note : In case of AFH mode, minimum number of hopping channels is 20.

Test Plots (GFSK)
Number of Channels (2.4 GHz - 2.441 GHz)

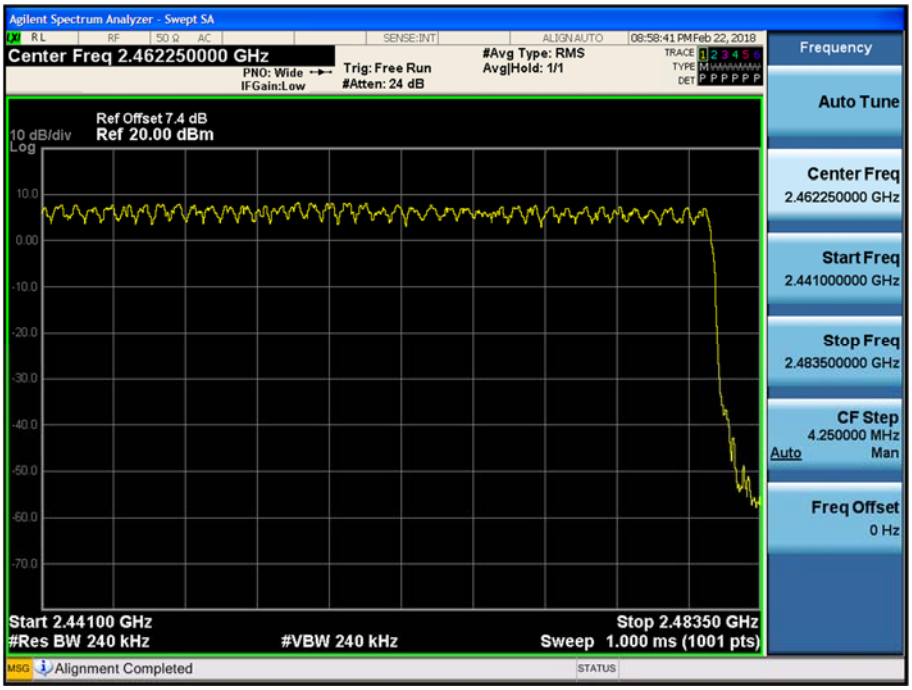
Test Plots (GFSK)
Number of Channels (2.441 GHz - 2.4835 GHz)



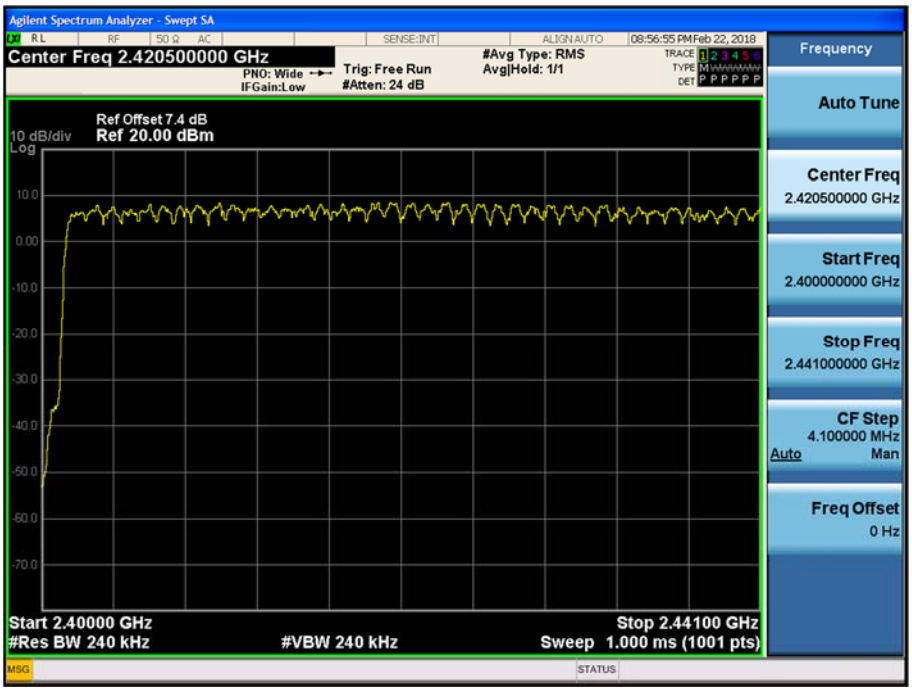
Test Plots (8DPSK)
Number of Channels (2.4 GHz - 2.441 GHz)



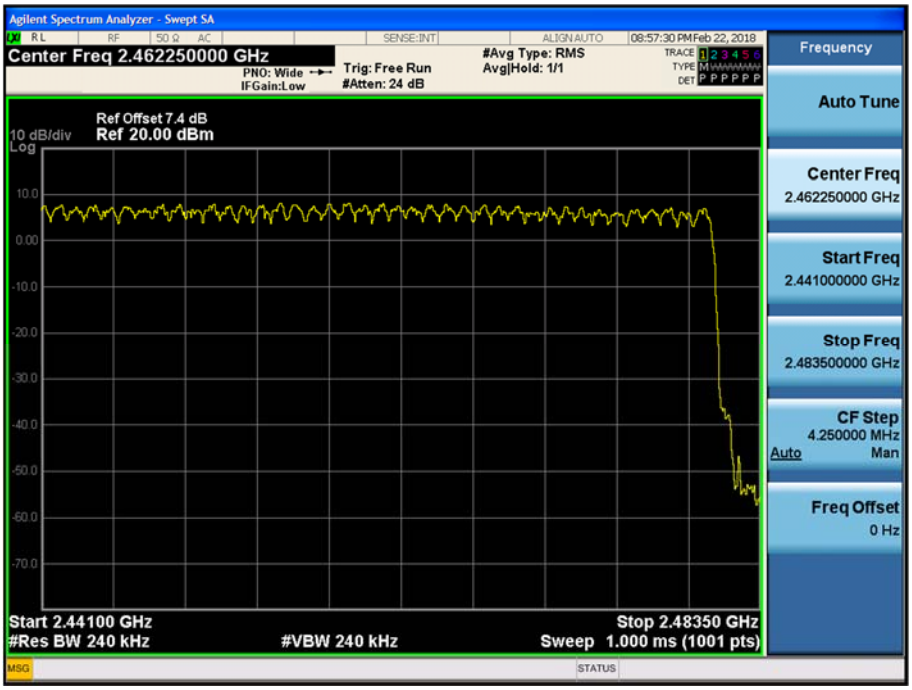
Test Plots (8DPSK)
Number of Channels (2.441 GHz - 2.4835 GHz)



Test Plots (π/4DQPSK)
Number of Channels (2.4 GHz - 2.441 GHz)



Test Plots (π/4DQPSK)
Number of Channels (2.441 GHz - 2.4835 GHz)

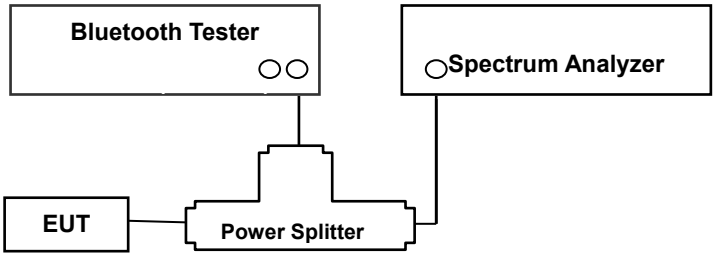


9.5 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400 MHz ~ 2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

Test Configuration



TEST PROCEDURE

This test is performed with hopping off.

EUT was set to transmit the longest packet type (DH5)

The Spectrum Analyzer is set to (7.8.4 in ANSI 63.10-2013)

1) Span: Zero span, centered on a hopping channel
2) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3) Sweep = as necessary to capture the entire dwell time per hopping channel
4) Detector: Peak
5) Trace: Max hold

The marker-delta function was used to determine the dwell time.

Normal Mode / EDR Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)

2-DH 5(The longest packet type for π/4DQPSK)

CH Mid : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)

3-DH 5(The longest packet type for 8DPSK)

CH Mid : 2.890 * (1600/6)/79 * 31.6 = 308.27 (ms)

AFH Mode

DH 5(The longest packet type for GFSK)

CH Mid : 2.890 * (800/6)/20 * 8.0 = 154.13 (ms)

2-DH 5(The longest packet type for π/4DQPSK)

CH Mid : 2.890 * (800/6)/20 * 8.0 = 154.13 (ms)

3-DH 5(The longest packet type for 8DPSK)

CH Mid : 2.890 * (800/6)/20 * 8.0 = 154.13 (ms)

Note :

A DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 1600/6 hops per second with 79 channels. So the system have each channel 3.3755 times per second and so for 31.6 seconds the system have 106.7 times of appearance.

Each tx-time per appearance of DH5 is 2.892 ms.

Dwell time = Tx-time * 106.7

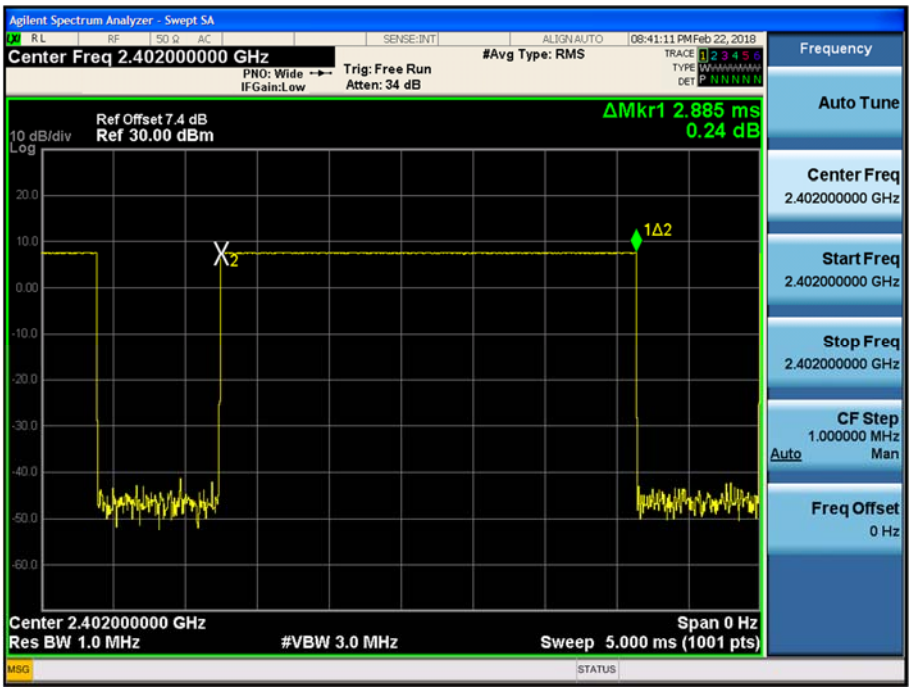
TEST RESULTS

See the table.

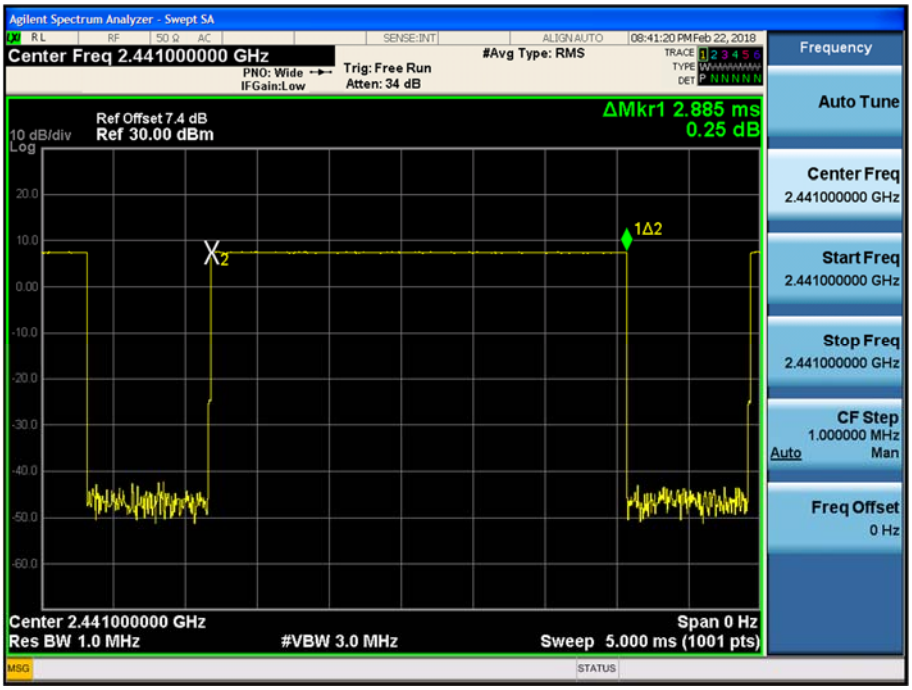
	Channel	GFSK	8DPSK	π/4DQPSK
Pulse Time (ms)	Low	2.885	2.890	2.890
	Mid	2.885	2.890	2.890
	High	2.890	2.890	2.890

	Channel	GFSK	8DPSK	π/4DQPSK	Period Time (s)	Limit (ms)	Result
Total of Dwell (ms)	Low	307.73	308.27	308.27	32	400	PASS
	Mid	307.73	308.27	308.27	32		PASS
	High	308.27	308.27	308.27	32		PASS

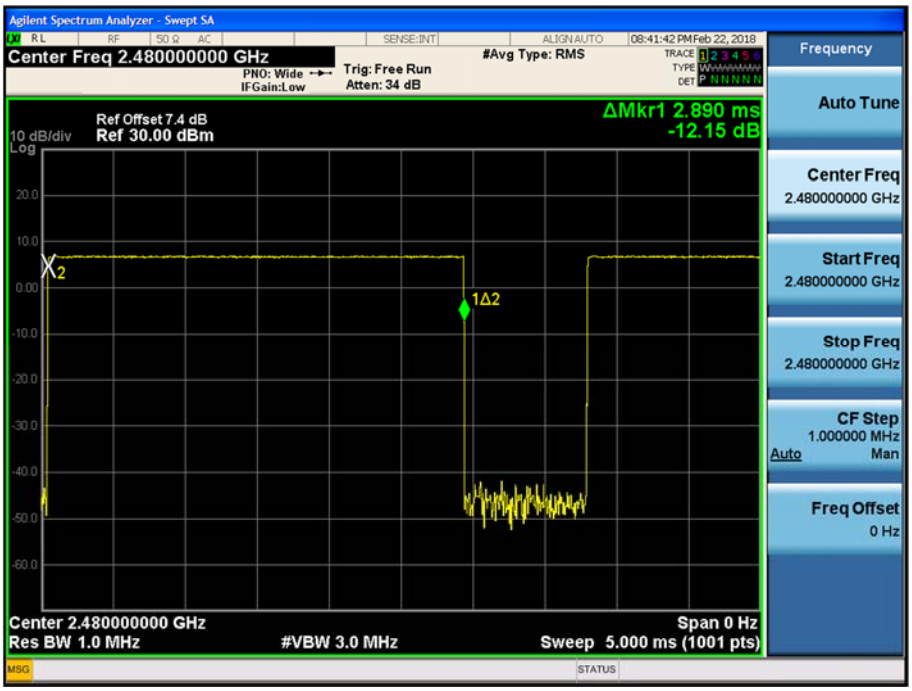
Test Plots (GFSK)
Dwell Time (CH.0)



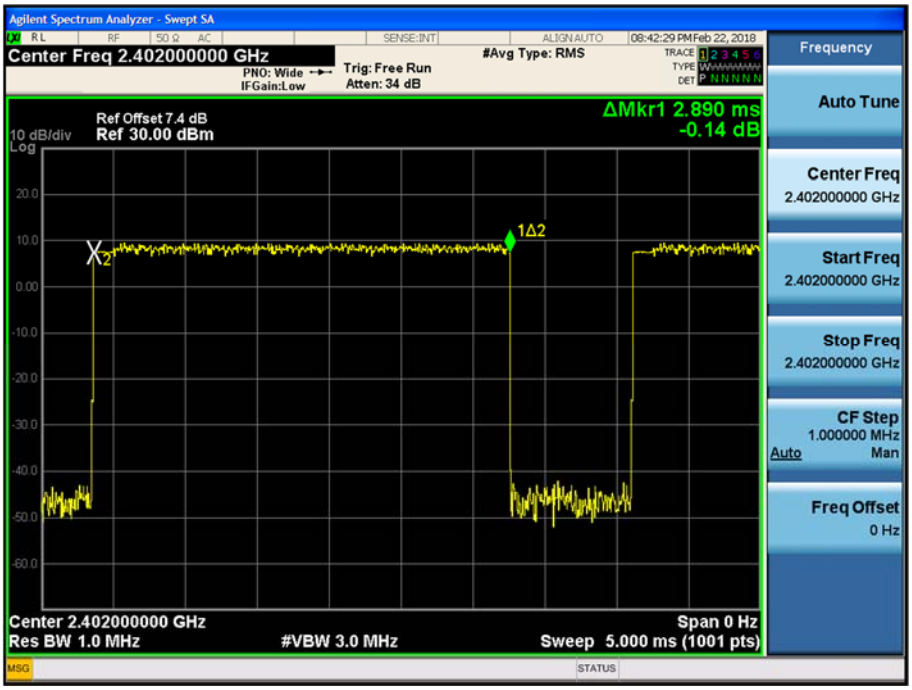
Test Plots (GFSK)
Dwell Time (CH.39)



Test Plots (GFSK)
Dwell Time (CH.78)

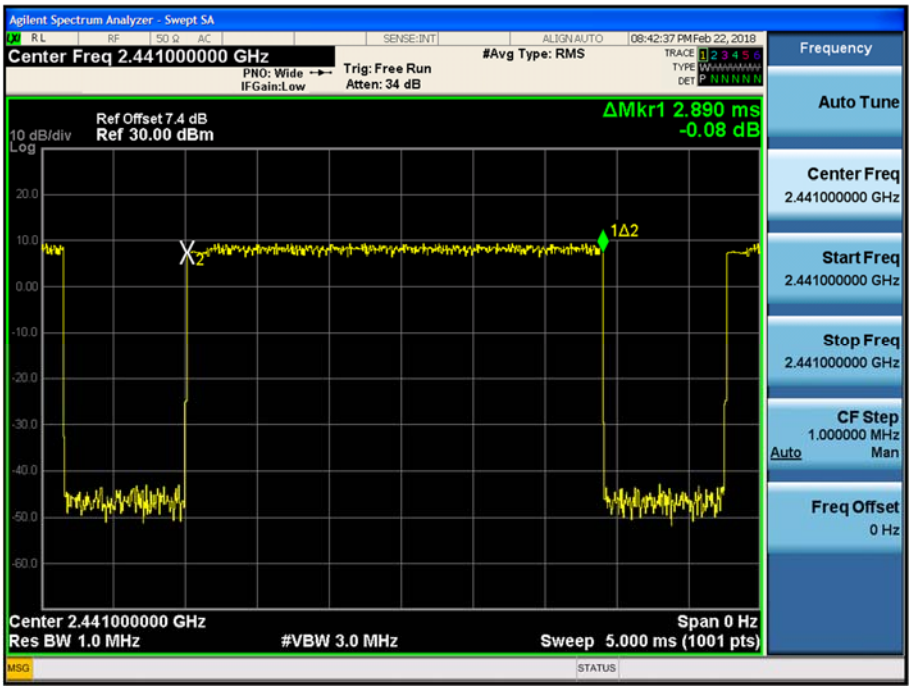


Test Plots (8DPSK)
Dwell Time (CH.0)



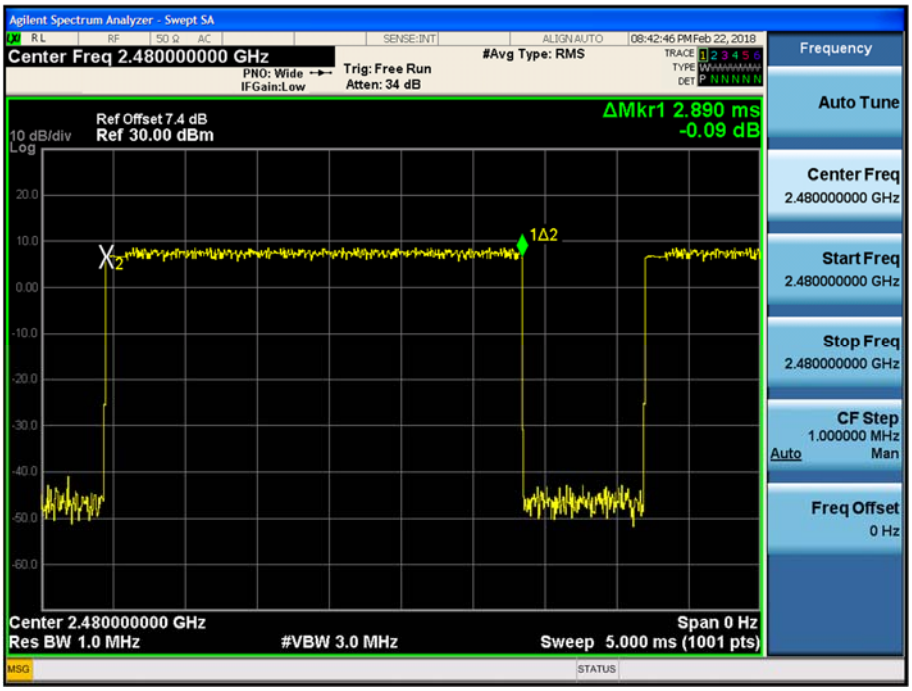
Test Plots (8DPSK)

Dwell Time (CH.39)

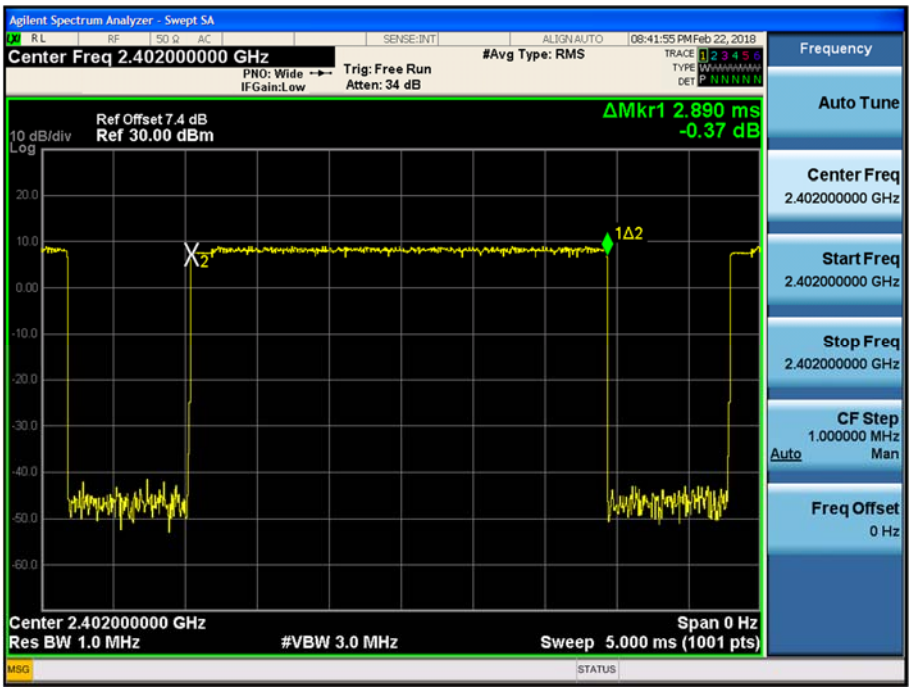


Test Plots (8DPSK)

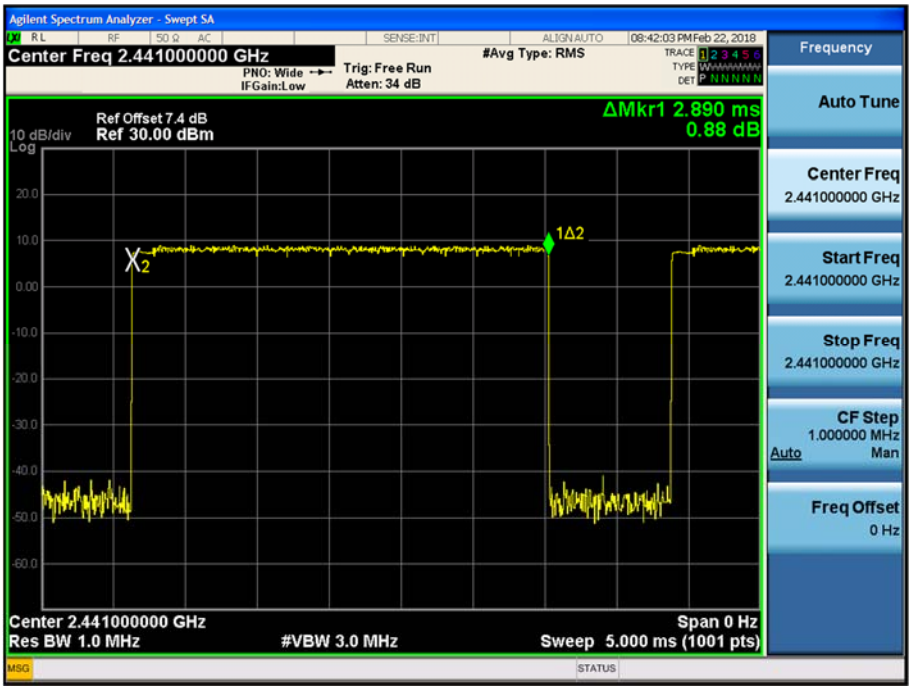
Dwell Time (CH.78)



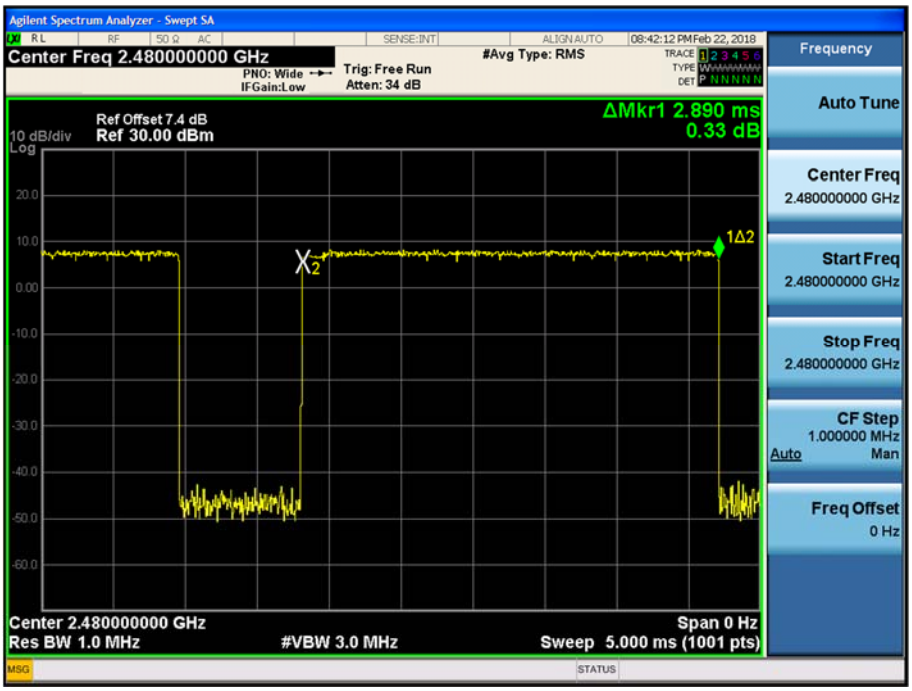
Test Plots (π/4DQPSK)
Dwell Time (CH.0)



Test Plots (π/4DQPSK)
Dwell Time (CH.39)



Test Plots (π/4DQPSK)
Dwell Time (CH.78)



9.6 SPURIOUS EMISSIONS

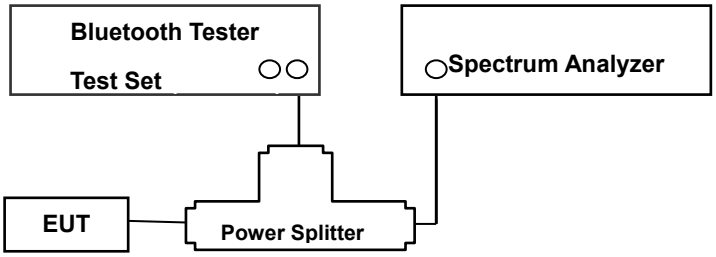
9.6.1 CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §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 § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit : 20 dBc

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer.

The Spectrum Analyzer is set to (7.8.8 in ANSI 63.10-2013)

1) Span: 30 MHz to 10 times the operating frequency in GHz.
2) RBW: 100 kHz
3) VBW: 300 kHz
4) Sweep: Coupled
5) Detector: Peak

Measurements are made over the 30 MHz to 26 GHz range with the transmitter set to the lowest, middle, and highest channels.

This test is performed with hopping off.

TEST RESULTS

No non-compliance noted.

Note : In order to simplify the report, attached plots were only the worst case channel and data rate.

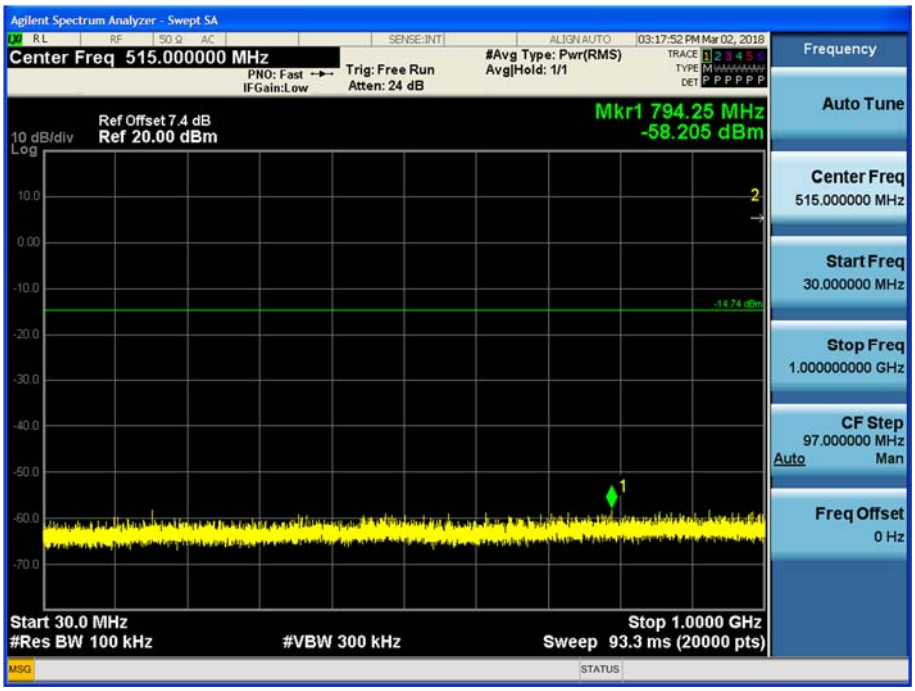
FACTORS FOR FREQUENCY

Freq(MHz)	Factor(dB)
30	7.18
100	6.35
200	7.04
300	6.58
400	6.26
500	5.95
600	6.17
700	6.34
800	6.72
900	7.08
1000	7.38
2000	7.78
2400*	7.36
2500*	7.44
3000	7.88
4000	8.95
5000	9.57
6000	6.68
7000	9.99
8000	8.34
9000	9.61
10000	10.47
11000	8.96
12000	9.73
13000	8.84
14000	9.50
15000	11.54
16000	8.14
17000	11.73
18000	9.71
19000	10.40
20000	11.69
21000	10.72
22000	12.31
23000	9.85
24000	12.52
25000	11.07
26000	10.50

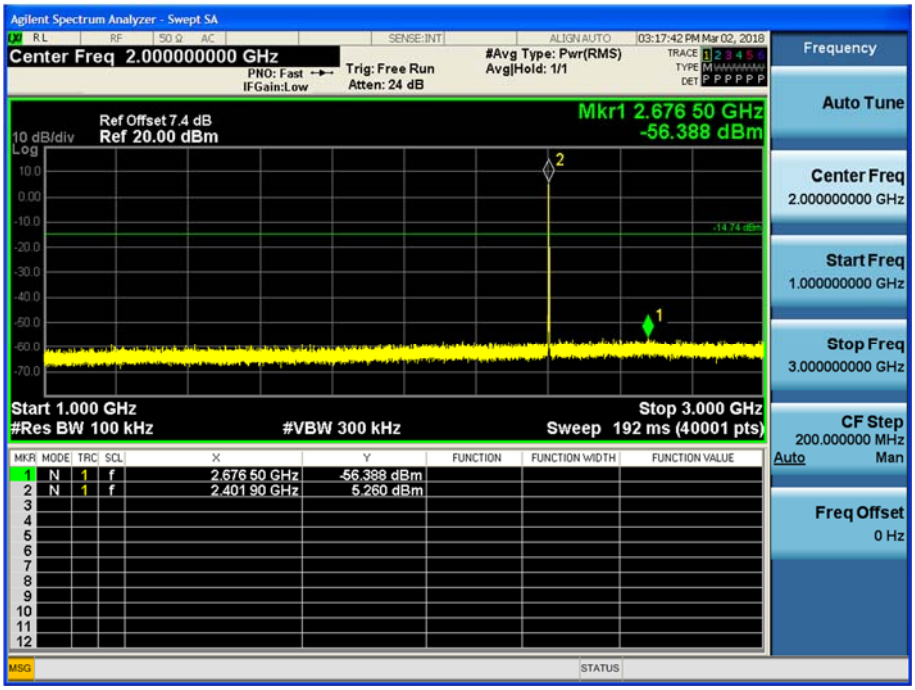
Note : 1. '*' is fundamental frequency range.

2. Factor = Cable loss + Splitter loss

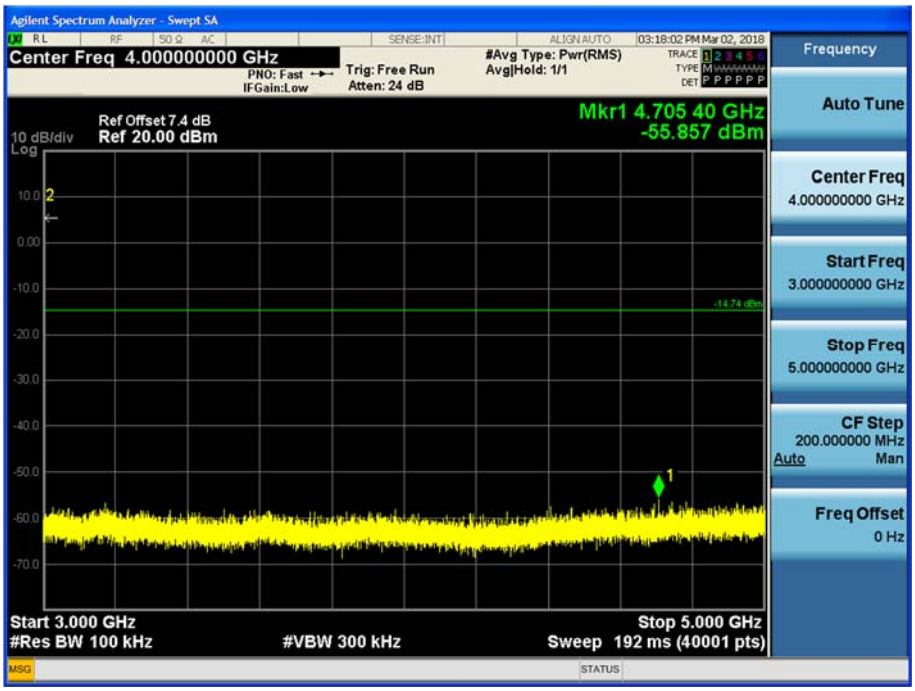
Test Plots (8DPSK)- 30 MHz - 1 GHz
Spurious Emission (CH.0)



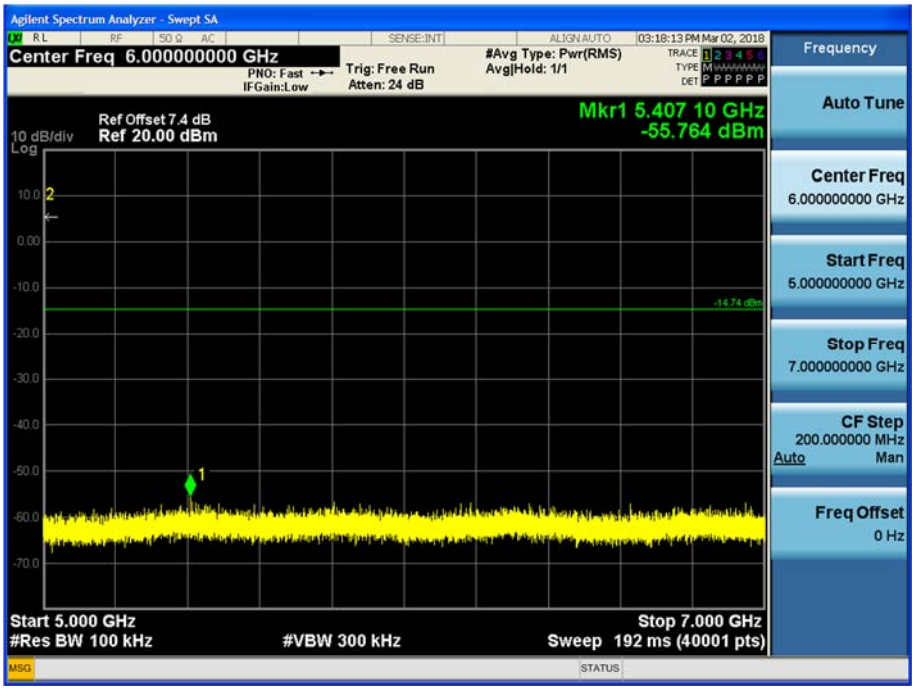
Test Plots (8DPSK)- 1 GHz – 3 GHz
Spurious Emission (CH.0)



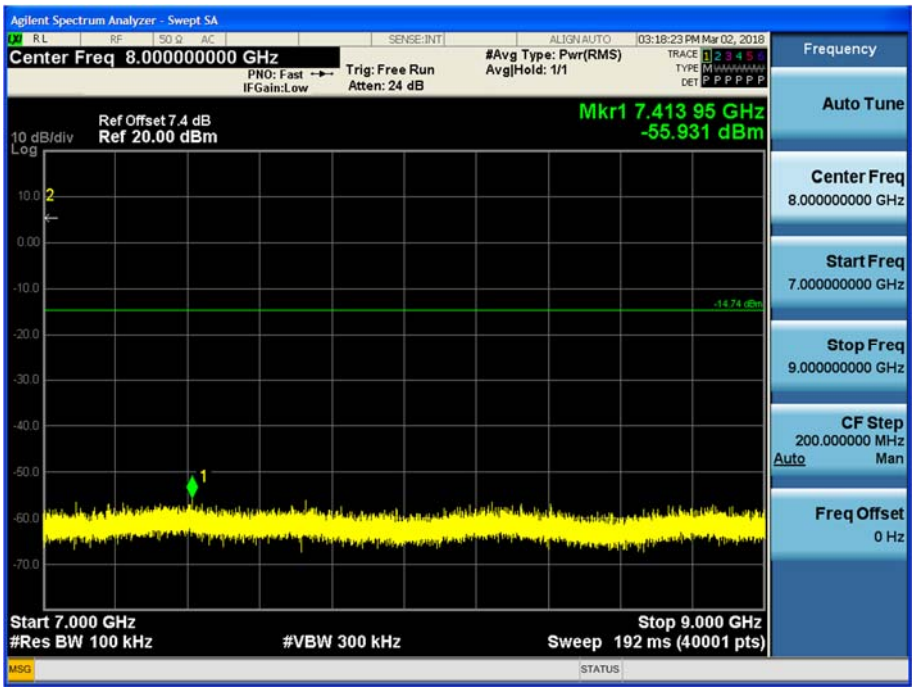
Test Plots(8DPSK)- 3 GHz - 5 GHz
Spurious Emission (CH.0)



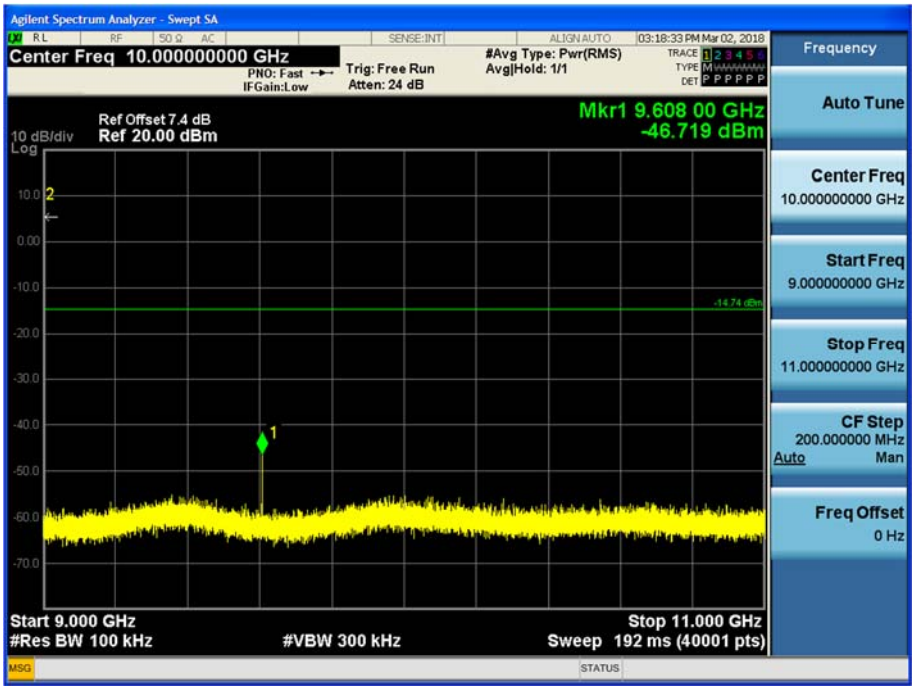
Test Plots (8DPSK)- 5 GHz - 7 GHz
Spurious Emission (CH.0)



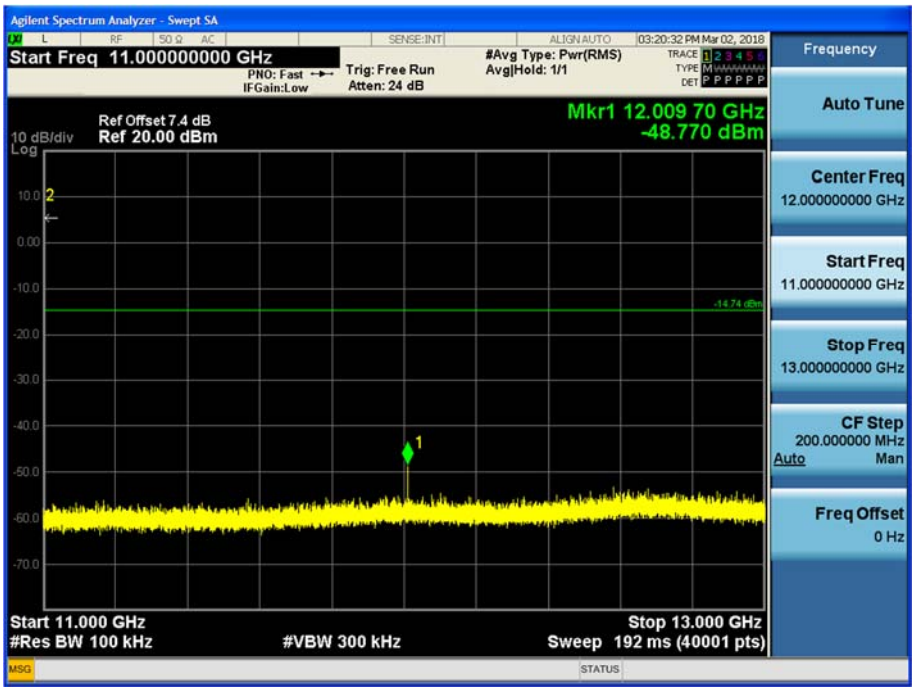
Test Plots(8DPSK)- 7 GHz - 9 GHz
Spurious Emission (CH.0)



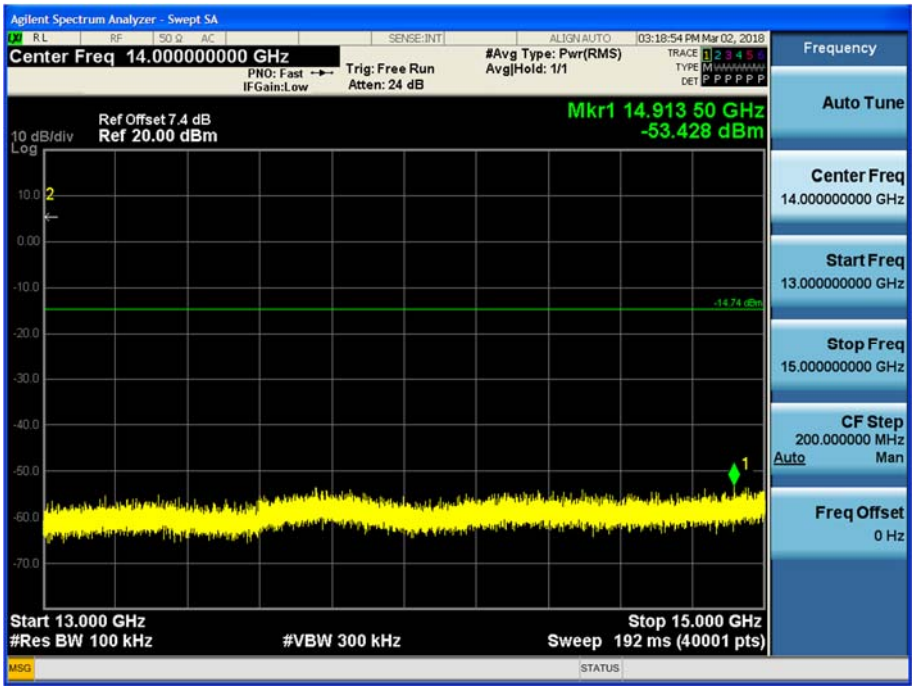
Test Plots(8DPSK)- 9 GHz - 11 GHz
Spurious Emission (CH.0)



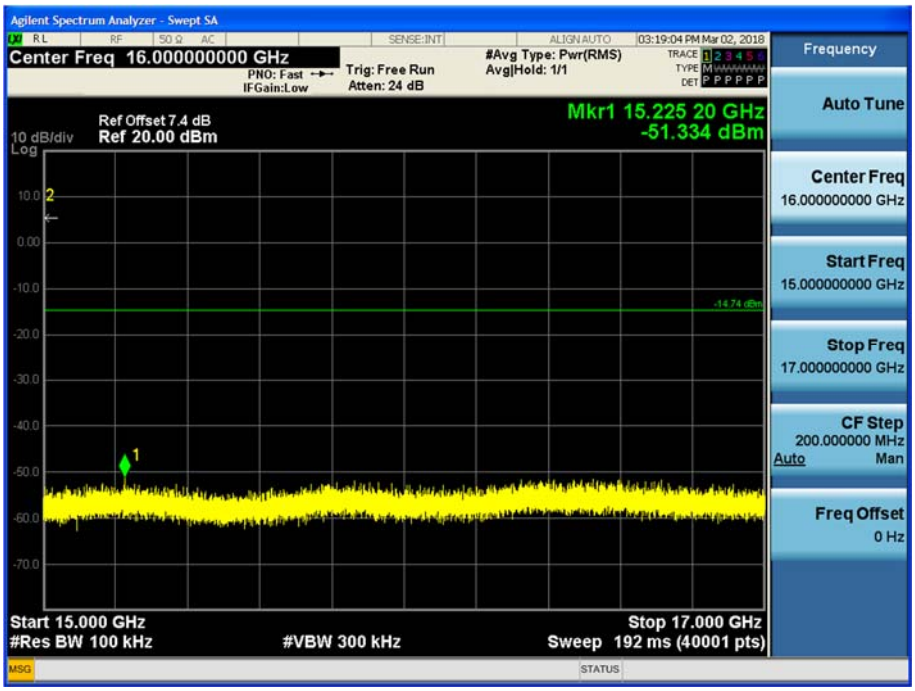
Test Plots(8DPSK) 11 GHz - 13 GHz
Spurious Emission (CH.0)



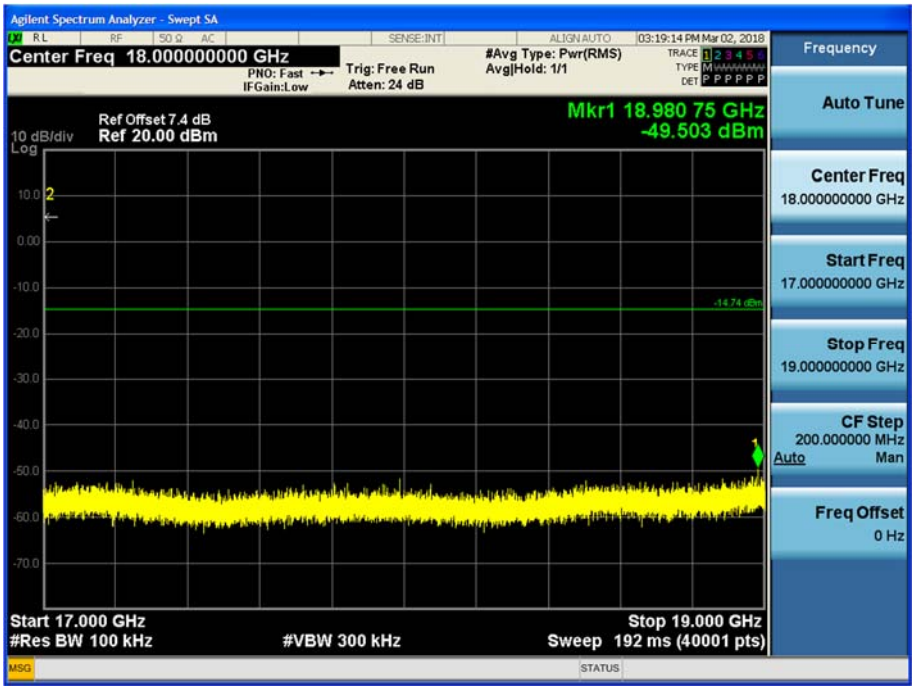
Test Plots (8DPSK)- 13 GHz – 15 GHz
Spurious Emission (CH.0)



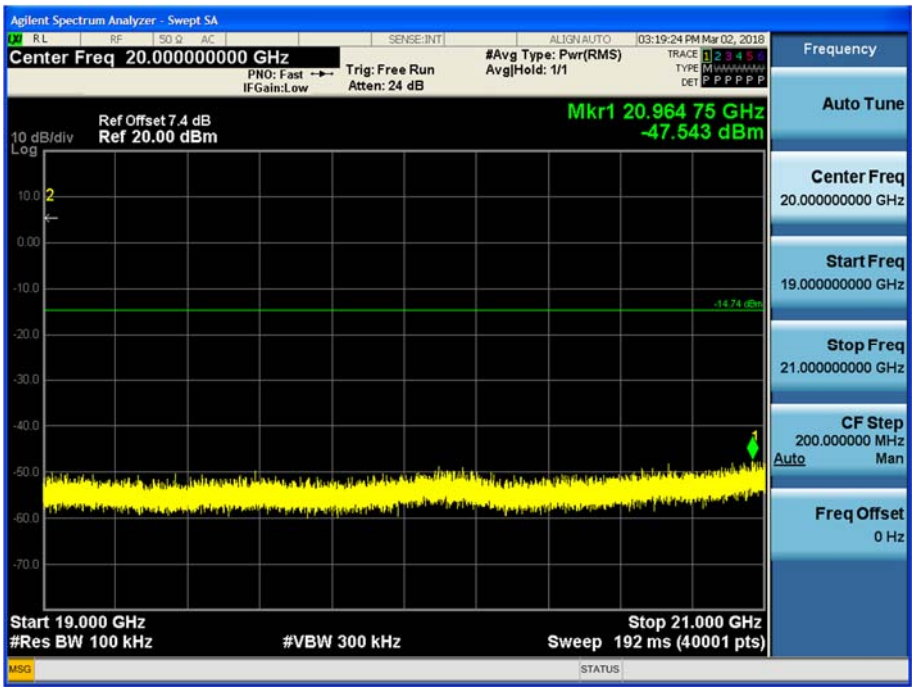
Test Plots(8DPSK)– 15 GHz - 17 GHz
Spurious Emission (CH.0)



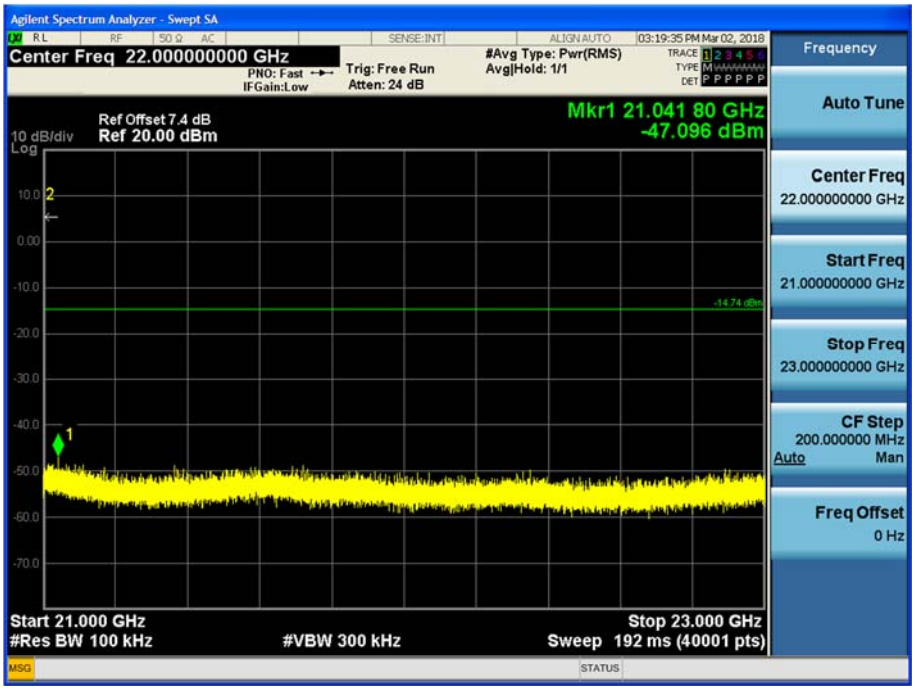
Test Plots(8DPSK)- 17 GHz - 19 GHz
Spurious Emission (CH.0)



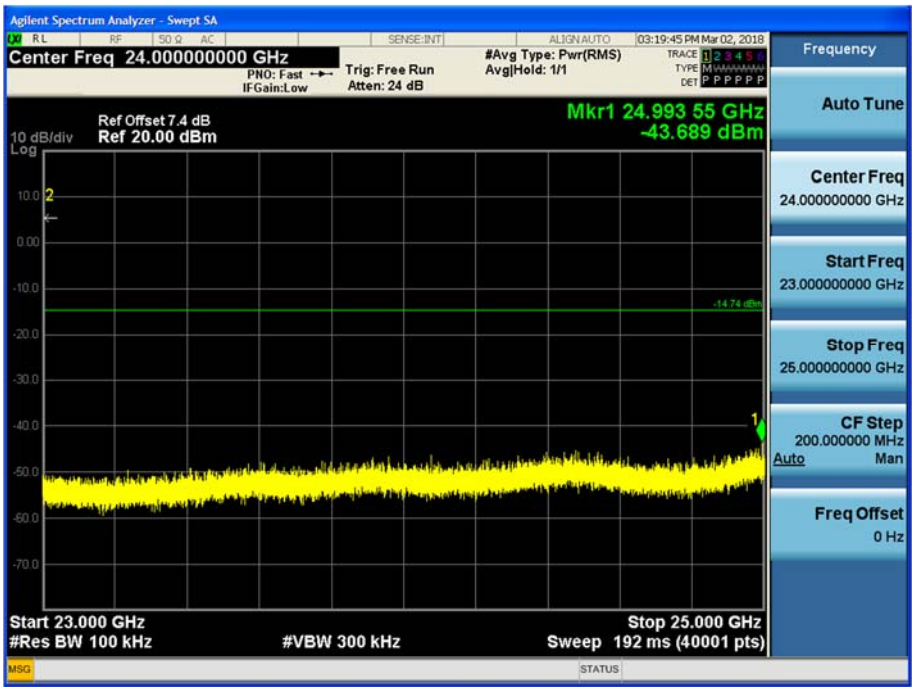
Test Plots (8DPSK)- 19 GHz - 21 GHz
Spurious Emission (CH.0)



Test Plots (8DPSK)- 21 GHz - 23 GHz
Spurious Emission (CH.0)



Test Plots (8DPSK)- 23 GHz - 25 GHz
Spurious Emission (CH.0)



9.6.2 RADIATED SPURIOUS EMISSIONS

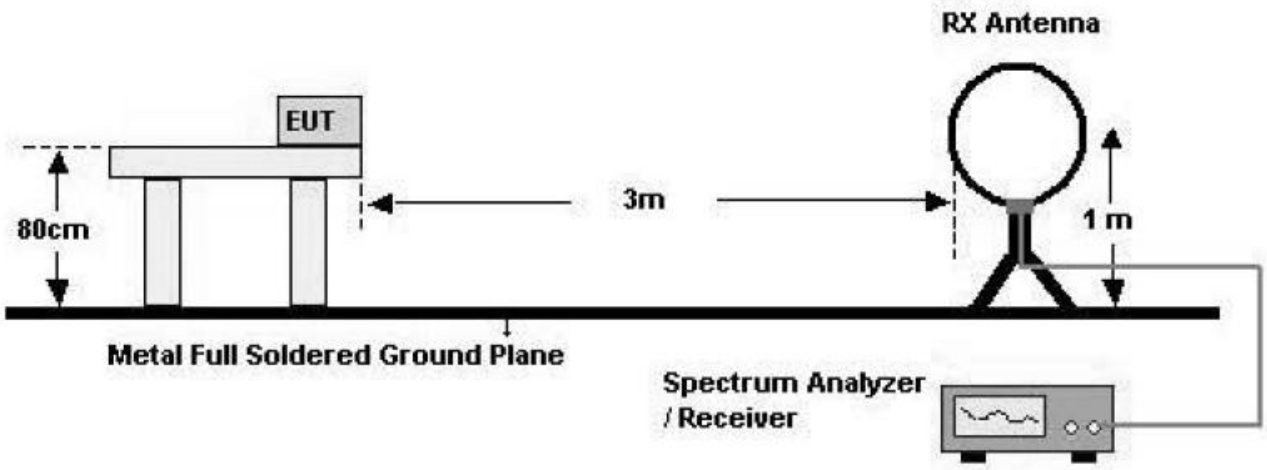
LIMIT : §15.247(d), §15.205, §15.209

1. 20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

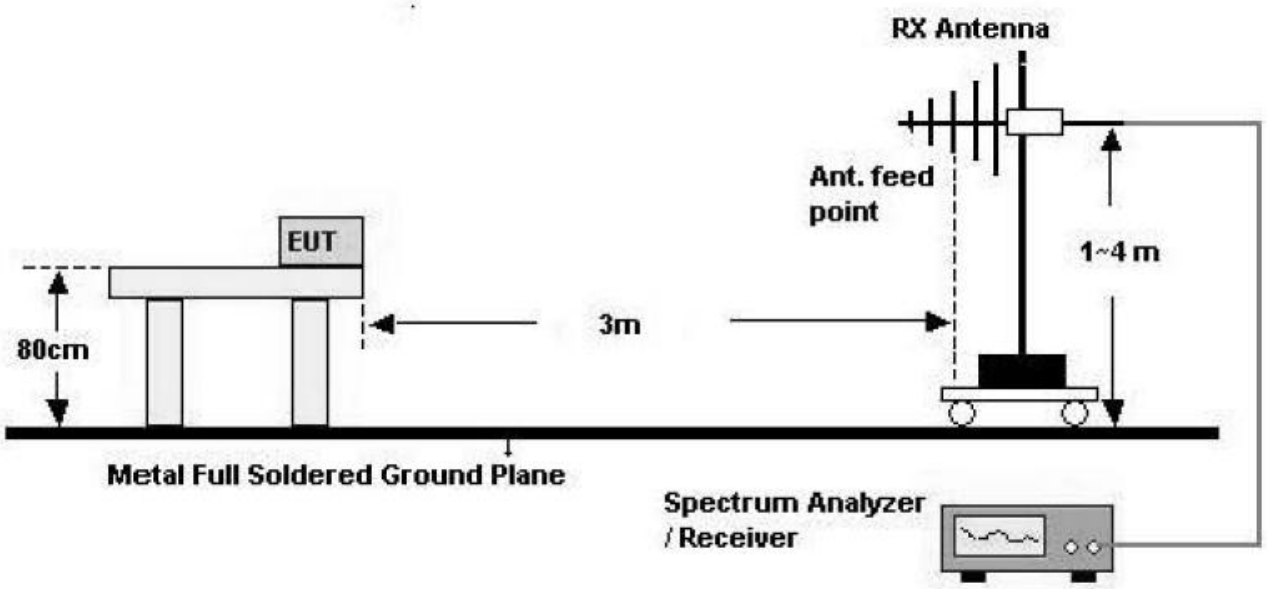
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

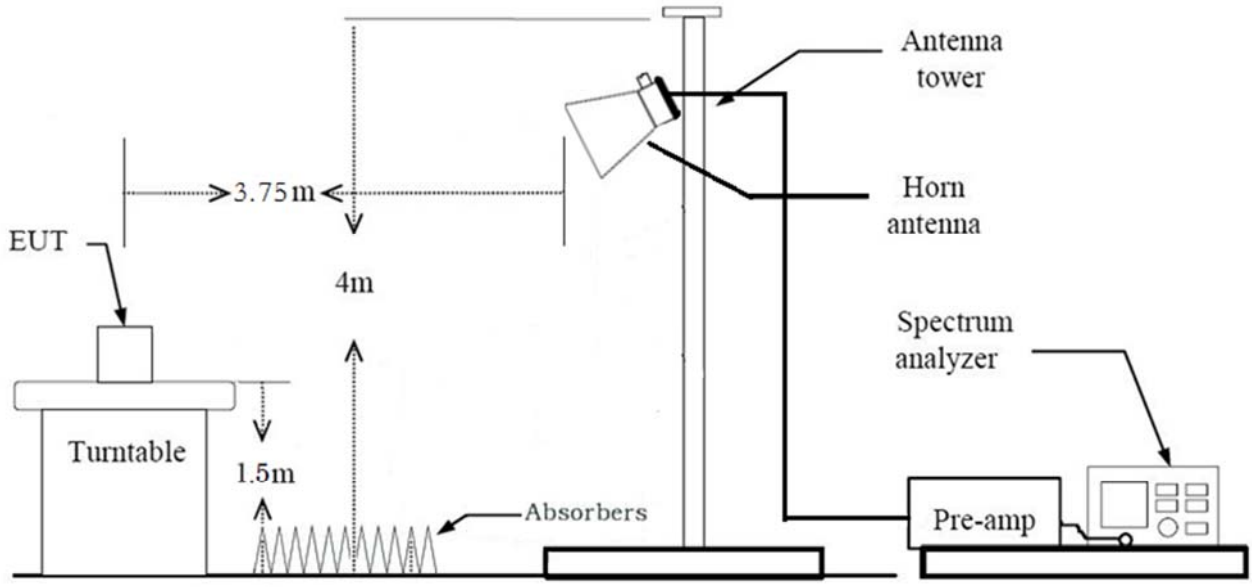
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. Spectrum Setting

   a. Peak: 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥3*RBW

   b. Average: 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds.

Note :

1. We are performed the RSE and radiated band edge using standard radiated method.
2. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
4. The duty cycle factor for BT mode.

BT Mode	T_{on} (ms)	VBW(1/T) (Hz)	The actual setting value of VBW (Hz)
GFSK	2.885	347	1000
π/4DQPSK	2.890	346	1000
8DPSK	2.890	346	1000

TEST RESULTS

9 kHz – 30MHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 9 kHz to the 30MHz.
2. The reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
3. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
4. Limit line = specific Limits (dBuV) + Distance extrapolation factor
5. This test is performed with hopping off.
6. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Mode

Frequency	Reading	Ant. factor	Cable loss	Ant. POL	Total	Limit	Margin
MHz	dBuV/m	dBm/m	dBm	(H/V)	dBuV/m	dBuV/m	dB
No Critical peaks found							

Notes:

1. Measuring frequencies from 30 MHz to the 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Quasi peak detector mode.
3. This test is performed with hopping off.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Above 1 GHz

Operation Mode: CH Low(GFSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	50.61	0.62	V	51.23	73.98	22.75	PK
4804	39.52	0.62	V	40.14	53.98	13.84	AV
7206	48.78	10.05	V	58.83	73.98	15.15	PK
7206	38.75	10.05	V	48.8	53.98	5.18	AV
4804	51.80	0.62	H	52.42	73.98	21.56	PK
4804	41.95	0.62	H	42.57	53.98	11.41	AV
7206	49.19	10.05	H	59.24	73.98	14.74	PK
7206	39.98	10.05	H	50.03	53.98	3.95	AV

Operation Mode: CH Low(8DPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	51.33	0.62	V	51.95	73.98	22.03	PK
4804	38.35	0.62	V	38.97	53.98	15.01	AV
7206	50.15	10.05	V	60.2	73.98	13.78	PK
7206	37.70	10.05	V	47.75	53.98	6.23	AV
4804	51.66	0.62	H	52.28	73.98	21.70	PK
4804	40.09	0.62	H	40.71	53.98	13.27	AV
7206	51.00	10.05	H	61.05	73.98	12.93	PK
7206	38.83	10.05	H	48.88	53.98	5.10	AV

Operation Mode: CH Low(π/4DQPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	51.31	0.62	V	51.93	73.98	22.05	PK
4804	38.46	0.62	V	39.08	53.98	14.90	AV
7206	50.39	10.05	V	60.44	73.98	13.54	PK
7206	38.20	10.05	V	48.25	53.98	5.73	AV
4804	51.90	0.62	H	52.52	73.98	21.46	PK
4804	40.19	0.62	H	40.81	53.98	13.17	AV
7206	50.64	10.05	H	60.69	73.98	13.29	PK
7206	39.00	10.05	H	49.05	53.98	4.93	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / AMP.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
7. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
8. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' = 2*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB
   e. We applied DCCF in the test result which hopping channel number is 20.

9. We have done Normal Mode and EDR Mode test.
10. This test is performed with hopping off.
11. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH Mid(GFSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	50.27	1.61	V	0	51.88	73.98	22.10	PK
4882	39.18	1.61	V	-24.73	16.06	53.98	37.92	AV
7323	50.31	10.02	V	0	60.33	73.98	13.65	PK
7323	42.11	10.02	V	-24.73	27.40	53.98	26.58	AV
4882	51.47	1.61	H	0	53.08	73.98	20.90	PK
4882	40.34	1.61	H	-24.73	17.22	53.98	36.76	AV
7323	50.67	10.02	H	0	60.69	73.98	13.29	PK
7323	42.46	10.02	H	-24.73	27.75	53.98	26.23	AV

Operation Mode: CH Mid(8DPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	51.11	1.61	V	0	52.72	73.98	21.26	PK
4882	39.27	1.61	V	-24.73	16.15	53.98	37.83	AV
7323	52.20	10.02	V	0	62.22	73.98	11.76	PK
7323	39.97	10.02	V	-24.73	25.26	53.98	28.72	AV
4882	52.23	1.61	H	0	53.84	73.98	20.14	PK
4882	40.24	1.61	H	-24.73	17.12	53.98	36.86	AV
7323	53.22	10.02	H	0	63.24	73.98	10.74	PK
7323	40.80	10.02	H	-24.73	26.09	53.98	27.89	AV

Operation Mode: CH Mid(π/4DQPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4882	50.48	1.61	V	0	52.09	73.98	21.89	PK
4882	39.61	1.61	V	-24.73	16.49	53.98	37.49	AV
7323	52.13	10.02	V	0	62.15	73.98	11.83	PK
7323	40.78	10.02	V	-24.73	26.07	53.98	27.91	AV
4882	51.63	1.61	H	0	53.24	73.98	20.74	PK
4882	40.35	1.61	H	-24.73	17.23	53.98	36.75	AV
7323	53.36	10.02	H	0	63.38	73.98	10.60	PK
7323	41.53	10.02	H	-24.73	26.82	53.98	27.16	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / AMP.G. : Amplifier Gain / D.F. : Distance Factor

Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
7. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
8. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' = 2*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB

e. We applied DCCF in the test result which hopping channel number is 20.

9. We have done Normal Mode and EDR Mode test.

10. This test is performed with hopping off.

11. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode: CH High(GFSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.16	1.69	V	51.85	73.98	22.13	PK
4960	38.46	1.69	V	40.15	53.98	13.83	AV
7440	46.75	11.43	V	58.18	73.98	15.80	PK
7440	35.23	11.43	V	46.66	53.98	7.32	AV
4960	50.87	1.69	H	52.56	73.98	21.42	PK
4960	40.13	1.69	H	41.82	53.98	12.16	AV
7440	47.68	11.43	H	59.11	73.98	14.87	PK
7440	36.10	11.43	H	47.53	53.98	6.45	AV

Operation Mode: CH High(8DPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.49	1.69	V	52.18	73.98	21.80	PK
4960	38.94	1.69	V	40.63	53.98	13.35	AV
7440	47.79	11.43	V	59.22	73.98	14.76	PK
7440	35.42	11.43	V	46.85	53.98	7.13	AV
4960	51.67	1.69	H	53.36	73.98	20.62	PK
4960	39.07	1.69	H	40.76	53.98	13.22	AV
7440	48.38	11.43	H	59.81	73.98	14.17	PK
7440	35.60	11.43	H	47.03	53.98	6.95	AV

Operation Mode: CH High (π/4DQPSK)

Frequency [MHz]	Reading [dBuV]	※A.F.+C.L.-A.G.+D.F. [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	50.37	1.69	V	52.06	73.98	21.92	PK
4960	38.72	1.69	V	40.41	53.98	13.57	AV
7440	47.11	11.43	V	58.54	73.98	15.44	PK
7440	35.12	11.43	V	46.55	53.98	7.43	AV
4960	51.61	1.69	H	53.3	73.98	20.68	PK
4960	39.15	1.69	H	40.84	53.98	13.14	AV
7440	49.72	11.43	H	61.15	73.98	12.83	PK
7440	35.68	11.43	H	47.11	53.98	6.87	AV

*A.F. : Antenna Factor / C.L. : Cable Loss / AMP.G. : Amplifier Gain / D.F. : Distance Factor

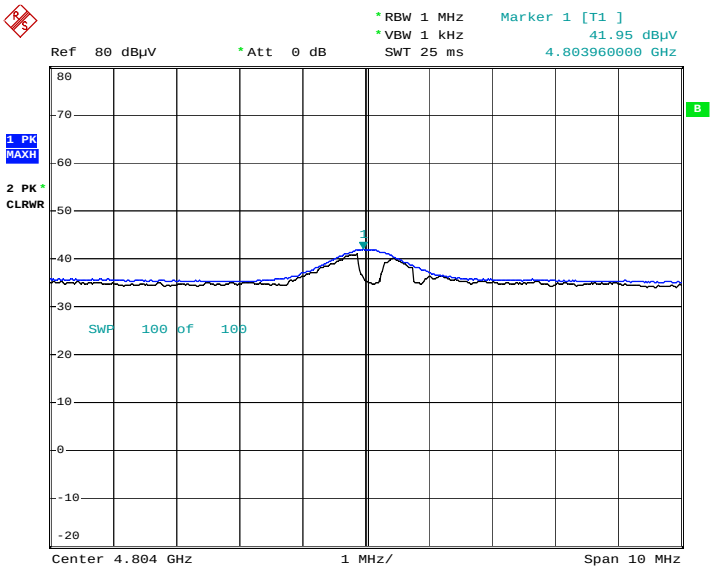
Notes:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Total = Reading Value + Antenna Factor + Cable Loss - Amp Gain + Distance Factor
5. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
6. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds. We performed using a reduced video BW method was done with the analyzer in linear mode.
7. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
8. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' = 2*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 5.800 ms
   d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB
   e. We applied DCCF in the test result which hopping channel number is 20.

9. We have done Normal Mode and EDR Mode test.
10. This test is performed with hopping off.
11. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

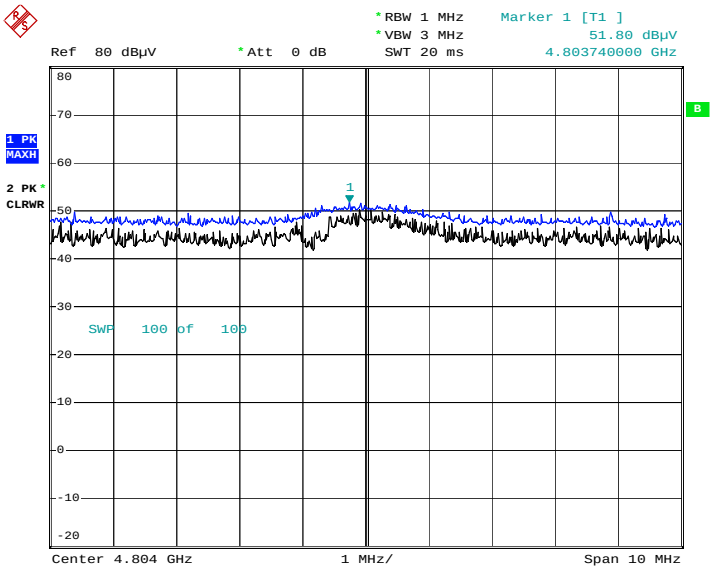
▣ RESULT PLOTS (Worst case : Z-H)

Radiated Spurious Emissions plot – Average Reading (GFSK, Ch.0 2nd Harmonic)



Date: 23.FEB.2018 09:36:29

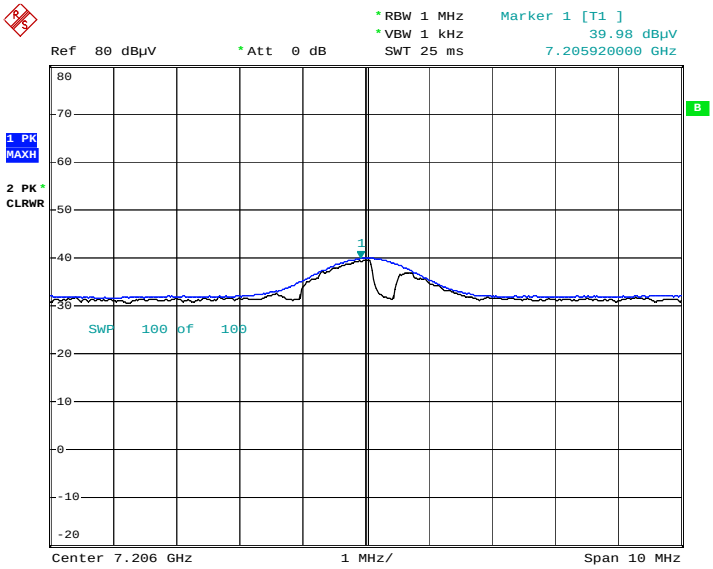
Radiated Spurious Emissions plot – Peak Reading (GFSK, Ch.0 2nd Harmonic)



Date: 23.FEB.2018 09:37:06

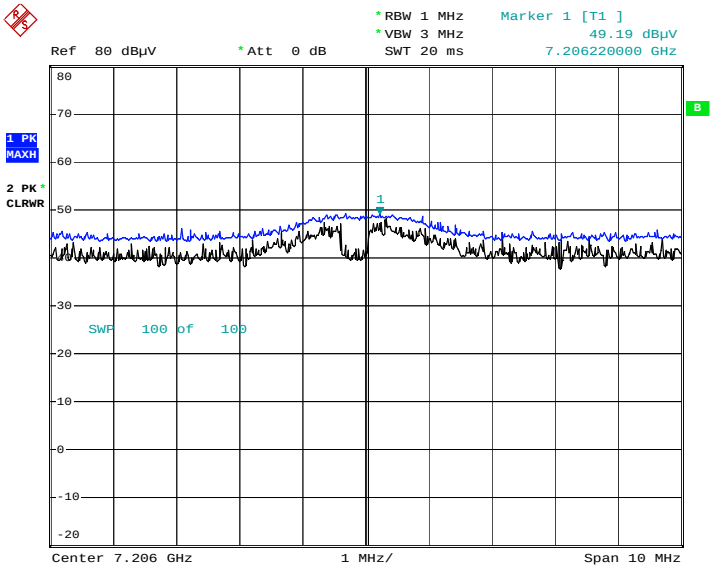
▣ RESULT PLOTS (Worst case : X-H)

Radiated Spurious Emissions plot – Average Reading (GFSK, Ch.0 3rd Harmonic)



Date: 23.FEB.2018 09:43:31

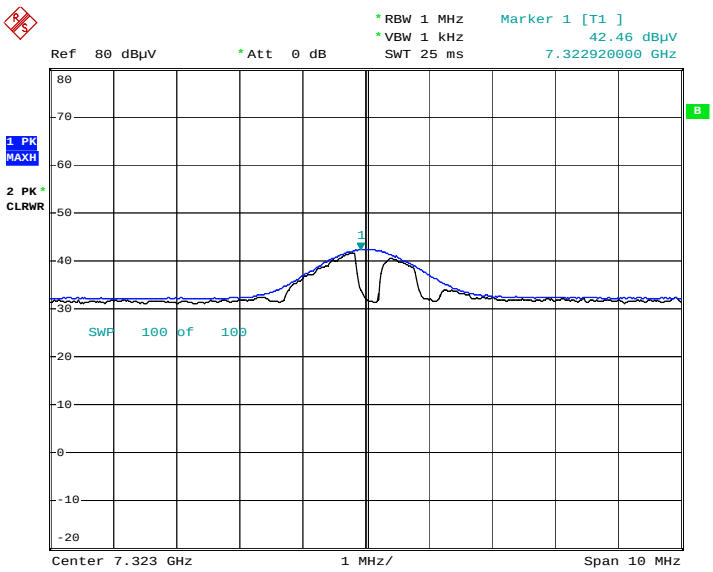
Radiated Spurious Emissions plot – Peak Reading (GFSK, Ch.0 3rd Harmonic)



Date: 23.FEB.2018 09:44:01

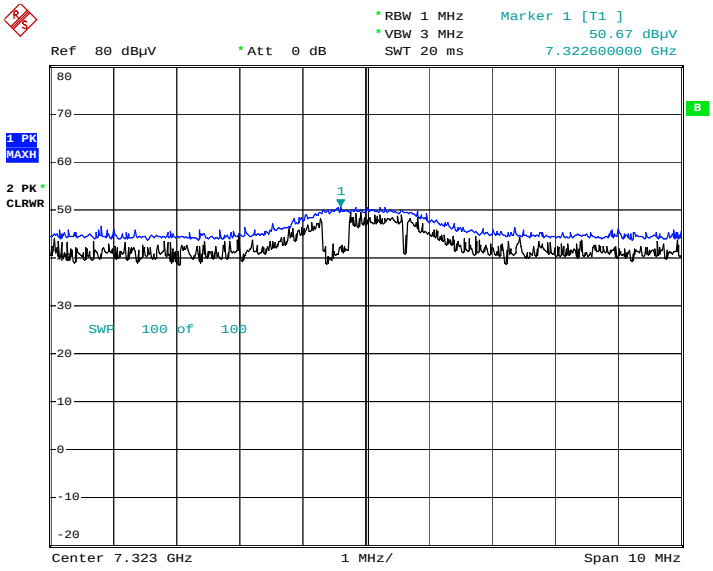
▣ RESULT PLOTS (Worst case : X-H)

Radiated Spurious Emissions plot – Average Reading (π/4DQPSK, Ch.39 3rd Harmonic)



Date: 23.FEB.2018 09:48:39

Radiated Spurious Emissions plot – Peak Reading (π/4DQPSK, Ch.39 3rd Harmonic)



Date: 23.FEB.2018 09:49:13

9.6.3 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d), §15.205, §15.209

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a) (See section 15.205(c).

Operation Mode	Normal(GFSK)
Operating Frequency	2402 MHz, 2480 MHz
Channel No	CH 0, CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+C.L.+D.F. [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	24.98	33.30	H	0	58.28	73.98	15.70	PK
2390.0	12.20	33.30	H	-24.73	20.77	53.98	33.21	AV
2390.0	25.17	33.30	V	0	58.47	73.98	15.51	PK
2390.0	12.23	33.30	V	-24.73	20.80	53.98	33.18	AV
2483.5	36.21	33.41	H	0	69.62	73.98	4.36	PK
2483.5	33.52	33.41	H	-24.73	42.20	53.98	11.78	AV
2483.5	36.37	33.41	V	0	69.78	73.98	4.20	PK
2483.5	33.79	33.41	V	-24.73	42.47	53.98	11.51	AV

Operation Mode	EDR(8DPSK)
Operating Frequency	2402 MHz
Channel No	CH 0,

Frequency [MHz]	Reading dBuV	※ A.F.+C.L.+D.F. [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	25.02	33.30	H	0	58.32	73.98	15.66	PK
2390.0	12.21	33.30	H	-24.73	20.78	53.98	33.20	AV
2390.0	25.09	33.30	V	0	58.39	73.98	15.59	PK
2390.0	12.30	33.30	V	-24.73	20.87	53.98	33.11	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2402 MHz
Channel No	CH 0

Frequency [MHz]	Reading dBuV	※ A.F.+C.L.+D.F. [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	25.14	33.30	H	0	58.44	73.98	15.54	PK
2390.0	12.25	33.30	H	-24.73	20.82	53.98	33.16	AV
2390.0	25.28	33.30	V	0	58.58	73.98	15.40	PK
2390.0	12.29	33.30	V	-24.73	20.86	53.98	33.12	AV

Notes:

1. Frequency range of measurement = 2483.5 MHz ~ 2500 MHz
2. Total = Reading Value + Antenna Factor + Cable Loss + Distance Factor + Duty Cycle Correction Factor
3. Distance extrapolation factor = 20 log (test distance / specific distance) (dB)
4. Spectrum setting:
   a. Peak Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW = 3 MHz.
   b. Average Setting 1 GHz – 25 GHz, RBW = 1 MHz, VBW ≥ 1/τ Hz, where τ = pulse width in seconds.
   We performed using a reduced video BW method was done with the analyzer in linear mode.
5. FYI : Duty Cycle Correction Factor (79 channel hopping)
   a. Time to cycle through all channels= Δ t= τ [ms] x 79 channels = 229.100 ms, where τ = pulse width
   b. 100 ms/ Δt [ms] = *H* → Round up to next highest integer, *H ' =1*
   c. Worst Case Dwell Time = τ [ms] x *H '* = 2.900 ms
   d. Duty Cycle Correction = 20log (Worst Case Dwell Time/ 100ms) dB = -30.752 dB
6. Duty Cycle Correction Factor(AFH mode – minimum channel number case - 20 channels)
   a. Time to cycle through all channels= Δ t= τ [ms] x 20 channels = 58.00 ms, where τ = pulse width

b. 100 ms/ Δt [ms] = $H \rightarrow$ Round up to next highest integer, $H' = 2$

c. Worst Case Dwell Time = τ [ms] x H' = 5.800 ms

d. Duty Cycle Correction(AFH) = 20log (Worst Case Dwell Time/ 100ms) dB = -24.7314 dB

e. We applied DCCF in the test result which hopping channel number is 20.

7. We have done Normal Mode, EDR Mode.
8. This test is performed with hopping off.
9. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.

Operation Mode	EDR(8DPSK)
Operating Frequency	2480 MHz
Channel No	CH 78

Frequency [MHz]	*Fund. Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	*Fundamental [dBuV/m]	Delta Value [dBuV/m]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2483.5	75.69	33.41	H	109.10	59.97	49.13	73.98	24.85	PK
2483.5	71.87	33.41	H	105.28	59.97	45.31	53.98	8.67	AV
2483.5	76.13	33.41	V	109.54	60.26	49.28	73.98	24.70	PK
2483.5	72.31	33.41	V	105.72	60.26	45.46	53.98	8.52	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2480 MHz
Channel No	CH 78

Frequency [MHz]	*Fund. Reading dBuV	※ A.F.+CL [dB]	Ant. Pol. [H/V]	*Fundamental [dBuV/m]	Delta Value [dBuV/m]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2483.5	75.55	33.41	H	108.96	59.35	49.61	73.98	24.37	PK
2483.5	72.07	33.41	H	105.48	59.35	46.13	53.98	7.85	AV
2483.5	76.01	33.41	V	109.42	59.64	49.78	73.98	24.20	PK
2483.5	72.51	33.41	V	105.92	59.64	46.28	53.98	7.70	AV

Notes:

1. Frequency range of measurement = 2483.5 MHz ~ 2485.5 MHz
2. Total (Peak) = Reading Value + Antenna Factor + Cable Loss + Distance Factor - Delta Value
   Total (Average) = Reading Value + Antenna Factor + Cable Loss + Distance Factor - Delta Value
3. Marker-delta method
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna

Operation Mode	EDR(8DPSK)
Operating Frequency	2480 MHz
Channel No	CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2485.5	24.78	33.41	H	58.19	73.98	15.79	PK
2485.5	15.53	33.41	H	48.94	53.98	5.04	AV
2485.5	25.13	33.41	V	58.54	73.98	15.44	PK
2485.5	15.94	33.41	V	49.35	53.98	4.63	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2480 MHz
Channel No	CH 78

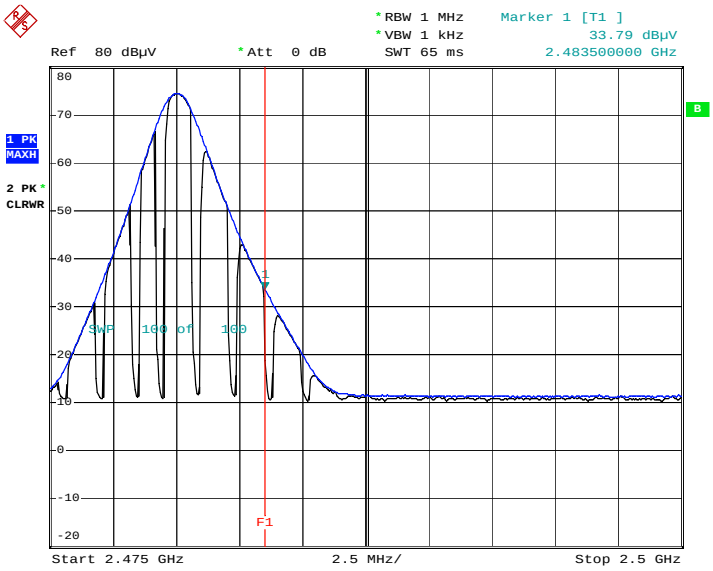
Frequency [MHz]	Reading dBuV	※ A.F.+CL [dB]	ANT. POL [H/V]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Detect
2485.5	24.69	33.41	H	58.10	73.98	15.88	PK
2485.5	15.56	33.41	H	48.97	53.98	5.01	AV
2485.5	25.29	33.41	V	58.70	73.98	15.28	PK
2485.5	15.90	33.41	V	49.31	53.98	4.67	AV

Notes:

1. Frequency range of measurement = 2485.5 MHz ~ 2500 MHz
2. Total (Peak) = Reading Value + Antenna Factor + Cable Loss + Distance Factor
3. Standard method
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna

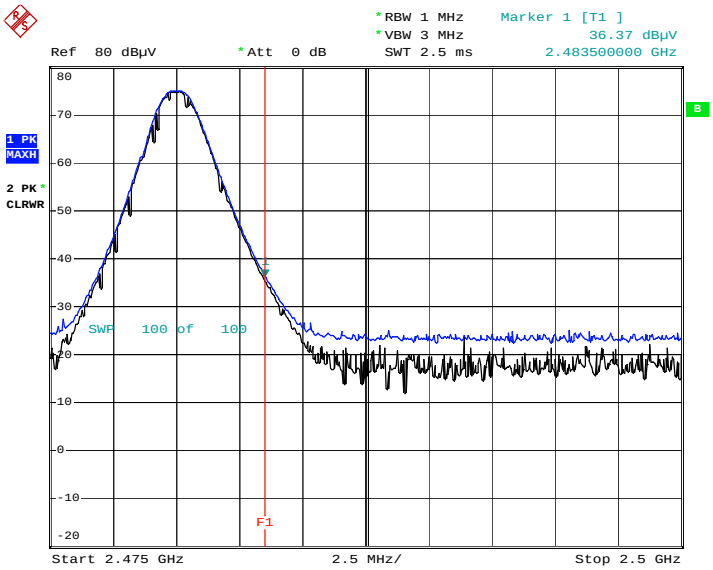
▣ RESULT PLOTS (Worst case : Z-V)

Radiated Restricted Band Edges plot – Average Reading (GFSK, Ch.78)



Date: 22.FEB.2018 21:14:23

Radiated Restricted Band Edges plot – Peak Reading (GFSK, Ch.78)

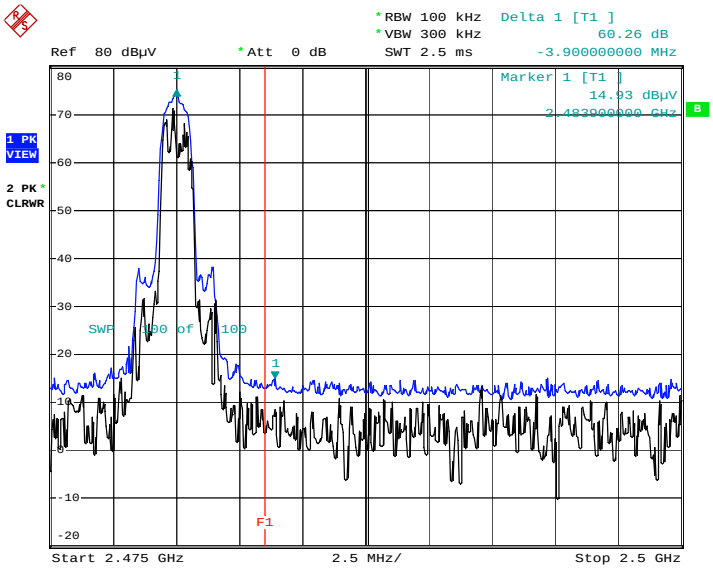


Date: 22.FEB.2018 21:13:58

Note : Only the worst case plots for Radiated Restricted Band Edges.

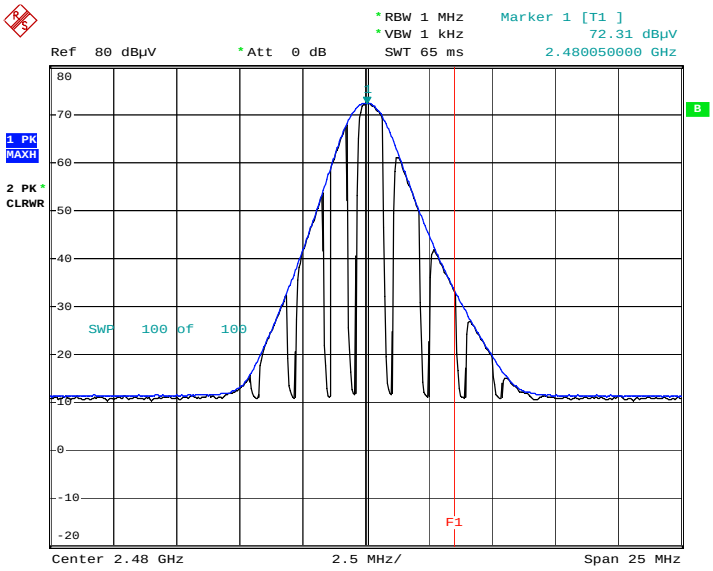
▣ RESULT PLOTS (Worst case :Z-V)

Radiated Restricted Band Edges plot – 8DPSK Delta Marker



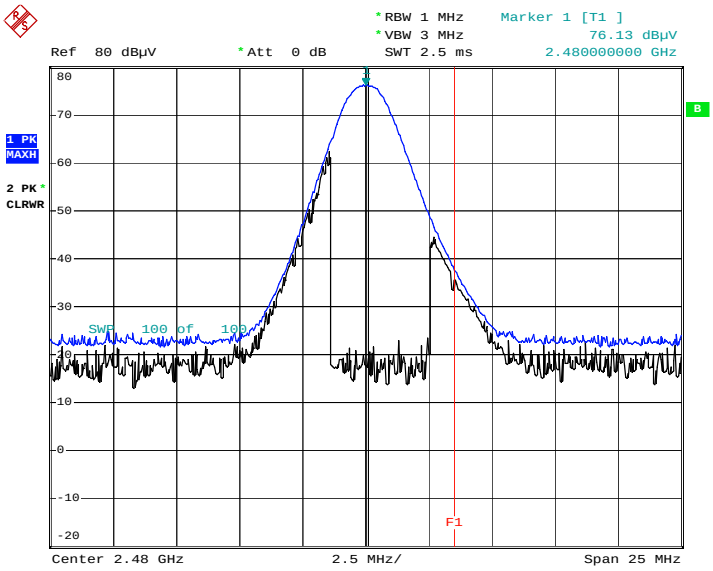
Date: 23.FEB.2018 10:02:07

Radiated Restricted Band Edges plot – Average Reading (8DPSK, ch.78)



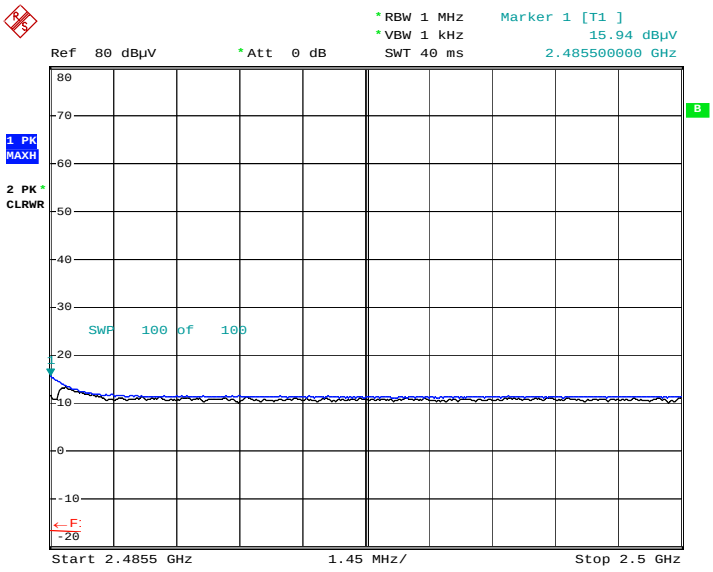
Date: 22.FEB.2018 21:01:43

Radiated Restricted Band Edges plot – Peak Reading (8DPSK, ch.78)



Date: 22.FEB.2018 21:01:16

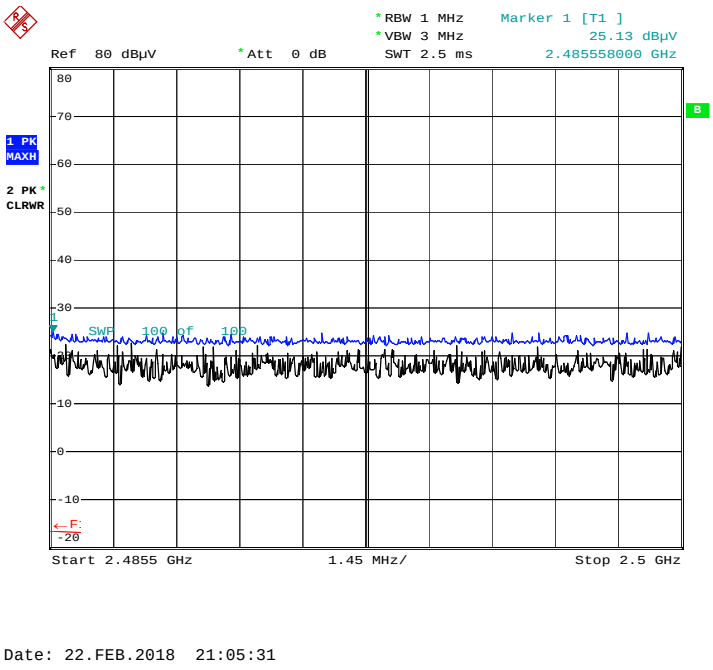
Radiated Restricted Band Edges plot – Average Reading (8DPSK, Ch.78) _ 2 485.5 MHz ~ 2 500.0 MHz



Date: 22.FEB.2018 21:02:10

Radiated Restricted Band Edges plot – Peak Reading (8DPSK, Ch.78)

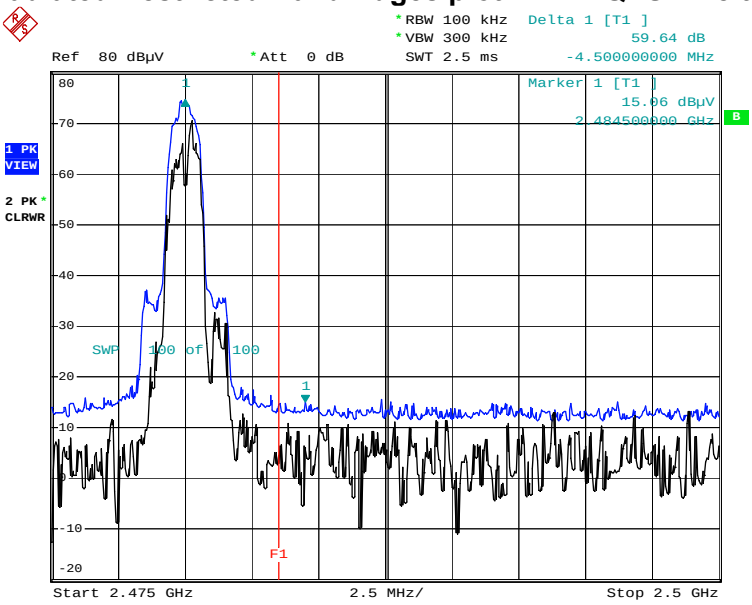
_ 2 485.5 MHz ~ 2 500.0 MHz



Note : Only the worst case plots for Radiated Restricted Band Edges.

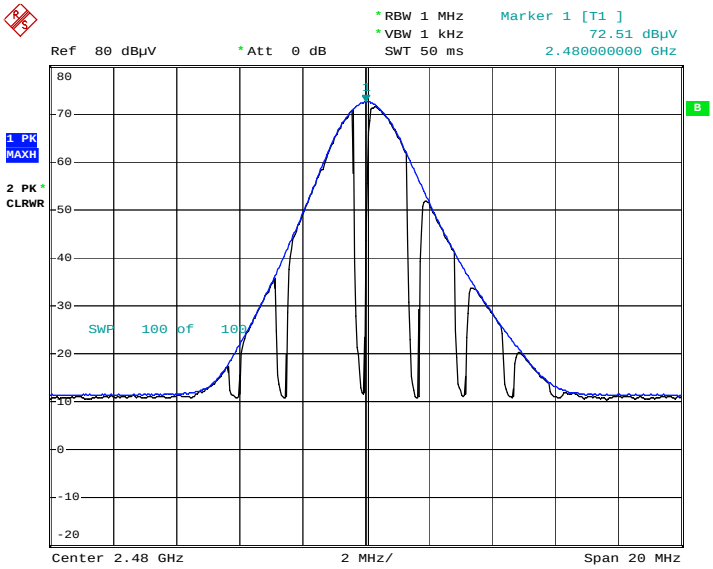
▣ RESULT PLOTS (Worst case :Z-V)

Radiated Restricted Band Edges plot – π/4DQPSK Delta Marker



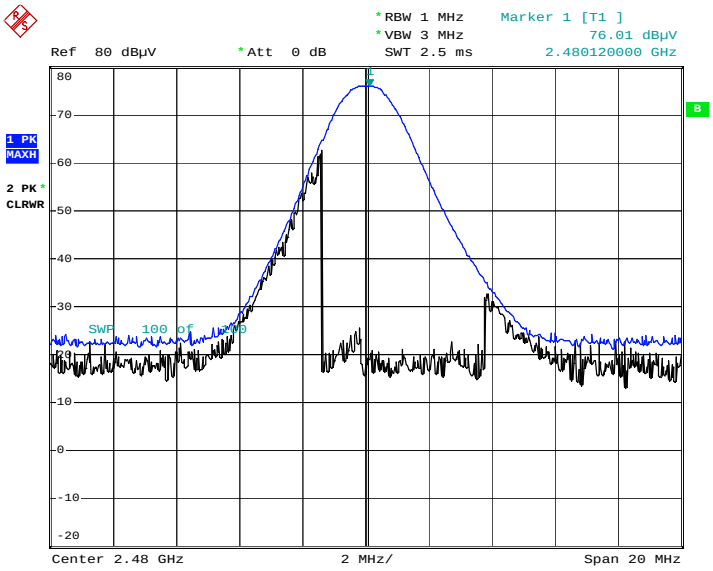
Date: 23.FEB.2018 10:03:57

Radiated Restricted Band Edges plot – Average Reading (π/4DQPSK, Ch.78)



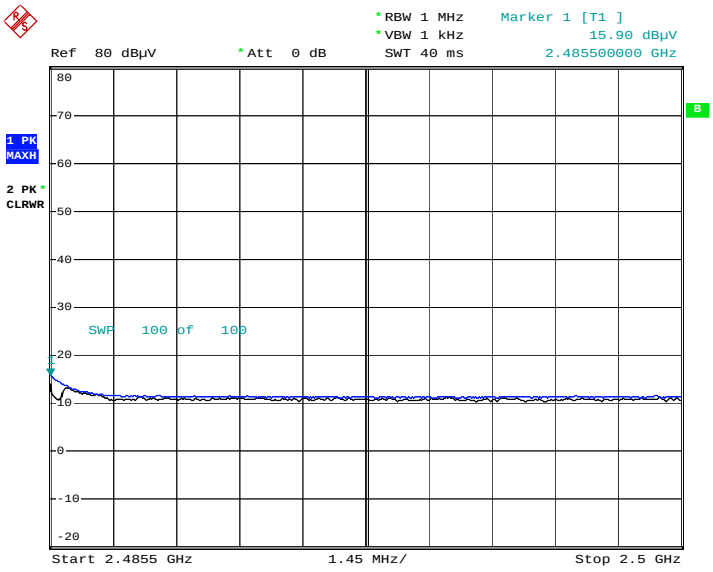
Date: 22.FEB.2018 20:56:49

Radiated Restricted Band Edges plot – Peak Reading (π/4DQPSK, Ch.78)



Date: 22.FEB.2018 20:56:28

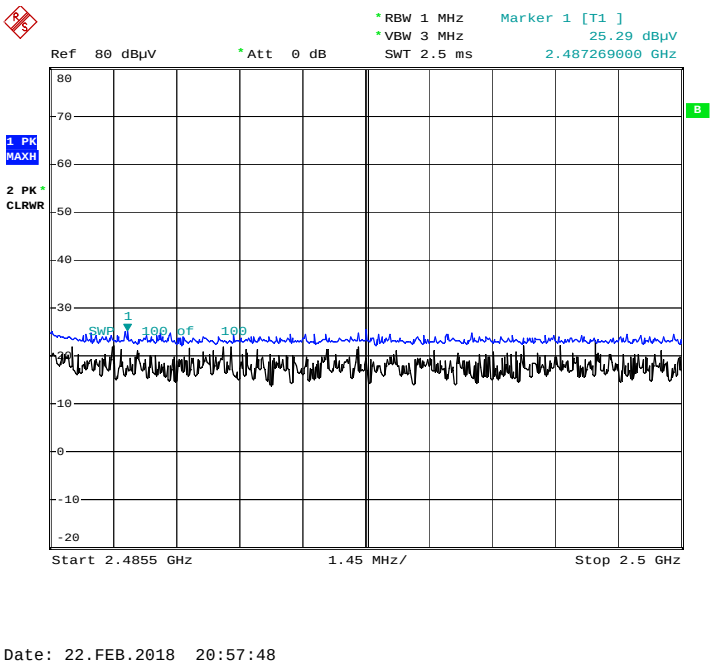
Radiated Restricted Band Edges plot – Average Reading (π/4DQPSK, Ch.78) _ 2 485.5 MHz ~ 2 500.0 MHz



Date: 22.FEB.2018 20:57:05

Radiated Restricted Band Edges plot – Peak Reading (π/4DQPSK, Ch.78)

_ 2 485.5 MHz ~ 2 500.0 MHz



Note : Only the worst case plots for Radiated Restricted Band Edges.

9.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which 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 250 microvolt (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors – Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

▣ RESULT PLOTS

Conducted Emissions (Line 1)

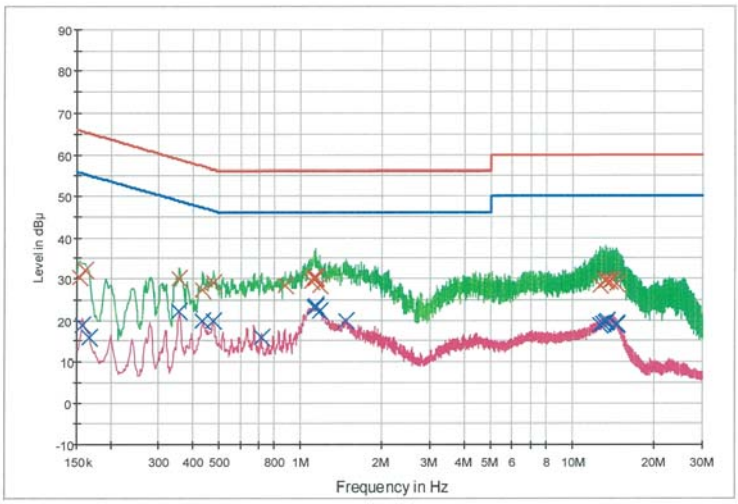
EMI Auto Test(19) 1 / 2

HCT TEST Report

Common Information

EUT:	LM-X210EM
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE

FCC CLASS B_Exten Cable



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154000	30.2	9.000	Off	N	9.7	35.6	65.8
0.160000	32.0	9.000	Off	N	9.7	33.4	65.5
0.358000	30.1	9.000	Off	N	9.7	28.7	58.8
0.436000	27.2	9.000	Off	N	9.7	30.0	57.1
0.478000	29.0	9.000	Off	N	9.7	27.4	56.4
0.876000	28.1	9.000	Off	N	9.7	27.9	56.0
1.098000	29.5	9.000	Off	N	9.8	26.5	56.0
1.116000	30.3	9.000	Off	N	9.8	25.7	56.0
1.122000	30.1	9.000	Off	N	9.8	25.9	56.0
1.134000	30.0	9.000	Off	N	9.8	26.0	56.0
1.138000	30.2	9.000	Off	N	9.8	25.8	56.0
1.176000	28.4	9.000	Off	N	9.8	27.6	56.0
12.690000	28.4	9.000	Off	N	10.4	31.6	60.0
13.172000	29.2	9.000	Off	N	10.4	30.8	60.0
13.238000	29.8	9.000	Off	N	10.4	30.2	60.0
13.746000	29.3	9.000	Off	N	10.4	30.7	60.0
14.090000	29.5	9.000	Off	N	10.4	30.5	60.0
14.586000	28.8	9.000	Off	N	10.5	31.2	60.0

Final Result 2

2018-02-20 오후 7:17:38

EMI Auto Test(19) 2 / 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	18.7	9.000	Off	N	9.7	36.8	55.6
0.166000	15.6	9.000	Off	N	9.7	39.5	55.2
0.358000	22.1	9.000	Off	N	9.7	26.7	48.8
0.436000	19.9	9.000	Off	N	9.7	27.3	47.1
0.478000	20.0	9.000	Off	N	9.7	26.4	46.4
0.716000	15.6	9.000	Off	N	9.7	30.4	46.0
1.120000	23.3	9.000	Off	N	9.8	22.7	46.0
1.126000	23.1	9.000	Off	N	9.8	22.9	46.0
1.134000	23.2	9.000	Off	N	9.8	22.8	46.0
1.138000	23.5	9.000	Off	N	9.8	22.5	46.0
1.176000	22.2	9.000	Off	N	9.8	23.8	46.0
1.470000	19.9	9.000	Off	N	9.8	26.1	46.0
12.690000	18.8	9.000	Off	N	10.4	31.2	50.0
12.968000	19.3	9.000	Off	N	10.4	30.7	50.0
13.238000	19.7	9.000	Off	N	10.4	30.3	50.0
13.424000	20.0	9.000	Off	N	10.4	30.0	50.0
14.560000	19.0	9.000	Off	N	10.5	31.0	50.0
14.586000	18.8	9.000	Off	N	10.5	31.2	50.0

2018-02-20 오후 7:17:38

Conducted Emissions (Line 2)

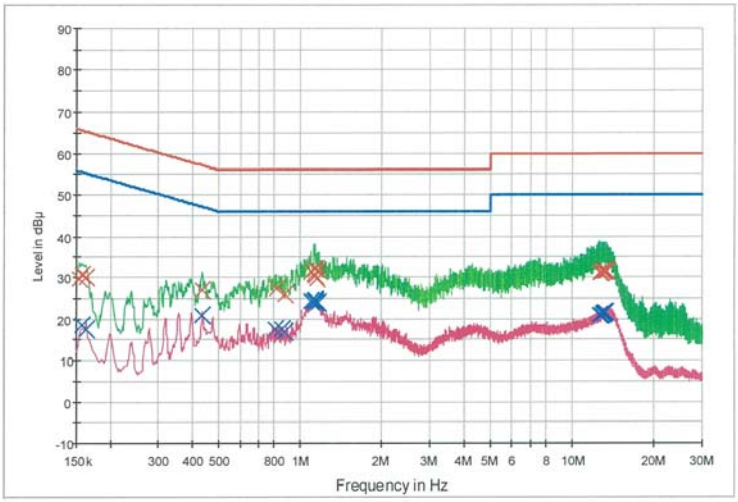
EMI Auto Test(19) 1 / 2

HCT TEST Report

Common Information

EUT:	LM-X210EM
Manufacturer:	LG
Test Site:	SHIELD ROOM
Operating Conditions:	BT MODE

FCC CLASS B_Exten Cable



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154000	29.7	9.000	Off	L1	9.7	36.1	65.8
0.158000	30.5	9.000	Off	L1	9.7	35.0	65.6
0.162000	29.9	9.000	Off	L1	9.7	35.5	65.4
0.436000	27.1	9.000	Off	L1	9.7	30.1	57.1
0.814000	27.4	9.000	Off	L1	9.7	28.6	56.0
0.876000	26.0	9.000	Off	L1	9.7	30.0	56.0
1.092000	31.2	9.000	Off	L1	9.8	24.8	56.0
1.124000	30.6	9.000	Off	L1	9.8	25.4	56.0
1.132000	32.1	9.000	Off	L1	9.8	23.9	56.0
1.140000	30.2	9.000	Off	L1	9.8	25.8	56.0
1.146000	29.7	9.000	Off	L1	9.8	26.3	56.0
1.168000	31.7	9.000	Off	L1	9.8	24.3	56.0
12.694000	31.2	9.000	Off	L1	10.2	28.8	60.0
12.810000	30.9	9.000	Off	L1	10.2	29.1	60.0
12.878000	31.3	9.000	Off	L1	10.2	28.7	60.0
13.022000	31.3	9.000	Off	L1	10.2	28.7	60.0
13.174000	31.5	9.000	Off	L1	10.2	28.5	60.0
13.430000	31.5	9.000	Off	L1	10.2	28.5	60.0

Final Result 2

2018-02-20 오후 7:26:42

EMI Auto Test(19) 2 / 2

Frequency (MHz)	CAverage (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	18.4	9.000	Off	L1	9.7	37.2	55.6
0.162000	17.5	9.000	Off	L1	9.7	37.9	55.4
0.436000	20.7	9.000	Off	L1	9.7	26.4	47.1
0.812000	17.6	9.000	Off	L1	9.7	28.4	46.0
0.854000	17.4	9.000	Off	L1	9.7	28.6	46.0
0.876000	16.8	9.000	Off	L1	9.7	29.2	46.0
1.092000	24.1	9.000	Off	L1	9.8	21.9	46.0
1.126000	24.2	9.000	Off	L1	9.8	21.8	46.0
1.130000	24.7	9.000	Off	L1	9.8	21.3	46.0
1.134000	24.3	9.000	Off	L1	9.8	21.7	46.0
1.140000	23.8	9.000	Off	L1	9.8	22.2	46.0
1.168000	23.9	9.000	Off	L1	9.8	22.1	46.0
12.694000	20.8	9.000	Off	L1	10.2	29.2	50.0
12.810000	21.0	9.000	Off	L1	10.2	29.0	50.0
12.878000	21.2	9.000	Off	L1	10.2	28.8	50.0
13.022000	21.4	9.000	Off	L1	10.2	28.6	50.0
13.122000	21.4	9.000	Off	L1	10.2	28.6	50.0
13.174000	21.5	9.000	Off	L1	10.2	28.5	50.0

2018-02-20 오후 7:26:42

10. LIST OF TEST EQUIPMENT

10.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Rohde & Schwarz	ENV216 / LISN	12/20/2017	Annual	102245
Rohde & Schwarz	ESCI / Test Receiver	06/27/2017	Annual	100033
ESPAC	SU-642 /Temperature Chamber	03/31/2017	Annual	0093008124
Agilent	N9020A / Signal Analyzer	06/13/2017	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	11/22/2017	Annual	MY49431210
Agilent	N1911A / Power Meter	04/17/2017	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/17/2017	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/20/2017	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	06/12/2017	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	06/30/2017	Annual	KR75303960
Agilent	8493C / Attenuator(10 dB)	07/10/2017	Annual	07560
Rohde & Schwarz	EMC32 / Software	N/A	N/A	N/A
HCT CO., LTD.	FCC WLAN&BT&BLE Conducted Test Software	N/A	N/A	N/A
Rohde & Schwarz	CBT / Bluetooth Tester	05/16/2017	Annual	100422

10.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacturer	Model / Equipment	Calibration Date	Calibration Interval	Serial No.
Innco system	CO3000 / Controller(Antenna mast)	N/A	N/A	CO3000-4p
Innco system	MA4000-EP / Antenna Position Tower	N/A	N/A	N/A
Audix	EM1000 / Controller	N/A	N/A	060520
Audix	Turn Table	N/A	N/A	N/A
Rohde & Schwarz	Loop Antenna	04/19/2017	Biennial	1513-175
Schwarzbeck	VULB 9168 / Hybrid Antenna	04/06/2017	Biennial	760
Schwarzbeck	BBHA 9120D / Horn Antenna	05/02/2017	Biennial	9120D-937
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	12/04/2017	Biennial	BBHA9170541
Rohde & Schwarz	FSP(9 kHz ~ 30 GHz) / Spectrum Analyzer	09/06/2017	Annual	100688
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/27/2017	Annual	101068-SZ
Wainwright Instruments	WHK3.0/18G-10EF / High Pass Filter	06/12/2017	Annual	8
Wainwright Instruments	WHFX7.0/18G-8SS / High Pass Filter	05/15/2017	Annual	29
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	06/30/2017	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	01/03/2018	Annual	2
Agilent	8493C-10 / Attenuator(10 dB)	07/19/2017	Annual	08285
CERNEX	CBLU1183540 / Power Amplifier	07/11/2017	Annual	22964
CERNEX	CBL06185030 / Power Amplifier	07/11/2017	Annual	22965
CERNEX	CBL18265035 / Power Amplifier	01/10/2018	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	06/30/2017	Annual	25956
TESCOM	TC-3000C / Bluetooth Tester	03/31/2017	Annual	3000C000276