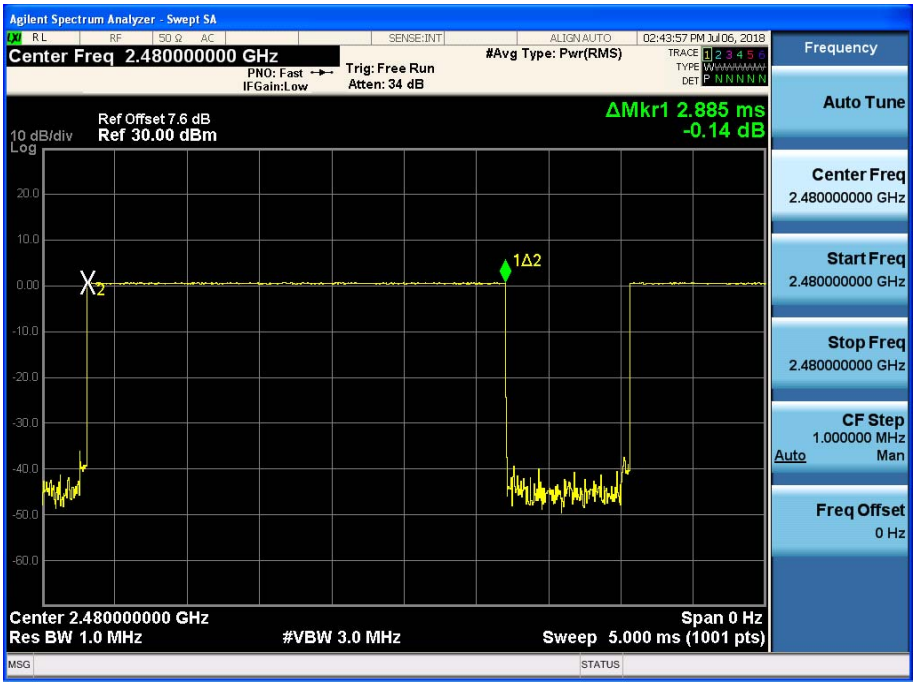
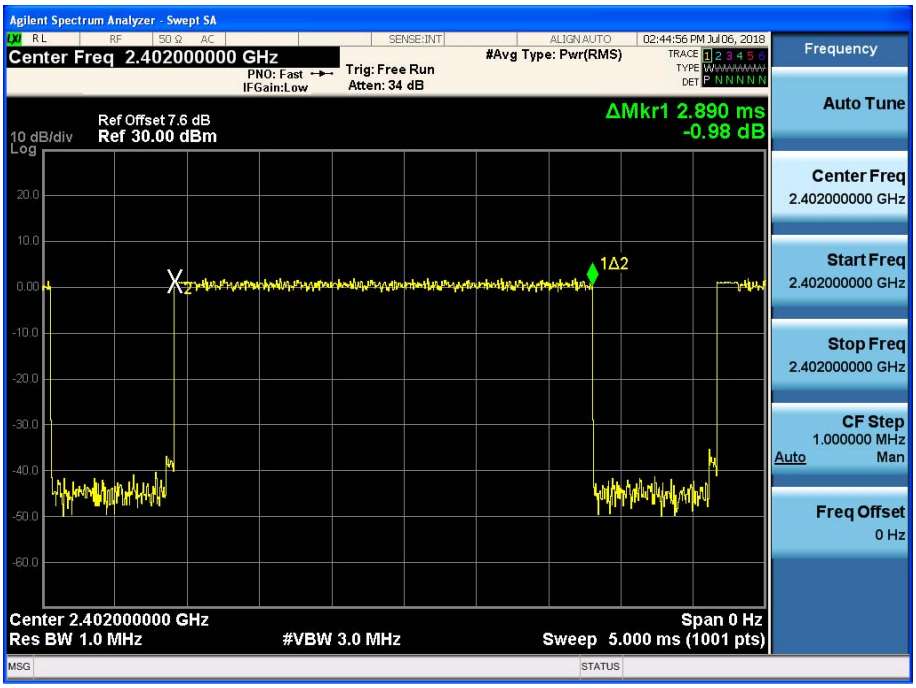
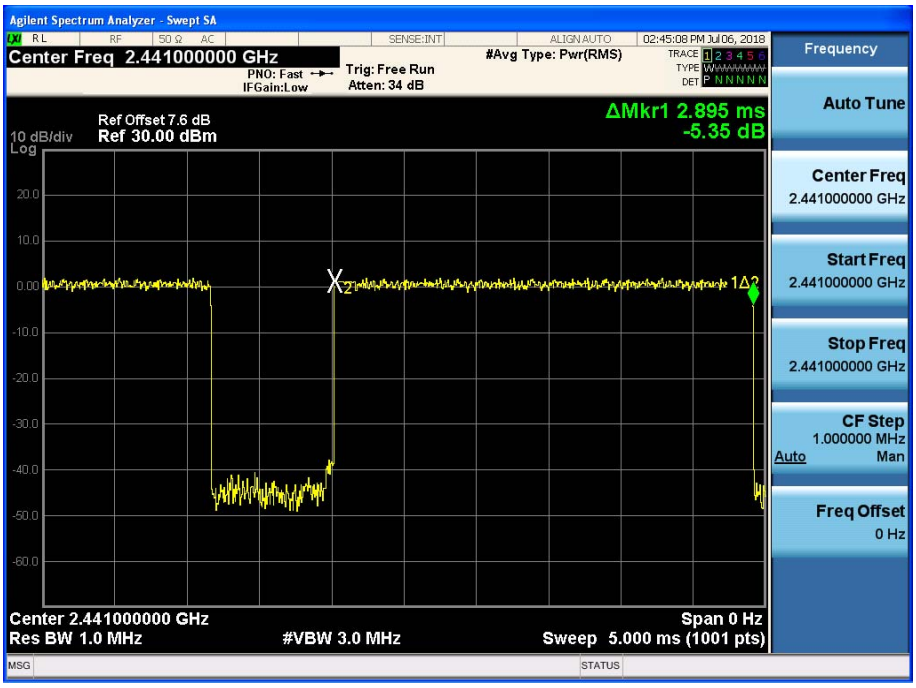
Test Plots (GFSK)
Dwell Time (CH.78)



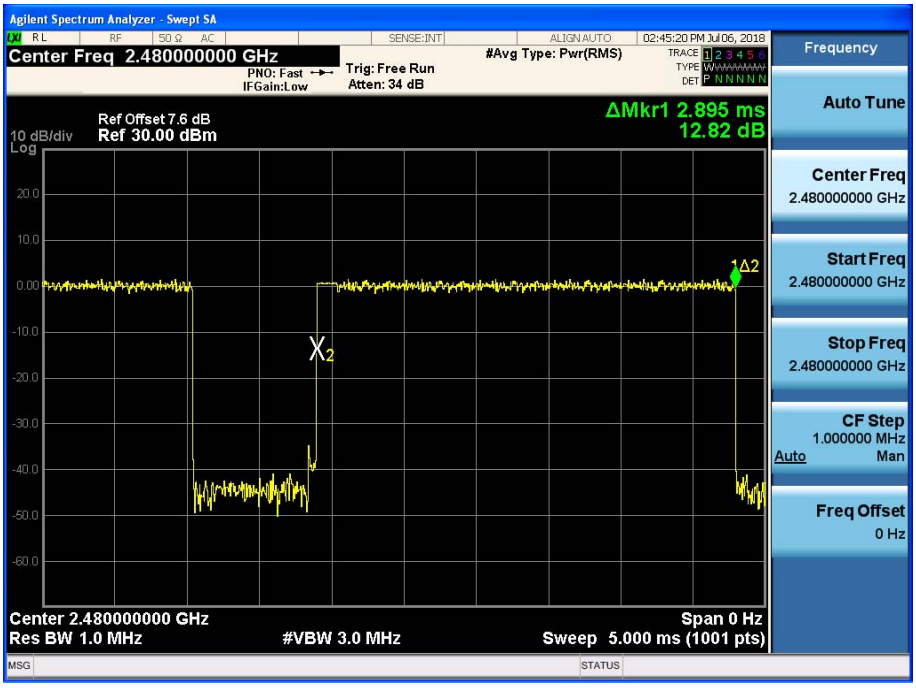
Test Plots (8DPSK)
Dwell Time (CH.0)



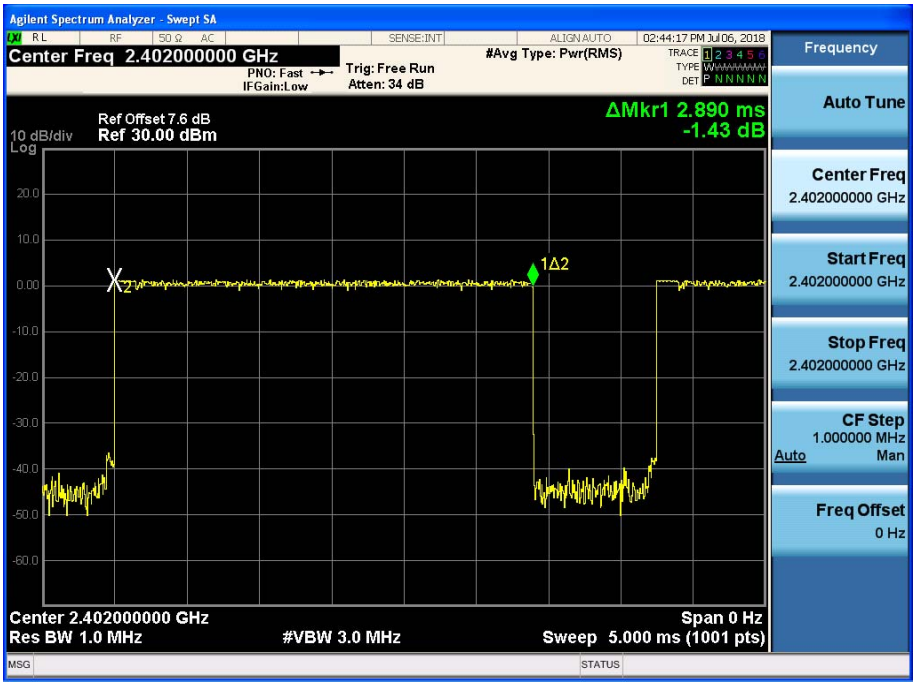
Test Plots (8DPSK)
Dwell Time (CH.39)



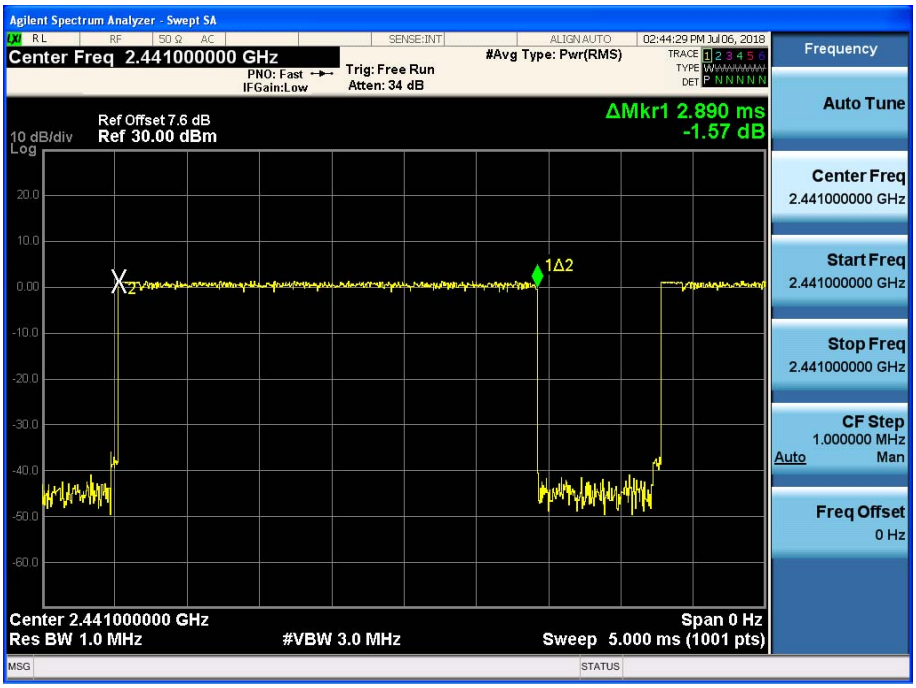
Test Plots (8DPSK)
Dwell Time (CH.78)



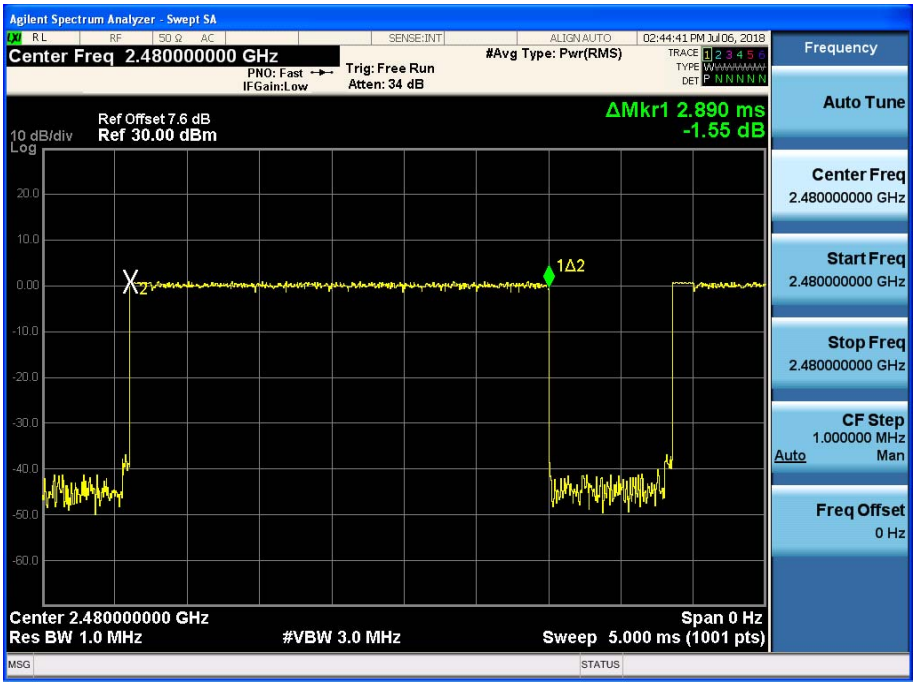
Test Plots (π/4DQPSK)
Dwell Time (CH.0)



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



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



9.6 SPURIOUS EMISSIONS

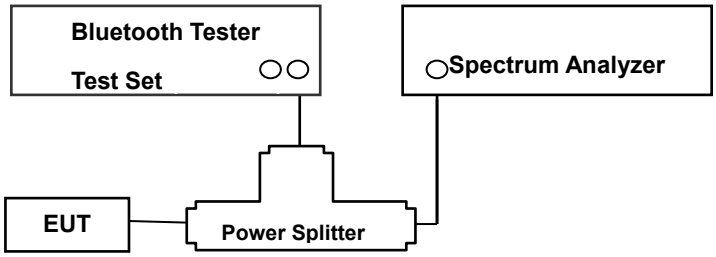
9.6.1 CONDUCTED SPURIOUS EMISSIONS

Test Requirements and limit, §15.247(d) / RSS-247(Issue 2) Section 5.5

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) / RSS-Gen 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

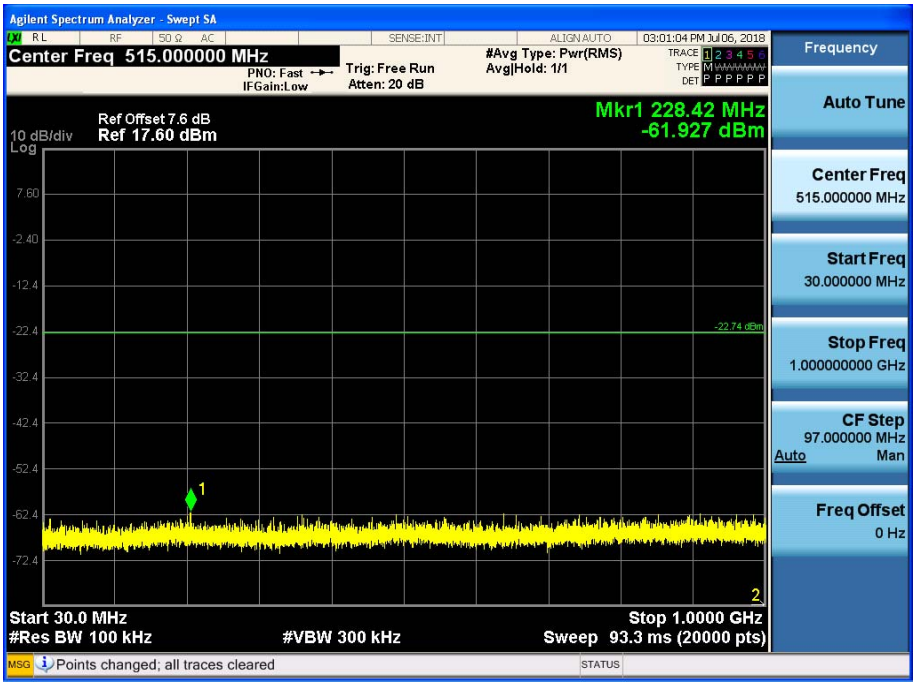
Freq(MHz)	Factor(dB)
30	7.18
100	6.35
200	7.04
300	6.58
400	6.26
500	5.95
600	6.17
700	6.34
800	6.72
900	7.08
1000	7.38
2000	7.78
2400*	8.30
2500*	8.51
3000	8.73
4000	8.95
5000	9.57
6000	6.68
7000	9.99
8000	8.34
9000	9.61
10000	10.47
11000	8.96
12000	9.73
13000	8.84
14000	9.50
15000	11.54
16000	8.14
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.

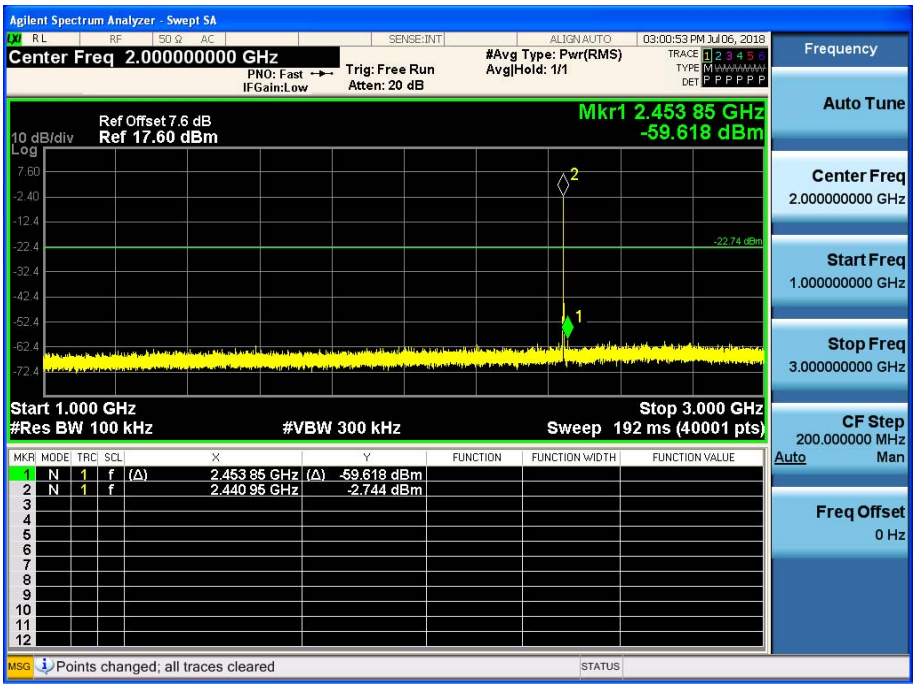
2. Factor = Cable loss + Splitter loss

3. And the loss of the added RF cable is 0.6dB.

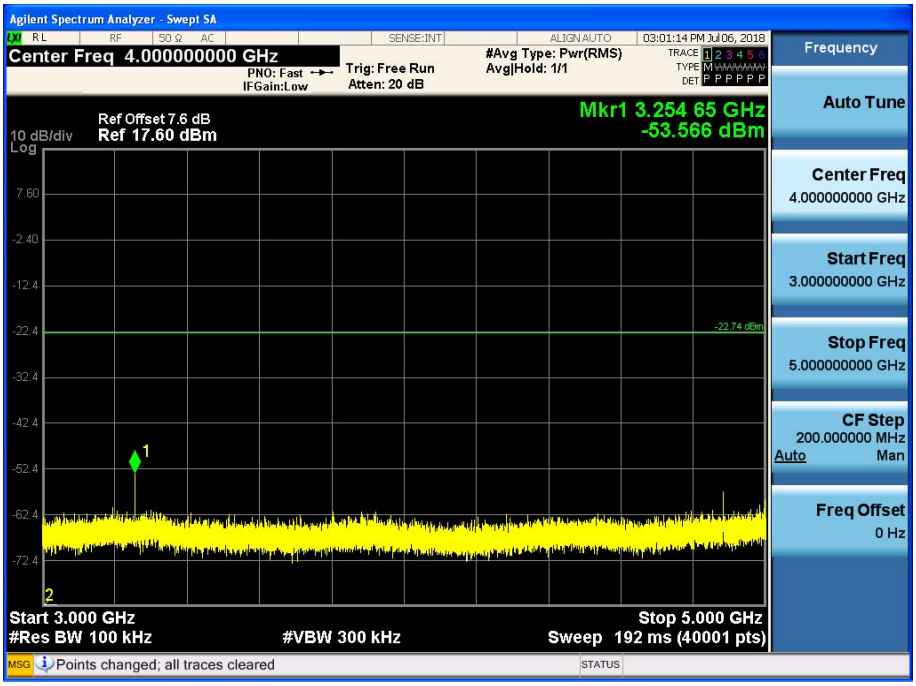
Test Plots (8DPSK)- 30 MHz - 1 GHz
Spurious Emission (CH.39)



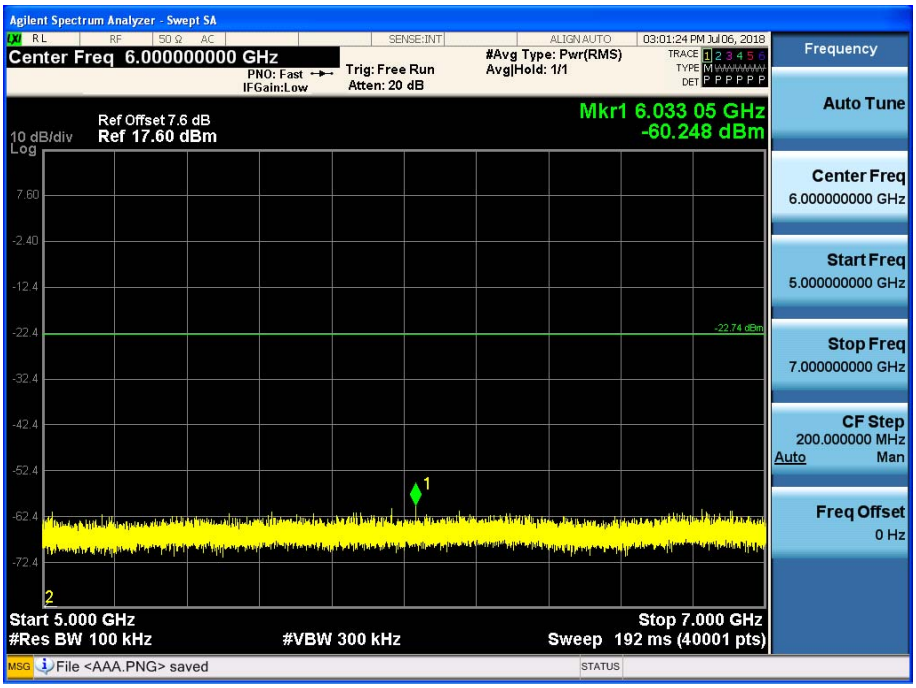
Test Plots (8DPSK)- 1 GHz – 3 GHz
Spurious Emission (CH.39)



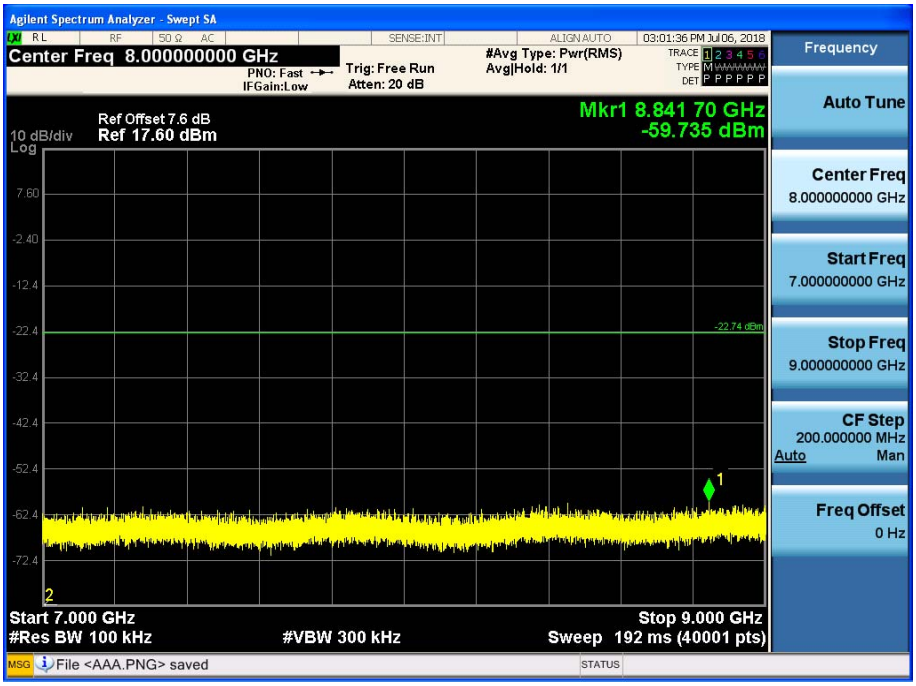
Test Plots(8DPSK)- 3 GHz - 5 GHz
Spurious Emission (CH.39)



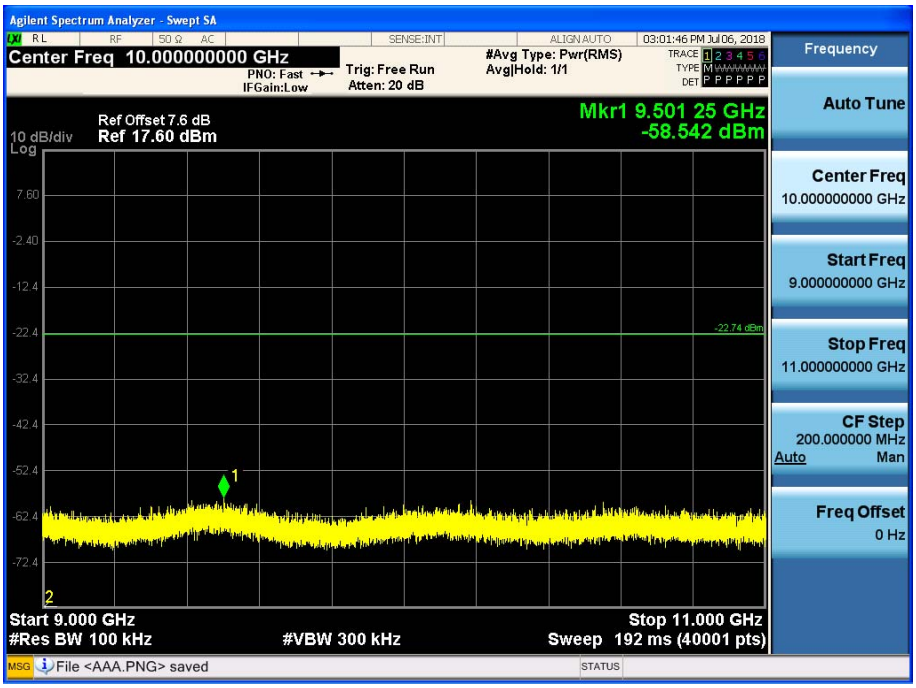
Test Plots (8DPSK)- 5 GHz - 7 GHz
Spurious Emission (CH.39)



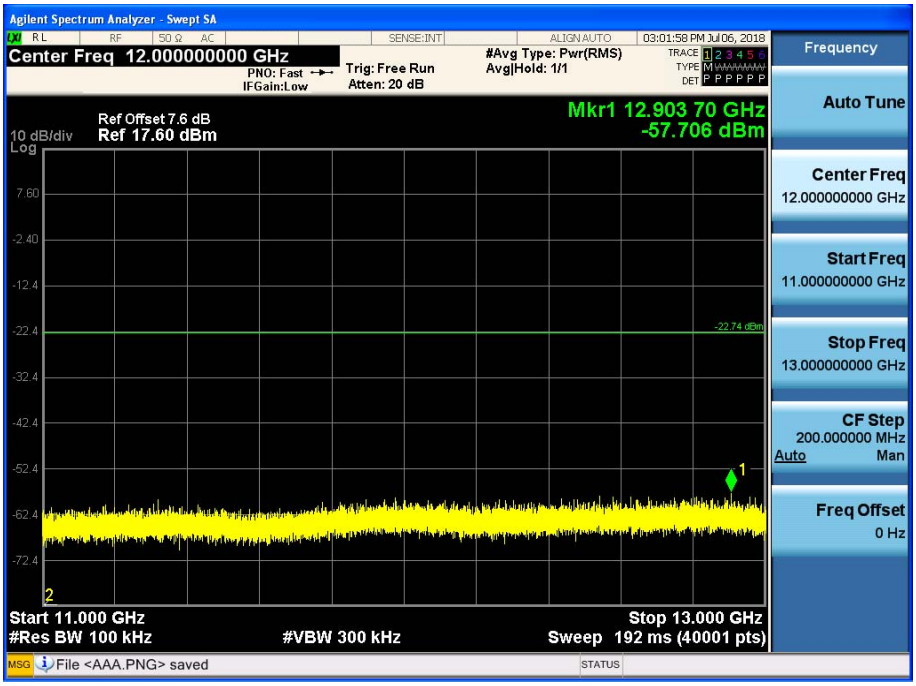
Test Plots(8DPSK)- 7 GHz - 9 GHz
Spurious Emission (CH.39)



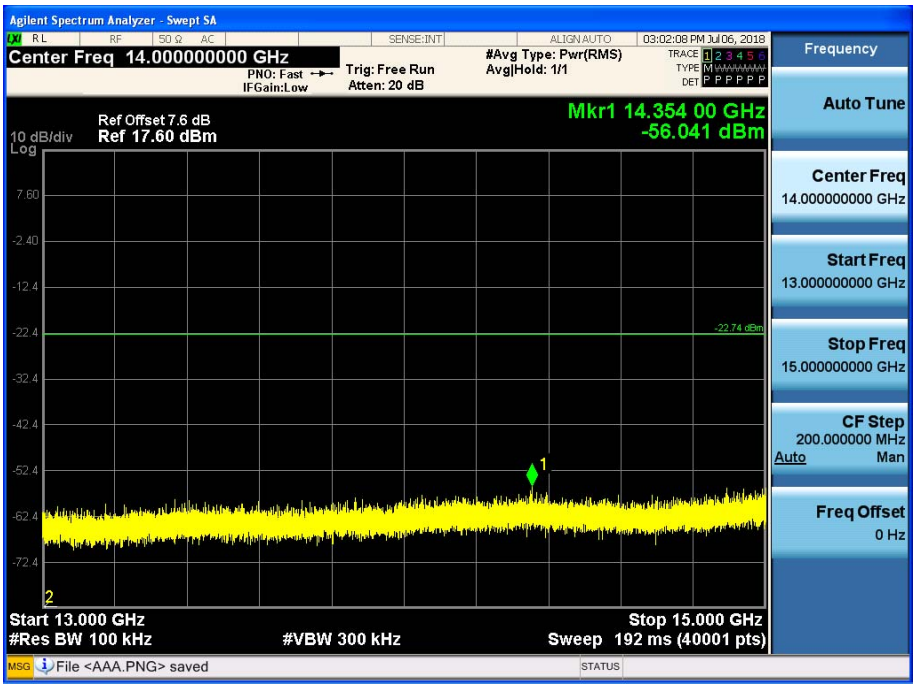
Test Plots(8DPSK)- 9 GHz - 11 GHz
Spurious Emission (CH.39)



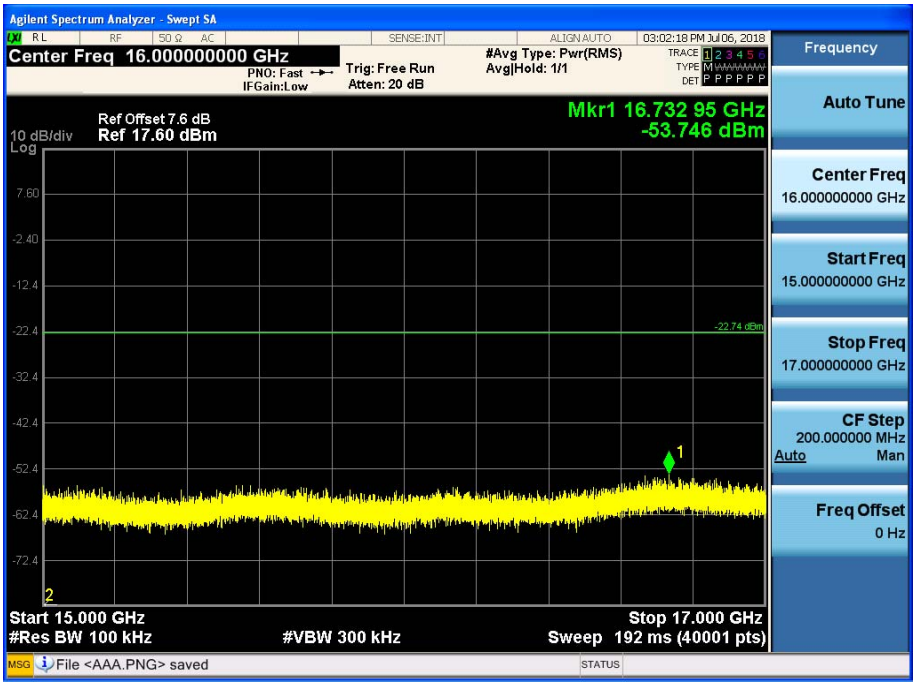
Test Plots(8DPSK) 11 GHz - 13 GHz
Spurious Emission (CH.39)



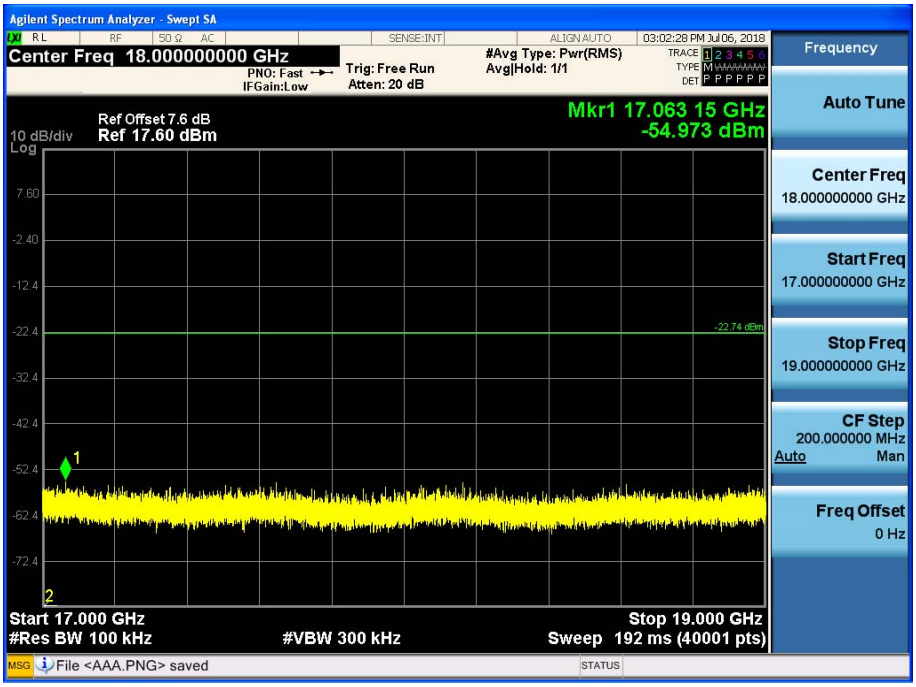
Test Plots (8DPSK)- 13 GHz – 15 GHz
Spurious Emission (CH.39)



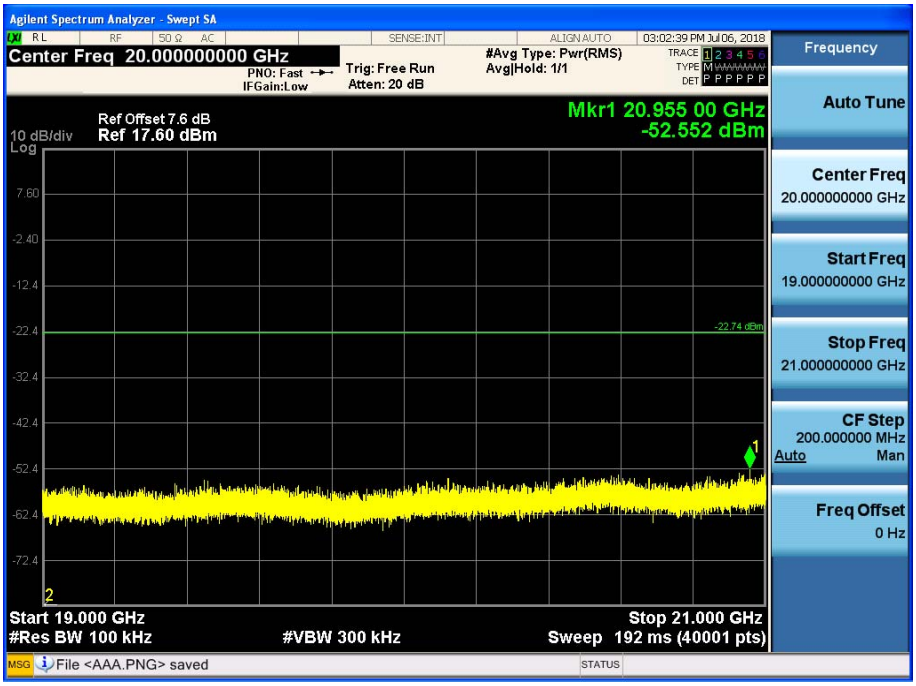
Test Plots(8DPSK)– 15 GHz - 17 GHz
Spurious Emission (CH.39)



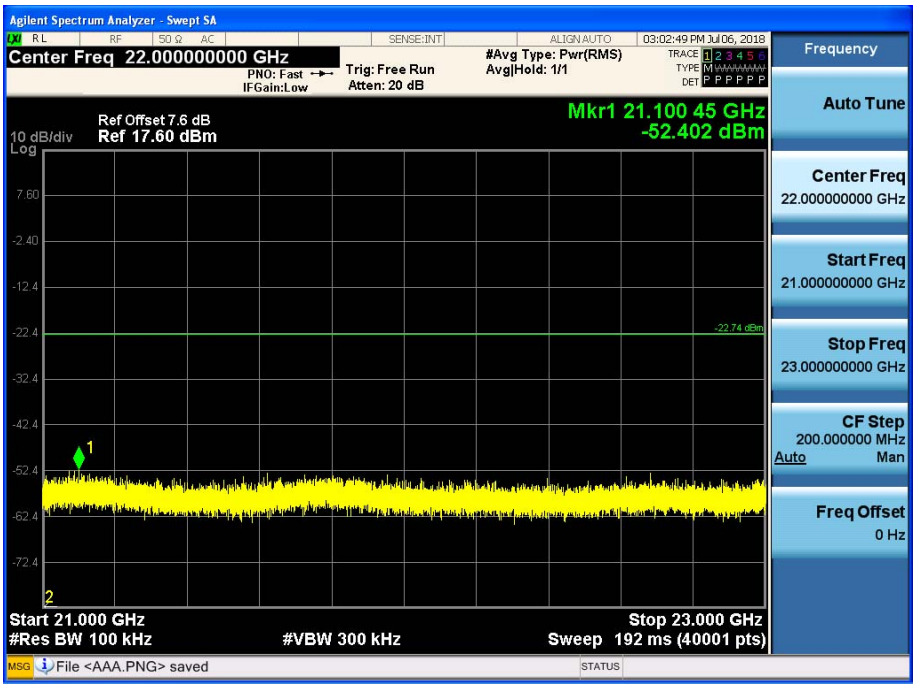
Test Plots(8DPSK)- 17 GHz - 19 GHz
Spurious Emission (CH.39)



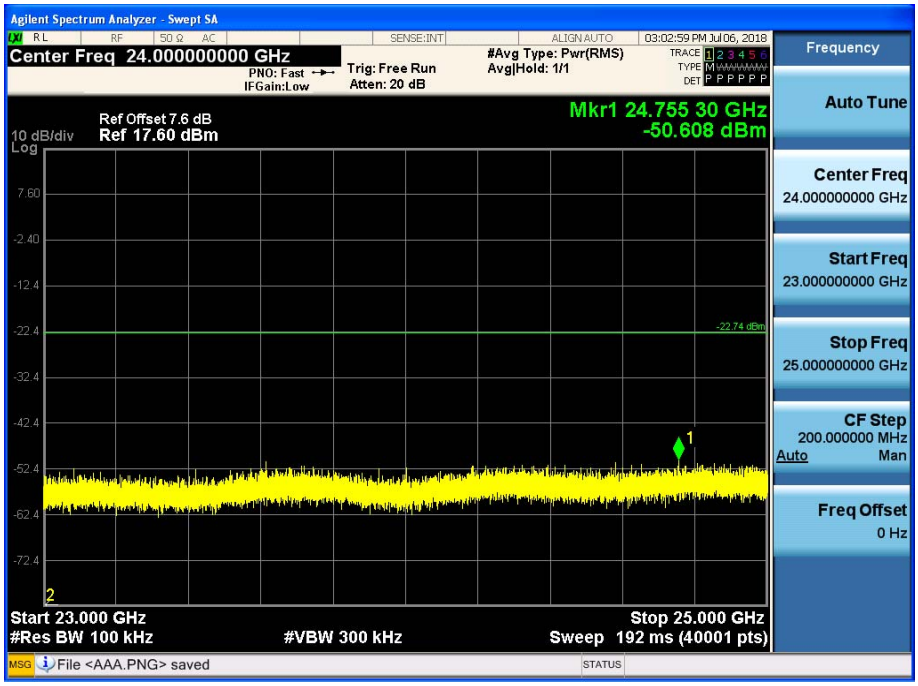
Test Plots (8DPSK)- 19 GHz - 21 GHz
Spurious Emission (CH.39)



Test Plots (8DPSK)- 21 GHz - 23 GHz
Spurious Emission (CH.39)



Test Plots (8DPSK)- 23 GHz - 25 GHz
Spurious Emission (CH.39)



9.6.2 RADIATED SPURIOUS EMISSIONS

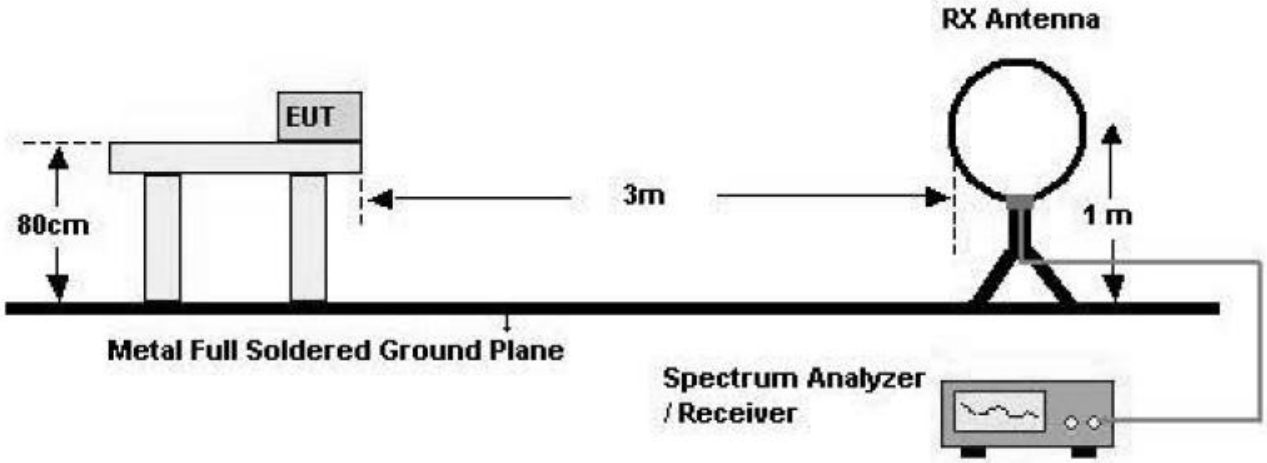
LIMIT : §15.247(d), §15.205, §15.209 / RSS-Gen(Issue 5) Section 8.9, 8.10

20dBc in any 100kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a) / RSS-Gen 8.10, then the 15.209(a) / RSS-Gen 8.9 limit in the table below has to be followed.

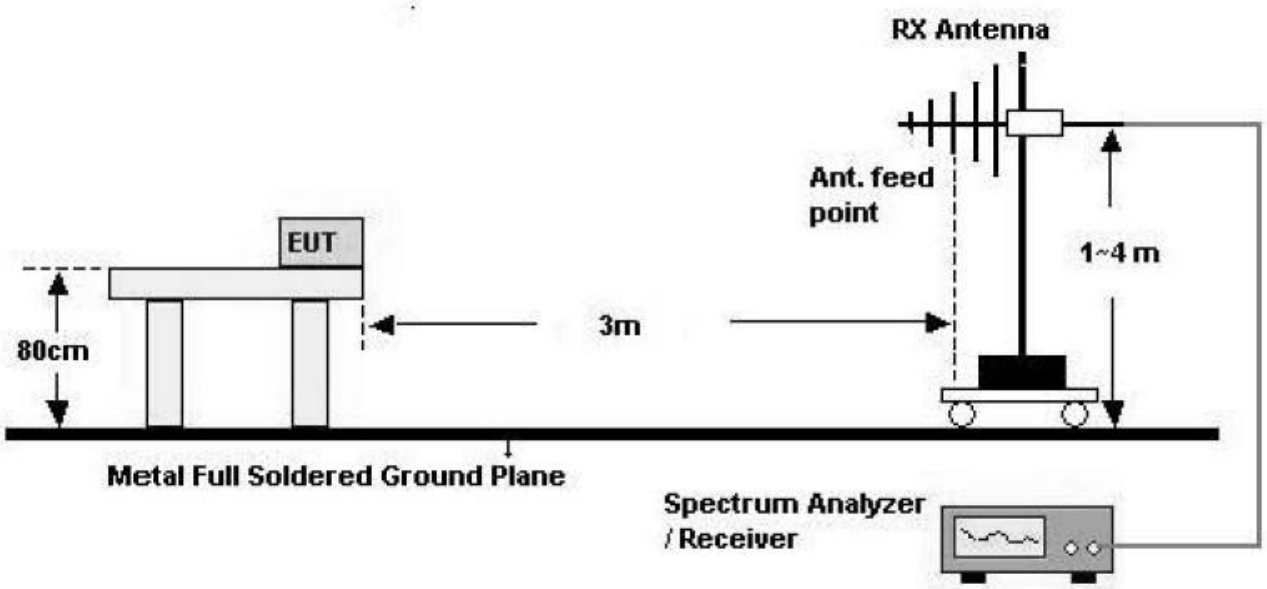
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

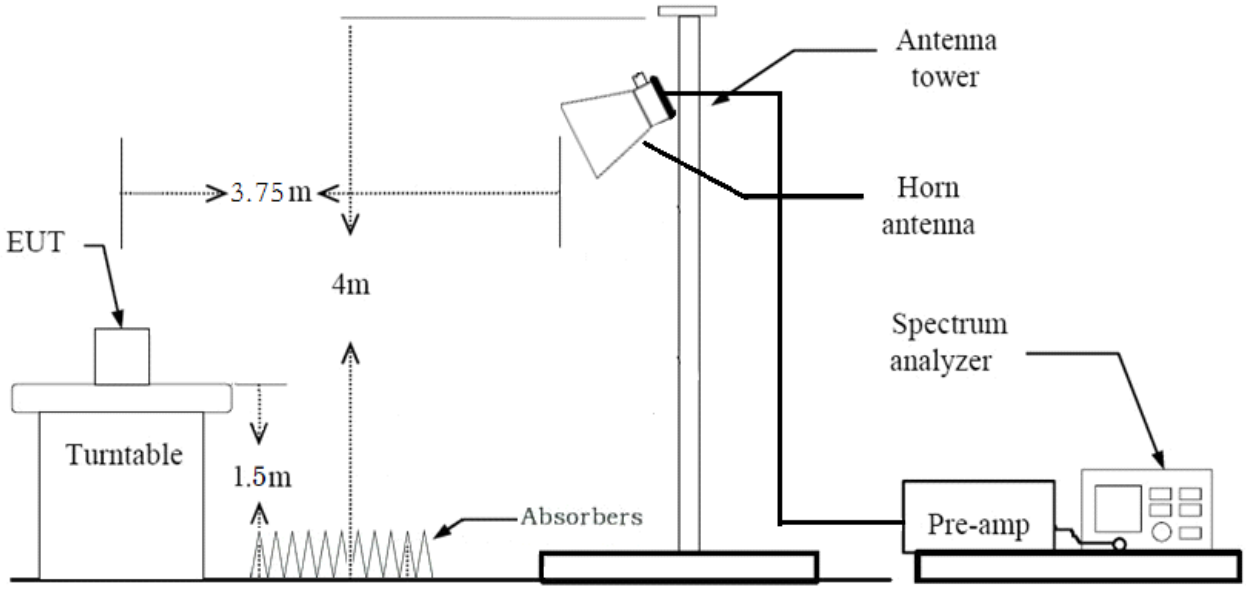
Below 30 MHz



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	2.890	346	1000
π/4DQPSK	2.890	346	1000
8DPSK	2.895	345	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.
7. The test results for below 30 MHz is correlated to an open site.

The result on OATS is about 2 dB higher than semi-anechoic chamber(10 m chamber)

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]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4804	52.18	-0.42	V	0	51.76	73.98	22.22	PK
4804	40.38	-0.42	V	-24.73	15.23	53.98	38.75	AV
7206	51.49	5.40	V	0	56.89	73.98	17.10	PK
7206	38.03	5.40	V	-24.73	18.69	53.98	35.29	AV
4804	51.86	-0.42	H	0	51.44	73.98	22.54	PK
4804	40.11	-0.42	H	-24.73	14.96	53.98	39.02	AV
7206	51.19	5.40	H	0	56.59	73.98	17.40	PK
7206	37.82	5.40	H	-24.73	18.48	53.98	35.50	AV

Operation Mode: CH Low(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
4804	52.11	-0.42	V	0	51.69	73.98	22.29	PK
4804	39.25	-0.42	V	-24.73	14.10	53.98	39.88	AV
7206	51.99	5.40	V	0	57.39	73.98	16.60	PK
7206	37.85	5.40	V	-24.73	18.51	53.98	35.47	AV
4804	51.95	-0.42	H	0	51.53	73.98	22.45	PK
4804	38.99	-0.42	H	-24.73	13.84	53.98	40.14	AV
7206	51.84	5.40	H	0	57.24	73.98	16.75	PK
7206	37.56	5.40	H	-24.73	18.22	53.98	35.76	AV

Operation Mode: CH Low(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
4804	52.64	-0.42	V	0	52.22	73.98	21.76	PK
4804	39.11	-0.42	V	-24.73	13.96	53.98	40.02	AV
7206	52.30	5.40	V	0	57.70	73.98	16.29	PK
7206	37.96	5.40	V	-24.73	18.62	53.98	35.36	AV
4804	52.05	-0.42	H	0	51.63	73.98	22.35	PK
4804	38.88	-0.42	H	-24.73	13.73	53.98	40.25	AV
7206	51.94	5.40	H	0	57.34	73.98	16.65	PK
7206	37.46	5.40	H	-24.73	18.12	53.98	35.86	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] = $H \rightarrow$ 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] = $H \rightarrow$ 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.

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	52.59	-0.27	V	0	52.33	73.98	21.66	PK
4882	39.07	-0.27	V	-24.73	14.07	53.98	39.91	AV
7323	51.59	5.42	V	0	57.01	73.98	16.97	PK
7323	38.03	5.42	V	-24.73	18.72	53.98	35.26	AV
4882	51.78	-0.27	H	0	51.52	73.98	22.47	PK
4882	38.96	-0.27	H	-24.73	13.96	53.98	40.02	AV
7323	51.27	5.42	H	0	56.69	73.98	17.29	PK
7323	37.58	5.42	H	-24.73	18.27	53.98	35.71	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	52.42	-0.27	V	0	52.16	73.98	21.83	PK
4882	38.45	-0.27	V	-24.73	13.45	53.98	40.53	AV
7323	50.63	5.42	V	0	56.05	73.98	17.93	PK
7323	37.29	5.42	V	-24.73	17.98	53.98	36.00	AV
4882	52.17	-0.27	H	0	51.91	73.98	22.08	PK
4882	38.29	-0.27	H	-24.73	13.29	53.98	40.69	AV
7323	50.28	5.42	H	0	55.70	73.98	18.28	PK
7323	37.15	5.42	H	-24.73	17.84	53.98	36.14	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	52.30	-0.27	V	0	52.04	73.98	21.95	PK
4882	38.62	-0.27	V	-24.73	13.62	53.98	40.36	AV
7323	51.15	5.42	V	0	56.57	73.98	17.41	PK
7323	37.30	5.42	V	-24.73	17.99	53.98	35.99	AV
4882	51.74	-0.27	H	0	51.48	73.98	22.51	PK
4882	38.55	-0.27	H	-24.73	13.55	53.98	40.43	AV
7323	51.00	5.42	H	0	56.42	73.98	17.56	PK
7323	37.08	5.42	H	-24.73	17.77	53.98	36.21	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]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
4960	52.88	-0.67	V	0	52.21	73.98	21.77	PK
4960	38.41	-0.67	V	-24.73	13.01	53.98	40.97	AV
7440	50.21	5.70	V	0	55.91	73.98	18.07	PK
7440	37.01	5.70	V	-24.73	17.98	53.98	36.00	AV
4960	52.38	-0.67	H	0	51.71	73.98	22.27	PK
4960	38.16	-0.67	H	-24.73	12.76	53.98	41.22	AV
7440	49.86	5.70	H	0	55.56	73.98	18.42	PK
7440	36.82	5.70	H	-24.73	17.79	53.98	36.19	AV

Operation Mode: CH High(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
4960	52.02	-0.67	V	0	51.35	73.98	22.63	PK
4960	39.16	-0.67	V	-24.73	13.76	53.98	40.22	AV
7440	50.42	5.70	V	0	56.12	73.98	17.86	PK
7440	36.86	5.70	V	-24.73	17.83	53.98	36.15	AV
4960	51.69	-0.67	H	0	51.02	73.98	22.96	PK
4960	38.86	-0.67	H	-24.73	13.46	53.98	40.52	AV
7440	49.95	5.70	H	0	55.65	73.98	18.33	PK
7440	36.46	5.70	H	-24.73	17.43	53.98	36.55	AV

Operation Mode: CH High (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
4960	52.04	-0.67	V	0	51.37	73.98	22.61	PK
4960	39.15	-0.67	V	-24.73	13.75	53.98	40.23	AV
7440	50.55	5.70	V	0	56.25	73.98	17.73	PK
7440	36.86	5.70	V	-24.73	17.83	53.98	36.15	AV
4960	51.75	-0.67	H	0	51.08	73.98	22.90	PK
4960	38.84	-0.67	H	-24.73	13.44	53.98	40.54	AV
7440	50.25	5.70	H	0	55.95	73.98	18.03	PK
7440	36.37	5.70	H	-24.73	17.34	53.98	36.64	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.

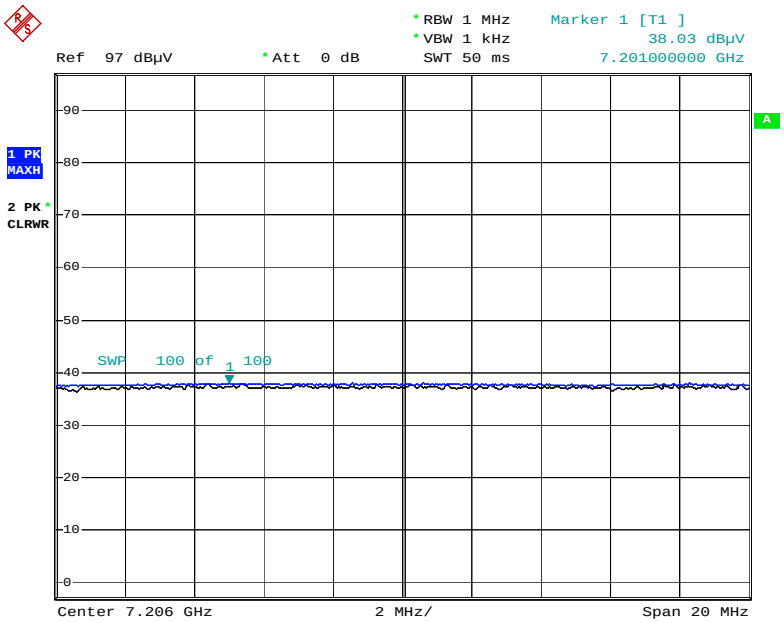
9. We have done Normal Mode and EDR Mode test.

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 : X-V)

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



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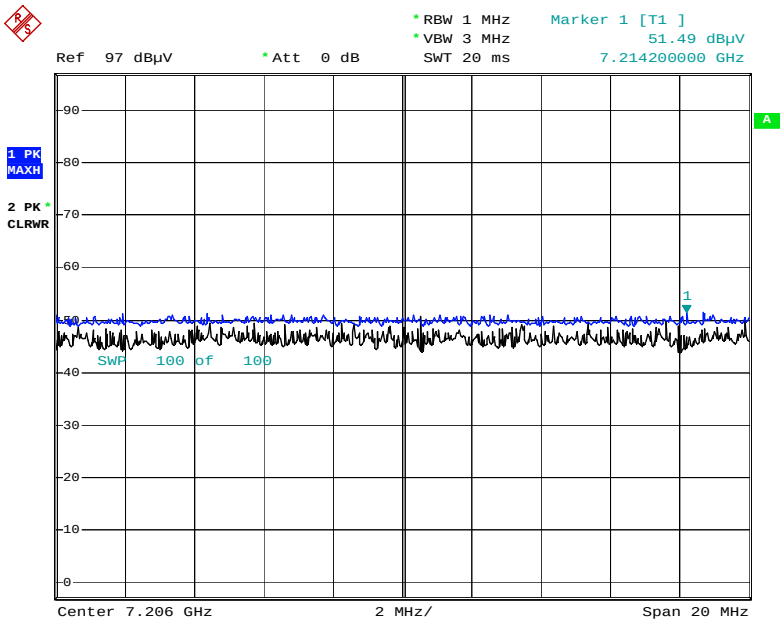
Radiated Spurious Emissions plot – Peak Reading (GFSK, Ch.0 3rd Harmonic)



Date: 6.JUL.2018 07:37:22

Note : Only the worst case plots for Radiated Spurious Emissions.

9.6.3 RADIATED RESTRICTED BAND EDGES

Test Requirements and limit, §15.247(d), §15.205, §15.209 / RSS-Gen(Issue 5) Section 8.10

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) / RSS-Gen 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	52.97	1.34	H	0	54.31	73.98	19.67	PK
2390.0	40.58	1.34	H	-24.73	17.19	53.98	36.79	AV
2390.0	53.93	1.34	V	0	55.27	73.98	18.71	PK
2390.0	41.35	1.34	V	-24.73	17.96	53.98	36.02	AV
2483.5	57.81	0.37	H	0	58.18	73.98	15.80	PK
2483.5	54.84	0.37	H	-24.73	30.48	53.98	23.50	AV
2483.5	58.36	0.37	V	0	58.73	73.98	15.25	PK
2483.5	55.27	0.37	V	-24.73	30.91	53.98	23.07	AV

Operation Mode	EDR(8DPSK)
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	53.17	1.34	H	0	54.51	73.98	19.47	PK
2390.0	40.65	1.34	H	-24.73	17.26	53.98	36.72	AV
2390.0	53.77	1.34	V	0	55.11	73.98	18.87	PK
2390.0	40.99	1.34	V	-24.73	17.60	53.98	36.38	AV
2483.5	58.54	0.37	H	0	58.91	73.98	15.07	PK
2483.5	53.22	0.37	H	-24.73	28.86	53.98	25.12	AV
2483.5	59.21	0.37	V	0	59.58	73.98	14.40	PK
2483.5	53.91	0.37	V	-24.73	29.55	53.98	24.43	AV

Operation Mode	EDR(π/4DQPSK)
Operating Frequency	2402 MHz , 2480 MHz
Channel No	CH 0, CH 78

Frequency [MHz]	Reading dBuV	※ A.F.+CL + D.F. [dB]	Ant. Pol. [H/V]	Duty Cycle Correction [dB]	Total [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Measurement Type
2390.0	53.84	1.34	H	0	55.18	73.98	18.80	PK
2390.0	40.26	1.34	H	-24.73	16.87	53.98	37.11	AV
2390.0	54.40	1.34	V	0	55.74	73.98	18.24	PK
2390.0	40.73	1.34	V	-24.73	17.34	53.98	36.64	AV
2483.5	58.44	0.37	H	0	58.81	73.98	15.17	PK
2483.5	52.96	0.37	H	-24.73	28.60	53.98	25.38	AV
2483.5	59.48	0.37	V	0	59.85	73.98	14.13	PK
2483.5	53.84	0.37	V	-24.73	29.48	53.98	24.50	AV

*A.F. : Antenna Factor

C.L. : Cable Loss

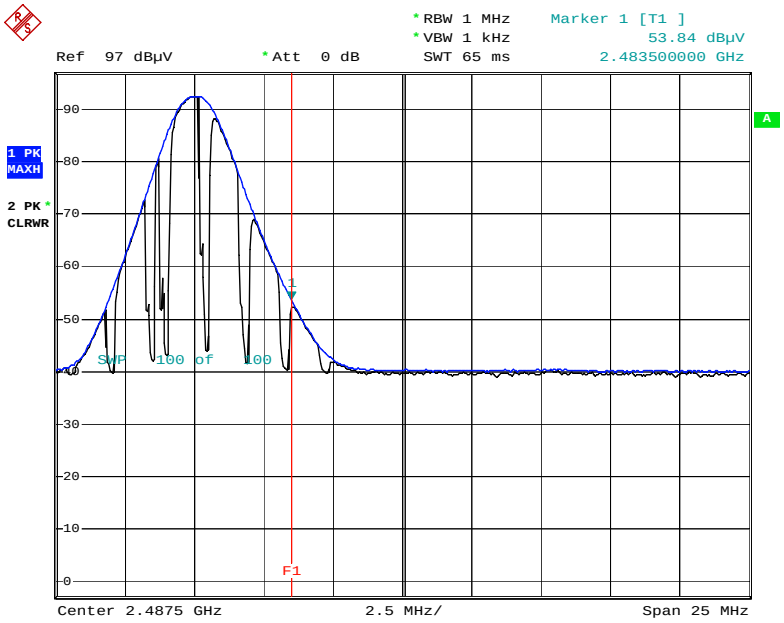
D.F. : Distance Factor

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* → 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.

▣ RESULT PLOTS (Worst case : X-V)

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



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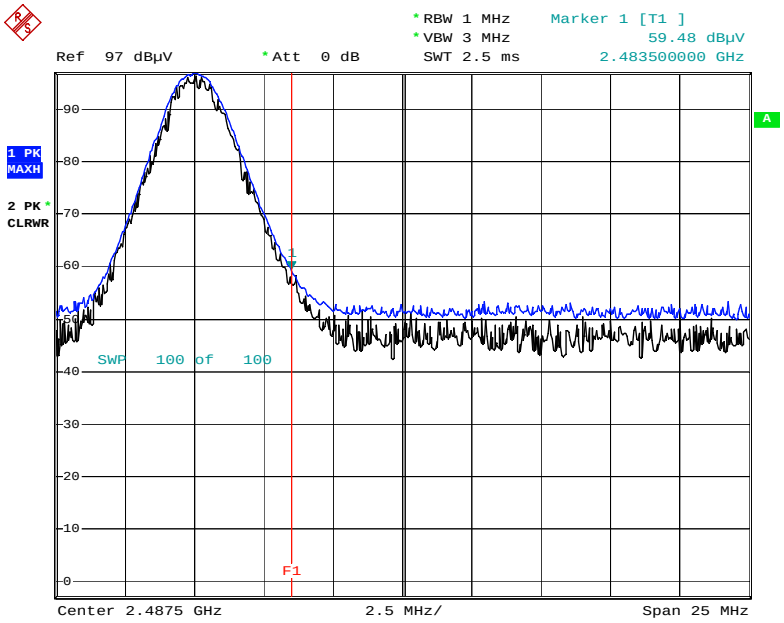
Radiated Restricted Band Edges plot – Peak Reading (EDR(π/4DQPSK)), Ch.78)



Date: 6.JUL.2018 07:08:45

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

9.6.4 RECEIVER SPURIOUS EMISSIONS

ISED Rule(s):	**RSS-GEN**
Test Requirements:	**Blow the table**
Operating conditions:	**Under normal test conditions**
Method of testing:	**Radiated**
S/A. Settings:	**F < 1 GHz: RBW: 120 kHz, VBW: 300 kHz (Quasi Peak)** **F > 1 GHz: RBW: 1 MHz, VBW: 1 MHz (Peak)**
Mode of operation:	**Receive**

Frequency (MHz)	Field Strength (microvolts/m at 3 meters)
30 – 88	100
88 - 216	150
216 – 960	200
Above 960	500

Operation Mode: Receive:

30 MHz ~ 1 GHz

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

Above 1 GHz

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

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

Note : We don’t perform powerline conducted emission test. Because this EUT is used with vehicle.

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	06/27/2018	Annual	100033
ESPAC	SU-642 /Temperature Chamber	03/30/2018	Annual	0093008124
Agilent	N9020A / Signal Analyzer	06/08/2018	Annual	MY51110085
Agilent	N9030A / Signal Analyzer	11/22/2017	Annual	MY49431210
Agilent	N1911A / Power Meter	04/16/2018	Annual	MY45100523
Agilent	N1921A / Power Sensor	04/16/2018	Annual	MY52260025
Agilent	87300B / Directional Coupler	11/20/2017	Annual	3116A03621
Hewlett Packard	11667B / Power Splitter	06/07/2018	Annual	05001
Hewlett Packard	E3632A / DC Power Supply	06/26/2018	Annual	KR75303960
Agilent	8493C / Attenuator(10 dB)	07/10/2018	Annual	07560
Rohde & Schwarz	EMC32 / Software	N/A	N/A	N/A
HCT CO., LTD.	FCC WLAN&BT&BLE Conducted Test Software v3.0	N/A	N/A	N/A
Rohde & Schwarz	CBT / Bluetooth Tester	05/17/2018	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	MA4640/800-XP-EP / Antenna Position Tower	N/A	N/A	N/A
Emco	2090 / Controller	N/A	N/A	060520
Ets	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	11/21/2017	Biennial	9120D-1191
Schwarzbeck	BBHA9170 / Horn Antenna(15 GHz ~ 40 GHz)	12/04/2017	Biennial	BBHA9170541
Rohde & Schwarz	FSP(9 kHz ~ 30 GHz) / Spectrum Analyzer	09/21/2017	Annual	836650/016
Rohde & Schwarz	FSV40-N / Spectrum Analyzer	09/27/2017	Annual	101068-SZ
Wainwright Instruments	WHKX10-2700-3000-18000-40SS / High Pass Filter	08/01/2017	Annual	4
Wainwright Instruments	WHKX8-6090-7000-18000-40SS / High Pass Filter	07/10/2018	Annual	5
Wainwright Instruments	WRCJV2400/2483.5-2370/2520-60/12SS / Band Reject Filter	08/29/2018	Annual	2
Wainwright Instruments	WRCJV5100/5850-40/50-8EEK / Band Reject Filter	01/03/2018	Annual	2
Api tech.	18B-03 / Attenuator (3 dB)	06/07/2018	Annual	2
WEINSCHEL	56-10 / Attenuator(10 dB)	10/13/2017	Annual	72316
CERNEX	CBLU1183540 / Broadband Low Noise Amplifier	01/03/2018	Annual	24613
CERNEX	CBL06185030 / Broadband Low Noise Amplifier	01/03/2018	Annual	24615
CERNEX	CBL18265035 / Power Amplifier	01/10/2018	Annual	22966
CERNEX	CBL26405040 / Power Amplifier	06/29/2018	Annual	25956
TESCOM	TC-3000C / Bluetooth Tester	03/27/2018	Annual	3000C000276

11. APPENDIX A_ TEST SETUP PHOTO

Please refer to test setup photo file no. as follows;

No.	Description
1	HCT-RF-1807-FI007-P