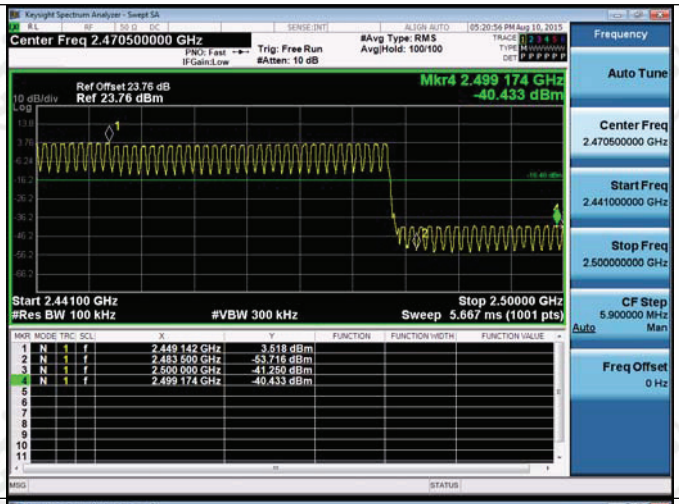
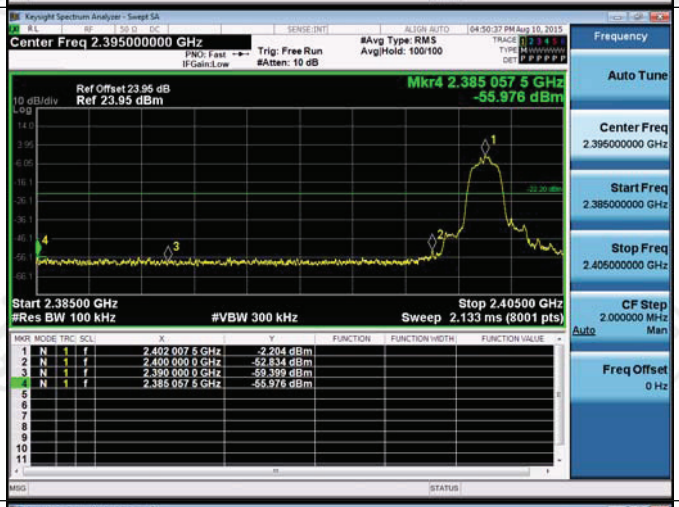
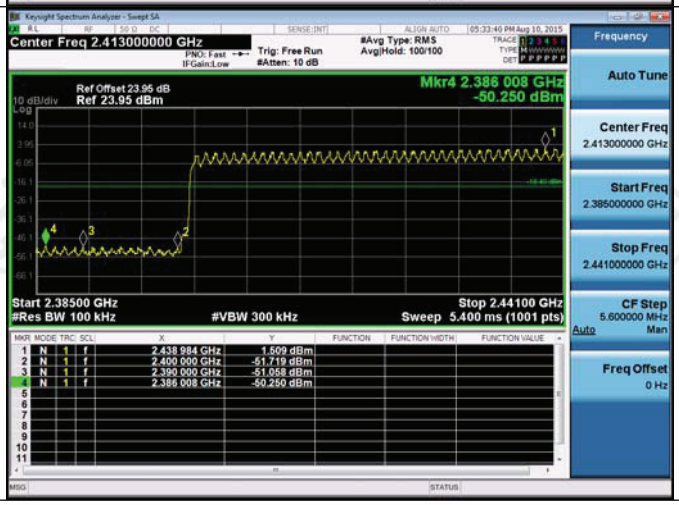
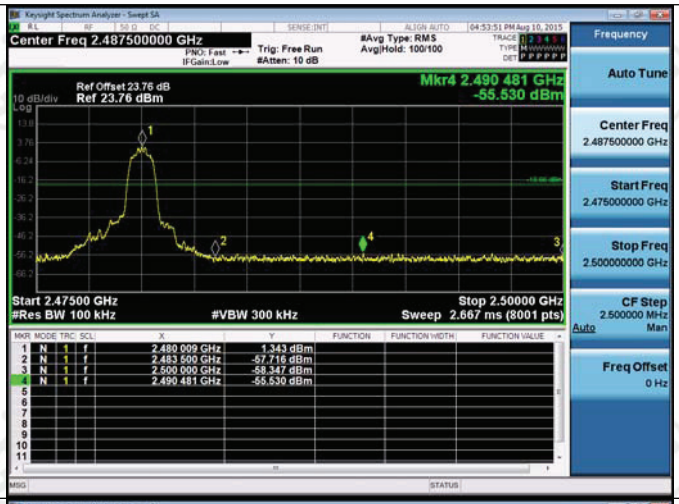
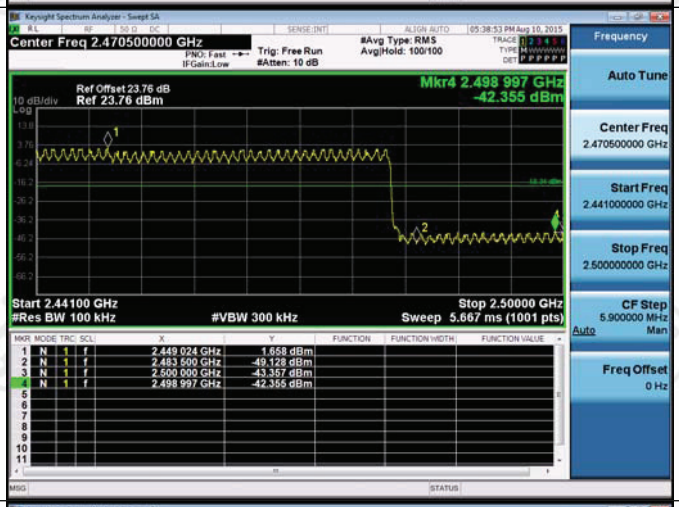
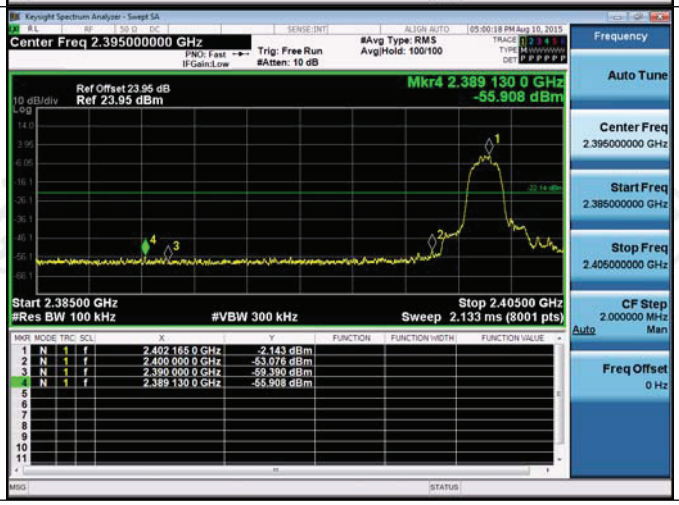
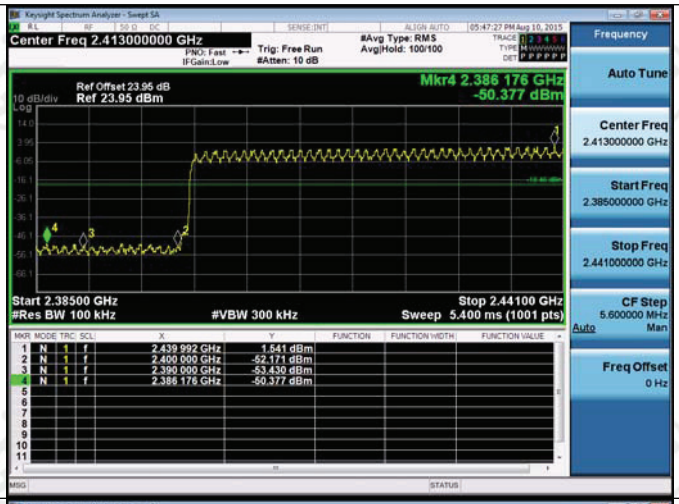
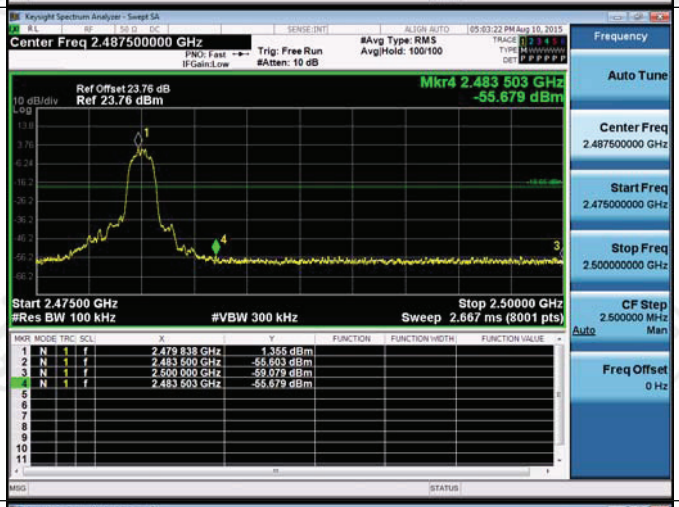
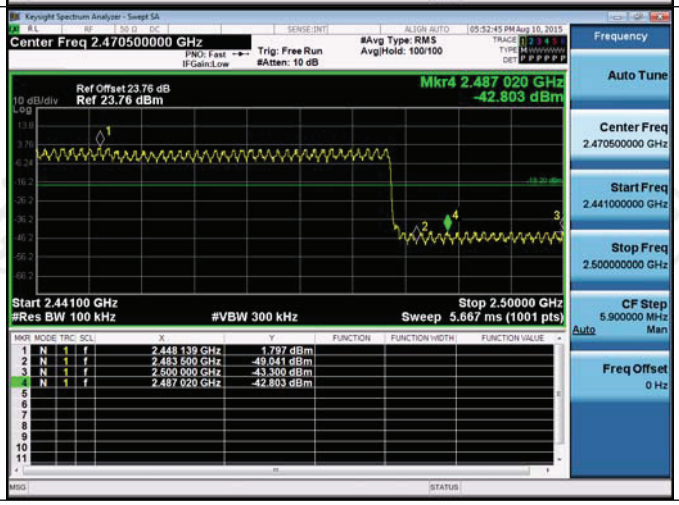
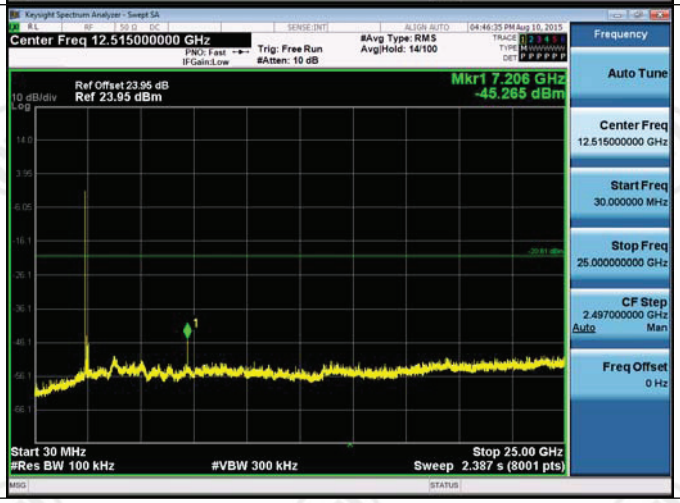
GFSK/HCH/Hop			
π/4DQPSK/LCH/ No Hop			
π/4DQPSK/LCH/ Hop			

π/4DQPSK/HCH/ No Hop			
π/4DQPSK/HCH/ Hop			
8DPSK/LCH/No Hop			

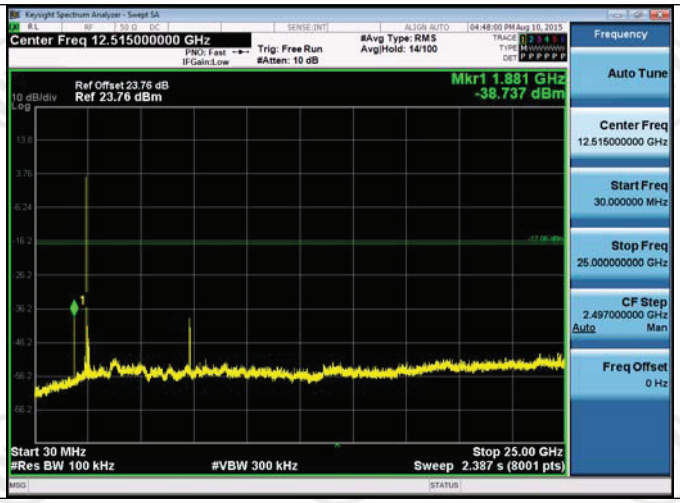
8DPSK/LCH/Hop			
8DPSK/HCH/No Hop			
8DPSK/HCH/Hop			

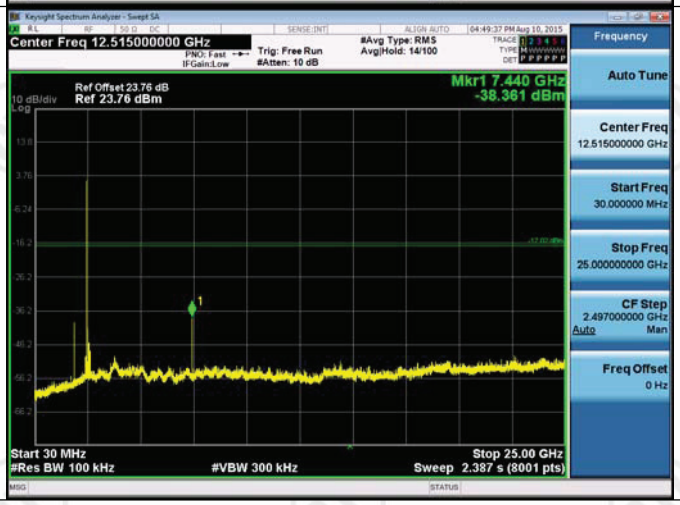
Appendix G) RF Conducted Spurious Emissions

Test Graph

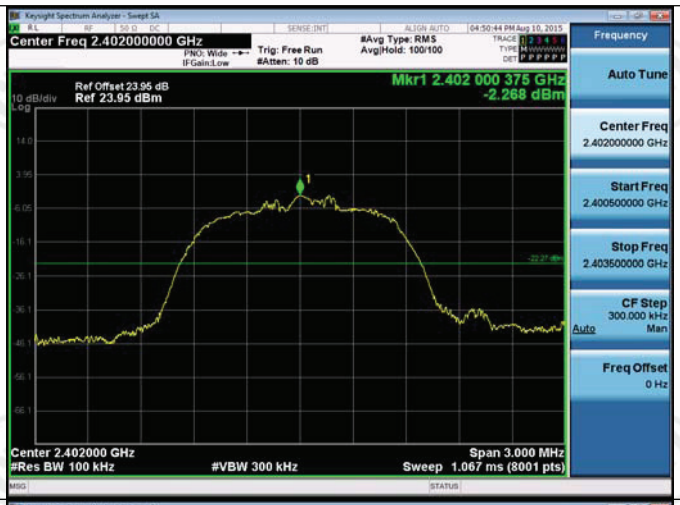
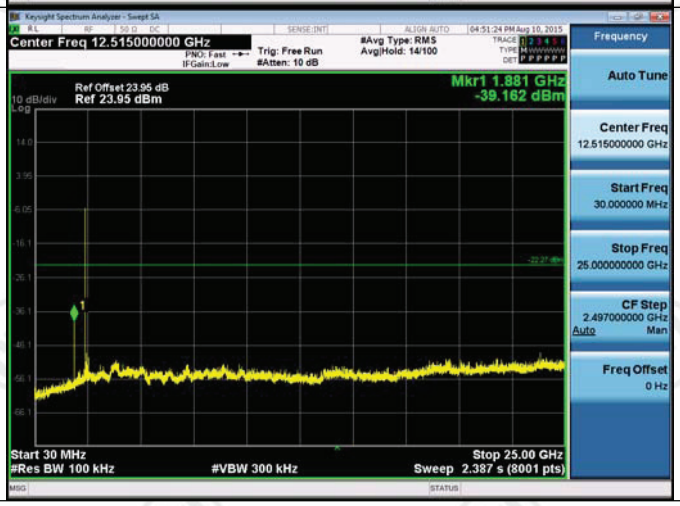
GFSK_LCH_Graphs		
Pref		
Puw		

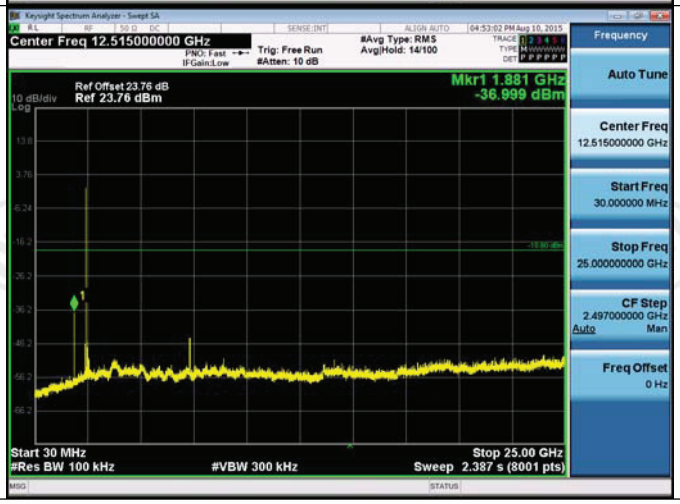
GFSK_MCH_Graphs		
Pref		

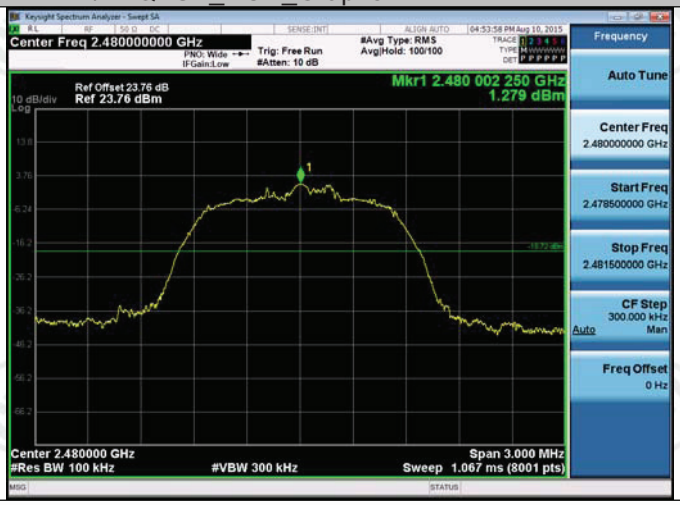
Puw	

GFSK_HCH_Graphs	
Pref	
Puw	

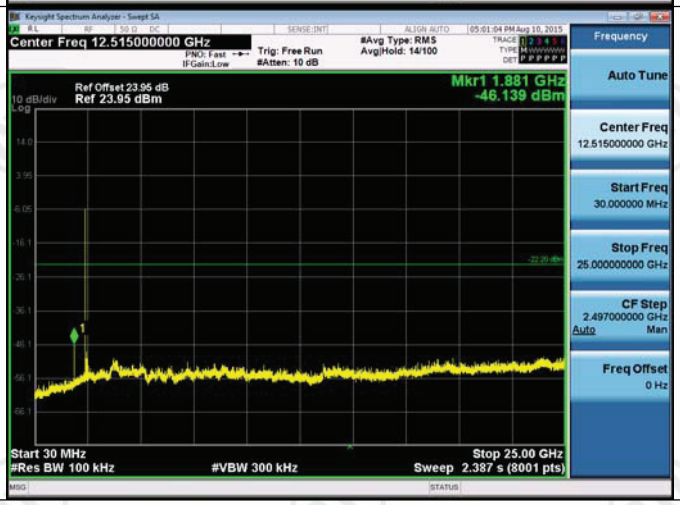
π/4DQPSK_LCH_Graphs

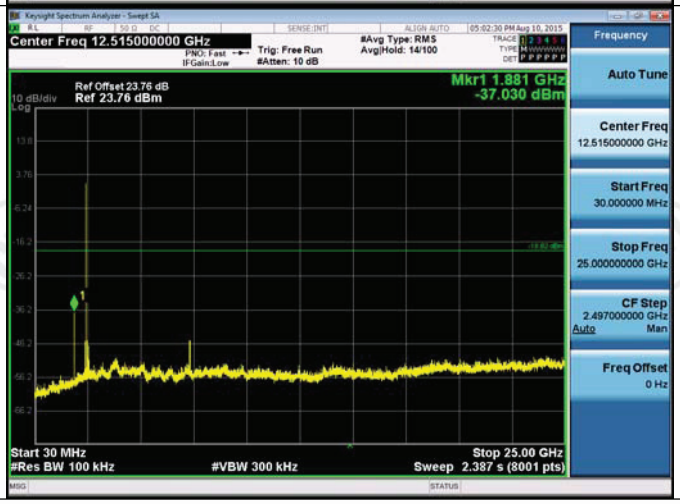
Pref		 Center Freq 2.402000000 GHz Trig: Free Run #Atten: 10 dB #Avg Type: RMS Avg|Hold: 100/100 Ref Offset 23.95 dB 10 dB/div Ref 23.95 dBm Mkr1 2.402 000 375 GHz -2.268 dBm Center 2.402000 GHz #Res BW 100 kHz #VBW 300 kHz Span 3.000 MHz Sweep 1.067 ms (8001 pts) Frequency Auto Tune Center Freq 2.402000000 GHz Start Freq 2.400500000 GHz Stop Freq 2.403500000 GHz CF Step 300.000 kHz Auto Man Freq Offset 0 Hz	
Puw		 Center Freq 12.515000000 GHz Trig: Free Run #Atten: 10 dB #Avg Type: RMS Avg|Hold: 14/100 Ref Offset 23.95 dB 10 dB/div Ref 23.95 dBm Mkr1 1.881 GHz -39.162 dBm Start 30 MHz #Res BW 100 kHz #VBW 300 kHz Stop 25.00 GHz Sweep 2.387 s (8001 pts) Frequency Auto Tune Center Freq 12.515000000 GHz Start Freq 30.000000 MHz Stop Freq 25.000000000 GHz CF Step 2.497000000 GHz Auto Man Freq Offset 0 Hz	

π/4DQPSK_MCH_Graphs		
Pref		
Puw		

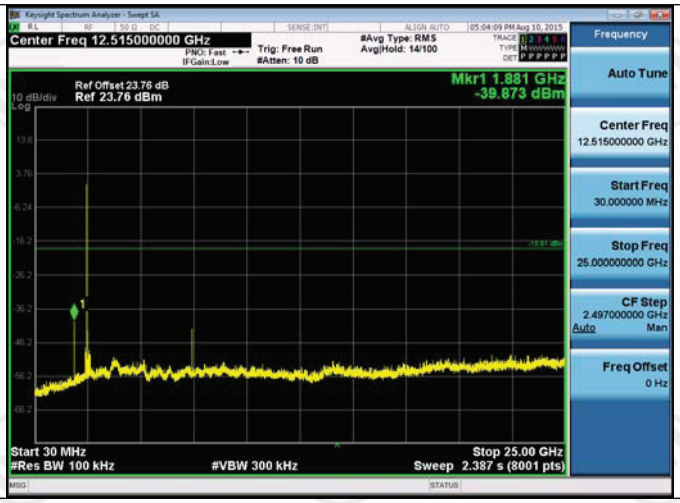
π/4DQPSK_HCH_Graphs		
Pref		

Puw	

8DPSK_LCH_Graphs	
Pref	
Puw	

8DPSK_MCH_Graphs		
Pref		
Puw		

8DPSK_HCH_Graphs		
Pref		

Puw		

Center Freq 12.515000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: RMS
Avg|Hold: 14/100
Ref Offset 23.76 dB
10 dB/div
Ref 23.76 dBm
Mkr1 1.881 GHz
-39.873 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.387 s (8001 pts)
Frequency
Auto Tune
Center Freq
12.515000000 GHz
Start Freq
30.000000 MHz
Stop Freq
25.000000000 GHz
CF Step
2.497000000 GHz
Auto
Man
Freq Offset
0 Hz

Appendix H) Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

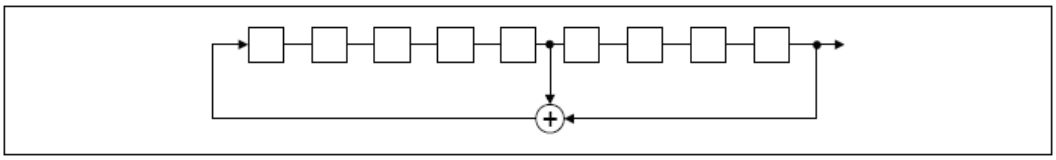
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

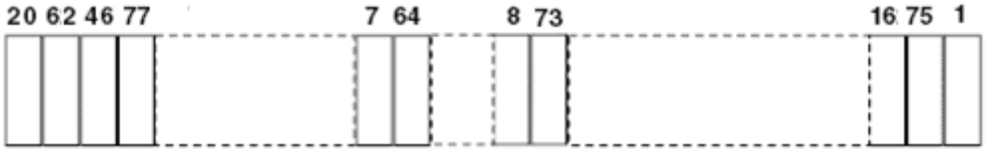
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Appendix I) Antenna Requirement

15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. 15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
EUT Antenna:
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

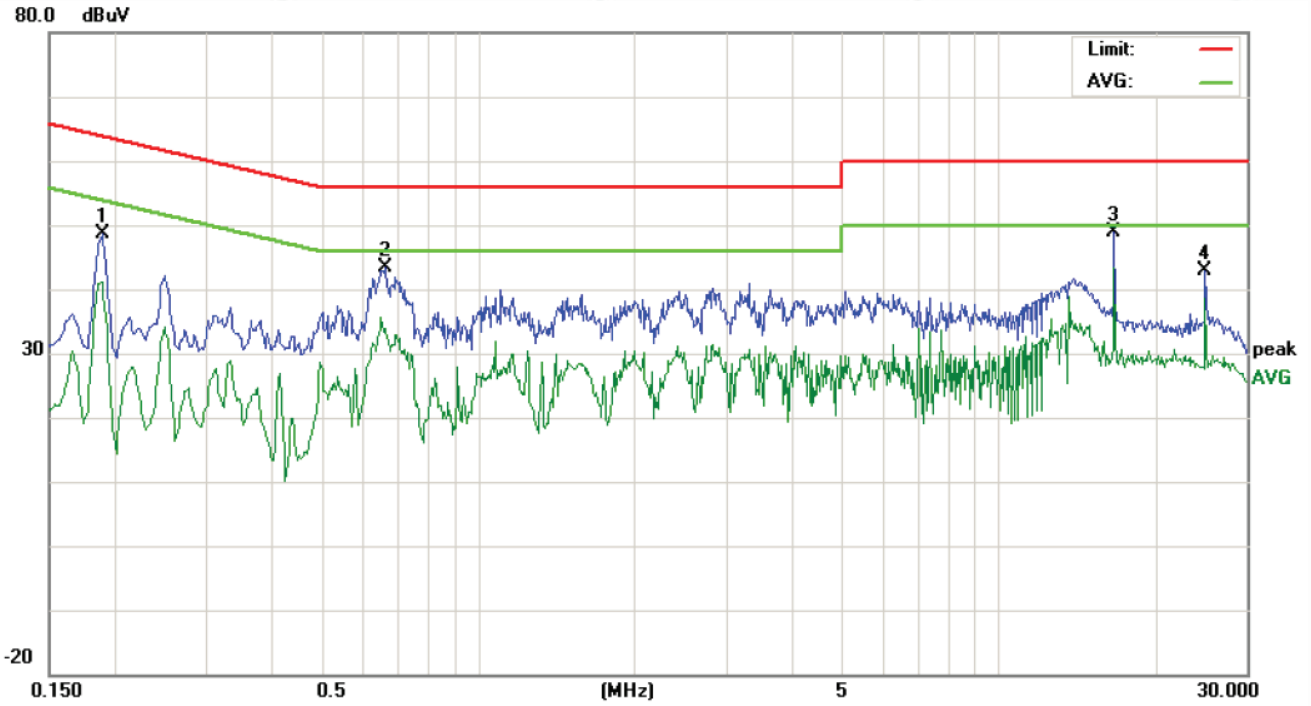
Appendix J) AC Power Line Conducted Emission

<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1)The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3)The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBμV)</th></tr>
<tr><th>Quasi-peak</th><th>Average</th></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

Measurement Data

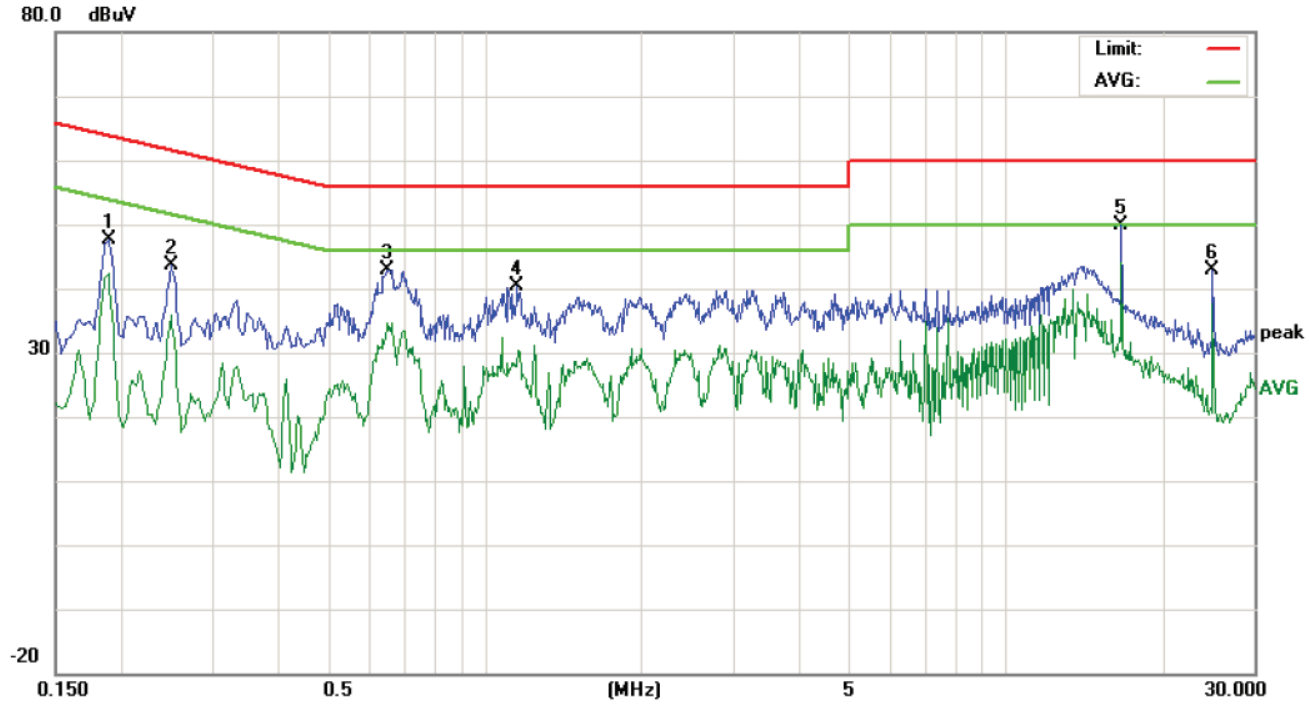
An initial pre-scan was performed on the live and neutral lines with peak detector.
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1900	38.61		31.15	9.90	48.51		41.05	64.03	54.03	-15.52	-12.98	P	
2	0.6620	33.43		24.06	9.90	43.33		33.96	56.00	46.00	-12.67	-12.04	P	
3	16.6980	38.77		33.26	10.07	48.84		43.33	60.00	50.00	-11.16	-6.67	P	
4	25.0500	32.65		28.31	10.30	42.95		38.61	60.00	50.00	-17.05	-11.39	P	

Neutral line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1900	37.83		32.40	9.90	47.73		42.30	64.03	54.03	-16.30	-11.73	P	
2	0.2500	33.61		25.94	9.90	43.51		35.84	61.75	51.75	-18.24	-15.91	P	
3	0.6540	33.09		24.62	9.90	42.99		34.52	56.00	46.00	-13.01	-11.48	P	
4	1.1580	30.37		17.98	9.90	40.27		27.88	56.00	46.00	-15.73	-18.12	P	
5	16.6980	39.69	38.33	33.62	10.07	49.76	48.40	43.69	60.00	50.00	-11.60	-6.31	P	
6	25.0500	32.52		27.26	10.30	42.82		37.56	60.00	50.00	-17.18	-12.44	P	

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

Appendix K) Restricted bands around fundamental frequency (Radiated)/Radiated Spurious Emissions

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.

i. Repeat above procedures until all frequencies measured was complete.

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.