



## 5.9 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane
	Remark: Offset=cable loss+ attenuation factor.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi$ /4DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Results:	Pass

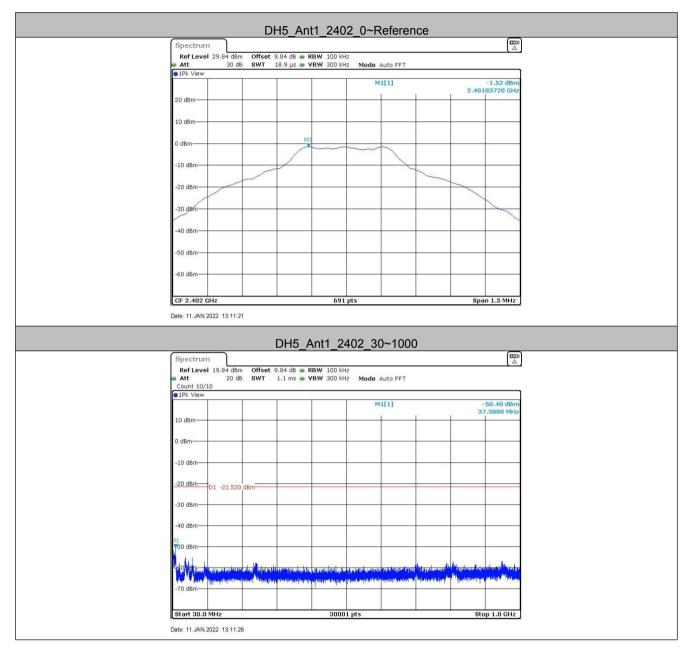


## Test Result

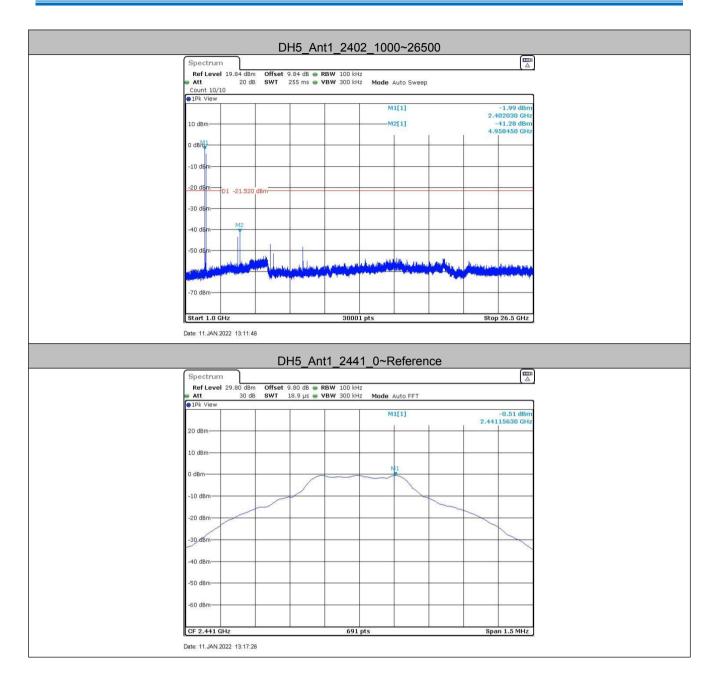
TestMode	Antenna	Channel	FreqRange	RefLevel	Result	Limit	Verdict
			[MHz]	[dBm]	[dBm]	[dBm]	
			Reference	-1.52	-1.52		PASS
		2402	30~1000	-1.52	-50.4	≤-21.52	PASS
			1000~26500	-1.52	-41.28	≤-21.52	PASS
			Reference	-0.51	-0.51		PASS
DH5	Ant1	2441	30~1000	-0.51	-49.47	≤-20.51	PASS
			1000~26500	-0.51	-40.77	≤-20.51	PASS
			Reference	-0.31	-0.31		PASS
		2480	30~1000	-0.31	-48.68	≤-20.31	PASS
			1000~26500	-0.31	-37.77	≤-20.31	PASS
			Reference	-1.23	-1.23		PASS
		2402	30~1000	-1.23	-55.45	≤-21.23	PASS
			1000~26500	-1.23	-45.77	≤-21.23	PASS
		2441	Reference	0.20	0.20		PASS
2DH5	Ant1		30~1000	0.20	-55.8	≤-19.8	PASS
			1000~26500	0.20	-45.78	≤-19.8	PASS
			Reference	0.45	0.45		PASS
		2480	30~1000	0.45	-55.12	≤-19.55	PASS
			1000~26500	0.45	-43.32	≤-19.55	PASS
			Reference	-1.13	-1.13		PASS
		2402	30~1000	-1.13	-54.52	≤-21.13	PASS
			1000~26500	-1.13	-46.48	≤-21.13	PASS
			Reference	0.44	0.44		PASS
3DH5 Ant1	2441	30~1000	0.44	-55.92	≤-19.56	PASS	
			1000~26500	0.44	-44.19	≤-19.56	PASS
		2480	Reference	0.67	0.67		PASS
			30~1000	0.67	-53.35	≤-19.33	PASS
			1000~26500	0.67	-43.44	≤-19.33	PASS



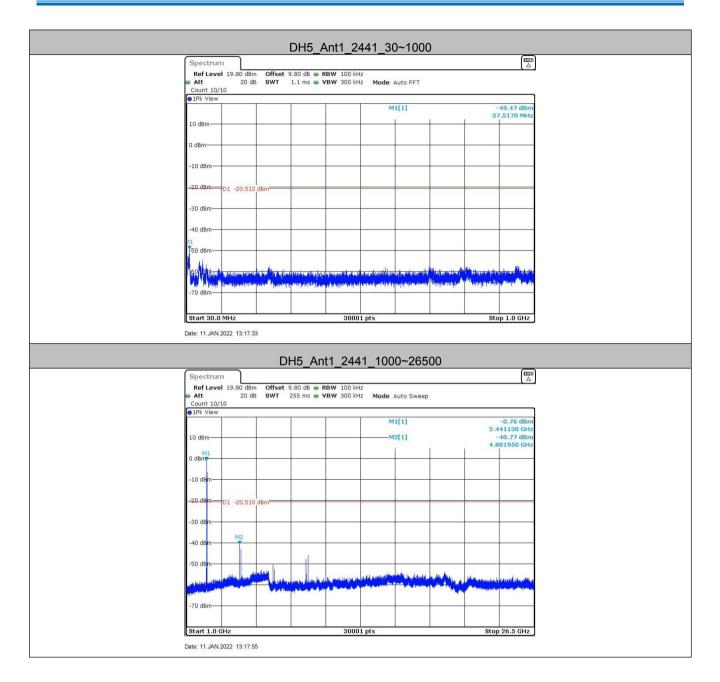
## **Test Graphs**



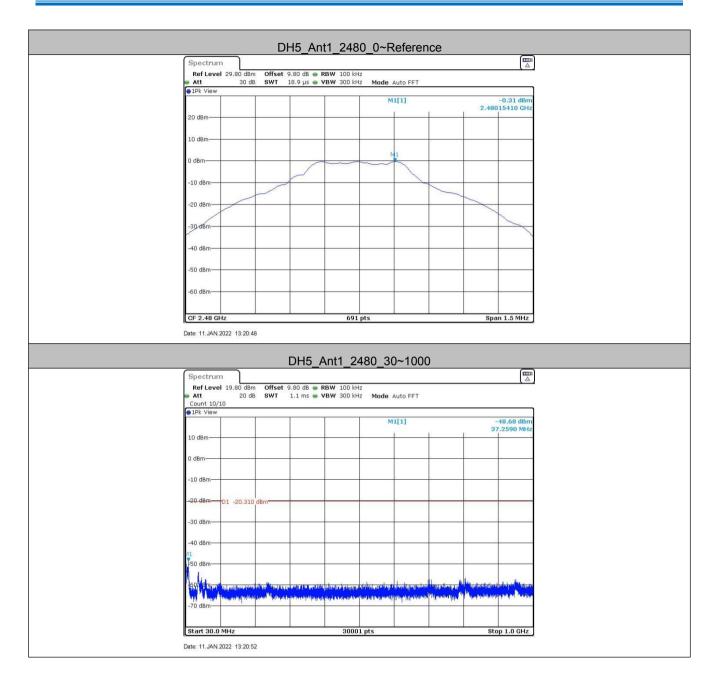




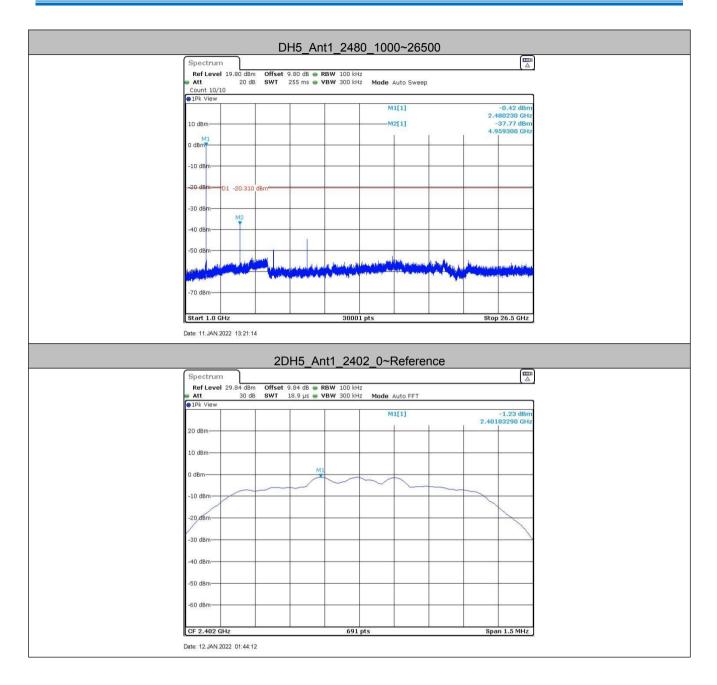




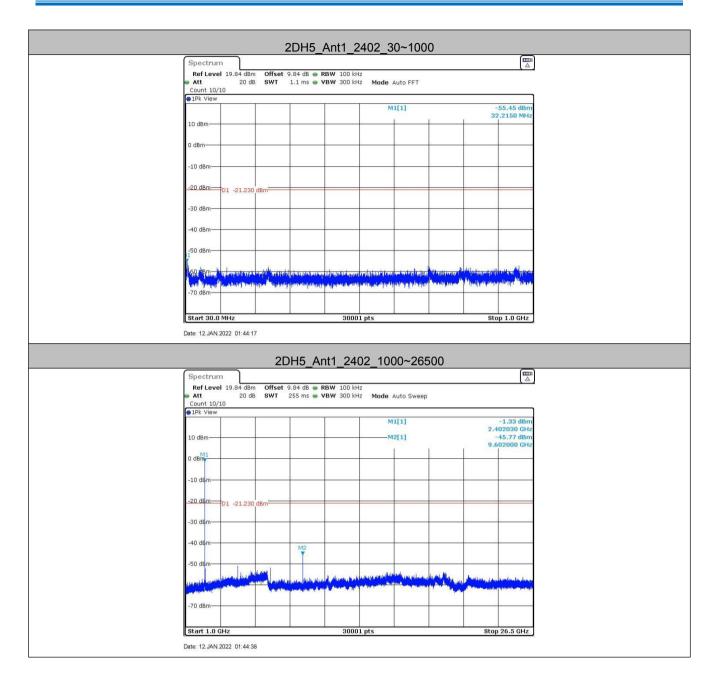




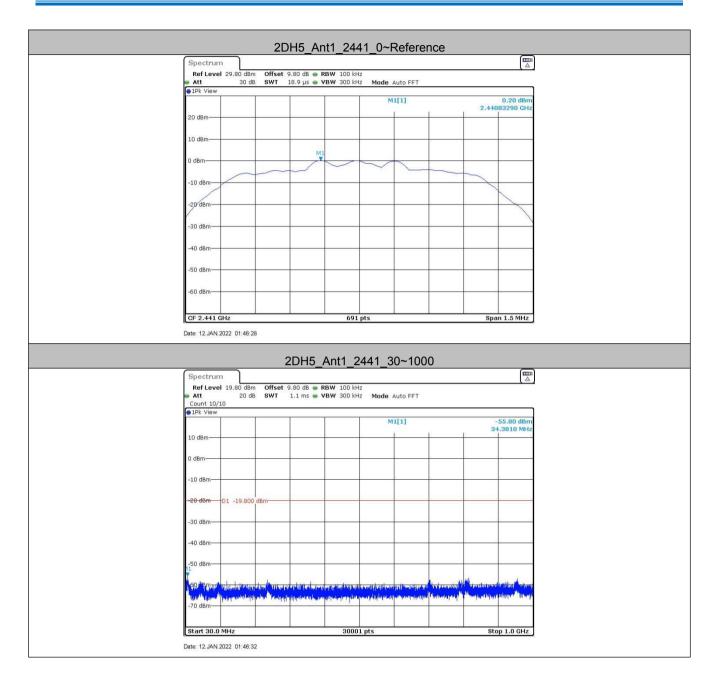




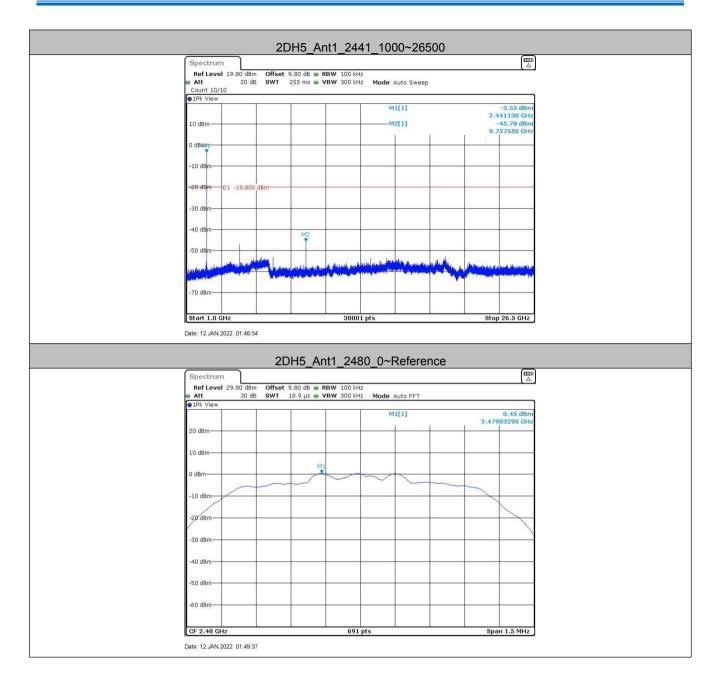




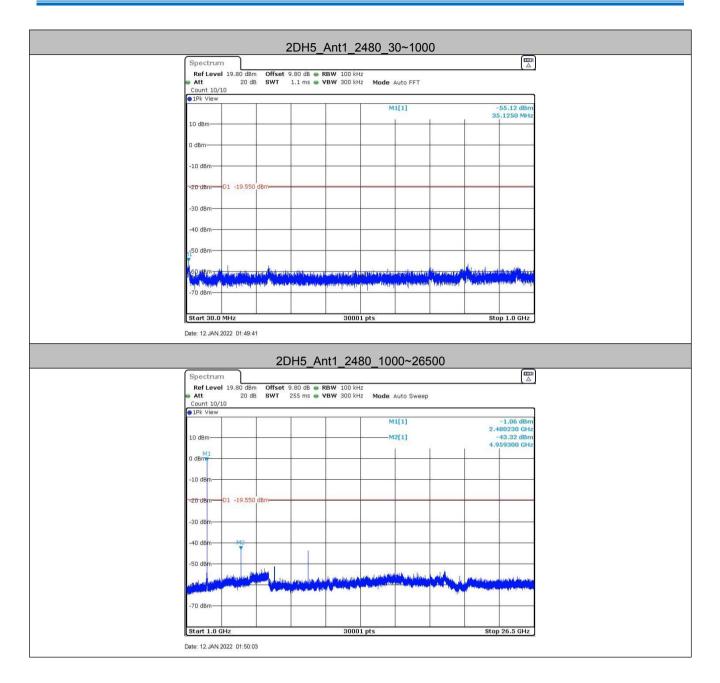




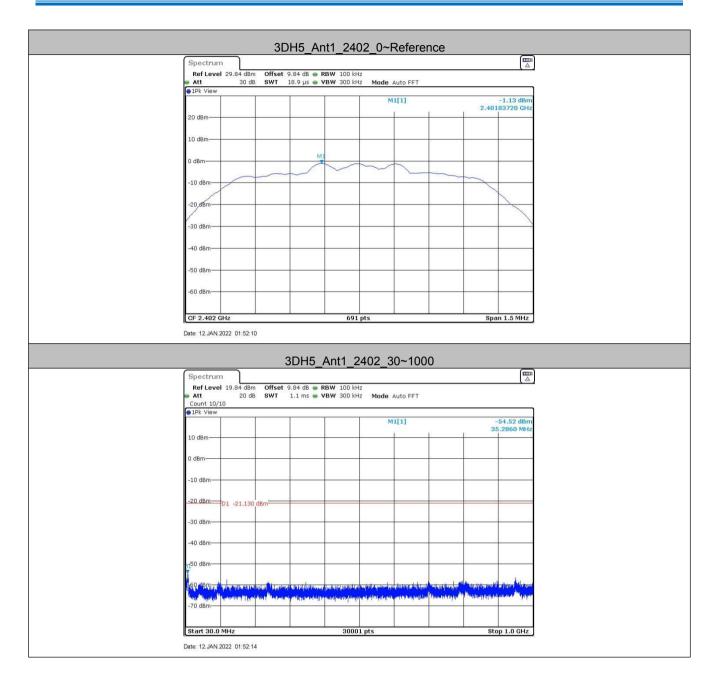




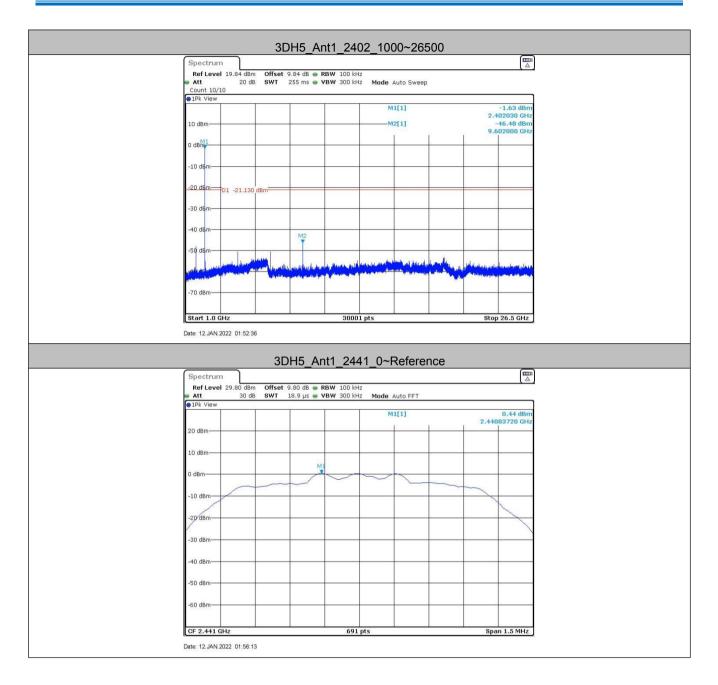




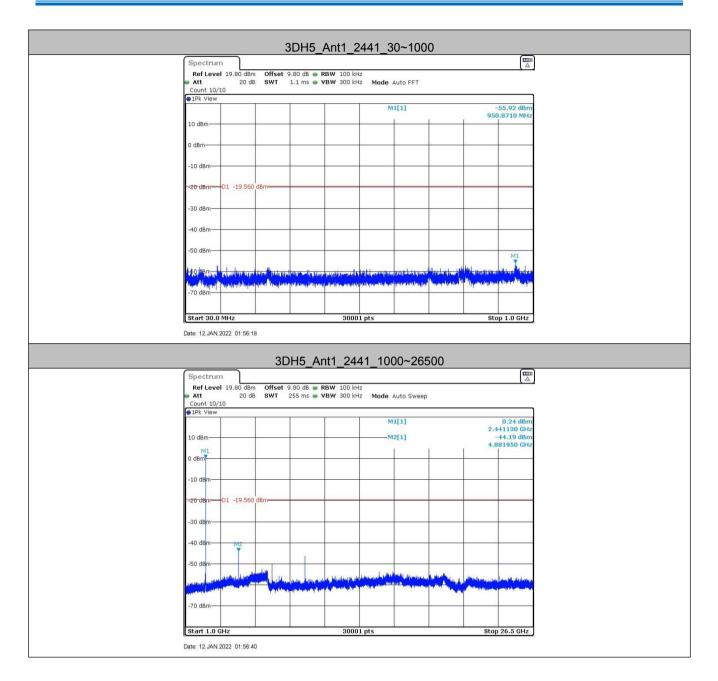




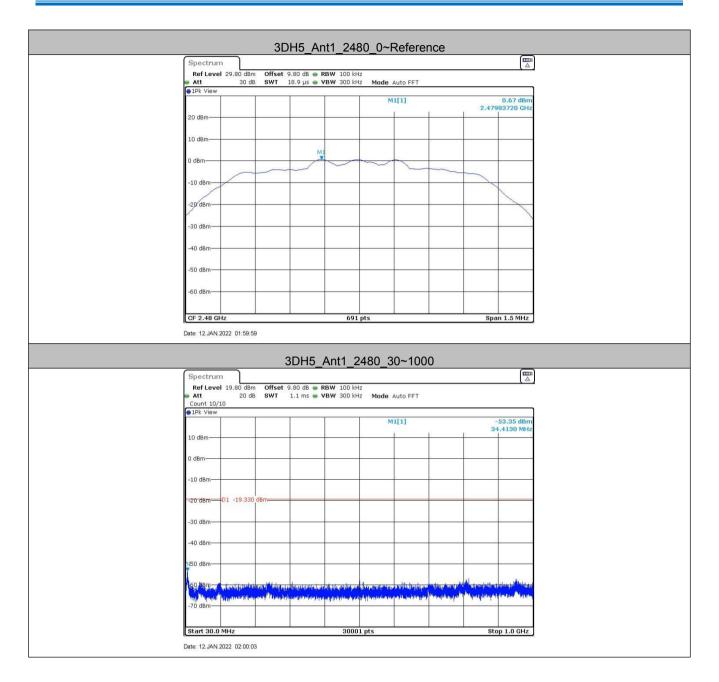




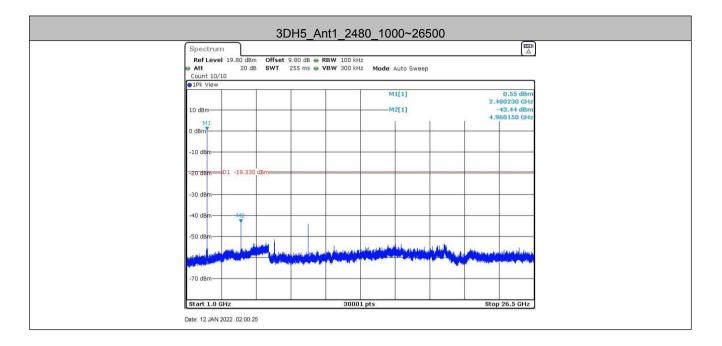












#### Remark:

Pre test 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.



## 5.10Other requirements Frequency Hopping Spread Spectrum System

5. TOOther requirements Fr	equency Hopping Spread Spectrum System
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1), (h) requirement:
rate from a Pseudorandom o on the average by each trans	nnel frequencies that are selected at the system hopping ordered list of hopping frequencies. Each frequency must be used equally smitter. The system receivers shall have input bandwidths that match the of their corresponding transmitters and shall shift frequencies in smitted signals.
channels during each transm receiver, must be designed t transmitter be presented with employing short transmission	spectrum systems are not required to employ all available hopping hission. However, the system, consisting of both the transmitter and the to comply with all of the regulations in this section should the h a continuous data (or information) stream. In addition, a system n bursts must comply with the definition of a frequency hopping system missions over the minimum number of hopping channels specified in
the system to recognize othe independently chooses and The coordination of frequence	ance within a frequency hopping spread spectrum system that permits ber users within the spectrum band so that it individually and adapts its hopsets to avoid hopping on occupied channels is permitted. by hopping systems in any other manner for the express purpose of ccupancy of individual hopping frequencies by multiple transmitters is
Compliance for section 15.	247(a)(1)
•	llo-two addition stage. And the result is fed back to the input of the first with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized ges: 9 sequence: 2 <sup>9</sup> -1 = 511 bits
Linear Feedback Si	hift Register for Generation of the PRBS sequence
An example of Pseudorando 20 62 46 77	m Frequency Hopping Sequence as follow: 7 64 8 73 16 75 1
According to Bluetooth Cord bandwidths that match the	on the average by each transmitter. e Specification, Bluetooth receivers are designed to have input and IF hopping channel bandwidths of any Bluetooth transmitters and shift on with the transmitted signals.
Compliance for section 15.	247(g)
pseudorandom hopping freq	re Specification, the Bluetooth system transmits the packet with the uency with a continuous data and the short burst transmission from the ansmitted under the frequency hopping system with the pseudorandom



#### Compliance for section 15.247(h)

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

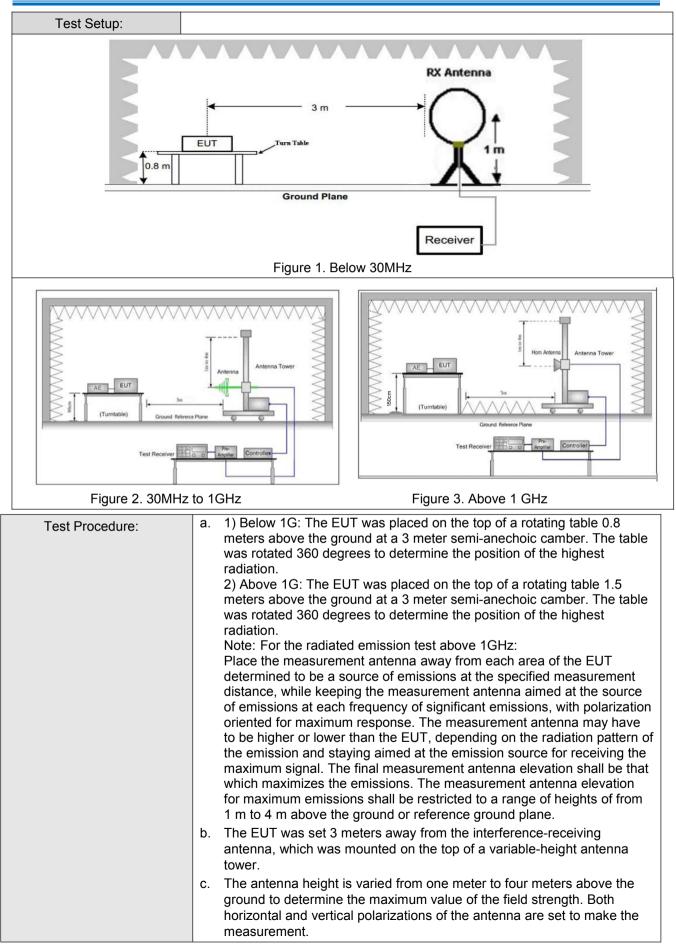


## 5.11 Radiated Spurious Emission & Restricted bands

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205									
Test Method:	ANSI C63.10: 2013									
Test Site:	Measurement Distance	Measurement Distance: 3m (Semi-Anechoic Chamber)								
Receiver Setup:	Frequency		Detector	RBW	VBW	Remark	]			
	0.009MHz-0.090MH	z	Peak	10kHz	z 30kHz	Peak				
	0.009MHz-0.090MH	Average	10kHz	z 30kHz	Average					
	0.090MHz-0.110MHz Quasi-peak			10kHz	z 30kHz	Quasi-peak				
	0.110MHz-0.490MH	z	Peak	10kHz	z 30kHz	Peak				
	0.110MHz-0.490MH	z	Average	10kHz	z 30kHz	Average				
	0.490MHz -30MHz		Quasi-peak	10kHz	z 30kHz	Quasi-peak				
	30MHz-1GHz		Peak	100 kH	z 300kHz	Peak				
	Above 1GHz		Peak	1MHz	3MHz	Peak				
	Above IGHz		Peak	1MHz	10Hz	Average				
Limit:	Frequency		eld strength crovolt/meter)	Limit (dBuV/m)	Remark	Measureme distance (n				
	0.009MHz-0.490MHz	2	400/F(kHz)	-	-	300				
	0.490MHz-1.705MHz	24	1000/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 emissions is 20dE applicable to the e peak emission lev	3 ab equi	ove the maxim pment under te	um perm est. This p	itted average	emission limit				









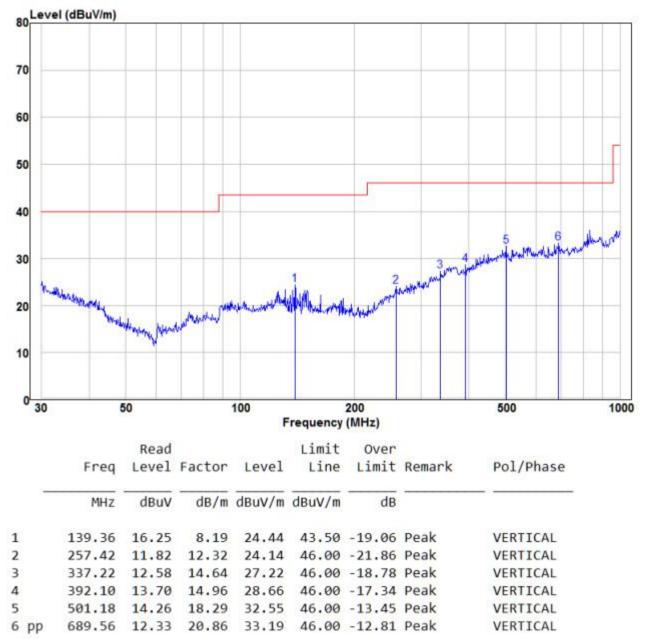
	<ul> <li>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> <li>g. Test the EUT in the lowest channel (2402MHz), the middle channel (2441MHz), the Highest channel (2480MHz)</li> <li>h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</li> <li>i. Repeat above procedures until all frequencies measured was complete.</li> </ul>
Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type Transmitting mode
Final Test Mode:	Through Pre-scan, find the DH5 of data type and GFSK modulation is the worst case. Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode which it is worse case For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Test Results:	Pass



### 5.11.1 Radiated Emission below 1GHz

#1

Vertical



#### Remark:

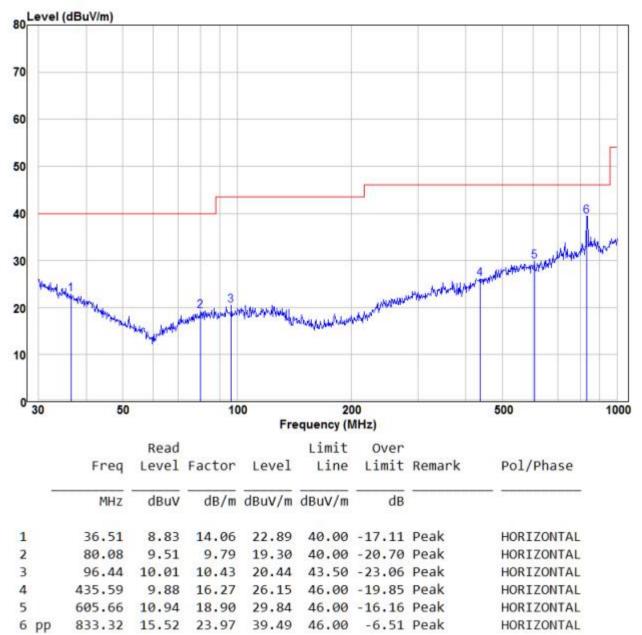
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Factor= Antenna Factor + Cable Factor – Preamplifier Factor,

Level = Read Level + Factor,



Horizontal



Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

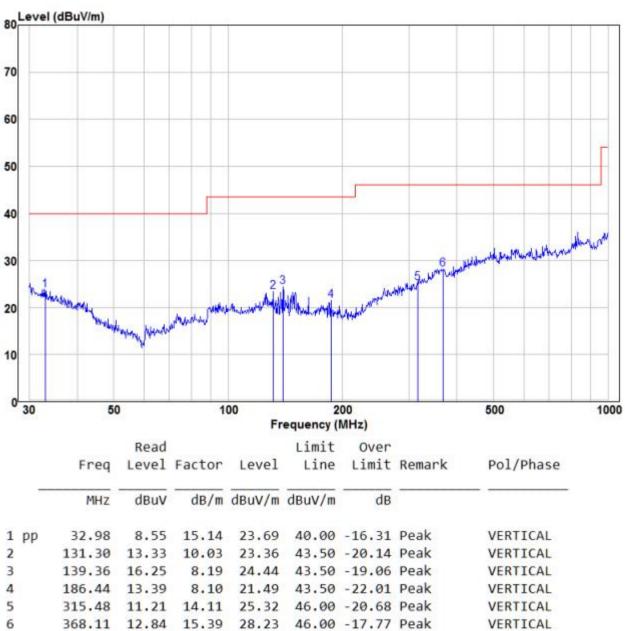
Factor= Antenna Factor + Cable Factor - Preamplifier Factor,

Level = Read Level + Factor,



#2





Remark:

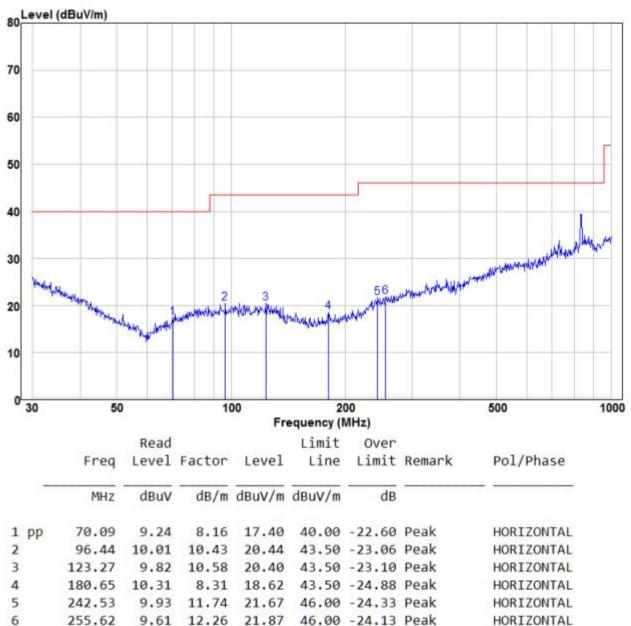
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Factor= Antenna Factor + Cable Factor - Preamplifier Factor,

Level = Read Level + Factor,



Horizontal



Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Factor= Antenna Factor + Cable Factor - Preamplifier Factor,

Level = Read Level + Factor,



# 5.11.2 Transmitter Emission above 1GHz

Worse case mode:		GFSK(DH5)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2390	55.54	-9.2	46.34	74	-27.66	Peak	н
2400	56.91	-9.39	47.52	74	-26.48	Peak	Н
4804	51.99	-4.33	47.66	74	-26.34	Peak	Н
7206	49.18	1.01	50.19	74	-23.81	Peak	Н
2390	55.46	-9.2	46.26	74	-27.74	Peak	V
2400	56.15	-9.39	46.76	74	-27.24	Peak	V
4804	52.84	-4.33	48.51	74	-25.49	Peak	V
7206	49.92	1.01	50.93	74	-23.07	Peak	V

Worse case mode:		GFSK(DH5)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
4882	52.32	-4.11	48.21	74	-25.79	peak	Н
7323	48.38	1.51	49.89	74	-24.11	peak	Н
4882	53.86	-4.11	49.75	74	-24.25	peak	V
7323	48.50	1.51	50.01	74	-23.99	peak	V

Worse case mode:		GFSK(DH5)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2483.5	56.12	-9.29	46.83	74	-27.17	Peak	н
4960	51.90	-4.04	47.86	74	-26.14	Peak	Н
7440	49.09	1.57	50.66	74	-23.34	Peak	Н
2483.5	53.78	-9.29	44.49	74	-29.51	Peak	v
4960	51.16	-4.04	47.12	74	-26.88	Peak	V
7440	49.47	1.57	51.04	74	-22.96	Peak	V



Worse case mode:		π/4DQPSk	(2DH5)	Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2390	53.57	-9.2	44.37	74	-29.63	Peak	н
2400	55.31	-9.39	45.92	74	-28.08	Peak	Н
4804	54.16	-4.33	49.83	74	-24.17	Peak	Н
7206	50.71	1.01	51.72	74	-22.28	Peak	Н
2390	55.57	-9.2	46.37	74	-27.63	Peak	v
2400	54.84	-9.39	45.45	74	-28.55	Peak	V
4804	54.53	-4.33	50.20	74	-23.80	Peak	V
7206	51.17	1.01	52.18	74	-21.82	Peak	V

Worse case mode:		π/4DQPSK (2DH5)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
4882	50.67	-4.11	46.56	74	-27.44	peak	Н
7323	49.78	1.51	51.29	74	-22.71	peak	Н
4882	53.64	-4.11	49.53	74	-24.47	peak	V
7323	49.04	1.51	50.55	74	-23.45	peak	V

Worse case mode:		π/4DQPSk	(2DH5)	Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2483.5	56.87	-9.29	47.58	74	-26.42	Peak	н
4960	52.31	-4.04	48.27	74	-25.73	Peak	Н
7440	50.79	1.57	52.36	74	-21.64	Peak	Н
2483.5	53.59	-9.29	44.30	74	-29.70	Peak	v
4960	50.29	-4.04	46.25	74	-27.75	Peak	V
7440	50.66	1.57	52.23	74	-21.77	Peak	V



Worse case mode:		8DPSK (3DH5)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2390	54.61	-9.2	45.41	74	-28.59	Peak	н
2400	56.37	-9.39	46.98	74	-27.02	Peak	Н
4804	53.59	-4.33	49.26	74	-24.74	Peak	Н
7206	48.89	1.01	49.90	74	-24.10	Peak	Н
2390	55.64	-9.2	46.44	74	-27.56	Peak	v
2400	55.14	-9.39	45.75	74	-28.25	Peak	V
4804	52.61	-4.33	48.28	74	-25.72	Peak	V
7206	50.04	1.01	51.05	74	-22.95	Peak	V

Worse case mode:		8DPSK (3DH5)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
4882	53.11	-4.11	49.00	74	-25.00	peak	Н
7323	51.04	1.51	52.55	74	-21.45	peak	Н
4882	52.13	-4.11	48.02	74	-25.98	peak	V
7323	51.08	1.51	52.59	74	-21.41	peak	V

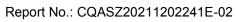
Worse case mode:		8DPSK (3DH5)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2483.5	55.75	-9.29	46.46	74	-27.54	Peak	н
4960	50.87	-4.04	46.83	74	-27.17	Peak	Н
7440	51.06	1.57	52.63	74	-21.37	Peak	Н
2483.5	54.70	-9.29	45.41	74	-28.59	Peak	v
4960	50.14	-4.04	46.10	74	-27.90	Peak	V
7440	48.85	1.57	50.42	74	-23.58	Peak	V

#### Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

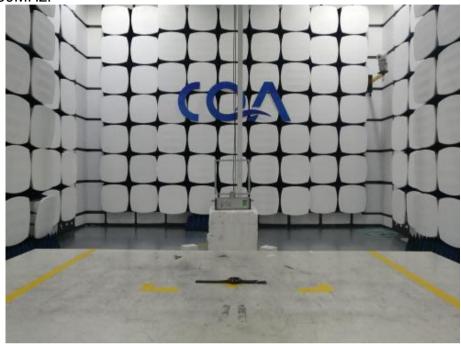




# 6 Photographs - EUT Test Setup

## 6.1 Radiated Emission

9KHz~30MHz:



30MHz~1GHz:







## 6.2 Conducted Emission





# 7 Photographs - EUT Constructional Details

Refer to Photographs - EUT Constructional Details OF EUT for CQASZ20211202241E-01.

\*\*\* END OF REPORT \*\*\*