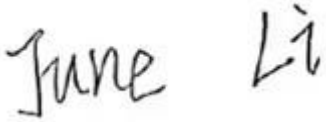
TEST REPORT

Application No.:	BTEK250717099A01-T01
Applicant:	Heavys Inc.
Address of Applicant:	1216 Broadway street, Suit 209, New York 10001, NY, United States
Manufacturer:	Heavys Inc.
Address of Manufacturer:	1216 Broadway street, Suit 209, New York 10001, NY, United States
Equipment Under Test (EUT):	
EUT Name:	H1E True Wireless Stereo Earbuds
Test Model.:	H1E
Adding Model(s):	/
Trade Mark:	Heavys
FCC ID:	2BAOA-H1E
Standard(s) :	47 CFR Part 15, Subpart C 15.247 KDB558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013
Date of Receipt Sample(s):	2025-07-25
Date of Test:	2025-07-25 to 2025-08-08
Date of Issue:	2025-08-11
Test Result:	**Pass***

* In the configuration tested, the EUT complied with the standards specified above.

Alex Wang / Approved & Authorized
EMC Laboratory Manager

Revision Record			
Version	**Issue Date**	**Revisions**	**Remarks**
V0	2025-08-11	Initial	Valid

Authorized for issue by:				
		 **Karl Liu / File Editor**		
		 **June Li/Reviewer**		

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Test Summary

Radio Spectrum Technical Requirement				
Standard	**Item**	**Method**	**Requirement**	**Result**
47 CFR Part 15, Subpart C 15.247	Antenna Requirement	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
	Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence	N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Standard	**Item**	**Method**	**Requirement**	**Result**
47 CFR Part 15, Subpart C 15.247	Conducted Emissions at AC Power Line (150kHz-30MHz)	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
	Conducted Peak Output Power	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
	20dB Bandwidth	ANSI C63.10 (2013) Section 7.8.7	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
	Carrier Frequencies Separation	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
	Hopping Channel Number	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
	Dwell Time	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
	Conducted Band Edges Measurement	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
	Conducted Spurious Emissions	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
	Radiated Emissions which fall in the restricted bands	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
	Radiated Spurious Emissions	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass

Declaration of EUT Family Grouping:

3 Contents

4 General Information

4.1 Details of E.U.T.

Power supply:	Earphone case: DC 5V from by USB-C port Battery:DC 3.7V⎓450mAh 1.665wh Earphone LIR1054 Battery:DC 3.6V⎓45mAh
Frequency Range:	2402MHz to 2480MHz
Bluetooth Version:	V5.0 classic
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channels:	79
Channel Spacing:	1MHz
Antenna Type:	FPC Antenna
Antenna Gain:	Left:-0.37dBi Right:-0.61dBi
Sample No.:	BTEK250717099A01-01
Model(s) Difference Statement	☒Single Model.
	☐Multi-Models:

4.2 EUT Test Mode and Test Condition

Test Mode	Description	Remark
1	Low/mid/High Channel	GFSK, π/4DQPSK, 8DPSK
2	Hopping	GFSK, π/4DQPSK, 8DPSK
Remark:1.only show the worst case in the test report. Remark:2.The left and right earphone modules are mirror images of each other, and the antennas are basically the same. Select the one with the higher antenna gain for testing.		

Test Conditions	
Temperature:	23.4 °C
Relative Humidity:	59 %
ATM Pressure:	1008 mbar

4.3 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
/	/	/	/

4.4 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	±3.12dB
Conducted Peak Output Power	± 0.76dB
20dB Bandwidth	± 3%
Carrier Frequencies Separation	± 7.3 x 10-8
Hopping Channel Number	± 7.3 x 10-8
Dwell Time	± 0.4%
Conducted Band Edges Measurement	± 0.8dB
Conducted Spurious Emissions	± 0.8dB
Radiated Emissions which fall in the restricted bands	±5.1dB (1GHz-6GHz); ±5.2dB(above 6GHz)
Radiated Spurious Emissions (Below 1GHz)	±5.1dB
Radiated Spurious Emissions (Above 1GHz)	±5.1dB (1GHz-6GHz); ±5.2dB(above 6GHz)

4.5 Test Location

All tests were performed at:
Shenzhen BANTEK Testing Co., Ltd.,
A5&A6, Building B1&B2, No.45 Gangtou Road, Bogang Community, Shajing Street, Bao'an District, Shenzhen, Guangdong, China 518104
Tel:0755-2334 4200 Fax: 0755-2334 4200
FCC Registration Number: 264293
Designation Number: CN1356
No tests were sub-contracted.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

Conducted Emissions at AC Power Line (150kHz-30MHz)					
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Shielding Room	YIHENG ENECTRONIC	9*5*3.3	YH-BT-220304-04	2025-02-15	2028-02-14
EMI Test Receiver	Rohde&Schwarz	ESCI	101021	2025-06-18	2026-06-17
Measurement Software	Fara	EZ_EMC Ver. FA-03A2	N/A	N/A	N/A
LISN	Rohde&Schwarz	ENV216	101472	2025-06-18	2026-06-17
LISN	Schwarzbeck	NSLK 8128	05127	2025-06-18	2026-06-17

RF Conducted					
Equipment	**Manufacturer**	**Model No**	**Serial No**	**Cal Date**	**Cal Due Date**
Shielding Room	YIHENG ENECTRONIC	5.5*3.1*3	YH-BT-220304-03	2025-02-15	2028-02-14
EXA Signal Analyzer	KEYSIGHT	N9020A	MY54230486	2025-06-19	2026-06-18
DC Power Supply	E3632A	E3642A	KR75304416	2025-06-19	2026-06-18
Attenuator	RswTech	SMA-JK-6dB	N/A	2025-06-19	2026-06-18
Attenuator	RswTech	SMA-JK-3dB	N/A	2025-06-19	2026-06-18
RF Control Unit	Techy	TR1029-1	N/A	2025-06-19	2026-06-18
RF Sensor Unit	Techy	TR1029-2	N/A	2025-06-19	2026-06-18
WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	141258	2025-06-19	2026-06-18
MXG Vector Signal Generator	Agilent	N5182A	US46240522	2025-06-19	2026-06-18
Programmable Temperature&Humidity Chamber	GRT	GR-HWX1000	GR22051001	2025-06-19	2026-06-18
Measurement Software	TACHOY	RF TestSoft V2.0.0.0	N/A	N/A	N/A

RSE					
Equipment	**Manufacturer**	**Model No**	**Serial No**	**Cal Date**	**Cal Due Date**
3m Semi-Anechoic Chamber	YIHENG ENECTRONIC	966	YH-BT-220304-01	2025-02-15	2028-02-14
EMI Test Receiver	Rohde&Schwarz	ESCI	100694	2025-06-18	2026-06-17
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	01324	2025-06-18	2026-06-17
Pre-Amplifier	Schwarzbeck	BBV 9745	#180	2025-06-18	2026-06-17
Measurement Software	Fara	EZ_EMC Ver. FA-03A2	N/A	2025-06-18	2026-06-17
EXA Signal Analyzer	Keysight	N9020A	MY54440290	2025-06-18	2026-06-17
Horn Antenna	Schwarzbeck	BBHA 9120D	02695	2025-06-18	2026-06-17
Pre-Amplifier	Tonscend	TAP0118045	AP20K806109	2025-06-18	2026-06-17
Horn Antenna	SCHWARZBECK	BBHA9170	1157	2025-06-18	2026-06-17
Low Noise Pre-amplifier	SKET	LNPA-1840G-50	SK2022032902	2025-06-18	2026-06-17

Signal analyzer	ROHDE&SCHWARZ	FSQ40	100010	2025-06-18	2026-06-17
Loop Antenna	ETS	6502	00201177	2025-06-18	2026-06-17
Cable	BTEK	LMR400UF-NMNM-7.00M	/	2025-06-18	2026-06-17
Cable	BTEK	LMR400UF-NMNM-2.50M	/	2025-06-18	2026-06-17
Cable	BTEK	LMR400UF-NMNM-3.00M	/	2025-06-18	2026-06-17
Cable	BTEK	SFT205PUR-MNSWSM-7.00M	/	2025-06-18	2026-06-17
Cable	BTEK	SFT205PUR-MNSWSM-2.50M	/	2025-06-18	2026-06-17
Cable	BTEK	SFT205PUR-MNSWSM-2.50M	/	2025-06-18	2026-06-17
Cable	BTEK	SFT205PUR-MNSWSM-0.30M	/	2025-06-18	2026-06-17

6 Radio Spectrum Technical Requirement

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

6.1.2 Conclusion

This product has an FPC antenna, fulfill the requirement of this section.

6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

Limit:

Standard Requirement:

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.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, 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.

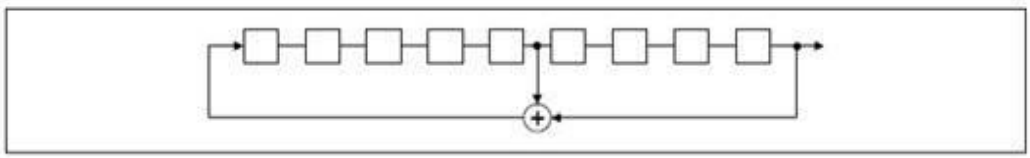
> Number of shift register stages: 9

> Length of pseudo-random sequence: 29 -1 = 511 bits

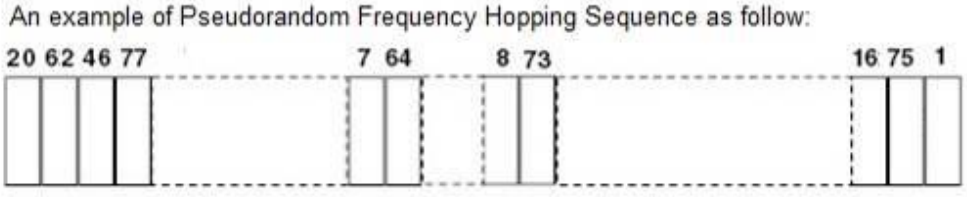
> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Linear Feedback Shift Register for Generation of the PRBS sequence



Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the 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.

The 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.

6.2.2 Conclusion

Standard Requirement:

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.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1):

According to Technical Specification, 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: 29 -1 = 511 bits

> Longest sequence of zeros: 8 (non-inverted signal)

Linear Feedback Shift Register for Generation of the PRBS sequence

Each frequency used equally on the average by each transmitter.

According to Technical Specification, the receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g):

According to Technical Specification, the system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Technical specification, the 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.

The 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.

7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

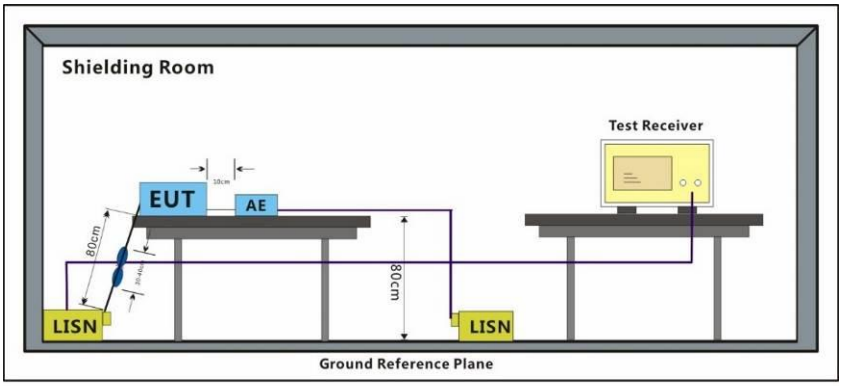
Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
*Decreases with the logarithm of the frequency.		
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz		

7.1.1 Test Setup Diagram



7.1.2 Measurement Procedure and Data

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 50ohm/50μH + 5ohm 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.

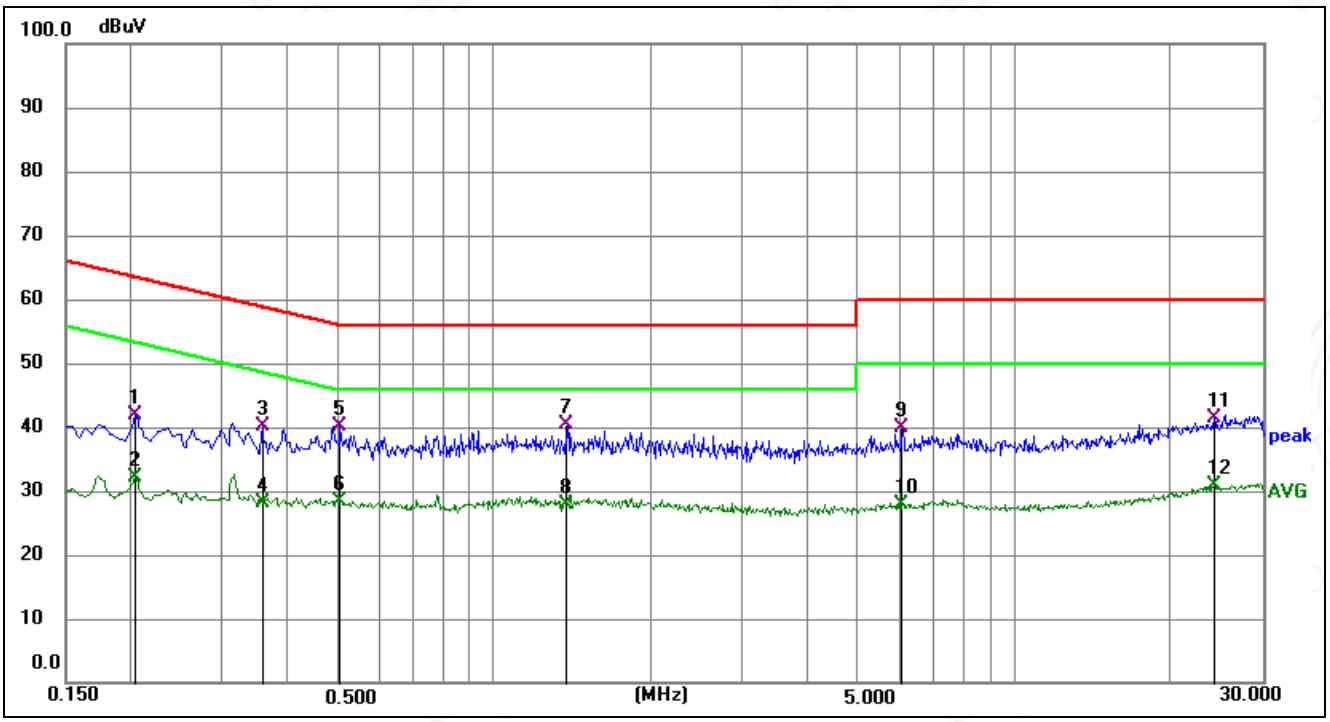
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.

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.

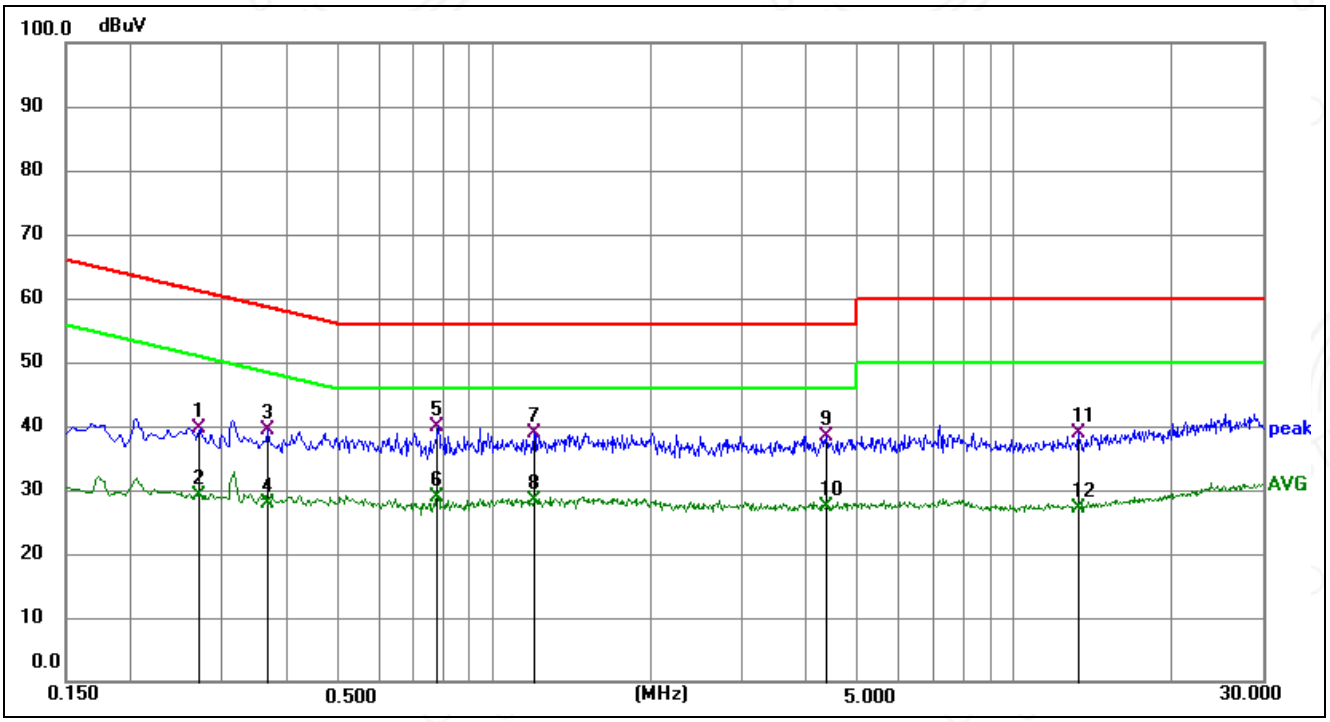
Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Test Mode	Communication	Polarity:	Neutral



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2040	22.31	19.46	41.77	63.45	-21.68	QP	P	
2	0.2040	12.72	19.46	32.18	53.45	-21.27	AVG	P	
3	0.3570	20.47	19.69	40.16	58.80	-18.64	QP	P	
4	0.3570	8.41	19.69	28.10	48.80	-20.70	AVG	P	
5	0.5055	20.41	19.65	40.06	56.00	-15.94	QP	P	
6	0.5055	8.74	19.65	28.39	46.00	-17.61	AVG	P	
7 *	1.3829	19.71	20.55	40.26	56.00	-15.74	QP	P	
8	1.3829	7.42	20.55	27.97	46.00	-18.03	AVG	P	
9	6.0944	18.82	20.97	39.79	60.00	-20.21	QP	P	
10	6.0944	7.01	20.97	27.98	50.00	-22.02	AVG	P	
11	24.1530	18.27	23.19	41.46	60.00	-18.54	QP	P	
12	24.1530	7.71	23.19	30.90	50.00	-19.10	AVG	P	

Test Mode	Communication	Polarity:	Line



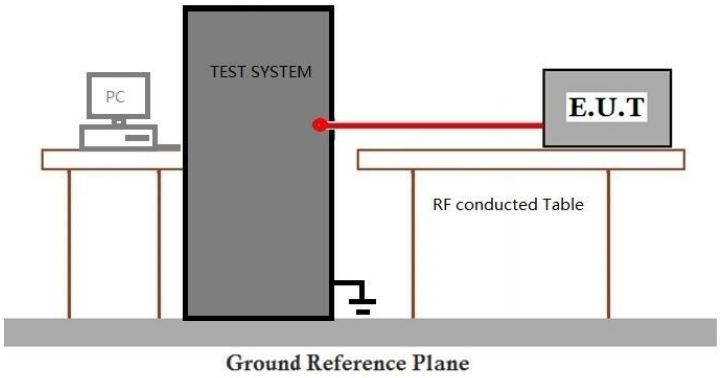
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.2714	20.03	19.63	39.66	61.07	-21.41	QP	P	
2	0.2714	9.41	19.63	29.04	51.07	-22.03	AVG	P	
3	0.3660	19.83	19.67	39.50	58.59	-19.09	QP	P	
4	0.3660	8.27	19.67	27.94	48.59	-20.65	AVG	P	
5 *	0.7799	20.40	19.45	39.85	56.00	-16.15	QP	P	
6	0.7799	9.52	19.45	28.97	46.00	-17.03	AVG	P	
7	1.1940	18.60	20.33	38.93	56.00	-17.07	QP	P	
8	1.1940	8.14	20.33	28.47	46.00	-17.53	AVG	P	
9	4.3395	17.39	21.09	38.48	56.00	-17.52	QP	P	
10	4.3395	6.21	21.09	27.30	46.00	-18.70	AVG	P	
11	13.2945	17.25	21.54	38.79	60.00	-21.21	QP	P	
12	13.2945	5.65	21.54	27.19	50.00	-22.81	AVG	P	

7.2 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.5
Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥50 hopping channels
	0.25 for 25≤ hopping channels <50
	1 for digital modulation
2400-2483.5	1 for ≥75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

7.2.1 Test Setup Diagram



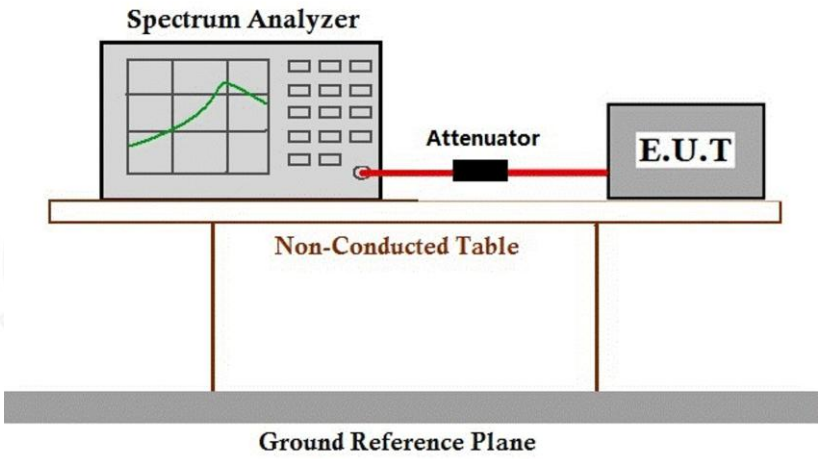
7.2.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.3 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method: ANSI C63.10 (2013) Section 7.8.7

7.3.1 Test Setup Diagram



7.3.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.4 Carrier Frequencies Separation

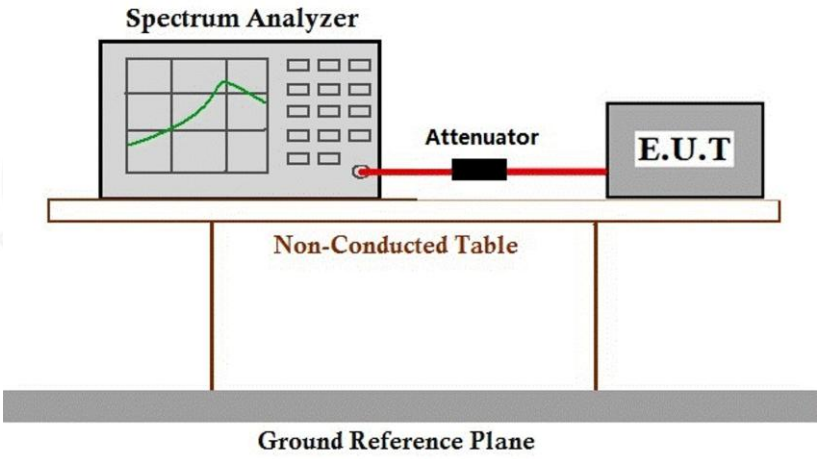
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)

Test Method: ANSI C63.10 (2013) Section 7.8.2

Limit:

2/3 of the 20dB bandwidth base on the transmission power is less than 0.125W.

7.4.1 Test Setup Diagram



7.4.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.5 Hopping Channel Number

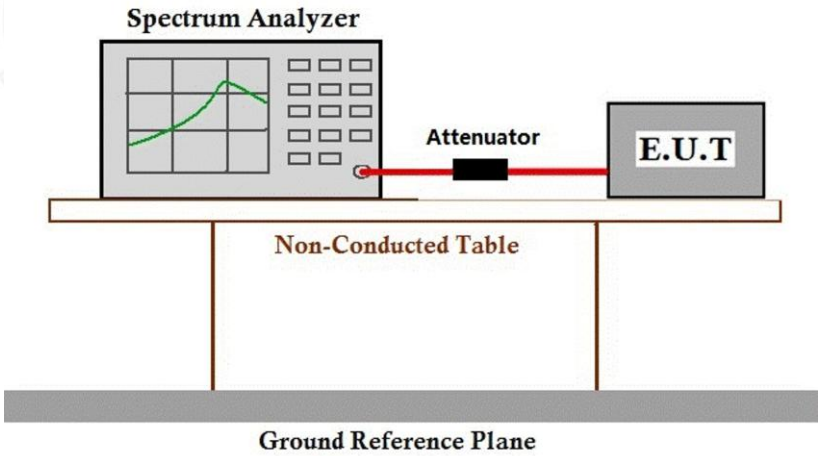
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)

Test Method: ANSI C63.10 (2013) Section 7.8.3

Limit:

Frequency range(MHz)	Number of hopping channels (minimum)
902-928	50 for 20dB bandwidth <250kHz
	25 for 20dB bandwidth ≥250kHz
2400-2483.5	15
5725-5850	75

7.5.1 Test Setup Diagram



7.5.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.6 Dwell Time

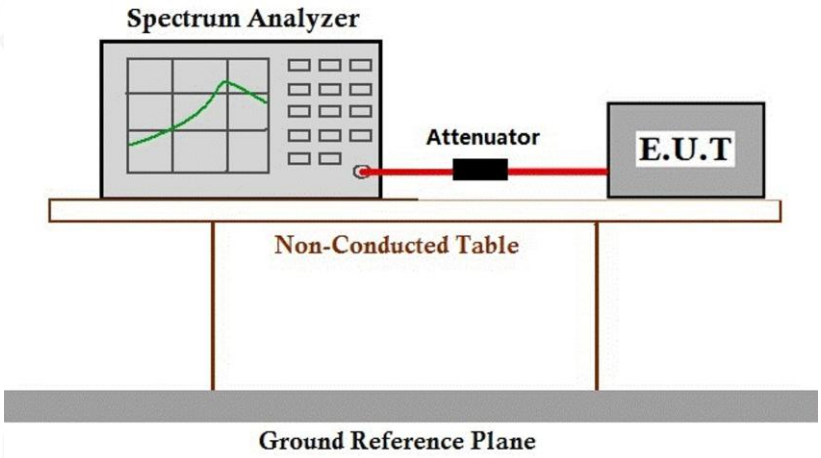
Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)

Test Method: ANSI C63.10 (2013) Section 7.8.4

Limit:

Frequency(MHz)	Limit
902-928	0.4s within a 20s period(20dB bandwidth<250kHz)
	0.4s within a 10s period(20dB bandwidth≥250kHz)
2400-2483.5	0.4s within a period of 0.4s multiplied by the number of hopping channels
5725-5850	0.4s within a 30s period

7.6.1 Test Setup Diagram



7.6.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.7 Conducted Band Edges Measurement

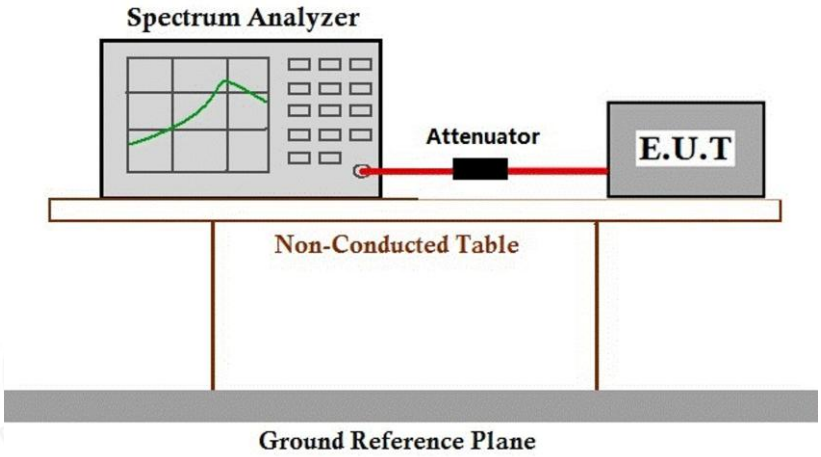
Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.6

Limit:

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).

7.7.1 Test Setup Diagram



7.7.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.8 Conducted Spurious Emissions

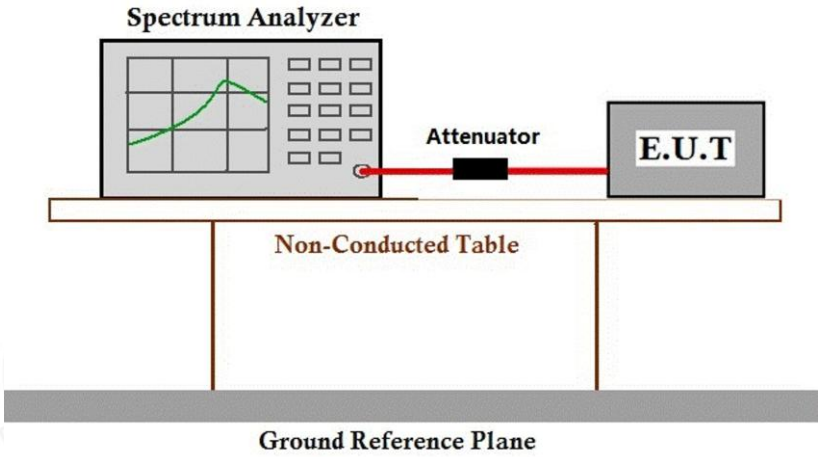
Test Requirement 47 CFR Part 15, Subpart C 15.247(d)

Test Method: ANSI C63.10 (2013) Section 7.8.8

Limit:

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).

7.8.1 Test Setup Diagram



7.8.2 Measurement Procedure and Data

Please Refer to Appendix for Details

7.9 Radiated Emissions which fall in the restricted bands

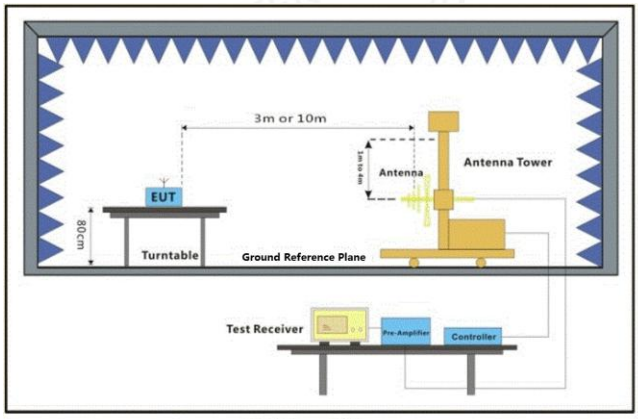
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10 (2013) Section 6.10.5

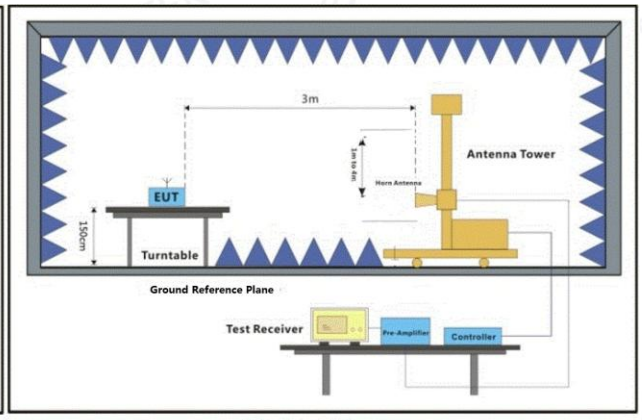
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, 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.		

7.9.1 Test Setup Diagram



30MHz-1GHz



Above 1GHz

7.9.2 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. 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.

e. 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.

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

g. 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.

h. Test the EUT in the lowest channel, the Highest channel.

i. 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.

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

Remark 1: Level= Reading Level + Factor

Remark 2: 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Note:1) Level = Reading level + Factor

2) Through pre-scan found the worst case is GFSK mode. Only the worst case is recorded in the report.

Polarity: Horizontal; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2310.00	65.79	-24.14	41.65	74.00	-32.35	peak	P
2	2310.00	55.42	-24.14	31.28	54.00	-22.72	Average	P
3	2390.00	71.93	-23.92	48.01	74.00	-25.99	peak	P
4	2390.00	61.71	-23.92	37.79	54.00	-16.21	Average	P
5	2400.00	63.48	-23.92	39.56	74.00	-34.44	peak	P
6	2400.00	53.86	-23.92	29.94	54.00	-24.06	Average	P

Polarity: Vertical; Modulation: GFSK; Channel: Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2310.00	69.04	-24.14	44.90	74.00	-29.10	peak	P
2	2310.00	59.11	-24.14	34.97	54.00	-19.03	Average	P
3	2390.00	70.99	-23.92	47.07	74.00	-26.93	peak	P
4	2390.00	60.16	-23.92	36.24	54.00	-17.76	Average	P
5	2400.00	68.95	-23.92	45.03	74.00	-28.97	peak	P
6	2400.00	58.58	-23.92	34.66	54.00	-19.34	Average	P

Polarity: Horizontal; Modulation: GFSK; Channel: High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2483.50	69.16	-23.65	45.51	74.00	-28.49	peak	P
2	2483.50	58.96	-23.65	35.31	54.00	-18.69	Average	P
3	2500.00	74	-23.65	50.35	74.00	-23.65	peak	P
4	2500.00	59.82	-23.65	36.17	54.00	-17.83	Average	P

Polarity: Vertical; Modulation:GFSK; Channel: High

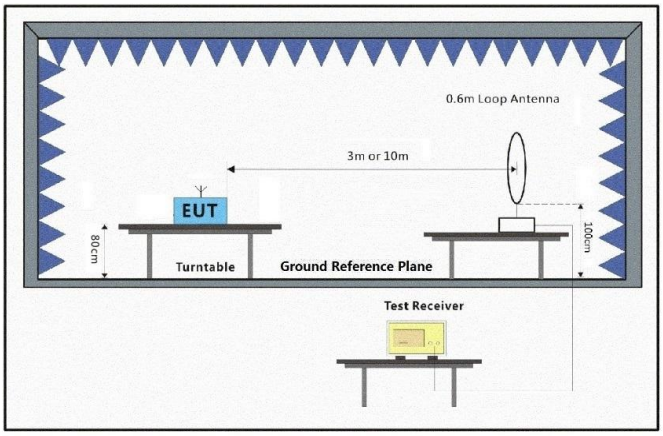
No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	2483.50	67.32	-23.65	43.67	74.00	-30.33	peak	P
2	2483.50	57.46	-23.65	33.81	54.00	-20.19	Average	P
3	2500.00	71.14	-23.65	47.49	74.00	-26.51	peak	P
4	2500.00	61.02	-23.65	37.37	54.00	-16.63	Average	P

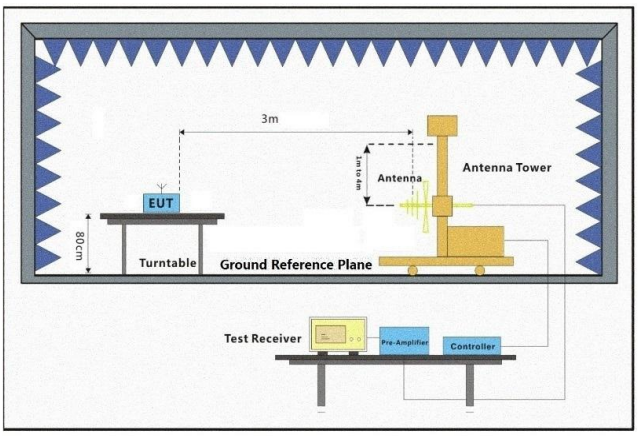
7.10 Radiated Spurious Emissions

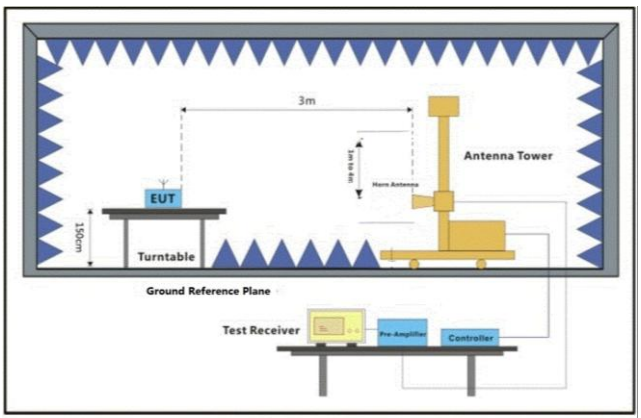
Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6
Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, 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.		

7.10.1 Test Setup Diagram







Above 1GHz

7.10.2 Measurement Procedure and Data

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 or 10 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.

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 the worst case.

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

a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. 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 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.

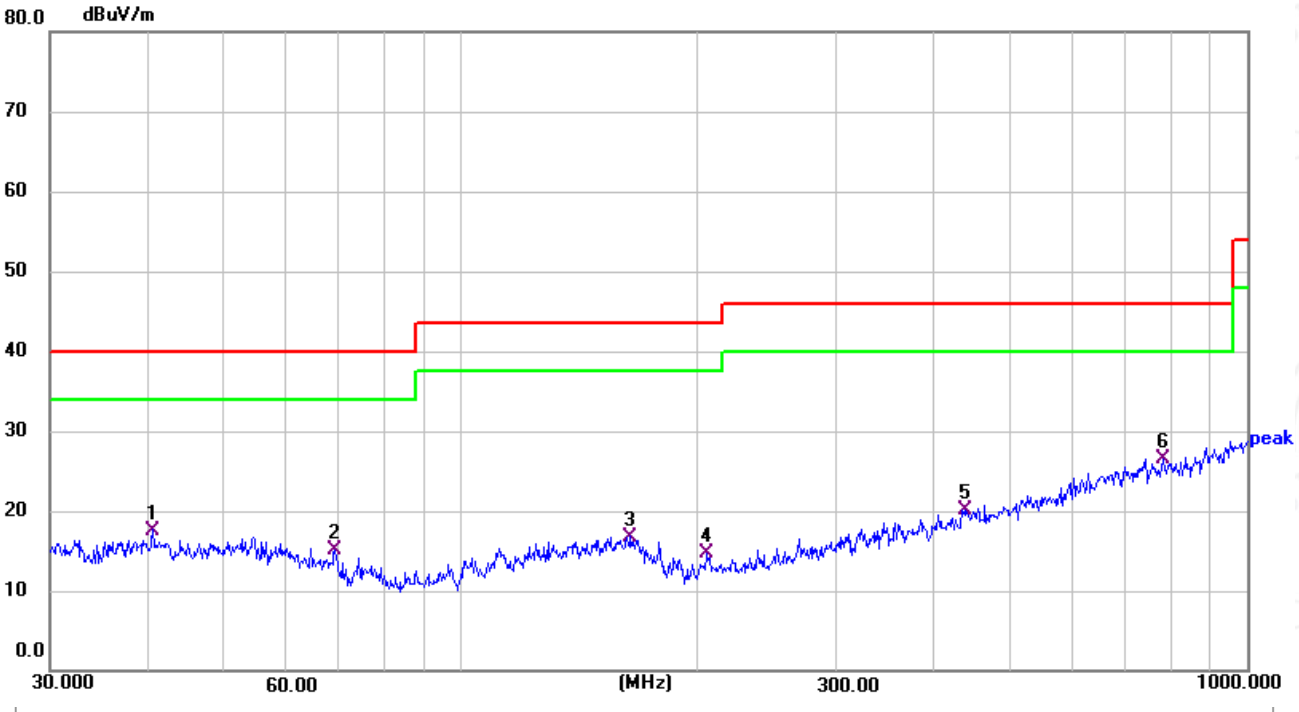
g. Test the EUT in the lowest channel, the middle channel, the Highest channel.

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

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

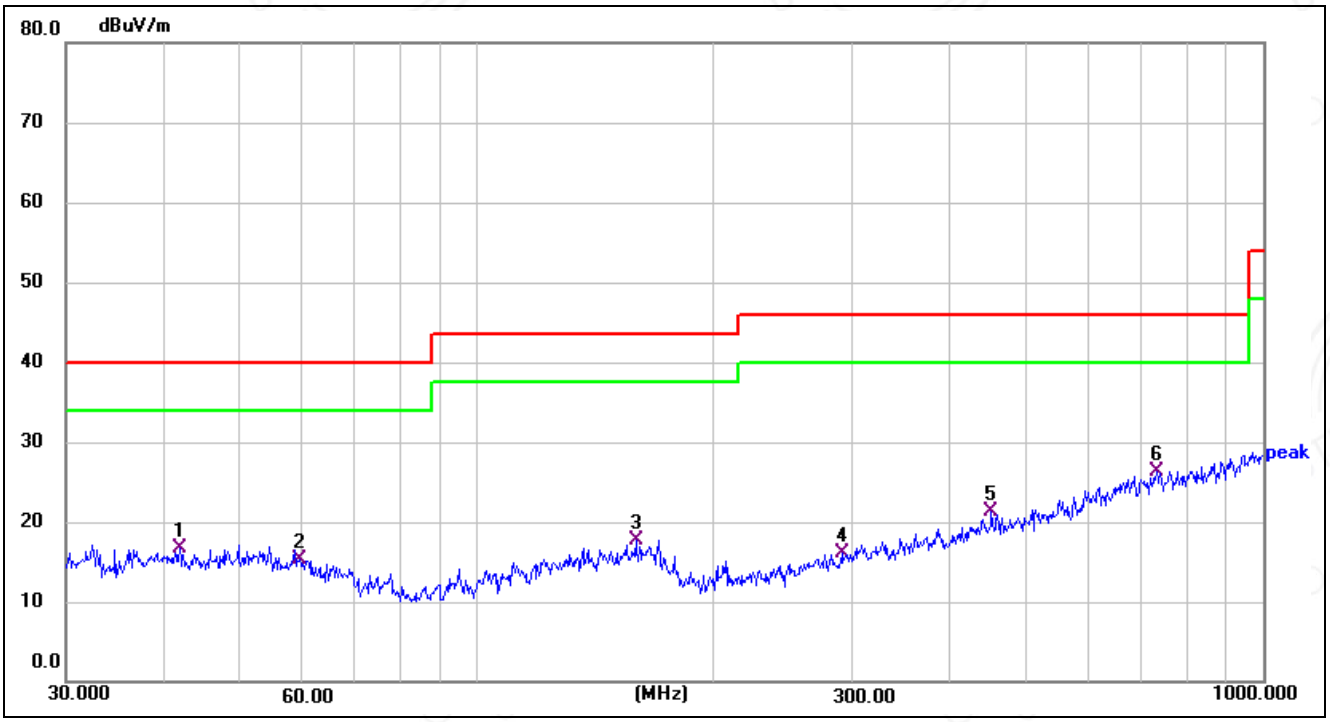
➢ Spurious Emissions Below 1GHz

Test Channel	Low	Polarity:	Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	40.5591	28.97	-11.37	17.60	40.00	-22.40	QP	100	0	P	
2	69.1141	28.44	-13.33	15.11	40.00	-24.89	QP	100	0	P	
3	164.3301	27.62	-10.82	16.80	43.50	-26.70	QP	100	0	P	
4	205.6751	28.18	-13.51	14.67	43.50	-28.83	QP	100	0	P	
5	438.6554	28.49	-8.31	20.18	46.00	-25.82	QP	100	0	P	
6 *	782.3453	29.73	-3.23	26.50	46.00	-19.50	QP	100	0	P	

Test Channel	Low	Polarity:	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	41.8596	28.15	-11.49	16.66	40.00	-23.34	QP	100	360	P	
2	59.4405	27.44	-12.10	15.34	40.00	-24.66	QP	100	360	P	
3	159.2251	29.02	-11.30	17.72	43.50	-25.78	QP	100	360	P	
4	291.0360	28.50	-12.34	16.16	46.00	-29.84	QP	100	360	P	
5	451.1350	29.90	-8.51	21.39	46.00	-24.61	QP	100	360	P	
6 *	731.9203	30.28	-3.89	26.39	46.00	-19.61	QP	100	360	P	

Remark:

1) Through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.

2) 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 = Reading Level + Factor

3) Scan from 9kHz to 1 GHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

Above 1GHz

Polarity: Horizontal; Modulation:GFSK; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4803.16	64.51	-15.60	48.91	74.00	-25.09	peak	P
2	4803.16	54.46	-15.60	38.86	54.00	-15.14	Average	P
3	7205.04	55.92	-10.97	44.95	74.00	-29.05	peak	P
4	7205.04	45.47	-10.97	34.50	54.00	-19.50	Average	P

Polarity: Vertical; Modulation:GFSK; Channel:Low

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4803.543	63.31	-15.60	47.71	74.00	-26.29	peak	P
2	4803.543	53.28	-15.60	37.68	54.00	-16.32	Average	P
3	7206.000	56.31	-10.97	45.34	74.00	-28.66	peak	P
4	7206.000	46.92	-10.97	35.95	54.00	-18.05	Average	P

Polarity: Horizontal; Modulation:GFSK; Channel:middle

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4883.68	66.41	-15.60	50.81	74.00	-23.19	peak	P
2	4883.68	56.88	-15.60	41.28	54.00	-12.72	Average	P
3	7326.00	57.2	-10.97	46.23	74.00	-27.77	peak	P
4	7326.00	47.62	-10.97	36.65	54.00	-17.35	Average	P

Polarity: Vertical; Modulation:GFSK; Channel:middle

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4883.435	66.41	-15.60	50.81	74.00	-23.19	peak	P
2	4883.435	56.81	-15.60	41.21	54.00	-12.79	Average	P
3	7320.000	57.2	-10.97	46.23	74.00	-27.77	peak	P
4	7320.000	47.29	-10.97	36.32	54.00	-17.68	Average	P

Polarity: Horizontal; Modulation:GFSK; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4960.536	66.99	-15.60	51.39	74.00	-22.61	peak	P
2	4960.536	55.87	-15.60	40.27	54.00	-13.73	Average	P
3	7439.411	61.77	-10.97	50.80	74.00	-23.20	peak	P
4	7439.411	51.64	-10.97	40.67	54.00	-13.33	Average	P

Polarity: Vertical; Modulation:GFSK; Channel:High

No.	Frequency (MHz)	Reading (dBuv)	Factor (dB/m)	Level (dBuv/m)	Limit (dBuv/m)	Margin(dB)	Detector	P/F
1	4960.000	66.9	-15.60	51.30	74.00	-22.70	peak	P
2	4960.000	55.93	-15.60	40.33	54.00	-13.67	Average	P
3	7440.000	58.92	-10.97	47.95	74.00	-26.05	peak	P
4	7440.000	48.97	-10.97	38.00	54.00	-16.00	Average	P

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) Through pre-scan found the worst case is GFSK mode. Only the worst case is recorded in the report.

3) Scan from 1GHz to 25GHz, the disturbance above 18GHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

4) 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. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

8 Test Setup Photo

Refer to Appendix – Test Setup Photos.

9 EUT Constructional Details (EUT Photos)

Refer to Appendix - External and Internal Appendix EUT Photos

- End of the Report -