Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road,
Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No. ..... :	**GTS20190531004-1-17**
FCC ID. ..... :	**2AUL8HT-F580**
Compiled by (position+printed name+signature) . :	File administrators Peter Xiao
Supervised by (position+printed name+signature) . :	Test Engineer Moon Tan
Approved by (position+printed name+signature) . :	Manager Simon Hu
Date of issue .....:	Sep.18,2019
Representative Laboratory Name.:	**Shenzhen Global Test Service Co.,Ltd.**
Address .....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong,China
Applicant's name.....:	**Shenzhen Aerospace Innotech Corporation Limited**
Address .....:	D9,The 10th Kejinan Road,High-Tech Zone, Nanshan Dist, Shenzhen,P.R.China
Test specification.....**:**	
Standard.....:	**FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd.
Master TRF .....:	Dated 2014-12

Test item description .....:	**RFID Reader**
Trade Mark.....:	N/A
Manufacturer .....:	Shenzhen Aerospace Innotech Corporation Limited
Model/Type reference .....:	HT-F580
Listed Models .....:	HT-F581, HT-I580, HT-I581, HT-I582, HT-I583, HT-I584, HT-D580
Modulation Type.....:	DSB-ASK
Operation Frequency .....:	From 902.75MHz to 927.25MHz
Hardware Version .....:	N/A
Software Version.....:	N/A
Rating.....:	DC 12.0V by Adapter
Result .....:	**PASS**

T E S T R E P O R T

Test Report No. :	**GTS20190531004-1-17**	Sep.18,2019 Date of issue

Equipment under Test	:	RFID Reader
Model /Type	:	HT-F580
Listed Models	:	HT-F581, HT-I580, HT-I581, HT-I582, HT-I583, HT-I584, HT-D580
Applicant	:	**Shenzhen Aerospace Innotech Corporation Limited**
Address	:	D9,The 10th Kejinan Road,High-Tech Zone,Nanshan Dist,Shenzhen,P.R.China
Manufacturer	:	**Shenzhen Aerospace Innotech Corporation Limited**
Address	:	D9,The 10th Kejinan Road,High-Tech Zone,Nanshan Dist,Shenzhen,P.R.China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Aug.27, 2019
Testing commenced on	:	Aug.27, 2019
Testing concluded on	:	Sep.18,2019

2.2. Product Description

Product Name:	RFID Reader
Trade Mark:	N/A
Model/Type reference:	HT-F580
List Model:	HT-F581, HT-I580, HT-I581, HT-I582, HT-I583, HT-I584, HT-D580
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power supply:	DC 12.0V by Adapter
RFID	
Operation frequency	902.75-927.25MHz
Channel Number	50 Channels
Channel Spacing	0.5MHz
Modulation Type	DSB-ASK
Antenna Type	RFID Support Four Same External Antenna, Not Support MIMO Technology;
Antenna Gain	8.0dBi(Max.)

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		●	12 V DC	○	24 V DC
		○	Other (specified in blank below)		

DC 12V form Adapter

2.4. Short description of the Equipment under Test (EUT)

This is a RFID Reader

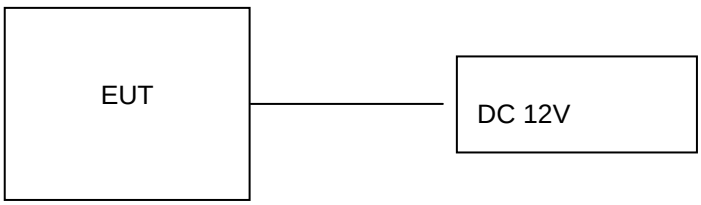
For more details, refer to the user's manual of the EUT.

2.5. EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 50 channels provided to the EUT. Channel 01/25/50 was selected to test.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
01	**902.75**	26	915.25
02	903.25	27	915.75
03	903.75	28	916.25
--	--	--	--
--	--	--	--
24	914.25	49	926.75
25	**914.75**	**50**	**927.25**

2.6. Block Diagram of Test Setup



2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID:2AUL8HT-F580** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
Mean Well Enterpriese Co.,Ltd	Adapter	GST25A12	--	SDOC

2.9. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong,China,China.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Summary of measurement results

Applied Standard: FCC Part 15 Subpart C			
FCC Rules	**Description of Test**	**Test Sample**	**Result**
§15.247(b)(2)	Maximum Conducted Output Power	Sample 1	Compliant
§15.247(c)	Frequency Separation And 20 dB Bandwidth	Sample 1	Compliant
§15.247(b)(2)	Number Of Hopping Frequency	Sample 2	Compliant
§15.247(a)(1)(i)	Time Of Occupancy (Dwell Time)	Sample 2	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Sample 1	Compliant
§15.205	Emissions at Restricted Band	Sample 1	Compliant
§15.207(a)	Conducted Emissions	Sample 1	Compliant
§15.203	Antenna Requirements	Sample 1	Compliant
§15.247(i)§2.1091	RF Exposure	N/A	Compliant

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. We tested all test mode and recorded worst case in report

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.6. Equipments Used during the Test

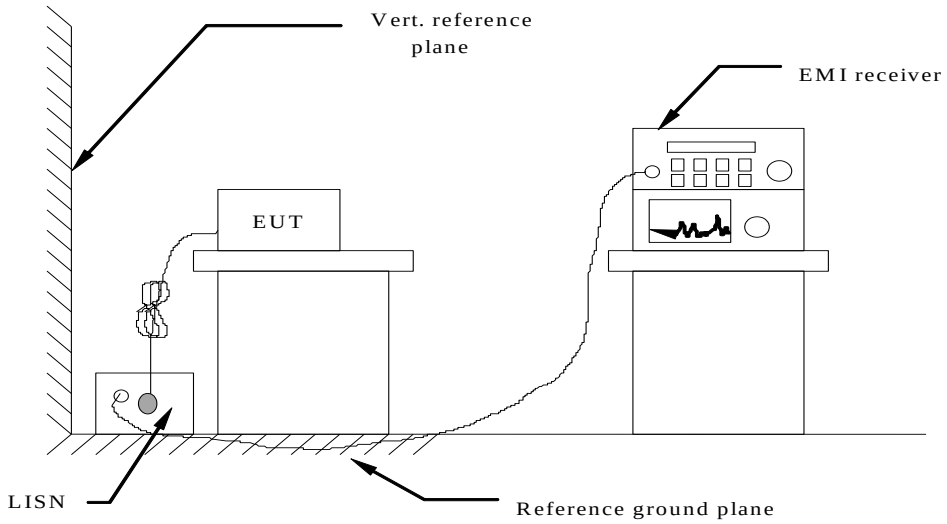
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2018/09/28	2019/09/27
LISN	R&S	ESH2-Z5	893606/008	2018/09/27	2019/09/26
By-log Antenna	SCHWARZBECK	VULB9163	000976	2018/09/29	2019/09/28
EMI Test Receiver	R&S	ESCI	101102	2018/09/26	2019/09/25
Spectrum Analyzer	Agilent	N9020A	MY48010425	2018/09/17	2019/09/16
Spectrum Analyzer	R&S	FSV40-N	101800	2018/09/17	2019/09/16
Controller	EM Electronics	Controller EM 1000	N/A	2018/09/21	2019/09/20
Double Ridged Horn Antenna (1~18GHz)	SCHWARZBECK	BBHA 9120D	01622	2018/09/19	2019/09/18
Double Ridged Horn Antenna	Rohde&Schwarz	HF907	100265	2018/09/19	2019/09/18
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2018/09/19	2019/09/18
Horn Antenna (18GHz~40GHz)	ETS	3116	00086467	2018/12/29	2019/12/28
Amplifier (26.5GHz~40GHz)	EMCI	EMC2654045	980028	2018/09/18	2019/09/17
Amplifier (0.1GHz~26.5GHz)	EMCI	EMC012645SE	980355	2018/09/19	2019/09/18
Temperature/Humidity Meter	Gangxing	CTH-608	02	2018/09/20	2019/09/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2018/09/20	2019/09/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2018/09/20	2019/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2018/09/20	2019/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2018/09/20	2019/09/19
RF Cable	HUBER+SUHNER	RG214	N/A	2018/09/20	2019/09/19
Broadband Antenna	SCHWARZBECK	VULB 9163	00976	2018/09/29	2019/09/28
Conducted Emission	ES-K1	V1.71	N/A	N/A	N/A
Radiated Emission	JS32-RE	V2.5.0.9	N/A	N/A	N/A

Note: The Cal.Interval was one year.

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013.
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013.
4 The EUT received DC 12V power, the adapter received AC120V/60Hz or AC 240V/50Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5 All support equipments received AC power from a second LISN, if any.
6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

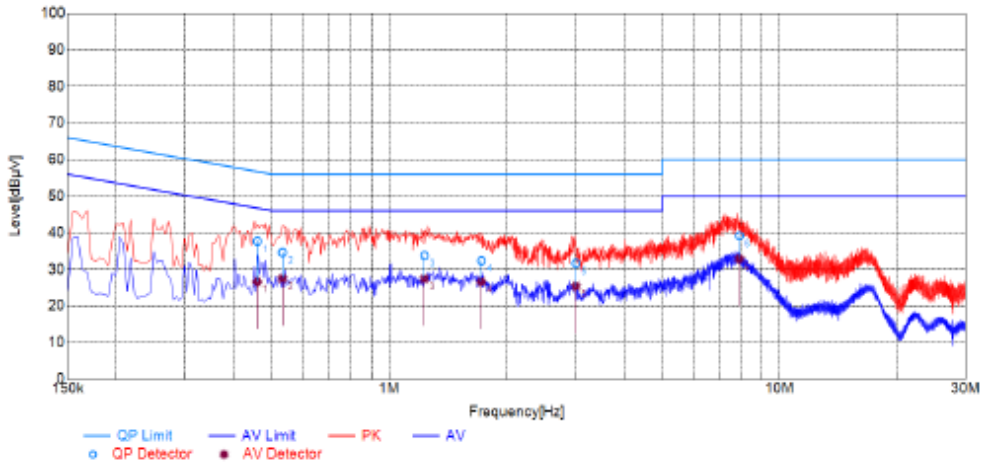
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark: We measured Conducted Emission at DSB-ASK mode in AC 120V/60Hz and AC 240V/50Hz, the worst case was recorded .

Power supply:	AC 120V/60Hz	Polarization	L

Test Graph



Final Data List

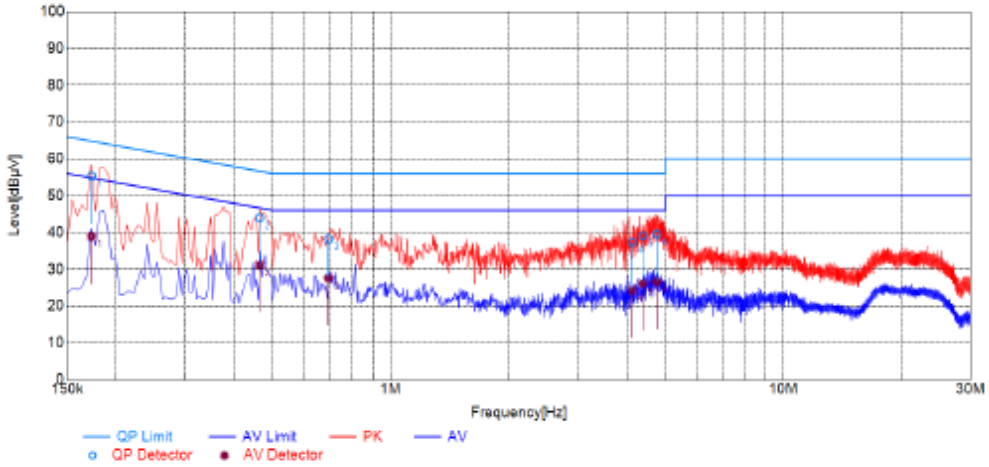
NO.	Frequency [MHz]	QP Reading [dBµV]	AVG. Reading [dBµV]	Factor [dB]	QP Result [dBµV]	AVG. Result [dBµV]	QP Limit [dBµV]	AVG. Limit [dBµV]	QP Margin [dB]	AVG. Margin [dB]	Line	Remark
1	0.4591	27.42	16.37	10.23	37.65	26.60	56.71	46.71	19.06	20.11	L1	PASS
2	0.5324	24.37	17.26	10.23	34.60	27.49	56.00	46.00	21.40	18.51	L1	PASS
3	1.2300	23.52	17.21	10.22	33.74	27.43	56.00	46.00	22.26	18.57	L1	PASS
4	1.7207	22.11	16.34	10.25	32.36	26.59	56.00	46.00	23.64	19.41	L1	PASS
5	3.0060	21.34	15.05	10.34	31.68	25.39	56.00	46.00	24.32	20.61	L1	PASS
6	7.8864	28.61	22.31	10.57	39.18	32.88	60.00	50.00	20.82	17.12	L1	PASS

Note:1. Result (dBµV) = Reading (dBµV) + Factor (dB).

2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

Power supply:	AC 120V/60Hz	Polarization	N

Test Graph



Final Data List

NO.	Frequency [MHz]	QP Reading [dBµV]	AVG. Reading [dBµV]	Factor [dB]	QP Result [dBµV]	AVG. Result [dBµV]	QP Limit [dBµV]	AVG. Limit [dBµV]	QP Margin [dB]	AVG. Margin [dB]	Line	Remark
1	0.1731	45.07	28.64	10.24	55.31	38.88	64.81	54.81	9.50	15.93	N	PASS
2	0.4637	33.76	20.98	10.23	43.99	31.21	56.63	46.63	12.64	15.42	N	PASS
3	0.6939	27.90	17.41	10.22	38.12	27.63	56.00	46.00	17.88	18.37	N	PASS
4	4.1217	26.97	13.95	10.36	37.33	24.31	56.00	46.00	18.67	21.69	N	PASS
5	4.3847	28.75	15.76	10.36	39.11	26.12	56.00	46.00	16.89	19.88	N	PASS
6	4.7609	29.16	16.27	10.35	39.51	26.62	56.00	46.00	16.49	19.38	N	PASS

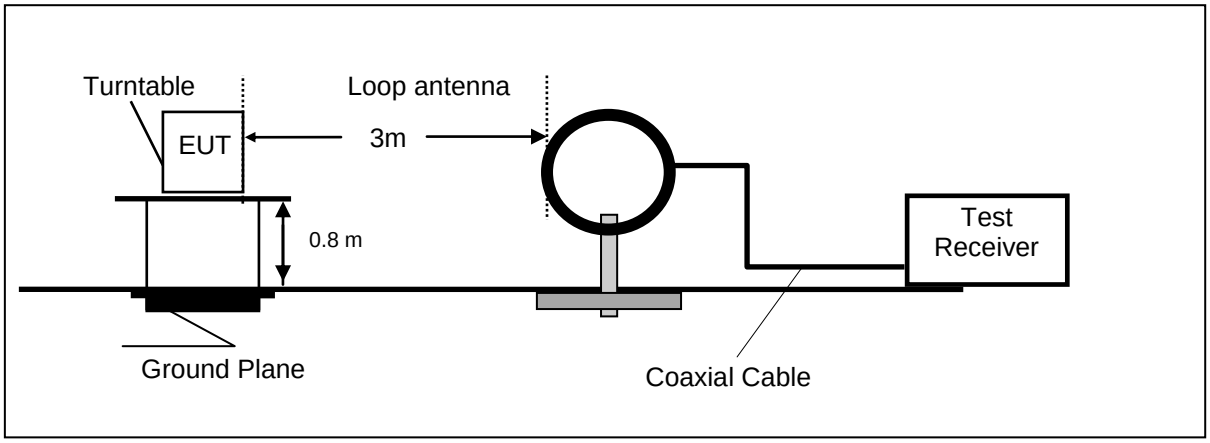
Note:1. Result (dBµV) = Reading (dBµV) + Factor (dB).

2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

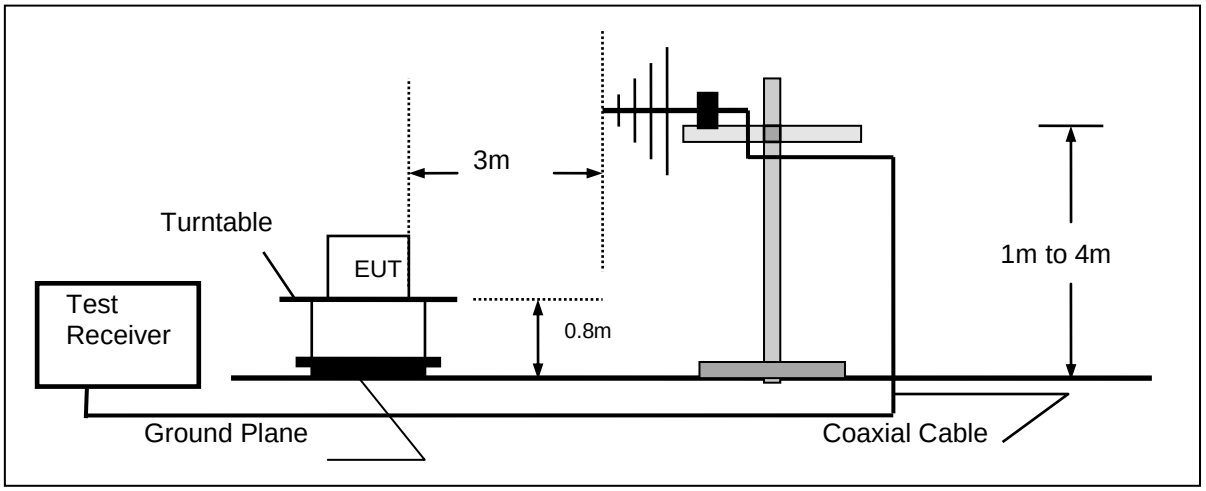
4.2. Radiated Emission

TEST CONFIGURATION

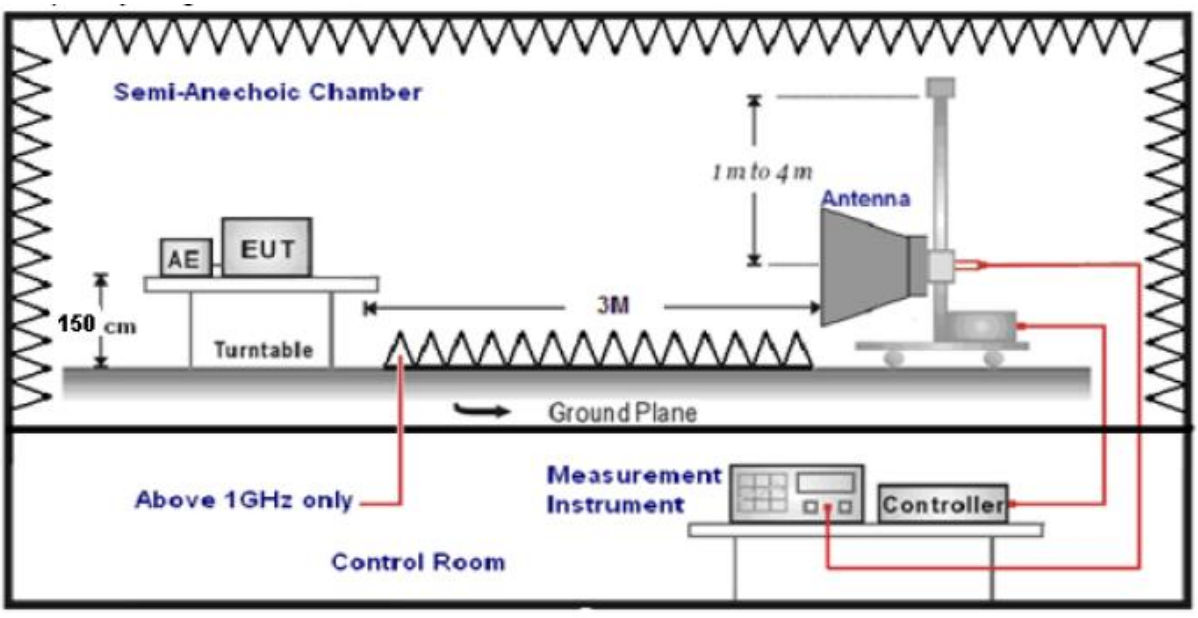
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.
The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

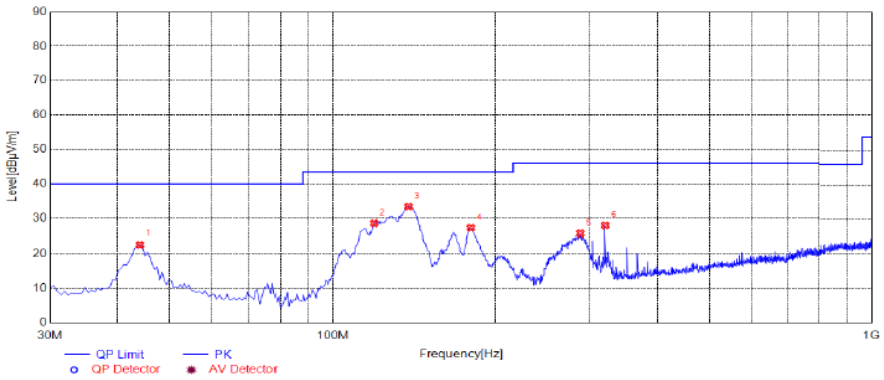
TEST RESULTS

Remark: We measured Radiated Emission at DSB-ASK mode from 30MHz to 25GHz and recorded worst case at DSB-ASK mode.

For 30MHz-1GHz

Horizontal

Test Graph



Suspected List

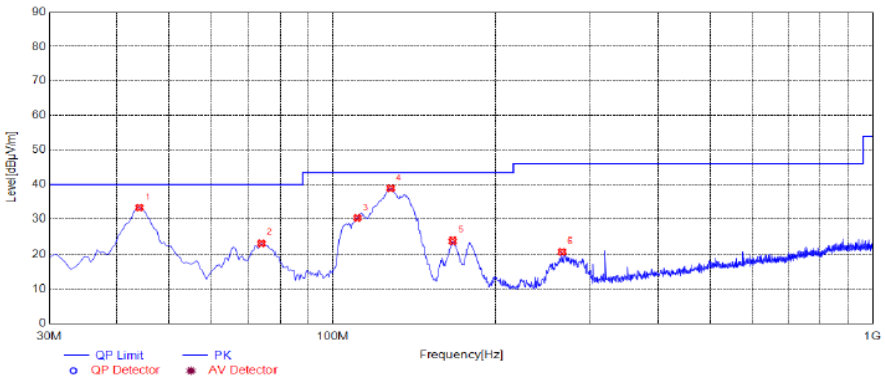
NO.	Frequency [MHz]	Reading [dBµV/m]	Factor [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	44.0720	37.66	-14.98	22.68	40.00	17.32	100	274	PK	Horizonta	PASS
2	119.2846	46.91	-18.31	28.60	43.50	14.90	100	358	PK	Horizonta	PASS
3	138.2091	53.82	-20.37	33.45	43.50	10.05	100	360	PK	Horizonta	PASS
4	180.4252	45.67	-18.40	27.27	43.50	16.23	100	338	PK	Horizonta	PASS
5	288.1491	40.11	-14.39	25.72	46.00	20.28	100	66	PK	Horizonta	PASS
6	320.1751	41.67	-13.68	27.99	46.00	18.01	100	46	PK	Horizonta	PASS

Note: 1. Result (dBµV/m) = Reading(dBµV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

Vertical

Test Graph



Suspected List

NO.	Frequency [MHz]	Reading [dBµV/m]	Factor [dB]	Result [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	44.0720	48.31	-14.98	33.33	40.00	6.67	100	274	PK	Vertical	PASS
2	74.1571	43.00	-19.73	23.27	40.00	16.73	100	294	PK	Vertical	PASS
3	111.0355	47.50	-17.17	30.33	43.50	13.17	100	36	PK	Vertical	PASS
4	128.0190	58.83	-19.88	38.95	43.50	4.55	100	15	PK	Vertical	PASS
5	166.8384	42.98	-19.09	23.89	43.50	19.61	100	52	PK	Vertical	PASS
6	265.8279	35.55	-14.68	20.87	46.00	25.13	100	161	PK	Vertical	PASS

Note: 1. Result (dBµV/m) = Reading(dBµV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

For 1GHz to 25GHz

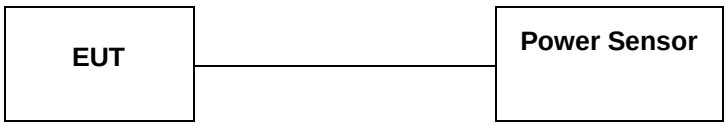
Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector Type	Comment
(MHz)	(dBμV)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		
TX-902.75									
1805.5	53.02	32.44	30.25	7.95	63.16	74.00	-10.84	Pk	Vertical
1805.5	38.77	32.44	30.25	7.95	48.91	54.00	-5.09	AV	Vertical
1805.5	52.24	32.44	30.25	7.95	62.38	74.00	-11.62	Pk	Horizontal
1805.5	35.06	32.44	30.25	7.95	45.20	54.00	-8.80	AV	Horizontal
TX-914.75									
1829.5	49.68	32.52	30.31	8.12	60.01	74.00	-13.99	Pk	Vertical
1829.5	36.47	32.52	30.31	8.12	46.80	54.00	-7.20	AV	Vertical
1829.5	52.28	32.52	30.31	8.12	62.61	74.00	-11.39	Pk	Horizontal
1829.5	36.43	32.52	30.31	8.12	46.76	54.00	-7.24	AV	Horizontal
TX-927.25									
1854.5	51.06	32.68	30.27	7.88	61.35	74.00	-12.65	Pk	Vertical
1854.5	36.57	32.68	30.27	7.88	46.86	54.00	-7.14	AV	Vertical
1854.5	50.24	32.68	30.27	7.88	60.53	74.00	-13.47	Pk	Horizontal
1854.5	39.33	32.68	30.27	7.88	49.62	54.00	-4.38	AV	Horizontal

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:
The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.
The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

LIMIT

According to §15.247(b)(2),For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

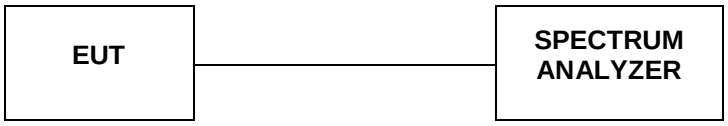
TEST RESULTS

Modulation	Channel	Peak Output power (dBm)	Average Output power (dBm)	Limit (dBm)	Result
DSB-ASK	01	26.91	23.41	28.0	Pass
	25	26.81	23.37		
	50	27.15	23.65		

Note: The test results including the cable lose.

4.4. 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

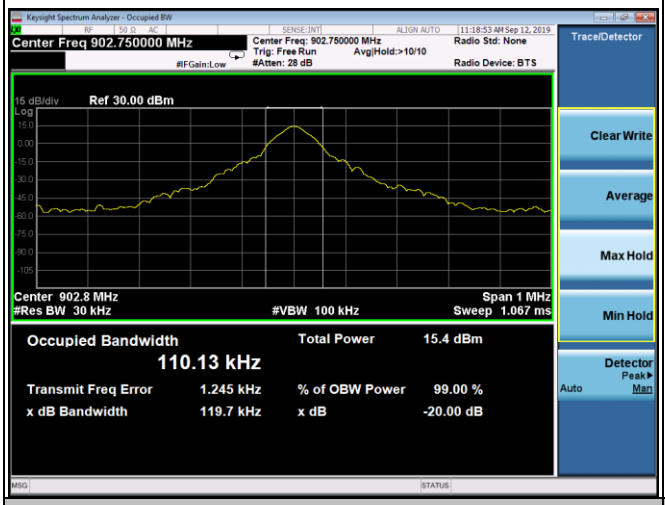
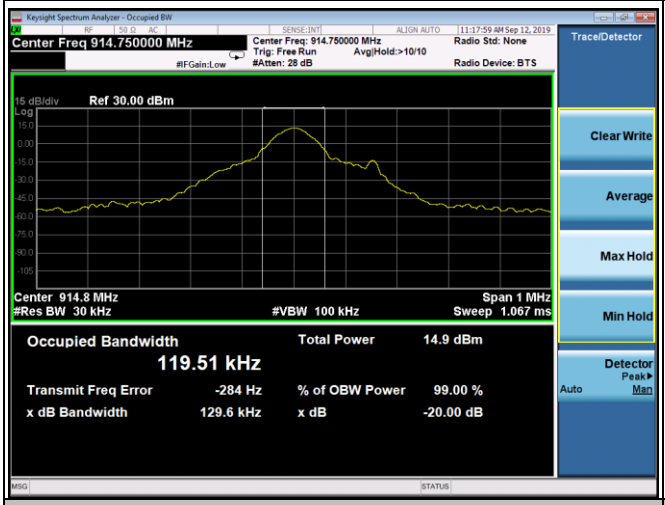
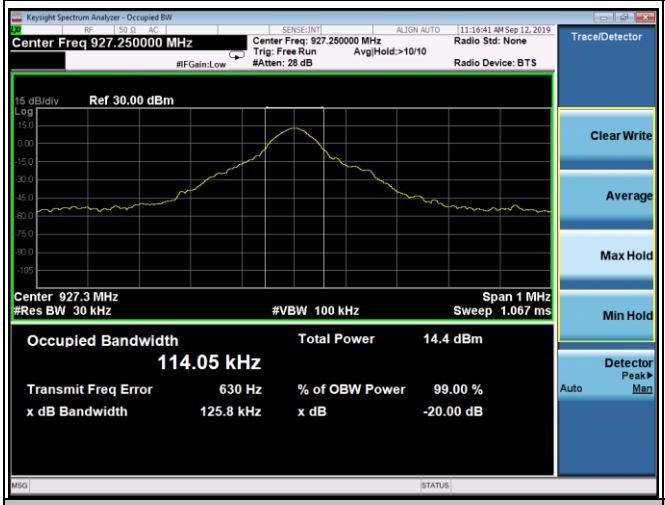
LIMIT

According to §15.247(i),For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

TEST RESULTS

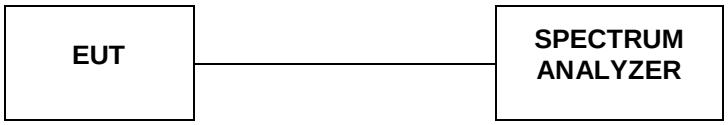
Modulation	Channel	20dB Bandwidth (MHz)	Result
DSB-ASK	01	0.1197	PASS
	25	0.1296	PASS
	50	0.1258	PASS

Test plot as follows:

DSB-ASK	
	
Channel 01	
	
Channel 25	
	
Channel 50	

4.5. Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.

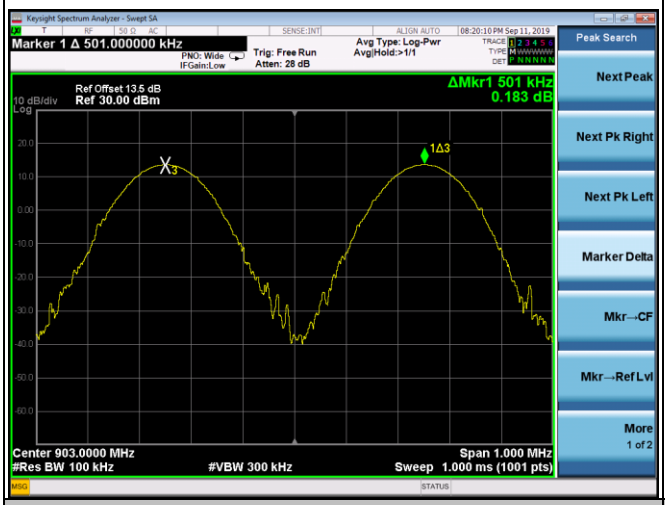
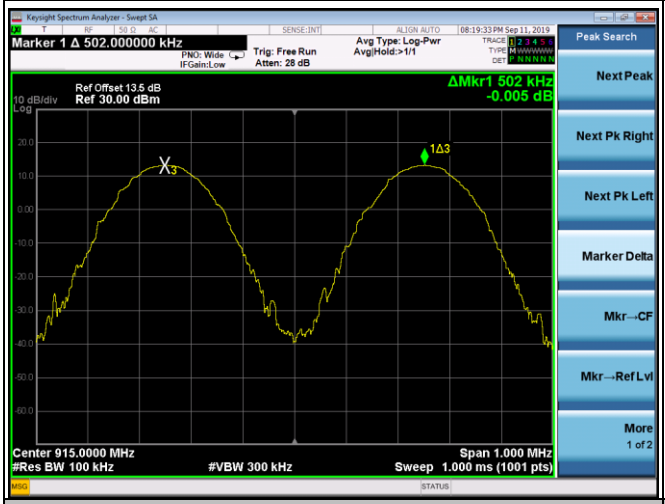
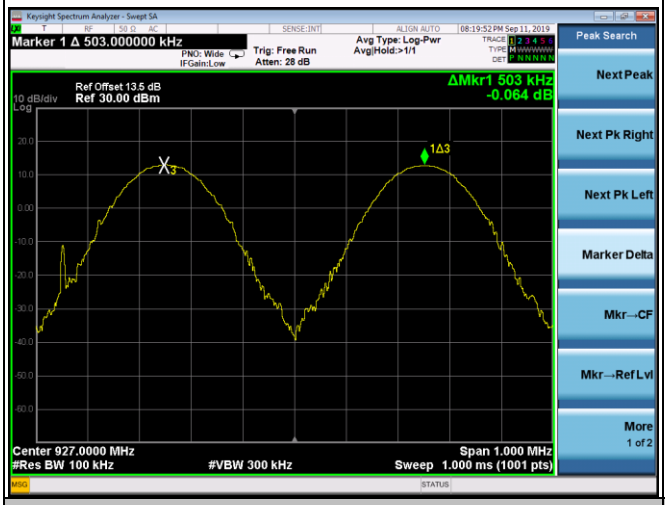
LIMIT

According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

TEST RESULTS

Modulation	Channel	Ch. Separation (MHz)	Limit (MHz)	Result
DSB-ASK	01	0.501	>=0.0798	Complies
	25	0.502	>=0.0864	Complies
	50	0.503	>=0.0839	Complies

Ch. Separation Limits: > 2/3 of 20dB bandwidth

DSB-ASK	
	
Channel 01	
	
Channel 25	
	
Channel 50	

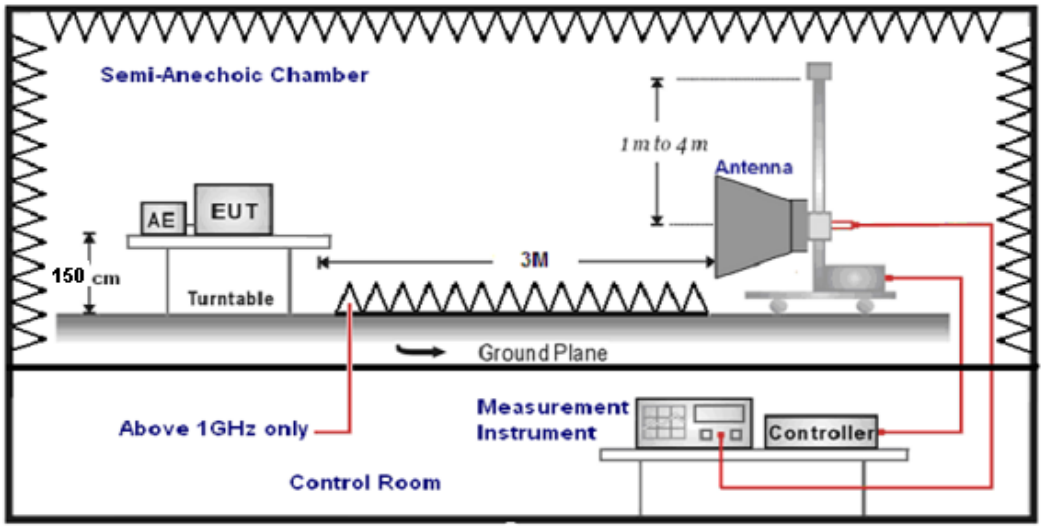
4.6. Band Edge Compliance of RF Emission

TEST REQUIREMENT

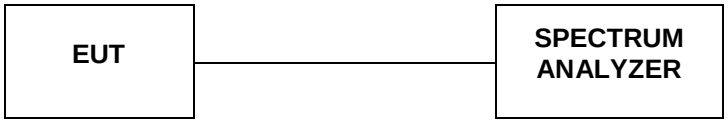
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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)).

TEST CONFIGURATION

For Radiated



For Conducted



TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

LIMIT

Below -20dB of the highest emission level in operating band.
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)

TEST RESULTS

Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1.

4.6.1 For Radiated Bandedge Measurement

Remark: we tested radiated bandedge at both hopping and no-hopping modes,recorded worst case at no-hopping mode

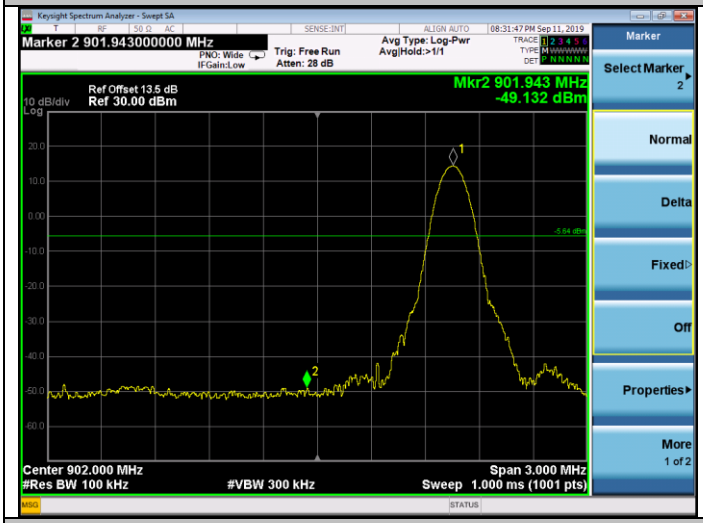
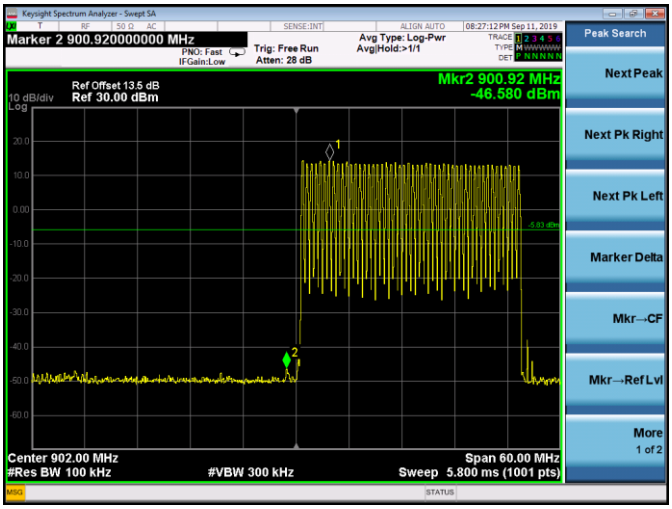
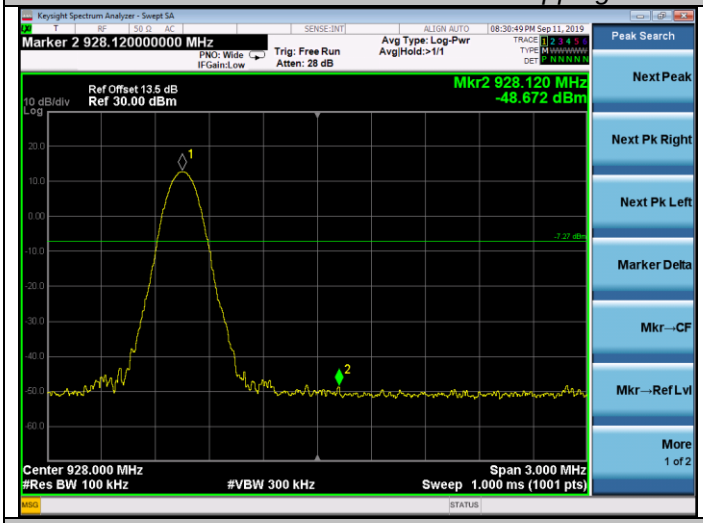
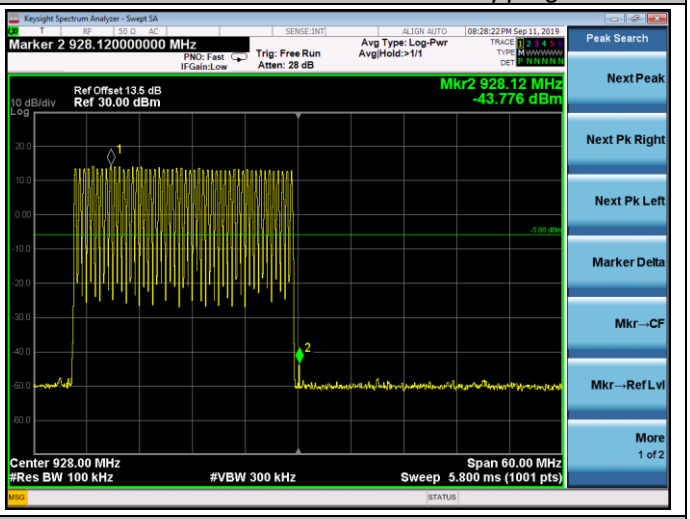
DSB-ASK

Frequency(MHz):			**902.75**			**Polarity:**			**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
902.00	45.58	PK	74	-28.42	1	228	50.89	27.49	3.32	36.12	-5.31
902.00	33.75	AV	54	-20.25	1	228	39.06	27.49	3.32	36.12	-5.31
Frequency(MHz):			**902.75**			**Polarity:**			**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
902.00	45.98	PK	74	-28.02	1	132	51.29	27.49	3.32	36.12	-5.31
902.00	35.34	AV	54	-18.66	1	132	40.65	27.49	3.32	36.12	-5.31
Frequency(MHz):			**927.25**			**Polarity:**			**HORIZONTAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
928.00	49.00	PK	74	-25.00	1	145	54.72	27.45	3.38	36.55	-5.72
928.00	36.73	AV	54	-17.27	1	145	42.45	27.45	3.38	36.55	-5.72
Frequency(MHz):			**927.25**			**Polarity:**			**VERTICAL**		
Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier	Correction Factor (dB/m)
928.00	49.75	PK	74	-24.25	1	297	55.47	27.45	3.38	36.55	-5.72
928.00	36.02	AV	54	-17.98	1	297	41.74	27.45	3.38	36.55	-5.72

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

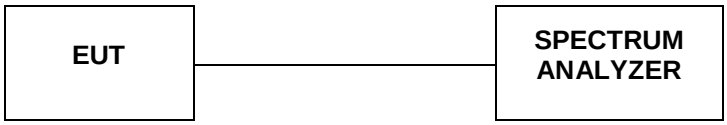
4.6.2 For Conducted Bandedge Measurement

Band-edge for RF conducted emissions	
DSB-ASK	
	
Channel 01 / 902.75MHz – Non-Hopping	*Channel 01 / 902.75MHz – Hopping*
	
Channel 50 / 927.25 MHz – Non-Hopping	*Channel 50 / 927.25 MHz – Hopping*

NOTE: Hopping enabled and disabled have evaluated, and the worst data was reported.

4.7. Number of hopping frequency

TEST CONFIGURATION



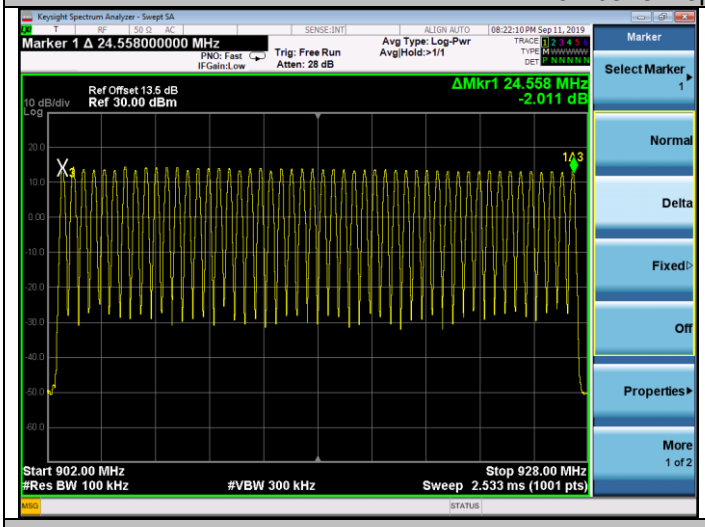
TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 902MHz to 928MHz with RBW=1MHz and VBW=3MHz.

LIMIT

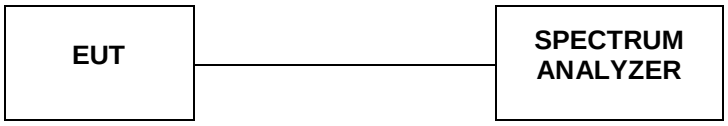
According to §15.247(b)(2), For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Modulation	Number of Hopping Channel	Limit	Result
DSB-ASK	50	≥50	Pass

Number of hopping frequency	
	
DSB-ASK	

4.8. Time Of Occupancy(Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

LIMIT

According to §15.247(a)(1)(i),For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

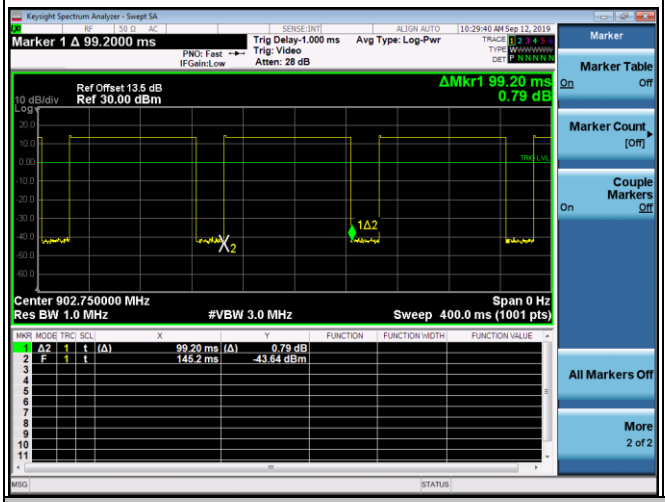
TEST RESULTS

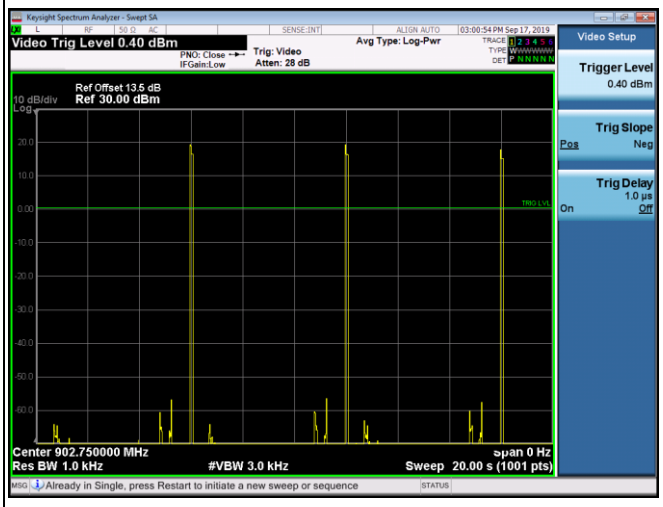
Modulation	Channel	Frequency	Pulse Duration	Dwell Time	Limits
			(ms)	(s)	(s)
DSB-ASK	01	902.75 MHz	99.20	0.30	0.4
	25	914.75 MHz	98.80	0.30	0.4
	50	927.25 MHz	98.80	0.30	0.4

Remark:

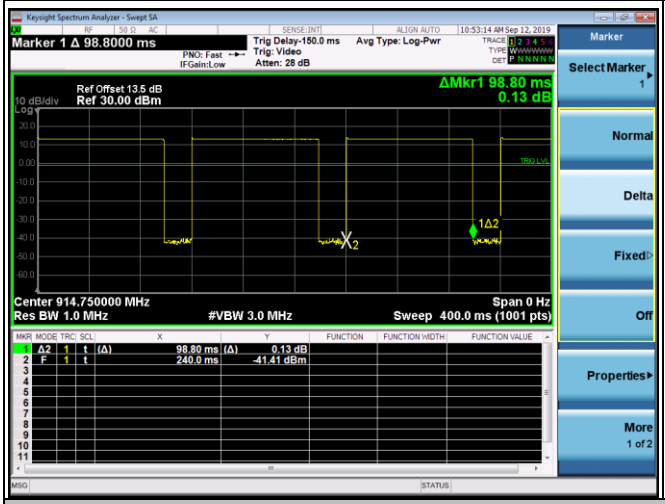
1. *The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:*
2. *Test results including cable loss;*
3. *please refer to following plots;*
4. *Measured at difference Packet Type for each mode and recorded woest case for each mode.*
5. *Dwell Time Calculate formula:*
   Dwell time=Pulse time (ms) ×20 second pulse count
6. *Measured at low, middle and high channel, recorded worst at middle channel;*

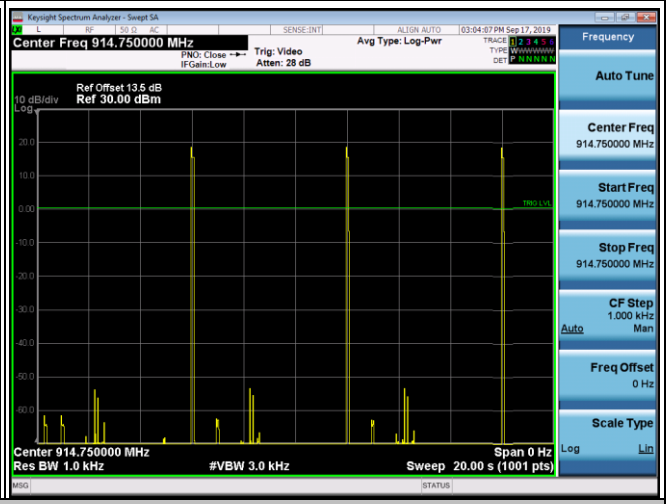
DSB-ASK



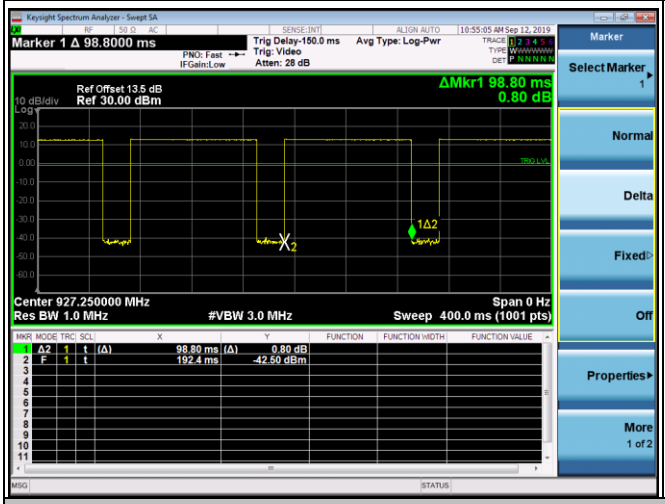


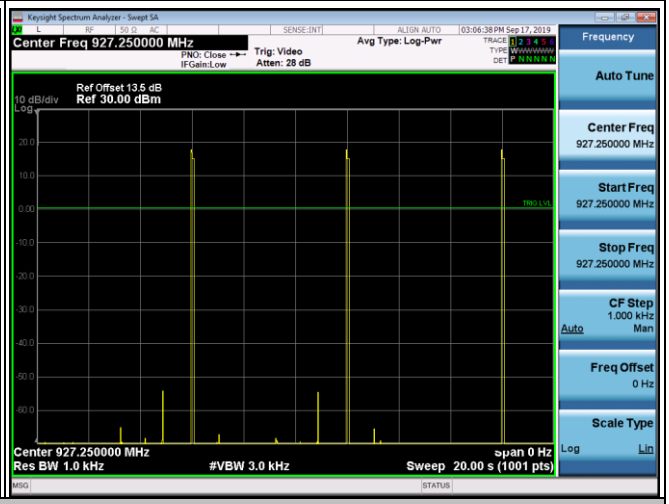
Channel 01





Channel 25





Channel 50

4.9. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

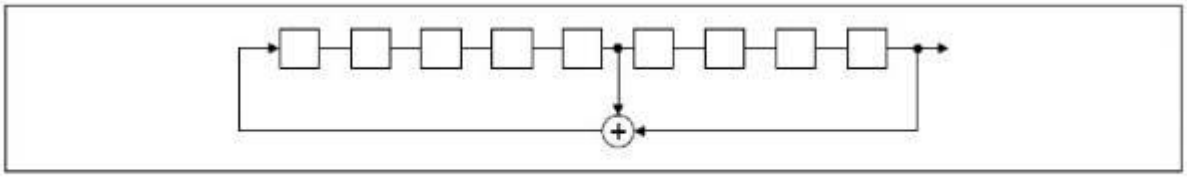
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

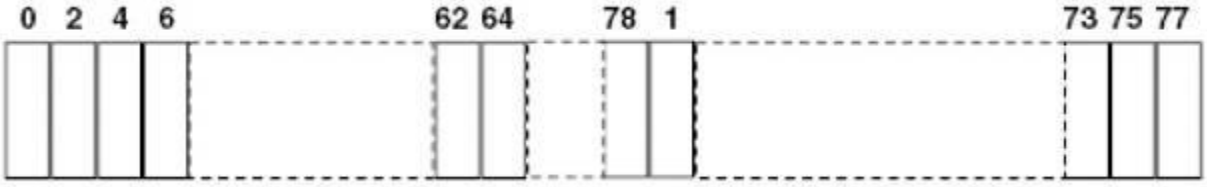
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the 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 explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.10. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, 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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Test Result

The antenna used for this product is External Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 8.0dBi.

5. Test Setup Photos of the EUT

Radiated Emission Test

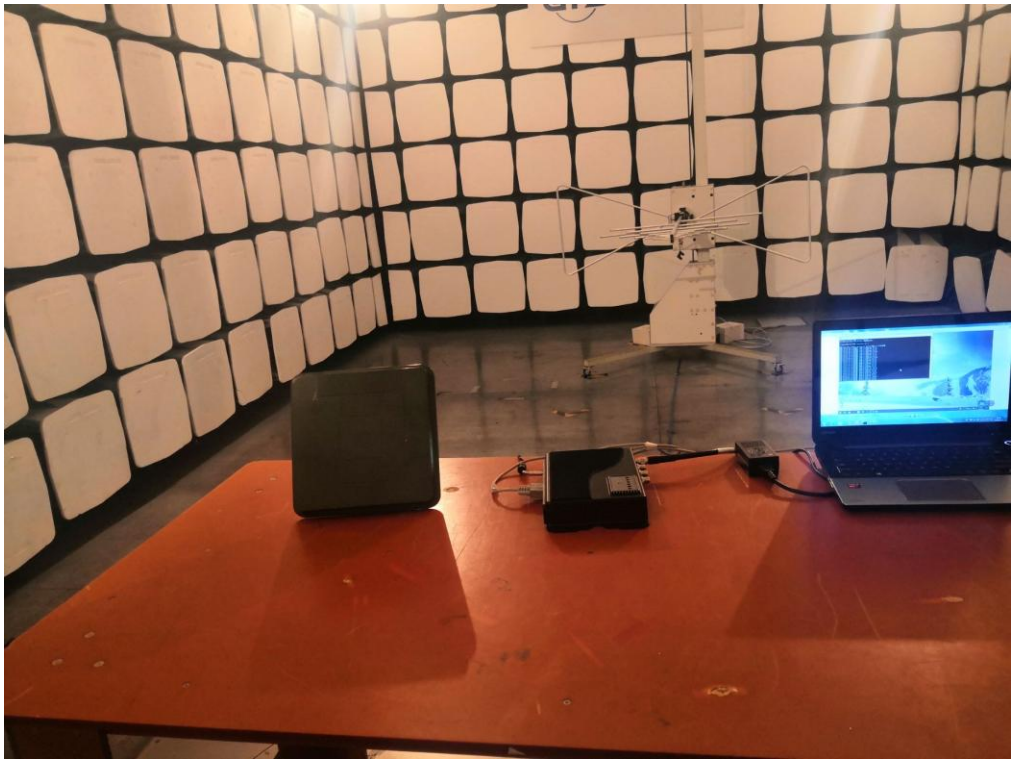


Fig.1

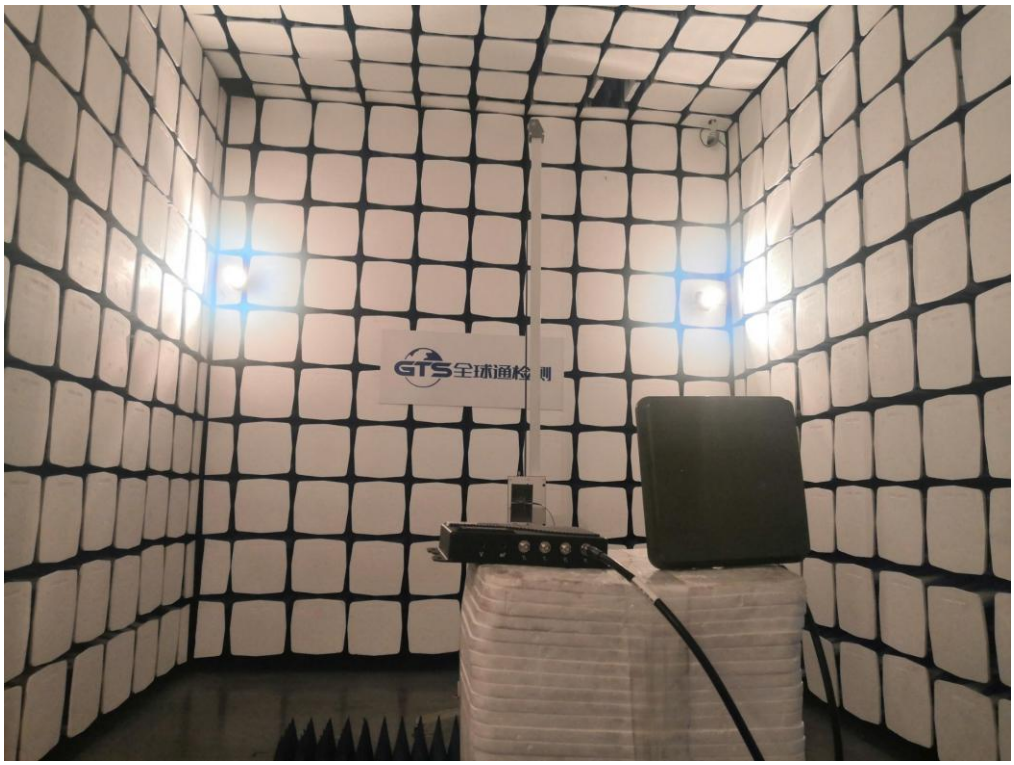


Fig.2

Conducted Emission

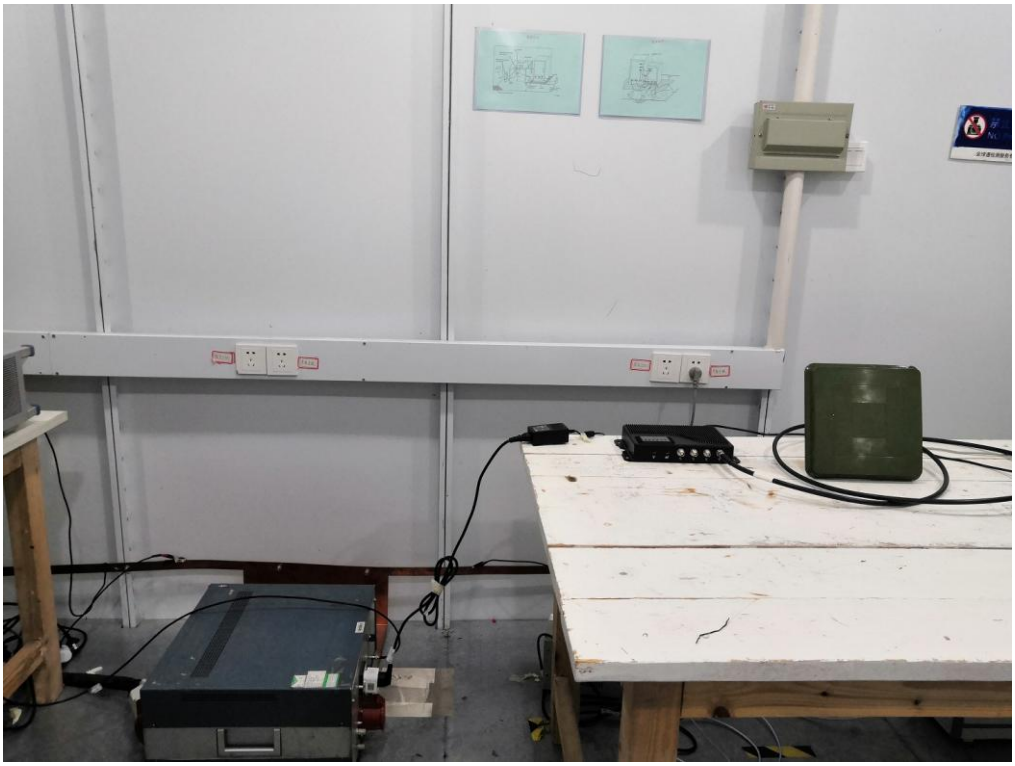


Fig.3

6. External and Internal Photos of the EUT

Reference to the test report No. **External and Internal photos**

.....End of Report.....