TEST REPORT

FCC ID: 2AEIGKNNS0005

Applicant : Firelands Group, LLC
Address : 1214 Dorchester Dr, 2919 Crossing Court,Suite 2, Champaign, IL 61822

Equipment Under Test (EUT):

Name	:	Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter
Model	:	KNNS0005

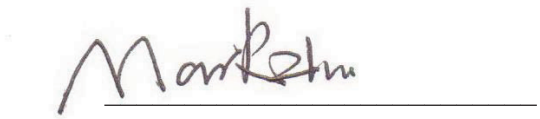
In Accordance with: FCC PART 15, SUBPART C : 2014 (Section 15.247)

Report No : A1850210 01
Date of Test : March 26 to April 09, 2015
Date of Issue : April 09, 2015

Test Result: **PASS**

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

Authorized Signature



(Mark Zhu)
General Manager

Contents

1. General Information

1.1. Description of Device (EUT)

EUT	:	Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter
Model No.	:	KNNS0005
DIFF.	:	N/A
Trade mark	:	N/A
Power supply	:	DC 6V from battery, 4*1.5V AA battery
Radio Technology	:	2.4G ISM Band
Operation frequency	:	2405-2478MHz
Modulation	:	FHSS(FSK)
Antenna Type	:	Integrated Antenna, max gain 2.5dBi.
Applicant	:	Firelands Group, LLC
Address	:	1214 Dorchester Dr, 2919 Crossing Court,Suite 2, Champaign, IL 61822
Manufacturer		KATUMFEI INDUSTRY LIMITED(HK)
Address		FuCheng Industrial Town,Hong Tian,ShaJing,ShenZhen

1.2. Accessories of device (EUT)

Accessories	:	N/A
Model		N/A
Input		N/A
Output		N/A
Accessories2	:	N/A
Model		N/A

1.3. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd
Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road,
Bao'an, Shenzhen, China

August 11, 2014 File on Federal Communication Commission
Registration Number: 203110

July 18, 2014 Certificated by IC
Registration Number: 12135A

2. Summary of test

2.1. Summary of test result

Description of Test Item	Standard	Results
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1) ANSI C63.4 :2009	PASS
Bandwidth	FCC Part 15: 15.215 ANSI C63.4 :2009	PASS
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1) ANSI C63.4 :2009	PASS
Number Of Hopping Channel	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.4 :2009	PASS
Dwell Time	FCC Part 15: 15.247(a)(1)(iii) ANSI C63.4 :2009	PASS
Radiated Emission	FCC Part 15: 15.209 FCC Part 15: 15.247(d) ANSI C63.4 :2009	PASS
Band Edge Compliance	FCC Part 15: 15.247(d) ANSI C63.4 :2009	PASS
Power Line Conducted Emissions	FCC Part 15: 15.207 ANSI C63.4 :2009	N/A
Antenna requirement	FCC Part 15: 15.203	PASS

2.2. Assistant equipment used for test

Description	:	N/A
Manufacturer	:	N/A
Model No.	:	N/A

2.3. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 meter high above ground. EUT was set into test mode before test.

2.4. Test mode

NEW BATTERY IS USED DURING ALL TEST

EUT work in Continuous TX mode, and select test channel, wireless mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
FHSS(FSK)	Low :CH1	2405
	Middle: CH37	2441
	High: CH74	2478

Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2405	37	2441
2	2406	…	…
3	2407	71	2475
4	2408	72	2476
…	…	73	2477
36	2440	74	2478

2.5. Test Conditions

Temperature range	21-25℃
Humidity range	40-75%
Pressure range	86-106kPa

2.6. Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB	Polarize: V
	2.57dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V
Uncertainty for radio frequency	1×10-9	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2℃	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

2.7. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Last Cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2015.01.19	1Year
Spectrum analyzer	Agilent	E4407B	MY49510055	2015.01.19	1Year
Receiver	R&S	ESCI	101165	2015.01.19	1Year
Bilog Antenna	SCHWARZBECK	VULB 9168	9168-438	2014.01.21	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D(1201)	2014.01.21	2Year
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170 D(1432)	2014.01.21	2Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2015.01.19	1Year
Cable	Resenberger	SUCOFLEX 104	MY6562/4	2015.01.19	1Year
Cable	Resenberger	SUCOFLEX 104	309972/4	2015.01.19	1Year
Cable	Resenberger	SUCOFLEX 104	329112/4	2015.01.19	1Year
Power Meter	Anritsu	ML2487A	6K00001491	2015.01.19	1Year
Power sensor	Anritsu	ML2491A	32516	2015.01.19	1Year
Pre-amplifier	SCHWARZBECK	BBV9743	9743-019	2015.01.19	1Year
Pre-amplifier	Quietek	AP-180C	CHM-0602012	2015.01.19	1Year

3. Maximum Peak Output power

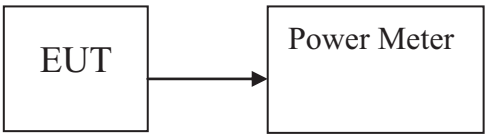
3.1. Limit

Please refer section15.247.
For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W

3.2. Test Procedure

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.

3.3. Test Setup



3.4. Test Result

EUT: Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter				M/N: KNNS0005	
Test date: 2015-04-03		Test site: RF site	Tested by: Peter		
Mode	Freq (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)	Margin (dB)
FHSS(FSK)	2405	14.640	29.11	21	6.36
	2441	15.947	39.33	21	5.053
	2478	15.145	32.70	21	5.855
Conclusion: PASS					

4. Bandwidth

4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.2. Test Procedure

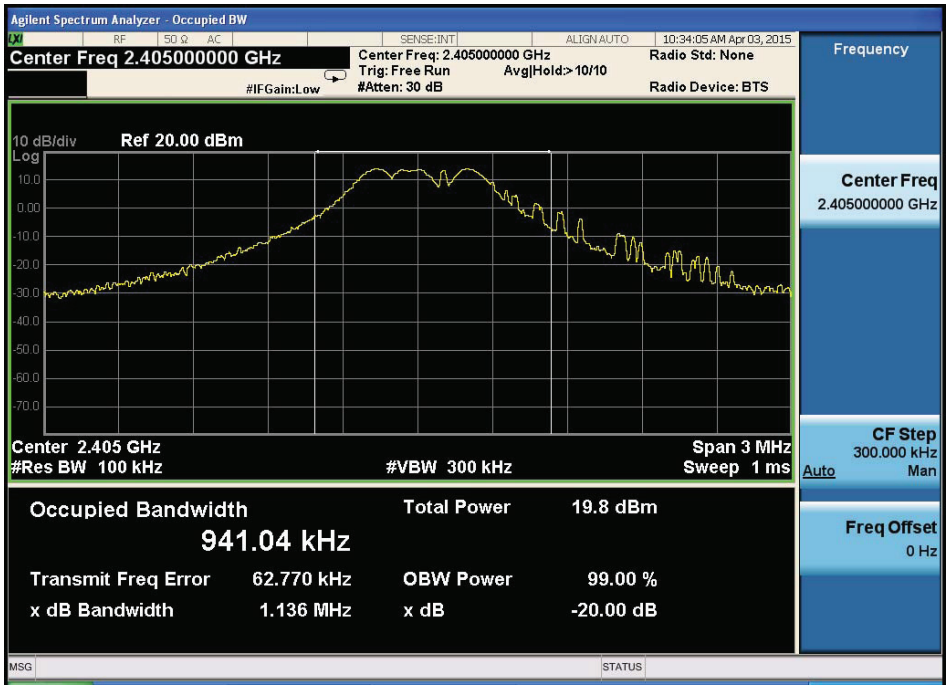
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 30kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

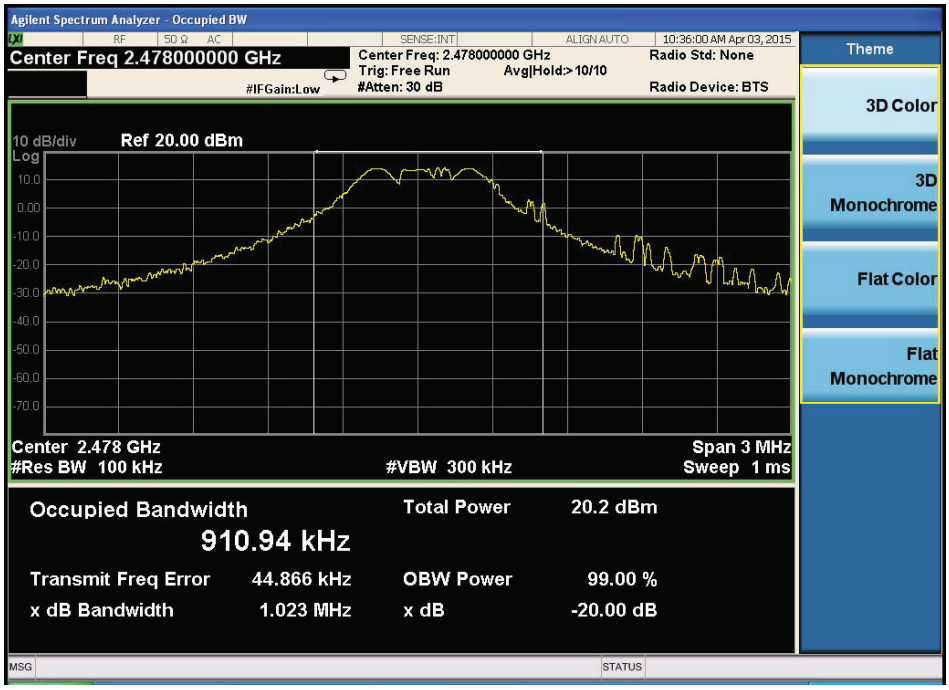
4.3. Test Result

EUT: Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter M/N: KNNS0005				
Test date: 2015-04-03		Test site: RF site	Tested by: Peter	
Mode	Freq (MHz)	20dB Bandwidth (MHz)	Limit (kHz)	Conclusion
FHSS(FSK)	2405	1.136	/	PASS
	2441	1.205	/	PASS
	2478	1.023	/	PASS

Orginal Test data For 20dB bandwidth

FHSS(FSK):




Agilent Spectrum Analyzer - Occupied BW
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:36:00 AM Apr 03, 2015
Center Freq 2.478000000 GHz
Center Freq: 2.478000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.478 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
910.94 kHz
Total Power
20.2 dBm
Transmit Freq Error
44.866 kHz
OBW Power
99.00 %
x dB Bandwidth
1.023 MHz
x dB
-20.00 dB
MSG
STATUS
Theme
3D Color
3D Monochrome
Flat Color
Flat Monochrome

5. Carrier Frequency Separation

5.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW

5.2. Test Procedure

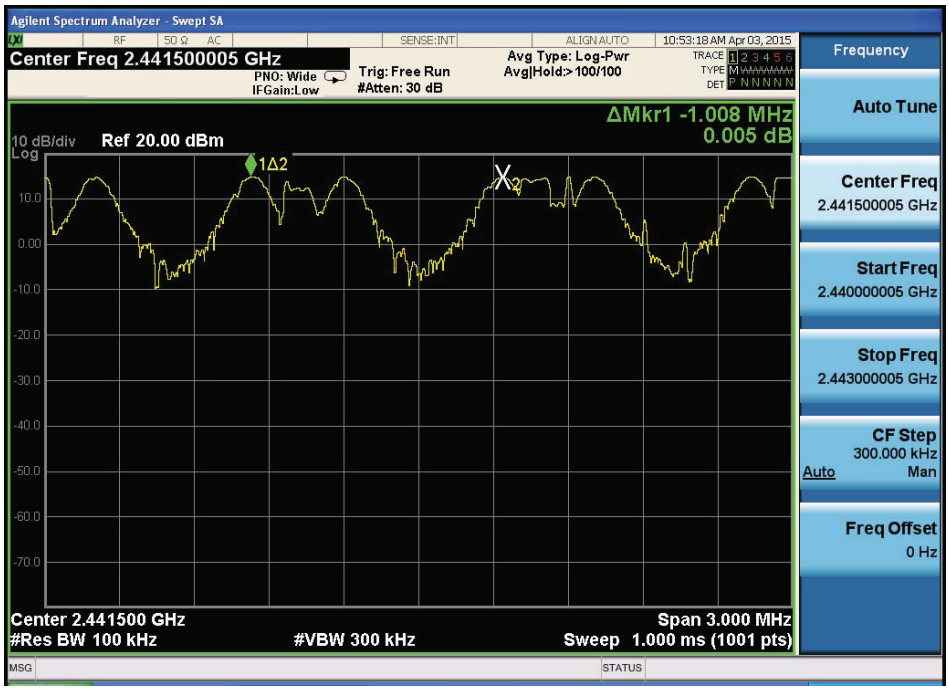
The transmitter output was coupled to a spectrum analyzer via a antenna. The carrier frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW.

5.3. Test Result

EUT: Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter M/N: KNNS0005				
Test date: 2015-04-03		Test site: RF site	Tested by: Simple	
Mode/Channel	Channel separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz) 2/3 20dB bandwidth	Conclusion
FHSS(FSK)	1.008	1.205	0.803	PASS

Orginal test data for channel separation

FHSS(FSK)



6. Number Of Hopping Channel

6.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels

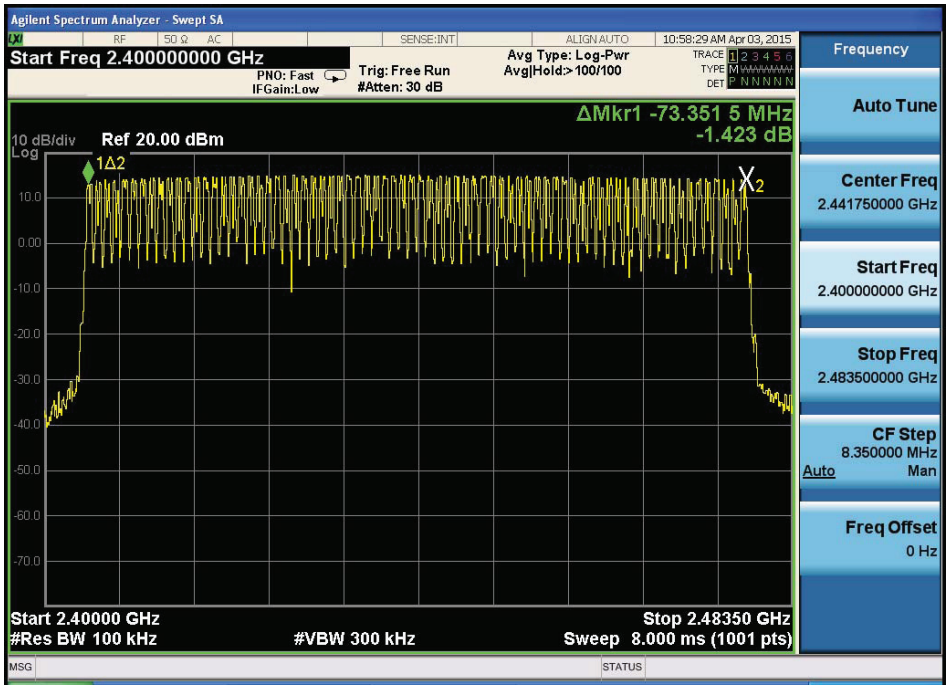
6.2. Test Procedure

The transmitter output was coupled to a spectrum analyzer via a antenna. The number of hopping channel was measured by spectrum analyzer with 100kHz RBW and 300KHz VBW.

6.3. Test Result

EUT: Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter M/N: KNNS0005			
Test date: 2015-04-03	Test site: RF site	Tested by: Peter	
Mode	Number of hopping channel	Limit	Conclusion
FHSS(FSK)	74	>15	PASS

Original test data for hopping channel number
FHSS(FSK)



7. Dwell Time

7.1. Test limit

Please refer section15.247

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 sec- onds multiplied by the number of hopping channel employed.

7.2. Test Procedure

7.2.1. Place the EUT on the table and set it in transmitting mode.

7.2.2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

7.2.3. Set center frequency of spectrum analyzer = operating frequency.

7.2.4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.

7.2.5. Repeat above procedures until all frequency measured were complete.

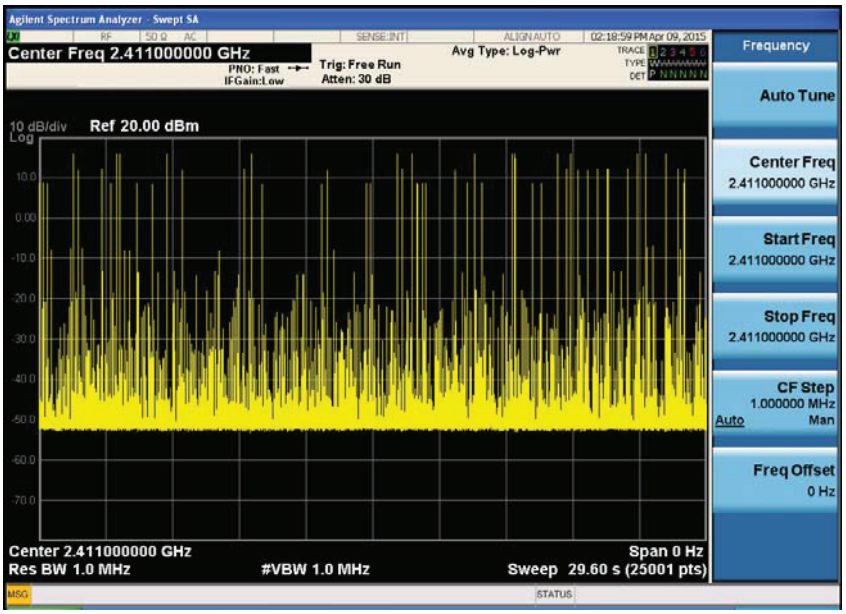
7.3. Test Results

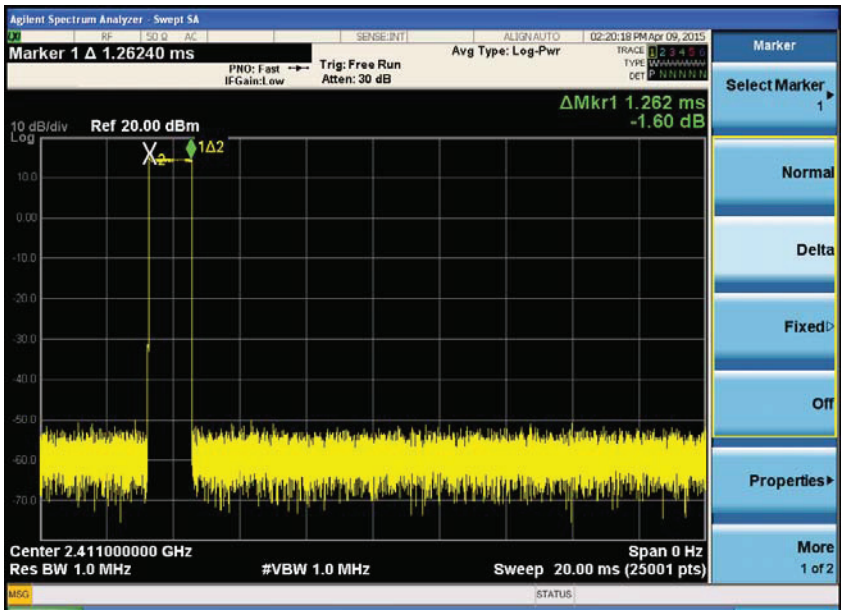
PASS.

Detailed information please see the following page.

EUT: Ikonnik HRS3.2 3Ch 2.4GHz Xenon (Xe) Transmitter M/N: KNNS0005					
Test date: 2015-04-09	Test site: RF site Tested by: Peter				
Mode	Frequency (MHz)	Total Pulse Duration (ms)	Total Dwell Time (ms)	Limit (s)	Conclusion
FHSS(FSK)	2441	51*1.262=64.362	64.362	<0.4	PASS
Note1: A period time = 0.4 (s) * 74 = 29.6(s)					

FHSS(FSK)





8. Radiated emissions

8.1. Limit

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

15.205 Restricted frequency band

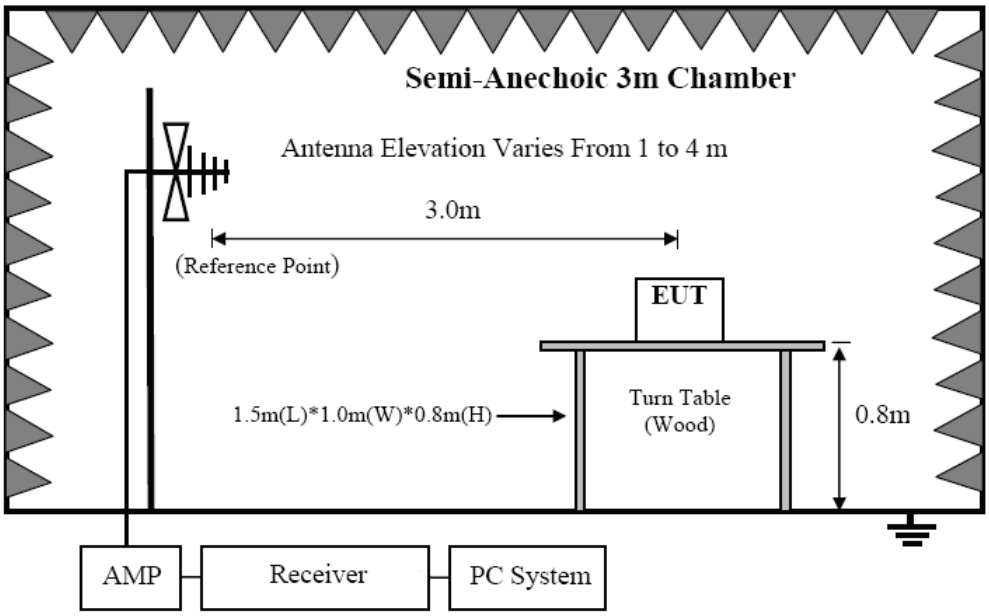
MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

15.209 Limit

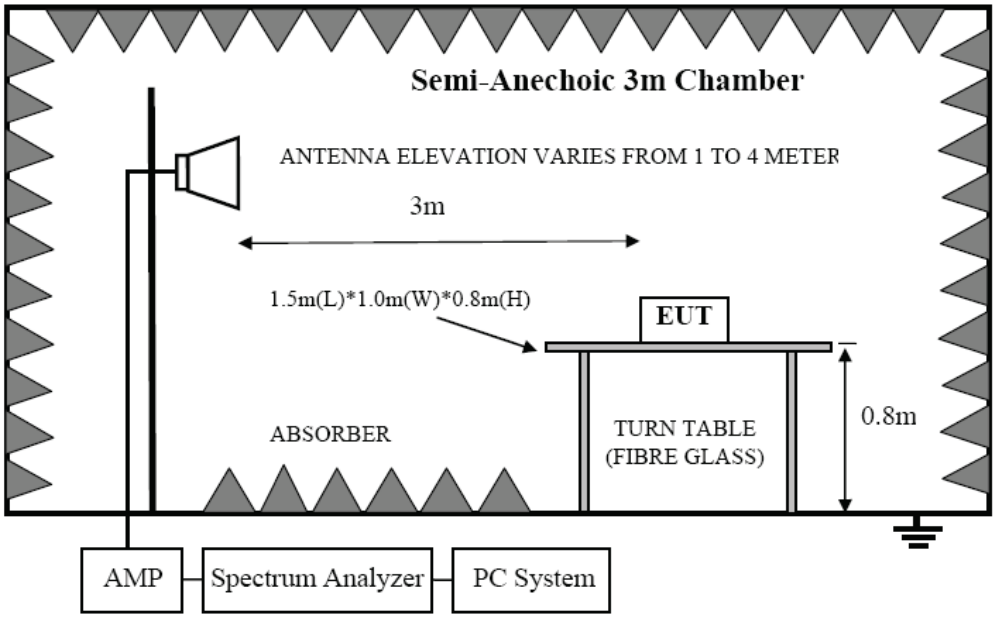
FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
0.009-0.490	300	2400/F(KHz)	/
0.490-1.705	30	24000/F(KHz)	/
1.705-30	30	30	29.5
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

8.2. Block Diagram of Test setup

8.2.1 In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



8.2.2 In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

8.3. Test Procedure

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.