FCC TEST REPORT

Product	:	Control Fob
Trade mark	:	Ring
Model/Type reference	:	RSURC
Serial Number	:	N/A
Report Number	:	EED32L00265101
FCC ID	:	2AUOBRSURC
Date of Issue	:	Jan. 14, 2020
Test Standards	:	47 CFR Part 15 Subpart C
Test result	:	PASS

Prepared for:

Ring Automotive
GelderdRoad, Leeds, LS12 6NA, UK.

Prepared by:

Centre Testing International Group Co., Ltd.
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Compiled by:	Sunlight Sun	Reviewed by:	Ware Xin
Approved by:	San Chuang	Date:	Jan. 14, 2020

Check No.:3915681977

2 Version

Version No.	Date	Description
00	Jan. 14, 2020	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	PASS
Field Strength of the Fundamental Signal	47 CFR Part 15 Subpart C Section 15.249 (a)	ANSI C63.10-2013	PASS
Spurious Emissions	47 CFR Part 15 Subpart C Section 15.249 (a)/15.209	ANSI C63.10-2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15 Subpart C Section 15.249(a)/15.205	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.215 (c)	ANSI C63.10-2013	PASS

Remark:
The tested sample(s) and the sample information are provided by the client.

4 Contents

Page

.....1

2 VERSION.....2

3 TEST SUMMARY.....3

4 CONTENTS.....4

5 GENERAL INFORMATION.....5

5.1 CLIENT INFORMATION.....5
5.2 GENERAL DESCRIPTION OF EUT.....5
5.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD.....6
5.4 TEST ENVIRONMENT AND MODE.....7
5.5 DESCRIPTION OF SUPPORT UNITS.....7
5.6 TEST LOCATION.....7
5.7 DEVIATION FROM STANDARDS.....7
5.8 ABNORMALITIES FROM STANDARD CONDITIONS.....7
5.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER.....7
5.10 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2).....7

6 EQUIPMENT LIST.....8

7 TEST RESULTS AND MEASUREMENT DATA.....12

7.1 ANTENNA REQUIREMENT.....12
7.2 CONDUCTED EMISSIONS.....13
7.3 RADIATED SPURIOUS EMISSIONS.....16
7.4 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY.....22
7.5 20DB BANDWIDTH.....32

APPENDIX 1 PHOTOGRAPHS OF TEST SETUP.....36

APPENDIX 2 PHOTOGRAPHS OF EUT.....39

5 General Information

5.1 Client Information

Applicant:	Ring Automotive
Address of Applicant:	GelderdRoad, Leeds, LS12 6NA, UK.
Manufacturer:	Zhejiang Leiya Electronics Co., Ltd.
Address of Manufacturer:	No.519,Fifteen Road, Binhai Park, Econ and Technological Development Zone, Wenzhou City, P.R. China
Factory:	Zhejiang Leiya Electronics Co., Ltd.
Address of Factory:	No.519,Fifteen Road, Binhai Park, Econ and Technological Development Zone, Wenzhou City, P.R. China

5.2 General Description of EUT

Product Name:	Control Fob
Model No.(EUT):	RSURC
Trade Mark:	Ring
EUT Supports Radios application:	2401MHz to 2479MHz
Power Supply:	DC12V

5.3 Product Specification subjective to this standard

Frequency Range:	2401MHz~2479MHz
Modulation Type:	GFSK
Test Power Grade:	Defualt
Test Software of EUT:	Defualt
Antenna Type:	PCB antenna;
Antenna Gain:	-5 dBi
Test voltage:	DC12V
Sample Received Date:	Sep. 17, 2019
Sample tested Date:	Sep. 17, 2019 to Nov. 12, 2019

Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency
1CH	2401 MHz	14CH	2440 MHz	27CH	2476 MHz
2CH	2404 MHz	15CH	2443 MHz	28CH	2479 MHz
3CH	2407 MHz	16CH	2446 MHz		
4CH	2410 MHz	17CH	2449 MHz		
5CH	2413 MHz	18CH	2452 MHz		
6CH	2416 MHz	19CH	2453 MHz		
7CH	2419 MHz	20CH	2456MHz		
8CH	2422 MHz	21CH	2459 MHz		
9CH	2425 MHz	22CH	2462 MHz		
10CH	2428 MHz	23CH	2465 MHz		
11CH	2431 MHz	24CH	2467 MHz		
12CH	2434 MHz	25CH	2470 MHz		
13CH	2437 MHz	26CH	2473 MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH1)	2401MHz
The Middle channel(CH14)	2440MHz
The Highest channel(CH28)	2479MHz

5.4 Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	52 % RH
Atmospheric Pressure:	1010mbar
Test mode:	
Transmitting mode:	Keep the EUT in transmitting mode with modulation.

5.5 Description of Support Units

The EUT has been tested independently

5.6 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd
Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China
Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385
No tests were sub-contracted.
FCC Designation No.: CN1164

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Other Information Requested by the Customer

None.

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

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

6 Equipment List

RF test system					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Signal Generator	Keysight	E8257D	MY53401106	03-01-2019	02-29-2020
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-01-2019	02-29-2020
Signal Generator	Keysight	N5182B	MY53051549	03-01-2019	02-29-2020
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
DC Power	Keysight	E3642A	MY54426035	03-01-2019	02-29-2020
PC-1	Lenovo	R4960d	---	03-01-2019	02-29-2020
BT&WI-FI Automatic control	R&S	OSP120	101374	03-01-2019	02-29-2020
RF control unit	JS Tonscend	JS0806-2	15860006	03-01-2019	02-29-2020
RF control unit	JS Tonscend	JS0806-1	15860004	03-01-2019	02-29-2020
RF control unit	JS Tonscend	JS0806-4	158060007	03-01-2019	02-29-2020
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	03-01-2019	02-29-2020
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	07-26-2019	07-25-2020

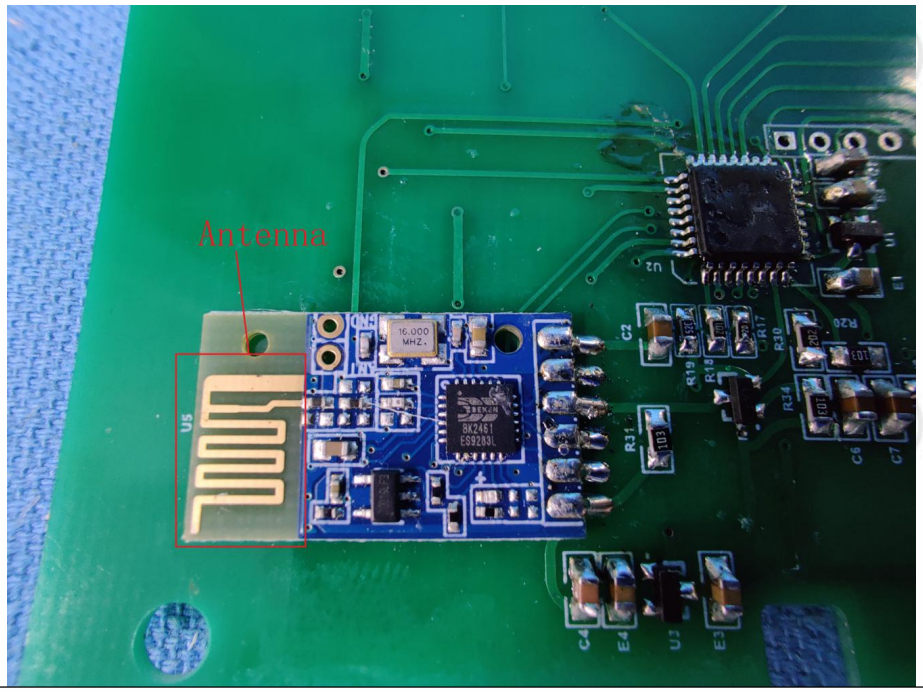
Conducted disturbance Test					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Receiver	R&S	ESCI	100435	05-20-2019	05-19-2020
Temperature/ Humidity Indicator	Defu	TH128	/	06-14-2019	06-13-2020
Communication test set	Agilent	E5515C	GB47050 534	03-01-2019	02-28-2022
Communication test set	R&S	CMW500	152394	03-01-2019	02-29-2020
LISN	R&S	ENV216	100098	05-08-2019	05-07-2020
LISN	schwarzbeck	NNLK8121	8121-529	05-08-2019	05-07-2020
Voltage Probe	R&S	ESH2-Z3 0299.7810.5 6	100042	06-13-2017	06-12-2020
Current Probe	R&S	EZ-17 816.2063.03	100106	05-20-2019	05-19-2020
ISN	TESEQ	ISN T800	30297	01-16-2019	01-15-2020
Barometer	changchun	DYM3	1188	06-20-2019	06-19-2020

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05-24-2019	05-23-2022
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-401	12-21-2018	12-20-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-26-2019	07-25-2020
Microwave Preamplifier	Agilent	8449B	3008A02425	07-12-2019	07-11-2020
Microwave Preamplifier	Tonscend	EMC051845SE	980380	01-16-2019	01-15-2020
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1869	04-25-2018	04-24-2021
Horn Antenna	ETS-LINDGREN	3117	00057410	06-05-2018	06-04-2021
Double ridge horn antenna	A.H.SYSTEMS	SAS-574	374	06-05-2018	06-04-2021
Pre-amplifier	A.H.SYSTEMS	PAP-1840-60	6041.6042	07-26-2019	07-25-2020
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-24-2021
Spectrum Analyzer	R&S	FSP40	100416	04-28-2019	04-27-2020
Receiver	R&S	ESCI	100435	05-20-2019	05-19-2020
Receiver	R&S	ESCI7	100938-003	11-23-2018	11-22-2019
Multi device Controller	maturo	NCD/070/10711112	---	01-09-2019	01-08-2020
LISN	Schwarzbeck	NNBM8125	81251547	05-08-2019	05-07-2020
LISN	Schwarzbeck	NNBM8125	81251548	05-08-2019	05-07-2020
Signal Generator	Agilent	E4438C	MY45095744	03-01-2019	02-29-2020
Signal Generator	Keysight	E8257D	MY53401106	03-01-2019	02-29-2020
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	07-26-2019	07-25-2020
Communication test set	Agilent	E5515C	GB47050534	03-01-2019	02-28-2022
Cable line	Fulai(7M)	SF106	5219/6A	01-09-2019	01-08-2020
Cable line	Fulai(6M)	SF106	5220/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5216/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5217/6A	01-09-2019	01-08-2020
Communication test set	R&S	CMW500	104466	01-18-2019	01-17-2020
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA09CL12-0395-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA08CL12-0393-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA04CL12-0396-002	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA03CL12-0394-001	---	01-09-2019	01-08-2020

3M full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	06-19-2019	06-18-2020
Receiver	Keysight	N9038A	MY57290136	03-27-2019	03-26-2020
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-27-2019	03-26-2020
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-27-2019	03-26-2020
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-075	04-25-2018	04-24-2021
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-24-2021
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-25-2018	04-24-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-24-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-829	04-25-2018	04-24-2021
Communication Antenna	Schwarzbeck	CLSA 0110L	1014	02-14-2019	02-13-2020
Biconical antenna	Schwarzbeck	VUBA 9117	9117-381	04-25-2018	04-24-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-09-2021
Preamplifier	EMCI	EMC184055SE	980596	05-22-2019	5-21-2020
Communication test set	R&S	CMW500	102898	01-18-2019	01-17-2020
Preamplifier	EMCI	EMC001330	980563	05-08-2019	05-07-2020
Preamplifier	Agilent	8449B	3008A02425	07-12-2019	07-11-2020
Temperature/ Humidity Indicator	biaozhi	GM1360	EE1186631	04-30-2019	04-29-2020
Signal Generator	KEYSIGHT	E8257D	MY53401106	03-01-2019	02-29-2020
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-16-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-09-2021
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	01-09-2019	01-08-2020
Cable line	Times	EMC104-NMNM-1000	SN160710	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	01-09-2019	01-08-2020
Cable line	Times	HF160-KMKM-3.00M	393493-0001	01-09-2019	01-08-2020

7 Test results and Measurement Data

7.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
EUT Antenna:	
The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -5 dBi.  	

7.2 Conducted Emissions

Test Requirement: 47 CFR Part 15C Section 15.207

Test Method: ANSI C63.10

Test Frequency Range: 150kHz to 30MHz

Limit:

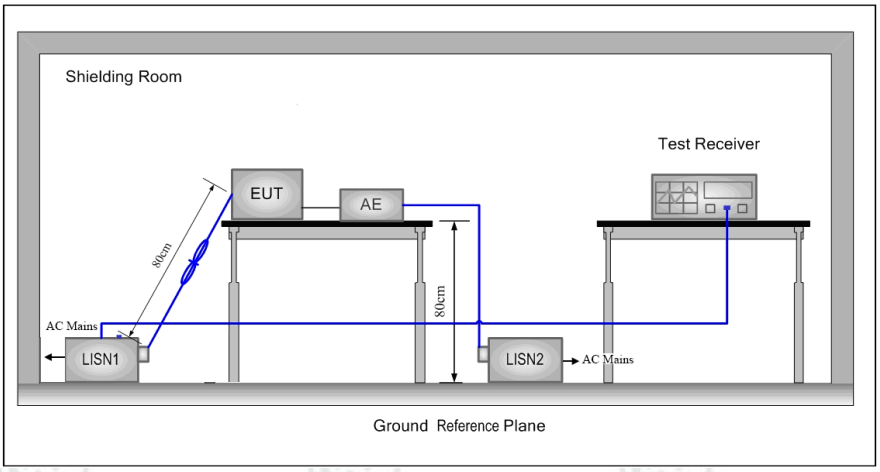
Frequency range (MHz)	Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Procedure:

1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.

Test Setup:



Test Mode: Transmitter mode

Instruments Used: Refer to section 6 for details

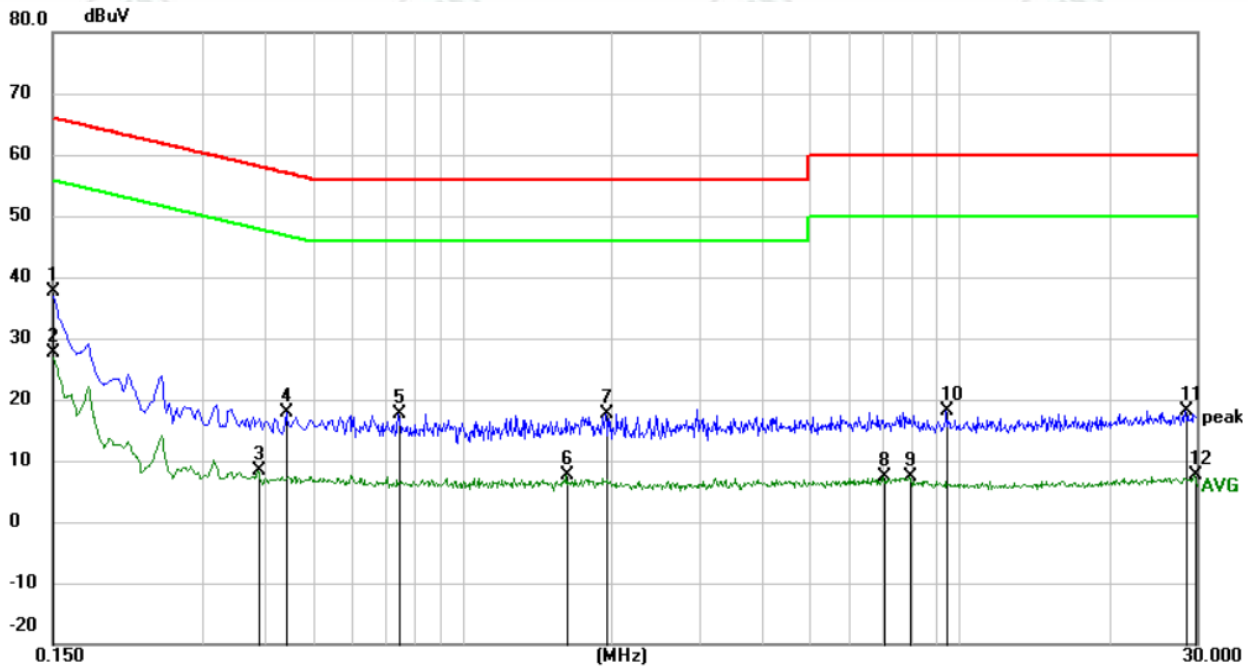
Test Results: Pass

Measurement Data

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

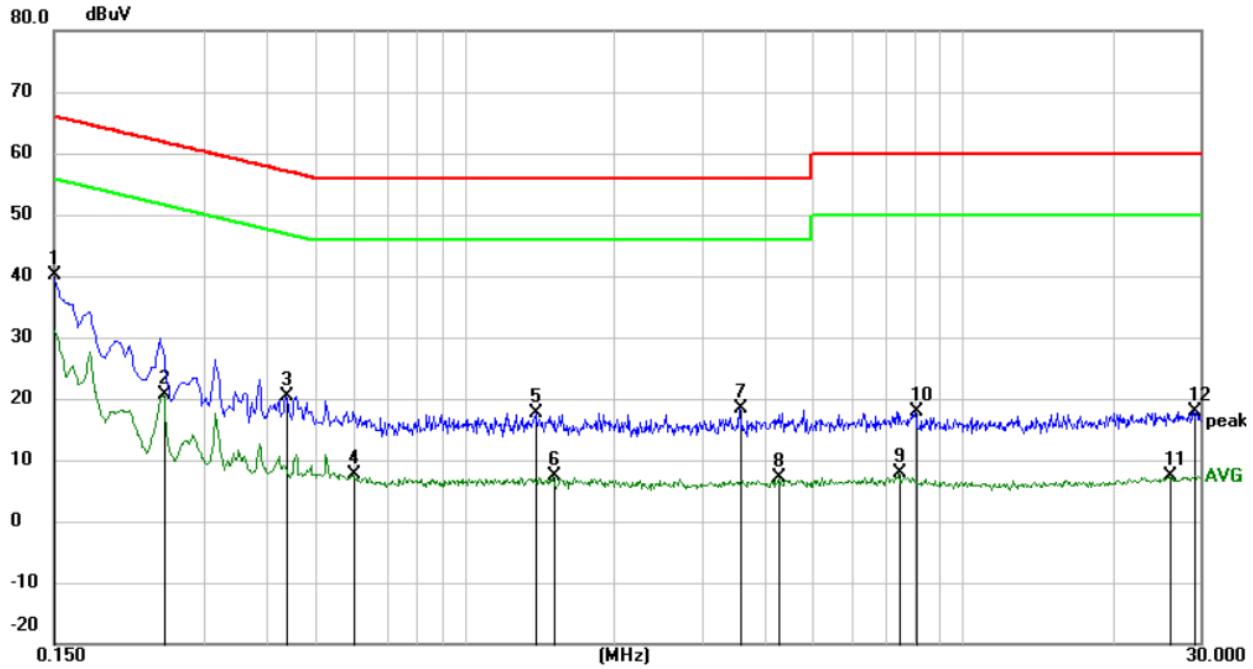
Product	:	Control Fob	**Model/Type reference**	:	RSURC
Temperature	:	24.0 °C	**Humidity**	:	52%

Live line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1500	27.76	9.97	37.73	66.00	-28.27	peak	
2		0.1500	17.54	9.97	27.51	56.00	-28.49	AVG	
3		0.3885	-1.63	10.01	8.38	48.10	-39.72	AVG	
4		0.4425	7.85	10.00	17.85	57.01	-39.16	peak	
5		0.7440	7.97	9.76	17.73	56.00	-38.27	peak	
6		1.6215	-2.28	9.86	7.58	46.00	-38.42	AVG	
7		1.9410	7.90	9.83	17.73	56.00	-38.27	peak	
8		7.0530	-2.48	9.85	7.37	50.00	-42.63	AVG	
9		7.9620	-2.47	9.89	7.42	50.00	-42.58	AVG	
10		9.4110	8.11	9.94	18.05	60.00	-41.95	peak	
11		28.5090	8.15	9.97	18.12	60.00	-41.88	peak	
12		29.8140	-2.38	9.98	7.60	50.00	-42.40	AVG	

Neutral line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1500	30.09	9.97	40.06	66.00	-25.94	peak	
2		0.2490	10.54	10.06	20.60	51.79	-31.19	AVG	
3		0.4380	10.35	10.00	20.35	57.10	-36.75	peak	
4		0.6000	-2.49	10.12	7.63	46.00	-38.37	AVG	
5		1.3920	7.71	9.88	17.59	56.00	-38.41	peak	
6		1.5045	-2.47	9.87	7.40	46.00	-38.60	AVG	
7		3.5655	8.46	9.83	18.29	56.00	-37.71	peak	
8		4.2810	-2.78	9.83	7.05	46.00	-38.95	AVG	
9		7.4805	-2.01	9.87	7.86	50.00	-42.14	AVG	
10		8.0475	8.10	9.89	17.99	60.00	-42.01	peak	
11		26.0115	-2.48	9.96	7.48	50.00	-42.52	AVG	
12		29.2110	7.96	9.98	17.94	60.00	-42.06	peak	

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

7.3 Radiated Spurious Emissions

Test Requirement: 47 CFR Part 15C Section 15.249 and 15.209

Test Method: ANSI C63.10

Test Site: Measurement Distance: 3m (Semi-Anechoic Chamber)

Receiver Setup:

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

Test Setup:

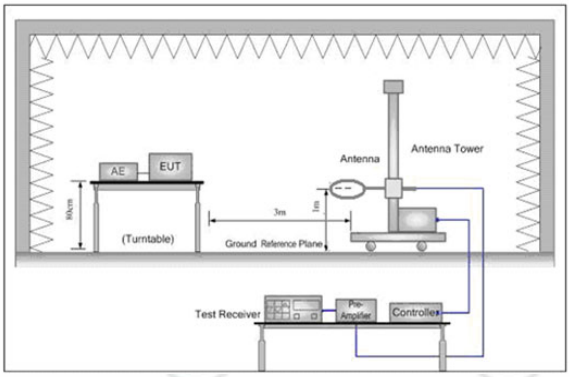


Figure 1. Below 30MHz

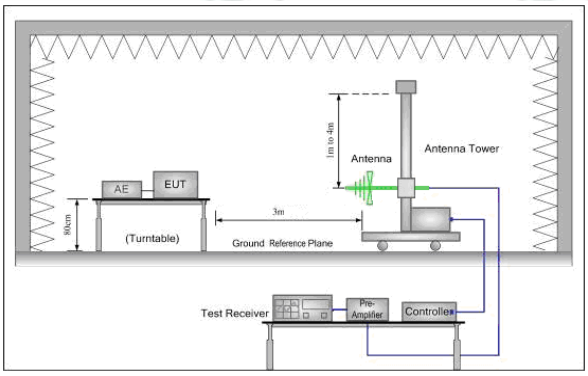


Figure 2. 30MHz to 1GHz

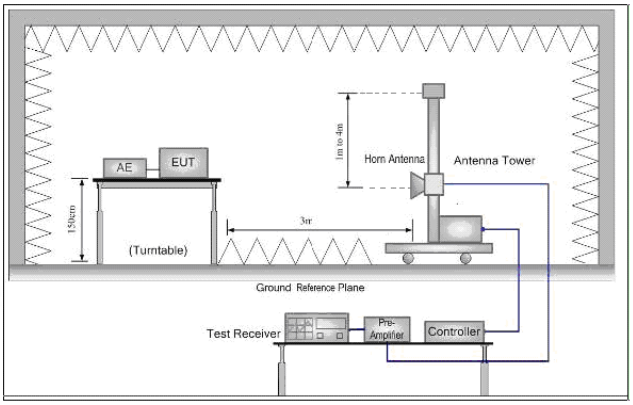


Figure 3. Above 1GHz

Test Procedure:

Below 1GHz test procedure as below:
The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
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.
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 rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Above 1GHz test procedure as below:
Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
Test the EUT in the lowest channel ,middle channel, the Highest channel
The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
Repeat above procedures until all frequencies measured was complete.

Limit:
(Spurious Emissions)

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

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

Limit:
(Field strength of the fundamental signal)

Frequency	Limit (dBμV/m @3m)	Remark
2400MHz-2483.5MHz	94.0	Average Value
	114.0	Peak Value

Test Setup:

Exploratory Test Mode: Transmitting mode,Charge +Transmitting mode

Final Test Mode: Pretest the EUT at Transmitting mode and Charge +Transmitting mode, found the Charge +Transmitting mode which it is worse case
Only the worst case is recorded in the report.

Instruments Used: Refer to section 6 for details

Test Results: Pass

Measurement Data

Product : Control Fob **Model/Type reference** : RSURC

Temperature : 23.0 °C **Humidity** : 54%

Field Strength Of The Fundamental Signal

NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2401	32.26	3.46	-42.43	100.94	94.23	114	19.77	Pass	H	PK
	2401	32.26	3.46	-42.43	99.83	93.12	94	0.88	Pass	H	AV
2	2401	32.26	3.46	-42.43	101.56	94.85	114	19.15	Pass	V	PK
	2401	32.26	3.46	-42.43	100.22	93.51	94	0.49	Pass	V	AV
3	2440	32.32	3.35	-42.42	98.6	91.85	114	22.15	Pass	H	PK
	2440	32.32	3.35	-42.42	97.36	90.61	94	3.39	Pass	H	AV
4	2440	32.32	3.35	-42.42	98.2	91.45	114	22.55	Pass	V	PK
	2440	32.32	3.35	-42.42	97.1	90.35	94	3.65	Pass	V	AV
5	2479	32.37	3.44	-42.4	97.81	91.22	114	22.78	Pass	H	PK
	2479	32.37	3.44	-42.4	96.63	90.04	94	3.96	Pass	H	AV
6	2479	32.37	3.44	-42.4	97.81	91.22	114	22.78	Pass	V	PK
	2479	32.37	3.44	-42.4	96.63	90.04	94	3.96	Pass	V	AV

Spurious Emissions

Mode:			GFSK Transmitting				Channel:		2401		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	57.2597	12.04	0.87	-32.07	37.74	18.58	40.00	21.42	Pass	H	PK
2	120.0250	9.20	1.30	-32.07	38.21	16.64	43.50	26.86	Pass	H	PK
3	208.8859	11.13	1.71	-31.94	48.24	29.14	43.50	14.36	Pass	H	PK
4	499.7210	17.00	2.67	-31.91	31.86	19.62	46.00	26.38	Pass	H	PK
5	687.5318	19.70	3.14	-32.06	33.80	24.58	46.00	21.42	Pass	H	PK
6	889.4089	21.97	3.58	-31.62	28.16	22.09	46.00	23.91	Pass	H	PK
7	71.9082	8.64	0.97	-32.05	31.84	9.40	40.00	30.60	Pass	V	PK
8	137.0987	7.35	1.37	-32.00	37.25	13.97	43.50	29.53	Pass	V	PK
9	208.8859	11.13	1.71	-31.94	39.11	20.01	43.50	23.49	Pass	V	PK
10	360.0270	14.52	2.27	-31.84	36.19	21.14	46.00	24.86	Pass	V	PK
11	687.5318	19.70	3.14	-32.06	34.59	25.37	46.00	20.63	Pass	V	PK
12	932.9663	22.30	3.66	-31.33	28.39	23.02	46.00	22.98	Pass	V	PK

Mode:			GFSK Transmitting				Channel:		2440		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	54.9315	12.41	0.84	-32.08	36.81	17.98	40.00	22.02	Pass	H	PK
2	71.9082	8.64	0.97	-32.05	36.92	14.48	40.00	25.52	Pass	H	PK
3	86.3626	8.56	1.07	-32.08	36.07	13.62	40.00	26.38	Pass	H	PK
4	171.4401	8.53	1.54	-31.97	43.88	21.98	43.50	21.52	Pass	H	PK
5	208.8859	11.13	1.71	-31.94	48.26	29.16	43.50	14.34	Pass	H	PK
6	687.5318	19.70	3.14	-32.06	34.15	24.93	46.00	21.07	Pass	H	PK
7	137.0987	7.35	1.37	-32.00	38.14	14.86	43.50	28.64	Pass	V	PK
8	208.8859	11.13	1.71	-31.94	39.18	20.08	43.50	23.42	Pass	V	PK
9	360.0270	14.52	2.27	-31.84	36.07	21.02	46.00	24.98	Pass	V	PK
10	519.9960	17.40	2.73	-31.93	31.26	19.46	46.00	26.54	Pass	V	PK
11	687.5318	19.70	3.14	-32.06	35.22	26.00	46.00	20.00	Pass	V	PK
12	941.1151	22.35	3.68	-31.25	29.63	24.41	46.00	21.59	Pass	V	PK

Mode:			GFSK Transmitting				Channel:		2479		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	54.9315	12.41	0.84	-32.08	37.58	18.75	40.00	21.25	Pass	H	PK
2	120.0250	9.20	1.30	-32.07	38.77	17.20	43.50	26.30	Pass	H	PK
3	171.4401	8.53	1.54	-31.97	43.55	21.65	43.50	21.85	Pass	H	PK
4	208.8859	11.13	1.71	-31.94	48.27	29.17	43.50	14.33	Pass	H	PK
5	539.9800	17.80	2.79	-31.95	33.17	21.81	46.00	24.19	Pass	H	PK
6	912.5943	22.18	3.61	-31.46	29.18	23.51	46.00	22.49	Pass	H	PK
7	93.1533	9.90	1.11	-32.07	31.17	10.11	43.50	33.39	Pass	V	PK
8	137.0987	7.35	1.37	-32.00	37.12	13.84	43.50	29.66	Pass	V	PK
9	208.8859	11.13	1.71	-31.94	39.15	20.05	43.50	23.45	Pass	V	PK
10	360.0270	14.52	2.27	-31.84	35.85	20.80	46.00	25.20	Pass	V	PK
11	687.5318	19.70	3.14	-32.06	34.94	25.72	46.00	20.28	Pass	V	PK
12	960.7111	22.46	3.71	-31.08	29.96	25.05	54.00	28.95	Pass	V	PK

Mode:			GFSK Transmitting				Channel:		2401		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	3201.0134	33.28	4.65	-42.00	50.10	46.03	74.00	27.97	Pass	H	PK
2	4802.1201	34.50	4.55	-40.67	55.71	54.09	74.00	19.91	Pass	H	PK
3	5602.1735	35.16	5.08	-40.72	49.60	49.12	74.00	24.88	Pass	H	PK
4	7007.2672	36.11	5.68	-41.18	49.44	50.05	74.00	23.95	Pass	H	PK
5	8815.3877	37.29	6.39	-40.64	49.42	52.46	74.00	21.54	Pass	H	PK
6	10231.482	38.12	6.83	-40.75	49.71	53.91	74.00	20.09	Pass	H	PK
7	3928.0619	33.74	4.34	-40.93	49.77	46.92	74.00	27.08	Pass	V	PK
8	4491.0994	34.49	4.67	-40.91	49.79	48.04	74.00	25.96	Pass	V	PK
9	5009.1339	34.51	4.83	-40.50	50.69	49.53	74.00	24.47	Pass	V	PK
10	5565.1710	35.10	5.14	-40.70	49.95	49.49	74.00	24.51	Pass	V	PK
11	8173.3449	36.47	6.39	-40.85	49.54	51.55	74.00	22.45	Pass	V	PK
12	10246.483	38.15	6.82	-40.79	49.34	53.52	74.00	20.48	Pass	V	PK

Mode:			GFSK Transmitting				Channel:		2440		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	3049.0033	33.22	4.83	-42.09	50.39	46.35	74.00	27.65	Pass	H	PK
2	4880.1253	34.50	4.80	-40.60	55.97	54.67	74.00	19.33	Pass	H	PK
3	6468.2312	35.89	5.50	-41.18	49.81	50.02	74.00	23.98	Pass	H	PK
4	8317.3545	36.53	6.13	-40.72	49.60	51.54	74.00	22.46	Pass	H	PK
5	9626.4418	37.65	6.67	-40.74	49.82	53.40	74.00	20.60	Pass	H	PK
6	10331.488	38.26	6.90	-40.92	49.58	53.82	74.00	20.18	Pass	H	PK
7	3068.0045	33.23	4.79	-42.08	49.49	45.43	74.00	28.57	Pass	V	PK
8	3832.0555	33.67	4.36	-41.13	49.95	46.85	74.00	27.15	Pass	V	PK
9	5010.1340	34.51	4.83	-40.50	50.95	49.79	74.00	24.21	Pass	V	PK
10	6410.2273	35.88	5.35	-41.17	49.63	49.69	74.00	24.31	Pass	V	PK
11	7680.3120	36.53	6.22	-40.86	49.51	51.40	74.00	22.60	Pass	V	PK
12	10135.475	37.99	6.87	-40.62	49.32	53.56	74.00	20.44	Pass	V	PK

Mode:			GFSK Transmitting				Channel:		2479		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	3436.0291	33.37	4.47	-41.86	49.48	45.46	74.00	28.54	Pass	H	PK
2	3948.0632	33.76	4.34	-40.89	50.22	47.43	74.00	26.57	Pass	H	PK
3	4958.1305	34.50	4.82	-40.53	56.59	55.38	74.00	18.62	Pass	H	PK
4	6440.2293	35.89	5.48	-41.18	48.83	49.02	74.00	24.98	Pass	H	PK
5	7436.2958	36.54	5.85	-40.83	54.10	55.66	74.00	18.34	Pass	H	PK
6	9203.4136	37.66	6.45	-40.75	49.59	52.95	74.00	21.05	Pass	H	PK
7	4957.4605	34.50	4.82	-40.53	52.12	50.91	54.00	3.09	Pass	H	AV
8	3323.0215	33.33	4.55	-41.92	49.74	45.70	74.00	28.30	Pass	V	PK
9	4993.1329	34.50	4.82	-40.51	50.64	49.45	74.00	24.55	Pass	V	PK
10	6243.2162	35.85	5.33	-41.14	48.73	48.77	74.00	25.23	Pass	V	PK
11	7437.2958	36.54	5.85	-40.83	49.78	51.34	74.00	22.66	Pass	V	PK
12	8863.3909	37.40	6.41	-40.65	48.94	52.10	74.00	21.90	Pass	V	PK
13	9204.4136	37.66	6.45	-40.75	49.77	53.13	74.00	20.87	Pass	V	PK

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 - Correct Factor
   Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

2) Scan from 9kHz to 25GHz,The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

7.4 Restricted bands around fundamental frequency

Test Requirement: 47 CFR Part 15C Section 15.209 and 15.205

Test Method: ANSI C63.10

Test Site: Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit(band edge): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

Frequency	Limit (dBμV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Setup:

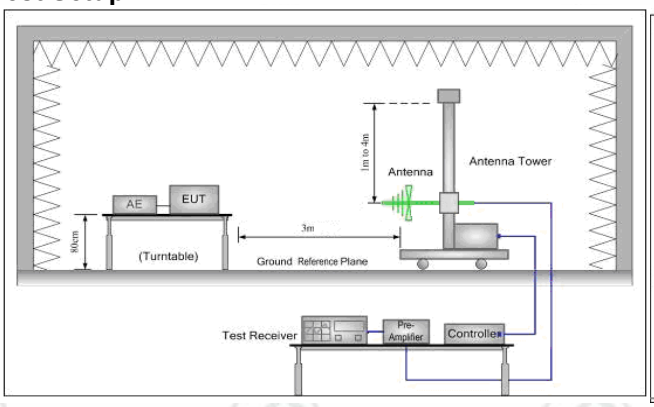


Figure 1. 30MHz to 1GHz

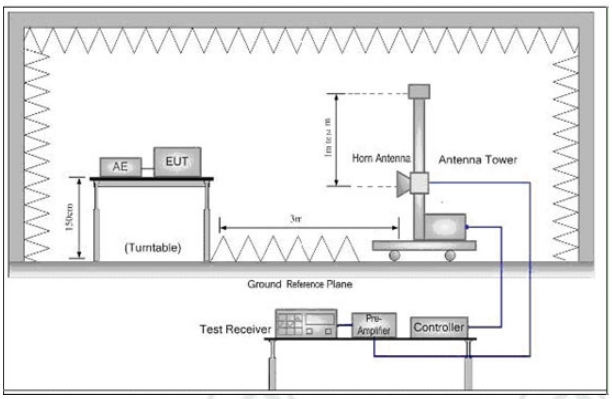


Figure 2. Above 1 GHz

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
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 worse case.
j. Repeat above procedures until all frequencies measured was complete.

Exploratory Test Mode: Transmitting mode,Charge +Transmitting mode

Final Test Mode: Pretest the EUT at Transmitting mode and Charge +Transmitting mode, found the Charge +Transmitting mode which it is worse case
Only the worst case is recorded in the report.

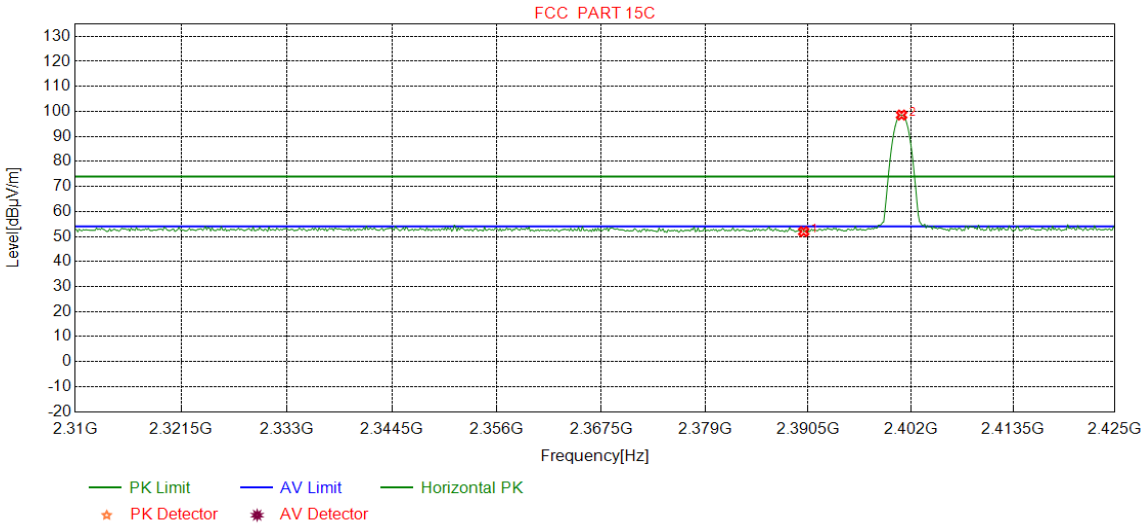
Instruments Used: Refer to section 6 for details

Test Results: Pass

Test plot as follows:

Mode:	GFSK Transmitting	Channel:	2401
Remark:	PK		

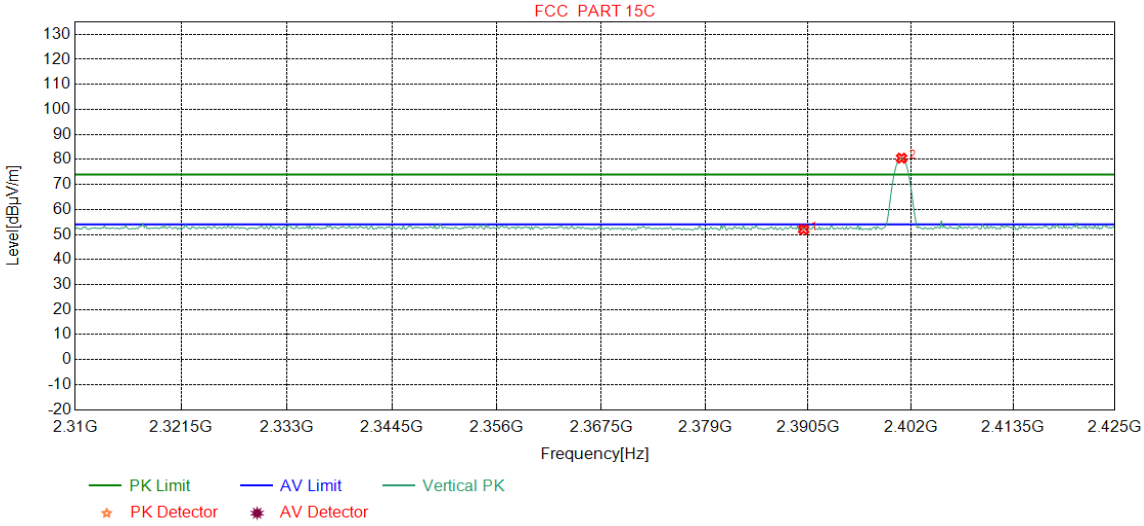
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	48.77	51.95	74.00	22.05	Pass	Horizontal
2	2400.9637	32.26	13.30	-42.43	95.42	98.55	74.00	-24.55	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2410
Remark:	PK		

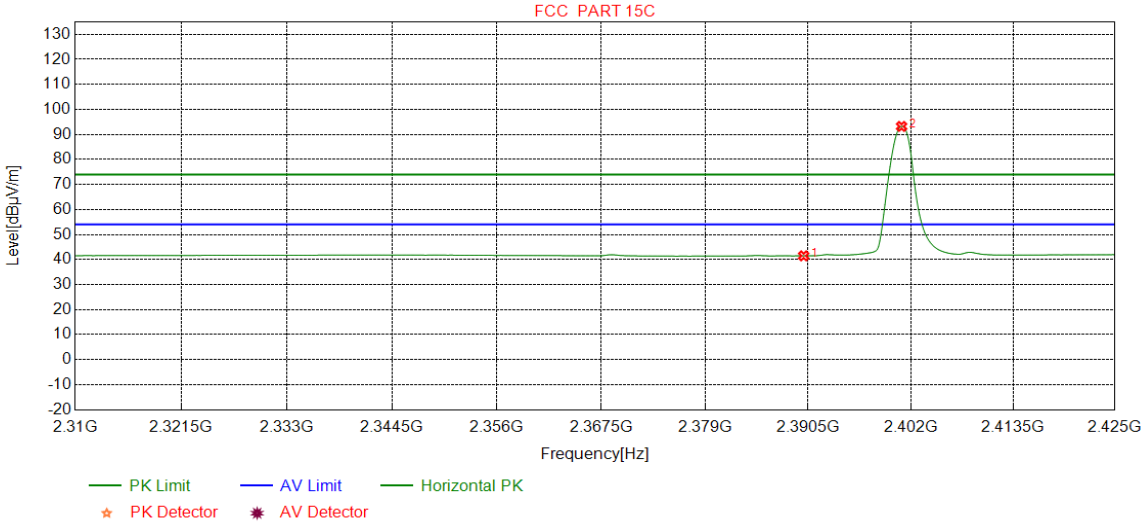
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	48.84	52.02	74.00	21.98	Pass	Vertical
2	2400.9637	32.26	13.30	-42.43	77.39	80.52	74.00	-6.52	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2410
Remark:	AV		

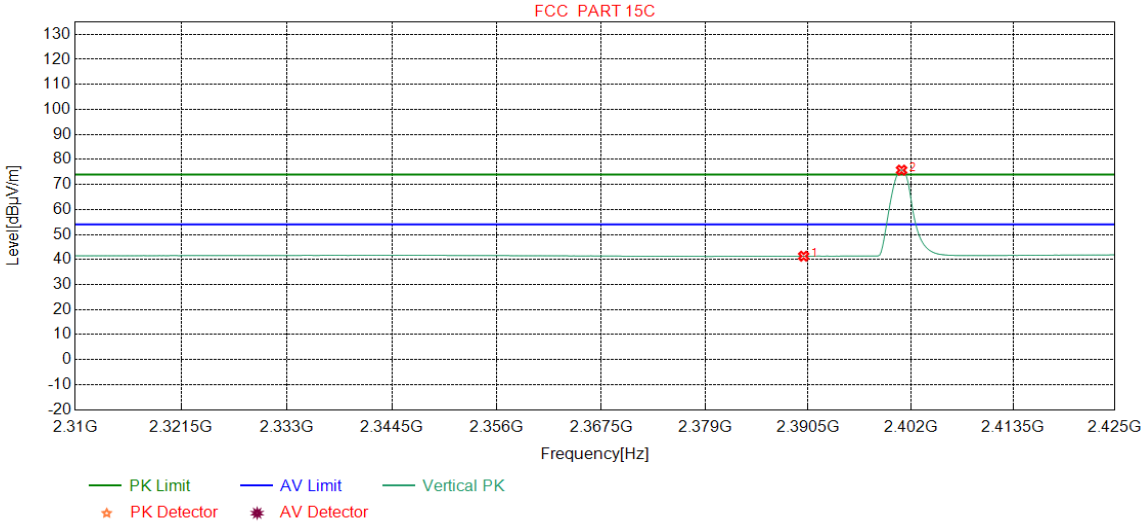
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	38.29	41.47	54.00	12.53	Pass	Horizontal
2	2400.9637	32.26	13.30	-42.43	90.08	93.21	54.00	-39.21	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2410
Remark:	AV		

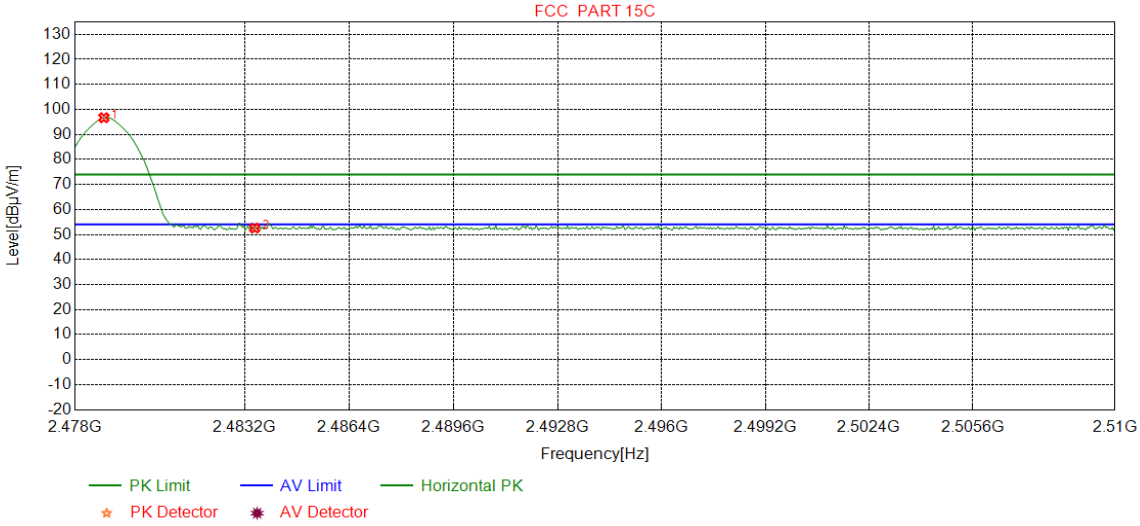
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	38.16	41.34	54.00	12.66	Pass	Vertical
2	2400.9637	32.26	13.30	-42.43	72.60	75.73	54.00	-21.73	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2479
Remark:	PK		

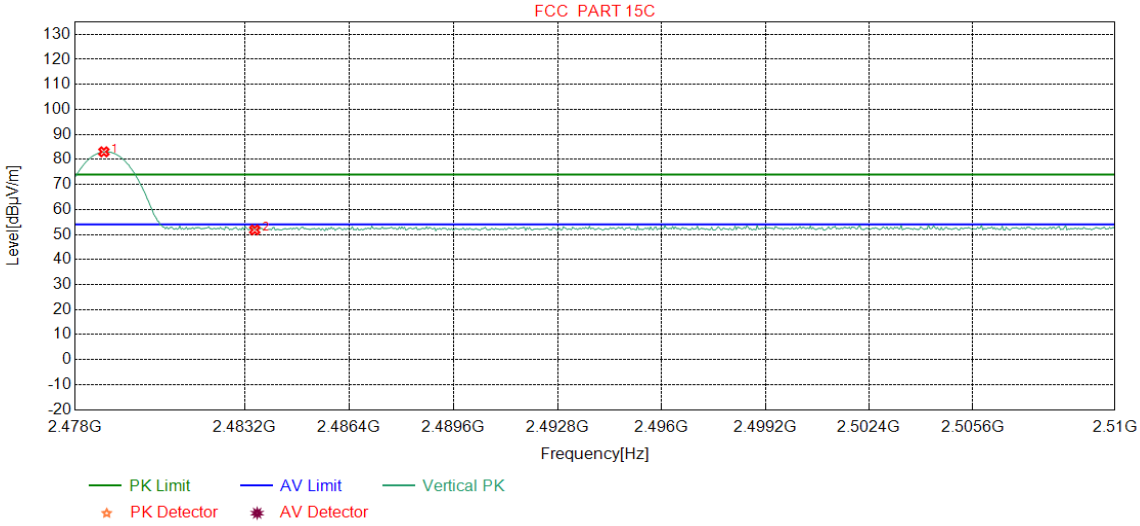
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2478.8811	32.37	13.40	-42.40	93.31	96.68	74.00	-22.68	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	49.20	52.56	74.00	21.44	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2479
Remark:	PK		

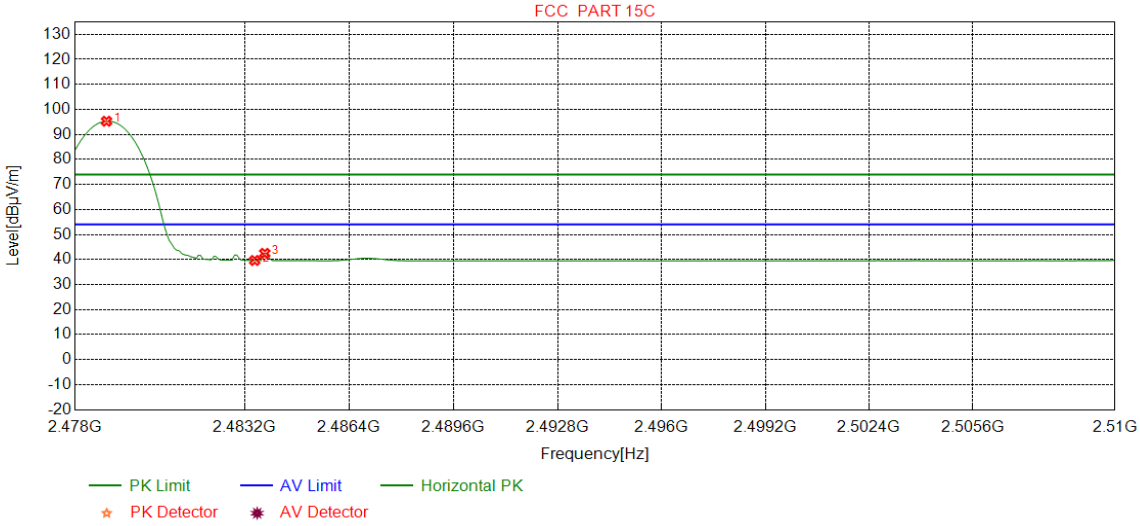
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2478.8811	32.37	13.40	-42.40	79.68	83.05	74.00	-9.05	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	48.47	51.83	74.00	22.17	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2479
Remark:	AV		

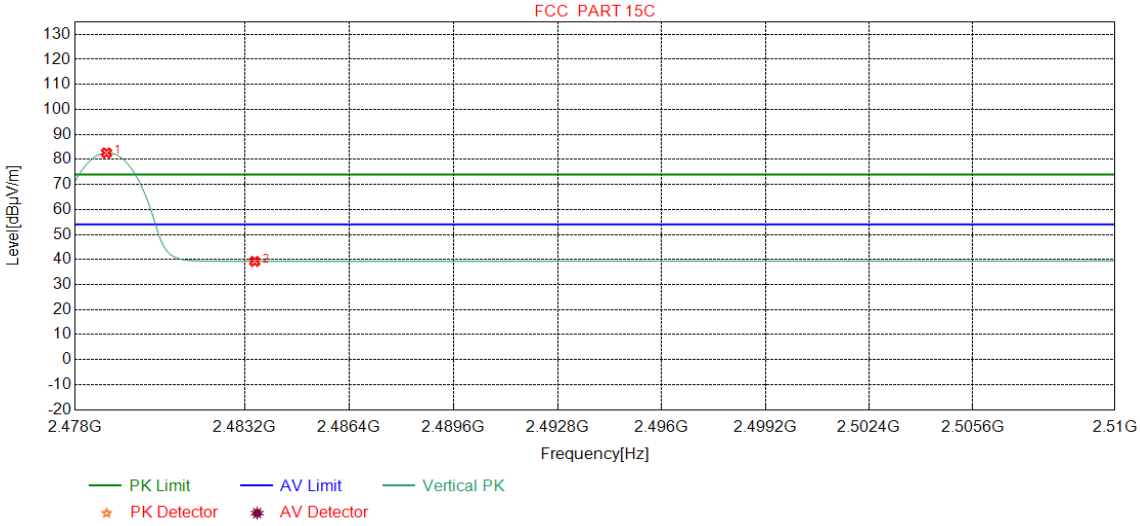
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2478.9612	32.37	13.40	-42.40	91.91	95.28	54.00	-41.28	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	36.27	39.63	54.00	14.37	Pass	Horizontal
3	2483.8073	32.38	13.37	-42.40	39.12	42.47	54.00	11.53	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2479
Remark:	AV		

Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity
1	2478.9612	32.37	13.40	-42.40	79.27	82.64	54.00	-28.64	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	35.89	39.25	54.00	14.75	Pass	Vertical

Note:

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 - Correct Factor

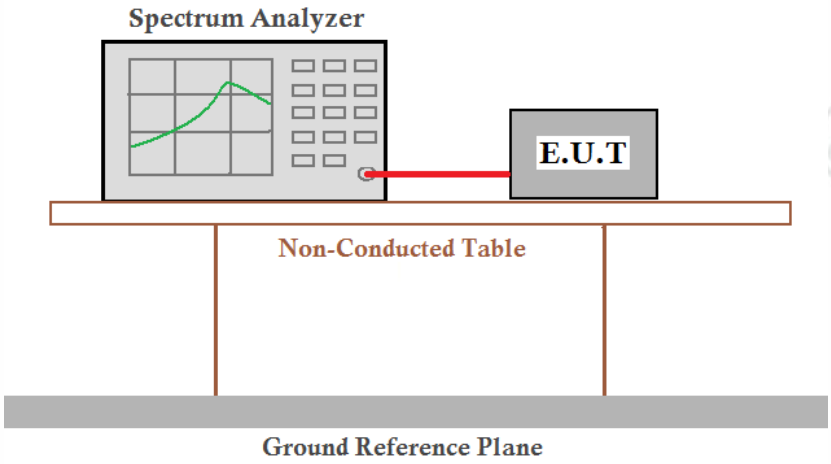
Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

7.5 20dB Bandwidth

Test Requirement: 47 CFR Part 15C Section 15.215

Test Method: ANSI C63.10

Test Setup:



Limit: N/A

Exploratory Test Mode: Transmitter mode

Final Test Mode: Through Pre-scan, find the 1Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g; 6Mbps of rate is the worst case of 802.11n(HT20);6Mbps of rate is the worst case of 802.11n(HT40)

Instruments Used: Refer to section 6 for details

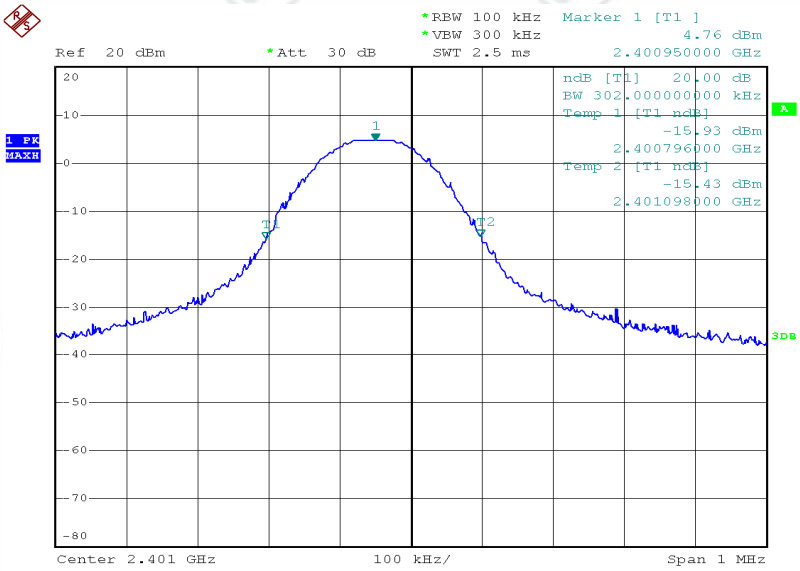
Test Results: Pass

Measurement Data

Test Channel	20dB bandwidth (MHz)	Results
Lowest	0.302	Pass
Middle	0.3	Pass
Highest	0.292	Pass

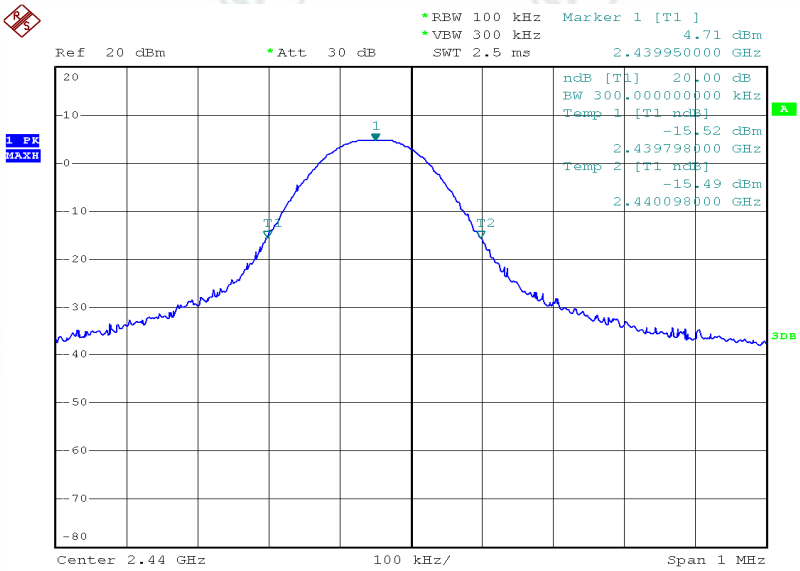
Test plot as follows:

Test channel:2401MHz	Lowest



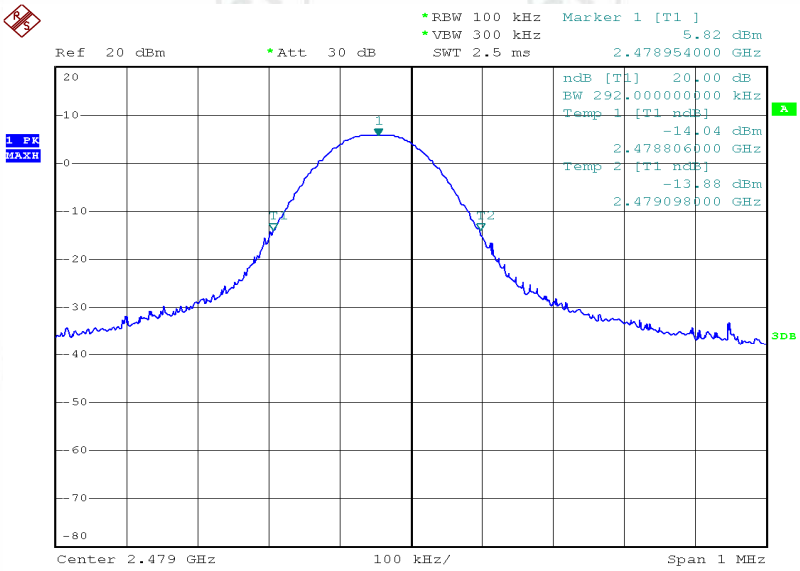
Date: 28.OCT.2019 10:31:53

Test channel:2440MHz	Middle



Date: 28.OCT.2019 10:23:53

Test channel:2479MHz	Highest



Date: 28.OCT.2019 12:06:43