



FCC RADIO TEST REPORT

Applicant : FEGO Precision Industrial Co.,Ltd

Address : 947 Lin-Sen Rd,Wu-Fong Tai-Chung 413
Taiwan ROC

Equipment : Transmitter

S-RF1、 S-RF1-1、 S-RF1-2、 S-RF1-3、

Model No. : S-RF1-4、 S-RF1-5、 S-RF1-6、 S-RF1-7、
S-RF1-8、 S-RF1-9

FCC ID. : M8C-S-RF1-RF433

Trade Name : SUNON、 TUMA

I HEREBY CERTIFY THAT :

The sample was received on Apr. 01, 2019 and the testing was completed on Jun. 10, 2019 at CerpPASS Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of CerpPASS Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

CerpPASS Technology Corporation Test Laboratory





Contents

1. Summary of Test Procedure and Test Results.....	4
1.1 Applicable Standards	4
2. Test Configuration of Equipment under Test.....	5
2.1 Feature of Equipment under Test.....	5
2.2 Model Difference	5
2.3 Test Mode and Test Software	5
2.4 Description of Test System.....	6
2.5 General Information of Test.....	6
2.6 Measurement Uncertainty	6
3. Test Equipment and Ancillaries Used for Tests	7
4. Antenna Requirements	8
4.1 Standard Applicable	8
4.2 Antenna Construction and Directional Gain.....	8
5. Test of Conducted Emission.....	9
5.1 Test Limit	9
5.2 Test Procedures	9
5.3 Typical Test Setup	10
5.4 Test Result and Data.....	10
6. Test of Radiated Emission	11
6.1 Test Limit	11
6.2 Test Procedures	12
6.3 Typical Test Setup	15
6.4 Test Result and Data.....	16
6.5 Test Photographs (30MHz~1GHz)	24
6.6 Test Photographs (Above 1GHz)	25
7. 20dB Bandwidth Measurement.....	27
7.1 Test Procedure	27
7.2 Test Setup Layout	27
7.3 Limits of Band Edges Measurement	27
7.4 Test Result and Data.....	27
8. Transmission Time Control.....	29
8.1 Test Procedure	29
8.2 Test Setup Layout	29
8.3 Test Limit	29
8.4 Test Result and Data.....	30



History of this test report

Report No.	Issue Date	Description
TEFL1903189	Jun. 18, 2019	Original



1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.4:2014

ANSI C63.10:2013

FCC Rules and Regulations Part 15 Subpart C §15.231

FCC Rule	Test Type	Result
15.203	Antenna Requirement	PASS
15.209 15.231	Radiated Emission	PASS
15.231	20dB Occupied Bandwidth Measurement	PASS
15.231	Transmission Time Control	PASS

*The principle of judgment is made according to the laboratory's reporting control and measurement uncertainty standard procedures.



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Equipment	Transmitter	
Model No.	S-RF1、S-RF1-1、S-RF1-2、S-RF1-3、S-RF1-4、S-RF1-5、S-RF1-6、S-RF1-7、S-RF1-8、S-RF1-9	
Modulation Type	ASK	
Frequency Range	433.05MHz~434.79MHz	
Antenna Type	PCB antenna	
Antenna gain	0dBi	
Operating Temperature	Tnom	25℃
	Tmax	40℃
	Tmin	0℃
Operating Voltage	Vnom	3.0V
	Vmax	3.2V
	Vmin	2.4V

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.2 Model Difference

The differences between all model numbers as below:

Model No.	Remark
S-RF1	Market segmentation.
S-RF1-1	
S-RF1-2	
S-RF1-3	
S-RF1-4	
S-RF1-5	
S-RF1-6	
S-RF1-7	
S-RF1-8	
S-RF1-9	

2.3 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10.
- b. The complete test system included EUT for the test.
- c. XYZ 3 axis of the EUT have been tested, only the worst axis was reported.
- d. New battery was used for all the testing on this report.
- e. Use physical buttons to transmit wireless 433.92MHz signal



2.4 Description of Test System

The EUT was tested alone. No support devices are needed for testing.

2.5 General Information of Test

Test Site	CerpPASS Technology Corporation Test Laboratory Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881	
	FCC	TW1439, TW1079
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication test C-4663 for Conducted emission test R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 40,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

Test Item	Test Site	Tested Date	Environmental Conditions	Tested By
Radiated Emissions	3M02-NK	2019/06/10	25°C / 45%	Spree Yeh

2.6 Measurement Uncertainty

Measurement Item	Uncertainty
Radiated Spurious Emission(9KHz~30MHz)	±3.405dB
Radiated Spurious Emission(30MHz~1GHz)	±5.326dB
Radiated Spurious Emission(1GHz~18GHz)	±5.748dB
20dB Bandwidth	±5.493%
Occupied Bandwidth	±4.569%
Deactivation Time	±0.11%



3. Test Equipment and Ancillaries Used for Tests

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M02-NK)				
Instrument	Manufacturer	Model No	Serial No	Calibration Date	Valid Date
Bilog Antenna	Schwarzbeck	VULB9168	275	2018/09/17	2019/09/16
Active Loop Antenna	EMCO	6507	40855	2019/05/24	2020/05/23
Horn Antenna	EMCO	3115	31589	2019/04/01	2020/03/31
Horn Antenna	EMCO	3116	31974	2018/09/07	2019/09/06
EMI Receiver	ROHDE & SCHWARZ	ESCI	101423	2018/06/11	2019/06/10
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100219	2018/07/03	2019/07/02
Preamplifier	EM Electronics corp.	EM330	60660	2019/03/11	2020/03/10
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2018/09/18	2019/09/17
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2019/04/07	2020/04/06
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1316	2018/09/12	2019/09/11
Cable-0.5m(1G-40G)	Rapidtek	40GHZ 50CM	38MS-38MS50314	2019/04/09	2020/04/08
Cable-3m(1G-40G)	Rapidtek	40GHZ 300CM	38MS-38MS300314	2019/04/09	2020/04/08
Cable-8m(1G-40G)	Rapidtek	40GHZ 800CM	38MS-38MS800314	2019/04/10	2020/04/09
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA



4. Antenna Requirements

4.1 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.

4.2 Antenna Construction and Directional Gain

- | | |
|-----------------------|---------------------|
| 1.1 Antenna type : | PCB Antenna |
| 1.2 Frequency Range : | 433.05MHz~434.79MHz |
| 1.3 Antenna Gain: | 0dBi |



5. Test of Conducted Emission

5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

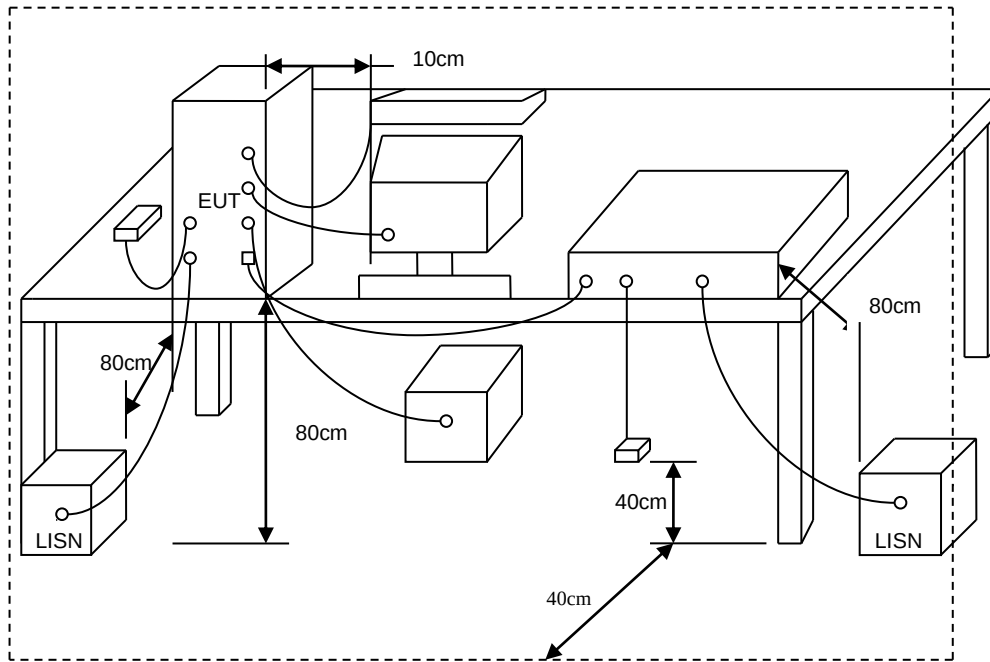
*Decreases with the logarithm of the frequency.

5.2 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- Connect EUT to the power mains through a line impedance stabilization network (LISN).
- All the support units are connecting to the other LISN.
- The LISN provides 50 ohm coupling impedance for the measuring instrument.
- The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
- Both sides of AC line were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched.
- Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.



5.3 Typical Test Setup



5.4 Test Result and Data

The test item is not applicable because the EUT is powered from DC.



6. Test of Radiated Emission

6.1 Test Limit

According to 15.231(e) the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious	
	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$	$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
40.66 ~ 40.70	1000	60	100	40
70 ~ 130	500	54	50	34
130 ~ 174	500 ~ 1500	54 ~ 63.5	50 ~ 150	34 ~ 43.5
174 ~ 260	1500	63.5	150	43.5
260 ~ 470	1500 ~ 5000	63.5 ~ 74	150 ~ 500	43.5 ~ 54
Above 470	5000	74	500	54

NOTE:

1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, $\mu\text{V/m}$ at 3 meters = $22.72727(F)-2454.545$; for the band 260-470 MHz, $\mu\text{V/m}$ at 3 meters = $16.6667(F)-2833.3333$. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequency (MHz)	Distance	Limit ($\mu\text{V/m}$)
0.09 ~ 0.490	300m	$2400/F(\text{kHz})$
0.490 ~ 1.705	30m	$24000/ F(\text{kHz})$
1.705 ~ 30	30m	30
30 ~ 88	3m	100
88 ~ 216	3m	150
216 ~ 960	3m	200
Above 960	3m	500

As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



6.2 Test Procedures

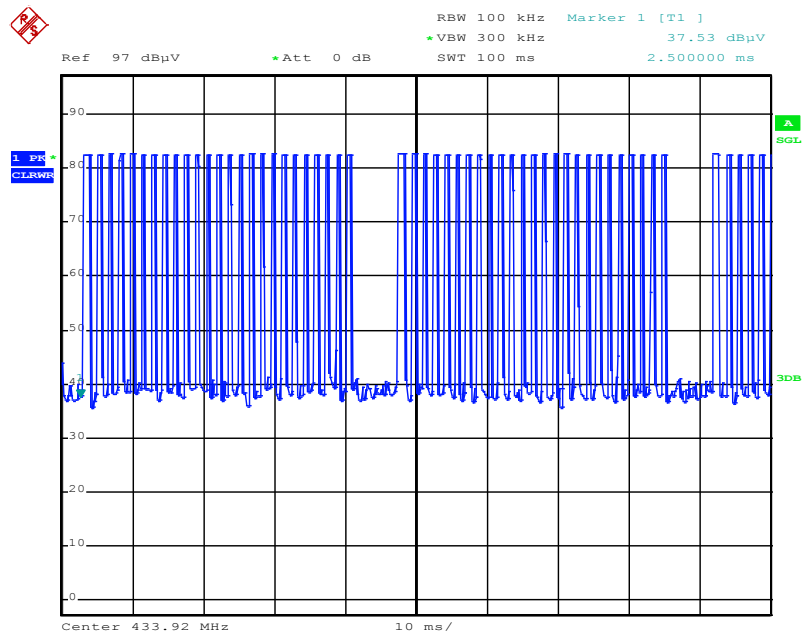
- a. The EUT was placed on a rotatable table top 0.8 meter above ground.
- b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
- c. The table was rotated 360 degrees to determine the position of the highest radiation.
- d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
- e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
- f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
- h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- i. "Cone of radiation" has been considered to be 3dB beamwidth of the measurement antenna.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.
3. The Average value = Peak value + 20log(Duty cycle)
4. Duty Factor = 20log(total duty / period of pulse train)
= 20log((Long Pulse + Short Pulse) / period of pulse train)
= 20log[(3 * 1.14ms + 52 * 0.6ms) / 100ms]
= -9.21

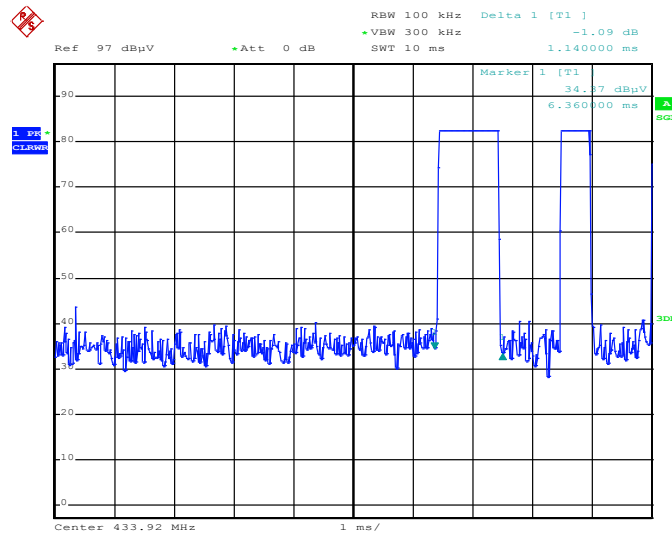


Period of Pulse Train

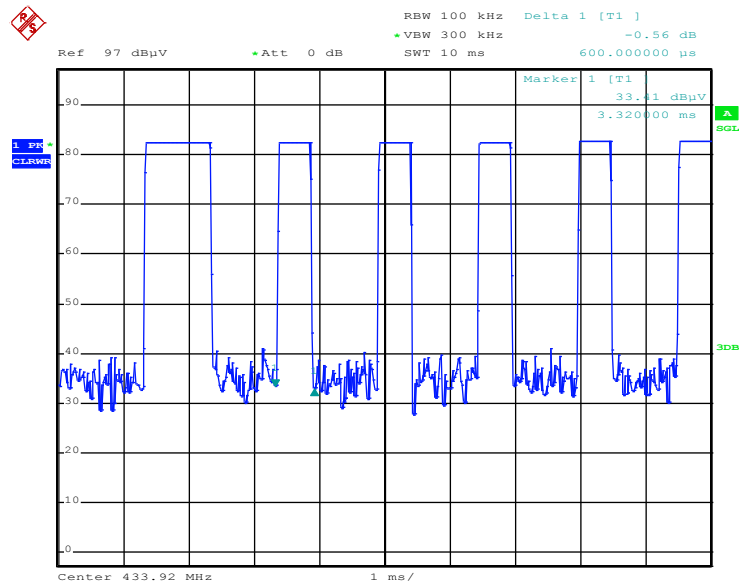




Long Pulse Transmit Time



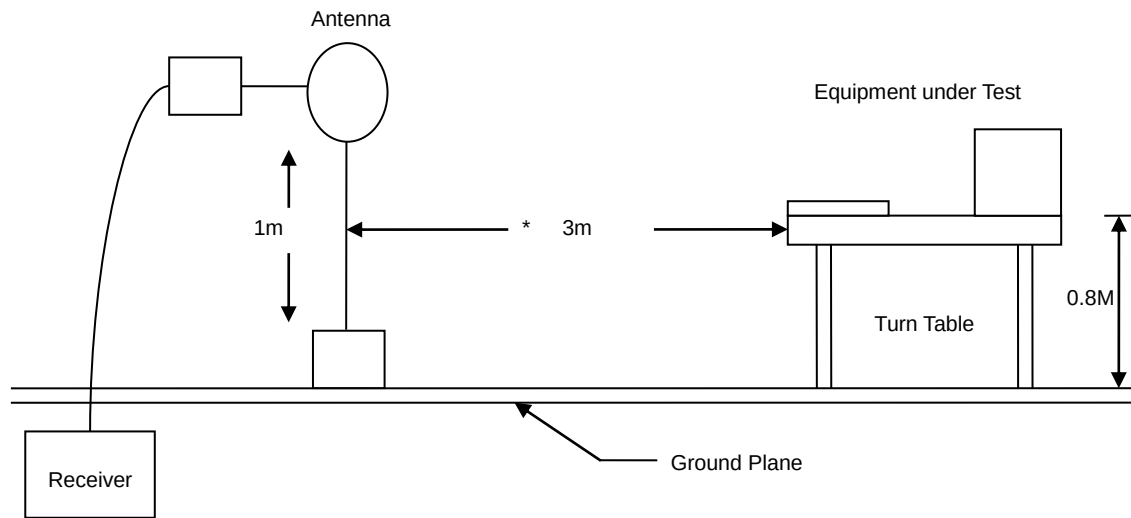
Short Pulse Transmit Time



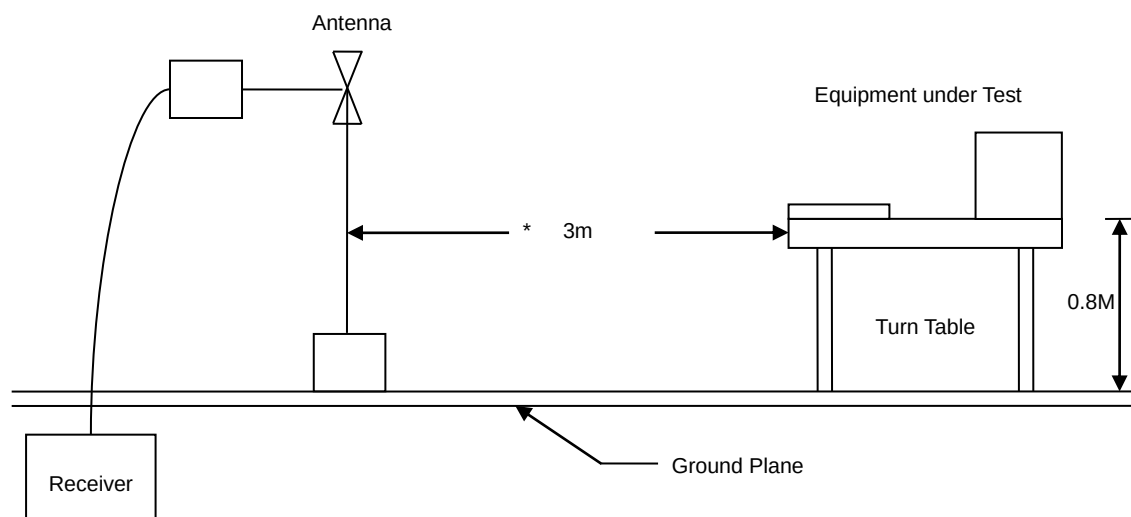


6.3 Typical Test Setup

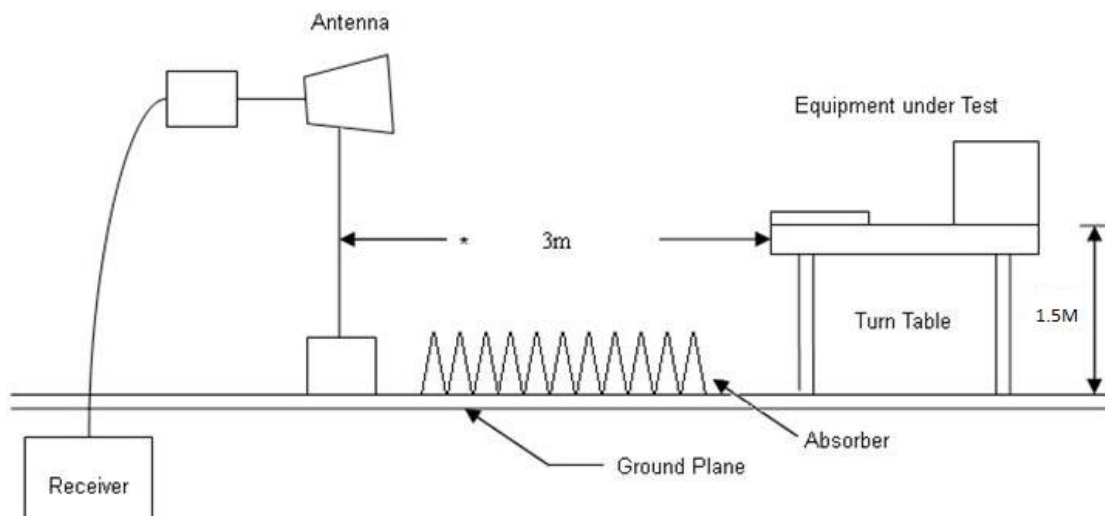
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup

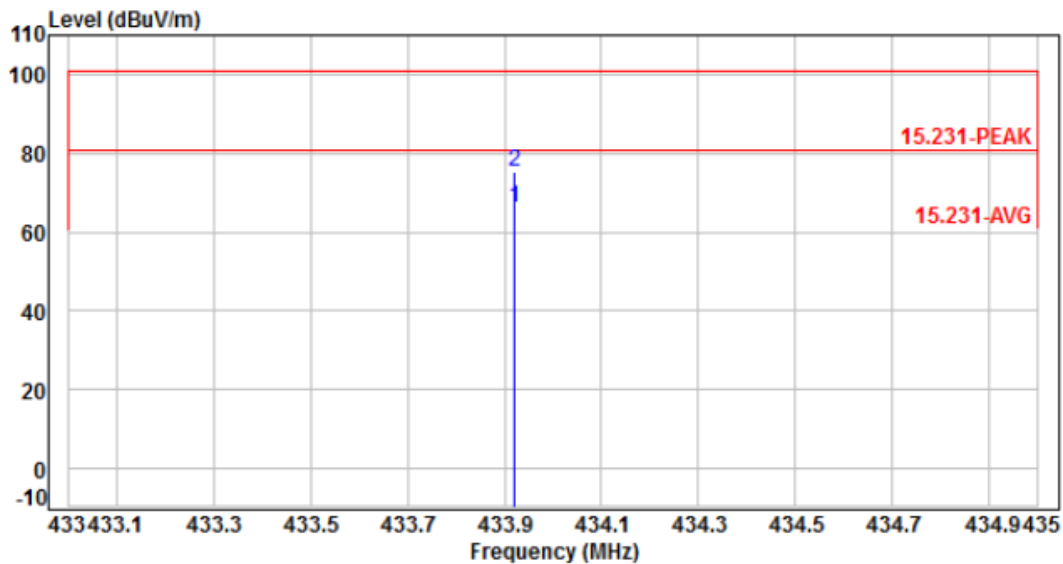




6.4 Test Result and Data

6.4.1 Test Result of Fundamental Emission

Power	:	DC 3V	Pol/Phase	:	VERTICAL
Test Mode	:	TX 433.92MHz		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	433.92	-5.15	71.38	66.23	80.83	-14.60	Average	230	180	P
2	433.92	-5.15	80.59	75.44	100.83	-25.39	Peak	230	180	P

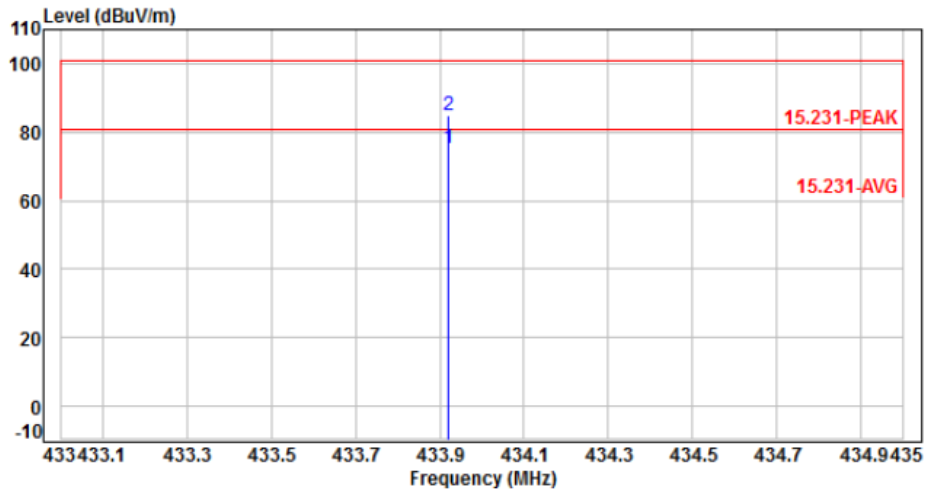
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 3V	Pol/Phase	:	HORIZONTAL
Test Mode	:	TX 433.92MHz		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	433.92	-5.15	80.68	75.53	80.83	-5.30	Average	220	250	P
2	433.92	-5.15	89.89	84.74	100.83	-16.09	Peak	220	250	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

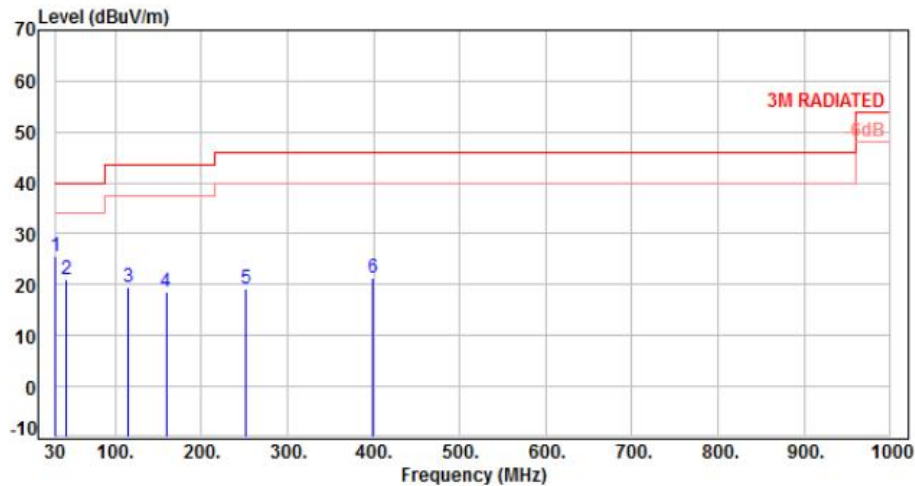


6.4.2 Test Result of Unwanted Spurious emission(9KHz-30MHz)

The 9kHz - 30MHz spurious emission is under limit 20dB more.

6.4.3 Test Result of Unwanted Spurious emission(30MHz-1GHz)

Power	:	DC 3V	Pol/Phase	:	VERTICAL
Test Mode	:	TX 433.92MHz		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	30.00	-10.51	36.05	25.54	40.00	-14.46	Peak	200	0	P
2	42.61	-9.56	30.66	21.10	40.00	-18.90	Peak	200	0	P
3	114.39	-12.35	31.86	19.51	43.50	-23.99	Peak	200	0	P
4	159.01	-9.34	27.80	18.46	43.50	-25.04	Peak	200	0	P
5	252.13	-10.27	29.49	19.22	46.00	-26.78	Peak	200	0	P
6	398.60	-5.98	27.35	21.37	46.00	-24.63	Peak	200	0	P

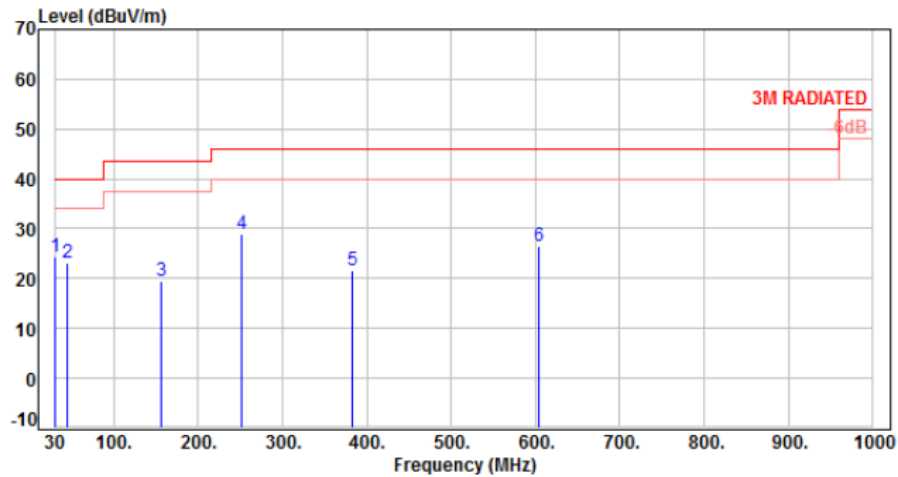
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC 3V	Pol/Phase	: HORIZONTAL
Test Mode	: TX 433.92MHz		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	30.00	-10.51	34.76	24.25	40.00	-15.75	Peak	100	0	P
2	44.55	-9.44	32.74	23.30	40.00	-16.70	Peak	100	0	P
3	157.07	-9.45	29.08	19.63	43.50	-23.87	Peak	100	0	P
4	252.13	-10.27	39.28	29.01	46.00	-16.99	Peak	100	0	P
5	382.11	-6.42	28.20	21.78	46.00	-24.22	Peak	100	0	P
6	603.27	-1.59	28.02	26.43	46.00	-19.57	Peak	100	0	P

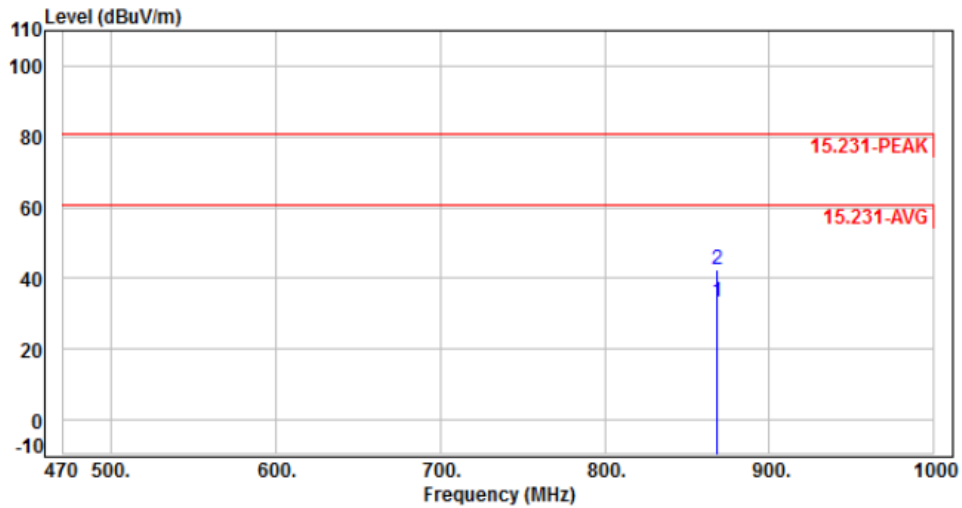
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 3V	Pol/Phase	:	VERTICAL
Test Mode	:	TX 433.92MHz		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	867.84	2.24	30.98	33.22	60.83	-27.61	Average	300	54	P
2	867.84	2.24	40.19	42.43	80.83	-38.40	Peak	300	54	P

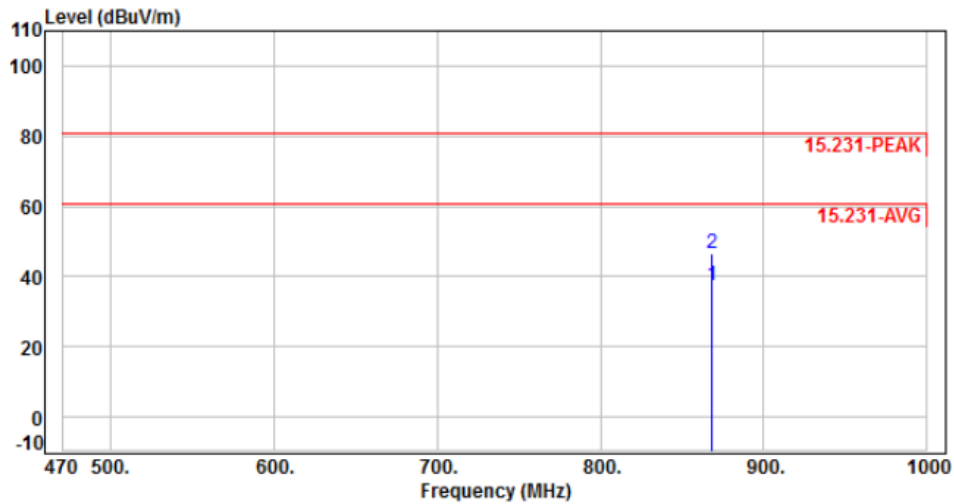
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	:	DC 3V	Pol/Phase	:	HORIZONTAL
Test Mode	:	TX 433.92MHz		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	867.84	2.24	35.28	37.52	60.83	-23.31	Average	180	33	P
2	867.84	2.24	44.49	46.73	80.83	-34.10	Peak	180	33	P

Note: Level=Reading+Factor

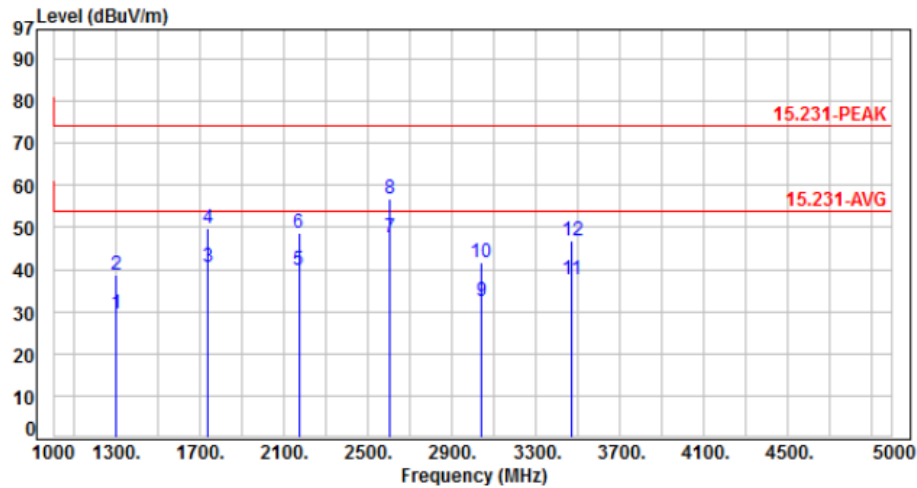
Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



6.4.4 Test Result of Unwanted Spurious emission(Above 1GHz)

Power	: DC 3V	Pol/Phase	: VERTICAL
Test Mode	: TX 433.92MHz		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	1301.76	-22.22	51.89	29.67	54.00	-24.33	Average	400	0	P
2	1301.76	-22.22	61.10	38.88	74.00	-35.12	Peak	400	0	P
3	1735.68	-20.16	60.80	40.64	54.00	-13.36	Average	400	0	P
4	1735.68	-20.16	70.01	49.85	74.00	-24.15	Peak	400	0	P
5	2169.60	-18.93	58.59	39.66	54.00	-14.34	Average	400	0	P
6	2169.60	-18.93	67.80	48.87	74.00	-25.13	Peak	400	0	P
7	2603.52	-17.43	65.09	47.66	54.00	-6.34	Average	400	0	P
8	2603.52	-17.43	74.30	56.87	74.00	-17.13	Peak	400	0	P
9	3037.44	-15.68	48.30	32.62	54.00	-21.38	Average	400	0	P
10	3037.44	-15.68	57.51	41.83	74.00	-32.17	Peak	400	0	P
11	3471.36	-14.50	51.98	37.48	54.00	-16.52	Average	400	0	P
12	3471.36	-14.50	61.19	46.69	74.00	-27.31	Peak	400	0	P

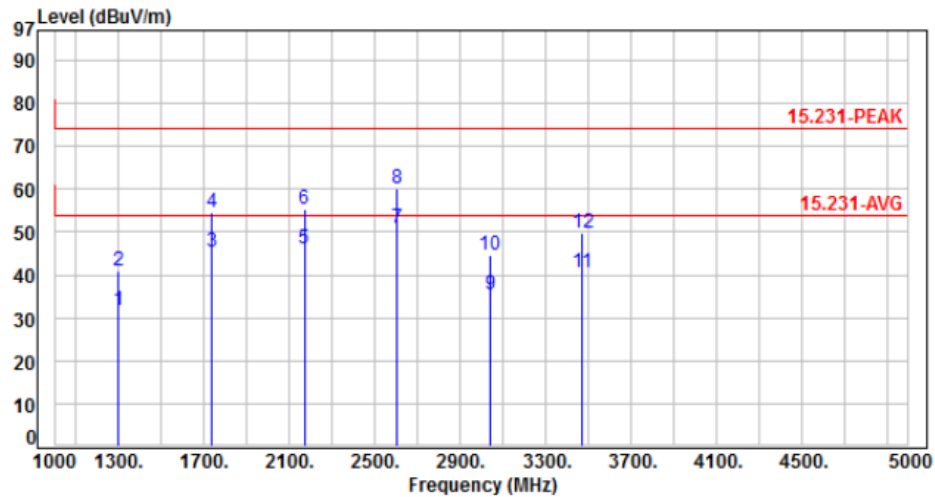
Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor



Power	: DC 3V	Pol/Phase	: HORIZONTAL
Test Mode	: TX 433.92MHz		:



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	1301.76	-22.22	53.99	31.77	54.00	-22.23	Average	100	0	P
2	1301.76	-22.22	63.20	40.98	74.00	-33.02	Peak	100	0	P
3	1735.68	-20.16	65.50	45.34	54.00	-8.66	Average	100	0	P
4	1735.68	-20.16	74.71	54.55	74.00	-19.45	Peak	100	0	P
5	2169.60	-18.93	65.09	46.16	54.00	-7.84	Average	100	0	P
6	2169.60	-18.93	74.30	55.37	74.00	-18.63	Peak	100	0	P
7	2603.52	-17.43	68.49	51.06	54.00	-2.94	Average	166	300	P
8	2603.52	-17.43	77.70	60.27	74.00	-13.73	Peak	166	300	P
9	3037.44	-15.68	51.20	35.52	54.00	-18.48	Average	100	0	P
10	3037.44	-15.68	60.41	44.73	74.00	-29.27	Peak	100	0	P
11	3471.36	-14.50	55.08	40.58	54.00	-13.42	Average	100	0	P
12	3471.36	-14.50	64.29	49.79	74.00	-24.21	Peak	100	0	P

Note: Level=Reading+Factor

Margin=Level-Limit

Factor=Antenna Factor + cable loss - Amplifier Factor

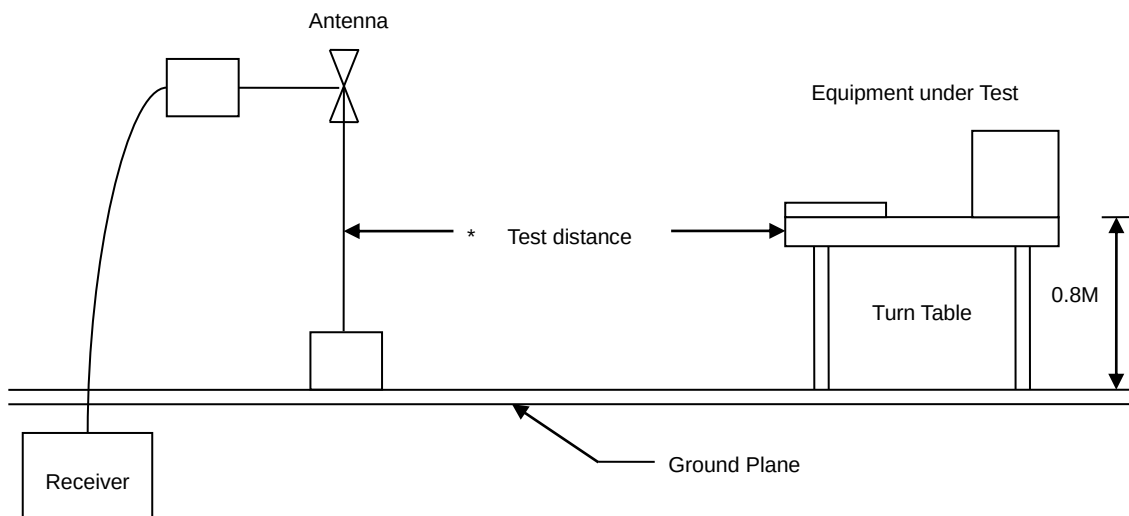


7. 20dB Bandwidth Measurement

7.1 Test Procedure

- The EUT placed on the turning table.
- The signal was coupled to the spectrum analyzer through an antenna.
- Set the resolution bandwidth to 3kHz and video bandwidth to 10kHz then select Peak function to scan the channel frequency.
- The 20dB bandwidth was measured and recorded.

7.2 Test Setup Layout



7.3 Limits of Band Edges Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and above 900 MHz.

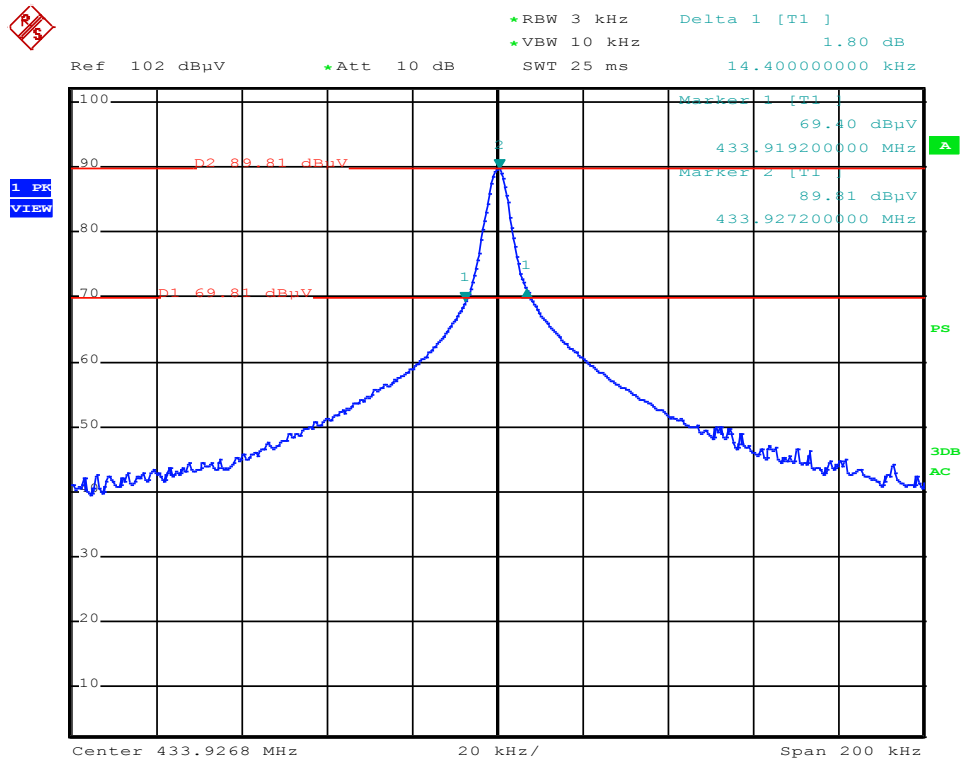
7.4 Test Result and Data

20dB Spectrum Bandwidth Measurement

Frequency (MHz)	20dB bandwidth (MHz)	20dB Bandwidth Limit (MHz)	PASS / FAIL
433.92	0.014	1.0848	PASS



Frequency: 433.92MHz



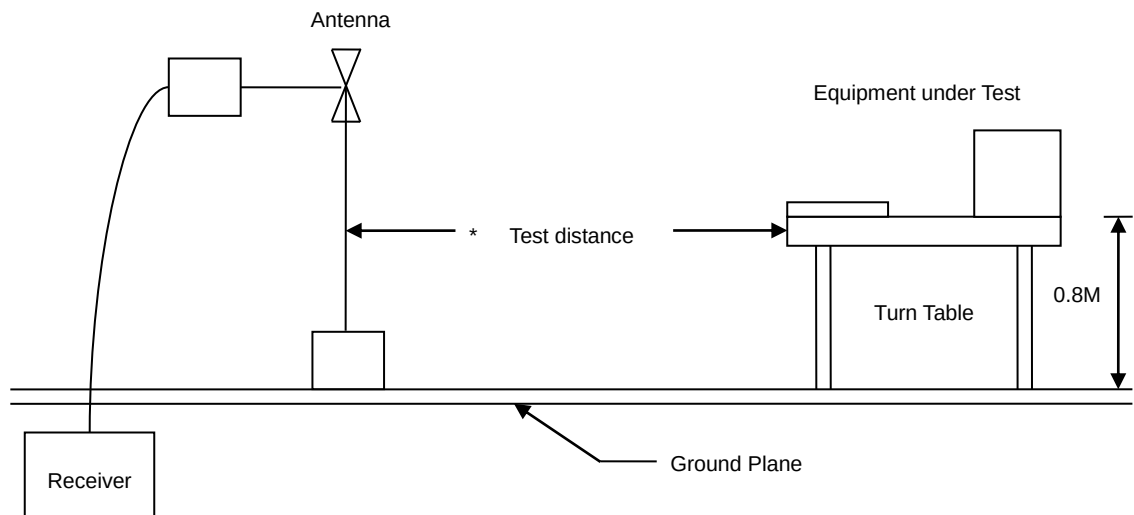


8. Transmission Time Control

8.1 Test Procedure

1. Set up the EUT in the state of Transmitter.
2. Set up the Spectrum, judge whether to accord with the regulation demand or not.

8.2 Test Setup Layout



8.3 Test Limit

- a. In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.
- b. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- c. polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

**8.4 Test Result and Data**

- (A) In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

Deactivation Time			
Frequency(MHz)	Duration of each transmission(S)	Limit (s)	Pass/Fail
433.92	0.480	5.0	PASS



Frequency: 433.92MHz

