



FCC RADIO TEST REPORT

Applicant : FrontAnD Technology Corporation

Address : No. 9, Neixi Rd., Luzhu Dist., Taoyuan City
: 33852, Taiwan, R.O.C.

Equipment : LED Light Bar and RF Control System

Model No. : RFD1000T/R, LBwww-xxx-yy-Lzzz
www: Version(21B/31B/2N7/3N7/2NT/3NT/
51/61/51T/61T/5N/6N/5NT/6NT)

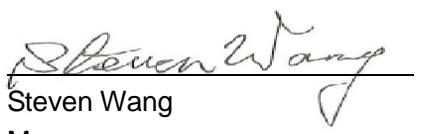
Trade Name : FRONTAND
Technology

FCC ID : 2AFZDFADRFD00000001

I HEREBY CERTIFY THAT :

The sample was received on Sep. 15, 2014 and the testing was carried out on Sep. 30, 2014 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.

Approved by:


Steven Wang
Manager

Tested by:


Aiden Lu
Engineer

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory



Cerpass Technology(SuZhou) Co., Ltd.





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History of this test report

■ ORIGINAL.

Additional attachment as following record:



1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.4: 2009

FCC Rules and Regulations Part 15 Subpart C §15.231

FCC Rule	Description of Test	Result
15.203	. Antenna Requirement	Pass
15.207	. AC Power Line Conducted Emission	Pass
15.209 15.231	. Spurious Emission(Radiated)	Pass
15.231	. 20dB Occupied Bandwidth Measurement	Pass
15.231	. Transmission Time Control	Pass

This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report.



2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Modulation Type	ASK
Frequency Range	433.92MHz
Channel Number	1
Antenna Type/ gain	Monopole Printing Antenna

2.2 Test Mode and Test Software

- a. During testing, the interface cables and equipment positions were varied according to ANSI C63.4.
- b. The complete test system included EUT for the test.
- c. XYZ 3 axes of the EUT have been tested, only the worst axis was reported.
- d. New battery was used for all the testing on this report.

2.3 Description of Test System

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



2.4 General Information of Test

<input checked="" type="checkbox"/> Test Site	Cerpass 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 Address: No.68-1, Shihbachongsi, Shihding Township, New Taipei City 223, Taiwan, R.O.C. Tel: +886-2-2663-8582	
	FCC	TW1079, TW1061, 390316, 228391, 641184
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication Test C-4663 for Conducted emission test R-3428, R-4218 for Radiated emission test G-812, G-813 for radiated disturbance above 1GHz
<input type="checkbox"/> Test Site	Cerpass Technology (Suzhou) Co.,Ltd Address: No.66,Tangzhuang Road, Suzhou Industrial Park, Jiangsu 215006, China Tel: +86-512-6917-5888 Fax: +86-512-6917-5666	
	FCC	916572, 331395
	IC	7290A-1, 7290A-2
	VCCI	T-343 for Telecommunication Test C-2919 for Conducted emission test R-2670 for Radiated emission test G-227 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 4,500MHz	
Test Distance :	The test distance of radiated emission above 1GHz from antenna to EUT is 3 M.	



3. Test Equipment and Ancillaries Used for Tests

Instrument	Model No.	Manufacturer	Serial No.	Calibration Date	Valid Date
Bilog Antenna	Schwarzbeck	VULB9168	275	2015/9/3	2016/9/2
Active Loop Antenna	EMCO	6507	40855	2015/3/12	2016/3/11
Horn Antenna	EMCO	3115	31601	2015/9/2	2016/9/1
Horn Antenna	EMCO	3116	31974	2015/9/7	2016/9/6
EXA Signal Analyzer	KEYSIGHT	N9010A	MY542002 07	2015/3/14	2016/3/13
Preamplifier	QuieTek	AP-0100A	CHM09060 75	2015/9/17	2016/9/16
Preamplifier	Agilent	8449B	3008A0195 4	2015/3/5	2016/3/4
Preamplifier	MITEQ	AMF-7D-0010 100-30-10P	1860212	2015/3/9	2016/3/8
Preamplifier	EMC INSTRUMENT S	EMC184045	980065	2015/9/4	2016/9/3
Signal Generator	KEYSIGHT	83640A	2927A0010 7	2015/9/1	2016/8/31
MXG MW Analog Signal Generator	KEYSIGHT	N5183A	MY501429 31	2015/3/13	2016/3/12
MXG-B RF Vector Signal Generator	KEYSIGHT	N5182B	MY530513 83	2015/3/12	2016/3/11
BLUETOOTH TESTER	R&S	CBT	101133	2015/3/12	2016/3/11
Attenuator	KEYSIGHT	8491B	MY392507 05	2015/9/2	2016/9/1
Rotary Attenuator	Agilent	8494B	MY421544 66	2015/3/9	2016/3/8
Rotary Attenuator	Agilent	8495B	MY421466 80	2015/3/9	2016/3/8
Temp & Humi chamber	T-MACHINE	TMJ-9712	T-12-0401 11	2014/10/17	2015/10/16
Series Power Meter	Anritsu	ML2495A	1224005	2015/3/5	2016/3/4
Power Sensor	Anritsu	MA2411B	1207295	2015/3/5	2016/3/4
USB Average Power Sensor	Theda	4PS6A	TW545101 3~16	2014/11/8	2015/11/7



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.

And according to FCC 47 CFR Section 15.247(b), 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.

4.2 Antenna Construction and Directional Gain

No.	Antenna Type	Antenna Gain
1	Monopole Printing Antenna	-10 dBi



5. Test of AC Power Line Conducted Emission

5.1 Test Result and Data

The EUT is powered from battery; the test item is not applicable for the EUT.



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	
	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$
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, $\mu\text{V}/\text{m}$ at 3 meters = $22.72727(F)-2454.545$; for the band 260-470 MHz, $\mu\text{V}/\text{m}$ 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 ($\mu\text{V}/\text{m}$)
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 = $20\log\left(\frac{\text{total duty}}{\text{period of pulse train}}\right)$
= $20\log\left(\frac{0.181 \times 1}{10}\right)$
= -34.86

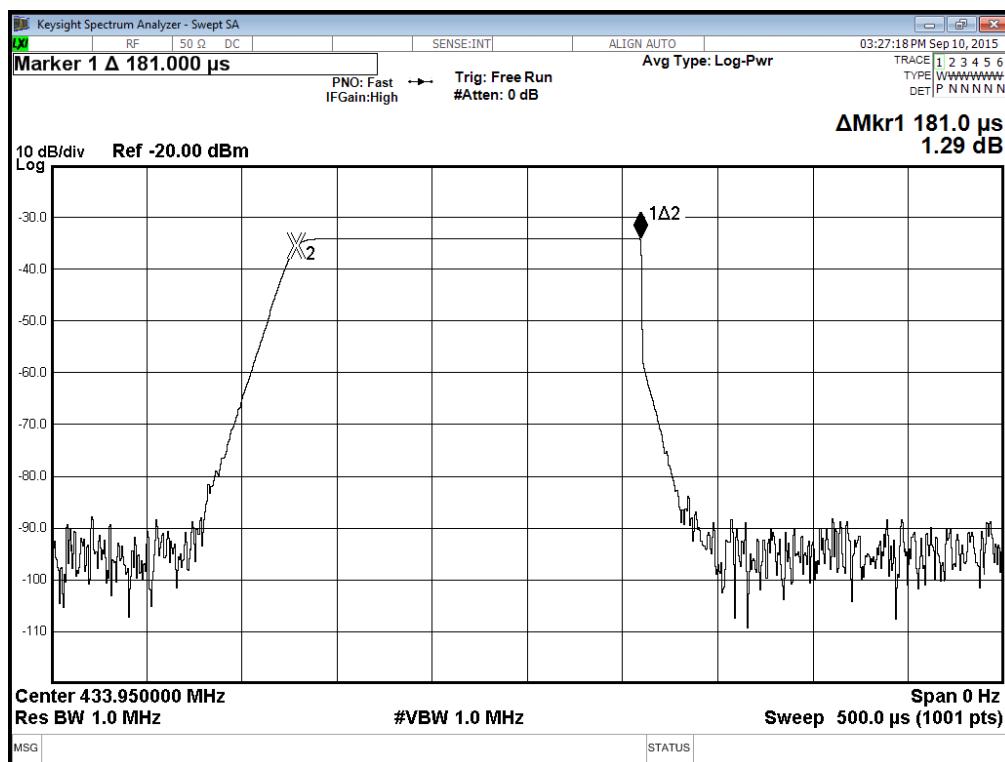
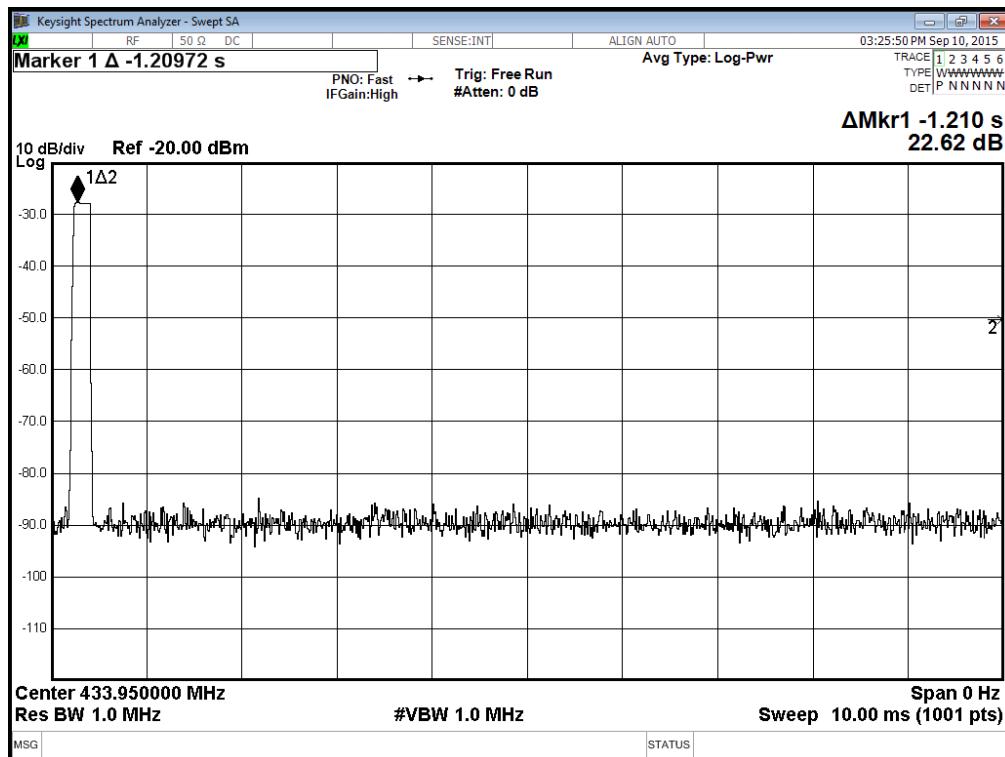


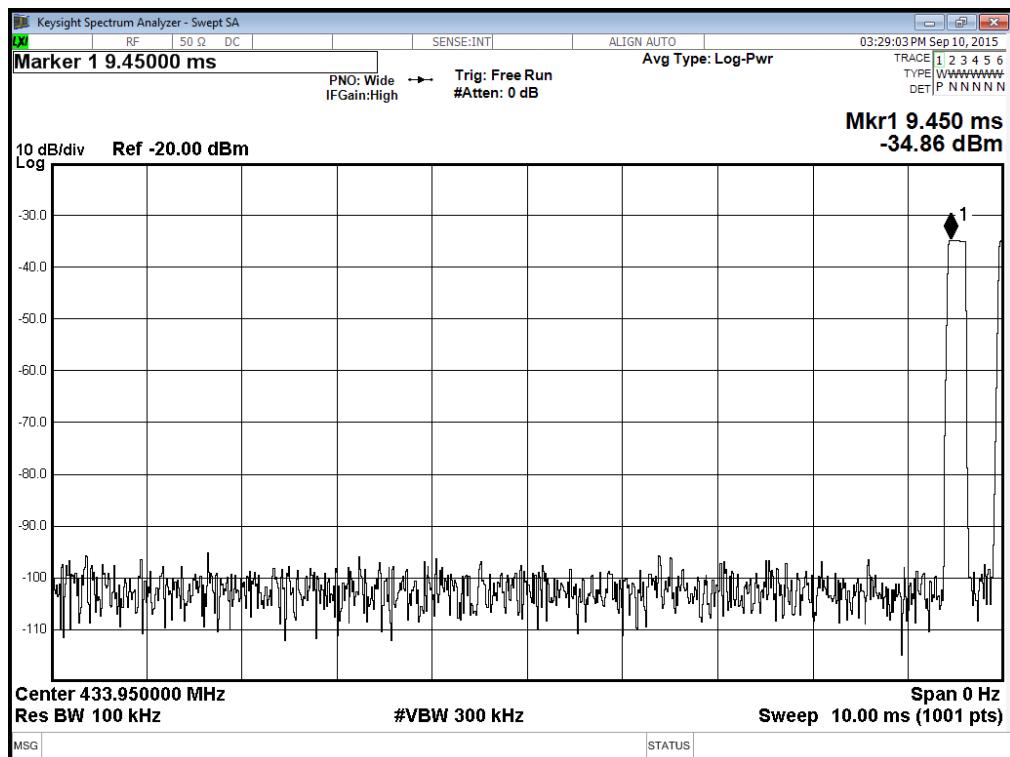
Test Date: Sep. 10, 2015

Temperature: 26°C

Atmospheric pressure: 1008 hPa

Humidity: 50%

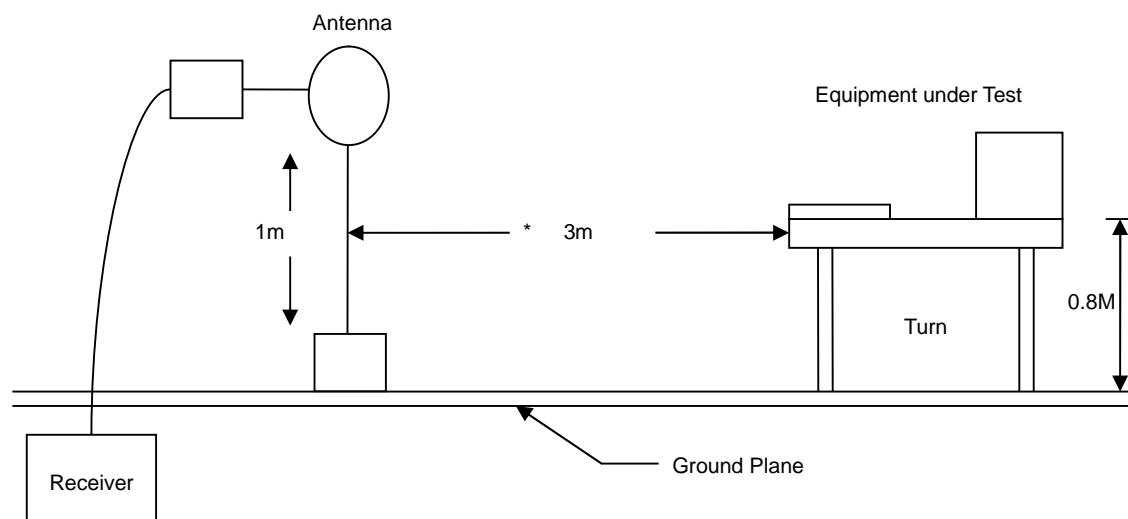




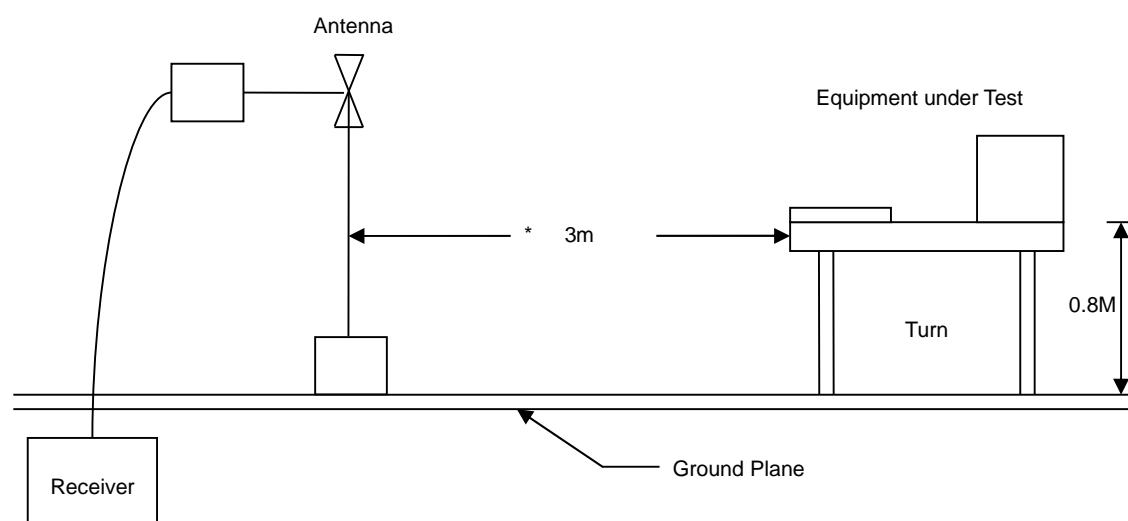


6.3 Typical Test Setup

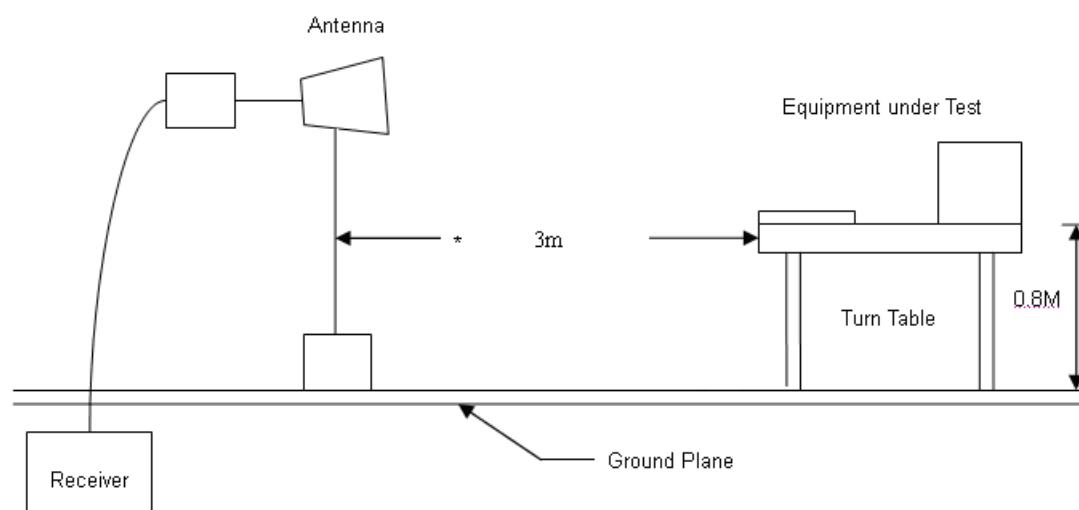
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup

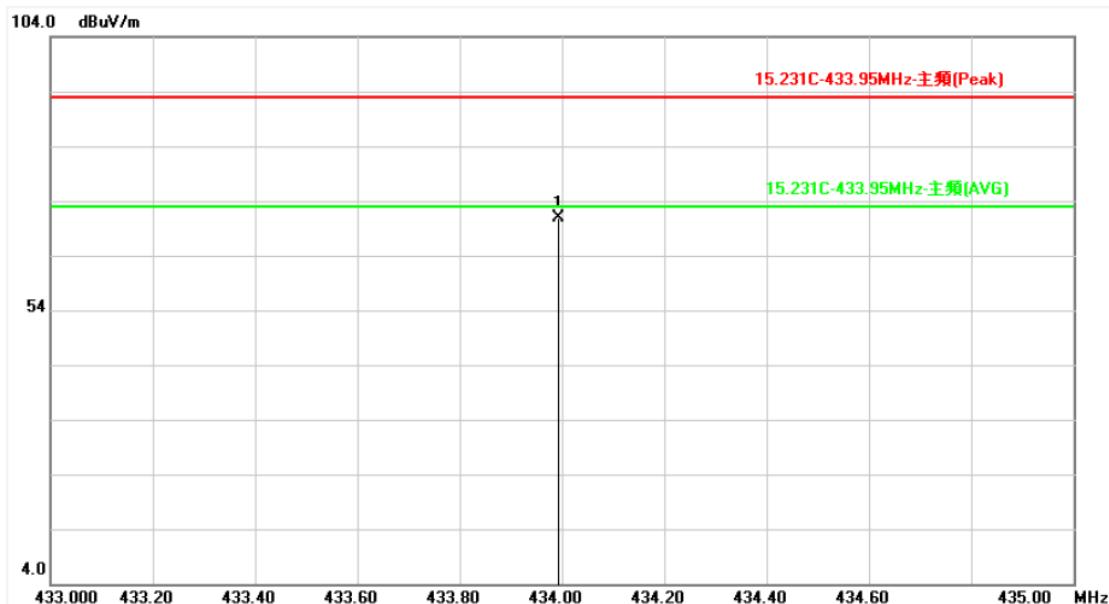




6.4 Test Result and Data

6.4.1 Test Result of Fundamental Emission

Power	: DC 3.3V	Pol/Phase	: VERTICAL
Test Mode	: Transmit	Temperature	: 23 °C
Test Date	: Sep. 11, 2015	Humidity	: 52 %
Memo		Atmospheric Pressure	: 1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	433.9940	-2.83	73.67	70.84	92.87	-22.03	peak	110	188	P

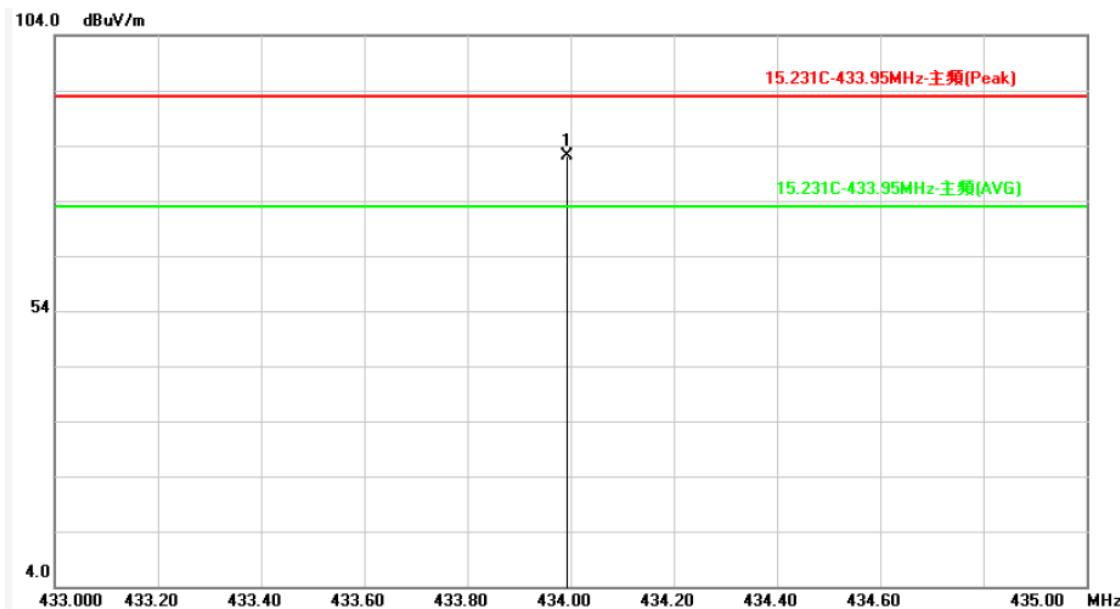
Note: Level = Reading + Factor

Margin = Level – Limit

AV=Peak value+ Duty cycle factor= 70.84+(-34.86)= 35.98< Limit 72.87dBuV/m



Power	: DC 3.3V	Pol/Phase	: HORIZONTAL
Test Mode	: Transmit	Temperature	: 23 °C
Test Date	: Sep. 11, 2015	Humidity	: 52 %
Memo	:	Atmospheric Pressure	: 1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	433.9940	-2.83	84.94	82.11	92.87	-10.76	peak	110	188	P

Note: Level = Reading + Factor

Margin = Level – Limit

AV=Peak value+ Duty cycle factor= 82.11+(-34.86)=47.25< Limit 72.87dBuV/m

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

Power	: DC 3.3V	Pol/Phase	: VERTICAL
Test Mode	: Transmit	Temperature	: 23 °C
Test Date	: Sep. 11, 2015	Humidity	: 53 %
Memo	:	Atmospheric Pressure	: 1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	41.6400	-7.36	40.42	33.06	40.00	-6.94	peak	102	186	P
2	49.3998	-7.20	39.25	32.05	40.00	-7.95	peak	102	186	P
3	150.2800	-7.30	35.31	28.01	43.50	-15.49	peak	102	186	P
4	166.7700	-7.56	35.12	27.56	43.50	-15.94	peak	102	186	P
5	410.2400	-3.45	30.69	27.24	46.00	-18.76	peak	102	186	P
6	869.0499	4.60	21.60	26.20	52.87	-26.67	QP	102	186	P

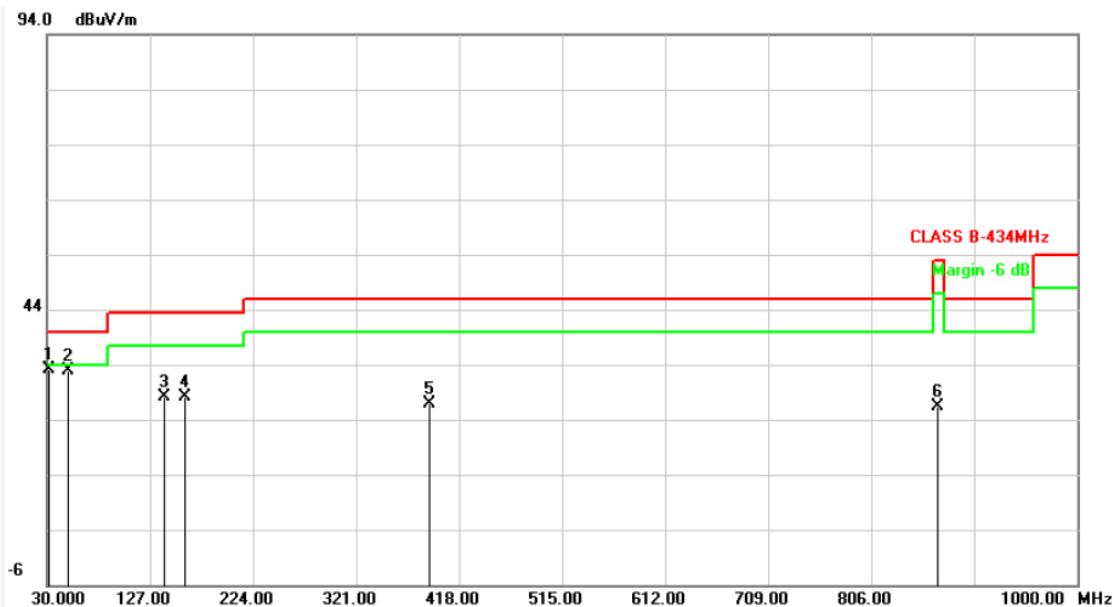
Note: Level = Reading + Factor

Margin = Level - Limit

Peak reading is below AV limit, no AV reading is reported.



Power :	DC 3.3V	Pol/Phase :	HORIZONTAL
Test Mode :	Transmit	Temperature :	23 °C
Test Date :	Sep. 11, 2015	Humidity :	53 %
Memo :		Atmospheric Pressure :	1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	31.9400	-7.97	41.01	33.04	40.00	-6.96	peak	102	186	P
2	50.3699	-7.26	40.21	32.95	40.00	-7.05	peak	102	186	P
3	140.5800	-7.55	35.70	28.15	43.50	-15.35	peak	102	186	P
4	159.9798	-7.25	35.28	28.03	43.50	-15.47	peak	102	186	P
5	389.8700	-4.00	30.87	26.87	46.00	-19.13	peak	102	186	P
6	869.0499	4.60	21.80	26.40	52.87	-26.47	QP	102	186	P

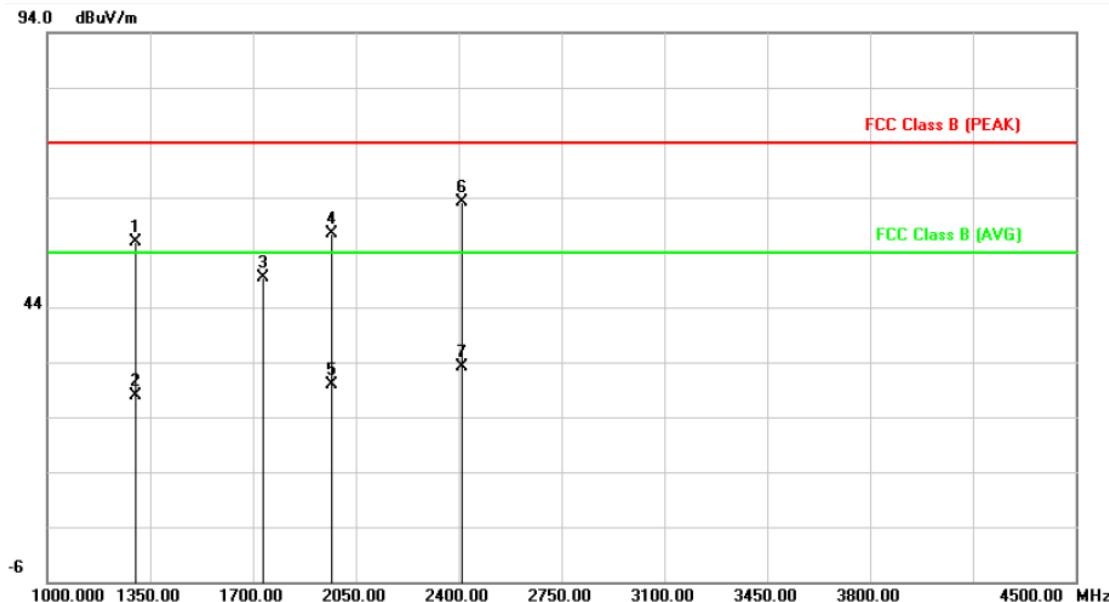
Note: Level = Reading + Factor

Margin = Level – Limit

Peak reading is below AV limit, no AV reading is reported.

**6.4.3 Test Result of Unwanted Spurious emission(Above 1GHz)**

Power :	DC 3.3V	Pol/Phase :	VERTICAL
Test Mode :	Transmit	Temperature :	23 °C
Test Date :	Sep. 11, 2015	Humidity :	53 %
Memo :		Atmospheric Pressure :	1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	1301.000	-6.95	62.90	55.95	74.00	-18.05	peak	102	186	P
2	1301.000	-6.95	34.95	28.00	54.00	-26.00	AVG	102	186	P
3	1735.000	-4.24	53.63	49.39	74.00	-24.61	peak	102	186	P
4	1969.500	-2.72	60.11	57.39	74.00	-16.61	peak	102	186	P
5	1969.500	-2.72	32.50	29.78	54.00	-24.22	AVG	102	186	P
6	2410.500	-0.90	64.04	63.14	74.00	-10.86	peak	102	186	P
7	2410.500	-0.90	33.91	33.01	54.00	-20.99	AVG	102	186	P

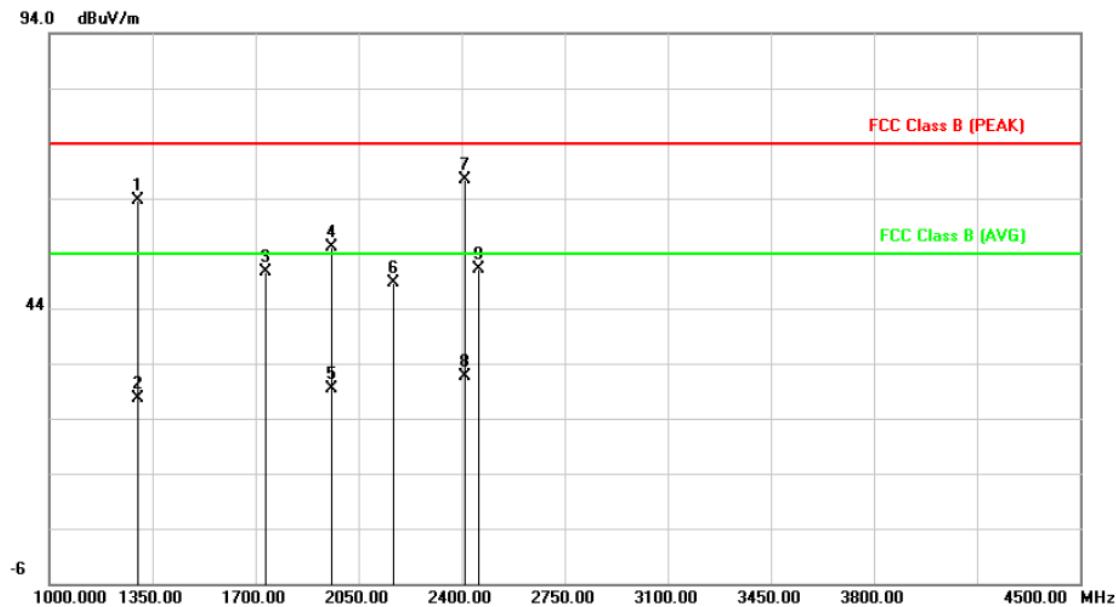
Note: Level = Reading + Factor

Margin = Level – Limit

Peak reading is below AV limit, no AV reading is reported.



Power	: DC 3.3V	Pol/Phase	: HORIZONTAL
Test Mode	: Transmit	Temperature	: 23 °C
Test Date	: Sep. 11, 2015	Humidity	: 53 %
Memo		Atmospheric Pressure	: 1036 hpa



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (°)	P/F
1	1301.000	-6.95	70.46	63.51	74.00	-10.49	peak	102	186	P
2	1301.000	-6.95	34.64	27.69	54.00	-26.31	AVG	102	186	P
3	1735.000	-4.24	54.91	50.67	74.00	-23.33	peak	102	186	P
4	1959.000	-2.79	57.92	55.13	74.00	-18.87	peak	102	186	P
5	1959.000	-2.79	32.29	29.50	54.00	-24.50	AVG	102	186	P
6	2169.000	-1.85	50.47	48.62	74.00	-25.38	peak	102	186	P
7	2410.500	-0.90	68.38	67.48	74.00	-6.52	peak	102	186	P
8	2410.500	-0.90	32.41	31.51	54.00	-22.49	AVG	102	186	P
9	2456.000	-0.72	51.89	51.17	74.00	-22.83	peak	102	186	P

Note: Level = Reading + Factor

Margin = Level – Limit

Peak reading is below AV limit, no AV reading is reported.

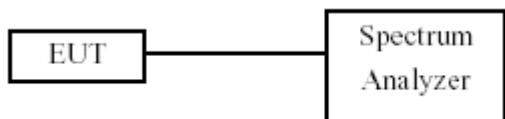


7. 20dB Occupied Bandwidth Measurement

7.1 Test Procedure

- a. The EUT placed on the turning table.
- b. The signal was coupled to the spectrum analyzer through an antenna.
- c. Set the resolution bandwidth to 100kHz and video bandwidth to 100kHz then select Peak function to scan the channel frequency.
- d. 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.

Frequency (MHz)	Limit of 20dB Bandwidth (MHz)
433.92	1.08

7.4 Test Result and Data

Test Date: Sep. 10, 2015

Temperature: 26°C

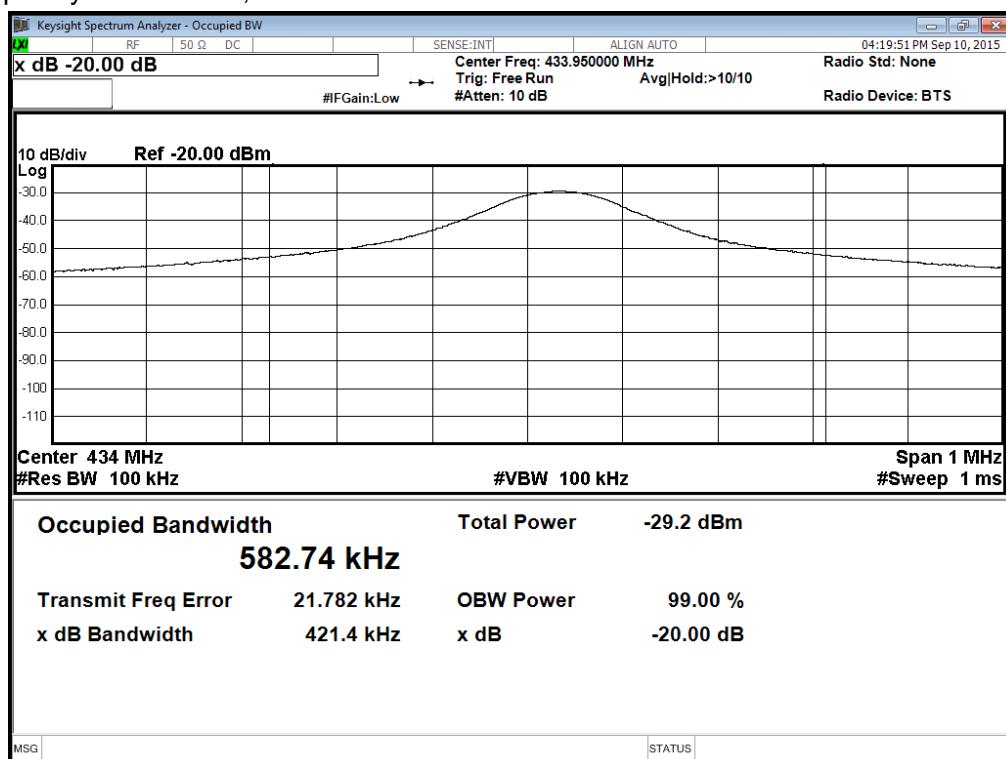
Atmospheric pressure: 1008 hPa

Humidity: 50%

Frequency (MHz)	20 dB bandwidth (MHz)	PASS / FAIL
433.95	0.582	PASS



Frequency: 433.95MHz, CH1



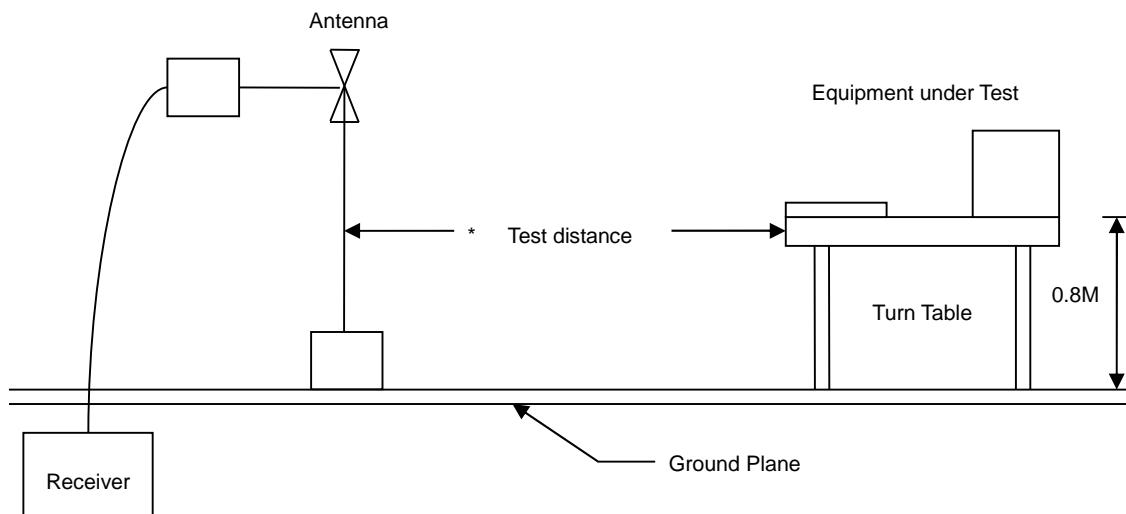


8. Transmission Time Control

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

Limits: 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.

8.4 Test Result and Data

Test Date: Sep. 10, 2015

Temperature: 26°C

Atmospheric pressure: 1008 hPa

Humidity: 50%

Frequency (MHz)	Operation time(Sec.)	Limit	PASS / FAIL
433.92	0.00017	<1 sec. and least 30 times the duration of the transmission, in no case less than 10 sec.	PASS



Frequency: 433.95MHz

