

BUREAU
VERITAS

Test Report No.: FC111222N023

TEST REPORT



To:	Current Cost Ltd.
Address:	Anglesey Lodge, Farnborough Road, Aldershot, Hampshire GU11 3BJ, UK

Manufacturer or Supplier	Current Cost Ltd.	
Address	Anglesey Lodge, Farnborough Road, Aldershot, Hampshire GU11 3BJ, UK	
Product:	15A US IAM	
Brand Name:	N/A	
Model:	15A US IAM	
Additional Model & Model Difference:	N/A	
Date of tests:	Dec. 23, 2011~ Apr. 11, 2012	

the tests have been carried out according to the requirements of the following standards:

☒ **FCC Part 15, Subpart C (Section 15.231e)**

CONCLUSION: The submitted sample was found to COMPLY with the test requirement

Prepared by Glyn He Project Engineer / EMC Department	Approved by Sam Tung Manager / EMC Department
	 Date: Apr.11, 2012

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	N/A	Apr. 11, 2012



1 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.231)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
§15.203	Antenna Requirement	PASS	Compliant
§15.207 (a)	Conducted Emission	PASS	Compliant
§15.231(b) §15.35	Duty Cycle	PASS	Compliant
§15.209 §15.231(e)	Radiated Emission	PASS	Compliant
§15.231 (e)	Deactivation Testing	PASS	Compliant
§15.231(c)	20dB Bandwidth Test	PASS	Compliant

2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44dB
Radiated emissions	30MHz ~ 200MHz	3.19dB
	200MHz ~1000MHz	3.21dB
	1GHz ~ 18GHz	2.26dB
	18GHz ~ 40GHz	1.94dB

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



3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	15A US IAM
MODEL NO.	15A US IAM
FCC ID	WW9-US-IAM
NOMINAL VOLTAGE	AC 100-120V/60Hz
MODULATION TYPE	FSK
OPERATING FREQUENCY	433.9MHz
NUMBER OF CHANNEL	1
ANTENNA TYPE	Integral Antenna
I/O PORTS	AC Output
DATA CABLE SUPPLIED	N/A

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. The EUT was powered by the following adapters:

ADAPTER	
BRAND:	N/A
MODEL:	N/A
INPUT:	N/A
OUTPUT:	N/A
DC LINE:	N/A

3.2 DESCRIPTION OF TEST MODES

The EUT was tested under the following modes' the final worst mode were marked in boldface and recorded in this report.

FREQUENCY	TEST MODES
433.9MHz	Transmitting



3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.231e)

ANSI C63.4-2009

All test items have been performed and recorded as per the above standards.

3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	N/A				

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	N/A



4. TEST TYPES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100199	May 25,11	May 25,12
Test software	ADT_Cond_V7.3.7	N/A	N/A	N/A
Artificial Mains Network ROHDE & SCHWARZ	ENV216	101173	May 25,11	May 25,12
RF Cable FUJIKURA	3D-2W	844 Cable	May 02,11	May 02,12
ISN TESEQ	ISN T800	27957	Oct 16,11	Oct 16,12

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA
2. The test was performed in Dongguan Shielded Room 553.



4.1.3 TEST PROCEDURES

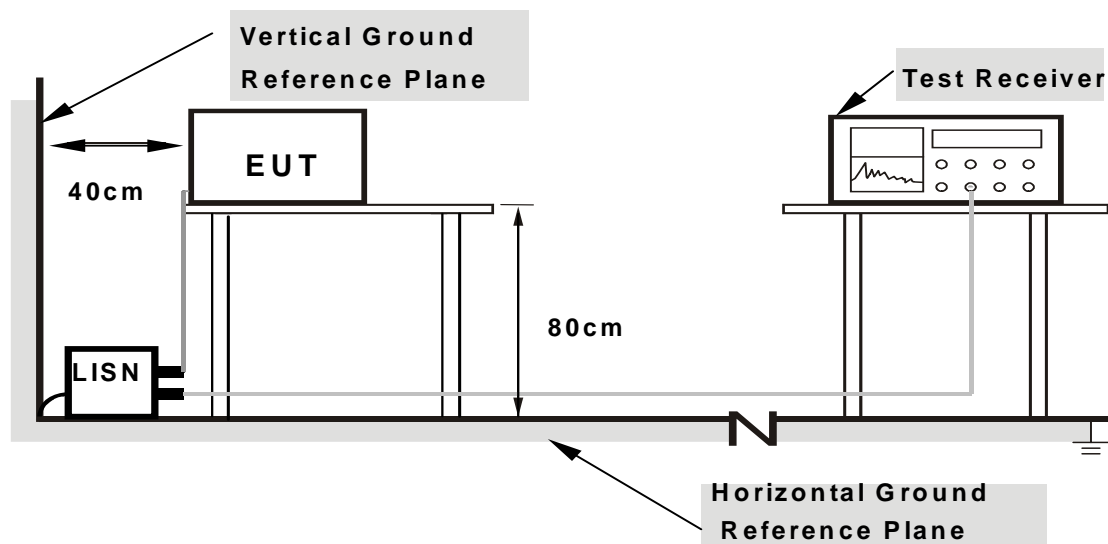
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation.

4.1.5 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT OPERATING CONDITIONS

- a. Turned on the power of all equipment.
- b. EUT was operated according to the type used was description in manufacturer's specifications or the User's Manual.



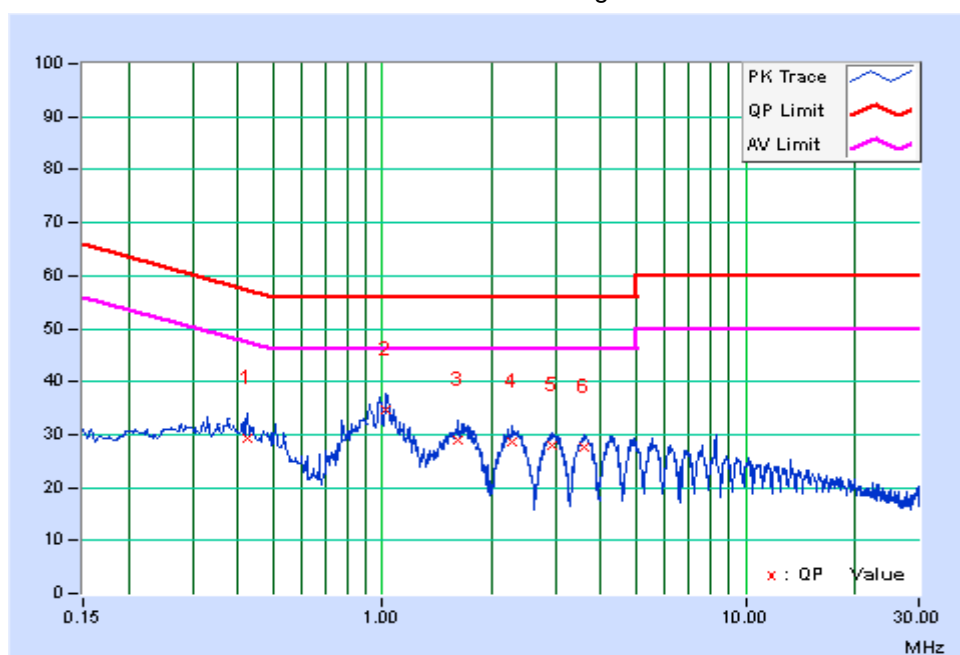
4.1.7 TEST RESULTS

CONDUCTED WORST-CASE DATA

INPUT POWER	AC 120V/60Hz	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 46% RH, 1008 hPa	PHASE	Line
TESTED BY	Glyn		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.4237	9.76	19.37	15.98	29.13	25.74	57.38	47.38	-28.25	-21.64
2	1.02193	9.79	25.01	20.39	34.80	30.18	56.00	46.00	-21.20	-15.82
3	1.60843	9.80	19.18	16.57	28.98	26.37	56.00	46.00	-27.02	-19.63
4	2.27704	9.82	18.68	16.21	28.50	26.03	56.00	46.00	-27.50	-19.97
5	2.91828	9.83	18.01	15.49	27.84	25.32	56.00	46.00	-28.16	-20.68
6	3.61035	9.84	17.71	15.25	27.55	25.09	56.00	46.00	-28.45	-20.91

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.

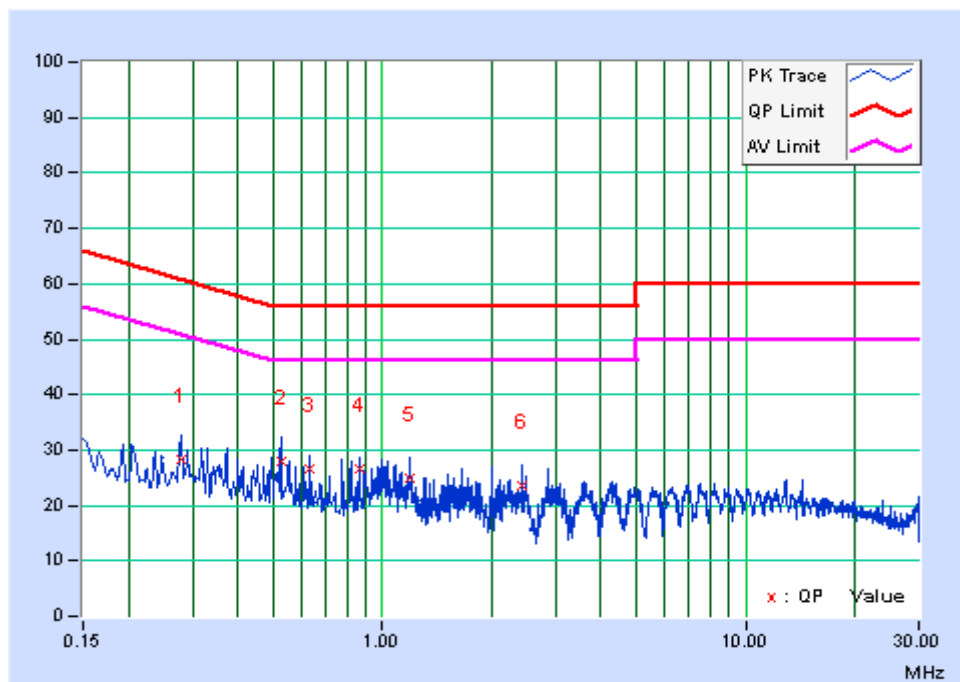




INPUT POWER	AC 120V/60Hz	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 46% RH, 1008 hPa	PHASE	Neutral
TESTED BY	Glyn		

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.27903	9.77	18.46	9.56	28.23	19.33	60.84	50.84	-32.61	-31.51
2	0.52536	9.78	18.13	9.36	27.91	19.14	56.00	46.00	-28.09	-26.86
3	0.63093	9.79	16.81	6.39	26.60	16.18	56.00	46.00	-29.40	-29.82
4	0.86553	9.77	16.97	7.19	26.74	16.96	56.00	46.00	-29.26	-29.04
5	1.19397	9.77	15.30	7.51	25.07	17.28	56.00	46.00	-30.93	-28.72
6	2.41389	9.82	13.76	6.30	23.58	16.12	56.00	46.00	-32.42	-29.88

- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
 3. The emission levels of other frequencies were very low against the limit.
 4. Margin value = Emission level - Limit value
 5. Correction factor = Insertion loss + Cable loss
 6. Emission Level = Correction Factor + Reading Value.





4.2 DUTY CYCLE TEST

4.2.1 STANDARD APPLICABLE

According to FCC 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer Agilent	E7405A	MY45118807	May 25,11	May 25,12

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA.
 2. The test was performed in Dongguan Chamber RF

4.2.3 TEST PROCEDURES

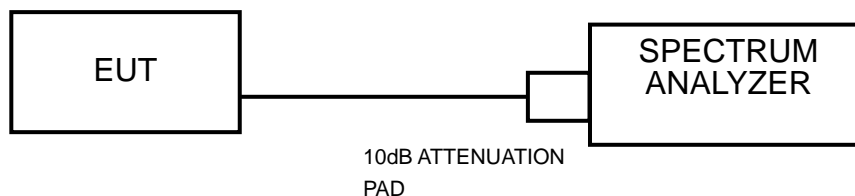
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.9MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation



4.2.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- With the EUT's antenna attached, which was connected to the spectrum analyzer set to the EUT's operation frequencies.

4.2.7 TEST RESULTS

$$T_p = 45\text{ms}$$

$$T_{on} = T_{on1} * \text{Number} + T_{on2} * \text{Number} = 512.5 * 10 + 300 * 37 = 16.225\text{ms}$$

$$\text{Duty Cycle} = T_{on} / T_p * 100\% = 36.06\%$$

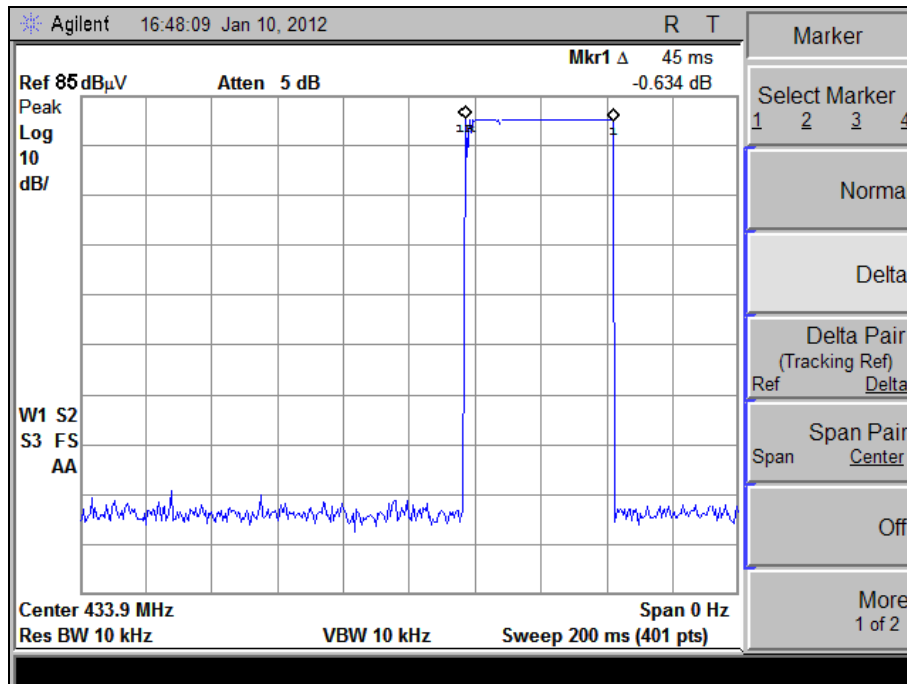
$$\text{Factor} = 20 * \log(T_{on}/T_p) = -8.86$$



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T_p

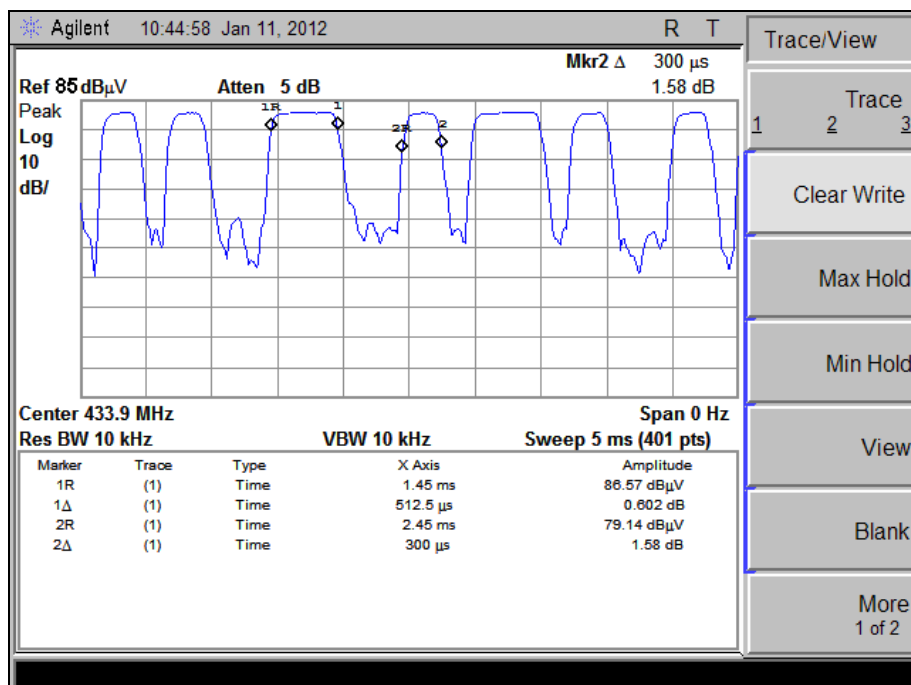
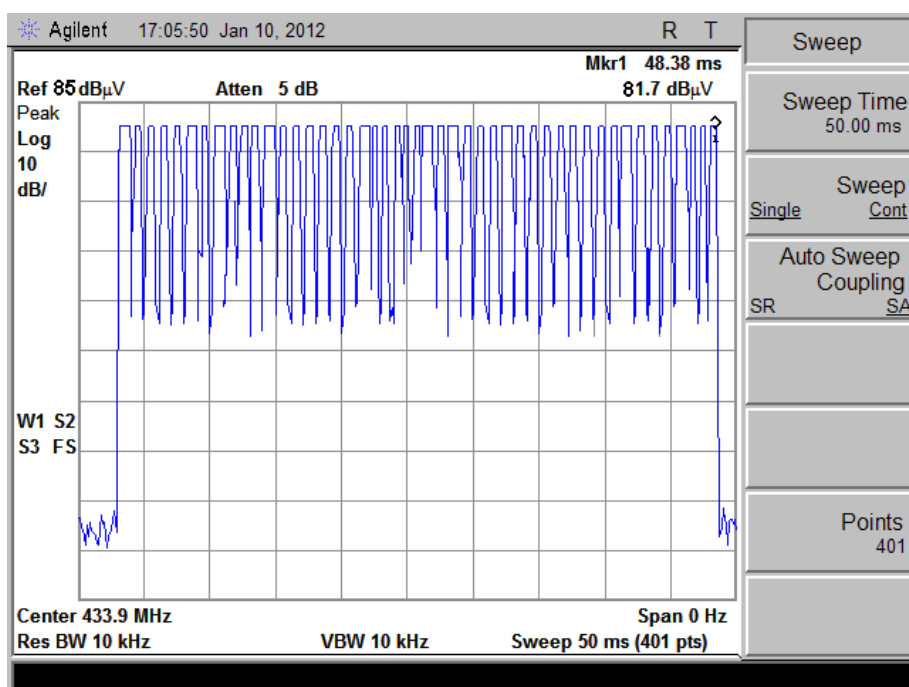




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$$T_{on} = 512.5 \times 10 + 300 \times 37 = 16.225 \text{ ms}$$





4.3 RADIATED EMISSION MEASUREMENT

4.3.1 LIMITS OF RADIATED EMISSION MEASUREMENT

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

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

According to §15.231(e), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66–40.70	1,000	100
70–130	500	50
130–174	500 to 1,500 ¹	50 to 150 ¹
174–260	1,500	150
260–470	1,500 to 5,000 ¹	150 to 500 ¹
Above 470	5,000	500

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. 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.

**4.3.2 TEST INSTRUMENTS**

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer Agilent	E4446A	MY46180622	Apr. 25, 11	Apr. 25, 12
Spectrum Analyzer Agilent	E7405A	MY45118807	May 25, 11	May 25, 12
Test Receiver ROHDE & SCHWARZ	ESVD	847398/003	May 25, 11	May 25, 12
Bilog Antenna TESEQ	CBL 6111D	27089	Jul 24, 11	Jul 24, 12
Horn Antenna EMCO	3117	00062558	Nov.07,11	Nov.07,12
10m Semi-anechoic Chamber ETS-LINDGREN	21.4m*12.1m*8.8m	NSEMC006	May 02, 11	May 02, 12
RF Cable IMRO	IMRO-400	10m Cable 1#10m	May 02, 11	May 02, 12
RF Cable IMRO	IMRO-400	10m Cable 2#3m	May 02, 11	May 02, 12
Signal Amplifier EMCI	EMC330	980095	Nov 07, 11	Nov 07, 12
Signal Amplifier EMCI	EMC0140045	980102	Nov 07, 11	Nov 07, 12
Spectrum Analyzer HP	8593E	3448U00806	May 25, 11	May 25, 12
RF Cable DRAKA	M06/25-RG102	10m Cable 2#	May 02, 11	May 02, 12
Test software	ADT_Radiated_V7. 6.15	N/A	N/A	N/A

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA.
 2. The test was performed in Dongguan Chamber 10m.
 3. The horn antenna are used only for the measurement of emission frequency above 1GHz if tested.

4.3.3 TEST PROCEDURES

The basic test procedure was in accordance with ANSI C63.4 (section 12).

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters Semi-anechoic chamber room. 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 height of antenna 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 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 when the test frequency is below 1 GHz.
- f. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, For battery operated equipment, the equipment tests shall be perform using new battery. The turntable was rotated to maximize the emission level.

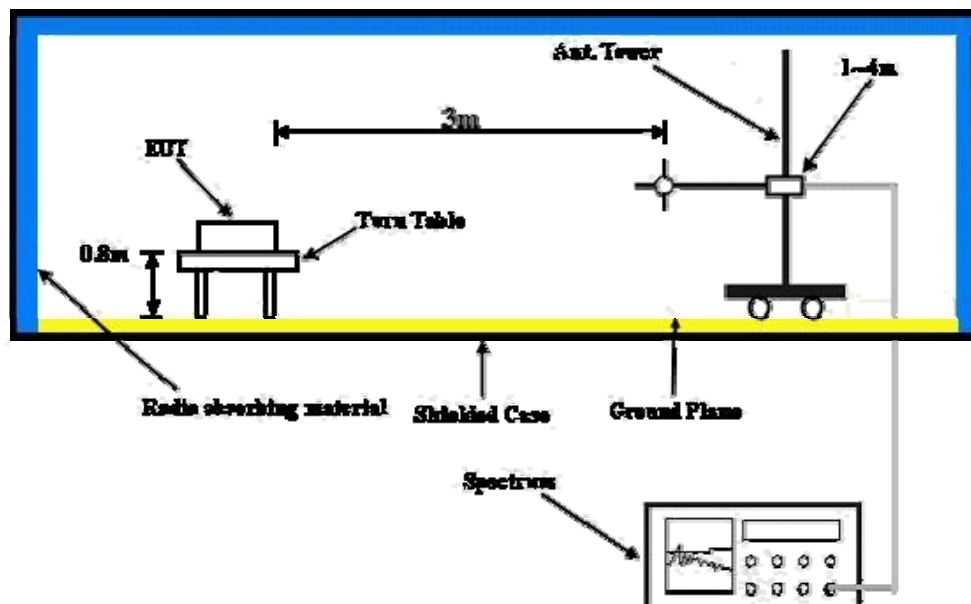
NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) at frequency below 1GHz.
2. $\text{Emission level(dBuV/m)} = \text{Raw Value(dBuV)} + \text{Correction Factor(dB/m)}$
3. $\text{Correction Factor(dB/m)} = \text{Antenna Factor (dB/m)} + \text{Cable Factor (dB)}$
4. $\text{Margin value} = \text{Emission level} - \text{Limit value.}$
5. $\text{Fundamental AV value} = \text{PK Emission} + 20 \cdot \log(\text{duty cycle})$

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.3.6 EUT OPERATING CONDITIONS

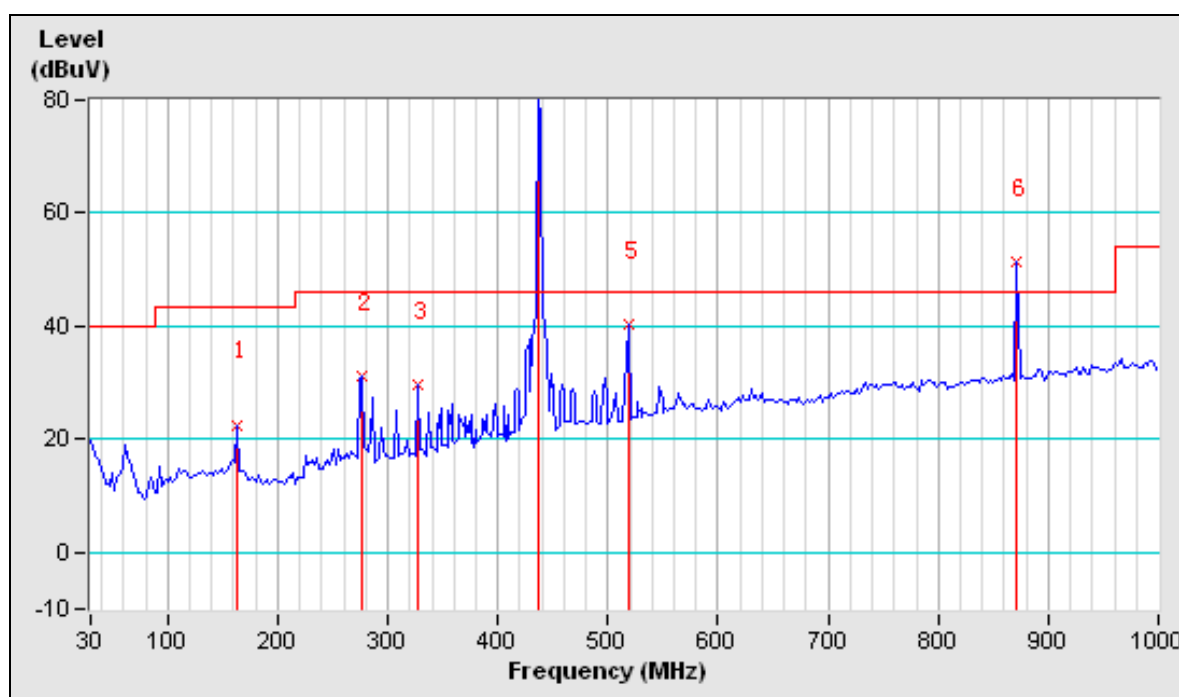
- Placed the EUT on the testing table.
- Enable EUT under transmission condition continuously at specific channel frequency.



4.3.7 TEST RESULTS

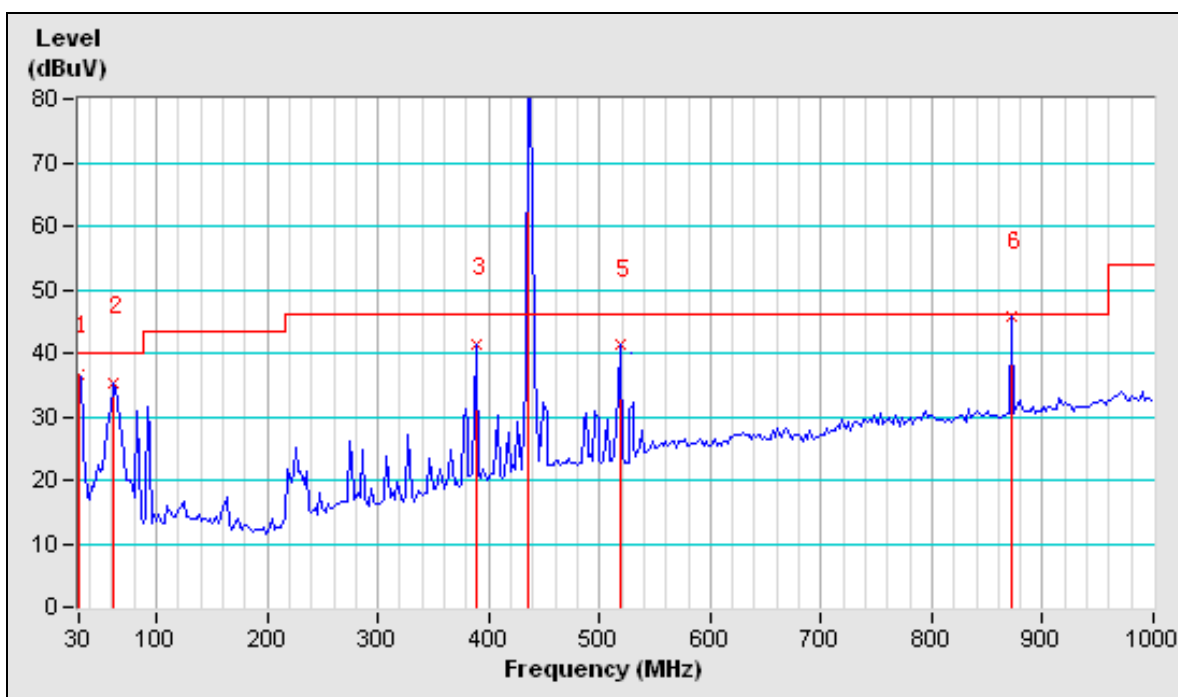
BELOW 1GHz WORST-CASE DATA: Transmitting

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	163.04 PK	11.91	10.66	22.57	43.50	-20.93	322	301
2	276.73 PK	15.47	15.60	31.07	46.00	-14.93	360	247
3	327.53 PK	16.52	13.02	29.54	46.00	-16.46	346	134
4	433.90 PK	20.67	57.71	78.38	92.87	-14.49	375	266
	433.90 AV	-8.86	/	69.52	72.87	-3.35	375	266
5	518.63 PK	22.19	18.19	40.38	46.00	-5.62	216	100
6	871.80 PK	29.56	21.80	51.36	72.87	-21.51	350	149
	871.80 AV	-8.86	/	42.50	52.87	-10.37	350	149





ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M								
No.	Freq. (MHz)	Correction Factor (dB/m)	Raw Value (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (cm)	Table Angle (Degree)
1	30.00 PK	19.75	17.00	36.75	40.00	-3.25	150	44
2	61.45 PK	7.79	27.44	35.23	40.00	-4.77	150	63
3	388.00 PK	18.93	22.36	41.29	46.00	-4.71	150	22
4	433.90 PK	20.67	51.69	72.36	92.87	-20.51	100	11
	433.90 AV	-8.86	/	63.5	72.87	-9.37	100	11
5	518.63 PK	22.19	19.05	41.24	46.00	-4.76	100	112
6	871.80 PK	29.56	16.11	45.67	72.87	-27.2	100	219
	871.80 AV	-8.86	/	36.81	52.87	-16.06	100	220



ABOVE 1GHz WORST-CASE DATA: Transmitting

Emissions attenuated more than 20 dB below the permissible value are not reported.



4.4 20dB BANDWIDTH MEASUREMENT

4.4.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

According to FCC 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

$$\text{Limit} = \text{Fundamental Frequency} \times 0.25\% = 433.9 \times 0.25\% = 1084.75 \text{ kHz}$$

4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer Agilent	E7405A	MY45118807	May 25,11	May 25,12

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA

2. The test was performed in Dongguan Chamber RF

4.4.3 TEST PROCEDURE

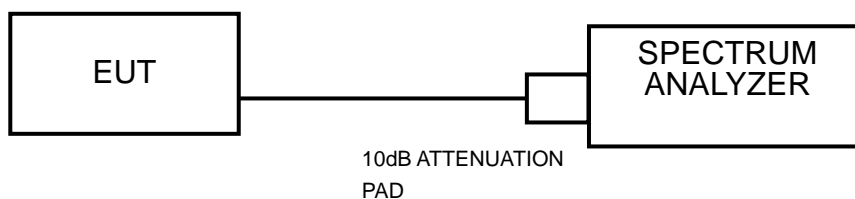
The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.



4.4.5 TEST SETUP



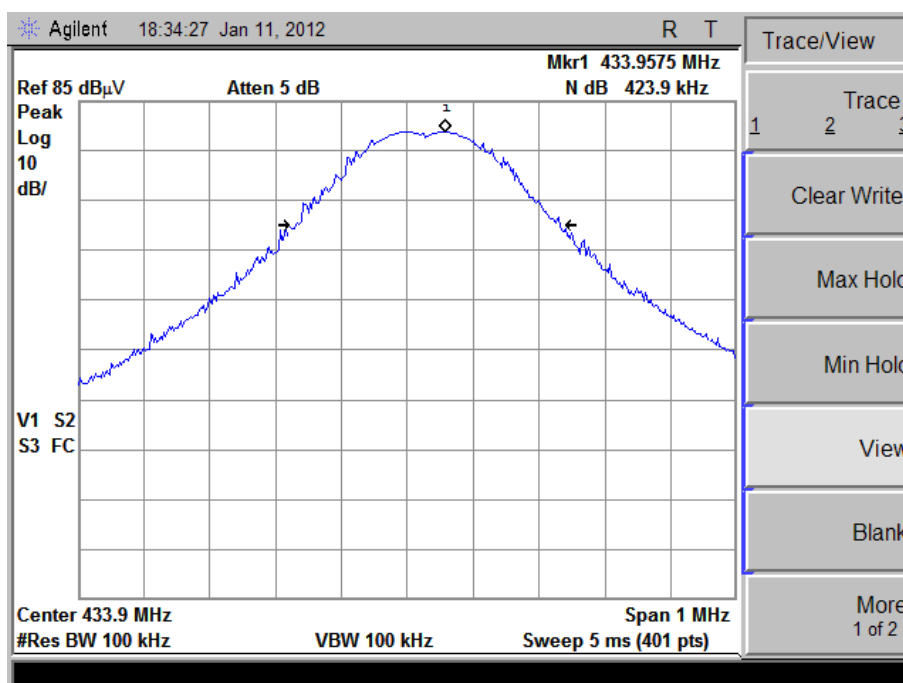
4.4.6 EUT OPERATING CONDITIONS

- Placed the EUT on the testing table.
- With the EUT's antenna attached, which was connected to the spectrum analyzer set to the EUT's operation frequencies.

4.4.7 TEST RESULTS

CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (KHz)	LIMIT (KHz)
433.9	423.9	1084.75

Test Data:





4.5 DEACTIVATION TEST

4.5.1 LIMITS OF DEACTIVATION TEST

According to FCC 15.231(e), 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.

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Spectrum Analyzer Agilent	E7405A	MY45118807	May 25,11	May 25,12

- NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to CEPREI/CHINA and NIM/CHINA
2. The test was performed in Dongguan Chamber RF

4.5.3 TEST PROCEDURE

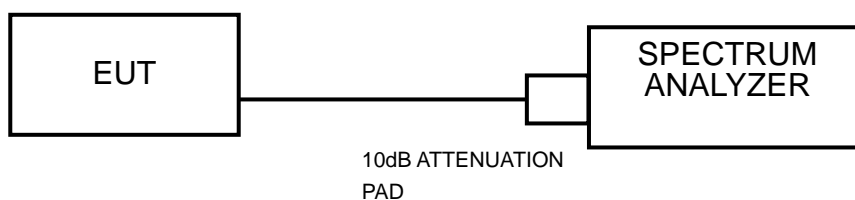
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.9MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.



4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITIONS

- a. Placed the EUT on the testing table.
- b. With the EUT's antenna attached, which was connected to the spectrum analyzer set to the EUT's operation frequencies.

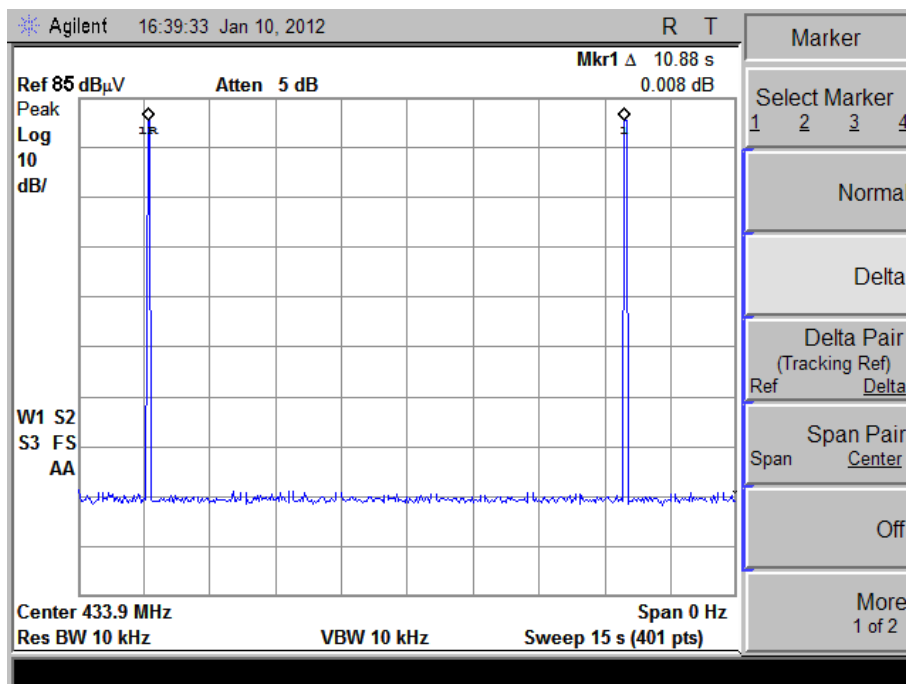
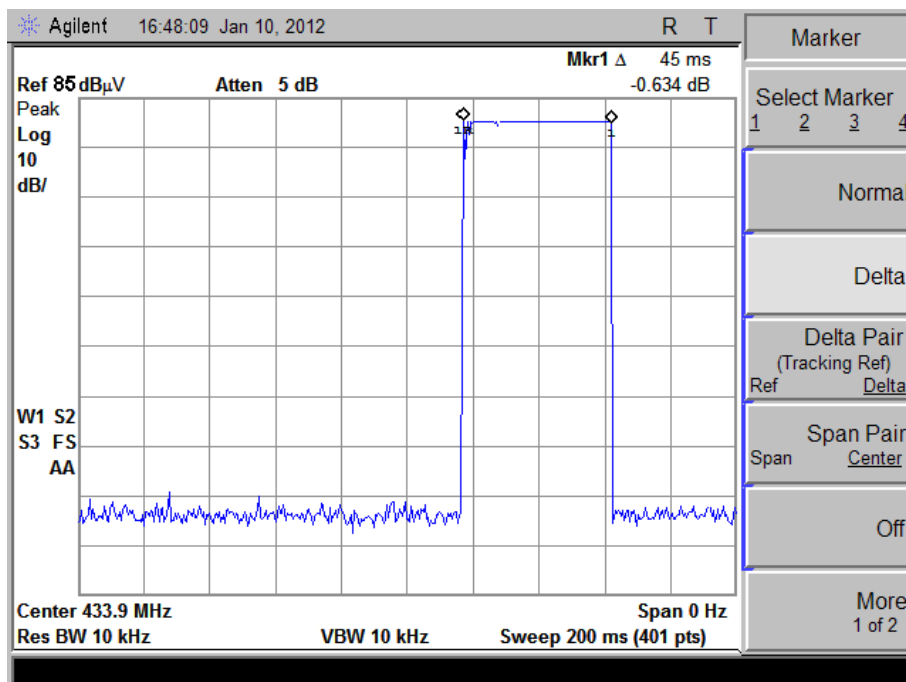


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4.5.7 TEST RESULTS

Test Data: Duration=45ms<1 second





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5 PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



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6 APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

---END---