

CFR 47 FCC Part 15.231

TEST REPORT

Product : **Transmitter**

Trade Name : OMEGA ; EXCALIBUR

Model Number : #111-03; #111-07

FCC ID : L2M111

Prepared for

Omega Research and Development, Inc.

981 N Burnt Hickory Rd, Douglasville, Ga 30134

TEL. : 770-942-9876

Prepared by

Interocean EMC Technology Corp.

244 No.5-2, Lin 1, Tin-Fu Tsun, Lin-Kou Hsiang,

Taipei County, Taiwan, R.O.C.

TEL.: +886 2 2600 6861

FAX.: +886 2 2600 6859

Remark:

The test report consists of **24** pages in total. It shall not be reproduced except in full, without the written approval of IETC. This document may be altered or revised by IETC only, and shall be noted in the revision section of the document.

The test results in the report only to the tested sample.

Statement of Compliance

Applicant: Omega Research and Development, Inc.

Manufacturer: Nutek Corporation

Product: Transmitter

Model No.: #111-03; #111-07

Tested Power Supply: 12Vdc Battery

Date of Final Test: Sep. 01, 2008

Configuration of Measurements and Standards Used :

FCC Rules and Regulations Part 15 Subpart C

1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of IETC.

Report Issued: 2008/10/07

Project Engineer: 
Anya Lee

Approved: 
Jerry Liu

Table of Contents

1	Summary of Measurement	4
2	General Information	5
2.1	Description of Equipment Under Test	5
2.2	Details of tested peripheral equipment	6
2.3	Test Facility	7
3	Test specifications	8
3.1	Test standard	8
3.2	Operation mode	8
3.3	Test Equipment	9
4	Radiated emission test	10
4.1	Limits	10
4.2	Calculation of Average Factor	11
4.3	Configuration of Measurement	15
4.4	Test Procedure	15
4.5	Test Result	15
5	Emission bandwidth	18
5.1	Limits	18
5.2	Test Result	18
6	Photographs of Test	20
6.1	Radiated Emission Measurement	20
7	Photographs of EUT	21

1 Summary of Measurement

Report Clause	Test Parameter	Reference Document CFR47 Part15	Results
4	Radiated Emission	§15.231(b), 15.209	Pass
5	Emission bandwidth	§15.231(c)	Pass

2 General Information

2.1 Description of Equipment Under Test

- Product** : Transmitter
- Model Number** : #111-03; #111-07
- Applicant** : **Omega Research and Development, Inc.**
981 N Burnt Hickory Rd, Douglasville, Ga 30134
- Manufacturer** : **Nutek Corporation**
NO. 167, Lane 235, Bauchiau Rd., Shindian City, Taipei Country
23145, Taiwan
- Power Supply** : 12Vdc Battery
- Operating Frequency** : 433.92MHz
- Channel Number** : 1 channel
- Type of Modulation** : ASK
- Antenna description** : This device uses Monopole antenna.
- Sample Receive date** : Aug. 26, 2008
- Date of Test** : Aug. 26 ~ Sep. 01, 2008
- Additional Description** : 1) The EUT is **Transmitter**.
2) The Model Number "**#111-03**" is representative selected in the test and included in this report.
3) For market purpose, manufacturer use different logo to separate the market for #111-03 and #111-07. The difference please see detail as follows:

Model No.	Logo
#111-03	EXCALIBUR
#111-07	OMEGA

2.2 Details of tested peripheral equipment

N/A

2.3 Test Facility

- Site Description** : ☑OATS 2
- Name of Firm** : Interocean EMC Technology Corp.
- Company web** : <http://www.ietc.com.tw>
- Site 1, 2 Location** : No.5-2, Lin 1, Tin-Fu Tsun, Lin-Kou Hsiang,
Taipei County, Taiwan, R.O.C.
- Site 3, 4 Location** : No. 12, Ruei-Shu Valley, Ruei-Ping Tsun, Lin-Kou Hsiang,
Taipei County, Taiwan, R.O.C.
- Site Filing** :
- Federal Communication Commissions – USA
Registration No.: 96399 (OATS 1 & 2)
Registration No.: 518958 (OATS 3 & 4)
 - Voluntary Control Council for Interference by Information
Technology Equipment (VCCI) – Japan
Registration No. (Conducted Room): C-1094
Registration No. (Conducted Room): T-271
Registration No. (OATS 1): R-1040
Registration No. (OATS 2): R-1041
 - Industry Canada (IC)
Submission: 113543
 - Japan Electrical Safety & Environment Technology Laboratories (JET)
Registration No.: 04S03-01
- Site Accreditation** :
- Bureau of Standards and Metrology and Inspection (BSMI) –
Taiwan, R.O.C.
Accreditation No.:
SL2-IN-E-0026 for CNS13438 / CISPR22
SL2-R1-E-0026 for CNS13439 / CISPR13
SL2-R2-E-0026 for CNS13439 / CISPR13
SL2-A1-E-0026 for CNS13783-1 / CISPR14-1
 - Taiwan Accreditation Foundation (TAF)
Accreditation No.: 1113
 - TÜV NORD
Certificate No: TNTW0801R



3 Test specifications

3.1 Test standard

The EUT was performed according to FCC Part 15 Subpart C Section 15.231 procedure and setup followed by ANSI C63.4, 2003 requirements.

3.2 Operation mode

By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "X axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report

The EUT was operated in continuous transmission mode during all of the tests.



X axis mode



Y axis mode



Z axis mode

3.3 Test Equipment

Instrument	Manufacturer	Model	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSP30	100002	2008/12/14
Spectrum Analyzer	Agilent	8564EC	4046A00331	2009/04/11
Preamplifier	Agilent	8449B	3008A01434	2009/03/31
Preamplifier	SCHAFFNER	CA30100	2	2008/10/21
Horn Antenna	COM-POWER	AH-118	10081	2010/05/12
Horn Antenna	Schwarzbeck	BBHA 9120	9120D-583	2008/12/17
Horn Antenna	Schwarzbeck	BBHA 9170	213	2010/06/08
Wide Bandwidth Sensor	Anritsu	MA2491A	728133	2008/10/18
Power Meter	Anritsu	ML2495A	736010	2008/10/28
Temp & Humidity chamber	GIAN FORCE	GTH-150-40-2P-U	MAA0305-012	2009/05/14
Signal Generator	Agilent	E8254A	US41140164	2009/05/21

Note: The above equipments are within the valid calibration period.

4 Radiated emission test

4.1 Limits

According to FCC 15.231(b) requirement:

In addition to the provisions of §15.205, the field strength of emissions from intentional radiator operated under this section shall not exceed the following:

Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(μ V/m@3m)	(dB μ V/m@3m)	(μ V/m@3m)	(dB μ V/m@3m)
433.92	10996	80.8	1099.6	60.8

General Radiated Emission Limits

Spurious Emission tested through until 10th harmonic. Radiated emissions, which fall in the restricted bands, as defined in §15.205 (a), comply with the radiated emission limits specified in §15.209 (a).

Frequency (MHz)	15.209 Limits	
	(μ V/m@3m)	(dB μ V/m@3m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remark :

1. The table above tighter limit applies at the band edges.
2. The measurement distance in meters, which that between form closest point of EUT to instrument antenna.

4.2 Calculation of Average Factor

The output field strengths of specification in accordance with the FCC rules specify measurements with an average detector. During the test, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The duty cycle is measured in 100 ms or the repetition cycle period, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer to set zero span at 100kHz resolution bandwidth.

Averaging factor in dB = $20 \log (\text{duty cycle})$

The duty cycle is simply the on-time divided by 100ms

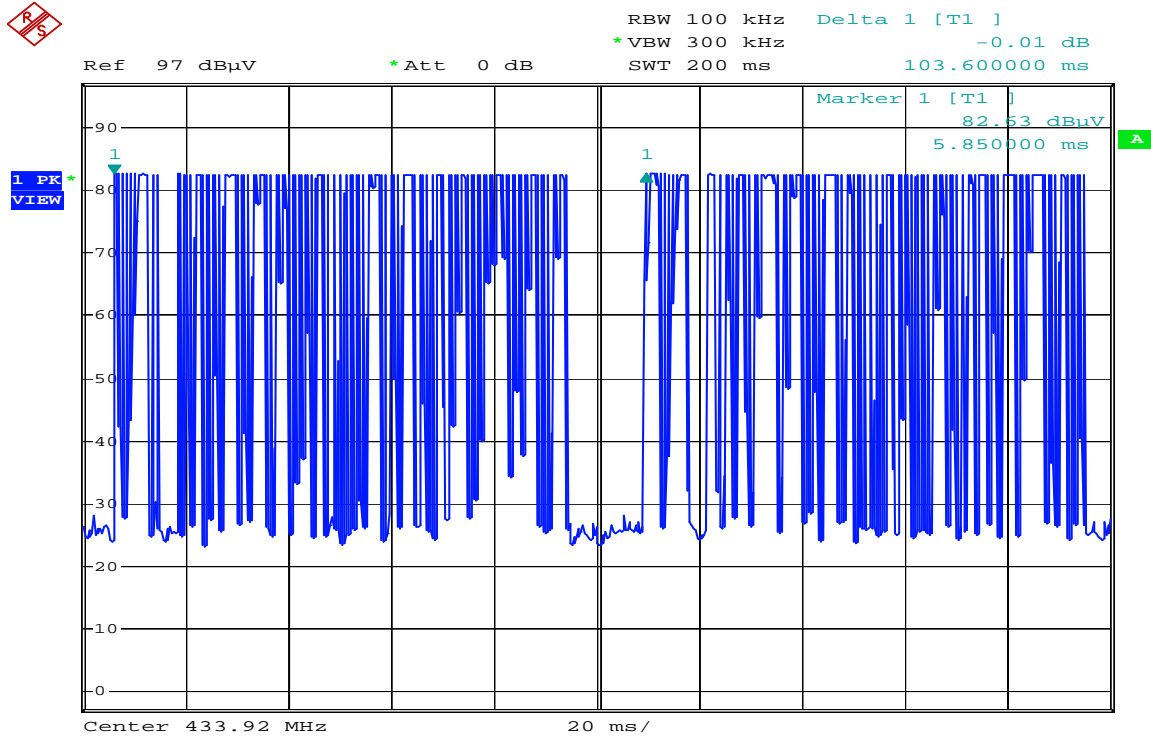
The duration of one cycle = 103.60ms

Duty Cycle = $(0.608\text{ms} \times 51 + 0.188\text{ms} \times 24) / 100\text{ms} = 0.355$

Therefore, the averaging factor is found by $20 \log 0.355 = -8.99\text{dB}$

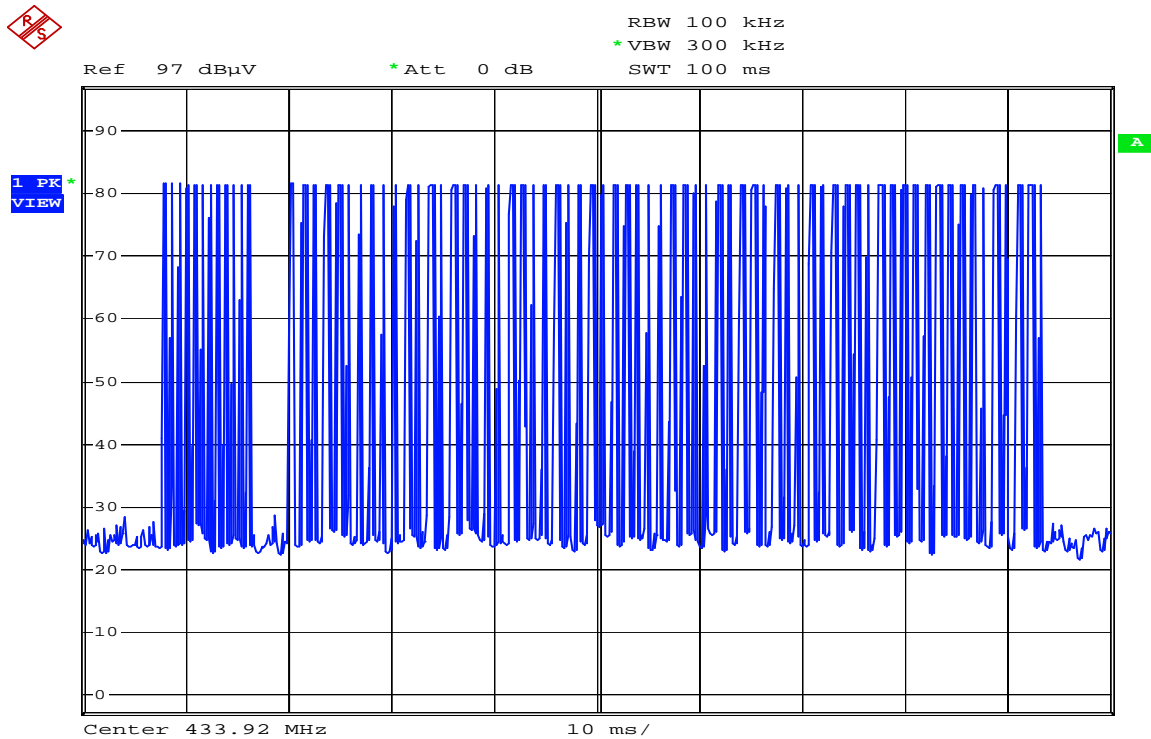
Please see the diagrams below.

Duty Cycle



Comment: Duty Cycle
Date: 27.AUG.2008 17:08:27

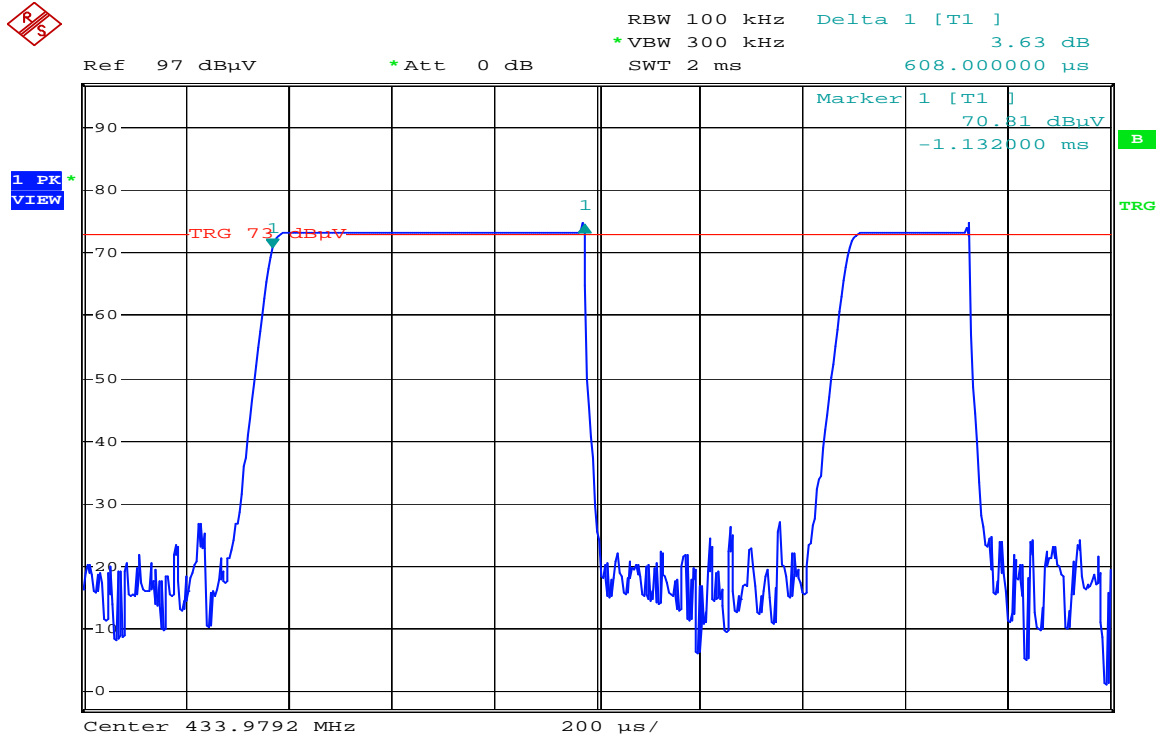
Duty cycle 1



Comment: Duty Cycle
Date: 27.AUG.2008 17:05:25

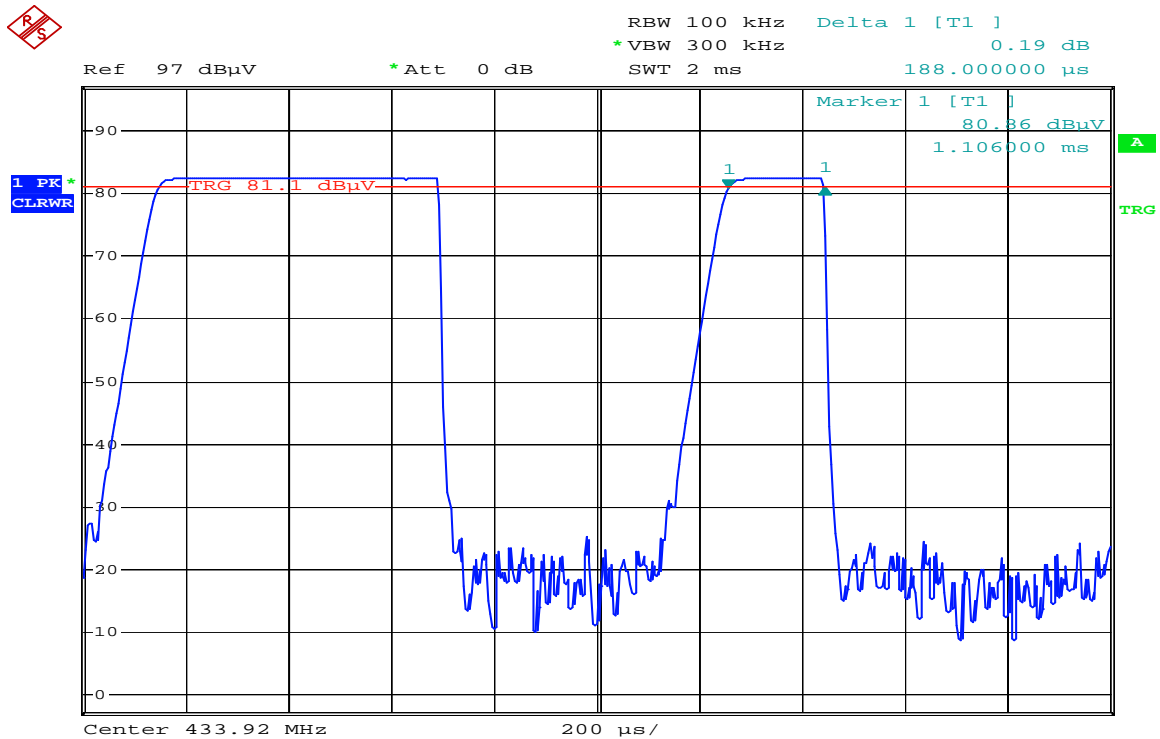
Duty cycle 2

Time Slot



Comment: Time Slot
Date: 27.AUG.2008 16:16:54

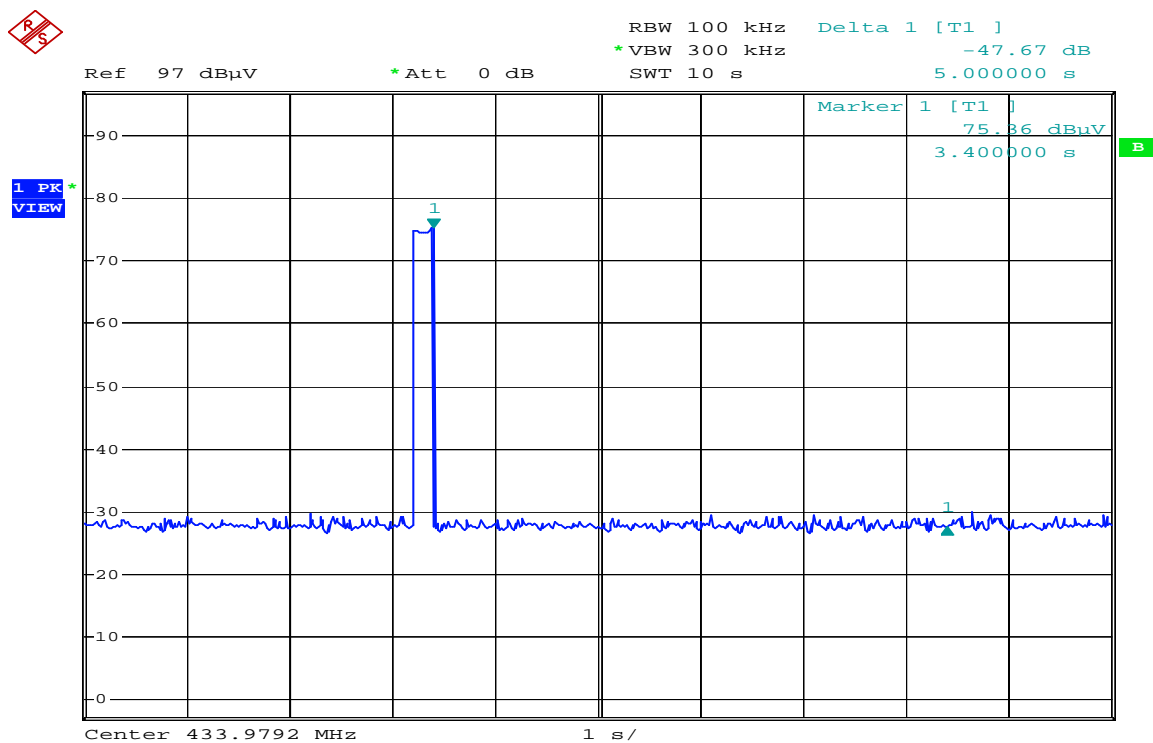
Time Slot 1



Comment: Time Slot
Date: 27.AUG.2008 17:10:17

Time Slot 2

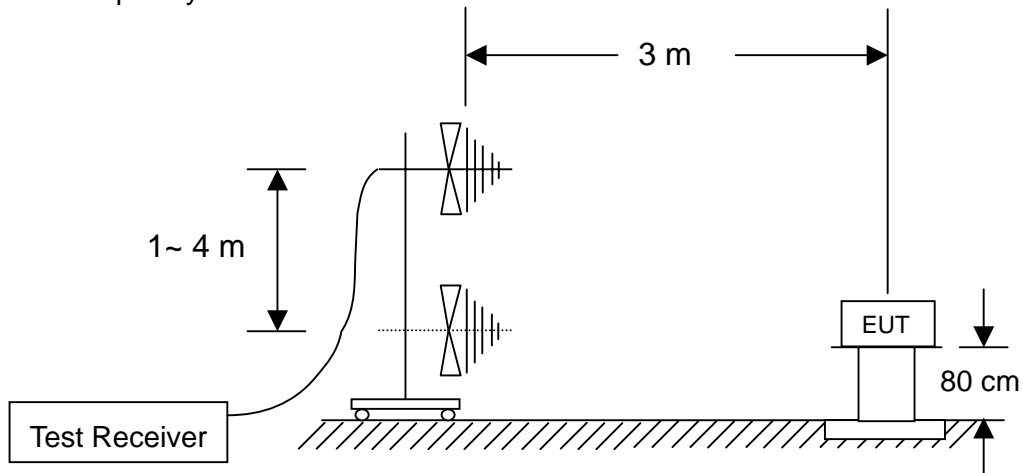
The EUT was complied with the requirement of FCC 15.231 (a)(1), which employed a switch that will automatically deactivate the transmitter within less than 5 seconds of being released.



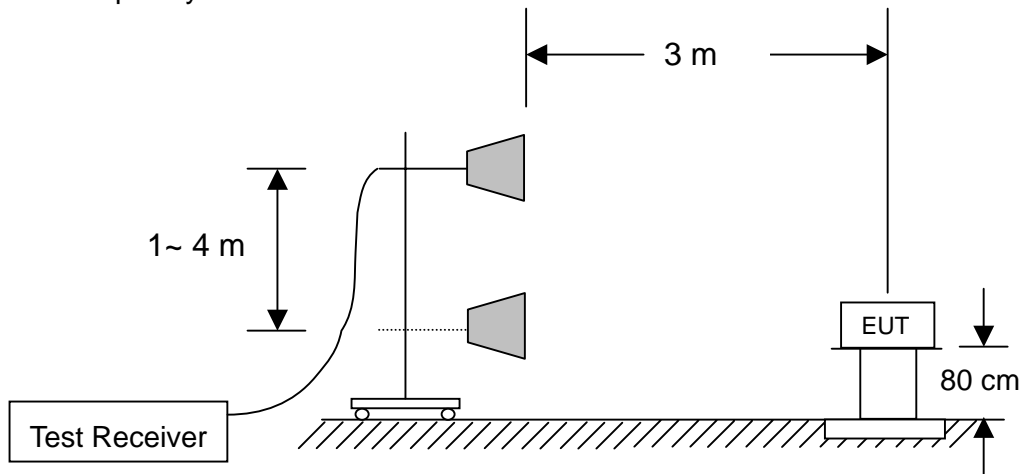
Comment: Deactivation
Date: 27.AUG.2008 15:33:39

4.3 Configuration of Measurement

Measurement Frequency under 1GHz



Measurement Frequency above 1GHz



4.4 Test Procedure

Radiated emission measurements frequency range were performed from 30MHz to 5GHz. Spectrum Analyzer Resolution Bandwidth set to 100kHz or greater for frequencies from 30MHz to 1GHz, and set 1MHz Resolution Bandwidth for frequencies above 1GHz.

The EUT is place on non-conductive turntable for the test. If peripheral devices apply to the EUT, the peripheral devices will be connected to EUT and whole system. During the emission test, the signal is maximized through rotation and all cables were present worst-case emissions. The height of antenna and polarization is constantly changed for exploring maximum signal reading. The height of antenna can be up form reference ground to 4 meter and down to 1 meter.

4.5 Test Result

PASS.

The final test emission data is shown on as following tables.

Radiated Emission below 1GHz

Frequency (MHz)	Antenna Polarization	Reading (dB μ V)	Preamp (dB)	Correction Factor (dB/m)	Corrected Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Det. Mode
253.100	H	54.08	31.28	12.51	35.31	46.00	-10.69	QP
381.625	H	40.59	31.24	20.79	30.14	46.00	-15.86	QP
631.400	H	32.48	31.10	31.10	32.48	46.00	-13.52	QP
932.100	H	34.16	30.97	29.87	33.06	46.00	-12.94	QP
107.600	V	33.12	31.30	19.08	20.90	40.00	-19.10	QP
160.950	V	32.23	31.29	21.85	22.79	40.00	-17.21	QP
323.425	V	32.67	31.26	21.66	23.07	46.00	-22.93	QP
924.825	V	33.40	30.96	29.12	31.56	46.00	-14.44	QP

Remark : Corrected Level = Reading – Preamp + Correction Factor
 Correction Factor = Antenna Factor + Cable Loss

Fundamental and harmonics emissions

Freq. (MHz)	Antenna Polarization	Reading (dB μ V)	Preamp (dB)	Correction Factor (dB/m)	Average Factor (dB)	Corrected Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Det. Mode
433.90	H	61.49	36.40	26.08	--	51.17	80.8	-29.63	PK
867.80	H	32.37	36.40	26.78	--	22.75	60.8	-38.05	PK
433.90	V	74.54	36.40	26.08	--	64.22	80.8	-16.58	PK
867.78	V	36.41	36.40	26.78	--	26.79	60.8	-34.01	PK

Remark :

1. Corrected Level = Reading – Preamp + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. The present spurious points only shows that above noise level and the frequency range test from 30MHz to 10th harmonic of frequency.

5 Emission bandwidth

5.1 Limits

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

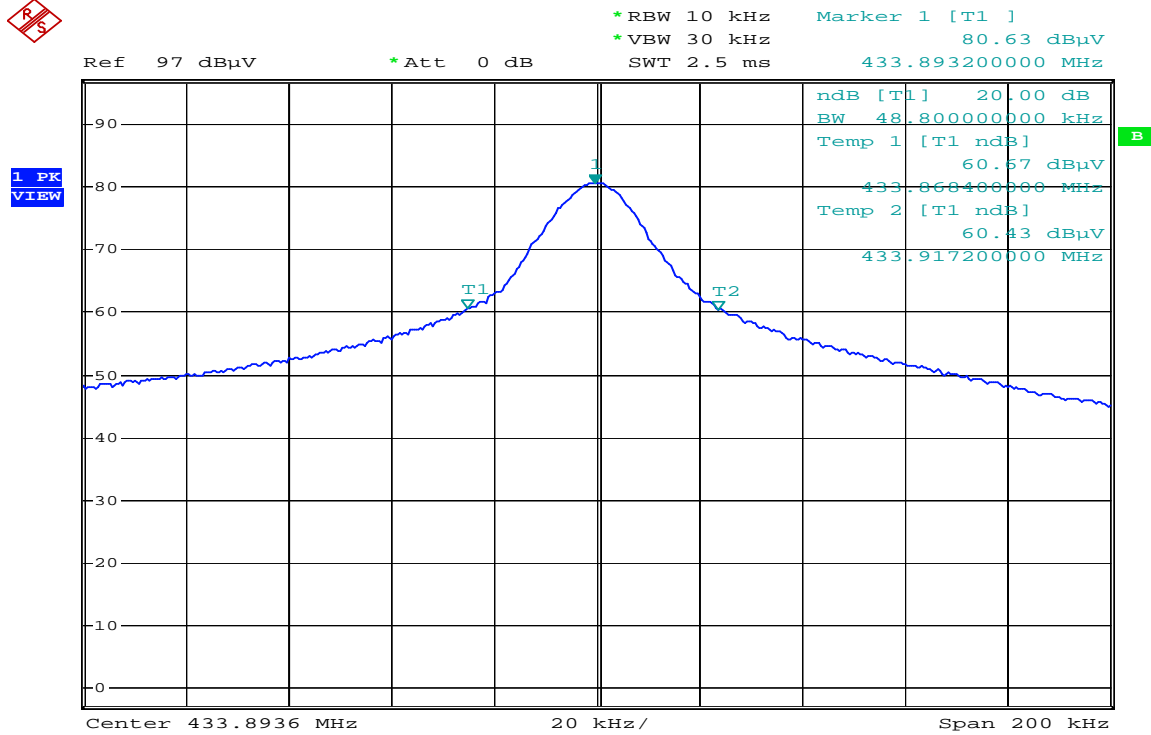
B.W (20dBc) Limit = 0.25% * f(MHz) = 0.25% * 433.89MHz = 1084.725kHz

5.2 Test Result

PASS.

The final test data is shown on as following.

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit (kHz)
433.89	48.8	1084.725



Comment: 20dB Bandwidth
 Date: 27.AUG.2008 15:18:48