

# CFR 47 FCC Part 15.231

## TEST REPORT

Product : **Transmitter**

Trade Name : N/A

Model Number : GM-TX 001

FCC ID : ELVUTII

Prepared for

### **Nutek Corporation**

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Prepared by

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#### **Remark:**

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

# Statement of Compliance

**Applicant:** Nutek Corporation

**Manufacturer:** Nutek Corporation

**Product:** Transmitter

**Model No.:** GM-TX 001

**Tested Power Supply:** 3Vdc Battery

**Date of Final Test:** Dec. 23, 2009

**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: 2009/12/24

Project Engineer: *Anya Lee*  
Anya Lee

Approved: *Jerry Liu*  
Jerry Liu

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## 1 Summary of Measurement

<b>Report Clause</b>	<b>Test Parameter</b>	<b>Reference Document CFR47 Part15</b>	<b>Results</b>
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** : GM-TX 001
- Applicant** : **Nutek Corporation**  
NO.167, Lane 235, Bauchiau Rd., Shindian City, Taipei County  
23145, Taiwan
- Manufacturer** : **Nutek Corporation**  
NO. 167, Lane 235, Bauchiau Rd., Shindian City, Taipei County  
23145, Taiwan
- Power Supply** : 3Vdc Battery
- Operating Frequency** : 433.92MHz
- Channel Number** : 1 channel
- Type of Modulation** : ASK
- Antenna description** : This device uses PCB antenna.  
The antenna is integral to the device, thereby meeting the  
requirement of FCC 15.203.
- Date of Receipt Sample** : Dec. 16, 2009
- Date of Test** : Dec. 16 ~ 23, 2009
- Additional Description** : 1) The Model Number "**GM-TX 001**" is representative selected in  
the test and included in this report.  
2) For more detail specification about EUT, please refer to the  
user's manual.

## 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)  
Designation No.: TW1020
  - Voluntary Control Council for Interference by Information Technology Equipment (VCCI) – Japan  
Member No.: 1349  
Registration No. (Conducted Room): C-1094  
Registration No. (Conducted Room): T-1562  
Registration No. (OATS 1): R-1040  
Registration No. (OATS 2): R-1041
  - Industry Canada (IC)  
OUR FILE: 46405-4437 Submission: 130946  
Registration No. (OATS 1): 4437A-1  
Registration No. (OATS 2): 4437A-2  
Registration No. (OATS 3): 4437A-3  
Registration No. (OATS 4): 4437A-4
  - 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 CNS 13438 / CISPR 22  
SL2-R1-E-0026 for CNS 13439 / CISPR 13  
SL2-R2-E-0026 for CNS 13439 / CISPR 13  
SL2-A1-E-0026 for CNS 13783-1 / CISPR 14-1  
SL2-L1-E-0026 for CNS 14115 / CISPR 15
  - Taiwan Accreditation Foundation (TAF)  
Accreditation No.: 1113
  - TÜV NORD  
Certificate No: TNTW0801R-02

### 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	2010/12/08
Spectrum Analyzer	R&S	FSP40	100478	2010/04/15
Preamplifier	Agilent	8449B	3008A01434	2010/04/01
Horn Antenna	COM-POWER	AH-118	10081	2010/05/12
Horn Antenna	Schwarzbeck	BBHA 9120	9120D-583	2011/02/09
Horn Antenna	Schwarzbeck	BBHA 9170	213	2010/06/08
Wide Bandwidth Sensor	Anritsu	MA2491A	728133	2010/10/15
Power Meter	Anritsu	ML2495A	736010	2010/10/15
Temp & Humidity chamber	GIAN FORCE	GTH-150-40-2P-U	MAA0305-012	2011/05/07

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	
	( $\mu$ V/m@3m)	(dB $\mu$ V/m@3m)	( $\mu$ V/m@3m)	(dB $\mu$ V/m@3m)
433.92	10996	80.8	1099.6	60.8

#### General Radiated emission Limit

Spurious Emission tested through until 10<sup>th</sup> 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	
	( $\mu$ V/m@3m)	(dB $\mu$ 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

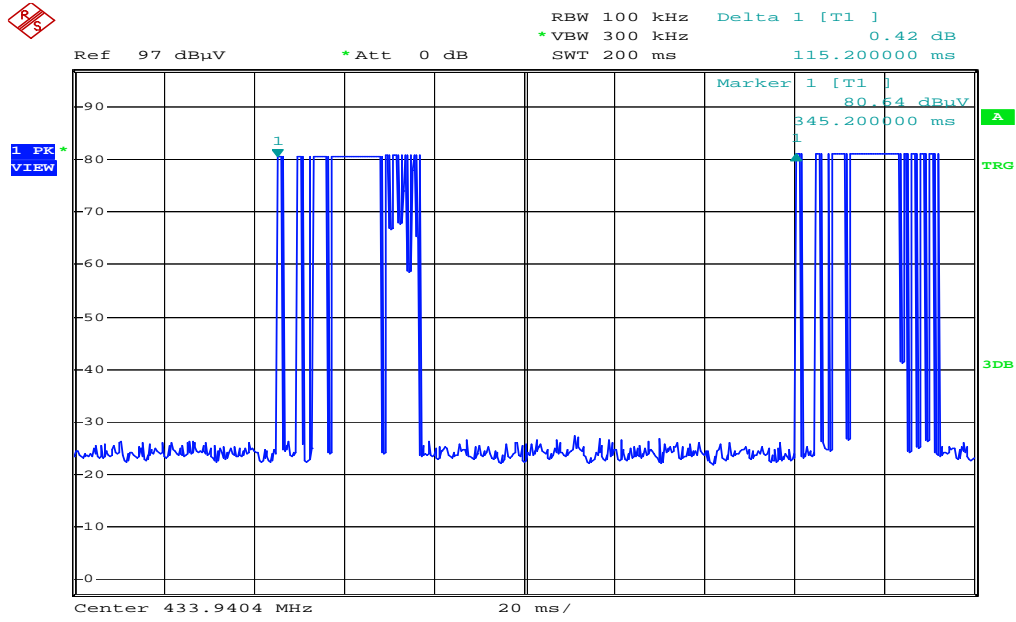
The duration of one cycle = 100ms

Duty Cycle =  $(1.3\text{ms} \cdot 1 + 0.4\text{ms} \cdot 8 + 0.1\text{ms} \cdot 37) / 100\text{ms} = 8.2\text{ms} / 100\text{ms}$

Therefore, the averaging factor is found by  $20 \log 0.082 = -21.72\text{dB}$

Please see the diagrams below.

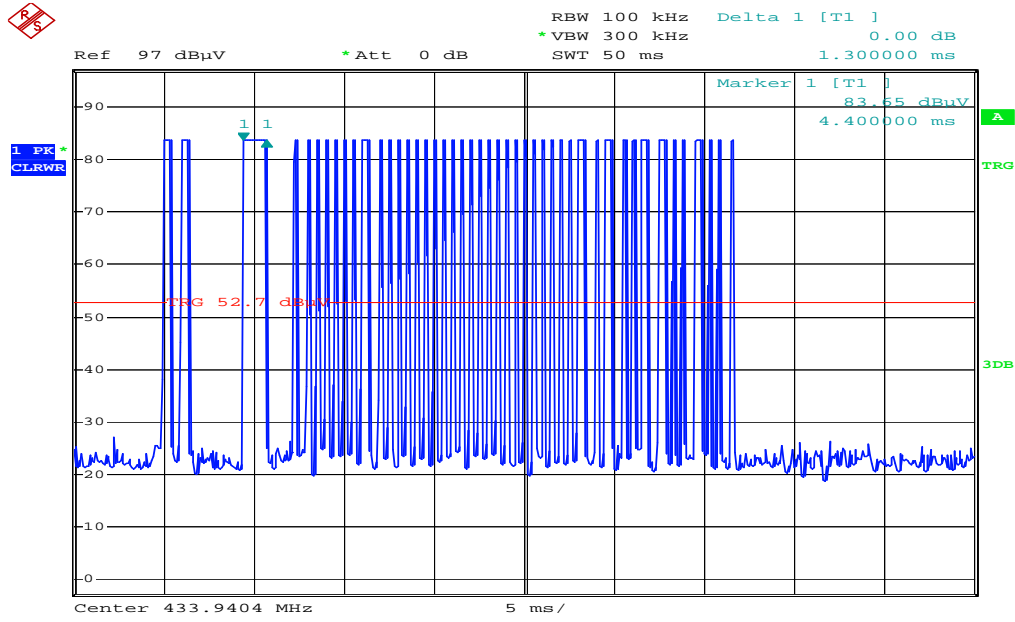
# Duty Cycle



Duty Cycle

Date: 23.DEC.2009 09:16:24

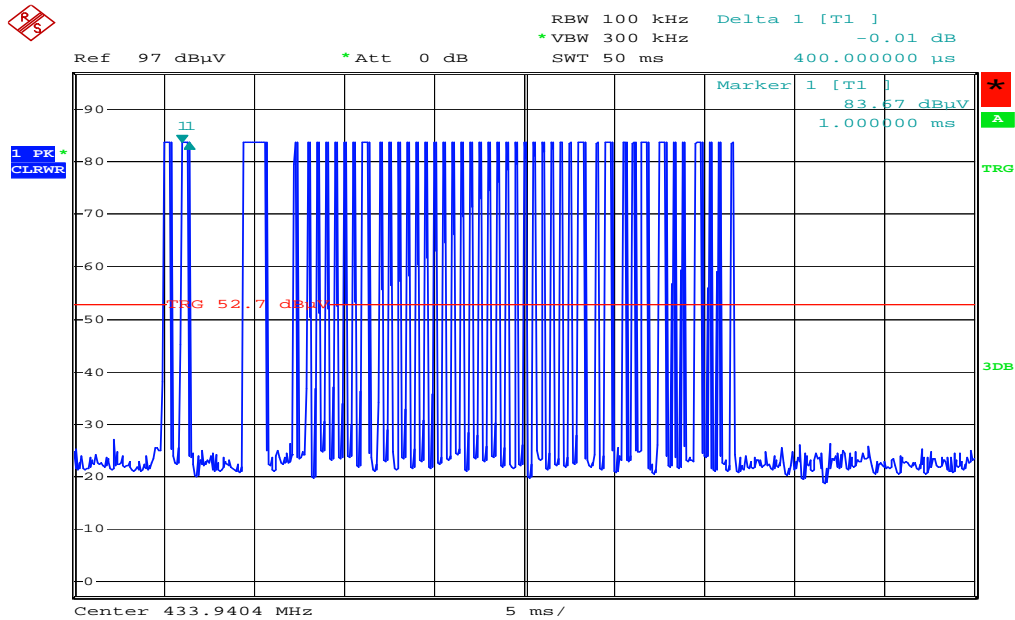
### Time Slot



Ton1

Date: 23.DEC.2009 09:28:07

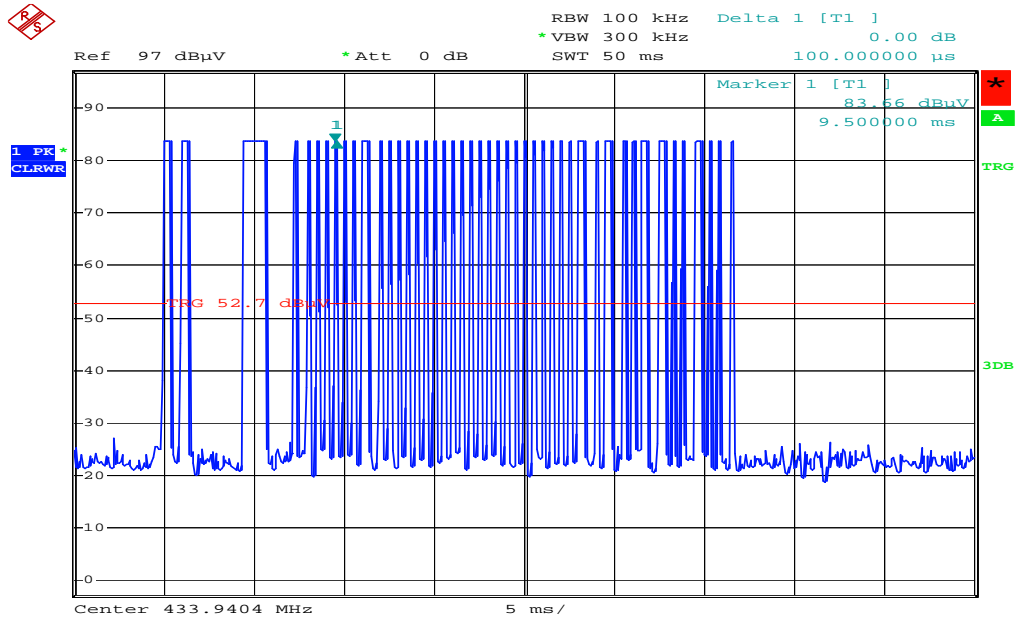
### Time Slot 1



Ton2

Date: 23.DEC.2009 09:28:39

### Time Slot 2

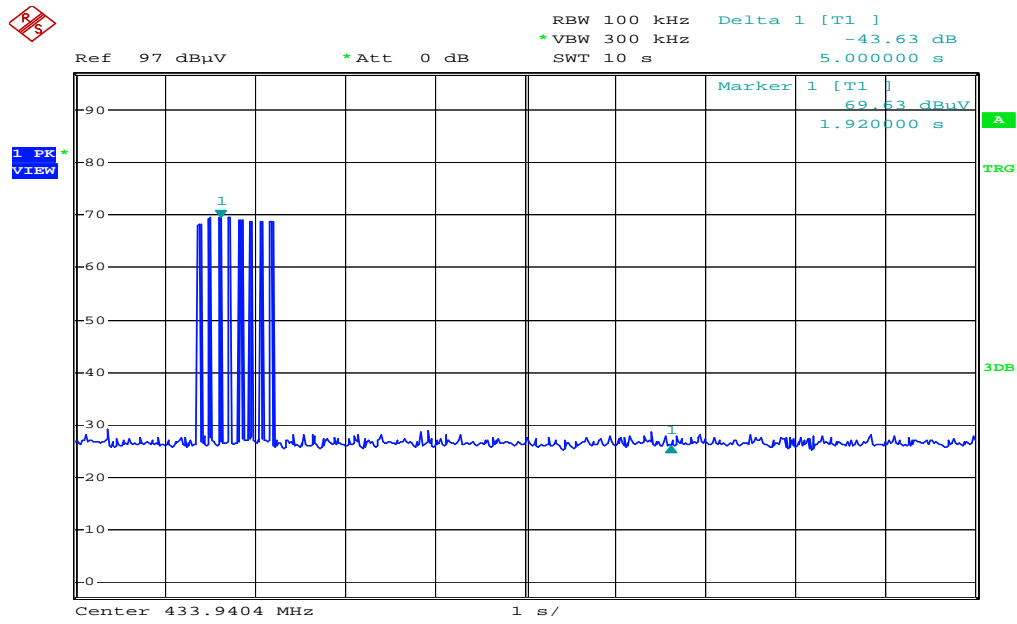


Ton3

Date: 23.DEC.2009 09:29:10

### Time Slot 3

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.

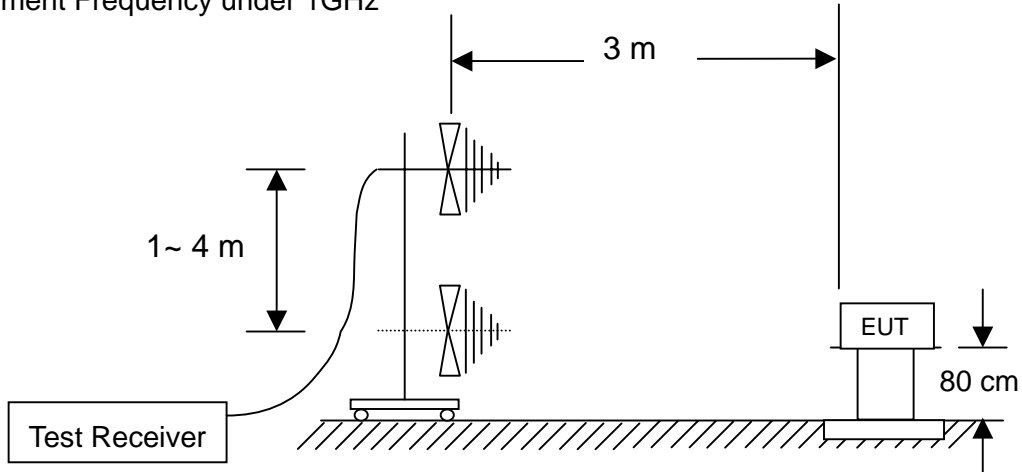


Deactivation

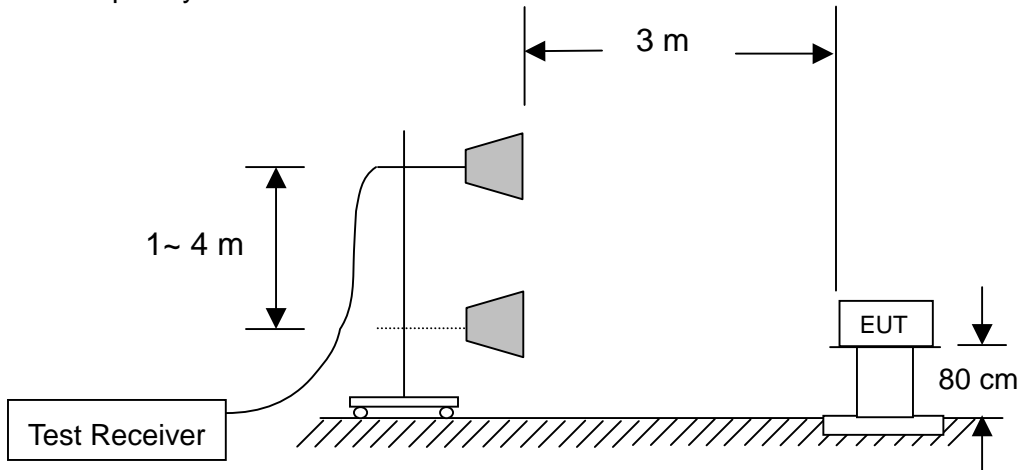
Date: 23.DEC.2009 09:14:05

### 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 as following tables.



### Radiated Emission below 1GHz

Frequency (MHz)	Antenna Polarization	Reading (dB $\mu$ V)	Preamp (dB)	Correction Factor (dB/m)	Corrected Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Det. Mode
74.620	H	36.25	13.35	6.96	29.86	40.00	-10.14	QP
284.174	H	29.30	13.46	21.97	37.81	46.00	-8.19	QP
408.300	H	28.64	12.53	19.90	36.01	46.00	-9.99	QP
668.260	H	20.14	12.88	24.07	31.33	46.00	-14.67	QP
421.880	H	32.54	12.51	19.82	39.85	46.00	-6.15	QP
709.000	H	23.44	12.99	25.07	35.52	46.00	-10.48	QP
69.550	V	35.74	13.35	7.15	29.54	40.00	-10.46	QP
260.564	V	35.94	13.41	20.98	43.51	46.00	-2.49	QP
334.545	V	32.47	13.06	17.13	36.54	46.00	-9.46	QP
447.000	V	31.50	12.40	20.10	39.20	46.00	-6.80	QP
552.300	V	30.51	12.66	22.15	40.00	46.00	-6.00	QP
660.100	V	30.18	12.85	23.74	41.07	46.00	-4.93	QP

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

## Fundamental and harmonics emissions

Freq. (MHz)	Antenna Polarization	Reading (dB $\mu$ V)	Preamp (dB)	Correction Factor (dB/m)	Average Factor (dB)	Corrected Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Det. Mode
433.92	H	97.88	32.45	19.72	--	85.15	100.8	-15.65	PK
433.92	H	97.88	32.45	19.72	-21.72	63.43	80.8	-17.37	AV
867.84	H	56.71	33.11	25.95	--	49.55	60.8	-11.25	PK
1301.76	H	50.31	36.30	27.84	--	41.85	54.0	-12.15	PK
1735.68	H	54.60	36.01	28.58	--	47.17	60.8	-13.63	PK
2169.60	H	51.52	35.97	30.46	--	46.01	60.8	-14.79	PK
2603.52	H	54.03	36.16	31.90	--	49.77	60.8	-11.03	PK
3037.44	H	47.70	36.41	32.71	--	44.00	60.8	-16.80	PK
*3471.36	H	43.01	36.49	33.31	--	39.83	60.8	-20.97	PK
*3905.28	H	42.52	36.26	34.71	--	40.97	54.0	-13.03	PK
*4339.2	H	43.23	36.27	36.35	--	43.31	54.0	-10.69	PK
433.92	V	80.88	32.45	19.72	--	68.15	80.8	-12.65	PK
867.84	V	46.24	33.11	25.95	--	39.08	60.8	-21.72	PK
1301.76	V	49.34	36.30	27.84	--	40.88	54.0	-13.12	PK
1735.68	V	50.20	36.01	28.58	--	42.77	60.8	-18.03	PK
2169.96	V	49.45	35.97	30.46	--	43.94	60.8	-16.86	PK
2603.52	V	53.57	36.16	31.90	--	49.31	60.8	-11.49	PK
3037.44	V	48.09	36.41	32.71	--	44.39	60.8	-16.41	PK
*3471.36	V	43.23	36.49	33.31	--	40.05	60.8	-20.75	PK
*3905.28	V	41.29	36.26	34.71	--	39.74	54.0	-14.26	PK
*4339.2	V	43.66	36.27	36.35	--	43.74	54.0	-10.26	PK

Remark :

1. Corrected Level = Reading – Preamp + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. “ \* ” Mark indicated Background Noise Level

## **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.

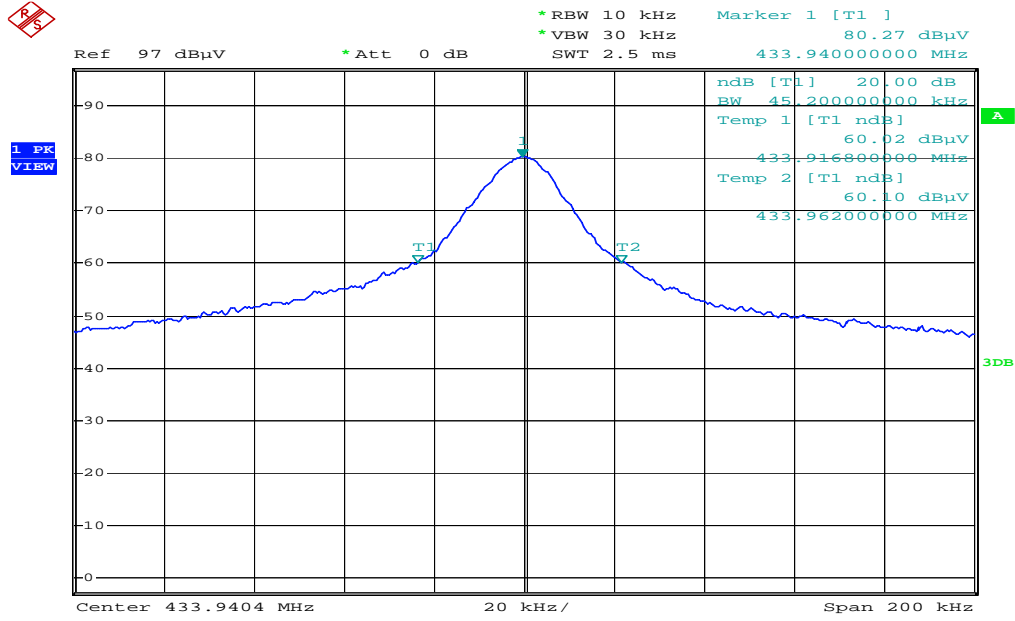
B.W (20dBc) Limit = 0.25% \* f(MHz) = 0.25% \* 433.92MHz = 1084.8kHz

### **5.2 Test Result**

**PASS.**

The final test data is shown as following.

Channel Frequency (MHz)	Measured 20dB Bandwidth (kHz)	Limit (kHz)
433.92	45.2	1084.8



20dB BandWidth

Date: 23.DEC.2009 09:35:08