

FCC CERTIFICATION TEST REPORT

for

ThinkOptics, Inc

WavIt MC Handset

Model Number :100-01-02

Prepared for : ThinkOptics, Inc  
Address : 5568 Del Oro Dr., San Jose, CA 94124, USA

Prepared By : NS Technology Co., Ltd.  
Address : Chenwu Industrial Zone, Houjie Town, Dongguan City,  
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Date of Test : Apr. 21, 2007  
Date of Report : Apr. 21, 2007

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# NS Technology Co., Ltd.

**Applicant:**

ThinkOptics, Inc

**Address:**

5568 Del Oro Dr., San Jose, CA 94124, USA

**Manufacturer:**

Unlsen Industrial Limited

**Address:**

128 Industrial Zone, Banfu, Huangjiang Town, Dongguan City, Guangdong, China

**E.U.T:**

WavIt MC Handset

**Model Number:**

100-01-02

**Trade Name:**

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**Serial No.:**

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**Date of Receipt:**

Apr. 21, 2005

**Date of Test:**

May 15, 2006

**Test Specification:**

FCC Part 15: February, 2006

ANSI C63.4: 2003

**Test Result:**

The equipment under test was found to be compliance with the requirements of the standards applied.

**Issue Date: May 21, 2006**

Tested by:

Kelly / Engineer

Reviewed by:

Chris Du / Supervisor

Approved by:

Steven Lee / Manager

**Other Aspects:**

None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products, It is not permitted to be duplicated in extracts without written approval of NS Electromagnetic Technology Co., Ltd..

# 1. GENERAL PRODUCT INFORMATION

## 1.1. Product Function

Refer to Technical Construction Form and User Manual.

## 1.2. Description of Device (EUT)

E.U.T.	: WavIt MC Handset
Model No.	: 100-01-02
System Input Voltage	: DC 3V(Battery supply)
Operating Frequency	: 2.405GHz-2.480GHz
Antenna Type	: Internal Antenna
Modulation method	: Direct sequence spread spectrum
Temperature Range(Operating)	: +15 ~+ 35°C

## 1.3. Difference between Model Numbers

N/A

## 1.4. Independent Operation Modes

The basic operation modes are:

Channel	Operation Frequency(GHz)	Channel	Operation frequency(GHz)
CH0	2.405	CH9	2.450
CH1	2.410	CH10	2.455
CH2	2.415	CH11	2.460
CH3	2.420	CH12	2.465
CH4	2.425	CH13	2.470
CH5	2.430	CH14	2.475
CH6	2.435	CH15	2.480
CH7	2.440		
CH8	2.445		

The tested mode are:

1.4.1. CH0 (2.405GHz),

1.4.2. CH7 (2.440GHz)

1.4.3. CH15 (2.480GHz)

## 1.5. Test Supporting System

### 1.5.1. PC

Model Number	:	8179
Serial Number	:	99PZTL5
Manufacturer	:	IBM

### 1.5.2. Monitor

Model Number	:	vs17e
Serial Number	:	CND6270KVM
Manufacturer	:	HP
Data Cable	:	Shielded, Undetectable, 1.5m

### 1.5.3. Keyboard(PS II)

Model Number	:	MU29J
Serial Number	:	23-039797
Manufacturer	:	IBM
Data Cable	:	Shielded, Undetectable, 1.8m

### 1.5.4. Printer

Model Number	:	B161A
Serial Number	:	C48220005L73317358
Manufacturer	:	EPSON
Data Cable	:	Shielded, Detachable, 1.5m

### 1.5.5. Mouse(PSII)

Model Number	:	PR-R6764
Manufacturer	:	Primax
Data Cable	:	Shielded, Detachable, 1.5m

### 1.5.6. Mouse(USB)

Model Number	:	800DP1
Manufacturer	:	STONE
Data Cable	:	Shielded, Undetectable, 1.8m

### 1.5.7. Modem

Model Number	:	DB-R6764
Manufacturer	:	Qiao shu
Data Cable	:	Shielded, Undetectable, 1.5m

## 2. TEST SITES

### 2.1. Test Facilities

EMC Lab : Certificated by TUV Rheinland, Germany.  
Date of registration: July 28, 2003

Certificated by FCC, USA  
Registration No.: 897109  
Date of registration: October 10, 2003

Certificated by VCCI, Japan  
Registration No.: R-1798 & C-1926  
Date of registration: January 30, 2004

Certificated by CNAL, CHINA  
Registration No.: L1744  
Date of registration: November 25, 2004

Certificated by Intertek ETL SEMKO  
Registration No.: TMP-013  
Date of registration: June 11, 2005

Certificated by TUV/PS, Hong Kong  
Date of registration: December 1, 2005

Certificated by Industry Canada  
Registration No.: 5936  
Date of registration: March 24, 2006

Name of Firm : NS Technology Co., Ltd.

Site Location : Chenwu Industrial Zone, Houjie Town, Dongguan City,  
Guangdong, China

## 2.2. List of Test and Measurement Instruments

### 2.2.1. For conducted emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Test Receiver	Rohde & Schwarz	ESCS30	100199	Mar. 24,07	Mar.24,08
L.I.S.N.#1	Rohde & Schwarz	ESH2-Z5	100071	Mar. 24,07	Mar.24,08
L.I.S.N.#2(AUX)	Rohde & Schwarz	ESH3-Z5	100317	Mar. 24,07	Mar.24,08

### 2.2.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Test Receiver	Rohde & Schwarz	ESCS30	100340	Mar. 24,07	Mar.24,08
Spectrum Analyzer	HP	8593E	3448U00806	Mar. 24,07	Mar.24,08
Amplifier	Agilent	8447D	2944A10488	May 2,07	May 2,08
Bilog Antenna	EMCO	3142B	00022050	May 2,07	May 2,08
Horn Antenna	EMCO	3117	00062558	May 4,07	May 4,08
Amplifier	EMCO	PEC-38-30M 18G-12-SFF	00075634	May 4,07	May 4,08

### 2.2.3. For Band edge test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	HP	8593E	3448U00806	Mar. 24,07	Mar.24,08
Horn Antenna	EMCO	3117	00062558	May 4,07	May 4,08
Amplifier	EMCO	PEC-38-30M 18G-12-SFF	00075634	May 4,07	May 4,08

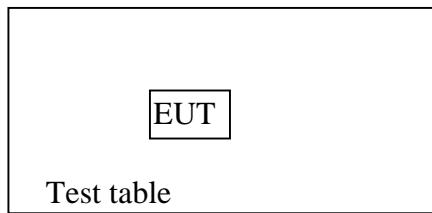
### 3. TEST SET-UP AND OPERATION MODES

#### 3.1. Principle of Configuration Selection

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

#### 3.2. Block Diagram of Test Set-up

System Diagram of Connections Between EUT and Simulators



(EUT: WavIt MC Handset)

*Note: we test lie orientation, side orientation and stand orientation. The lie orientation is the worst mode, so only the worst mode test data was included in the report.*

#### 3.3. Test Operation Mode and Test Software

Refer to Test Setup in clause 4 & 5.

#### 3.4. Special Accessories and Auxiliary Equipment

None.

#### 3.5. Countermeasures to Achieve EMC Compliance

None.

## 4. EMISSION TEST RESULTS

### 4.1. CONDUCTED EMISSION TEST

#### 4.1.1. Test standard and limits

##### 4.1.1.1. Test standard

FCC Part 15:2005, Subpart C (Section:15.207)

##### 4.1.1.2. Test limits

Frequency of Emission (MHz)	Conducted limit(dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

#### 4.1.2. Test procedure

The EUT was put on a wooden table which was 0.8metre high above the ground and connected to the AC mains through a Artificial Mains Network (A.M.N). The mains lead in excess of 1 m separating the EUT from the AMN was folded back and forth parallel to the lead so as to form a bundle with a length of 0.3m to 0.4m.

The EUT was kept 0.4m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during conducted emission test.

The bandwidth of the test receiver (R&S ESCS30) was set at 9KHz.

The frequency range from 150 KHz to 30 MHz was investigated.

#### 4.1.3. Test result

N/A

According to paragraph(f) of FCC Part 15 Section 15.207, measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation, and which do not operate from the AC power lines or contain provision for operation while connected to the AC power.

Note: N/A is not apply

## 4.2. Radiated Emission Test

### 4.2.1. Test Standard and limit:

#### 4.2.1.1 Test Standard

FCC Part 15:2005, Subpart C (Section:15.205)

FCC Part 15:2005, Subpart C (Section:15.209)

FCC Part 15:2005, Subpart C (Section:15.249)

#### 4.2.1.1 Test limit

According to 15.249 the field strength of emissions from intentional radiators operated under these frequencies bands shall not exceed the following:

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Spurious	
	mV/meter	dBuV/meter	uV/meter	dBuV/meter
902-928MHz	50	94	500	54
2400-2483.5MHz	50	94	500	54
5725-5875MHz	50	94	500	54
24.0-24.25GHz	250	108	2500	68

(2) The above field strength limits are specified at a distance of 3 meters. Emissions radiated outside of the specified bands,shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength uV/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

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.

### Frequency Range of Radiated Measurement

(For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes(MHz)	Range(MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5 <sup>th</sup> harmonic of the highest frequency or 40GHz,whichever is lower

#### 4.2.2 Test Produce

The EUT was placed on a turntable which was 0.8 meter above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on a antenna tower. At the frequency band of 30MHz to 1GHz, The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 to 4 m for horizontal and vertical polarizations. The broadband antenna (calibrated by dipole antenna) was used as a receiving antenna. At the frequency band of 1GHz to 25GHz, The measuring antenna moved from 1 to 4 m for horizontal and vertical polarization. The horn antenna was used as a receiving antenna.

The resolution bandwidth and video bandwidth of the test receiver was 120 KHz for Quasi-peak detection at frequency below 1GHz.

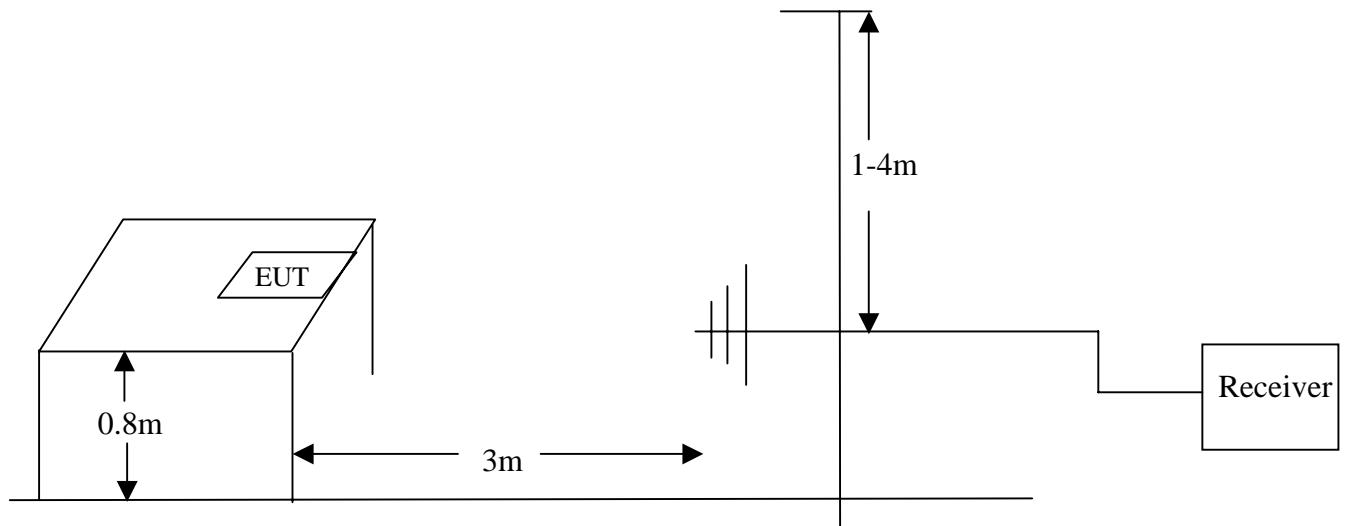
The resolution bandwidth and video bandwidth of the test receiver was 1MHz for Peak detection at frequency below 1GHz. was 1MHz above 1GHz.

The resolution bandwidth of the test receiver was 1MHz and the video bandwidth are 10Hz for Average detection at frequency above 1GHz.

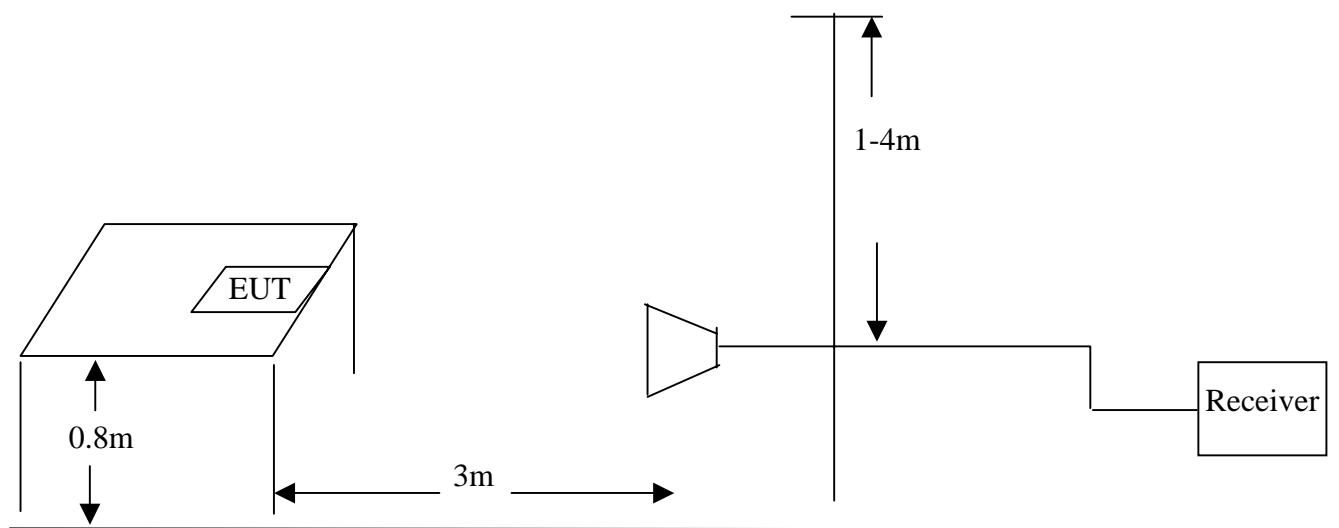
The EUT was tested in Chamber Site.

#### 4.2.3 Test Setup Diagram

4.2.3.1. Frequency range: 30MHz-1000MHz



4.2.3.2. Frequency range: 1 GHz -25GHz



## 4.2.3. Test Result

EUT:	WavIt MC Handset	Temperature:	24°C
M/N:	100-01-02	Humidity:	56%
Test Mode:	CH0	Test Engineer:	Kelly

Frequency MHz	Antenn a Factor	Cable Loss dB	Meter Reading dB $\mu$ V	Emission Level dB $\mu$ V/m	Over Limits dB	Limits dB $\mu$ V/m	Detector	Polarity	Result
67.83	9.09	1.26	27.05	37.40	-2.60	40.00	QP	H	PASS
164.83	11.60	2.00	23.17	36.77	-6.73	43.50	QP	H	PASS
207.98	12.53	2.28	20.00	34.81	-8.69	43.50	QP	H	PASS
1134.75	27.35	2.11	31.79	61.25	-12.75	74.00	PK	H	PASS
1134.75	27.35	2.11	17.35	46.81	-7.19	54.00	AV	H	PASS
2405.00	31.51	2.23	27.13	60.87	-53.13	114.00	PK	H	PASS
2405.00	31.51	2.23	14.02	47.76	-46.24	94.00	AV	H	PASS
15468.5	41.67	3.03	19.29	63.90	-10.10	74.00	PK	H	PASS
15468.5	41.67	3.03	5.15	49.85	-4.15	54.00	AV	H	PASS
59.98	9.36	1.10	24.21	34.67	-5.33	40.00	QP	V	PASS
65.78	9.15	1.22	26.70	37.07	-2.93	40.00	QP	V	PASS
207.98	12.53	2.28	21.30	36.11	-7.39	43.50	QP	V	PASS
1134.75	27.35	2.11	30.65	60.11	-13.89	74.00	PK	V	PASS
1134.75	27.35	2.11	15.87	45.33	-8.67	54.00	AV	V	PASS
2405.00	31.51	2.23	26.34	60.08	-53.92	114.00	PK	V	PASS
2405.00	31.51	2.23	13.02	46.76	-47.24	94.00	AV	V	PASS
15468.5	41.67	3.03	18.29	62.90	-10.10	74.00	PK	V	PASS
15468.5	41.67	3.03	5.00	49.70	-4.30	54.00	AV	V	PASS

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading  
 3. Over Limits = Emission Level – Limits  
 4. Test uncertainty:  $\pm 4.76\text{dB}$  at a level of confidence of 95%

EUT:	WavIt MC Handset	Temperature:	24°C
M/N:	100-01-02	Humidity:	56%
Test Mode:	CH7	Test Engineer:	Kelly

Frequency MHz	Antenn a Factor	Cable Loss dB	Meter Reading dB $\mu$ V	Emission Level dB $\mu$ V/m	Over dB	Limits dB $\mu$ V/m	Detector	Polarity	Result
66.0	9.15	1.22	26.60	36.97	-3.03	40.00	QP	H	PASS
78.65	9.65	1.30	24.65	35.60	-4.40	40.00	QP	H	PASS
207.90	11.77	2.08	23.35	20.29	35.10	43.50	QP	H	PASS
1134.75	27.35	2.11	22.54	52.00	-22.00	74.00	PK	H	PASS
1134.75	27.35	2.11	7.13	36.59	-17.41	54.00	AV	H	PASS
2440.00	31.55	2.23	49.80	83.58	-30.42	114.00	PK	H	PASS
2440.00	31.55	2.23	24.30	58.08	-35.92	94.00	AV	H	PASS
15468.5	41.67	3.03	19.29	63.90	-10.10	74.00	PK	H	PASS
15468.5	41.67	3.03	5.15	49.85	-4.15	54.00	AV	H	PASS
66.25	9.15	1.22	27.30	37.67	-2.33	40.00	QP	V	PASS
78.60	9.65	1.30	23.65	34.60	-5.40	40.00	QP	V	PASS
207.98	12.63	2.28	23.39	38.20	-5.30	43.50	QP	V	PASS
1134.75	27.35	2.11	29.49	58.95	-15.05	74.00	PK	V	PASS
1134.75	27.35	2.11	10.13	39.59	-14.41	54.00	AV	V	PASS
2440.00	31.55	2.23	52.95	86.73	-27.27	114.00	PK	V	PASS
2440.00	31.55	2.23	26.81	60.59	-33.41	94.00	AV	V	PASS
15468.5	41.67	3.03	18.29	62.90	-10.10	74.00	PK	V	PASS
15468.5	41.67	3.03	5.00	49.70	-4.30	54.00	AV	V	PASS

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading  
 3. Over Limits = Emission Level – Limits  
 4. Test uncertainty:  $\pm 4.76\text{dB}$  at a level of confidence of 95%

EUT:	WavIt MC Handset	Temperature:	24°C
M/N:	100-01-02	Humidity:	56%
Test Mode:	CH15	Test Engineer:	Kelly

Frequency MHz	Antenn a Factor	Cable Loss dB	Meter Reading dB $\mu$ V	Emission Level dB $\mu$ V/m	Over Limits dB	Limits dB $\mu$ V/m	Detector	Polarity	Result
66.50	9.12	1.24	25.24	35.60	-4.40	40.00	QP	H	PASS
172.60	11.73	2.08	24.79	38.60	-4.90	43.50	QP	H	PASS
207.90	12.53	2.28	24.79	39.60	-3.90	43.50	QP	H	PASS
1134.75	27.35	2.11	22.54	52.00	22.00	74.00	PK	H	PASS
1134.75	27.35	2.11	9.31	38.77	-15.23	54.00	AV	H	PASS
2480.00	31.59	2.23	57.62	91.44	-22.56	114.00	PK	H	PASS
2480.00	31.59	2.23	39.83	73.65	-20.35	94.00	AV	H	PASS
15468.5	41.67	3.03	19.29	63.90	-10.10	74.00	PK	H	PASS
15468.5	41.67	3.03	5.15	49.85	-4.15	54.00	AV	H	PASS
66.85	9.12	1.24	27.14	37.50	-2.50	40.00	QP	V	PASS
176.50	11.87	2.09	20.59	35.40	-5.90	43.50	QP	V	PASS
207.9	12.53	2.28	20.59	35.40	-8.10	43.50	QP	V	PASS
1112.00	27.32	2.11	28.82	58.25	-15.75	74.00	PK	V	PASS
1112.00	27.32	2.11	13.24	42.67	-11.33	54.00	AV	V	PASS
2480.00	31.59	2.23	52.10	85.92	-28.08	114.00	PK	V	PASS
2480.00	31.59	2.23	34.57	68.39	-25.61	94.00	AV	V	PASS
15468.5	41.67	3.03	18.29	62.90	-10.10	74.00	PK	V	PASS
15468.5	41.67	3.03	5.00	49.70	-4.30	54.00	AV	V	PASS

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading

3. Over Limits = Emission Level - Limits

4. Test uncertainty:  $\pm 4.76\text{dB}$  at a level of confidence of 95%

### 4.3. Band edge test

#### 4.3.1 Limits:

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

#### 4.3.2 Test Procedure:

The EUT was placed on a turntable which was 0.8 meter above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on a antenna tower.

Set RBW=100kHz. VBW=100kHz. Sweep time= auto    Detector function=peak  
Trace= max hold

#### 4.3.3 Test Set-up:

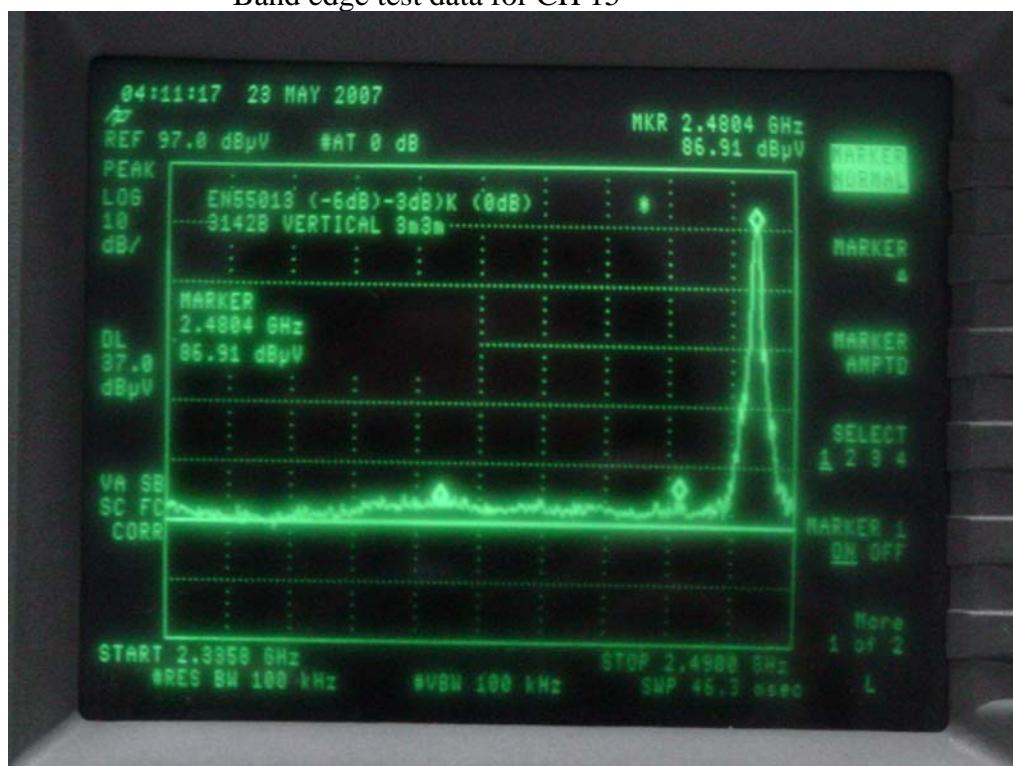
Refer to 4.2.3.2.

#### 4.3.4 Test Result:

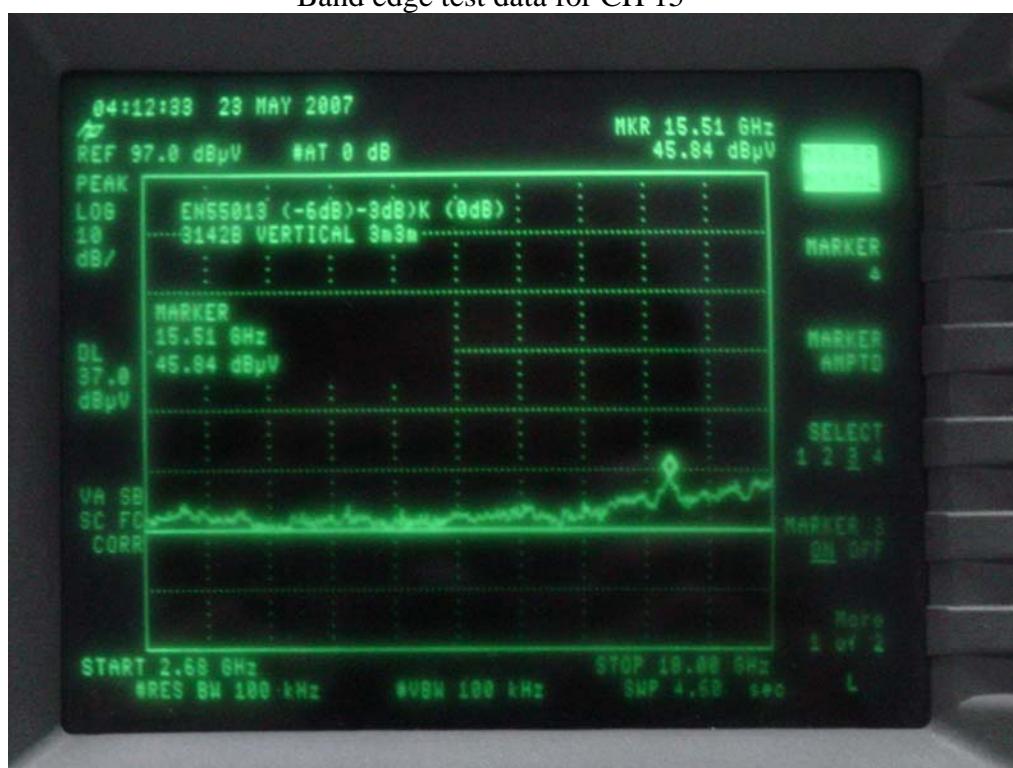
Compliance with the section 15.209 limits

#### 4.3.5 The plot of test result is attached as below:

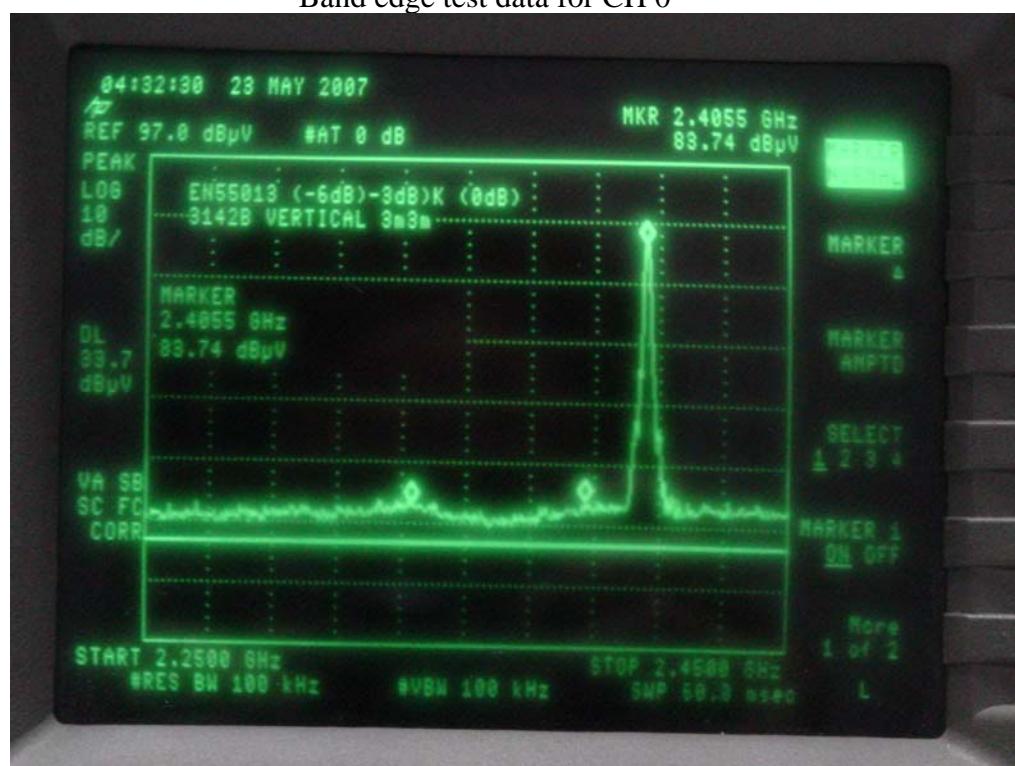
Band edge test data for CH 15



Band edge test data for CH 15



## Band edge test data for CH 0



## Band edge test data for CH 0

