

Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT : Wireless FM Modulator
MODEL/TYPE NO : RFMWL 3
FCC ID : OXERFMWL3
APPLICANT : ACCELE ELECTRONICS INC.
17900 Crusader Avenue Cerritos CA. 90703 U.S.A
Attn. : Mr. Allen Arzoumanian/President
MANUFACTURER : Sky Sound Corporation.
Rm.803,Nok-Won Bldg, #302, Haan-Dong, KwangMyung-City,
KyungKi-Do, Korea
FCC CLASSIFICATION : Low Power Communication Device Transmitter :
Intentional Radiator
FCC RULE PART(S) : FCC Part 15 Subpart C § 15.239 and CISPR 22 Class B
FCC PROCEDURE : Certification
TRADE NAME : Accele Vision
TEST REPORT No. : E03.0522.FCC.285N
DATES OF TEST : May 20 ~ 21, 2003
DATES OF ISSUE : May 22, 2003
TEST LAB. : ETL Inc (FCC Registration Number : 95422)
#584 Sangwhal-ri, Kanam-myon, Yoju-kun,
Kyounggi-do, 469-880, Korea
Tel : (031) 885-0072 Fax : (031) 885-0074

This Wireless FM Modulator has been tested in accordance with the measurement procedures specified in ANSI C63.4-1992 at the ETL/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C section15.239. I attest to the accuracy of data. All measurement herein performed by me or made under my supervision and correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.



Name : Yo Han, Park

Title : Chief Engineer

E-RAE Testing Laboratory Inc.

**#584 Sangwhal-ri, Kanam-myon, Yoju-kun,
Kyounggi-do, 469-880, Korea**

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FCC MEASUREMENT REPORT

Scope - *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

General Information

Applicant Name : Accele Electronics Inc.
Address : 17900 Crusader Avenue Cerritos CA.
90703 U.S.A
Contact Person : Mr. Allen Arzoumanian/President

- EUT Type : Wireless FM Modulator.
- Model Number : RFMWL 3
- FCC Identifier : OXERFMWL3
- Freq. Range : 88.1 MHz – 88.9 MHz
- FCC Rule Part(s) : Part 15 Subpart C Section 15.239 and CISPR 22 Class B
- Test Procedure : ANSI C63.4-1992
- FCC Classification : DXX - Low Power Communication Device Transmitter :
Intentional Radiator
- Dates of Tests : May 20 ~ 21, 2003
- Place of Tests : ETL Inc
EMC Testing Lab (FCC Registration Number : 95422)
584, Sangwhal-Ri, Kanam-Myun, Yoju-Kun,
Kyounggi-Do, 469-880, Korea
Tel : (031) 885-0072 Fax : (031) 885-0074
- Test Report No. : E03.0522.FCC.285N

1. INTRODUCTION

The measurement test for radiated and conducted emission test were conducted at the open area test site of E-RAE Testing Laboratory Inc. facility located at 584, Sangwhal-ri, Ganam-myun, Youju-kun, Kyoungki-do, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-1992 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 and 10 meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1992 and registered to the Federal Communications Commission(Registration Number : 95422).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-1992) was used in determining radiated and conducted emissions from the Accele Electronics Inc.. Wireless FM Modulator Model : RFMWL 3.

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the Accele Electronics Inc. Wireless FM Modulator Model:RFMWL 3(FCC ID : OXERFMWL3). This Wireless FM Modulator is supply powered by DC 12V. This equipment is Modulated FM RF signals transmitting to any FM receiver such as home FM stereo receivers.

The wireless is support with audio source for FM frequency band of 88.1 ~ 88.9 MHz FM stereo receivers.

2.2 General Specification

| | |
|---|---------------------|
| - Chassis Type | Plastic |
| - List of Each OSC. Or X-Tal. Freq.(>=1MHz) | X1:7.6MHz |
| - Main IC | BA1417F |
| - RF Frequency Out | 88.1 MHz – 88.9 MHz |
| - I/O Cable(s) | Unshielded |
| - Power Requirement | DC 12V |
| - Dimension(LxD) | 600 x 550 mm |

3. DESCRIPTION OF TESTS

3.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-1992. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50 /50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table in which is placed 40cm away from the vertical wall, and 1.5m away from the side wall of the chamber room. Two EMCO 3825/2 LISNs are bonded to the shielded room. The EUT is powered from the EMCO LISN and the support equipment is powered from another EMCO LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling(serprntine fashion) to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the R3261A Spectrum Analyzer to determine the frequency producing the max. emission from the EUT. The frequency producing the max. level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode. Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

3. DESCRIPTION OF TESTS

3.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 10meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using biconilog antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies which were selected as bottom, middle and top frequency in the operating band. Emission level from the EUT with various configurations were examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 10-meter test range using biconilog antenna. The output from the antenna was connected, via a pre-selector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer(for above 1GHz). The detector function was set to the quasi-peak or peak and average mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission. The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Each emission was maximized by varying the mode of operating frequencies of the EUT. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20dB/decade) as per section 15.31(f).

Photographs of the worst-case emission test setup can be seen in Appendix B.

3. DESCRIPTION OF TESTS

3.3 Emission Bandwidth Measurement

Emissions from the intentional radiator shall be confined within a band 200 kHz wide centered on the operating frequency. The 200 kHz band shall lie wholly within the frequency range of 88 – 108 MHz. Position the EUT as shown in the radiated emission measurement and set it to any one measured frequency within its operating range and make sure the measuring instrument is operated in its linear range. Set both RBW and VBW of the spectrum analyzer to 10 kHz and 100 kHz respectively with a convenient frequency span including 200kHz bandwidth of the emission.

The bandwidth of emission shall be no wider than of 200kHz of the center frequency for EUT operating within 88.0 MHz to 108.0 MHz. The bandwidth is determined at the frequency 26dB down from the modulated carrier. Plot the graph on spectrum analyzer.

4. TEST CONDITION

4.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner which intends to maximize its emission level in a typical application.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/1992 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were conducted at 10 meter open field test site.

To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes. All testing was performed at AC/DC Adaptor.

4.2 EUT operation

The EUT was stereo audio signal input to wireless FM Modulator from any audio sources such as DVD,VCR, GAME and etc.

4.3 Support Equipment Used

Following peripheral devices and interface cables were connected during the measurement:

EUT- Wireless FM Modulator.

| | |
|-------------------|--------------------------|
| FCC ID | : OXERFMWL3 |
| Model Name | : RFMWL 3 |
| Serial No. | : Prototype |
| Manufacturer | : SKY Sound Corporation. |
| Power Supply Type | : DC 12V |
| Power Cord | : N/A |
| Interface Cable | : R.C.A & Power |

Support Unit 1 – CD- Player

| | |
|-------------------|---------------|
| FCC ID | : N/A |
| Model Name | : SL-CT540 |
| Serial No. | : FC1CA013527 |
| Manufacturer | : Panasonic |
| Power Supply Type | : DC 4.5V |
| Interface cable | : R.C.A |

Support Unit 2 – DC Adapter

| | |
|-------------------|----------|
| FCC ID | : N/A |
| Model Name | : |
| Serial No. | : None |
| Manufacturer | : |
| Power Supply Type | : Linear |
| Power Cord | : N/A |

5. TEST RESULTS

5.1 Summary of Test Results

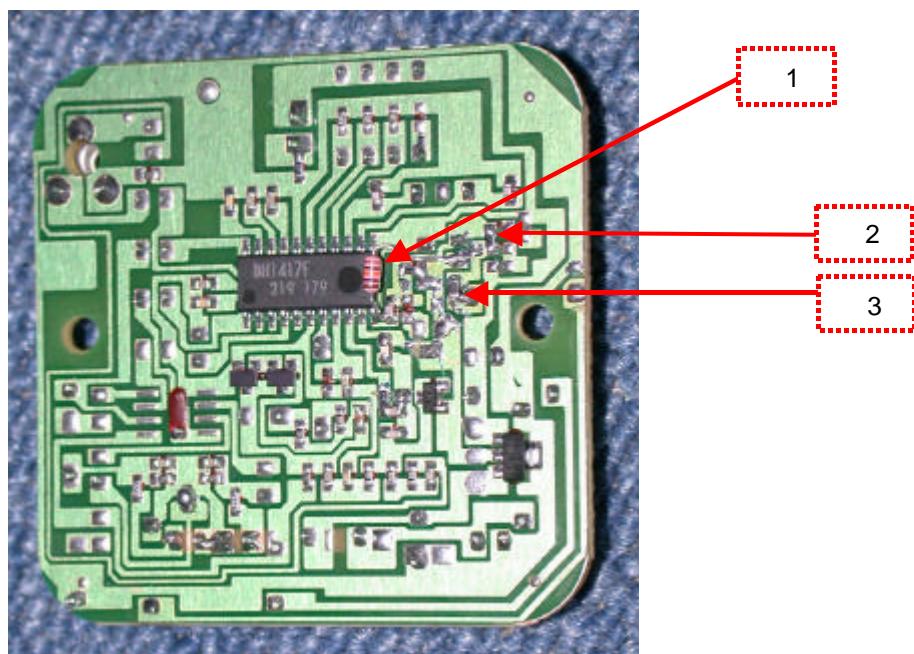
The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

| FCC Rule Parts | Measurement Required | Result |
|----------------|--|--------------------|
| 15.239(b) | Radiated Emissions of RF Carrier frequency | Passed by -15.24dB |
| 15.239(c) | Out-of-band Radiated Emissions | Passed by -9.90dB |
| 15.239(a) | Emission Bandwidth Measurement | Passed |

The data collected shows that the **Accele Electronics Inc. Wireless FM Modulator RFMWL 3** complies with technical requirements of the Part 15.239 of the FCC Rules.

This equipment is the operated device by DC12V. The Conducted emission measurement according to the section 15.207 is not applicable to this equipment.

The equipment is modified, mechanical or circuits to improve EMI status during a measurement. EMI suppression device(s) was added and/or modified during testing.



- 1) Capacitor (1 nF) was added
- 2) Inductor(22 nH) was added
- 3) Inductor(1 uH) was added

5. TEST RESULTS

5.2 Conducted Emissions Measurement

| | |
|-----------------------|---|
| EUT | Wireless FM Modulator /RFMWL 3 |
| Limit apply to | FCC Part15 Subpart C Section 15.239(b) |
| Test Date | May 19, 2003 |
| Operating Condition | RF transmit With Signal Audio |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22 |
| Result | Not Applicable |

Conducted Emission Test Data

Detector mode : CISPR Quasi-Peak mode (6dB Bandwidth : 9 KHz)

| Frequency [MHz] | Reading [dB μ V] | | Phase (*H/**N) | Limit [dB μ V] | | Margin [dB] | |
|--|-------------------------|---------|-------------------|-----------------------|---------|----------------|---------|
| | Quasi-peak | Average | | Quasi-peak | Average | Q. Peak | Average |
|  | | | | | | | |

NOTES :

1. * H : HOT Line , **N : Neutral Line
2. Margin value = Limit – Reading
3. Measurement were performed at the AC/DC Power Inlet in the frequency band of 450kHz ~ 30MHz



Tested by : Ho Jin, Kim
Test Engineer

5. TEST RESULTS

5.3 Radiated Emissions of RF Carrier frequency

| | |
|-----------------------|---|
| EUT | Wireless FM Modulator /RFMWL 3 |
| Limit apply to | FCC Part15 Subpart C Section 15.239(b) |
| Test Date | May 19, 2003 |
| Operating Condition | RF transmit With Signal Audio |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22 |
| Result | Passed by – 15.24dB |

Detector mode : Peak mode

Measurement Distance : 3 meters

| Frequency [MHz] | Reading [dB μ V] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] |
|-----------------|----------------------|-----------------------|------------------|-----------------|-------------------------------|----------------------|-------------|
| 88.10 | 22.78 | V | 7.42 | 2.30 | 32.50 | 68.0 | 35.50 |
| 88.50 | 23.86 | V | 7.42 | 2.30 | 33.58 | 68.0 | 34.42 |
| 88.90 | 22.18 | V | 7.42 | 2.30 | 31.90 | 68.0 | 36.10 |

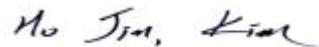
Detector mode : Average mode

Measurement Distance : 3 meters

| Frequency [MHz] | Reading [dB μ V] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] |
|-----------------|----------------------|-----------------------|------------------|-----------------|-------------------------------|----------------------|-------------|
| 88.10 | 21.78 | V | 7.42 | 2.30 | 31.50 | 48.0 | 16.50 |
| 88.50 | 23.04 | V | 7.42 | 2.30 | 32.76 | 48.0 | 15.24 |
| 88.90 | 21.56 | V | 7.42 | 2.30 | 31.28 | 48.0 | 16.72 |

NOTES :

4. * H : Horizontal polarization , ** V : Vertical polarization
5. Emission Level = Reading + Antenna factor + Cable loss
6. Margin value = Limit - Emission Level
7. Measurement was performed at three frequencies as bottom, middle and top of the operating frequency range.



Tested by : Ho Jin, Kim
 Test Engineer

5. TEST RESULTS

5.4 Out-of-band Radiated Emissions

| | |
|-----------------------|---|
| EUT | Wireless FM Modulator /RFMWL 3 |
| Limit apply to | FCC Part15 Subpart C Section 15.23(b) and CISPR Class B |
| Test Date | May 19, 2003 |
| Operating Condition | RF transmit With Signal Audio |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22 |
| Result | Passed by – 9.90dB |

Radiated Emission Test Data

Detector mode : CISPR Quasi-Peak mode (6dB Bandwidth : 120 kHz)

Measurement Distance : 10 meters

| Frequency [MHz] | Reading [dB μ V] | Polarization (*H/**V) | Ant. Factor [dB] | Cable Loss [dB] | Emission Level [dB μ V/m] | Limit [dB μ V/m] | Margin [dB] |
|-----------------|----------------------|-----------------------|------------------|-----------------|-------------------------------|----------------------|-------------|
| 30.68 | 6.79 | V | 11.91 | 1.40 | 20.10 | 30.0 | 9.90 |
| 135.30 | 2.78 | H | 12.12 | 2.90 | 17.80 | 30.0 | 12.20 |
| 140.02 | 2.90 | H | 12.50 | 3.00 | 18.40 | 30.0 | 11.60 |
| 156.90 | 2.20 | V | 12.92 | 3.10 | 18.22 | 30.0 | 11.78 |

NOTES :

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Emission Level = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Emission Level
4. All other emissions not reported were more than 25dB below the permitted limit.



Tested by : Ho Jin, Kim
Test Engineer

5. TEST RESULTS

5.5 Emission Bandwidth Measurement

| | |
|-----------------------|---|
| EUT | Wireless FM Modulator /RFMWL 3 |
| Limit apply to | FCC Part15 Subpart C Section 15.23(b) |
| Test Date | May 20, 2003 |
| Operating Condition | RF transmit With Signal Audio |
| Environment Condition | Humidity Level : 37 %RH, Temperature : 22 |
| Result | Passed |

Measurement Data

| Emission Frequency [MHz] | Emission Bandwidth [kHz] | Limit [kHz] | Remark |
|-----------------------------|-----------------------------|----------------|--------|
| 88.10 | < 160 | 200 | |
| 88.50 | < 165 | 200 | |
| 88.90 | < 140 | 200 | |

NOTES :

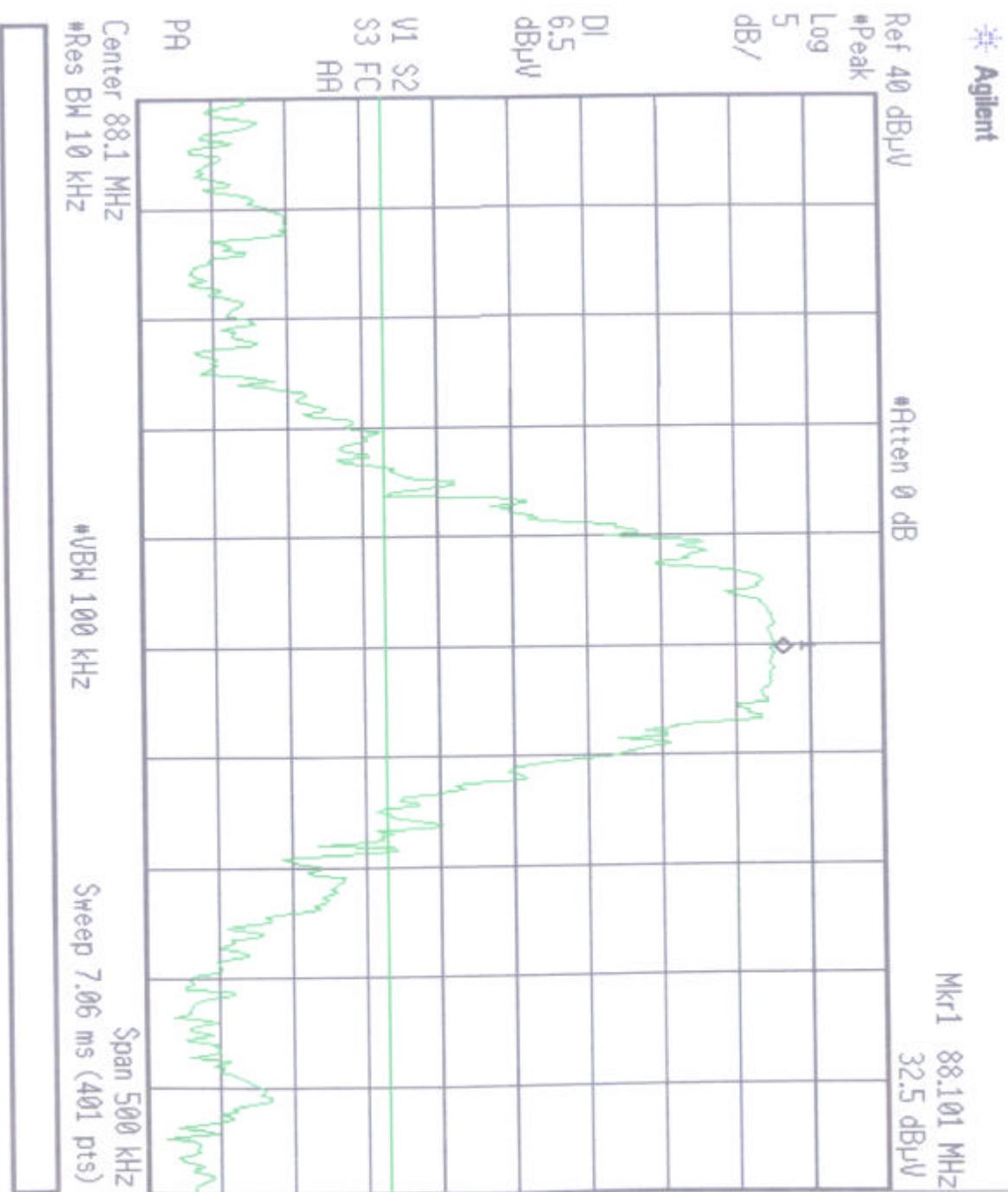
1. Please see the measured bandwidth plot in next page.
2. The emission bandwidth shall be no wider than 200kHz of the center frequency of the equipment operating within 88.0 MHz to 108.00 MHz. The bandwidth is determined at the points 26dB down from the modulated carrier.
3. Spectrum analyzer settings
Resolution bandwidth : 10 kHz
Video bandwidth : 100 kHz
Frequency span : 500 kHz



Tested by : Ho Jin, Kim
Test Engineer

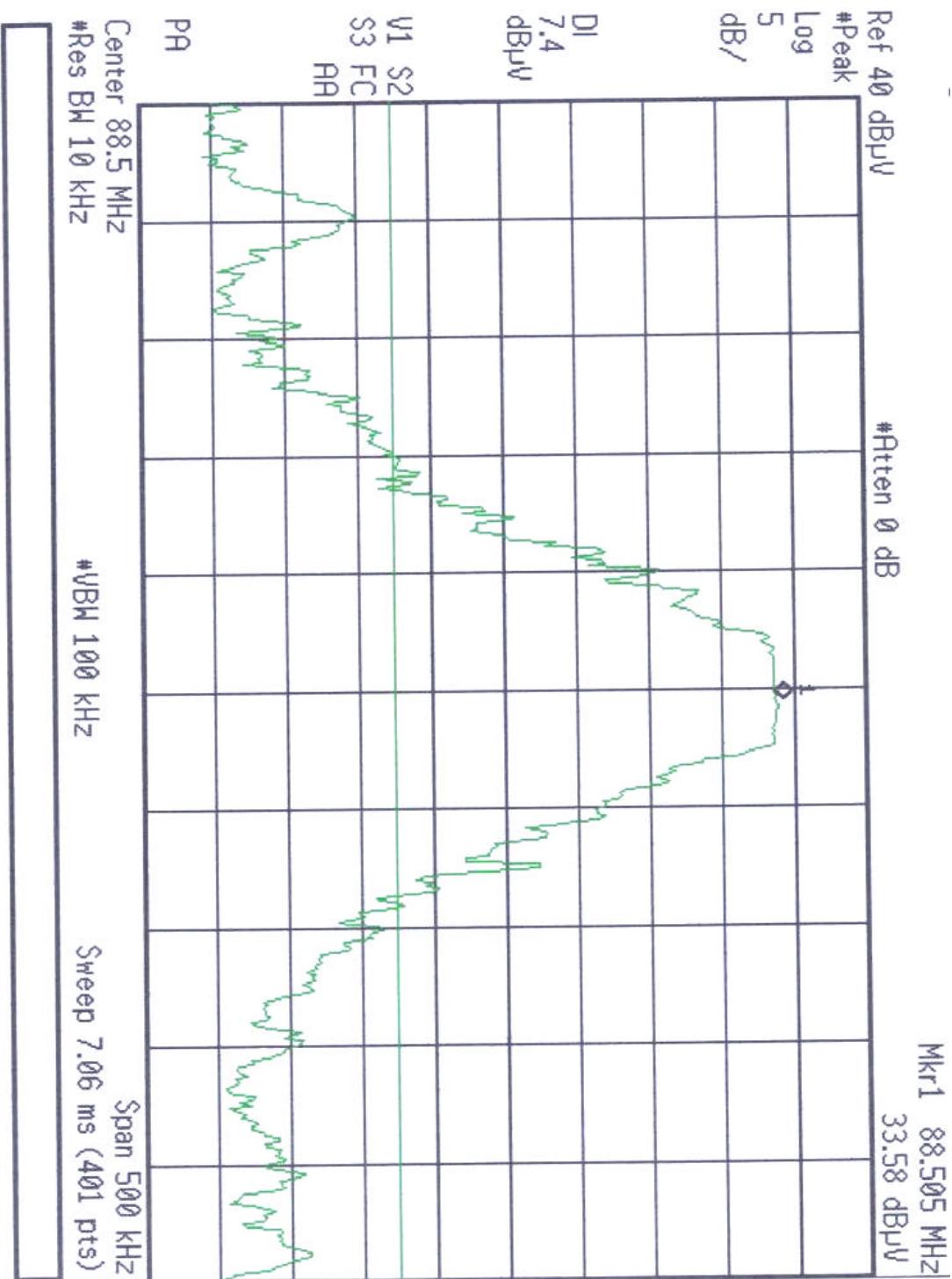
5. TEST RESULTS

Frequency: 88.10MHz



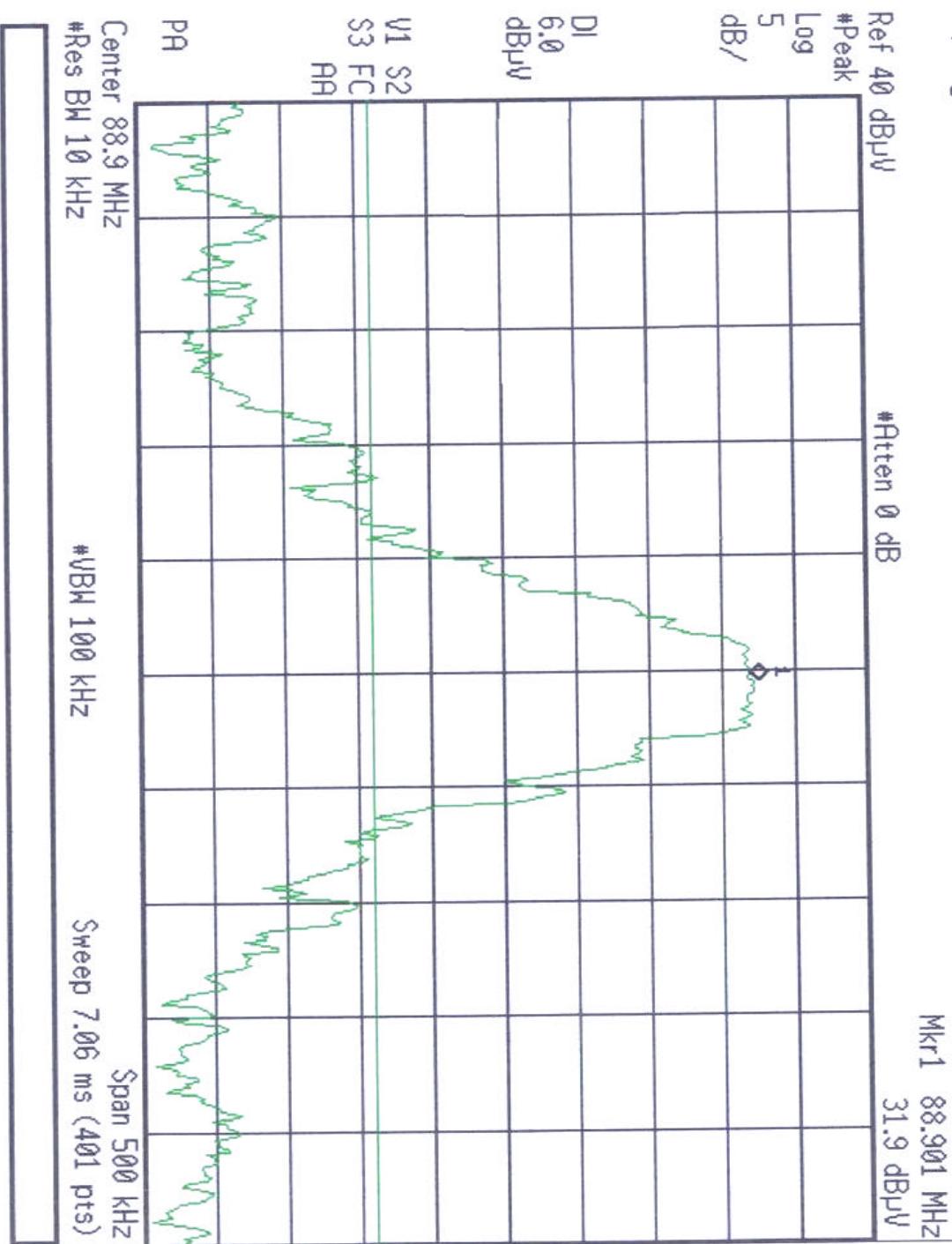
5. TEST RESULTS

Frequency: 88.50MHz



5. TEST RESULTS

Frequency: 88.90MHz



6. SAMPLE CALCULATION

Sample Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor.
The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF$$

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

$$dB(\mu V/m) = 20 \log_{10} (\mu V /m) : \text{Equation 1}$$

$$dB\mu V = dBm + 107 : \text{Equation 2}$$

Example 1 : @ 30.67MHz

| | | | | |
|-----------------------------|---|-------------------|---|----------------------|
| Class B Limit | = | 100 μ V | = | 40.0 dB μ V/m |
| Reading | = | 16.79 dB μ V | | |
| Antenna Factor + Cable Loss | = | 13.31 dB | | |
| Total | = | 30.10dB μ V/m | | |
| Margin | = | 30.10 - 40.0 | = | -9.90 |
| | | | = | -9.90 dB below Limit |

7. TEST EQUIPMENT LIST

List of Test Equipments Used for Measurements

| Test Equipment | | Model | Mfg. | Serial No. | Cal. Due Date |
|-------------------------------------|------------------------|-----------|--------------|-------------|---------------|
| <input checked="" type="checkbox"/> | Spectrum Analyzer | R3261A | Advantest | 21720033 | 03-10-26 |
| <input checked="" type="checkbox"/> | Receiver | ESVS 10 | R & S | 835165/001 | 04-04-06 |
| <input checked="" type="checkbox"/> | Preamplifier | HP8447D | HP | 2944A07626 | 04-01-10 |
| <input checked="" type="checkbox"/> | LISN | 3825/2 | EMCO | 9006-1669 | 03-12-27 |
| <input checked="" type="checkbox"/> | LISN | 3825/2 | EMCO | 9208-1995 | 03-12-27 |
| <input checked="" type="checkbox"/> | TriLog Antenna | VULB9160 | Schwarz Beck | 3082 | 04-05-08 |
| <input checked="" type="checkbox"/> | Dipole Antenna | VHAP | Schwarz Beck | 964 | 04-05-03 |
| <input checked="" type="checkbox"/> | Dipole Antenna | VHAP | Schwarz Beck | 965 | 04-05-03 |
| <input checked="" type="checkbox"/> | Dipole Antenna | UHAP | Schwarz Beck | 949 | 04-05-03 |
| <input checked="" type="checkbox"/> | Dipole Antenna | UHAP | Schwarz Beck | 950 | 04-05-03 |
| <input checked="" type="checkbox"/> | Turn-Table | DETT-03 | Daeil EMC | - | N/A |
| <input checked="" type="checkbox"/> | Antenna Master | DEAM-03 | Daeil EMC | - | N/A |
| <input type="checkbox"/> | Plotter | 7440A | H.P | 2725A 75722 | N/A |
| <input checked="" type="checkbox"/> | Chamber | DTEC01 | DAETONG | - | N/A |
| <input checked="" type="checkbox"/> | Impedance Matching Pad | 6001.01.A | SUNNER | 3252 | 03-09-22 |
| <input checked="" type="checkbox"/> | Thermo Hygrograph | 3-3122 | ISUZU | 3312201 | 03-12-20 |
| <input type="checkbox"/> | BaroMeter | - | Regulus | - | - |