

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	: FM equalizer
MODEL/Serial No.	: FTE-AIR / Proto type
FCC ID	: VIV-FTE-AIR
APPLICANT	: ARTECSOUND Co., Ltd. #540-6 Kwansan, Koyang city, Kyunggi-do, Korea [412-804] Attn. : Mr. Young Choi / Managing Director
MANUFACTURER	: ARTECSOUND Co., Ltd. Jiaozhou, Qingdao, Shandong, China
FCC CLASSIFICATION	: DXX: Low Power Communication Device Transmitter
RULE PART(S)	: FCC Title 47, Part 15 Subpart C
FCC PROCEDURE	: ANSI C63.4-2003
TEST RESULT	: The above-mentioned device has been tested and passed.
TEST REPORT No.	: ETLE070720.480
DATES OF TEST	: July 25, 2007 ~ July 27, 2007
REPORT ISSUE DATE	: July 30, 2007
TEST LABORATORY	: ETL Inc. (FCC Registration Number : 95422)

This FM equalizer, Model FTE-AIR has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL 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 was performed by me or was made under my supervision and is 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.


Hyung Seok, Lee / Chief Engineer

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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	: ARTECSOUND Co., Ltd.
Address	: #540-6 Kwansan, Koyang city, Kyunggi-do, Korea [412-804]
Attention	: Mr. Young Choi / Managing Director

- EUT Type :** FM equalizer
- Model Number :** FTE-AIR
- S/N :** Proto type
- Freq. Range :** 90.30 MHz – 93.30 MHz(Variable Knob)
- FCC Rule Part(s) :** FCC Part 15 Subpart C Section 15.239
- Test Procedure :** ANSI C63.4-2003
- FCC Classification :** DXX: Low Power Communication Device Transmitter
- Dates of Tests :** July 25, 2007 ~ July 27, 2007
- Place of Tests :**
Radiated Emission test;
#584, Sangwhal-ri, Ganam-myeon, Yoju-gun,
Gyeonggi-do, 469-885, Korea
- Conducted Emission test;**
ETL Inc. Testing Lab.
371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
- Test Report No. :** ETLE070720.480



1. INTRODUCTION

The measurement test for radiated and conducted emission test was conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC 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 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the ARTECSOUND Co., Ltd.. Model: FTE-AIR

2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test(EUT) is the ARTECSOUND Co., Ltd. FM equalizer. Model: FTE-AIR. This is FM transmitter. It's fixed inside the vehicle and powered 9 V from battery. FM transmitter is designed to operate on frequency in the 90,30 MHz ~ 93,30 MHz.

The amplified RF is transmitted via transmitting antenna.

The frequency is controlled by turning Frequency control knob continuously.

2.2 General Specification

- Chassis Type	Plastic
- Features	Bass: ±12 dB at 100 Hz Middle : ±12 dB at 800 Hz Treble : ±12 dB at 3 kHz Volume : 0 ~ 10 Tune : 90,3 MHz ~ 93,3 MHz FM Transmitter LED 2,5 mm Input Jack 1/4" Output Jack w/ cable
- Current	0.5 mA (2.5 mA)
- Battery life time	Only EQ use: over 1 000 hours FM Transmitter: over 300 hours

3. DESCRIPTION OF TESTS

3.1 Radiated Emission Measurement

The following paragraphs describe the procedures that may be used for making final radiated emission measurements on intentional radiators. Additional guidance and step-by-step procedures for preparing the setups and making the required radiated emission measurements are contained in Annex H of ANSI C63.4-2003.

Preliminary measurements were made at indoors 3 m 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 was noted for each frequency found. The spectrum was scanned from 30 to 1 000 MHz using biconilog antenna and above 1 000 MHz; linearly polarized double ridge horn antennas were used. Above 1 GHz, 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 was examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3 m 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 1 GHz). 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 120 kHz (1MHz for measurement above 1 GHz), 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 1 m x 1.5 m 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 (20 dB/decade) as per section 15.31(f).

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

3.2 Occupied 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 90.3 MHz – 93.3 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 200 kHz bandwidth of the emission.

The Measurements were performed at three channels: low (90.3 MHz), middle (91.8 MHz) and high (93.3MHz). The spectrum trace data around transmitter fundamental frequency was obtained with the spectrum analyzer in "Max Hold" mode. The bandwidth value was determined between two points 26 dB down from the center frequency. The measured results are less than 200 kHz. The measured spectrum of the signal is shown in Figure 1. From the plot we see that in the worst case, the bandwidth is 56.5 kHz at 93.3 MHz.

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 following conditions and configurations were used.

4.2 EUT operation

The EUT was tested on the design frequency of the device. In the case of EUTs that can operate on more than one frequency, unless otherwise specified in the individual tests, measurements shall be made with the EUT set to a frequency or frequencies as provided in Table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
Less than 1 MHz	1	1 near middle
1 to 10 MHz	2	1 near top, 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle, and 1, near bottom

The EUT was fixed inside the vehicle and powered 9 V from battery. FM transmitter is designed to operate on frequency in the 90.30 MHz ~ 93.30 MHz.

Operating Mode	The worst operating condition
- Frequency tuning 90.3 MHz	X
- Frequency tuning 91.8 MHz	X
- Frequency tuning 93.3 MHz	◎

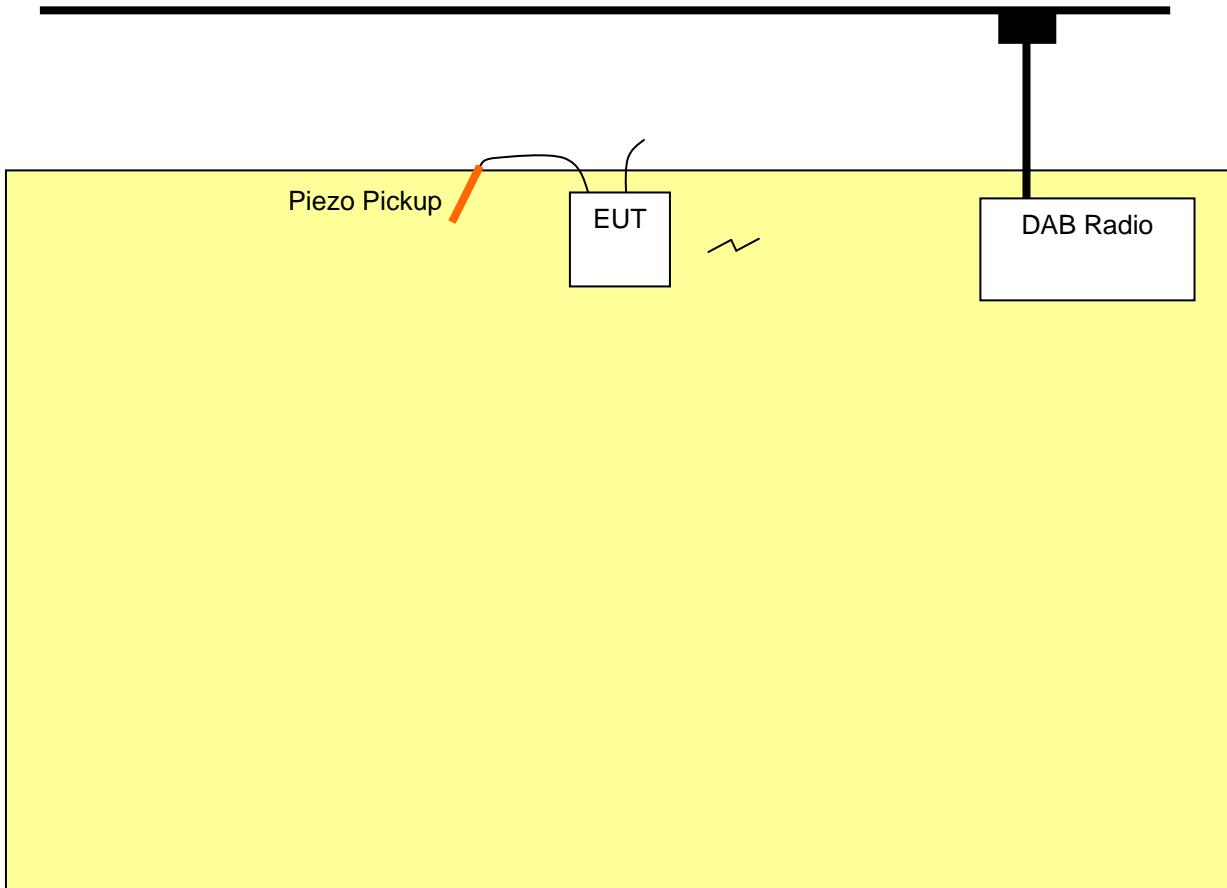
◎ : Worst case investigated during the test.

4.3 Support Equipment Used

Description	Model Name	Serial No.	Manufacturer
PIEZO PICKUP	PG-607	NONE	ARTECSOUND Co., Ltd.
Active Humbucker	LZ1	NONE	ARTECSOUND Co., Ltd.
DAB Radio	FSP-2100	NONE	Freesat Korea
AC/DC Adapter	DSA-0131F-12 US 12	NONE	DVE

4.4 Type of Cables Used

Device from	Device to	Type of I/O port	Length(m)	Type of shield
EUT	Piezo Pickup	Audio Input	0,2	Shielded
DAB Radio	Adapter	DC power input	1,5	Unshielded

4.5 The setup drawing(s)

_____ : Data Line

_____ : Power Line

_____ : Adapter

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	Measurement Required	Result
15.239(b)	Radiated Emissions of RF Carrier frequency	Passed
15.239(c)	Out-of-band Radiated Emissions	Passed
15.239(a)	Occupied Bandwidth Measurement	Passed

The data collected shows that the **ARTECSOUND Co., Ltd. / FM equalizer / FTE-AIR** complied with technical requirements of the Part 15.239 of the FCC Rules.

The equipment is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified during testing.

5.2 Radiated Emissions of RF Carrier frequency

EUT	FM equalizer / FTE-AIR (SN: Proto type)
Limit apply to	FCC Part15 Subpart C
Test Date	July 27, 2007
Operating Condition	RF transmit with frequency tuned mode
Environment Condition	Humidity Level: 47 %R.H., Temperature: 27 °C
Result	Passed by 6,11 dB

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.

Detector mode : Peak mode

Measurement distance : 3 m

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
90,30	31,35	H	8,06	2,99	42,40	68,0	25,60
91,80	28,92	H	8,23	2,95	40,10	68,0	27,90
93,30	30,99	H	8,41	2,90	42,30	68,0	25,70

Detector mode : Average mode

Measurement distance : 3 m

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
90,30	31,02	H	8,06	2,99	42,07	48,0	5,93
91,80	28,57	H	8,23	2,95	39,75	48,0	8,25
93,30	30,58	H	8,41	2,90	41,89	48,0	6,11

NOTES :

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. Measurement was performed at three frequencies as bottom, middle and top of the operating frequency range.
5. The EUT was tested in all the three orthogonal planes and the worst-case emission was vertical axes.
6. The average detection mode was used. The EUT has met the average emission requirements. The peak emission limitations (measured with peak detector) of § 15.35 have also met, the maximum difference between peak and average emission was 0.4 dB.



Test Engineer: K.K. Yoon

5.3 Out-of-band Radiated Emissions

EUT	FM equalizer / FTE-AIR (SN: Proto type)
Limit apply to	FCC Part15 Subpart C
Test Date	July 27, 2007
Operating Condition	RF transmit with frequency tuned mode
Environment Condition	Humidity Level: 45 %R.H., Temperature: 27 °C
Result	Passed by 12,10 dB

Radiated Emission Test Data

The following table shows the highest levels of radiated emissions on both polarization of horizontal and vertical.(The test is 90.3 MHz, 91.8 MHz, 93.3 MHz worst case)

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

Measurement Distance : 3 m

Frequency [MHz]	Reading [dB μ V]	Polarization (*H/**V)	Ant. Factor [dB]	Cable Loss [dB]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]
180,60	15,22	H	10,78	3,90	29,90	43,5	13,60
183,60	17,01	H	10,48	3,92	31,40	43,5	12,10
186,60	16,29	H	10,17	3,93	30,40	43,5	13,10

NOTES :

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The EUT was tested in all the three orthogonal planes and the worst case of emissions was vertical axes.



Test Engineer: K.K. Yoon

5.4 Occupied Bandwidth Measurement

EUT	FM equalizer / FTE-AIR (SN: Proto type)
Limit apply to	FCC Part15 Subpart C
Test Date	July 27, 2007
Operating Condition	RF transmit with acoustic guitar signal(maximum typical sound)
Environment Condition	Humidity Level: 54 %R.H., Temperature: 22 °C
Result	Passed

Measurement Data

Center Frequency [MHz]	Measured occupied bandwidth [kHz]	Limit [kHz]	Rusult
90,30	< 100	200	Pass
91,80	< 100	200	Pass
93,30	< 100	200	Pass

NOTES :

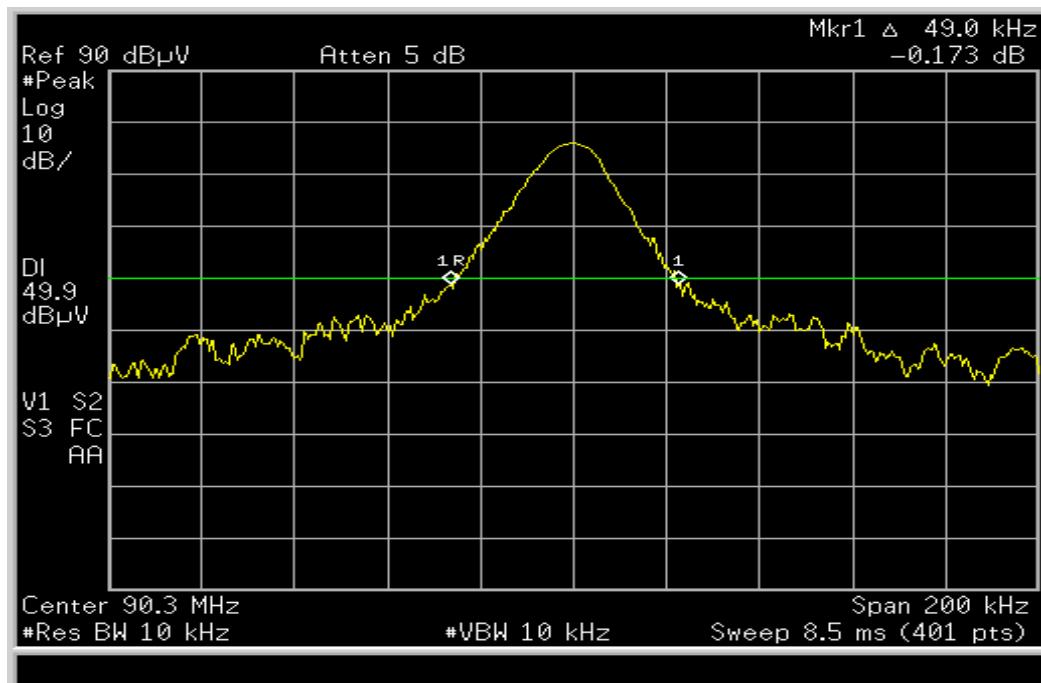
1. Please see the measured bandwidth plot in next page.
2. The occupied bandwidth shall be no wider than 200kHz of the center frequency of the equipment operating within 90.3 MHz to 93.3 MHz. The bandwidth is determined at the points 26dB down from the modulated carrier.
3. Spectrum analyzer settings
Resolution bandwidth : 10 kHz
Video bandwidth : 10 kHz
Frequency span : 200 kHz



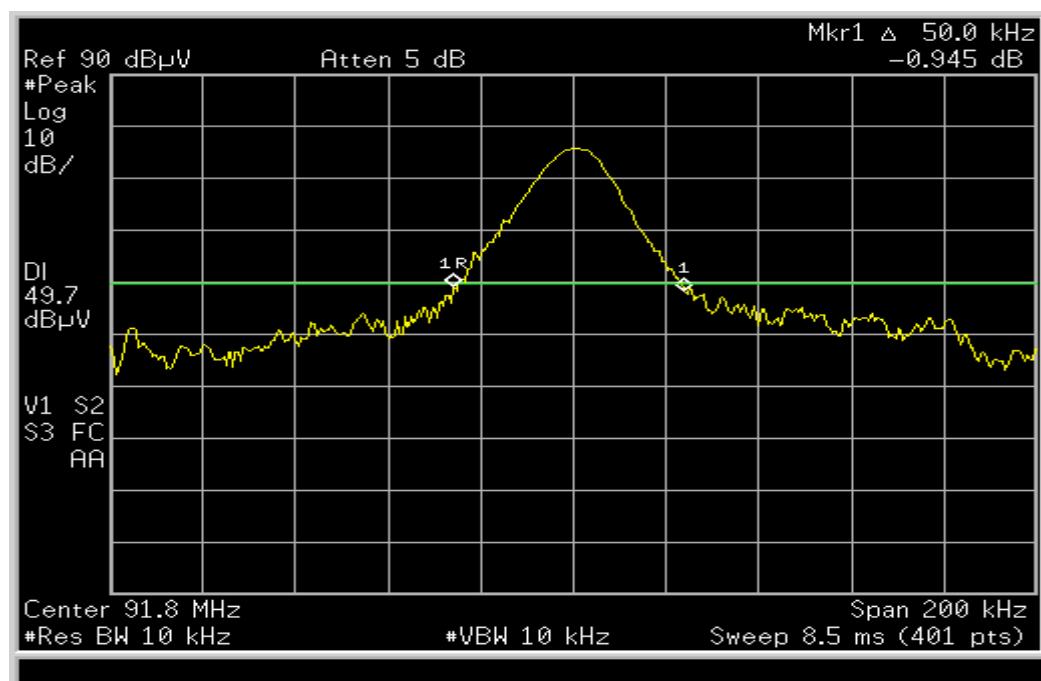
Test Engineer: K.K. Yoon

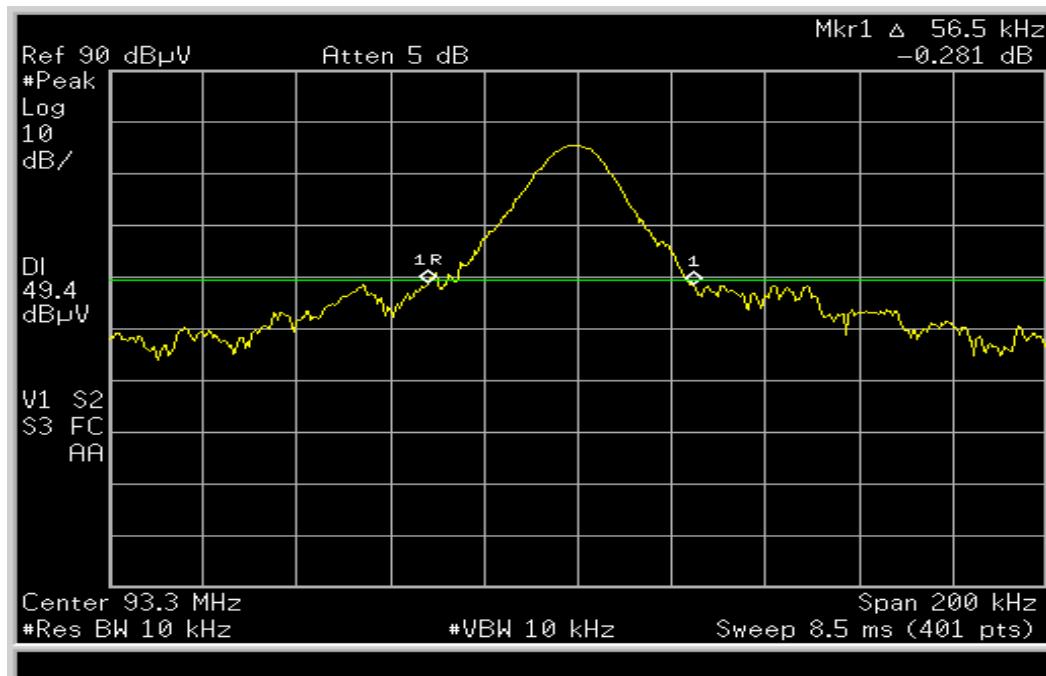
5. TEST RESULTS

90.3 MHz



91.8 MHz



5. TEST RESULTS**93.3 MHz**

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

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

Example : @ 93,30 MHz

Limit	=	48,00 dBuV/m
Reading	=	30,58 dBuV
Antenna Factor + Cable Loss	=	8,41 + 2,90 = 11,41 dBuV/m
Total	=	41,89 dBuV/m
Margin	=	48,00 - 41,89 = 6,11 dB
		= 6,11 dB below Limit



FCC TEST REPORT

7. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
<input checked="" type="checkbox"/>	Receiver	ESVS 10	R & S	835165/001	08.05.03
<input checked="" type="checkbox"/>	LogBicon	VULB9160	Schwarz Beck	3082	07.08.11
<input checked="" type="checkbox"/>	Spectrum Analyzer	E7405A	Agilent	US41160290	07.10.18
<input checked="" type="checkbox"/>	Turn-Table	DETT-03	Daeil EMC	-	N/A
<input checked="" type="checkbox"/>	Antenna Master	DEAM-03	Daeil EMC	-	N/A

End of Test Report