

TEST REPORT

Report No.: HK09080476-1

RadioShack Corporation

Application
For
Certification
(Original Grant)
(FCC ID: AAO330282T)

Transceiver

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Date: October 14, 2009

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GENERAL INFORMATION

RadioShack Corporation
BRAND NAME: AUVIO, MODEL: 33-282

FCC ID: AAO330282T

Grantee:	RadioShack Corporation
Grantee Address:	300 RadioShack Circle, Mail Stop WF4-136, Fort Worth, Texas, 76102-2802, USA.
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Manufacturer:	N/A
Manufacturer Address:	N/A
Brand Name:	AUVIO
Model:	33-282
Type of EUT:	Transceiver
Description of EUT:	900MHz Stereo Digital Wireless Headphones
Serial Number:	N/A
FCC ID:	AAO330282T
Date of Sample Submitted:	August 12, 2009
Date of Test:	August 27, 2009
Report No.:	HK09080476-1
Report Date:	October 14, 2009
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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SUMMARY OF TEST RESULT

RadioShack Corporation
BRAND NAME: AUVIO, MODEL: 33-282

FCC ID: AAO330282T

TEST SPECIFICATION	REFERENCE	RESULTS
Maximum Peak Output Power	15.247(b), (c) / RSS-210 A8.4	Pass
6 dB Bandwidth	15.247(a)(2) / RSS-210 A8.2	Pass
Maximum Power Density	15.247(e) / RSS-210 A8.2	Pass
Out of Band Antenna Conducted Emission	15.247(d) / RSS-210 A8.5	Pass
Radiated Emission in Restricted Bands	15.247(d)	Pass
Radiated Spurious Emissions	15.247(d) / RSS-210 A8.5	Pass
Transmitter Power Line Conducted Emissions	15.207 / RSS-Gen 7.2.2	Pass
Antenna Requirement	15.203	Pass (See Note 1)

Note: 1. The EUT uses a permanently attached antenna which, in accordance to section 15.203, is considered sufficient to comply with the pervisions of this section.

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Table of Contents

1.0	<u>General Description</u>	1
1.1	Product Description	1
1.2	Related Submittal(s) Grants.....	1
1.3	Test Methodology.....	1
1.4	Test Facility	1
2.0	<u>System Test Configuration</u>	2
2.1	Justification	2
2.2	EUT Exercising Software.....	2
2.3	Special Accessories	2
2.4	Equipment Modification	2
2.5	Measurement Uncertainty.....	2
2.6	Support Equipment List and Description	3
3.0	<u>Emission Results</u>	3
3.1	Field Strength Calculation.....	3
3.2	Radiated Emission Configuration Photograph.....	4
3.3	Radiated Emission Data	4
3.4	Conducted Emission Configuration Photograph.....	4
3.5	Conducted Emission Data	4
4.0	<u>Measurement Results</u>	5
4.1	Maximum Conducted Output Power at Antenna Terminals	5
4.2	Minimum 6 dB RF Bandwidth	5
4.3	Maximum Power Density Reading.....	6
4.4	Out of Band Conducted Emissions	6
4.5	Out of Band Radiated Emissions (for emissions in 4.4 above that are less than 20dB below carrier).....	7
4.6	Radiated Spurious Emissions.....	8
4.7	Transmitter Duty Cycle Calculation and Measurements	10
4.8	AC Line Conducted Emission	11
5.0	<u>Equipment Photographs</u>	12
6.0	<u>Product Labelling</u>	12
7.0	<u>Technical Specifications</u>	12
8.0	<u>Instruction Manual</u>	12
9.0	<u>Miscellaneous Information</u>	13
9.1	Calculation of Average Factor.....	13
9.2	Emissions Test Procedures	13
10.0	<u>Confidentiality Request</u>	14
11.0	<u>Equipment List</u>	15

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1.0 General Description

1.1 Product Description

33-282 is 900MHz Stereo Digital Wireless Headphones with 3 channels. The frequencies are 910.5MHz, 915MHz and 919.5MHz respectively. It is powered by 120VAC. The base unit also used to charge the headphones when rechargeable batteries are used. It uses digital modulation technique which can strengthen range and sound quality. Moreover, its features of Voice clarity and E-bass can enhance sound quality for speech and bass. Especially, the feature of Ambient Sound Isolation enables you to switch between your entertainment and external conversation without removing the headphones. For the communication protocol, after the base unit transmitted a data pack, it will wait for the acknowledgement signal from headphone. After that it will transmit the next data pack and so on. On the other hand, when the headphone received a correct data pack, it will transmit an acknowledgement signal to the base unit. The RF Module of the base unit and the headphone are the same.

Antenna Type: Internal, Integral

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

The Certification procedure of the corresponding transceiver for this transceiver (with FCC ID: AAO330282R) is being processed as the same time of this application. The receiver portion of this transceiver has been authorized by Verification procedure.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (2003). All radiated measurements were performed in an Open Area Test Site. Preliminary scans were performed in the Open Area Test Site only to determine worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the “**Justification Section**” of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

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2.0 **System Test Configuration**

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.4 (2003).

The device was powered from 120VAC.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The rear of unit shall be flushed with the rear of the table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit enters test mode, it transmits the RF signal continuously.

2.3 Special Accessories

AC-DC adaptor (Model: U090020D, 32-1257, Input: 120VAC 60Hz, Output: 9VDC 200mA).

2.4 Equipment Modification

Any modifications installed previous to testing by RadioShack Corporation will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services Hong Kong Ltd.

2.5 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

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2.6 Support Equipment List and Description

1. I-Pod Nano 4GB EW-2464 (Provided by Intertek)

3.0 **Emission Results**

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any), Average Factor (optional) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG - AV$$

where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- AV = Average Factor in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where

- FS = Field Strength in dB μ V/m
- RR = RA - AG - AV in dB μ V
- LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB and average factor of 5 dB are subtracted, giving a field strength of 27 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

RA = 52.0 dB μ V/m	
AF = 7.4 dB	RR = 18.0 dB μ V
CF = 1.6 dB	LF = 9.0 dB
AG = 29.0 dB	
AV = 5.0 dB	
FS = RR + LF	
FS = 18 + 9 = 27 dB μ V/m	

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(27 \text{ dB}\mu\text{V/m})/20] = 22.4 \mu\text{V/m}$$

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3.2 Radiated Emission Configuration Photograph

The worst case in radiated emission was found at 2731.524 MHz

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgment: Passed by 11.7 dB

3.4 Conducted Emission Configuration Photograph

For electronic filing, the worst case line-conducted configuration photographs are saved with filename: conducted photos.pdf.

3.5 Conducted Emission Data

For electronic filing, the graph and data table of conducted emission is saved with filename: conducted.pdf.

Judgment: Passed by more than 20 dB

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4.0 Measurement Results

4.1 Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(3):

Test Setup:

The antenna power of the EUT was connected to the input of a power meter. Power was read directly and cable loss correction was added to the reading to obtain power at the EUT antenna terminals.

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).

Frequency (MHz)	Maximum Antenna Gain = 0dBi	
	Output in dBm	Output in mWatt
Lowest Channel: 910.5	2.26	1.68
Highest Channel: 919.5	2.23	1.67

EUT dBm max. output level = 2.26 dBm (+30 dBm or less)

Limit: ≤ 30 dBm

For RF Safety, the information is saved with filename: RF exposure.pdf.

4.2 Minimum 6 dB RF Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 6 dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	6 dB Bandwidth (kHz)
910.5	1610
919.5	1600

Limit: at least 500kHz

For electronic filing, the above plots are saved with filename: 6db.pdf

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4.3 Maximum Power Density Reading, FCC Rule 15.247(e) :

The spectrum analyzer RES BW was set to 3kHz. In order to look for a peak, the START and STOP frequencies were set to the band edges of the maximum output passband. If there is no clear maximum amplitude in any given portion of the band, it may be necessary to make measurements at a number of bands defined by several START and STOP frequency pairs.

Frequency Span = 1.5 MHz

Sweep Time = 500 seconds

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are added to the analyzer raw readings.

Frequency (MHz)	Power Density (dBm/3kHz)
910.530	-15.83
919.524	-12.80

Peak Power Density (at 919.524MHz) = -12.80 dBm/3kHz

Limit: 8dBm/ 3kHz

4.4 Out of Band Conducted Emissions, FCC Rule 15.247(d)

In any 100 kHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

All other types of emissions from the EUT shall meet the general limits for radiated frequencies outside the passband.

The plots showed all spurious emission up to the tenth harmonic. They were found to be at least 20 dB below the highest level of the desired power in the passband.

For the electronic filing, the above plots are saved with filename: oob.pdf

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- 4.5 Out of Band Radiated Emissions (for emissions in 4.4 above that are less than 20dB below carrier), FCC Rule 15.247(d):

For out of band emissions that are close to or that exceed the 20dB attenuation requirement described in the specification, radiated measurements were performed at a 3m separation distance to determine whether these emissions complied with the general radiated emission requirement.

See section 4.6

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4.6 Radiated Spurious Emissions

Applicant: RadioShack Corporation

Date of Test: August 27, 2009

Model: 33-282

Worst-Case Operating Mode: TX mode (Lowest Channel)

Table 1

**Radiated Emissions
Pursuant to FCC Part 15 Section 15.209: Emissions Requirement**

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	2731.524	44.9	33	30.4	42.3	0	42.3	54.0	-11.7
V	3642.032	36.4	33	33.3	36.7	0	36.7	54.0	-17.3
V	4552.540	35.9	33	34.9	37.8	0	37.8	54.0	-16.2

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative sign in the column shows value below limit.

4. Horn antenna is used for the emission over 1000MHz.

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Applicant: RadioShack Corporation

Date of Test: August 27, 2009

Model: 33-282

Worst-Case Operating Mode: TX mode (Highest Channel)

Table 2

**Radiated Emissions
Pursuant to FCC Part 15 Section 15.209: Emissions Requirement**

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Average Factor (dB)	Calculated at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	2751.000	40.5	33	30.4	37.9	0	37.9	54.0	-16.1
V	3678.040	35.9	33	33.3	36.2	0	36.2	54.0	-17.8
V	4595.500	37.1	33	34.9	39.0	0	39.0	54.0	-15.0

NOTES: 1. Peak Detector Data unless otherwise stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative sign in the column shows value below limit.
4. Horn antenna is used for the emission over 1000MHz.

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4.7 Transmitter Duty Cycle Calculation and Measurements, FCC Rule 15.35(b), (c)

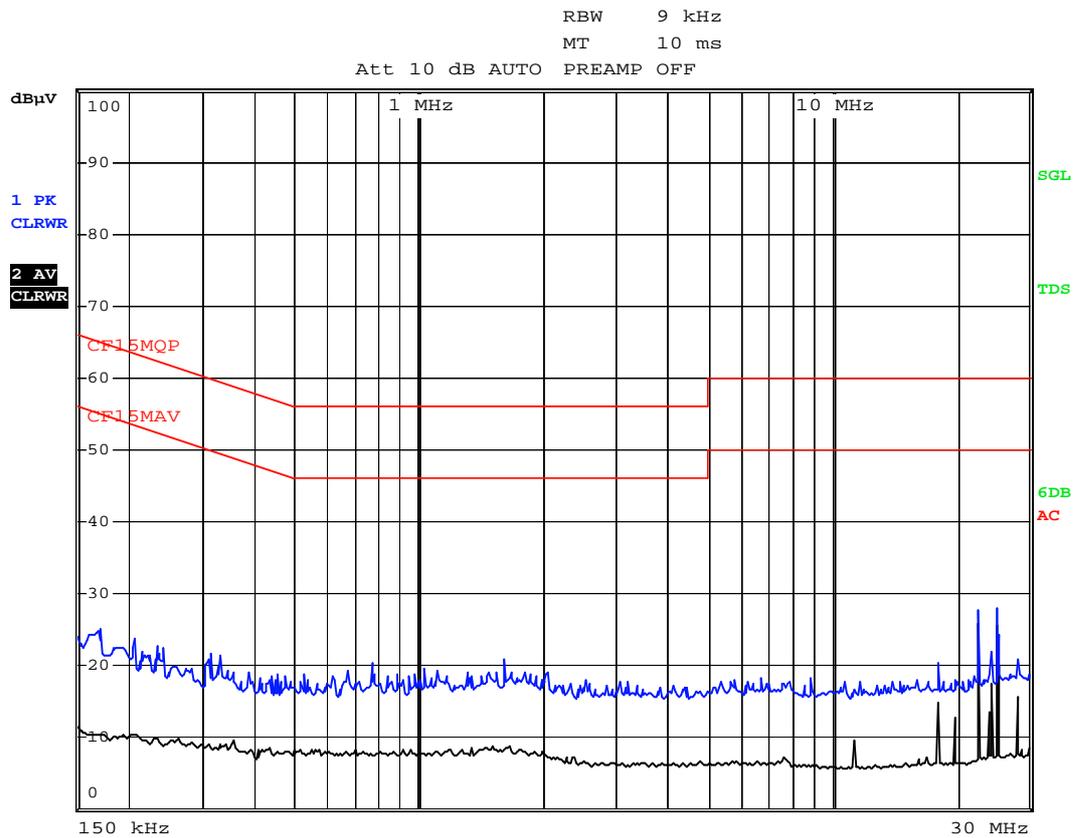
The EUT antenna output port was connected to the input of the spectrum analyzer. The analyzer center frequency was set to EUT RF channel carrier. The SWEPT function on the analyzer was set to ZERO SPAN. The transmitter ON time was determined from the resultant time-amplitude display:

Not applicable, duty cycle was not used.

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4.8 AC Line Conducted Emission, FCC Rule 15.207:

Phase: Live / Neutral
Model No.: 33-282
Worst Case: Tx (AC Mains)



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5.0 **Equipment Photographs**

For electronic filing, the photographs are saved with filename: external photos.pdf and internal photos.pdf.

6.0 **Product Labelling**

For electronics filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

7.0 **Technical Specifications**

For electronic filing, the block diagram and schematic of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

8.0 **Instruction Manual**

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

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9.0 **Miscellaneous Information**

The miscellaneous information includes details of the test procedure and calculation of factor such as averaging factor (calculation and timing diagram).

9.1 **Calculation of Average Factor**

Not applicable, duty cycle was not used.

9.2 **Emissions Test Procedures**

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of transmitter operating under the Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 2003. A typical or an unmodulated CW signal at the operating frequency of the EUT has been supplied to the EUT for all measurements. Such a signal is supplied by a signal generator and an antenna in close proximity to the EUT. The signal level is sufficient to stabilize the local oscillator of the EUT.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz.

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9.2 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.4 - 2003.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater when frequency is below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.1). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.

10.0 Confidentiality Request

For electronic filing, a preliminary copy of the confidentiality request is saved with filename: request.pdf.

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11.0 Equipment List

1) Radiated Emissions Test

Equipment	EMI Test Receiver	Biconical Antenna	Log Periodic Antenna
Registration No.	EW-0014	EW-0954	EW-0446
Manufacturer	R&S	EMCO	EMCO
Model No.	ESVS30	3104C	3146
Calibration Date	Jun. 01, 2009	Sep. 30, 2008	Oct. 02, 2008
Calibration Due Date	Jun. 01, 2010	Mar. 30, 2010	Apr. 02, 2010

Equipment	Spectrum Analyzer	Double Ridged Guide Antenna
Registration No.	EW-2249	EW-1015
Manufacturer	R&S	EMCO
Model No.	FSP30	3115
Calibration Date	Jun. 25, 2009	Jul. 28, 2008
Calibration Due Date	Jun. 25, 2010	Jan. 28, 2010

2) Conducted Emissions Test

Equipment	EMI Test Receiver	LISN	Pulse Limiter
Registration No.	EW-2251	EW-0192	EW-0698
Manufacturer	R&S	R&S	R&S
Model No.	ESCI	ESH3-Z5	ESH3-Z2
Calibration Date	Oct. 28, 2008	Nov. 12, 2008	Feb 03, 2009
Calibration Due Date	Oct. 28, 2009	Nov. 12, 2009	Feb 03, 2010

3) 15.247 Test

Equipment	Spectrum Analyzer
Registration No.	EW-2249
Manufacturer	ROHDESCHWARZ
Model No.	FSP30
Calibration Date	Jun. 25, 2009
Calibration Due Date	Jun. 25, 2010