

FCC 15.225 Test Report

On Model Name: SCR331-DI

Prepared for SCM Microsystems, Inc.

According to FCC Part 15.225 (Dec. 08, 2003)

Job Number #: SCM-0408-1002-TCB
Prepared by: Arcelia Maldonado
QC Manager: Tony Wang

Test Report Released by:



Tony Wang

October 11, 2004

Date

List of Attached Files

<i>Exhibit Type</i>	<i>File Description</i>	<i>File Name</i>
<i>Test Report</i>	<i>Test Report</i>	<i>Report.pdf</i>
<i>Operation Description</i>	<i>Technical Description</i>	<i>Op-description.pdf</i>
<i>External Photos</i>	<i>External Photos</i>	<i>External photos.pdf</i>
<i>Internal Photos</i>	<i>Internal Photos</i>	<i>Internal photos.pdf</i>
<i>Test Set-up Photos</i>	<i>Set-up Photos</i>	<i>Test Set-up photos.pdf</i>
<i>Block Diagram</i>	<i>Block Diagram</i>	<i>Block.pdf</i>
<i>Schematics</i>	<i>Circuit Diagram</i>	<i>Schematics.pdf</i>
<i>ID Label/Location</i>	<i>Label Artwork and Location</i>	<i>Label.pdf</i>
<i>User Manual</i>	<i>User Manual</i>	<i>Manual.pdf</i>

Test Location

EMC Compliance Management Group is located at 670 National Ave., Mountain View, CA 94043, USA.

Accreditation Bodies

EMC Compliance Management Group is a fully accredited Test Laboratory for ITE, ISM and Telecommunications Products.



In compliance with the site registration requirements of Section 2.948 of the FCC Rules to perform EMI measurements for the general public.



Accredited by the National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code # 200068-0.

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Administrative Data

Test Sample : *Smart Card Reader (Engineering Sample)*

Model Name : *SCR331-DI*

Serial Number : *N/A*

Date Tested : *08/26/2004-08/31/2004*

Manufacturer : *SCM Microsystems, Inc.*
466 Kato Terrace
Fremont, CA 94539

Telephone : *+1-510-360-2300*

Fax : *+1-510-360-0211*

EUT Description

SCM Microsystems, Inc. model name SCR331-DI (referred to as the EUT in this report) is a Smart Card Reader.

Test Summary

This report an application for Certification of a Transmitter operation pursuant to FCC Part 15.225 The product covered by this report is the SCM Model: SCR331-DI. This report is designed to demonstrate the compliance of this device with the requirements outlined in FCC Part 15.225 using the methods in FCC CFR 47 Part 2.

FCC Section	Requirements	Comments
15.203	<i>The transmitter shall use a transmitting antenna that is an integral part of the device</i>	<i>Pass</i>
2.1049	<i>20 dB Bandwidth</i>	<i>Pass</i>
15.225(a)(b)(c)(d)	<i>Transmitter radiated emissions-Fundamental, Harmonic and Spurious</i>	<i>Pass</i>
15.225(e)	<i>Frequency Stability vs Temperature</i>	<i>Pass</i>
15.209(a)	<i>Radiated emissions, general requirements</i>	<i>Pass</i>
15.207(a)	<i>AC power conducted emissions</i>	<i>Pass</i>

Test Mode Justification

The EUT exercise program was used during radiated testing and was designed to exercise the various system components in a manner similar to a typical use.

For emission testing, the unit was setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing.

Equipment Modification

Any modifications installed previous to testing by SCM Microsystems, Inc. will be incorporated in each production model sold or leased in United States.

There were no modifications installed by EMC Compliance Management Group.

Test System Details

EUT				
Model Name:	SCR331-DI			
Description:	Smart Card Reader			
Manufacturer:	SCM Microsystems (India) Pvt., Ltd.			
Support Equipment				
Description	Model Number	Serial Number	Manufacturer	Power Cable Description
<i>Notebook Computer</i>	<i>Presario R3000</i>	<i>CND4251V 17</i>	<i>Compaq</i>	<i>Unshielded 1.5m</i>
<i>Power Adapter</i>	<i>PPP017H</i>	<i>F3-0405034679A</i>	<i>HP</i>	<i>Unshielded 1.5m</i>
<i>Mouse</i>	<i>19430</i>	<i>A002014377</i>	<i>Kensington</i>	<i>None</i>
Cable Description				
From	To	Length (Meters)	Shielded (Y/N)	Ferrite Loaded (Y/N)
<i>EUT</i>	<i>Notebook Computer</i>	<i>1.5</i>	<i>N</i>	<i>N</i>
<i>Mouse</i>	<i>Notebook Computer</i>	<i>1.5</i>	<i>N</i>	<i>N</i>
<i>Notebook Computer</i>	<i>Power Adapter</i>	<i>1.5</i>	<i>N</i>	<i>Y (x1)</i>
<i>Power Adapter</i>	<i>AC</i>	<i>1.5</i>	<i>N</i>	<i>N</i>

Test Methodology

Radiated emissions testing are performed according to the procedures specified in ANSI C63.4-2001 and FCC Part 15.225.

Frequency Range investigated: 10 KHz to 30 MHz and 30 MHz to 1 GHz

Measurement setup:

Frequency	RBW	VBW	Sweep	Detector	Distance	Antenna polarization	Antenna height
10 KHz - 30 MHz	9KHz	≥RBW	Auto	Peak	3 m	Vertical & Horizontal	1 m - 4 m
30 - 1000 MHz	100 KHz	≥RBW	Auto	Peak	3 m	Vertical & Horizontal	1 m - 4 m

FCC Part 15.225 Radiated emission limits:

Frequency (MHz)	Fundamental uV/m	Fundamental dBuV/m	Measured Distance (meter)
13.553-13.567	15,848	84	30

* $\text{dBuV/m} = 20 \times \text{Log}(\text{uV/m})$

EUT power Source: Power through USB bus from Notebook

Emission Maximization: Antenna (1m to 4m) height and Horizontal/Vertical polarization 360-degree turntable rotated and EUT rotated three orthogonal axes.

Bandwidth of the Operating Frequency

Bandwidth is determined at the point 20dB down from the modulated carrier.

Test Procedures:

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

Instrument setup:

RBW	VBW	SWP	SPAN	Detector
3 KHz	3 KHz	100 ms	50 KHz	Peak

Test Data:

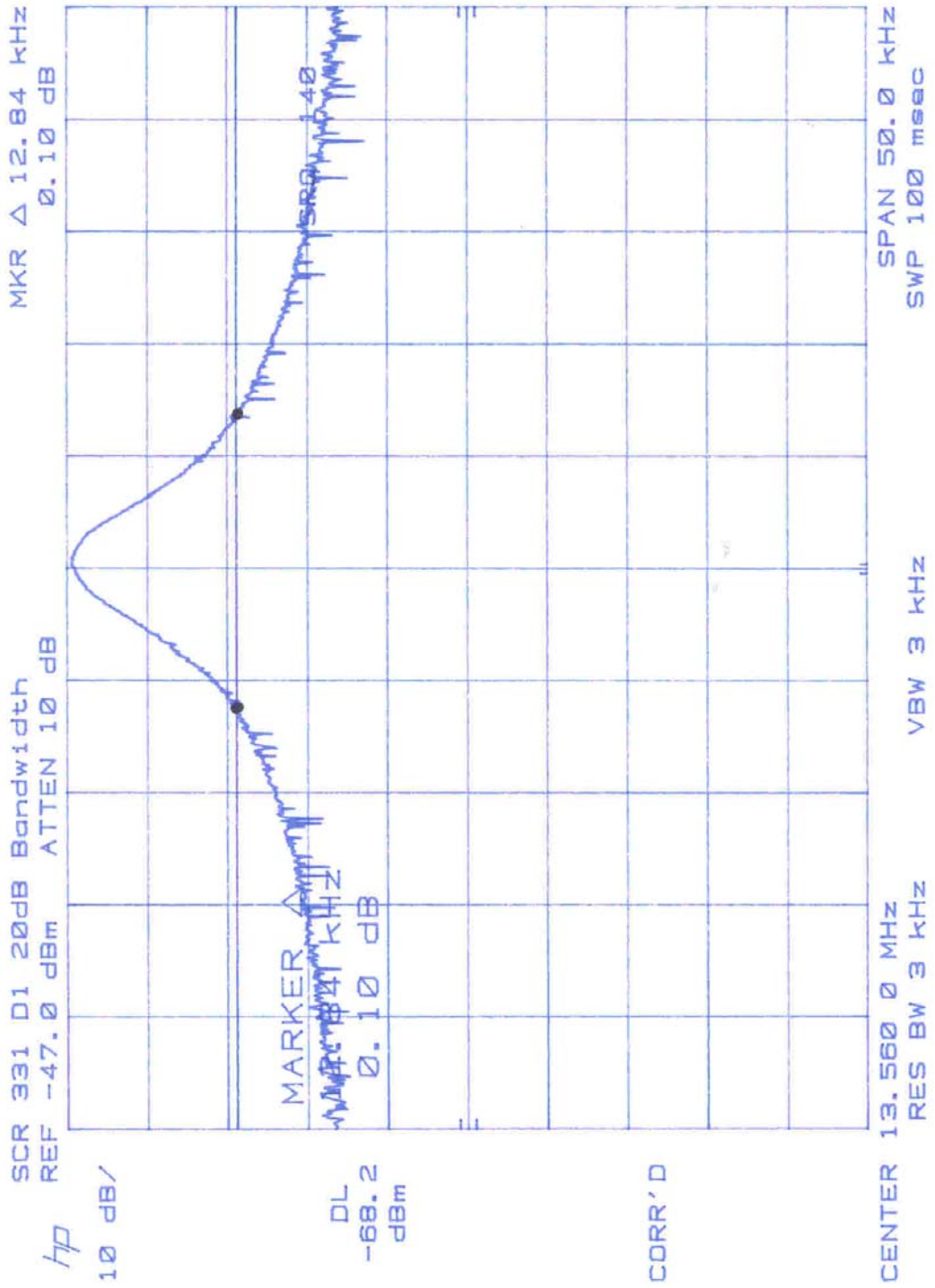
Carrier Freq. (MHz)	20 dB Bandwidth (KHz)	Limit (KHz)	Plot #
13.56	12.84	14.0	1 - see next page.

Temperature: 22°C **Humidity:** 43%
Tested by: Tony Wang **Date:** August 17, 2004
Test Result: EUT Pass, Meets Requirement.

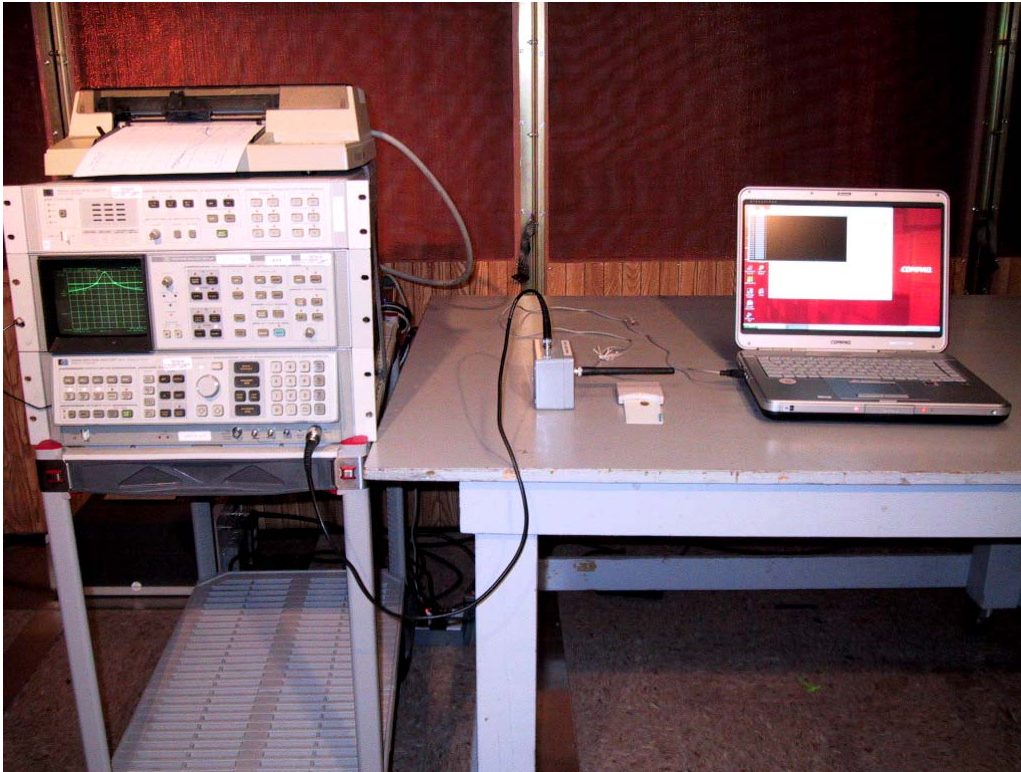
Test Equipment List:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Spectrum Analyzer	HP	8566B	2410A00224	06/07/04	06/07/05
Quasi Peak Adapter	HP	85650A	3145A01658	06/07/04	06/07/05
Plotter	HP	7470A	2308A27405	No Cal required	No Cal required

Note: All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

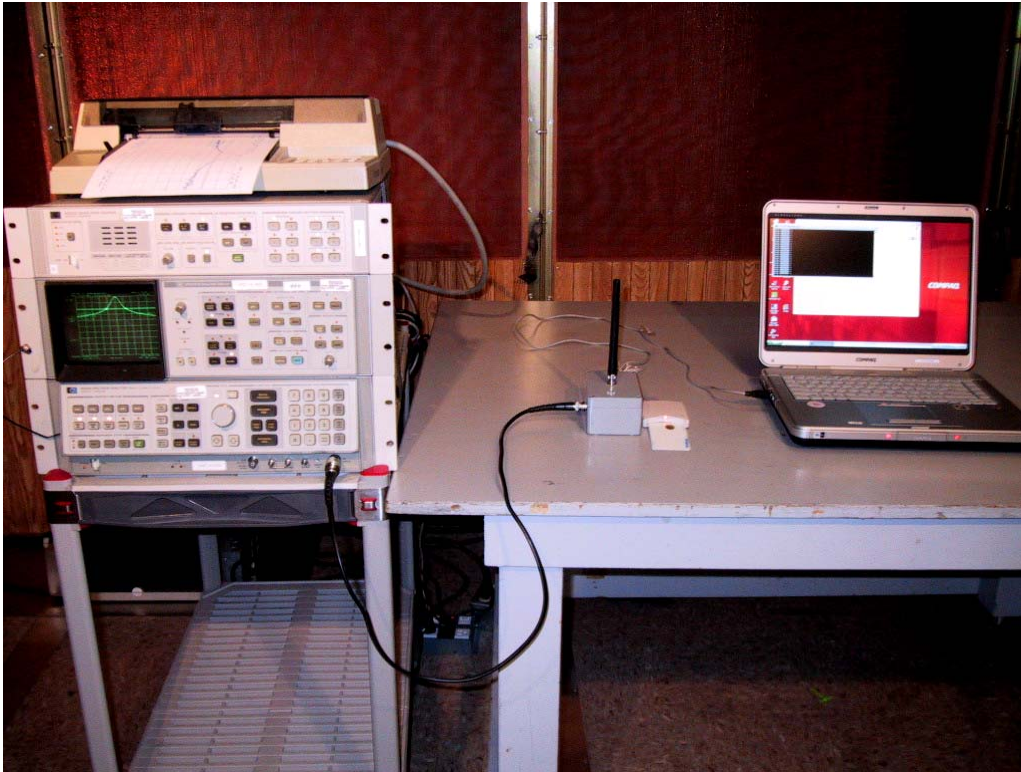


EUT Model: SCR331-DI



Bandwidth of the Operating Frequency Test Set-up

EUT Model: SCR331-DI



Bandwidth of the Operating Frequency Test Set-up

Radiated Emissions Measurement

Test Procedure:

a. The field strength of emissions from Intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental $\mu\text{V/m}$	Field Strength of Fundamental $\text{dB}\mu\text{V/m}$	Measured Distance (meter)
13.553-13.567	15,848	84	30

- b. The EUT was placed on a 1m x 1.5m wide and 0.8m high nonconductive table that is placed on a flush mounted metal turntable. The turntable can rotate 360 degree to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna that was mounted on a non-conductive mast. The antenna can move up and down between 1 to 4 meters to find out the maximum emission level.
- c. The EUT equipment was performed using a new battery.
- d. Field strength limits are specified at a distance of 3 meters.
- e. The EUT is situated in three orthogonal planes.

FCC Part 15.225(a) Radiated emission limits:

Frequency (MHz)	Fundamental $\mu\text{V/m}$	Fundamental $\text{dB}\mu\text{V/m}$ (30 m)	Fundamental $\text{dB}\mu\text{V/m}$ (3 m)
13.56	15,848	84	104

$$\text{dB}\mu\text{V/m} = 20 \times \text{Log}(\mu\text{V/m})$$

$$\text{dB}\mu\text{V/m} = 20 \times \text{log}(15,848 \mu\text{V/m}) = 84$$

Distance Extrapolation Factor calculation:

For test distance other than what is specified, but fulfilling the requirements of section 15.31(f)(1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade. The basic equation with a sample calculation is as follows:

DF = Distance Extrapolation Factor in dB

Where $DF = 20 \log(Dt/Ds) = 20 \log(3\text{m}/30\text{m}) = -20 \text{ dB}$

Dt=Test Distance (3m)

Ds=Specified Distance (30m)

FCC Part 15.225(b)(c)(d) Field Strength limits:

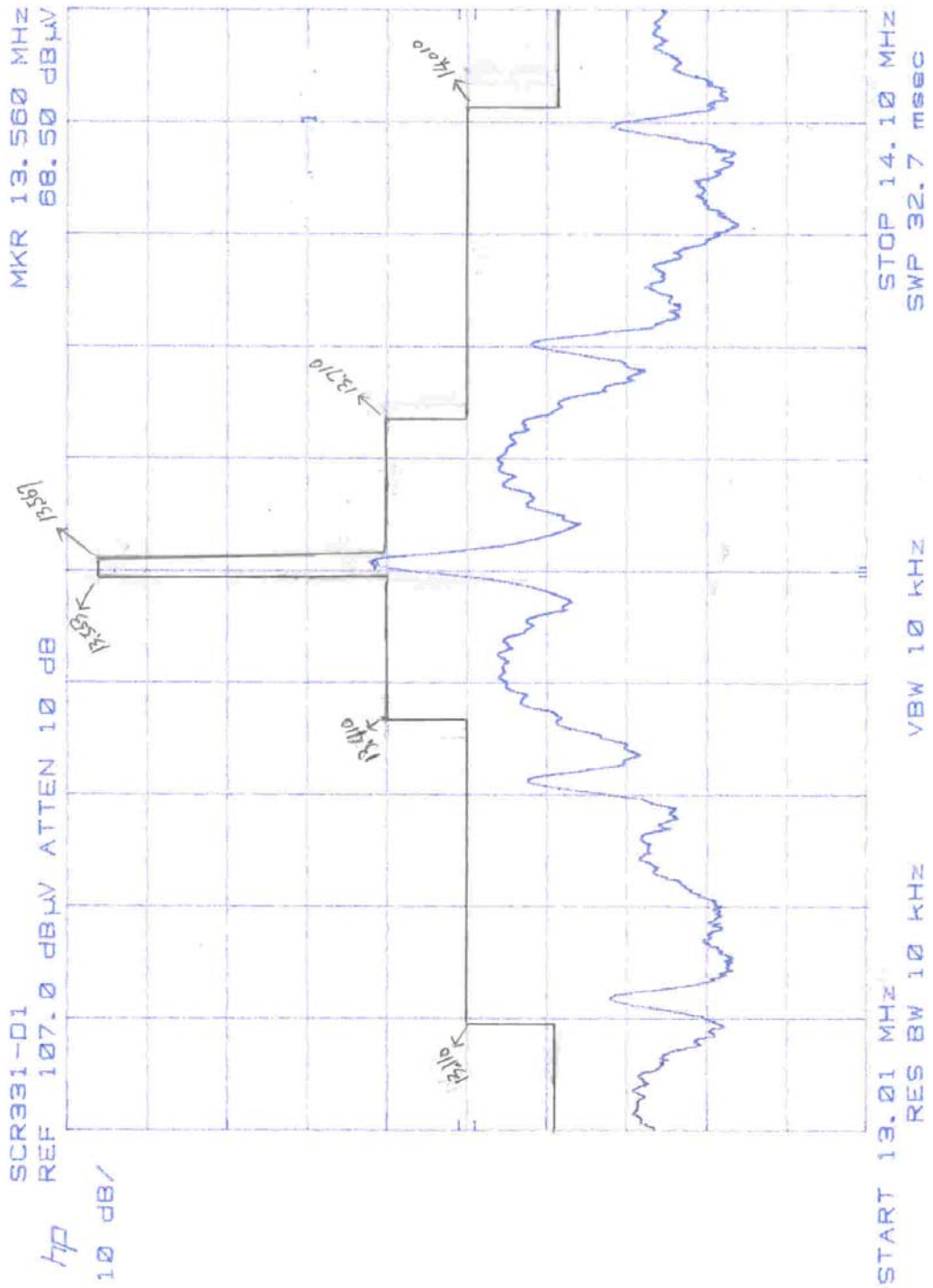
Frequency (MHz)	Field Strength uV/m (30m)	Field Strength dBuV/m (30m)	Field Strength dBuV/m (3m)	Plot #
13.410 - 13.553	334	50.4	70.4	2 - see next page.
13.567 - 13.710	334	50.4	70.4	2 - see next page.
13.110 - 13.410	106	40.5	60.4	2 - see next page.
13.710 - 14.010	106	40.5	60.4	2 - see next page.
Outside of the 13.110 - 14.010	30	29.5	49.5	2 - see next page.

Temperature: 23°C **Humidity:** 41%
Tested by: Tony Wang **Date:** August 17, 2004
Test Result: EUT Pass, Meets Requirement.

Test Equipment List:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
Spectrum Analyzer	HP	8566B	2410A00224	06/07/04	06/07/05
Quasi Peak Adapter	HP	85650A	3145A01658	06/07/04	06/07/05
Plotter	HP	7470A	2308A27405	No Cal required	No Cal required

Note: All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).



Calculation of Field Strength Limits

Frequency (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measurement Distance	Reference
1.705-30.0	30	49.5	3	15.225(d), 15.209
30 -88	100	40	3	15.225(d), 15.209
88 - 216	150	43.5	3	15.225(d), 15.209
216 - 960	200	46	3	15.225(d), 15.209
960 - 26,500	500	54	3	15.225(d), 15.209

Fundamental Frequency Test Data:

Frequency (MHz)	Ant. Pol.	Raw reading (dBuV)	Antenna Factor (dB/m)	Cable loss (dB)	Preamp Gain (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)
13.56	H	43.7	10.7	0.5	0	54.9	104	-49.1
13.56	V	47.3	10.7	0.5	0	58.5	104	-45.5

Note: Corrected reading=Raw reading + AF + Cable loss - Preamp gain

Frequency Range from 9 KHz to 30 MHz Test Data:

Frequency (MHz)	Ant. Pol.	Raw reading (dBuV)	Antenna Factor (dB/m)	Cable loss (dB)	Preamp Gain (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)
27.12	V	36.0	9.0	0.5	0	45.5	49.5	-4.0
27.12	H	33.1	9.0	0.5	0	42.6	49.5	-6.9

Note: No other emissions were found between 9 KHz to 30 MHz

Frequency Range from 30 MHz to 1 GHz Test Data at Contact less Mode: (Transmit Mode):

Frequency (MHz)	Ant. Pol.	Raw reading (dBuV)	Antenna Factor (dB/m)	Cable loss (dB)	Preamp Gain (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)
40.90	V	43.1	14.0	0.6	21	36.7	40.0	-3.3
54.24	V	48.1	8.0	0.7	21	35.8	40.0	-4.2
67.80	V	38	8.5	0.8	21	26.3	40.0	-13.7
122.05	V	43.8	14.1	1.0	21	35.9	43.5	-7.6
176.25	V	44.5	12.1	0.9	21	36.5	43.5	-7.0
189.84	V	42.6	11.7	1.3	21	34.0	43.5	-9.5
203.40	V	45.1	12.0	1.3	21	37.4	43.5	-6.1
481.6	V	38.9	17.4	2.0	21	37.3	46.0	-8.7

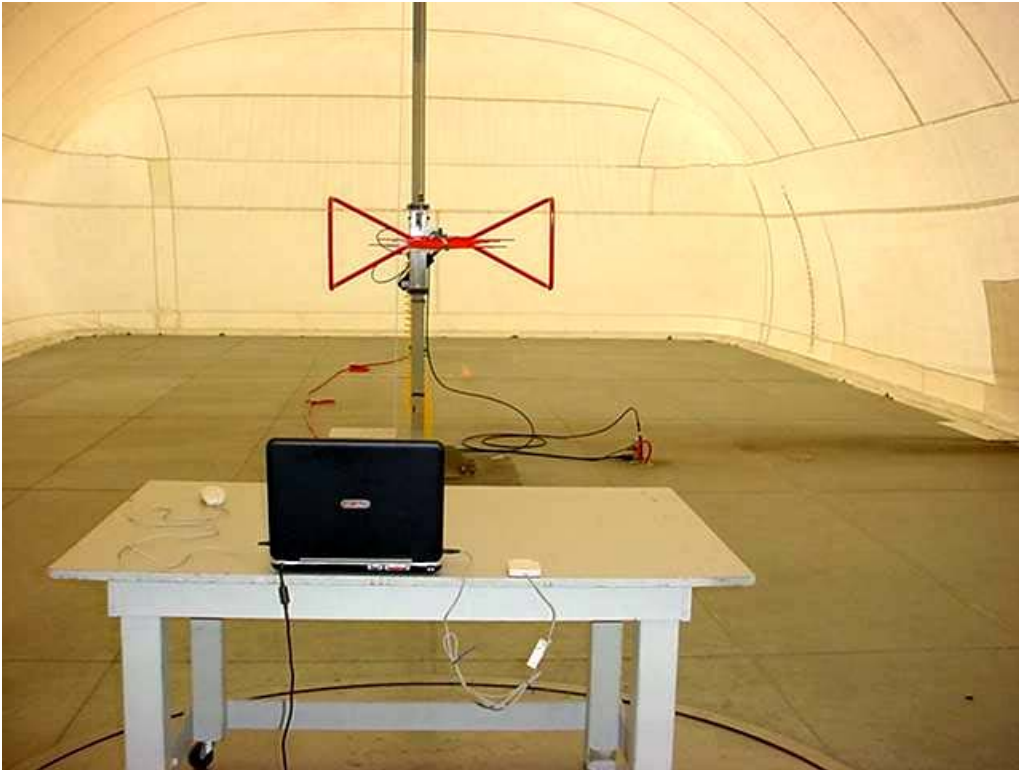
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EUT Model: SCR331-DI



Radiated Emissions at 3m - Front View

EUT Model: SCR331-DI



Radiated Emissions at 3m - Back View

EUT Model: SCR331-DI



Radiated Emissions at 3m - Front View

Frequency Stability, Section 15.225 (e) & 2.1055

Limits:

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test Procedure:

Set the environmental temperature chamber to temperature of (-20°C to +50°C) wait the temperature of the chamber to stabilize.

While maintaining a constant temperature inside the environmental chamber, turn the EUT on and measure the EUT operating frequency at the start-up, 10 minutes, and 30 minutes after startup.

Frequency stability VS Temperature Measurement Data:

Timing	-20°C	-10°C	0°C	+10°C	+20°C	+30°C	+40°C	+50°C
Start-up	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063
10 Min.	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063	13.56063
30 Min.	13.56053	13.56058	13.56058	13.56025	13.56038	13.56050	13.56050	13.56038

Tested by: Tony Wang **Date:** August 23, 2004
Test Result: EUT Pass, Meets Requirement.

Test Equipment List:

Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
EMI Receiver	HP	8594EM	3801A00353	04/15/04	04/15/05
Temperature/ Humidity Chamber -24°C to 93°C	BLUE M	FR-256PB-1	F2-109	05/17/04	05/17/05

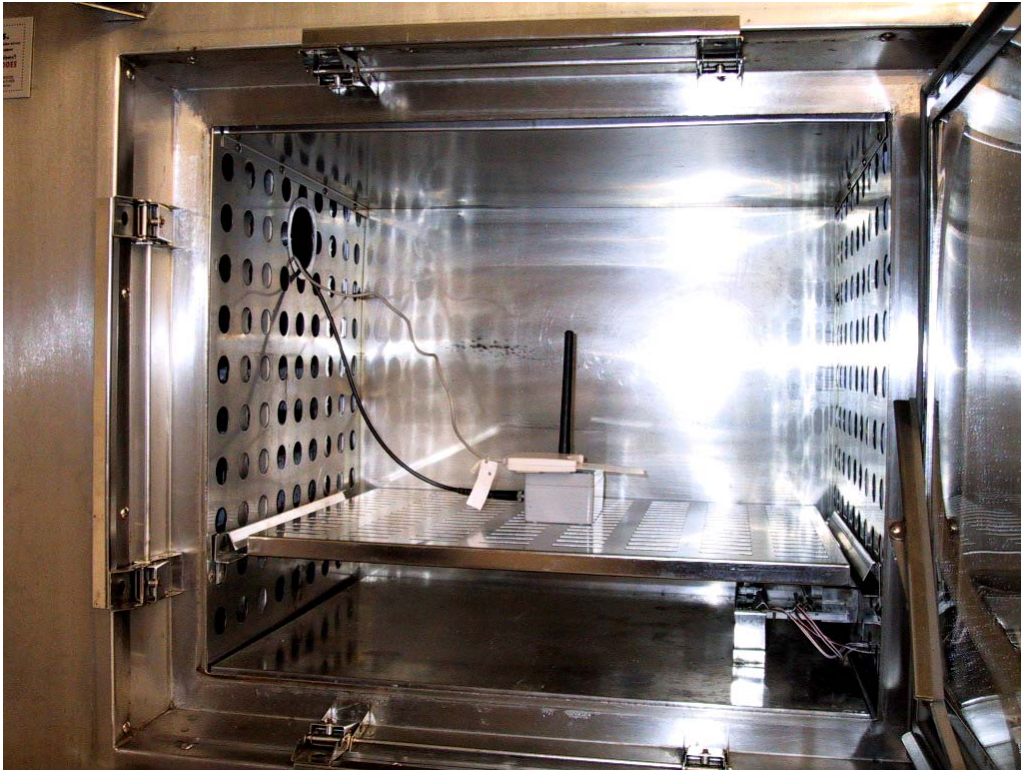
Note: All test instruments were calibrated and traceable to the National Institute of Standards and Technology (NIST).

EUT Model: SCR331-DI



Frequency stability vs. Temperature Test Set-Up

EUT Model: SCR331-DI



Frequency stability vs. Temperature Test Set-Up

AC Power line Conducted Emission Measurement

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

Test Procedures:

The EUT was placed on a non-conductive table at 0.8 meter above the ground plane of a shielded enclosure, and 40 cm away from the shielded enclosure wall. The AC power cord of the EUT was plugged into a 50 ohm, 50 μ H LISN.

RF emissions on the AC power line were measured using the spectrum analyzer connected to the LISN RF port via coaxial cable.

The lower limit applies at the boundary between the frequency ranges.
Frequency of Emission (MHz) Conducted Limit (dBuV)

Frequency (MHz)	QP (dBuV)	Average (dBuV)
0.15 - 0.5	66 - 56*	56 - 46*
0.5 - 5.0	56	46
5.0 - 30	60	50

*Decreases with the Logarithm of the Frequency

Contact Less Mode:

Line	Frequency [MHz]	Corrected QP Reading [dB(μ V)]	Delta QP [dB]	Corrected AVE Reading [dB(μ V)]	Delta AVE [dB]
L1	0.194	59.56	-5.44	52.84	-2.15
L1	0.185	59.51	-5.46	52.93	-2.04
L1	0.302	49.24	-12.39	46.44	-5.19
L1	0.247	52.01	-11.21	45.29	-7.93
L1	13.56	46.20	-13.80	44.04	-3.96
L1	0.367	45.30	-14.48	41.09	-8.69
L2	0.183	58.24	-6.79	52.93	-2.09
L2	0.184	58.12	-6.89	52.94	-2.07
L2	0.303	48.69	-12.91	46.36	-5.24
L2	0.242	50.99	-12.37	39.27	-14.08
L2	13.56	48.27	-11.73	46.12	-3.88

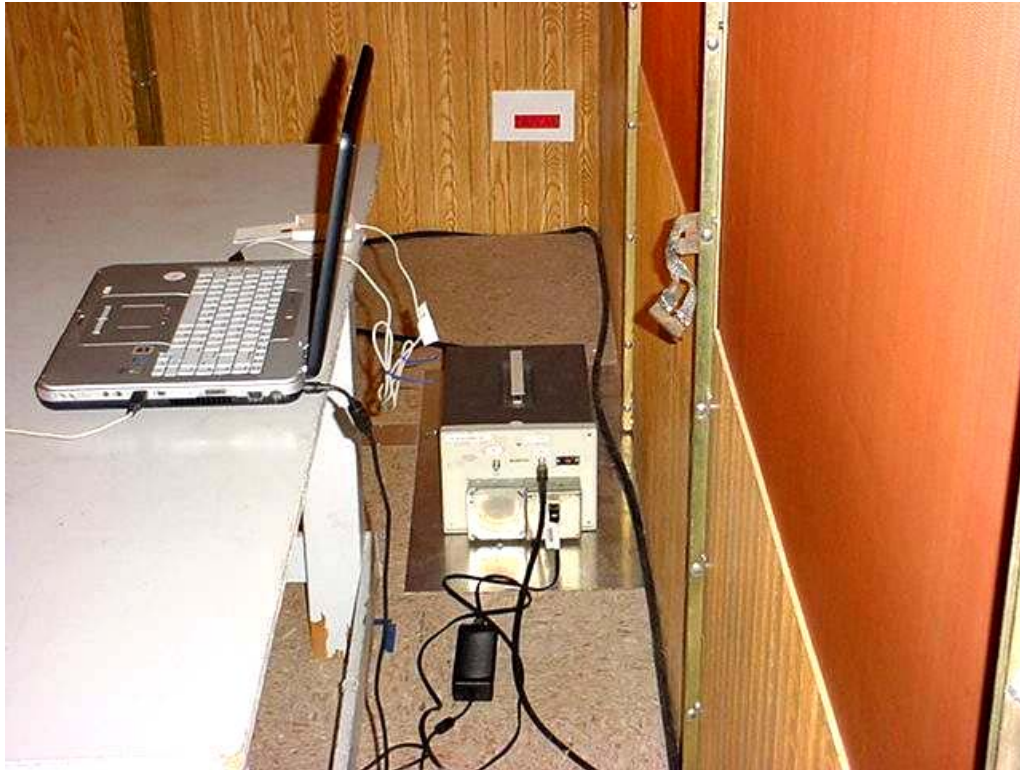
Note: All readings are using a bandwidth of 9 kHz, with a 30 ms sweep time. A video filter was not used.

EUT Model: SCR331-DI



Conducted Emissions Test Set-up - Front View

EUT Model: SCR331-DI



Conducted Emissions Test Set-up - Rear Side View