

# FCC PART 15.225

## EMI MEASUREMENT AND TEST REPORT

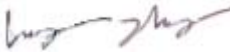

For

### S1 Corporation

10th Fl., Samsung Life Insurance & S1 Bldg. 168,  
Soonhwa-Dong, Jung-Gu Seoul, Korea 100-130

**FCC ID: Q54CDR-0191**

2004-01-12

<b>This Report Concerns:</b> <input checked="" type="checkbox"/> Original Report	<b>Equipment Type:</b> Fingerprint Attendance & Absence Reader
<b>Test Engineer:</b>  Ling Zhang	
<b>Report No.:</b> R0312093	
<b>Test Date:</b> 2003-012-12	
<b>Reviewed By:</b>  Ming Jing	
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**Note:** This test report is specially limited to the above client company and product model only. It may not be duplicated without prior written consent of Bay Area Compliance Laboratory Corporation. This report **must not** be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

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## GENERAL INFORMATION

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### Product Description for Equipment Under Test (EUT)

The *S1 Corporation* 's product, model *CDR-0191* or the "EUT" as referred to in this report is a Fingerprint Attendance & Absence Reader. The EUT measures approximately 170mm (L) x 115mm (W) x 48mm (H).

The EUT was fed by HP Power Supply, M/N: 2003A05705

*\* The test data gathered is from production samples, serial number: S09122, provided by the manufacturer.*

### Objective

This Type approval report is prepared on behalf of *S1 Corporation* in accordance with Part 2, Subpart J, and Part 15 Subpart C of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules, Part 15, sec 15.35, sec 15.203, sec 15.205, sec 15.207, sec 15.209 and sec 15.225.

### Related Submittal(s)/Grant(s)

No Related Submittals.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 10 meters.

### Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

### Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
HP	Power Supply	6236B	2003A05705	None

### Printed Circuit Boards in EUT

Manufacturer/Description	Rev.	# of Layers	Crystals (MHz)
S1 Corp / Reader Main Board	1.0	4	22.1184MHz
S1 Corp / Reader Transceiver Board	1.0	4	13.56MHz

## **SYSTEM TEST CONFIGURATION**

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### **Justification**

The EUT was configured for testing according to ANSI C63.4-2001.

### **EUT Exercise Software**

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components.

### **Special Accessories**

As shown in the following test setup block diagram, all interface cables used for compliance testing are shielded.

### **Schematics and Block Diagram**

Please refer to Appendix D.

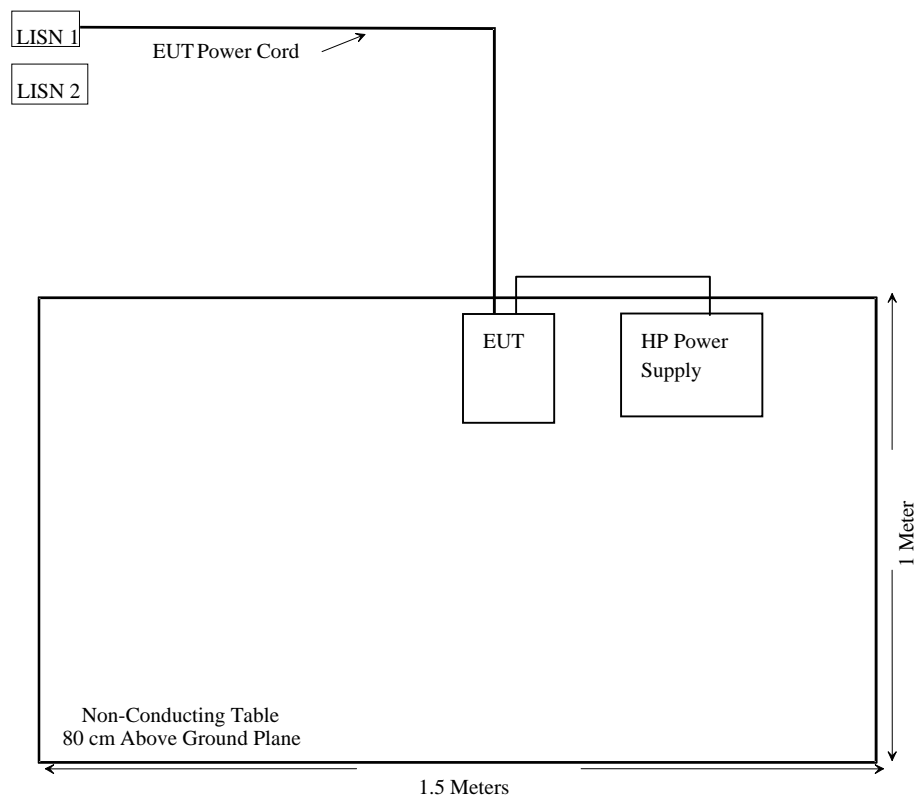
### **Equipment Modifications**

No modifications were made to the EUT

## Test Setup Configuration



## Test Setup Block Diagram



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**SUMMARY OF TEST RESULTS**

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FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§ 15.35 § 15.205 § 15.209 § 15.225	Radiated Emission	Compliant
§ 15.207	Conducted Emission	Compliant
§15.225(c)	Frequency Stability	Compliant

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## § 15.35, § 15.205 , § 15.209 , § 15.225 - RADIATED EMISSION TEST

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### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is  $\pm 4.0$  dB.

### EUT Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup accordance with the ANSI C63.4-1992. The specification used was the FCC Class C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of test table and bundle when necessary.

The EUT was placed on the center of the back edge on the test table, connected to 115Vac/60Hz power source.

### Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, the EUT was tested to 1 GHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

<b><i>Frequency Range</i></b>	<b><i>RBW</i></b>	<b><i>Video B/W</i></b>
Below 30MHz	10kHz	10kHz
30 – 1000MHz	100kHz	100kHz
Above 1000MHz	1MHz	1MHz



## Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8565EC	3964A00131	2003-06-30
HP	Amplifier(0.1-1300MHz)	8447E	1937A010046	2003-08-20
HP	Amplifier(1-26.5GHz)	8449B	3147A00400	2003-03-14
EMCO	Biconical Antenna	3110B	9603-2315	2003-10-11
ETS	Logperiodic Antenna	3148	0004-1155	2003-10-11
A.H. System	Horn Antenna	SAS-200/511	261	2003-08-02
ARA	Horn Antenna	DRG-118/A	1132	2003-09-30
Com-Power	Active Loop Antenna	AL-130	17043	2003-04-03

\* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

## Test Procedure

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings performed only when an emission was found to be marginal (within -4 dB of specification limitation), and are distinguished with a "QP" in the data table.

The EUT was operating at normal to represent worst case during final qualification test. Therefore, this configuration was used for final test data recorded in the table(s) listed under section 4.7 of this report.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

## Summary of Test Results

According to the final data in the following table, the EUT complied with the FCC 15.225, FCC 15.209 and FCC 15.35 standards, and had the worst margin of:

-2.83 dB at 230.54 MHz in the Horizontal polarization

## Environmental Conditions

Temperature:	12° C
Relative Humidity:	55%
ATM Pressure:	1018 mbar

## Radiated Emissions Test Result Data

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR				CORRECTED AMPLITUDE	FCC 15 CLASS B	
Frequency	Reading	Angle	Height	Polar	Antenna	Cable	Amp.	15.31 Correction	Reading	Limit	Margin
MHz	dBμV	Degree	Meter	H/ V	dBμV/m	dB	dB	dB	dBμV	dBμV	dB
230.545	56.6	45	1.4	H	12.6	2.17	28.2		43.17	46.0	-2.83
217.00	56.9	30	1.2	H	11.9	2.17	28.2		42.77	46.0	-3.23
40.688	50.2	330	1.3	V	11.9	1.18	28.9		34.38	40.0	-5.62
230.545	53.1	60	1.5	V	12.6	2.17	28.2		39.67	46.0	-6.33
217.00	52.8	0	1.0	V	11.9	2.17	28.2		38.67	46.0	-7.33
40.688	48.1	90	1.2	H	11.9	1.18	28.9		32.30	40.0	-7.70
54.255	49.0	200	1.6	H	10.2	1.01	28.8		31.41	40.0	-8.59
27.120	55.8	0	1.3	V	10.8	1.5	28.7	20	19.40	29.5	-10.1
244.056	48.1	330	1.0	H	13.8	2.17	28.2		35.87	46.0	-10.13
54.253	47.2	45	1.8	V	10.2	1.01	28.8		29.64	40.0	-10.36
244.056	42.2	0	1.6	V	13.8	2.17	28.2		29.97	46.0	-16.03
27.120	49.2	60	1.1	H	10.8	1.5	28.7	20	12.8	29.5	-16.70
13.56 (F)	78.3	30	1.2	V	10.8	1.5	29.1	20	41.53	84.0	-42.47 F
13.56 (F)	73.8	90	1.0	H	10.8	1.5	29.1	20	37.03	84.0	-46.97 F

Note: F = Fundamental Frequency

## Compliance Statement:

According to FCC Part 15, at 3-meter distance the emission from an intentional radiator shall not exceed the field strength level 40 dBuV/m within 30-88 MHz, 43.5 dBuV/m within 88-216 MHz, 46dBuV/m within 226-960 MHz, 54BuV/m above 960 MHz. The level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The levels of unwanted emission of this device were too low to be detected. This device was compliant with the FCC Part 15.

Note: The filed strengths of emissions below 30 MHz are tested at 10 meter distance. Data corrected for test distance in accordance with FCC 15.31 40dB/Decade.

## **§ 15.203 – ANTENNA REQUIREMENT**

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### **Standard Applicable**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Refer to statement below for compliance.

“The antenna for this device is an integral antenna that the end user cannot access. Furthermore the device is for indoor/outdoor use as detailed in the Users Manual and Operational Description”.

### **Antenna Connected Construction**

This device has an integral antenna; it is a permanently attached antenna.

## § 15.207 – CONDUCTED EMISSIONS TEST

### Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is  $\pm 2.4$  dB.

### EUT Setup

The measurement was performed in the shielded room, using the same setup per ANSI C63.4-2001 measurement procedure. The specification used was FCC 15 Class B limits.

The EUT was placed on the test table and connected to the power supply.

External I/O cables were draped along the edge of the test table and bundle when necessary.

### Spectrum Analyzer Setup

The EMI test receiver was set to investigate the spectrum from 150 KHz to 30 MHz.

### Test Equipment

Manufacturer	Description	Model	Serial No.	Calibration Due Date
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2003-05-06
Rohde & Schwarz	Artificial LISN	ESH2-Z5	871884/039	2003-03-28

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

### Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within  $-4$  dB $\mu$ V of specification limits). Quasi-peak readings are distinguished with a "Qp".

## Summary of Test Results

According to the data in the following table, the EUT complies with the FCC 15 Class B Conducted margin for a Class B device, and these test results is deemed as satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the worst margin reading of:

-19.9 dB at 20.0 MHz in the Line mode

### Environmental Conditions

Temperature:	12° C
Relative Humidity:	55%
ATM Pressure:	1018 mbar

### Conducted Emissions Test Data

Frequency MHz	LINE CONDUCTED EMISSIONS			FCC 15 CLASS B	
	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
20.0	30.1	AVG	Line	50	-19.9
13.6	34.3	QP	Neutral	56	-21.7
20.0	27.7	AVG	Neutral	50	-22.3
13.6	33.3	QP	Line	56	-22.7
0.15	41.5	QP	Line	66	-24.5
14.8	18.8	AVG	Neutral	46	-27.2
20.0	29.0	QP	Line	60	-31.0
20.0	28.0	QP	Neutral	60	-32.0
14.1	10.0	AVG	Line	46	-36.0
12.2	29.9	QP	Neutral	66	-36.1
12.2	17.9	AVG	Neutral	56	-38.1
0.15	14.9	AVG	Line	56	-41.1

### Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented hereinafter as reference.

Bay Area Compliance Laboratory Corp  
CISPR CLASS B

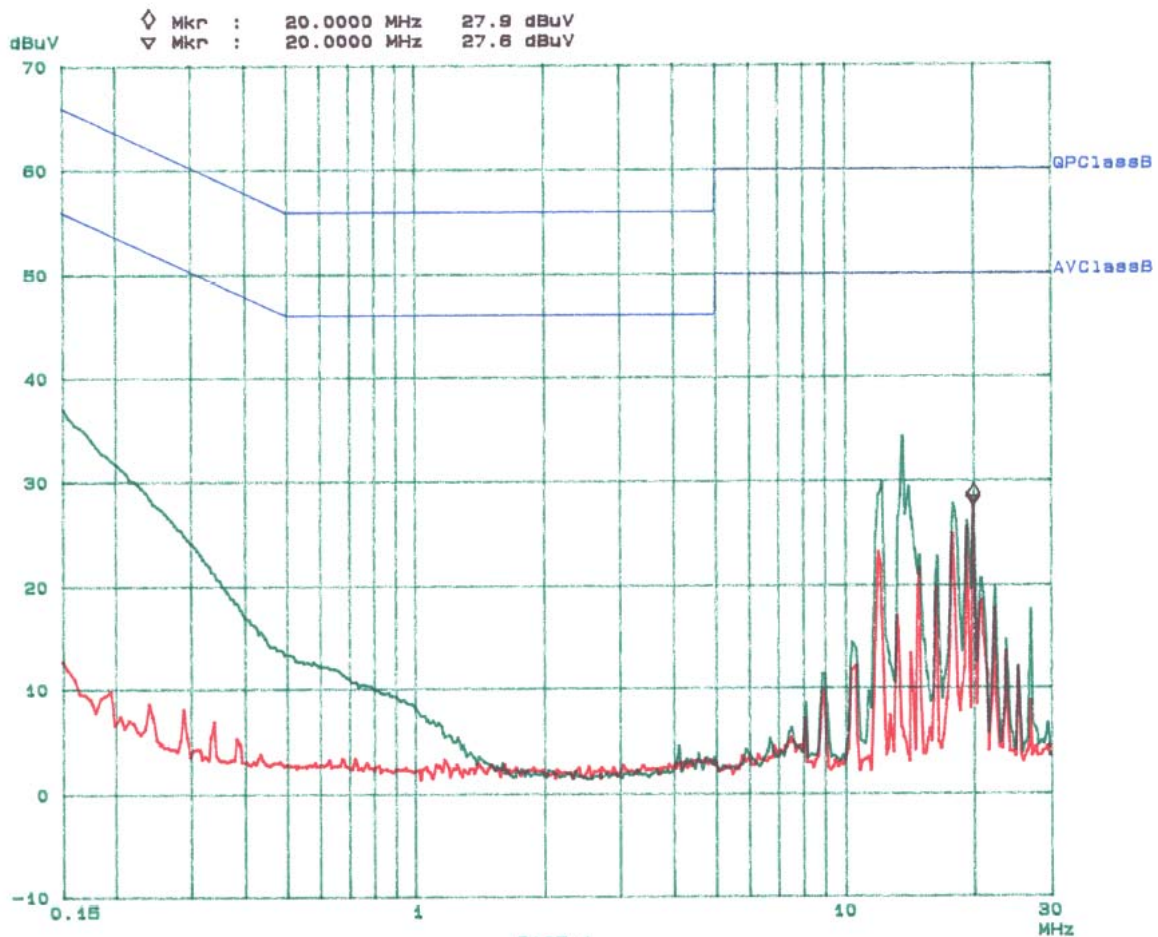
15. Dec 03 10:02

EUT: CDR-0192  
Manuf: S1 CORP  
Op Cond: Normal  
Operator: LING  
Comment: N

## Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF

Final Measurement: x QP / + AV  
Meas Time: 1 ms



Bay Area Compliance Laboratory Corp  
CISPR CLASS B

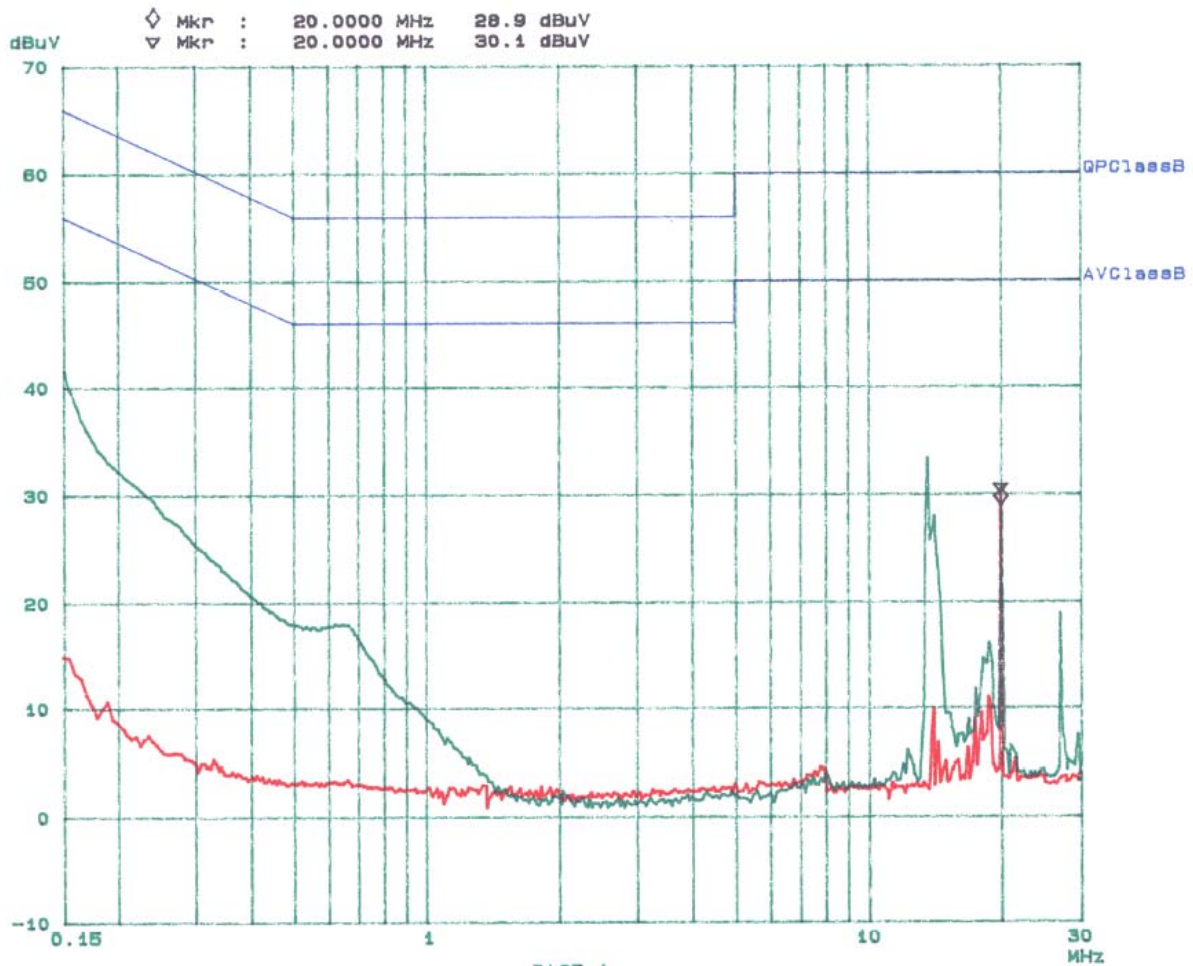
15. Dec 03 09:20

EUT: CDR-0192  
Manuf: S1 CORP  
Op Cond: Normal  
Operator: LING  
Comment: L

## Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Stop	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	5k	9k	QP+AV	20ms	15dB LN	OFF
1M	5M	10k	9k	QP+AV	1ms	15dB LN	OFF
5M	30M	100k	9k	QP+AV	1ms	15dB LN	OFF

Final Measurement: x QP / + AV  
Meas Time: 1 ms



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## § 15.225(c) - FREQUENCY STABILITY MEASUREMENT

### Standard Applicable

According to FCC §15.225(c), the frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  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. For battery operated equipment, the equipment tests shall be performed using a new battery.

### Test Procedure

#### Frequency stability versus environmental temperature

The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

#### Frequency Stability versus Input Voltage

At room temperature ( $25\pm 5^{\circ}\text{C}$ ), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

### Test Equipment List and Details

Manufacturer	Description	Model	Serial No.	Calibration Due Date
HP	Spectrum Analyzer	8565EC	2517A0160	2003-01-22
Com-Power	Active Loop Antenna	AL-130	17043	2003-04-03
Tenny	Temperature Chamber	Versa Tenna	N/A	2003-04-23

\* **Statement of Traceability:** BACL Corp. certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

**Test Results**

Reference Frequency: 13.56157 MHz, limit: 0.01%			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	Percentage
50	24V	13.56153	-0.0003%
40	24V	13.56154	-0.0002%
30	24V	13.56155	-0.0001%
20	24V	13.56157	0.0000%
10	24V	13.56157	0.0000%
0	24V	13.56158	0.0001%
-10	24V	13.56159	0.0001%
-20	24V	13.56160	0.0002%

*Frequency Stability Versus Battery Voltage*

Reference Frequency: 13.5600 MHz, limit: 0.01%			
Power Supplied (Vdc)	Environment Temperature (°C)	MHz	Percentage
19.6V	20	13.56160	0.0002%
27.8V	20	13.56163	0.0004%

Conclusion: The EUT complied with the applicable Frequency Stability Limits.