FLEXTRONICS

Emissions
Test Report

EUT Name: SARS MP9112

EUT Model: HI469-112

FCC Title 47, Part 15, SubpartC, RSS-210 Issue 5

Prepared for:

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Report/Issue Date: 15 April 2003
Report Number: 5071sam1

Statement of Compliance

Manufacturer: Samsys Technologies
2525 Meridian Parkway, Suite 60
Durham, NC 27713
919-281-1559
Requester / Applicant: Clifton Morgan
Name of Equipment: SARS MP9112
Model No. HI469-112
Type of Equipment: Intentional Radiator
Application of Regulations: FCC Title 47, Part 15, SubpartC, RSS-210 Issue 5
Test Dates: 29 October, 2002 to 29 October, 2002

Guidance Documents:

Emissions: FCC 47 CFR Part 15, RSS-210 Issue 5

Test Methods:

Emissions: ANSI C63.4:1992

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by Flextronics Compliance Laboratories, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

Steve O'Steen
Operations Manager
NVLAP Signatory

15 April 2003
Date

Table of Contents

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, SubpartC, RSS-210 Issue 5 based on the results of testing performed on *29 October,* 2002 through *29 October,* 2002 on the *SARS MP9112* Model No. *HI469-112* manufactured by Samsys Technologies. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Emission	Test Method(s)	Test Parameters	Result
Radiated Emissions	47 CFR Part 15.209, ANSI C63.4:1992, RSS-210 Issue 5	9 KHz to 1000 MHz	compliant
Conducted Emissions	47 CFR Part 15.207, ANSI C63.4:1992, RSS-210 Issue 5	150 kHz to 30 MHz	compliant

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

Flextronics Compliance Laboratories is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

Flextronics Compliance Laboratories is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 25 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 TUV Rheinland of North America, Inc.

TUV Rheinland of North America, Inc. is a Nationally Recognized Testing Laboratory (NRTL). Flextronics Compliance Laboratories has been assessed and approved in accordance with EN 45001 and has been authorized to carry out EMC tests based on a Contract for the Co-Operation of TUV Rheinland of N.A., Inc with a Sub-Contracted EMC Laboratory.

2.1.4 NEMKO

NEMKO is a Nationally Recognized Testing Laboratory (NRTL). Flextronics Compliance Laboratories has been assessed and approved in accordance with EN 45001 and Nemko Document ELA 10 (Aut. No.: ELA 185).

2.1.5 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. Flextronics Compliance Laboratories has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174 and C-1236).

2.1.6 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all Flextronics Compliance Laboratories' test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site, Registration Number 90552, has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is an FCC 2.948 Listed laboratory and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 meters. This site, Registration Number 100881, has been described in reports dated April 20, 2001, submitted to the FCC, and accepted by letter dated May 4, 2001. A report detailing this site can be obtained from Flextronics Compliance Laboratories.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The Flextronics Compliance Laboratories test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of ± 1.2 dB. The radiated test system has a combined standard uncertainty of ± 1.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 25.

3 Product Information

Figure 1 – EUT with old Model number, Model number changed from MP9111 to MP9112.

Figure 2 – Photo of the bottom of the EUT

Figure 3 – Photo of the connectors for the EUT

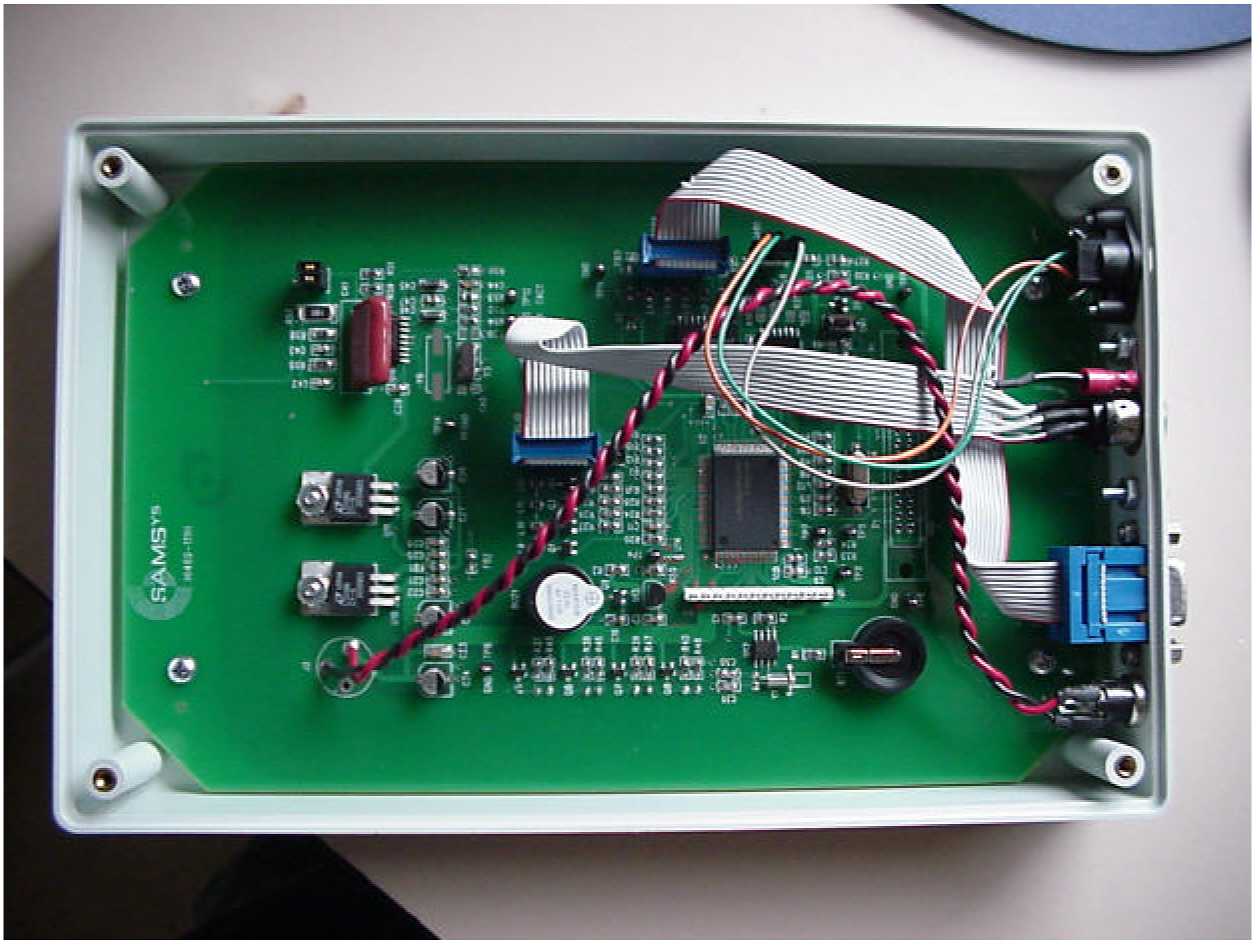

Figure 4 – Photo of EUT with the Circuit board installed

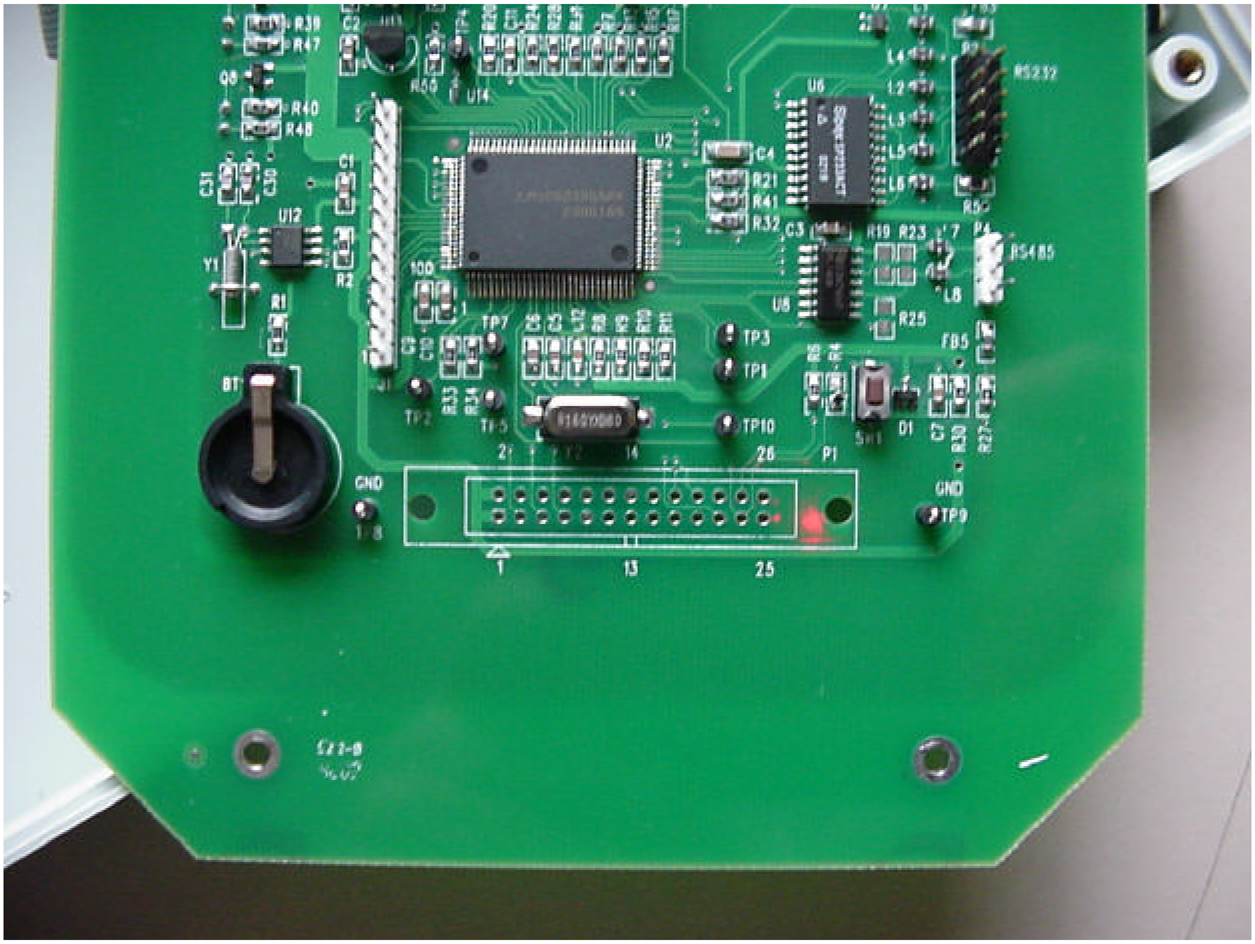

Figure 5 – Photo of the front bottom side of the Circuit Board

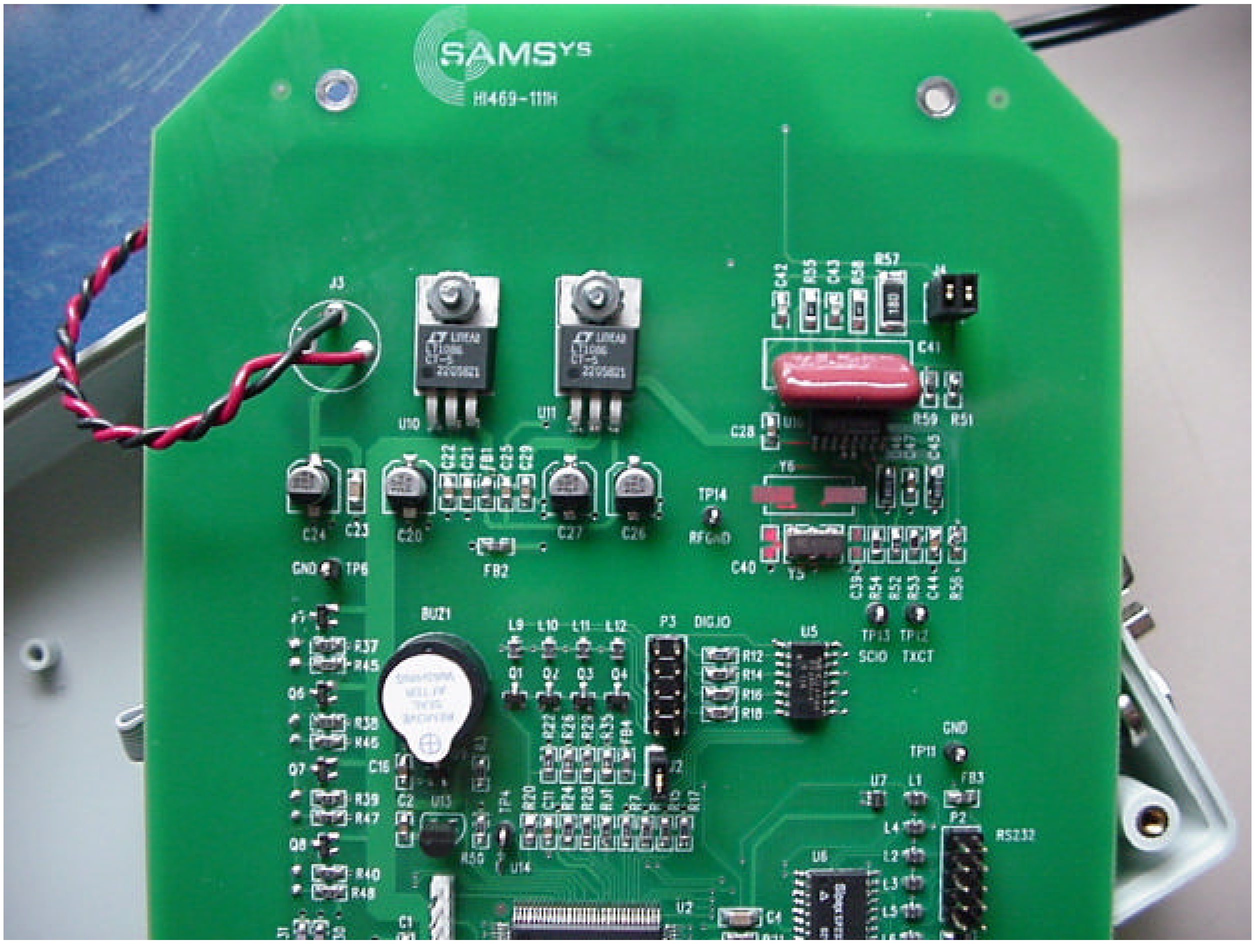

Figure 6 – Photo of the front top side of the Circuit Board

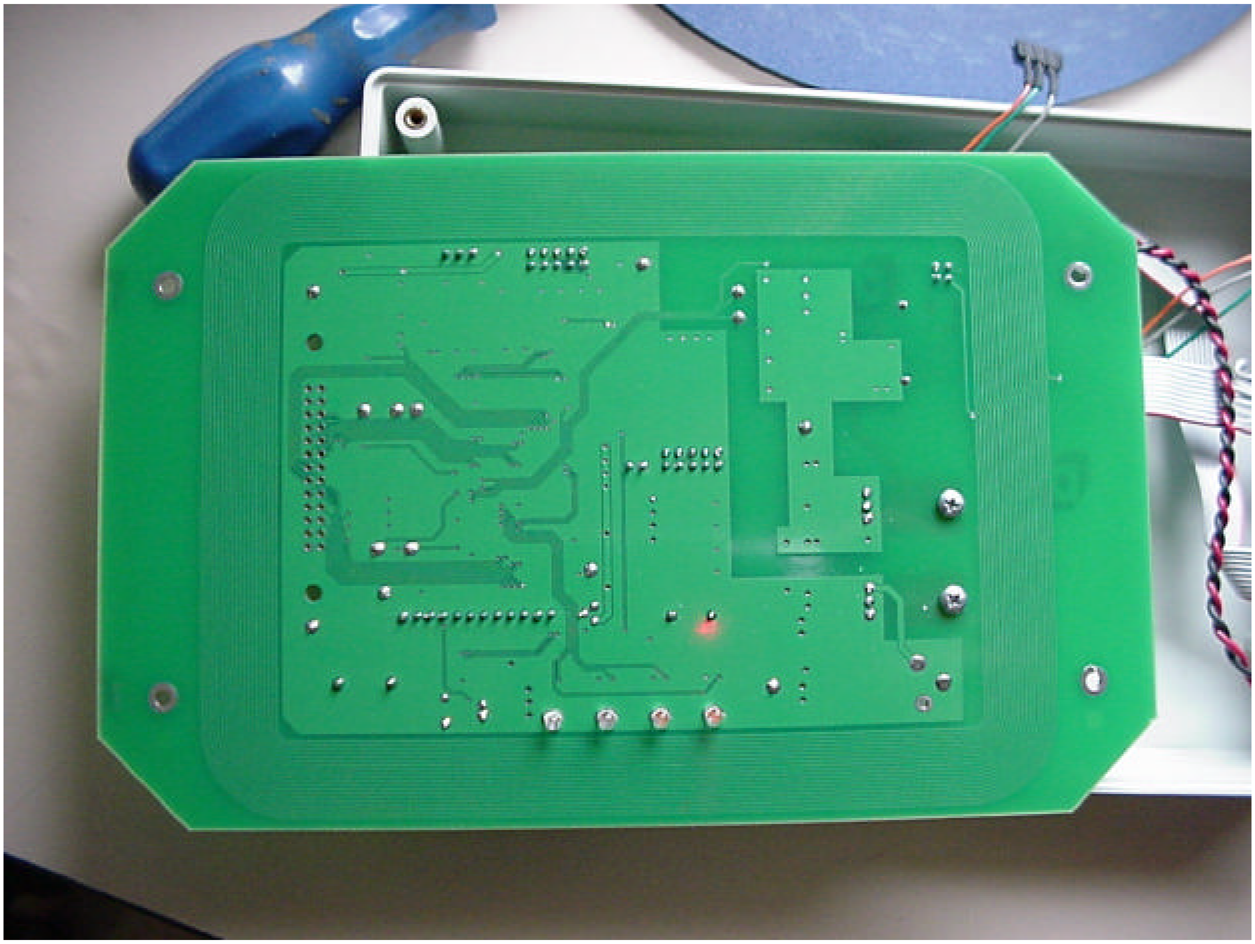

Figure 7 – Photo of the back of the Circuit board

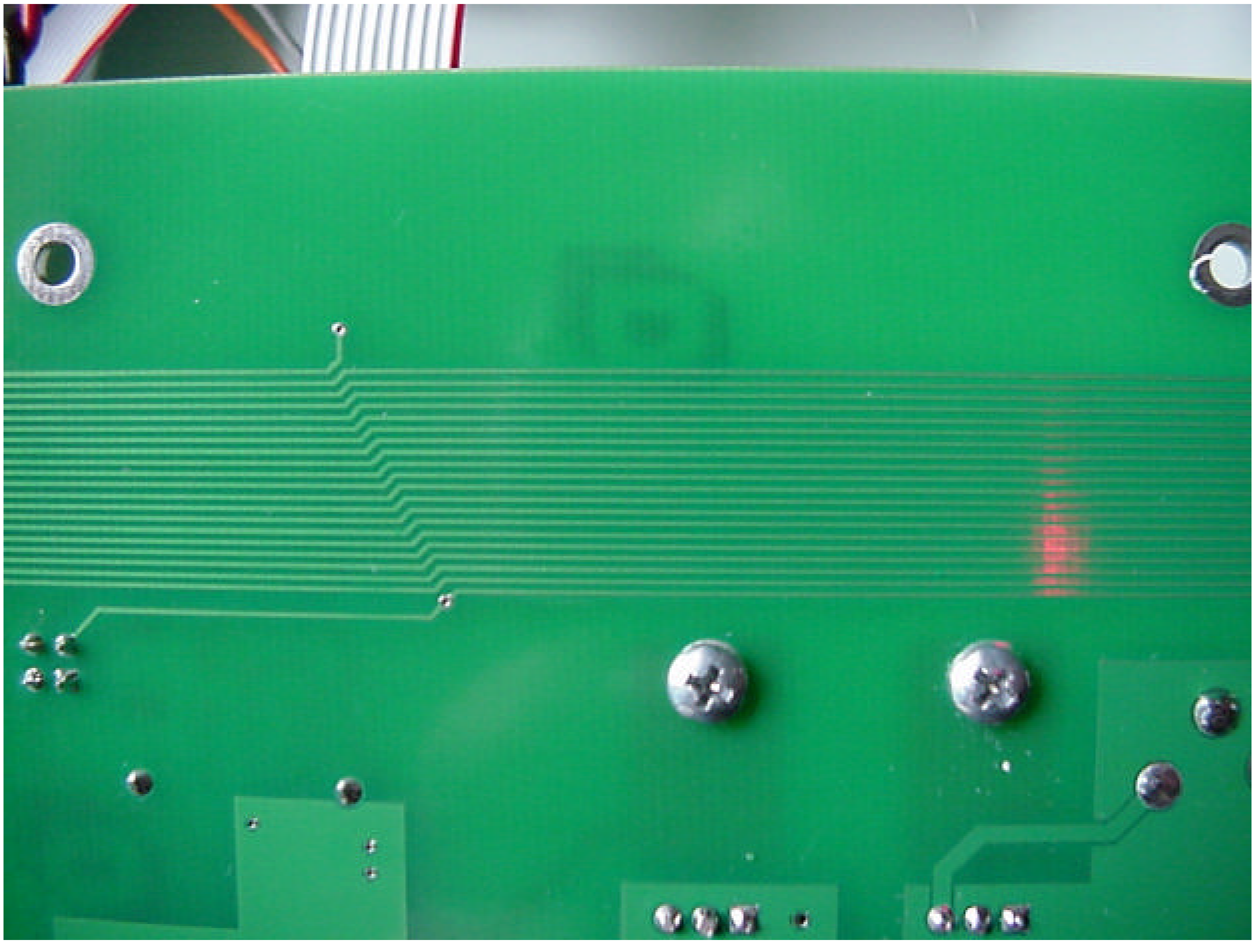

Figure 8 – Photo of a section of the Antenna

3.1 Product Description

The information for all equipment used in the tested system, including: descriptions of cables, clock and microprocessor frequencies, EMI critical components, and accessory equipment has been supplied by the manufacturer and is listed in the EMC Test Plan found in Section 6.

3.2 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. This configuration is reflected in the test report photos in sections 4.1.3 and 4.2.3. The transmitter in the EUT was set for maximum permissible output power during the test. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

3.3 Operation Mode

A description and justification of the operation mode is given in the EMC Test Plan.

In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. The transmitter in the EUT was set for maximum permissible output power during the test. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

4 Emissions

4.1 Radiated Emissions

Testing was performed in accordance with 47 CFR Part 15.209, ANSI C63.4:1992, RSS-210 Issue 5. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1.1 Test Methodology

4.1.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT. Preliminary scans record the emissions data in peak mode with the resolution bandwidth set to 30 KHz unless otherwise specified.

4.1.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. When using the loop antenna, the signal was maximized by turning the antenna about the vertical axis as well as measuring the signal strength in all three orthogonal planes, X, Y and Z. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs. Discrete frequency measurements are recorded using an average or quasi-peak detector, which ever is applicable and the resolution bandwidth is set to 120 KHz unless otherwise specified. Measurements recorded that are below 30 MHz were made at a test distance of 3 meters and extrapolated out to the proper distance using the square of an inverse linear distance extrapolation factor of 40 dB/decade.

4.1.1.3 Deviations

There were no deviations from this test methodology.

4.1.2 Test Results

Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.1.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

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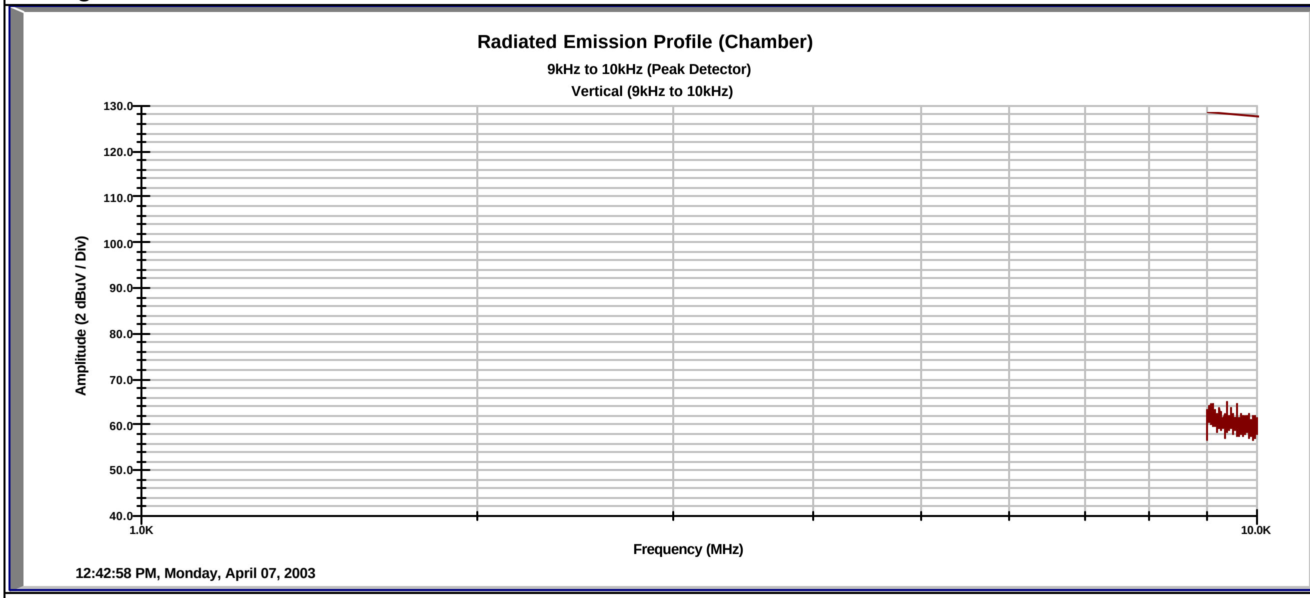
EUT Name	SARS MP9112	**Date**	29 October, 2002
EUT Model	HI469-112	**Temp / Hum in**	70 deg. F / 65 %rh
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3 meters / 6511	**Performed by**	Randy Sherian
Configuration	See notes.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: EUT on table laying flat as it would be in normal use with a cardboard box on top. The tag was placed on top of the box. The cardboard box was used to provide some separation between the EUT and tag. See Figures 9 and 10.

Scans recording peak mode. Resolution bandwidth set to 9 KHz and Video bandwidth set to 30 KHz for the scan and discrete measurements.

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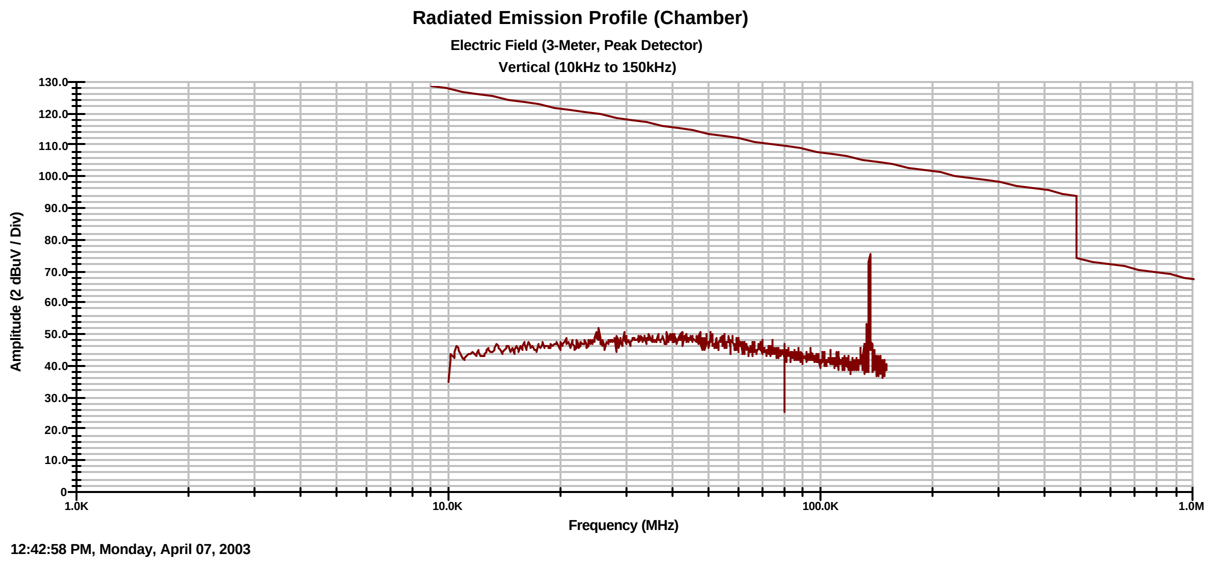
EUT Name	SARS MP9112	**Date**	29 October, 2002
EUT Model	HI469-112	**Temp / Hum in**	70 deg. F / 65 %rh
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3 meters / 6502	**Performed by**	Randy Sherian
Configuration	Scans conducted in chamber, fundamental frequency measurements made outdoors.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
Fundamental Frequency: Z orientation, EUT facing the antenna and upright.										
0.135		1.0	0	78.65	0.00	0.02	11.8	90.47	105.0	-14.53
Fundamental Frequency: X orientation, EUT on it's back on the table.										
0.135		1.0	10	53.53	0.00	0.02	11.8	65.35	105.0	-39.65
Fundamental Frequency: Y orientation, EUT on it's side on the table.										
0.135		1.0	90	66.4	0.00	0.02	11.8	78.22	105.0	-26.78

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: Scans recording peak mode. Average detector used for measuring the fundamental frequency. Resolution bandwidth set to 9 KHz and Video bandwidth set to 30 KHz for the scan and discrete measurements.

EUT in Z orientation. EUT at 102 VAC operating voltage: 78.69 dBuV. EUT at 138 VAC: 78.67 dBuV
Occupied Bandwidth Measurement, 20dB: 20.48 KHz, see Figure 11.
Voltage variation measurement, +/- 15% nominal voltage, see Figure 12.
For scans, the EUT was placed on the table laying flat as it would be in normal use with a cardboard box on top. The tag was placed on top of the box. The cardboard box was used to provide some separation between the EUT and tag. See Figures 9 and 10. During the fundamental measurement, Frequency Stability and Occupied Bandwidth testing the EUT was setup as seen in Figures 13 and 14. The loop antenna was rotated to maximize the fundamental frequency in each plane.

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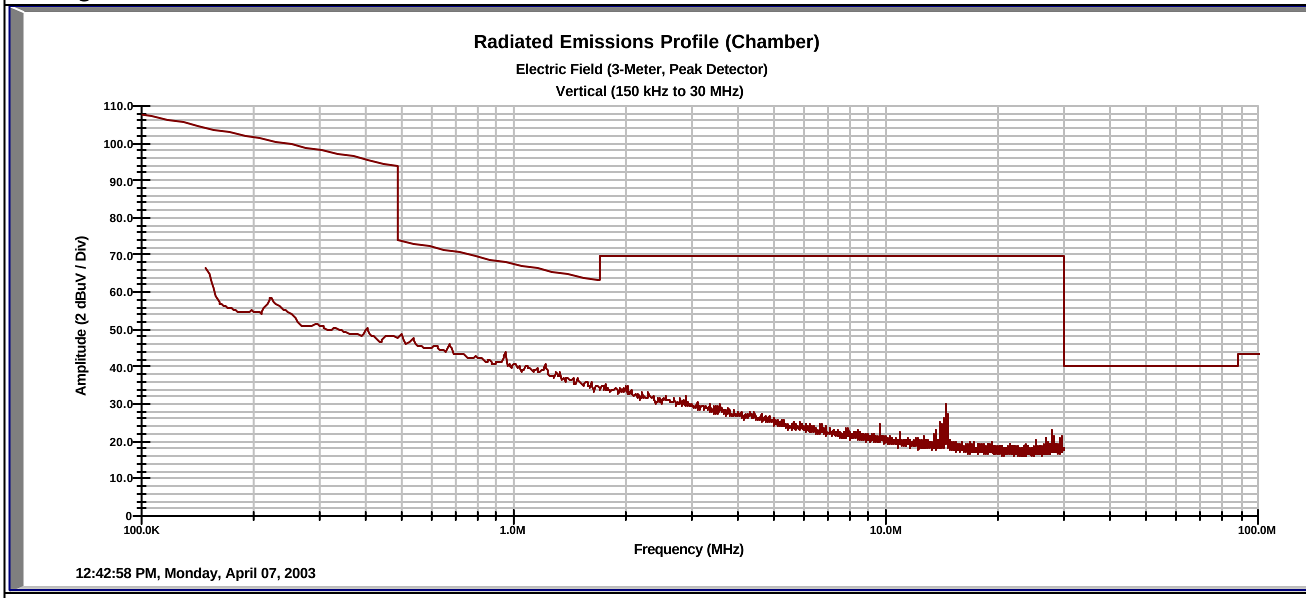
EUT Name	SARS MP9112	**Date**	29 October, 2002
EUT Model	HI469-112	**Temp / Hum in**	70 deg. F / 65 %rh
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3 meters / 6502	**Performed by**	Randy Sherian
Configuration	See notes.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
0.15	H	1.0	60	40.26	0.00	0.06	11.8	52.12	104.08	-51.96
0.27	H	1.0	10	34.76	0.00	0.06	11.7	46.52	98.98	-52.46
0.405	H	1.0	350	34.34	0.00	0.06	11.7	46.1	95.46	-49.36
0.675	H	1.0	296	31.23	0.00	0.03	11.6	43.04	71.02	-27.98
0.945	H	1.0	246	29.89	0.00	0.05	11.5	41.44	68.1	-26.66
14.48	H	1.0	16	17.65	0.00	0.52	10.4	28.57	69.54	-40.97

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: EUT on table laying flat as it would be in normal use with a cardboard box on top. The tag was placed on top of the box. The cardboard box was used to provide some separation between the EUT and tag. See Figures 9 and 10.

Scans recording peak mode. Discrete frequencies measured using average or quasi-peak detectors, which ever is applicable. Resolution bandwidth set to 9 KHz and Video bandwidth set to 30 KHz for the scan and discrete measurements.

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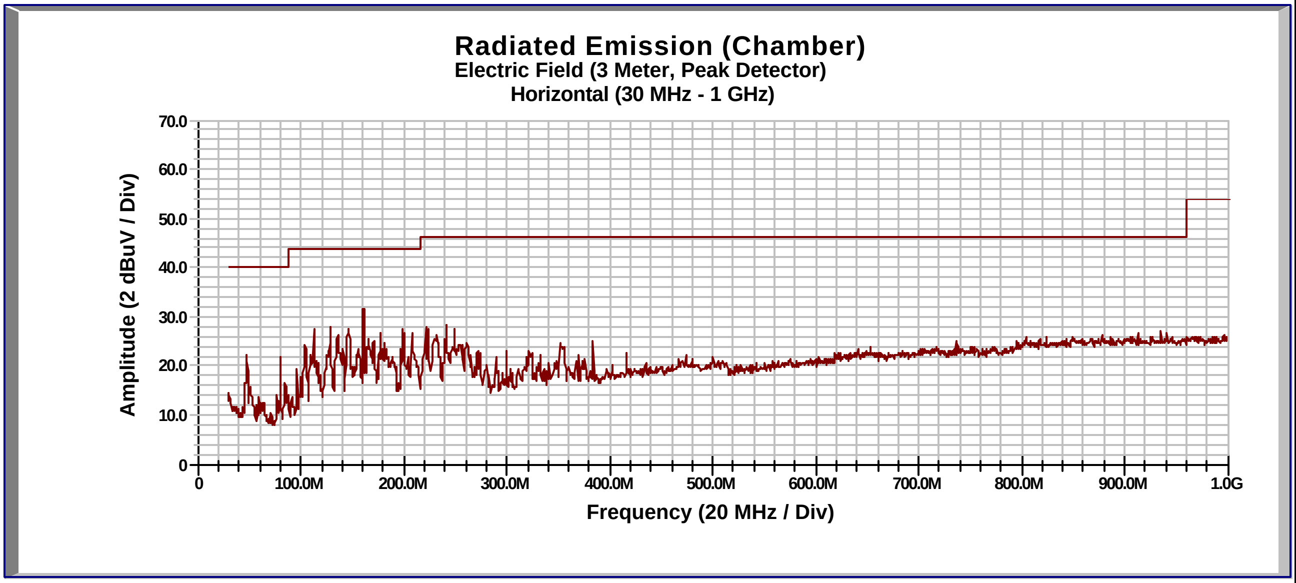
EUT Name	SARS MP9112	**Date**	29 October, 2002
EUT Model	HI469-112	**Temp / Hum in**	70 deg. F / 65 %rh
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3 meters / 3110B, SAS-516	**Performed by**	Randy Sherian
Configuration	See notes.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
128.80	H	1.53	256	15.97	0.00	1.60	11.85	29.42	43.50	-14.08
161.20	H	1.79	268	18.33	0.00	1.75	12.48	32.55	43.50	-10.95
241.70	H	1.0	105	14.35	0.00	2.13	12.37	28.85	46.00	-17.15

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB   Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT on table laying flat as it would be in normal use with a cardboard box on top. The tag was placed on top of the box. The cardboard box was used to provide some separation between the EUT and tag. See Figures 9 and 10.

Scans recording peak mode. Resolution bandwidth set to 120 KHz and Video bandwidth set to 300 KHz for this scan.

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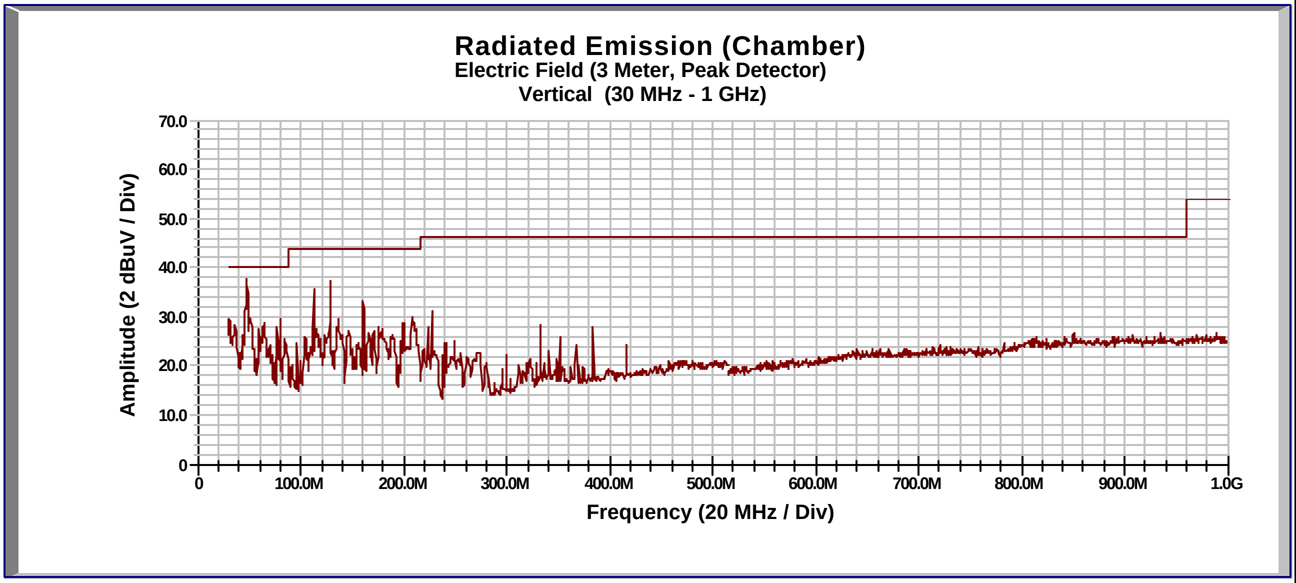
EUT Name	SARS MP9112	**Date**	29 October, 2002
EUT Model	HI469-112	**Temp / Hum in**	70 deg. F / 65 %rh
EUT Serial	None	**Temp / Hum out**	N/A
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC / Freq**	120 VAC / 60 Hz
Dist/Ant Used	3 meters / 3110B, SAS-516	**Performed by**	Randy Sherian
Configuration	See notes.		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
48.44	V	1.0	354	26.21	0.00	0.91	9.74	36.86	40.00	-3.14
112.70	V	1.0	337	21.34	0.00	1.48	11.42	34.24	43.50	-9.26
128.80	V	1.0	109	23.38	0.00	1.60	12.70	37.68	43.50	-5.82
161.10	V	1.0	18	14.97	0.00	1.75	13.57	30.28	43.50	-13.22
227.80	V	1.0	277	18.82	0.00	2.05	11.66	32.52	46.00	-13.48
384.20	V	1.0	257	10.07	0.00	2.74	15.88	28.70	46.00	-17.30

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.6$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: EUT on table laying flat as it would be in normal use with a cardboard box on top. The tag was placed on top of the box. The cardboard box was used to provide some separation between the EUT and tag. See Figures 9 and 10.

Scans recording peak mode. Resolution bandwidth set to 120 KHz and Video bandwidth set to 300 KHz for this scan.

4.1.3 Photos

Figure 9 - Radiated Emissions Test Setup (Chamber - Front)

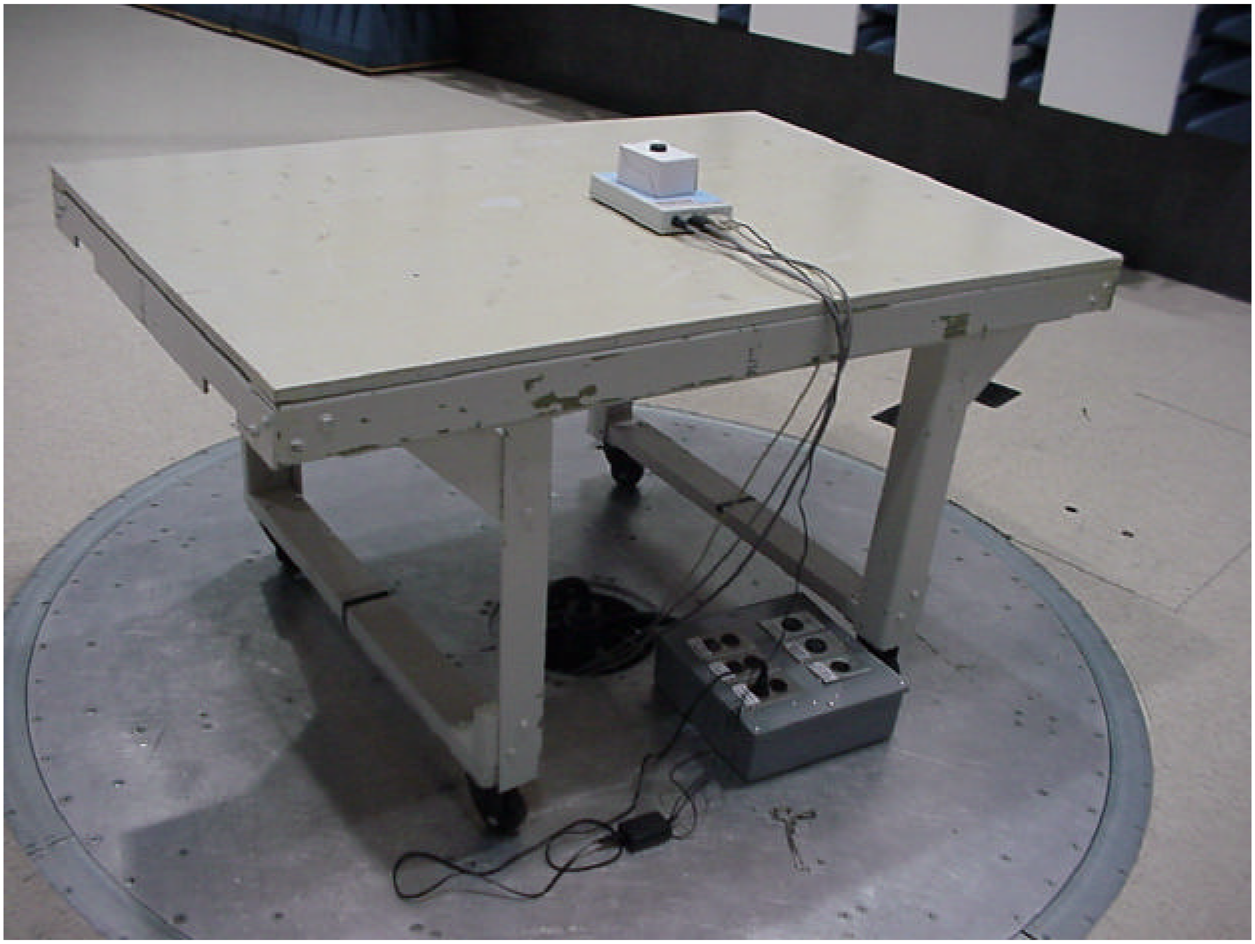


Figure 10 - Radiated Emissions Test Setup (Chamber - Back)

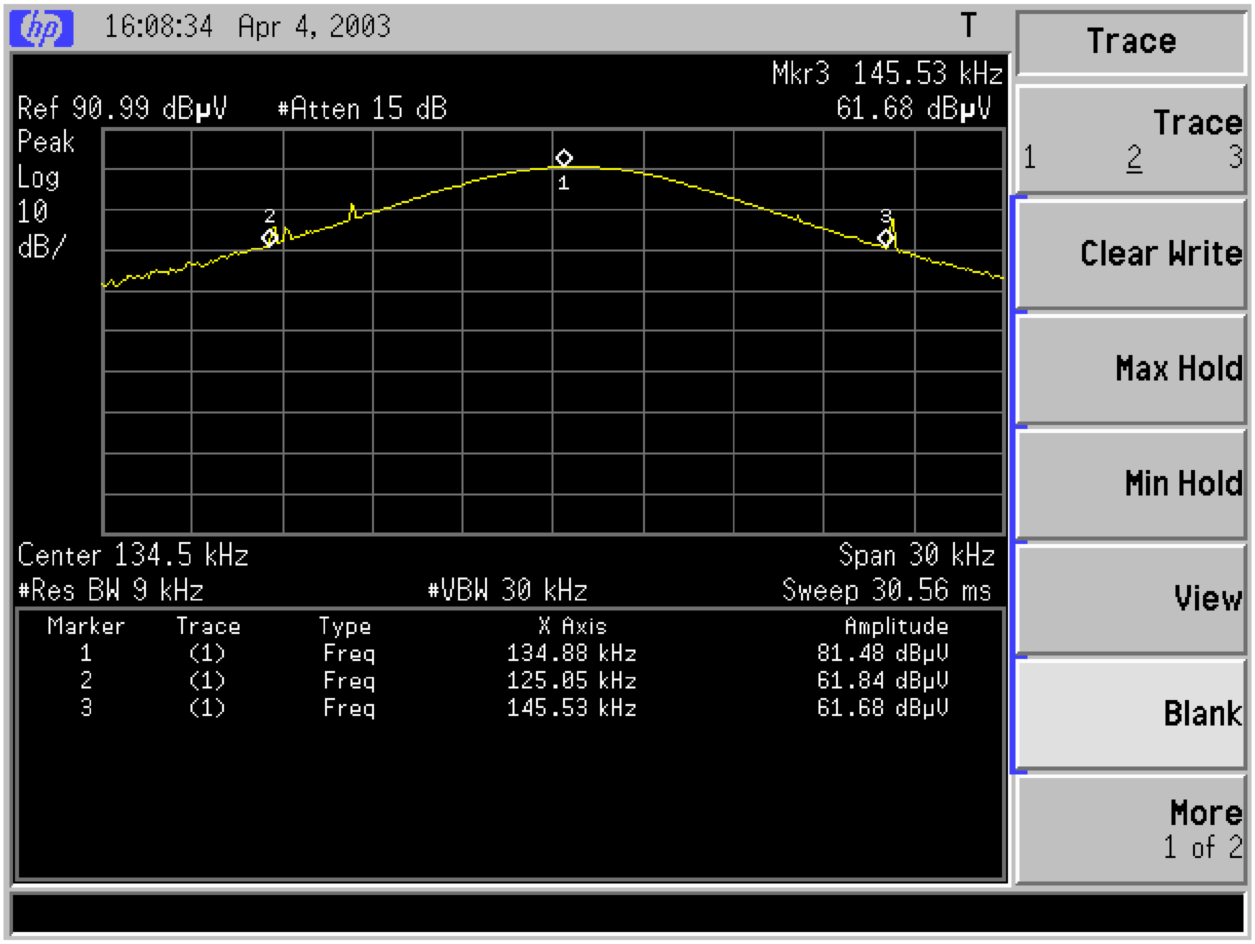


Figure 11 – Occupied Bandwidth Measurement, Z orientation

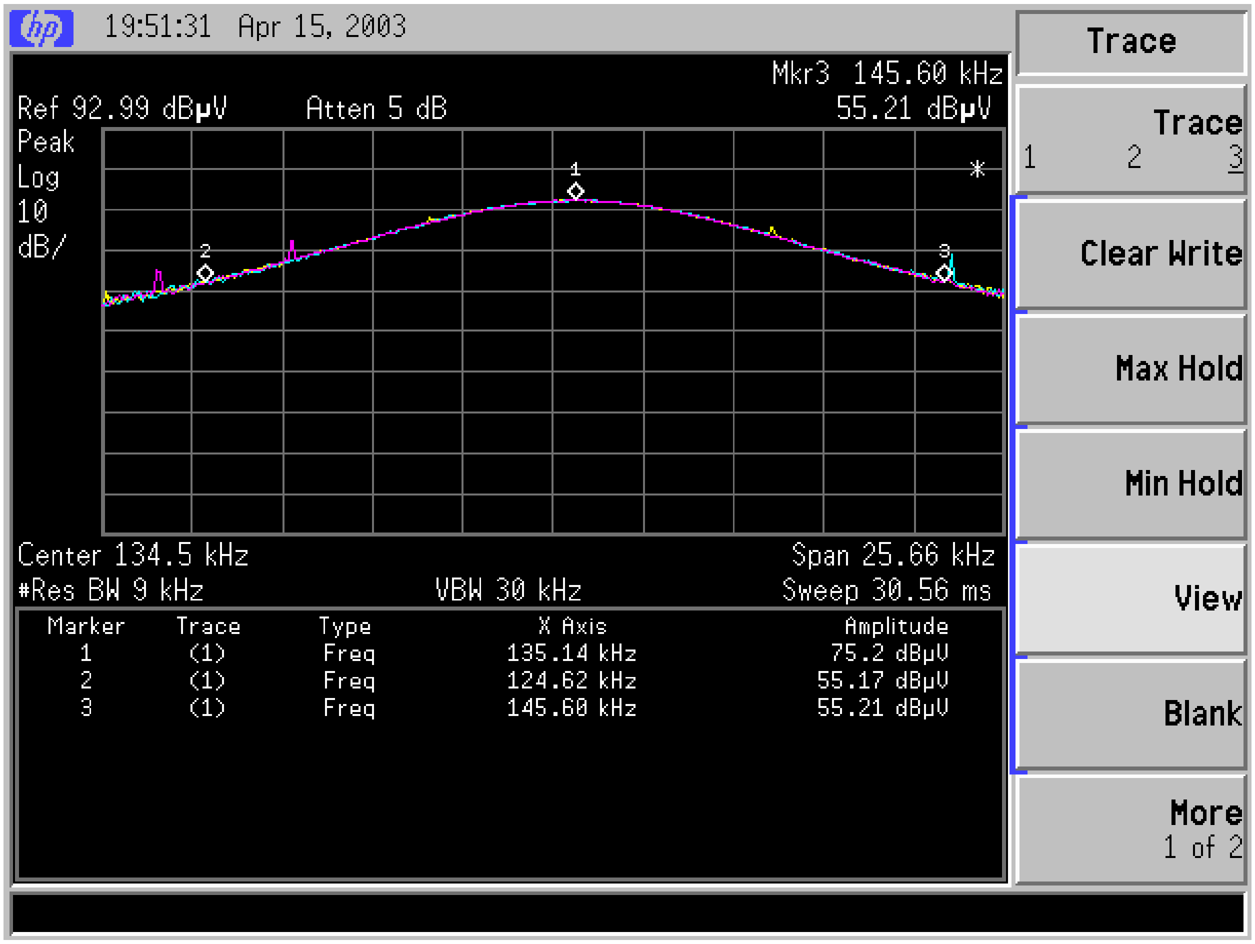


Figure 12 – Voltage Variation Frequency Stability (+/-15% Nominal)

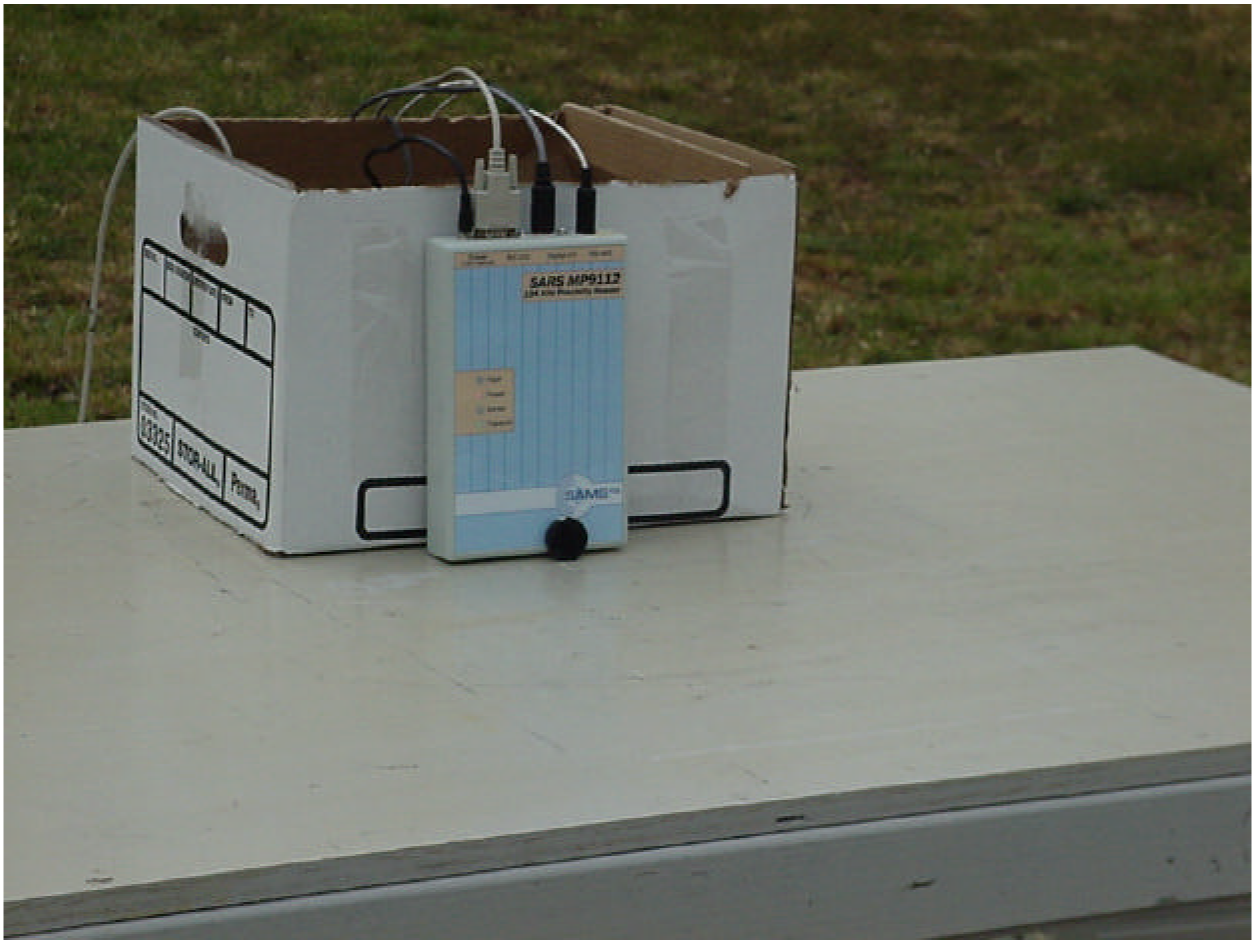


Figure 13 - Radiated Emissions Test Setup (9KHz to 30 MHz)

Figure 14 - Radiated Emissions Test Setup (9KHz to 30 MHz)

4.1.4 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBµV/m) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBµV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dBmV/m}{20}}$$

4.2 Conducted Emissions

Testing was performed in accordance with 47 CFR Part 15.207, ANSI C63.4:1992, RSS-210 Issue 5. These test methods are listed under the laboratory's NVLAP Scope of Accreditation.

This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.2.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with ¼ inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane. The frequency resolution was set to 9 KHz for the scans as well as the discrete measurements.

4.2.1.1 Deviations

There were no deviations from this test methodology.

4.2.2 Test Results

Section 4.2.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

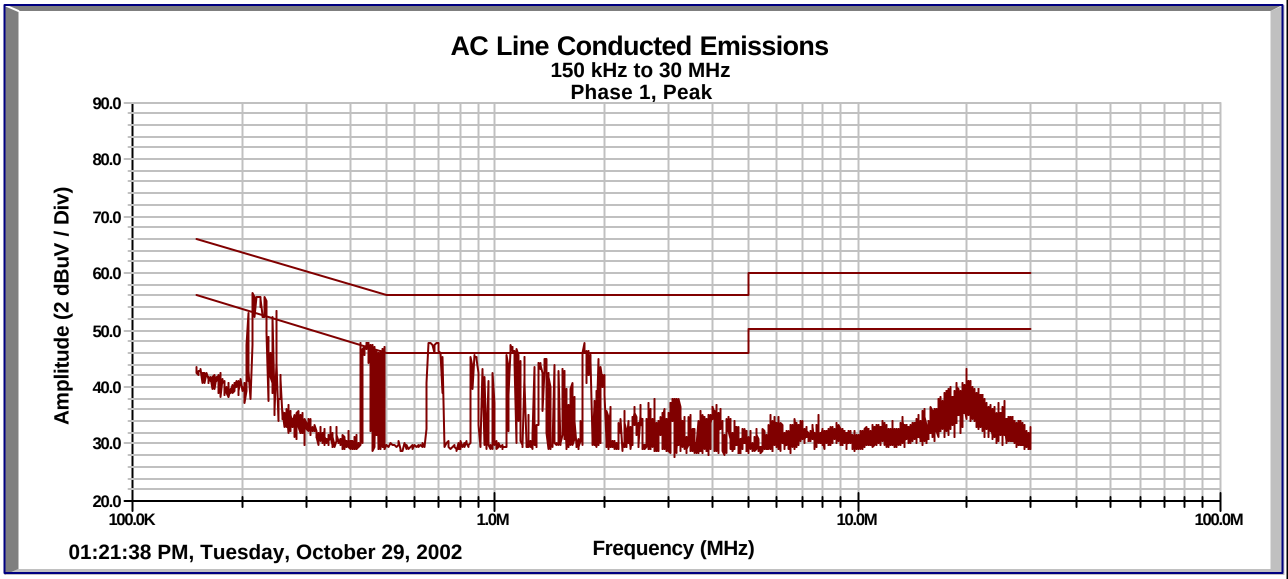
Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

4.2.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 2 Conducted Emissions   Tracking # 5071sam1   Page 1 of 4

EUT Name	SARS MP9112	**Date**	29 October 2002
EUT Model	HI469-112	**Temperature**	71 deg. F
EUT Serial	None	**Humidity**	54 %rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Randy Sherian
Configuration	With CUI Stack EPA-121DA-12 Switching Power Supply.		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN CF (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
20	1	31.54	30.27	0.14	10.36	60.0	50.0	-17.96	-9.23
0.459	1	32.57	20.05	0.02	9.86	57.0	47.0	-14.55	-17.07
0.680	1	32.32	14.48	0.03	9.87	56.0	46.0	-13.78	-21.62
0.870	1	32.93	23.0	0.03	9.88	56.0	46.0	-13.16	-13.09
1.1	1	34.24	24.04	0.04	9.9	56.0	46.0	-11.82	-12.02
1.69	1	25.89	3.88	0.04	9.91	56.0	46.0	-20.16	-32.17
0.224	1	45.5	40.3	0.01	9.87	63.0	53.0	-7.62	-2.82

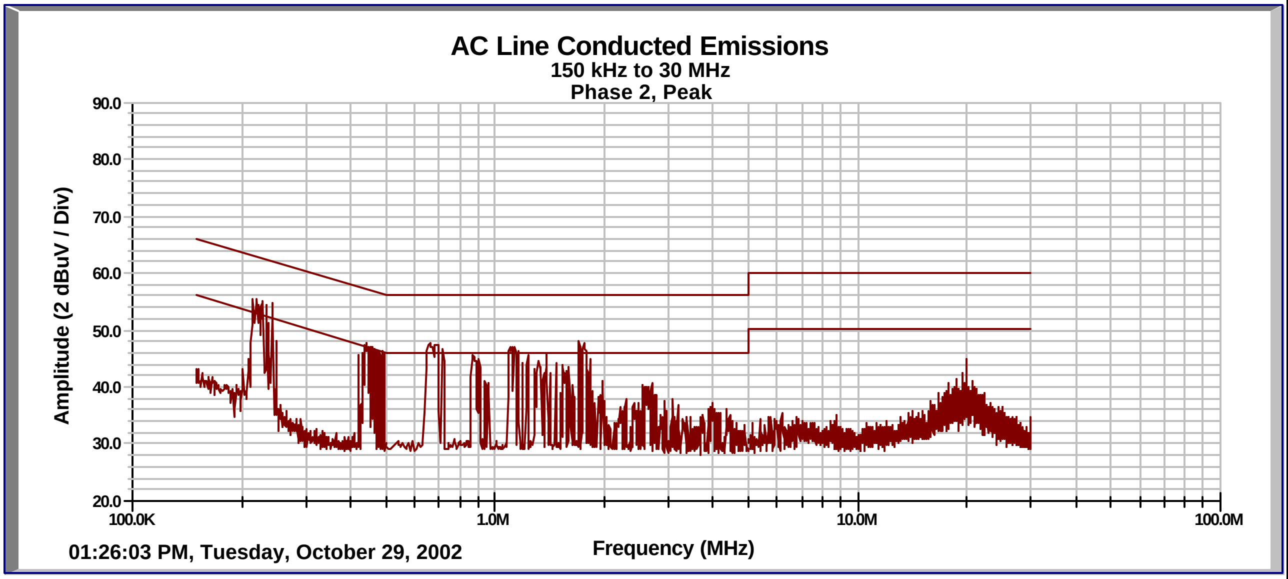
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB   Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

SOP 2 Conducted Emissions   Tracking # 5071sam1   Page 2 of 4

EUT Name	SARS MP9112	**Date**	29 October 2002
EUT Model	HI469-112	**Temperature**	71 deg. F
EUT Serial	None	**Humidity**	54 %rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Randy Sherian
Configuration	With CUI Stack EPA-121DA-12 Switching Power Supply.		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN CF (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.464	2	32.61	19.89	0.02	9.86	57.0	47.0	-14.51	-17.23
0.662	2	35.36	28.36	0.03	9.86	56.0	46.0	-10.75	-7.75
0.881	2	32.25	23.33	0.03	9.88	56.0	46.0	-13.84	-12.76
1.1	2	34.55	24.29	0.04	9.9	56.0	46.0	-11.51	-11.77
1.7	2	29.64	7.58	0.04	9.91	56.0	46.0	-16.41	-28.47
20	2	31.78	30.47	0.14	10.36	60.0	50.0	-17.72	-9.03
0.219	2	44.1	40.2	0.01	9.87	63.0	53.0	-9.02	-2.92

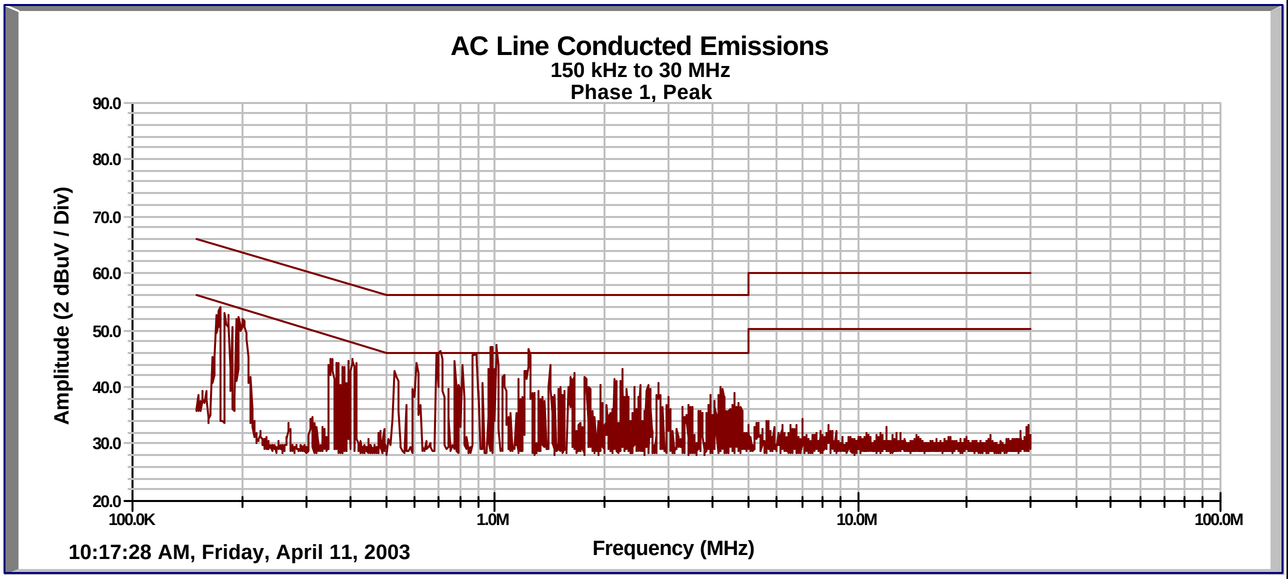
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

SOP 2 Conducted Emissions   Tracking # 5071sam1   Page 3 of 4

EUT Name	SARS MP9112	**Date**	29 October 2002
EUT Model	HI469-112	**Temperature**	71 deg. F
EUT Serial	None	**Humidity**	54 %rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Randy Sherian
Configuration	With CUI Stack Model DSA-0151A-12 Switching Power Supply.		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN CF (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.202	1	39.65	35.36	0.01	9.87	63.0	53.0	-13.47	-7.76
0.404	1	32.27	26.86	0.02	9.86	57.0	47.0	-14.85	-10.26
0.711	1	32.24	20.48	0.03	9.87	56.0	46.0	-13.86	-15.62
1.01	1	35.08	26.77	0.03	9.89	56.0	46.0	-11.0	-9.31
1.23	1	32.74	16.71	0.03	9.89	56.0	46.0	-13.34	-19.37
1.61	1	30.12	18.72	0.04	9.91	56.0	46.0	-15.93	-17.33

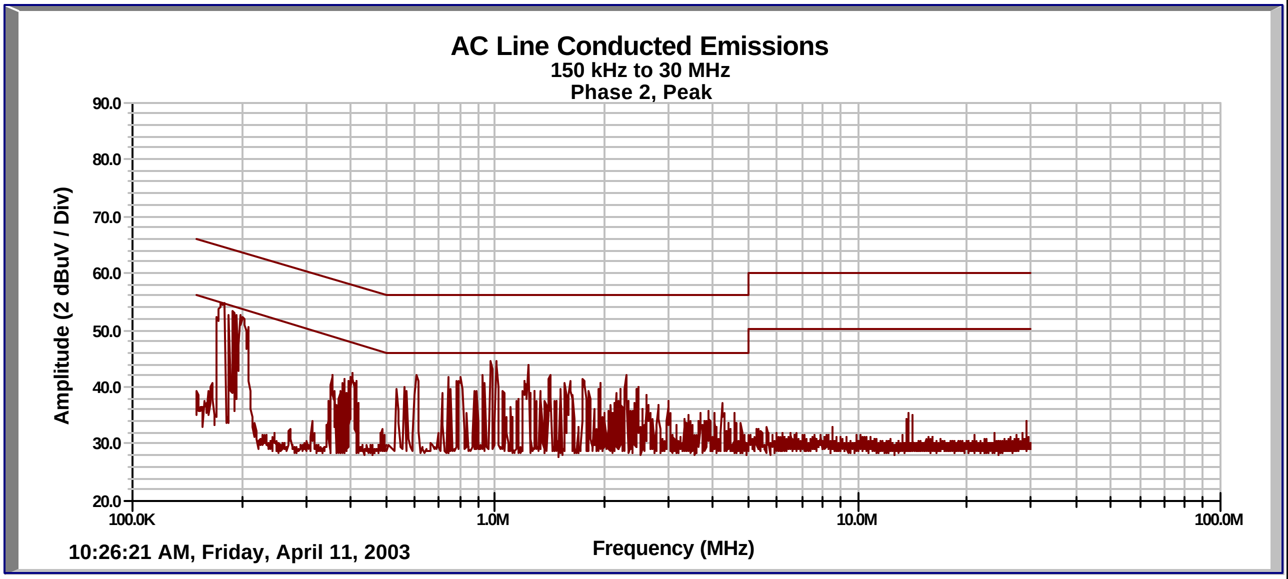
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

SOP 2 Conducted Emissions   Tracking # 5071sam1   Page 4 of 4

EUT Name	SARS MP9112	**Date**	29 October 2002
EUT Model	HI469-112	**Temperature**	71 deg. F
EUT Serial	None	**Humidity**	54 %rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 5	**Line AC /Freq**	120 VAC / 60 Hz
LISNs Used	7, 8	**Performed by**	Randy Sherian
Configuration	With CUI Stack Model DSA-0151A-12 Switching Power Supply.		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN CF (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.177	2	42.35	33.93	0.01	9.86	65.0	55.0	-12.78	-11.2
0.407	2	28.46	21.98	0.02	9.86	57.0	47.0	-18.66	-15.14
1.01	2	32.66	24.39	0.03	9.89	56.0	46.0	-13.42	-11.69
1.23	2	30.18	13.53	0.03	9.89	56.0	46.0	-15.9	-22.55
2.30	2	27.39	8.52	0.05	9.94	56.0	46.0	-18.62	-27.49

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB   Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes:

4.2.3 Photos

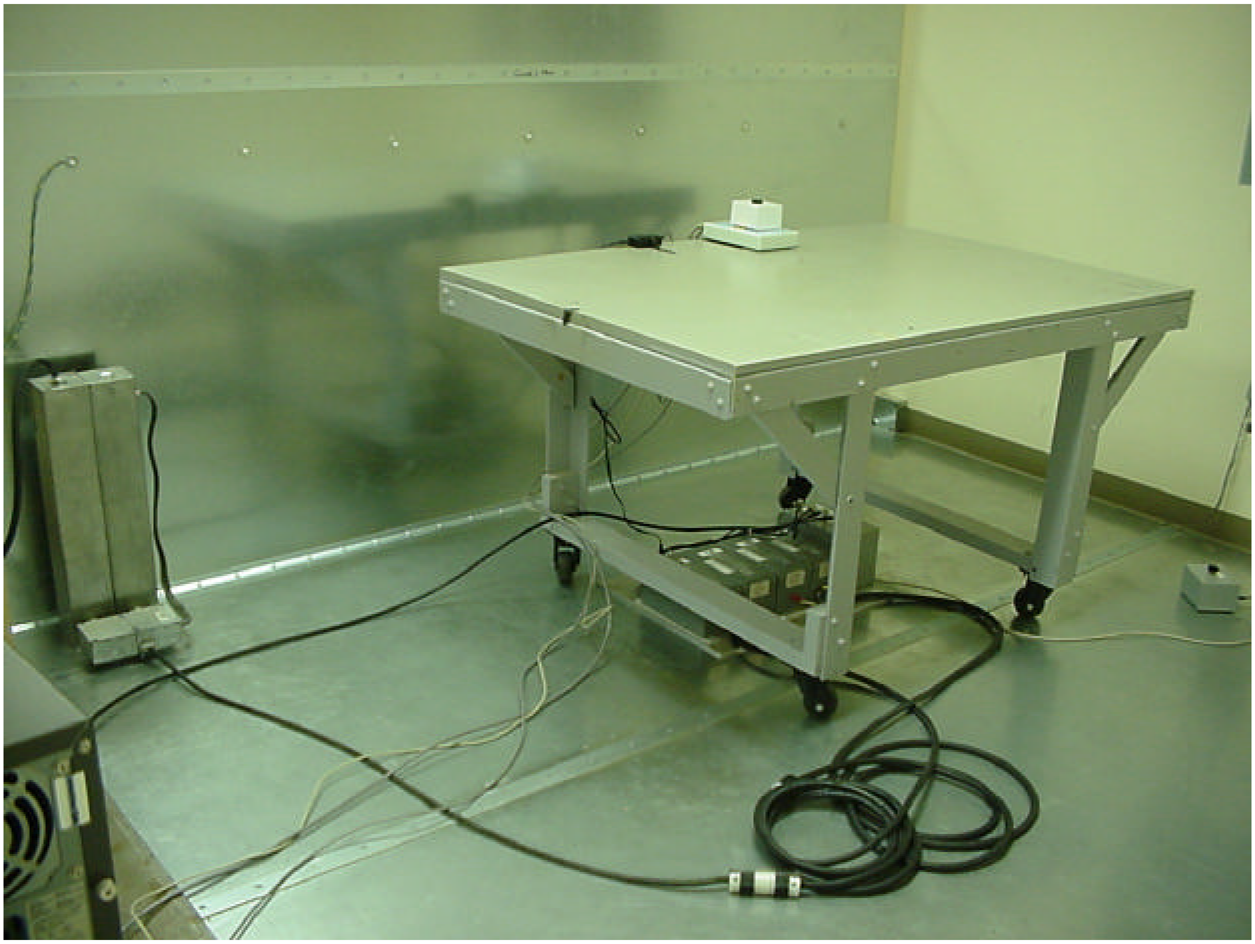


Figure 15 - Conducted Emissions Test Setup (Front) CUI Stack EPA-121DA-12

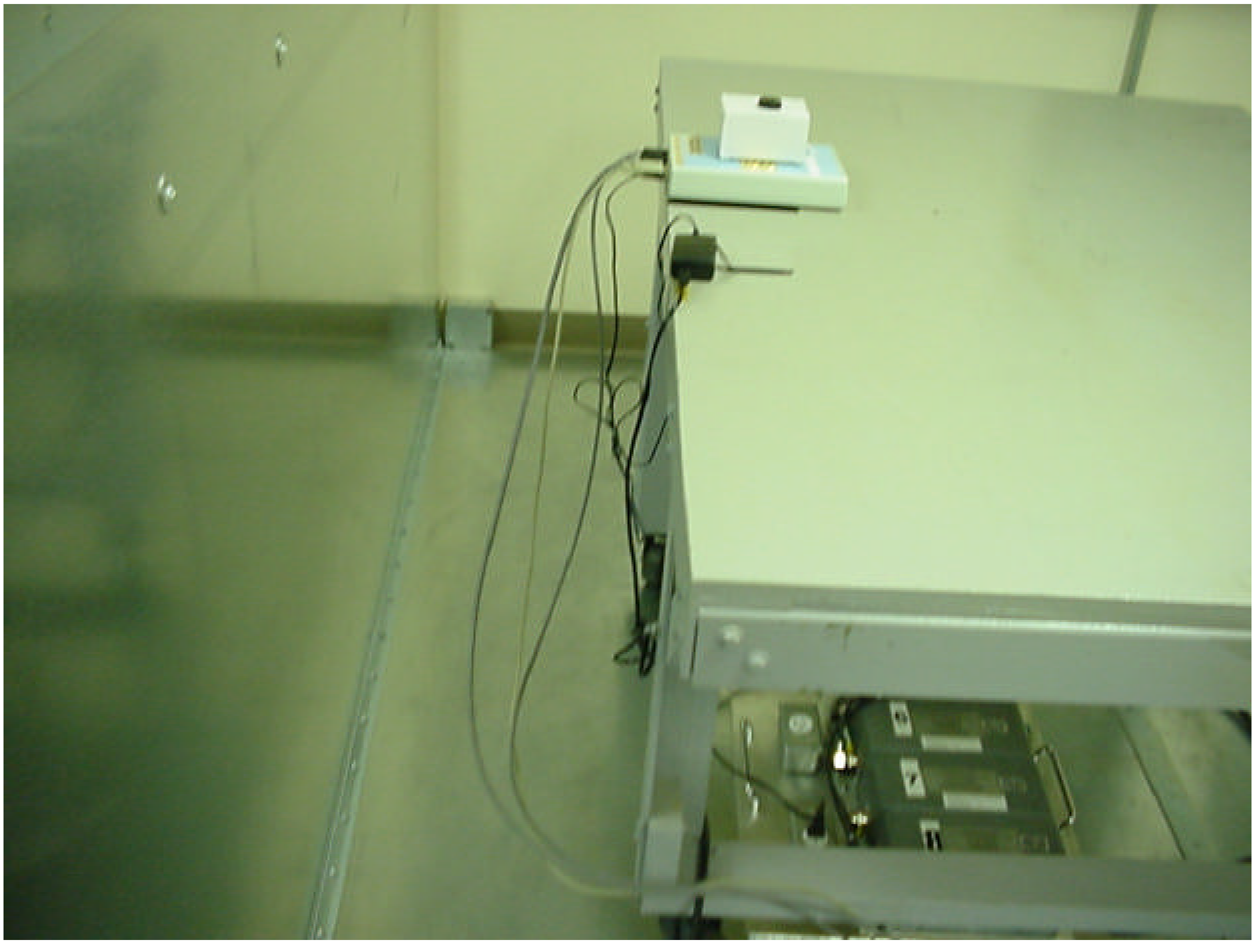


Figure 16 - Conducted Emissions Test Setup (Back) CUI Stack EPA-121DA-12

Figure 17 - Conducted Emissions Test Setup (Front) CUI Stack Model DSA-0151A-12

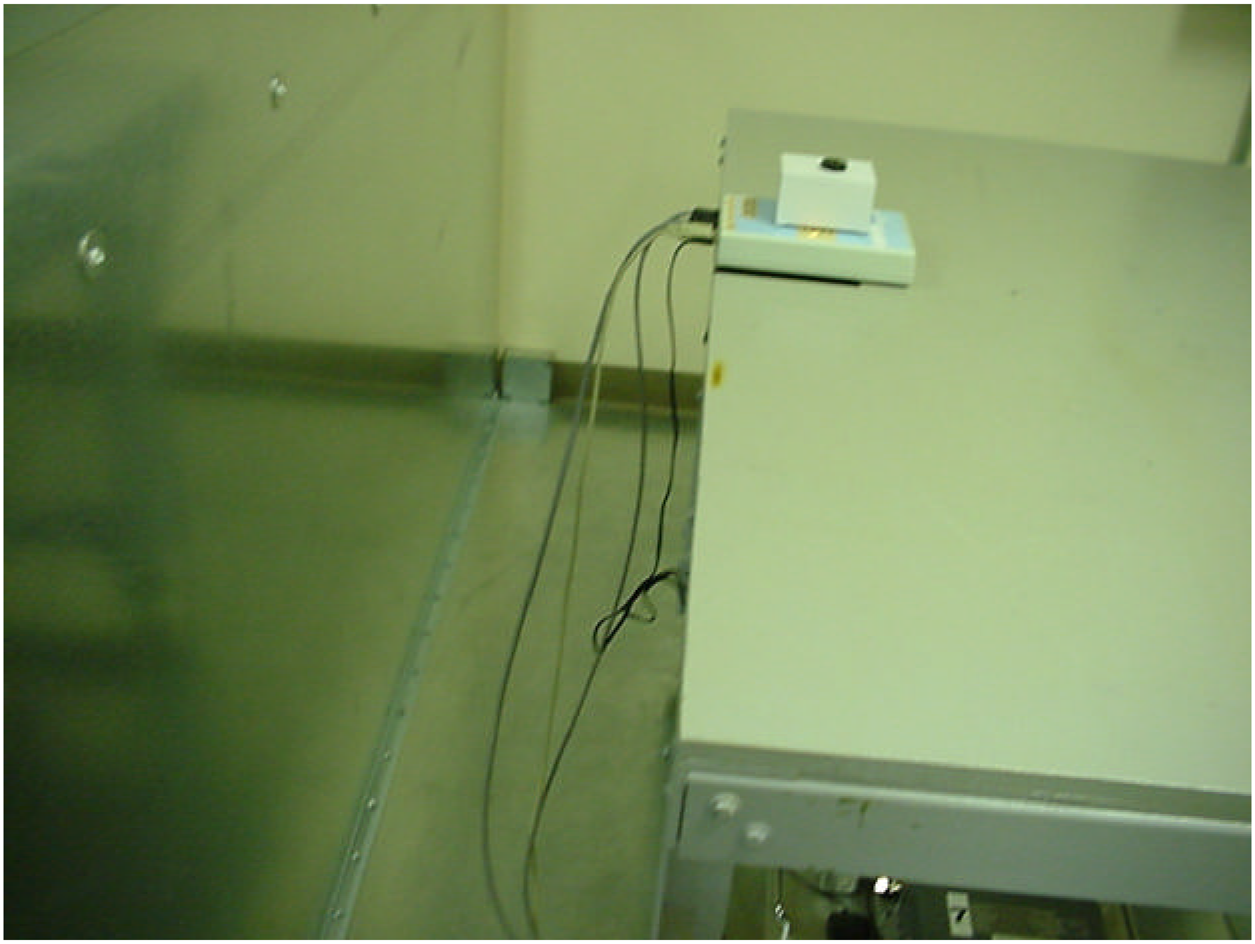


Figure 18 - Conducted Emissions Test Setup (Back) CUI Stack Model DSA-0151A-12

4.2.4 Sample Calculation

The signal strength is calculated by adding the LISN Correction Factor and Cable Loss to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM + CBL + LCF

Where: FIM = Field Intensity Meter (dBμV)
CBL = Cable Loss (dB)
LCF = LISN Loss (dB)

$$\mu V/m = 10^{\frac{dBmV/m}{20}}$$

5 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Ant. Biconical	EMCO	3110B	3367	28-Nov-01	28-Nov-02
Ant. Log Periodic	AH Systems	SAS-516	133	26-Nov-01	26-Nov-02
Cable, Coax	Andrew	FSJ1-50A	034	6-Feb-02	6-Feb-03
Cable, Coax	Andrew	FSJ1-50A	045	29-Jan-02	29-Jan-03
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	26-Mar-02	26-Mar-03
Data Table, EMCWin	Flextronics EMC	EMCWin.dll	002	6-Jan-02	6-Jan-03
Receiver, EMI	Rohde & Schwarz	ESI40	100043	4-Sep-02	4-Sep-03
Antenna Loop	EMCO	6502	3336	10-Nov-01	10-Nov-02
Antenna Loop	EMCO	6511	0004-1175	29-Aug-02	29-Aug-03
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	5-Aug-02	5-Aug-03

SOP 2 - Conducted Emissions (AC/DC and Signal I/O)					
Cable, Coax	Belden	RG-213	004	28-Jan-02	28-Jan-03
LISN (7) 50mH/50O	Solar Electronics	8028-50-TS-24	990443	8-Aug-02	8-Aug-03
LISN (8) 50mH/50O	Solar Electronics	8028-50-TS-24	990444	8-Aug-02	8-Aug-03
LISN Selection Box	Flextronics EMC	CFL-9206	1650	23-Aug-02	23-Aug-03
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	5-Aug-02	5-Aug-03

General Laboratory Equipment					
Meter, Temp/Humid/Barom	Fisher	02-400	01	21-Aug-02	21-Aug-03

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

The attached EMC test plan has been generated by the manufacturer and implemented as recorded in this test report.

6.1 *Introduction*

This manufacturer-supplied document provides a description of the Equipment Under Test (EUT), configuration(s), operating condition(s), and performance acceptance criteria. It is intended to provide the test laboratory with the essential information needed to perform the requested testing.

6.2 *Customer*

Table 2 – Manufacturer Information

Company Name:	SAMSys Technologies, Inc.
Street Address:	2525 Meridian Parkway, Suite 60
City, State, Zip Code:	Durham, N.C. 27713
Tel:	919-281-1541
Fax:	919-281-1551

Table 3 – Technical Contact Information

Contact Name	Telephone	Fax	Email address
Clifton Morgan	919-281-1559	919-281-1559	clifton.morgan@samsys.com

6.3 *Equipment Under Test (EUT)*

Table 4 – EUT Designation

Model Name:	SARS MP9112
Model Number:	HI469-112

6.3.1 Technical Description

The SARS MP9112 is a single board proximity reader for 134 KHz half duplex tags with typical read ranges of around six inches over a reading surface of approximately 4.5 inches by 6 inches. The unit must capable of operating in both Europe and North America within regulatory limits such that site licensing is not required when used with the built in antenna.

The initial protocols must include the half-duplex TIRIS tags from TI. These are non-arbitration tags and can be used when there is only one tag in the reading field at a time. Update firmware will be used to add future protocol and application support in the field without requiring hardware changes.

Multiple protocols can be enabled to run simultaneously in the read cycles. The reader is also capable of writing to or programming those tags with write capability. This reader also retains the current SARS family functionality such as digital I/O and the multiple serial connection possibilities.

The typical application will be to function as a plastic case enclosed stationary proximity reader using the on-board antenna and an external wall plug-in power supply. This unit would normally be networked with other readers on a simple RS-485 network to a concentrator, although it can also be used as a single reader connected with RS-232 to a PC. The reader can also be used as a reader board inside an OEM's piece of equipment with an external antenna if required.

Specifications Include:

Four optically isolated digital input lines and Four open-collector digital output lines
In-circuit programmability and integrated persistent storage
SOAP stack with the SAMSys Concentrator module (XML-based messaging protocol)
Integrated antenna
System scalability
Detection range: Up to 12 in (30.48 cm) depending on tag type
Average read times: 0.5 sec
Operating frequency: 134 KHz
Power supply: 12-15 VDC
Output levels: TTL RS-232 RS-485
Connections: I2C, RS-232, RS-485, Wiegand
Signaling: System Fault LED, Power Status LED, Tag Sense LED, RF Transmit LED
Memory: 4k SRAM, 16k EEPROM
Material: Flame-retardant ABS plastic
Dimensions: 8.66 x 5.51 x 1.58 in (22.00 x 14.00 x 4.05 cm)
Weight: 12.8 oz (362.88 g)
Operating temperature: -4° F to 122° F (-20° C to 50° C)
Operating humidity: 0–95% relative, non-condensing
Storage temperature: -40° F to 185° F (-40° C to 85° C)
Storage humidity: 0–95% relative, non-condensing
Model number: HI469-112
Modulation Type: ASK (or On-Off Keying)
Duty Cycle of Transmitter: 1/134KHz (Period of the Fundamental)
Antenna Type: One Loop, Permanently Attached
Antenna Proximity: To Case Body – 5mm, To Tag – 15cm
Mounting Technique: Desk Top or Wall Mount

6.3.2 Configuration(s)

Block Diagram of SARS MP9112 Test Setup

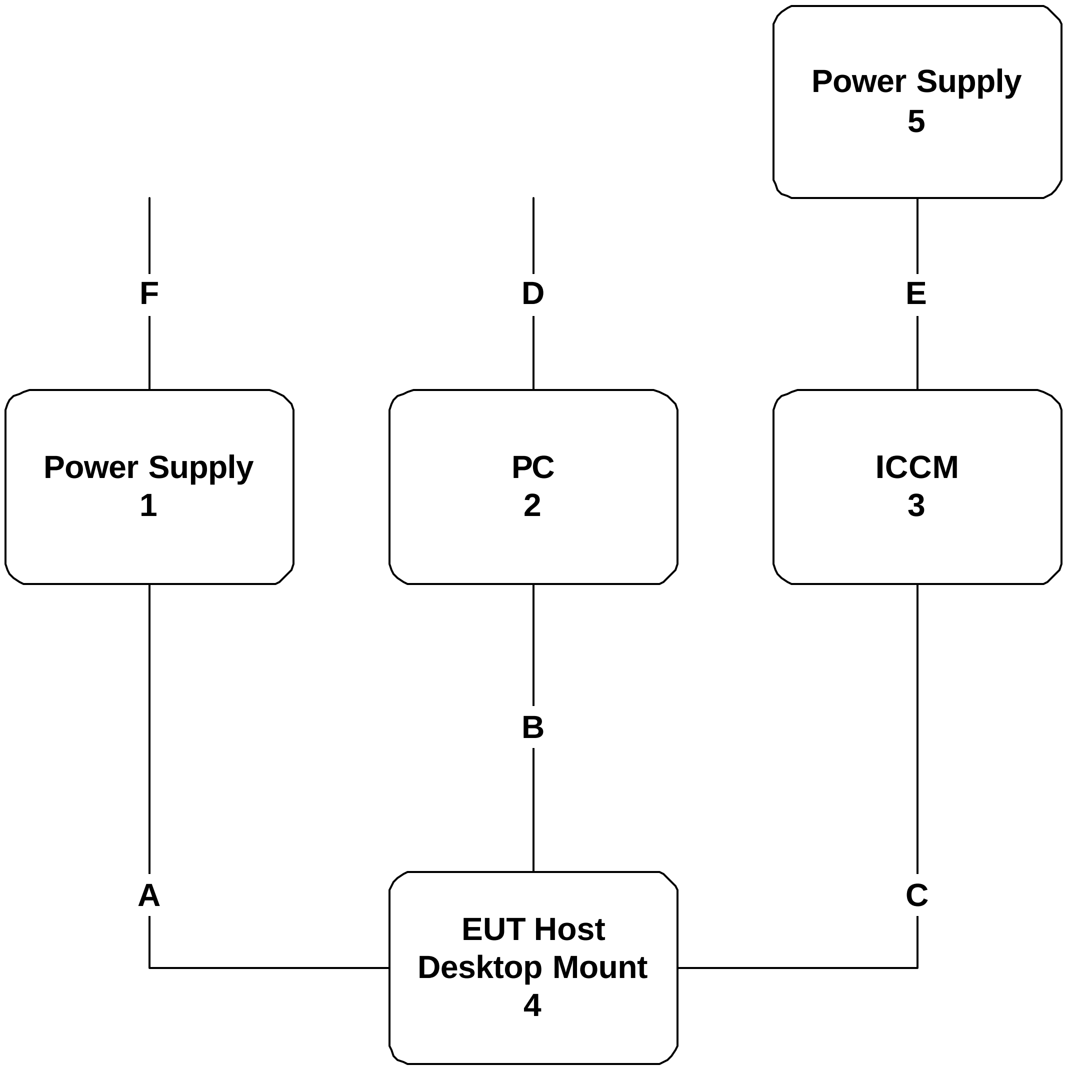


Figure 19 - Block Diagram of EUT Set-Up

Table 5 – Equipment Chassis Shown in Block Diagram

Des.	Manufacturer	Model No.	Rev.	Serial No.	Description
1	Phihong	PSA31U-120	N/A	N/A	12VDC Power Supply
2					Standard PC w/ RS-232 Serial Port
3	SAMSys	HI471-11	N/A	N/A	ICCM (concentrator)
4	SARS MP9111	HI469-111	N/A	N/A	RFID reader EUT
5	CUI Stack	DSA-0151A-05A	N/A	N/A	5VDC Power Supply

Table 6 – Cables Shown in Block Diagram

Des.	Cable Function	Type of Cable (Data or Power)	Shielded or Unshielded	Length (m)
A	12VDC Power Cable	Power	Unshielded	1.83
B	Serial Comm. (RS232)	Data	Unshielded	1.83
C	Serial Comm. (RS485)	Data	Shielded	10
D	AC Power Cable	Power	Unshielded	1.83
E	5VDC Power Cable	Power	Unshielded	1.83
F	AC Power Cable	Power	Unshielded	1.83
G				
H				

Table 7 – Subassemblies within each Chassis

Des.	Manufacturer	Model No.	Rev.	Serial No.	Description
1	Phihong	PSA31U-120			Universal-Input 12V Power Supply
2					Typical PC
3	SAMSys	HI471-11H	A	NA	Interface Module
3	SAMSys	HI426-1H	A	NA	Touch-panel Control Module
3	J.K. Micro	84-0050	C	NA	Single Board computer
3	Hantronix	HDM3224TS-1-C20F	NA	N/A	LCD Touch Screen
4					EUT
5					Wall mount Power Supply

6.3.3 Operating Conditions

There are eight operating modes for the reader, where Mode 07 is worst case. The cycle time for Mode 07 is approximately 2 seconds.

Mode	RF Function	Communication Function	Cycle Time (Seconds)
00	RF on for approximately 2 seconds in response to serial command	Communicates tag data when polled	1
01	RF on for approximately 2 seconds in response to serial command	Communicates tag data as soon as it is available	2
02	RF Periodic: 1. RF is on when the reader is scanning for tag data. 2. RF turns off after the reader captures the tag data. RF remains off while the reader waiting to be polled. 3. RF turns back on after the polled reader sends tag data to serial port.	Communicates tag data when polled	1
03	RF Periodic: 1. RF is on when the reader is scanning for tag data. 2. RF turns off after the reader captures the tag data and remains off while the reader automatically (no polling) sends data to the serial port. 3. RF turns back on after the tag data has been sent to the serial port.	Communicates tag data as soon as it is available	2
04	RF Periodic On/Off state controlled by software	Communicates tag data when polled	1
05	RF Periodic On/Off state controlled by software	Communicates tag data as soon as it is available	2
06	Continuous RF	Communicates tag data when polled	1
07	Continuous RF	Communicates tag data as soon as it is available	2

6.3.3.1 Software

SARS MP9112: LFSARS_TE 1.20pK, Proprietary of SAMSys Technologies, Inc.

6.3.3.2 Mode(s)

Instructions for setting up the EUT in each operating mode to be investigated:

1. Set up the EUT according the block diagram in Figure 1.
2. Using a terminal emulator (hyper-terminal) on the PC:
   a. Enter the following command to the EUT: }:Ws,d:xx! Where xx is one of the modes stated in paragraph 1.3.3.
   b. When operating in modes 00, 02, 04, or 06, the reader may be polled by typing the following command at the terminal: **}:Rd!**

6.3.4 Performance Criteria (Required for Immunity Testing Only)

1. Mode 00
   a. Power LED remains ON; all others remain OFF.
   b. Place a tag on the reader and enter terminal command **}Rd!**
   c. Transmit LED flashes, Sense LED fla shes, and audible alarm sounds.
   d. The tag ID is displayed on the PC.
2. Mode 01
   a. Power LED remains ON; all others remain OFF.
   b. Place a tag on the reader and enter terminal command **}Rd!**
   c. Transmit LED flashes, Sense LED flashes, and audible alarm sounds twice.
   d. The tag ID is displayed on the PC and the ICCM.
3. Mode 02
   a. Power LED remains ON; Transmit LED flashes; all others remain OFF.
   b. Place a tag on the reader.
   c. Transmit LED goes OFF and the Sense LED comes ON.
   d. Remove the tag from the reader.
   e. Enter terminal command **}Rd!**
   f. Sense LED goes OFF, Transmit LED comes ON and flashes, audible alarm sounds, tag ID is displayed on the PC and the ICCM.
4. Mode 03
   a. Power LED remains ON; Transmit LED flashes; all others remain OFF.
   b. Place a tag on the reader.
   c. Transmit LED continues to flash, the Sense LED flashes and audible alarm sounds.
   d. Tag ID is displayed continuously one the PC and only displayed once on the ICCM.
   e. Step 4c will repeat approximately once every second while a tag remains in the field.

5. Mode 04
    a. Power LED remains ON; all others remain OFF.
    b. Place a tag on the reader and enter terminal command **}Rd!**
    c. Transmit LED flashes, Sense LED flashes, and audible alarm sounds twice.
    d. The tag ID is displayed on the PC and the ICCM.
6. Mode 05
    a. Power LED remains ON; all others remain OFF.
    b. Place a tag on the reader and enter terminal command **}Rd!**
    c. Transmit LED flashes, Sense LED flashes, and audible alarm sounds twice.
    d. The tag ID is displayed on the PC and the ICCM.
7. Mode 06
    a. Power and Transmit LEDs ON, all others Off.
    b. Place a tag on the reader.
    c. Transmit LED goes OFF and Sense LED comes ON.
    d. Remove tag from the reader.
    e. Enter terminal command **}Rd!**
    f. Sense LED goes OFF, Transmit LED comes ON, tag ID is displayed on the PC, and the ICCM.
8. Mode 07
    a. Power LED remains ON; Transmit LED flashes; all others remain OFF.
    b. Place a tag on the reader.
    c. Transmit LED continues to flash, the Sense LED flashes and audible alarm sounds.
    d. Tag ID is displayed continuously one the PC and only displayed once on the ICCM.
    e. Step 4c will repeat approximately once every second while a tag remains in the field.

6.3.4.1 Generic Performance Criteria "A"

The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

6.3.4.2 Manufacturer Specific Performance Criteria "A"

EUT may experience a temporary Fault LED ON condition. The Fault LED clears automatically after approximately three seconds.

6.3.4.3 Generic Performance Criteria "B"

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer, when the apparatus is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed. If the minimum performance loss is not specified by the manufacturer then either of these may be derived from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

6.3.4.4 Manufacturer Specific Performance Criteria "B"

EUT may require a power reset. Disconnect power from the EUT for 5 seconds before reconnecting power. Upon start-up, the EUT operates normally.

6.3.5 Power Requirements

Describe the input power requirements and power connections of the EUT. Please specify whether or not the EUT requires AC or DC. If special receptacles or physical connections are required, please note them in this section.

Table 8 - Power Requirements

Parameter	Value
Input Voltage	+12 Volts DC
Input Frequency	N/A
Input Current (rated)	500 mA
1ϕ, 3ϕ, or DC	DC
Plug Type	Barrel Connector

6.3.6 Oscillator / Microprocessor Frequencies

Table 9 - Oscillator Frequency List

Frequency (MHz)	Description of Use
16	Micro-processor clock
4.0	RF transceiver
0.032768	Real-time clock option