EMI TESTING

TEST REPORT PREPARED BY

MET LABORATORIES, UNION CITY, CA

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Electromagnetic Compatibility Criteria Test Report

for the

Planar Monolithics Industries, Inc.
Successive Detection Log Video Amplifier

Verified under
the rules contained in
MIL-STD-461C/462

MET Report: EMCU14749-MIL

March 8, 2004

Prepared For:

Planar Monolithics Industries, Inc.
7311-G Grove Road
Fredrick, MD 21704

Prepared By:
MET Laboratories, Inc.
33439 Western Ave.
Union City, California 94587

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Tested Under

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MIL-STD-461C/462
EMC Requirements

Testing Performed By:

Asad Bajwa, Manager
Electromagnetic Compatibility Lab

Report Prepared By:

Cheryl Anicete
Documentation Department

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	March 8, 2004	Initial Issue.

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List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
cm	Centimeters
d	Measurement Distance
dB	Decibels
dBμA	Decibels above one **micro**amp
dBμV	Decibels above one **micro**volt
dBμA/m	Decibels above one **micro**amp **per** meter
dBμV/m	Decibels above one **micro**volt **per** meter
DC	Direct Current
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EMC	Electro**m**agnetic Compatibility
EUT	Equipment Under Test
f	Frequency
FCC	Federal Communications Commission
FREQ	**Fre**quency
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	**micro**henry
μF	**micro**farad
μs	**micro**seconds
NEBS	Network Equipment-Building System
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts **per** meter
VCP	Vertical Coupling Plane

I. Executive Summary

A. Purpose of Test

The purpose of these tests was to verify compliance of the Planar Monolithics Industries, Inc., Successive Detection Log Video Amplifier (referred to as EUT hereafter) to the specifications listed in Table 1.

B. Executive Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with MIL-STD-461C/462 EMC Requirements for Navy - shipboard below deck limits. All tests were performed in accordance with Planar Monolithics Industries, Inc. Purchase Order.

Reference	Description	Compliance
Purchase Order #31100535	Purchase Order for Planar Monolithics Industries, Inc., Successive Detection Log Video Amplifier Testing	
MIL-STD-461C, CE03	Conducted Emissions, Power and Interconnecting Leads, 0.015 kHz to 50 MHz	Compliant
MIL-STD-461C, CS01	Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz	Compliant
MIL-STD-461C, CS02	Conducted Susceptibility, Power Leads, 50 kHz to 400 MHz	Compliant
MIL-STD-461C, CS04	Undesired Signal Rejection	Compliant
MIL-STD-461C, CS06	Conducted Susceptibility, Spikes, Power Leads	Compliant
MIL-STD-461C, RE02	Radiated Emissions, Electric Field, 14 kHz to 18 GHz	Compliant

Table 1. Executive Summary of MIL-STD-461C/462 ComplianceTesting

II. Equipment Configuration

Model(s) Tested:	SDLVA-61F-80 OPT. 5829387-002, TBRK
Model(s) Covered:	SDLVA-61F-80 OPT. 5829387-002, TBRK
S/N's	PM311204, PM311205, and PM311206
Analysis:	The results obtained relate only to the item(s) tested.
Evaluated by:	Asad Bajwa
Date(s):	12/08/03, 12/09/03, and 12/11/03

A. Overview

The purpose of this series of tests was to verify compliance of the Planar Monolithics Industries, Inc., Successive Detection Log Video Amplifier with the limits and test methods indicated in MIL-STD-461C/462.

B. References

MIL-STD-461C: 1986	Military Standard--Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference
MIL-STD-461D: 1993	Military Standard--Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility
MIL-STD-461E: 1999	Military Standard--Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-462: 1993	Military Standard--Test Method Standard for Measurements of Electromagnetic Interference Characteristics
MIL-STD-45662A	Calibration System Requirements
ANSI/ISO/IEC 17025: 2000	General Requirements for the Competence of Testing and Calibration Laboratories

C. Test Site

All testing was performed at MET Laboratories, Inc., 53439 Western Ave., Union City, California 94587. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

D. Description of Test Sample

The Successive Detection Log Video Amplifier (SDLVA-61F-80 OPT. 5829387-002, TBRK), Equipment Under Test (EUT) for the remainder of this document, operates at 61.25 MHz.

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

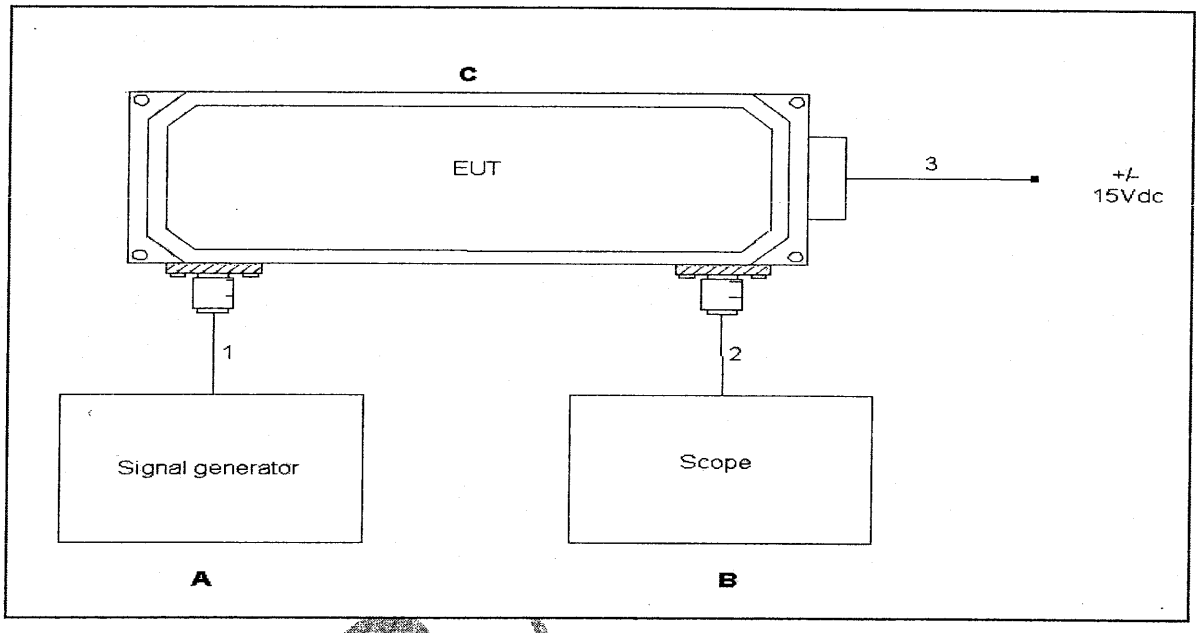


Figure 1. Block Diagram of Test Configuration

Ref. ID	Name / Description	Model Number	Serial Number	Revision
A	Signal Source	N/A	N/A	N/A
B	Oscilloscope	N/A	N/A	N/A
C	Successive Detection Log Video Amplifier	SDLVA-61F-80 OPT. 5829387-002	PM311204, PM311205, PM311206	N/A

Test Setup: During all the EMC testing, the EUT was setup on a table with a metallic top inside shielded enclosure. All the I/O and power cables were raised from the tabletop by 5-cm spacers and routed as specified in MIL-STD-461C/462 standard. LISNs were used at the power input to provide stable impedance. The EUT is a successive detection log video amplifier (SDLVA-61F-80 OPT. 5829387-002, TBRK), it operates at 61.25MHz. EUT was exercised by applying a 61.25 MHz signal from a signal generator as shown in test setup.

F. Method of Monitoring EUT Operation

The EUT was powered by a duel power supply as shown in setup. It was being exercised by applying a 61.25 MHz signal from a signal generator as shown in test setup (see Figure 1) and the output was being monitored with the help of an Oscilloscope.

G. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

H. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Planar Monolithics Industries, Inc. upon completion of testing.

III. Electromagnetic Compatibility Conducted Emission and Susceptibility Criteria

A. CE03, Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz

Test Requirement(s): This requirement is applicable for the following types of leads:

AC and DC leads, which obtain power from other sources or provide power to other equipment, distribution panels, or subsystems; ground or neutrals, which are not grounded internally to the subsystem or equipment being measured; and, for Army and Navy procurements, interconnecting control leads which provide AC and DC power from or to the test sample. The requirement is not applicable for interconnecting signal leads such as a clock, IF audio, firing, digital, radio frequency (RF), and the like, unless otherwise specified by the Command or agency concerned. For Army procurements, the requirement is applicable using the Line Impedance Stabilization Network, as described in MIL-STD-462.

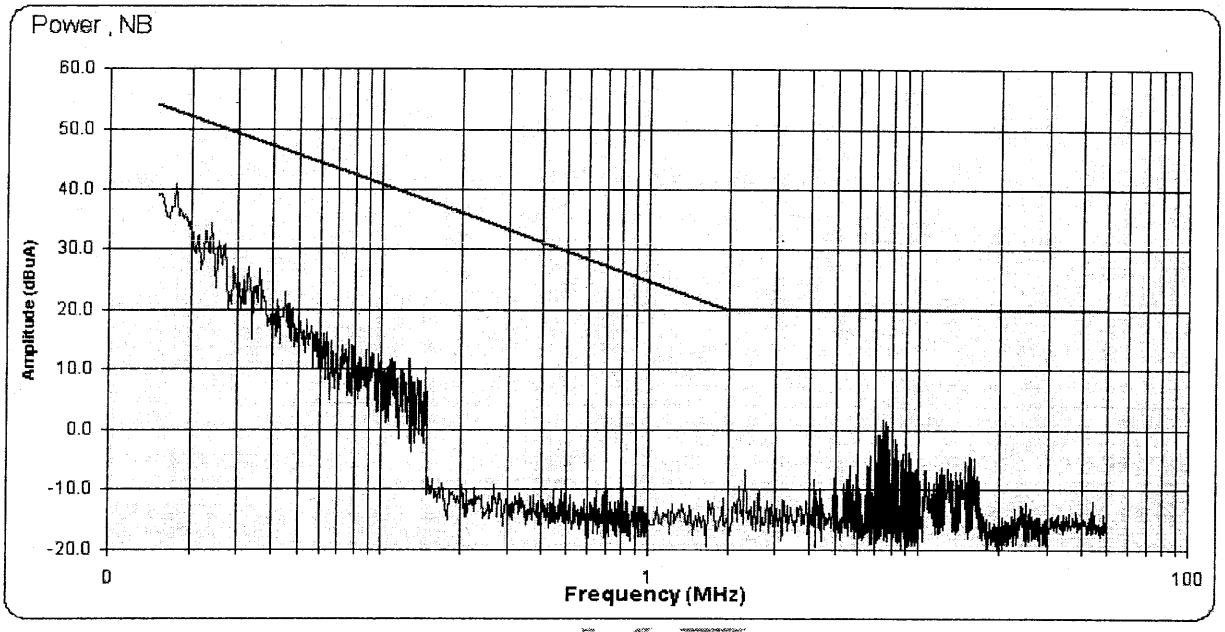
Test Conditions: The Data Collection System used the current probe to measure the conducted emissions on each phase and/or neutral of the input power. LISNs were placed in series with the power line. The system scanned the applicable frequency range and produced graphical and tabular data identifying the largest signals with respect to the applicable limits. All correction factors of the test setup such as cable loss and transducer correction factors are accounted for in the Data Collection System Software. All cables were elevated 5 cm from the ground plane with standoffs.

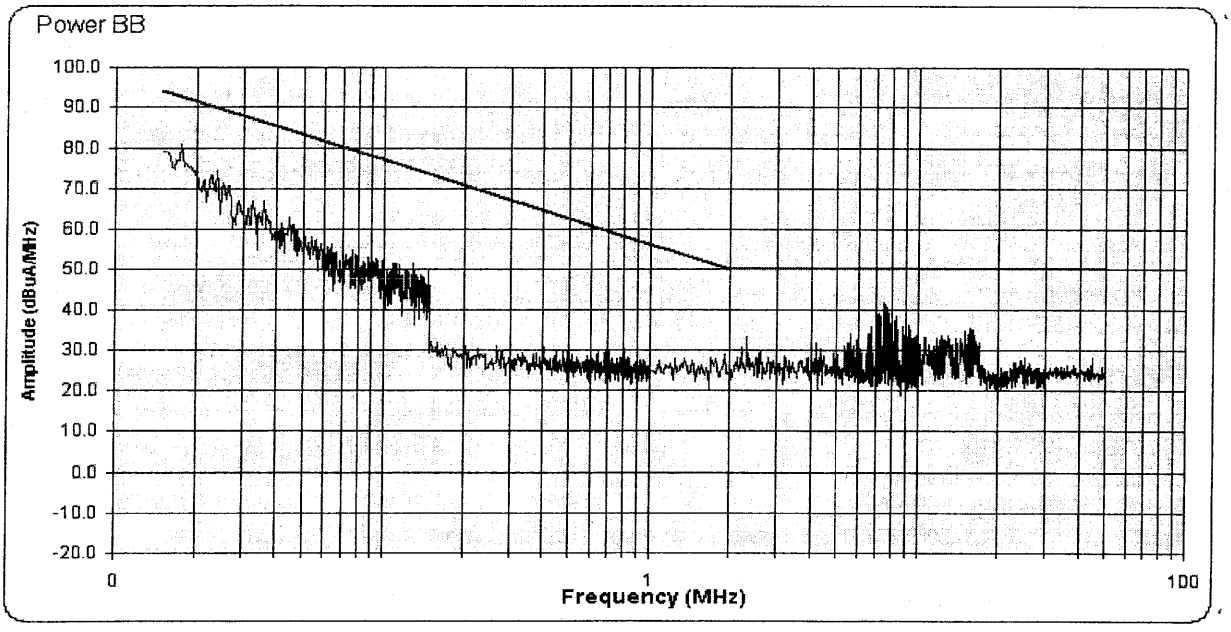
Test Results: The EUT was found compliant with the specified CE03 Conducted Emissions, Power and Interconnecting Leads (0.015 to 50 MHz) limits. Test result details appear on following pages.

Test Engineer(s): Asad Bajwa

Test Date(s): 12/09/03

CE03, Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz, continued





CE03, Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz, continued

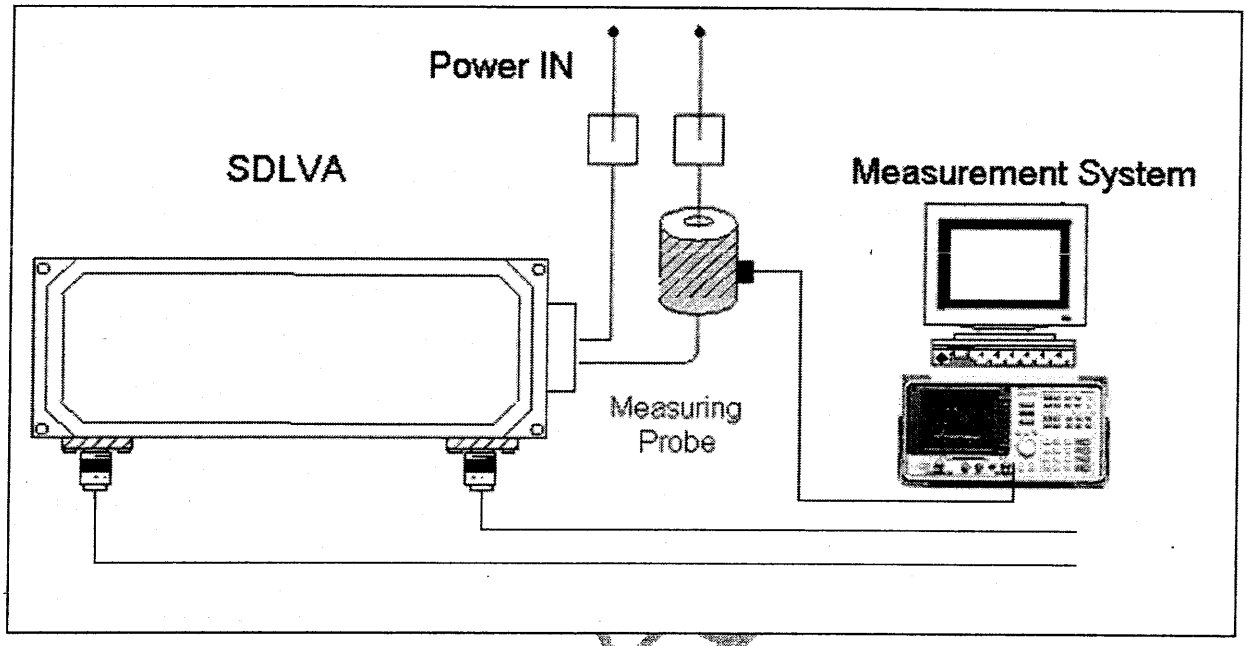
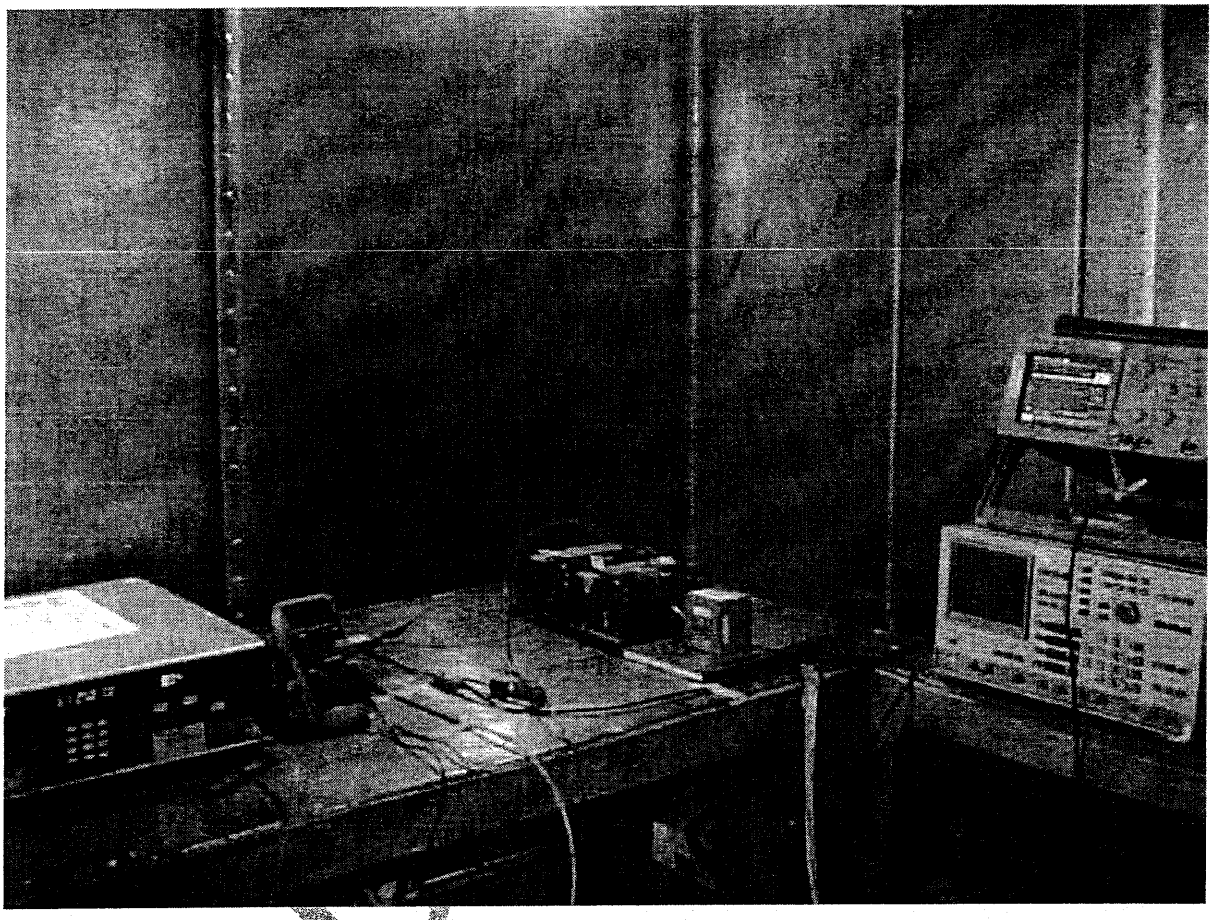


Figure 2. CE03, Setup Block Diagram

CE03, Conducted Emissions, Power and Interconnecting Leads, 0.015 to 50 MHz, continued



Photograph 1. CE03 Conducted Emissions, Power and Interconnecting Leads (0.015 to 50 MHz) Test Setup

B. CS01, Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz

Test Requirement(s): This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem. This requirement is not applicable within ±5 percent of the power frequency (ies). For Navy procurements, this requirement may be deleted for AC leads, with the approval of the Command or agency concerned, if no circuit within the equipment or system is more sensitive that 100 milliVolts (mV). For equipment and subsystems procured solely for Army use, this requirement is applicable for DC leads only.

Test was performed at Navy - shipboard below deck limits.

Test Conditions: The Data Collection System used the "Current Injection Probe" to inject the conducted signals on each phase and or neutral of the input power. LISNs were placed in series with the power line. The system swept the applicable frequency range. All cables were elevated 5 cm from the ground plane with standoffs.

Test Results: The EUT was found compliant with the specified CS01 Conducted Susceptibility, Power Leads (30 Hz to 50 kHz) limits. Test result details appear on following pages.

Test Engineer(s): Asad Bajwa

Test Date(s): 12/08/03

CS01, Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz, continued

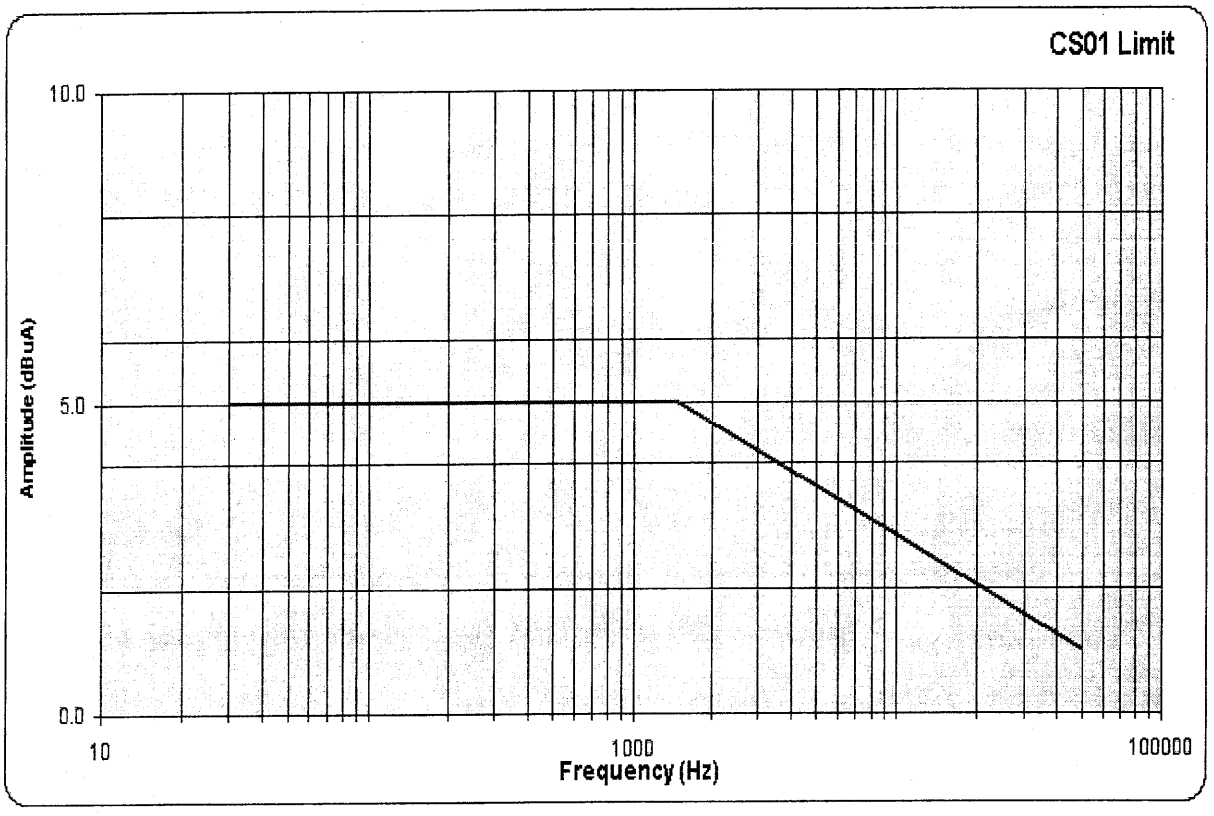


Figure 3. Limit for CS01

CS01, Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz, continued

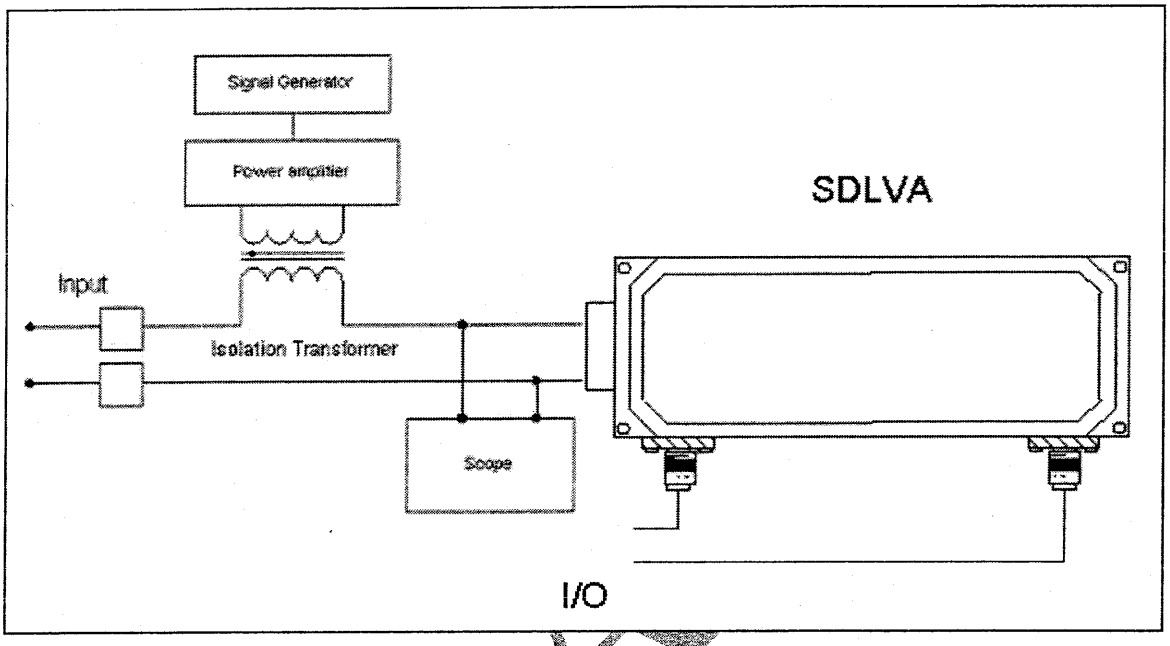
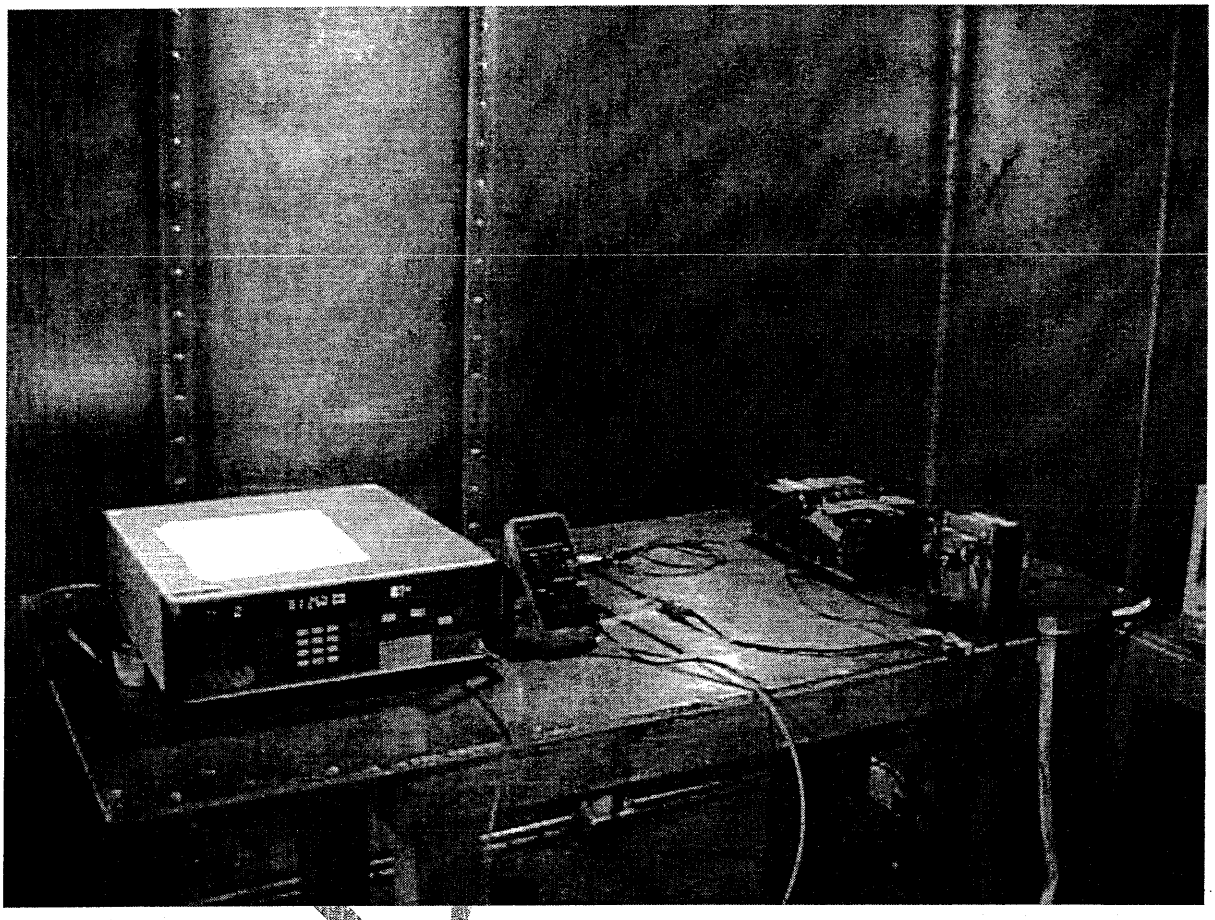


Figure 4. CS01, Setup Block Diagram

CS01, Conducted Susceptibility, Power Leads, 30 Hz to 50 kHz, continued



Photograph 2. CS01 Conducted Susceptibility, Power Leads (30 Hz to 50 kHz) Test Setup

C. CS02, Conducted Susceptibility, Power Leads, 50 kHz to 400 MHz

Test Requirement(s): This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem. This requirement is not applicable within ±5 percent of the power frequency (ies). For Navy procurements, this requirement may be deleted for AC leads, with the approval of the Command or agency concerned, if no circuit within the equipment or system is more sensitive that 100 milliVolts (mV). For equipment and subsystems procured solely for Army use, this requirement is applicable for DC leads only.

The test sample shall not exhibit any malfunction, or degradation of performance, or deviation from specified indications beyond the tolerances indicated when subjected .to 1 volts from a 50 ohm source. Test was performed at Navy - shipboard below deck limits.

Test Conditions: The Data Collection System used the "Current Injection Probe" to inject the conducted signals on each phase and or neutral of the input power. LISNs were placed in series with the power line. The system swept the applicable frequency range. All cables were elevated 5 cm from the ground plane with standoffs.

Test Results: The EUT was found compliant with the specified CS02 Conducted Susceptibility, Power Leads (50 kHz to 400 MHz) limits. Test result details appear on following pages.

Test Engineer(s): Asad Bajwa

Test Date(s): 12/08/03

CS02, Conducted Susceptibility, Power Leads, 50 kHz to 400 MHz, continued

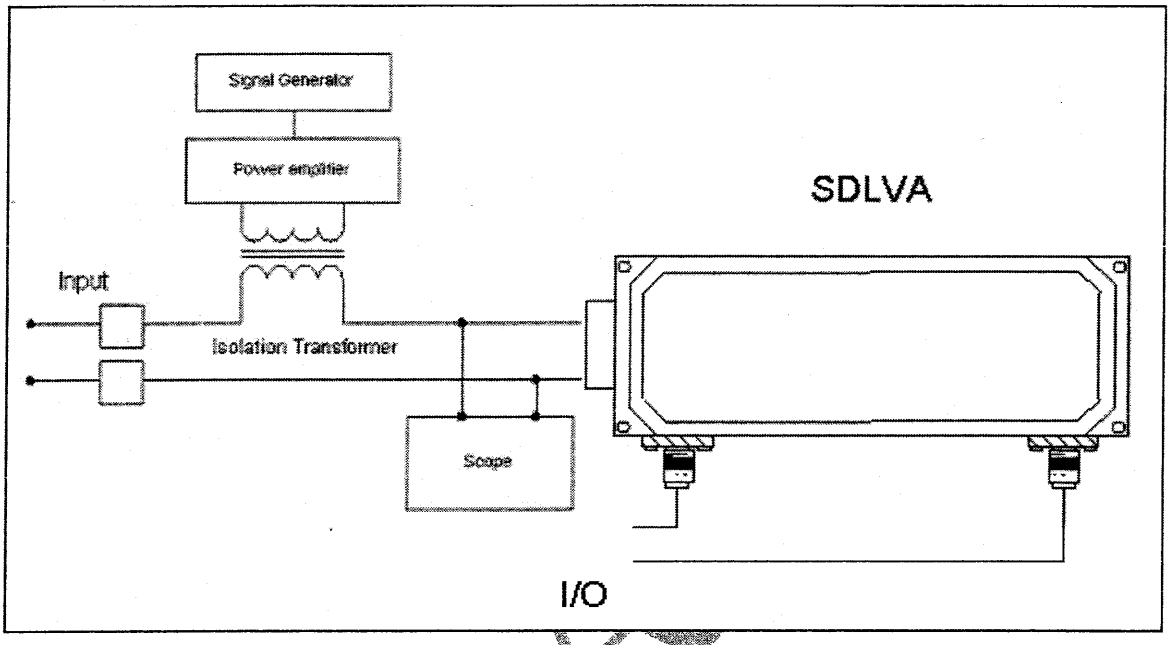
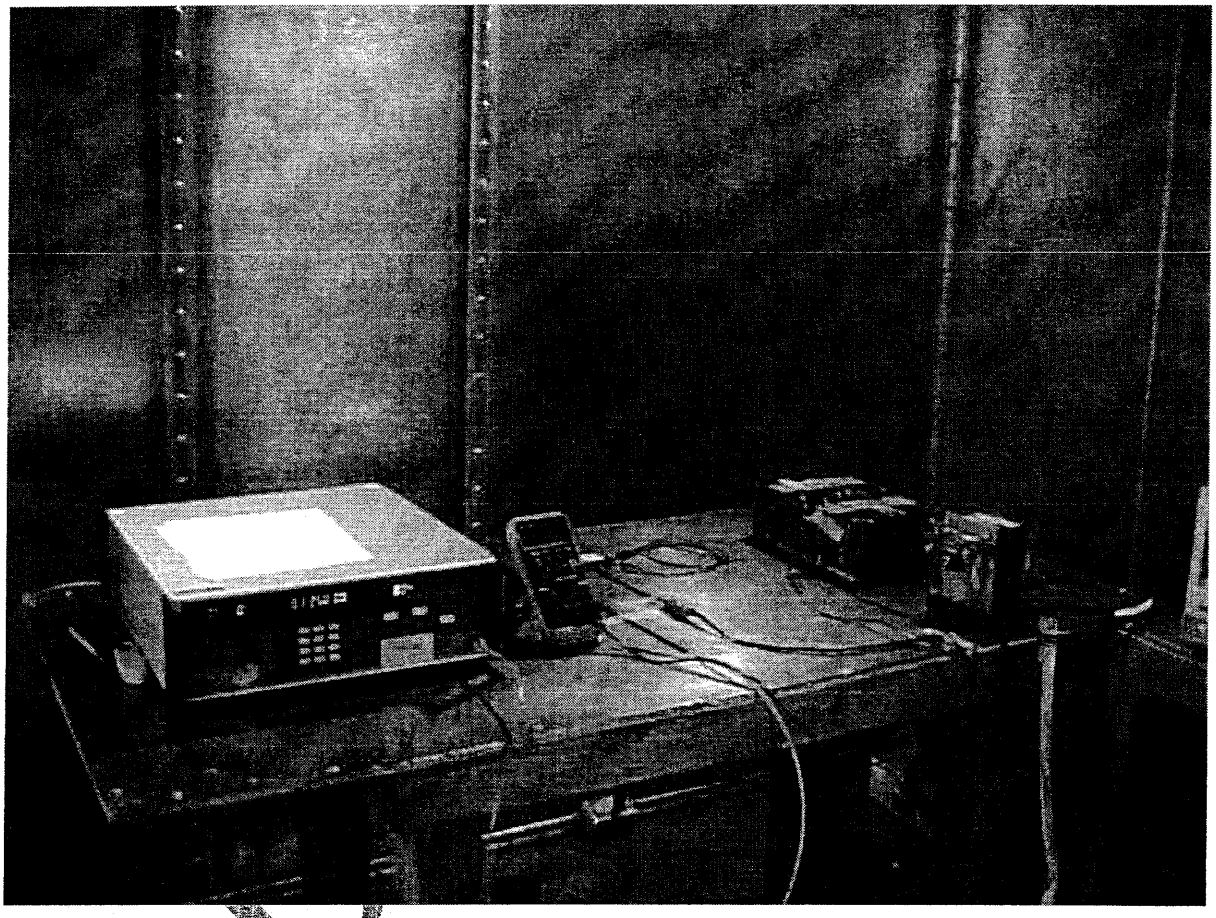


Figure 5. CS02, Setup Block Diagram

CS02, Conducted Susceptibility, Power Leads, 50 kHz to 400 MHz, continued



Photograph 3. CS02 Conducted Susceptibility, Power Leads (30 Hz to 50 kHz) Test Setup

D. CS04, Undesired Signal Rejection

Test Requirement(s): This requirement is applicable to receiving equipment and subsystems, such as receivers, RF amplifiers, transceivers, and the like. The applicable frequency range for this requirement is dependent on the operating frequency of the test sample as specified in MIL-STD-462.
Test was performed at Navy - shipboard below deck limits.

Test Conditions: The Data Collection System used the "Current Injection Probe" to inject the conducted signals on each phase and or neutral of the input power. LISNs were placed in series with the power line. The system swept the applicable frequency range. All cables were elevated 5 cm from the ground plane with standoffs.

Test Results: The EUT was found compliant with the specified CS04 Conducted Susceptibility, undesired Signal rejection limits. Test result details appear on following pages.

Test Engineer(s): Asad Bajwa

Test Date(s): 12/08/03

CS04, Undesired Signal Rejection, continued

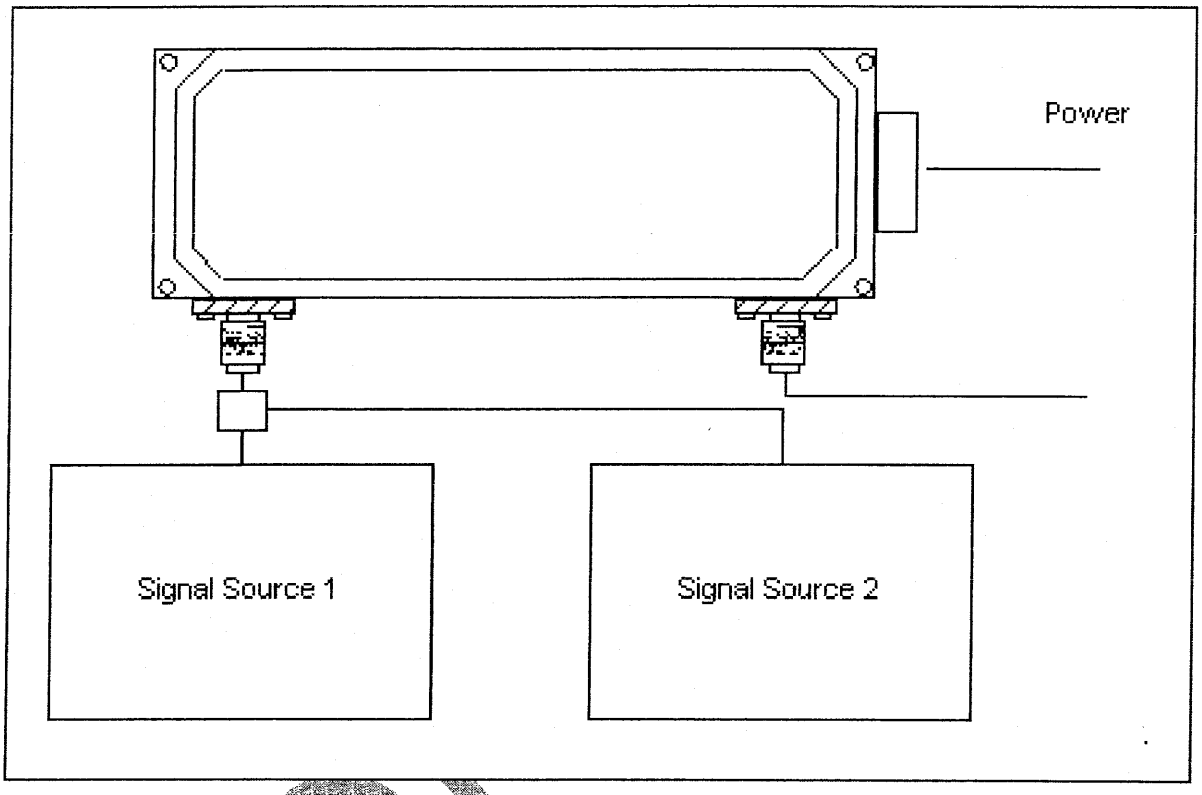
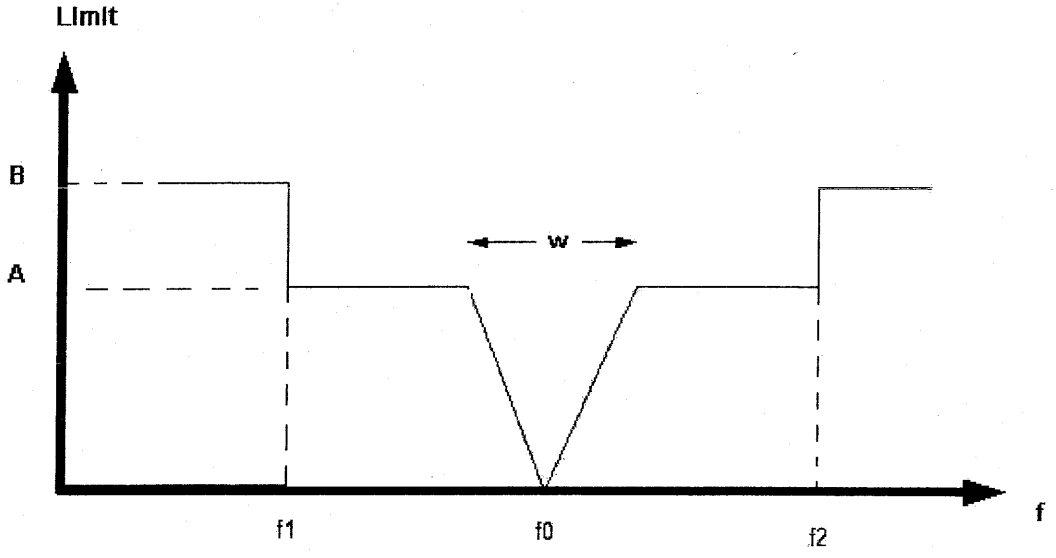


Figure 6. CS04, Setup Block Diagram

CS04, Undesired Signal Rejection, continued



f_0 = Receiver tuned frequency or band center for amplifiers.

f_1 = Lowest tunable frequency of receiver band in use or the lowest frequency of amplifier passband.

f_2 = Highest tunable frequency of receiver band in use or the highest frequency of amplifier passband.

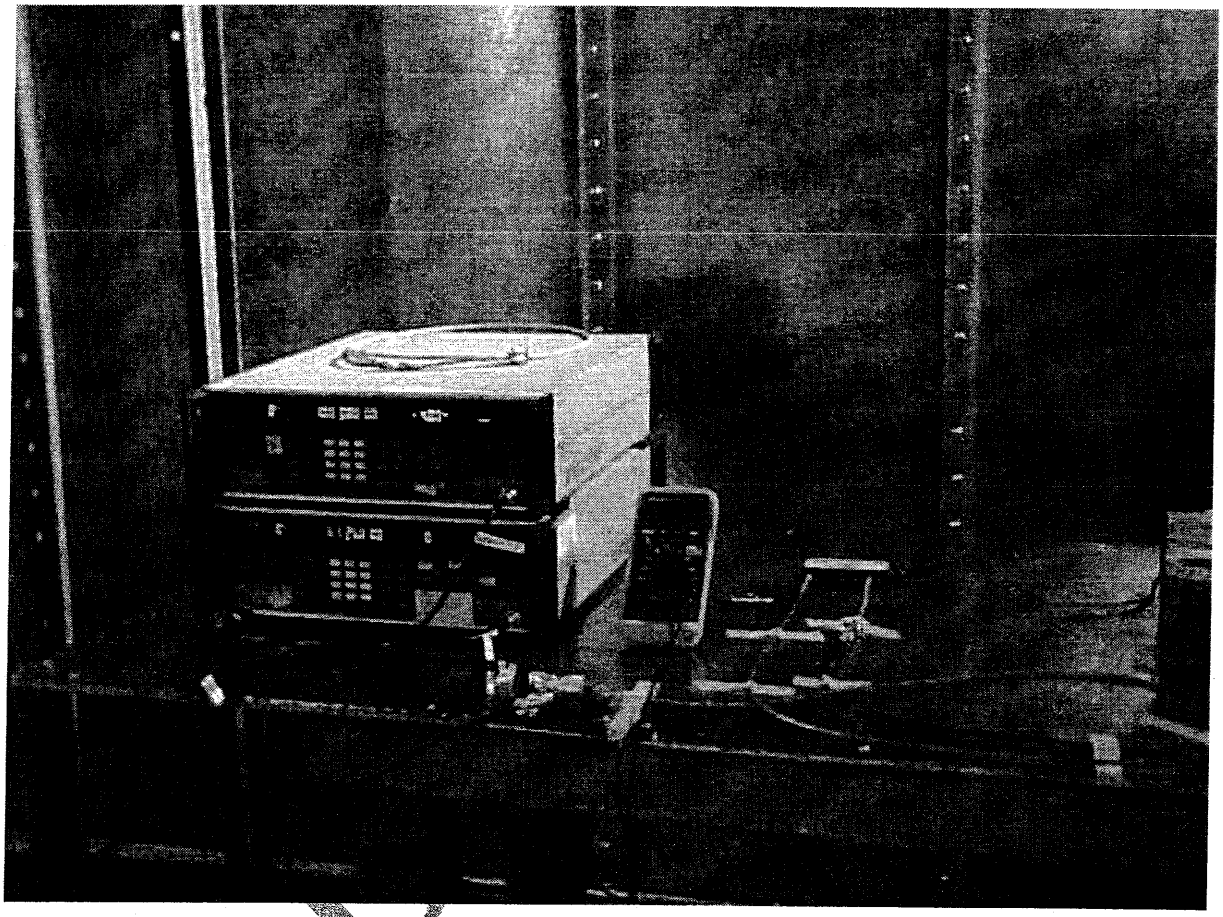
W = Bandwidth between the 80 dB points of the receiver selectivity curve as defined in the test sample's technical requirements or the control plan.

Limits:

1. The limit at A is 80 dB above the input level required to produce the standard reference output. (This limit shall not be used for amplifiers)
2. The limit at B shall be set as follows:
   a. Receivers: 0 dBm applied directly to the receiver input terminals.
   b. Amplifiers: The limit shall be as specified in the test sample's technical requirement or control plan. If no limit is defined in the above documents, the 0 dBm value shall be used.

Figure 7. Limit for CS04

CS04, Undesired Signal Rejection, continued



Photograph 4. CS04, Undesired Signal Rejection

E. CS06, Conducted Susceptibility, Spikes, Power Leads

Test Requirement(s): This requirement is applicable to equipment and subsystem AC and DC power leads, including grounds and neutrals which are not grounded internally to the equipment or subsystem.
Test was performed at Navy - shipboard below deck limits.

Test Condition: The EUT and the spike generator were connected as shown in the diagram below. The output waveform of the spike generator was verified using the oscilloscope. Synchronization and triggering was used to position the spike to the specific test sample signal position to produce maximum susceptibility. Positive and negative, single and repetitive (10pps) spikes were applied to the EUT for the time duration as specified in MIL-STD-461/462 standard. Spikes were synchronized to the power line frequency and position on each 90-degree phase position for a period of 5 minutes.

Spike #1, E_1 = 200V t_1 = 10 µSec

Spike #2, E_2 = 200V t_2 = 0.15 µSec

Test Results: The EUT was found compliant with the specified CS06 Conducted Susceptibility, Spikes, Power Leads when tested for the levels specified in the standard. Test result details appear on following pages. No anomalies were observed.

Test Engineer(s): Asad Bajwa

Test Date(s): 12/09/03

CS06, Conducted Susceptibility, Spikes, Power Leads, continued

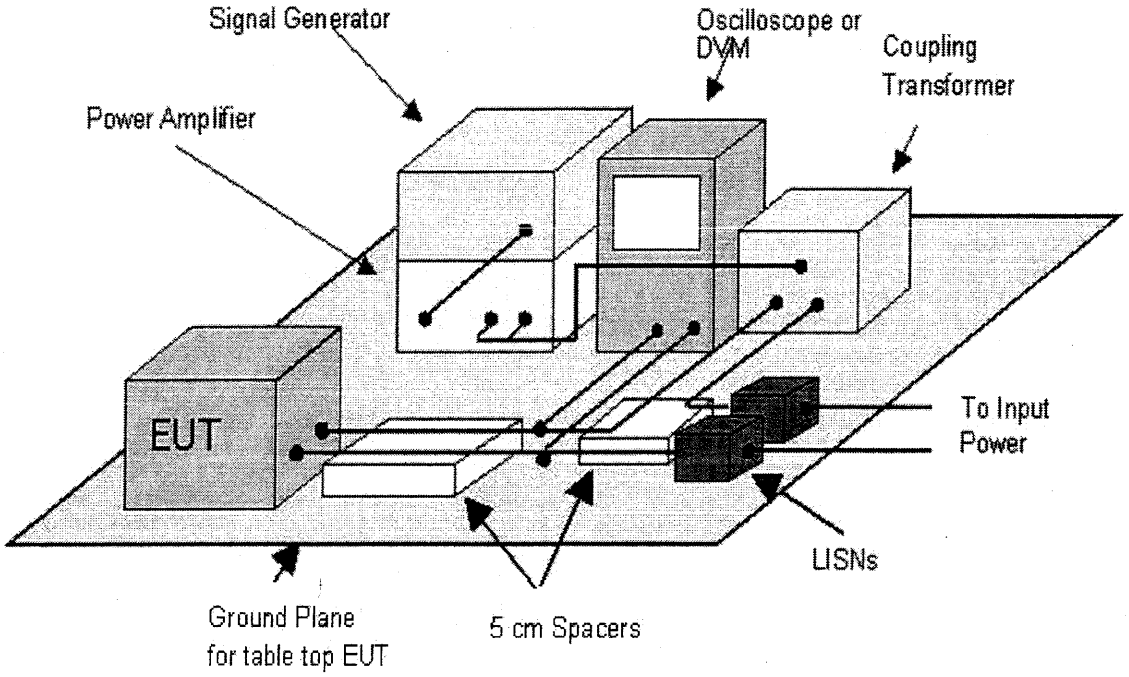
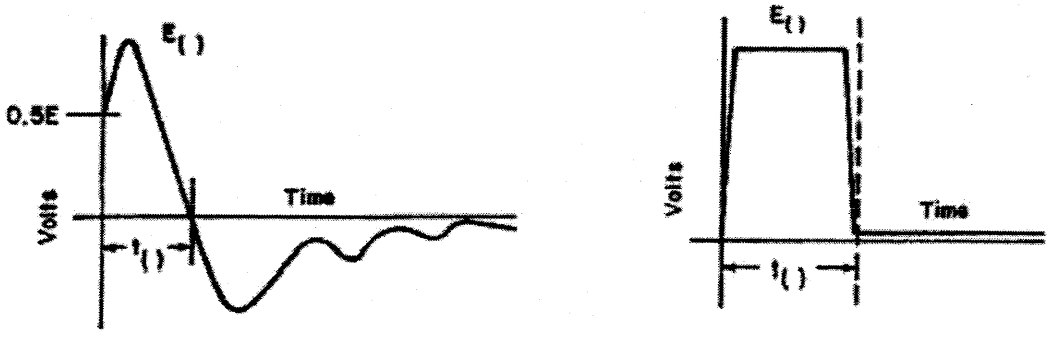


Figure 8. CS06, Setup Block Diagram

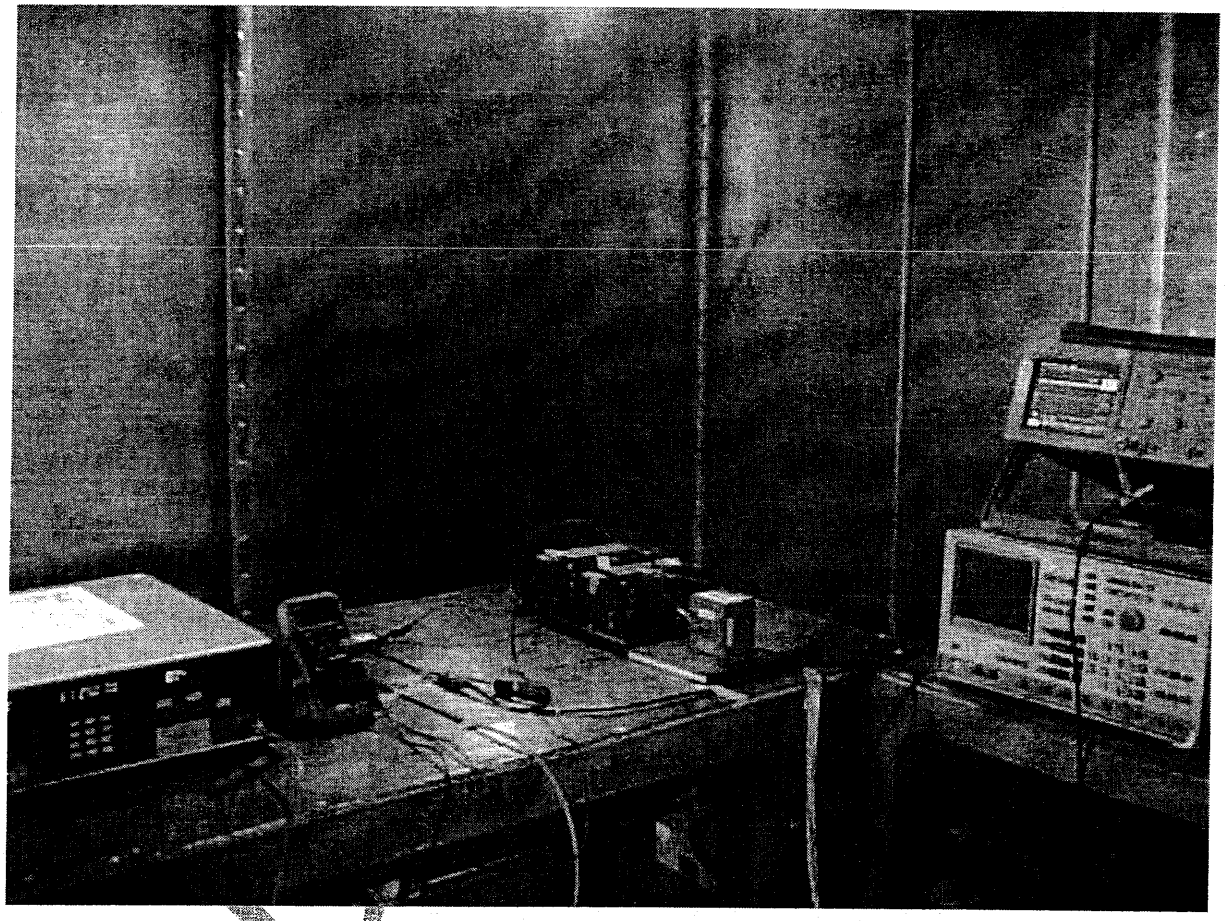
CS06, Conducted Susceptibility, Spikes, Power Leads, continued



NOTE: The test sample shall be subjected to the spike(s) with the waveform shown and with the specified voltage(s) and pulsewidth(s).

Figure 9. CS06, Acceptable Waveshapes

CS06, Conducted Susceptibility, Spikes, Power Leads, continued



Photograph 5. CS06 Conducted Susceptibility, Spikes, Power Leads Test Setup

IV. Electromagnetic Compatibility Radiated Emission Criteria

A. RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz

Test Requirement(s): This requirement is applicable for radiated emissions from equipment and subsystems, cables (including control, pulse, IF, power, and antennas transmission lines) and interconnecting wiring of the test sample; for narrowband, it applies at the fundamental frequencies and all spurious emissions, including harmonics, but does not apply to radiation from antennas. This requirement is applicable for broadband emissions from 14 kHz to 1 GHz and for narrowband emissions from 14 kHz to 18 GHz.

Test was performed at Navy - shipboard below deck limits.

Test Conditions: The EUT was tested within the anechoic chamber at MET Laboratories. The receiving antennas were set up perpendicular to and 1 m away from the EUT.

Test Procedure: The method of testing, test conditions, and test procedures of MIL-STD-461C were used. The EUT was examined by using various hand held EMI probes and broadband antennas to locate the area of highest emissions. Each antenna was positioned one meter away from the EUT at a height of one meter, parallel to the area of highest emissions.

The EUT was operated for sufficient period of time before stating the test and the test was performed in accordance with MIL-STD-461C. The data collection system scanned the frequency range of 14 kHz - 30 MHz using the active rod antenna. The biconical antenna was used for the frequency range of 30 MHz - 1 GHz. The Horn antenna was used for the frequency range of 1 GHz - 18 GHz. For frequencies above 30 MHz, the test was performed with the antennas positioned horizontally and vertically.

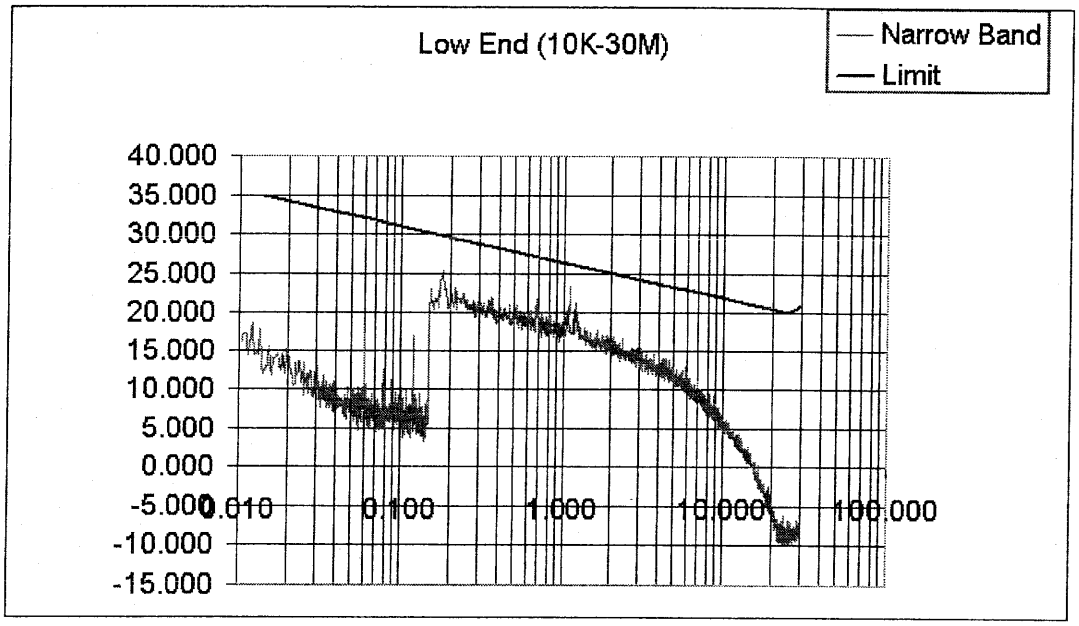
Test Results: The EUT ***was compliant*** with the specified RE02 Radiated Emissions, Electric Field, and 14 kHz to 18 GHz. Test result details appear on following pages. Refer to Section D for modifications made to EUT to achieve compliance.

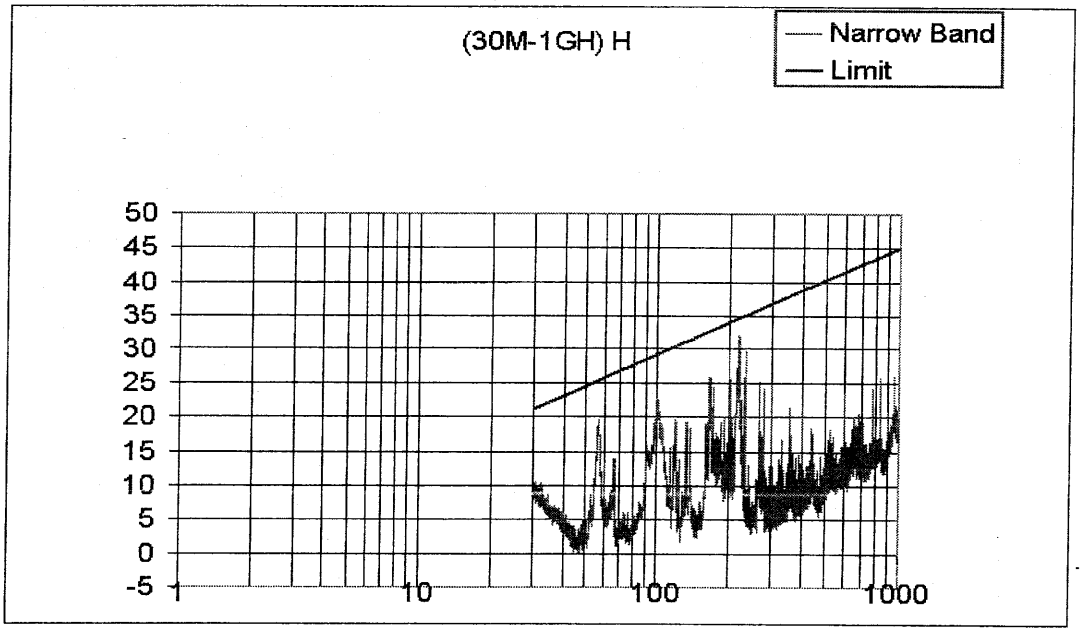
Test Engineer(s): Asad Bajwa

Test Date(s): 12/11/03

RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, continued

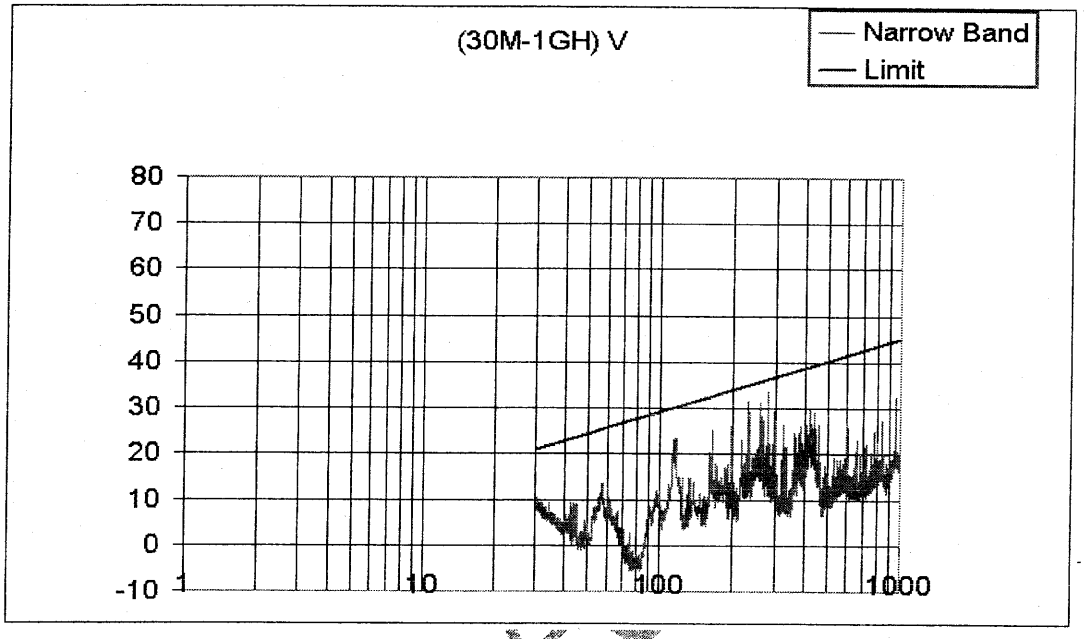
Narrowband Plots

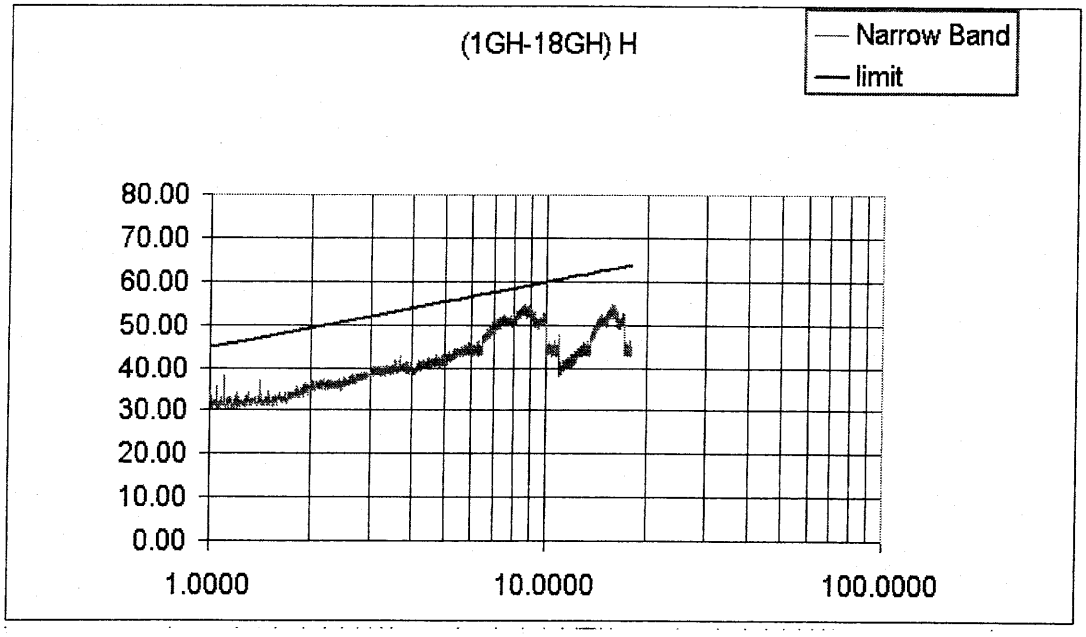




RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, continued

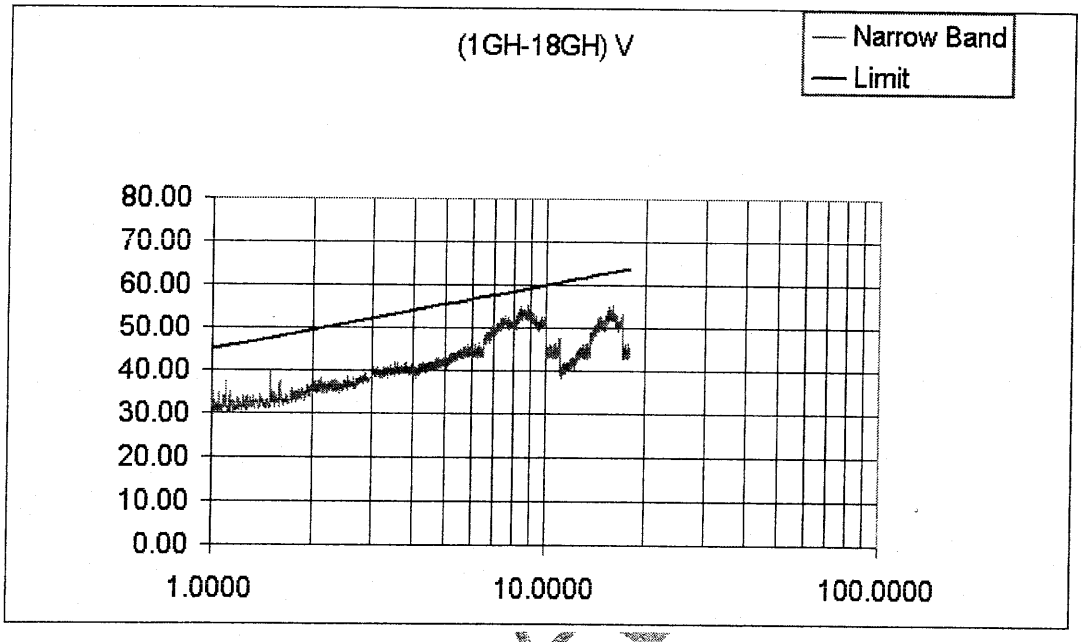
Narrowband Plots, cont.





RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, continued

Narrowband Plots, cont.



RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, continued

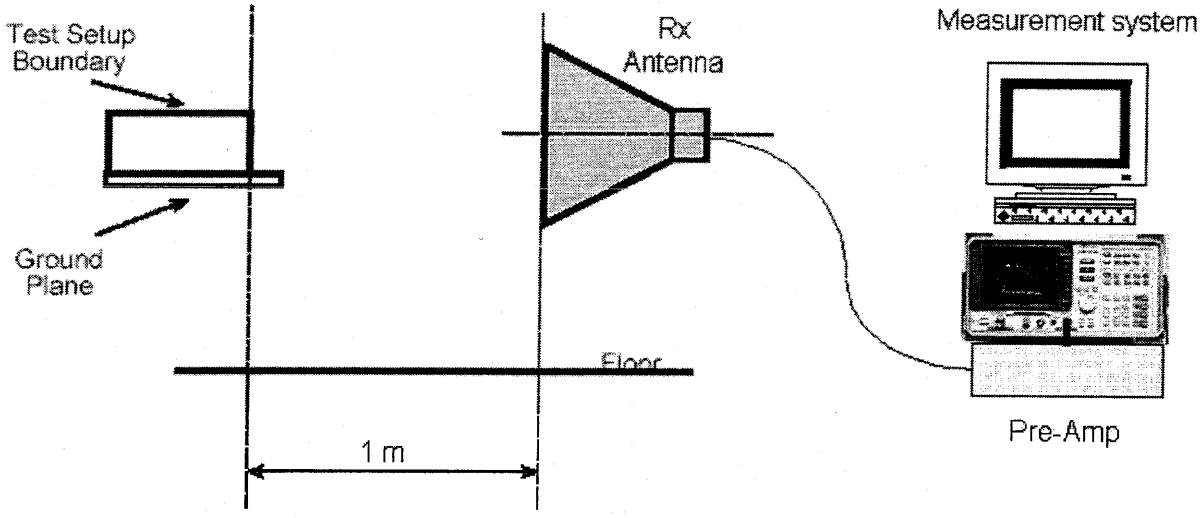
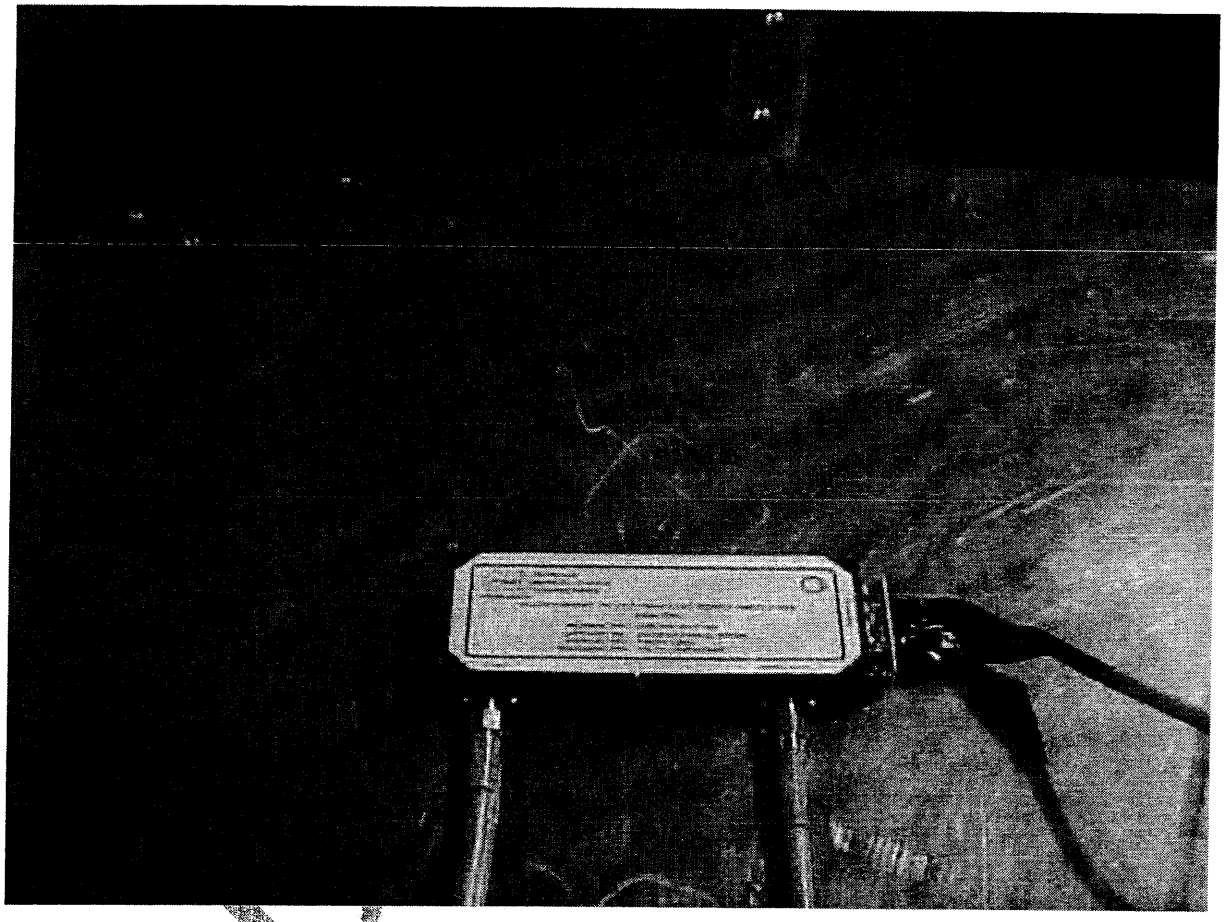


Figure 10. RE02, Setup Block Diagram

RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, continued



Photograph 6. RE02, Radiated Emissions, Electric Field, 14 kHz to 18 GHz, Test Setup

V. Test Equipment

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ANSI/NCSL Z540-1-1994 and ANSI/ISO/IEC 17025:2000.

Test Name: CE03					Test Date(s): 12/09/03
MET Asset #	Nomenclature	Manufacturer	Model	Last Cal Date	Cal Due Date
Test Equipment not available at this time. Will be completed at the time of final issue.					
Test Name: CS01					**Test Date(s):** 12/08/03
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
Test Name: CS02					**Test Date(s):** 12/08/03
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
Test Name: CS04					**Test Date(s):** 12/08/03
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
Test Name: CS06					**Test Date(s):** 12/09/03
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**
Test Name: RE02					**Test Date(s):** 12/11/03
MET Asset #	**Nomenclature**	**Manufacturer**	**Model**	**Last Cal Date**	**Cal Due Date**

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report