# MEASUREMENT AND TECHNICAL REPORT ON THE MARCONI COMMERCE SYSTEMS TRIND™ TIRIS™ RADIO FREQUENCY IDENTIFICATION DEVICE

**Southwest Research Institute**
**6220 Culebra Road**
**San Antonio, Texas 78228-0510**

**Project 10-3084.01.006**
**Report Number EMCR 00/062**

**Prepared for:**

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**P.O. Box 22087**
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**Dave Carmony**

**August 2000**

*The results of this test report apply only to the specific samples tested. If the manufacturer extends the test results to apply to other samples of the same model, or from the same lot or batch, the manufacturer should ensure the additional samples are manufactured using identical electrical and mechanical components.*



| **Reviewed by:** | **Approved by:** |
|---|---|
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**Communications Engineering Department**

# TABLE OF CONTENTS

**Page**

## LIST OF TABLES

# 1.0 GENERAL INFORMATION

## 1.1 Product Description

The TRIND™ TIRIS™ (Part No. C00011-xxx) is a Radio Frequency Identification Device (RFID) which is designed for use in conjunction with both battery-powered vehicle transponders (Texas Instruments Part No. 9795101, FCC ID: A92VEHICLE) and handheld battery-less transponders (Texas Instruments RI-TRP-Series such as a key ring tag). The vehicle transponder is mounted in the back window of an automobile and the handheld transponder is carried by the user. The transmitter portion of the TRIND™ TIRIS™ operates at 134.2 kHz and is subject to FCC Part 15, Subpart C, "Intentional Radiator," paragraphs 15.207 and 15.209. The digital electronics portion of the TRIND™ TIRIS™ is subject to FCC Part 15, Subpart B, "Unintentional Radiator," paragraph 15.109, under the Class A limits and as such, the TRIND™ TIRIS™ is incorporated into an application that is subject to Class A limits. Attachment 1 contains a detailed technical description and functionality of the TRIND™ TIRIS™ and its components. Photos of the TRIND™ TIRIS™ are provided in Appendix D.

## 1.2 Related Grants

A vehicle transponder (FCC ID: A92VEHICLE) and a handheld battery-less transponder (Texas Instruments RI-TRP-Series key ring tag) were used to exercise the TRIND™ TIRIS™ during the intentional radiator radiated and conducted tests. The microreader module (Texas Instruments part No. RI-STU-MRD1) which provides the 134.2 kHz fundamental emission is a component of the TRIND™ TIRIS™ and has previously received certification under FCC ID: A92MICRO.

## 1.3 Tested System Details

The TRIND™ TIRIS™ is intended to be mounted into an enclosure such as a fueling dispenser and includes two overhead 134.2 kHz low Q transmit antennas with tuning boards, a low frequency (LF) transmitter module (which includes two remote 134.2 kHz RF transmitters), a data control board, a UHF 902.858 MHz receiver, two UHF receiving antennas, two 134.2 kHz LF PCA (printed circuit assembly) antennas, and two light microreader/LED bezel assemblies. These components are assembled per the drawings in Attachment 1.

The TRIND™ TIRIS™ operates from 120 VAC converted to 22.5 Vdc and 5 Vdc using power supply Part No. T20314-G1. The system description, functionality and block diagrams are located in Attachment 1. Cabling is denoted in the dispenser block diagram located in Attachment 1. The components on the system are listed below in Table 1.1.

**TABLE 1.1**
**TRIND™ TIRIS™ COMPONENTS**

| Component Description | Part Number |
|---|---|
| TIRIS Data Control Board with UHF Receiver DCB 1<br>TIRIS Data Control Board with UHF Receiver DCB 2 | Q13563-04<br>Q13563-01 |
| TIRIS 134 kHz Transmitter Board with Remote Radio Frequency Module (two each) and Carrier Board | Q13579-01 |
| TIRIS 902-928 MHz Receiver Board | RI-RFM-HREA (TI) |
| Marconi Power Supply | T20314-G1 |
| TRIND Gateway Board | T20128-GX |
| Antenna Specialist 902-928 MHz Receive Antenna (.50”x3.0” PCB) | Q13851-01 |
| LF Bezel Antennas (2 Per Installation) | T20524-G1 |
| Overhead Antenna Tuning Board | T20579-GX |
| Light/Microreader Board | T20601 (Advantage)<br>M001218 (Encore) |

The TRIND™ TIRIS™ is used with Marconi Commerce Systems Advantage, MPD-3, and Encore line of fuel dispensers. Each type of fuel dispenser uses an identical TRIND™ TIRIS™ system with the exception of slight differences in the overhead antennas, door antennas, and tuning board. The following TRIND™ TIRIS™ configurations were tested.

**TABLE 1.2**
**ANTENNA CONFIGURATIONS TESTED**

| Dispenser | Overhead Antenna (for car tag) | Door Antenna (for hand-held tag) | Tuning Board Note 1 |
|---|---|---|---|
| Advantage and MPD-3 | (2) 9.5” x 42.34” single-loop antenna, 3/8" diameter aluminum tubing (tested configuration had this antenna on one side) | (2) 5.2” x 10.2” 134 kHz antennas mounted to the plastic bezel doors | T20579 bareboard<br>C1= 15nF<br>C2= 10nF<br>C3= 1800pF |
| | (2) 9.5” x 30.34” single-loop antenna, 3/8" diameter aluminum tubing (tested configuration had this antenna on other side) | | Same as above except C3= 3900pF |
| | No overhead antenna (hand-held only configuration). “Dummy” resistive loads were connected to the Transmitter Board outputs. | | N/A |
| Encore | 9.5” x 35.42” single-loop antenna, 3/8" diameter aluminum tubing | (2) 3.5” x 10.25” 134 kHz antennas mounted to the plastic bezel doors | Same as above except C3= 2700pF |
| | No overhead antenna (hand-held only configuration). “Dummy” resistive loads were connected to the Transmitter Board outputs. | | N/A |

Note 1: Each overhead antenna size variation uses the same PC board-based tuning circuitry with the only difference being capacitor values which customizes that board for the inductance required for a given antenna size/geometry.

## 1.4 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4-1992, and the limits prescribed in CFR 47, FCC 15.207, 15.109, and 15.209. Radiated testing was performed at antenna-to-EUT distances of 3, 10, and 30 meters.

A test fixture for the TRIND™ TIRIS™ system was used during radiated emissions testing to replicate the actual installation of the system in a high hose fueling dispenser (gas pump) with the 134kHz transmit antenna at the heights they would be in the field. The test fixture was constructed from materials which would not provide additional shielding (wood & PVC pipe). Pre-compliance testing demonstrated that this arrangement is "worst case" with respect to the radiated emissions limits, particularly when measuring the harmonics of the 134 kHz intentionally radiated signal at close distances (3 meters). Photographs of the radiated emissions test setup showing the test fixtures are provided in Appendix E.

## 1.5 Test Facility

The Open Area Test Site (OATS) and the Radiated/Conducted Measurement Facility used to collect data are located at Southwest Research Institute, 6220 Culebra Road, San Antonio, Texas. Details concerning the test site and measurement facility are found in a letter from SwRI to the FCC dated 23 May 2000, which is on file with the FCC Laboratory Division in Columbia, Maryland. On June 2, 2000, the FCC approved the sites for the purpose of providing test results for submission with equipment authorization applications under the Commission's Equipment Authorization Program.

# 2.0 PRODUCT LABELING

## 2.1 FCC ID Label

The FCC ID label is shown in the drawing in Attachment 3.

## 2.2 Location of Label on EUT

The location of the label is shown in the drawing in Attachment 3.

## 2.3 Label for the Exterior of Devices Incorporating the EUT

The TRIND™ TIRIS™ will be incorporated in other devices such as a fuel dispenser (e.g., a fueling dispenser (gasoline pump) employed at a service station). A label will be supplied with the TRIND™ TIRIS™ for placement on the exterior of the device in which the equipment is incorporated. This label is shown in a drawing in Attachment 3.

## 2.4 Supplemental Information to be in the Reader Manual

In addition to reiteration of required information as on intentional radiator, in keeping with sections 15.21 and 15.105 of the FCC rules, the manual supplied with the TRIND™ TIRIS™ will also include the following admonitions:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference; in which case, the user will be required to correct the interference at his own expense.

NO MODIFICATIONS: Modifications to this device shall not be made without the written consent of Marconi Commerce Systems. Unauthorized modifications may void the authority granted under Federal Communications Commission Rules permitting the operation of this device.

# 3.0 SYSTEM TEST CONFIGURATION

## 3.1 Justification

Radiated tests were performed on the TRIND™ TIRIS™ intentional radiator from 134 kHz to 30 MHz for the highest fundamental and harmonics. Three polarizations of the receive loop antenna were used. Radiated tests were performed up to 1 GHz for spurious emissions related to the digital electronics portion of the unit. Both vertical and horizontal polarizations of the receive dipoles were tested. Radiated signature scans were made at 3 meters in a shielded anechoic chamber.

Conducted tests were performed on the AC power of the TRIND™ TIRIS™ from 450 kHz to 30 MHz.

## 3.2 EUT Exercise

The TRIND™ TIRIS™ is powered by 120VAC. During conducted tests, the unit was exercised by establishing the interrogation reply sequence using handheld transponders. Dummy loads were used in place of the overhead antennas during conducted tests.

During radiated tests of the intentional radiator, the unit was exercised by establishing the interrogation reply sequence using both vehicle and handheld transponders.

For radiated tests of the digital electronics, the 134 kHz overhead antenna transmitter and the microreader transmitter were disabled. L2 was lifted from the Vcc side to disable the microreader. The overhead antenna transmitters were disabled by removing the fuse on each of the LF transmitter modules' carrier boards, which removed Vcc from the final stage of the transmitter.

## 3.3 Special Accessories

In order to meet the FCC radiated limit for the spurious emissions, three ferrite beads were added to the TRIND™ TIRIS™. A ferrite bead (Fair-Rite p/n 0431167281) was installed on each of the two Light/MicroReader data/power cables. For the Advantage configuration a ferrite bead (Fair-Rite p/n 0444164181) was also installed on the overhead antenna cable assembly at the point where the cable exits the card cage.

In order to meet the FCC limits for conducted emissions shielded power cables were used for both the Encore and the Advantage configurations. Additionally, the Encore configuration, when tested with the digital circuit board, DCB 1, required ferrites on both cable harnesses.

## 3.4 Equipment Modification

The need for special accessories noted in 3.3 above was determined during equipment testing.

## 3.5 Configuration of Tested System

Refer to Figure 4.1 for block diagram of tested configuration.

## 4.0 BLOCK DIAGRAM OF THE TRIND™ TIRIS™ SYSTEM

A block diagram of the TRIND™ TIRIS™ system is provided in Attachment 1.

## 5.0 CONDUCTED AND RADIATED MEASUREMENT PHOTOS

Refer to Appendix E for photographs of the conducted and radiated test setups.

# 6.0 CONDUCTED EMISSION DATA

## 6.1 Conducted Measurement Data

Two configurations of the TRIND™ TIRIS™ system were tested for conducted emissions. Both the Advantage/MPD-3 system and the Encore system were tested for conducted emissions in the "no overhead antenna" (hand-held only configuration - see Table 1.2). In accordance with C63.4, Appendix I, "dummy" resistive loads were connected to the Transmitter Board outputs in place of the overhead antennas. Each TRIND™ TIRIS™ configuration was also tested with two different versions of the Data Control Board, DCB 1 and DCB 2. A complete conducted emissions test was performed with each version of the Data Control Board installed.

The initial step in collecting conducted data was to perform a spectrum analyzer peak scan of the measurement range to determine worst case. A computer-controlled spectrum analyzer was used to produce a peak measurement data plot. Quasi-peak measurements were made on signals that were close to or above the paragraph 15.207 limit. The worst case emission levels are provided in Table 6.1. Appendix A contains conducted emission measurement plots.

**TABLE 6.1**
**WORST CASE CONDUCTED EMISSION LEVELS**

| Judgment: EUT Passed By 0.5 dB | | | | |
|---|---|---|---|---|
| **TRIND™ TIRIS™ Configuration** | **FREQUENCY (MHz)** | **MEASURED LEVEL (dBuV)** | | **LIMIT (dBuV)** |
| | | **LINE** | **NEUTRAL** | |
| Advantage/MPD-3 no overhead antenna – DCB 1 | 0.75 | 43[1] | | 48 |
| | 0.75 | | 43[1] | 48 |
| Advantage/MPD-3 no overhead antenna – DCB 2 | 1.3 | 47.5[1] | | 48 |
| | 18 | | 46.5[2] | 48 |
| Encore no overhead antenna – DCB 1 | 15 | 46.5[1] | | 48 |
| | 16 | | 44[1] | 48 |
| Encore no overhead antenna – DCB 2 | 18 | 47[2] | | 48 |
| | 18.5 | | 45[2] | 48 |

[1] Readings are quasi-peak measurements made with a spectrum analyzer.
[2] Readings are peak measurements made with a spectrum analyzer, which are under the 15.207 (equivalent class B) limit.

## 6.2 Conducted Test Instrumentation

The test instrumentation used to make conducted measurements is given in Appendix C.

# 7.0 RADIATED EMISSION DATA

## 7.1 Configurations Tested

Both the TRIND™ TIRIS™ Advantage/MPD-3 system and the TRIND™ TIRIS™ Encore system were tested for radiated emissions. The Encore system was tested with a DCB 1 (Data Control Board) installed and then the test was repeated with a DCB 2 installed. The Advantage system was also tested first with the DCB 1 installed and then tested again with the DCB 2 installed. Both the Encore and Advantage systems were also tested with the overhead antenna(s) replaced with a dummy load(s) leaving only the hand-held configuration active. All tested configurations are listed in Table 7.1.

As can be seen in the table, full prescans from 134 kHz to 1000 MHz were performed on the Advantage/MPD-3 system with both overhead antennas installed. OATS tests from 30 MHz to 1000 MHz were performed with DCB 2 installed because prescans confirmed the Advantage had higher levels of emissions with DCB 2 installed than it had with DCB 1 installed. Measurements at the OATS of the signals from the printed circuit assembly antennas were made from 134 kHz to 30 MHz, including the measurement of the fundamental emission. During measurement of the printed circuit assembly antenna emissions, the overhead antennas were replaced with a dummy load.

Prescans and OATS testing from 134 kHz to 1000 MHz were performed on the Encore system that uses an overhead antenna. Measurements at the OATS from 134 kHz to 30 MHz, including the measurement of the fundamental emission, were also made on the “no overhead antenna” configuration. All measurements at the OATs were made with DCB 2 installed which had been found to be worse case during the prescans in the anechoic chamber.

**TABLE 7.1**
**CONFIGURATIONS TESTED FOR RADIATED EMISSIONS**

<table>
<tr><th>Dispenser</th><th>Overhead Antenna<br>(for car tag)</th><th>Pre-scan</th><th>OATS</th></tr>
<tr><td rowspan="3">Advantage and MPD-3</td><td>1 ea 9.5” X 42.34” single loop antenna, made from 3/8” diameter tubing mounted on one side.<br>And<br>1 ea 9.5” X 30.34” single loop antenna, made from 3/8” diameter tubing mounted on the other side.<br>With DCB 1</td><td>Full<br>(134 kHz- 1000 MHz)</td><td rowspan="2">During pre scans it was determined that the configuration with DCB 2 installed was the worse case. A full scan from 134.2 kHz to 1000 MHz was performed at the OATs with DCB 2 installed.</td></tr>
<tr><td>1 ea 9.5” X 42.34” single loop antenna, made from 3/8” diameter tubing mounted on one side.<br>And<br>1 ea 9.5” X 30.34” single loop antenna, made from 3/8” diameter tubing mounted on the other side.<br>With DCB 2</td><td>Full<br>(134 kHz- 1000 MHz)</td></tr>
<tr><td>No overhead antenna (hand-held only configuration). “Dummy” resistive loads were connected to the Transmitter Board outputs.</td><td>Bandpass of 134.2 kHz carrier only.</td><td>Partial<br>(134 kHz- 30 MHz)</td></tr>
</table>

**TABLE 7.1 (Cont)**
**CONFIGURATIONS TESTED FOR RADIATED EMISSIONS**

| Dispenser | Overhead Antenna (for car tag) | Pre-scan | OATS |
|---|---|---|---|
| Encore | 1 ea 9.5” X 35.42” single loop antenna, made from 3/8” diameter tubing. *With DCB 1* | Full (134 kHz- 1000 MHz) | During pre scans it was determined that the configuration with DCB 2 installed was the worse case. A full scan from 134.2 kHz to 1000 MHz was performed at the OATs with DCB 2 installed. |
| | 1 ea 9.5” X 35.42” single loop antenna, made from 3/8” diameter tubing. *With DCB 2* | Full (134 kHz- 1000 MHz) | |
| | No overhead antenna (hand-held only configuration). “Dummy” resistive loads were connected to the Transmitter Board outputs. | Bandpass of 134.2 kHz carrier only. | Partial (134 kHz- 30 MHz) |

## 7.2 Radiated Measurement Data

The data below are the corrected highest level EME measurements taken from the radiated data sheets provided in Appendix B. The data sheets include the emission frequencies and the corrected level. An explanation of the field strength calculation is given in paragraph 7.4.

Measurements were made of the fundamental frequency of 134.2 kHz on each of the configurations listed in Table 7.1. Additionally, the spectrum was investigated for harmonics and spurious emissions to 30 MHz at 30 meters. No harmonics or spurious emissions were detected up to 30 MHz on any configuration at 30 meters. The measurement level of the fundamental of each configuration is shown in Table 7.2.

**TABLE 7.2**
**MEASUREMENT OF FUNDAMENTAL FREQUENCY**

**Judgment: EUT Passed by 4.0 dB**

| Configuration | Freq. (kHz) | Corrected Level | | Limit 10 Meters[1] | | Limit 3 Meters[1] | |
|---|---|---|---|---|---|---|---|
| | | Peak dB(uV/m) | Average dB(uV/m) | Peak dB(uV/m) | Average dB(uV/m) | Peak dB(uV/m) | Average dB(uV/m) |
| Advantage 9.5” x 42.34” And 9.5” x 30.34” | 134 | 100.6 | 81.0 | 104 | 85 | N/A | N/A |
| Advantage No OH antenna | 134 | 92.5 | 84.4 | NA | NA | 125 | 105 |
| Encore 9.5” x 35.42” | 134 | 100.3 | 78.1 | 104 | 85 | N/A | N/A |
| Encore No OH antenna | 134 | 88.1 | 77.2 | NA | NA | 125 | 105 |

[1]Limits at 10 and 3 meters are calculated using a 40 dB/decade extrapolation factor, in accordance with FCC Part 15, Subpart C, Intentional Radiator, paragraph 15.31, (f), (2). Fundamental emissions could not be detected beyond the 3 and 10 meter distance.

The spectrum from 30 MHz to 1000 MHz was investigated for spurious emissions. The worst case spurious emission levels, taken from the data sheets in Appendix B, are given in Table 7.3. Prescans revealed emission levels were highest with DCB 2 installed. OATS testing was performed only with DCB 2 installed. Plots of the peak signature scans of the Advantage/MPD-3 9.5" x 42.34" and 9.5x30.34" and Encore 9.5" x 35.42" configurations, with DCB 2 and DCB1 installed are not included in the report but are on file at Southwest Research Institute.

**TABLE 7.3**
**MEASUREMENT OF SPURIOUS EMISSIONS**

| Judgment EUT passed by 2.1 dB | | | | |
|---|---|---|---|---|
| **Configuration** | **Frequency (MHz)** | **Corrected Level [1] dB(uV/m)** | **Limit[2] dB(uV/m)** | **dB under limit** |
| Advantage/MPD-3 | 72.025 | 33.6 | 39 | 5.4 |
| | 48 | 35.8 | 39 | 3.2 |
| | 36 | 36.9 | 39 | 2.4 |
| Encore | 36 | 36.6 | 39 | 2.1 |
| | 103.071 | 38.8 | 43.5 | 4.7 |
| | 108.011 | 36.9 | 43.5 | 6.6 |

[1] All readings are quasi-peak manual measurements made with a receiver.
[2] These emissions are related to the digital electronics and are compared to the 15.109 Class A limit.

The frequency and amplitude stability of the TRIND™ TIRIS™ fundamental emission were verified by varying the AC input voltage between 85% and 115% of the nominal 120 VAC. Both the TRIND™ TIRIS™ Encore and Advantage/MPD-3 configurations were tested. The amplitude of the fundamental emission changed by a maximum of 0.4 dB. The frequency of the fundamental emission changed by a maximum of 1000 Hz.

### 7.3 Test Instrumentation for Radiated Measurements

Scans were made at an open area test site (OATS) and in an RF semi-anechoic chamber 28' long x 16' wide x 16' high with its interior lined on the ceiling and four walls with pyramidal absorber material up to four feet in length. Measurements were made with a spectrum analyzer and a quasi-peak adapter in the anechoic chamber and with a receiver at the OATS. The list of test instrumentation used to perform the testing is shown in Appendix C.

### 7.4 Field Strength Calculation

The field strength was calculated by adding the antenna factor and cable factor, and subtracting the amplifier gain (when used) from the measured reading. The basic equation with a sample calculation is provided below:

FS = RA + AF + CF - AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation
AG = Amplifier Gain

For example, reducing the first row of the enclosed radiated data sheet on page 27 (36 MHz):

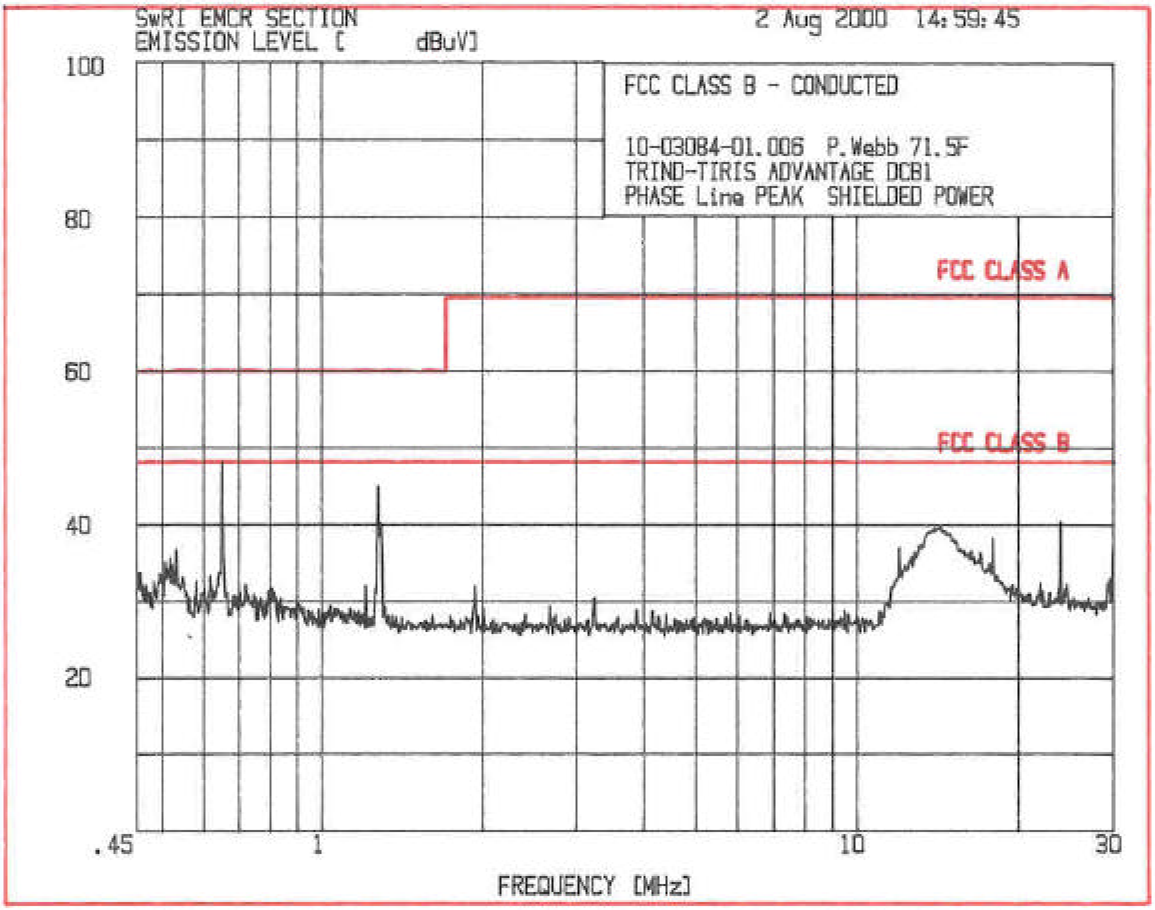
|  |  |
|---|---|
|  | 15.3 dB(uV) |
|  | 19.2 dB(1/m) |
|  | 2.4 dB (CF/AG FACTOR) |
| FS = | 36.9 dB(uV/m) |

To convert the dB(uV/m) value to its corresponding level in uV/m is as follows:

Level in uV/m Common Antilogarithm [(36.9 dBuV/m)/20] = 69.98 uV/m

# APPENDIX A

## CONDUCTED MEASUREMENT PLOTS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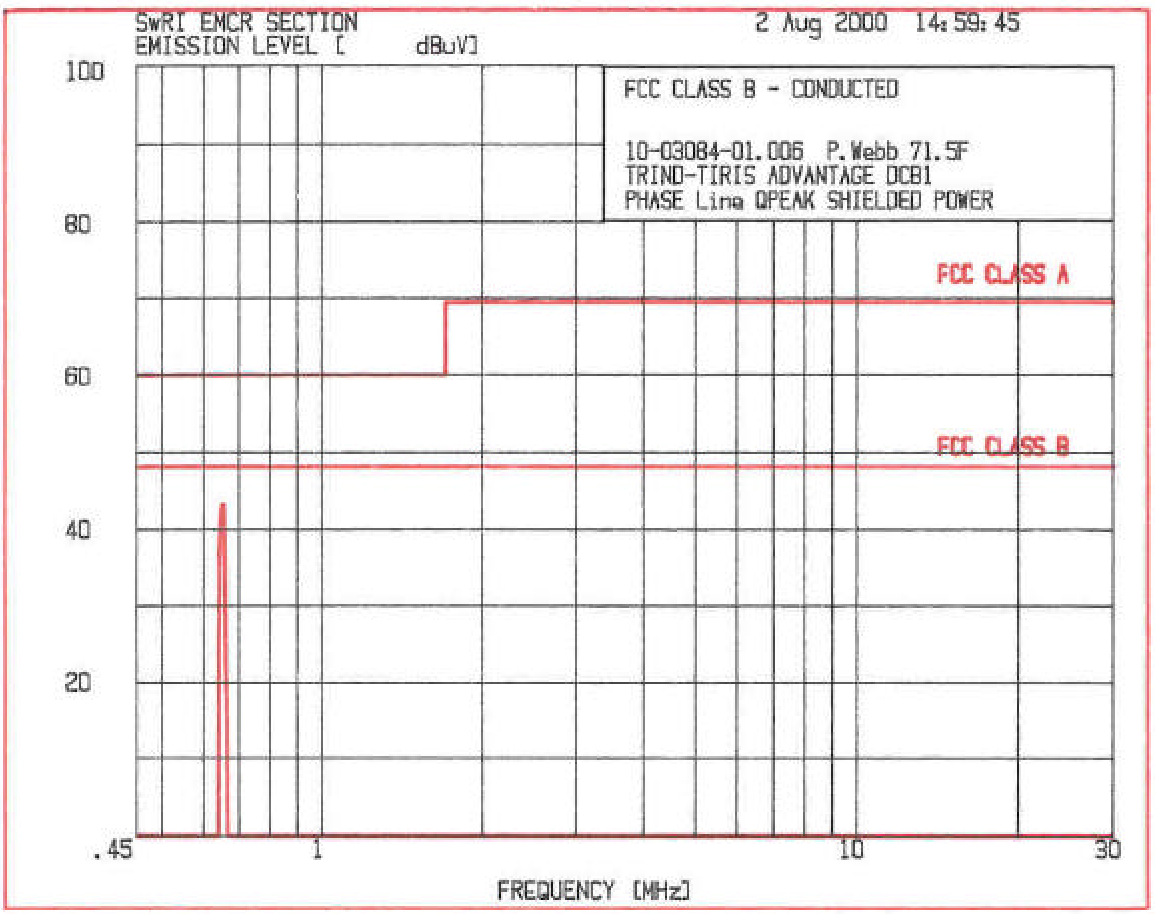
EMISSION LEVEL [ dBuV]
2 Aug 2000 14:59:45
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ADVANTAGE DCB1
PHASE Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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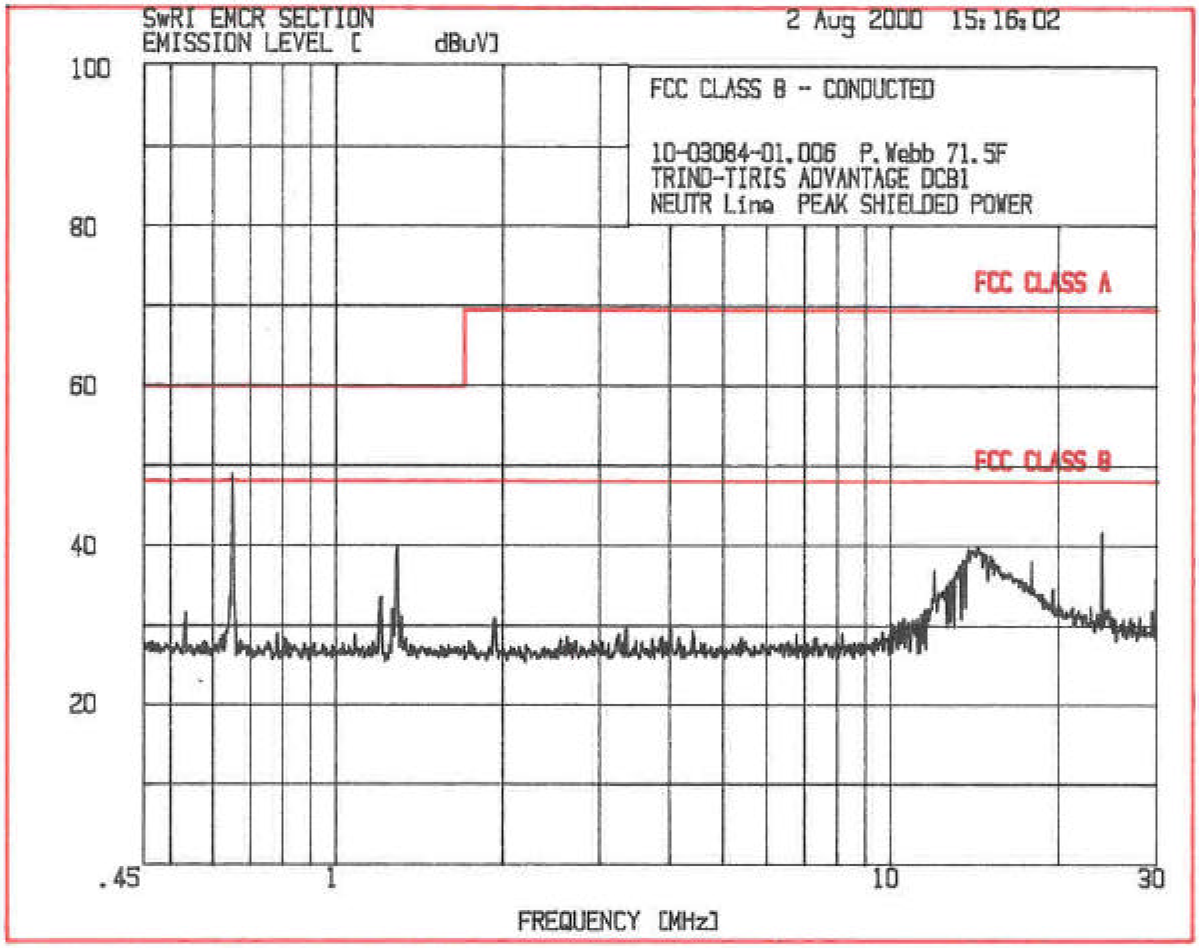
EMISSION LEVEL [ dBuV]
2 Aug 2000 14:59:45
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ADVANTAGE DCB1
PHASE Line QPEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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EMISSION LEVEL [ dBuV]
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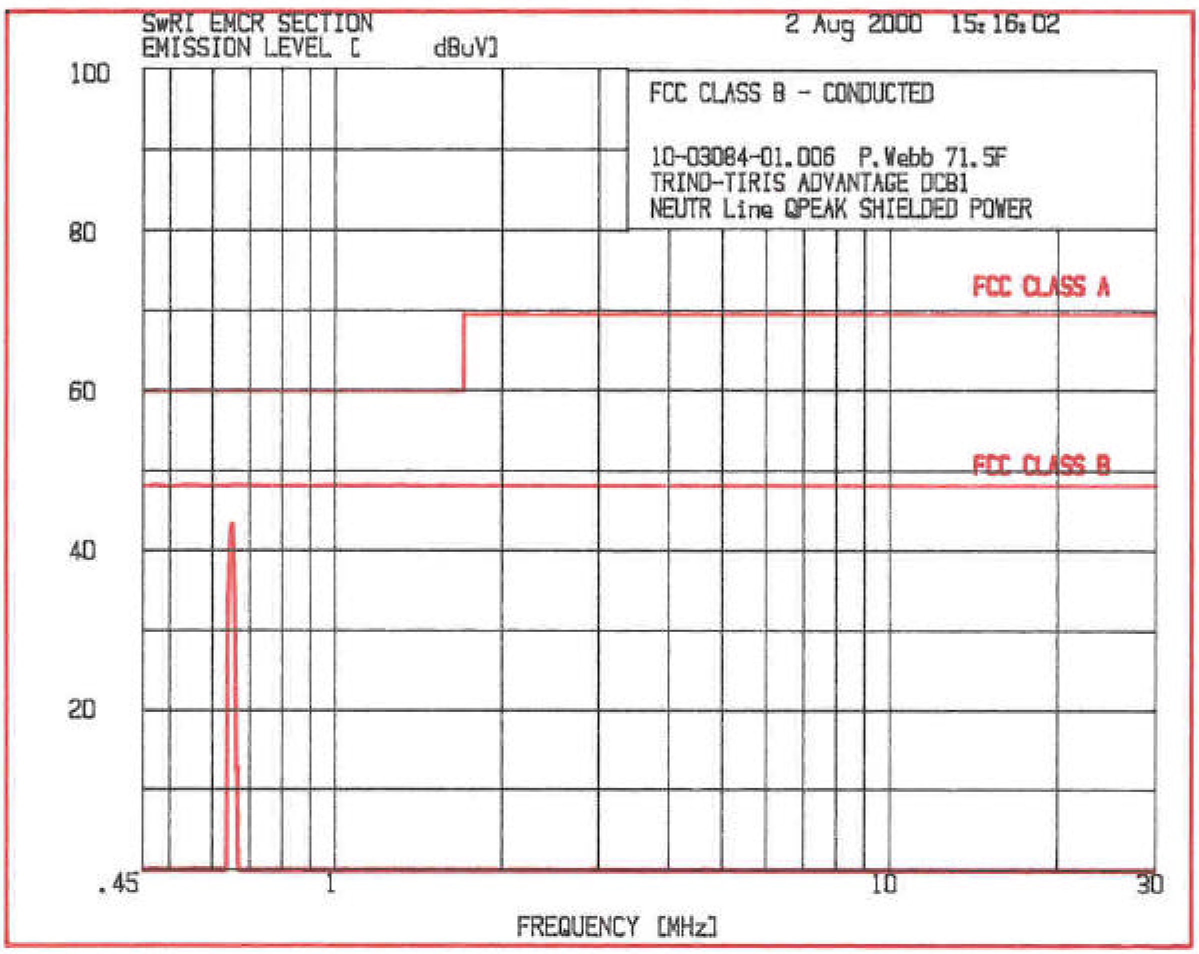
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ADVANTAGE DCB1
NEUTR Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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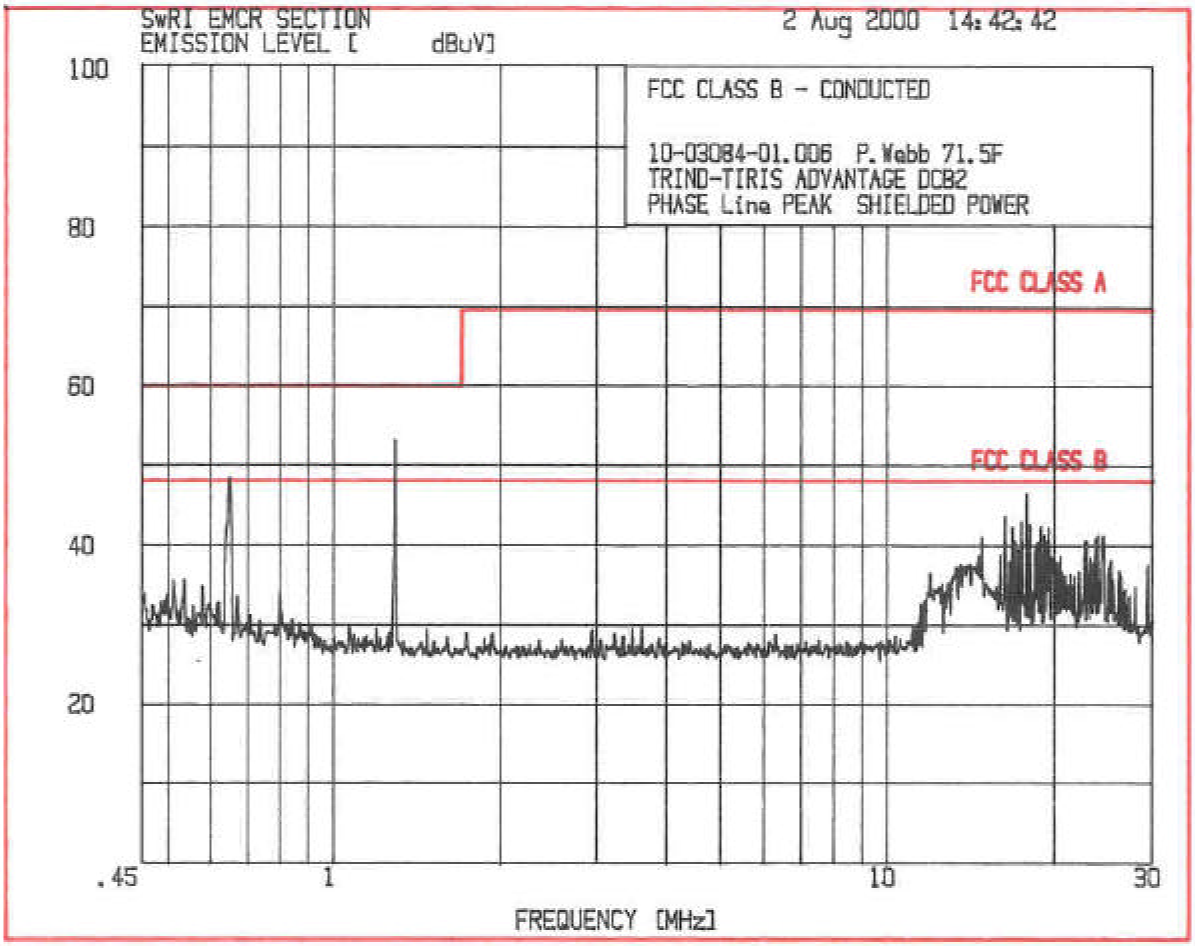
EMISSION LEVEL [ dBuV]
2 Aug 2000 15:16:02
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ADVANTAGE DCB1
NEUTR Line QPEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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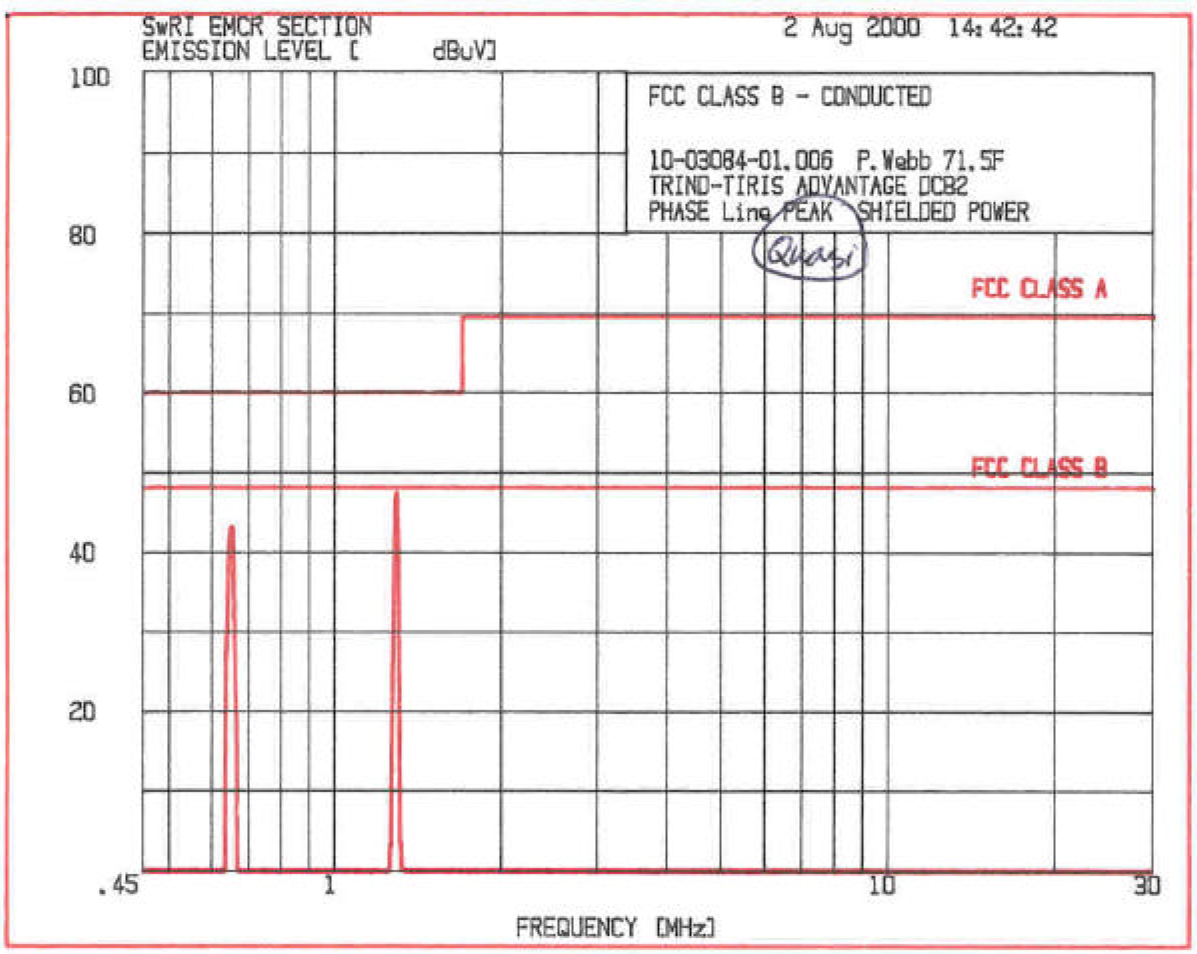
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ADVANTAGE DCB2
PHASE Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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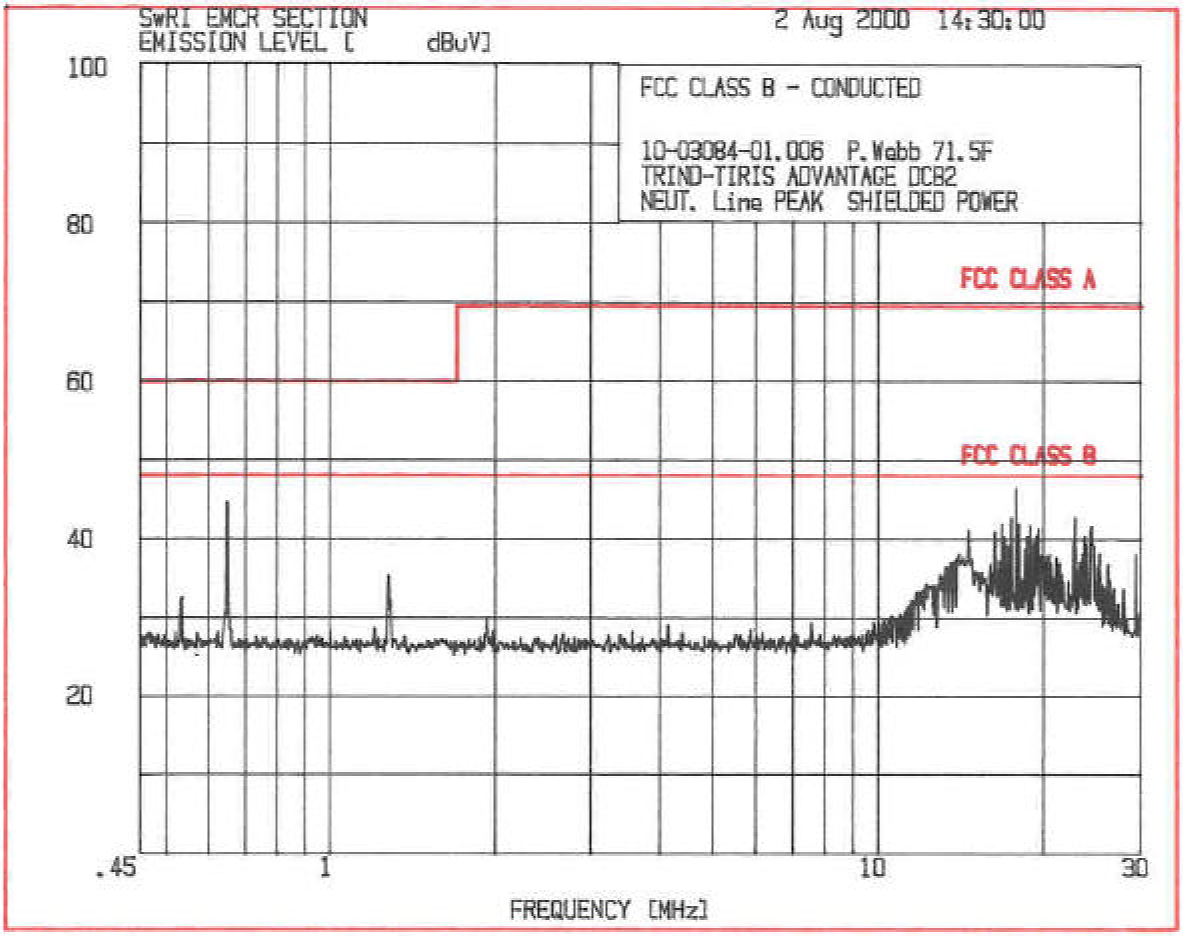
PHASE Line PEAK SHIELDED POWER
Quasi
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]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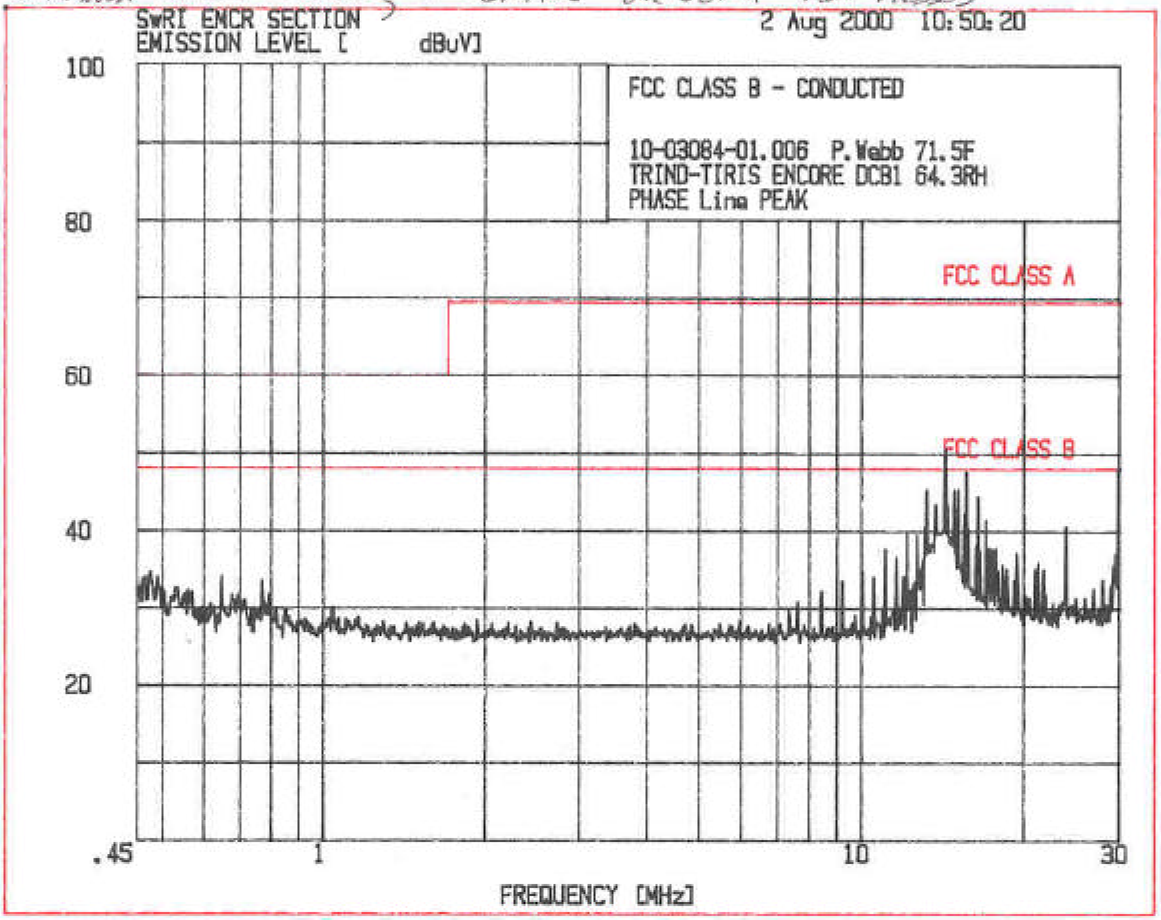
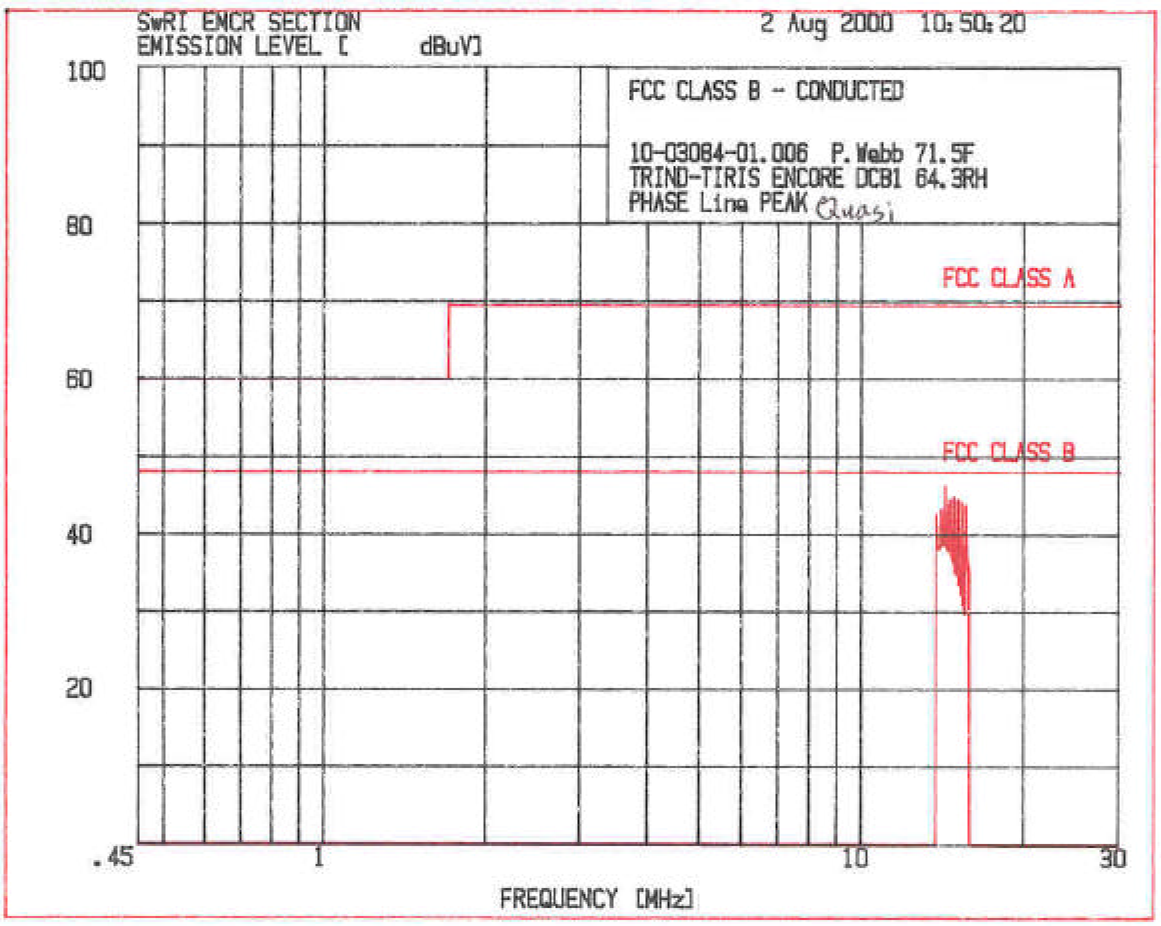
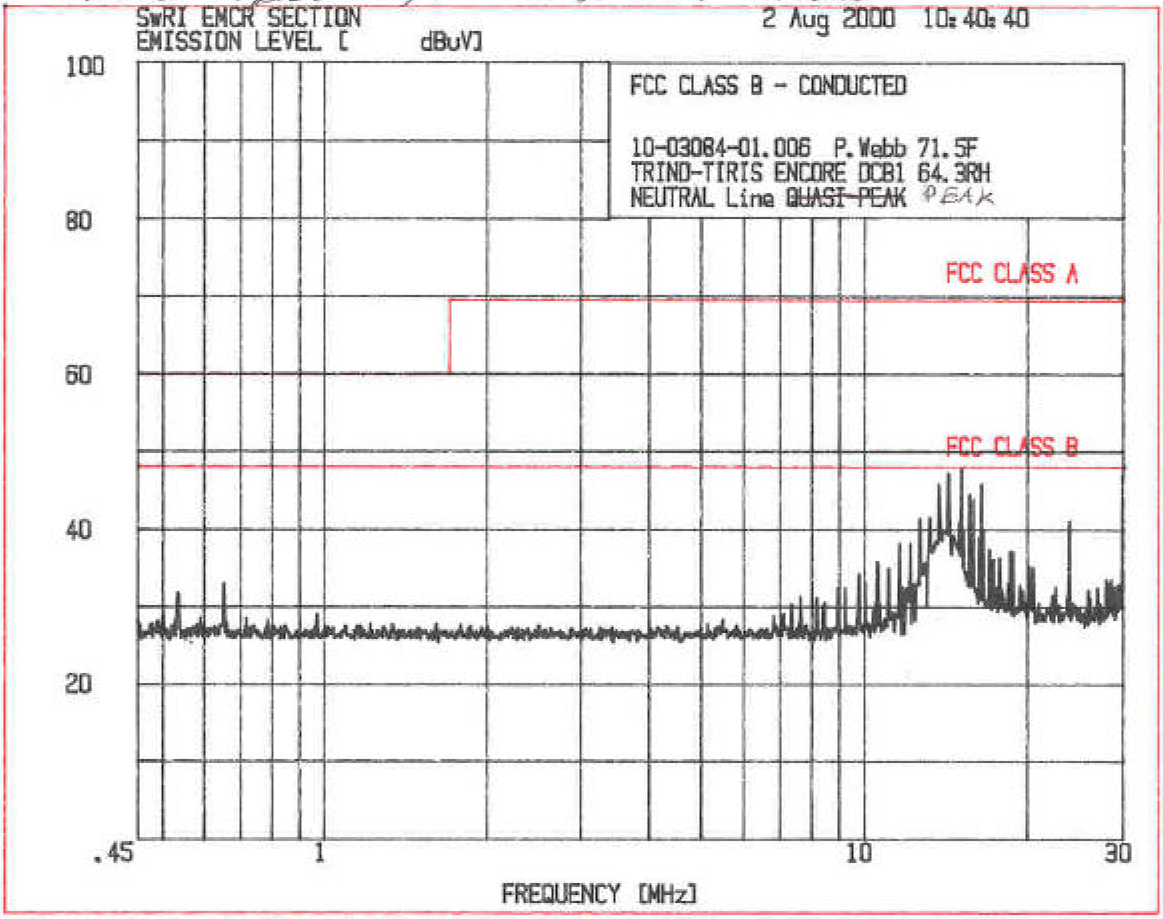
TRIND-TIRIS ADVANTAGE DCB2
NEUT. Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

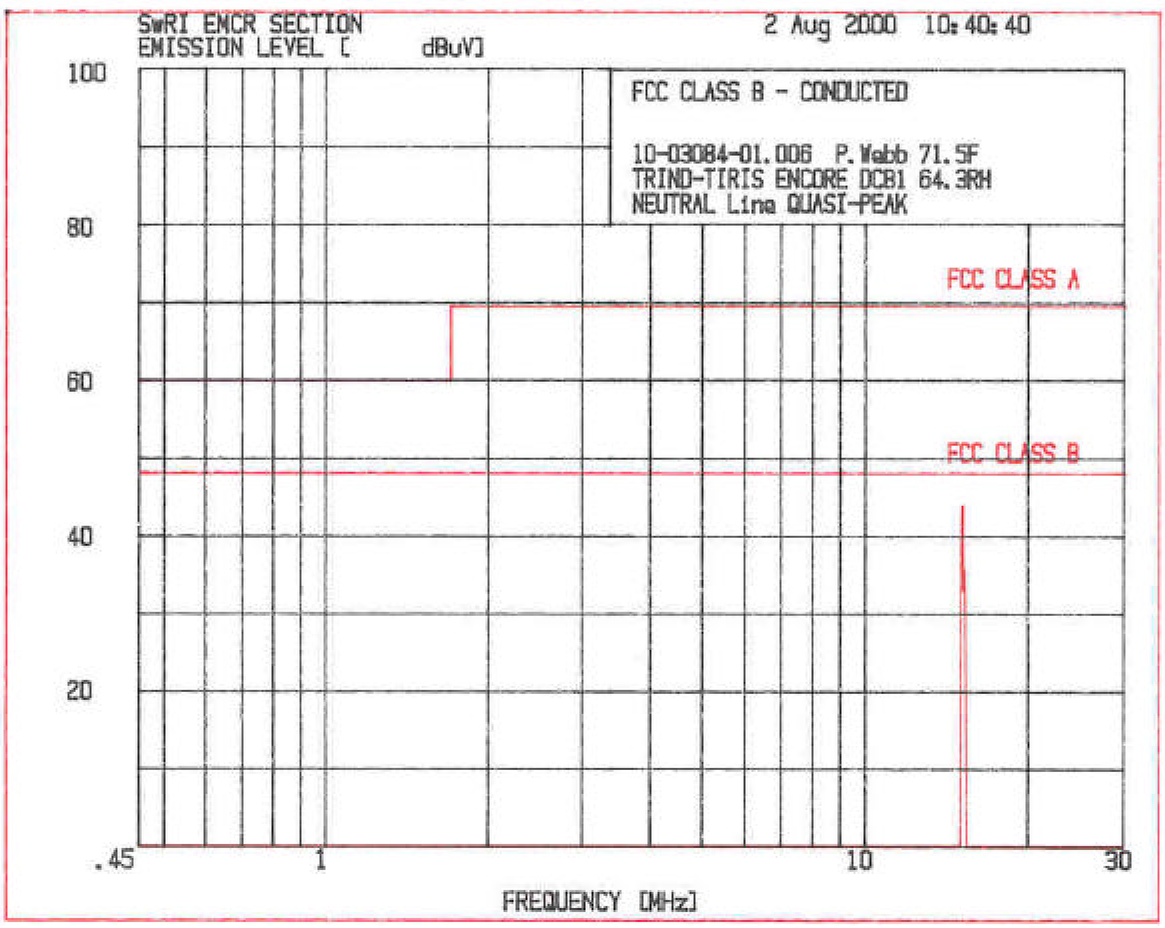
Shielded Power Cable, + ferrite on both harnesses

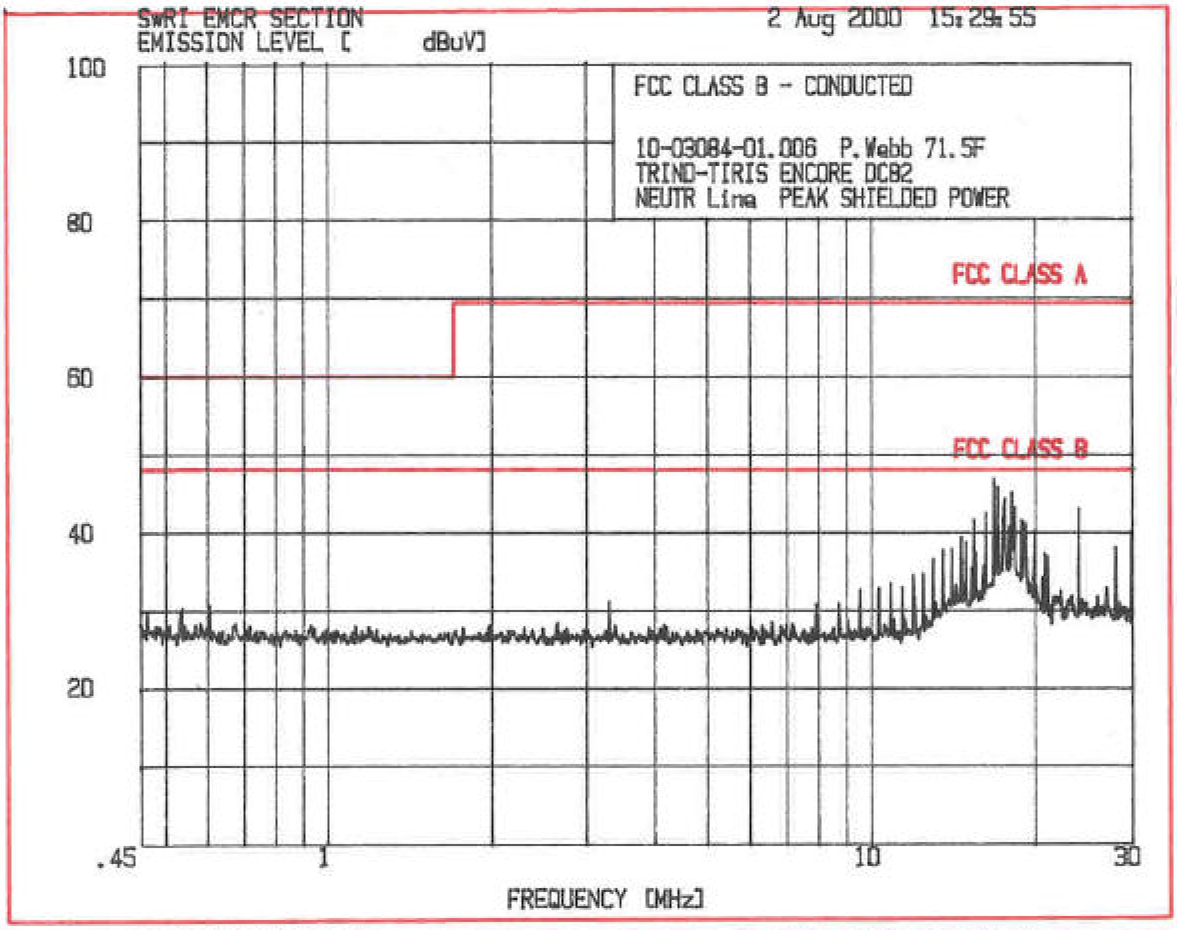


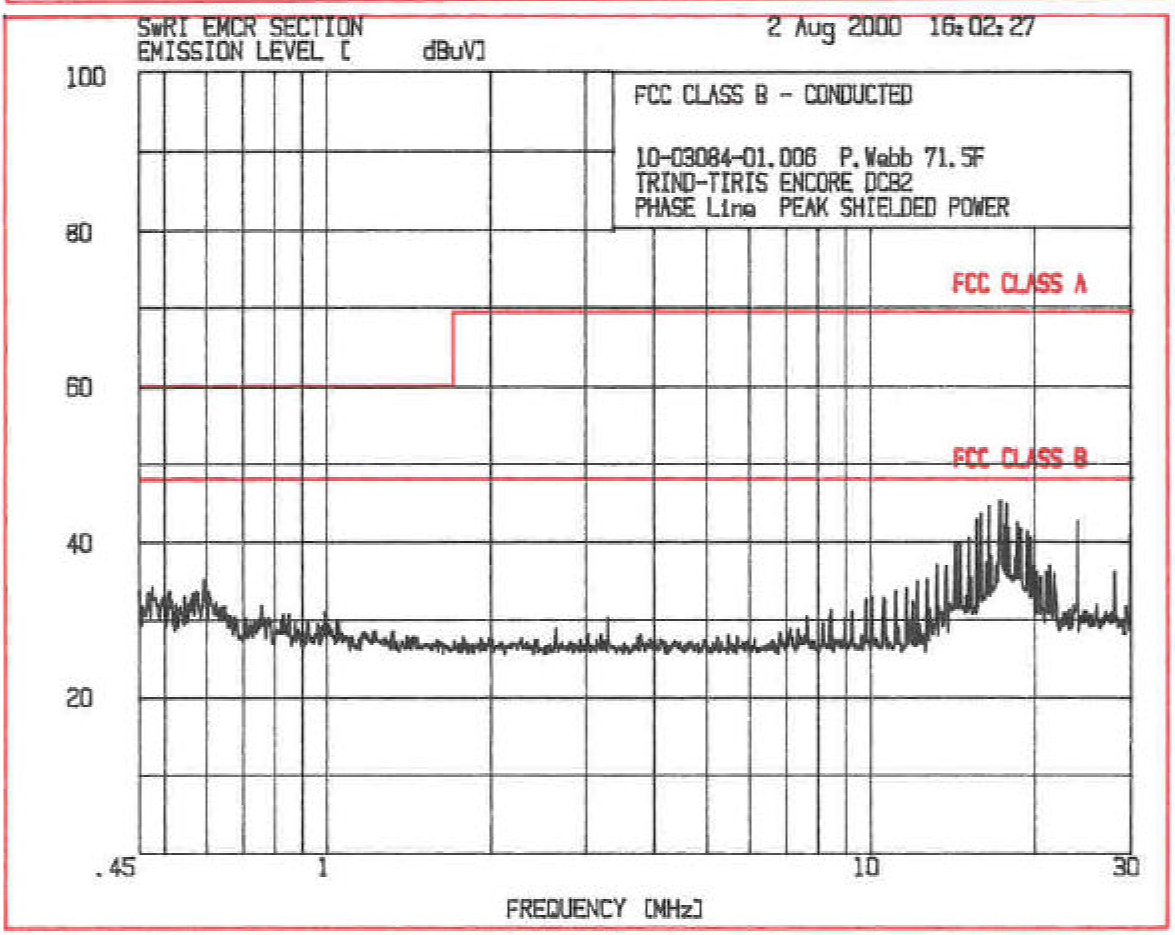



Shielded cable (Amer) ferrite on both harnesses




SwRI EMCR SECTION
EMISSION LEVEL [ dBuV]
2 Aug 2000 15:29:55
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ENCORE DCB2
NEUTR Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]


SwRI EMCR SECTION
EMISSION LEVEL [ dBuV]
2 Aug 2000 16:02:27
FCC CLASS B - CONDUCTED
10-03084-01.006 P.Webb 71.5F
TRIND-TIRIS ENCORE DCB2
PHASE Line PEAK SHIELDED POWER
FCC CLASS A
FCC CLASS B
100
80
60
40
20
.45
1
10
30
FREQUENCY [MHz]

# APPENDIX B

# RADIATED MEASUREMENT DATA SHEETS

| | ⑥ | ⑥ | ⑥ | ⑥ | | ⑦ | ⑦ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY (MHz) | 0.134 | 0.134 | .403 | .403 | | 0.134 | 0.134 | | | |
| TRANSDUCER | Emco | 6512 | → | → | | EMCO | 6512 | | | |
| TRANSDUCER DIST. from EUT(m)/HEIGHT(m) | 3 / 1 | 3 / 1 | 3 / 1 | 3 / 1 | / | 10 / 1 | 10 / 1 | / | / | / |
| POLARIZATION (V,H) AMBIENT NOISE (A) | Parallel TO EUT | → | → | → | | Parallel To EUT | → | Parallel to EUT Had highest Emissions | | |
| SIGNAL DIRECTION | 217 ° | 217 ° | 217 ° | 217 ° | ° | 193 ° | 193 ° | ° | ° | ° |
| RECEIVER ATTENUATION (dB) | — | — | — | — | | | | Fundamental Frequencies could not be seen at 30 meters | | |
| METER READING (dBμV) | 27.8 | 19.7 | 6.8 | -3.4 | | 35.9 | 16.3 | | | |
| TRANSDUCER FACTOR (dB) | 64.3 | 64.3 | 64.3 | 64.3 | | 64.3 | 64.3 | | | |
| EXTERNAL GAIN/ CABLE LOSS (dB) | 0.4 | 0.4 | 0.4 | 0.4 | | 0.4 | 0.4 | | | |
| CORRECTED LEVEL (dBμV/m) | 92.5 | 84.4 | 71.5 | 61.3 | | 100.6 | 81.0 | | | |
| LIMIT (dBμV/m) | 125 | 105 | 125 | 105 | | ~~125~~ 104 (10-9-00 CAR) | 85 | | | |
| | ① | ② | ① | ② | | ① | ② | | | |

Date: 4 Aug 00 Detection Method: ___ CISPR ___ PEAK ___ AVERAGE ___ Other

OPR/Asst.: C Hale EUT Advantage and MPD-3 DCB 2

Conf. ______ Run _____ of ______ Notes, ① Peak measurement ② Average measurement ③ QP measurement

Page _______ of _______ ④ Peak Limit at 30 meters = 85dBμV/m, at 10 meters = 104 dBμV/m at 3 meters

Project No.: 10-03084.01.006 =125dBμV/m ⑤ AVG Limit at 30meters = 65 dBμV/m, at 10 meters = 84 dBμV/m,

Test Category: FCC Part 15, 15.209 at 3 meters = 105dBμV/m. ⑥ Door Antenna ⑦ Overhead Antenna

Time, Temp., & % r.H.: 11:10, 84°, 61% Approved: David A. Carmany

| FREQUENCY (MHz) | 3 | 30 | 3 | 30 | 3 | 30 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TRANSDUCER | EMCO | 6512 | → | → | → | → | | | | |
| TRANSDUCER DIST. from EUT(m)/HEIGHT(m) | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | / | / | / | / |
| POLARIZATION (V,H) AMBIENT NOISE (A) | Parallel to EUT | → | Perpendicular to EUT | → | Parallel to Ground | → | | | | |
| SIGNAL DIRECTION | 360 ° | 360 ° | 360 ° | 360 ° | 360 ° | 360 ° | ° | ° | ° | ° |
| RECEIVER ATTENUATION (dB) | → | → | → | → | → | → | | | | |
| METER READING (dBμV) | -6.7 | -6.6 | -7.7 | -6.6 | -7.6 | -7.1 | | | | |
| TRANSDUCER FACTOR (dB) | 39.2 | 33.8 | 39.2 | 33.8 | 39.2 | 33.8 | | | | |
| EXTERNAL GAIN/ CABLE LOSS (dB) | 0.7 | 2.2 | 0.7 | 2.2 | 0.7 | 2.2 | | | | |
| CORRECTED LEVEL (dBμV/m) | 33.2 | 29.3 | 32.2 | 29.4 | 32.3 | 28.8 | | | | |
| LIMIT (dBμV/m) | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | | | | |
| | ① | ① | ① | ① | ① | ① | | | | |

Date: 4Aug 00

Detection Method: X CISPR ___ PEAK ___ AVERAGE ___ Other

OPR/Asst.: Hal

EUT Advantage and MPD-3 OCB 2

Conf. ______ Run _____ of ______

Page _______ of _______

Notes, ALL 3 orthogonal planes scanned from 134kHz to 30MHz

① AMBIENT ONLY

Project No.: 10-03084.01,006

Test Category: FCC Part 15, 15.209

Time, Temp., & % r.H.: 14:00 81° 80%

Approved: [signature]

**SwRI Open Area Test Site Radiated Emissions v2_2**

**Device Under Test:** Advantage And MPD-3 DCB2
**Date / Time:** 8/4/00 11:10
**Test Standard**(primary limit): FCC Class A, Part 15 (10 m radiated)
**Test Standard**(optional limit):
**Test Sponsor:** Marconi
**Test Technician:** Charles Hale
**Temp.(°F)/Humidity(%):** 84/61

**Project Number:** 10-03084.01.006
**Detection Method:** QP **EUT Mode:** Power On
**Test Receiver:** Rohde&Schwarz ESS EMI sn: DE31157
**Antenna:** 3: BDA25S sn:535 (primary)
5: T2 sn:L178 (primary)
7: T3 sn:L108 (primary)
Ferrite added to cable Harness Assembly leading to O'head Antennas.

| FREQ MHz | Orient. θ° | Antenna I.D. | Antenna Pol. | Antenna Ht(m) | Antenna Dis(m) | UnCorr'd Level (dBuV) | Correction Factors (dB) Ant | Correction Factors (dB) Cable | Corr'd Level (dBuV/m) | Primary Limit (dBuV/m) | Optional Limit (dBuV/m) | Margin (Primary) (dB) | Comments (** denotes a measurement above the primary limit) Note: Cable factor includes preamplifier gain at frequencies above 200 MHz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36.000 | 360 | 3 | V | 1.42 | 10 | 15.3 | 19.2 | 2.4 | 36.9 | 39.0 | | -2.1 | Digital Emission |
| 48.000 | 360 | 3 | V | 1.42 | 10 | 20.4 | 12.6 | 2.8 | 35.8 | 39.0 | | -3.2 | Digital Emission |
| 60.000 | 360 | 3 | V | 1.42 | 10 | 17.4 | 7.2 | 3.3 | 27.9 | 39.0 | | -11.1 | |
| 66.000 | 34 | 3 | V | 1.52 | 10 | 16.6 | 7.2 | 3.5 | 27.3 | 39.0 | | -11.7 | |
| 69.921 | 358 | 3 | V | 1.61 | 10 | 14.7 | 7.4 | 3.6 | 25.7 | 39.0 | | -13.3 | |
| 72.035 | -3 | 3 | V | 1.42 | 10 | 22.5 | 7.5 | 3.7 | 33.6 | 39.0 | | -5.4 | Digital Emission |
| 150.000 | -3 | 3 | V | 1.42 | 10 | 8.0 | 15.9 | 5.8 | 29.6 | 43.5 | | -13.9 | Ambient |
| 119.995 | 179 | 3 | H | 4.01 | 10 | 12.4 | 13.8 | 5.0 | 31.2 | 43.5 | | -12.3 | |
| 203.991 | 183 | 5 | H | 4.01 | 10 | 31.3 | 19.4 | -20.9 | 29.9 | 43.5 | | -13.6 | |
| 221.991 | 253 | 5 | H | 3.15 | 10 | 30.7 | 20.2 | -20.6 | 30.2 | 46.5 | | -16.3 | |
| 203.990 | 53 | 5 | V | 1.04 | 10 | 32.3 | 19.4 | -20.9 | 30.8 | 43.5 | | -12.7 | |
| 224.000 | 69 | 5 | V | 1.00 | 10 | 25.8 | 20.2 | -20.5 | 25.5 | 46.5 | | -21.0 | |
| 524.100 | 69 | 7 | V | 1.82 | 10 | 22.0 | 25.6 | -15.4 | 32.2 | 46.5 | | -14.3 | Ambient |
| 960.000 | 69 | 7 | V | 1.82 | 10 | 16.6 | 35.9 | -11.1 | 41.3 | 49.5 | | -8.2 | Ambient |
| 960.000 | 69 | 7 | H | 1.82 | 10 | 16.6 | 35.9 | -11.1 | 41.4 | 49.5 | | -8.1 | Ambient |
| 524.000 | 0 | 7 | H | 1.82 | 10 | 24.3 | 25.7 | -15.4 | 34.6 | 46.5 | | -11.9 | Ambient |
| 216.000 | 65 | 5 | H | 2.68 | 10 | 29.5 | 20.5 | -20.7 | 29.3 | 46.5 | | -17.2 | |
| 275.991 | 363 | 5 | H | 2.82 | 10 | 25.8 | 21.2 | -19.7 | 27.3 | 46.5 | | -19.2 | |
| 304.001 | 30 | 5 | V | 2.03 | 10 | 28.9 | 18.4 | -19.1 | 28.2 | 46.5 | | -18.3 | |
| 320.000 | 30 | 5 | V | 2.03 | 10 | 29.4 | 18.5 | -18.7 | 29.2 | 46.5 | | -17.3 | |

| | ⑥ | ⑥ | ⑥ | ⑥ | | ⑦ | ⑦ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FREQUENCY (MHz) | 134 KHz | 134 KHz | (3rd harmonic) 403 KHz | 403 KHz | | 134 KHz | 134 KHz | | | |
| TRANSDUCER | EMCO 6512 | S/N 1265 | → | | | | → | | | |
| TRANSDUCER DIST. from EUT(m)/HEIGHT(m) | 3 / 1 | 3 / 1 | 3 / 1 | 3 / 1 | | 10 / 1 | 10 / 1 | | | |
| POLARIZATION (V,H) AMBIENT NOISE (A) | PARALLEL TO EUT | → | | → | | PARALLEL TO EUT | → | EMISSIONS ON THE OTHER TWO H-FIELD POLORIZATIONS WERE LOWER IN LEVEL. | | |
| SIGNAL DIRECTION | 345 ° | 345 ° | 345 ° | 345 ° | ° | 0 ° | 0 ° | ° | ° | ° |
| RECEIVER ATTENUATION (dB) | – | – | – | – | | – | – | FUNDAMENTAL EMISSION COULD NOT BE SEEN AT 30METERS. | | |
| METER READING (dBμV) | 23.4 | 12.4 | 16.3 | -0.7 | | 35.6 | 13.3 | | | |
| TRANSDUCER FACTOR (dB) | 64.3 | 64.3 | 54.6 | 54.6 | | 64.3 | 64.3 | | | |
| EXTERNAL GAIN/ CABLE LOSS (dB) | 0.4 | 0.4 | 0.4 | 0.4 | | 0.4 | 0.4 | | | |
| CORRECTED LEVEL (dBμV/m) | 88.1 | 77.2 | 71.3 | 54.3 | | 100.3 | 78.1 | | | |
| LIMIT (dBμV/m) | 125 ④ | 105 ⑤ | 115.5 | 95.5 | | 104 | 85 | | | |
| | ① | ② | ① | ② | | ① | ② | | | |

Date: AUG 3, 2000

Detection Method: ___ CISPR ___ PEAK ___ AVERAGE ___ Other

OPR/Asst.: C. HALE

EUT ENCORE DCB 2

Conf. ______ Run _____ of _______

Page _______ of _______

Notes, ① PEAK MEASUREMENT ② AVERAGE MEASUREMENT ~~③ QP MEASUREMENT~~ DCC
④ PEAK LIMIT @ 30METERS = 85 dBuV/m ; @ 3 METERS = 125 dBuV/m (40 dB PER DECADE ROLLOFF. ⑤ AVG LIMIT @ 30METERS = 65 dBuV/m; @ 3 METERS = 105 dBuV/m (40 dB PER DECADE ROLLOFF) ⑥ DOOR ANTENNA ⑦ OVERHEAD ANTENNA

Project No.: 10-03084.01.006

Test Category: FCC PART 15, 15.209

Time, Temp., & % r.H.: 83.9°F, 59.1%

Approved: David A. Carmony

| FREQUENCY (MHz) | 3MHz | 30MHz | 3MHz | 30MHz | 3MHz | 30MHz | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TRANSDUCER | EMCO 6512 S/N 1265 → | | | | | | | | | |
| TRANSDUCER DIST. from EUT(m)/HEIGHT(m) | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | 30 / 1 | | | | |
| POLARIZATION (V,H) AMBIENT NOISE (A) | PARALLEL TO EUT | → | PERPENDICULAR TO EUT | → | PARALLEL TO GROUND | → | | | | |
| SIGNAL DIRECTION | 0 ° | 0 ° | 0 ° | 0 ° | 0 ° | 0 ° | ° | ° | ° | ° |
| RECEIVER ATTENUATION (dB) | — | — | — | — | — | — | | | | |
| METER READING (dBμV) | -15.6 | -3.7 | -15.6 | -3.3 | -16 | -3.8 | | | | |
| TRANSDUCER FACTOR (dB) | 39.2 | 33.8 | 39.2 | 33.8 | 39.2 | 33.8 | | | | |
| EXTERNAL GAIN/ CABLE LOSS (dB) | 0.7 | 2.2 | 0.7 | 2.2 | 0.7 | 2.2 | | | | |
| CORRECTED LEVEL (dBμV/m) | 24.3 | 32.3 | 24.3 | 32.7 | 24 | 32.2 | | | | |
| LIMIT (dBμV/m) | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | 29.5 | | | | |
| | (1) | (1) | (1) | (1) | | | | | | |

Date: AUG 3, 2000

Detection Method: X CISPR ___ PEAK ___ AVERAGE ___ Other

OPR/Asst.: C. HALE

EUT ENCORE DCB 2 : BOTH OVERHEAD AND DOOR ANTENNAS CONNECTED

Conf. ______ Run _____ of _______
Page _______ of _______

Notes, (1) AMBIENT ONLY

Project No.: 10-03084.01.006

Scanned 134kHz to 30MHz, 3 polarizations

Test Category: FCC PART 15, 15.209

Time, Temp., & % r.H.: 83.9°F, 57.1%

Approved: David A. Carm[illegible]

**SwRI Open Area Test Site Radiated Emissions v2_2**

**Device Under Test:** Encore DCB2
**Date / Time:** 3 Aug 00, 9:00
**Test Standard**(primary limit): FCC Class A, Part 15 (10 m radiated)
**Test Standard**(optional limit): none
**Test Sponsor:** Marconi Commerce Systems
**Test Technician:** C. Hale
**Temp.(°F)/Humidity(%):** 83.9F, 59.1%

**Project Number:** 10-03084.01.006
**Detection Method:** QP
**EUT Mode:** Normal
**Test Receiver:** Rohde&Schwarz ESS EMI sn: DE31157
**Antenna:** 3: BDA25S sn:535 (primary)
5: T2 sn:L178 (primary)
8: T3 sn:L175

| FREQ MHz | Orient. θ° | Antenna I.D. | Antenna Pol. | Antenna Ht(m) | Antenna Dis(m) | UnCorr'd Level (dBuV) | Correction Factors (dB) Ant | Correction Factors (dB) Cable | Corr'd Level (dBuV/m) | Primary Limit (dBuV/m) | Optional Limit (dBuV/m) | Margin (Primary) (dB) | Comments (** denotes a measurement above the primary limit) Note: Cable factor includes preamplifier gain at frequencies above 200 MHz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36.000 | 266 | 3 | V | 2.34 | 10 | 15.0 | 19.2 | 2.4 | 36.6 | 39.0 | | -2.4 | EUT Related (DIGITAL EMISSION) |
| 48.000 | 160 | 3 | V | 1.62 | 10 | 8.0 | 12.6 | 2.8 | 23.4 | 39.0 | | -15.6 | EUT Related |
| 68.712 | 246 | 3 | V | 2.60 | 10 | 14.3 | 7.4 | 3.5 | 25.3 | 39.0 | | -13.7 | EUT Related |
| 80.000 | -1 | 3 | V | 1.53 | 10 | 14.4 | 8.5 | 3.9 | 26.8 | 39.0 | | -12.2 | EUT Related |
| 81.432 | 300 | 3 | V | 1.56 | 10 | 16.2 | 8.8 | 3.9 | 28.9 | 39.0 | | -10.1 | EUT Related |
| 137.426 | 295 | 3 | V | 1.58 | 10 | 11.9 | 15.0 | 5.5 | 32.5 | 43.5 | | -11.0 | EUT Related |
| 171.800 | 0 | 3 | V | 1.54 | 10 | 10.7 | 17.8 | 6.3 | 34.7 | 43.5 | | -8.8 | EUT Related (DIGITAL EMISSION) |
| 60.000 | 229 | 3 | H | 4.01 | 10 | 9.3 | 7.2 | 3.3 | 19.8 | 39.0 | | -19.2 | EUT Related |
| 85.889 | 179 | 3 | H | 4.01 | 10 | 17.6 | 9.8 | 4.1 | 31.4 | 39.0 | | -7.6 | EUT Related (DIGITAL EMISSION) |
| 103.071 | 182 | 3 | H | 3.46 | 10 | 21.9 | 12.3 | 4.7 | 38.8 | 43.5 | | -4.7 | EUT Related plus FM station (DIGITAL EMISSION) |
| 103.071 | 182 | 3 | H | 3.46 | 10 | 16.6 | 12.3 | 4.7 | 33.5 | 43.5 | | -10.0 | FM station only |
| 108.011 | 360 | 3 | H | 4.01 | 10 | 19.1 | 13.0 | 4.8 | 36.9 | 43.5 | | -6.6 | EUT Related (DIGITAL EMISSION) |
| 119.993 | 360 | 3 | H | 4.01 | 10 | 15.1 | 13.8 | 5.0 | 34.0 | 43.5 | | -9.5 | EUT Related (DIGITAL EMISSION) |
| 126.000 | 0 | 3 | H | 2.71 | 10 | 10.1 | 14.2 | 5.2 | 29.5 | 43.5 | | -14.0 | EUT Related |
| 131.997 | 360 | 3 | H | 4.01 | 10 | 13.0 | 14.6 | 5.4 | 32.9 | 43.5 | | -10.6 | EUT Related |
| 144.000 | 92 | 3 | H | 4.01 | 10 | 12.2 | 15.5 | 5.7 | 33.4 | 43.5 | | -10.1 | EUT Related |
| 150.000 | 90 | 3 | H | 4.01 | 10 | 7.3 | 15.9 | 5.8 | 28.9 | 43.5 | | -14.6 | EUT Related |
| 221.993 | 91 | 5 | V | 1.00 | 10 | 30.2 | 20.2 | -20.6 | 29.7 | 46.5 | | -16.8 | EUT Related |
| 257.995 | 81 | 5 | V | 1.00 | 10 | 23.8 | 21.8 | -19.9 | 25.6 | 46.5 | | -20.9 | EUT Related |
| 288.000 | 360 | 5 | V | 4.00 | 10 | 30.4 | 20.0 | -19.5 | 30.9 | 46.5 | | -15.6 | EUT Related |
| 304.000 | 191 | 5 | V | 4.00 | 10 | 27.8 | 18.4 | -19.1 | 27.0 | 46.5 | | -19.5 | EUT Related |
| 216.000 | 0 | 5 | H | 3.03 | 10 | 36.8 | 20.5 | -20.7 | 36.6 | 46.5 | | -9.9 | EUT Related (DIGITAL EMISSION) |
| 222.000 | 360 | 5 | H | 3.01 | 10 | 32.4 | 20.2 | -20.6 | 32.0 | 46.5 | | -14.5 | EUT Related |
| 227.994 | 0 | 5 | H | 3.01 | 10 | 32.5 | 20.5 | -20.5 | 32.5 | 46.5 | | -14.0 | EUT Related |
| 540.000 | 0 | 8 | V | 2.35 | 10 | 13.5 | 24.1 | -15.3 | 22.3 | 46.5 | | -24.2 | Ambient |
| 700.000 | 0 | 8 | V | 2.35 | 10 | 11.2 | 27.7 | -13.6 | 25.2 | 46.5 | | -21.3 | Ambient |

**SwRI Open Area Test Site Radiated Emissions v2_2**

**Device Under Test:** Encore DCB2
**Date / Time:** 3 Aug 00, 9:00
**Test Standard** (primary limit): FCC Class A, Part 15 (10 m radiated)
**Test Standard** (optional limit): none
**Test Sponsor:** Marconi Commerce Systems
**Test Technician:** C. Hale
**Temp.(°F)/Humidity(%):** 83.9F, 59.1%

**Project Number:** 10-03084.01.006
**Detection Method:** QP
**EUT Mode:** Normal
**Test Receiver:** Rohde&Schwarz ESS EMI sn: DE31157
**Antenna:** 3: BDA25S sn:535 (primary)
5: T2 sn:L178 (primary)
8: T3 sn:L175

| FREQ | Orient. | Antenna | | | | UnCorr'd Level | Correction Factors (dB) | | Corr'd Level | Primary Limit | Optional Limit | Margin (Primary) | Comments (** denotes a measurement above the primary limit) Note: Cable factor includes preamplifier gain at frequencies above 200 MHz. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MHz | θ° | I.D. | Pol. | Ht(m) | Dis(m) | (dBuV) | Ant | Cable | (dBuV/m) | (dBuV/m) | (dBuV/m) | (dB) | |
| 975.000 | 0 | 8 | V | 2.35 | 10 | 21.8 | 35.0 | -10.7 | 46.2 | 49.5 | | -3.3 | Ambient |
| 540.000 | 0 | 8 | H | 2.35 | 10 | 11.7 | 24.1 | -15.3 | 20.5 | 46.5 | | -26.0 | Ambient |
| 700.000 | 0 | 8 | H | 2.35 | 10 | 11.1 | 27.7 | -13.6 | 25.1 | 46.5 | | -21.4 | Ambient |
| 975.000 | 0 | 8 | H | 2.35 | 10 | 9.1 | 35.0 | -10.7 | 33.4 | 49.5 | | -16.1 | Ambient |

# APPENDIX C

# TEST INSTRUMENTATION

**EQUIPMENT USE REPORT**

| MANUFACTURER | MODEL NO. | DESCRIPTION | SERIAL NO. | CAL DATE |
|---|---|---|---|---|
| **CONDUCTED EMISSIONS** | | | | |
| Rhode & Schwarz | ESH2-Z5 | LISN | 872461/021 | 26 Apr 01 |
| SwRI | --- | 3 dB Transient Suppressor | --- | --- |
| Rotronic | PA1 | Hygrometer | 60857 | 02 Dec 00 |
| Rhode & Schwarz | ESH-2 | Receiver | 879014/018 | 01 Feb 01 |
| HP | 8566B | Spectrum Analyzer | 2421A00543 | 27 Oct 00 |
| HP | 85650A | Quasi-Peak Adapter | 2043A00213 | 13 Oct 00 |
| **ANECHOIC CHAMBER** | | | | |
| SwRI | UTC10-221-1 | RF Amplifier | 9112SN15 | Checked |
| Hewlett Packard | 8568B | Spectrum Analyzer | 2152A03081 | 13 Oct 00 |
| Hewlett Packard | 85650A | Quasi Peak Adapter | 2043A00254 | 01 Sep 00 |
| EMCO | 3121-DB3 | Dipole Antenna | 148 | Verified |
| EMCO | 3121-DB4 | Dipole Antenna | 1097 | Verified |
| EMCO | 3121-DB2 | Dipole Antenna | 147 | Verified |
| EMCO | 6512 | Passive loop Antenna | 1265 | Verified |
| **OATS** | | | | |
| Rhode & Schwarz | ESS | EMI Test Receiver | 848588/003 | 16 May 01 |
| SwRI | 2 MHz-1GHz | OATS Pre-Amp | 14-82-020 | Verified |
| Electro Metrics | BDA-25S | Dipole Antenna | 535 | 28 May 01 |
| Electro Metrics | DM-105-T2 | Dipole Antenna | L-000178 | 30 May 01 |
| Electro Metrics | DM-105-T3 | Dipole Antenna | L-000108 | 30 May 01 |
| EMCO | 6512 | Loop Antenna | 0001-1265 | 31 Jul 01 |
| **VOLTAGE VARIATION** | | | | |
| HP | 8568B | Spectrum Analyzer | 2152A03881 | 13 Oct 00 |
| EMCO | 6512 | Loop Antenna | 1265 | 31 July 00 |
| Rhode & Schwarz | ESH 2 | Test Receiver | 879014/018 | 01 Feb 01 |

**APPENDIX D**

**PHOTOS OF TESTED EUT**

The photos of the tested EUT are in the electronic file “Appendix D Photos of Tested EUT.jpg”

## APPENDIX E

## PHOTOS OF TEST SETUPS

The test setup photos are in the electronic file “Appendix E Test Setup Photos.jpg”

# ATTACHMENT 1

# FUNCTIONAL DESCRIPTION AND BLOCK DIAGRAM

# ATTACHMENT 2

# INSTALLATION INSTRUCTIONS

**ATTACHMENT 3**

**FCC ID LABEL**

**ATTACHMENT 4**

**SCHEMATICS**