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Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C Specifications for an Intentional Radiator on the Thrucomm Model: DP1000

FCC ID:	MAWDP1000V18
GRANTEE:	Thrucomm 100 Second Avenue South Suite 901 St. Petersberg, FL. 33701
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	August 2, 2000
FINAL TEST DATE:	July 18 and July 19, 2000

AUTHORIZED SIGNATORY: _____

Mark R. Briggs
Manager, EMC Consulting Services

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SCOPE

An electromagnetic emissions test has been performed on the Thrucomm model DP1000 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Thrucomm model DP1000 and therefore apply only to the tested sample. The sample was selected and prepared by Keith Roweof Thrucomm

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units subsequently manufactured.

STATEMENT OF COMPLIANCE

The tested sample of Thrucomm model DP1000 complied with the requirements of Subpart C of Part 15 of the FCC Rules for low power intentional radiators.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

EMISSION TEST RESULTS

The following emissions tests were performed on the Thrucomm model DP1000. The actual test results are contained in an exhibit of this report.

LIMITS OF CONDUCTED INTERFERENCE VOLTAGE

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.207.

The following measurement was extracted from the data recorded during the conducted emissions scan and represents the highest amplitude emission relative to the specification limit. The actual test data and any correction factors are contained in an exhibit of this report.

LIMITS OF ANTENNA CONDUCTED POWER

These tests were not performed. The proposed changes to the device (addition of new antennas to the system) would not affect the antenna conducted emissions previously reported to the FCC.

LIMITS OFPROCESSING GAIN, POWER AND BANDWIDTH

These tests were not performed. The proposed changes to the device (addition of new antennas to the system) would not affect the processing gain, power, power spectral density or bandwidth as previously reported to the FCC.

RADIATED SPURIOUS EMISSION IN RESTRICTED BANDS

The EUT tested complied with the limits detailed in FCC Rules Part 15 Section 15.247 and 15.209 in the case of emissions falling within the frequency bands specified in Section 15.205. Tests were performed with the EUT connected to each of the new antennas that are proposed for use with the DP1000 system.

Measurements were only made with the EUT operating on the high channel. This channel was selected in accordance with the original test plan for the DP1000 system as agreed upon by the FCC, which required that the system be evaluated for radiated spurious emissions with additional channels on the high channel only. The high channel was originally selected because of its proximity to the closest restricted band at 960 MHz.

The following measurement was extracted from the data recorded during the radiated electric field emissions scan and represents the highest amplitude emission relative to the specification limit for each antenna. The actual test data and any correction factors are contained in an exhibit of this report.

Antenna	Margin / Frequency
KDI 9 dB YAGI (A)	-6.0 dB @ 5440MHz
Seavey SSU-09H-1 Remote Corner Reflector	-2.8dB @ 982.497MHz
Seavey RSA-09H-120, Horz 120 Antenna	-6.8dB @ 5440MHz
Seavey RSA-09H1, Horz 9 dB OmniDirectional	-3dB @ 982.497MHz
Antel Type BCD HP-7 WD EDIN	-7.1dB @ 5440MHz
YAGI (C) KDI-900-S	-10.7dB @ 982.5MHz
YAGI (B), KDI-900-L	-8.3dB @ 982.5MHz

MEASUREMENT UNCERTAINTIES

ISO Guide 25 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.2

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Thrucomm model DP1000 is a spread spectrum radio in the 902 to 928 MHz band which is designed to transmit data. Its digital interface consists of one synchronous port. Normally, the EUT would be placed on a tabletop during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment. The electrical rating of the EUT is 18 V, 60 Hz.

The sample was received on July 18, 2000 and tested on July 18 and July 19, 2000. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Thrucomm	DP1000	Transceiver	-	MAWDP1000V18

OTHER EUT DETAILS

The following antenna were tested:

Description	Model Number	Manufacturer	Gain
Seavey Remote Corner Reflector	SSU-09H-1	Seavey Eng Assoc.	9.0 dBi
Seavey 120 degree Directional	RSA-09H-120	Seavey Eng Assoc.	9.0 dBi
Seavey 9dBi Horizontal Omni	RSA-09H-1	Seavey Eng Assoc.	9.0 dBi
Antel Horizontal Omni Antenna	BCD-HP7 WD	Antel International	9.0 dBi
Yagi KDI-900-S	KDI-900-S	KDI Precision Prod	9.0 dBi
Yagi KDI-900-L	KDI-900-L	KDI Precision Prod	9.0 dBi

ENCLOSURE

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 10 cm wide by 28 cm deep by 8 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Configuration #1

Manufacturer	Model	Description	Serial Number
Ault Inc	None	AC adpater 18V AC	None

Configuration #2

Manufacturer	Model	Description	Serial Number	FCC ID
Ault Inc	None	AC adpater 18V AC	None	None
Hewlett Packard	2225C	Parallel Printer	2714540166	DS16XU2225

No remote support equipment was used during emissions testing.

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Configuration #1

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
RF I/O	Antenna	LMR 400 RF Coax	Shielded	25
Power	AC Adapter			1

Note: The Configuration port is used to configure unit only. It is not used during normal operation and was not cabled.

Configuration #2

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
RF I/O	Antenna	LMR 400 RF Coax	Shielded	25.0
Power	AC Adapter	Power Wires	Unshielded	1.0
Data I/O	Parallel Printer	Parallel Cable	Shielded	1.0
DB9 Configuration	Uncabled	For configuration only	-	-

EUT OPERATION

The EUT was set to continuously transmit on the high channel (924 MHz).

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the Thrucomm model DP1000 being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

POWER INPUT

No modifications.

INTERNAL CABLING/WIRING

No Modifications

EXTERNAL I/O PORTS

No Modifications

PRINTED WIRING BOARD LAYOUT

No Modifications

OTHER

The modifications proposed for the DP1000 are to add the following antennas for use with the system:

Description	Model Number	Manufacturer	Gain
Seavey Remote Corner Reflector	SSU-09H-1	Seavey Eng Assoc.	9.0 dBi
Seavey 120 degree Directional	RSA-09H-120	Seavey Eng Assoc.	9.0 dBi
Seavey 180 degree Directional	RSA-09H-180	Seavey Eng Assoc.	9.0 dBi
Seavey 9dBi Horizontal Omni	RSA-09H-1	Seavey Eng Assoc.	9.0 dBi
Antel Horizontal Omni Antenna	BCD-HP7 WD	Antel International	9.0 dBi
Antel 120 degree Directional	BCR-HP7 120	Antel International	9.0 dBi
Yagi KDI-900-S	KDI-900-S	KDI Precision Prod	9.0 dBi
Yagi KDI-900-L	KDI-900-L	KDI Precision Prod	9.0 dBi

Of these antennas, the following were tested since they represented the highest gain antennas for each antenna type: SSU-09H-1, RSA-09H-120, RSA-09H-1, BCD-HP7 WD, KDI-900-S, KDI. In addition, two other KDI Yagi antennae with 9dBi gain were also tested.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on July 18 and July 19, 2000 at the Elliott Laboratories Open Area Test Site #1 & 3 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal standardized RF impedance, provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors, which are programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these are with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS, SECTION 15.207

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS, SECTION 15.209

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level- Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

Radiated Emissions, 1 - 10GHz, 18-Jul-00 06:00 PM
Engineer: Chris

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	868	12	09/25/1999	09/25/2000
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 ¸9 KHz -26.5GHz	8593EM	1141	12	12/22/1999	12/22/2000
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	12/02/1999	12/02/2000
Narda West	EMI Filter 1.9 GHz, High Pass	HPF-161	248	12	03/27/2000	03/27/2001

Radiated Emissions and Bench Testing per FCC 15.247, 19-Jul-00 04:40 PM
Engineer: Conrad

Manufacturer	Description	Model #	Assett #	Cal interval	Last Calibrated	Cal Due
Chase	BiLog Antenna, 30 - 1000 MHz	CA 1030		12	06/07/2000	06/07/2001
EMCO	D. Ridge Horn Antenna, 1-18GHz	3115	487	12	03/24/2000	03/24/2001
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 ¸9 KHz -26.5GHz	8593EM	1141	12	12/22/1999	12/22/2000
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12	11/15/1999	11/15/2000
Hewlett Packard	Power Meter	432A	259, (F304)	12	02/17/2000	02/17/2001
Narda West	EMI Filter 1.9 GHz, High Pass	HPF-161	248	12	03/27/2000	03/27/2001
Rohde &Schwarz	Test Receiver, 20-1300MHz	ESVP	213, (F196)	12	05/30/2000	05/30/2001

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T 38415 10 Pages

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EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Emissions Spec:	FCC	Class:	15.205 / 15.247
Immunity Spec:		Environment:	

EMC Test Data

For The

Thrucomm

Model

DP1000

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Emissions Spec:	FCC	Class:	15.205 / 15.247
Immunity Spec:		Environment:	

EUT INFORMATION

General Description

The EUT is a spread spectrum radio in the 902 to 928 MHz band which is designed to transmit data. Its digital interface consists of one synchronous port. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during emissions testing to simulate the end user environment. The electrical rating of the EUT is 18 V, 60 Hz.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Thrucomm	DP1000	Transciever	-	MAWDP1000V18

Other EUT Details

The following antenna were tested:
Seavey RSA-09H-120 S/N 129318
Seavey SSU-09H-1 S/N 129320
Seavey RSA-09H-1 S/N 129895
KDI 9 dB YAGI (A), Stainless Steel
YAGI (C), Part Number KDI-900-S
YAGI (B), Part Number KDI-900-L
Antel BCD WP-7 HD S/N

EUT Enclosure

The EUT enclosure is primarily constructed of fabricated sheet steel. It measures approximately 10 cm wide by 28 cm deep by 8 cm high.

Modification History

Mod. #	Test	Date	Modificaiton
1			
2			
3			

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EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Emissions Spec:	FCC	Class:	15.205 / 15.247
Immunity Spec:		Environment:	

Test Configuration Information (1)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Ault Inc	None	AC adpater 18V AC	None	None

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

EUT Interface Ports

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
RF I/O	Antenna	LMR 400 RF Coax	Shielded	25
Power	AC Adapter			1

Note: The Configuration port is used to configure unit only. It is not used during normal operation and was not cabled

EUT Operation During Emissions

The EUT was transmitting continuously at 924 MHz

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Emissions Spec:	FCC	Class:	15.205 / 15.247
Immunity Spec:		Environment:	

Test Configuration Information (2)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Ault Inc	None	AC adpater 18V AC	None	None
Hewlett Packard	2225C	Parallel Printer	2714540166	DS16XU2225

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None	-	-	-	-

EUT Interface Ports

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
RF I/O	Antenna	LMR 400 RF Coax	Shielded	25.0
Power	AC Adapter	Power Wires	Unshielded	1.0
Data I/O	Parallel Printer	Parallel Cable	Shielded	1.0
DB9 Configuration	Uncabled	For configuration only	-	-

EUT Operation During Emissions

The EUT was set to continuously transmit on the high channel (924 MHz).

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EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 7/18/2000, 7/19/00
Test Engineer: Chris Byleckie / Conrad Chu
Test Location: SVOATS #3, #1

Config. Used: 1
Config Change:
EUT Voltage: 18V AC

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Chris Byleckie perfromed the measurements in the frequency range 1 - 10GHz on Site #3 on 7/18/00 and Conrad Chu perfromed the measurements from 30 - 1000 MHz on Site #1 on 7/19/00.

Ambient Conditions:

Temperature: 25°C
Rel. Humidity: 51%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Spurious RE, 30 - 10,000 MHz KDI 9 dB YAGI (A)	FCC Part 15.209 / 15.247(c)	Pass	-6.0 dB @ 5440MHz
2	Spurious RE, 30 - 10,000 MHz Seavey SSU-09H-1 Remote Corner Reflector	FCC Part 15.209 / 15.247(c)	Pass	-2.8dB @ 982.497MHz
3	Spurious RE, 30 - 10,000 MHz Seavey RSA-09H-120, Horz 120 Antenna	FCC Part 15.209 / 15.247(c)	Pass	-6.8dB @ 5440MHz
4	Spurious RE, 30 - 10,000 MHz Seavey RSA-09H1, Horz 9 dB OmniDirectional	FCC Part 15.209 / 15.247(c)	Pass	-3dB @ 982.497MHz
5	Spurious RE, 30 - 10,000 MHz Antel Type BCD HP-7 WD EDIN	FCC Part 15.209 / 15.247(c)	Pass	-7.1dB @ 5440MHz

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EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	N/A

Modifications Made During Testing: None

Run #1: Radiated Spurious Emissions, 30-10000 MHz. High Channel @ 924 MHz. Sorted by margin
Antenna: KDI 9 dB YAGI (A), Stainless Steel
Measured Pout at 924 MHz is 26.3 dBm

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.000	48.1	v	54.0	-5.9	PK	0	1.0	Note 2, 3
4620.000	46.1	v	54.0	-7.9	PK	0	1.0	Note 2, 3
5440.000	45.9	h	54.0	-8.1	PK	0	1.0	Note 2,4
982.498	47.3	h	56.0	-8.7	QP	0	1.0	
4620.000	45.0	h	54.0	-9.0	PK	0	1.0	Note 2,3
3696.000	44.7	h	54.0	-9.3	PK	0	1.0	Note 2,3
3696.000	43.8	v	54.0	-10.2	Pk	0	1.0	Note 2, 3
2772.000	41.5	h	54.0	-12.5	PK	250	1.0	Note 2
982.500	41.1	v	54.0	-12.9	QP	211	1.2	
975.000	38.6	v	54.0	-15.4	QP	196	1.2	
1000.000	39.3	h	55.0	-15.7	QP	360	1.3	
2772.000	36.1	v	54.0	-17.9	Pk	173	1.0	Note 2
1000.000	35.2	v	54.0	-18.8	QP	195	1.2	

Note 2:	Pk reading vs. average limit
Note 3:	Noise floor

Elliott

EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	N/A

Run #2: Radiated Spurious Emissions, 30-10000 MHz. High Channel @ 924 MHz. Sorted by margin
Antenna: Seavey Engineering SSU-09H-1 Remote Corner Reflector, 902-928 MHz, 129320

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
982.497	51.3	v	54.0	-2.7	QP	0	1.8	narrowband & broadband noise
5440.000	48.0	h	54.0	-6.0	PK	0	1.0	Note 2,3
5440.000	47.4	v	54.0	-6.6	PK	295	1.0	Note 2,3
4620.000	45.9	h	54.0	-8.1	PK	0	1.0	Note 2,3
963.400	45.5	v	54.0	-8.5	QP	0	1.8	broadband noise
4620.000	44.5	v	54.0	-9.5	PK	0	1.0	Note 2,3
2772.000	44.1	v	54.0	-9.9	PK	347	1.0	Note 2
3696.000	44.1	v	54.0	-9.9	PK	172	1.0	Note 2
3696.000	43.7	h	54.0	-10.3	PK	0	1.0	Note 2,3
1000.000	43.2	v	54.0	-10.8	QP	0	1.8	broadband noise
2772.000	40.2	h	54.0	-13.9	PK	23	1.3	Note 2
982.500	40.0	h	54.0	-14.0	QP	0	1.0	broadband noise

Note 2:	Pk reading vs. average limit
Note 3:	Noise floor

Run #3: Radiated Spurious Emissions, 30-10000 MHz. High Channel @ 924 MHz. Sorted by margin
Antenna: Seavey Engineering RSA-09H-120, Horz 120 Degree Directional Antenna, 902-928 MHz, 129318

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.000	47.2	h	54.0	-6.8	PK	0	1.0	Note 2,3
5440.000	46.9	v	54.0	-7.1	PK	0	1.0	Note 2,3
4620.000	45.8	v	54.0	-8.2	PK	0	1.0	Note 2,3
4620.000	45.5	h	54.0	-8.5	PK	0	1.0	Note 2,3
3696.000	43.6	v	54.0	-10.4	PK	171	1.0	Note 2
3696.000	43.6	h	54.0	-10.4	PK	0	1.0	Note 2,3
2772.000	41.9	v	54.0	-12.1	PK	227	1.0	Note 2
2772.000	41.2	h	54.0	-12.8	PK	35	1.0	Note 2
982.500	39.0	v	54.0	-15.0	QP	27	1.0	

Note 2:	Pk reading vs. average limit
Note 3:	Noise floor

Elliott

EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	N/A

Run #4: Radiated Spurious Emissions, 30-10000 MHz. High Channel @ 924 MHz. Sorted by margin
Antenna: Seavey Engineering RSA-09H1, Horz 9 dB OmniDirectional Antenna, 902-928 MHz, 129895

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
982.497	51.0	h	54.0	-3.0	QP	295	1.0	
963.100	47.1	h	54.0	-6.9	QP	298	1.1	broadband noise
5440.000	44.4	h	54.0	-9.7	PK	0	1.0	Note 2,3
5440.000	43.3	v	54.0	-10.8	PK	0	1.0	Note 2,3
2772.000	41.8	v	54.0	-12.2	PK	165	1.0	Note 2
4620.000	41.5	v	54.0	-12.5	PK	0	1.0	Note 2,3
3696.000	41.2	h	54.0	-12.8	PK	160	1.0	Note 2
4620.000	41.0	h	54.0	-13.0	PK	0	1.0	Note 2,3
2772.000	40.4	h	54.0	-13.6	PK	0	1.0	Note 2,3
3696.000	40.3	v	54.0	-13.7	PK	0	1.0	Note 2,3
982.500	37.8	v	54.0	-16.2	QP	304	1.0	

Note 2:	Pk reading vs. average limit
Note 3:	Noise floor

Run #5: Radiated Spurious Emissions, 30-10000 MHz. High Channel @ 924 MHz. Sorted by margin
Antenna: Antel Type BCD HP-7 WD EDIN, 902-928 MHz, s/n 73113, 500W, 50 Ohms
Antel Antenna

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5440.000	46.9	h	54.0	-7.1	PK	0	1.0	Note 2,3
5440.000	46.3	v	54.0	-7.7	PK	0	1.0	Note 2,3
4620.000	45.2	h	54.0	-8.8	PK	0	1.0	Note 2,3
4620.000	45.2	v	54.0	-8.8	PK	0	1.0	Note 2,3
3696.000	45.1	h	54.0	-8.9	PK	198	1.0	Note 2
3696.000	43.0	v	54.0	-11.0	PK	0	1.0	Note 2,3
2772.000	41.4	h	54.0	-12.7	PK	173	1.0	Note 2
2772.000	39.9	v	54.0	-14.1	PK	0	1.0	Note 2,3
982.500	34.0	h	54.0	-20.0	QP	224	2.6	
975.000	32.8	v	54.0	-21.2	QP	222	1.0	

Note 2:	Pk reading vs. average limit
Note 3:	Noise floor

Elliott

EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	15.205 / 15.247

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 07/19/2000
Test Engineer: Conrad Chu
Test Location: SVOATS #1

Config. Used: 2
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing.

For radiated emissions testing between 30 MHz and 10 GHz, the measurement antenna was located at 3 meters distance from the EUT.

Measurements above 1GHz made using Preamp #870, Analyzer #780, Horn #487, high-pass filter #248.

Ambient Conditions:

Temperature: 22°C
Rel. Humidity: 63%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Spurious RE, 30 - 10,000 MHz YAGI (C) KDI-900-S	FCC Part 15.209 / 15.247(c)	Pass	-10.7dB @ 982.5MHz
2	Spurious RE, 30 - 10,000 MHz YAGI (B), KDI-900-L	FCC Part 15.209 / 15.247(c)	Pass	-8.3dB @ 982.5MHz

Modifications Made During Testing: None

Elliott

EMC Test Data

Client:	Thrucomm	Job Number:	J38182
Model:	DP1000	T-Log Number:	T38415
		Proj Eng:	David Bare
Contact:	Keith Rowe		
Spec:	FCC	Class:	15.205 / 15.247

Run #1: Spurious radiated emissions in restricted bands, 30 - 10,000 MHz only
Antenna: YAGI (C), Part Number KDI-900-S

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
982.500	44.4	h	55.0	-10.6	QP	293	1.4	
982.500	42.3	v	54.0	-11.7	QP	14	1.1	
4620.000	41.1	v	54.0	-12.9	Avg	99	1.3	
2773.000	41.1	h	54.0	-12.9	Avg	153	1.7	
4620.000	41.1	h	54.0	-12.9	Avg	257	1.0	
3696.000	38.9	v	54.0	-15.1	Avg	44	1.2	
3696.000	38.8	h	54.0	-15.2	Avg	257	1.0	
2773.000	38.3	v	54.0	-15.7	Avg	172	1.0	
975.000	37.7	v	54.0	-16.3	QP	220	1.0	
4620.000	53.8	v	74.0	-20.2	Pk	99	1.3	
2773.000	53.8	h	74.0	-20.2	Pk	153	1.7	
4620.000	53.5	h	74.0	-20.5	Pk	257	1.0	
3696.000	51.3	v	74.0	-22.7	Pk	44	1.2	
2773.000	51.2	v	74.0	-22.8	Pk	172	1.0	
3696.000	51.0	h	74.0	-23.0	Pk	257	1.0	

Run #2: Spurious radiated emissions in restricted bands, 30 - 10,000 MHz only
Antenna: YAGI (B), Part Number KDI-900-L

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
982.500	45.7	h	54.0	-8.3	QP	183	1.5	
982.500	42.3	v	54.0	-11.7	QP	306	1.7	
4620.000	41.0	h	54.0	-13.0	Avg	266	1.2	
4620.000	40.9	v	54.0	-13.1	Avg	210	1.0	
975.000	41.7	h	55.0	-13.3	QP	207	1.5	
2773.000	40.6	h	54.0	-13.4	Avg	142	1.2	
3696.000	39.2	v	54.0	-14.8	Avg	194	1.0	
975.000	39.0	v	54.0	-15.0	QP	195	1.1	
3696.000	39.0	h	54.0	-15.0	Avg	205	1.2	
2773.000	38.0	v	54.0	-16.0	Avg	229	1.0	
4620.000	54.1	h	74.0	-19.9	Pk	266	1.2	
4620.000	53.1	v	74.0	-20.9	Pk	210	1.0	
2773.000	52.9	h	74.0	-21.1	Pk	142	1.2	
3696.000	51.4	h	74.0	-22.6	Pk	205	1.2	
3696.000	51.2	v	74.0	-22.8	Pk	194	1.0	
2773.000	50.6	v	74.0	-23.4	Pk	229	1.0	

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

YAGI Antenna

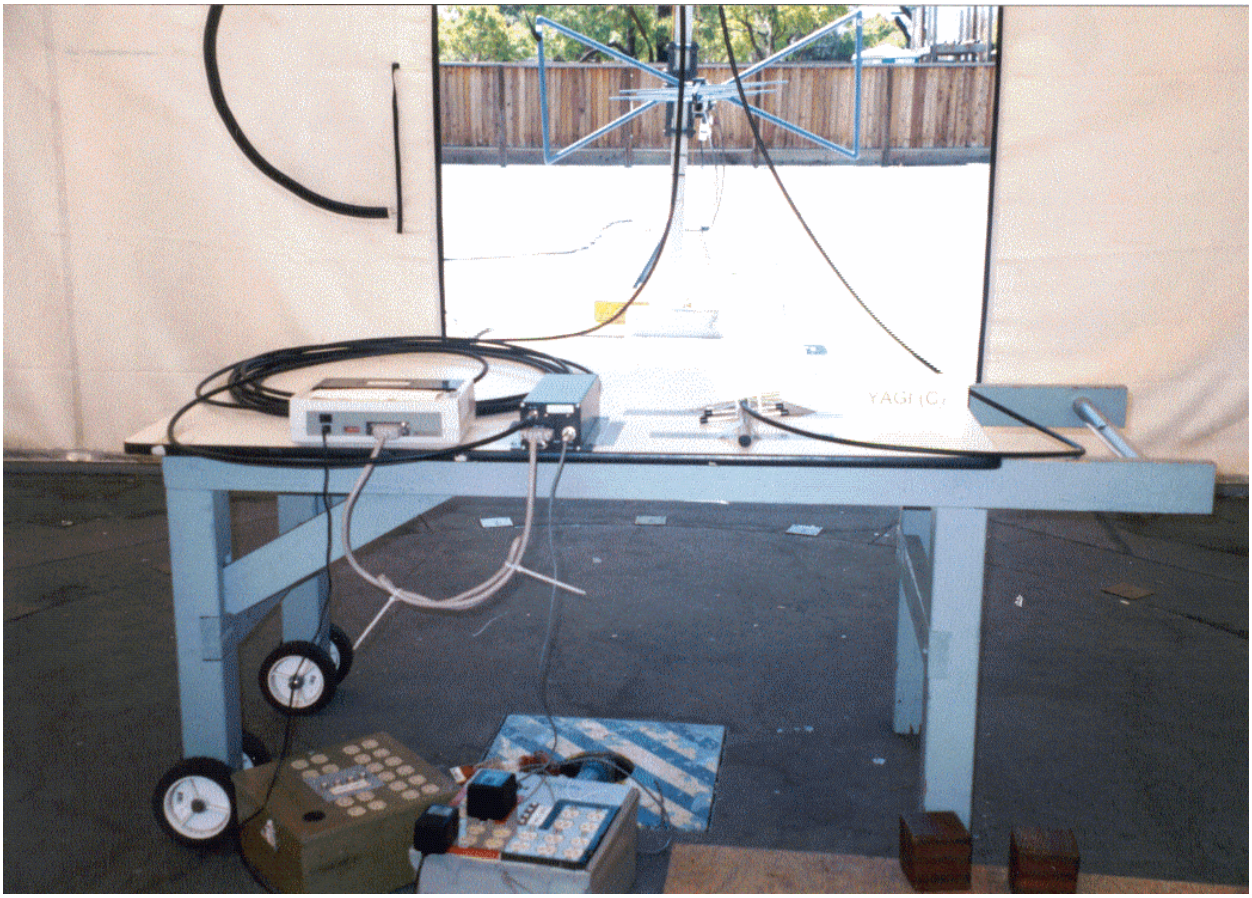

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

YAGI Antenna

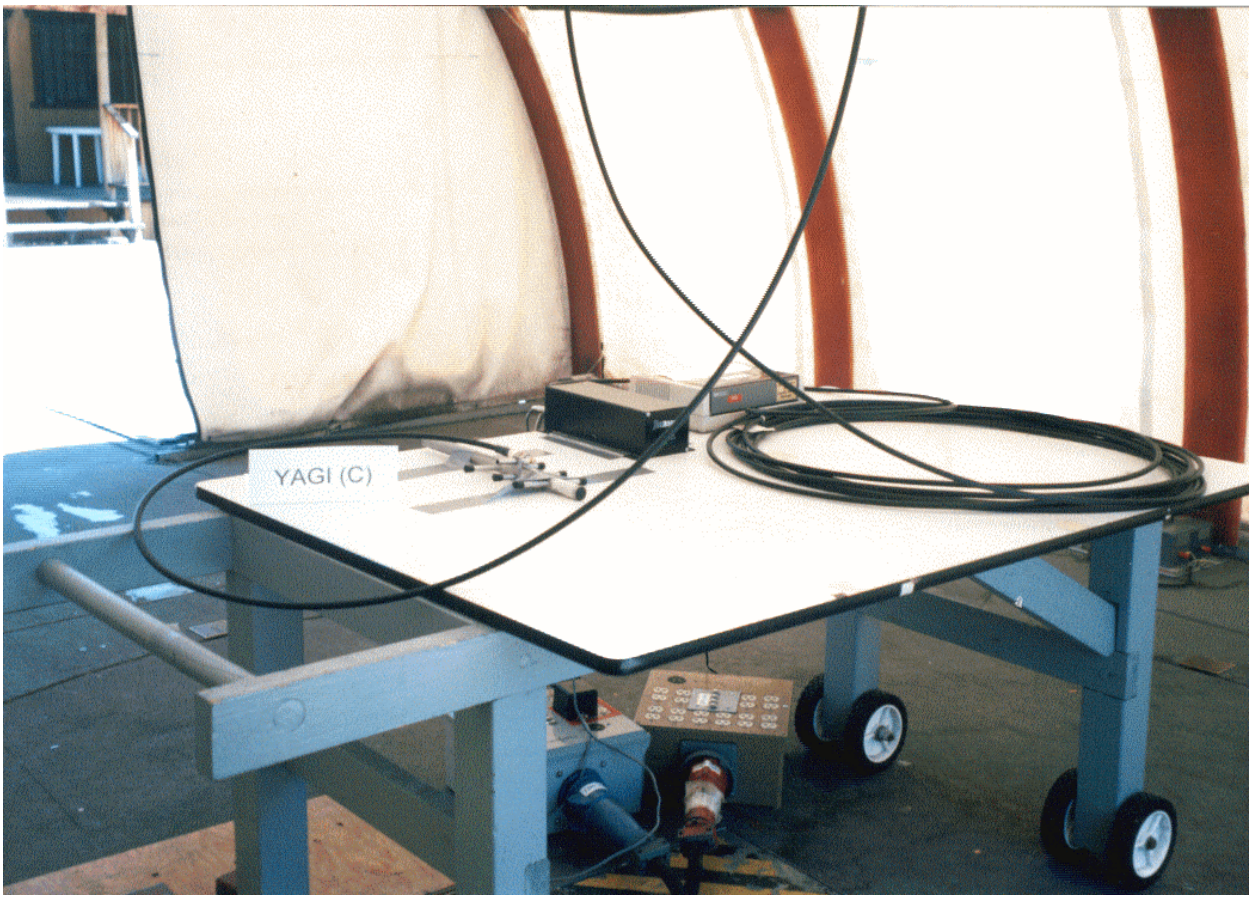

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Corner Reflector Antenna

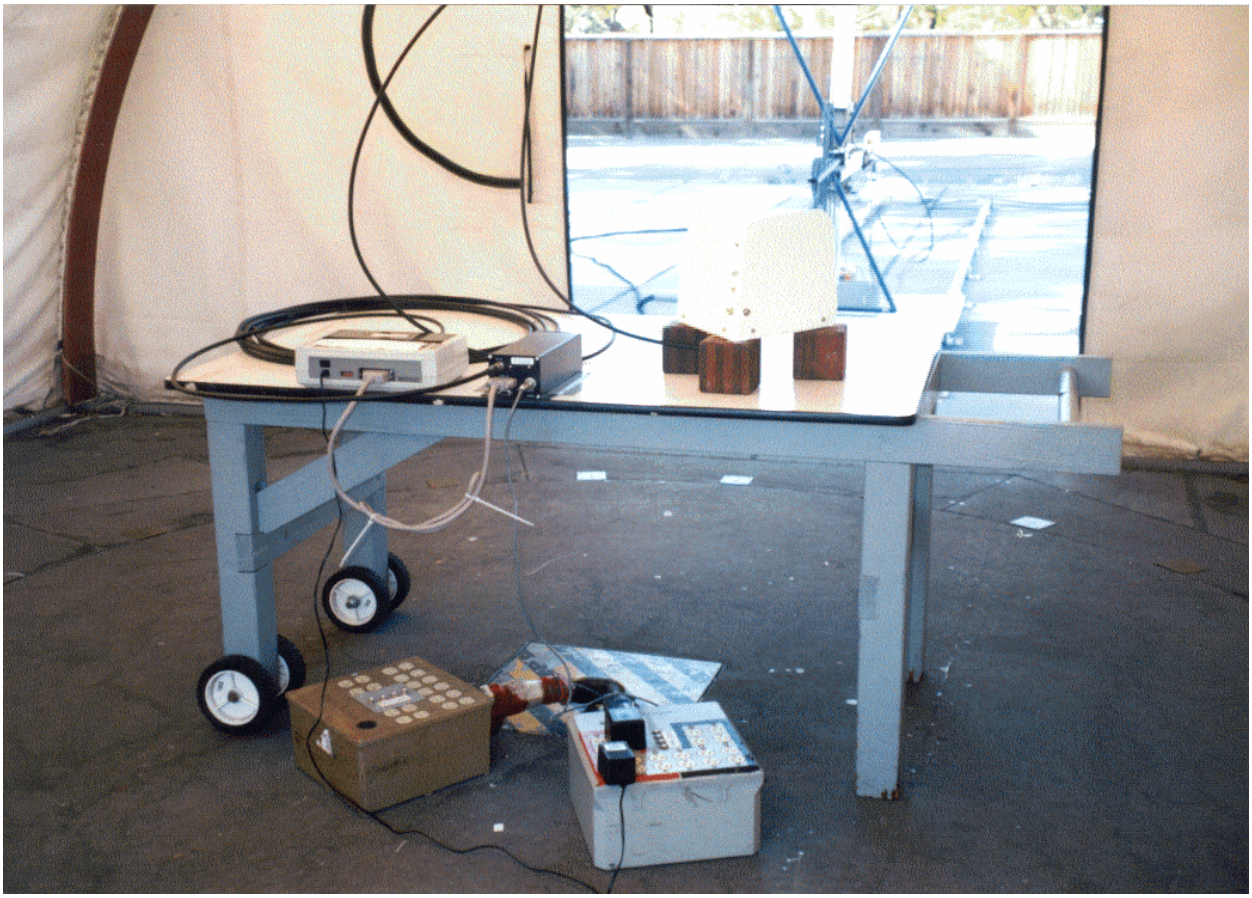

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Corner Reflector Antenna

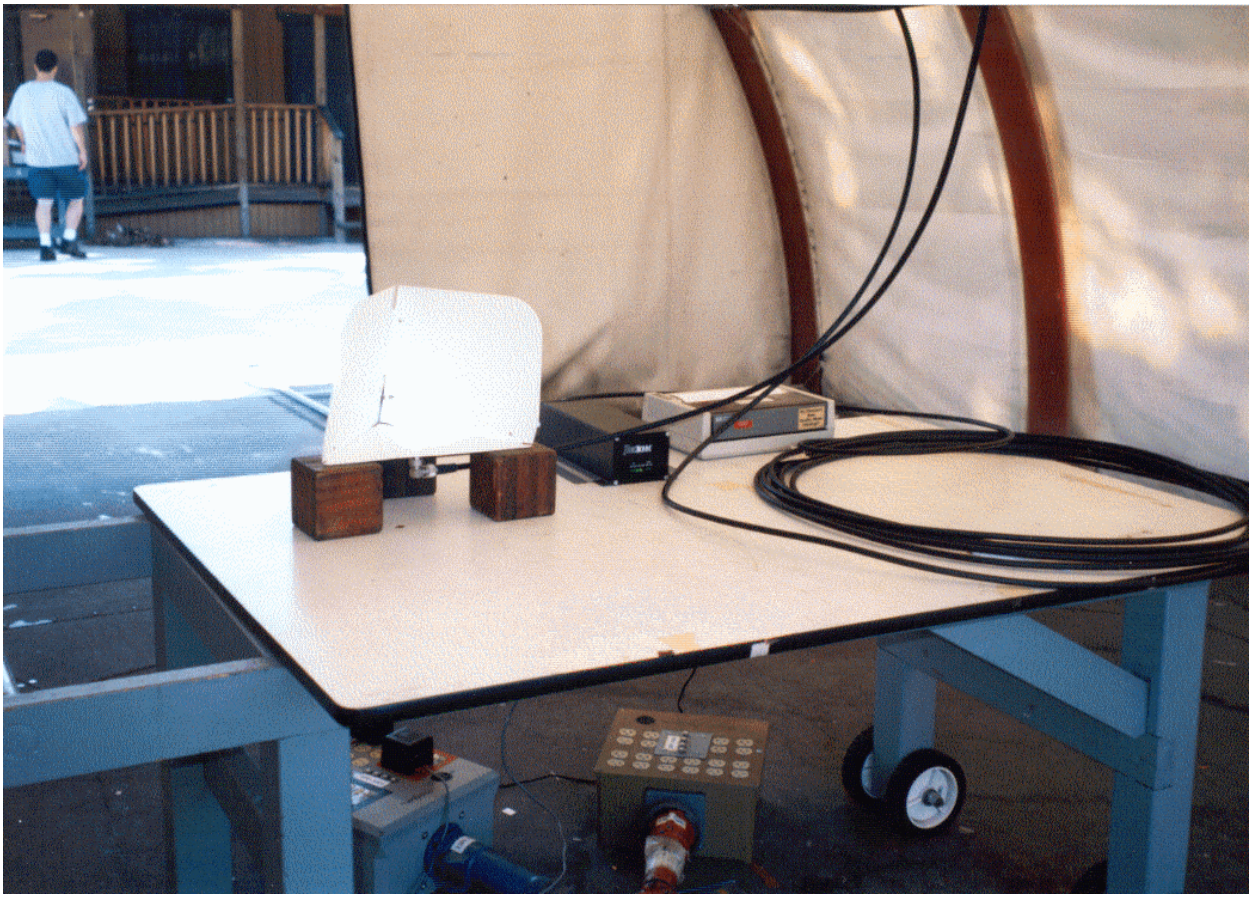

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Seavey Horizontal Omni-Directional Antenna

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Seavey Horizontal Omni-Directional Antenna

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Antel Horizontal Omni-Directional Antenna

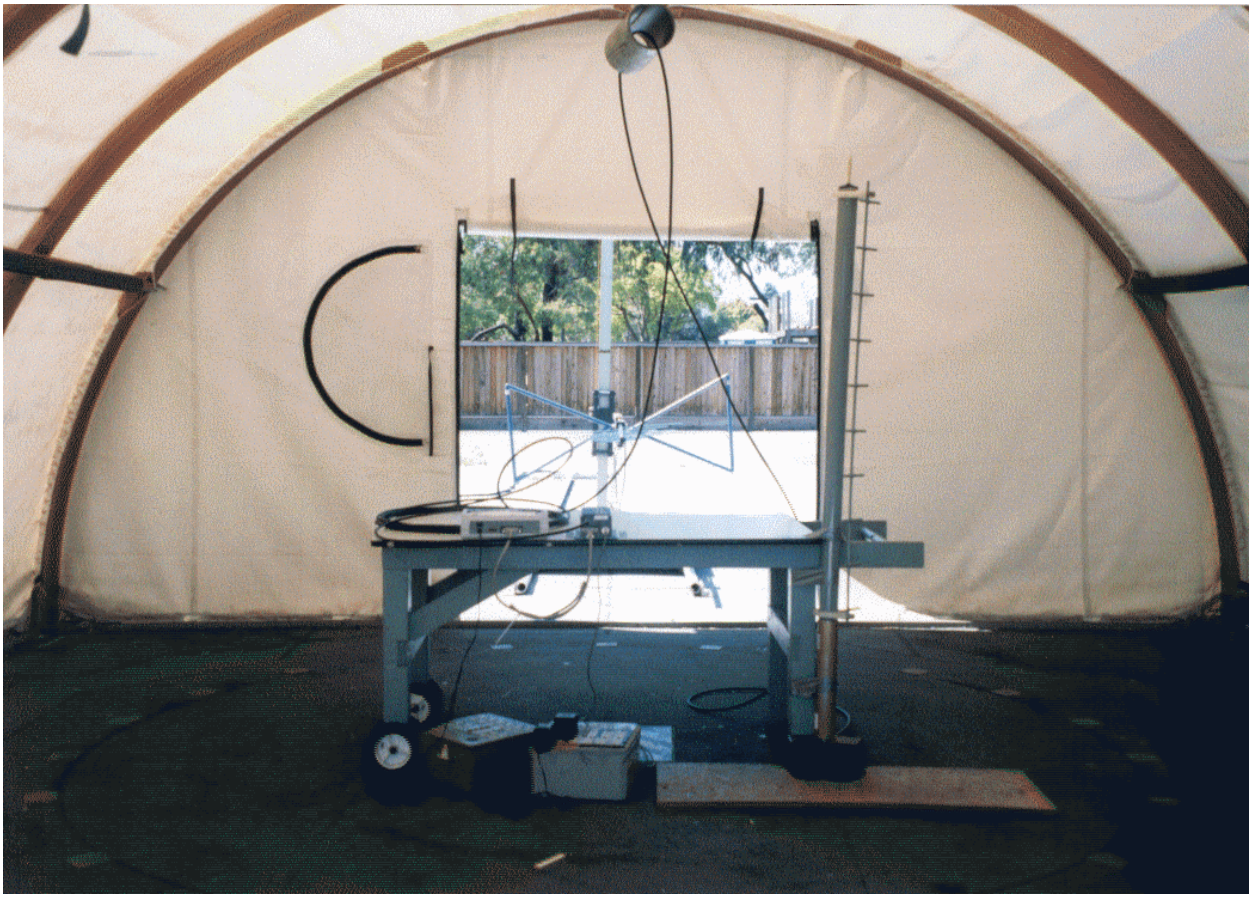

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

Antel Horizontal Omni-Directional Antenna

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

120-Degree Directional Antenna

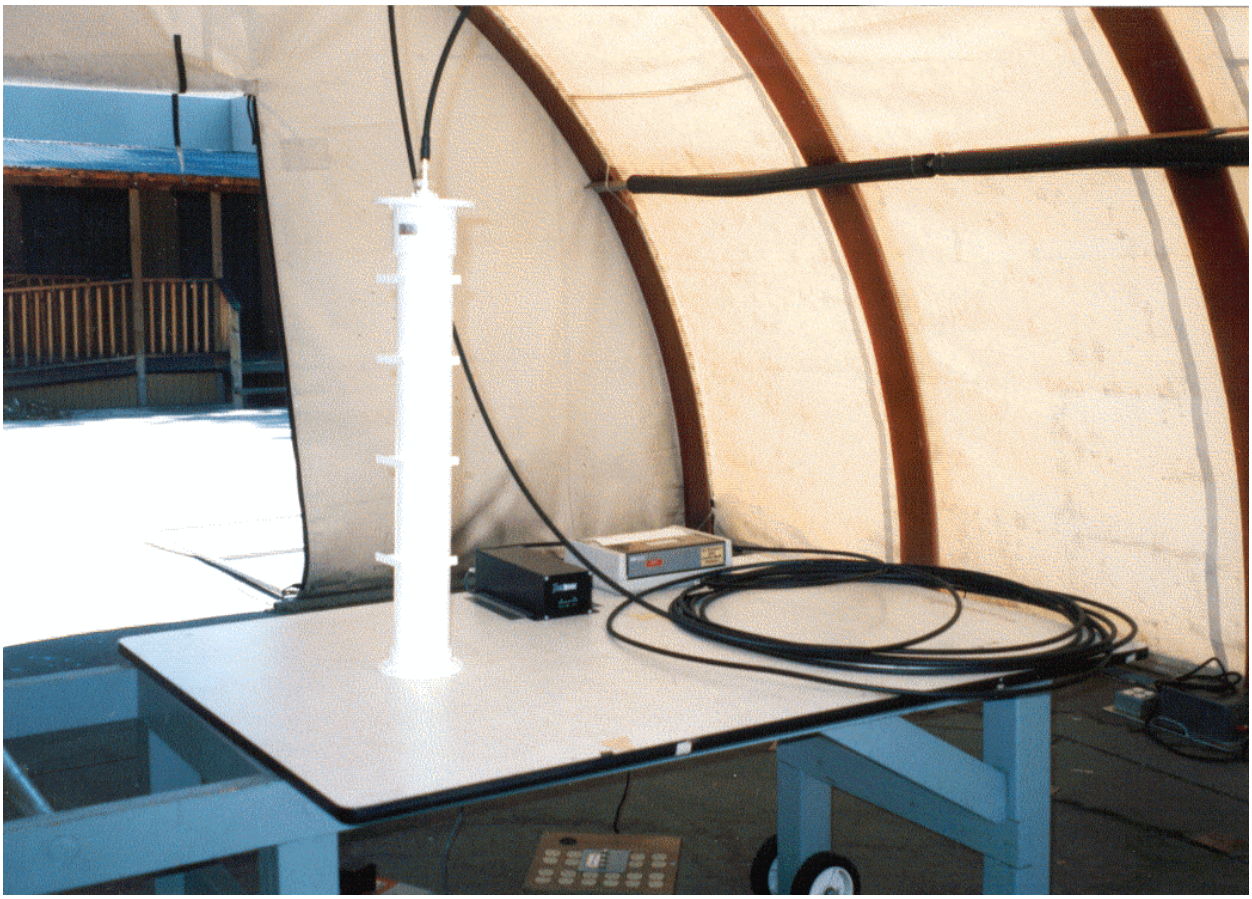

EXHIBIT 3: Radiated Emissions Test Configuration Photographs

120-Degree Directional Antenna

EXHIBIT 4: Theory of Operation for Thrucomm Model DP1000

Remains unchanged from Original Application

EXHIBIT 5: Proposed FCC ID Label & Label Location

Remains unchanged from Original Application

EXHIBIT 6: Detailed Photographs of Thrucomm Model DP1000 Construction

Remains unchanged from Original Application

EXHIBIT 7: Operator's Manual for Thrucomm Model DP1000

Remains unchanged from Original Application

EXHIBIT 8: Block Diagram of Thrucomm Model DP1000

Remains unchanged from Original Application

EXHIBIT 9: Schematic Diagrams for Thrucomm Model DP1000

Remains unchanged from Original Application