Intertek Testing Services
ETL SEMKO

TEST REPORT

Report Number: 0235583W.doc
Project Number: 3035583
Revision 3
February 25, 2003

Testing performed on the
Radar Vision
Model Number: RV-2000
to

FCC Part 15, Subpart B

Class B
For
Time Domain Corporation

Test Performed by:	Test Authorized by:
Intertek Testing Services 1950 Evergreen Blvd, Suite 100 Duluth, GA 30096	Time Domain Corporation 7057 Old Madison Pike Huntsville, AL 35806

Prepared by: Jeffrey D. Hiday Date: 02.25.2003

Reviewed by: David J. Schramm Date: 2/25/2003

TABLE OF CONTENTS

EXECUTIVE SUMMARY **3**

1 JOB DESCRIPTION **4**
1.1 CLIENT INFORMATION 4
1.2 TEST PLAN REFERENCE: 4
1.3 EQUIPMENT UNDER TEST (EUT) 4
1.3.1 System Support Equipment 5
1.3.2 Cables associated with EUT 5
1.3.3 System Block Diagram 6
1.3.4 Justification 7
1.3.5 Mode(s) of operation 7
1.4 MODIFICATIONS REQUIRED FOR COMPLIANCE 7

2 TEST ENVIRONMENT **8**
2.1 TEST FACILITY 8
2.2 TEST EQUIPMENT 8
2.3 EXAMPLE FIELD STRENGTH CALCULATION 9
2.4 MEASUREMENT UNCERTAINTY 10

3 ELECTROMAGNETIC RADIATION DISTURBANCE **11**
3.1 TEST LIMITS 11
3.2 TEST PROCEDURE 12
3.3 TEST RESULTS 13
3.4 TEST CONFIGURATION PHOTOGRAPH 16

4 AC MAINS LINE-CONDUCTED DISTURBANCE **18**

5 LABELING AND INSTRUCTION MANUAL REQUIREMENTS **19**
5.1 USA 19

6 REVISION HISTORY **20**

Executive Summary

Testing performed for: Time Domain Corporation

Equipment Under Test: RV-2000, Radar Vision

Test Description	Class	Pass/Fail Comments
Radiated Emissions		
• FCC Part 15	B	Pass
Conducted Emissions (AC Mains)		
• FCC Part 15	B	N/A[1]

[1] The RV-2000 is DC powered therefore conducted emissions testing is not required.

1 JOB DESCRIPTION

1.1 Client information

The Radar Vision was tested at the request of

Company: Time Domain Corporation
7057 Old Madison Pike
Huntsville, AL 35806

Name of contact: Pawan Mathur
Telephone: (256) 428-6591
Fax: (256) 922-0387

1.2 Test plan reference:

Tests were performed to the following standards and test plan:

- FCC Part 15, Subpart B rules for an unintentional radiator
- Time Domain Test Plan, Radiated Emissions Test Procedures for Indoor UWB Devices (410-0048)
- FCC Waiver, dated June 29, 2002

The test procedures described in American National Standards Institute C63.4: 1992 were employed.

1.3 Equipment Under Test (EUT)

Equipment Under Test		
Description	**Model Number**	**Serial Number**
Radar Vision	RV-2000	R2HA00001

EUT receive date: December 4, 2002

EUT receive condition: The EUT was received in good condition with no apparent damage.

Test start date: December 4, 2002

Test completion date: December 4, 2002

The test results in this report pertain only to the item tested.

The following description of the Radar Vision was supplied by Time Domain Corporation:

The Radar Vision (M/N: RV-2000) is a hand held radar device. The RV-2000 uses UWB technology to detect movement and display this movement on a small monitor for the user. The RV-2000 is DC powered at 7.2V.

1.3.1 System Support Equipment

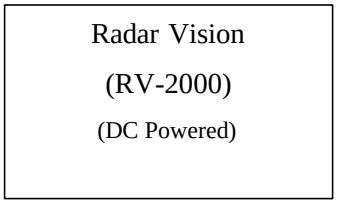
There was no support equipment required for the operation of the of the EUT.

1.3.2 Cables associated with EUT

There were no cables required for the operation of the EUT. It is a hand-held, battery powered device.

1.3.3 System Block Diagram

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.



1.3.4 Justification

The EUT was configured to transmit continuously.

To insure maximum emissions were detected, the system was rotated 360 degrees, the antenna height was varied from 1 to 4 meters above the ground plane in both horizontal and vertical polarizations. These maximum emissions are represented in Section 3.

Above 960 MHz, the measurements were made at 1 meter due to the extremely low emission limit. At 3 meters, the instrument noise floor is at or above the limits specified in 15.517(c) and (e).

The highest frequency scanned was 40 GHz.

1.3.5 Mode(s) of operation

The EUT was powered from 7.2V DC (Battery Powered).

The EUT was set to run continuously at full power.

1.4 Modifications required for compliance

No modifications were implemented by Intertek Testing Services.

2 TEST ENVIRONMENT

2.1 Test Facility

The Duluth 10-meter chamber site is located at 1950 Evergreen Blvd., Suite 100, Duluth, Georgia. The test site is a 10-meter semi-anechoic chamber. The site meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

The A2LA accreditation code for this site is 121624 under certificate number 1455.01.

2.2 Test Equipment

Table 2.2-1 contains a list of the test equipment used during the testing.

Table 2.2-1 List of Test Equipment

Description	Make	Model	Serial #	Cal DueDate
EMI Receiver	HP	8546A	3410A00173	3/28/03
RF Filter Selector	HP	85460A	3348A00203	3/28/03
Spectrum Analyzer	HP	8564EC	3946A00149	6/18/03
PreAmp	HP	8449B	3008A0089	4/30/03
PreAmp	HP	8447D	2648A04296	2/22/03
Antenna	Schaffner-Chase	CBL6112B	2622	8/24/03
Horn Antenna	AH Systems	571	246	1/13/03
Horn Antenna	EMCO	3116	9310-2222	2/18/03
Cable	Huber-Suhner	HS7kNN	None	6/4/03
Cable	Huber-Suhner	HS4kNN	None	6/4/03
Cable	Andrews	CableTW3	ITS#211412	6/4/03
Cable	N/A	Cable N2	ITS#211999a2	6/4/03

2.3 Example Field Strength Calculation

The field strength was calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation was as follows:

FS = RA + AF + CF – PA

Where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(1/m)
PA= Preamplifier Factor in dB

Assume a receiver reading of 52.0 dB(μV) was obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB was added. The amplifier gain of 29 dB was subtracted, giving a field strength of 32 dB(μV/m).

RA = 52.0 dB(μV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
PA = 29.0 dB
FS = RF + AF + CF – PA
FS = 52.0 + 7.4 + 1.6 – 29.0
FS = 32 dB(μV/m)

2.4 Measurement Uncertainty

Compliance of the product was based on the measured value. However, the measurement uncertainty is included here for informational purposes.

The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz was determined to be:

±3.5 dB at 10m, ±3.8 dB at 3m, ±4.2 dB at 1m

The expanded uncertainty (k = 2) for radiated emissions from 1 to 18 GHz was determined to be:

±4.6 dB at 1m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz was determined to be:

±2.6 dB

3 ELECTROMAGNETIC RADIATION DISTURBANCE

3.1 Test Limits

Table 3.1-1 Radiated Disturbance Limit for FCC Part 15 Subpart B

Radiated Emission Limits at 10 meters[2]		
Frequency (MHz)	Class A Quasi-Peak limits, dB (μV/m)	Class B Quasi-Peak limits, dB (μV/m)
30 to 88	39.1	29.5
88 to 216	43.5	33.0
216 to 960	46.4	35.5
960 and up	49.5	43.5

[2] *If the field strength measurement at 10m cannot be made because of high ambient noise levels or for other reasons, measurement of Class B EUT's may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specific distance for determining compliance. For example, a factor of –10.5 dB should be applied to a reading taken at 3 meters*

3.2 Test Procedure

Measurements were conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz. The measuring receiver met the requirements of Section One of CISPR 16 and the measuring antenna correlated to a balanced dipole.

Radiated field measurements between 30MHz and 1GHz field were made with the antenna located at a distance of 3-meters from the EUT.

Radiated field measurements above 960MHz were made with the antenna located at a distance of 1-meter from the EUT. Two types of readings were taken for these measurements. The peak detector was used with a resolution bandwidth of 1MHz and video bandwidth of 1MHz. Average measurements were accomplished by using the peak detector with the resolution bandwidth set to 1MHz and the video bandwidth set to 10kHz.

Measurements above 11GHz were made at a distance closer then 1-meter and no emissions were detected. The highest frequency scanned was 40GHz.

The antenna was adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth was varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) was varied during the measurements to find the maximum field-strength readings.

The EUT was placed on a table whose top was 0.8m above the ground plane. The table was constructed of non-conductive materials. Its dimensions were 1m by 1.5m.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4: 1992.

3.3 Test Results

The Radar Vision met the radiated disturbance requirements of FCC Part 15, Subpart B for a Class B device. The test results are located in Table 3.3-1, Table 3.3-2 and Table 3.3-3.

Table 3.3-1 FCC Part 15 Subpart B Radiated Disturbance

Company: **Time Domain**
Model: **RV-2000**
Project No.: **3035583**
Date: 12/04/02
Standard: FCC15
Class: B Group: None
Notes: S/N: R2HA00001

Tested by: Jeffrey D. Hiday
Location: Duluth
Detector: HP8546
Antenna: CHAS2622
PreAmp: HP8447d
Cable(s): CABLEN2 TW3 + HS4000 N-N
Distance: **3**

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB
V	122.000	43.5	12.3	1.8	25.9	0.0	31.7	43.5	-11.8
V	112.603	45.3	11.8	1.8	25.9	0.0	33.0	43.5	-10.5
H	159.538	48.2	10.1	2.1	25.7	0.0	34.7	43.5	-8.8
H	168.910	48.6	9.9	2.3	25.7	0.0	35.1	43.5	-8.4
H	187.688	45.5	9.4	2.4	25.5	0.0	31.7	43.5	-11.8
V	126.738	38.6	12.3	1.9	25.9	0.0	27.0	43.5	-16.5

Figure 3-1: Peak Pre-scan plot 30MHz to 1GHz

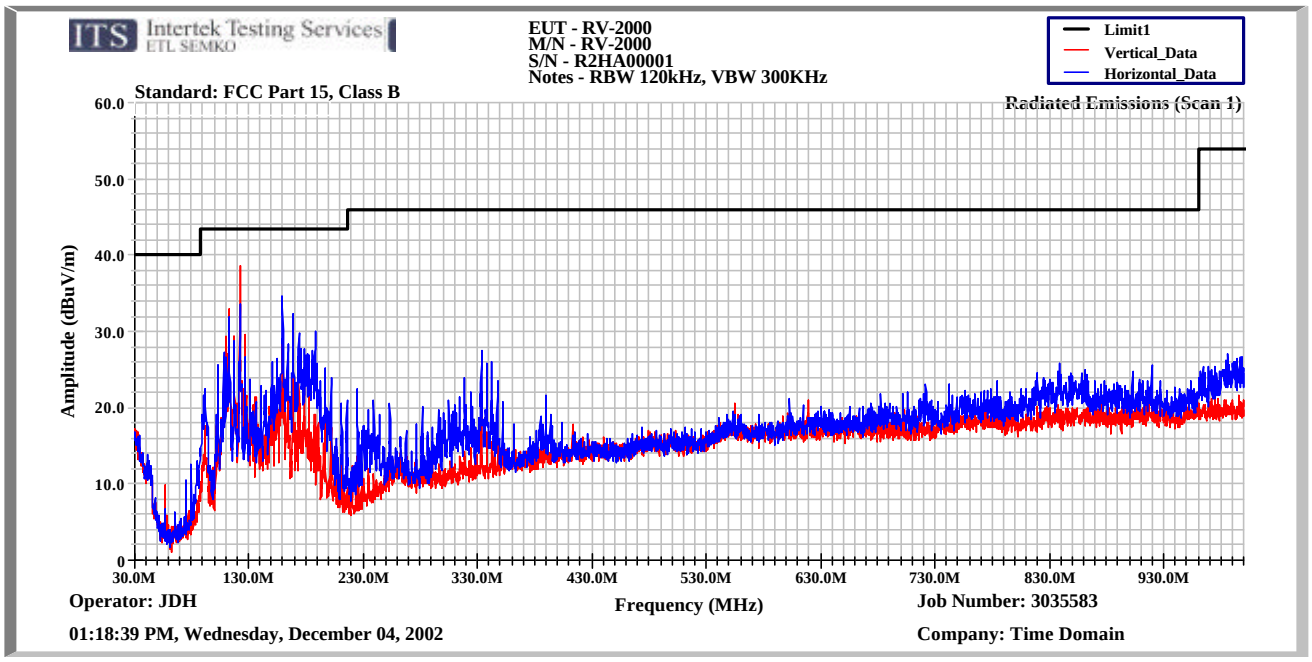


Table 3.3-2 FCC Radiated Disturbance, Average measurements

Company: **Time Domain**
Model: **RV-2000**
Project No.: **3035583**
Date: 12/04/02
Standard: FCC15
Class: B Group: None
Notes: S/N: R2HA00001

Tested by: Jeffrey D. Hiday
Location: Duluth
Detector: HP8546
Antenna: AH571
PreAmp: hp8449b
Cable(s): TW3 + HS400(HS7000 N-SMA
Distance: **1**

Averaging using peak detector and RBW 1MHz, VBW 10KHz

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	3 meter Limit dB(uV/m)	Margin dB
H	1919.500	53.3	29.5	8.5	37.2	9.5	44.6	54.0	-9.4
H	2207.500	58.3	30.2	9.1	37.1	9.5	51.1	54.0	-2.9
H	2267.000	57.2	30.3	9.3	37.0	9.5	50.2	54.0	-3.8
H	2692.857	53.2	30.6	10.4	37.0	9.5	47.8	54.0	-6.2
H	3382.000	52.3	31.6	12.0	36.8	9.5	49.6	54.0	-4.4

Table 3.3-3 FCC Radiated Disturbance, Peak measurements[3]

Company: **Time Domain**
Model: **RV-2000**
Project No.: **3035583**
Date: 12/04/02
Standard: FCC15
Class: B Group: None
Notes: S/N: R2HA00001

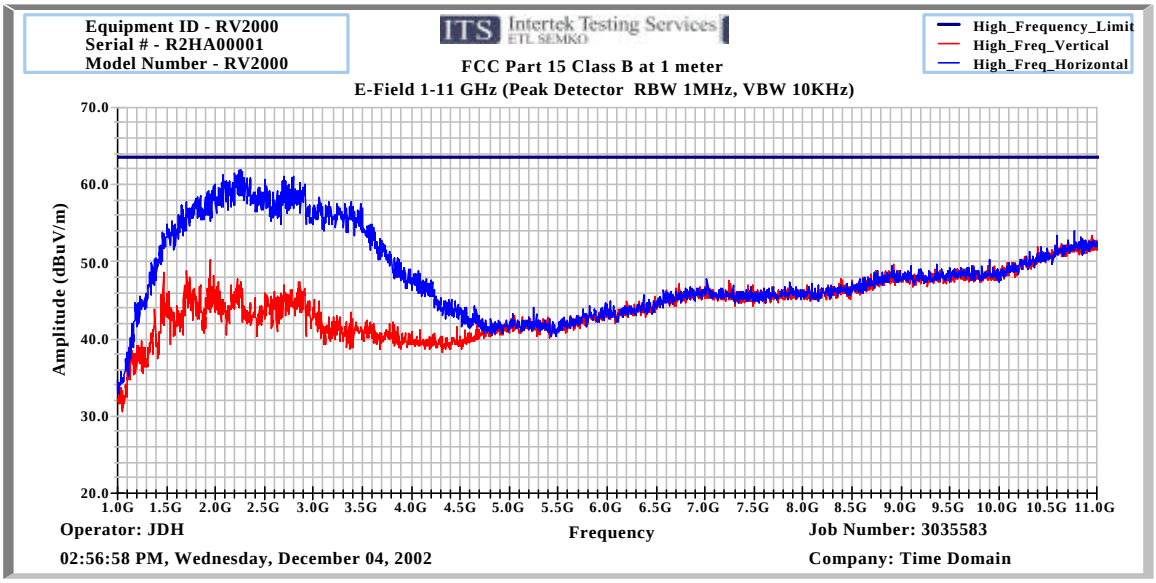
Tested by: Jeffrey D. Hiday
Location: Duluth
Detector: HP8546, Peak
Antenna: AH571
PreAmp: hp8449b
Cable(s): TW3 + HS400(HS7000 N-SMA
Distance: **1**

For Peak Readings RBW 1MHz, VBW 1MHz

Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	3 meter Limit dB(uV/m)	Margin dB
H	1919.500	58.7	29.5	8.5	37.2	9.5	50.0	80.0	-30.0
H	2207.500	64.1	30.2	9.1	37.1	9.5	56.9	80.0	-23.1
H	2267.000	63.4	30.3	9.3	37.0	9.5	56.4	80.0	-23.6
H	2692.857	59.6	30.6	10.4	37.0	9.5	54.2	80.0	-25.8
H	3382.000	59.1	31.6	12.0	36.8	9.5	56.4	80.0	-23.6

[3] Peak to Average limit was set to 26dB by NTIA document for conditions to accept the FCC waiver

Figure 3-2: Average Pre-scan plot 1 to 11GHz



3.4 Test Configuration Photograph

Figure 3-3 and Figure 3-4 show the testing configurations used.

Figure 3-3: Configuration photograph, radiated disturbance, front view

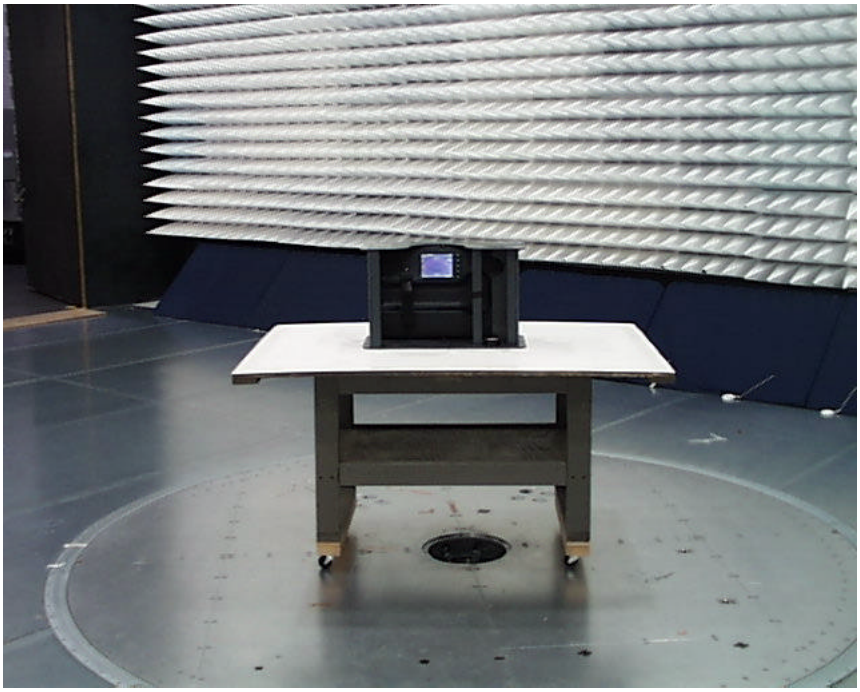


Figure 3-4: Configuration photograph, radiated disturbance, rear view

4 AC MAINS LINE-CONDUCTED DISTURBANCE

This test was not applicable to the EUT because it is powered only by internal batteries.

5 LABELING AND INSTRUCTION MANUAL REQUIREMENTS

5.1 USA

Labeling requirements.

Devices subject to verification must be labeled with the following statement:

> **This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

Information to the user.

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class A digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the test of the manual:

> **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.**

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

> ***NOTE:*** **This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:**
>
> - **Reorient or relocate the receiving antenna.**
> - **Increase the separation between the equipment and receiver.**
> - **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
> - **Consult the dealer or an experienced radio TV technician for help.**

If shielded cables or other specialized accessories are necessary for the unit to achieve compliance, a statement similar to the following should be added:

> **Shielded cables must be used with this unit to ensure compliance with the Class B FCC limits.**

6 REVISION HISTORY

Revision Level	Date	Notes
Original issue date	December 31, 2003	--
Level One	January 7, 2003	Edit text in product description and test procedure sections
Level Two	January 9, 2003	Added measurement uncertainty for 1m test distance
Level Three	February 25, 2003	Adjusted Tables 3.3.1 to 3.3.3 to show 3 meter limit and appropriate distance correction factor.