



Intertek Testing Services
ETL SEMKO

TEST REPORT

Report Number: 0227351uwb.doc

Project Number: 3027351

July 19, 2002

Evaluation of the
TAG

Model Number: 100-0011C
to

CFR 47 Part 15, Subpart F

For
Time Domain Corporation

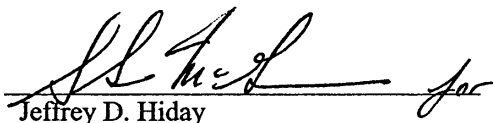
Test Performed by:

Intertek Testing Services
1950 Evergreen Blvd, Suite 100
Duluth, GA 30096

Test Authorized by:

Time Domain Corporation
7057 Old Madison Pike
Huntsville, AL 35806

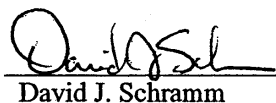
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7/22/02

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Executive Summary

Testing performed for: Time Domain Corporation

Equipment Under Test: 100-0011C, TAG

Test Description	FCC Section	Pass/Fail Comments
• Operational limitations	15.517(a)	Time Domain Corporation has been notified of these requirements
• UWB bandwidth	15.517(b)	Pass
• Radiated Emissions	15.517(c) 15.209	Pass (See Note 1)
• Radiated emissions in GPS bands	15.517(e)	Pass
• Peak emission within a 50 MHz bandwidth	15.517(f)	Pass
• Labeling requirements	15.517(g)	Time Domain Corporation has been notified of these requirements
• Conducted emissions, AC Mains	15.207	Pass

Note 1: Measured result is below the specification limit by a margin less than the measurement uncertainty; it is not therefore possible to determine compliance at a level of confidence of 95%. However, the measured result indicates a higher probability that the product tested complies with the specification limit.

1 JOB DESCRIPTION

1.1 Client information

The TAG has been 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:

- CFR 47 Part 15, Subpart C rules for an intentional radiator
- CFR 47 Part 15, Subpart F rules for a UWB device

The test procedures described in American National Standards Institute C63.4: 1992, CISPR 16-1: 1993, and CFR 47 Part 15, Subpart F were employed.

“Radiated Emissions Test Procedure for Indoor UWB Devices,” written by Time Domain Corporation, was also used as a reference.

1.3 Equipment Under Test (EUT)

Equipment Under Test		
Description	Model Number	Serial Number
TAG	100-0011C	TGHC000024
Switching Power Supply (Globtek, Inc.)	SA-072A0F-11	006680

EUT receive date: June 26, 2002

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

Test start date: June 26, 2002

Test completion date: July 18, 2002

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

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

The TAG is an AC mains powered ultra-wideband transmitter for indoor use.

Intertek Testing Services

1.3.1 System Support Equipment

Table 1.3-1 contains the details of the support equipment associated with the Equipment Under Test.

Table 1.3-1: System Support Equipment

Description	Manufacturer	Model Number	Serial Number	FCC ID number
Laptop computer	Dell	PPX Inspiron 3800	33-460-78	Not labeled

1.3.2 Cables associated with EUT

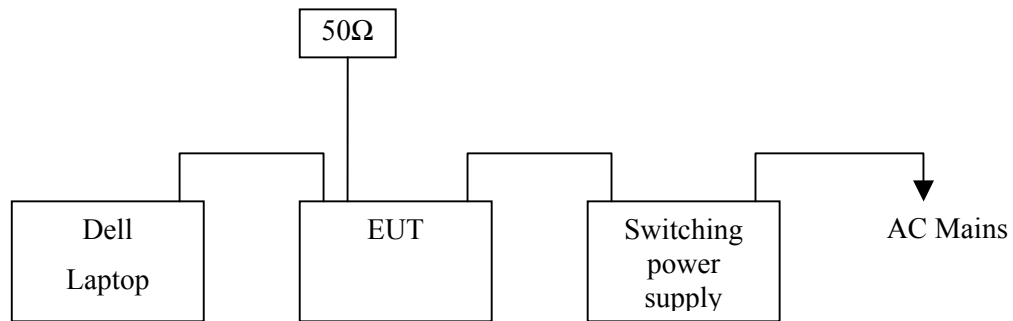
Table 1.3-2 contains the details of the cables associated with the EUT.

Table 1.3-2: Interconnecting cables between modules of EUT

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
AC Power cable	1.6 m	None	None	Power supply	AC Mains
DC Power cable	1.5 m	None	None	Power supply	EUT
High frequency cable	1 m	Coax	None	EUT	50 ohm termination
Serial cable	1.5 m	Foil	None	EUT	Laptop computer

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 system was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst-case emissions.

The EUT was configured to transmit continuously.

The TAG has four transmit modes. For test purposes, the TAG was placed in the “TAG ID Only” mode, which produces the worst-case spectral features.

All interconnecting cables dropped from the rear of the turntable, but none were within 40 cm of the groundplane.

The arrangement of the cables dangling from the rear of the table was varied to the extent possible to produce the maximum emissions.

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 4, Section 5, Section 6, and Section 7.

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).

Frequency determining parameters

The highest frequency employed in CFR 47 Section 15.33 to determine the frequency range over which radiated emissions are made were based on the center frequency, f_c , unless a higher frequency was generated within the UWB device. For measuring emission levels, the spectrum were investigated from the lowest frequency generated in the UWB, without going below 9 kHz, up to the frequency range shown in Section 15.33(a) of CFR 47 or up to $f_c + 3/(\text{pulse width in seconds})$, whichever was higher. There is no requirement to measure emissions beyond 40 GHz provided f_c was less than 10 GHz; beyond 100 GHz if f_c was at or above 10 GHz and below 30 GHz; or beyond 200 GHz if f_c was at or above 30 GHz.

The center frequency f_c was found to be 5185 MHz.

The pulse width of the EUT was 500 picoseconds.

Therefore, the highest frequency to be measured was 40 GHz.

1.3.5 Mode(s) of operation

The EUT was powered from 120 Vac, 60 Hz.

Pulse repetition frequency (PRF) is 10 MHz and is not adjustable.

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

Duluth Test Equipment for Radiated Emissions				
Description	Make	Model	Serial #	Cal Date
EMI Receiver	HP	85462A	3650A00362	3/28/2002
RF Filter Selector	HP	85460A	3704A00331	3/28/2002
Spectrum Analyzer	HP	8566B	2134A01032	12/3/2001
Spectrum Analyzer	HP	8564E	3846A01503	11/15/2001
PreAmp	HP	8449B	3008A0089	10/24/2001
PreAmp	HP	8447D	2648A04296	2/22/02
PreAmp	Miteq	JS2-00100400-10-10A	386277	6/6/2002
BiLog Antenna	Chase	CBL6112B	2622	8/14/2001
Horn Antenna	AH Systems	SAS 200/571	246	1/13/2002
Horn Antenna	EMCO	3116	9310-2222	2/18/2002
Cable	N/A	Cable N2	ITS# 211999a2	6/12/2002
Cable	Huber Suhner	HS 7000	HS7kNSma	6/12/2002
Cable	Huber Suhner	HS 4000	HS7kNN	6/12/2002
Cable	N/A	CableTW3	ITS# 211412	6/12/2002
LISN	Fischer	FCC-LISN-50-50-M	2020	12/7/2001
LISN	Fischer	FCC-LISN-50-50-M	2019	12/7/2001
Cable	N/A	Cable TT4	ITS# 211404	6/12/2002

* All calibrations are on 12-month cycles unless otherwise indicated

2.3 Measurement Calculations

2.3.1 Example Field Strength Calculation

The field strength is 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 is as follows:

$$FS = RA + AF + CF - PA$$

Where

- FS = Field Strength in dB(μ V/m)
- RA = Receiver Amplitude (including preamplifier) in dB(μ V)
- 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(μ V) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB(μ V/m).

$$RA = 52.0 \text{ dB}(\mu\text{V})$$

$$AF = 7.4 \text{ dB}(1/\text{m})$$

$$CF = 1.6 \text{ dB}$$

$$PA = 29.0 \text{ dB}$$

$$FS = RF + AF + CF - PA$$

$$FS = 52.0 + 7.4 + 1.6 - 29.0$$

$$FS = 32 \text{ dB}(\mu\text{V}/\text{m})$$

2.3.2 EIRP Calculations

As defined in CFR 47 Part 15.503(k), EIRP is the equivalent isotropic radiated power, i.e. the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. The EIRP, in terms of dBm, can be converted to a field strength, in dB μ V/m at 3 meters, by adding 95.2. As used in Subpart F, EIRP refers to the highest signal strength measured in any direction and at any frequency from the UWB device, as tested in accordance with the procedures specified in 15.31(a) and 15.523 of CFR 47.

2.4 Measurement Uncertainty

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

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

± 3.5 dB at 10m

± 3.8 dB at 3m

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

± 4.6 dB at 3m

± 4.5 dB at 1m

The expanded uncertainty ($k = 2$) for radiated emissions from 18 to 40 GHz has been determined to be:

± 4.2 dB at 1m

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

± 2.6 dB

3 OPERATIONAL LIMITATIONS

CFR 47 Section 15.517(a)(1)

Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.

The TAG, Model Number 100-0011C, operates solely through the AC mains. It is not intended to operate from any other power source.

CFR 47 Section 15.517(a)(2)

The emissions from equipment operated under this section shall not be intentionally directed outside of the building in which the equipment is located, such as through a window or a doorway, to perform an outside function, such as the detection of persons about to enter a building.

Time Domain Corporation has been informed of this requirement.

CFR 47 Section 15.517(a)(3)

The use of outdoor antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

Time Domain Corporation has been informed of this requirement.

CFR 47 Section 15.517(a)(4)

Field disturbance sensors installed inside of metal or underground storage tanks are considered to operate indoors provide emissions are directed towards the ground.

CFR 47 Section 15.517(a)(5)

A communications system shall transmit only when the intentional radiator is sending information to an associated receiver.

Time Domain Corporation has been informed of this requirement.

4 UWB BANDWIDTH

CFR 47 Section 15.517(c)

The UWB bandwidth of a UWB system operating under the provisions of CFR 47 Section 15.517 must be contained between 3100 MHz and 10,600 MHz.

4.1 Test Procedure

Due to the extremely wide nature of UWB emissions, special considerations were taken to make the bandwidth measurements. The emissions were measured in a manner similar to those stated in Section 5.2 of this document.

The resolution bandwidth was set to 1 MHz. The video bandwidth was set to 3 MHz. The test distance was 1 meter.

A computer runs the maximization routine and records the highest emissions over a frequency range of 3 to 11 GHz. The maximization routine rotates the table through 360 degrees and moves the measurement antenna from 1 to 4 meters above the ground plane.

4.2 Test Results

The bandwidth of the TAG, Model Number 100-0011C, was found to comply with the requirements of CFR 47 Section 15.517(c). A bandwidth plot is located in Figure 4-1.

$$f_L = 3.42 \text{ GHz}, f_H = 6.95 \text{ GHz}, f_M = 5.423 \text{ GHz}, \text{ and Bandwidth} = 3.53 \text{ GHz}$$

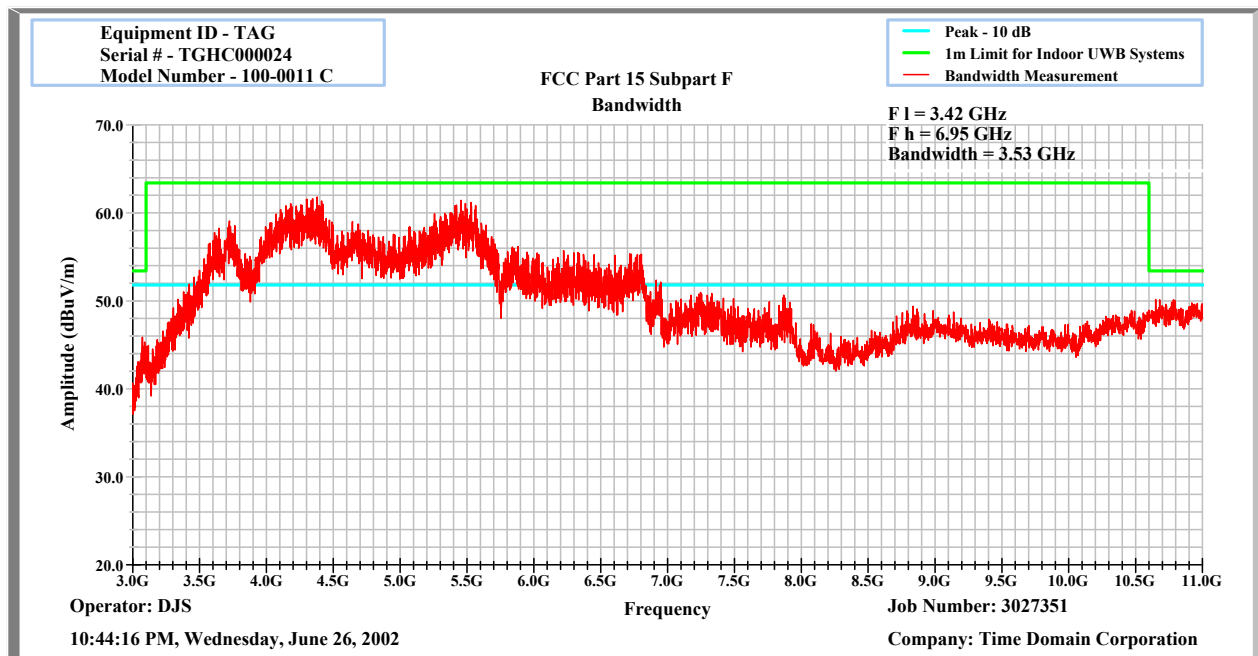


Figure 4-1: Composite Bandwidth Plot

5 RADIATED EMISSIONS, UWB SPECIFIC REQUIREMENTS

5.1 Test limits

The radiated emissions at or below 960 MHz from a device operating under the provisions of CFR 47 Section 15.517 shall not exceed the emission level in CFR 47 Section 15.209. The radiated emissions above 960 MHz from a device operating under CFF 47 Section 15.517 shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Table 5.1-1 Radiated emission limits for UWB transmitters

Frequency MHz	EIRP dBm	Measurement distance meters
960 to 1610	-75.3	3
1610 to 1990	-53.3	3
1990 to 3100	-51.3	3
3100 to 10600	-41.3	3
Above 10600	-51.3	3

From CFR 47 Section 15.521 (c): As noted in Section 15.3(k) of this chapter, digital circuitry that is used only to enable the operation of a transmitter and that does not control additional functions or capabilities is not classified as a digital device. Instead, the emissions from that digital circuitry are subject to the same limits as those applicable to the transmitter. If it can be clearly demonstrated that an emissions from a UWB transmitter is due solely to the emissions from digital circuitry contained within the transmitter and that the emission is not intended to be radiated from the transmitter's antenna, the limits shown in CFR 47 Section 15.209 shall apply to that emission rather than the limits specified in CFR 47 Section 15 Subpart F.

Table 5.1-2 Radiated emission limits, general requirements

Frequency (MHz)	Field strength (μ V/m)	Measurement distance (meters)
0.009 to 0.490	2400/F(kHz)	300
0.490 to 1.705	24000/F(kHz)	30
1.705 to 30	30	30
30 to 88	39.1	3
88 to 216	43.5	3
216 to 960	46.4	3
960 and up	49.5	3

5.2 Test Procedure

Measurements in the frequency range of 30 MHz to 960 MHz were conducted with a measurement receiver equipped with a quasi-peak detector. Measurements above 960 MHz were based on RMS average measurements over a 1 MHz resolution bandwidth.

An RMS detector was not available during testing, therefore the spectrum analyzer resolution bandwidth was set to a 1 MHz, the video bandwidth was set to 1 MHz, and the detector set to sample. The spectrum analyzer trace was exported to a spread sheet and post processed to determine the RMS value of the emission. The procedure described in Appendix F of CFR 47, Part 15, Subpart F, Paragraph (3) was used.

Measurements of the radiated field from 30 MHz to 960 MHz were made with the measurement antenna located at a distance of 3 meters from the EUT unless specified otherwise in the measurement results.

Measurements of the radiated field above 960 MHz were made with the measurement antenna located at a distance of 1 meter from the EUT unless specified otherwise in the measurement results.

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 from zero to 360 degrees during the measurement to find the maximum field-strength readings.

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

The EUT, where intended for tabletop use, was placed on a table whose top is 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.

5.3 Test Results

The TAG met the radiated emission requirements of FCC CFR 47 Section 15.517(c). The spectrum between 960 MHz and 3100 MHz contained no intentional emissions above the measurement noise floor. There was no change in the emission profile in the 960 MHz to 3100 MHz band when the antenna was terminated into a non-radiating 50-ohm load. Terminating the antenna port and re-measuring all emissions that were above the -75.3 dBm limit when the antenna was attached verified this. There were no other emissions detected above 10600 MHz. The maximum frequency scanned was 40 GHz.

Table 5.3-1 Radiated Emissions, 30 to 960 MHz

Company: **Time Domain Corporation**
 Model: **TAG (SN: TGH000024)**
 Project No.: **3027351**
 Date: 06/26/02
 Standard: FCC15
 Class: B
 Notes: UWB Product

Tested by: Matthew Van Steen
 Location: Duluth
 Detector: HP8546
 Antenna: CHAS2622
 PreAmp: HP-1G
 Cable(s): Cable N2 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	153.610	43.0	10.2	2.0	25.7	0.0	29.5	43.5	-14.0
H	153.610	38.0	10.2	2.0	25.7	0.0	24.5	43.5	-19.0
H	230.048	48.4	9.6	2.5	25.3	0.0	35.3	46.0	-10.7
H	307.210	37.2	12.9	2.9	25.3	0.0	27.6	46.0	-18.4
H	384.010	41.9	14.5	3.2	25.8	0.0	33.8	46.0	-12.2
H	844.800	39.2	20.0	5.0	26.3	0.0	37.9	46.0	-8.1

Table 5.3-2 Radiated Emissions, 960 to 11600 MHz

Company: **Time Domain Corporation**
 Model: **TAG (SN: TGH000024)**
 Project No.: **3027351**
 Date: 07/18/02
 Standard: FCC15
 Notes: Post processed for RMS reading
 RBW/VBW: 1 MHz / 1 MHz

Tested by: David J. Schramm
 Location: Duluth
 Detector: HP8566, Sample
 Antenna: AH571
 PreAmp: Hp1-26g
 Cable(s): HS7000 N-SM TW3 + HS4000 N-N
 Distance: **1**

Ant. Pol. (V/H)	Frequency MHz	RMS Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Convert to dBm	Net dBm	1 meter Limit dBm	Margin dB
V	3100.000	37.7	31.2	11.9	37.0	95.2	-51.4	-41.8	-9.6
V	3657.750	45.9	32.3	12.4	36.6	95.2	-41.2	-31.8	-9.4
V	3741.000	45.6	32.6	12.9	36.4	95.2	-40.5	-31.8	-8.7
V	4300.140	47.2	33.6	14.0	36.3	95.2	-36.7	-31.8	-5.0
V	4374.920	47.9	33.6	14.1	36.4	95.2	-36.0	-31.8	-4.2
V	4652.380	45.8	34.3	14.5	36.5	95.2	-37.1	-31.8	-5.4
V	5047.300	46.4	35.6	15.1	36.5	95.2	-34.6	-31.8	-2.8
V	5406.350	45.9	35.2	16.0	36.1	95.2	-34.2	-31.8	-2.4
V	5423.670	45.0	35.2	16.0	36.1	95.2	-35.2	-31.8	-3.4
V	5842.500	40.0	36.3	17.0	36.2	95.2	-38.1	-31.8	-6.4
V	6937.600	36.0	37.6	21.3	36.6	95.2	-36.9	-31.8	-5.1

5.4 Test Configuration Photograph

Figure 5-1 and Figure 5-2 show the testing configurations used.



Figure 5-1: Configuration photograph, radiated disturbance, front view

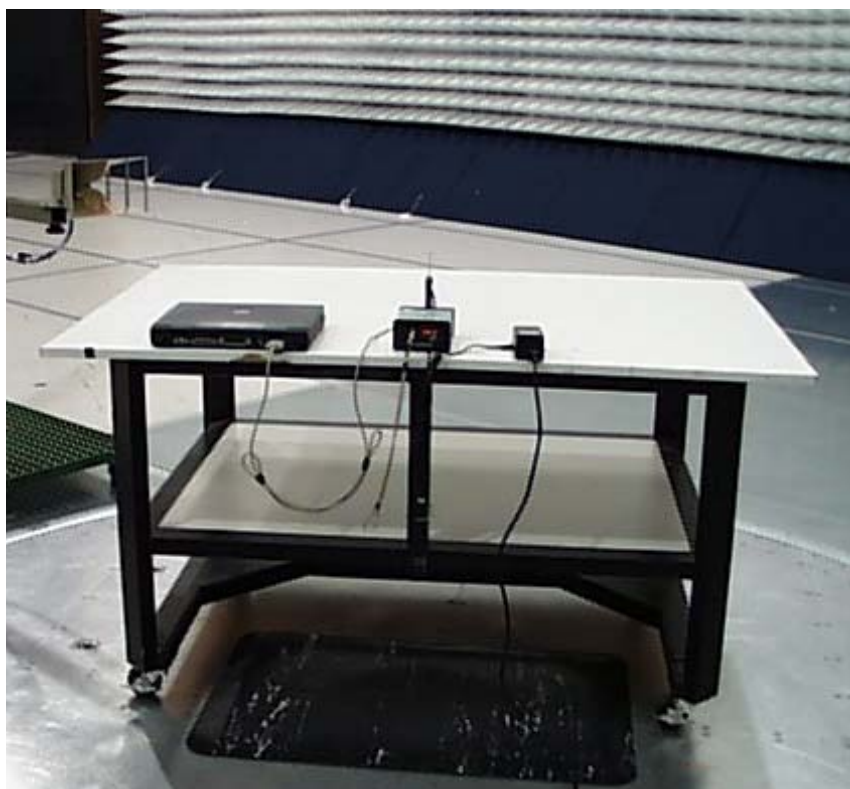


Figure 5-2: Configuration photograph, radiated disturbance, rear view

6 RADIATED EMISSIONS IN GPS BANDS

6.1 Test limits

In addition to the radiated emission limits specified in Table 5.1-1, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz.

*Table 6.1-1 Radiated emission limits for UWB transmitters
using RBW of ≥ 1 kHz.*

Frequency in MHz	EIRP at 3 meters dBm
1164 to 1240	-85.3
1559 to 1610	-85.3

6.2 Test Procedure

Measurements in this section were made using a resolution bandwidth of 1 kHz, a video bandwidth of 30 kHz, and the detector set to sample. The spectrum analyzer trace was exported to a spread sheet and post processed to determine the RMS value of the emission. The procedure described in Appendix F of CFR 47, Part 15, Subpart F, Paragraph (3) was used.

Measurements of the radiated field were made with the measurement antenna located at a distance of 1 meter from the EUT unless specified otherwise in the measurement results.

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 from zero to 360 degrees during the measurement to find the maximum field-strength readings.

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

The EUT, where intended for tabletop use, was placed on a table whose top is 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.

6.3 Test Results

The TAG met the radiated emission requirements of FCC CFR 47 Section 15.517(e). There were no intentional emissions above the measurement noise floor within these bands. There was no change in the emission profile in the 1164 - 1240 MHz and the 1559 – 1610 MHz bands when the antenna was terminated into a non-radiating 50-ohm load. Terminating the antenna port and re-measuring all emissions that were above the –85.3 dBm limit when the antenna was attached verified this. The measurement noise floor is at least 4 dB below the specified limit.

7 PEAK EMISSION WITHIN A 50 MHZ BANDWIDTH

7.1 Test limit

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emissions occurs, f_M . That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit.

7.2 Test procedure

When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified CFR 47 Part 15, Subpart F. The resolution bandwidth was set to 3 MHz, and the measurement was centered on the frequency at which the highest radiated emission occurred, f_M . Since a resolution bandwidth other than 50 MHz was employed, the peak EIRP limit was $20\log(RBW/50)$ dBm where RBW was the resolution bandwidth in megahertz that was employed. This level is -24.4 dBm. This was converted to a peak field strength level at 3 meters using $E(\text{dBuV/m}) = P(\text{dBm EIRP}) + 95.2$.

The measurements recorded in this section were obtained using a resolution bandwidth of 3 MHz, a video bandwidth of 3 MHz, and with peak detector with the trace set to maximum-hold.

Measurements of the radiated field were made with the measurement antenna located at a distance of 1 meter from the EUT unless specified otherwise in the measurement results.

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 from zero to 360 degrees during the measurement to find the maximum field-strength readings.

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

The EUT was placed on a table whose top is 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.

7.3 Test Results

The TAG met the radiated emission requirements of FCC CFR 47 Section 15.517(f).

Table 7.3-1 UWB Radiated Emissions

Company: **Time Domain Corporation**
 Model: **TAG (SN: TGH000024)**
 Project No.: **3027351**
 Date: 07/18/02
 Standard: FCC15
 Notes: Maximum hold trace was used
 RBW/VBW: 3 MHz / 3 MHz

Tested by: David J. Schramm
 Location: Duluth
 Detector: HP8566, Positive Peak
 Antenna: AH571
 PreAmp: Hp1-26g
 Cable(s): HS7000 N-SMA TW3 + HS4000 N-N
 Distance: **1**

Ant. Pol. (V/H)	Frequency MHz	Peak Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Convert to dBm	3 MHz to 50 MHz BW Correction dB	Net dBm	1 meter EIRP Limit dBm	Margin dB
V	3100.000	60.2	31.2	11.9	37.0	95.2	24.4	-4.5	9.5	-14.0
V	3657.750	59.0	32.3	12.4	36.6	95.2	24.4	-3.7	9.5	-13.2
V	3749.480	58.5	32.6	13.0	36.4	95.2	24.4	-3.1	9.5	-12.6
V	4300.140	59.6	33.6	14.0	36.3	95.2	24.4	0.1	9.5	-9.4
V	4652.380	49.5	34.3	14.5	36.5	95.2	24.4	-9.0	9.5	-18.6
V	4652.380	58.1	34.3	14.5	36.5	95.2	24.4	-0.4	9.5	-10.0
V	5047.300	56.6	35.6	15.1	36.5	95.2	24.4	0.0	9.5	-9.5
V	5406.350	56.1	35.2	16.0	36.1	95.2	24.4	0.4	9.5	-9.1
V	5423.670	58.1	35.2	16.0	36.1	95.2	24.4	2.4	9.5	-7.2
V	6937.600	49.0	37.6	21.3	36.6	95.2	24.4	0.5	9.5	-9.0

8 AC MAINS LINE-CONDUCTED DISTURBANCE

8.1 Test Limits

*Table 8.1-1 FCC Part 15.207 Limits
for Conducted Disturbance at the Mains Ports*

Frequency band MHz	Class B Limit dB(μ V)
	Average
0.45-1.705	48
1.705-30	48

8.2 Test Procedure

Measurements were carried out using quasi-peak and average detector receivers in accordance with ANSI C63.4: 1992. An LISN was required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An LISN as defined in ANSI C63.4: 1992 was used.

The EUT was located so that the distance between the boundary of the EUT and the closest surface of the LISN is 0.8m.

Where a flexible mains cord was provided by the manufacturer, it was 1m long or if in excess of 1m, the excess cable was folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT was arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance was measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values were reported.

The EUT was placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane was placed 0.4m from the EUT. The vertical metal reference-plane was at least 2m by 2m. The EUT was kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table was constructed of non-conductive materials. Its dimensions were 1m by 1.5m, but may have been extended for larger EUT.

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

8.3 Test Results

The TAG met the conducted disturbance requirements of FCC Part 15.207. The test results are located in Table 8.3-1.

Table 8.3-1 FCC Part 15.207 Conducted Disturbance at AC Mains

Company: **Time Domain Corporation**

Model: **TAG (SN: TGHC000024)**

Job No.: **3027351**

Date: 06/26/02

Standard: FCC15

Class: B

Notes: 120 Vac

Group: None

Tested by: Matthew Van Steen

Location: Duluth

Detector: HP8546

Cable(s): Cable TT4

Limiter: no

Frequency MHz	Reading Side A dB	Reading Side B dB	Attenuator Factor dB	System Loss dB	Qausi-Peak		
					Net dB(uV)	Limit dB(uV)	Margin dB
1.623	38.7	37.4	0.0	1.0	39.7	48.0	-8.3
1.977	34.4	35.5	0.0	1.0	36.5	48.0	-11.5
2.864	35.0	33.1	0.0	1.0	36.0	48.0	-12.0
12.150	27.6	22.0	0.0	1.2	28.8	48.0	-19.2
15.550	28.5	32.3	0.0	1.2	33.5	48.0	-14.5
17.430	28.2	28.8	0.0	1.2	30.0	48.0	-18.0

8.4 Test Configuration Photographs

Figure 8-1 and Figure 8-2 show the testing configurations used.

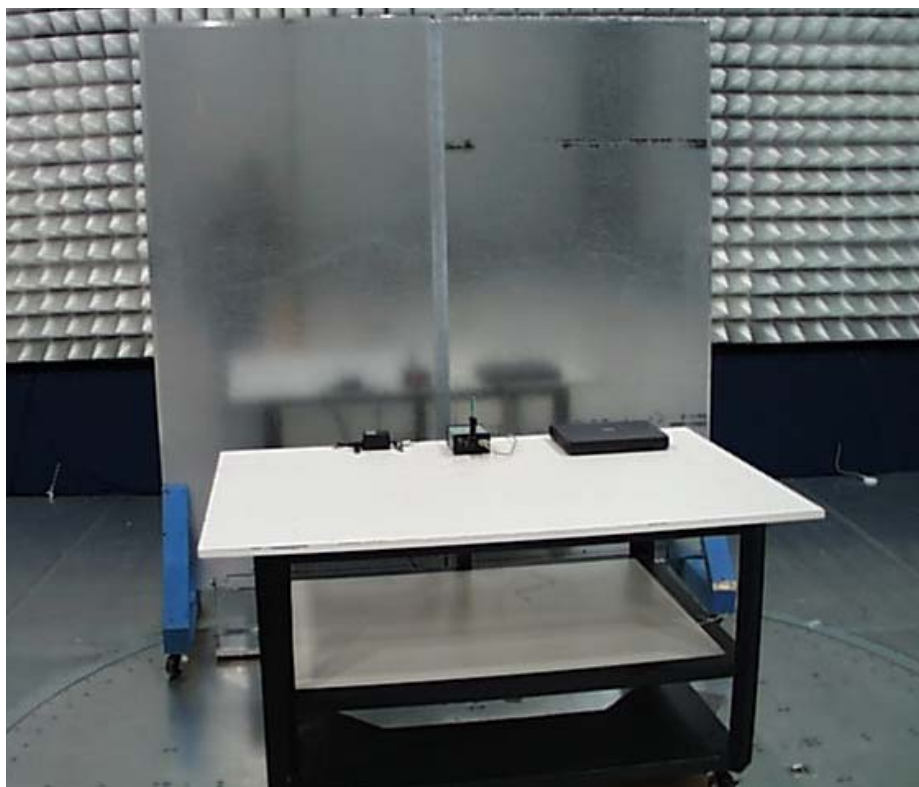


Figure 8-1: Configuration photograph, conducted emissions, front view

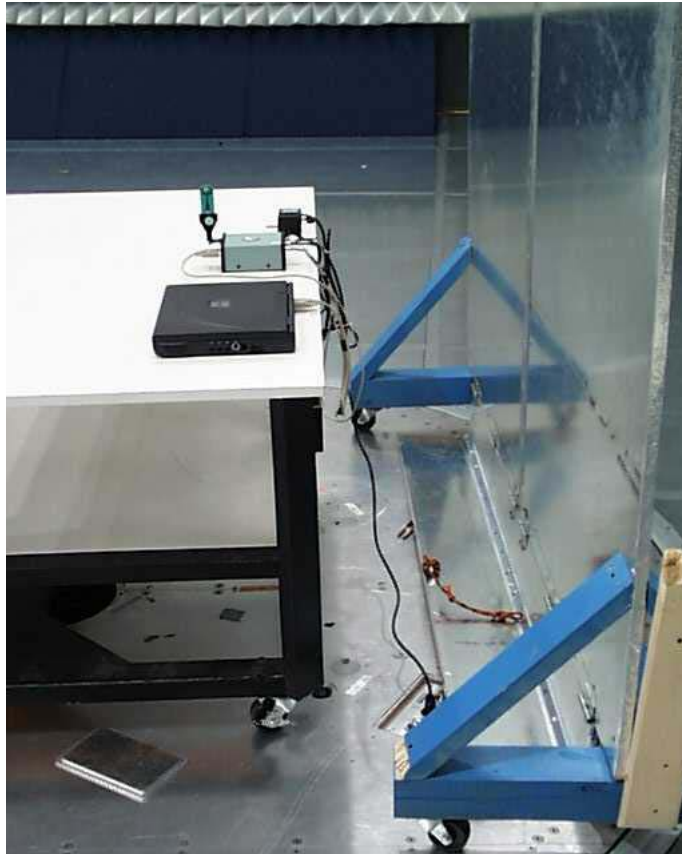


Figure 8-2: Configuration photograph, conducted emissions, rear view

9 LABELING AND INSTRUCTION MANUAL REQUIREMENTS

Please refer to http://www.etlsemko.com/shell/label_instruct.htm for labeling and instruction manual requirements.

In addition to these requirements, UWB systems operating under the provisions of CFR 47 Section 15.517(g) shall bear the following or similar statement in a conspicuous location on the device or in the instruction manual supplied with the device:

This equipment may only be operated indoors. Operation outdoors is in violation of U.S.C. 47 paragraph 301 and could subject the operator to serious legal penalties.