



## MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

May 12, 2005

GTCO  
7125 Riverwood Drive  
Columbia, MD 21046

Dear Mark Plasterer,

Enclosed is the EMC test report for compliance testing of the GTCO, Wireless Pen as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-03 ed.), Part 15 Subpart C, §15.209 for Intentional Radiators.

Thank you for using the services of MET Laboratories, Inc. If you have any questions regarding these results or if MET can be of further service to you, please feel free to contact me.

Sincerely yours,  
MET LABORATORIES, INC.

Rob Beauvais  
Documentation Department

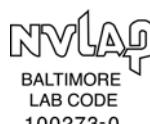
Reference: (\GTCO\ Wireless Pen \ EMC16643-FCC\_15.209)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc. While use of the National Voluntary Laboratory Accreditation Program (NVLAP) letters or the NVLAP Logo, the Standards Council of Canada Logo, A2LA, or the Nationally Recognized Testing Laboratory (NRTL) Letters in this report reflects MET Accreditation under these programs, these letters, logo, or statements do not claim product endorsement by these organizations or any Agency of the U.S. Government. This letter of transmittal is not a part of the attached report.

DOC-EMC702 2/26/2004



*The Nation's First Licensed Nationally Recognized Testing Laboratory*





**MET Laboratories, Inc.** *Safety Certification - EMI - Telecom Environmental Simulation*  
914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230-3432 • PHONE (410) 354-3300 • FAX (410) 354-3313

## **Electromagnetic Compatibility Criteria Test Report**

For the

**GTCO  
Wireless Pen**

Tested under

**FCC Certification Rules  
Title 47 of the CFR, Part 15, Subpart C for Intentional Radiators**

**MET Report: 16643-FCC209**

May 12, 2005

**Prepared For:**

**GTCO  
7125 Riverwood Drive  
Columbia, MD 21046**

**Prepared By:**  
**MET Laboratories, Inc.**  
914 W. Patapsco Ave  
Baltimore, MD 21230



GTCO  
Wireless Pen

CFR Title 47, Part 15, Subpart C

## Electromagnetic Compatibility Criteria Test Report

For the

**GTCO  
Wireless Pen**

Tested Under

**FCC Certification Rules  
Title 47 of the CFR, Part 15, Subpart C for Intentional Radiators**

A handwritten signature in blue ink that appears to read "Kevin Mehaffey".

Kevin Mehaffey  
Manager, Electromagnetic Compatibility Lab

A handwritten signature in blue ink that appears to read "Rob Beauvais".

Rob Beauvais  
Documentation Department

**Engineering Statement:** The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 15, §15.209 of the FCC Rules under normal use and maintenance.

A handwritten signature in blue ink that appears to read "Chris Eckert".

Chris Eckert  
Electromagnetic Compatibility Lab



GTCO  
Wireless Pen

CFR Title 47, Part 15, Subpart C

## Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	May 12, 2005	Initial Issue.



## Table of Contents

<b>1</b>	<b>Requirements Summary .....</b>	<b>1</b>
<b>2</b>	<b>Equipment Configuration.....</b>	<b>2</b>
2.1	Overview .....	2
2.2	Test Site.....	3
2.3	Description of Test Sample.....	3
2.4	Equipment Configuration.....	3
2.5	Support Equipment.....	4
2.6	Ports and Cabling Information.....	4
2.7	Mode of Operation .....	6
2.8	Method of Monitoring EUT Operation.....	6
2.9	Modifications .....	6
2.9.1	Modifications to EUT .....	6
2.9.2	Modifications to Test Standard .....	6
2.10	Disposition of EUT .....	6
<b>3</b>	<b>Electromagnetic Compatibility Criteria for Intentional Radiators .....</b>	<b>7</b>
3.1	Antenna Requirement.....	7
3.2	Conducted Limits .....	8
3.3	Intentional Radiated Emission Limits.....	16
<b>4</b>	<b>Test Equipment.....</b>	<b>20</b>
<b>5</b>	<b>Compliance Information.....</b>	<b>21</b>
5.1	Certification Information .....	21
5.2	Label and User's Manual Information .....	25



## List of Tables

Table 1 Requirements Summary of EMC Part 15 Subpart C Compliance Testing .....	1
Table 2. Equipment Configuration .....	3
Table 3. Support Equipment.....	4
Table 4. Ports and Cabling Information .....	4
Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.207(a) .....	8
Table 6. Conducted Emissions - Voltage, Worst Case Emissions, AC Power, Phase Line (Power Supply Model GT-21089-1509).....	10
Table 7. Conducted Emissions - Voltage, Worst Case Emissions, AC Power, Neutral Line (Power Supply Model: LF91000D-41).....	10
Table 8. Restricted Bands of Operation from FCC Part 15, § 15.205 .....	16
Table 9. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a) .....	17

## List of Figures

Figure 1. Block Diagram of Test Configuration .....	5
---	---

## List of Photographs

Photograph 1. Conducted Emissions Test Setup with Power Supply Model: GT-21089-1509 .....	14
Photograph 2. Conducted Emissions Test Setup with Power Supply Model: LF91000D-41 .....	15
Photograph 3. Intentional Radiated Emissions, Test Setup – Operation at 230 kHz.....	19



## List of Terms and Abbreviations

<b>AC</b>	Alternating Current
<b>ACF</b>	Antenna Correction Factor
<b>Cal</b>	Calibration
<b>d</b>	Measurement Distance
<b>dB</b>	Deci Bels
<b>dB<math>\mu</math>V</b>	Deci-Bels above one <b>micro Volt</b>
<b>dB<math>\mu</math>V/m</b>	Deci-Bels above one <b>micro Volt per meter</b>
<b>DC</b>	Direct Current
<b>DCF</b>	Distance Correction Factor
<b>E</b>	Electric Field
<b>DSL</b>	Digital Subscriber Line
<b>ESD</b>	Electrostatic Discharge
<b>EUT</b>	Equipment Under Test
<b>f</b>	Frequency
<b>FCC</b>	Federal Communications Commission
<b>H</b>	Magnetic Field
<b>GHz</b>	Giga Hertz
<b>Hz</b>	Hertz
<b>ICES</b>	Interference-Causing Equipment Standard
<b>kHz</b>	kilohertz
<b>kPa</b>	kilopascal
<b>kV</b>	kilo Volt
<b>LISN</b>	Line Impedance Stabilization Network
<b>MHz</b>	MegaHertz
<b><math>\mu</math>H</b>	<b>micro</b> Henry
<b><math>\mu</math>F</b>	<b>micro</b> Farad
<b><math>\mu</math>s</b>	<b>micro</b> seconds
<b>RF</b>	Radio Frequency
<b>RMS</b>	Root-Mean-Square



## 1.0 Requirements Summary

Reference	Description	Compliance
Title 47 of the CFR, Part 15, Subpart C, §15.203	Antenna Requirement	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.205	Emissions at Restricted Band	Complaint
Title 47 of the CFR, Part 15, Subpart C, §15.207(a);	Electromagnetic Compatibility - Conducted Emissions for Intentional Radiators	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.209(a); §15.247(a) and (b)	Electromagnetic Compatibility - Radiated Emissions for Intentional Radiators	Compliant

**Table 1 Requirements Summary of EMC Part 15 Subpart C Compliance Testing**

Note 1: Tablet PC on which the device is used uses a pre-certified FCC module (FCC ID# PI4-TDK-BTISM).



## 2.0 Equipment Configuration

### 2.1 Overview

An EMC evaluation to determine compliance of the GTCO, Wireless Pen with the requirements of Part 15, Subpart C, was performed. All references are to the most current version of Title 47 of the Code of Federal Regulations in effect. In accordance with §2.1033, the following data is presented in support of the Certification of the GTCO Wireless Pen. GTCO should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the Wireless Pen has been **permanently** discontinued.

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, Subpart C, in accordance with GTCO, purchase order number JDI2593. All tests were conducted using measurement procedure ANSI C63.4-1992.

Type of Submission/Rule:	Part 15 Subpart 15.209
Model(s) Tested:	Wireless Pen
Model(s) Covered:	Wireless Pen
EUT Specifications:	<b>Primary Power:</b> 1.2VDC NiMH battery, 9VDC @ 1A power supply used for charging
	<b>FCC ID:</b> CTW-RPN
	<b>RF Power Output:</b> 2.50dBuA/m @ 1 meter (0.00 Watts)
	<b>Equipment Frequency Range:</b> 230 kHz
Analysis:	The results obtained relate only to the item(s) tested.
Evaluated by:	Chris Eckert
Date(s):	12/16/2004; 12/21/2004



## 2.2 Test Site

All testing was performed at MET Laboratories, Inc., 914 W. Patapsco Ave., Baltimore, MD 21230. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary Laboratory Accreditation Program (Lab Code: 100273-0).

## 2.3 Description of Test Sample

The Wireless Pen, Equipment Under Test (EUT), consists of wireless digital pad and wireless pen used to increase communication in a corporate setting as well as schools and government agencies. The wireless pen uses a low power 230 kHz transmitter to act as a wireless mouse or as a drawing tool when one of the InterWrite annotation tools is selected, and the pen is touching the stylus of the wireless pad. The wireless pad contains a certified Bluetooth transceiver module that is used to establish a connection to a PC.

## 2.4 Equipment Configuration

The EUT was set up as outlined in Figure 1. All equipment incorporated as part(s) of the EUT are included in the following list.

Ref. ID	Name / Description	Model Number	Part Number	Serial Number
C	Wireless Pen	MP400 Rechargeable Pen	None Listed	None Listed

**Table 2. Equipment Configuration**



## 2.5 Support Equipment

Support equipment necessary for the operation and testing of the EUT is included listed in the following list.

Ref. ID	Name / Description	Manufacturer	Model Number
E	Laptop Computer	Dell	PPO1S
A	Wireless Pad	MP400	TRBLU20-0010
B	Power Converter	US LF91000D-41	None Listed
D	TDK Bluetooth Dongle	USB Adaptor II	None Listed

**Table 3. Support Equipment**

## 2.6 Ports and Cabling Information

Ref. ID	Port Name on EUT	Cable Description	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port ID
A, 1	Power	20AWGX2C	1	2.0	No	B, 1
B, 1	Power	20AWGX2C	1	2.0	No	A, 1
B, 2	Power	3X18AWG	1	2.3	Yes	VAC Source
D, 1	Bluetooth Dongle	24AWGX4C	1	0.5	Yes	E, 1

**Table 4. Ports and Cabling Information**

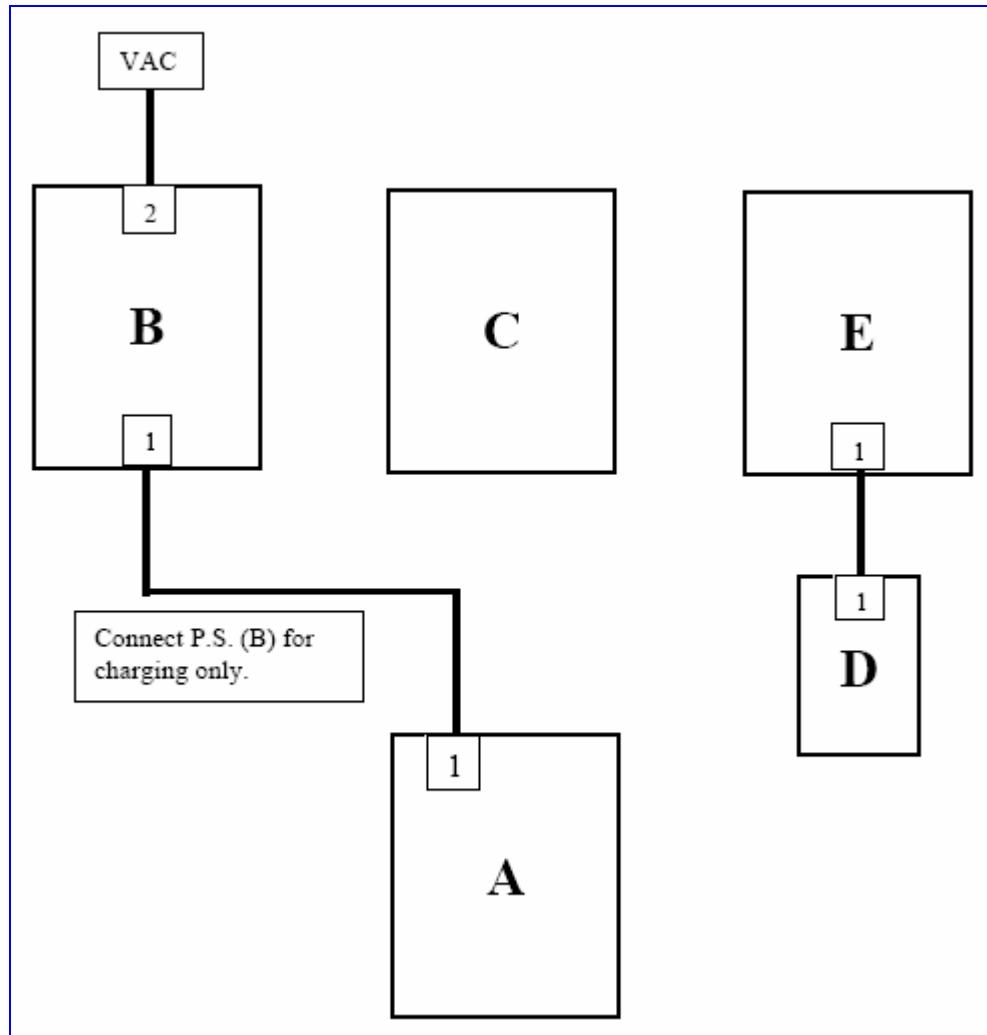


Figure 1. Block Diagram of Test Configuration



## 2.7 Mode of Operation

The wireless pen is used on the pad like a mouse. With the InterWrite application software running, the EUT can be used to make annotations or freehand sketches. There is only one mode of operation.

## 2.8 Method of Monitoring EUT Operation

The EUT must be able to communicate in mouse mode, using the GTCO CalComp supplied InterWrite software.

## 2.9 Modifications

### 2.9.1 Modifications to EUT

No modifications were made to the EUT.

### 2.9.2 Modifications to Test Standard

No modifications were made to the test standard.

## 2.10 Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to GTCO upon completion of testing.



### 3.0 Electromagnetic Compatibility Criteria for Intentional Radiators

#### 3.1 Antenna Requirement

**Test Requirement:** **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

**Test Results:** The device uses an integral antenna.



### 3.2 Conducted Limits

**Test Requirement(s):** **15.207(a)**, Except as shown in paragraphs (b) and (c) of this section\*, charging, AC adapters or battery eliminators the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the Table 5, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Note: \*Testing is applicable except to carrier current systems operating as intentional radiators on frequencies below 30 MHz, containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver, or devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines 15.207 (b), or for an intentional radiator that is designed to be connected to the public utility (AC) power line 15.207 (c).

Frequency range (MHz)	Class A Conducted Limits (dB $\mu$ V)		*Class B Conducted Limits (dB $\mu$ V)	
	Quasi-Peak	Average	Quasi-Peak	Average
* 0.15- 0.45	79	66	66 - 56	56 - 46
0.45 - 0.5	79	66	56	46
0.5 - 30	73	60	60	50

Note 1 — The lower limit shall apply at the transition frequencies.

Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.

\* -- Limits per Subsection 15.207(a).

**Table 5. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15  
Section 15.207(a)**



**GTCO**  
Wireless Pen

**Electromagnetic Compatibility**  
**Criteria for Intentional Radiators**  
**CFR Title 47, Part 15, Subpart C**

**Test Procedure:**

The EUT was installed placed on a 0.8 m high wooden table inside a shielded enclosure (See Figure Photograph 1 and Photograph 2). The EUT was situated such that the back of the EUT was 0.4 m from one wall of the shielded enclosure, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a  $50\ \Omega/50\ \mu\text{H}$  Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.4-2003 "Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40 GHz"*. The measurements were performed over the frequency range of 0.45 MHz to 30 MHz using a  $50\ \Omega/50\ \mu\text{H}$  LISN as the input transducer to an EMC/field intensity meter. The tests were conducted in a RF-shielded enclosure.

**Results:**

The EUT complies with the requirements of this section.

**Test Engineer(s):**

Chris G. Eckert

**Test Date(s):**

12/16/2004



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

**Conducted Emissions - Voltage, Class B Worst Case Emissions, AC Power (Power Supply Model GT-21089-1509)**

Line under Test	Frequency (MHz)	Quasi-Peak Amplitude (dB $\mu$ V)	Quasi-Peak Limit (dB $\mu$ V)	Quasi-Peak Margin (dB $\mu$ V)	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Average Margin (dB $\mu$ V)
Phase A	0.151	48.40	65.95	-17.55	26.10	55.95	-29.85
Phase A	0.172	46.90	64.86	-17.96	30.90	54.86	-23.96
Phase A	0.206	41.40	63.37	-21.97	25.30	53.37	-28.07
Phase A	0.235	42.00	62.27	-20.27	32.80	52.27	-19.47
Phase A	3.001	32.60	56.00	-23.40	20.10	46.00	-25.90
Phase A	15.169	48.50	60.00	-11.50	43.70	50.00	-6.30
Neutral	0.156	49.00	65.67	-16.67	26.30	55.67	-29.37
Neutral	0.177	44.90	64.63	-19.73	29.40	54.63	-25.23
Neutral	0.192	41.40	63.95	-22.55	25.60	53.95	-28.35
Neutral	0.234	37.80	62.31	-24.51	25.30	52.31	-27.01
Neutral	2.899	41.50	56.00	-14.50	34.20	46.00	-11.80
Neutral	3.147	35.10	56.00	-20.90	28.50	46.00	-17.50
Neutral	2.955	33.50	56.00	-22.50	17.70	46.00	-28.30
Neutral	15.165	39.60	60.00	-20.40	36.40	50.00	-13.60

**Table 6. Conducted Emissions - Voltage, Worst Case Emissions, AC Power, Phase Line (Power Supply Model GT-21089-1509)**

**Conducted Emissions - Voltage, Class B Worst Case Emissions, AC Power (Power Supply Model: LF91000D-41)**

Line under Test	Frequency (MHz)	Quasi-Peak Amplitude (dB $\mu$ V)	Quasi-Peak Limit (dB $\mu$ V)	Quasi-Peak Margin (dB $\mu$ V)	Average Amplitude (dB $\mu$ V)	Average Limit (dB $\mu$ V)	Average Margin (dB $\mu$ V)
Phase A	0.154	46.50	65.78	-19.28	26.80	55.78	-28.98
Phase A	0.163	47.50	65.31	-17.81	28.30	55.31	-27.01
Phase A	0.176	46.80	64.67	-17.87	26.80	54.67	-27.87
Phase A	0.216	43.50	62.97	-19.47	22.90	52.97	-30.07
Phase A	0.180	46.30	64.49	-18.19	27.10	54.49	-27.39
Phase A	0.562	34.60	56.00	-21.40	20.10	46.00	-25.90
Neutral	0.157	46.20	65.62	-19.42	27.30	55.62	-28.32
Neutral	0.171	46.80	64.91	-18.11	27.20	54.91	-27.71
Neutral	0.213	43.90	63.09	-19.19	24.30	53.09	-28.79
Neutral	0.237	42.30	62.20	-19.90	23.40	52.20	-28.80
Neutral	0.256	41.80	61.56	-19.76	23.00	51.56	-28.56
Neutral	0.662	29.60	56.00	-26.40	20.30	46.00	-25.70

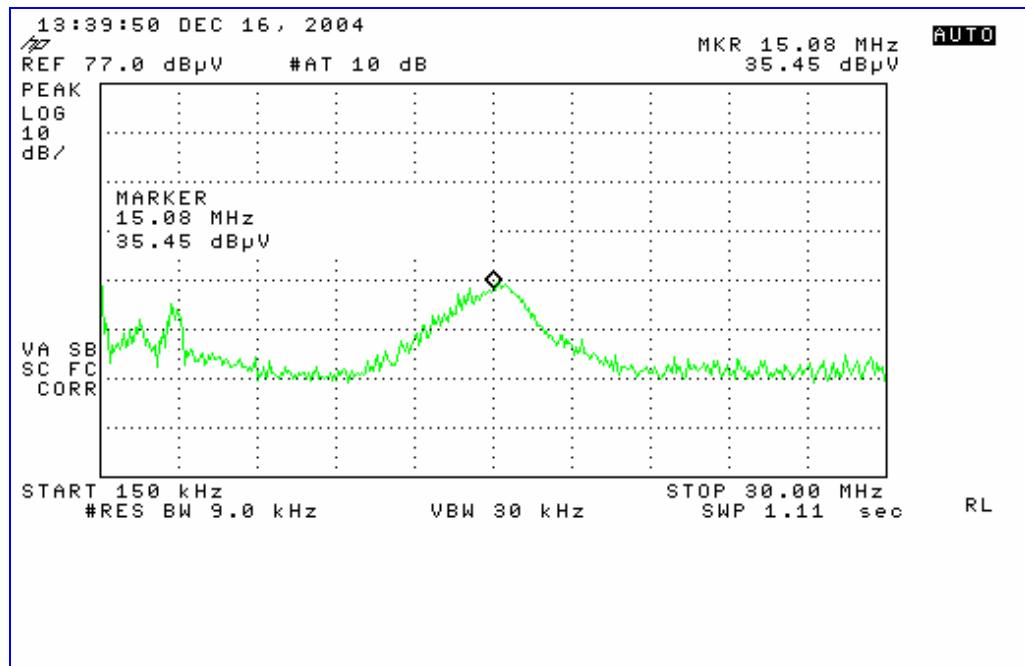
**Table 7. Conducted Emissions - Voltage, Worst Case Emissions, AC Power, Neutral Line (Power Supply Model: LF91000D-41)**



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

Conducted Emissions - Voltage, Class B Worst Case Emissions, AC Power (Power Supply Model GT-21089-1509)



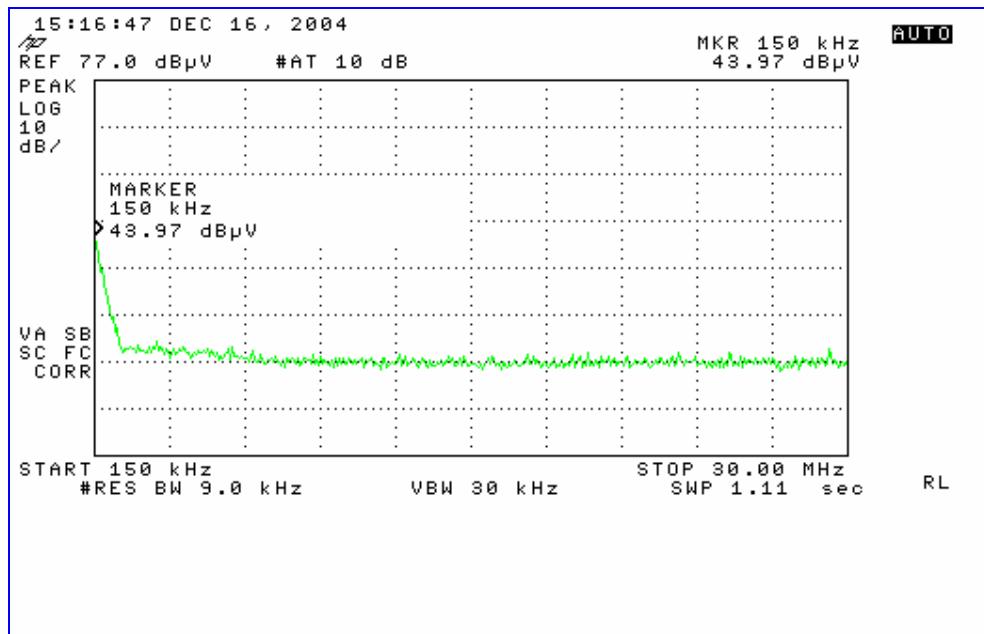
Plot 1. Conducted Emission Class B Limits, Power Supply Model GT-21089-1509 Phase Line Plot –



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

Conducted Emissions - Voltage, Class B Worst Case Emissions, AC Power, (Power Supply Model: LF91000D-41)



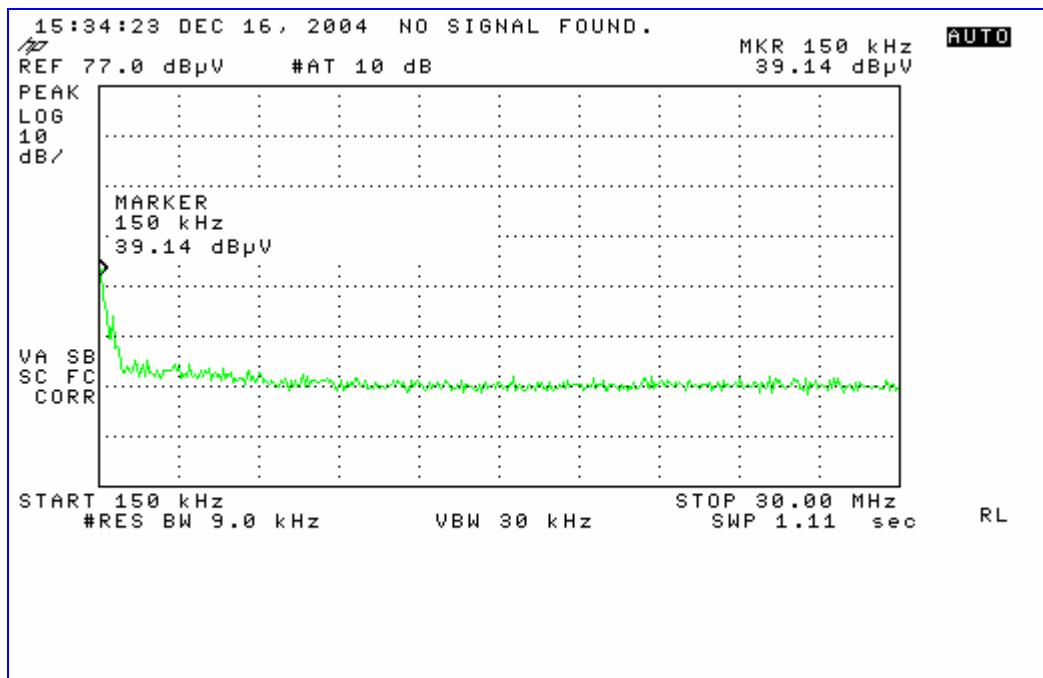
Plot 2. Conducted Emission Class B Limits, Power Supply Model: LF91000D-41Phase Line Plot -



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

Conducted Emissions - Voltage, Class B Worst Case Emissions, AC Power, (Power Supply Model: LF91000D-41)



Plot 3. Conducted Emission Class B Limits, Power Supply Model: LF91000D-41Neutral Line Plot -



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

## Conducted Emission Test Setup



Photograph 1. Conducted Emissions Test Setup with Power Supply Model: GT-21089-1509



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

## Conducted Emission Test Setup



Photograph 2. Conducted Emissions Test Setup with Power Supply Model: LF91000D-41



### 3.3 Intentional Radiated Emission Limits

**Test Requirement(s):** **§ 15.205 (a):** Except as shown in paragraph (d) of **15.205 Restricted bands of operation**, only spurious emissions are permitted in any of the frequency bands specified in Table 8:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505 (Note 1)	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2655–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	(Note 2)
13.36–13.41.			

Note 1: Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

Note 2: Above 38.6

**Table 8. Restricted Bands of Operation from FCC Part 15, § 15.205**

**§ 15.205 (b):** Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209.

**§ 15.209 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 9.



Frequency (MHz)	§15.209(a), Radiated Emission Limits (dB $\mu$ V) @ 3m	Measurement Distance in meters
0.009 – 0.490	20log(2400/F)**	300
0.490 – 1.705	20log(24000/F)**	30
1.705 - 30	29.54	30
30 – 88	40.00*	3
88 – 216	43.50*	3
216 – 960	46.00*	3
Above 960	54.00	3
* -- Except perimeter protection systems operating under paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Subpart.		** - - F is the frequency in kHz.

**Table 9. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)**

**Test Procedure:**

The EUT was installed placed on a 0.8 m high wooden table located in a shielded enclosure (See Photograph 3). Various antennas were placed near the EUT and measurements were taken of the field strengths and frequencies. For final radiated measurements, the EUT was placed in a semi-anechoic chamber, and located 1 m and 3 m from an adjustable antenna mast. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst case orientation for maximum emissions. For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth. Measurements above 1 GHz were made with a resolution bandwidth of 1MHz and a video bandwidth of 10 Hz.

In accordance with §15.35(b) the limit on the radio frequency emissions as measured using instrumentation with a peak detector function shall be 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.

**Test Results:**

The EUT complied with the requirement(s) of this section.

**Test Engineer(s):**

Chris Eckert

**Test Date(s):**

12/21/2004



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Criteria for Intentional Radiators  
CFR Title 47, Part 15, Subpart C

## Intentional Radiated Emissions Data: Wireless Pen

### Radiated Emissions Limits Test Results, 15.209 (a), Operating at 230 kHz

Frequency (MHz)	Azimuth of EUT	Degree	Height (m)	Measured Amplitude (dB $\mu$ V/m)	ACF (dB)	System Gain (dB)	Distance Correction (dB)	Corrected Amplitude (dB $\mu$ V/m)	Limit	Margin
0.2340	0	90	1.0	16.12	59.85	26.81	99.08	-49.92	--	0.00
0.4628	0	90	1.0	8.75	53.64	26.82	99.08	-63.51	14.3	-77.81
0.6942	0	90	1.0	17.92	49.99	26.75	59.08	-17.93	30.8	-48.70
0.9256	0	90	1.0	14.76	47.82	26.67	59.08	-23.18	28.3	-51.45
1.1570	0	90	1.0	17.27	46.69	26.67	59.08	-21.80	26.3	-48.14
1.3880	0	90	1.0	15.40	45.38	26.76	59.08	-25.06	24.8	-49.81
1.6200	0	90	1.0	15.46	43.95	26.76	59.08	-26.43	23.4	-49.85
1.8510	0	90	1.0	12.63	42.90	26.74	59.08	-30.29	30.0	-60.29
2.0830	0	90	1.0	12.98	41.56	26.80	59.08	-31.34	30.0	-61.34
2.3140	0	90	1.0	11.61	40.89	26.79	59.08	-33.38	30.0	-63.38

Notes: The EUT was tested at 1 m. It was necessary to make these measurements in the near field due to the extremely low output of the EUT. These measurements were made in accordance with 15.31 (f) and 15.209. Below 490 kHz, the preferred measurement distance is 300 meters and the data has been corrected using the formula  $40\log(300/1)$ . From 490 kHz to 30 MHz the preferred measurement distance is 30 meters and the data has been corrected using the formula  $40\log(30/1)$ . The factor of 40 gives greater relaxation of the limit to compensate for the measuring in the near field.

The limit at 300 m at 460.8 kHz in  $\mu$ V/m is  $2400 / F$  where F is in kHz. Then the limit in dB $\mu$ V/m is  $20\log(2400 / 462.8)$ , or 14.3 dB $\mu$ V/m.

The limit at 30 m for spurious emissions from 490 kHz to 1.705 MHz is  $20\log(24000 / F)$ , where F is in kHz. Then the 30 m limit in dB $\mu$ V/m at 1.62 MHz is  $20\log(24000/1620) = 23.4$ .

## Intentional Radiated Emissions Test Setup



Photograph 3. Intentional Radiated Emissions, Test Setup – Operation at 230 kHz



GTCO  
Wireless Pen

Electromagnetic Compatibility  
Compliance Information  
CFR Title 47, Part 15, Subpart C

## 4.0 Test Equipment

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

Test Name: <b>Conducted Emissions</b>			Test Date(s): <b>12/16/2004</b>		
<b>MET Asset #</b>	<b>Nomenclature</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Last Cal Date</b>	<b>Cal Due Date</b>
1T4222	SPECTRUM ANALYZER	HEWLETT PACKARD	8591E	04/20/2004	04/20/2005
1T4428	THERMO-HYGROMETER	CONTROL COMPANY	61220-601	05/14/2004	05/14/2006
1T2948	LISN	SOLAR	8028-50-TS-24-BNC	10/08/2004	10/08/2005
1T4390	ISOLATION TRANSFORMER	TOPAZ	91005-31	SEE NOTE	SEE NOTE
1T4079	LISN; SWITCH	SOLAR	8012-50-R-24-BNC	01/14/2004	01/14/2005
1T4146	TRANSIENT LIMITER	HEWLETT PACKARD	11947A	SEE NOTE	SEE NOTE
Test Name: <b>Radiated Emissions at 230 kHz</b>			Test Date(s): <b>1/16/2005</b>		
<b>MET Asset #</b>	<b>Nomenclature</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Last Cal Date</b>	<b>Cal Due Date</b>
1T4272	ANTENNA; LOOP	EMCO	10/29/1917	12/20/2004	12/20/2005
1T4288	SPECTRUM ANALYZER	HEWLETT PACKARD	8563A	12/13/2004	12/13/2005
1T4300	SHIELD ROOM 1	EMC TEST SYSTEMS	NONE	05/03/2003	04/03/2006
1T4428	THERMO-HYGROMETER	CONTROL COMPANY	61220-601	05/14/2004	05/14/2006
1T3360	AMPLIFIER	HEWLETT PACKARD	8447F	SEE NOTE	SEE NOTE

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



## 5.0 Compliance Information

### 5.1 Certification Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart I — Marketing of Radio frequency devices:

#### § 2.801 Radio-frequency device defined.

As used in this part, a radio-frequency device is any device which in its operation is capable of Emitting radio-frequency energy by radiation, conduction, or other means. Radio- frequency devices include, but are not limited to:

- (a) The various types of radio communication transmitting devices described throughout this chapter.
- (b) *The incidental, unintentional and intentional radiators defined in Part 15 of this chapter.*
- (c) The industrial, scientific, and medical equipment described in Part 18 of this chapter.
- (d) Any part or component thereof which in use emits radio-frequency energy by radiation, conduction, or other means.

#### § 2.803 Marketing of radio frequency devices prior to equipment authorization.

- (a) Except as provided elsewhere in this chapter, no person shall sell or lease, or offer for sale or lease (including advertising for sale or lease), or import, ship or distribute for the purpose of selling or leasing or offering for sale or lease, any radio frequency device unless:
  - (1) In the case of a device subject to certification, such device has been authorized by the Commission in accordance with the rules in this chapter and is properly identified and labeled as required by §2.925 and other relevant sections in this chapter; or
  - (2) In the case of a device that is not required to have a grant of equipment authorization issued by the Commission, but which must comply with the specified technical standards prior to use, such device also complies with all applicable administrative (including verification of the equipment or authorization under a Declaration of Conformity, where required), technical, labeling and identification requirements specified in this chapter.
- (d) Notwithstanding the provisions of paragraph (a) of this section, the offer for sale solely to business, commercial, industrial, scientific or medical users (but not an offer for sale to other parties or to end users located in a residential environment) of a radio frequency device that is in the conceptual, developmental, design or pre-production stage is permitted prior to equipment authorization or, for devices not subject to the equipment authorization requirements, prior to a determination of compliance with the applicable technical requirements *provided* that the prospective buyer is advised in writing at the time of the offer for sale that the equipment is subject to the FCC rules and that the equipment will comply with the appropriate rules before delivery to the buyer or to centers of distribution.



- (e)(1) Notwithstanding the provisions of paragraph (a) of this section, prior to equipment authorization or determination of compliance with the applicable technical requirements any radio frequency device may be operated, but not marketed, for the following purposes and under the following conditions:
- (i) *Compliance testing;*
  - (ii) Demonstrations at a trade show provided the notice contained in paragraph (c) of this section is displayed in a conspicuous location on, or immediately adjacent to, the device;
  - (iii) Demonstrations at an exhibition conducted at a business, commercial, industrial, scientific or medical location, but excluding locations in a residential environment, provided the notice contained in paragraphs (c) or (d) of this section, as appropriate, is displayed in a conspicuous location on, or immediately adjacent to, the device;
  - (iv) Evaluation of product performance and determination of customer acceptability, provided such operation takes place at the manufacturer's facilities during developmental, design or pre-production states; or
  - (v) Evaluation of product performance and determination of customer acceptability where customer acceptability of a radio frequency device cannot be determined at the manufacturer's facilities because of size or unique capability of the device, provided the device is operated at a business, commercial, industrial, scientific or medical user's site, but not at a residential site, during the development, design or pre-production stages.
- (e)(2) For the purpose of paragraphs (e)(1)(iv) and (e)(1)(v) of this section, the term *manufacturer's facilities* includes the facilities of the party responsible for compliance with the regulations and the manufacturer's premises, as well as the facilities of other entities working under the authorization of the responsible party in connection with the development and manufacture, but not the marketing, of the equipment.
- (f) For radio frequency devices subject to verification and sold solely to business, commercial, industrial, scientific and medical users (excluding products sold to other parties or for operation in a residential environment), parties responsible for verification of the devices shall have the option of ensuring compliance with the applicable technical specifications of this chapter at each end user's location after installation, provided that the purchase or lease agreement includes a proviso that such a determination of compliance be made and is the responsibility of the party responsible for verification of the equipment.



**The following is extracted from Title 47 of the Code of Federal Regulations, Part 2, Subpart J — Equipment Authorization Procedures:**

**§ 2.901 Basis and Purpose**

- (a) In order to carry out its responsibilities under the Communications Act and the various treaties and international regulations, and in order to promote efficient use of the radio spectrum, the Commission has developed technical standards for radio frequency equipment and parts or components thereof. The technical standards applicable to individual types of equipment are found in that part of the rules governing the service wherein the equipment is to be operated.<sup>1</sup> *In addition to the technical standards provided, the rules governing the service may require that such equipment be verified by the manufacturer or importer*, be authorized under a Declaration of Conformity, or receive an equipment authorization from the Commission by one of the following procedures: certification or registration.
- (b) The following sections describe the verification procedure, the procedure for a Declaration of Conformity, and the procedures to be followed in obtaining certification from the Commission and the conditions attendant to such a grant.

**§ 2.907 Certification.**

- (a) Certification is an equipment authorization issued by the Commission, based on representation and test data submitted by the applicant.
- (b) Certification attaches to all units subsequently marketed by the grantee which are identical (see Section 2.908) to the sample tested except for permissive changes or other variations authorized by the Commission pursuant to Section 2.1043.

---

<sup>1</sup> In this case, the equipment is subject to the rules of Part 15. More specifically, the equipment falls under Subpart B (of Part 15), which deals with unintentional radiators.



**§ 2.948 Description of measurement facilities.**

- (a) Each party making measurements of equipment that is subject to an equipment authorization under Part 15 or Part 18 of this chapter, regardless of whether the measurements are filed with the Commission or kept on file by the party responsible for compliance of equipment marketed within the U.S. or its possessions, shall compile a description of the measurement facilities employed.
  - (1) If the measured equipment is subject to the verification procedure, the description of the measurement facilities shall be retained by the party responsible for verification of the equipment.
    - (i) *If the equipment is verified through measurements performed by an independent laboratory, it is acceptable for the party responsible for verification of the equipment to rely upon the description of the measurement facilities retained by or placed on file with the Commission by that laboratory. In this situation, the party responsible for the verification of the equipment is not required to retain a duplicate copy of the description of the measurement facilities.*
    - (ii) If the equipment is verified based on measurements performed at the installation site of the equipment, no specific site calibration data is required. It is acceptable to retain the description of the measurement facilities at the site at which the measurements were performed.
  - (2) If the equipment is to be authorized by the Commission under the certification procedure, the description of the measurement facilities shall be filed with the Commission's Laboratory in Columbia, Maryland. The data describing the measurement facilities need only be filed once but must be updated as changes are made to the measurement facilities or as otherwise described in this section. At least every three years, the organization responsible for filing the data with the Commission shall certify that the data on file is current.



## 5.2 Label and User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart A — General:

### § 15.19 Labeling requirements.

(a) *In addition to the requirements in Part 2 of this chapter, a device subject to certification or verification shall be labeled as follows:*

(1) Receivers associated with the operation of a licensed radio service, e.g., FM broadcast under Part 73 of this chapter, land mobile operation under Part 90, etc., shall bear the following statement in a conspicuous location on the device:

This device complies with Part 15 of the FCC Rules. Operation is subject to the condition that this device does not cause harmful interference.

(2) A stand-alone cable input selector switch, shall bear the following statement in a conspicuous location on the device:

This device is verified to comply with Part 15 of the FCC Rules for use with cable television service.

(3) All other devices shall bear the following statement in a conspicuous location on the device:

*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.*

(4) Where a device is constructed in two or more sections connected by wires and marketed together, the statement specified under paragraph (a) of this section is required to be affixed only to the main control unit.

(5) When the device is so small or for such use that it is not practicable to place the statement specified under paragraph (a) of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

### § 15.21 Information to 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.



#### § 15.27 Special Accessories.

(a) Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the cables and/or special connectors are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e. shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge.

Information detailing any alternative method used to supply the special accessories for a grant of equipment authorization or retained in the verification records, as appropriate. The party responsible for the equipment, as detailed in §2.909 of this chapter, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

#### § 15.105 Information to the user.

(a) 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 when the equipment is operated in a residential 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. 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.