



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

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November 16, 2006

Crossbow
4145 North First Street
San Jose, CA 95134

Dear Afshin Afzali,

Enclosed is the EMC test report for compliance testing of the Crossbow, MTP400CA (8350 – 0391-01) as tested to the requirements of Title 47 of the CFR, Ch. 1 (10-1-04 ed.), Part 15, Subpart B for a Class A Digital Device and Subpart C 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.

Jennifer Sanchez
Documentation Department

Reference: (\Crossbow\EMCS21056-FCC249)

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Crossbow
MTP400CA (8350 - 0391-01)

Electromagnetic Compatibility
Cover Page
CFR Title 47, Part 15, Subpart B & C

Electromagnetic Compatibility Criteria Test Report

for the

**Crossbow
Model MTP400CA (8350 - 0391-01)**

Verified under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15 Subpart B and Part 15.249
for Low Power License-Exempt Radio Communications Devices
Intentional Radiators

MET Report: EMCS21056-FCC239

November 16, 2006

Prepared For:

**Crossbow
4145 North First Street
San Jose, CA 95134**

Prepared By:
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Crossbow
MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
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CFR Title 47, Part 15, Subpart B & C

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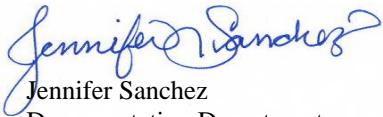
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the FCC Certification Rules
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Title 47 of the CFR, Part 15 Subpart B and Part 15.249
for Low Power License-Exempt Radio Communications Devices
Intentional Radiators



Shawn McMillen, Project Engineer
Electromagnetic Compatibility Lab



Jennifer Sanchez
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 Subpart B and Part 15.249, of the FCC Rules under normal use and maintenance.



Tony Permsombut, Manager
Electromagnetic Compatibility Lab



Crossbow
MTP400CA (8350 - 0391-01)

Electromagnetic Compatibility
Report Status
CFR Title 47, Part 15, Subpart B & C

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	November 16, 2006	Initial Issue.



Table of Contents

I.	Executive Summary	1
A.	Purpose of Test	2
B.	Executive Summary	2
II.	Equipment Configuration	3
A.	Overview.....	4
B.	References.....	5
C.	Test Site	6
D.	Description of Test Sample.....	6
E.	Equipment Configuration.....	9
F.	Support Equipment	9
G.	Ports and Cabling Information.....	9
H.	Mode of Operation.....	10
I.	Method of Monitoring EUT Operation	10
J.	Modifications	10
a)	Modifications to EUT.....	10
b)	Modifications to Test Standard.....	10
K.	Disposition of EUT	10
III.	Electromagnetic Compatibility Criteria for Unintentional Radiators	11
§ 15.109(a) Radiated Emission Limits	12	
§ 15.09(a) Radiated Emissions Limits.....	12	
IV.	Electromagnetic Compatibility Criteria for Intentional Radiators.....	15
§ 15.203 Antenna Requirement	16	
§ 15.249(a) Radiated Fundamental.....	17	
§ 15.249 Spurious Emissions Requirements – Radiated	18	
§ 15.249(a) 6 dB and 99% Bandwidth.....	22	
V.	Test Equipment	25
VI.	Certification & User's Manual Information.....	27
A.	Certification Information	28
B.	Label and User's Manual Information	32



List of Tables

Table 1. Executive Summary of EMC Part 15.249 Compliance Testing	2
Table 2. EUT Specifications	4
Table 3. Equipment Configuration	9
Table 4. Support Equipment	9
Table 5. Ports and Cabling Information	9
Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)	12
Table 7. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz	13
Table 8. Radiated Fundamentals Results	17
Table 9. Restricted Bands of Operation	19

List of Figures

Figure 1. Block Diagram of Test Configuration (Conducted Measurement)	7
Figure 2. Block Diagram of Test Configuration	8

List of Photographs

Photograph 1. Crossbow MTP400CA (8350 – 0391-01)	6
Photograph 2. Radiated Emission Test Setup 30 MHz - 1 GHz	14
Photograph 3. Test Equipment and setup for various Radiated Measurements	21



List of Terms and Abbreviations

AC	Alternating Current
ACF	Antenna Correction Factor
Cal	Calibration
<i>d</i>	Measurement Distance
dB	Decibels
dBμA	Decibels above one microamp
dBμV	Decibels above one microvolt
dBμA/m	Decibels above one microamp per meter
dBμV/m	Decibels above one microvolt per meter
DC	Direct Current μ
E	Electric Field
DSL	Digital Subscriber Line
ESD	Electrostatic Discharge
EUT	Equipment Under Test
<i>f</i>	Frequency
FCC	Federal Communications Commission
GRP	Ground Reference Plane
H	Magnetic Field
HCP	Horizontal Coupling Plane
Hz	Hertz
IEC	International Electrotechnical Commission
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μH	microhenry
μ	microfarad
μ s	microseconds
PRF	Pulse Repetition Frequency
RF	Radio Frequency
RMS	Root-Mean-Square
TWT	Traveling Wave Tube
V/m	Volts per meter
VCP	Vertical Coupling Plane



Crossbow
MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
Executive Summary
CFR Title 47, Part 15, Subpart B & C

I. Executive Summary



A. Purpose of Test

An EMC evaluation was performed to determine compliance of the Crossbow MTP400CA (8350 – 0391-01), with the requirements of Part 15, §15.249. 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 MTP400CA (8350 – 0391-01). Crossbow should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the MTP400CA (8350 – 0391-01), has been **permanently** discontinued

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15, §15.249, in accordance with Crossbow, purchase order number 21744. All tests were conducted using measurement procedure ANSI C63.4-2003.

FCC Reference	RSS-210 and RSS-GEN	Description	Results
Transmitter Mode (TX)			
§15.207	RSS GEN §7.2.2	AC Power Line Conducted Emissions	N/A – EUT DC powered
§15.249(d), §15.209, §15.205	RSS-Gen §4.7 and RSS-210 §2.7	Radiated Spurious and Harmonic Emissions	Compliant
§15.203	RSS GEN §7.1.4	Antenna Requirement	Compliant
§15.249 (a)	RSS-Gen§4.7 and RSS-210 §A2.9	Radiated Fundamentals	Compliant
§15.215(c)	RSS GEN §4.4.1	Emission Bandwidth	Compliant
Receiver Mode (RX)			
15.107	RSS-GEN §7.2.3	AC Power Line Conducted Emissions	N/A – EUT DC Powered
15.109	RSS-Gen §4.8 and RSS-Gen §6(a)	Radiated Spurious Emissions	Compliant

Table 1 Executive Summary of EMC Part 15.249 Compliance Testing



Crossbow
MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
Equipment Configuration
CFR Title 47, Part 15, Subpart B & C

II. Equipment Configuration



A. Overview

MET Laboratories, Inc. was contracted by Crossbow to perform testing on the MTP400CA (8350 – 0391-01), under Crossbow's purchase order number 21744.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Crossbow, MTP400CA (8350 – 0391-01).

The results obtained relate only to the item(s) tested.

Model(s) Tested:	MTP400CA (8350 – 0391-01)	
Model(s) Covered:	MTP400CA (8350 – 0391-01)	
EUT Specifications:	Primary Power: 3.0 to 4.8VDC (battery type: 3.6Volt, 19.0AH, Lithium)	
	FCC ID: SHU004MTP400	
	Type of Modulations:	FSK (Frequency Shift Keying)
	Equipment Code:	DXT
	EUT Frequency Ranges:	903MHz to 927MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature (15-35° C)	
	Relative Humidity (30-60%)	
	Barometric Pressure (860-1060 mbar)	
Evaluated by:	Shawn McMillen	
Date(s):	November 16, 2006	

Table 2. EUT Specifications



B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
CFR 47, Part 15, Subpart B	Electromagnetic Compatibility: Criteria for Radio Frequency Devices
ANSI C63.4:2003	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI/NCSL Z540-1-1994	Calibration Laboratories and Measuring and Test Equipment - General Requirements
ANSI/ISO/IEC 17025:2000	General Requirements for the Competence of Testing and Calibration Laboratories

C. Test Site

All testing was performed at MET Laboratories, Inc., 4855 Patrick Henry Drive, Building 6, Santa Clara, California 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

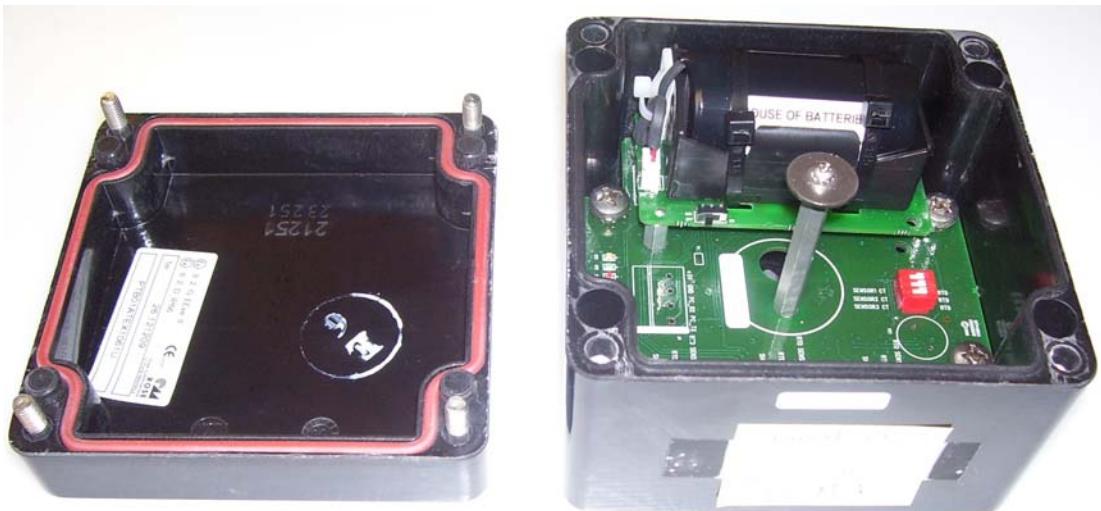
Radiated Emissions measurements were performed in a semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories. In accordance with §2.948(d), MET Laboratories has been accredited by the National Voluntary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

D. Description of Test Sample

The Crossbow MTP400CA (8350 – 0391-01), is a Device provides wireless connectivity between similar EUTs and central controller (server) to monitor the temperature of the environment.

EUT functional areas are:

- 900MHz BFSK radio transceiver
- 8 Bit Micro Controller including ISP (in-system-programming)
- Power Management
- Signal conditioning for temperature sensors
- User interface (including switches and LEDs)



Photograph 1. Crossbow MTP400CA (8350 – 0391-01)

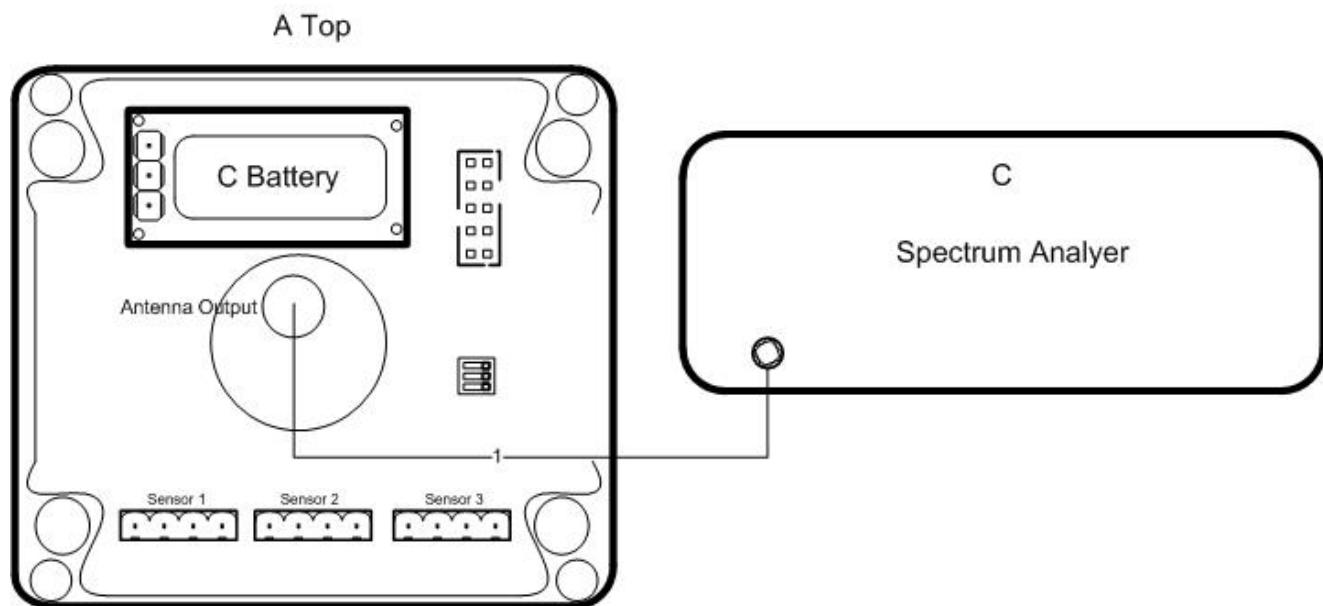


Figure 1. Block Diagram of Test Configuration (Conducted Measurement)

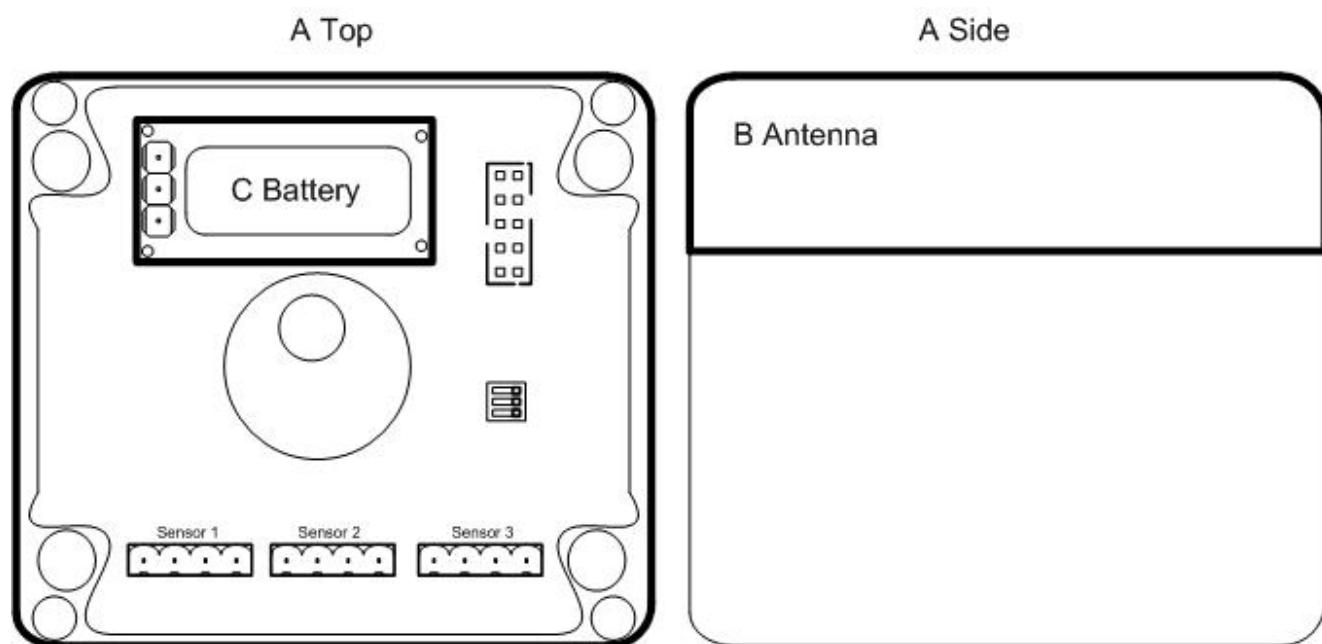


Figure 2. Block Diagram of Test Configuration



Crossbow
MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
Equipment Configuration
CFR Title 47, Part 15, Subpart B & C

E. Equipment Configuration

The EUT was set up as outlined in Figure 1, Block Diagram of Test Setup. All cards, racks, etc., incorporated as part of the EUT is included in the following list.

Ref. ID	Name / Description	Model Number	Serial Number
A	Receiver	MTP400CACA	05FA-36D8-0E01-0079
B	Antenna	26 121209	PTB01ATEX1061U
C	Battery	8350-0392-01	WO.33356

Table 3. Equipment Configuration

F. Support Equipment

Crossbow supplied support equipment necessary for the operation and testing of the MTP400CA (8350 – 0391-01). All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
1	Spectrum Analyzer	Agilent	E4407B	-

Table 4. Support Equipment

* The 'Customer Supplied Calibration Data' column will be marked as either not applicable, not available, or will contain the calibration date supplied by the customer.

** The AC/DC Adapter was use to power the EUT for testing purpose only, will not be sold with radio.

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Y/N)	Termination Box ID & Port ID
Conducted Measurement						
1	A top, antenna output	Coaxial	1	1	y	C, Spectrum Analyzer

Table 5. Ports and Cabling Information



H. Mode of Operation

EUT measures the temperature of the environment on a regular basis using CT (Current Transformer) or RTD (resistance temperature detectors) sensors, and it transmits this data to the server using a wireless network.

Also, EUT transmits network related data packets such as health and route messages to maintain the network for data transmission.

There are two modes of operation:

- Transmit radio packets
- Receive radio packets

I. Method of Monitoring EUT Operation

The proper operation of the EUT is verified by the server which receives the data through wireless network.

The available physical interface to the user is the LEDs. They turn on after reboot and indicate joining process of the EUT to the network.

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

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



Crossbow
MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
Unintentional Radiators
CFR Title 47, Part 15, Subpart B

III. Electromagnetic Compatibility Criteria for Unintentional Radiators



Radiated Emission Limits

§ 15.109 Radiated Emissions Limits

Test Requirement(s): **15.109 (a)** Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the Class B limits expressed in Table 6.

15.109 (b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the Class A limits expressed in Table 6.

Frequency (MHz)	Field Strength (dB μ V/m)	
	§15.109 (b), Class A Limit (dB μ V) @ 10m	§15.109 (a), Class B Limit (dB μ V) @ 3m
30 - 88	39.00	40.00
88 - 216	43.50	43.50
216 - 960	46.40	46.00
Above 960	49.50	54.00

Table 6. Radiated Emissions Limits calculated from FCC Part 15, §15.109 (a) (b)

Test Procedures:

The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.4 were used. An antenna was located 10 m from the EUT on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT was rotated and the antenna height was varied between 1 m and 4 m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. Unless otherwise specified, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

Test Results:

The EUT was found Compliant with the Class A requirement(s) of this section. Measured emissions were below applicable limits

Test Engineer(s):

Shawn McMillen

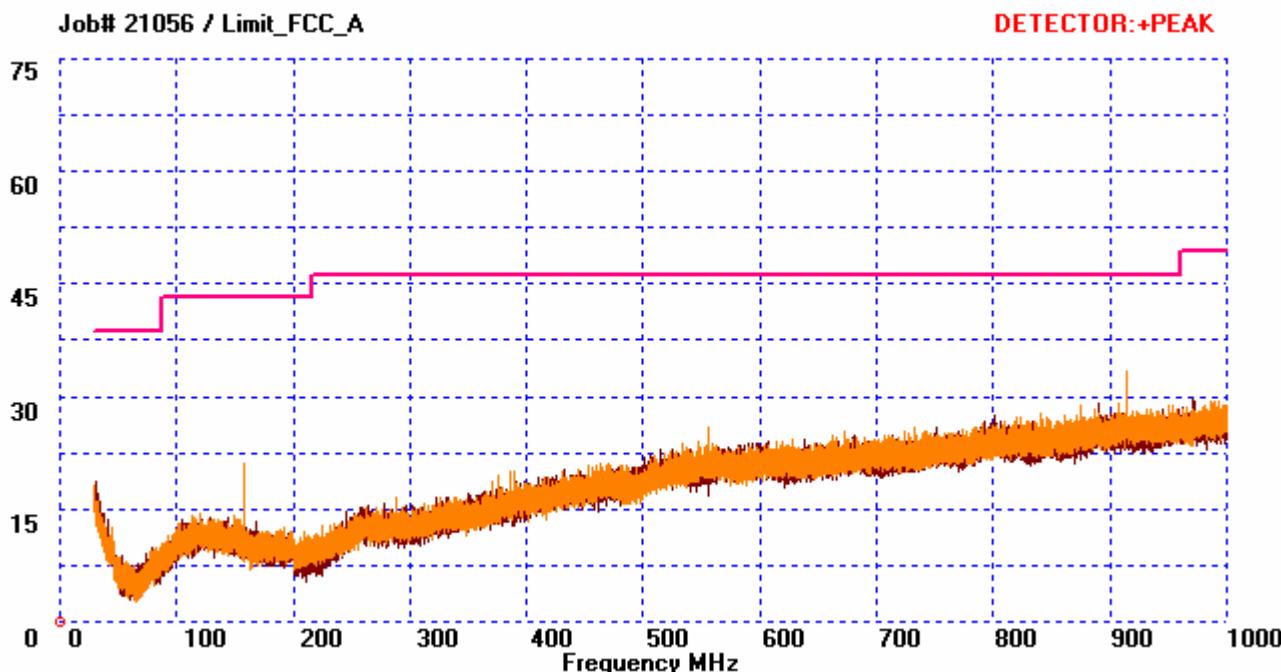
Test Date(s):

November 3, 2006

Radiated Emissions Limits Test Results, Class A

Frequency (MHz)	Antenna Polarity (H/V)	EUT Azimuth (Degrees)	Antenna HEIGHT (m)	Uncorrected Amplitude QP Detector (dBuV)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Corrected Amplitude (dBuV/m)	Limit (dBuV/m)	Margin (dB)
195.7	V	99	100	17.22	9.33	2.51	29.05	43.50	-14.45
564.24	H	204	106	-4.20	18.91	4.39	19.10	46.40	-27.30
874.3	V	166.2	109	2.78	21.09	5.80	29.66	46.40	-16.74
890.2	H	127.6	122	3.22	21.29	5.87	30.38	46.40	-16.02
913.24	H	308	167	10.45	20.47	5.97	36.89	46.40	-9.51
913.24	H	316	100	2.53	20.47	5.97	28.97	46.40	-17.43
913.24	V	157.2	105	9.32	21.37	5.97	36.66	46.40	-9.74

Table 7. Radiated Emissions Limits Test Results, 30 MHz – 1 GHz



Radiated Emission Limits Test Setup



Photograph 2. Radiated Emission Test Setup 30 MHz - 1 GHz



Crossbow
MTP400CA (8350 – 0391-01)

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

IV. Electromagnetic Compatibility Criteria for Intentional Radiators



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.203 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 must 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.

Results: The EUT as tested meets the criteria of this rule by virtue of having professionally installed. The EUT is therefore compliant with §15.203.

Antenna Type: Integrated Monopole rod - Maximum gain of 1.8dBi

Test Engineer(s): Shawn McMillen

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.249(a) Radiated Field Strength of Fundamental

Test Requirements: **§ 15.249(a):** The 3 meter field strength of the fundamental emissions from intentional radiators operated within the 902 – 928 MHz frequency bands shall comply with the following requirement: 50 millivolts/meter (94dB μ V/m), quasi-peak mode measurement. The peak field strength of any emission shall not exceed the maximum permitted average limits specified by more than 20 dB under any condition of modulation.

Test Procedure: The transmitter was set to the mid channel at the highest output power and placed on a 0.8 m high wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. Measurement were repeated the measurement at the low and highest channels.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

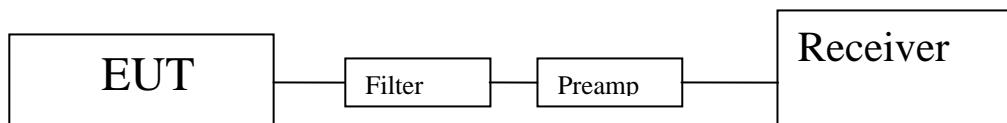
Test Results Equipment complies with § 15.249.

Frequency (MHz)	Antenna Polarity (H/V)	EUT Azimuth (Degrees)	Antenna HEIGHT (m)	Uncorrected Amplitude QP Detector (dB μ V)	Antenna Correction Factor (dB/m) (+)	Cable Loss (dB) (+)	Corrected Amplitude (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
903.05	V	238	1.09	63.88	21.16	5.93	90.97	94.00	3.03
913.08	V	94	1	63.38	21.36	5.97	90.72	94.00	3.29
927.09	V	320	1.07	66.30	21.50	6.04	93.84	94.00	0.16

Table 8. Radiated Fundamentals Results

Test Engineer(s): Shawn McMillen

Test Date(s): November 10, 2006



Block Diagram 1. Radiated Fundamental Test Setup



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.249(d) Harmonic Emissions – Radiated

Test Requirements: **§15.249(d); §15.205:** Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a).

Test Procedure: The transmitter was set to the mid channel at the highest output power and placed on a 0.8 m high wooden table inside in a semi-anechoic chamber. Measurements were performed with the EUT rotated 360 degrees and varying the adjustable antenna mast with 1 m to 4 m height to determine worst case orientation for maximum emissions. Measurement were repeated the measurement at the low and highest channels.

For frequencies from 30 MHz to 1 GHz, measurements were made using a quasi-peak detector with a 120 kHz bandwidth.

For intentional radiators with a digital device portion which operates below 10 GHz, the spectrum was investigated as per §15.33(a)(1) and §15.33(a)(4); i.e., the lowest RF signal generated or used in the device up to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

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

EUT Field Strength Final Amplitude = Raw Amplitude – Preamp gain + Antenna Factor + Cable Loss – Distance Correction Factor (1 meter)



Crossbow
MTP400CA (8350 – 0391-01)

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

§15.205(a): Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110-----	16.42–16.423	399.9–410	4.5–5.15
¹ 0.495–0.505-----	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	(²)

Table 9. Restricted Bands of Operation

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

² Above 38.6



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.249(d) Harmonic Emissions Requirements

Frequency (MHz)	Receive Antenna Polarity (H/V)	Uncorrected Field strength (dB μ V)@ 3m	Antenna Factor (dB)	Cable Loss (dB)	Corrected Field Strength @ 3m (dB μ V)	Limit @ 3m (dB μ V)	Margin (dB)	Measurement Type
1806	V	23.85	27.0	2.3	53.15	74	20.9	Peak
2709	V	21.96	30.0	2.9	54.86	74	19.1	Peak
2709	V	18.62	30.0	2.9	51.52	54	2.5	Avg
Low Channel 903MHz								
Frequency (MHz)	Receive Antenna Polarity (H/V)	Uncorrected Field strength (dB μ V)@ 3m	Antenna Factor (dB)	Cable Loss (dB)	Corrected Field Strength @ 3m (dB μ V)	Limit @ 3m (dB μ V)	Margin (dB)	Measurement Type
1826	V	22.89	27.0	2.3	52.19	74	21.8	Peak
2739	V	21.82	30.0	2.9	54.72	74	19.3	Peak
2739	V	18.34	30.0	2.9	51.24	54	2.8	Avg
Mid Channel 913MHz								
Frequency (MHz)	Receive Antenna Polarity (H/V)	Uncorrected Field strength (dB μ V)@ 3m	Antenna Factor (dB)	Cable Loss (dB)	Corrected Field Strength @ 3m (dB μ V)	Limit @ 3m (dB μ V)	Margin (dB)	Measurement Type
1854	V	23.31	27.0	2.3	52.61	74	21.4	Peak
2781	V	19.90	30.0	2.9	52.80	74	21.2	Peak
2781	V	15.48	30.0	2.9	48.38	54	5.6	Avg
High Channel 927MHz								

Note: All other emissions were measured at the noise floor of the spectrum analyzer



Photograph 3. Test Equipment and setup for various Radiated Measurements

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.215(c) Emission Bandwidth

Test Requirements: **§ 15.215(c):** Intentional radiators operating under the alternative provisions to the general emission limits, as contained in Sec. Sec. 15.217 through 15.257 and in Subpart E, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

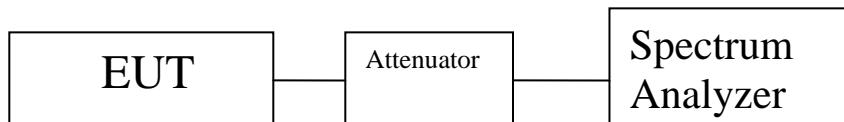
Test Procedure: The transmitter was set to the mid channel at the highest output power and connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using a RBW approximately equal to 1% of the total emission bandwidth, $VBW > RBW$.

Test Results

Carrier Channel	Frequency (MHz)	Measured 26 dB Bandwidth (KHz)	Measured 99% Bandwidth (KHz)
Mid	913	274.4	192.8

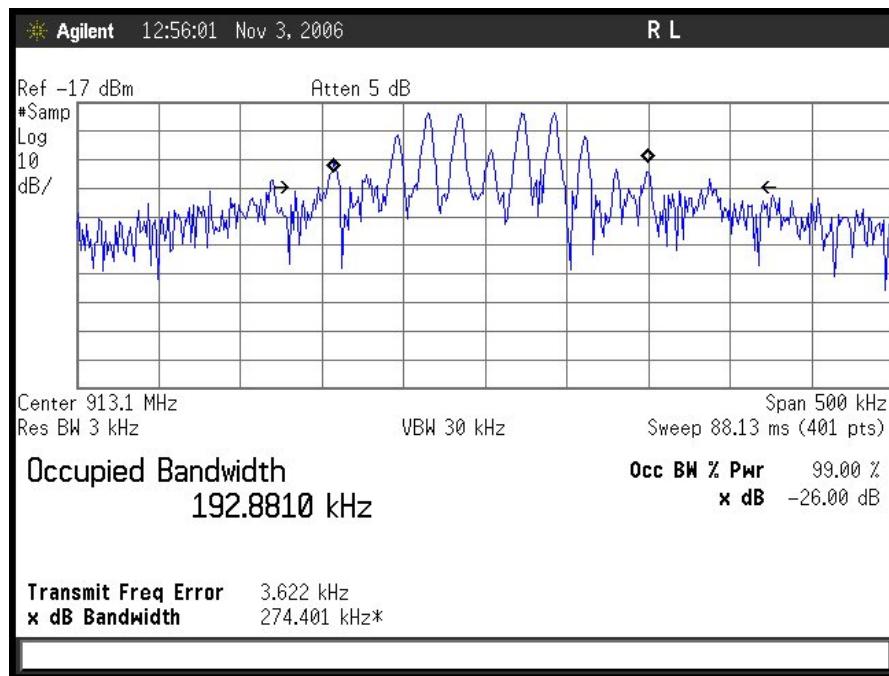
Test Engineer(s): Shawn McMillen

Test Date(s): 11/03/06

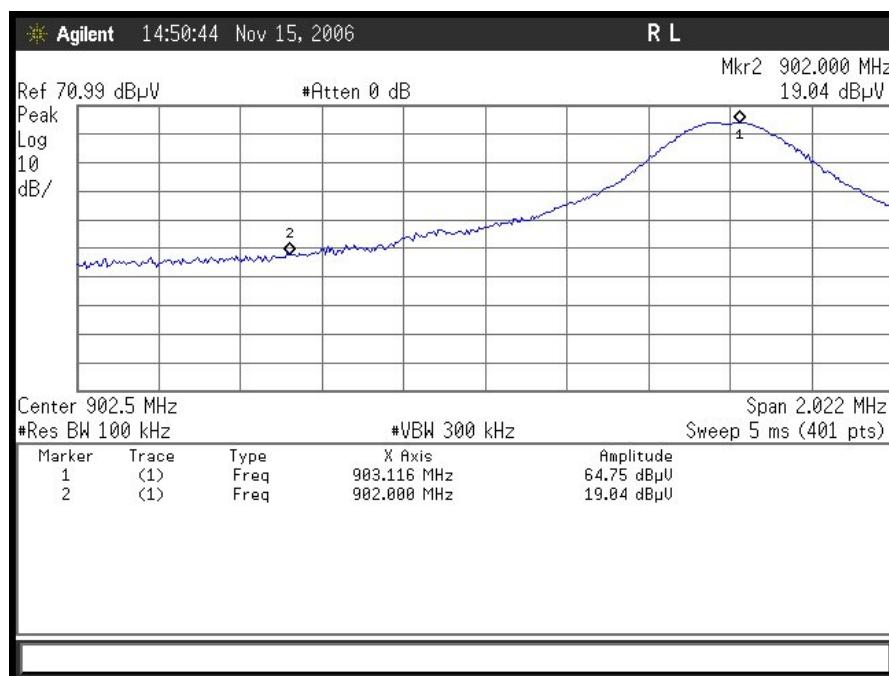


Block Diagram 2. Occupied Bandwidth Test Setup

Electromagnetic Compatibility Criteria for Intentional Radiators



Occupied Band Width

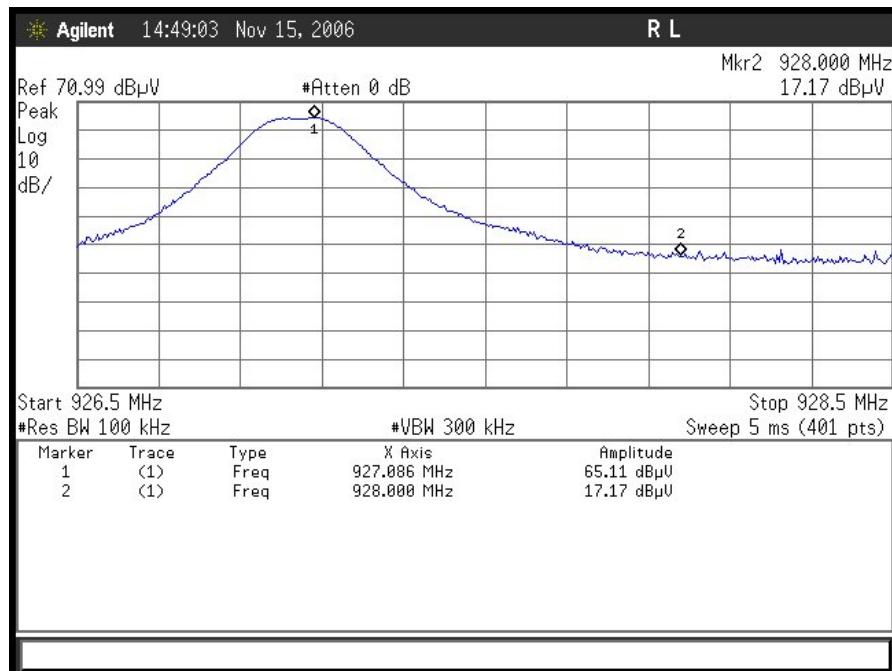


Lower Band Edge



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





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Electromagnetic Compatibility
Test Equipment
CFR Title 47, Part 15, Subpart B & C

IV. Test Equipment



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.

MET Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2421	EMI RECEIVER	ROHDE&SCHWARZ	ESIB 7	2/9/2006	2/9/2007
1S2184	BILOG ANTENNA	CHASE	CBL6112A	1/12/2006	1/12/2007
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	10/27/2005	11/14/2006
1S2198	ANTENNA, HORN	EMCO	3115	8/17/2006	8/17/2007
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	3/23/2004	3/23/2007
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2263	CHAMBER, 10 METER	RANTEC	N2-14	8/15/2006	8/15/2007
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2006	1/12/2007
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2006	1/12/2007
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2460	Analyzer, Spectrum 9 kHz-40GHz	Agilent	E4407B	07/06/2006	07/06/2007
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2006	1/12/2007
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2006	1/12/2007
1S2034	COUPLER, DIRECTIONAL 1-20 GHz	KRYTAR	101020020	SEE NOTE	
1S2041	COUPLER, BI DIRECTIONALCOAXIAL	NARDA	N/A	SEE NOTE	
1S2128	Harmonic Mixer	Hewlett Packard	11970A	10/26/2006	10/26/2009
1S2129	Harmonic Mixer	Hewlett Packard	11970K	10/26/2009	10/26/2009

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



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MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
Certification & User's Manual Information
CFR Title 47, Part 15, Subpart B & C

V. Certification & User's Manual Information



Certification & User's Manual Information

A. 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.



Certification & User's Manual Information

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.¹ *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.

¹ 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.



Certification & User's Manual Information

§ 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.



Certification & User's Manual Information

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.



Verification & User's Manual Information

The following is extracted from Title 47 of the Code of Federal Regulations, Part 15, Subpart B — Unintentional Radiators:

§ 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.



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MTP400CA (8350 – 0391-01)

Electromagnetic Compatibility
End of Report
CFR Title 47, Part 15, Subpart B & C

End of Report