



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

33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372

3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

November 23, 2010

Audio-Technica
1221 Commerce Drive
Stow, Ohio 44224-1760

Dear Chris Henderson,

Enclosed is the EMC test report for compliance testing of the Audio-Technica, SpectraPulse Beltpack, MTU301, tested to the requirements of Title 47 of the Code of Federal Regulations (CFR), Part 15.517 Subpart F and RSS-220, Issue 1, March 2009 for Ultra-Wideband Operation.

Based on these results, MET Laboratories, Inc. certifies that the SpectraPulse Beltpack, MTU301, tested as configured, meets the requirements and interference limitations for Digital Devices under Title 47 of the CFR, Part 15.517, Subpart F and RSS-220, Issue 1, March 2009 for Ultra-Wideband Operation.

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 Warnell
Documentation Department

Reference: (\Audio-Technica\EMC30074-FCC517 Rev. 1)

Certificates and reports shall not be reproduced except in full, without the written permission of MET Laboratories, Inc. This letter of transmittal is not a part of the attached report.



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

33439 WESTERN AVENUE • UNION CITY, CALIFORNIA 94587 • PHONE (510) 489-6300 • FAX (510) 489-6372

3162 BELICK STREET • SANTA CLARA, CALIFORNIA 95054 • PHONE (408) 748-3585 • FAX (510) 489-6372

**Electromagnetic Compatibility Criteria
Test Report**

For the

**Audio-Technica
SpectraPulse Beltpack, MTU301**

FCC ID: JFZMTU301

Verified under
the FCC Certification Rules contained in
Title 47 of the CFR, Part 15.517, Subpart F
& RSS-220, Issue 1, March 2009
for Ultra-Wideband Operation

MET Report: EMC30074-FCC517 Rev. 1

November 23, 2010

Prepared For:

**Audio-Technica
1221 Commerce Drive
Stow, Ohio 44224-1760**

**Prepared By:
MET Laboratories, Inc.
914 West Patapsco Avenue
Baltimore, MD 21230**



**Electromagnetic Compatibility Criteria
Test Report**

for the

**Audio-Technica
SpectraPulse Beltpack, MTU301**

FCC ID: JFZMTU301

**Title 47 of the CFR, Part 15.517, Subpart F
& RSS-220, Issue 1, March 2009
for Ultra-Wideband Operation**

Dusmantha Tennakoon
Project Engineer, Electromagnetic Compatibility Lab

Jennifer Warnell
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, Section 15.517 of the FCC Rules and Industry Canada standard RSS-220, Issue 1, March 2009 under normal use and maintenance.

Shawn McMillen,
Wireless Manager, Electromagnetic Compatibility Lab



Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	November 12, 2010	Initial Issue.
1	November 23, 2010	Revised to reflect engineer corrections.



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	5
	D. Description of Test Sample	5
	E. Equipment Configuration	8
	F. Support Equipment	8
	G. Ports and Cabling Information	8
	H. Mode of Operation	9
	I. Method of Monitoring EUT Operation	9
	J. Modifications	9
	a) Modifications to EUT	9
	b) Modifications to Test Standard	9
	K. Frequency Determining Parameters	9
	L. Disposition of EUT	10
	M. Test Procedures	10
III.	Electromagnetic Compatibility Criteria for Intentional Radiators	11
	§ 15.203 Antenna Requirement	12
	§ 15.207(a) Conducted Emissions Limits	13
	§ 15.517(b) Ultra-Wide Operation Bandwidth	19
	§ 15.517(c) Radiated Emission Limits	21
	§ 15.209(a) Radiated Emission Limits	24
	§ 15.517(d) Radiated Emissions in GPS bands	27
	§ 15.517(e) Peak Emissions within a 50 MHz Bandwidth	29
IV.	Test Equipment	31
V.	Certification & User's Manual Information	33
	A. Certification Information	34
	B. Label and User's Manual Information	38
VI.	ICES-003 Procedural & Labeling Requirements	40



List of Tables

Table 1. Executive Summary of EMC Part 15.517 Compliance Testing	2
Table 2. EUT Overview	4
Table 3. Equipment Configuration	8
Table 4. Support Equipment.....	8
Table 5. Ports and Cabling Information	8
Table 6. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)	13
Table 7. Conducted Emissions, 15.207, Phase Line, Test Results, Computer Peripheral	14
Table 8. Conducted Emissions, 15.207, Neutral Line, Test Results, Computer Peripheral	15
Table 9. Conducted Emissions, 15.207, Phase Line, Test Results, Charging Mode	16
Table 10. Conducted Emissions, 15.207, Neutral Line, Test Results, Charging Mode.....	17
Table 11. Radiated Emission Requirements from §15.517(c).....	21
Table 12. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)	24
Table 13. Radiated Emissions Test Results, 30 MHz – 960 MHz.....	25
Table 14. Radiated Emission Requirements from §15.517(d).....	27
Table 15. Test Equipment	32

List of Figures

Figure 1. Block Diagram of Test Configuration.....	7
Figure 2. Peak Radiated Emissions, Test Setup	30

List of Photographs

Photograph 1. Audio-Technica, SpectraPulse Beltpack, MTU301	6
Photograph 2. Conducted Emissions, 15.207, Test Setup, Computer Peripheral	18
Photograph 3. Conducted Emissions, 15.207, Test Setup, Charging Mode	18
Photograph 4. Radiated Emissions, Test Setup, Below 960 MHz.....	26



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
E	Electric Field
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
kHz	kilohertz
kV	kilovolt
LISN	Line Impedance Stabilization Network
MHz	Megahertz
μ H	microhenry
μ F	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



I. Executive Summary



A. Purpose of Test

An EMC evaluation to determine compliance of the Audio-Technica, SpectraPulse Beltpack, MTU301 with the requirements of Part 15, Subpart F, §15.517 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 Audio-Technica, SpectraPulse Beltpack, MTU301. Audio-Technica should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the SpectraPulse Beltpack, MTU301 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, Subpart F, §15.517. All tests were conducted using measurement procedure ANSI C63.4-2003.

Reference	IC Reference RSS-220, Issue 1, March 2009	Description	Compliance
Title 47 of the CFR, Part 15, Subpart C, §15.203	RSS-220; Section 5.1(b)	Antenna Requirements	Compliant
Title 47 of the CFR, Part 15.521(j), §15.207 (a)	RSS-220; Section 5.2.1(b)	Conducted Emissions for Intentional Radiators	Compliant
Title 47 of the CFR, Part 15, Subpart C, §15.209 (a)	RSS-220; Section 3.4	Radiated Emissions below 960 MHz	Compliant
Title 47 of the CFR, Part 15, Subpart F, §15.517 (a)	RSS-220; Section 5.2.1(a)	Indoor Operation Limitation	Applicant has been advised of these requirements.
Title 47 of the CFR, Part 15, Subpart F, §15.517 (b)	RSS-220; Section 5.1(a)	10 dB UWB Bandwidth	Compliant
Title 47 of the CFR, Part 15, Subpart F, §15.517 (c)	RSS-220; Section 5.2.1(d)	Radiated Emissions above 960 MHz	Compliant
Title 47 of the CFR, Part 15, Subpart F, §15.517 (d)	RSS-220; Section 5.2.1(e)	Radiated Emissions Limits in GPS band	Compliant
Title 47 of the CFR, Part 15, Subpart F, §15.517 (e)	RSS-220; Section 5.2.1(g)	Peak Emissions within 50 MHz bandwidth	Compliant
Title 47 of the CFR, Part 15, Subpart F, §15.517 (f)	RSS-Gen	UWB Labeling Requirements	Applicant has been advised of these requirements

Table 1. Executive Summary of EMC Part 15.517 Compliance Testing



II. Equipment Configuration



A. Overview

MET Laboratories, Inc. was contracted by Audio-Technica to perform testing on the SpectraPulse Beltpack, MTU301, under Audio-Technica purchase order number 4500002833.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the Audio-Technica, SpectraPulse Beltpack, MTU301.

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

Type of Submission/Rule:	Part 15.517 Original Filing
Model(s) Tested:	SpectraPulse Beltpack, MTU301
Model(s) Number:	SpectraPulse Beltpack, MTU301
EUT Specifications:	Primary Power: 3 VDC
	UWB 10 dB Bandwidth: 0.8344 GHz
	FCC ID: JFZMTU301 IC: 1752B-MTU301
	Equipment Code: UWB
Lab Ambient (Normal) Test Conditions:	Temperature: 15-35° C
	Relative Humidity: 30-60%
	Atmospheric Pressure: 860-1060 mbar
Evaluated by:	Dusmantha Tennakoon
Date(s):	November 23, 2010

Table 2. EUT Overview



B. References

CFR 47, Part 2	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations
CFR 47, Part 15	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: Radio Frequency Devices
RSS-220, Issue 1, March 2009	Devices Using Ultra-Wideband (UWB) Technology
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
ANSI C63.10-2009	American National Standard for Testing Unlicensed Wireless Devices

C. Test Site

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

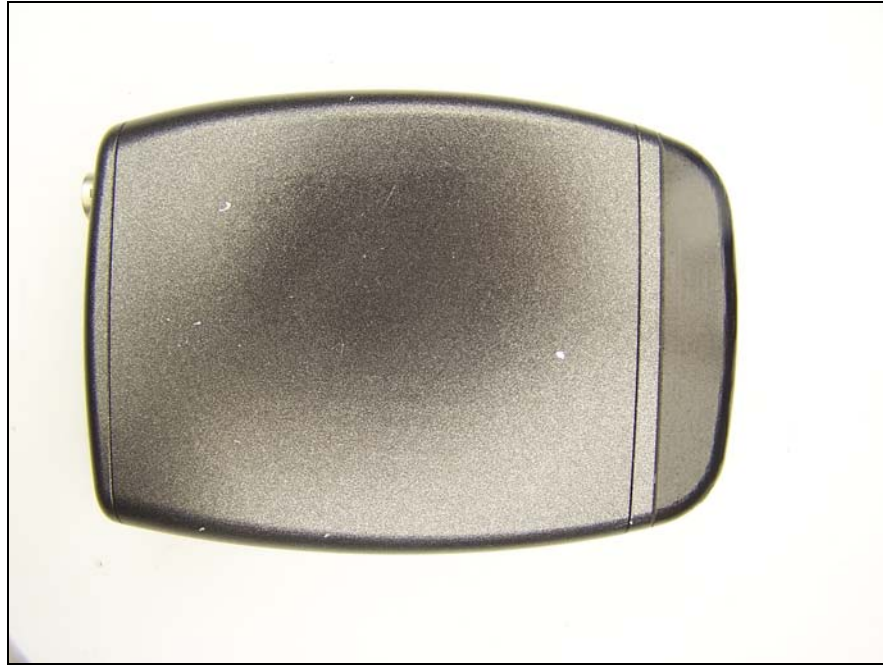
Radiated Emissions measurements were performed in a semi-anechoic chamber. In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

D. Description of Test Sample

The SpectraPulse Beltpack, MTU301, Equipment Under Test (EUT), is a wireless microphone system. The intended use is for boardroom or like applications used for recording, telephone communications, and sound reinforcement.

This particular unit is a beltpack transceiver intended to be used with a lavalier or head-worn type microphone.

The EUT has no data ports and is an Indoor Communication Device.



Photograph 1. Audio-Technica, SpectraPulse Beltpack, MTU301

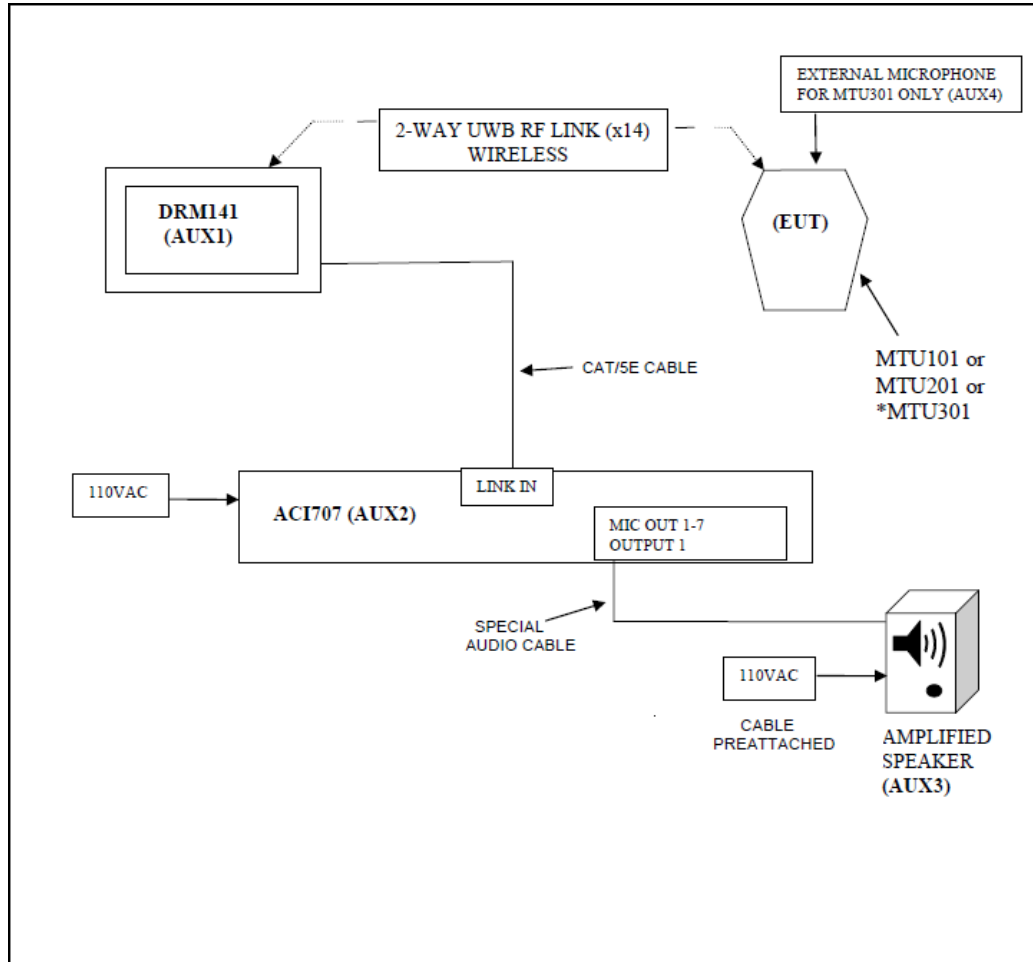


Figure 1. Block Diagram of Test Configuration



E. Equipment Configuration

Ref. ID	Name / Description	Model Number	Serial Number
EUT1	Microphone Transmitter Unit	MTU301	ES 04 6/1/10

Table 3. Equipment Configuration

F. Support Equipment

Ref. ID	Name / Description	Manufacturer	Model Number	Serial Number
AUX1	Digital Receiver Module	Audio-Technica	DRM141	1026-03026
AUX2	Audio Controller Interface	Audio-Technica	ACI707	NW-828428
AUX3	Computer Speaker	unknown	MMS 557	E154645B
AUX4	Head-worn Microphone	Audio-Technica	AT892	PSC88-2058

Table 4. Support Equipment

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
EUT1	No ports		-			
AUX1	LINK OUT	CAT 5e 8-cond	1	6	Y	LINK IN on AUX2
AUX2	LINK IN	CAT 5e 8-cond	1	6	Y	LINK OUT on AUX1
	LINK OUT	Not Used	-			
	RS-232(front panel)	Not Used	-			
	VAC IN	IEC 3-cond	1	2	N	110VAC LINE FEED
	CONTROL INPUTS	Not Used	-			
	CONTROL OUTPUTS	Not Used	-			
	MIC OUT 1	Special 3 – pin audio	1		Y	(PHONO) R INPUT on AUX3
	MIC OUT 2 - 7	Not Used	-			
AUX3	AUX INPUT R	Special 3 – pin audio	1		Y	MIC OUT 1 on AUX2
	AUX INPUT L	Not Used	-			
	VAC IN	Pre-connected	1	2	N	110VAC LINE FEED
AUX4	HIROSE 4-PIN FEMALE	Audio Input into EUT Beltpack	1		Y	INTO EUT MIC INPUT

Table 5. Ports and Cabling Information



H. Mode of Operation

Spectrapulse is a UWB wireless microphone system. The transmitter (microphone) has no direct connection and is connected via air link to the rest of the system. The only required connection in the system is a CAT5e cable that plugs into the rear of the DRM141 and on to the ACI141.

The ACI141 requires 110VAC to operate.

I. Method of Monitoring EUT Operation

Spectrapulse is a UWB wireless microphone system. The only monitoring required is that the ACI707 unit displays a link to the microphone once the microphone is turned “on”. The audio output from the microphone can be monitored through the use of an external speaker for verification.

J. Modifications

a) Modifications to EUT

A charging cable with a ferrite was required to pass radiated emissions testing. The part number is 31-480002 5'.

b) Modifications to Test Standard

No modifications were made to the Test Standard.

K. Frequency Determining Parameters

The highest frequency employed in §15.33 to determine the frequency range over which radiated emissions are made was based on the center frequency, f_c , unless a higher frequency was generated within the UWB device. For measuring emission levels, the spectrum was 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 the 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.

$$f_c = (f_L + f_h)/2 = 6.3316 \text{ GHz}$$

$$f_M = 6.3717 \text{ GHz}$$

$$\text{Pulse width} = 2\text{ns}$$

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



L. Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electro-Magnetic Compatibility Lab for testing was returned to Audio-Technica upon completion of testing.

M. Test Procedures

1. FCC's UWB guidance was followed when making field strength of radiated emissions.
2. The orientation of the EUT was adjusted during testing when making field strength measurements.

III. 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 was compliant with the requirements of this section. The device has an integral antenna.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/12/10

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.207 Conducted Emissions Limits

Test Requirement(s): § 15.207 (a): For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω 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 frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dB μ V)	
	Quasi-Peak	Average
* 0.15- 0.45	66 - 56	56 - 46
0.45 - 0.5	56	46
0.5 - 30	60	50

Table 6. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Test Procedure: The EUT was placed on a 0.8 m-high wooden table inside a screen room. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, 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 Ω /50 μ 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 0.15 MHz to 30 MHz using a 50 Ω /50 μ H LISN as the input transducer to an EMC/field intensity meter. For the purpose of this testing, the transmitter was turned on. Scans were performed with the transmitter on.

Test Results: The EUT was compliant with this requirement. Measured emissions were below applicable limits.

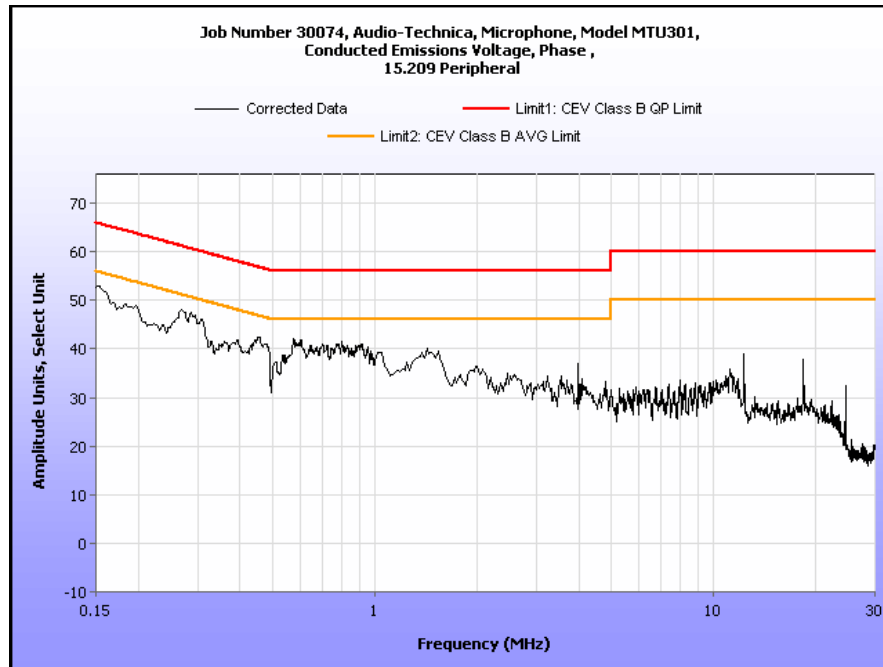
Test Engineer(s): Manasi Bhandiwad

Test Date(s): 10/25/10

15.207 Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.15	49.68	0	49.68	66	-16.32	35.4	0	35.4	56	-20.6
0.27	44.4	0	44.4	61.12	-16.72	35.57	0	35.57	51.12	-15.55
0.458	37.34	0	37.34	56.73	-19.39	21.43	0	21.43	46.73	-25.3
0.583	36.13	0	36.13	56	-19.87	25.32	0	25.32	46	-20.68
1.53	34.36	0	34.36	56	-21.64	24.13	0	24.13	46	-21.87
2.035	31.08	0	31.08	56	-24.92	18.52	0	18.52	46	-27.48

Table 7. Conducted Emissions, 15.207, Phase Line, Test Results, Computer Peripheral

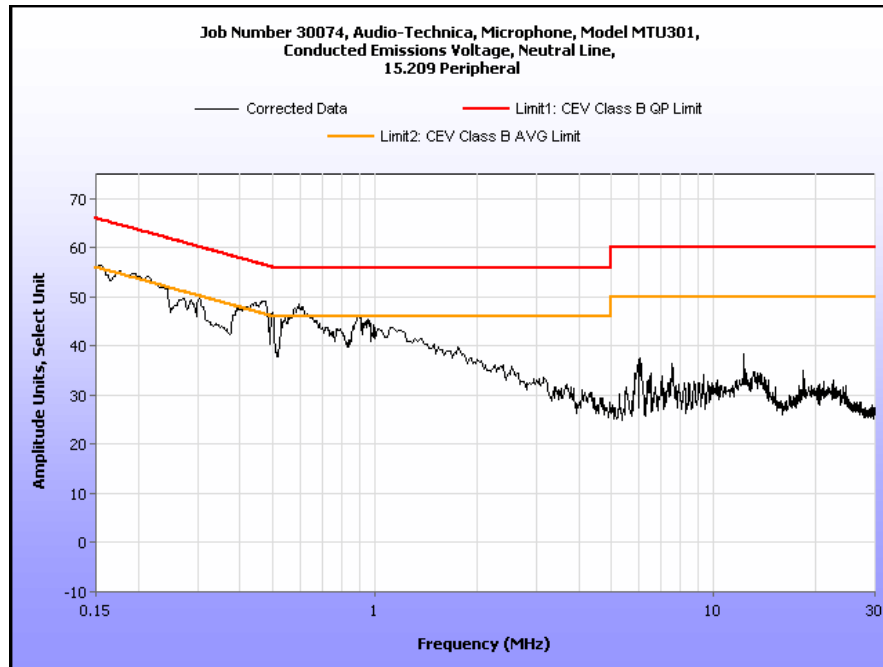


Plot 1. Conducted Emissions, Phase Line, Computer Peripheral

15.207 Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.151	52.91	0	52.91	65.95	-13.04	38.8	0	38.8	55.95	-17.15
0.455	45.39	0	45.39	56.78	-11.39	28.52	0	28.52	46.78	-18.26
0.594	46.22	0	46.22	56	-9.78	35.6	0	35.6	46	-10.4
0.949	40.87	0	40.87	56	-15.13	25.84	0	25.84	46	-20.16
1.195	36.95	0	36.95	56	-19.05	26.83	0	26.83	46	-19.17
5.93	30.14	0.05	30.19	60	-29.81	18.37	0.05	18.42	50	-31.58

Table 8. Conducted Emissions, 15.207, Neutral Line, Test Results, Computer Peripheral

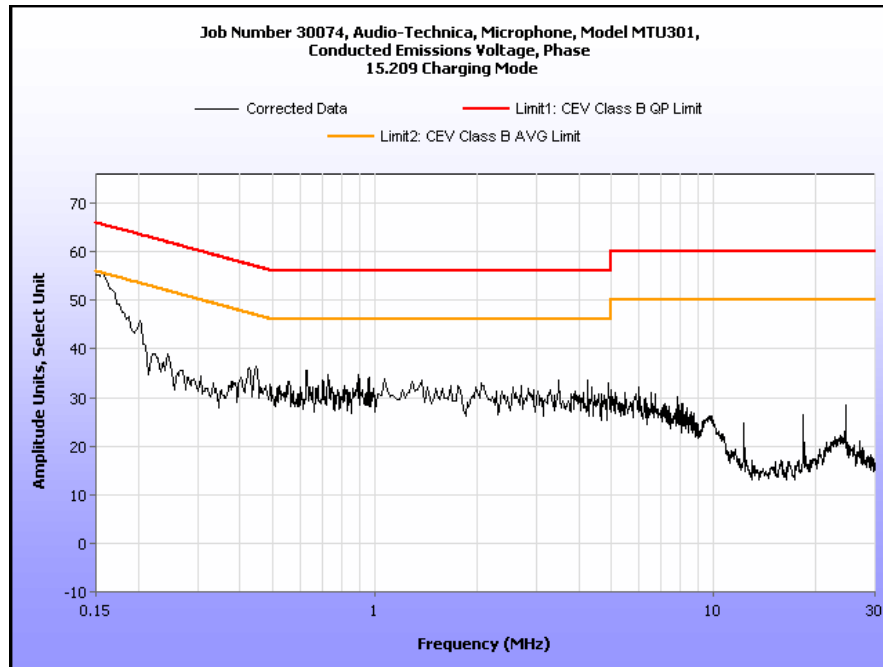


Plot 2. Conducted Emissions, Neutral Line, Computer Peripheral

15.207 Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.157	47.96	0	47.96	65.62	-17.66	35.6	0	35.6	55.62	-20.02
0.184	41.34	0	41.34	64.3	-22.96	28.65	0	28.65	54.3	-25.65
0.244	34.32	0	34.32	61.96	-27.64	25.29	0	25.29	51.96	-26.67
0.446	34.51	0	34.51	56.95	-22.44	26.67	0	26.67	46.95	-20.28
0.611	23.19	0	23.19	56	-32.81	10.55	0	10.55	46	-35.45
1.22	23.29	0	23.29	56	-32.71	10.5	0	10.5	46	-35.5

Table 9. Conducted Emissions, 15.207, Phase Line, Test Results, Charging Mode

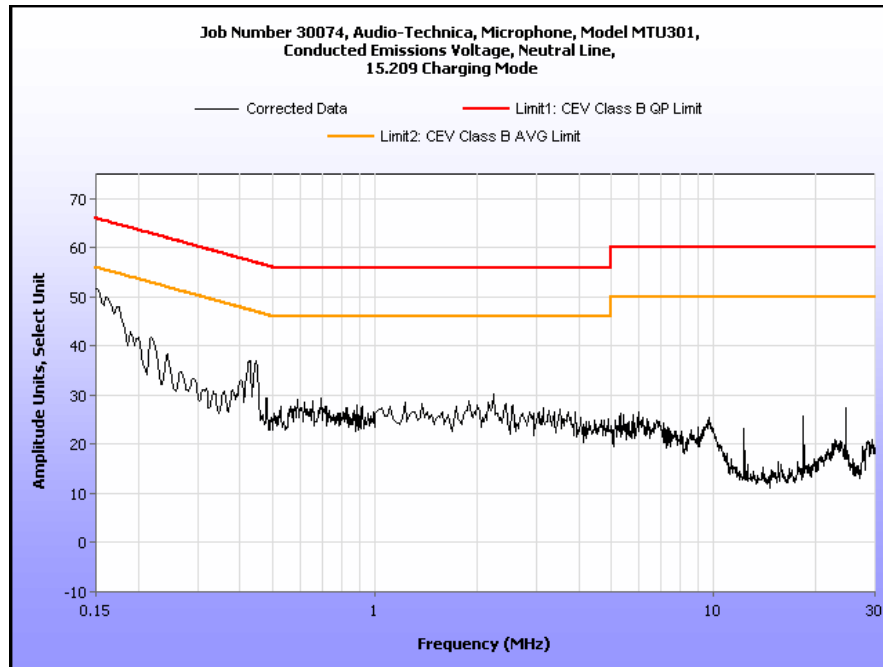


Plot 3. Conducted Emissions, Phase Line, Charging Mode

15.207 Conducted Emissions Test Results

Frequency (MHz)	Uncorrected Meter Reading (dBuV) QP	Cable Loss (dB)	Corrected Measurement (dBuV) QP	Limit (dBuV) QP	Margin (dB) QP	Uncorrected Meter Reading (dBuV) Avg.	Cable Loss (dB)	Corrected Measurement (dBuV) AVG	Limit (dBuV) AVG	Margin (dB) AVG
0.156	44.53	0	44.53	65.67	-21.14	35.2	0	35.2	55.67	-20.47
0.201	38.76	0	38.76	63.57	-24.81	28.89	0	28.89	53.57	-24.68
0.223	36.73	0	36.73	62.71	-25.98	28.04	0	28.04	52.71	-24.67
0.427	33.34	0	33.34	57.31	-23.97	25.98	0	25.98	47.31	-21.33
2.77	18.27	0	18.27	56	-37.73	8.7	0	8.7	46	-37.3
9.83	20.6	0.06	20.66	60	-39.34	12.26	0.06	12.32	50	-37.68

Table 10. Conducted Emissions, 15.207, Neutral Line, Test Results, Charging Mode



Plot 4. Conducted Emissions, Neutral Line, Charging Mode

15.207 Conducted Emissions Test Setup Photo



Photograph 2. Conducted Emissions, 15.207, Test Setup, Computer Peripheral

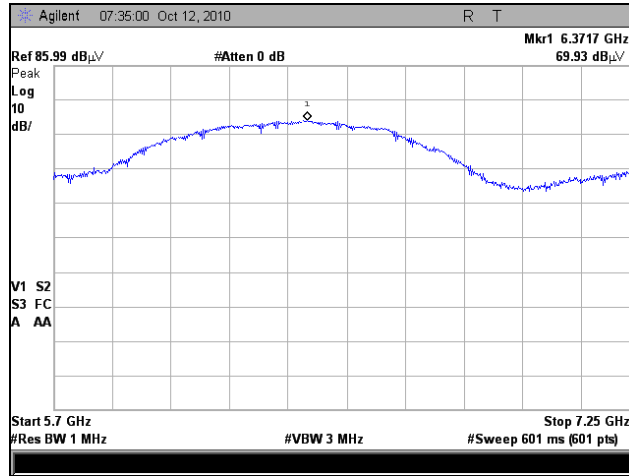


Photograph 3. Conducted Emissions, 15.207, Test Setup, Charging Mode

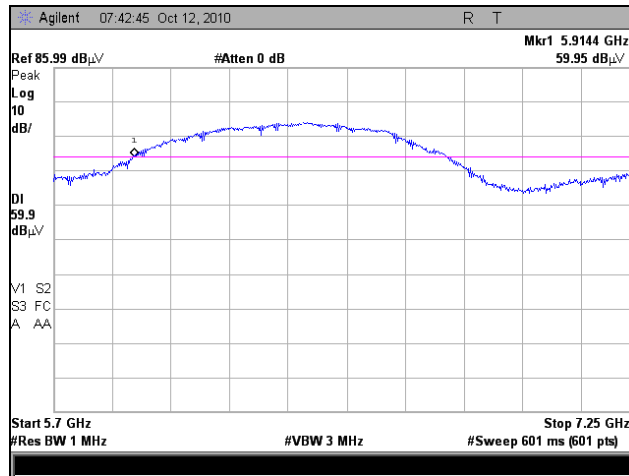
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.517(b) Ultra-Wide Operation Bandwidth

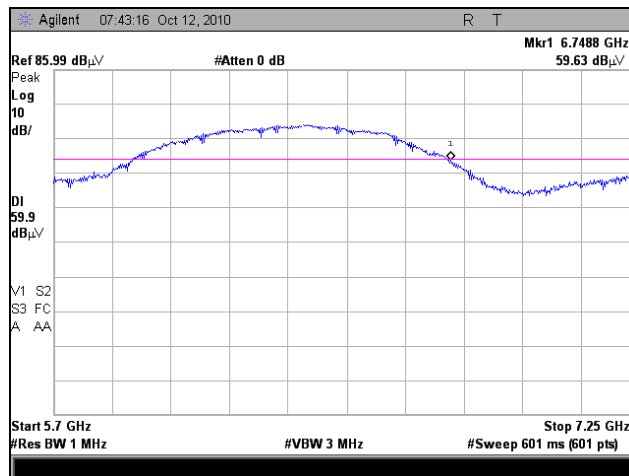
- Test Requirements:**
- § 15.517(b): The UWB bandwidth of a UWB system operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.
 - § 15.503(a): The UWB bandwidth should be measured by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna.
 - § 15.503(d): An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.
- Test Procedure:** The transmitter was set to transmit at maximum output power and placed on a 1 m high acrylic stand inside in a chamber. The antenna was located 1 meter from the EUT. Measurements were performed with the EUT rotated 360 degrees and varying the receiving antenna height to determine worst case orientation for maximum emissions. The 10 dB bandwidth was measured and recorded. During initial measurements a wider spectrum was looked at to make sure that the emission does not increase in power above the first 10dB points.
- Test Results:** The EUT was found compliant with the Radiated Emission limits of §15.517(b). See following pages for detailed test results: 10dB Bandwidth = 0.8344 GHz, $f_L = 5.9144$ GHz, $f_H = 6.7488$ GHz and $f_M = 6.3717$ GHz.
- Note: Antenna correction factor, cable loss and pre-amp gain have been corrected for in the SA.
- Test Engineer:** Dusmantha Tennakoon
- Test Date(s):** 10/15/10



Plot 5. UWB Bandwidth, $f_M = 6.3717$ GHz



Plot 6. UWB Bandwidth, $f_L = 5.9144$ GHz



Plot 7. UWB Bandwidth, $f_H = 6.7488$ GHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.517(c) Radiated Emission Limits above 960 MHz

Test Requirements: §15.517(c): The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960 – 1610	- 75.3
1610 – 1990	- 53.3
1990 – 3100	- 51.3
3100 – 10600	- 41.3
Above 10600	- 51.3

Table 11. Radiated Emission Requirements from §15.517(c)

Note: A RMS detector was used for measurements above 960 MHz.

Test Limits: Calculation of Limit:

Avg EIRP Limit in the 3100-10600 MHz band = -41.3 dBm.

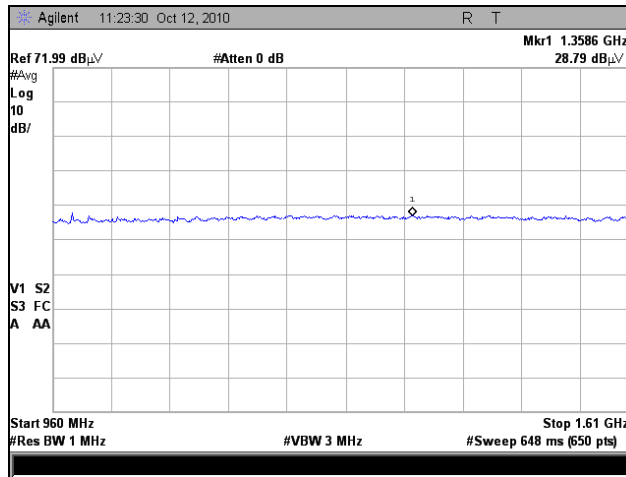
The equivalent field strength at 1m = (-41.3) + 104.8 = 63.5 dBμV/m

Test Results: The EUT was found compliant with the Radiated Emission limits of §15.517. See following pages for detailed test results for measurements above 960 MHz. All corrections have been pre-programmed in to spectrum analyzer. Measurements were made to 40 GHz but no emissions were seen.

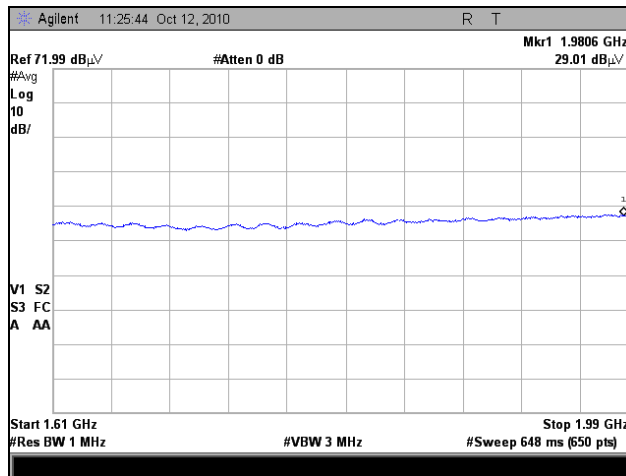
Test Engineer: Dusmantha Tennakoon

Test Date(s): 10/15/10

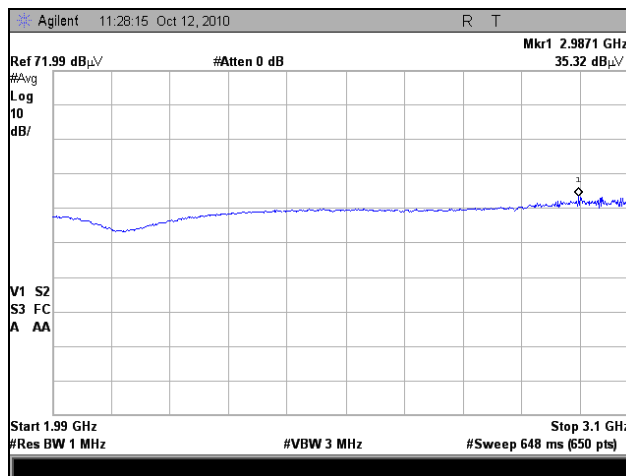
§ 15.517(c) Radiated Emission Limits



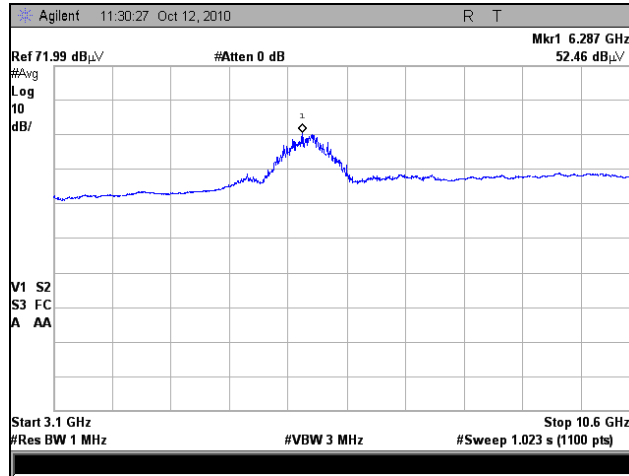
Plot 8. Radiated Emissions, 910 MHz – 1610 MHz



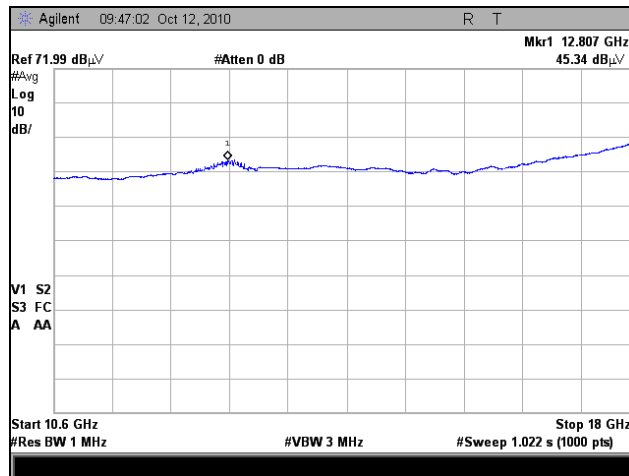
Plot 9. Radiated Emissions, 1610 MHz – 1990 MHz



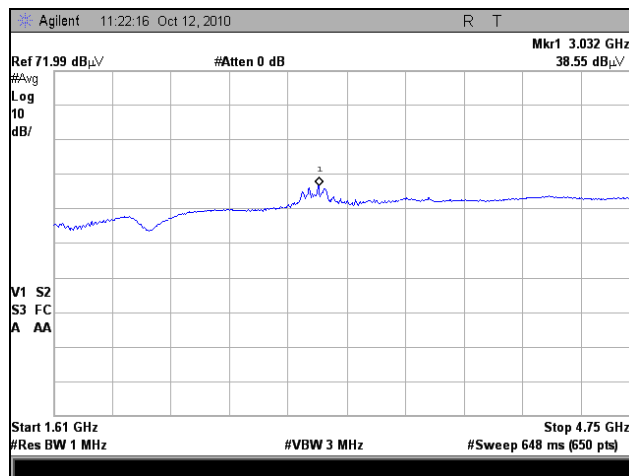
Plot 10. Radiated Emissions, 1990 MHz – 3100 MHz



Plot 11. Radiated Emissions, 3.1 GHz – 10.6 GHz



Plot 12. Radiated Emissions, Above 10.6 GHz



Plot 13. Radiated Emissions, 1.61 GHz – 4.75 GHz, Industry Canada Limits

Note: The measurement was made at 0.2 m.

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209(a) Radiated Emission Limits below 960 MHz

Test Requirement(s): § 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 12.

Frequency (MHz)	§ 15.209(a), Radiated Emission Limits (dB μ V/m) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	Refer to section 15.517(c)

Table 12. Radiated Emissions Limits Calculated from FCC Part 15, § 15.209 (a)

Test Procedure: The transmitter was set to transmit at maximum output power and placed on a 0.8 m high acrylic table inside in a semi-anechoic chamber. The antenna was located 3 m from the EUT. Measurements were performed with the EUT rotated 360 degrees and varying the receiving antenna height from 1 to 4 meters 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.

Test Results: The EUT was found compliant with the Radiated Emission limits of §15.209 for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Dusmantha Tennakoon

Test Date(s): 10/15/10

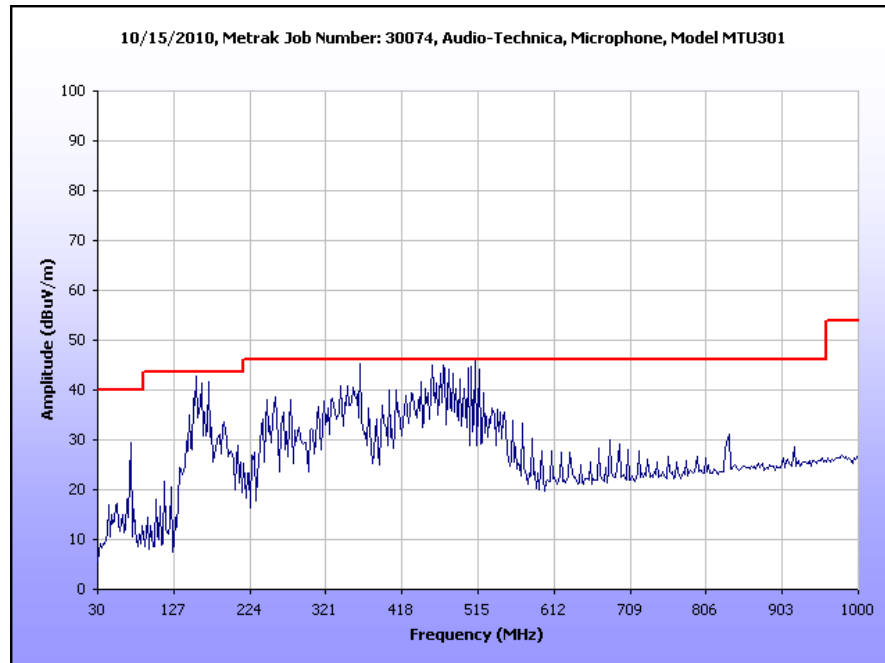
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209(a) Radiated Emission

Frequency (MHz)	EUT Azimuth (Degrees)	Antenna Polarity (H/V)	Antenna HEIGHT (m)	Uncorrected Amplitude (dBuv)	Antenna Correction Factor (dB) (+)	Cable Loss (dB) (+)	Distance Correction Factor (dB) (-)	Corrected Amplitude (dBuv)	Limit (dBuv)	Margin (dB)
157.26804	323	H	2.20	29.05	8.06	0.23	0.00	37.34	43.50	-6.16
157.26804	23	V	1.00	33.33	8.06	0.23	0.00	41.62	43.50	-1.88
511.1498	271	H	1.90	27.45	17.15	1.00	0.00	45.60	46.00	-0.40
511.1498	361	V	2.14	9.87	17.15	1.00	0.00	28.02	46.00	-17.98
358.79459	270	H	1.00	30.10	14.70	0.83	0.00	45.63	46.00	-0.37
358.79459	163	V	1.00	20.98	14.70	0.83	0.00	36.51	46.00	-9.49
476.76202	267	H	2.08	24.97	16.90	1.00	0.00	42.87	46.00	-3.13
476.76202	111	V	1.00	18.24	16.90	1.00	0.00	36.14	46.00	-9.86
457.1017	210	H	2.12	24.00	16.58	1.00	0.00	41.58	46.00	-4.42
457.1017	-2	V	2.01	16.28	16.58	1.00	0.00	33.86	46.00	-12.14

Table 13. Radiated Emissions Test Results, 30 MHz – 960 MHz

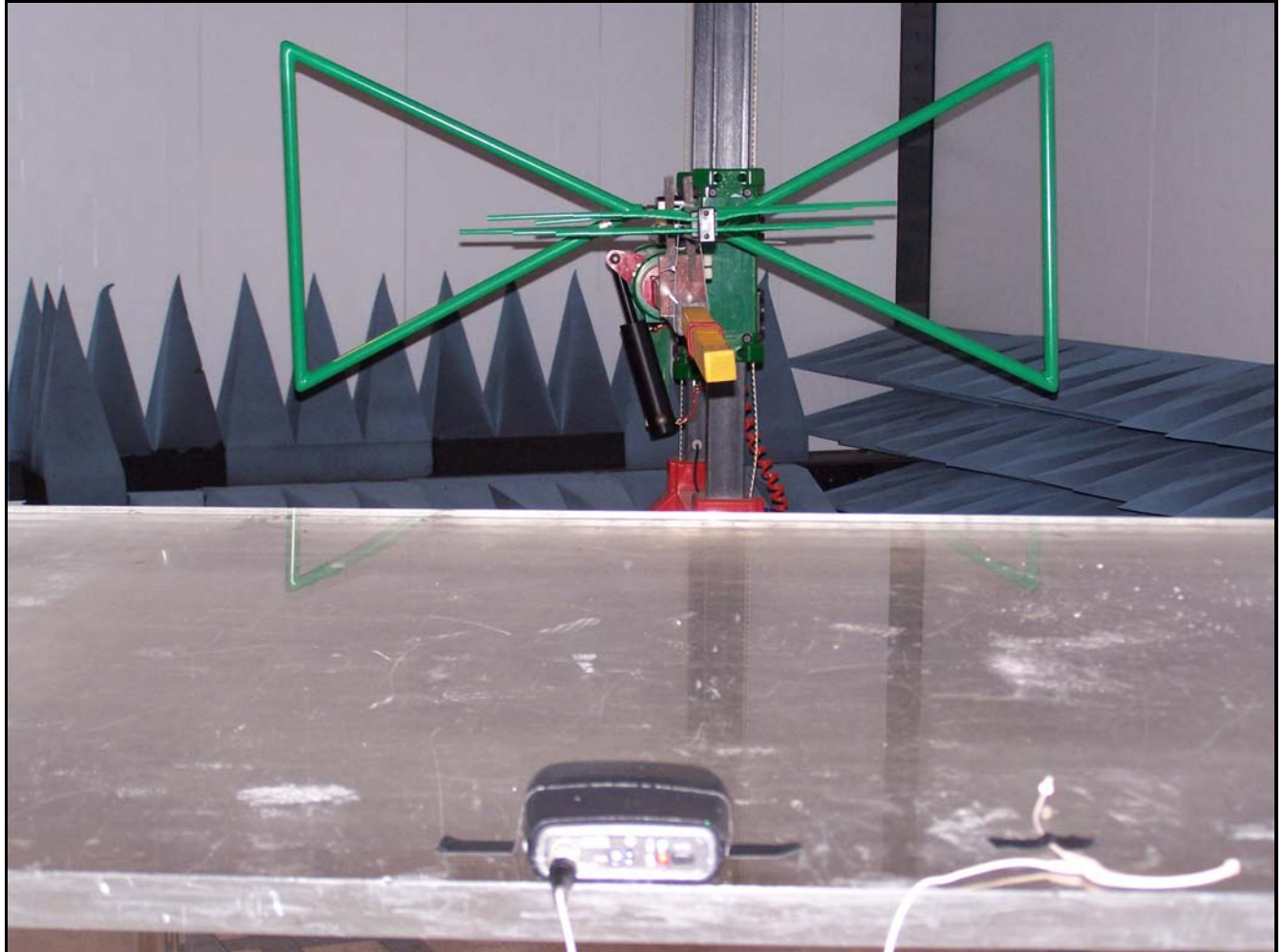
Note: The EUT was tested at 3 m.



Plot 14. Radiated Emissions, Below 960 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209(a) Radiated Emission



Photograph 4. Radiated Emissions, Test Setup, Below 960 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.517(d) Radiated Emissions in GPS bands

Test Requirements: §15.517(d): In addition to the radiated emission limits specified in the table in paragraph (c) of this section, 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:

Frequency in MHz	EIRP in dBm
1164 – 1240	– 85.3
1559 – 1610	– 85.3

Table 14. Radiated Emission Requirements from §15.517(d)

Test Procedure: The transmitter was set to transmit at maximum output power and placed on a 1 m high acrylic stand inside a chamber. The antenna was located 1 m away from the EUT. Measurements were performed with the EUT rotated 360 degrees and varying the receiving antenna height to determine worst case orientation for maximum emissions. Tests were performed with vertical and horizontal polarization.

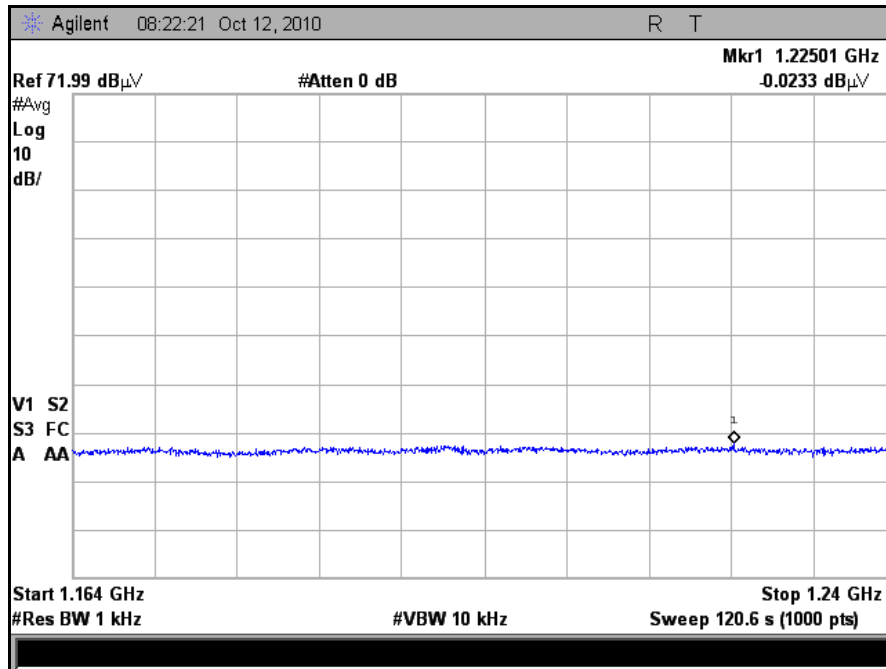
Average measurements were made with RMS detector activated on the spectrum analyzer and having the resolution bandwidth set to 1 kHz and video bandwidth set to 10 kHz.

Calculation of Limit: The EIRP limit is mathematically converted to the equivalent 1 m field strength using the following equation: $E(\text{dBuV/m}) = P(\text{dBm EIRP}) + 104.8 - 20\log D = 19.5 \text{ dBuV/m}$.

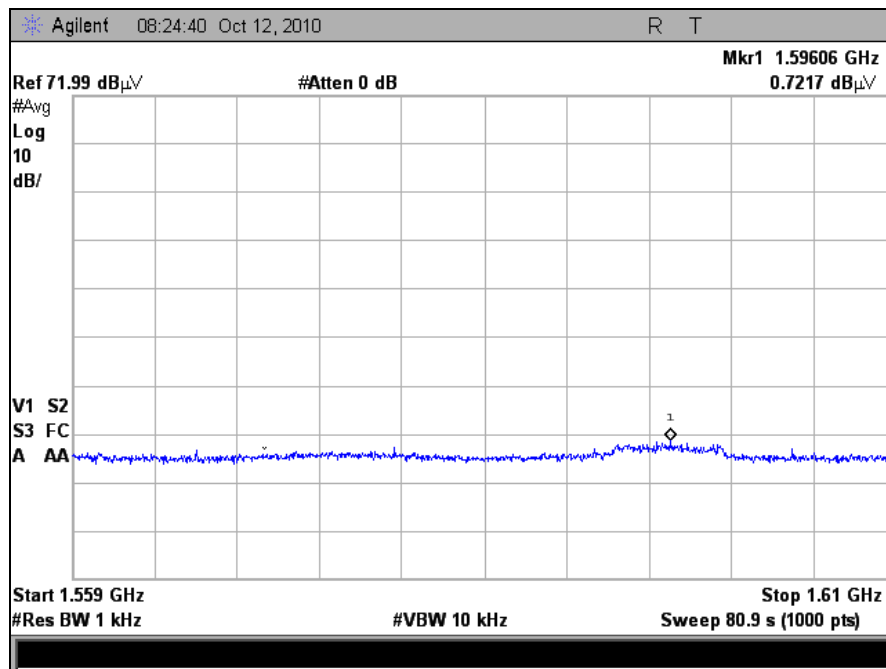
Test Results: The EUT was found compliant with the requirements of this section. See following pages for detailed test results. All corrections have been pre-programmed in to spectrum analyzer.

Test Engineer: Dusmantha Tennakoon

Test Date: 10/15/10



Plot 15. Radiated Emissions, GPS Bands, 1164 MHz – 1240 MHz



Plot 16. Radiated Emissions, GPS Bands, 1559 MHz – 1610 MHz

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.517(e) Peak Emissions within a 50 MHz Bandwidth

Test Requirements: §15.517(e): The peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission 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, following the procedures described in §15.521.

§15.517(g): If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be $20 \log (RBW/50)$ dBm where RBW is the resolution bandwidth in megahertz that is employed.

Test Procedure: The transmitter was set to transmit at maximum output power and placed on a 1 m high acrylic stand inside a chamber. The antenna was located 1 m away from the EUT. Measurements were performed with the EUT rotated 360 degrees and varying the receiving antenna height to determine worst case orientation for maximum emissions. Tests were performed with vertical and horizontal polarization.

The E-field strength level were converted from dB μ V/m to dBm, EIRP, in accordance with the equation: $P(\text{dBm EIRP}) = E(\text{dB}\mu\text{V/m}) + 20\log D - 104.8$

Measurements were made with PEAK detector activated to the spectrum analyzer and having the resolution bandwidth set to 1 MHz and video bandwidth set to 3 MHz.

Therefore, the limit calculated is $20 \log (1/50) = -34.0$ dB.

The equivalent field strength at 1m = $-34 + 104.8$
= 70.8 dB μ V/m

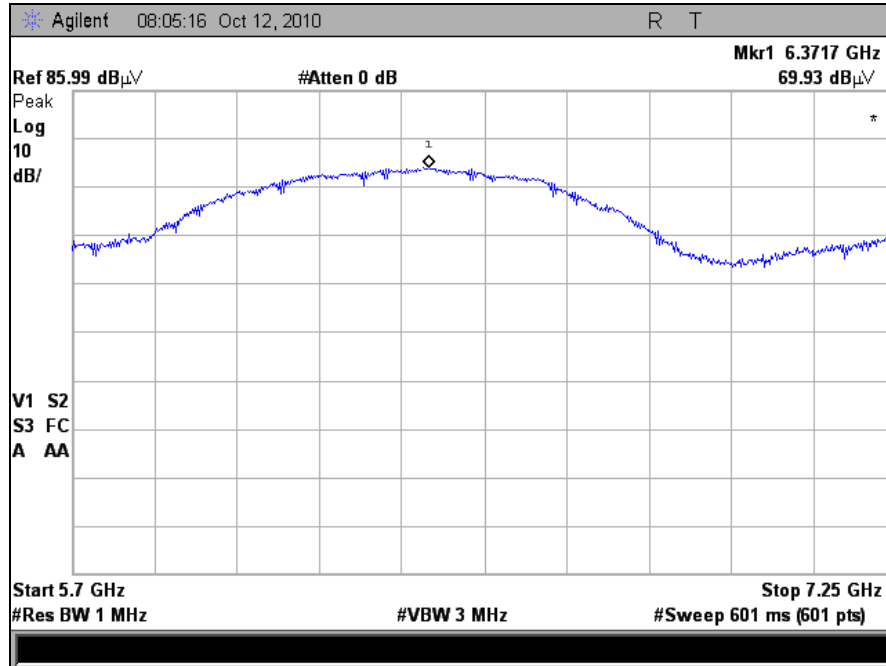
Test Results: The EUT was found compliant with the Radiated Emission limits of §15.517(e). See following pages for detailed test results. All corrections have been pre-programmed into spectrum analyzer.

Test Engineer: Dusmantha Tennakoon

Test Date: 10/15/10

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.517(e) Peak Emissions within a 50 MHz Bandwidth



Plot 17. Peak Radiated Emissions, Test Results



Figure 2. Peak Radiated Emissions, Test Setup

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.

TEST SECTIONS: FCC SUBPART F - 15.517			TEST DATE(S): 10/15/10		
MET ASSET #	NOMENCLATURE	MANUFACTURER	MODEL	LAST CAL DATE	CAL DUE DATE
1T4621	ESA-E SERIES SPECTRUM ANALYZER	AGILENT	E4402B	05/10/2010	05/10/2011
1T2665	HORN ANTENNA	EMCO	3115	07/15/2010	07/15/2011
1T4300	SEMI-ANECHOIC CHAMBER # 1	EMC TEST SYSTEMS	NONE	08/23/2010	08/23/2011
1S2485	ANTENNA; BILOG	TESEQ	CBL6112D	5/7/2010	5/7/2011
1T4354	SIGNAL GENERATOR	HEWLETT PACKARD	83752A	03/11/2010	03/11/2011
1T4409	EMI RECEIVER	ROHDE & SCHWARZ	ESIB7	05/25/2010	05/25/2011
1T4592	RF FILTER KIT	VARIOUS	N/A	SEE NOTE	
1T4414	MICROWAVE PRE-AMPLIFIER	A.H. SYSTEMS	PAM-0118	SEE NOTE	

Table 15. Test Equipment

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



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

B. 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.



ICES-003 Procedural & Labeling Requirements

From the Industry Canada Electromagnetic Compatibility Advisory Bulletin entitled, "Implementation and Interpretation of the Interference-Causing Equipment Standard for Digital Apparatus, ICES-003" (EMCAB-3, Issue 2, July 1995):

"At present, CISPR 22: 2002 and ICES technical requirements are essentially equivalent. Therefore, if you have CISPR 22: 2002 approval by meeting CISPR Publication 22, the only additional requirements are: to attach a note to the report of the test results for compliance, indicating that these results are deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations; to maintain these records on file for the requisite five year period; and to provide the device with a notice of compliance in accordance with ICES-003."

Procedural Requirements:

According to Industry Canada's Interference Causing Equipment Standard for Digital Apparatus ICES-003 Issue 4, February 2004:

- Section 6.1: A record of the measurements and results, showing the date that the measurements were completed, shall be retained by the manufacturer or importer for a period of at least five years from the date shown in the record and made available for examination on the request of the Minister.
- Section 6.2: A written notice indicating compliance must accompany each unit of digital apparatus to the end user. The notice shall be in the form of a label that is affixed to the apparatus. Where because of insufficient space or other constraints it is not feasible to affix a label to the apparatus, the notice may be in the form of a statement in the user's manual.

Labeling Requirements:

The suggested text for the notice, in English and in French, is provided below, from the Annex of ICES-003:

This Class [²] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [¹] est conforme à la norme NMB-003 du Canada.

² Insert either A or B but not both as appropriate for the equipment requirements.



End of Report