Electromagnetic Compatibility Criteria
Test Report

for the

Sentinel Vision
SafeScout

Verified under
the FCC Certification Rules
contained in
Title 47 of the CFR, Part 15.231, Subpart B and C

MET Report: EMCS18082B-FCC231

January 6, 2006

Prepared For:

Sentinel Vision
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Prepared By:
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for Intentional Radiators

Shawn McMillen, Project Engineer
Electromagnetic Compatibility Lab

Cheryl Anicete
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 15.231, of the FCC Rules under normal use and maintenance.

Tony Permsombut, Manager
Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	January 6, 2006	Initial Issue.

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List of Terms and Abbreviations

AC	**A**lternating **C**urrent
ACF	**A**ntenna **C**orrection **F**actor
Cal	**Cal**ibration
d	**M**easurement **D**istance
dB	**D**eci**b**els
dBµA	**D**eci**b**els above one **micro**amp
dBµV	**D**eci**b**els above one **micro**volt
dBµA/m	**D**eci**b**els above one **micro**amp **per m**eter
dBµV/m	**D**eci**b**els above one **micro**volt **per m**eter
DC	**D**irect **C**urrent µ
E	**E**lectric Field
DSL	**D**igital **S**ubscriber **L**ine
ESD	**E**lectro**s**tatic **D**ischarge
EUT	**E**quipment **U**nder **T**est
f	**F**requency
FCC	**F**ederal **C**ommunications **C**ommission
GR-1089-CORE	***(GR)*** **G**eneral **R**equirement(s) imposed by the NEBS standard, ***(CORE)*** **C**entral **O**ffice **R**ecovery **E**xpress (AT&T), ***(1089)*** specifies various parts of the General Requirements under Bellcore Technical Standard, Requirements for Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment
GRP	**G**round **R**eference **P**lane
H	Magnetic Field
HCP	**H**orizontal **C**oupling **P**lane
Hz	**H**ert**z**
IEC	**I**nternational **E**lectrotechnical **C**ommission
kHz	**k**ilo**h**ert**z**
kPa	**k**ilo**pa**scal
kV	**k**ilo**v**olt
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
MHz	**M**ega**h**ertz
µH	**microh**enry
µ	**microf**arad
µs	**micros**econds
NEBS	**N**etwork **E**quipment-**B**uilding **S**ystem
PRF	**P**ulse **R**epetition **F**requency
RF	**R**adio **F**requency
RMS	**R**oot-**M**ean-**S**quare
TWT	**T**raveling **W**ave **T**ube
V/m	**V**olts **per m**eter
VCP	**V**ertical **C**oupling **P**lane

I. Executive Summary

A. Purpose of Test

An EMC evaluation to determine compliance of the Sentinel Vision, SafeScout, with the requirements of Part 15, Subpart B and C, §15.231 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 Sentinel Vision, SafeScout. Sentinel Vision should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the SafeScout 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 B and C, §15.231, in accordance with Sentinel Vision, purchase order number 080805MET-JK. All tests were conducted using measurement procedure ANSI C63.4-2003.

Reference	Description	Results
15.203	Antenna Requirements	Compliant
15.207	AC Conducted Emissions	N/A
15.231 (b)(3) / 15.209	Radiated Emissions	Compliant
15.231 (b)(2) / 15.205	Radiated Emission	Compliant
15.231 (a)(1) & (a)(2)	Required measurement for manually and automatic operated transmitter equipment. <5 Sec. after activation	Compliant
15.231 (b)(1)	Radiated Emission	Compliant
15.231 (a3)	Transmission at predetermined/regular intervals are not permitted	N/A
15.231 (c)	Devices operated within the frequency band of 70 – 900MHz: -20dBc Bandwidth maximum of 0.25% of the center frequency	Compliant
15.231 (d)	Frequency Stability	N/A

Table 1 Executive Summary of EMC Part 15 ComplianceTesting

II. Equipment Configuration

Model(s) Tested:	SafeScout
Model(s) Covered:	SafeScout
EUT Specifications:	Primary Power: 12VDC
	Secondary Power: 9VDC
	FCC ID: TOW-MU100
	Type of Modulation: OFDM
	Emission Designator: 270KF1D
	Equipment Code: DSR
	Equipment Frequency: 433.5 MHz
Analysis:	The results obtained relate only to the item(s) tested.
Environmental Test Conditions:	Temperature (15-35º C): 21.5º C
	Relative Humidity (30-60%): 48%
Evaluated by:	Shawn McMillen
Date(s):	January 6, 2006

A. Overview

The purpose of this series of tests was to verify compliance of the Sentinel Vision SafeScout with the limits of CFR 47, §15.231 for Intentional Radiators.

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 10 meter 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 SafeScout operates at 433.5 MHz with FSK modulation. It is a sophisticated monitor that includes a PIR motion detector, digital imager, microphone, memory chip and modem. When the unit detects motion, images and sound are captured. The unit dials out on your existing telephone line and sends the images and sound to the Sentinel Vision automated control center. From there, the alert and images and/or sound (as predetermined by the owner who registered the system) are sent to the owner's selected contacts.

Photograph 1. SafeScout

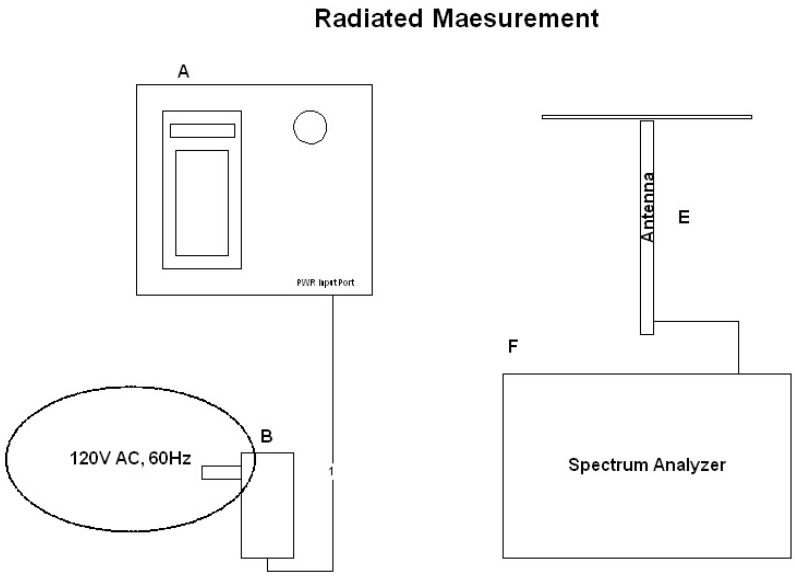


Figure 1. Block Diagram of Test Configuration (Radiated Emissions)

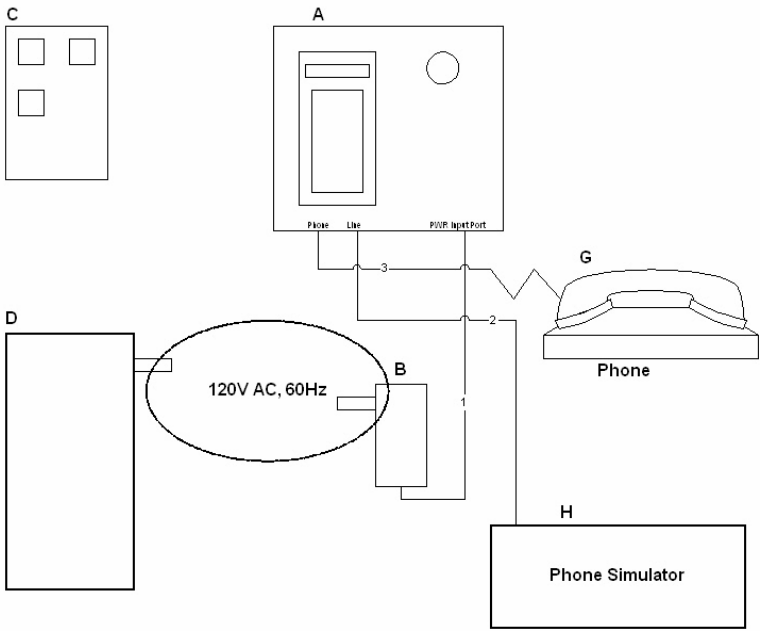


Figure 2. Block Diagram of Test Configuration (Unintentional Radiated Emissions)

E. Equipment Configuration

The EUT was set up as outlined in Figure 1 and Figure 2, 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	Part Number	Serial Number	Rev. #
A	SafeScout Monitoring Unit	N/A	N/A	N/A	N/A
B	AC-DC PWR adaptor (by CUI INC)	KSA FD1200125W1US	N/A	N/A	N/A

Table 2. Equipment Configuration (Radiated Emissions)

Ref. ID	Name / Description	Model Number	Part Number	Serial Number	Rev. #
A	SafeScout Monitoring Unit	N/A	N/A	N/A	N/A
B	AC-DC PWR adaptor (by CUI INC)	KSA FD1200125W1US	N/A	N/A	N/A
C	Key Fob	N/A	N/A	N/A	N/A
D	Wireless Siren	N/A	N/A	N/A	N/A

Table 3. Equipment Configuration (Unintentional Radiated Emissions)

F. Support Equipment

Sentinel Vision supplied support equipment necessary for the operation and testing of the SafeScout. All support equipment supplied is listed in the following Support Equipment List.

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
E	Antenna	MET	450MHz (1S2453)	N/A
F	Spectrum Analyzer	Agilent	E4407B (1S2460)	N/A

Table 4. Support Equipment (Radiated Emissions)

Ref. ID	Name / Description	Manufacturer	Model Number	*Customer Supplied Calibration Data
G	Phone	AT&T	210	N/A
H	Phone Simulator	Teltone	TLS-3	N/A

Table 5. Support Equipment (Unintentional Radiated Emissions)

* 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.

G. Ports and Cabling Information

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Yes/No)	Termination Box ID & Port ID
1	A, PWR input Port	DC PWR cable	1	3	No	B

Table 6. Ports and Cabling Information (Radiated Emissions)

Ref. ID	Port name on EUT	Cable Description or reason for no cable	Qty.	Length (m)	Shielded (Yes/No)	Termination Box ID & Port ID
1	A, PWR Input	DC PWR cord	1	2	No	B
2	A, Line	RJ11	1	3.5	No	H
3	A, Phone	RJ11	1	3.5	No	G

Table 7. Ports and Cabling Information (Unintentional Radiated Emissions)

H. Mode of Operation

The EUT was set to maximum transmit power at 100% duty cycle.

I. Method of Monitoring EUT Operation

A spectrum analyzer was used for all EUT monitoring.

J. Modifications

a) Modifications to EUT

The following is the modification for Siren Unit in order to comply with Conducted Emission AC power:

1. Resistor R23 was changed from a 22 ohms to 523 ohms.
2. Capacitor CHANDADD was added. This is an X2 class across the lines 0.47uF EMI suppression filter. Note that its electrical position within the circuit is still within fused protection.

The following modification was made to comply with Radiated Emission:

5X 0.001uf capacitors were added on AV board (between Imager circuits and mic/speaker circuits).

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 Sentinel Vision upon completion of testing.

III. Electromagnetic Compatibility Criteria for Unintentional Radiators

Electromagnetic Compatibility Criteria for Unintentional Radiators

§ 15.107 Conducted Emissions Limits

Test Requirement(s):

15.107 (a) "Except for Class A digital devices, for equipment 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 30 MHz shall not exceed the limits in Table 8. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals."

15.107 (b) "For a Class A digital device 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 30 MHz shall not exceed the limits in Table 8. Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminals. The lower limit applies at the band edges."

Frequency range (MHz)	15.107(b), Class A Limits (dBμV)		15.107(a), Class B Limits (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15- 0.5	79	66	66 - 56	56 - 46
0.5 – 5.0	73	60	56	46
5.0 - 30	73	60	60	50
Note 1 — The lower limit shall apply at the transition frequencies.				
Note 2 — The limit decreases linearly with the logarithm if the frequency in the range 0.15 MHz to 0.5 MHz.				

Table 8. Conducted Limits for Radio Frequency Devices calculated from FCC Part 15 Section 15.107(a) (b)

Test Procedures:

The EUT was placed on a 0.8m-high wooden table inside a semi-anechoic chamber. The method of testing, test conditions, and test procedures of ANSI C63.4 were used. The EUT was powered through a 50Ω/50μH LISN. An EMI receiver, connected to the measurement port of the LISN, scanned the frequency range from 150 kHz to 30 MHz in order to find the peak conducted emissions. All peak emissions within 6 dB of the limit were measured using a quasi-peak and/or average detector as appropriate.

Test Results:

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

Test Engineer(s):

Billy Kwan

Test Date(s):

12/05/2205

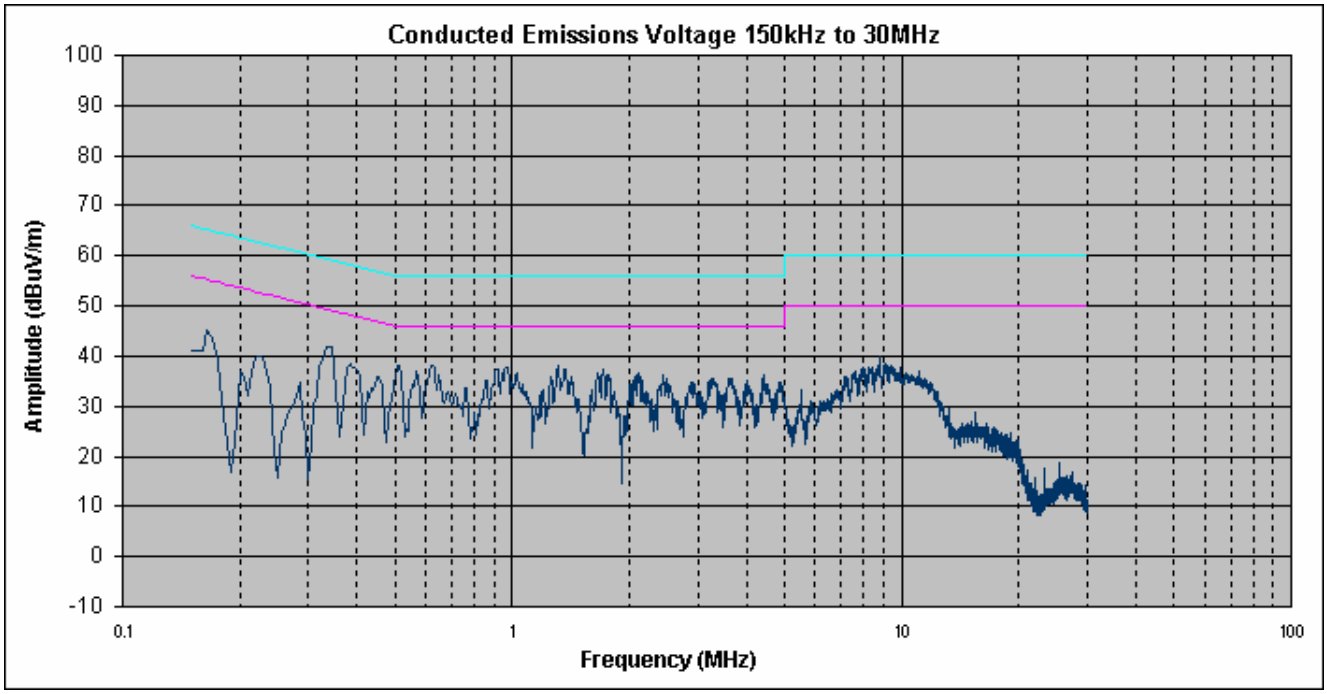
FREQ. (MHz)	Corrected Amplitude (dBµV) QP	Limit (dBµV) QP	Pass/Fail QP	Margin (dB) QP	Corrected Amplitude (dBµV) AVG	Limit (dBµV) AVG	Pass/Fail AVG	Margin (dB) AVG
0.339	41.33	59.23	PASS	-17.9	38.28	49.23	PASS	-10.95
0.621	37.68	56	PASS	-18.32	33.2	46	PASS	-12.8
0.964	37.15	56	PASS	-18.85	33.83	46	PASS	-12.17
8.82	36.03	60	PASS	-23.97	31.45	50	PASS	-18.55

Table 9. Conducted Emissions - Voltage, AC Power, Phase Line (110 VAC, 60 Hz)

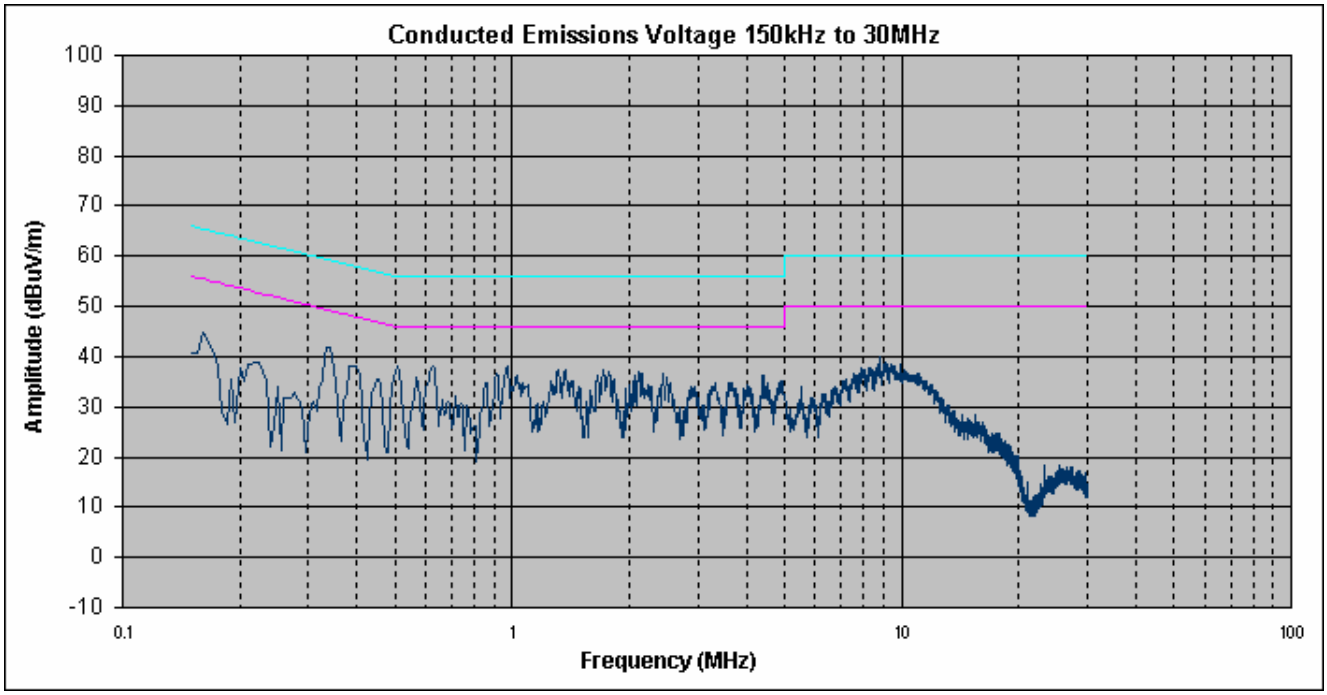
FREQ. (MHz)	Corrected Amplitude (dBµV) QP	Limit (dBµV) QP	Pass/Fail QP	Margin (dB) QP	Corrected Amplitude (dBµV) AVG	Limit (dBµV) AVG	Pass/Fail AVG	Margin (dB) AVG
0.338	40.9	59.25	PASS	-18.35	37.55	49.25	PASS	-11.7
0.621	37.5	56	PASS	-18.5	33.54	46	PASS	-12.46
0.963	36.81	56	PASS	-19.19	33.61	46	PASS	-12.39
8.82	36.41	60	PASS	-23.59	31.56	50	PASS	-18.44

Table 10. Conducted Emissions - Voltage, AC Power, Neutral Line (110 VAC, 60 Hz)

Conducted Emissions - Voltage, Worst Case Emissions, AC Power, (110 VAC, 60 Hz)

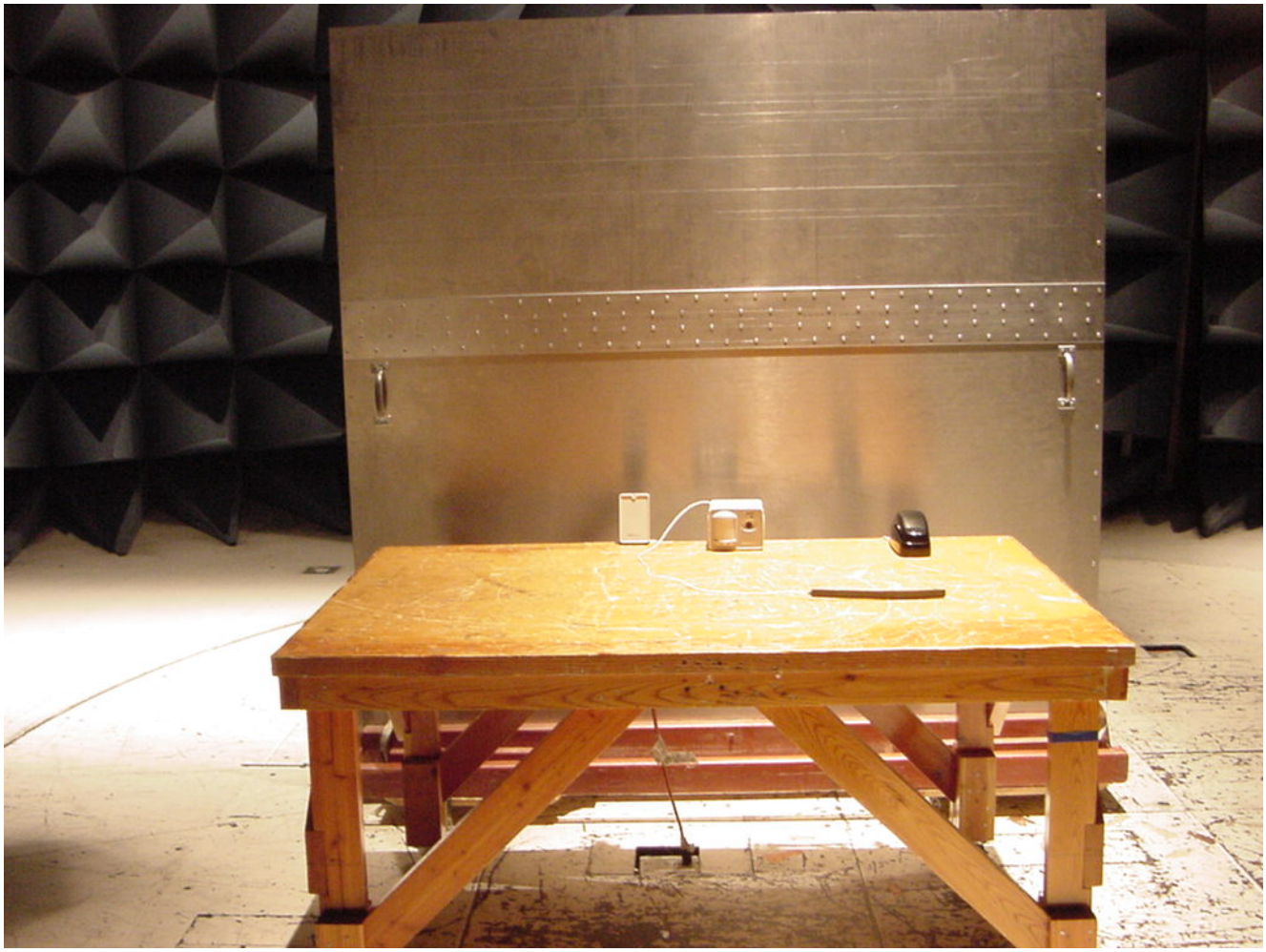


Conducted Emission, Phase Line Plots



Conducted Emission, Neutral Line Plots

Conducted Emission Limits Test Setup



Photograph 2. Conducted Emissions Test Setup

Electromagnetic Compatibility Criteria for Unintentional Radiators

§ 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 11.

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 11.

Frequency (MHz)	Field Strength (dBµV/m)	
	§15.109 (b), Class A Limit (dBµV) @ 10m	§15.109 (a),Class B Limit (dBµV) @ 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 11. 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 3 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 B requirement(s) of this section. Measured emissions were below applicable limits.

Test Engineer(s): Billy Kwan

Test Date(s): 12/05/2005

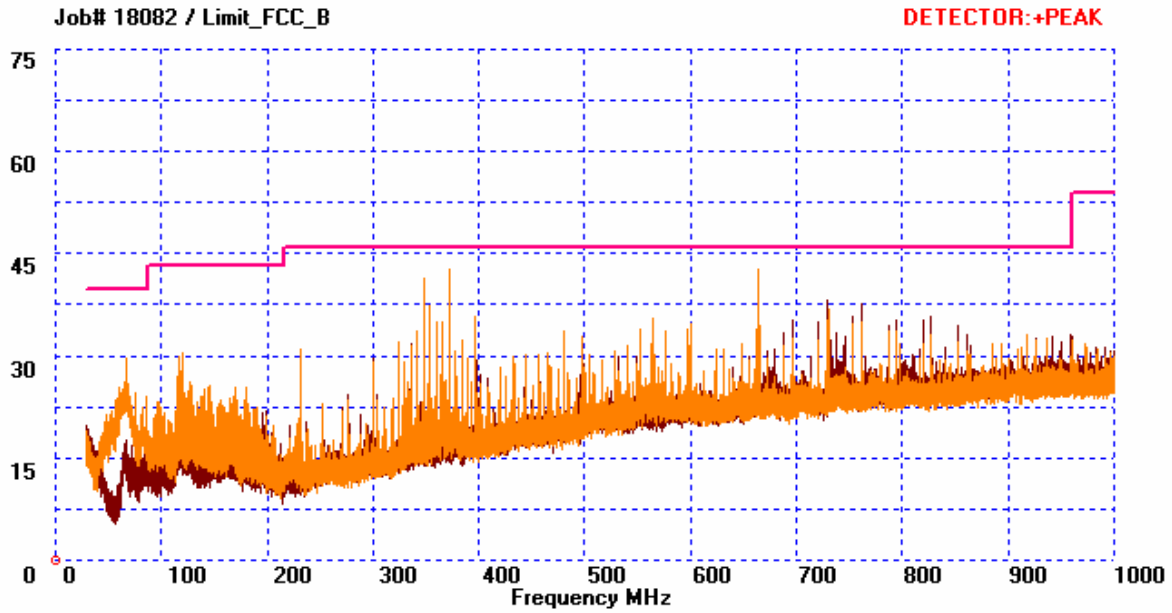
Electromagnetic Compatibility Criteria for Unintentional Radiators

Radiated Emissions Limits Test Results, Class B

Frequency (MHz)	Antenna Polarity (H/V)	EUT Azimuth (Degrees)	Antenna Height (m)	Uncorrected Amplitude (dBµV)	Antenna Correction Factor (dB/m) (+)	Pre Amp Gain (dB) (-)	Cable Loss (dB) (+)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)
66.4	V	234	1.54	21.70	6.94	0.00	1.34	29.98	40.00	-10.02
***348**	**V**	**147**	**1.24**	**25.14**	**14.97**	**0.00**	**3.19**	**43.30**	**46.00**	**-2.70**
***372**	**V**	**163**	**1.27**	**25.05**	**15.59**	**0.00**	**3.33**	**43.97**	**46.00**	**-2.03**
***664.08**	**V**	**0**	**1**	**18.35**	**19.80**	**0.00**	**4.85**	**43.00**	**46.00**	**-3.00**
***729.04**	**H**	**213**	**1**	**17.82**	**20.30**	**0.00**	**5.09**	**43.21**	**46.00**	**-2.79**
761.84	H	266	1	15.42	20.70	0.00	5.25	41.37	46.00	-4.63

Table 12. Radiated Emissions Limits Test Results

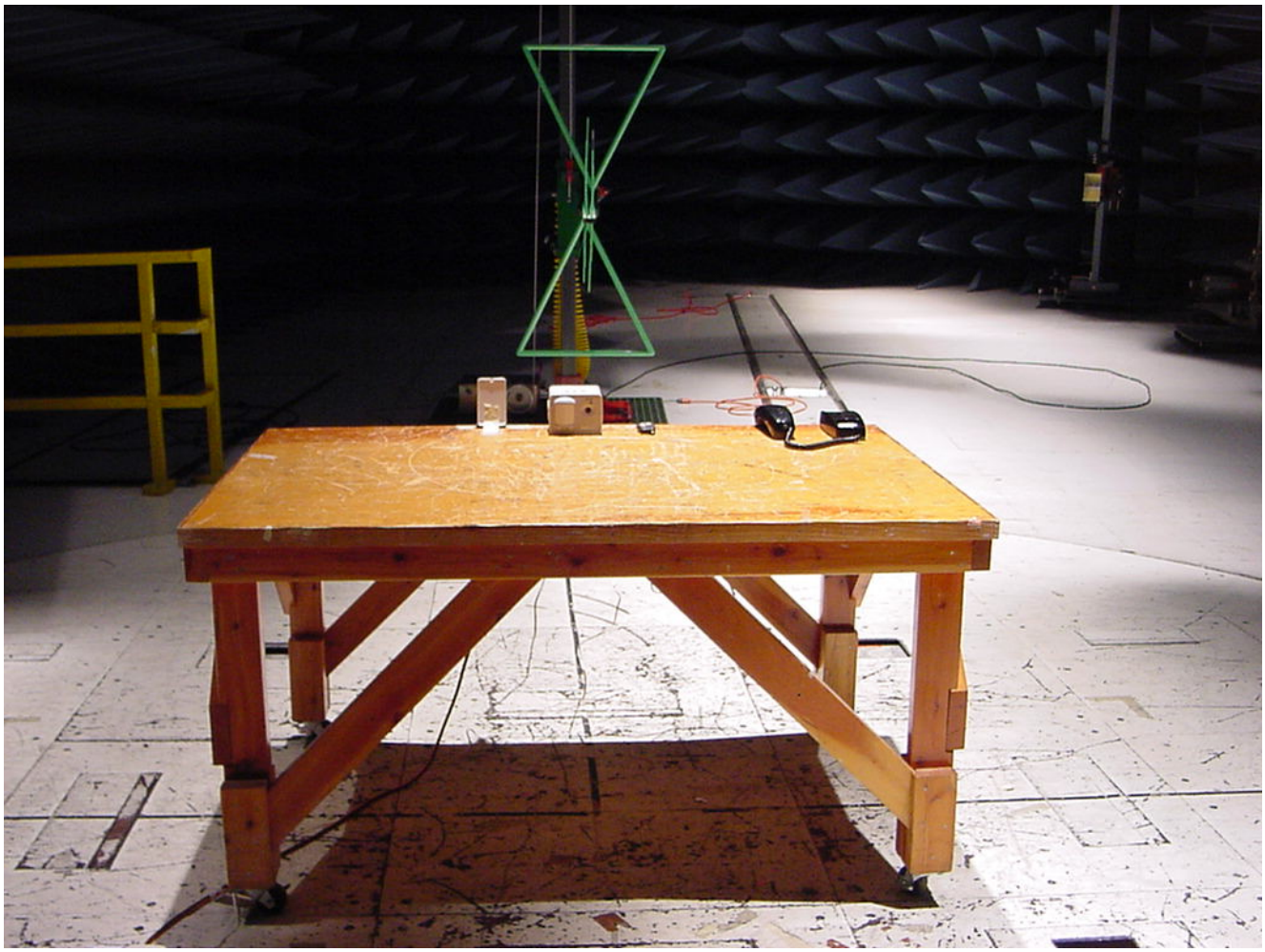
Note: * - At this frequency, the measured electric-field strength exhibits a margin of compliance that is less than 3 dB below the specification limit. We recommend that every emission measured, have at least a 3 dB margin to allow for deviations in the emission characteristics that may occur during the production process.



Frequency	Azimuth	Antenna Polarity	Height	Raw Amp. @ 3m	P.Amp	Ant.Cor. Factor	Cable Loss	EUT Field Strength Final Amp.	Limit per FCC pt 15@ 3m	Delta
(GHz)	(Degrees)	(H/V)	(m)	(Avg)	(dB)	(dB/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
1.0625	135	**V**	1	38.5	35.17	24.17	2.18	29.68	54	-24.32

Electromagnetic Compatibility Criteria for Unintentional Radiators

Radiated Emission Limits Test Setup



Photograph 3. Unintentional Radiated Emission Test Setup

IV. Electromagnetic Compatibility Criteria for Intentional Radiators

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231 (a) Radiated Emissions Limits

Test Requirement(s): **§ 15.231 (a):** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in Table 13.

Frequency (MHz)	§ 15.231 (a),Radiated Emission Limits (dBµV) @ 3m
30 - 88	40.00
88 - 216	43.50
216 - 960	46.00
Above 960	54.00

Table 13. Radiated Emissions Limits Calculated from FCC Part 15, § 15.231 (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)

Test Engineer(s): 12/05/2005

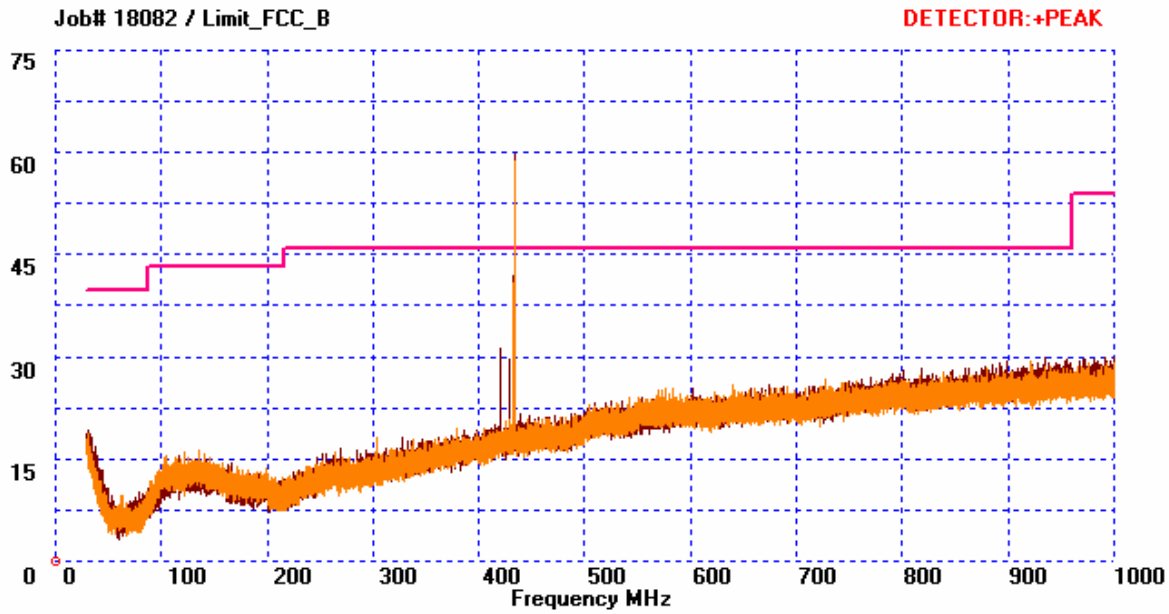
Test Date(s): Billy Kwan

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209 (a) Radiated Emissions Limits

Frequency (MHz)	Antenna Polarity (H/V)	Detector	Uncorrected Amplitude (dBµV)	Antenna Correction Factor (dB/m) (+)	Pre Amp Gain (dB) (-)	Cable Loss (dB) (+)	Corrected Amplitude (dBµV/m)	FCC 15.231 Limit (dBµV/m)	Margin (dB)
433.56	H	Peak	70.60	17.36	0.00	3.67	91.62	100.80	-9.18
433.56	H	Avg	53.80	17.20	0.00	3.67	74.67	80.80	-6.13
433.56	V	Peak	75.90	17.36	0.00	3.67	96.92	100.80	-3.88
433.56	V	Avg	56.23	17.20	0.00	3.67	77.10	80.80	-3.70

Table 14. Radiated Emissions Limits Test Results



Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209 Radiated Emissions Limits

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 15. Restricted Bands of Operation

[1] Until February 1, 1999, this restricted band shall be 0.490 – 0.510 MHz.
[2] Above 38.6

Test Results: The EUT was found compliant with the Radiated Emission limits of **§15.231(a)** for Intentional Radiators. See following pages for detailed test results.

Test Engineer(s): Shawn McMillen

Test Date(s): 09/20/2005

Electromagnetic Compatibility Criteria for Intentional Radiators

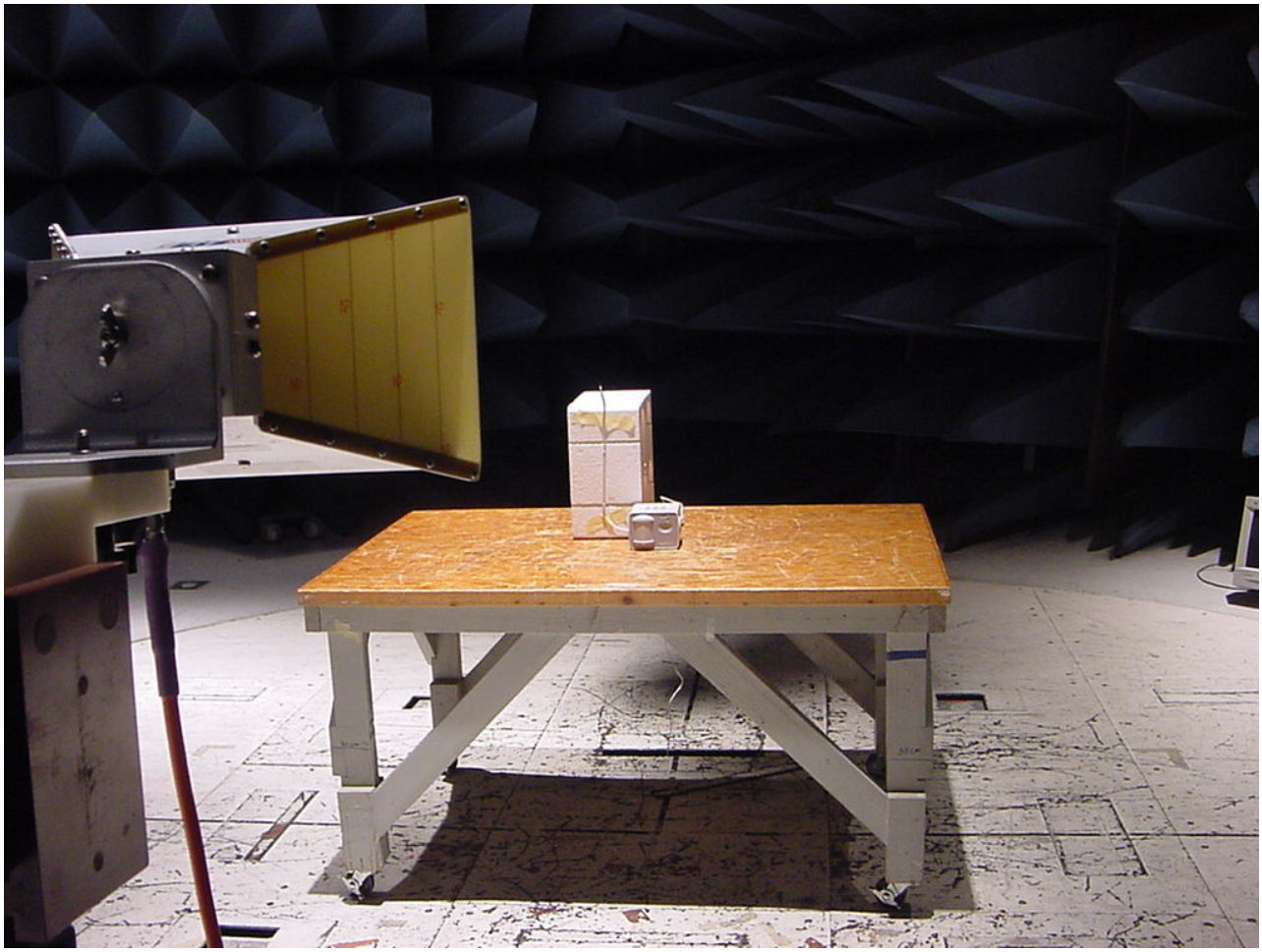
§ 15.231(a) Harmonic Emissions Requirements –

Harmonic	Freq	Peak Value dBµV	Average Value dBµV	AF CL dB	Peak Value Corrected	Average Value Corrected	Peak Limit dBµV	Average Limit dBµV	Peak Margin	Average Margin
2nd	867.0	15.4	N/A	25.9	41.3	N/A	80.8	N/A	39.5	N/A
3rd	1300.5	33.7	24.5	27.0	60.7	51.5	74.0	54.0	13.3	2.5
4th	1734.0	33.8	24.6	28.2	62.0	52.8	74.0	54.0	12.0	1.2
5th	2167.5	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6th	2601.0	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A
7th	3034.5	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8th	3468.0	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A
9th	3901.5	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A
10th	4335.0	SNF	SNF	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*** Note: SNF - Readings are at the noise floor of the spectrum analyzer**

Electromagnetic Compatibility Criteria for Intentional Radiators

Photograph 4: Radiated Emission Test Setup < 1 GHz



Photograph 5: Radiated Emissions Test Setup > I GHz

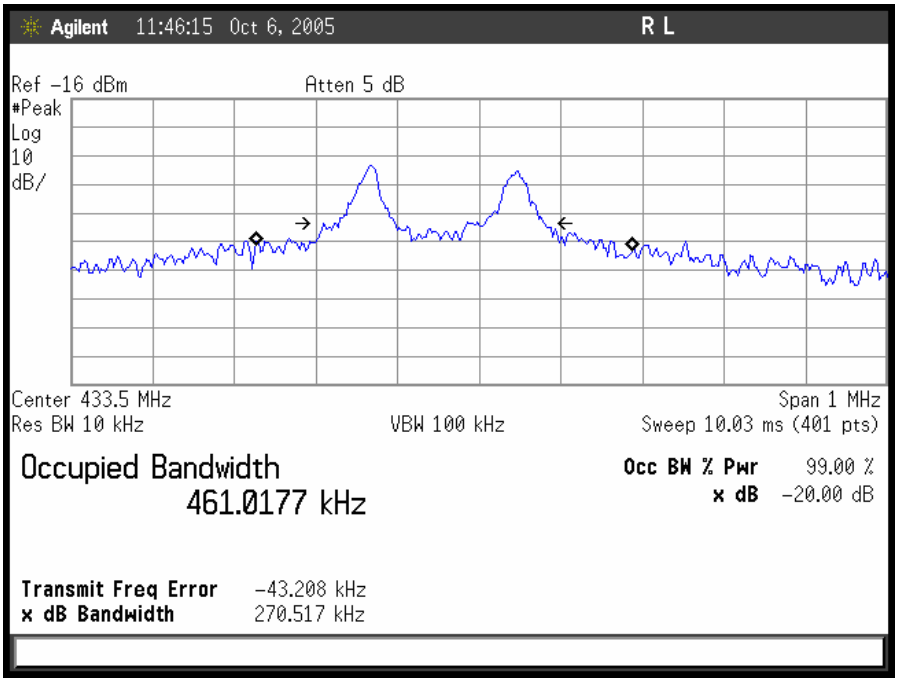
Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231(c) 20dB Bandwidth

Test Requirements: **§15.231(c):** The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20dB down from the modulated carrier. Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

Test Results: Equipment complies with § 15.231 (c).

Carrier Frequency (MHz)	Measured 20 dB Bandwidth (kHz)
433.5	270.517



Test Engineer: Shawn McMillen

Test Date: 09/20/2005

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.231(a1) Calculation of Duty Cycle

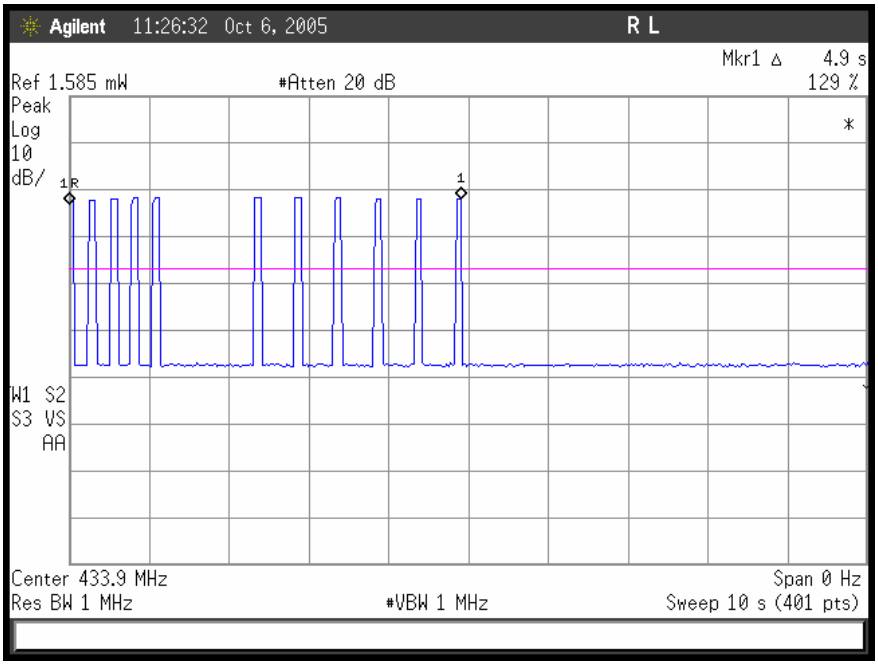
Test Requirements: §15.231(a1). A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

Test Results: The transmitter will cease transmission immediately after being released but will transmitter no greater than 4.9 seconds if keyed continually.

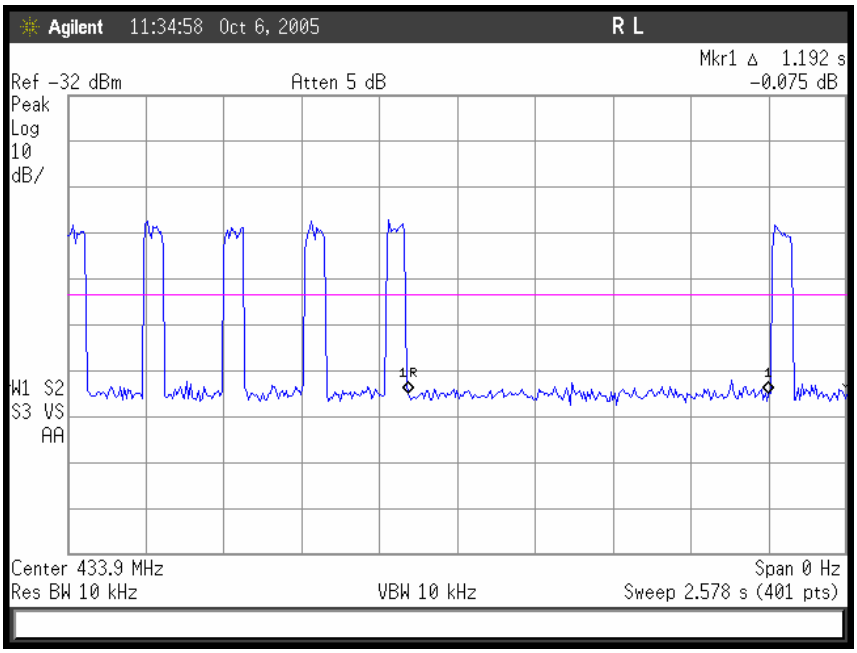
Maximum Transmission time = 4.9s
Pulse width = 65.43ms
Maximum Number of Pulses = 10
Total On time = 0.654s
Duty Cycle = 0.654/4.9 = 13%

Test Engineer: Shawn McMillen

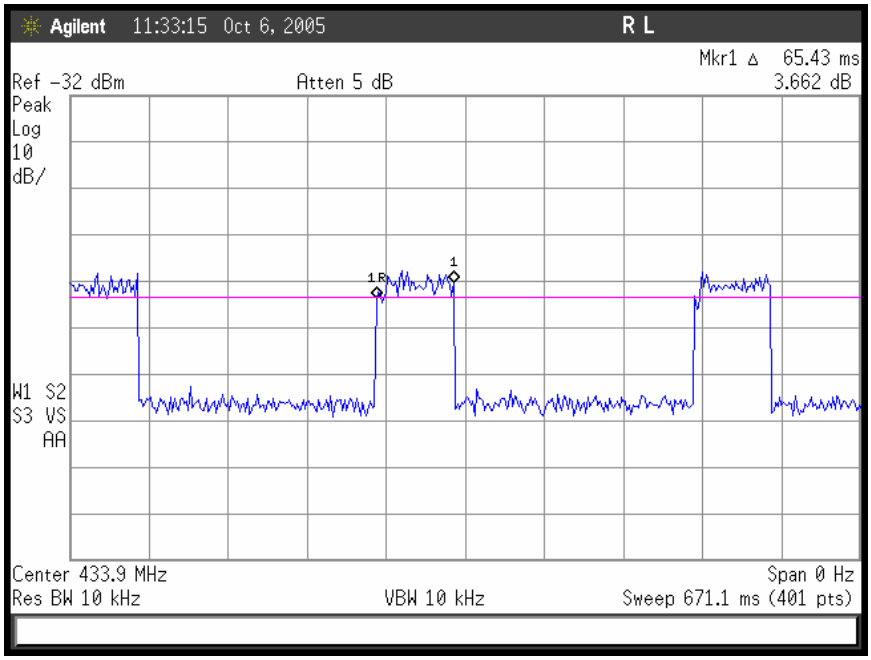
Test Date: 09/20/2005



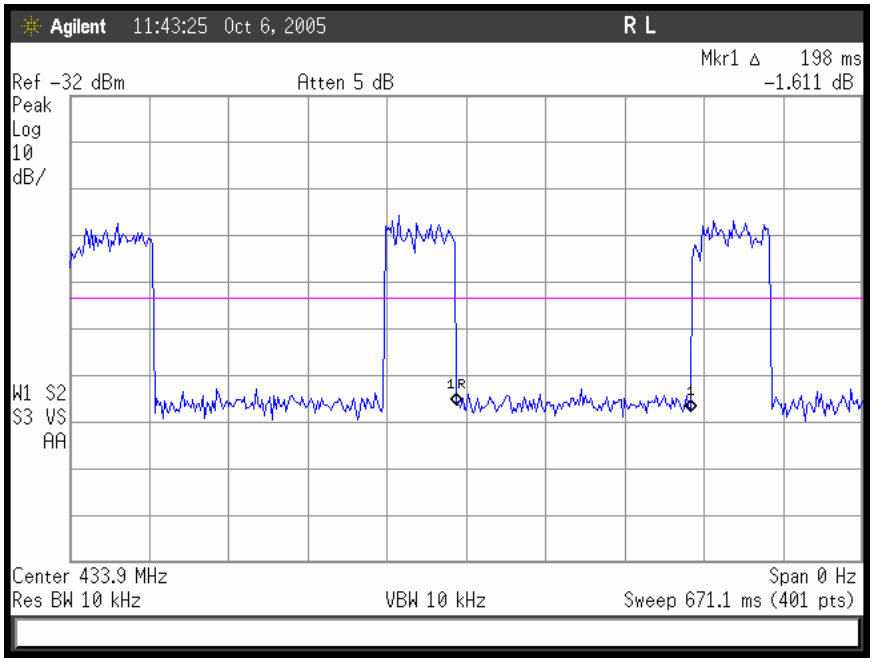
Total Duration of Pulses



Off Time between both pulse packets



On time for each pulse



Off Time between successive pulses

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	2/9/2005	2/9/2006
1S2184	BILOG ANTENNA	CHASE	CBL6112A	1/12/2005	1/12/2006
1S2121	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	10/14/2005	10/14/2006
1S2198	ANTENNA, HORN	EMCO	3115	7/14/2005	7/14/2006
1S2202	ANTENNA, HORN, 1 METER	EMCO	3116	3/23/2005	3/23/2007
N/A	HIGH PASS FILTER	MICRO-TRONICS	HPM13146	SEE NOTE	
1S2263	CHAMBER, 10 METER	RANTEC	N2-14	7/25/2005	7/25/2006
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2005	1/12/2006
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2005	1/12/2006
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	07/06/2005	07/06/2008
1S2430	WIDEBAND POWER METER	ANRITSU COMPANY	ML2488A	1/12/2005	1/12/2006
1S2432	WIDEBAND POWER SENSOR	ANRITSU COMPANY	MA2491A	1/12/2005	1/12/2006
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	N/A	3/10/2006
1S2129	Harmonic Mixer	Hewlett Packard	11970K	N/A	3/10/2006

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

1. §15.231(a). The provisions of this Section are restricted to periodic operation within the band 40.66-40.70MHz and above 70MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmission, such as voice or video, and data transmission are not permitted. The prohibition against data transmission does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

   Results:
   The EUT is similar to a remote switch and meets the requirements of this section.

2. §15.231(a1). A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

   Results
   The transmitter will cease transmission immediately after being released but will transmitter no greater than 5 seconds if keyed continually.

3. §15.231(a2). A transmitter activated automatically shall cease transmission within 5 seconds after action.

   Results: The EUT does not have automatic transmission.

4. §15.231(a3). Periodic transmission at regular predetermined intervals are not permitted. However, polling or supervision transmission to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of the transmission does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

   Results: The EUT does not employ periodic transmission.

5. §15.231(a4). Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate the pendency of the alarm condition.

   Results: This section does not apply to the EUT

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.

VI. Exhibits

Exhibit A, Hopping Capability Requirements

Exhibit B, Non-Coordination Requirements

End of Report

