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ENGINEERING TEST REPORT # 306216

Compliance Testing of:
Wireless Foot Pedal
Model 1866055

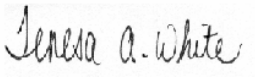
Test Date(s):
April 12TH and 13TH, 2006

Prepared For:
Johnson Outdoors, Incorporated

In accordance with:
Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.231(b)
Operating in the
Frequency Band 260 MHz - 470 MHz

This Test Report is issued under the Authority of:
Brian E. Petted, VP of Engineering

Signature:  Date: July 17, 2006

Test Report Prepared by:	**Tested by:**
Teresa A. White, Document Coordinator	Abtin Spantman, RF / EMC Engineer
Signature: 	Signature: 
Date: July 17, 2006	Date: July 17, 2006

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LSR Revision Control

Date	Revision #	Revised By
7-17-06	1.0	TAW

EXHIBIT 1. INTRODUCTION

1.1 SCOPE

References:	FCC Part 15, Subpart C, Section 15.231(b)
Title:	Telecommunication – Code of Federal Regulations, CFR 47, Part 15
Purpose of Test:	To gain FCC Certification Authorization for Transmitters operating in the Frequency Band of 260 MHz – 470 MHz
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	• Commercial, Industrial or Business • Residential

1.2 NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-15	2005	Code of Federal Regulations - Telecommunications
RSS-Gen RSS-210, Issue 6	2005	Requirements for License-exempt Radio Communication Devices
ANSI C63.4	2004	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
CISPR 22 CISPR 22 +A1 EN 55022	2003, 04-10 2004, 10-14 2003	Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: www.lsr.com. Accreditation status can be verified at A2LA's web site: www.a2la2.net.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 TEST EQUIPMENT UTILIZED

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	**Johnson Outdoors, Incorporated**
Address:	**1531 East Madison Avenue Mankato, MN 56002-8129**
Contact Person:	**Mr. Dan Baston (507) 345-0323**

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	Wireless Foot Pedal
Model Number:	1866055
Serial Number:	Engineering Sample

2.3 ASSOCIATED ANTENNA DESCRIPTION

The antenna in this product is an internal wire whip 14cm in length, formed and fixed in position within the product. This product does not have contingencies for connections to any other antennas.

2.4 EUT'S TECHNICAL SPECIFICATIONS

Additional Information:

Frequency Range (in MHz)	433.92 MHz
RF Power in Watts	0.00022 Watts
Field Strength (and at what distance)	88.7 dBµV/m at 3m (433.9 MHz)
Occupied Bandwidth (99% BW)	200 kHz
Type of Modulation	FSK
Emission Designator	200K F1D
Transmitter Spurious (worst case)	60.7 dBµV/m at 3m (2604 MHz)
Frequency Tolerance %, Hz, ppm	100 ppm
Microprocessor Model # (if applicable)	Microchip PIC16LC505
EUT will be operated under FCC Rule Part(s)	15.231 (a)
Modular Filing	☐ Yes ☒ No

RF Technical Information:

Type of Evaluation (check one)		SAR Evaluation: Device Used in the Vicinity of the Human Head
		SAR Evaluation: Body-worn Device
	x	RF Evaluation

If RF Evaluation checked above, test engineer to complete the following:

- Evaluated against exposure limits: ☒ General Public Use ☐ Controlled Use
- Duty Cycle used in evaluation: ___100____ %
- Standard used for evaluation: __OET Bulleting 65, and RSS-210_
- Measurement Distance: _____3_ m
- RF Value: _____0.027_____ ☒ V/m ☐ A/m ☐ W/m^2
  ☒ Measured ☐ Computed ☐ Calculated

2.5 PRODUCT DESCRIPTION

The Johnson Outdoors' Wireless Foot Pedal transmitter is an FM wireless transmitter designed to control trolling motors on boats. The system allows the fisherman to control the direction and speed of the trolling motor by remote, via foot control. The system is composed of a transmitter, and a receiver assembly. The transmitter, as tested here, and covered in this report, is designed for operation by the fisherman's foot, and would almost always be placed flat on the floor of the boat.

The system utilizes a standard telecommand scheme, by translating the information from a touch-pad key-matrix into a packet of binary encoded data. The encoded data is then sent to an FM transmitter IC, with a crystal controlled reference oscillator, for frequency-shift-keeing (FSK) mode of transmission.

The data packets are approximately 40ms in length, and composed of 45 data bits. The 45 bits are further broken down into 16 'preamble' bits, 13 'sync' bits, and 16 'data' bits. The bits are Manchester-encoded, with an encoded period of 848μs. The bits are transmitted using an encoded data rate of 1.2 kbits/sec (chip rate) using frequency modulation techniques at a peak deviation of 35 kHz.

The transmitter has an internal wire-whip antenna, and operates on 3.0 VDC as provided by two standard 'AA' batteries.

All buttons send one packet in any 100 ms window, and cease transmission immediately upon release, except for the steer left/right buttons. The steer left/right buttons send two additional packets after the buttons are released. In all cases, the transmissions cease well before the 5 second allotted window.

The Johnson Outdoors Wireless Footpedal

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Condition	Normal Conditions (actual)
Temperature:	20 – 25 °C (23°C)
Relative Humidity:	30 – 60% (40%)
Atmospheric Pressure:	86 kPa – 106 kPa (98.4kPa)

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Paragraph	Test Requirements	Compliance (yes/no)
15.207	Power Line Conducted Emissions Measurements	N/A
15.231(a)	Periodic operation of low-power transmitters	Yes
15.231(b), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
15.231(c)	Occupied Operational Bandwidth	Yes
15.231(d)	Stability with temperature and voltage variations	Yes
1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers. The Receiver Test Report is available upon request.		

3.3 MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

☒ None ☒ Yes (explain below)

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

☒ None ☐ Yes (explain below)

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.231, and Industry Canada RSS-210 (Annex 1.1).

If some emissions are seen to be within 3 dB of their respective limits:
As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 Test Setup

The EUT was placed on an 80cm high, non-conductive pedestal, which was centered on a flush-mounted 2m diameter metal turntable. The EUT was configured to run in a continuous CW transmit mode during the 15.231(a) and 15.231(b) measurements. A Peak Detector was used on the receiver for the reported measurements. The EUT was then returned to normal operation for measurements of the data packet length and occupied bandwidth.

5.2 Test Setup Photo(s)

Close up view of the EUT in Horizontal orientaiton

View of the EUT as positioned on the test pedestal

5.3 Test Procedure

The fundamental and spurious (harmonic) emissions of the transmitter were tested for compliance to FCC Title 47 CFR Part 15.231(b) limits for manually operated periodic devices.

The EUT was tested from the lowest frequency generated by the transmitter (without going below 9 kHz) to the 10th harmonic of the fundamental frequency generated by the device. The appropriate limits were also observed when the fundamental or spurious signals were located within any of the restricted bands as described in FCC Part 15.205(a).

When a measurement is made using the Peak Detector, a duty cycle correction factor may be applied for conversion to an average reading. This operation can be used when measuring short-duration bursts of data transmission, under FCC Part 15.231. Please refer to later sections in this report for a formal justification of the requested relaxation factor.

The resultant average measurement can then be compared to the appropriate limit in order to determine compliance with the limits. The HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz).

The device was investigated in horizontal orientation only, as that would be the only defined orientation for normal operation.

The battery was checked and replaced as necessary during the course of the investigations.

5.4 Test Equipment Utilized

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. In addition, the Connecting Cables were measured for losses using a calibrated Signal Generator and a HP 8546A EMI Receiver. The resulting correction factors and the cable loss factors from these calibrations were entered into the HP 8546A EMI Receiver database. As a result, the data taken from the HP 8546A EMI Receiver accounts for the antenna correction factor as well as cable loss or other corrections, and can therefore be entered into the database as a corrected measurement. The HP 8546A EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz.

Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.231(b) for a momentary operated low power transmitter [Canada RSS-210 (2006), Annex 1]. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

5.5 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	HP	8546A	3617A00320
EMI Receiver Pre-Select.	HP	85460A	3448A00296
Spectrum Analyzer	Agilent	E4446A	US45300564
Log Periodic Antenna	EMCO	93146	9701-4855
Horn Antenna	EMCO	3115	6907
Bicon Antenna	EMCO	93110B	9702-2918
Pre-Amp	Adv. Microwave	WLA612	1145A04094
Horn Antenna – Std. Gain	EMCO	3160-09	9809-1120

5.6 CALCULATION OF RADIATED EMISSIONS LIMITS

FIELD STRENGTH OF FUNDAMENTAL FREQUENCIES:
The calculation involves a linear interpolation of 3750 to 12500 µV/m over 260-470 MHz, where field strength of the fundamental frequency (f_0) when 260 ≤ f_0 ≤ 470 MHz, can be found by: 41.6667*(f_0)-7083.3333, where f_0 is in MHz.

FIELD STRENGTH OF SPURIOUS/HARMONIC FREQUENCIES:
The spurious and harmonic emissions are subject to the limits expressed in FCC Parts 15.205 and 15.209, if within the restricted bands and dictated by the following calculation elsewhere.

The calculation involves a linear interpolation of 375 to 1250 µV/m over 260 to 470 MHz, where field strength of the harmonic frequencies (2 f_0, 3 f_0…) when 260 ≤ f_0 ≤ 470 MHz, can be found by: 4.1667*(f_0)-708.3333, where f_0 is in MHz.

At fundamental frequency f_0 = 433.92 MHz
Fundamental Limit: 41.6667*(f_0)-7083.3333 = µV/m @ 3m
Harmonic Limit: 4.1667*(f_0)-708.3333 = µV/m @ 3m
Above 470 MHz, the limit on the spurious and harmonic emissions is 1,250 µV/m @ 3m.

Frequency (MHz)	*Fundamental Limit (µV/m @ 3m)*	*Fundamental Limit (dBµV/m @ 3m)*	*Harmonic Limit (µV/m @3m)*	*Harmonic Limit (dBµV/m @ 3m)*
433.92	***10,996.7***	***80.8***	***1099.7***	***60.8***

Spurious RF emissions limits as described in 47CFR 15.209 and 15.205

Frequency (MHz)	3 m Limit µV/m	3 m Limit (dBµV/m)	1 m Limit (dBµV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-24,000	500	54.0	63.5

Sample conversion from field strength µV/m to dBµV/m:
dBµV/m = 20 $\log_{10}$ (100)
= 40 dBµV/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

960 MHz to 10,000 MHz
500µV/m or 54.0 dB/µV/m at 3 meters
54.0 + 9.5 = 63.5 dB/µV/m at 1 meter

5.7 RADIATED EMISSIONS DATA CHART

3 Meter Measurements of Electromagnetic Radiated Emissions
Test Standard: 47CFR, Part 15.231(b)
Frequency Range Inspected: 30 MHz to 5000 MHz

Manufacturer:	Johnson Outdoors, Incorporated					
Date(s) of Test:	April 12TH and 13TH, 2006					
Test Engineer(s):	Abtin Spantman					
Voltage:	3.0 VDC					
Operation Mode:	Continuous transmit C.W. mode					
Environmental Conditions in the Lab:	Temperature: 20 – 25° C Relative Humidity: 30 – 60 %					
EUT Power:		Single Phase ___VAC		3 Phase ___VAC		
	√	Battery		Other:		
EUT Placement:	√	80cm non-conductive table		10cm Spacers		
EUT Test Location:	√	3 Meter Semi-Anechoic FCC Listed Chamber		3/10m OATS		
Measurements:		Pre-Compliance		Preliminary	√	Final
Detectors Used:	√	Peak		Quasi-Peak		Average

The table depicts the level of significant radiated emissions found:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBμV/m)	EFI Corrected For Averaging (dBμV/m)	15.231(b) Limit (dBμV/m)	Margin (dB)
433.9	H / H	1.00	330	88.7	80.7	80.8	0.1
867.8	H / H	1.00	95	40.8	32.8	60.8	28.0
1302	H / H	1.15	0	44.5	36.5	54.0	17.5
1736	V / H	1.10	275	49.1	41.1	60.8	19.7
2170	H / H	1.00	330	60.3	52.3	60.8	8.5
2604	H / H	1.05	160	60.7	52.7	60.8	8.1
3037	V / H	1.20	285	52.5	44.5	60.8	16.3
3471	V / H	1.30	0	49.2	41.2	60.8	19.6
3905	V / H	1.10	15	53.0	45.0	54.0	9.0
4339	V / H	1.00	280	56.7	48.7	54.0	5.3

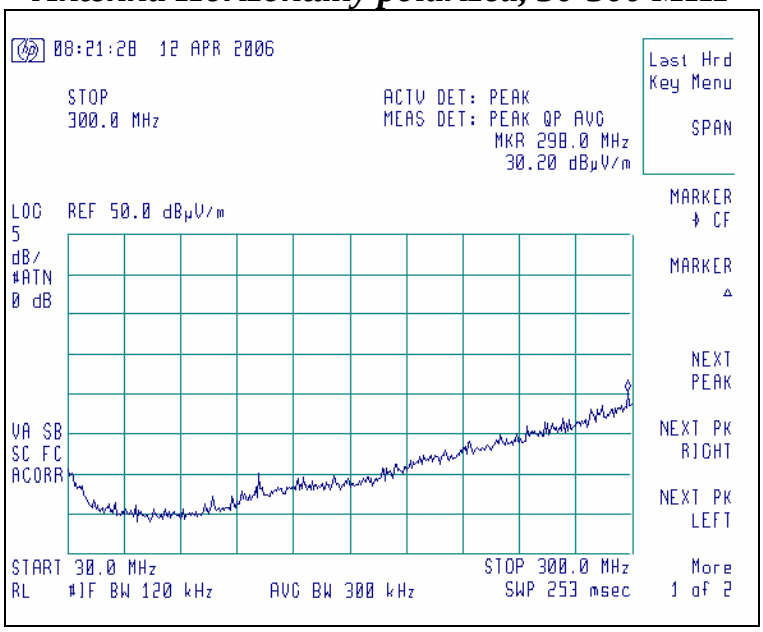
Notes:

1) Measurement of the fundamental and all harmonics were made with the EUT in CW mode.
2) A Peak Detector was used in measurements of the fundamental and harmonics below 5 GHz.
3) A relaxation of the Peak EFI measurements by 8.0 dB is requested based on the average duty factor of the transmitter on-air-time. Justification for this request appears in the appendix section of this report, and is supported by measurements as documented in the body of this report.
4) Measurement at receiver system noise floor.

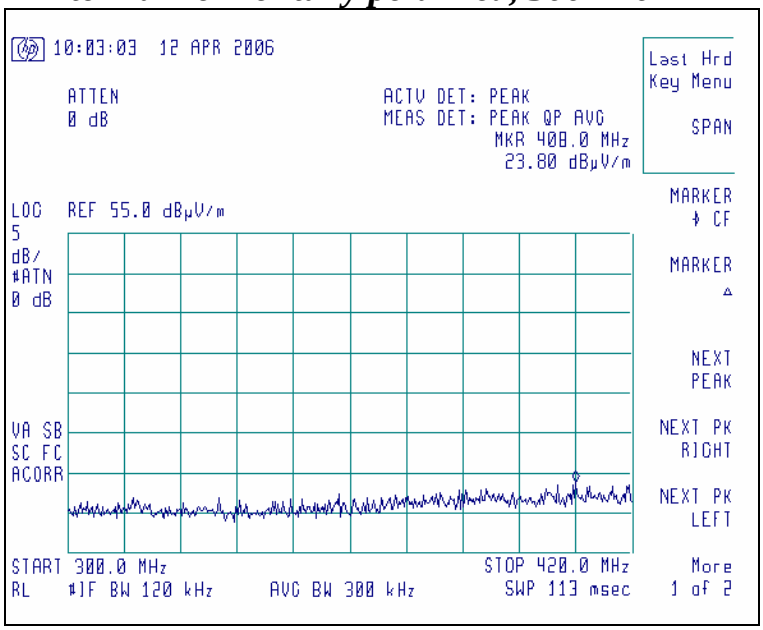
5.8 Screen Captures - Radiated Emissions Testing

The signature scans shown here are from worst-case emissions, as measured with the sense antennas both in vertical and horizontal polarity for worst case presentations.

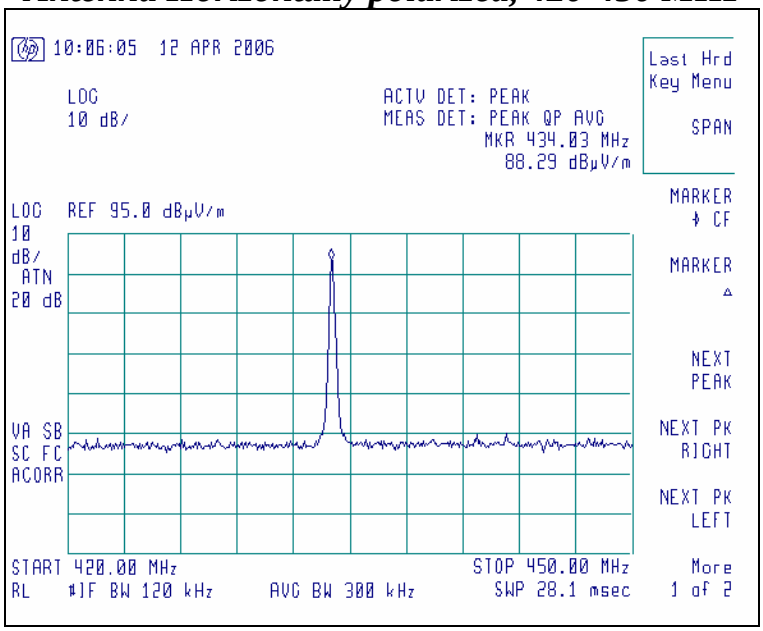
Antenna Horizontally polarized, 30-300 MHz



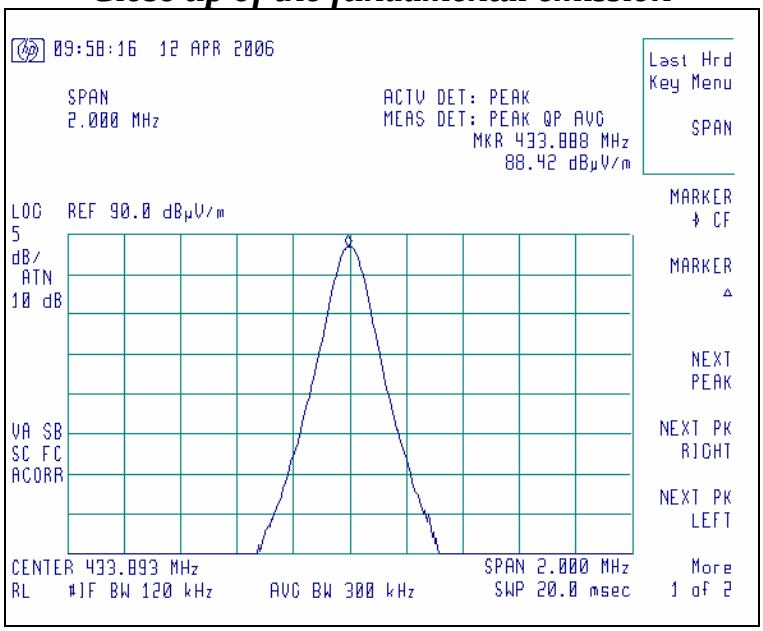
Antenna Horizontally polarized, 300-420 MHz



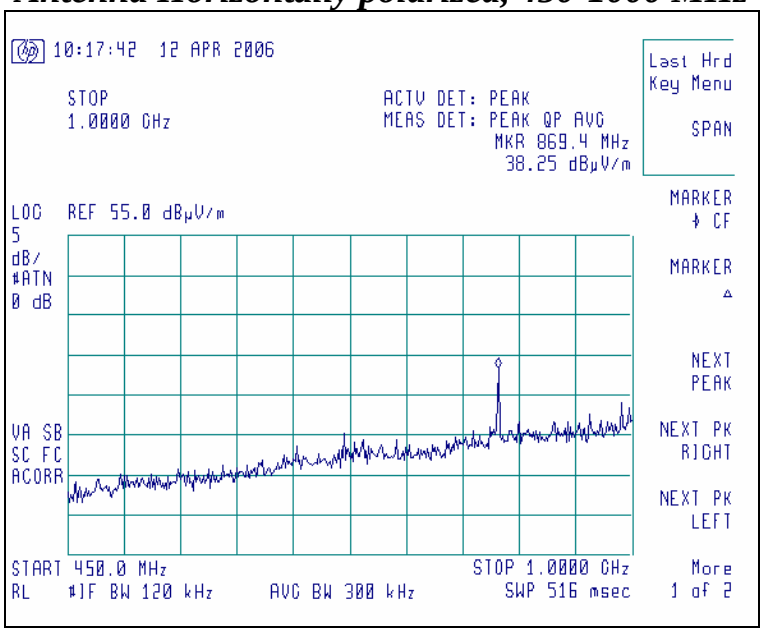
Antenna Horizontally polarized, 420-450 MHz



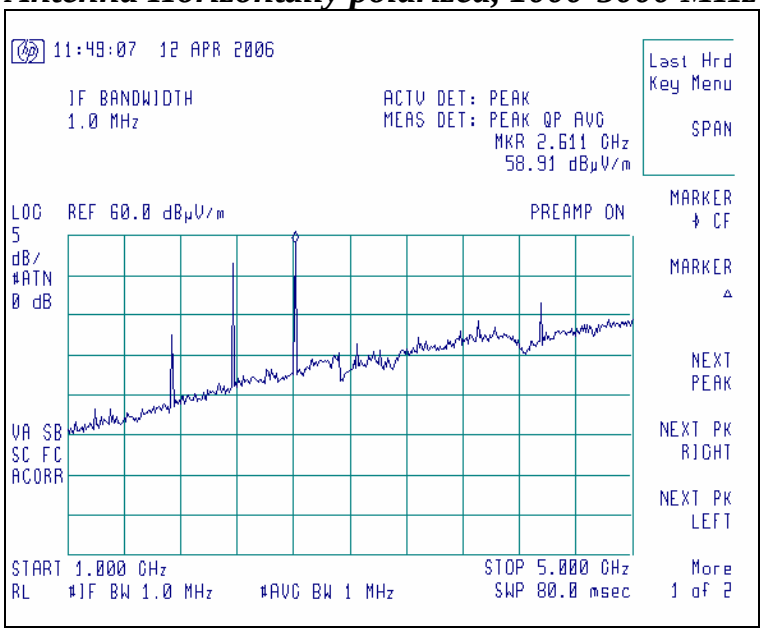
Antenna Horizontally polarized, 433.9 MHz
Close up of the fundamental emission



Antenna Horizontally polarized, 450-1000 MHz

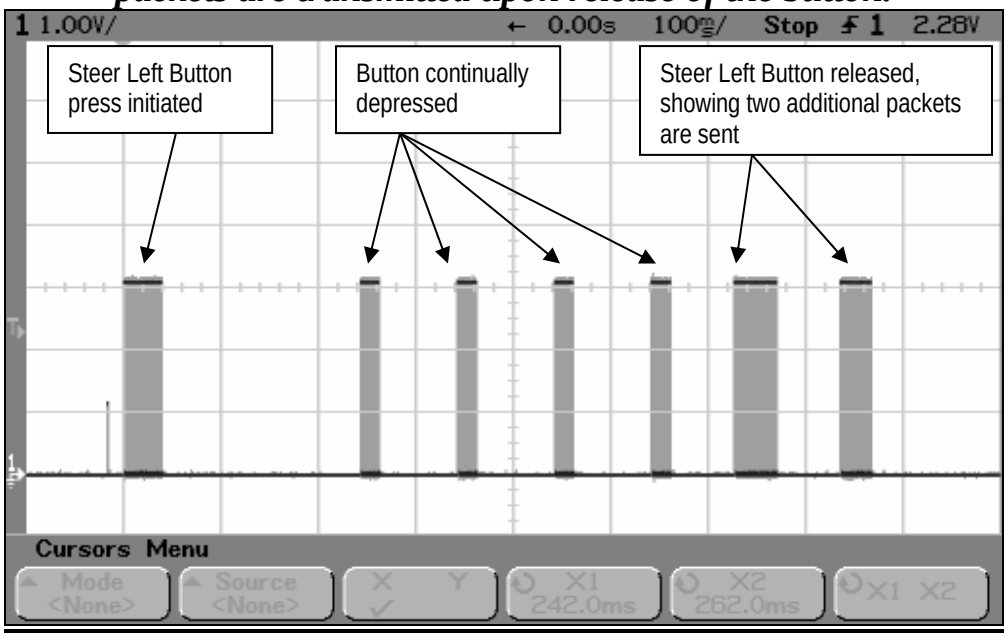


Antenna Horizontally polarized, 1000-5000 MHz

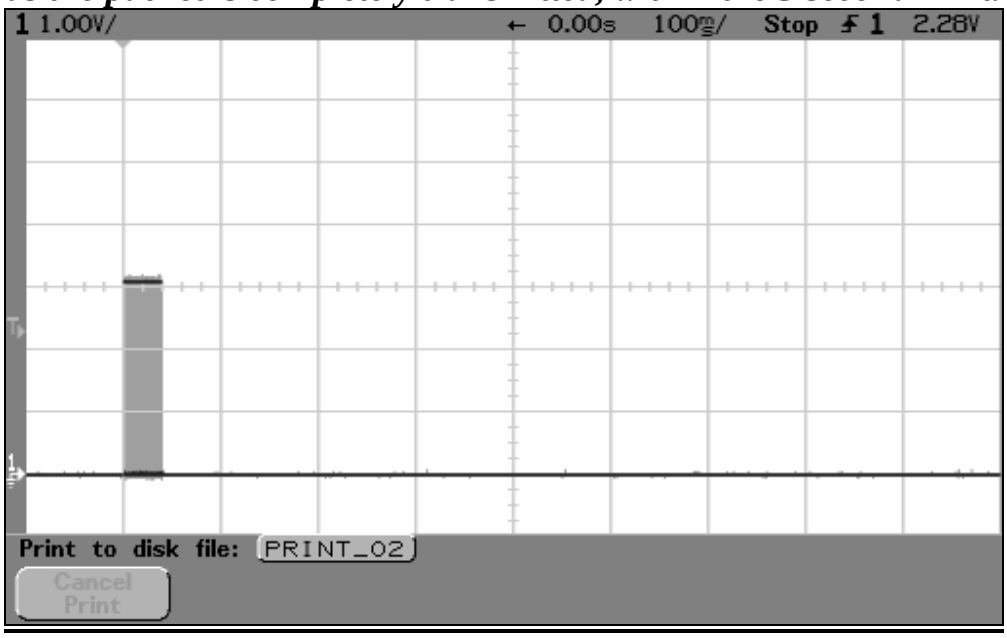


5.8 Data Packet Detail – Radiated Emissions, 100ms Window\

Detail showing different packet lengths, and that packets are transmitted far enough apart in time that there are no overlaps in any 100ms window. This detail is from the "Steer Left" button, which also shows that two additional packets are transmitted upon release of the button.

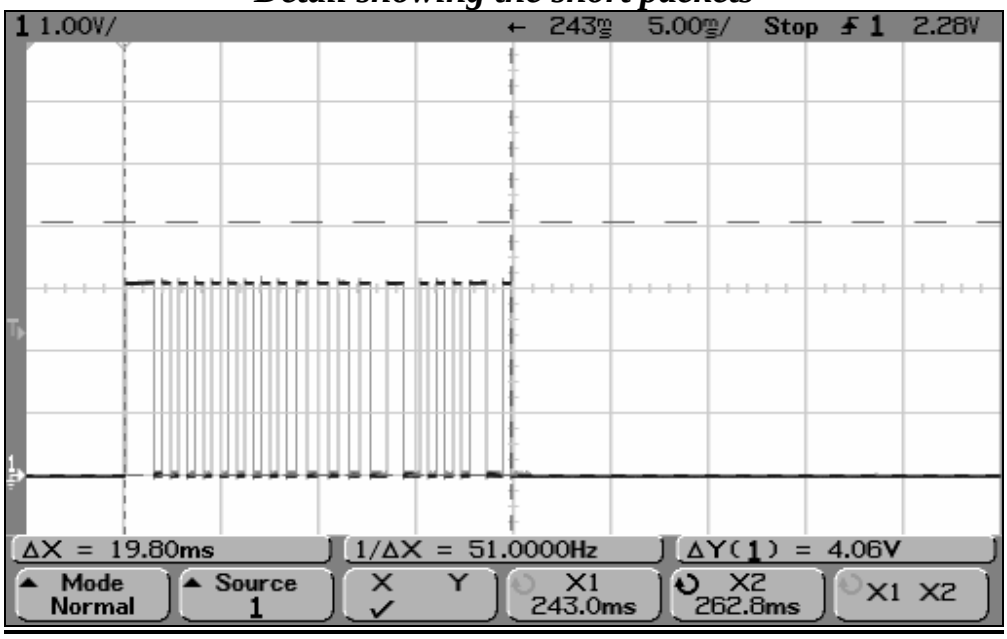


Detail showing that transmission ceases upon release of all other buttons, as soon as the packet is completely transmitted, within the 5 second limit.

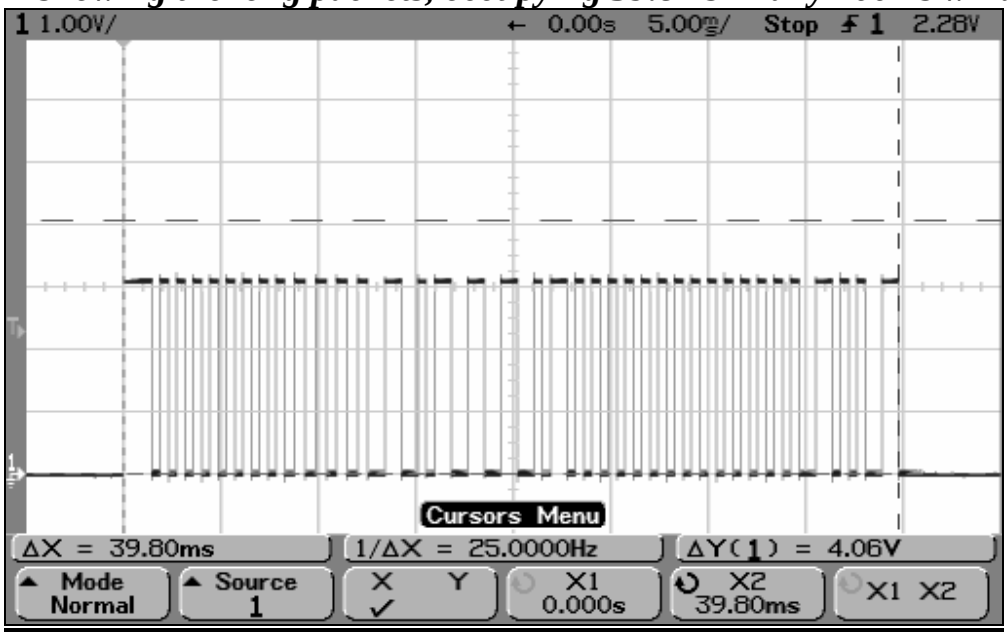


5.9 Individual Data Packet Detail

Detail showing the short packets



Detail showing the long packets, occupying 39.8ms in any 100ms window.



Permissible Relaxation factor = 20xLog_{10} (39.8ms/100ms)= -8.00dB

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE: 15.207

This device does not contain any contingencies for connection to AC Mains.
No emissions testing onto AC Mains was performed on this device.

EXHIBIT 7. OCCUPIED BANDWIDTH: 15.231(c)

7.1 Test Procedure

In addition to measuring the levels of Radiated Emissions, the Occupied Bandwidth of the transmitter was measured. In accordance with FCC Part 15.231(c), the -20 dB_C bandwidth of the transmitted signal should be within a window of 0.25% of the center carrier frequency. The resolution bandwidth was set to the closest available filter setting on the HP 8546A EMI Receiver, then corresponded to 5% of the allowable bandwidth determined in the calculation mentioned above, without going below the resolution bandwidth of 10 kHz, as dictated in ANSI C63.4.

7.2 Test Equipment Utilized

The connecting cables used were also measured for loss using a calibrated Signal Generator and the HP 8546A EMI Receiver. The resulting loss factors were entered into the HP 8546A EMI Receiver database. This allowed for automatic change in the antenna correction factor. The resulting data taken from the HP 8546A EMI Receiver is an actual measurement and can be entered into the database as a corrected measurement.

7.3 Occupied Bandwidth Calculations

FCC Part 15.231(c) states that the bandwidth of a manually operated device shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz and 900 MHz.

Said bandwidth is determined at the -20 dB reference to peak carrier points.

Refer to the set of screen captures in this report, which show the actual Occupied Bandwidth of the transmitter as measured.

For this device, operating at a center frequency of 433.92 MHz, the allowed Occupied Bandwidth is calculated to be:

433.92 MHz x 0.0025 = 1.084 MHz

7.4 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

7.5 Test Data

Frequency (MHz)	-20 dB_C Occupied Bandwidth (MHz)	Occupied Bandwidth Limit (MHz)	Pass/Fail
433.92	0.200	1.084	Pass

7.6 Screen Captures – OCCUPIED BANDWIDTH

Occupied Bandwidth

Measurement of the Occupied Bandwidth was made with the EUT in continuous transmit mode, with typical modulation as applied by the EUT circuitry.

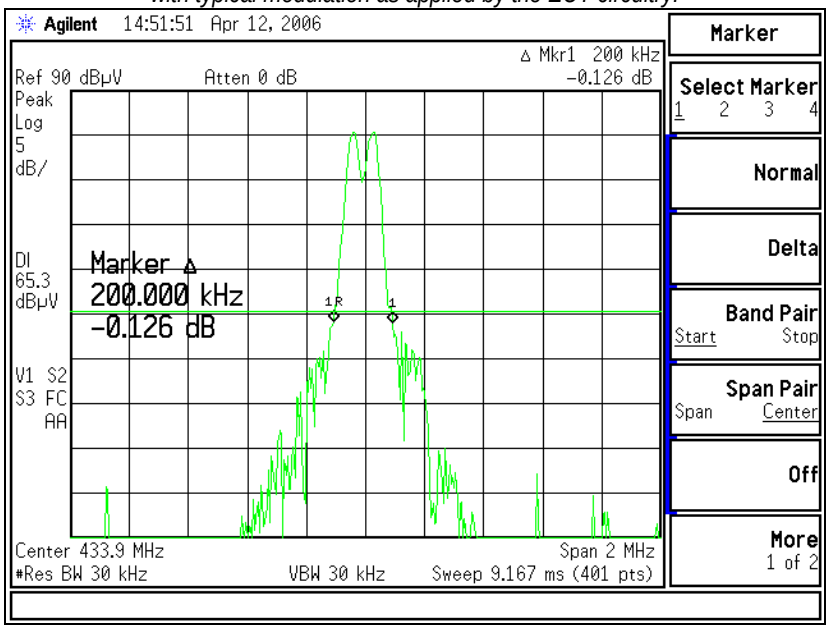


EXHIBIT 8. STABILITY OVER VOLTAGE VARIATIONS

The stability of the device was examined as a function of the input voltage available to the EUT. A Spectrum Analyzer was used to measure the frequency at the appropriate frequency markers. The EUT was placed in continuous transmit CW mode. Power was supplied by an external bench-type variable power supply, and the frequency of operation was monitored using the spectrum analyzer.

The EUT uses two standard type “AA” batteries, with a nominal voltage of 3.0 VDC, and a minimum working voltage of 2.7 VDC.

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied.

DC Voltage Source		
2.70 VDC	3.00 VDC	3.45 VDC
433.8982 (MHz)	433.8982 (MHz)	433.8982 (MHz)

The RF Power Output of the EUT was also monitored in a separate test, also using a Spectrum Analyzer with RBW=120 kHz setting while the voltage was varied.

DC Voltage Source		
2.70 VDC	3.00 VDC	3.45 VDC
85.6 (dBµV/m)	87.4 (dBµV/m)	87.9 (dBµV/m)

The power was then cycled On/Off to observe system response. No unusual response was observed, the emission characterizes were well behaved, and the system returned to the same state of operation as before the power cycle.

A wide frequency sweep was also investigated, with minimum and maximum input voltages, to ensure that no unexpected anomalies have occurred.

EXHIBIT 14. MPE CALCULATIONS

The following MPE calculations are based on the antenna in this product, which is an internal wire whip 14cm in length, formed and fixed in position within the product. This product does not have contingencies for connections to any other antennas. The measured EIRP of 88.7 dBµV/m, at 3 meters was used along with the assertion of 0 dBi for the antenna gain, as any inherent gain is already accounted for in the EIRP figure.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	-6.50	(dBm)
Maximum peak output power at antenna input terminal:	0.224	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1.000	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	433.9	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	0.275	(mW/cm^2)
Power density at prediction frequency:	0.000045	(mW/cm^2)
Maximum allowable antenna gain:	37.9	(dBi)
Margin of Compliance at 20 cm =	37.9	dB

EXHIBIT 10. TRANSMITTER DUTY CYCLE AND RELAXATION FACTOR CALCULATIONS

The following calculations support the request for relaxation factor as applied to the radiated EFI measurements, based on the duty factor of the transmitter.

For a graphical presentation of the data packets from the transmitter, refer to the Data Packet Detail in previous sections of this report. These images were captured on an oscilloscope, while probing the data line, feeding into the transmitter. The transmitter was functioning in normal operating mode, and activated by pressing one of the transmit buttons.

Packet Timing Description:

The data packets are approximately 40ms in length, and composed of 45 data bits. The 45 bits are further broken down into 16 'preamble' bits, 13 'sync' bits, and 16 'data' bits. The bits are Manchester-encoded, with an encoded period of 848μs. The bits are transmitted using an encoded data rate of 1.2 kbits/sec (chip rate) using frequency modulation techniques at a peak deviation of 35 kHz.

Calculation of Average (Relaxation) Factor

Average Factor = 20 * Log_{10} (Worst Case EUT On-time over 100 ms time window)

For this product, a maximum of only one transmit packets can fit within any 100 ms window. As shown in previous sections of this report, the longest packets occupy approximately 40 ms out of any 100 ms window. Each Manchester encoded pulse was confirmed at 848μs. However, since this system is an FM/FSK system, only the packet envelope may be used in calculation of the relaxation factor. The largest packet envelop measured had an on-air time of 39.8ms.

Therefore, the worst-case relaxation factor allowance is calculated as follows:

Relaxation factor = 20xLog_{10} (39.8ms/100ms)= -8.0dB

A relaxation factor of 8.0 dB would be allowable for this product.

APPENDIX A

Test Equipment List

Asset #	Manufacturer	Model #	Serial #	Description	Date	Due
AA960008	EMCO	3816/2NM	9701-1057	Line Impedance Stabilization Network	9/27/05	9/27/06
AA960031	HP	119474A	3107A01708	Transient Limiter	Note 1	Note 1
AA960077	EMCO	93110B	9702-2918	Biconical Antenna	9/27/05	9/27/06
AA960078	EMCO	93146	9701-4855	Log-Periodic Antenna	9/27/05	9/27/06
AA960081	EMCO	3115	6907	Double Ridge Horn Antenna	12/07/05	12/07/06
CC00221C	Agilent	E4407B	US39160256	Spectrum Analyzer	12/29/05	12/29/06
EE960004	EMCO	2090	9607-1164	Device Controller	N/A	N/A
EE960013	HP	8546A	3617A00320	Receiver RF Section	9/29/05	9/29/06
EE960014	HP	85460A	3448A00296	Receiver Pre-Selector	9/29/05	9/29/06
EE960073	Agilent	E4446A	US45300564	Spectrum Analyzer	2/01/06	2/01/07
N/A	LSC	Cable	0011	3 Meter ½" Armored Cable	Note 1	Note 1
N/A	LSC	Cable	0050	10 Meter RG 214 Cable	Note 1	Note 1
N/A	Pasternack	Attenuator	N/A	10 dB Attenuator	Note 1	Note 1

Note 1 - Equipment calibrated within a traceable system.

Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V