



## TEST REPORT #060306

**STANDARD: FCC PART 15**

**SUBPART C--INTENTIONAL RADIATORS**

**SECTION 15. 247 OPERATION  
WITHIN THE BANDS  
902-928 MHZ, 2400-2483.5 MHZ, AND 5725-5850 MHZ**

**EQUIPMENT TESTED:**

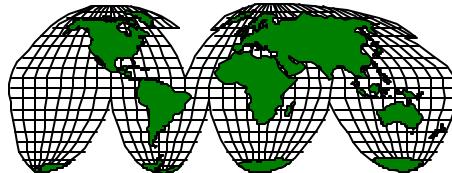
**ADVANCED MEDICAL ELECTRONICS, INC.**

**MODEL: BLUEMOD**

**TEST DATE: 06 MARCH 2006**

1100 Falcon Avenue  
Glencoe, MN 55336

**INTERNATIONAL**



Tele: 320-864-4444  
Fax: 320-864-6611

**CERTIFICATION SERVICES, INC.**

**Prepared for:** Advanced Medical Electronics, Inc.  
6901 East Fish Lake Road, Suite 190  
Maple Grove, MN 55369

**Test agent:** International Certification Services, Inc.  
1100 Falcon Avenue  
Glencoe, MN 55336  
Tele: 320-864-4444  
Fax: 320-864-6611

**Test location:** International Certification Services, Inc.  
1100 Falcon Avenue  
Glencoe, MN 55336  
Tele: 320-864-4444  
Fax: 320-864-6611

**Prepared by:** International Certification Services, Inc.  
1100 Falcon Avenue  
Glencoe, MN 55336

**International Certification Services represents to the client that testing is done in accordance with standard procedures applicable and that reported test results are accurate within generally accepted commercial ranges of accuracy.**

• This report only applies to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. International Certification Services shall have no liability for any deductions, inferences or generalizations drawn by the client or others from this report.

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## **1.0 TEST SUMMARY**

**TEST REPORT:** #060306

**COMPANY:** Advanced Medical Electronics, Inc.,

**AGENT:** International Certification Services, Inc.

**PHONE:** 320-864-4444

**TEST DATE:** 06 March, 2006

**EQUIPMENT UNDER TEST:** BlueMod Bluetooth transmitter module

**GENERAL TEST SUMMARY:** The testing was performed at International Certification Services, Inc. at 1100 Falcon Ave, Glencoe, MN 55336

**VERIFICATION / CERTIFICATION STATUS:** The Advanced Medical Electronics, Inc. Model: Bluemod was found to be in compliance with the FCC Part 15 Subpart C, Section 15.247 requirements.

**MODIFICATIONS NECESSARY:** None

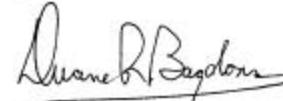
**TESTED BY**

Steve Wendlandt



**WRITTEN BY**

Duane R. Bagdons



## Applicable Standards

47 CFR Ch.1 (10-1-98 Edition)

FCC Part 15      Radio Frequency Devices

Subpart C      Intentional Radiators

Section 15.247      Operation within the bands 902-928 Mhz, 2400-2483.5 Mhz and 5725-5850 Mhz..

## 2.1 Referenced Standards

ANSI C63.4-2003      Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 Khz to 40 Ghz.

## 2.2 Equipment Units Tested

The equipment tested was a battery powered Bluetooth module subassembly. This module is designed around the LMX9830 Bluetooth Radio by National Semiconductor and including support electronics, antenna, and shielding. This subassembly is designed to be included within a host PCB application by soldering the module to the host PCB. The antenna is included on the module board as a soldered on component. During test the Bluemod subassembly was soldered to a test board that provided the data input signals for the transmitter. This assembly was battery powered so no power line conducted emissions were measured. There was no enclosure provided with the EUT, only the bare PC board.

## 2.3 Equipment and Cable Configuration

See photo of the EUT test configuration setup in Attachment A

## 2.4 List of Test Equipment

<u>Test Equipment</u>	<u>Model</u>	<u>S/N</u>	<u>Cal Date</u>
Spectrum Analyzer	Hewlett-Packard 8566B	2421A00458	06/17/05
Preamp	Nextec Model: NB00391	378	12/12/05
Biconical Antenna	EMCO Model 93110B	105799	02/16/06
Log Periodic Antenna (200-1000 MHz)	EMCO 3146	9101-2991	02/16/06
Horn Antenna (1-18 Ghz)	EMCO 3115	5697	02/16/06
Horn Antenna (18-40 Ghz)	EMCO 3116	1983	02/16/06

Measurement cable losses, and antenna correction factors are included in the data sheets. The Resolution BW was set at 1 Mhz and the Video BW was set at 1 Hz with a Span of 0 Hz to perform the correct average detected measurements.

## 2.5 Units of Measurement.

All measurements were taken in dBuV/m with the antenna located at 3 meters distance from the EUT. Frequency measurements are recorded in Mhz



## 2.6 Location of Test Site

The open area test site (OATS) measurement facility used to collect the data was International Certification Services, Inc. at 1100 Falcon Ave in Glencoe, MN 55336. This site has been certified to be in spec of the normalized site attenuation per ANSI C63.4-2003.

## 2.7 Measurement Procedures

The antenna was placed at a distance of 3 meters from the EUT. The EUT was set on an insulating table in the OATS site and rotated through 360 degrees to determine the worst case EUT orientation. The antenna was then positioned vertical and horizontal to determine which antenna polarity orientation was worst case. Then certification data was recorded at all the transmitter frequencies from the fundamental to the 10<sup>th</sup> harmonic at an antenna height variation of from 1-4 meters.

## 2.8 Reporting Measurement Data

See data sheets and plots in Attachment B.

## 2.9 Radiated Emissions Data

The frequency and amplitude of the tuned frequency of the EUT along with the frequencies and amplitudes of the harmonics up to the 10<sup>th</sup> harmonic are reported in the data sheets in Attachment B. Signal frequencies above 4800 Mhz were below the noise floor of the measurement system. Both Horizontal and Vertical antenna polarities as well as antenna heights of 1 to 4 meters were observed but all maximum signal strengths occurred in the Horizontal antenna polarity and at 1 meter antenna height.

The Final Level, expressed in dBuV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBuV) and adding the antenna correction factor and cable loss factor (Factor dB) and subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the margin which gives the tabular data as shown in the data sheets in Attachment B.

Example:

<u>Frequency</u> <u>(MHz)</u>	<u>Level</u> <u>(dBuV)</u>	<u>+</u>	<u>Factor</u> <u>(dB)</u>	<u>=</u>	<u>Corr Data</u> <u>(dBuV/m)</u>	<u>-</u>	<u>FCC Limit</u> <u>(dBuV/m)</u>	<u>=</u>	<u>Margin</u> <u>(dB)</u>
100.0	20.6	+	11.0	=	31.6	-	43.5	=	-11.9

## 2.10 Summary of Results

The EUT passed the requirements of FCC Part 15 Subpart C, Section 15.247. No modifications were necessary to accomplish this compliance.

## **ATTACHMENT A**

### **RADIATED MEASUREMENT**

#### **TEST SET UP**

**Advanced Medical Electronics, Inc.  
Model: Bluemod  
FCC 15.247 Radiated Emissions Test Configuration**



## **ATTACHMENT B**

### **DETAILED TEST DATA SHEETS**

Each radiated emissions plot indicates the receiving antenna measurement distance in meters and the emission amplitudes with respect to their applicable limits. The associated tabulation for each radiated plot lists the emission frequency, the final emission level, and the margin from the limit.

Advanced Medical Electronics, Inc.  
Model: Bluemod  
Temperature: 16.8 Deg C.  
Humidity: 48 % R.H.

Test Technician: Steve Wendlandt

**Output Power:**

Preliminary testing was done to determine what antenna polarity and antenna height generated the highest signal levels. Tests were performed at this test configuration and then each frequency was maximized to 0-360 degrees orientation and antenna height of 1-4 meters.

Field strength measurements were made at an antenna distance of 3 meters and this data was corrected with the proper correction factors and then converted to actual power output using the following equation:

$$P = (Ed)^2 / 30 * G$$

P=power output

E=Measured field strength

d=antenna distance from the EUT

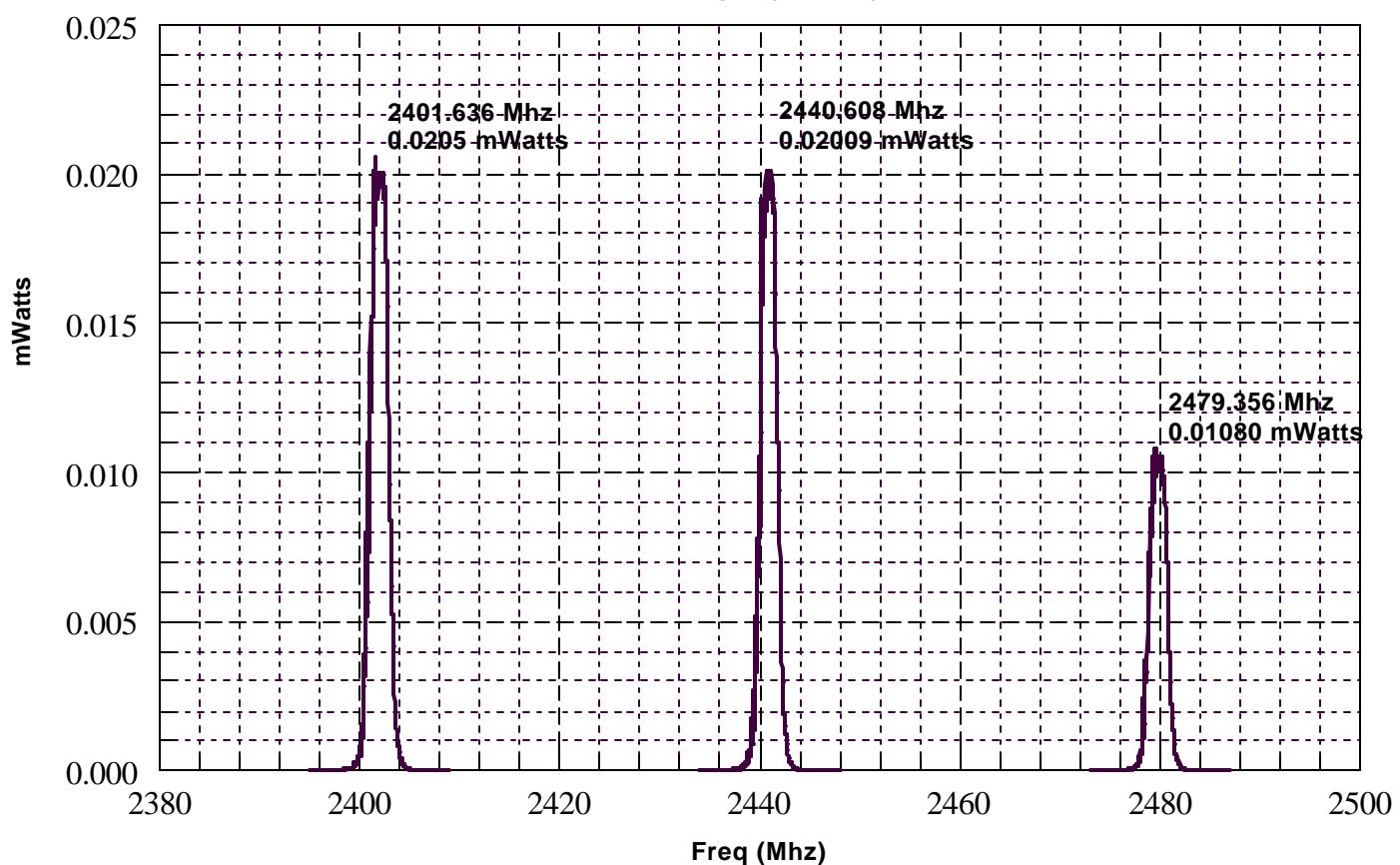
G=Numerical gain factor of the receiving antenna

Frequency (Mhz)	Peak Field Strength (V/m)	Antenna Numerical Gain (dB)	Peak Power Output (watts)
2479.356 (High)	0.015718	6.86	0.01080
2440.608 (Mid)	0.021434	6.86	0.02009
2401.636 (Low)	0.021669	6.86	0.02053

Initial testing was performed in the anechoic shield room to determine if there were any other spurious emissions other than the fundamental and its harmonics. No other emissions were found.

Certification testing was performed at the OATS site with an antenna distance of 3 meters and the EUT at 0 Degrees to the antenna. This was the worst case orientation of the EUT.

Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Max Power Output (mWatts)



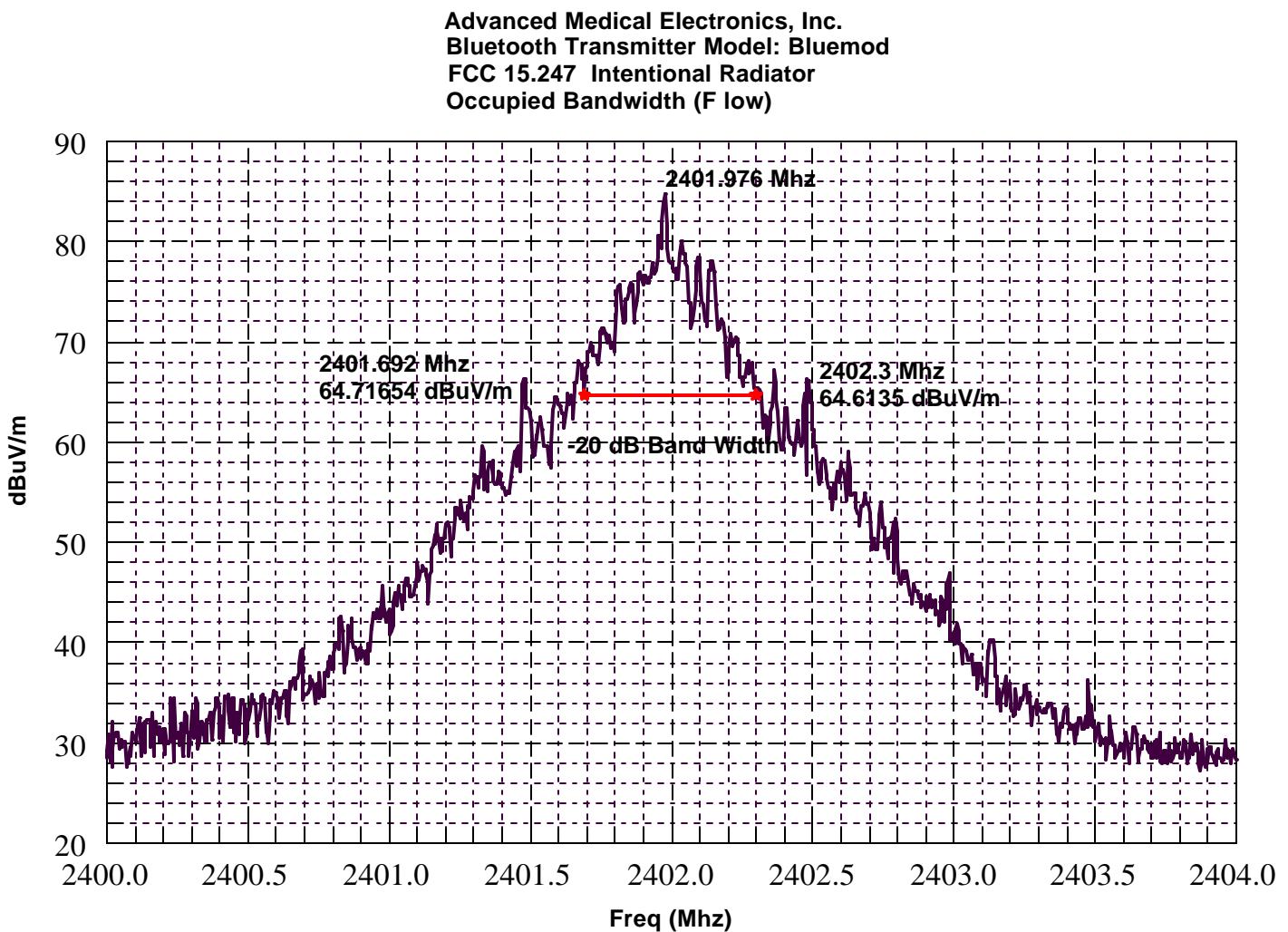
International Certification Services, Inc.

March 06, 2006

## Occupied Bandwidth:

Transmit signal total BW at 20 dB down from peak carrier amplitude

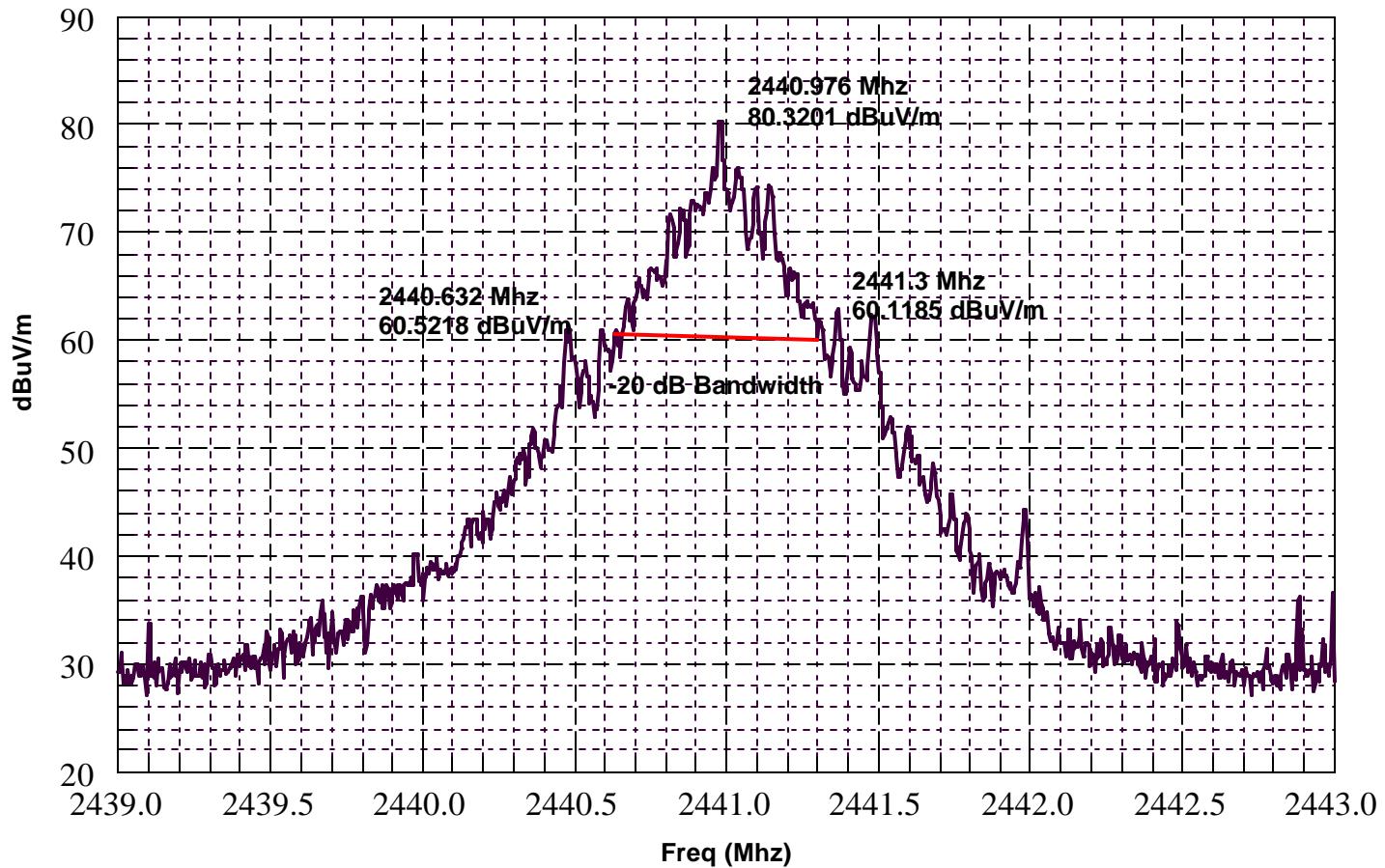
Frequency (Mhz)	20 dB Occupied Bandwidth (Khz)
2479.356 (High)	732
2440.608 (Mid)	668
2401.636 (Low)	608



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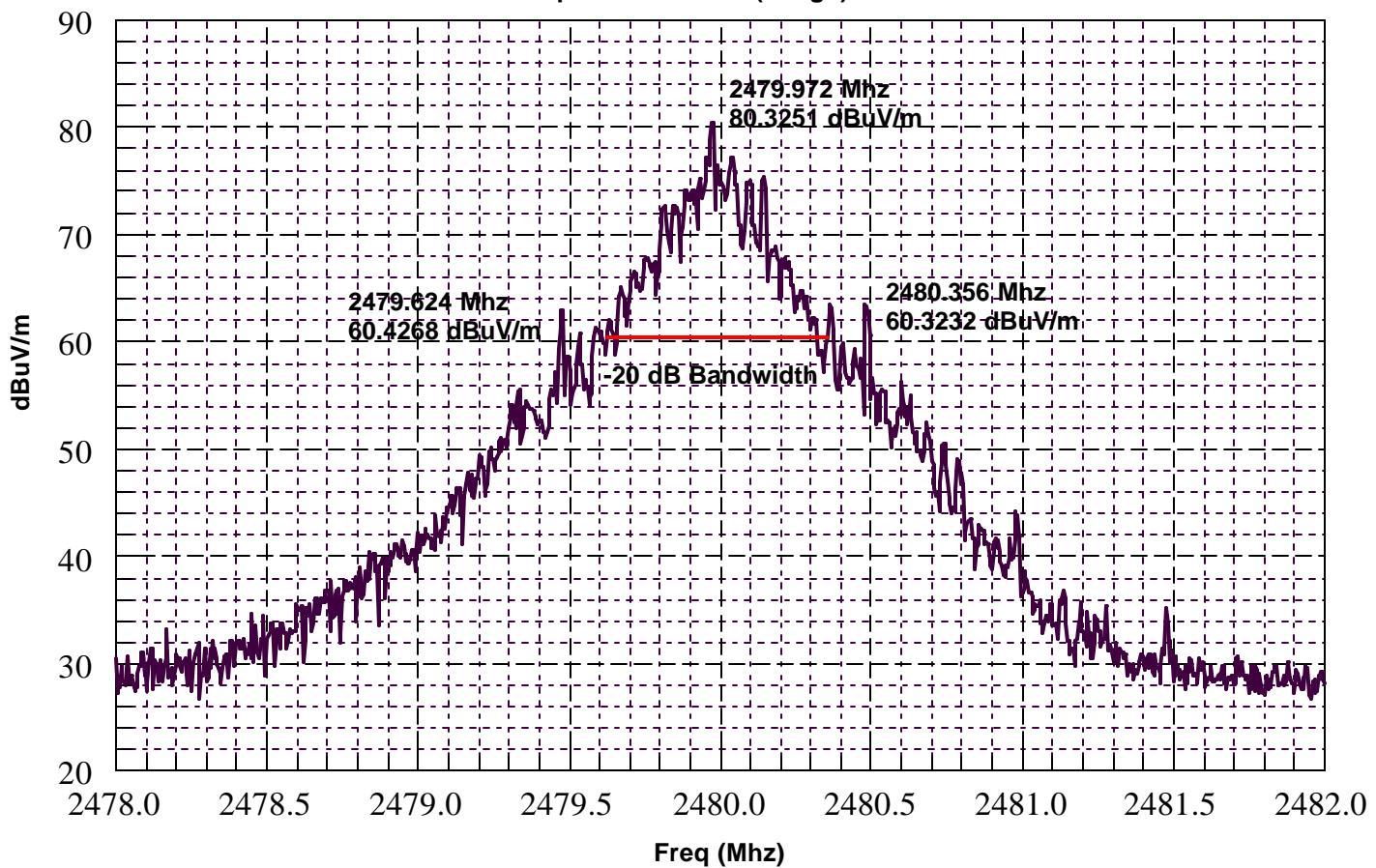
Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Occupied Bandwidth (F mid)



International Certification Services, Inc.

March 06, 2006

Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Occupied Bandwidth (F high)



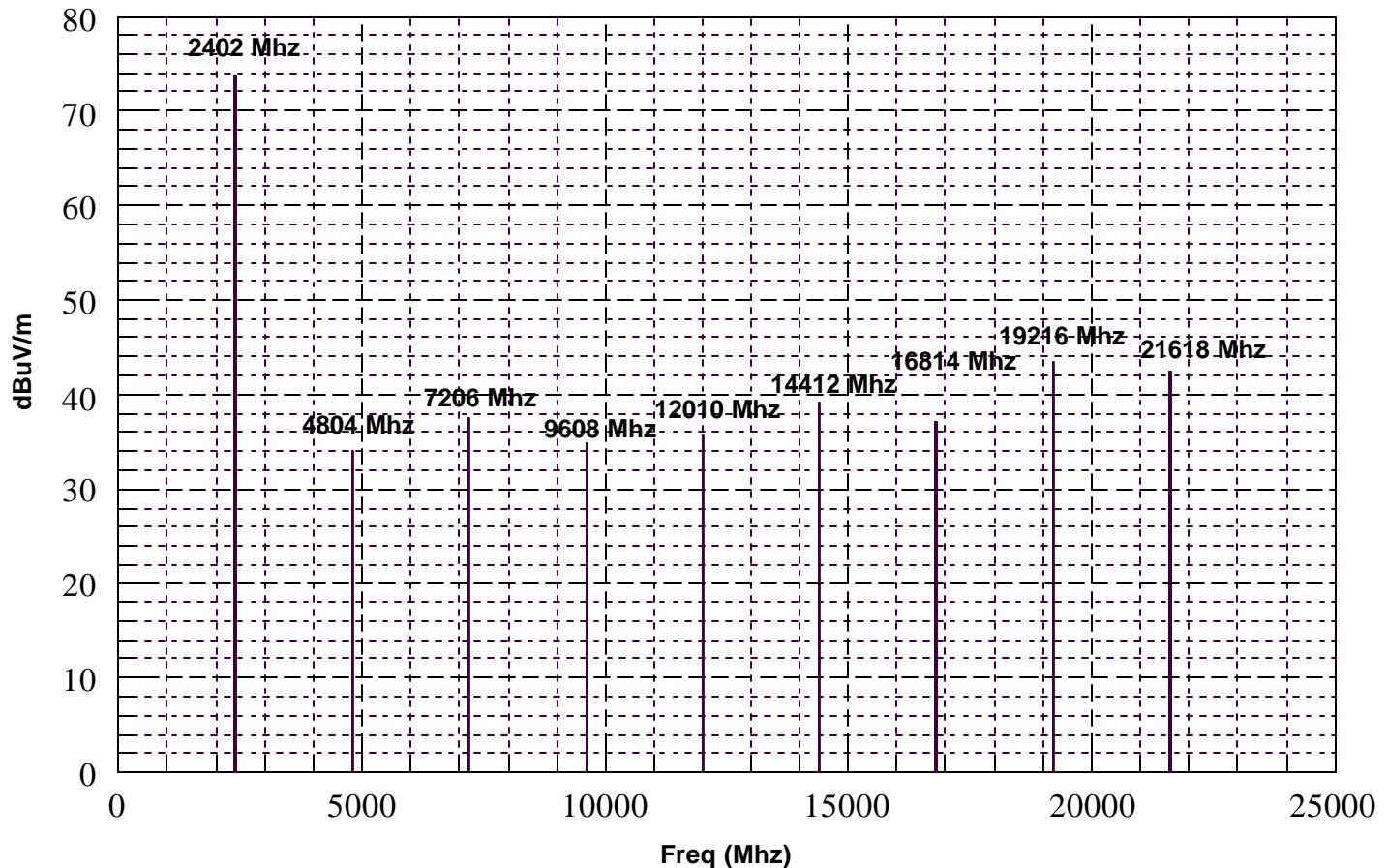
International Certification Services, Inc.

March 06, 2006

## Harmonic Frequencies:

Frequency (Mhz)	dBuV/m	dB diff from fundamental freq
<b>F low</b>		
2402	73.7	<b>Fundamental</b>
4804	34	-39.7
7206	37.45	-36.25
9608	34.9	-38.8
12010	35.7	-38
14412	39.05	-34.65
16814	37.15	-36.55
19216	43.5	-30.2
21618	42.5	-31.2
<b>F middle</b>		
2441	76.8	<b>Fundamental</b>
4882	32.1	-44.7
7323	35.6	-41.2
9764	35.1	-41.7
12205	34.1	-42.7
14646	38.9	-37.9
17987	37.5	-39.3
19528	42.7	-34.1
21969	42.1	-34.7
<b>F high</b>		
2480	72.1	<b>Fundamental</b>
4960	30.5	-41.6
7440	33.7	-38.4
9920	34.6	-37.5
12400	33.7	-38.4
14880	37.4	-34.7
17360	38.4	-33.7
19840	42	-30.1
22320	43.7	-28.4

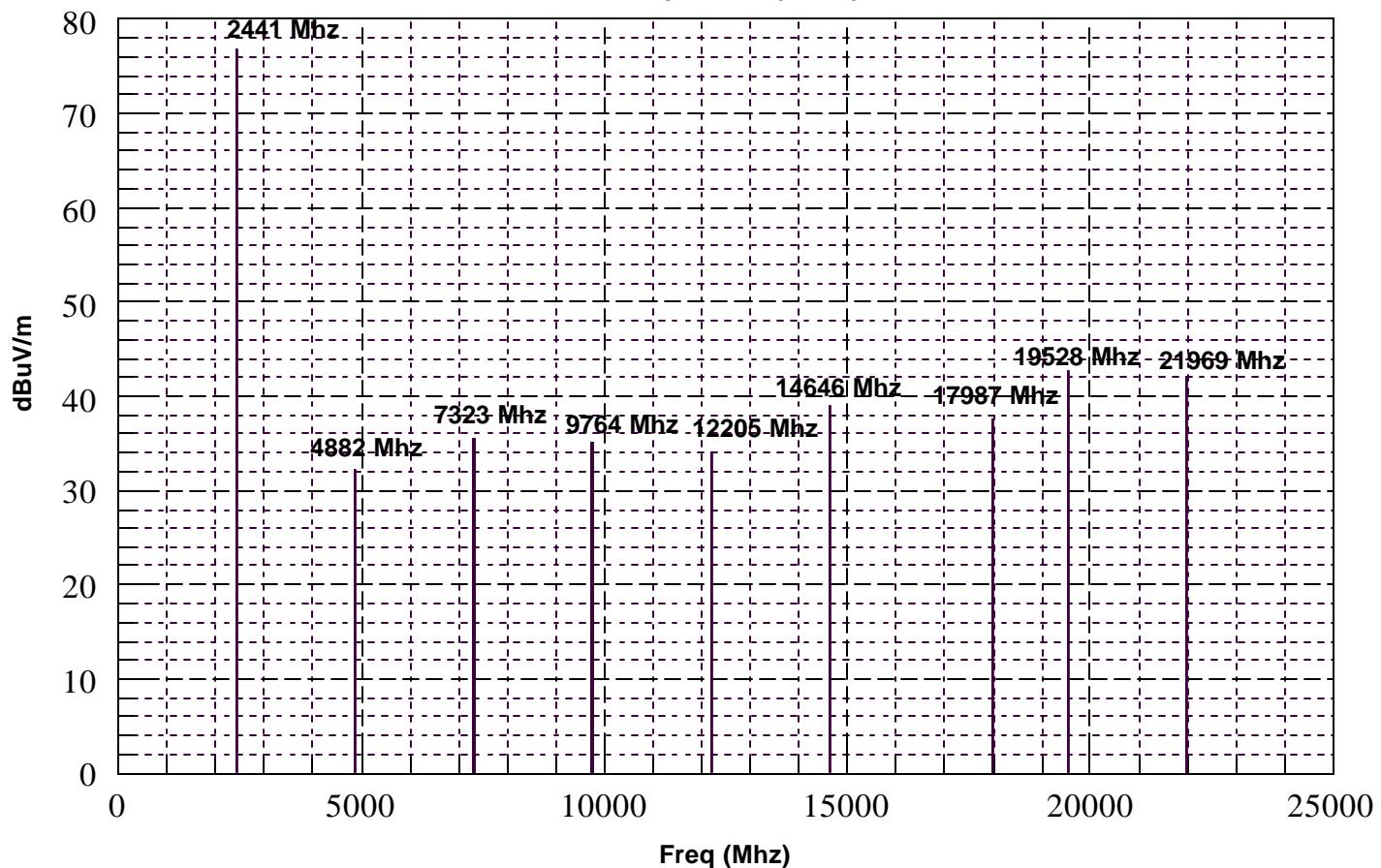
Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Harmonic Frequencies (F low)



International Certification Services, Inc.

March 06, 2006

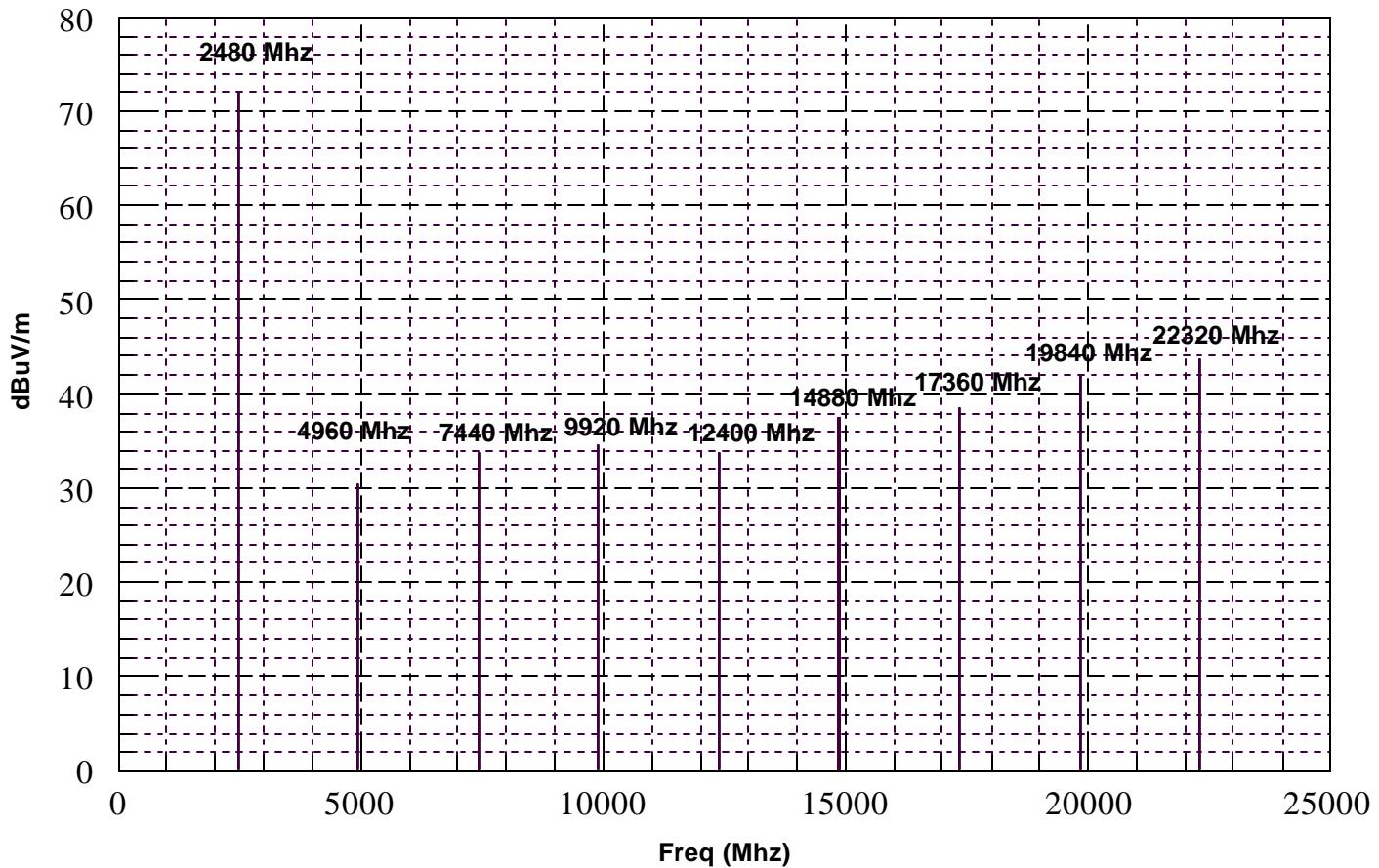
Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Harmonic Frequencies (F mid)



International Certification Services, Inc.

March 06, 2006

Advanced Medical Electronics, Inc.  
Bluetooth Transmitter Model: Bluemod  
FCC 15.247 Intentional Radiator  
Harmonic Frequencies (F high)



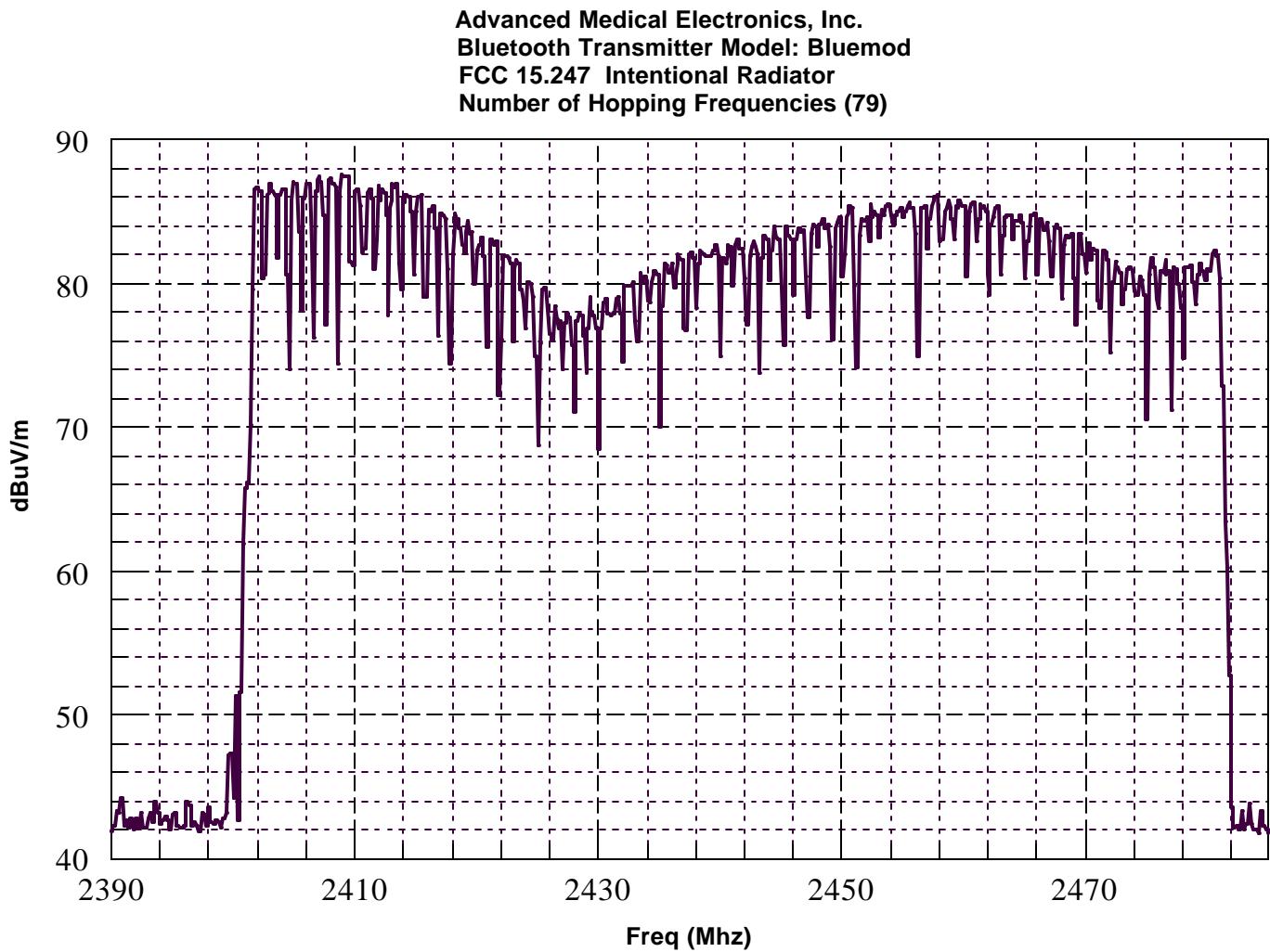
International Certification Services, Inc.

March 06, 2006

## Bandedge Signals

Frequency (Mhz)	dBuV/m
2400	28.625
2482	28.115

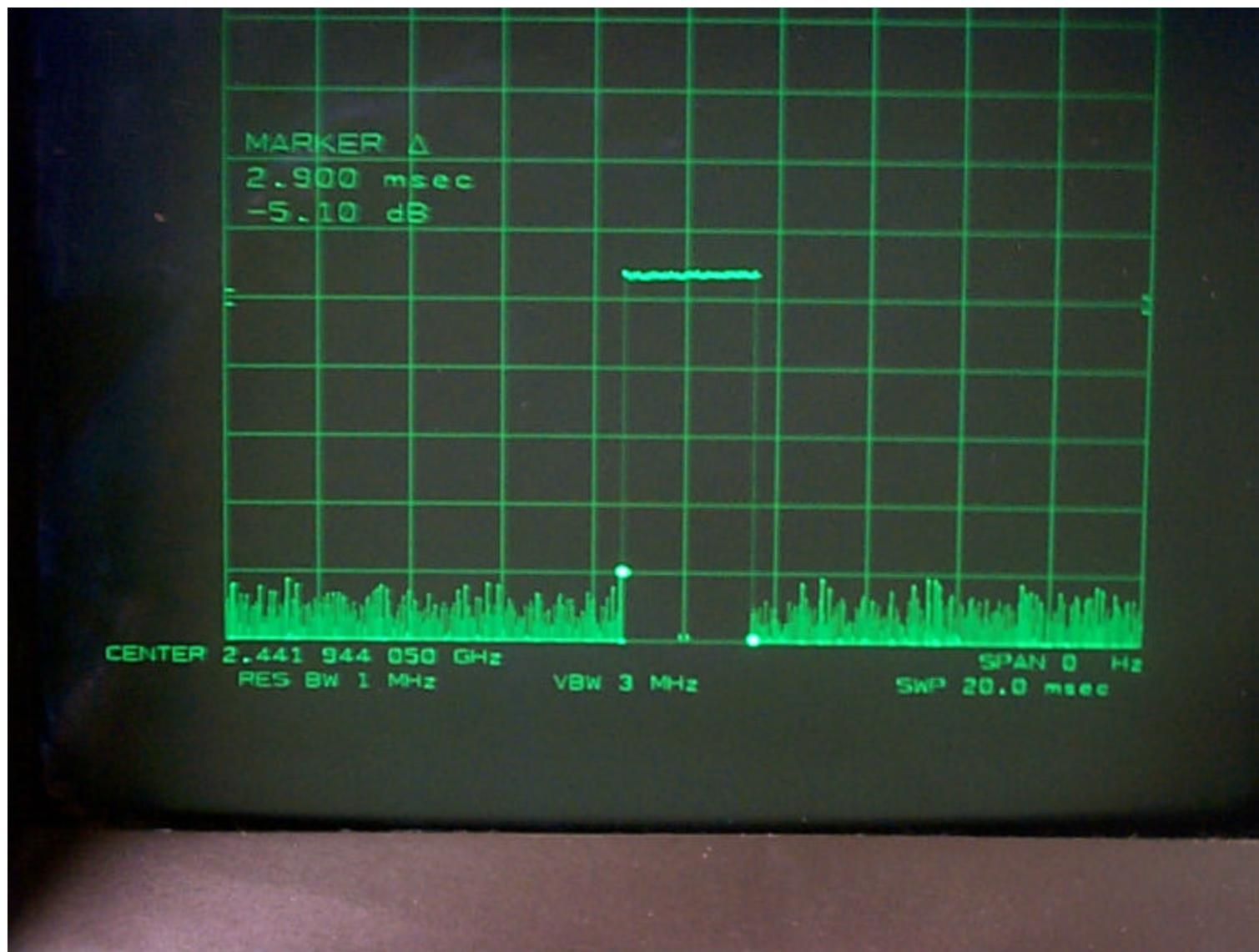
## Number of Hopping Frequencies:



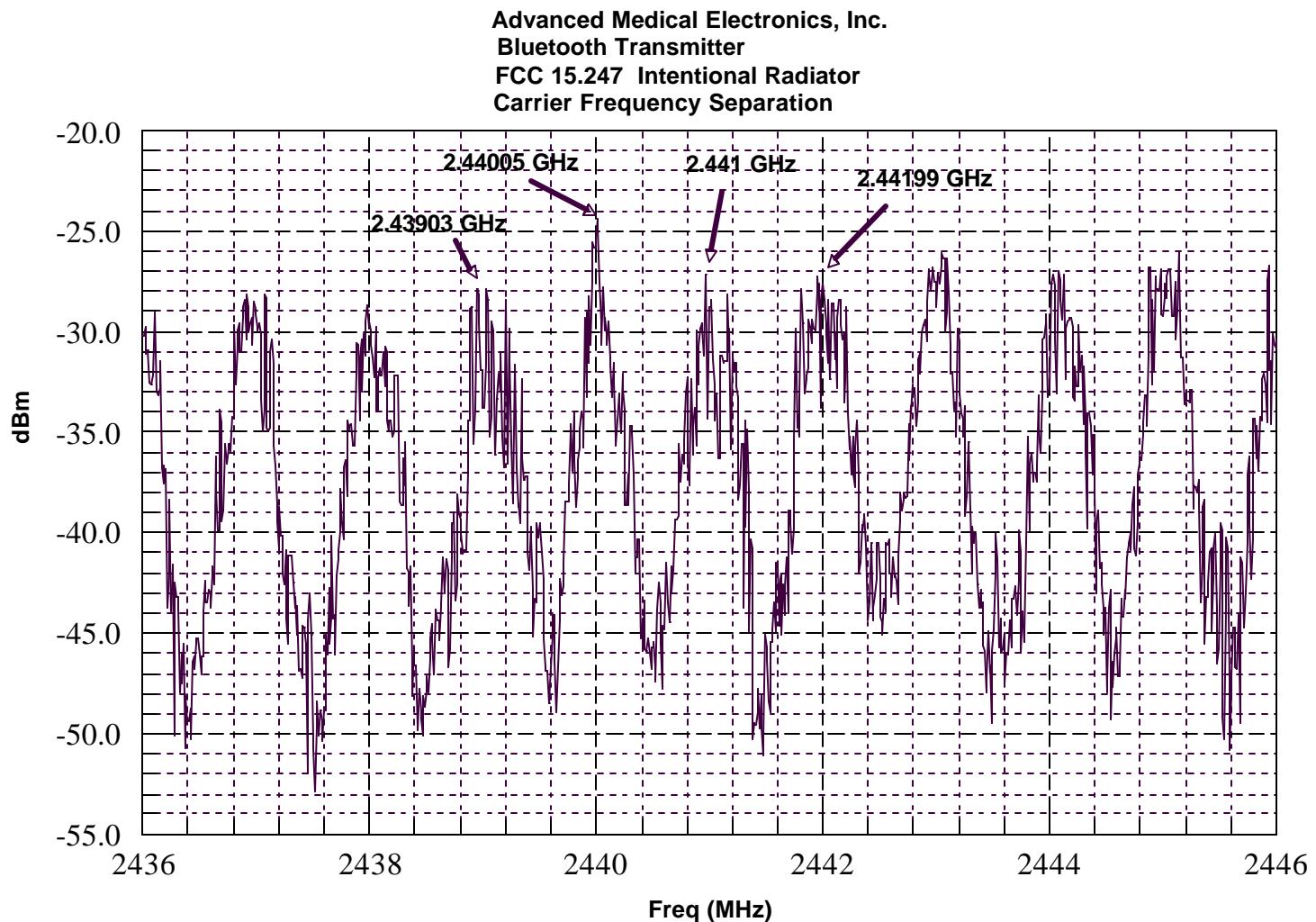
International Certification Services, Inc.

March 06, 2006

## Dwell Time



## Carrier Frequency Separation:



International Certification Services, Inc.

03-06-06

## **Equal Hopping Frequency Use:**

A National SemiConductor LMX9830 Chip is used to generate the Hopping frequencies. This is the information that the manufacturer sent to me regarding the equal hopping frequency use.

"The National Semiconductor LMX9830 Bluetooth Serial Port module is a highly integrated Bluetooth 2.0 baseband controller and 2.4 Ghz radio, combined to form a complete small form factor Bluetooth node. All hardware and firmware is included to provide a complete solution from antenna through the complete lower and upper layers of the Bluetooth stack, up to the application including the Generic Access Profile (GAP), the Service Discovery Application Profile (SDAP), and the Serial Port Profile (SPP). The module includes a configurable service database to fulfil service request for additional profiles on the host. The LMX9830 is pre-qualified as a Bluetooth Integrated Component. The integrated Bluetooth Lower Link Controller (LLC) complies with the Bluetooth Specification version 2.0 and implements the following functions:

- ?? Adaptive Frequency Hopping
- ?? Interlaced Scanning
- ?? Fast Connect
- ?? Support for 1,2 and 5 slot packet types
- ?? 79 Channel hop frequency generation circuitry
- ?? Fast frequency hopping at 1600 hops per second
- ?? Power management control
- ?? Access code correlation and slot timing recovery

## Appendix IV - Sample Data



Hop sequence {k} for CONNECTION STATE:

CLK start: 0x00000010

ULAP: 0x00000000

#ticks: 00 02 | 04 06 | 08 0a | 0c 0e | 10 12 | 14 16 | 18 1a | 1c 1e |

0x00000010:	08 66	10 70	12 19	14 23	16 01	18 05	20 33	22 37
0x00000030:	24 03	26 07	28 35	30 39	32 72	34 76	36 25	38 29
0x00000050:	40 74	42 78	44 27	46 31	48 09	50 13	52 41	54 45
0x00000070:	56 11	58 15	60 43	62 47	32 17	36 19	34 49	38 51
0x00000090:	40 21	44 23	42 53	46 55	48 33	52 35	50 65	54 67
0x00000b0:	56 37	60 39	58 69	62 71	64 25	68 27	66 57	70 59
0x00000d0:	72 29	76 31	74 61	78 63	01 41	05 43	03 73	07 75
0x00000f0:	09 45	13 47	11 77	15 00	64 49	66 53	68 02	70 06
0x0000110:	01 51	03 55	05 04	07 08	72 57	74 61	76 10	78 14
0x0000130:	09 59	11 63	13 12	15 16	17 65	19 69	21 18	23 22
0x0000150:	33 67	35 71	37 20	39 24	25 73	27 77	29 26	31 30
0x0000170:	41 75	43 00	45 28	47 32	17 02	21 04	19 34	23 36
0x0000190:	33 06	37 08	35 38	39 40	25 10	29 12	27 42	31 44
0x00001b0:	41 14	45 16	43 46	47 48	49 18	53 20	51 50	55 52
0x00001d0:	65 22	69 24	67 54	71 56	57 26	61 28	59 58	63 60
0x00001f0:	73 30	77 32	75 62	00 64	49 34	51 42	57 66	59 74
0x0000210:	53 36	55 44	61 68	63 76	65 50	67 58	73 03	75 11
0x0000230:	69 52	71 60	77 05	00 13	02 38	04 46	10 70	12 78
0x0000250:	06 40	08 48	14 72	16 01	18 54	20 62	26 07	28 15
0x0000270:	22 56	24 64	30 09	32 17	02 66	06 74	10 19	14 27
0x0000290:	04 70	08 78	12 23	16 31	18 03	22 11	26 35	30 43
0x00002b0:	20 07	24 15	28 39	32 47	34 68	38 76	42 21	46 29
0x00002d0:	36 72	40 01	44 25	48 33	50 05	54 13	58 37	62 45
0x00002f0:	52 09	56 17	60 41	64 49	34 19	36 35	50 51	52 67
0x0000310:	38 21	40 37	54 53	56 69	42 27	44 43	58 59	60 75
0x0000330:	46 29	48 45	62 61	64 77	66 23	68 39	03 55	05 71
0x0000350:	70 25	72 41	07 57	09 73	74 31	76 47	11 63	13 00
0x0000370:	78 33	01 49	15 65	17 02	66 51	70 67	03 04	07 20
0x0000390:	68 55	72 71	05 08	09 24	74 59	78 75	11 12	15 28
0x00003b0:	76 63	01 00	13 16	17 32	19 53	23 69	35 06	39 22
0x00003d0:	21 57	25 73	37 10	41 26	27 61	31 77	43 14	47 30
0x00003f0:	29 65	33 02	45 18	49 34	19 04	21 08	23 20	25 24

## **ATTACHMENT C**

**PRODUCT DATA SHEET OR PRODUCT INFORMATION FORM AS SUPPLIED BY  
THE CUSTOMER**

**COMPANY NAME:** Advanced Medical Electronics, Inc.

**CUSTOMER REPRESENTATIVE:** International Certification Services, Inc.

**EQUIPMENT DESCRIPTION:** Bluemod

**MODEL NUMBER:** 1.0

**SERIAL NUMBER:** Engineering Unit

**TYPE OF TEST:**  Development  
 Initial Design Verification  
 Design Change (Please describe exact changes below)  
 Production Sample (Audit Test)

Changes made: NONE

**OSCILLATOR FREQUENCIES:**

13 Mhz

**PRODUCT SHIELDING PROVISION:**

No Enclosure

**SOFTWARE AND / OR OPERATING MODES:**

Continuous operation for testing purposes only

**I/O CABLES:** **NONE**