RADIO FREQUENCY CONDUCTED EMISSIONS TEST REPORT

FOR

CLEVELAND MEDICAL DEVICES, INC.

FCC part 15.249
Frequency Hopping Intentional Radiator
Operating In The Frequency Range of 902-928 MHz

Transceiver FCC ID: N9Y0087

Clevelabs
BioRadio 150
Crystal 20 - 900
Crystal 20S - 900
Crystal 20E - 900

Prepared by:

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Sr. RF Engineer
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CERTIFICATE OF COMPLIANCE

1. Manufacturer:	Cleveland Medical Devices, Inc. 4415 Euclid Ave., 4th Floor Cleveland, OH 44103
2. Contact:	Hani Kayyali Cleveland Medical Devices, Inc. 216/791-6720
3. Regulation:	CFR47 – Part 15 15.247
4. Measurement Method:	ANSI C63.4-1992 FCC Public Notice DA 00-705
5. EUT:	Base Model #502-0087, Transceiver aka Crystal 20., BioRadio 150, CleveLabs. FCC ID: N9Y0087
6. Type:	Biomedical Transceiver
7. Tuned Frequency	902.24990 MHz – 927.74368 MHz
8. Test Dates:	24 SEP 04, 27 SEP 04
9. Test Location	Cleveland Medical Devices, Inc. Engineering Lab 4415 Euclid Ave, Suite 400 Cleveland, OH 44103

10. Statement of Compliance:

I hereby certify that measurements of radio frequency emissions from the Cleveland Medical Devices Base Model #502-0087 transceiver were performed by me on September 24 and 27, 2004, and that the results of the measurements confirmed that the units tested are capable of compliance with the above regulation.

April 29. 2004 _____

David Halley
Sr. RF Engineer

RADIO FREQUENCY EMISSION MEASUREMENTS

OBJECTIVE:

The transceiver conducted emissions were measured in order to show that the emissions from the transceiver were within the requirements of FCC Part 15.247 for equipment of this type.

SUMMARY:

The Cleveland Medical Devices, Base Model #502-0087 transceiver has been shown to be Compliant with the requirements of the Federal Communications Commission for a certified intentional radiator under Part 15.247.

Radiated emissions were tested by Smith Laboratories, Inc to verify compliance with the following:

15.205 "Restricted bands of operation"
15.102 "Computer boards and power supplies used in personal computers"
15.103(e) "Exempted Devices"
15.109(a) and (b) "Radiated emission limits"

These reports are:

"RADIO-FREQUENCY EMISSIONS TEST REPORT FOR CLEVELAND MEDICAL DEVICES, INC., Frequency Hopping Transceiver, FCC ID: N9Y0087, October 26, 2004"

"RADIO-FREQUENCY EMISSIONS TEST REPORT FOR CLEVELAND MEDICAL DEVICES, INC., Transceiver, FCC ID: N9Y0087, October 20, 2004"

TEST INFORMATION

EQUIPMENT UNDER TEST	Base Model #502-0087, Transceiver aka Crystal 20., BioRadio 150, CleveLabs. FCC ID: N9Y0087
MANUFACTURER	Cleveland Medical Devices, Inc. 4415 Euclid Ave., 4th Floor Cleveland, OH 44103
TEST DATES	September 24 and 27, 2004
TEST LABORATORY	Cleveland Medical Devices, Inc. Engineering Lab 4415 Euclid Ave, Suite 400 Cleveland, OH 44103 (216) 619-5931
MEASUREMENT EQUIPMENT	Sony/Tektronix WCA-380 Communications System Analyzer (Cal: 24 FEB 04) Advantest R3265A Spectrum Analyzer (6 JUL 04)
ANTENNAS	AEL Spiral Model SN112A S/N 329 Frequency Range 1 to 4 GHz
MISCELLANEOUS	1 m RG-142/U coaxial cable

TEST REPORT

INTRODUCTION

The Base Model #502-0087 transceiver is part of a system specifically designed for the transmissions of data from external sensors. The subject data is frequency modulated onto the transmitted signal, picked up by the companion transceiver and transferred to a host computer for later analysis. The data transmission is a bi-directional link allowing for retransmission of any missed data. The base and patient unit can transmit and receive information.

The Base Model #502-0087, is an intentional radiator under Part 15.247. Its frequency range can be factory programmed to hop on a set of 25 channels in the range of 902-915 MHz or 915-928 MHz. This report indicates that the emissions of the transmitter are within the limits set by 15.247.

The Base Model #502-0087 can be factory programmed to operate as an intentional radiator under part 15.249. The evaluation report on this operating mode is a separate report.

The Base Model #502-0087 is also a digital device that, although it would appear to be exempt as a medical device under 15.103(e), has been examined to verify compliance to 15.109 as a Class A digital device.

RADIATED EMISSIONS

Field strength measurements were performed at Smith Electronics, Inc., 3 meter open field test site located at 8200 Snowville Road, Brecksville, OH using the procedures of ANSI C63.4-1992. Site attenuation data pertinent to this site is on file with the FCC. A tuned dipole antenna was used with a spectrum analyzer using peak detection. The harmonic frequencies were measured in an area of the facility free of reflecting surfaces at a test distance of either 1 meter or 0.5 meters. Details of this testing is documented in a separate report included with this submission.

CONDUCTED EMISSIONS

Conducted emissions were measured in the Cleveland Medical Devices, Inc engineering lab located at 4415 Euclid Ave, Cleveland, Ohio. The test unit was a production sample operated in a test mode. The test mode allows direct control of operating parameters by a computer. The test unit was connected to the measurement equipment with a coaxial cable.

Measurements of the 15.247 (a)(1)(i) -- Time of Occupancy (Dwell Time) were made with an antenna. A patient unit and base station were turned on in normal operating mode. Digital data was transferred between the patient unit and base unit utilizing FHSS

mode. The antenna was connected to the communications spectrum analyzer and timing measurements were made.

CONCLUSIONS

Based upon the measurements made and reported herein, the Cleveland Medical Devices, Inc. modified Base Model #502-0087 transceiver is found to be capable of complying with the requirements of Part 15.247 of the FCC Rules and Regulations when operated in a manner consistent with its intended use and purpose.

FCC PART 15 VERIFICATION DETAIL

Section 15.203 – Antenna Requirement

The antenna on the Crystal 20 patient unit and the Crystal 20 base station are both fixed to the respective housings during manufacture. The antenna's are not replaceable by the user. As a secondary protection, the interface between the antenna and the radio is made with an MMCX type connector. This connector type is not typically available without OEM efforts.

Section 15.207 – Conducted Limits

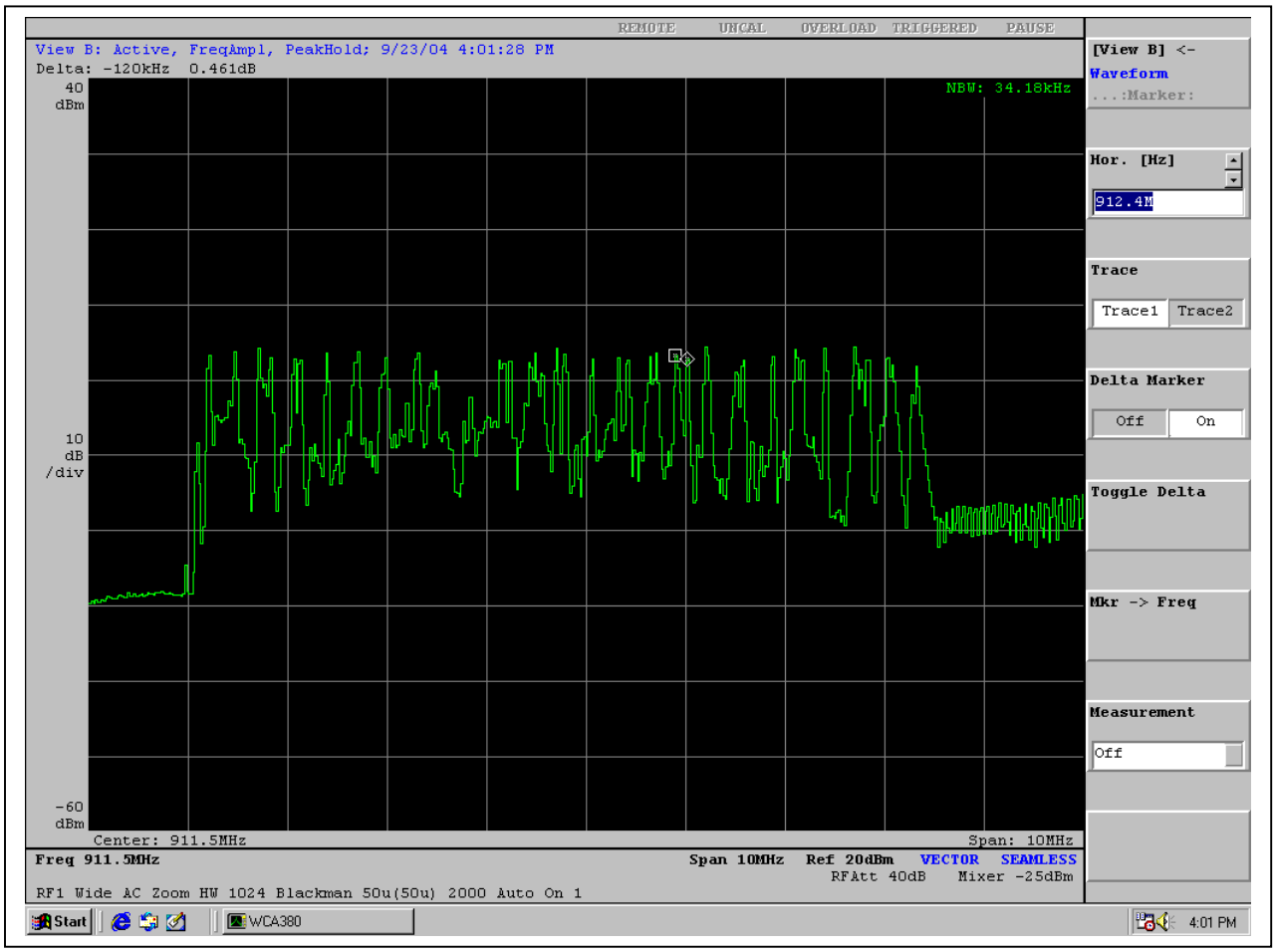
The Crystal 20 patient unit is powered by user replaceable batteries and does not have provision to be connected to a public utility power line. The Crystal 20 base station is directly powered from the USB connector on a personal computer and does not have provision to be connected to a public utility power line.

15.247 (a)(1) -- Carrier Frequency Separation

Test Set Up:

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 911.5 MHz
Span = 5 MHz
Resolution Bandwidth = 100 kHz
Detector Function = Peak
Trace = Max Hold

Measured Result: Carrier Frequency Separation= 290 kHz

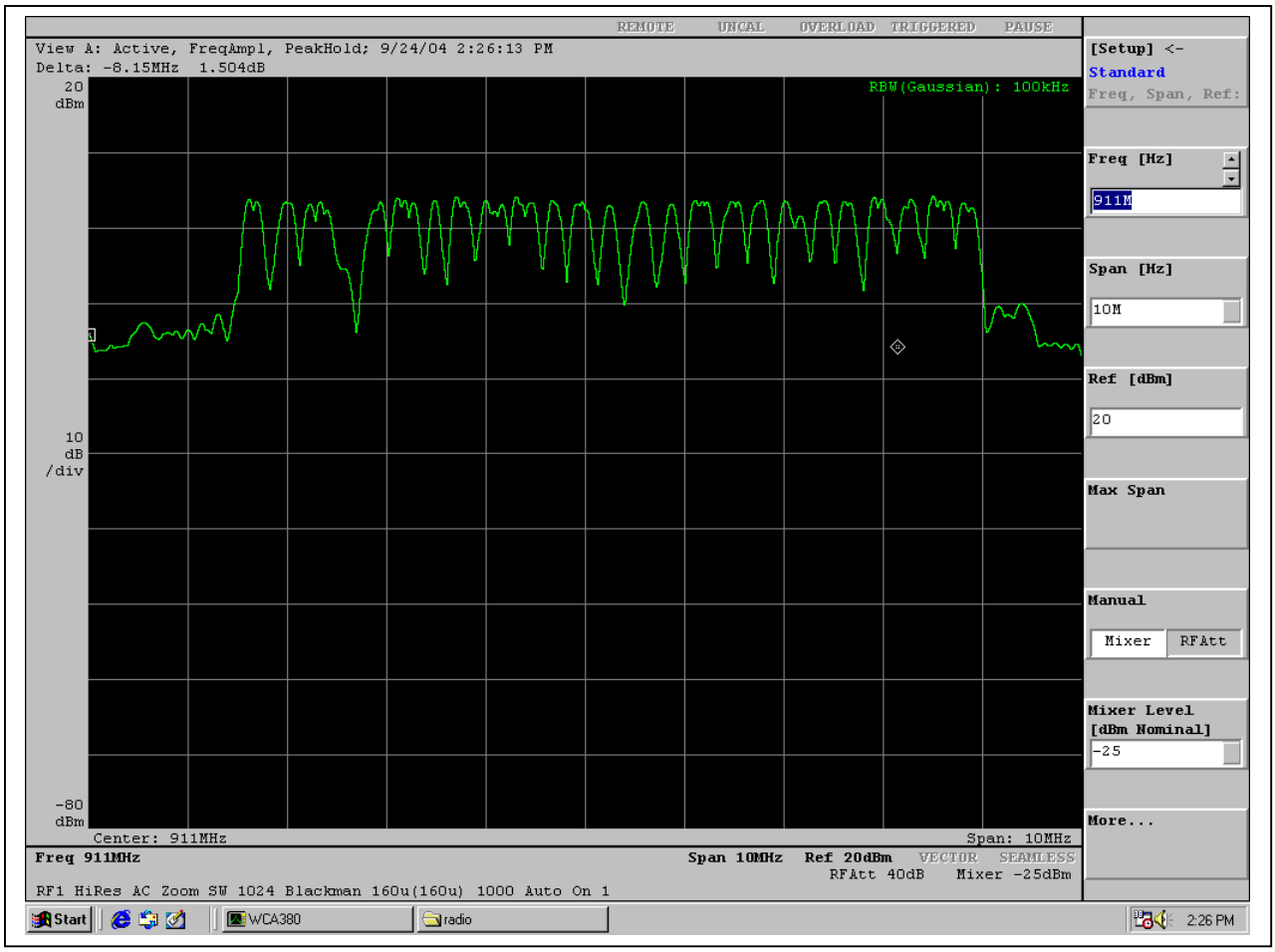


15.247 (a)(1)(i) -- Number of Hoping Frequencies

Test Set Up:

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 911 MHz
Span = 10 MHz
Resolution Bandwidth = 110 kHz
Detector Function = Peak
Trace = Max Hold

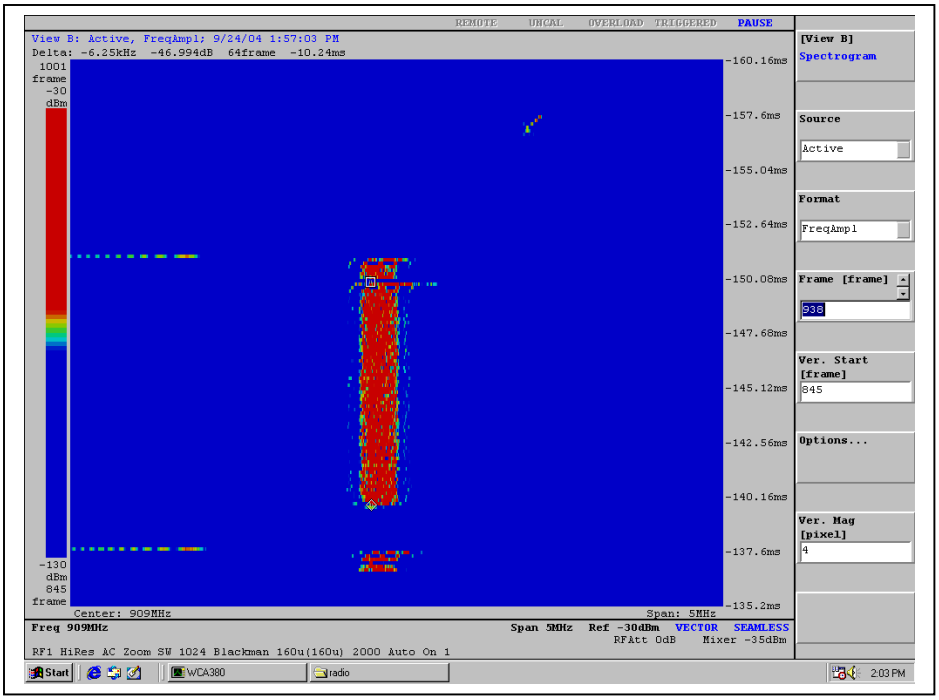
Measured Result: Number of Hopping Channels = 25

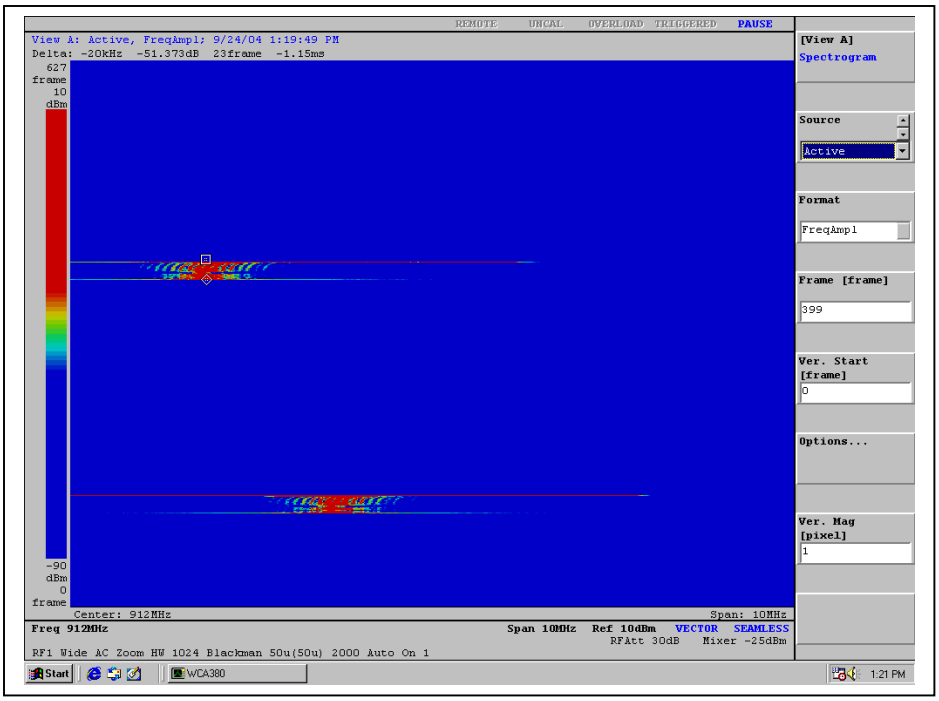


15.247 (a)(1)(i) -- Time of Occupancy (Dwell Time)

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 909 MHz
Span = 10 MHz

Measured Results: Data Packet Time = 10.2 mSec
Acknowledge Packet Time = 1 mSec
Base Station Polling Packet Time = 1.5 mSec
Transmit to Receive Turnaround Time = 160 uSec





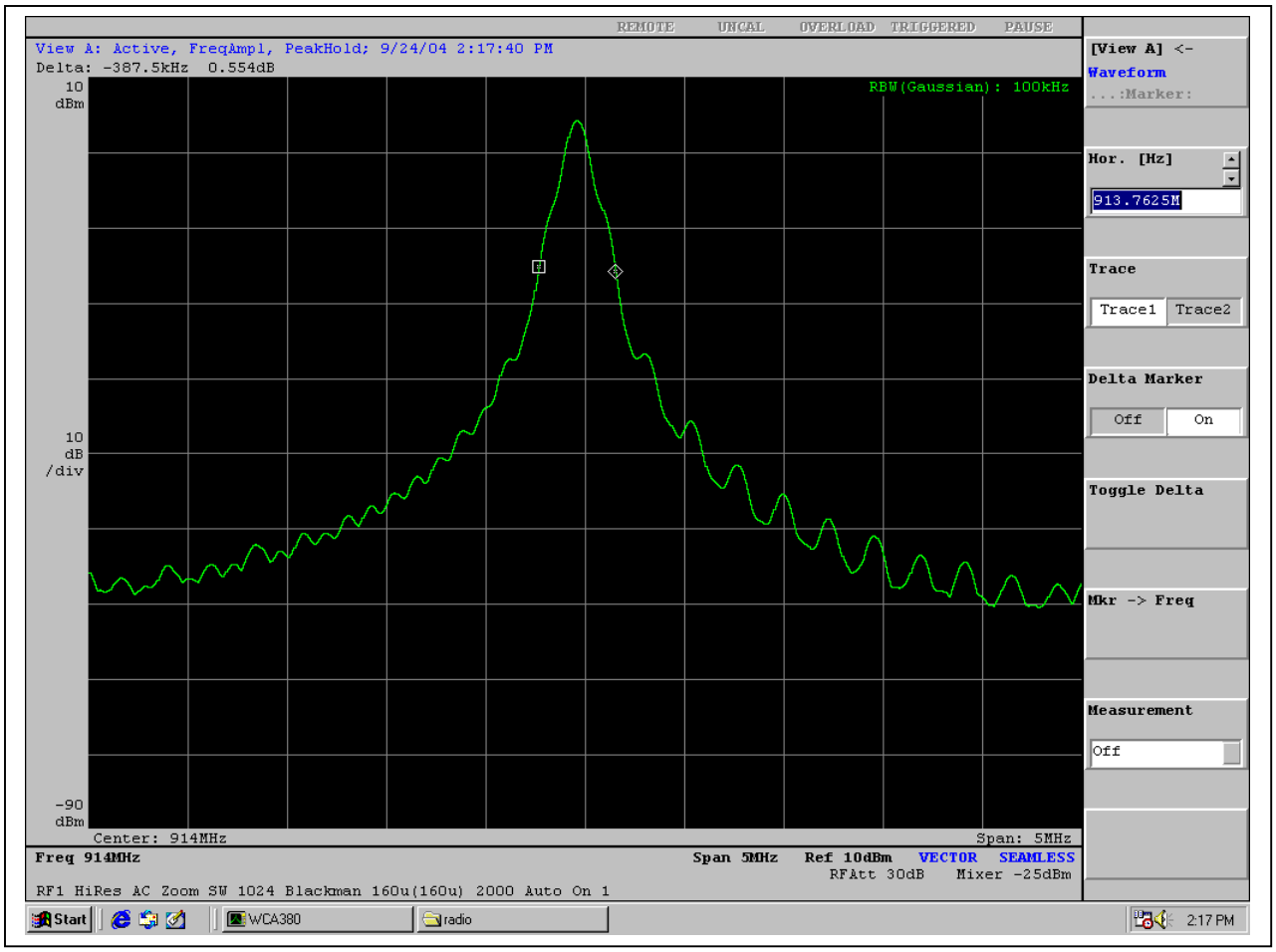
15.247 (a)(1)(i) -- 20 dB Bandwidth

Test Set Up:

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 914 MHz
Span = 5 MHz
Resolution Bandwidth = 100 kHz
Detector Function = Peak
Trace = Max Hold

Transmit data rate 115 kBps

Measured Result: 20 dB Bandwidth= 387 kHz



15.247 (a)(1) -- Pseudorandom Frequency Hopping Sequence

The Crystal 20 radio is configured to operate in one of two sections of frequency in the 902-928 MHz ISM band. A "low" radio operates between 902-915 MHz and a "high" radio operates between 915 and 928 MHz. 86 channels are defined within the band. Channel "0" is 902.2499084 MHz and channel 85 is 927.743682 MHz. Channels are equally spaced between these frequencies with a channel size of 299.9268 MHz. Not all channels are used. Some channels are unusable because of transmit DDS spurious responses and some from receive spurious responses. A set of 25 channels is defined in firmware for each band.

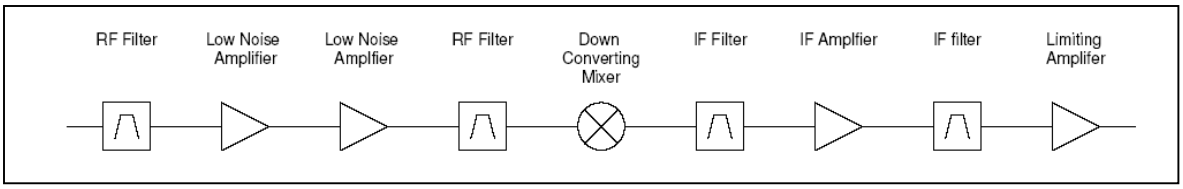
ch#	f nominal:	ch#	f nominal:	ch#	f nominal:	ch#	f nominal:
0	902249908.4	23	909148223.9	46	916046539.3	69	922944854.7
1	902549835.2	24	909448150.6	47	916346466.1	70	923244781.5
2	902849762.0	25	909748077.4	48	916646392.8	71	923544708.3
3	903149688.7	26	910048004.2	49	916946319.6	72	923844635.0
4	903449615.5	27	910347930.9	50	917246246.3	73	924144561.8
5	903749542.2	28	910647857.7	51	917546173.1	74	924444488.5
6	904049469.0	29	910947784.4	52	917846099.9	75	924744415.3
7	904349395.8	30	911247711.2	53	918146026.6	76	925044342.0
8	904649322.5	31	911547637.9	54	918445953.4	77	925344268.8
9	904949249.3	32	911847564.7	55	918745880.1	78	925644195.6
10	905249176.0	33	912147491.5	56	919045806.9	79	925944122.3
11	905549102.8	34	912447418.2	57	919345733.6	80	926244049.1
12	905849029.5	35	912747345.0	58	919645660.4	81	926543975.8
13	906148956.3	36	913047271.7	59	919945587.2	82	926843902.6
14	906448883.1	37	913347198.5	60	920245513.9	83	927143829.3
15	906748809.8	38	913647125.2	61	920545440.7	84	927443756.1
16	907048736.6	39	913947052.0	62	920845367.4	85	927743682.9
17	907348663.3	40	914246978.8	63	921145294.2		
18	907648590.1	41	914546905.5	64	921445220.9		
19	907948516.8	42	914846832.3	65	921745147.7		
20	908248443.6	43	915146759.0	66	922045074.5		
21	908548370.4	44	915446685.8	67	922345001.2		
22	908848297.1	45	915746612.5	68	922644928.0		

15.247 (a)(1) -- Equal Hopping Frequency Use

The radios will send one Data packet and one Acknowledge packet on each channel and then go to the next channel in the list. At the end of the channel list, the radio starts over at the first channel. In this manner, all channels are equally used.

15.247 (a)(1) -- System Receiver Input Bandwidth

Receive chain block diagram



The RF filter bandwidth is 26 MHz. Following the down converting mixer, the two IF filters each have a bandwidth of 330 kHz. As measured earlier, the center - to - center channels spacing is 290 kHz and the 20 dB channel bandwidth is 387 kHz. The IF filters set the receiver bandwidth to match the transmit bandwidth.

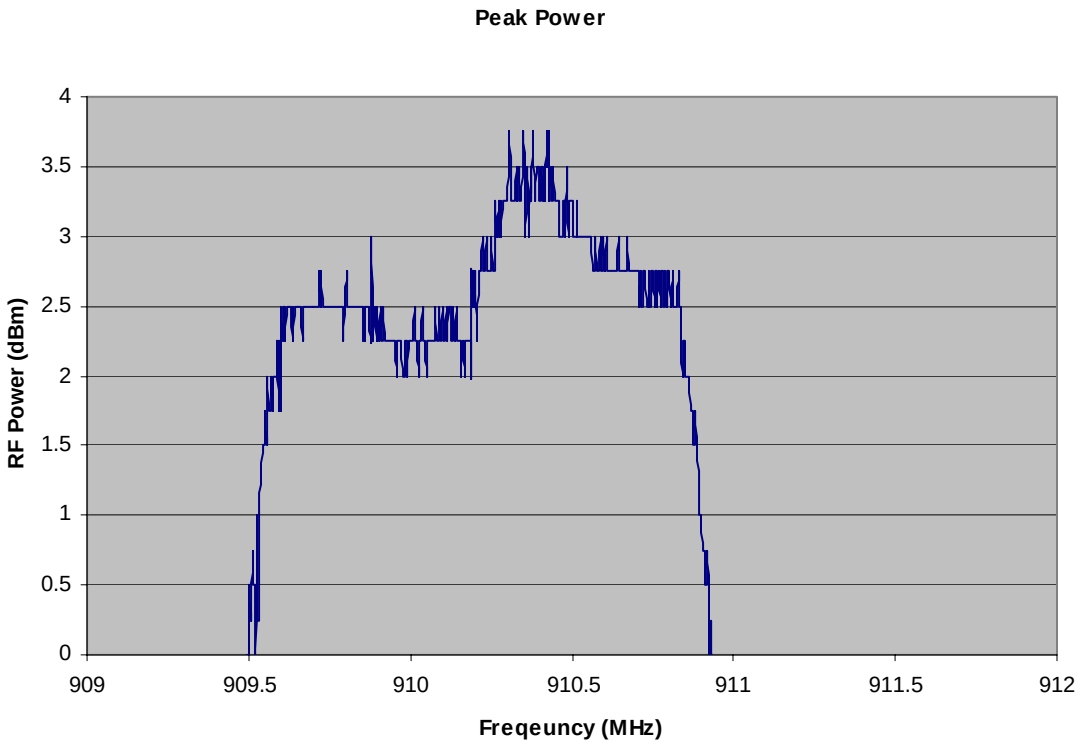
15.247 (b)(2) -- Peak Output Power

Test Set Up:

Advantest R3265A Spectrum Analyzer (Last Cal: 6 JUL 04)
Center Frequency = 910.5 MHz
Span = 3 MHz
Resolution Bandwidth = 3 kHz
Detector Function = Peak
Trace = Max Hold

Cable Loss: 0.8 dB

Measured Result: Peak Output Power= 4.55 dBm



15.247 (b)(3) -- De Facto EIRP Limit

The Crystal 20 radio has a measured peak output power of 4.55 dBm (2.85 mW). The Crystal 20 radio having 25 hopping channels is permitted to operate up to 250 mW. The 2.85 mW level is below this limit. The antenna used on the radio is fixed to the unit and not user serviceable. The antenna has a specified gain of 2 dBi.

Additionally, radiated emissions testing performed by Smith Laboratories (report included with submission) measured the field strength of 38,019 uV/m at a distance of 3 meters. Assuming isotropic radiation, the EIRP level to generate this field strength is –---- -3.6 dBm (0.434 mW).

15.247 (b)(3)(iii) -- Point-to-Point Operation

The Crystal 20 radio is not intended for point-to-point operation and the antenna interface is not user serviceable.

15.247 (b)(4) -- RF Exposure Compliance Requirements

Measurements of radiated emissions were conducted by Smith Laboratories (report included with submission). The measured field strength was 38,019 uV/m at a distance of 3 meters. From:

$$Ptrans = \frac{4 \times \pi \times D^2}{377} \times \left(\frac{E}{1 \times 10^6} \right)^2$$

$Ptrans(watts)$

$D(meters)$

$E(uV/m)$

This equates to an ERP level at the antenna of 0.434 mW. Using this ERP number, we calculate the field strength and power density from:

$$E = 1 \times 10^6 \times \sqrt{\frac{377 \times Ptrans}{4 \times \pi \times D^2}}$$

$$S = \frac{E^2}{3770}$$

$E(uV/m)$

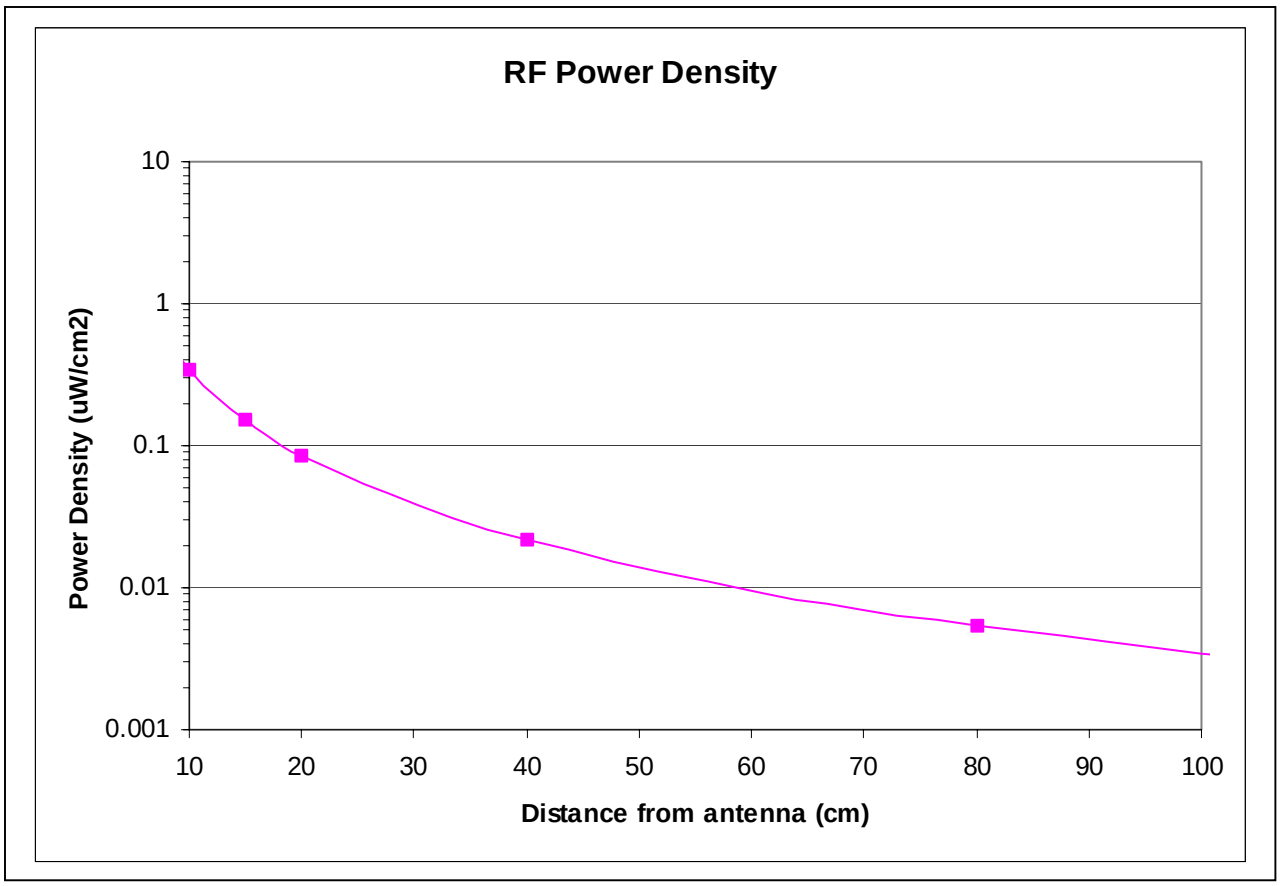
$D(meters)$

$Ptrans(watts)$

$$S = \frac{E^2}{3770}$$

$E(V/m)$

$S(mW/cm^2)$



The specified limit from CFR 47 part 1.311 at 915 MHz is 3.05 mW/cm^2. This calculation shows that we are better than 30 dB below the limit for permissible exposure.

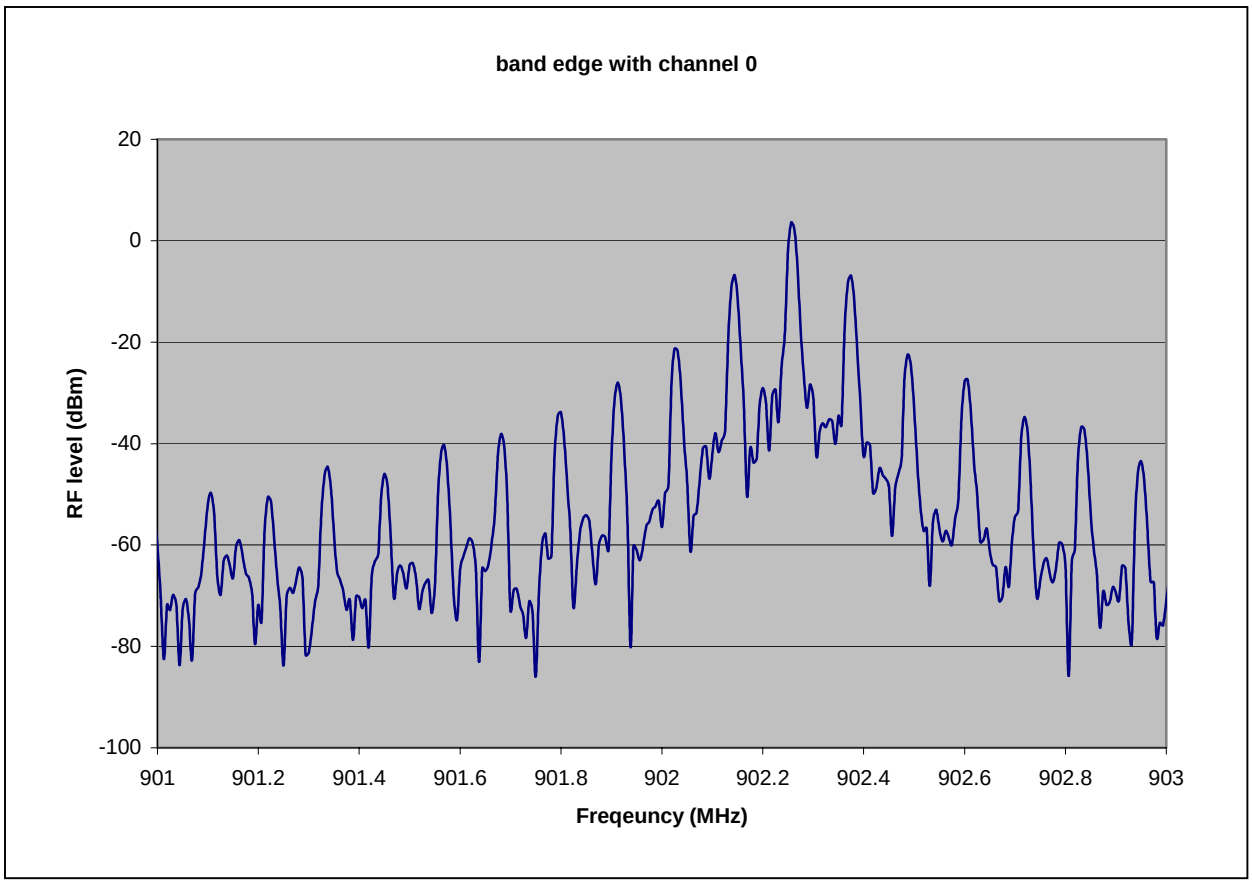
15.247 (c) – Band Edge Compliance of RF Conducted Emissions

Test Set Up for lower band edge:

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 902 MHz
Span = 5 MHz
Resolution Bandwidth = 100 kHz
Detector Function = Peak
Trace = Max Hold

Transmit data rate 115 kBps
Radio tuned to channel 0 (902.257 MHz)

Measured Result: level at 902 MHz = 25 dBc



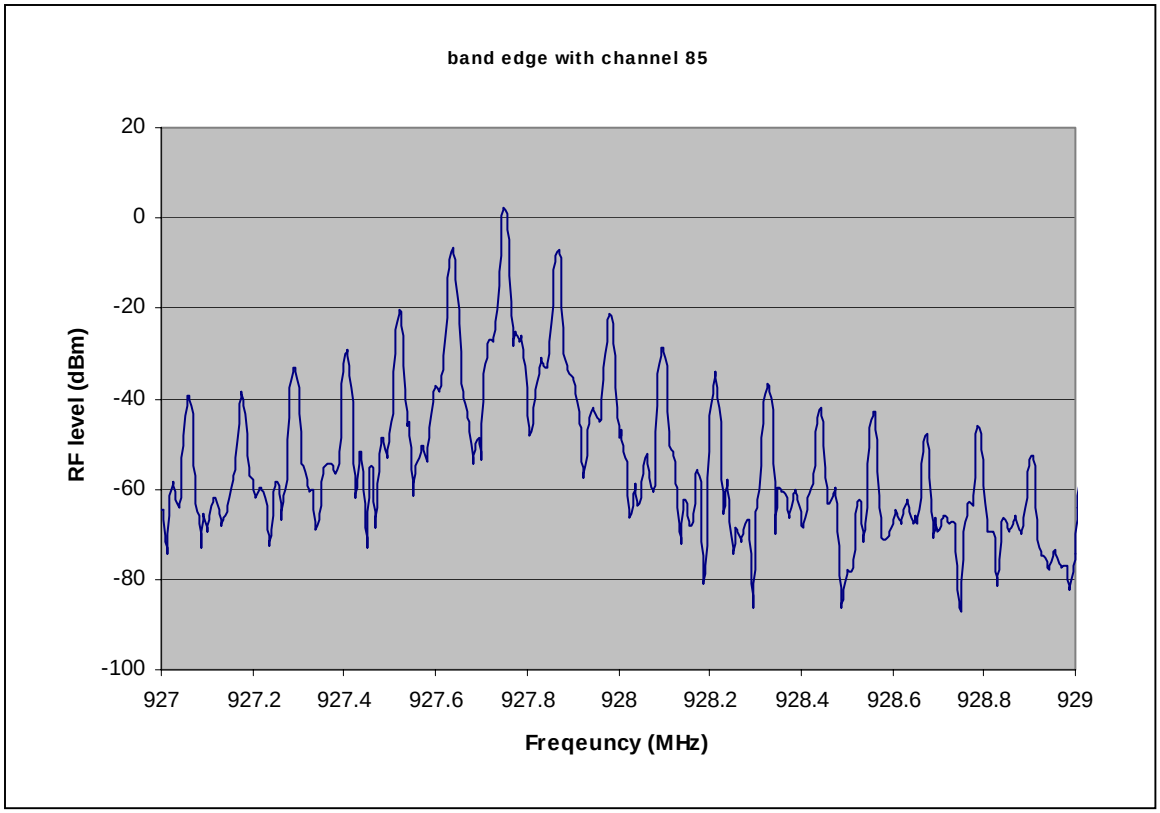
Test Set Up for upper band edge:

Sony/Tektronix WCA-380 Communications System Analyzer (Last Cal: 24 FEB 04)
Center Frequency = 928 MHz
Span = 5 MHz

Resolution Bandwidth = 100 kHz
Detector Function = Peak
Trace = Max Hold

Transmit data rate 115 kBps
Radio tuned to channel 0 (927.750 MHz)

Measured Result: level at 928 MHz = 23 dBc



15.247 (c) – Spurious Conducted Emissions

Test Set Up:

Advantest R3265A Spectrum Analyzer (Last Cal: 6 JUL 04)
Center Frequency = fundamental and harmonics.
Span = 1 MHz
Resolution Bandwidth = 100 kHz
Detector Function = Peak
Trace = Max Hold

Results:

Frequency	RF level	dBc
914	2.7	0
1828	-58	60.7
2742	-69	71.7
3656	-64	66.7
4570	-75	77.7
5484	-90	92.7
6398	-98	100.7
7312	-98	100.7
8226	n/a	
9140	n/a	

15.247 (c) – Spurious Radiated Emissions:

Reference open range report from Smith Labs.

15.247 (g) -- Compliance With FHSS Definition:

The Crystal 20 patient unit and Crystal 20 base station meet the frequency hopping definition of section 15.247 (a)(1)(i) by the following:

- The 20 dB bandwidth of the hopping channel is 387 kHz. Requirement is for bandwidth > 250 kHz and < 500 kHz.
- The system uses 25 hopping channels. Requirement is for 25 minimum channels.
- 300 kHz separates the frequency channels. Requirement is for channel separation of at least 250 kHz.
- The system receivers have a 3 dB IF bandwidth of 330 kHz. The requirement is that the receive bandwidth match the channel bandwidth.
- On each hop transmission, the data portion of the transmission is 16 mSec long and the acknowledge portion of the packet is 2 mSec long. Only one data/ACQ transmission on each hop channel in sequence. The hop channels are used in order 1,2,3,……25,1,2,3…..etc. The requirement is that 1) the frequencies are

used equally, 2) the time of occupancy is less than 400 mSec in any 10 second period.

- The system hopping rate is 20 mSec. Both the base transceiver and the patient transceiver change frequencies at this rate. The requirement is that the system will hop to channel to channel frequencies at the system hopping rate.

15.247 (h) -- Incorporation Of Intelligence Between Radios:

Each Crystal 20 patient unit and Crystal 20 base station communicate directly to each other. There is no provision in the software to have base stations coordinate transmission channels with other units in real time. Any collisions are managed by repeating the data on the next channel in the hopping list.

Installation/Operation Manual Requirements

SMITH ELECTRONICS, INC.
ELECTROMAGNETIC COMPATIBILITY LABORATORIES

RADIO-FREQUENCY EMISSIONS TEST REPORT

FOR

CLEVELAND MEDICAL DEVICES, INC.

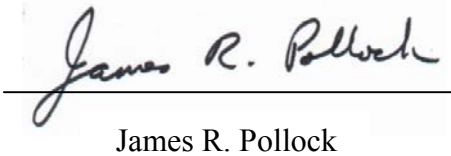
Frequency Hopping Transceiver
FCC ID: N9Y0087

Trade Names:

Clevelabs
BioRadio 150
Crystal 20 - 900
Crystal 20S - 900
Crystal 20E - 900

October 26, 2004

Prepared by:



James R. Pollock

Prepared for:

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RESTRICTED BAND EMISSIONS MEASUREMENTS

INTRODUCTION:

The BioRadio 150, *et al.*, transceiver (EUT) was tested in the frequency-hopping mode to determine that any emissions in the restricted bands of 15.205 were compliant with the requirements.

MEASUREMENT PROCEDURE:

The basic procedures of ANSI C63.4-1992 were followed except as noted. Measurement of frequencies below 1000 MHz was made at a 3 meter distance on the Smith Electronics, Inc. open area test site. A description of this site is on file with the FCC. Measurement of frequencies above 1000 MHz was made at a distance of 0.5 m in a shielded room to attain the required sensitivity. Radio-frequency absorbing material was placed behind the EUT to reduce the effect of any reflections. The battery powered EUT was placed on a turntable in the upright position which was the orientation of maximum emissions for the harmonic frequencies. A pulse-ox sensor was connected to the EUT. The EUT was rotated during the test procedure, but due to the close spacing, the antenna elevation was not performed. The test set-up is shown in Pictorial 1.

The frequency range between 30 MHz and 1000 MHz was scanned in the non-hopping mode and no emissions other than the signal were observed. This range was not further examined in the hopping mode.

For each of the restricted bands that contained a harmonic emission, an analyzer scan was made using a 1 MHz resolution bandwidth. If a signal or the noise level was above the limit for that frequency range, another scan was made with an average bandwidth narrow enough to reduce the noise below the limit. The bandwidth was chosen as a compromise between noise level and sweep speed and was typically 1 kHz.

All measured signals with the EUT in the hopping mode were compared to the restricted band limits. The change in measurement distance was accounted for by using an inverse distance relationship and increasing the limit by the ratio of the limit distance and the measurement distance. Since the measurement distance was 0.5 m and the limit distance 3 m, the 3 m limit was multiplied by 6.

Only a third harmonic signal was observed in a restricted band. The two plots made of this signal are found in Fig. 1. The signal data of this harmonic and the noise floor data of the other restricted bands is found in Table 1.

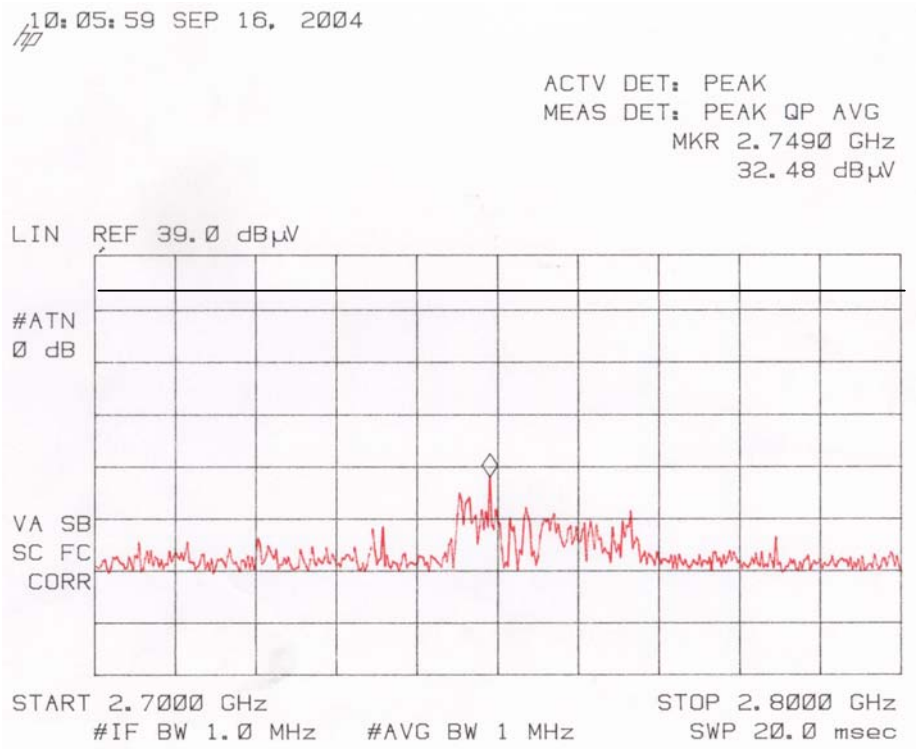
TEST RESULTS:

With the EUT in the hopping mode, only one signal other than the transmitted signal was observed in a restricted band. The third harmonic signal was observed in the restricted band of 2655 MHz to 2900 MHz. The analyzer plot of this signal is seen in Fig. 1. The signal and noise levels found in the restricted bands containing harmonic frequencies are found in Table 1. No harmonic signal greater than the 15.102 limit was found in the restricted bands, and the EUT is in compliance with the requirements of 15.102.

TABLE 1

RESTRICTEDBAND EMISSIONS
Cleveland Medical Devices Transceiver
FCC ID: N9Y0087

Restricted Band Freq. (GHz)*	Avg. BW (MHz)	Value (dBuV) @ 0.5 m.	AF (dB)	CL (dB)	Field Strength (dBuV/m)	Field Strength (uV/m)	Limit (uV/m)	dB / Limit
2.655 – 2.900	Pk 1.0	32.5	30.0	0.5	63.0	1,412	3,000	-6.5
	Av .001	28.5	30.0	0.5	59.0	891	3,000	-10.5
3.6 – 4.4	Pk 1.0	≤29.7	32.9	0.6	63.2	1,445	3,000	-6.3
4.5 – 5.15	Pk 1.0	≤29.6	33.0	0.7	63.3	1,462	3,500	-6.2
5.35 – 5.46	Pk 1.0	≤29.6	36.2	0.7	66.5	2,113	3,000	-3.0
7.25 – 7.75	Pk 1.0	≤38.1	37.4	0.9	76.4	6,607	3,000	+6.9
	Av .001	≤25.8	37.4	0.9	64.1	1,603	3,000	-5.4
8.025 – 8.5	Pk 1.0	≤38.2	38.1	0.9	77.2	7,244	3,000	+7.7
	Av .001	≤25.8	38.1	0.9	64.8	1,738	3,000	-4.7
9.0 – 9.2	Pk 1.0	≤37.5	38.4	1.0	76.9	6,998	3,000	+7.4
9.3 – 9.5	Av .001	≤24.9	38.4	1.0	64.3	1,641	3,000	-5.2



Limit = 39 dB

Limit = 39 dB

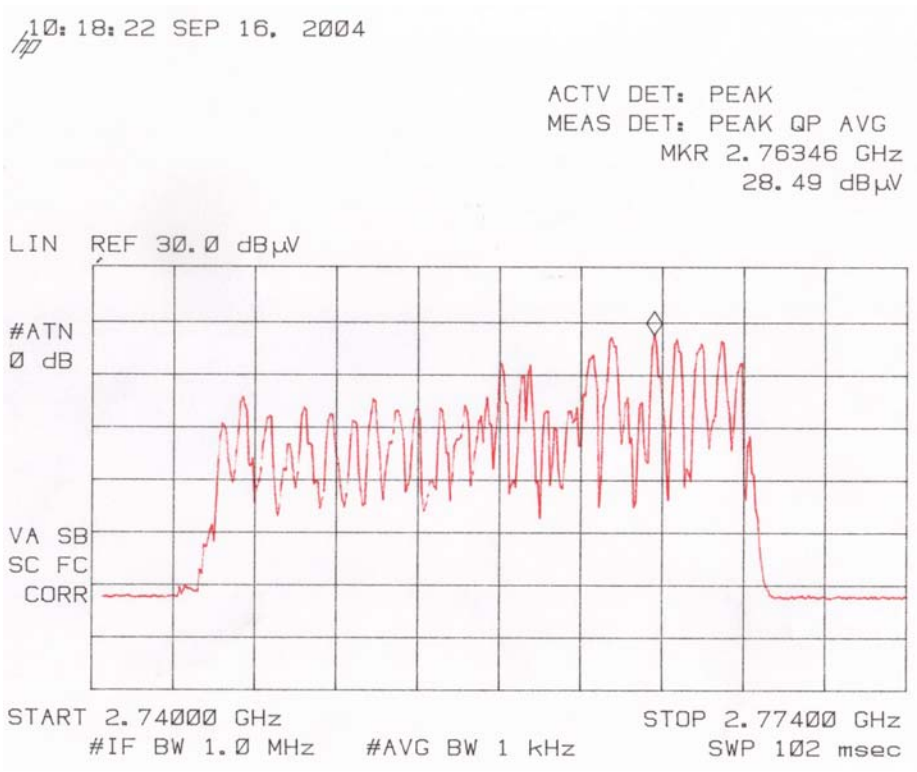


Fig. 1
N9Y0087 Transceiver
Restricted Band Emissions
2.655 GHZ – 2.900 GHz

Pictorial 1
N9Y0087 Test Set-up
Restricted Band Emissions

METHOD OF CALCULATION

Signal strength readings were made in units of dBuV from the spectrum analyzer. To these values an antenna factor in dB and a coax loss factor in dB were added to arrive at a field strength in dBuV/m at the measurement distance. This value is converted to

field strength in uV/m and compared to the limit corrected for distance. An inverse distance correction factor was used to convert limit values from one distance to another.

SAMPLE CALCULATION

From Table 1 in the 2655 – 2900 MHz band, an average measured value at 0.5 m of
28.5 dBuV is added to the antenna factor (30.0 dB) and coax factor (0.5 dB) to arrive at a field strength of 59.0 dBuV/m.

$$28.5 + 30.0 + 0.5 = 59.0 \text{ dBuV/m}$$

To convert dBuV/m to uV/m use the following equation:

$$\text{uV/m} = 10^{(59.0/20)} = 891 \text{ uV/m at 0.5 meter}$$

As the test limit at this frequency is 500 uV/m at 3 meters, the field strength could be divided by six to adjust to the 3 m distance. Conversely, the limit can be multiplied by six for the adjustment. For the purposes of this report, the limit values have been multiplied to account for the different distances. For the 0.5 meter distance, the limit was multiplied by six to adjust to the equivalent 3 meter distance.

891 uV/m is 10.5 dB below the 0.5 m limit of 3000 uV/m

SMITH ELECTRONICS, INC.
ELECTROMAGNETIC COMPATIBILITY LABORATORIES

RADIO-FREQUENCY EMISSIONS TEST REPORT
FOR

CLEVELAND MEDICAL DEVICES, INC.

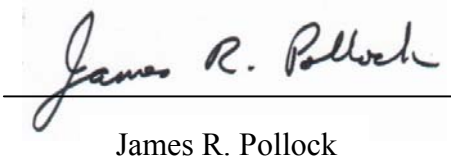
Transceiver
FCC ID: N9Y0087

Trade Names:

Clevelabs
BioRadio 150
Crystal 20 - 900
Crystal 20S - 900
Crystal 20E - 900

October 20, 2004

Prepared by:



James R. Pollock

Prepared for:

Cleveland Medical Devices, Inc.
4415 Euclid Ave. Suite 409
Cleveland, OH 44103

Smith Electronics, Inc.
8200 Snowville Road
Brecksville, OH 44141
Phone: (440) 526-4386
Fax: (440) 526-9205

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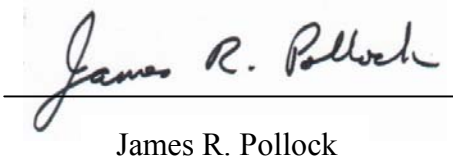
CERTIFICATE OF COMPLIANCE

1.	Manufacturer:	Cleveland Medical Devices, Inc. 4415 Euclid Ave. Suite 409 Cleveland, OH 44103
2.	Contact:	Warren Bendler Cleveland Medical Devices, Inc. 216/791-6720 X1106
3.	Regulation:	CFR47 – Part 15 15.249
4.	Measurement Method:	ANSI C63.4-1992
5.	EUT:	Transceiver FCC ID: N9Y0087 See Trade Names on Title Page
6.	Type:	Biomedical Transceiver
7.	Tuned Frequency	902.257 MHz – 927.751 MHz
8.	Test Dates:	Sept. 3, 14, 15, & 16, 2004
9.	Test Location	Smith Electronics, Inc. Test Lab and Open Field Site 8200 Snowville Rd. Brecksville, OH

10. Statement of Compliance:

I hereby certify that measurements of radio frequency emissions from the Cleveland Medical Devices transceiver were performed by me on Sept. 3, 14, 15, & 16, 2004, and that the results of the measurements confirmed that the unit tested is capable of compliance with the above regulation.

October 20, 2004
Date



James R. Pollock

RADIO FREQUENCY EMISSION MEASUREMENTS

OBJECTIVE:

The transmitter emissions were measured in order to show that the emissions from the transmitter are within the requirements of FCC Part 15.249 for equipment of this type. Emissions from the receiver and digital portions of the unit were examined and verified to be within the limits of 15.109(a).

SUMMARY:

The model of the Cleveland Medical Devices, transceiver has been shown to be capable of complying with those requirements of the Federal Communications Commission for a certified intentional radiator under Part 15.249 when set for single frequency and low power.

The measured value closest to the appropriate limit was found at the fundamental of the middle frequency. The margin was 4.0 dB below the limit as seen in Table 2.

The digital device portion of the transceiver should be exempt as a specialized medical device per 15.103(e). The measurements made verify that it is within the requirements for a Class B device.

TEST INFORMATION

EQUIPMENT UNDER TEST	Transceiver See Trade Names on Title Page
MANUFACTURER	Cleveland Medical Devices, Inc. 4415 Euclid Ave. Suite 409 Cleveland, OH 44103
TEST DATES	September 3, 14, 15, & 16, 2004
TEST LABORATORY	Smith Electronics, Inc. 8200 Snowville Rd. Brecksville, OH 44141 (440)526-4386
MEASUREMENT EQUIPMENT	Hewlett-Packard Spectrum Analyzer 8568B with: 85650A RF Section S/N 2216A02120 85662A Display Section S/N 2152A03686 85650A Quasi-Peak Adaptor S/N 2043A00350 Calibrated 7/04
	Hewlett Packard Spectrum Analyzer Model 8593EM S/N 3536A00147 Calibrated 1/04
ANTENNAS	EMCO Biconical Model 3104 Frequency Range 20 – 200 MHz
	EMCO Log-Periodic Model 3146 Frequency Range 200 – 1000 MHz
	Stoddart Tuned Dipole Model 91598-2 Frequency Range 400 – 1000 MHz
	EMCO Double Ridged Guide Horn Model 3115 Frequency Range 1 – 18 GHz
MISCELLANEOUS	Hewlett-Packard Preamplifier Model 8447D S/N 1937A03103
	12.2 m RG-214/U coaxial cable
	0.9 m RG-214/U coaxial cable

TEST REPORT

INTRODUCTION

The transceiver (EUT), manufactured by Cleveland Medical Devices, (CMD) is part of a system specifically designed for the transmissions of data from patient sensors. The subject data is FSK modulated onto the transmitted signal, picked up by the "patient unit" transceiver and transferred to the patient unit's host computer for later analysis.

The EUT is battery powered and its transmission frequency can be factory programmed between 902.257 MHz and 927.751 MHz. This report indicates that the emissions of the transmitter are within the limits set by 15.249.

The EUT is also a digital device that, although it would appear to be exempt as a medical device under 15.103(e), has had measurements performed to verify compliance to 15.109(b) as a Class A digital device. The receiver portion has also been verified to meet the requirements of 15.109(a).

RADIATED EMISSIONS

Field strength measurements were performed on the EUT to assure that the radiated emissions were capable of compliance with the requirements of 15.249.

Measurement of the fundamental frequency was performed on the Smith Electronics, Inc., 3 meter open field test site located at 8200 Snowville Road, Brecksville, OH using the procedures of ANSI C63.4-1992. Site attenuation data pertinent to this site is on file with the FCC. A tuned dipole antenna was used with a spectrum analyzer using peak detection.

The harmonic frequencies were measured in an area of the facility free of reflecting surfaces at a test distance of either 1 meter or 0.5 meters. A double ridged wave-guide antenna and a spectrum analyzer were used for these measurements.

Measurements were made on the EUT with a pulse-ox sensor installed and all other input ports of the unit unoccupied.

Measurements were made with the EUT tuned to three frequencies; one at the low end of the tuning range, one at the high end and one in the middle of the range. Tests on the EUT were performed with the unit in three orthogonal orientations. Results of the measurements are found in Tables 1 through 3.

Each of the three tables contains the highest measured data from one of the test frequencies. To save space in the tables, nominal test frequencies were used to the nearest MHz. Table 4 lists each of the actual test frequencies and the nominal frequency used to designate that frequency.

No emissions from the EUT were observed other than the fundamental and its harmonics.

CONCLUSIONS

Based upon the measurements made and reported herein, the Cleveland Medical Devices, Inc. transceiver is found to be capable of complying with the requirements of

Part 15.249 of the FCC Rules and Regulations when operated in a manner consistent with its intended use and purpose.

METHOD OF CALCULATION

Signal strength readings were made in units of dBuV from the spectrum analyzer. To these values an antenna factor in dB and a coax loss factor in dB were added to arrive at a field strength in dBuV/m at the measurement distance. This value is converted to field strength in uV/m and compared to the limit corrected for distance. An inverse distance correction factor was used to convert limit values from one distance to another.

SAMPLE CALCULATION

From Table 2 at 1830 MHz, a measured value at one meter of 25.2 dBuV is added to the antenna factor (27.5 dB) and coax factor (0.4 dB) to arrive at a field strength of 53.1 dBuV/m.

$$25.2 + 27.5 + 0.4 = 53.1 \text{ dBuV/m}$$

To convert dBuV/m to uV/m use the following equation:

$$\text{uV/m} = 10^{(53.1/20)} = 452 \text{ uV/m at 1 meter}$$

As the test limit at this frequency is 500 uV/m at 3 meters, the field strength could be divided by three to adjust to the 3 m distance. Conversely, the limit can be multiplied by three for the adjustment. For the purposes of this report, the limit values have been multiplied to account for the different distances. For the 1 meter measurement distance, the limit was multiplied by three. For the 0.5 meter distance, the limit was multiplied by six to adjust to the equivalent 3 meter distance.

452 uV/m is 10.4 dB below the 1 m limit of 1500 uV/m

TABLE 1

FUNDAMENTAL AND SPURIOUS EMISSIONS
Cleveland Medical Devices Transceiver
TUNED TO 902.257 MHz

Nom. Freq. (MHz)*	Value (dBuV) @ Dist.	AF (dB)	CL (dB)	Field Strength (dBuV/m)	(uV/m)	Limit (uV/m)	dB / Limit
902	58.7 @3m	28.9	1.7	89.3	29,174	50,000	-4.7
1805	26.5 @1m	27.3	0.4	54.2	513	1,500	-9.3
2707	≤18.6 @1m	30.0	0.5	49.1	285	1,500	-14.4
3609	≤18.7 @1m	32.5	0.6	51.8	389	1,500	-11.7
4511	≤18.6 @1m	32.7	0.6	51.9	394	1,500	-11.6
5414	≤18.6 @1m	35.8	0.7	55.1	569	1,500	-8.4
6316	≤18.4 @1m	35.5	0.8	54.7	543	1,500	-8.8
7218	≤26.2 @0.5m	37.1	0.9	64.2	1,622	3,000	-5.3
8120	≤26.7 @0.5m	38.1	0.9	65.7	1,928	3,000	-3.8
9023	≤26.1 @0.5m	38.4	1.0	65.5	1,884	3,000	-4.0

* = Nominal Frequency: For actual frequency see Table 4.
AF = Antenna Factor
CL = Coax Loss Factor

Frequencies below 1 MHz were made with a peak detector. For those above 1 MHz, peak detection was used with a 1 MHz resolution bandwidth. A 3 kHz video bandwidth was used to reduce the instrument noise level. The reduced video bandwidth has no effect on the signal other than to reduce the noise.

TABLE 2

FUNDAMENTAL AND SPURIOUS EMISSIONS
Cleveland Medical Devices Transceiver
TUNED TO 915.154

Nom. Freq. (MHz)*	Value (dBuV) @ Dist.	AF (dB)	CL (dB)	Field Strength (dBuV/m)	(uV/m)	Limit (uV/m)	dB / Limit
915	59.3 @3m	29.0	1.7	90.0	31,623	50,000	-4.0
1830	25.2 @1m	27.5	0.4	53.1	452	1,500	-10.4
2745	≤18.6 @1m	30.0	0.5	49.1	285	1,500	-14.4
3661	≤18.7 @1m	32.7	0.6	52.0	398	1,500	-11.5
4576	≤18.4 @1m	32.8	0.6	51.8	389	1,500	-11.7
5491	≤18.6 @1m	36.2	0.7	55.5	596	1,500	-8.0
6406	≤18.5 @1m	35.5	0.8	54.8	550	1,500	-8.7
7321	≤26.7 @0.5m	37.3	0.9	64.9	1,758	3,000	-4.6
8236	≤26.9 @0.5m	38.1	0.9	65.9	1,972	3,000	-3.6
9152	≤25.8 @0.5m	38.4	1.0	65.2	1,820	3,000	-4.3

* = Nominal Frequency: For actual frequency see Table 4.
AF = Antenna Factor
CL = Coax Loss Factor

Frequencies below 1 MHz were made with a peak detector. For those above 1 MHz, peak detection was used with a 1 MHz resolution bandwidth. A 3 kHz video bandwidth was used to reduce the instrument noise level. The reduced video bandwidth has no effect on the signal other than to reduce the noise.

TABLE 3

FUNDAMENTAL AND SPURIOUS EMISSIONS
Cleveland Medical Devices Transceiver
TUNED TO 927.751 MHz

Nom. Freq. (MHz)*	Value (dBuV) @ Dist.	AF (dB)	CL (dB)	Field Strength (dBuV/m)	(uV/m)	Limit (uV/m)	dB / Limit
927	59.0 @3m	29.2	1.7	89.9	31,260	50,000	-4.1
1855	25.3 @1m	27.9	0.4	53.6	479	1,500	-9.9
2783	≤18.7 @1m	30.0	0.5	49.2	288	1,500	-14.3
3711	≤18.5 @1m	32.9	0.6	52.0	398	1,500	-11.5
4639	≤18.7 @1m	33.0	0.7	52.4	417	1,500	-11.1
5567	≤18.5 @1m	36.1	0.7	55.3	582	1,500	-8.2
6494	≤18.7 @1m	35.6	0.8	55.1	569	1,500	-8.4
7422	≤27.0 @0.5m	37.4	0.9	65.3	1,841	3,000	-4.2
8350	≤26.9 @0.5m	38.1	0.9	65.9	1,972	3,000	-3.6
9278	≤27.1 @0.5m	38.5	1.0	66.6	2,138	3,000	-2.9

* = Nominal Frequency: For actual frequency see Table 4.
AF = Antenna Factor
CL = Coax Loss Factor

Frequencies below 1 MHz were made with a peak detector. For those above 1 MHz, peak detection was used with a 1 MHz resolution bandwidth. A 3 kHz video bandwidth was used to reduce the instrument noise level. The reduced video bandwidth has no effect on the signal other than to reduce the noise.

TABLE 4

NOMINAL FREQUENCY vs. ACTUAL FREQUENCY

LOW RANGE

NOMINAL	ACTUAL
902	902.257
1805	1804.514
2707	2706.771
3609	3609.028
4511	4511.285
5414	5413.542
6316	6315.799
7218	7218.056
8120	8120.313
9023	9022.570

MID RANGE

915	915.154
1830	1830.308
2745	2745.462
3661	3660.616
4576	4575.770
5491	5490.924
6406	6406.078
7321	7321.232
8236	8236.386
9152	9151.540

HIGH RANGE

927	927.751
1855	1855.502
2783	2783.253
3711	3711.004
4639	4638.755
5567	5566.506
6494	6494.257
7422	7422.008
8350	8349.759
9278	9277.510

The unit was also tested laying on its side and back

PICTORIAL 1
Cleveland Medical Devices Transceiver
TYPICAL TEST SET-UP