

TEST REPORT FROM:

COMMUNICATION CERTIFICATION LABORATORY
1940 W. Alexander Street
Salt Lake City, Utah
84119-2039

Type of Report: Certification

TEST OF: CR2

FCC ID: QQ6-CR201

To FCC PART 15.247, Subpart C

Test Report Serial No: 73-7847

Applicant:

Code Corporation
11814 S Election Rd Suite 200
Draper, UT 84020

Date of Test: February 6, 2003

Issue Date: March 6, 2003

Equipment Receipt Date: February 6, 2003

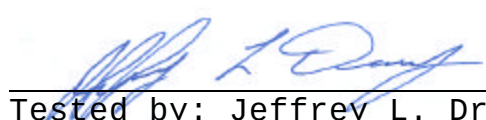
CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Communication Certification Laboratory to determine compliance of the device described below with the requirements of FCC PART 15.247, Subpart C. This report may be reproduced in full, partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: Code Corporation
- Manufacturer: Code Corporation
- Brand Name: Code Reader 2
- Model Number: CR2
- FCC ID: QQ6-CR201

On this 6th day of March 2003, I, individually, and for Communication Certification Laboratory, certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

COMMUNICATION CERTIFICATION LABORATORY



Tested by: Jeffrey L. Draney
EMC Technician

TABLE OF CONTENTS

	<u>PAGE</u>
SECTION 1. CLIENT INFORMATION AND MANUFACTURER:	3
SECTION 2. EQUIPMENT UNDER TEST (EUT)	4
SECTION 3. TEST SPECIFICATION, METHODS & PROCEDURES	7
SECTION 4. OPERATION OF EUT DURING TESTING.	13
SECTION 5. SUMMARY OF TEST RESULTS:	14
SECTION 6. MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS:.....	15
APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT	48
APPENDIX 2 Photographs	56

SECTION 1. CLIENT INFORMATION AND MANUFACTURER:

1.1 Applicant:

Company Name: Code Corporation
11814 S Election Rd Suite 200
Draper, UT 84020

Contact Name: Kevin Marriott
Title: Design Engineer

1.2 Manufacturer:

Company Name: Stars Microelectronics Co. Ltd
586 Moo 2 Bang-Pa In
District EPZ
Ayutthaya 13160
Thailand

SECTION 2. EQUIPMENT UNDER TEST (EUT)**2.1 Identification of EUT:**

Trade Name: Code Corporation
Model Name or Number: CR2
Serial Number: N/A
Options Fitted: None

2.2 Description of EUT:

The CR2 is a handheld barcode reader. The barcode information is transmitted to the host computer through a USB, RS-232 serial, or a Bluetooth radio. The CR2 is powered from a rechargeable battery or through the computers USB port or serial cable (with external power adapter).

This report covers the transmitter only. The receiver and class B computer peripheral are covered under a separate declaration of conformity report.

2.3 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification.

2.4 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test (including inserted cards) are listed below:

Brand Name Model Number	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Code Reader 2 MN: CR2 (1)	QQ6-CR201	Barcode Reader	See Section 2.4.
BN: IBM MN: 2640 SN: 78-BDH00	DoC	Laptop Computer	Parallel/Printer Com1/CR2 (2) USB/CR2 (2)

Note: (1) EUT.

(2) Interface port connected to EUT (See Section 2.5)

The support equipment listed above was not modified in order to achieve compliance with this standard.

2.5 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT.	Cable Descriptions/Length
USB	1	Connected directly to the radio board for control of the transmitter.
Antenna	1	N/A

2.6 List of Channels:

Channel Number	Channel Frequency (MHz)	Channel Number	Channel Frequency (MHz)
1	2402.0	41	2442.0
2	2403.0	42	2443.0
3	2404.0	43	2444.0
4	2405.0	44	2445.0
5	2406.0	45	2446.0
6	2407.0	46	2447.0
7	2408.0	47	2448.0
8	2409.0	48	2449.0
9	2410.0	49	2450.0
10	2411.0	50	2451.0
11	2412.0	51	2452.0
12	2413.0	52	2453.0
13	2414.0	53	2454.0
14	2415.0	54	2455.0
15	2416.0	55	2456.0
16	2417.0	56	2457.0
17	2418.0	57	2458.0
18	2419.0	58	2459.0
19	2420.0	59	2460.0
20	2421.0	60	2461.0
21	2422.0	61	2462.0
22	2423.0	62	2463.0
23	2424.0	63	2464.0
24	2425.0	64	2465.0
25	2426.0	65	2466.0
26	2427.0	66	2467.0
27	2428.0	67	2468.0
28	2429.0	68	2469.0
29	2430.0	69	2470.0
30	2431.0	70	2471.0
31	2432.0	71	2472.0
32	2433.0	72	2473.0
33	2434.0	73	2474.0
34	2435.0	74	2475.0
35	2436.0	75	2476.0
36	2437.0	76	2477.0
37	2438.0	77	2478.0
38	2439.0	78	2479.0
39	2440.0	79	2480.0
40	2441.0		

SECTION 3. TEST SPECIFICATION, METHODS & PROCEDURES**3.1 Test Specification:**

Title: FCC PART 15.247, Subpart C (47 CFR 15).

Limits and methods of measurement of radio interference characteristics of radio frequency devices. Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.

Purpose of Test: The tests were performed to demonstrate Initial compliance.

3.2 Methods & Procedures:**3.2.1 § 15.247**

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.

(2) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

(b) The maximum peak output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

(4) Except as shown in paragraphs (b)(4)(i), (ii), and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (b)(4)(i) and (b)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

(c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

(d) For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to

the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

(e) Reserved

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

3.2.2 § 15.207 Conducted Limits

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this

paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

(b) The shown limit in paragraph (a) of this Section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 uV within the frequency band 535-1705 kHz, as measured using a 50 μ H/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in Section 15.205 and Section 15.209, 15.221, 15.223, 15.225 or 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provision for, the use of battery chargers which permit operating while charging, AC adaptors or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

3.2.3 Test Procedure

The line conducted emissions testing was performed

according to the procedures in ANSI C63.4 (1992). Testing was performed at CCL's Wanship open area test site #2, located at 550 West Wanship Road, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated October 23, 2000 (90504).

The testing was performed according to the procedures in ANSI C63.4 (1992). Radiated testing was performed at CCL's anechoic chamber located in Salt Lake City, Utah. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated March 1, 1999 (31040/SIT).

CCL participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accepted under NVLAP Lab Code:100272-0, which is effective until September 30, 2003.

For radiated emissions testing that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

SECTION 4. OPERATION OF EUT DURING TESTING.**4.1 Operating Environment:**

Power Supply: 120 VAC
AC Mains Frequency: 60 HZ

4.2 Operating Modes:

Each mode of operation was exercised to produce worst-case emissions. The worst-case emissions were with the CR2 running in the following mode. The CR2 was placed in the transmit mode with the same type of modulation that would normally be used during normal operation.

4.3 Configuration & Peripherals:

The CR2 was placed on the table in the transmit mode with the same type of modulation that would normally be used during normal operation.

SECTION 5. SUMMARY OF TEST RESULTS:**5.1 FCC PART 15.247, Subpart C****5.1.1 Summary of Tests:**

Section	Test Performed	Frequency Range (MHz)	Result
15.247 (a)(1)	Hopping Channel Carrier Frequencies	2400 to 2483.5	Complied
15.247 (a)(1)(iii)	Average Time of Occupancy	2400 to 2483.5	Complied
15.247 (a)(1)(iii)	Emission Bandwidth	2400 to 2483.5	Complied
15.247 (b)(1)	Peak Output Power	2400 to 2483.5	Complied
15.247 (C)	Antenna Conducted Spurious Emissions	10 to 25,000	Complied
15.247 (C)	Radiated Spurious Emissions	30 to 25,000	Complied
15.247 (f)	Hybrid Systems	2400 to 2483.5	N/A
15.247 (g)	Channel Use	2400 to 2483.5	Complied
15.247 (h)	Hopping Intelligence	2400 to 2483.5	Complies
15.207	Line Conducted Emissions (Hot Lead to Ground)	0.15 to 30	N/A
15.207	Line Conducted Emissions (Neutral Lead to Ground)	0.15 to 30	N/A

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

SECTION 6. MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS:**6.1 General Comments:**

This section contains the test results only. Details of the test methods used, etc., can be found in Appendix 1 of this report.

6.2 Test Results**6.2.1 § 15.247 (a)(1) pseudorandomly ordered list of hopping frequencies and receiver input bandwidth**

The CR2 is designed to comply with this section; see technical description in manufacturer's Exhibit 12.

**6.2.2 § 15.247 (a)(1) Hopping Channel Carrier Frequencies
§ 15.247 (a)(1)(iii) Number of Hopping Channels**

The CR2 contains a transceiver module that determines the pseudorandom sequence of the hop set in the data mode. The following are two examples of possible 79 channel hopping sequences with channels identified as 1 through 79. The channel numbering scheme starts with channel 2 at 2402 MHz with the 79th channel then appearing at 2480 MHz as channel 80.

Sequence a:

2, 17, 68, 55, 4, 77, 56, 27, 70, 80, 22, 33, 57, 34, 29,
79, 44, 50, 3, 71, 66, 36, 78, 20, 67, 30, 24, 11, 37, 69, 23,
7, 41, 38, 63, 14, 31, 59, 40, 13, 6, 25, 65, 15, 61, 73, 58,
47, 19, 28, 54, 76, 74, 48, 52, 75, 5, 42, 64, 72, 62, 51, 60,
18, 45, 53, 16, 39, 46, 32, 49, 43, 8, 21, 9, 12, 10, 26, 35

Sequence b:

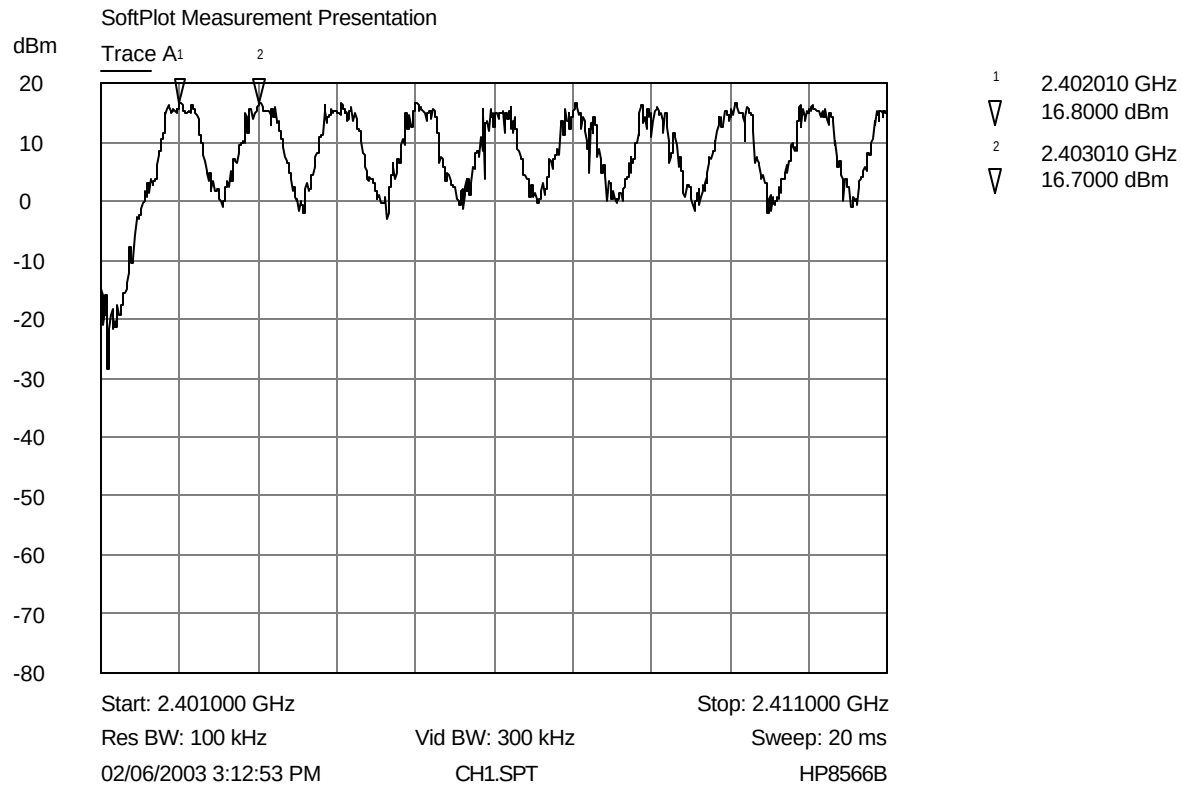
50, 6, 41, 57, 64, 14, 42, 33, 79, 3, 20, 38, 56, 69, 75,
21, 80, 23, 31, 40, 45, 68, 32, 28, 4, 15, 34, 59, 71, 61, 70,
5, 72, 13, 48, 70, 39, 54, 78, 7, 77, 62, 30, 2, 8, 55, 10,
63, 12, 16, 37, 11, 43, 66, 25, 51, 58, 74, 17, 47, 9, 29, 65,
19, 53, 18, 52, 3 6, 27, 26, 44, 22, 49, 24, 35, 60, 73, 76,
67

The pseudorandom sequence is generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage with the result fed back to the input of the first stage. This produces a pseudorandom sequence length of 511 bits. Please see the detailed description in the attached Bluetooth Specification Page 126, Section 11.

COMMUNICATION CERTIFICATION LABORATORY

TEST REPORT: 73-7847
FCC ID: QQ6-CR201
Page 16 of 65

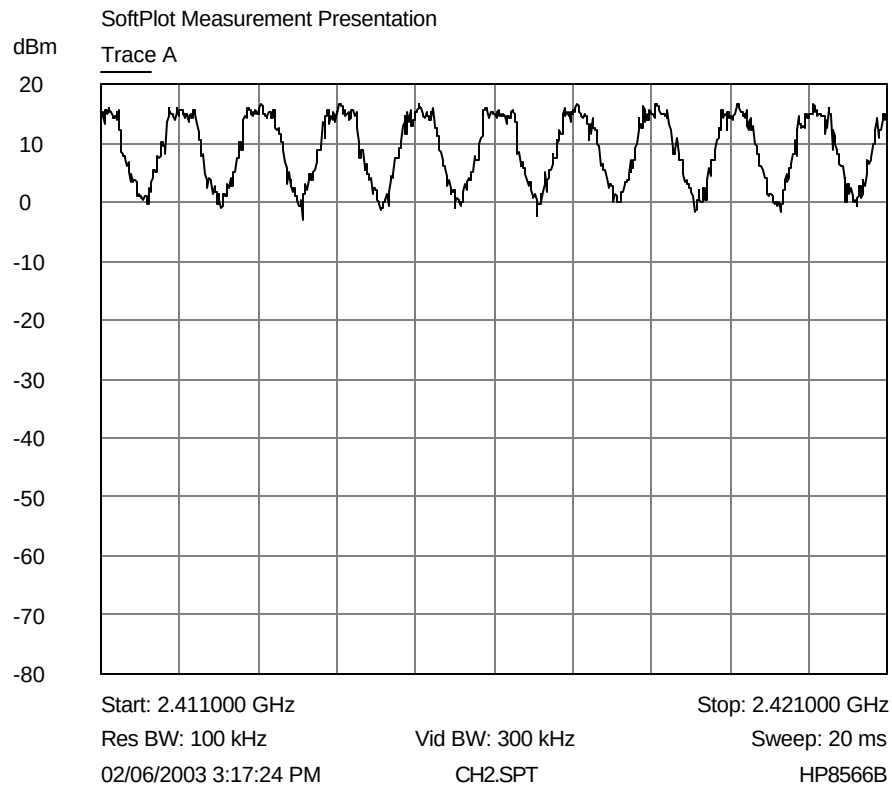
Number of Hopping Channels (Plot 1)



NUMBER OF CHANNEL (PLOT 1)

Trace A COD CORP CR2

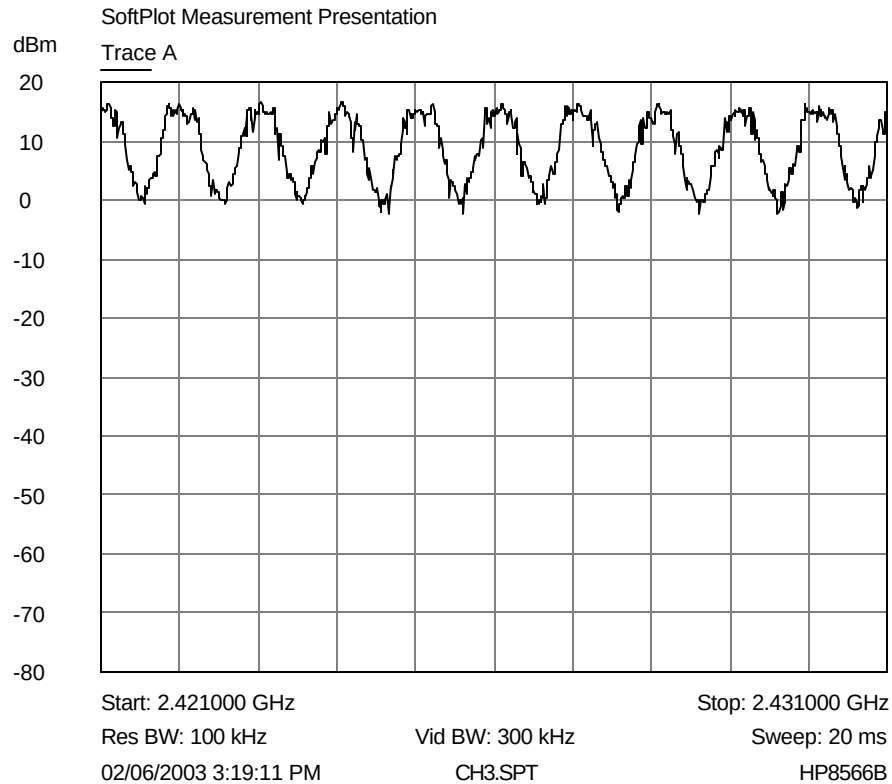
Number of Hopping Channels (Plot 2)



NUMBER OF CHANNEL (PLOT 2)

Trace A COD CORP CR2

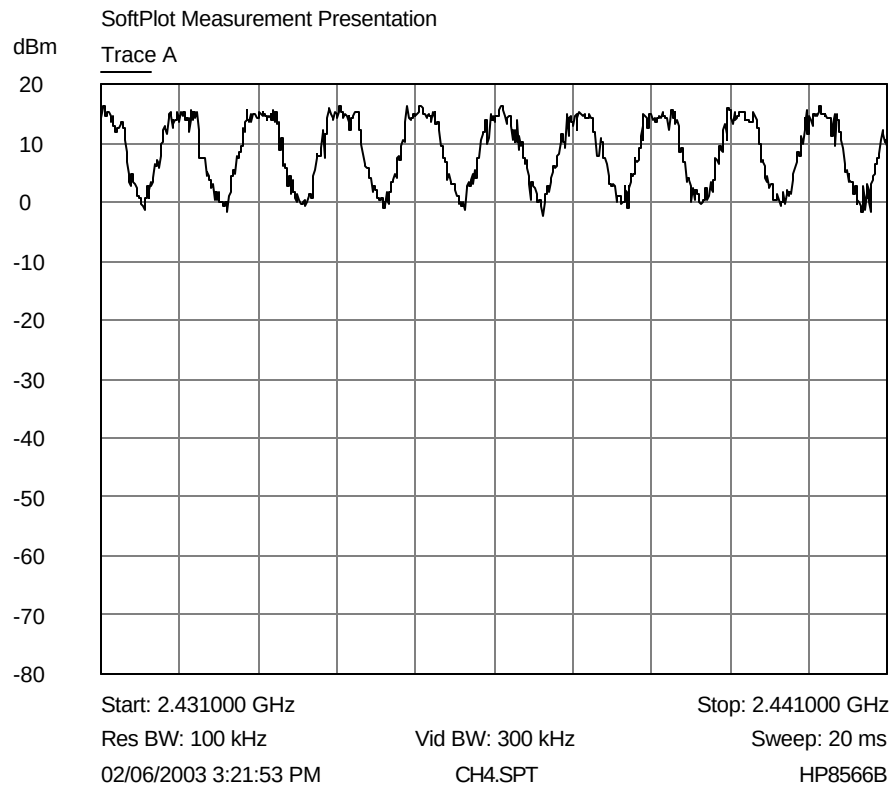
Number of Hopping Channels (Plot 3)



NUMBER OF CHANNEL (PLOT 3)

Trace A COD CORP CR2

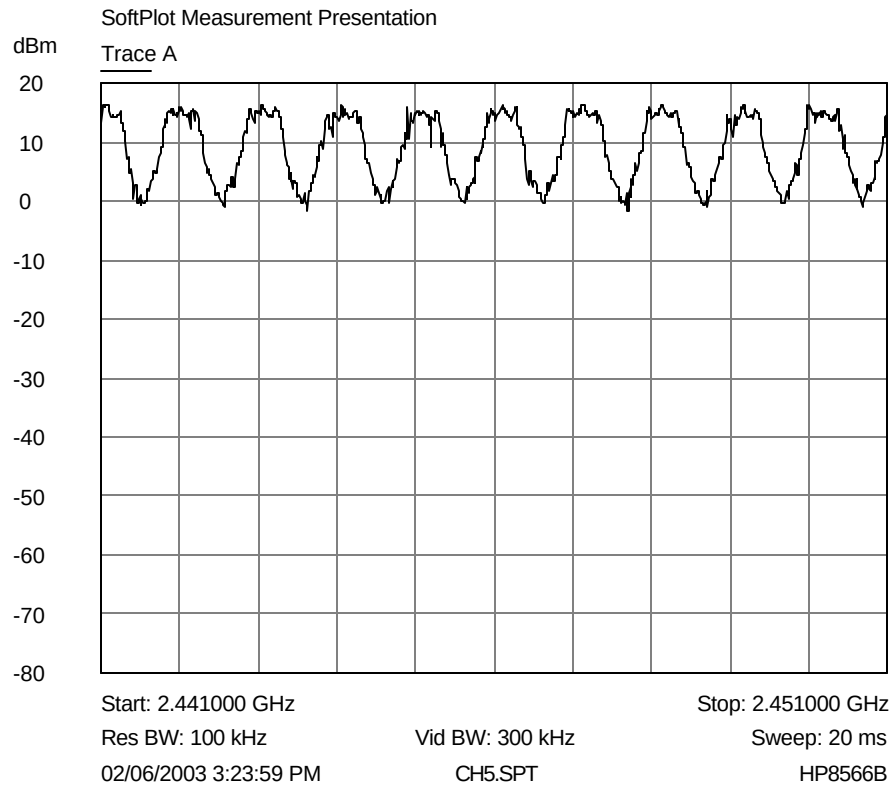
Number of Hopping Channels (Plot 4)



NUMBER OF CHANNEL (PLOT 4)

Trace A COD CORP CR2

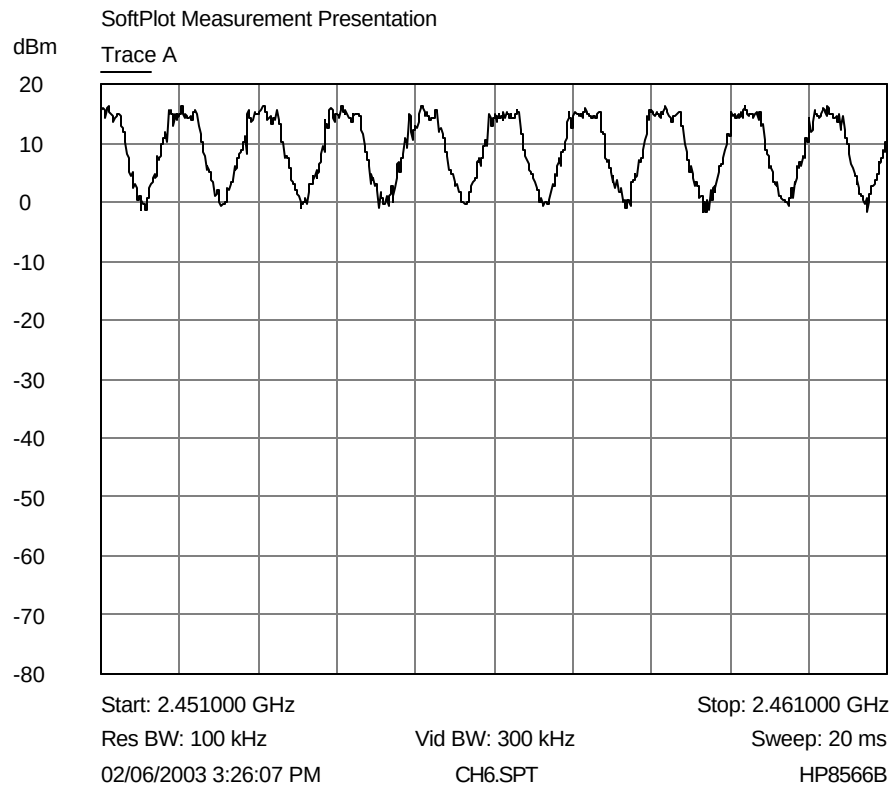
Number of Hopping Channels (Plot 5)



NUMBER OF CHANNEL (PLOT 5)

Trace A COD CORP CR2

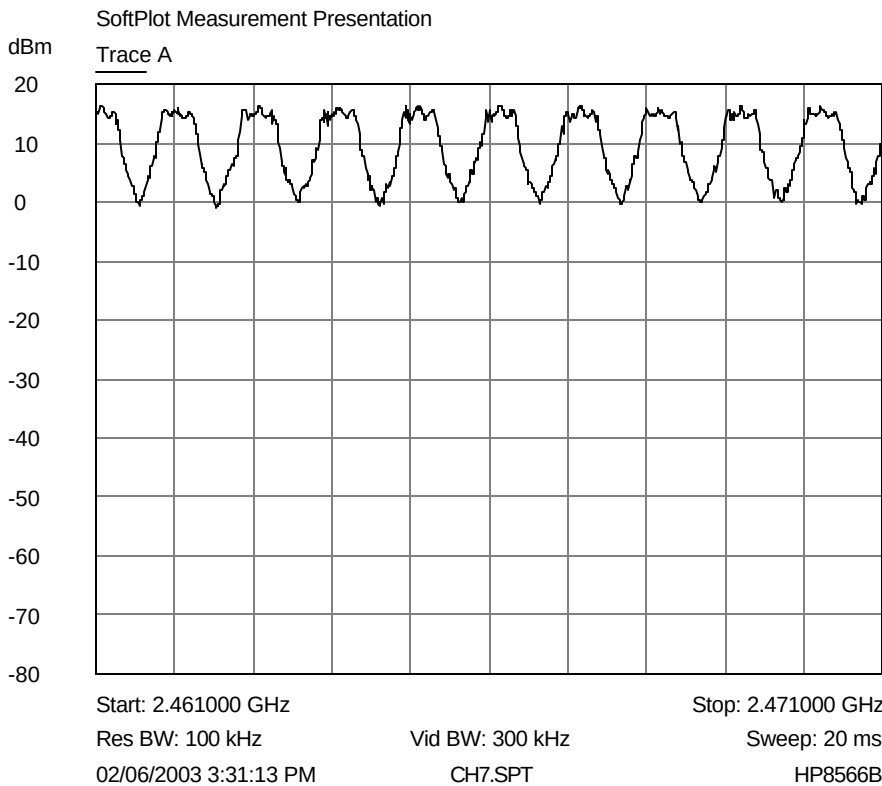
Number of Hopping Channels (Plot 6)



NUMBER OF CHANNEL (PLOT 6)

Trace A COD CORP CR2

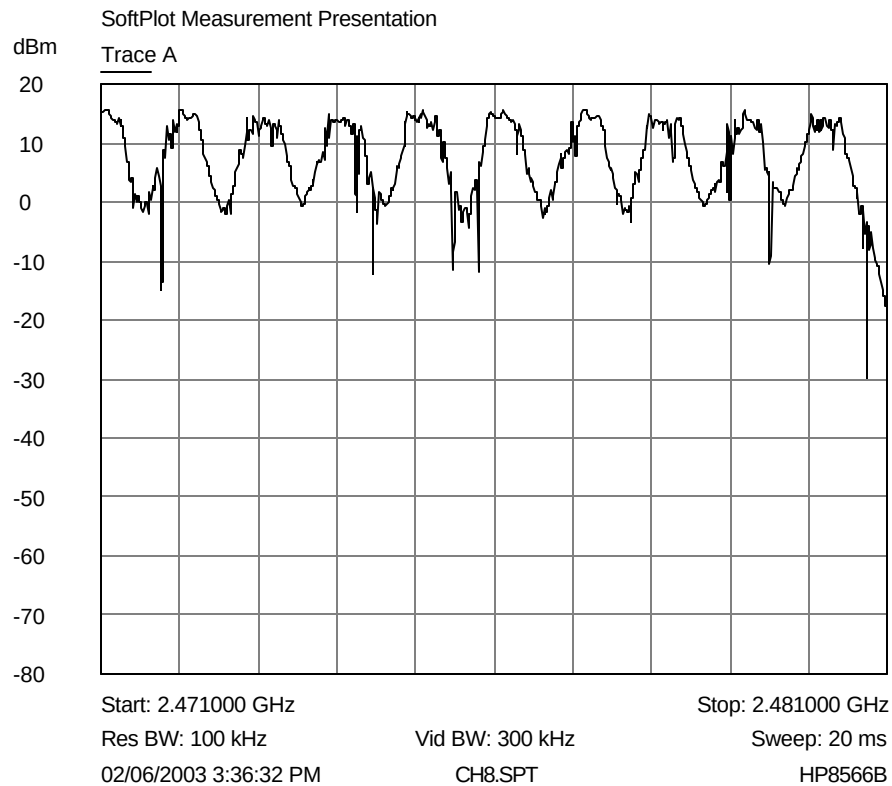
Number of Hopping Channels (Plot 7)



NUMBER OF CHANNEL (PLOT 7)

Trace A COD CORP CR2

Number of Hopping Channels (Plot 8)



NUMBER OF CHANNEL (PLOT 8)

Trace A COD CORP CR2

6.2.3 § 15.247 (a)(1)(iii) Average Time of Occupancy

The CR2 hops 1600 times per second. Since the CR2 uses 79 hopping channels and each channel is used equally (see manufacturer's Exhibit 12), each channel will transmit 20.25 times per second (1600 hops/second divided by 79 channels); therefore, in any 31.6 second period (79×0.4) the channel will transmit 639.9 times. This device only transmits when there is data to be sent and the amount of data to be sent depends on the file size. In the worst-case mode the maximum on time is 440 μ s before it hops to the next channel in its hop list. Therefore, the worst-case time of occupancy in a 31.6 sec span is 281.6 msec (see calculation below).

Hop sequence duration: 49.375 msec (79 channels divided by 1600 hops/second; the time needed to complete a full hop sequence and return to a specific channel)

Number of hops per second: 20.25 (1600 hops/second divided by 79 channels)

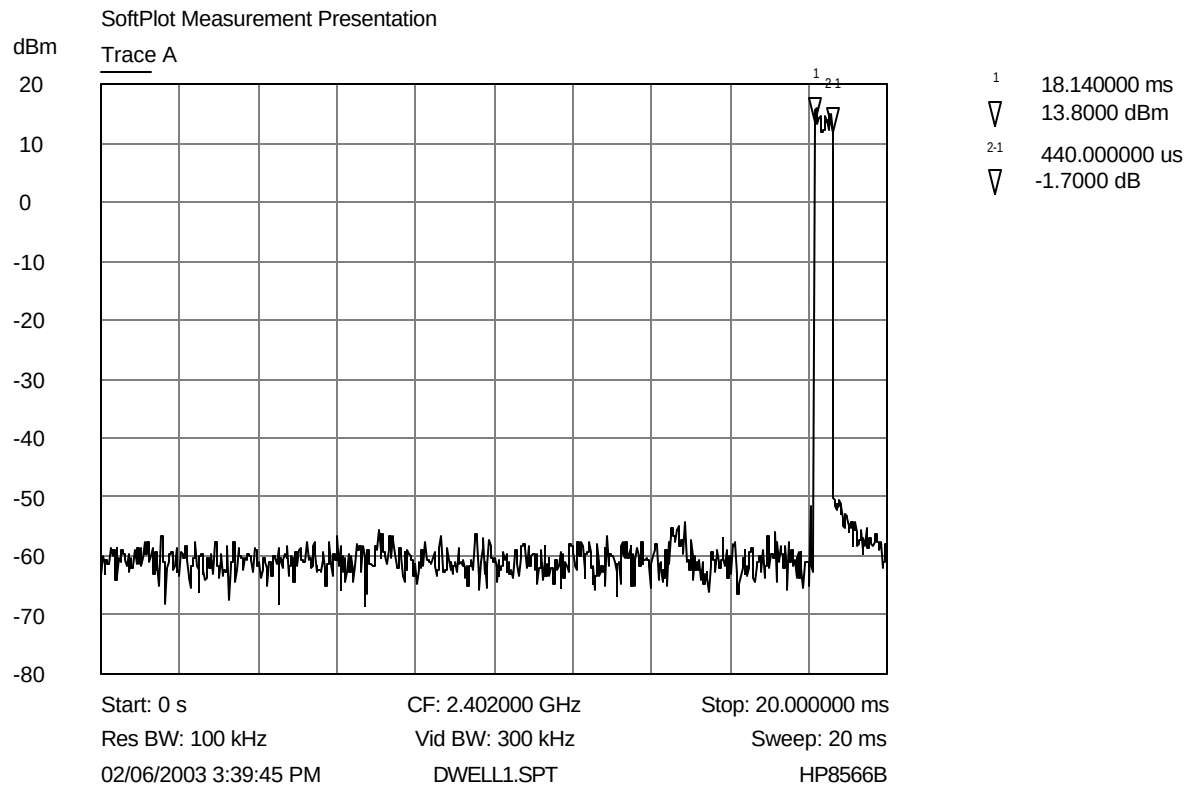
Single Channel hits in 31.6 sec: 639.9 hits (20.25 times 31.6)

Maximum time of single channel occupancy: 440 μ s (see plot below)

Maximum channel time of occupancy: (560 μ sec/hit) $\times$ (639.9 hits per 31.6 sec) = 281.6 msec

The maximum time of occupancy for a particular channel is 281.6 msec in any 31.6 second period, which is less than the 400 msec allowed by the rules; therefore, it meets the requirements of this section.

Time of single channel occupancy



DWELL

Trace A COD CORP CR2

6.2.4 § 15.247 (a)(1)(ii) Emission Bandwidth**Measurement Data:**

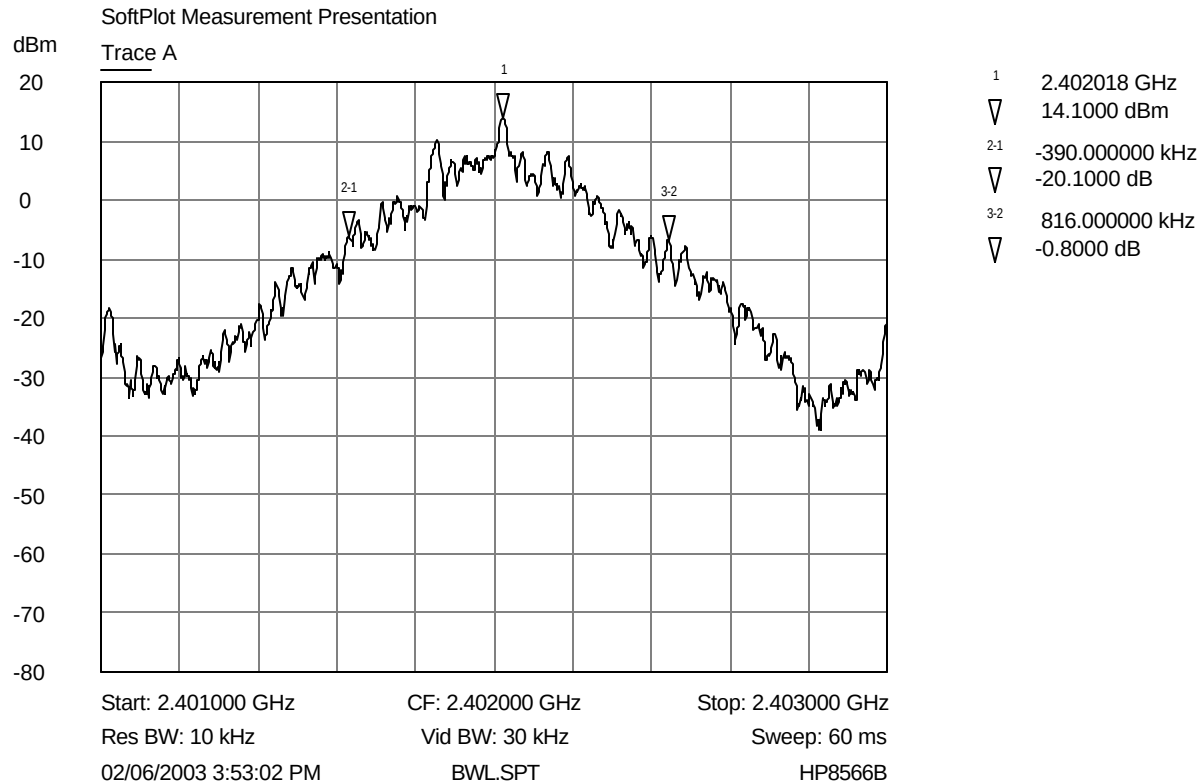
A diagram of the test configuration and the test equipment used is enclosed in Appendix 1.

Frequency (MHz)	Emission Bandwidth (kHz)
2402.0	816.0
2440.0	822.0
2480.0	822.0

RESULT

In the configuration tested, the 20 dB bandwidth was less than 1 MHz; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).

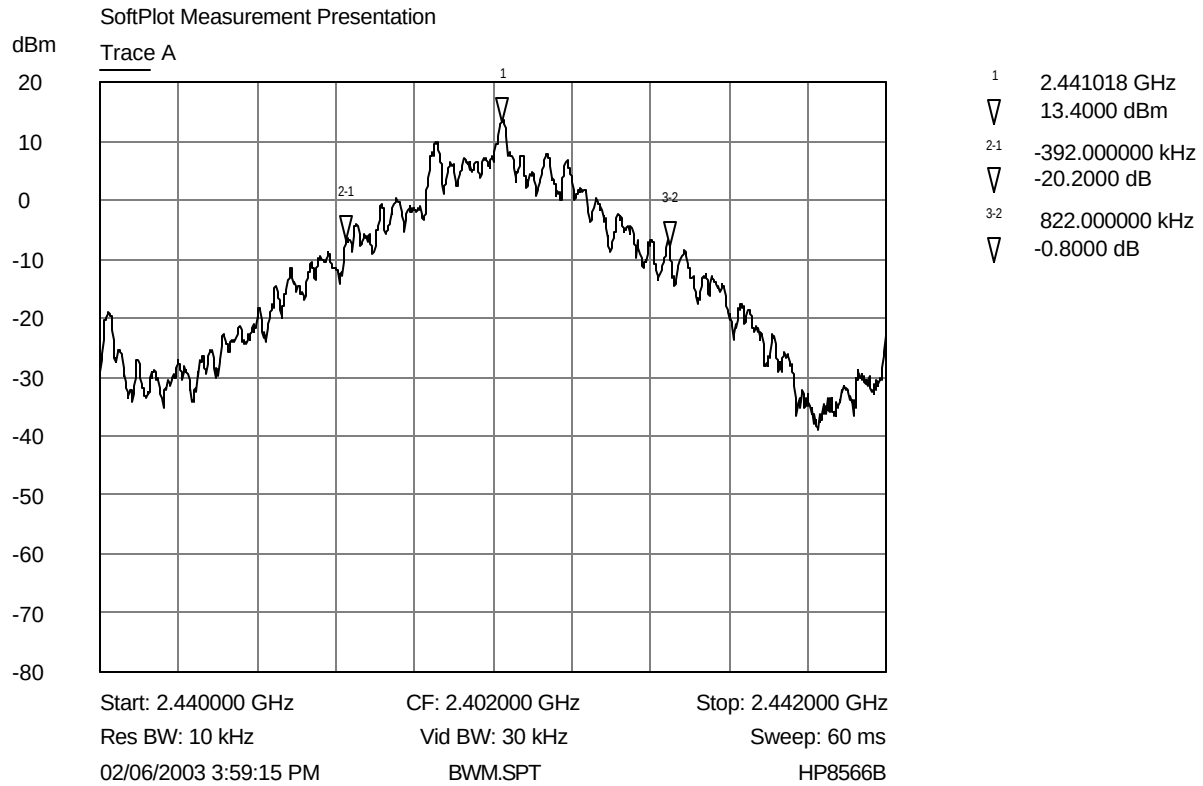
Emission Bandwidth Plot - (Low Channel)



BANDWIDTH PLOT 2402 MHz

Trace A COD CORP CR2

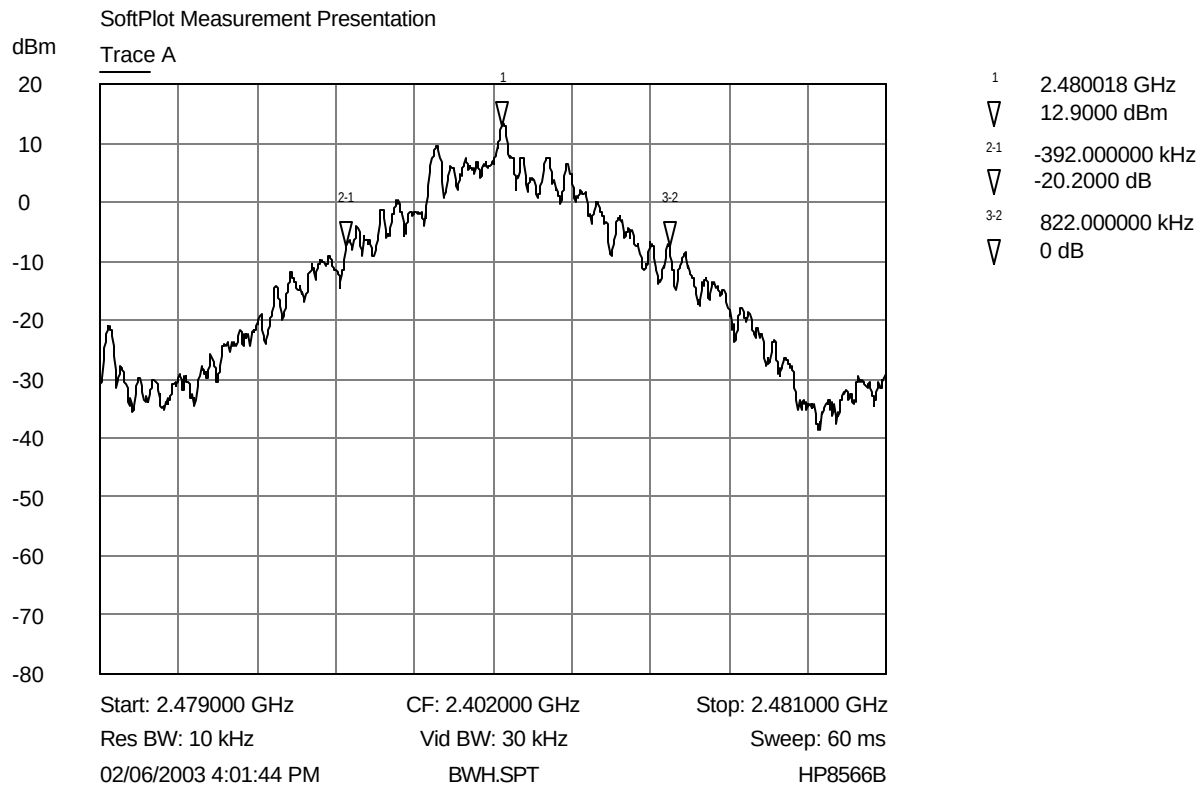
Emission Bandwidth Plot - (Middle Channel)



BANDWIDTH PLOT 2441 MHZ

Trace A COD CORP CR2

Emission Bandwidth Plot - (High Channel)



BANDWIDTH PLOT 2480 MHZ

Trace A COD CORP CR2

6.2.5 § 15.247 (b)(1) Peak Output Power:**Measurement Data:**

The maximum peak RF Conducted output power measured for this device was 1.26 mW or 1.0 dBm. The maximum directional gain of the antenna is less than 6 dBi; therefore, the maximum output power is not required to be reduced from the value measured.

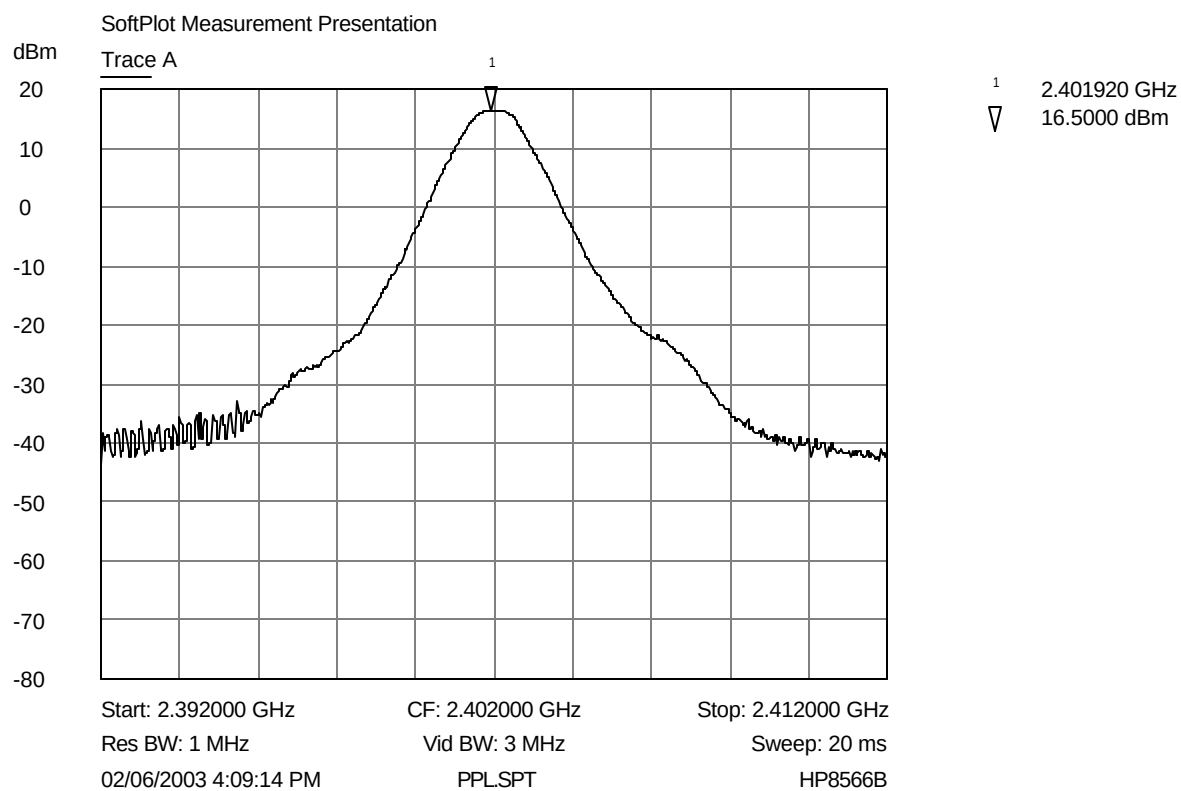
A diagram of the test configuration and the test equipment used is enclosed in Appendix 1.

Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)
2402.0	16.5	44.7
2441.0	16.1	40.7
2480.0	15.9	38.9

RESULT

In the configuration tested, the RF peak output power was less than 1 Watt; therefore, the EUT complied with the requirements of the specification (see spectrum analyzer plots below).

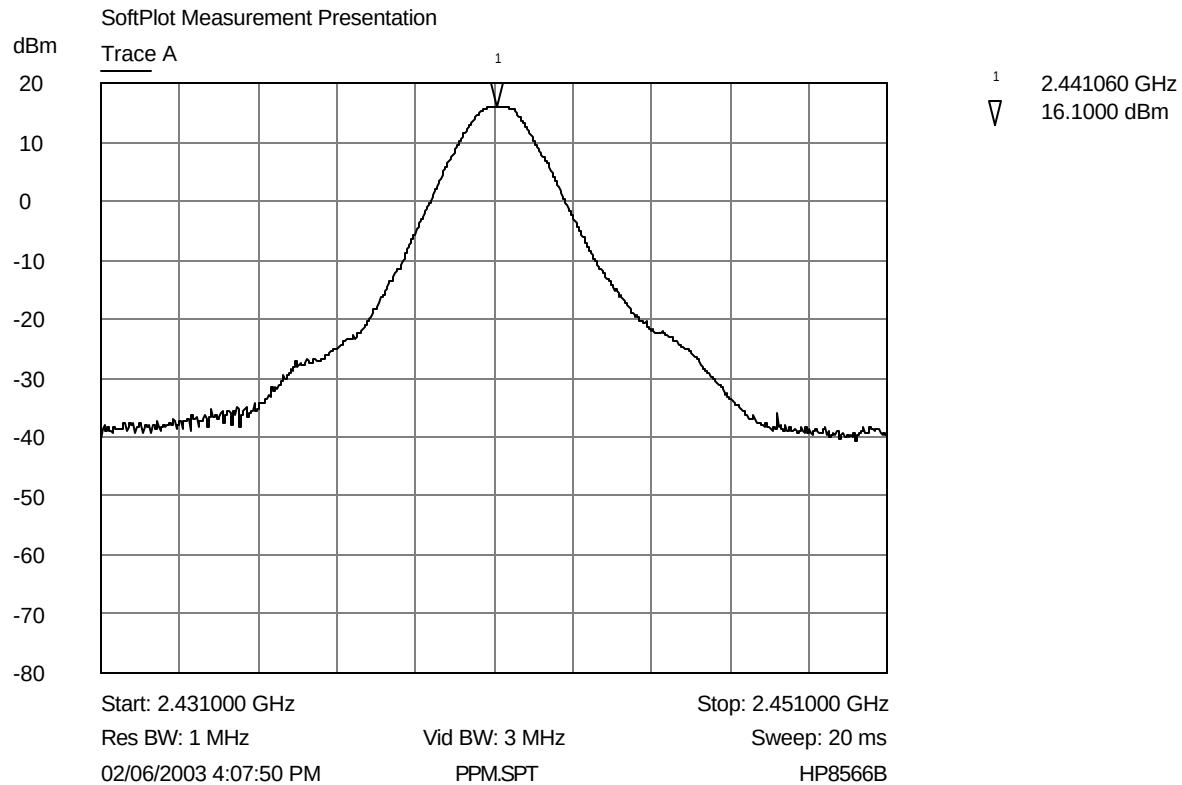
Peak Output Power Plot - (Low Channel)



PEAK POWER 2402 MHZ

Trace A COD CORP CR2

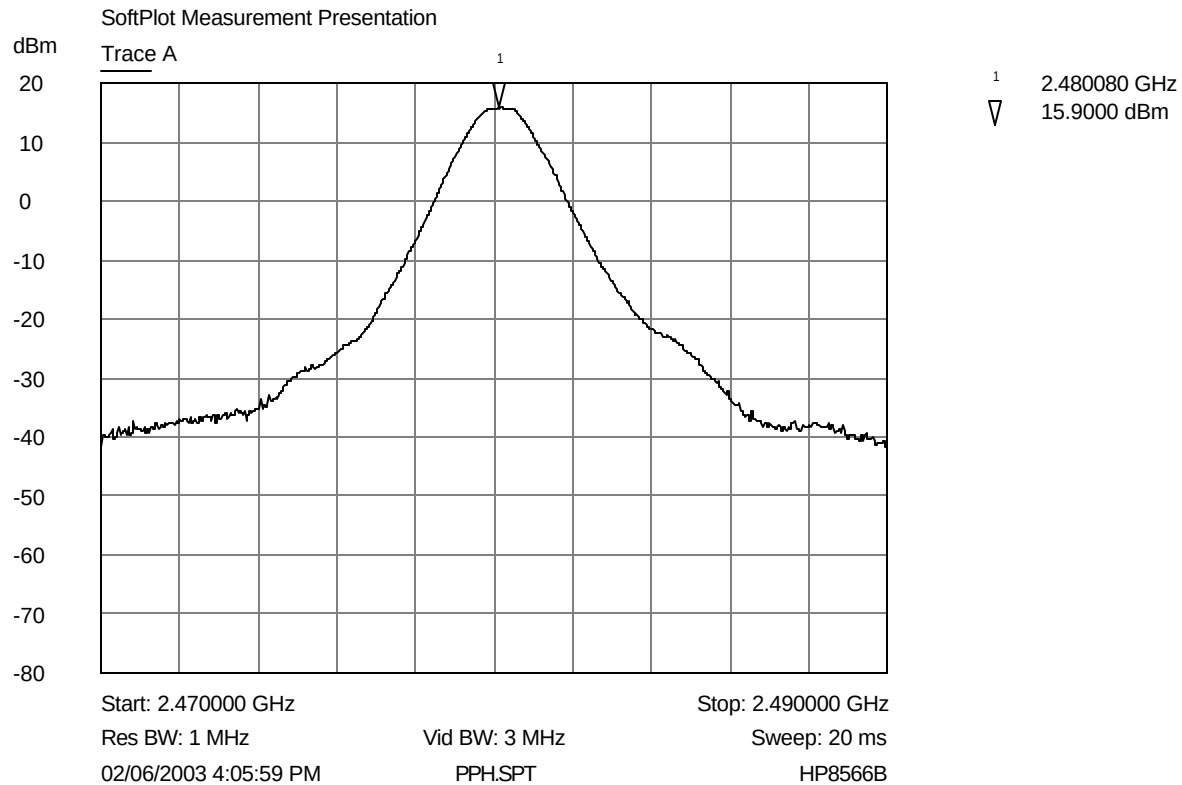
Peak Output Power Plot - (Middle Channel)



PEAK POWER 2441 MHZ

Trace A COD CORP CR2

Peak Output Power Plot - (High Channel)



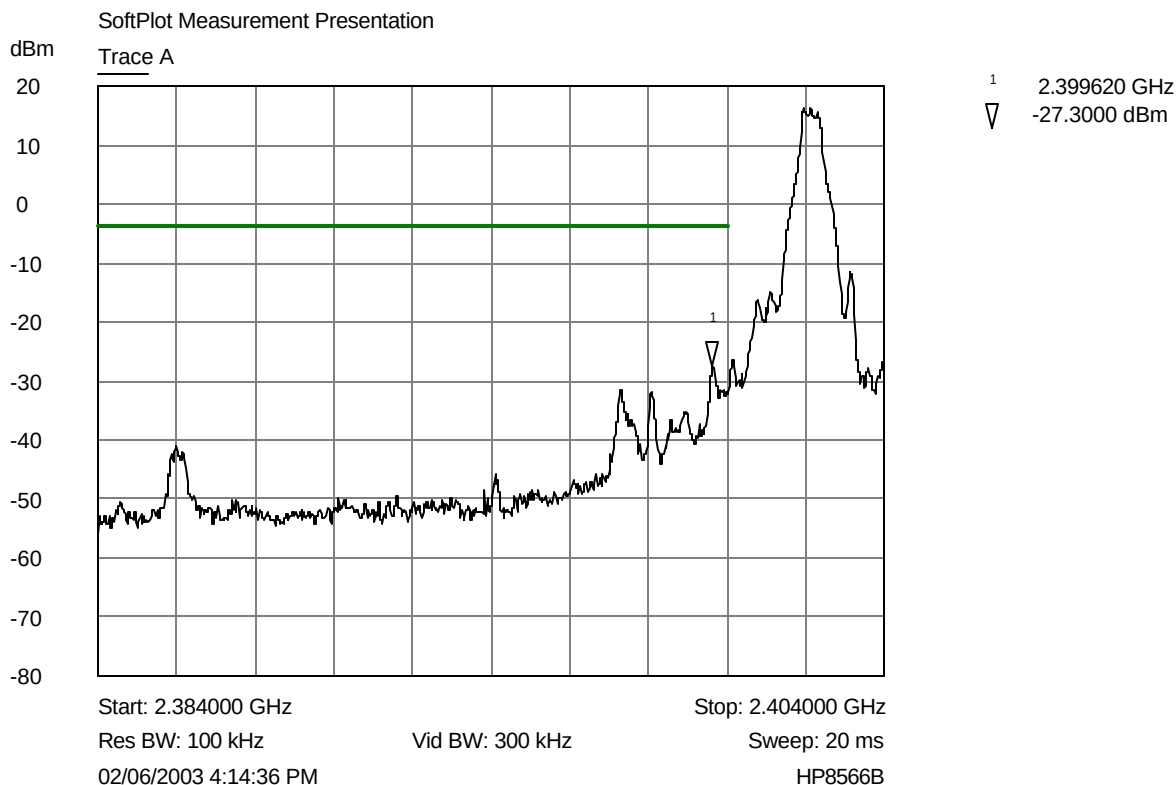
PEAK POWER 2480 MHZ

Trace A COD CORP CR2

6.2.6 § 15.247 (c) Spurious Emissions:**Measurement Data Antenna Conducted Emissions:**

The frequency range from 10 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any antenna-conducted emissions. Shown below are plots with the CR2 tuned to the upper and lower channels. These demonstrate compliance with the provisions of this section.

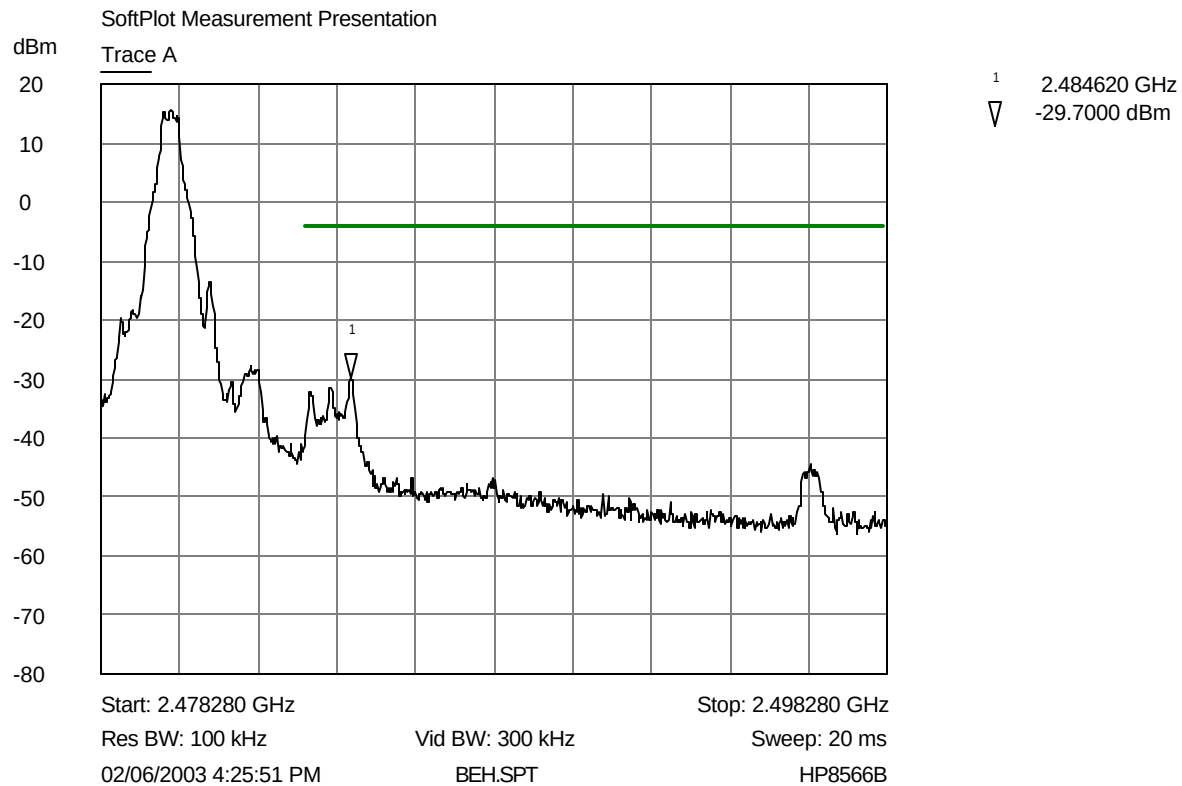
A diagram of the test configuration and the test equipment used is provided in Appendix 1.

Spurious emissions plot (Transmitting at 2402.0 MHz)

BAND EDGE PLOT 2402 MHz

Trace A COD CORP CR2

Spurious emissions plot (Transmitting at 2480.0 MHz)



BAND EDGE PLOT 2480 MHZ

Trace A COD CORP CR2

The emissions must be attenuated 20 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW; the highest level measured with a 100 kHz RBW was 16.5 dBm therefore, the criteria is $16.5 - 20.0 = -3.5$ dBm.

Transmitting at 2402.0 MHz			
Frequency Range MHz	Frequency MHz	Corrected Level dBm	Criteria dBm
10 - 30	12.8	-82.4	-3.5
30 - 200	134.6	-66.3	-3.5
200 - 500	287.0	-43.4	-3.5
500 - 1000	591.0	-34.7	-3.5
1000 - 2000	1796.0	-16.5	-3.5
2000 - 2399.9	2399.9	-28.9	-3.5
2483.6 - 4000	2593.0	-42.7	-3.5
4000 - 6000	4806.0	-51.4	-3.5
6000 - 8000	7206.0	-66.6	-3.5
8000 - 10,000	9616.0	-59.4	-3.5
10,000 - 13,000	12010.0	-77.0*	-3.5
13,000 - 15,000	13796.0	-76.9*	-3.5
15,000 - 18,000	17766.0	-76.5*	-3.5
18,000 - 21,000	20454.0	-72.5*	-3.5
21,000 - 23,000	22418.0	-70.9*	-3.5
23,000 - 25,000	23764.0	-69.9*	-3.5
* Noise Floor			

The emissions must be attenuated 20 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW; the highest level measured with a 100 kHz RBW was 16.1 dBm therefore, the criteria is $16.1 - 20.0 = -3.9$ dBm.

Transmitting at 2440.0 MHz			
Frequency Range MHz	Frequency MHz	Corrected Level dBm	Criteria dBm
10 - 30	26.8	-28.9	-3.9
30 - 200	80.3	-29.3	-3.9
200 - 500	335.9	-52.0	-3.9
500 - 1000	630.0	-37.1	-3.9
1000 - 2000	1856.0	-20.1	-3.9
2000 - 2399.9	2367.1	-59.5	-3.9
2483.6 - 4000	2632.0	-48.9	-3.9
4000 - 6000	4884.0	-71.7	-3.9
6000 - 8000	7326.0	-66.6	-3.9
8000 - 10,000	9764.0	-63.3	-3.9
10,000 - 13,000	12796.0	-78.1*	-3.9
13,000 - 15,000	13840.0	-77.3*	-3.9
15,000 - 18,000	15471.0	-76.6*	-3.9
18,000 - 21,000	20484.0	-72.2*	-3.9
21,000 - 23,000	22450.0	-71.0*	-3.9
23,000 - 25,000	23870.0	-69.5*	-3.9
* Noise Floor			

The emissions must be attenuated 20 dB below the highest power level measured within the authorized band as measured with a 100 kHz RBW; the highest level measured with a 100 kHz RBW was 15.9 dBm therefore, the criteria is $15.9 - 20.0 = -4.1$ dBm.

Transmitting at 2480.0 MHz			
Frequency Range MHz	Frequency MHz	Corrected Level dBm	Criteria dBm
10 - 30	17.8	-82.9	-4.1
30 - 200	198.5	-19.9	-4.1
200 - 500	384.8	-33.1	-4.1
500 - 1000	768.0	-32.7	-4.1
1000 - 2000	1914.0	-16.6	-4.1
2000 - 2399.9	2288.9	-48.4	-4.1
2483.6 - 4000	2484.0	-29.8	-4.1
4000 - 6000	4962.0	-68.1	-4.1
6000 - 8000	7444.0	-69.6	-4.1
8000 - 10,000	9928.0	-66.5	-4.1
10,000 - 13,000	12880.0	-68.5*	-4.1
13,000 - 15,000	13786.0	-66.9*	-4.1
15,000 - 18,000	15396.0	-67.0*	-4.1
18,000 - 21,000	20448.0	-62.8*	-4.1
21,000 - 23,000	21194.0	-61.0*	-4.1
23,000 - 25,000	23526.0	-60.8*	-4.1
* Noise Floor			

Measurement Data Radiated Emissions Restricted Bands § 15.205:

The frequency range from 30 MHz to 25 GHz was investigated to measure any radiated emissions in the restricted bands. Shown below are any emissions that fell into the restricted bands of § 15.205.

A diagram of the test configuration and the test equipment used is enclosed in Appendix 1. For frequencies below 1000 MHz RBW = 100 kHz and VBW = 300 kHz, For frequencies above 1000 MHz RBW = 1 Mhz and VBW = 3 MHz. For average readings the VBW was reduced to 10 Hz.

AVERAGE FACTOR

The CR2 transmits continuously therefore; there is not an average factor for this device.

Vertical Polarity

Transmitting at 2402.0 MHz							
Frequency MHz	Detectio n Mode	Receiver Reading dBμV	Correctio n Factor dB	Average Factor dB	Corrected Reading dBμV/m	Limit dBμV/m	Margin dB
2483.5	P(1)*	9.7	31.5	0.0	41.2	54.0	-12.8
4804.0	P	16.3	37.1	0.0	53.4	74.0	-20.6
4804.0	A	4.9	37.1	0.0	42.0	54.0	-12.0
12,010.0	P*	6.4	45.1	0.0	51.5	74.0	-22.5
12,010.0	A*	-4.2	45.1	0.0	40.9	54.0	-13.1
19,216.0	P*	11.5	50.1	0.0	61.6	74.0	-12.4
19,216.0	A*	1.6	50.1	0.0	51.7	54.0	-2.3

P = Peak Detection
A = Average Detection

* No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer

(1) Peak reading compared to Average Limits

(2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading

Transmitting at 2441.0 MHz							
Frequency MHz	Detectio n Mode	Receiver Reading dBµV	Correctio n Factor dB	Average Factor dB	Corrected Reading dBµV/m	Limit dBµV/m	Margin dB
2483.5	P(1) *	8.0	31.5	0.0	39.5	54.0	-14.5
4882.0	P	23.4	37.2	0.0	60.6	74.0	-13.4
4882.0	A	10.9	37.2	0.0	48.1	54.0	-5.9
7323.0	P	17.0	41.6	0.0	58.6	74.0	-15.4
7323.0	A	6.3	41.6	0.0	47.9	54.0	-6.1
12,205.0	P*	7.3	45.2	0.0	52.5	74.0	-21.5
12,205.0	A*	-4.8	45.2	0.0	40.4	54.0	-13.6
19,528.0	P*	13.5	50.4	0.0	63.9	74.0	-10.1
19,528.0	A*	2.1	50.4	0.0	52.5	54.0	-1.5

P = Peak Detection
A = Average Detection

* No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer

(1) Peak reading compared to Average Limits

(2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading

Transmitting at 2480.0 MHz							
Frequency MHz	Detection Mode	Receiver Reading dBµV	Correction Factor dB	Average Factor dB	Corrected Reading dBµV/m	Limit dBµV/m	Margin DB
2483.5	P	40.1	31.5	0.0	71.6	74.0	-2.4
2483.5	A	7.2	31.5	0.0	38.7	54.0	-15.3
4960.0	P	22.1	37.5	0.0	59.6	74.0	-14.4
4960.0	A	6.7	37.5	0.0	44.2	54.0	-9.8
7440.0	P	18.1	41.7	0.0	59.8	74.0	-14.2
7440.0	A	6.4	41.7	0.0	48.1	54.0	-5.9
12,400.0	P*	7.0	45.4	0.0	52.4	74.0	-21.6
12,400.0	A*	-5.1	45.4	0.0	40.3	54.0	-13.7
19,840.0	P*	12.5	50.6	0.0	63.1	74.0	-10.9
19,840.0	A*	2.0	50.6	0.0	52.6	54.0	-1.4
22,320.0	P(2)*	4.9	52.4	0.0	57.3	74.0	-16.7
22,320.0	A(2)*	-6.8	52.4	0.0	45.6	54.0	-8.4

P = Peak Detection

A = Average Detection

* No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer

(1) Peak reading compared to Average Limits

(2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading

Horizontal Polarity

Transmitting at 2402.0 MHz							
Frequency MHz	Detection Mode	Receiver Reading dBμV	Correction Factor dB	Average Factor dB	Corrected Reading dBμV/m	Limit dBμV/m	Margin dB
2483.5	P(1)*	9.3	31.5	0.0	40.8	54.0	-13.2
4804.0	P	20.1	37.1	0.0	57.2	74.0	-16.8
4804.0	A	9.6	37.1	0.0	46.7	54.0	-7.3
12,010.0	P*	6.3	45.1	0.0	51.4	74.0	-22.6
12,010.0	A*	-4.3	45.1	0.0	40.8	54.0	-13.2
19,216.0	P*	11.7	50.1	0.0	61.8	74.0	-12.2
19,216.0	A*	1.6	50.1	0.0	51.7	54.0	-2.3

P = Peak Detection
A = Average Detection

* No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer

(1) Peak reading compared to Average Limits

(2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading

Transmitting at 2441.0 MHz							
Frequency MHz	Detectio n Mode	Receiver Reading dBµV	Correctio n Factor dB	Average Factor dB	Corrected Reading dBµV/m	Limit dBµV/m	Margin dB
2483.5	P(1)*	8.7	31.5	0.0	40.2	54.0	-13.8
4882.0	P	13.1	37.2	0.0	58.4	74.0	-15.6
4882.0	A	11.0	37.2	0.0	48.2	54.0	-5.8
7323.0	P	15.9	41.6	0.0	57.5	74.0	-16.5
7323.0	A	5.1	41.6	0.0	46.7	54.0	-7.3
12,205.0	P*	7.6	45.2	0.0	52.8	74.0	-21.2
12,205.0	A*	-4.8	45.2	0.0	40.4	54.0	-13.6
19,528.0	P*	13.9	50.4	0.0	64.3	74.0	-9.7
19,528.0	A*	2.1	50.4	0.0	52.5	54.0	-1.5

P = Peak Detection
A = Average Detection

* No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer

(1) Peak reading compared to Average Limits

(2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading

Transmitting at 2480.0 MHz							
Frequency MHz	Detection Mode	Receiver Reading dBμV	Correction Factor dB	Average Factor dB	Corrected Reading dBμV/m	Limit dBμV/m	Margin dB
2483.5	P	40.1	31.5	0.0	71.6	74.0	-2.4
2483.5	A	9.5	31.5	0.0	41.0	54.0	-13.0
4960.0	P	21.9	37.5	0.0	59.4	74.0	-14.6
4960.0	A	9.1	37.5	0.0	46.6	54.0	-7.4
7440.0	P	18.7	41.7	0.0	60.4	74.0	-13.6
7440.0	A	6.4	41.7	0.0	48.1	54.0	-5.9
12,400.0	P*	5.7	45.4	0.0	51.1	54.0	-22.9
12,400.0	A*	-5.1	45.4	0.0	40.3	54.0	-13.7
19,840.0	P*	12.2	50.6	0.0	62.8	74.0	-11.2
19,840.0	A*	2.1	50.6	0.0	52.7	54.0	-1.3
22,320.0	P(2)*	4.2	52.4	0.0	56.6	74.0	-17.4
22,320.0	A(2)*	-6.8	52.4	0.0	45.6	54.0	-8.4
P = Peak Detection A = Average Detection * No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer (1) Peak reading compared to Average Limits (2) No emissions were detected with the antenna 1 meter from the EUT, the indicated readings are the noise floor measurements from the spectrum analyzer and adjusted to a 3 meter reading							

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor), to the measured level from the receiver. The basic equation with a sample calculation is shown below:

$FS = RA + CF - AF$ Where
 FS = Field Strength
 RA = Receiver Amplitude (Receiver Reading - Amplifier Gain)
 CF = Correction Factor (Antenna Factor + Cable Factor)
 AF = Average Factor

RESULT

In the configuration tested, the EUT complied with the

requirements of the specification.

6.2.7 § 15.247 (f) Hybrid System:

N/A.

6.2.7 § 15.247 (g) and § 15.247 (h):

The CR2 is designed to comply with these sections; see technical description in manufacturer's Exhibit 12.

6.2.8 § 15.207 Line Conducted Emissions:

N/A. The CR2 is battery powered when transmitting.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT**FCC Sections 15.247 (a)(1)(iii) Emission Bandwidth**

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

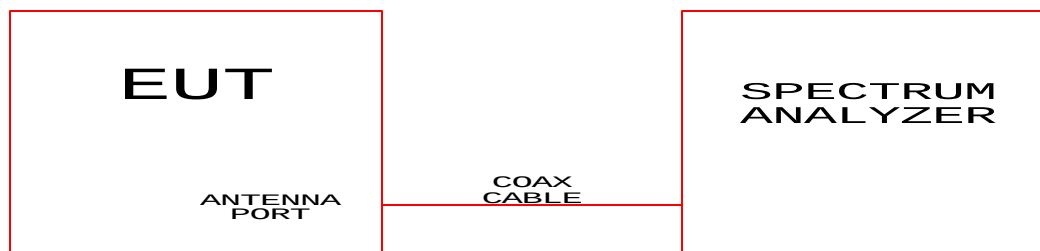
The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

RBW = 10 kHz

VBW = 30 kHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	8565A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

All the equipment listed above is calibrated every 12 months by an independent calibration laboratory or by CCL personal following outlined calibration procedures.

Test Configuration Block Diagram**FCC Sections 15.247 (b)(1) Peak Output Power**

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

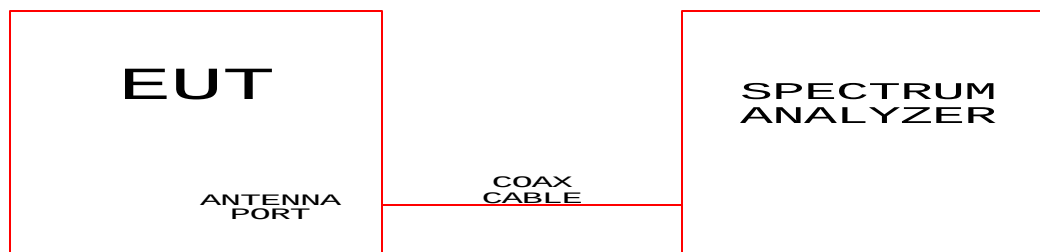
RBW = 3 MHz

VBW = 3 MHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	8565A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

All the equipment listed above is calibrated every 12 months by an independent calibration laboratory or by CCL personal following outlined calibration procedures.

Test Configuration Block Diagram



FCC Sections 15.247 (c) Spurious Emissions**Conducted Spurious Emissions**

The EUT was directly connected to the spectrum analyzer via the antenna output port as shown in the block diagram below.

The measurements were performed on three channels, as per 47 CFR 15.31(m), one near the bottom of the spectrum, one near the middle of the spectrum and one near the top of the spectrum.

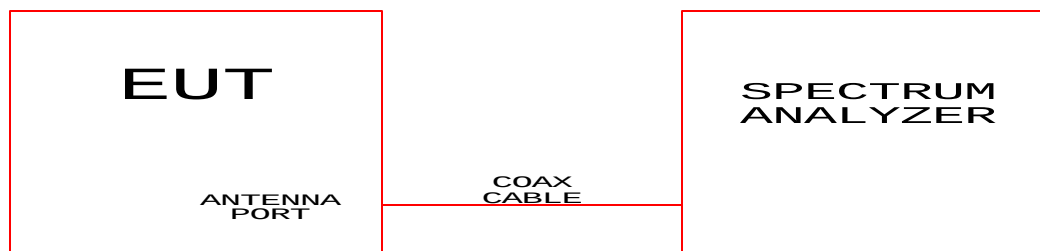
The spectrum analyzer's resolution bandwidth and video bandwidth were set as follows:

RBW = 100 kHz

VBW = 300 kHz

Type of Equipment	Manufacturer	Model Number	Serial Number
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	8565A	3107A01582
Low Loss Cable (1 dB)	N/A	N/A	N/A

All the equipment listed above is calibrated every 12 months by an independent calibration laboratory or by CCL personal following outlined calibration procedures.

Test Configuration Block Diagram

Radiated Spurious Emissions in Restricted Bands:

The radiated emissions from the intentional radiator were measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings. An amplifier and preamplifier were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges. For peak emissions above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the video bandwidth was set to 3 MHz. For average emissions above 1000 MHz the spectrum analyzer's resolution bandwidth was set to 1 MHz and the video bandwidth was set to 10 Hz.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz and a Double Ridge Guide Horn antenna was used to measure the frequency range of 1 GHz to 18 GHz, and a Pyramidal Horn antenna was used to measure the frequency range of 18 GHz to 25 GHz, at a distance of 3 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

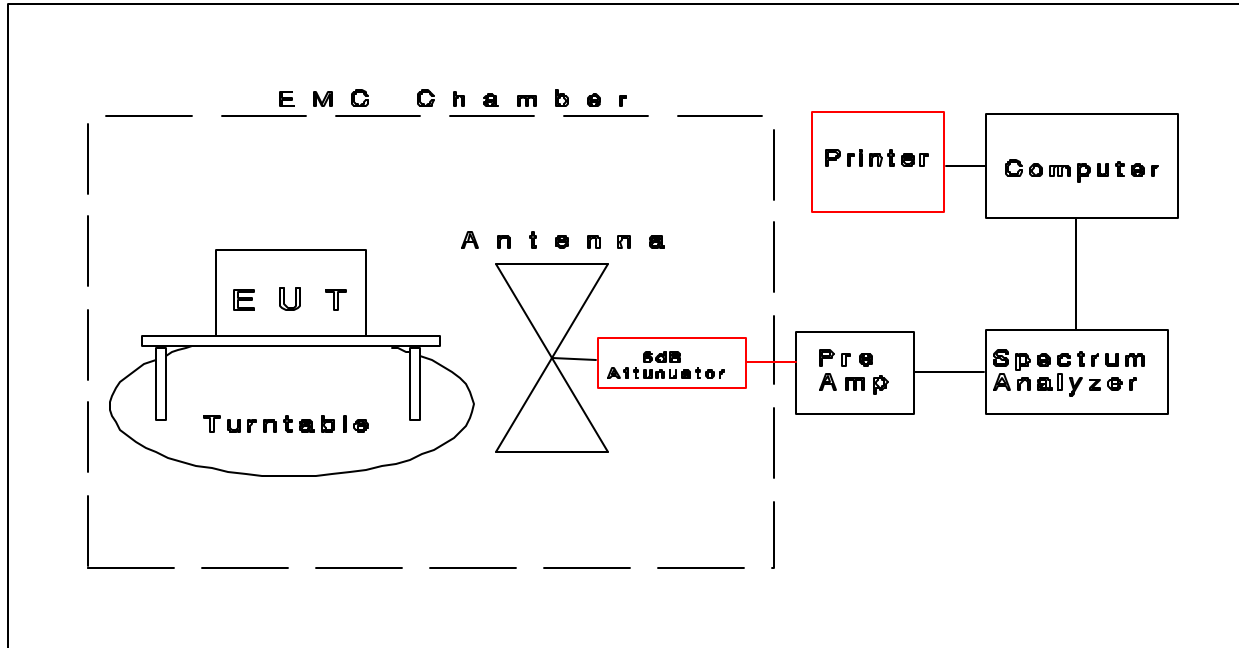
The configuration of the intentional radiator was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.4 via the interconnecting cables listed in Section 2.5. These interconnecting cables were manipulated manually by a technician to obtain worst case radiated emissions. The intentional radiator was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there were multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

Desktop intentional radiator is measured on a non-conducting table 80 centimeters above the ground plane. The table is placed on a turntable which is level with the ground plane. The turntable has slip rings, which supply AC power to the intentional radiator. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number
Anechoic Chamber	CCL	N/A	N/A
Test Software	CCL	Radiated Emissions	Revision 1.3
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	8565A	3107A01582
Biconilog Antenna	EMCO	3142	9601-1009
Double Ridged Guide Antenna	EMCO	3115	9409-4355
Pyramidal Horn Antenna	EMCO	3160-09	0003-1197
Harmonic Mixer	Hewlett Packard	11970K	3003A05756
Radiated Emissions Cable	CCL	812	N/A
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161
Pre-Amplifier	Hewlett Packard	8449B	3008A00990
6 dB Attenuator	Hewlett Packard	8491A	32835

All the equipment listed above is calibrated every 12 months by an independent calibration laboratory or by CCL personal following outlined calibration procedures.

R a d i a t e d E m i s s i o n s T e s t



FCC Sections 15.207 AC Line Conducted Emissions:

The conducted disturbance at mains ports from the ITE was measured using a spectrum analyzer with a quasi-peak adapter for peak, quasi-peak and average readings. The quasi-peak adapter uses a bandwidth of 9 kHz, with the spectrum analyzer's resolution bandwidth set at 100 kHz, for readings in the 150 kHz to 30 MHz frequency ranges.

The conducted disturbance at mains ports measurements are performed in a screen room using a (50 Ω /50 μ H) Line Impedance Stabilization Network (LISN).

Where mains flexible power cords are longer than 1 m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4 m in length.

Where the EUT is a collection of ITE with each ITE having its own power cord, the point of connection for the LISN is determined from the following rules:

- Each power cord, which is terminated in a mains supply plug, shall be tested separately.
- Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
- Power cords which are specified by the manufacturer to be

connected via a host unit or other power supplying equipment shall be connected to that host unit and the power cords of that host unit connected to the LISN and tested.

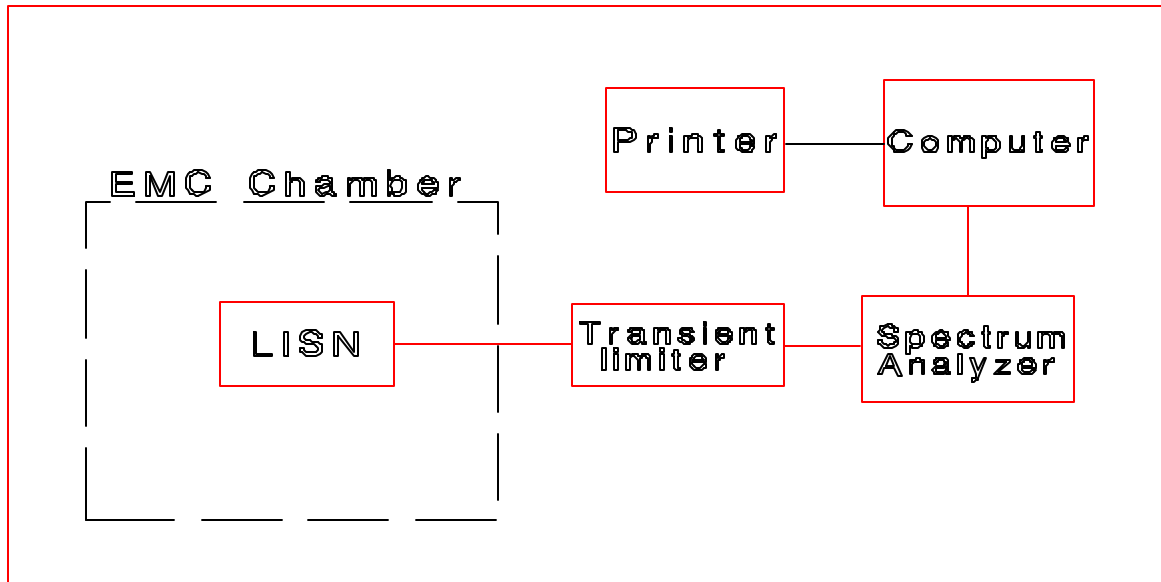
- d) Where a special connection is specified, the necessary hardware to effect the connection is supplied by the manufacturer for the testing purpose.
- e) When testing equipment with multiple mains cords, those cords not under test are connected to an artificial mains network (AMN) different than the AMN used for the mains cord under test.

Desktop ITE are placed on a non-conducting table at least 0.8 meters from the metallic floor. The equipment is placed a minimum of 40 cm from all walls. Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number
Wanship Open Area Test Site #2	CCL	N/A	N/A
Test Software	CCL	Conducted Emissions	Revision 1.2
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711
Quasi-Peak Detector	Hewlett Packard	8565A	3107A01582
LISN	EMCO	3825/2	9307-1893
Conductance Cable Wanship Site #2	CCL	Cable J	N/A
Transient Limiter	Hewlett Packard	11947A	3107A02266

An independent calibration laboratory or CCL personal calibrates all the equipment listed above every 12 months following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Line Conducted Emissions Test

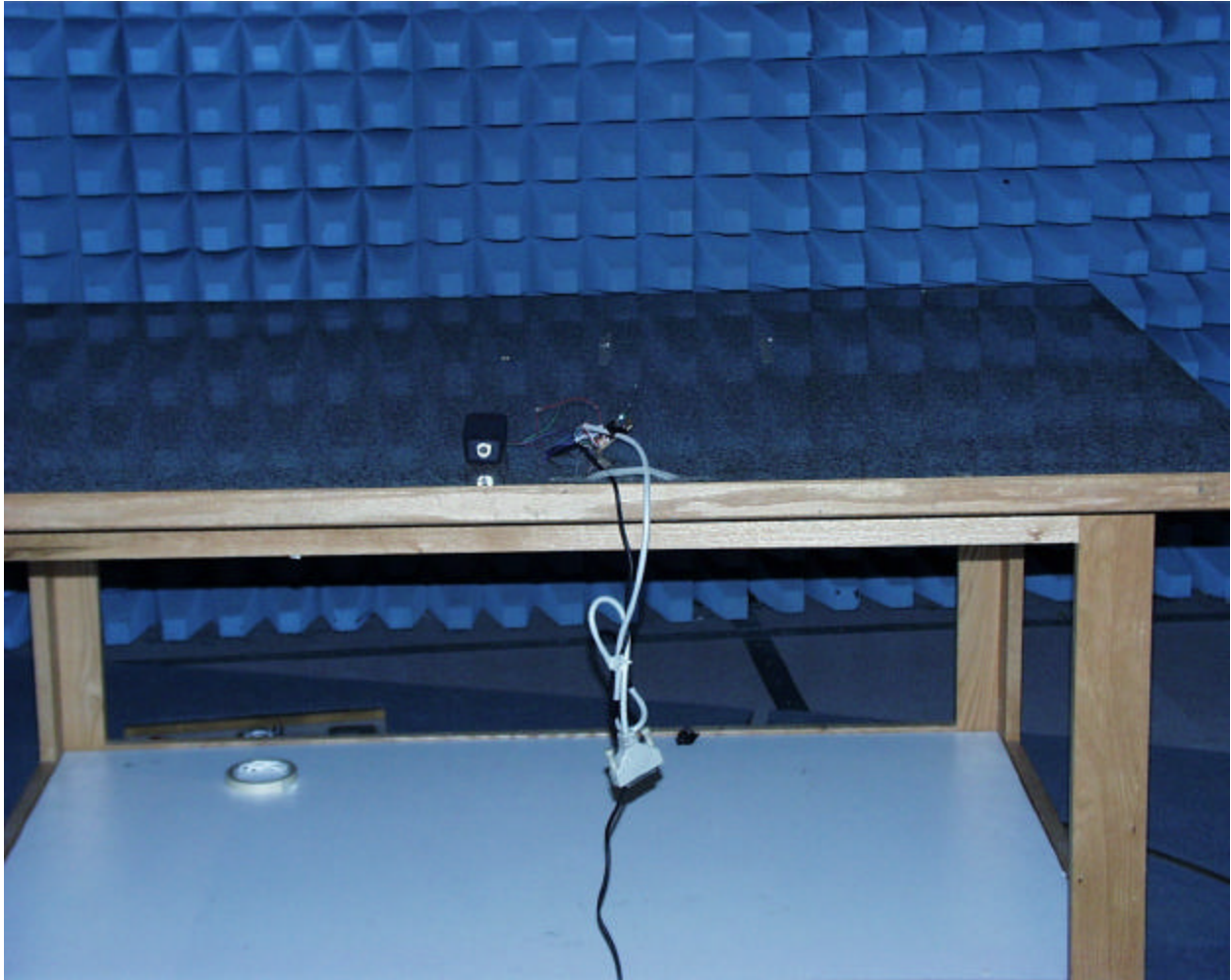


APPENDIX 2 Photographs

Front View of Radiated Test Setup



Back View Of Radiated Test Setup



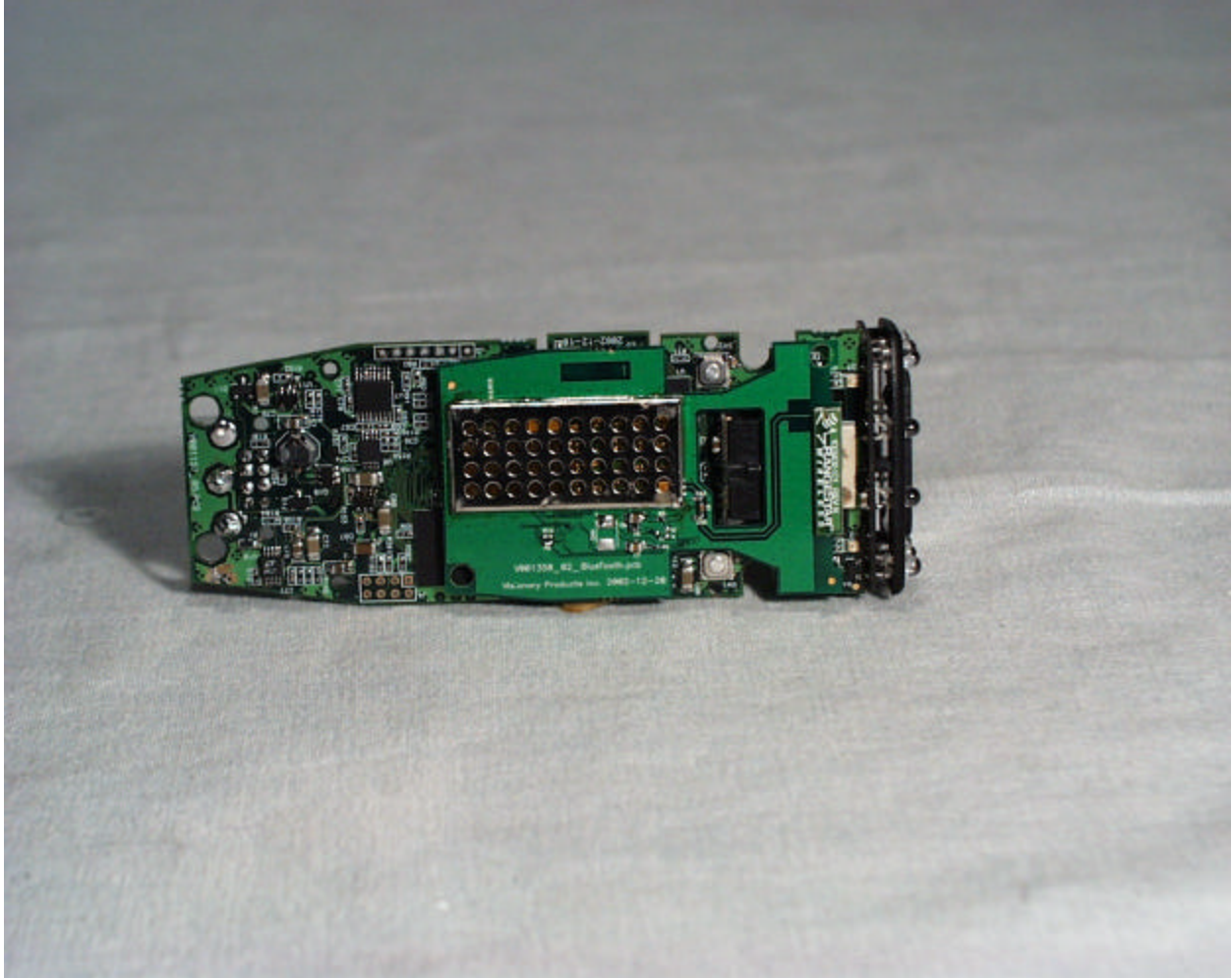
Front View of the CR2



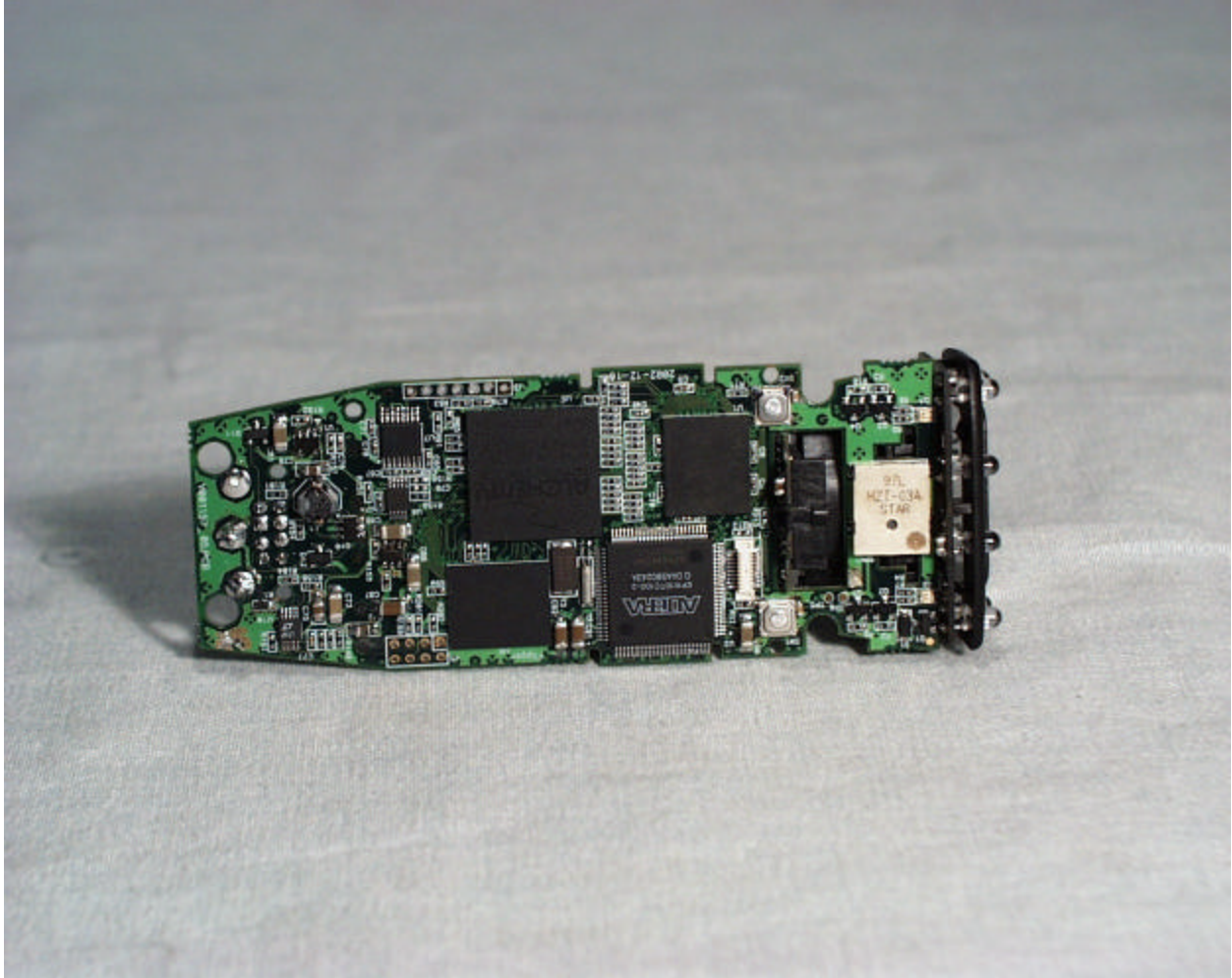
Back View of the CR2



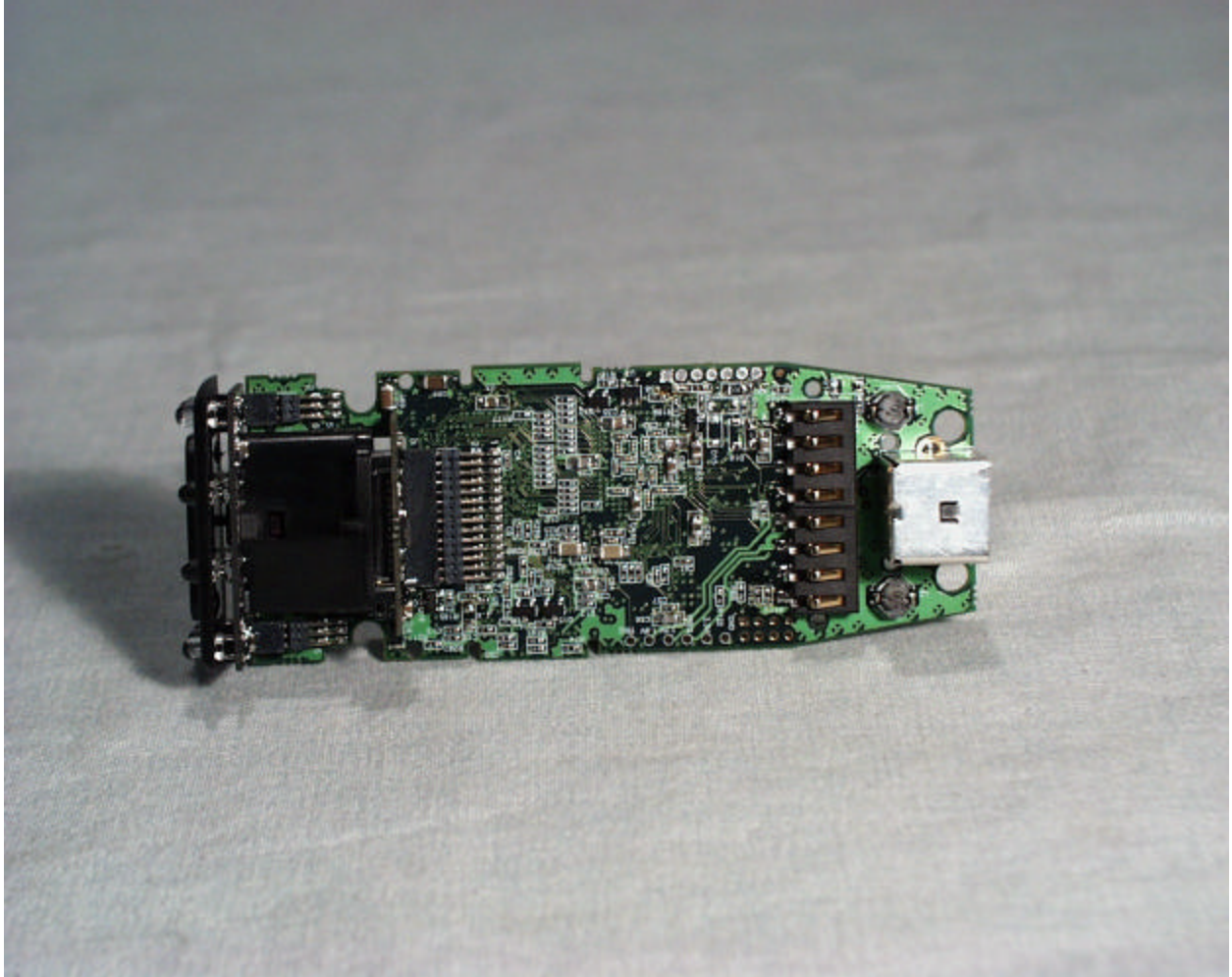
Top view of main board with RF board attached



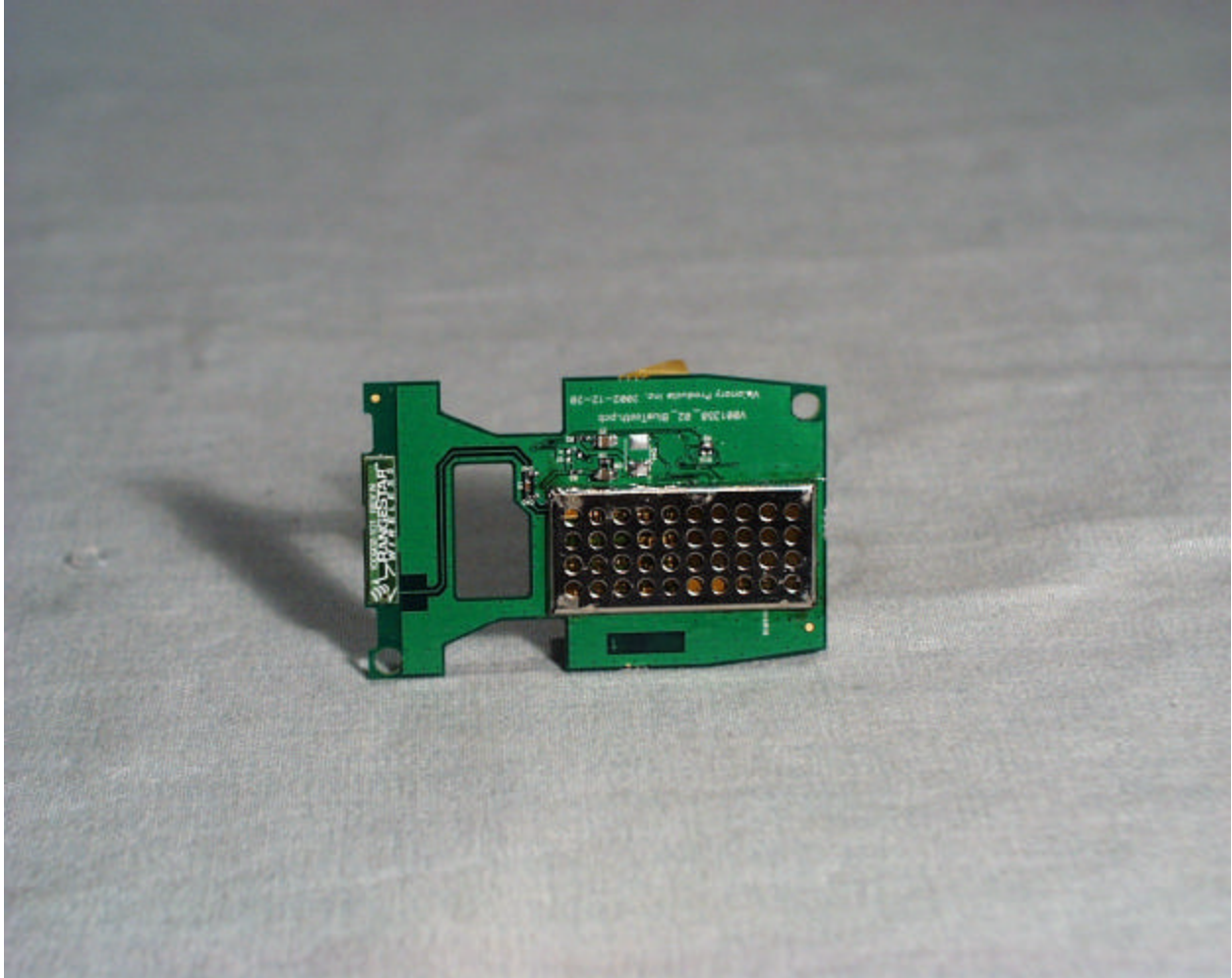
Top view of main board



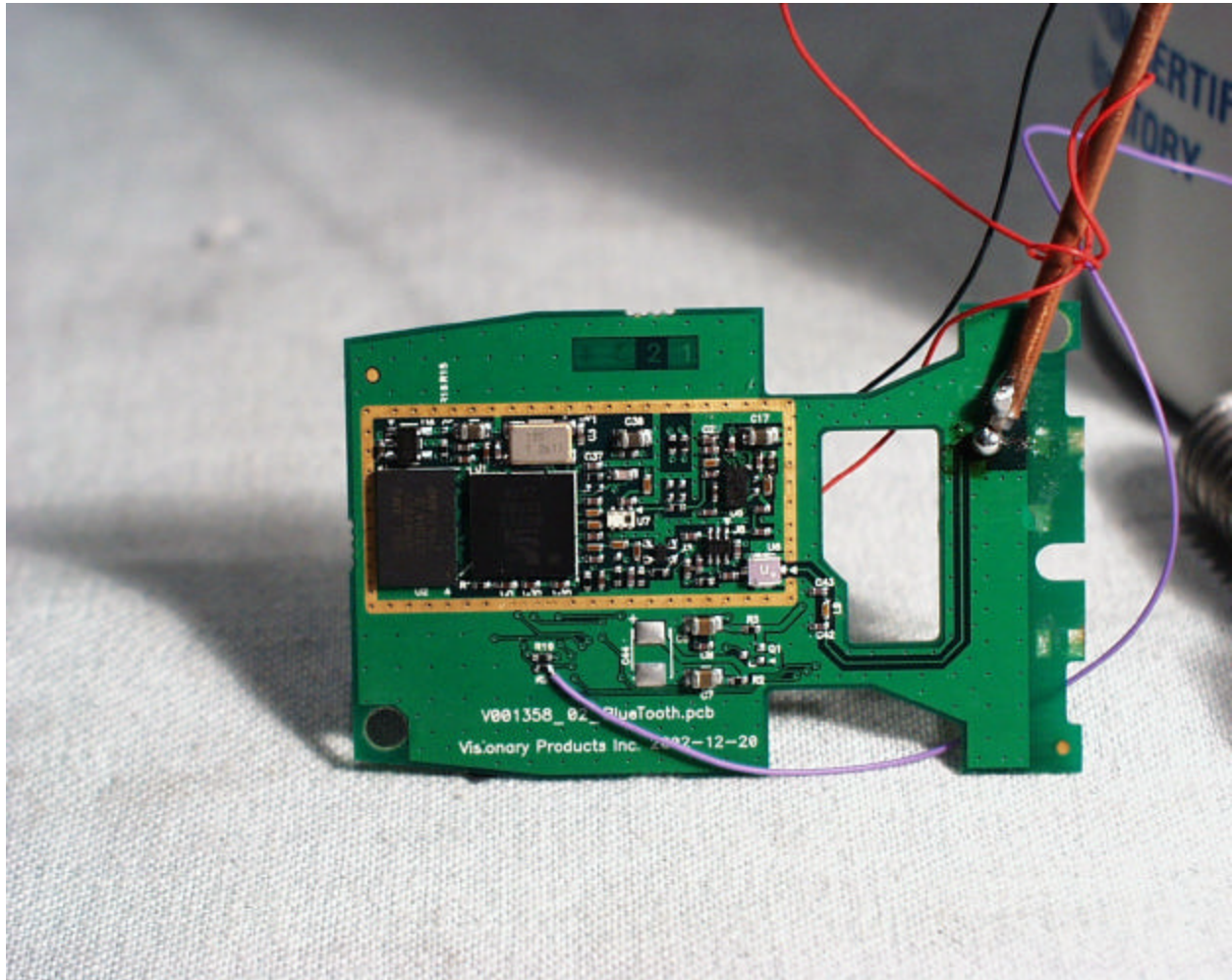
Bottom view of main board



Side A of the CR2 RF PCB with shield



Side A of the CR2 RF PCB with shield removed



Side B of the CR2 RF PCB

