COMMUNICATION CERTIFICATION LABORATORY

1940 West Alexander Street
Salt Lake City, UT 84119
801-972-6146

Test Report

Certification

TEST OF: RTSS

FCC ID: PII-VSUB233

To FCC PART 15, Subpart C

Test Report Serial No: 73-8305

Applicant:

Vantage Controls
1061 South 800 East
Orem, UT 84097

Dates of Test: April 26 & May 1, 2006

Issue Date: May 24, 2006

Equipment Receipt Date: April 26, 2006

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

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- Applicant: Vantage Controls
- Manufacturer: Vantage Controls
- Brand Name: Vantage Controls
- Model Number: RTSS
- FCC ID Number: PII-VSUB233

On this 24th day of May 2006, 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.

Although NVLAP has recognized that the Communication Certification Laboratory EMC testing facilities are in good standing, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

COMMUNICATION CERTIFICATION LABORATORY

Norman P Hansen

Tested by: Norman P. Hansen
EMC Technician

TABLE OF CONTENTS

SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: Vantage Controls
1061 South 800 East
Orem, UT 84097

Contact Name: Jim Beagley
Title: Engineer

1.2 Manufacturer:

Company Name: Vantage Controls
1061 South 800 East
Orem, UT 84097

Contact Name: Jim Beagley
Title: Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	Vantage Controls
Model Number:	RTSS
Serial Number:	None
Options Fitted:	N/A
Country of Manufacture:	U.S.A.

2.2 Description of EUT:

The RTSS transceiver is a product designed to enable wireless control of motorized shade and blind controllers and other systems. The RTSS incorporates 2 separate RF circuits. The RTS transmitter operates at 433.4 MHz. The RadioLink transceiver is frequency hopping, spread spectrum and operates in the 902 - 928 MHz band. The transmitters are controlled so that they can never transmit at the same moment.

This report covers the transmitters that are required to meet the requirements of FCC Part 15, Subpart C. The receiver and digital circuitry is covered in separate testing and report.

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: Vantage Controls MN: RTSS (Note 1)	PII-VSUB233	Transceiver Unit	See Section 2.4

Note: (1) EUT

2.4 Interface Ports on EUT:

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
Power	1	Direct connection to the AC mains

2.5 Modification Incorporated/Special Accessories on EUT:

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

Signature: ______________________________

Typed Name: Jim Beagley

Title: Engineer

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

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

Purpose of Test: The tests were performed to demonstrate initial compliance for modular certification.

3.2 Requirements:

3.2.1 §15.203 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

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 μH/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 band edges.

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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 µH/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 §15.231 Periodic Operation in the Band 40.66 – 40.70 MHz and Above 70 MHz

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

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

(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmission to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

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

(b) In addition to the provisions of §15.205, the field strength of emission from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 -130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** Linear interpolations

(1) the above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band

edges.

(2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provision in §15.35 for averaging pulsed emission and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emission in the above table are based on the fundamental frequency of the intentional radiator. Spurious emission shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

(c) The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

(d) For devices operating within the frequency band 40.66-40.70 MHz, the bandwidth of the emission shall be confined within the band edges and the frequency tolerance of the carrier shall be ±0.01%. This frequency tolerance shall be maintained for a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation on the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(e) Intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) of this section and may be employed for any type of operation, including operation prohibited in paragraph (a) of this section, provided that intentional radiator complies with the provisions of paragraphs (b) through (d) of this section except the field strength table in paragraph (b) of this section is replaced by the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 -130	500	50
130 - 174	500 to 1,500 **	50 to 150 **
174 - 260	1,500	150
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** Linear interpolations

In addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent periods between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

3.2.4 §15.247 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz

(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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. 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 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 may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 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 conducted 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 non-overlapping 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. As an alternative to a peak power measurement, compliance with the

one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted 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.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(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 conducted 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 conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(4)(i) and (c)(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.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do [the word "do" should be deleted from this sentence] emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

(d) 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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)).

(e) For digitally modulated systems, the 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. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

(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.

(i) 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.

Note: Spread spectrum systems are sharing these bands on a noninterference basis with systems supporting critical Government requirements that have been allocated the usage of these bands, secondary only to ISM equipment operated under the provisions of Part 18 of this Chapter. Many of these Government systems are airborne radiolocation systems that emit a high EIRP which can cause interference to other users. Also, investigations of the effect of spread spectrum interference to U. S. Government operations in the 902-928 MHz band may require a future decrease in the power limits allowed for spread spectrum operation.

3.3 Test Procedure:

The line conducted and radiated emissions testing was performed according to the procedures in ANSI C63.4 (2003). 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 August 11, 2003 (90504).

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, 2006.

For radiated emissions testing at 30 MHz or above 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 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 120 VAC
Frequency: 60 Hz

4.2 Operating Modes:

The EUT was tested in 3 orthogonal placements. The worst-case emissions were with the RTSS constantly transmitting, placed vertically on the EUT table in a test fixture. The EUT operates on 25 channels in the band of 907.3 to 916.9 MHz (9.6 MHz band range) and was tested at the lowest frequency and the highest frequency to meet the requirements of §15.31(m). When testing the 433.4 MHz transmitter, the above configuration showed the worst-case emissions.

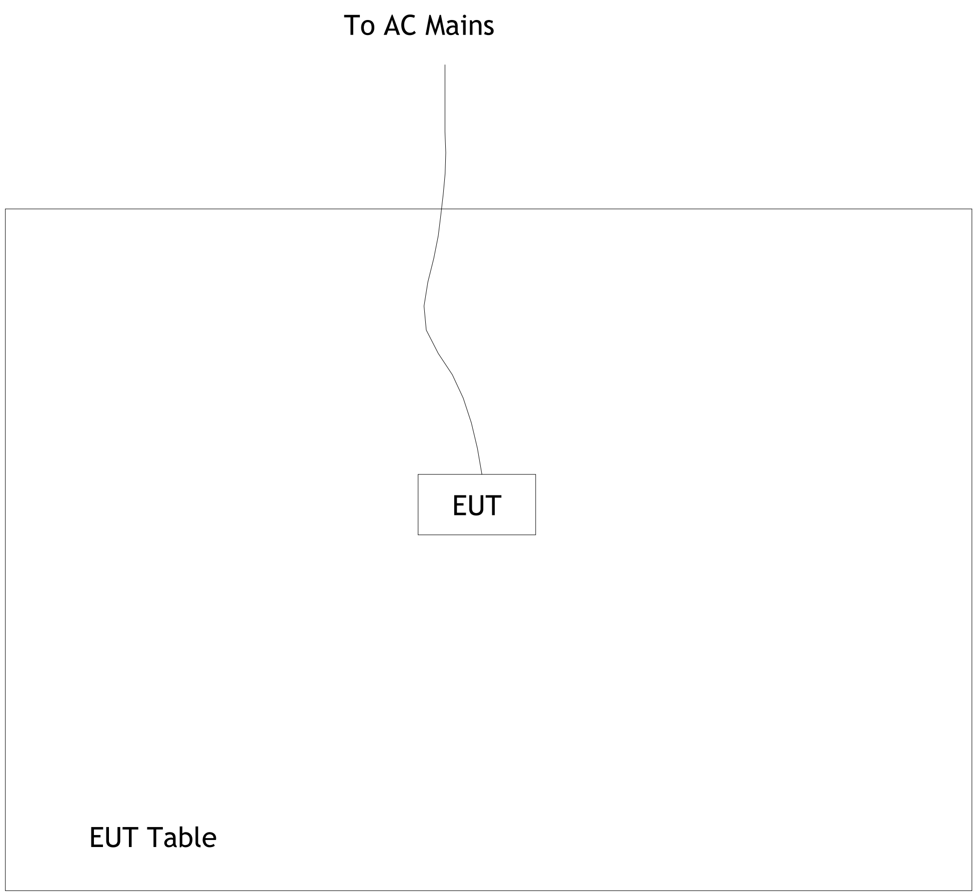
4.3 EUT Exercise Software:

Vantage Controls software was used to control the RTSS transmitter.

4.4 Configuration & Peripherals:

The RTSS was placed on the table and connected to the support equipment listed in Section 2.3 via each port listed in Section 2.4. Shown in Section 4.5 is a block diagram of the test configuration.

4.5 Block Diagram of Test Configuration:



SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Section	Environmental Phenomena	Frequency Range (MHz)	Report Section	Result
15.203	Antenna Requirement	N/A	6.2	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	6.3	Complied
15.231(a)	Periodic Operation	433.4	6.4.1	Complied
15.231(b)	Radiated Emissions	30 to 4334	6.4.2	Complied
15.231(c)	Bandwidth	433.4	6.4.3	Complied
15.231(d)	Frequency Stability	40.66 to 40.70	6.4.4	Not Applicable
15.231(e)	Radiated Emissions	30 to 4334	6.4.5	Not Applicable
15.247(a)	Transmitter Channel Characteristics	902 - 928	6.5.1 & 6.5.2	Complied
15.247(b)	Transmitter Output Power	902 - 928	6.5.3	Complied
15.247(c)	Operation with Directional Antenna Gains Greater than 6 dBi	902 - 928	6.5.4	Not Applicable
15.247(d)	Conducted Emissions at the Antenna Port	8 - 9280	6.5.5.1	Complied
15.247(d)	Radiated Emissions in the Restricted Bands	8 - 9280	6.5.5.2	Complied
15.247(e)	3 kHz Power Spectral Density	902 – 928	6.5.6	Not Applicable

Section	**Environmental Phenomena**	**Frequency Range (MHz)**	**Report Section**	**Result**
15.247(f)	Hybrid Systems	902 – 928	6.5.7	Not Applicable
15.247(g)	Channel Usage	902 – 928	6.5.8	Complied
15.247(h)	Channel Hopset Coordination	902 - 928	6.5.9	Complied
15.247(i)	RF Exposure	902 - 928	6.5.10	Complied

5.2 Result

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

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments:

This section contains the test results and determinations only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

6.2 §15.203 Antenna Requirement

The antennas are etched traces on the PCB and can not be modified or replaced; therefore, the EUT meets the requirements of §15.203.

6.3 §15.207 Conducted Disturbance at Mains Ports Data

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.15	Hot Lead	Quasi-Peak (Note 1)	54.8	66.0	-11.2
0.15	Hot Lead	Average (Note 1)	45.6	56.0	-10.4
0.27	Hot Lead	Quasi-Peak (Note 1)	54.5	61.2	-6.7
0.27	Hot Lead	Average (Note 1)	43.6	51.2	-7.6
0.41	Hot Lead	Quasi-Peak (Note 1)	49.7	57.7	-8.0
0.41	Hot Lead	Average (Note 1)	40.3	47.7	-7.4
0.54	Hot Lead	Quasi-Peak (Note 1)	49.8	56.0	-6.2
0.54	Hot Lead	Average (Note 1)	41.0	46.0	-5.0
0.68	Hot Lead	Quasi-Peak (Note 1)	47.8	56.0	-8.2
0.68	Hot Lead	Average (Note 1)	38.9	46.0	-7.1
0.80	Hot Lead	Quasi-Peak (Note 1)	47.6	56.0	-8.4
0.80	Hot Lead	Average (Note 1)	39.8	46.0	-6.2
0.16	Neutral Lead	Quasi-Peak (Note 1)	54.1	65.7	-11.6
0.16	Neutral Lead	Average (Note 1)	40.9	55.7	-14.8
0.27	Neutral Lead	Quasi-Peak (Note 1)	53.7	61.1	-7.4
0.27	Neutral Lead	Average (Note 1)	41.6	51.1	-9.5
0.39	Neutral Lead	Quasi-Peak (Note 1)	47.9	58.0	-10.1

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.39	Neutral Lead	Average (Note 1)	31.4	48.0	-16.6
0.53	Neutral Lead	Quasi-Peak (Note 1)	48.6	56.0	-7.4
0.53	Neutral Lead	Average (Note 1)	38.6	46.0	-7.4
0.65	Neutral Lead	Quasi-Peak (Note 1)	45.3	56.0	-10.7
0.65	Neutral Lead	Average (Note 1)	34.3	46.0	-11.7
0.78	Neutral Lead	Quasi-Peak (Note 1)	43.3	56.0	-12.7
0.78	Neutral Lead	Average (Note 1)	32.7	46.0	-13.3
Note 1: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.					

6.4 §15.231 Periodic Operation in the Band 40.66 – 40.70 MHz and Above 70 MHz

6.4.1 §15.231(a)

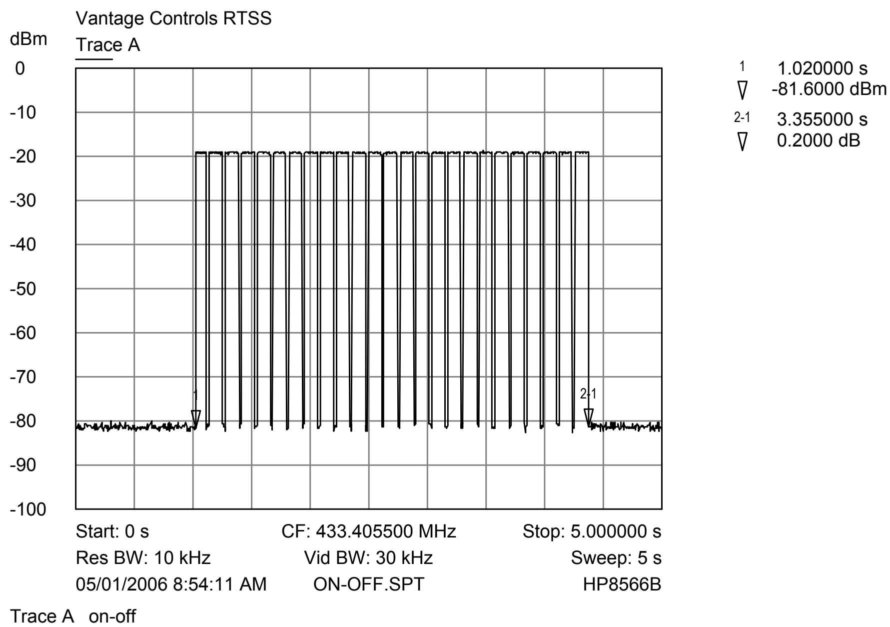
Demonstration of Compliance:

1. A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. The EUT ceases transmission within 3.5 seconds of being manually activated.

2. The RTSS can be automatically activated from a command received by the RadioLink transceiver. The duration of this transmission does not exceed 3.5 seconds, meeting the requirement to cease transmission within 5 seconds of activation.

3. The RTSS does not transmit at regular predetermined intervals. The RTSS only transmits if manually activated or a command to transmit is received by the RadioLink transceiver.

The plot below shows the transmitter activated and turning off after 3.36 seconds.



RESULT

In the configuration tested, the EUT complied with the requirements of this section.

6.4.2 §15.231(b) Radiated Emissions

Demonstration of Compliance:

The RTSS operates at 433.4 MHz, therefore; the field strength of the fundamental must be less than 10975.0 μV/m (80.8 dBμV/m) at 3 meters and the field strength of the unwanted emissions must be attenuated 20 dB below the maximum permitted fundamental strength or 60.8 dBμV/m at 3 meters.

The limits for a distance of 3 meters are determined using the formula:

Limit in the 260 – 470 MHz band = 41.6667(F) – 7083.3333

Where F is the frequency in MHz

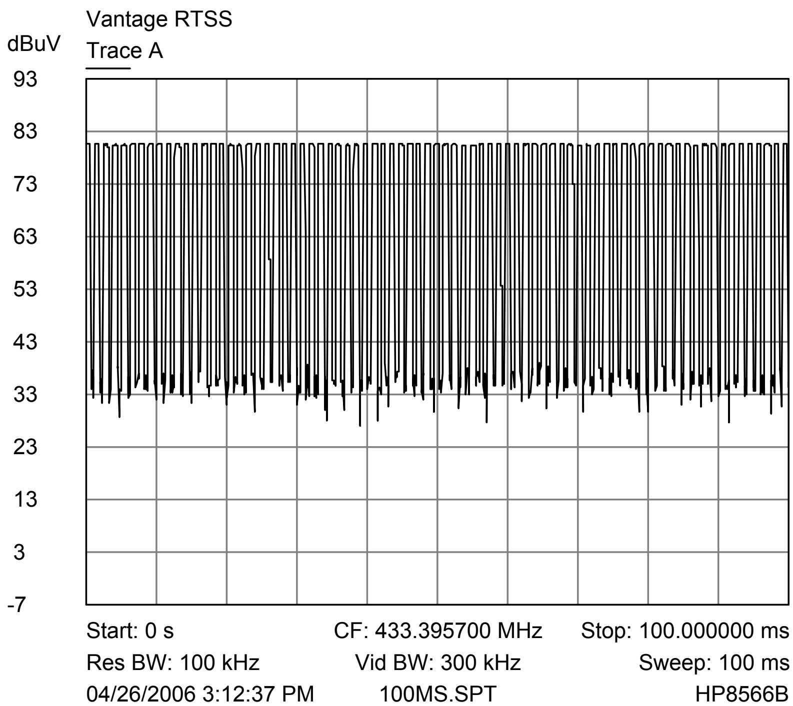
Emissions in the restricted bands of §15.205 must meet the limits specified in §15.209.

Measurement Data Fundamental and Harmonic Emissions:

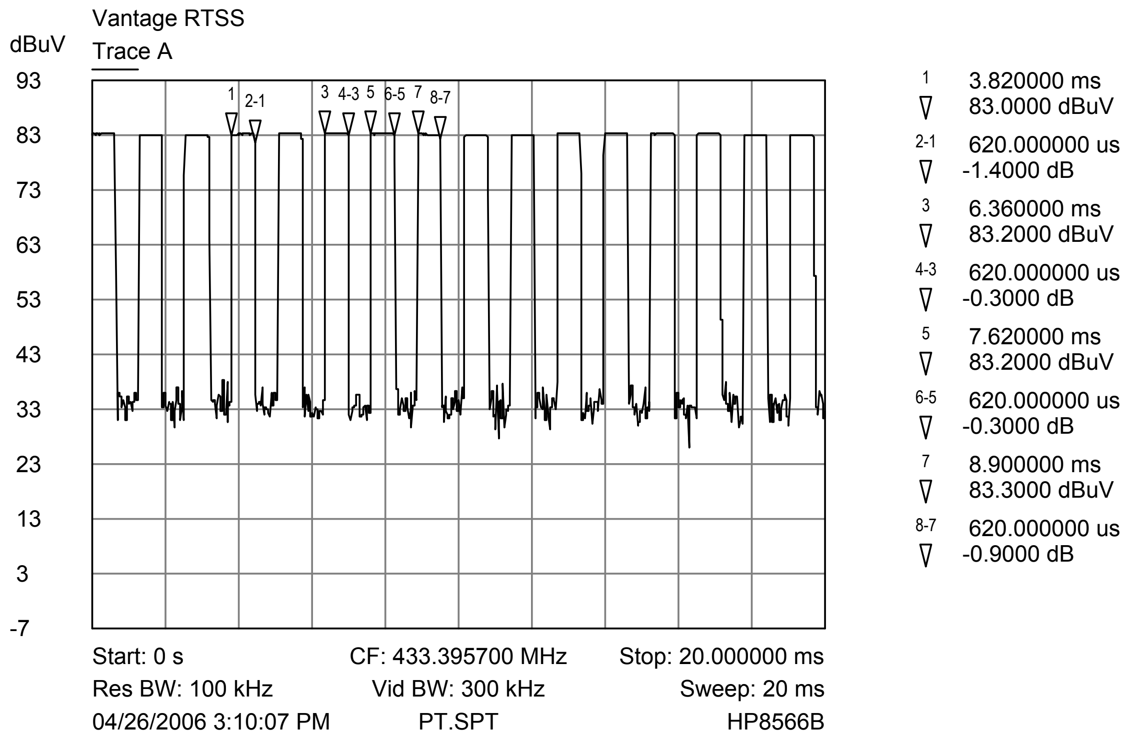
The frequency range from 30 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any radiated emissions.

Pulsed Emission Averaging Factor:

The RTSS transmitter is a pulsed emission device; therefore, the method of §15.35 for averaging a pulsed emission may be used. The plot of the pulse train and the average factor calculations are shown below:



Trace A 100 ms plot



Trace A pulse train

Average factor calculation

The pulse train is longer than 100 msec; therefore, the average factor will be calculated over a period of 100 msec as specified in §15.35. The OOK Manchester modulation guarantees that the device during transmission is never above a 50% duty cycle as the plot above demonstrates. See Exhibit #12 a full description of the encoding process and timings. The Average Factor calculation is shown below:

Average Factor = 20 log (on time/ 100 msec)
= 20 log (50 msec/100 msec)
= -6.0 dB

The peak measurements were adjusted using –6.0 dB as the average factor.

Radiated Interference Level Data – (Vertical Polarity)

Frequency MHz	Detector	Receiver Reading dBμV	Average Factor dB	Correction Factor dB	Field Strength dBμV/m	Limit dBμV/m	Delta dB
433.4	Peak	63.5	-6.0	20.2	77.7	80.8	-3.1
866.8	Peak	31.9	-6.0	27.7	53.6	60.8	-7.2
1300.2*	Peak	7.2	-6.0	25.6	26.8	54.0	-27.2
1733.6	Peak	8.4	-6.0	27.0	29.4	60.8	-31.4
2167.0	Peak	6.6	-6.0	28.9	29.5	60.8	-31.3
2600.4	Peak	7.0	-6.0	30.0	31.0	60.8	-29.8
3033.8	Peak	5.8	-6.0	31.5	31.3	60.8	-29.5
3467.2	Peak	4.2	-6.0	32.6	30.8	60.8	-30.0
3900.6*	Peak	5.3	-6.0	33.8	33.1	54.0	-20.9
4339.0*	Peak	4.6	-6.0	34.4	33.0	54.0	-21.0
* Emissions within restricted bands							

Radiated Interference Level Data - (Horizontal Polarity)

Frequency MHz	Detector	Receiver Reading dBμV	Average Factor dB	Correction Factor dB	Field Strength dBμV/m	Limit dBμV/m	Delta dB
433.4	Peak	59.8	-6.0	20.2	74.0	80.8	-6.8
866.8	Peak	25.7	-6.0	27.7	47.4	60.8	-13.4
1300.2*	Peak	4.0	-6.0	25.6	23.6	54.0	-30.4
1733.6	Peak	6.1	-6.0	27.0	27.1	60.8	-33.7
2167.0	Peak	5.2	-6.0	28.9	28.1	60.8	-32.7
2600.4	Peak	6.5	-6.0	30.0	30.5	60.8	-30.3
3033.8	Peak	5.6	-6.0	31.5	31.1	60.8	-29.7
3467.2	Peak	3.5	-6.0	32.6	30.1	60.8	-30.7
3900.6*	Peak	4.3	-6.0	33.8	32.1	54.0	-21.9
4339.0*	Peak	5.1	-6.0	34.4	33.5	54.0	-20.5
* Emissions within restricted bands							

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and the Average Factor to the measured level of the receiver. The receiver amplitude reading is compensated for any amplifier gain.

The basic equation with a sample calculation is shown below:

FS = RA + CF + AV Where

FS = Field Strength
RA = Receiver Amplitude Reading
CF = Correction Factor (Antenna Factor + Cable Factor)
AV = Averaging Factor

Assume a receiver reading of 44.2 dBμV is obtained from the receiver, with an average factor of –8.6 dB and a correction factor of 17.5 dB. The field strength is calculated by adding the correction factor and the average factor, giving a field strength of 53.1 dBμV/m, FS = 44.2 + 17.5 + (-8.6) = 53.1 dBμV/m

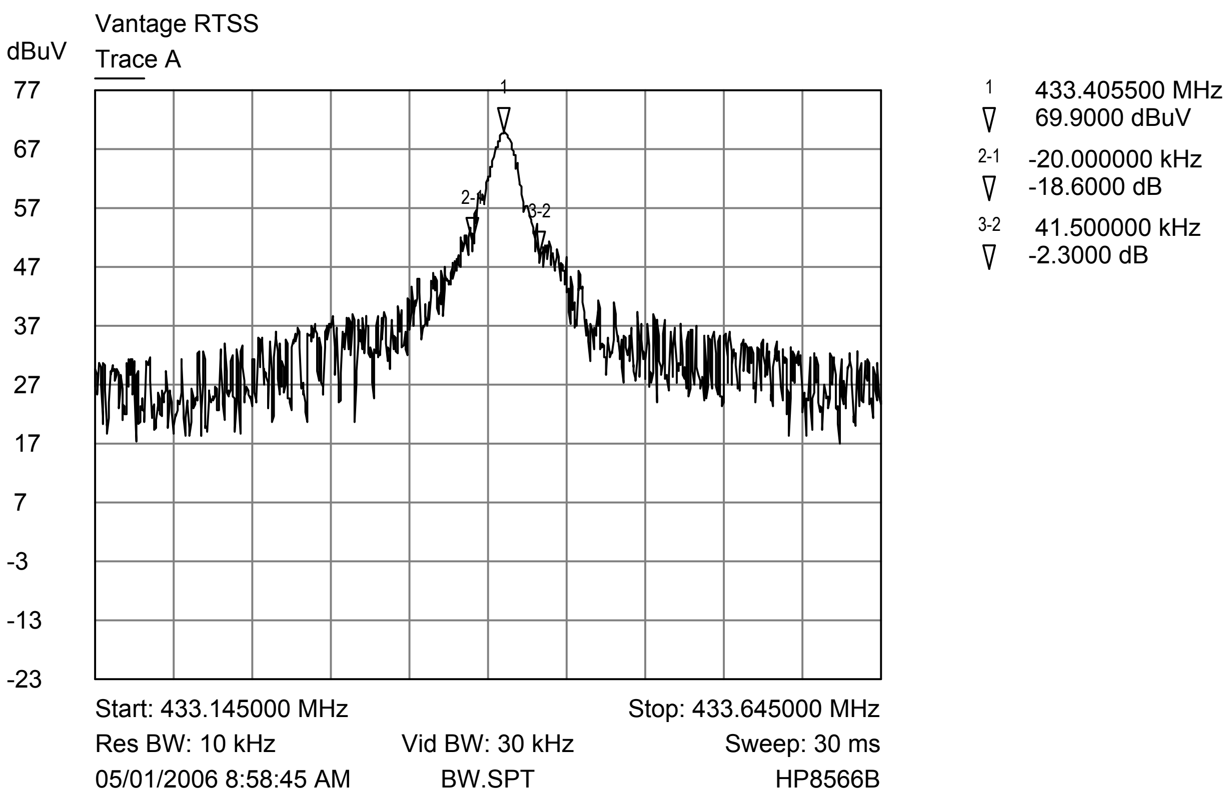
RESULT

In the configuration tested, the EUT complied with the requirements of this section.

6.4.3 §15.231(c) Bandwidth

Demonstration of Compliance:

The bandwidth of the emission must not be wider than 0.25% of the center frequency. The center frequency is 433.4 MHz, therefore the bandwidth must not be wider than 1.0835 MHz. The RTSS bandwidth was 57.0 kHz; therefore, it meets the bandwidth requirements. See spectrum analyzer plot below.



Trace A bandwidth

RESULT

In the configuration tested, the EUT complied with the requirements of this section.

6.4.4 §15.231(d) Frequency Stability

The EUT does not operate in the frequency band 40.66 to 40.70 MHz; therefore this test is not applicable.

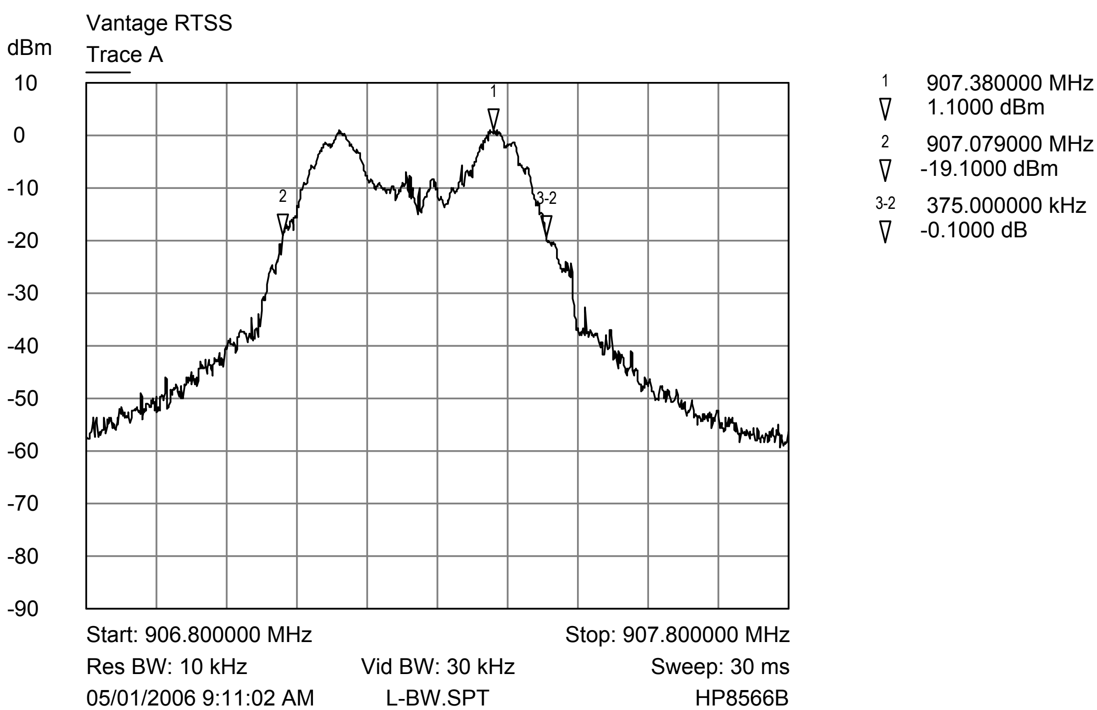
6.4.5 §15.231(e) Reduced Field Strengths

The EUT does not exceed the periodic rate of operation specified in paragraph (a); therefore, this test is not applicable.

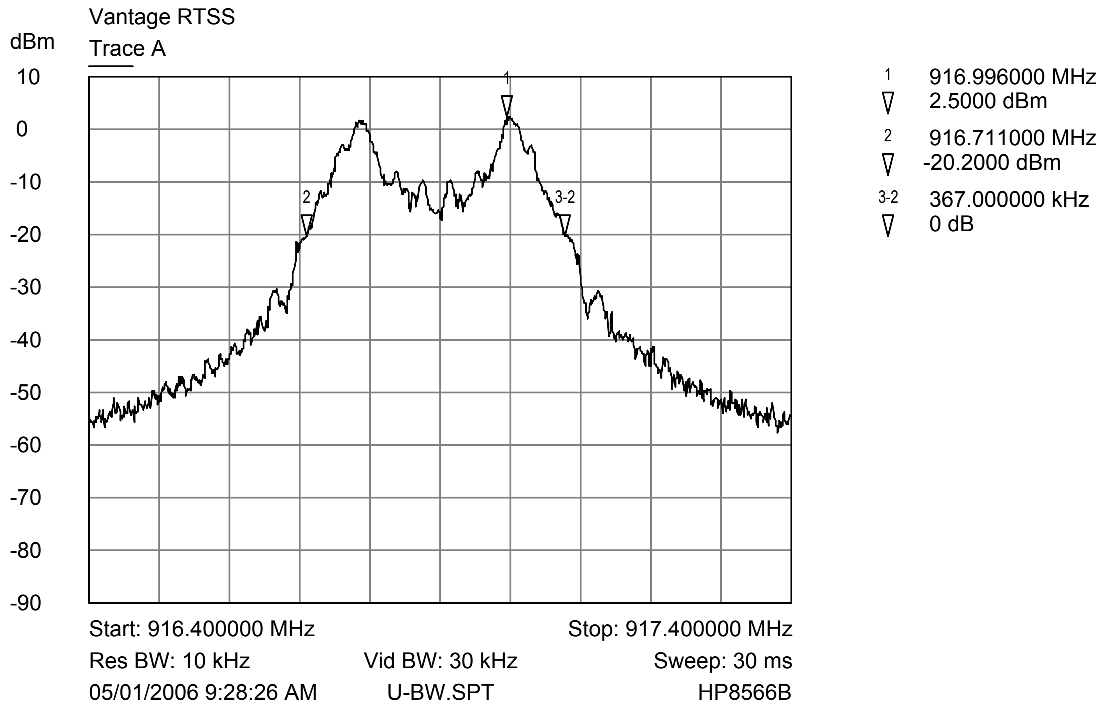
6.5 §15.247 Operation within the Bands 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 2850 MHz

6.5.1 §15.247(a)(1)

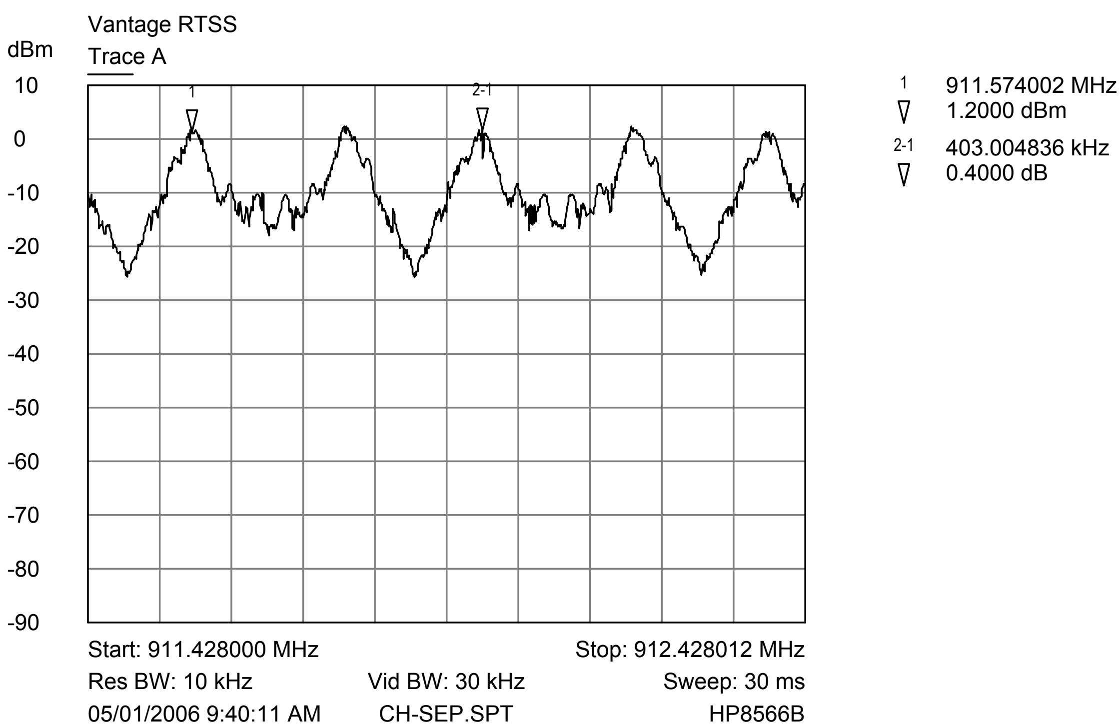
The EUT shall have the hopping channels separated by the greater of 25 kHz or the 20 dB bandwidth. The 20 dB bandwidth is 375 kHz and the channel separation is 403 kHz. See the plots below:



Trace A Lower channel bandwidth plot



Trace A Upper channel band width plot



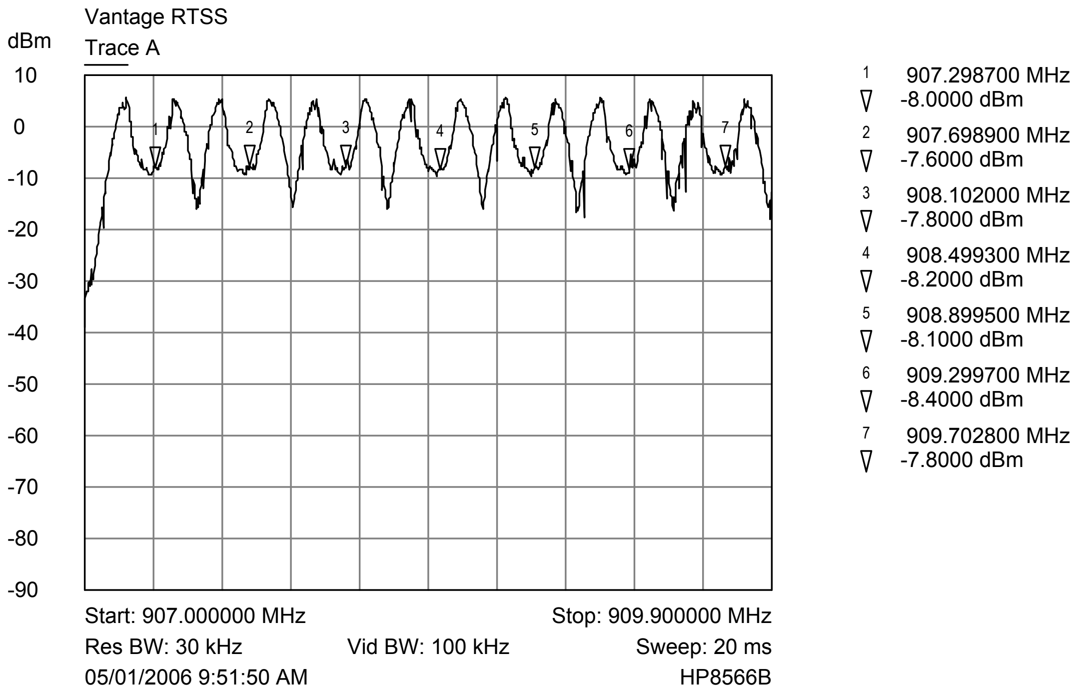
Trace A Channel separation

The EUT hops to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency is used equally on the average by each transmitter. See the hop sequence table below. The receiver has input bandwidths that match the hopping channel bandwidths of the corresponding transmitter and shifts frequencies in synchronization with the transmitted signals.

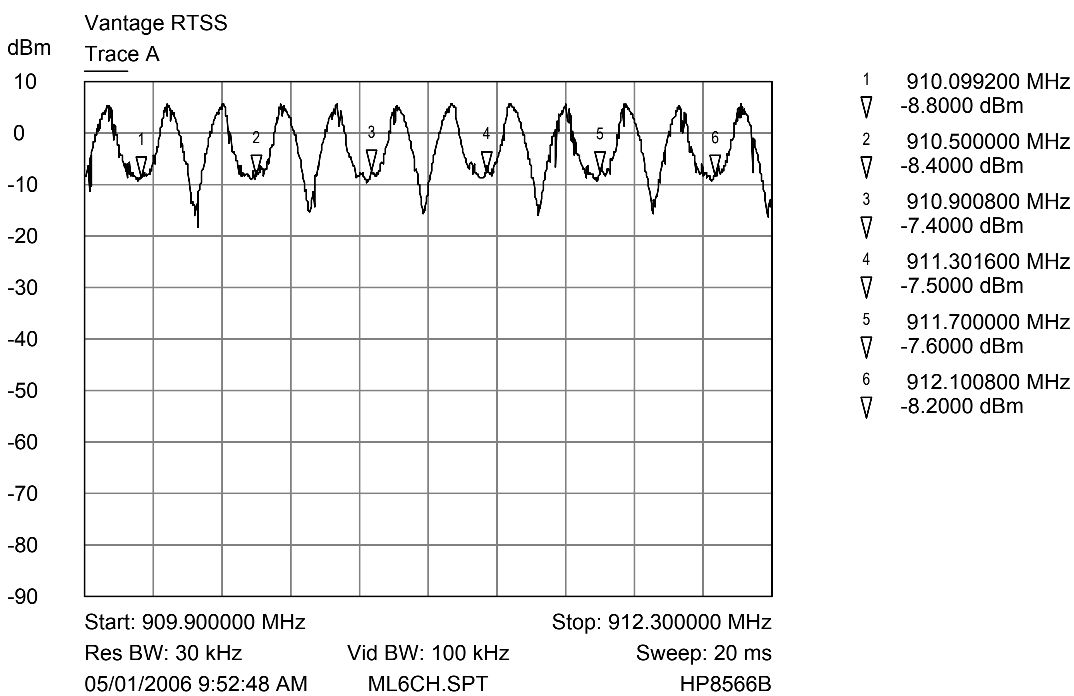
Hop Sequences															
#1	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**	**#10**	**#11**	**#12**	**#13**	**#14**	**#15**	**#16**
2	1	17	21	5	3	20	24	13	22	9	14	10	12	21	717
12	13	10	16	10	23	9	14	20	15	4	5	23	6	8	6
18	9	3	8	18	10	21	3	16	9	24	12	19	24	12	14
11	3	7	4	2	2	14	21	5	23	16	3	3	7	17	7
24	19	25	19	11	9	18	11	22	18	6	24	8	2	9	11
17	12	8	9	15	18	3	1	12	14	19	8	2	13	1	25
21	22	23	25	25	6	22	12	23	24	1	21	14	25	11	20
3	11	4	1	12	17	17	20	11	2	8	1	6	3	16	12
25	23	21	6	16	8	11	5	7	21	18	20	20	16	3	1
10	2	2	10	21	24	4	19	14	10	22	4	11	22	14	15
15	10	16	17	7	15	8	15	1	19	7	25	22	8	25	21
6	4	24	3	20	19	13	8	18	7	17	16	1	19	15	13
23	15	12	20	13	11	7	17	4	13	12	23	21	14	7	18
16	24	5	7	8	21	23	22	17	3	2	6	12	21	19	5
7	18	1	15	14	25	1	10	25	11	15	11	25	4	5	24
1	25	19	22	19	13	25	25	19	5	20	19	17	11	23	19
5	7	6	14	23	4	5	4	10	17	25	13	7	20	13	4
9	21	13	2	3	12	16	13	21	4	11	17	18	10	24	23
19	17	22	23	17	7	12	6	6	20	3	2	24	1	4	8
8	5	18	12	1	16	19	18	2	1	13	18	9	9	18	3
20	14	9	24	24	1	24	23	8	16	23	7	13	17	10	10
14	8	14	5	6	14	10	9	15	25	14	22	5	23	20	22
4	16	20	11	22	22	6	16	3	6	10	9	15	15	2	16
22	20	15	18	4	5	15	2	9	12	5	15	4	5	22	9
13	6	11	13	9	20	2	7	24	8	21	10	16	18	6	2

6.5.2 §15.247(a)(1)(i)

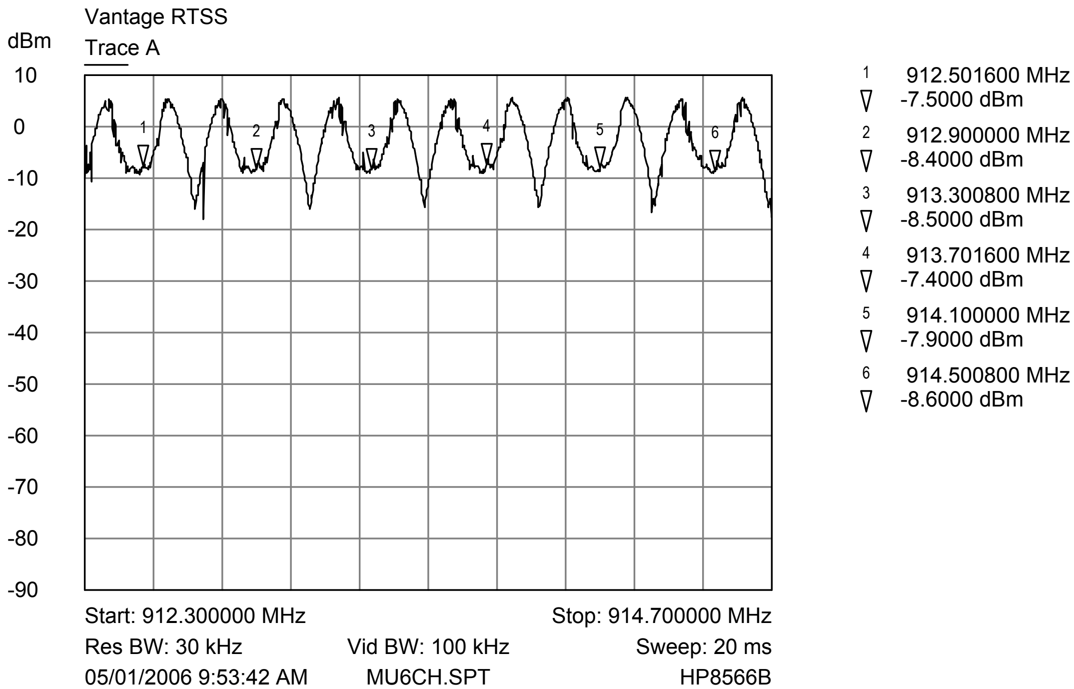
The EUT has a channel bandwidth of 375 kHz (see the plots of 6.5.1) and uses 25 channels. The average time of channel occupancy is 395.5 milliseconds within any 10 second time frame. See the plots below:



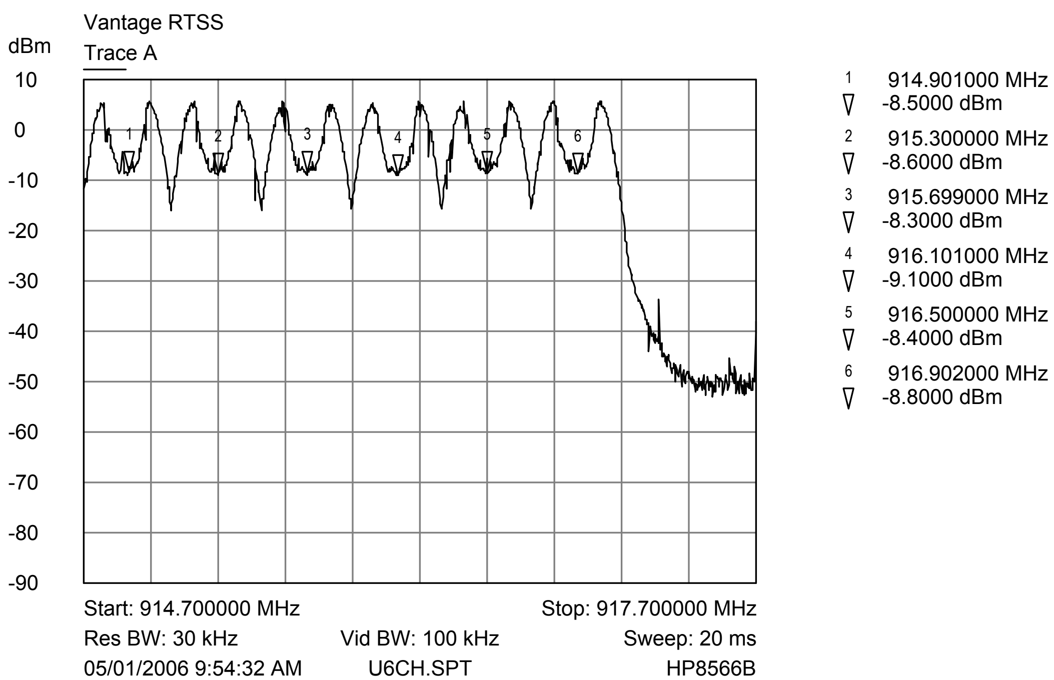
Trace A lower 7 channels



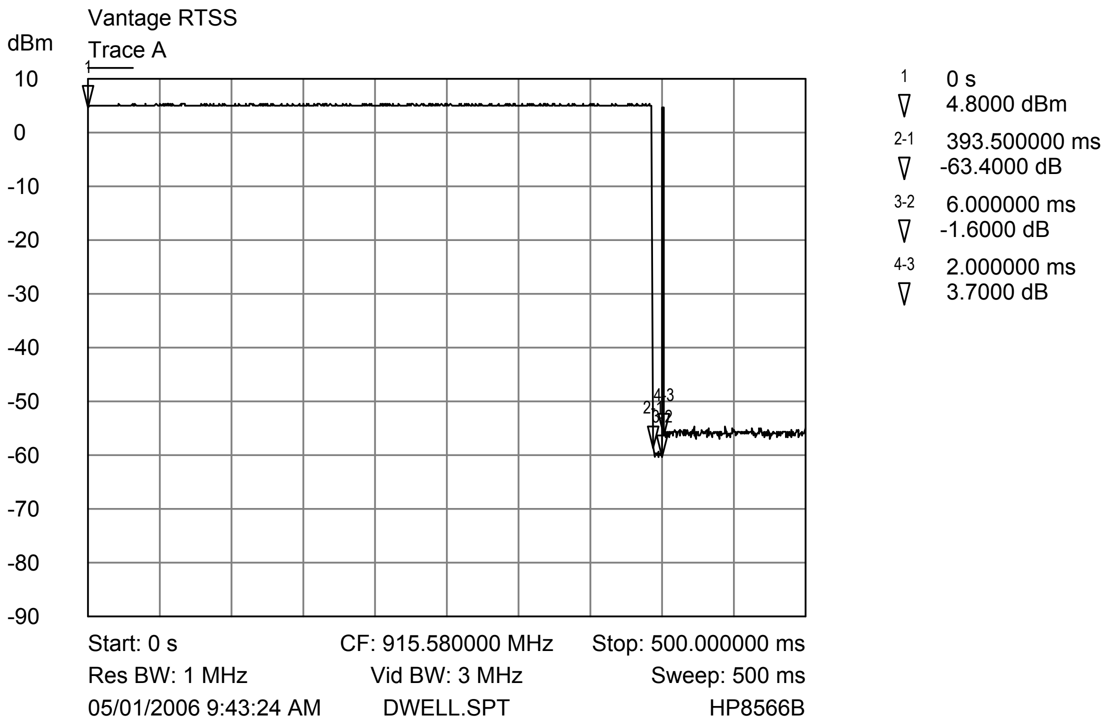
Trace A lower 6 middle channels



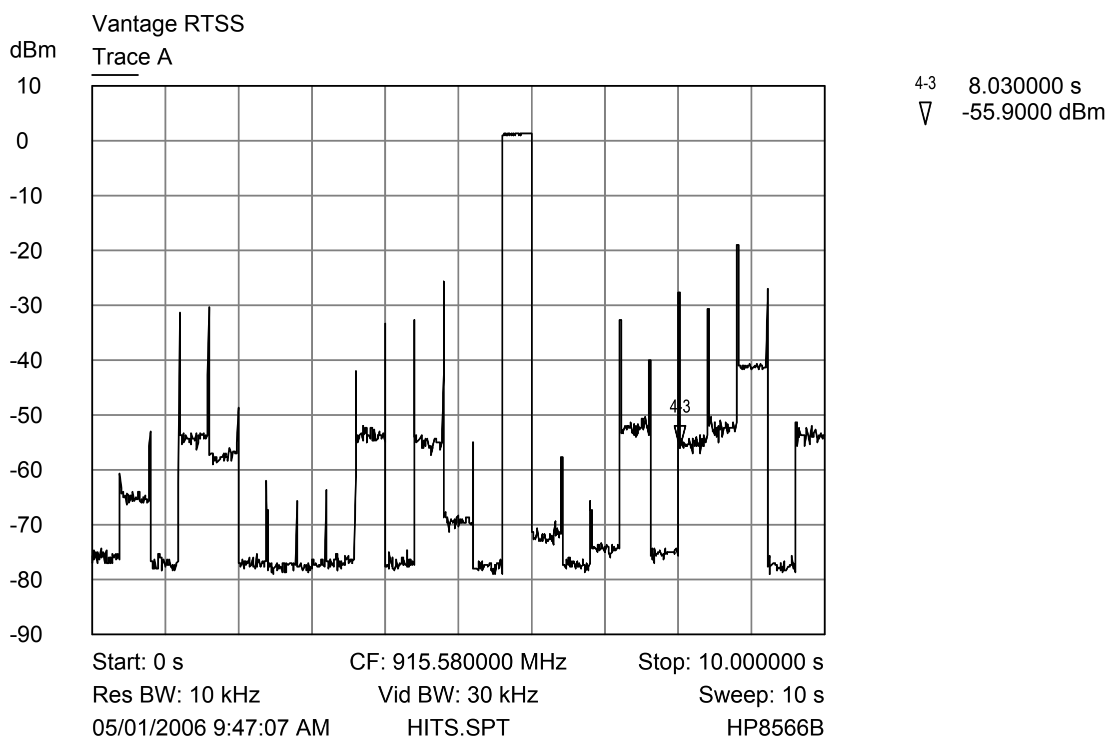
Trace A upper 6 middle channels



Trace A upper 6 channels



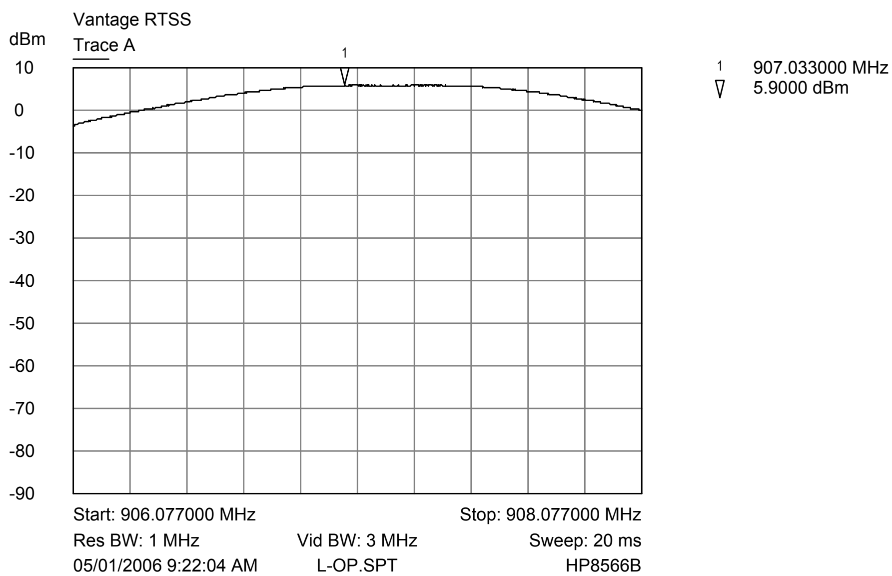
Trace A dwell time



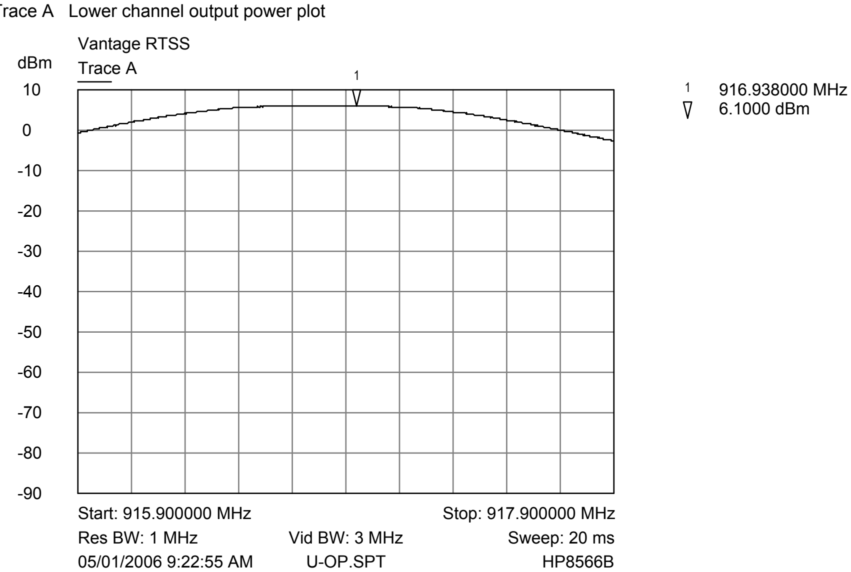
Trace A hits per 10 seconds

6.5.3 §15.247(b)(2) Peak Conducted Power Requirement

The EUT has a measured peak conducted power of 6.1 dBm or 4.1 mW. The limit for this device is 250 mW or 23.98 dBm. See the plots below. §15.247(b)(4) states that if antennas with directional gain of more than 6 dBi are used, the output power of the transmitter shall be reduced below the stated limits by the amount that the directional gain exceeds 6 dBi. The EUT does not use an antenna with greater than 6 dBi gain.



Trace A Lower channel output power plot



Trace A Upper channel output power plot

6.5.4 §15.247(e) Operation with Directional Antenna Gains Greater than 6 dBi

The antenna has a directional gain of less than 6 dBi; therefore this section does not apply.

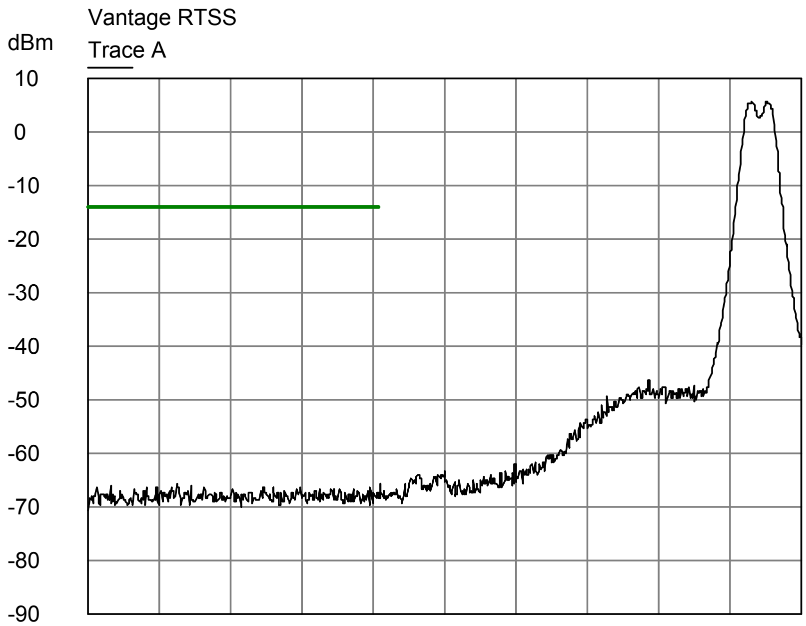
6.5.5 §15.247(d) Spurious Emission Measurements

6.5.5.1 Conducted Measurements at the Antenna Port

The conducted spurious emissions, in any 100 kHz bandwidth outside the operating band, must be attenuated to at least 20 dB below the measured fundamental emission level. The measured level was 6.1 dBm; therefore, the spurious conducted emissions must be attenuated below −13.9 dBm. The EUT maximum conducted spurious emission was measured at −26.6 dBm on a frequency of 1814.6 MHz. See the tables and plots below:

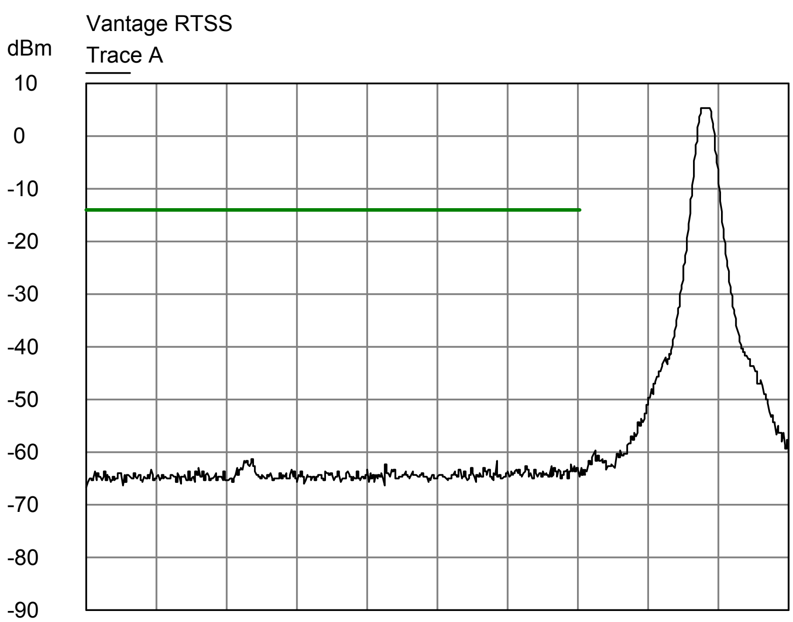
907.3 MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
1814.6	-26.6	-13.9	-12.7
2721.9	-64.1	-13.9	-50.2
3629.2	-58.7	-13.9	-44.8
4536.5	-65.6	-13.9	-51.7
5443.8	-65.9	-13.9	-52.0
6351.1	-62.5	-13.9	-48.6
7258.4	-60.9	-13.9	-47.0
8165.7	-61.8	-13.9	-47.9
9073.0	-61.0	-13.9	-47.1

916.9 MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Margin (dB)
1833.8	-27.5	-13.9	-13.6
2750.7	-65.4	-13.9	-51.5
3667.6	-59.9	-13.9	-46.0
4584.5	-65.3	-13.9	-51.4
5501.4	-66.4	-13.9	-52.5
6418.3	-61.5	-13.9	-47.6
7335.2	-61.9	-13.9	-48.0
8252.1	-62.6	-13.9	-48.7
9169.0	-61.0	-13.9	-47.1



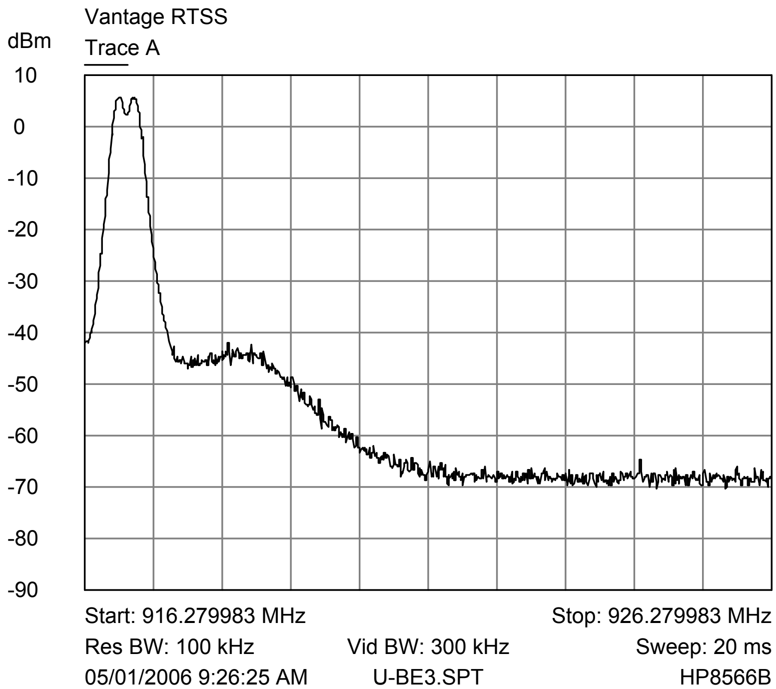
Start: 897.919927 MHz Stop: 907.919927 MHz
Res BW: 100 kHz Vid BW: 300 kHz Sweep: 20 ms
05/01/2006 9:16:30 AM L-BE2.SPT HP8566B

Trace A Lower channel bandedge plot

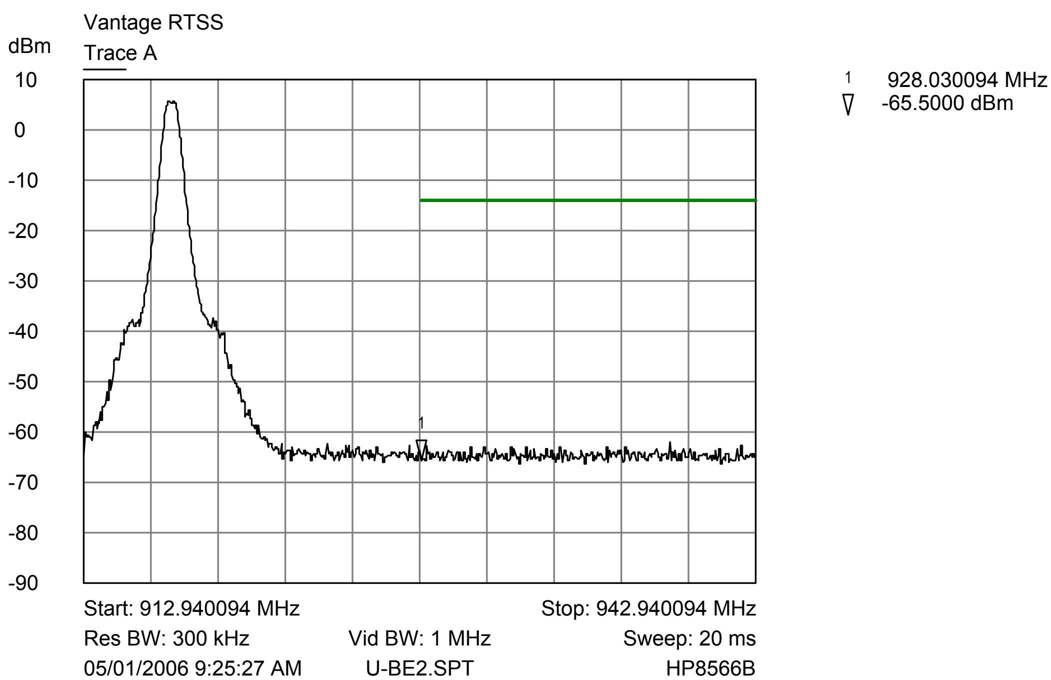


Start: 880.899888 MHz Stop: 910.899888 MHz
Res BW: 300 kHz Vid BW: 1 MHz Sweep: 20 ms
05/01/2006 9:17:42 AM L-BE3.SPT HP8566B

Trace A Lower channel bandedge plot



Trace A Upper channel band edge plot



Trace A Upper channel band edge plot

6.5.5.2 Radiated Spurious Emission Measurements

The radiated spurious emissions that fall in restricted bands, as specified in §15.205, must comply with the limits of §15.209. The nearest emission to the limit, was 10.9 dB below the limit at 3629.2 MHz. See the tables below:

907.3 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2721.9	Peak	Vertical	16.0	30.8	46.8	74.0	-27.2
2721.9	Average	Vertical	4.6	30.8	35.4	54.0	-18.6
2721.9	Peak	Horizontal	16.8	30.8	47.6	74.0	-26.4
2721.9	Average	Horizontal	6.6	30.8	37.4	54.0	-16.6
3629.2	Peak	Vertical	19.0	33.4	52.4	74.0	-21.6
3629.2	Average	Vertical	9.0	33.4	42.4	54.0	-11.6
3629.2	Peak	Horizontal	18.7	33.4	52.1	74.0	-21.9
3629.2	Average	Horizontal	9.7	33.4	43.1	54.0	-10.9
4536.5	Peak	Vertical	12.5	34.5	47.0	74.0	-27.0
4536.5	Average	Vertical	0.9	34.5	35.4	54.0	-18.6
4536.5	Peak	Horizontal	13.4	34.5	47.9	74.0	-26.1
4536.5	Average	Horizontal	1.2	34.5	35.7	54.0	-18.3
5443.8	Peak	Vertical	11.3	36.3	47.6	74.0	-26.4
5443.8	Average	Vertical	-0.9	36.3	35.4	54.0	-18.6
5443.8	Peak	Horizontal	11.6	36.3	47.9	74.0	-26.1
5443.8	Average	Horizontal	-1.0	36.3	35.3	54.0	-18.7
7258.4	Peak	Vertical	11.6	39.1	50.7	74.0	-23.3
7258.4	Average	Vertical	0.0	39.1	39.1	54.0	-14.9
7258.4	Peak	Horizontal	12.4	39.1	51.5	74.0	-22.5
7258.4	Average	Horizontal	0.1	39.1	39.2	54.0	-14.8
8165.7	Peak	Vertical	9.4	40.4	49.8	74.0	-24.2
8165.7	Average	Vertical	-2.9	40.4	37.5	54.0	-16.5
8165.7	Peak	Horizontal	9.6	40.4	50.0	74.0	-24.0
8165.7	Average	Horizontal	-2.8	40.4	37.6	54.0	-16.4
9073.0	Peak	Vertical	11.2	41.8	53.0	74.0	-21.0
9073.0	Average	Vertical	-1.0	41.8	40.8	54.0	-13.2
9073.0	Peak	Horizontal	10.7	41.8	52.5	74.0	-21.5
9073.0	Average	Horizontal	-0.9	41.8	40.9	54.0	-13.1

916.9 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2750.7	Peak	Vertical	14.6	30.9	45.5	74.0	-28.5
2750.7	Average	Vertical	5.4	30.9	36.3	54.0	-17.7
2750.7	Peak	Horizontal	16.2	30.9	47.1	74.0	-26.9
2750.7	Average	Horizontal	6.0	30.9	36.9	54.0	-17.1
3667.6	Peak	Vertical	15.2	33.5	48.7	74.0	-25.3
3667.6	Average	Vertical	5.4	33.5	38.9	54.0	-15.1
3667.6	Peak	Horizontal	14.8	33.5	48.3	74.0	-25.7
3667.6	Average	Horizontal	5.3	33.5	38.8	54.0	-15.2
4584.5	Peak	Vertical	11.9	34.6	46.5	74.0	27.5
4584.5	Average	Vertical	0.4	34.6	35.0	54.0	-19.0
4584.5	Peak	Horizontal	12.3	34.6	46.9	74.0	-27.1
4584.5	Average	Horizontal	0.6	34.6	35.2	54.0	-18.8
7335.2	Peak	Vertical	12.8	39.3	52.1	74.0	-21.9
7335.2	Average	Vertical	0.0	39.3	39.3	54.0	-14.7
7335.2	Peak	Horizontal	11.7	39.3	51.0	74.0	-23.0
7335.2	Average	Horizontal	0.0	39.3	39.3	54.0	-14.7
8252.1	Peak	Vertical	9.4	40.5	49.9	74.0	-24.1
8252.1	Average	Vertical	-2.9	40.5	37.6	54.0	-16.4
8252.1	Peak	Horizontal	9.6	40.5	50.1	74.0	-23.9
8252.1	Average	Horizontal	-2.8	40.5	37.7	54.0	-16.3
9169.0	Peak	Vertical	11.2	41.7	52.9	74.0	-21.1
9169.0	Average	Vertical	-1.0	41.7	40.7	54.0	-13.3
9169.0	Peak	Horizontal	10.7	41.7	52.4	74.0	-21.6
9169.0	Average	Horizontal	-0.9	41.7	40.8	54.0	-13.2

6.5.5.3 Sample Field Strength Calculation for Radiated Measurements:

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

FS = RA + CF Where

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

Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m, FS = (42.5 - 26.5) + 8.5 = 24.5 dBμV/m.

6.5.6 §15.247(e) 3 kHz Power Spectral Density

The EUT uses FSK modulation; therefore, this test is not applicable.

6.5.7 §15.247(f) Hybrid Systems

The EUT is not a hybrid system; therefore, this section does not apply.

6.5.8 §15.247(g) Channel Usage

The EUT meets the requirements of this section as described in Exhibit 12 (Operational Description) of the submittal files.

6.5.9 §15.247(h) Channel Coordination

The EUT meets the requirements of this section as described in Exhibit 12 (Operational Description) of the submittal files.

6.5.10 §15.247(i) Exposure to RF Energy

MPE data and calculations are found in Exhibit 11 of the submittal files. The limit is 0.6 mW/cm^2 and the maximum exposure possible was calculated at 0.01 mW/cm^2.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Conducted Disturbance at Mains Ports:

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 μH) 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:

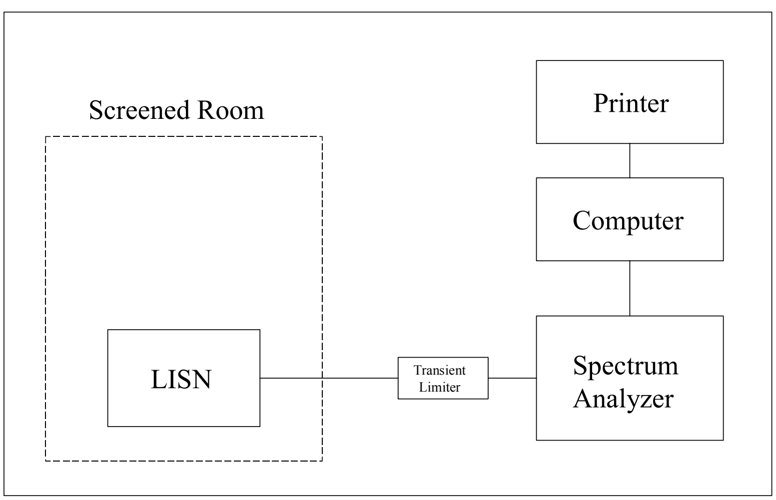
a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
c) Power cords which are specified by the manufacturer to be connected via a host unit or 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 is placed on a non-conducting table at 0.8 meters from the metallic floor. The vertical coupling plane (wall of the screened room) is located 40 cm to the rear of the EUT. Floor standing equipment is placed directly on the earth grounded floor.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/28/2005
Test Software	CCL	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/10/2005
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	03/06/2006
LISN	EMCO	3825/2	9508-2435	03/15/2006
Conductance Cable Wanship Site #2	CCL	Cable J	N/A	12/12/2005
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/12/2005

An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 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.

Conducted Emissions Test Setup



A1.2 Radiated Disturbance:

The radiated disturbance from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings. A preamplifier with a fixed gain of 26 dB and a power amplifier with a fixed gain of 22 dB 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.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, 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. A double-ridged guide antenna was used to measure the emissions at frequencies above 1000 MHz at a distance of 3 meters from the EUT.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there was 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.

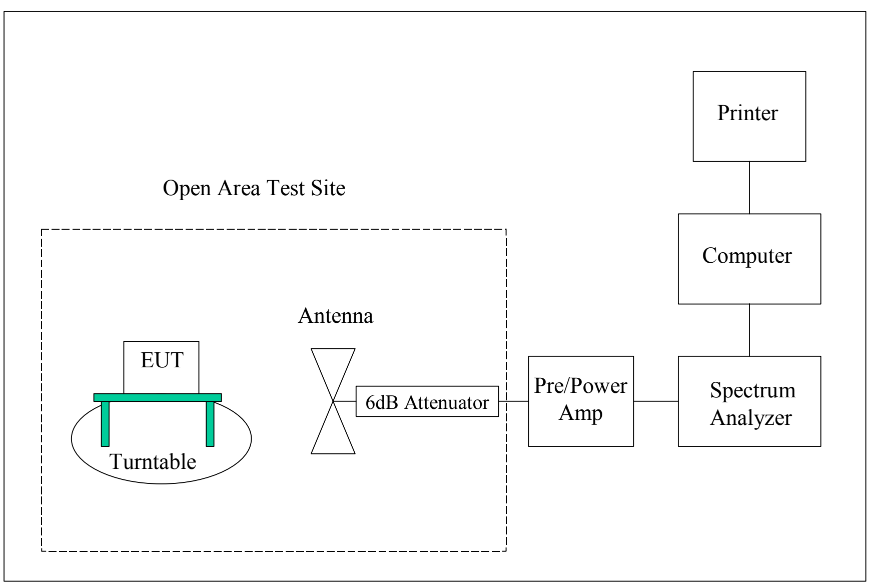
Desktop equipment is measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/28/2005
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/10/2005
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	03/06/2006

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Biconilog Antenna	EMCO	3142	9601-1009	12/28/2005
Double Ridged Guide Antenna	EMCO	3115	9604-4779	05/26/2005
High Frequency Amplifier	Hewlett Packard	8449B	3008A00990	05/25/2005
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/12/2005
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	09/19/2005
6 dB Attenuator	Hewlett Packard	8491A	32835	12/12/2005

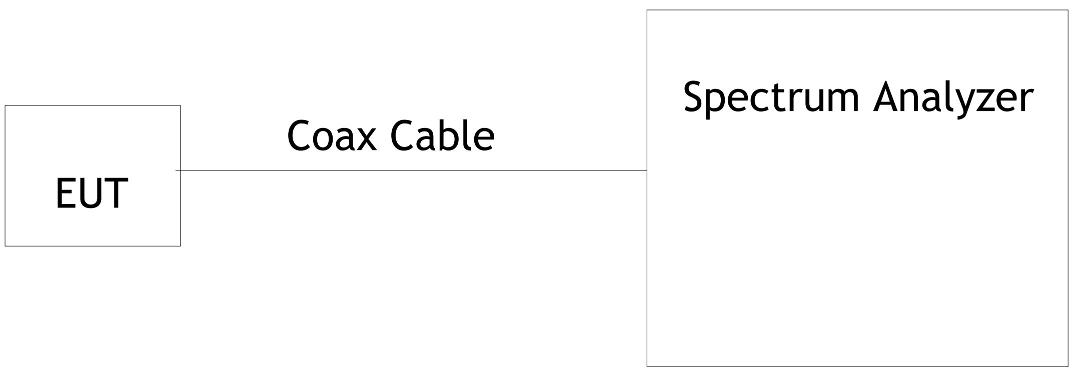
An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

Radiated Emissions Test Setup



A1.3 Measurements at the Antenna Port

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/10/2005
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	03/06/2006
Cable	Andrews	Coax w/SMA	001116	11/16/2005
6 dB Attenuator	Hewlett Packard	8491A	32835	12/12/2005



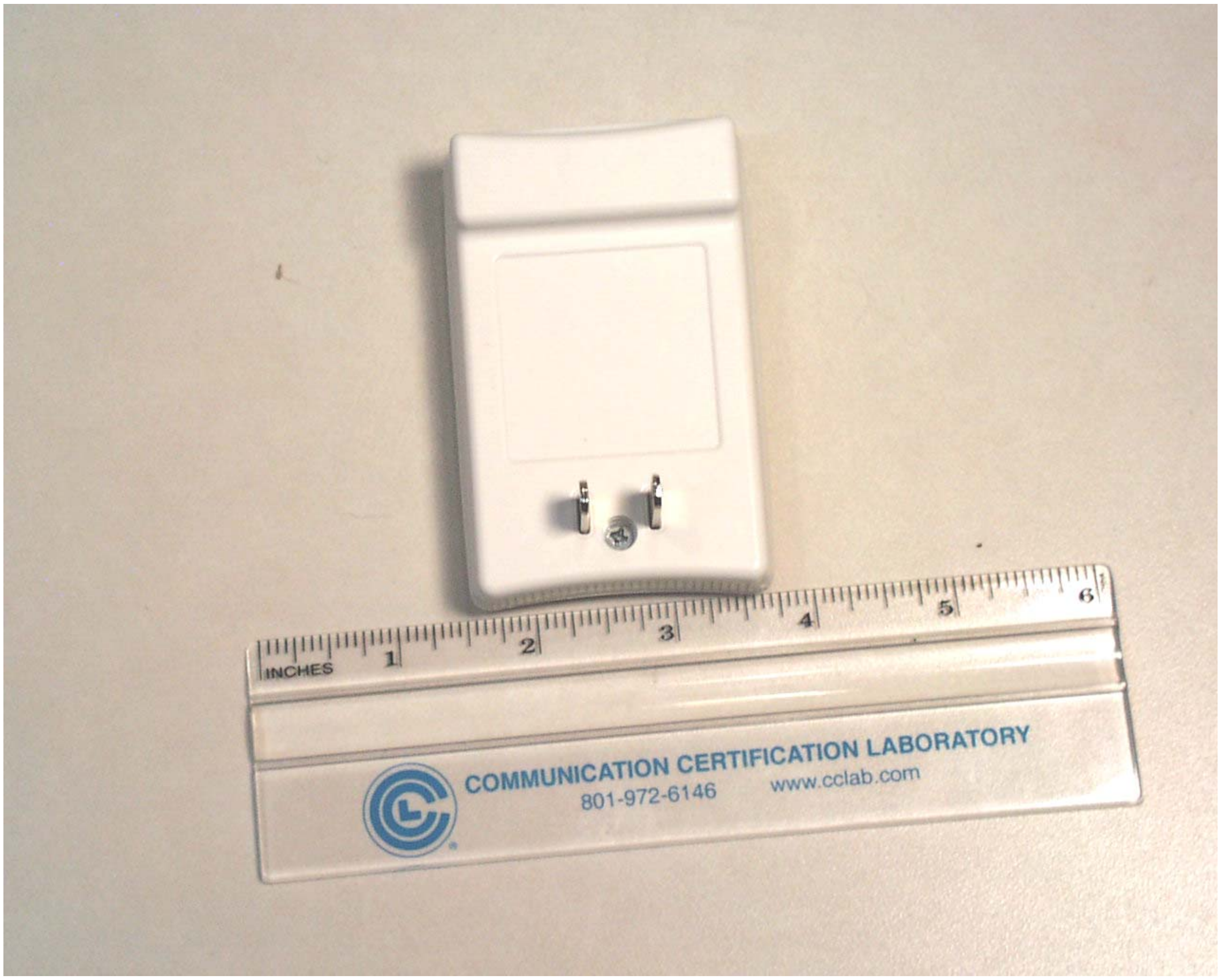
APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Radiated Disturbance Worst Case Configuration

Photograph 2 – Conducted Disturbance Worst Case Configuration

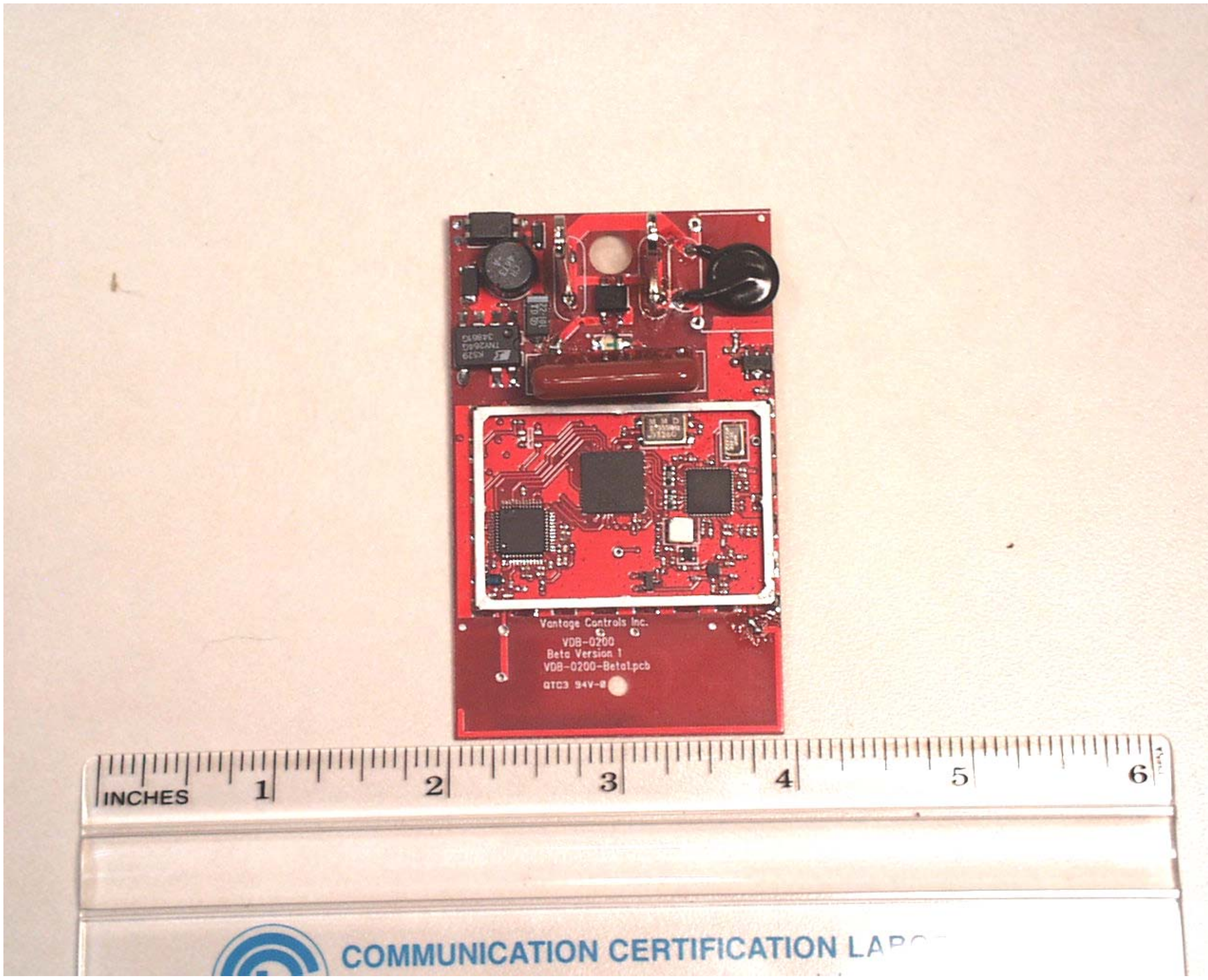
Photograph 3 – Front View of the EUT

Photograph 4 – Back View of the EUT



Photograph 7 – Component Side of the PCB with Shield in Place

Photograph 8 – Component Side of the PCB with Shield Removed



Photograph 9 – Trace Side of the PCB