COMMUNICATION CERTIFICATION LABORATORY

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

Test Report

Certification

Test Of:

IP 3222

FCC ID:

VHY3222

Test Specification:

FCC PART 15, Subpart C

Test Report Serial No: 2173

Applicant:

IPICO
22 Redcliffe Gardens Drive
Clontarf
QLD 4019 Australia

Dates of Test: May 4 – 7, 2009

Issue Date: June 9, 2009

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

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- Applicant: IPICO
- Manufacturer: IPICO
- Brand Name: IPICO
- Model Number: IP 3222
- FCC ID Number: VHY3222

On this 9th day of June 2009, 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 accredited the Communication Certification Laboratory EMC testing facilities, 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

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: IPICO
22 Redcliffe Gardens Drive
Clontarf
QLD 4019 Australia

Contact Name: Marius van Dyk
Title: Product Manager

1.2 Manufacturer:

Company Name: IPICO
Prospect Close 5B, 311 Regency St
Route 21 Corporate Park, Irene
Pretoria, South Africa

Contact Name: Marius van Dyk
Title: Product Manager

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	IPICO
Model Number:	IP 3222
Serial Number:	None
Options Fitted:	N/A

2.2 Description of EUT:

The IP 3222 is a passive RFID tag reader that operates in the 902 - 928 MHz ISM band. The IP 3222 uses a 245 channel frequency hopping spread spectrum transmitter. The IP 3222 is powered by 12 Vdc which the customer provides. For testing, a CUI Inc. 3A-161WU12 wall mount power supply was used to power the EUT. Communication with a host system is via RS-232 over the communication/power cable. The IP 3222 uses passive RFID tags.

This report covers the transmitter, subject to FCC Part 15, Subpart C. The circuitry of the device subject to FCC Part 15, Subpart B, has been tested and is covered in CCL report #2171.

2.3 EUT and Support Equipment:

The FCC ID numbers for 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: IPICO MN: IP 3222 (Note 1)	VHY3222	RFID Tag Reader	See Section 2.4
BN: Apple MN: Macbook Pro	DoC	Computer	USB/connection to USB to Serial adapter (Note 2)

Note: (1) EUT
(2) Interface port connected to EUT (See Section 2.4)

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

2.4 Interface Ports on EUT:

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
Power/Communication	1	Unshielded 9 conductor cable with Mil type connector/>3 meters

2.5 Modification Incorporated/Special Accessories on EUT:

The following modifications were made to the IP 3222 by the Client during testing to comply with the specification. These modifications will be implemented during manufacturing.

1. The output power was adjusted down 0.6 dB from the current factory setting to 27.9 dBm, while transmitting constantly at 927.2 MHz, using the potentiometer in the transmitter module. The adjustment point is accessible only by removing the transmitter from the EUT housing.

Signature: ______________________________

Typed Name: Marius van Dyk

Title: Project Manager

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 §15.247 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 March 11, 2009 (90504).

CCL is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2009.

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/60 Hz to CUI Inc 3A-161WU12 power supply
12 VDC to EUT from CUI Inc power supply

4.2 Operating Modes:

The EUT was tested in 3 orthogonal orientations. The worst-case emissions were with the IP 3222 constantly transmitting at the desired frequency while mounted vertically on the EUT table.

4.3 EUT Exercise Software:

Test software was used to control the IP 3222 transmitter.

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)	Result
15.203	Antenna Requirement	N/A	Complied
15.207	Conducted Disturbance at Mains Ports	0.15 to 30	Complied
15.247(a)	Transmitter Channel Characteristics	902.0 – 928.0	Complied
15.247(b)	Transmitter Output Power	902.0 – 928.0	Complied
15.247(c)	Operation with Directional Antenna Gains Greater than 6 dBi	902.0 – 928.0	Not Applicable
15.247(d)	Conducted Emissions at the Antenna Port	902.0 – 928.0	Complied
15.247(d)	Radiated Emissions in the Restricted Bands	30 – 9280.0	Complied
15.247(e)	3 kHz Power Spectral Density	902.0 – 928.0	Not Applicable
15.247(f)	Hybrid Systems	902.0 – 928.0	Not Applicable
15.247(g)	Channel Usage	902.0 – 928.0	Complied
15.247(h)	Channel Hopset Coordination	902.0 – 928.0	Complied
15.247(i)	RF Exposure	902.0 – 928.0	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 Test Results:

6.2.1 §15.203 Antenna Requirement

The antenna is an 8 dBi antenna mounted inside the EUT housing. The EUT housing must be opened in order to access the antenna. The antenna is not designed to be user replaceable and uses a coax with soldered connection to the antenna.

6.2.2 Conducted Disturbance at Mains Ports Data

Frequency (MHz)	AC Mains Lead	Detector	Measured Level (dBμV)	Limit (dBμV)	Margin (dB)
0.15	Hot Lead	Peak (Note 1)	50.8	56.0	-5.2
0.21	Hot Lead	Peak (Note 1)	45.8	53.3	-7.5
2.33	Hot Lead	Peak (Note 1)	37.8	46.0	-8.2
2.40	Hot Lead	Peak (Note 1)	40.1	46.0	-5.9
2.45	Hot Lead	Peak (Note 1)	40.4	46.0	-5.6
2.52	Hot Lead	Peak (Note 1)	38.7	46.0	-7.3
0.19	Neutral Lead	Peak (Note 1)	48.0	54.1	-6.1
0.22	Neutral Lead	Peak (Note 1)	46.5	52.9	-6.4
2.32	Neutral Lead	Peak (Note 1)	36.4	46.0	-9.6
2.45	Neutral Lead	Peak (Note 1)	37.0	46.0	-9.0
2.51	Neutral Lead	Peak (Note 1)	39.3	46.0	-6.7
2.58	Neutral Lead	Peak (Note 1)	37.9	46.0	-8.1

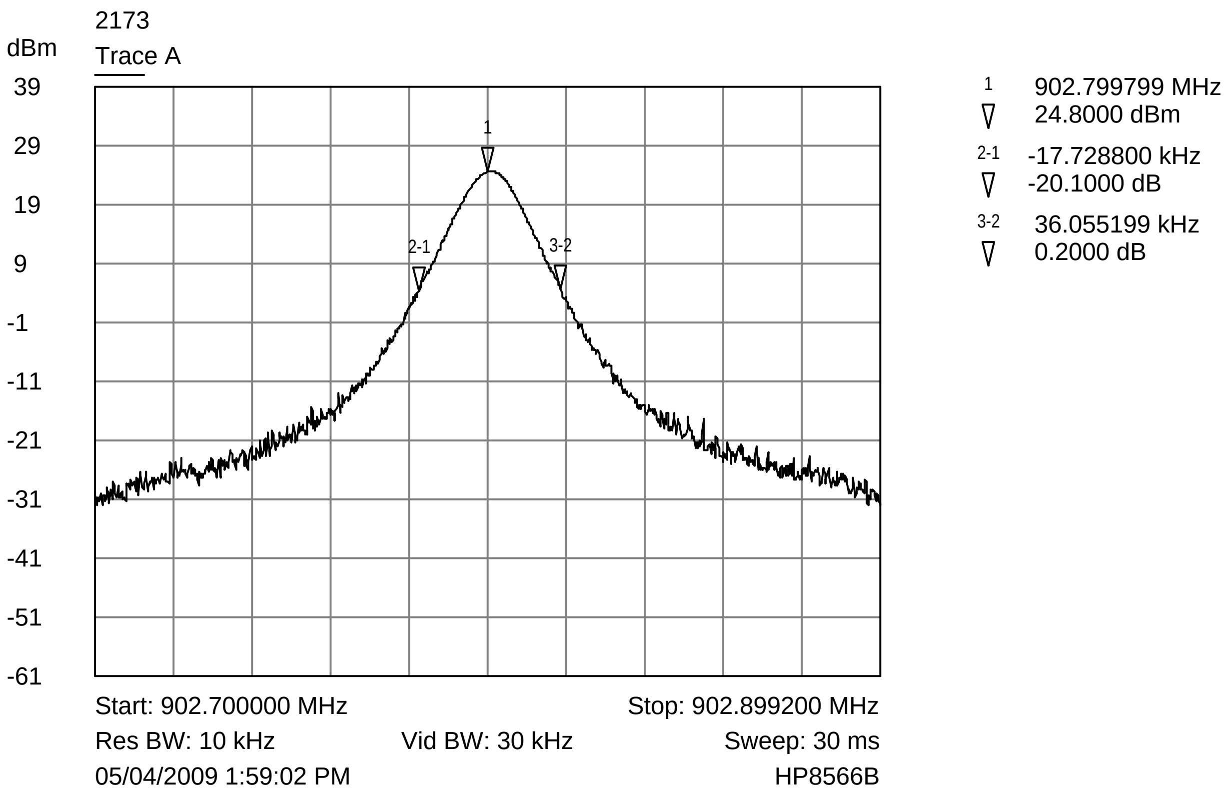
Note 1: The reference detector used for the measurements was Quasi-Peak or Peak and the data was compared to the average limit; therefore, the EUT was deemed to meet both the average and quasi-peak limits.

Note 2: The reference detector used for the measurements was quasi-peak and average and the data was compared to the respective limits.

6.2.3 §15.247(a)

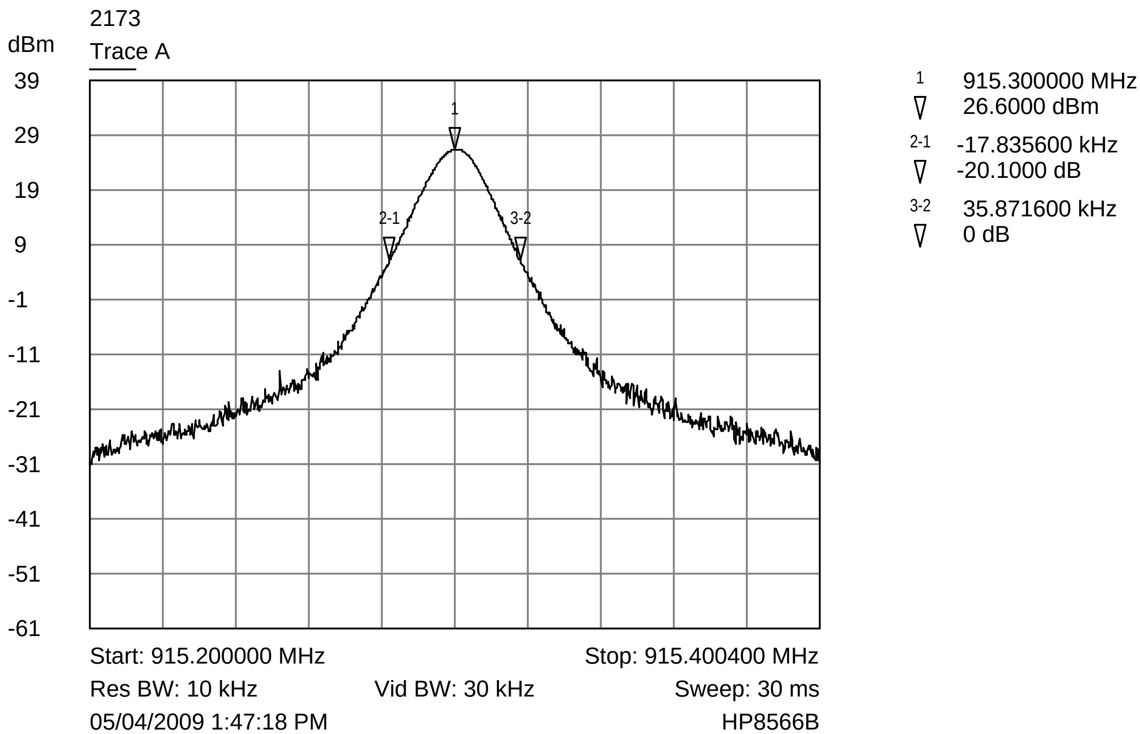
6.2.3.1 §15.247(a)(1)

The EUT shall have the hopping channels separated by the greater of 25 kHz or the 20 dB bandwidth of the hopping channel. The 20 dB bandwidth is 36.0 kHz and the channel separation is 99.8 kHz. See the plots below:



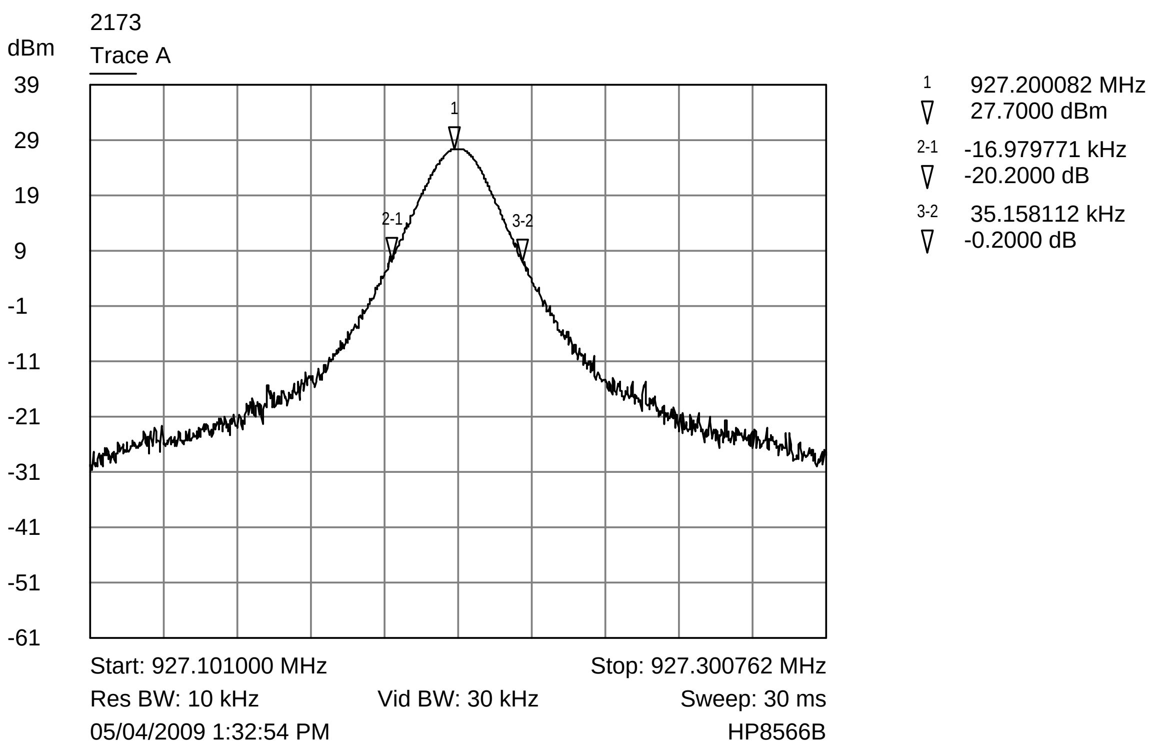
IP3222

Trace A lower channel band width plot



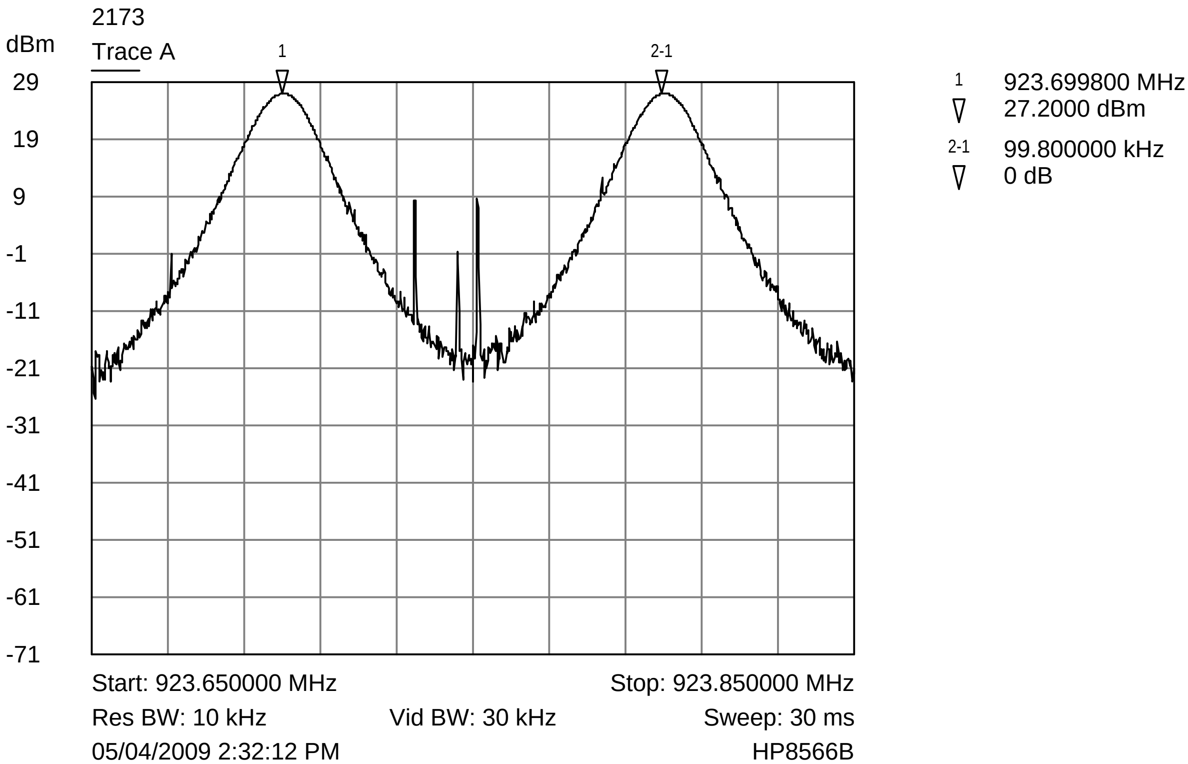
IP3222r

Trace A Middle channel band width plot



IP3222

Trace A Upper channel bandwidth plot



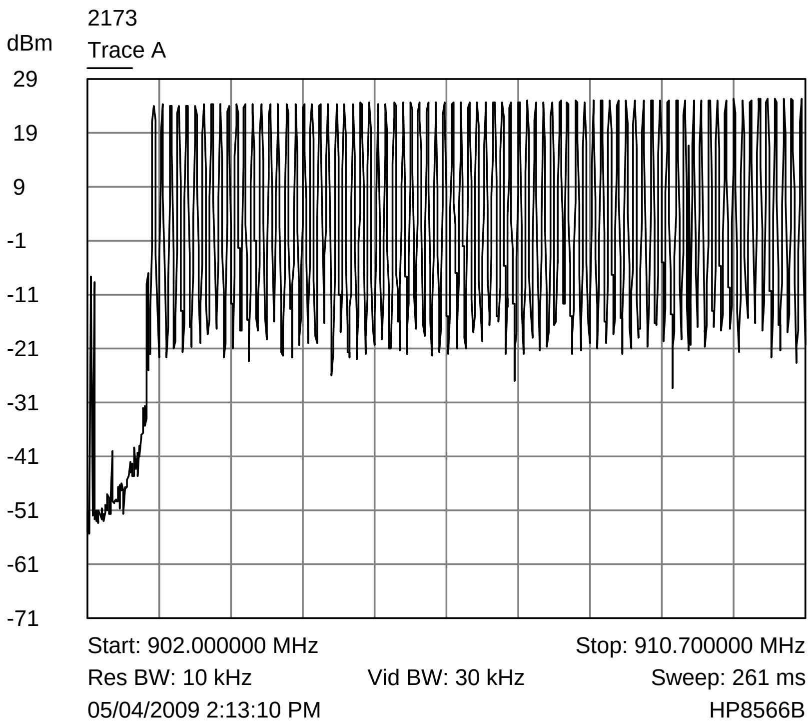
IP3222

Trace A Channel spacing plot

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. The receiver has input bandwidths that match the hopping channel bandwidths of the corresponding transmitter and shifts frequencies in synchronization with the transmitted signals.

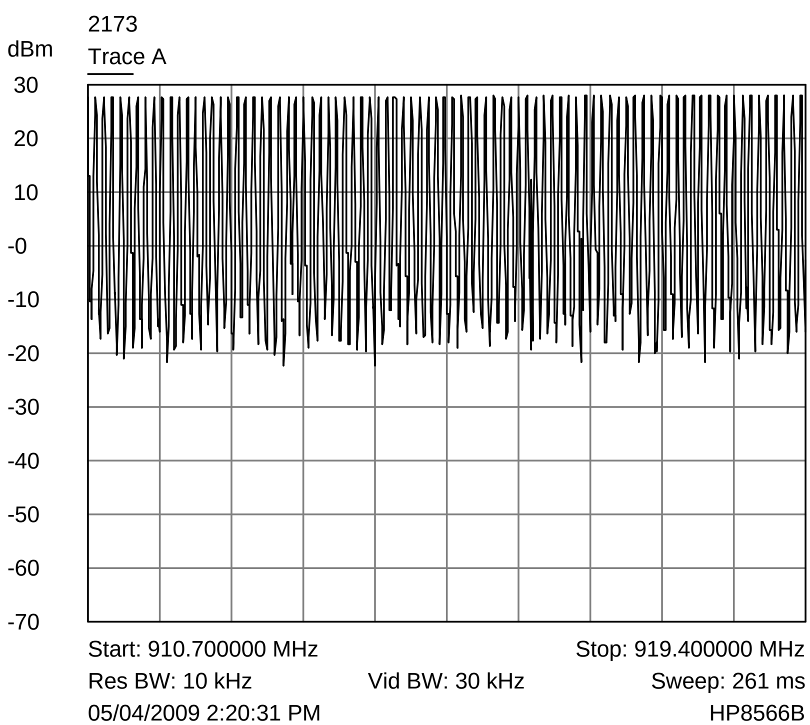
6.2.3.2 §15.247(a)(1)(i)

The EUT uses 245 hopping channels and the 20 dB bandwidth is 36.0 kHz; therefore, the average time of occupancy on any frequency must not be greater than 0.4 seconds within a 20 second period. The EUT has a dwell time of 370.0 milliseconds in a 20 second period. See the plots below.



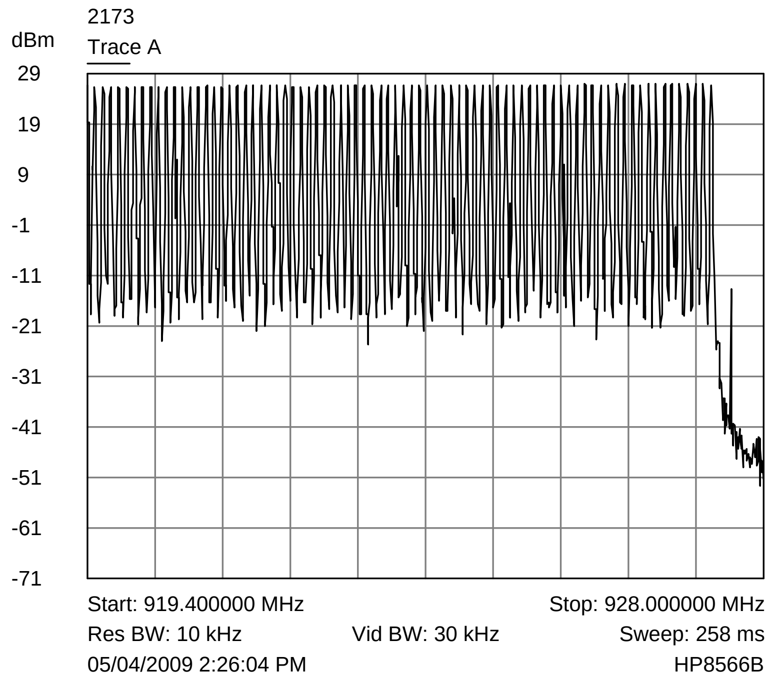
IP3222

Trace A lower channels



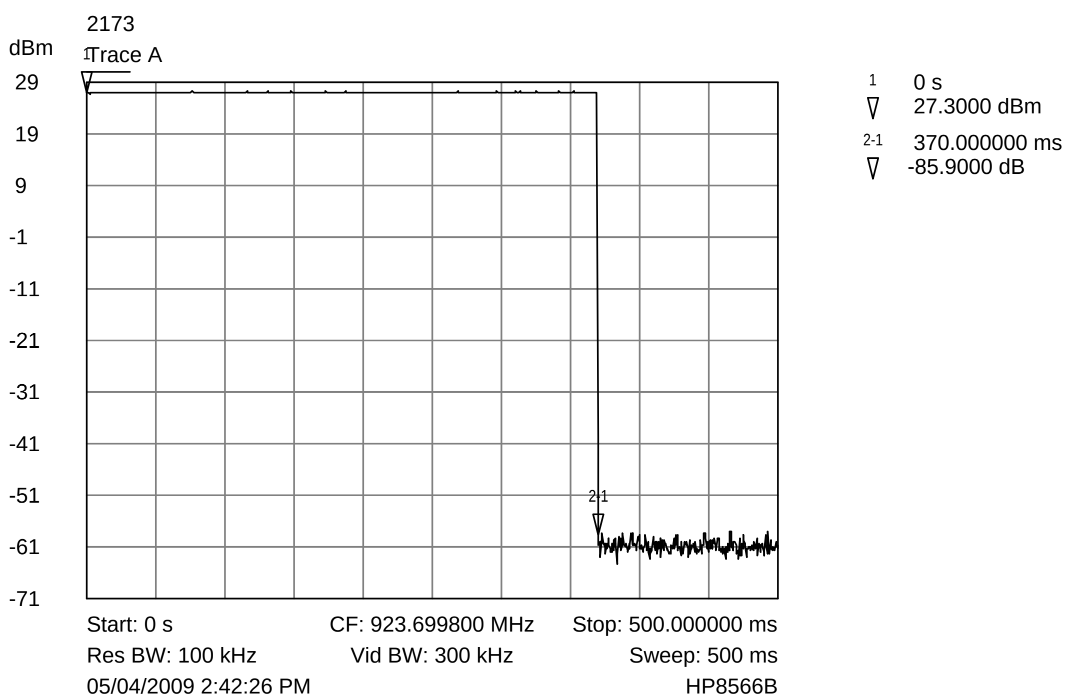
IP3222

Trace A Middle channels



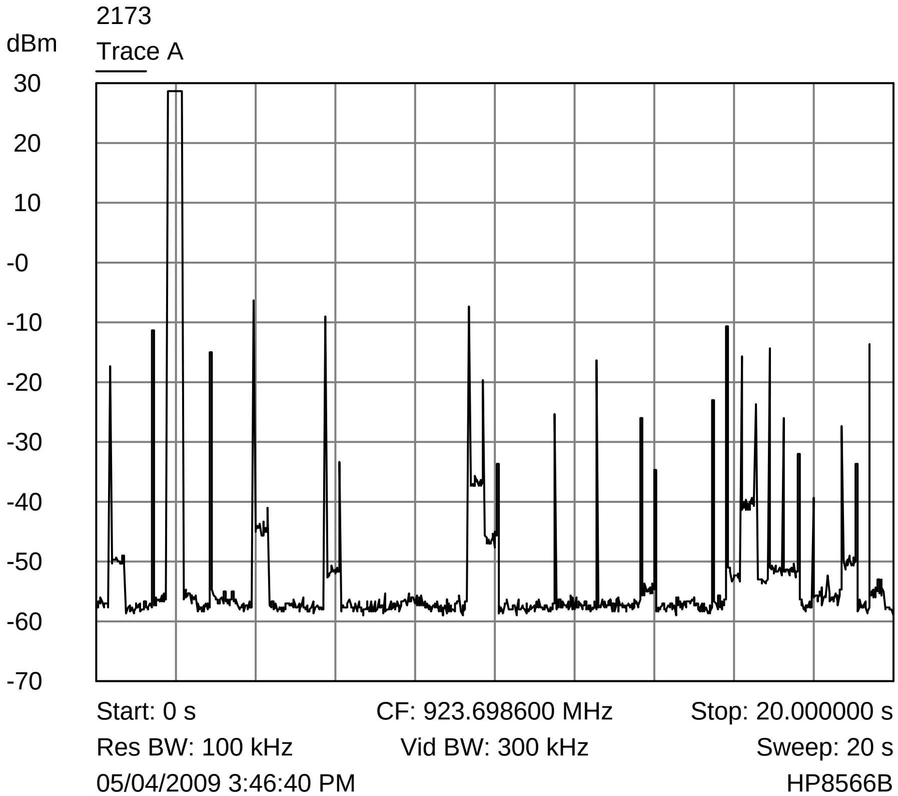
IP3222

Trace A upper channels



IP3222

Trace A Channel dwell time

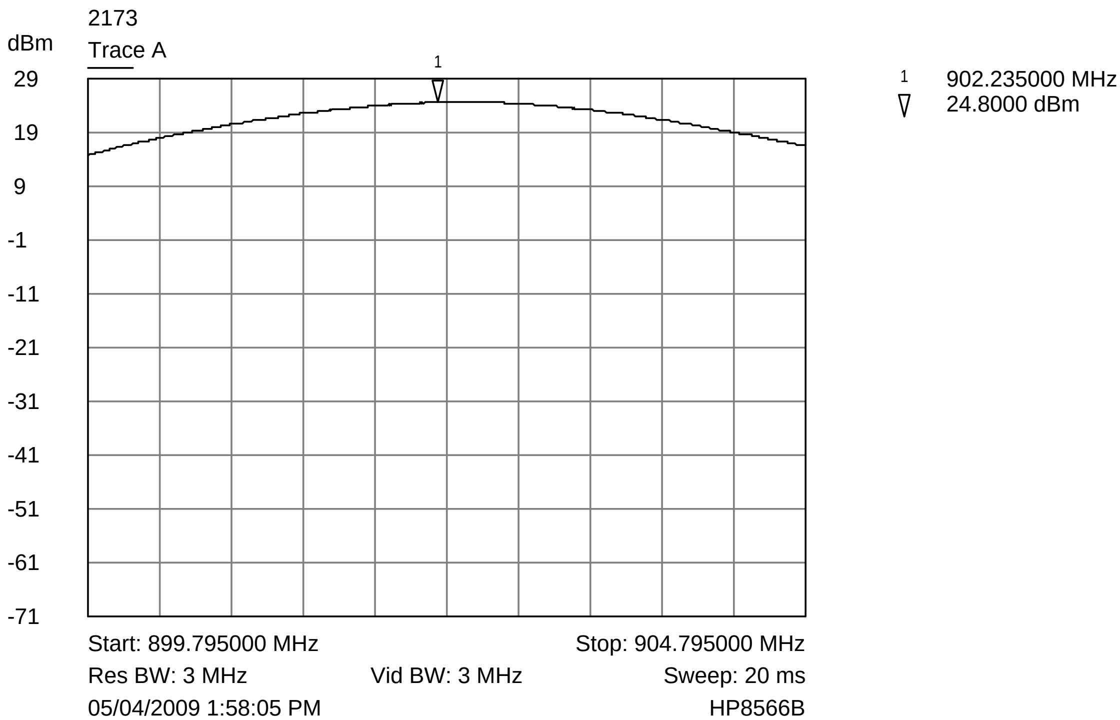


IP3222

Trace A channel hits in 20 seconds

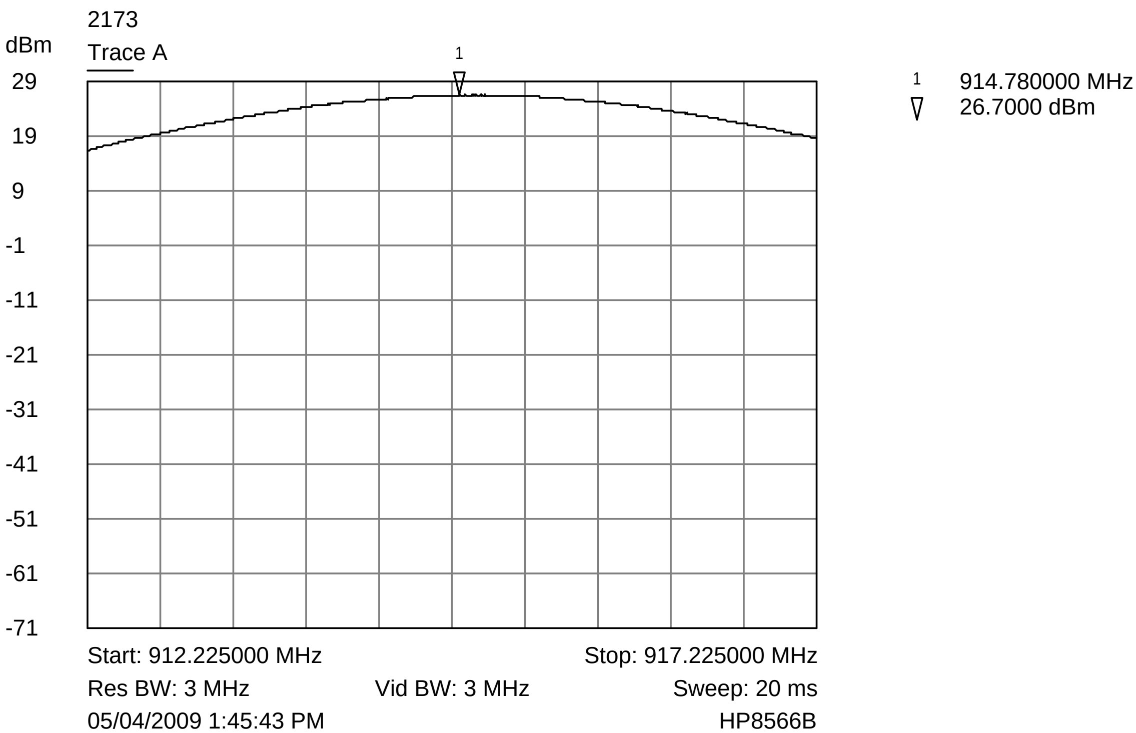
6.2.4 §15.247(b)(2) Peak Conducted Power Requirement

The limit for this device is 1 W or 30.0 dBm when using a 6 dBi or less antenna; however, this device uses an 8 dBi antenna so the conducted limit is 28.0 dBm. The EUT has a measured peak conducted power of 27.9 dBm or 616.6 mW. See the plots below.



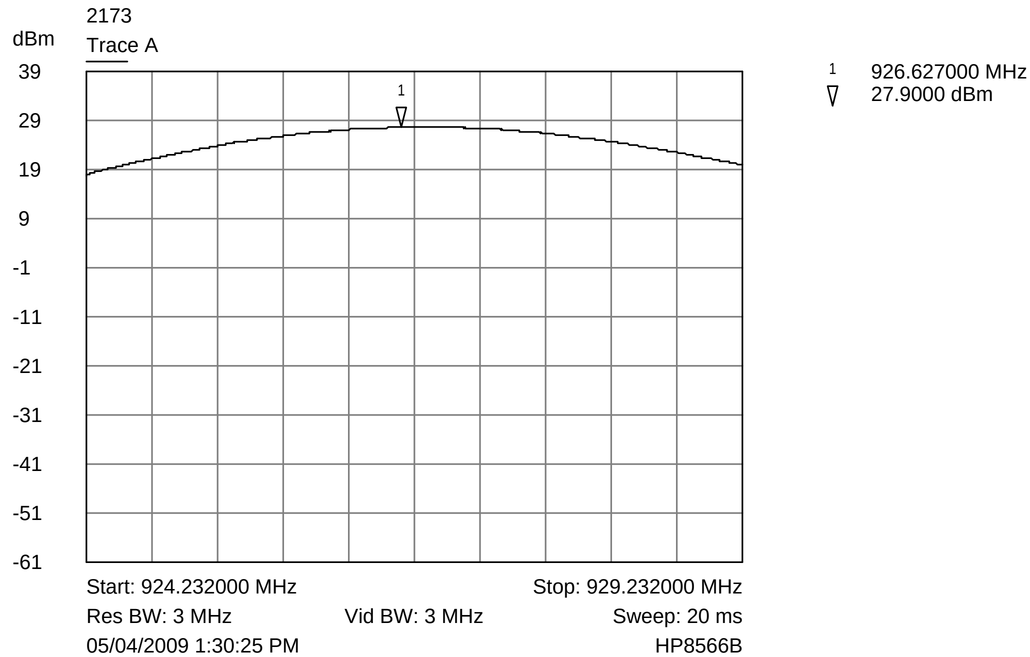
IP3222

Trace A lower channel output power plot



IP3222

Trace A Middle channel output power plot



IP3222

Trace A Upper channel output power plot

6.2.5 §15.247(d) Spurious Emission Measurements

6.2.5.1 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 27.9 dBm; therefore, the spurious conducted emissions must be attenuated below 7.9 dBm. See the tables and plots below:

Transmitting on the Lowest Channel (902.8 MHz)

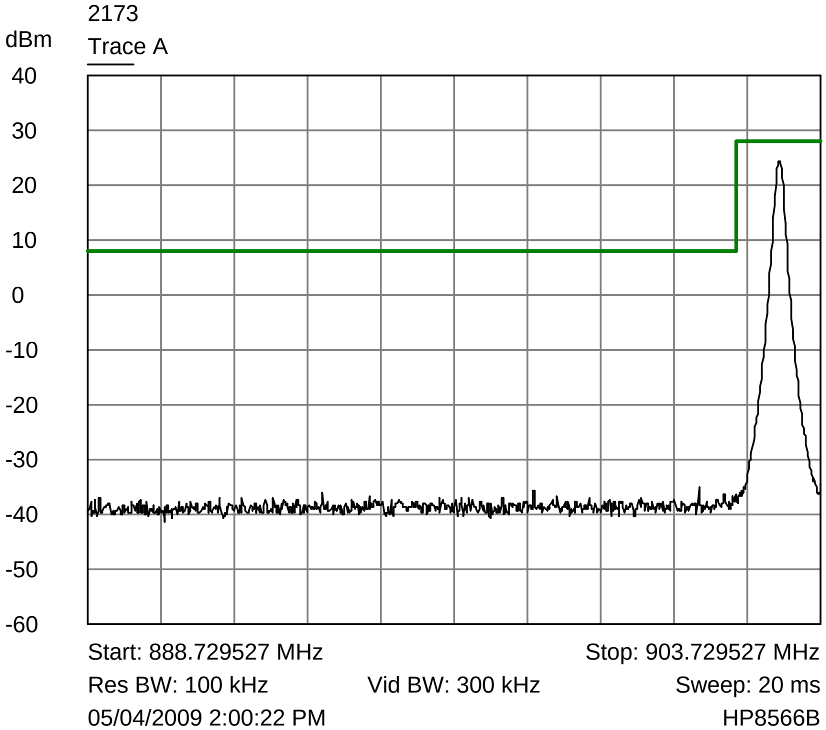
Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)
1805.6	-60.5	7.9
2708.4	-59.2	7.9
3611.2	-75.3	7.9
4514.0	-69.4	7.9
5416.8	-74.7	7.9
3619.6	-50.1	7.9
7222.4	-65.5	7.9
8125.2	-69.3	7.9
9028.0	-69.2	7.9

Transmitting on the Middle Channel (915.2 MHz GHz)

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)
1830.6	-72.4	7.9
2745.9	-67.9	7.9
3661.2	-73.4	7.9
4576.5	-67.1	7.9
5491.8	-73.3	7.9
6407.1	-56.9	7.9
7322.4	-61.4	7.9
8237.7	-69.8	7.9
9153.0	-69.9	7.9

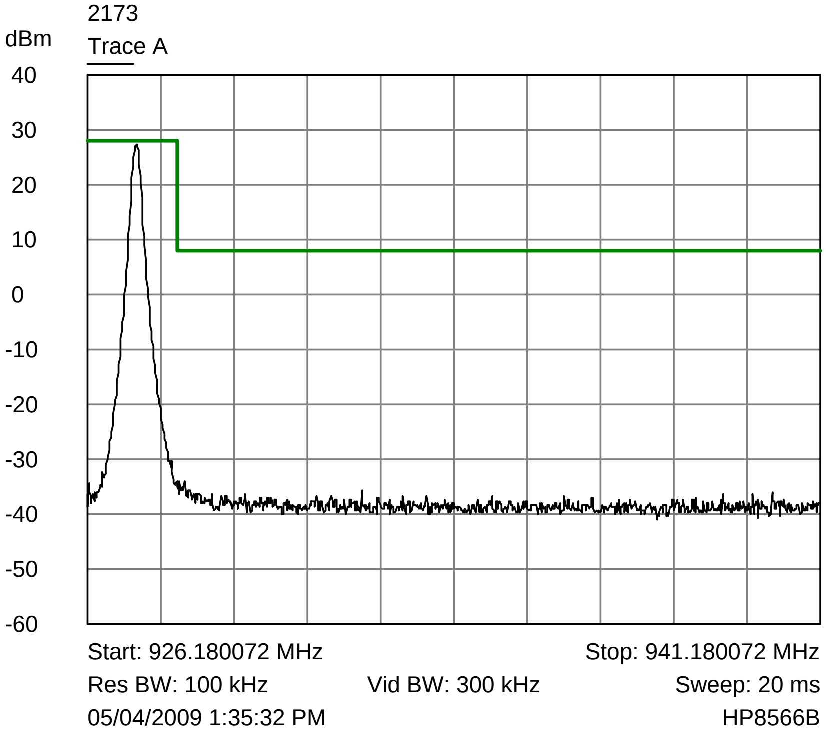
Transmitting on the Highest Channel (927.2 MHz)

Frequency (MHz)	Corrected Level (dBm)	Criteria (dBm)
1854.4	-68.7	7.9
2781.6	-65.8	7.9
3708.8	-69.8	7.9
4636.0	-66.0	7.9
5563.2	-74.0	7.9
6490.4	-57.7	7.9
7417.6	-61.5	7.9
8344.8	-70.3	7.9
9272.0	-69.1	7.9



IP3222

Trace A lower channel band edge plot



IP3222

Trace A Upper channel bandedge plot

6.2.5.2 Radiated Spurious Emission Measurements

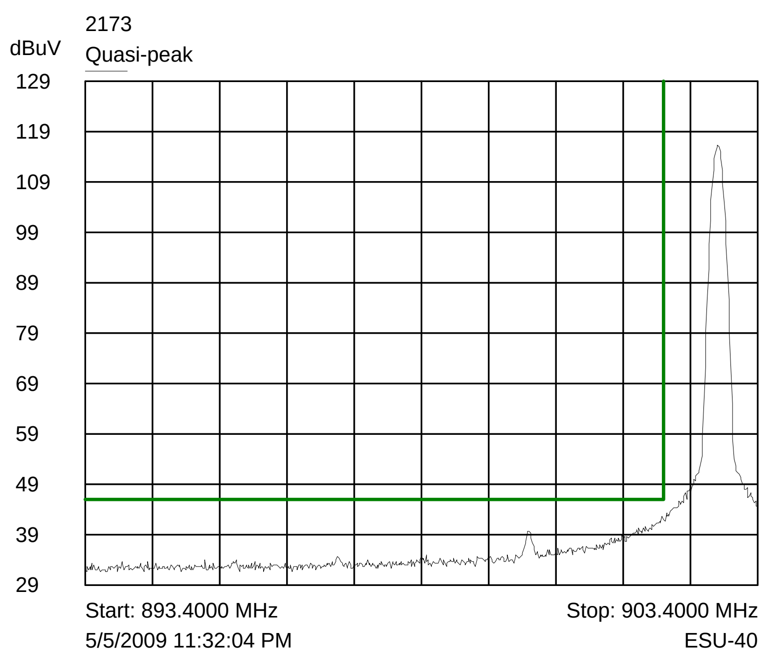
The radiated spurious emissions that fall in restricted bands, as specified in §15.205, must comply with the limits of §15.209. See the tables and plots below:

902.8 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2708.4	Peak	Vertical	7.7	32.4	40.1	74.0	-33.9
2708.4	Average	Vertical	1.7	32.4	34.1	54.0	-19.9
2708.4	Peak	Horizontal	7.8	32.4	40.2	74.0	-33.8
2708.4	Average	Horizontal	2.1	32.4	34.5	54.0	-19.5
3611.2	Peak	Vertical	4.7	35.3	40.0	74.0	-34.0
3611.2	Average	Vertical	-5.0	35.3	30.3	54.0	-23.7
3611.2	Peak	Horizontal	6.1	35.3	41.4	74.0	-32.6
3611.2	Average	Horizontal	-1.9	35.3	33.4	54.0	-20.6
4514.0	Peak	Vertical	4.9	36.9	41.8	74.0	-32.2
4514.0	Average	Vertical	-6.7	36.9	30.2	54.0	-23.8
4514.0	Peak	Horizontal	4.6	36.9	41.5	74.0	-32.5
4514.0	Average	Horizontal	-5.3	36.9	31.6	54.0	-22.4
5416.8	Peak	Vertical	4.1	38.3	42.4	74.0	-31.6
5416.8	Average	Vertical	-5.8	38.3	32.5	54.0	-21.5
5416.8	Peak	Horizontal	4.6	38.3	42.9	74.0	-31.1
5416.8	Average	Horizontal	-6.0	38.3	32.3	54.0	-21.7
7222.4	Peak	Vertical	2.5	41.4	43.9	74.0	-30.1
7222.4	Average	Vertical	-8.2	41.4	33.2	54.0	-20.8
7222.4	Peak	Horizontal	5.3	41.4	46.7	74.0	-27.3
7222.4	Average	Horizontal	-5.0	41.4	36.4	54.0	-17.6
8125.2	Peak	Vertical	1.7	42.7	44.4	74.0	-29.6
8125.2	Average	Vertical	-9.1	42.7	33.6	54.0	-20.4
8125.2	Peak	Horizontal	2.1	42.7	44.8	74.0	-29.2
8125.2	Average	Horizontal	-8.8	42.7	33.9	54.0	-20.1
9028.0	Peak	Vertical	2.5	43.4	45.9	74.0	-28.1
9028.0	Average	Vertical	-8.5	43.4	34.9	54.0	-19.1
9028.0	Peak	Horizontal	4.3	43.4	47.7	74.0	-26.3
9028.0	Average	Horizontal	-8.1	43.4	35.3	54.0	-18.7

915.2 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2745.9	Peak	Vertical	5.2	32.6	37.8	74.0	-36.2
2745.9	Average	Vertical	-0.4	32.6	32.2	54.0	-21.8
2745.9	Peak	Horizontal	5.4	32.6	38.0	74.0	-36.0
2745.9	Average	Horizontal	0.8	32.6	33.4	54.0	-20.6
3661.2	Peak	Vertical	4.5	35.5	40.0	74.0	-34.0
3661.2	Average	Vertical	-2.5	35.5	33.0	54.0	-21.0
3661.2	Peak	Horizontal	8.2	35.5	43.7	74.0	-30.3
3661.2	Average	Horizontal	2.7	35.5	38.2	54.0	-15.8
4576.5	Peak	Vertical	2.9	37.0	39.9	74.0	-34.1
4576.5	Average	Vertical	-7.5	37.0	29.5	54.0	-24.5
4576.5	Peak	Horizontal	3.3	37.0	40.3	74.0	-33.7
4576.5	Average	Horizontal	-7.1	37.0	29.9	54.0	-24.1
7322.4	Peak	Vertical	3.0	41.7	44.7	74.0	-29.3
7322.4	Average	Vertical	-7.8	41.7	33.9	54.0	-20.1
7322.4	Peak	Horizontal	4.2	41.7	45.9	74.0	-28.1
7322.4	Average	Horizontal	-6.2	41.7	35.5	54.0	-18.5
8237.7	Peak	Vertical	1.4	42.8	44.2	74.0	-29.8
8237.7	Average	Vertical	-9.6	42.8	33.2	54.0	-20.8
8237.7	Peak	Horizontal	1.9	42.8	44.7	74.0	-29.3
8237.7	Average	Horizontal	-9.6	42.8	33.2	54.0	-20.8
9153.0	Peak	Horizontal	2.0	43.5	45.5	74.0	-28.5
9153.0	Average	Horizontal	-8.7	43.5	34.8	54.0	-19.2
9153.0	Peak	Vertical	2.3	43.5	45.8	74.0	-28.2
9153.0	Average	Vertical	-8.2	43.5	35.3	54.0	-18.7

927.2 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2781.6	Peak	Vertical	8.9	32.8	41.7	74.0	-32.3
2781.6	Average	Vertical	3.0	32.8	35.8	54.0	-18.2
2781.6	Peak	Horizontal	6.8	32.8	39.6	74.0	-34.4
2781.6	Average	Horizontal	2.6	32.8	35.4	54.0	-18.6
3708.8	Peak	Vertical	5.4	35.6	41.0	74.0	-33.0
3708.8	Average	Vertical	-1.6	35.6	34.0	54.0	-20.0
3708.8	Peak	Horizontal	7.0	35.6	42.6	74.0	-31.4

927.2 MHz							
Frequency (MHz)	Detection Mode	Antenna Polarity	Receiver Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
3708.8	Average	Horizontal	0.9	35.6	36.5	54.0	-17.5
4636.0	Peak	Vertical	3.2	37.1	40.3	74.0	-33.7
4636.0	Average	Vertical	-7.4	37.1	29.7	54.0	-24.3
4636.0	Peak	Horizontal	3.5	37.1	40.6	74.0	-33.4
4636.0	Average	Horizontal	-7.8	37.1	29.3	54.0	-24.7
7417.6	Peak	Vertical	4.2	41.9	46.1	74.0	-27.9
7417.6	Average	Vertical	-6.9	41.9	35.0	54.0	-19.0
7417.6	Peak	Horizontal	3.5	41.9	45.4	74.0	-28.6
7417.6	Average	Horizontal	-7.5	41.9	34.4	54.0	-19.6
8344.8	Peak	Vertical	1.8	43.0	44.8	74.0	-29.2
8344.8	Average	Vertical	-7.6	43.0	35.4	54.0	-18.6
8344.8	Peak	Horizontal	4.1	43.0	47.1	74.0	-26.9
8344.8	Average	Horizontal	-7.3	43.0	35.7	54.0	-18.3
9272.0	Peak	Vertical	4.7	43.7	48.4	74.0	-25.6
9272.0	Average	Vertical	-5.3	43.7	38.4	54.0	-15.6
9272.0	Peak	Horizontal	5.2	43.7	48.9	74.0	-25.1
9272.0	Average	Horizontal	-5.8	43.7	37.9	54.0	-16.1



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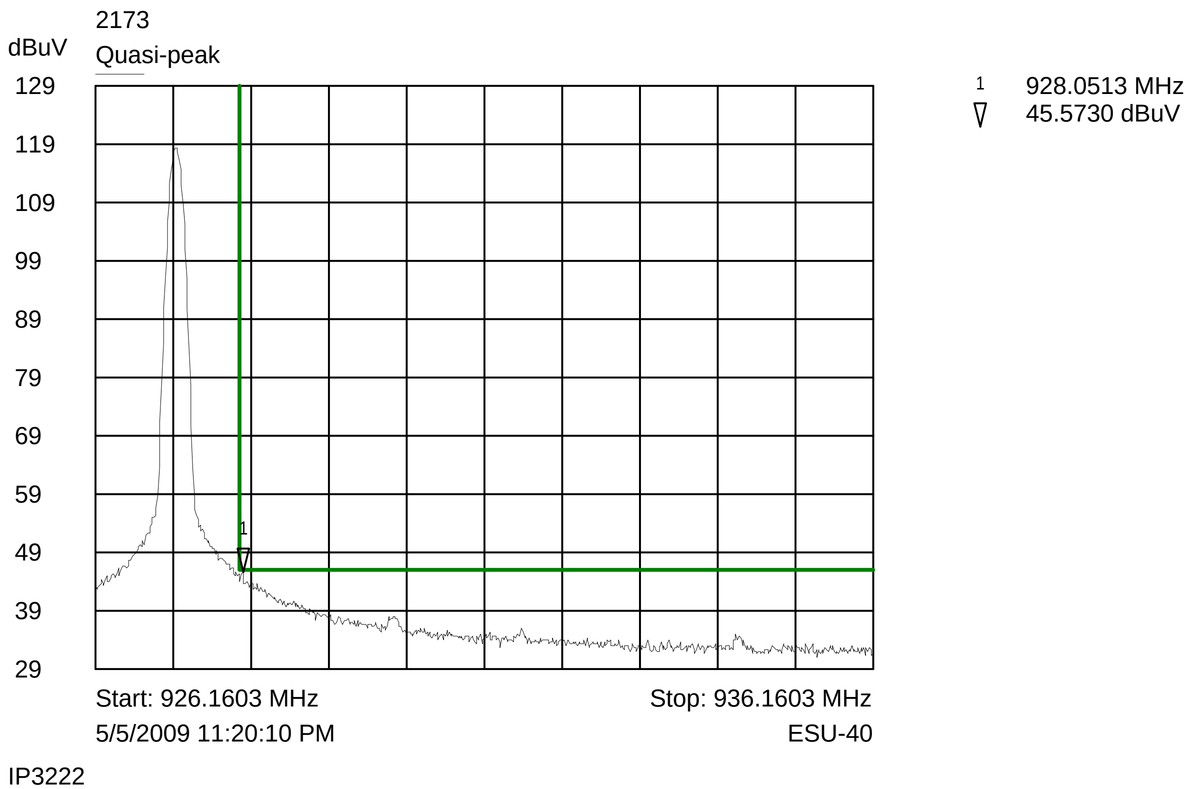


6.2.5.3 Sample Field Strength Calculation for Radiated Measurements:

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.

6.2.6 §15.247(g) Channel Usage

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

6.2.7 §15.247(h) Channel Coordination

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

6.2.7 §15.247(i) Exposure to RF Energy

The EUT meets the requirements of this section as described in Exhibit 11 (Maximum Permitted Exposure) of the submittal files.

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Conducted Disturbance at Mains Ports:

The conducted disturbance at mains ports from the EUT 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 EUT with each EUT having its own power cord, the point of connection for the LISN is determined from the following rules:

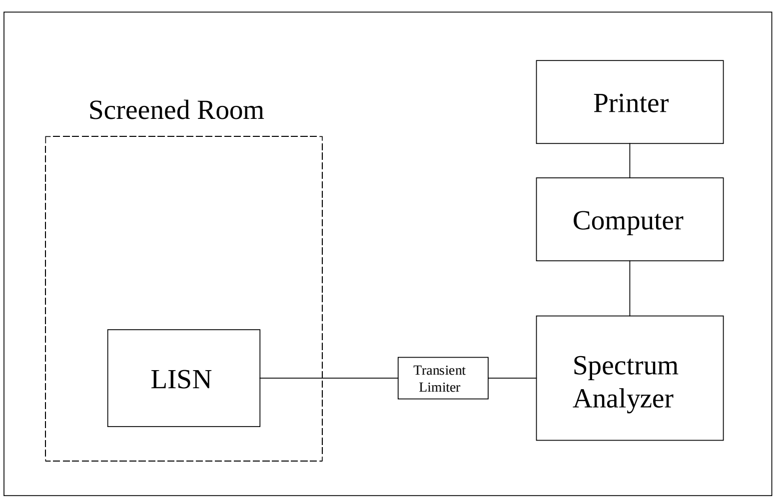
a) Each power cord, which is terminated in a mains supply plug, shall be tested separately.
b) Power cords, which are not specified by the manufacturer to be connected via a host unit, shall be tested separately.
c) Power cords which are specified by the manufacturer to be connected via a host unit or 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 EUT are 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	10/08/2008
Test Software	CCL	Conducted Emissions	Revision 1.2	N/A
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/31/2008
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/05/2008
LISN	EMCO	3825/2	9305-2099	03/09/2009
Conductance Cable Wanship Site #2	CCL	Cable J	N/A	12/31/2008
Transient Limiter	Hewlett Packard	11947A	3107A02266	12/31/2008

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.

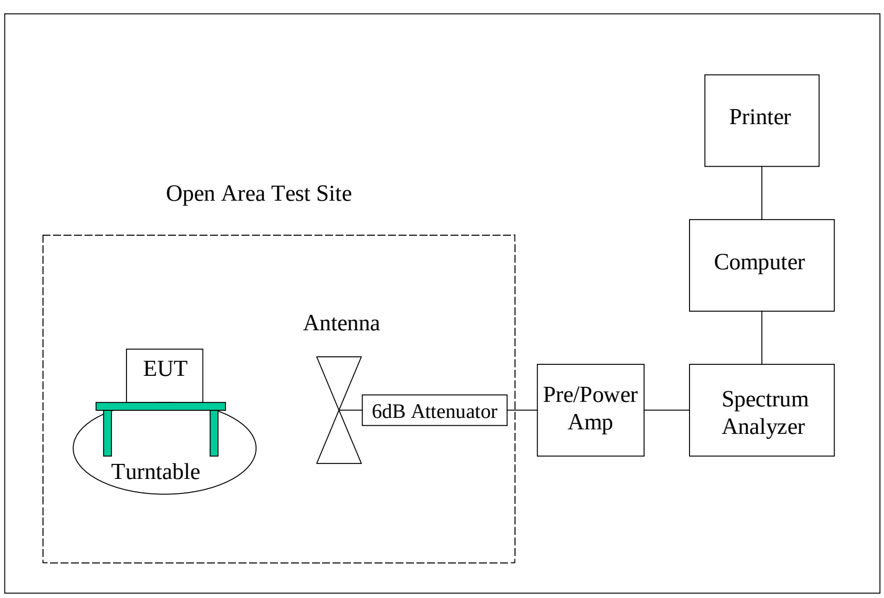
Desktop equipment is measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/08/2008
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rhode & Schwarz	1302.6005.40	100064	06/23/2008
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/31/2008
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/05/2008

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Biconilog Antenna	EMCO	3142	9601-1008	9/26/2008
Double Ridged Guide Antenna	EMCO	3115	9409-4355	03/11/2009
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	05/29/2007
900 MHz Filter	Microtronics	HPM50108	001	01/21/2009
20’ High Frequency Cable	Utiflex	UFA210A-1-2400-30050U	1175	03/05/2009
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/31/2008
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/28/2008
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2008

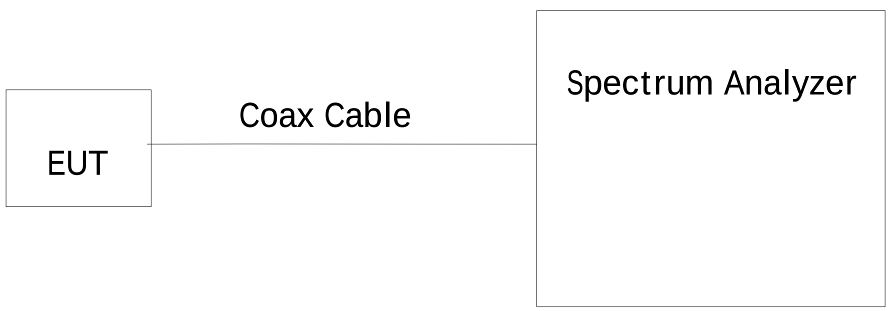
An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting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

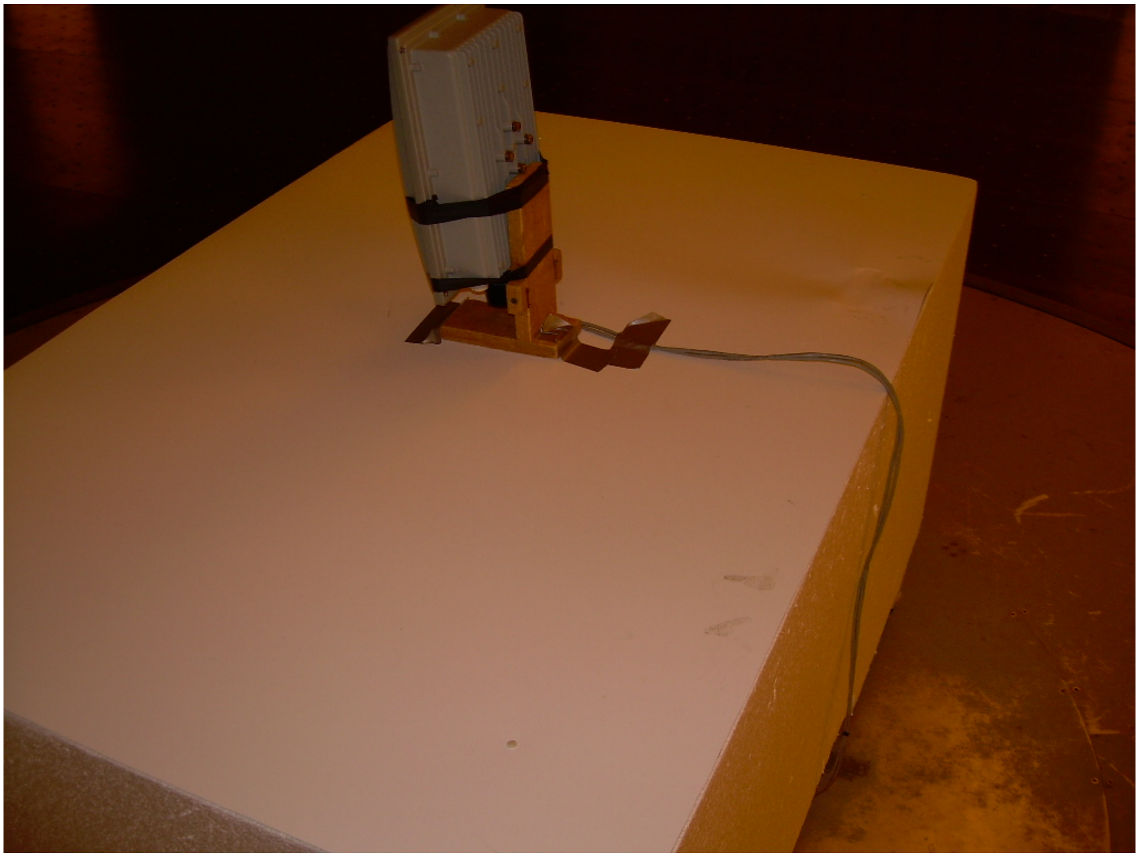
Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Spectrum Analyzer/Receiver	Rhode & Schwarz	1302.6005.40	100064	06/23/2008
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/31/2008
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/05/2008
Cable	Andrews	Coax w/SMA	001116	12/31/2008
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2008



APPENDIX 2 PHOTOGRAPHS

Photograph 1 – Front View Radiated Disturbance Worst Case Configuration

Photograph 2 – Back View Radiated Disturbance Worst Case Configuration

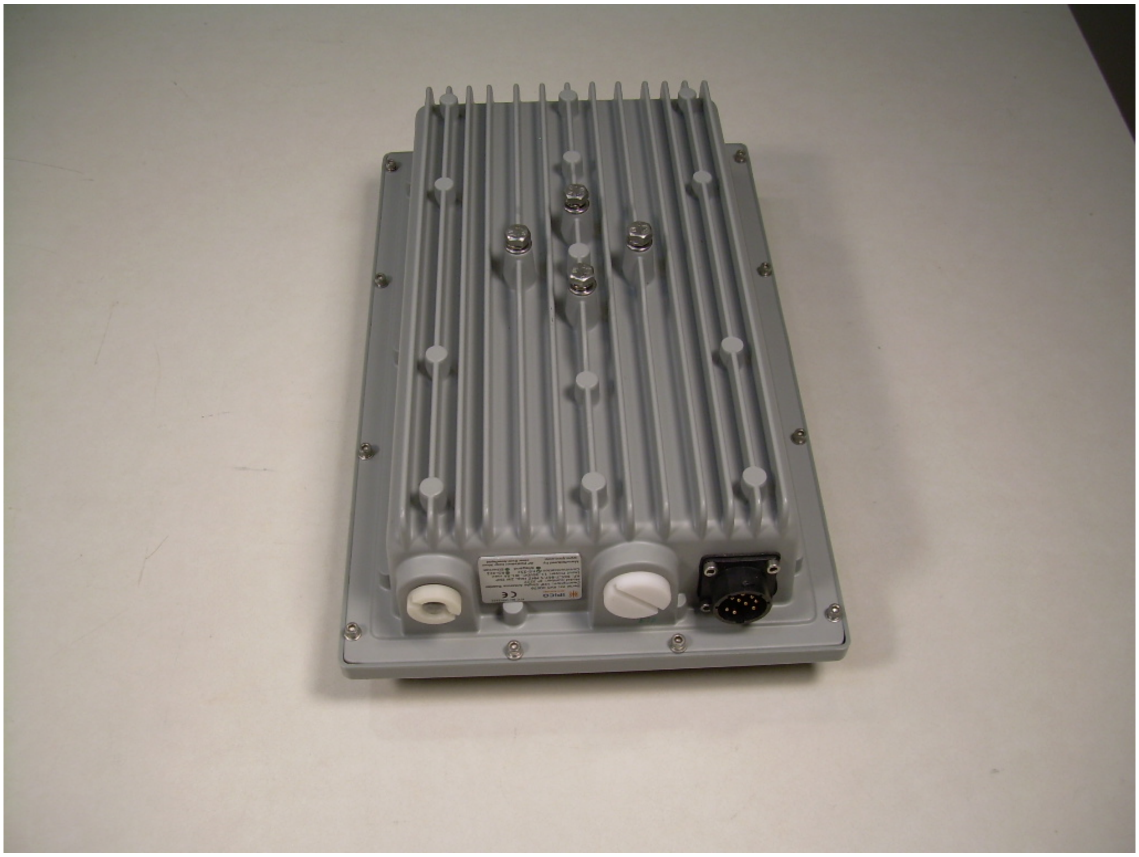


Photograph 3 – Front View Conducted Disturbance Worst Case Configuration

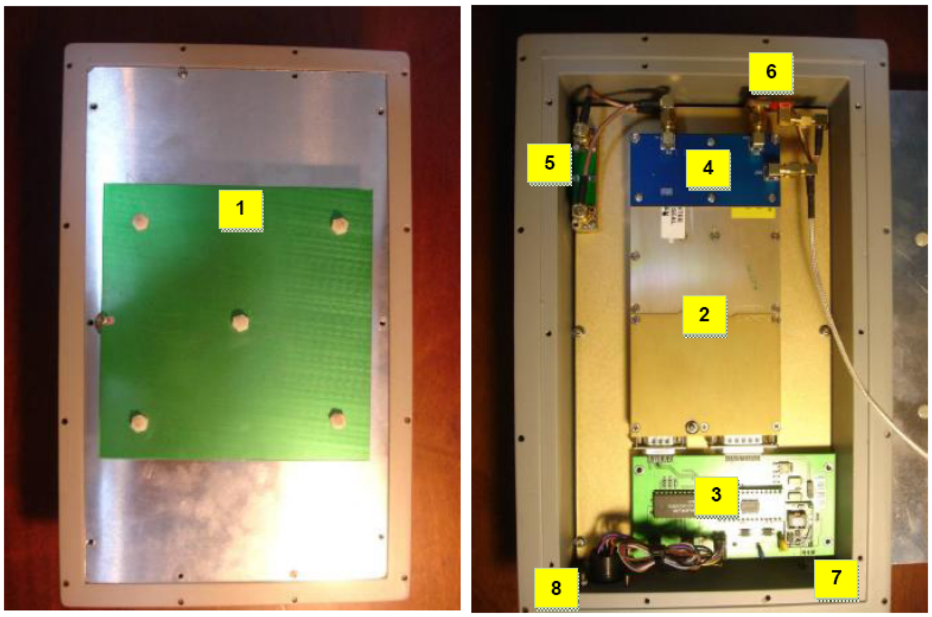
Photograph 4 – Back View Conducted Disturbance Worst Case Configuration

Photograph 5 – Front View of the EUT

Photograph 6 – Back View of the EUT



Photograph 7 – Internal View of the EUT



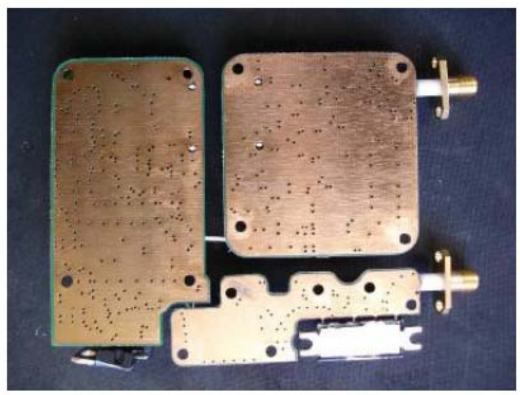
1 TX/RX antenna
2 Radio Frequency Unit
3 Protocol converter/PSU board
4 Strip line coupler
5 1GHz low pass filter
6 13dB Attenuator
7 Status indicator
8 Interface connector

Photograph 8 – View of the RF and Decoder PCBs

Decoder Top view

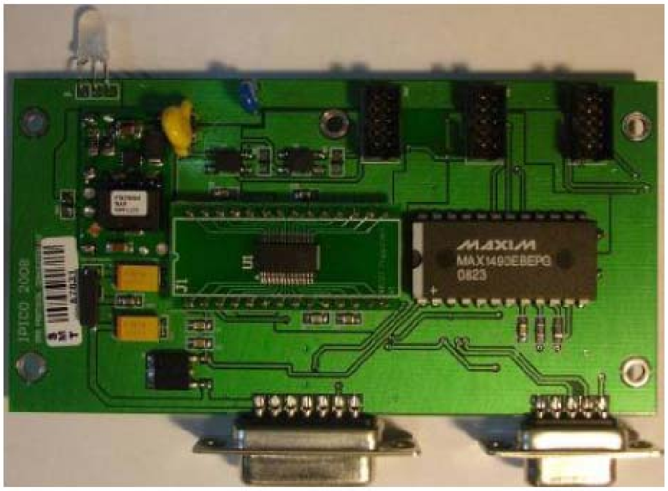
RF Front-end Top view

Decoder Bottom view

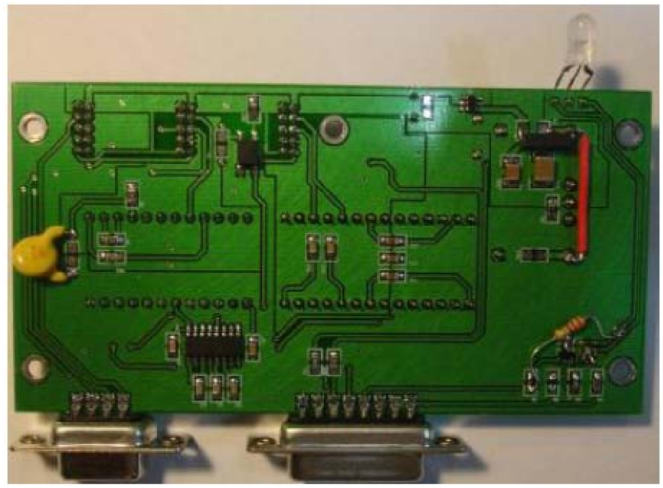


RF Front-end Bottom view

Photograph 9 – View of the Protocol Converter PCB



Protocol converter mother board Top view



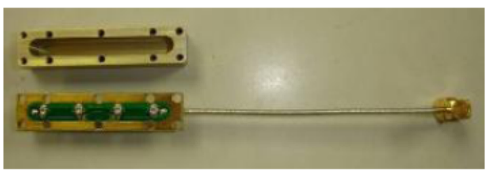
Protocol converter mother board Bottom view

Photograph 10 – View of the Accessory Assemblies

Accessory assemblies

13dB Attenuator Top view

13dB Attenuator Bottom view



1GHz filter Top view

1GHz filter Bottom view

Strip line coupler Top view

Strip line coupler Bottom view