TUV Rheinland of North America

FCCID: M4Z IN510

Emissions Test Report

EUT Name: INfinity 510

EUT Model: IN510

FCC Title 47, Part 15, Subpart C, RSS-210 Issue 6

Prepared for:

Robert Sadler
Sirit, Inc
2525 Meridian Parkway, Lake Level Suite 60
Durham, NC 27713
Tel: 919-281-0025
Fax: 919-281-1551

Prepared by:

TUV Rheinland of North America
762 Park Avenue
Youngsville, NC 27596
Tel: (919) 554-0901
Fax: (919) 556-2043
http://www.tuv.com/

Report/Issue Date: 23 August 2006
Report Number: 30661254.001

Statement of Compliance

Manufacturer:	Sirit, Inc 2525 Meridian Parkway, Lake Level Suite 60 Durham, NC 27713 919-281-0025
Requester / Applicant:	Robert Sadler
Name of Equipment:	INfinity 510 Model No. IN510
Type of Equipment:	Intentional Radiator
Application of Regulations:	FCC Title 47, Part 15, Subpart C, RSS-210 Issue 6
Test Dates:	22 June 2005 to 22 July 2005

Guidance Documents:

Emissions: FCC 47 CFR Part 15, RSS-210 Issue 6

Test Methods:

Emissions: ANSI C63.4:2005

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

[signature]	23 August 2006
Test Engineer: Mark Ryan	Date

NVLAP	FCC	Industry Canada
200094-0	90552 and 100881	IC3755

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Title 47, Part 15, Subpart C, RSS-210 Issue 6 based on the results of testing performed on *22 June* 2005 through *22 July* 2005 on the *INfinity 510* Model No. *IN510* manufactured by Sirit, Inc. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

1.3 Summary of Test Results

Table 1 - Summary of Test Results

Test	Test Method(s)	Test Parameters	Measurement	Result
Channel Separation	FCC Part 15.247(a)(1)	Greater of 25 kHz or 20 dB bandwidth	400 kHz	**compliant**
Pseudorandom Hopping Algorithm	FCC Part 15.247(a)(1)			**compliant**
Time of Occupancy	FCC Part 15.247(a)(1)(i)	=<0.4 sec in 10 sec.	400 ms in 10sec	**compliant**
20dB Occupied Bandwidth	FCC Part 15.247(a)(1)(i)	=<500kHz	127.2 kHz	**compliant**
99% Power Bandwidth	I.C. RSS-210 Part 5.9.1		109.2 kHz	**compliant**
Peak Output Power	FCC Part 15.247(b)(2)	1 Watt (direct to port)	29.9dBm	**compliant**
Spurious Emissions	FCC Part 15.247(c)	Table FCC Part 15.209	31.9 dBuV/m @ 3meters QP	**compliant**
Frequency Hopping Spread Spectrum Systems	FCC Part 15.247(g)			**compliant**
Incorporation of Intelligence	FCC Part 15.247(h)			**compliant**
Frequency Stability	FCC Part 15.215(c)	Containment of 20 dB bandwidth between 902 and 928	903.1 MHz - 926.9 MHz	**compliant**
Radiated Emissions Class B (when not transmitting)	FCC Part 15.109(a)	Table FCC Part 15.109(a)	43.68 dBuV/m @ 3meters QP	**compliant**
Conducted Emissions	FCC Parts 15.107(a) and 15.207	Table FCC Parts 15.107(a) and 15.207	31.98 dBuV (avg) @ 480kHz	**compliant**

1.4 Special Accessories or Equipment Modifications

No special accessories or modifications were necessary in order to achieve compliance.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 25 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174 and C-1236).

2.1.4 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:2005, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The conducted test system has a combined standard uncertainty of ± 1.2 dB. The radiated test system has a combined standard uncertainty of ± 1.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 25.

3 Product Information

3.1 Product Description

The information for all equipment used in the tested system, including: descriptions of cables, clock and microprocessor frequencies, EMI critical components, and accessory equipment has been supplied by the manufacturer and is listed in the EMC Test Plan found in Section 6.

The serial number of the product tested is Not Serialized.

Figure 1 – Photo of EUT

3.2 Equipment Configuration

A description and justification of the equipment configuration is given in the EMC Test Plan. The EUT was tested as described in the EMC Test Plan and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to warm up to normal operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Equipment Configuration given in the EMC Test Plan.

3.3 Operation Mode

A description and justification of the operation mode is given in the EMC Test Plan.

In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce worse case radiation and place the EUT in the most susceptible state. There were no deviations from the description of the Operation Mode given in the EMC Test Plan.

4 Emissions

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:2005, RSS-210 Issue 6. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.1 Channel Seperation Part 15.247(a)(1)

Frequency hopping Systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The EUT can be programmed with 200kHz or 500kHz channel separation.

Bandwidth=127.2 kHz worst case
Channel Separation=200 kHz

Bandwidth=127.2 kHz worst case
Channel Separation=500 kHz

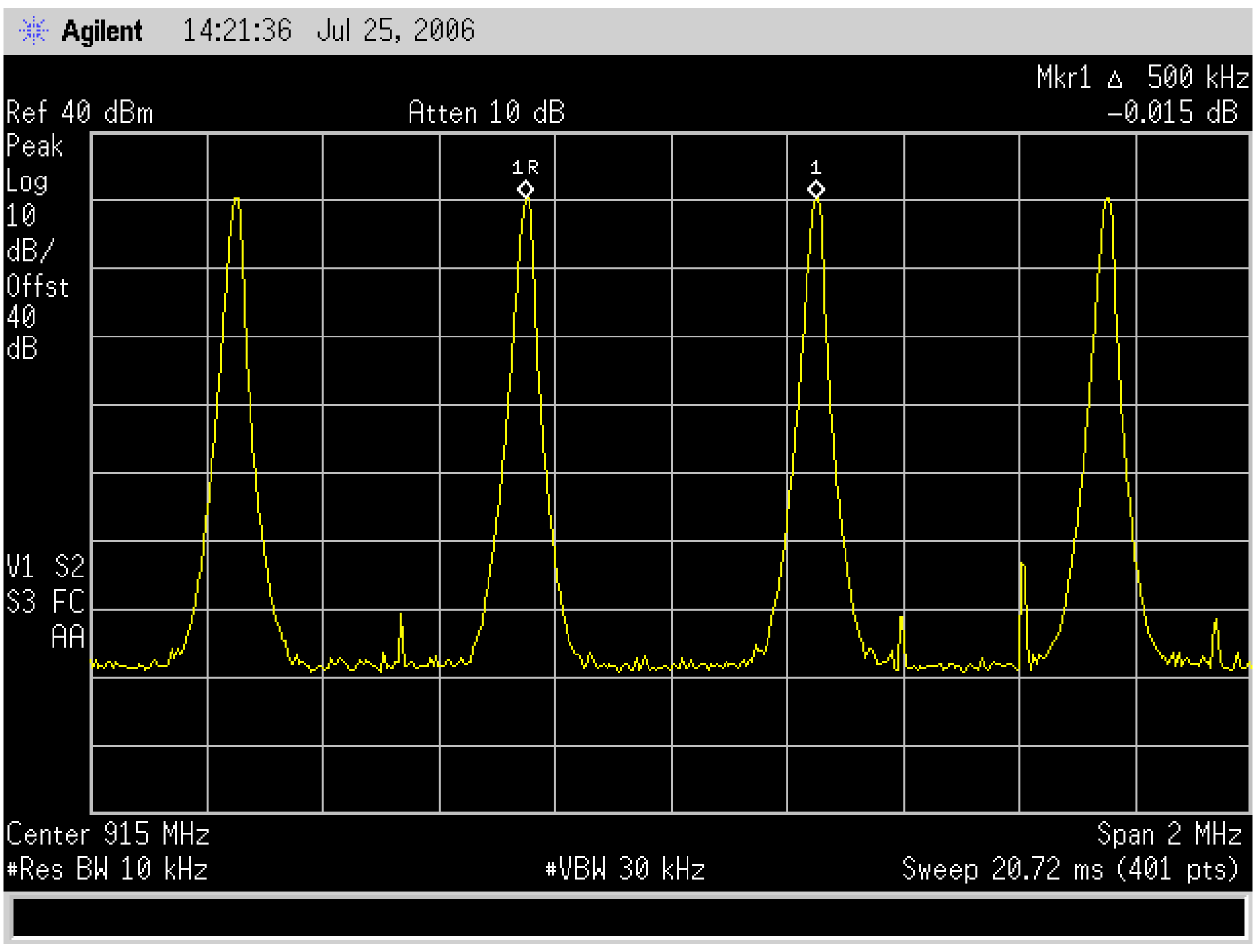


Figure 2 – 500 kHz Channel Separation (Un-modulated)

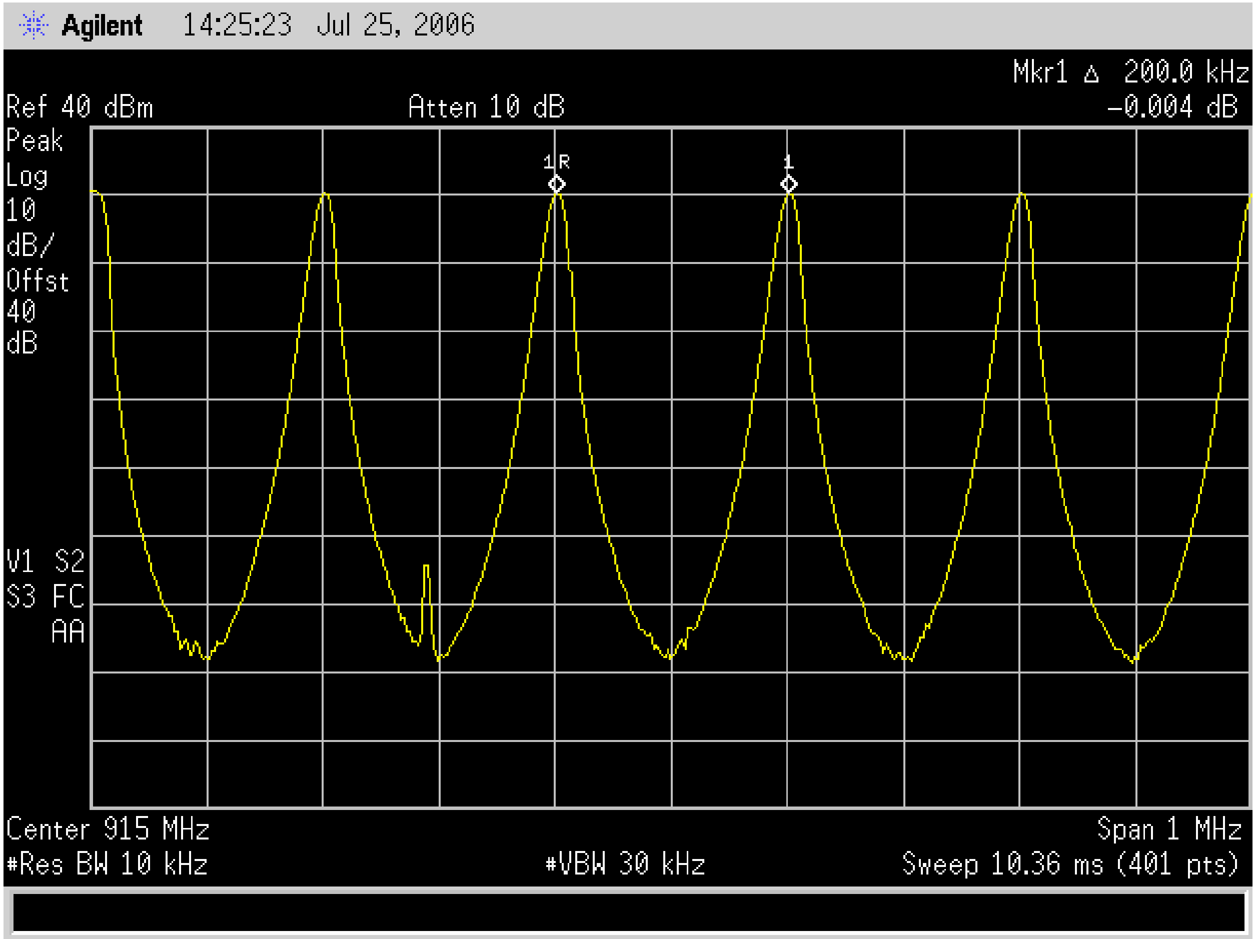


Figure 3 – 200 kHz Channel Separation (Un-modulated)

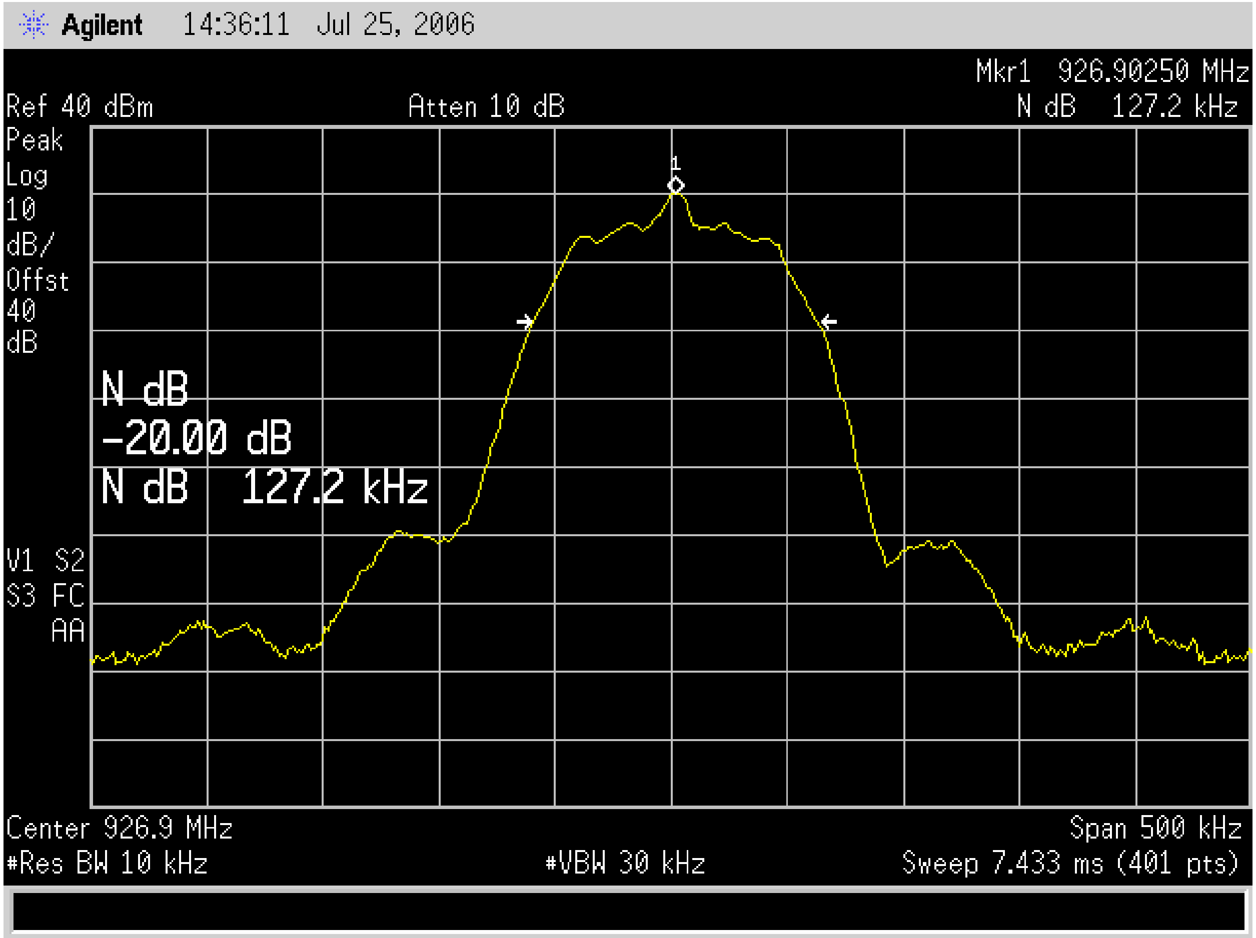


Figure 4 – Typical 20dB signal bandwidth (worst case)

4.2 Pseudorandom Hopping Algorithm FCC Part 15.247(a)(1)

The system shall hop to channel frequencies that are selected from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their transmitters and shall shift frequencies in synchronization with the transmitted signals.

The reader can be configured to operate in one of four frequency band sets, as shown in the table below.

Table 2 – Time of Occupancy Results

Frequency Band Set	Frequency Range (MHz, inclusive)	Channel Spacing (kHz)	Number of Channels
FCC_A	902.3 – 912.1	200	50
FCC_B	910.1 – 919.9	200	50
FCC_C	917.9 – 927.7	200	50
FCC_DENSE	902.75 – 927.25	500	50

4.2.1 *Pseudo-randomization mode*

The entire frequency list is shuffled using a pseudo-random number generator. The frequencies in the shuffled list are then used in sequence; when the last frequency has been used, the list is reshuffled. Using this “Shuffle” mode, no frequency is ever repeated until the entire list has been used, and all frequencies will be used equally.

Note: Refer to test plan on page 56 of this report, for a detailed randomization description.

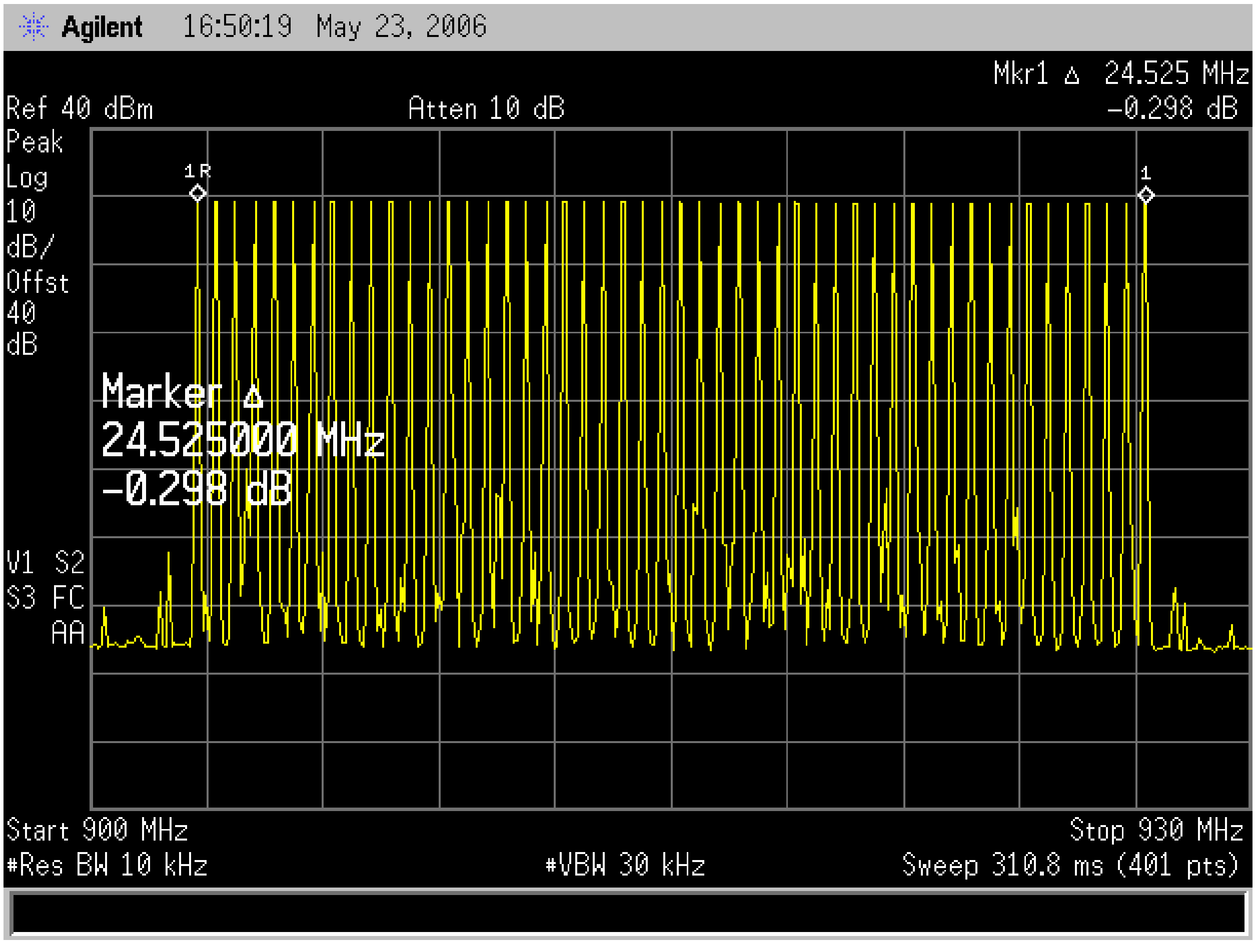


Figure 5 - Plot of EUT programmed for 50 hopping Channels

4.3 Time of Occupancy FCC Part 15.247(a)(1)(i)

For frequency hopping systems operating in the 902-928MHz band; if the 20 dB bandwidth of the hopping channel is less than 250kHz, 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 (400 ms) within a 20 second period.

Table 3 – Time of Occupancy Results

Frequency Band (MHz)	20 dB Bandwidth	Number of Hopping Channels	Average Time of Occupancy
902 - 928	127.2 kHz	>= 50	200 - 400ms

The spectrum analyzer was set as follows:

RBW=120 kHz

VBW=300kHz

Span=0Hz

LOG dB/div.= 10dB

Sweep = 1 Sec.

The worst case occupancy time was measured as above. The time of occupancy was directly measured using a spectrum analyzer. The time of occupancy is programmable by the manufacturer. The graphs are shown below.

Maximum Time of Occupancy = 400 ms in any 20 second period.

Note: Refer to test plan on page 56 of this report, for a detailed timing considerations description.

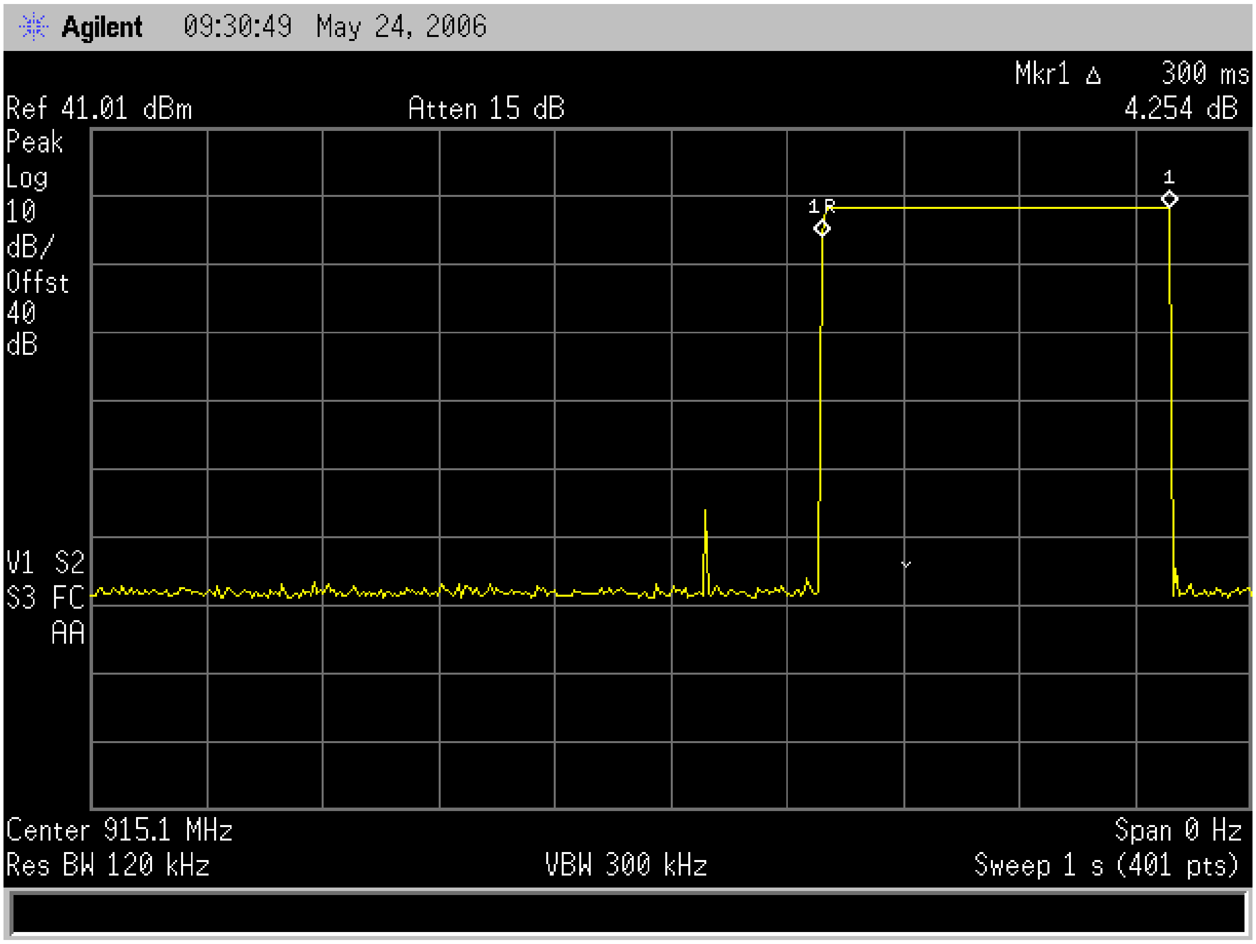


Figure 6 - Plot of EUT programmed for 300 ms Occupancy

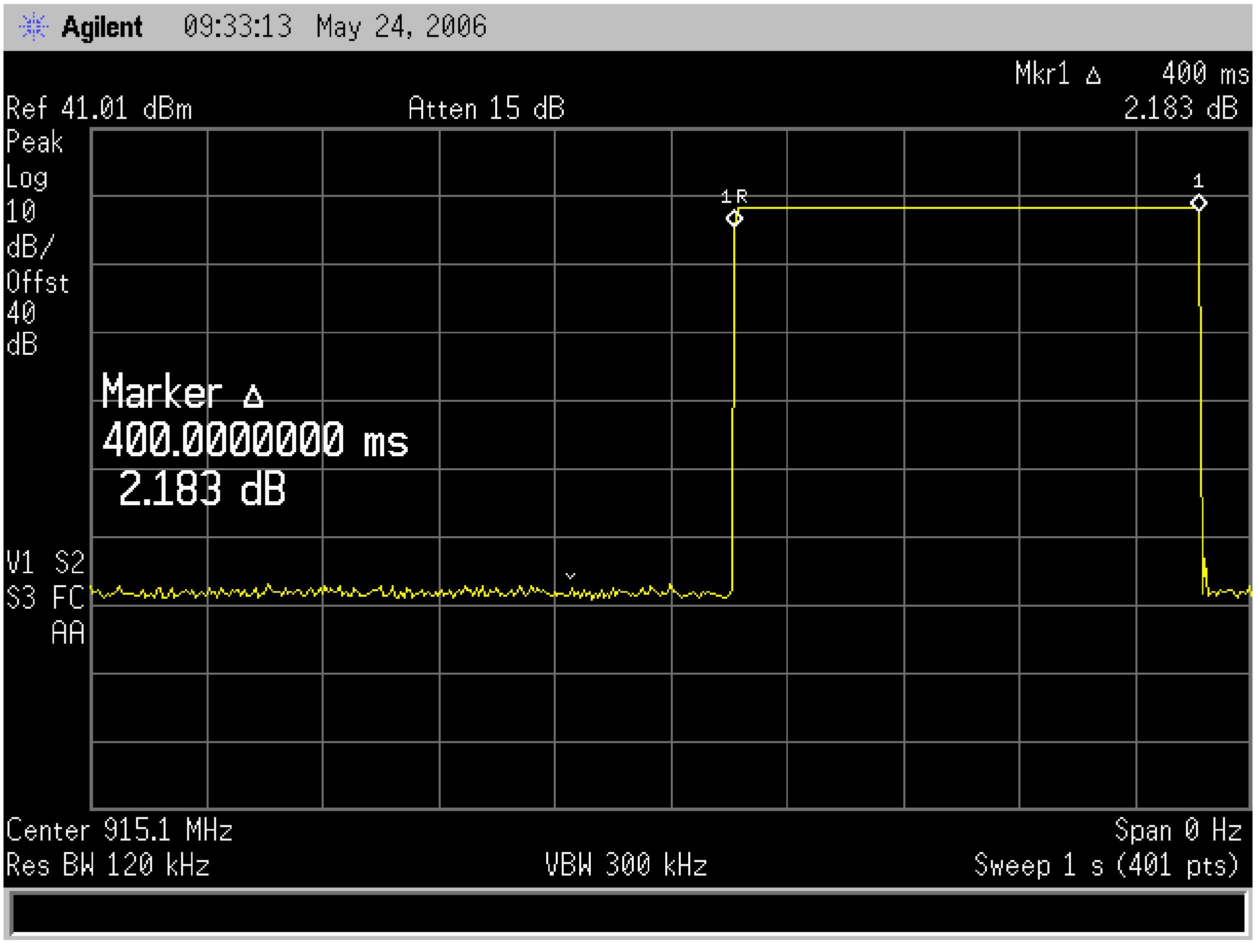
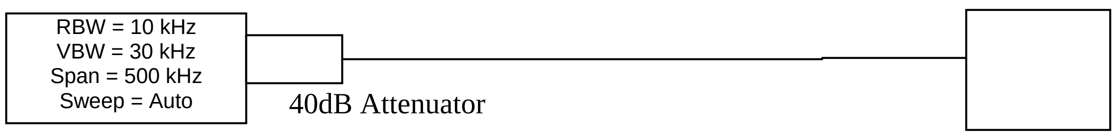


Figure 7 - Plot of EUT programmed for maximum 400 ms Occupancy

4.4 20dB Bandwidth; §15.247(a)(1)

The bandwidths are measured with a spectrum analyzer connected directly to the antenna termination, while the EUT is operating in transmission mode at the appropriate center frequency.

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz



Spectrum Analyzer RF Output connection

Measurement Test set up

Table 4 – Table of Results

Center Frequency (MHz)	20dB Bandwidth (kHz)
903.1 - low	**127.2**
915.1 - mid	**127.2**
926.9 - high	**127.2**

Note: Emissions shown in red are worst case, see plots below

.

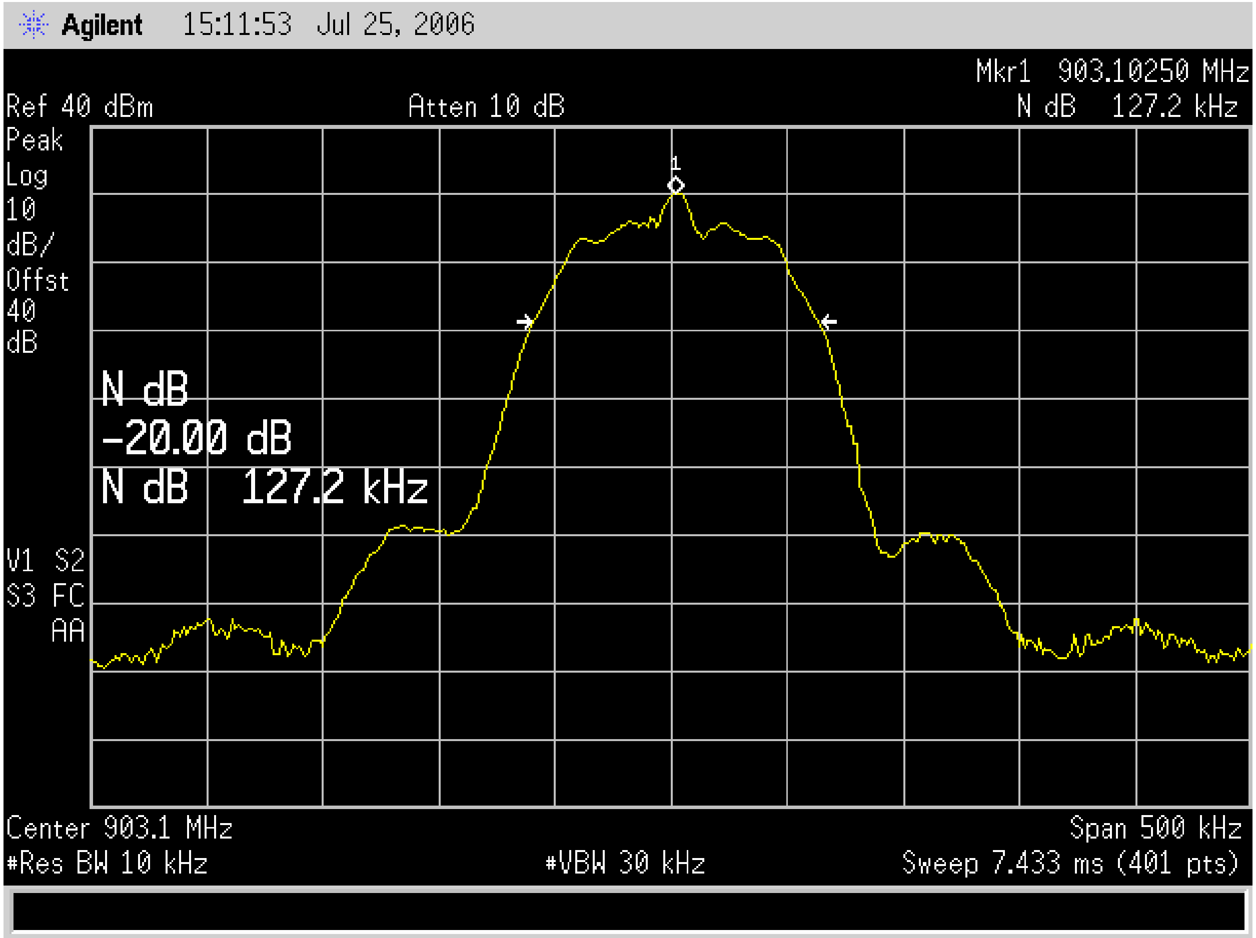


Figure 8 – Low-band Occupied Bandwidth

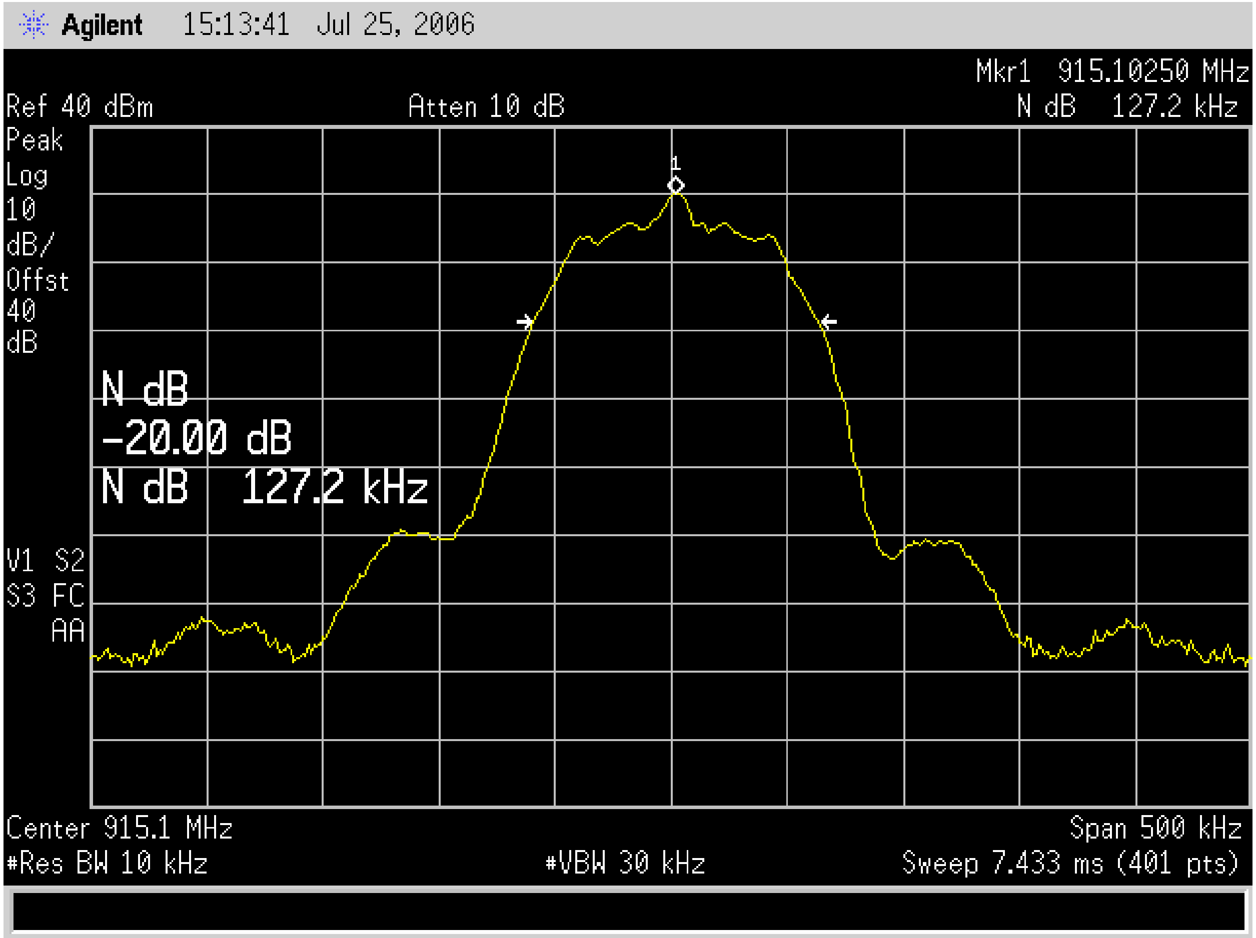


Figure 9 – Mid-band Occupied Bandwidth

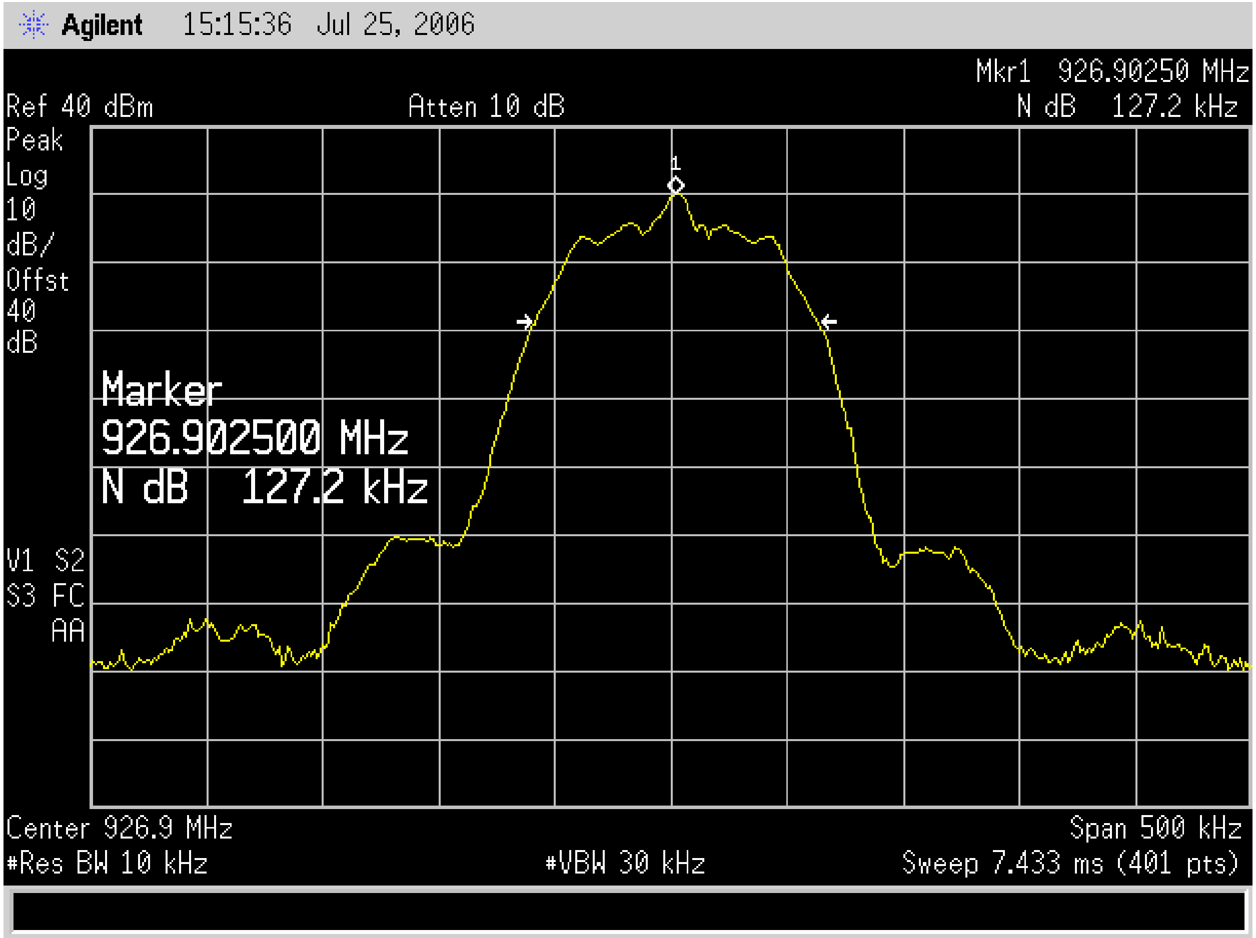


Figure 10 – High-band Occupied Bandwidth

4.5 99% Power Bandwidth; RSS-210 §5.9.1

The bandwidths are measured with a spectrum analyzer connected directly to the antenna termination, while the EUT is operating in transmission mode at the appropriate center frequency.

Measurement Test set up

Table 5 – Table of Results

Center Frequency (GHz)	99% Power Bandwidth (kHz)
903.1 - low	**109.22**
915.1 - mid	**109.22**
926.9 - high	**109.22**

Note: Emissions shown in red are worst case, see plots below

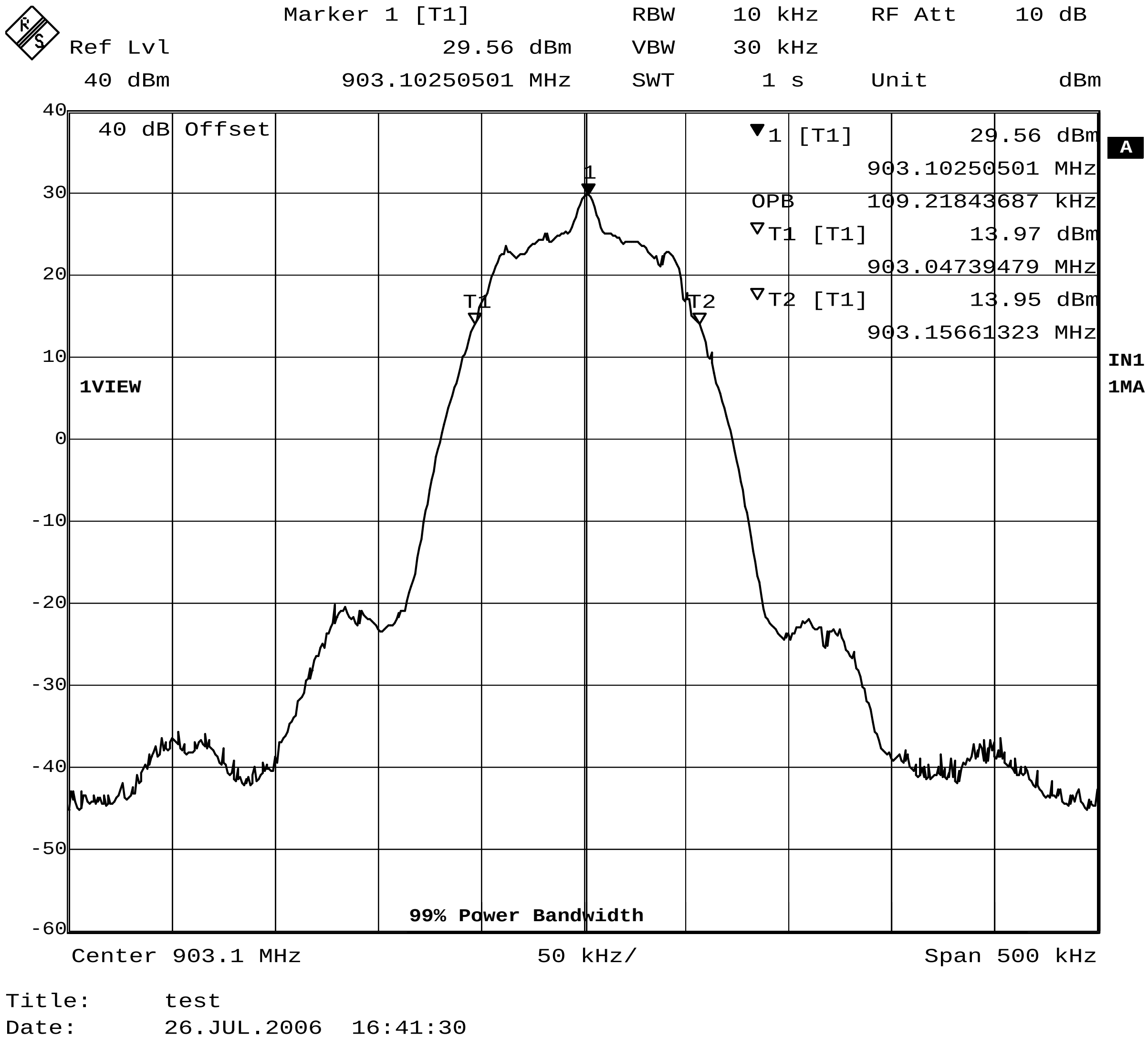


Figure 11 – Low-band Occupied Bandwidth

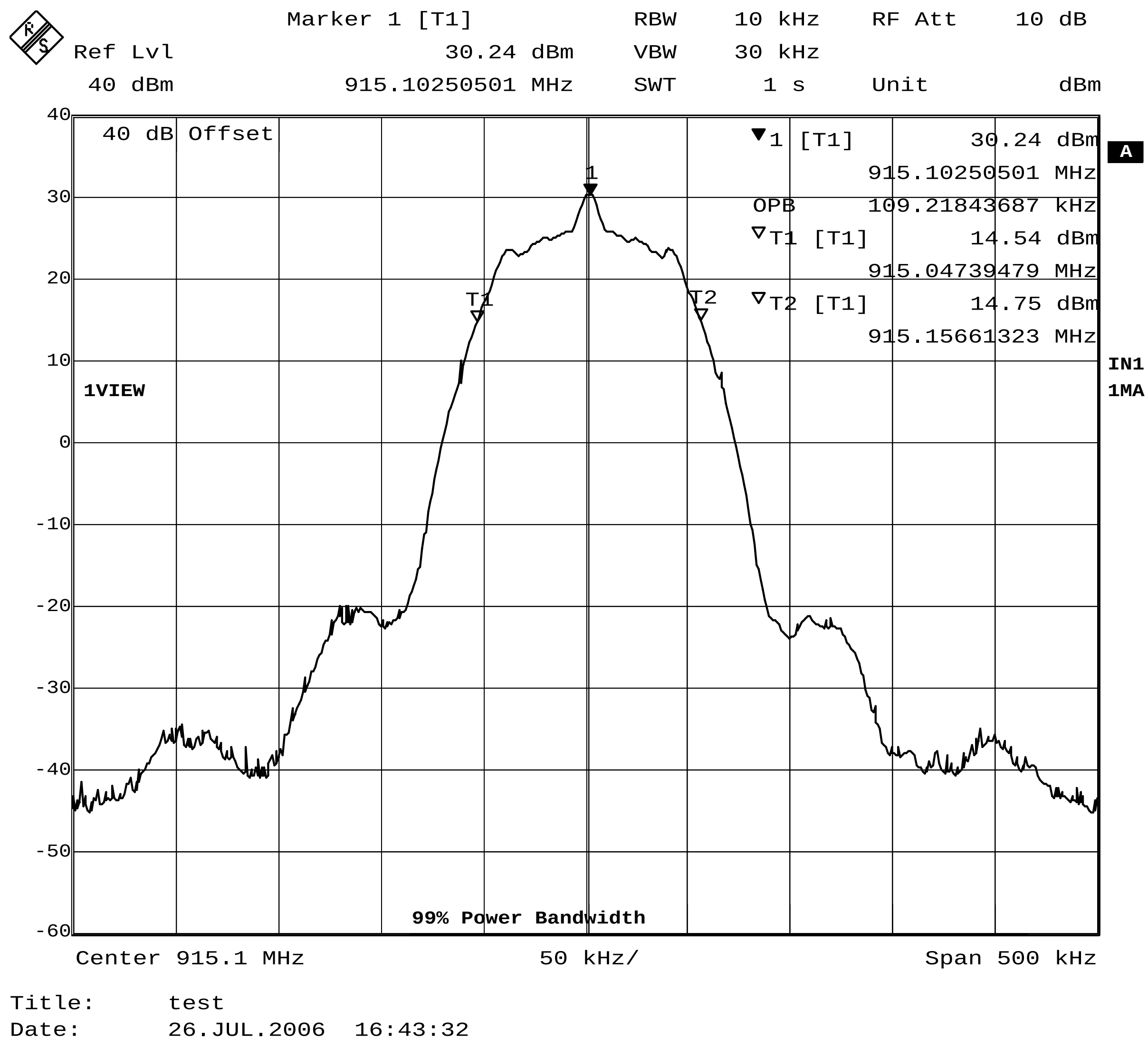


Figure 12 – Mid-band Occupied Bandwidth

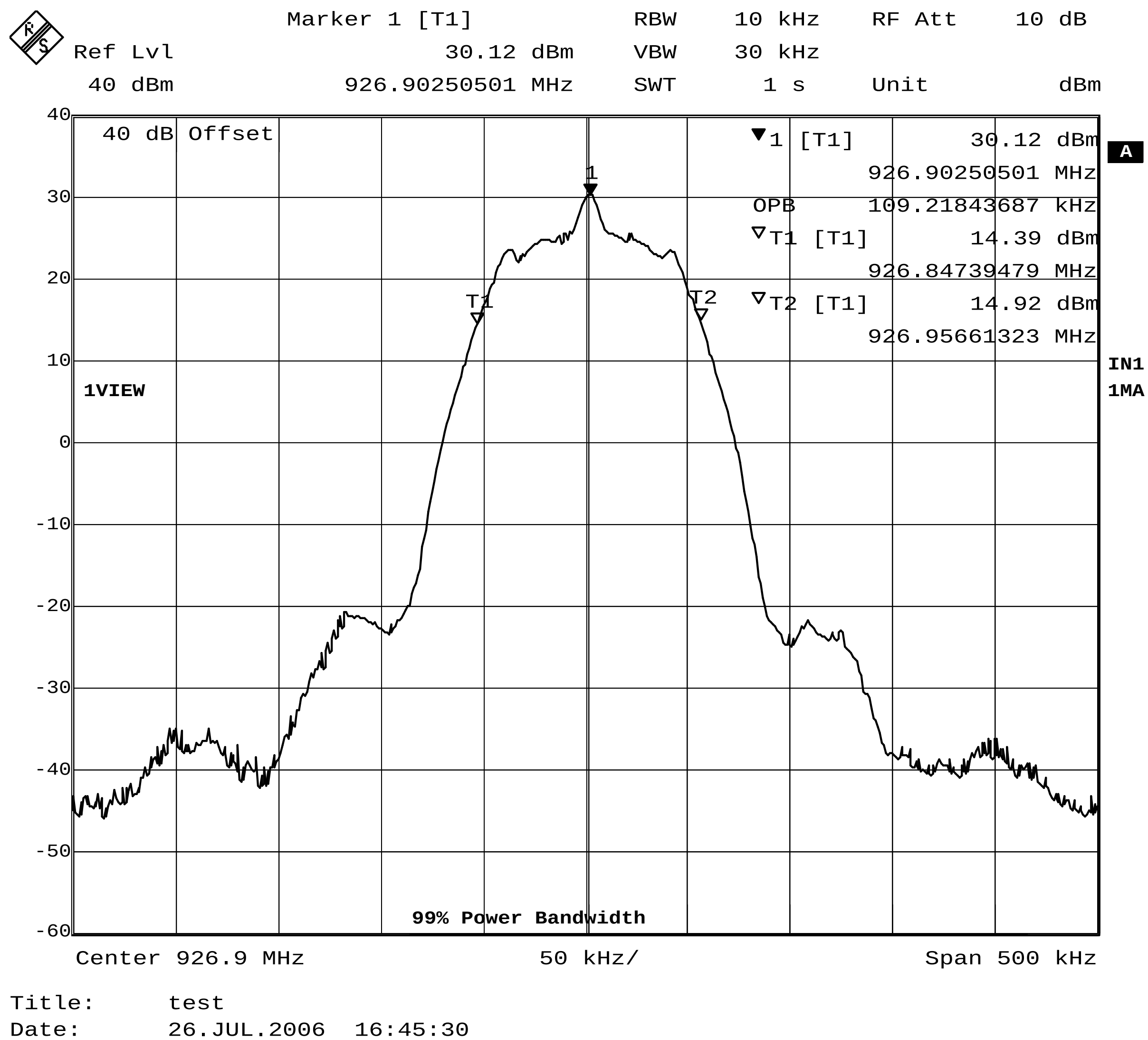


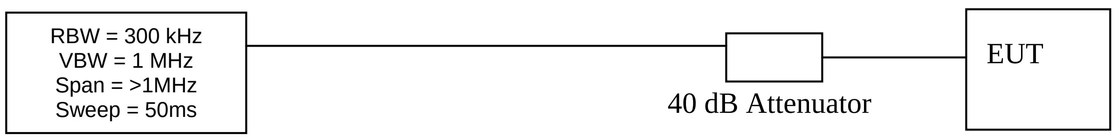
Figure 13 – High-band Occupied Bandwidth

4.6 Peak Output Power FCC Part 15.247(b)(2)

For frequency hopping systems operating in the 902-928MHz band, the maximum peak power shall be: 1Watt (30dBm) for systems employing at least 50 hopping channels. (Conducted Measurement)

The peak output power was measured at low-band, mid-band, and at high-band. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The cable loss and the attenuator factors were added to the measurements. The spectrum analyzer's resolution bandwidth was greater than the 20dB bandwidth of the modulated carrier and the video bandwidth was equal to the resolution bandwidth.

Test Setup:



Spectrum Analyzer

RF Output connection

4.6.1 Antenna Gain

The gain of the antenna and loss of the transmissions line will be included in the initial setup. This setup is performed by the manufacturer, and is not accessible to the end user of the device. For this test a 0dB gain antenna was assumed, however if an antenna has greater gain than 6dBi, then the output will be reduced as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.6.1.1 Results as tested

Table 6 – Carrier Power Results

Frequency MHz	Measured Power in dBm	Limit dBm (Watts)	Margin to Limit dBm
903.1	29.14	30 (1)	0.86
915.1	29.16	30 (1)	0.84
926.9	28.96	30 (1)	1.04

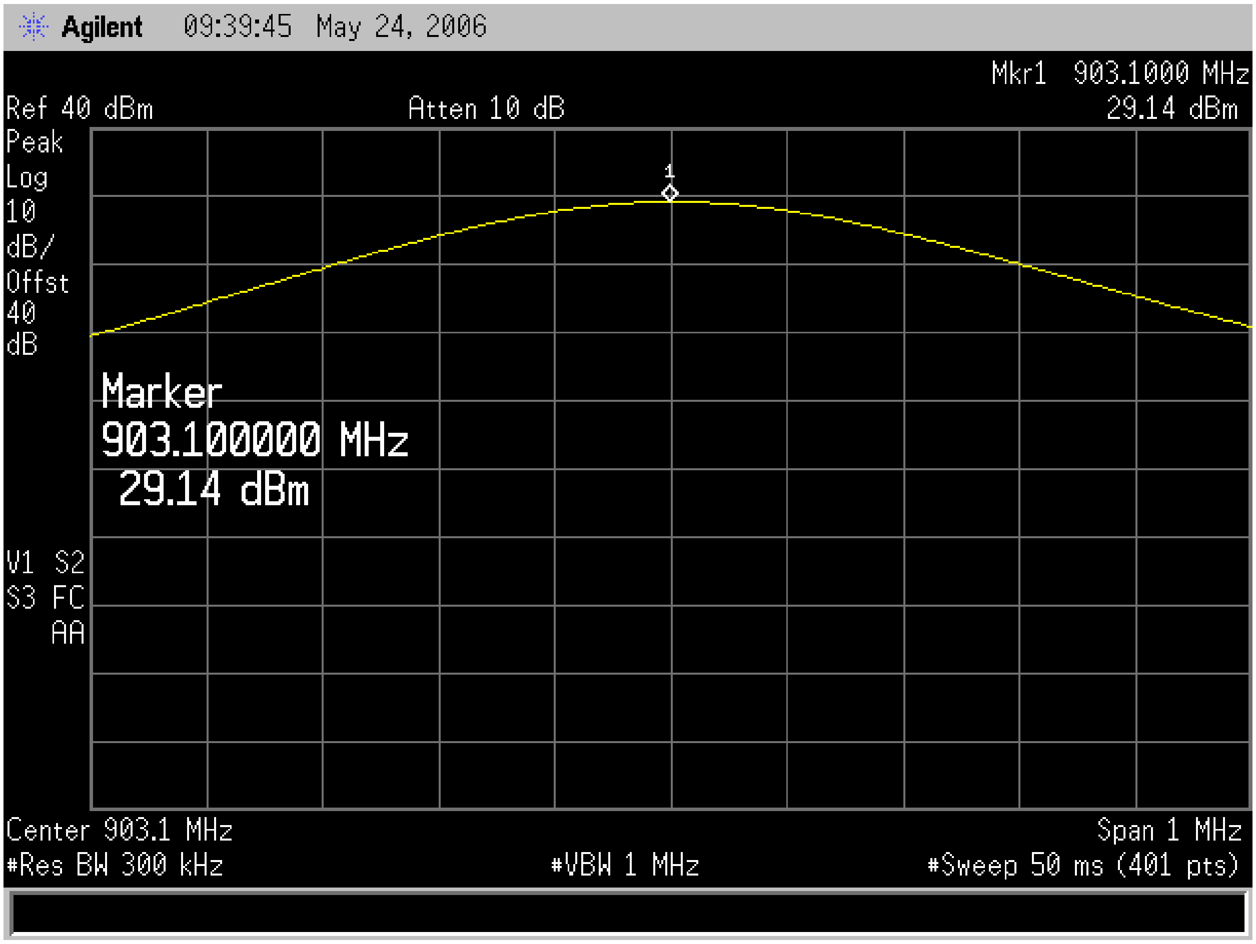


Figure 14 – Peak Power Output at low-band (un-modulated)

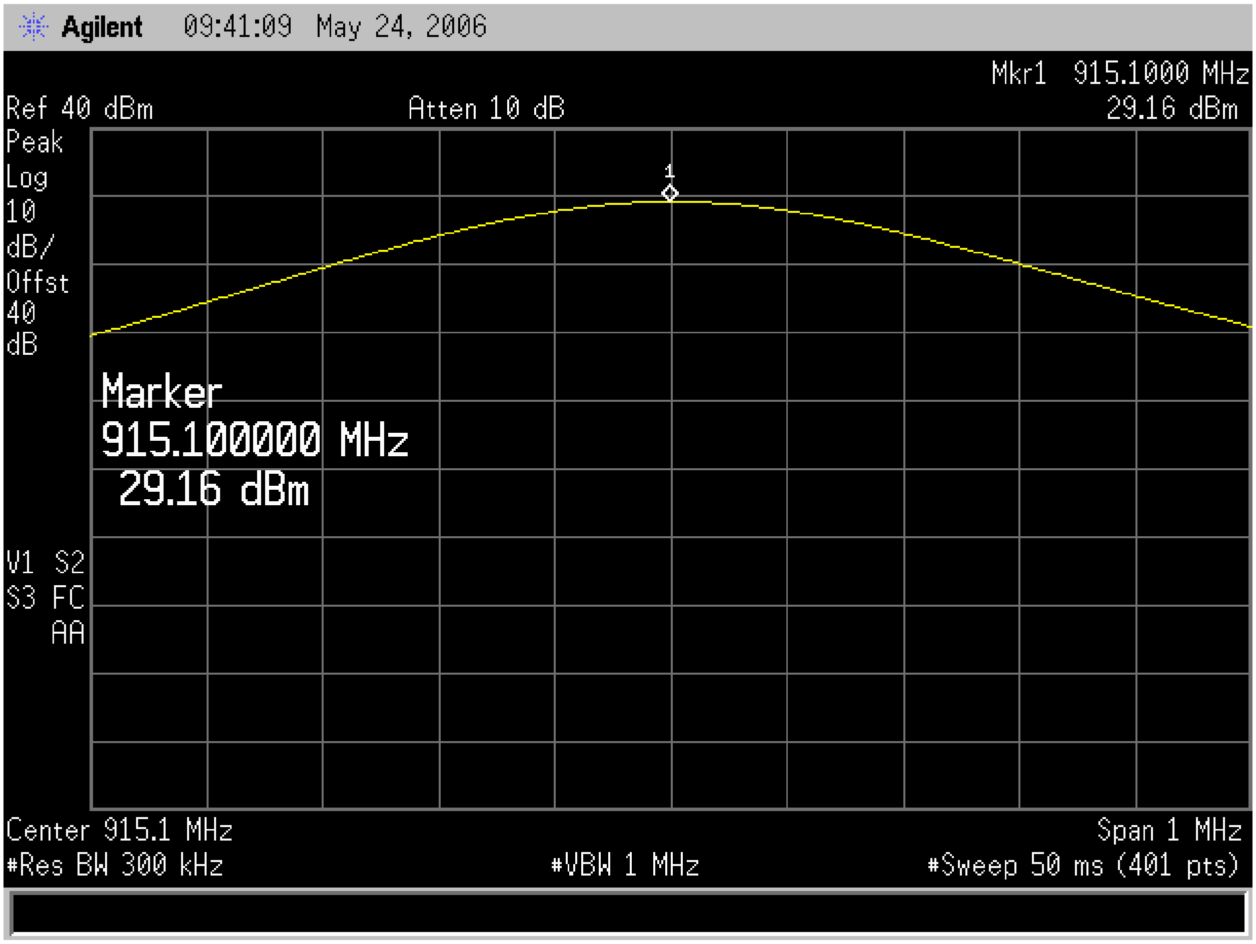


Figure 15 – Peak Power Output at mid-band (un-modulated)

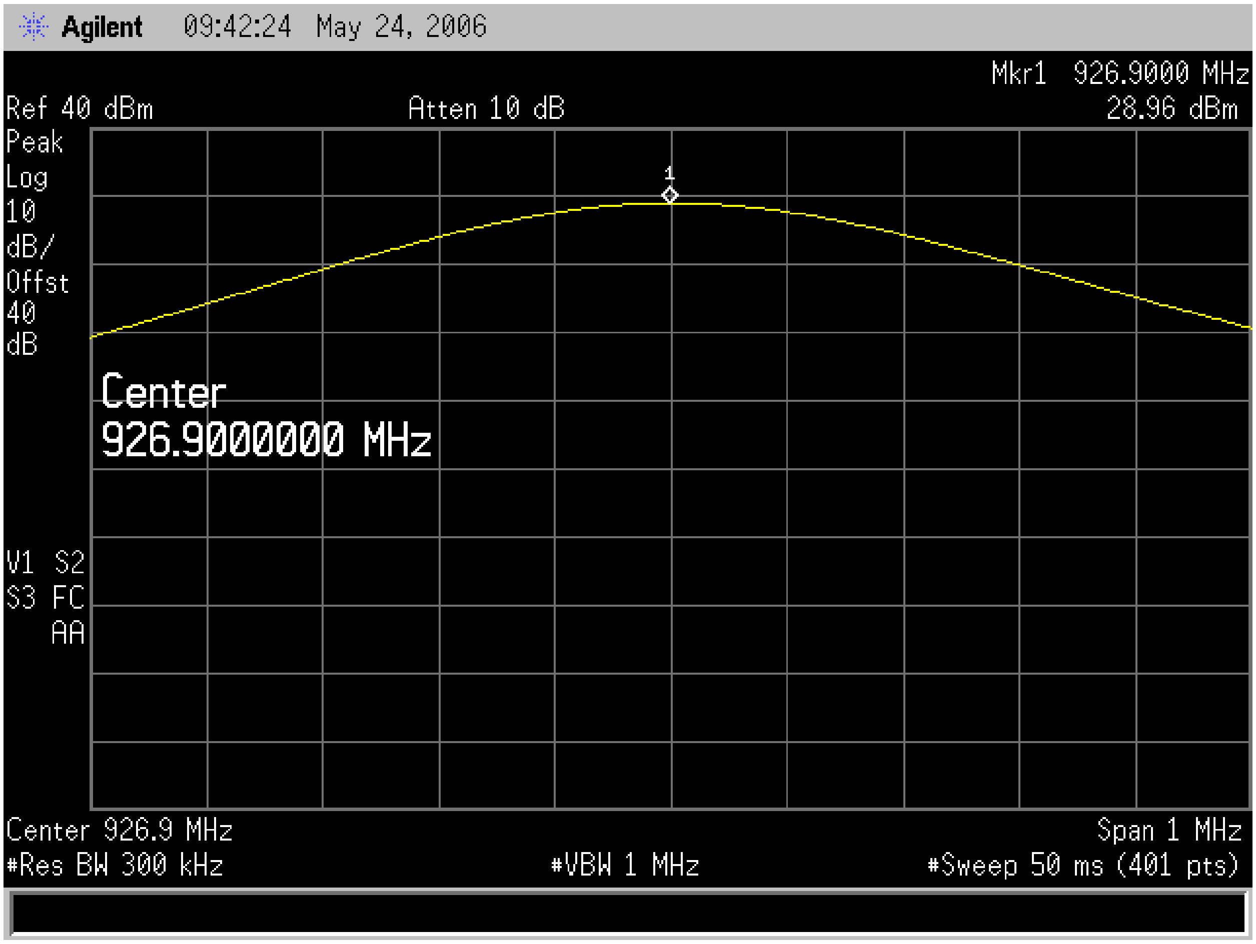


Figure 16 – Peak Power Output at high-band (un-modulated)

4.7 Maximum Permissible Exposure; FCC §15.247(b)(5), RSS-210 §14

4.7.1 Maximum Permissible Exposure Limits

The EUT shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the FCC guidelines, per FCC §1.307(b)(1).

For 300 MHz to 1500MHz, the Limit S = f_{MHz} /1500 mW/cm^2 for no more than 30 minutes exposure from Table 1 of FCC §1.1310. The manufacturer specifies a separation distance of 20cm from the antenna.

4.7.2 Calculations for Maximum Permissible Exposure Levels

Given:

$$E = \sqrt{(30 * P)} / D$$

And

$$S = E^2 / 3770$$

Where:

E = calculated field strength in volts/meter
P = 1 Watt maximum output power (adjusted to include antenna gain)
D = 0.2m separation distance (20cm was specified by manufacturer)
S = calculated power density limit in milliwatts / cm^2

At 903.1MHz - Where:
S = Power Density Limit in mW/cm^2 = f_{MHz} / 1500 = 0.6 mW/cm^2 (from Table 1 of FCC §1.1310).

At 926.9MHz - Where:
S = Power Density Limit in mW/cm^2 = f_{MHz} / 1500 = 0.62 mW/cm^2 (from Table 1 of FCC §1.1310).

The worst-case power density limit value of 0.6 mW/cm^2 will be used.

1.1.1.1 Results

The calculated power density at 20cm is 0.2 mW/cm^2.

Table 7 – Power Density calculation

Frequency	Maximum Output Power (Watts)	Power Density Limit (mW/cm^2)	Power Density in mW/cm^2 at 20cm	Margin to Limit (mW/cm^2)
903.1 MHz	1	0.6	**0.2**	-0.4

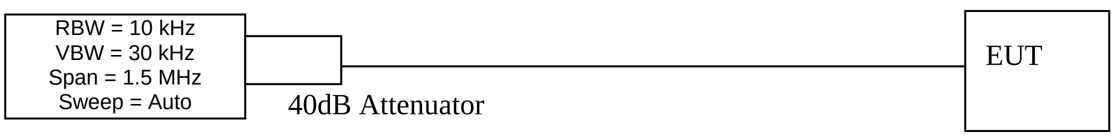
4.8 Band-Edge Measurement FCC §15.247(c), RSS-210 §6.2.2(o)(e1)

4.8.1 Test Procedure

For band-edges not adjacent to the restricted bands in §15.205, the direct measurement method was used where the band-edge is measured at 20dB below the highest in-band density measured with a spectrum analyzer connected directly to the antenna terminal of the transmitter, while the EUT is operating in continuous transmissions mode at the appropriate center frequencies.

Since the nearest restricted band-edge is at 960MHz (32MHz above the 902-928MHz band), the requirements of part 15.205 does not apply.

Test Setup:



Spectrum Analyzer

Table 8 –- Band-Edge Results

Center Frequency (MHz)	Band Edge Frequency (MHz)	Limit at -20dB below peak	Amplitude at Band edge (dBm)	Margin (dB)
903.05	902	8.06 dBm	-39.79	-47.85
926.90	928	7.95 dBm	-39.79	-47.74

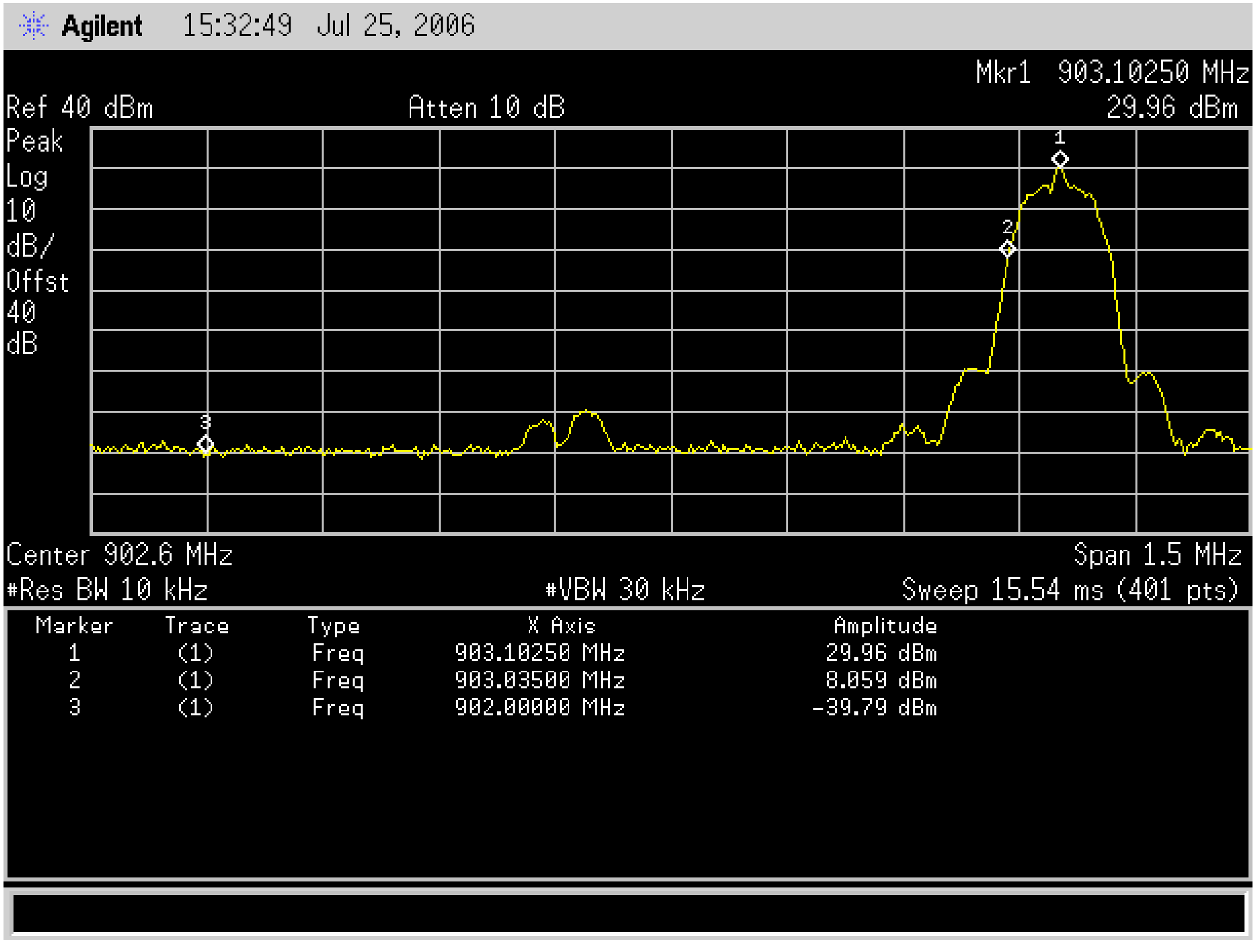


Figure 17 – Band-edge measurement at low band

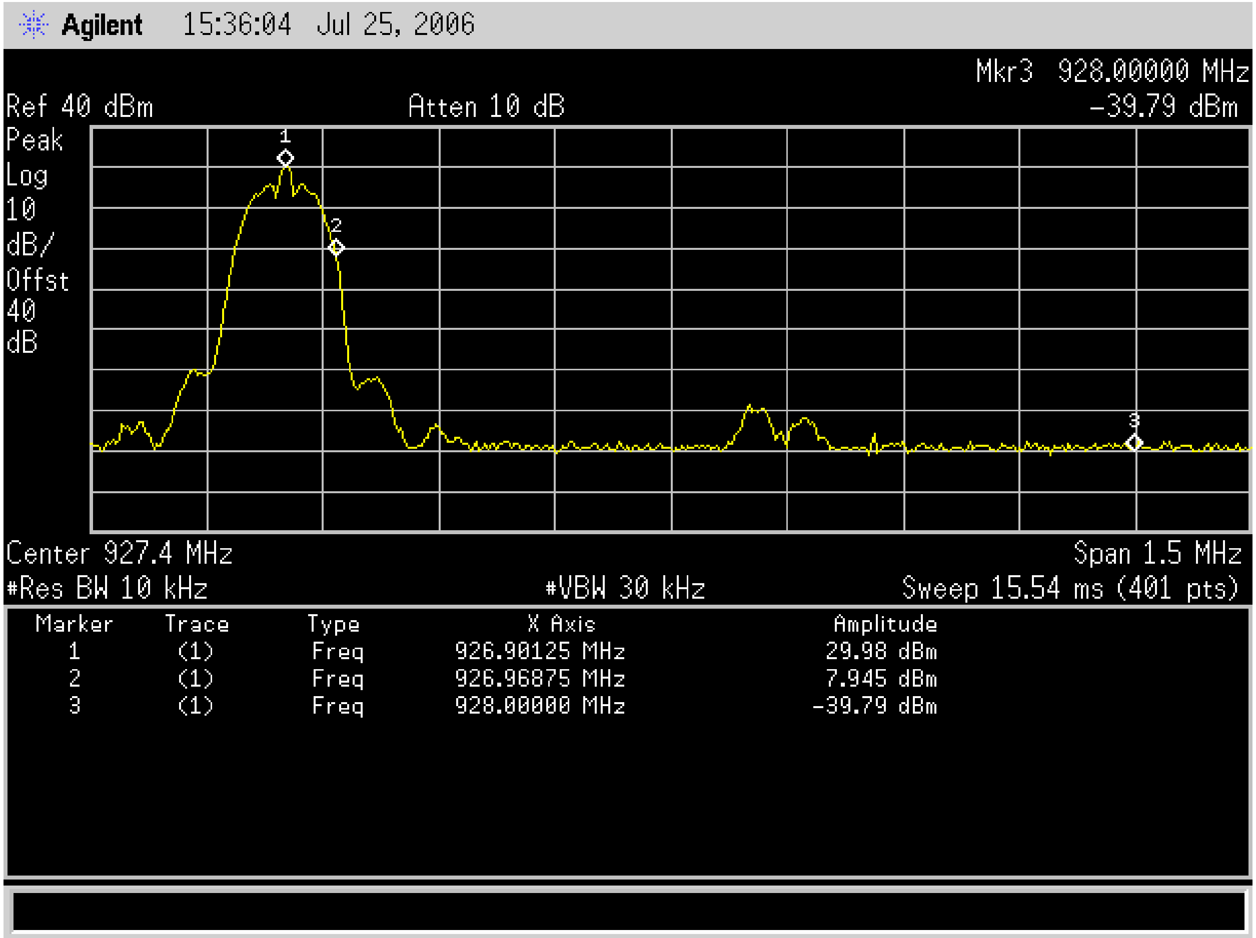


Figure 18 – Peak Power Output at high-band (un-modulated)

4.9 Spurious Emissions; FCC §15.247(c), RSS-210 §6.2.2(q1)

4.9.1 Test Procedure

4.9.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for each 6° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.9.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs. The range of the test was from 30MHz to 10GHz to include the 10^{th} harmonic of the fundamental frequency.

The Quasi-Peak (QP) detector was used for frequencies at or less than 1000 MHz. Above 1000 MHz, the Average (Av) detector was used, and per part 15.35(b), the Peak limit is 20dB above the average limit.

4.9.1.3 Deviations

There were no deviations from this test methodology.

4.9.2 Test Results

All harmonic emissions are more than 20dB below the fundamental frequencies. All emissions including emissions in all restricted bands, other than the fundamental frequencies and their harmonics, are below the 15.209 limits. As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

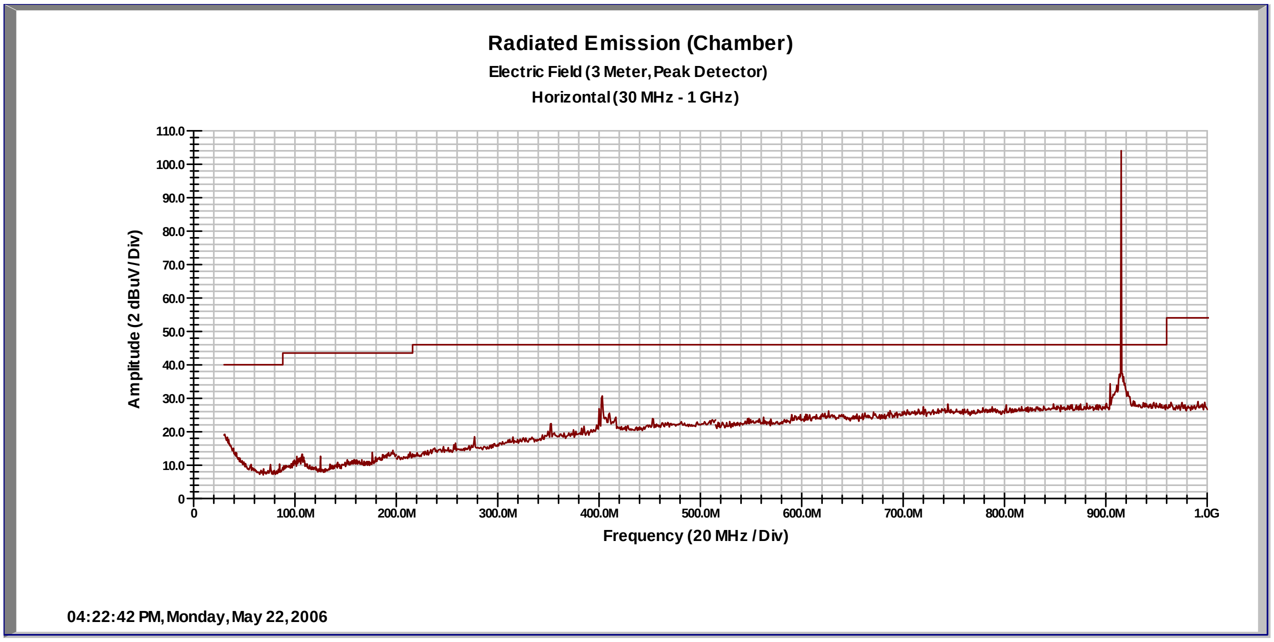
4.9.2.1 Radiated Emissions outside the Frequency Band

In any 100kHz 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 desired power, based on radiated measurements.

SOP 1 Radiated Emissions

Tracking # 30661254.001 Page 1 of 4

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	74ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	38%rh
Deg/sweep	12	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / 3142_1007	**Performed by**	Mark Ryan
Configuration	Single channel transmit, modulated		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
400.00	H	1	90	26.21	0.00	5.88	-1.00	31.09	46.00	-14.91

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

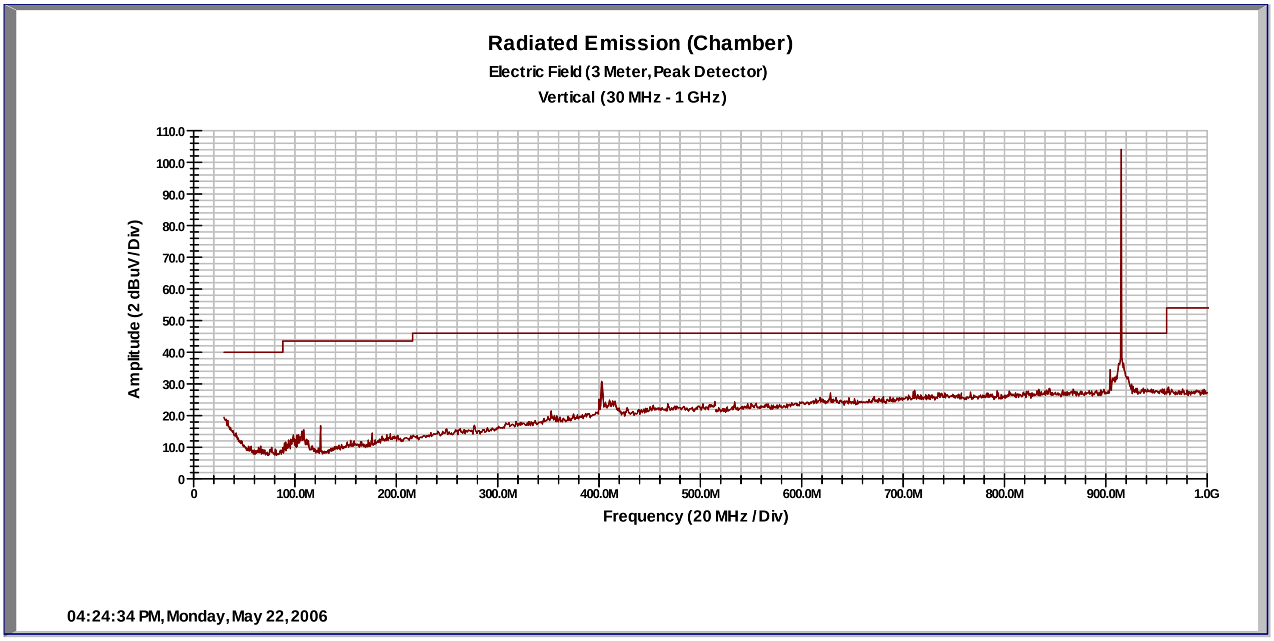
Notes: The emission in RED is the worst case emission (excluding the fundamental frequency)

The large peak is the output of the transmitter.

All peak emissions were below the limits of part 15.209.

SOP 1 Radiated Emissions Tracking # 30661254.001 Page 2 of 4

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	74ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	38%rh
Deg/sweep	12	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / 3142_1007	**Performed by**	Mark Ryan
Configuration	Single channel transmit, modulated		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

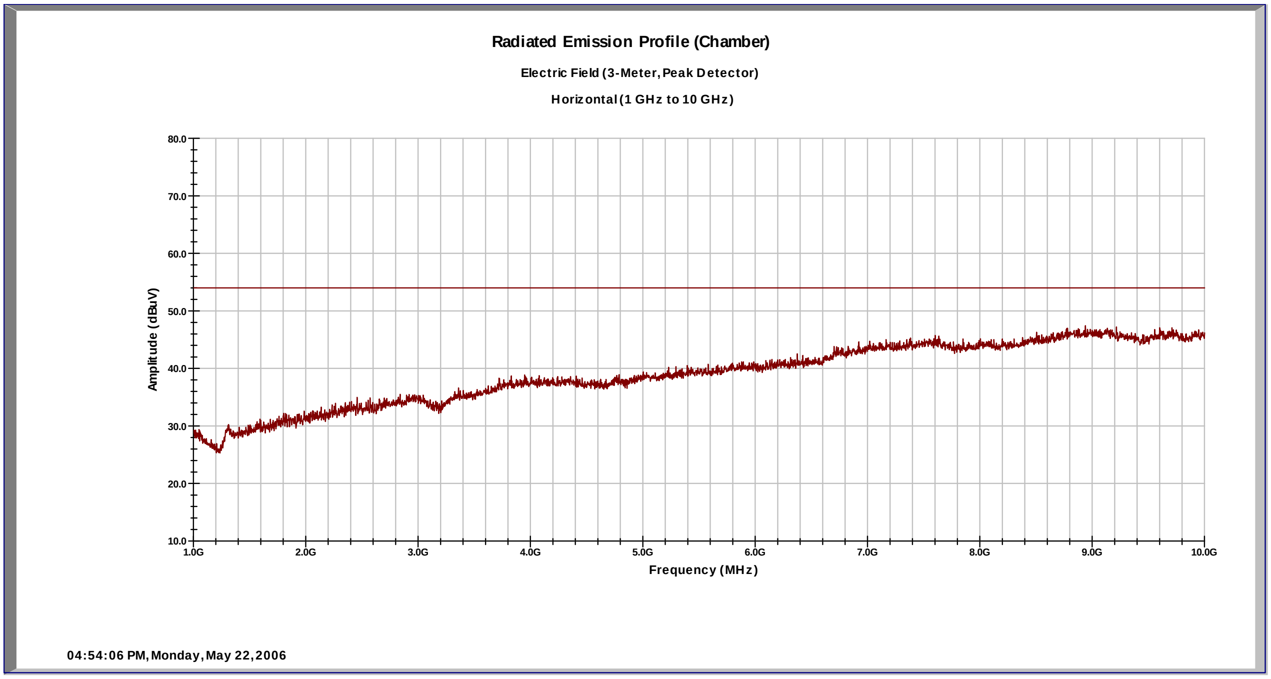
Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: The large peak is the output of the transmitter.

All peak emissions were below the limits of part 15.209.

SOP 1 Radiated Emissions — Tracking # 30661254.001 Page 3 of 4

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	74ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	38%rh
Deg/sweep	6	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 3115_2236	**Performed by**	Mark Ryan
Configuration	Single channel transmit, modulated		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

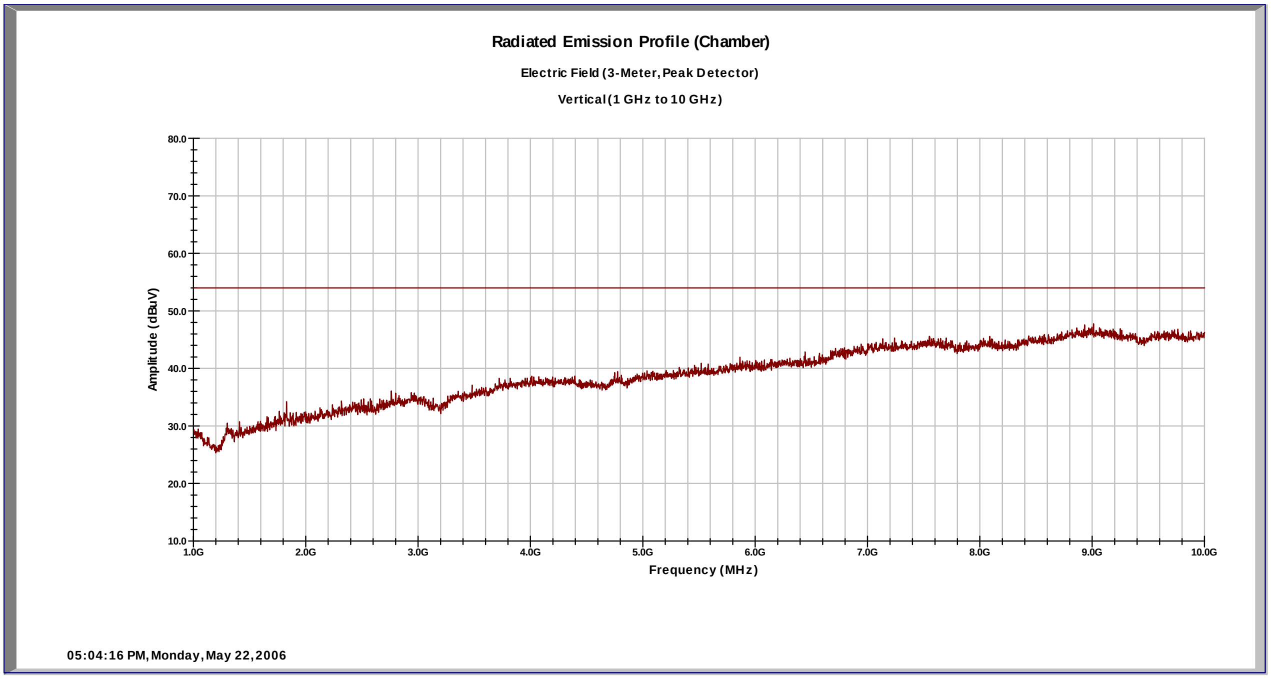
Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Any emission is indistinguishable from the receiver noise floor.

SOP 1 Radiated Emissions

Tracking # 30661254.001 Page 4 of 4

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	74ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	38%rh
Deg/sweep	6	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 3115_2236	**Performed by**	Mark Ryan
Configuration	Single channel transmit, modulated		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Any emission is indistinguishable from the receiver noise floor.

4.10 Frequency Hopping Spread Spectrum Systems FCC Part 15.247(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 bur4sts 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.

When the INfinity 510 is presented with a continuous data stream, each packet transmitted by the device will be sent on the next channel in the pseudo-random list. When a continuous data stream is presented, the INfinity 510 adheres to the 0.4 second dwell time limit for each 20 second window requirement. The INfinity 510 is programmed using a pseudo-random shuffle mode that will, utilize all the channels equally. The entire frequency channel list is shuffled using a pseudo-random number generator. The frequencies in the shuffled list are then used in sequence; when the last frequency has been used, the list is reshuffled. No frequency is ever repeated until the entire list has been used.

In compliance with FCC Part 15 regulations, the reader never stays on one frequency for more than 400 ms. There are several mechanisms at work to enforce the 400 ms cutoff. First, as the reader performs tag inventories, from time to time it will check to see how much time is remaining from the 400 ms allotment for a given frequency. If there is less than 100 ms remaining, the reader will hop to the next frequency. Second, in some cases, if more than one antenna is in use, the reader will change frequencies when an antenna change is performed; these antenna changes typically occur many times within any 400 ms time period. Finally, a hardware timer in the reader is dedicated to tracking the 400ms dwell time. Should a frequency continue to be used for 400 ms, because none of the above conditions caused it to be changed, the timer will force a frequency change at the 400 ms mark.

For more information, refer to section 6 of this report.

4.11 Incorporation of Intelligence FCC Part 15.247(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 hop-sets 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.

The INfinity 510 does not attempt to recognize other users or interferers within this spectrum band.

4.12 Frequency Stability FCC Part 15.215(c)

The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

4.12.1 Containment of the Emission during Variations in Temperature

The EUT was placed in an environmental temperature test chamber, supplied with the normal AC voltage, and with a spectrum analyzer with attenuator was attached to the output port.

The temperature inside the chamber is then raised to the highest temperature specified and allowed sufficient time for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the environmental chamber, the carrier signal was then measured 40 min after temperature stabilization. Then the above process is repeated for the lowest temperature specified and 10 degree Centigrade increments between the extremes thereafter.

4.12.1.1 Results

The EUT was placed in a temperature chamber that was increased in 10º steps from the extremes of equipment operation (-30ºC to +50ºC). No appreciable change in fundamental frequency was observed during this period. The equipment complied with the specification.

Table 9 – Temperature Stability

Temperature ° C	Frequency in MHz measured 20dB below peak		Margin to Band Edge in MHz		Results
	LOW	HIGH	902	928	
-30	903.04115	926.9640	-1.04115	-1.0360	**Pass**
-20	903.0400	926.9625	-1.040	-1.0375	**Pass**
-10	903.0400	926.9625	-1.040	-1.0375	**Pass**
0	903.0400	926.9625	-1.040	-1.0375	**Pass**
10	903.0400	926.9625	-1.040	-1.0375	**Pass**
20	903.0400	926.9625	-1.040	-1.0375	**Pass**
30	903.0400	926.9625	-1.040	-1.0375	**Pass**
40	903.0400	926.9625	-1.040	-1.0375	**Pass**
50	903.0400	926.9625	-1.040	-1.0375	**Pass**

Spectrum Analyzer Parameters:

RBW=10kHz
VBW=30kHz
Span=500kHz
LOG dB/div.= 10dB
Sweep = 50 mS

4.12.2 Containment of the Emission during Variations in Voltage

The setup was identical section 4.10.1. The variation in voltage tests were made simultaneously with the variations in temperature tests. A reference was taken at the nominal voltage, and then the Voltage was varied from 85% to 115% of the nominal voltage.

The power supply as a voltage range of 100 to 240VAC, so the low voltage was set to 85VAC, and the high voltage was set at 276VAC. 120VAC was used as the nominal value. All tests were performed at 60Hz.

4.12.2.1 Results

The ac supply voltage was varied between 85% and 115% of the nominal rated supply voltage. No change in fundamental frequency was observed during the variation. The equipment was found to be compliant.

Table 10 – Voltage Stability

Voltage	Frequency in MHz measured 20dB below peak		Margin to Band Edge in MHz		Results
	LOW	HIGH	902	928	
85.0	903.0400	926.9625	-1.040	-1.0375	**Pass**
120.0	903.0400	926.9625	-1.040	-1.0375	**Pass**
276.0	903.0400	926.9625	-1.040	-1.0375	**Pass**

Spectrum Analyzer Parameters:

RBW=10kHz
VBW=30kHz
Span=500kHz
LOG dB/div.= 10dB
Sweep = 50 mS

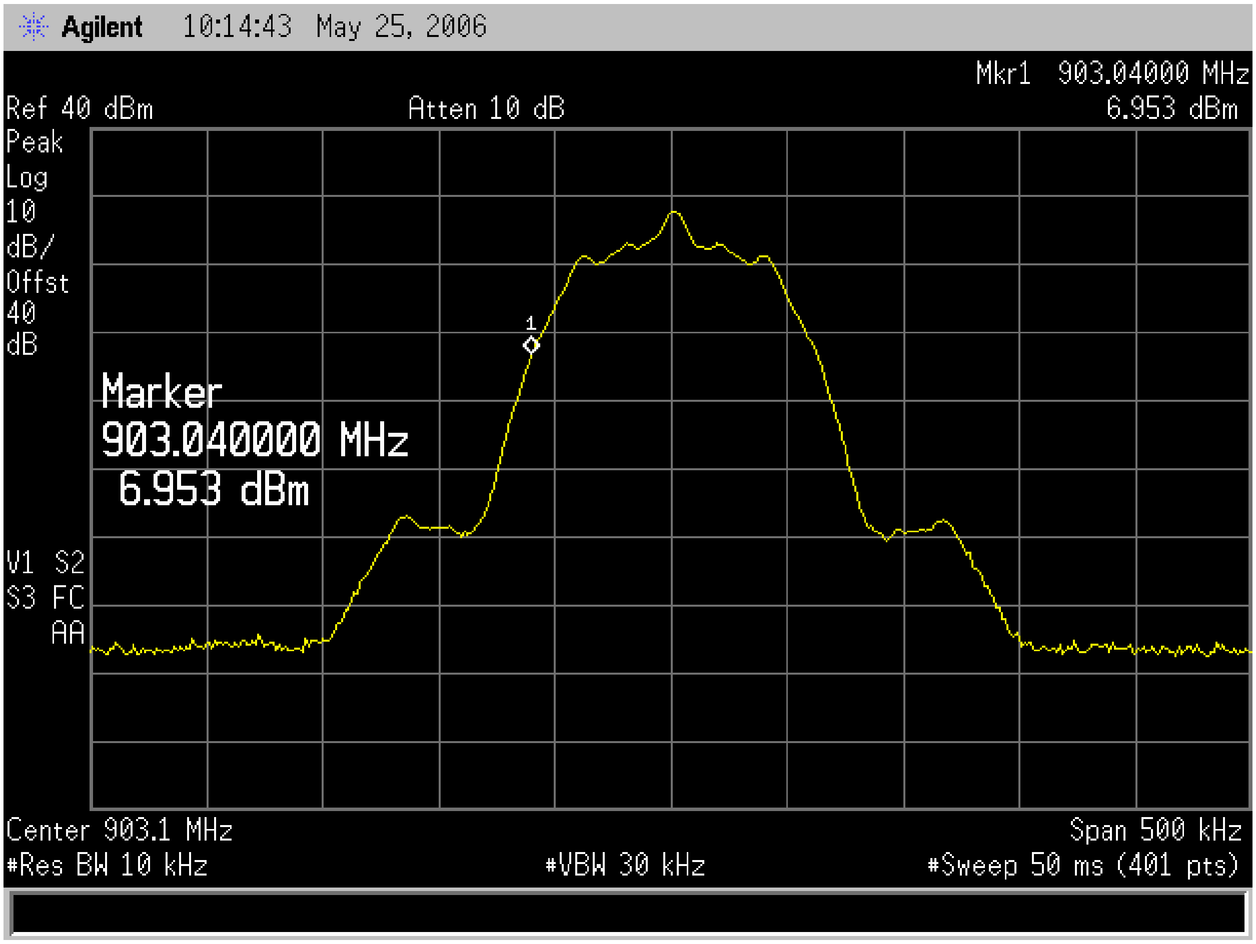


Figure 19 – Typical Frequency Stability graph (Lowest channel -20dB band edge)
Similar results for both Temperature and Voltage variations.

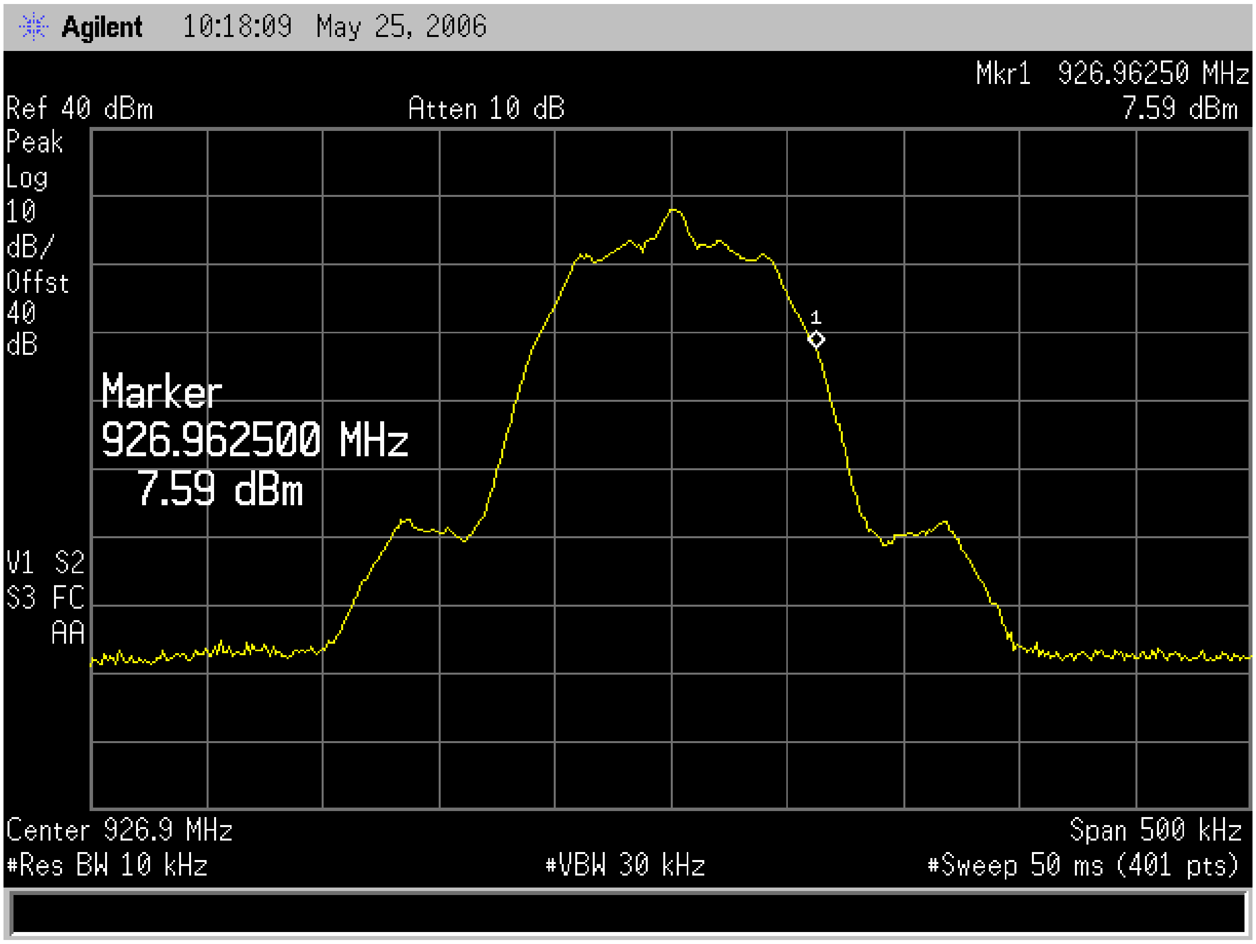


Figure 20 – Typical Frequency Stability graph (Lowest channel -20dB band edge)
Similar results for both Temperature and Voltage variations.

4.13 Radiated Emissions when not transmitting FCC Part 15.109(a)

Testing was performed in accordance with FCC part 15.109(a). These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.13.1 Test Methodology

4.13.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 300 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarizations. Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

4.13.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked. Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.13.1.3 Deviations

There were no deviations from this test methodology.

4.13.2 Test Results

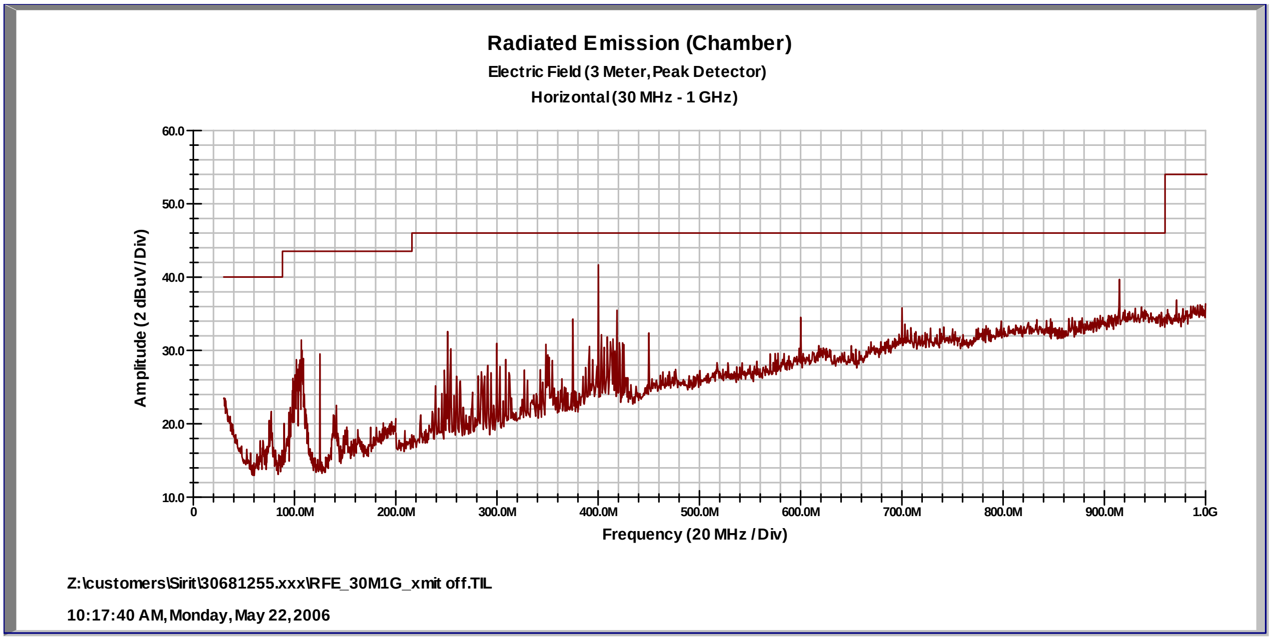
Section 4.13.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.13.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 1 Radiated Emissions — Tracking # 30661254.001 Page 1 of 2

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	68 ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	46 %rh
Deg/sweep	12	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / 3142_1007	**Performed by**	Mark Ryan
Configuration	Receive mode		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
106.72	H	3.25	165	25.14	0.00	4.13	8.70	37.96	43.50	-5.54
125.00	H	2.3	248	21.44	0.00	4.21	7.40	33.05	43.50	-10.45
400.00	H	1	325	21.44	0.00	5.24	17.00	43.68	46.00	-2.32
251.52	H	1.2	200	16.91	0.00	4.75	12.80	34.46	46.00	-11.54
600.00	H	1.2	237	14.26	0.00	5.75	20.70	40.71	46.00	-5.29

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

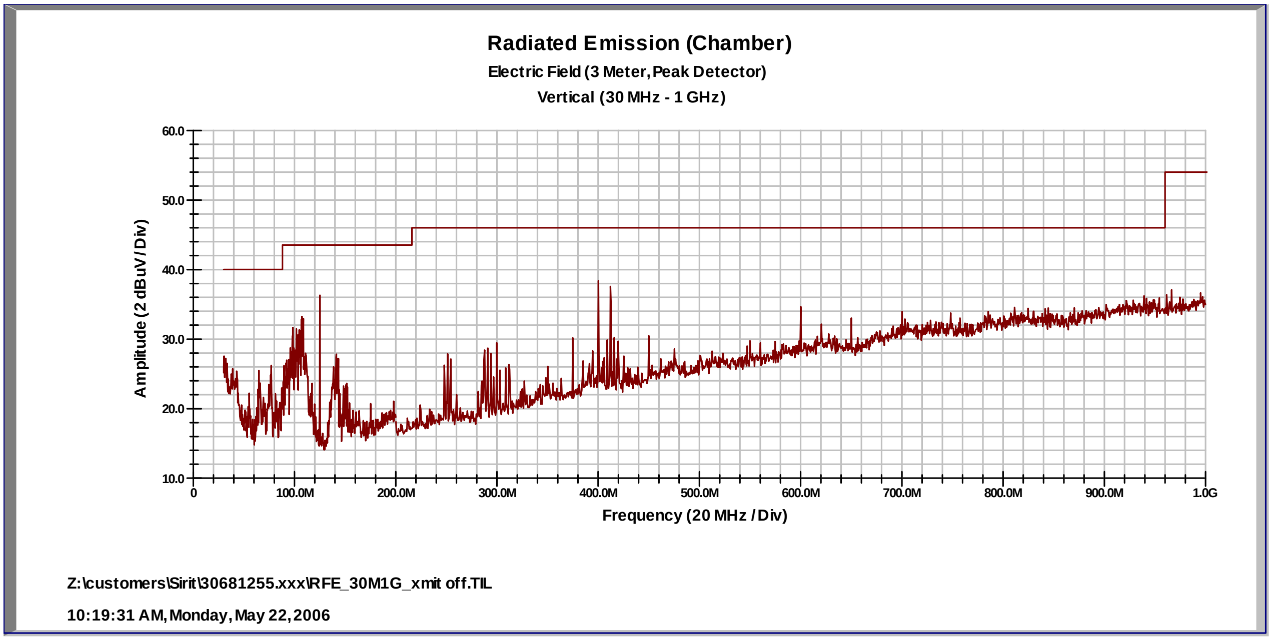
Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: Emissions shown in RED is the worst case emission.

SOP 1 Radiated Emissions

Tracking # 30661254.001 Page 2 of 2

EUT Name	**INfinity 510**	**Date**	22 May 2006
EUT Model	**IN510**	**Temp / Hum in**	N/A
EUT Serial	**Not Serialized**	**Temp / Hum out**	68ºF
Standard	**FCC 47 CFR Part 15,** RSS-210 Issue 6	**Line AC / Freq.**	46%rh
Deg/sweep	12	**RBW / VBW**	120kHz / 300kHz
Dist/Ant Used	3m / 3142_1007	**Performed by**	Mark Ryan
Configuration	Receive mode		



Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	QP FIM Value (dBuV)	Amp Gain (dB)	Cable Loss (dB)	ANT Factor (dB/m)	E-Field Value (dBuV/m)	Spec Limit (dBuV/m)	Spec Margin (dB)
106.72	V	1	0	25.19	0.00	4.13	8.33	37.65	43.50	-5.85
125.00	V	1	236	26.10	0.00	4.21	7.40	37.71	43.50	-5.79
251.52	V	1	113	12.60	0.00	4.75	12.70	30.05	46.00	-15.95
600.00	V	1.2	55	13.80	0.00	5.75	20.00	39.55	46.00	-6.45
915.00	V	1.5	10	12.39	0.00	6.41	22.70	41.50	46.00	-4.50

Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.6dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

4.13.3 Sample Calculation

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

4.14 Conducted Emissions FCC Part 15.107(a) and 15.207

Testing was performed in accordance with FCC Part 15.107(a), and 15.207. These test methods are listed under the laboratory's NVLAP Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

4.14.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. For each frequency sub-range, each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs. Testing is either performed in the anechoic chamber or on PLC Site 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the anechoic chamber is a 2m x 2m wooden frame that is covered with ¼ inch hardware cloth and is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN. Floor-standing equipment is placed directly on the ground plane.

4.14.1.1 Deviations

There were no deviations from this test methodology.

4.14.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Plots of the EUT's AC Line Conducted emissions are contained in the following sections. The plots show peak and/or average emissions and the corresponding peak and/or average limits. If the peak emissions are below the average limit, then the EUT is considered to pass and no average measurements are made. If the peak emissions are below the quasi-peak limit and the average emissions are below the average limit, then the EUT is considered to pass and no further measurements are made. Otherwise, individual frequencies are measured and compared to the corresponding limit for the detector used (quasi-peak or average).

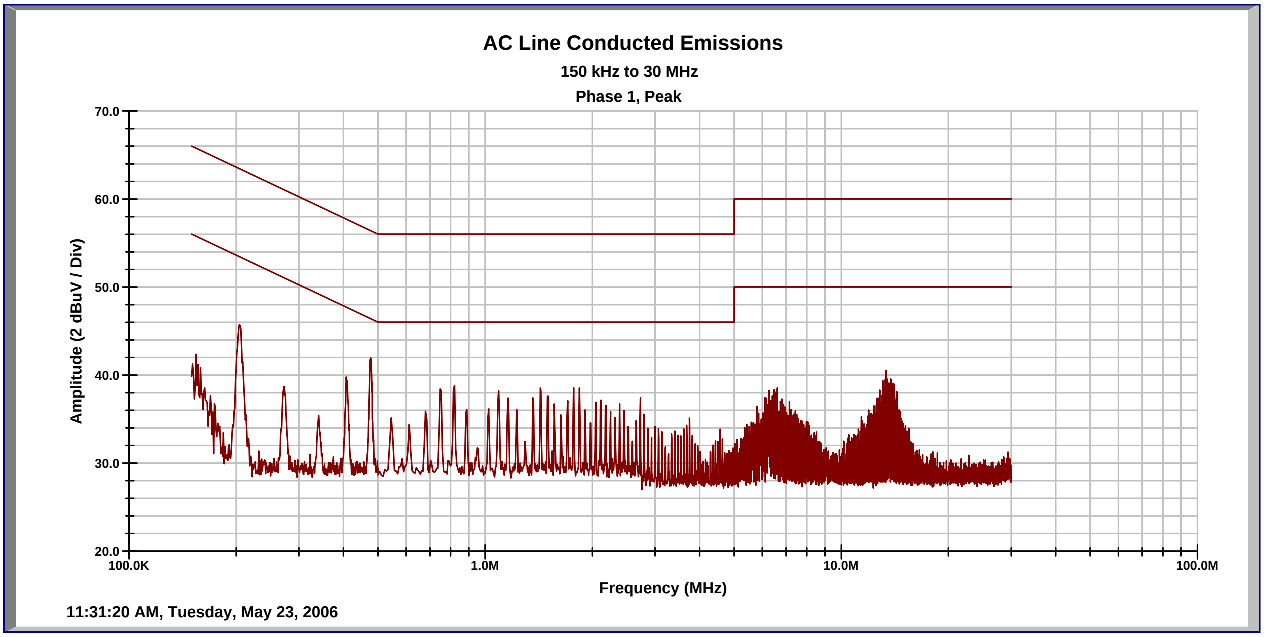
4.14.2.1 Final Data

The data recorded in this section contains the final results under the worst-case conditions and with any modifications or special accessories implemented as the manufacturer intends.

SOP 2 Conducted Emissions

Tracking # 30661254.001 Page 1 of 4

EUT Name	INfinity 510	**Date**	23 May 2006
EUT Model	IN510	**Temperature**	70ºF
EUT Serial	**Not Serialized**	**Humidity**	43%rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 6	**Line AC /Freq**	120VAC / 60Hz
LISNs Used	1	**Performed by**	Mark Ryan
Configuration	Receive mode - no transmit for FCC 15.107(a)		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.20	1	34.21	26.80	0.00	10.02	63.61	53.61	-19.38	-16.79
0.48	1	29.77	29.39	0.02	10.03	56.34	46.34	-16.52	-6.90
0.82	1	24.33	24.80	0.03	10.04	56.00	46.00	-21.60	-11.13
1.43	1	25.34	24.33	0.04	10.05	56.00	46.00	-20.57	-11.58
6.48	1	26.37	23.53	0.08	10.24	60.00	50.00	-23.31	-16.15

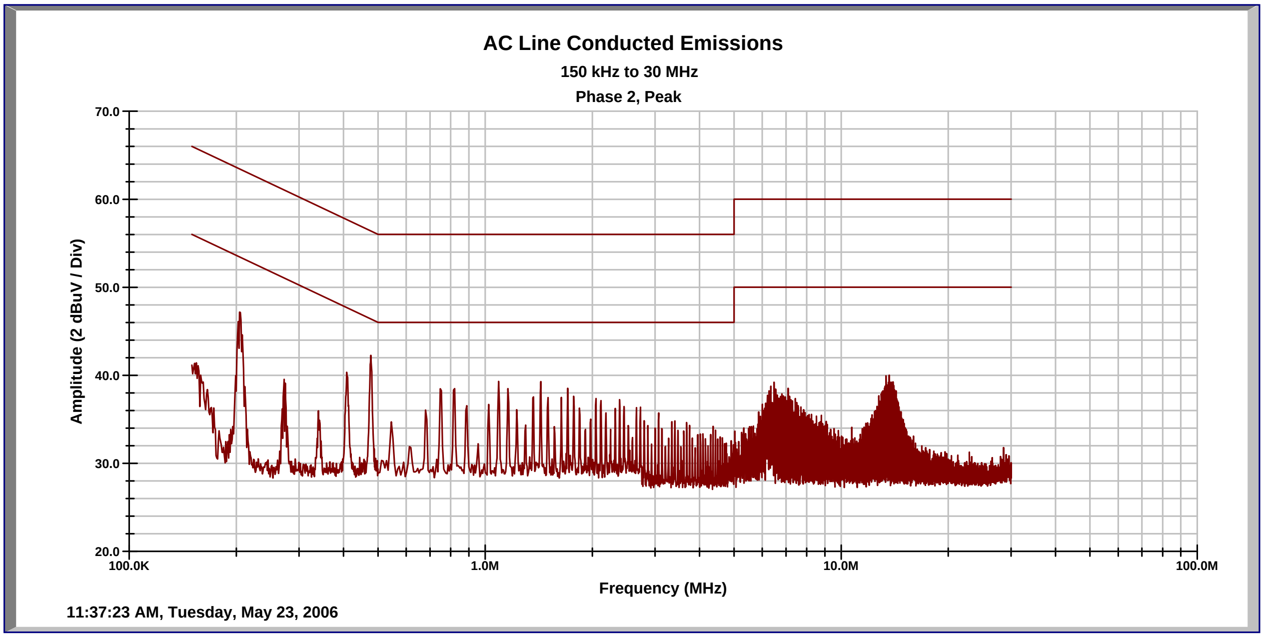
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: The emission in RED is the worst case.

SOP 2 Conducted Emissions Tracking # 30661254.001 Page 2 of 4

EUT Name	INfinity 510	**Date**	23 May 2006
EUT Model	IN510	**Temperature**	70ºF
EUT Serial	**Not Serialized**	**Humidity**	43%rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 6	**Line AC /Freq**	120VAC / 60Hz
LISNs Used	2	**Performed by**	Mark Ryan
Configuration	Receive mode - no transmit for FCC 15.107(a)		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.20	2	36.08	30.76	0.00	10.11	63.61	53.61	-17.42	-12.74
0.48	2	29.63	29.22	0.02	10.09	56.34	46.34	-16.60	-7.01
0.82	2	25.78	25.22	0.03	10.06	56.00	46.00	-20.13	-10.69
1.43	2	26.90	25.46	0.04	10.05	56.00	46.00	-19.01	-10.45
6.60	2	25.96	24.74	0.08	10.25	60.00	50.00	-23.71	-14.93
13.69	2	26.62	24.99	0.13	10.45	60.00	50.00	-22.80	-14.43

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

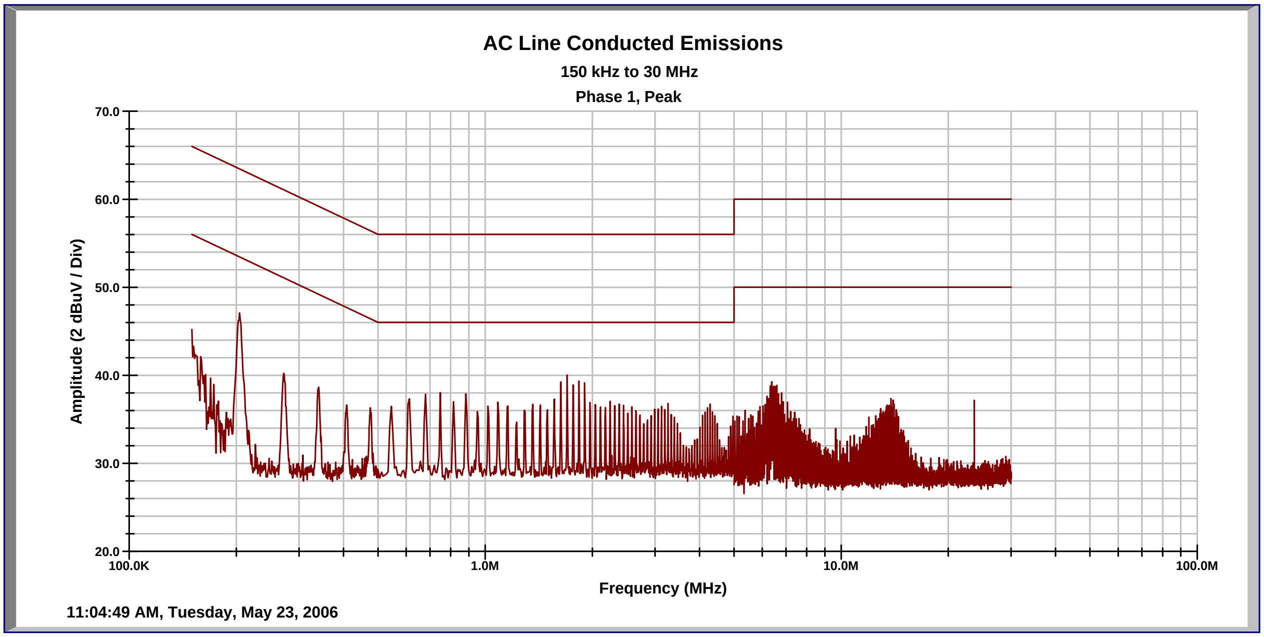
Notes:

SOP 2 Conducted Emissions

Tracking # 30661254.001 Page 3 of 4

EUT Name	INfinity 510	**Date**	23 May 2006
EUT Model	IN510	**Temperature**	70ºF
EUT Serial	**Not Serialized**	**Humidity**	43%rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 6	**Line AC /Freq**	120VAC / 60Hz
LISNs Used	1	**Performed by**	Mark Ryan

Configuration Typical transmit mode - transmitter on – modulated on single channel, for FCC 15.207



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.20	1	35.19	24.64	0.00	10.02	63.61	53.61	-18.40	-18.95
0.48	**1**	24.52	**21.93**	0.02	10.03	56.34	46.34	-21.77	**-14.36**
1.70	1	27.58	20.27	0.03	10.06	56.00	46.00	-18.33	-15.64
3.13	1	22.57	17.42	0.05	10.10	56.00	46.00	-23.28	-18.43
6.33	1	26.21	21.74	0.08	10.23	60.00	50.00	-23.48	-17.95
13.75	1	23.45	18.72	0.13	10.45	60.00	50.00	-25.97	-20.70

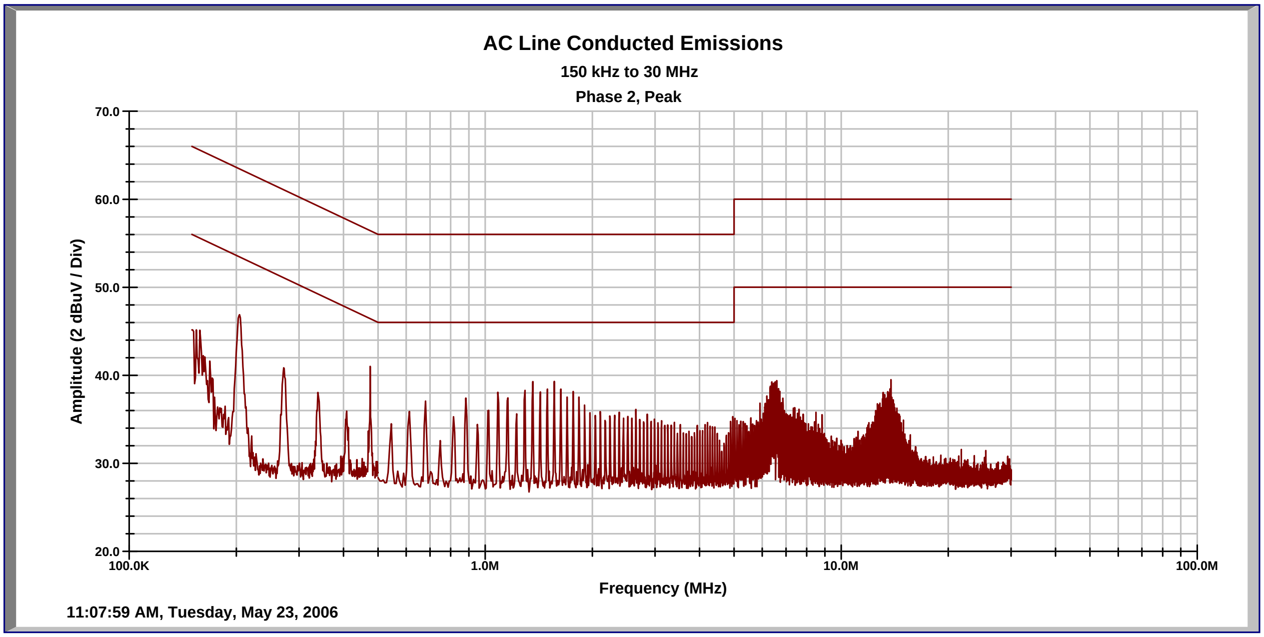
Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Notes: The emission in **BLUE** is the worst case while transmitting.

SOP 2 Conducted Emissions — Tracking # 30661254.001 Page 4 of 4

EUT Name	INfinity 510	**Date**	23 May 2006
EUT Model	IN510	**Temperature**	70ºF
EUT Serial	**Not Serialized**	**Humidity**	43%rh
Standard	FCC 47 CFR Part 15, RSS-210 Issue 6	**Line AC /Freq**	120VAC / 60Hz
LISNs Used	2	**Performed by**	Mark Ryan
Configuration	Typical transmit mode - transmitter on – modulated on single channel, for FCC 15.207		



Emission Freq (MHz)	Line ID (1,2,3,N)	FIM Quasi (dBuV)	FIM Ave (dBuV)	Cable Loss (dB)	LISN + T Limiter (dB)	Quasi Limit (dBuV)	Ave Limit (dBuV)	Quasi Spec Margin (dB)	Ave Spec Margin (dB)
0.20	2	34.71	24.71	0.00	10.11	63.61	53.61	-18.79	-18.79
0.48	2	23.46	18.53	0.02	10.09	56.34	46.34	-22.77	-17.70
1.63	2	27.04	23.44	0.03	10.06	56.00	46.00	-18.87	-12.47
2.79	2	22.59	19.55	0.05	10.09	56.00	46.00	-23.27	-16.31
6.39	2	27.43	23.06	0.07	10.24	60.00	50.00	-22.26	-16.63
13.82	2	22.34	15.96	0.13	10.45	60.00	50.00	-27.08	-23.46

Quasi Spec Margin = Quasi FIM + Cable Loss + LISN CF - Quasi Limit ± Uncertainty
Ave Spec Margin = Ave FIM + Cable Loss + LISN CF - Ave Limit ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2dB   Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes:

5 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
SOP 1 - Radiated Emissions (5 Meter Chamber)					
Ant. BiconiLog	EMCO	3142	1007	9-Feb-06	9-Feb-07
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	5-Aug-05	5-Aug-06
Cable, Coax	Andrew	FSJ1-50A	03	15-Jan-06	15-Jan-07
Cable, Coax	Andrew	FSJ1-50A	30	15-Jan-06	15-Jan-07
Cable, Coax	Andrew	FSJ1-50A	45	15-Jan-06	15-Jan-07
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	22-Dec-05	22-Dec-06
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	27-Feb-06	27-Feb-07

General Laboratory Equipment					
Meter, Multi	Fluke	79-3	69200606	5-Aug-05	5-Aug-06
Meter, Temp/Humid/Barom	Fisher	02-400	01	24-Oct-05	24-Oct-06
Power Supply, AC	California Instruments	1251P	L06429	CNR II	CNR II

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

6.1 EMC Test Plan

The attached EMC test plan has been generated by the manufacturer and implemented as recorded in this test report.

Introduction

This manufacturer-supplied document provides a description of the Equipment Under Test (EUT), configuration(s), operating condition(s), and performance acceptance criteria. It is intended to provide the test laboratory with the essential information needed to perform the requested testing.

Customer

The information in the following tables is required, as it should appear in the final test report.

Table 11 – Customer Information

Company Name	sirit vision beyond sight™
Web Site	www.sirit.com
Address 1	2525 Meridian Parkway
Address 2	Suite 60
City	Durham
State	NC
Zip	27713
Phone	919-281-1541
Fax	919-281-1551

Table 12 – Technical Contact Information

Name	Kimberly Francisco
E-mail	kfrancisco@sirit.com
Phone	919-281-1572
Fax	919-281-1551

Equipment Under Test (EUT)

Table 13 – EUT Designation

Product Name	INfinity
System Name	Non-applicable
Model Number	510
Line Cards	Non-applicable
Product Description	UHF RFID Interrogator/Reader

Product Specifications

Table 14 – EUT Specifications

Size *(in inches)*	22 cm H 30cm W 5.6 cm D
Weight *(in pounds)*	2 kg.
Power Supply *(check all that apply)*	Voltage Type ☒ DC ☒ AC (with supplied power module)
	Operating Voltage 12-24 VDC Operating Frequency N/A
	Multiple Feeds ☒ No ☐ Yes - how many
	Current *(Max)* 2.5-5 (A)
	Power Consumption *(Max loaded)* 60 (W)
Clock Oscillator Switching Power Supply Operating Frequencies:	see table below
Is the EUT a frame or a shelf product? *(Note: shelf = 36" or less)*	☒ Table Top ☒ Rack mount ☐ Floor standing cabinet ☐ Other *describe*

Clock / Oscillator / Switching Power Supply Operating Frequencies:

Type	**Frequency**		**Type**	**Frequency**	
TCXO	10 MHz		XTAL OSC	25 MHz	
VCO	864-955 MHz		XTAL OSC	32.768 kHz	
XTAL OSC	38.4 MHz				
XTAL OSC	13 MHz				

Interface Specifications

Table 15 – Interface Specifications

Interface Design/ Port Name	Number of this type Interfaces	Cabled with what type of cable?	Is the cable shielded?	What is the maximum potential length of the cable?	Metallic (M), Coax (C) or Fiber (F)?
RF/Antenna	5	coax	☒Yes ☐No	10m	☐M ☒C ☐F
RS-232	1	RS-232	☐Yes ☒No		☐M ☐C ☐F
Ethernet	1	RJ-45	☐Yes ☒No		☐M ☐C ☐F

Note: The RF / Antenna ports use reverse-polarized TNC connectors

Technical Description

INfinity 510 Operational Description

The IN*finity* 510 UHF Reader is a member of the Sirit family of Radio Frequency Identification (RFID) products. RFID is a wireless data acquisition method used to remotely retrieve product data such as part number, date-of-manufacture, quantity, version, and other information. All RFID systems are comprised of the following components:

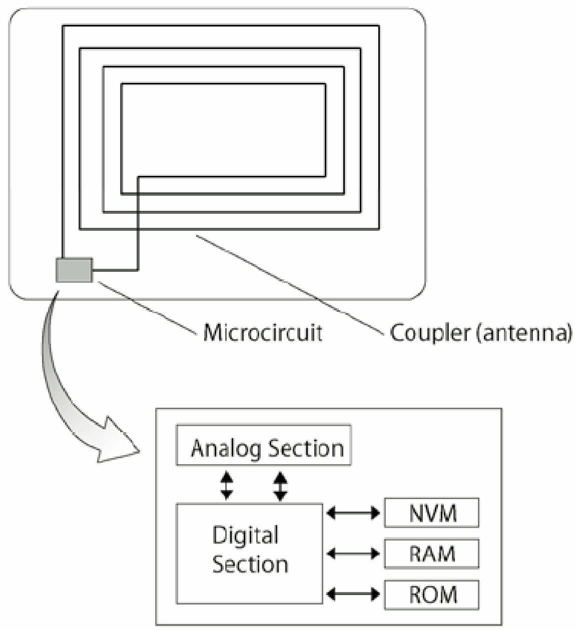
• Transponders (tags) attached to a product

• Reader/Interrogator to write and read tag data

• Reader/Interrogator Antenna

Transponders (Tags)

The transponder or tag is the data-carrying device attached to the product or container and can come in any shape or size. The most common are the "credit card" tags used for security access and the larger plastic, anti-theft tags used by retailers. Whatever the size or application, each tag always consists of a coupler (antenna element) and a microcircuit. Tags operate in read/write mode. In other words, data can be rewritten to the tag as well as read from the tag.



The tag communicates with the reader across the air-interface. This interface is defined by its carrier frequency, bit data rate, encoding method and other parameters.

Tags are typically referred to as either active or passive devices depending on the power source. Active tags contain an internal battery and have longer read ranges but a limited operation life.

Low frequency passive tags do not have an internal battery and are powered by inductive or capacitance coupling when the tag is in the RF field of the reader. These tags typically have shorter read ranges, but have substantially longer operational lives.

UHF tags, like those used with the IN*finity* 510, use reflected electromagnetic backscatter coupling. These tags operate in the 864-955 MHz range and typically have longer read ranges.

When a UHF tag passes through the RF field, the tag is energized by the reader's time-varying, electromagnetic RF wave. This signal is called the carrier signal. When the RF field passes through the antenna, an AC voltage is generated. This voltage is rectified to supply power to the tag's microcircuit. As the microcircuit loads and unloads the tag's antenna terminals, the information in the tag is transmitted back to the reader. This modulation scheme is referred to as Amplitude Shift Keying (ASK) or On-Off Keying (OOK).

IN*finity* 510 Reader

The IN*finity* 510 operates in the 864 MHz to 955 MHz UHF band. The 510 supports ISO 18000-6B, Ucode 1.19, and EPCglobal Generation 2 (ISO 18000-6C), as well as optional support for EPCglobal Generation 1 (Class 0 and Class 1) RFID protocols. The reader supports single, multiple, and dense reader modes and may integrate into most UHF installations including dock door portals, conveyor systems, access control, and many others. The 510 provides interface options including RS-232 serial, Ethernet, and digital I/O to support most domestic and international RFID applications.

The IN*finity* 510 is equipped with five RFID antenna ports: 4 Transmit / Receive (TX/RX) and one listen antenna for “Listen-Before-Talk” (LBT) operation. The 4 TX/RX ports are multiplexed, i.e. only one port is active at any given time. A typical application is a dock door portal, in which 4 antennas are placed at various locations around the portal. The reader would then poll each antenna to detect any RFID tags within the portal. Conducted output power is user-adjustable up to 1 Watt maximum. In addition to flexibility in power level, the transmitter has been optimized to handle the demanding requirements of dense reader modes. These optimizations include the use of phase reversal keying and substantial filtering to reduce out-of-band emissions to well below industry standards.

The reader contains a transmitter section, receiver section, synthesizer section and modem. The transmitter section contains a digital/analog converter, I/Q modulator, filtering, power amplifier and the coupling circuit. The receiver section contains amplifiers, I/Q demodulator, filtering and analog/digital converter. The synthesizer section contains a voltage-controlled oscillator and phase-locked loop. The modem includes the microprocessor, DSP, FPGA and input/output communication interfaces.

The reader transmits to one of the external antennas. This RF field can range from 6 inches to 30 feet depending on the power and frequency. The RF field generated by the reader performs the following:

- Energize the tag antenna to provide power to the integrated circuit

- Provide a synchronized clock source for the tag

- Act as a carrier for returned tag data

The reader can be configured to constantly generate the RF carrier, but in many applications, to minimize radio interference, the reader’s transmitter is idle until an event triggers the reader to begin transmission. While the RF carrier is transmitted, the reader is monitoring the return signal for modulation indicating the presence of a tag.

When a tag enters the RF field, the antenna is energized and the tag starts to divide down the carrier, demodulate commands from the reader, and begins to clock data to the output transistor. The output transistor shunts the antenna element causing momentary fluctuations in the carrier amplitude. The reader detects this amplitude-modulated data and decodes the resulting bit stream into the actual tag data. The decoding scheme depends on the specific tag protocol.

Frequency Hopping Mechanism

Frequency set

The reader can be configured to operate in one of four frequency band sets, as shown in the table below.

Frequency Band Set	Frequency Range (MHz, inclusive)	Channel Spacing (kHz)	Number of Channels
FCC_A	902.3 – 912.1	200	50
FCC_B	910.1 – 919.9	200	50
FCC_C	917.9 – 927.7	200	50
FCC_DENSE	902.75 – 927.25	500	50

Randomization mode

The reader hops from one frequency to another at times as described in the “Timing Considerations” subsection below.

The entire frequency list is shuffled using a pseudo-random number generator. The frequencies in the shuffled list are then used in sequence; when the last frequency has been used, the list is reshuffled. No frequency is ever repeated until the entire list has been used.

Timing considerations

In compliance with FCC Part 15 regulations, the reader never stays on one frequency for more than 400 ms. There are several mechanisms at work to enforce the 400 ms cutoff. First, as the reader performs tag inventories, from time to time it will check to see how much time is remaining from the 400 ms allotment for a given frequency. If there is less than 100 ms remaining, the reader will hop to the next frequency. Second, in some cases, if more than one antenna is in use, the reader will change frequencies when an antenna change is performed; these antenna changes typically occur many times within any 400 ms time period. Finally, a hardware timer in the reader is dedicated to tracking the 400ms dwell time. Should a frequency continue to be used for 400 ms, because none of the above conditions caused it to be changed, the timer will force a frequency change at the 400 ms mark.

Configuration(s)

The EUT is to be tested in a Table Top configuration. It is considered to be Equipment Type III as defined in table 1 on EN 301 489-3. Emissions testing to be performed with EUT oriented in X, Y and Z axes on table top.

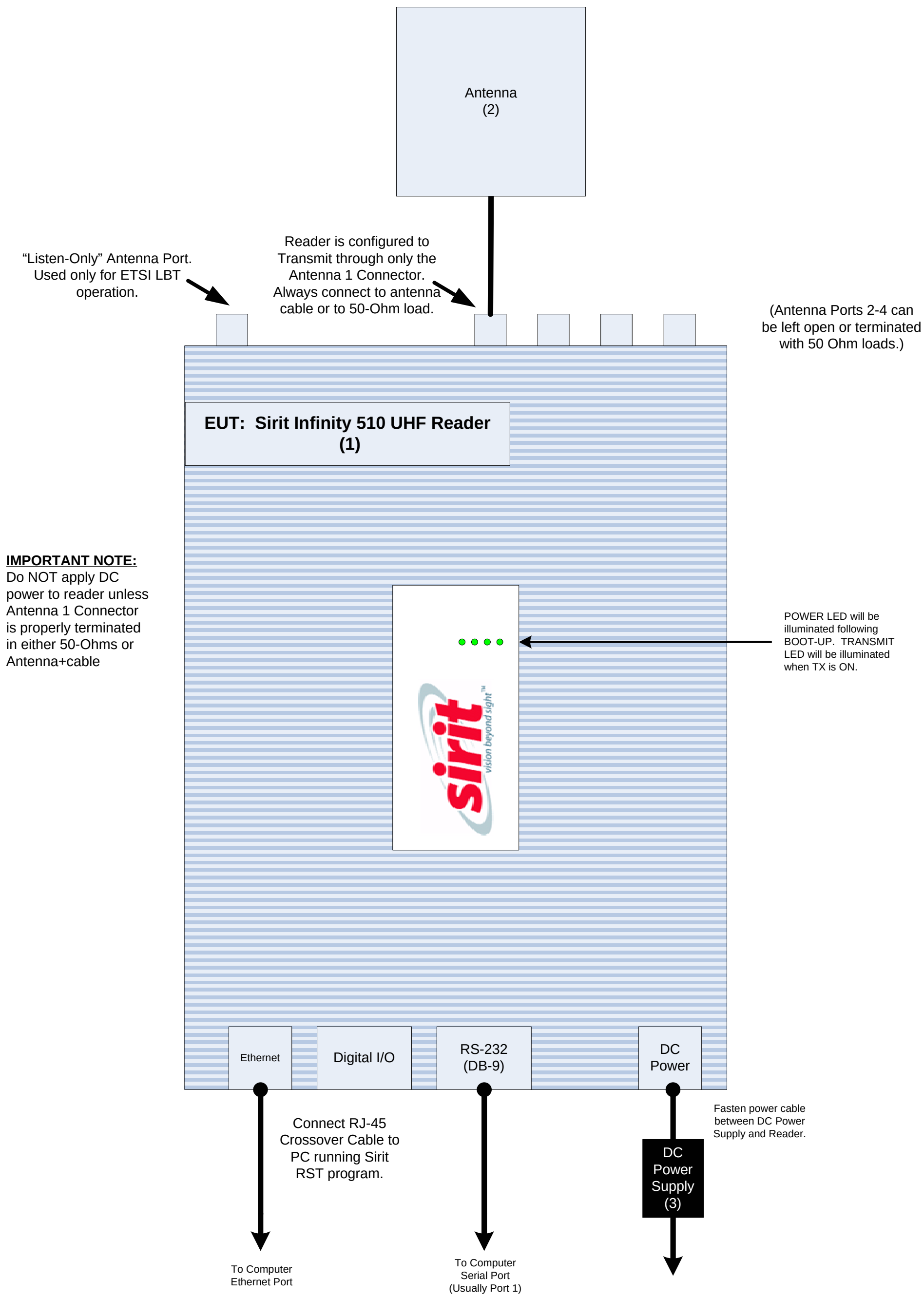


Figure 21 - Block Diagram of EUT Set-Up

Table 16 – Equipment Chassis Shown in Block Diagram

Des.	Manufacturer	Model No.	Description
1	Sirit	INfinity 510	EUT. UHF RFID Reader
2	Poynting	PATCH-A0025	+7dBi Antenna
3	Phi Hong	PSA65U-150-R	+15V 60W AC Adapter

Table 17 – Cables Shown in Block Diagram

Des.	Cable Name	Port Reference
A	Antenna Cable	RF-1
B	RS-232 Cable	RS-232
C	RJ-45 Crossover Cable	Ethernet

Table 18 – Subassemblies within each Chassis

Des.	Manufacturer	Model No.	Description
1	Sirit	KX0061	Digital PCB Assembly
1	Sirit	KX0071	RF PCB Assembly
1	Sirit	KX0081	DC Power Supply PCB Assembly

Operating Conditions

The EUT is to be tested in a "typical" operating mode consistent with its intended use.

Software

The EUT utilizes three different firmware components. All three of these components are packaged into a single, indivisible entity. The package is referenced by a single release identifier. The EUT is using firmware release <TBD>

The EUT may be configured using any terminal emulation program, such as HyperTerminal. Alternatively, Sirit has developed applications that simplify configuration of the EUT. For purposes of regulatory testing, Sirit’s Reader Startup Tool (RST) will be used to configure the EUT.

Mode(s)

EUT will be configured using Sirit RST tool. The tool will include “macro buttons” for each of the configurations that will be required for testing. A laptop computer with the RST tool installed will be provided with the sample EUT.

Specifications

Top Level Fixed Reader Environmental, Reliability, and Regulatory Requirements

Environmental Requirements

Operating Environment

The INfinity 510 platform shall be designed for industrial use.

Operating Temperature

INfinity 510 shall operate in a temperature range of -20 C to +55 C.

Storage Temperature

INfinity 510 shall withstand storage temperatures between -55 C and +125 C with no permanent damage.

Relative Humidity

INfinity 510 shall operate in environments with relative humidity within the range of 5% to 80%, non-condensing.

Maximum Shock

INfinity 510 shall tolerate a 3-foot drop to any corner without permanent damage.

Electrostatic Discharge Protection

INfinity 510 shall be designed to withstand ESD limits according to IEC 61000-4-2. These limits are ±8 kV for Contact Discharge and ±15 kV for Air Discharge.

Accessories

Accessories required for proper operation of the INfinity 510 Products shall meet or exceed the environmental requirements as listed for the associated INfinity 510 Product. Deviations from this compliance must be approved by the Director of Engineering.

Reliability

General Reliability Requirements

INfinity 510 shall not be designed with a requirement for replaceable parts or scheduled service items.

MTTF

INfinity 510 shall be designed for a Mean-Time-To-Failure of 25,000 hours (approximately 3 years continuous use).

Regulatory Requirements

General Compliance

In addition to regulatory compliance details specified in this section, refer to Section 0, Appendix A, International RF Regulations for specific radiation radio frequency emissions limits and methods of measurement. Note that Appendix A is only for reference. Inclusion of a region's regulations in Appendix A does not imply a requirement for INFINITY 510.

Safety Compliance

INfinity 510 shall be designed to IEC 60950-1 applicable to battery-powered equipment with rated voltages less than 600V.

INfinity 510 shall be designed to EN 50364 and 47 CFR Part 1 for limiting human exposure to electromagnetic fields.

Region 1 (Europe) Compliance

CE Mark

INfinity 510 shall be designed to all applicable standards that allow a declaration of European Conformity and application of the CE mark.

Technical and EMC Compliance

INfinity 510 shall be designed to ETSI EN 300 220-3 compliance at the single operating frequencies of 869.525 MHz and 869.850 MHz.

INfinity 510 shall be designed to ETSI EN 302 208-2 compliance over the operating frequency range of 865.0 MHz to 868.0 MHz.

Immunity Compliance

INfinity 510 shall be designed to ETSI EN 301 489-3 compliance for immunity to ESD (IEC 61000-4-2), radiated EM interference (IEC 61000-4-3) fast transients (IEC 61000-4-4), and conducted EM interference (IEC 61000-4-6).

Appendix A. International RF Regulations

Table 1 – International RF Regulations Tables Notes

Note 1:	For FCC Part 15.247 the Channel Spacing cannot be less than the Occupied BW; in addition, for Occupied BW <250kHz, at least 50 hopping channels are required, for larger Occupied BW, 25 hopping channels are required; Table assumes 200kHz
Note 2:	For the 500 KHz region ajacent to the allowed Frequency Band the measurement RBW is 3kHz
Note 3:	The Receiver Sensing Threshold in Korea is based on Conducted RF Power, not ERP, and is 3dB lower than the ETSI limits; i.e. <50mW => -83 dBm, 51mW to 250 mW => -90 dBm, and 251mW to 1W => -96dBm
Note 4:	Not well defined for RFID; AS/NZS 4771:2000 for Spread Spectrum Transmitters was used in this table; Spurious levels are measured outside the operating frequency band
Note 5:	Spurious limits are -54dBm between 47 - 74, 87.5 - 118, 174 - 230, and 470 - 862
Note 6:	Spurious limits are -61dBm between 715 - 945 MHz and between 1884.5 - 1919.6 MHz w/1 MHz RBW, -61dBm between 945 - 950 MHz and between 956 - 960 MHz w/100 kHz RBW, and -39dBm in the 2 MHz adjacent to 952-954 MHz w/100 kHz RBW
Note 7:	Readers certified for multiple- or dense-Interrogator environments have requirements for channelization (in subcarrier mode), frequency stability, and transmit mask not applicable to other modes and protocols; shown are the more stringent dense-Interrogator mode.
Note 8:	For the purposes of transmit mask measurement, the ACP BW is calculated as 2.5/Tari which equals 400kHz for a 6.25us Tari.
Note 9:	All frequencies are in MHz unless otherwise noted.

Appendix A. Europe and North America

	Europe			North America	
	EN 302 208	**EN 300 220**	**REC 70-03 Annex 1**	**FCC Part 15.247**	**Gen2 (Note 7)**
FREQUENCY BAND	865.0 - 868.0	869.4 - 869.65	869.7 - 870.0 MHz	902.0 - 928.0	902.0 - 928.0
CONDUCTED POWER	NA	NA	NA	1W	1W
RADIATED POWER	2W ERP	0.5W ERP	5mW ERP	4W EIRP	4W EIRP
CHNL SPACING	200 kHz	NA	NA	See Note 1	500 kHz
CHNL ASSIGMENT	C1 = 865.1	C1 = 869.525	C1 = 869.85	C1 = 902.3	C1 = 902.75
	C2 = 865.3			C2 = 902.5	C2 = 903.25
	C15 = 867.9			C128 = 927.7	C50 = 927.25
FREQ STABILITY	±20 ppm	±100 ppm	±20 ppm	NA	±10 ppm
OCCUPIED BW	200 kHz	250 kHz	300 kHz	200 kHz	400 kHz
	• -30dBc @ ±100kHz	• -36dBm @ ±125kHz	• -36dBm @ ±150kHz	See Note 1	• -30dBc @ ±200kHz
	• 3kHz RBW	• 100 kHz RBW	• 100 kHz RBW		
TRANSMIT MASK	< -36 dBm	< -36 dBm	< -36 dBm	<-30 dBc	< -30 dBch ACP
	• @ >±200 kHz	• @ >±125 kHz	• @ >±150 kHz	· 902-928	< -60 dBch ACP2
measured w/ 3kHz RBW	< -30 dBm	< -30 dBm	< -30 dBm	= 100kHz RBW	• See Note 8
unless specified	• @ >1 GHz	• @ >1 GHz	• @ >1 GHz	< -30 dBm	< -35 dBm
		100 kHz RBW	100 kHz RBW	• elsewhere	• elsewhere
				= 1MHz RBW	2.5/Tari RBW
INTERFERENCE MANAGEMENT METHOD	LBT	None	None	FHSS	FHSS
SAFETY	EN 60950-1	EN 60950-1	EN 60950-1	UL60950-1 (optional)	
	EN 50364	EN 50364	EN 50364	MPE per 47 CFR Part 1	
OTHER	See EN 300 489 for EM Immunity	See EN 300 489 for EM Immunity	See EN 300 489 for EM Immunity		
	Max ERP is limited in C1, C2, C3, C14, C15	See EN 300 220 for RX Blocking	See EN 300 220 for RX Blocking		
	RX Spurious < -57 dBm		All other general requirements of EN 300 220 apply		
	See EN 302 208 for LBT Timing and Rx Blocking in Listen Mode				

Appendix A. Korea and Singapore

	Korea		Singapore	
	Mode 1	**Mode 3**	**Band 1**	**Band 2**
FREQUENCY BAND	910.0 - 914.0	908.5 - 914.0	866.0 - 869.0	923.0 - 925.0
CNDCTD POWER	1W	1W	NA	1W
RADIATED POWER	4W EIRP	4W EIRP	0.5W ERP	2W ERP
CHNL SPACING	200 kHz	200 kHz	200 kHz	200 kHz
CHNL ASSIGMENT	C1 = 910.5	C1 = 908.9	C1 = 866.1	C1 = 923.1
	C2 = 910.7	C2 = 909.1	C2 = 866.3	C2 = 923.3
	C16 = 913.5	C24 = 913.5	C15 = 868.9	C10 = 924.9
FREQ STABILITY	±20 ppm	±20 ppm	±20 ppm	±20 ppm
OCCUPIED BW	200 kHz	200 kHz	200 kHz	200 kHz
	• -20dBc @ ±100kHz	• -20dBc @ ±100kHz	• -32dBc @ ±100kHz	• -32dBc @ ±100kHz
	• 3kHz RBW	• 3kHz RBW	3kHz RBW	• 3kHz RBW
TRANSMIT MASK	< -36 dBm	< -36 dBm	< -36 dBm	<-32 dBc
	• @ <1 GHz	• @ <1 GHz	@ >±125 kHz	· 923-925
measured w/ 3kHz RBW	100 kHz RBW	100 kHz RBW	< -30 dBm	100kHz RBW
unless specified	• See Note 2	• See Note 2	• @ >1 GHz	< -30 dBm
	< -30 dBm	< -30 dBm		• elsewhere
	@ >1 GHz	• @ >1 GHz		= 1 RBW
	1 MHz RBW	1 MHz RBW		
INTERFERENCE MANAGEMENT METHOD	FHSS	LBT	LBT (optional)	FHSS
SAFETY	None	None	None	None
OTHER	FHSS follows FCC Part 15 rules	LBT follows ETSI EN 302 208 rules	Must comply with EN 300 220 or EN 302 208	
		See Note 3 for Carrier Sensing Level limits	Max ERP is **<u>not</u>** limited in C1, C2, C3, C14, C15	
			RX Spurious < -57 dBm	
			See EN 302 208 for LBT Timing and Rx Blocking in Listen Mode	

Appendix A. Hong Kong, China, Japan, Australia, and New Zealand

	Hong Kong		China	Japan	Australia	New Zealand
	Band 1	Band 2				
FREQUENCY BAND	865.0 - 868.0	920.0 - 925.0	TBD	952.0 - 954.0	918.0 - 926.0	864.0 - 868.0
CNDCTD POWER	NA	1W		1W EIRP	NA	NA
RADIATED POWER	2W ERP	4W EIRP		4W EIRP	1W EIRP	4W EIRP
CHNL SPACING	200 kHz	200 kHz		TBD	200 kHz	200 kHz
CHNL ASSIGMENT	C1 = 865.1	C1 = 920.1		TBD	C1 = 918.3	C1 = 864.3
	C2 = 865.3	C2 = 920.3			C2 = 918.5	C2 = 865.3
	C15 = 867.9	C10 = 924.9			:	:
FREQ STABILITY	±20 ppm	±20 ppm			C36 = 925.5	C18 = 867.7
OCCUPIED BW	200 kHz	200 kHz		NA	±20 ppm	±20 ppm
	• -30dBc @ ±100kHz	• -32dBc @ ±100kHz		TBD	200 kHz	200 kHz
	3kHz RBW	3kHz RBW			• See Note 4	• See Note 4
TRANSMIT MASK	< -36 dBm	<-30 dBc				
	@ >±200 kHz	· 920-925		< -36 dBm	< -36 dBm	< -36 dBm
measured w/ 3kHz RBW	< -30 dBm	100kHz RBW		• @ <1 GHz	• @ <1 GHz	• @ <1 GHz
unless specified	• @ >1 GHz	< -20 dBm		100 kHz RBW	100 kHz RBW	100 kHz RBW
	< -54 dBm	• elsewhere		< -30 dBm	• See Note 4	• See Note 4
	@ Restricted Bands	1MHz RBW		• @ >1 GHz	< -30 dBm	< -30 dBm
	See Note 5			1 MHz RBW	• @ >1 GHz	• @ >1 GHz
	LBT (optional)	FHSS		See Note 6	100 kHz RBW	100 kHz RBW
INTERFERENCE MANAGEMENT METHOD	HKTA 2001	HKTA 2001		TBD	FHSS	FHSS
SAFETY	EN50364 or equiv	EN50364 or equiv		TBD	AS/NZ 60950	AS/NZ 60950
	Must comply with EN 302 208					
OTHER	Max ERP is limited in C1, C2, C3, C14, C15					
	RX Spurious < -57 dBm					
	See EN 302 208 for LBT Timing and Rx Blocking in Listen Mode					

Detailed Power Supply Environmental, Reliability, and Regulatory Requirements

Environmental Requirements

Operating Environment

The INFINITY 510 power supply shall be designed for industrial use.

Operating Temperature

The INFINITY 510 power supply shall be designed to operate convection cooled in a temperature range of -20 C to +85 C.

Storage Temperature

The INFINITY 510 power supply shall withstand storage temperatures between -55 C and +125 C with no permanent damage.

Relative Humidity

The INFINITY 510 power supply shall operate in environments with relative humidity within the range of 5% to 80%, non-condensing.

Shock and Vibration

When mounted inside an aluminum enclosure, the INFINITY 510 power supply shall tolerate a 3-foot drop at any angle without permanent damage. In addition, the power supply shall be designed to withstand shock and vibration found in commercial vehicular applications; including forklifts, automobiles, and trucks (delivery, garbage, etc.)

Electrostatic Discharge Protection

The INFINITY 510 power supply shall be designed to withstand ESD limits according to IEC 61000-4-2. These limits are ±8 kV for Contact Discharge and ±15 kV for Air Discharge.

Reliability

General Reliability Requirements

The INFINITY 510 power supply shall not be designed with a requirement for replaceable parts or scheduled service items.

MTTF

The INFINITY 510 power supply shall be designed for a Mean-Time-To-Failure of 25,000 hours (approximately 3 years continuous use) when each internal supply is operated at 80% of rated output power.

Regulatory Requirements

CE Mark

The INFINITY 510 power supply shall be designed to all applicable standards that allow a declaration of European Conformity and application of the CE mark.

Preliminary Power Supply Electrical Requirements

AC Power Supply

The AC power supply section shall accept an AC power input and provide a single DC power output. Table 1 lists the electrical requirements for the AC power supply.

Table 2 – AC Supply Electrical Requirements

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage		85		265	VAC
Input Frequency		47		63	Hz
Output Voltage	Vin = 85 to 265 VAC	17	21	25	VDC
Output Power	Vin = 85 to 265 VAC	10	52.5	60	W
Efficiency	Vin = 120 VAC, Pout = 50W	85			%
Output Ripple and Noise	Vin = 120 VAC, Pout = 50W			100	mVp-p
Safety Ground Leakage Current	Vin = 120 VAC, Pout = 50W			3	mA

Reader External DC Input Requirements

The INFINITY 510 power supply shall accept a DC power input with characteristics listed in Table 2.

Table 3– External DC Input Electrical Requirements

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage		8		40	VDC
Input Ripple and Noise	Vin = 8 to 40 VDC			100	mVp-p

DC-DC Converter Requirements

The INFINITY 510 power supply shall supply three DC power outputs to the INFINITY 510 Reader system with requirements listed in Tables 3, 4, and 5.

Table 4 +5 VDC Supply Electrical Requirements

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage		7.3		39.3	VDC
Input Ripple and Noise	Vin = 7.3 to 39.3 VDC			100	mVp-p
Output Voltage	Vin = 7.3 to 39.3 VDC	4.75	5.0	5.25	VDC
Output Current	Vin = 7.3 to 39.3 VDC	0	2.1	2.44	A
Output Ripple and Noise	Vin = 28 VDC, Iout = 2.0A			15	mVp-p
Hold-up Capacitor Energy Storage		100			mJ

Table 5 – +3.6 VDC Supply Electrical Requirements

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage		4.75	5.0	5.25	VDC
Input Ripple and Noise	Vin = 4.75 to 5.25 VDC			50	mVp-p
Output Voltage	Vin = 4.75 to 5.25 VDC	3.4	3.6	3.8	VDC
Output Current	Vin = 4.75 to 5.25 VDC	0.8	2.9	3.54	A
Output Ripple and Noise	Vin = 5 VDC, Iout = 2.8A			50	mVp-p

Table 6 – +28 VDC Supply Electrical Requirements

Parameter	Conditions	Min	Typ	Max	Units
Input Voltage		4.75	5.0	5.25	VDC
Input Ripple and Noise	Vin = 4.75 to 5.25 VDC			50	mVp-p
Output Voltage	Vin = 4.75 to 5.25 VDC	26.5	28	29.5	VDC
Output Current	Vin = 4.75 to 5.25 VDC	0.01	0.8	1.06	A
Output Ripple and Noise	Vin = 4.75 VDC, Iout = 1.0A			10	mVp-p

Interface Requirements

AC Power Entry Module

The AC power entry module shall be the Schurter KM00.1205.11. It shall contain an ON-OFF switch, accept an IEC power line connector, and contain an internal fuse.

The connection between the INFINITY 510 power supply PCB and the power entry module shall be TBD.

DC Power Entry Connector

The DC input connector shall be mounted on the PCB and be a Kycon part number KPJX-3S.

DC Output Connector

The DC output connector shall be mounted on the PCB and be a Molex MII part number 53324-1460. The pin description of the DC output connector is shown in Table 6.

Table 7 – INFINITY 510 Power Supply DC Output Connector

Description	**Pin Number(s)**	**Comments**
+28 VDC	1	1.06A to RF PCB
+28 VDC	3,5	2.44A (total) to RF PCB
+3.6 VDC	10,12,14	3.54A (total) to Digital PCB
RF Ground	2,4,6	3.5A (total) to RF PCB
Digital Ground	9,11,13	3.54A (total) to Digital PCB
Loss of Power Alarm	7	+3.3 V logic level to Digital PCB
Spare	8	To Digital PCB