Electromagnetic Compatibility Test Report

Prepared in accordance with

FCC Part 15C, RSS-210 Issue 7 and ANSI C63.10

On

ELECTRONIC ARTICLE SURVEILLANCE DEVICE

NANO GATE RF

Alpha-High Theft Solutions

A Division of Checkpoint Systems, Inc.

10715 Sikes Place, Ste 200

Charlotte, NC 28277, USA

Prepared by:

TUV Rheinland of North America, Inc.

Manufacturer's statement / attestation

The manufacturer; Alpha-High Theft Solutions, A Division of Checkpoint Systems, as the responsible party for the equipment tested, hereby affirms:

a) That he/she has reviewed and concurs that the test shown in this report are reflective of the operational characteristics of the device for which certification is sought;

b) That the device in this test report will be representative of production units;

c) That all changes (in hardware and software/firmware) to the subject device will be reviewed.

d) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving (certifying) the subject equipment.

Lee Eckert
Printed name of official

Signature of official

10715 Sikes Place, Ste 200
Charlotte, NC 28277, USA
Address

15 November 2010
Date

704-206-7849 x327
Telephone number

LeeEckert@alphaworld.com
Email address of official

Client:	Alpha-High Theft Solutions A Division of Checkpoint Systems, Inc. 10715 Sikes Place, Ste 200 Charlotte, NC 28277, USA	Lee Eckert 704-206-7849 x327 LeeEckert@alphaworld.com	
Identification:	ELECTRONIC ARTICLE SURVEILLANCE DEVICE	***Serial No.:***	Production Prototype
Test item:	NANO GATE RF	***Date tested:***	27 October 2010
Testing location:	TUV Rheinland of North America 762 Park Avenue Youngsville, NC 27596-9470 U.S.A.	Tel: (919) 554-3668 Fax: (919) 554-3542	
Test specification:	**Emissions:** FCC Part 15, Subpart C, RSS-210 Issue 7: FCC Part 15.207(a) and RSS-GEN 7.2.2 FCC Parts 15.223(b), 15.205, 15.209, RSS-210 A2.3 and RSS-GEN 7.2.1 FCC Part 15.223(a) and RSS-GEN 4.6.1, FCC Part 15.215(c) and RSS-210 2.2, FCC Parts 15.107, 15.109 and RSS-210 2.2, 2.6,A8.5, RSS-GEN 7.2.3.2 FCC Part 2.1093 and RSS-102, Issue 4,		
Test Result	**The above product was found to be Compliant to the above test standard(s)**		
tested by: Mark Ryan		***reviewed by:*** Robert Richards	
2 December 2010 ***Signature***		Digitally signed by Bob Richards Date: 2010.12.02 13:41:31 -05'00' 2 December 2010 ***Signature***	
Other Aspects:	**None**		

Abbreviations: OK, Pass, Compliant, Complies = passed
Fail, Not Compliant, Does Not Comply = failed
N/A = not applicable

90552 and 100881	**NVLAP Lab Code (200094-0)**	**Industry Canada** **IC-2932H**

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1 General Information

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 15C, RSS-210 Issue 7 and ANSI C63.10 based on the results of testing performed on 27 October 2010 on the ELECTRONIC ARTICLE SURVEILLANCE DEVICE, Model; NANO GATE RF, manufactured by Alpha-High Theft Solutions, a division of Checkpoint Systems, 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 (Equipment Under Test) 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*

Applicant	Alpha-High Theft Solutions A Division of Checkpoint Systems, Inc. 10715 Sikes Place, Ste 200 Charlotte, NC 28277, USA	**Tel**	704-206-7849 x327	**Contact**	Lee Eckert
		Fax	704-845-2965	**e-mail**	LeeEckert@alphaworld.com
Description	ELECTRONIC ARTICLE SURVEILLANCE DEVICE	**Test Item**	NANO GATE RF		
Serial Number	Production Prototype	**Test Voltage/Freq.**	100-240 VAC / 50-60 Hz		
Test Date Completed:	27 October 2010	**Test Engineer**	Mark Ryan		

Standards	Description	Severity Level or Limit	Criteria	Test Result
FCC Part 15, Subpart C Standard	Radio Frequency Devices-Subpart C: Intentional Radiators	See called out parts below	See Below	**Complies**
RSS-210 Issue 7 Standard	Low-Power Licence-exempt Radiocommunication Devices Category I Equipment	See called out parts below	See Below	**Complies**
FCC Part 15.223(a) and RSS-210 Annex 2	Operation in the band 1.705–10 MHz	See called out parts below	Below Limit	Complies
FCC Parts 15.223(b), 15.205, 15.209, RSS-210 A2.3 and RSS-GEN 7.2.1	Out-of-Band Spurious and Harmonic Emissions (EUT in Transmit Mode)	Below the applicable limits	Below Limit	Complies
FCC Part 15.207(a) and RSS-GEN 7.2.2	Conducted Emissions on AC Mains	150kHz - 30MHz	Limit	Complies
FCC Part 15.215(c) and RSS-210 2.2	Band Edge Radiated Emission	Per requirements of the standard	Below Limit	Complies
FCC Part 15.223(a) and RSS-GEN 4.6.1	Occupied Bandwidth	6 dB 99% BW ≤ 0.5% of center freq.	Within Limit	Complies
FCC Part 15.31(e)	Voltage Requirements	Output at 0.85% and 1.15% of Nominal Voltage	Below Limit	Complies
FCC Parts 15.107, 15.109 and RSS-210 2.2, 2.6,A8.5, RSS-GEN 7.2.3.2	Radiated Emissions while EUT in Receive Mode	The EUT does not employ a receiver	NA	NA
FCC Part 2.1093 and RSS-102, Issue 4	RF Exposure	SAR or MPE Requirements	Below Limit	Complies (without testing)

2 Laboratory Information

2.1 Accreditations and Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America located at 762 Park Avenue, Youngsville, NC 27596-9470 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, and 18. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

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 Standard 17025:2005 (Lab code: 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Industry Canada

Registration No.: IC-2932H The OATS has been accepted by Industry Canada to perform testing to 3 and to 10m, based on the test procedures described in ANSI C63.10-2009.

2.1.4 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 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, R-1679, C-1790 and C-1791).

2.1.5 Sample Calculation – radiated & conducted emissions

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) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

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

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.2 Measurement Uncertainty Emissions

	U_{lab}	U_{cispr}
Radiated Disturbance @ 10m		
30 MHz – 1,000 MHz	3.3 dB	5.2 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.18 dB	3.6 dB
Disturbance Power		
30 MHz – 300 MHz	3.88 dB	4.5 dB

2.3 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 Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

2.4 Measurement Equipment Used

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Radiated and Conducted RF Emissions (5 Meter Chamber)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	24-Feb-10	24-Feb-11
Ant. BiconiLog	Chase	CBL6140A	1108	13-Jun-08	13-Jun-10
Antenna Horn 1-18GHz	EMCO	3115	2236	12-Mar-09	12-Mar-11
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	29-Jun-09	29-Jun-10
Spectrum Analyzer	Agilent Tec.	E7405A	US39440157	04-Dec-09	04-Dec-10
Micro wave Frequency Counter	EIP	458A	01576	24-Feb-10	24-Feb-11
Cable, Coax	Andrew	FSJ1-50A	003	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	030	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	045	14-Dec-09	14-Dec-10
Cable, Coax	Andrew	FSJ1-50A	049	14-Dec-09	14-Dec-10
1.5 GHz High Pass Filter	Bonn Electronik	BHF 1500	025155	16-Feb-10	16-Feb-11
General Laboratory Equipment					
Meter, Temp/Humid/Barom	Fisher	02-400	01	28-Dec-09	28-Dec-10
Meter, Temp/Humidity	Dickson Company	TH550	6215304	19-Mar-09	19-Mar-11
Meter, Multi	Fluke	179	90580752	01-Dec-10	01-Dec-11

3 Product Information

3.1 Product Description

The Nano Gate is an EAS (Electronic Article Surveillance) device that puts out a signature signal in order to alarm Alpha 3 alarm security tags. The unit has two modes of operation, battery powered, and DC powered. The signature signal does not change regardless of how the unit is powered.

When on battery power, the unit uses a PIR (Passive Infrared) sensor to detect movement and begins transmitting the signature signal. After a timeout period, if no further movement is detected the unit stops transmitting the signature signal and goes to sleep. When the PIR again senses movement the unit wakes up and begins transmitting again.

When DC powered, the Nano Gate continuously transmits the signature signal.

When mounted, a switch on the back of the Nano Gate is pressed which allows the Nano Gate to sense whether the unit is mounted. When the Nano Gate is initially mounted the unit will check this switch and after a period of time begin normal operation. The mounting brackets allow the unit to rotate. If the unit is held is rotated it will sound 5 warnings at roughly 1 second intervals, if after the warnings the unit is still rotated it will sound an alarm for roughly 2 minutes.

The Nano Gate will be mounted on a stand so that the switch on the back of the unit is pressed and in normal operation.

For EMC testing, the firmware is modified so that the unit continuously transmits regardless of whether it is battery powered or DC powered. This is done to avoid the unit going to sleep during testing where the PIR sensor cannot be continuously activated.

3.2 Equipment Modifications

No modifications were needed to bring product into compliance.

4 Emissions

4.1 Radiated Output Power, FCC 15.223(a) and RSS-210 A2.3

The field strength of any emission within the band 1.705–10.0 MHz shall not exceed 100 microvolts/meter at a distance of 30 meters. However, if the bandwidth of the emission is less than 10% of the center frequency, the field strength shall not exceed 15 microvolts / meter or (the bandwidth of the device in kHz) divided by (the center frequency of the device in MHz) microvolts/meter at a distance of 30 meters, whichever is the higher level. For the purposes of this section, bandwidth is determined at the points 6 dB down from the modulated carrier. The emission limits in this paragraph are based on measurement instrumentation employing an average detector. The provisions in FCC part 15.35(b) for limiting peak emissions apply.

4.1.1 Test Over View

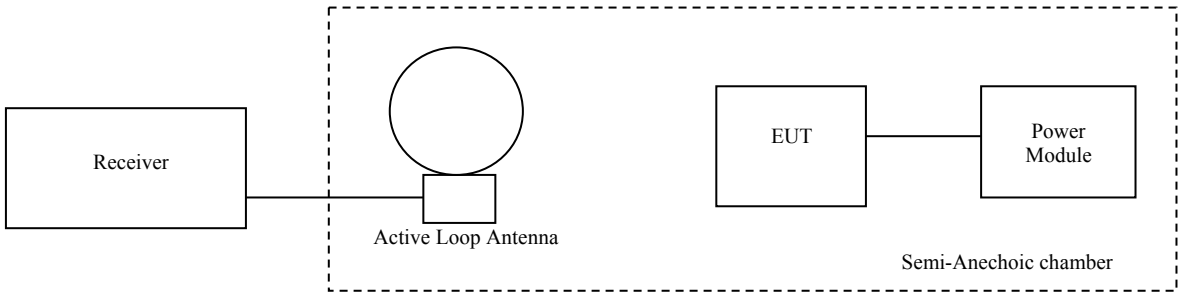
Results	**Complies** (as tested per this report)					**Date**	25 OCT 2010
Standard	FCC Part 15.223(a) and RSS-210 A2.3						
Product Model	NANO GATE RF			**Serial#**	Production Prototype		
Test Set-up	Radiated Measurement						
EUT Powered By	100-240 VAC / 50-60 Hz	**Temp**	74º F	**Humidity**	66%	**Pressure**	1001 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.1.2 Test Procedure

Radiated and FCC emissions tests were performed using the procedures of ANSI C63.10 including methods for signal maximizations and EUT configuration. The test setup photos report shows the EUT in its maximized configuration.

Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber. The limits shown are adjusted from 30m measuring distance to 3m using the square of an inverse linear distance extrapolation factor of 40dB/decade per FCC Part 15.31(f)(2).

4.1.1 Test Setup



4.1.2 Deviations

Radiated emission testing was performed at a distance of 3 meters in a 5 meter semi-anechoic chamber. The limits shown below are adjusted from 30m measuring distance to 3m using the square of an inverse linear distance extrapolation factor of 40dB/decade per FCC Part 15.31(f)(2).

4.1.3 Final Test

The EUT's 6dB bandwidth is 293kHz (see bandwidth section), which is less than 10% of the center frequency (810kHz). However the bandwidth of the device (kHz) divided by the center frequency of the device (MHz) is 293 / 8.1 = 36.17 microvolts/meter at 30 meters is the emission limit.

Limit = 20*Log (36.17 µV/m) = 31.17 dBµV/m at 30 meters

The interpolated limit at 3 m = 31.17 dBµV/m + (40*Log(30m/3m))

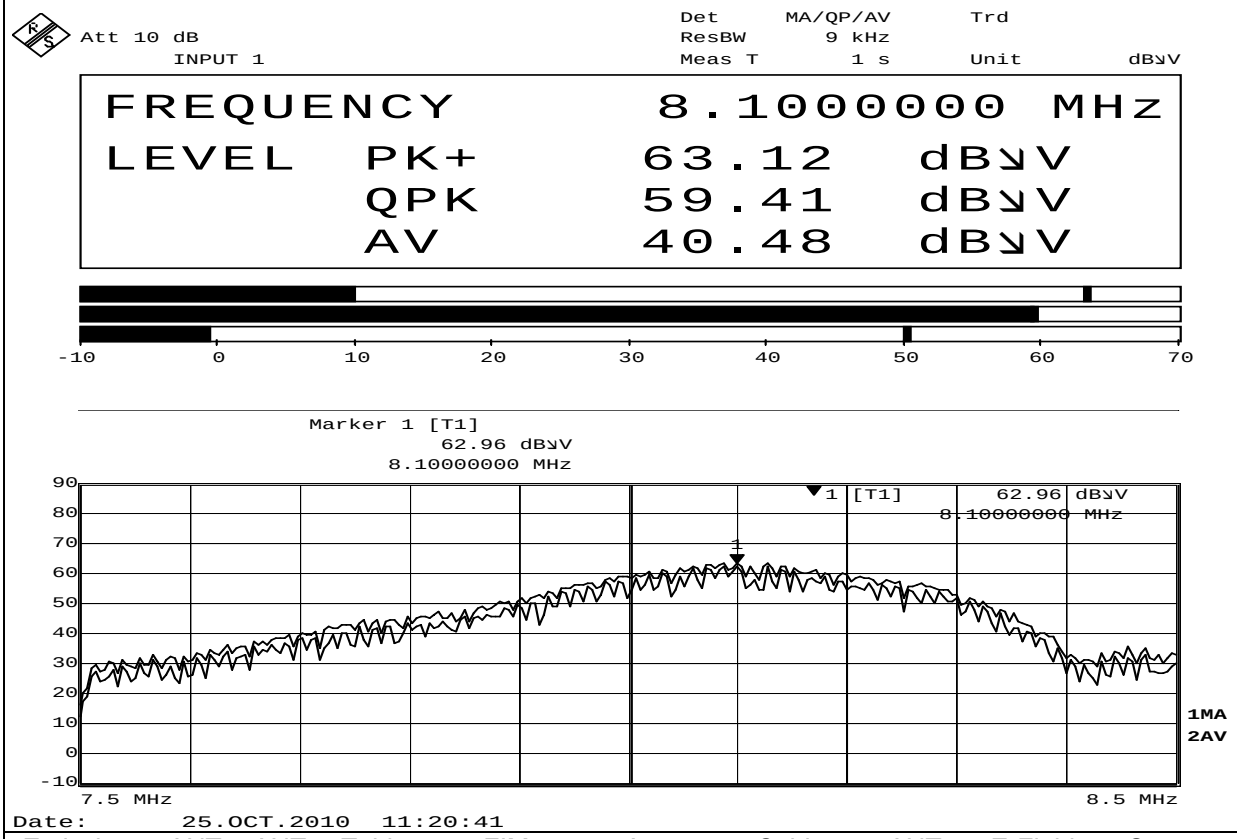
Using the Average detector, the limit would be; 31.17 dBµV/m + 40dB = 71.17 dBµV/m at 3m.

Using the Peak detector, the limit would be; 71.17 dBµV/m +20 dB = 91.17 dBµV/m at 3m.

4.1.4 Power Output at 3m

Radiated Emissions Fundamental frequency measured at 3m

Parallel Loop Antenna – Highest Emission



Emission Freq (MHz)	ANT Polar (deg)	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)
8.10	45	1	266	63.12	0.00	0.31	10.8	74.23	91.17	-16.94
8.10	45	1	266	59.41	0.00	0.31	10.8	70.52	NA	NA
8.10	45	1	266	39.48	0.00	0.31	10.8	50.95	71.17	-20.22

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

Notes: Spec limit is adjusted for a 6 dB bandwidth of 293 kHz at 3m measuring distance.
The emission shown in red is using the peak detector, the emission in green is using the quasi-peak detector and the emission in blue is using the average detector.
Loop antenna was rotated from Parallel to Perpendicular until a peak emissions was found.

Results

As tested, the EUT was found to be compliant to the requirements of the test standard.

4.2 Emissions Outside the band - FCC Part 15.233(b)and RSS210 A2.3

The field strength of emissions outside of the band 1.705–10.0 MHz shall not exceed the general radiated emission limits in § 15.209 and RSS-210, tables 2 and 3.

4.2.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	25 October 2010	
Standard	FCC Parts 15.205, 15.209, 15.215(c), 15.233(b), RSS-210 A2.3						
Product Model	NANO GATE RF			**Serial#**	Production Prototype		
Test Set-up	Tested in a 5m Semi Anechoic chamber, placed on a non-conductive floor standing fixture over the ground plane on a turn-table. See test plans for details						
EUT Powered By	100-240 VAC / 50-60 Hz	**Temp**	74º F	**Humidity**	66%	**Pressure**	1001 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.2.2 Test Procedure

Testing was performed in accordance with the procedures in 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. 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.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the radiated emission test.

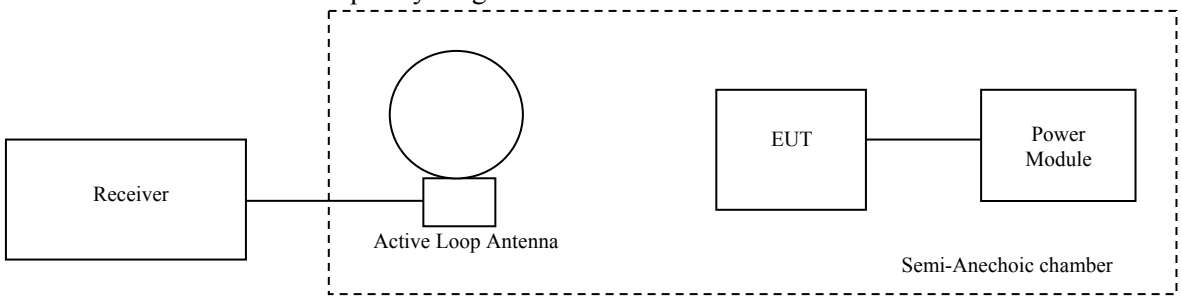
4.2.4 Final Test

All final radiated spurious emissions measurements were below (in compliance) the limits.

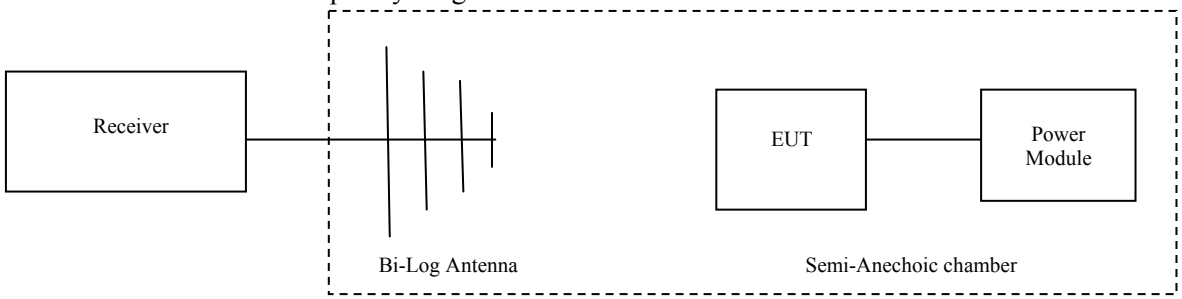
The worst –case emissions are shown below. All other emissions are on file at TUV Rheinland.

4.2.1 Test Setup

For frequency range from 10 kHz to 30 MHz:

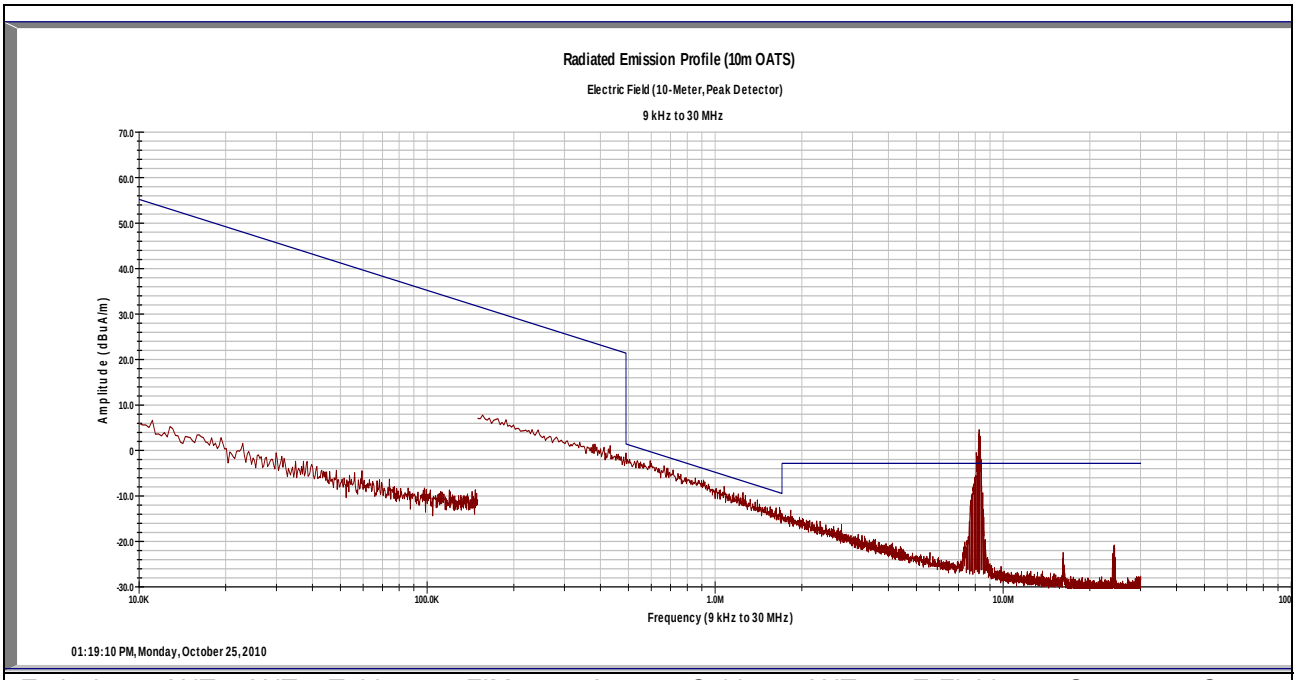


For frequency range from 30 MHz to 1000 MHz:



4.2.1 Final Graphs and Tabulated Data

Radiated Emissions 1.705 MHz to 10 MHz
Parallel Loop Antenna – Worst Case



Emission Freq (MHz)	ANT Polar (deg)	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)
16.02	45	1	132	16.09	0.00	0.42	10.8	27.31	89.54	-62.23
16.02	45	1	132	-2.22	0.00	0.42	10.8	9.00	69.54	-60.54
24.20	45	1	309	22.10	0.00	0.52	9.3	31.92	89.54	-57.62
24.20	45	1	309	4.31	0.00	0.52	9.3	14.13	69.54	-55.41

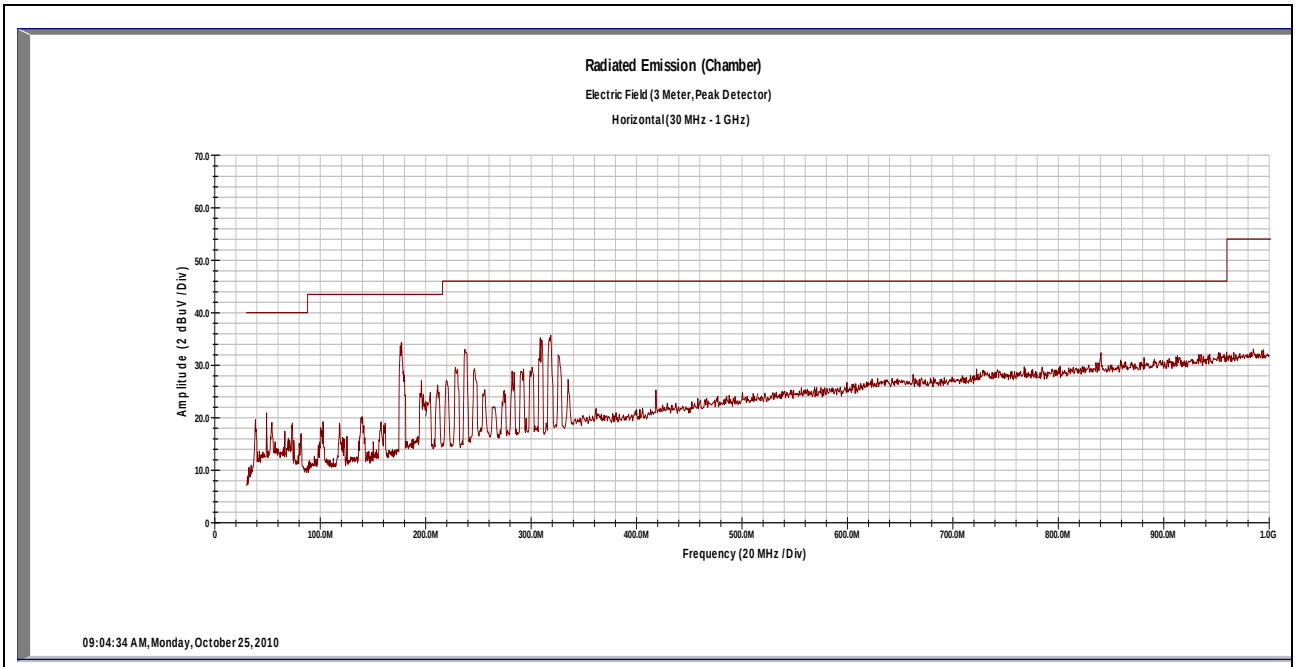
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.65dB Expanded Uncertainty $U = 3.3\ ku_c(y)$ k = 2 for 95% confidence

Notes: The signal at 8.1 MHz is the fundamental.
The Graph shown is in dBµA/m but the data is shown as dBµV/m.
The limits are from FCC Part 15.209(a) at 3m
The emission in red is using the peak detector and the emission in blue is using the average detector.
Antenna Polarization: P= Parallel, p= Perpendicular
Except for the fundamental, all other emissions are below the noise-floor of the receiver
.

Radiated Emissions - 30MHz to 1 GHZ, Battery Operated

Horizontal



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)
176.84	H	1	90	12.76	0.00	1.43	9.15	23.33	43.50	-20.17
236.64	H	1	254	15.92	0.00	1.67	11.20	28.78	46.00	-17.22
315.12	H	1	85	8.33	0.00	1.93	13.01	23.27	46.00	-22.73

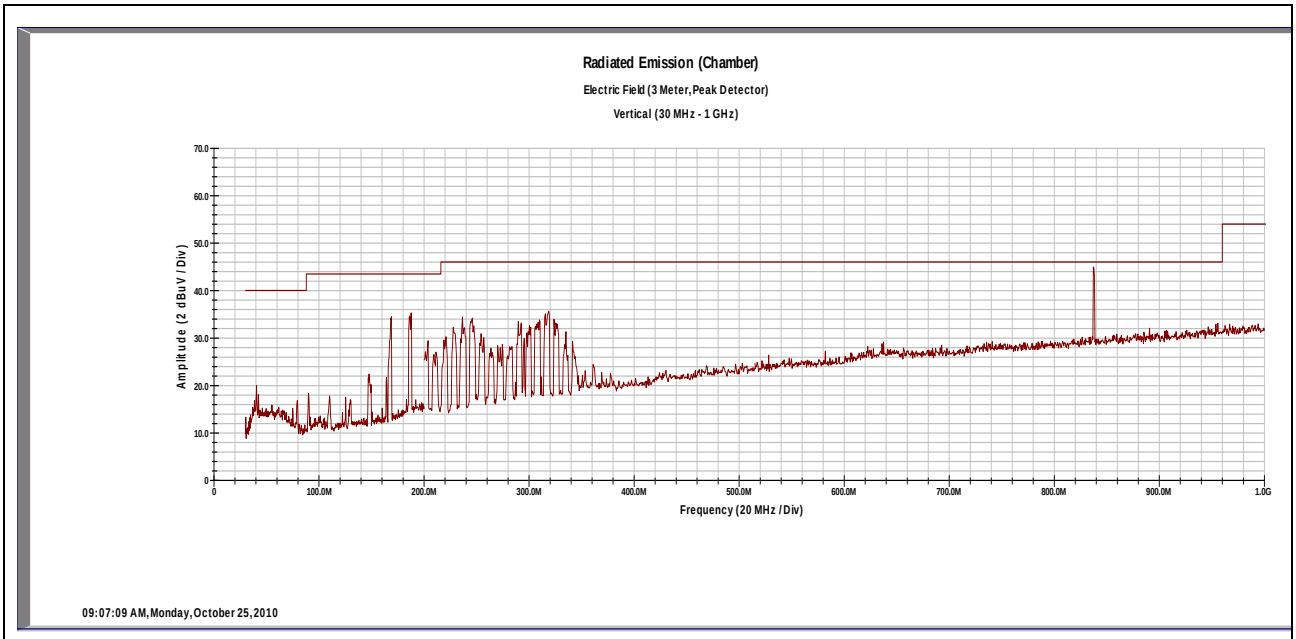
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.65dB Expanded Uncertainty $U = 3.3\ ku_c(y)$ k = 2 for 95% confidence

Notes:

Radiated Emissions - 30MHz to 1 GHZ, Battery Operated

Vertical



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)
174.48	V	2.2	21	23.22	0.00	1.42	9.08	33.72	43.50	-9.78
244.44	V	1.6	331	12.60	0.00	1.70	13.11	27.41	46.00	-18.59
321.68	V	1.1	50	9.92	0.00	1.95	14.37	26.23	46.00	-19.77

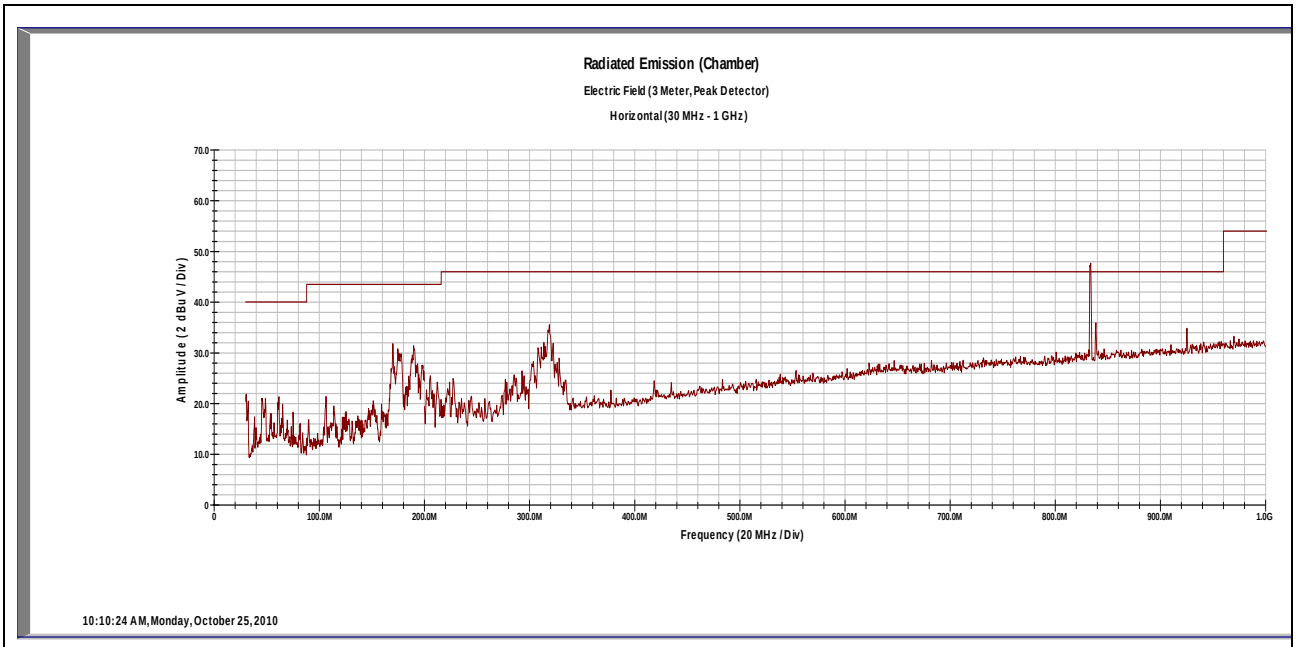
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.65dB Expanded Uncertainty $U = 3.3\ ku_c(y)$ k = 2 for 95% confidence

Notes: The signal at 840 MHz is an intermittent transient that was could not be measured on the receiver.

Radiated Emissions - 30MHz to 1 GHZ, AC Powered

Horizontal



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)
174.12	H	1	90	15.21	0.00	1.42	8.95	25.57	43.50	-17.93
319.76	H	1	270	12.21	0.00	1.94	13.48	27.63	46.00	-18.37

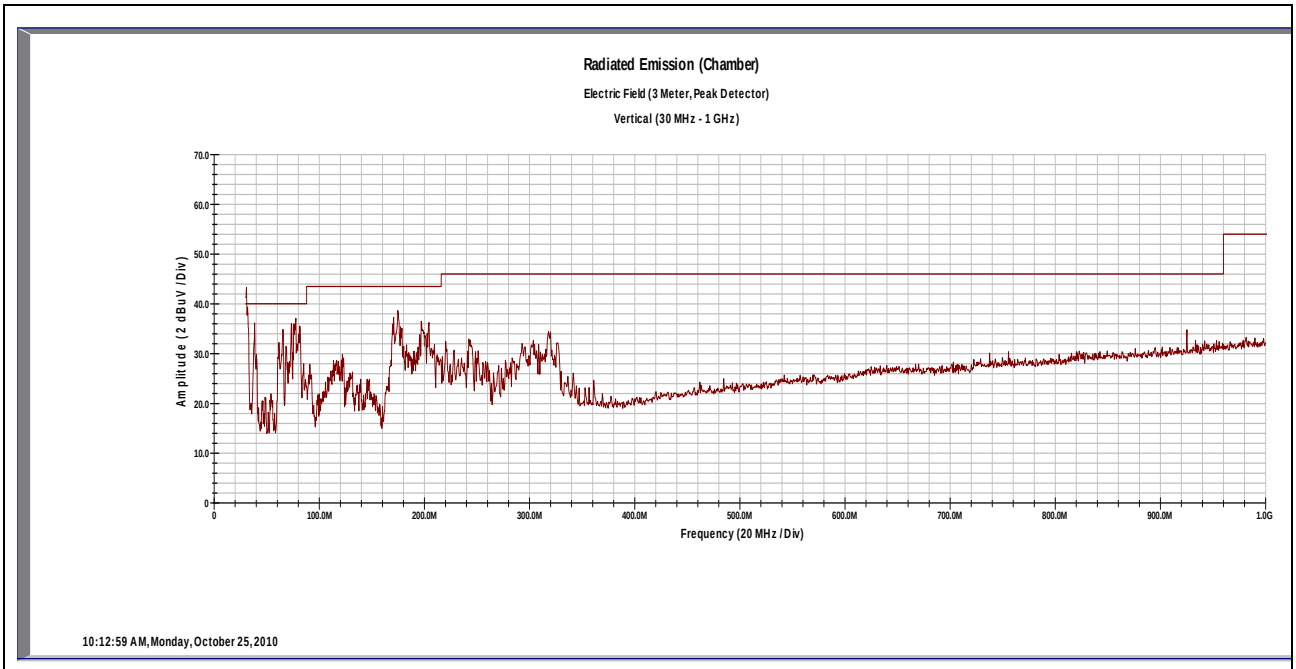
Spec Margin = E-Field Value - Limit, E-Field Value = FIM Value - Amp Gain + Cable Loss + ANT Factor

Combined Standard Uncertainty $u_c(y)$ = ± 1.65dB Expanded Uncertainty $U = 3.3\ ku_c(y)$ k = 2 for 95% confidence

Notes: The signal at 840 MHz is an intermittent transient that was could not be measured on the receiver.

Radiated Emissions - 30MHz to 1 GHZ, AC Powered

Vertical



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)
30.48	V	1	300	29.24	0.00	0.58	4.41	34.23	40.00	-5.77
76.12	V	1	246	16.75	0.00	0.93	6.66	24.33	40.00	-15.67
172.52	V	1	257	16.02	0.00	1.41	9.00	26.43	43.50	-17.07
204.76	V	1.7	132	17.76	0.00	1.54	10.19	29.49	43.50	-14.01
319.64	V	1	72	9.15	0.00	1.94	14.36	25.45	46.00	-20.55

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

Combined Standard Uncertainty $u_c(y)$ = ± 1.65dB Expanded Uncertainty $U = 3.3\ ku_c(y)$ k = 2 for 95% confidence

Notes:

4.1 Band Edge FCC part 15.215(c) and RSS-210 2.2

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the 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. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.1.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	14 June 2010
Standard	FCC Part 15.247(d), RSS 210 2.2						
Product Model	NANO GATE RF			**Serial#**	Production Prototype		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240 VAC / 50-60 Hz	**Temp**	76º F	**Humidity**	46%	**Pressure**	1002 mbar
Perf. Criteria	(Below Limit)			**Perf. Verification**	Readings Under Limit		
Mod. to EUT	None			**Test Performed By**	Mark Ryan		

4.1.2 Test Procedure

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the 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. If frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

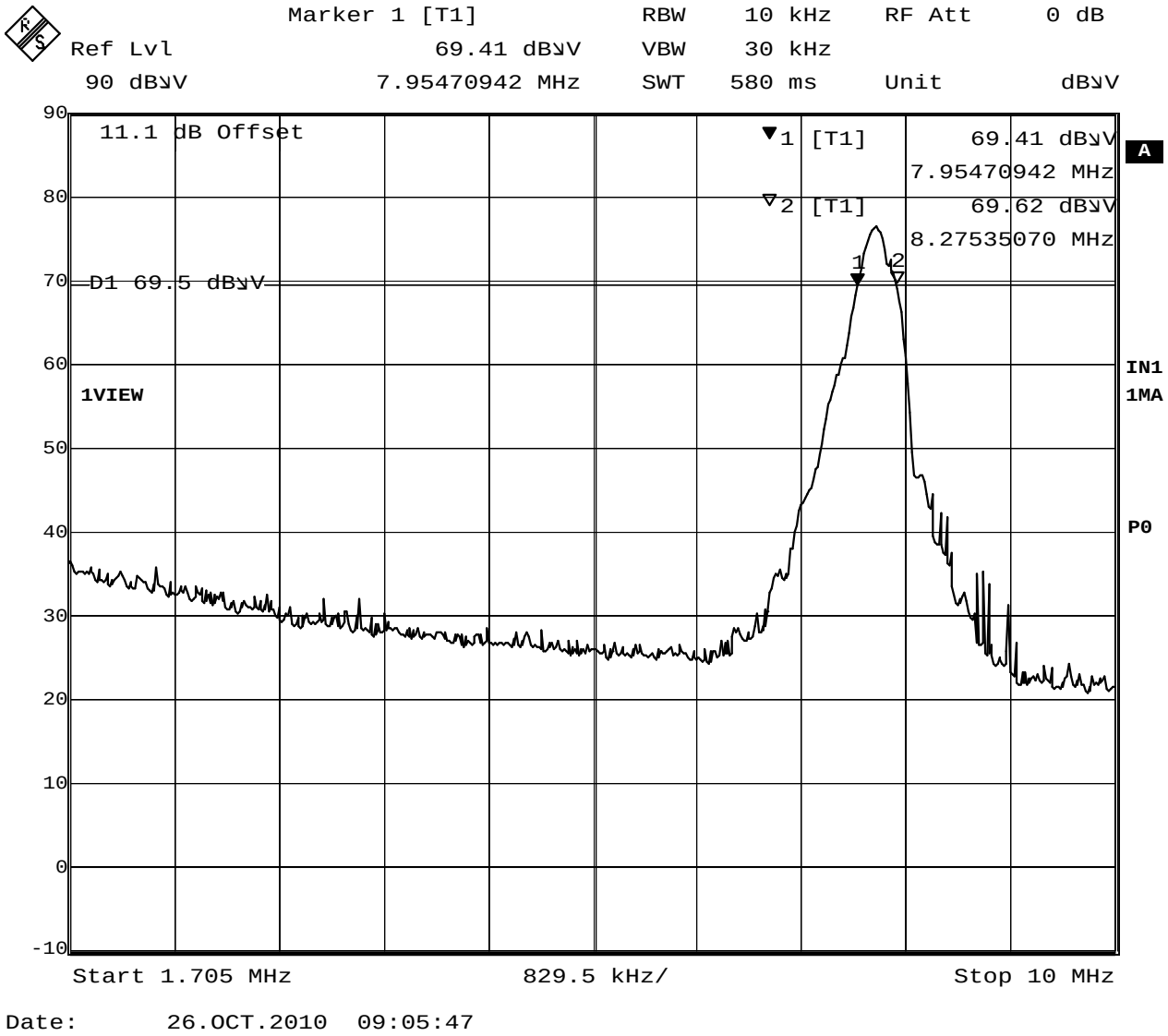
4.1.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

4.1.4 Final Test

The EUT met the performance criteria requirement as specified in the standards.

4.1 Final Graphs and Tabulated Data



Date: 26.OCT.2010 09:05:47

Notes: Measured using the Peak detector. Band Edge is at 1.705 MHz and 10 MHz.

The 69.5 dBµV/mDisplay line is the 30µV/m limit adjusted to dBµV/m at 3m.

Figure 1: Band Edge Measurement (Radiated Emission)

The EUT is compliant with the rules.

4.1 Conducted Emissions on AC Mains

This test measures the electromagnet levels of spurious signals generated by the EUT on the AC power line that may affect the performance of other nearby electronic equipment.

4.1.1 Over View of Test

Results	**Complies** (as tested per this report)				**Date**	26 October 2010	
Standard	FCC Part 15.207(a) and RSS-GEN 7.2.2						
Product Model	NANO GATE RF			**Serial#**	Production Prototype		
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details						
EUT Powered By	4.5VDC battery	**Temp**	73º F	**Humidity**	25%	**Pressure**	1011 mbar
Frequency Range	150 kHz – 30 MHz						
Perf. Criteria	(Below Limit)	**Perf. Verification**	Readings Under Limit for L1 & Neutral				
Mod. to EUT	None	**Test Performed By**	Mark Ryan				

4.1.2 Test Procedure

Conducted and FCC emissions tests were performed using the procedures of ANSI C63.4 including methods for signal maximizations and EUT configuration. The photos included with the report show the EUT in its maximized configuration.

The frequency range from 150 kHz – 30 MHz was investigated for conducted emissions on AC Mains.

Conducted Emissions measurements were performed in the shielded room using procedures specified in the test plan and standard.

4.1.1 Deviations

There were no deviations from the test methodology listed in the test plan for the conducted emission test.

Per FCC Publication Number 174176, the AC line conducted tests were performed with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band. The EUT was retested with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

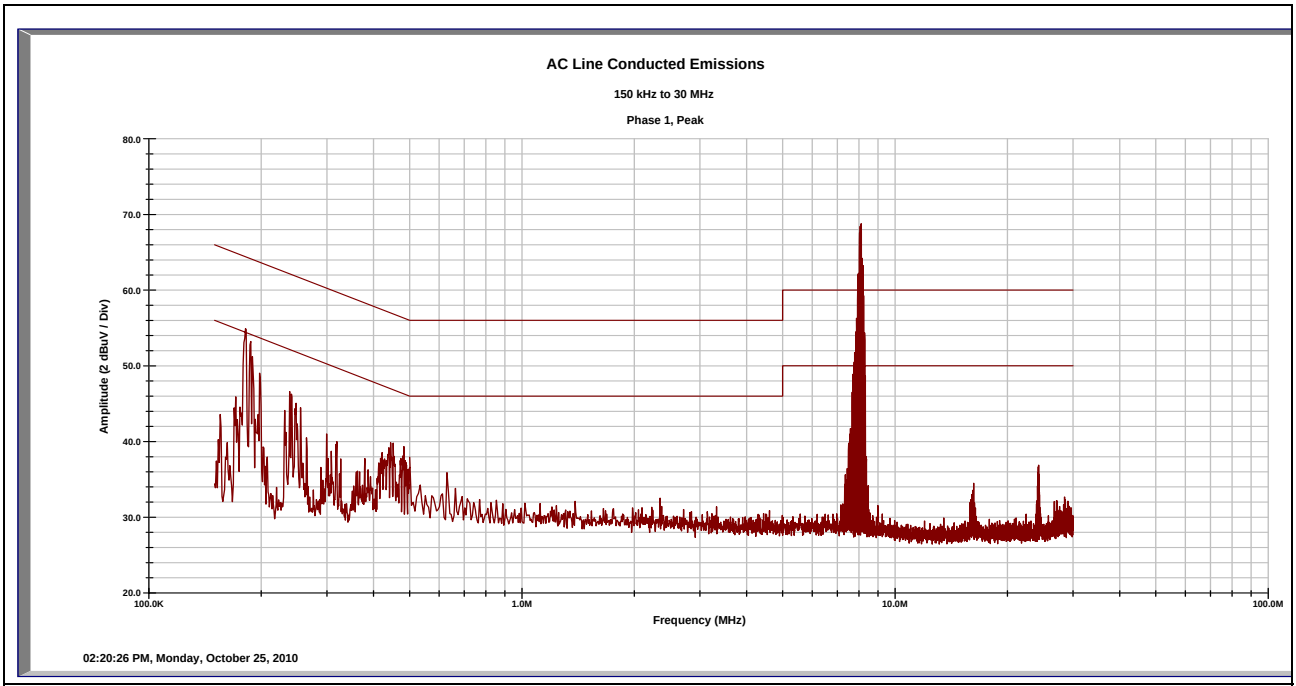
4.1.2 Final Test

All final conducted emissions measurements were below (in compliance) the limits.

The worst case test is shown below. The test data at 230VAC is on file at TUV Rheinland.

4.1.1 Final Graphs and Tabulated Data

Conducted Emissions @ 120V/60Hz w/ Antenna
Line 1



Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBuV)	Ave FIM (dBuV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBuV)	Limit AVE (dBuV)	Margin QP (dB)	Margin AVE (dB)
8.10	1	52.39	29.35	0.21	10.37	60.00	50.00	2.97	-10.07

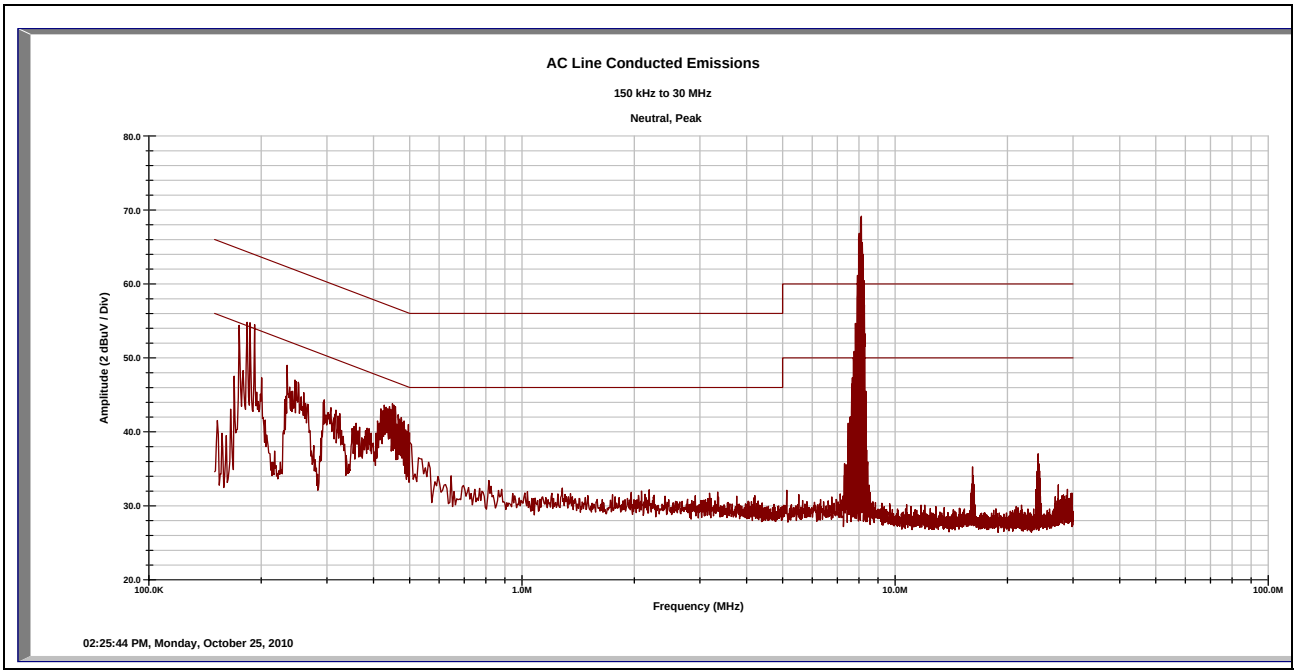
Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Combined Standard Uncertainty $u_c(y)$ = ± 1.09dB Expanded Uncertainty U =2.18 $ku_c(y)$ k = 2 for 95% confidence

Notes: The Emission at 8.1 MHz is the fundamental of the intentional radiator. Per FCC publication 174176, a dummy load was inserted in place of the antenna and tested again, see plots below.

Conducted Emissions @ 120V/60Hz w/ Antenna

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBuV)	Ave FIM (dBuV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBuV)	Limit AVE (dBuV)	Margin QP (dB)	Margin AVE (dB)
8.10	N	51.76	29.37	0.21	10.35	60.00	50.00	2.32	-10.07

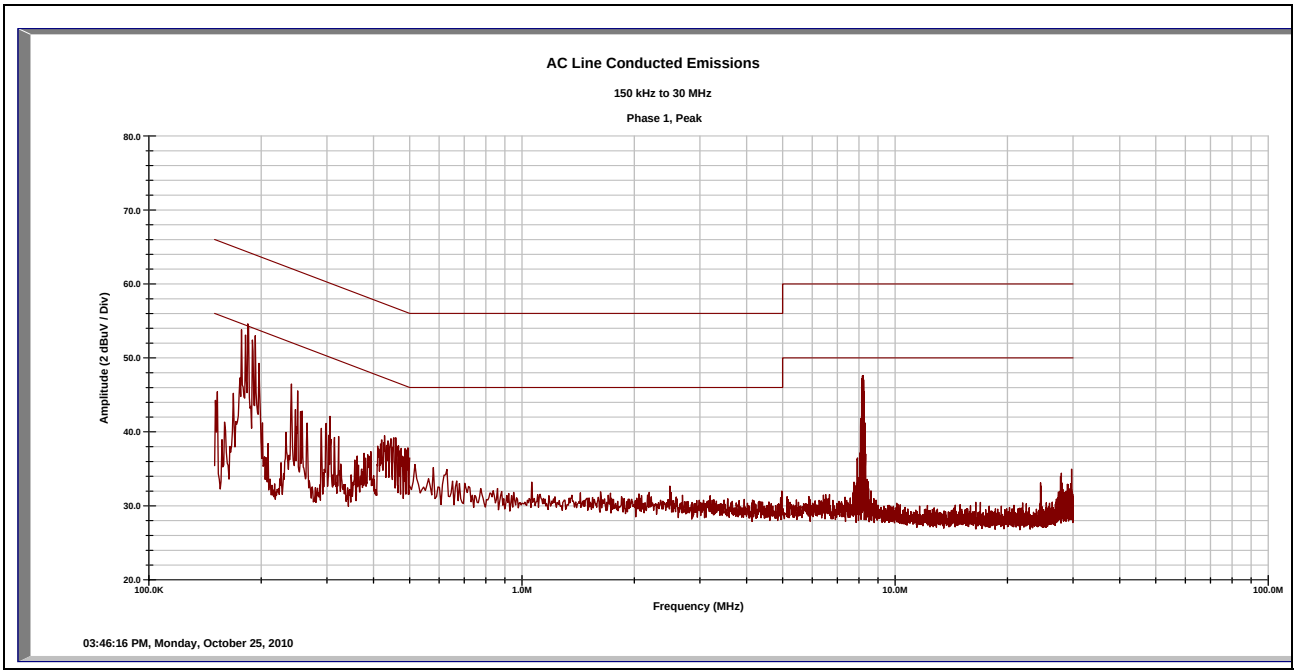
Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Combined Standard Uncertainty $u_c(y) = \pm 1.09$dB Expanded Uncertainty $U = 2.18\ ku_c(y)$ $k = 2$ for 95% confidence

Notes: The Emission at 8.1 MHz is the fundamental of the intentional radiator. Per FCC publication 174176, a dummy load was inserted in place of the antenna and tested again, see plots below.

Conducted Emissions @ 120V/60Hz – w/ Dummy Load

Line 1



Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBuV)	Ave FIM (dBuV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBuV)	Limit AVE (dBuV)	Margin QP (dB)	Margin AVE (dB)
0.18	1	37.05	19.50	0.03	9.97	64.57	54.57	-17.53	-25.08
0.25	1	28.15	14.57	0.03	9.99	61.84	51.84	-23.67	-27.25
0.32	1	21.90	11.59	0.03	10.01	59.76	49.76	-27.82	-28.13
0.45	1	22.94	12.84	0.04	10.03	56.95	46.95	-23.95	-24.05
8.10	1	33.19	16.53	0.21	10.37	60.00	50.00	-16.23	-22.89
24.57	1	16.06	0.47	0.35	10.52	60.00	50.00	-33.08	-38.67
29.30	1	10.88	0.34	0.38	10.77	60.00	50.00	-37.97	-38.51

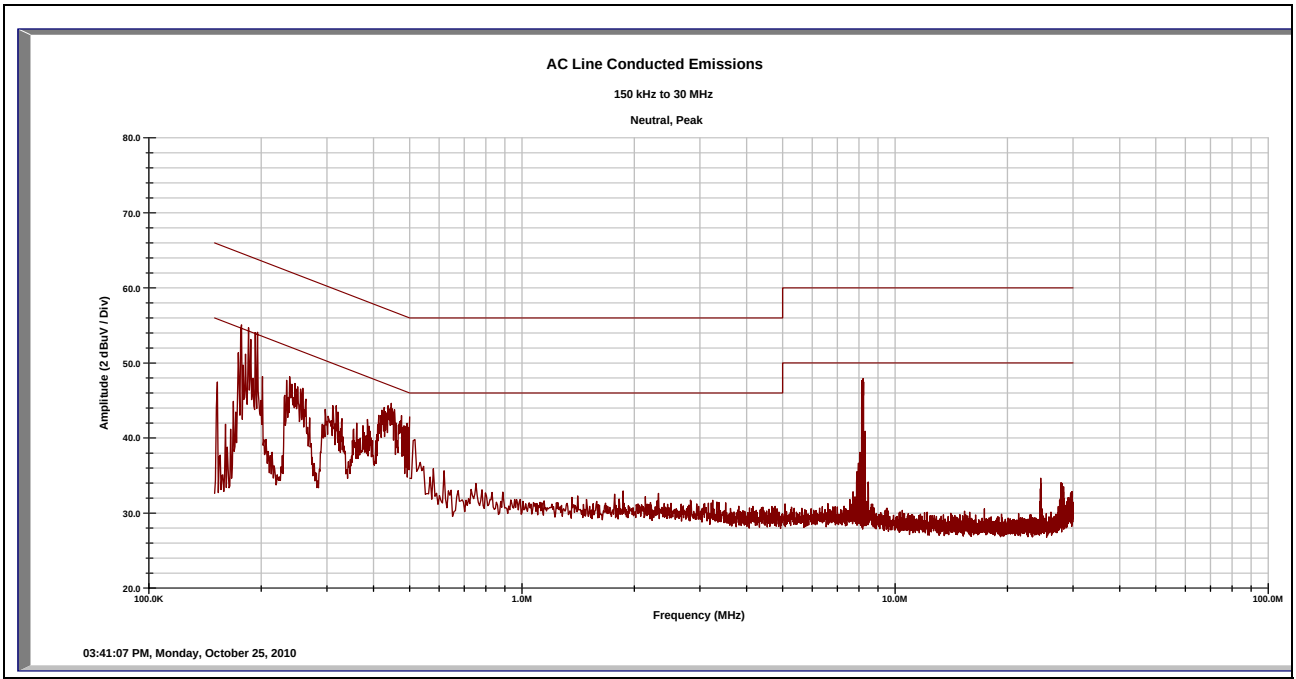
Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Combined Standard Uncertainty $u_c(y)$ = ± 1.09dB Expanded Uncertainty U =2.18 $ku_c(y)$ k = 2 for 95% confidence

Notes:

Conducted Emissions @ 120V/60Hz – w/ Dummy Load

Neutral



Freq (MHz)	ID (1,2,3,N)	Quasi FIM (dBuV)	Ave FIM (dBuV)	Cable Loss (dB)	TL/LISN (dB)	Limit QP (dBuV)	Limit AVE (dBuV)	Margin QP (dB)	Margin AVE (dB)
0.18	N	38.49	20.01	0.03	9.97	64.38	54.38	-15.90	-24.38
0.24	N	32.58	19.53	0.03	9.99	61.98	51.98	-19.39	-22.44
0.32	N	27.45	16.17	0.03	10.01	59.67	49.67	-22.18	-23.46
0.44	N	28.83	16.42	0.04	10.03	57.07	47.07	-18.18	-20.59
8.10	N	34.97	16.28	0.21	10.35	60.00	50.00	-14.47	-23.16
24.57	N	14.12	0.54	0.35	10.14	60.00	50.00	-35.40	-38.98
29.50	N	11.03	0.66	0.39	10.20	60.00	50.00	-38.38	-38.75

Quasi Spec Margin = Quasi FIM + Cable Loss + TL/LISN - QP Limit
Ave Spec Margin = Ave FIM + Cable Loss + TL/LISN CF - Ave Limit

Combined Standard Uncertainty $u_c(y) = \pm 1.09$dB Expanded Uncertainty $U = 2.18\, ku_c(y)$ $k = 2$ for 95% confidence

Notes:

4.2 Emission Bandwidth

The power limit of FCC Part 15.223(a) and RSS-210 A2.3 is determined by the 6dB bandwidth of the modulated carrier.

4.2.1 Test Over View

Results	**Complies** (as tested per this report)					**Date**	25 October 2010
Standard	FCC Part 15.223(a) and RSS-GEN 4.6.1						
Product Model	NANO GATE RF			**Serial#**	Production Prototype		
Test Set-up	Direct Measurement from antenna port						
EUT Powered By	100-240 VAC / 50-60 Hz	**Temp**	74º F	**Humidity**	32%	**Pressure**	1010 mbar
Perf. Criteria	(Below Limit)		**Perf. Verification**		Readings Under Limit		
Mod. to EUT	None		**Test Performed By**		Mark Ryan		

4.2.2 Test Procedure

Testing was performed in accordance with the procedures in 47 CFR Part 15, ANSI C63.10:2009, RSS-GEN Issue 2. 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.

If bandwidth of the emission is less than 10% of the center frequency, the field strength shall not exceed 15 microvolts/meter or (the bandwidth of the device in kHz) divided by (the center frequency of the device in MHz) microvolts/meter at a distance of 30 meters, whichever is the higher level.

4.2.3 Deviations

There were no deviations from the test methodology listed in the test plan for the Radiated Immunity test.

4.2.4 Final Test

6dB Band width is 293 kHz which is < 10% of 8.1 MHz.

The limit is determined by:

6dB Bandwidth (in kHz) / Center Frequency (MHz) = 293/8.1 µV at 30m = 36.2 µV at 30m.

4.2.5 Final Data

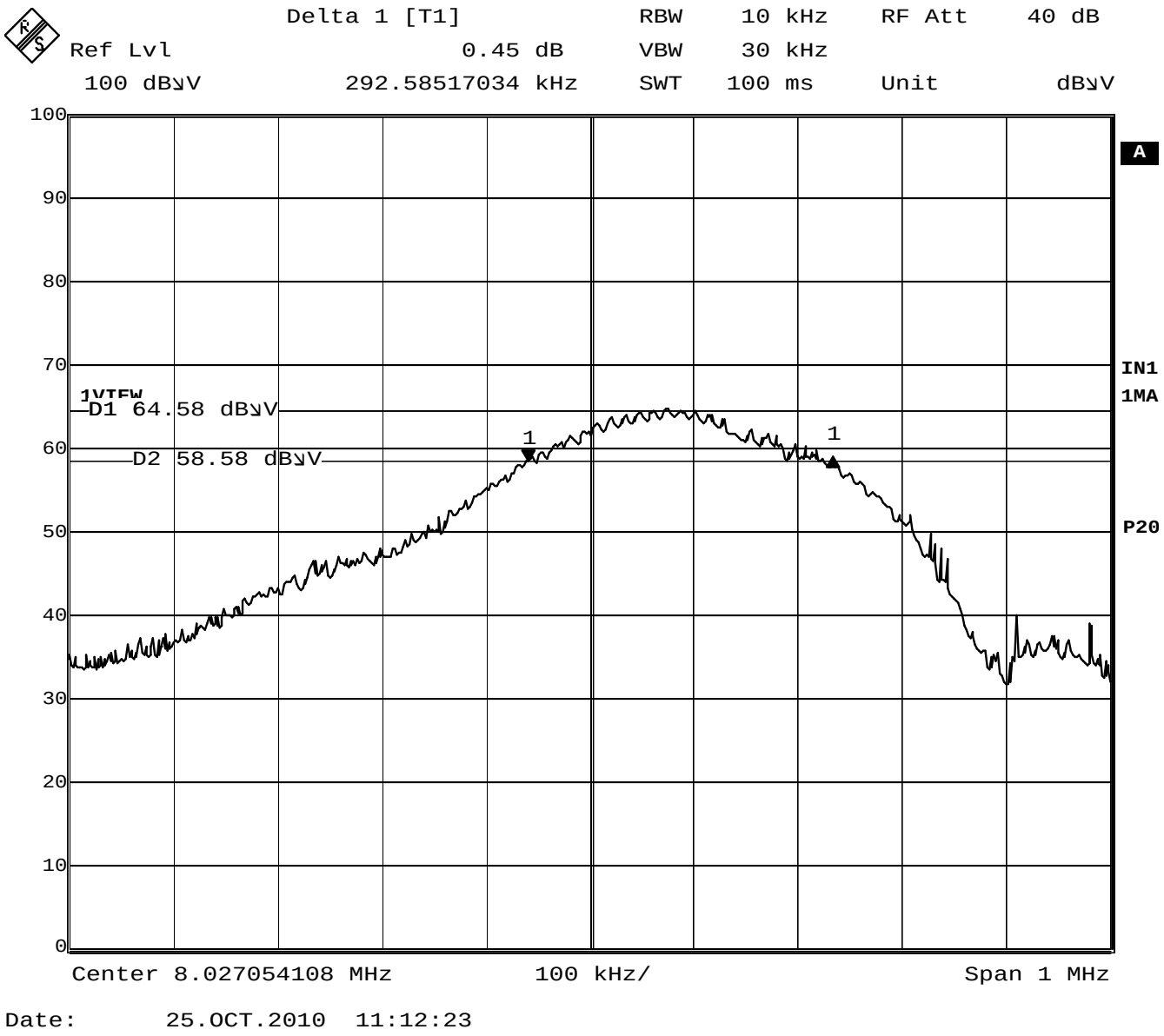


Figure 2: 6dB Occupied Bandwidth

The 6dB Band width is **293 kHz** which is < 10% of 8.1 MHz (810 kHz).

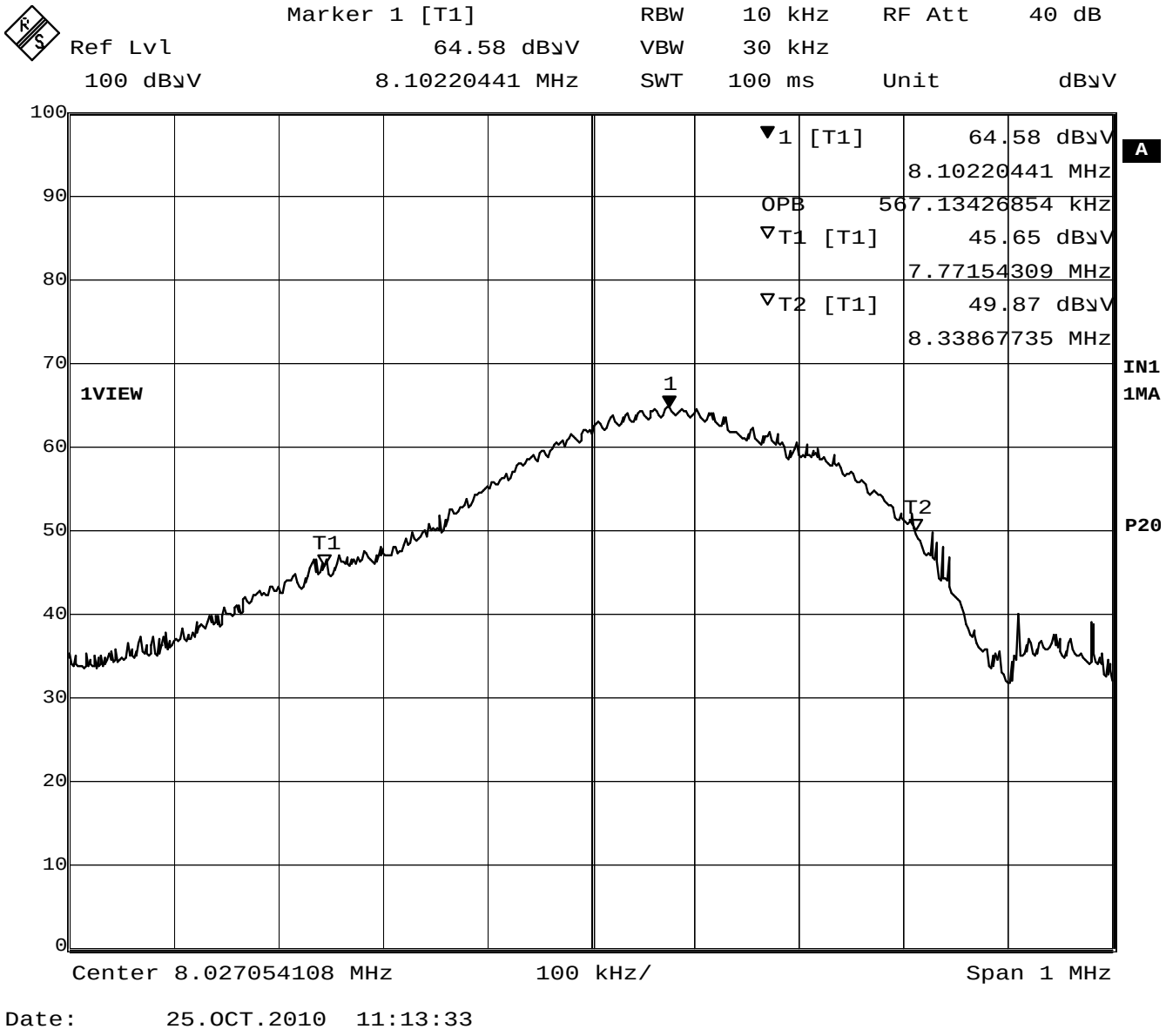


Figure 3: 99% Power Bandwidth for Industry Canada

The 99% PBW is **567 kHz**

4.3 Voltage Requirements FCC Part 15.31(e)

FCC Part 15.31 states that for intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.3.1 Over View of Test

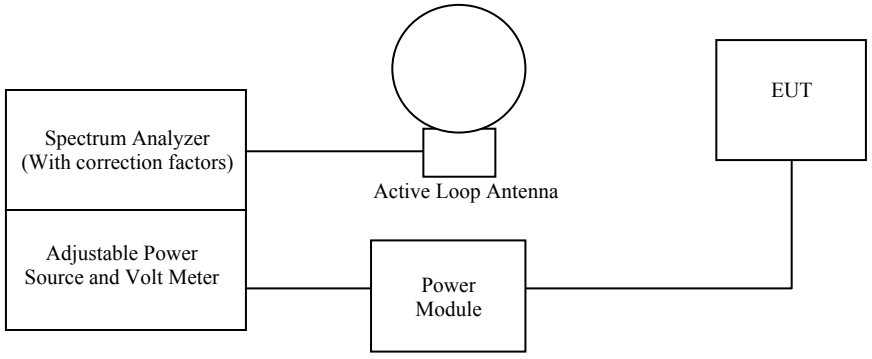
Results	**Complies** (as tested per this report)	**Date**	28 October 2010
Standard	FCC Part 15.31(e)		
Product Model	NANO GATE RF	**Serial#**	Production Prototype
Test Set-up	Tested in shielded room. EUT placed on table, see test plans for details		
Mod. to EUT	None	**Test Performed By**	Mark Ryan

4.3.2 Test Procedure

Rated voltage range for the power module: 100 - 240 VAC. The test will be performed at ±15% of rated voltage. The EUT was tested using normal temperature and humidity conditions.

Note: This apparatus used a regulated power module and is intended to be used with internal batteries. It also includes internal regulators and a voltage monitor. As such no change in transmitter output was noted during this test procedure.

4.3.3 Test Setup



4.3.1 Final Test

Volts	P(dBm)	Frequency in Hz	Δ to nominal Frequency (Hz)
120	-8.371	8,143,665	NA
276	-8.375	8,143,665	0
85	-8.363	8,143,665	0

Note: Reading highlighted in Yellow is the reference

Nominal Rated Voltage (V_{Nom}):	120 VAC
+15% Max Voltage (V_{max}):	1.15 * 240 = 276 Volts
-15% Minimum Voltage (V_{min}):	0.85 * 100 = 85 Volts

As tested, the EUT was found to be compliant to the requirements of the test standard.

5 Emissions in Receive Mode.

This test measures the electromagnetic levels of spurious signals generated by the EUT that radiated from the EUT and may affect the performance of other nearby electronic equipment.

The EUT does not have an RF receiver, therefore these tests are not required.

6 RF Exposure

6.1 Exposure Requirements – FCC Part 2.1093 and RSS-102 Issue 4

FCC Part 15.247(d) states that SAR evaluation in not required if "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 CFR 47."

RSS-102 section 2.5.1 states that a device is exempt from SAR evaluation if the frequency is "above 2.2 GHz and up to 3 GHz inclusively, and with output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power) that is less than or equal to 20 mW for general public use…".

6.1.1 Test Procedure

If the antenna is located > 20cm from the user, then an MPE calculation is acceptable.

If the antenna is located < 20cm (portable / mobile / hand-held device) from the user, then SAR evaluation is required.

6.1.2 Evaluation

The antenna on the EUT is indented to be located greater than 20cm from humans with momentary close proximity to the antenna. Therefore, an MPE calculation is sufficient.

6.2 Evaluation for FCC

Per table 1 of FCC part 1.1311; the maximum permissible exposure (electric field strength), for the general population of an intentional radiator in the range of 3.0 to 30 MHz, is to be $842/f_{(MHz)}$ for a 30 minute average exposure time.

From Page 11 of this report, the time averaged signal output is 50.95 dBµV/m at 3m.

Max Electric field = 824 / 8.1 = 101.73 V/m at 20cm.
= 20 * log (101.73 * 10^6 V/m) = 160.14 dBµV at 20cm

50.95 dBµV/m at 3m would be equivalent to 50.95 + (40 * (log 3m / 0.2m)) = 98.0 dBµV/m at 20cm. This is also equivalent to 0.08V/m at 20cm.

The EUT is 62.15 dB below the MPE limit.

6.2.1 Conclusion

The MPE level is compliant with the FCC rules.

6.3 Evaluation for Industry Canada

Per section 4.2 of RSS-102; the maximum permissible exposure (electric field strength), for the general population of an intentional radiator in the range of 1 to 10 MHz, is to be $280/f_{(MHz)}$ for a 6 minute average exposure time. From Page 11 of this report, the time averaged signal output is 50.95 dBµV/m at 3m.

Max Electric field = 280 / 8.1 = 34.57 V/m at 20cm.
= 20 * log (34.57 * 10^6 V/m) = 150.77 dBµV at 20cm

50.95 dBµV/m at 3m would be equivalent to 50.95 + (40 * (log 3m / 0.2m)) = 98.0 dBµV/m at 20cm. This is also equivalent to 0.08V/m at 20cm.

The EUT is 52.77 dB below the MPE limit.

6.3.1 Conclusion

The MPE level is compliant with the Industry Canada rules.