TÜV

TUV Rheinland
of North America

Emissions
Test Report

EUT Name: Autotether System

EUT Model: FOB and HOST

FCC Title 47, Part 15, Subpart C Section 15.249

Prepared for:

Martin LoSchiavo
Autotether
145 Dividend Rd, Bldg 10
Rocky Hill, CT 06067
Tel: 860 436-6694
Fax: 860 721-9594

Prepared by:

TUV Rheinland of North America
762 Park Avenue
Youngsville, NC 27596
Tel: (919) 554-3668
Fax: (919) 554-3542
http://www.tuv.com/

Report/Issue Date: 11 September 2007
Report Number: 30762597.001

Statement of Compliance

Manufacturer:	Autotether 145 Dividend Rd, Bldg 10 Rocky Hill, CT 06067 860 436-6694
Requester / Applicant:	Martin LoSchiavo
Name of Equipment:	Autotether System
Model No.	FOB and HOST
Type of Equipment:	Intentional Radiator
Application of Regulations:	FCC Title 47, Part 15, Subpart C Section 15.249
Test Dates:	7 September 2007 to 8 September 2007

Guidance Documents:

Emissions: FCC 47 CFR Part 15

Test Methods:

Emissions: ANSI C63.4:2003

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.

11 September 2007

Reviewer

Date

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 Section 15.249 based on the results of testing performed on *7 September* 2007 through *8 September* 2007 on the *Autotether System* Model No. *FOB and HOST* manufactured by Autotether. 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

Emission	Test Method(s)	Test Parameters	Result
Radiated Emissions	47 CFR Part 15, ANSI C63.4:2003	30 MHz to 26000 MHz	compliant
Conducted Emissions	47 CFR Part 15.207, ANSI C63.4:2003	150 kHz to 30 MHz	N/a
Variations in Voltage vs. Frequency Stability	47 CFR Part 15.31 (e), ANSI C63.4:2003		Compliant
Band Edge Compliance	47 CFR Part 15.215 (c)		Compliant

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

No modifications were found to be 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 17025:1999 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, R-1679, C-1790 and C-1791).

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 C63.4:2003, 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 C63.4:2003, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

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 test system for radiated immunity is defined as the antenna, amplifier, cables, signal generator field probe and spectrum analyzer. The test system for conducted immunity is defined as the coupling/decoupling device, amplifier, cables, signal generator and spectrum analyzer. The test system for voltage variations and interruptions immunity is defined as the AC power source and the interruptions generator. The test system for electrical fast transient immunity is defined as the AC power output source and the fast transient generator. The test system for lightning surge immunity is defined as the AC power output source and the lightning surge generator. The test system for electrostatic discharge immunity is defined as the air and contact discharge generators. The test system for power frequency magnetic field immunity is defined as the AC voltage source. The test system for the damped oscillatory wave immunity is defined as the AC power output source and the oscillatory wave generator. The test system for harmonic current and voltage flicker test is defined as the AC power source and the detection devices. The conducted emissions test system has a combined standard uncertainty of ± 1.2 dB. The

radiated emissions test system has a combined standard uncertainty of ± 1.6 dB. The radiated immunity test system has a combined standard uncertainty of ± 2.7 dB. The conducted immunity test system has a combined standard uncertainty of ± 1.5 dB. The voltage variations and interruptions immunity test system has a combined standard uncertainty of ± 4.3 dB. The electrical fast transients immunity test system has a combined standard uncertainty of ± 5.8 dB. The lightning surge immunity test system has a combined standard uncertainty of ± 8.0 dB. The electrostatic discharge immunity test system has a combined standard uncertainty of ± 4.1 dB. The power frequency magnetic field immunity test system has a combined standard uncertainty of ± 0.58 dB. The damped oscillatory wave immunity test system has a combined standard uncertainty of ± 8.7 dB. The harmonic current and voltage flicker test system has a combined standard uncertainty of ± 11.6 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 17025:1999.

3 Product Information

3.1 Product Description

The AUTOTETHER™ system comes with a transmitter (Host) that is attached to your vessel's dashboard and two (2) Personal Sensors (FOBs) one yellow for the operator and one white for the passengers. Additional white passenger FOBs can be ordered from the AUTOTETHER™ website. AUTOTETHER™ can monitor up to four (4) FOBs simultaneously. Both the Host and each FOB are powered by alkaline AAA batteries. AUTOTETHER™ FOBs are worn by the vessel's operator and up to three (3) passengers. When the Host is properly installed and activated, it automatically establishes communications with each active FOB and continuously monitors each active FOB. If an active yellow (operator) FOB is submerged for more than 0.5 seconds, the Host triggers the AUTOTETHER™ audio alarm and shuts off the engine(s) by activating the spring-loaded AUTOTETHER™ kill switch clip, if a active white (passenger) Fob is submerged it will trigger the audible and flashing light alarm mode only, allowing the operator to respond quickly and pick up the passenger. In addition, if an active and registered FOB goes beyond the Host detectable range (typically 50 to 200 feet) the appropriate FOB alarm mode will be triggered, or if an active and registered FOB is manually turned off by pushing and holding the off button for more than 2 seconds, the AUTOTETHER™ audio alarm sounds and the spring-loaded AUTOTETHER™ kill switch clip is triggered, shutting off the vessel's engine(s).

3.2 Test Configuration

The HOST and FOB was configured to transmit continiously to each other. Both the FOB and HOST were placed in the chamber for testing.

3.3 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This

requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221.

The EUT contains a On-board transmit and receive antenna

3.3.1 Results

The antenna is permanently attached.

4 Emissions

4.1 Radiated Emissions (Fundamental and Spurious per 15.249)

Testing was performed in accordance with 47 CFR Part 15, ANSI C63.4:2003. 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.

4.1.1 Test Methodology

4.1.1.1 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 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.

4.1.1.2 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.

4.1.1.3 Deviations

There were no deviations from this test methodology.

4.1.2 Test Results

Section 4.1.3 contains preliminary test data as well as any engineering data used to determine any modifications or special accessories. Section 4.1.2.1 lists the final measurement data under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and 1.5.

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

4.1.2.1 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

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EUT Name	Autotether System	**Date**	7 September 2007
EUT Model	FOB and HOST	**Temp / Hum in**	71 deg. F / 48 %rh
EUT Serial	Not Serialized	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15	**Line AC / Freq**	120 VAC / 60 Hz
Deg/sweep	N/a	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 6140	**Performed by**	Michael Moranha

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)	Fundamental Limit (dBuV/m)	Spec Margin (dB)
Fundamental CH 1: Peak										
2405.00	H	1.24	188	59.84	0.00	4.08	28.23	92.16	114.00	-21.84
2405.00	V	1.12	355	58.64	0.00	4.08	28.22	90.94	114.00	-23.06
Fundamental CH 1: Average										
2405.00	H	1.24	188	45.23	0.00	4.08	28.23	77.55	94.00	-16.45
2405.00	V	1.12	355	44.38	0.00	4.08	28.22	76.68	94.00	-17.32
Fundamental CH 8: Peak										
2445.00	H	8	123	50.65	0.00	5.70	28.31	84.66	114.00	-29.34
2445.00	V	301	102	55.33	0.00	5.70	28.30	89.33	114.00	-24.67
Fundamental CH 8: Average										
2445.00	H	8	123	39.03	0.00	5.70	28.31	73.04	94.00	-20.96
2445.00	V	8	102	41.46	0.00	5.70	28.30	75.46	94.00	-18.54
Fundamental CH 16: Peak										
2480.00	H	1.0	227	50.46	0.00	11.44	28.38	90.28	114.00	-23.72
2480.00	V	1.0	273	49.31	0.00	11.44	28.37	89.12	114.00	-24.88
Fundamental CH 16: Average										
2480.00	H	1.0	227	35.13	0.00	11.44	28.38	74.95	94.00	-19.05
2480.00	V		273	33.41	0.00	11.44	28.37	73.22	94.00	-20.78

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:

RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
RBW/VBW=1MHz/100Hz for frequencies above 1 GHz for average measurements.
The fundamental of the EUT was tested in all three planes and the Z plane was worst case.

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EUT Name	Autotether System	**Date**	7 September 2007
EUT Model	FOB and HOST	**Temp / Hum in**	71 deg. F / 48 %rh
EUT Serial	Not Serialized	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15	**Line AC / Freq**	120 VAC / 60 Hz
Deg/sweep	N/a	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 6140	**Performed by**	Michael Moranha

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)
Fundamental CH 1										
Spurious Emissions, Peak Measurements										
4810.00	H	1.0	10	36.28	35.15	10.09	32.78	44.00	74.00	-30.00
7215.00	H	1.0	10	35.89	35.58	12.10	35.91	48.33	74.00	-25.67
9620.00	H	1.0	10	35.09	36.43	14.95	38.36	51.96	74.00	-22.04
Spurious Emissions, Average Measurements										
4810.00	H	1.0	10	24.38	35.15	10.09	32.78	32.10	54.00	-21.90
7215.00	H	1.0	10	23.97	35.58	12.10	35.91	36.41	54.00	-17.59
9620.00	H	1.0	10	23.06	36.43	14.95	38.36	39.93	54.00	-14.07

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

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

Notes:
RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
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The fundamental of the EUT was tested in all three planes and the Z plane was worst case.

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Deg/sweep	N/a	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 6140	**Performed by**	Michael Moranha

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)
Fundamental CH 1:										
Spurious Emissions, Peak Measurements										
4810.00	V	1.0	10	36.36	35.15	10.09	32.82	44.11	74.00	-29.89
7215.00	V	1.0	10	36.60	35.58	12.10	35.78	48.91	74.00	-25.09
9620.00	V	1.0	10	34.77	36.43	14.95	38.28	51.56	74.00	-22.44
Spurious Emissions, Average Measurements										
4810.00	V	1.0	10	24.44	35.15	10.09	32.82	32.19	54.00	-21.81
7215.00	V	1.0	10	23.97	35.58	12.10	35.78	36.28	54.00	-17.72
9620.00	V	1.0	10	23.06	36.43	14.95	38.28	39.85	54.00	-14.15

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:
RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
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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)
Fundamental CH 8:										
Spurious Emissions, Peak Measurements										
4890.00	H	1.0	10	35.73	35.35	3.60	32.94	36.92	74.00	-37.08
7295.00	H	1.0	10	35.19	35.48	4.44	36.10	40.25	74.00	-33.75
9700.00	H	1.0	10	34.44	36.49	5.41	38.46	41.82	74.00	-32.18
Spurious Emissions, Average Measurements										
4890.00	H	1.0	10	24.02	35.35	3.60	32.94	25.21	54.00	-28.79
7295.00	H	1.0	10	23.73	35.48	4.44	36.10	28.79	54.00	-25.21
9700.00	H	1.0	10	22.70	36.49	5.41	38.46	30.08	54.00	-23.92

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

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

Notes:
RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
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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)
Fundamental CH 8:										
Spurious Emissions, Peak Measurements										
4890.00	V	1.0	355	36.43	35.35	3.60	32.99	37.67	74.00	-36.33
7295.00	V	1.0	355	35.38	35.48	4.44	35.98	40.32	74.00	-33.68
9700.00	V	1.0	355	34.00	36.49	5.41	38.38	41.30	74.00	-32.70
Spurious Emissions, Average Measurements										
4890.00	V	1.0	355	24.41	35.35	3.60	32.99	25.65	54.00	-28.35
7295.00	V	1.0	355	23.88	35.48	4.44	35.98	28.82	54.00	-25.18
9700.00	V	1.0	355	22.60	36.49	5.41	38.38	29.90	54.00	-24.10

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

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

Notes:
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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)
Fundamental CH 16:										
Spurious Emissions, Peak Measurements										
4960.00	H	1.0	5	35.82	35.20	10.11	33.08	43.82	74.00	-30.18
7440.00	H	1.0	5	35.00	34.81	12.87	36.45	49.51	74.00	-24.49
9920.00	H	1.0	5	22.58	36.41	15.70	38.76	40.64	74.00	-33.36
Spurious Emissions, Average Measurements										
4960.00	H	1.0	5	23.81	35.20	10.11	33.08	31.81	54.00	-22.19
7440.00	H	1.0	5	23.39	34.81	12.87	36.45	37.90	54.00	-16.10
9920.00	H	1.0	5	22.58	36.41	15.70	38.76	40.64	54.00	-13.36

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:
RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
RBW/VBW=1MHz/100Hz for frequencies above 1 GHz for average measurements.

The fundamental of the EUT was tested in all three planes and the Z plane was worst case.

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EUT Name	Autotether System	**Date**	7 September 2007
EUT Model	FOB and HOST	**Temp / Hum in**	71 deg. F / 48 %rh
EUT Serial	Not Serialized	**Temp / Hum out**	n/a
Standard	FCC 47 CFR Part 15	**Line AC / Freq**	120 VAC / 60 Hz
Deg/sweep	N/a	**RBW / VBW**	1MHz / 3MHz
Dist/Ant Used	3m / 6140	**Performed by**	Michael Moranha

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)
Fundamental CH 16:										
Spurious Emissions, Peak Measurements										
4960.00	V	1.0	0	36.00	35.20	10.11	33.14	44.06	74.00	-29.94
7440.00	V	1.0	0	35.59	34.81	12.87	36.36	50.01	74.00	-23.99
9920.00	V	1.0	0	34.44	36.41	15.70	38.66	52.39	74.00	-21.61
Spurious Emissions, Average Measurements										
4960.00	V	1.0	0	23.88	35.20	10.11	33.14	31.94	54.00	-22.06
7440.00	V	1.0	0	23.39	34.81	12.87	36.36	37.81	54.00	-16.19
9920.00	V	1.0	0	22.73	36.41	15.70	38.66	40.68	54.00	-13.32

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:
RBW/VBW=1MHz/1MHz for frequencies above 1 GHz for peak measurements.
RBW/VBW=1MHz/100Hz for frequencies above 1 GHz for average measurements.

The fundamental of the EUT was tested in all three planes and the Z plane was worst case.

4.1.3 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)

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

4.2 Conducted Emissions (Per 15.207)

The Intentional Radiator is battery operated, therefore testing to 47 CFR Part 15.207, ANSI C63.4:2003 is not required.

4.3 Variations in Voltage vs. Frequency Stability (Per 15.31 (e))

The setup was identical to radiated emissions. 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. If the EUT is battery operated, a new battery will placed in the EUT and the frequency is measured.

4.3.1 Results

Channel 1 (Modulated)

Voltage	Horizontal Radiated Field Strength Measurement Peak
New Battery	92.71 dBuV

Channel 8 (Modulated)

Voltage	Horizontal Radiated Field Strength Measurement
New Battery	84.34 dBuV

Channel 16 (Modulated)

Voltage	Horizontal Radiated Field Strength Measurement
New Battery	89.92 dBuV

Spectrum Analyzer Parameters:

RBW=1MHz

VBW=3MHz

Span=1MHz

LOG dB/div.= 10dB

Trigger Video

4.4 Band Edge Compliance (Per 15.215 (c))

The setup was identical to radiated emissions. Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, 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.

4.4.1 Results

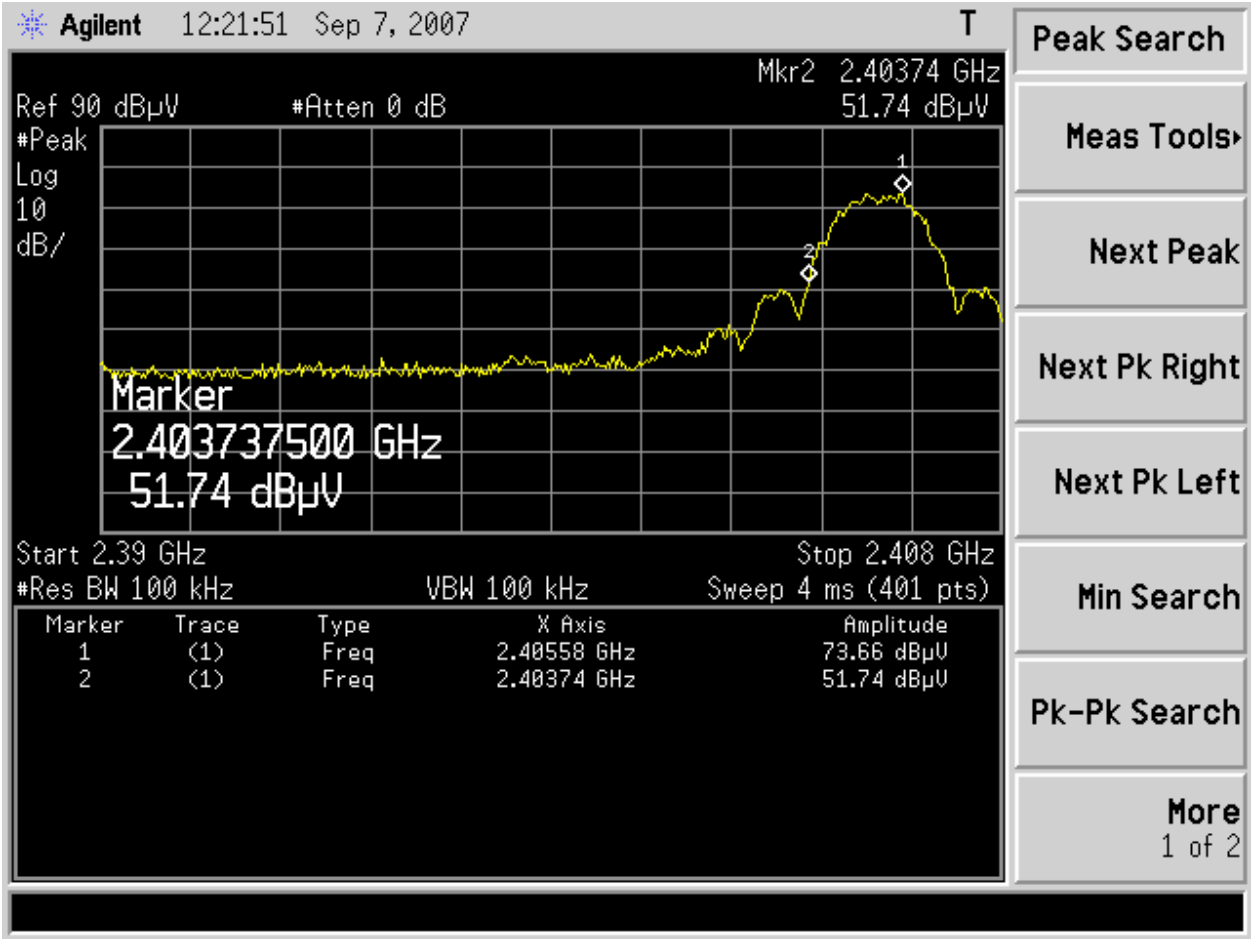

Figure 1 – Channel 1 Band edge Results

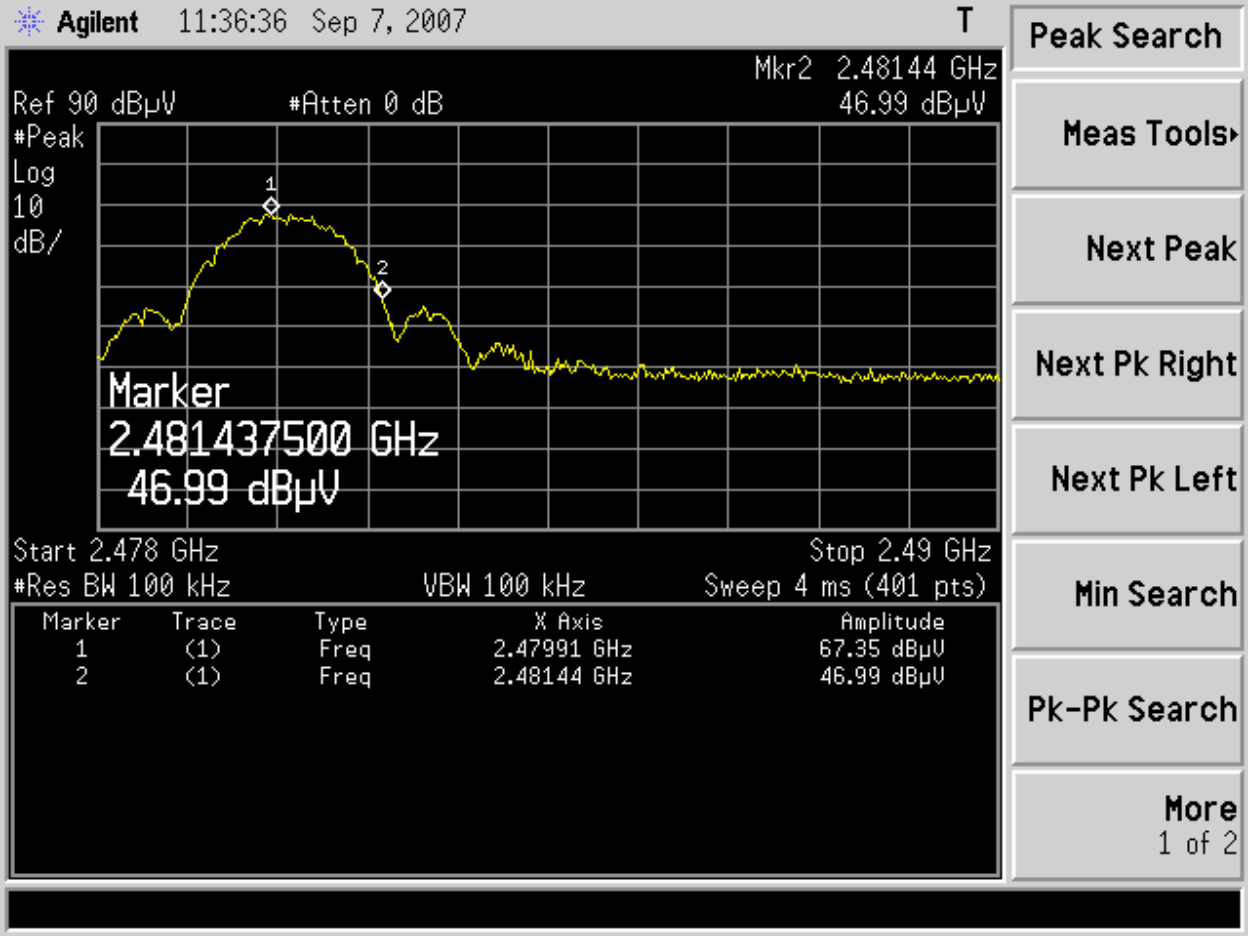

Figure 2 – Channel 16 Band edge Results

5 Test Equipment Use List

5.1 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)					
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	25-Sep-2006	25-Sep-2007
Antenna Horn 1-18GHz	EMCO	3115	2236	25-Jan-2007	25-Jan-2009
Ant. BiconiLog	Chase	CBL6140A	1108	16-May-2006	16-May-2008
Spectrum Analyzer	Agilent Tec.	E7405A	US39440161	29-Jun-2007	29-Jun-2008
Cable, Coax	Andrew	FSJ1-50A	036	14-Mar-2007	14-Mar-2008
Cable, Coax	Andrew	FSJ1-50A	030	24-Jan-2007	24-Jan-2008
Cable, Coax	Andrew	FSJ1-50A	045	24-Jan-2007	24-Jan-2008
General Laboratory Equipment					
Meter, Temp/Humid/Barom	Fisher	02-400	01	25-Jan-07	25-Jan-08

* 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.