dBi Corporation

FCC/IC Certification Test Report
Point Six 3003-01 People Counter
Report Number 11dBi013
August 29, 2011

Testing Certificate #1985.01

ADMINISTRATIVE INFORMATION

Historical record:
Because dBi Corporation is a testing entity, and not a manufacturer, this original test report of the 3003-01 People Counter is being transmitted to the manufacturer, Point Six Wireless. dBi will keep a copy for its historical records and to satisfy A2LA-Audit requirements. We strongly recommend archiving the unit that we tested, to facilitate answering future inquiries regarding this product.

Retention of records:
The FCC requires the records for a Class A or Class B product to be retained by the responsible party for at least two years after the manufacture of said product has been permanently discontinued. These records should include the original certification or verification test report, quality audit data, and the test procedures used.

The European Union requires the Declaration of Conformity (DoC) and all supporting data for a product bearing the CE Marking to be retained, and available for inspection by enforcement authorities, for 10 years after placing the product on the market.

Australia and New Zealand require the Declaration of Conformity, test reports, a description of the product, documentation that clearly identifies the product, and paperwork showing the product's brand name, model number, etc. to be kept for at least five years after the product ceases to be supplied to Australia or New Zealand.

Measurement uncertainties:
The Lexmark Electromagnetic Compatibility Laboratory (EMC Lab) has a documented calculation of the measurement uncertainties associated with tests performed at the Lexmark site.

Ongoing compliance:
This report applies only to the sample tested. Point Six is responsibility for ensuring that the production models of this product complies with the FCC and Industry Canada (IC) requirements, and continue to complies throughout its manufacturing life. Point Six should check any changes to the product that could change its interference profile.

A2LA approval:
dBi Corporation has been accredited by the American Association for Laboratory Accreditation (A2LA) for Radiated Emissions and Conducted Emissions, Electromagnetic Interference, and Electrostatic Discharge testing. Copies of our Accreditation Certificate and Scope of Accreditation follow.

The Federal Communications Commission (FCC) recognized the Lexmark site as meeting section 2.948 of the FCC Rules in letters dated December 8, 2010 (Registration No. 949691) and January 14, 2010 (Registration No. 991141). Industry Canada recognizes the Lexmark site in letters dated November 16, 2009 (number 2376A-1) and March 20, 2009 (number 2376A-3).
Please note: This report may be copied as needed, as long as it is copied in its entirety.

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

DBI CORPORATION

Lexington, KY

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 8th day of September 2010.

President & CEO
For the Accreditation Council
Certificate Number 1985.01
Valid to September 30, 2012

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

The American Association for Laboratory Accreditation

"World Class Accreditation"

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

dBi CORPORATION
216 Hillsboro Avenue[1]
Lexington, KY 40511-2105
John R. Barnes Phone: 859 253 1178

ELECTRICAL (EMC)

Valid To: September 30, 2012 Certificate Number: 1985.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following tests:

Test Technology	Test Method(s)
Radiated Emissions (Up to 18 GHz)	FCC 47 CFR Part 15, Subpart A, B and C (Using C63.4: 2003, 2009 and C63.10: 2009); ICES-003:2004 (using CAN/CSA-CEI/IEC CISPR 22:2002); CISPR 22 (1997, 2003, 2005, 2008); EN 55022 (1994, 1998, 2006); AS/NZS CISPR 22 (2006, 2009); VCCI V-3 (2009, 2010); IEC 61000-6-3: 2006; EN 61000-6-3: 2007; AS/NZS 61000-6-3: 2007; AS/NZS 61000-6-4: 2007; IEC 61000-6-4: 2006; EN 61000-6-4: 2007; EN 55013: 2001(Up to 1 GHz); AS/NZS CISPR 13: 2004 (Up to 1 GHz); CISPR 13: 2001(Up to 1 GHz); IEC 61326-1: 2005; EN 61326-1: 2006; IEC 61326-2-3: 2006; EN 61326-2-3: 2006

(A2LA Cert. No. 1985.01) 09/08/2010 Page 1 of 4

Test Technology	Test Method(s)
Conducted Emissions	FCC 47 CFR Part 15 (using C63.4-2003, 2009, C63.10-2009); ICES-003 (2004 using CAN/CSA-CEI/IEC CISPR 22:2002); CISPR 22 (1997, 2003, 2005, 2008); EN 55022 (1994, 1998, 2006); AS/NZS CISPR 22 (2006, 2009); VCCI V-3 (2009, 2010); IEC 61000-6-3: 2006; EN 61000-6-3: 2007; AS/NZS 61000-6-3: 2007; AS/NZS 61000-6-4: 2007; IEC 61000-6-4: 2006; EN 61000-6-4: 2007; EN 55013: 2001; AS/NZS CISPR 13: 2004; IEC 61326-1: 2005; EN 61326-1: 2006; IEC 61326-2-3: 2006; EN 61326-2-3: 2006
Disturbance Power	EN 55013: 2001; AS/NZS CISPR 13: 2004; CISPR 13: 2001
Harmonics	IEC 61000-3-2: 2005; EN 61000-3-2: 2006; AS/NZS 61000-3-2: 2007
Flicker	IEC 61000-3-3 (1994, 2002, 2008); EN 61000-3-3 (1995, 2008); AS/NZS 61000-3-3: 2006
Electrostatic Discharge	IEC 61000-4-2 (1995, 2008); EN 61000-4-2 (1995, 2009); AS/NZS 61000-4-2: 2002)
Radiated Immunity (80 MHz to 150MHz, 6V/m; 150 MHz to 1 GHz, 10V/m; 1GHz to 2GHz, 3V/m; 2GHz to 3GHz, 1V/m)	IEC 61000-4-3 (1995, 2002, 2006); EN 61000-4-3 (1996, 2006); AS/NZS 61000-4-3: 2006
Electrical Fast Transient/Burst	IEC 61000-4-4 (1995, 2004); EN 61000-4-4 (1995, 2004); AS/NZS 61000-4-4: 2006

(A2LA Cert. No. 1985.01) 09/08/2010 Peter Mhyer Page 2 of 4

Test Technology	Test Method(s)
Surge Immunity	IEC 61000-4-5 (1995, 2005); EN 61000-4-5 (1995, 2006); AS/NZS 61000-4-5: 2006
Conducted Immunity	IEC 61000-4-6 (1996, 2003, 2008); EN 61000-4-6 (1996, 2009); AS/NZS 61000-4-6: 2006
Magnetic Field Immunity	IEC 61000-4-8 (1993, 2001); EN 61000-4-8: 1993; AS/NZS 61000-4-8: 2002
Voltage Dip Immunity	IEC 61000-4-11 (1994, 2001, 2004); EN 61000-4-11 (1994, 2004); AS/NZS 61000-4-11: 2005
ITE Product Family	CISPR 24: 1997; EN 55024: 1998; CISPR 22:1997, 2003, 2005, 2008; EN 55022:1994, 1998, 2006; AS/NZS CISPR 22:2006, 2009; AS/NZS CISPR 24:2002; VCCI V-3 2009, 2010
Generic Devices for Residential, Commercial, and Light Industrial Use	IEC 61000-6-1: 2005; EN 61000-6-1: 2007; IEC 61000-6-3: 2006; EN 61000-6-3: 2007; AS/NZS 61000-6-1: 2006; AS/NZS 61000-6-3: 2007
Generic Devices for Industrial Use	IEC 61000-6-2: 2005; EN 61000-6-2: 2005; IEC 61000-6-4: 2006; EN 61000-6-4: 2007; AS/NZS 61000-6-2: 2006; AS/NZS 61000-6-4: 2007
Electrical Equipment for Measurement, Control and Laboratory Use	IEC 61326-1: 2005; EN 61326-1: 2006; IEC 61326-2-6: 2006; IEC 61326-2-6: 2006
Sound and Television Broadcast Receivers and Associated Equipment	EN 55013: 2001; AS/NZS CISPR 13: 2004; CISPR 13: 2001

(A2LA Cert. No. 1985.01) 09/08/2010 Peter Mhyer Page 3 of 4

Types of products, materials, and/or industry that the laboratory tests:
-Information Technology Equipment (ITE) – Computers, Printers, Peripheral Devices;
-Generic Devices for Residential, Commercial, and Light Industrial Use;
-Generic Devices for Industrial Use;
-Electrical Equipment for Measurement, Control, and Laboratory Use;
-Sound and Television Broadcast Receivers and Associated Equipment

[1]Note: Testing is performed using the equipment and facility at:
Lexmark International EMC Laboratory
740 New Circle Road NW
Lexington, KY 40550-1876
(A2LA Accreditaiton Certificate 0872.01)

(A2LA Cert. No. 1985.01) 09/08/2010 Page 4 of 4

ADMINISTRATIVE DATA

Manufacturer:

Point Six Wireless
161 Prosperous Place, Suite 200
Lexington, KY 40509

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)

Power Line Filters and RF Suppression Components: see attached sheets
Measurement Equipment used: see attached sheets.
Measurements According to, and Sample Units Comply with:

FCC 47 CFR Part 15-2011 for the US, using ANSI C63.4:2003, with >= 9.19dB Margin for Radiated Emissions.
RSS-210 Issue 8 (December 2010) for Canada, using RSS-Gen Issue 3 (December 2010), with >= 9.19dB margin for Radiated Emissions
Industry Canada (IC) ICES-003:2004 Class B for Canada, using CAN/CSA-CEI/IEC CISPR 22:02, with >= 9.19dB margin for Radiated Emissions.

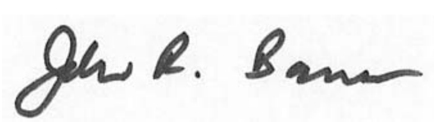
Report Prepared By: John R. Barnes KS4GL, PE, NCE, NCT, ESDC Eng, ESDC Tech, PSE, SM IEEE

Testing Performed by:

dBi Corporation
216 Hillsboro Avenue
Lexington, KY 40511-2105, USA

on August 25-26, 2011
at: Lexmark International, Inc.
Development Lab.
Lexington, KY 40550, USA

Reviewed and Approved by: John R. Barnes KS4GL, PE, NCE, NCT, ESDC Eng, ESDC Tech, PSE, SM IEEE



SIGNED________________________________**DATE**__August 29, 2011__
John R. Barnes, PRESIDENT dBi Corp.

INFORMATION RELATING TO PRODUCT RF INTERFERENCE

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)

Power Line Filters: none
RF Suppression Components: none

Clock Frequencies: 12.4MHz and 418MHz

External Cables: none.

Electronic Printed Circuit Boards:

Counter Side PCB	P/N: P3328
Beacon Side PCB	P/N: P3329

Size of Product: 90mm long x 45mm wide x 28mm high (two units)
Weight of Product: 0.2kg
Operating Environment: Indoors

Test Samples Received: August 25, 2011

Overall Test Plan:

These units shall be tested as tabletop equipment. Equipment that normally is stacked, may be stacked in any convenient order. Tests may be performed in any order, except that that the last two tests shall be (if required):

1. Electrostatic Discharge (ESD).
2. Surge Immunity.

Composition of Equipment-Under-Test (EUT): Standard

Assembly of EUT (Options): Standard

Input/Output Ports: None

Auxiliary Equipment (AE): None

Cabling and grounding: No cables. No intentional grounding.

Test Configuration: Standalone unit, orientation to be determined during testing.

Operating Mode:

Monitoring infrared beam and transmitting data once every 2 seconds.

Symptoms of Malfunction for Immunity Tests:

Stops transmitting, or transmits incorrect data.

Performance Criteria for Immunity Tests:

1 or A = normal performance within the specification limits.
2 or B = temporary degradation, or temporary loss of function or performance during the test, which is self-recoverable.
3 or C = temporary degradation, or temporary loss of function or performance during the test, which requires operator intervention.
4 or D = loss of data, degradation, or loss of function or performance during the test, which is not recoverable due to damage to the hardware or software of the EUT.

Radiated Emissions 30-4,180 MHz (Internal Battery)

Radiated Emission Standards:

FCC 47 CFR Part 15-2011 section 15.231(e) and Class B, using ANSI C63.4-2003
RSS-210 Issue 8 (December 2010) section A1.1.5, using RSS-Gen Issue 3 (December 2010)
ICES-003:2004 Class B, using CAN/CSA-CEI/IEC CISPR 22:02

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)
Serial Number: P0000010

Host and Other Peripherals: None

Name of Test: Radiated Interference
Test Procedure: ANSI C63.4-2003, RSS-Gen Issue 3 (December 2010)
Test Location: 10m & 5m semianechoic chamber
Test Distance: 10m as a digital device, & 3m as an intentional radiator
Test Instrumentation: See attached sheets

Notes: Tests performed at 21.8°C, 74.0% relative humidity, and 98.08kPa atmospheric pressure in 10m chamber. Tests performed at 20.5°C, 73.1% relative humidity, and 98.08kPa atmospheric pressure in 5m chamber. Before starting any approval tests, we do Total Cals on all of the receivers, then do a Radiated Checkout of the 10m Chamber (antenna, cables, and preamp) if one has not been performed within the last week The expanded uncertainty (k=2 for 95% probability) is +/-3.26dB for electric fields from 30MHz to 1000MHz; +/-3.84dB for electric fields from 1GHz to 18GHz, and +/-3.40dB for electric and magnetic fields below 30MHz;

Most Radiated Emissions tests at 10m distance are performed in the 10m Chamber. Most Radiated Emissions tests at 3m distance are performed in the 5m Chamber. All Radiated Emissions tests above 1GHz are performed in the 5m Chamber, and may require the use of a suitable extrapolation factor if the Radiated Emissions limit(s) is specified at a distance over 5m. For Europe, Australia, and New Zealand, Radiated Emissions tests below 30MHz are performed at the Open Air Test Site (OATS) away from the groundplane. For the US and Canada, Radiated Emissions tests below 30MHz may be performed in the 10m Chamber, in the 5m Chamber, or at the OATS.

In general, we prefer to put the auxiliary equipment (AE) on the table with the equipment-under-test (EUT). Noisy AE, such as a Class A host computer or Class A router being used to test a Class B product, may be installed in the pit under the turntable or in the control room, cabled to the EUT through the hole in the middle of the turntable— with ferrites on the cable(s) underneath the turntable.

The equipment-under-test (EUT) and auxiliary equipment (AE) are placed on a table according to the test plan and the test procedures. This table is 0.8m high for most Radiated Emission tests. Some European Union (EU) and Australia/New Zealand (AUS/NZ) Radiated Emission tests of tabletop intentional radiators require boxes/reams of paper or foam blocks under the EUT, to raise it to 1.0m or 1.5m height. We position the EUT and AE in a typical operating configuration, along the back edge/front edge/ center of the table, with units spaced 10cm apart. Units that are designed to be stacked may be stacked in any convenient order (usually with the EUT on top for easy access). A computer monitor may be set alongside or on top of the host computer. A brick/wallwart power supply for the EUT must be placed on the table— plugged into a power strip if the linecord won't reach the floor. Brick/wallwart power supplies for AE sit on the floor.

If standard cables are available for an EUT's input/output port(s), we prefer to use them. If cables are custom-made for each installation of an EUT, we use cables that are at least 1m long. At least one port of each type on the EUT is connected to AE with a cable— except that we do not put cables on ports that are used only for manufacturing or service. If the EUT has multiple ports of a certain type, we add cables (that may go to AE, terminate in dummy loads, or be left unterminated) until adding cables makes less than a 2dB worts-case increase in the emissions. The number of cables needed may be determined by testing this EUT, or by prior experience on previous products. If an EUT has several ports with identical functions that are mutually-exclusive— only one of them *can* be used in a particular installation of the EUT— we try to run the test with all of the cables attached, but only the noisiest port providing data to the EUT. If this configuration puts us over the limits, we experiment with one port at a time cabled to AE and providing data, with the other ports left unconnected. Then we make the official measurements using the noisiest port that will typically be used by users.

Linecords drop straight to the floor. Long input/output cables are draped over the edge of the table. If a cable hangs closer to the floor than 40cm, it must be serpentined into a bundle between 30cm and 40cm long, that will hang approximately horizontal and at least 40cm off the floor. Most of the tables that we use for Radiated Emissions tests have a shelf at 40cm height. A standard letter-size pad of paper is almost exactly 30cm long, and makes a convenient form for bundling cables. These cable bundles may be secured by tie-wraps, velcro strips, rubber bands, electrical tape, or other means.

We put the EUT in the typical operating mode that maximizes Radiated Emissions. This may require some experimenting to determine for sure, but is usually the mode that has as many subsystems of the EUT active simultaneously as possible, at their highest resolution, and operating at maximum speed.

For Radiated Emission tests from 30MHz to 1000MHz (1GHz), and maybe up to 3000MHz (3GHz), we use a linearly-polarized bilog antenna mounted on an antenna mast so we can vary its height from 1m to 4m. A low-noise preamplifier is mounted under the chamber floor, to lower the noise floor, boost the signal level, and increase the signal-to-noise ratio (SNR) of the measurements. The preamplifier's output cable goes to a splitter, which feeds two EMI receivers. For 30MHz to 1000MHz (1GHz) we set the EMI receivers for 120kHz 6dB resolution bandwidth (RBW). Above 1GHz we set the EMI receiver for 1MHz 6dB RBW.

Feeding two EMI receivers in parallel has a number of benefits:

1. For wideband scans, one EMI receiver monitors 30-500MHz while the second EMI receiver monitors 500-1000MHz, giving us < 1MHz-wide.frequency bins over the entire 970MHz span.
2. While making quasipeak/average/peak measurements with one EMI receiver, we can simultaneously watch the 5MHz span around this frequency to see just what the equipment-under-test (EUT) and auxiliary equipment (AE) are doing. This can be extremely useful when the noise level suddenly jumps up, to determine if a clock/ strobe turns on, a switching regulator turns on or changes mode, data transfers start/ stop, or whatever else may be causing the noise change.
3. We can simultaneously monitor two different frequency bands-- in close detail-- to see if noise on them has the same/different cause(s).
4. We can (manually) put one EMI Receiver into Spectrum Analyzer mode with 0-Hz span. This effectively turns it into a oscilloscope for one frequency, letting us see the waveform(s) that are causing us problems while we observe the noise level/noise envelope with the second receiver.
5. Any other crazy experiments that we may come up with while chasing down noise problems, where seeing time- and frequency-domain data, or two different types of frequency-domain data, can help us identify the noise source(s) and antenna(s).

For Radiated Emission tests above 1GHz, we use a linearly-polarized horn antenna mounted on an antenna mast so we can vary its height from 1m to 4m.. A preamplifier is mounted on the boom, right after any attenuators/filters connected to the horn antenna. The preamplifier's output cable goes to one EMI receiver. Above 1GHz we set the EMI receiver for 1MHz 6dB RBW.

For Radiated Emission tests below 30MHz, we use an unpolarized shielded-loop antenna on a tripod, set to a specified height. We can turn the loop antenna to maximize the received signal, which is *usually* with the EUT's antenna aimed at the loop antenna, and with the plane of the loop antenna roughly perpendicular to the line-of-sight between the loop antenna and the EUT's antenna. The signal cable and control cable go to one EMI receiver. For 9kHz to 150kHz we set the EMI receiver for 200Hz 6dB RBW. For 150kHz to 30MHz we set the EMI receiver for 9kHz 6dB RBW..

When testing intentional radiators, we may need to add an attenuator or filter at the antenna, to prevent overloading the preamplifier/EMI receiver. Strong input signals can generate spurious harmonics, cause signal compression, or desensitize the EMI receiver to other signals. These attenuators/ filters are calibrated, and we manually include their frequency-dependent losses in our calculations for the Radiated Emissions data.

At any time during the testing, if a measurement is above or close to a limit, we try to determine the cause of the problem, and fix it. Fixes to the EUT will be documented in the test notes and test report. If a piece of AE is the source of the noise, we may try a replacement (such as another hub/router, or using a crossover cable in place of a hub), or move the AE outside of the chamber. If AE is the source of the noise, and we can't resolve the problem any other way, we will measure these frequencies with the AE turned on and again with it turned off. We then note in the test notes, test plots, and test report that the excessive emissions at frequency ____ are due to _____ piece of AE.

The Radiated Emissions test programs automatically measure quasipeak (QP) emissions from 30MHz to 1000MHz (1GHz), and peak (PK+) and average (AV) emissions above 1GHz. All other measurements must be made manually, between a measurement run and the next narrowband run, or after stopping the Radiated Emissions test program. For a given waveform (shape, modulation, duty cycle) the true PK+, QP, and AV values are all be proportional to one another and to the magnitude of the signal.. *Measured* PK+, QP, and AV values will be higher than the true PK+, QP, and AV values, because the receiving antenna picks up noise from the Auxilary Equipment (AE) in addition to the desired signal from the equipment-under- test (EUT), and the EMI Receiver also sees thermal (and other) noise from the antenna, cables, preamplifier(s), and itself. These unwanted noise sources set a noise floor (minimum noise level) that depends on the frequency, detector, bandwidth, and any filters that we are using. But an antenna polarization, azimuth (turntable angle), and antenna height that maximizes the measured value with one detector maximizes the measured values for all detectors.

For intentional radiators there is very little consistency between nations, between overlapping standards/regulations within a nation, between versions of a standard, or even *within a standard* for:

- Electric field strength, magnetic field strength, RF carrier current, effective radiated power (ERP), or equivalent isotropic radiated power (EIRP).
- 15dB, 20dB, or 33dB bandwidth.
- Of the fundamental, harmonics, out-of –band emissions, or spurious emissions,
- Measured with peak, quasipeak, or average detectors.
- Expressed in uV/m, dBuV/m, dBuA/m, or Watts
- Measured over a ground plane or not,
- At 300m, 30m, 10m, or 3m distance,
- Under 30MHz, extrapolated to other distances by using the square of the ratio of the distances (40dB/decade distance), by measurements at two distances on one radial from the EUT, or by using a frequency-dependent conversion factor,
- With tabletop EUT's on an 0.8m, 1.0m, or 1.5m high support,
- With floor-standing EUT's on a <= 12mm-thick insulator.
- With the center, or the bottom, of the loop antenna at 1m height,
- Over 0°C to 35°C, 0°C to 40°C, 0°C to 55°C, -10°C to 55°C, –20°C to 50°C, or -20°C to +55°C temperature ranges,
- Over nominal supply voltage +/-10%, nominal–10% to nominal+30%, nominal +/-15%, with a freshly-charged battery, or with a new battery.

- At temperature extremes, over a temperature range, or at temperature *and* supply voltage extremes.
- At 0 minutes, 1 minute, 2 minutes, 5 minutes, 10 minutes, 15 minutes, or 30 minutes after startup at a specific temperature/voltage.

For intentional radiators that operate under 30MHz, various standards require some or all of the following tests:

Test Name	**Applies to xxxxHz xxxx**	**Status**
Power-line conducted emissions		
Radiated emissions		
Transmitter spectrum mask		
Antenna port conducted signals		
Carrier frequency stability		
Occupied bandwidth		
Output power		
Power spectral density		
In-situ radiated emissions		
Cordless phone security code		
Cordless phone frequency pairing		
Input power		
Periodic operation		
Average value of pulsed emissions		
Compliance with periodic emissions		
Frequency hopping		
Millimeter wave device		
Transmitter etiquette		
UWB device		
Duty cycle		
Operating frequency		
Modulation bandwidth		
Out-of-band transmissions		
Spurious transmissions		
Receiver adjacent channel sensitivity		
Receiver blocking/desensitization		
Receiver spurious emissions		

For the test report we'll translate these values into dBuV/m, dBuA/m, uV/m, and uA/m using the equations (or their inverses):

- Electric field strengh in uV/m = 377 ohms * magnetic field strength in uA/m.
- Electric field strength in dBuV/m = 20 * log (electric field strength in uV/m).
- Magnetic field strength in dBuA/m = 20 * log (magnetic field strngth in uA/m)

Extrapolation to other measurement distances, or conversion to power in Watts, is done using the formulas in the specific standards, To estimate emissions at temperatures other than those at which the Chamber/OATS test were run, we put the EUT in a thermal chamber. We attach a magnetic field (H-field) probe to the antenna of the EUT using rubber bands, tape, or some other means to keep it in a fixed position with respect to the EUT. A coaxial cable, running through a port in the side/back of the thermal chamber, connects the H-field probe to an EMI receiver outside the chamber. We do a TOTAL CAL of the EMI receiver before starting testing. We put the EUT in the same mode, with the same supply voltage, and at the same temperature, at which the reference Chamber/OATS tests were run. After letting the temperature of the EUT stabilize, we measure the EUT's output as our baseline measurement. Then we vary the temperature, supply voltage, time from power-up, etc., as needed to get the variations due to temperature, supply voltage, and whatever else is specified by the standard(s).

The US and Canada permit these measurements to be made with a groundplane (in the 10m or 5m Chamber) or without a groundplane (next to the open air test site (OATS)). A tabletop EUT sits on an 0.8m high table, with the center of the loop antenna 1.0m high and 3m or 10m from the EUT. We use inverse square of the ratio of distances (-40dB/decade distance) to correct for electric and magnetic fields at other distances.(FCC 47 CFR Part 15 15.31(f)(1)) For 9-90kHz and 110-490kHz we use average and peak measurements, with the peak limit 20dB above the average limit (FCC 47 CFR Part 15 15.35(b)), otherwise we use quasipeak measurements. The loop antenna is the most sensitive when the coil is perpendicular to the line-of-sight. Record the temperature, humidity, and atmospheric pressure, as the baseline for temperature-chamber tests. Measure the fundamental and all of the harmonics (up through the 10^{th}) that fall into the frequency range 9kHz-30MHz..

For Europe, Australia, and New Zealand, these measurements must be made without a groundplane, at the open air test site (OATS). A tabletop EUT will be on a 1.0m or 1.5m high support (use the mag field table, and add boxes or reams of paper to get the desired height). Set the bottom of the loop antenna 1.0m high, 10m away.from the EUT. Make quasipeak measurements. The loop antenna is the most sensitive when the coil is perpendicular to the line-of-sight. Record the temperature, humidity, and atmospheric pressure, as the baseline for temperature-chamber tests. . Measure the fundamental and all of the harmonics (up through the 10^{th}) that fall into the frequency range 9kHz-30MHz..

For intentional radiators to be approved to EU and AUS/NZ standards, the fundamental and harmonics in the 30-1000MHz range should also be quasipeak measured with the EUT at 1.0m and 1.5m heights, at 10m distance.

To tell if our intentional-emitter measurements are significant, we measure the noise floor + ambient noise level with everything set up as for the real measurements, but with the EUT and any AE turned off (unplugged from AC power, or batteries removed). For measurements in the 10m or 5m Chamber, we leave the door between the chamber and the control room open, and close the doors to the other chamber and the debug area.

Noise Floor measurements at the OATS are made with everything connected and placed for official measurements, but with the EUT powered off

Many intentional radiators are designed to transmit infrequently, or only when some event occurs. For Radiated Emissions testing, we will need a test mode— or even special test code— to make the EUT transmit continuously, or frequently enough (say, once every one or two seconds) that we can measure its transmissions in a reasonable time.

Once we have everything set up, and we have made any necessary noise floor + ambient noise level measurements, we run the Radiated Emissions tests as follows:
1. Record temperature, humidity, atmospheric pressure, and supply voltage.
2. Turn on the EUT and AE, with a specified power source, and put the EUT in the desired operating mode.
3. Do preliminary scans to find the noisiest frequencies/antenna polarizations.
4. Maximize Radiated Emissions from the EUT.
5. Use the Radiated Emissions test programs to find and measure the noisiest frequencies, measuring the noise with at least one detector, and determining the azimuth (turntable angle) and antenna height that maximize the emissions for a given antenna polarization.
6. If required— manually measure the noise with other detectors at the same frequencies, antenna polarizations, azimuths, and antenna heights.
7. Repeat steps 1 through 6 at other operating modes and supply voltages/frequencies, as needed.

For preliminary scans:from 30MHz to 1000MHz, we put the bilog antenna in vertical polarization, then let the turntable make one or more full turns with the antenna at 1m, 2.5m, and 4m heights. . At 10m distance, these antenna positions are approximately 9° apart vertically, as seen from the EUT, At 5m distance they are approximately 18° apart vertically. An antenna would need to have a very-narrow beamwidth, and be aimed just right, for us to completely miss it in these preliminary scans. For convenience, we let the Spectrum Analyzer continue to scan while we change the antenna height, which gives us some additional nondeterministic coverage at intermediate heights. We quasipeak the 3-5 frequencies whose Radiated Emissions appear to be highest with respect to the test limits. Then we repeat this process with the bilog antenna in horizontal polarization.

For preliminary scans:above 1GHz, we put the horn antenna in vertical polarization, then let the turntable make one or more full turns with the antenna at 1m, and at a greater height if needed to provide full coverage of the EUT. We quasipeak the 3-5 frequencies whose Radiated Emissions appear to be highest with respect to the test limits. Then we repeat this process with the horn antenna in horizontal polarization.

For preliminary scans:below 30MHz, we set the loop antenna perpendicular to the line of sight to the center of the turntable, then we let the turntable make one or more full turns. We quasipeak the 3-5 frequencies whose Radiated Emissions appear to be highest with respect to the test limits.

For intentional radiators that can operate in any orientation, we do three sets of preliminary scans with the EUT on its bottom/top, front/back, and left side/right side. . If the intentional radiator is designed to operate only in a certain position(s), we will do initial scans in that/those position(s). We record the EUT orientation that maximized emissions at the transmit frequency, and use this orientation for the rest of the Radiated Emissions tests.

If the preliminary scans show that any emissions from the EUT are over or close to the legal limits, we need to find and fix the problem(s). If all emissions from the EUT are at least 6dB below the legal limits, we can proceed directly to the official Radiated Emission test runs. Otherwise (the usual case) we need to move cables and linecords to maximize emissions. We return to the frequency, antenna polarization, azimuth, and antenna height with the minimum margin. We turn on the video projector in the chamber, or turn on the audio feedback, and take a baseline reading while standing near the back wall of the chamber. Now we move one cable or linecord at a time, then return to our standing position by the wall, to see whether we had any effect on emissions. We continue moving cables/linecords until any further changes reduce the emissions or leave them unchanged. This is our worst-case configuration of the cables/linecords, which we will photograph, and use for the official Radiated Emission test runs.

We now perform the official Radiated Emissions test runs. For each polarization of the antenna, we turn the turntable at least one full turn at each height that we used for our preliminary scans. The standards only require us to measure 6 frequencies, but I like to choose at least 10 frequencies at each antenna polarization that look “interesting”. Even if the wideband scans don’t show anything around 30MHz, I like to check a frequency down here, because I have been unpleasantly “surprised” on numerous occasions. For intentional radiators, I also check the fundamental and the 2nd through 10th harmonic just on general principles. I figure that it is much easier to collect a little extra data while everything is set up— which we can throw away if it isn’t significant— than to have to retest the EUT later because we missed something important!

At each of these frequencies, we do a narrowband scan to find the precise frequency, then let the Radiated Emissions test program measure the maximum quasipeak emissions for 30MHz-1000MHz, or the maximum peak and average emissions above 1GHz. At the antenna height that we think will maximize emissions (usually 1m. or 4m for the bilog antenna in horizontal polarization), let the turntable make one or more full turns. Return to the azimuth with the highest emissions so far. Wait here for a few seconds, then vary the antenna height. If no other antenna height gives us higher emissions, we are done with this frequency/antenna polarization.

Otherwise we return to the antenna height with higher emissions, and spin the turntable again to see if another azimuth has even higher emissions, If the EMI receiver shows “overload”, we increase its input attenuation in 10dB steps until it come out of this mode, We may want to bump the attenuation up another 10dB— to make sure that it doesn’t change (a sign of signal compression)— then back down 10dB again to make an accurate measurement. If the signal is pulsing, we may jog the turntable clockwise and counter-clockwise a few degrees to make sure we have found the tip of the lobe. One we have found the tip of the lobe, we sit there a few seconds to make sure that we catch the maximum emissions.

If we need measurements with other detectors, click the DONE icon to finish the quasipeak or peak/average measurements. Push the LOCAL button on the EMI receiver. Now turn on the desired detectors, and set the sampling time, to take PK+, QP, and AV measurements manually.

An alternative is to let the Radiated Emission test program take all of its normal measurements. Print out the results, and exit the program. Put the EMI receiver and the EMCO controller in local mode. Set the EMI receiver to continuous scan, with the PK+, QP, and AV detectors turned on, and an appropriate measurement time (usually 1s or 0.1s). Punch in a desired frequency. Turn the turntable to the desired azimuth, and raise/ lower the antenna to the desired height. Watch the EMI receiver for 10+ seconds for each measurement, and record the highest PK+, QP, and AV measurements in the work notes. Do this for all of the frequencies on the list.

All quasipeak/average/peak measurements are made in EMI Receiver mode, so according to the receiver specifications, video bandwidth (VBW) doesn't apply, the bandwidth error is under 10% and the shape factor (B(60dB)/B(6dB)) is under 10.

In the tables in this section, "Cable Correction Factor dB" is the total power loss (+dB)/gain (-dB) of the cable(s), preamplifier (if present), and splitter (if present) in the standard signal chain between the antenna and the EMI receiver. The Cable Correction Factor is measured with a vector network analyzer (VNA) during chamber/OATS calibration.For Radiated Emission measurements with a:

- Loop antenna, below 30MHz, the standard signal chain consists of just the signal cable between the antenna and the EMI receiver. The EMI receiver gets the antenna identifier via the control cable, which also identifies the signal cable and its length, and thus the default antenna factors and cable losses.
- Bilog antenna, for 30 to 1000MHz, the standard signal chain consists of a coaxial cable with ferrites, a preamplifier under the chamber floor, coaxial cable(s) to the control station, a signal splitter, and short coaxial cables to two EMI receivers.
- Horn antenna, above 1GHz, the standard signal chain consists of a preamplifier next to the antenna, a coaxial cable to another preamplifier under the chamber floor, and a second coaxial cable to the EMI receiver.

Due to software limitations, we must measure peak (PK+), quasipeak (QP), and average (AV) emissions of intentional radiators at least partly in manual mode. For a given waveform (shape, modulation, duty cycle) the true PK+, QP, and AV values are all be proportional to one another and to the magnitude of the signal.. *Measured* PK+, QP, and AV values will be higher than the true PK+, QP, and AV values, because the receiving antenna picks up noise from the Auxilary Equipment (AE) in addition to the desired signal from the equipment-under- test (EUT), and the EMI Receiver also sees thermal (and other) noise from the antenna, cables, preamplifier(s), and itself. These unwanted noise sources set a noise floor (minimum noise level) that depends on the frequency, detector, bandwidth, and any filters that we are using. But if we find an antenna polarization, azimuth (turntable angle), and antenna height that maximizes the measured value with one of the detectors, it will maximize the measured values for all detectors.

Thus we use a four-step process to measure the Radiated Emissions of intentional radiators:
1. Put the EUT into its noisiest operating mode
2. Identify the noise frequencies coming from the EUT.
3. Center the receive antenna in the strongest lobe of the noise coming from the EUT.
4. Measure PK+, QP, and AV.

For measurements from 30-1000MHz we use the standard Radiated Emissions software to measure in peak mode, then in quasipeak mode. For measurements above 1GHz we use the standard Radiated Emissions software to measure in peak and average mode. For measurements below 30MHz we put the EMI Receiver in Spectrum Analyzer mode, measuring in peak mode.
We first do a peak wideband scan of 9kHz to 30MHz, 30MHz to 1000MHz, 1GHz to 18GHz, or 18GHz to 40GHz to find suspicious signals. Then we do peak narrowband scans of this initial list, with a span less than 1% of the wideband span, to find the worst noise frequencies with kilohertz precision. Now we switch to EMI Receiver mode, with an appropriate detector (peak, quasipeak, or average).. We spin the turntable 360°, with the antenna at the height that we think will maximize the signal:
- For the loop antenna, whatever height is specified by the standard(s).
- 1m height for the bilog antenna in vertical polarization.
- 4m height for the bilog antenna in horizontal polarization.
- The same height as the EUT for the horn antenna(s).

We turn the turntable to the azimuth (angle) that saw the maximum emissions during the first spin. If the signal is pulsing, we may jog the turntable clockwise and counter-clockwise a few degrees to make sure we have found the tip of the lobe. If the EMI receiver shows “overload”, we increase its input attenuation in 10dB steps until it come out of this mode, and can make accurate measurements again. We now sit at this azimuth for a few seconds, to let the EUT go through a complete operating cycle.

The last step, taking peak, quasipeak, and average measurements, is completely manual. If we have been using the Radiated Emissions software, we close the program to keep it from butting in. We now:
- Turn on the peak, quasipeak, and average detectors.
- Set the sampling time to 1 second.
- Select continuous scan mode.
- Set the receiver bandwidth, if it hasn’t done so automatically.
- For each frequency on our list:
    1. Set the EMI receiver to the desired frequency.

2. Set the antenna to the desired polarization.
3. Turn the turntable to the azimuth we recorded earlier.
4. Raise/lower the antenna to the height we recorded earlier.
5. Watch the receiver for 10+ seconds per measurement, recording the highest values.

If the receiver shows "overload", we increase the input attenuation in 10dB steps until the measurements don't change (the receiver isn't compressing the signal), then decrease the input 10dB to take the measurements.

If we had to use an attenuator or a high-pass filter right after the antenna—that isn't part of the standard signal chain—we record its equipment number, so we can include its (frequency-dependent) attenuation in our calculations.

When testing intentional radiators operating under 30MHz, we record the temperature, humidity, atmospheric pressure, and supply voltage at the test site as a baseline value for temperature/supply voltage measurements. If the EUT is AC powered, we test it at nominal, low, and high input voltage for each distance/EUT height/loop-antenna height/mode. We check emissions at the fundamental frequency, and for any harmonics (up through the 10^{th} harmonic) that fall into the frequency range being tested (i.e 9kHz to 30MHz, 30MHz to 1000MHz). For each test point (frequency, distance, EUT height, loop antenna height) we record the peak, quasipeak, and average values in whatever units the EMI receiver provides. With the EMI receiver set to a 1-second measurement time (so we have long enough to note the full reading), we observe the signal level for at least 10 seconds (>= 10 samples) with each detector, and record the highest level seen during this interval.

The test unit transmitted at 2 second intervals to speed up testing. This was a special code spin for EMC testing. The standard code transmits once every 10 to 600 seconds.

Based on our experiences testing previous FCC Part 15.231(e) products, we put a calibrated 20dB attenuator right after the bilog antenna to prevent signal compression in the preamp/receiver chain. for 3m measurements from 30-1000MHz. We added its loss (20.194dB at 418MHz, 20.15dB at 836MHz) to the field strengths measured by the receiver in this band. We used a different antenna and preamp for measurements above 1GHz. The FCC Part 15.231(e) limits above 1GHz are lower than the FCC Class A limits above 1GHz, thus any linearity concerns had already been addressed during equipment calibration.

We measured PK+, QP, and AVE for 418MHz and 836MHz in manual mode, as follows:

1. With the equipment-under-test (EUT) upright, measure 418MHz and 836MHz in QP mode with the bilog antenna vertical and horizontal (Lexmark's EMC software records the azimuth and antenna elevation for the highest QP emissions). If the receiver shows an overload, increase input attenuation by 10dB, then redo the measurement.
2. Repeat step 1 with the EUT on its back or front.
3. Repeat step 1 with the EUT on its right or left side.

4. Study the plots to determine which orientation of the EUT had the highest emissions in QP mode.
5. Return the EUT to this position. With the bilog antenna vertical, go back to the azimuth and antenna elevation that maximized the QP emissions at a given frequency.
6. Using a 1 second sampling time, measure PK+ and QP, taking the maximum values seen on the receiver over 10-20 seconds. If the receiver showed an overload, or we still suspected signal compression, we increased the input attenuation by 10dB. If the measurement stayed the same, we used the previous reading. If the value increased, we continued increasing the attenuation in 10dB steps until the measurement stayed the same, then reduced the attenuation 10dB for the official measurement.
7. Using a 100 millisecond sampling time, measure AVE, taking taking the maximum value seen on the receiver over 10-20 seconds. (Since we could only catch the top 2 digits, we used 0.99dB as the fractional part to be conservative.)
8. In the calculations, add the attenuator's loss to the measured value to get the true field strength.
9. Repeat steps 5 to 8 with the bilog antenna horizontal.

Under Section 15.231(e), the average limit for the fundamental is calculated by linear interpolation from 1500uV/m at 260MHz to 5000uV/m at 470MHz when measured at 3m. Average limit = ((5000uV/m-1500uV/m)*(418MHz-260MHz)/(470MHz-260MHz))+1500uV/m = 4133uV/m = 20*log(4133) dB(uV/m) = 72.33dB(uV/m). Section 15.35(b) sets the peak limit for the fundamental to 20 dB above the average limit, or 92.33dB(uV/m) at 3m. For spurious emissions, Section 15.231(e) sets the average limit to 20dB below the maximum permitted fundamental level, or 52.33dB(uV/m) at 3m, with the peak limit 20dB higher at 72.33dB(uV/m).

These sensors transmit a 14-16ms data burst, depending on the identification (ID) code. The duty cycle within a data burst is nominally 50%, but can be as high as 66%. Thus the maximum total transmit time is 0.66 * 16ms = 10.56ms within any 100ms time interval.
Averaged over a 100ms interval, the AVE measurement should be at least 20*log(10.56ms/100ms) = -19.53dB from PK+ measurements. The measured difference may be less if the AVE signal level is under the noise floor of the receiver, artificially increasing its value. On a previous product we were told that for pulsed emissions, that the AVE emissions must be calculated by *subtracting* a duty-cycle correction factor = 20*log(worst case ON-TIME (ms) in any 100ms window / 100 ms) from the peak value, with the duty-cycle correction factor between 0dB and 20dB. (There is a sign error in the description we were given, because log of a number between 0 and 1 is negative.) We have not found this requirement documented anywhere in the FCC Regulations or in ANSI C63.4-2003, but to keep everyone happy, we show both *measured* AVE values and *calculated* AVE values for this sensor.

Modifications to the Equipment Under Test: None

Test Results: Tables 1 through 5 show that this unit meets the radiated interference requirements of FCC Part 15 Section 15.231(e) and RS-210 Section A1.1.5, and the Class B radiated interference requirements of FCC Part 15 and ICES-003..

SIGNED________________________________**DATE** _August 29, 2011__
John R. Barnes, PRESIDENT dBi Corp.

Radiated Emissions Data 30-4,180MHz

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)
Serial Number: P0000010

TABLE 1: QUASIPEAK EMISSIONS AT 10m

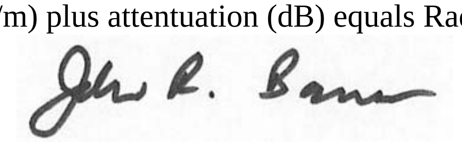
Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)	Receiver Reading Horiz. dB(uV)	Cable Corr. Factor dB	Antenna Factor dB(/m)	Atten. dB	Rad. Interference Field Strength Vert. dB(uV/m)	Rad. Interference Field Strength Horiz. dB(uV/m)	CISPR 22 QPK Limit dB(uV/m)
31.470	------	16.326	-21.780	17.865	0.000	------	12.411	30
32.063	15.237	------	-20.402	17.568	0.000	12.403	------	30
33.489	------	16.747	-21.777	16.855	0.000	------	11.825	30
33.569	16.805	------	-21.854	16.815	0.000	11.766	------	30
204.000	23.851	------	-21.200	8.700	0.000	11.351	------	30
227.992	21.439	------	-21.012	9.699	0.000	10.126	------	30
264.003	20.698	16.709	-18.447	13.800	0.000	16.051	12.062	37
418.004	63.446	71.833	-17.893	16.500	0.000	62.053	70.440	
748.623	------	14.597	-17.317	22.162	0.000	------	19.442	37
836.008	14.320	14.580	-16.623	22.700	0.000	20.397	20.657	

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus attentuation (dB) equals Radiated Interference Field Strength dB(uV/m).

TABLE 2: QUASIPEAK EMISSIONS AT 3m

Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)	Receiver Reading Horiz. dB(uV)	Cable Corr. Factor dB	Antenna Factor dB(/m)	Atten. dB	Rad. Interference Field Strength Vert. dB(uV/m)	Rad. Interference Field Strength Horiz. dB(uV/m)	15.231(e) QPK Limit dB(uV/m)
418.005	55.946	60.006	-19.216	16.300	20.194	73.224	77.284	
836.010	24.091	24.091	-17.622	22.601	20.150	49.220	49.220	

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus attentuation (dB) equals Radiated Interference Field Strength dB(uV/m).



SIGNED________________________________**DATE** August 29, 2011

John R. Barnes, PRESIDENT dBi Corp.

Radiated Emissions Data 30-4,180MHz (cont.)

TABLE 3: PEAK EMISSIONS AT 3m

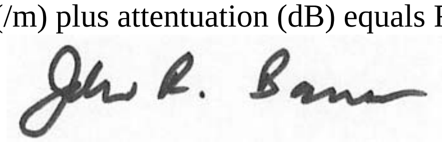
Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)	Receiver Reading Horiz. dB(uV)	Cable Corr. Factor dB	Antenna Factor dB(/m)	Atten. dB	Rad. Interference Field Strength Vert. dB(uV/m)	Rad. Interference Field Strength Horiz. dB(uV/m)	15.231(e) PK+ Limit dB(uV/m)
418.0	59.586	63.666	-19.216	16.300	20.194	76.864	80.944	92.33
836.0	30.532	30.522	-17.622	22.600	20.150	55.660	55.650	72.33
1254.2	51.152	40.470	-26.065	25.204	0.000	50.291	39.609	72.33
1672.3	53.927	41.377	-24.104	25.406	0.000	55.229	42.679	72.33
2090.1	50.801	39.034	-23.057	28.403	0.000	56.147	44.380	72.33
2508.0	39.419	33.085	-22.356	28.913	0.000	45.976	39.642	72.33
2926.0	48.544	41.861	-21.611	29.691	0.000	56.624	49.941	72.33
3344.2	48.544	37.592	-20.862	31.032	0.000	58.714	47.762	72.33
3762.2	34.334	31.744	-20.122	30.944	0.000	45.156	42.566	72.33
4180.0	31.184	30.780	-19.440	31.592	0.000	43.336	42.932	72.33

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus attentuation (dB) equals Radiated Interference Field Strength dB(uV/m).

TABLE 4: MEASURED AVERAGE EMISSIONS AT 3m

Receiver Meas. Freq. MHz	Receiver Reading Vert. dB(uV)	Receiver Reading Horiz. dB(uV)	Cable Corr. Factor dB	Antenna Factor dB(/m)	Atten. dB	Rad. Interference Field Strength Vert. dB(uV/m)	Rad. Interference Field Strength Horiz. dB(uV/m)	15.231(e) AVE Limit dB(uV/m)
418.0	38.906	42.906	-19.216	16.300	20.194	56.184	60.184	72.33
836.0	18.012	18.012	-17.622	22.600	20.150	43.140	43.140	52.33
1254.2	31.620	23.539	-26.065	25.204	0.000	30.759	22.678	52.33
1672.3	32.436	23.251	-24.104	25.406	0.000	33.738	24.553	52.33
2090.1	30.500	19.827	-23.057	28.403	0.000	35.846	25.173	52.33
2508.0	21.771	17.811	-22.356	28.913	0.000	28.328	24.368	52.33
2926.0	28.114	22.425	-21.611	29.691	0.000	36.194	30.505	52.33
3344.2	27.531	18.887	-20.862	31.032	0.000	37.701	29.057	52.33
3762.2	17.484	15.416	-20.122	30.944	0.000	28.306	26.238	52.33
4180.0	15.417	14.153	-19.440	31.592	0.000	27.569	26.305	52.33

Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus attentuation (dB) equals Radiated Interference Field Strength dB(uV/m).



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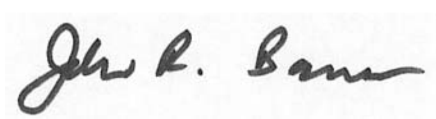
John R. Barnes, PRESIDENT dBi Corp.

Radiated Emissions Data 30-4,180MHz (cont.)

TABLE 5: CALCULATED AVERAGE EMISSIONS AT 3m

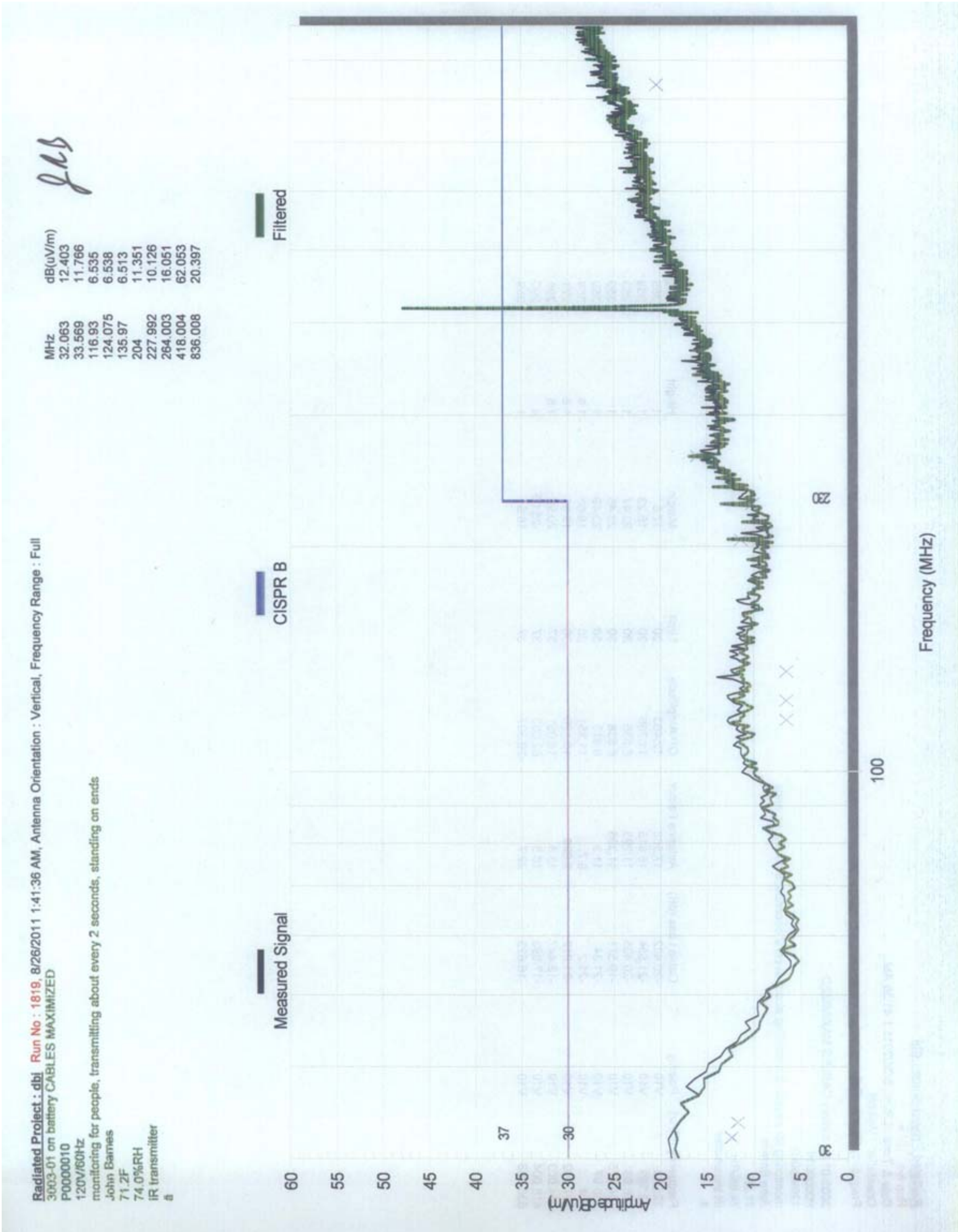
Receiver 15.231(e) Meas. Freq. MHz	Receiver Reading Vert. dB(uV)	Receiver Reading Horiz. dB(uV)	Cable Corr. Factor dB	Antenna Factor dB(/m)	Atten. dB	Duty-cyc. Corr. Factor dB	Rad. Interfer Field Strength Vert. dB(uV/m)	Rad. Interfer Field Strength Horiz. dB(uV/m)	AVE Limit dB(uV/m)
418.0	59.586	63.666	-19.216	16.300	20.194	-19.527	57.337	61.417	72.33
836.0	30.532	30.522	-17.622	22.600	20.150	-19.527	36.133	36.123	52.33
1254.2	51.152	40.470	-26.065	25.204	0.000	-19.527	30.764	20.082	52.33
1672.3	53.927	41.377	-24.104	25.406	0.000	-19.527	35.702	23.152	52.33
2090.1	50.801	39.034	-23.057	28.403	0.000	-19.527	36.620	24.853	52.33
2508.0	39.419	33.085	-22.356	28.913	0.000	-19.527	26.449	20.115	52.33
2926.0	48.544	41.861	-21.611	29.691	0.000	-19.527	37.097	30.414	52.33
3344.2	48.544	37.592	-20.862	31.032	0.000	-19.527	39.187	28.235	52.33
3762.2	34.334	31.744	-20.122	30.944	0.000	-19.527	25.629	23.039	52.33
4180.0	31.184	30.780	-19.440	31.592	0.000	-19.527	23.809	23.405	52.33

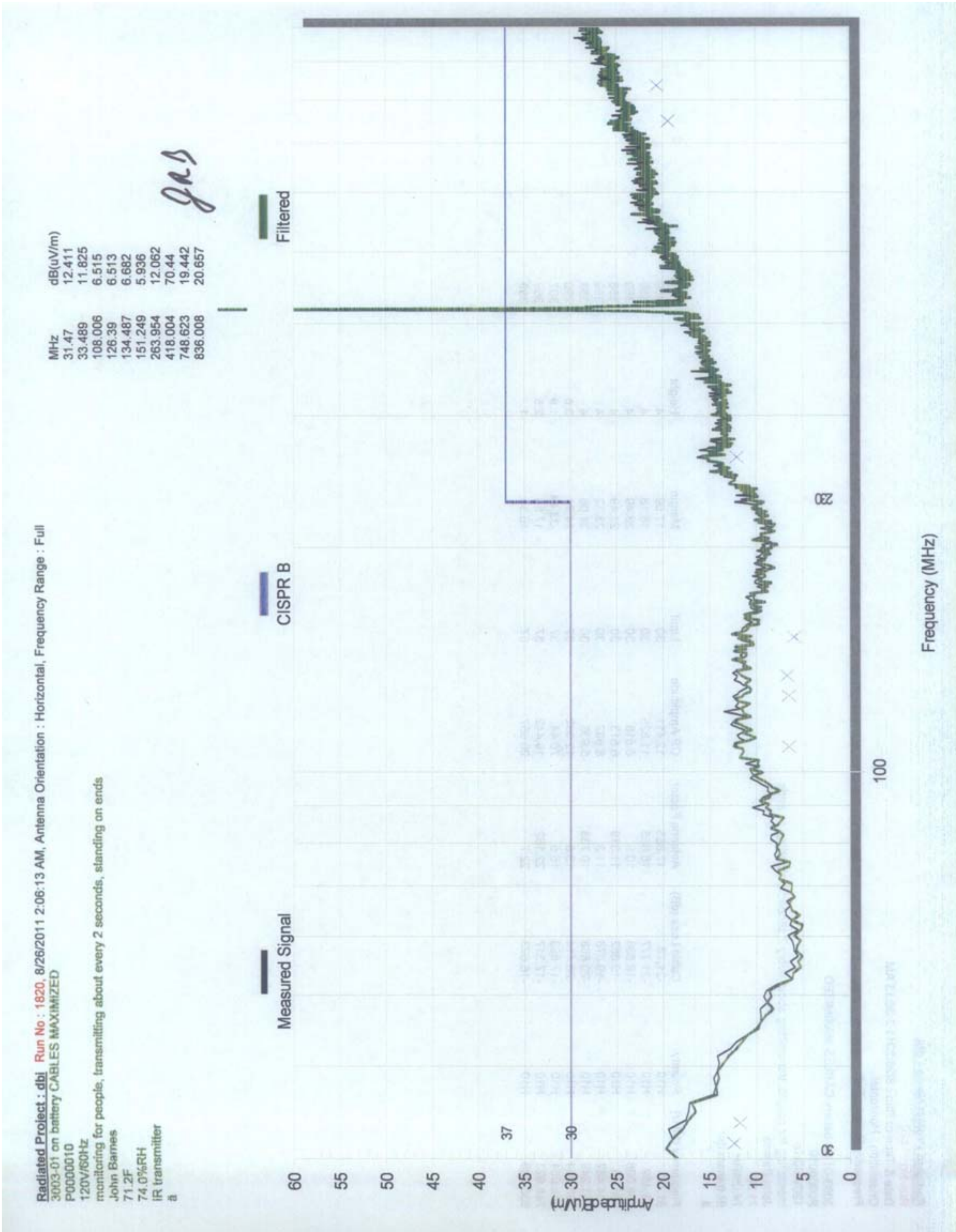
Sample Calculation: Receiver reading dB(uV) plus cable correction factor (dB) plus antenna factor dB(/m) plus attentuation (dB) plus duty-cycle correction factor equals Radiated Interference Field Strength dB(uV/m).



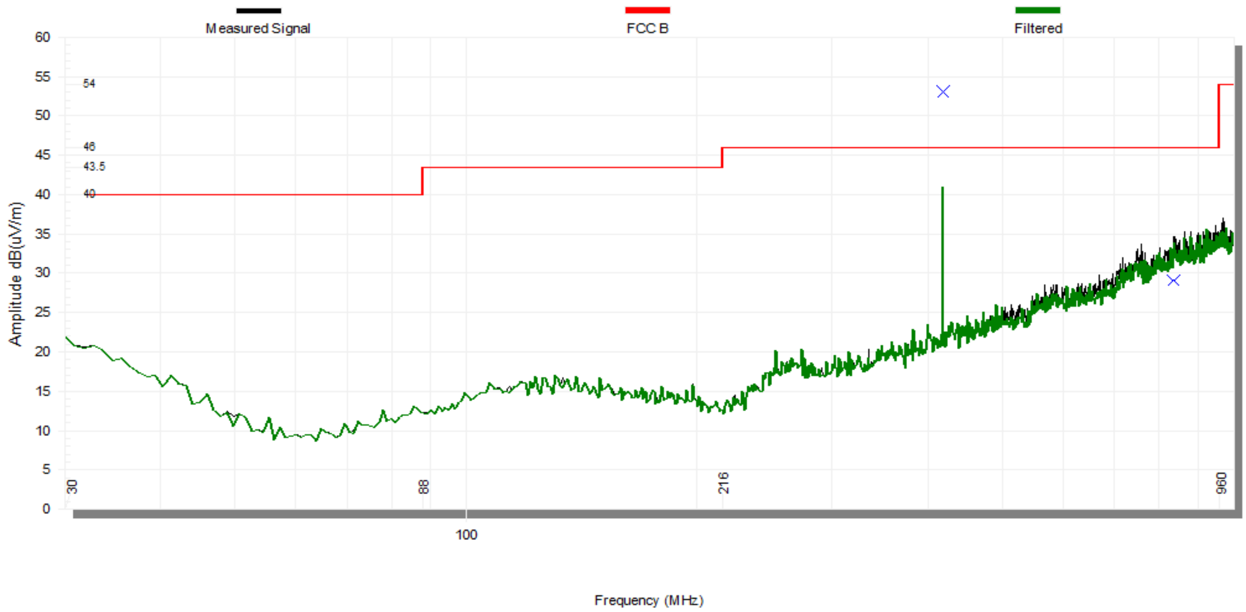
Signed____________________________________**Date** __August 29, 2011__

John R. Barnes, PRESIDENT dBi Corporation


Radiated Project : dbi Run No : 1819, 8/26/2011 1:41:36 AM, Antenna Orientation : Vertical, Frequency Range : Full
3003-01 on battery CABLES MAXIMIZED
P0000010
120V/60Hz
monitoring for people, transmitting about every 2 seconds, standing on ends
John Barnes
71.2F
74.0%RH
IR transmitter
MHz
32.063
33.569
116.93
124.075
135.97
204
227.992
264.003
418.004
836.008
dB(uV/m)
12.403
11.766
6.535
6.538
6.513
11.351
10.126
16.051
62.053
20.397
Measured Signal
CISPR B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
100
37
30
60
55
50
45
40
35
30
25
20
15
10
5
0

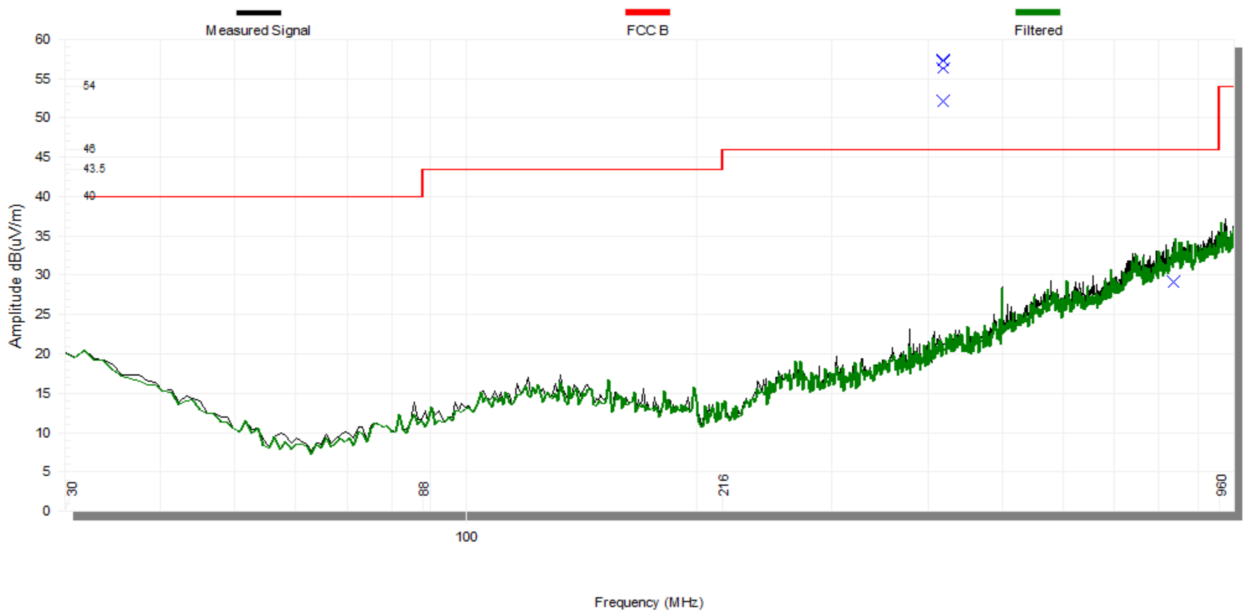

Radiated Project : dbi Run No : 1820, 8/26/2011 2:06:13 AM, Antenna Orientation : Horizontal, Frequency Range : Full
3003-01 on battery CABLES MAXIMIZED
P0000010
120V/60Hz
monitoring for people, transmitting about every 2 seconds, standing on ends
John Barnes
71.2F
74.0%RH
IR transmitter
a
MHz dB(uV/m)
31.47 12.411
33.489 11.825
108.006 6.515
126.39 6.513
134.487 6.682
151.249 5.936
263.954 12.062
418.004 70.44
748.623 19.442
836.008 20.657
Measured Signal
CISPR B
Filtered
Amplitude dB(uV/m)
Frequency (MHz)
100
37
30

Radiated Project: dbi, Run No: 468, 8/25/2011 11:26:52 PM
Vertical, Frequency Range: Full
Product Name: 3003-01 on battery, S/N: P0000010
EUT Line Voltage: 120V/60Hz
Mode: monitor for people, transmitting about every 2 seconds, standing on ends
Tested by: John Barnes, Temperature: 68.9F, Humidity: 73.1% RH
Test Setup: IR transmitter



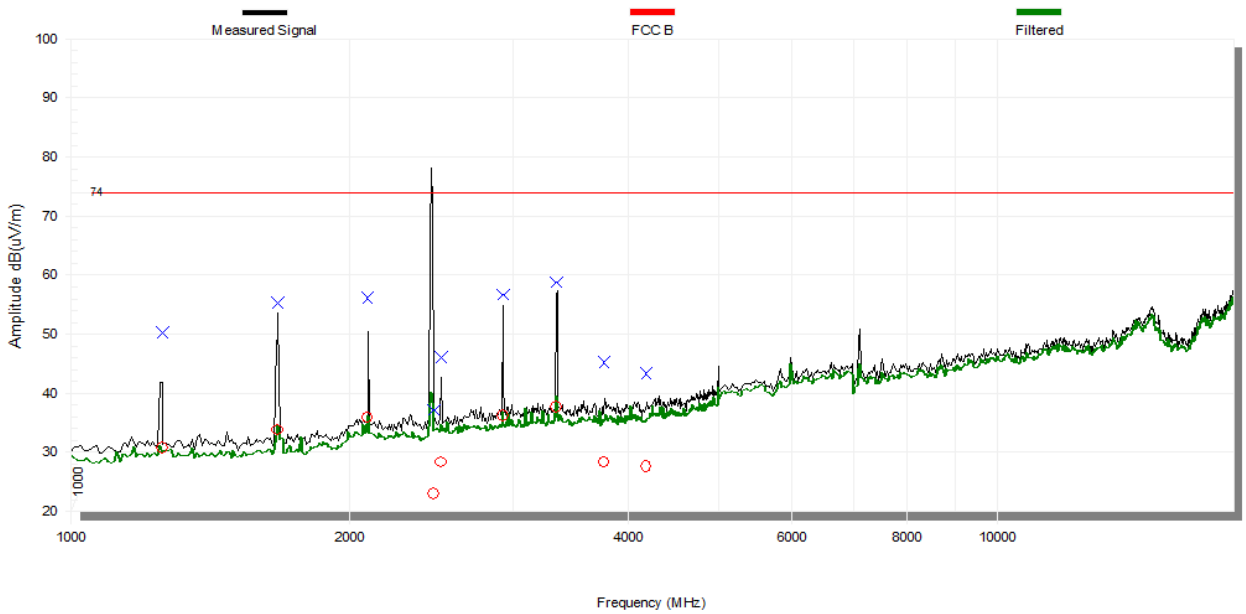
Frequency (MHz)	Polarity	Cable Loss (dB)	Antenna Factor (dB(1/m))	QP Amplitude (dB(uV/m))	Limit (dB(uV/m))	Margin (dB)	Max Height (meters)	Max Angle (Deg)
418.004	V3	-19.216	16.3	53.031	46	-7.03	1.3	273
836.008	V3	-17.622	22.6	29.072	46	16.93	1.2	359

Radiated Project: dbi, Run No: 467, 8/25/2011 11:00:55 PM
Horizontal, Frequency Range: Full
Product Name: 3003-01 on battery, S/N: P0000010
EUT Line Voltage: 120V/60Hz
Mode: monitor for people, transmitting about every 2 seconds, standing on ends
Tested by: John Barnes, Temperature: 68.9F, Humidity: 73.1% RH
Test Setup: IR transmitter



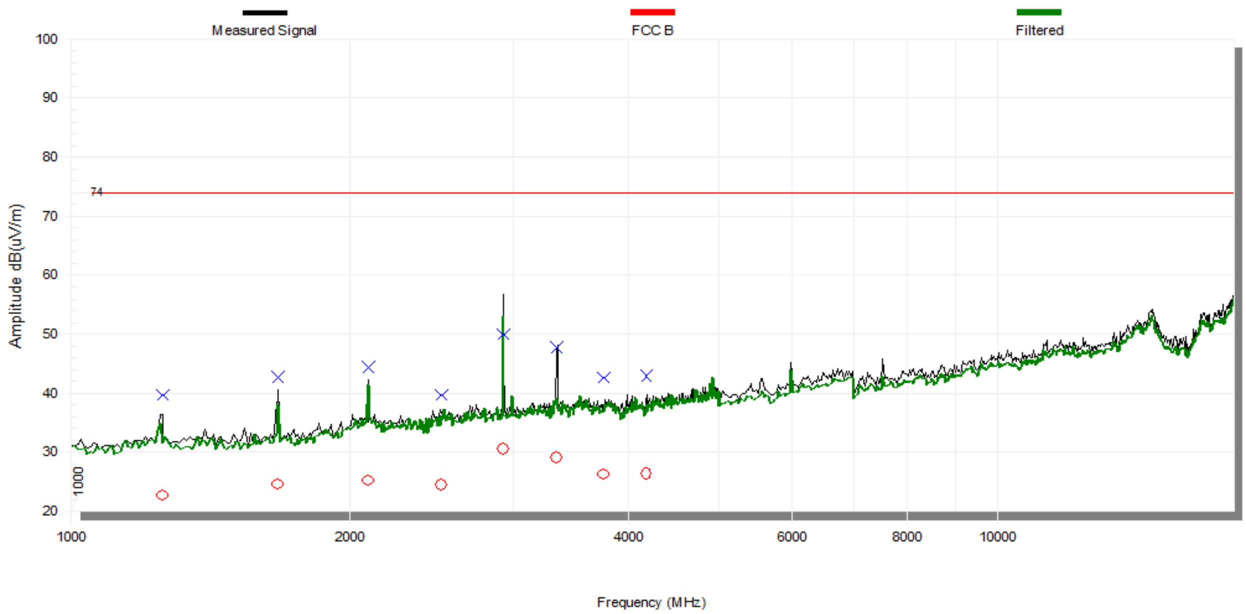
Frequency (MHz)	Polarity	Cable Loss (dB)	Antenna Factor (dB(1/m))	QP Amplitude (dB(uV/m))	Limit (dB(uV/m))	Margin (dB)	Max Height (meters)	Max Angle (Deg)
418.006	H3	-19.216	16.3	57.202	46	-11.2	1	111
418.006	H3	-19.216	16.3	56.254	46	-10.25	1	199
418.006	H3	-19.216	16.3	52.128	46	-6.13	1	259
418.006	H3	-19.216	16.3	57.27	46	-11.27	1	125
836.012	H3	-17.622	22.601	29.101	46	16.9	1.5	358

Radiated Project: dbi, Run No: 469, 8/26/2011 12:19:36 AM
Vertical, Frequency Range: Full
Product Name: 3003-01 on battery CABLES MAXIMIZED, S/N: P0000010
EUT Line Voltage: 120V/60Hz
Mode: monitor for people, transmitting about every 2 seconds, standing on ends
Tested by: John Barnes, Temperature: 68.9F, Humidity: 73.1% RH
Test Setup: IR transmitter



Frequency (MHz)	Polarity	Cable Loss (dB)	Antenna Factor (dB(1/m))	Peak Amplitude (dB(uV/m))	Peak Limit (dB(uV/m))	Peak Margin (dB)	Max Height (meters)	Max Angle (Deg)	Average Amplitude (dB(uV/m))	Average Margin (dB)
1254.1	V3	-26.065	25.204	-56.505	74	130.51	163544.594	188090848	-.862	54.86
1254.2	V3	-26.065	25.204	50.291	74	23.71	1	149	30.759	23.24
1672.3	V3	-24.104	25.406	55.229	74	18.77	1	330	33.738	20.26
2090.1	V3	-23.057	28.403	56.147	74	17.85	1	160	35.846	18.15
2465.6	V3	-22.422	28.638	37.129	74	36.87	1	255	22.955	31.05
2508	V3	-22.356	28.913	45.976	74	28.02	1	328	28.328	25.67
2926	V3	-21.611	29.691	56.624	74	17.38	1	38	36.194	17.81
3344.2	V3	-20.862	31.032	58.714	74	15.29	1	350	37.701	16.3
3762.2	V3	-20.122	30.944	45.156	74	28.84	1	345	28.306	25.69
4180	V3	-19.44	31.592	43.336	74	30.66	1	7	27.569	26.43

Radiated Project: dbi, Run No: 470, 8/26/2011 12:34:45 AM
Horizontal, Frequency Range: Full
Product Name: 3003-01 on battery CABLES MAXIMIZED, S/N: P0000010
EUT Line Voltage: 120V/60Hz
Mode: monitor for people, transmitting about every 2 seconds, standing on ends
Tested by: John Barnes, Temperature: 68.9F, Humidity: 73.1% RH
Test Setup: IR transmitter

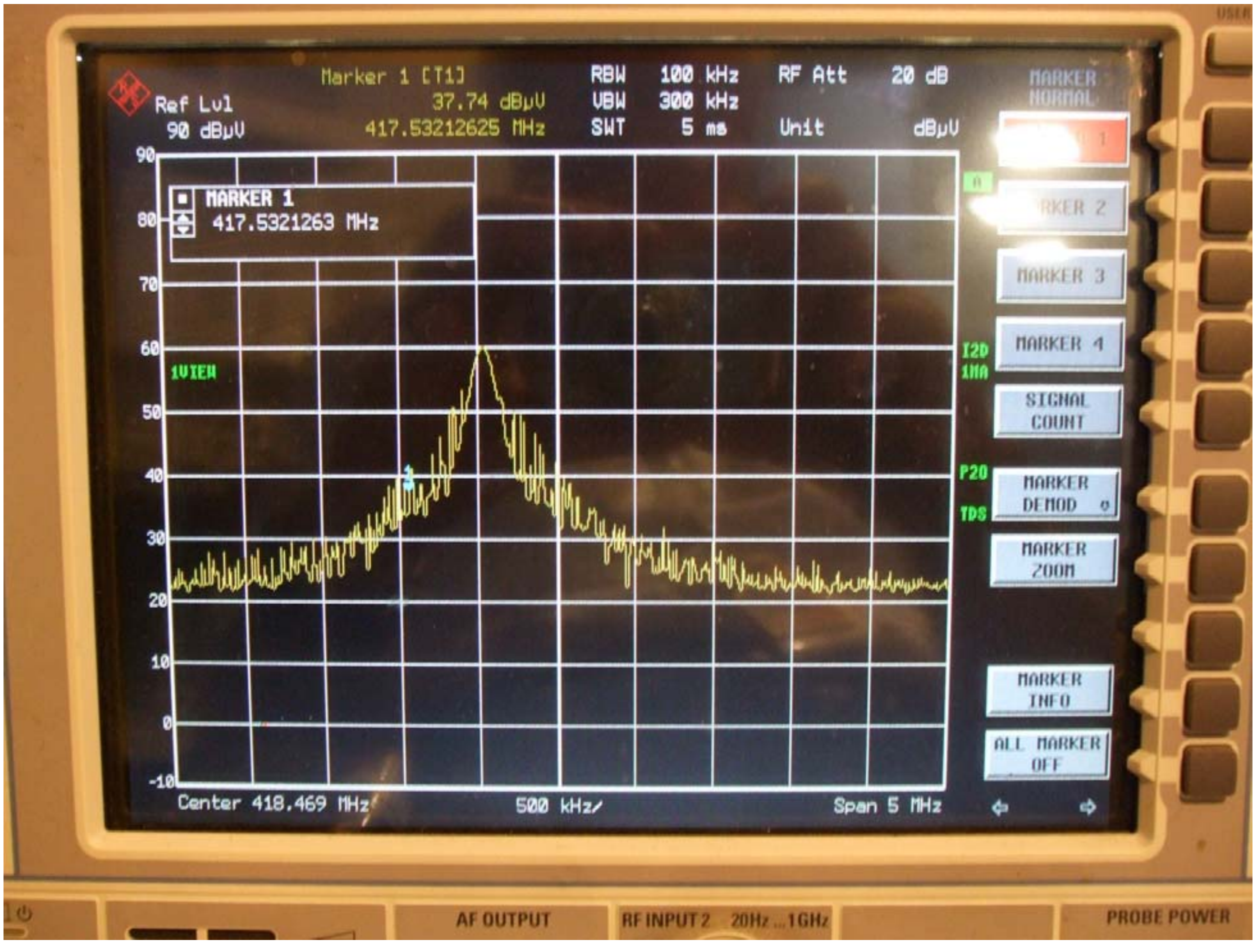


Frequency (MHz)	Polarity	Cable Loss (dB)	Antenna Factor (dB(1/m))	Peak Amplitude (dB(uV/m))	Peak Limit (dB(uV/m))	Peak Margin (dB)	Max Height (meters)	Max Angle (Deg)	Average Amplitude (dB(uV/m))	Average Margin (dB)
1254	H3	-26.066	25.204	39.609	74	34.39	1	273	22.678	31.32
1672	H3	-24.105	25.406	42.679	74	31.32	1	221	24.553	29.45
2090.5	H3	-23.056	28.405	44.38	74	29.62	1	357	25.173	28.83
2508	H3	-22.356	28.913	39.642	74	34.36	1	353	24.368	29.63
2926	H3	-21.611	29.691	49.941	74	24.06	1	342	30.505	23.49
3344	H3	-20.862	31.032	47.762	74	26.24	1	354	29.057	24.94
3762	H3	-20.122	30.944	42.566	74	31.43	1	156	26.238	27.76
4180	H3	-19.44	31.592	42.932	74	31.07	1	110	26.305	27.7

Transmitted Bandwidth Data

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)
Serial Number: P0000010

PROCEDURE: Test Performed Per ANSI 63.4 – 2003 and RSS-Gen Issue 3 (December 2010).



Modifications to the Equipment Under Test: None.

Test Results: The 20dB transmitted bandwidth of the 3003-01 is 961.9kHz (417.5321MHz to 418.4940MHz), within the 1045kHz (0.25% of 418MHz) maximum bandwidth permitted by FCC Part 15 Section 15.231(c). In the photo, each horizontal division is 500kHz, and each vertical division is 10dB. The RBW bandwidth was 100kHz, and the VBW bandwidth was 300kHz, with a sweep time of 5ms.

Signed____________________________________**Date** __August 29, 2011__

John R. Barnes, PRESIDENT dBi Corporation

Conducted Emissions 150 kHz-30 MHz (Internal Battery)

Conducted Emission Standards:

FCC 47 CFR Part 15-2011 section 15.231(e), using ANSI C63.4-2003
RSS-210 Issue 8 (December 2010) section A1.1.5, using RSS-Gen Issue 3 (December 2010)
ICES-003:2004 Class B, using CAN/CSA-CEI/IEC CISPR 22:02

Appliance/Product: 3003-01 People Counter
Model/Type Number: 3003-01
FCC ID: M5ZTMPC
Rating: 3.6VDC (lithium batteries)
Serial Number: P0000010

Host and Other Peripherals: None

Name of Test: Powerline Conducted Interference
Test Procedure: ANSI C63.4-2003
Test Location: All welded 18 ft x 18 ft shielded enclosure, Lexmark test facility, located in Lexington, Kentucky
Test Instrumentation: See attached sheets

Note: Tests performed at 15-35°C, any relative humidity, and any atmospheric pressure. Before starting any approval tests, we do a Total Cal of the receiver, then do a Conducted Checkout of the LISN, 150kHz highpass filter, 10dB attenuator, and cables. The expanded uncertainty (k=2 for 95% probability) is +/-2.76dB on AC power; and +/-2.85dB on input/output cables.

The equipment-under-test (EUT) and auxiliary equipment (AE) are set up in the shielded room according to the test plan and the test procedure(s). The EUT plugs into the main line-impedance stabilization network (LISN). AE plugs into multi-outlet strips attached to separate LISN's. Long input/output cables are serpentined to keep them >40cm from the floor.

If standard cables are available for an EUT's input/output port(s), we prefer to use them. If cables are custom-made for each installation of an EUT, we use cables that are at least 1m long. At least one port of each type on the EUT is connected to AE with a cable— except that we do not put cables on ports that are used only for manufacturing or servicing. If the EUT has multiple ports of a certain type, we add cables (that may go to AE, terminate in dummy loads, or be left unterminated) until adding a cable makes less than a 2dB increase in the emissions. The additional cables needed may be determined by testing this EUT, or by prior experience with these same input/output ports on previous products. If an EUT has several ports with identical functions that are mutually-exclusive— only one of them *can* be used in a particular installation of the EUT— we try to run the test with all of the cables attached, but only the noisiest port providing data to the EUT. If this configuration puts us over the limits, we experiment with one port at a time cabled to AE and providing data, with the other ports left unconnected. Then we make the official measurements with the noisiest port that will typically be used by users.

We set up the EUT, AE, input/output cables, and line cords/power cables in the configuration and typical operating mode that we think will maximize emissions. This may require some experimenting to determine for sure, but is usually the configuration/operating mode that has as many subsystems of the EUT active simultaneously as possible, at their highest resolution, and operating at maximum speed.

We run initial scans on phase and neutral. We quasipeak and average measure the 3-5 frequencies whose Conducted Emissions appear to be highest with respect to the test limits.

At any time during the approval testing, if a measurement is above or close to a limit, we try to determine the cause of the problem, and fix it. Fixes to the EUT will be documented in the test notes and test report. If a piece of AE is the source of the noise, we may try a replacement (such as another hub/router, or using a crossover cable in place of a hub), or move the AE outside of the chamber. If AE is the source of the noise, and we can't resolve the problem any other way, we will measure these frequencies with the AE turned on and again with it turned off. We then note in the test notes, test plots, and test report that the excessive emissions are due to __________ piece of AE.

We examine the initial plots to see which frequency on phase/neutral has the minimum margin versus the test limits. If the minimum margin is >6dB, we treate the cables as already being maximized, and perform the official tests. Otherwise we return to the AC line and frequency with the highest emissions. We take a baseline reading before we touch anything. Then we move cables and line cords, trying to increase the emissions at this frequency, until any further changes have no effect, or reduce the emissions. This becomes our maximized cable configuration for the official tests, which will be photographed and included in the test report.

We now perform the official Conducted Emissions measurements. For each AC line (phase, neutral) we choose at least 10 frequencies that look "interesting". At each of these frequencies we do a narrowband scan to find the frequency with the least margin against the test limits. We quasipeak and average measure these specific frequencies on phase and neutral. These become our official measurements. We repeat this process for all AC input voltages/frequencies of interest.

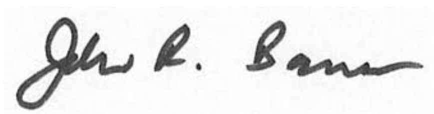
When the test standards require Conducted Emissions measurements on an input/output cable, such as a phone line or Ethernet port, we connect this cable to an impedance stabilization network (ISN) if one is available. If we don't have a suitable ISN, we run this cable through a current probe and a voltage probe, and maybe through a bunch of ferrite cores, before connecting it to the AE (see CISPR 22/EN 55022 Appendix C). The EUT still plugs into the main LISN. We make one set of measurements per cable, with all other cables in the configuration that maximized AC Conducted Emissions.

In the tables below, “Cable Correction Factor dB” covers everything in the standard signal chain between the LISN/ISN/current clamp, and the EMI receiver. This includes a high-pass filter, a 10dB pad, and the coaxial cable to the EMI receiver.

When calibrating the chamber, we use a vector network analyzer (VNA) to measure the total power loss/gain from the connector going to the LISN/ISN/cable clamp to the connector going to the EMI receiver(s). This power loss/gain is our Cable Correction Factor.

Modifications to the Equipment Under Test: None

Test Results: This unit gets power from internal batteries, and has no connection to AC power lines. Therefore it meets the Class B conducted interference requirements of FCC Part 15 and ICES-003 without testing.



SIGNED________________________________DATE __August 29, 2011__
John R. Barnes, PRESIDENT dBi Corp.

TESTING AND MEASURING EQUIPMENT USED AT LEXMARK

Radiated Interference and Bandwidth Measurements 30-4,180MHz:

ARA Horn Antenna, 1GHz to 18GHz #0389	DRG-118/A, S/N 1091 (Cal date: 3/22/11, Cal due date: 3/22/13)
Schaffner-Chase BI-Log Antenna 30 to 1000 MHz #0507	CBL6111C, S/N 2460 (Cal date: 3/1/11, Cal due date: 3/1/13)
Schaffner-Chase BI-Log Antenna 30 to 1000 MHz #0508	CBL6111C, S/N 2449 (Cal date: 3/1/11, Cal due date: 3/1/13)
Rohde & Schwarz EMI Test Receiver #0549	ESI7, S/N 100009 (Cal date: 6/10/11, Cal due date: 6/10/13)
Rohde & Schwarz EMI Test Receiver #0632	ESIB7, S/N 100093 (Cal date: 5/12/11, Cal due date: 5/12/13)
Rohde & Schwarz EMI Test Receiver #0700	ESIB40, S/N 100148 (Cal date: 6/24/10, Cal due date: 6/24/12)

Calibration: The measuring equipment used at Lexmark is calibrated according to the instruction manual once a day. Once a week the accuracy of the test system is checked. This includes the test equipment, associated cables, and antennas. This is accomplished with a calibrated radiating source for the radiated measurements, and a synthesized signal generator for the conducted measurements.

RADIATED-EMISSIONS & BANDWIDTH TEST CONFIGURATION
3003-01
10m AND 5m SEMIANECHOIC CHAMBER
LEXMARK INTERNATIONAL, LEXINGTON KY.