

EMC EMISSIONS - TEST REPORT (Full)

Test Report No. **3162583DEN-004B** Issue Date: Thursday 2/Oct/2008

Model / Serial No. Model: EN Series [See Page 3]

Product Type EN Series Sensors, Transmitters & Receivers

Client Inovonics Wireless Corporation

Manufacturer Inovonics Wireless Corporation

License holder Inovonics Wireless Corporation

Address 315 - CTC Boulevard

Louisville, CO 80027

Test Criteria Applied
Test Result

CISPR 22: 2005 Class B

PASS

INFORMATION TECHNOLOGY
EQUIPMENT - RADIO DISTURBANCE
CHARACTERISTICS - LIMITS AND
METHODS AND MEASUREMENTS

Test Project Number
References
Total Pages
Including
Appendices:

3162583

19

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Michael Spataro

Reviewed By : Michael Spataro

REVISION SUMMARY - The following changes have been made to this Report:

Rev.	Revision Statement	Author	Revision Date
	Initial Release of Document	See above	See above

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Lab Number:
SL2-IN-E-029R

Lab Code:200264-0

The entity logos above are for reference only and may not apply to this test report.

DIRECTORY

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STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty for Conducted Emissions in the frequency range of 150kHz – 30MHz is calculated to be $\pm 2.30\text{dB}$ and for Radiated Emissions is calculated to be $\pm 3.60\text{dB}$ in the frequency range of 30MHz – 200MHz and $\pm 3.38\text{dB}$ in the frequency range of 200MHz – 1000MHz.

EUT Received Date: 28-Aug-2008

Testing Start Date: 28-Aug-2008

Testing End Date: 28-Aug-2008

The tests were performed according to following regulations:

1. EMC Directive 2004/108/EC
2. IEC/CISPR 22: 1997, +A1: 2000, +A2: 2002
3. EN 55022: 1998, +A1: 2000, +A2: 2003
4. FCC CFR47 Part 15
5. AS/NZS CISPR22: 2004/ VCCI-03: 2004
6. ICES-003, Issue-4

Emission Test Results:

Radiated Emissions (Electric Field) - Unintentional - PASS

Test Result

Minimum limit margin - 5.10 dB at 150.00 MHz

Remarks: Quasi-Peak Measurement - Vertical

GENERAL REMARKS: Products tested in a multi-product "bundle" per client.
Conducted Emissions is not required as the product is not packaged/shipped with an AC adapter included.

The following products were tested:

Model: EN1242	S/N: 3803181	Smoke Detector	
Model: EN1261HT	S/N: 3812502	Motion Sensor	
Model: EN7280	S/N: 3178518/ 3708448 [Kitted Product]	Translator Receiver Kit	

Sample:

Production Prototype See Appendix B

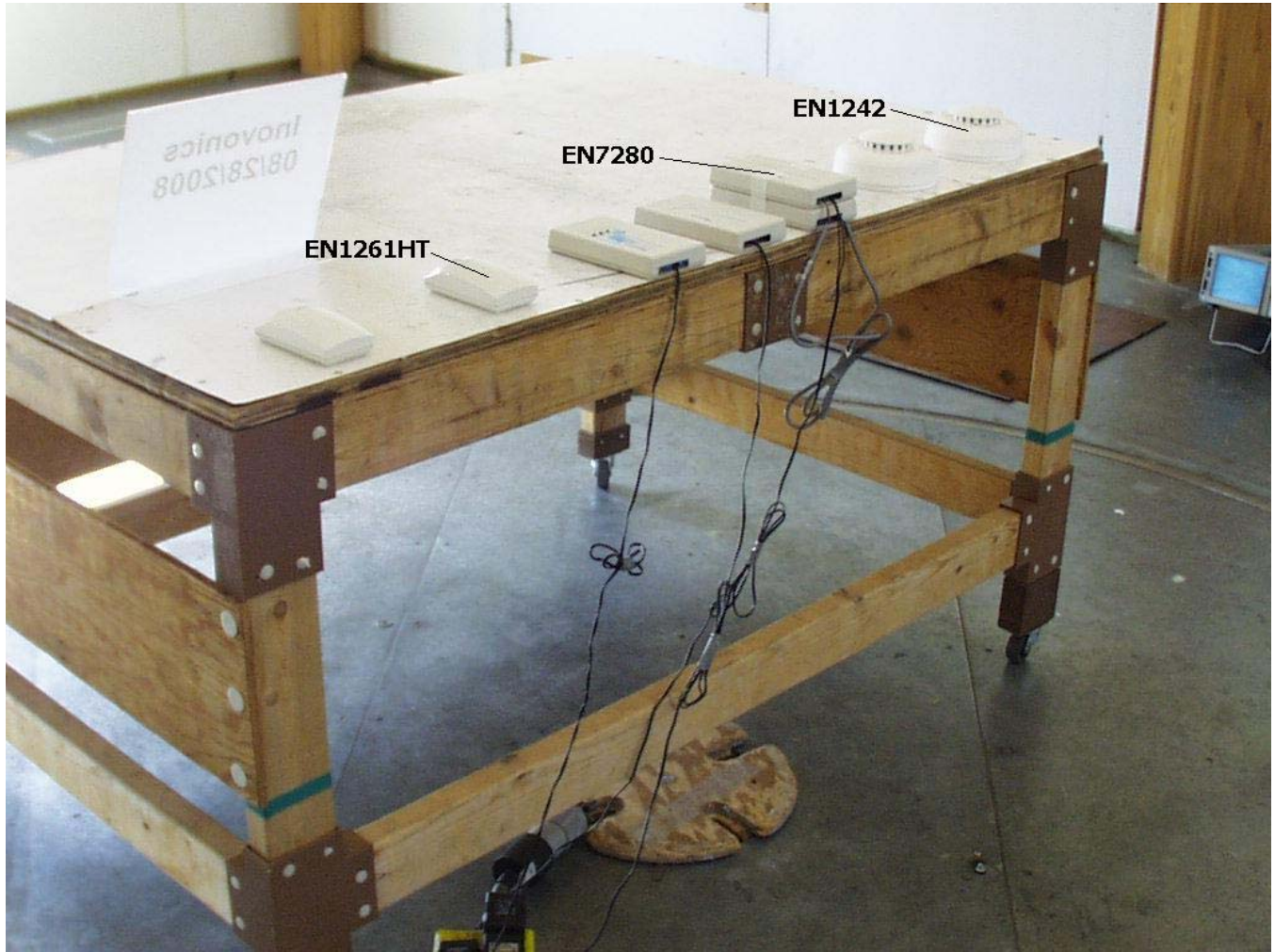
Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s):
Radiated Emissions



Test-setup photo(s):
Radiated Emissions



Appendix A

Test Data Sheets
and
Test Equipment Used

Radiated Emissions Data

Where Applicable the Data Flows as Follows:

**30-1000 MHz at 100VAC/50Hz, 110VAC/60Hz, 220VAC/60Hz, 230VAC/50Hz
>1000MHz at 110VAC/60Hz**

Radiated Electromagnetic Emissions

Test Report #: 8-28-08 Run 01	Test Area: Pinewood Site 1 (10m)	Temperature: 23.7 °C
Test Method: EN55022	Test Date: 28-Aug-2008	Relative Humidity: 36.9 %
EUT Model #: EN7280, EN1261HT, EN1242	EUT Power: 3 VDC Battery & 12VDC [AC Adapter]	Air Pressure: 99.7 kPa
EUT Serial #: 3178518/3708448, 3812502, 3803181		

Manufacturer: Inovonics
 EUT Description: EN Series Sensors, Transmitters & Receivers

Level Key	
Pk – Peak	Nb – Narrow Band
Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Notes: _____

 Tested in multi-product bundle per client

 Board Clocks: 16MHz, 4MHz, 32.768kHz, 10kHz, 12.8MHz

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) EN55022 B	DELTA2 (dB) EN55022 A
30-1000MHz Vertical 0 degrees						
32.00	27.4 Qp	1.6 / 19.5 / 28.2	20.3	V / 1.0 / 0.0	-9.7	-19.7
48.00	40.0 Qp	1.8 / 9.3 / 28.2	23.0	V / 1.0 / 0.0	-7.0	-17.0
72.00	41.0 Qp	2.3 / 8.0 / 28.1	23.1	V / 1.0 / 0.0	-6.9	-16.9
204.00	31.1 Qp	3.9 / 11.4 / 27.4	19.1	V / 1.0 / 0.0	-10.9	-20.9
228.00	26.3 Qp	4.1 / 11.0 / 27.2	14.2	V / 1.0 / 0.0	-15.8	-25.8
284.00	22.9 Qp	4.5 / 13.6 / 27.0	14.0	V / 1.0 / 0.0	-23.0	-33.0
320.00	23.8 Qp	4.8 / 14.1 / 27.2	15.5	V / 1.0 / 0.0	-21.5	-31.5
380.00	22.4 Qp	5.3 / 15.1 / 27.6	15.3	V / 1.0 / 0.0	-21.7	-31.7
400.00	23.2 Qp	5.5 / 15.6 / 27.7	16.6	V / 1.0 / 0.0	-20.4	-30.4
888.00	24.3 Qp	8.7 / 21.8 / 27.5	27.3	V / 1.0 / 0.0	-9.7	-19.7
960.00	23.1 Qp	9.1 / 22.4 / 27.3	27.3	V / 1.0 / 0.0	-9.7	-19.7
38.40	34.4 Qp	1.8 / 15.2 / 28.3	23.1	V / 1.0 / 0.0	-6.9	-16.9
448.00	22.6 Qp	5.9 / 16.8 / 28.1	17.2	V / 1.0 / 0.0	-19.8	-29.8
640.00	23.6 Qp	7.1 / 19.6 / 28.3	22.1	V / 1.0 / 0.0	-14.9	-24.9
768.00	22.1 Qp	8.2 / 20.8 / 28.0	23.0	V / 1.0 / 0.0	-14.0	-24.0
50.00	39.2 Qp	1.8 / 8.6 / 28.2	21.4	V / 1.0 / 0.0	-8.6	-18.6
150.00	28.3 Qp	3.2 / 12.6 / 27.7	16.4	V / 1.0 / 0.0	-13.6	-23.6
33.00	28.4 Qp	1.6 / 19.0 / 28.2	20.8	V / 1.0 / 0.0	-9.2	-19.2
528.00	22.2 Qp	6.3 / 18.0 / 28.3	18.3	V / 1.0 / 0.0	-18.7	-28.7
200.00	29.2 Qp	3.9 / 12.3 / 27.3	18.1	V / 1.0 / 0.0	-11.9	-21.9
250.00	32.8 Qp	4.2 / 11.7 / 27.2	21.5	V / 1.0 / 0.0	-15.5	-25.5
240.00	29.4 Qp	4.1 / 11.6 / 27.2	17.9	V / 1.0 / 0.0	-19.1	-29.1
157.19	32.4 Qp	3.3 / 12.5 / 27.7	20.4	V / 1.0 / 0.0	-9.6	-19.6
251.70	29.5 Qp	4.2 / 11.7 / 27.0	18.4	V / 1.0 / 0.0	-18.6	-28.6
267.55	30.1 Qp	4.4 / 13.1 / 27.2	20.5	V / 1.0 / 0.0	-16.5	-26.5
469.49	29.7 Qp	6.0 / 17.3 / 28.2	24.9	V / 1.0 / 0.0	-12.1	-22.1
607.75	26.9 Qp	7.0 / 18.9 / 28.3	24.5	V / 1.0 / 0.0	-12.5	-22.5
30-1000MHz Vertical 90 degrees						
380.00	27.9 Qp	5.3 / 15.1 / 27.6	20.7	V / 1.0 / 90.0	-16.3	-26.3
469.49	28.0 Qp	6.0 / 17.3 / 28.2	23.2	V / 1.0 / 90.0	-13.8	-23.8
607.75	27.1 Qp	7.0 / 18.9 / 28.3	24.7	V / 1.0 / 90.0	-12.3	-22.3
960.00	24.1 Qp	9.1 / 22.4 / 27.3	28.3	V / 1.0 / 90.0	-8.7	-18.7

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB/m) (dB)	(dBuV/m)	(m) (DEG)	EN55022 B	EN55022 A
30-1000 MHz Vertical 180 degrees						
469.49	29.6 Qp	6.0 / 17.3 / 28.2	24.7	V / 1.0 / 180.0	-12.3	-22.3
607.75	27.4 Qp	7.0 / 18.9 / 28.3	25.0	V / 1.0 / 180.0	-12.0	-22.0
30-1000MHz Vertical 270 degrees						
228.00	30.1 Qp	4.1 / 11.0 / 27.2	18.0	V / 1.0 / 270.0	-12.0	-22.0
251.70	31.1 Qp	4.2 / 11.7 / 27.0	19.9	V / 1.0 / 270.0	-17.1	-27.1
Following signals maximized between 30 & 1000MHz Vertical						
38.40	33.5 Qp	1.8 / 15.2 / 28.3	22.2	V / 1.0 / 18.0	-7.8	-17.8
48.00	39.6 Qp	1.8 / 9.3 / 28.2	22.7	V / 1.0 / 254.0	-7.3	-17.3
72.00	38.4 Qp	2.3 / 8.0 / 28.1	20.5	V / 1.0 / 178.0	-9.5	-19.5
160.00	33.1 Qp	3.3 / 12.4 / 27.7	21.2	V / 1.0 / 276.0	-8.8	-18.8
960.00	24.1 Qp	9.1 / 22.4 / 27.3	28.2	V / 1.0 / 354.0	-8.8	-18.8
150.00	36.8 Qp	3.2 / 12.6 / 27.7	24.9	V / 1.0 / 12.0	-5.1	-15.1
160.00	33.2 Qp	3.3 / 12.4 / 27.7	21.3	V / 1.0 / 276.0	-8.7	-18.7
30-1000MHz Horizontal 0 degrees						
48.00	24.4 Qp	1.8 / 9.3 / 28.2	7.4	H / 1.8 / 0.0	-22.6	-32.6
38.40	21.7 Qp	1.8 / 15.2 / 28.3	10.4	H / 1.8 / 0.0	-19.6	-29.6
50.00	32.6 Qp	1.8 / 8.6 / 28.2	14.8	H / 1.8 / 0.0	-15.2	-25.2
72.00	32.5 Qp	2.3 / 8.0 / 28.2	14.6	H / 1.8 / 0.0	-15.4	-25.4
150.00	29.2 Qp	3.2 / 12.6 / 27.7	17.3	H / 1.8 / 0.0	-12.7	-22.7
160.00	30.2 Qp	3.3 / 12.4 / 27.7	18.2	H / 1.8 / 0.0	-11.8	-21.8
250.00	24.9 Qp	4.2 / 11.7 / 27.2	13.7	H / 1.8 / 0.0	-23.3	-33.3
251.70	27.8 Qp	4.2 / 11.7 / 27.0	16.6	H / 1.8 / 0.0	-20.4	-30.4
267.55	23.5 Qp	4.4 / 13.1 / 27.2	13.8	H / 1.8 / 0.0	-23.2	-33.2
607.75	25.7 Qp	7.0 / 18.9 / 28.3	23.2	H / 1.8 / 0.0	-13.8	-23.8
960.00	21.9 Qp	9.1 / 22.4 / 27.3	26.0	H / 1.8 / 0.0	-11.0	-21.0
30-1000MHz Horizontal 90 degrees						
50.00	34.8 Qp	1.8 / 8.6 / 28.2	17.0	H / 1.8 / 90.0	-13.0	-23.0
250.00	24.4 Qp	4.2 / 11.7 / 27.2	13.1	H / 1.8 / 90.0	-23.9	-33.9
251.70	30.6 Qp	4.2 / 11.7 / 27.0	19.4	H / 1.8 / 90.0	-17.6	-27.6
267.55	23.8 Qp	4.4 / 13.1 / 27.2	14.1	H / 1.8 / 90.0	-22.9	-32.9
30-1000MHz Horizontal 180 degrees						
251.70	30.7 Qp	4.2 / 11.7 / 27.0	19.5	H / 1.8 / 180.0	-17.5	-27.5
30-1000MHz Horizontal 270 degrees						
No higher signals found: 30-1000MHz Horizontal 270 degrees						
Following signals maximized between 30 & 1000MHz Horizontal						
48.00	32.9 Qp	1.8 / 9.3 / 28.2	15.9	H / 2.4 / 356.0	-14.1	-24.1
72.00	40.6 Qp	2.3 / 8.0 / 28.2	22.7	H / 2.7 / 168.0	-7.3	-17.3
150.00	36.6 Qp	3.2 / 12.6 / 27.7	24.7	H / 2.8 / 208.0	-5.3	-15.3

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	EN55022 B	EN55022 A
160.00	34.0 Qp	3.3 / 12.4 / 27.7	22.0	H / 2.5 / 286.0	-8.0	-18.0
960.00	23.1 Qp	9.1 / 22.4 / 27.3	27.3	H / 1.3 / 12.0	-9.7	-19.7

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB\m) (dB)	(dBuV/m)	(m) (DEG)	EN55022 B	EN55022 A
***** Measurement Summary *****						
150.00	36.8 Qp	3.2 / 12.6 / 27.7	24.9	V / 1.0 / 12.0	-5.1	-15.1
38.40	34.4 Qp	1.8 / 15.2 / 28.3	23.1	V / 1.0 / 0.0	-6.9	-16.9
72.00	41.0 Qp	2.3 / 8.0 / 28.1	23.1	V / 1.0 / 0.0	-6.9	-16.9
48.00	40.0 Qp	1.8 / 9.3 / 28.2	23.0	V / 1.0 / 0.0	-7.0	-17.0
160.00	34.0 Qp	3.3 / 12.4 / 27.7	22.0	H / 2.5 / 286.0	-8.0	-18.0
50.00	39.2 Qp	1.8 / 8.6 / 28.2	21.4	V / 1.0 / 0.0	-8.6	-18.6
960.00	24.1 Qp	9.1 / 22.4 / 27.3	28.3	V / 1.0 / 90.0	-8.7	-18.7
33.00	28.4 Qp	1.6 / 19.0 / 28.2	20.8	V / 1.0 / 0.0	-9.2	-19.2
157.19	32.4 Qp	3.3 / 12.5 / 27.7	20.4	V / 1.0 / 0.0	-9.6	-19.6
32.00	27.4 Qp	1.6 / 19.5 / 28.2	20.3	V / 1.0 / 0.0	-9.7	-19.7
888.00	24.3 Qp	8.7 / 21.8 / 27.5	27.3	V / 1.0 / 0.0	-9.7	-19.7
204.00	31.1 Qp	3.9 / 11.4 / 27.4	19.1	V / 1.0 / 0.0	-10.9	-20.9
200.00	29.2 Qp	3.9 / 12.3 / 27.3	18.1	V / 1.0 / 0.0	-11.9	-21.9
228.00	30.1 Qp	4.1 / 11.0 / 27.2	18.0	V / 1.0 / 270.0	-12.0	-22.0
607.75	27.4 Qp	7.0 / 18.9 / 28.3	25.0	V / 1.0 / 180.0	-12.0	-22.0
469.49	29.7 Qp	6.0 / 17.3 / 28.2	24.9	V / 1.0 / 0.0	-12.1	-22.1
768.00	22.1 Qp	8.2 / 20.8 / 28.0	23.0	V / 1.0 / 0.0	-14.0	-24.0
640.00	23.6 Qp	7.1 / 19.6 / 28.3	22.1	V / 1.0 / 0.0	-14.9	-24.9
250.00	32.8 Qp	4.2 / 11.7 / 27.2	21.5	V / 1.0 / 0.0	-15.5	-25.5
380.00	27.9 Qp	5.3 / 15.1 / 27.6	20.7	V / 1.0 / 90.0	-16.3	-26.3
267.55	30.1 Qp	4.4 / 13.1 / 27.2	20.5	V / 1.0 / 0.0	-16.5	-26.5
251.70	31.1 Qp	4.2 / 11.7 / 27.0	19.9	V / 1.0 / 270.0	-17.1	-27.1
528.00	22.2 Qp	6.3 / 18.0 / 28.3	18.3	V / 1.0 / 0.0	-18.7	-28.7
240.00	29.4 Qp	4.1 / 11.6 / 27.2	17.9	V / 1.0 / 0.0	-19.1	-29.1
448.00	22.6 Qp	5.9 / 16.8 / 28.1	17.2	V / 1.0 / 0.0	-19.8	-29.8
400.00	23.2 Qp	5.5 / 15.6 / 27.7	16.6	V / 1.0 / 0.0	-20.4	-30.4
320.00	23.8 Qp	4.8 / 14.1 / 27.2	15.5	V / 1.0 / 0.0	-21.5	-31.5
284.00	22.9 Qp	4.5 / 13.6 / 27.0	14.0	V / 1.0 / 0.0	-23.0	-33.0

List of Equipment Utilized for Final Test

Project Report

Begin Date: 8/28/2008 **End Date:** 8/28/2008

Technician Randall Thompson

Project 3162583

Capital Asset ID	Manufacturer	Model #	Serial #	Description	Test Performed	Service Type	Service Date	Service Due
18880	Hewlett-Packard	85650A	2811A01300	Q.P Adapter	R Radiated Emissions	For Cal	11/15/2007	11/15/2008
18882	Hewlett-Packard	8566B	2410A00154	Spectrum Analyzer (dc-22 GHz)	R Radiated Emissions	For Cal	11/13/2007	11/13/2008
18912	Hewlett-Packard	8447F	3113A05545	9 kHz- 1.3GHz Pre Amp	R Radiated Emissions	For Ver	5/2/2008	5/2/2009
19937	Sunol Sciences	JB6	019937	BiLog 30 to 2GHz	R Radiated Emissions	For Cal	12/19/2007	12/19/2008

Appendix B

Test Plan & Constructional Data Form

[To be provided by Client]

Appendix C

Measurement Protocol

And

Test Procedures

MEASUREMENT PROTOCOL

GENERAL INFORMATION

Test Methodology

Conducted and radiated emission testing is performed according to the procedures in ANSI C63.4 & CNS13438.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into its characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dB μ V, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the applicable limit.

To convert between dB μ V and μ V, the following conversions apply:

- dB μ V = 20(log μ V)
- μ V = Inverse log(dB μ V/20)

RADIATED EMISSIONS

The final level, expressed in dB μ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB μ V) and adding the antenna correction factor and cable loss factor (Factor dB) to it. This result then has the applicable limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment B. The amplifier gain is automatically accounted for by using an analyzer offset.

Example: At a Test Frequency of 30 MHz, with a peak reading on the spectrum analyzer or measuring receiver of 14 dB μ V:

Measured Level	+	Transducer & Cable Loss factor	=	Corrected Reading	Specification Limit	-	Corrected Reading	=	Delta Specification
(dB μ V)		(dB)		(dB μ V/m)	(dB μ V/m)		(dB μ V/m)		
14.0		14.9		28.9	40.0		28.9		-11.1

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-2003 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω /50 μ H (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 22GHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3, 10 or 30 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees.

Conducted Emissions Diagram:

