

**IAL****INTERNATIONAL APPROVALS  
LABORATORIES****EMC EMISSIONS - TEST REPORT (In-Part)**Test Report No. **BC300339-1a** Issue Date: **Thu 11/Sep/2003**Model / Serial No. **ES1223 / SN: 1**Product Type **Small Pendant**Client **Inovonics Wireless**Manufacturer **Inovonics Wireless**License holder **Inovonics Wireless**Address **315 CTC Boulevard****Louisville, CO 80027**Test Criteria Applied **FCC Part 15.247**  
Test Result **PASS**Test Project Number **BC300339-1a** FCC CFR47 Part 15: Radio Frequency  
References **BC300339-1a** Devices  
Total Pages **23**  
Including  
Appendices:*Todd Seeley**Robert Cresswell*

Reviewed By : Todd Seeley

Approved By : Robert Cresswell

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Lab Code: 200624-0

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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: 26-August-2003

Testing Start Date: 26-August-2003

Testing End Date: 11-Sep-2003

**The tests were performed according to following regulations :**

1. FCC CFR47 Part 15.209
2. FCC CFR47 Part 15.205
3. FCC CFR47 Part 15.247 (b) & (c)

**Emission Test Results:**

**Conducted Emissions, Powerline - 15.207 (not applicable)**

**Test Result**

Minimum limit margin \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Maximum limit exceeding \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

**Radiated Emissions (Electric Field) - 15.209 - PASS**

**Test Result**

Minimum limit margin 16.70 dB at 811.66 MHz

Maximum limit exceeding \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

**Radiated Emissions (Electric Field) - 15.247(b) - PASS**

**Test Result**

Minimum limit margin 26.58 dB at 902.41 MHz

Maximum limit exceeding \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

**Radiated Emissions (Electric Field) - 15.247(c) - PASS**

**Test Result**

Minimum limit margin 8.18 dB at 3609.51 MHz

Maximum limit exceeding \_\_\_\_\_ dB at \_\_\_\_\_ MHz

Remarks: \_\_\_\_\_

**GENERAL REMARKS: None**

Modifications required to pass: None

Test Specification Deviations: Additions to or Exclusions from: None

Test-setup photo(s):  
Unintentional Radiated Emissions



Test-setup photo(s):  
Unintentional Radiated Emissions



Test-setup photo(s):  
Intentional Radiated Emissions



Test-setup photo(s):  
Intentional Radiated Emissions



**Appendix A**

Test Data Sheets  
and  
Test Equipment Used



# Unintentional Radiated Emissions

Test Report #: **BC300339 Run 10**  
 Test Method: FCC Part 15.209  
 EUT Model #: ES1223, ES1233, ES1260, ES1247  
 EUT Serial #: 1, 1, 1, 1  
 Manufacturer: Inovonics  
 EUT Description: Security Transmitters  
 Notes: All four units are being tested simultaneously  
 All transmitters are hopping, normal operation

Test Area: Pinewood Site 1 (3m)  
 Test Date: 11-Sep-2003  
 EUT Power: 3 VDC

Temperature: 21.6 °C  
 Relative Humidity: 54 %  
 Air Pressure: 81 kPa

Page: 1 of 5

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

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC B (< 1GHz)	DELTA2 (dB) FCC B (> 1GHz)
Log Antenna, Vertical, 200-1,000 MHz						
0 degrees						
No emissions detected						
90 degrees						
No emissions detected						
180 degrees						
No emissions detected						
270 degrees						
No emissions detected						
The following reading is a noise floor measurement						
760.36	21.6 Qp	2.4 / 21.2 / 28.2	17.0	V / 1.0 / 0.0	-29.0	N/A
0 degrees						
No emissions detected						
90 degrees						
811.66	32.3 Qp	2.4 / 21.7 / 28.3	28.1	H / 1.0 / 0.0	-17.9	N/A
180 degrees						
No emissions detected						
270 degrees						
No emissions detected						
Maximized emissions, Horizontal from 200-1,000 MHz						
811.66	33.5 Qp	2.4 / 21.7 / 28.3	29.3	H / 1.2 / 129.0	-16.7	N/A
Bicon Antenna, 0 degrees						

# Unintentional Radiated Emissions

Test Report #: **BC300339 Run 10**  
 Test Method: FCC Part 15.209  
 EUT Model #: ES1223, ES1233, ES1260, ES1247  
 EUT Serial #: 1, 1, 1, 1  
 Manufacturer: Inovonics  
 EUT Description: Security Transmitters  
 Notes: All four units are being tested simultaneously  
 All transmitters are hopping, normal operation

Test Area: Pinewood Site 1 (3m)  
 Test Date: 11-Sep-2003  
 EUT Power: 3 VDC

Temperature: 21.6 °C  
 Relative Humidity: 54 %  
 Air Pressure: 81 kPa

Page: 2 of 5

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

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC B (< 1GHz)	DELTA2 (dB) FCC B (> 1GHz)
No emissions detected						
90 degrees						
No emissions detected						
180 degrees						
No emissions detected						
270 degrees						
No emissions detected						
Changing to Horizontal polarization						
0 degrees						
The following reading is a noise floor measurement						
The antenna is Vertical for the following reading						
30.00	28.4 Qp	0.6 / 13.1 / 28.3	13.8	V / 1.2 / 129.0	-26.2	N/A
Horiz. 0 degees						
No emissions detected						
90 degrees						
No emissions detected						
180 degrees						
No emissions detected						
270 degrees						
No emissions detected						
The following reading is a noise floor measurement						
30.00	23.6 Qp	0.6 / 13.1 / 28.3	9.0	H / 2.2 / 0.0	-31.0	N/A

# Unintentional Radiated Emissions

Test Report #: **BC300339 Run 10**  
 Test Method: FCC Part 15.209  
 EUT Model #: ES1223, ES1233, ES1260, ES1247  
 EUT Serial #: 1, 1, 1, 1  
 Manufacturer: Inovonics  
 EUT Description: Security Transmitters  
 Notes: All four units are being tested simultaneously  
 All transmitters are hopping, normal operation

Test Area: Pinewood Site 1 (3m)  
 Test Date: 11-Sep-2003  
 EUT Power: 3 VDC

Temperature: 21.6 °C  
 Relative Humidity: 54 %  
 Air Pressure: 81 kPa

Page: 3 of 5

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dB/m) (dB)	(dBuV/m)	(m) (DEG)	FCC B (< 1GHz)	FCC B (> 1GHz)
Horn Antenna, Vertical						
0 degrees						
No emissions detected						
90 degrees						
No emissions detected						
180 degrees						
No emissions detected						
270 degrees						
no emissions detected						
The following two readings are noise floor						
1000.00	35.5 Av	2.5 / 24.9 / 37.1	25.7	V / 1.0 / 0.0	N/A	-28.3
2500.00	36.5 Av	4.9 / 29.1 / 36.1	34.4	V / 1.0 / 0.0	N/A	-19.6
Horizontal, 0 degrees						
No emissions detected						
90 degrees						
No emissions detected						
180 degrees						
No emissions detected						
270 degrees						
No emissions detected						
The following two readings are noise floor						

# Unintentional Radiated Emissions

Test Report #: **BC300339 Run 10**  
 Test Method: FCC Part 15.209  
 EUT Model #: ES1223, ES1233, ES1260, ES1247  
 EUT Serial #: 1, 1, 1, 1  
 Manufacturer: Inovonics  
 EUT Description: Security Transmitters  
 Notes: All four units are being tested simultaneously  
 All transmitters are hopping, normal operation

Test Area: Pinewood Site 1 (3m)  
 Test Date: 11-Sep-2003  
 EUT Power: 3 VDC

Temperature: 21.6 °C  
 Relative Humidity: 54 %  
 Air Pressure: 81 kPa

Page: 4 of 5

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

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB/m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC B (< 1GHz)	DELTA2 (dB) FCC B (> 1GHz)
1000.00	35.1 Av	2.5 / 24.9 / 37.1	25.4	H / 1.0 / 0.0	N/A	-28.6
2500.00	36.4 Av	4.9 / 29.1 / 36.1	34.3	H / 1.0 / 0.0	N/A	-19.7
Checking from 4-5 GHz						
Horizontal, 0 degrees						
No emissions detected						
90 degrees						
No emissions detected						
180 degree						
No emissions detected						
270 degrees						
No emissions detected						
The following readings are noise floor measurements						
4000.00	34.0 Av	4.8 / 33.0 / 37.6	34.1	H / 1.0 / 0.0	N/A	-19.9
5000.00	34.2 Av	5.7 / 34.7 / 38.2	36.4	H / 1.0 / 0.0	N/A	-17.6
Changing to Vertical						
No emissions found: 4 to 5 GHz Horizontal.						
Noise floor.						
4500.00	34.8 Av	5.2 / 32.9 / 39.0	33.9	V / 1.0 / 0.0	N/A	-20.1

# Unintentional Radiated Emissions

Test Report #: **BC300339 Run 10**  
 Test Method: FCC Part 15.209  
 EUT Model #: ES1223, ES1233, ES1260, ES1247  
 EUT Serial #: 1, 1, 1, 1  
 Manufacturer: Inovonics  
 EUT Description: Security Transmitters  
 Notes: All four units are being tested simultaneously  
 All transmitters are hopping, normal operation

Test Area: Pinewood Site 1 (3m)  
 Test Date: 11-Sep-2003  
 EUT Power: 3 VDC  
 Temperature: 21.6 °C  
 Relative Humidity: 54 %  
 Air Pressure: 81 kPa  
 Page: 5 of 5

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

FREQ (MHz)	LEVEL (dBuV)	CABLE / ANT / PREAMP (dB) (dB\m) (dB)	FINAL (dBuV/m)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) FCC B (< 1GHz)	DELTA2 (dB) FCC B (> 1GHz)
<b>***** Measurement Summary *****</b>						
811.66	33.5 Qp	2.4 / 21.7 / 28.3	29.3	H / 1.2 / 129.0	-16.7	N/A
5000.00	34.2 Av	5.7 / 34.7 / 38.2	36.4	H / 1.0 / 0.0	N/A	-17.6
2500.00	36.5 Av	4.9 / 29.1 / 36.1	34.4	V / 1.0 / 0.0	N/A	-19.6
4000.00	34.0 Av	4.8 / 33.0 / 37.6	34.1	H / 1.0 / 0.0	N/A	-19.9
4500.00	34.8 Av	5.2 / 32.9 / 39.0	33.9	V / 1.0 / 0.0	N/A	-20.1
30.00	28.4 Qp	0.6 / 13.1 / 28.3	13.8	V / 1.2 / 129.0	-26.2	N/A
1000.00	35.5 Av	2.5 / 24.9 / 37.1	25.7	V / 1.0 / 0.0	N/A	-28.3
760.36	21.6 Qp	2.4 / 21.2 / 28.2	17.0	V / 1.0 / 0.0	-29.0	N/A

# Intentional Radiated Emissions

Test Report #: **BC300339 Run 09**  
 Test Method: **FCC CFR47 Part 15.247**  
 EUT Model #: **ES1223**  
 EUT Serial #: **1**  
 Manufacturer: **Inovonics**  
 EUT Description: **Small Pendant**  
 Notes: **Shield Was added to the RF Section to Pass**

Test Area: **Pinewood Site 1 (3m)**  
 Test Date: **09-Sep-2003**  
 EUT Power: **3 VDC**

Temperature: **21.6** °C  
 Relative Humidity: **54** %  
 Air Pressure: **81** kPa  
 Page: **1** of **3**

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	15.247(b)	15.247(c)

Testing was completed utilizing maximum amplitude peaks for this device considering the device could not be taken into a CW Mode of operation. Care was taken through the maximization process to ensure that the maximum amplitude peaks were observed and recorded.

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) emissions and delta limits were calculated as follows:

Final Corrected Peak Measurement – Duty Cycle Correction Factor\* = Final Calculated Emission

The Final Calculated Emission was then compared to the Limits in CFR47 Part 15.209 and the emission/limit delta was calculated.

In this case, the maximum time that the carrier would dwell on any hopping channel is 5mS in a 100mS window. Therefore, the maximum Duty Cycle correction factor of 20dB was utilized in the calculation for the final measurement.

\* the DTCF is calculated as follows  $20 \cdot \log_{10}(\text{duty cycle in } 100\text{mS})$  "not to exceed 20dB"

Low Channel						
902.41	79.0 Pk	2.5 / 22.9 / 0.0	104.4	V / 1.2 / 98.0	-26.58	N/A
902.41	76.2 Pk	2.5 / 22.9 / 0.0	101.5	H / 1.0 / 355.0	-29.48	N/A
Mid Channel						
914.81	76.0 Pk	2.5 / 22.9 / 0.0	101.4	H / 1.0 / 0.0	-29.58	N/A
914.81	78.0 Pk	2.5 / 22.9 / 0.0	103.4	V / 1.2 / 95.0	-27.58	N/A
High Channel						
927.62	78.0 Pk	2.5 / 23.2 / 0.0	103.7	V / 1.2 / 95.0	-27.28	N/A
927.62	74.8 Pk	2.5 / 23.2 / 0.0	100.5	H / 1.1 / 5.0	-30.48	N/A
Mid Channel						
1829.58	75.5 Pk	4.3 / 27.8 / 38.0	69.6	H / 1.0 / 194.0	N/A	-19.5
2744.35	65.0 Pk	4.4 / 29.7 / 37.7	61.4	H / 1.0 / 10.0	N/A	-12.58
3659.11	65.8 Pk	5.2 / 32.1 / 38.1	65.0	H / 1.7 / 234.0	N/A	-8.98
4573.89	54.0 Pk	5.2 / 33.2 / 38.9	53.4	H / 1.3 / 238.0	N/A	-20.58
5488.65	45.2 Pk	6.4 / 34.7 / 37.7	48.6	H / 1.5 / 341.0	N/A	-40.5
6403.28	48.3 Pk	8.5 / 35.4 / 39.8	52.3	H / 1.0 / 128.0	N/A	-36.8
7318.03	46.8 Pk	8.4 / 36.8 / 40.5	51.5	H / 1.5 / 128.0	N/A	-37.60
8232.83	49.0 Pk	9.0 / 38.2 / 45.9	50.2	H / 1.4 / 45.0	N/A	-23.78
9147.65	51.8 Pk	8.3 / 38.7 / 48.0	50.7	H / 1.2 / 0.0	N/A	-23.28

# Intentional Radiated Emissions



Test Report #: **BC300339 Run 09**  
 Test Method: **FCC CFR47 Part 15.247**  
 EUT Model #: **ES1223**  
 EUT Serial #: **1**  
 Manufacturer: **Inovonics**  
 EUT Description: **Small Pendant**  
 Notes: **Shield Was added to the RF Section to Pass**

Test Area: **Pinewood Site 1 (3m)**  
 Test Date: **09-Sep-2003**  
 EUT Power: **3 VDC**

Temperature: **21.6** °C  
 Relative Humidity: **54** %  
 Air Pressure: **81** kPa  
 Page: **2** of **3**

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	15.247(b)	15.247(c)
9147.68	50.6 Pk	8.3 / 38.7 / 48.0	49.6	V / 1.5 / 142.0	N/A	-24.38
8232.80	50.1 Pk	9.0 / 38.2 / 45.9	51.3	V / 1.3 / 149.0	N/A	-22.68
7318.05	52.1 Pk	8.4 / 36.8 / 40.5	56.8	V / 1.5 / 201.0	N/A	-32.3
6403.28	48.8 Pk	8.5 / 35.4 / 39.8	52.8	V / 1.5 / 15.0	N/A	-36.3
5488.62	48.1 Pk	6.4 / 34.7 / 37.7	51.4	V / 1.2 / 236.0	N/A	-22.58
4573.88	49.8 Pk	5.2 / 33.2 / 38.9	49.2	V / 2.6 / 236.0	N/A	-24.78
3659.11	61.6 Pk	5.2 / 32.1 / 38.1	60.8	V / 1.5 / 305.0	N/A	-13.18
2744.34	65.8 Pk	4.4 / 29.7 / 37.7	62.2	V / 1.2 / 234.0	N/A	-11.78
1829.58	75.4 Pk	4.3 / 27.8 / 38.0	69.5	V / 1.2 / 309.0	N/A	-19.6
High Channel						
1855.18	74.2 Pk	4.4 / 27.9 / 37.8	68.7	V / 1.0 / 297.0	N/A	-20.4
2782.75	67.2 Pk	4.3 / 29.8 / 36.8	64.6	V / 1.7 / 298.0	N/A	-9.38
3710.31	62.2 Pk	5.2 / 32.2 / 36.8	62.8	V / 1.9 / 278.0	N/A	-11.18
4637.84	47.6 Pk	5.3 / 33.4 / 38.9	47.3	V / 1.2 / 343.0	N/A	-26.68
5565.43	48.9 Pk	6.6 / 34.7 / 37.7	52.5	V / 1.2 / 238.0	N/A	-36.6
6492.88	45.7 Pk	8.7 / 35.5 / 40.5	49.4	V / 1.2 / 200.0	N/A	-39.7
7420.45	46.1 Pk	8.2 / 36.7 / 39.9	51.0	V / 1.8 / 210.0	N/A	-22.98
8348.04	51.1 Pk	8.9 / 38.0 / 46.0	52.1	V / 1.5 / 188.0	N/A	-21.88
9275.72	45.3 Pk	8.3 / 38.8 / 48.1	44.3	V / 1.5 / 0.0	N/A	-29.68
9275.64	47.1 Pk	8.3 / 38.8 / 48.1	46.1	H / 1.0 / 0.0	N/A	-27.88
8348.05	52.6 Pk	8.9 / 38.0 / 46.0	53.6	H / 1.7 / 105.0	N/A	-20.38
7420.52	43.8 Pk	8.2 / 36.7 / 39.9	48.7	H / 1.2 / 70.0	N/A	-25.28
6492.89	45.6 Pk	8.7 / 35.5 / 40.5	49.4	H / 1.2 / 217.0	N/A	-39.7
5565.44	46.4 Pk	6.6 / 34.7 / 37.7	50.0	H / 1.3 / 58.0	N/A	-39.1
4637.87	52.5 Pk	5.3 / 33.4 / 38.9	52.2	H / 1.3 / 247.0	N/A	-21.78
3710.30	62.8 Pk	5.2 / 32.2 / 36.8	63.4	H / 1.6 / 231.0	N/A	-10.58
2782.75	68.0 Pk	4.3 / 29.8 / 36.8	65.4	H / 1.2 / 172.0	N/A	-8.58
1855.19	74.2 Pk	4.4 / 27.9 / 37.8	68.7	H / 1.2 / 15.0	N/A	-20.4

# Intentional Radiated Emissions



Test Report #: **BC300339 Run 09**  
 Test Method: **FCC CFR47 Part 15.247**  
 EUT Model #: **ES1223**  
 EUT Serial #: **1**  
 Manufacturer: **Inovonics**  
 EUT Description: **Small Pendent**  
 Notes: **Shield Was added to the RF Section to Pass**

Test Area: **Pinewood Site 1 (3m)**  
 Test Date: **09-Sep-2003**  
 EUT Power: **3 VDC**

Temperature: **21.6** °C  
 Relative Humidity: **54** %  
 Air Pressure: **81** kPa  
 Page: **3** of **3**

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	DELTA1 (dB)	DELTA2 (dB)
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	15.247(b)	15.247(c)
Low Channel						
1804.78	76.0 Pk	4.2 / 27.7 / 38.1	69.9	H / 1.1 / 168.0	N/A	-19.2
2707.15	66.5 Pk	4.5 / 29.6 / 36.2	64.4	H / 1.6 / 214.0	N/A	-9.58
3609.51	65.5 Pk	5.3 / 32.0 / 36.9	65.8	H / 1.5 / 233.0	N/A	-8.18
4511.87	59.0 Pk	5.2 / 32.9 / 39.0	58.1	H / 1.5 / 67.0	N/A	-15.88
5414.20	40.8 Pk	6.3 / 34.7 / 37.6	44.1	H / 1.5 / 67.0	N/A	-45
6316.48	45.6 Pk	8.3 / 35.3 / 39.3	49.9	H / 1.0 / 112.0	N/A	-39.2
7218.89	44.2 Pk	8.5 / 36.9 / 40.8	48.9	H / 1.4 / 10.0	N/A	-25.08
8121.20	51.6 Pk	9.0 / 38.4 / 45.9	53.1	H / 1.8 / 80.0	N/A	-20.88
9023.65	46.0 Pk	8.2 / 38.5 / 47.8	44.9	H / 1.8 / 82.0	N/A	-29.08
9023.53	48.0 Pk	8.2 / 38.5 / 47.8	46.8	V / 1.2 / 15.0	N/A	-27.18
8121.24	52.3 Pk	9.0 / 38.4 / 45.9	53.8	V / 1.5 / 187.0	N/A	-20.18
7218.85	47.4 Pk	8.5 / 36.9 / 40.8	52.0	V / 1.9 / 214.0	N/A	-21.98
6316.48	45.8 Pk	8.3 / 35.3 / 39.3	50.1	V / 1.2 / 10.0	N/A	-39
5414.25	39.4 Pk	6.3 / 34.7 / 37.6	42.7	V / 1.2 / 10.0	N/A	-46.4
4511.82	52.4 Pk	5.2 / 32.9 / 39.0	51.5	V / 1.4 / 210.0	N/A	-22.48
3609.51	62.5 Pk	5.3 / 32.0 / 36.9	62.9	V / 1.4 / 83.0	N/A	-11.08
2707.15	65.4 Pk	4.5 / 29.6 / 36.2	63.3	V / 1.7 / 285.0	N/A	-10.68
1804.78	76.0 Pk	4.2 / 27.7 / 38.1	69.8	V / 1.0 / 309.0	N/A	-19.3



# Project Report

**Begin Date:** 8/26/2003

**Technician** Mike Spataro

**Project:** BC300339

Capital Asset ID	Manufacturer	Model #	Serial #	Description	Test Performed	Cal Date	Cal Due
106	TENSOR	4105	2020	Ridged Guide Antenna 1-18GHz	R Radiated Emissions	7/11/2003	7/11/2004
138	EMC TEST SYSTEMS	3109	3142	Biconical Antenna 30-3000MHz	R Radiated Emissions	9/30/2002	9/30/2003
202	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	R Radiated Emissions	4/23/2003	4/23/2004
203	Avantek	AFT97-8434-10F	1007	RF Pre-Amplifier (4-8 GHz)	R Radiated Emissions	4/23/2003	4/23/2004
209	Hewlett-Packard	85662A	2403A08749	Display Section	R Radiated Emissions	10/21/2002	10/21/2003
210	Hewlett-Packard	8566B	2410A00154	Spectrum Analyzer (dc-22 GHz)	R Radiated Emissions	10/21/2002	10/21/2003
211	Hewlett-Packard	85650A	2043A00256	Quasi Peak Adapter (set 1)	R Radiated Emissions	9/17/2003	9/17/2004
213	Mini-Circuits Lab	ZHL-42	N052792-2	Amplifier	R Radiated Emissions	6/20/2003	6/20/2004
217	EMCO	3146	9203-3376	Log Periodic Antenna	R Radiated Emissions	9/11/2002	10/11/2003
248	Hewlett-Packard	8447F	3113A05545	9 kHz- 1.3GHz Pre Amp	R Radiated Emissions	6/5/2003	6/5/2004

Friday, September 19, 2003

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**Appendix B**

Test Plan  
and  
Constructional Data Form

**To be supplied by Customer**

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 $\mu$ 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 $\mu$ V and  $\mu$ V, the following conversions apply:

- dB $\mu$ V = 20(log  $\mu$ V)
- $\mu$ V = Inverse log(dB $\mu$ V/20)

### RADIATED EMISSIONS

The final level, expressed in dB $\mu$ V/m, is arrived at by taking the reading from the spectrum analyzer (Level dB $\mu$ 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 $\mu$ V:*

Measured Level		Transducer & Cable Loss factor		Corrected Reading	Specification Limit		Corrected Reading		Delta Specification
(dB $\mu$ V)	+	(dB)	=	(dB $\mu$ V/m)	(dB $\mu$ V/m)	-	(dB $\mu$ V/m)	=	
<b>14.0</b>		<b>14.9</b>		<b>28.9</b>	<b>40.0</b>		<b>28.9</b>		<b>-11.1</b>

## DETAILS OF TEST PROCEDURES

### *General Standard Information*

The test methods used comply with ANSI C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

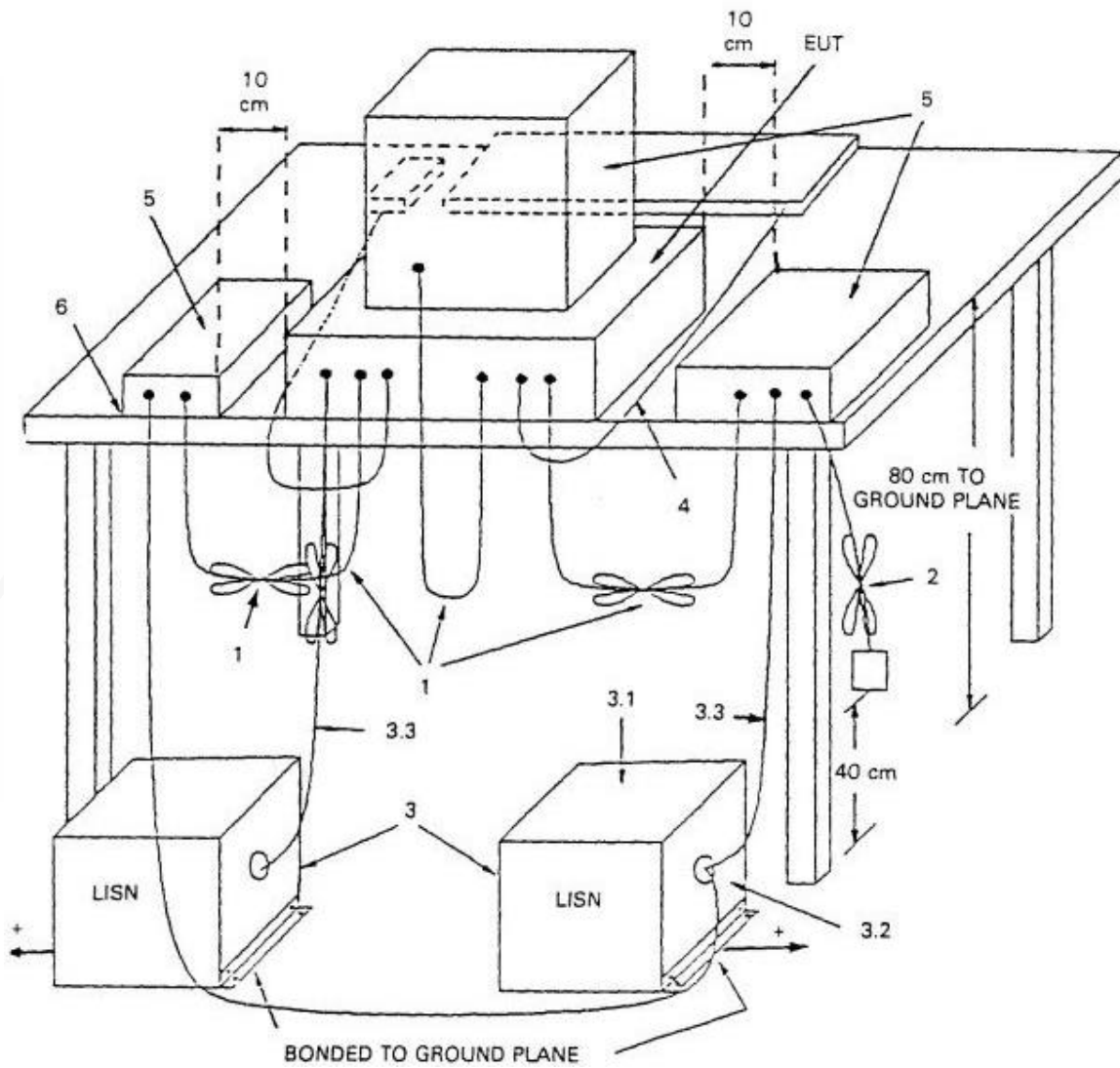
### **Conducted Emissions**

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  $\Omega$ /50  $\mu$ 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:**



**Radiated Emissions Diagram:**

