

**IAL****INTERNATIONAL APPROVALS
LABORATORIES****EMC EMISSIONS - TEST REPORT (In-Part)**Test Report No. **BC300339-1b** Issue Date: **Thu 11/Sep/2003**Model / Serial No. **ES1233 / SN: 1**Product Type **Large Pendent**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 **BC300339-1b** FCC CFR47 Part 15: Radio Frequency
References **BC300339-1b** 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

**Accredited**

D I R E C T O R Y

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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: 2-Sep-2003

Testing Start Date: 2-Sep-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 0811.6 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 902.4 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

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Page: 2 of 5

Level Key	
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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**
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Page: 3 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)
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	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)
***** Measurement Summary *****						
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 07**
 Test Method: CFF CFR47 Part 15.247
 EUT Model #: ES1233
 EUT Serial #: 1
 Manufacturer: Inovonics
 EUT Description: Large Pendant
 Notes:

Test Area: Pinewood Site 1 (3m)
 Test Date: 02-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) (dB/m) (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 $20 \cdot \log_{10}(\text{duty cycle in 100mS})$ "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
9147.68	50.6 Pk	8.3 / 38.7 / 48.0	49.6	V / 1.5 / 142.0	N/A	-24.38

Intentional Radiated Emissions

Test Report #: **BC300339 Run 07**
 Test Method: CFF CFR47 Part 15.247
 EUT Model #: ES1233
 EUT Serial #: 1
 Manufacturer: Inovonics
 EUT Description: Large Pendent

Test Area: Pinewood Site 1 (3m)
 Test Date: 02-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	

Notes:

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)
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
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

Intentional Radiated Emissions

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Test Area: Pinewood Site 1 (3m)
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 Relative Humidity: 54 %
 Air Pressure: 81 kPa
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Level Key	
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Qp – QuasiPeak	Bb – Broad Band
Av - Average	

Notes:

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)
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 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 C63.4-1992 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

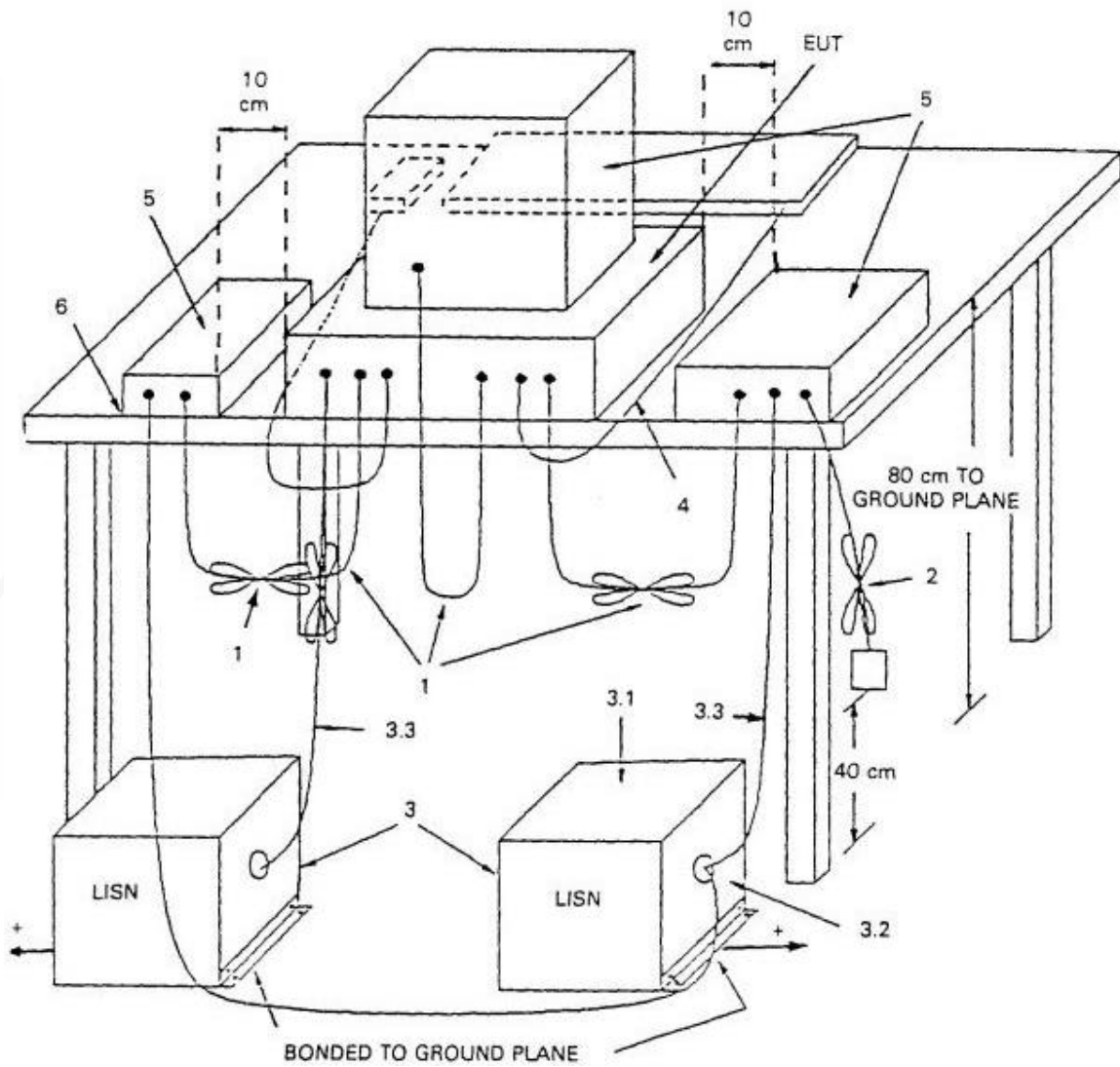
Conducted Emissions

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 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:



Radiated Emissions Diagram:

