

**IAL****INTERNATIONAL APPROVALS  
LABORATORIES****EMC EMISSIONS - TEST REPORT (In-Part)**Test Report No. **BC400425-1** Issue Date: **March 14, 2005**Model / Serial No. **ES1941 / 1**Product Type **Intentional Transmitter**Client **Inovonics Wireless Corp.**Manufacturer **Inovonics Wireless Corp.**License holder **Inovonics Wireless Corp.**Address **315 CTC Blvd****Louisville, CO 80027**Test Criteria Applied **FCC CFR47 Part 15.247**  
Test Result **PASS**Test Project Number **BC400278-1** Title 47 CFR 15: RADIO FREQUENCY DEVICES  
References  
Total Pages **30**  
Including  
Appendices:*Todd Jackson*

Reviewed By :

*Robert Crosswell*

Approved By :

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Lab Code: 200624-0

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## 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: 1-June-2004

Testing Start Date: 1-June-2004

Testing End Date: 6-July-2004



#### GENERAL REMARKS:

The following remarks are to be considered as “where applicable” and are taken into account while completing any FCC/IC/ETSI radio tests at International Approvals Laboratories, LLC.

Testing was performed in 3 different orthogonal axis to determine the worst case emissions from the device. The worst case emissions measurements are shown in this report.

**FCC CFR47 Part 15.31: Measurement Standards:** In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was varied per Part 15.31 to find worst case emissions.

**FCC CFR47 Part 15.35: Measurement Detector Functions and Bandwidths:** FCC Part 15.35 was utilized when performing the measurements within this report.

In any case where the device is powered off a battery, a fresh battery was used during test. In cases where the device is powered off an AC supply, voltage was verified per Part 15.31 to find worst case emissions.

The actual test distance for the FCC Part 15.209 testing was conducted at 10m for the fact that the device was being tested to EN55022 Class B from 30 MHz to 1000 MHz (meets/exceeds the FCC Part 15.209 & 109B limits) The data is automatically extrapolated back to the FCC 3m limits and measurements are corrected to better show the compliance to FCC requirements and reduce confusion. A correction factor of 10.54dB is used in cases of 30MHz and up for a difference between 10m and 3m measurement distances. All measurements that are lesser than 30MHz where applicable are accompanied with the fall of measurements and calculations to support the interpolation.

Modifications required to pass:

Test Specification Deviations: Additions to or Exclusions from

**This test report is in-part, International Approvals Laboratories, LLC was asked to test only the field strength of the fundamental and harmonics as well as the unintentional radiated and conducted emissions when applicable.**

**Required Information In Accordance to FCC CFR 47 Part 2.1033:**

<i>Rule Part 11, 15 &amp; 18 Devices</i>	<i>Other Rule Part Devices</i>	<i>Description</i>	<i>Comments</i>
2.1033(b)(1)	2.1033(c)(1)	Manu. Contact	See Page 1 of this report
2.1033(b)(2)	2.1033(c)(2)	FCC Identifier	
2.1033(b)(3)	2.1033(c)(3)	Users Manual to include Operating, installation	Attached as Exhibit
	2.1033(c)(4)	Emissions Designator per 2.	
	2.1033(c)(5)	Frequency Range	Not Applicable to Part 15 Devcies
	2.1033(c)(6)	Power range and controls	Not Applicable to Part 15 Devcies
	2.1033(c)(7)	Maximum power ouput rating	Not Applicable to Part 15 Devcies
	2.1033(c)(8)	DC Voltage and Current supplying final RF stages	Not Applicable to Part 15 Devcies
2.1033(b)(3)	2.1033(c)(9)	Tune –up procedure	Please refer to the users manual for applicability
2.1033(b)(4&5)	2.1033(c)(10)	Complete Circuit Diagrams and circuit operation description	Attached as Exhibit
2.1033(b)(7)	2.1033(c)(11)	Photographs/drawings of the identification label & its location on the device	Attached as Exhibit
2.1033(b)(7)	2.1033(c)(12)	Photographs of the external and internal surfaces, and construction	Attached as Exhibit
	2.1033(c)(13)	Digital Modulation	Not Applicable
2.1033(b)(6)	2.1033(c)(14)	Report of Measurement Data Required by 2.1046 –2.1057	See Data Below (This report consists of the testing required under Part 15.231)
2.1033(b)(8)		Description of publicly available support equipment used during test	Refer to Exhibit B of this report (Client Test Plan)
2.1033(b)(9)		Statement of Autorization to Part 15.37 of CFR47	The equipment herein is being authorized in accordance to 15.37 of the CFR47 Rules.
2.1033(b)(10)		Direct Sequence Spread Spectrum Devices (DSSS)	Exhibit of compliance to 15.247(e)
2.1033(b)(10)		Frequency Hopping Devices	Exhibit of compliance to 15.247(a)(1)
2.1033(b)(11)		Scanning receiver construction	Exhibit stating compliance to construction in accordance to 15.121.
15.31	15.31	Transmitter Supply Voltage	Testing herein was completed in accordance to FCC CFR47 Part 15.31

**Exhibits Including (where applicable):**

- |                                    |   |
|------------------------------------|---|
| 1. Users Manual                    | 7. Parts List   |
| 2. Operation Description           | 8. Tuning Procedure (if applicable)                     |
| 3. Block Diagram                   | 9. Test Setup Photograph                                |
| 4. Report of Measurement           | 10. Label Drawings and or Photographs                   |
| 5. External & Internal Photographs | 11. Description of Support Equipment (where Applicable) |
| 6. Schematic                       |   |

**Required Information in Accordance to Industry Canada Regulations (In addition to the above):**

<i>Information Required</i>	<i>Description</i>	<i>Comments</i>
<b>Modulation Type</b>	(i.e. ASK, NON, FSK, DSSS, FHSS, etc.)	
<b>Emissions Designator</b>	Per TRC-49	
<b>In Country Representative</b>	Contact Information	
<b>99% Bandwidth Measurement</b>	Per RSS-210	

Test-setup photo(s):  
Conducted Emissions

**Not Applicable**



Test-setup photo(s):  
Radiated Intentional Emissions





Test-setup photo(s):  
Radiated Intentional Emissions





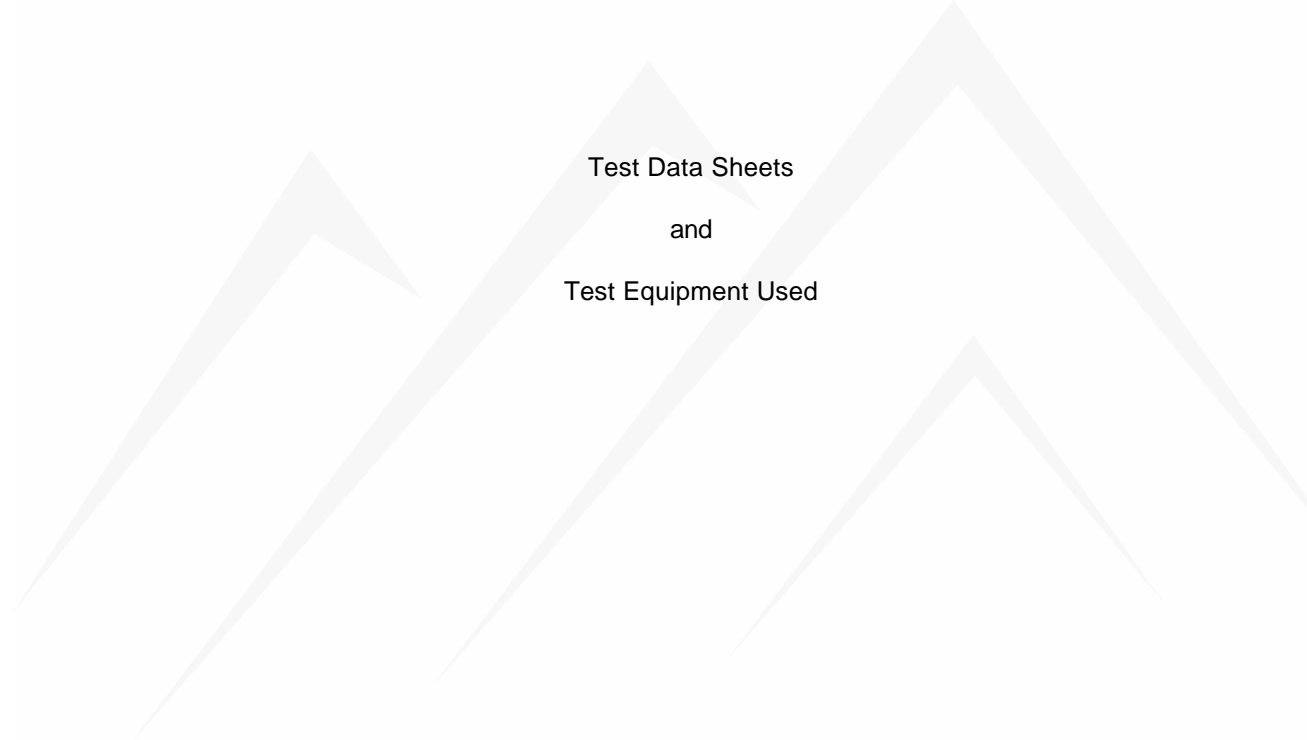
Test-setup photo(s):  
Radiated Unintentional Emissions



Test-setup photo(s):  
Radiated Unintentional Emissions



**Appendix A**



Test Data Sheets  
and  
Test Equipment Used



**15.209 Test Data**

# Radiated Electromagnetic Emissions

Test Report #: **BC400425 Run 01**  
 Test Method: FCC Part 15.209  
 EUT Model #: EN1941  
 EUT Serial #: 1  
 Manufacturer: Inovonics

Test Area: Pinewood Site 1 (3m)  
 Test Date: 19-Feb-2005  
 EUT Power: 3.2 VDC Battery

Temperature: \_\_\_\_\_ °C  
 Relative Humidity: \_\_\_\_\_ %  
 Air Pressure: \_\_\_\_\_ kPa

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EUT Description: OEM Transmitter  
 Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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)	POL / HGT / AZ (m) (DEG)	DELTA1 (dB) 15.209 <30MHz	DELTA2 (dB) 15.209 >30MHz
No emissions were seen from the EUT other than the Fundamental and its harmonics.						
All of the following are noise floor points.						
0.150	40.8 Qp	0.1 / 10.3 / 0.0	51.2	V / 1.0 / 0.0	-32.9	N/A
2.50	32.2 Qp	0.1 / 10.2 / 0.0	42.5	V / 1.0 / 0.0	-7.0	N/A
20.00	10.7 Qp	0.4 / 10.1 / 0.0	21.2	V / 1.0 / 0.0	-28.3	N/A
0.400	38.0 Qp	0.1 / 10.2 / 0.0	48.3	H / 1.0 / 0.0	-27.3	N/A
6.50	19.7 Qp	0.1 / 10.1 / 0.0	29.9	H / 1.0 / 0.0	-19.6	N/A
29.90	1.8 Qp	0.5 / 8.2 / 0.0	10.6	H / 1.0 / 0.0	-38.9	N/A
35.00	21.9 Qp	0.6 / 12.3 / 28.4	6.4	H / 1.0 / 0.0	N/A	-33.6
100.00	25.4 Qp	1.1 / 9.4 / 28.2	7.7	H / 1.0 / 0.0	N/A	-35.8
195.00	19.4 Qp	1.5 / 13.2 / 27.6	6.4	H / 1.0 / 0.0	N/A	-37.1
30.00	31.0 Qp	0.5 / 12.9 / 28.4	16.0	V / 1.0 / 0.0	-33.5	-24.0
80.00	30.6 Qp	0.9 / 6.9 / 28.2	10.2	V / 1.0 / 0.0	N/A	-29.8
190.00	20.1 Qp	1.4 / 12.8 / 27.7	6.7	V / 1.0 / 0.0	N/A	-36.8
250.00	19.9 Qp	1.7 / 11.2 / 27.3	5.6	V / 1.0 / 0.0	N/A	-40.4
550.00	19.6 Qp	2.6 / 17.8 / 28.5	11.5	V / 1.0 / 0.0	N/A	-34.5
1000.00	19.1 Qp	3.7 / 23.2 / 27.4	18.7	V / 1.0 / 0.0	N/A	-35.3
200.00	23.2 Qp	1.5 / 10.9 / 27.6	8.0	H / 1.0 / 0.0	N/A	-35.5
500.00	19.5 Qp	2.6 / 17.0 / 28.6	10.5	H / 1.0 / 0.0	N/A	-35.5
990.00	18.9 Qp	3.7 / 22.9 / 27.6	17.9	H / 1.0 / 0.0	N/A	-36.1
1500.00	34.3 Av	2.9 / 25.1 / 37.0	25.3	H / 1.0 / 0.0	N/A	-28.7
3500.00	34.7 Av	4.8 / 31.5 / 37.8	33.2	H / 1.0 / 0.0	N/A	-20.8
2000.00	34.8 Av	3.2 / 27.4 / 37.3	28.1	V / 1.0 / 0.0	N/A	-25.9

# Radiated Electromagnetic Emissions

Test Report #: **BC400425 Run 01**  
 Test Method: FCC Part 15.209  
 EUT Model #: EN1941  
 EUT Serial #: 1  
 Manufacturer: Inovonics  
 EUT Description: OEM Transmitter  
 Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Test Area: Pinewood Site 1 (3m)  
 Test Date: 19-Feb-2005  
 EUT Power: 3.2 VDC Battery

Temperature: \_\_\_\_\_ °C  
 Relative Humidity: \_\_\_\_\_ %  
 Air Pressure: \_\_\_\_\_ kPa  
 Page: 14 of 4

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)	POL / HGT / AZ (m) (DEG)	DELTA (dB)	
					15.209 <30MHz	15.209 >30MHz
3900.00	34.3 Av	5.5 / 32.5 / 37.7	34.6	V / 1.0 / 0.0	N/A	-19.4
4000.00	31.8 Av	5.7 / 32.8 / 38.7	31.6	V / 1.0 / 0.0	N/A	-22.4
6000.00	31.7 Av	7.7 / 34.7 / 39.1	35.0	V / 1.0 / 0.0	N/A	-19.0
7500.00	31.2 Av	8.2 / 36.8 / 39.6	36.6	V / 1.0 / 0.0	N/A	-17.4
4500.00	32.8 Av	6.6 / 32.3 / 39.6	32.1	H / 1.0 / 0.0	N/A	-21.9
6500.00	31.5 Av	8.5 / 34.9 / 39.1	35.8	H / 1.0 / 0.0	N/A	-18.2
7900.00	32.1 Av	8.3 / 36.9 / 39.9	37.3	H / 1.0 / 0.0	N/A	-16.7
8000.00	41.0 Av	8.3 / 36.9 / 45.5	40.7	H / 1.0 / 0.0	N/A	-13.3
9500.00	42.4 Av	9.4 / 37.9 / 47.8	41.9	H / 1.0 / 0.0	N/A	-12.1
8500.00	42.0 Av	8.5 / 37.2 / 45.0	42.7	V / 1.0 / 0.0	N/A	-11.3
10000.0	42.3 Av	9.5 / 38.4 / 48.3	41.9	V / 1.0 / 0.0	N/A	-12.1

# Radiated Electromagnetic Emissions

Test Report #: BC400425 Run 01      Test Area: Pinewood Site 1 (3m)  
 Test Method: FCC Part 15.209      Test Date: 19-Feb-2005  
 EUT Model #: EN1941      EUT Power: 3.2 VDC Battery  
 EUT Serial #: 1  
 Manufacturer: Inovonics  
 EUT Description: OEM Transmitter  
 Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Temperature: \_\_\_\_\_ °C  
 Relative Humidity: \_\_\_\_\_ %  
 Air Pressure: \_\_\_\_\_ kPa  
 Page: 15 of 4

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)	15.209 <30MHz	15.209 >30MHz
<b>***** Measurement Summary *****</b>						
2.50	32.2 Qp	0.1 / 10.2 / 0.0	42.5	V / 1.0 / 0.0	-7.0	N/A
8500.00	42.0 Av	8.5 / 37.2 / 45.0	42.7	V / 1.0 / 0.0	N/A	-11.3
9500.00	42.4 Av	9.4 / 37.9 / 47.8	41.9	H / 1.0 / 0.0	N/A	-12.1
10000.0	42.3 Av	9.5 / 38.4 / 48.3	41.9	V / 1.0 / 0.0	N/A	-12.1
8000.00	41.0 Av	8.3 / 36.9 / 45.5	40.7	H / 1.0 / 0.0	N/A	-13.3
7900.00	32.1 Av	8.3 / 36.9 / 39.9	37.3	H / 1.0 / 0.0	N/A	-16.7
7500.00	31.2 Av	8.2 / 36.8 / 39.6	36.6	V / 1.0 / 0.0	N/A	-17.4
6500.00	31.5 Av	8.5 / 34.9 / 39.1	35.8	H / 1.0 / 0.0	N/A	-18.2
6000.00	31.7 Av	7.7 / 34.7 / 39.1	35.0	V / 1.0 / 0.0	N/A	-19.0
3900.00	34.3 Av	5.5 / 32.5 / 37.7	34.6	V / 1.0 / 0.0	N/A	-19.4
6.50	19.7 Qp	0.1 / 10.1 / 0.0	29.9	H / 1.0 / 0.0	-19.6	N/A
3500.00	34.7 Av	4.8 / 31.5 / 37.8	33.2	H / 1.0 / 0.0	N/A	-20.8
4500.00	32.8 Av	6.6 / 32.3 / 39.6	32.1	H / 1.0 / 0.0	N/A	-21.9
4000.00	31.8 Av	5.7 / 32.8 / 38.7	31.6	V / 1.0 / 0.0	N/A	-22.4
30.00	31.0 Qp	0.5 / 12.9 / 28.4	16.0	V / 1.0 / 0.0	-33.5	-24.0
2000.00	34.8 Av	3.2 / 27.4 / 37.3	28.1	V / 1.0 / 0.0	N/A	-25.9
0.400	38.0 Qp	0.1 / 10.2 / 0.0	48.3	H / 1.0 / 0.0	-27.3	N/A
20.00	10.7 Qp	0.4 / 10.1 / 0.0	21.2	V / 1.0 / 0.0	-28.3	N/A
1500.00	34.3 Av	2.9 / 25.1 / 37.0	25.3	H / 1.0 / 0.0	N/A	-28.7
80.00	30.6 Qp	0.9 / 6.9 / 28.2	10.2	V / 1.0 / 0.0	N/A	-29.8
0.150	40.8 Qp	0.1 / 10.3 / 0.0	51.2	V / 1.0 / 0.0	-32.9	N/A
35.00	21.9 Qp	0.6 / 12.3 / 28.4	6.4	H / 1.0 / 0.0	N/A	-33.6
550.00	19.6 Qp	2.6 / 17.8 / 28.5	11.5	V / 1.0 / 0.0	N/A	-34.5
1000.00	19.1 Qp	3.7 / 23.2 / 27.4	18.7	V / 1.0 / 0.0	N/A	-35.3
200.00	23.2 Qp	1.5 / 10.9 / 27.6	8.0	H / 1.0 / 0.0	N/A	-35.5
500.00	19.5 Qp	2.6 / 17.0 / 28.6	10.5	H / 1.0 / 0.0	N/A	-35.5
100.00	25.4 Qp	1.1 / 9.4 / 28.2	7.7	H / 1.0 / 0.0	N/A	-35.8
990.00	18.9 Qp	3.7 / 22.9 / 27.6	17.9	H / 1.0 / 0.0	N/A	-36.1



# Radiated Electromagnetic Emissions

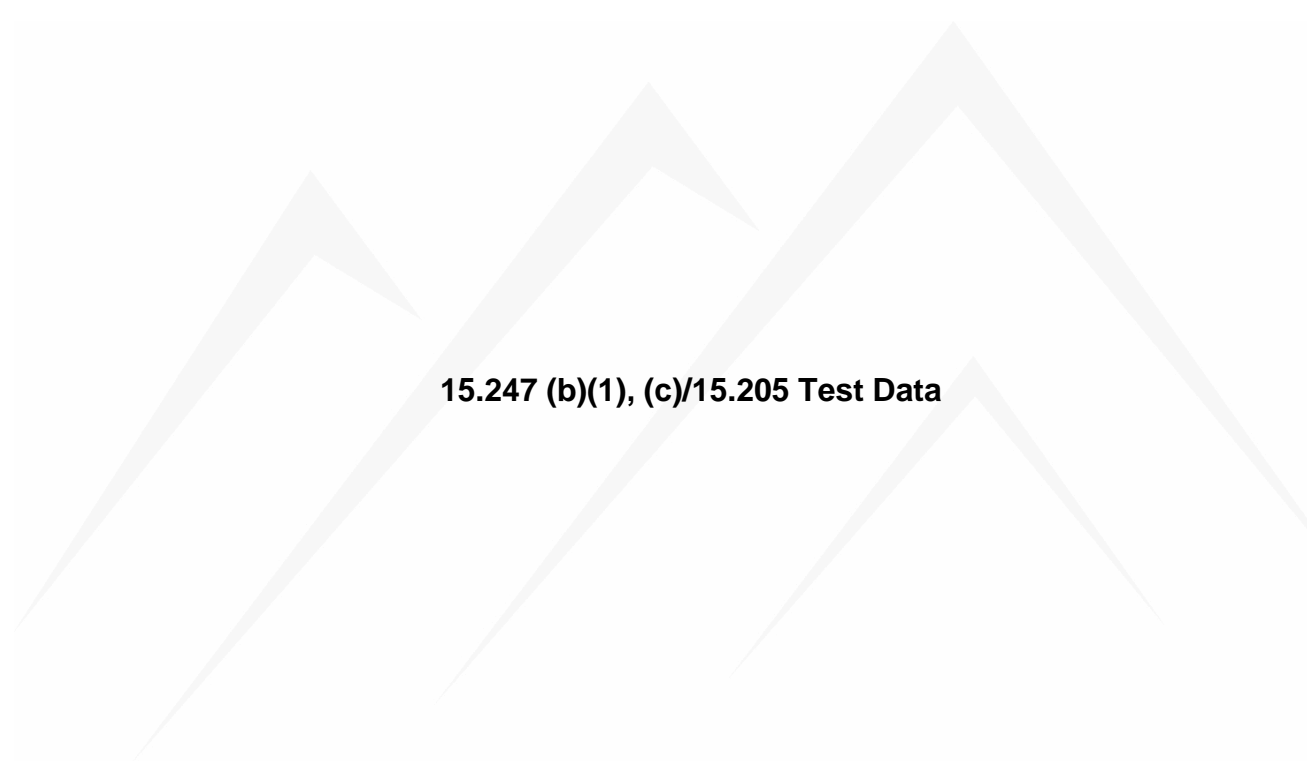
Test Report #: **BC400425 Run 01**  
 Test Method: FCC Part 15.209  
 EUT Model #: EN1941  
 EUT Serial #: 1  
 Manufacturer: Inovonics  
 EUT Description: OEM Transmitter  
 Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Test Area: Pinewood Site 1 (3m)  
 Test Date: 19-Feb-2005  
 EUT Power: 3.2 VDC Battery

Temperature: \_\_\_\_\_ °C  
 Relative Humidity: \_\_\_\_\_ %  
 Air Pressure: \_\_\_\_\_ kPa  
 Page: 16 of 4

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)	15.209 <30MHz	15.209 >30MHz
190.00	20.1 Qp	1.4 / 12.8 / 27.7	6.7	V / 1.0 / 0.0	N/A	-36.8
195.00	19.4 Qp	1.5 / 13.2 / 27.6	6.4	H / 1.0 / 0.0	N/A	-37.1
29.90	1.8 Qp	0.5 / 8.2 / 0.0	10.6	H / 1.0 / 0.0	-38.9	N/A
250.00	19.9 Qp	1.7 / 11.2 / 27.3	5.6	V / 1.0 / 0.0	N/A	-40.4



**15.247 (b)(1), (c)/15.205 Test Data**

# Field Strength Measurements Fundamental and Spurious of the Transmitter



Test Report #: **BC400425 Run 01**  
 Test Method: FCC CFR47 Part 15.247/205  
 EUT Model #: EN1941  
 EUT Serial #: 1  
 Manufacturer: Inovonics  
 EUT Description: OEM Transmitter  
 Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Test Area: Pinewood Site 1 (3m)  
 Test Date: 19-Feb-2005  
 EUT Power: 3.2 VDC Battery

Temperature: 22.6 °C  
 Relative Humidity: 39 %  
 Air Pressure: 80 kPa  
 Page: \_\_\_\_\_

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

The following duty cycle was declared by the manufacturer.  
 Duty Cycle = active / 100ms. = 20%

**Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 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 15.247 and the emission/limit delta was calculated.

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

Part 15.247 and 15.205 Respectively

EUT Vertical on the table.

Low channel

902.20	72.5 Pk	2.2 / 23.3 / 0.0	98.0	H / 1.0 / 216.0	0	98.0	119	-21
902.20	69.2 Pk	2.2 / 23.3 / 0.0	94.7	V / 1.2 / 245.6	0	94.7	119	-24.3

Mid Channel

914.57	73.3 Pk	2.2 / 23.1 / 0.0	98.6	V / 1.7 / 239.6	0	98.6	119	-20.4
914.58	74.4 Pk	2.2 / 23.1 / 0.0	99.7	H / 1.5 / 215.0	0	99.7	119	-19.3

High Channel

927.38	76.7 Pk	2.2 / 23.3 / 0.0	102.2	H / 1.0 / 0.0	0	102.2	119	-16.8
927.38	73.2 Pk	2.2 / 23.3 / 0.0	98.8	V / 1.7 / 249.0	0	98.8	119	-21.2

EUT is flat on is back.

Low Channel

902.18	67.3 Qp	2.2 / 23.3 / 0.0	92.9	V / 1.0 / 52.4	0	92.9	119	-26.1
902.18	77.8 Pk	2.2 / 23.3 / 0.0	103.4	H / 1.0 / 223.9	0	103.4	119	-15.6

Mid Channel

914.57	78.1 Pk	2.2 / 23.1 / 0.0	103.4	H / 1.0 / 227.9	0	103.4	119	-15.6
914.57	66.2 Pk	2.2 / 23.1 / 0.0	91.5	V / 1.0 / 100.7	0	91.5	119	-27.5

High Channel

927.37	68.2 Pk	2.2 / 23.3 / 0.0	93.7	V / 1.0 / 100.0	0	93.7	119	-25.7
927.40	74.5 Pk	2.2 / 23.3 / 0.0	100.1	H / 1.4 / 100.0	0	100.1	119	-18.9

# Field Strength Measurements Fundamental and Spurious of the Transmitter

Test Report #: <b>BC400425 Run 01</b>	Test Area: Pinewood Site 1 (3m)	Temperature: 22.6 °C
Test Method: FCC CFR47 Part 15.247/205	Test Date: 19-Feb-2005	Relative Humidity: 39 %
EUT Model #: EN1941	EUT Power: 3.2 VDC Battery	Air Pressure: 80 kPa
EUT Serial #: 1		
Manufacturer: Inovonics		
EUT Description: OEM Transmitter		
Notes:		

Nb – Narrow Band  
 Qp – QuasiPeak    Bb – Broad Band  
 Av – Average

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

The following duty cycle was declared by the manufacturer.

Duty Cycle = active / 100ms. = 20%

**Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 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 15.247 and the emission/limit delta was calculated.

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

Part 15.247 and 15.205 Respectively

EUT is vertical on the table on its side.

**Low Channel**

902.20	69.5 Pk	2.2 / 23.3 / 0.0	95.1	V / 1.2 / 255.4	0	95.1	119	-23.9
902.21	66.0 Pk	2.2 / 23.3 / 0.0	91.5	H / 1.0 / 312.1	0	91.5	119	-27.5

**Mid Channel**

914.58	67.0 Pk	2.2 / 23.1 / 0.0	92.2	H / 1.0 / 311.5	0	92.2	119	-26.8
914.58	70.5 Pk	2.2 / 23.1 / 0.0	95.7	V / 1.1 / 256.0	0	95.7	119	-23.3

**High Channel**

927.38	72.9 Pk	2.2 / 23.3 / 0.0	98.4	V / 1.2 / 303.2	0	98.4	119	-20.6
927.36	70.2 Pk	2.2 / 23.3 / 0.0	95.7	H / 1.0 / 309.5	0	95.7	119	-23.3

Harmonics EUT was placed in its worst case position.

**Low Channel**

1804.67	27.9 Pk	3.1 / 28.2 / 0.0	59.3	V / 1.0 / 61.1	-13.98	45.32	99	-53.68
1804.67	29.4 Pk	3.1 / 28.2 / 0.0	60.7	H / 1.0 / 256.0	-13.98	46.72	99	-52.28
2706.03	52.5 Pk	4.2 / 31.1 / 37.5	50.3	H / 1.0 / 184.4	-13.98	36.32	54	-17.68
2706.03	53.9 Pk	4.2 / 31.1 / 37.5	51.7	V / 1.0 / 74.6	-13.98	37.72	54	-16.28
3609.20	44.4 Pk	5.0 / 33.1 / 37.8	44.7	V / 1.0 / 68.4	-13.98	30.72	54	-23.28
3609.29	45.0 Pk	5.0 / 33.1 / 37.8	45.4	H / 1.0 / 235.5	-13.98	31.42	54	-22.58
4511.60	44.7 Pk	6.6 / 33.5 / 39.6	45.3	4511.60	-13.98	31.32	54	-22.68
4511.68	45.2 Pk	6.6 / 33.5 / 39.6	45.8	4511.68	-13.98	31.82	54	-22.18
5413.78	41.0 Pk	6.9 / 35.5 / 38.3	45.2	V / 1.0 / 0.0	-13.98	31.22	54	-22.78

# Field Strength Measurements Fundamental and Spurious of the Transmitter

Test Report #: <b>BC400425 Run 01</b>	Test Area: Pinewood Site 1 (3m)	Temperature: 22.6 °C
Test Method: FCC CFR47 Part 15.247/205	Test Date: 19-Feb-2005	Relative Humidity: 39 %
EUT Model #: EN1941	EUT Power: 3.2 VDC Battery	Air Pressure: 80 kPa
EUT Serial #: 1		
Manufacturer: Inovonics		
EUT Description: OEM Transmitter		
Notes:		

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

The following duty cycle was declared by the manufacturer.

Duty Cycle = active / 100ms. = 20%

**Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 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 15.247 and the emission/limit delta was calculated.

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

**Part 15.247 and 15.205** Respectively

5414.20	41.2 Pk	6.9 / 35.5 / 38.3	45.4	H / 1.0 / 0.0	-13.98	31.42	54	-22.58
6316.38	43.9 Pk	8.2 / 36.5 / 38.9	49.6	H / 2.4 / 91.0	-13.98	35.62	99	-63.38
6316.38	43.0 Pk	8.2 / 36.5 / 38.9	48.8	V / 2.1 / 306.0	-13.98	34.82	99	-64.18
7218.56	42.0 Pk	8.1 / 37.4 / 40.7	46.9	V / 1.0 / 0.0	-13.98	32.92	99	-66.08
7218.56	42.8 Pk	8.1 / 37.4 / 40.7	47.6	H / 1.0 / 0.0	-13.98	33.62	99	-65.38
8120.74	52.0 Pk	8.3 / 38.0 / 45.4	53.0	H / 1.0 / 0.0	-13.98	39.02	54	-14.98
8120.74	51.4 Pk	8.3 / 38.0 / 45.4	52.4	V / 1.0 / 0.0	-13.98	38.42	54	-15.58
9022.92	52.9 Pk	8.5 / 39.9 / 46.8	54.5	H / 1.0 / 0.0	-13.98	40.52	54	-13.48
9022.92	51.5 Pk	8.5 / 39.9 / 46.8	53.1	V / 1.0 / 0.0	-13.98	39.12	54	-14.88

**Mid Channel**

1829.34	29.8 Pk	3.1 / 28.3 / 0.0	61.2	H / 1.0 / 266.8	-13.98	47.22	99	-51.78
1829.32	27.4 Pk	3.1 / 28.3 / 0.0	58.9	V / 1.0 / 71.7	-13.98	44.92	99	-54.08
2744.18	53.5 Pk	4.3 / 31.1 / 37.5	51.5	V / 1.2 / 128.7	-13.98	37.52	54	-16.48
2744.18	53.5 Pk	4.3 / 31.1 / 37.5	51.4	H / 1.0 / 195.8	-13.98	37.42	54	-16.58
3656.00	44.2 Pk	5.1 / 33.3 / 37.9	44.7	H / 1.0 / 0.0	-13.98	30.72	54	-23.28
3656.00	43.7 Pk	5.1 / 33.3 / 37.9	44.2	V / 1.0 / 0.0	-13.98	30.22	54	-23.78
4573.69	46.9 Pk	6.7 / 33.7 / 39.4	47.9	V / 1.5 / 168.6	-13.98	33.92	54	-20.08
4573.69	45.9 Pk	6.7 / 33.7 / 39.4	46.9	H / 1.0 / 29.4	-13.98	32.92	54	-21.08
5487.48	42.0 Pk	6.7 / 35.7 / 38.6	45.7	H / 1.0 / 0.0	-13.98	31.72	99	-67.28

# Field Strength Measurements Fundamental and Spurious of the Transmitter

Test Report #: <b>BC400425 Run 01</b>	Test Area: Pinewood Site 1 (3m)	Temperature: 22.6 °C
Test Method: FCC CFR47 Part 15.247/205	Test Date: 19-Feb-2005	Relative Humidity: 39 %
EUT Model #: EN1941	EUT Power: 3.2 VDC Battery	Air Pressure: 80 kPa
EUT Serial #: 1		
Manufacturer: Inovonics		
EUT Description: OEM Transmitter		
Notes:		

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

The following duty cycle was declared by the manufacturer.

Duty Cycle = active / 100ms. = 20%

**Averaging method for pulsed signals and calculation in accordance to FCC CFR47 Part 15.35 utilized to calculate field strength emissions.**

The testing performed in accordance to FCC CFR47 Part 15.205 (restricted bands of operation) and 15.247 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 15.247 and the emission/limit delta was calculated.

The DTCF is calculated as follows  $20 \cdot \log_{10}(\text{duty cycle in 100ms})$  “not to exceed 20dB”

**Part 15.247 and 15.205** Respectively

5488.66	43.1 Pk	6.7 / 35.7 / 38.6	46.9	V / 1.0 / 117.0	-13.98	32.92	99	-66.08
6402.06	42.0 Pk	8.3 / 36.4 / 39.0	47.8	H / 1.0 / 0.0	-13.98	33.82	99	-65.18
6403.24	42.1 Pk	8.3 / 36.4 / 39.0	48.0	V / 1.0 / 239.0	-13.98	34.02	99	-64.98
7316.64	41.7 Pk	8.2 / 37.6 / 40.5	47.0	H / 1.0 / 0.0	-13.98	33.02	54	-20.98
7316.64	41.6 Pk	8.2 / 37.6 / 40.5	46.9	V / 1.0 / 0.0	-13.98	32.92	54	-21.08
8231.13	51.3 Pk	8.4 / 38.3 / 45.3	52.7	H / 1.0 / 0.0	-13.98	38.72	54	-15.28
8231.13	51.3 Pk	8.4 / 38.3 / 45.3	52.7	H / 1.0 / 0.0	-13.98	38.72	54	-15.28
8231.13	51.3 Pk	8.4 / 38.3 / 45.3	52.7	H / 1.0 / 0.0	-13.98	38.72	54	-15.28
8231.13	51.3 Pk	8.4 / 38.3 / 45.3	52.7	H / 1.0 / 0.0	-13.98	38.72	54	-15.28
High Channel								
1854.92	28.3 Pk	3.1 / 28.5 / 0.0	59.9	V / 1.0 / 226.7	-13.98	45.92	99	-53.08
1854.92	30.1 Pk	3.1 / 28.5 / 0.0	61.6	H / 1.0 / 70.6	-13.98	47.62	99	-51.38
2782.51	52.9 Pk	4.3 / 31.2 / 37.5	51.0	H / 1.1 / 184.6	-13.98	37.02	54	-16.98
2782.51	52.0 Pk	4.3 / 31.2 / 37.5	50.1	V / 1.1 / 137.7	-13.98	36.12	54	-17.88
3710.29	44.0 Pk	5.2 / 33.5 / 37.9	44.8	V / 1.0 / 0.0	-13.98	30.82	54	-23.18
3710.29	44.8 Pk	5.2 / 33.5 / 37.9	45.5	H / 1.0 / 0.0	-13.98	31.52	54	-22.48
4637.64	44.0 Pk	6.9 / 33.9 / 39.2	45.6	H / 1.0 / 134.0	-13.98	31.62	54	-22.38
4637.64	46.3 Pk	6.9 / 33.9 / 39.2	47.9	V / 1.0 / 196.9	-13.98	33.92	54	-20.08
5565.02	43.3 Pk	6.8 / 35.8 / 38.4	47.5	V / 1.6 / 117.7	-13.98	33.52	99	-65.48

# Field Strength Measurements Fundamental and Spurious of the Transmitter

Test Report #: <b>BC400425 Run 01</b>	Test Area: Pinewood Site 1 (3m)	Temperature: 22.6 °C
Test Method: FCC CFR47 Part 15.247/205	Test Date: 19-Feb-2005	Relative Humidity: 39 %
EUT Model #: EN1941	EUT Power: 3.2 VDC Battery	Air Pressure: 80 kPa
EUT Serial #: 1		
Manufacturer: Inovonics		
EUT Description: OEM Transmitter		
Notes:		

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

FREQ	LEVEL	CABLE / ANT / PREAMP	FINAL	POL / HGT / AZ	Duty Cycle Correction	Final Corrected	Limit	DELTA
(MHz)	(dBuV)	(dB) (dBm) (dB)	(dBuV)	(m) (DEG)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
5565.02	40.9 Pk	6.8 / 35.8 / 38.4	45.1	H / 1.0 / 0.0	-13.98	31.12	99	-67.88
6492.82	43.2 Pk	8.5 / 36.4 / 39.1	49.1	V / 2.2 / 37.7	-13.98	35.12	99	-63.88
6492.93	42.4 Pk	8.5 / 36.4 / 39.1	48.2	H / 1.0 / 117.8	-13.98	34.22	99	-64.78
7420.20	42.3 Pk	8.2 / 37.8 / 40.0	48.3	V / 1.0 / 0.0	-13.98	34.32	54	-19.68
7420.20	42.3 Pk	8.2 / 37.8 / 40.0	48.3	H / 1.0 / 0.0	-13.98	34.32	54	-19.68
8346.42	51.5 Pk	8.4 / 38.5 / 45.2	53.3	H / 1.0 / 0.0	-13.98	39.32	54	-14.68
8346.42	51.6 Pk	8.4 / 38.5 / 45.2	53.4	V / 1.0 / 0.0	-13.98	39.42	54	-14.58
9273.80	52.0 Pk	9.0 / 39.2 / 47.3	52.8	H / 1.0 / 0.0	-13.98	38.82	99	-60.18
9273.80	51.8 Pk	9.0 / 39.2 / 47.3	52.6	V / 1.0 / 0.0	-13.98	38.62	99	-60.38



# Project Report

**Begin Date:**      **End Date:**      2/19/2005: 2/19/2005

**Technician**    Alisha Bullock

**Project:** BC400275

Capital Asset ID	Manufacturer	Model #	Serial #	Description	Test Performed	Service Type	Service Date	Service Due
6	Hewlett-Packard	8594E	3223A00145	Spectrum Analyzer	R Radiated Emissions	For Cal	1/16/2005	1/16/2006
138	EMC TEST SYSTEMS	3109	3142	Biconical Antenna 30-300MHz	R Radiated Emissions	For Cal	10/3/2004	10/3/2005
171	Hewlett-Packard	85662A	1928A01169	Spectrum Analyzer - Display Section	R Radiated Emissions	For Cal	1/21/2005	1/21/2006
172	Hewlett-Packard	8566B	2430A00759	Spectrum Analyzer	R Radiated Emissions	For Cal	1/21/2005	1/21/2006
187	EMCO	3115	9205-3886	Horn Antenna 1-18GHz	R Radiated Emissions	For Cal	10/6/2004	10/6/2005
202	Avantek	AWT-18037	1002	RF Pre-Amplifier (8-18 GHz)	R Radiated Emissions	For Ver	4/7/2004	4/7/2005
203	Avantek	AFT97-8434-10F	1007	RF Pre-Amplifier (4-8 GHz)	R Radiated Emissions	For Ver	4/7/2004	4/7/2005
213	Mini-Circuits Lab	ZHL-42	N052792-2	Amplifier	R Radiated Emissions	For Ver	6/5/2004	6/5/2005
217	EMCO	3146	9203-3376	Log Periodic Antenna	R Radiated Emissions	For Cal	10/3/2004	10/3/2005
248	Hewlett-Packard	8447F	3113A05545	9 kHz- 1.3GHz Pre Amp	R Radiated Emissions	For Ver	6/22/2004	6/22/2005

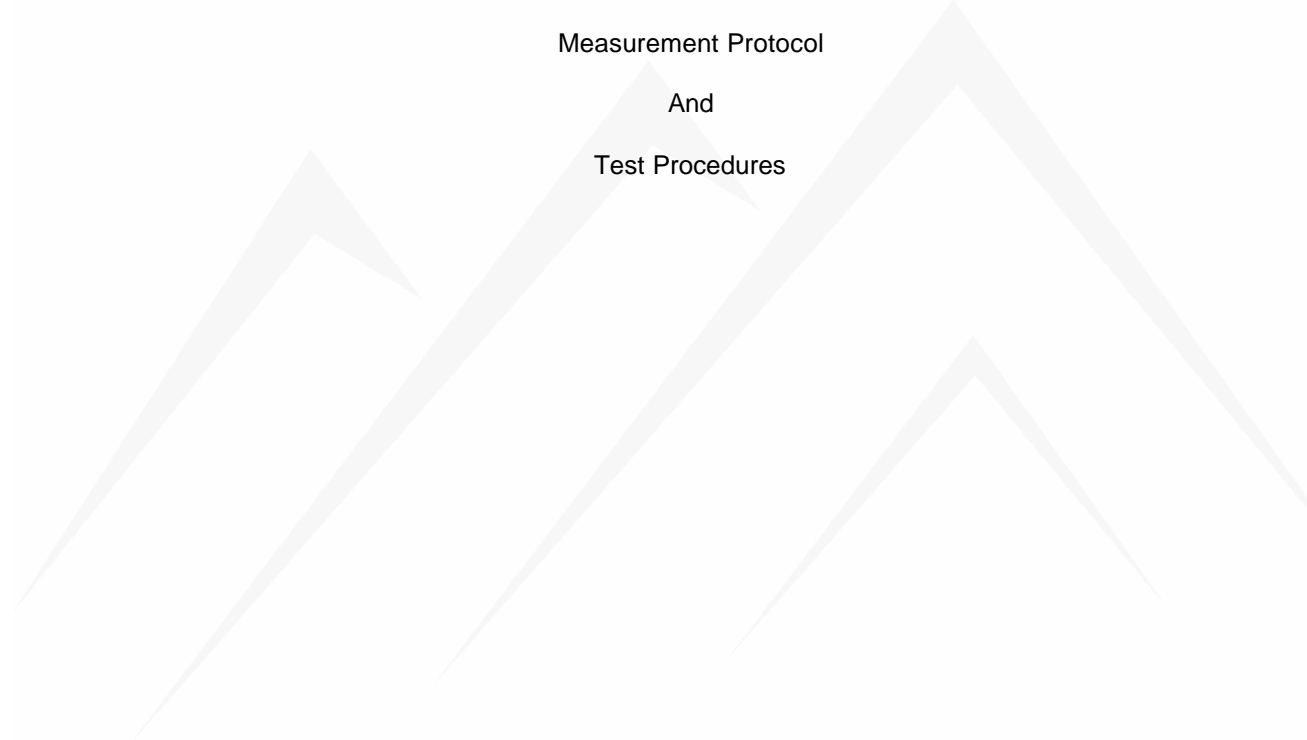
**Appendix B**

Test Plan  
and  
Constructional Data Form

**To be supplied by the 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:

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

#### 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."

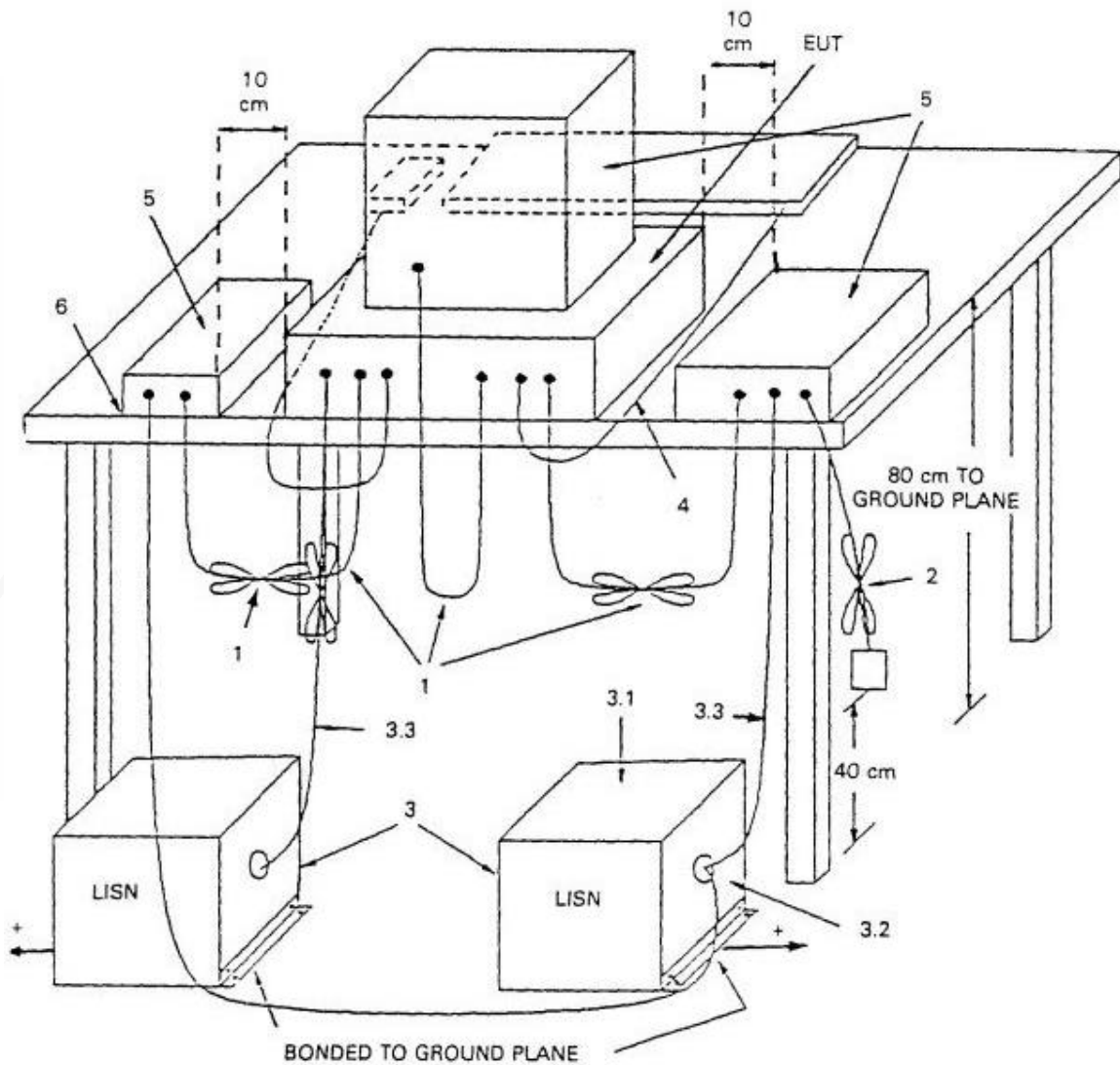
### **Conducted Emissions**

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:**

