Test of LMX9820A

To: FCC 47 CFR Part 15.247

Test Report Serial No.: GCCO06-A2 Rev A

TEST REPORT

FROM

Test of LMX9820A

To FCC 47 CFR Part 15.247

Test Report Serial No.: GCCO06-A2 Rev A

Note: This report was created as a result of a product development program and is subjected to the FCC's Class II Permissive Change rules.

This report supersedes none

Manufacturer: National Semiconductor
10105 Pacific Heights Blvd, Suite 100
San Diego, CA 92121
USA

Product Function: Bluetooth Wireless Device

Copy No: pdf **Issue Date:** 21st April 2006

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
3922 Valley Avenue, Suite B
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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TABLE OF CONTENTS

ACCREDITATION

MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

THE AMERICAN
ASSOCIATION
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ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 14th day of September 2005.

American Association for Laboratory Accreditation
Corporate SEAL 1978 District of Columbia
A2LA

President
For the Accreditation Council
Certificate Number 2381.01
Valid to: November 30, 2007

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

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	21st April 2006	First issue.

1. TEST RESULT CERTIFICATE

Manufacturer:	National Semiconductor 10105 Pacific Heights Blvd, Suite 100 San Diego, CA 92121 USA	Tested:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	Bluetooth Wireless Module	Tel:	+1 925 462 0304
Model:	LMX9820A	Fax:	+1 925 462 0306
S/N(s):	None		
Test Date(s):	5th - 11th April 2006	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.247	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

ACCREDITED
CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.247	Sept 2005	Code of Federal Regulations
(ii)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(iii)	CISPR 22/ EN 55022	1997/ 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(iv)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(v)	LAB34	Edition 1 August 2002	The expression of uncertainty in EMC Testing
(vi)	ETSI TR 100 028 V1.4.1	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(vii)	A2LA	14th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the LMX9820A to FCC Part 15.247 regulations
Applicant:	Global Certification Corporation 15800 Via Rivera' San Lorenzo, California 94580 USA
Manufacturer:	National Semiconductor 10105 Pacific Heights Blvd, Suite 100 San Diego, CA 92121 USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite “B” Pleasanton, California 94566 USA
Test report reference number:	GCCO06-A2 Rev A
Date EUT received:	3rd April 2006
Standard(s) applied:	FCC 47 CFR Part 15.247
Dates of test (from - to):	5th - 11th April 2006
No of Units Tested:	One
Type of Equipment:	Bluetooth Wireless Module
Manufacturers Trade Name:	LMX8920A
Model:	LMX8920A
Location for use:	Indoors / Outdoors
EUT Modes of Operation:	Intermittent Transmitter – Master and Slave
Declared Frequency Range(s):	Transmitter 2,402 – 2,480 MHz Receiver 2,400 – 2,478 MHz
Type of Modulation:	FHSS
Declared Nominal Output Power:	+0 dBm
Transmit/Receive Operation:	Simplex
Rated Input Voltage and Current:	3.3 V dc nominal, 40 mA
Operating Temperature Range:	-40º to +85ºC
Clock/Oscillator(s):	12 MHz, 32 kHz
Frequency Stability:	±20 ppm
Equipment Dimensions:	10.1 X 14.1 X 2.0 mm
Primary function of equipment:	Bluetooth Wireless Device

3.2. Scope of Test Program

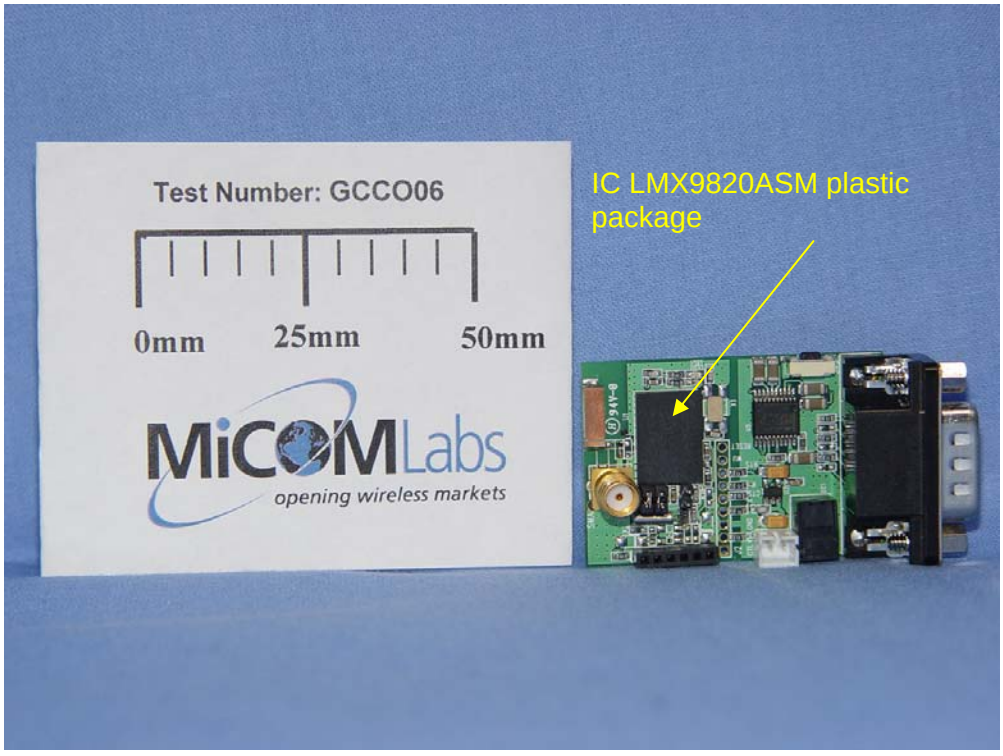
The primary objective was to prove that the LMX9820A 2.4 GHz Bluetooth Module continued to comply with FCC regulation 15.247 after product development.

Product Change
IC LMX9820ASM was changed to a plastic package instead of having a metal shield surrounding it. Client declared that no critical components have been changed. As a result of this modification only field strength and spurious emissions above and below 1 GHz were performed on the device.

Description of EUT

The National Semiconductor LMX9820A Bluetooth Serial Port module is a highly integrated radio, base band controller, and memory device implemented on an FR4 substrate. All hardware and firmware is included to provide a complete solution from the complete lower and upper layers of the Bluetooth stack, up to the application support layers including the Generic Access Profile (GAP), the Service Discovery Application Profile (SDAP), and the Serial Port Profile (SPP).

National Semiconductor LMX9820A



3.3. Equipment Model(s) and Serial Number(s)

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Bluetooth Serial Port module	National Semiconductor	LMX9820A	None
Support	Power Supply	CUI	EPA-121DA-05	None

3.4. Antenna Details

Antenna Type
Integral

3.5. Cabling and I/O Ports

1. RS 232 Serial Port
2. 5v dc power

3.6. Test Configurations

Matrix of test configurations

Frequencies (MHz)
2,402
2,441
2,480

Notes on Radiated Emissions Test Configuration;-

The EUT was placed on a 0.8 meter high table and positioned consecutively in the X, Y and Z axis and rotated through 360 degrees to determine the orientation of the EUT for maximum emissions. Worst case emission profile was used to measure the emission data reported in this report.

Worst case plots are provided for each test parameter within this report. Plots not included are held on file by the test laboratory and available upon request with client permission.

3.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements performed under **FCC CFR47 Part 15.247** for devices operating at 2.4 GHz.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(b)	Peak Output Power	Shall not exceed 1W	Conducted	Complies	5.1
15.247(d) **15.209**	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz	Radiated	Complies	5.2.1
		Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	5.2.2

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*

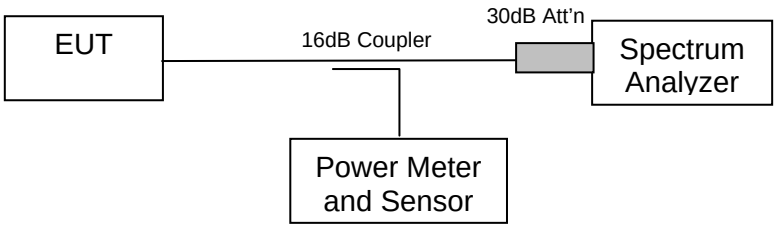
5. TEST RESULTS

5.1. Peak Output Power

FCC, Part 15 Subpart C §15.247(b)

Test Procedure
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. The resolution filter bandwidth was set to 3 dB, peak detector selected and the analyzer built-in power function was used to measure peak power over the 99 % bandwidth. Initial measurements were employed to define which data rate provided the highest output power.

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

Ambient conditions.

Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

TABLE OF RESULTS

Center Frequency (MHz)	Peak Power (dBm)
2,402	+2.36
2,441	+2.22
2,480	+1.93

Specification Limits

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.2. Radiated Emissions

5.2.1. Transmitter Radiated Emissions (above 1 GHz)

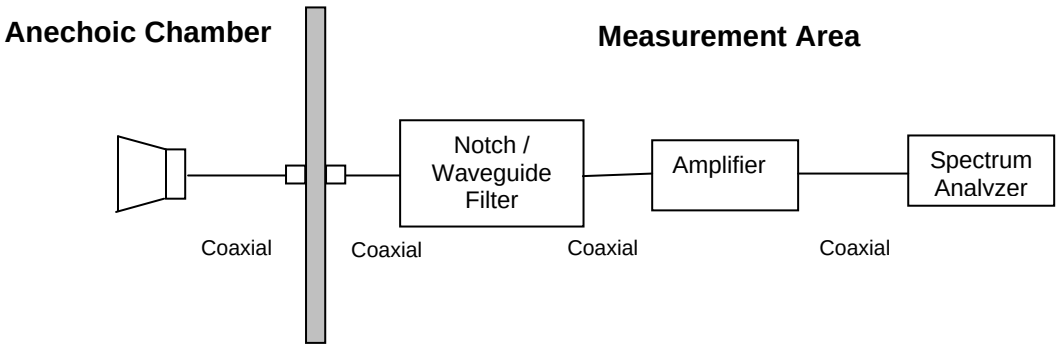
FCC, Part 15 Subpart C §15.247(d); §15.209

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO

where:

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For example:
Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

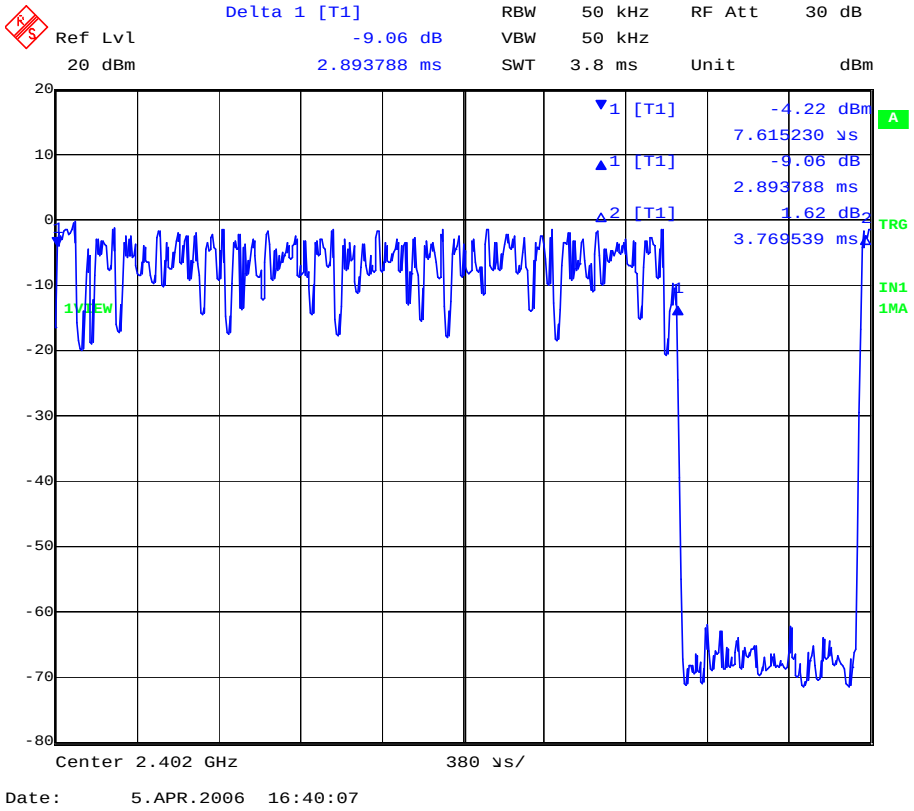
FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

System Duty Cycle



Period = 3.8m Secs
ON = 2.9 mSecs

Duty Cycle = 76.3%

Offset added to the average value of any spurious as a result of the duty cycle = 1.2 dB

Transmitter Radiated Spurious Emissions above 1 GHz (continued)

Measurement Results

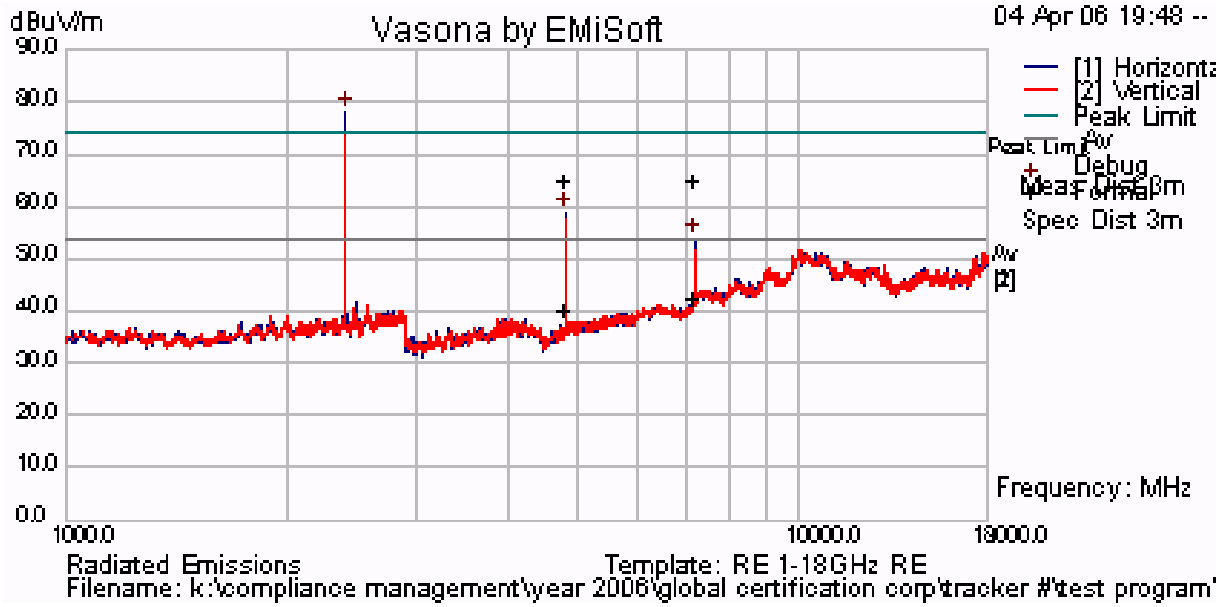
Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

TABLE OF RESULTS - Channel 2402 MHz

Freq. (MHz)	Polarity (H/V)	Peak Raw Reading (dBµV/m)	Corrected Field Strength Average (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
4803.71	V	61.25	38.64	54	-15.36
7205.15	H	58.11	40.84	54	-13.16

Note; The emission breaking the 74 dBµV/m Peak Limit line is the Transmitter fundamental at 2,402 MHz.

Channel Frequency 2402 MHz Transmitter Radiated Spurious Emissions



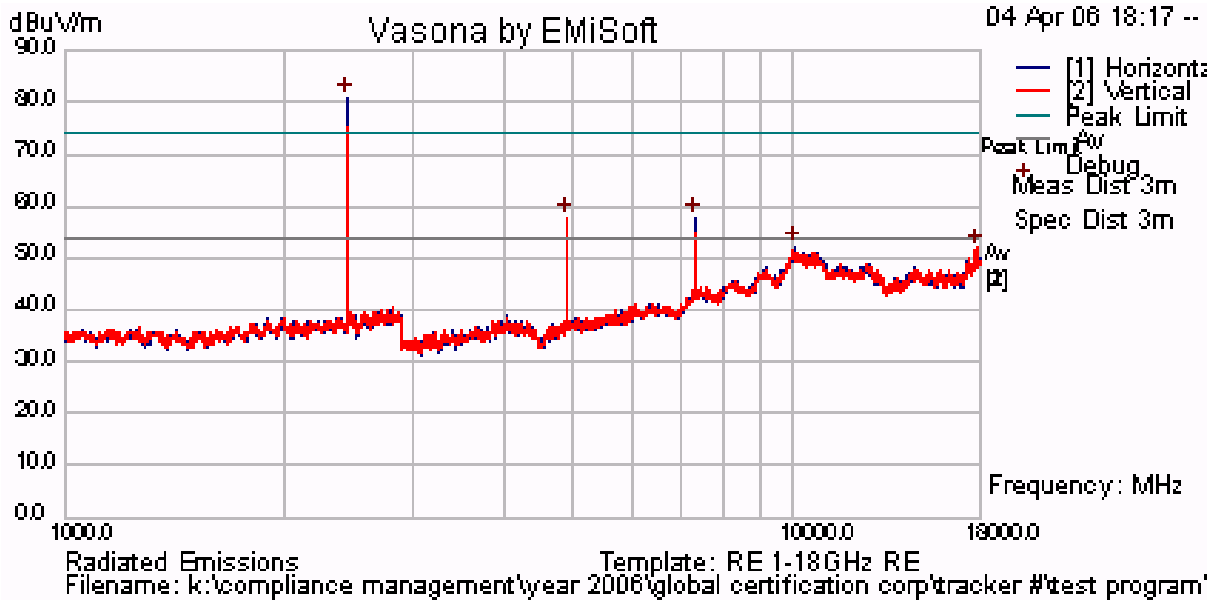
Transmitter Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS - Channel 2441 MHz

Freq. (MHz)	Polarity (H/V)	Peak Raw Reading (dBµV/m)	Corrected Field Strength Average (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
7322.36	V	64.23	42.33	54	-11.67
4881.38	H	63.72	39.62	54	-14.38

Note; The emission breaking the 74 dBµV/m Peak Limit line is the Transmitter fundamental at 2,441 MHz.

Channel Frequency 2441 MHz Transmitter Radiated Spurious Emissions



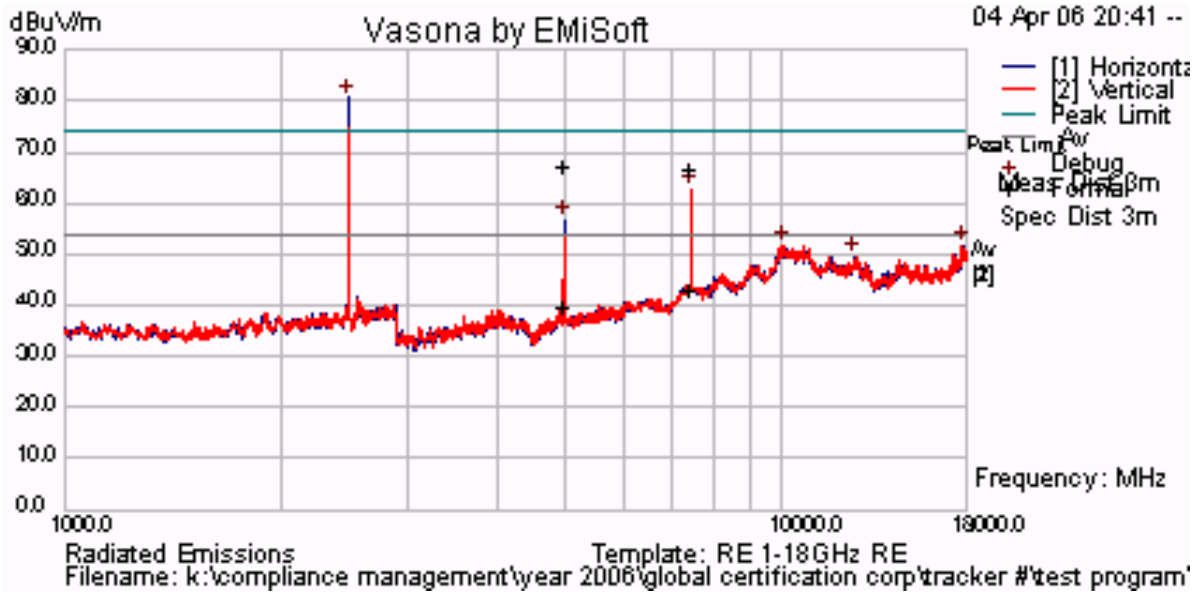
Transmitter Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS - Channel 2480 MHz

Freq. (MHz)	Polarity (H/V)	Peak Raw Reading (dBµV/m)	Corrected Field Strength Average (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
7439.12	V	64.12	41.73	54	-12.27
4959.55	H	64.69	38.06	54	-15.94

Note; The emission breaking the 74 dBµV/m Peak Limit line is the Transmitter fundamental at 2,480 MHz.

Channel Frequency 2480 MHz Transmitter Radiated Spurious Emissions



Specification

Limits

§15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

Frequency (MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Measurement Uncertainty Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0104, 0158, 0184, 0193, 0134, 0310, 0312, 0252.

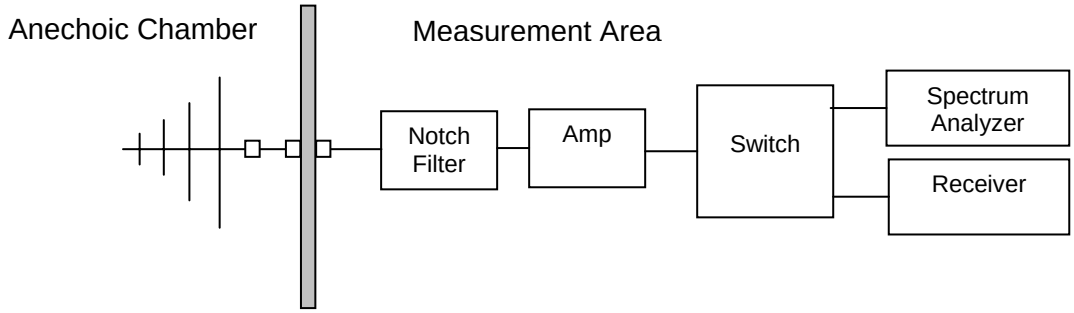
5.2.2. Radiated Spurious Emissions (30M-1 GHz)

FCC, Part 15 Subpart C §15.209

Test Procedure

Preliminary radiated emissions are measured in the anechoic chamber at a 10-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

Test Measurement Set up



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

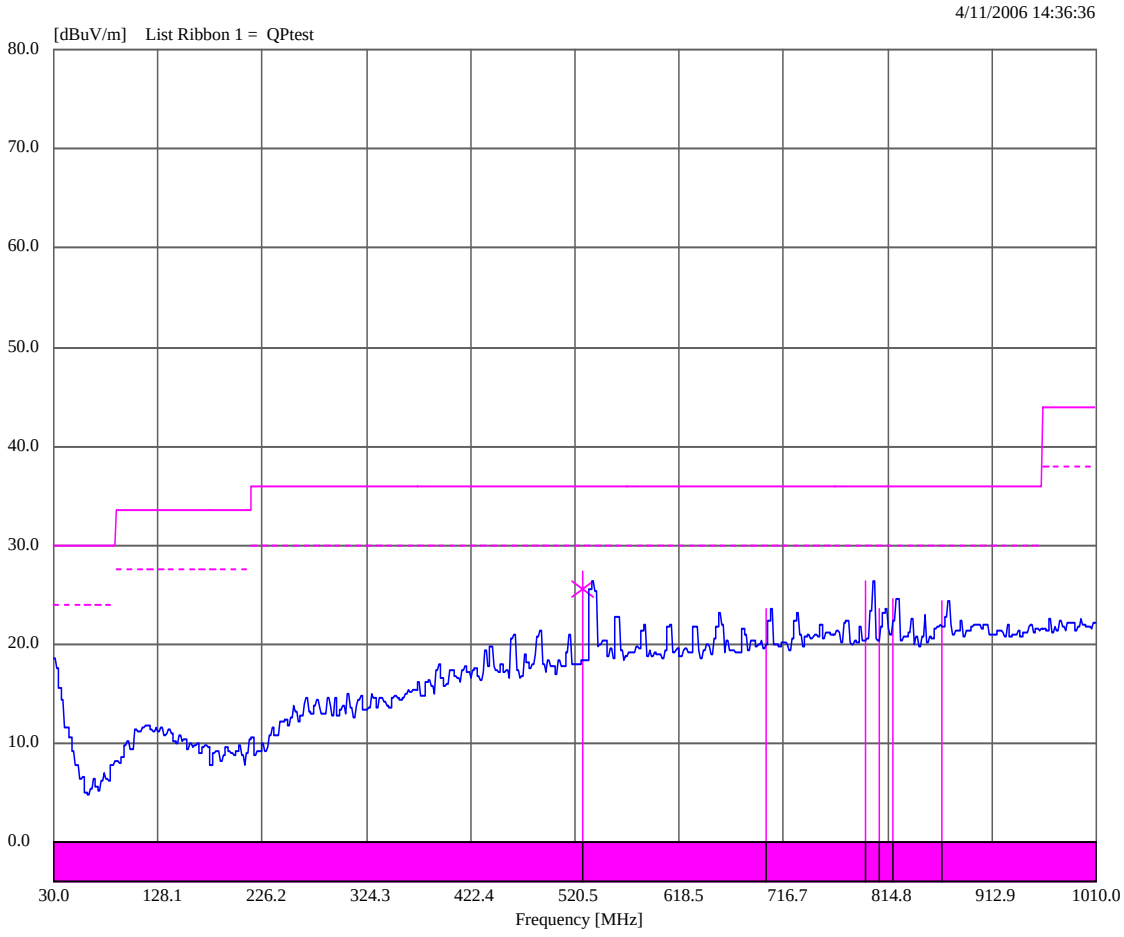
Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.
Temperature: 19 to 26 °C Relative humidity: 31 to 57 % Pressure: 999 to 1009 mbar

TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Pol	Total Correc-tion Factor
527.997662	27.29	25.60	35.60	-10.00	223	200	H	-6.73
700.200000	23.54	--.--	35.60	--.--	98	100	H	-4.71
794.750000	26.42	--.--	35.60	--.--	290	100	H	-3.13
807.000000	23.63	--.--	35.60	--.--	290	100	H	-2.91
820.250000	24.52	--.--	35.60	--.--	336	100	H	-3.13
865.800000	24.41	--.--	35.60	--.--	281	100	H	-2.41

Radiated Emissions < 1 GHz



Specification

Limits

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

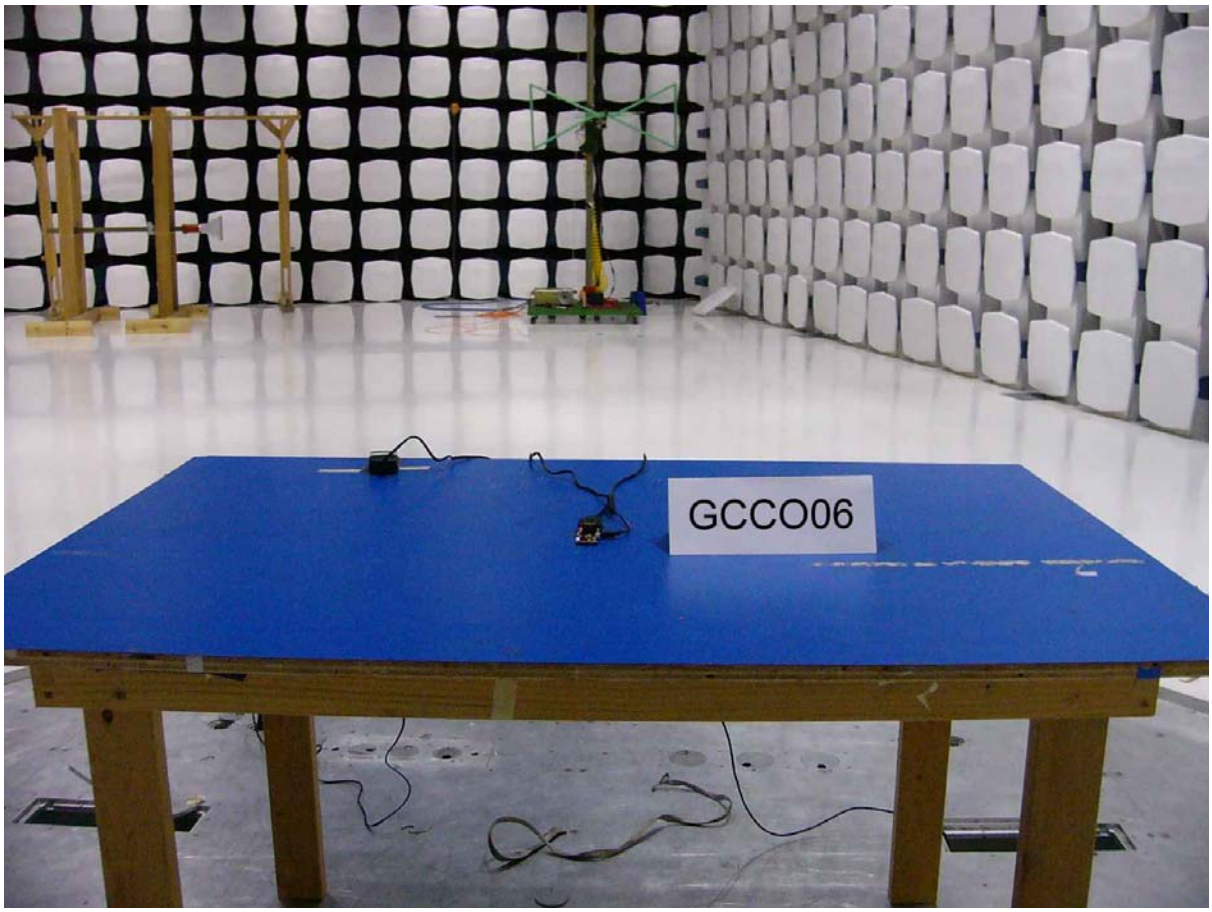
Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

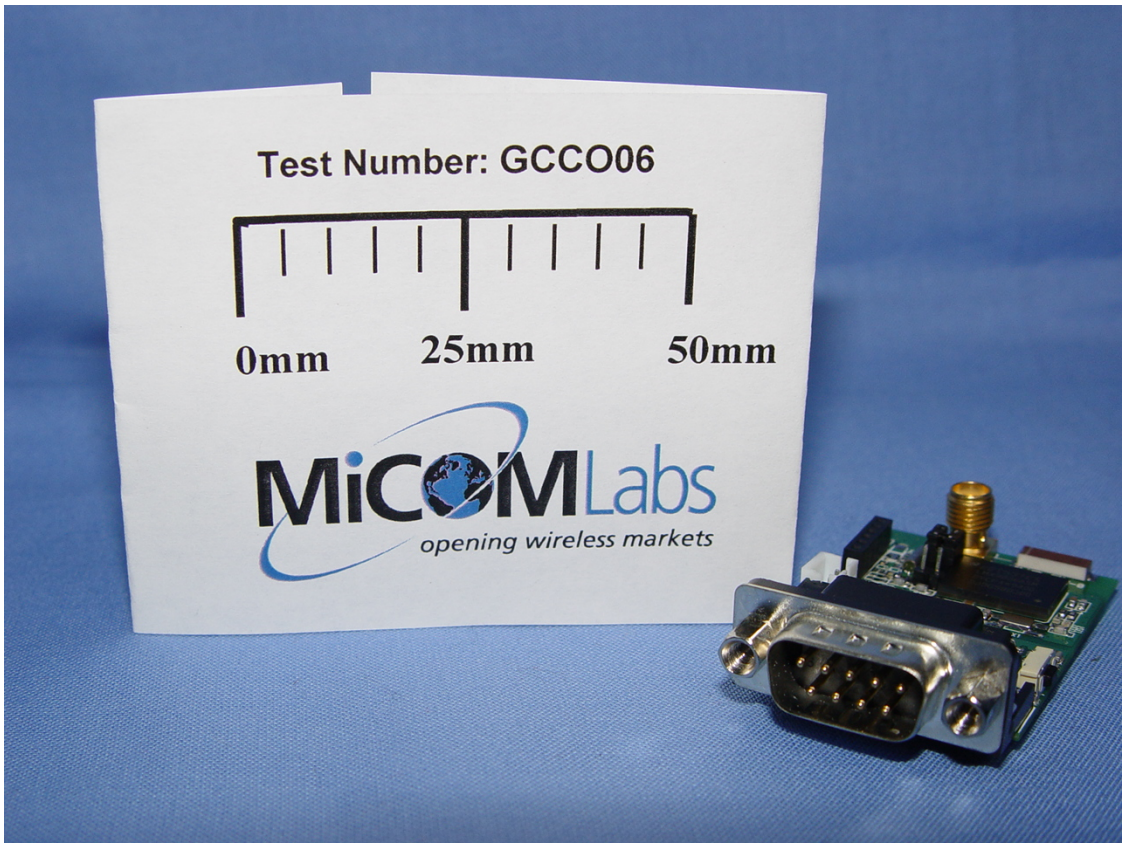
6. PHOTOGRAPHS

6.1. Radiated Emissions (30 MHz-1 GHz)



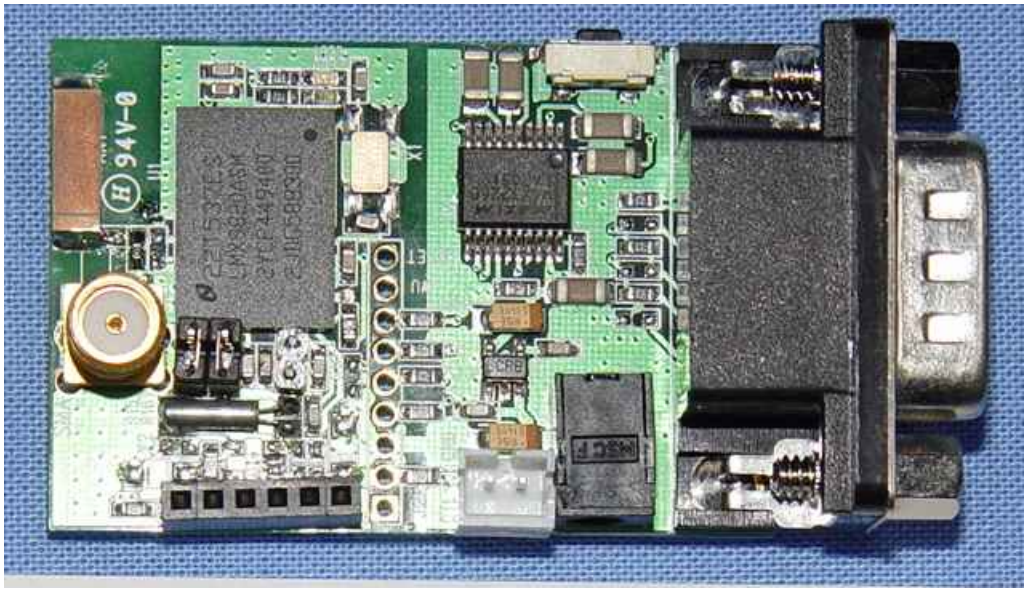
6.2. Radiated Emissions above 1GHz

6.3. Photograph of EUT Interface Ports

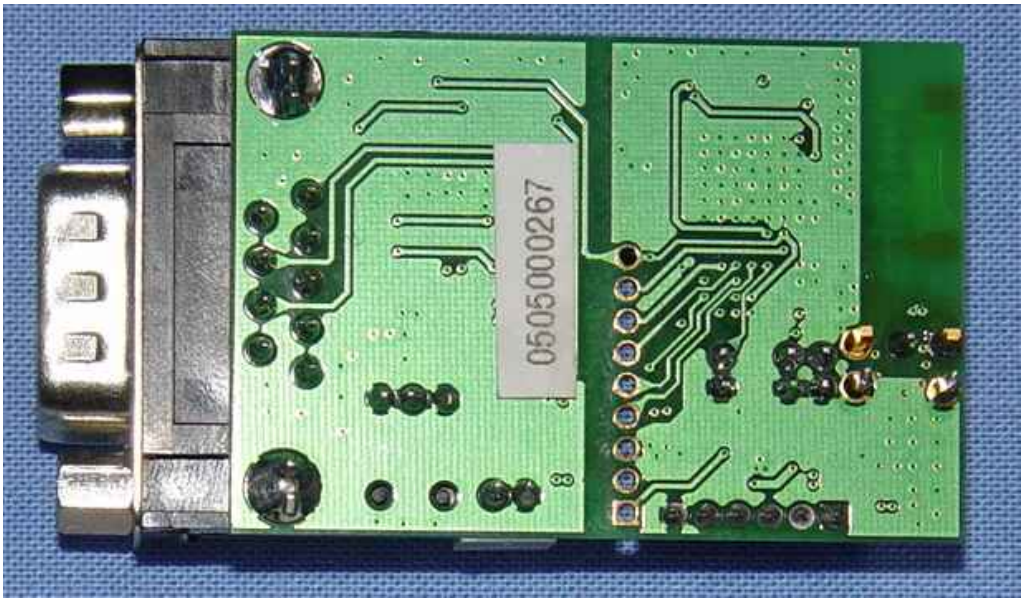


6.4. Photograph of EUT Assembly

Assembly Top View



Assembly Bottom View



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Calibration Due Date	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	20th June '06	3410A00141
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	21st Oct '06	9205-3882
0134	Amplifier	Com Power	PA 122	1st Dec '06	181910
0158	Barometer /Thermometer	Control Co.	4196	25th Aug '06	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	8th Apr '06	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	11th Jun '06	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	7th Dec '06	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	9h Dec '06	209092-001

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