

TEST REPORT



Your Ref:

Date: 30 Aug 2004

Our Ref: 56S040534/01

Page: 1 of 14

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
FCC Part 15C : 2004
OF A
CLASS 1 BLUETOOTH CARRIER MODULE
[MODEL : iMBTC1P-RevA]
[FCC ID : Q9WIMBTC1PV10]

TEST FACILITY Telecoms & EMC, Testing Group, PSB Corporation Pte Ltd
1 Science Park Drive, Singapore 118221

FCC REG. NO. 90937 (3m & 10m OATS)
99142 (10m Anechoic Chamber)
871638 (5m Anechoic Chamber)

IND. CANADA REG. NO. IC 4257 (10m Anechoic Chamber)

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JOB NUMBER 56S040534

TEST PERIOD 24 Aug 2004 – 28 Aug 2004

PREPARED BY

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LA-2001-0212-A
LA-2001-0213-F
LA-2001-0214-E
LA-2001-0215-B
LA-2001-0216-G
LA-2001-0217-G

The results reported herein have been performed in accordance with the laboratory's terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme

TEST SUMMARY

PRODUCT DESCRIPTION

SUPPORTING
EQUIPMENT LIST

EUT OPERATING
CONDITION

TEST RESULTS

- | | | |
|---------|---|--|
| ANNEX A | - | TEST INSTRUMENTATION & GENERAL PROCEDURES |
| ANNEX B | - | EUT PHOTOGRAPHS / DIAGRAMS |
| ANNEX C | - | USER MANUAL, TECHNICAL DESCRIPTION, BLOCK & CIRCUIT DIAGRAMS |
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The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail
FCC Part 15C: 2004		
15.107, 15.207	Conducted Emissions	Pass
15.205	Radiated Emissions (Restricted Band Requirements)	Pass
15.109, 15.209	Radiated Emissions (Spurious Emissions)	Pass

Notes

- Three channels as listed below, which respectively represent the lower, middle and upper channels of the equipment under test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the Bluetooth test mode

<u>Transmit Channel</u>	<u>Frequency (GHz)</u>
Channel 0	2.402
Channel 39	2.441
Channel 78	2.480
- The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.
- The initial EUT's swivel antenna (from job 56Q030987/01) has been changed to a SMA connector antenna. Therefore, class II permissible change applies to this unit. With this change, only the above mentioned tests need to be repeated to ensure the modified EUT shows compliance.

Modifications

No modifications were done.

PRODUCT DESCRIPTION

Description	: The Equipment Under Test (EUT) is a Class 1 Bluetooth Carrier Module .
Model Number	: IMBTC1P-RevA
FCC ID	: Q9WIMBTC1PV10
Serial Number	: Nil
Microprocessor	: CSR BC212015BD
Operating / Transmitting Frequency	: 2.402GHz to 2.480GHz 79 channels. Starting at 2.402MHz with subsequent channel at 1MHz interval from the preceding channel.
Clock / Oscillator Frequency	: 16MHz
Modulation	: Gaussian Frequency Shift Keying (GFSK) with BT = 0.5
Pulse Train Cycle	: 1.25ms / 3.75ms / 6.25ms / Continuous signal (in testing)
Port / Connectors	: 1 x DC port 1 x RS232 port
Rated Input Power	: 5.0 VDC

SUPPORTING EQUIPMENT DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
HP OmniBook Notebook	M/N: XE3 S/N: TW04903634 FCC ID: DoC	1.8m unshielded AC/DC power adapter cable 1.5m standard serial cable
Newstar AC/DC Power Adapter (Power adapter for EUT)	M/N: CE-502RS S/N: Nil FCC ID: Nil	1.5m unshielded AC/DC power adapter cable

EUT OPERATING CONDITIONS

The Class 1 Bluetooth Carrier Module was powered from 110V, 60Hz mains supply via an AC/DC power adapter.

Tests	Description Of Operation
1. Conducted Emissions 2. Radiated Emissions	<p>The EUT was exercised by operating in the Bluetooth test mode with maximum transmitting power and following configuration during the tests:</p> <p><u>Conducted Emissions, Radiated Emissions</u> Frequency hopping is off and the modulation is on.</p> <p>Note: For all the tests mentioned above, the DH1 packet was used with the PRBS 9 as the payload.</p>

FCC Part 15C (15.107 & 15.207) Conducted Emission Results

Frequency (MHz)	Q-P Value (dBμV)	Q-P Margin (dB)	AV Value (dBμV)	AV Margin (dB)	Line	Channel
0.2777	40.8	-21.5	27.6	-24.7	Neutral	78
0.3474	39.5	-20.8	22.6	-27.7	Live	0
0.4164	33.8	-24.6	31.1	-17.2	Neutral	39
0.6244	28.7	-27.3	23.8	-22.2	Neutral	78
0.7639	24.7	-31.3	23.0	-23.0	Live	0
4.5096	29.1	-26.9	26.8	-19.2	Neutral	39

Tested by: DP

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
9kHz - 30MHz
RBW: 10kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ± 2.4 dB.



Conducted Emissions Setup (Front View)



Conducted Emissions Setup (Rear View)

FCC Part 15C (15.109 & 15.209) Radiated Emission (Spurious Emissions) Results

Test Distance : 3m

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Margin (dB)	Channel	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
31.0439	21.0	-19.0	39	269	100	H
50.9519	24.8	-15.2	0	129	100	V
75.5371	23.3	-16.7	78	108	100	V
90.4749	24.3	-19.2	0	178	120	V
431.9699	22.1	-23.9	39	307	100	H
935.2562	23.5	-22.5	0	281	100	H

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBµV/m)	Average Value (dBµV/m)	Average Margin (dB) See Note 3	Channel	Azimuth (Degrees)	Height (cm)	Pol (H/V)
1.2953	44.4	See Note 2	-9.5	0	63	100	H
1.8978	43.1	See Note 2	-10.8	78	231	100	H
2.6312	49.0	See Note 2	-4.9	39	120	138	H
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Tested by: DP

Notes

- All possible modes of operation were investigated from 30MHz to 25GHz. All other emissions were relatively insignificant.
- As the measured peak shows compliance to the average limit, as such no average measurement was required.
- The average margin indicates the margin of the measured peak value below the average limit.
- "--" indicates no emissions were found and shows compliance to the limits as specified in section 15.209. The emissions were merely the noise floor.
- Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
 RBW: 120kHz VBW: 1MHz
>1GHz
 RBW: 1MHz VBW: 1MHz

8. The peak emissions above 1GHz show compliance to the requirement stated in Section 15.35 (b).
9. Radiated Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz (QP only @ 3m & 10m) is $\pm 4.3\text{dB}$ (for EUTs < 0.5m X 0.5m X 0.5m).

FCC Part 15C (15.205) Radiated Emissions (Restricted Band Requirements) Results

Test Distance : 3m

Spurious Emissions (Restricted Band) ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Channel	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
108.0132	20.6	-22.9	0	189	100	V
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Spurious Emissions above 1GHz

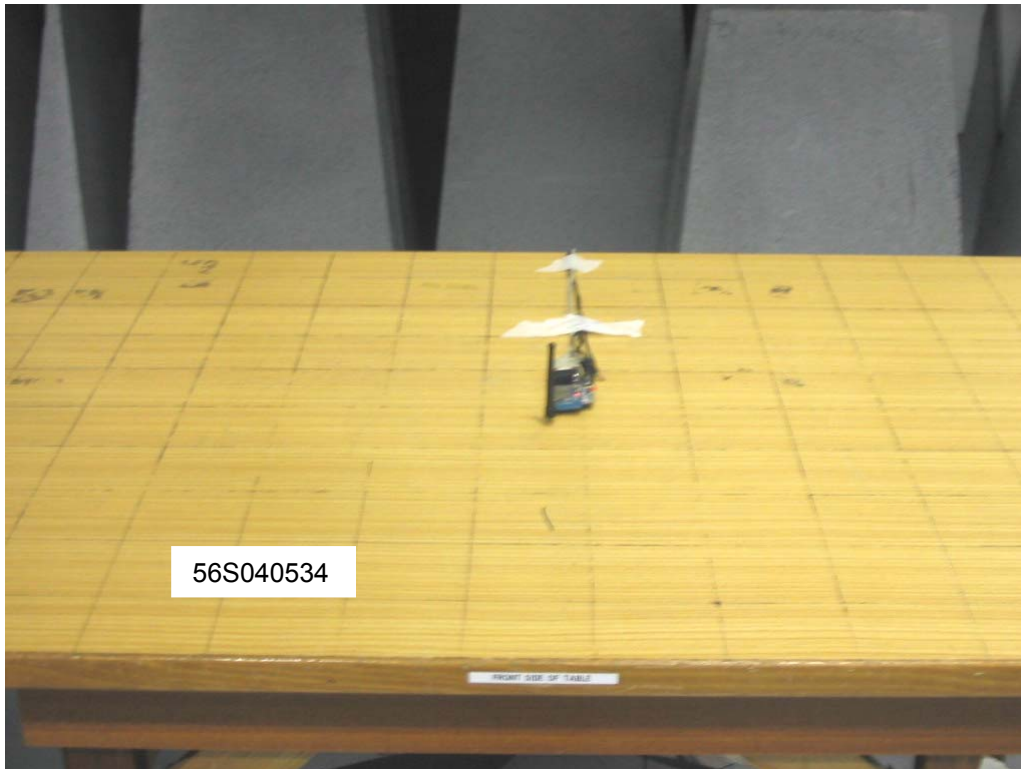
Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB) See Note 3	Channel	Azimuth (Degrees)	Height (cm)	Pol (H/V)
2.2786	45.2	See Note 2	-8.7	0	214	100	V
2.3266	47.3	See Note 2	-6.6	78	181	100	V
2.6873	50.2	See Note 2	-3.7	0	138	100	H
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Tested by: DP

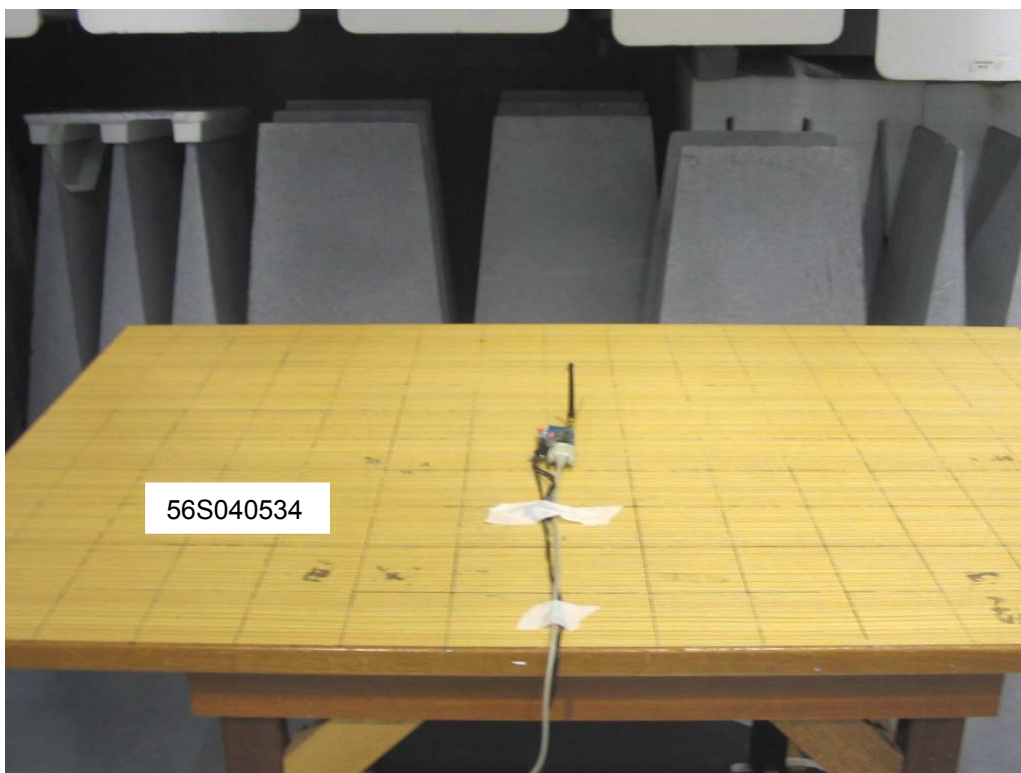
Notes

- All possible modes of operation were investigated from 30MHz to 25GHz. All other emissions were relatively insignificant.
- As the measured peak shows compliance to the average limit, as such no average measurement was required.
- The average margin indicates the margin of the measured peak value below the average limit.
- "--" indicates no emissions were found and shows compliance to the limits as specified in section 15.209. The emissions were merely the noise floor.
- Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
 RBW: 120kHz VBW: 1MHz
>1GHz
 RBW: 1MHz VBW: 1MHz

8. The peak emissions above 1GHz show compliance to the requirement stated in Section 15.35 (b).
9. Radiated Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz (QP only @ 3m & 10m) is $\pm 4.3\text{dB}$ (for EUTs < 0.5m X 0.5m X 0.5m).



Radiated Emissions Setup (Front View)



Radiated Emissions Setup (Rear View)

This Report is issued under the following conditions:

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August 2003

ANNEX A

TEST INSTRUMENTATION & GENERAL PROCEDURES

TEST INSTRUMENTATION & GENERAL PROCEDURES

ANNEX A

3m OATS Test Instrumentation (Conducted Emissions)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>	
R&S Test Receiver (9kHz-30MHz)	ESH3	862301/005	25 Jul 2005	x
Schaffner Pulse Limiter	CFL 9206	1720	1 Apr 2005	x
EMCO LISN (for EUT) – LISN6	3825/2	9309-2127	20 May 2005	x

3m Anechoic Chamber Test Instrumentation (Radiated Emissions)

<u>Instrument</u>	<u>Model</u>	<u>S/No</u>	<u>Cal Due Date</u>	
R&S Test Receiver – ESI3	ESIB7	100015	5 Aug 2005	x
HP Preamplifier (for ESM13, 0.01-3GHz) – PA6	87405A	3950M00353	1 Apr 2005	x
MITEQ Preamplifier (0.1-26.5GHz) – PA11	NSP2650-N	728231	1 Apr 2005	x
Schaffner Bilog Antenna – BL5	CBL6143	5041	18 May 2005	x
EMCO Horn Antenna – H14	3115	0003-6087	22 May 2005	x
Micro-tronics Band-Stop Filter	BRM50701	017	1 Apr 2005	x

CONDUCTED EMISSIONS TEST DESCRIPTION**Test Set-up**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a $50\Omega/50\mu\text{H}$ EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz	limit = $250\ \mu\text{V}$ = 47.96 dB μV
Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB	
Q-P reading obtained directly from EMI Receiver = 40 dB μV (Calibrated for system losses)	
Therefore, Q-P margin = $40 - 47.96 = -7.96$	i.e. 7.96 dB below limit

TEST INSTRUMENTATION & GENERAL PROCEDURES**ANNEX A****RADIATED EMISSIONS TEST DESCRIPTION (3m ANC)****Test Set-up**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to find out the EUT highest emissions relative to the limit by rotating the EUT through three orthogonal axes to determine which attitude and equipment arrangement produces such emissions.
3. The final measurement was then carried out at the selected frequency points based on the highest emissions arrangement found from step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 25GHz, using the Bi-log antenna for frequencies from 30MHz up to 3GHz, and the Horn antenna above 3GHz.

Sample Calculation Example

At 300 MHz	limit = $200 \mu\text{V/m} = 46 \text{ dB}\mu\text{V/m}$
Log-periodic antenna factor & cable loss at 300 MHz = 18.511 dB	
Q-P reading obtained directly from EMI Receiver = $40 \text{ dB}\mu\text{V/m}$ (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = $40 - 46 = -6$	i.e. 6 dB below limit

ANNEX B

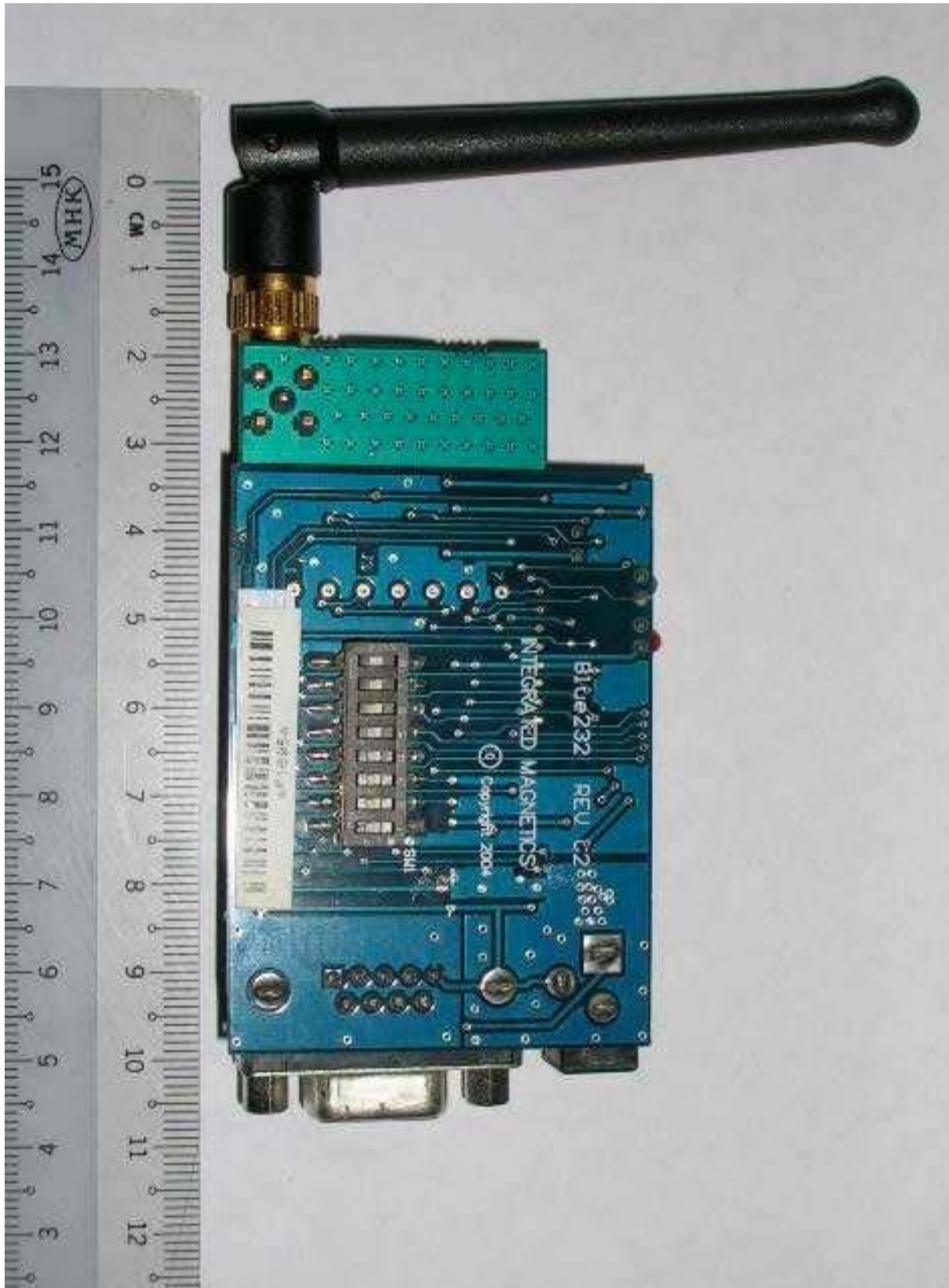
TEST PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS



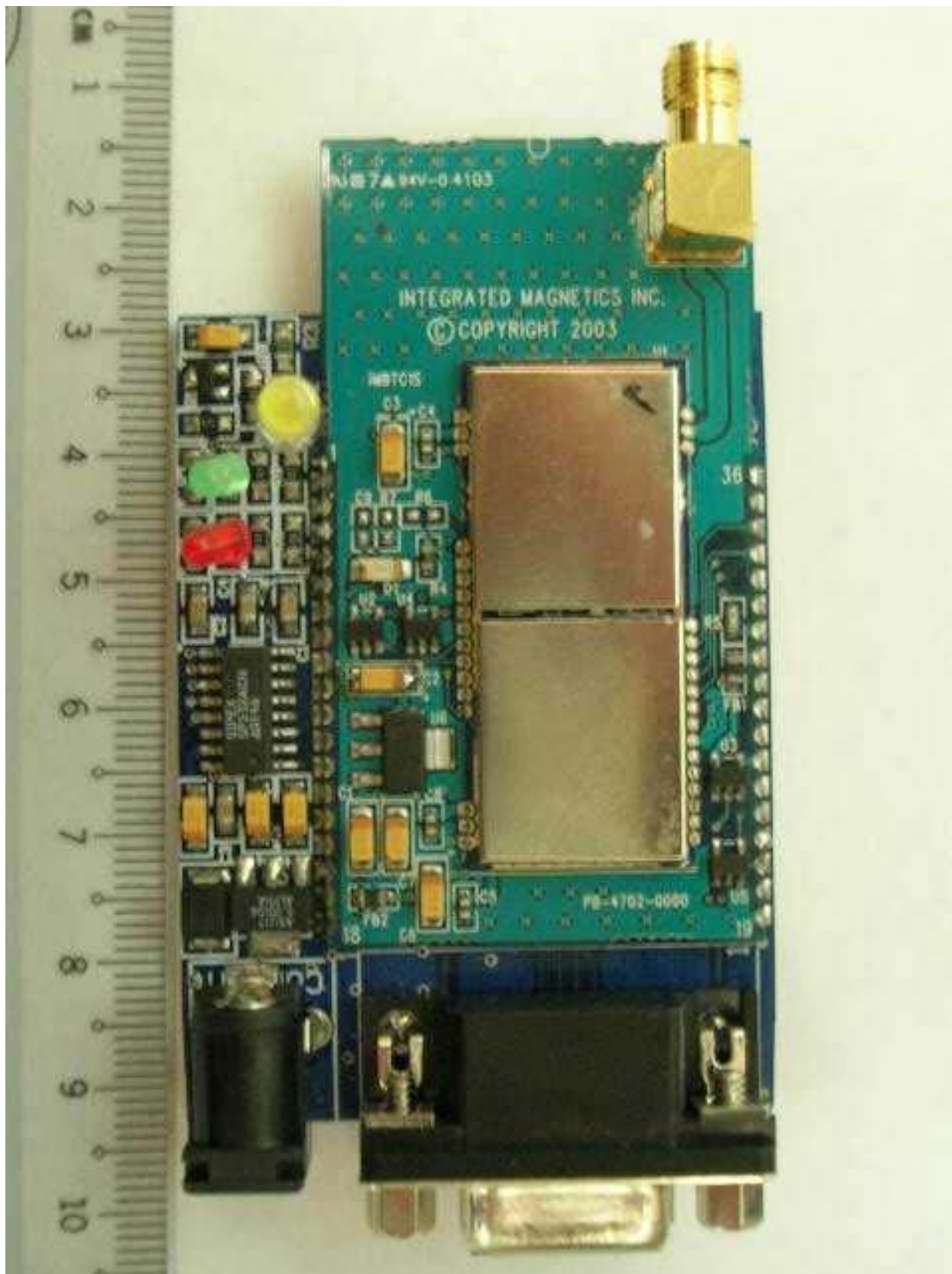
Front View

EUT PHOTOGRAPHS



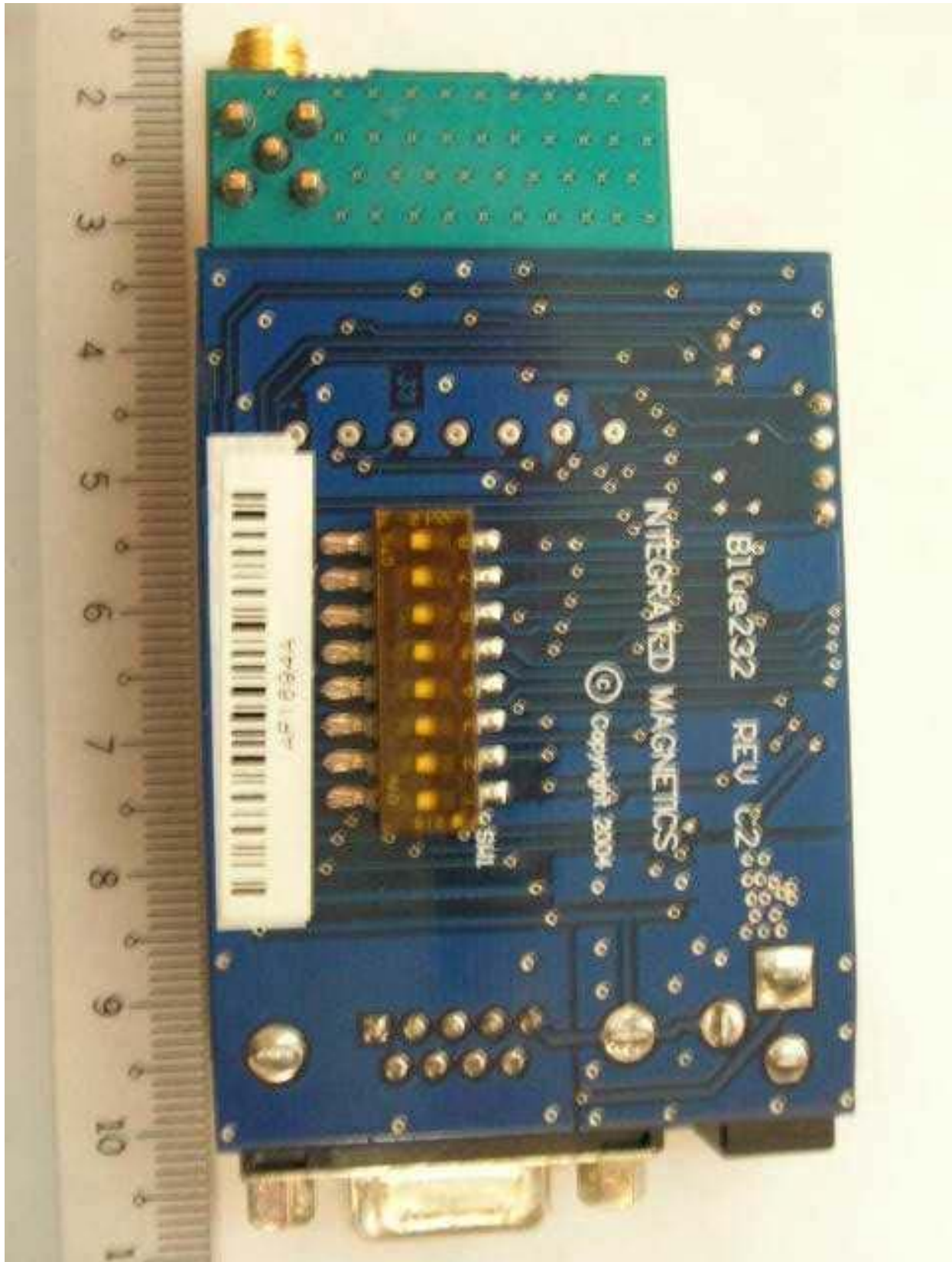
Rear View

EUT PHOTOGRAPHS



Front View

EUT PHOTOGRAPHS



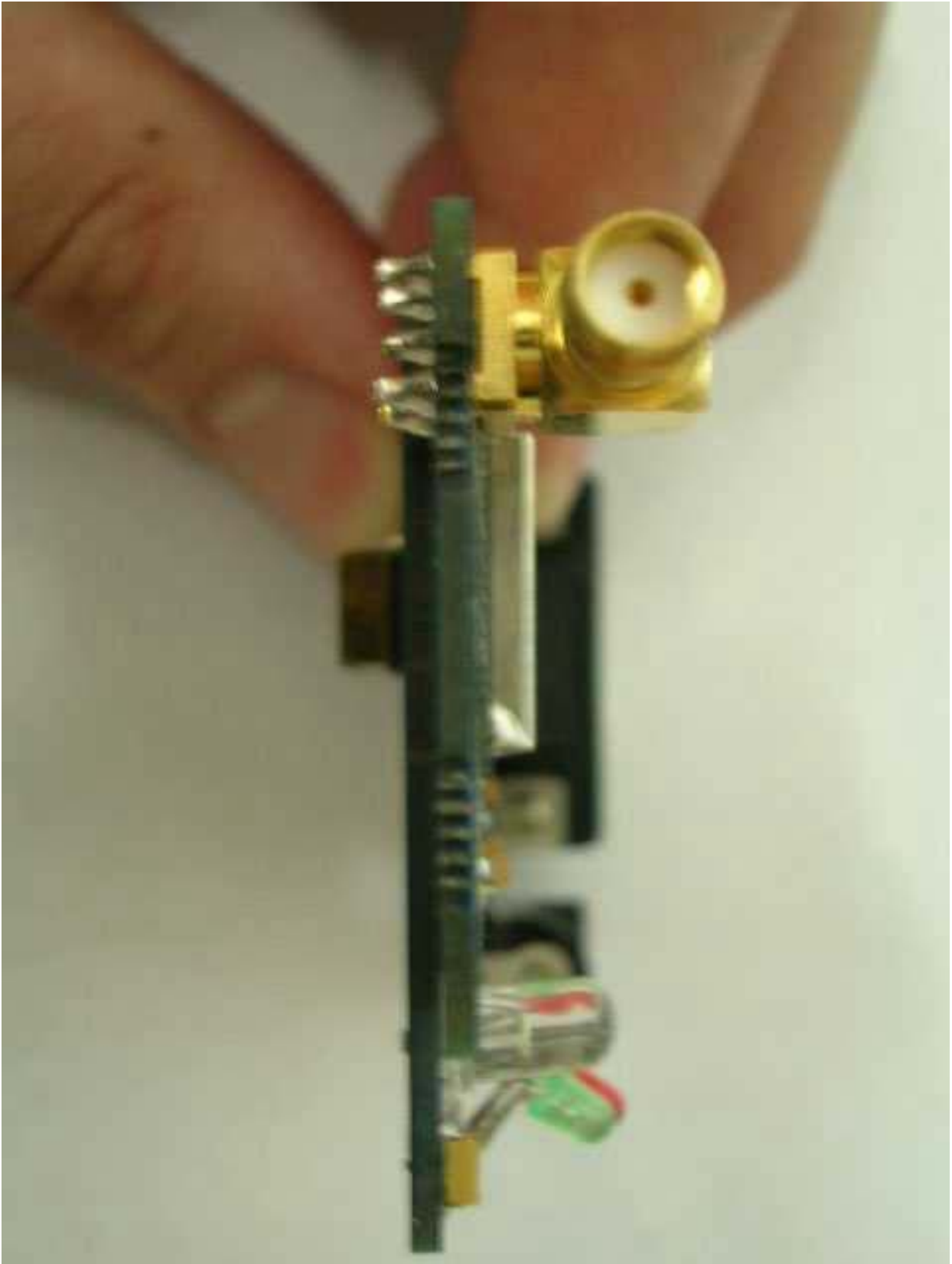
Rear View

EUT PHOTOGRAPHS



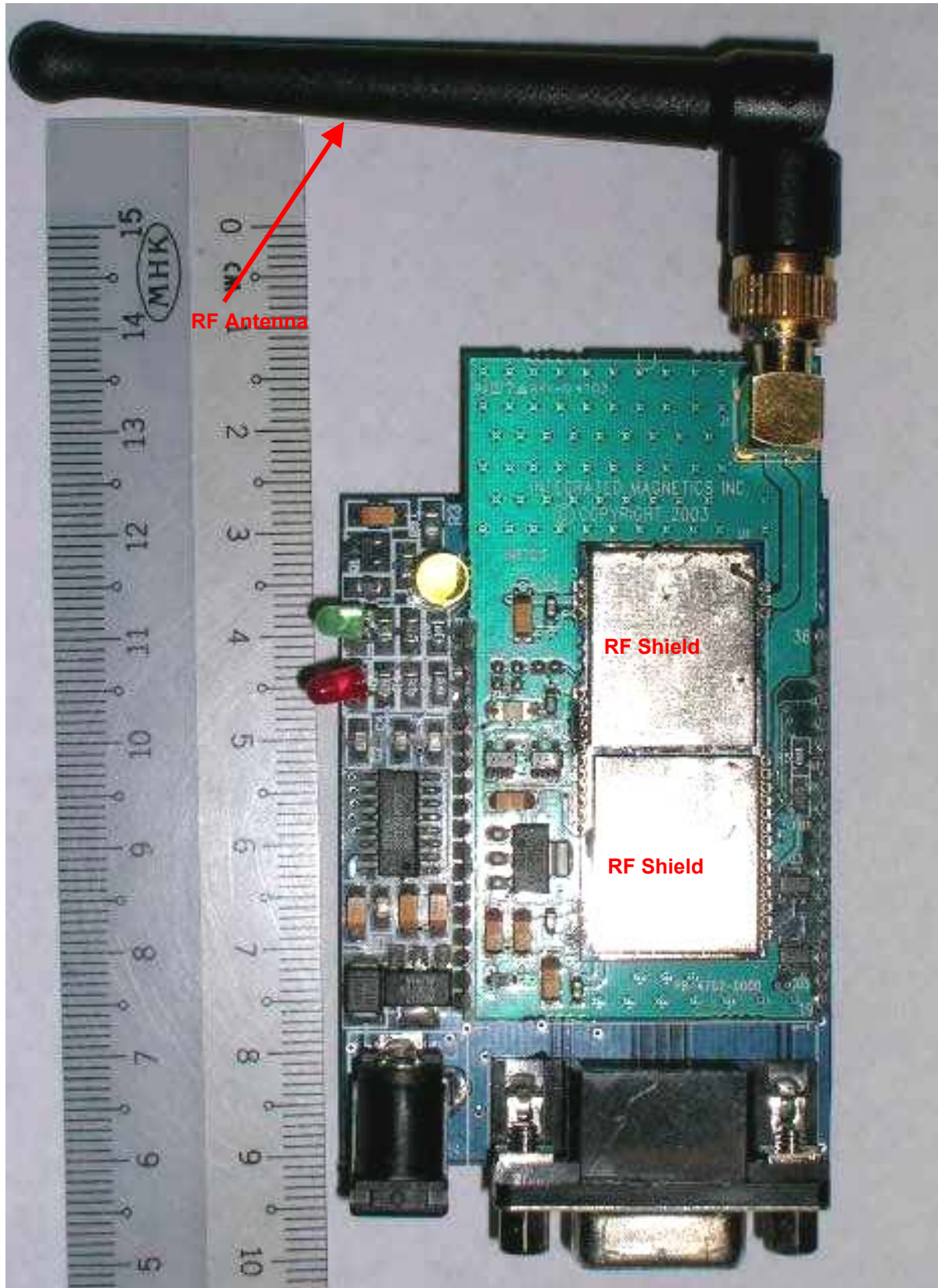
SMA connector at antenna

EUT PHOTOGRAPHS



SMA antenna connector at PCB

EUT PHOTOGRAPHS



EUT RF Antenna and Shield Locations

ANNEX C

**USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS**

(Please refer to attached copy)

ANNEX D

FCC LABEL & POSITION

FCC LABEL & POSITION

ANNEX D

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

iM® INTEGRATED MAGNETICS INC.®
Model #: iMBTC1P-RevA

Class 1 Carrier Module
With Picea Antenna

S/N:

FCC ID:

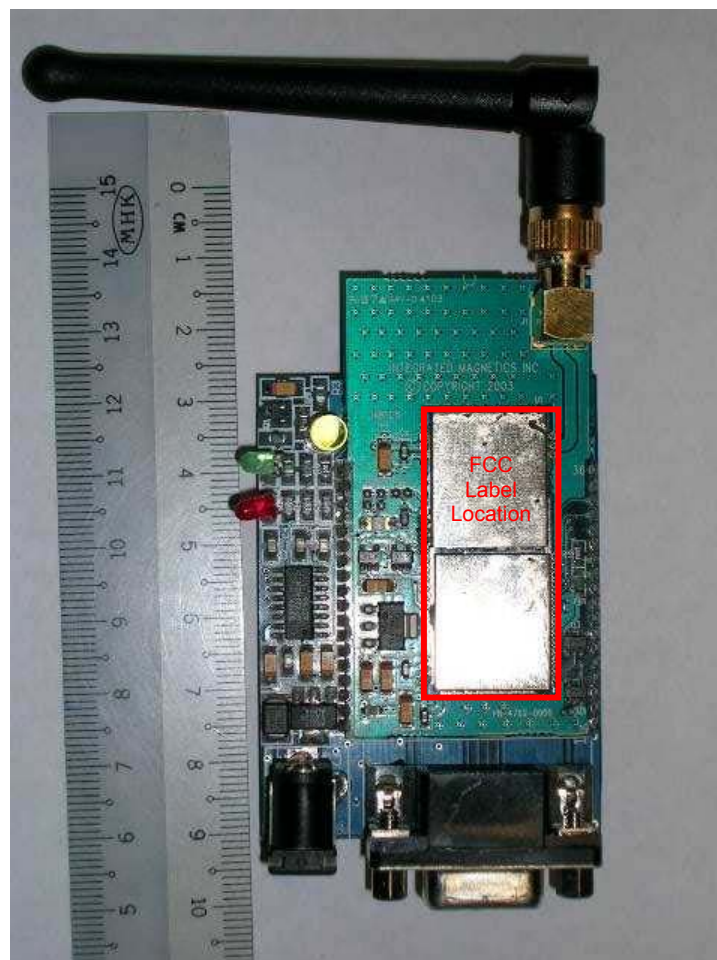
Q9WIMBTC1PV10

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undersired operation.

Sample Label



Physical Location of FCC Label on EUT