

BAND EDGE COMPLIANCE TEST**FCC Part 15.247(d) Band Edge Compliance Limits**

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance Test Instrumentation

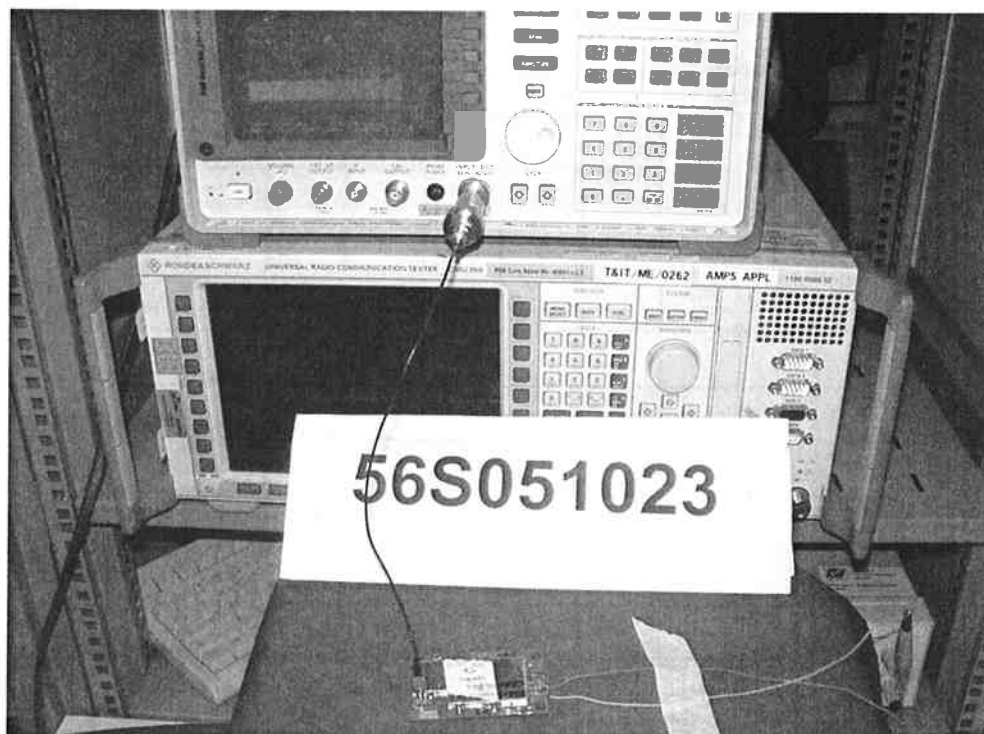
Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyzer	8564E	3846A01433	27 Apr 2006

FCC Part 15.247(d) Band Edge Compliance Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

BAND EDGE COMPLIANCE TEST**Band Edge Compliance Test Setup****FCC Part 15.247(d) Band Edge Compliance Results**

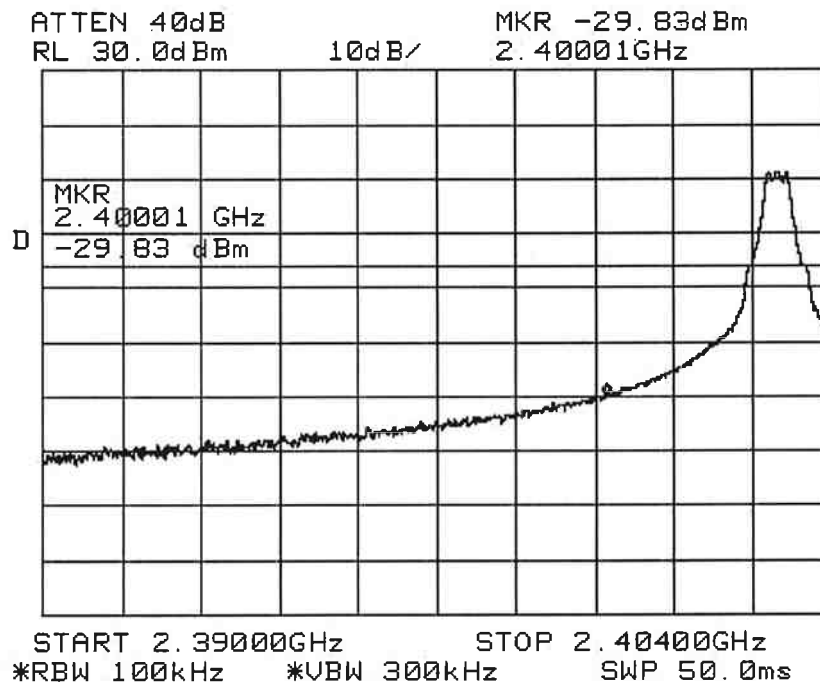
Test Input Power	5Vdc	Temperature	24°C
Attached Plots	39 - 40	Relative Humidity	59%
Module	Transmitter	Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

Test Input Power	5Vdc	Temperature	24°C
Attached Plots	41 - 42	Relative Humidity	59%
Module	Receiver	Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

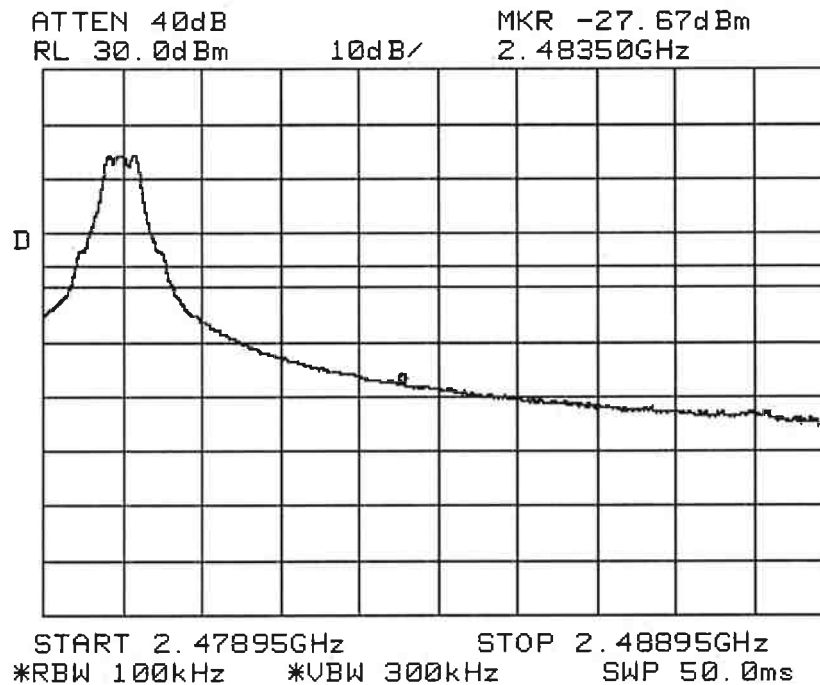
No significant signal was found and they were below the specified limit.

BAND EDGE COMPLIANCE TEST

Band Edge Compliance Plots - Transmitter



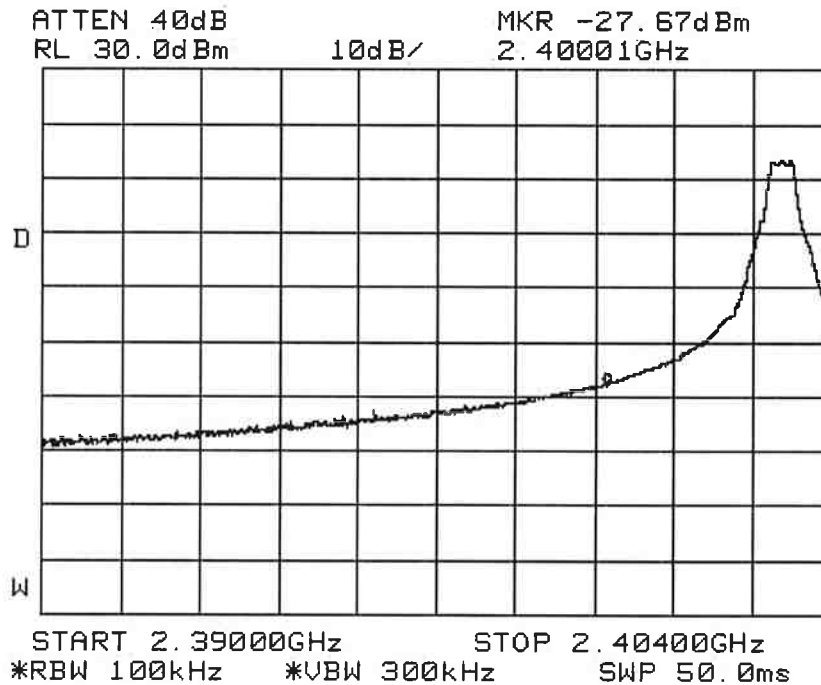
Plot 39 – Lower Band Edge at 2.4000GHz



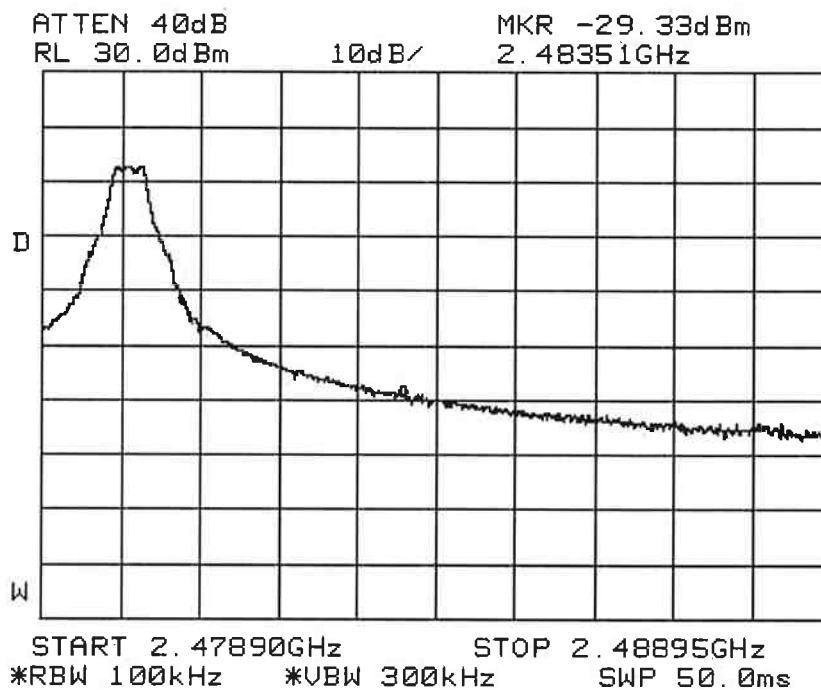
Plot 40 – Upper Band Edge at 2.4835GHz

BAND EDGE COMPLIANCE TEST

Band Edge Compliance Plots - Receiver



Plot 41 – Lower Band Edge at 2.4000GHz



Plot 42 – Upper Band Edge at 2.4835GHz

PEAK POWER SPECTRAL DENSITY TEST**FCC Part 15.247(e) Peak Power Spectral Density Limits**

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

FCC Part 15.247(e) Peak Power Spectral Density Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyzer	8564E	3846A01433	27 Apr 2006

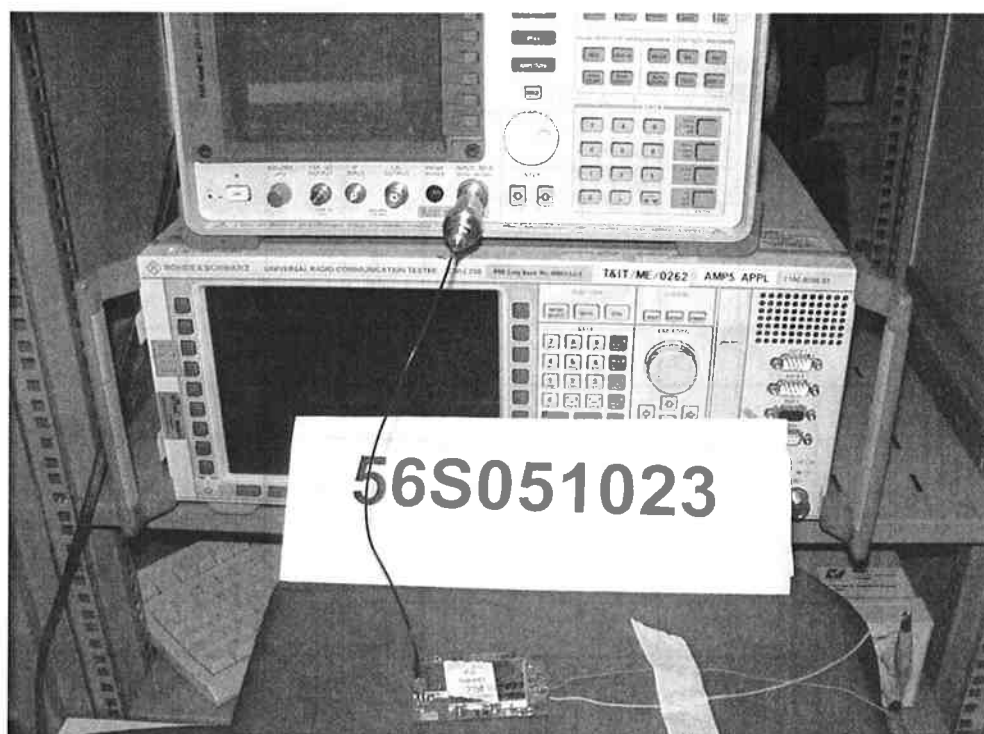
FCC Part 15.247(e) Peak Power Spectral Density Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 10kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(e) Peak Power Spectral Density Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 1 (2.403GHz).
2. The sweep time of the spectrum analyser was set to the value of the ratio of the frequency span divided by the RBW.
3. The peak power density of the transmitting frequency was detected and recorded.
4. The step 3 was repeated with the transmitting frequency was set to Channel 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

PEAK POWER SPECTRAL DENSITY TEST



Peak Power Spectral Density Test Setup

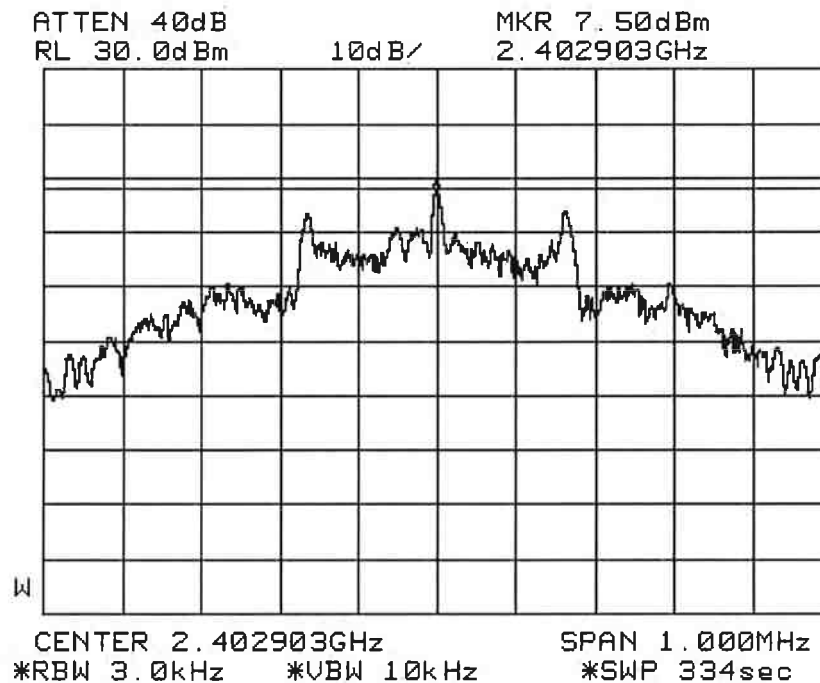
FCC Part 15.247(e) Peak Power Spectral Density Results

Test Input Power	5Vdc	Temperature	24°C
Attached Plots	43 – 45	Relative Humidity	60%
Module	Transmitter	Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

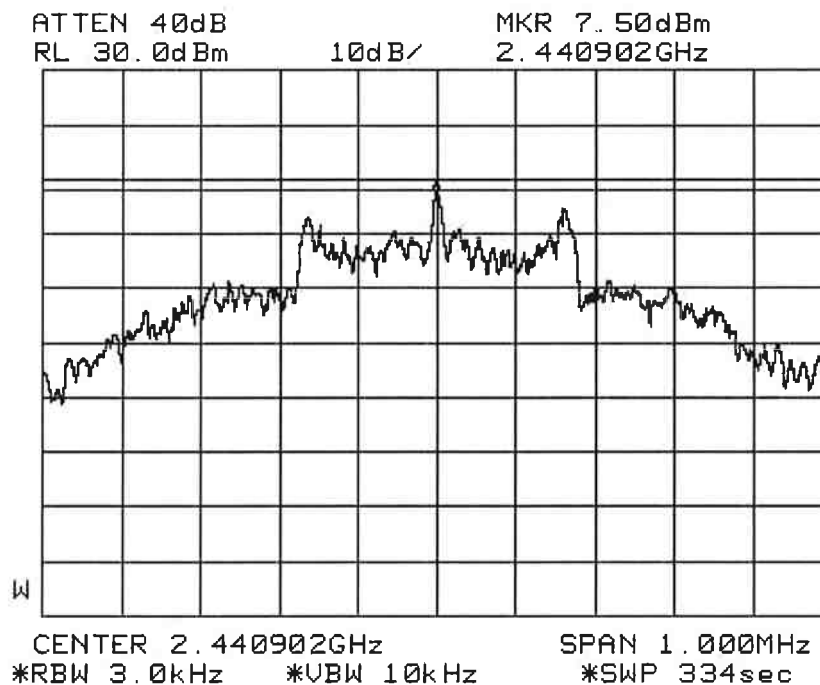
Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
1	2.403	5.624	6.3
39	2.441	5.624	6.3
78	2.480	5.848	6.3

PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots - Transmitter



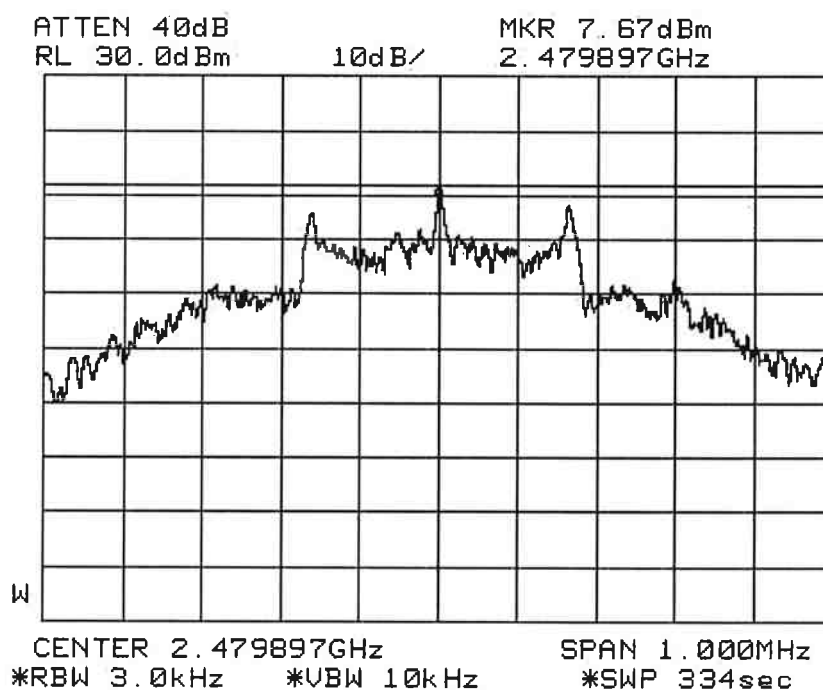
Plot 43 – Channel 1



Plot 44 – Channel 39

PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots - Transmitter



Plot 45 – Channel 78

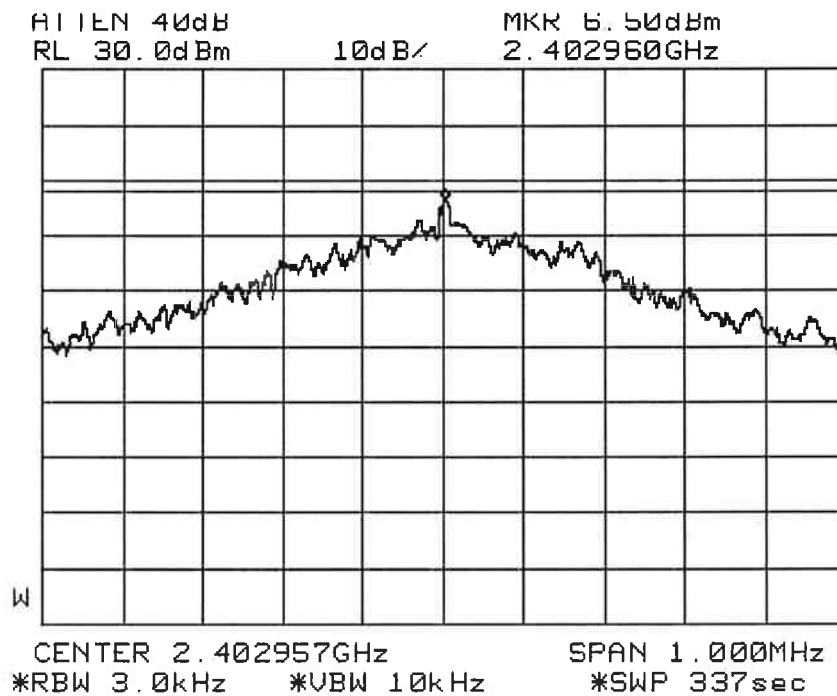
PEAK POWER SPECTRAL DENSITY TEST

FCC Part 15.247(e) Peak Power Spectral Density Results

Test Input Power	5Vdc	Temperature	24°C
Attached Plots	46 - 48	Relative Humidity	60%
Module	Receiver	Atmospheric Pressure	1030mbar
		Tested By	Johnsen Tia

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
1	2.403	4.467	6.3
39	2.441	4.467	6.3
78	2.480	2.711	6.3

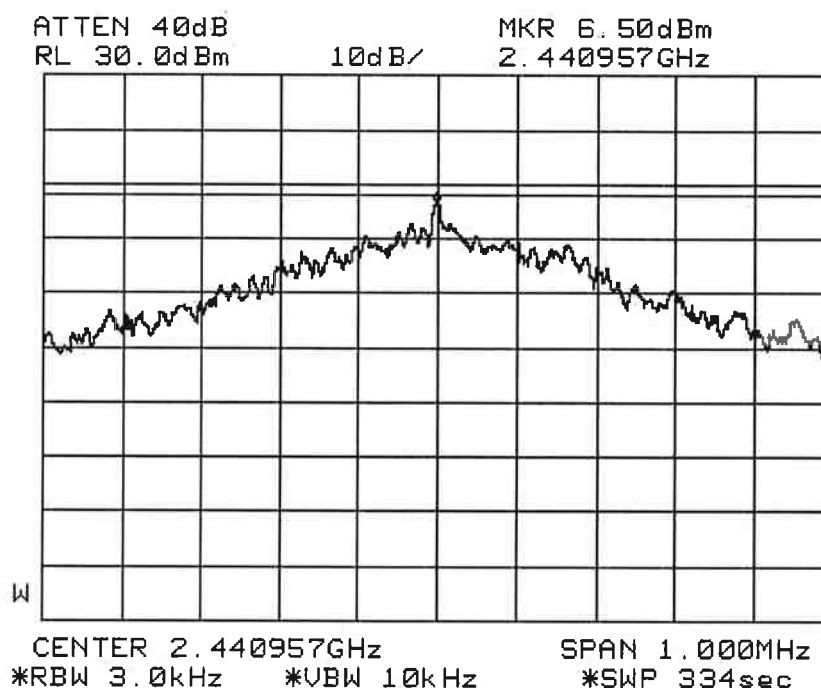
Peak Power Spectral Density Plots - Receiver



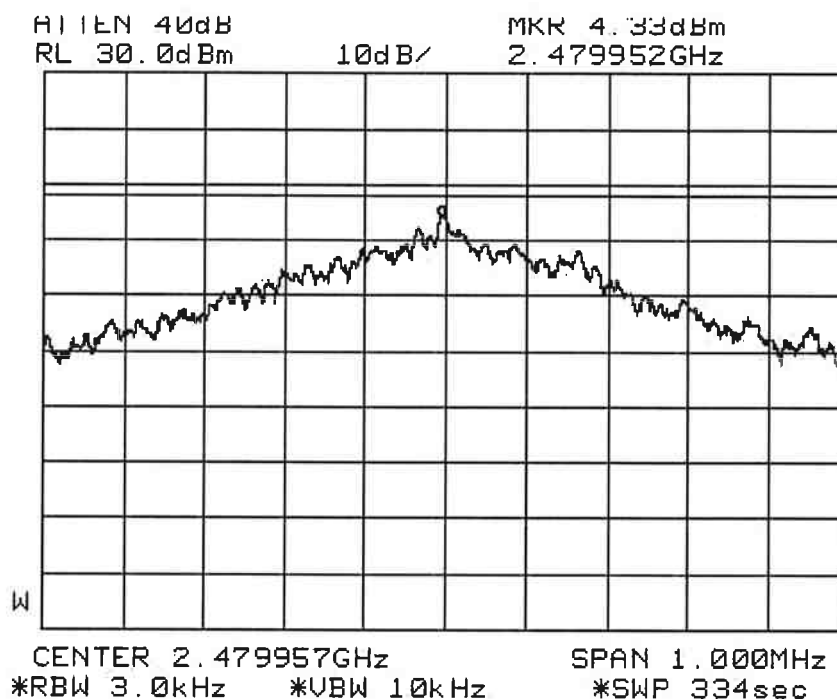
Plot 46 – Channel 1

PEAK POWER SPECTRAL DENSITY TEST

Peak Power Spectral Density Plots – Receiver



Plot 47 – Channel 39



Plot 48 – Channel 78

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST**FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits**

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (min)
0.3 - 1.34	614	1.63	100 ^{Note 2}	30
1.34 – 30	824 / f	2.19 / f	180 / f ² ^{Note 2}	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	-	-	f / 1500	30
1500 – 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
PMM 8053 Portable Field Meter	8053	0220J10308	03 Mar 2006

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Setup

1. The EUT and supporting equipment were set up as shown on the setup photo.
2. The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was first carried out at one of the positions / sides of the EUT.
3. Power density measurement (mW/cm²) was made using the field meter set to the required averaging time.
4. Steps 2 and 3 were repeated for the next position and its associate EUT operating mode, until all possible positions and modes were measured.

Sample Calculation Example

At 2400 MHz, limit = 1.0 mW/cm²

Power density reading obtained directly from field meter = 0.3 mW/cm² averaged over the required 30 minutes.

Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm²

i.e. 0.7 mW/cm² below limit

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST



Maximum Permissible Exposure (MPE) Test Setup

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Results

Test Input Power	110Vac 60Hz	Temperature	22°C
Test Distance	20cm	Relative Humidity	58%
Eut	Transmitter	Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm ²)	Margin (mW/cm ²)	Averaging Time (min)	Limit (mW/cm ²)
1	2.403	0.0032	-0.9968	30	1.0
39	2.441	0.0064	-0.9936	30	1.0
78	2.480	0.0045	-0.9955	30	1.0

Test Input Power	110Vac 60Hz	Temperature	22°C
Test Distance	20cm	Relative Humidity	58%
Eut	Receiver	Atmospheric Pressure	1030mbar
		Tested By	Kenneth Ler

Channel	Channel Frequency (GHz)	Power Density Value (mW/cm ²)	Margin (mW/cm ²)	Averaging Time (min)	Limit (mW/cm ²)
1	2.403	0.0011	-0.9989	30	1.0
39	2.441	0.0018	-0.9982	30	1.0
78	2.480	0.0008	-0.9992	30	1.0

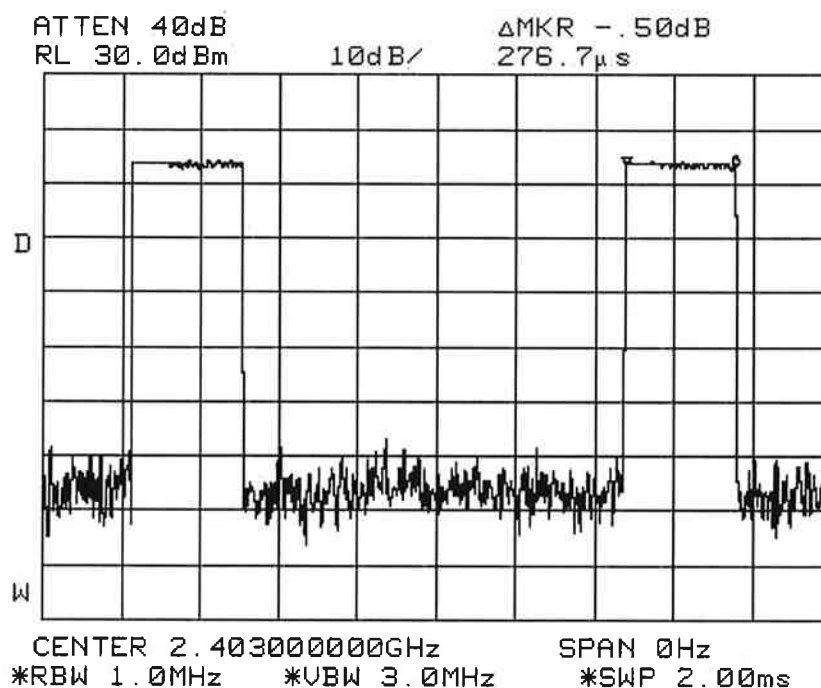
MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

Notes

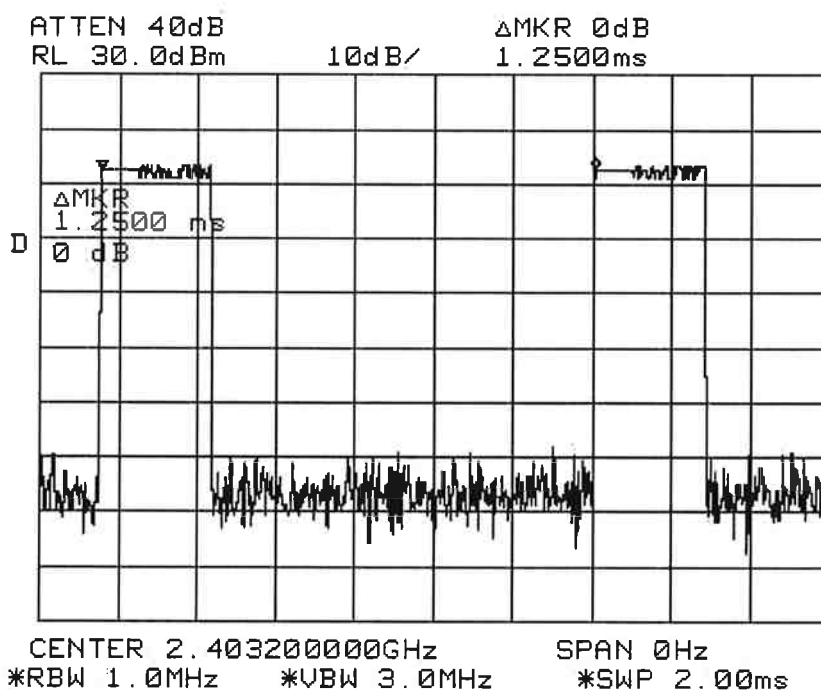
1. All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. 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 0.1MHz – 3GHz is $\pm 15\%$.

DUTY CYCLE FACTOR COMPUTATION

FCC Part 15.35(c) Duty Cycle Correction Factor - Transmitter



On Time



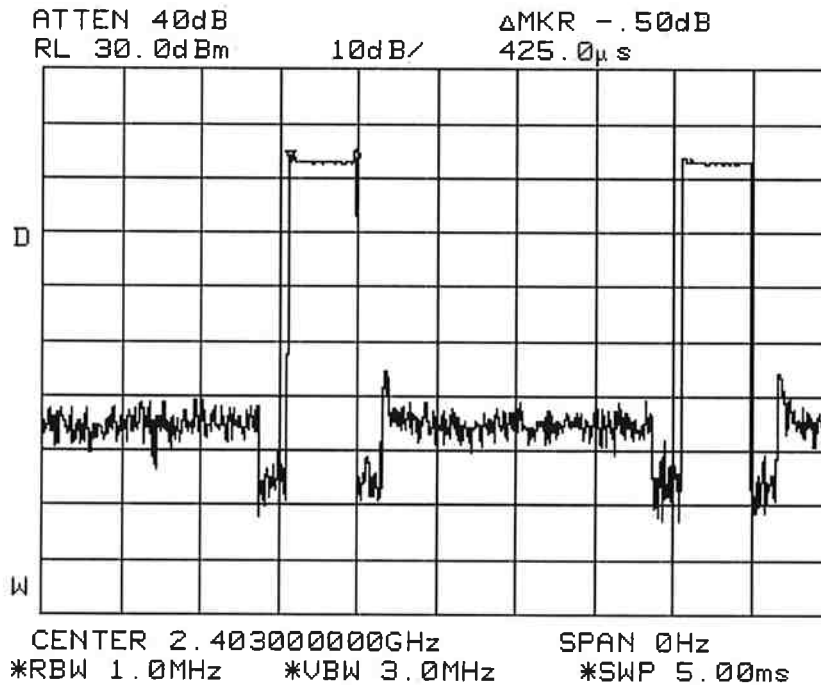
Period

DUTY CYCLE FACTOR COMPUTATION

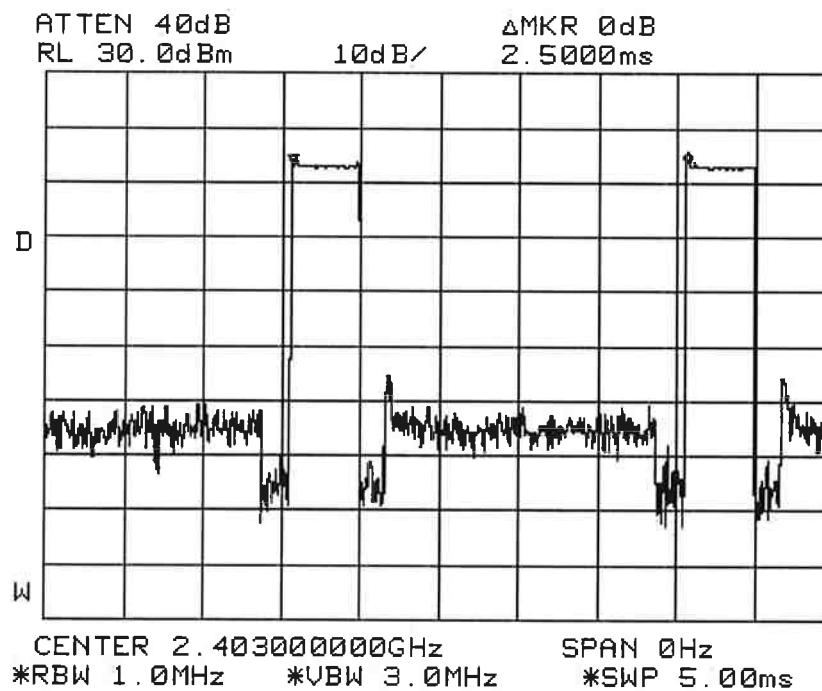
$$\begin{aligned}
 \text{Duty Cycle Factor (worst- case)} &= 20 \log [\text{Total On time / Period}] \\
 &= 20 \log [(0.2767 / 1.25)] \\
 &= \underline{\underline{-13.1\text{dB}}}
 \end{aligned}$$

DUTY CYCLE FACTOR COMPUTATION

FCC Part 15.35(c) Duty Cycle Correction Factor - Receiver



On Time



Period

DUTY CYCLE FACTOR COMPUTATION

$$\begin{aligned}\text{Duty Cycle Factor (worst- case)} &= 20 \log [\text{Total On time} / \text{Period}] \\ &= 20 \log [0.425 / 2.50] \\ &= \underline{\underline{-15.4}}\end{aligned}$$

This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.
2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.
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May 2005

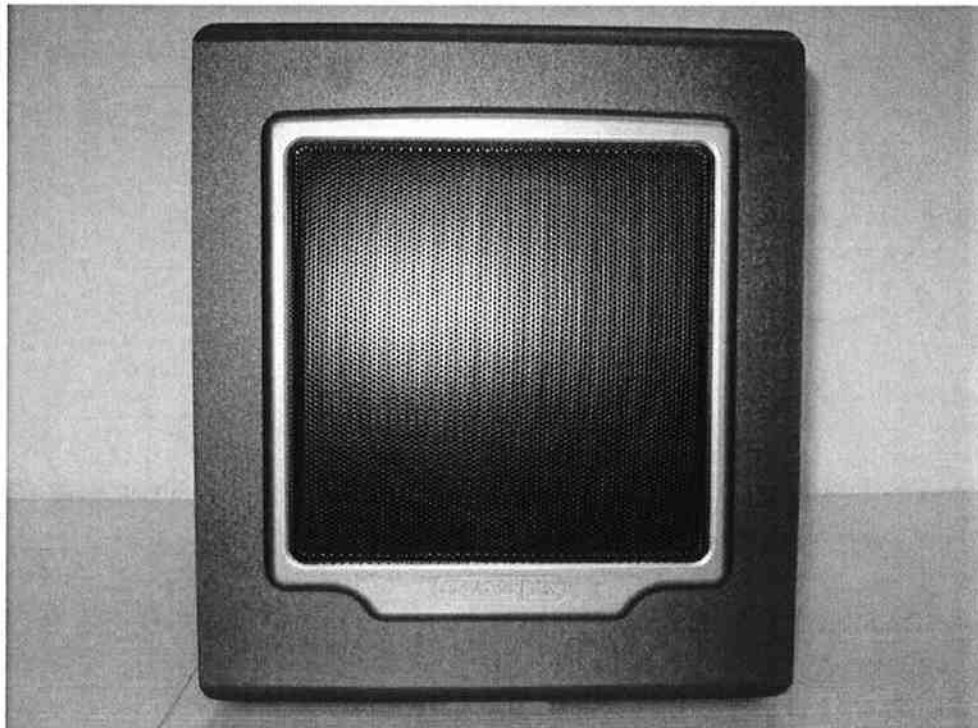
ANNEX A

EUT PHOTOGRAPHS / DIAGRAMS

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Front View

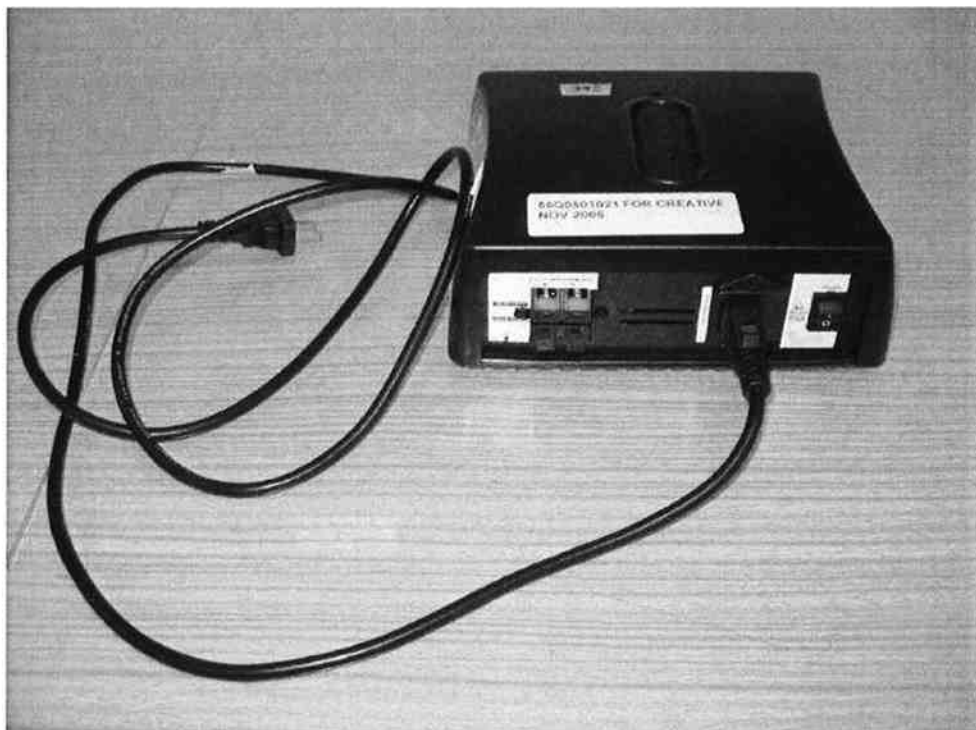


Rear View

EUT PHOTOGRAPHS

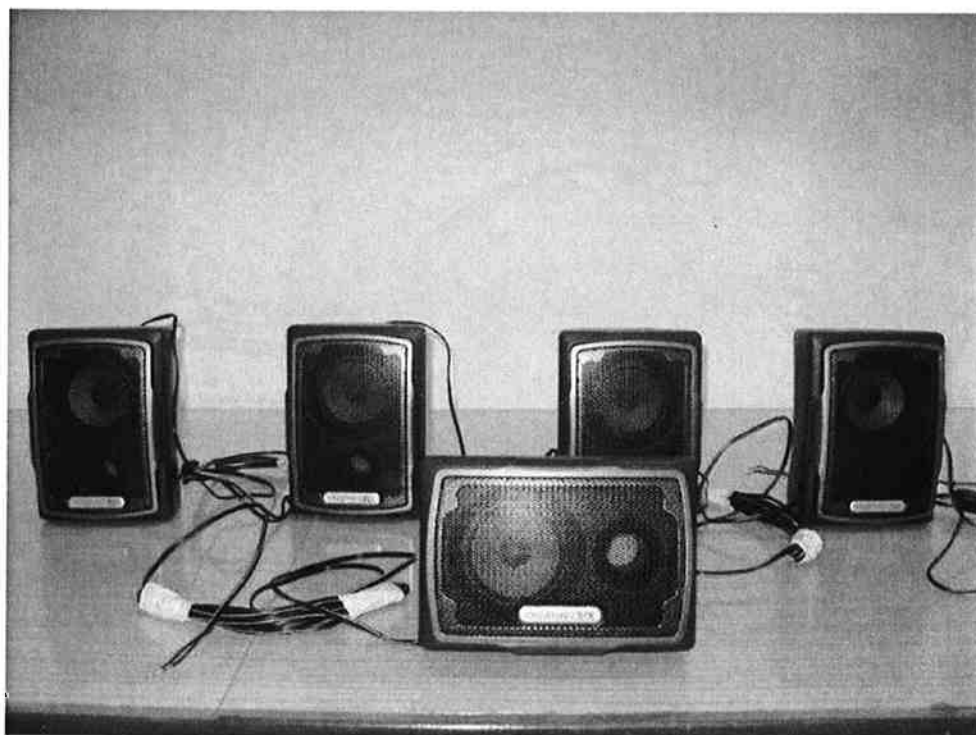


Front View



Rear View

EUT PHOTOGRAPHS



Front View

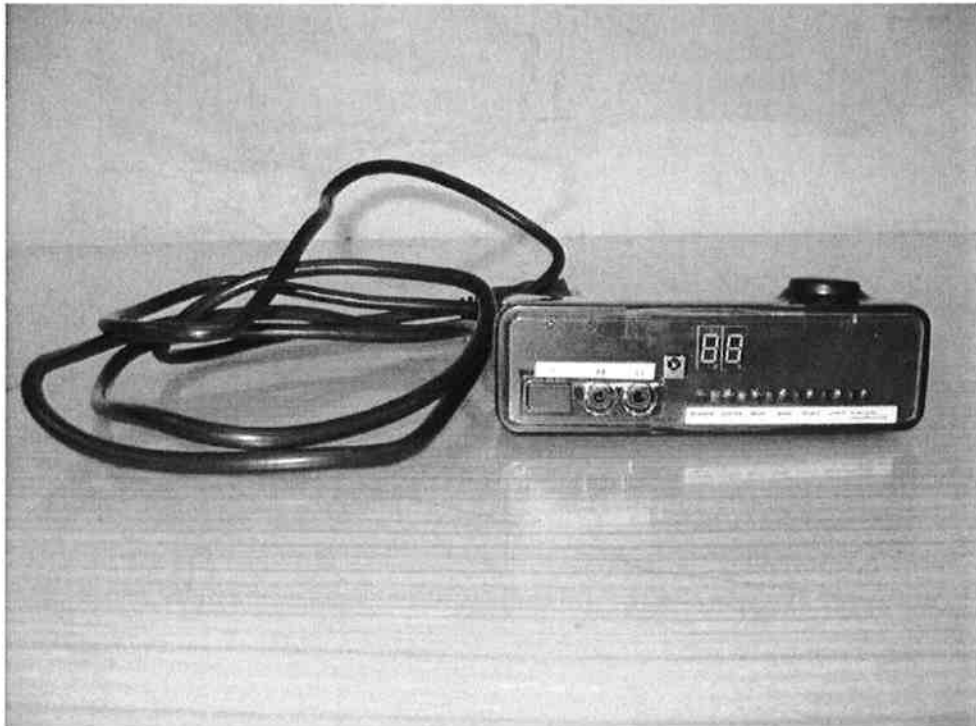


Rear View

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS



Front View



Rear View

EUT PHOTOGRAPHS



EUT Top Housing External View

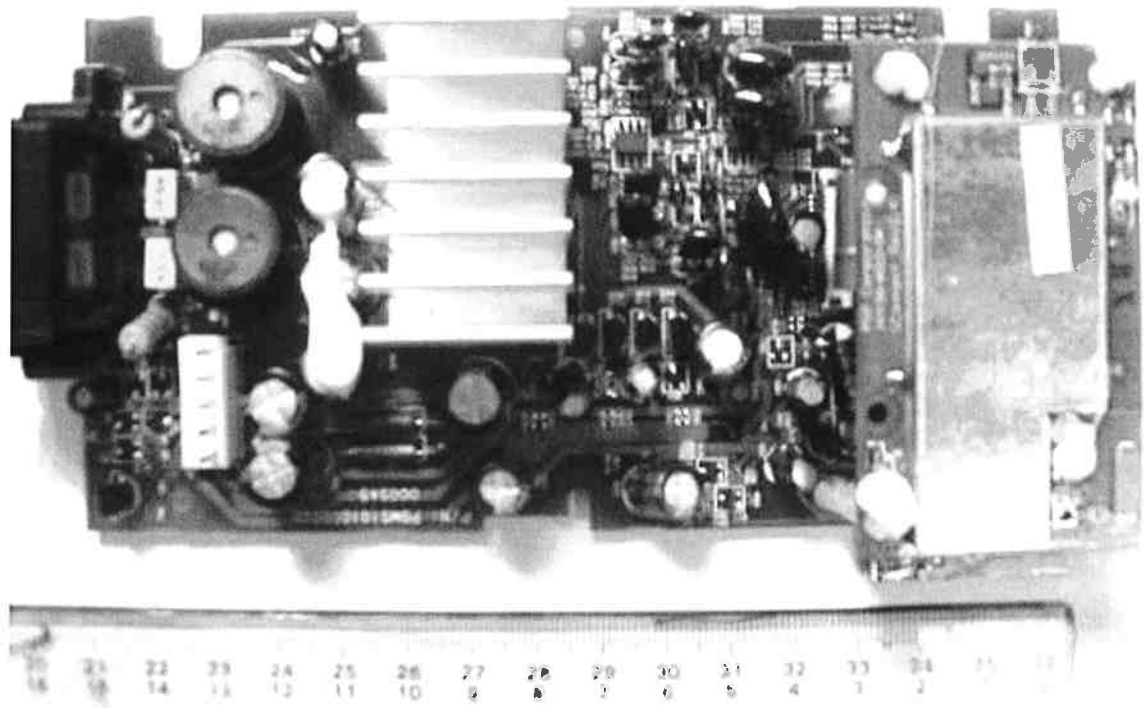
EUT PHOTOGRAPHS

56S051023/01



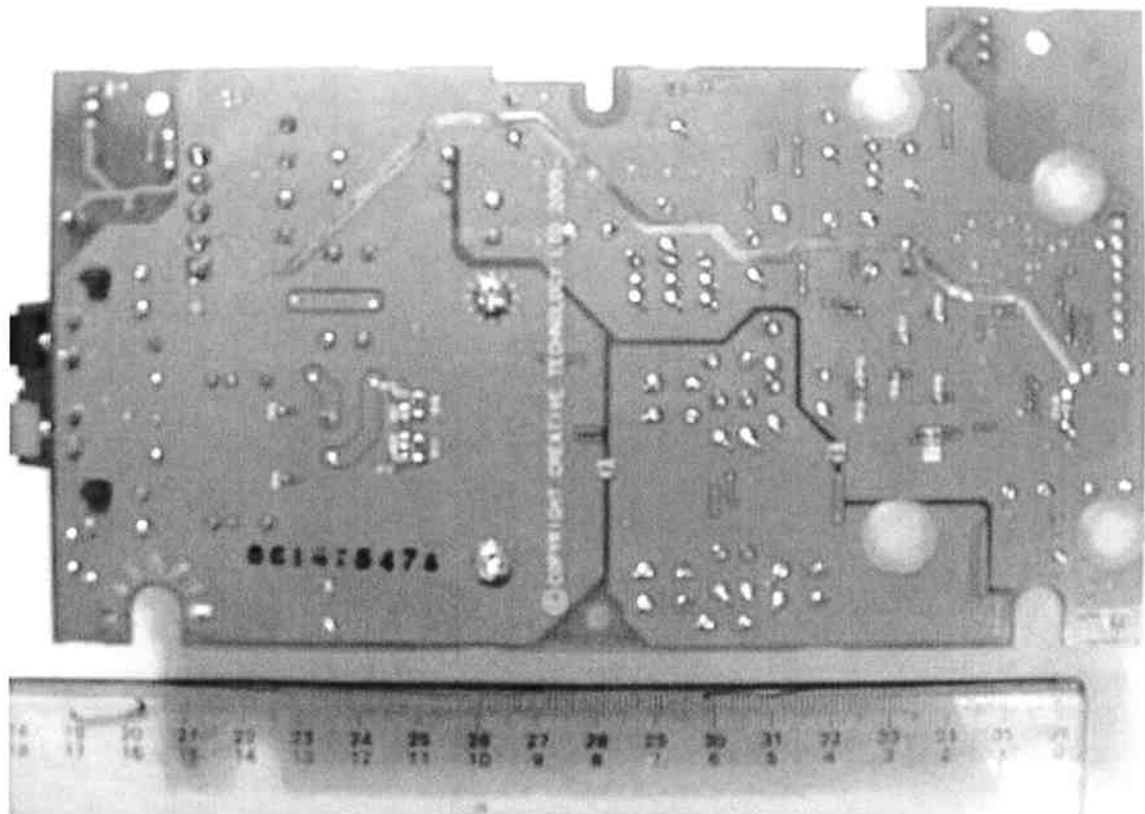
EUT Top Housing Internal View

EUT PHOTOGRAPHS



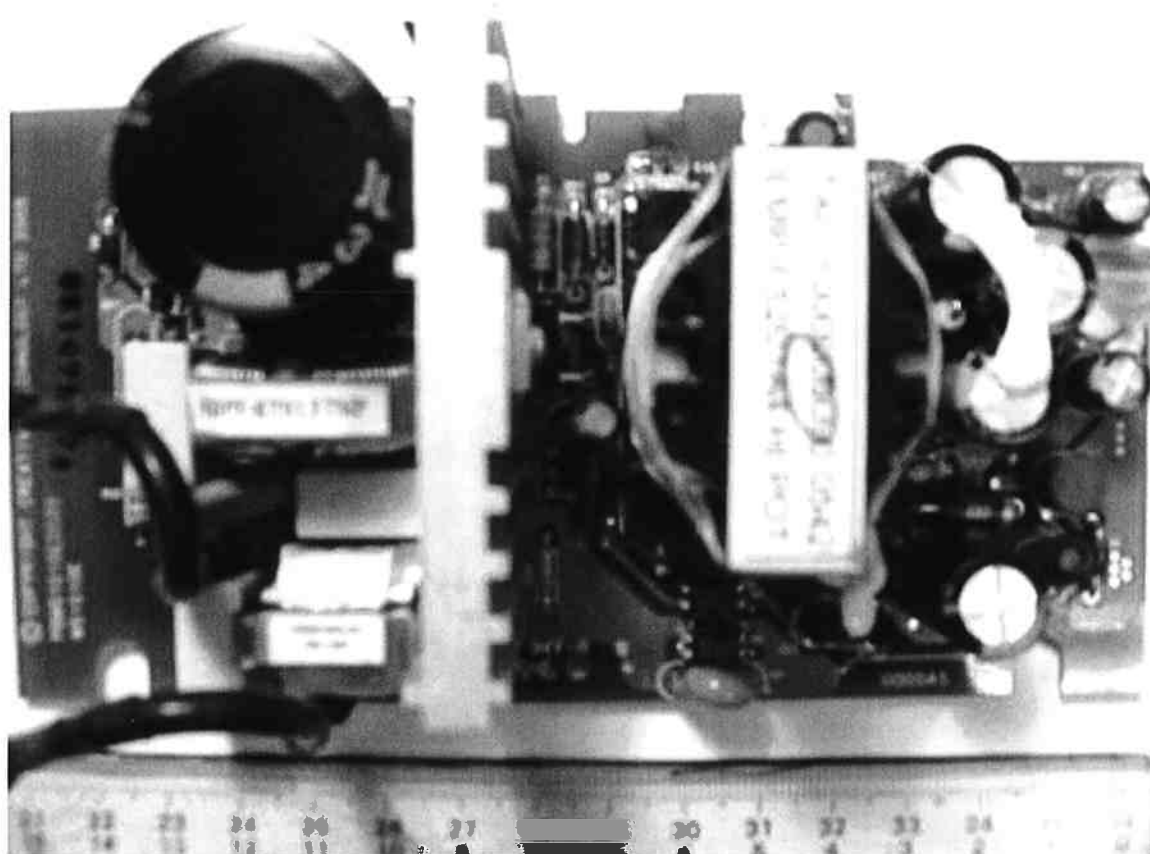
EUT PCB Component Side

EUT PHOTOGRAPHS



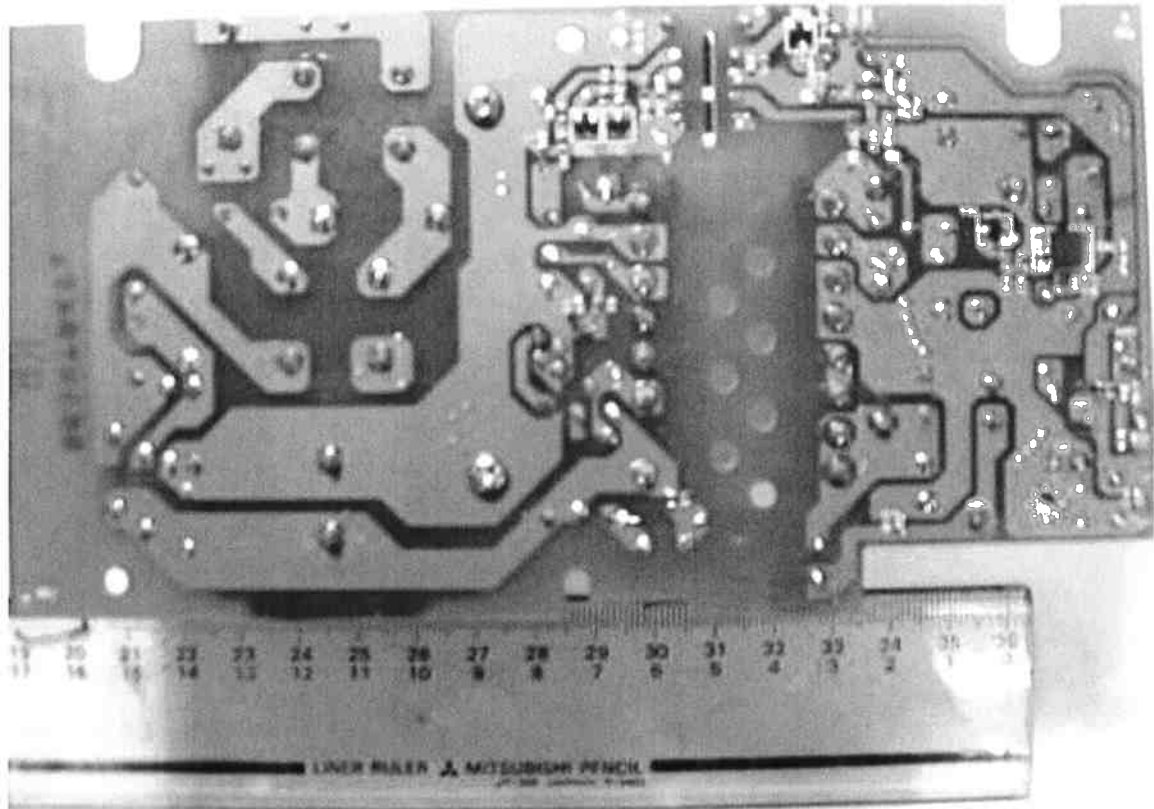
EUT PCB Trace Side

EUT PHOTOGRAPHS



EUT PCB Component Side

EUT PHOTOGRAPHS



EUT PCB Trace Side

EUT PHOTOGRAPHS



EUT Top Housing External View

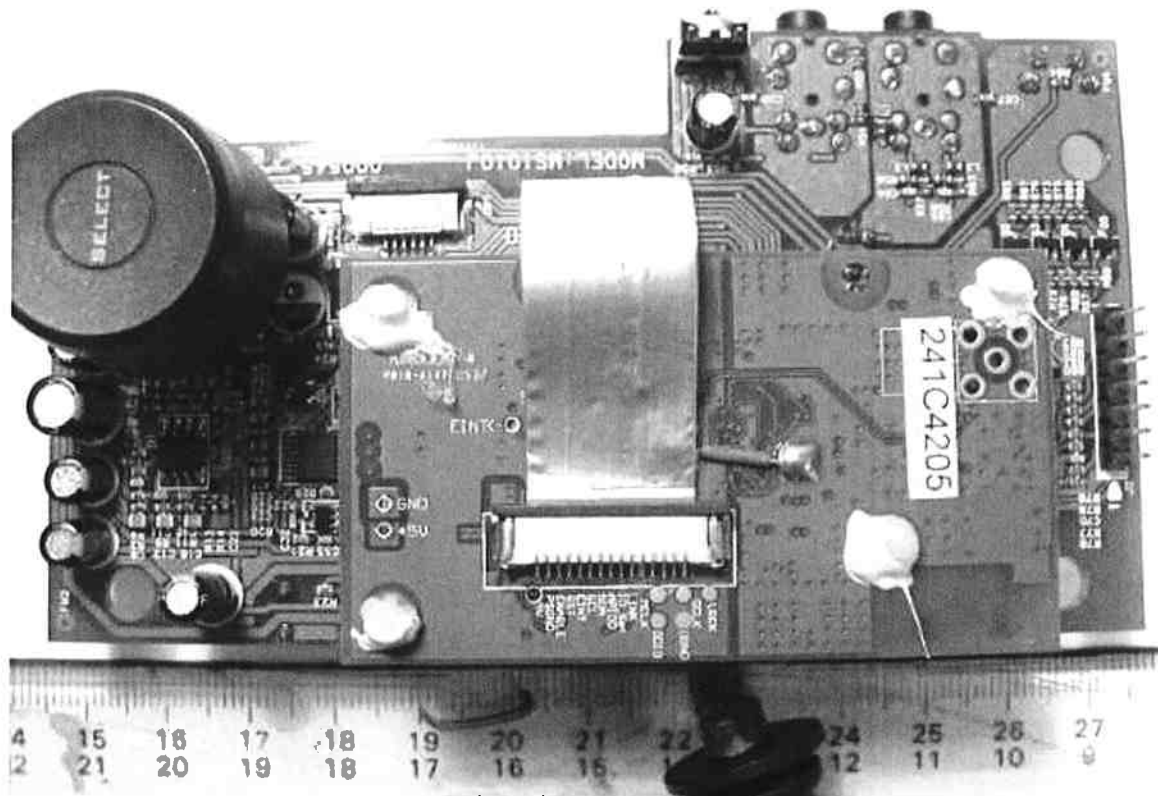
EUT PHOTOGRAPHS

56S051023/01



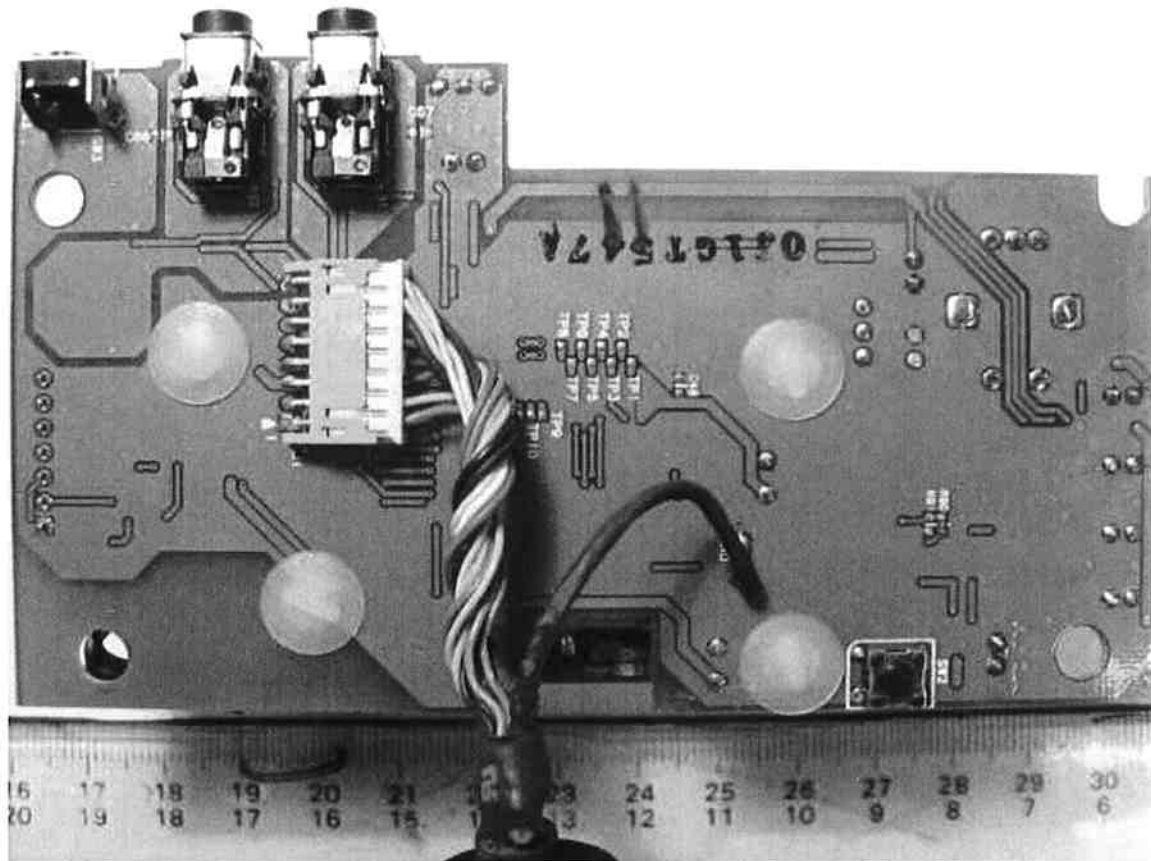
EUT Top Housing Internal View

EUT PHOTOGRAPHS



EUT PCB Component Side

EUT PHOTOGRAPHS



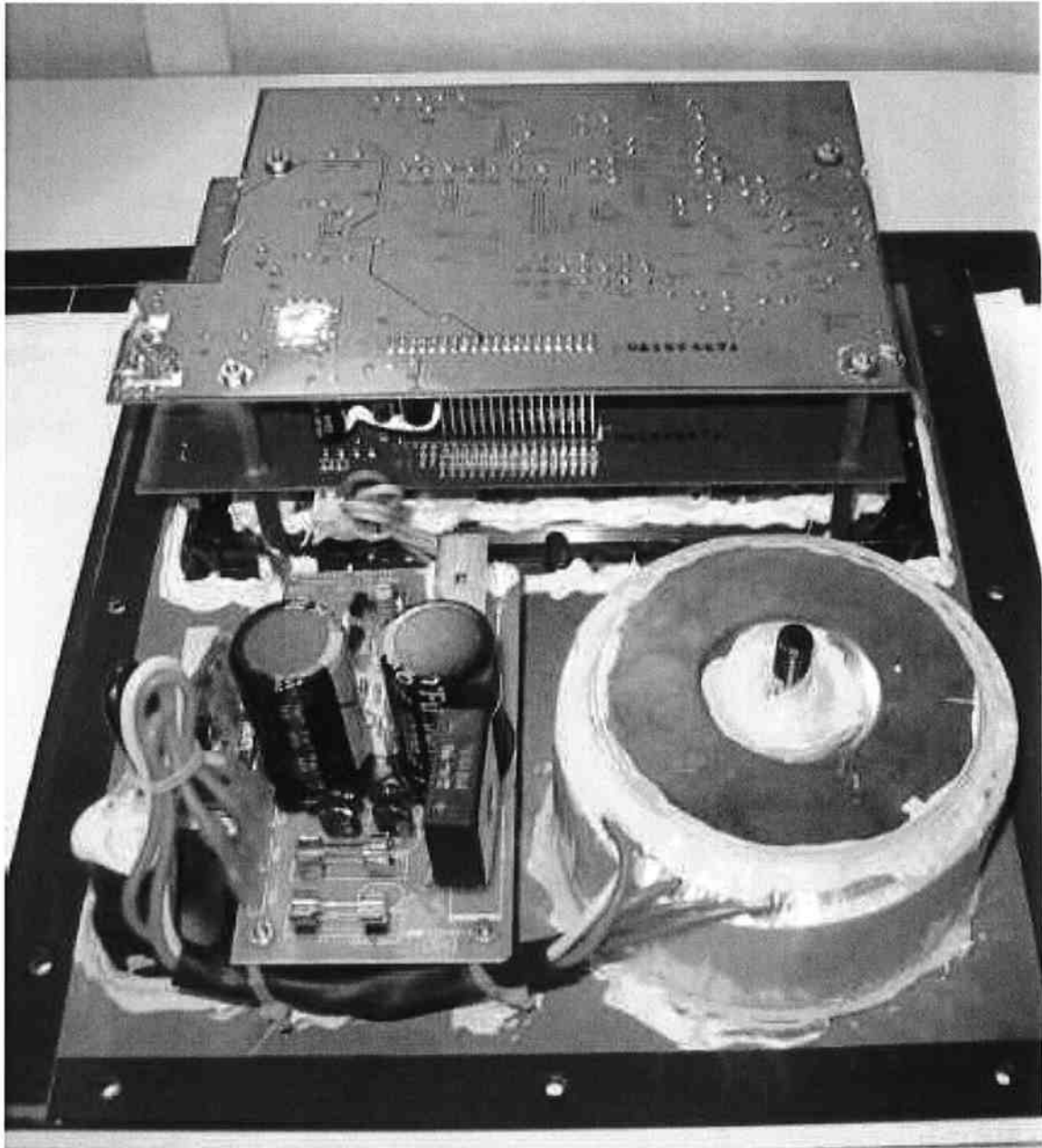
EUT PCB Trace Side

EUT PHOTOGRAPHS



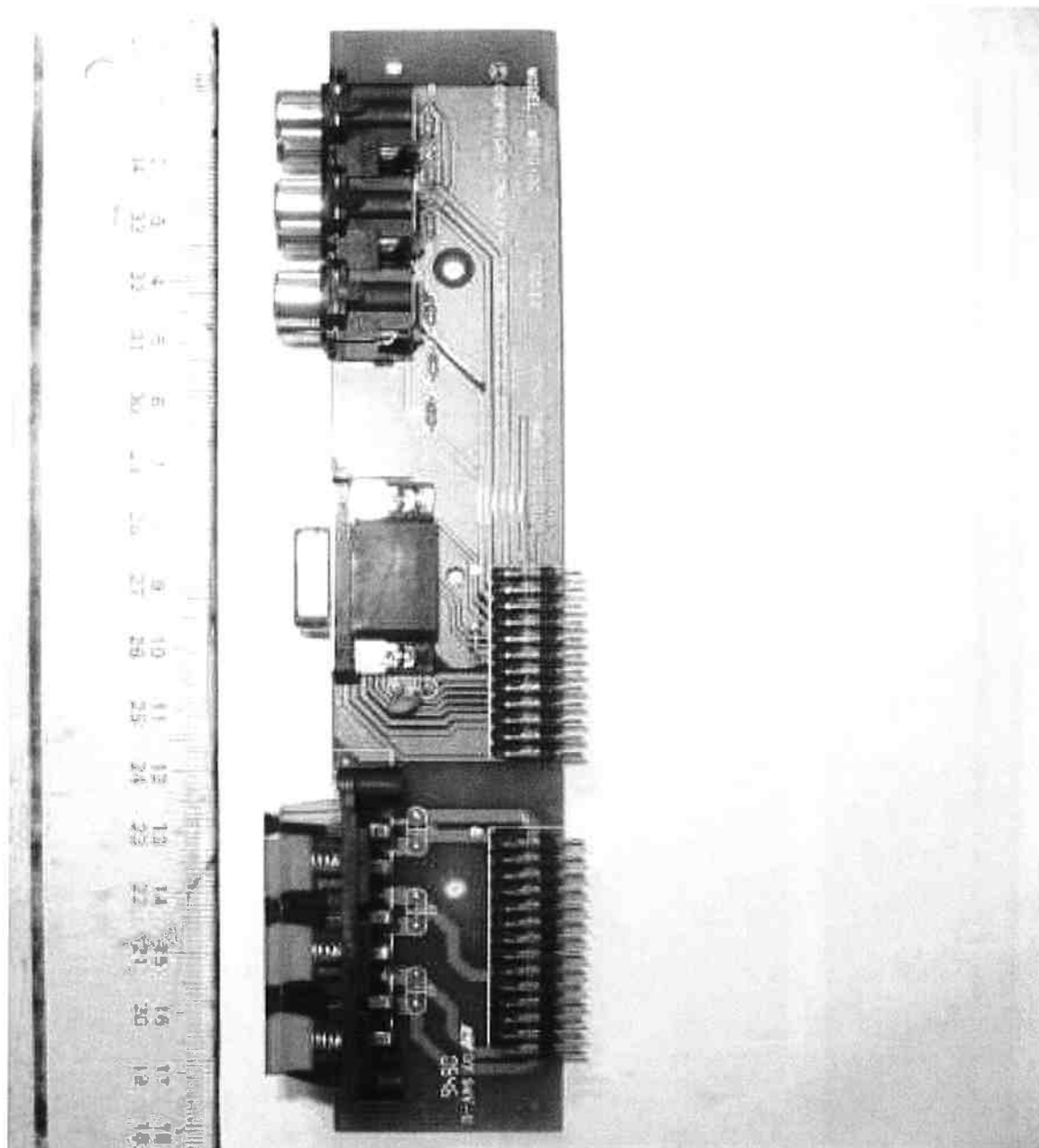
EUT Top Housing External View

EUT PHOTOGRAPHS



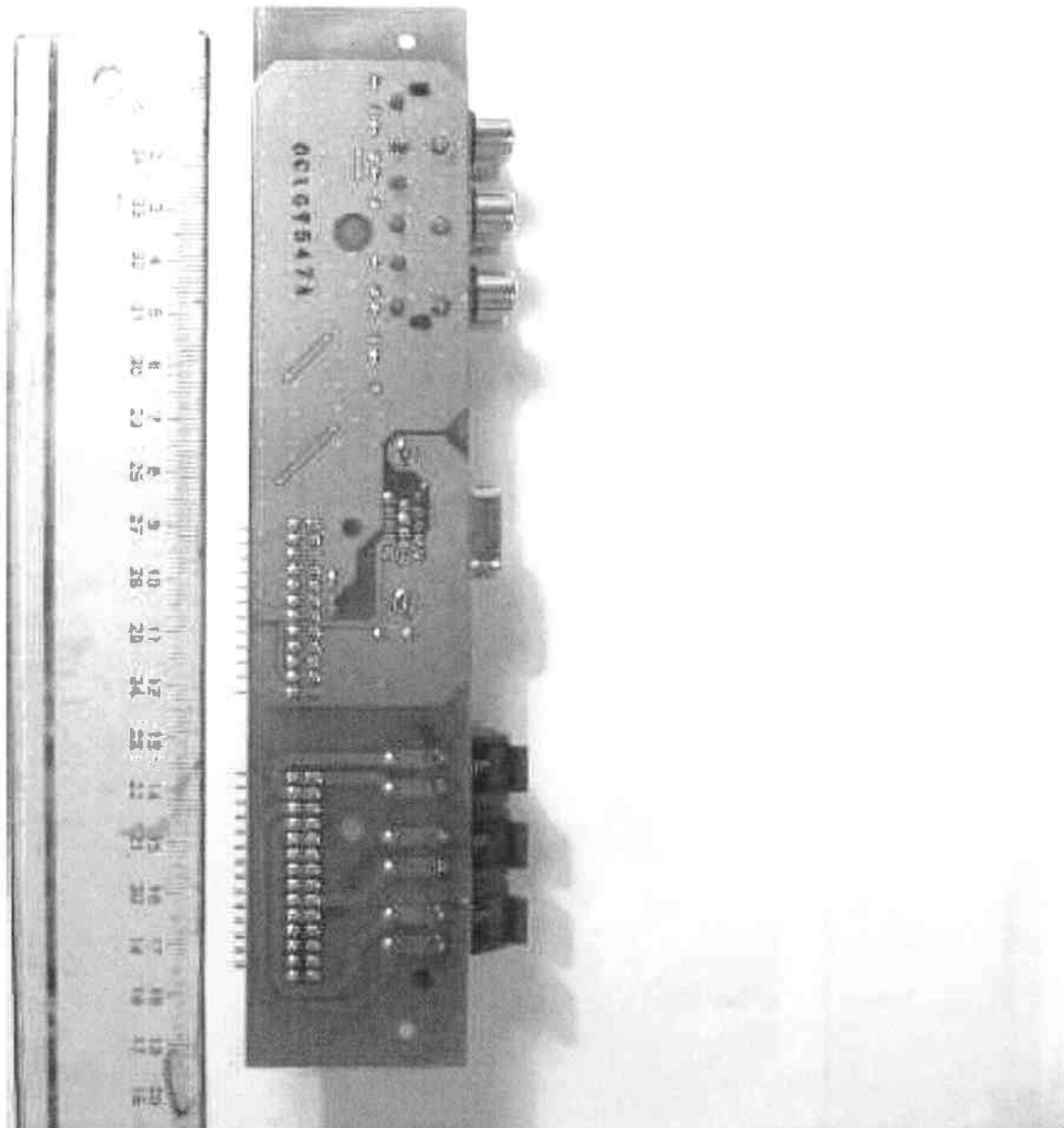
EUT Top Housing Internal View

EUT PHOTOGRAPHS



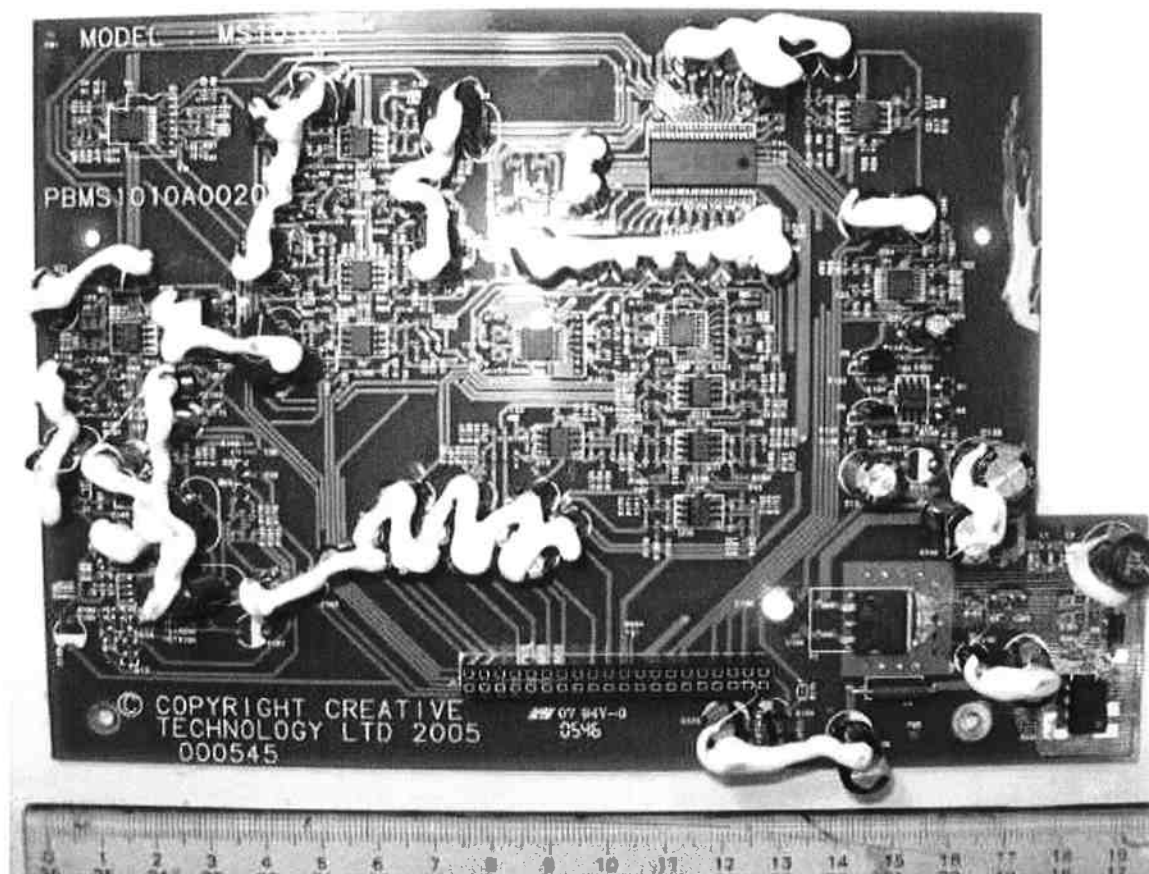
EUT PCB Component Side

EUT PHOTOGRAPHS



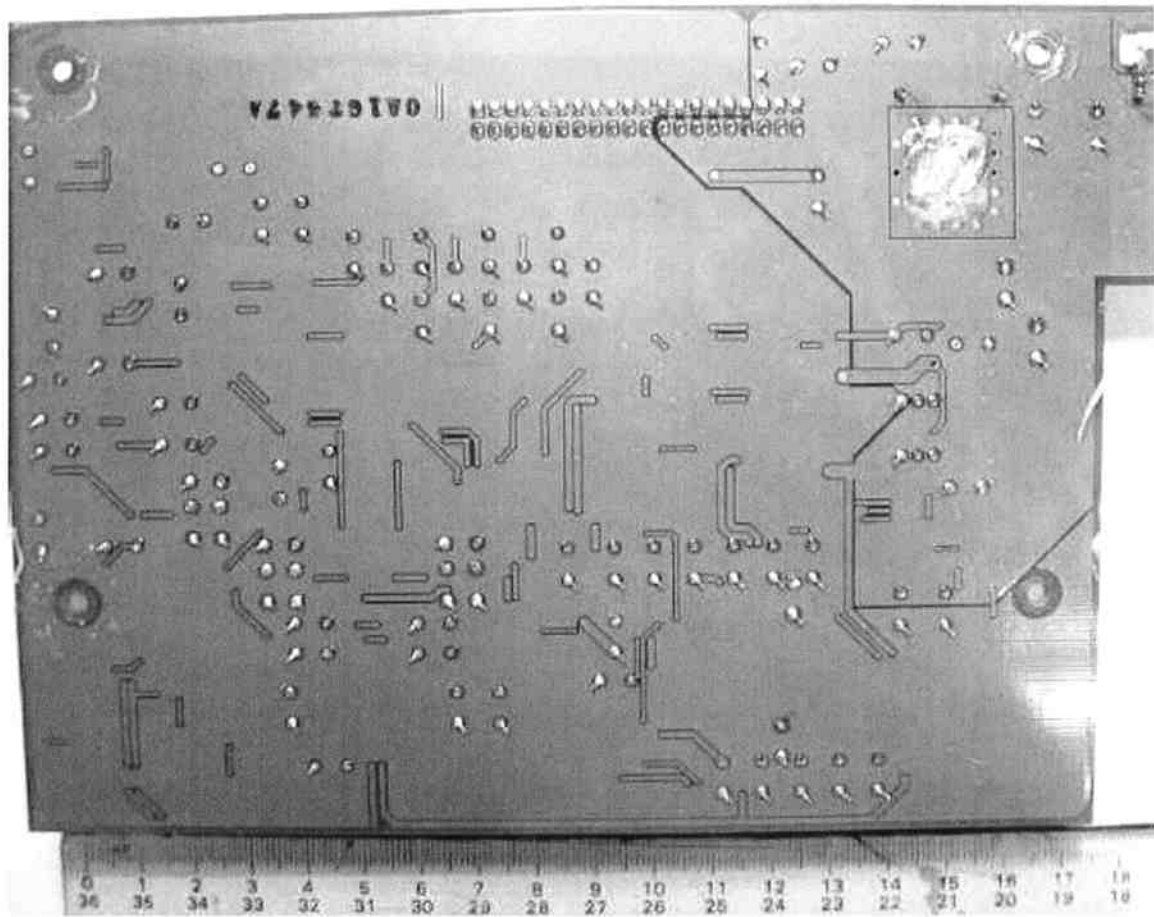
EUT PCB Trace Side

EUT PHOTOGRAPHS



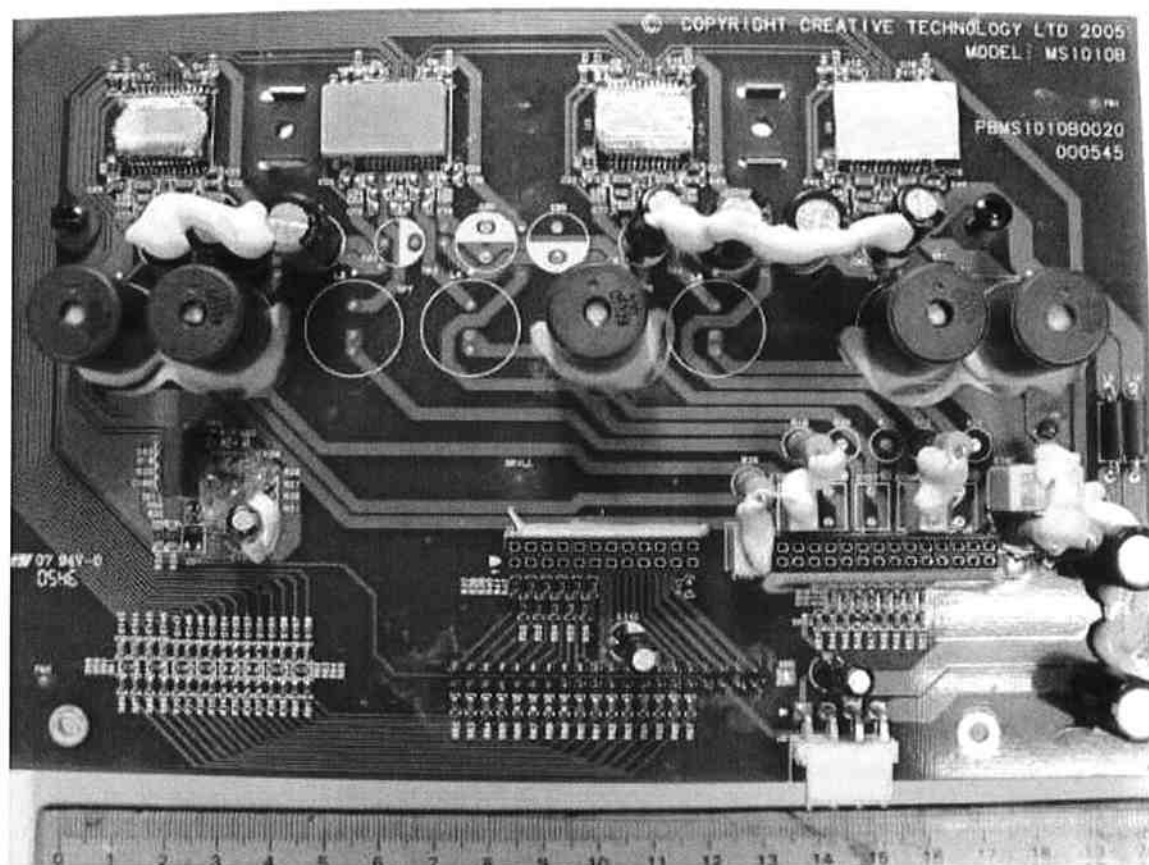
EUT PCB Component Side

EUT PHOTOGRAPHS



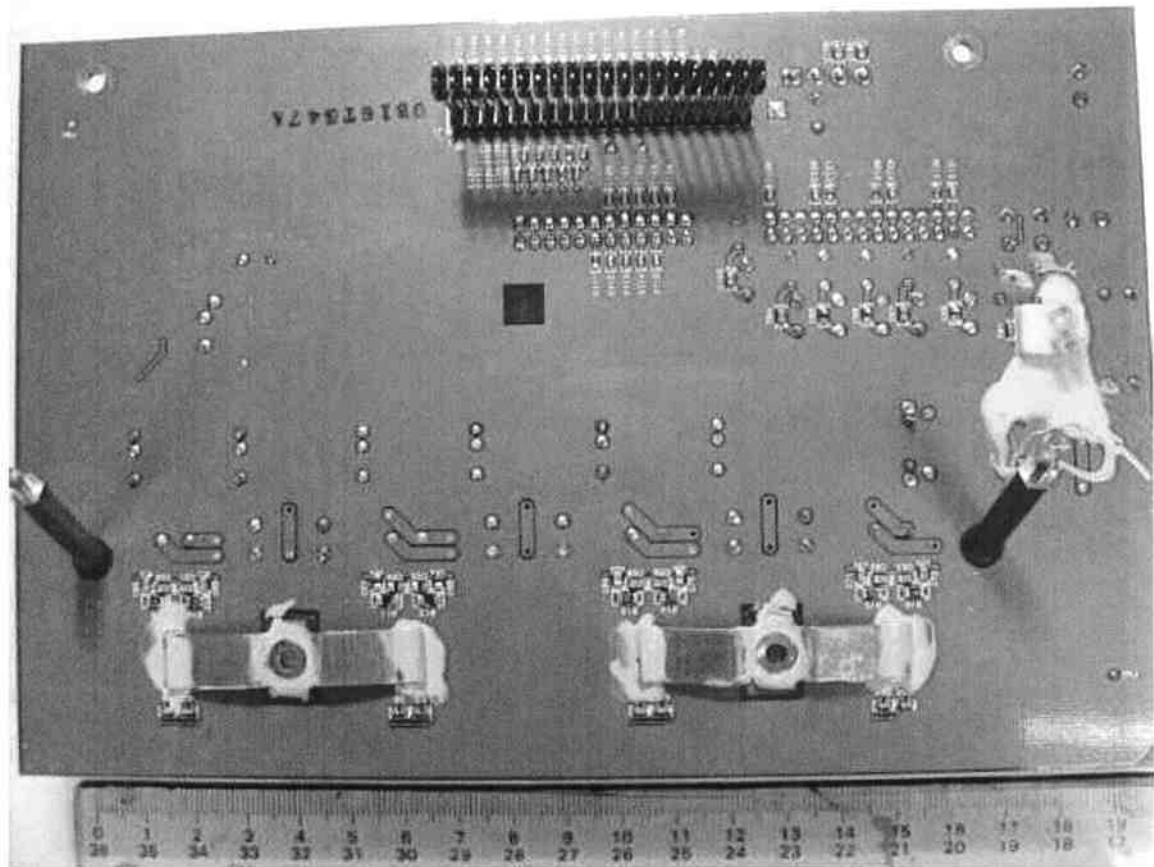
EUT PCB Trace Side

EUT PHOTOGRAPHS



EUT PCB Component Side

EUT PHOTOGRAPHS



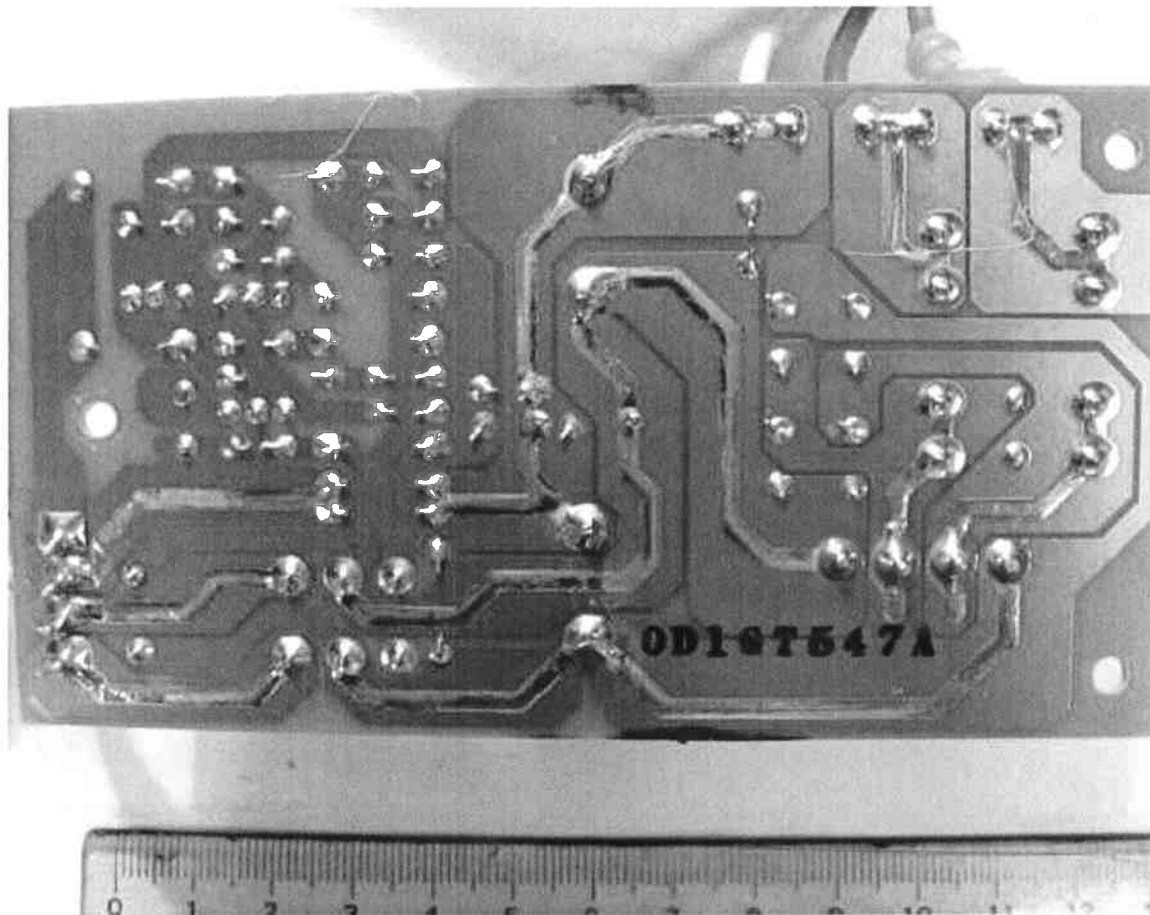
EUT PCB Trace Side

EUT PHOTOGRAPHS



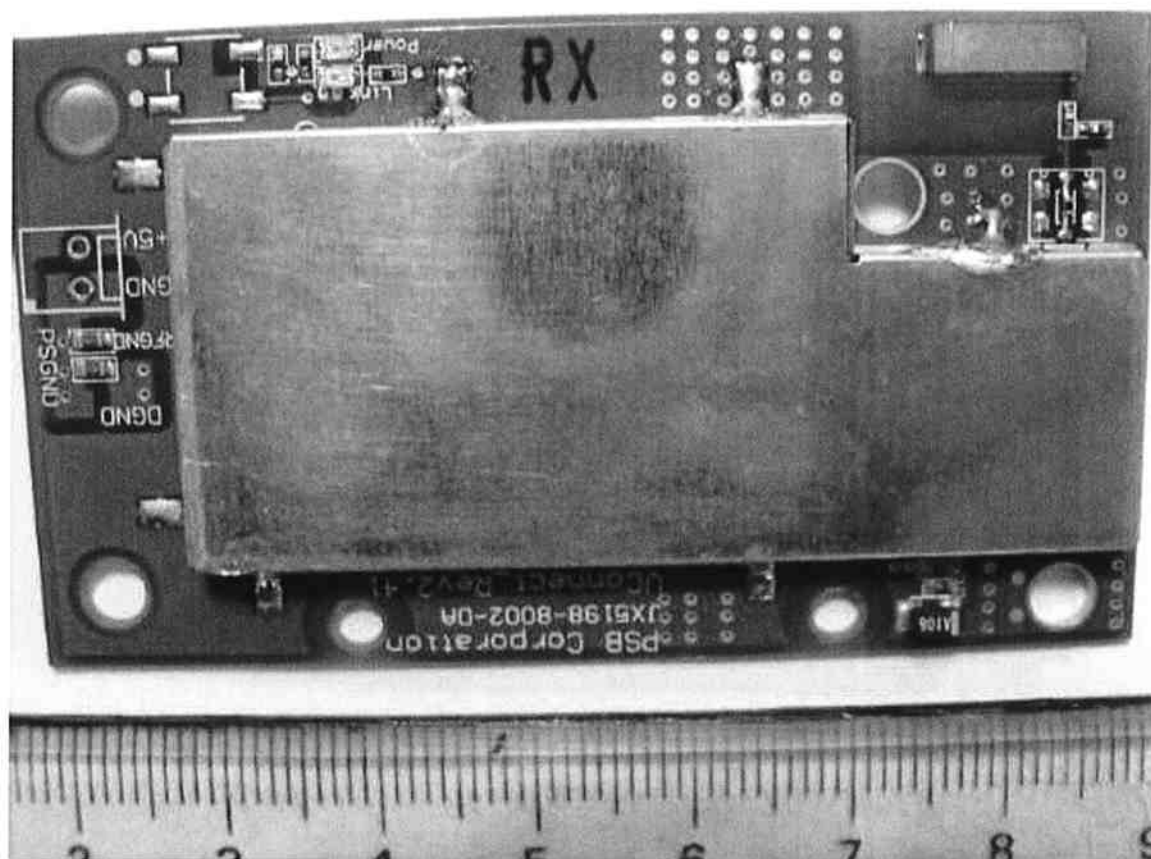
EUT PCB Component Side

EUT PHOTOGRAPHS



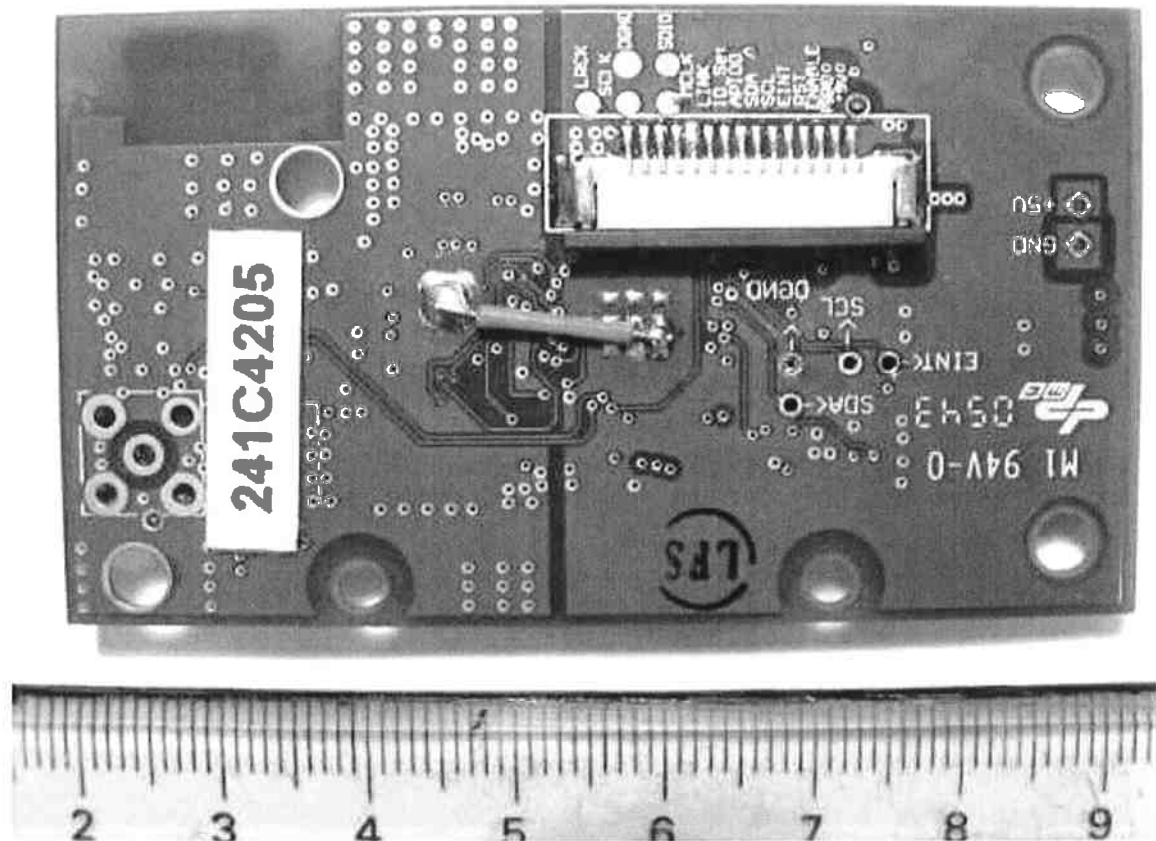
EUT PCB Trace Side

EUT PHOTOGRAPHS – RECEIVER MODULE



EUT PCB Component Side

EUT PHOTOGRAPHS- RECEIVER MODULE

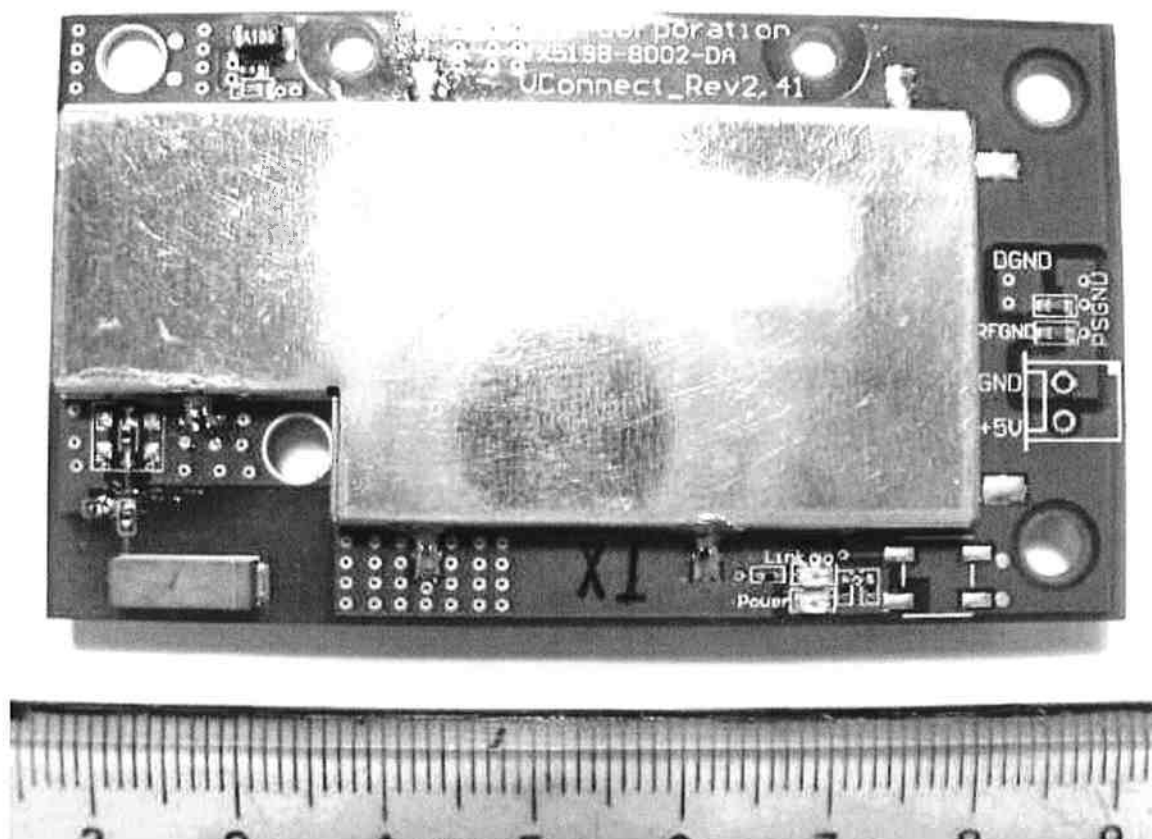


EUT PCB Trace Side

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS – TRANSMITTER MODULE

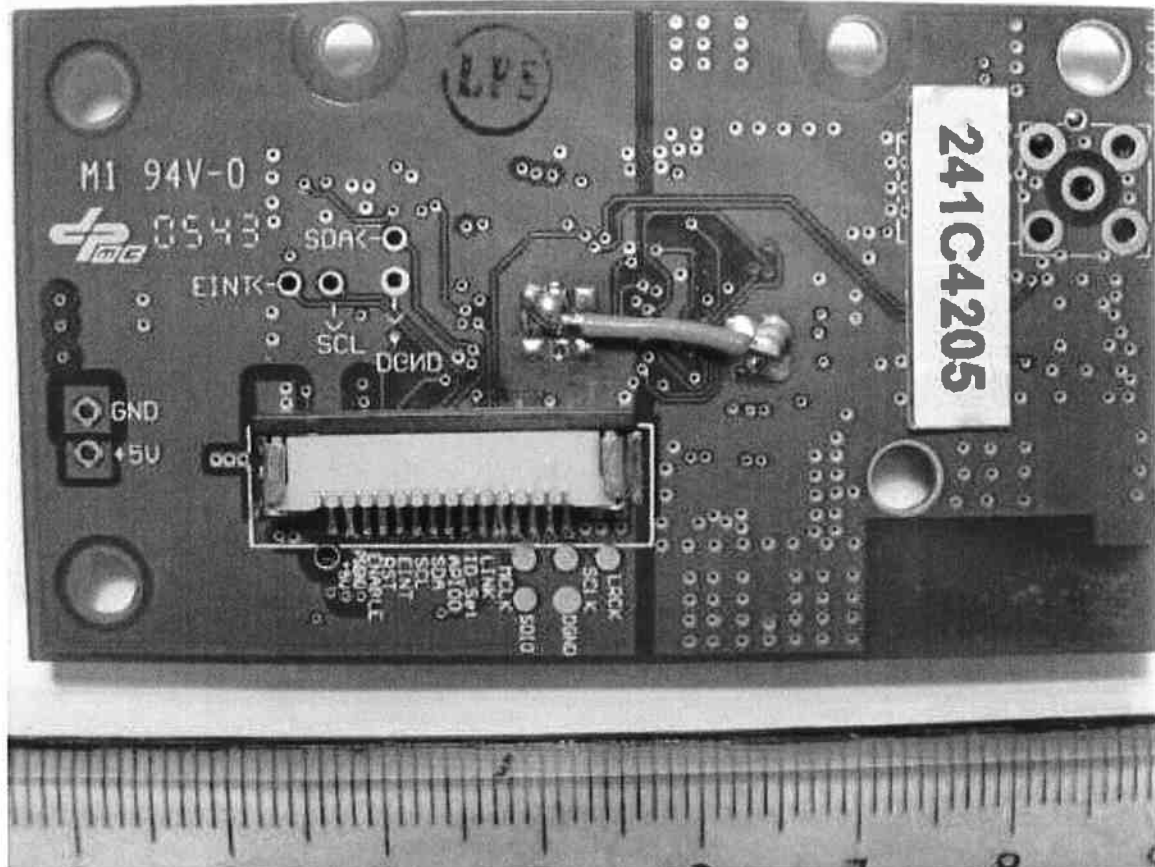


EUT PCB Component Side

EUT PHOTOGRAPHS / DIAGRAMS

ANNEX A

EUT PHOTOGRAPHS- TRANSMITTER MODULE



EUT PCB Trace Side

ANNEX B

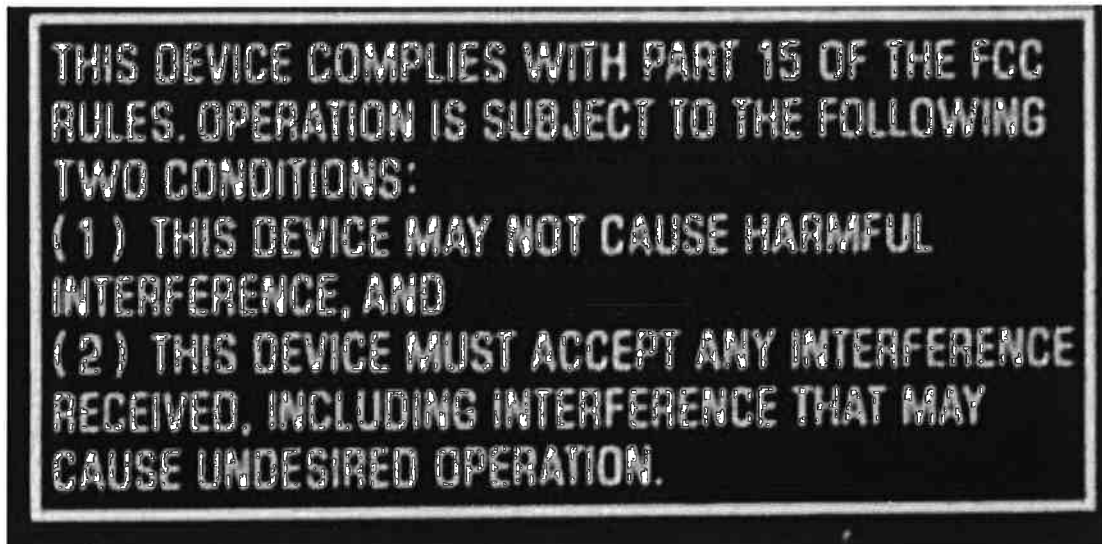
FCC LABEL & POSITION

FCC LABEL & POSITION

ANNEX B

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.



Sample Label



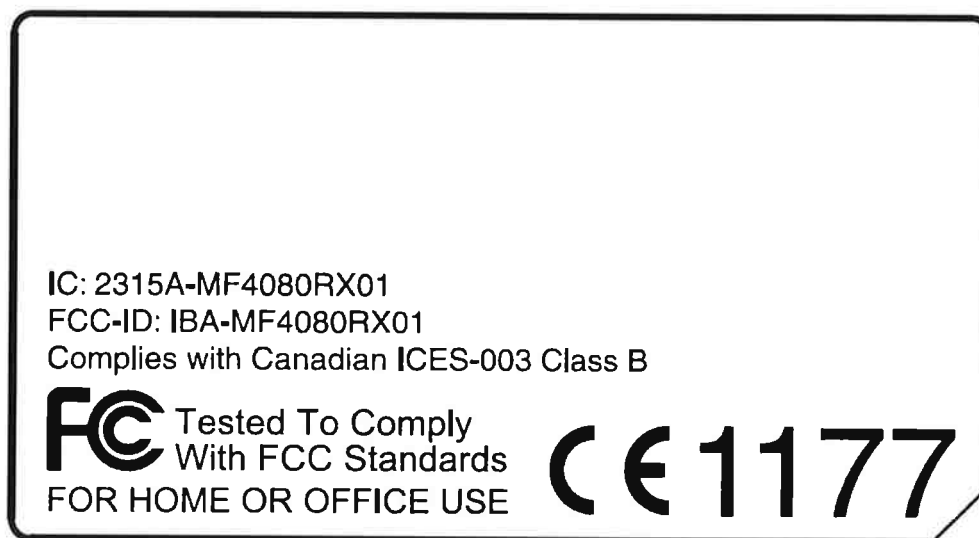
Physical Location of FCC Label on EUT

FCC LABEL & POSITION

ANNEX B

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.



Sample Label



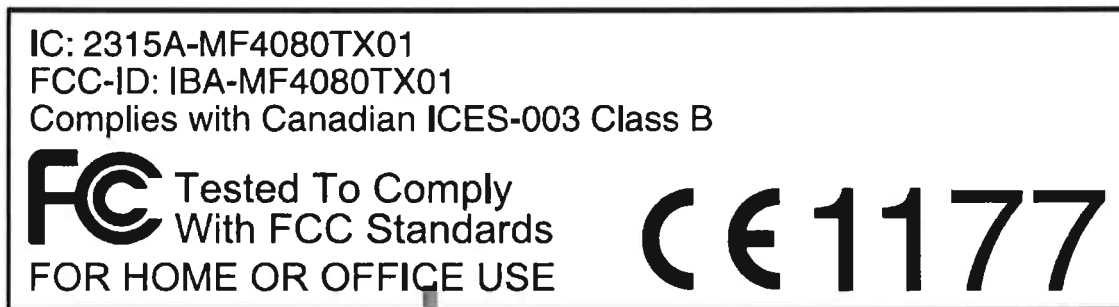
Physical Location of FCC Label on EUT

FCC LABEL & POSITION

ANNEX B

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.



Sample Label



Physical Location of FCC Label on EUT

ANNEX C

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

(Please refer to manufacturer for details)