

Commercial In Confidence

TEST REPORT No: P4325-1/FCC

Customer/Applicant: Rochford Thompson Equipment Ltd

Address: The Votec Centre,
Hambridge Lane
Newbury
Berkshire
RG14 5TN

Subject: **RADIO FREQUENCY DEVICES**

Customer Ref: 2439

Manufacturer: Rochford Thompson Equipment Ltd

Product: Page Reader

Model/Trade Name: RTE 8000 RFID

Model No/Type: 13.56 MHz

Serial No/Lot No: D28

Tests Carried Out: FCC CFR 47 Part 15C (Intentional Radiators)
Sections 15.207, 15.209, 15.225

Location EMC Projects Ltd., Ringwood, Hants, BH24 2DB

This Report applies only to the above referenced EQUIPMENT and details the tests applied using test equipment calibrated to traceable National Standards and is not indicative of the qualities of identical or similar products

Report Author: F. Barkas
Title: (EMC Engineer)

Checked By: O.W.Cockram
Title: (General Manager)

Signature

Signature

Issue Date: Dec 2005

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Report Summary

Report Number: P4325-1/FCC
Project Number: P4325
Test Dates: 24th – 25th, 29th – 30th November and 2nd December 05
Test Engineer: Mr Frank Barkas
In Attendance: Mr D Quinton G Cook
Product Tested: Page reader
Model/Type Tested RTE 8000 RFID
Operating Frequency 13.56 MHz
Test Specification: CFR 47 Part 15C (Intentional Radiators)
 Sections 15.207, 15.209 & 15.225
Channel Spacing -
Number of Channels 1
Antenna Type Integral
Alternative Antenna Type -
Power Supply 110 V 60Hz

Summary of Results:

The equipment was assessed to the requirements of the following tests:-

Rule Part	Test Description	Result	Levels/Comments/Limits
15.225(a)	Intentional Emission Frequency	Pass	13.56 MHz
15.225(a)	Intentional Emission Field Strength	Pass	77.5 dBµV/m @ 10 m
15.225(e)	Intentional Emission Band Occupancy	Pass	13.558964 – 13.559234 MHz
15.207	Conducted Emissions	Pass	Maximum Level 39dBµV @ 0.65 MHz 7dB below limit
15.209	Spurious emissions transmitter operating – radiated <1000 MHz	Pass	Maximum level 216.9 MHz @ 31.7 dBµV/m 1.3 dB below limit
15.209	Spurious emissions transmitter operating – radiated >1000 MHz	Pass	-
15.203	Antenna Arrangements Integral	Pass	-
15.204	Antenna Arrangements External Connector	N/A	-
15.205	Restricted Bands	-	-
15.31(f)	Extrapolation Factor	-	40 dB/decade <30 MHz 20dB/decade >30MHz

For full details of pass level/criteria/class etc. see individual test results

Table 1

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Rochford Thompson Equipment Ltd
 EMC Projects Limited
 TRL Compliance Services

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1. Applicants Summary/Declarations

1	Duty Cycle	Triggered By Document	100 % when on
2	Equipment Category	Yes	Single Channel
		-	Two Channel
		-	Multi-Channel
3	Channel Spacing	Yes	Narrowband
		-	Wideband
4	Frequency Generation	-	SAW Resonator
		Yes	Crystal
		-	Synthesiser
5	Modulation Method	Load	Amplitude
		-	Digital
		-	Angle
6	Applicants Contact Person		Greville Parmenter
		e-mail	greville.parmenter@rte.co.uk
		Tel	00441635580666
		Fax	0044163536940
7	Applicants Category	Yes	Manufacturer

2. List Of Measurements

The list of measured parameters called for in FCC Rules CFR Part 15 is given below.

Rule Part	Transmitter parameters	Applied	Comments
15.225(a)	Intentional Emission Frequency	Yes	Peak Detector
15.225(a)	Intentional Emission Field Strength	Yes	Quasi Peak Detector
15.225(e)	Intentional Emission Band Occupancy	Yes	Peak Detector
15.207	Spurious emissions transmitter operating – conducted <30 MHz	Yes	Quasi Peak Detector
15.209	Spurious emissions transmitter operating – radiated <1000 MHz	Yes	Quasi Peak Detector
15.209	Spurious emissions transmitter operating – radiated >1000 MHz	Yes	Peak Detector
15.203	Antenna Arrangements Integral	Yes	-
15.204	Antenna Arrangements External Connector	No	-
15.205	Restricted Bands	-	-
15.31(f)	Extrapolation Factor	Yes	40 dB/decade <30 MHz 20dB/decade >30MHz

3. Modes of operation

For the duration of the testing the EUT (Equipment Under Test) was operated in the following modes:-

1. The transmitter in the transmit condition

The full operational mode required is detailed on a test-by-test basis.

4. Test Setup

The EUT was set-up for the individual tests in accordance with the test specification requirements as shown in the test section.

5. Deviations from Standard

No deviations from the applied standards were carried out unless stated in the individual test results

6. Test Procedures

Procedures and methods of test employed were in accordance with the requirements of the specifications applied, using accredited in-house test procedures. During testing the ambient conditions required were measured and found to be satisfactory.

7. Modification

No modifications were carried out by EMC Projects Ltd in order for the equipment to comply with the requirements of the standard applied.

Rochford Thompson Equipment Ltd carried out modifications to the EUT in order to meet the requirements of the standard applied.

- 1 A Snubber capacitor was fitted across the switch mode power supply inductor
- 2 Ferrites (Würth 742 712 21) fitted to each end of the USB cable

8. Part 15.225 - Transmitter Intentional Emissions – Radiated**8.1. Intentional Emission Frequency****8.2. Intentional Emission Field Strength****8.3. Intentional Emission Frequency Tolerance**

Ambient temperature °C	16	Channel No	1
Extreme Temperatures °C	-20 & +55	Measurement Distance	10 m
Relative humidity %	42	Extrapolated Distance	From 10 to 3m
Supply Voltage V	110 @ 60Hz	Detector function – 8.1,8.3	Peak
Supply Variations	85 & 115%	Detector function – 8.2	Quasi Peak

Graphs & Plots Figure 1 as representative sample - intentional emission
Figure 2 as representative sample - 9kHz to 30 MHz Radiated

Freq (MHz)	Test Volts (V)	OATS Reading (dBµV)	Antenna Correction (dB)	Cable Correction (dB)	10m Field Strength (dBµV/m)	Extrapolation Factor (dB)	3m Field Strength (dBµV/m)
13.56	110	24.74	36	0.5	61.24	21	82.24
Limit @ fc @3m				124 dBµV/m			
Frequency Tolerance Temperature				f lower		f higher	
Frequency Tolerance Voltage				13.558964 MHz		13.559234 MHz	
Frequency Drift limit 1356 Hz				13.558982 MHz		13.559042 MHz	
				-1036		-958	

8.4. Test Method**Part 15.225**

- As per Radio-Noise Emissions, ANSI C63.4:2004
- An initial assessment was carried out on a indoor test site, to obtain the position and setup of the EUT which gave maximum emission levels, the results of this assessment was used during final calibrated measurement on a Open Area Test Site (OATS)
- The EUT was placed at a height of 0.8 metres above the ground plane
- Emissions maximised:-
 - by rotation of the EUT, on a automatic turntable.
 - receiving antenna was raised and lowered between 1-4 m above the ground plane
 - using both the horizontal & vertical polarisations of the receiving antenna
 - the maximum-recorded emissions recorded.
- Receiver Bandwidth >30 MHz 120kHz Quasi Peak 100kHz Peak/Average Detector
<30 MHz 9kHz Quasi Peak 10kHz Peak/Average Detector
>150kHz 100Hz Quasi Peak 100Hz Peak/Average Detector
- Final measurements were carried out as required by part 15.31e

8.5. Test Equipment Used:

AV10	EMC70	OATS2	OATS2/3	RX11	RX12	RX14	EC1	PSU10	YI5
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9. Part 15.209 - Transmitter Spurious Emissions – Conducted**9.1. Transmitter Spurious Emissions <30MHz**

Ambient temperature °C	16	Supply Voltage V	110 @ 60Hz
Relative humidity %	42	Channel No	1
		Detector function	Quasi Peak

Graphs & Plots Figure 3 Spurious Emissions Conducted Live Line With Antenna
 Figure 4 Spurious Emissions Conducted Neutral Line With Dummy Antenna

Only worse case recorded emissions in each band referenced to the limit are listed below

Frequency Range (MHz)	Freq (MHz)	Reading (dBµV) With Antenna	Reading (dBµV) With Dummy Antenna	Limit Quasi- Peak Detector (dBµV/m)	Limit Average Detector (dBµV/m)
0.15-0.5				66-56	56-46
0.5-5	0.65	39	39	56	46
5-30	13.56	>70	41	60	50

9.2. Test Method**Part 15.209**

7. As per Radio-Noise Emissions, ANSI C63.4:2004
8. Emissions were searched to 30 MHz inclusive as required by part 15.207
9. The EUT was placed at a height of 0.8 metres above the ground plane
10. Receiver Bandwidth >30 MHz 120kHz Quasi Peak 100kHz Peak/Average Detector
 <30 MHz 9kHz Quasi Peak 10kHz Peak/Average Detector
 >150kHz 100Hz Quasi Peak 100Hz Peak/Average Detector

9.3. Test Equipment Used:

RX12	RX14	L2/2		
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10. Part 15.209 - Transmitter Spurious Emissions – Radiated**10.1. Transmitter Spurious Emissions <1000MHz**

Ambient temperature °C	16	Measurement Distance	3 m < 30 MHz 10 m >30MHz
Relative humidity %	42	Extrapolated Distance	From 10 to 3 m
Supply Voltage V	110 @ 60Hz	Detector function	Quasi Peak
Channel No	1		

Graphs & Plots Figure 2 Radiated Spurious Emissions Below 30 MHz
 Figure 5 Radiated Spurious Emissions 30-230 MHz
 Figure 6 Radiated Spurious Emissions 200-1000 MHz
 Figure 7 Radiated Spurious Emissions Open Area Test Site Levels

Only worse case recorded emissions in each band of the limit are listed below

Frequency Range (MHz)	Freq (MHz)	OATS Reading (dBµV)	Antenna Correc. (dB)	Cable Correc. (dB)	Field Strength (dBµV/m)	Extrapolation Factor (dB)	Field Strength (dBµV/m)	Limit @3m µV/m (dBµV/m)
0.009-0.49	0.009	45	77.6	0.5	123.1	-	123.1	128.5 -74
0.49-1.705	0.65	14	43	0.5	57.5	-	57.5	74 - 63
1.705-30	6.0	-14	37.1	0.5	23.1	-	23.1	69.5
30-88	69.2	21	5.24	1.68	24.27	10.46	34.73	40
88-216	168	16	9.3	2.84	28.14	10.46	38.60	43.5
216-960	216.9	20	8.5	3.2	31.7	10.46	42.16	46
Above 960								54

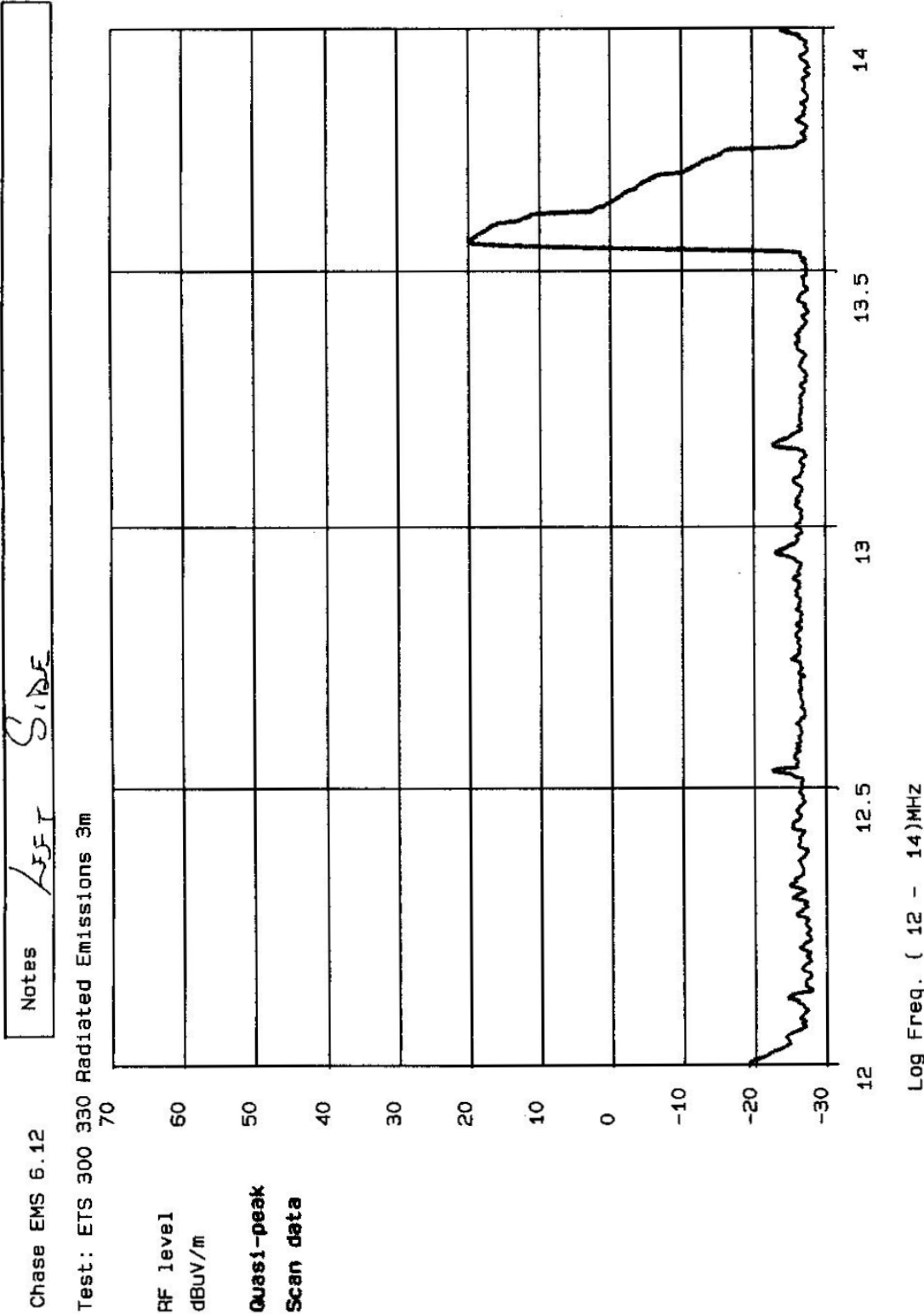
10.2. Test Method**Part 15.225**

- As per Radio-Noise Emissions, ANSI C63.4:2004
- Emissions were searched to 1000 MHz inclusive as required by part 15.33a
- An initial assessment was carried out on a indoor test site, to obtain the position and setup of the EUT which gave maximum emission levels, the results of this assessment was used during final calibrated measurement on a Open Area Test Site (OATS)
- The EUT was placed at a height of 0.8 metres above the ground plane
- Emissions maximised:-
 - by rotation of the EUT, on a automatic turntable.
 - receiving antenna was raised and lowered between 1-4 m above the ground plane
 - using both the horizontal & vertical polarisations of the receiving antenna
 - the maximum-recorded emissions recorded.
- Extrapolation factor 20dB/decade or 40dB/decade as part 15.31(f) (1&2)
- Receiver Bandwidth >30 MHz 120kHz Quasi Peak 100kHz Peak/Average Detector
 <30 MHz 9kHz Quasi Peak 10kHz Peak/Average Detector
 >150kHz 100Hz Quasi Peak 100Hz Peak/Average Detector
- Final measurements were carried out as required by part 15.31e

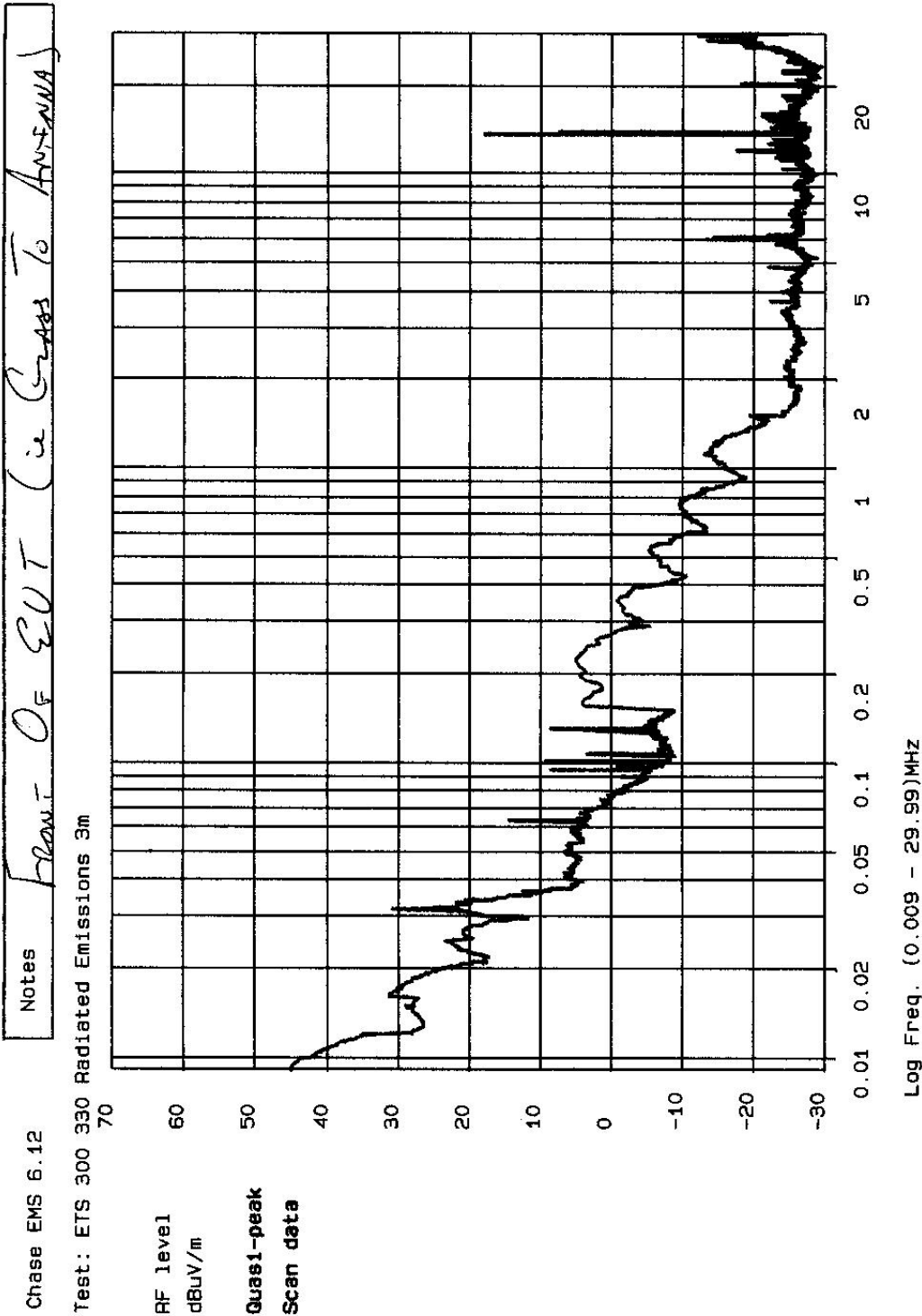
10.3. Test Equipment Used:

AV10	BA4	OATS2	OATS2/3	RX11	RX12	RX14	EMC70		
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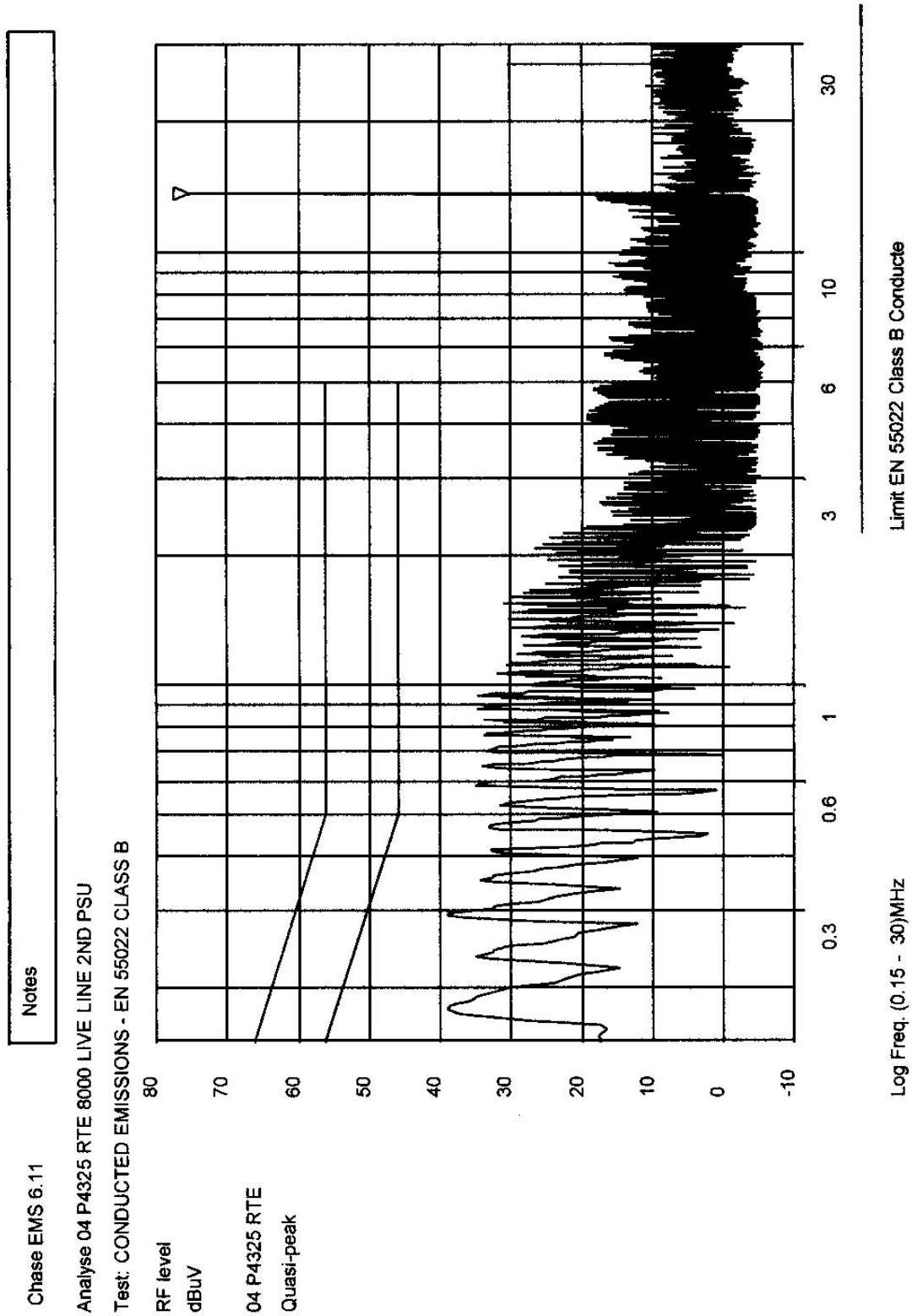
10.4. Figure 1-Radiated Emission Transmitter On
(Un-corrected Screened Enclosure Emission Measurements @ 3 m)



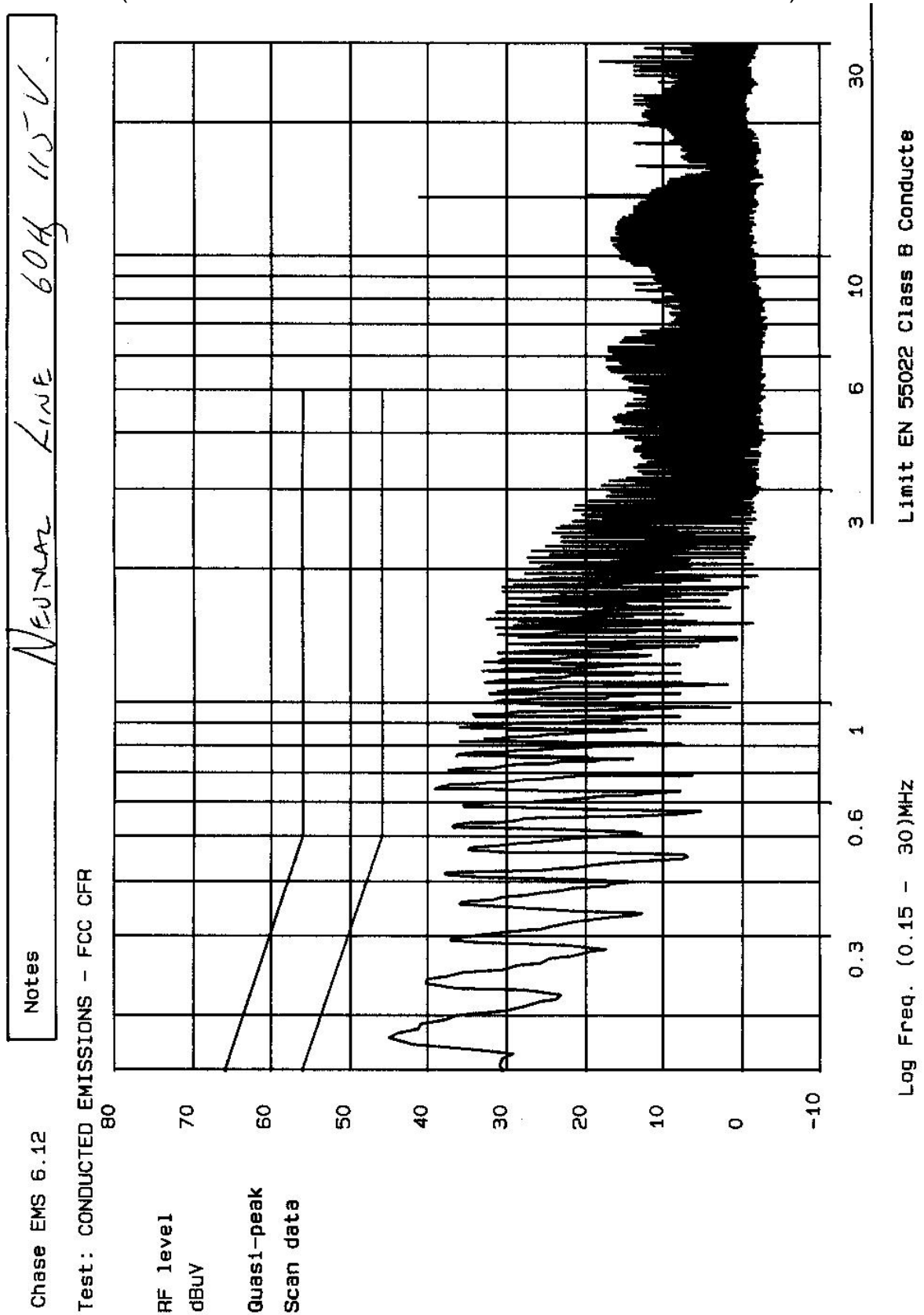
10.5. Figure 2 -Radiated Emission Transmitter 9 kHz-30 MHz
(Un-corrected Screened Enclosure Emission Measurements @ 3 m)



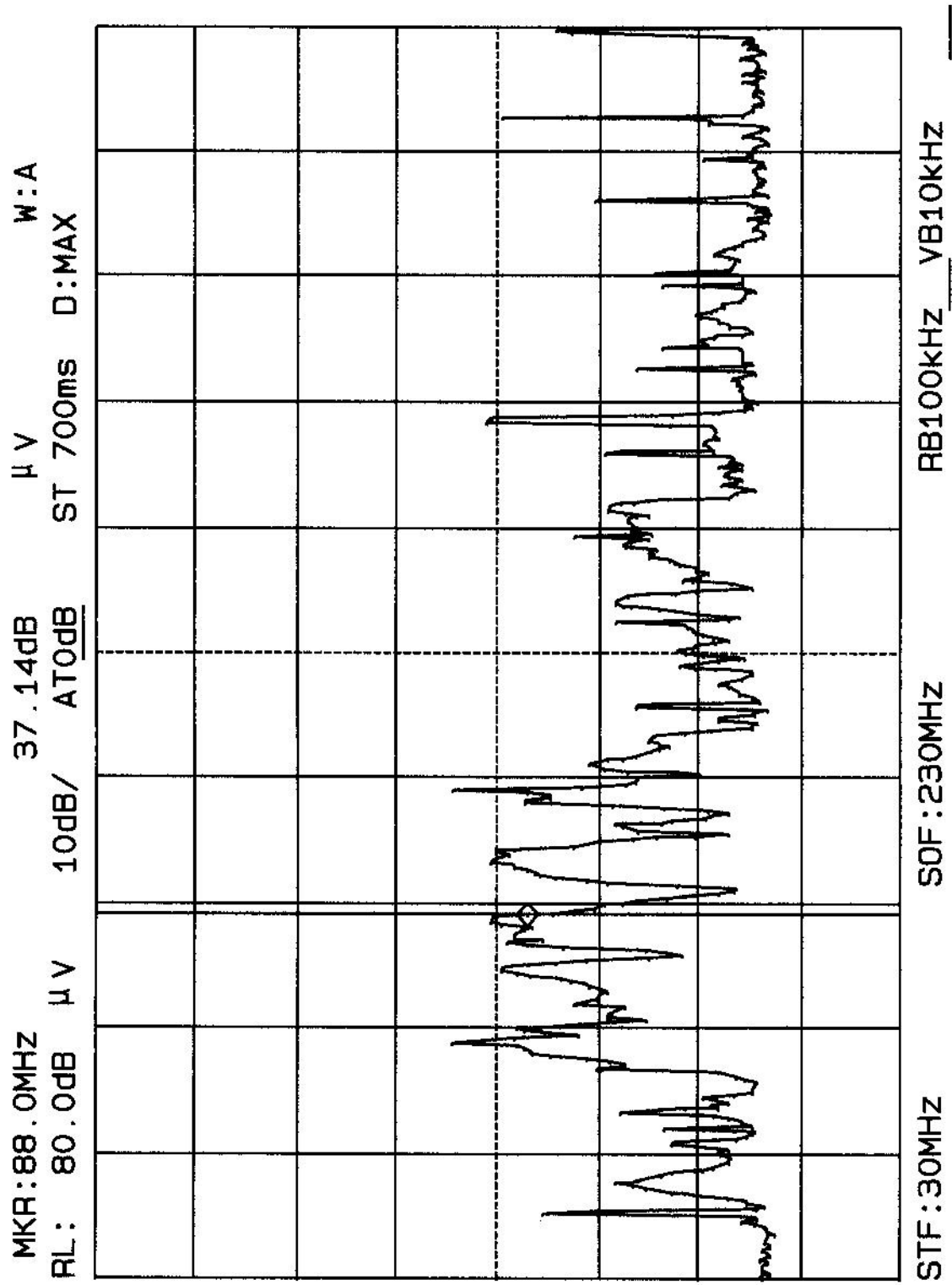
10.6. Figure 3-Conducted Emission Live Line With Antenna
(Un-corrected Screened Enclosure Emission Measurements)



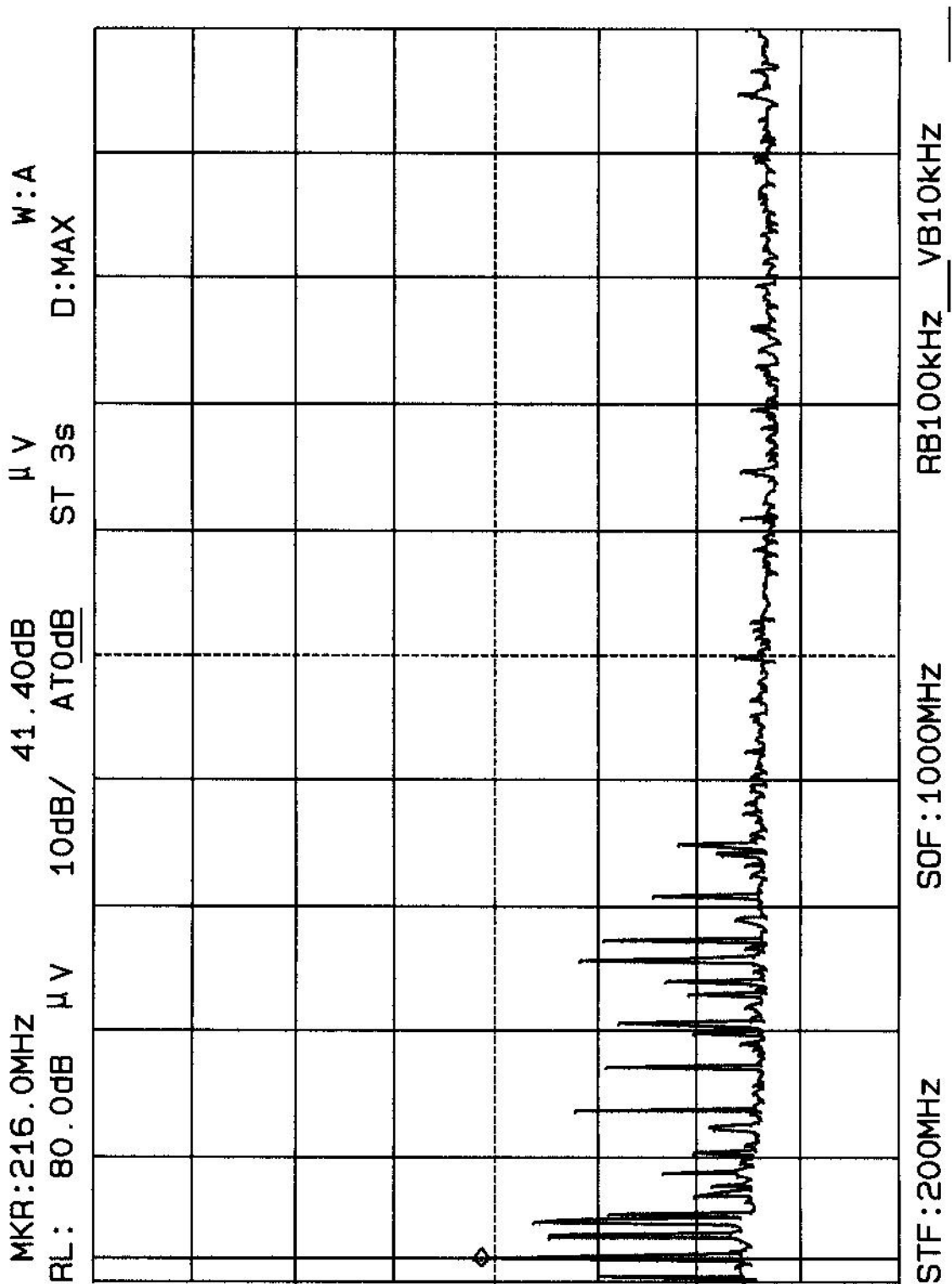
10.7. Figure 4-Conducted Emission Live Line With Dummy Antenna
(Un-corrected Screened Enclosure Emission Measurements)



10.8. Figure 5-Radiated Emission 30-230 MHz Peak Detector
(Un-corrected Screened Enclosure Emission Measurements @ 1 m)

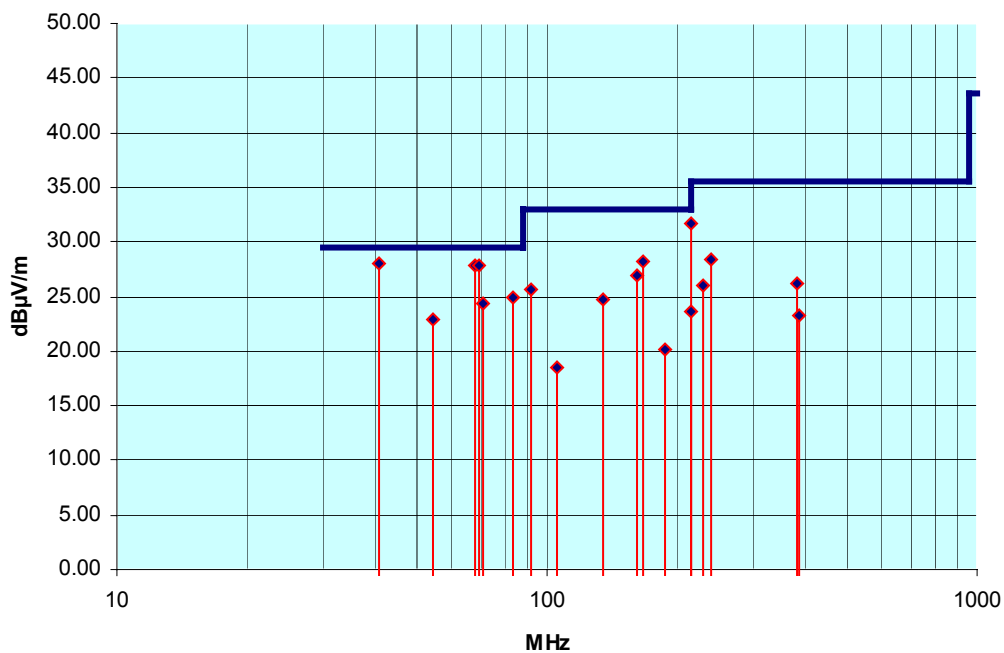


10.9. Figure 6-Radiated Emission 30-230 MHz Peak Detector
(Un-corrected Screened Enclosure Emission Measurements @ 1 m)



**10.10. Figure 7- Radiated Emissions 10 m Open Area Test Site (OATS)
(30 to 1000 MHz) Quasi Peak Detector**

Frequency MHz	Reading dB μ V/m	Antenna Correction dB	Cable Correction dB	Total dB μ V/m	Pass Fail
40.67	14.00	12.77	1.22	27.99	Pass
54.24	15.00	6.30	1.50	22.80	Pass
68.3	21.00	5.13	1.67	27.80	Pass
69.2	21.00	5.24	1.68	27.92	Pass
71.3	17.00	5.56	1.71	24.27	Pass
83.6	15.50	7.52	1.80	24.82	Pass
92	15.00	8.80	1.86	25.66	Pass
106	6.00	10.40	2.10	18.50	Pass
135.6	11.00	11.30	2.40	24.70	Pass
162.7	14.50	9.70	2.68	26.88	Pass
168	16.00	9.30	2.84	28.14	Pass
188.7	9.00	8.20	2.99	20.19	Pass
216	12.00	8.50	3.20	23.70	Pass
216.9	20.00	8.50	3.20	31.70	Pass
230.4	13.00	9.68	3.31	25.99	Pass
240	14.00	10.90	3.50	28.40	Pass
379.6	6.00	15.36	4.79	26.15	Pass
384	3.00	15.50	4.80	23.30	Pass



11. Test Equipment And Ancillaries Used For Tests

All test equipment used for the tests was calibrated and its operation verified prior to being used:-

No	Instrument Or Ancillary	Type	Manufacturer	Serial No.
AV10	Multimeter	AVO8 Mk2	AVO	1037M91516
BA4	Bilog Antenna	CBL6111A	Chase	1667
BIC5	Biconical Antenna	VHBC 9133	Scharzbeck	9124/0272
CT1	Communication Set	CMS 52	Rohde & Schwarz	825384/001
DRGFS	Double Ridge Guide Horn Antenna	EMCO 3115	EMC Test Systems	9701-5093
EC1	Environmental	Chamber	Fison	5360
EMC70	Magnetic Loop Antenna	HF Loop	EMC Projects	-
GS1	G Strip Chamber	Comtest	Comtest ThermoVoltek	CC107-0050
LP4	Log Periodic	9107	Schwarzbeck	9107534
LP7	Log Periodic	VUSLP 9111	Schwarzbeck	9111197
OATS2	OATS		EMC Projects	
OATS2/3	Cable		EMC Projects	OAT2/3
OSC3	2 Channel Oscilloscope	TDS360	Tektronix	BO11912
PA2	Pre Amplifier		EMC Projects	PA2
PA5	Pre Amplifier	8449B	Hewlett Packard	3008A00176
Rx11	Receiver	UHR 4000	Chase	6114
Rx12	Receiver ESAI-D	804.8932.52	Rhode & Schwarz	87961/035
Rx14	ESMI-RF Receiver	1032.5510.53	Rhode & Schwarz	87961/035
SA10	Spectrum Analyser	2390A	Marconi	1601
SA14	Spectrum Analyser	8591EM	Hewlett Packard	3536A00301
SA8	Spectrum Analyser	MS2601B	Anritsu	MW39953
SA9	Spectrum Analyser	MS2601B	Anritsu	MT54360
SG20	Signal Generator	2031	Marconi	119595/009
SG21	Signal Generator	2023	Marconi	112158/001
YI5	Digital Temperature Meter	2455	Yokagawa	75JV0142
	Probe for YI5	Type K	Yokagawa	08471T

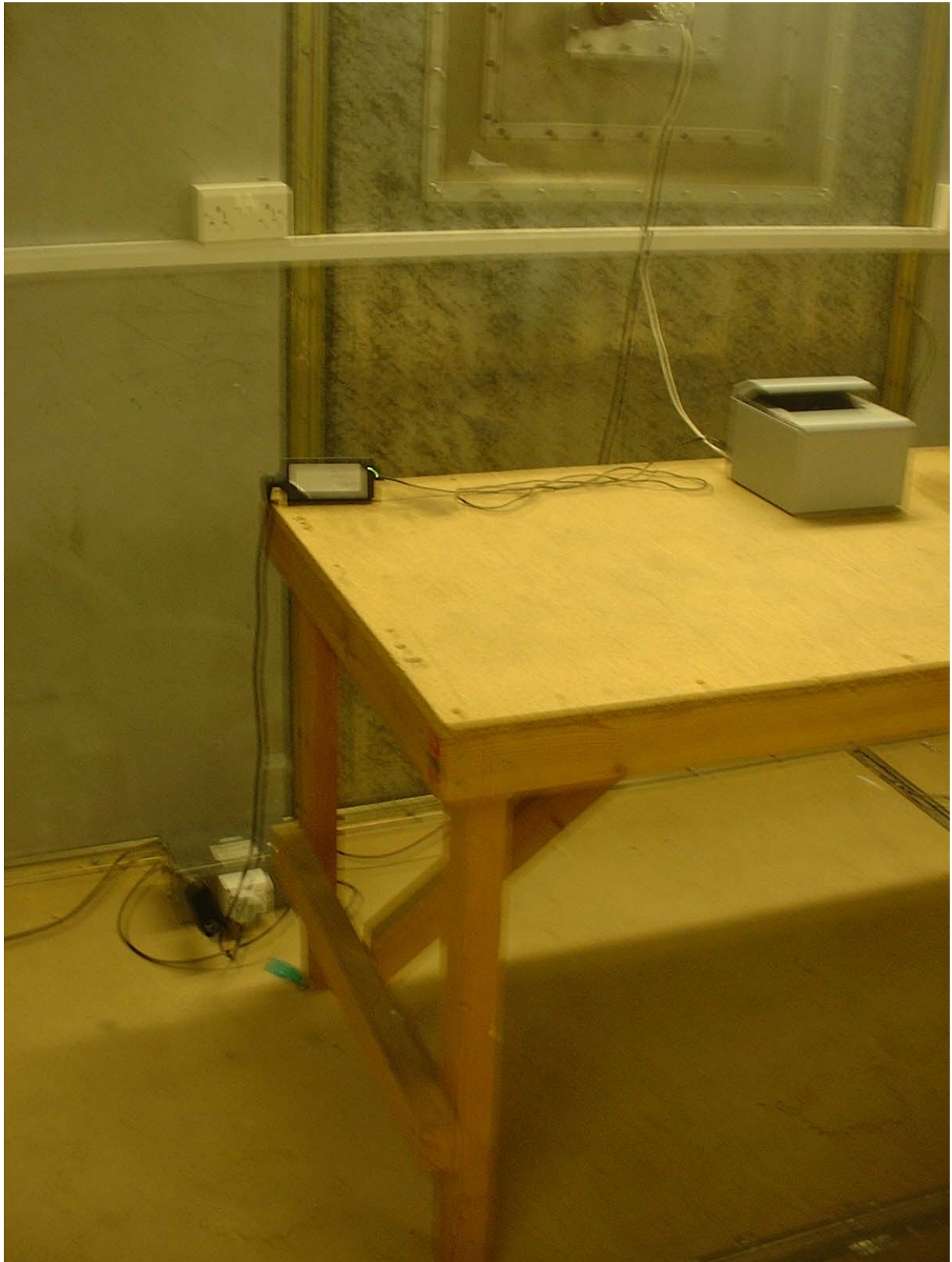
12. Photographs

All size were indicated are in centimetre's

12.1. Figure 8 Test Set Up OATS



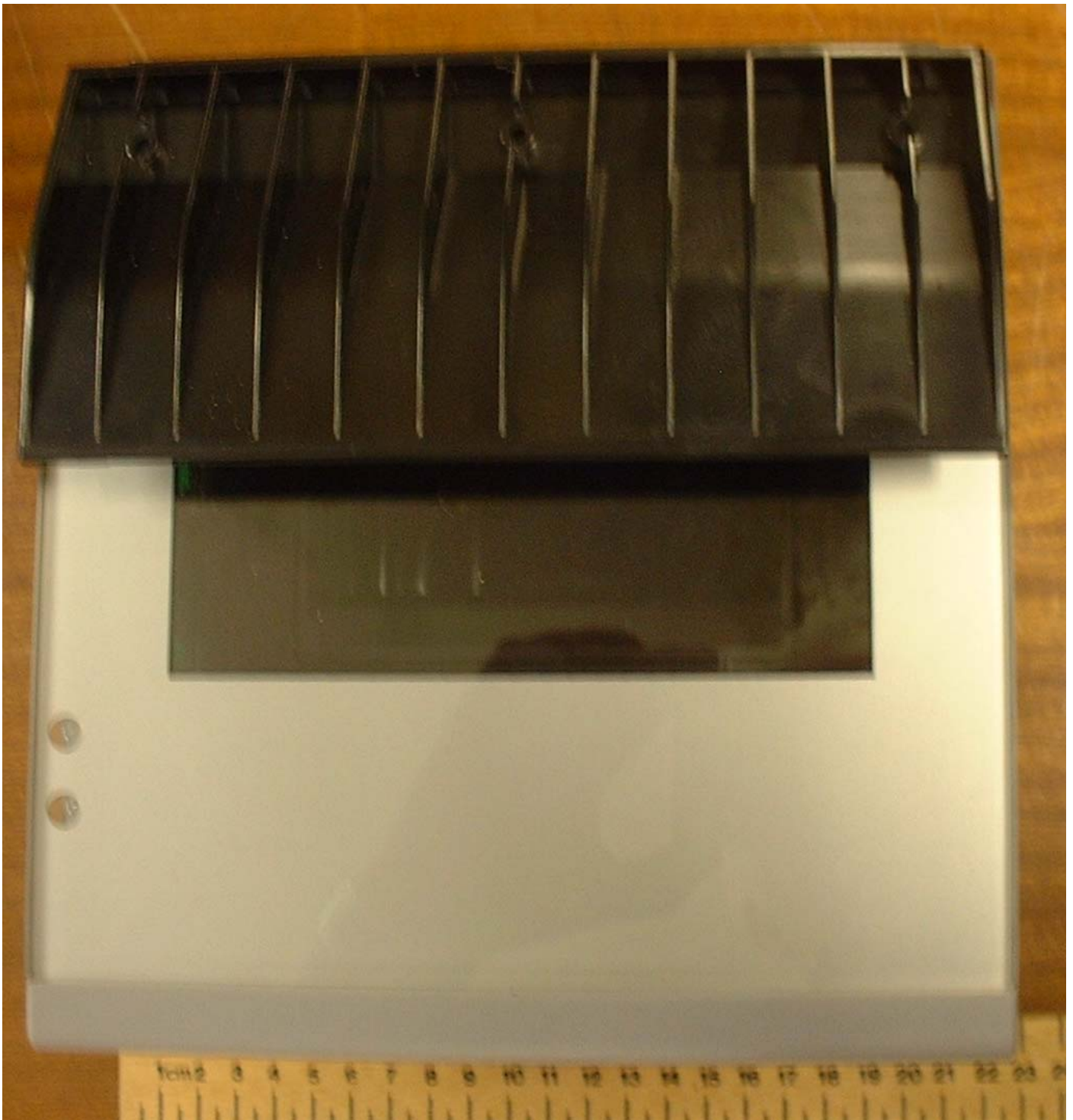
12.2. Figure 9 Test Set Up Conducted Emissions



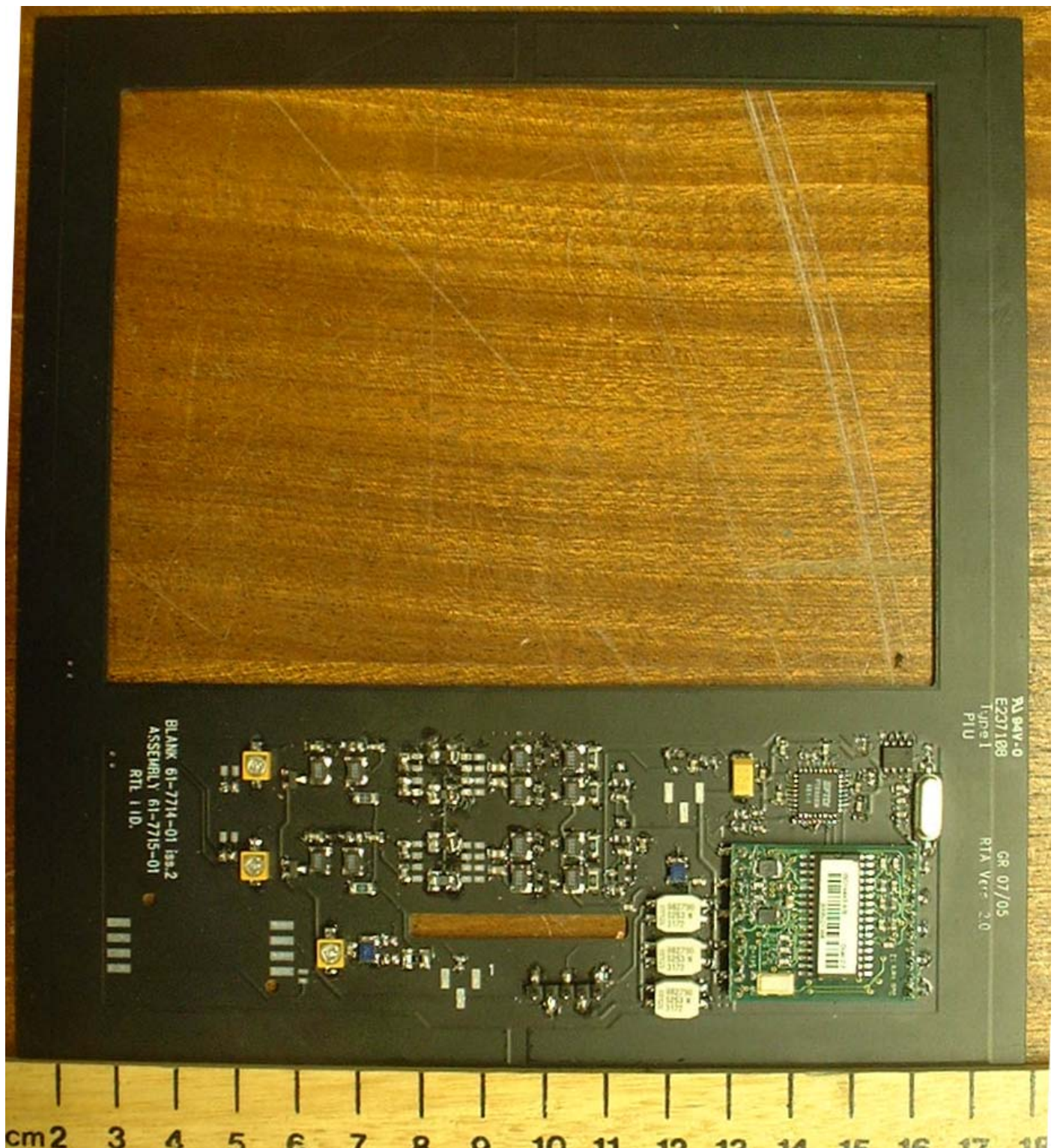
12.3. Figure 10 Test Set Up Screened Room



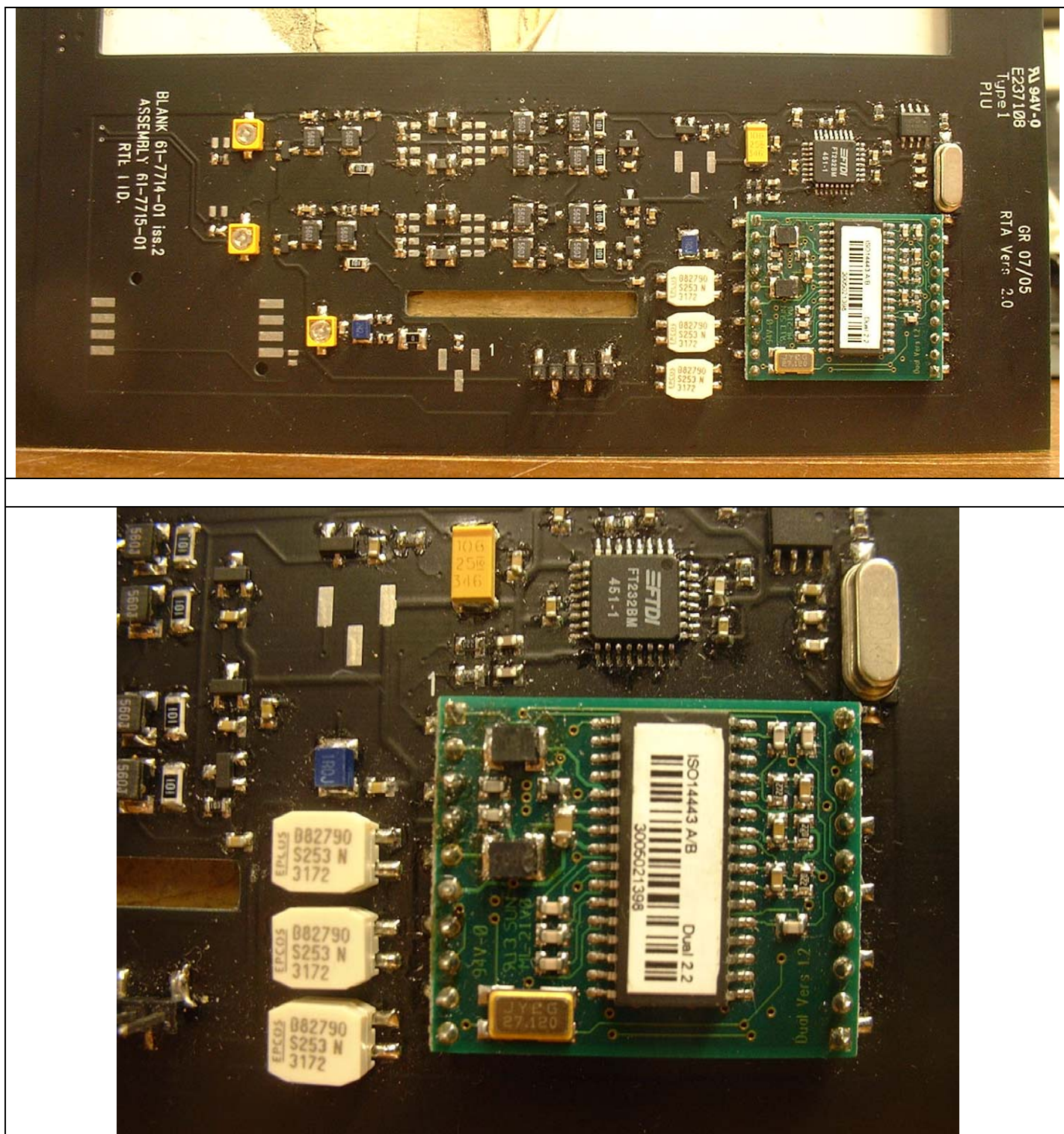
12.4. Figure 11 EUT as Supplied Top View



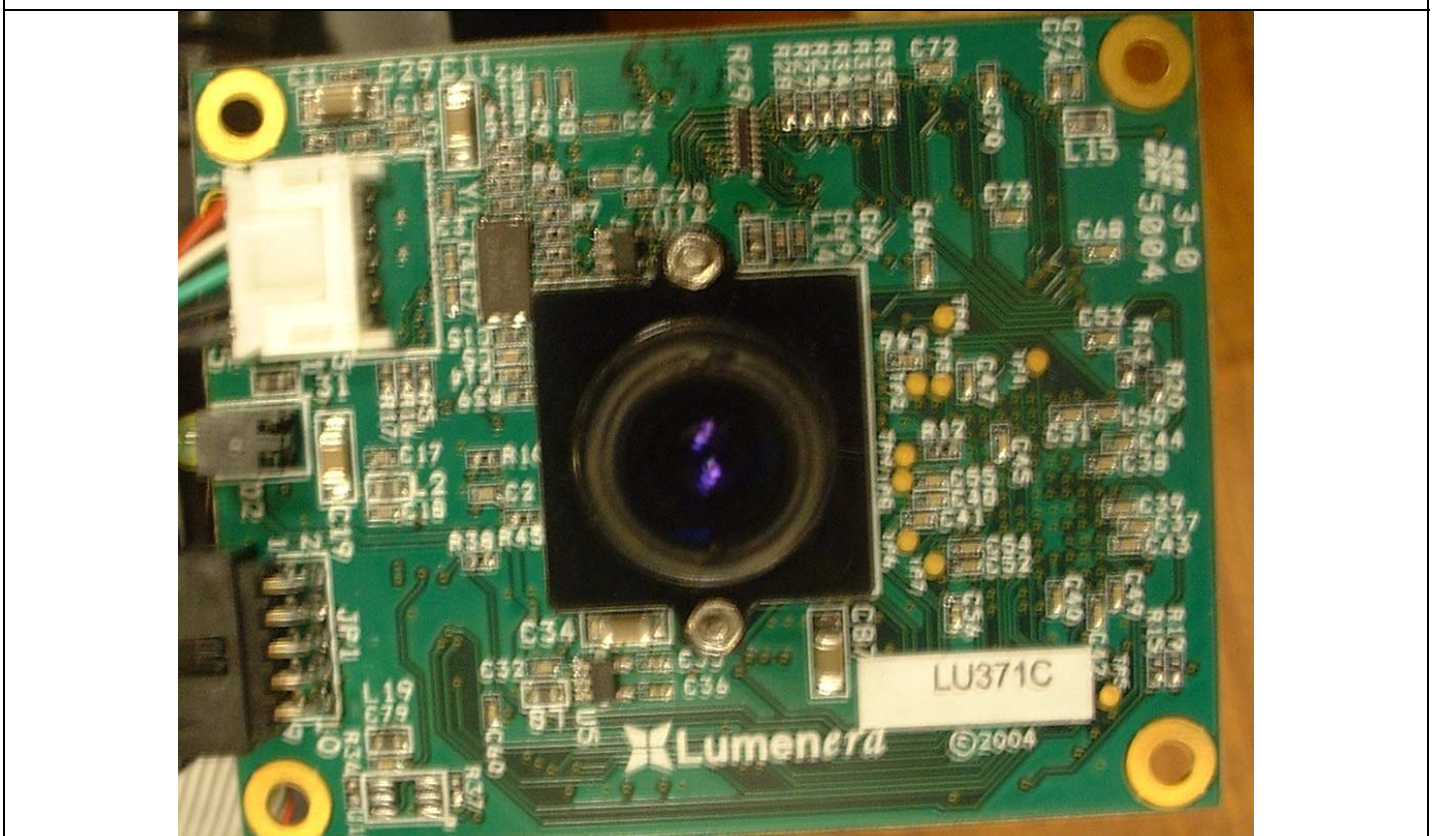
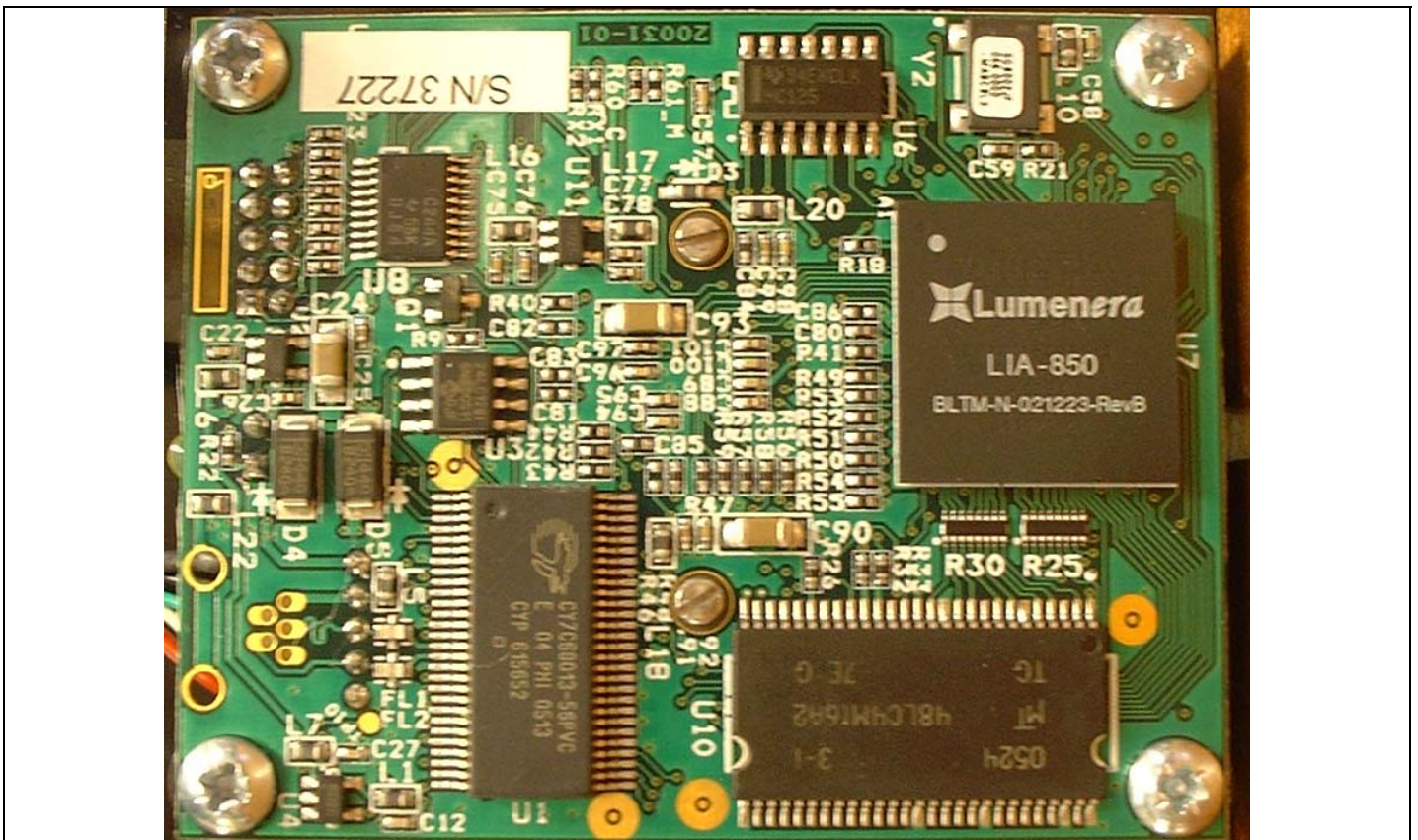
12.5. Figure 12 Transmitter and antenna as supplied



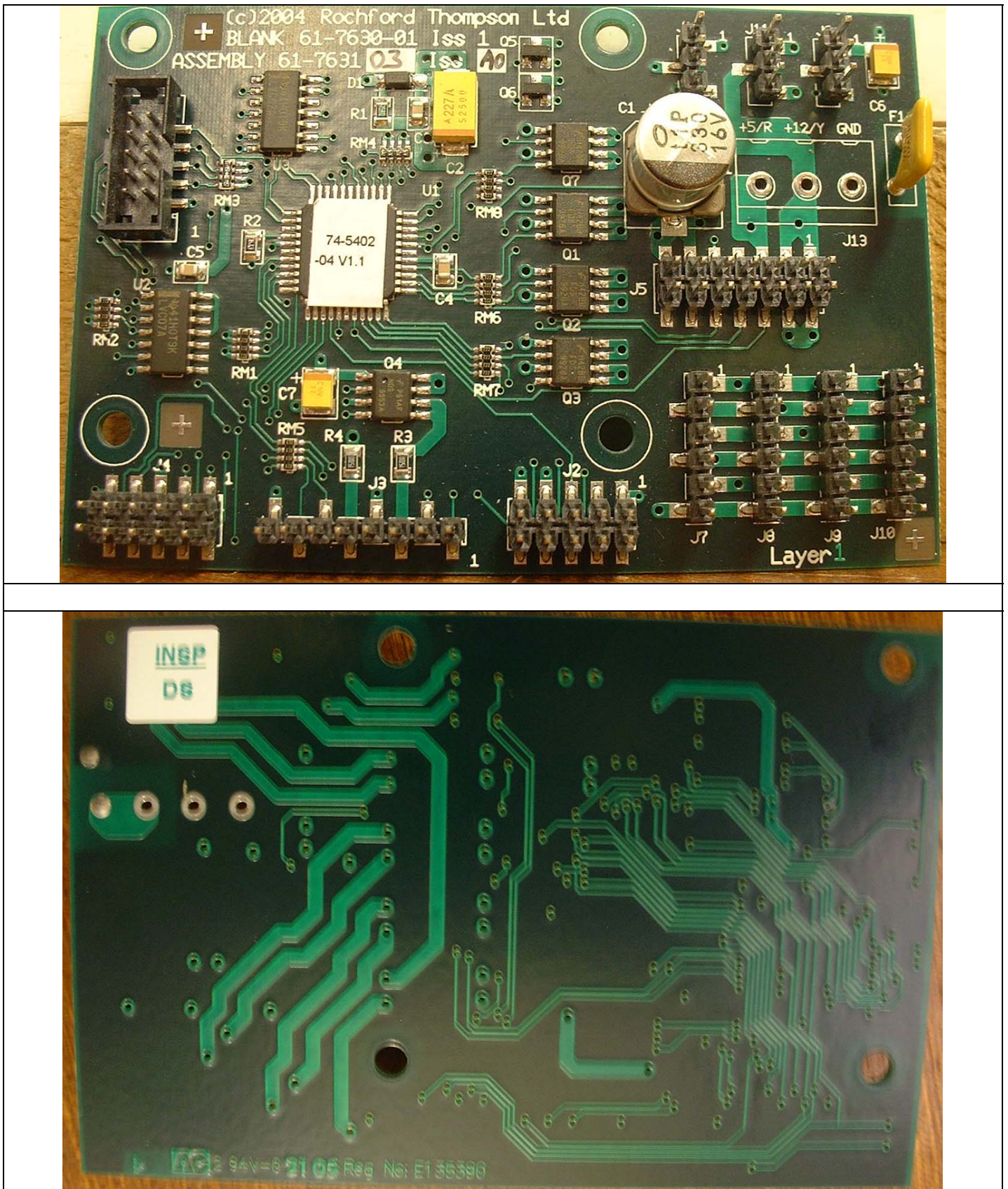
12.6. Figure 13 Transmitter Circuit Board View 1



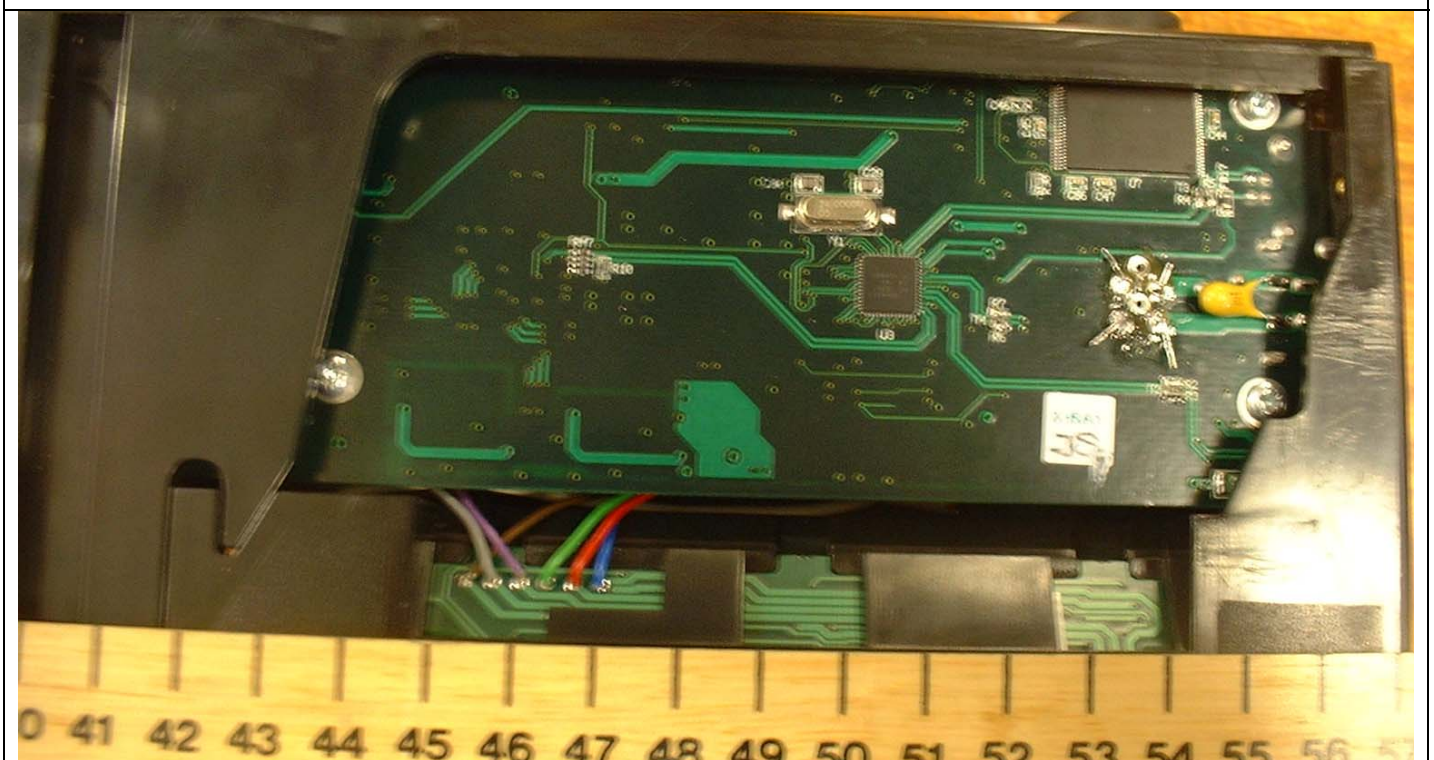
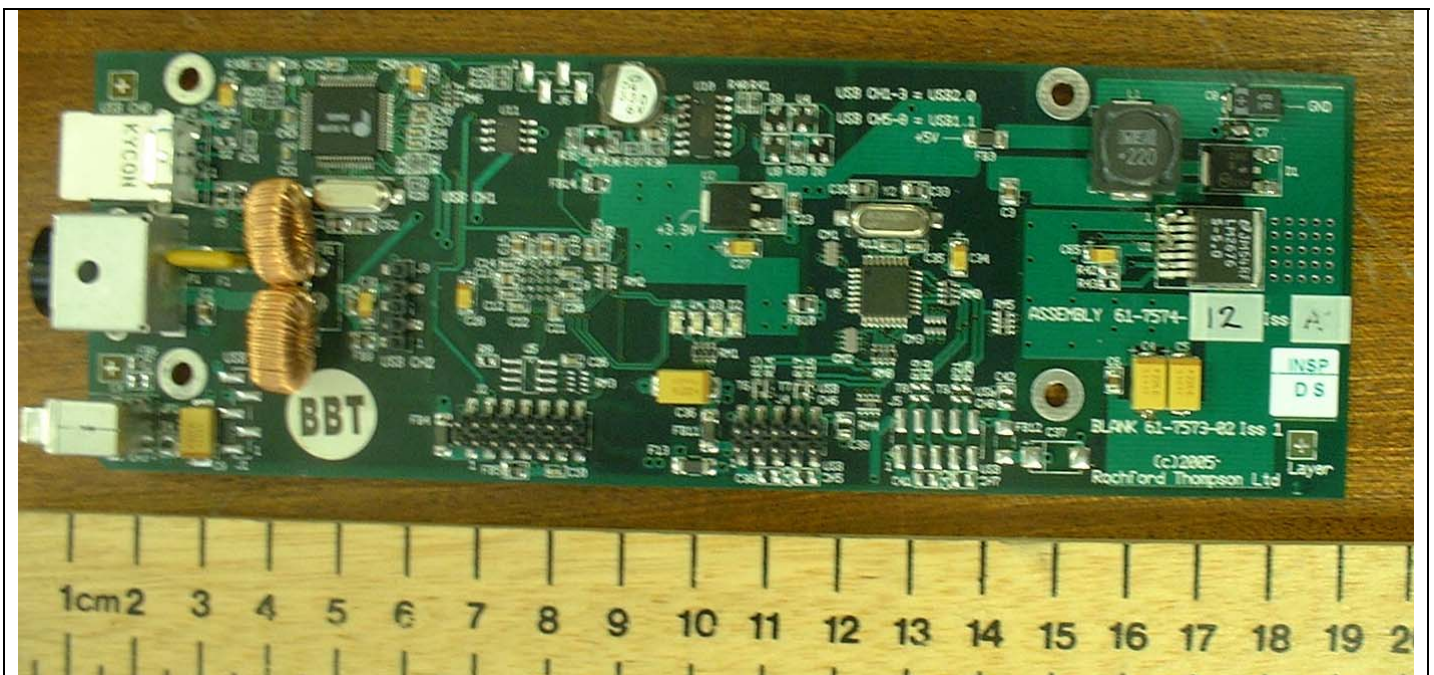
12.7. Figure 14 Camera Circuit Board



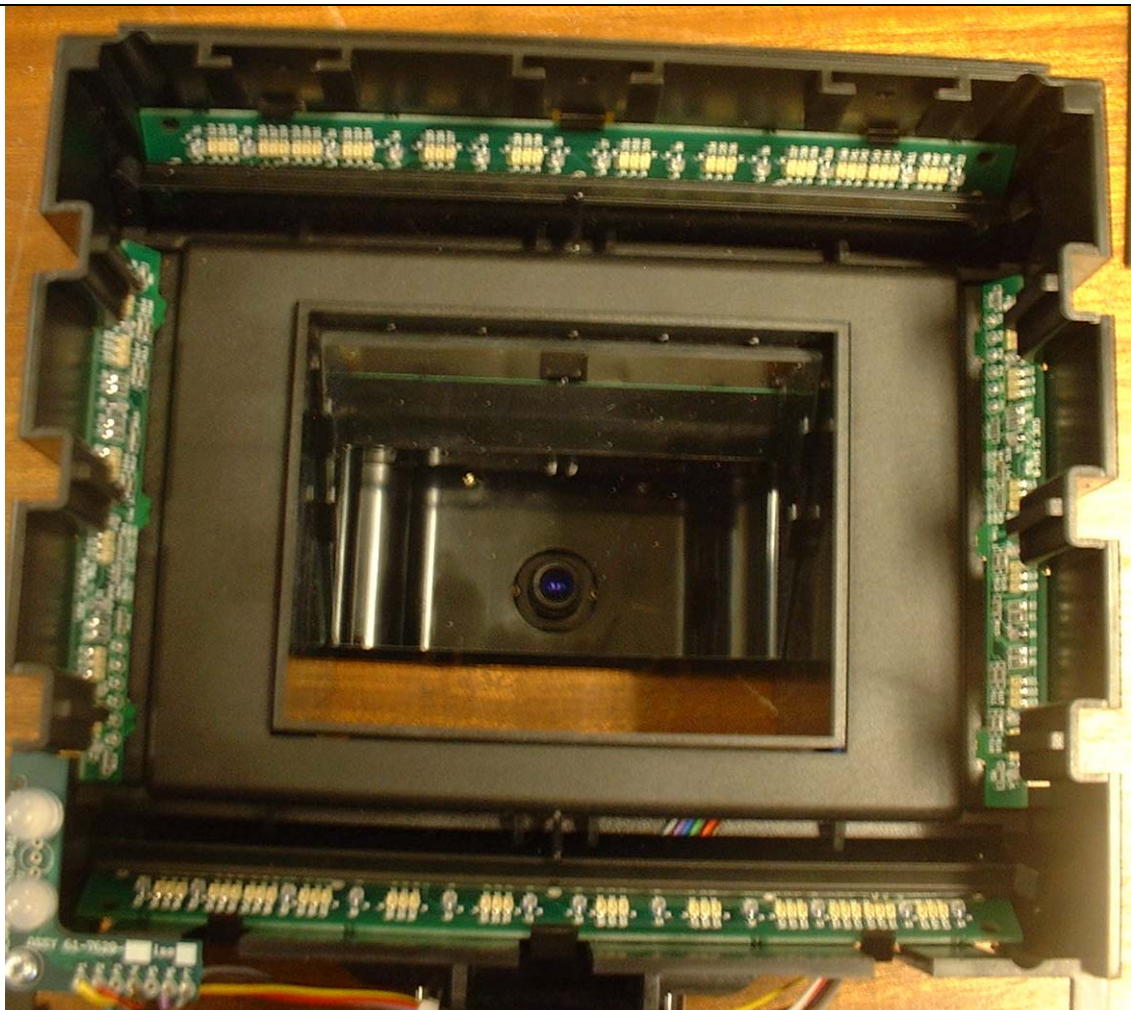
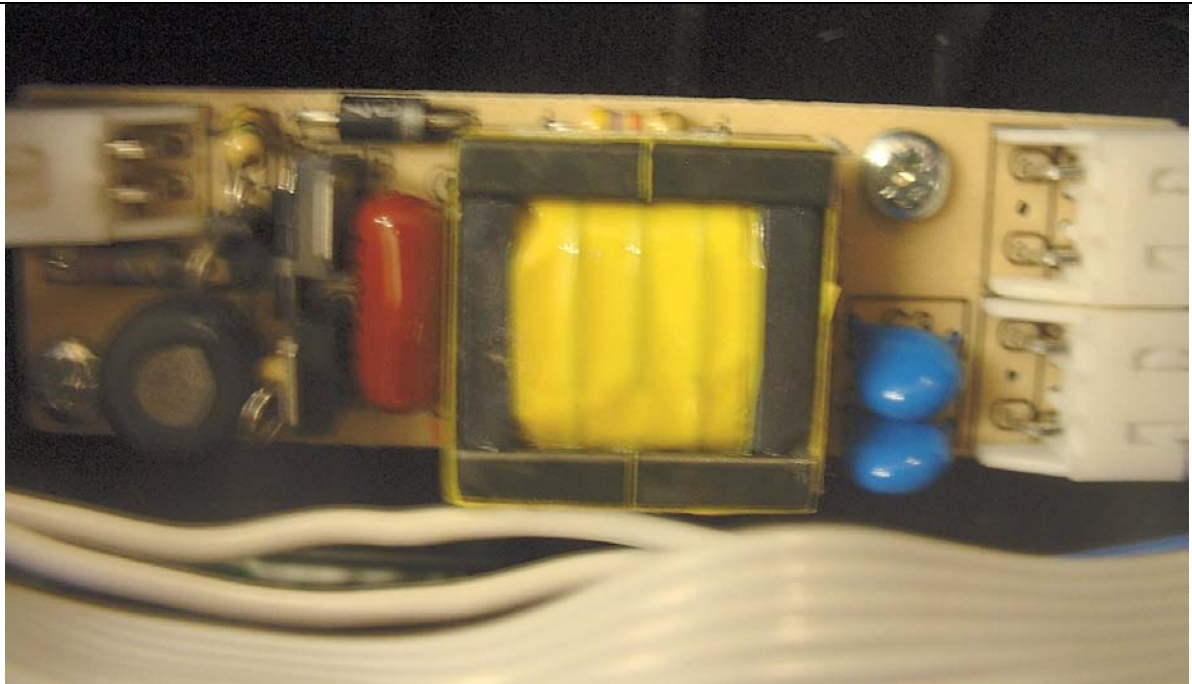
12.8. Figure 15 Circuit Board 61-7631-03



12.9. Figure 16 Circuit Board 61-7574-12



12.10. Figure 17 Circuit Board Miscellaneous



12.11. Figure 18 Ancillary Items

Power Supply Unit Used During Testing



Ferrites Fitted To USB Cable



12.12. List Of Ancillaries and Component Parts

Item	Model/ No.	Part/ assembly No	Serial No.	Software
Toshiba T91000 TECRA	PT910E-00E3J-EN		723575176	XP Professional
Adaptec USB2 Connect for Notebooks	AVA-1420 A	2032100 A QXDA 3439 I LM		Usb2.0 Card bus
Power Solve 12V 5.5A dc	PS70A1212A03		70120-0000596	
Camera Board			37227	
Transmitter Board	61-7714-01 Iss 2	61-7715-01		
Cct Board Rochford Thomson	61-7630-01	61-7631-03		
Cct Board Rochford Thomson	61-7573-02 Iss 1	61-7574-12 Iss A		

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