

TEST REPORT NO: RL1051/5158

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**REPORT ON THE
CERTIFICATION TESTING OF A
GROUP 4 TECHNOLOGY Ltd.
S711 READER:- MODEL 8000-5244-A
IDENTITY TAG DATA TRANSCEIVER
S/No. 001-000049
WITH RESPECT TO THE
FCC 47CFR, Pt's 15.107, 15.109, 15.207 & 15.225
INTENTIONAL RADIATOR
& UNINTENTIONAL RADIATOR
CLASS B
SPECIFICATIONS**

TEST DATE(s): 11th to 20th April 2000

TESTED BY: R P I PARRY

APPROVED BY: S P HAYES

ISSUE DATE:

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CONTENTS

	page	
APPLICANT'S SUMMARY	3	
CERTIFICATE OF CONFORMITY & COMPLIANCE	4	
DESCRIPTION OF TRANSCEIVER	4	
EQUIPMENT TEST CONDITIONS	5	
TESTS REQUIRED	6	
SAMPLE CALCULATIONS	6	
TEST RESULTS	7 - 17	
PHOTOGRAPHS	ANNEX A	[X]
PHOTOGRAPH No 1: Test site with Tx/Rx, conducted & radiated.	ANNEX A1	
PHOTOGRAPH No 2: Tx/Rx, front.	ANNEX A2	
PHOTOGRAPH No 3: Tx/Rx, rear.	ANNEX A3	
PHOTOGRAPH No 4: Tx/Rx, rf & display pcb, top.	ANNEX A4	
PHOTOGRAPH No 5: Tx/Rx, rf & display pcb, bottom.	ANNEX A5	
PHOTOGRAPH No 6: Tx/Rx, rf & display pcb, w/o Ae.	ANNEX A6	
PHOTOGRAPH No 7: Control pcb, top.	ANNEX A7	
PHOTOGRAPH No 8: Control pcb, bottom.	ANNEX A8	
TEST EQUIPMENT LIST	ANNEX B	[X]
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST	ANNEX C	[n/a]
MEASURING DISTANCE EXTRAPOLATION GRAPH(S)	ANNEX D	[X]
TRANSMITTER CARRIER FREQUENCY GRAPH(S)	ANNEX E	[n/a]

Notes:-

- | | | |
|----------------------------------|-----|------------|
| 1. Component failure during test | YES | [] |
| | NO | [X] |
1. If Yes, details of failure:-
1. All measurement uncertainty calculations detailed in this report are carried out in accordance with UKAS Publication NIS 81, Edition 1, May 1994, for a 95% confidence level.
1. The contents of the attached applicant's declarations and other supplied information are not covered by the scope of this laboratory's UKAS or FCC accreditations and is provided in good faith.

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT): S711 Reader:- Model 8000-5244-A

EQUIPMENT TYPE: Identity Tag Data Transceiver

SERIAL NUMBER OF EUT: S/No. 001-000049

PURPOSE OF TEST: FCC Certification

TEST SPECIFICATION(s): FCC 47CFR Pt's 15.107, 15.109, 15.207 & 15.225

TEST RESULT: Compliant Yes
No

APPLICANT'S CATEGORY: (a) Manufacturer
(b) Importer
(c) Distributor
(d) Agent

APPLICANT'S ORDER No(s): P10361

APPLICANT'S CONTACT PERSON: Mr. Eric Porter

APPLICANT: Group 4 Technology Ltd.

ADDRESS: Challenge House,
Northway Lane,
Tewkesbury,
Glos.,
GL20. 8JG.,
United Kingdom

Tel:- +44 1684 850977

Fax:- +44 1684 290166

MANUFACTURER: Group 4 Technology Ltd.

ADDRESS: Challenge House,
Northway Lane,
Tewkesbury,
Glos.,
GL20. 8JG.,
United Kingdom

Tel:- +44 1684 850977

Fax:- +44 1684 290166

EUT(s) COUNTRY OF ORIGIN: United Kingdom

TEST LABORATORY: TRL EMC Ltd.

UKAS ACCREDITATION No: 0728

TEST DATE(s): 11th to 20th April 2000

TEST REPORT No: RL1051/5158

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: OE5S711

PURPOSE OF TEST: FCC Certification

TEST SPECIFICATION: FCC 47CFR, Parts 15.107, 15.109, 15.207 & 15.225

TEST RESULT: Compliant to specification

EQUIPMENT UNDER TEST: S711 Reader:- Model 8000-5244-A

EQUIPMENT SERIAL No: S/No. 001-000049

ITU EMISSION CODE: 14k0L1D

EQUIPMENT TYPE: Identity Tag Data Transceiver

UTILISATION: Identification and access control

CARRIER EMISSION: +22.1dB μ V/m @ 30m

ANTENNA TYPE: Fixed, or Integral

ALTERNATIVE AE: None, as per Part 15.203

BAND OF OPERATION: 13.553MHz to 13.567MHz

CHANNEL SPACING: not applicable

No. of CHANNELS: 1 (one)

FREQUENCY CONVERSION: Superhet [] ; Direct [X] ; Regenerative []

INTERMEDIATE FREQUENCY: 1ST [n/a] ; 2ND [n/a] ; 3RD [n/a]

LOCAL OSCILLATOR: Higher [] ; Lower [] ; not applicable [X]

FREQUENCY GENERATION: SAW Resonator [] ; Crystal [X] ; Synthesizer []

MODULATION METHOD: Amplitude [] ; Digital [X] ; Angle []

POWER SOURCE(s): 110Vac

TEST DATE(s): 11th to 20th April 2000

ORDER No(s): P10361

APPLICANT: Group 4 Technology Ltd.,
Challenge House,
Northway Lane,
Tewkesbury,
Glos., GL20. 8JG.,
United Kingdom

TESTED BY: R P I PARRY

APPROVED BY: S P HAYES
EMC MANAGER

TESTS REQUIRED

TRANSMITTER & RECEIVER TESTS

Receiver Spurious Emissions - Powerline - Part 15.107	[X]
Receiver Spurious Emissions - Radiated - Part 15.109 - >30MHz	[X]
Receiver Spurious Emissions - Radiated - Part 15.209 - <30MHz	[X]
Transmitter Spurious Emissions - Powerline - Part 15.207	[X]
Transmitter Spurious Emissions - Radiated - Part 15.209.c - <30MHz	[X]
Transmitter Spurious Emissions - Radiated - Part 15.209.c - >30MHz	[X]
Transmitter Carrier Emission - Radiated - Part 15.225.a	[X]
Transmitter Carrier Frequency - Radiated - Part 15.225.c	[X]

Notes:-

- | | |
|---|-------|
| 1. Equipment tested for (mains ac) 110V powerline emissions. | [X] |
| 1. Equipment tested as (fixed) integral antenna configuration. | [X] |
| 1. All tests were carried out with new batteries, as per Part 15.31.e. | [n/a] |
| 1. Equipment tested for radiated emissions as per Part 15.109. | [X] |
| 1. Equipment tested for radiated emissions as per Part 15.225.b {15.209.c}. | [X] |
| 1. Equipment tested for unintentional radiator digital device Class B | [X] |

SAMPLE CALCULATIONS

Parts 15.107 & 15.207 - Powerline.

Frequency (MHz)	Rx (dB μ V)	LISN Correction (dB)	Cable loss (dB)	Powerline (dB μ V)
13.5612	+40.8	+0.6	+0.1	+41.5

Parts 15.109, 15.209 & 15.225 - Radiated.

Frequency (MHz)	Rx (dB μ V)	3m Correction (dB)	Ae AF & Cable loss (dB/m & dB)	Field Strength @ ?m (dB μ V/m)
13.5612	+47.2 *	-25.1	n/a	+22.1 @ 30m
27.1224	+26.2 *	-20.0	n/a	+6.2 @ 30m
94.9200	+19.5	n/a	+10.7	+30.2 @ 3m

* Reading using directly calibrated loop antenna in dB μ V/m.

RECEIVER TESTS

RECEIVER SPURIOUS EMISSIONS - POWERLINE - PART 15.107

Ambient temperature	=	+19 C	Class A digital device	[]
Relative humidity	=	43%	Class B digital device	[X]
Conditions	=	Indoors		
Supply voltage	=	Vnom		
Channel number	=	1		

Frequency & Level 450kHz to 1705kHz		all emissions	-20dB below limit
Frequency & Level 1705kHz to 30MHz		13.5612MHz other emissions	+35.4dB μ V -20dB below limit
Limits	450kHz to 1705kHz	+60.0 dB μ V [] ; +48.0 dB μ V [X]	
	1705kHz to 30MHz	+69.5 dB μ V [] ; +48.0 dB μ V [X]	
Measurement Uncertainty		4.0dB	

Notes:-

- Receiver detector = CISPR, Quasi-Peak, 10kHz bandwidth.
- Sample calculation, see page 6.
- PSU used for test = Lascar PSU 20112".

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- EUT located 0.4m from wall of shielded room, 0.8m from LISN. & above the ground plane.
- EUT emissions evaluated for live and neutral lines at power terminals of the ac mains supply.
- EUT emissions evaluated with an ac mains supply frequency of 50Hz.
- EUT emissions evaluated with an ac mains supply voltage of 110V.
- Worst case results recorded and reported.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL289, TRL237, TRL12, TRL89.

RECEIVER TESTS

RECEIVER SPURIOUS EMISSIONS - RADIATED - PART 15.109 - >30MHz

Ambient temperature	=	+16 C (<1GHz), n/a (>1GHz)	Class A digital device	[]
Relative humidity	=	72% (<1GHz), n/a (>1GHz)	Class B digital device	[X]
Conditions	=	Open Area Test Site (OATS)	10m measurements <1GHz	[]
Supply voltage	=	Vnom	3m measurements <1GHz	[]
Channel number	=	1	1m measurements >1GHz	[]

Frequency & Level 30MHz to 88MHz	Nil emissions	-20dB below limit
Frequency & Level 88MHz to 216MHz	94.920MHz 135.600MHz 203.400MHz	+28.5dB μ V/m @ 3m +24.9dB μ V/m @ 3m +24.0dB μ V/m @ 3m
Frequency & Level 216MHz to 960MHz	216.960MHz 244.080MHz 257.640MHz 325.440MHz	+27.5dB μ V/m @ 3m +33.1dB μ V/m @ 3m +26.1dB μ V/m @ 3m +27.3dB μ V/m @ 3m
Frequency & Level 960MHz to (x) MHz	Nil emissions	-20dB below limit
Limits	30MHz to 88MHz	+39.0dB μ V/m @ 10m []; +40.0dB μ V/m @ 3m [X]
	88MHz to 216MHz	+43.5dB μ V/m @ 10m []; +43.5dB μ V/m @ 3m [X]
	216MHz to 960MHz	+46.4dB μ V/m @ 10m []; +46.0dB μ V/m @ 3m [X]
	960MHz to (x) MHz	+49.5dB μ V/m @ 10m []; +54.0dB μ V/m @ 3m [X]
Measurement Uncertainty	4.1dB	

Notes:-

- Results quoted are extrapolated as indicated.
- Emissions were searched to:- (x) 1000MHz inclusive, as per Part 15.33b.
- Extrapolation factor @ 20dB/decade from 10m to 1m, as per Part 15.31f.
- Extrapolation factor @ 10.5dB from 10m to 3m.
- Extrapolation factor @ 9.5dB from 3m to 1m.
- Measurements <1GHz @ 10m (Class A), or @ 3m (Class B), as per Part 15.109.
- Measurements >1GHz @ 1m, as per Part 15.31f (1).
- Receiver Detector <1GHz = CISPR, Quasi-Peak, 120kHz Bandwidth.
- Receiver Detector >1GHz = Peak Hold, 1MHz Resolution Bandwidth.
- Sample calculation, see page 6.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- Measuring distances as Notes 1, 2 & 3 above.
- EUT 0.8 metre above ground plane.
- Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL08, TRL317, TRL274, TRL12.

RECEIVER TESTS

RECEIVER SPURIOUS EMISSIONS - RADIATED - PART 15.209 - <30MHz

Ambient temperature	=	+21 C (<30MHz)	Class A digital device	[]
Relative humidity	=	48% (<30MHz)	Class B digital device	[X]
Conditions	=	Open Area Test Site (OATS)	300m extrapolated from 3m	[X]
Supply voltage	=	Vnom	30m extrapolated from 3m	[X]
Channel number	=	1		

Frequency & Level 9kHz to 490kHz	nil emissions	-20dB below limit
Frequency & Level 490kHz to 1705kHz	nil emissions	-20dB below limit
Frequency & Level 1705kHz to 30MHz	13.5612MHz other emissions	+21.9dB _μ V/m @ 30m -20dB below limit
Limits	9kHz to 490kHz	20Log ₁₀ [2400/F(kHz)]dB _μ V/m @ 300m
	490kHz to 1705kHz	20Log ₁₀ [24000/F(kHz)]dB _μ V/m @ 30m
	1705kHz to 30MHz	+29.5dB _μ V/m @ 30m
Measurement Uncertainty	4.2dB	

Notes:-

- Results quoted are extrapolated as indicated.
- Emissions were searched from 9kHz to 30MHz inclusive, as per Part 15.109e.
- Extrapolation factor @ 40dB/decade from 300m to 30m, as per Part 15.31f.
- Extrapolation factor @ graph values from 30m to 3m, as per Annex D.
- Measurements <490kHz @ 3m, as per Part 15.31f (2).
- Measurements <1705kHz @ 3m, as per Part 15.31f (2).
- Measurements <30MHz @ 3m, as per Part 15.31f (2).
- Receiver detector <30MHz = CISPR, Quasi-Peak, 10kHz Bandwidth.
- Nil emissions sensitivity of +36dB V/m @ 3m.
- Sample calculation, see page 6.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- Measuring distances as Notes 1 to 7 (inc) above.
- EUT 0.8 metre above ground plane.
- Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL08, TRL07, TRL237, TRL12.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS - POWERLINE - PART 15.207

Ambient temperature = +19 C
 Relative humidity = 43%
 Conditions = Indoors
 Supply voltage = Vnom
 Channel number = 1

Frequency & Level 450kHz to 30MHz		13.5612MHz 27.1224MHz other emissions	+41.5dB μ V +34.1dB μ V -20dB below limit
Limit	450kHz to 30MHz	+48.0 dB μ V	
Measurement Uncertainty		4.0dB	

Notes:-

1. Receiver detector = CISPR, Quasi-Peak, 10kHz bandwidth.
1. Sample calculation, see page 6.
1. PSU used for test = Lascar PSU 20112".

Test Method:-

1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
1. EUT located 0.4m from wall of shielded room, 0.8m from LISN. & above the ground plane.
1. EUT emissions evaluated for live and neutral lines at power terminals of the ac mains supply
1. EUT emissions evaluated with an ac mains supply frequency of 50Hz.
1. EUT emissions evaluated with an ac mains supply voltage of 110V.
1. Worst case results recorded and reported.

Test Equipment Used:-

1. Full description at Annex B.
1. TRL190, TRL191, TRL289, TRL237, TRL12, TRL89.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 15.209.c - <30MHz

Ambient temperature	=	+21 C	3m measurements <30MHz	[]
Relative humidity	=	48%	300m extrapolated from 3m	[X]
Conditions	=	Open Area Test Site (OATS)	30m extrapolated from 3m	[X]
Supply voltage	=	Vnom		
Channel number	=			

Frequency & Level 9kHz to 490kHz		Nil emissions	-20dB below limit
Frequency & Level 490kHz to 1705kHz		Nil emissions	-20dB below limit
Frequency & Level 1705kHz to 30MHz		Nil emissions	-20dB below limit
Limits	9kHz to 490kHz	$20\text{Log}_{10}[2400/F(\text{kHz})]\text{dB}_{\mu\text{V/m}} @ 300\text{m}$	
	490kHz to 1705kHz	$20\text{Log}_{10}[24000/F(\text{kHz})]\text{dB}_{\mu\text{V/m}} @ 30\text{m}$	
	1705kHz to 30MHz	+29.5dB $_{\mu\text{V/m}} @ 30\text{m}$	
Measurement Uncertainty		4.2dB	

Notes:-

- Results quoted are extrapolated as indicated.
- Emissions were searched to:- (x) 1000MHz inclusive, as per Part 15.33a.
- Extrapolation factor @ 40dB/decade from 300m to 30m, as per Part 15.31f.
- Extrapolation factor @ graph values from 30m to 3m, as per Annex D.
- Measurements <490kHz @ 3m, as per Part 15.31f (2).
- Measurements <1705kHz @ 3m, as per Part 15.31f (2).
- Measurements <30MHz @ 3m, as per Part 15.31f (2).
- Receiver detector <30MHz = CISPR, Quasi-Peak, 10kHz bandwidth.
- Nil emissions sensitivity of +36dB V/m @ 3m.
- Sample calculation, see page 6.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- Measuring distances as Notes 1 to 7 (inc) above.
- EUT 0.8 metre above ground plane.
- Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL08, TRL07, TRL237, TRL12.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 15.209.c - >30MHz

Ambient temperature	=	+16 C (<1GHz), n/a (>1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	72% (<1GHz), n/a (>1GHz)	1m measurements >1GHz	[]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[]
Supply voltage	=	Vnom		
Channel number	=	1		

Frequency & Level 30MHz to 88MHz	40.680MHz 54.240MHz	+22.8dB μ V/m @ 3m +22.3dB μ V/m @ 3m
Frequency & Level 88MHz to 216MHz	94.920MHz 135.600MHz 203.400MHz	+30.2dB μ V/m @ 3m +29.3dB μ V/m @ 3m +23.7dB μ V/m @ 3m
Frequency & Level 216MHz to 960MHz	216.960MHz 244.080MHz 257.640MHz 325.440MHz	+28.7dB μ V/m @ 3m +32.6dB μ V/m @ 3m +27.0dB μ V/m @ 3m +27.5dB μ V/m @ 3m
Frequency & Level 960MHz to (x) MHz	nil emissions	-20dB below limit
Limits	30MHz to 88MHz	+40.0dB μ V/m @ 3m
	88MHz to 216MHz	+43.5dB μ V/m @ 3m
	216MHz to 960MHz	+46.0dB μ V/m @ 3m
	960MHz to (x) MHz	+54.0dB μ V/m @ 3m
Measurement Uncertainty	4.1dB	

Notes:-

1. Results quoted are extrapolated as indicated.
1. Emissions were searched to:- (x) 1000MHz inclusive, as per Part 15.33a.
1. Extrapolation factor @ 9.5dB from 1m to 3m, as per Part 15.31f.
1. Measurements >1GHz @ 1m, as per Part 15.31f (1).
1. Receiver detector <1GHz = CISPR, Quasi-Peak, 120kHz bandwidth.
1. Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth.
1. Sample calculation, see page 6.

Test Method:-

1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
1. Measuring distances as Notes 1 to 4 above.
1. EUT 0.8 metre above ground plane.
1. Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

1. Full description at Annex B.
1. TRL190, TRL191, TRL08, TRL317, TRL274, TRL12.

TRANSMITTER TESTS

TRANSMITTER CARRIER EMISSION - RADIATED - PART 15.225.a

Ambient temperature	=	+21 C	3m measurements @ fc	[X]
Relative humidity	=	48%	10m measurements @ fc	[]
Conditions	=	Open Area Test Site (OATS)	30m measurements @ fc	[]
Supply voltage	=	Vnom	30m extrapolated from 3m	[]
Channel number	=	1	30m extrapolated from 10m	[]

Frequency & Level	13.5612MHz	+22.1dB μ V/m @ 30m
Limit	13.553MHz to 13.567MHz	+80.0dB μ V/m @ 30m
Measurement Uncertainty	4.2dB	

Notes:-

1. Results quoted are extrapolated as indicated.
1. Extrapolation factor @ 9.5dB from 10m to 30m, as per Part 15.31f.
1. Extrapolation factor @ graph values from 3m to 10m, or 30m, as per Annex D.
1. Receiver detector @ fc = CISPR, Quasi-Peak, 10kHz bandwidth.
1. Sample calculation, see page 6.

Test Method:-

1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
1. Measuring distances as Notes 1 to 7 (inc) above.
1. EUT 0.8 metre above ground plane.
1. Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations, with worst case results recorded.

Test Equipment Used:-

1. Full description at Annex B.
1. TRL190, TRL191, TRL08, TRL07, TRL237, TRL12.

TRANSMITTER TESTS

TRANSMITTER CARRIER FREQUENCY - RADIATED - PART 15.225.c

Ambient temperature = +20 C
 Relative humidity = 65%
 Conditions = Indoors
 Supply voltage = Vnom
 Channel number = 1
 Period after startup = 0mins

Tnom +20 C	Vmin (-15%)	13.561203MHz	0.00002%	+3Hz
	Vnom (00%)	13.561223MHz	0.00016%	+23Hz
	Vmax (+15%)	13.561195MHz	0.00004%	-5Hz
Tmin	Vnom (00%)	13.561255MHz	0.00040%	+55Hz
Tmax	Vnom (00%)	13.561190MHz	0.00008%	-10Hz
Limit		13.561200MHz 0.01% = 1356Hz(nom)		
Measurement Uncertainty		2.7 x 10 ⁻⁷ Hz [X] ; 0.0002% 200Hz []		

Notes:-

- Equipment carrier frequency graph(s) @ Annex E [n/a], emission peak level @ < spurious limit.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- EUT operated and tested with a new battery [n/a].
- EUT operated and tested @ 0, 2, 5 & 10mins after startup.
- RF Spectrum Analyser set to:-
 - Res BW = 100Hz @ fc.
 - Video BW = as per Res BW.
 - Detector = Peak Hold.
 - Freq. Span = as appropriate.
 - Res/Span = as appropriate.
 - Scan Rate = Auto.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL11, TRL05, TRL164, TRL12.

Conclusion:-

- Total maximum to minimum variation = 163Hz = 0.0012019%.

TRANSMITTER TESTS

TRANSMITTER CARRIER FREQUENCY - RADIATED - PART 15.225.c

Ambient temperature = +20 C
 Relative humidity = 65%
 Conditions = Indoors
 Supply voltage = Vnom
 Channel number = 1
 Period after startup = **2mins**

Tnom +20 C	Vmin (-15%)	13.561202MHz	0.00001%	+2Hz
	Vnom (00%)	13.561216MHz	0.00011%	+16Hz
	Vmax (+15%)	13.561190MHz	0.00008%	-10Hz
Tmin	Vnom (00%)	13.561267MHz	0.00049%	+67Hz
Tmax	Vnom (00%)	13.561176MHz	0.00018%	-24Hz
Limit		13.561200MHz 0.01% = 1356Hz(nom)		
Measurement Uncertainty		2.7 x 10 ⁻⁷ Hz [X] ; 0.0002% 200Hz []		

Notes:-

- Equipment carrier frequency graph(s) @ Annex E [n/a], emission peak level @ < spurious limit.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- EUT operated and tested with a new battery [n/a].
- EUT operated and tested @ 0, 2, 5 & 10mins after startup.
- RF Spectrum Analyser set to:-
 - Res BW = 100Hz @ fc.
 - Video BW = as per Res BW.
 - Detector = Peak Hold.
 - Freq. Span = as appropriate.
 - Res/Span = as appropriate.
 - Scan Rate = Auto.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL11, TRL05, TRL164, TRL12

Conclusion:-

- Total maximum to minimum variation = 163Hz = 0.0012019%.

TRANSMITTER TESTS

TRANSMITTER CARRIER FREQUENCY - RADIATED - PART 15.225.c

Ambient temperature = +20 C
 Relative humidity = 65%
 Conditions = Indoors
 Supply voltage = Vnom
 Channel number = 1
 Period after startup = 5mins

Tnom +20 C	Vmin (-15%)	13.561198MHz	0.00002%	-2Hz
	Vnom (00%)	13.561209MHz	0.00006%	+9Hz
	Vmax (+15%)	13.561194MHz	0.00005%	-6Hz
Tmin	Vnom (00%)	13.561273MHz	0.00053%	+73Hz
Tmax	Vnom (00%)	13.561152MHz	0.00036%	-48Hz
Limit		13.561200MHz 0.01% = 1356Hz(nom)		
Measurement Uncertainty		2.7 x 10 ⁻⁷ Hz [X] ; 0.0002% 200Hz []		

Notes:-

- Equipment carrier frequency graph(s) @ Annex E [n/a], emission peak level @ < spurious limit.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- EUT operated and tested with a new battery [n/a].
- EUT operated and tested @ 0, 2, 5 & 10mins after startup.
- RF Spectrum Analyser set to:-
 - Res BW = 100Hz @ fc.
 - Video BW = as per Res BW.
 - Detector = Peak Hold.
 - Freq. Span = as appropriate.
 - Res/Span = as appropriate.
 - Scan Rate = Auto.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL11, TRL05, TRL164, TRL12.

Conclusion:-

- Total maximum to minimum variation = 163Hz = 0.0012019%.

TRANSMITTER TESTS

TRANSMITTER CARRIER FREQUENCY - RADIATED - PART 15.225.c

Ambient temperature = +20 C
 Relative humidity = 65%
 Conditions = Indoors
 Supply voltage = Vnom
 Channel number = 1
 Period after startup = **10mins**

Tnom +20 C	Vmin (-15%)	13.561192MHz	0.00006%	-8Hz
	Vnom (00%)	13.561203MHz	0.00002%	+3Hz
	Vmax (+15%)	13.561188MHz	0.00009%	-12Hz
Tmin	Vnom (00%)	13.561286MHz	0.00063%	+86Hz
Tmax	Vnom (00%)	13.561123MHz	0.00057%	-77Hz
Limit		13.561200MHz 0.01% = 1356Hz(nom)		
Measurement Uncertainty		2.7 x 10 ⁻⁷ Hz [X] ; 0.0002% 200Hz []		

Notes:-

- Equipment carrier frequency graph(s) @ Annex E [n/a], emission peak level @ < spurious limit.

Test Method:-

- As per Radio - Noise Emissions, ANSI C63.4: 1992.
- EUT operated and tested with a new battery [n/a].
- EUT operated and tested @ 0, 2, 5 & 10mins after startup.
- RF Spectrum Analyser set to:-
 - Res BW = 100Hz @ fc.
 - Video BW = as per Res BW.
 - Detector = Peak Hold.
 - Freq. Span = as appropriate.
 - Res/Span = as appropriate.
 - Scan Rate = Auto.

Test Equipment Used:-

- Full description at Annex B.
- TRL190, TRL191, TRL11, TRL05, TRL164, TRL12.

Conclusion:-

- Total maximum to minimum variation = 163Hz = 0.0012019%.

ANNEX A

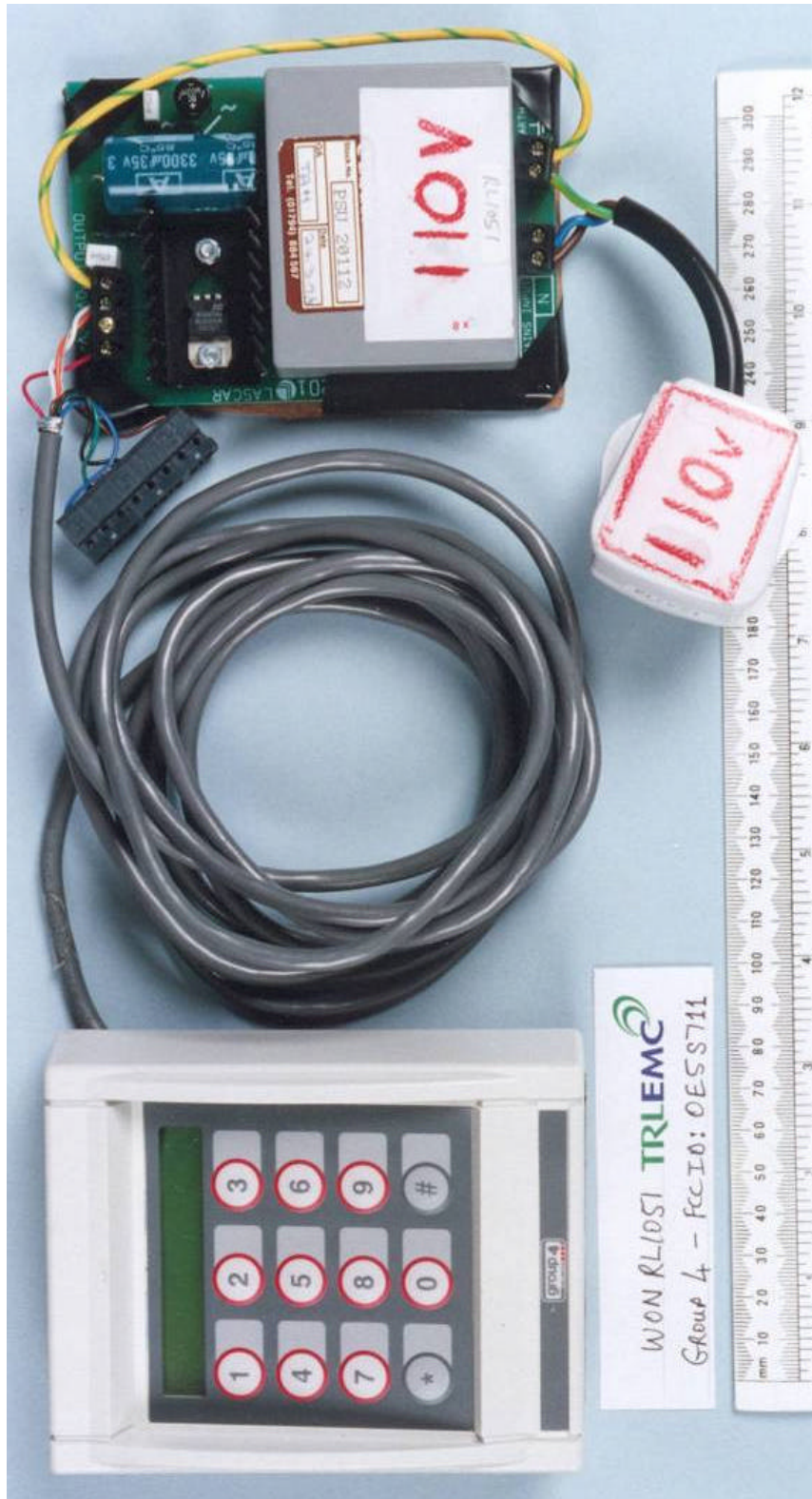
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A-1
Title: Test site with Tx, conducted & radiated.

ANNEX A

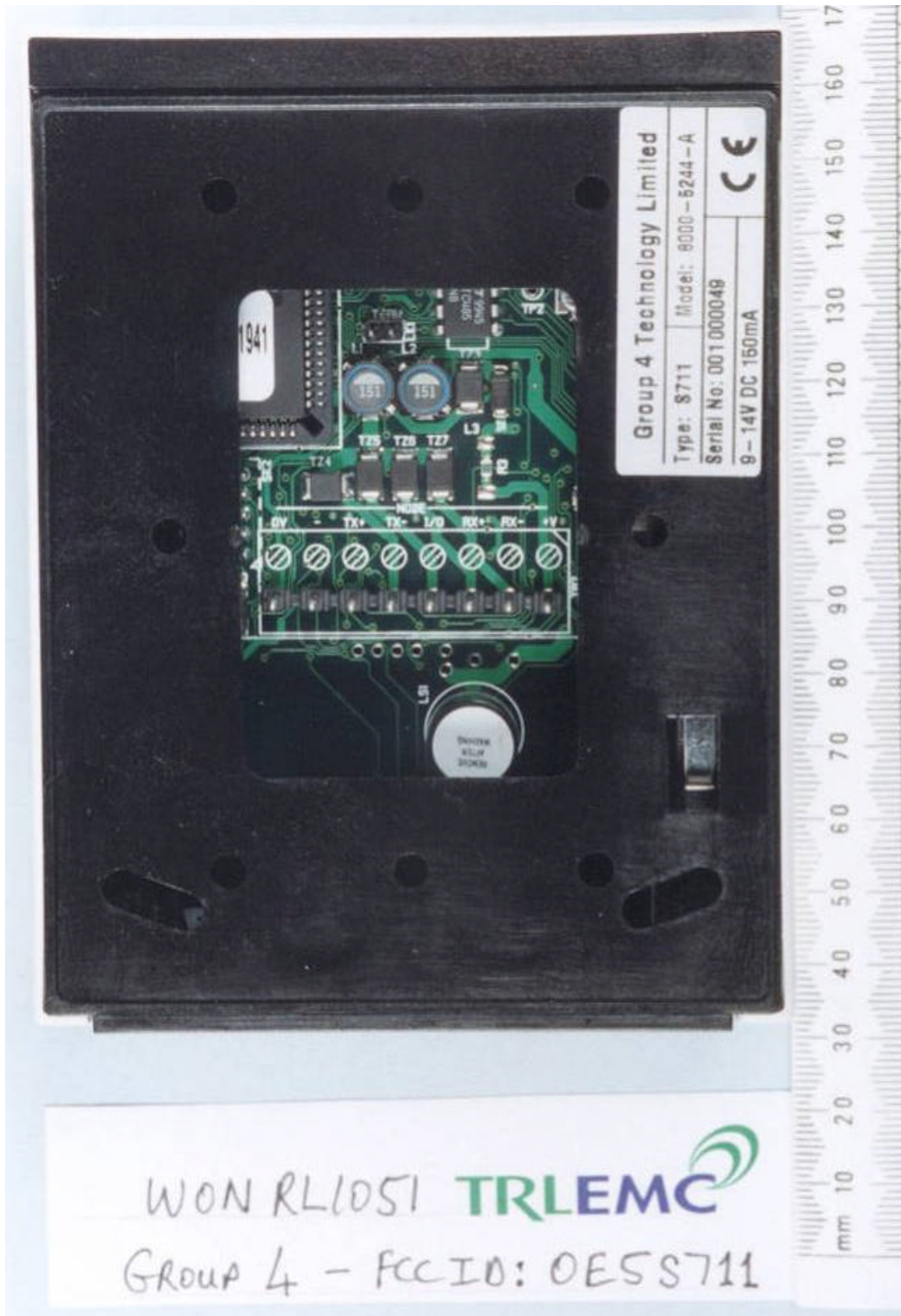
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A2
Title:Tx, front.

ANNEX A

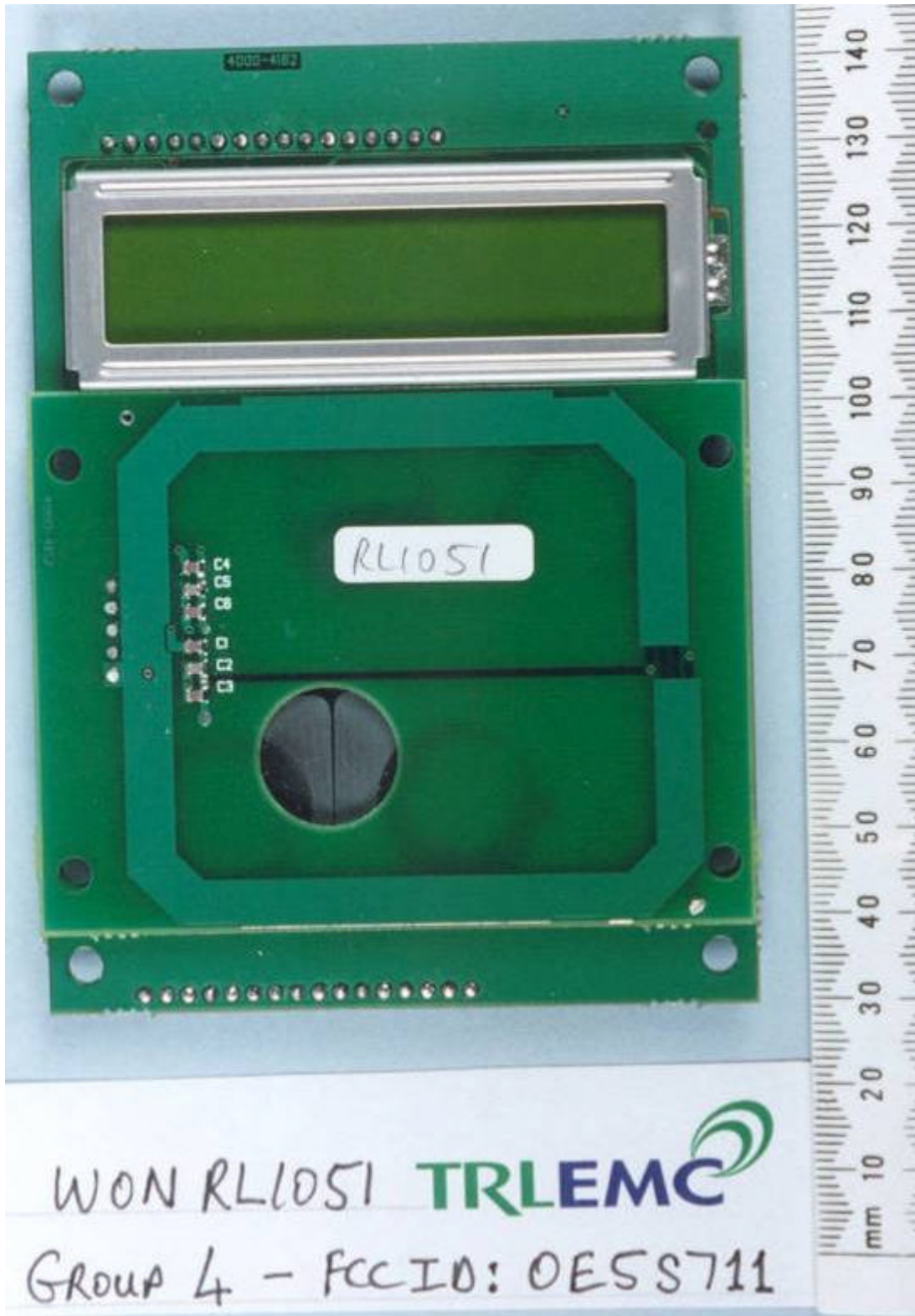
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A3
Title: Tx, rear.

ANNEX A

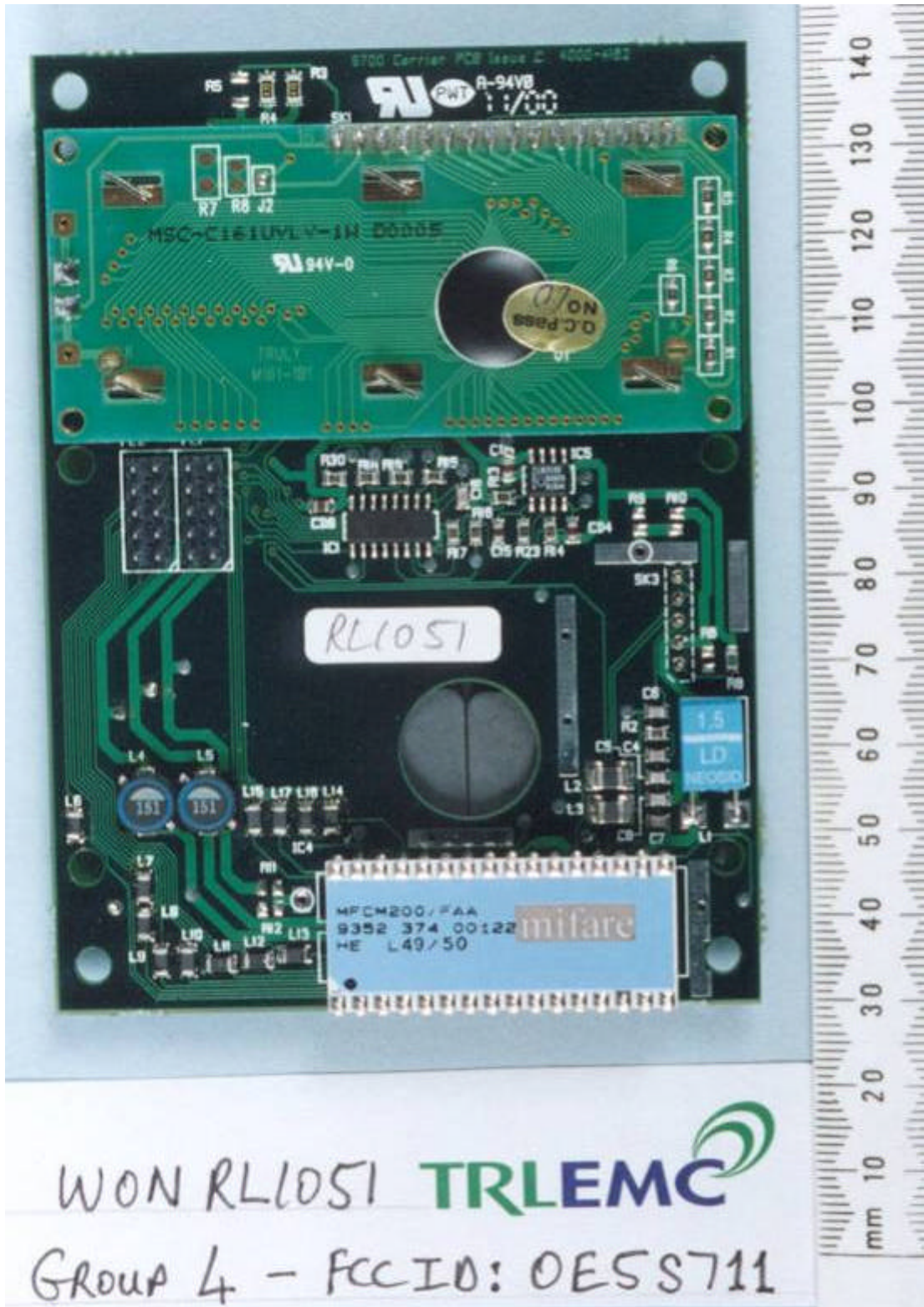
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A4
Title: Tx, rf & display pcb, top.

ANNEX A

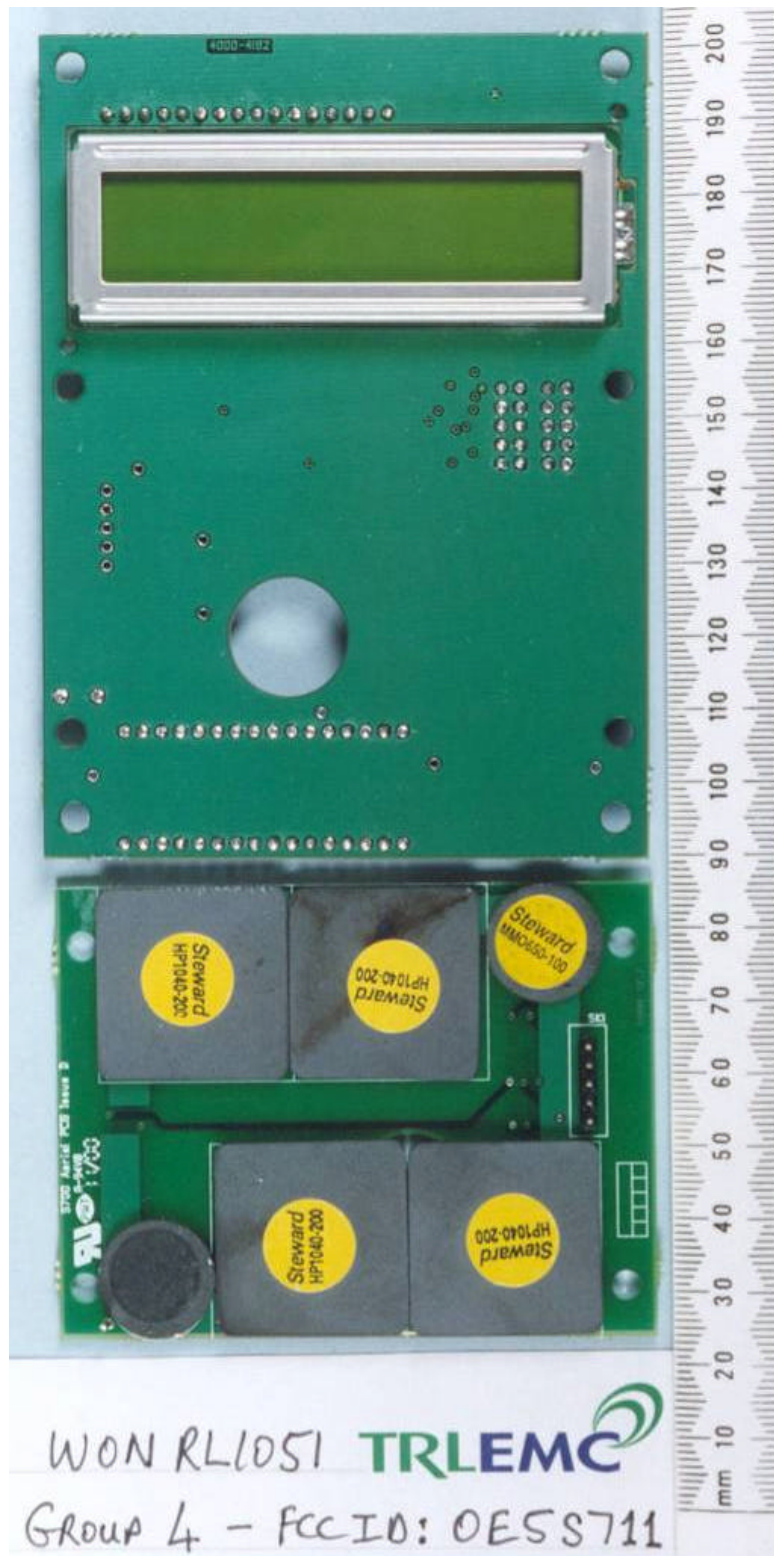
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A5
Title: Tx, rf & display pcb, bottom.

ANNEX A

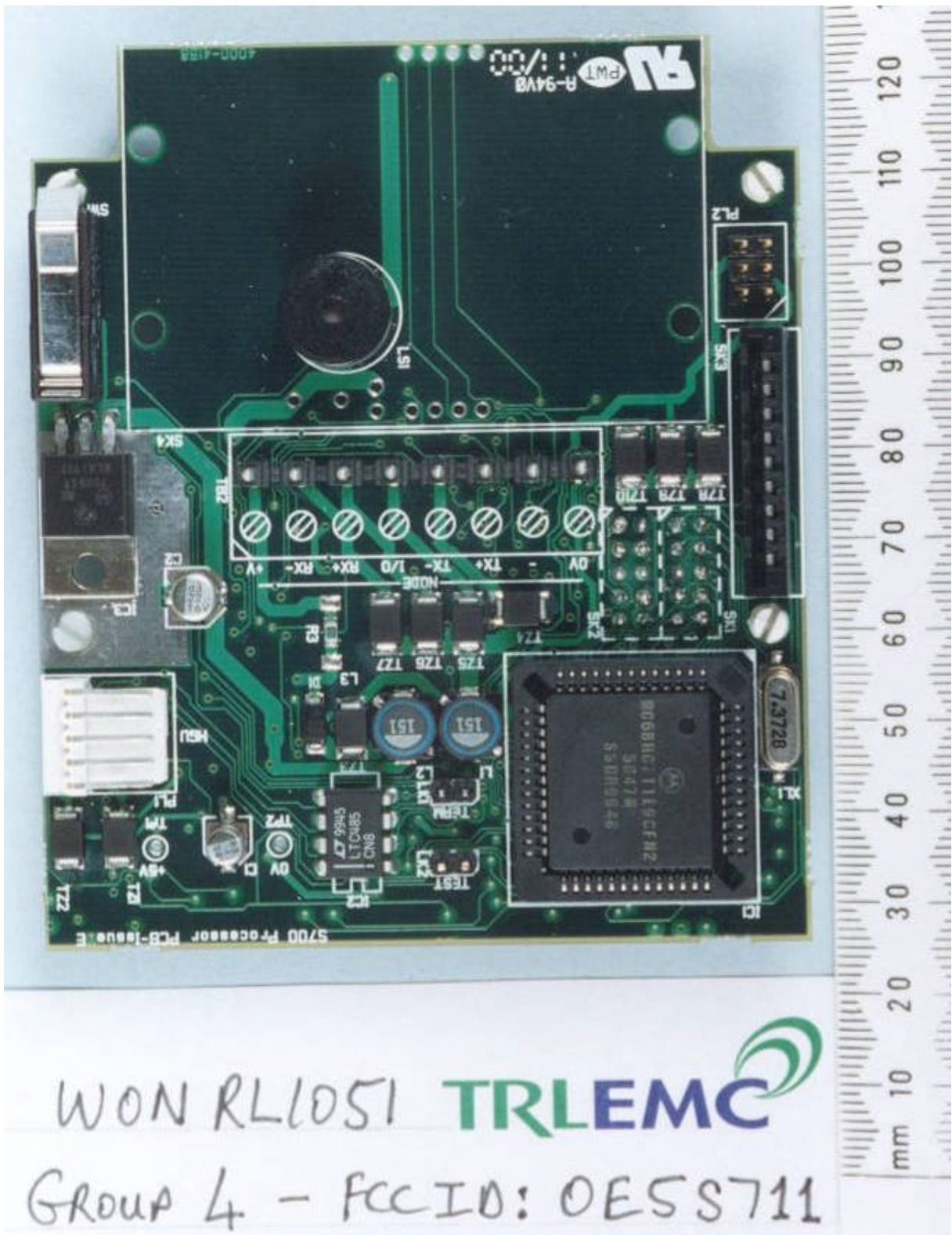
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A6
Title: Tx, rf & display pcb, w/o Ae.

ANNEX A

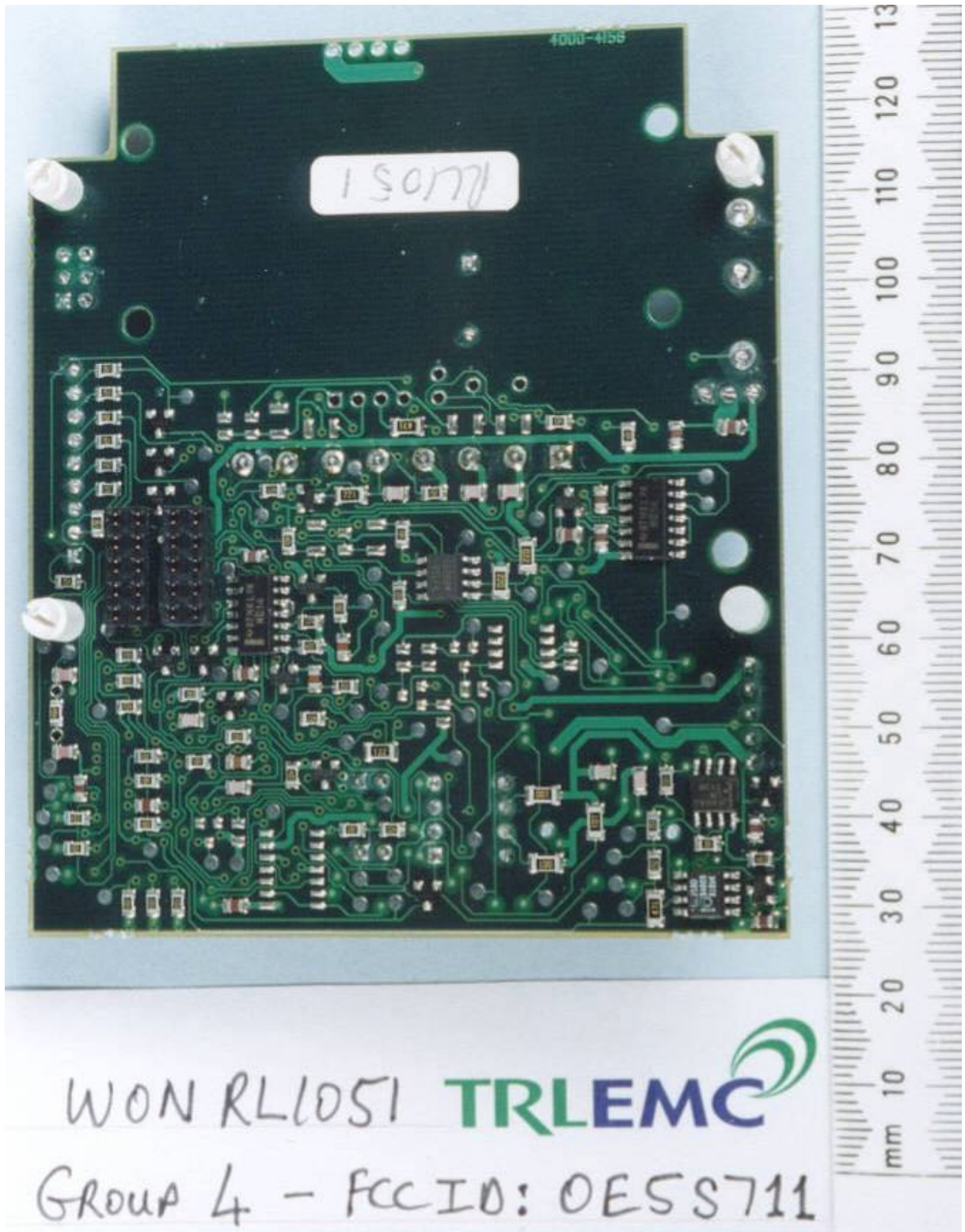
PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A7
Title: Control pcb, top.

ANNEX A

PHOTOGRAPHS OF THE EQUIPMENT:
(taken on completion of all tests)



Photograph A8
Title: Control pcb, bottom.

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESH2	879014 / 028	TRL 06
RF PULSE LIMITER	ROHDE&SCHWARZ	ESH3Z2	M494	TRL 06A
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE&SCHWARZ	HFH2	881058 - 53	TRL 07
RANGE 1 (3 - 30m)	TRL	N/A	N/A	TRL 08
VARIAC, 230V, 10A	ZENITH	100R	V265537	TRL 12
dc PSU, VARIABLE, 30v, 10A, 300W	TOPWARD ELECTRONIC	23010	899672	TRL 15
RF SIGNAL GEN, 10kHz - 1000MHz	MARCONI	2022	119022 / 205	TRL 17
LISN, ac MAINS	CHASE	MN2050	1431	TRL 25
HF RECEIVER, 150kHz - 30MHz	CHASE	HFR2000	2158	TRL 26
LF RECEIVER, 9kHz - 150kHz	CHASE	LFR1000	1020	TRL 27
HF RECEIVER, 150kHz - 30MHz	CHASE	HFR2000	2187	TRL 28
AE, DIPOLE, 20MHz - 300MHz	CHASE	VHA9103	7106	TRL 35
AE, DIPOLE, 20MHz - 300MHz	CHASE	VHA9103	7011	TRL 36
AE, DIPOLE, 300MHz - 1GHz	CHASE	VHA9105	7107	TRL 37
AE, DIPOLE, 300MHz - 1GHz	CHASE	VHA9105	N/A	TRL 38
ATU, RECEIVER, 9kHz - 30MHz	SCHWARZBECK	FMZL1514	1514338	TRL 42
COAX LOAD, 2W, N, 50 , dc - 4GHz	BIRD	8360NM	N/A	TRL 113
COAX LOAD, 2W, N, 50 , dc - 4GHz	BIRD	8360NM	N/A	TRL 114
COAX LOAD, 2W, BNC, 50 , dc - 4GHz	BIRD	8360B	N/A	TRL 115
COAX LOAD, 2W, BNC, 50 , dc - 4GHz	BIRD	8360B	N/A	TRL 116
COAX LOAD, 1W, BNC, 50 , dc - 1GHz (min)	SUHNER	65BNC - 50 - 0 - 1	N/A	TRL 117
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3580	TRL 138

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
AE, DRG HORN, 1GHz - 18GHz	EMCO	3115	9010 - 3581	TRL 139
RF ANALYSER, 10kHz - 60GHz	TEKTRONIX	2756P	B010109	TRL 164
MULTIMETER (mc) 20k / V (sens)	AVO	MODEL 8, MK.V.	0545248	TRL 169
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119388 / 080	TRL 176
RANGE 2 (3 - 10m)	TRL	N/A	N/A	TRL 182
VARIAC, 230V, 10A	VARATLAN	Z710R	N/A	TRL 186
ANTENNA MAST	CHASE	HM9104	N/A	TRL 189
MULTIMETER (dig)	ISOTECH	IDM91	00606606	TRL 190
THERMOMETER & HYGROMETER	RS	212 - 146	N/A	TRL 191
AE, BICONE, 20MHz - 300MHz	CHASE	BBA 9106	N/A	TRL 193
SCOPE, 20MHz, 2CH, DIG STORAGE	BECKMAN	9302	2090044	TRL 197
AE, LOG PERIODIC, 300MHz - 1GHz	CHASE	UPA6108	1061	TRL 203
ac PSU, VARIABLE, 300V, 5A, 1kVA, 45Hz - 440Hz	MAGNUS	MP500	1108	TRL 204
TRANSFORMER, ISOLATION, 240Vac	RS	209 - 099	N/A	TRL 205
TRANSFORMER, ISOLATION, 110Vac	RS	208 - 636	N/A	TRL 206
LISN, 3ph MAINS ac	SCHWARZBECK	NSKL8128	8128151	TRL 207
COAX LOAD, 5W, BNC, 50 , dc - 4GHz	BIRD	80BNCM	5866	TRL 223
dc PSU, VARIABLE, 15/30V, 2/1A, 30W	WIER	731	88829	TRL 224
VARIAC, 230V, 2A	REGULAC	RB3 - MT	N/A	TRL 225
VARIAC, 230V, 2A	REGULAC	RB3 - MT	N/A	TRL 226
THERMOMETER & HYGROMETER	RS	212 - 124	227	TRL 227
THERMOMETER & HYGROMETER	RS	212 - 124	228	TRL 228
THERMOMETER & HYGROMETER	RS	212 - 124	229	TRL 229

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
THERMOMETER & HYGROMETER	RS	212 - 124	230	TRL 230
THERMOMETER & HYGROMETER	RS	212 - 124	231	TRL 231
AE, LOG PERIODIC, 300MHz - 1GHz	EMCO	3146	N/A	TRL 233
dc PSU, VARIABLE, (2x) 32V, 3A, 100W	THURLBY THANDAR	PL330	046542	TRL 235
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS20	837960 / 003	TRL 237
LISN, ac MAINS	ROHDE&SCHWARZ	ESHS3 - Z5	839135 / 013	TRL 238
MULTIMETER, (dig)	ISOTECH	IDM97	32202147	TRL 239
THERMOMETER & BAROMETER	RS	216435	N/A	TRL 240
COAX CABLE, 50 , 18GHz, TNC, 1.25m	W L GORE	3390 / 265 / 1	8420202	TRL 249
COAX CABLE, 50 , 18GHz, TNC, 1.25m	W L GORE	3390 / 265 / 1	8420223	TRL 250
AE, BICONE, 20MHz - 300MHz	CHASE	VBA6106A	1193	TRL 251
AE, EASY 1, 30MHz - 1GHz	FARNELL	S30280	017	TRL 253
RF SIGNAL GEN, LOW NOISE -90dBc, 10kHz - 5.4GHz	MARCONI	2042	119562 / 021	TRL 254
SCOPE, 400MHz, 4CH, DIG STORAGE	TEKTRONIX	TDS460A	B020781	TRL 258
RF SIGNAL GEN, 10kHz - 1GHz	MARCONI	2022D	119224 - 023	TRL 264
MULTIMETER, (dig)	ISOTECH	IDM97 RMS	32202307	TRL 273
AE, BILOG, 20MHz - 2GHz	CHASE	CBL6112	2098	TRL 274
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 275
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 276
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 277
COAX ADAPTOR, 18GHz, TNC / N	ROSENBERGER	05S106 - K0053	N/A	TRL 278
COAX CABLE, 18GHz, N, 0.5M	ROSENBERGER	RTK161 - GP - Nm90 - 50cms	N/A	TRL 279
COAX CABLE, 18GHz, N, 3.0M	ROSENBERGER	RTK161 - GP - Nm90 - 300cms	N/A	TRL 280

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
COAX CABLE, 50 , 4GHz, N, 12m	TRL	WESTFLEX 103	N/A	TRL 286
COAX CABLE, 50 , 4GHz, N, 12m	TRL	WESTFLEX 103	N/A	TRL 287
LISN, ac MAINS	ROHDE&SCHWARZ	ESH3 - Z5	837469 / 010	TRL 289
AE, BILOG, 20MHz - 1GHz	CHASE	CBL6111B	1945	TRL 290
MULTIMETER (dig)	ISOTECH	IDM97 RMS	32202547	TRL 291
MULTIMETER (dig)	ISOTECH	IDM97 RMS	32202565	TRL 292
THERMOMETER & BAROMETER	RS	216435	N/A	TRL 293
COAX CABLE, 50 , 26.5GHz, SMA, 2m, c/w 3 ADAPTORS	GORE	145	MFR65474	TRL 308
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS10	837948 / 003	TRL 317
RF PULSE LIMITER	ROHDE&SCHWARZ	ESH3Z2	A400	TRL 318
RF SIGNAL GEN, 9kHz - 1.2GHz	MARCONI	2023	112224 / 036	TRL 320
AE, LOG PERIODIC, 300MHz - 1GHz	CHASE	UPA6108	1016	TRL 344
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS10	844594 / 0003	TRL 352
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS10	844077 / 019	TRL 353
COAX CABLE, 50 , 4GHz, N, 0.5m	TRL	NA	NA	TRL 358
COAX CABLE, 50 , 4GHz, N, 16m	TRL	NA	NA	TRL 359
COAX CABLE, 50 , 4GHz, N, 1m	TRL	NA	NA	TRL 360
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 363
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 364
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 365
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 366
V / UHF RECEIVER, 20MHz - 1GHz	ROHDE&SCHWARZ	ESVS20	838804 / 005	TRL 415
RF ANALYSER, 9kHz - 1GHz	WAYNE KERR	SSA1000A	9800001488	TRL 416

ANNEX B**TEST EQUIPMENT LIST**

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
LF / HF RECEIVER, 9kHz - 30MHz	ROHDE&SCHWARZ	ESHS10	830051 / 001	TRLUH 03
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE&SCHWARZ	HFH - Z2	892246 / 023	TRLUH 23
RF ANALYSER, dc - 26.5GHz	MARCONI	2380	152089 / 009	TRLUH 120
		2386	152076 / 044	

ANNEX D

30m to 3m Near Field Range Characteristics

