

TEST REPORT NO: EU1554/3256

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**REPORT ON THE
CERTIFICATION TESTING OF A
FSL ELECTRONICS LIMITED
ULTRATRACK
TRANSMITTER
WITH RESPECT TO
THE FCC 47CFR, Pt's 15.231 AND 15.209,
INTENTIONAL RADIATOR
SPECIFICATIONS**

TEST DATE(s): 13th & 14th JUNE 2001

TESTED BY: J CHARTERS

APPROVED BY: S P HAYES

ISSUE DATE:

Distribution Copy No's:-

- 1 FSL ELECTRONICS LIMITED
- 2 TRL EMC Ltd

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 Notes:-			
1. Component failure during test	YES NO		☐ ☒
2. If Yes, details of failure:-			
3. 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.			
4. 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): ULTRATRACK

EQUIPMENT TYPE: DIGGER CONTROL TRANSMITTER

SERIAL NUMBER OF EUT: Engineering sample

PURPOSE OF TEST: FCC CERTIFICATION

TEST SPECIFICATION(s): FCC 47CFR Pt's 15.231, 15.209

TEST RESULT: COMPLIANT YES ☒
NO ☐

APPLICANT'S CATEGORY: (a) MANUFACTURER ☒
(b) IMPORTER ☐
(c) DISTRIBUTOR ☐
(d) AGENT ☐

APPLICANT'S ORDER No(s): 15022

APPLICANT'S CONTACT PERSON: PAUL BRENNAN

APPLICANT: FSL ELECTRONICS LIMITED

ADDRESS: SANDHOLES ROAD
COOKSTOWN
Co. TYRONE
BT80 9AR

TEL: +44 (0) 28 867 66131

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MANUFACTURER: FSL ELECTRONICS LIMITED

ADDRESS: SANDHOLES ROAD
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BT80 9AR

TEL: +44 (0) 28 867 66131

FAX: +44 (0) 28 867 62414

EUT(s) COUNTRY OF ORIGIN: UNITED KINGDOM

TEST LABORATORY: TRL EMC LTD

UKAS ACCREDITATION No: 0728

TEST DATE(s): 13th & 14th JUNE 2001

TEST REPORT No: EU1554/3256

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: PNEUBTXR19

PURPOSE OF TEST: FCC Certification

TEST SPECIFICATION: FCC 47CFR, Parts 15.231, 15.209

TEST RESULT: Compliant to Specification

EQUIPMENT UNDER TEST: ULTRATRACK

EQUIPMENT SERIAL No: Engineering Sample

ITU EMISSION CODE: 160KF1DAN

EQUIPMENT TYPE: Remote Control Transmitter

UTILISATION: Telecommand for Outdoor Machinery

CARRIER EMISSION: 77.1dBV/m @ 3m

ANTENNA TYPE: Fixed, or Integral

ALTERNATIVE AE: None, as per Part 15.203

BAND OF OPERATION: 410.00MHz - 470.00MHz

CHANNEL SPACING: Not applicable

No. of CHANNELS: 1

FREQUENCY GENERATION: SAW Resonator ☒; Crystal ☐; Synthesizer ☐

MODULATION METHOD: Amplitude ☐; Digital ☒; Angle ☐

POWER SOURCE(s): 9Vdc battery

TEST DATE(s): 13th & 14th JUNE 2001

ORDER No(s): 15022

APPLICANT: FSL ELECTRONICS LIMITED
COOKSTOWN
Co. TYRONE
BT80 9AR

TESTED BY: J CHARTERS

APPROVED BY: S P HAYES
EMC MANAGER

EQUIPMENT TEST CONDITIONS

1.

EQUIPMENT SERIAL / MODEL IDENTITY	CHANNEL NUMBER	Tx NOMINAL FREQUENCY MHz	Rx NOMINAL FREQUENCY MHz	TESTS REQUIRED	REMARKS
ULTRATRACK	1	433.9	N/A	TX radiated	Pt15.209
				TX carrier	Pt15.249

2. Equipment category:	Single channel	☒
	Two channel	☐
	Multi-channel	☐

3. Supply voltages: $V_{nom} = 9V_{dc}$

Note:- Vnom voltages are as stated above unless otherwise shown on the test report page.

4. Temperatures: (Ambient) T_{nom} = [see test]

5. Transmitter maximum deviation or shift: kHz = n/a

6. Transmitter maximum bit or pulse rate & level: bps = 160K/bps
 Level = Internal

7. Channel spacing: kHz =

Narrowband []

Wholeband [☒]

TESTS REQUIRED

TRANSMITTER & RECEIVER TESTS

Transmitter Spurious Emissions - Powerline - Part 15.207	[]
Transmitter Spurious Emissions - Radiated - Part 15.209	[X]
Transmitter Carrier Emission - Radiated - Part 15.231	[X]
Transmitter Carrier Frequency - Radiated - Part 15.231	[X]

Notes:-

- | | |
|--|-------|
| 1. Equipment tested for (mains ac) 110V powerline emissions. | [n/a] |
| 2. Equipment tested as (fixed) integral antenna configuration. | [X] |
| 3. All tests were carried out with new batteries, as per Part 15.31.e. | [X] |
| 4. Equipment tested for radiated emissions as per Part 15.209. | [X] |
| 5. Equipment tested for radiated emissions as per Part 15.231 | [X] |
| 6. Equipment tested for unintentional radiator digital device Class B | [n/a] |

SAMPLE CALCULATIONS

Parts 15.209 & 15.231 - Radiated.

Frequency (MHz)	Rx (dBFV)	Ae AF & Cable loss (dB/m & dB)	Field Strength @ 3m (dBFV/m)
433.9	58.3	16.4 2.4	77.1 (7079FV/m)

Part 15.231 - Limit is calculated as follows:

FCC Part number	Fc (MHz)	$(125/3)*F_c(\text{MHz})-(21250/3)$ (FV/m)	Limit @ 3m (FV/m)
15.231	433.9	$41.667*433.9-7083.333$	10996 FV/m

TRANSMITTER TESTS

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

Ambient temperature	=	16EC (<1GHz), 22EC (>1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	54% (<1GHz), 54% (>1GHz)	1m measurements >1GHz	[]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[]
Supply voltage	=	9Vnom		
Channel number	=	1		

Frequency & Level 30MHz to 88MHz		nil emission	>-20 below limit
Frequency & Level 88MHz to 216MHz		nil emission	>-20dB below limit
Frequency & Level 216MHz to 960MHz		nil emission	>-20dB below limit
Frequency & Level 960MHz to 5000 MHz		1301.7 1735.6 2169.5	39.4dBuV 41.8dBuV 42.6dBuV
Limits	30MHz to 88MHz	+40.0dBV/m @ 3m	
	88MHz to 216MHz	+43.5dBV/m @ 3m	
	216MHz to 960MHz	+46.0dBV/m @ 3m	
	960MHz to 5000 MHz	+54.0dBV/m @ 3m	
Measurement Uncertainty		±4.1dB	

Notes:-

- Results quoted are extrapolated as indicated.
- Emissions were searched to:- 5000MHz inclusive, as per Part 15.33a.
- Extrapolation factor @ 9.5dB from 1m to 3m, as per Part 15.31f.
- 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 to 4 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, orientation of EUT in three orthogonal planes, with worst case results recorded.

Test Equipment Used:-

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

TRANSMITTER TESTS

TRANSMITTER CARRIER EMISSION - RADIATED - PART 15.231

Ambient temperature	=	16EC	3m measurements @ fc	[X]
Relative humidity	=	54%	10m measurements @ fc	[]
Conditions	=	Open Area Test Site (OATS)	30m measurements @ fc	[]
Supply voltage	=	+9Vnom	30m extrapolated from 3m	[]
Channel number	=	1	30m extrapolated from 10m	[]

Frequency & Level	433.9MHz	77.1dBFV/m (7079FV/m)
Limit @ fc	+80.8dBFV/m (10996FV/m) @ 3m	
Measurement Uncertainty	±4.2dB	

TRANSMITTER CARRIER CEASE TIME - PART 15.231

Transmission cease time	Measured	Limit
	0.5 second	5 seconds

Notes:-

1. Results quoted are extrapolated as indicated.
2. Extrapolation factor @ 9.5dB from 10m to 30m, as per Part 15.31f.
3. Extrapolation factor @ graph values from 3m to 10m, or 30m, as per Annex D.
4. Receiver detector @ fc = CISPR, Quasi-Peak, 120kHz bandwidth.
5. Sample calculation, see page 6.
6. The transmission stops with in 5seconds of releasing button and does not transmit again unit the original transmission has finished.

Test Method:-

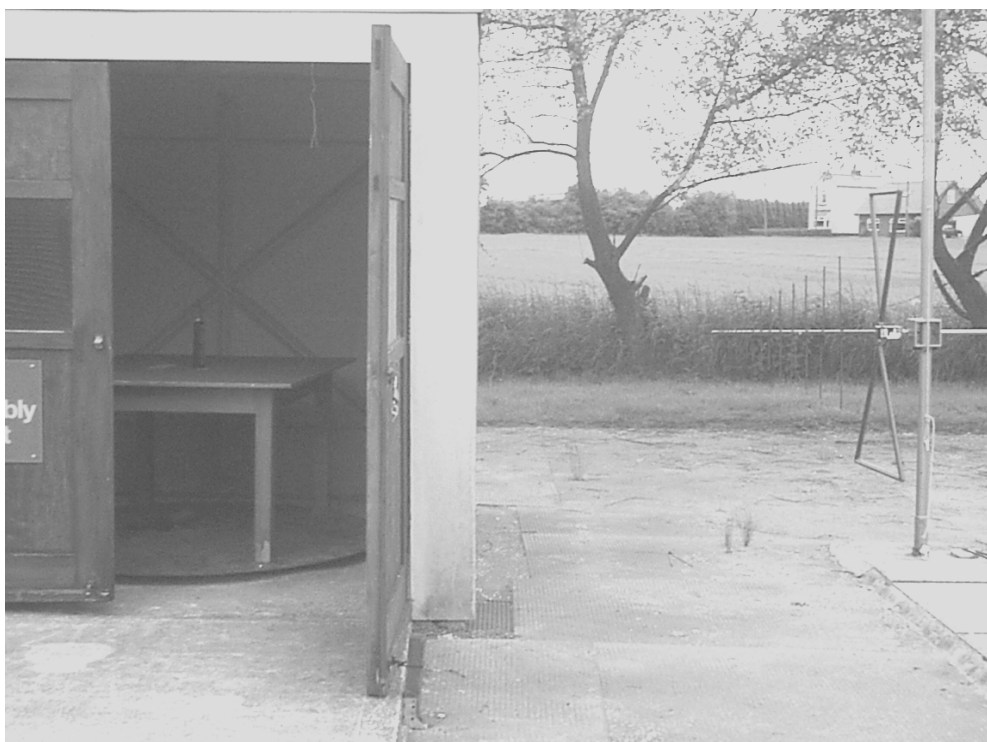
1. As per Radio - Noise Emissions, ANSI C63.4: 1992.
2. Measuring distances as Notes 1 to 7 (inc) above.
3. EUT 0.8 metre above ground plane.
4. Emissions maximised by rotation of EUT, on an automatic turntable, raising and lowering the receiver antenna between 1m & 4m in horizontal and vertical polarisations,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

Test Equipment Used:-

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

ANNEX A

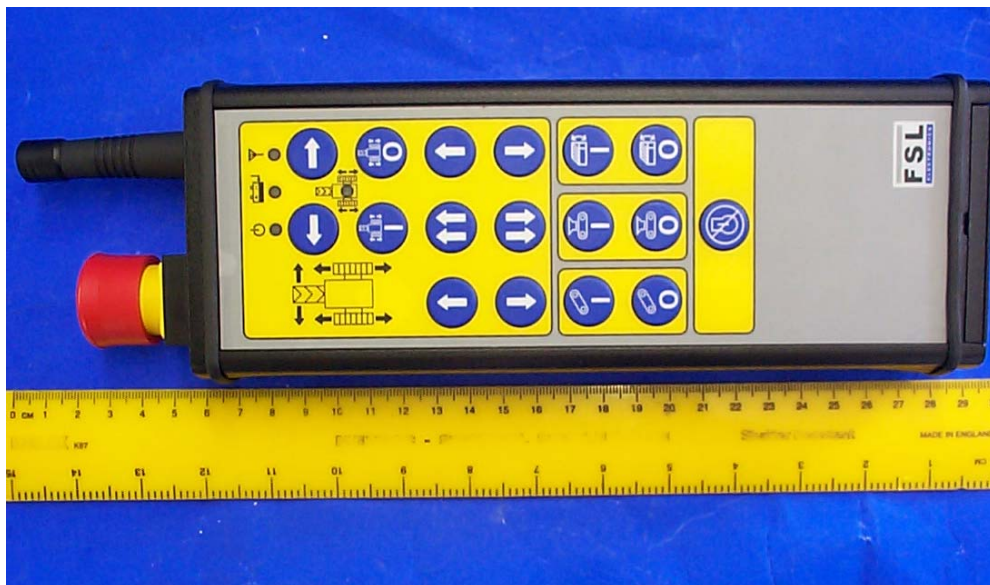
PHOTOGRAPHS OF THE EQUIPMENT: (taken on completion of all tests)



Photograph A-1
Title: Test site with Tx.

ANNEX A

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



Photograph A2
Title:Tx, front.

ANNEX A

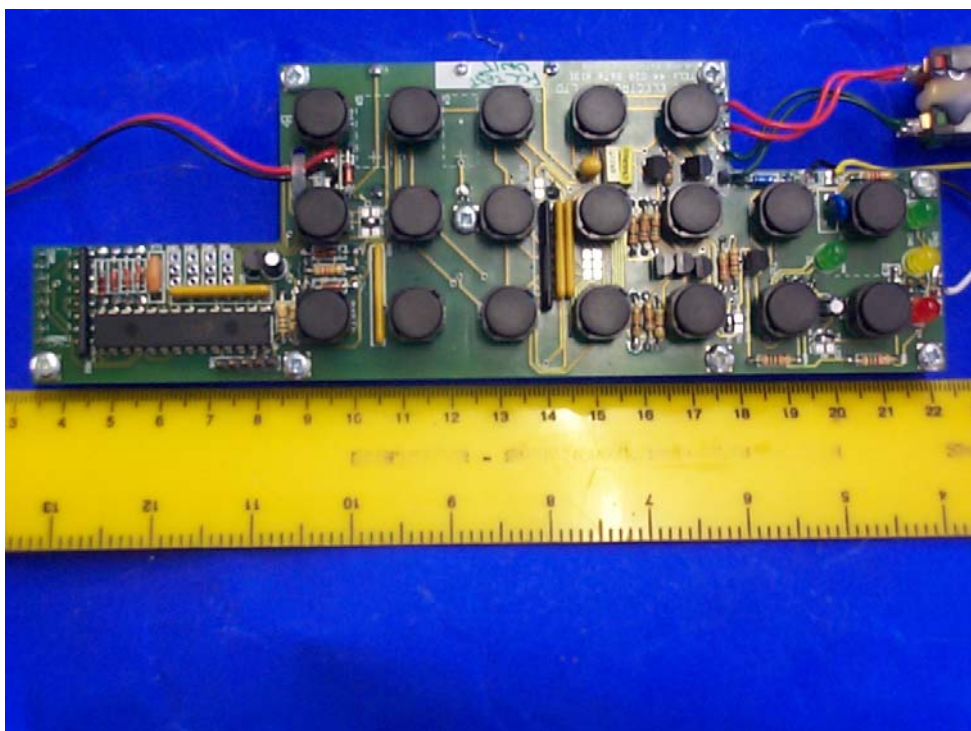
PHOTOGRAPHS OF THE EQUIPMENT: (taken on completion of all tests)



Photograph A3
Title: Tx, rear.

ANNEX A

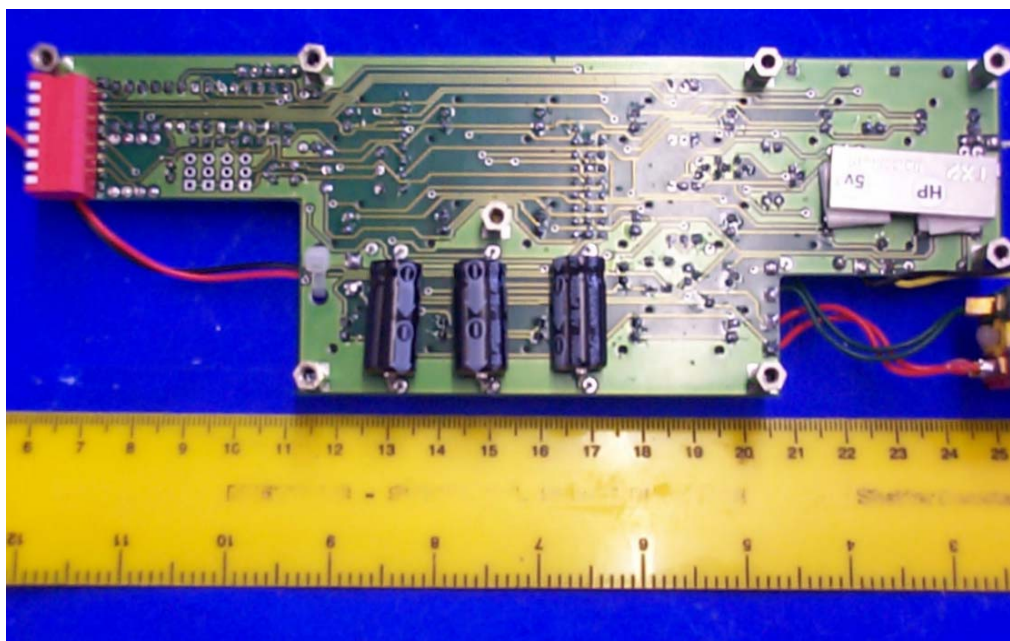
PHOTOGRAPHS OF THE EQUIPMENT: (taken on completion of all tests)



Photograph A4
Title: Tx, rf pcb, top.

ANNEX A

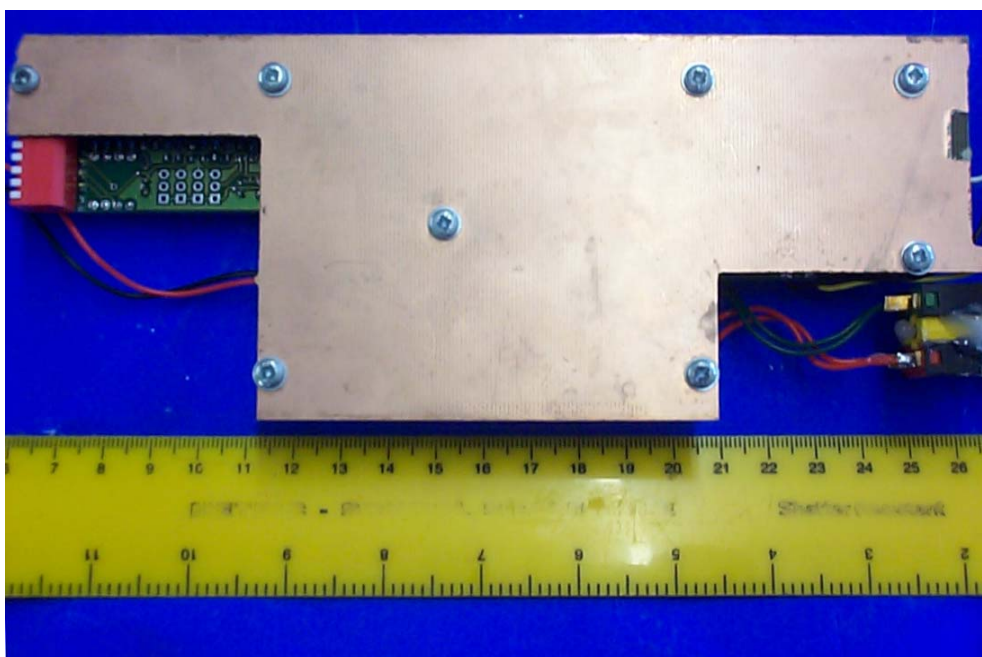
PHOTOGRAPHS OF THE EQUIPMENT: (taken on completion of all tests)



Photograph A5
Title: Tx, rf pcb, bottom.

ANNEX A

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



Photograph A6
Title: Tx pcb, with cover

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, 50Ω, dc - 4GHz	BIRD	8360NM	N/A	TRL 113
COAX LOAD, 2W, N, 50Ω, dc - 4GHz	BIRD	8360NM	N/A	TRL 114
COAX LOAD, 2W, BNC, 50Ω, dc - 4GHz	BIRD	8360B	N/A	TRL 115
COAX LOAD, 2W, BNC, 50Ω, dc - 4GHz	BIRD	8360B	N/A	TRL 116
COAX LOAD, 1W, BNC, 50Ω, 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 Ω / 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 Ω , 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
THERMOMETER & HYGROMETER	RS	212 - 124	230	TRL 230

ANNEX B

TEST EQUIPMENT LIST

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
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, 50Ω, 18GHz, TNC, 1.25m	W L GORE	3390 / 265 / 1	8420202	TRL 249
COAX CABLE, 50Ω, 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
COAX CABLE, 50Ω, 4GHz, N, 12m	TRL	WESTFLEX 103	N/A	TRL 286

INSTRUMENT	SUPPLIER	TYPE No	SERIAL No	TRL EMC No
COAX CABLE, 50Ω, 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, 50Ω, 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, 50Ω, 4GHz, N, 0.5m	TRL	NA	NA	TRL 358
COAX CABLE, 50Ω, 4GHz, N, 16m	TRL	NA	NA	TRL 359
COAX CABLE, 50Ω, 4GHz, N, 1m	TRL	NA	NA	TRL 360
THERMOMETER & HYGROMETER	RS	204 - 072	NA	TRL 363
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
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 F

OCCUPIED BANDWIDTH

