



TEST REPORT NO: RU1112/5860
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**REPORT ON THE CERTIFICATION TESTING OF A
SOLARTRON MOBREY
MRL800 RADAR LEVEL TRANSMITTER
WITH RESPECT TO
THE FCC RULES CFR 47, PART 15.209
INTENTIONAL RADIATOR SPECIFICATION**

TEST DATE: 28th July 2004 – 29th October 2004

TESTED BY: J CHARTERS

APPROVED BY: P GREEN
EMC PRODUCT
MANAGER

DATE:

Distribution:

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Notes:		
1. Component failure during test	YES NO	[] [X]
2. If Yes, details of failure:		
3. The facilities used for the testing of the product contain in this report are FCC Listed.		
4. The contents of the attached applicants 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.		



CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY: RXJ-MRL800

PURPOSE OF TEST: Certification

TEST SPECIFICATION: FCC RULES CFR 47, Part 15.209

TEST RESULT: Compliant to Specification

EQUIPMENT UNDER TEST: MRL800 RADAR LEVEL TRANSMITTER

EQUIPMENT SERIAL No: Dev04W25-001, Dev04W25-002, Dev04W25-003

ITU EMISSION CODE: 863MF3N

EQUIPMENT TYPE: RADAR DEPTH GAUGE

PRODUCT USE: LEVEL MEASUREMENT

MODULATION TYPE: FMCW

ANTENNA TYPE: Integral 4 Inch Horn, 6 Inch Horn, and Rod Antenna

ALTERNATIVE ANTENNA: Not Applicable

FREQUENCY OF OPERATION: 5500 MHz – 6450 MHz

CHANNEL SPACING: Not Applicable, wideband

NUMBER OF CHANNELS: 1

FREQUENCY GENERATION: SAW Resonator ☐ Crystal ☐ Synthesiser ☒

MODULATION METHOD: Amplitude ☐ Digital ☐ Angle ☒

POWER SOURCE(s): +24Vdc

TEST DATE(s): 25th October 2004 – 29th October 2004

ORDER No(s): MPO44671

APPLICANT: Solarton Mobrey

ADDRESS: 158 Edinburgh Avenue
Slough
Berkshire
SL1 4UE

TESTED BY: _____ J CHARTERS

APPROVED BY: _____ P GREEN
EMC PRODUCT
MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	MRL800 RADAR LEVEL TRANSMITTER
EQUIPMENT TYPE:	Radar Depth Level Gauge
SERIAL NUMBER OF EUT:	Dev04W25-001, Dev04W25-002, Dev04W25-003
PURPOSE OF TEST:	Certification
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 15.209
TEST RESULT:	COMPLIANT Yes ☒ No ☐
APPLICANT'S CATEGORY:	MANUFACTURER ☒ IMPORTER ☐ DISTRIBUTOR ☐ TEST HOUSE ☐ AGENT ☐
APPLICANT'S ORDER No(s):	MPO44671
APPLICANT'S CONTACT PERSON(s):	Mr D Kent
E-mail address:	davidkent@solartron.com
APPLICANT:	Solarton Mobrey
ADDRESS:	158 Edinburgh Avenue Slough Berkshire SL1 4UE
TEL:	+44 (0)1753 756 600
FAX:	+44 (0)1753 787 108
MANUFACTURER:	Solarton Mobrey
EUT(s) COUNTRY OF ORIGIN:	United Kingdom
TEST LABORATORY:	TRL EMC
UKAS ACCREDITATION No:	0728
TEST DATE(s)	28 th July 2004 – 29 th October 2004
TEST REPORT No:	RU1112/5860

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.	TEST/EXAMINATION	RULE PART	DETECTOR	APPLICABILITY
	Intentional Emission Frequency:	15.209	Average	YES
	Intentional Emission Field Strength:	15.209	Average	YES
	Intentional Emission Band Occupancy:	15.215(a)	Peak	YES
	Intentional Emission ERP (mW):	-	-	NO
	Spurious Emissions – Conducted:	15.207	Quasi Peak Average	YES
	Spurious Emissions – Radiated <1000MHz:	15.209	Quasi Peak	YES
	Spurious Emissions – Radiated >1000MHz:	15.209	Peak	YES
	Maximum Frequency of Search:	15.33	-	
	Antenna Arrangements Integral:	15.203	-	YES
	Antenna Arrangements External Connector:	15.204	-	NO
	Restricted Bands	15.205	-	YES
	Extrapolation Factor	15.31(f)	-	YES

- | | | |
|--|----------------------|--|
| 2. | Product Use: | LEVEL MEASUREMENT |
| 3. | Emission Designator: | 855MF3N |
| 4. | Duty Cycle: | 0.0027% |
| 5. | Temperatures: | Ambient (Tnom) 22°C |
| 6. | Supply Voltages: | Vnom +24Vdc |
| Note: Vnom voltages are as stated above unless otherwise shown on the test report page | | |
| 7. | Equipment Category: | Single channel [X]
Two channel []
Multi-channel [] |
| 8. | Channel spacing: | Narrowband []
Wideband [X] |

INTRODUCTION

The Solartron Mobrey MRL800 radar level transmitters operate using FMCW modulation. The frequency range swept by the FMCW signal is 5500MHz – 6450 MHz, for this reason the units must comply with part 15.209. As the units will only be used as depth gauges the antenna will always point towards the ground inside a tank and will be tested as such. The Solartron Mobrey MRL800 radar level transmitters have 3 different antenna types listed below and all 3 antenna types were tested in the 3 different enclosure materials listed below:

Antenna Type

4 Inch Horn
6 Inch Horn
Rod Antenna

Note: Antennas are integral and cannot be changed by the customer.

Enclosure Material

Metal	approx. 2mm Thick
Concrete	approx. 35mm Thick
Plastic	approx. 12mm Thick

Note: Approximate thicknesses of material applicable to TRL laboratory only

TEST LOCATIONS

TRL Laboratory	Site 1 – Concrete Tank	Site 2 – Plastic Tank
Moss View Nipe Lane Up Holland West Lancashire	Underwater Films Mollison Avenue Waltham Cross Hertfordshire	Sarena mfg Ltd Sarena House Beechings Way Gillingham Kent

The 3 different antenna types were tested in all 3 different enclosure materials at the TRL laboratory, in a concrete tank at site 1 and in a plastic tank at site 3.

MEASUREMENT PROCEDURE

The MRL800 radar level transmitters operate a FMCW signal linearly swept over the frequency range 5500MHz to 6450MHz in 5.36mSeconds (Ton). The time between sweeps is 1.969 Seconds (Toff) (see annex C). Radiated measurements were made with a spectrum analyser using a 1MHz BW and a 600 second sweep time, a preamp was also used to improve signal level. A peak detector was used to measure the signal strength. A peak to average correction factor was derived from the duty cycle as follows.

Peak to Average Factor = $20 \log(X)$ Where $X = T_{on} / (T_{on} + T_{off})$

Peak to Average Factor = $20 \log(5.36mS/1.97436s)$

Peak to Average Factor = -51.33 (dB)

Measurements were performed at a distance of 0.3 meters from the edge of the enclosure and extrapolated to 3m as per 15.31f(1). The distance from the EUT to the edge of the enclosure was approximately 0.3m in each case.

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209 – METAL

Ambient temperature	=	22°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	53% (<1GHz),	0.3m measurements >1GHz	[X]
Conditions	=	Anechoic Chamber	3m extrapolated from 0.3m	[X]
Supply voltage	=	+24Vdc	4 Inch Horn Antenna	[X]
Channel number	=	1	6 Inch Horn Antenna	[X]
			Rod Antenna	[X]

FREQ RANGE (MHz)	FREQ. (MHz)	MEAS. Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT.	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT.	AVERAGE FIELD STRENGTH (μV/m)
1.705 - 30					-		-51.33	See Note 8
30 - 88					-		-51.33	See Note 8
88 - 216					-		-51.33	See Note 8
216 - 960					-		-51.33	See Note 8
960 - 1000					-		-51.33	See Note 8
1000 - 60000					-20		-51.33	See Note 8
Limits	FREQ RANGE		Average Limit			Peak Limit		
	1.705MHz to 30MHz		30μV/m @ 30m			300μV/m @ 30m		
	30MHz to 88MHz		100μV/m @ 3m			1000μV/m @ 3m		
	88MHz to 216MHz		150μV/m @ 3m			1500μV/m @ 3m		
	216MHz to 960MHz		200μV/m @ 3m			2000μV/m @ 3m		
	960MHz to 1GHz		500μV/m @ 3m			5000μV/m @ 3m		
	1GHz to 5GHz		500μV/m @ 3m			5000μV/m @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Emissions were searched to: (x) 1000MHz inclusive, as per Part 15.33a
- Extrapolation factor 20dB from 0.3m to 3m, as per Part 15.31f
- Measurements >1GHz @ 0.3m as per Part 15.31f(1)
- Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
- Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
- New batteries used for battery powered products.
- Only emissions within 20dB's of the limit are recorded
- Measurements as per 15.35 (b) and (c)
- (R) indicates emission in restricted band
- See annex F for lower bandedge compliance with the restricted band 5.35 GHz -5.46 GHz

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded.

The test equipment used for the Transmitter Spurious Emissions – Radiated – Part 15.209 test is shown overleaf:

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209 – CONCRETE

Ambient temperature	=	22°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	53% (<1GHz),	0.3m measurements >1GHz	[X]
Conditions	=	Anechoic Chamber	3m extrapolated from 0.3m	[X]
Supply voltage	=	+24Vdc	4 Inch Horn Antenna	[X]
Channel number	=	1	6 Inch Horn Antenna	[X]
			Rod Antenna	[X]

FREQ RANGE (MHz)	FREQ. (MHz)	MEAS. Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT.	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT.	AVERAGE FIELD STRENGTH (μV/m)
1.705 - 30					-		-51.33	See Note 8
30 - 88					-		-51.33	See Note 8
88 - 216					-		-51.33	See Note 8
216 - 960					-		-51.33	See Note 8
960 - 1000					-		-51.33	See Note 8
1000 - 5000					-20		-51.33	See Note 8
Limits	FREQ RANGE		Average Limit			Peak Limit		
	1.705MHz to 30MHz		30μV/m @ 30m			300μV/m @ 30m		
	30MHz to 88MHz		100μV/m @ 3m			1000μV/m @ 3m		
	88MHz to 216MHz		150μV/m @ 3m			1500μV/m @ 3m		
	216MHz to 960MHz		200μV/m @ 3m			2000μV/m @ 3m		
	960MHz to 1GHz		500μV/m @ 3m			5000μV/m @ 3m		
	1GHz to 5GHz		500μV/m @ 3m			5000μV/m @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Emissions were searched to: (x) 1000MHz inclusive, as per Part 15.33a
- Extrapolation factor 20dB from 0.3m to 3m, as per Part 15.31f
- Measurements >1GHz @ 0.3m as per Part 15.31f(1)
- Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
- Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
- New batteries used for battery powered products.
- Only emissions within 20dB's of the limit are recorded
- Measurements as per 15.35 (b) and (c)
- (R) indicates emission in restricted band
- See annex F for lower bandedge compliance with the restricted band 5.35 GHz -5.46 GHz

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded.

The test equipment used for the Transmitter Spurious Emissions – Radiated – Part 15.209 test is shown overleaf:

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 15.209 – PLASTIC

Ambient temperature	=	22°C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	53% (<1GHz),	0.3m measurements >1GHz	[X]
Conditions	=	Anechoic Chamber	3m extrapolated from 0.3m	[X]
Supply voltage	=	+24Vdc	4 Inch Horn Antenna	[X]
Channel number	=	1	6 Inch Horn Antenna	[X]
			Rod Antenna	[X]

FREQ RANGE (MHz)	FREQ. (MHz)	MEAS. Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT.	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT.	AVERAGE FIELD STRENGTH (μV/m)
1.705 - 30					-		-51.33	See Note 8
30 - 88					-		-51.33	See Note 8
88 - 216					-		-51.33	See Note 8
216 - 960					-		-51.33	See Note 8
960 - 1000					-		-51.33	See Note 8
1000 - 5000					-20		-51.33	See Note 8
Limits	FREQ RANGE		Average Limit			Peak Limit		
	1.705MHz to 30MHz		30μV/m @ 30m			300μV/m @ 30m		
	30MHz to 88MHz		100μV/m @ 3m			1000μV/m @ 3m		
	88MHz to 216MHz		150μV/m @ 3m			1500μV/m @ 3m		
	216MHz to 960MHz		200μV/m @ 3m			2000μV/m @ 3m		
	960MHz to 1GHz		500μV/m @ 3m			5000μV/m @ 3m		
	1GHz to 5GHz		500μV/m @ 3m			5000μV/m @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Emissions were searched to: (x) 1000MHz inclusive, as per Part 15.33a
- Extrapolation factor 20dB from 0.3m to 3m, as per Part 15.31f
- Measurements >1GHz @ 0.3m as per Part 15.31f(1)
- Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
- Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
- New batteries used for battery powered products.
- Only emissions within 20dB's of the limit are recorded
- Measurements as per 15.35 (b) and (c)
- (R) indicates emission in a restricted band
- See annex F for lower bandedge compliance with the restricted band 5.35 GHz -5.46 GHz

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded.

The test equipment used for the Transmitter Spurious Emissions – Radiated – Part 15.209 test is shown overleaf:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
HORN ANTENNA	EMCO	3115	9010-3580	138	X
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	R&S	ESIB 7		630	X
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESVS10	837948/003	317	
RECEIVER	ROHDE & SCHWARZ	ESVS10	844594/003	352	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
V / UHF RECEIVER 20MHz - 1GHz	ROHDE & SCHWARZ	ESVS 20	838804 / 005	415	
BILOG ANTENNA	YORK	CBL611/A	1618	UH191	X
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	X
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	X
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
PREAMP	AGILENT	8449B	3008A01610	572	X

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.209 – METAL

Ambient temperature	=	22°C(<1GHz),	0.3m measurements @ fc	[X]
Relative humidity	=	53%(<1GHz),	4 Inch Horn Antenna	[X]
Conditions	=	Anechoic Chamber	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]

4 Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
6340.280	80.35	2.93	34.9	-36	-20	1285.287	-51.33	3.478
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

6 Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5652.505	76.85	2.95	34.8	-36	-20	851.138	-51.33	2.309
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Rod Antenna

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5739.070	84.41	2.97	34.8	-36	-20	2037.042	-51.33	5.527
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Receiver detector @ fc = Peak, 1MHz bandwidth

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- Measuring distances 3m
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.209 tests is shown overleaf:

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.209 – CONCRETE

Ambient temperature	=	22°C(<1GHz),	0.3m measurements @ fc	[X]
Relative humidity	=	53%(<1GHz),	4 Inch Horn Antenna	[X]
Conditions	=	Anechoic Chamber	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]

4 Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5767.935	78.77	2.90	34.9	-36	-20	1067.825	-51.33	2.897
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

6 Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5659.719	77.36	3.05	34.8	-36	-20	913.061	-51.33	2.477
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Rod Antenna

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5722.244	86.36	2.99	34.9	-36	-20	2585.235	-51.33	7.015
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Receiver detector @ fc = Peak, 1MHz bandwidth

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- Measuring distances 3m
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.209 tests is shown overleaf.

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.209 – PLASTIC

Ambient temperature	=	22°C(<1GHz),	0.3m measurements @ fc	[X]
Relative humidity	=	53%(<1GHz),	4 Inch Horn Antenna	[X]
Conditions	=	Anechoic Chamber	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]

4 Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5690.981	84.55	2.95	34.9	-36	-20	2089.926	-51.33	5.669
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

6Inch Horn

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5945.891	78.90	3.0	34.9	-36	-20	1096.478	-51.33	2.975
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Rod Antenna

FREQ. (MHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5816.032	90.40	2.97	34.9	-36	-20	4154.321	-51.33	11.272
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Receiver detector @ fc = Peak, 1MHz bandwidth

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- Measuring distances 3m
- 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.209 tests is shown overleaf:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
HORN ANTENNA	EMCO	3115	9010-3580	138	X
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	R&S	ESIB 7		630	X
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESVS10	837948/003	317	
RECEIVER	ROHDE & SCHWARZ	ESVS10	844594/003	352	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
V / UHF RECEIVER 20MHz - 1GHz	ROHDE & SCHWARZ	ESVS 20	838804 / 005	415	
BILOG ANTENNA	YORK	CBL611/A	1618	UH191	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	
PREAMP	AGILENT	8449B	3008A01610	572	X

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER INTENTIONAL EMISSION – BAND OCCUPANCY – PART 15.215(a)

Ambient temperature	=	22°C(<1GHz),	Conducted measurements	[X]
Relative humidity	=	53%(<1GHz),	4 Inch Horn Antenna	[X]
Conditions	=	Radio Laboratory	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]
Channel	=	1		

EUT Connected to 4 Inch Horn Antenna

Band Occupancy @ -20dBc (See Annex D for band occupancy plots)	f lower	f higher
	5548.1 MHz	6397.1 MHz
	Occupied Bandwidth = 849 MHz	

EUT Connected to 6 Inch Horn Antenna

Band Occupancy @ -20dBc (See Annex D for band occupancy plots)	f lower	f higher
	5545.0 MHz	6400.0 MHz
	Occupied Bandwidth = 855 MHz	

EUT Connected to Rod Antenna

Band Occupancy @ -20dBc (See Annex D for band occupancy plots)	f lower	f higher
	5551.4 MHz	6401.4 MHz
	Occupied Bandwidth = 850 MHz	

Notes:

- 1 Receiver detector @ f_c = Peak, 1MHz bandwidth
- 2 See Annex D for Plots

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.4: 2001
- 2 Conducted Measurement

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
HORN ANTENNA	EMCO	3115	9010-3580	138	
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	R&S	ESIB 7		630	
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESVS10	837948/003	317	
RECEIVER	ROHDE & SCHWARZ	ESVS10	844594/003	352	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
V / UHF RECEIVER 20MHz - 1GHz	ROHDE & SCHWARZ	ESVS 20	838804 / 005	415	
BILOG ANTENNA	YORK	CBL611/A	1618	UH191	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	
AE, LOOP, Z2, 9kHz - 30MHz	ROHDE & SCHWARZ	HFH2	881058 - 53	07	
BILOG ANTENNA	CHASE	CBL6112	2129	UH93	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
PREAMP	AGILENT	8449B	3008A01610	572	

TRANSMITTER TESTS – TEST LABORATORY

TRANSMITTER CONDUCTED EMISSIONS – AC POWER LINE Part 15.207

Ambient temperature	=	22°C(<1GHz),	4 Inch Horn Antenna	[X]
Relative humidity	=	53%(<1GHz),	6 Inch Horn Antenna	[X]
Conditions	=	Power Line Laboratory	Rod Antenna	[X]
Supply voltage	=	110V AC		
Supply Frequency	=	60Hz		

SIGNIFICANT EMISSIONS

FREQUENCY (MHz)	MEASUREMENT RECEIVER READING (dBµV)	DETECTOR	LISN CORRECTION (dB)	CONDUCTOR (L or N)	EMISSION (µV)
No significant emissions within 20 dB's of the limit					

Notes:

- 1 See conducted emission plots in Annex E
- 2 Emissions more than 20dB's below the limit are not necessarily recorded

Test Method:

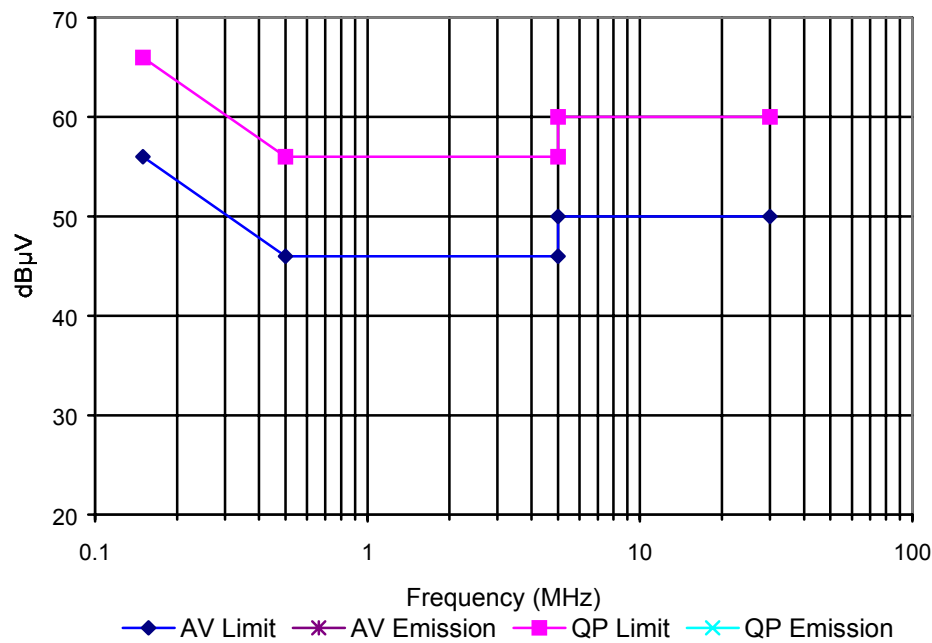
- 1 As per Radio – Noise Emissions, ANSI C63.4: 2001

The test equipment used for the Transmitter Conducted Emissions – AC Power Line Part 15.207 test was:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
LISN / AMN	ROHDE & SCHWARZ	ESH3-Z5	83746/010	289	
RECEIVER	ROHDE & SCHWARZ	ESHS10	844077/019	353	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
LISN/AMN	ROHDE & SCHWARZ	ESH3-Z5	863906/018	UH05	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	

POWER LINE CONDUCTION EMISSIONS

Quasi Peak Limit Part 15.207



No Significant Emissions Within 20dB's of the limit

TRANSMITTER TESTS – TEST SITE 1

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.209 – CONCRETE

Ambient temperature	=	30°C(<1GHz),	0.3m measurements @ fc	[X]
Relative humidity	=	40%(<1GHz),	4 Inch Horn Antenna	[]
Conditions	=	Site	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]

6 Inch Horn

FREQ. (GHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5.6.- 6.5	Note 6	2.93	34.9	-36	-20	-		-
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Rod Antenna

FREQ. (GHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5.6.- 6.5	Note 6	2.93	34.9	-36	-20	-		-
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Notes:

- Results quoted are extrapolated as indicated
- Receiver detector @ fc = Peak, 1MHz bandwidth
- No emissions detected at all locations and orientations of antenna (see diagram annex H)
- Water was 75cm from antenna tip depth on 3 metres
- Concrete tank 30cm thick
- No emissions detected
- See photographs annex I

Test Method:

- As per Radio – Noise Emissions, ANSI C63.4: 2001
- Measuring distances 30cm
- Horizontal and vertical polarisations, of the receive antenna.

The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.209 tests is shown overleaf:

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
HORN ANTENNA	EMCO	3115	9010-3580	138	X
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	R&S	ESIB 7		630	
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
PREAMP	AGILENT	8449B	3008A01610	572	X

TRANSMITTER TESTS – TEST SITE 2

TRANSMITTER INTENTIONAL EMISSION – RADIATED – Part 15.209 – PLASTIC

Ambient temperature	=	27°C(<1GHz),	0.3m measurements @ fc	[X]
Relative humidity	=	40%(<1GHz),	4 Inch Horn Antenna	[]
Conditions	=	Site	6 Inch Horn Antenna	[X]
Supply voltage	=	+24Vdc	Rod Antenna	[X]

6 Inch Horn

FREQ. (GHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5.6.- 6.5	Note 6	2.93	34.9	-36	-20	-		-
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

Rod Antenna

FREQ. (GHz)	MEAS Rx. (dBμV)	CABLE LOSS (dB)	ANT FACT	PRE AMP GAIN (dB)	EXTRAP. FACTOR (dB)	PEAK FIELD STRENGTH (μV/m)	PEAK TO AVERAGE FACT (dB)	AVERAGE FIELD STRENGTH (μV/m)
5.6.- 6.5	Note 6	2.93	34.9	-36	-20	-		-
Peak Limit value @ fc						5000 (μV/m) @ 3m		
Average Limit value @ fc						500 (μV/m) @ 3m		

- Notes:**
- Results quoted are extrapolated as indicated
 - Receiver detector @ fc = Peak, 1MHz bandwidth
 - No emissions detected at all locations and orientations of antenna (see diagram annex H)
 - Tank one was empty. Tank two water depth 1.6m .
 - Fibre Glass tank 25 mm thick
 - No emissions detected in both tank 1 and 2
 - Measurement was take above the EUT to check for reflected radiation (see diagram annex H)
 - See photograph annex I

- Test Method:**
- As per Radio – Noise Emissions, ANSI C63.4: 2001
 - Measuring distances 30cm
 - Horizontal and vertical polarisations, of the receive antenna.

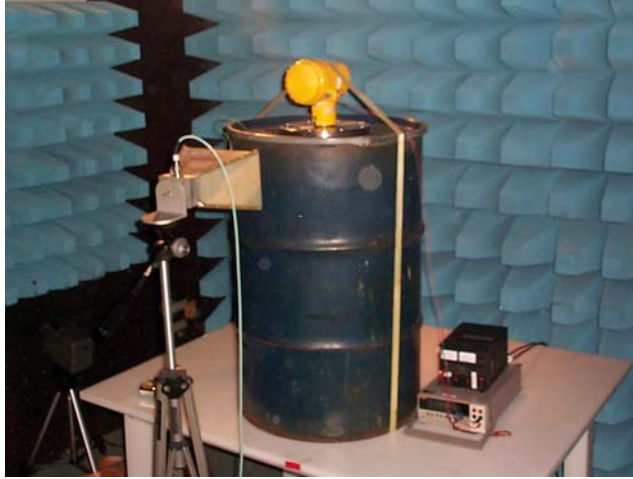
The test equipment used for the Transmitter Intentional Emission – Radiated – Part 15.209 tests is shown overleaf:

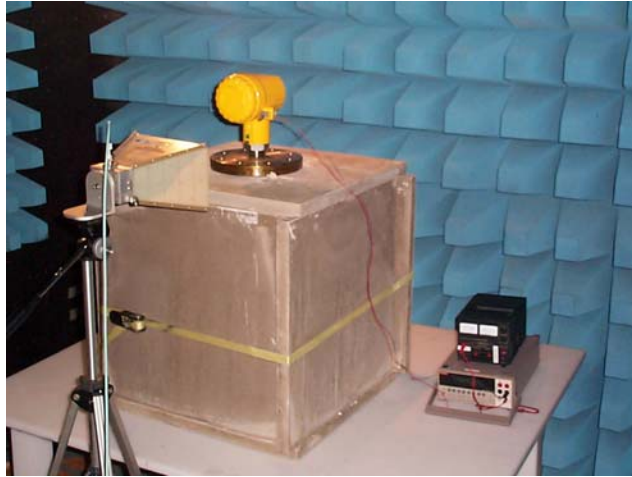
TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No	ACTUAL EQUIPMENT USED
HORN ANTENNA	EMCO	3115	9010-3580	138	X
HORN ANTENNA	EMCO	3115	9010-3581	139	
SPECTRUM ANALYSER	R&S	ESIB 7		630	
RECEIVER	ROHDE & SCHWARZ	ESHS20	837960/003	237	
ANTENNA, BICONE 20MHz - 300MHz	CHASE	VBA6106A	1193	251	
BILOG ANTENNA	CHASE	CBL6112	2098	274	
RECEIVER	ROHDE & SCHWARZ	ESHS 10	830051/001	UH03	
RECEIVER	ROHDE & SCHWARZ	ESVS 10	825892/003	UH04	
RANGE 1	TRL	3 METRE	N/A	UH06	
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120	
SPECTRUM ANALYSER	ANRITSU	MS2665C	MT26089	479	X
PREAMP	AGILENT	8449B	3008A01610	572	X

ANNEX A
PHOTOGRAPHS

PHOTOGRAPH No. 1

TEST SETUP - METAL







PHOTOGRAPH No. 4

TEST SETUP - CONDUCTED



PHOTOGRAPH No. 5

4 Inch Horn OVERVIEW





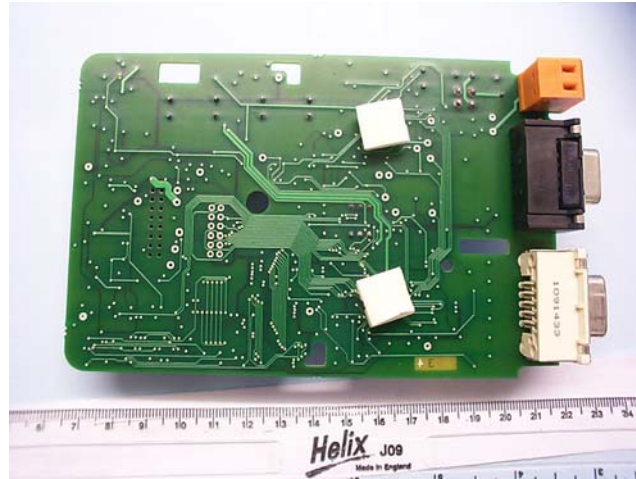
PHOTOGRAPH No. 7

ROD ANTENNA OVERVIEW



PHOTOGRAPH No. 8

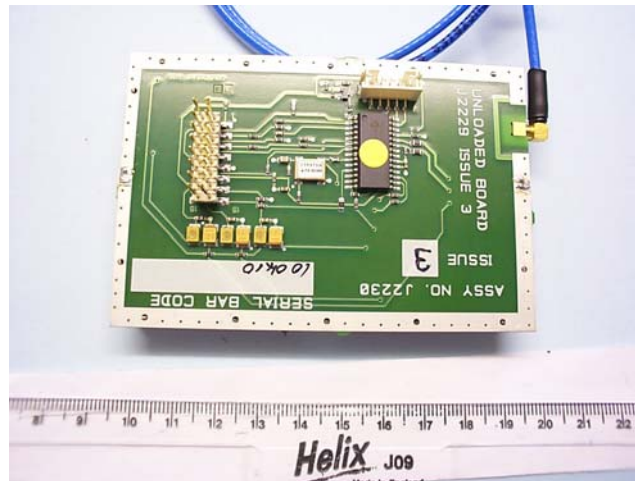
MAIN PCB TRACK SIDE



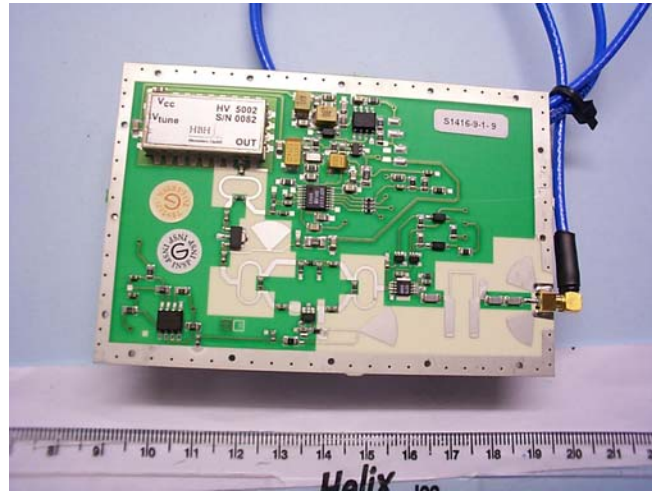


PHOTOGRAPH No. 10

RF PCB TRACK SIDE



PHOTOGRAPH No. 11 RF PCB COMPONENT SIDE COVER REMOVED

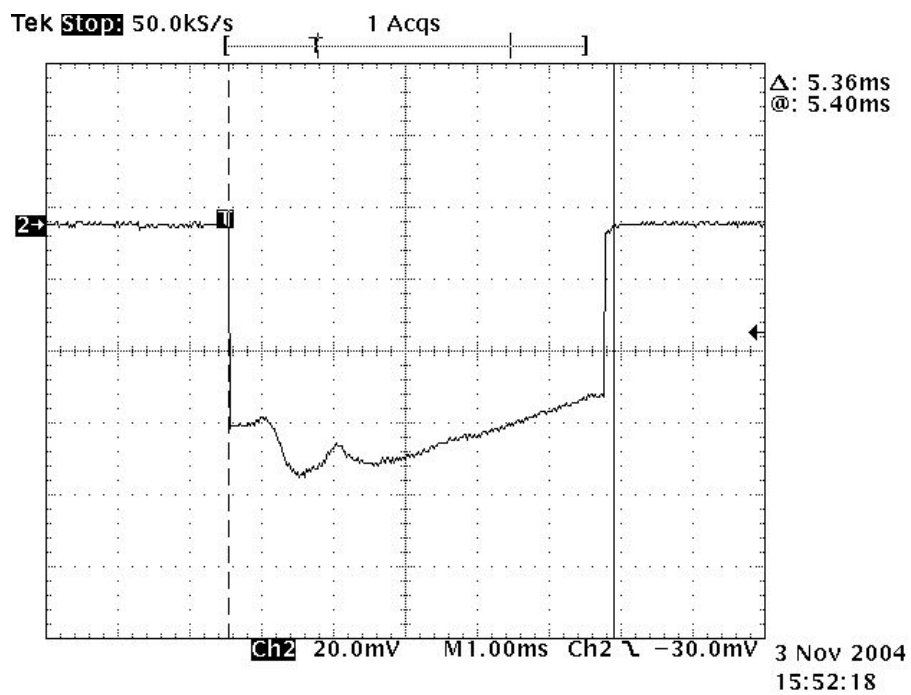


ANNEX B
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

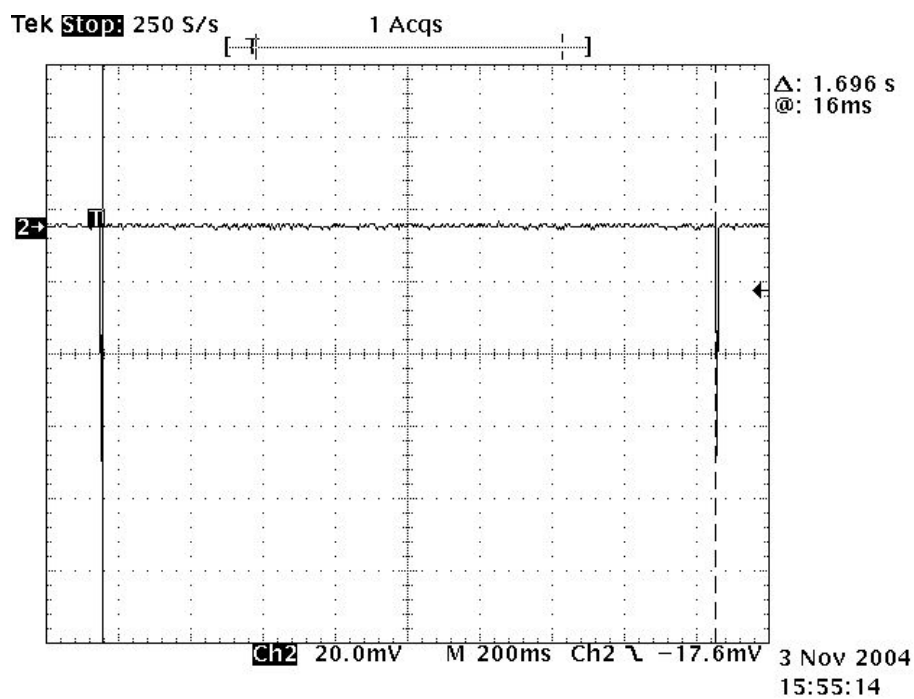
APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[]
		-	FEE	[]
b.	AGENT'S LETTER OF AUTHORISATION	-		[]
c.	MODEL(s) vs IDENTITY	-		[]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[]
e.	LABELLING	-	PHOTOGRAPHS	[]
		-	DECLARATION	[]
		-	DRAWINGS	[]
f.	TECHNICAL DESCRIPTION	-		[]
g.	BLOCK DIAGRAMS	-	Tx	[]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
h.	CIRCUIT DIAGRAMS	-	Tx	[]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
i.	COMPONENT LOCATION	-	Tx	[]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
j.	PCB TRACK LAYOUT	-	Tx	[]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
k.	BILL OF MATERIALS	-	Tx	[]
		-	Rx	[]
		-	PSU	[]
		-	AUX	[]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[]

ANNEX C
DUTY CYCLE PLOT(s)

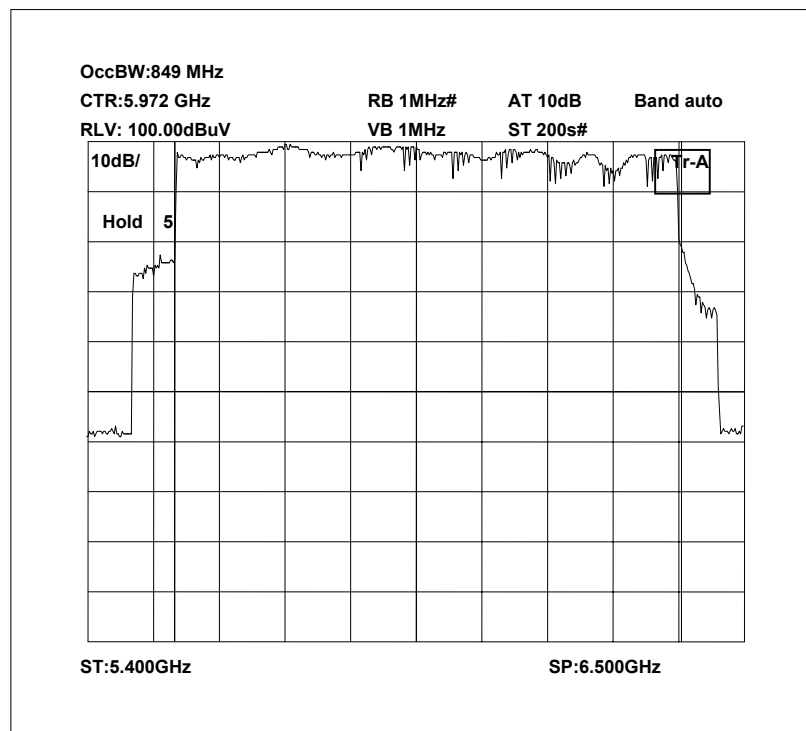


Ton



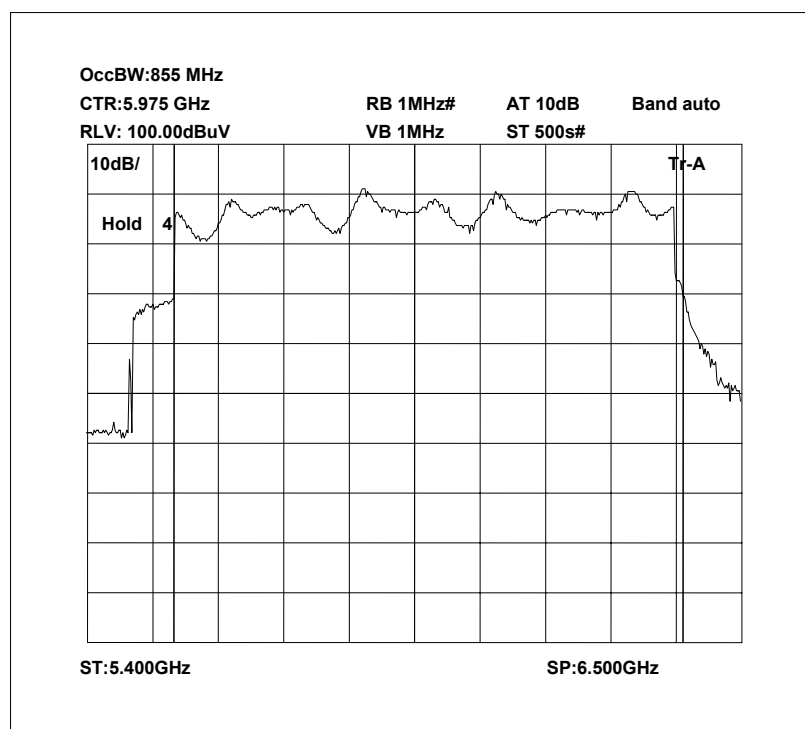
Toff

ANNEX D
BANDWIDTH OCCUPANCY



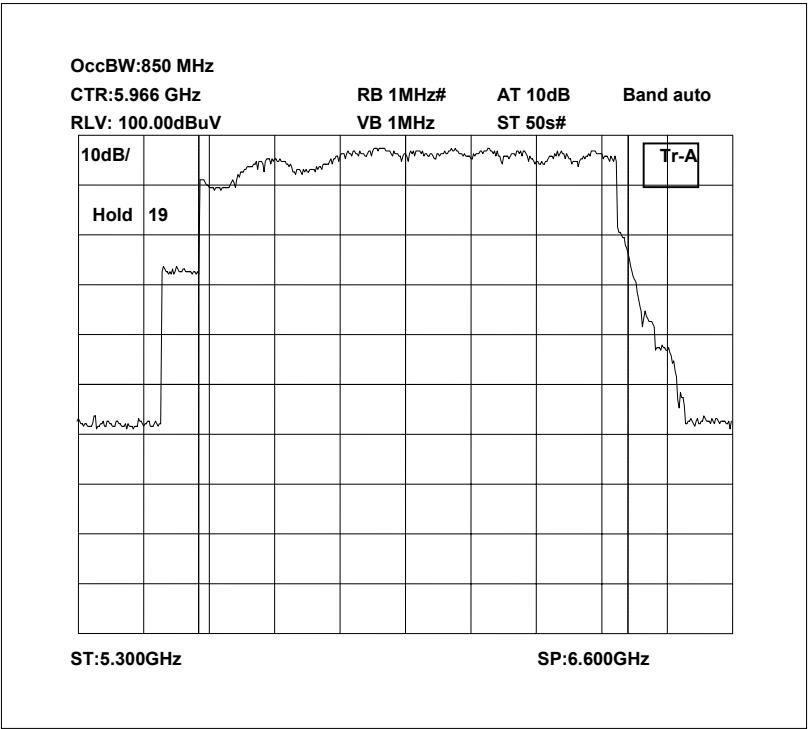
3 INCH HORN

Occupied Bandwidth = 849 MHz
 f lower = 5548.1 MHz
 f higher = 6397.1 MHz



6 INCH HORN

Occupied Bandwidth = 855 MHz
 f lower = 5545.0 MHz
 f higher = 6400.0 MHz



ROD ANTENNA

Occupied Bandwidth = 850 MHz
f lower = 5551.4 MHz
f higher = 6401.4 MHz

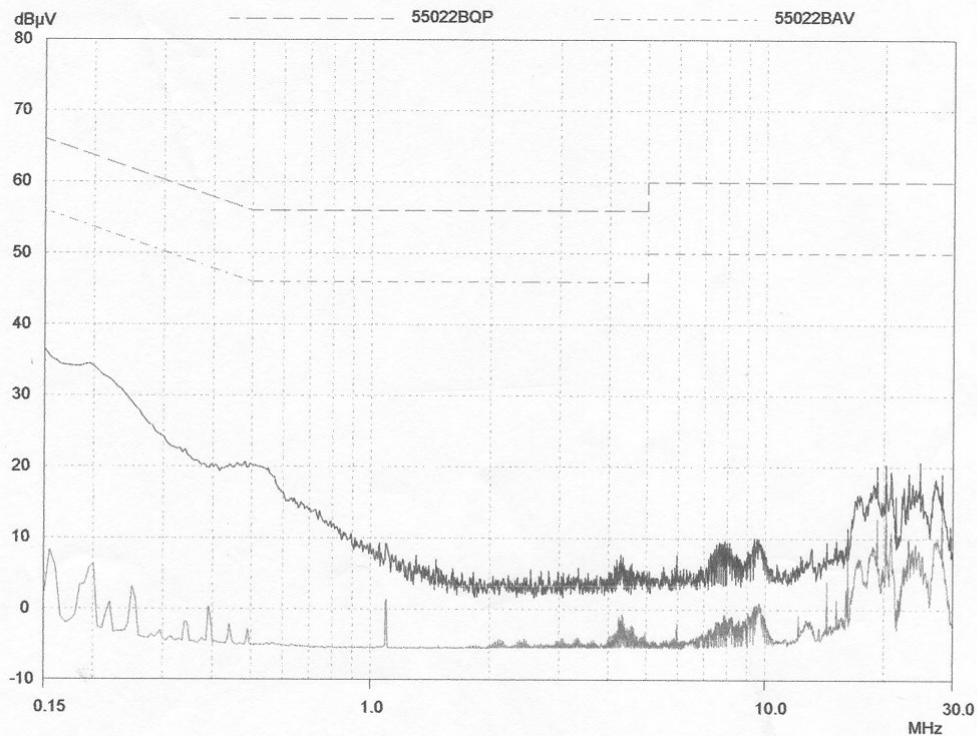
ANNEX E
CONDUCTED EMISSION PLOT(s)

Powerline Conduction

150kHz - 30MHz

EUT: Depth radar 3 inch horn
 Manuf: Solartron
 Op Cond: LISN UH195, cable UH21 & Receiver UH03
 Operator: J C
 Test Spec: EN55022 Class B (or Variant)
 Comment: Live line EUT operating

Scan Settings		(1 Range)			Receiver Settings				
Frequencies		Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
Start	Stop	5kHz	10kHz	PK+AV	50msec	Auto	OFF	60dB	
150kHz	30MHz								
Transducer	No.	Start	Stop	Name					
	1	150kHz	30MHz	UH21					
Prescan Measurement:		Detectors:	X PK / + AV						
		Meas Time:	see scan settings						
		Subranges:	25						
		Acc Margin:	20 dB						

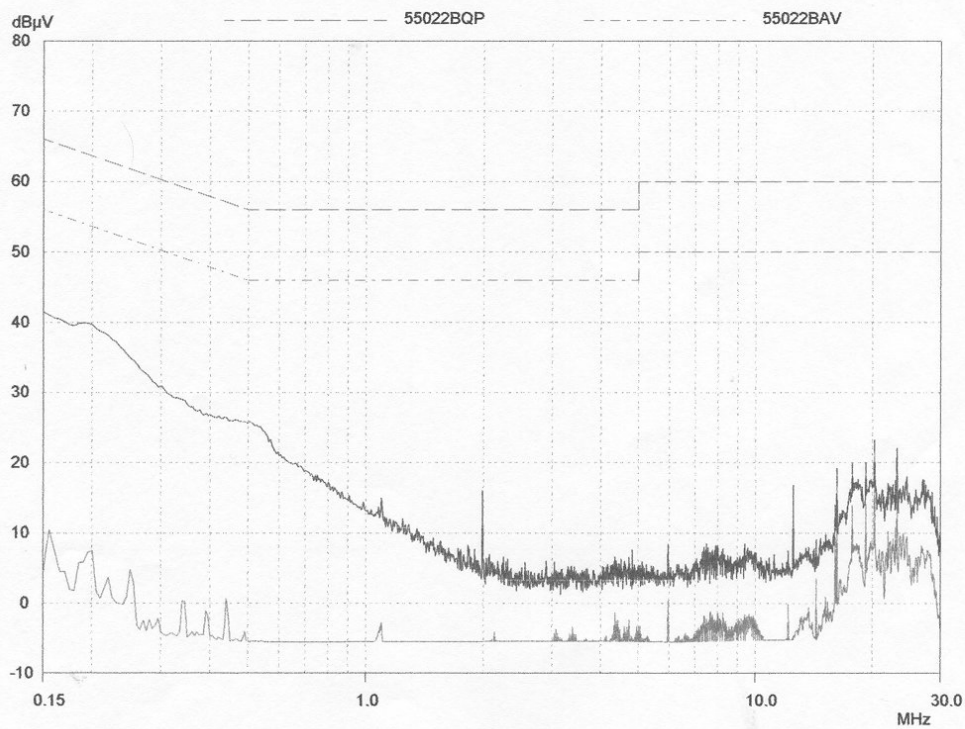


Powerline Conduction

150kHz - 30MHz

EUT: Depth radar 6 inch horn
 Manuf: Solartron
 Op Cond: LISN UH195, cable UH21 & Receiver UH03
 Operator: J C
 Test Spec: EN55022 Class B (or Variant)
 Comment: Live line EUT operating

Scan Settings		(1 Range)			Receiver Settings				
Start	Stop	Frequencies	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
150kHz	30MHz		5kHz	10kHz	PK+AV	50msec	Auto	OFF	60dB
Transducer	No.	Start	Stop	Name					
	1	150kHz	30MHz	UH21					
Prescan Measurement:		Detectors:	X PK / + AV						
		Meas Time:	see scan settings						
		Subranges:	25						
		Acc Margin:	20 dB						



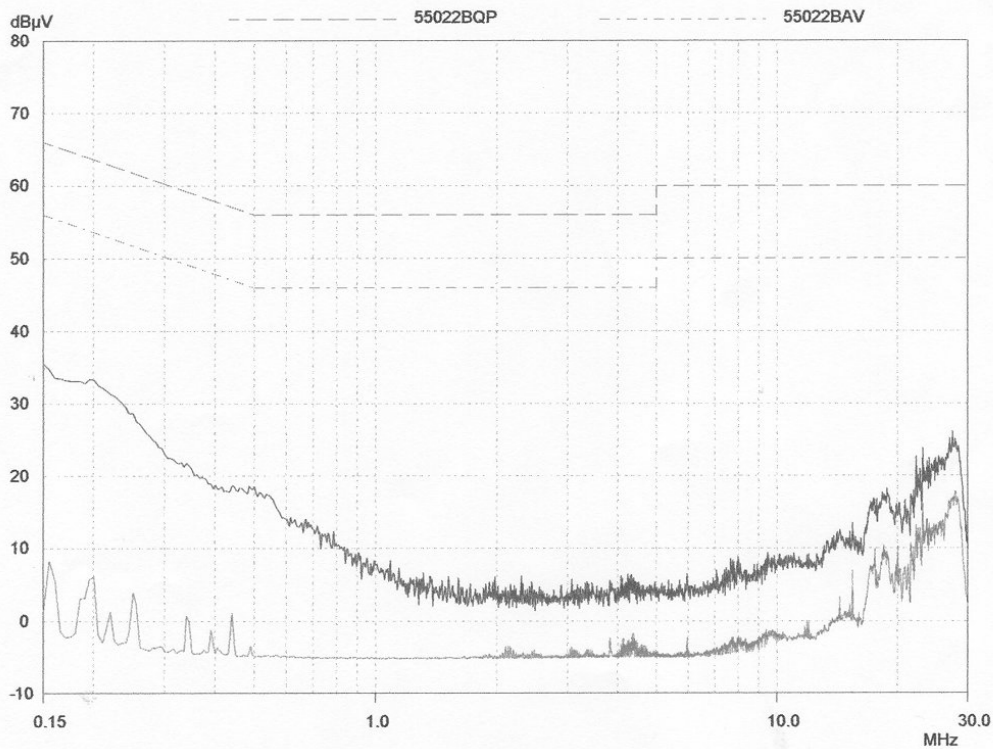
PAGE 1

Powerline Conduction

150kHz - 30MHz

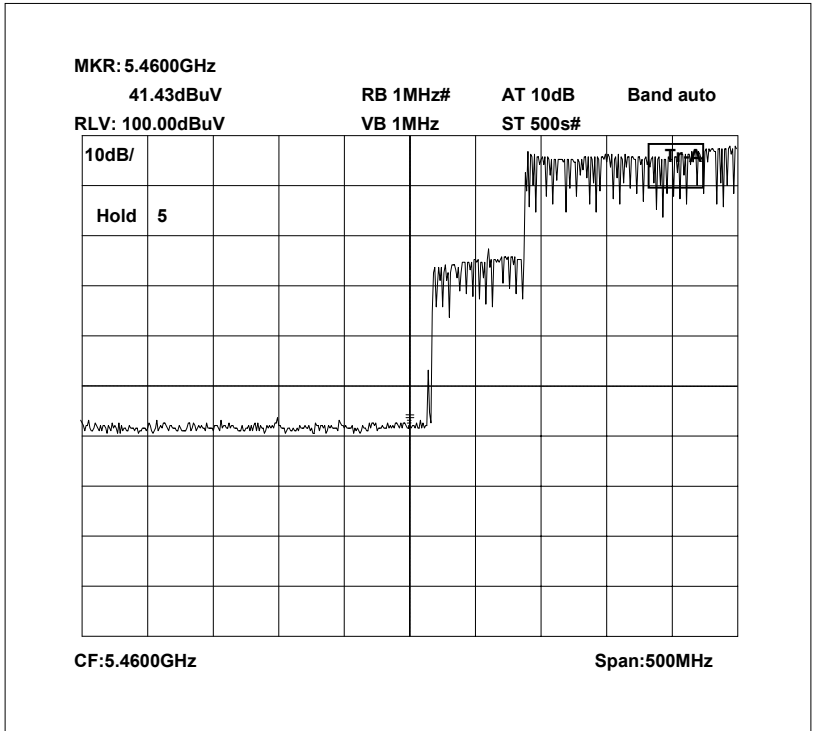
EUT: Depth Radar Rod Antenna
 Manuf: Solartron Mobray
 Op Cond: LISN UH195, cable UH21 & Receiver UH03
 Operator: J C
 Test Spec: EN55022 Class B (or Variant)
 Comment: Live line Unit operating

Scan Settings		(1 Range)			Receiver Settings				
Frequencies									
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge	
150kHz	30MHz	5kHz	10kHz	PK+AV	50msec	Auto	OFF	60dB	
Transducer	No.	Start	Stop	Name					
	1	150kHz	30MHz	UH21					
Prescan Measurement:		Detectors:	X PK / + AV						
		Meas Time:	see scan settings						
		Subranges:	25						
		Acc Margin:	20 dB						

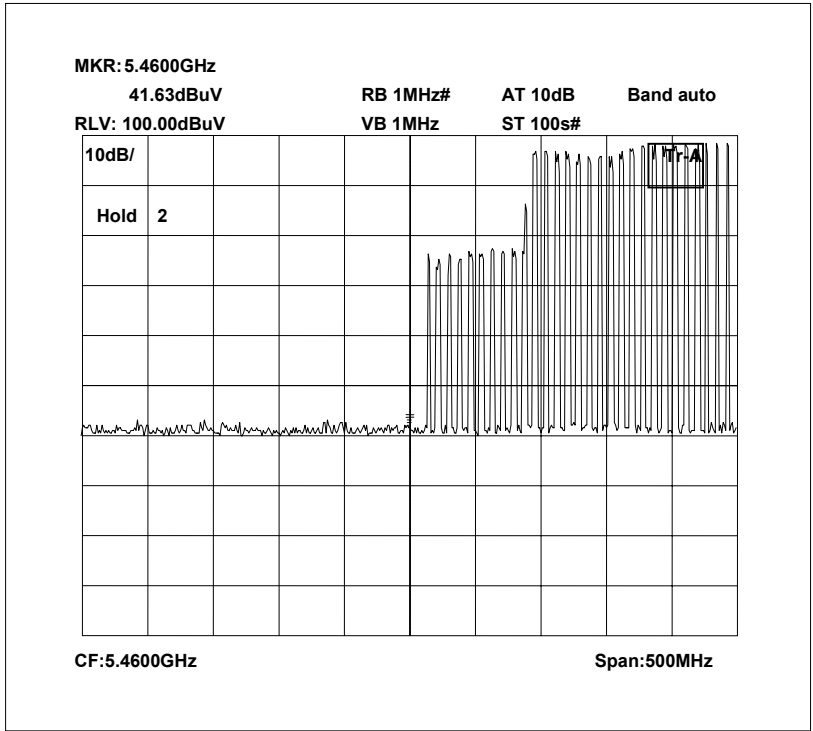


ANNEX F

BANEDGE COMPLIANCE WITH RESTRICTED BAND



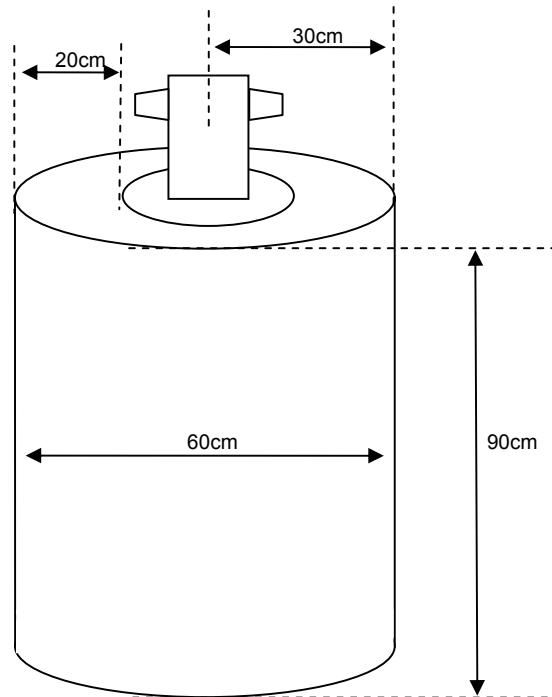
4 INCH HORN



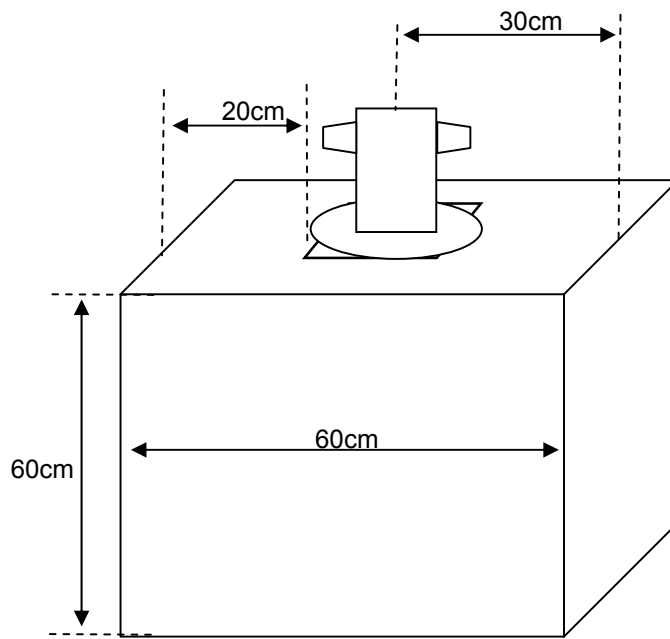
ROD ANTENNA

ANNEX G
ENCLOSURE DIMENSIONS

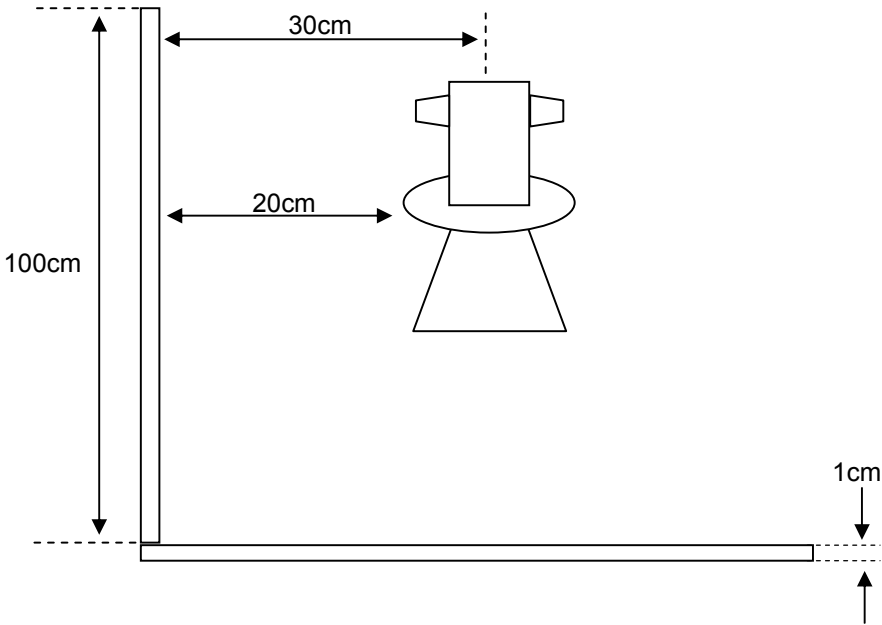
METAL ENCLOSURE



CONCRETE ENCLOSURE

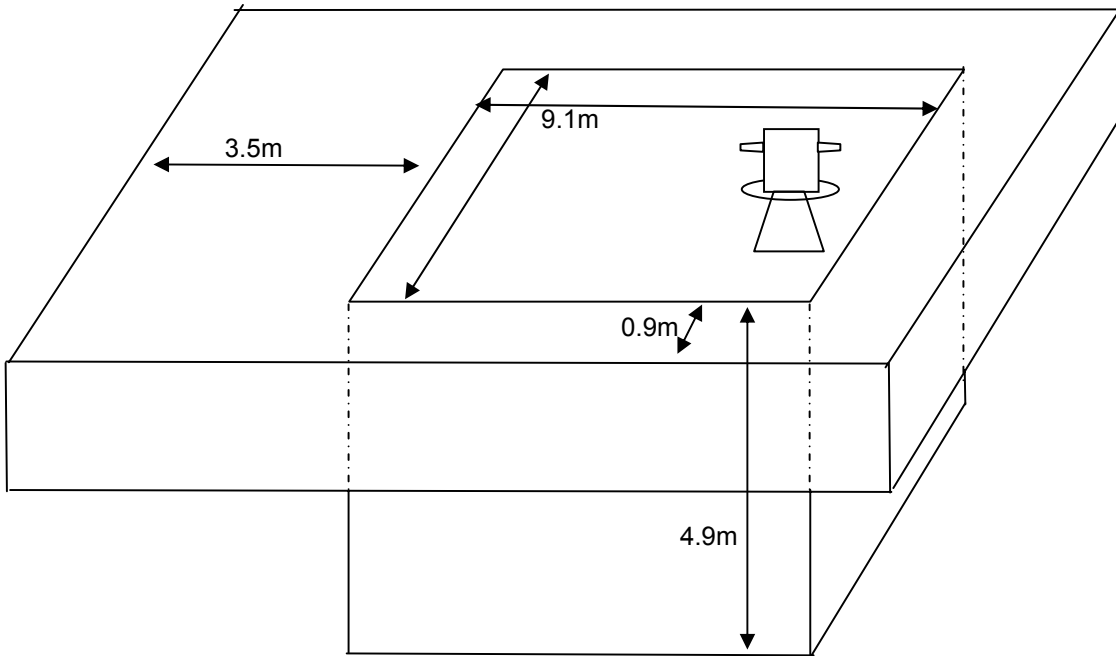


PLASTIC ENCLOSURE



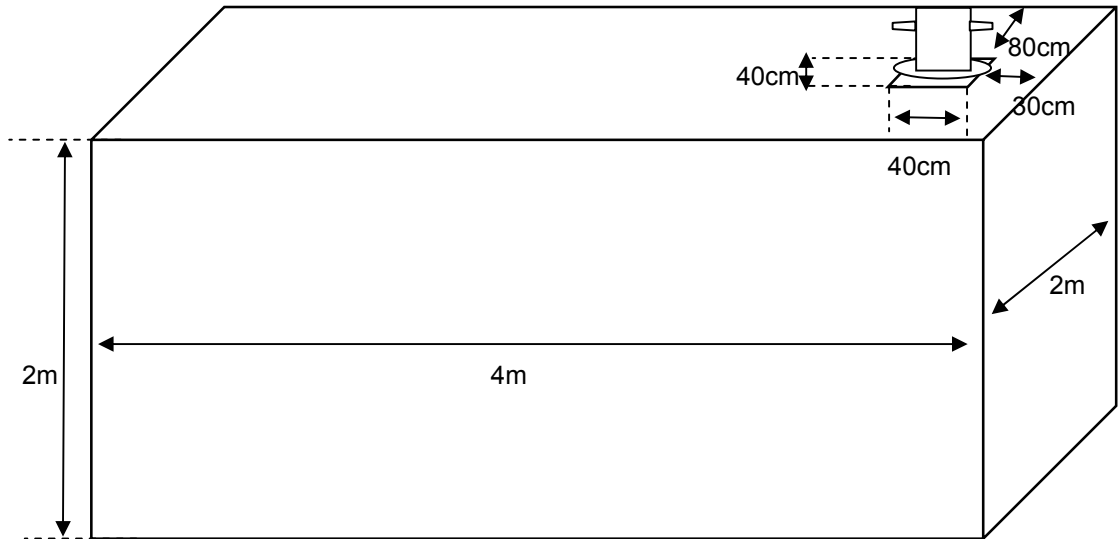
ANNEX H
DIAGRAM OF SITE TANK DIMENSIONS

Site 1

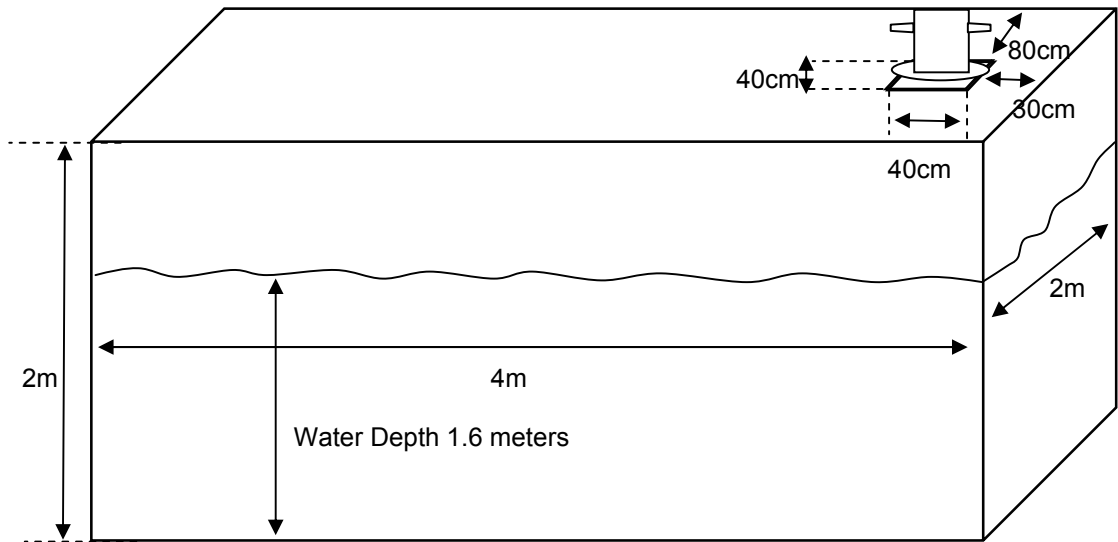


Unit suspended over the open top tank with cables

SITE 2



Site 2 Empty Tank



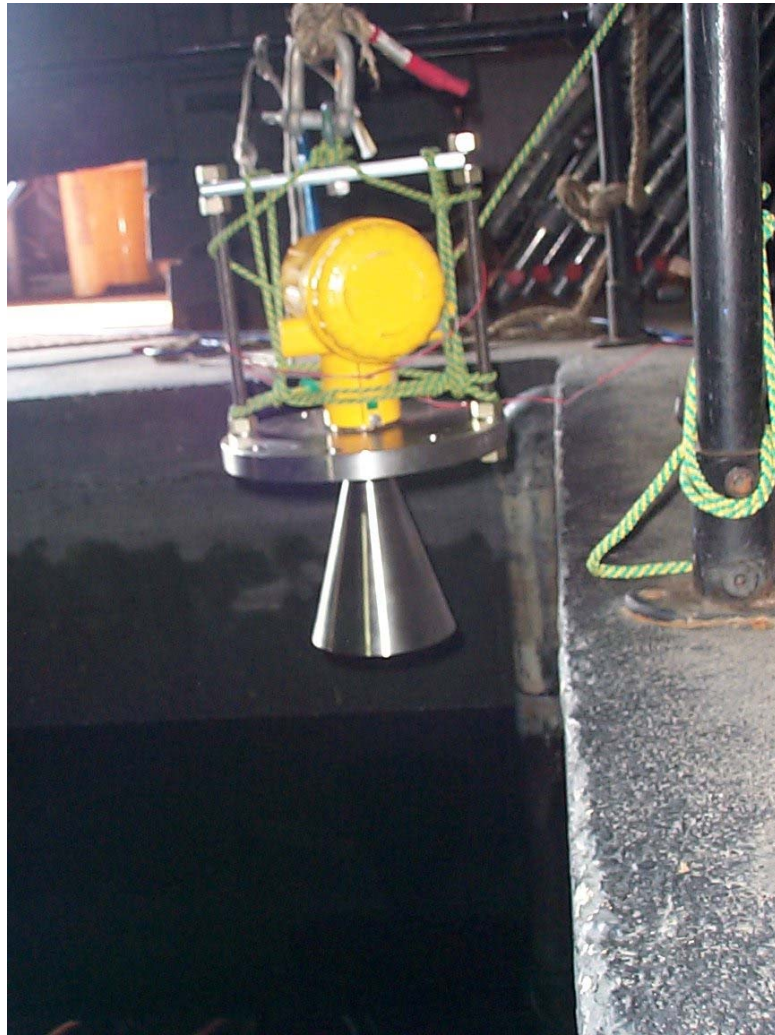
Site 2 tank containing water

ANNEX I
PHOTOGRAPHS OF SITE TESTING

PHOTOGRAPH No. 1

ROD ANTENNA SITE 1





PHOTOGRAPH No. 3

SITE 1 ANTENNA LOCATION







